



**PATRICK JOSEPH DYER**  
**WA5IYX**  
SAN ANTONIO, TEXAS

**1947 - 2016**



**WORLD LOSES LONGTIME SPORADIC-E AND VHF  
PROPAGATION EXPERT**

**FOURTH ROUND OF SPECTRUM AUCTION SUCCEEDS,  
WAVE GOODBYE TO UHF BAND ABOVE CHANNEL 36**

**HD RADIO SLOWLY MOVES FORWARD IN CANADA**

The Official Publication of the Worldwide TV-FM DX Association



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# THE WORLDWIDE TV-FM DX ASSOCIATION

Serving the UHF-VHF Enthusiast

THE VHF-UHF DIGEST IS THE OFFICIAL PUBLICATION OF THE WORLDWIDE TV-FM DX ASSOCIATION DEDICATED TO THE OBSERVATION AND STUDY OF THE PROPAGATION OF LONG DISTANCE TELEVISION AND FM BROADCASTING SIGNALS AT VHF AND UHF. WTFDA IS GOVERNED BY A BOARD OF DIRECTORS: DOUG SMITH, GREG CONIGLIO, KEITH MCGINNIS AND MIKE BUGAJ.



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## The Mailbox

PAGE TWO

P.O. Box 501 Somersville, CT 06072

Mike Bugaj - Enfield, CT [mikeb@wtfda.org](mailto:mikeb@wtfda.org)



FEBRUARY 2017

### Dues Received

DATE RCVD	NAME	S/P	ENDS
1/3/17	Charles Gauthier	QC	1-18
1/16/17	Dave Pomeroy	KS	12-17
1/21/17	Fred McCormack	MN	12-17
1/27/17	Scott Hood	MA	1-18
1/27/17	George Rogers	GA	3-18

January was very, very slow. I thank everyone who took the time to send in their dues and support the club!

### Database News

We are almost at the point where we can say "it's done"! Our last Central American country to be added is Honduras and I am a bit over half way done in adding the 780+ entries to that database. Once that's done, our WTFDA FM database will be *the* place to go for information on the USA, Canada, Mexico, Central America and a good part of the Caribbean (if it isn't already). Thanks goes to Jim Thomas for supplying the info for Central America, Cuba and Mexico. Jim has also updated the Cuban database with brand new information. The database is ready for DX season!

### The Auction is Over!

It seems like the auction took forever, but Phase Four of the spectrum auction concluded successfully. Here's what we can expect in the weeks ahead. This info is from Chris Lucas: "Now that the FCC has determined that the current Phase IV of the auction is the last, and now that the reverse portion of this auction has been completed, the FCC knows which stations will be going off the air and which will be remaining. Thus, the FCC is currently working on the new channel assignment plan... which will not be released until the forward auction phase IV is complete.

A couple additional notes:

- A total of 1274 stations will be moved. (This does not include any LD's and translators that might ultimately survive.)
- An unknown number (by me) of stations will be either leaving the air completely, or pairing up with another station covering their COL while going dark themselves.
- Within about 2 weeks from now, stations remaining on the air and changing channel will receive notice from FCC of new channels, and other transition info.
- New channel assignments will be made public when the auction ends. This could be a bit more than 2 weeks from now.
- All stations within a given DMA (market) will be assigned to up to 2 transition phases with a phase completion date. There are

10 phases in all... the final one ends 39 months after FCC releases new allocation plan.

- Stations will be required to tolerate a small amount of additional interference during the transition phases.

Fun times ahead!!"

Yes, fun times indeed. -Ed

### FM Boosters for AM Stations?

Bill Hale found this while working on the WTFDA FM Database: "Don't know if you were aware of this, but WJNT 1180, Pearl, MS has an FM booster station. WJNT-FM1 on 103.3mhz with 500 watts. It operates from local sunset to local sunrise to overcome Cuban interference to the AM station, according to their application. Evidently it's been operating since 1999! The facility ID is 166241. I thought it may be a one-of-a-kind situation in the US (an AM station with an FM booster), but it's not..."



This is last known activity that Pat had posted on the TV FM Skip log public forum.....

Dec17 21:38 copy from log - sri no photo/video - it was 1958 - de WA5IYX

<http://www.qsl.net/wa5iyx/images/19580420-meteor.jpg>

Gentlemen, I have just one amusing observation I would like to share, regarding Pat.

I didn't know Pat very good or for a very long time, but I would've loved to meet him and spend a little time listening to him speak about things related to dxing. I spent some time chatting with him on the TV FM DX logger, seeing that he was always there. I think that's where he felt his friends were. I know he was a vast well of knowledge on the subject of electronics and radio propagation. And he was very humble in sharing information and passing on suggestions. And, Pat was a true analyst. I spent several hours the last couple days sorting through his archives of pictures he uploaded to his radio website. It appears most of them were there for storage, as he didn't have direct links to view many of them on the pages. As I say, he truly was an analyst. He would take close up pictures of things, and I always noticed he layed a pencil in the picture to maintain scale I was going through pictures and I came upon one from the 50th high school reunion (last year). He snapped a picture of some food, which I presume, he was going to eat. Maybe a diabetic?? On one plate was a prepared hot dog on a bun, and next to it were two chocolate donuts on another plate. And right behind both plates - a pencil was lying on the table!

I couldn't help but laugh when I saw that! Just thought I would share that. I know that the people that really knew him are going to miss him and think about him. I'd like to encourage those thoughts to be good ones. It breaks my heart that he had to pass on, all alone. That's what makes me cry inside.

Jim Thomas  
Springfield, Missouri

Editor's note: Artie Bigley also checked in to remark on Pat's dedication to the hobby. They'd exchanged e-mails over the last several years. Pat did do some research on Astronomy, the Sun and VHF prorogation but DXing took about 95% of his waking hours as far as Artie is concerned. He laments the passing of a true DXing pioneer.

Since 1988(!) WCRT 1160 Donelson, TN has been operating an FM booster. Originally on 106.7, they moved to 98.7 in 1998, then to 103.9 and now are on 106.3mhz. The moves were made in order to mitigate interference to other FM facilities over the years. Its facility ID is 166220. Their current operation is WCRT-FM1 106.3 with 75 watts. It also operates from local sunset to sunrise to alleviate significant interference from co-channel Cuban stations (on AM).

### One Less DXer

We may be reading more about this elsewhere in this VUD, but longtime FM Dixer and WTFDA member Pat Dyer passed away on December 17<sup>th</sup> of a heart attack at his home in San Antonio, Texas. Pat's website at qrz.net has been moved to the WTFDA website and can be found at the following address: <http://www.wtfda.org/pjdyer>.

And that is it for February. See you next time. Mike

# TV News

Douglas E. Smith  
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<http://www.w9wi.com>



**February 2017**






## Abbreviations:


- Aux **A**uxiliary (backup) transmitter
- FTP **F**ailure to **P**rosecute
- ROA **R**equest of **A**pplicant
- STA **S**pecial **T**emporary **A**uthority
- LPDTV **L**ow **P**ower **D**igital **T**V
- DRT **D**igital **R**eplacement **T**ranslator


## News:


(full-power digital stations in **bold face**; LPTV and translators in regular type; full-power analog stations in **bold italics**; low-power analog stations in *regular italics*)

Location	RF Ch	Callsign	Notes
			
<b>Alaska</b>			
Fairbanks	13	KXDF-CD	Call changed from KXDD-CD
			
<b>Arizona</b>			
Parker	49	KJPO-LD	License cancelled
Quartzsite	21	KRPO-LD	License cancelled


<i>Location</i>	<i>RF Ch</i>	<i>Callsign</i>	<i>Notes</i>
			
<b>Baja California Norte</b>			
Tijuana	23	XETV-TDT	CW affiliation lost. Station is switching to Gala TV from Mexico City.
Tijuana	34	XHAS-TDT	Telemundo affiliation lost. New programming unknown.








			
<b>California</b>			
Cloverdale	11	K11WP	Granted power reduction to 4 watts, 38-30-32/122-39-44 (KXFX-FM, Santa Rosa)
Los Angeles	34	KMEX-DT	Application for new backup transmitter, 255kw at same site as main
Riverside	10	KZSW-LD	Sold to 3 Angels Broadcasting Network







			
<b>Colorado</b>			
Aspen	34	KLNU-LD	Call changed from K34LM
Vail	38	KVNN-LD	Call changed from K38NT

			
<b>Connecticut</b>			
Norwich	9	WEDN	Granted Special Temporary Authority to operate at 4.2kw due to transmitter failure and delay in shipment of replacement parts; see text.

			
<b>Delaware</b>			
Rehoboth	33	W33DP	New to air, 295 watts, 38-55-50/74-55-15 (Marquis de Lafayette Hotel, Cape May, N.J.); requests power increase to 15kw

			
<b>Florida</b>			
Gainesville	23	WUOF-LD	Requests power increase to 10kw
Ocala	18	WQFT-LD	Call changed from W18EF

<i>Location</i>	<i>RF Ch</i>	<i>Callsign</i>	<i>Notes</i>
	<b>Illinois</b>		
Ottawa	18	WAUR-LD	Granted Special Temporary Authority to move from channel 29, 12kw, 41-39-55/88-34-34. (between Plano & Sandwich) To avoid interference to WMAQ-TV Chicago.
	<b>Indiana</b>		
West Lafayette	20	WUVI-LD	Power increased to 3kw
	<b>Kentucky</b>		
Bowling Green	14	W14DG	Power increased to 4.8kw, 36-57-37/86-29-36 (WBKO-TV studios)
	<b>Missouri</b>		
Kansas City	46	KQML-LD	Call changed from K46MA
Lewiston	9	K09XZ	Requests conversion to digital
	<b>Montana</b>		
Quartz Creek	16	K16KZ	Requests power increase to 431 watts
	<b>Nebraska</b>		
Lincoln	26	KFDY-LD	Call changed from K26JQ
Omaha	17	KYNE-TV	Power reduced to 21.5kw/284m, 41-18-32/96-01-33
	<b>New Jersey</b>		
Newark	13	WNET	Requests new auxiliary backup transmitter, 12.5kw/297m, 40-45-22/73-59-12

<i>Location</i>	<i>RF Ch</i>	<i>Callsign</i>	<i>Notes</i>
			
<b>New Mexico</b>			
Albuquerque	24	KNAT-TV	Granted Special Temporary Authority to operate at 9.8kw/1245m, reduced power & temporary antenna while failed transmission line is replaced.
Bloomfield	9	K09JJ	License cancelled
			
<b>Puerto Rico</b>			
Mayaguez	44	W44DW	New to air, 11kw, 18-18-42/67-11-24 (Juan Carlos Matos Barreto)
			
<b>South Carolina</b>			
Charleston	12	WHDC-LP	Granted STA to operate in digital with 117 watts.
			
<b>Texas</b>			
Dayton	5	KTDJ-LD	Granted site change to 29-45-30/95-22-03 (Houston)
Rio Grande City	22	KTLM	Granted power reduction to 14.92kw (Digital Replacement Translator in Harlingen)
			
<b>Washington</b>			
Yakima	36	K49GF	Application for new station, 4.9kw, 46-31-59/120-29-37; Digital Companion for analog 49
			
<b>Wisconsin</b>			
Janesville	32	WIFS	Call changed from WBUW

I suspect the 4.2kw figure for the Special Temporary Authority for WEDN is a typo. That appears to be their normal, licensed power. I think the STA power is probably closer to 2kw.

The spectrum auction has succeeded. On January 18<sup>th</sup> the FCC announced the amount bid by wireless companies in the forward auction had exceeded the "clearing cost". The "clearing cost" is the sum of the amount the TV stations to be purchased had requested for their channels; the cost of moving those stations which will be forced to new channels; and the cost of administering the auction. As I write the amount bid

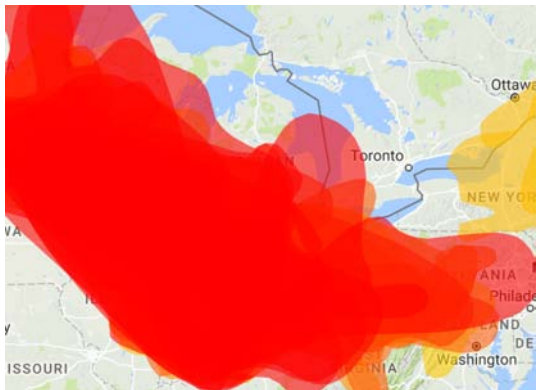
exceeds the clearing cost by roughly \$8,000,000,000. (8 billion dollars) The forward auction is not yet complete, so the proceeds are likely to increase.

What this means... is that channels 38-51 will be lost to television. Stations will be repacked into channels 2-36. This is a *far* better outcome than initially predicted; some thought channels 30-36 could also be lost. It will still be challenging.

Remember that the FCC cannot *force* any station to go off the air; to move from UHF to VHF; to move from high-VHF to low-VHF; or to share its channel with any other station. However, stations may *volunteer* to make any of these moves in return for a cut of the auction revenue. That's part of (most of) the "clearing cost". We don't yet know which stations have taken any of these options. Remember also that the FCC must maintain the coverage area of any station which doesn't volunteer to shut down.

The Commission has an ambitious schedule to complete this repacking. Engineers have expressed doubt that it can be accomplished in the available time.

It's been a slow month for classified changes. Depending on how quickly the FCC releases the new channel assignments, next month may also be slow. Once the new assignments are released, things will get busy VERY QUICKLY.



# Coast to Coast TV DX

Featuring reports from the entire United States and all of Canada.

Send reports by the 15<sup>th</sup> of each month to:  
Nick Langan  
42 Holly Park Drive  
Tabernacle, NJ 08088  
E-mail: [nickl@wtfda.org](mailto:nickl@wtfda.org)

### The Editor's Note

East of the Rockies, the month of January turned out rather mild weather-wise, and the atmosphere was ripe for several unusual tropo openings for this time of year, including the pictured APRS map 144 MHz. paths across the Great Lakes on the 19<sup>th</sup>. DTV logs up to 450 miles were reported by Steve Rich via his remote Milford, IL DX site. Tropo shifted south later in the month, more typical of winter, including intense conditions around the Gulf of Mexico on the 24<sup>th</sup>. DTV decodes from FL into LA were reported that evening, while Fred Nordquist had what he suspected to be Cuban analog signals on the 25<sup>th</sup> from his location in SC, a distance of over 700 miles.

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### Doug Smith (W9WI)

Pleasant View, TN

<http://www.w9wi.com>

I neglected to mark the WAND logging from Nov. 27 as new to the log.

1 Jan 2017 Tr:

2258	WLMT 31	TN	Memphis	169
2304	WREG 28	TN	Memphis	175
2339	WKNO 29	TN	Memphis	175

18 Jan 2017 Tr:

1641	KDNL 31	MO	St. Louis	232
1705	KSDK 35	MO	St. Louis	232
2302	WTTK 29	IN	Kokomo	245
2358	WAWV 39	IN	Terre Haute	196



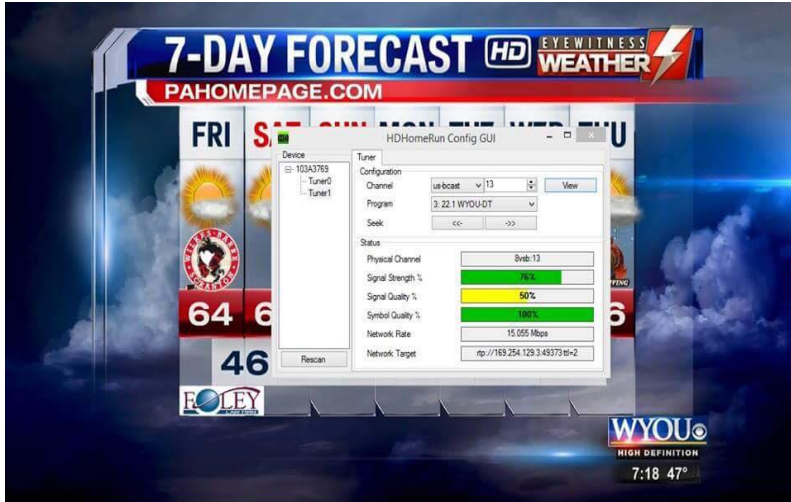
# PHOTO NEWS



Jeff Kruszka  
 1909 Lost Lake Pl.  
 Pearland, TX 77581  
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February 2017

And still more from Andrew Knafel in Medina, OH:



WYOU-13 Scranton, PA  
 303 mi Tr seen 11-17-16



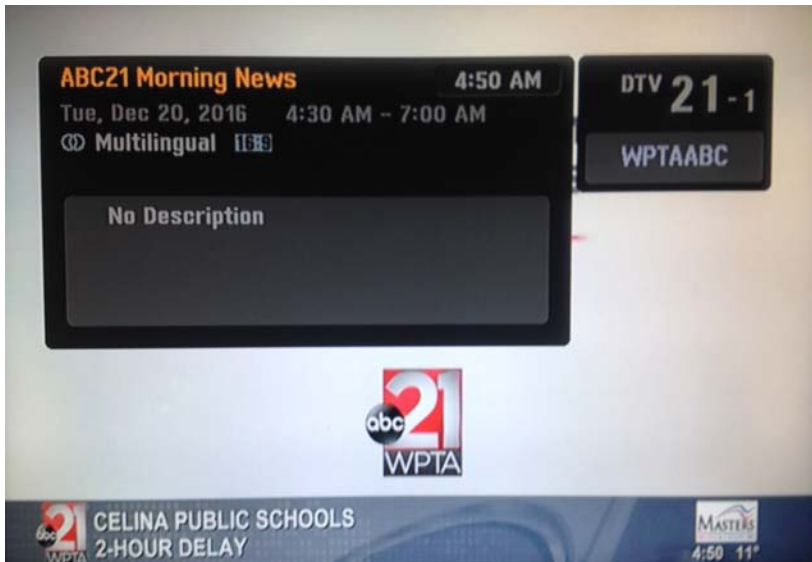
WFYI-21 Indianapolis, IN  
 247 mi Tr seen 11-22-16



WFLD-31 Chicago, IL  
 306 mi Tr seen 12-5-16



WJYS-36 Hammond, IN  
306 mi Tr seen 12-5-16



WPTA-24 Ft. Wayne, IN  
177 mi Tr seen 12-20-16



WXIN-45 Indianapolis, IN  
247 mi Tr seen 12-20-16

## Final Stage Auction Rule Met at \$18.2 Billion

Assignment phase to follow

Written by Deborah D. McAdams for *TVTechnology* [Jan 18, 2017]

Source: <http://www.tvtechnology.com/news/0002/auction-closes-at-xxx-billion/280166>



**WASHINGTON**—The closing criteria of the television spectrum incentive auction have been met at \$18.2 billion in bids for 70 MHz of public airwaves. The closing criteria—i.e., clearing costs plus expenses and a benchmark bid price— were finally met after 43 weeks and four separate stages targeting progressively less spectrum.

Stage 4 targeted 84 MHz, which participating broadcasters agreed to vacate for [\\$10 billion](#) in the fourth-stage reverse auction that ended Friday, Jan. 13. The clearing cost criteria comprised this \$10 billion ask, plus the \$1.75 billion Congress allocated to move broadcasters as well as the administrative costs of holding the auction, for a total of just over \$12 billion.

Bidding in the fourth-stage forward auction commenced at 10 a.m. Wednesday, Jan. 18. By noon, the clearing cost criteria was met with bids totaling more than \$17.7 billion from participating wireless providers, or \$17.2 billion after discounts for rural and smaller entities, but still enough to cover the \$12 billion. However, bids fell less than three cents short of the benchmark bid price of \$1.25 per MHz/Pop (one megahertz of spectrum passing by one person in a given market area), triggering a second round of bidding.

Second-round bids totaled \$18.2 billion, or \$17.7 billion after discounts, and slightly surpassed the \$1.25 MHz/Pop benchmark at \$1.2570, for the 70 MHz available out of the 84 MHz clearing target after consideration for guard bands.

The next step involves implementation of the spectrum reserve rule in which “each Category 1 product for which at least one reserve-eligible bidder has processed demand at the time is split into two products: reserved and unreserved,” according to the Federal Communication Commission’s [auction dashboard](#). “Reserve” refers to 30 MHz of spectrum set aside in each wireless geographic area for wireless providers who hold less than one-third of available low-band spectrum in a license area.

“In order to provide bidders with additional time to bid in the first round after the spectrum reserve has been implemented, round 3 will be extended to six hours. It will be held tomorrow, Jan. 19, from 10 a.m. until 4 p.m. Eastern.”

There will be no bidding on Friday, Jan. 20, due to the inauguration. Bidding will resume in two-hour increments on Monday, Jan. 23, at 10 a.m and 2 p.m.

The auction will close when demand no longer exceeds supply, as it now does in several wireless geographic units. Once the auction closes, an assignment phase where winning bidders of generic frequency blocks will be able to bid on specific frequencies, will begin.

Addendum: Outgoing FCC Chairman Tom Wheeler issued the following statement after the final stage rule was met:

“The world’s first spectrum incentive auction has delivered on its ambitious promise. Reaching the Final Stage Rule means the benefits of the auction are indisputable. We will repurpose 70 MHz of

high-value, completely clear low-band spectrum for mobile broadband on a nationwide basis. On top of that, 14 MHz of new unlicensed spectrum—the test bed for wireless innovation—will be available for consumer devices and new services. The auction will provide \$10.05 billion to broadcast television licensees who participated and billions towards deficit reduction.

“There is still a long road ahead to successfully implement the post-auction transition of broadcast stations to their new channels and bring the new wireless and unlicensed spectrum to market. This will be an extremely important task for my successor and the new commission; I wish them well.

“Now that we are assured of a successful auction, however, it is appropriate to acknowledge and thank some of those who helped us get here; a list that begins with our staff. For more than four years, Gary Epstein, chair of the Incentive Auction Task Force, has led a team of professionals more than 100 strong to assure that our actions were carefully coordinated and considered the public and stakeholder interests from all angles. The Task Force has worked tirelessly on this auction since 2012 and they have my deepest thanks.

“Congress made the incentive auction possible – both by passing the Spectrum Act in 2012 and through its continued guidance and oversight – thanks to the leadership of Reps. Upton, Waxman, Walden, Eshoo, and Pallone, and Senators Rockefeller, Thune, and Nelson. Committee staff, together with the staff of our federal agency partners, including NTIA and OMB, collaborated to draft a momentous piece of legislation designed to advance the goals of making more spectrum available for licensed and unlicensed use, funding an interoperable public safety network, and reducing the federal deficit.

“My predecessors as chair, Julius Genachowski and Mignon Clyburn, set the process in motion for this auction as well as for the 2014 AWS-3 auction, together with fellow Commissioners Robert McDowell, Jessica Rosenworcel, Ajit Pai and Mike O’Rielly. Congratulations to all on a job well done.”



## Digital has not killed the radio frequency in Canada — yet

As Norway moves to eliminate FM, 14 radio stations experimenting with HD Radio here

Written by Haydn Watters for CBC News [Jan 8, 2017]

Source: <http://www.cbc.ca/news/technology/digital-radio-canada-1.3924864>

**CBCnews**

Norway may be [switching off its FM radio network in favour of digital](#) but don't expect the same type of tune-out to happen in Canada any time soon.

The shift to digital radio technology — touted for its clearer sound and potential for more channels — is taking place at a much slower, wait-and-see pace here, say broadcasters and industry analysts.

That's not to say we haven't already tried. During the late '90s and 2000s, Canada experimented with the digital audio broadcasting (DAB) model that Norway will shift to this week — and it was a flop.

Duff Roman was instrumental in trying to make DAB a success here as president of Digital Radio Rollout Inc., a consortium of private and public broadcasters, but ultimately couldn't woo the Americans to follow.

"We tried our best to get them onside. They didn't want to do it," he said.

They were already working on adopting HD Radio, another type of digital radio technology that's now slowly seeping its way into Canada. It is developed by a private company and [delivers digital versions of the audio](#) from FM stations via a special receiver.

Digital receivers can cost hundreds of dollars and inability to convince consumers to buy into a new system was part of the reason that DAB stalled.

Roman said he is disappointed because he thought DAB was the superior model.

"It's sort of like Beta and VHS," he said of the difference. "The best system didn't win."

"I'm over it now ... I think it will work as sort of an upgrade."

#### **14 Canadian stations testing out HD Radio**

The CRTC stopped renewing DAB licenses after 2012. Now, it oversees 14 Canadian stations who have started experimenting with HD Radio in Vancouver, Calgary, Toronto, Montreal and a few other cities.

These stations have largely been using it as a way to simulcast their AM talk radio stations with less fuzz and clearer audio.

It's not like internet radio, which is streamed off the internet, or satellite radio, which uses a particular frequency and has a wider footprint. Instead, HD Radio is broadcast in a local market and can only be heard via a HD receiver.

"It allows a radio station to use its analogue FM frequency to broadcast multiple digital audio signals on the [same] frequency," CRTC spokeswoman Patricia Valladao explained in an email.

She said the number of broadcasters adopting it remains small.

"Presently there are no public proceedings or applications before the CRTC related to this issue, nor is it under discussion."

Corus Entertainment has been testing out HD Radio in three of its markets — New Westminster, B.C., Hamilton and Calgary.

But Chris Sisam, vice-president of Corus Radio East, said widespread adoption is still a long way off.

"Really, we're just dipping our toe in the water," he said. "For us, it's just a better way of delivering an AM signal."



*Worker Ino Andre Nilsen arranges digital radios in an Expert City electronics shop in Oslo, Norway, on Wednesday. The country will switch off its FM radio network this week. (Alister Doyle/Reuters)*

Sisam said the number of people listening to the stations via HD Radio remains small — and that's just anecdotal. He said there is no way of measuring those who are listening via traditional FM radio separately from those listening by HD Radio.

Bell Media and Rogers Media, two of the other major Canadian broadcasters, are also experimenting with HD Radio in a few large markets. CBC is running a pilot project with HD Radio in Toronto for its French-radio service.

"At this time, we have no plan to abandon FM radio, but we are starting to explore digital technologies for radio broadcasting," CBC spokeswoman Emma Bédard said in an email.

"CBC/Radio-Canada supports HD Radio as a voluntary North American digital radio standard. As both U.S. and Mexican radio broadcasters have endorsed this standard, this will help ensure the widespread availability of receivers to North American radio audiences."

### **But will it catch on?**

When it comes to digital radio, America is much further along.

There are [around 4,000 stations using HD Radio technology](#) in the U.S. and an HD Radio receiver has become a common feature that's built into new cars. They are being installed with some new car models in Canada, but owning an HD Radio receiver is still pretty rare here.

"We don't have the reception system available," Sisam said. "We could deliver [programming on HD Radio], but no one could receive it."

- [Norway to become 1st country to switch off FM radio](#)
- [Canadians consuming less TV and radio but more media overall, CRTC says](#)

David Bray, president of the radio consulting firm Bray and Partners, thinks there is a "real possibility" that HD Radio might not catch on here.

"You still face the challenge of getting receivers out there," said Bray, who was also involved with the push for Canada to adopt DAB. "That's a huge practical problem."

He thinks the better sound and promise of more channels might not be enough of an incentive for people to go out and buy one.

"How are you going to get the public on board? It's really not that easy," he said, comparing it to DAB's struggles. "Apathy is the insurmountable problem."

Bray suggests creating some unique programming that's only available on HD Radio, similar to what some speciality satellite radio channels offer.

"Digital radio is almost certainly the future, but in what incarnation I'm not sure."

Johnston Laments FM Noise  
by Steve Johnston  
on 06.16.2011

The impact of indoor noise on AM broadcast reception is well known. For FM that's not the case thanks to the ability of FM receivers to hide the noise.

Radio hobbyists — ham radio operators, shortwave listeners, broadcast DXers and other enthusiasts — know about the growing radio noise issues in our modern world; but less-technical listeners seem unaware of such noise pollution. Yet while FM receivers may not emit the buzzes, growls or pops that make AM noise obvious, noise can mask weaker FM radio and, probably, digital HD Radio as well. Listeners may not know why; they just know the signal is "weak."



*Steve Johnston. Photo by Jim Peck*

I suspect all broadcast engineers have heard reception complaints; it's normal. But I've noticed a new trend: long-time listeners describing deteriorating reception. "I used to get good reception here, but not anymore ..."

Wisconsin Public Radio is a three-network, 30-station public radio group. It is one of the largest such groups, with complex interconnection systems serving AM and FM stations around the region. Thirteen of the 30 stations have been upgraded to include HD Radio multicast service.

In the past five years, WPR Audience Services "Listener Logs" show a 37 percent increase in e-mail and telephone complaints related to reception.

At the same time, FM's digital HD Radio indoor reception is simply not as good as predicted — both at WPR and industry-wide.

Could these phenomena be related?

My hypothesis was that growing levels of indoor noise from modern electronics may be masking weaker FM signals — and probably digital HD Radio and HDTV too. I further suspected that this noise increase creates the impression that HD Radio and HDTV have difficulty with "building penetration" and subsequently led to the effort to increase digital power.

To get a sense of the noise present in the FM band in a variety of indoor situations, and see if it might explain the trouble these listeners were having with digital reception, I made measurements with a portable spectrum analyzer and antenna. I studied several urban apartments, suburban houses and urban offices. All were found to have higher noise levels inside than outdoors on the same property. I also pinpointed some common sources of this noise.

## Measurements

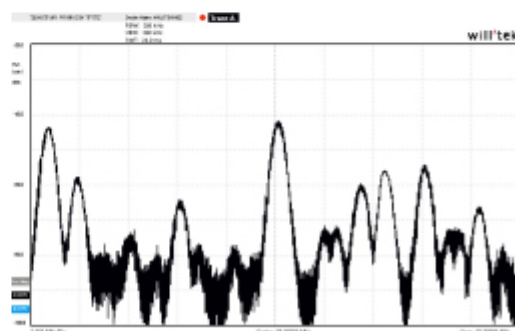
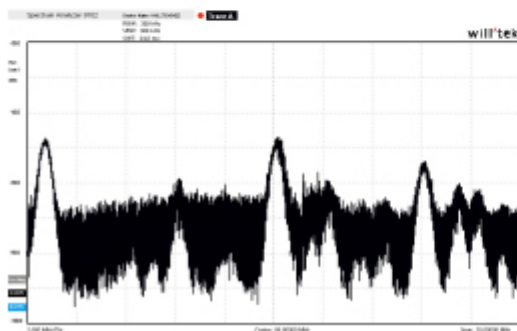
I made an informal study of some Wisconsin Public Radio listener and staff homes using a battery-powered spectrum analyzer (a radio receiver with visual display of strength vs. frequency) and a loop of stiff wire about one-quarter wavelength in circumference on a short length of coaxial cable as a pickup antenna. My goal was to get a better sense of the noise encountered in the 88–108 MHz range in a variety of indoor situations and see if it might explain the reception troubles.

It's important to note that I did not try to put numbers on the signal strength of the noise, but rather made a comparison of outdoor to indoor reception at the same location.

I visited several examples each of three types of locations: urban apartments, suburban houses and urban offices. In each location I inspected the signal-to-noise conditions, as shown on the spectrum analyzer, first just outside the premises, then inside.

## Results

My tests showed suburban homes had much more noise in the FM broadcast band indoors than outside in the driveway.



*Top: An example of suburban homes tested by the author, this one in Fitchburg, Wis. Left: Inside a suburban house. Right: Outside a suburban house.*

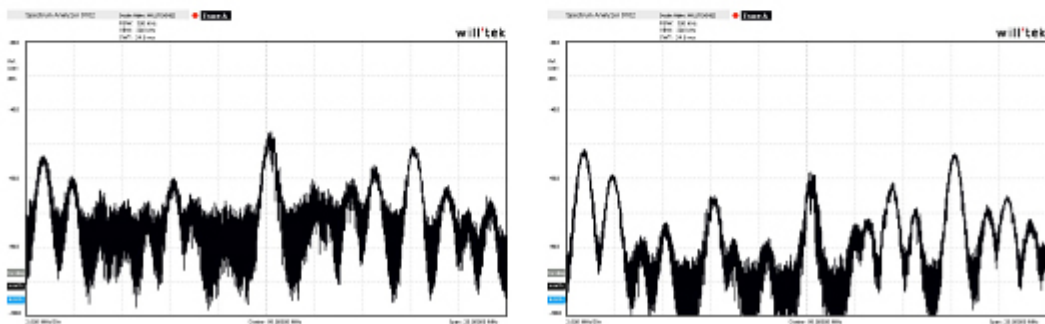
Note that my spectrum analyzer configuration was optimized to show conditions across the whole band in a very broad manner; the settings would not be appropriate to measure an individual signal.



The strongest noise sources I found inside the home were recently-manufactured “wall-wart” switch-mode power supplies used for charging batteries in cellphones and digital cameras. Some made a broad “hash” while others produced a series of noise peaks on discrete frequencies through the band, probably related to the switching frequency.

Some HDTV sets and DVD players also were very noisy in the FM band, maybe from their power supplies as well but with their internal supplies it was impossible to be certain. Some personal computers and digital clocks and telephones were quite noisy in the FM band too.

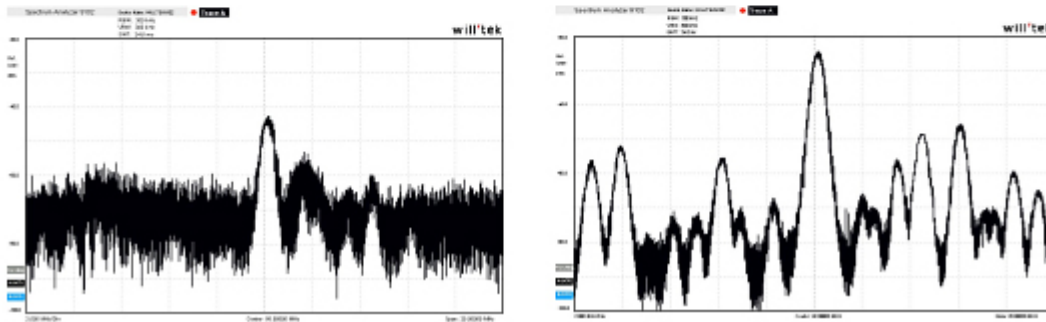
The urban apartments I checked also were awash in noise, much higher than the background level in the parking lot outside. With fewer square feet of space, noise sources were more concentrated than in the single-family home. I encountered a similar array of noise sources, though, and a similar increase in the overall noise from outside in the driveway to indoors.



Top: An example of urban apartment buildings tested by the author, this one in Madison, Wis. Left: Inside an urban apartment. Right: Outside an urban apartment.

We checked several urban office structures on our University of Wisconsin campus in Madison as well. They all suffered a bad combination of significant attenuation of the desired FM signals and high noise levels indoors.

I found it harder to find specific causes of the noise in this environment. Some computers were noisy, as were many of the telephones. Printers with their switching-mode power supplies were cranking out the noise as well.



An urban office building in Madison, Wis. Left: Inside an urban office building. Right: Outside an urban office building.

But some of the noise in the office areas was harder to pinpoint; I'm thinking there are more sources in this environment, on various floors and rooms, with more reflection and multipath propagation on the noise signals from the metallic structures, all of which tends to "blur" the source.

Using the loop antenna as a probe, I swept many rooms in the test buildings. Switching power supplies, consumer electronics and office equipment like computers, printers and monitors were among the worst culprits. Noise was pouring out of some of these devices at alarming levels. It seems impossible that they ever met existing specifications for radiated or conducted RF noise.

One cell phone battery charger was so noisy that when it was unplugged I could see a change in the noise outside the building.

## Conclusion

All locations visited showed a dramatically higher noise level indoors.

Putting numbers on this noise is difficult, as moving the antenna around even a bit greatly varies the absolute strength of the noise.

Stepping back and thinking of my overall experience, across the whole band, in all the locations, it would be fair to say I saw as much as a 20 to 30 dB increase in overall noise going from outside to indoors. Even without hard numbers it is clear that the modern indoor environment is much noisier in the 88–108 MHz range than nearby outdoor locations.

In the situations in which I was assisting a listener with a reception problem, I was able to find places to put the listener's radio and antenna to get better radio reception. In most cases the listener had installed his or her radio on a shelf or table quite close to other electronics, some of which were spewing out noise.

I moved the radio out from among the noise sources and reception was naturally better. But of course we cannot expect all listeners to have a broadcast engineer with test equipment available to come to their home and help position their radio for best reception.

Why the increasing noise problem indoors? My research seems to show that electronic devices are being manufactured without adequate concern for their incidental RF radiation.

I contacted five engineers working in the field of switch-mode power supplies. Four of the five indicated that radio frequency interference was not a major priority for their companies — especially if improved RFI performance would result in any increase in manufacturing cost. The fifth engineer said his work was on devices for the medical electronics market, and RFI specifications had some importance for his company.

One of these engineers also said that further cost cutting may occur when products are contract-manufactured at a distant factory. For example, shipments of a battery charger built in China were found to be lacking the specified metallic shielding paint applied to the inside of the plastic cabinets.

I also heard from several engineers who said the third-party switching power supplies that had been specified and tested for their products were later replaced by less expensive products that had not been tested for RFI compliance. The replacement power supplies had the correct mechanical form-factor and made the right voltages at the right currents, but were probably not as RF-quiet.

The fact that these manufacturing abuses can happen indicates to me that the regulatory agencies involved may have lost control of the situation.

As interference from these incidental noise emitters increases, all radio and "wireless" systems are at risk. We can expect our signal coverage to decrease and user complaints to rise. And new technologies, such as HD Radio and HDTV, may not perform as predicted due to the increasing noise levels.

In the face of intense competition for attention of listeners, broadcasters cannot afford to ignore this problem. Today's listeners and viewers have little patience with reception problems, and faced with any difficulty will go to other media for their news and entertainment.

In the short term, education about the noise pollution problem is helpful. Listeners can often reposition their radios and antennas, and/or disconnect offending noise sources, to get better reception. Radios tend to be placed on shelves or tables quite close to other electronics spewing out noise.

Moving the radio out from among the noise sources and reception naturally will help. But this is an example of treating the symptom rather than the cause.

For the long-term health of broadcasting, better control of radio noise at the manufacturing end is necessary.

This article is based in part on a paper delivered at last year's NAB Broadcast Engineering Conference.

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