AM/FM/TV Digital Broadcasting and **UHF Channel Packing Plan Recent History and Future Trends** Kevin Scott K4GTR kevindscott@bellsouth.net



TV Channels -Historical

- VHF Low CH 2 to 6
- VHF High CH 7 to 13
- UHF CH 14 to 83 (original)
- UHF CH 14 to 69 (less Cellular)
- UHF CH 14 to 51 (less 700 MHz LTE and Public Safety)
- UHF CH 14 to 36 (less 600 MHz for T-Mobile, Dish, US Cellular and several venture capital companies)
 - Chart states CH30 but should state CH36



The Shrinking of TV Broadcasting OTA Spectrum

https://2llos6vjz1k3skmx03njbqdc-wpengine.netdna-ssl.com/wpcontent/uploads/2016/04/Repack-2012-600MhzSpectrum-2.png

TV Channel Facts You May Not Know

- There is a 4 MHz gap between Channel 4 and 5
 - This is NOT the Four Meter amateur radio band mostly EU countries (approx. 70 70.5 MHz)
 - Used for highway call boxes
 - Hearing systems for auditorium, churches, etc.
- There is NO Channel 37 anywhere in the US: https://en.wikipedia.org/wiki/Channel_37
 - Reserved for Radio Astronomy
 - Medical Telemetry Equipment
- T-Band; 470 512 MHz (CH 14 20)
 - Used in 11 large metro areas for Public Safety
 - Proposed for these metro areas to move to other bands for TV repacking
- Analog CH 6 audio carrier was at 87.75. Since there is no CH 6 Digital TV in ATL, WTBS-LP is using 87.7 as a local FM radio station

Loss of Channels 70 to 83 (806 – 890 MHz)



- Prior to the reallocation, with the exception of a handful of full service TV stations, translators were the primary users of these channels
- Primary users of the new allocation (824 849 & 869 894 MHz):
 - Cellular, Wireline (Baby Bells) and Non-wireline (Airtouch, US Cellular, Cellular One, Alltel, etc.) carriers
 - Land Mobile (806 824 MHz)
 - Public Safety
 - Trunked mobile systems
 - Nextel
 - Nextel channels were in between Public Safety channels caused much interference
 - Later moved to 2 GHz and then ceased service

Loss of Channels 51 to 69 (698 - 806 MHz)

- Lower 700 is primarily allocated to AT&T and Verizon for LTE 4G services
- Upper 700 is allocated to Land Mobile Public Safety
 - Local services, cities, counties, etc.
 - Broadband nationwide service, FirstNet (AT&T)
- Channel 55: Originally allocated nationwide to MediaFLO – a portable TV subscription streaming service with a separate device. Owned by QualComm. Service stopped Oct 2010. AT&T now has this allocation



https://awt-global.com/wp3/resources/700-mhz-band-plan/

Loss of Channels 51 to 69 (698 - 806 MHz)

- TV stations in this channel range moved to Channels 51 and below during the Digital TV transition in 2009
 - Some stations went off the air for good
- Movement of Atlanta TV stations during 700 MHz transition
 - CH 69 (Originally UPN, now The CW) moved to CH 43
 - CH 63 (TBN) moved to CH 44
 - CH 57 (Religious) moved to CH 41
- 700 MHz wireless microphones had to cease operation and are now illegal

Loss of Channels 38 to 51 (614 – 698 MHz)



- 600 MHz Auction results: <u>https://www.fiercewireless.com/wireless/checking-top-10-owners-600-mhz-spectrum-licenses</u>
- Primary winner of auction is T-Mobile. They already have TV commercials touting their new 600 MHz service
- Other auction winners include:
 - Dish Network
 - Comcast
 - US Cellular
 - Several venture capital groups
- Many TV stations are still operating in this range as they prepare for a new channel transition
- Atlanta's transition, for the most part occurred Aug/Sep 2019
- Wireless microphones will need to cease operation here, too

Digital TV Properties

- US Digital TV uses the ATSC 1.0 protocol. The modulation is 8VSB
- Same channel bandwidth, 6 MHz, as the analog standard (NTSC)
- Digital TV is essentially a high bandwidth data stream of 19.39 Mbps
 - This allows for multiple sub-channels to be broadcasted within a 6 MHz channel
 - One or two HDTV and several SDTV sub-channels
 - Several SDTV sub-channels plus many audio channels
- Each TV station can "tweak" the compression and resolution bandwidth to balance between visual quality, number of sub-channels and data
 - 720p & 1080i have around an 11+ MBPS data rate
 - 480i have around a 4 MBPS, perhaps less, data rate
 - Some of the baseline transport of the TV carrier consumes a portion of the overall data rate



Digital TV Properties

- Virtual Channel vs Transmit Channel
 - Since many people are familiar with the historical analog channel of many TV stations, a "Virtual Channel" was a feature set up in the ATSC standard to allow stations to still use that channel number
 - WSB has three sub-channels
 - 2.1 is a high definition 720P channel
 - 2.2 is a standard definition 480i channel
 - 2.3 is a standard definition 480i channel
 - The analog NTSC equivalent is 486i of visible raster

TV Channel - Network 🔻	Angle Degrees	Range Miles	Signal	dBm	al	RF Ch Callsign	ERP kW	MSL meters	City State
02.1 - ABC 02.2 - Escape 02.3 - Laff	216	24.4	<mark>60%</mark>	-37		39, UHF WSB-TV	1000	608 m	Atlanta GA

- Channels 2 to 6 used to be prime "real estate" for Analog TV (especially CH 2) because of their extended range compared to VHF-High and especially UHF with lower power
 - VHF Low 100 kW max (Analog)
 - VHF High 316 kW max (Analog)
 - UHF 5 MW max (Analog)
- For Digital TV, these channels have poor impulse noise rejection and are therefore rarely used for high power DTV

Examples of Multiple Sub-channels

63.1 - TBN 63.2 - Hillsong Channel 63.3 - JUCE 63.3 - Smile of a Child 63.4 - Enlace USA 63.5 - TBN Salsa	80	2.8	90%	-13	111	44, UHF WHSG-TV	1000	596 m	Monroe GA
32.1 - Biz TV 32.2 - This TV 32.3 - Infomercials 32.4 - Movies 32.5 - Classic Shows 32.6 - Comet TV 32.7 - Retro TV 32.8 - LATV 32.9 - Charge! 32.1 - Estrella TV 32.21 Audio 32.22 Audio 32.23 Audio 32.24 Audio 32.25 Audio 32.26 Audio 32.27 Audio 32.28 Audio 32.29 Audio 32.3 - Audio	80	2.8	72%	-28	.111	32, UHF WANN-CE	105	604 m	Atlanta GA
14.1 - ION 14.2 - Qubo 14.3 - ION Life 14.4 - Infomercials 14.5 - QVC 14.6 - HSN 47.1 - TLMD	337	38.5	54%	-41	a 11 ,	31, UHF VPXA-TV	1000 \$	926 m	Rome GA

Atlanta TV Stations (CH38 – 51) That Must Move Channels

Call Letters	Network	Virtual Channel	Current TX Channel	New TX Channel
WSB	ABC	2	39	32
WUVG	Univision	34	48	18
WIGL-LD	ТСТ	38	38	8
WIRE-CD	Info	40	40	33
WTHC-LD	Tourist	42	42	3
W45DX-D	HSN	45	45	X
WKTB-CD	Telemundo	47	47	23
WATC	Religious	57	41	34
WHSG	TBN	63	44	22
WUPA	CW	69	43	36

Atlanta TV Stations Are Packed Tightly

NOTE: In addition to RF CH 10, WXIA has a virtual channel 11-11 that is on WATL's CH 25 carrier. It is also 1080i like the VHF channel. So, CH 25 has two 1080i sub-channels plus a few more 480i sub-channels. Perhaps it is because all of the rest of the TV stations are on UHF, too, and people's attic and home antennas are primarily UHF gain antennas with no gain on VHF-Highband

Call Letters	Network	Virtual Channel	Current TX Channel	New TX Channel
WTHC-LD	Tourist	42	42	3
WUVM-LP		4	4	4
WTBS-LP		26	26	6
WGTV	PBS/GPTV	8	8	7
WIGL-LD	ТСТ	38	38	8
WEQT-LD		9	9	9
WXIA	NBC	11	10	10
WDNV-LD	This	12	12	12
WSKC-CD	Korean	22	22	14
WAGC-LD	Info	51	14	15
WPXA	ION	14	16	16
WUVG	Univision	34	48	18
WGCL	CBS	46	19	19
WANN-CD		32	29	20
WPBA	PBS	30	21	21
WHSG	TBN	63	44	22
WKTB-CD	Telemundo	47	47	23
WATL	MyN	36	25	25
WLVO-LD	Diya	21	26	26
WAGA	Fox	5	27	27
WYGA-CD	Shop	16	16	29
WTBS-LD		26	30	30
WPCH	Peachtree	17	20	31
WSB	ABC	2	39	32
WIRE-CD	Info	40	40	33
WATC	Religious	57	41	34
WDTA-LD	Daystar	35	35	35
WUPA	CW	69	43	36
W45DX-D	HSN	45	45	Х

What Other TV Markets are Doing

• In Chattanooga both ABC and Fox are on the same main channel

Channel	Video	Aspect	PSIP Short	Name		Program	nming ^[0]			
9.1	720n		ABC		Main	WTVC pro	gramming	/ ABC		
9.2	720p	16:9	FOX		Fox					
9.3	480i		TBD		TBD					
09.1 - A 09.2 - F 09.3 - T	BC OX BD			27	' 0	24.8	64%	-33	ııll	09, VHF-Hi WTVC

 In Memphis, a full-power station, WMC-TV is on Channel 5

05.1 - NBC 05.2 - Bounce TV 05.3 - Grit	79	9.3	83%	-19	ıılİ	05, VHF-Lo WMC-TV	
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 In Gainesville, FL, Fox and Ion are on one channel, ABC and CW are also on one channel

5 5 5	1.1 - FOX 1.2 - Movies! 1.3 - ION	179	21.7	58%	-39	ıil	31, UHF WOGX
2 2 2	0.1 - ABC 0.2 - CW+ 0.3 - Me-TV	202	10.2	<mark>66%</mark>	-32	ıll	16, UHF WCJB-TV

How to find the DTV channel locations and direction

- My favorite is: <u>https://otadtv.com/tvtower/index.html</u>
- It has a sortable table for **many** important properties including:
 - Channel number
 - Distance from your QTH (miles)
 - TX Channel
 - Direction
 - TX ERP and height
 - Estimate signal strength



TV Channel - Network	Angle Degrees	Range Miles	Signal	dBm ₊	ıtl	RF Ch Callsign	ERP kW	MSL meters	City State
46.1 - CBS 46.2 - COZI TV 46.3 - Grit	80	2.8	93%	-11	ııll	19, UHF WGCL-TV	1000	615 m	Atlanta GA
17.1 - Independent 17.2 - WPCH-SD	80	2.8	93%	-11	ıIİ	20, UHF WPCH-TV	1000	596 m	Atlanta GA
05.1 - FOX 05.2 - Movies! 05.3 - BUZZR 05.4 - Light TV	93	3.1	91%	-12	ألد	27, UHF WAGA-TV	1000	618 m	Atlanta GA
69.1 - CW 69.2 - Decades	80	2.8	90%	-13	ıIİ	43, UHF WUPA	1000	616 m	Atlanta GA
63.1 - TBN 63.2 - Hillsong Channel 63.3 - JUCE 63.3 - Smile of a Child 63.4 - Enlace USA 63.5 - TBN Salsa	80	2.8	90%	-13	ıll	44, UHF WHSG-TV	1000	596 m	Monroe GA
34.1 - Univision 34.2 - UniMas 34.3 - GetTV 34.4 - Escape	80	2.8	90%	-13	ıılİ	48, UHF WUVG-DT	1000	596 m	Athens GA
36.1 - MyN 36.2 - This TV 36.3 - Antenna TV	80	2.8	89%	-14	ıIİ	25, UHF WATL	500	615 m	Atlanta GA
11.1 - NBC 11.2 - WeatherNation 11.3 - Justice Network 11.4 - Quest	133	4.4	86%	-16	ıılİ	10, VHF-Hi WXIA-TV	80	595 m	Atlanta GA
02.1 - ABC 02.2 - Escape	149	2.9	83%	-19	ıIİ	39, UHF WSB-TV	1000	608 m	Atlanta GA

Other Websites to Find TV Stations

Antenna Direct: <u>https://www.antennasdirect.com/transmitter-locator.html</u>



			Available	Channels			
Call Sign		Affiliate	Virtual Channel Displayed on TV	DTV Channel	Band	True Heading	Distance
kbs24		Ethnic	22.1	22	UHF	211.30°	7.25 mi
kbs24		Korean	22.2	22	UHF	211.30°	7.25 mi
kbs24		CGN	22.3	22	UHF	211.30°	7.25 mi
SHOP	Carlo Street	Infomercials	22.4	22	UHF	211.30°	7.25 mi
TLMD		Telemundo	47.2	47	UHF	211.55°	12.16 mi
TELEXIT		TeleXitos	47.3	47	UHF	211.55°	12.16 mi
KTN-1		Korean	47.4	47	UHF	211.55°	12.16 mi
KTN MBC			47.5	47	UHF	211.55°	12.16 mi
WKTB			47.6	47	UHF	211.55°	12.16 mi
WGTV-HD	O 785	PBS	08.1	8	VHF	189.66°	18.36 mi
CREATE	©create	Create	08.2	8	VHF	189.66°	18.36 mi
KNOWLED	W)RLD	World Channel	08.3	8	VHF	189.66°	18.36 mi
KIDS		PBS Kids 24/7	08.4	8	VHF	189.66°	18.36 mi

Other Websites to Find TV Stations

DTV Coverage

Signal Legends

atl		al		d.		×	
Str	ong	Mode	erate	We	ak	No Sigr	nal
Inc	entive	e Auct	ion (IA)	Info	orma	tion	
Mo	ouse o	ver th	e letter	for	mor	e detai	s
ab	out th	at call	sign.				
Ca	llsign		Netwo	rk	Ch#	Band	IA
Cli	ck on	callsig	n for de	etai			
all	WUP/	4	THE		69	UHF	R
all	WGCI	L-TV	CBS		46	UHF	
all	WUV	G-DT	UNIV		34	UHF	R
all	WAGA	A-TV	FOX		5	UHF	
all	WPCH	H-TV	IND		17	UHF	R
all	WATL		MY N		36	UHF	
all	WSB-	TV	ABC		2	UHF	R
all	WHSC	G-TV	TRIN		63	UHF	R
all	WATC	DT	ETV		57	UHF	R
all	WPXA	A-TV	ION		14	UHF	R
all	WXIA-	-TV	NBC		11	Hi-V	
all	WGT\	/	PBS		8	Hi-V	R
atl	WANI	N-CD				UHF	R
atl	WKTE	3-CD				UHF	R



FCC: https://www.fcc.gov/media/engineering/dtvmaps

III WSB-TVABC2UHFRWSB-TV Facility ID: 23960WSB-TV (Licensing) (Public File)WSB-TV (License: ATLANTA, GACity of License: ATLANTA, GARF Channel: 32RX Strength: 100 dbuV/mTower Distance: 23 mi; Direction: 227°Repacked Channel: 32Repacking Dates: 8/3/2019 to 9/6/2019

Other Websites to Find TV Stations

Over the Air Digital TV: <u>https://www.overtheairdigitaltv.com/t</u> <u>v-station-locator-tool/</u>

- typical range of indoor antenna

		Dig	ital			Tullahoma (74) Synta
ut method: 🖲 Address or 🔘 Coordinates	Callsign	Chan	Network	Dist (mi) Path	NM (dB)	iburg
	○ WATC-DT	0 41 (57.1)) Ind	21.5 LOS	56.0	Chatjanooga (74) Murphy all of Franklin (4)
Address:	○ WPXA-TV	🧿 31	ION	36.7 LOS	45.7	
City: Suwanee	WGCL-DT	🧿 19 (46.1) CBS	23.2 2Edge	38.6	Deletroper Delet
	○ WPCH-TV	0 20 (17.1)	23.2 2Edge	37.8	21 Scottsboro Seneci
State/Province: GA V Zip/Postal Code: 30024	WGGD-LD	O 15		9.6 LOS	36.3	
	WAGA-DT	0 27 (5.1) Fox	23.6 2Edge	35.7	stall and Forthayne Combour
	WATL-DT	0 25 (36.1) MyN	23.2 2Edge	34.4	ntersville
Map this	WUPA	<mark>O</mark> 43	CW	23.2 2Edge	34.2	Albertyller Bone Contraction
	WHSG-TV	0 44 (63.1) Ind	23.2 2Edge	33.4	Alpharetta
	WUVG-DT	0 48 (34.1) Uni	23.2 2Edge	32.7	Gadsa m
	WGTV-DT	0 8 (8.1) PBS	18.4 1Edge	32.0	278
	WXIA-DT	0 10 (11.1) NBC	25.8 1Edge	30.9	Jacrsonelle Atlanta (44)
	WSB-DT	0 39 (2.1) ABC	26.4 1Edge	28.2	Anniston
	WUVG-DT	<mark>0</mark> 17	Uni	13.3 1Edge	26.3	Canoliton Ganoliton Greensboro
	WAGC-LD	<mark>O</mark> 14		23.2 2Edge	17.6	Talladega
	WLVO-LD	26		23.2 2Edge	16.6	
	WTBS-LD	<mark>O</mark> 30		23.2 2Edge	16.3	National Forest
	WPBA-DT	O 21 (30.1) PBS	25.8 2Edge	16.2	(280) (431) LaGrange (23) Milledgeville
	WANN-CD	O 29 (32.1)	23.2 2Edge	16.2	Alexander City San
	○ WSB-TV	0 46	ABC	13.3 1Edae	15.9	Macon Map data
	WKTB-CD	47		12.4 1Edae	15.6	Color Scale
				5		VERY STRONG STRONG MEDIUM WEAK VERY WEAK

Other Websites to Find TV Stations

 This site shows the resolution, 480i, 720p or 1080i (upper left) plus "Technical Data shows more station antenna information and signal plot (bottom)

https://www.rabbitears.info/market.ph p?mktid=10

 This site provides a wide view of TV stations but no direction (upper right) <u>https://www.rabbitears.info/market.ph</u> <u>p?request=print_market&mktid=10</u>



Digital TV Market Listings

Click here to sort by physical channel.

	RE	ADS			Name			Stations	
		8		Atlanta.	Georgia			39	
Display Channel	Physical Channel	Statio (s)	n	City	State			Expand/Contract All	Print Al
2	32; 46	WSB-	IV	ATLANTA	GA (13		ABC		
Display Channel	Physical Channel	Video	Audio	Call Sign	Network/Programming	Nickname		Notes	Print
02-1.9	32.1	720p	DD5.1 🗐	WSB-HD	ABC@	"WSB-TV 2"			
02-2	32.2	480i (w)	DD2.0	Bounce	Bounce TV #				
02-3	32.3	480i (w)	DD2.0	LAFF	Laff#				
02-7 #	46.1	720p	DD5.1 📢	WSB-HD	ABC	"WSB-TV 2"			
02-8	46.2	480i (w)	DD2.0	Bounce	Bounce TV @				
02-9	46.3	480i (w)	DD2.0	LAFF	Laff@				
Technical I	Data								

Display Channel	Digital Channel	Call Sign	Network	Nickname
WSB-TV	ATLANT	FA, GA		
02-1	32.1	WSB-HD	ABC	"WSB-TV 2"
02-2	32.2	Bounce	Bounce TV	
02-3	32.3	LAFF	Laff	
WAGA-TV	ATLANT	FA, GA		
05-1	27.3	WAGA-HD	FOX	"Fox 5 Atlanta"
05-2	27.4	MOVIES!	Movies!	
05-3	27.5	BUZZR	BUZZR	
05-4	27.6	LIGHTtv	Light TV	
05-5	27.7		Decades	
W08EG-D	TOCCO.	A, GA		
08-1	8.1	WGTV-HD	PBS	"GPB"
WGTV	ATHENS	6, GA		
08-1	8.1	WGTV-HD	PBS	"GPB"
W08EG-D	TOCCO	A, GA		
08-2	8.2	CREATE	Create	
WGTV	ATHENS	6, GA		
08-2	8.2	CREATE	Create	
08-3	8.3	KNOWLED	World Channel	"GPB Knowledge"
W08EG-D	TOCCO	A, GA		
08-3	8.3	KNOWLED	World Channel	"GPB Knowledge"
WGTV	ATHENS	s, GA		
08-4	8.4	KIDS	PBS Kids 24/7	
W08EG-D	TOCCO.	A, GA		
08-4	8.4	KIDS	PBS Kids 24/7	
WGTV	ATHENS	s, GA		
08-8	8.8		Audio	"GPB Radio"
THORE &	-			



Stations for Atlanta, Georgia

TV translators

- Used to fill-in gaps in coverage that the main transmitter does not reach. Used often in the mountains
- Example is WSB-TV. They needed to re-create the same coverage that was lost when they transitioned to Digital
- Original analog CH 2 had incredible coverage because of its low frequency and coverage was reduced because of a high UHF channel assignment (was CH 39 and now CH 32 compared to CH 2)
- Stone Mountain causes a signal shadow to the east
- For CH 46, virtual channels are 2.4, 2.5 & 2.6 to distinguish from main transmitter
- For CH 31, virtual channels are 2.7, 2.8 & 2.9 to distinguish from main transmitter
- <u>https://en.wikipedia.org/wiki/WSB-TV</u>
- Some or all may go off the air because of the Channel Repack

City of license	Callsign/channel	Transmitter power	Coordinates
Athens	WSB-TV 31	5,000 watts	🔍 34°7'32"N 83°51'32"W
Gainesville	WSB-TV 46	9,000 watts	🔍 32°55′51″N 83°47′0″W
Newnan	WSB-TV 17	10,000 watts (CP)	🔍 33°24'43"N 84°50'3"W (CP)
Rome	WSB-TV 14	1,000 watts (application)	Q 34°14'2"N 85°13'50"W (application)

Near Wayah Bald, NC







Brasstown Bald

CH 12 – Young Harris







TV Tower Tour – Richland Towers

- WGCL CH46, WPCH CH17, WATL CH 36, WUPA CH 69 and more with Analog and Digital channel antennas
- Many FM Radio Stations
- MediaFLO
- Candelabra platform is at 1000 feet elevation
- Two x Two-person elevator in center

Tower Top

- UHF Analog & Digital
- FM 6-bay
- Spare UHF (beneath)
- Work platforms
- MediaFLO below FM



UHF Digital upper/Analog lower FM

MediaFLO CH55

FM Combiners and Filters – Five Stations

- WZGC 92.9
- WUBL 94.9
- WWPW 96.1
- WWWQ 99.7
- WKHX 101.5



FM HD Radio Digital Mask Filters





UHF TV Mask Filter



UHF Filter/Combiner



Out to the Tower



At the Top

Elevator Top (right) and Coming up from the Lower Level

Note the rigid line "plumbing" in the background



Looking Out and Down









10 Bay FM Antenna Array

Bays on three sides Circular polarized

UHF Antenna

- Analog on bottom
- Digital on top
- Analog and Digital were broadcasting at the same time but on different frequencies (or channels)



CH 55 MediaFLO Antenna

No Longer in Active Service



WATL-36 & WUPA – 69 Antennas

- On adjacent tower
- Analog channel on bottom
- Digital channel on top
- TV antenna mount with feedline (red)
- FM bays side-mounted just below (yellow)



Downtown View

Through one of WRFG's bays



Antenna Farm







Nice Views of Emory, Stone Mountain and the old Georgia Dome

What's Next? NEXTGENTV

Advanced Television Systems Committee ATSC 3.0

- Next generation TV standard: <u>https://www.mediapost.com/publications/article/341286/atsc-30-enabled-tvs-get-consumer-branding-nextge.html</u>
- Still using a 6 MHz channel
- Capable of 4k 3D UHD transmission
 - In operation at Incheon Airport. Picture was incredible
- Includes Mobile TV
- Max Data Rate 57 Mbps
- Transition in US is not mandatory
- TVs require a new tuner; not backward compatible with ATSC 1.0
- Modulation is OFDM
- NextGenTV sets will be available later this year in 2020. Will use logo
- <u>https://www.tvtechnology.com/atsc3/what-will-atsc-3-0-mean-for-the-broadcast-industry</u>





ATSC 1.0 to ATSC 3.0 Transition Proposal

- Expect full transition by 2024 to 2025
- Major stations will move to a separate shared ATSC 1.0 channel or channels; will broadcast in SDTV to maximize number of sub-channels
- Will simulcast ATSC 3.0 programming on their main channel while consumers purchase new TVs and/or buy ATSC 3.0-to-HDMI tuners
- Cable and Satellite companies will need upgraded boxes to provide both 4k and lower programming via HDMI to existing TVs
- Eventually the ATSC 1.0 TV channel will cease operation

HD Radio - AM and FM



- As in Digital TV, HD radio allows for multiple "stations" or sub-carriers. On FM there are typically three and sometimes four separate audio feeds
- Find a station listing: <u>https://hdradio.com/stations/</u>
- Typically, the HD-1 channel is an HD version of the main analog channel

Spectrum – Analog Mono & Stereo FM



FM channel = 200 kHz

Baseband image is +/- around "0" to show full channel

Max audio frequency = 15 kHz

- Mono audio is represented by the L+R channels and is FM
- Pilot is the reference (19 kHz) used for stereo demodulation plus the stereo light or display
- The L-R audio spectrum is a DSB sub-carrier using the Pilot Tone as a reference for demodulation. The L+R and L-R are routed through sum and difference amplifiers to product 2L and 2R or Left and Right audio channels
- For weak FM signals, the audio will have "hiss". This is because the L-R is amplitude modulation and is susceptible to noise. The automatic "Stereo Blend" feature on many car radios cut off the hiss but lose a lot of stereo separation (6 dB vs 20 dB)

FM Analog + HD Radio Spectrum

- Since there is never another local station on an adjacent channel, the HD radio carriers operate in the region above and below the analog carrier as shown below
- The HD carrier power level is from 10 to 20 dB below the main analog carrier depending the the main carrier power







HD Radio on the AM Band

 Each AM channel is officially +/- 5 kHz wide but the FCC allows audio up to 10 kHz with a sharp roll-off of higher frequencies



HD Radio on the AM Band

- HD Radio has carriers from 5 to 15 kHz on either side of the main carrier
- AM HD transmitters are only allow to operate during the daytime
- WCNN (680 the Fan) used to operate an HD transmitter. In the early morning, you could listen to 670 or 690. Once they turned on their HD transmitter all you would hear afterwards is digital noise
- This is why HD radio cannot be used at night as it would kill all analog AM radio reception due to interference

All Digital AM Radio

- WWFD, 820 kHz, Frederick, MD has been experimenting with an all-digital AM HD radio signal.
- The primary carrier fits within a +/- 5 kHz window so adjacent channel interference is minimized
- If the blue channels are eliminated, then nighttime operation will be fine
- However, these blue channels are at a much lower power level so it might mimic the current analog interference



The all-digital AM signal consists of two types of digital subcarriers: the "core mode," shown in orange, and the "enhanced mode," shown in blue.



FM Translators

- Translators are a low power FM transmitter from 10 to 250 watts.
- They cannot originate programming. They can only relay programming from another station.
 - Via satellite
 - AM radio station (680 The Fan on 93.7)
 - Another FM radio station (The Joy FM, 93.3 on 92.5)
 - An HD radio station (such as WSRV HD-2 on 97.7)
- In the Atlanta market a majority of the "clear spaces" have been filled by translators to create new stations, extend the range of low power stations or allow 24 hour reception of AM stations that are forced to cut power or sign off at sunset

Local Translator Stations

Call Sign	Freq.	Dist./Signal	City	School	Format
# 🛈 <u>W201CC</u> (<u>KAWZ</u>)	88.1 FM	9.3 mi.	Buford, GA		Religious
\$ (<u>KAWZ</u>)	90.5 FM	7.5 mi. 🕿	Snellville, GA		Religious
(W223CQ (WLKQ-HD2)	92.5 FM	4.4 mi.	Lawrenceville, GA		Christian Contemporary
🗲 🛈 W228CA (WSRV)	93.5 FM	14.2 mi.	<u>Suwanee, GA</u>		Classic Hits
5 W229AG (WCNN-AM)	93.7 FM	22.3 mi. 🕿	<u>Atlanta, GA</u>		Sports
W243CE (WOKS-AM)	96.5 FM	14.2 mi.	Winder, GA		Urban Contemporary
# 1 W249CK (WSRV)	97.7 FM	13.3 mi.	Duluth, GA		Classic Hits
W250BC (<u>WWWQ-HD3</u>)	97.9 FM	22.3 mi.	<u>Atlanta, GA</u>		Нір Нор
(WPLO-AM)	100.1 FM	12.2 mi.	<u>Atlanta, GA</u>		Spanish Hits
(W1ZA-AM) (CP)	101.9 FM	12.3 mi.	<u>Atlanta, GA</u>		Spanish
W280EZ (<u>WISK-AM</u>)	103.9 FM	1.2 mi.🚘	Lawrenceville, GA		Regional Mexican

Crowded FM Broadcast Band in Suwanee





LPFM – Low Power FM Station

- For communities, churches, non-profit groups
- Non-commercial. Finances must be provided by the station licensee
- 10 or 100 watts





Call Sign	Freq.	Dist./Signal	City	School	Format
WAOO (LPFM)	94.5 FM	3.8 mi.	Suwanee, GA		Spanish Christian
WNRE (LPFM)	98.1 FM	1.3 mi.🚘	Duluth, GA		Religious

Another CH 2 Story – WESH Daytona/Orlando

- Originally on CH 2 on a 1740 foot tower between Daytona and Orlando. Coverage was to Gainesville to the NW, near Jacksonville to the north and to Vero Beach to the south
- Main transmitter is on CH 11 east of Orlando (with all of the other main stations)
- Translators are in Deltona (CH 18) and Ocala (CH 19) to fill in the areas up north
 - Perhaps the CH 18 translator is there to give WESH an overlapping signal on UHF since many HD antennas are primarily UHF with gain and simple dipoles for VHF





Thank You