MIDWEST REGIONAL

BROADCASTERS CLINIC

Why Worry about your Air Chain?

September 2024


VOTE MAD VOTE
ALFRED E. NEUMAN
FOR
PRESIDENT
"WHAT-ME WORRY?"


What—Me Worry? I'm Voting MAD
ALFRED E. NEUMAN FOR PRESIDENT

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

We Are Audio Processing

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

OPTIMOD Trio

Next generation of AM, FM and Digital Media Audio Processing

Now Shipping!

orban

OPTIMOD 5950 and 5750

Next generation of FM processing based on 50 years experience

Now Shipping!

Best of Show 2023
RADIOWORLD
WINNER

orban

OPTIMOD 5950 Super HiFi Edition

Next generation of FM processing with Super HiFi HLS+ decoder

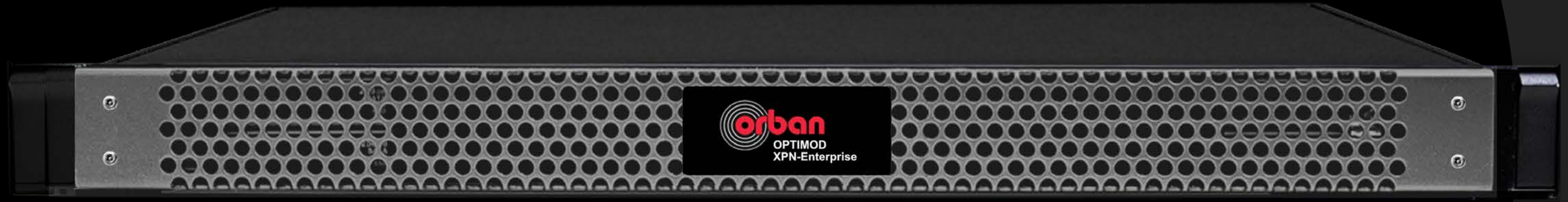
Now Shipping!

BEST OF SHOW 2024
RADIOWORLD
WINNER

orban

Introducing: Orban XPN-Enterprise

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



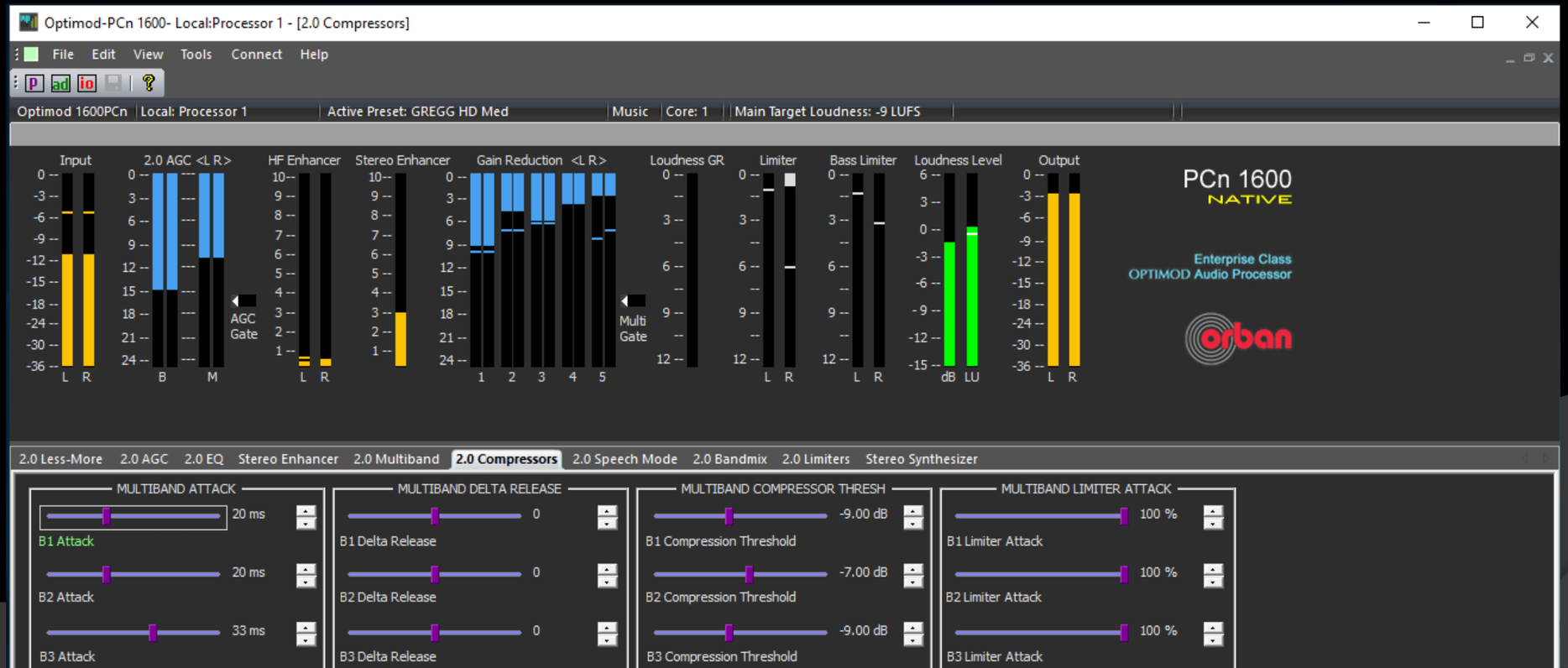
Best of Show 2022 WINNER

Now Shipping!

orban

Orban PCN1600

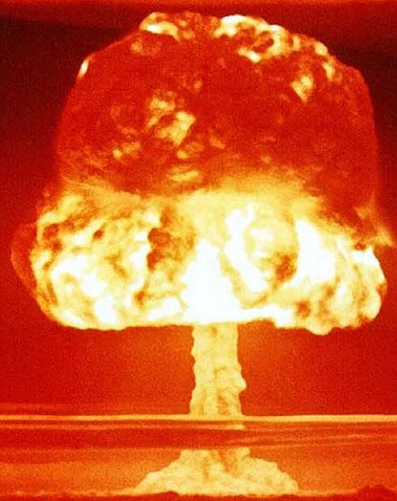
- X86 based processing for HD, Streaming, Podcasting
- Virtual Machine Capable
- Optional Nielsen PPM Encoding



orban

XPN-AM

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

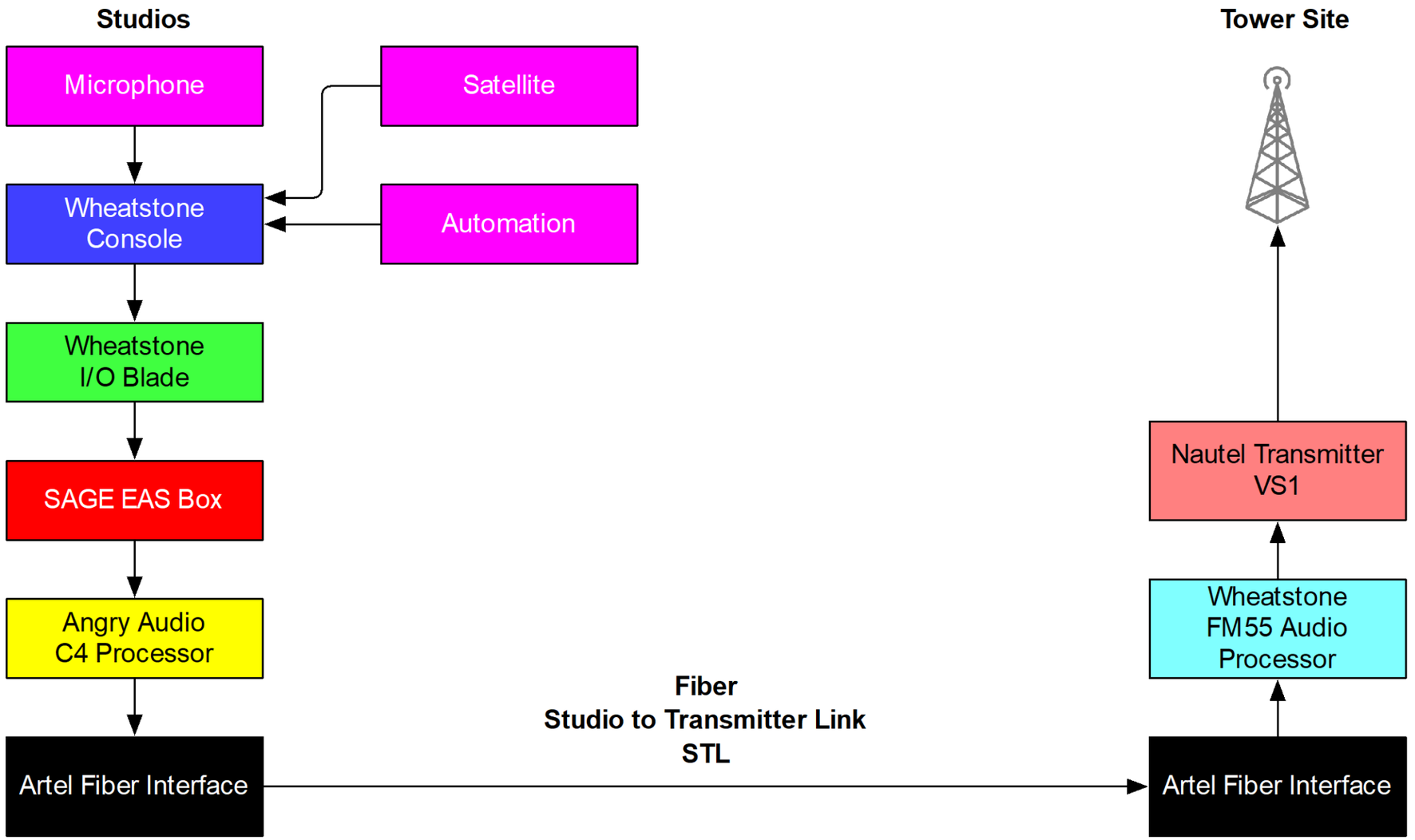
On the air in NYC
WFAN 660 KHz
WABC 770 KHz
WCBS 880 KHz
WNYM 970 KHz
WINS 1010 KHz
WEPN 1050 KHz

orban

Air Chain 101

- What’s an “Air Chain”
- It’s the complete system from source(s) to transmitter

WHRU Block Diagram

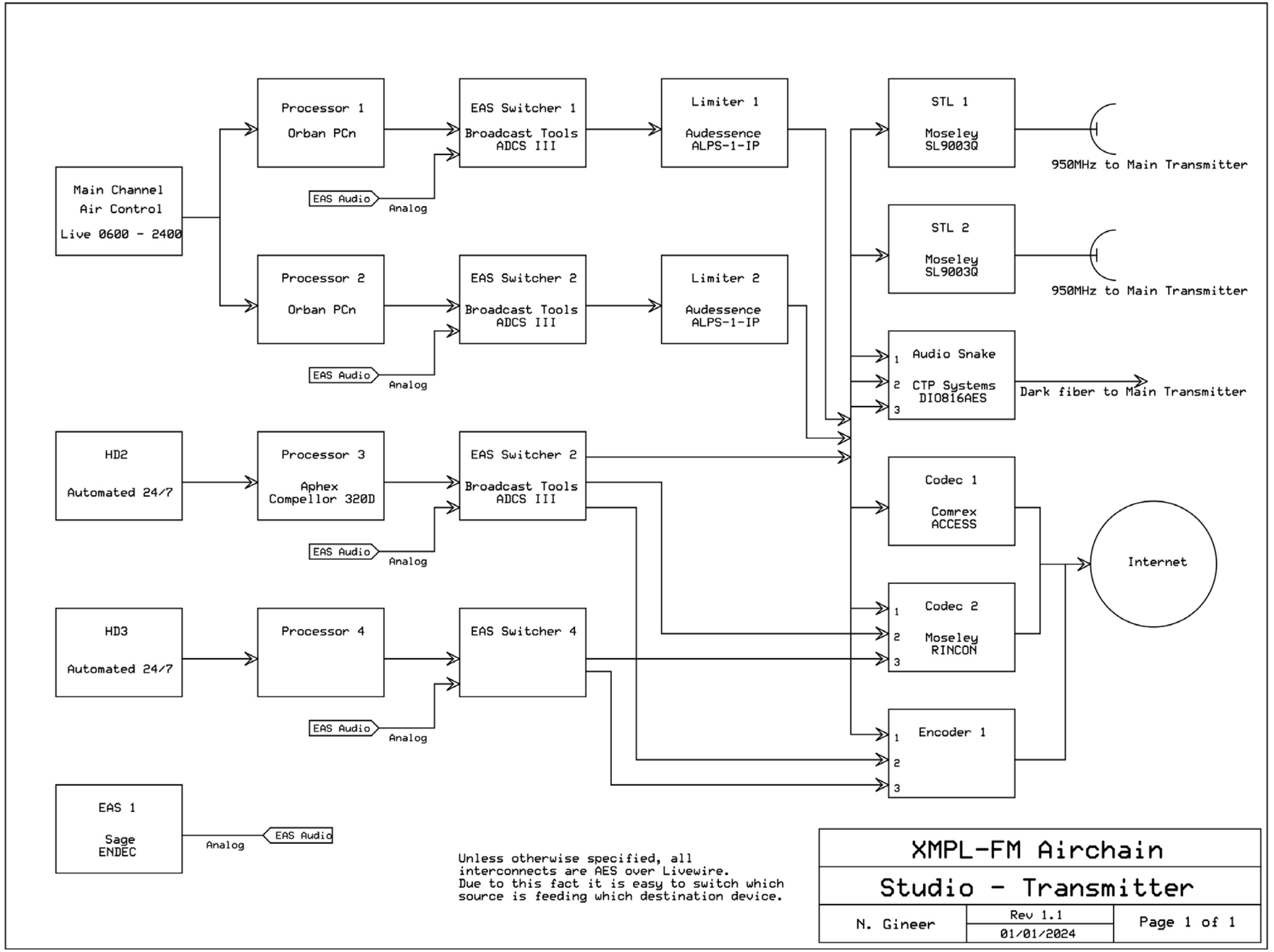


Air Chain 101

- Sources
  - Automation
  - Mics
  - Satellite fed programming
  - Anything that makes audio you want to transmit

Air Chain 101

- Plant
  - Consoles
  - Routers
  - EAS
  - PPM Encoder
  - Processing
  - STL


Main Channel
Air Control
Live 0600 - 2400
Processor 1
Orban PCn
Processor 2
Orban PCn
EAS Audio
Analog
EAS Audio
Analog
EAS Switcher 1
Broadcast Tools
ADCS III
EAS Switcher 2
Broadcast Tools
ADCS III
Limiter 1
Audessence
ALPS-1-IP
Limiter 2
Audessence
ALPS-1-IP
STL 1
Moseley
SL9003Q
STL 2
Moseley
SL9003Q
950MHz to Main Transmitter
950MHz to Main Transmitter
Audio Snake
1
2
3
CTP Systems
DIO816AES
Dark fiber to Main Transmitter
HD2
Automated 24/7
Processor 3
Aphex
Compellor 320D
EAS Audio
Analog
EAS Switcher 2
Broadcast Tools
ADCS III
Codec 1
Comrex
ACCESS
Internet
HD3
Automated 24/7
Processor 4
EAS Audio
Analog
EAS Switcher 4
Codec 2
1
2
3
Moseley
RINCON
Encoder 1
1
2
3
EAS 1
Sage
ENDEC
Analog
EAS Audio
Unless otherwise specified, all
interconnects are AES over Livewire.
Due to this fact it is easy to switch which
source is feeding which destination device.
XMPL-FM Airchain
Studio - Transmitter
N. Gineer
Rev 1.1
01/01/2024
Page 1 of 1

Air Chain 101

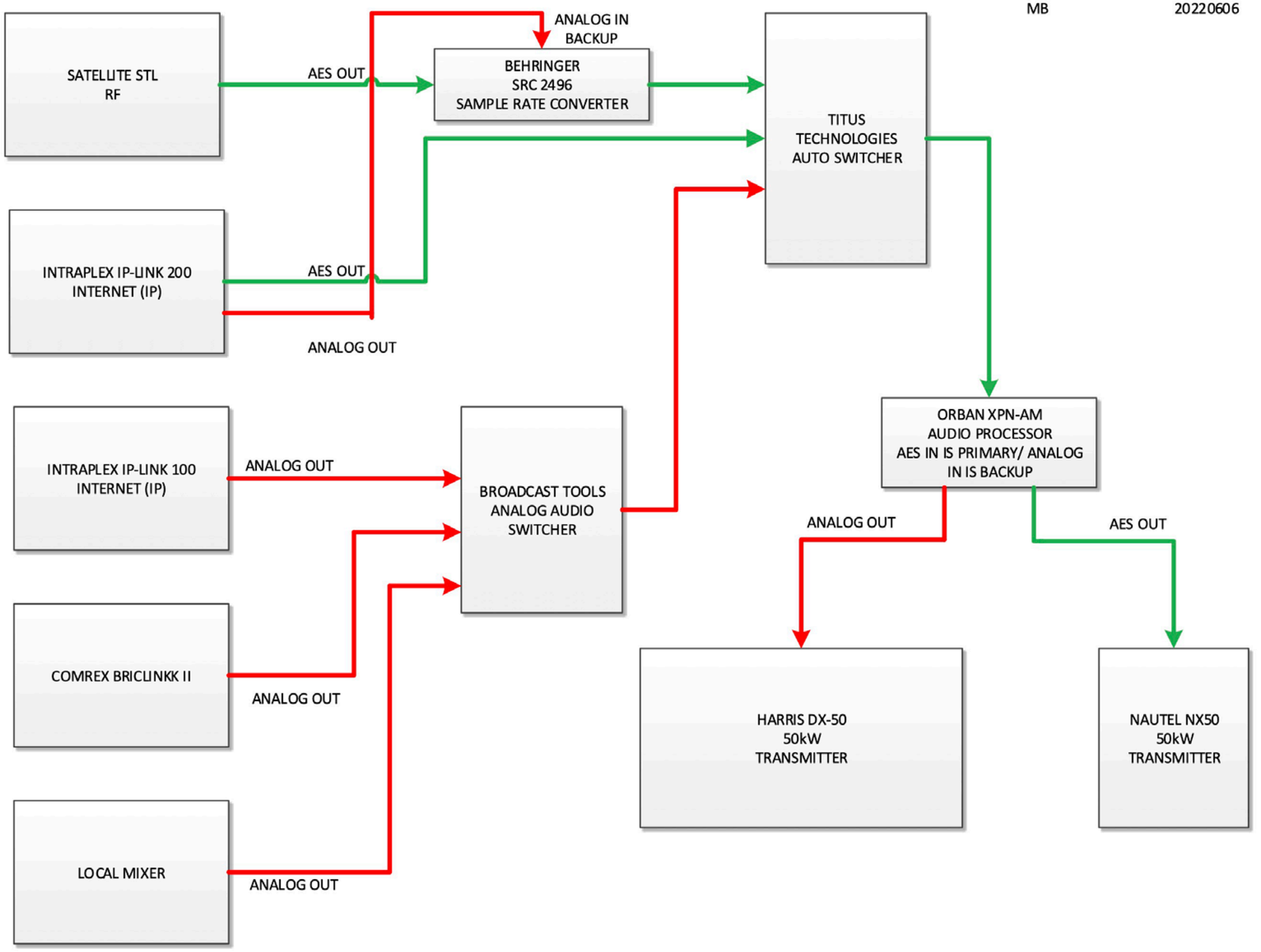
- Transmitter Site
  - Transmitter
  - STL
  - EAS?

KLAA AM 830, ORANGE, CA

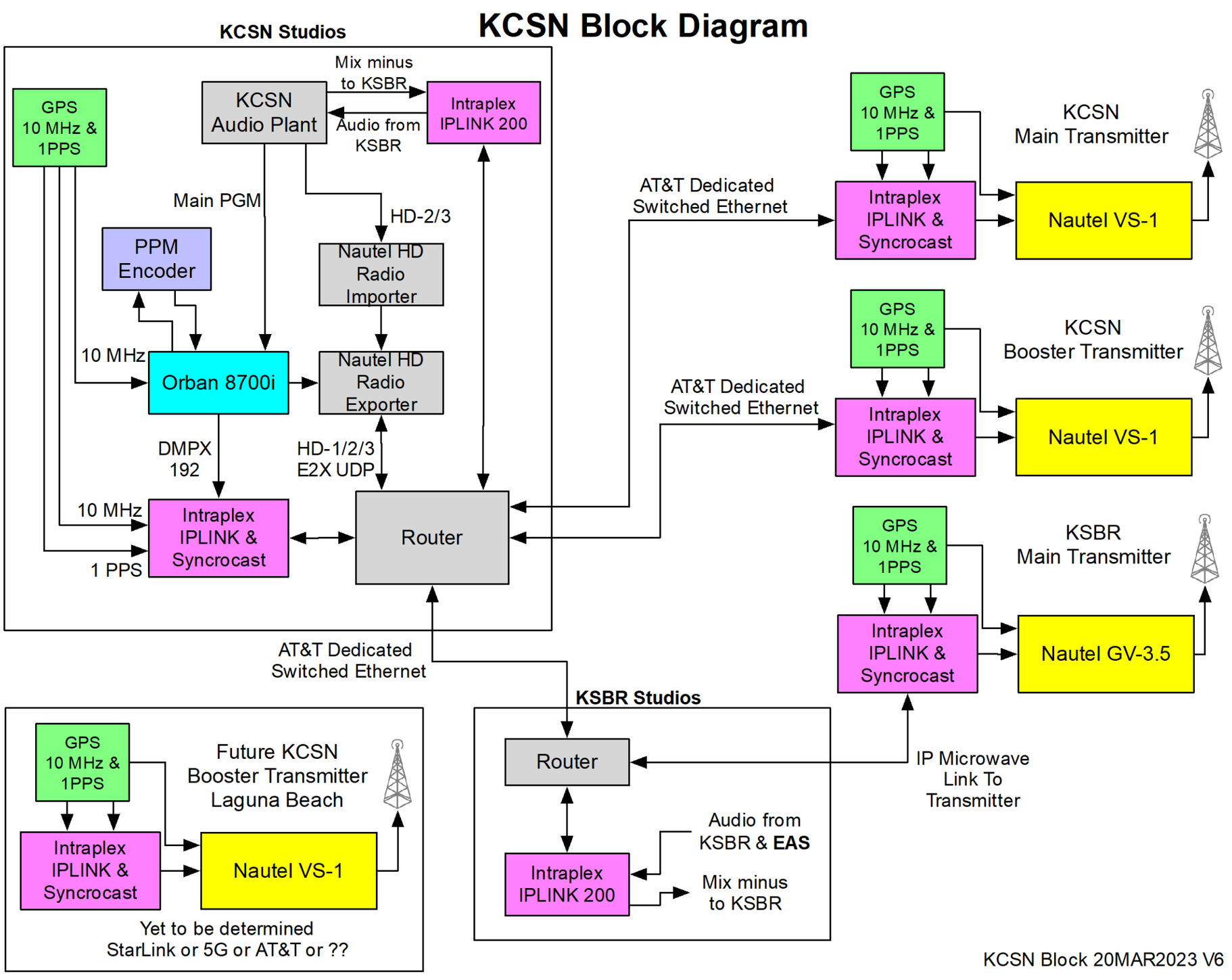
50,000 Watts ND / 20,000 Watts DA-N

TRANSMITTER SITE AUDIO DIAGRAM

MB 20220606 V4.1



KCSN Block Diagram

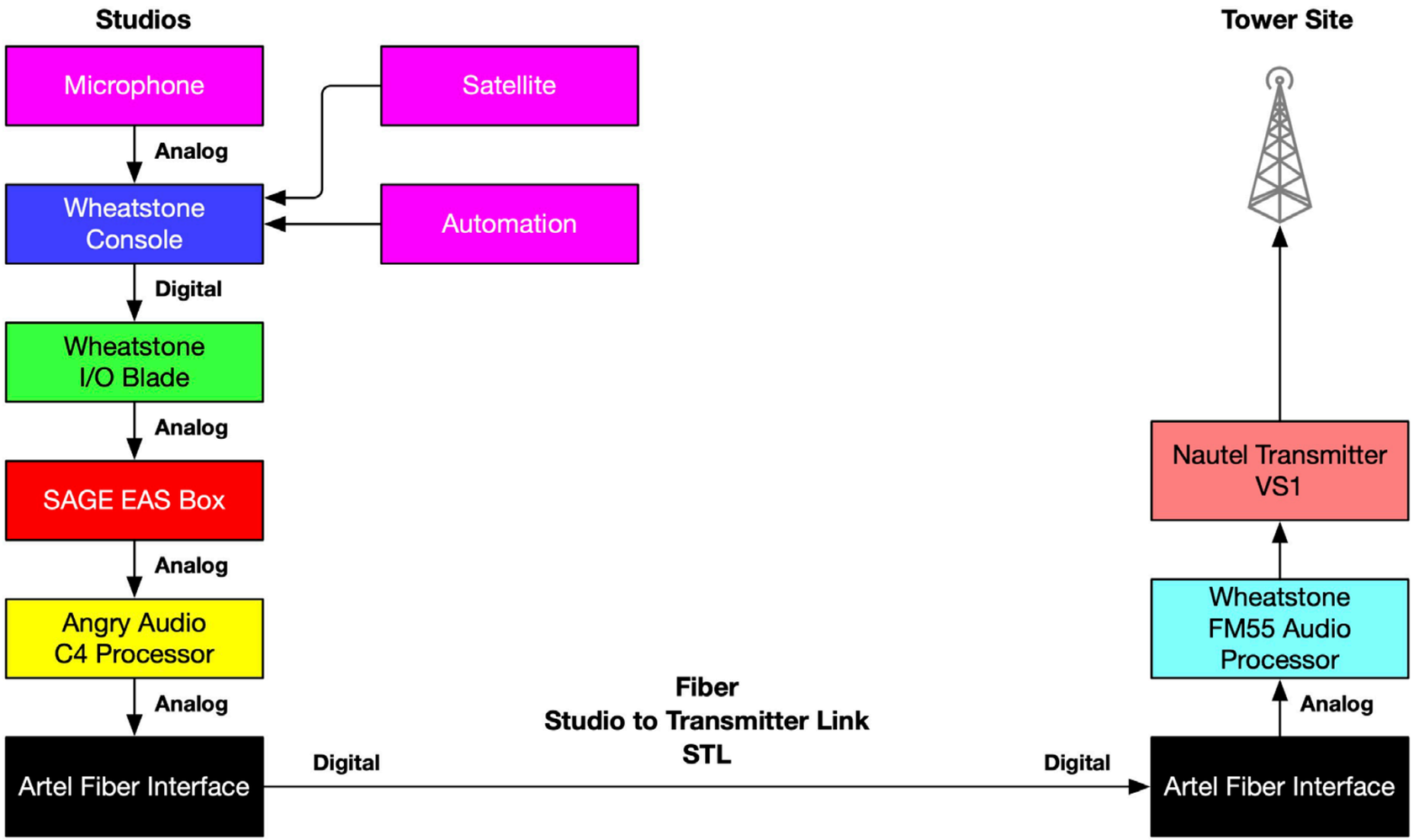


KCSN Block 20MAR2023 V6

Airchain Evaluation

- Make a block diagram
  - Dig around and find everything in the chain
  - Look in every rack and closet!
  - You might be surprised what you find
    - Cascaded processing?
  - Look at unnecessary digital to analog and analog to digital conversions
  - Listen to everything!

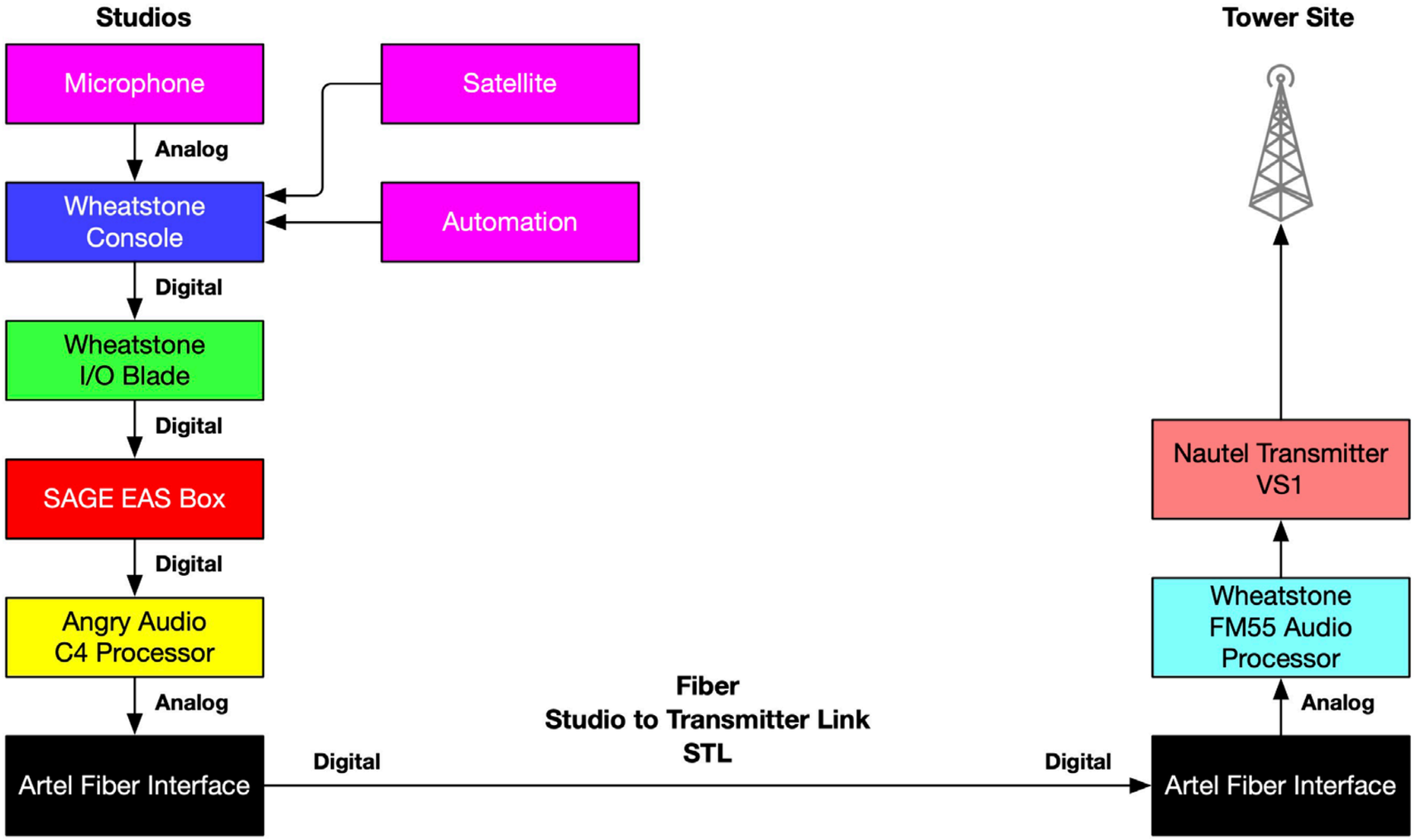
WHRU Block Diagram



Air Chain Evaluation

- Quick/easy fixes
  - Swap the analog to digital
  - It’s a cable move
  - Zero Cost

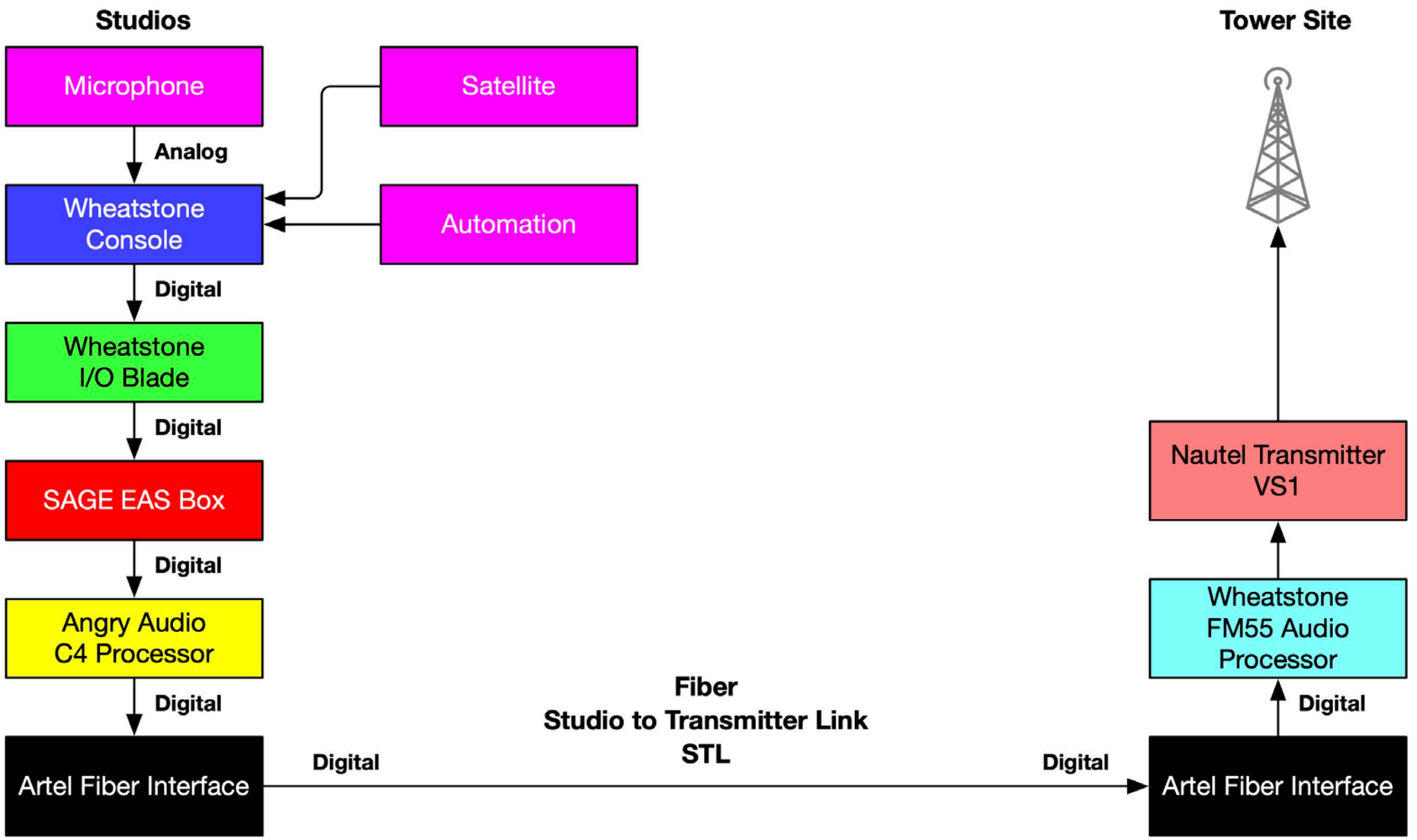
WHRU Block Diagram



Air Chain Evaluation

- The Artel fiber interfaces are analog I/O only
- Swap those out for AES I/O and you have a complete digital airchain

WHRU Block Diagram



Air Chain Evaluation

- The advantage of an all digital airchain
  - Better signal to noise
  - Lower distortion
  - Better PPM encoding
  - Better Audio!

Airchain Evaluation

- STL Evaluation
  - Nick Straka @ DNAV says “There are a lot of Ugly STL’s out there”
  - If the STL is old enough to “drink” you might need to look at replacing it
  - Lots of options these days for STL

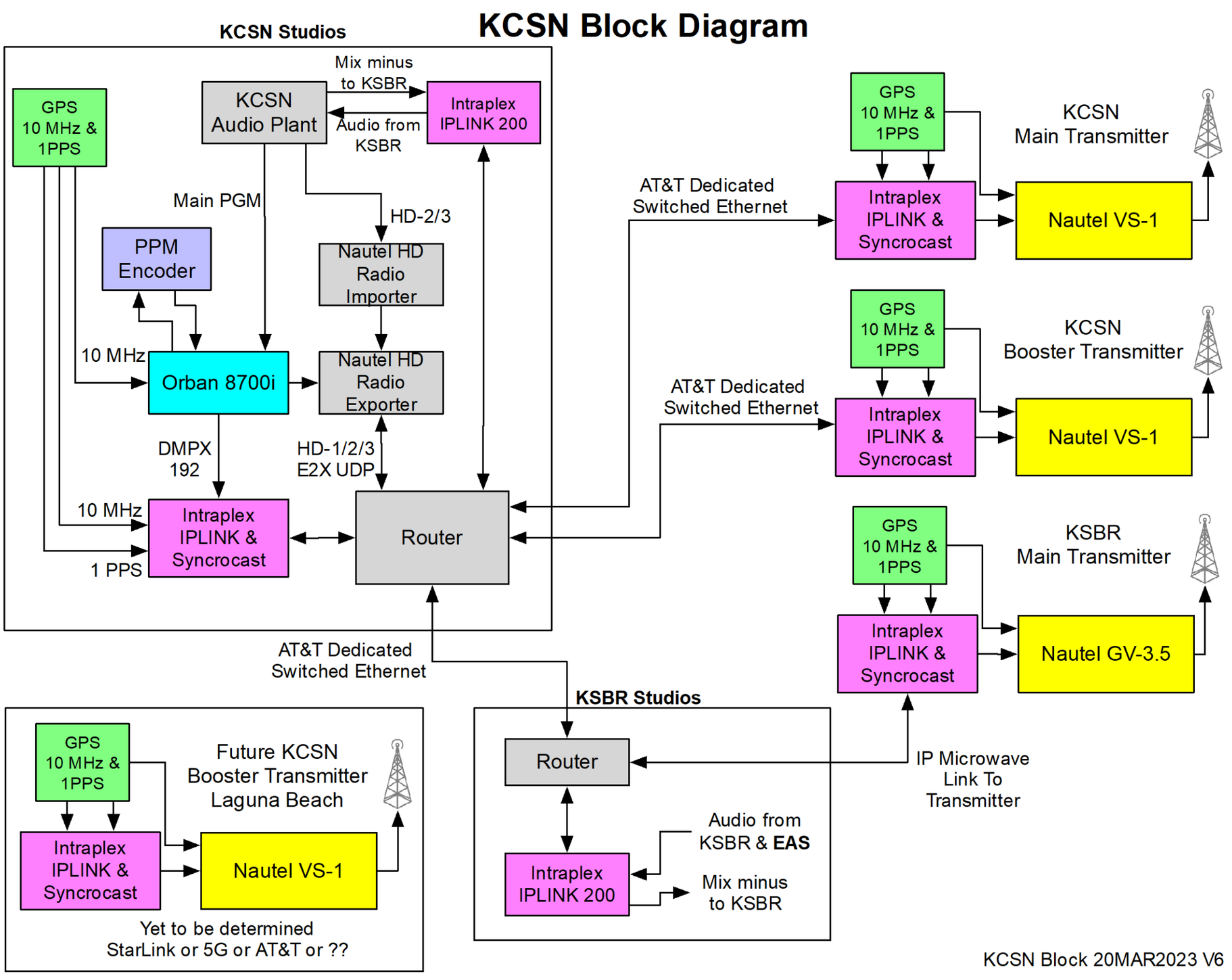
Air Chain Evaluation

- STL Evaluation
  - If you are running a microwave STL when was the last time you looked at it?
  - Receive level the same when it got installed?
  - Receive level within a couple of dB of the predicted path?
  - Looked at the error rate on the digital STL?
  - Listened to the output of it?

Air Chain Evaluation

- STL Evaluation
  - Dark Fiber
  - Public Internet
  - Dedicated Switched Ethernet
  - IP based microwave (licensed)
  - Backed up with 5G or Starlink or your existing STL

KCSN Block Diagram

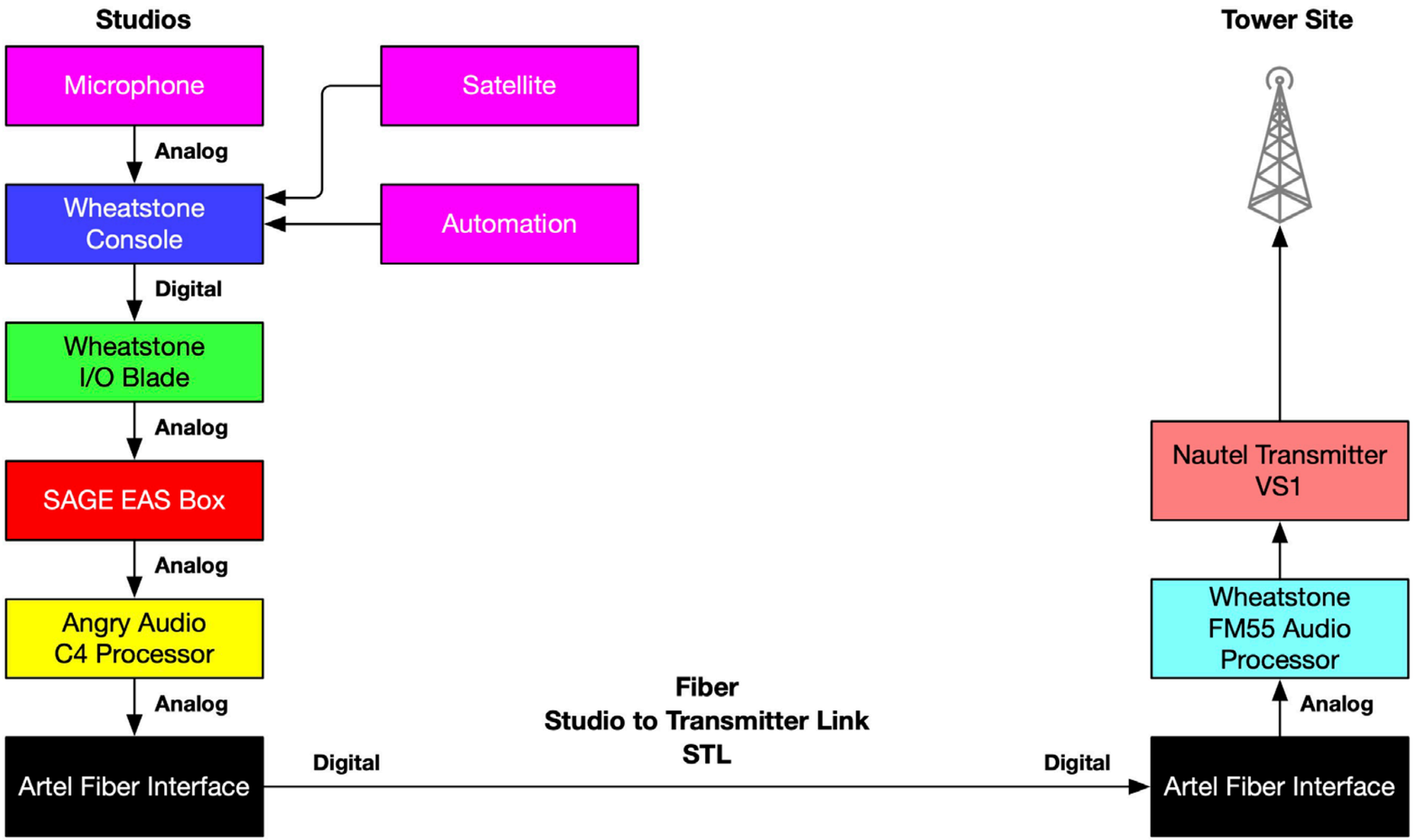


KCSN Block 20MAR2023 V6

Air Chain Evaluation

- STL Evaluation
  - AGC before STL
  - Throwback to the days of analog STL
  - Have to defeat the AGC in the processor
    - Or there will be a War between them
    - Pumping and breathing = Bad Audio

WHRU Block Diagram



Air Chain Evaluation

- STL Evaluation
  - AGC before STL
    - Must be setup correctly
    - Orban ACG should be set for 9 dB to 12 dB of AGC action with “Nominal” plant level
      - This is the #1 problem I find in the field
    - This gives you 24 dB of correction

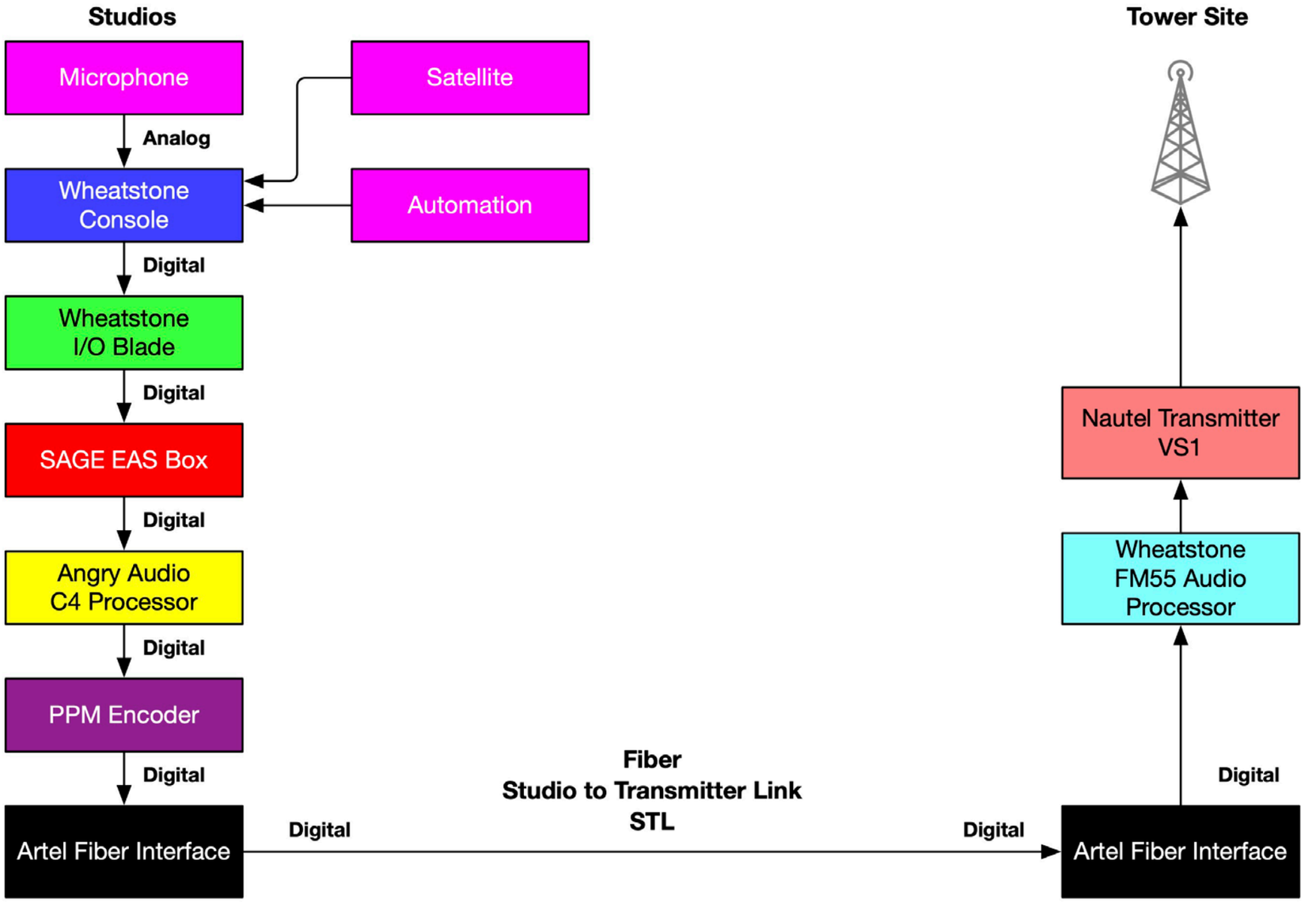
Air Chain Evaluation

- STL Evaluation
  - AGC before STL
    - You might find with a great digital STL that this is unnecessary
    - Less is always More with air chains!

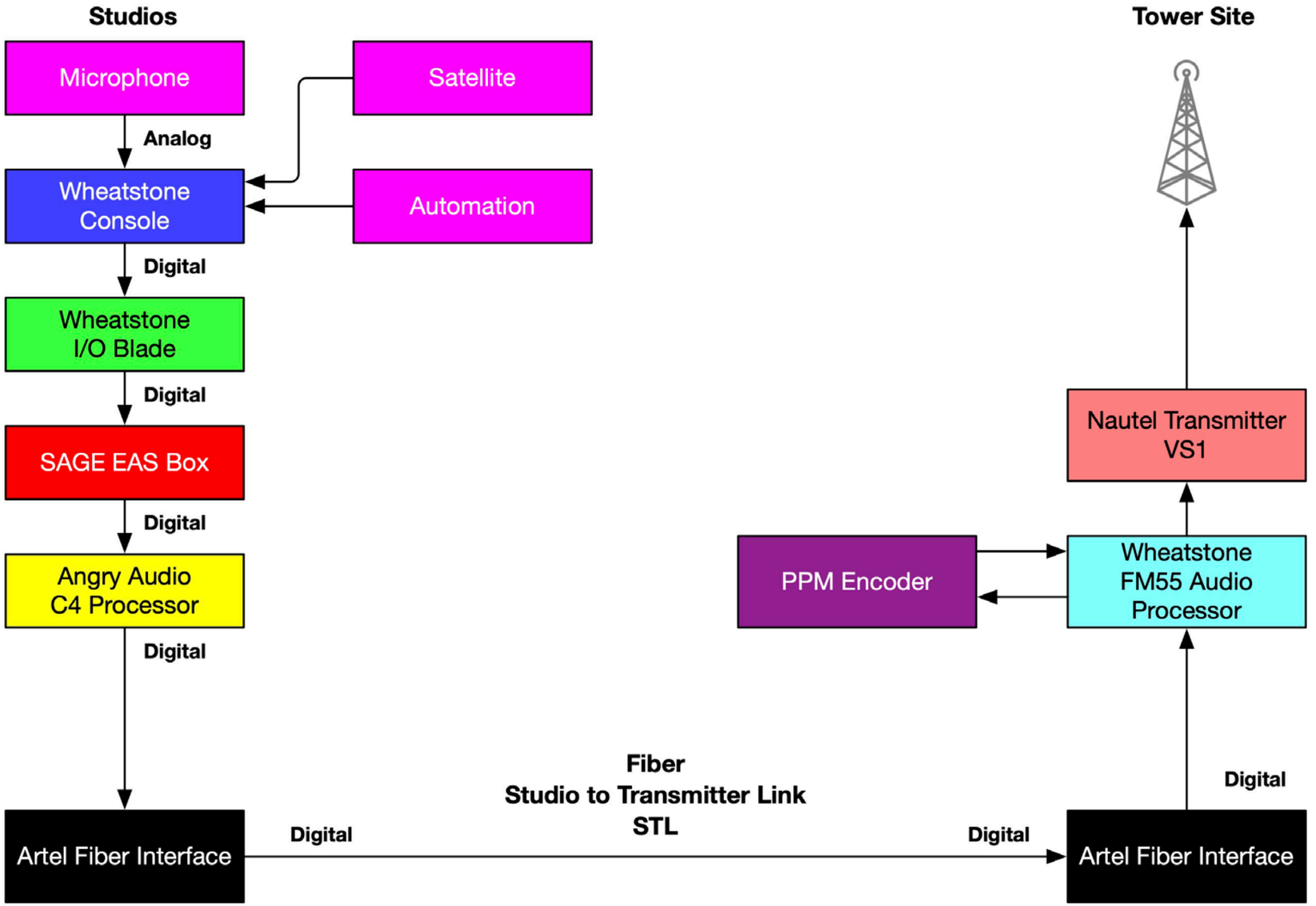
Air Chain Evaluation

- PPM Encoding
  - PPM encoding requires the cleanest, highest density audio you can feed the encoder with
    - Bad audio or poorly processed audio will negatively impact PPM encodability
  - At a minimum PPM encoding should be done after the AGC

WHRU Block Diagram

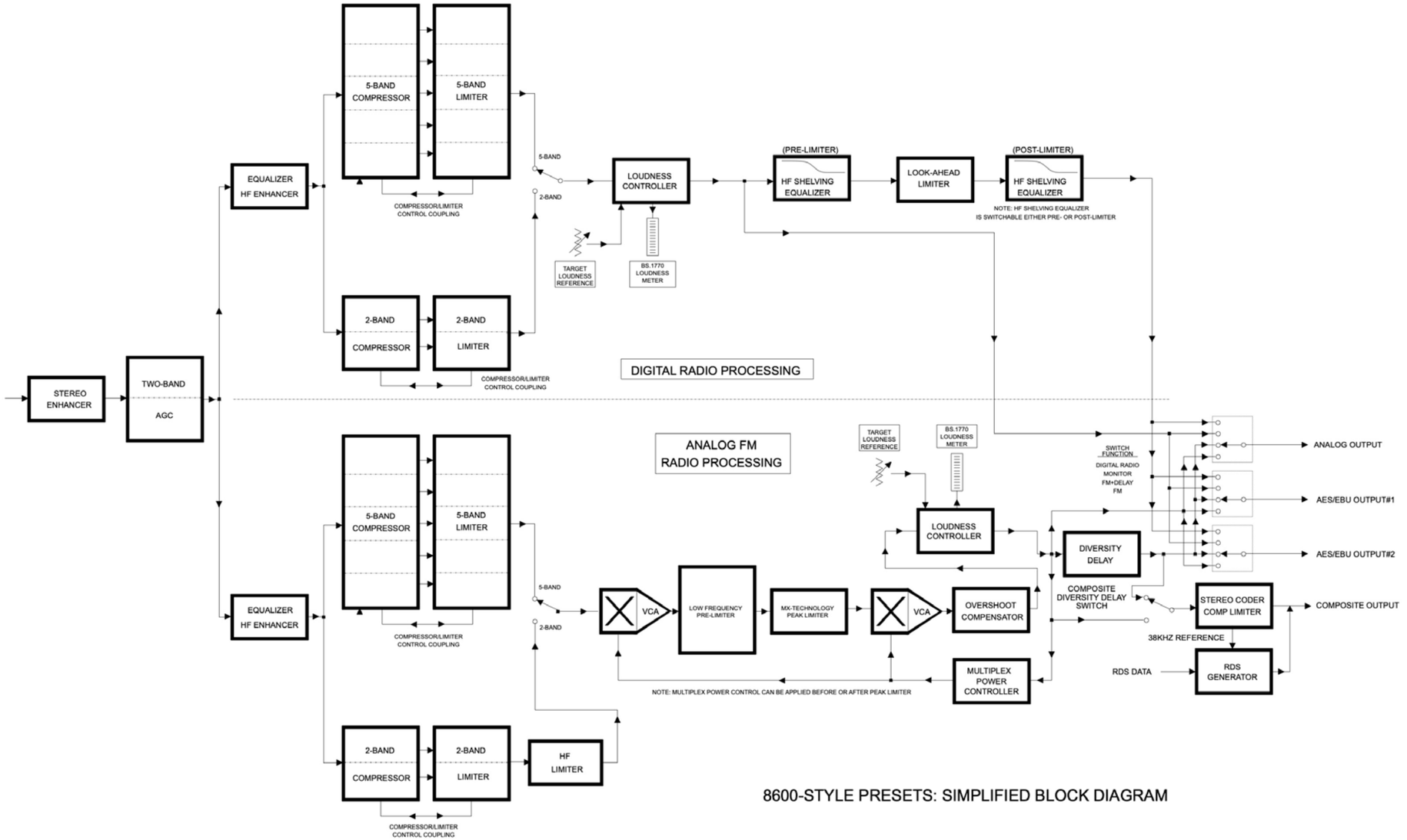


WHRU Block Diagram



Air Chain Evaluation

- PPM Encoding
  - It is significantly more effective to encode PPM after all of the multiband processing and before the safety limiter
  - That requires dual PPM encoders if you are running HD
  - Audio processors with onboard PPM encoding are more effective than external outboard hardware encoders even with “PPM Enhancers”



8600-STYLE PRESETS: SIMPLIFIED BLOCK DIAGRAM

Air Chain Evaluation

- PPM Encoding
  - Do not use lossy codecs on PPM encoded audio
  - Be wary of lossy compressed composite schemes too
  - These can seriously degrade your PPM encoding and damage your Nielsen numbers
  - By upwards of 20%!

Air Chain Microphones

- Typical Dynamic Mics
  - EV RE 20 series
  - Shure SM7
  - Sennheiser MD421
  - Neumann BCM-705
  - Heil PR40

Air Chain Microphones

- Dynamic Microphones
- They tend to not pickup room problems and extraneous noise
- They can have reduced HF response
- Output levels are typically in the range of -50 dB to -60 dB measured at 1 Pascal (94 dB SPL)
- Which means at a typical conversation level of 70 dB SPL the output level is going to be in the range of -74 dB to -86 dB
  - Mic preamp is going to have to be well designed

RE20
Variable-D® Dynamic Cardioid Microphone

Key Features:

- Favorite of broadcast show hosts and voice-over studios
- Ideal for instrument recording, especially kick drums and acoustic guitars
- Studio condenser response yet no powering required and immune to overloading
- Large Acoustalloy diaphragm and low-mass aluminum voice-coil
- Dual-ported, continuously Variable-D® with minimal proximity effect
- Steel case and hum-bucking coil provide exceptional magnetic shielding

General Description:

The Electro-Voice RE20 is a professional-quality dynamic cardioid microphone created specially for recording, broadcast and sound-reinforcement applications requiring essentially flat response over a very wide frequency range. The wide frequency response, coupled with excellent transient response, make the RE20 easily comparable to the finest condenser cardioid microphones and an easily operated "bass tilt down" switch corrects spectrum balance for use in long-reach situations or other applications where bass attenuation is needed.

A true cardioid microphone, the RE20 offers greatest rejection at 180° off axis - directly to the rear of the microphone. Pattern control is so consistent that the frequency response is nearly independent of angular location of the sound source, creating virtually no off-axis coloration, yet providing greatest possible rejection of unwanted

Technical Specifications:

Element Type:	Dynamic
Frequency Response:	45 Hz - 18,000 Hz
Polar Pattern:	Cardioid
Impedance:	150 ohms balanced
Sensitivity, Open Circuit Voltage, 1 kHz:	1.5 mV/pascal
Hum Pickup Level, typical (60 Hz/1 millioersted field):	-130 dBm
Polarity:	Pin 2 will be positive referenced to Pin 3 with positive pressure on diaprhagm
Case Material:	Steel
Finish:	Fawn beige

SM7B Cardioid Dynamic Microphone

Overview

The SM7B is a selectable frequency response microphone that delivers warm and smooth audio in close-proximity studio and vocal applications. Optimized shielding from external electromagnetic hum, along with internal shock mounting, external windscreens and adjustable bass roll-off and mid-range emphasis response settings provide clean, consistent reproduction.

Features

- Flat, wide-range frequency response for exceptionally clean and natural reproduction of both music and speech
- Bass rolloff and mid-range emphasis (presence boost) controls with graphic display of response setting
- Improved rejection of electromagnetic hum, optimized for shielding against broadband interference emitted by computer monitors
- Internal “air suspension” shock isolation virtually eliminates mechanical noise transmission
- Highly effective pop filter eliminates need for any add-on protection against explosive breath sounds, even for close-up vocals or narration
- Now shipping with the A7WS detachable windscreen, designed to reduce plosive sounds and gives a warmer tone for close-talk vocals
- Yoke mounting with captive stand nut for easy mounting and dismounting provides precise control of microphone position
- Classic cardioid polar pattern, uniform with frequency and symmetrical about axis, to provide maximum rejection and minimum coloration of off-axis sound
- Rugged construction and excellent cartridge protection for outstanding reliability

SM7B

Available Models

SM7B	Includes foam windscreen, close-talk windscreen, and locking yoke mount.

Specifications

Type	Dynamic
Frequency Response	50 to 20,000 Hz
Polar Pattern	Cardioid
Electromagnetic Hum Sensitivity *(Typical, Equivalent SPL/milliOersted)*	60 Hz: 11 dB 500 Hz: 24 dB 1 kHz: 33 dB
Impedance	150 ohms for connection to microphone inputs rated at 19 to 300 ohms.
Output Level (at 1,000 Hz)	Open Circuit Voltage: – 59.0 dB (1.12 mV) *0 dB = 1 volt per Pascal*
Switches	Bass rolloff and mid-range emphasis: Slotted response selector switches.
Cartridge Shock Mount	Internal air-suspension shock and vibration isolator.
Microphone Connector	Three-pin professional audio (XLR)
Swivel Assembly	Integrated, captive nut for ease of attachment to stand, fits 5/8 in.–27 thread.
Polarity	Positive pressure on diaphragm produces positive voltage on pin 2 relative to pin 3.
Case	Dark gray enamel aluminum and steel case with dark gray foam windscreen.
Net Weight	765.4 grams (1 lb, 11 oz)

Air Chain Microphones

- Dynamic Microphones
- How big a problem is the output level of dynamic mics?
- Shure released an SM7dB with a switchable internal preamp with up to 28 dB of gain
- EV released the RE27ND which has about 5 dB more output level than an RE20

RE27N/D

Variable-D® N/DYM® Dynamic Cardioid Microphone

Key Features:

- **Studio condenser performance from self-generating transducer**
- **Consummate announce microphone**
- **Ideal for sampling**
- **Switch-selected E.Q.**
- **Effective internal shock, pop and wind protection**
- **Exceptional sensitivity assures high signal-to-noise**

General Description:

The Electro-Voice RE27N/D is a professional-quality dynamic cardioid microphone designed for broadcast production announce and voice-over, high-quality recording and sound reinforcement applications. The RE27N/D utilizes a revolutionary neodymium-alloy magnet and a reinforced diaphragm dome, a combination offering increased sensitivity (up to 6-dB more output), undistorted output at high sound pressure levels and an extended high-frequency response. The exceptional sensitivity of the RE27N/D, excellent transient response and inherently low noise of the dynamic transducer, all combine to ensure a superior signal-to-noise ratio, easily comparable to the finest condenser cardioid microphones. to

Technical Specifications:

Generating Element:	Dynamic N/DYM Magnet Structure
Frequency Response:	45 - 20,000 Hz
Polar Pattern:	Cardioid
Impedance:	150 ohms balanced
Sensitivity, Open Circuit Voltage:	2.52 mV/pascal = 1 kHz
Power Level, 1 kHz (0 dB = 1 mV/Pascal):	-51 dB
Hum Pickup Level, typical (60 Hz/ 1 millioersted field):	-130 dBm

Air Chain Microphones

- Typical Condenser Mics
  - Neumann U-87
  - Neumann BCM-104
  - AKG 414

Air Chain Microphones

- Condenser Microphones
- They tend to pickup room problems and extraneous noise
- Output levels are typically in the range of -31 dB to -36 dB measured at 1 Pascal (94 dB SPL) which is about 20 dB higher than a dynamic mic
- Which means at a typical conversation level of 70 dB SPL the output level is going to be in the range of -55 dB to -60 dB
  - Mic preamp is not going to be as critical

Acoustical operating principle	Pressure gradient transducer
Directional Pattern	Omnidirectional, cardioid, figure-8
Frequency Range	20 Hz ... 20 kHz
Sensitivity at 1 kHz into 1 kohm	20/28/22 mV/Pa ± 1 dB (Omni/cardioid
Rated Impedance	200 ohms
Rated load impedance	1 kohms
Equivalent noise level, CCIR[1)]	26/23/25 dB (Omni/cardioid/8)
Equivalent noise level, A-weighted[1)]	15/12/14 dB-A (Omni/cardioid/8)
Maximum SPL for THD 0.5%[2)]	117 dB (cardioid)
Maximum SPL for THD 0.5% with preattenuation[2)]	127 dB
Signal-to-noise ratio, CCIR (re. 94 dB SPL)[1)]	68/71/69 dB (Omni/cardioid/8)
Signal-to-noise ratio, A-weighted (re. 94 dB SPL)[1)]	79/82/80 dB (Omni/cardioid/8)
Maximum output voltage	-6 dBu
Supply voltage (P48, IEC 61938)	48 V ± 4 V

Acoustical operating principle	Pressure gradient transducer
Directional Pattern	Cardioid
Frequency Range	20 Hz ... 20 kHz
Sensitivity at 1 kHz into 1 kohm	22 mV/Pa = –33.1 dBV ± 1 dB
Sensitivity at –14 dB attenuation	4.4 mV/Pa
Rated Impedance	50 ohms
Rated load impedance	1 kohms
Equivalent noise level, CCIR[1)]	18 dB
Equivalent noise level, A-weighted[1)]	7 dB-A
Maximum SPL for THD 0.5%[2)]	138 dB
Maximum SPL for THD 0.5% with preattenuation[2)]	152 dB
Signal-to-noise ratio, CCIR (re. 94 dB SPL)[1)]	76 dB
Signal-to-noise ratio, A-weighted (re. 94 dB SPL)[1)]	87 dB
Maximum output voltage	10 dBu
Supply voltage (P48, IEC 61938)	48 V ± 4 V

Air Chain Microphones

- Mic Preamps
- There is a dearth of well-designed mic preamps
- Many sound OK at low gain but fall apart at 60 dB to 70 dB of gain that dynamic mics typically need in a broadcast environment
- Listen for lack of high frequencies, hard/elongated/unnatural sibilance & excessive noise
- You aren’t going to be able to fix those problems with processing

Air Chain Microphones

- Mics & Preamps
  - Listen to the mics and preamps carefully!
  - Problems will be very difficult to fix
  - And don’t ignore room acoustics
    - Rooms that have bad acoustics are going to sound bad on the air

Air Chain Human Factor

- Board ops & Talent
  - Training Training Training
  - Board Metering and what it means
  - What faders do and how to use them
  - Microphones

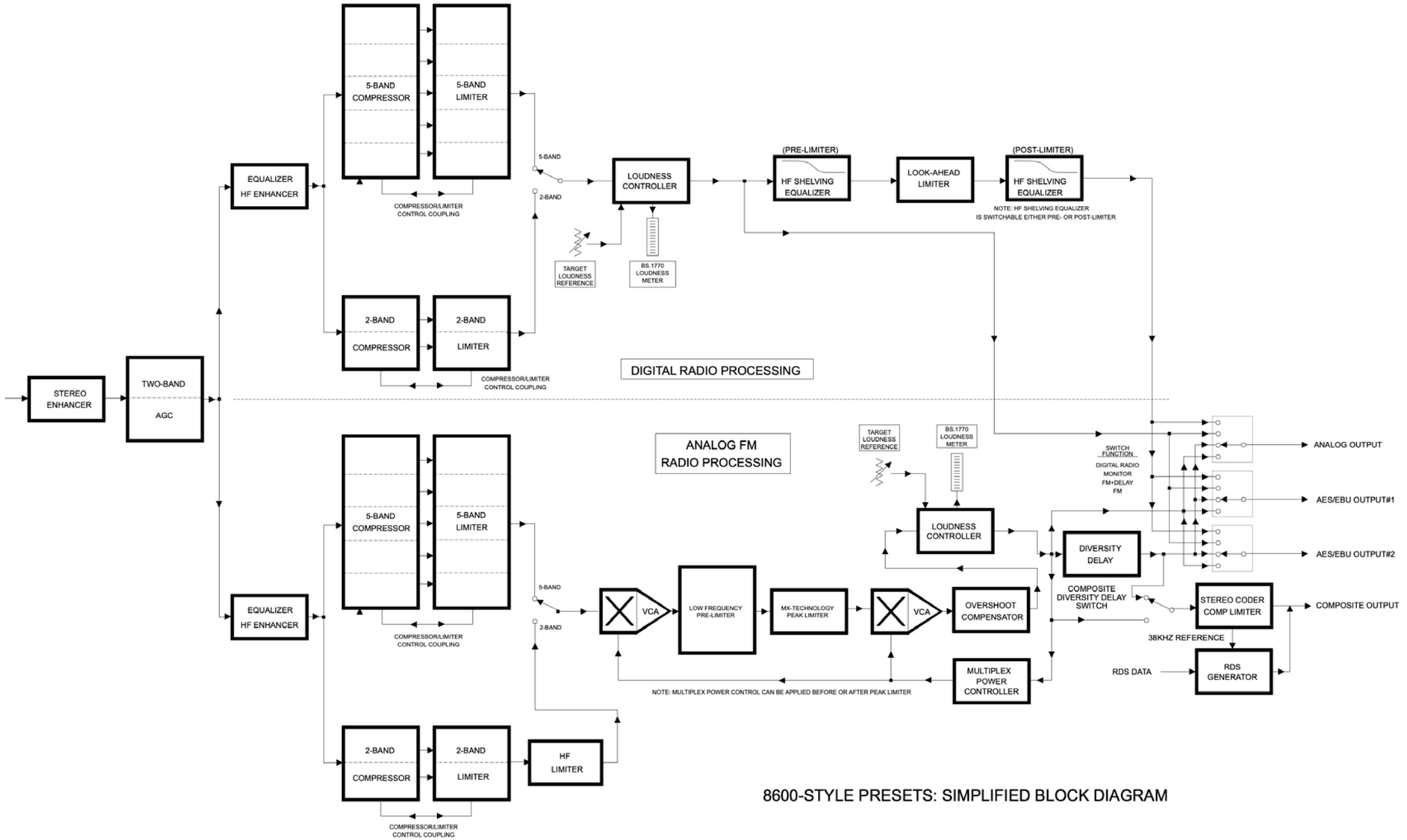

iSL 20.2
TIMER
SAS
Mic 1
Mic 2
Mic 3
Mic 4
Mic 5
WO 1
WO 2
WO 3
WO 4
WO Mix
ISDN 1A
VoxPro
CoolEdit
NEWS
NPR
NEWS
ON
OFF
TALKBACK
CUE
SPEAKER
HEADSET

Audio Processing 101

- Consistent loudness
  - Between mics, music, spots, audio from networks
- Consistent spectral balance
- Sonic Signature

Audio Processing

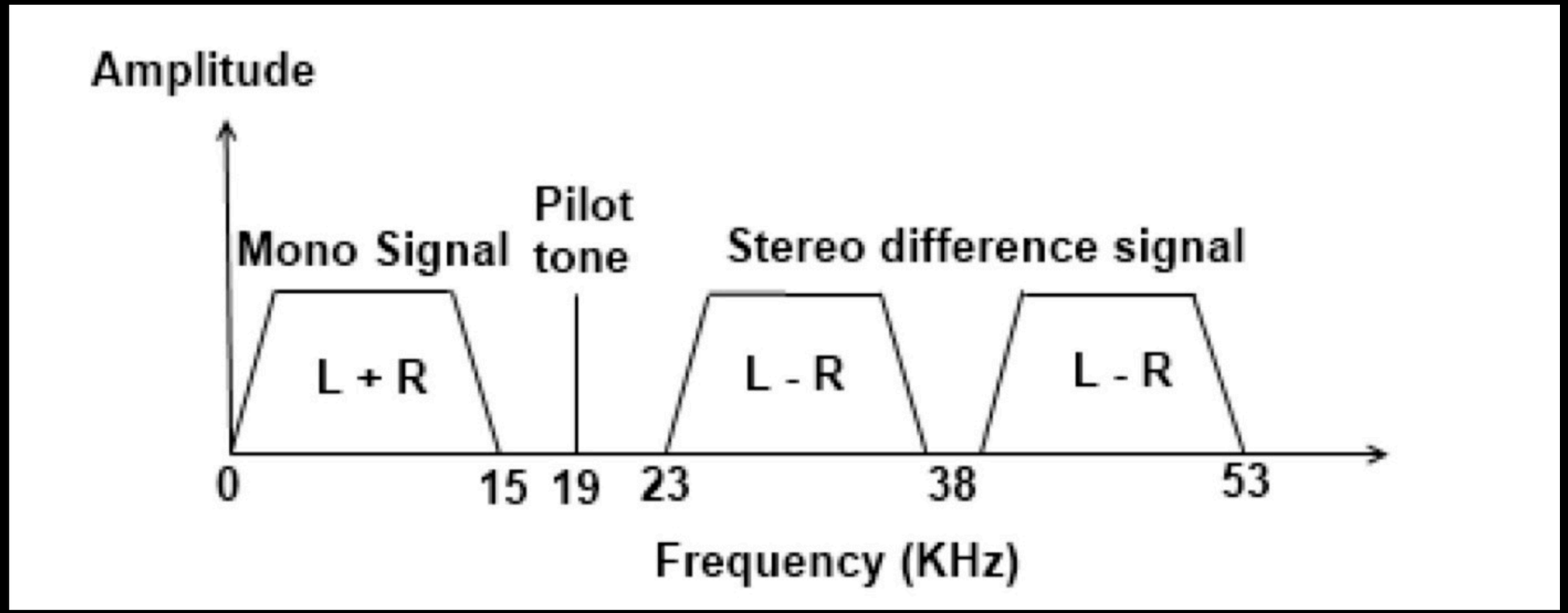
- Uses
  - AGC Automatic Gain Control
  - Compression
  - Limiting



8600-STYLE PRESETS: SIMPLIFIED BLOCK DIAGRAM

Audio Processing

- Creates
  - Composite
    - L+R
    - L-R
    - 19 kHz Pilot
  - Adds 75 uS pre-emphasis
  - Analog & Digital


Amplitude
Mono Signal
Pilot tone
Stereo difference signal
L + R
L - R
L - R
0
15
19
23
38
53
Frequency (KHz)

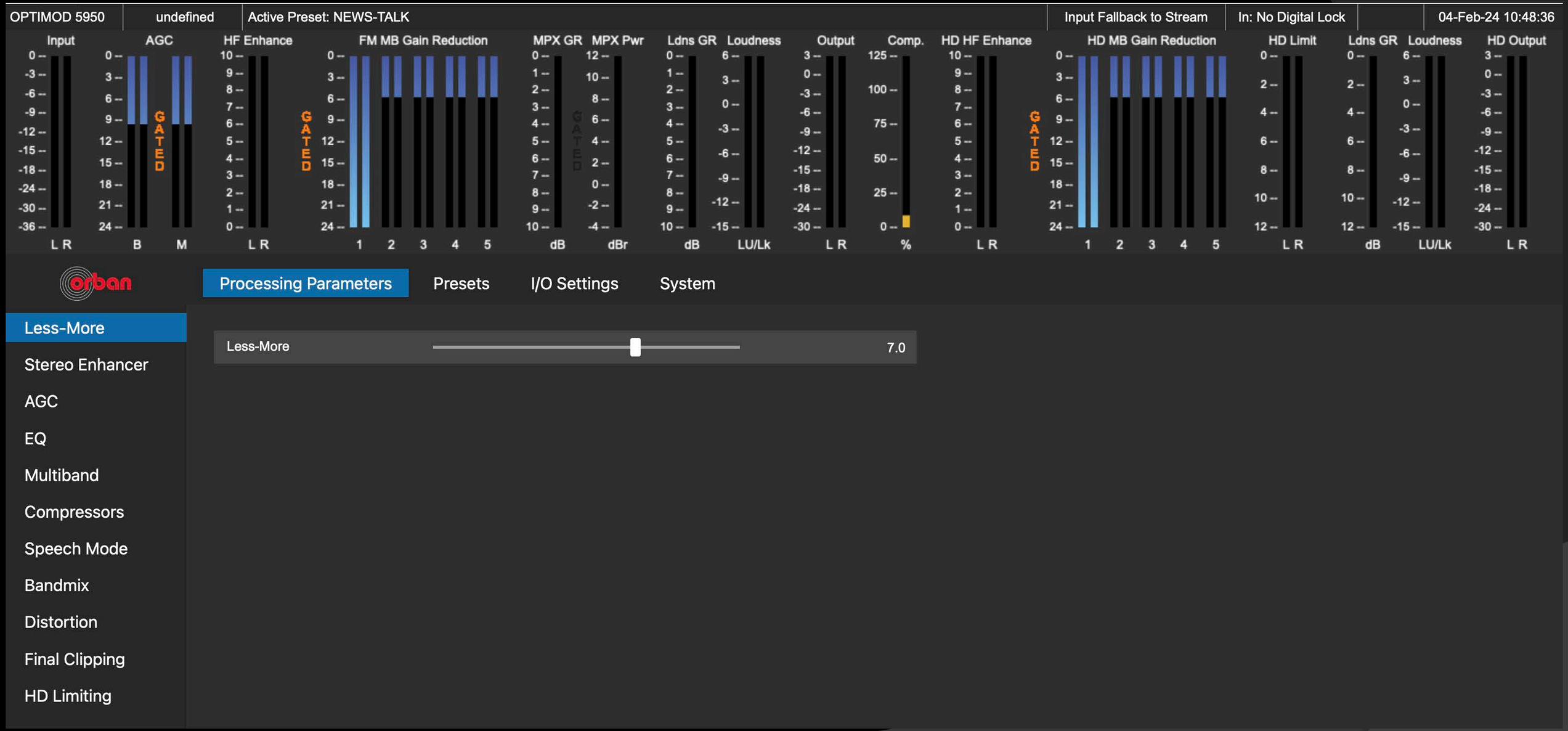
Audio Processing

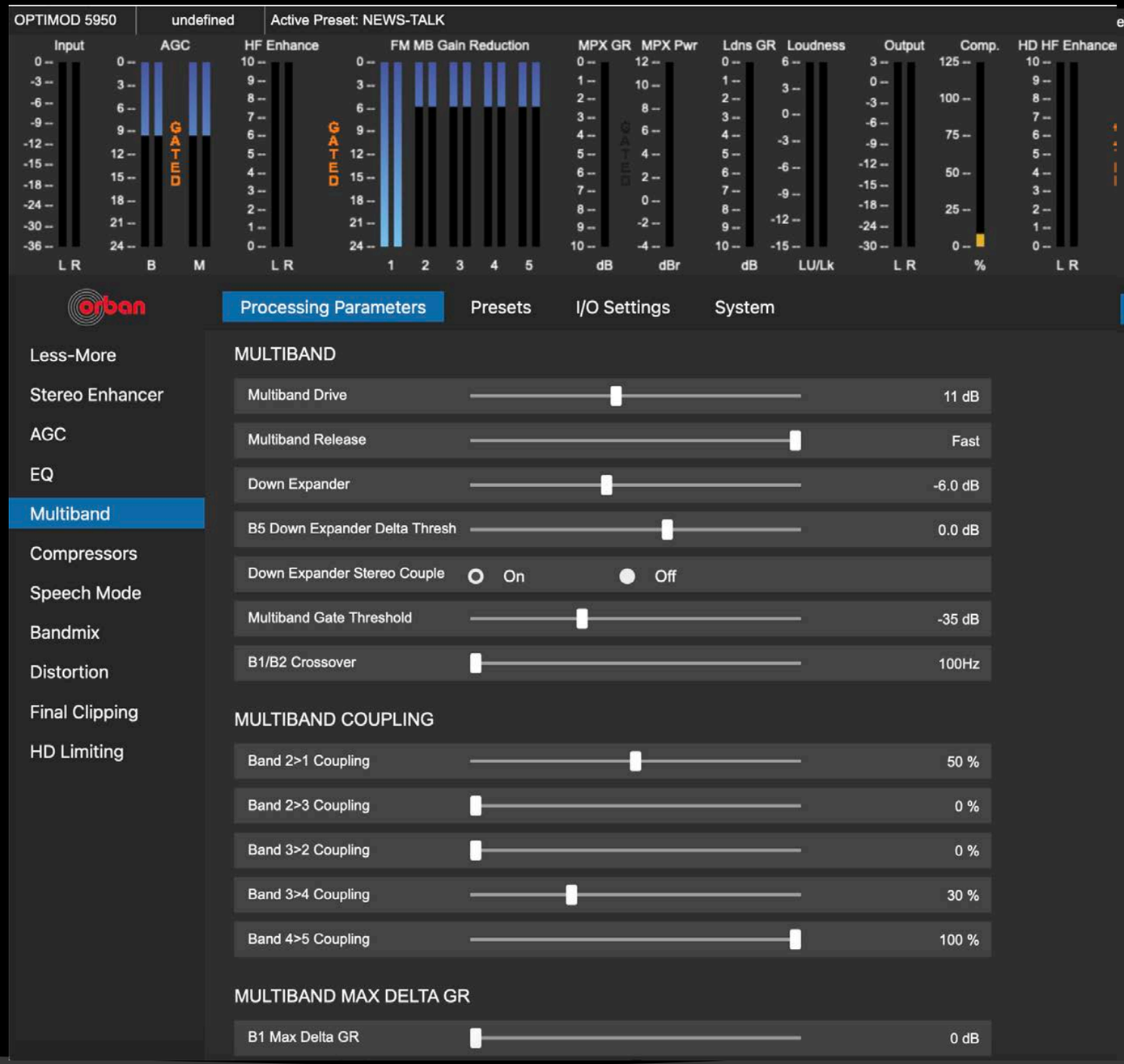
- Read the Quick Start Guide!
- Read the manual
- Audition a couple of the factory presets
- Pick one that gets you close and go from there
- On Orban processors use the Less-More control

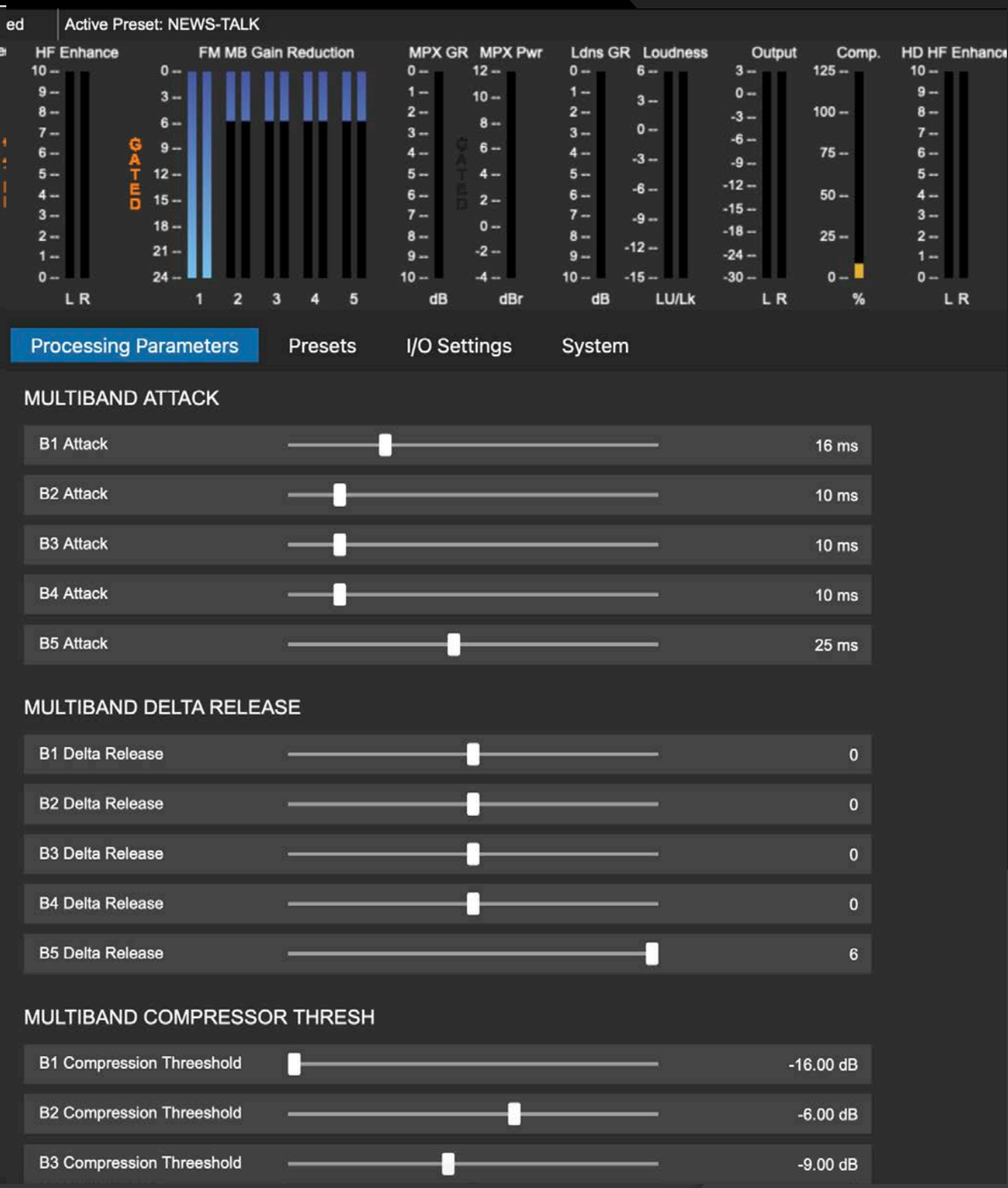
NEWS-TALK
PROTECT-0DB
ROCK-DENSE
ROCK-GEN UL
ROCK-MEDIUM
ROCK-MEDIUM MX
ROCK-MEDIUM+LOWBASS
ROCK-MEDIUM+MIDBASS
ROCK-OPEN
ROCK-OPEN UL
ROCK-SMOOTH
ROCK-SMOOTH MX
ROCK-SOFT
ROCK-SOFT MX
SMOOTH JAZZ
SMOOTH JAZZ MX
SPORTS
URBAN UL
URBAN-LIGHT
---------- User ----------
MKE EFX
MKE EFX A
MKE EFX Louder
MKE Full Round

Recall Preset | Save Preset | Delete Preset

NEWS-TALK


OPTIMOD 5950
undefined
Active Preset: NEWS-TALK
Input Fallback to Stream
In: No Digital Lock
04-Feb-24 10:48:36
Input
AGC
HF Enhance
FM MB Gain Reduction
MPX GR
MPX Pwr
Ldns GR
Loudness
Output
Comp.
HD HF Enhance
HD MB Gain Reduction
HD Limit
Ldns GR
Loudness
HD Output
GATED
L R
B
M
1 2 3 4 5
dB
dBr
%
LU/Lk
orban
Processing Parameters
Presets
I/O Settings
System
Less-More
Stereo Enhancer
AGC
EQ
Multiband
Compressors
Speech Mode
Bandmix
Distortion
Final Clipping
HD Limiting
Less-More
7.0


OPTIMOD 5950
undefined
Active Preset: NEWS-TALK
Input
AGC
HF Enhance
FM MB Gain Reduction
MPX GR
MPX Pwr
Ldns GR
Loudness
Output
Comp.
HD HF Enhance
GATED
L R
B
M
1 2 3 4 5
dB
dBr
LU/Lk
%
orban
Processing Parameters
Presets
I/O Settings
System
Less-More
Stereo Enhancer
AGC
EQ
Multiband
Compressors
Speech Mode
Bandmix
Distortion
Final Clipping
HD Limiting
MULTIBAND
Multiband Drive 11 dB
Multiband Release Fast
Down Expander -6.0 dB
B5 Down Expander Delta Thresh 0.0 dB
Down Expander Stereo Couple On Off
Multiband Gate Threshold -35 dB
B1/B2 Crossover 100Hz
MULTIBAND COUPLING
Band 2>1 Coupling 50 %
Band 2>3 Coupling 0 %
Band 3>2 Coupling 0 %
Band 3>4 Coupling 30 %
Band 4>5 Coupling 100 %
MULTIBAND MAX DELTA GR
B1 Max Delta GR 0 dB


ed
Active Preset: NEWS-TALK
HF Enhance
FM MB Gain Reduction
MPX GR
MPX Pwr
Ldns GR
Loudness
Output
Comp.
HD HF Enhance
GATED
L R
1 2 3 4 5
dB
dBr
LU/Lk
%
Processing Parameters
Presets
I/O Settings
System
MULTIBAND ATTACK
B1 Attack 16 ms
B2 Attack 10 ms
B3 Attack 10 ms
B4 Attack 10 ms
B5 Attack 25 ms
MULTIBAND DELTA RELEASE
B1 Delta Release 0
B2 Delta Release 0
B3 Delta Release 0
B4 Delta Release 0
B5 Delta Release 6
MULTIBAND COMPRESSOR THRESH
B1 Compression Threeshold -16.00 dB
B2 Compression Threeshold -6.00 dB
B3 Compression Threeshold -9.00 dB

Introducing: Orban 5950

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

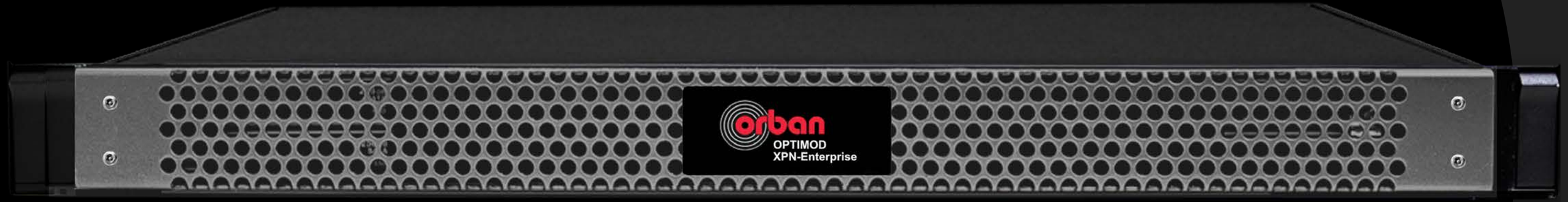
Now Shipping!

Best of Show 2023
RADIOWORLD
WINNER

orban

Introducing: Orban XPN-Enterprise

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



Best of Show 2022 WINNER

Shipping Now!

orban

Resources

- Mike Pappas mike@orban.com
- https://products.electrovoice.com/na/en/re20
- https://www.shure.com/en-US/products/microphones/sm7b?variant=SM7B
- https://www.neumann.com/en-en
- https://afar.net/rf-link-budget-calculator/

Thank You!

MIDWEST REGIONAL

BROADCASTERS CLINIC