



Last Mile Solutions Deep Dive

October 2023



Who is Orban?

- Founded 55 years ago by Robert Orban
- Today – Audio Processing Experts with offices in Stuttgart, Philadelphia and San Francisco; US and Germany production
- Processing over 14,800 Broadcasts and Live Events every year



UNIVISION



We Are Audio Processing

- Loudness + Dynamic Range measurement and control
- Stereo and multi-channel surround technologies
- Broadcast, consumer and content creation applications



Introducing: Orban 5950

- Next generation of FM processing based upon 50 years of FM Processing experience



Now Shipping!

Best of Show
2023

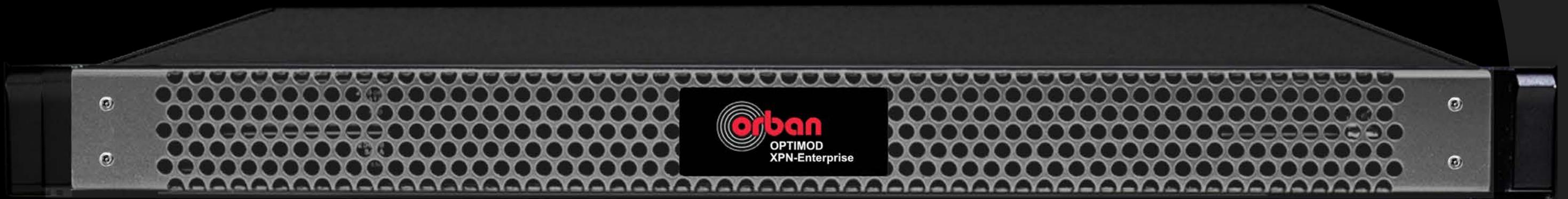
RADIO WORLD

WINNER



Introducing: Orban XPN-Enterprise

- Linux-based Dell Blade
- Processing power of 8 OPTIMOD 8700i in 1RU using FM/HD Nodes

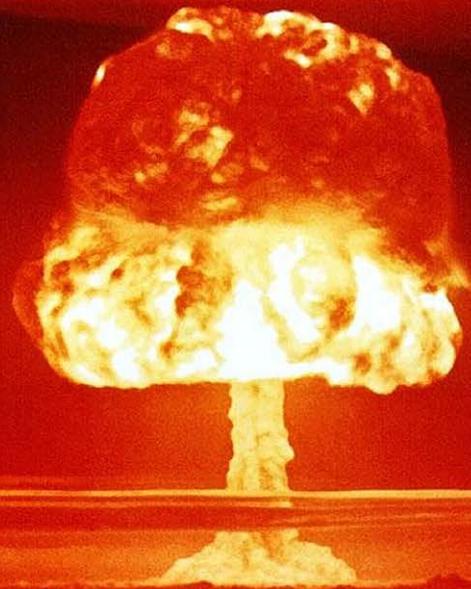


Shipping Now!





Atomic Option Slashes Your Power Bill



**Boost Your Ratings - Increase TSL
Sound Better, Louder and Cleaner
Major Increase in Coverage**

Ask Us How - sales@orban.com

**On the air in NYC
WFAN 660 KHz
WABC 770 KHz
WCBS 880 KHz
WNYM 970 KHz
WINS 1010 KHz
WEPN 1050 KHz**



A quick review

- Have fiber to your transmitter sites
- Have reliable 5G coverage at your transmitter sites (greater than 4 bars)
- Have both at the same site
- IP based Microwave
- Have remote sites fed via satellite (or something else)
- Have EAS receivers at transmitter sites
- Are encoding Nielsen PPM



Deployed Last Mile Solutions

- WCTS-AM St Paul
 - Satellite with Public internet backup
- KCSN LA
 - 3 site SFN on Dedicated AT&T Switched Ethernet links

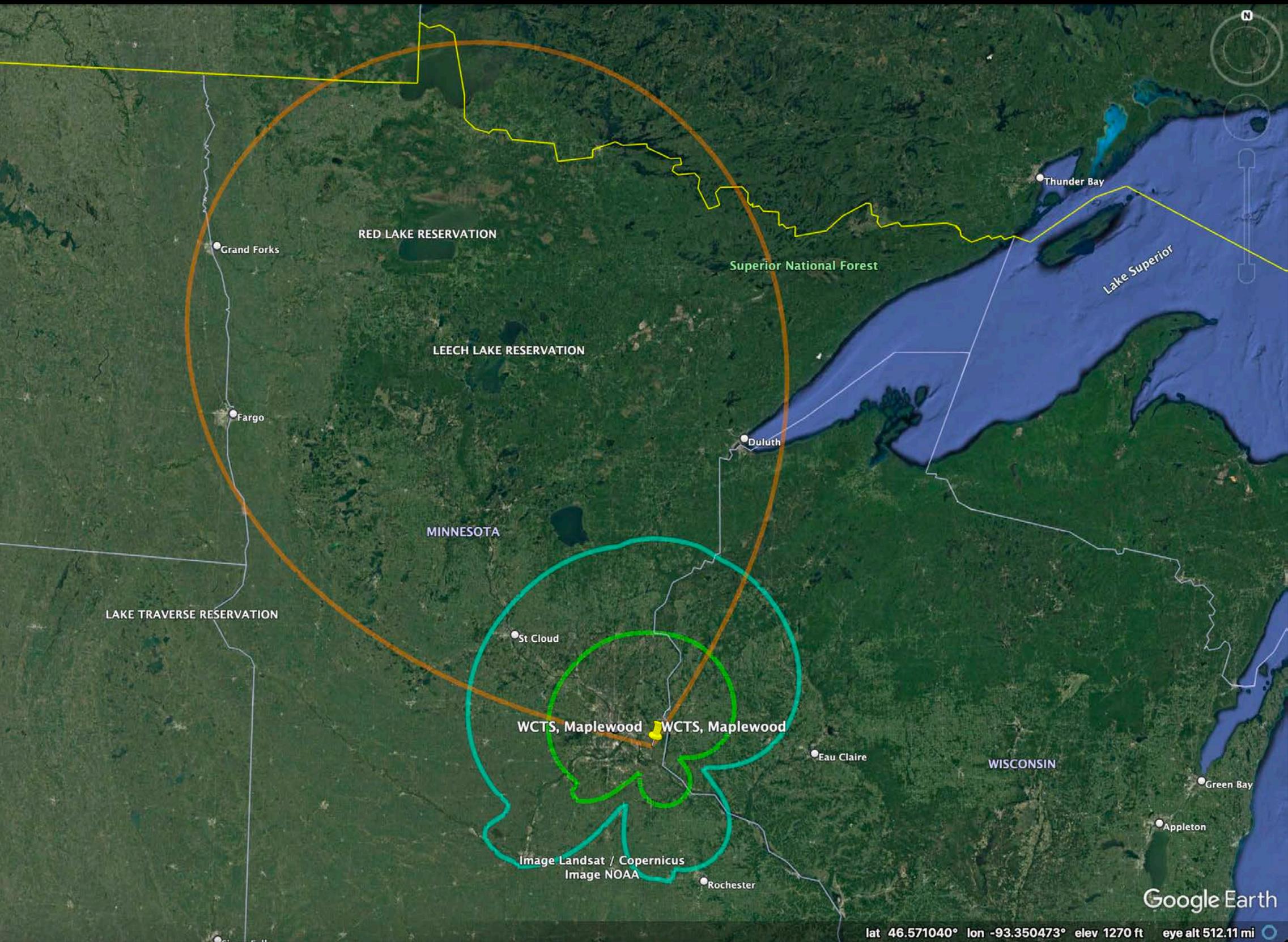


WCTS St Paul

- WCTS' first license was granted 07-28-1964
- 1030 kHz
- 5 tower array
- 50 kW daytime using towers #3 & #4
- 4 kW nighttime using all 5 towers
- <https://wctsradio.com>
- The Central Baptist Seminary owns WCTS







The WCTS Story

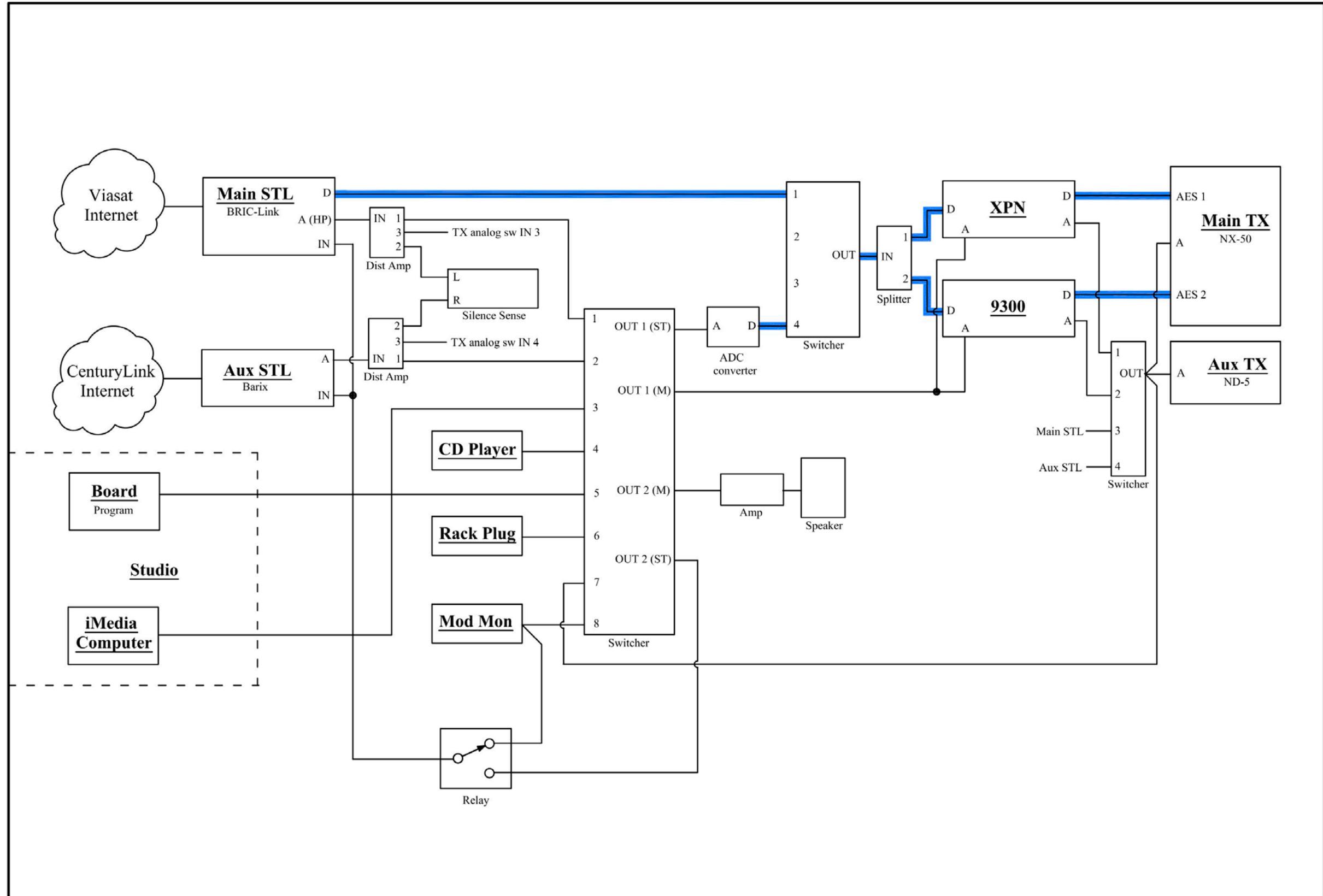
- WCTS wanted an Orban XPN-AM processor
 - To improve coverage
 - Allow them to get more benefit from running MDCL
- We were in the early roll out phase for the XPN-AM and I was installing all of them
- And this was in the middle of Covid in June of 2020
- I drove from Denver and helped them get it on the air



The WCTS STL

- Running BRIC-Link on Via-Sat primary
- Running a Barix on CenturyLink DSL as a backup
- A couple of other redundant audio sources were available
- And a bunch of silence switching





The WCTS STL

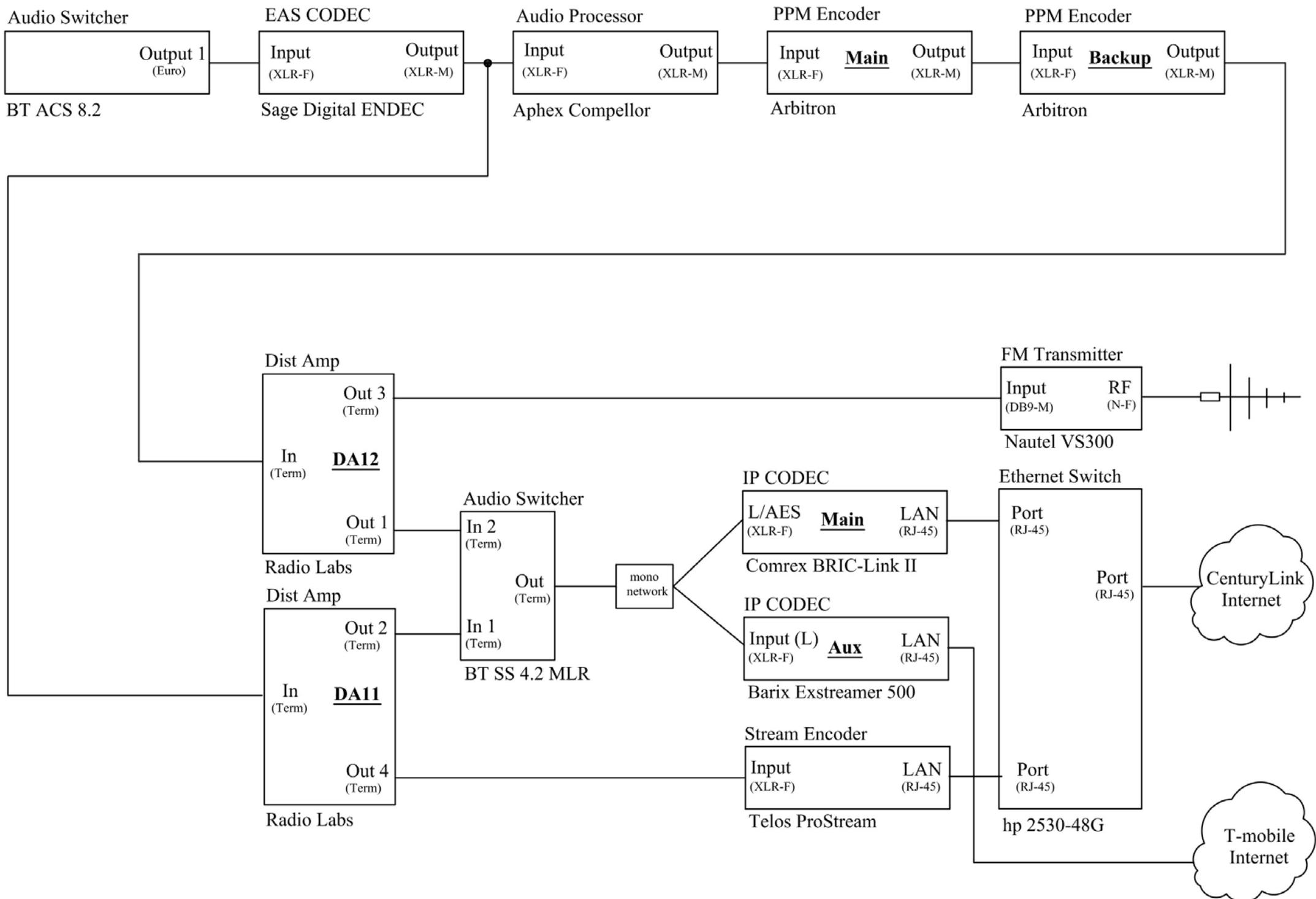
- Used a main silence detector to switch between the primary and the back feeds
- And used the silence detectors in both processors too!
- There was a small studio in the transmitter building that was all setup to be used incase the world completely ground to a halt



The WCTS STL

- EAS is inserted into the audio feed at the studio
- PPM encoding is done in the XPN-AM
 - Backup hardware PPM encoders are switched in when the backup Orban 9300 is being used





The WCTS STL

- This system worked very well and it was cost effective
- We did have a couple of audio issues that we spent two days working through
- The format runs the gamut from spoken word to symphonic performances



The WCTS STL

- The main studios are analog (+4 dBv nominal)
- The XPN-AM sounded great until program material got loud
- And then things sounded like “Satan’s ShopVac”
- Lots of really bad distortion
- Which you didn’t hear with the 9300 processor
- But would peel the paint off a battleship at 100 yards with the XPN-AM



The WCTS STL

- We dived down the rabbit hole looking for issues with the XPN-AM
- And we kind of forgot that the WCTS studios were (wait for it) analog
- And somehow that analog output was getting into the Brick-Link analog input
- Where it was being converted to digital



The WCTS STL

- And of course we didn't listen to the output of the Brick-Link at the transmitter site..
- And during the day it was mostly spoken word which sounded fine
- As I was sitting in my hotel room a couple of miles away listening at night was when they were running the symphonic program material that was falling apart



C.CRANE

CC SKYWAVE

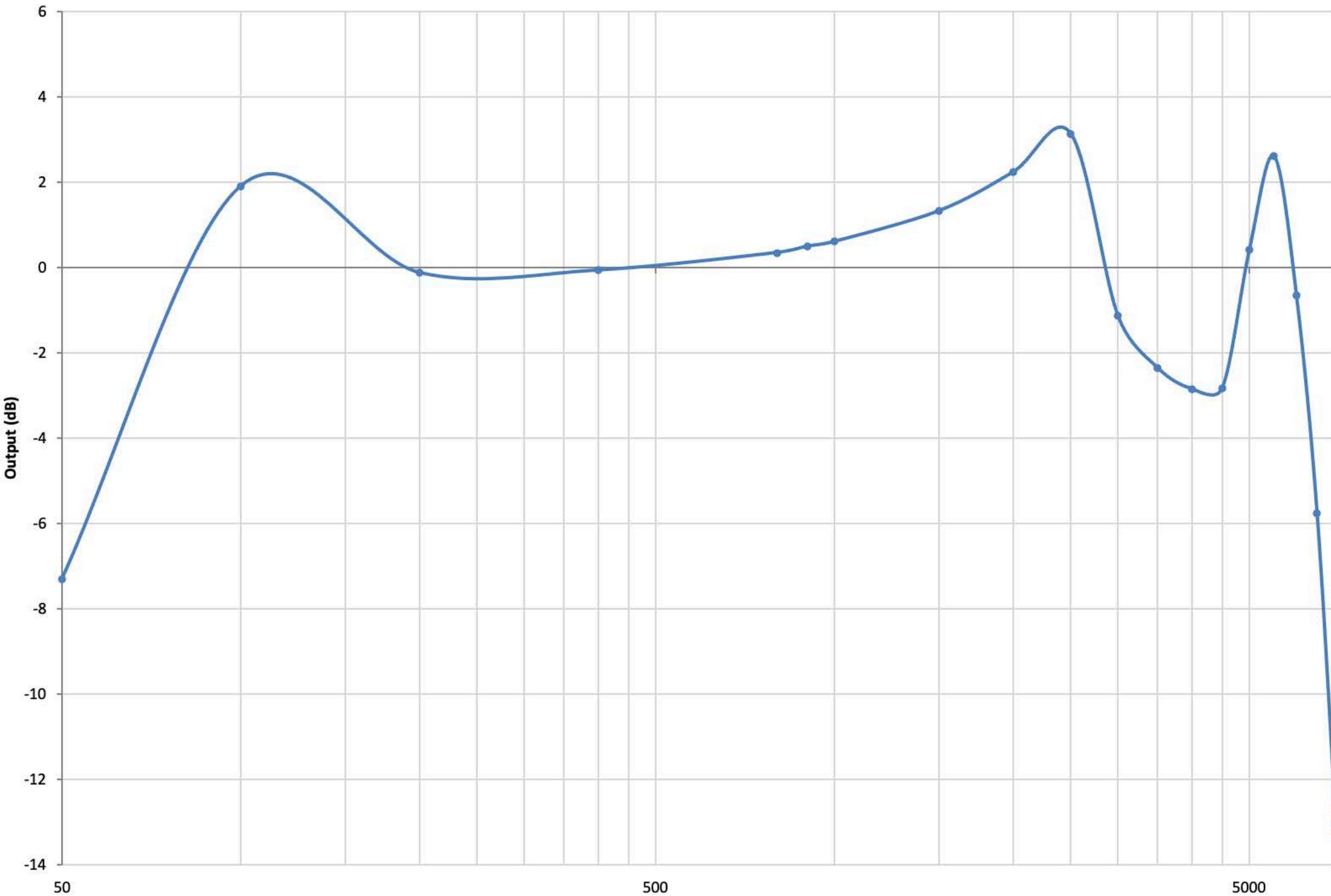


ALERT

1	2	3	FREQ
4	5	6	TONE
7	8	9	PAGE
0	0	0	ATS
0	0	0	BAND WIDTH
0	0	0	12/24H
0	0	0	WX SW AIR



CCrane Skywave Radio AM Frequency Response, NRSC 75 μ S



rbca



The WCTS STL

- Remember the studio is analog +4 dBv nominal
- It has +24 dBv max
- Its driving the BRIC-Link's analog input
- The BRIC-Link really needed a 20 dB pad!



The WCTS STL

- Once we padded the input to the BRIC-Link by 20 dB and added the 20 dB back in at the transmitter site the distortion was gone
- Dan Zimmerman had to look up how to build a 20 dB “H” pad
- <http://www.nu9n.com/tpad-calculator.html>
- And it only took a couple of days of head scratching to figure it out



The WCTS STL

- The WCTS Lesson
 - Anytime you are making "conversions" in an STL you need to be very careful about levels and headroom
 - The BRIC-Link didn't like any analog levels greater than +9 dBv (5 dB above +4dBv)
 - The 9300 "hid" the distortion that was always there
 - The XPN-AM has so much transparency the distortion was incredible



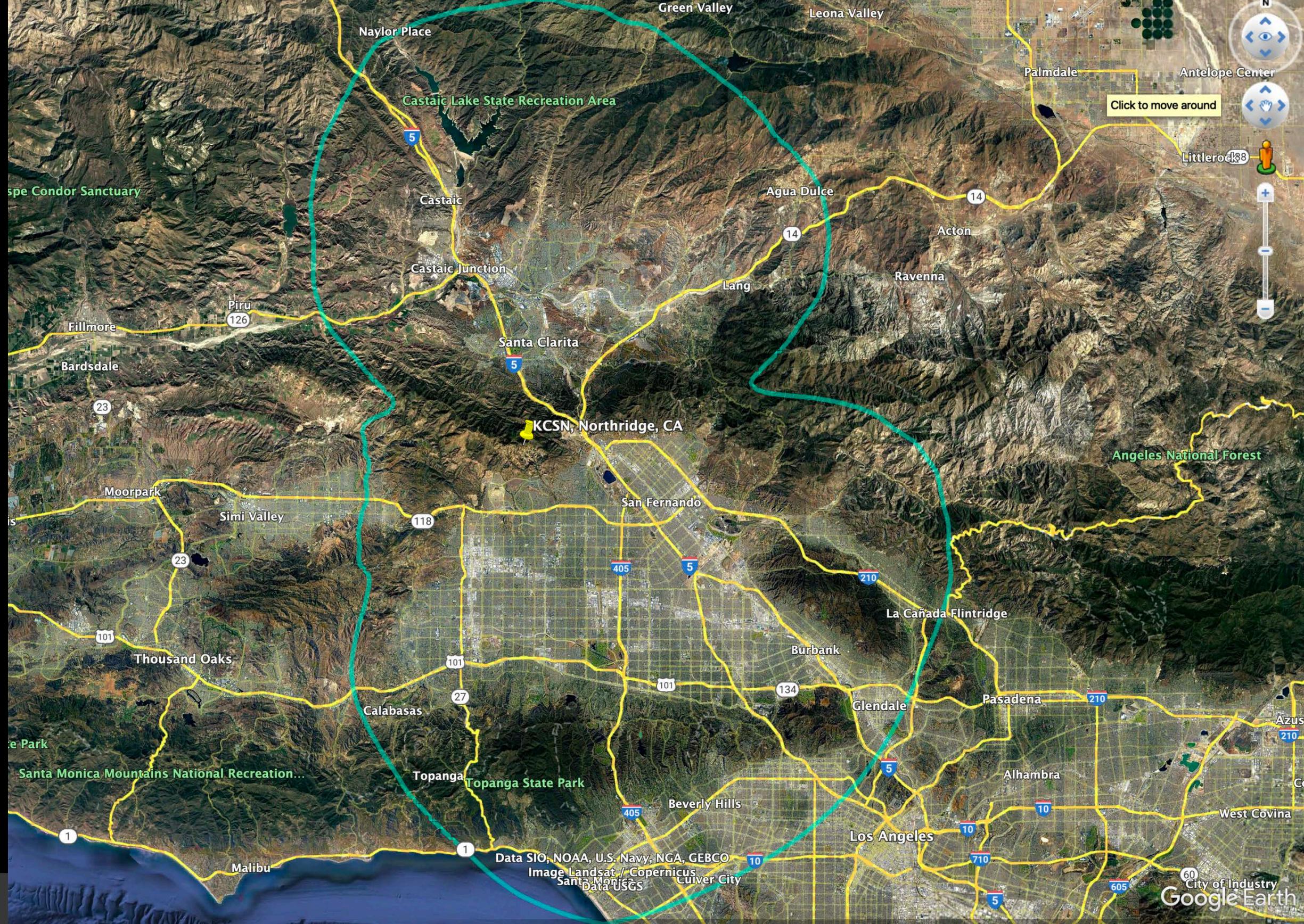


The KCSN Single Frequency Network

- KCSN's first license was granted 04-03-1964
- 501 Meters HAAT
- 943 Meters AMSL
- 0.370 kW ERP
- Directional
- On the same frequency as KSBR in Mission Viejo
- <https://www.thesocalsound.org>







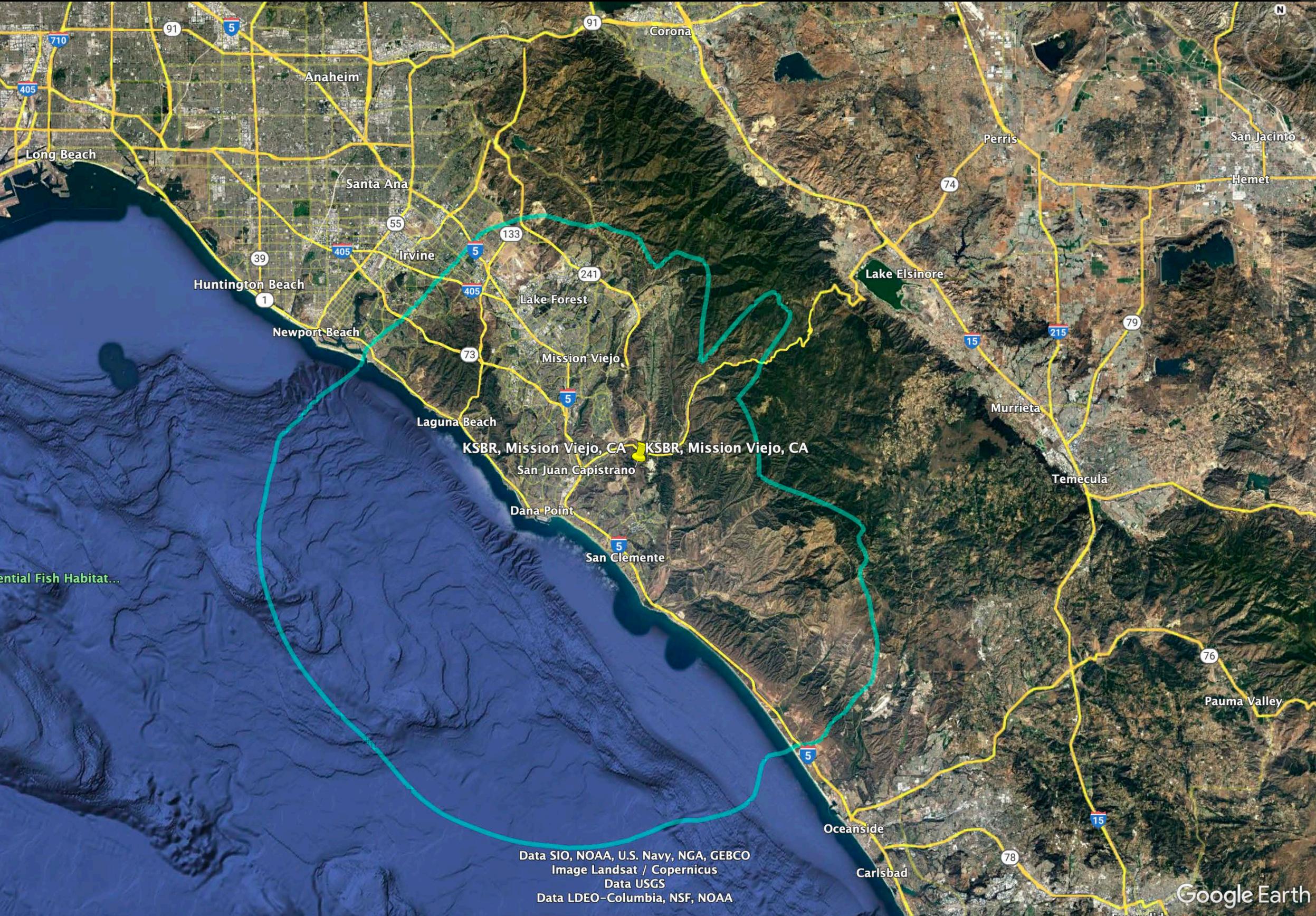
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Satellite Data USGS

City of Industry
Google Earth

The KCSN Single Frequency Network

- KSBR in Mission Viejo
- 189 Meters HAAT
- 361 Meters AMSL
- 1.8 kW ERP
- Directional
- On the same frequency as KCSN
- <https://www.jazz885.org>





ential Fish Habitat...

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Data USGS
Data LDEO-Columbia, NSF, NOAA

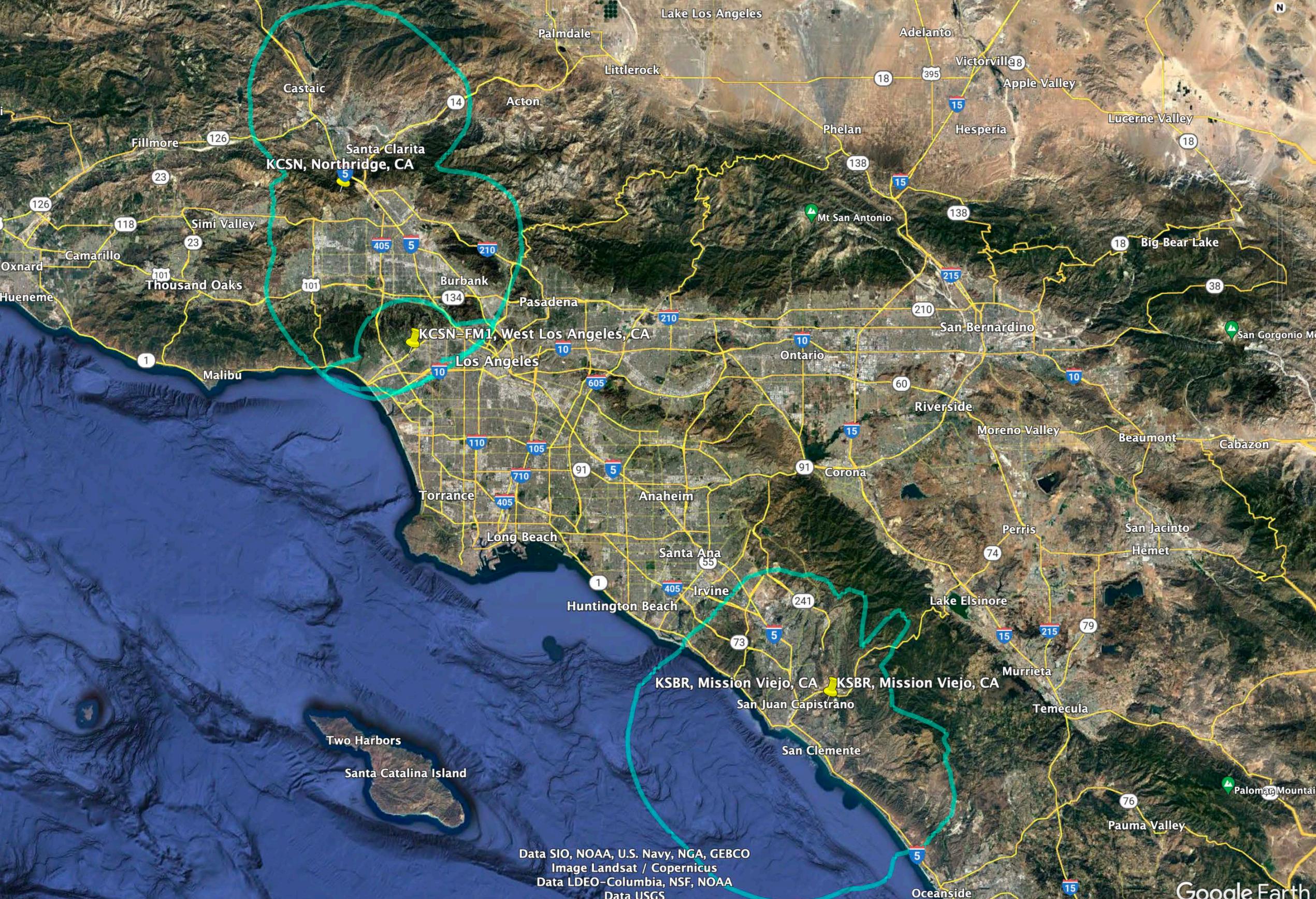
Google Earth



The KCSN Single Frequency Network

- Even though the patterns for each station looked like there was sufficient distance between them (78 miles) the interference was significant
- At times each station could be clearly heard in the other stations parking lots!
- In 2014 KCSN commissioned a study by John Kean @ NPR Labs to look at the interference and see if a SFN between the stations would solve it





KCSN, Northridge, CA

KCSN-FM1, West Los Angeles, CA

KSB, Mission Viejo, CA

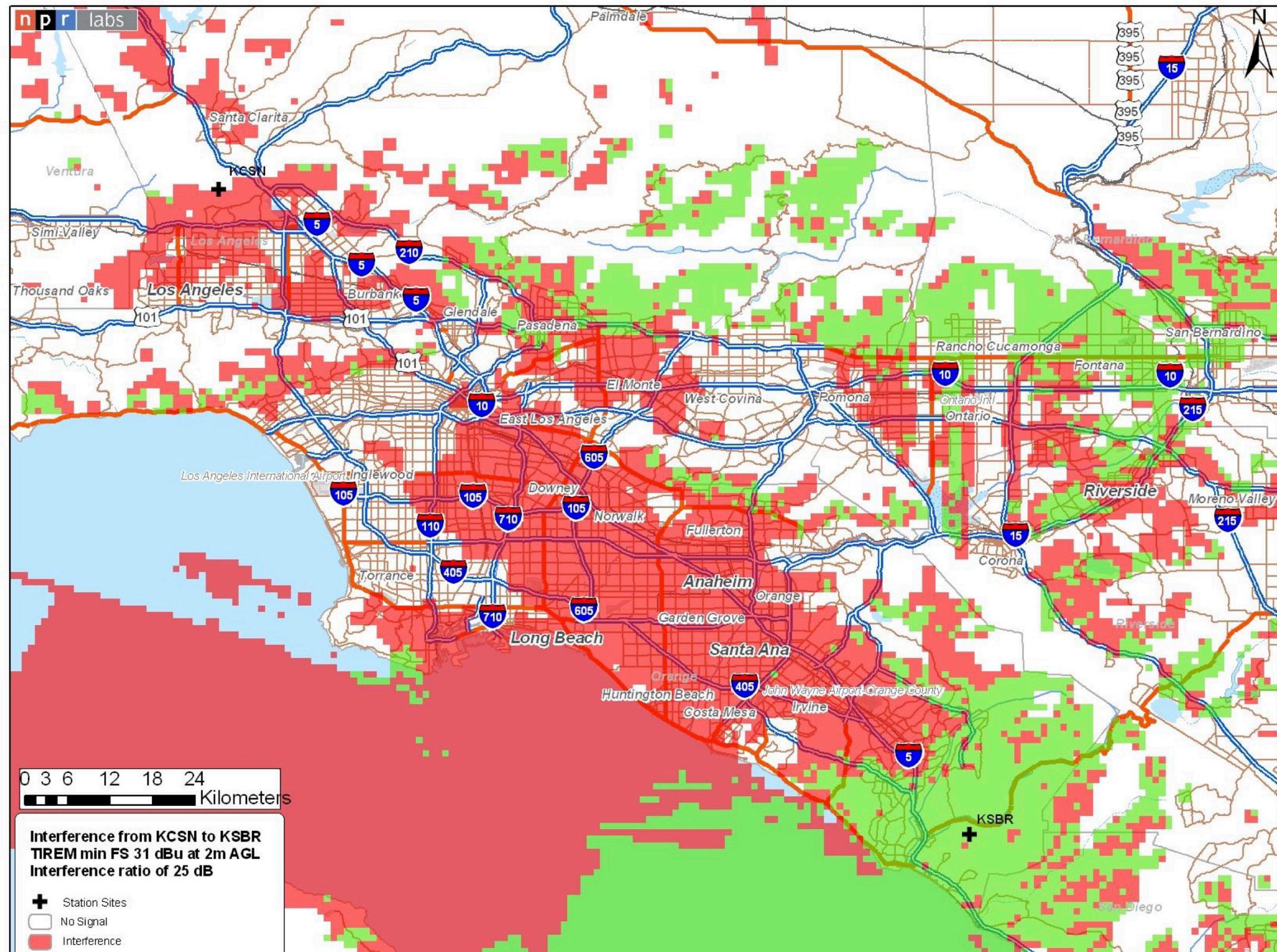
KSB, Mission Viejo, CA

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Data LDEO-Columbia, NSF, NOAA
Data USGS

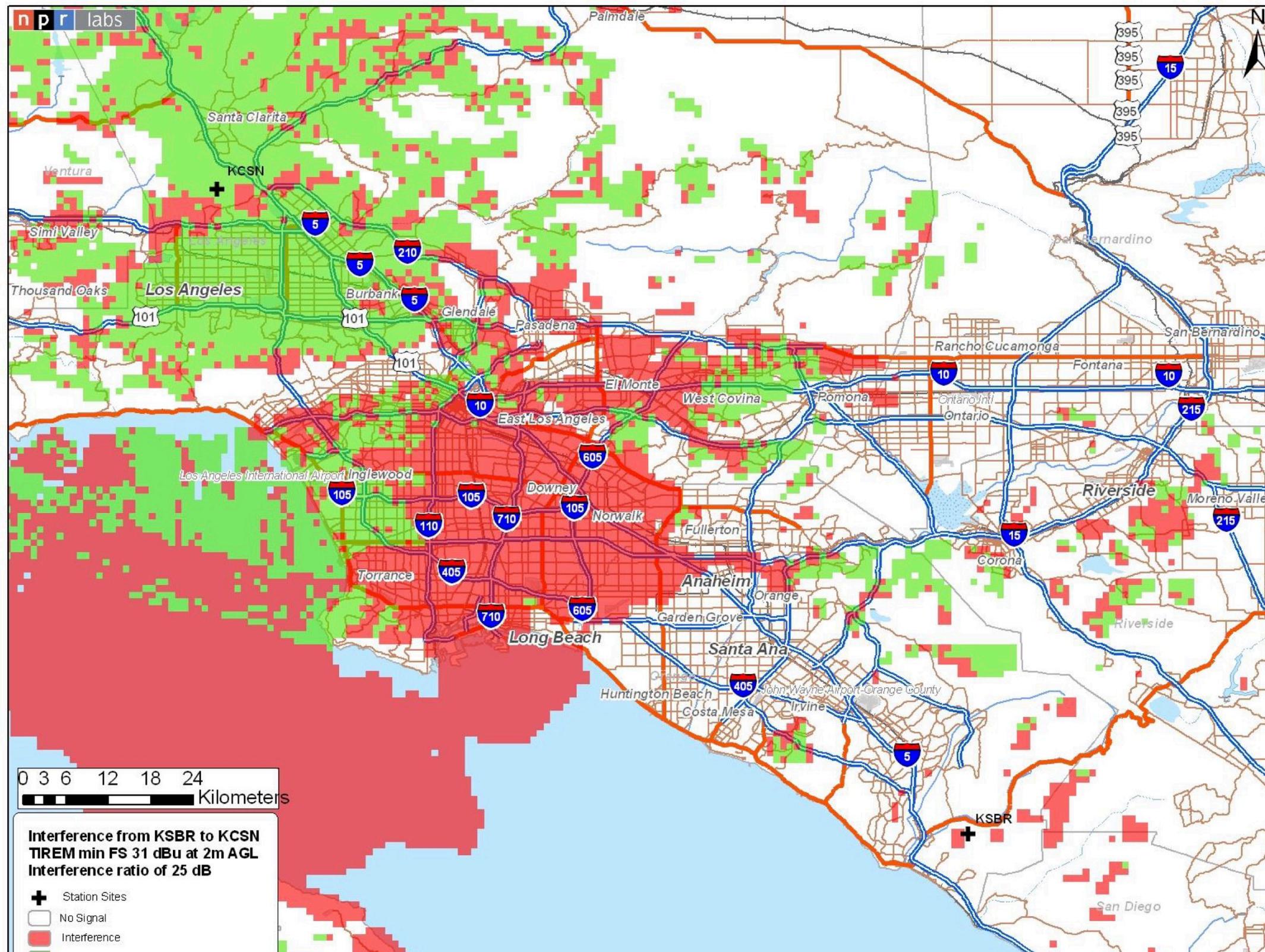
Google Earth



Appendix A - Map showing coverage and interference to KSBR



Appendix B - Map showing coverage and interference to KCSN

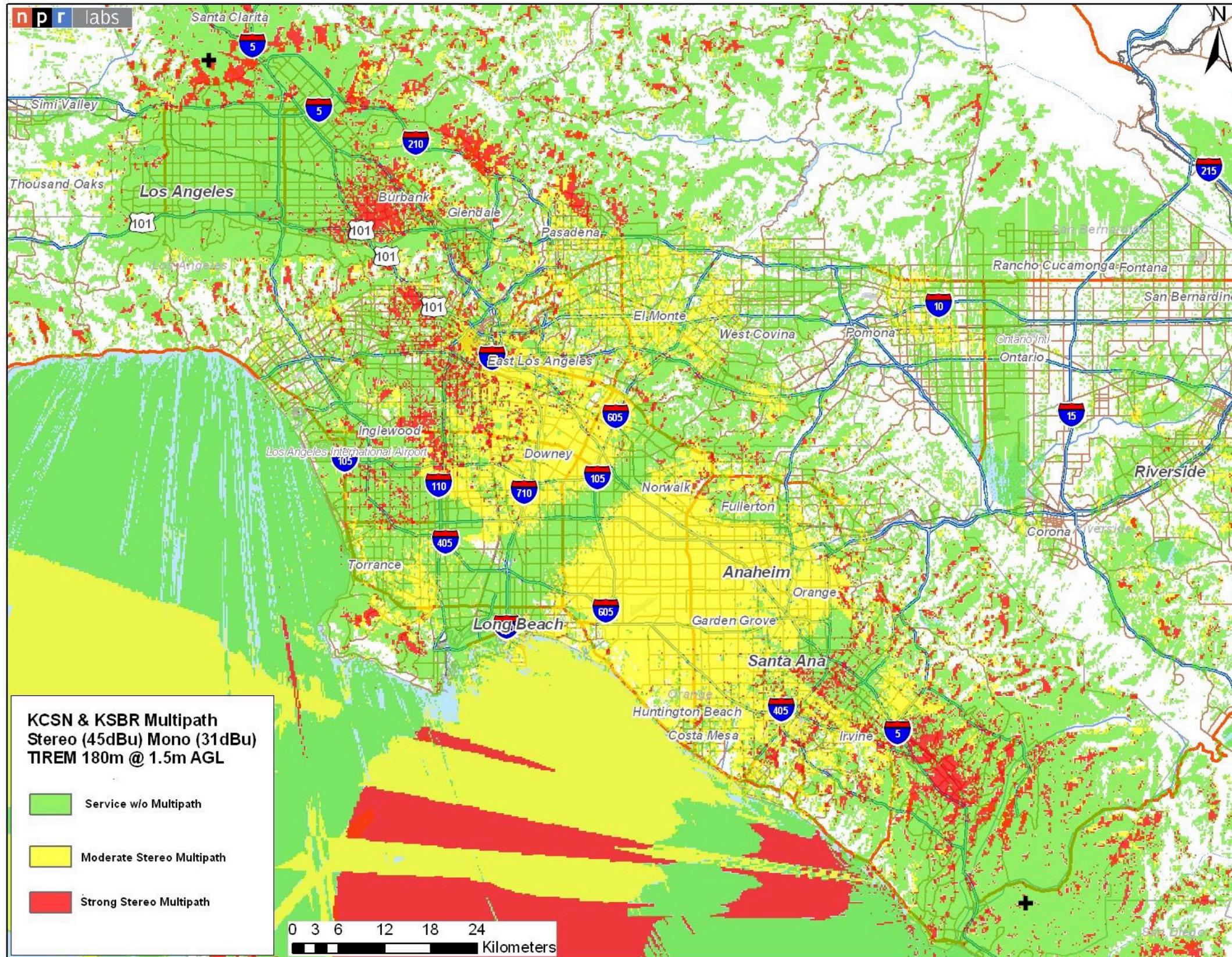


The KCSN Single Frequency Network

- Converting the two stations into a SFN would resolve a majority of the interference between them
- How to make that work from an "STL" standpoint?



Appendix C - Map showing predicted multipath-limited coverage for the synchronous network



- Project
- Network Sites 3
- Subscriber Sites 0
- PTP Links 1
- PMP Network Devices 0
- Mesh Links 0
- PMP Links 0
- Bill of Materials
- Advanced Features
- Best Server

Network Site 002 to Network Site 003

Warnings

Reason for error: Reliability

Link Description

Name

Network Site 002 to Network Site 003

Description

Equipment

Band

5.8 GHz

Product

PTP670

Regulation

Other

Precise Network Timing

Disabled

Product Configuration

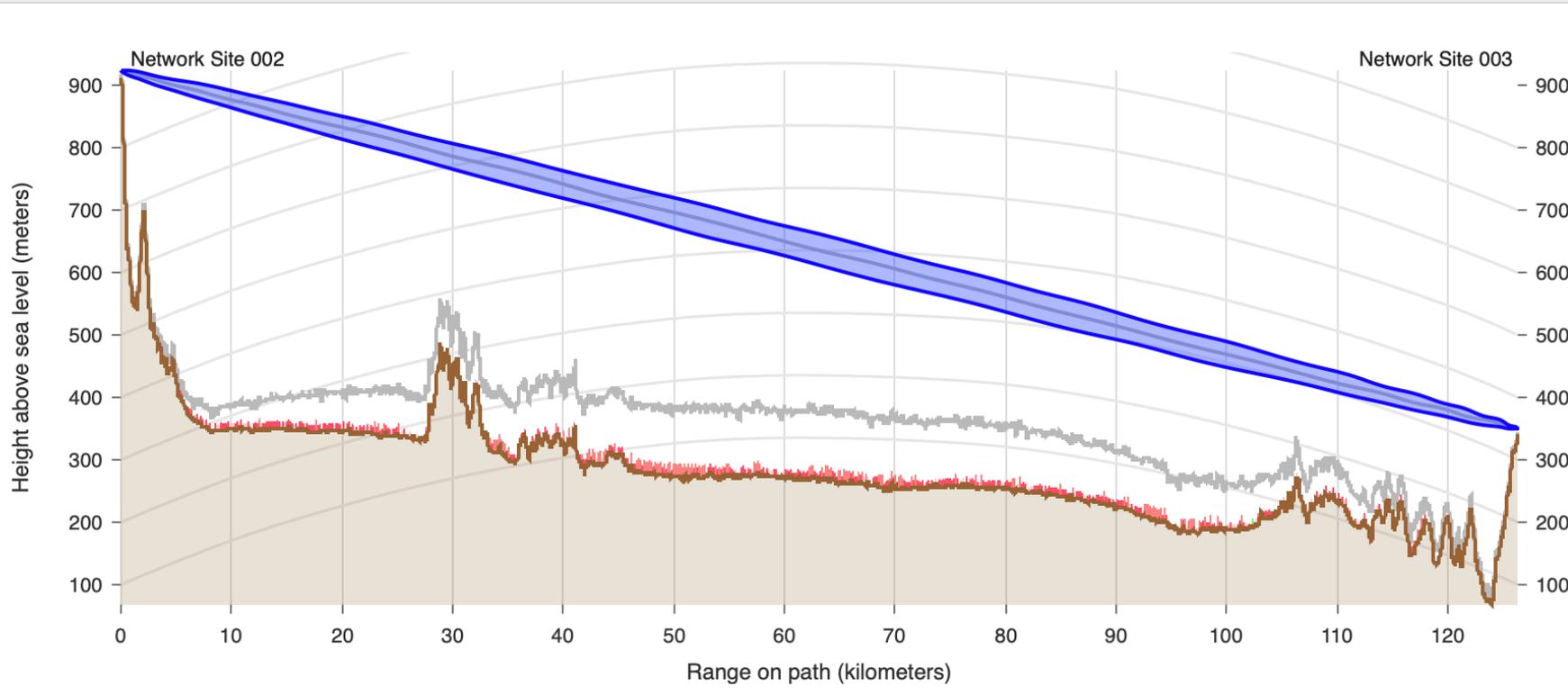
Bandwidth

45 MHz

E1/T1

None

Profile: 126.299 kilometers, Line-of-Sight



Configuration at Each End

Network Site 002

Antenna

(D) Cambium Networks High Gain Integrated (23.0 dBi)

Antenna Height

10.0 meters (Max height at site is 10.0m)

Positioner

Maximum EIRP

50.0 dBm User Limit

Maximum Power

27.0 dBm User Limit

Network Site 003

Antenna

(D) Cambium Networks High Gain Integrated (23.0 dBi)

Antenna Height

10.0 meters (Max height at site is 10.0m)

Positioner

Maximum EIRP

50.0 dBm User Limit

Maximum Power

27.0 dBm User Limit

The KCSN Single Frequency Network

- The audio has to be within 0.25 dB at each transmitter
- Must be delivered with precise timing that cannot change
- KCSN wanted to send digital multiplex with its sample rate locked to GPS to each transmitter
- Not a problem for the Orban 8700i to generate a DMPX output at 192 sample rate locked to 10 MHz external GPS reference
- How to get it to Mission Viejo was the problem





The KCSN Single Frequency Network

- DMPX is digital composite
 - It has L&R, L-R, Pilot & RDS
- Everything you need to make stereo FM with RDS
- DMPX at 192 @ 20 bits on AES-3
- 4.5 Mbits/S



The KCSN Single Frequency Network

- E2X for HD 1/2/3
- How is all of this going to be sent to the transmitters?



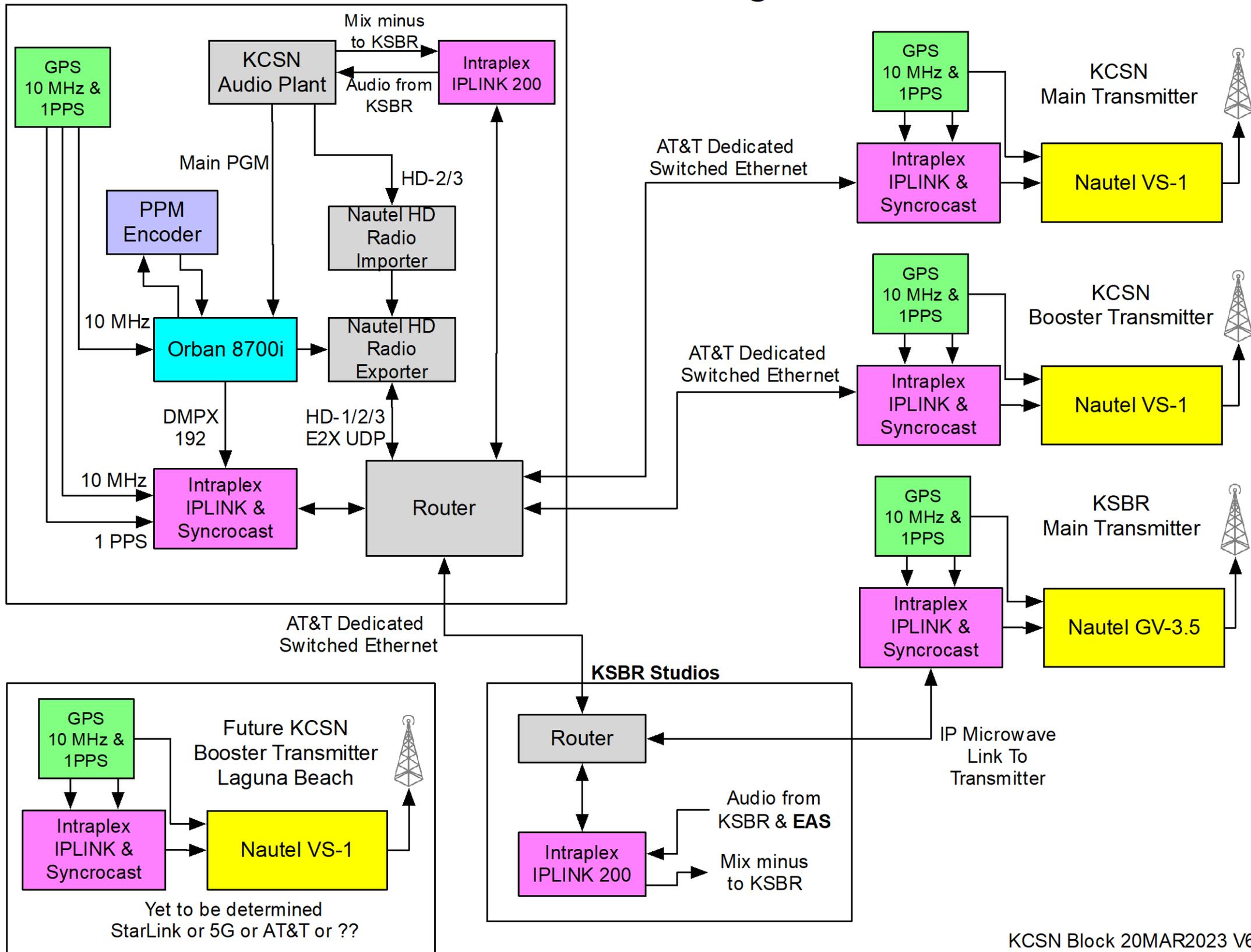
The KCSN Single Frequency Network

- Gates Air Intraplex IPLINK with MPX / “Syncrocast”
- Dedicated AT&T Switched Ethernet links
- IP microwave from Saddleback College to the transmitter site
- Nautel transmitters all locked to GPS
- HD -1/2/3 E2X is sent as separate UDP from Exporter via AT&T to Nautel HD exciter
 - Intraplex now supports E2X

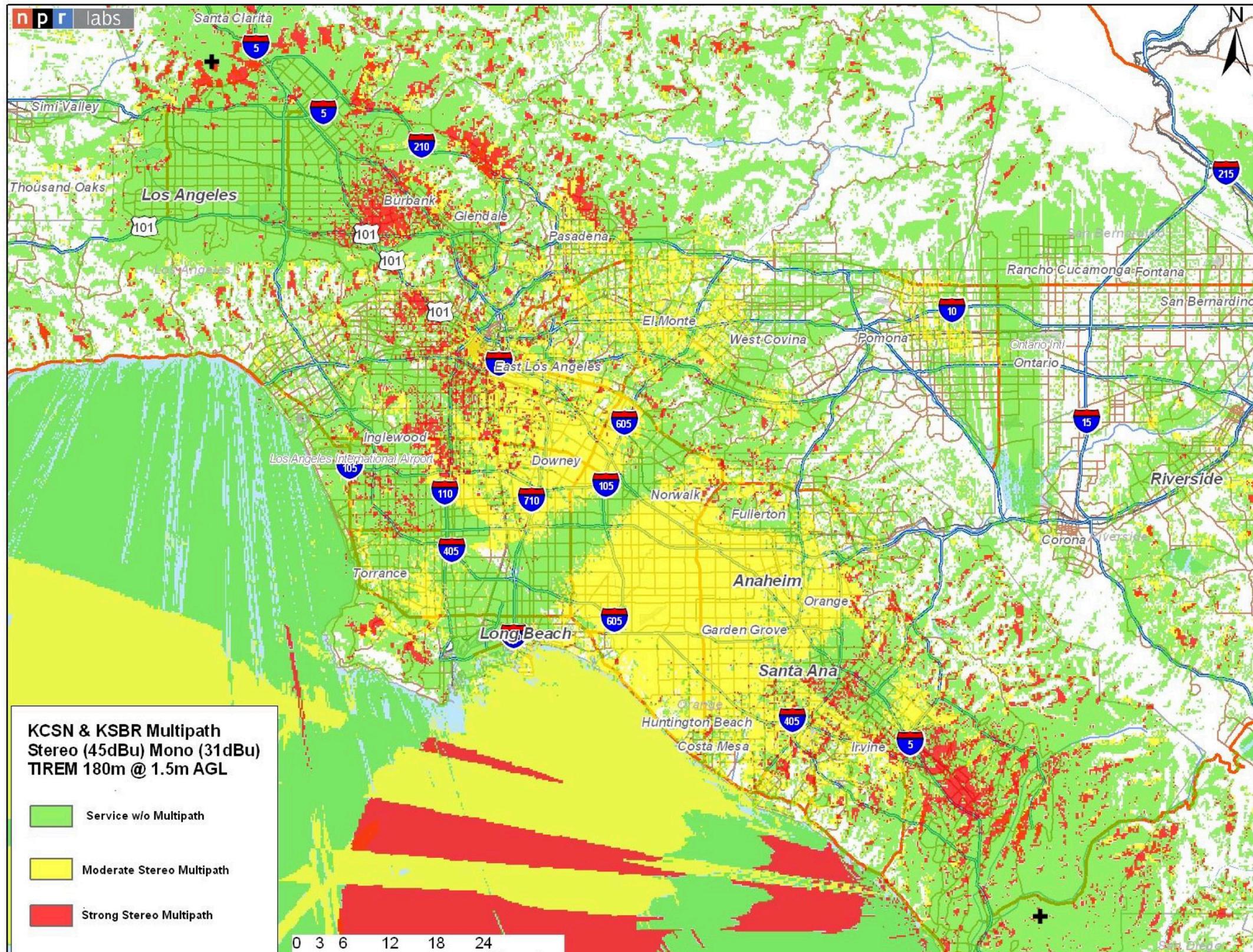


KCSN Studios

KCSN Block Diagram



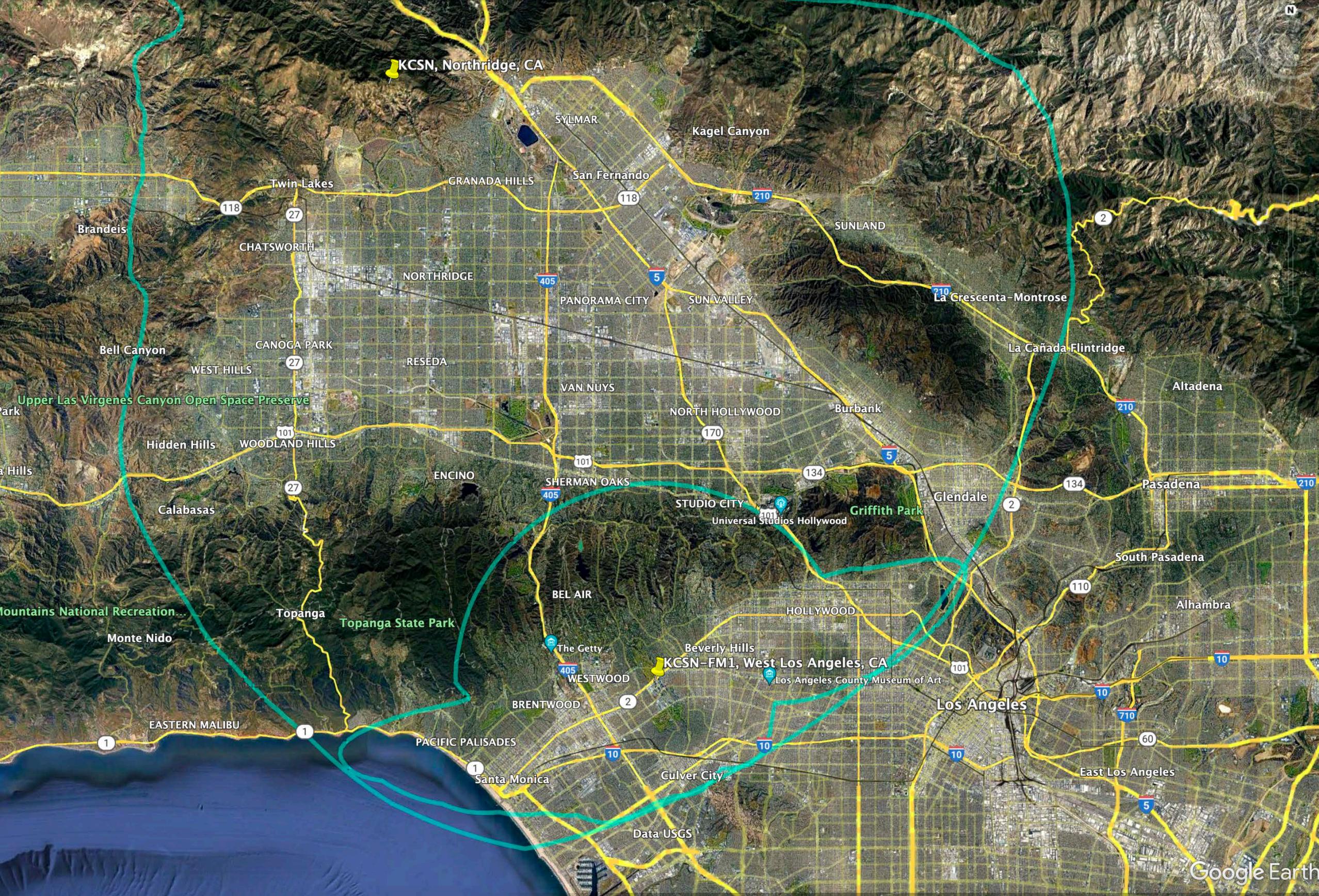
Appendix C - Map showing predicted multipath-limited coverage for the synchronous network



The KCSN Single Frequency Network

- Did I mention the KCSN Booster??





KCSN, Northridge, CA

KCSN-FM1, West Los Angeles, CA

urban

Google Earth

The KCSN Single Frequency Network

- What about EAS RWT ?
- The KCSN traffic manager schedules two Required Weekly Tests each week. One triggers the EAS box at KCSN (the braapps feed all transmitters) and the other one triggers the EAS box at KSBR (via relays and optos in Enco and the Intraplex 200) the braapps coming back to Northridge and then inserted into the PGM stream feeding all transmitters. Hence, two RWT are sent each week on all transmitters.



The KCSN Single Frequency Network

- What about EAS RMT?
- The Required Monthly Tests are on different days and times, Los Angeles County vs Orange County. These - and any real EAS events - simply interrupt the PGM stream for their duration.
- In other words all EAS activities are sent to all transmitters.





DO NOT PLACE
ANYTHING
ON THIS
TRANSMITTER

The KCSN Single Frequency Network

- What about Nielsen PPM Encoding?
 - All transmitters receive the same Nielsen PPM encoding
 - Originates from KSCN
- Nielsen PPM encoder is in the ratings encoder loop on the Orban 8700i



The KCSN Single Frequency Network

- System has been on the air since 2017
- Additional booster being added this year in Laguna Beach
- Yet to be determined as to how it will be fed.
 - 5G
 - StarLink
 - Fiber
 - AT&T Switched Ethernet
 - I have offered to go out and assist





The KCSN Single Frequency Network

- System was expensive to implement
- Reduced interference significantly
- Added an additional 8 million potential listeners bringing total potential listener to 12 million!



The KCSN Single Frequency Network

- AT&T has been almost 100% reliable
 - A single 1 hour outage in 5 years (43,800 hours)
 - Better than 5/9 reliability!



The KCSN Single Frequency Network

- AT&T Cost
 - KCSN Studios, Northridge 91330
 - Monthly Charge = \$432.25
 - Booster, LA 90067
 - Monthly Charge = \$388.55
 - KSBR, Mission Viejo 92695
 - Monthly Charge = \$388.55
 - Total \$1,209.35



Special Thanks to

- Dan Zimmermann WCTS Contract Engineer
- Mike Worral DOE KCSN



Introducing: Orban 5950

- Next generation of FM processing based upon 50 years of FM Processing experience



Now Shipping!

Best of Show
2023

RADIO WORLD

WINNER



Introducing: Orban XPN-Enterprise

- Linux-based Dell Blade
- Uses Ross Video's softGear platform



Shipping Now!



Questions?



Thank You!

