Wavelength and Half-Wave Dipole and Quarter-Wave Antenna Lengths

Free-space wavelength, half-wave dipole and quarter-wave monopole lengths and a quarter wavelength of cable, from the frequency, shortening and velocity factors.

Method: Free-space wavelength and resonant wire antennas

Input parameters

Unit system: SI

Parameter	Value	Unit
Frequency	433.00	MHz
End-effect shortening factor of the wire (about 0.95)	0.95000	
Velocity factor of the feed cable	0.66000	

Calculated results

Parameter	Value	Unit
Free-space wavelength	692.36	mm
Half-wave dipole tip-to-tip length	328.87	mm
Quarter-wave monopole (whip) length	164.44	mm
Electrical quarter wavelength in the cable	114.24	mm
Period	2.3095e-09	s

Notes for this case

• λ = c/f. Thin-wire dipoles resonate about 5 % shorter than λ/2 because of end effects; thicker elements need more shortening. The cable quarter wavelength uses the cable's velocity factor.

Formula and method

$$\lambda_0 = \frac{c}{f}, \quad L_{dipole} = k\frac{\lambda_0}{2}, \quad L_{mono} = k\frac{\lambda_0}{4}, \quad L_{\lambda/4,cable} = VF\frac{\lambda_0}{4}$$

Variables

f	Frequency	1/s
k	End-effect shortening factor of the wire (about 0.95)	-
VF	Velocity factor of the feed cable	-
λ_0	Free-space wavelength	m
L_{dipole}	Half-wave dipole tip-to-tip length	m
L_{mono}	Quarter-wave monopole (whip) length	m
$L_{\lambda/4,cable}$	Electrical quarter wavelength in the cable	m
T	Period	s

Method and standards

Wavelength and resonant antenna lengths.

Assumptions and limits

- Thin wire in free space; resonance near the stated factor.

References

Free-space wavelength and resonant wire antennas

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/electronics/antenna-wavelength-dipole

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.