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Kintronic Labs: POSSIBLE APPLICATIONS FOR USE OF AM BROADCAST TOWER SPACE

Presented by: Tom King, CEO and President

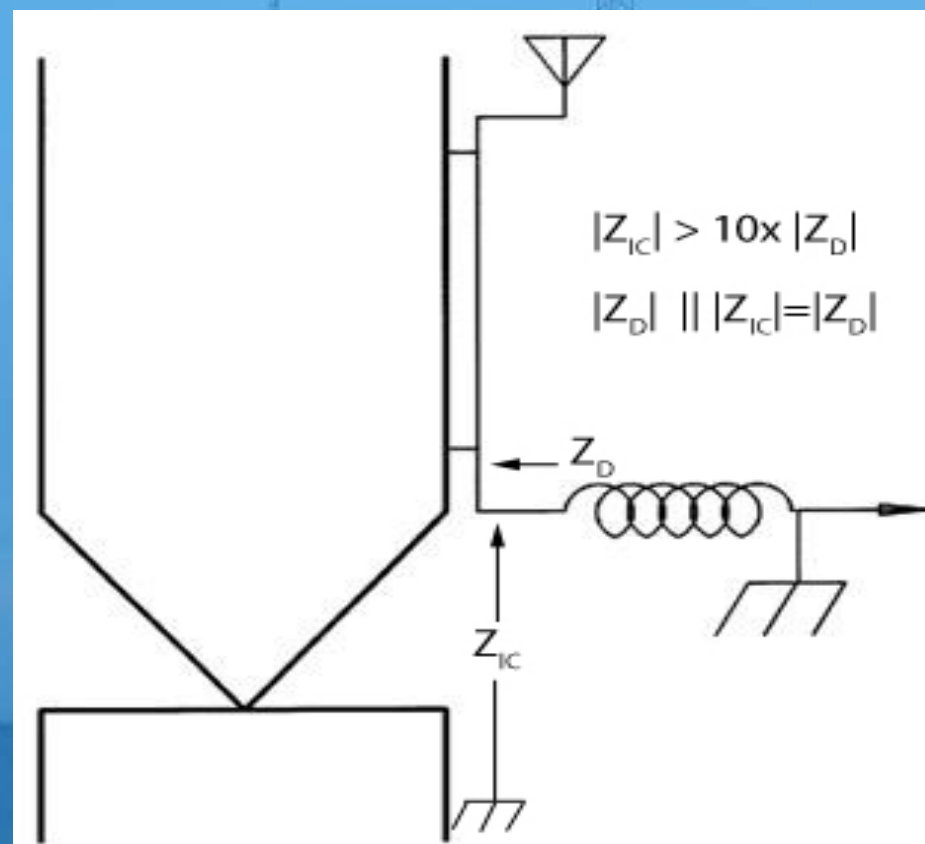


General Considerations for Co-locating Other Services on AM Base Insulated Towers

- Proposed techniques are applicable to NDA and DA towers
- The peak AM voltage across the base insulator is a critical design parameter in defining the isolation solution
- To minimize the impact of any isolation solution across a tower base insulator, the associated parallel impedance should be a minimum of 10x the magnitude of the tower drive impedance
- When multiple isolation solutions are possible cost will be the deciding factor
- By virtue of the fact that the isolation solution is installed directly across the base insulator, lightning tolerance must enter into the design



GENERAL AM ISOLATION REQUIREMENT





ISOLATION SOLUTION OPTIONS

- RF chokes
- Isolation inductor
- Slotted isolation inductor
- Isocoupler
- Hybrid cable isolation inductor
- Cat 6 cable isolation inductor



BUSINESS MOTIVATIONS

- Telecoms upgrades and next generation buildout
 - Long-Term Evolution(LTE), 4G and 5G
- 5G will require more cell sites
 - Sites closer together
 - Higher data capacity
 - Tower mounted amplifiers fed by fiber optic cable & power cable that requires isolation across the base insulator
- Know what's available in your local area
 - Do you have a unique site?
 - Zoning restrictions or other land use issues?
 - Ask other landlords – FOIA public agencies



ECONOMIC CONSIDERATIONS

- Will your AM transmitter site offer an economic advantage for the wireless provider?
 - You already have existing land use permits
 - Your site is geographically situated to serve as a gap-filler in existing telecom service
 - Adequate AC power would already be available at the tower site
- Leasing your tower space provides additional monthly revenue streams
 - Share cost of facility upgrade
 - Boost your bottom line
- Maintenance relief for broadcaster
 - Require site maintenance assistance from the service provider
- Opportunity to upgrade facilities in exchange for rent credit
- Use monthly income for facilities maintenance



BENEFITS TO WIRELESS PROVIDERS

- Thousands of available sites, some in desired coverage areas
- Existing towers resulting in minimal community resistance
- Appropriate Zoning/permitting already in place
- Less site work than a newly built site
- Faster time to market for new wireless facilities



CHALLENGES TO WIRELESS PROVIDERS

- Lack of understanding of AM broadcast towers
- Towers and radio stations sometimes under separate ownership
- RF exposure concerns
- Lack of understanding in addressing possible interference issues and the use of proper grounding and shielding practices



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ISOLATION SOLUTION EXAMPLES

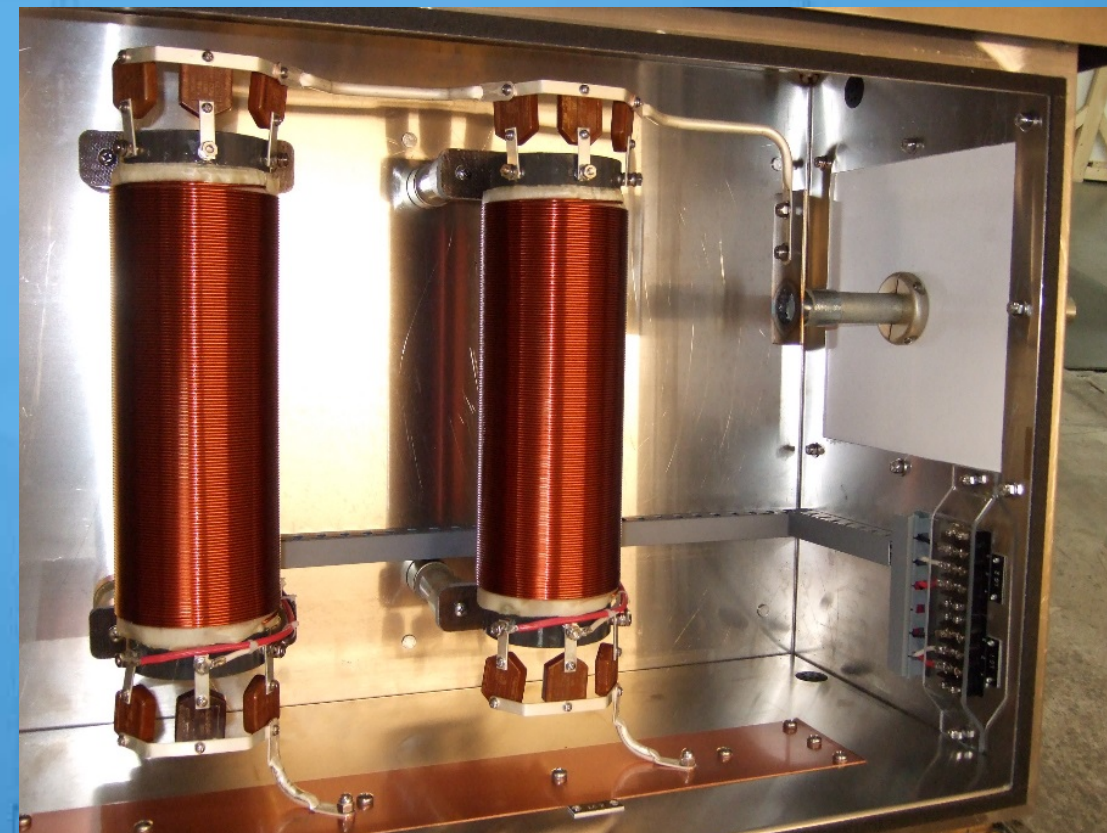
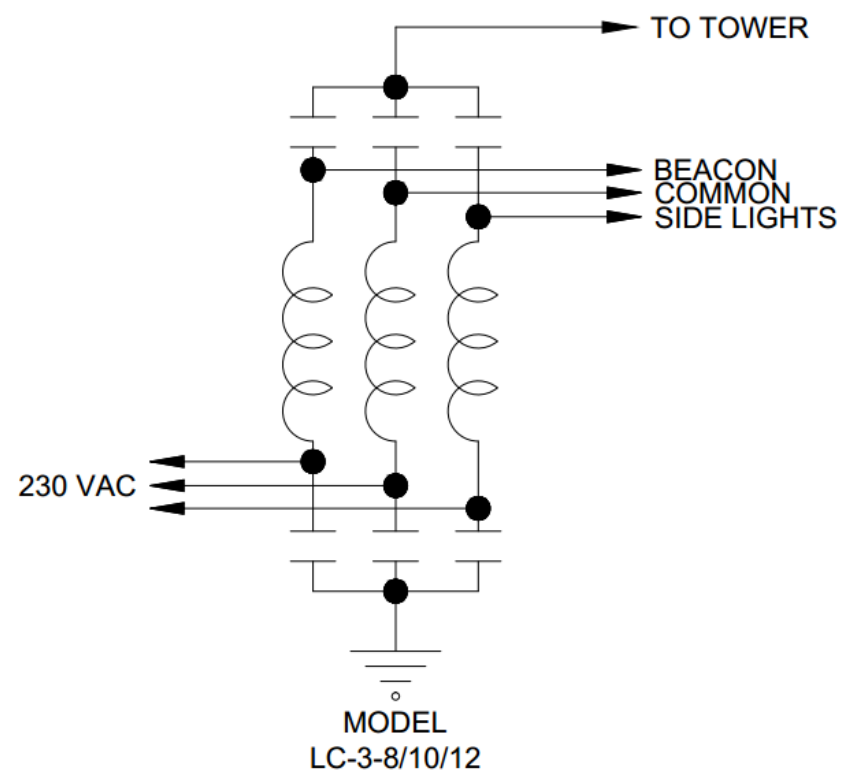


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LIGHTING CHOKES





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MULTIPLE LIGHTING CHOKES PROVIDE RRU DC POWER





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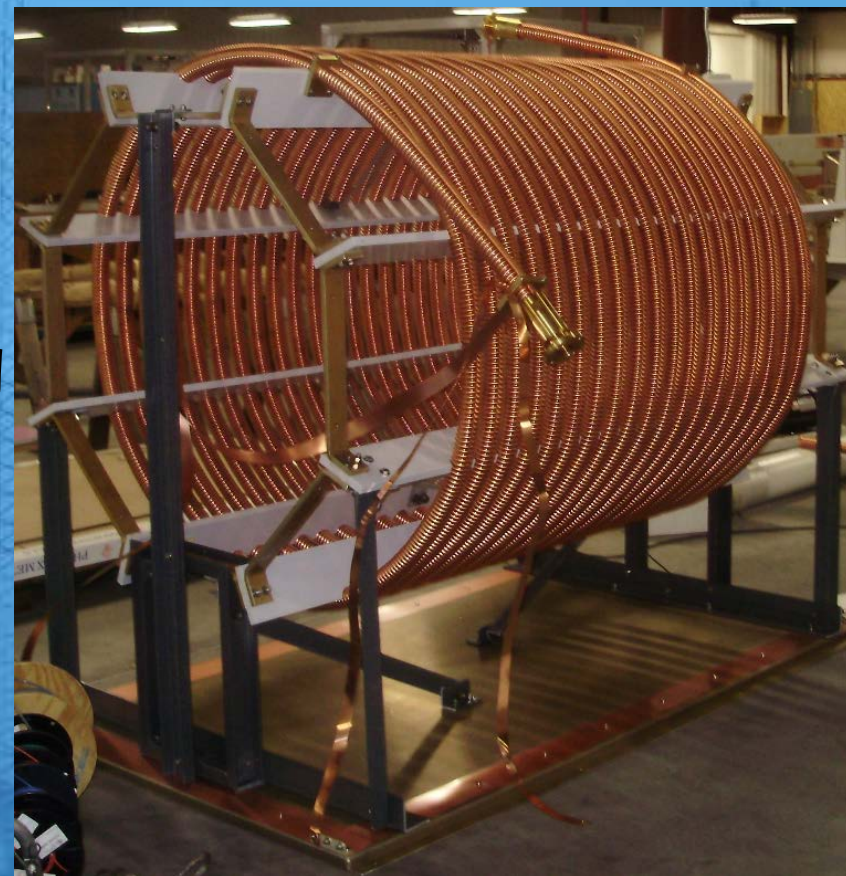
24-CONDUCTOR LIGHTING CHOKE ASSEMBLY





ISOLATION INDUCTOR

- Insertion loss < 1.0 dB
- No concerns with peak voltage handling capacity
- Robust solution in high lightning environment



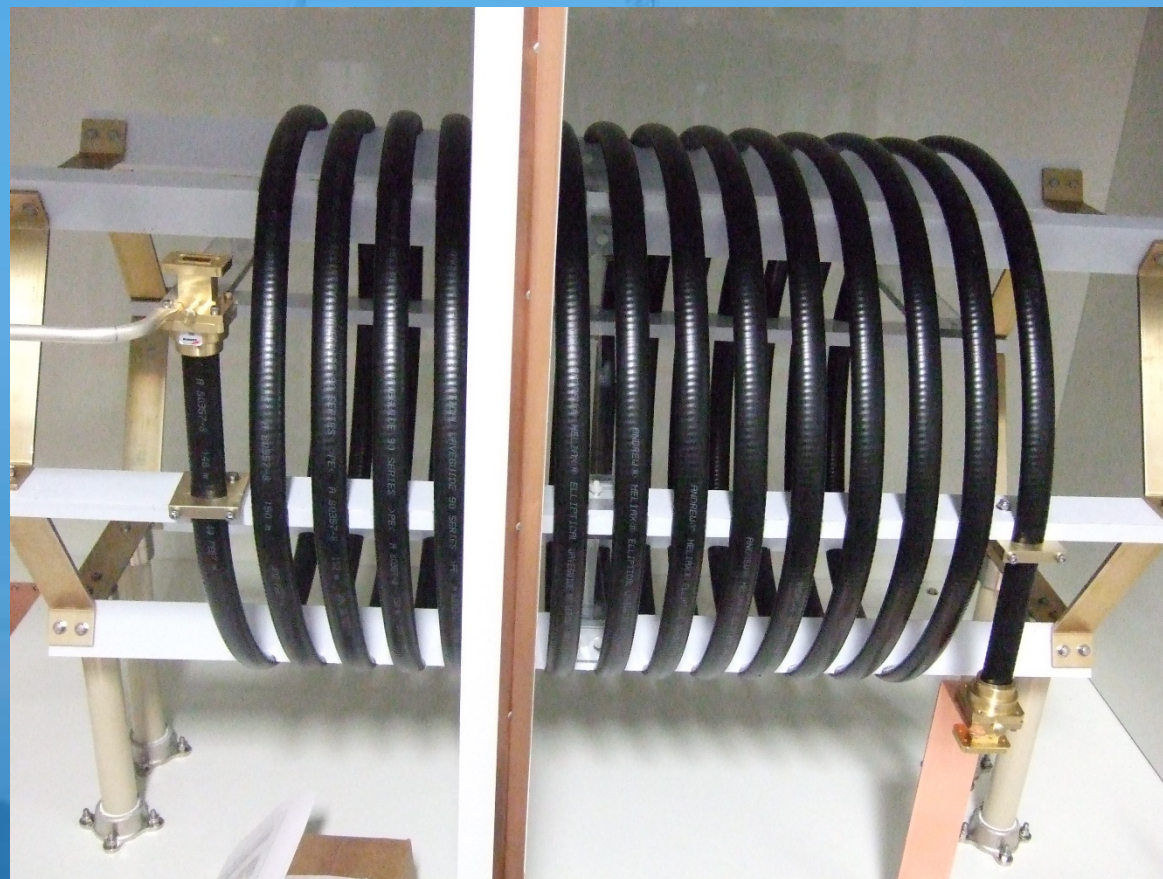


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11 GHZ MICROWAVE SERVICE ELLIPTICAL WAVEGUIDE ISOCOIL





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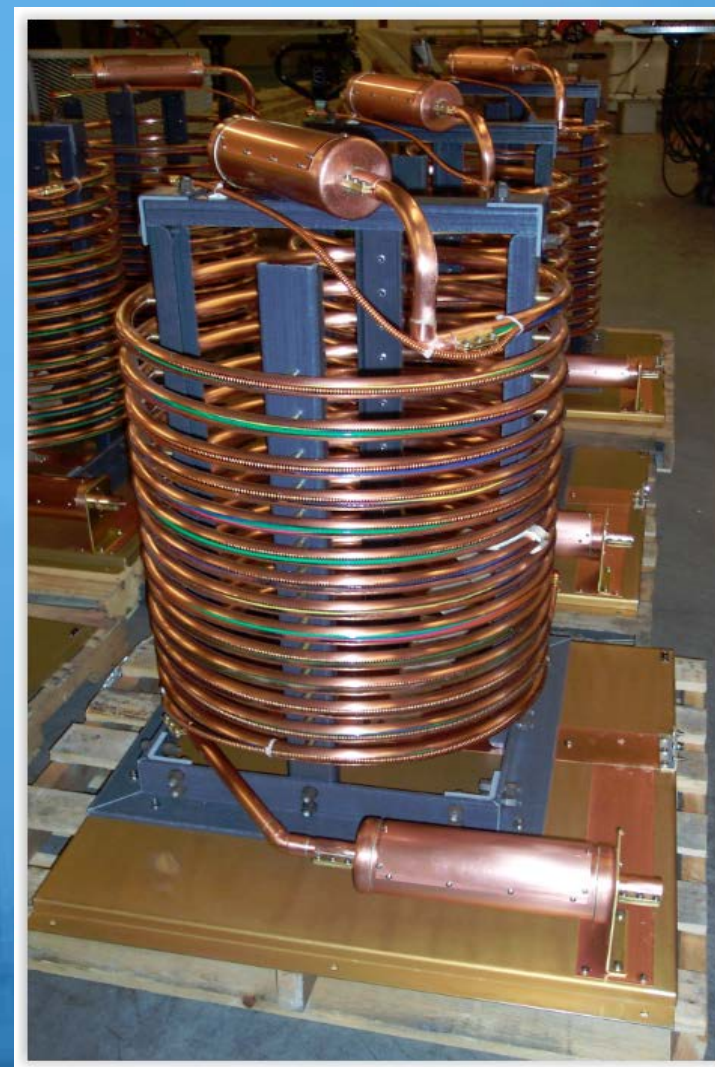
REMOTE ELECTRICAL TILT(RET) ISOCOIL





SLOTTED ISOLATION INDUCTOR

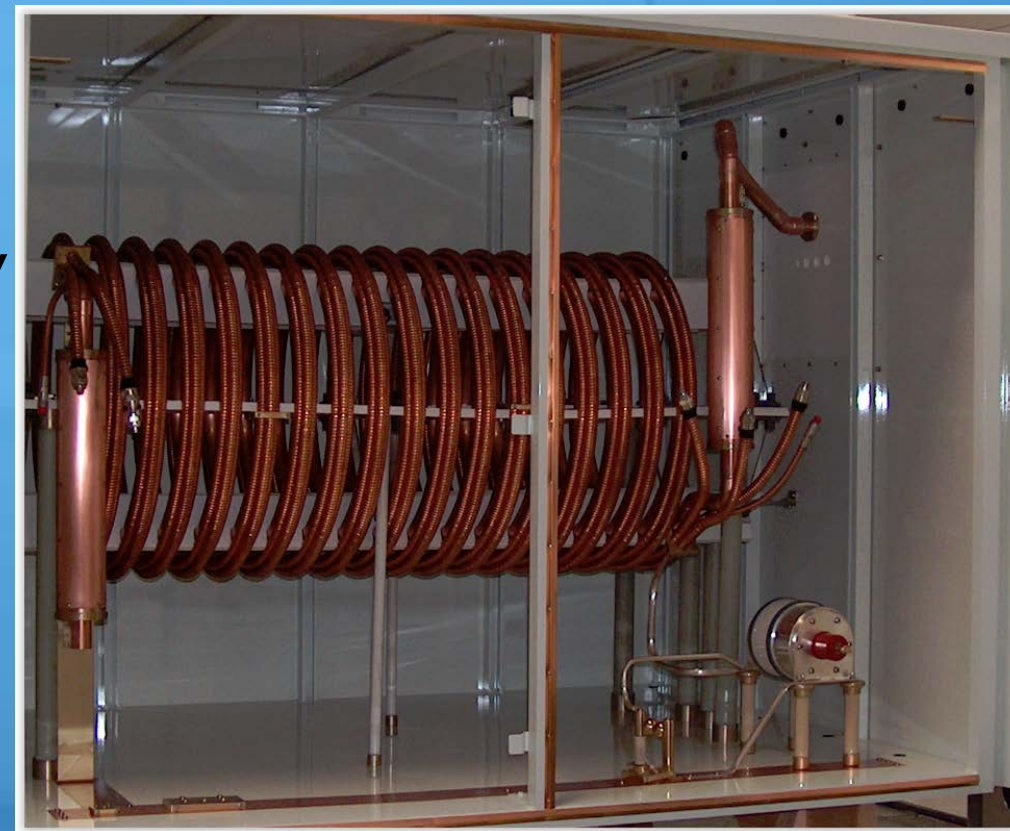
- Isolation of a large number of copper conductors
- Tunable inductor for tower pre-match
- Robust static drain choke
- Tower light circuit isolation
- Sampling line isolation





COMPLEX ISOCOIL

- 3 runs ofunjacketed 7/8" coax
- Parallel resonant variable capacitor to yield high Z at AM frequency
- Slotted isocoil with 21 internal copper conductors





LTE 4G MICROWAVE ISOCOUPLER

- Uses coupled microwave horns with air gap
- Requires separate unit for each transmit and receive antenna
- Operate in the 1.9GHZ or 2.4GHZ bands





FM ISOCOUPPLERS

- Utilize magnetically coupled loops
- Insertion loss typically < 0.2 dB
- Yield capacitive reactance in parallel with the AM tower drive $Z < 150$ pf
- In and out are series tuned LC terminations at the FM frequency





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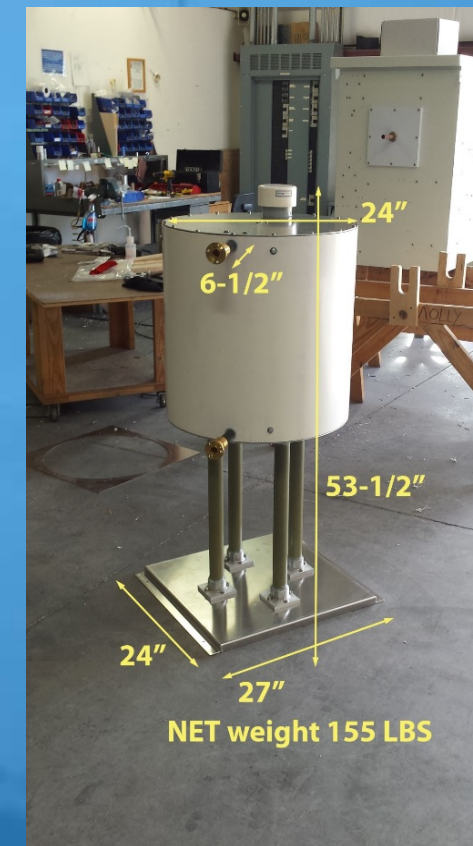
HIGH POWER TV & FM ISOCOILS





FM TRANSLATOR & LPTV ISOCOILS

- Not FM frequency specific
 - Applicable for combiner FM's
 - Available with resonating caps
 - Coax isocoils encapsulated in a non-conducting cylindrical enclosure
- | | |
|-----------|---------------|
| • ISO-130 | 350W FM power |
| • ISO-170 | 1 kW FM power |
| • ISO-100 | 3 kW FM power |





LTE SYSTEM LAYOUT

- Tower mounted transmitters & receivers [Remote Radio Units(RRU)] that require no coax feed
- A typical RRU may be fed with 2 pairs of 48 VDC 6AWG Power Conductors, 4 pairs Fiber Optic cable, and 1 pair 18 AWG alarm
- Hybrid cables include fiber optic, DC power and alarm pairs all combined into one cable with an aluminum corrugated outer jacket. One cable is typically sufficient to support Qty. 3 RRU's



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RFS HYBRIFLEX CABLE





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HYBRID CABLE ISOLATION INDUCTOR





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HYBRID ISOCOIL INSTALLED AT WLYQ/WVNT DIPLEXED AM SITE



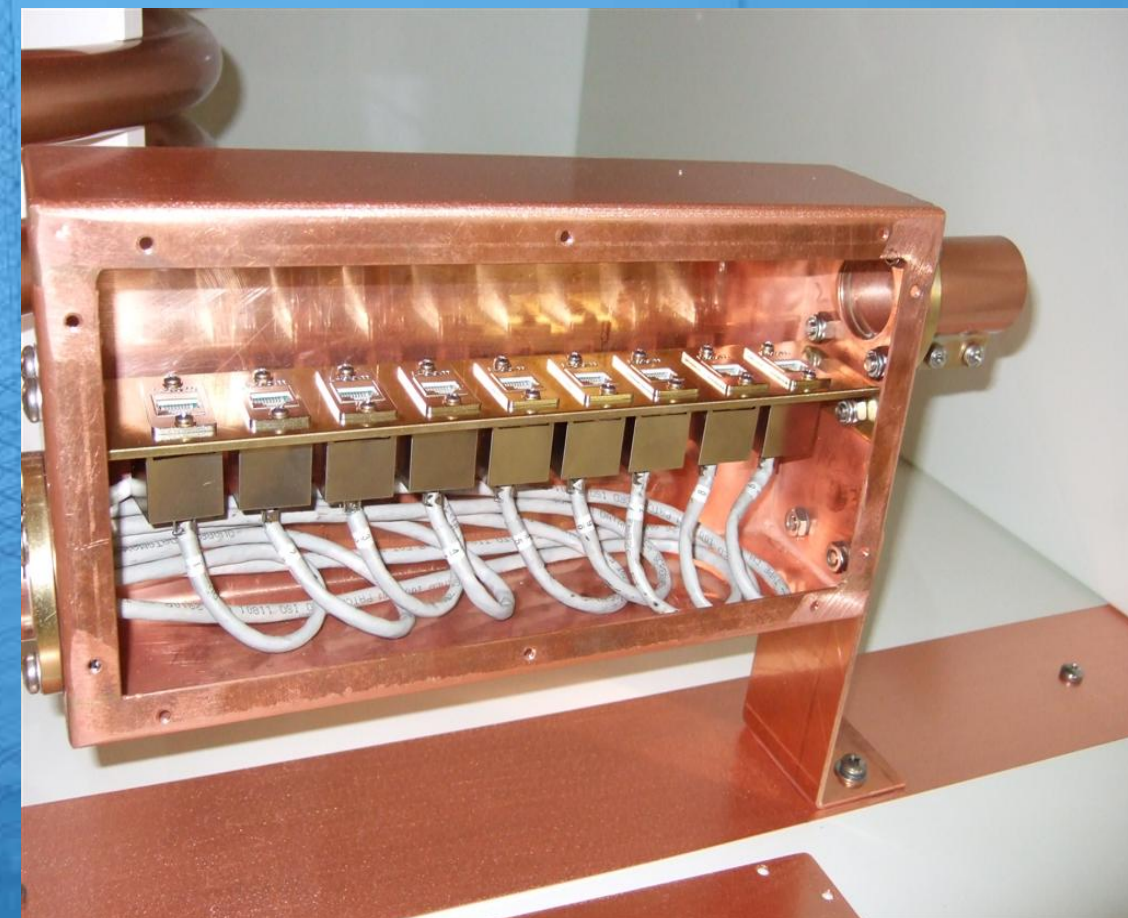
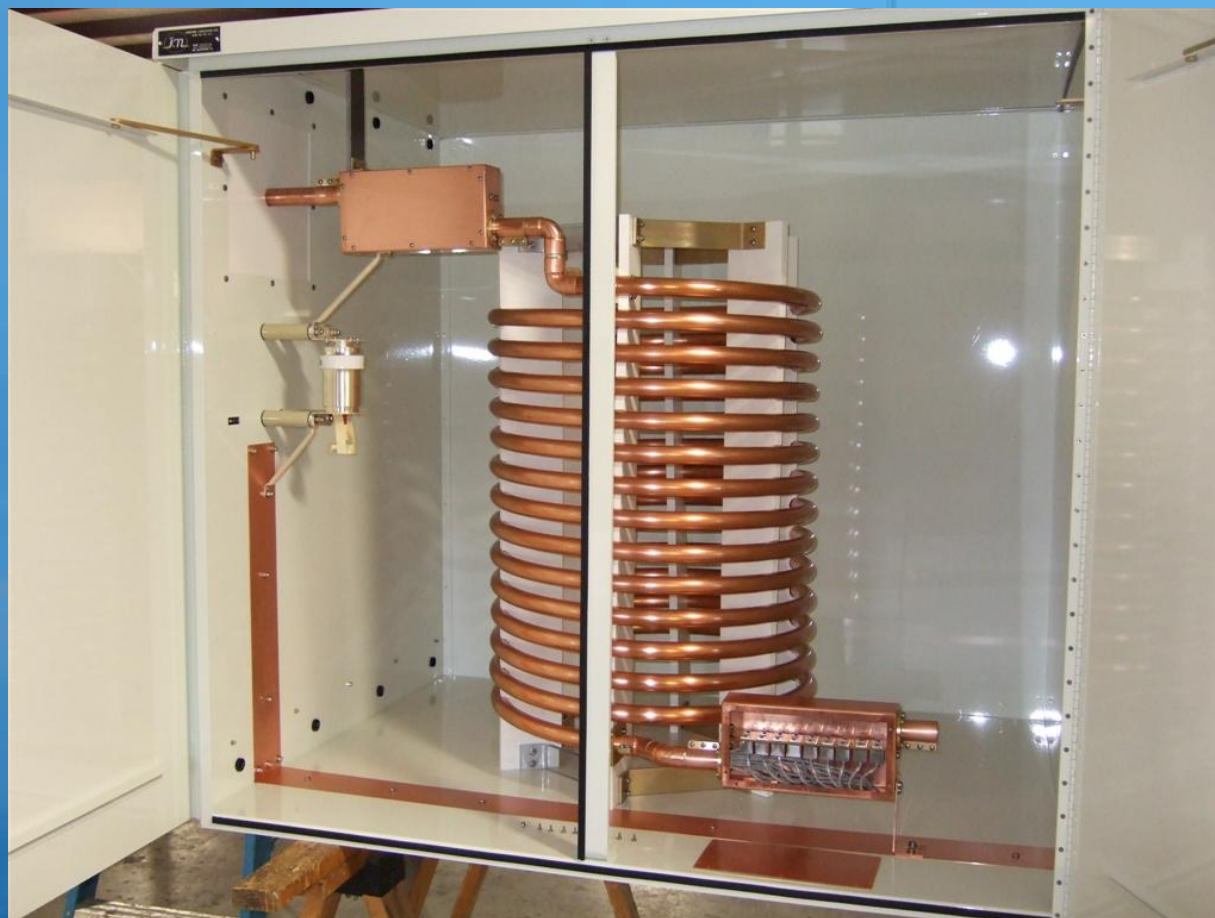


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ETHERNET ISOCOIL USING POWER OVER ETHERNET (CAT6 OR CAT7)





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QUESTIONS