



HF Small Transmitting Loop Antenna

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What is a Small Transmitting Loop Antenna (STL) ?

The STL is a *gap-resonated loop antenna having a circumference of $1/8 \lambda$ to $1/3 \lambda$ at the desired operating frequency.

- When used as a horizontal loop, the STL needs to be placed high above ground, same as a dipole antenna.

However,

- Used as a vertical Loop, the STL is Ground-independent, with the center of the loop being only One loop diameter above the ground. No ground radials are needed.

*The gap is resonated by a High Quality Capacitor.

QRP STL



QRO STL



Why use an STL ?

- Compact, Portable, easy to set up
- Does not need radials and does not need high supporting structures (is ground independent)
- Can be Very efficient on two HF Bands and useable on a 3rd HF Band
- Can be used in places where a Vertical or a Dipole Antenna won't fit
- Much more efficient than a vertical mobile antenna



For portability many radiating loops are made using Coax cable, which has about One Half the conductivity of pure copper

Loop circumference: commercially available STLs use an 8.5 foot loop(2.5908 meters) Allowing operation on 10m through 40m. The highest efficiency is on 10m.

Efficiency can be maximized by changing radiating loop circumference to be close to $\frac{1}{4}$ wavelength on the desired band.



LOOP EFFICIENCY is
determined by:

- The area within the loop
- Conductivity & Thickness of the radiating element
- Loss Resistance

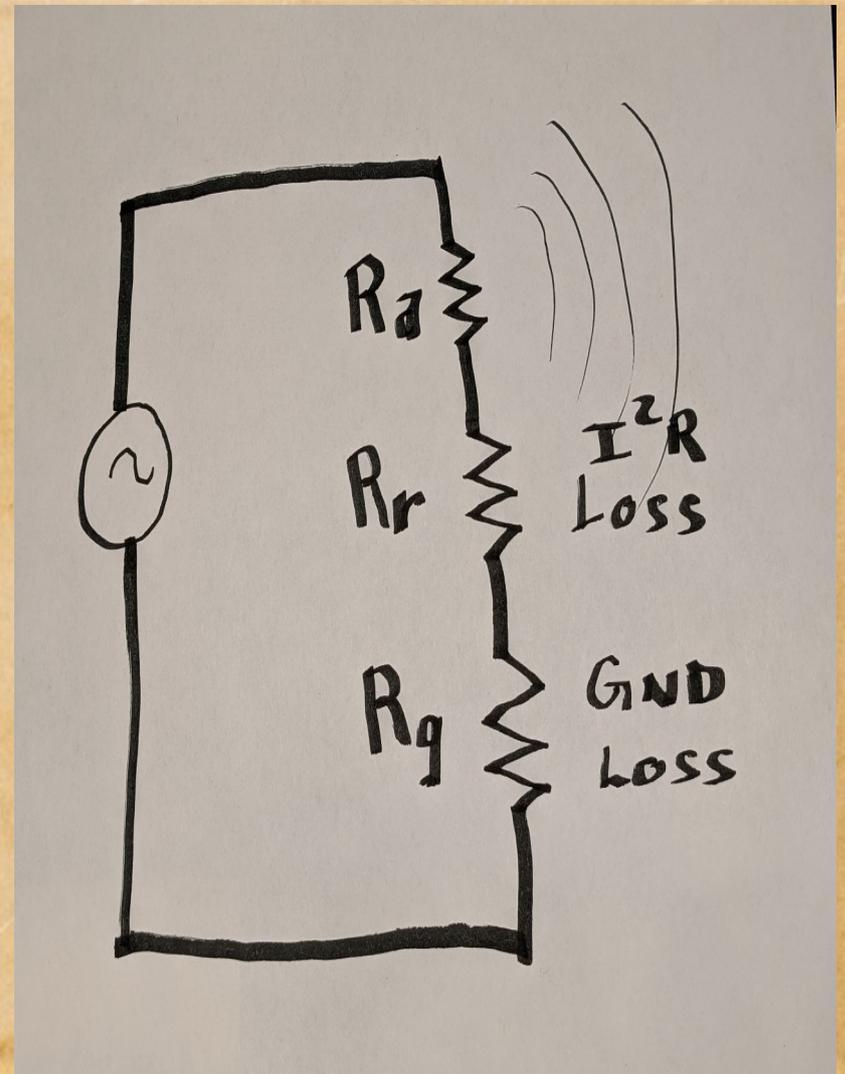
Highest efficiency:

- Obtained when the loop circumference approaches $\frac{1}{4} \lambda$ long.

This corresponds to the largest VSWR bandwidth and the lowest voltage across the tuning capacitor due to the higher radiation resistance and associated lower Q.

Antenna Radiation

- $\%Eff = (R_a / (R_a + R_r + R_g)) \times 100$
- Radiation Resistance
(the only one that causes radiation)
- Loss Resistance
- Ground loss
(A vertical STL has no ground loss)



$$\text{Efficiency} = R_a / (R_a + R_r + R_g)$$

- A Dipole has a radiation resistance of 73 ohms
- The Quarter wave vertical has 36 ohms radiation resistance.
- The STL has a radiation resistance measured in MILLIOHMS.
- Extreme care must be taken to minimize all loss resistance in the STL



A simple Dipole's Radiation efficiency can be anywhere from -1dB to -10dB or more, but a practical Dipole should be -1 to -2dB

63% to 79% efficient

100 watts input = 63 to 79 watts radiated



The Ground mounted Quarter Wave Vertical antenna

- With only the minimum Ground Rod may have a radiation efficiency of 30 to 40%
- With a Ground radial system of 32 or more radials and good ground conductivity the radiation efficiency could be between -2.5dB and -1dB or 55% to 79%

Short HF Vertical Mobile

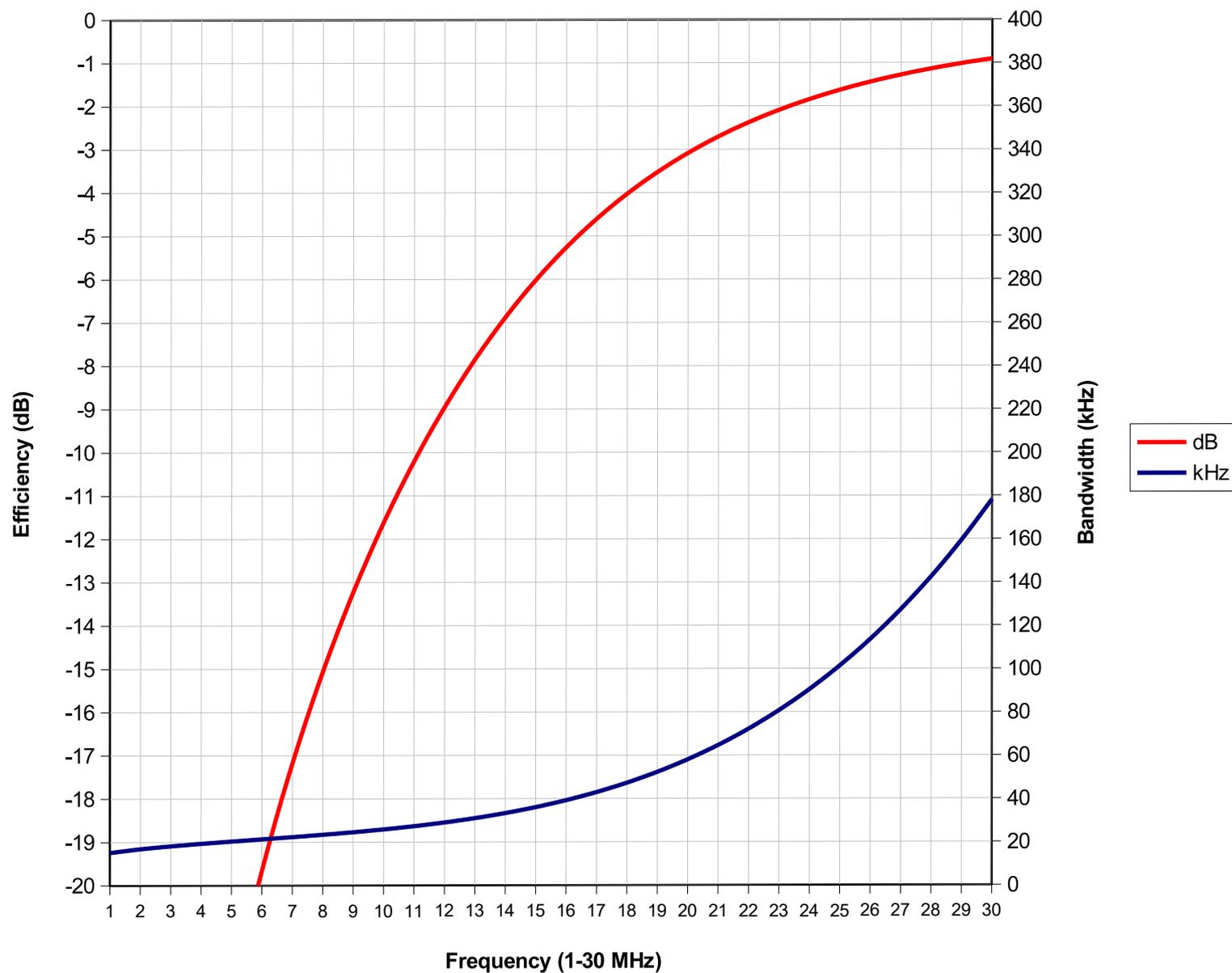
- Efficiency can be anywhere from 2% or less on 80 meters, up to 65% on 10 meters.
- Efficiency of a practical Mobile Antenna install can range from less than 4% to 40% on 40 meters.

Efficiency of commercial STL with a 9 ft long circumference:

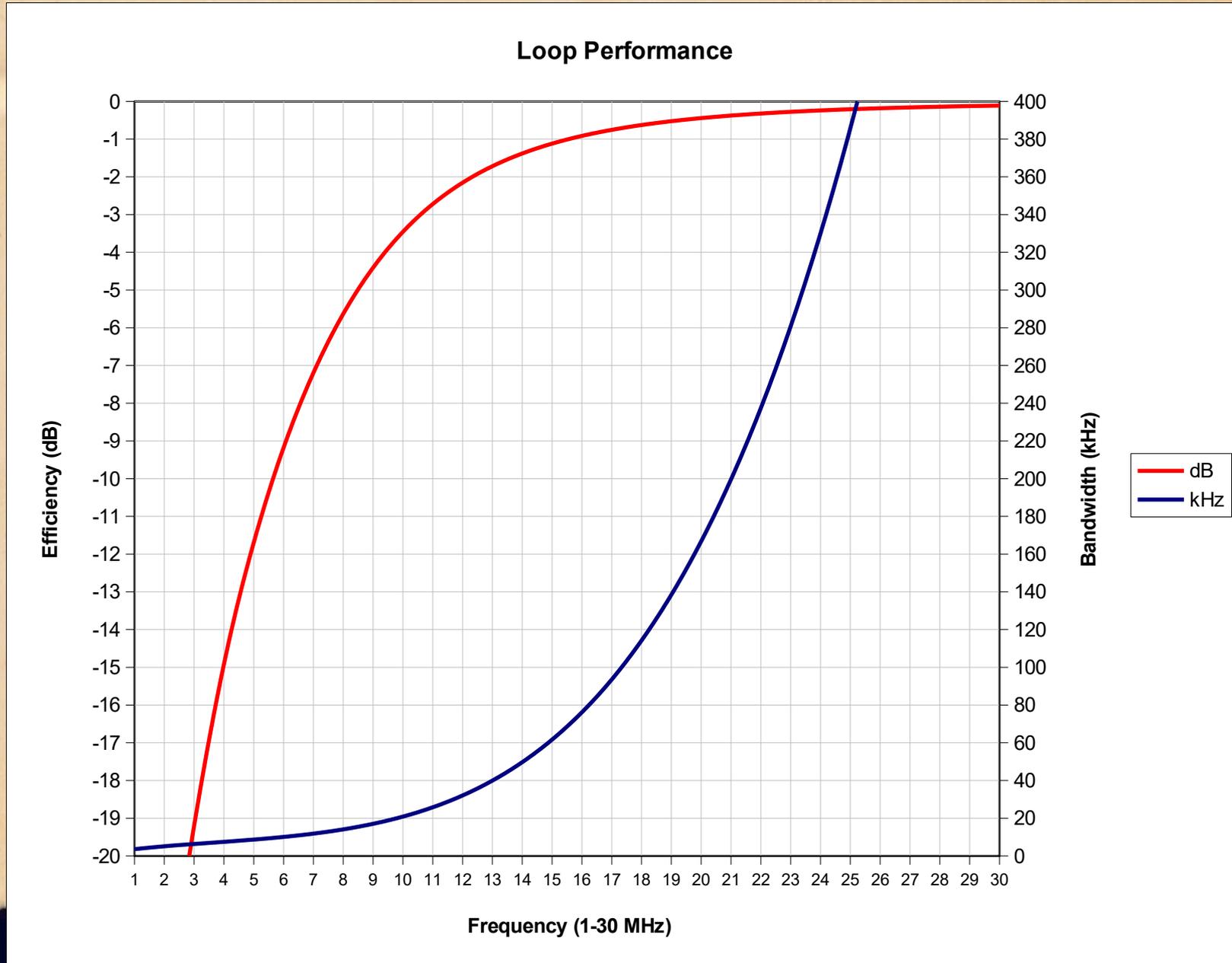
Band	%	dB
10 meters	82.41	-0.84
12 meters	73.79	-1.32
15 meters	50.93	-2.93
17 meters	36.81	-4.34
20 meters	19.82	-7.03
30 meters	7.67	-11.15
40 meters	2.65	-15.77

9 foot Circumference Loop

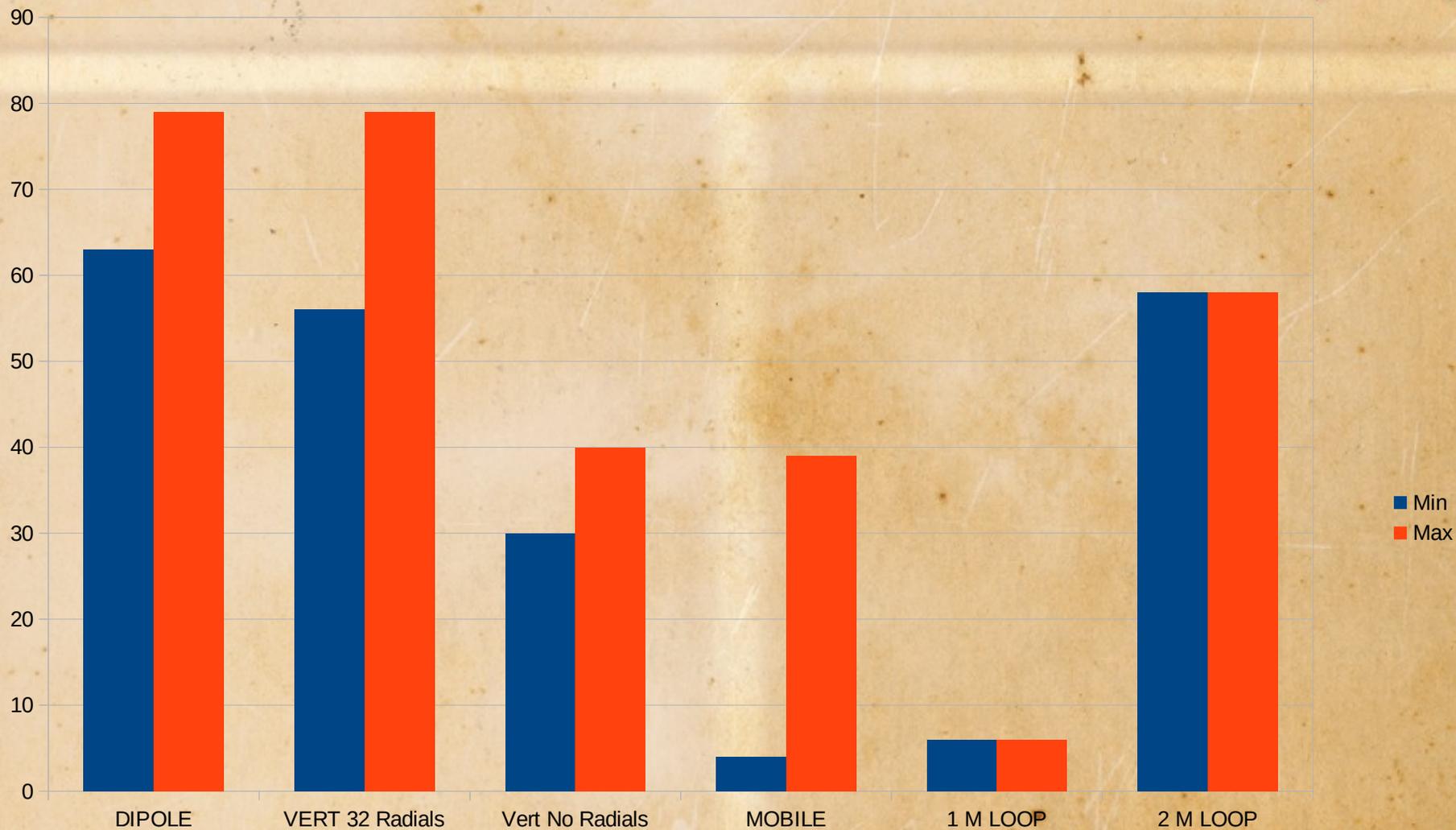
Loop Performance



16 Ft circumference Loop



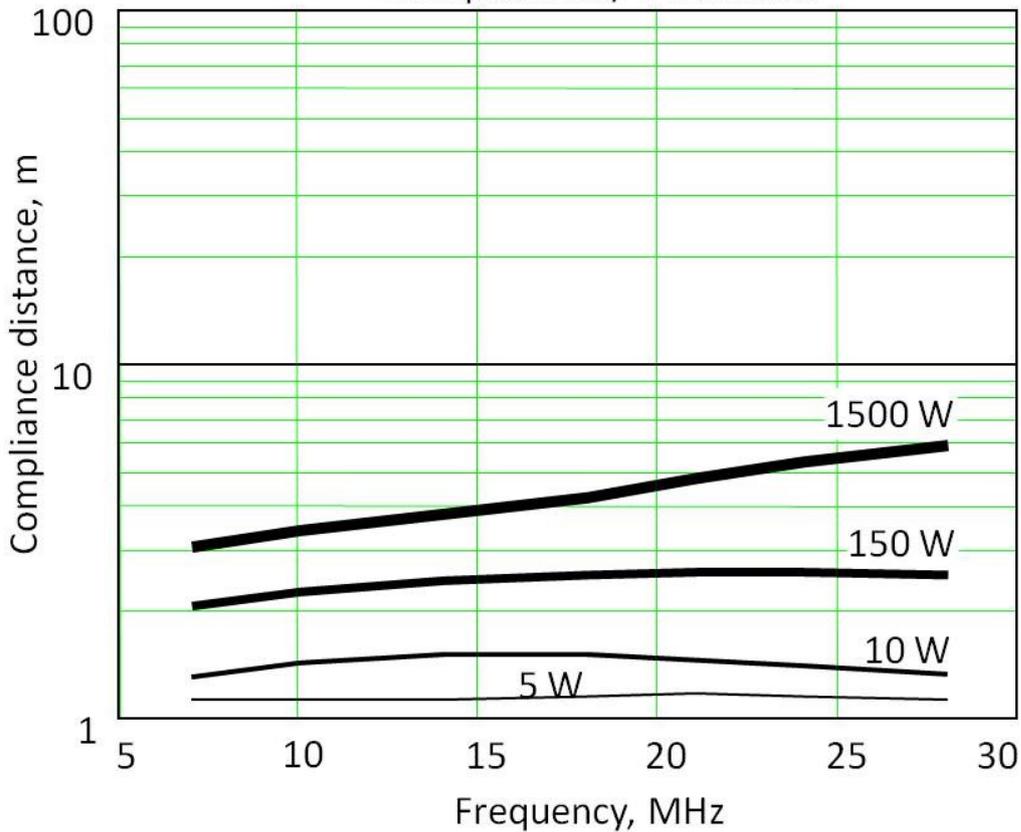
EFFICIENCY ON 40 METER BAND



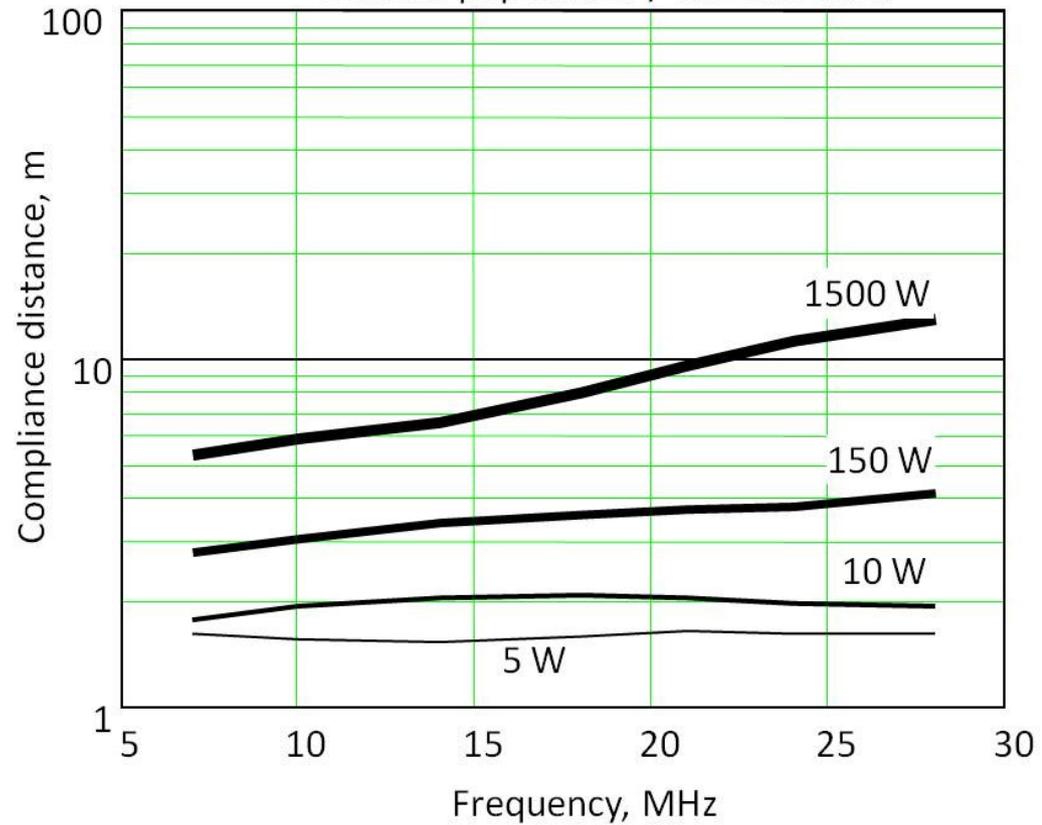
STL RF SAFETY



Occupational / Controlled



General population / Uncontrolled







Thank you.

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- DB & percent efficiency

• -1dB 79%	• -8dB 15%	• -15dB 3%
• -2dB 63%	• -9dB 12%	• -16dB 2.5%
• -3dB 50%	• -10dB 10%	• -17dB 2%
• -4dB 40%	• -11dB 8%	• -18dB 1.5%
• -5dB 30%	• -12dB 6%	• -19dB 1.25%
• -6dB 25%	• -13dB 5%	• -20dB 1%
• -7dB 20%	• -14dB 4%	• -30dB 0.1%

- (for reference only)