



Ottawa Amateur Radio Club

Groundwave

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June 2016

A reminder that June 8 is the Annual General Meeting at which elections for the OARC executive will be held. There are several vacancies to be filled.

Upcoming events include Field Day, the weekend of June 25-26, which will now be held at the Corkery Community Centre. Then, there is the RAC Canada Day Contest which is, of course, on July 1 (UDT), and the IARU Contest July 9-10.

See you at the meeting.

Ian Jeffrey, VE3IGJ
Editor



Check out our Web Page: www.oarc.net

**Next Meeting 7:30 pm, Wednesday, June 8th
in the Colonel By Room at Ottawa City Hall**

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Articles may be submitted for use in this publication provided that they portray events or activities that promote Amateur Radio. Letters and comments are also welcome. Submissions may be made by mail addressed to the Editor care of the OARC, or by e-mail to "ve3igj@rac.ca". Deadline for submissions occurs three days after the regular monthly meeting of the OARC.

Please support your local radio organisations. They support you!

Club Information

The Ottawa Amateur Radio Club Inc. is an association of Radio Amateurs devoted to the promotion of interest in Amateur Radio communications in the National Capital Area and to the advancement and achievement of club members.

Regular Meetings of the OARC Inc. are held on the second Wednesday of each month (except July and August) in the Honeywell Room which is on the second floor of Ottawa City Hall, formerly Regional Municipality of Ottawa Carleton Headquarters, on Lisgar Street. Meetings commence at approximately 19:30 hours. Further details about each meeting are noted elsewhere in this publication.

Executive Meetings of the OARC Inc. are normally held on the first Wednesday of each month at 19:30 hours. Contact the President to confirm the date, time and place of the next meeting.

The CAPITAL CITY FM Net meets every Monday (except some holidays) at 20:00 hours on the club repeater **VE2CRA 146.940(-)** to pass traffic and to make announcements of interest to Amateurs in the National Capital Region.

The Rubber Boot Net runs week days at 07:30 on VE3MPC, 147.150 + hosted by Mike, VA3TJP. The Rubber Boot net has been running since the early 1980's and is popular for the early risers and the go to work crowd.

The POT-HOLE Net is a SSB/HF net sponsored by the Ottawa Valley Mobile Radio Club and is conducted every Sunday at 10:00 hours on **3.760 MHz**. All amateurs are welcome to check in.

The POT-LID CW Net is an informal slow-speed **CW** net that meets every Sunday, except during July and August, at 11:00 hours on **3.620 MHz**, to promote interest in CW and CW procedures.

The QCWA CHAPTER 70 Net meets every Monday evening at 19:30 hours on repeater **VE3MPC 147.150(+)**. You do not have to be a QCWA member to participate.

The Ottawa Valley VHF/UHF SSB Net is sponsored by the West Carleton ARC. Look for it every Tuesday night (except the first Tuesday of the month) around 21:00 on **144.250**, (roll calls after net on 50.150, 432.150, 222.150, and 1296.100.) Horizontal polarization is preferred.

The Phoenix Net meets Tuesday evenings at 20:00 on VE3MPC (147.150+, no tones).

VE3TEN
 Tuning in the beacon so that it makes sense requires you tune to **28.175** on **CW** and read the tone that is there. The spaces between the elements are the higher tone. If that doesn't work, tune to **28.175.28** on **lower sideband** for better results.

The Ottawa Amateur Radio Club bulletin "Groundwave" is published and distributed to club members. Publication dates may vary but it is hoped that the bulletin arrives at its destination before the events listed in it have expired. The bulletin is not published for July and August when meetings do not occur. Every effort is made to provide accurate information in the bulletin, however we are all human and mistakes can be made. The OARC accepts no responsibility for any damages that may result from this. The opinions expressed in this bulletin are those of the author.

Voice (VHF) 146.940/146.340 100Hz CTCSS required
 (UHF) 443.300/448.300 100Hz CTCSS required

VE3TVA Amateur Fast Scan Television Repeater
 Currently off the air and looking for a new home.

IRLP Node 2040 146.940/146.340 (VE2CRA/VE3RC)
 (Code 411 for info) (Code 204 for activity)
 (Code 88 for time)

For further information please contact the Repeater Chair.

Note: The IRLP link is not connected to ECHOLINK. Please do not try to connect using the alpha keys on your keypad. It just confuses the operator.

Note: The IRLP link is disabled during the Monday night Capital City FM Net from 20:00 to about 21:45.



May Minutes

May 11, 2016

19:40 Meeting started by Glenn VE3XRA

Guests

Gil VE3JRY

Cody VE3QBR

Reports

CN Cycle for CHEO (May 1) (Arthur VA3BIT and Harold VA3UNK). We had 32 amateur radio volunteers, including VE3QBR who configured his downtown digipeater just for us! Despite a cold and somewhat drizzly day, about 2000 cyclists turned out and a record near-million dollars was raised for children's cancer research. The event went smoothly and no major issues were raised on the radio network.

Lanark Highlands on (May 7) (Mike VE3FFK)

A lot of the organizing seemed to happen the day of the event, but it all worked out well. About 30 hams participated with three from OARC. Most amateur radio volunteers are once-a-year hams that belong to the car rally community, but Mike said the three from OARC managed to keep things going well.

Rideau Lakes Cycle Tour (June 11-12) (Margaret VA3VXN) We have about 16 volunteers. Could use several more at fixed locations, and one or two for mobile duties who are available for the whole weekend. Overall, there will be 18-20 stationary locations for logistics and safety communications, and about half a dozen mobile operators assigned to support vehicles. For the mobile operators, accommodations at Queens University the night of Saturday, June 11, are provided as is dinner on Saturday evening and breakfast on Sunday morning.

ARRL June VHF Contest (June 11-12) (Clayton VE3IRR) West Carleton ARC will be operating a station at the Corkery Community Centre again this year. Would like to contact as many local operators as possible either fixed at their home stations or as rovers. Help operating and setup/take

Dates to Remember

2016

- Feb. 20, 21 Canada Ski Marathon
- Apr. 13 Homebrew Night
- Jun. 8 OARC AGM and Elections
- Jun. 25, 26 Field Day
- Jul. 1 RAC Canada Day Contest
- Sep. 10 Hamfest
- Sep. 30 Membership Renewals Due
- Nov. 1 Joe Norton Award Subm. Due
- Dec. ?? RAC Winter Contest

down would be appreciated. Last year, WCARC made several contacts on microwave frequencies using Hack RF gear.

Lap the Gats for Parkinson's (June 19) (Mike VE3FFK) Mostly a morning exercise. Could use several more volunteers. Ideally, the event could use about a dozen hams.

Field Day (June 25-26) (Greg VE3Y TZ)

The old site on Main Street is no longer available. A search committee comprised of Dave VE3KL, Harrie VE3HYS, Mike VE3FFK and Greg VE3Y TZ checked out about 10 possible sites over the winter. The best site has been determined to be behind the uOttawa Lees Avenue campus (old Algonquin College campus). The noise level on HF bands is remarkably low. Greg has approached uOttawa for permission to use the land, and will be meeting with them tomorrow (May 12). Greg described all the necessary planning and setup/teardown needed for the event. Greg passed around an equipment signup sheet.

Portable Station Demo (September 17) (Greg VE3Y TZ) If we get more than five people to sign up to operate your station, then the event will go ahead (a show of hands indicated at least seven interested persons). Location may be either Andrew Haydon Park or Britannia Park. Setup 09:00-10:00, operate from 10:00-12:00, followed by teardown. Breakfast at Kristie's at 08:00. Greg passed around a signup sheet. Dave VE3KL volunteered to write up the event for the Groundwave.

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Ottawa Amateur Radio Club

Groundwave

June 2016

mk's Word

One day Dave calls me up on the repeater and asks "Do you want to go and play radio somewhere?" The weather was absolutely perfect, so naturally I answer "Sure" and we load up and we're off. After a little discussion and a few "drive by's" we settle on Petrie Island. It turns out to be a great choice, with lots of room. Dave likes to park right at his antenna site, while I prefer a spot farther away from the pavement. Both are available there, with lots of room and no crowds. Dave put up a commercial antenna to see if it played the way it was advertised. I put up a paint pole vertical for 40m with measuring tapes for radials. After some fussing with both we made some measurements and some contacts. Weather stayed great, but other things on the schedule started to call us back to our respective homes. So after the outing, we started an email exchange. Dave did a simulation of the vertical and we looked at how we could improve it. Two radials or three? What happens to the pattern as the radials are moved around? For a given amount of mast, is it worth putting a loading coil near the top, and raising the radials? How much does it reduce the bandwidth if we go that route? How about making the antenna fatter? Why does the simulation show radials so much longer than a quarter wave? Who would have thought such a simple antenna would have so many possible different configurations and variations?

The reason for so much fussing with a vertical is that the field day site (if we get it) will have a bit of a lack of high points to hang dipoles, so having a vertical or three available may come in handy. Anyway, more antennas are always a good idea at field day if you can swing it. If we want to bump up the number of QSOs, we will have to be able to hear and be heard, on all the bands that are open, all over the map (at least the map of North American Hams), so some directivity would be a good idea. Since I don't see us putting up a Yagi on 40, a vertical with different radials should be a candidate. I wouldn't mind having something for 160, for those times when 40 and 80 have been drained dry.

BTW, the antenna Dave was testing was more hot air than hotshot antenna, but worked about as he expected. Didn't someone once say there are lies, damn lies and antenna claims?

73, CU@FD
mk VE3FFK & tnx VE3KL

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Transmitter Hunt (June 4) (Norm VE3LC)
A fox/bunnie hunt will be held Saturday, June 4 from about 11:00 on Petrie Island. There will be two transmitter locations (each 1mW power on 2m). The event is organized by OVMRC.

IEEE Ottawa Robotics Competition (May 28) (Glenn VE3XRA) Teens and pre-teen children. Robots based on Lego and Arduinos. Organizers have invited us to assist in entertaining the kids between events. Dave VE3KL, Norm VE3LC and Glenn VE3XRA have various ideas and are looking for volunteers to help out. Start about 09:00 and will probably end by 14:00.

Carp Hamfest (September 10) (Ed VE3WGO) Ed needs more volunteers. Setup on Friday afternoon 14:00-16:00. Time commitment on Saturday is from 07:00 to about 13:00.

Other Events

-Rideau Lakes (Smiths Falls) Hamfest (Ed VE3WGO): Reminder that this event is coming up this weekend.

-Dayton Hamvention (Glenn): Reminder that Dayton will be happening May 19-22.

June Meeting (AGM)

Pete VE3XEM is taking names for candidates for executive positions for the AGM next month, ie president, treasurer, membership, secretary plus three directors.

Have's & Wants

Mike VE3FFK: Needs at least 4 guy rings sized for military tent/mast poles.

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You Don't Actually Own Your Own Data and Devices

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Interesting Contacts

Dave VE3TLY: Worked HK3C (past president of OARC) a couple weeks ago on 17m.

Dave VE3KL: Had a great radio week including 9H3XX (Malta) on 17m CW on a newly designed antenna and first contact on his newly built regenerative rxer WRFI medium range log-periodic pointed at us.

Dave VA3AE: Used a WSPR receiver to scan the bands. Transmitted on many HF bands using QRP.

Show & Tell

Norm VE3LC: Omni SDR milli-wattmeter (mWattmeter) kit. Capable of measuring milli-watts to 20 watts forward and reverse. US\$29 for circuit boards, \$15 for the box from Gervais Electronics.

Jean VE3DNI: Made some more Near Field RF Probes (as a follow-up to his presentation last month). Passed them around.

Mini-Presentation (Harrie VE3HYS)

Multi-Couplers: What they are and how we use them.

Main Presentation (Vlad Sidarau VA3IAE)

High-End Music Reproduction

Audiophile caprices or engineering solutions

Meeting ended at about 22:11.

No 50/50.

Minutes taken by VA3BIT.

By Paul McFedries

Companies go to great lengths to lock us out from our own stuff

One of the contradictions of our age is that while the Internet increasingly makes all kinds of information available, many devices and services are increasingly including less accessibility as a feature. For every Wikipedia that you can edit, there are a thousand devices and appliances that are manufactured to discourage tampering. We like to think the world is becoming an open access and open content nirvana with information available to all, but the reality is that more and more knowledge is hiding behind paywalls and similar closed access barriers (and even super closed access channels, which make info available only through limited or hidden outlets).

We live in a renter society where we prefer to pay a monthly fee to use something for a short while and then move on when a new version comes along. Even the stuff we think we own is really not ours, the best example being all those ostensibly purchased e-books that it turns out you actually only rent and that can be undownloaded (that is, yanked from your e-reader) without warning. If this sounds fanciful, note that a few years back Amazon famously deleted George Orwell's books from customers' Kindles due to a digital rights management kerfuffle.

Even the things we do own don't last very long because we also live in a throwaway society. When something breaks, we'd rather toss it in the trash than get it fixed. The philosopher Albert Borgmann calls this disposable reality, one of the characteristics of which is the emphasis on consumption of things rather than engagement with things.

Although a few years ago I noted a resurgence of the DIY movement in this column ("The Hobbyist Renaissance," IEEE Spectrum, June

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Kiss Your TV Goodbye

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2007), the reality is that most people prefer to delegate the “doing” part to professionals. At best, a person might subscribe to BIY—buy-it-yourself—and purchase the materials required for a repair or renovation (while still relying on a tradesperson or other pro to perform the job). People lack—and perhaps more important, no longer value—the simple pleasures and rewards of manual competence. They’d prefer to be distraction addicts who barely notice the devices they use, rather than attempt the focal practice of actually engaging with those devices (say, by repairing or maintaining them, or by making something rather than merely using something). They’d prefer to live in a disposable society where there’s only a superficial interaction with devices, rather than living in a commanding reality where there’s a true sense of engagement with things.

However, even for those of us who do truly enjoy making and maintaining and repairing our things, performing those tasks is becoming more difficult because manufacturers are all too often keeping the innards of their devices hidden and inaccessible. This creeping concealedness comes in the form of cases that are tamper-resistant, parts that are not user-installable, and devices that are low on the reparability scale. The result is a culture of learned helplessness where, faced with innovations such as proprietary pentalobe screws and tamperproof exteriors, we throw up our hands and then throw out the thing we can no longer open, let alone fix.

Given these obstacles, how do we foster a sense of self-reliance? How can we have a relationship with our devices that is meaningful and hands-on rather than superficial and hands-off? Perhaps it’s time for a new form of device paradigm where the features we seek in the things we buy aren’t fashionable colors or sleek packaging but repairable components and openable cases. Through such an engaged consumerism we might once again become masters of our own stuff.

This article appears in the June 2016 print issue of IEEE Spectrum as “Are You Master of Your Own Stuff?”

By Paul O'Donovan

Radical new display and content-delivery technologies will kill off the television set

Since the 1950s, when television displaced radio as the major form of home entertainment, the TV set has ruled the consumer-electronics world. Its look has changed—from a tiny, round porthole in a sturdy, wood-grained cabinet to today’s impossibly thin screen balancing on a sculpted stand or hanging on the wall. But through its various incarnations, it has been this box of electronics—tuner/demodulator, video-processing boards, audio hardware—fronted by a glowing display that has determined the design of homes and the placement of furniture and, in general, dominated people’s entertainment lives.

There have been many technical skirmishes along the way. Flat-screen technologies displaced the cathode-ray tube, then warred with each other, the LED-backlit LCD emerging dominant (for now). In the 1980s, you probably took the antenna off your roof and plugged your TV into a cable box, and later you might have even bought something called a smart TV and started using it to watch Internet video along with broadcast shows. But there is still something in your house that you recognize as a television, even though it’s vastly flatter, lighter, and wider than the thing on which you watched cartoons as a child.

The TV set has taken many shapes in its nearly hundred-year history. Pictured (not to scale) are a 1946 RCA 630TS [1], a 1950 Philco Predicta [2], a 1954 RCA CT100 [3], a GE Portacolor from the late 1960s or early ’70s [4], a Kuba Komet from the 1960s [5], a 1970 Sony Trinitron [6], a 1981 Zenith Console TV [7], a 2004 32-inch Sony TV [8], a Sharp LCD TV from the early 2000s [9], a 2008 Sony XEL1 OLED TV [10], a 2010 Panasonic plasma television [11], and a curved Samsung TV from 2014 [12].

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That comfortable familiarity is about to end. First of all, the tuner—which converts RF signals into audio and video and, essentially, makes a TV a TV—is -getting pushed out, along with nearly all the other electronics in the box you call a TV today. And the screen itself, thanks to new display technologies, is about to disappear, at least when it's not in use.

Years of technological evolution have brought us to this point. When TV displays started going flat, some manufacturers began moving speakers, power supplies, and other electronics into a separate box. Their goal was to make the screens light enough to be easily hung on a wall. The changes also made the screens thinner, which became a selling point in itself, and manufacturers in recent years have continually pushed the limits of how thin a TV screen can be.

Other factors contributed to the thinning of the TV. By using LED backlights with light guides, engineers took the lighting systems from the back of the TV, where they add thickness, and put them on the edges, where they don't. More recently, the introduction of organic light--emitting-diode (OLED) screens has enabled displays as thin as 2.57 millimeters. Therefore, the electronics that tune in the TV signal and process the video and audio to drive the screen no longer fit in unobtrusively. So manufacturers also relocated them to a separate box or into the stand, connecting them to the screen with a high-data-rate cable.

Pioneer was one of the first to detach the tuner, in 2008, from its 50-inch plasma TV. The Pioneer Kuro KRP-500A display had two wires: one for power and the other for data from a separate media receiver. This was a nice feature for TVs meant to hang on the wall. You could hook up DVD players, video game systems, speakers, and other gear to the detached box without difficulty. In the same year, Philips followed with its 42-inch Essence LCD TV; this -model's separate media hub used a single cable to provide power and data to the screen. Also in 2008, Sony introduced the first OLED TV; its 11-inch XEL-1 put all the electronics into the stand to emphasize the thinness of this new display technology.

This trend of separating the electronics continues. For example, Samsung and LG are both selling superthin LCD and OLED TVs with the electronics either in separate boxes, like Samsung's One Connect Box models, or in the stand, as with LG's Signature G6 OLED 4K TVs, unveiled at CES 2016.

Futuristic as they might seem, all of these TVs still come with a dedicated tuner. That's what makes them tele-visions, even though you can completely ignore that tuner and use any device that can send video streams to feed these displays. That list includes smartphones, tablets, and PCs, as well as small peripherals dedicated to navigating and streaming Internet video, like Apple TV and Roku's various models, as well as dongles like Google's Chromecast and Amazon's Fire TV Stick.

These peripheral gadgets also work with screens that don't have tuners—such as PC monitors—as long as the monitor has an HDMI socket and speakers (though it is true that many monitors have HDMI sockets but no audio capabilities, limiting their usefulness as TV replacements).

Even with these products available, if you decided to get all of your TV on your computer monitor, you would still face a major hurdle. You wouldn't be able to receive signals from cable, a satellite dish, or an ordinary antenna without adding a suitable tuner. So you would not be able to receive many purely cable networks, such as Turner Classic Movies in the United States or Virgin Media in the United Kingdom. But that restriction is coming to matter less and less, thanks to all the on-demand services that now stream video content across the Internet, including Netflix, Comcast Xfinity, ESPN Player, HBO Go, and Hulu. These services give access to just about every current TV series and a host of movies and TV archives, except for most national and local TV news and scheduled network broadcasts.

That's not to say news and scheduled broadcasts couldn't be delivered over the Internet. If broadcasters chose to make them available

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online, most homes would not need to own a TV tuner of any sort. That day is coming—and sooner than you might think.

Even people who haven't yet embraced Internet video no longer really need a TV tuner. The only time a tuner gets any use today is when it's hooked up to an antenna, typically on the roof, designed to receive signals broadcast over the air. Most people who watch "traditional" TV channels do so via satellite or cable, so they connect to an external box rather than using the tuner in their TV. In the United States, the Consumer Electronics Association estimates that just 7 percent of households receive TV over the air—around 8 million homes. Far more people watch over-the-air broadcasts throughout the rest of the world: In Asia, 20 percent of TV households rely on the antennas on their roofs for TV reception, and in Europe, 40 percent do.

Still, even outside the United States, people are getting used to watching video on devices that don't have tuners, like phones, tablets, and computer monitors. Ironically, many efforts over the years to integrate tuners into these kinds of devices have failed—people didn't think they had any reason to watch TV if they were at their desks or on the move.

Given the pressure to make displays thin, more manufacturers are likely to begin quietly removing the tuner, a set of electronics that is about the size of a cigarette pack. That removal will lower manufacturing costs, of course, but not by much—the tuner and its associated circuitry costs about US \$4 to produce. So there's no big rush. Rather, it will likely fade away slowly over a long period of time, and hardly anyone will notice. Instead of assuming a TV includes a tuner, it may come to a point where consumers choose options when they purchase a screen, depending on how they intend to use it: Apple TV? Roku? Fed by a smartphone?

Once you remove the tuner from the screen, it's no different, really, from that computer monitor on which you watch Internet video at your desk, except your computer monitor may not have integrated speakers. You probably wouldn't call that

thing a monitor, though, because you'll probably never use it to access a traditional computer. Still, it's high time to call those large flat-panel displays in our family rooms something other than a TV. But what?

Perhaps we won't have too long to ponder that question, because soon we may lose those huge screens hanging on our walls, replacing them with some kind of disappearing display. When manufacturers first demonstrated the giant flat-screen TVs that have now become commonplace, they recognized the "black hole" on the wall problem. But they figured that eventually this problem would disappear: Display life would go up and energy consumption down to the point that people would simply just leave displays on all the time, showing family photos or favorite works of art. That's no longer the presumption.

In one approach to the disappearing screen, LG announced its flexible OLED-based display at CES in January 2014, and at CES 2016 it presented a flexible 18-inch OLED screen that could be rolled into a 3-centimeter-diameter tube. It would simply curl up like a window shade to hide away when not in use. Right now, the technology is prohibitively expensive: Early adopters can expect to pay more than \$6,000. But standard glass OLED displays—touted for years as the ultimate video display technology—aren't all that much cheaper to manufacture right now. However, when flexible screens reach the market, they will probably carry a premium price and be hyped as the ultimate solution. LG has said that it is confident it will be able to produce 55-inch and larger Ultra HD rollable TVs in the near future, although the company is not specific on dates yet.

In another approach to the disappearing display, earlier this year Samsung showed a concept 170-inch modular television screen, which is made up of a group of smaller panels that interconnect seamlessly to create a larger screen of any size or format—a sort of video wallpaper. This kind of modular system means consumers will be able to get bigger

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screens at far lower costs. And it means that home designers could tile a wall, say; the ultimate shape need not even be rectangular. This approach will, again, push the separation of the tuner from the display—nobody needs or wants 12 tuners.

Another intriguing future possibility is the transparent display. Panasonic showed such a prototype at CES this past January. When it's turned off, you can see a display of artwork or books on a shelf or the wall behind it.

The upshot is that the living room of the future is going to look very different. Many people who have gotten used to larger screen sizes really would prefer not to put up with having a big black rectangle as a focal point in their rooms when they are not watching video.

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Of course, it's unlikely that the silicon chips that perform the video processing will be made flexible anytime soon—getting emissive display technology to that flexible, rollable form has been difficult enough. Instead, it's likely most of the video-decoding and image-processing electronics will be housed separately from the display, transmitting all the video data wirelessly to the screen. So we're not only taking away the tuner that makes it a TV, we'll soon be taking away the electronics that make a screen a display. Anticipating screens without tuners, without much in the way of electronics, that disappear when not in use, you might think that the final death throes of the TV set are truly here.

But like so much in life, the loss of the tuner won't be straightforward. I predict that for mid- and low-price sets, the tuner will hang on as a sort of vestigial organ inside TVs for up to two decades. Or at the very least, it will be packed to ship separately with displays, along with the manual you never open and the RCA cables you never use. In the world of consumer electronics, a lot of technologies you think are obsolete stick around for years, even decades, before eventually disappearing, particularly if the technology owned a very big chunk

of the market for a very long time. Old habits die hard.

Consider the compact cassette tape format from Philips. You can still buy compact cassette tapes, players, and recorders today, 54 years after they were invented, despite the availability of far better, digital technologies, including CDs and chip-based recorders. And 3-D TV, which was introduced in 2010 as an incentive for people to trade up from older models, never caught the imagination of the public, and very little 3-D content is available. Yet most TVs today still have that function embedded in the multimedia processor as standard.

It is similarly likely that RF tuners will continue to be manufactured in volume for another 20 years, primarily for two reasons. In the global marketplace—including parts of Europe, the Middle East, Africa, and the Asia Pacific region—over-the-air broadcasting is still a major factor. And elsewhere, consumers will resist purchasing a tunerless TV for watching television, even if they haven't used a TV tuner in years.

We are seeing today a glimpse of the future, with rollable and multi-panel displays that eliminate the giant black rectangle in living rooms and family rooms, and a future in which we will be able to choose from a variety of gadgets to feed different types of video to our walls. We will be able to swap out these gadgets as new technologies emerge. This has to be better for the environment, our pockets, and our lifestyles. It will even be a better business model for the TV manufacturers, which will be able to innovate more quickly and differentiate themselves in a very competitive market.

And your grandchildren may very well look at pictures of the TV that's in your home today in the same way your children look at a record player and wonder, Whatever did you use that for?

This article appears in the May 2016 IEEE Spectrum issue as "The TV's Vanishing Act."



Single-Antenna Chip Transmits and Receives Simultaneously

A new wireless chip can perform a feat that could prove quite useful for the next generation of wireless technology: transmitting and receiving signals on the same frequency, at the same time with the help of a single antenna. This approach instantly doubles the data capacity of existing technology though is not yet capable of power levels necessary to operate on traditional mobile networks.

Last year, Harish Krishnaswamy, an electrical engineer at Columbia University demonstrated the ability to transmit and receive signals on the same frequency using two antennas in a full duplex radio that he built. Now, Negar Reiskarimian, a PhD student under Krishnaswamy, has embedded this technology on a chip that could eventually be used in smartphones and tablets. This time, the transmitter and receiver share a single antenna.

Devices such as smartphones and tablets typically exchange signals over at least two antennas—one for the transmitter and one for the receiver. These signals are usually coordinated in one of two ways: time-division duplex, in which a transmitter and receiver take turns broadcasting on the same frequency, and frequency-division duplex, in which the transmitter and receiver broadcast on separate frequencies at the same time.

Compared to the traditional models, the new full duplex radio chip is more efficient. “You’re not wasting time or frequency,” Krishnaswamy says. Such conservation is especially important as smartphones use more data, and companies search for ways to free up frequencies. Krishnaswamy says his lab is already working with several chip manufacturers to refine the concept.

To achieve its efficiency, the new chip had to circumvent a longstanding principle called Lorentz Reciprocity, in which electromagnetic waves are thought to move along the same paths when traveling both backward and forward.

In the past, electrical engineers have bypassed reciprocity by designing elements called circulators built of magnetic materials. By applying a magnetic field, an engineer can disrupt reciprocity by permitting waves to flow only forward and not backward, which allows for the simultaneous transmission of two signals.

But circulators built in this manner are often expensive and too bulky to insert into a smartphone. Plus, the magnetic fields they use would disrupt other functions if ever placed within an electronic device. Instead, these types of circulators have most often been used for military purposes (in fact, Krishnaswamy’s latest research was funded by DARPA).

To overcome that limitation, Reiskarimian implanted silicon transistors on the face of a CMOS chip in an arrangement that reroutes signals as they are captured by both the transmitter and the receiver in order to avoid interference. “You essentially want the signals to kind of circulate in a clockwise sense,” Krishnaswamy says.

It also helped to use an echo-cancelling receiver that the lab also pioneered. This receiver solves the classic problem that transmitted signals tend to “echo” back into a receiver when a full duplex radio is in operation. This echo can be billions of times stronger than any external signal that a receiver needs to process. The echo-cancelling receiver cuts through this noise by learning what the transmitted signal was and subtracting that out of the signal that the receiver processes.

He likens the final result to enabling two people to both talk and listen to one another at the same time. “You can double data capacity right down to the physical hardware,” he says. If integrated throughout an entire network, he thinks this technique could potentially reduce delays in data transmission.

For now, the new chip does not have a high enough broadcasting power level to connect to a mobile network. It’s in the neighborhood of 10 to 100 milliwatts, which is about where a Wi-Fi network typically starts, but mobile operates at higher levels. There are a few ways that Krishnaswamy is already planning to try to bolster the power level, such as by rearranging the components of the chip or choosing different hardware to build it.

Amy Nordrum, *IEEE Spectrum*

They say 3 weeks in the lab will save you a day in the library every time.



2016-2017 Membership Application/Renewal
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- Single \$25 (\$20 after Feb 1, 2017)
- Family \$30
- Junior \$15 (under 18 years of age)
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Callsign(s): _____

Qualifications: Basic Advanced Morse Code

Year Licensed: _____ RAC Member? Yes

Other Family Members

Name: _____ Callsign(s): _____

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All members who are in good standing on or before the December General Meeting will be eligible for a free one-time name badge. Members who wish a second or replacement badge may purchase one at the club price (approx \$10.00 plus tax). Ordered badges will be available in January.

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