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optimum short-wave antennas

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developed by hams for hams

OB 3-80+

3 Element Yagi 80m for SSB and CW operation

!!! Quality made in Germany !!!

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1. Introduction

The OB3-80+ is a high performing 3el Yagi antenna for the 80m band.
A specialty of this Yagi is that it can be switched between SSB and CW operation by means of a relay function.

OptiBeam shortwave antennas are designed and optimised by support of modern techniques such as computerised antenna simulation and are finally adjusted by extensive tests in practice.

To reduce the rather big wing span of an 80m element high Q coils (no traps) are used, carefully fabricated by OptiBeam. Hereby achieved is an almost loss free shortening of the element lengths.
So a gain is realised which is very close to that of a considerably larger full size Yagi and the power capability is principally unlimited.

In the following table the essential electrical and mechanical data can be seen:

Bands	80m
Gain (dBd)*	4,8
Gain (dBi)**	11,2
F/B (db)	21
SWR: **3,770 - 3,790 - 3,820** **3,500 - 3,520 - 3,550**	 1,7 - 1,1 - 1,8 1,7 - 1,1 - 1,7
Impedance (Ohm)	50
Elements	3
Max. element length (m)	23,06
Boom length (m)	20,00
Turning radius	15,26
Weight (kg)	180
Wind load at 130 km/h	2.434 N / 3,05 m² / 33,1 feet²

* = average gain over a dipole in free space
gain of monobanders for comparison: 2-element Yagi: 4 dbd, 3-element Yagi: 5-6 dbd
** = average gain at 30m above ground

2. Assembly

The included schematic diagram is needed for the assembly and the following information is given:

-> type of element (R=Reflector, S=Driver, D = Director) and the position on the boom
-> measurements of the element sections (length and diameter)
-> lengths of the element halves
-> distances between the elements.

The lengths are given in m (meters) and the diameters are given in mm (millimetres).

2.1 Sorting the parts

The antenna to a high amount consists of already pre assembled parts.
All parts of the antenna are marked.
For faster and easier assembly it is recommended to sort the parts for reflector, driver and director.

2.2 Assembly of boom

The massive square boom consists of 7 segments, 6 pieces of 3.00 meters and 1 piece of 2.00 meter length (front boom segment)
The three centre segments (segment no. 3, 4 and 5) have 5mm thick walls to guarantee the stability in the horizontal. The other four segments have walls of 2.5mm.

Two segments each have to be connected by four coupling pieces. Four nuts are pressed into each coupler, and so for each coupling piece 4 screws are needed.
The couplers have to be mounted to the **inside of the boom wall** and have to be screwed on correspondingly.
Due to the different wall thickness on the transition from **segment 2 to 3** as well from **segment 5 to 6** the levels are not equal. To achieve equal levels on the side of the boom segments with the thinner walls a **washer** has to be used on each nut hole of the couplers. These washers are already glued onto the corresponding eight couplers.
Therefore while assembling just pay attention that:

a. on these two special boom segment transitions you definitely will use the corresponding eight especially prepared couplers
b. these eight couplers will be inserted correctly, i.e. their side with the glued on washers will be on the side of the boom segments with the thinner walls.

Make sure that you follow the inscription on the boom segments, i.e. that finally all will be in the correct order and that the inscriptions point upwards.

The coupler screws have to be tightened finally not before the parts of the boom really **fit** to each other perfectly. They have to be tightened **very solidly** (use a solid ring key and a plastic hammer).

The OB3-80+ is a heavy antenna which means a lot of load on the boom as well.
Therefore the installation of the boom to the mast and the mounting of the boom truss to the mast to stabilise the boom should be done before lifting the antenna up, if possible.

2.3 Element-Platforms

For the element-to-boom brackets 4-cornered U-shaped plates of 150x40x4mmare used, 700 mm long. The insulation and solid fixing of the elements is realised by 4 special UV stabilised tube holders, mounted on each of the platforms.
The element middle sections (d = 60mm) are already inserted into the platforms (see picture on picture page).

On each platform you also find the already installed loading coils left and right of the element centre which electrically lengthen the element for CW operation and which are brought in function by a relay switch.
Furthermore you find the relay box installed below the element middle section.

The elements fixed on the platforms have to be mounted at the **underside** of the boom shortly before the end of the boom tips in between the marking lines.
Mount the element platforms to the boom as follows:

-> the reflector and director platform have to be installed in a way that the pins on the relay box for the 12 Volt power supply lead towards the centre of the boom
-> the driver platform which is located in front of the boom to mast plate has to be installed in a way that the pins for the 12 Volt connection lead towards the front. This way the balun coax connector points towards the centre and therefore towards the mast.
The installation of the driver platform is required this way as the boom to mast plate is located rather close to the driven element with the consequence of small available space in this area.
The balun box will sort of sit on one of the outer bolts which are used to mount the boom to mast plate to the boom (see picture page). This cannot be avoided as due to the high weight of the antenna the boom to mast plate cannot be moved out of the balance point.

In case the antenna cannot be reached easily while assembling naturally the elements can be assembled completely and then be mounted below the boom in one piece.

2.4 Attaching the elements to the boom

The element hangers with the already installed element centre sections have to be mounted on the **underside** of the boom in a way that they finally are located between the two position lines which you find on top of the boom.

All element hangers have to be fixed to the underside of the boom by the use of two **cross bars** on top and four M8 bolts which have to be vertically pushed through from the underside of the element hanger and through the cross bar on top.

We have already screwed the cross bars together with the vertical support mast of the T-mast which later will be needed for the element V-truss system.

The **bolts** which run from below the element platform vertically up through the cross bars exist in two different lengths:

a. the shorter ones are **150mm long** and are used to fix the element hangers to the boom (12 pieces).
b. the longer ones are **thick threaded rod, they are 200mm long** and will be needed to mount the boom to mast plate (8 pieces).

The element hangers are additionally strengthened by two **reinforcement straps** at the place where the bolts are pushed through vertically upwards into the cross bars.
The reinforcement straps are already taped by us at the corresponding position below the element hanger.

Each of the element hangers have to be held below the boom.
Then the four bolts have to be pushed through from below, through the reinforcement straps, through the element platform, upwards through the cross bars.
Finally M8 self locking nuts have to be screwed onto each bolt.
Make sure that the platforms are exactly in a right angle compared to the boom and fix all solidly.

2.5 Screw connections of the element sections

2.5.1 SEGMENT TRANSITIONS 60/55, 55/50, 50/45, 45/40 AND 40/35mm

To achieve a special stability the sections on the first five transitions have an overlap of 50 cm. In addition they are double drilled crosswise.
While assembling the element sections the following segments have to be inserted into the previous segments until the drill holes overlap perfectly. The outer drill hole will be in the vertical position.

Then the 8mm ss screws (the thickest ones) have to be pushed through the drill holes in a way that the screw heads of the outer screws point upwards.
On the opposite side the washers have to be slid over the screw shaft and the self securing nuts have to be screwed on and **tightened solidly** (hold the screw heads with the included tool).

Principally there are **screws of two different lengths** (70 and 55 mm).
The **longer** ones are used to connect the segments 60/55mm, 55/50 and 50/45 mm.
The **shorter ones** are used to connect the segments 45/40 and 40/35 mm (please orientate by the included schematic diagram of the antenna).
Regarding the transition 50/45mm the 70mm long screw has to be used only on the inner horizontal located drill hole.
Concerning the **outer vertical located 50/45mm drill hole** use one of the included extra long screws (counts for all six element halves). Here the **vertical insulator ring** of the inner element V truss will be fixed later.
In controversy to the above explanation this screw connection has to be realised in a way that the screw shaft points upwards because here the insulator ring of the inner element truss will be slid on (see fig. 2.6 and 2.8).

2.5.2 SEGMENT TRANSITIONS 35/30, 30/25, 25/20, 20/16 AND 16/12 mm

On the following five segment transitions the segments have an overlap of 10 cm and they are drilled to each other one time vertically.
While assembling the element sections the following segments have to be inserted into the previous segments with their side which has two drill-holes **equal in size**. The tubes have to be put in until the drill-holes of both segments overlap perfectly. The enlarged drill hole of the previous segment has to point **upwards**.
Then the corresponding ss screws have to be pushed through **from the side of the enlarged drill-hole** (= from the top) of the previous segment.

There are **screws of two different diameters** (6mm and 4mm) and of different lengths.
The **6mm screws** are used for the 35/30 mm and the 30/25 mm transition (please orientate by the included schematic diagram of the antenna).
The **4mm screws** have to be used as follows: 25/20mm transition = longest screw, 20/16mm transition = second longest screw, 16/12mm transition = shortest screw.
On the opposite side the washers have to be slid over the screw shaft and the self securing nuts have to be screwed on and **tightened solidly** (hold the screw heads with the included special screw-driver against turning, depending on the screw diameter use the thicker or thinner screw-driver, do it carefully, don't break the screws, the screw heads dive into the enlarged drill-hole, see picture page). This method results in an extremely solid mechanical connection and rattle sounds inside the segment overlaps are totally avoided.

By this way of assembling the required lengths of the sections and the element halves are achieved automatically.

While mounting the elements pay attention that all screw heads show **upwards**.
Keep in mind that the elements hang below the boom. Therefore the screw heads have to be on the same side of the elements where the element plates are located at.

2.6 Assembly of the element sections

We start with the already pre assembled middle section (d = 60mm) which is already fixed onto the element platform.
The following five cross drilled segments (= 55, 50, 45, 40 and 35mm) have to be connected like described at fig 2.5.1.
As already explained pay attention on the outer 50/45 mm transition that the included special 100mm long screw will be used and that the screw shaft points upwards.

The **45mm segment** is the one with the main coil, the coil is already inserted into this segment (see picture on picture page).
When inserting this segment into the previous one pay attention that

a. the **longer side has to be pushed into the previous 50mm segment**. So finally, after having installed this segment, left and right of the coil the same amount of 45mm tube has to be seen
b. the **screw connections of the coil point downwards** (see picture on picture page).

After having fixed this segment the **ring insulator of the inner element V trusses** (horizontal ring) can be mounted. The truss ropes are already fixed to the two corresponding ring insulators by means of a special loop.
The insulator ring has to be inserted in a way that it points upwards towards the element centre (see fig. 2.8 and the photo on the picture page). The insulator ring has to be fixed with a second nut.
When the two ring insulators are mounted on the left and the right side of the driver, reflector and director the **inner element V truss ropes** will hang slack below the element for the moment.

Into the 45mm segment the 40mm segment has to be inserted and into this the 35mm one (please orientate by the included schematic diagram of the antenna).
Starting with the 35mm segment, as already explained, pay attention that the **enlarged drill holes** of all the following segments point **upwards**.

Before the following 30mm section is inserted into the 35mm segment (this counts for all six element halves) slide the **vertical ring insulator** (see picture on picture page) -which represents the outer fastening of the **outer element V trusses** (see fig. 2.8)- over the 30mm tube. We have already fixed the truss ropes to the two ring insulators by means of a special loop. Pay attention that the ring insulator is slid over the segment in a way that the truss ropes which come out of the smaller hole lead **towards the centre of the element**.
When the two ring insulators are slid over on the left and the right half of the driver, reflector and director the outer V-truss ropes will hang slack below the elements for the moment.

You now have to insert the 25mm segments into the 30mm sections and the 20mm ones into the 20mm sections, followed by the 16mm ones.

Finally the 12mm tips have to be inserted. These 12mm end tubes have three drill holes (counts for driver and reflector). The **middle one** of the three drill-holes has to be chosen (regarding tuning facilities, see fig. 4).

2.7 Installation of the balun

The OB3-80+ is fed through a high quality 2 : 1 balun.

The balun has to be mounted at the driven element by means of two right angle aluminium connection straps.
Finally the balun has to be tightened to the boom by means of a tie wrap.

The entire installation can be seen on the picture page.

2.8 Installation of the inner and outer element V-truss

Due to reasons regarding stability and optic the driver and reflector are trussed in the centre by means of an element truss T-mast and four ropes each, i.e. the **inner and outer V trusses** (see pictures on picture page).

The element V trusses have to be mounted to a **T mast**.
Due to the transportation the T mast is split into two pieces, the vertical support mast and the horizontal cross arm. The entire T mast has to be pre assembled first.
At the bottom side of the vertical support mast we have already screwed on the cross bars which are used to fix the element platform onto the boom. The cross bars are mounted 90 degrees offset compared to the mounting angles for the cross arm (see below). This way the upper cross arm will finally have its' position 90 degrees crossed to the element (see picture on picture page).
On the upper side of the vertical support mast you will see two smaller right angle plates into which we have inserted two screws each (= total of 4 screws). On each screw you will find a big washer and a self locking nut screwed on. Remove the nuts and washers and put the cross arm onto the four screws. Then slide the big washers over and screw the cross mast on solidly.

All element truss ropes hang slack below the elements as they were already fixed to the elements by means of their corresponding ring insulators in the moment of the element assembly (see fig. 2.6).

In the centre of each V truss pair we have already fixed an insulator by means of a special double loop. These insulators now have to be inserted into the corresponding drill hole (left or right side) **on top** of the cross arm.
The ends of the V trusses are fixed to the corresponding ring insulators by means of a special loop as well (see picture on picture page). This loop means a continuous exact fastening and simultaneously delivers the possibility for an adjustment of the truss ropes at any time.
If necessary the element now can be brought into the horizontal position (no sag) by adjusting the ropes on both sides at the ring insulators.

For convenience we recommend to first remove the insulators from the cross arm so that the ropes are slack again. By using a pair of pliers the loops of the ropes can easily be pulled through the corresponding hole of the ring insulator and the rope can be adjusted as required. Then the loop has to be fixed again and the centre insulators have to be reinserted into the top of the cross arm.
Long remaining rests of the ropes can either be cut off or somehow fixed at the main ropes.

Important: When the ropes are under tension make sure that the ring insulators of the inner V trusses **point upwards towards the element centres** and that the ring insulators of the outer V trusses sit on the element in a way that the hole in the ring insulator where the ropes are fixed **point upwards**.

2.9 Installation of the boom to mast plate

The boom to mast plate is a solid plate of 500x400mm (width x height)
Four vertical arranged U-bolts are used .to fix the antenna to the mast.
The boom to mast plate hast to be mounted to the boom by using four pieces of the "general" cross bars (no screws which stick out) and eight pieces of the M8x170mm bolts. It has to be attached at the marked position about 10.20 meters from the rear. The installation by using the cross bars has to be done equivalently to the mounting of the element hangers, i.e. the 8mm bolts have to be slid through from the side of the plate through the cross bars. On the other side M8 nuts have to be screwed and all has to be fixed solidly.

2.10 Installation of the boom truss

The boom of the completed antenna mounted to the mast has to be trussed by four included stainless steel ropes of 6mm in diameter which have to be arranged in a **V-shape** configuration.
All four truss ropes have the same length.
Seen from the position of the mast two ropes lead towards the front, two to the back of the boom.
In the centre the truss ropes are spread into the V-shape by a 3 meter long **transverse steel pipe** which has to be mounted to the mast. This results in a horizontal stabilisation of the boom.

The transverse pipe has to be mounted to the mast in a way that, seen from the installation point at the mast, the **slightly longer side** runs across the boom. The transverse pipe needs to be slightly longer at one side to compensate the eccentric mounting of the mast (fixed at one side of the boom) and to finally guarantee an equal trussing of all four truss ropes.
Simultaneously the pre mounted steel eyes on the transverse pipe have to be **horizontal**.
Mount the transverse pipe with the already installed **square clamp** just above the boom in a way that later it can be slid upwards the mast (do not fasten the U-bolts finally yet).

At one side of all four truss ropes we have fixed a **turn buckle**.
Fix these turn buckles at the steel eyes of the transverse pipe (see pictures on picture page)
Make sure as well that the turn buckles are turned out by about 2/3 of their lengths.

At the other ends of the truss ropes there is a metal loop. The metal loops have to be connected to the **outer truss fixation** at the front and the back of the boom.
The outer truss fixation consists of two **cross bars**, one above and one below the boom and two 200 mm long M12 bolts which go through them. On top a nut has to be screwed on which later will fix this system solidly, but just leave everything moveable for the time being.
The outer truss fixations have to be located about **380 meters** from the front end and about **4.10 meters** from the rear end.
Install the metal loop between the two big washers and put the 12mm self locking nut on top, again in a way that the system will stay moveable for this moment.
The steel ropes have to lead towards the transverse pipe.

After this so far realized installation you now have to slide the transverse pipe up the mast by about **1.45 to 1.50 meters** (measured from the centre of the boom) until the truss ropes are pre tensioned and then fix it solidly.
Pay attention that the transverse pipe crosses the boom in a correct **right angle**.

By moving the outer truss fixations the **front and rear pre tension** of the steel ropes can be equalized. After this state is achieved the cross bars of the outer boom truss fixation can be fixed solidly by tightening the bottom nuts. Afterwards the upper nuts have to be tightened as well to finally fix the steel loops between the two big washers.

In case the **left and right side** are not equally pre tensioned after sliding the transverse pipe up the horizontal position of the transverse pipe can be adjusted by pushing it through the square clamp a bit more to the left or the right until both sides of the truss system are equally pre tensioned.
Finally use the turn buckles and tighten all four truss ropes equally until the boom is stable in the horizontal **without any sag**.

The entire installation can be seen on the picture pages.

Generally, in case it locally can be realized this way, we recommend to install the entire truss system together with the mast down at the ground before bringing the antenna up the tower.

2.11 Connection of the relay boxes

By means of the installed relay boxes the OB3-80+ alternatively can be operated in the SSB-DX or CW-DX frequency range.
As already explained in chapter 2.3 the CW loading coils, mounted to the element platforms, alternatively can be switched into function or short cut by the relays which are installed below the elements.

Both, the driver and the reflector, are split by an insulator in the centre.
The relay box is attached to this split insulator.
As well the relay box is connected by two pins each left and right to the loading coils (regarding tuning facilities, see fig. 4).

All three relay boxes have to be **connected with each other** by a common twin lead which has to be attached to the pins which are labelled with "12V DC".
Pay attention that you do not connect the relay boxes reverse, i.e. "plus" should be connected to "plus" and "minus" to "minus".

A second twin lead which delivers 12 Volts from a source in the shack has to be connected to one of the relay boxes, practically to the one of the driven element. This relay, being connected to the source, delivers current into the other relays through the twin lead connection between them.

The twin lead coming from the antenna has to be connected to the delivered **switch box** inside the shack. This switch box has to be connected to a 12 Volt source (range of 12 to about 19 Volts acceptable).
By means of the switch on this box you can choose between the **positions "SSB / high band" and "CW / low band"**.
The position "SSB" represents the current less mode, i.e. the relays on the antenna are closed and the CW loading coils are short cut.
In the position "CW" 12 Volts from the source are delivered into the relays, i.e. they are opened, the CW loading coils are in function and the elements are lengthened correspondingly.
At the bottom side of the relay box you will find a **green control light**. This light has to shine on both relay boxes in the CW mode.

If the **antenna is not used** keep the switch box in the "SSB" position as this way the relays are not under current all the time.

Attention: never switch while transmitting, only do so in the receive mode!!!

3. Connection of coax cable

The feeding of the antenna has to be done by 50 Ohm coax cable.
For connection a PL-259 connector is required which has to be screwed on to the balun housing. The connector should be sealed against water entry.

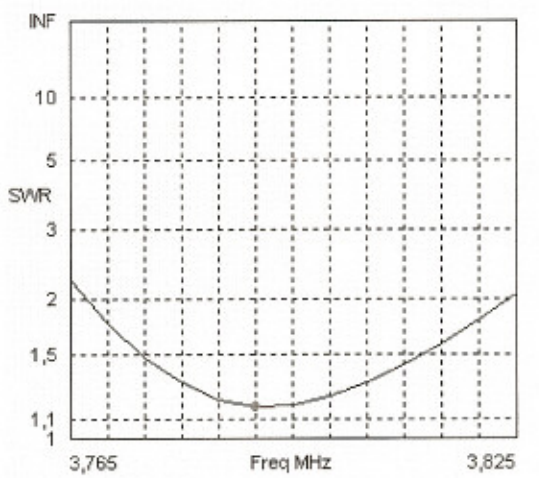
4. Adjustment of the antenna

An adjustment of the antenna is not necessary if the given dimensions are exactly observed.

By some influences of the direct surroundings and due to different heights it may happen that the resonance of the antenna (= point of best SWR) shifts slightly.

4.1 Adjustment in the SSB frequency range

The SWR in the SSB range should roughly show the following curve:



This plot indicates optimum SWR and perfect performance within the international SSB DX window.
Simultaneously this setting offers the possibility for US American users of this antenna to operate within their own specific band range (above 3.800 khz).

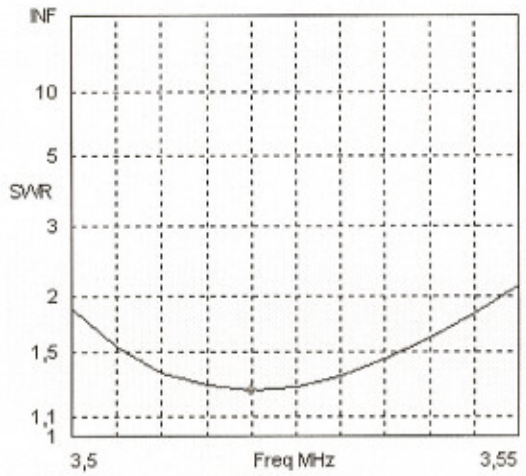
In case readjustments of the SSB resonance point (point of best SWR) are necessary it can be shifted to the desired point by minimum changes of the **tip lengths** on the elements (=shortening or lengthening of the outer 12mm sections).
By a slight decrease of the lengths of both element halves (push outer section in to the last drill-hole) the resonant frequency will be shifted upwards, by an increase (pull final section out to the first drill-hole) it will be shifted downwards.

The adjustment should be done in a way that the driver length would be changed first (shortened or lengthened).
In case that this action would not lead to a satisfying result the reflector and director length had to be changed correspondingly (shortened or lengthened).

Attention: Changes in the SSB frequency range will automatically result in a shift of the resonance point in the CW frequency range.
So in case changes on the element tip lengths are done adjustments have to be made for the CW mode as well even though the frequency coverage was perfect before.

4.2 Adjustment in the CW frequency range

The SWR in the CW range should roughly show the following curve:



This plot now indicates optimum SWR and performance within the CW DX window..

In case readjustments of the CW resonance point (point of best SWR) are necessary this can be done by changing the amount of coil windings on the CW loading coils (which has no influence on the SSB resonance point).

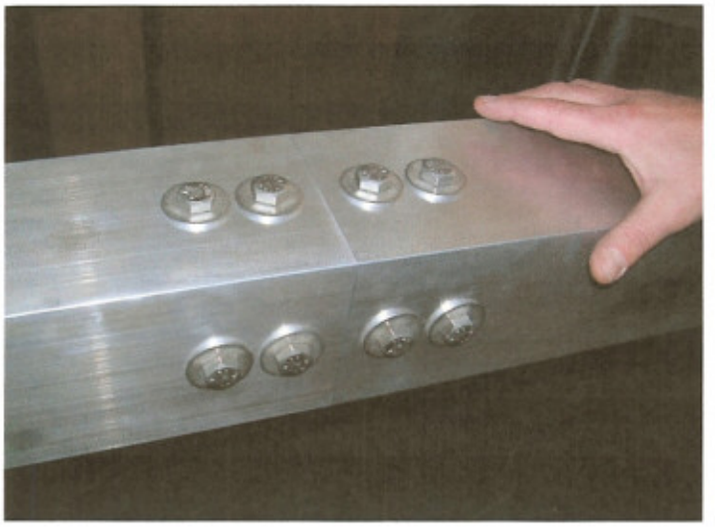
On the one hand the CW loading coils of each element are fixed electrically and mechanically to the two side pins of the relay box by diverse aluminium straps.
On the other hand they are connected on their **one end solidly** to a plastic spreader and on their **other end variably** by means of a "hand" and a steel ring.

By loosening the counter nut on the **steel ring** the 6mm screw which is screwed into it can be un tightened so that the steel ring can be moved on the coil winding.
In addition the corresponding nuts on the hand have to be unscrewed so that it can be moved like a joint.
After all corresponding parts are loosened the steel ring on the coil winding can be moved in the range of **plus / minus ½ a coil turn**.
By moving it towards the end of the coil the inductivity will be increased and the resonant frequency will be shifted downwards.
By moving it towards the centre the inductivity will be reduced and the resonance frequency will be shifted upwards.
But be careful: the coils react rather sensitive, therefore changes have to be done only by small amounts = few cm.
Likewise note that changes have to be done on all three elements and on each of the coils simultaneously by the same amount.

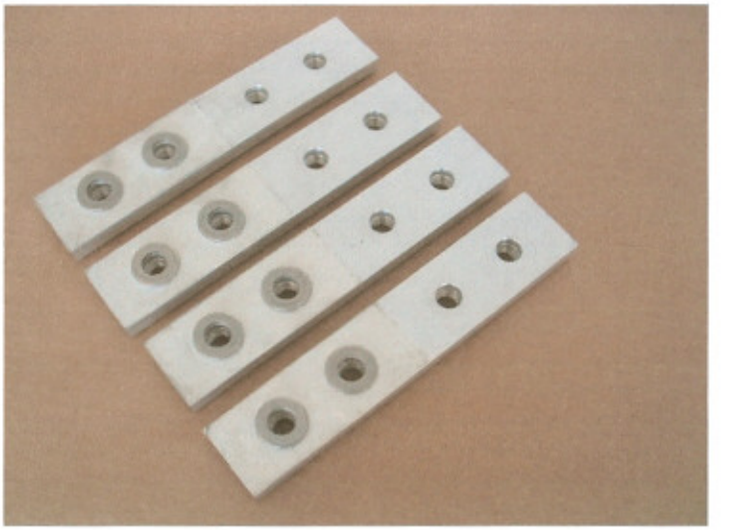
Important: the antenna is already optimally tuned for both frequency ranges. Changes should only be done if they are absolutely necessary.

5. Position of the antenna at strong winds

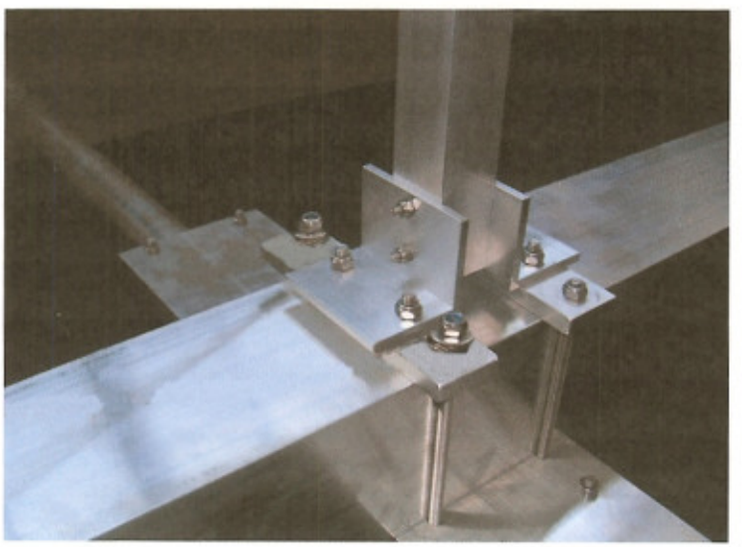
At strong winds the antenna should be placed in a way that the tips of the elements **show straight into the wind** which means that the boom stands broadside to it.
Hereby physical stress to the elements is avoided and their duration is enlarged.



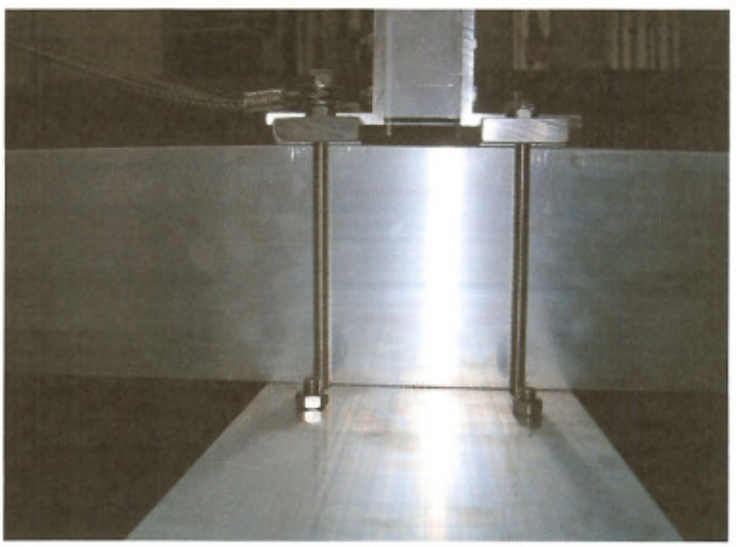
Boomsegment-Kopplungsstelle
boom segment transition



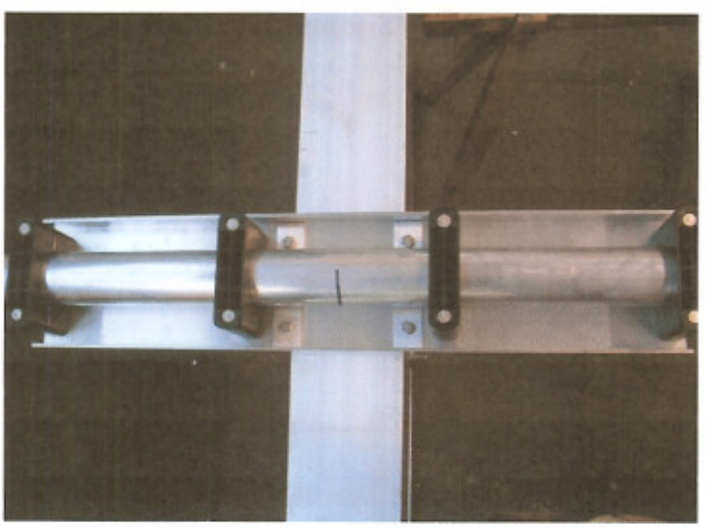
Mutternlaschen für Verbindung Boomsegmente 5mm auf 2,5mm Wand
couplers for transition between boom segments from 5mm to 2.5mm wall



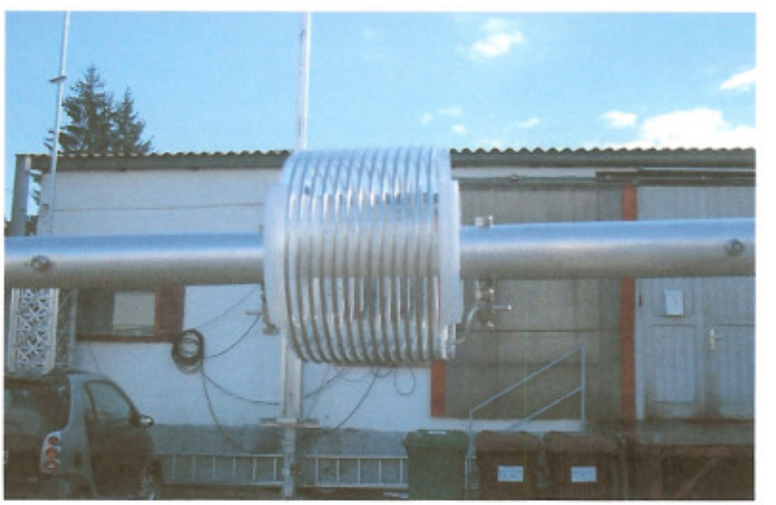
Elementhalter mit Quersteg und T-Träger
element hanger with cross bar and T-tower



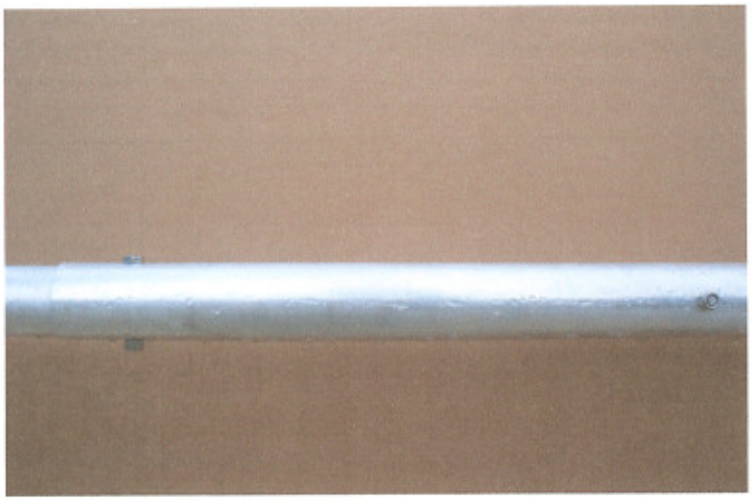
Befestigung Elementhalter Seitenansicht
side view of element hanger fixation



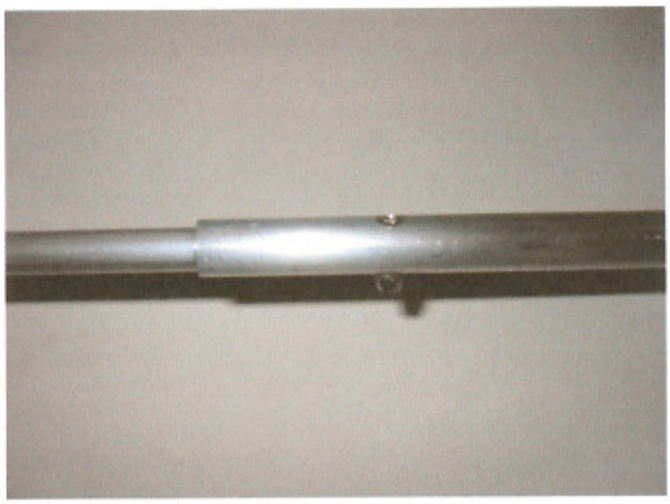
Elementhalter unten mit Verstärkungsriegel
element hanger bottom with reinforcement straps



80m Spule eingesetzt in Element
80m coil inserted into element segment



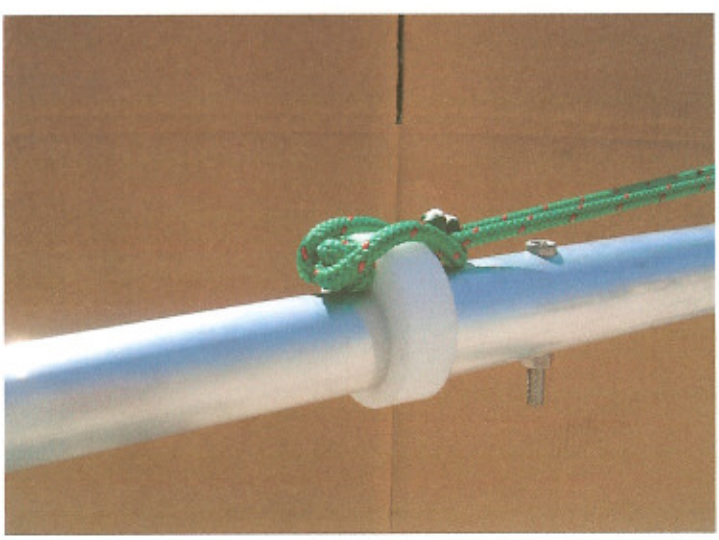
kreuzverbohrte Elementsegmente 60 bis 40mm
cross drilled element sections 60 to 40mm



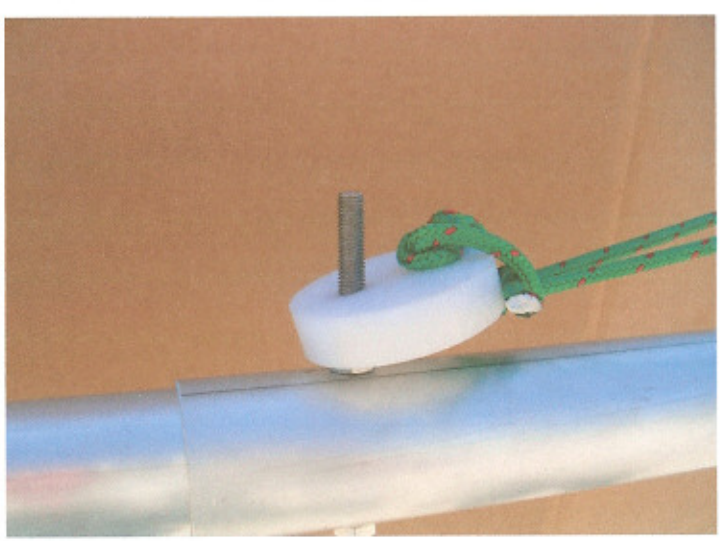
Elementübergänge 35 bis 12mm
element transitions 35 to 12mm

zentrale Doppel-Elementabspannung
centre double element truss

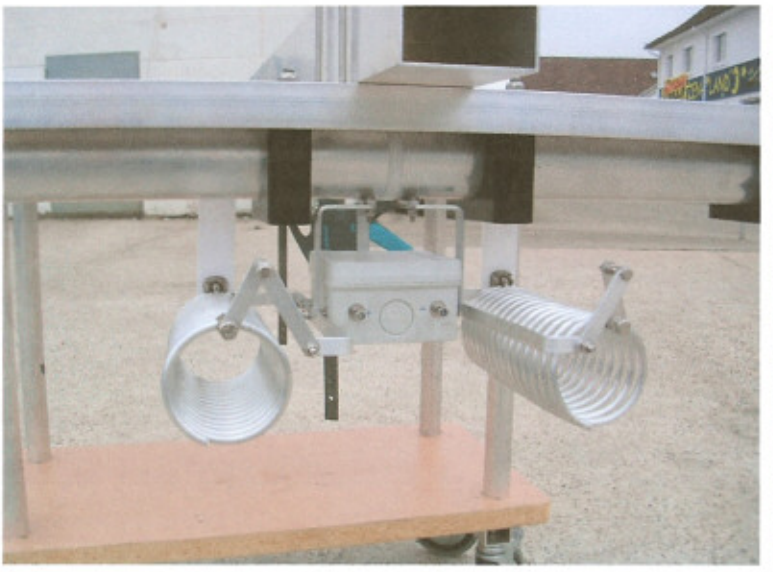
Element-T-Spannturm
element T truss tower

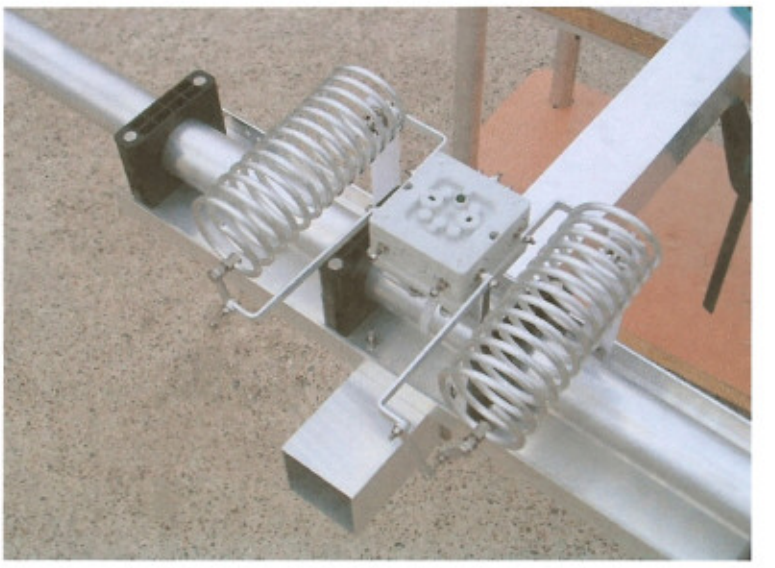


Elementaußenabspannung
outer element truss



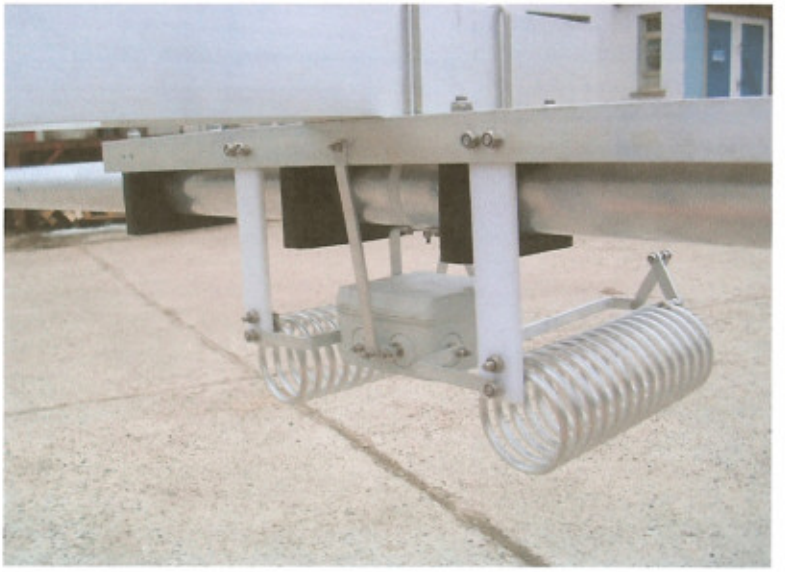
innere Elementabspannung
inner element truss

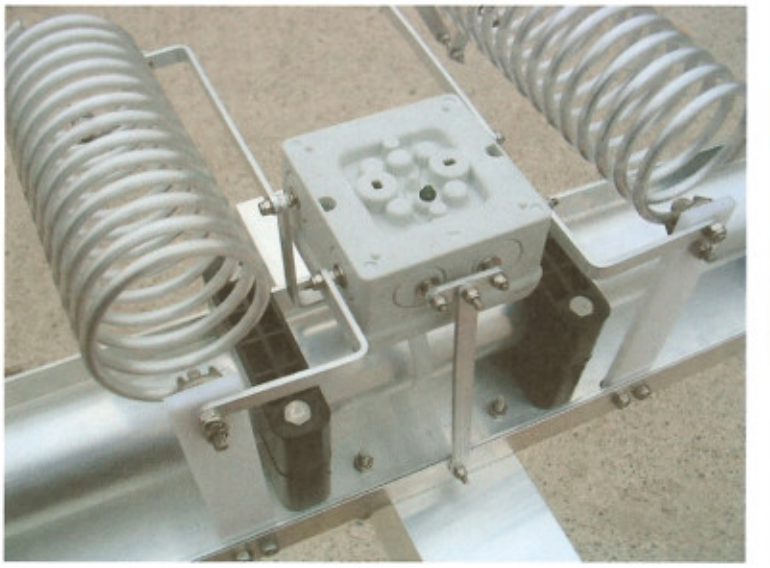




Relaisbox CW Umschaltung mit Ladespulen und variablem Zeiger Stromanschlussseite (Ober- und Unteeransicht)

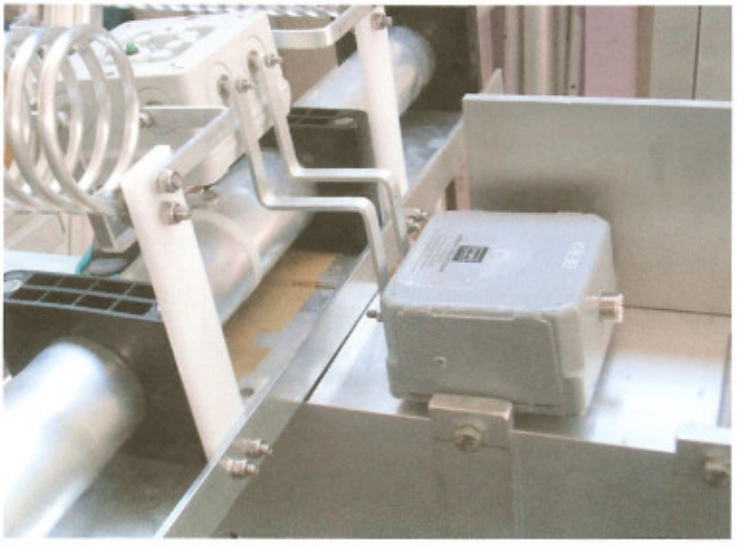
relay box for CW switch with loading coils and adjustable “hand” power display side (top and bottom view)





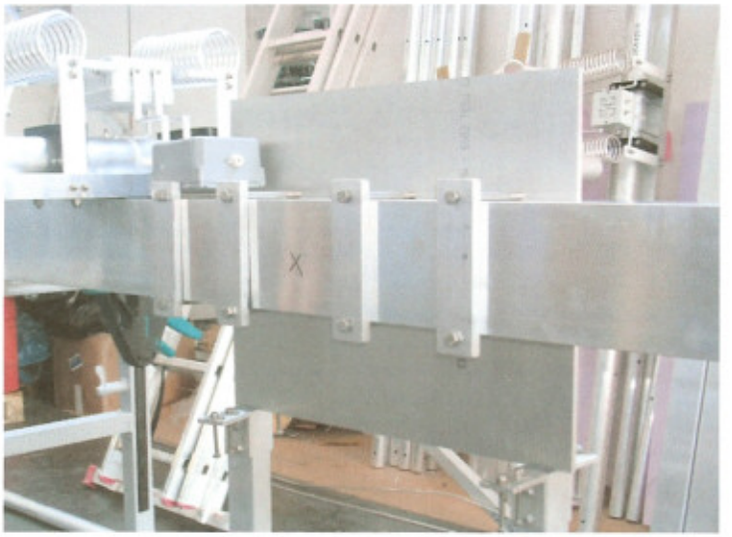
Relaisbox CW Umschaltung mit Ladespulen und Erdung an Parasitärplattform (Ober- und Unteeransicht)

relay box for CW switch with loading coils and grounding on parasitic element platform (top and bottom view)



Relaisbox CW Umschaltung mit Ladespulen und Balun an Strahlerplattform (Unteransicht)

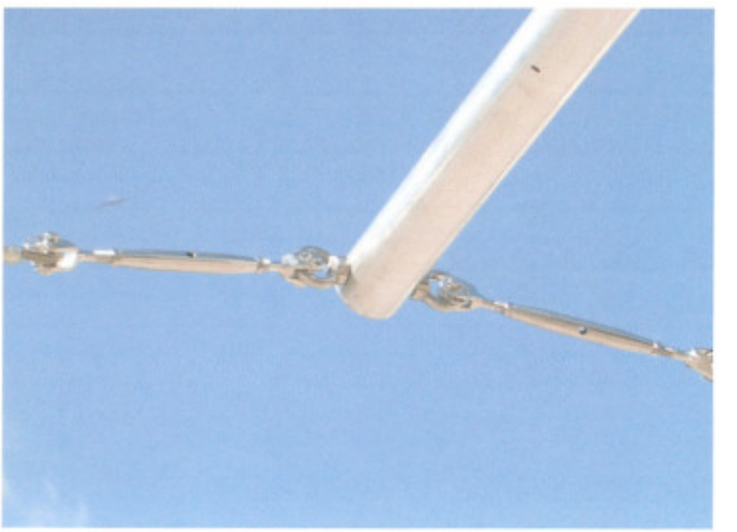
relay box for CW switch with loading coils and balun on driver element platform (bottom view)



Boom-Masthalterungs-Platte dicht an Strahlerelement-Plattform
boom to mast plate close to driven element platform

am Drehrohr montierte Kreuzschelle mit Traversrohr
square clamp mounted to the mast with installed transverse pipe

Traversrohr mit Boom-V-Abspannung
transverse pipe with boom V-truss



Nahansicht Wantenspanner-Befestigung an Traversrohr
close up view of turn buckles installed on transverse pipe

Aussenbefestigung Boom-V-Abspannung
outer fixation boom V-truss ropes