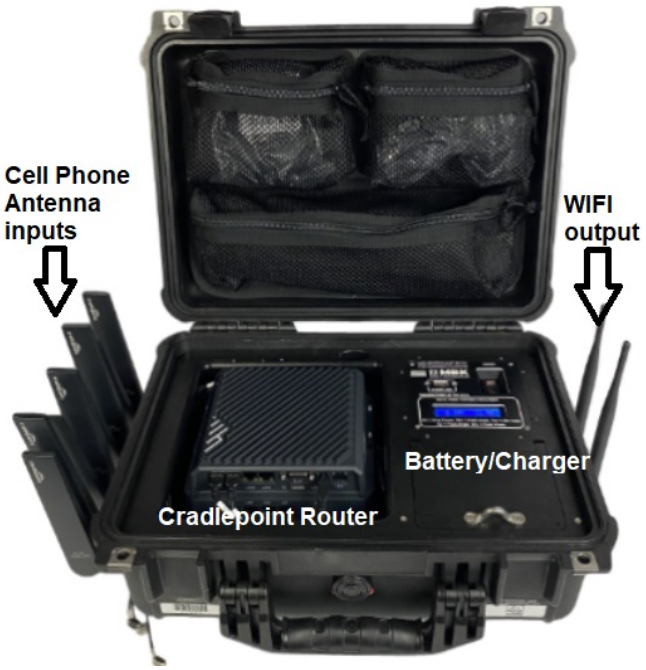
Alachua County Comms Volunteers Investigate Mobile Broadband Kit

by Gordon Gibby KX4Z



The mobile broadband kit (https://mobilebroadbandkits.com/) is a commercial version of a personal cell-phone hotspot, providing WIFI Internet to dozens of users from a high capacity cell data modem accessing existing cell service. Numerous military groups and emergency management teams have purchased the system sold by mobilbroadbandkits.com (appears to be a subsidiary of the Midland, GA firm 4KSolutions). Alachua County Emergency Management owns one of the complete $10,000 systems and invited members of our NFARC/ARES(R) volunteer group to an "inservice" practice with the device after it had been utilized in a couple of hurricane deployments.

ARES(R) and other ham radio volunteers are likely to have increasing contact with this commercial system for providing relatively high speed Internet to a deployed organization. Florida Baptist Disaster Relief already uses this type system as well. Cisco appears to have a competitive product (https://www.cisco.com/c/dam/en_us/about/doing_business/business_continuity/eck-cisco-solution-overview.pdf) Our experience is that ham radio expertise will be a huge help in getting one of these units working properly.

Supervised by Emergency Management Coordinator Dalton Herding KO4RGT (who got his license after one of our courses), Wendell Wright KN4TWS, David Huckstep W4JIR, Leland Gallup AA3YB and myself first opened up and examined the Pelican-cased MBK (mobile broadband kit) before tackling the mast and external antennas.

This pricey high-datarate system is built around the $2000 Cradlepoint R1900 router, with dual-SIMcard access to cellular networks, and a 8AHr LiFePO4 battery with charging system. The Cradlepoint R1900 router capabilities include both 5G and 4G LTE. (Ref: https://customer.cradlepoint.com/s/article/R1900-Getting-Started) Our system is configured for FirstNet and should add a second cell vendor in the future.

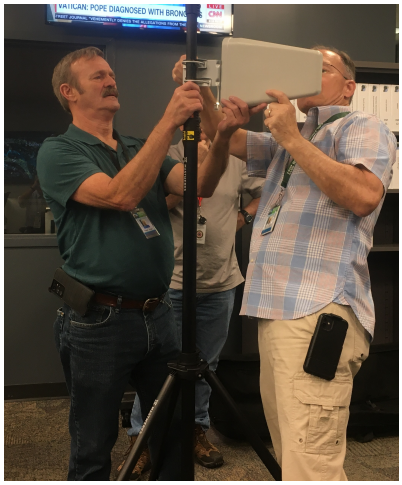
Multiple SMA connectors on the left side of the Pelican case allow cell service multi-band antennas to be installed, as well as a GPS antenna. On the right side, (a) power enters from any of several sources, including charger, solar powered charging system, or vehicular connection. Also on the right hand side are (b) multiple possible WIFI SMA output connectors.

Operation of this system is fairly turn-key. Turn it *on* with appropriate antennas connected, observe blue cell-service "bars" of signal eventually show up on the Router, and then use your computer or phone to find the SSID of its WIFI network, provide the proper password, and you are connected to the Internet. The EM Dept had a nice handout with all of the relevant names and passwords.

The solar power system has some "interesting" connectors and we were glad that we studied it carefully BEFORE it was desperately needed. After we figured out what goes where, we taped some connectors together to prevent confusion later.

MOVING TO THE TOWER

It got much more interesting when we started to deploy the $$$ 30-foot telescoping mast system (https://www.buddipole.com/10mmatrandma.html) and associated various cell-phone and wifi antennas. The cell antennas include both **wedge-shaped directional (10dBi) antennas** and **omnidirectional verticals** with N connectors. The wifi antennas are relatively short collinear antennas, also with wifi connectors. There are multiple 75 foot coaxial cables for both systems in the large pelican case for the antennas -- but only much later did we realize that the *MBK input connectors on the left side (cell phone antennas) and right side (wifi antennas) are DIFFERENT SMA "polarity" and that the supplied cables have different male/female SMA connectors to match*! Thankfully we didn't damage anything by forcing the wrong SMA connectors before we figured this out!



The instructions for the 30-foot mast are lengthy and confusing. First we worked INDOORS just to figure out the guy wires and mounting of the cell phone wed antennas (see photo). Then we moved OUTSIDE and dared to try to send this slender bendy tower up into the sky. Eschewing READING THE MANUAL, our team looked at the pictures and **forged ahead** -- ***leading to a moment when the mast almost tipped over or broke.*** Our patient EM mentor got a little "exercised" at that point! There are two sets of triplicate guy ropes (6 total) and "tent stakes." We found that following the instructions, and setting up the tent stakes and guy wires with the mast extended to the first position, and then the final position BEFORE adding antennas turned out to be a wise plan (and that of the instructions!) because even though the guys were quite loose until the mast reached normal height with antennas attached, they still acted effectively to prevent undue tilting/tipping.

UNRESOLVED ISSUES

There was a problem with the Cell antenna inputs. The Router apparently has MIMO (multiple-input-multiple-output) antenna capability. We did not understand this and probably did not provide the proper "pairs" of antennas (x2 or x4) to exploit this properly; using only a single cell phone external antenna (with 75 foot cable) we found only the left rear ("main") SMA connector actually took input and made cell connections.

We also found an issue with the external WIFI antennas. Comparing the short plastic indoor WIFI antennas right on the right-hand wifi outputs, to a collinear at 30 feet on the tower through 75 feet of the cable, we had a stronger signal to our cell phones even 30 yards away. A bit of internet sleuthing

suggested the loss in the 75 feet of cable was 10dB or more. Our conclusion was that the external cell phone mast antennas might be useful if local cell service is out; the ability of the expensive mast to rotate and align one of the 10dB gain wedge antennas might be very helpful in that circumstance. The indoor wifi antennas' lack of the 10db loss from the cabling suggested that positioning of the MBK itself optimally inside the building where service was needed might provide better service than the tower-mounted WIFI antennas.

Suggested Tutorial on MIMO:
https://www.electronicdesign.com/technologies/communications/article/21799530/the-fundamentals-of-mimo