



**SOUND**  **DEVICES**®



## Who We Are

# SOUND DEVICES<sup>®</sup>

Sound Devices is a worldwide leader in the design and manufacture of high-quality professional production sound products for a wide range of professional applications in film, television, and live events.

We specialize in mixer/recorders and wireless microphone products, receiving industry awards and recognition from the likes of the Cinema Audio Society (CAS) and Association of Motion Picture Sound (AMPS)



## Where We Are

**SOUND**  **DEVICES**<sup>®</sup>



Our headquarters and manufacturing plant are based in Reedsburg, Wisconsin, USA.

We also have offices in Madison, Wisconsin, and Rickmansworth, UK.



# Worldwide Support

**SOUND**  **DEVICES**



Our in-house tech support and servicing teams maintain our products and assist users around the world.

Service departments are based in both Reedsburg, Wisconsin, and Rickmansworth, UK





## About me



Gary Trendera – RF Applications Engineer

Previous experience in PMSE, including:

- Super Bowl Halftime Show
- Music Award Shows including Latin Grammy Awards and CMT Awards
- Cirque du Soleil
- Corporate conferences for SAP, Salesforce, Dell Computer, and others.



SOUND DEVICES  
**ASTRAL**



*Unlimited flexibility, wireless engineering excellence, and unparalleled power & control options for any application – TV & film, live events, theatre, worship, broadcast – anywhere the purest sound quality is required.*

# Astral Series



The Astral series shares ground-breaking features such as:

- SpectraBand - 169-1525MHz tuning range
- Real Time Spectrum Analyzer (RTSA) - 24MHz, independent of receiver channels
- NexLink – 2.4GHz bi-directional, long-range transmitter control & timecode sync
- AutoAssign – Set any number of channel frequencies in seconds with one click
- GainForward - Gain control at the receiver, not transmitters
- SAW filtering – 24MHz brick-wall RF filtering for reduced interference
- Q-Meter – Monitor RF signal quality, with history
- Digital Modulation – Standard 1.9ms, Long Range 3.9ms and intermodulation immune
- Flat, wideband 10Hz-20KHz audio response
- Onboard 32-bit recording



# SpectraBand



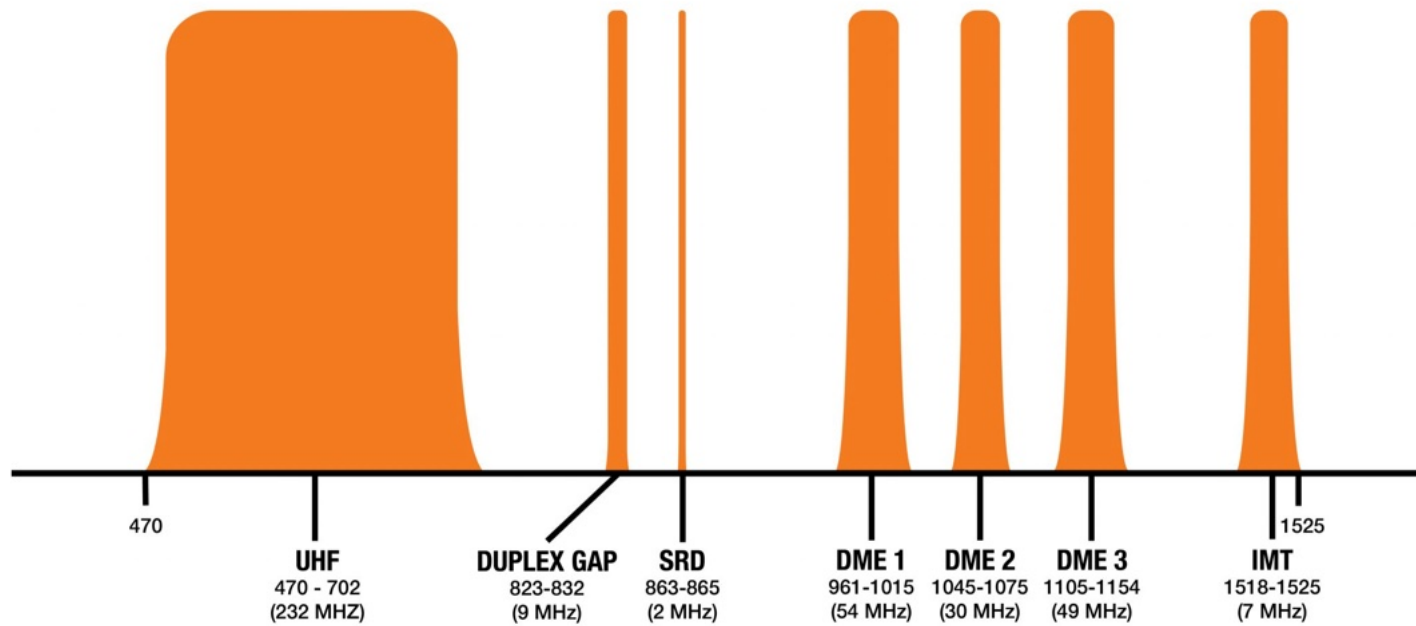
SpectraBand is a brand-new technology which gives an unprecedented tuning range: 169 MHz – 1525 MHz

- More operating frequencies are available in a given location
- Money is saved by purchasing only one piece of gear
- Worldwide travel is easier
- Exceptional filtering that improves immunity from strong interfering signals

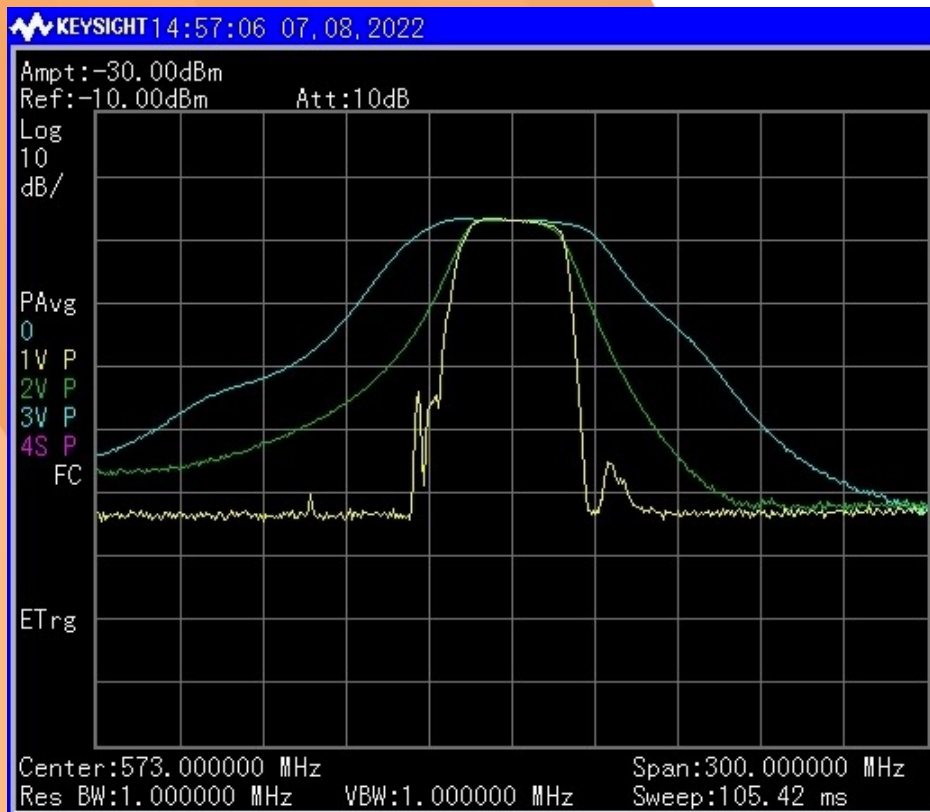




## SPECTRABAND IN UK



# SAW Filtering

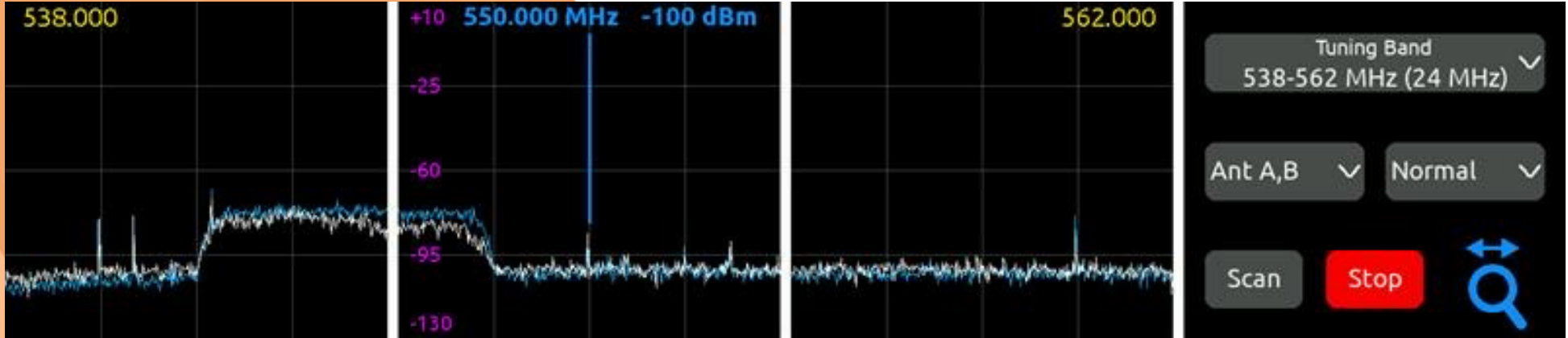


- Surface Acoustic Wave (SAW) RF filters provide excellent rejection of unwanted RF signals
- The graph compares the steep roll off of a SAW filter (shown in yellow) when compared to a more traditional L-C filter in green and blue
- These filters improve receiver performance, especially in noisy RF environments.

# RTSA

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## Real Time Spectrum Analyzer (RTSA)



- Gives unprecedented visibility of RF operating environment
- Runs while audio is decoding
- Allows for fast interference mitigation
- Facilitates AutoAssign function



## AutoAssign



AutoAssign does the tuning for you!

- Scans the current tuning band or user defined band within current tuning band
- Calculates available clean frequencies
- Assigns and pushes clean frequencies to Astral Series Tx



## GainForward



GainForward eliminates the need to set preamp gain at the transmitter input

- With over 130 dB of dynamic range, the entire signal from the microphone can be sent via the RF link to the receiver.
- If the analog outputs are used, the first gain setting is at the A20-Nexus receiver.
- If a digital output is being used, the first gain setting is at the mixer.
- Remember to select a microphone with appropriate sensitivity.



## Audio Recording



You can record a 48 kHz, 32-bit float WAV file on Astral Tx

- Excellent option for primary or backup recording.
- Full 10Hz-20kHz audio bandwidth.
- GainForward eliminates concerns about overloading the mic input.
- International models (transmitters sold outside of the USA) can record and transmit simultaneously.
- Ability to jam timecode via NexLink.



**NexLink**

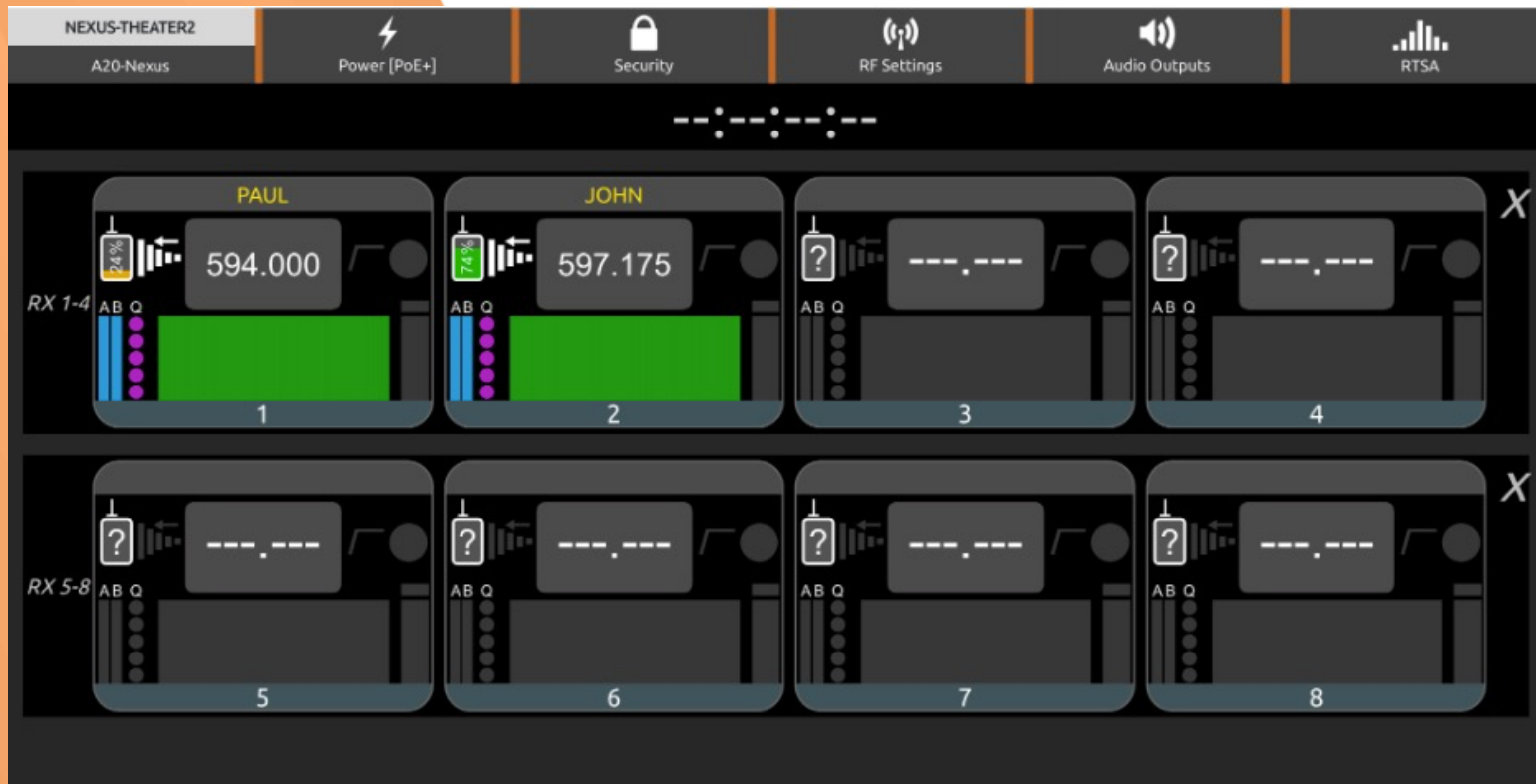
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Control Astral Tx using the built-in long range remote control link

- Proprietary 2.4GHz Technology
- Very robust within other 2.4GHz environments
- Long range, reaches further than RF range
- Controls all features of the Astral Tx
- Remains in control even with Astral Tx powered off



# Web Browser



Web interface for remote control





# Bluetooth Control



Android & iOS App for Bluetooth Control of Astral Tx

- Pair Multiple Astral Tx
- Control Astral Tx Settings
- GPS location via device location services
- Control active even with Astral Tx powered off



# A20-SuperNexus



# A20-SuperNexus



# A20-SuperNexus

- 16 x receiver channels as standard - expand to 24 or 32 with Expansion Licenses
- 8 x bright OLED touchscreens + 2 x rotary encoder and triangle home button
- 2 x ethernet RJ45 ports, 2 x SFP port for fibre optic.
- Dante 32 channels in and out
- MADI
- Nexus Web App – Complete remote control over IP from any PC, Tablet, Phone
- Mains AC C13 IEC power, optional 4-Pin XLR DC powering
- 12 x RJ45 ports for AES digital or analogue outputs - AES71 Type 1M standard





# A20-SuperNexus



- 3 pairs of antenna inputs and cascade outputs
- 3 x 24MHz independent tuning windows from 169-1525MHz
- Split diversity, 4iversity, Hexiversity
- Smart antenna control
- BNC for timecode/wordclock transmitter jamming
- Front & rear-mounted SMA connectors for NexLink
- Rear-mounted USB-A, or front mounted USB-C for pairing transmitters
- Front-mounted 3.5mm & ¼" headphone socket
- 1u 19" rack sized, ships with rack ears
- Optional A20-Opto expansion



# A20-Opto



# A20-Opto



# A20-Opto

- Compatible with A20-SuperNexus - cable free connection via expansion port
- 1U 19" rack size
- OPTOCORE A & B connections
- Redundant mains power for A20-SuperNexus
- Additional 12 x RJ45 ports for AES digital or analog audio outputs
  - AES72 Type 1M standard pinout
- Additional MADI outputs, with separate wordclock sync input
- GPIO for additional control



# A20-Outpost-NL



# A20-Outpost-NL





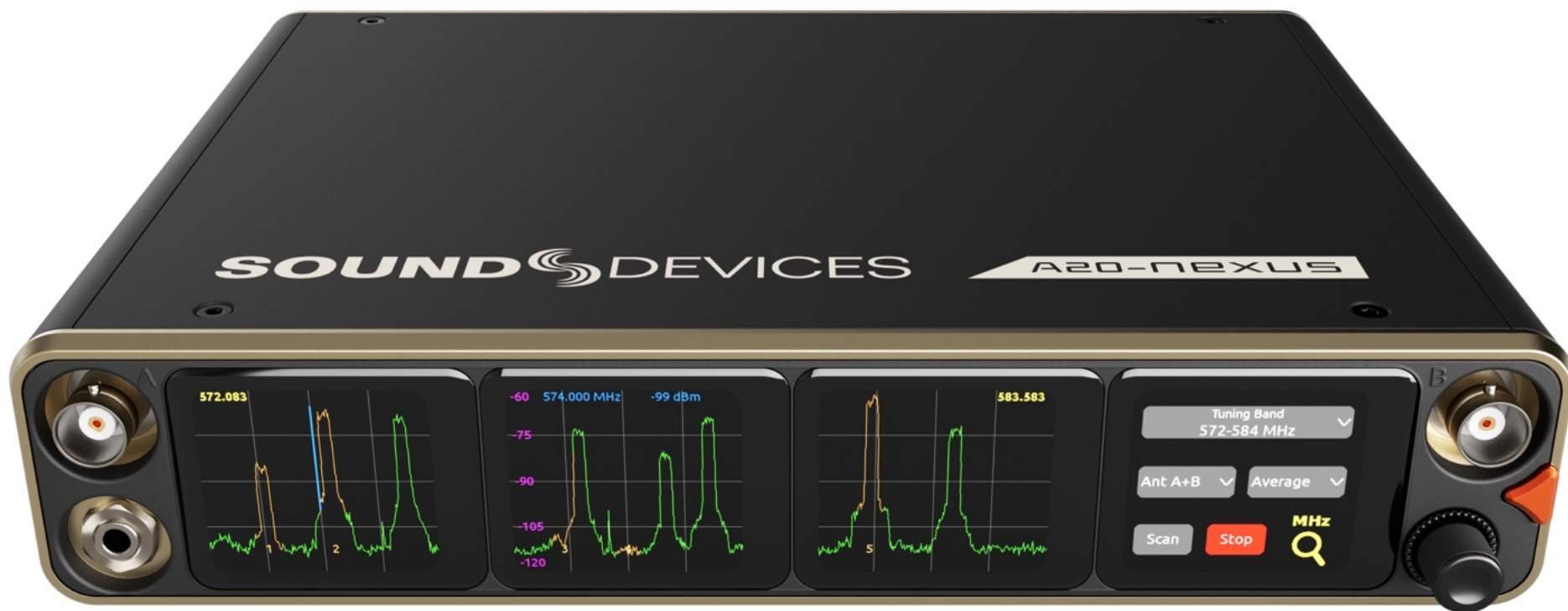
# A20-Outpost-NL



- Remotely extend NexLink
- EtherCon port for locking ethernet connection
- SFP port for fiber optic network connection
- Powered via PoE or USB-C with locking screw
- USB A for pairing and firmware updates
- Compatible with A20-Nexus & A20-SuperNexus
- Bottom & rear mounted 5/8"-27, 3/8"-16, and 1/4"-20 mounting threads



# A20-Nexus



# A20-Nexus



# A20-Nexus

- 8 x receiver channels as standard - upgrade to 12 or 16 with Expansion Licenses
- 4 x bright OLED touchscreens + rotary encoder and triangle button
- 2 x ethernet RJ45 ports, 1 x SFP port for fiber optic.
- Dante 16 channels in and out
- Nexus Web App – Complete remote control over IP from any PC, Tablet, Phone
- PoE+ powered or 2 x TA4F DC power inputs for redundancy
- 2 x 4-pin Hirose DC outputs
- 2 x DB25 connectors for digital or analogue outputs

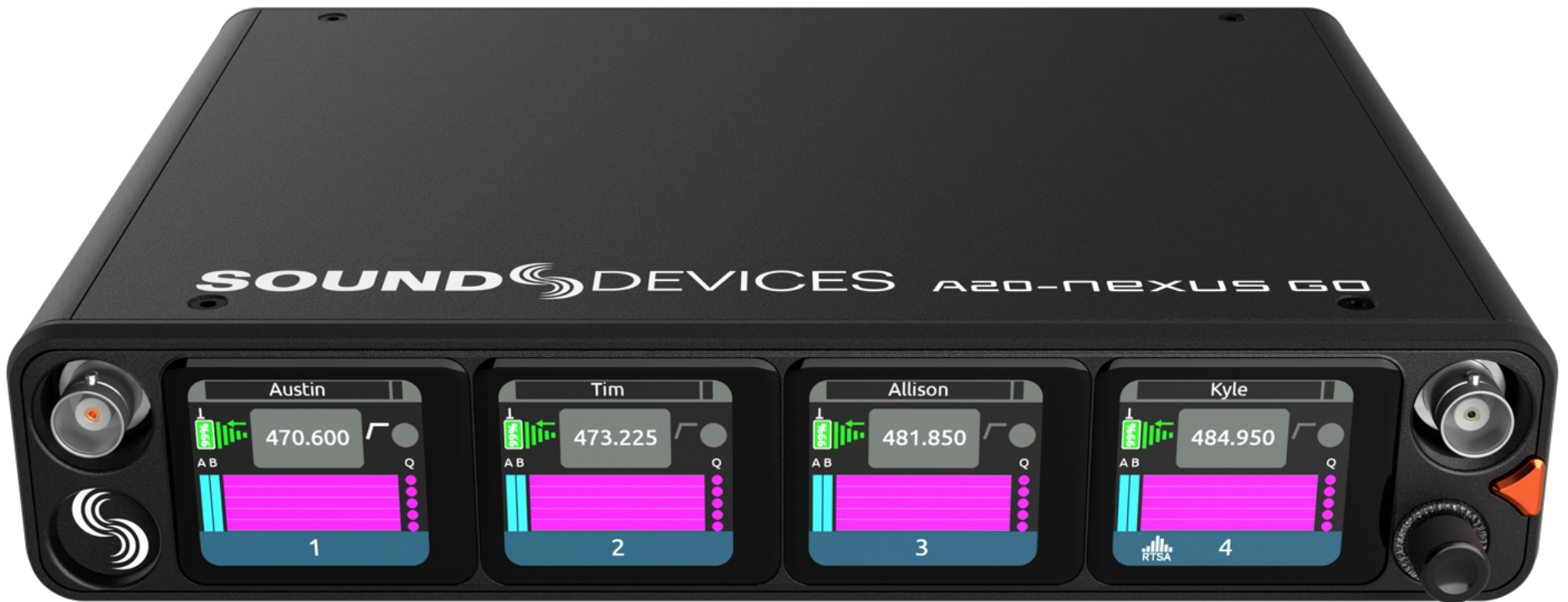


# A20-Nexus

- Front and rear mounted BNC for RF input or cascading
- 24MHz tuning window
- Smart antenna control
- BNC for timecode/wordclock transmitter jamming
- Rear-mounted SMA connectors for NexLink. Ships with brackets for front mounting
- Rear-mounted USB-A for pairing transmitters
- Front-mounted 3.5mm headphone socket
- Docks cable-free to any 8-Series mixer/recorder with A20-QuickDock
- ½ 1u 19" rack sized, mount with A20-Shelf



# A20-Nexus Go



# A20-Nexus Go





# A20-Nexus Go

- 4 x receiver channels as standard - upgrade to 6 or 8 with Expansion Licenses
- 4 x bright OLED touchscreens + rotary encoder and triangle button
- 1 x TA4F DC power input, 2 x 4-pin Hirose DC outputs
- 1 x DB25 connectors for digital or analogue outputs



# A20-Nexus Go

- Front and rear mounted BNC for RF input or cascading
- 24MHz tuning window
- Smart antenna control
- BNC for timecode/wordclock transmitter jamming
- Rear-mounted SMA connectors for NexLink. Ships with brackets for front mounting
- Rear-mounted USB-A for pairing transmitters
- Docks cable-free to any 8-Series mixer/recorder with A20-QuickDock
- ½ 1u 19" rack sized, mount with A20-Shelf



# A20-Monarch

- Passive omnidirectional antenna
- SpectraBand range from 470-1525MHz
- RF connection via BNC
- Mounting by ¼-20 thread mount
- Ships with a clamp mount and 30in/75cm BNC-BNC RF cable
- Pair supplied with every A20-Nexus Go, A20-Nexus and A20-SuperNexus



## A20-2.4G Ant + Mount

- Side mounted SMA bracket for 2.4GHz NexLink antennas
- Positions NexLink antennas at the front of the A20-Nexus or A20-Nexus Go
- Ships with A20-Nexus Go & A20-Nexus



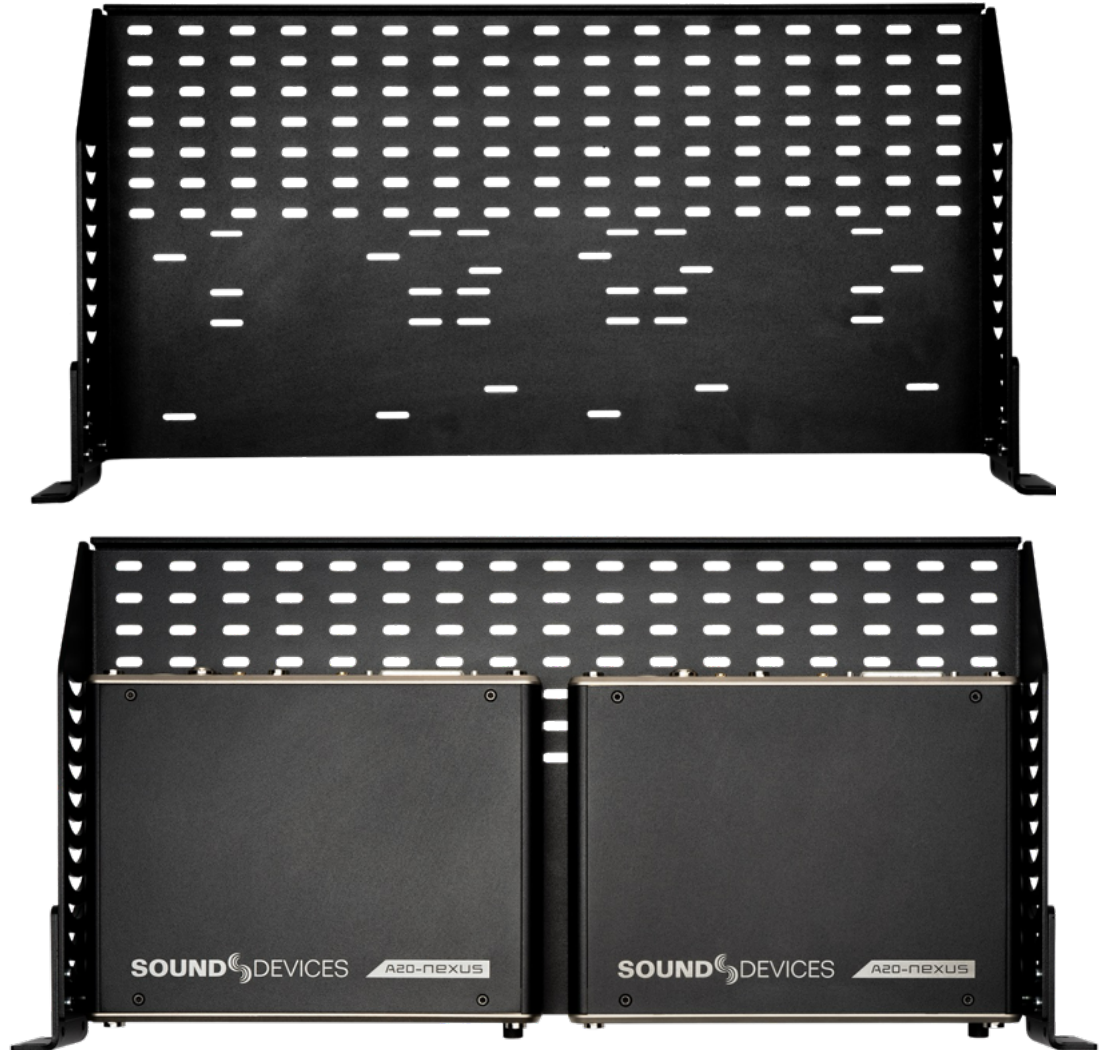
# A20-2.4G Ant

- NexLink 2.4Ghz tilt antenna
- 8-Series SD-Remote 2.4GHz SMA antenna will not work
- Ships with A20-Nexus Go, A20-Nexus & A20-SuperNexus



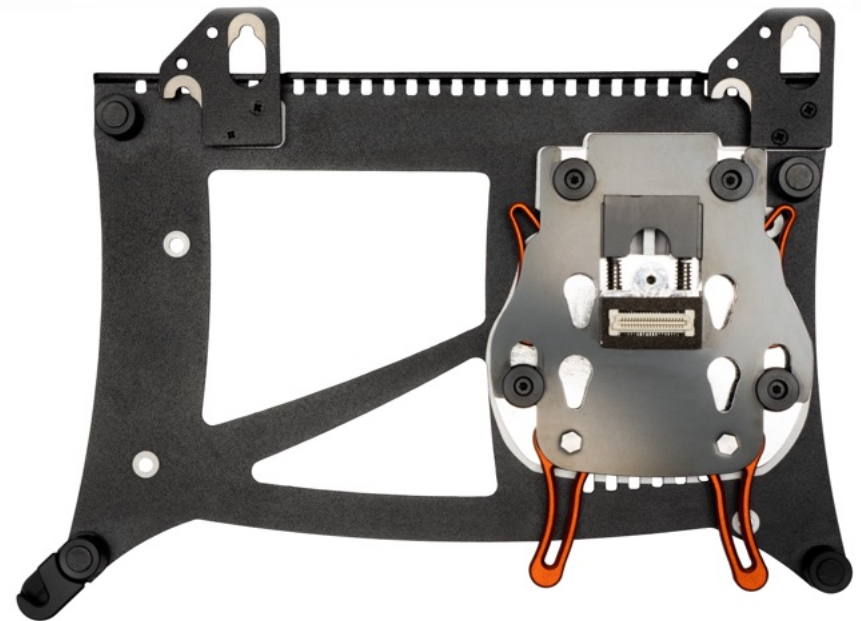
# A20-Shelf

- 1u 19" shelf mount for A20-Nexus, A20-Nexus Go or PowerStation-8M
- Multiple cable tie points
- Ventilation gaps
- No shelf lip to block the front touchscreens



# A20-QuickDock

- Cable-free connection between A20-Nexus Go or A20-Nexus and any 8-Series – 833, 888 or Scorpio
- Power & timecode from 8-Series
- Sends all audio and data to 8-Series
- Dock and undock in seconds





## A20-QuickDock-Pegs

- Set of mounting pegs that can be installed on secondary 8-Series mixer/recorders
- Allows an A20-Nexus or A20-Nexus Go to be QuickDocked from one mixer/recorder to another



# A20-RX



- 2 x Receiver channels
- Bright OLED display and 3 buttons for control
- Range of optional output and powering adaptors
- SuperSlot integration with SL-2/8-Series

# A20-RX Bottom Plates & Adaptors

- A-SL – 25-pin UniSlot/SuperSlot
- A-XLR – 3-pin XLR-M Audio & 4-pin Hirose power
- A-TA3 – TA3-M Audio & TA4 + 4-pin Hirose power



# RX Comparison



Feature	A20-Nexus	A20-Nexus Go	A20-RX	A20-SuperNexus
Receiver Channels	8, 12 or 16	4, 6 or 8	2	16, 24 or 32
SpectraBand (470-1525MHz)	Yes	Yes	Yes	Yes
VHF (169-236MHz)	Yes	Yes	Yes	Yes
Real Time Spectrum Analyzer	Yes	Yes	No	Yes
NexLink	Yes	Yes	No	Yes
AutoAssign	Yes, NexLink/IP Web access	Yes, NexLink	RX only	Yes, NexLink/IP Web access
Dante In/Out	Yes	No	No	Yes
Nexus Web App	Yes	No	No	Yes
A20-Opto compatible	No	No	No	Yes
A20-Outpost-NL compatible	Yes	Yes, 888 or Scorpio required	No	Yes

# A20-Mini



Super small Digital wireless transmitter with SpectraBand, GainForward, A20-Remote app, NexLink, onboard recording, 32-bit float



# Key Features



- 470 -1525MHz tuning range
- GainForward technology for full dynamic range transmission to receiver
- Onboard 32-float timecode stamped recording
- 64GB internal storage
- Powered by Sony NP-BX1 lithium rechargeable battery or AAA powered
- Top-mounted USBC for recharging, file offload and timecode jam



# Key Features



- RF output levels – 2mW, 10mW, 20mW and 40mW
- Standard and Long Range modulation
- Bluetooth control via A20-Remote App on iPhone or Android
- NexLink control when paired with A20-Nexus, A20-Nexus Go, A20-SuperNexus
- A20-Remote and NexLink can be used side-by-side





# Models Available



- International model - transmits & records at the same time (ships from Audio Ltd in the UK)
- US Model - transmits or records (ships from Sound Devices in the USA)



# A20-BatteryDoubler

- Field interchangeable with standard battery door
- Adds second Sony NP-BX1 to double the run time
- Use with NP-BX1 batteries only, not AAA
- Slight increase in width, contoured shapes keeps this unnoticeable
- PowerStation-8M can take 4 x A20-Mini with BatteryDoublers
- Charge NP-BX1's inside the A20-mini via USB-C cables or PowerStation 8M



# A20-Mini-Holster

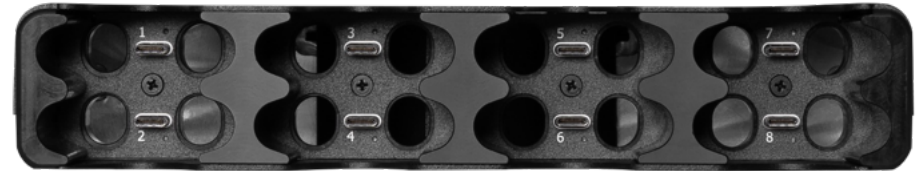
- Pouch for use with A20-Mini
- Use in up or down orientation
- Metal belt clip
- Hook and loop strap to secure the A20-mini
- Fits A20-Mini with A20-BatteryDouble tightly
- Ships with A20-mini





# PowerStation-8M

- Use with up to 8 x A20-mini or 4 x A20-mini with A20-BatteryDoubler
- Charges NP-BX1 battery
- File transfer for A20-Mini recordings
- Batch updating firmware
- Timecode jamming from one BNC input
- No need to disconnect the antenna
- Fits in half a single rack unit (½U)
- Mounts to A20-Shelf



# XL-TC-USBC-LEMO



- Used to jam A20-mini timecode from a 5-pin Lemo source
- Can be used to jam from 5-pin Lemo source such as Ambient Lockit, or 8-Series
- A20-Mini can also be jammed with a standard USB-A to USB-C cable from 8-series



# A20-TX

A Kaleidoscope of Connectivity



# Key Features



- 169-1525MHz SpectraBand tuning range
- 169-236MHz VHF + 470 – 1525MHz
- VHF available with A20-Nexus, A20-Nexus Go, A20-RX & A20-SuperNexus receivers, plus updates in the future for SL-2
- VHF SMA whip & helical antenna options
- GainForward technology
- Same preamp as our 8-Series mixer-recorders
- 140dB dynamic range
- Buttons for local control, with haptic feedback
- A20-Remote app Bluetooth for medium range control
- NexLink for long range control



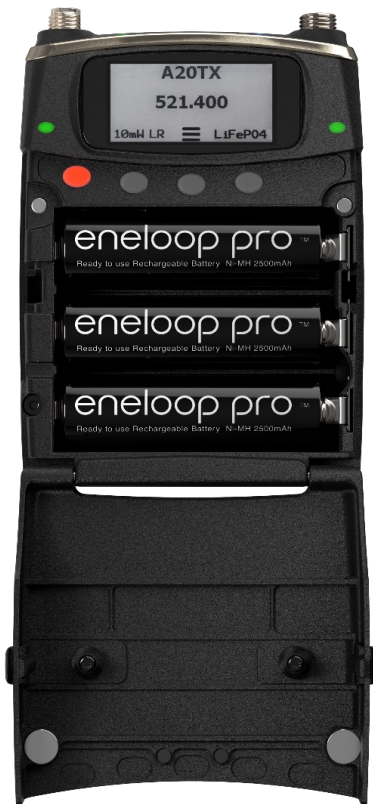


# Key Features

- 3-pin Lemo connector:
  - 2- or 3-wire lavalier
  - Balanced line level
  - Balanced mic level
  - 12/48V phantom powering (with BAL-XLR4 cable)
  - AES42 digital input
  - AES3 digital input
  - Guitar input (with Guitar cable, right angle or straight options available)



# Key Features



- Powered by up to 3 x AA
- 1.5V Alkaline, Lithium, or NiMH
- 3.7v Lithium-ion or LiFePO4 AA
- Any combination of 1, 2 or 3 AA can be used with 3.7v batteries
- Battery life up to 12 hours, extended by powering down via NexLink
- Charge Lithium-ion & LiFePO4 AA via USB-C
- Can be powered via USB-C



# Key Features



- Low power draw, sunlight readable e-Paper display
- When turned off, key information such as transmitter name & frequency are displayed, even with no batteries
- Backlight engages when battery door is open
- Switch between white or black background, and inverted for boom use
- Status LEDs on the front and top



# Key Features



- Onboard 32-bit float timecode-stamped recording
- Timecode jam via USB-C or NexLink
- Removable MicroSD
- USBC for file offload, firmware updates, NexLink pairing, powering and charging
- US models can transmit & record all inputs other than lavalier
- International models can transmit & record all inputs at the same time



# Key Features



- Various RF power levels:
  - Low - 2mW
  - Normal -10mW
  - High - 20mW
  - Extra High - 40mW
- Modulation Schemes:
  - Standard – 1.9ms
  - Long Range – 3.9ms
- Full 10Hz – 20KHz flat frequency response with all input types



# Key Features



- Similar size as A10-TX and only 20 grams heavier with 3 AA installed
- Aluminum construction & built for challenging environments
- Ships with wire belt clip, 3 antennas & caps
- Digital encryption for privacy
- 4-digit key set at receiver



# A20-TX Switch



- Bayonet-style spring-loaded multifunction switch
- Mechanically latching
- Screws to the top of the A20-TX
- Controls via an internal magnetic sensor
- Can toggle mute, RF, record & power
- Override from A20-Nexus, A20-Nexus Go and A20-SuperNexus





# AC-BALXLR-4



- 3-pin LEMO to low-profile XLR female cable that reduces RF interference
- 54.6 cm/21.5 in in length
- For use with balanced microphones
- Reduces unwanted RF signals by ~40dB
- Custom cables can be made with A-FILTER for straight female XLRs
- Or A-FILTER-R round filters for low-profile female XLRs

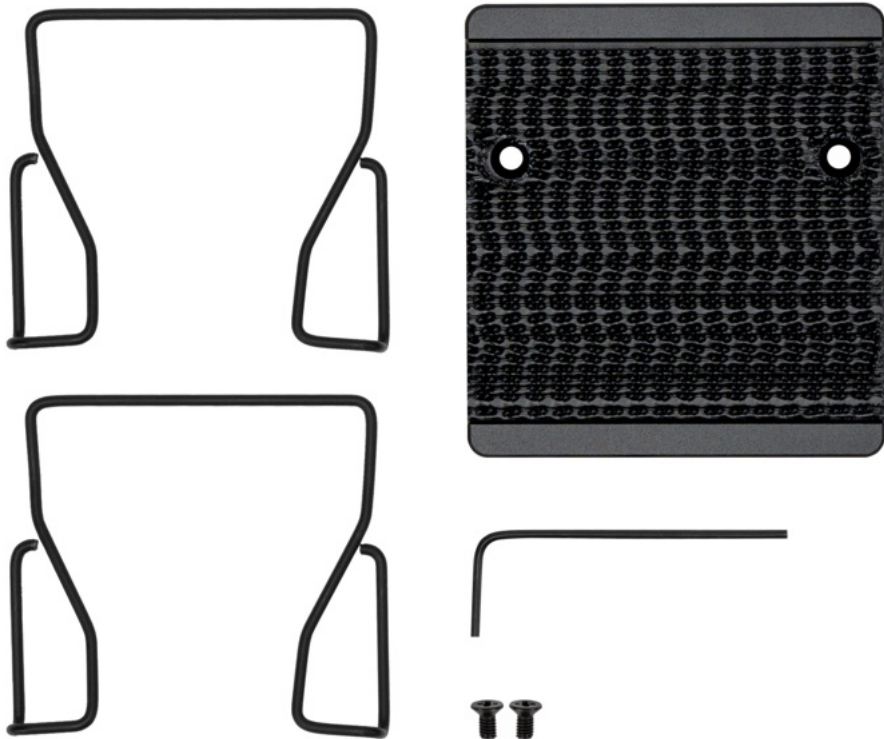


# A20-GuitarCable

- Straight and Right-angle versions available
- Compatible with A20-TX only



# A20-GuitarStrap



- Securely mount A20-TX to a Guitar strap
- Compatible with A20-TX only

# A-BOOM 2



- Boom pole mount for A20-TX
- Mounts to 3/8" thread top thread
- Keeps antenna pointed away from microphone
- A20-TX screen and buttons orientation can be inverted through the menu





# A-BOOM 2



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# **Wireless Audio Basics**



# Wireless Audio



- RF
  - Radio frequency (RF) is a measurement representing the oscillation rate of electromagnetic radiation spectrum, or electromagnetic radio waves, from frequencies ranging from as low as 9 kilohertz (kHz) to as high as 300 gigahertz (GHz).
- Digital vs. Analog
  - In wireless audio, the RF carrier signal can encode audio on the carrier in an analog or digital format.
- Common Analog Formats - AM and FM
  - Amplitude Modulation (AM) and Frequency Modulation (FM)
- Digital Modulation
  - Improved performance in hostile environments. Lower noise. Higher fidelity.





# Deployment



## Example of RF Bandplanning

- 72 - 88 MHz - IFB Tx
- 174 - 216 MHz - IFB Tx
- 470 - 500 MHz - Microphone Rx
- 506 - 554 MHz - IFB and IEM Tx
- 560 - 608 MHz - Microphone Rx
- 614 - 616 MHz - IFB and IEM Tx
- 653 - 657 MHz - Licensed Use Only
- 657 - 663 MHz - Microphones Rx
- 902 - 928 MHz - Intercom or Microphone
- 941.5 - 960 MHz - Licensed Use Only
- 1.4 GHz - RF Video or Microphones with STA
- 1.92-1.93 GHz - Intercom or Conferencing
- 2.4000 - 2.4835 GHz - WiFi and Control

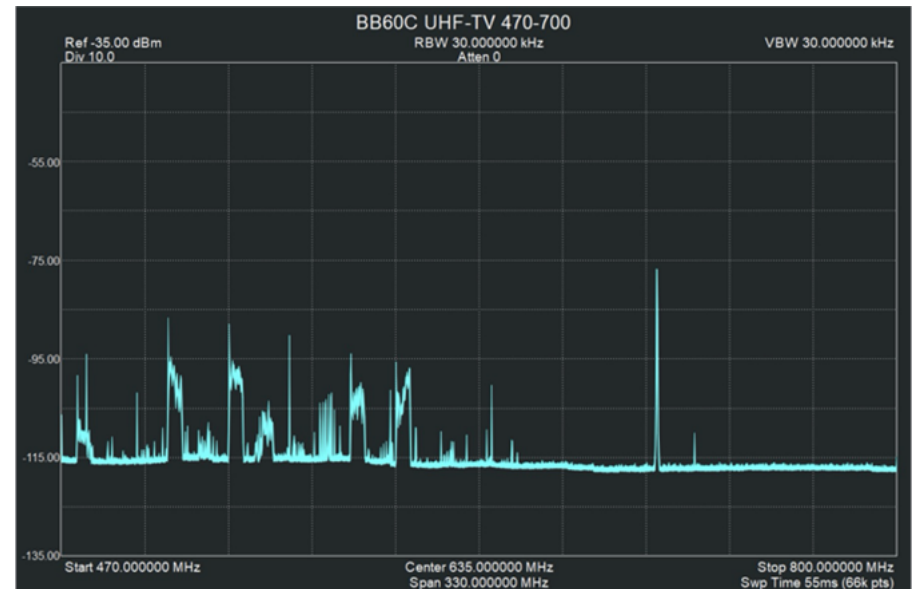


Image courtesy of Jason Glass - Clean Wireless Audio



**Deployment**

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## Antenna Types



Omnidirectional



LPDA

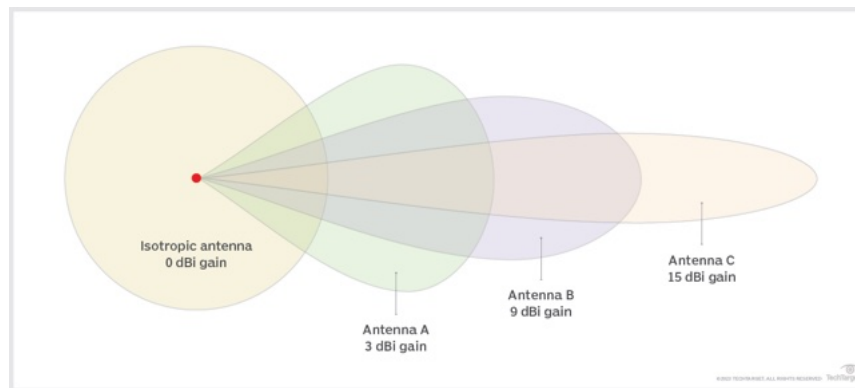
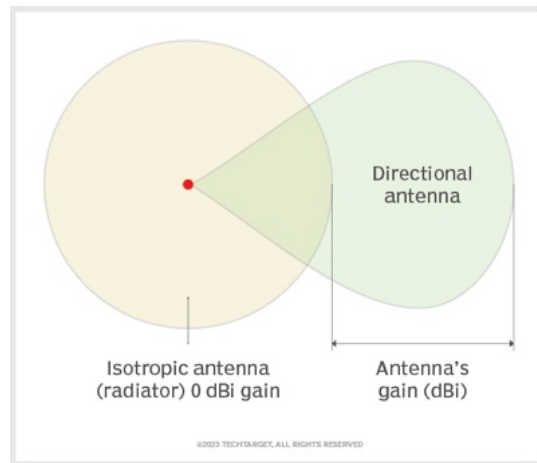


Helical

# Deployment

## Antenna Theory

- What is decibels relative to isotropic (dBi)?
- Decibels relative to isotropic (dBi) is a unit of measurement that describes how much power an antenna transmits in a single direction when compared to an ideal isotropic radiator, which transmits in all directions at once. The difference between the two is called antenna gain, which is represented as a numerical value in dBi.



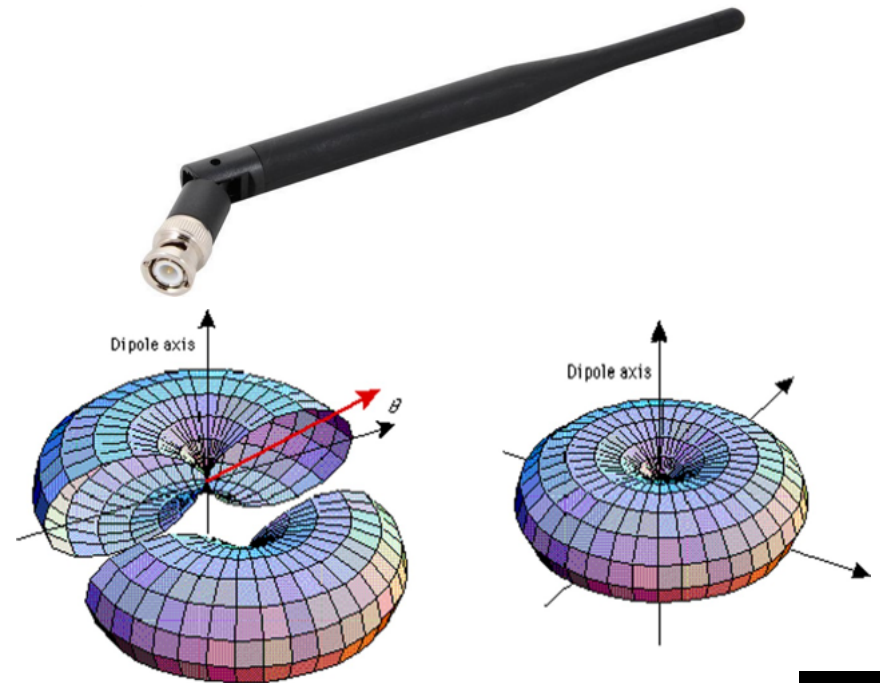
- What is antenna gain?
- Gain is an indicator of how effectively an antenna can send or receive a signal compared to a reference antenna. When dBi is used to measure gain, the reference antenna is an ideal isotropic radiator. An isotropic radiator is an antenna that transmits, or radiates, uniformly in all directions -- similar to how the sun radiates energy.
- This contrasts with most real-world antennas, which distribute their energy in specific directions. The concentration of energy increases their ability to send signals in the target direction or receive signals from that direction, although it decreases it in other directions. This concentration also enables a directional antenna to significantly exceed the capabilities of an isotropic antenna for the target direction.

# Deployment

## Dipole Antenna

- Narrowband
- 2.15 dBi (0 dBd)
- Omnidirectional

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# Deployment

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## Directional Antennas

Log Periodic Dipole Array

- Commonly 470-700 MHz
- Roughly 6 dBi Passive Gain (on axis)
- 70 Degrees Beamwidth
- Front to Back Ratio / Rear Rejection 18 dB



# Deployment



## Circular Polarized Antenna

### Four Turn Helical Antenna

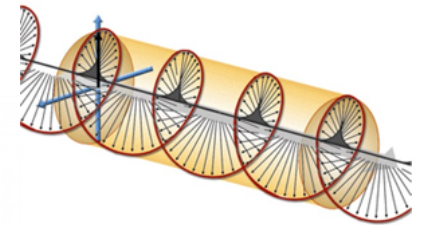
- Commonly 470-700 MHz
- 10-12 dBi Passive Gain (on axis)
- 63 Degrees Beamwidth
- Front to Back Ratio / Rear Rejection 12 dB

### Two Turn Helical Antenna

- Commonly 470-700 MHz
- 72 Degrees Beamwidth
- 9-11 dBi Passive Gain (on axis)
- Front to Back Ratio / Rear Rejection 14 dB



PWS 2 Turn "Dome"  
Helical



PWS - 4 Turn Helical



# Deployment

## Common Mistakes in Antenna Placement

- Antennas inside metal enclosures
- Antennas Touching External Metal Surfaces
- Antennas without Line of Sight
- Inadequate Spacing

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# Deployment



## Cable Loss

- Avoid using excessive cable length to keep cable loss at a minimum
- Use the appropriate cable for long cable runs
- Even Jumps between Cascade Ports introduce up to -3dB of Insertion Loss

Cable Loss at 585 MHz				
Cable Type	Loss @ 25'	Loss @ 50'	Loss @ 75'	Loss @ 100'
RG-58	3.1 dB	6.3 dB	9.4 dB	12.6 dB
LMR-240 UF	2 dB	4 dB	6 dB	8 dB
RG-8U	1.4 dB	2.9 dB	4.4 dB	5.9 dB
LMR-400 UF	1.1 dB	2.1 dB	3.1 dB	4.2 dB

# Deployment

## Frequency Coordination - Intermodulation

- What is it?
- Which intermodulation (IM) products are significant?
- We typically look at 3rd and 5th Order - 2 and 3 transmitter IM
- 2Tx30 Calculation - Examine potential nearby 3rd order intermod products between 2 frequencies (f1 and f2):
  - $IM1 = (2 \times f1) - f2$
  - $IM2 = (2 \times f2) - f1$
- In this example, transmit frequencies at 500 MHz and 501 MHz produce potential 3rd order products at 499 MHz and 502 MHz
- 2Tx50 Calculation
  - $IM1 = (3 \times f1) - (2 \times f2)$
  - $IM2 = (3 \times f2) - (2 \times f1)$
- Ten frequencies yields thousands of potential IM products
- Transmitter spacing is a significant factor
- Power levels also matter
- See "Selection and Operation of Wireless Microphone Systems" by Tim Vear (Shure Incorporated) - Appendix A

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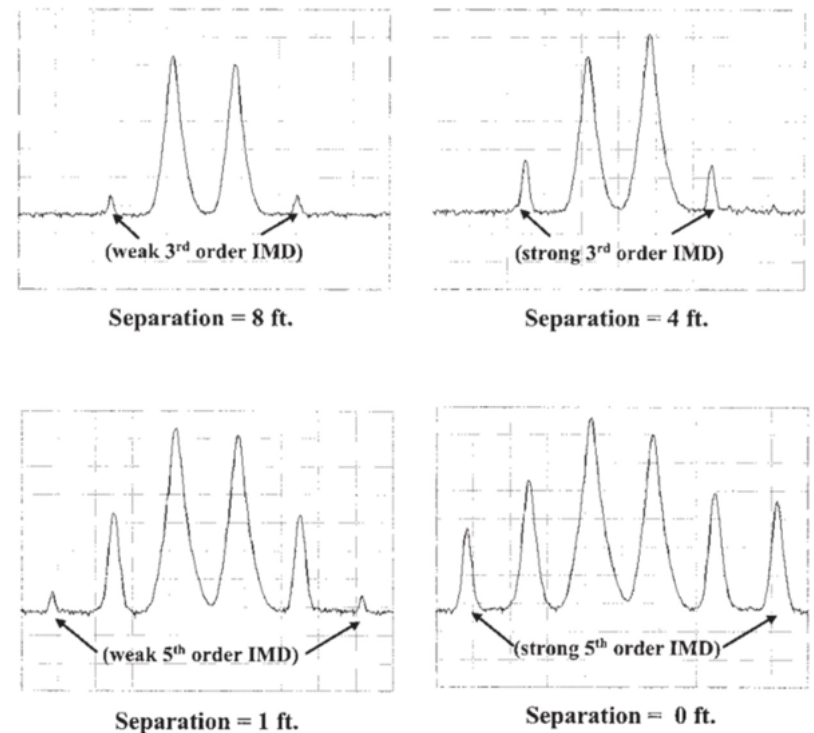


Image from Shure Incorporated



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**Thank You**

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