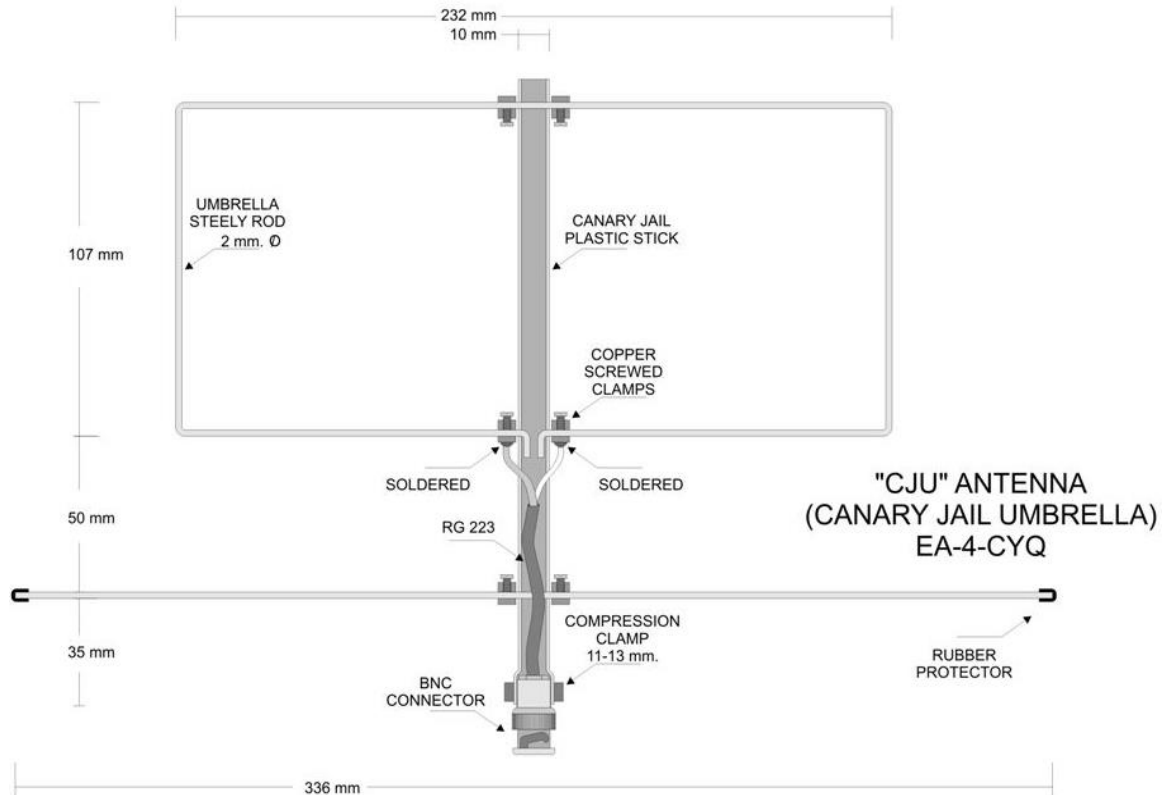


# THE 'CJU' ANTENNA

## THE MAGIC ANTENNA



*Scheme n°1: 'CJU' antenna scheme*

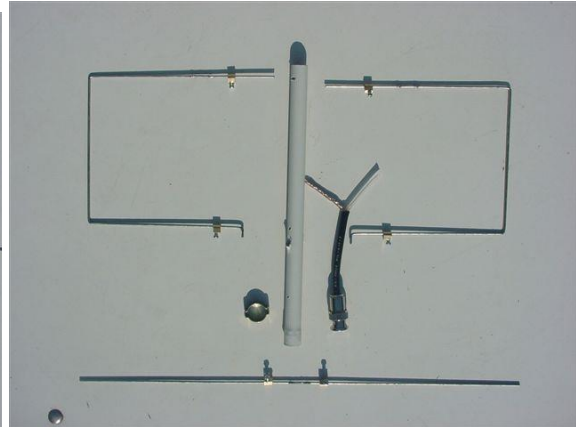
I have published in the Unión de Radioaficionados Españoles monthly magazine several articles about how to enjoy ham satellites, with an HT and a whip antenna or a bit more complex with a fix station.

Pedro EB4DKA published in January 2.000 a marvellous article in which we could learnt step to step how we can work LEO FM satellites with a simple portable station, a full-duplex FM 5 Watts HT and a high gain whip antenna. He showed us how to program the HT memories and what skills we must develop to change the frequency while we are searching for the right polarization.

Later in January 2.004 I published an article by means of which I tried to demonstrate that a 50 Watts satellite fix stations with a couple of little VHF and UHF yaguis could make the same contacts that a HF fix station with a three-band yagui without depending on the propagation. But somebody could say that a HF station is simpler to work, I disagree with this opinion because if you have a PC which aims the antennas at the moving satellite and changes the frequency, we only must talk, our reliable friend (the PC) will do the hard work.



*Photo n°1:  
The necessary stuff to build the  
"CJU" antenna.*



*Photo n°2:  
The different parts ready to be assembled.*

Pedro EB4DKA and I usually have long conversations and we always have the same idea on the brain, to make the ham satellites easier to work so more people will be able to work them. On this occasion we were thinking about how to improve our portable station to make it more efficient.

Lately we have been working in a mixed way which we name mobile/portable, well we stay in the driver's seat with the driver window facing to the satellite pass maximum elevation. On our left hand we handle our HT with a whip antenna changing the orientation to get the best downlink signal and a pair of headphones, with our right hand we handle the mobile station microphone with a  $1/4\lambda$  whip antenna on the roof car and 50 Watts to uplink. This way of working have given us a impressive outcome even with SSB LEO satellites, but I will not speak about them to clarify the article.

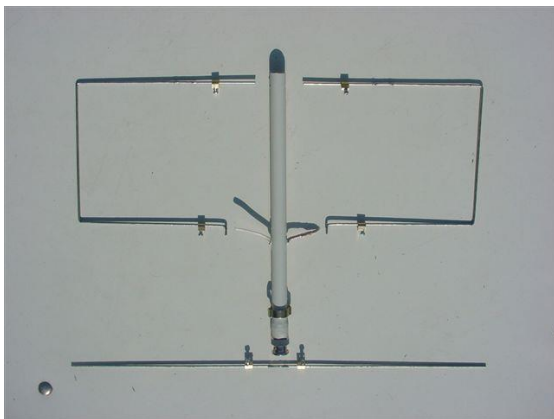
We were analysing how to improve this mobile/portable station and we decided that we must improve the reception because with the  $1/4\lambda$  whip antenna on the roof car and 50 watts we did not have any problem to uplink, and if it was necessary we could always increase the power out.

How all of us know the difficult thing is to receive the downlink because the satellites usually transmit with power out between 50mWatts and 500mWatts with changing polarization and up to 800Km far away. Somebody could think that it is impossible to receive with an HT and a whip antenna, but it is possible. We can not expect to hear it clearly, we will have to make an effort to pick the modulation up from the noise and we must add that we have to change the polarization and the frequency to face to the Doppler effect.

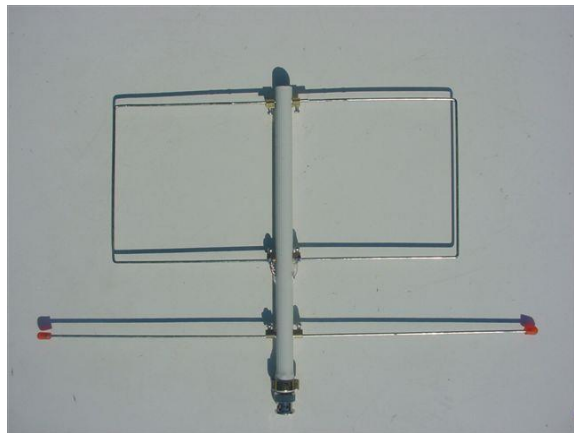
The LEO FM satellites usually work in V/U mode (we must transmit in the VHF band and receive in the UHF band), so the Doppler effect in the downlink is up to +/-10 KHz in the worst case. On the other hand in the VHF band the Doppler effect is less noticeable, only +/-2.5 KHz, we do not even need to change the transmitting frequency because the wideband of ham satellites are over 5 KHz, the same as our FM transceivers.

To sum up, we must try to improve the UHF received signals. When an antenna is attached to an HT, the feed line or no exist or it is too short that we do not have feed line losses, so to set a preamplifier is a nonsense. Then we only had a way, to improve the antenna.

We were browsing the Net searching for a high gain UHF antenna to be attached directly to the HT, but we only found whip antennas that we have just tested. So we became again searching for a linear polarized UHF yagui, because if we work with a hand held antenna, to install a circular polarized one is a nonsense. But it must be small enough to be directly attached to an HT.



*Photo n°3:  
The BNC connector definitely installed.*



*Photo n°4:  
CJU antenna ready to work, it has even installed the rubber protectors at the reflector endings.*

Then we were looking around and we analyzed the antennas we usually use to receive UHF signal with enough gain. The most veteran is the Arrow (we have just reviewed it in the January 2005 Unión de Radioaficionados Españoles monthly magazine). The Arrow antenna has seven elements in a 1.20 meters boom length, it is too large to be attached directly to an HT.

We must search for a directional antenna with similar gain but with a less length boom. We can only find this feature in the cubical quad antennas. Then we remembered a known good reputation antenna into the satellites world, the IOio antenna (We have just reviewed it in the January 2006 Unión de Radioaficionados Españoles monthly magazine). The IOio antenna, in its UHF part, is a square radiator and a linear reflector set in a 0.2 meters boom length. This antenna has a bit less gain than the seven elements Arrow antenna because the IOio antenna is equivalent to a four elements yagui antenna, but we have experienced that it has enough gain to receive the satellites comfortably. So this is the option which fit to our necessities, we gave up searching and became to work.

We needed a lightweight boom which it could be of plastic of 0.2 meters length and 10mm internal diameter, because it is the BNC connector external diameter, so it could be set into the plastic boom. We were searching around for some stuff suitable but we did not find it, so I talked about it with my father EA4ABV who apart from ham he enjoys raising canaries, and told me wait, perhaps the plastic stick where the canaries

perch on in the canary jails has this measurement. I used the inner diameter of the perch and it was perfect.

To build the radiant and reflector elements I needed a steel wire, when I came back from my father home to the mine a broken umbrella tossed in a trash can caught me eye. The rods were perfect too, it was a lucky morning walk. To connect the radiant element to the BNC connector I used a piece of RG223, a low losses 50 Ohm feed line with the same diameter than the RG58.

You can see the “CJU” antenna details in the Scheme n°1. The antenna consists of all the stuff you can see in the Photo n°1: the plastic stick, the umbrella rod, the BNC connector, the screwed cooper clamps used in electrical installations and a compression clamp to fix the BNC connector to the plastic stick.

In the Photo n°2 you can see the rod umbrella blended to the right length and the BNC connector soldered to a piece of RG223, the other end of the feed line has been uncovered a small length to solder later to the radiator element. The Photo n°3 shows the BNC connector in its definitive place and the Photo n°4 shows the finished antenna in which I have set a rubber protector at the reflector endings to avoid damaging anybody while we are managing it. In the Photo n°5 you can see me working with the antenna and in the Photo n°6 you can see the complete antenna system, a  $1/4\lambda$  whip on the car to uplink and the “CJU” antenna on my right hand to receive the downlink. Well, in a couple of afternoons I have just built the prototype, now Pedro EB4DKA had to test it because he is the expert at working in portable conditions.



*Photo n°5:  
EA4CYQ working with the ‘CJU’ antenna*



*Photo n°6:  
Complete EA4CYQ mobile/portable station.  
A  $1/4\lambda$  whip on the car roof to uplink and  
the ‘CJU’ in the downlink.*

When I told Pedro what kind of stuff I have used to build the antenna we were burst out laughing for a while and he quickly baptized the antenna as the Canary Jail Umbrella antenna in relation to the stuff it was built. But in our minds were the same question, Would it work?

Pedro has been testing the antenna for several weeks with all the V/U mode FM LEO satellites, and each time he listen to the satellites he is amazed because the feed line losses are nearly zero so it works as if a preamplifier was installed and the signal never were worse than the signal he received with the Arrow antenna. He has even

received the FO29 with signal 5 and he has listening to the SO-50 from AOS to LOS with any problem. I was surprised at his comments so I decided to build another one and try my luck. I usually receive the satellites in my shack with 15+15 elements crossed yagui with a switch capable to switch between right and left circular polarization plus 25 meters of 1/2" feed line without preamplifier. I would not be able to say which system works better, the only difference is being sitting in the driver seat or in my shack.

The outcomes are amazing and I invite you to build the 'CJU' antenna because it is very easy to build and you will be able to take advantage of its surprisingly performance even in terrestrial communications. Pedro EB4DKA is updating its WEB <http://www.eb4dka.tk>, and you can see us working with this amazing antenna in several video recorders.

You need to learn some skills to work satellites so at the beginning you must listening several passes before you push the PTT. You must take into account that a FM LEO satellite is a repeater with a sole bigger than Europe so if you keep the PTT on for several minutes to try to listening to yourself your are sending a carrier which interfere with other stations, so **IF YOU CAN NOT LISTENING TO YOURSELF YOU MUST NOT KEEP THE PTT ON**. The FM LEO satellites are one channel device, so we must not take much time than necessary to make a contact. We must give other hams the opportunity to make more contacts. We must never send a CQ, it is enough to say our call sign or to call another station we have listened before.

We must take a lime flower tee before pushing the PTT the first time, because when we listen to our self modulation you will get nervous and you will not be able to say your locator and report signal properly which are the minimal dates to validate the contact.

The following frequencies are exclusively for satellite use:

- VHF: between 145.800 MHz and 146.000 MHz all modes.
- UHF: between 435.000 MHz and 438.000 MHz all modes.

It is a pity to listen to hams, specially from our country, through the satellites. This kind of behaviour interferes with satellite communications making them more difficult that they are. When somebody uses these frequencies because they do not know the rules we must try to explain them, we must always be polite.

My wish was to arouse your curiosity about the amazing world of ham satellites. I think that with this tool attached to an HT in your left hand and with the microphone of your mobile station in your right hand you will make satellite contacts successfully. I am looking forward to listening to you soon!

I take advantage of this opportunity to say hello to all hams who work this mode and all the hams from Vegas Altas del Guadiana, because their experience and advice help us to bring out these easy projects.

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Note: This article was published in the Unión de Radioaficionados Españoles monthly magazine in June 2006, in the AMSAT bimonthly magazine in Ene./Feb. De 2006, in CQ DL-Special Antennas magazine in June 2006 y en CQ DL-Special Satellites magazine in October 2006.