

 Impedanz verschiedener Dipole des Durchmessers d, ungeradzahligter Vielfacher von Lambda/2 in
 Seewasser, sinusförmige Stromverteilung

- `reset():digits:=16:d:=1/1000:ZF0:=120*PI:ur:=0.999991:er:=81:lambda:=1:`

BALANIS-Funktionen

- `Z_Re:=(k)->ZF0*sqrt(ur/er)/(2*PI)*(EULER+ln(2*PI*k)-
 Ci(2*PI*k)+1/2*sin(2*PI*k)*(Si(4*PI*k)-
 2*Si(2*PI*k))+1/2*cos(2*PI*k)*(EULER+ln(PI*k)+Ci(4*PI*k)-
 2*Ci(2*PI*k))):`
- `Z_Im:=(k)-
 >ZF0*sqrt(ur/er)/(4*PI)*(2*Si(2*PI*k)+cos(2*PI*k)*(2*Si(2*PI*k)-
 Si(4*PI*k))-sin(2*PI*k)*(2*Ci(2*PI*k)-Ci(4*PI*k)-
 Ci(2*2*PI*d^2/4/k*(ur*er)/lambda^2))):`
- `m:=[(2*i-1)/2 $ i=1..10];`

$$\left[\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{7}{2}, \frac{9}{2}, \frac{11}{2}, \frac{13}{2}, \frac{15}{2}, \frac{17}{2}, \frac{19}{2} \right]$$
- `for i from 1 to 10 do
 Z[i]:=[op(m,i),float(Z_Re(op(m,i))+I*Z_Im(op(m,i)))]:
 end_for:`

Dipol-Impedanzen für l/Lambda laut Liste m

- `Z;`

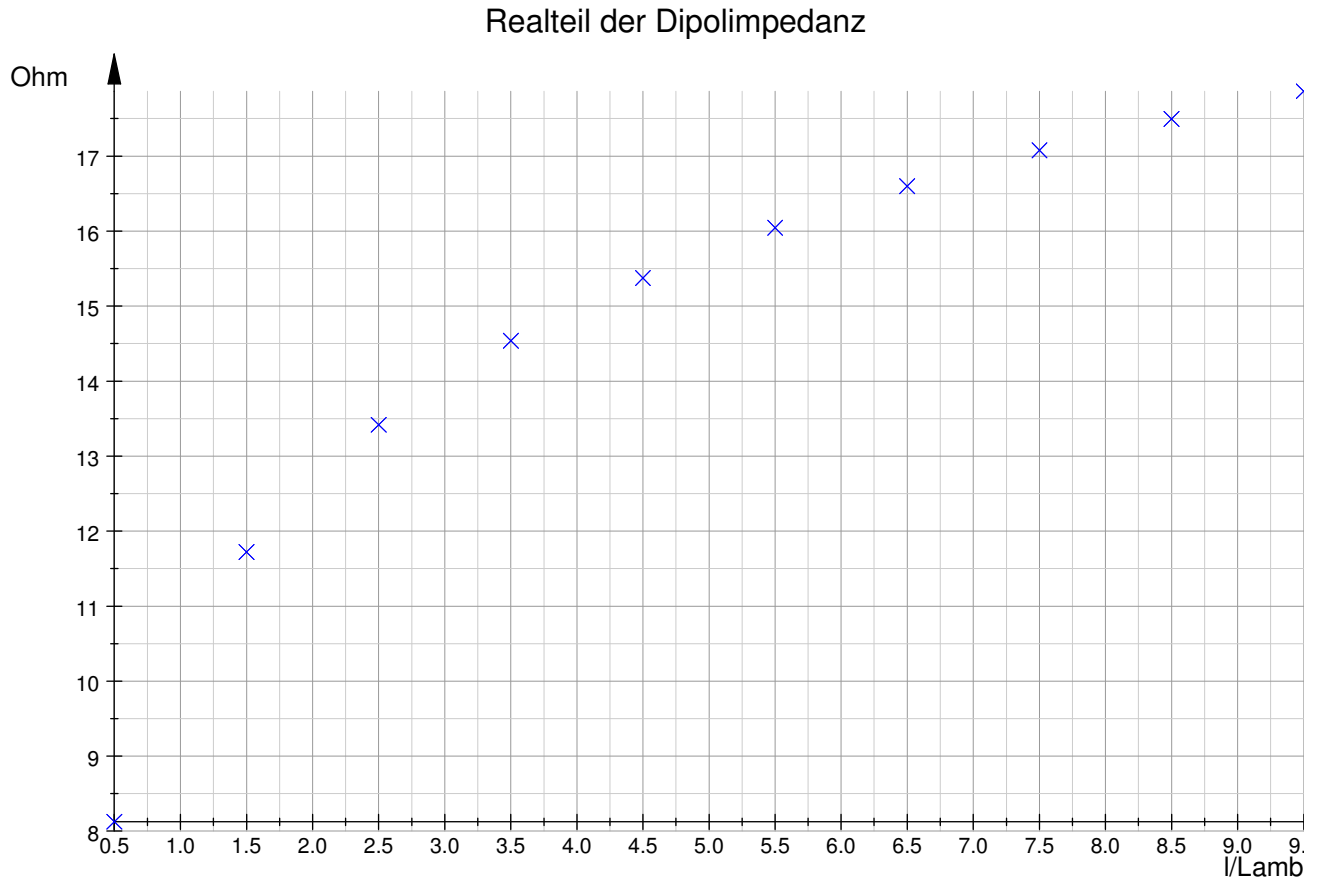
$$\left[\begin{array}{l} 1 = \left[\frac{1}{2}, 8.125474745 + 4.727150648 \cdot i \right] \\ 2 = \left[\frac{3}{2}, 11.72152851 + 5.060090434 \cdot i \right] \\ 3 = \left[\frac{5}{2}, 13.418399 + 5.130073846 \cdot i \right] \\ 4 = \left[\frac{7}{2}, 14.5383287 + 5.160254344 \cdot i \right] \\ 5 = \left[\frac{9}{2}, 15.37536248 + 5.177055387 \cdot i \right] \\ 6 = \left[\frac{11}{2}, 16.04391808 + 5.187755782 \cdot i \right] \\ 7 = \left[\frac{13}{2}, 16.60056476 + 5.195167629 \cdot i \right] \\ 8 = \left[\frac{15}{2}, 17.07744127 + 5.200604541 \cdot i \right] \\ 9 = \left[\frac{17}{2}, 17.49456687 + 5.204762948 \cdot i \right] \\ 10 = \left[\frac{19}{2}, 17.8652591 + 5.208046315 \cdot i \right] \end{array} \right.$$

- `Liste:=[[op(Z[i],1),Re(op(Z[i],2)),RGB::Blue] $ i=1..10]:`
- `plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2,`

```

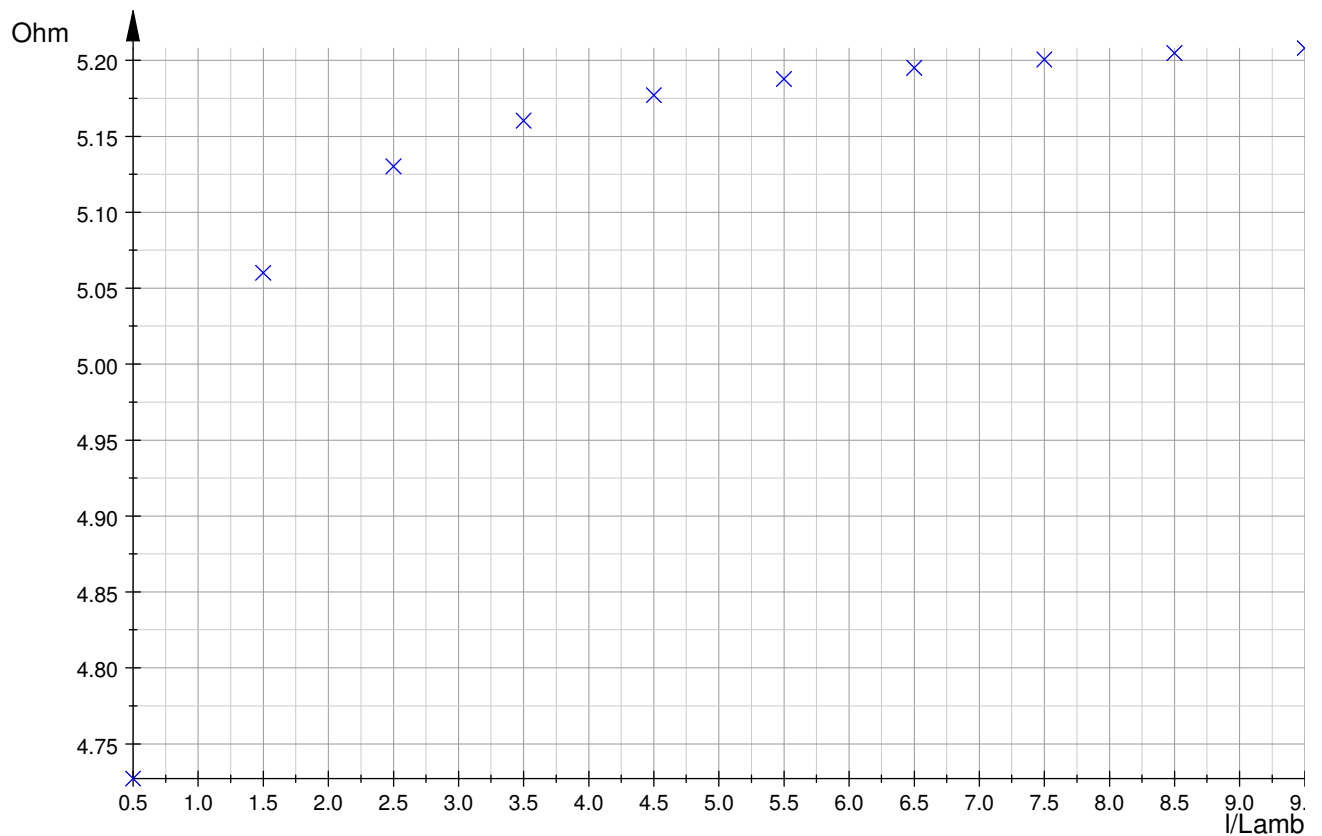
Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE,
      Scaling=Unconstrained,
AxesTitles=["l/Lambda", "Ohm"], Height=120*unit::mm,
Width=180*unit::mm, Header="Realteil der Dipolimpedanz"):

```



- `Liste:=[[op(Z[i],1),Im(op(Z[i],2)),RGB::Blue] $ i=1..10]:`
- `plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2, Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE, Scaling=Unconstrained, AxesTitles=["l/Lambda", "Ohm"], Height=120*unit::mm, Width=180*unit::mm, Header="Imaginärteil der Dipolimpedanz")):`

Imaginärteil der Dipolimpedanz



Impedanz verschiedener Dipole des Durchmessers d , geradzahliges Vielfaches von $\lambda/2$ in Seewasser, sinusförmige Stromverteilung

- `m:=[i $ i=1..10];`
`[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]`
- `for i from 1 to 10 do`
`Z[i]:=[op(m,i), float(Z_Re(op(m,i))+I*Z_Im(op(m,i)))]:`
`end_for:`

Dipol-Impedanzen für l/λ laut Liste `m`

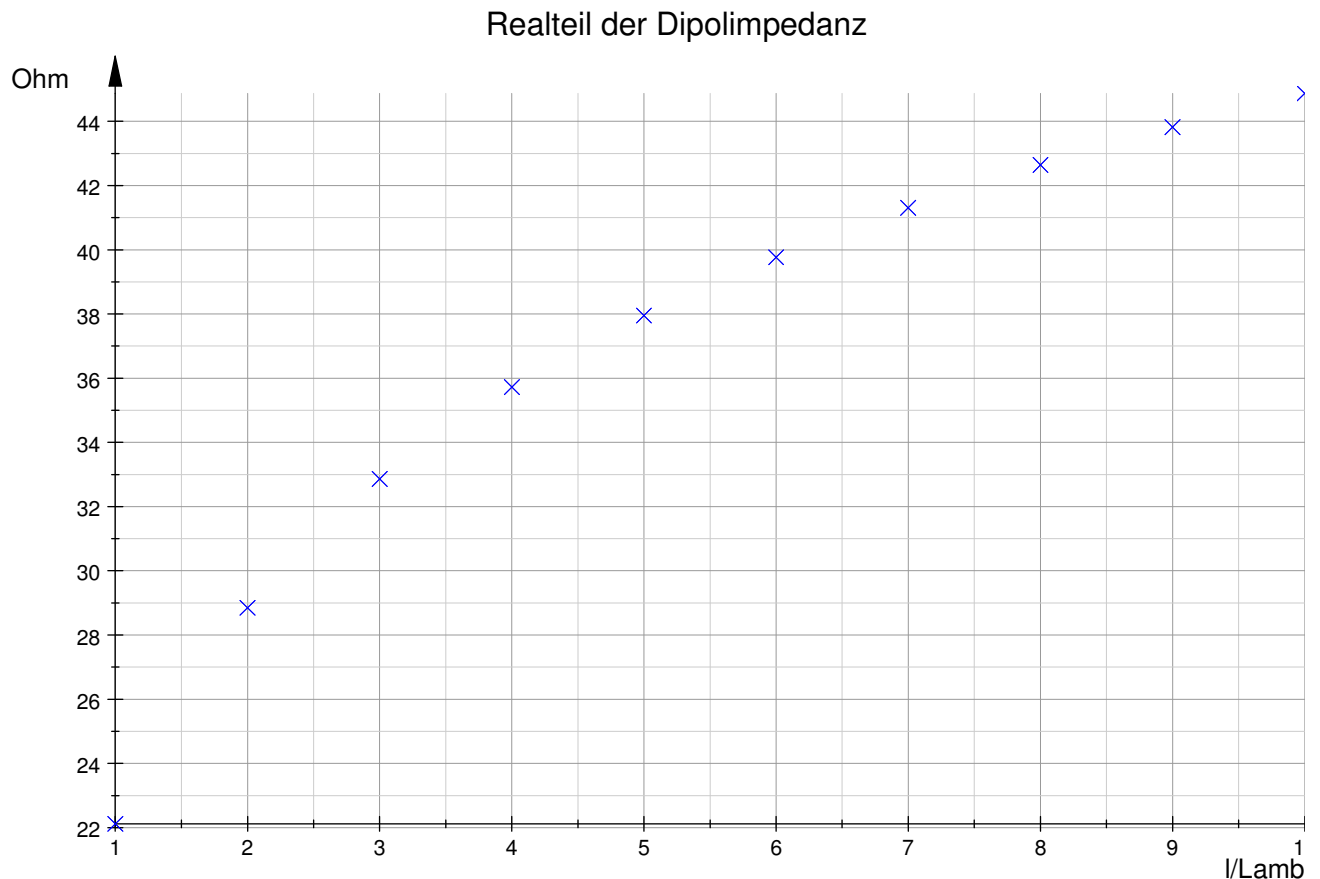
- `Z;`

```

1 = [1, 22.12075719 + 13.93475422 · i]
2 = [2, 28.84810538 + 14.79164549 · i]
3 = [3, 32.86100087 + 15.09269316 · i]
4 = [4, 35.72281743 + 15.24528975 · i]
5 = [5, 37.94712176 + 15.33746664 · i]
6 = [6, 39.76660925 + 15.3989041 · i]
7 = [7, 41.30579331 + 15.44293727 · i]
8 = [8, 42.63959533 + 15.4759951 · i]
9 = [9, 43.81638741 + 15.50172575 · i]
10 = [10, 44.86968383 + 15.52187315 · i]

```

- `Liste:=[[op(Z[i],1),Re(op(Z[i],2)),RGB::Blue] $ i=1..10]:`
- `plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2, Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE, Scaling=Unconstrained, AxesTitles=["l/Lambda", "Ohm"]), Height=120*unit::mm, Width=180*unit::mm, Header="Realteil der Dipolimpedanz"):`



- `Liste:=[[op(Z[i],1),Im(op(Z[i],2)),RGB::Blue] $ i=1..10]:`
- `plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2, Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE,`

```
Scaling=Unconstrained,  
AxesTitles=["l/Lambda", "Ohm"]), Height=120*unit::mm,  
Width=180*unit::mm, Header="Imaginärteil der Dipolimpedanz"):
```

Imaginärteil der Dipolimpedanz

