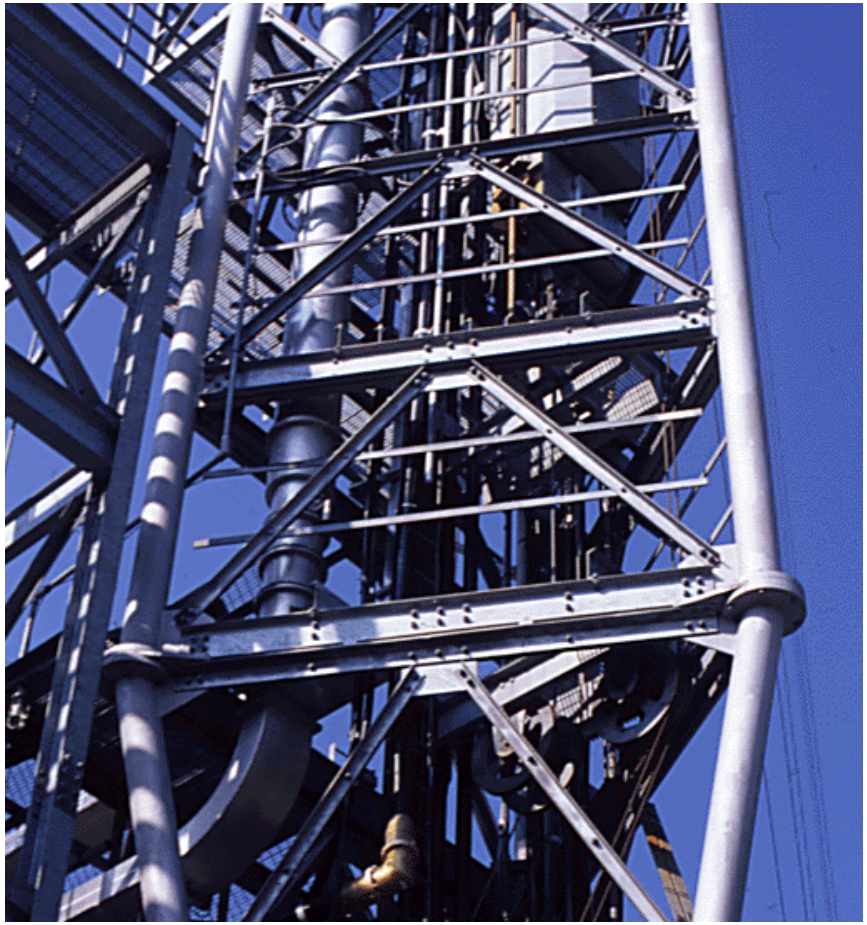
Advantages of Aluminum Transmission Line

Manuel Sone
Electronics Research Inc.
Chandler, Indiana

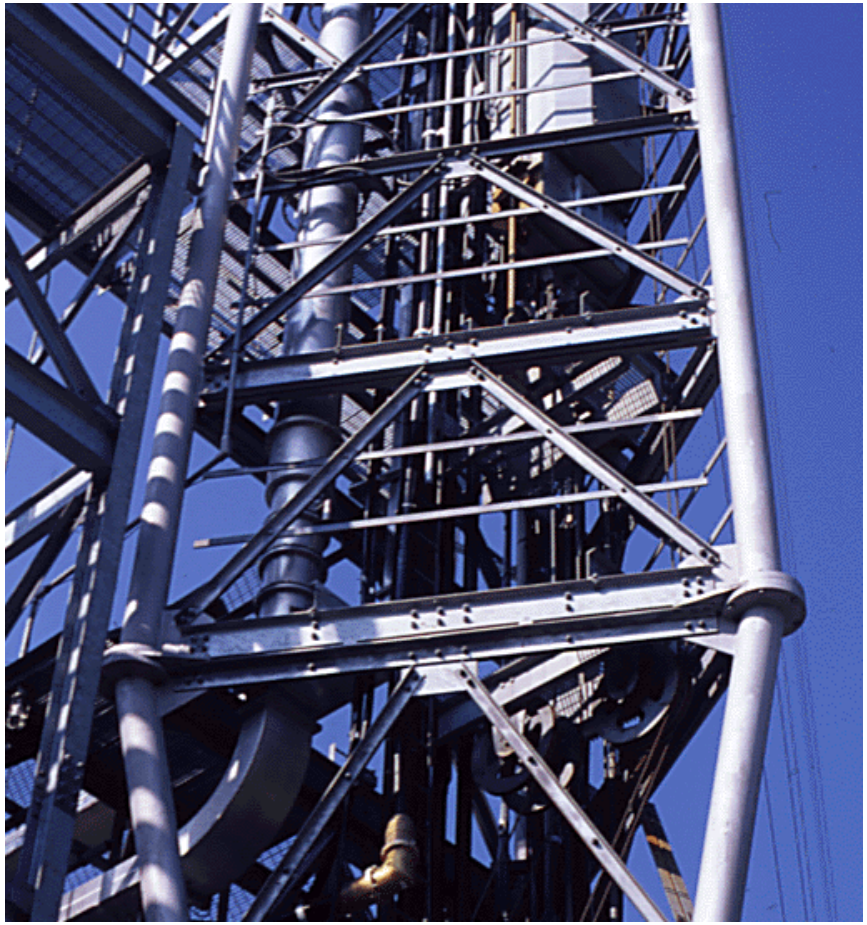
Advantages of Aluminum Transmission Line

- Theft
- Cost & Price
- Geometry
- Corrosion
- Installation
- Support System



Advantages of Aluminum Transmission Line

- Power
- Thermal Expansion
- Insertion Loss



Theft

- One $Billion Worth of Copper is Stolen Annually

Cost & Price

- Copper

Cost & Price

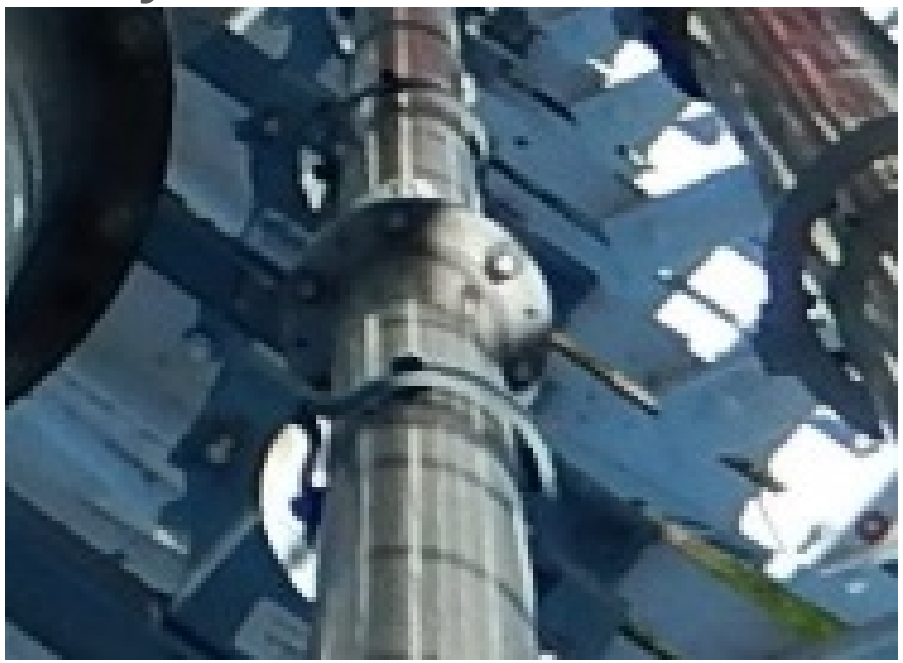
- Aluminum

Geometry

- Aluminum or copper tolerances usually outperform specifications.

Corrosion

- Nickel Plated Parts, Hardware coated with molybdenum disulfide

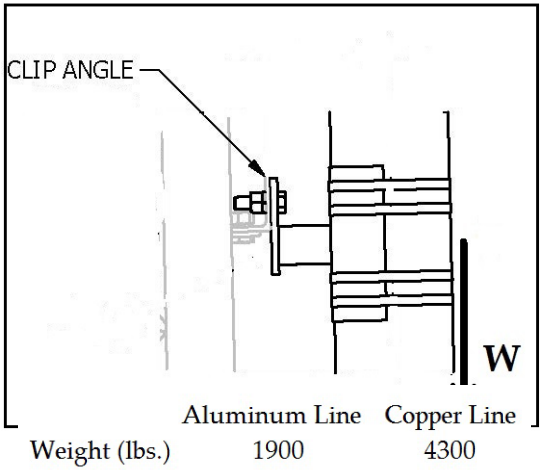


Installation

- Aluminum line weights less than 44 percent of copper

Support System

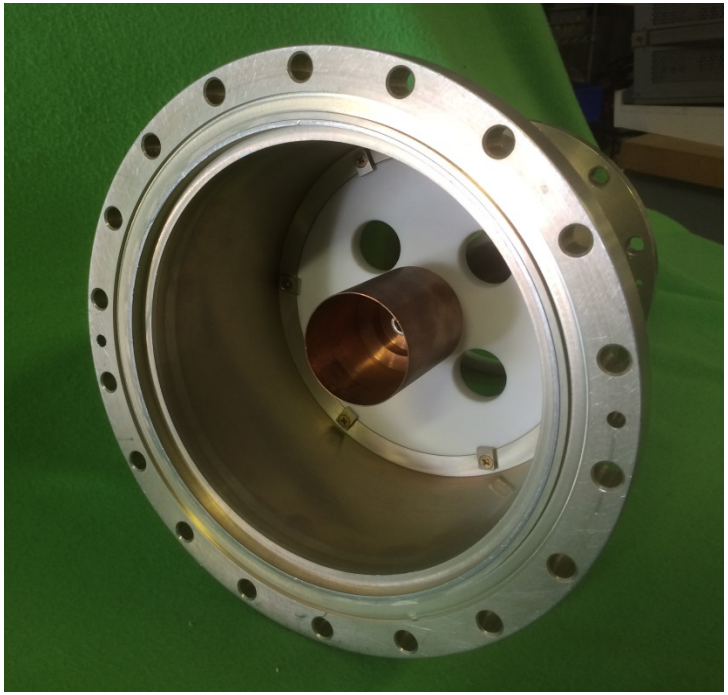
- The top stick must be supported with a fixed rigid hanger



	Rigid Hanger	Slip Hanger	Spring Hanger	Lateral Guide
Copper	1	97	45	2
Aluminum	1	97	23	2

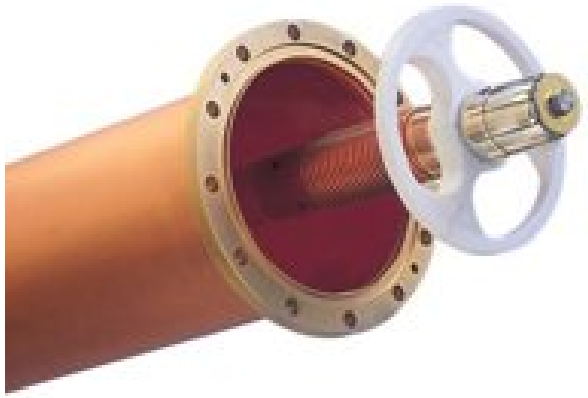
Power

- Peak and Average Power



Thermal Expansion

- In Cu/Cu transmission line systems the inner gets warmer than the outer conductor, resulting in differential expansion



Thermal Expansion

- The temperature expansion coefficient of aluminum is approximately 35% higher than that of copper

Thermal Expansion

CALCULATIONS WITH SYSTEM OFF (NOT TRANSMITTING)

Ambient	-20° F	+120° F
ΔT from "rest" (70° F)	-90° F	+50° F
Inner (CU) change	-.194 in	+.108 in
Outer (AL) change	-.259 in	+.144 in
Net Change	-.065 in	+.036 in
Bellows Compression	-.065 in	bullet gap increases from .070 in to .106 in

Thermal Expansion

CALCULATIONS WITH SYSTEM AT MAX POWER (100° F TEMP DELTA)

Ambient	-20° F		+120° F	
	Outer	Inner	Outer	Inner
Temp	-20° F	80° F	120° F	220° F
ΔT from "rest" (70° F)	-90° F	10° F	50° F	150° F
Net Change	-.259 in	+.022 in	+.144 in	+.324 in
Bellows Compression	N/A	-.281 in	N/A	-.180 in

Insertion Loss

- Broadcasters generally assume greater insertion loss values when comparing similar coaxial lines constructed with dissimilar outer conductor metal, in our present discussion of aluminum versus copper

Insertion Loss

Insertion Loss

Insertion Loss

VHF ATTENUATION
ALUMINUM VS COPPER

	FREQUENCY (MHz)	50	88	98	108	170	195	216
ATTENUATION (dB/100 FT)	ALUMINUM	0.0490	0.0696	0.0740	0.0780	0.0999	0.1063	0.1129
	COPPER	0.0509	0.0685	0.0725	0.0762	0.0959	0.1016	0.1078

Insertion Loss

UHF ATTENUATION
ALUMINUM VS COPPER

	FREQUENCY (MHz)	470	526	582	638	694	750	806
ATTENUATION (dB/100 FT)	ALUMINUM	0.1731	0.1778	0.2010	0.1967	0.2202	0.2148	0.2141
	COPPER	0.1630	0.1667	0.1890	0.1849	0.2079	0.2012	0.1966

Conclusion

- Theft
- Cost & Price
- Geometry
- Corrosion
- Installation
- Support System
- Power
- Thermal Expansion
- Insertion Loss