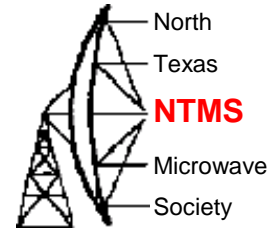


# Monitoring DTV Signals As Propagation Beacons

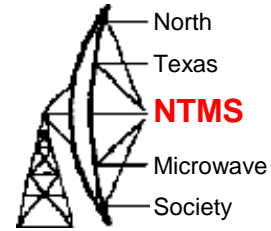
Wes Atchison  
WA5TKU

# Analog TV Channels

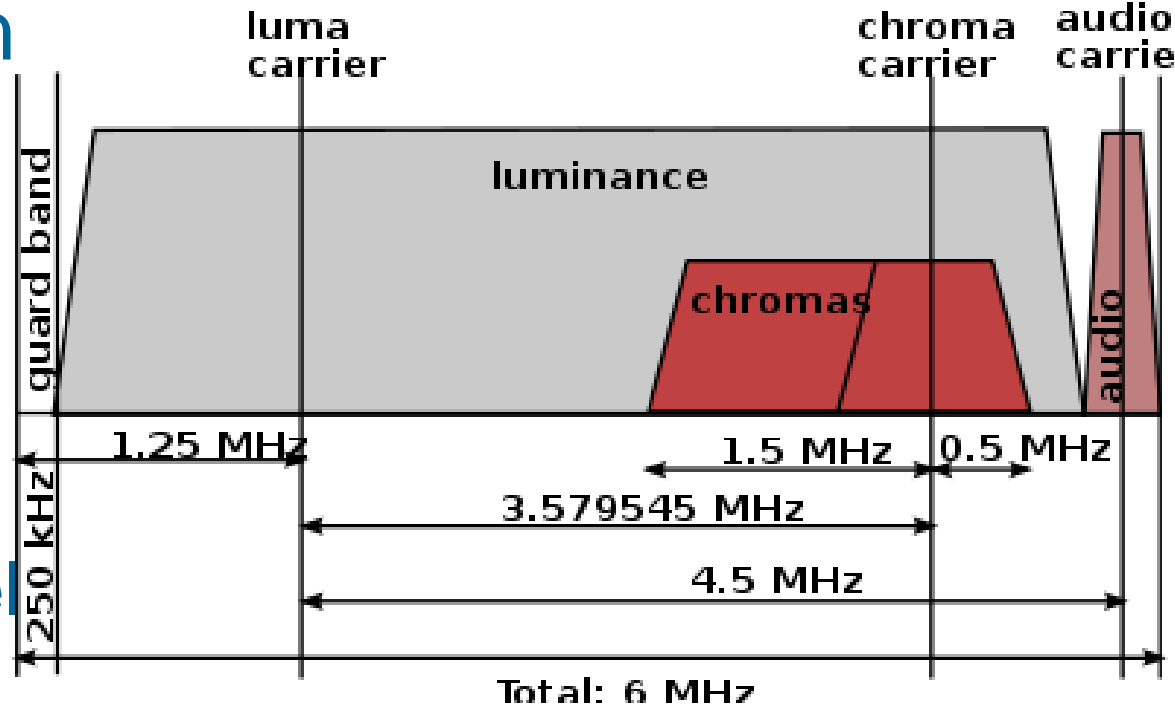


- Each Channel Allotted 6 MHz of Spectrum
  - Channel #1 Started at 44MHz
    - Removed in 1948 – Allocated to Land Mobile
  - Channel #2 – Starts at 54 MHz
- Low VHF Channels
  - 2 through 6
- High VHF Channels
  - 7 Through 13
- UHF Channels
  - 14 Through 83

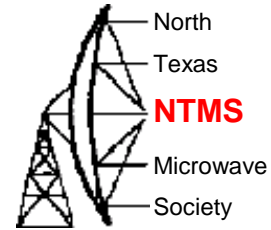
# Analog Television Channels



- FCC Allocation
  - 6 MHz Wide
- Analog TV
  - Video Carrier
  - Color Carrier
  - Audio Channel

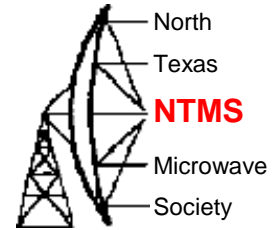


# DTV Channels

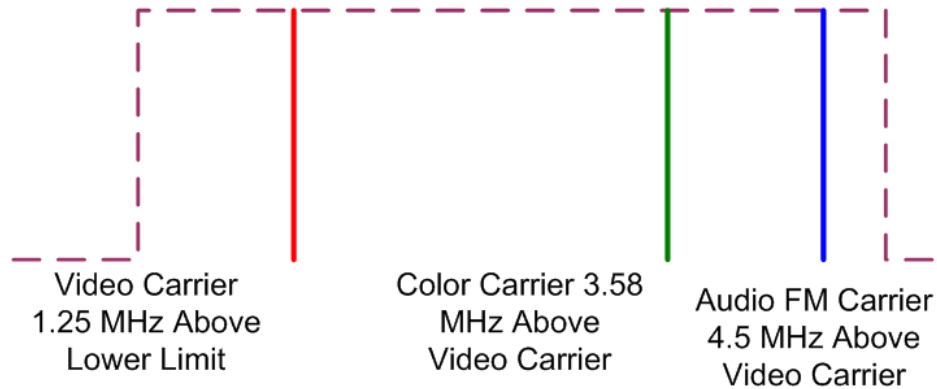


- FCC Re-allotted Channels 70 through 83
  - Channels Allotted to Other Uses
- UHF Channels Now 14 Through 69
- Low VHF Channels Limited to Low Power Analog and DTV Stations
- VHF DTV Channels 7 through 13
- All of the DTV Signal Must Fit Inside 6 MHz Allocation
- Transition to DTV Caused Shifting of Actual Frequencies Used By DTV Station
  - Term Virtual Channels Invented – Virtual Channel # Viewer Sees
  - Example TV Display of Channel 4 No Longer Uses 64 to 70 MHz Frequencies But Some Open UHF Channel Open in Area
  - Virtual Channel 4 In Dallas Area Uses Real Channel 35 (596 to 602 MHz)

# Analog vs DTV Channel



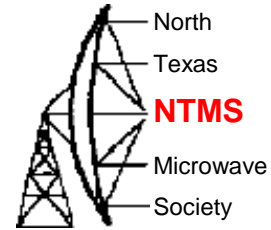
Analog NTSC TV  
Channel 6 MHz Wide



DTV Channel 6 MHz Wide

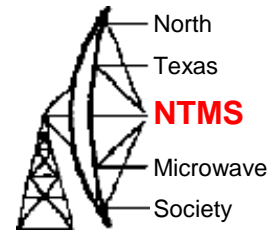


# Analog to DTV Transition Changes

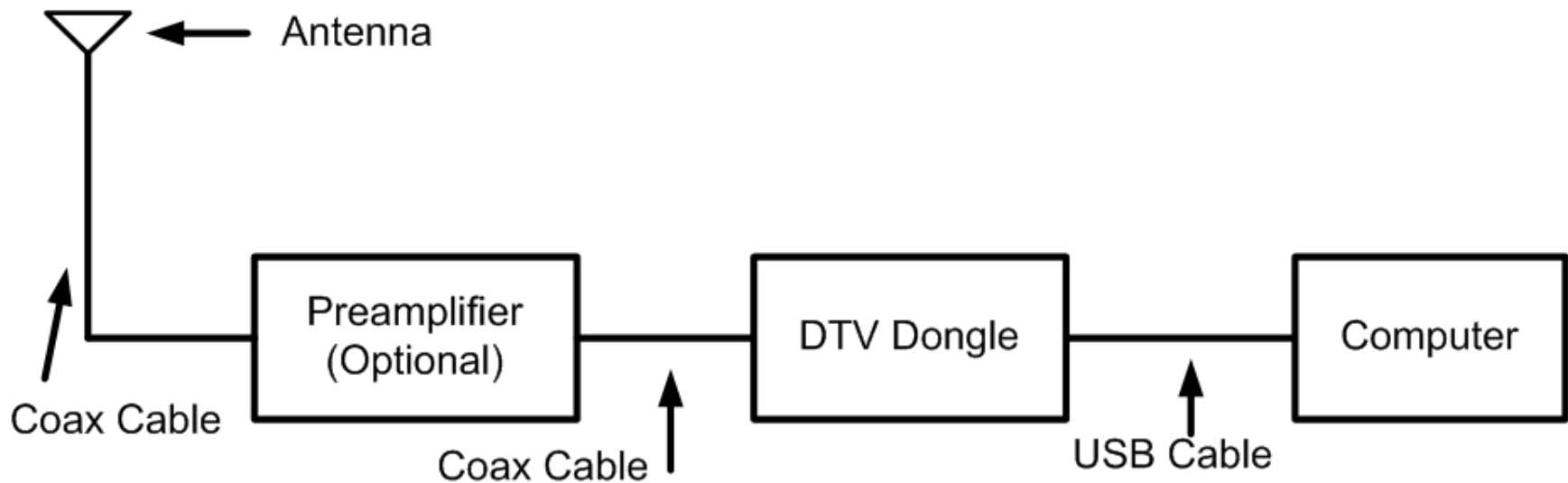


- Before DTV Transition
  - Listened to Video Carrier
  - Location Could be Identified By Video Carrier Offset - +/- 10 KHz
- After DTV Transition
  - Few to No Analog Transmitters
  - Analog Transmitters Are Low Power
    - Translators
  - Propagation Listeners Had to Change Frequencies
  - No Carrier Offset to Help Identify Individual Station

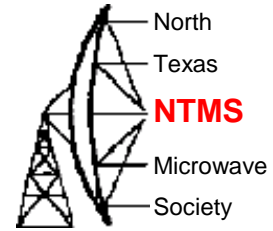
# Low Cost Receiving System



## Basic Software Defined Radio Setup



# OLD TV Antenna

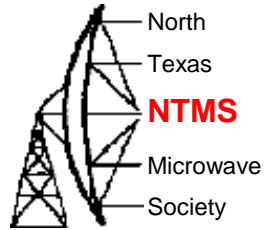


- New DTV Antennas **Do Not** Have Low VHF Channel Elements





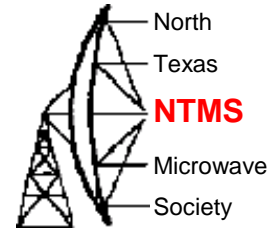
# SDR Receiver



- Cost About <\$25
- Often Shipped With CD Rom – **DO NOT USE**
- Several Sources of SDR Receiver
- Make Sure SDR Uses RTL2832U & R820T Chips
- Third Party Software Developed for These Chips



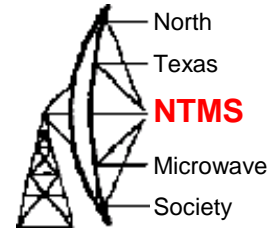
# NooElec RTL Receiver



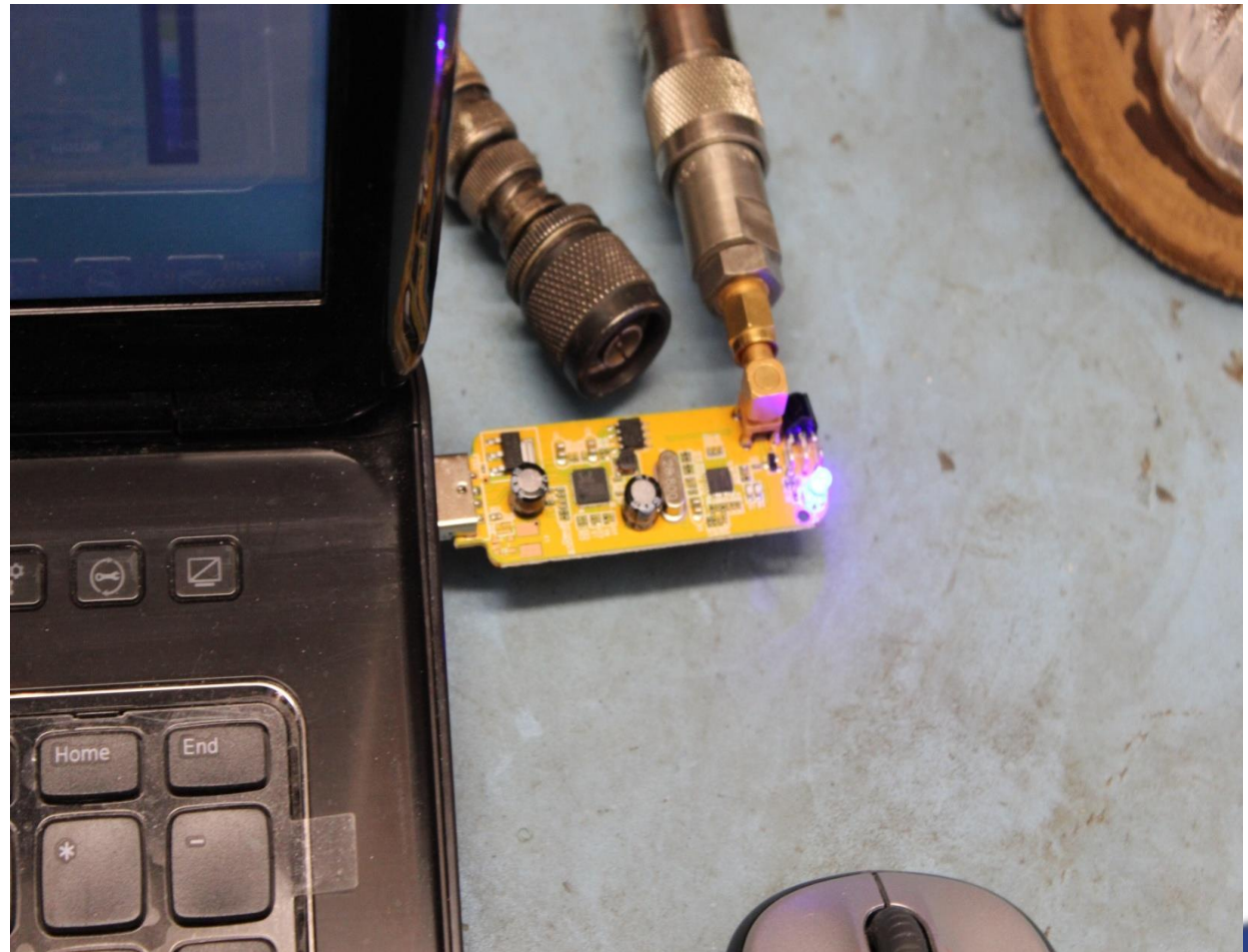
- Antenna Connector is MCX
- Must Adapt to More Common Connector Like UHF or SMA
- Adapter Cables Ready Made Sell for About <\$6



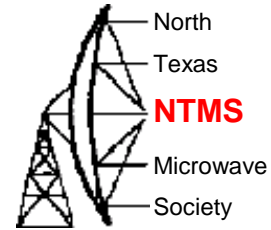
# NooElec Installed SMA



- Removed MCX Connector and Replaced with SMA
- Not for Novice

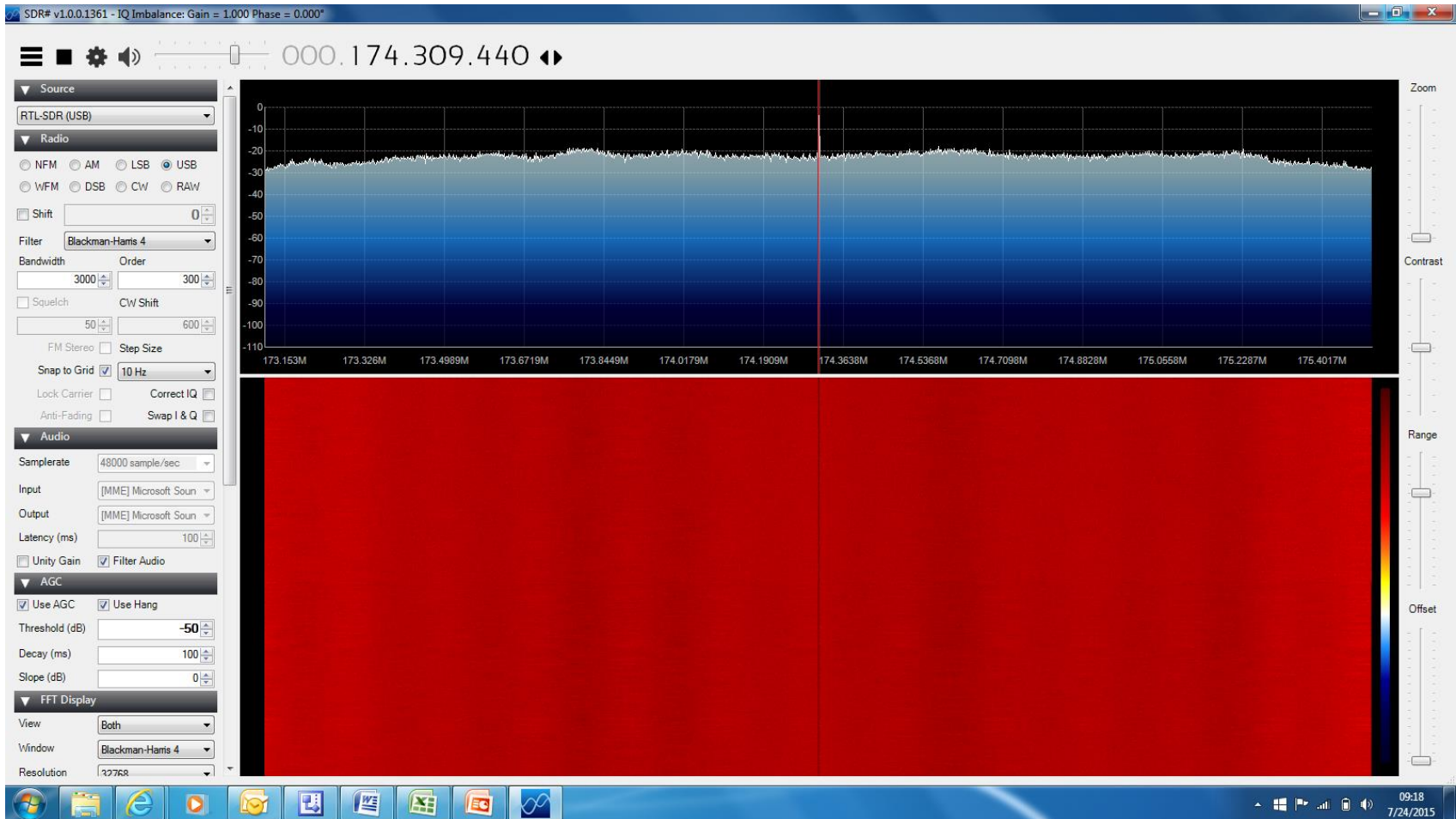
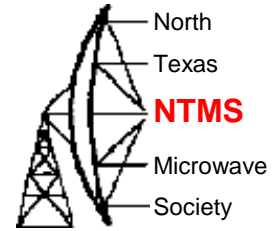


# Software

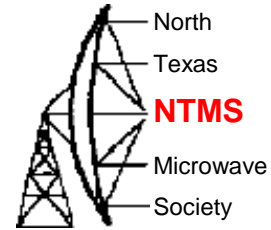


- Multiple Software Defined Radio (SDR) Control Programs
  - SDR#<sup>3</sup> Very Popular and Free – Windows
    - Control Software I Use
    - Yahoo Group for Support
  - HDSDR – Free – Windows
  - SDR-Radio.Com – Free – Windows
  - Linrad – Free – Windows/Linux/Mac

# SDR# Software<sup>3</sup>

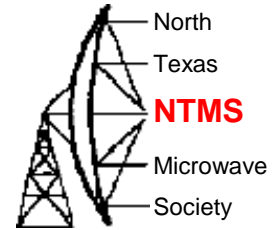


# Capture Software



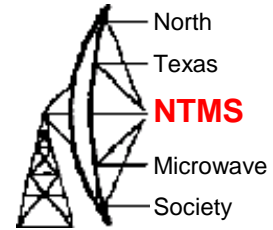
- Received Signal Capture Software
  - Argos<sup>4</sup> - Free
  - Spectran<sup>4</sup> – Free
  - Radio Sky<sup>7</sup> – Free Version Limited Features
    - Purchased Version Includes Many Additional Features
  - I Use All 3

# ARGOS<sup>4</sup>



The screenshot shows a Windows 7 desktop environment. The desktop background is a blue gradient with a satellite dish icon. Numerous application icons are visible, including Microsoft Office Word and Excel, Adobe Photoshop, and various astronomy and radio-related software like PHLab, PolarFinder, FocusPal, and ARGOS. The ARGOS software window is the central focus, displaying a QRSS spectrum plot. The plot shows a dense field of signals with a prominent horizontal line of activity around 944.60 MHz. The software interface includes a menu bar (Argo, Setup, Mode, Speed, Palette, Capture, FTP Upload, Log, About), a status bar (18:05:14 UTC 7/23/2015, Call and Loc. not set), and a control panel at the bottom with sliders for Visual Gain and Contrast, and buttons for Start and Exit. The taskbar at the bottom shows the Start button, several open application icons, and the system tray with the date and time (13:05 7/23/2015).

# Spectran<sup>4</sup>



Spectran Version 2 (build 216) - Audio source : Microphone (Realtek High Defini)

Spectran Setup Mode Palette Filters Capture About

09:20:01 7/24/2015  Record Ticks: 1 10 30 60 seconds

Peak at 678.30Hz [-41.4dB] 09:19:31

Vol Gain Speed

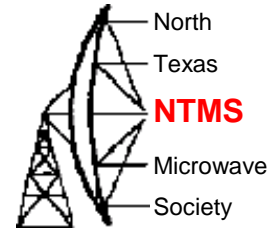
- Average
- Humid
- Denoiser
- BandPass
- BandRej.
- CW Peak
- Auto brig.
- PassThru

Contrast  Enable

Spectran hv IQPHD and IK2CZL Compact View Stop Show Controls Exit

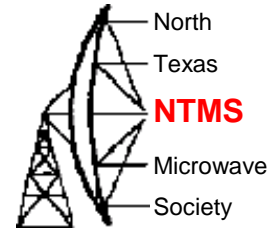


# Radio Sky Pipe<sup>7</sup>



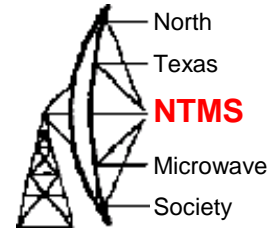
A screenshot of a Windows desktop environment. The desktop background is blue with a white and red diagonal stripe. Several icons are visible, including Recycle Bin, Microsoft Office applications, and various astronomy-related shortcuts like PHDLab, PolarFinder, and FocusPal. A "Radio-SkyPipe Wav Player" window is open, showing a "Play &amp; Chart" button and a progress bar. The main application window, "Radio-SkyPipe 2.6.5 Stand Alone", is open, displaying a spectrum plot. The plot shows a red line representing signal intensity over time, with a prominent peak at approximately 16:52:04. The y-axis ranges from 72 to 4456, and the x-axis shows time from 16:52:04 to 16:54:03. A status bar at the bottom of the application window indicates "12 Bytes Recorded" and "Finished making 150818165204\_150818165403.wav". The Windows taskbar at the bottom shows the system clock as 11:54 on 8/18/2015.

# How To Listen



- Listen on Unused TV Channel or FM Radio Channels in Your Area
- FCC TV Query<sup>5</sup> to Locate DTV Channels
  - Look for a Station in Direction of Interest
  - Not Necessary to Hear Station at All Times
  - Meteor Reflection Signal Strength Will Increase
- TV Fool<sup>8</sup>
  - Display Stations Possible to Watch at Your Local
  - Choose Other Cities Near For Possible Stations to Monitor

# FCC TV Query<sup>5</sup> Results



**KDFW**  
**USA**

**TX DALLAS**  
**CP**

Licensee: NW COMMUNICATIONS OF TEXAS,  
INC.

Service Designation: **DX** Digital auxiliary  
facility

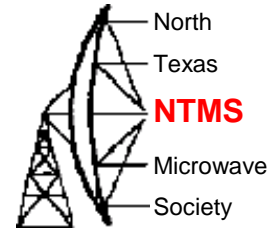
Transmit Channel: 35      596 - 602 MHz      **Construction Permit**  
Virtual channel: 4      (viewer sees this channel number)

Network affiliation: FOX

File No.:      BXPCDT-20100406AAG      Facility ID number: 33770  
CDBS Application ID No.: 1361378

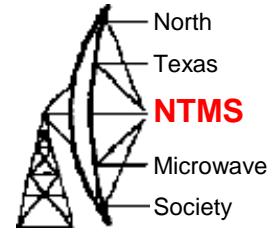
32° 35' 17.00" N Latitude  
96° 58' 34.00" W Longitude (NAD 27)

# Texas Channel 2 Stations<sup>6</sup>



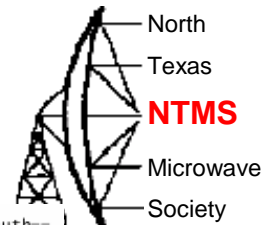
Call HAAT	Channel Licensee/Permittee	Service Status	City	State	Country	File Number	Docket	FacilityID	ERP
KNCD-LP kW	2 0. m	TX LIC INTERNATIONAL BROADCASTING NETWORK	NACOGDOCHES	TX	US	BLTVL-19930430IA	-	28986	0.063
K02RA-D kW	2 0. m	LD CP SPIRIT OF PRAYER MINISTRIES INC.	BEAUMONT	TX	US	BNPDVL-20100610AFB	-	187583	0.3
KSFV-LD kW	2 0. m	LD LIC DE MUJER A MUJER INTERNATIONAL	DALLAS	TX	US	BLANK-0000001483	-	130934	3.

# New Mexico Low VHF Stations<sup>6</sup>

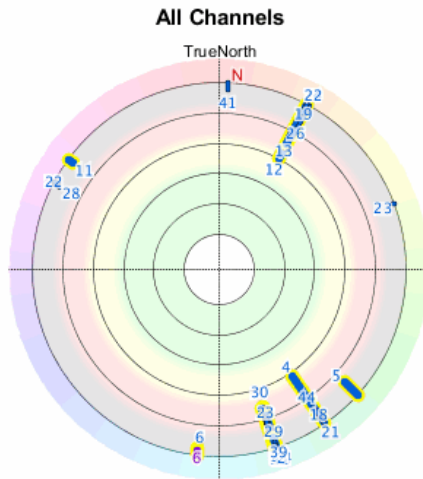


Call ERP	Channel HAAT	Service Licensee/Permittee	Status	City	State	Country	File Number	Docket	FacilityID
K02KP 0.042 kw	2 0. m	TX LIC REGENTS OF NEW MEXICO STATE UNIVERSITY		LORDBURG	NM	US	BLTTV-19831212IA	-	55483
K02KP 0.042 kw	2 0. m	LD APP REGENTS OF NEW MEXICO STATE UNIVERSITY		LORDBURG	NM	US	BDFCDTT-20060331BOZ	-	55483
K04RK-D 0.3 kw	4 0. m	LD CP ONE MINISTRIES, INC.		OROGRADE	NM	US	BNPDVL-20090825BLJ	-	182706
K06FT 0.001 kw	6 0. m	TX LIC KOB-TV, LLC		PENASCO	NM	US	BLTT-3074	-	52137
K06HX 0.004 kw	6 0. m	TX LIC LIN OF NEW MEXICO, LLC		MORA	NM	US	BLTTV-4009	-	43752
NEW 0. kw	6 0. m	DN APP SIERRA GRANDE BROADCASTING		DES MOINES	NM	US	BPRM-20011009AEH	-	137605
K06HX 0.001 kw	6 0. m	LD CP LIN OF NEW MEXICO, LLC		MORA	NM	US	BDFCDTV-20090824ADC	-	43752
K36JS-D 0.1 kw	6 0. m	LD APP KOB-TV, LLC		GRANTS	NM	US	BDISDTV-20081022ABF	-	35307
K06QI-D 0.3 kw	6 0. m	LD CP ONE MINISTRIES, INC.		OROGRADE	NM	US	BNPDVL-20090825BLT	-	182710
K06PR-D 0.3 kw	6 0. m	LD CP AVAILABLE MEDIA ASSOCIATES		CHAMITA	NM	US	BNPDVL-20090923ABL	-	183409
K06QK-D 3. kw	6 0. m	LD CP ONE MINISTRIES, INC.		RADIUM SPRINGS	NM	US	BNPDVL-20090917ACZ	-	183385
DK06JB 0.028 kw	6 0. m	TX APP CONCHAS TELEVISION ASSOCIATION		CONCHAS DAM, ETC.	NM	US	BSTA-20131104APH	-	13547

# TV FOOL<sup>8</sup>



Stations  
Viewable  
From My QTH



### Search Criteria

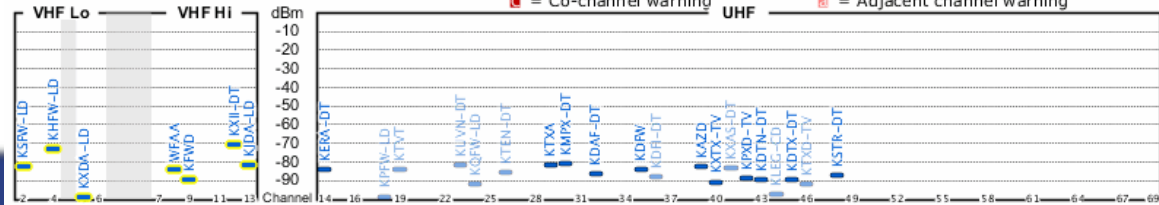
Lat: 33.33\*\*\*  
Lon: -97.25\*\*\*  
Height: 10.0 ft.

db datecode  
201506290913

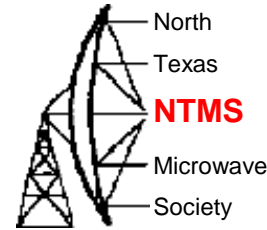
[www.tvfool.com](http://www.tvfool.com)

Callsign	==Channel==		Netwk	=====Signal=====			Dist miles	==Azimuth==	
	Real	(Virt)		NM(dB)	Pwr(dBm)	Path		True	(Magn)
KXII-DT	12	(12.1)	CBS	20.1	-70.7	LOS	54.7	28°	(24°)
KHFW-LD	4			17.9	-73.0	2Edge	46.1	146°	(142°)
KMPX-DT	30	(29.1)	Ind	10.3	-80.6	2Edge	53.9	162°	(159°)
KUVN-DT	23		Uni	9.4	-81.5	2Edge	53.8	162°	(159°)
KTXA	29	(21.1)	Ind	9.2	-81.7	2Edge	54.8	162°	(158°)
KJDA-LD	13			9.1	-81.7	1Edge	54.7	28°	(24°)
KAZD	39	(55.1)		8.5	-82.3	2Edge	54.0	162°	(158°)
KSFV-LD	2			8.1	-82.7	2Edge	54.2	162°	(158°)
KXAS-DT	41	(5.1)	NBC	7.6	-83.3	2Edge	54.1	162°	(159°)
WFAA	8	(8.1)	ABC	7.2	-83.6	2Edge	53.9	163°	(159°)
KTVT	19		CBS	7.0	-83.9	2Edge	57.0	163°	(159°)
KDFW	35	(4.1)	Fox	6.7	-84.2	2Edge	53.9	163°	(159°)
KERA-DT	14	(13.1)	PBS	6.5	-84.3	2Edge	54.8	162°	(158°)
KTEN-DT	26	(10.1)	NBC	5.5	-85.3	2Edge	81.1	29°	(25°)
KDAF-DT	32	(33.1)	Cw	4.5	-86.3	2Edge	57.0	163°	(159°)
KSTR-DT	48	(49.1)	Tel	4.1	-86.8	2Edge	57.0	163°	(159°)
KDFI-DT	36	(27.1)	MyN	2.7	-88.1	2Edge	57.0	163°	(159°)
KPXD-TV	42	(68.1)	ION	1.9	-88.9	2Edge	57.0	163°	(159°)
KFWL	9	(52.1)	Ind	1.5	-89.4	2Edge	53.9	162°	(159°)
KDTN-DT	43	(2.1)	Ind	1.4	-89.5	2Edge	57.0	163°	(159°)
KDTH-DT	45	(58.1)	Ind	1.2	-89.7	2Edge	57.0	163°	(159°)
KXTX-TV	40		TEL	0.3	-90.6	2Edge	54.1	162°	(159°)
KQFW-LD	24			-0.9	-91.7	1Edge	54.2	162°	(158°)
KTXD-TV	46	(47.1)		-1.1	-92.0	2Edge	57.0	163°	(159°)
KLEG-CD	44			-6.3	-97.2	2Edge	46.1	146°	(142°)
KPFW-LD	18	(18.1)		-7.6	-98.4	2Edge	46.1	146°	(142°)
KXDA-LD	5			-8.1	-99.0	2Edge	44.2	132°	(129°)
K19II-D	19			-12.8	-103.7	2Edge	54.7	28°	(24°)
K2230-D	22			-13.2	-104.1	2Edge	54.7	28°	(24°)
KHPK-LD	10			-13.3	-104.2	2Edge	53.8	162°	(159°)
K24TW-D	24			-13.5	-104.3	2Edge	54.7	28°	(24°)
KCYH-LD	41			-15.0	-105.9	2Edge	59.0	3°	(359°)
KFDX-DT	28	(3.1)	NBC	-15.3	-106.1	Tropo	84.7	297°	(294°)
KBFW-LP	6	(6.1)		-15.6	-106.4	2Edge	40.5	187°	(183°)
KSWO-DT	11	(7.1)	ABC	-15.9	-106.7	Tropo	104.2	306°	(302°)
KBOP-LD	20			-16.4	-107.3	2Edge	53.8	162°	(158°)
K25FW-D	25			-16.9	-107.7	2Edge	53.8	162°	(159°)
KAUZ-TV	22	(6.1)	CBS	-17.5	-108.4	Tropo	84.0	298°	(294°)
KBFW-LP	6			-17.7	-96.6	2Edge	40.5	187°	(183°)
KVFW-LD	38	(38.1)		-18.5	-109.4	2Edge	53.8	162°	(159°)
KQDA-LD	23			-19.3	-110.2	2Edge	47.5	69°	(66°)
KWDA-LD	21			-19.7	-110.6	2Edge	46.1	146°	(142°)
K31GL-D	31	(31.1)		-20.1	-110.9	2Edge	53.8	162°	(159°)
KJ3M-LD	34	(34.1)		-20.1	-110.9	2Edge	53.8	162°	(159°)
KOCO-TV	7	(5.1)	ABC	-20.4	-111.3	Tropo	154.3	355°	(351°)
K36KE-D	36			-20.9	-111.7	2Edge	60.2	5°	(2°)
K17FB	17	(17.1)		-21.4	-112.2	2Edge	76.4	2°	(358°)
KJTL-DT	15	(18.1)	Fox	-21.9	-112.8	Tropo	104.1	306°	(302°)
KATA-CD	50			-22.0	-112.9	2Edge	53.8	162°	(159°)
KTUZ-DT	29	(30.1)	TEL	-22.1	-112.9	Tropo	154.1	355°	(351°)
KOCB-DT	33	(34.1)	CW	-22.9	-113.8	Tropo	153.4	355°	(351°)

■ = Co-channel warning    ■ = Adjacent channel warning

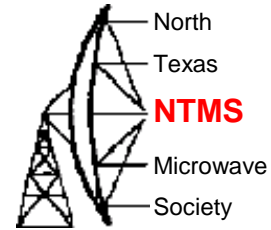


# Tips For Choosing Stations to Monitor



- Choose Station on Unused Channel
- Choose Station About 200 Miles Distant or Less If Low Power Station
- Fix Antenna in Direction of Station of Choice
- Be Patient – Propagation Do Not Always Occur When We Want
- Use Software to Capture Scatter Signals
- If You Can Hear Station of Choice Weakly That is a Good Choice When Starting Out

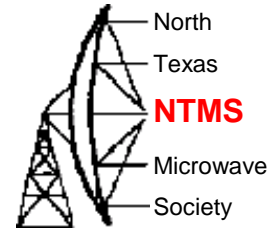
# References



1. [http://wiki.radioreference.com/index.php/Television\\_Frequencies](http://wiki.radioreference.com/index.php/Television_Frequencies), TV Frequencies
2. <https://www.fcc.gov/encyclopedia/tv-query-broadcast-station-search>
3. <http://sdrsharp.com/>
4. <http://www.weaksignals.com/>
5. <https://www.fcc.gov/encyclopedia/tv-query-broadcast-station-search>



# References



6. Lunsford, R., “Meteors and How to Observe Them”, ISBN: 978-0-387-09460-1, page 3-10.
7. <http://www.radiosky.com/>
8. <http://tvfool.com/>
9. <http://www.qsl.net/pa3hbb/6m3e1.htm>
10. <http://www.hamuniverse.com/6mdipolekk5id.html>