



# JETWAVE WIRELESS

Washington DC | New York City

# DAS RF Transmission RF over Fiber

April 15, 2020 - Wireless Happy Hour





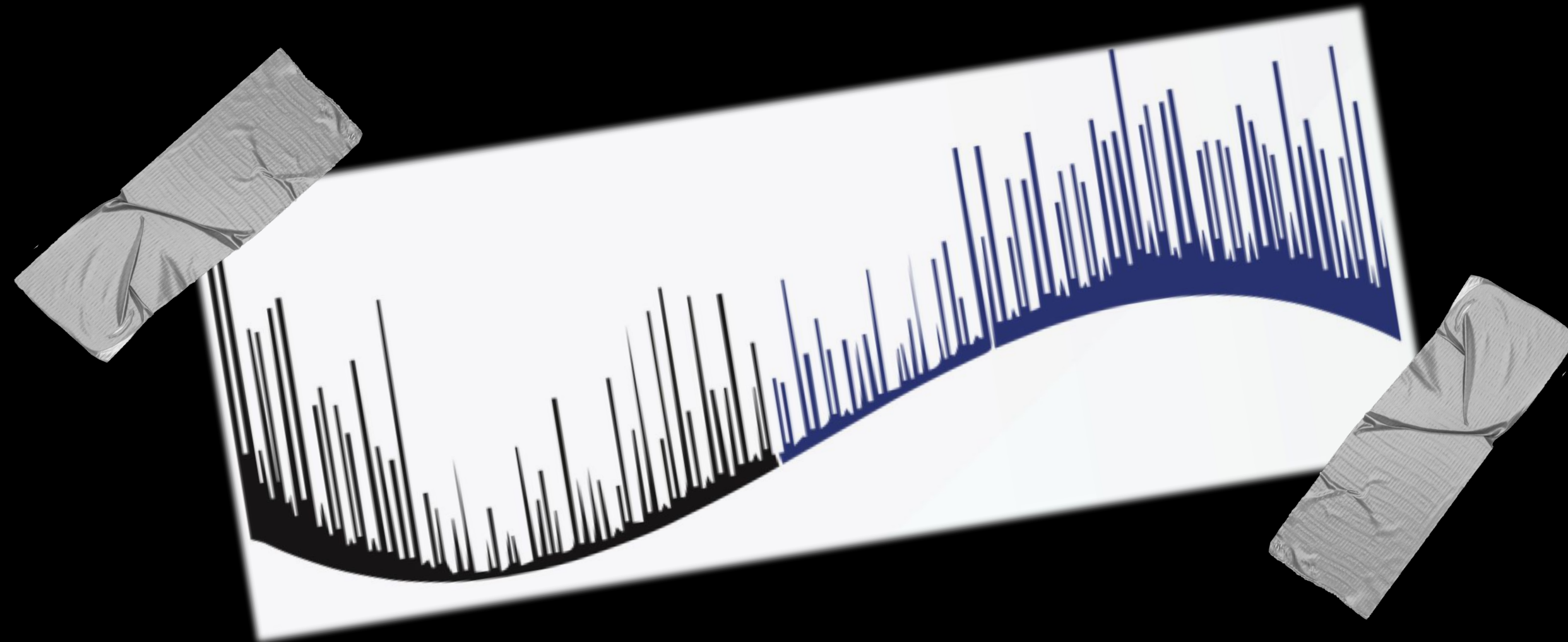
## Engineering Team

Jim Dugan

Dave Martin

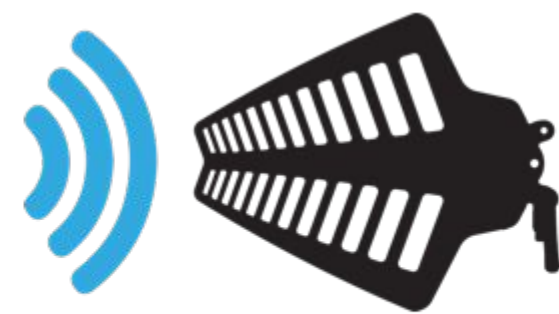
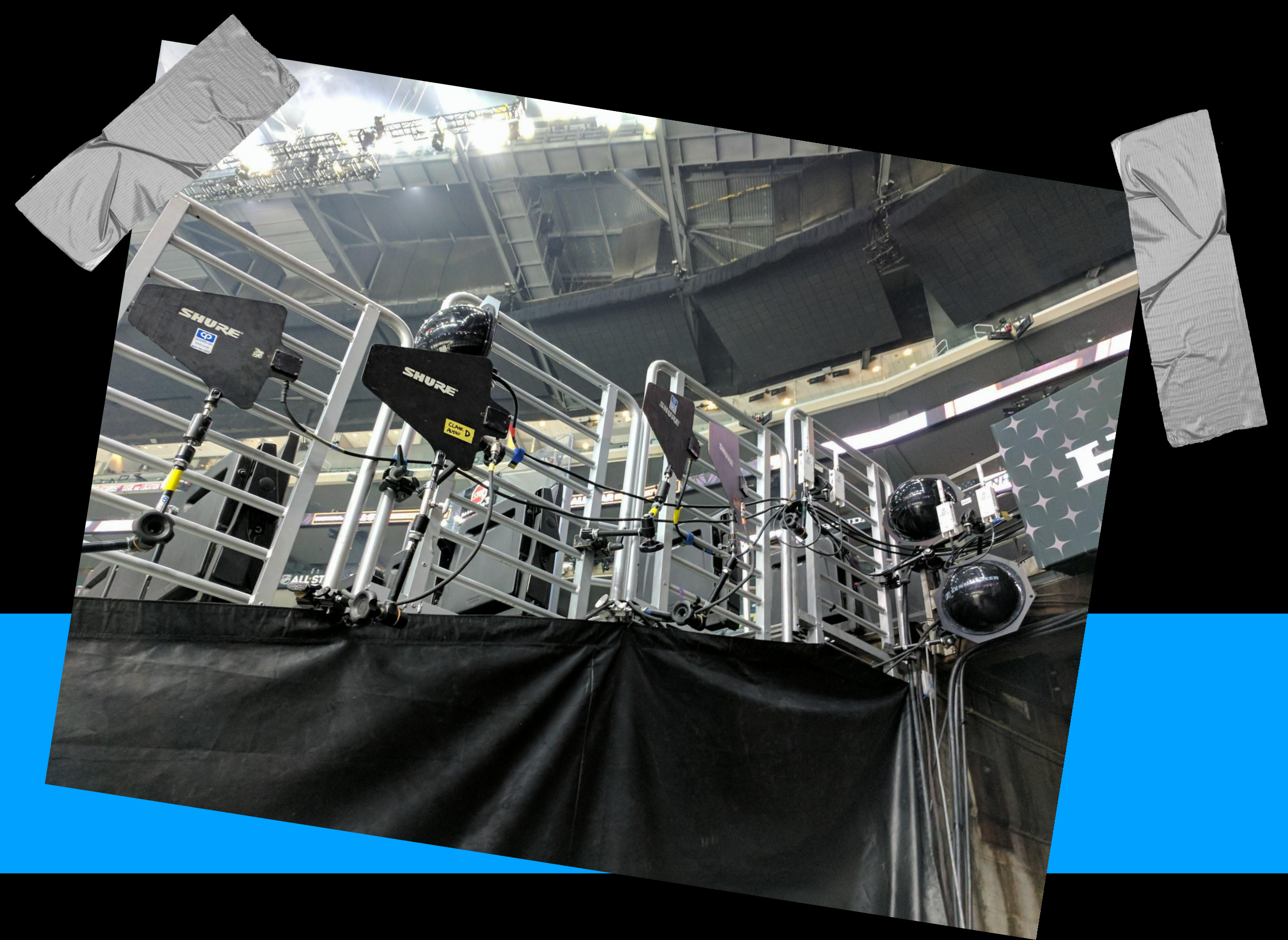
Josh Flower

Ryan Stotts

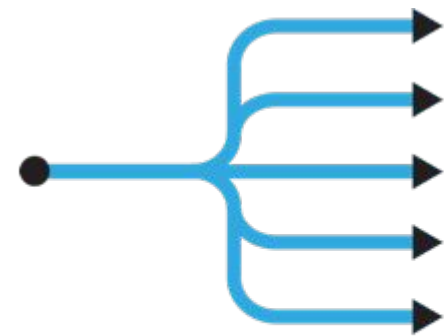




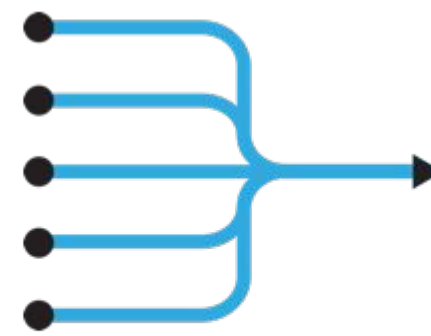
# Distributed Antenna Systems (DAS)



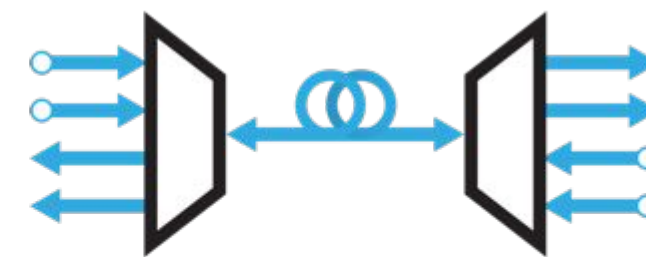
Receive Antennas & Boosters



Splitters



Combiners



RF Over Fiber



Transmit Antennas & Boosters



# Distributed Antenna Systems (DAS)

## Benefits

- RF Inventory is a shared resource
- Everything Everywhere
- Scalable inventory
- Remote Monitoring
- Spectral Efficiency
- You're going to look better doing this!!

## Challenges

- No Band plan
- Co-site interference
- Small coverage area
- Minimum Utilization
- Fragmented Inventory
- Multiple locations
- Low ROI





## System Design Considerations

### Distributed Antenna Systems (DAS)

- Coverage Requirements
  - How many zones?
    - Is Tx and Rx needed in all zones?
    - Is Intercom required in these zones as well?
      - What type of Intercom UHF, DECT, 2.4GHz, 5GHz?
- Hardware for DAS...
  - Wisycom MAT288, SPL2216, SPL2208, CSI16T, MPA4





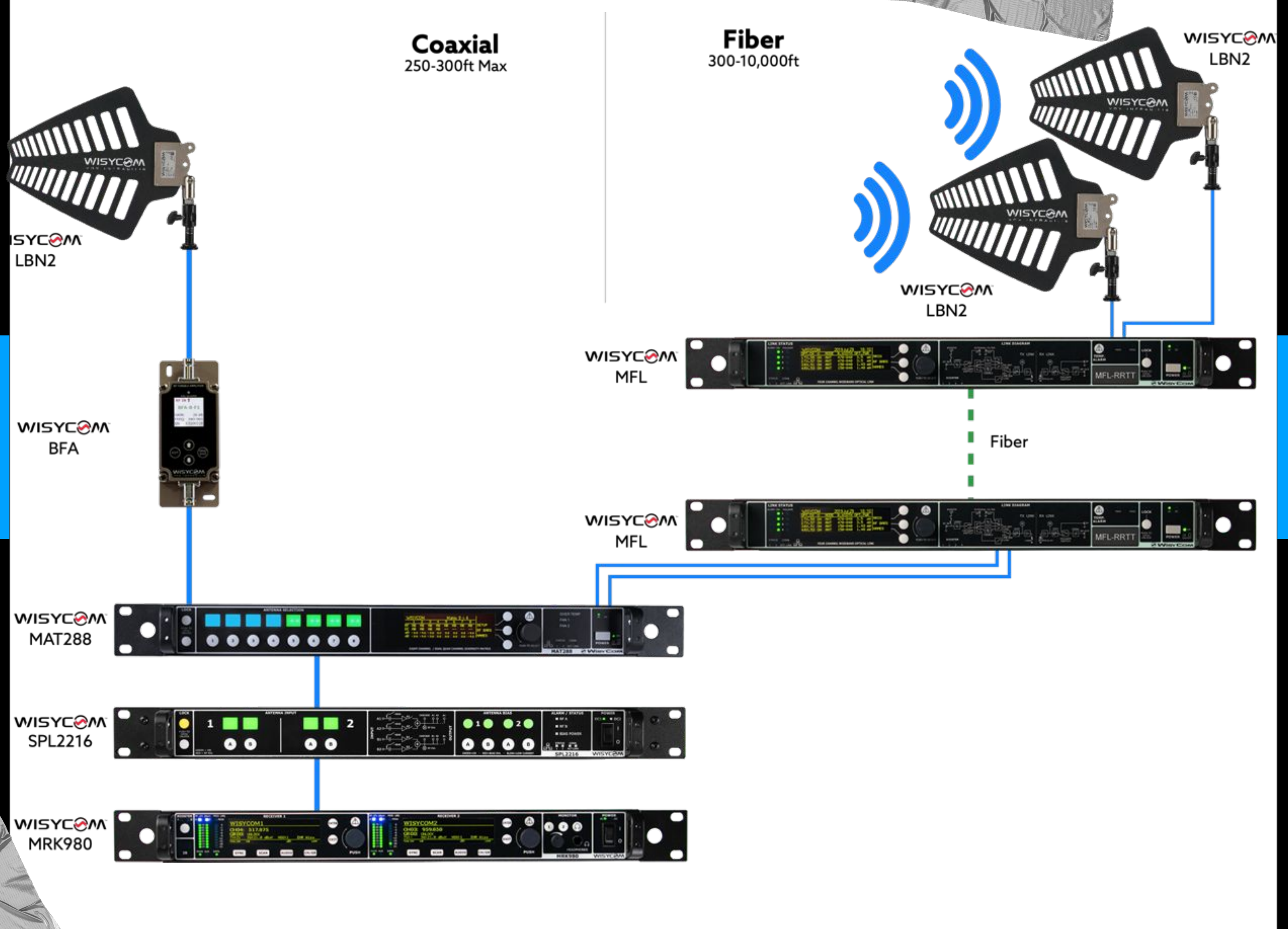
## MAT288



- Diversity combiner 8:1 or 8:4 or 2 x 4:2 (sw configurable)
- Wide bandwidth 150-1160 MHz operation
- Remote management and monitor of alarms thru Ethernet 10/100 base TX
- Antenna booster supply toggled on each input independently
- Voltage and current monitoring on each booster supply with alarm
- Programmable attenuators on each input
- Remote boost control (for gain/bandwidth) with a bidirectional data link thru coax (input BNCs)



## DAS Receive Example





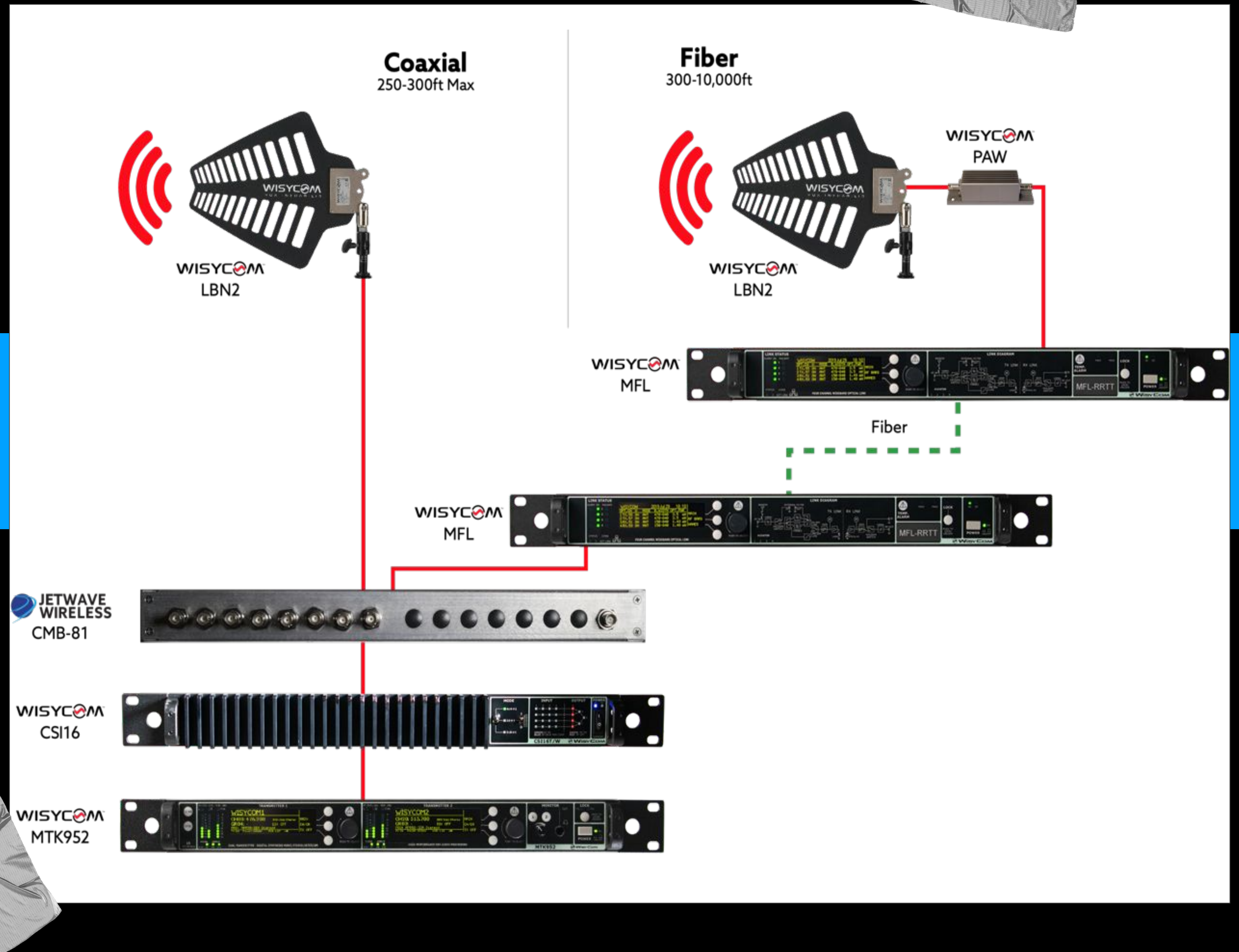


# DAS Receive Example





## DAS Transmit Example







# RF Transmission



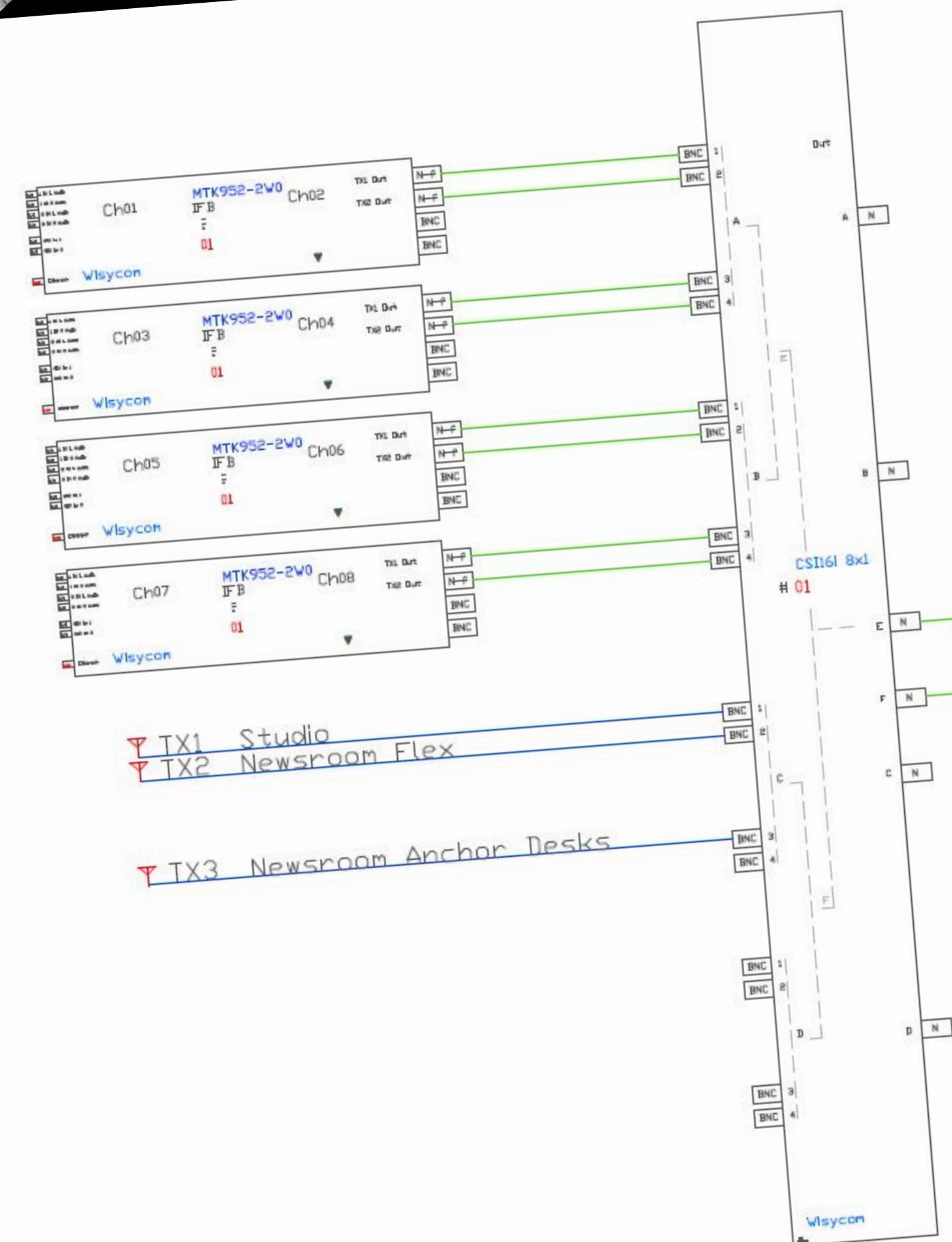
RF Happy Hour continues, have another round!



## System Design Considerations

### RF Transmission

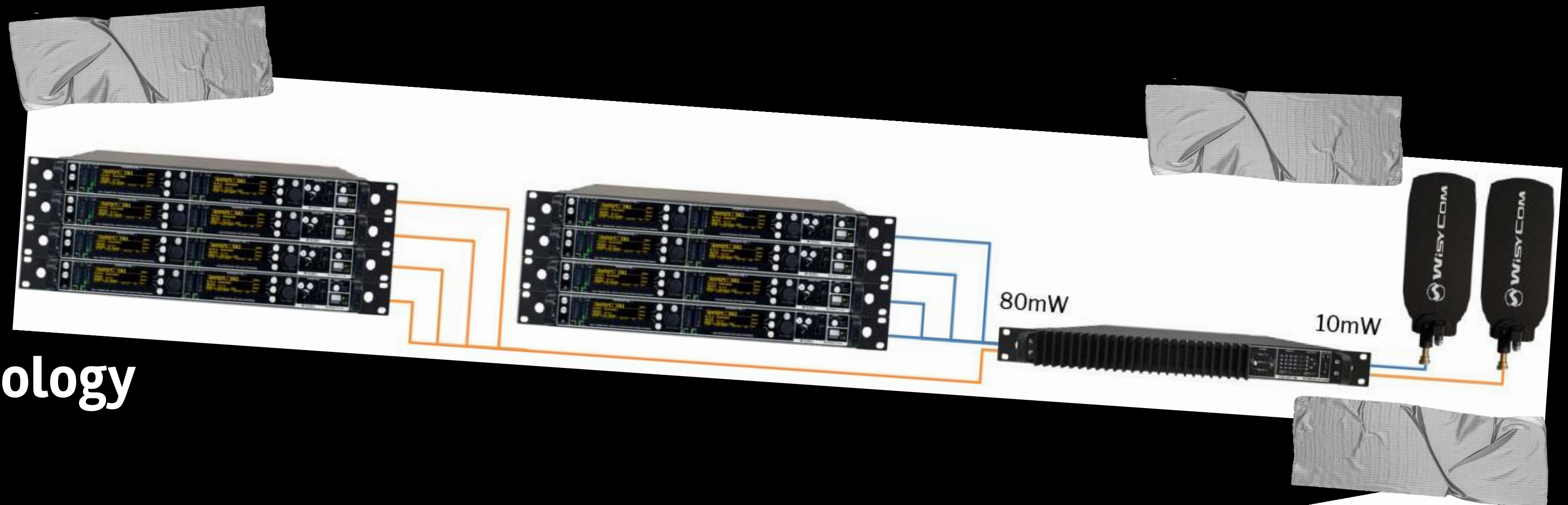
- Signal Path
  - Gain Structure
    - RF Power – when and when not to use
      - Where does system loss start?
- Antenna Placement
  - Physical setup at the venue
- Receiver location of use
  - Is it a single zone or stage to cover?
  - Are there multiple zones of coverage required?







## Transmit Technology Solutions



## RF Transmission

- In Ear Monitors... some not all...
  - Shure PSM1000
  - Wisycom MTK952 & MPR50 IEM
- Transmit Combiners... some not all...
  - Shure PA821B – 8 to 1 Wideband Combiner
  - Wisycom CSI16T – 16 to 1, 2x8 to 1, 4x4 to 1 Smart Wideband Combiner
  - Sennheiser AC3200
- Antenna Options
  - Long Throw, Short Throw
  - Omni Directional







# RF over Fiber



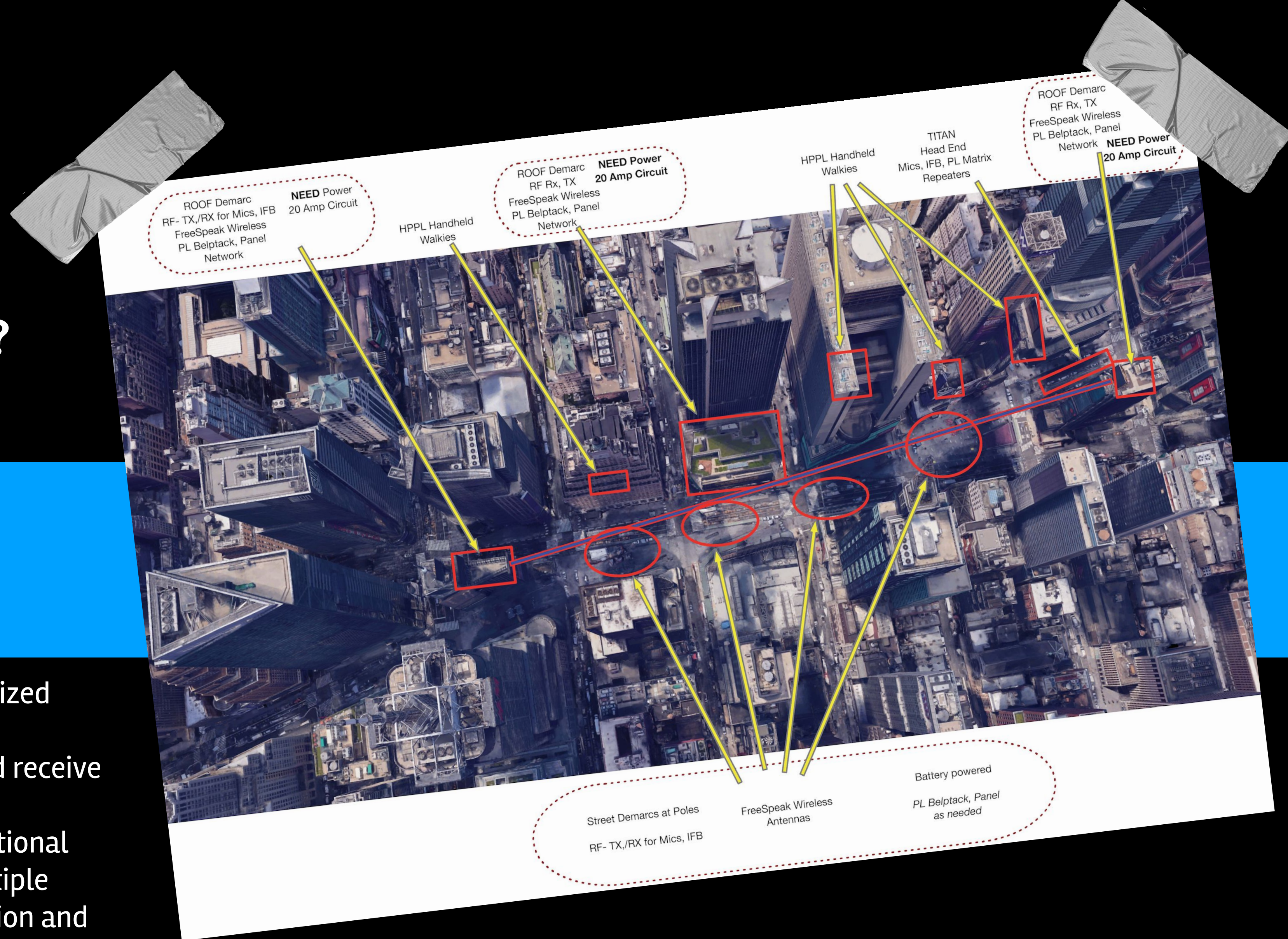
Last topic means last call for RF Happy Hour!



## What is this Voodoo Magic??

## RF over Fiber

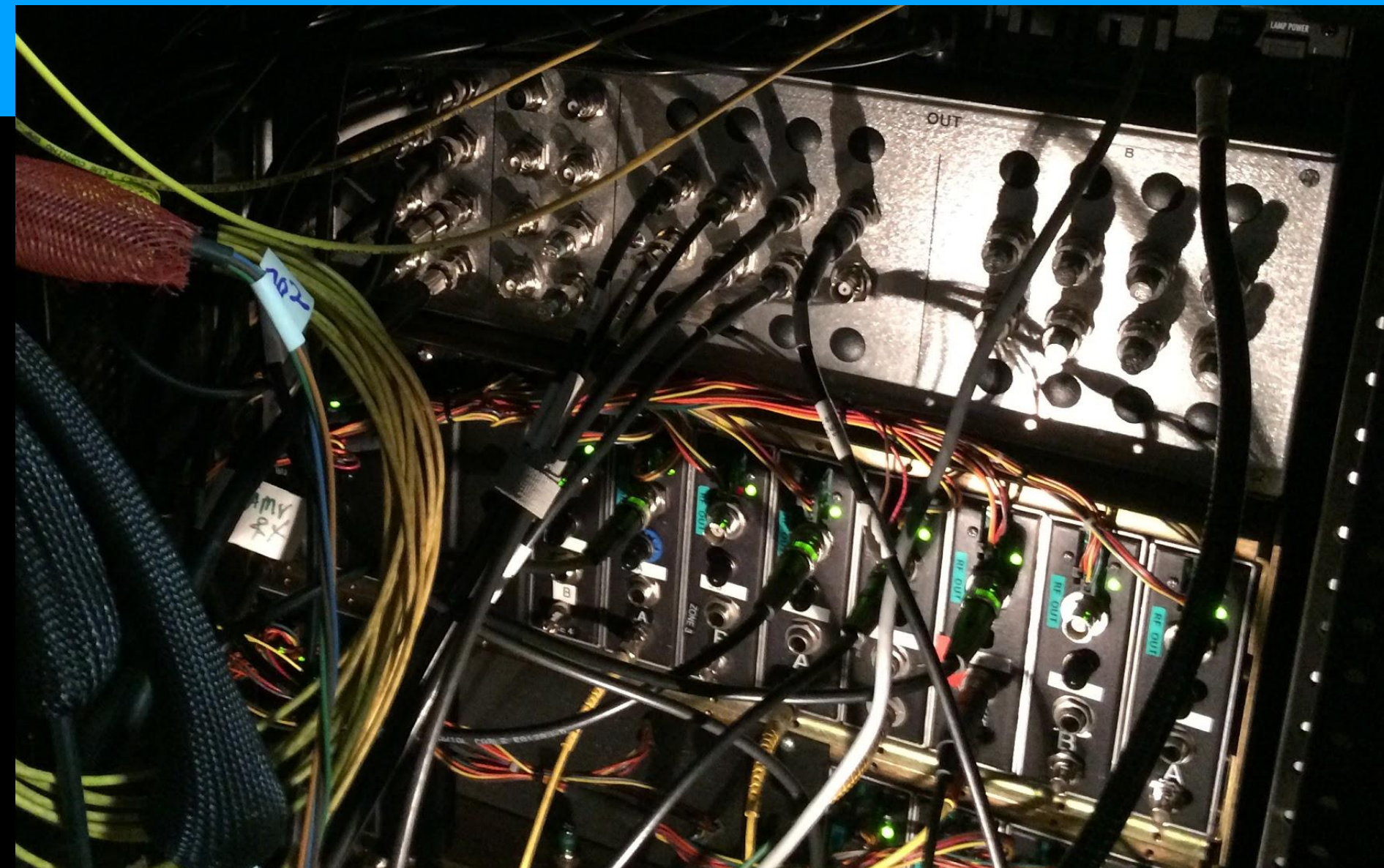
- Extend Range of wireless performance to centralized equipment
- Full Duplex capability allowing both transmit and receive
- Single interface point for audio
  - Conventional approaches would require additional power, line amps, additional mix inputs, multiple receivers, transmitters, synchronized activation and deactivation of redundant IFB transmitters, etc...







# A Little History of RFoF for Entertainment

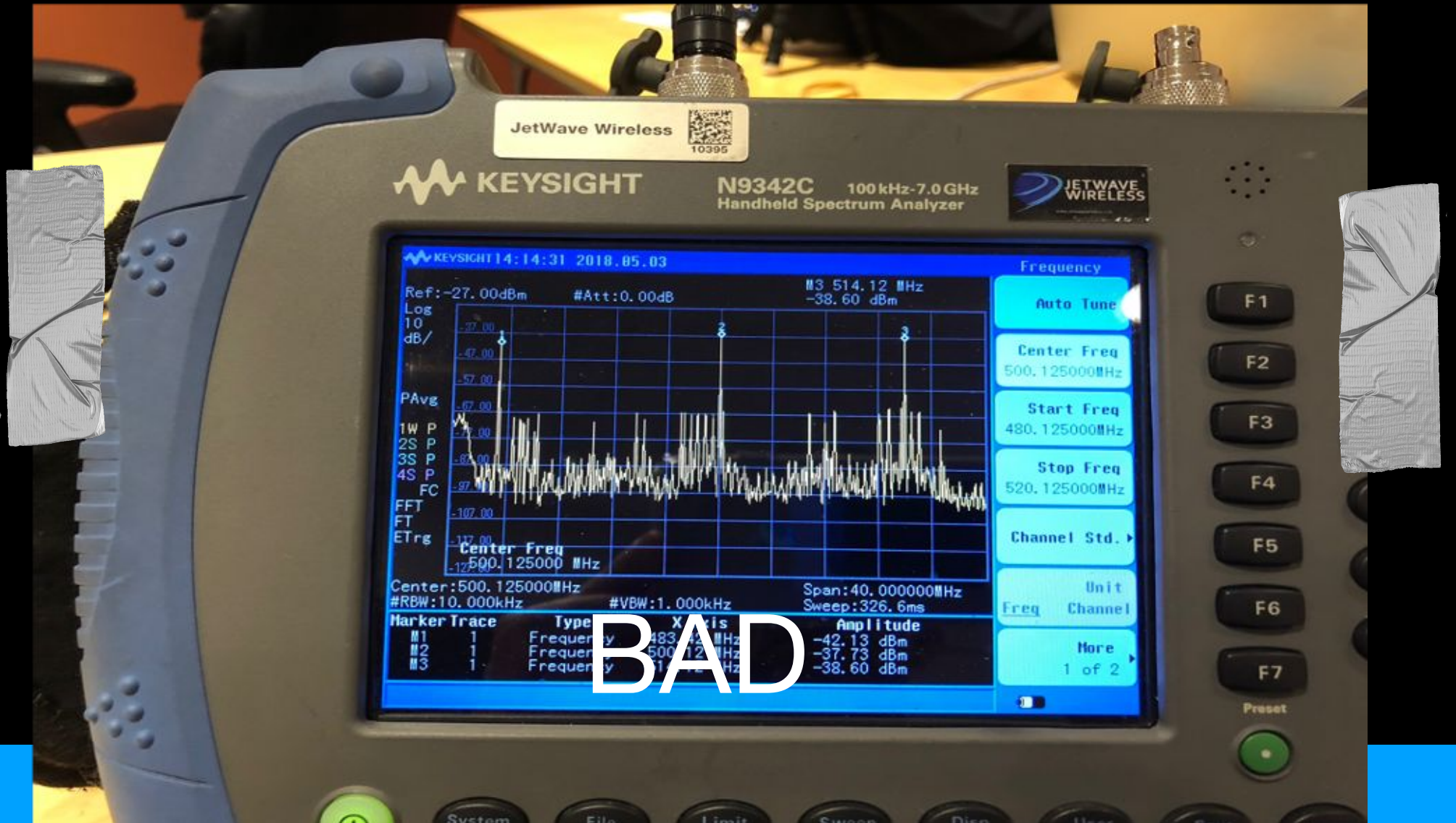




## RFoF System Design Considerations

### RF over Fiber

- Mode of fiber
- Type of connectors
- Number of connections
- Cleaning of fiber connections – especially on a mobile non-installed system
  - Do not use Fiber Optic pen cleaner on bulkhead APC connections
- Transmit power level input from transmission gear
- Transmit power output and downstream gain structure to antenna(s)
- Receive antenna(s) type, location, zones





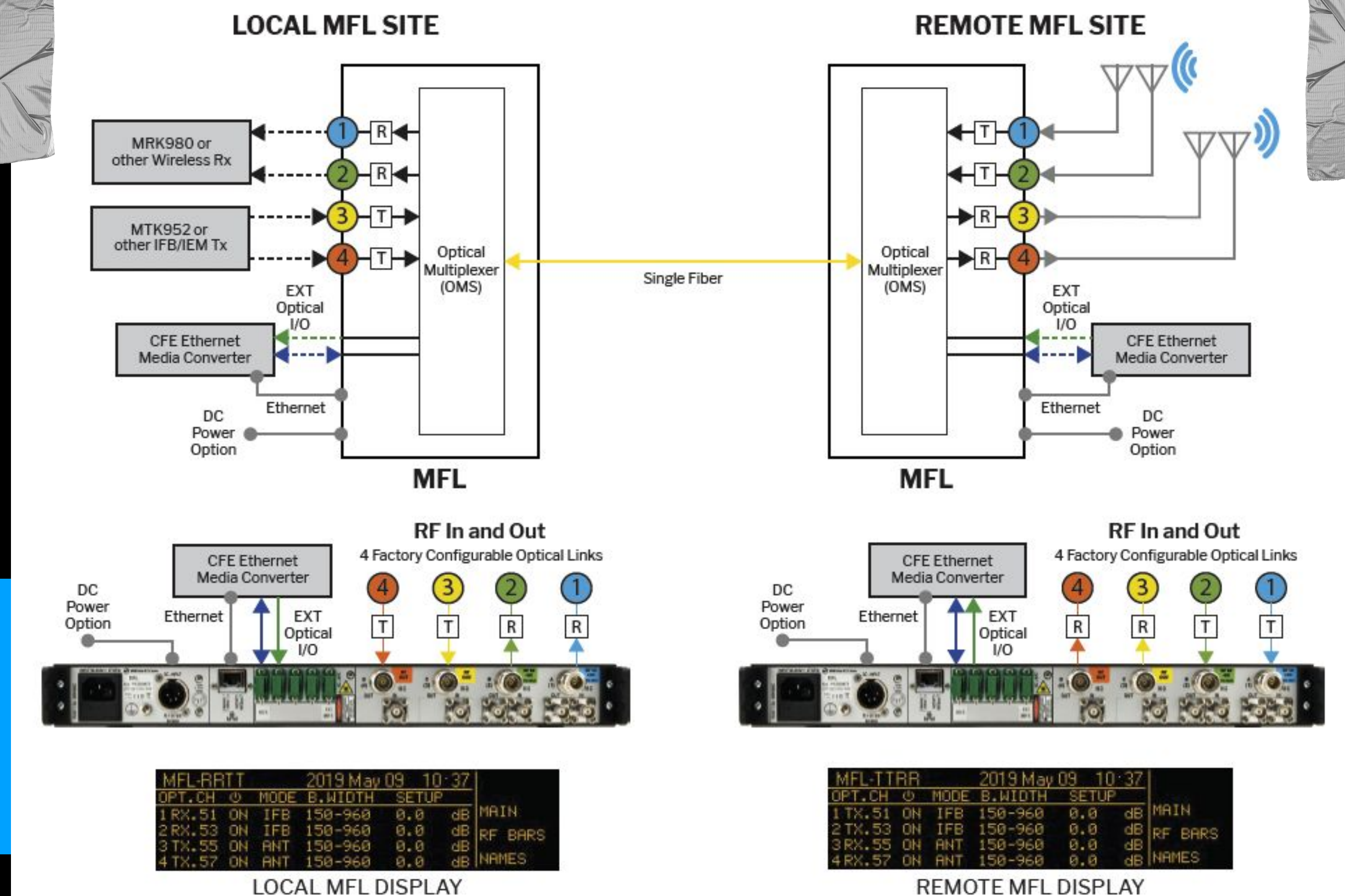


## RFoF Technology Solution

## RF over Fiber

- Wisycom MFL

- LOW NOISE DESIGN to allow great coverage when use to remote receiving antennas
- HIGH INTERFERENCE IMMUNITY thanks to high IP3 design and control/compensation of gain
- EASY TO USE thanks to integrated RF/optical power meter and optical power consumption
- REAL-TIME CLOCK with a backed-up static RAM to monitor and record internal RF levels and service data (i.e. laser life time)
- TX UNIT (remote RF reception, i.e. diversity antennas)
- RX UNIT (RF transmission, i.e. single-frequency master/slave areas)
- REMOTE MONITOR/CONTROL thanks to a data link on Ethernet 10/100 Base Tx
- RF INPUT/OUTPUT – Most common setup is 2 RF Input and 2 RF Output, but configuration is customizable from factory
- RF BOOSTER POWER – 12vDC power available to power inline amplifiers on both RF Transmit and RF Receive
- OPTICAL INPUT/OUTPUT – 5 connectors SC-APC type







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