VHF/UHF  Dual Band J-Pole

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The DBJ-2: A Portable VHF-UHF Roll-Up J-pole Antenna for ARES

WB6IQN reviews the theory of the dual band 2 meter / 70 cm J-pole antenna and then makes detailed measurements of a practical, easy to replicate, "roll-up" portable antenna.

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The DBJ-1: A VHF-UHF Dual-Band J-Pole

Searching for an inexpensive, high-performance dual-band base antenna for VHF and UHF? Build a simple antenna that uses a single feed line for less than $10.

Terry and antenna are small enough to be used in the lower frequency bands, and the availability of repeaters on this band greatly extends the range of VHF/UHF communications. For example, a 2 meter repeater is usually found at 145.00 MHz, which is a popular channel for local communications. The La Jolla Repeater group uses a 2 meter J-pole to extend the coverage of their local repeater.

The DBJ-1 was introduced to the amateur radio community during the ARRL International Field Day in 2013. The design is simple and effective, using a single J-pole and a small ground plane. The antenna is lightweight and easy to transport, making it ideal for emergency or portable operations.

The DBJ-1 is a good example of how simple and effective antennas can be. The design is easy to build and requires minimal tools and materials. It is a great addition to any amateur's antenna collection.
Why a J-pole?

- J-pole configuration - no radials
- Ground plane requires radials – high wind load
- Very close to an ideal dipole pattern
• First introduced to the ribbon J by AE6C in 1990
• Antenna excellent - considering simplicity
• Stick it in a PVC 3/4” - very durable
• Will last for years since PVC is UV protected.
• To date – we have delivered over 10,000
• Price to performance - excellent
• It will also resonate at odd harmonics
• Ah ha!!! It will also work at UHF
• Very poor performance because of phase cancellation
• Typically 6-8 dB of loss at 3\textsuperscript{rd} harmonic
• Goal is to design a dual band J-pole but without the loss
• New design must be simple, reproducible, no radials due to wind load.
• No inductors, no capacitors, because they are not easily reproduced.
• I tried all types of configurations, but this one seems to work the best.
• Basically matching is the same at VHF and UHF.
• A 1/4 wave decoupling stub (RG174) is used at UHF
Smith Chart

Inductive

Capacitive

Represents 1/2 wavelength once around
0 ohms on left side
infinity at right side
normalized to 1 at center
Splice and short together

Cut out a 1/4” notch

300 ohm twinlead

37 1/4”

15 1/4”

1 1/4”

RG174a coax

Splice and short together

Figure 1  The original 2 meter ribbon J-Pole.
Figure 2 Horizontal pattern of fundamental and 3\textsuperscript{rd} harmonic. At the third harmonic most of the energy is launched at 45°.
**Figure 3** The 2 meter J-pole modified for both VHF and UHF operation.
Figure 4  The dual band J-pole modified for portable operation. Note that dimensions are slightly longer due to the velocity factor of air.
Notice that the dimensions on the DBJ-2 (roll up) are longer than the DBJ-1 (base station). This is because we have compensated for the velocity factor of the pvc pipe.

The pvc pipe used is very important. We found that Lowe’s item #23990 was the best performance for RF.
Figure 5a  2 meter J-pole at UHF.

Figure 5b  DBJ-1 at UHF.
### Table I
Measured relative performance of the dual band antenna at 146MHz.

<table>
<thead>
<tr>
<th></th>
<th>VHF ¼ wave mobile</th>
<th>VHF rubber duck</th>
<th>Standard VHF J-Pole</th>
<th>Dual Band J-Pole</th>
</tr>
</thead>
<tbody>
<tr>
<td>-24.7db</td>
<td>-30.5 dB</td>
<td>-23.34 dB</td>
<td>-23.47 dB</td>
<td></td>
</tr>
</tbody>
</table>

### Table II
Measured relative performance of the dual band antenna at 445 MHz.

<table>
<thead>
<tr>
<th></th>
<th>UHF ¼ wave mobile</th>
<th>UHF rubber duck</th>
<th>Standard VHF J-Pole</th>
<th>Dual Band J-Pole</th>
</tr>
</thead>
<tbody>
<tr>
<td>-38.8 dB</td>
<td>-41.3 dB</td>
<td>-45 dB</td>
<td>-38.9 dB</td>
<td></td>
</tr>
</tbody>
</table>
Here I am in my lab using the HP8753D 6 GHz network analyzer.
Stub shows a clear resonant at 445MHz.
Hands touching at shorted end. Graphs changes, but not 445MHz resonant point. This says I can place anything at shorted end without affecting the 445MHz resonant high impedance.
146 MHz marker of the UHF shorted stub.
445 MHz marker of open wire.

146MHz marker
DBJ-1 mounted on the side of the roof.
DBJ-2 kit – roll up dual band with BNC, SMA, and reverse SMA. Also 6ft extension cable.
The two element UHF phase conlinear with the voltage and phase given on the right. Dimensions are given for insertion into ¾ inch 200 PSI pvc pipe. US patent 8,947,313
2mt / 220 MHz/ 70 cm - Tri band antenna with helical loop which allows for insertion into a ¾ inch pvc pipe. Total length is 5 ½ feet which is a practical length for ¾ inch 200 psi pvc pipe.
DBJ-1 dual band base antenna - available in HAM (144-148 MHz and 440-450 MHz) or Commercial (152-157 MHz and 460-470 MHz) $25

DBJ-2 dual band roll up antenna - available in HAM (144-148 MHz and 440-450 MHz) or Commercial (152-157 MHz and 460-470 MHz) includes 6ft extension, BNC, SMA and SMA female adapter $25

TBJ-1 triband base antenna 2mt/220 MHz/70 cm -- $60 - includes shipping with 6ft of pvc pipe.

50 ft RG8x coax cable with molded PL259 connectors $25

6ft extensions cables (BNC male to BNC female $5

BNC – female to PL259 (adapter for roll up DBJ-2 to mobile or base) $2