

QST



DIGITAL EDITION



ARRL The national association for **AMATEUR RADIO®**

January 2019 www.arrl.org

DEVOTED ENTIRELY TO AMATEUR RADIO

CHILL OUT with Amateur Radio

QST Reviews

Yaesu FT-818ND HF, VHF, and UHF Transceiver

SteppIR UrbanBeam 40- to 6-Meter Antenna

KKmoon 600X Digital Microscope

Four State QRP Group Murania Broadcast Band Receiver Kit



DIGITAL FEATURE



56 | Watch the Review of the **SteppIR UrbanBeam** 40- to 6-Meter Antenna by Pascal Villeneuve, VA2PV.

Howard E. Michel, WB2ITX
Publisher

Steve Ford, WB8IMY
Editor

Becky R. Schoenfeld, W1BXY
Managing Editor

Jen Glifort
Caroline Kenney
Allison McLellan
Assistant Editors

Bart Jahnke, W9JJ
Contest Branch Manager

Rick Lindquist, WW1ME
Happenings

Bob Allison, WB1GCM
Product Review Lab Testing

Mark J. Wilson, K1RO
Al Brogdon, W1AB
Bernie McClenny, W3UR
H. Ward Silver, N0AX
Paul Wade, W1GHZ
Jon Jones, N0JK
Rick Palm, K1CE
Joel R. Hallas, W1ZR
Barry Shackelford, W6YE
Kai Siwiak, KE4PT
Bruce Draper, AA5B
Contributing Editors

Michelle Bloom, WB1ENT
Production Supervisor

Jodi Morin, KA1JPA
Assistant Production Supervisor

Maty Weinberg, KB1EIB
Production Coordinator

Sue Fagan, KB1OKW
Graphic Design Supervisor

David Pingree, N1NAS
Senior Technical Illustrator

Janet Rocco, W1JLR
Advertising Sales Manager

Bob Inderbitzen, NQ1R
Marketing Manager

Yvette Vinci, KC1AIM
Circulation Manager

Diane Szlachetka, KB1OKV
Advertising Graphics Designer

Steve Ewald, WV1X
Field Organization Supervisor

Eric Casey
Convention and Event Coordinator

- 9** **Second Century**
Building Strength, Maintaining Balance
- 30** **Build a Portable DC Power Box**
Scott Skinner, N2ZLC
- 32** **QSL Card Display Using a Raspberry Pi**
Bill Salyers, AJ8B
- 35** **The 2-Meter Slot-Cube Antenna**
John Portune, W6NBC
- 37** **Matching Antenna Polarization**
Adeline F. Hillier, AA7HH
- 39** **The Cell Patch**
Gene Hinkle, K5PA, and Jim Millner, WB2REM
- 42** **Protecting Shack Equipment from Electrostatic Discharge**
Dino Papas, KL0S
- 44** **Advantages of Software-Defined Radio for Amateur Satellite Operation**
Ronald G. Parsons, W5RKN
- 48**  **Product Review**
Mark Wilson, K1RO
Yaesu FT-818ND HF, VHF, and UHF Transceiver; SteppIR UrbanBeam 40- to 6-Meter Antenna; KKmoon 600X Digital Microscope; Four State QRP Group Murania Broadcast Band Receiver Kit
- 69** **Rookie RTTY Contesting**
Jerry Flanders, W4UK
- 72** **FT8 in the ARRL RTTY Roundup**
Joe Taylor, K1JT
- 74** **Announcing the Winners of the 2018 QST Antenna Design Competition**
Steve Ford, WB8IMY
- 75** **Emily Calandrelli, KD8PKR — Science Explorer**
Jen Glifort
- 78**  **Growing Amateur Radio, One Pilot at a Time**
Frederick Hart, AA0JK, and Bob Inderbitzen, NQ1R
- 81** **2019 QST Key Competition**
- 92** **ARRL International Grid Chase Update**
- 99** **The Winter ARRL School Club Roundup**



The Cell Patch

Updating the old phone patch concept to work with cell phones.



**Gene Hinkle, K5PA,
and Jim Millner, WB2REM**

In October 2017, a few weeks after Hurricane Irma devastated Puerto Rico and other Caribbean islands, I heard a faint signal on the 7.163 MHz DX net. The station, originating from the city of Ponce in Puerto Rico, was weak but readable. The radio operator was requesting assistance in contacting his daughter in New Jersey. He needed to be evacuated from the island and had no other means of reaching her.

When the station asked for someone on the frequency to contact his daughter, my first thought was to use a phone patch. Unfortunately, I had gotten rid of mine and now that I no longer had a landline, it wouldn't have worked anyway. In the end, messages were passed and transportation was arranged, but without some sort of phone patch connection, we could not afford the parties the comfort of hearing each other's voices.

In order to be better prepared for the next emergency situation, we developed an easy-to-build cellular phone patch that takes advantage of modern cell phone technology and can be used from both fixed and remote locations.

Cell Patch in the Modern Era

The cell patch is the modern-day version of the original phone patch. A phone patch enables a person on a phone line to talk over a radio under the control of a licensed radio amateur. Last century, these patches were routinely used by people wanting to stay in touch with family members overseas in areas that were not readily accessible by telephone.

The realization that today's cell phones can connect three or more parties in a conference call led to the cell patch concept. Figure 1 shows how the system works. At a local Amateur Radio station, a cell phone connects to the station's transceiver via audio cables from its headphone and microphone jacks. A second cell phone is used to make a call to a third party who will be talking over the radio channel. The local transceiver

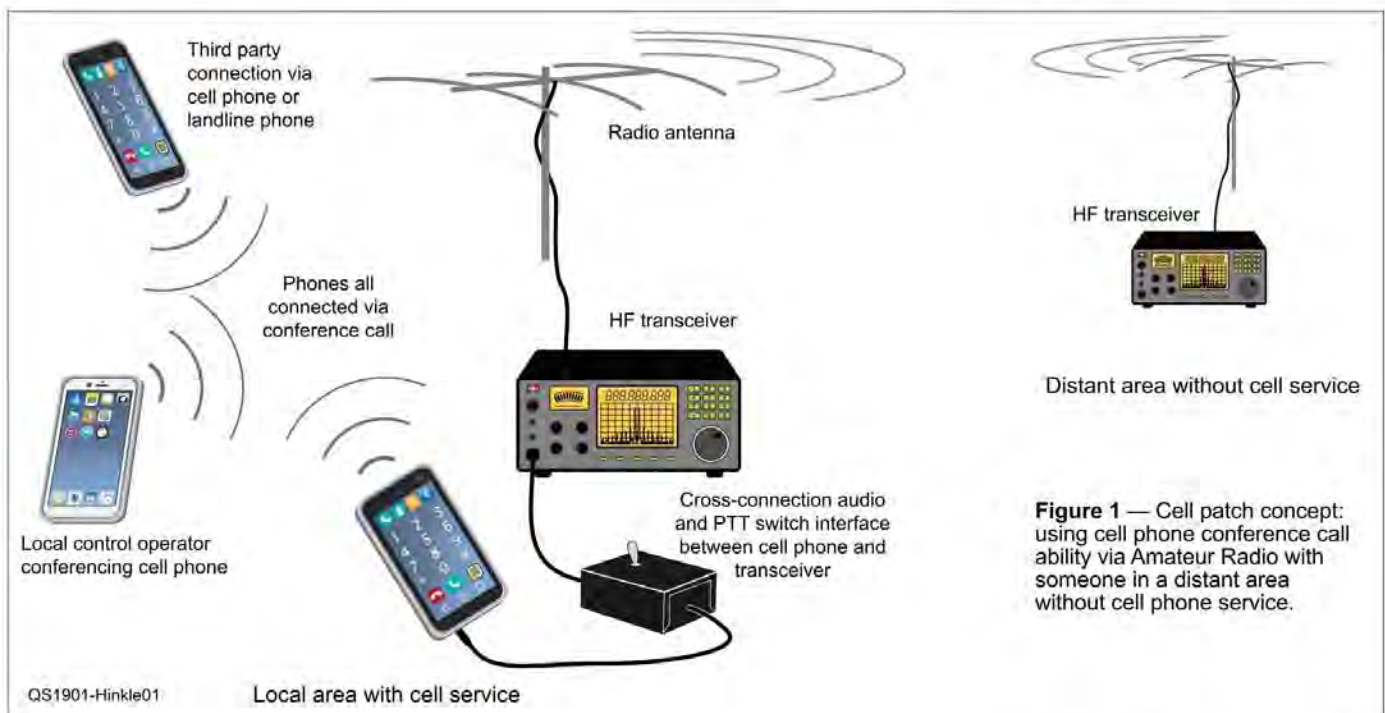


Figure 1 — Cell patch concept: using cell phone conference call ability via Amateur Radio with someone in a distant area without cell phone service.

should already be in communication with the distant radio prior to the phone call being made. Once the connection is made to the third party, a conference call is made to the local radio transceiver's cell phone. Upon connection, all phones have the same transmitted and received audio, and the cell patch is in progress.

Using conferencing greatly simplifies the interconnection of all parties. The third party and distant radio transceiver can talk back and forth while the local control operator can also talk to each person using the local cell phone. Although a voice-activated transmitter (VOX) could be used, it is best for the control operator to purposely transfer, transmit, and receive using the cell patch's built-in push-to-talk (PTT) toggle switch.

Cell Patch Unit

The completed cell patch unit is shown in Figure 2. Our cell patch is designed to connect to Icom transceivers that have both transmit and receive audio available on a Foster eight-pin, front-panel connector. The 1/8-inch-style phone plug is for connecting to the cell phone's headphone and microphone jack. A PTT switch is located on the box for transmit control. We found that the headphone/mic access holes in some cell phone protective cases have very small diameters. Fortunately, there is an inexpensive solution using a short extension cable available online. This extension cable's plug diameter is the same size of the stock cell phone headphone connectors, so it works well.

The schematic for the cell patch is shown in Figure 3, along with the parts lists and vendor information. The design simply connects the cell phone microphone connection to the transceiver's receiver output and the cell phone headphone to the transceiver's microphone connection. However, there are some



Figure 2 — Cell patch unit.

subtle design features that may not be apparent.

The headphone and microphone signals of the cell phone use three of the four terminals located on the TRRS 1/8-inch plug. The convention for the cell phone connector is the headphone (tip), ground (inner ring), and microphone (innermost contact sleeve). Because the microphone is on the innermost contact, it is best to not use a 1/8-inch plug that is shielded because the plug's case would be the microphone signal.

The signal levels going in both directions need some attenuation so that the cell phone and transceiver are kept within proper audio levels. This

is the purpose of the resistors R1, R2, R3, and R4. The resistor R4 is also required so that the cell phone can detect the use of an external headphone/microphone. Otherwise, the cell phone will use its own built-in speaker and microphone.

The audio paths also have capacitors C1 and C2 that are used to block the dc voltages if present on the transceiver and cell phone. These dc voltages are used to provide the voltage necessary for electret microphone elements to function. Capacitor C1 is shown with a polarity in the event one is marked. However, if using the suggested capacitors in the parts list, they are non-polarized, so the polarity on the schematic does not apply.

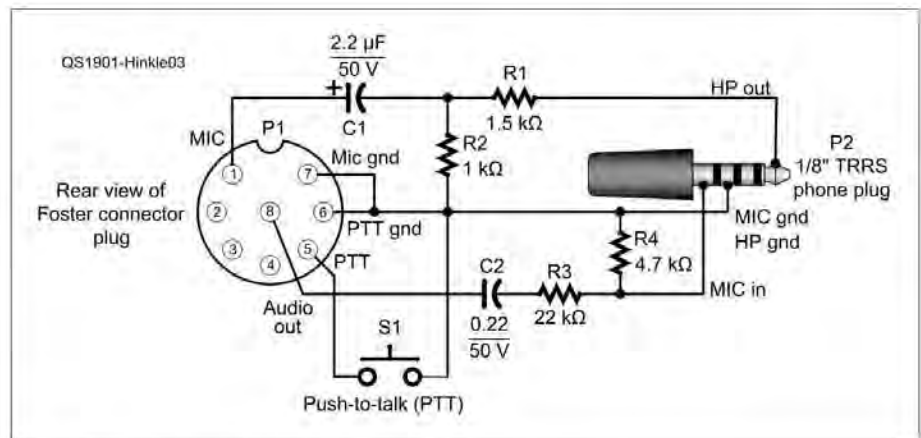


Figure 3 — Cell patch schematic.

- C1 — 2.2 µF 50 V 10% X7R capacitor
- C2 — 0.22 µF 50 V 10% X7R capacitor
- P1 — Foster eight-pin plug, Universal Radio Inc. item no. 2112
- P2 — TRRS cell phone plug, Mouser item no. 490-SP-35401
- R1 — 1.5 kΩ 5% 1/4 W resistor
- R2 — 1 kΩ 5% 1/4 W resistor
- R3 — 22 kΩ 5% 1/4 W resistor

- R4 — 4.7 kΩ 5% 1/4 W resistor
- S1 — SPST toggle switch
- Project box — 3.3 × 2.2 × 0.8 inches, Hammond Mfg. PN 1591XXMSBK, Mouser item no. 546-1591XXMSBK
- Extension cable — 3.5-millimeter TRRS male-to-female audio adapter for mobile credit card reader, Cellet model no. 420900 (Amazon)

Finally, the PTT switch is used to provide the connection to the PTT pin on the transceiver. We originally used a pushbutton but found it much easier to have a toggle switch. The control operator must keep the switch in the off position when the phone patch is not in use. Always remove the cell patch from the transmitter circuit once the phone patch is completed.

If adapting the cell patch to a different radio manufacturer, there are several simple changes to the diagram. First, check the transceiver's microphone connector and change the pin numbers accordingly for transmit audio, receive audio, PTT, and ground. If the receiver's audio is not available from the microphone connector, then connect this signal to the receiver's speaker or headphone jack using the appropriate connector.

We housed our cell patch in a small Hammond plastic project box. All components apart from the PTT toggle switch were mounted on a small perforated circuit board (PC board) and wired point-to-point. Component layout is not critical.

Using Cell Patch

It is fairly simple to initially set up the cell patch. Take the radio cable and plug it into the radio's microphone jack. Next, plug the other cable into one of two local cell phones. Using the second local cell phone, call the first phone. This establishes the primary connection. We suggest using a transmitter dummy load when initially setting up the patch.

Put the cell patch in transmit by throwing the switch on the breakout box. Adjust the radio receiver's audio out and microphone gain levels for normal operation by speaking and listening on the second phone while looking at the transceiver meters to adjust levels. Finally, using the second cell phone, call the third party into a conference call. The third party will be automatically patched into the radio.

Certain precautions with cell patches must be explained to the third party. Let them know that they are being transmitted live over the air with limited privacy, and the limitations on what kind of messages can be passed. They also need to say "over" to indicate the transfer of the conversation to the other party. Finally, inform them that music cannot be played or business transactions conducted. The cell patch session must be quickly terminated if any of the above rules are broken.

Conclusion

The cell patch is both versatile and practical. It is useful in the normal sense of the traditional phone patch where a station on the radio is connected through your station to a person on the telephone. In an emergency event, setting up the cell patch for field or mobile radio operation will enable contact by emergency personnel to a point with cell phone reception.

While phone patches may be archaic in some ways, recent emergencies have shown us that cell phone coverage is easily disrupted by severe storms. Amateur Radio operators equipped with a cell patch will be better prepared to provide emergency communications when the next disaster strikes.

New Products

Andress Technologies K7NV Mast Clamps for Rotators Now Available at DX Engineering

DX Engineering now carries one of Kurt Andress', K7NV, signature upgrades: the Mast Clamps for rotators. They are direct bolt-on replacements for the stock M2 OR-2800 or Yaesu DXA series rotator mast clamps, significantly improving the mast connection to the rotator and preventing mast slippage that can result with larger array setups. The mast-gripping pressure of these clamps can be adjusted by applying more torque to the included fasteners.

Clamp assemblies have a clearance hole in the center to fit over the bolt and bushing that holds the rotator output shaft up to the base plate of the OR-2800. The mast clamp plate has separate holes drilled for M2 or Yaesu rotators. The clamps accommodate 2-inch-diameter masts. They are compatible with either 6-inch round or 6 x 8 inch oval OR-2800 base plates, as well as the heavy-duty Yaesu DXA series.

Bolt kits for mounting K7NV Mast Clamps to either M2 OR-2800 or Yaesu DXA rotators are available separately from DX Engineering. Visit www.dxengineering.com for more information.

Photos by the authors.

Amateur Extra-class licensee and ARRL Life Member Gene Hinkle, K5PA, also serves as a Volunteer Examiner. He earned an MSEE from the University of Texas at Austin and is an IEEE Senior Life Member. Gene began experimenting with ham radio at a very young age, which led to his career in RF engineering. Recently retired from a radio technology company specializing in radio-geolocation, Gene is also a retired professional engineer in Texas. He enjoys working CW, low-bandwidth digital, and making DX contacts. His website, www.k5pa.com, shows his interests, photographs, and many publications.

Jim Millner, WB2REM, has been a ham radio operator for over 50 years. He is an avid DXer, world traveler, and licensed psychologist. He first began experimenting with remote control linking in the 1980s and published the first article on the subject, "The Missing Link," in the September 1986 issue of *73 Magazine*. In addition, his remote link was featured in a portion of the 1988 ARRL video, "The New World of Amateur Radio." In June 1995, *QST* published his article, "The WB2 'REmote' Link," which presented a hardware solution to remote linking. He has written other related articles for *QST* and ones pertaining to his profession and the current state of Amateur Radio for *CQ Amateur Radio* magazine.

For updates to this article, see the *QST* Feedback page at www.arri.org/feedback.

