Attenuation[0.025, 0.025, 0.1 / 1000, 1.9 * 10^9, 420]

b

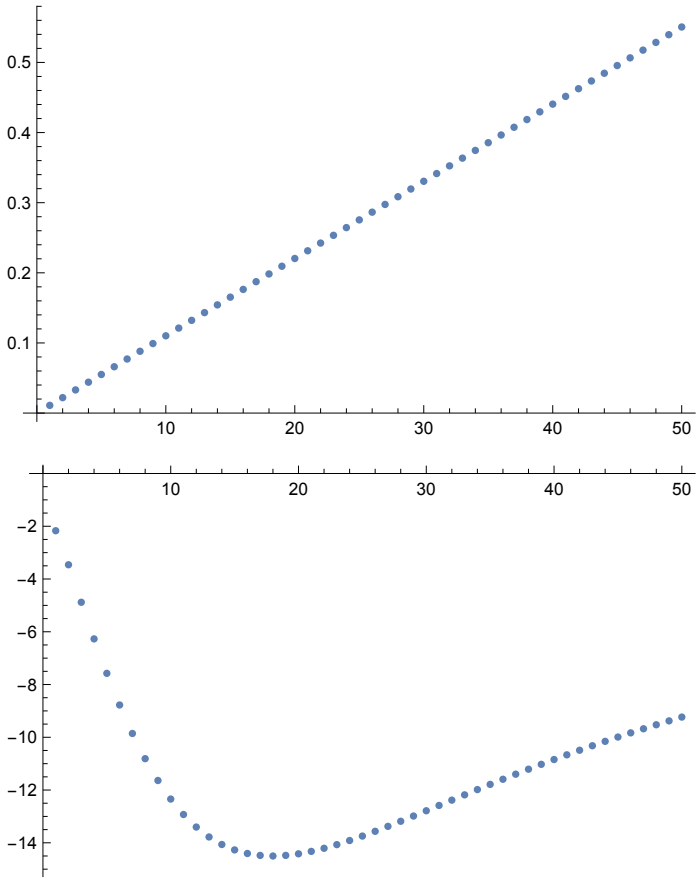
```
((0.0791762 - 0.0211136 i) BesselJ[1,
    0.025 √(1583.52 (-Sin[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
          Sin[VegetationAtten`Private`thetai] + Sin[VegetationAtten`Private`alpha -
            VegetationAtten`Private`phis] × Sin[VegetationAtten`Private`thetas])^2 +
       (Cos[39.7935 VegetationAtten`Private`beta (Cos[VegetationAtten`Private`alpha -
              VegetationAtten`Private`phii] × Sin[VegetationAtten`Private`thetai] -
            Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phis] ×
             Sin[VegetationAtten`Private`thetas])] + Sin[
          39.7935 VegetationAtten`Private`beta (Cos[VegetationAtten`Private`thetai] +
            Cos[VegetationAtten`Private`thetas])])^2)]
  (-0.00312567 Cos[ArcCos[(Cos[VegetationAtten`Private`thetai] ×
          Sin[VegetationAtten`Private`beta] + Cos[VegetationAtten`Private`beta] ×
          Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
          Sin[VegetationAtten`Private`thetai]) /
        (√(1 - (-Cos[VegetationAtten`Private`beta] × Cos[
              VegetationAtten`Private`thetai] + Cos[VegetationAtten`Private`alpha -
               VegetationAtten`Private`phii] × Sin[VegetationAtten`Private`beta] ×
             Sin[VegetationAtten`Private`thetai])^2))] - ArcCos[
      (-Cos[VegetationAtten`Private`thetas] × Sin[VegetationAtten`Private`beta] +
        Cos[VegetationAtten`Private`beta] × Cos[VegetationAtten`Private`alpha -
          VegetationAtten`Private`phis] × Sin[VegetationAtten`Private`thetas]) /
       (√(1 - (Cos[VegetationAtten`Private`beta] × Cos[
              VegetationAtten`Private`thetas] + Cos[VegetationAtten`Private`alpha -
               VegetationAtten`Private`phis] × Sin[VegetationAtten`Private`beta] ×
             Sin[VegetationAtten`Private`thetas])^2))]]
    (Cos[VegetationAtten`Private`beta] × Cos[VegetationAtten`Private`thetai] -
      Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
       Sin[VegetationAtten`Private`beta] ×
       Sin[VegetationAtten`Private`thetai])
    (-Cos[VegetationAtten`Private`beta] × Cos[VegetationAtten`Private`thetas] -
      Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phis] ×
       Sin[VegetationAtten`Private`beta] ×
       Sin[VegetationAtten`Private`thetas]) + 0.993749
    √(1 - (Cos[VegetationAtten`Private`beta] × Cos[VegetationAtten`Private`thetai] -
        Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
         Sin[VegetationAtten`Private`beta] × Sin[VegetationAtten`Private`thetai])^2)
    √(1 - (-Cos[VegetationAtten`Private`beta] × Cos[VegetationAtten`Private`thetas] -
        Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phis] × Sin[
          VegetationAtten`Private`beta] × Sin[VegetationAtten`Private`thetas])^2)) /
 (√(1583.52 (-Sin[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
        Sin[VegetationAtten`Private`thetai] +
       Sin[VegetationAtten`Private`alpha - VegetationAtten`Private`phis] ×
        Sin[VegetationAtten`Private`thetas])^2 +
```

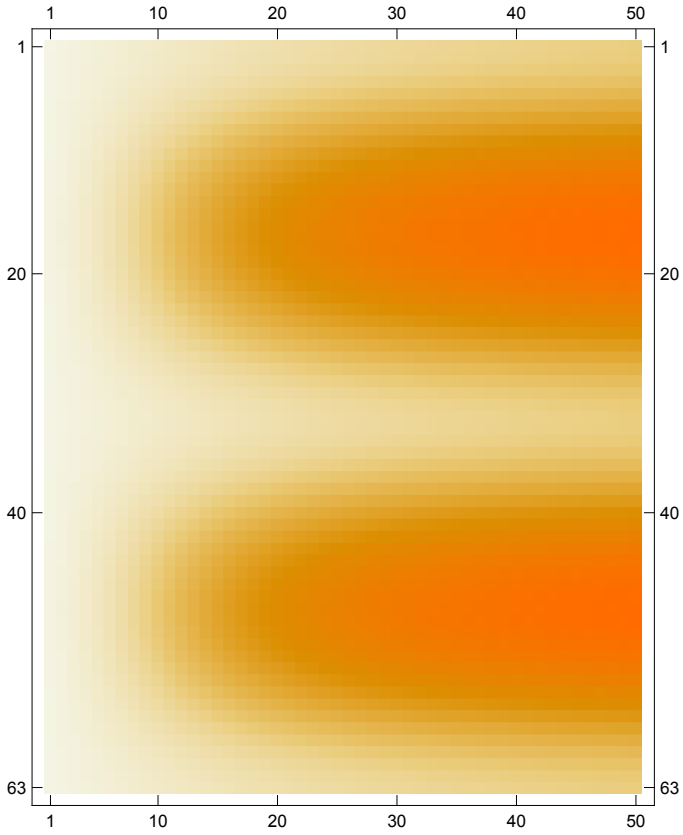
```
      (Cos[39.7935 VegetationAtten`Private`beta (Cos[VegetationAtten`Private`alpha -
                  VegetationAtten`Private`phii] × Sin[VegetationAtten`Private`thetai] -
              Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phis] ×
               Sin[VegetationAtten`Private`thetas])] +
          Sin[39.7935 VegetationAtten`Private`beta (Cos[VegetationAtten`Private`thetai] +
              Cos[VegetationAtten`Private`thetas])]^2))
 (Cos[VegetationAtten`Private`alpha] ×
    Sin[VegetationAtten`Private`beta] ((0. + 0. i) - (3.09324 × 10^-6 - 8.24863 × 10^-7 i)
       Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta]) -
   Cos[VegetationAtten`Private`beta] ((0. + 0. i) - (0.000989625 - 0.0002639 i)
       Cos[VegetationAtten`Private`beta] (-0.00312567 Sin[VegetationAtten`Private`alpha]^2
          Sin[VegetationAtten`Private`beta]^2 + 0.993749 (1 -
             Sin[VegetationAtten`Private`alpha]^2 Sin[VegetationAtten`Private`beta]^2)))) /
 (Sqrt[(Cos[VegetationAtten`Private`beta]^2 + Cos[VegetationAtten`Private`alpha]^2
       Sin[VegetationAtten`Private`beta]^2)^2])
-0.314391
```

ClearAll[beta, alpha]

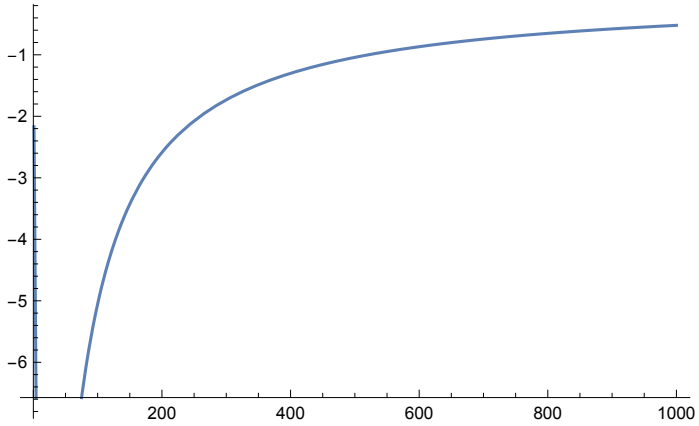
```
epsilonb = 28 - I * 7;
epsilonl[f_] := 3.1686 + (28.938 / (1 + I * (f / 10^9) / 18)) - I * (0.5672 / (f / 10^9));
start = 1 * 10^9;
end = 30 * 10^9;
step = 1 * 10^9;
arr = Table[Attenuation[0.114, 0.114, 1.31, i, epsilonb, Pi / 2, Pi / 2, 0.013],
    {i, start, end, step}] + Table[Attenuation[0.06, 0.06, 0.99,
     i, epsilonb, Pi / 2, Pi / 2, 0.073], {i, start, end, step}] +
  Table[Attenuation[0.028, 0.028, 0.82, i, epsilonb, Pi / 2, Pi / 2, 0.041],
    {i, start, end, step}] + Table[Attenuation[0.007, 0.007,
     0.54, i, epsilonb, Pi / 2, Pi / 2, 5.1], {i, start, end, step}] +
  Table[Attenuation[0.002, 0.002, 0.12, i, epsilonb, Pi / 2, Pi / 2, 56],
    {i, start, end, step}] + Table[Attenuation[0.037, 0.037, 0.0002,
     i, epsilonl[i], Pi / 2, Pi / 2, 0.013], {i, start, end, step}]

mat = Table[Attenuation[0.114, 0.114, 1.31, i, epsilonb, angle, Pi / 2, 0.013],
     {angle, 0, 2 * Pi, .1}, {i, start, end, step}] +
    Table[Attenuation[0.06, 0.06, 0.99, i, epsilonb, angle, Pi / 2, 0.073],
     {angle, 0, 2 * Pi, .1}, {i, start, end, step}] +
    Table[Attenuation[0.028, 0.028, 0.82, i, epsilonb, angle, Pi / 2, 0.041],
     {angle, 0, 2 * Pi, .1}, {i, start, end, step}] +
    Table[Attenuation[0.007, 0.007, 0.54, i, epsilonb, angle, Pi / 2, 5.1],
     {angle, 0, 2 * Pi, .1}, {i, start, end, step}] +
    Table[Attenuation[0.002, 0.002, 0.12, i, epsilonb, angle, Pi / 2, 56],
     {angle, 0, 2 * Pi, .1}, {i, start, end, step}] +
    Table[Attenuation[0.037, 0.037, 0.0002, i, epsilonl[i], angle, Pi / 2, 420],
     {angle, 0, 2 * Pi, .1}, {i, start, end, step}];
ListPlot[arr]
leafEpsilons = Table[Im[epsilonl[i]], {i, start, end, step}];
ListPlot[leafEpsilons]
MatrixPlot[mat]
```

```
{0.0109979, 0.0220004, 0.0330083, 0.0440212, 0.0550384, 0.0660592, 0.0770828,
 0.0881085, 0.0991356, 0.110163, 0.121191, 0.132219, 0.143246, 0.154273,
 0.165298, 0.176321, 0.187344, 0.198365, 0.209384, 0.220402, 0.231419,
 0.242434, 0.253448, 0.264461, 0.275472, 0.286483, 0.297492, 0.3085, 0.319508,
 0.330514, 0.34152, 0.352525, 0.36353, 0.374533, 0.385537, 0.396539,
 0.407541, 0.418543, 0.429544, 0.440545, 0.451545, 0.462545, 0.473545,
 0.484544, 0.495543, 0.506542, 0.51754, 0.528539, 0.539537, 0.550535}
```


0.5
0.4
0.3
0.2
0.1
10
20
30
40
50
10
20
30
40
50
−2
−4
−6
−8
−10
−12
−14



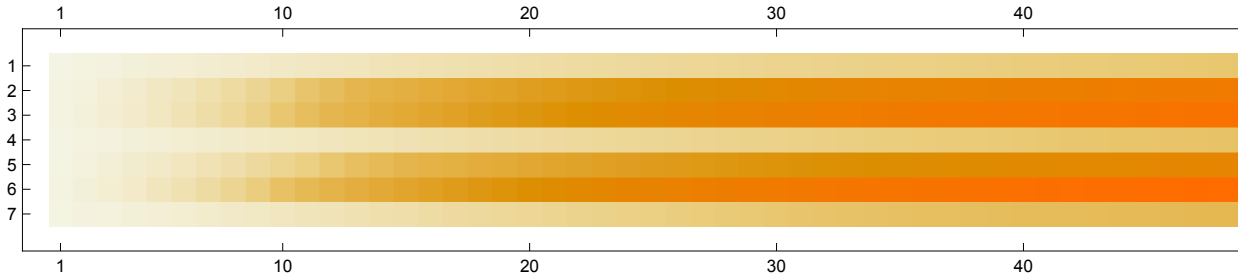

```
Plot[Im[epsilonl[f]], {f, 1, 1000}]
```




```
epsilonl[2 * 10^9]
```

```
31.7537 - 3.45972 i
```

```
MatrixPlot[mat]
```




```
Attenuation[0.037, 0.037, 0.0002, 1.9 * 10^9, epsilonl[1.9 * 10^9], Pi / 2, Pi / 2, 420]
```

```
(-Sin[VegetationAtten`Private`beta] ×
    Sin[VegetationAtten`Private`alpha - VegetationAtten`Private`phii]
    ((0. + 0. i) + (0.0000187576 - 2.02239 × 10^-6 i) Sin[VegetationAtten`Private`beta] ×
       Sin[VegetationAtten`Private`alpha - VegetationAtten`Private`phii]) +
   (-Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
       Cos[VegetationAtten`Private`thetai] × Sin[VegetationAtten`Private`beta] -
      Cos[VegetationAtten`Private`beta] × Sin[VegetationAtten`Private`thetai])
    ((0. + 0. i) + (0.00444877 - 0.000479652 i)
       (-Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
          Cos[VegetationAtten`Private`thetai] × Sin[VegetationAtten`Private`beta] -
         Cos[VegetationAtten`Private`beta] × Sin[VegetationAtten`Private`thetai])
       (-0.00421636 (Cos[VegetationAtten`Private`beta] × Cos[
                VegetationAtten`Private`thetai] - Cos[VegetationAtten`Private`alpha -
                 VegetationAtten`Private`phii] × Sin[VegetationAtten`Private`beta] ×
               Sin[VegetationAtten`Private`thetai])^2 + 0.991567
          (1 - (Cos[VegetationAtten`Private`beta] × Cos[VegetationAtten`Private`thetai] -
                Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
                 Sin[VegetationAtten`Private`beta] ×
                 Sin[VegetationAtten`Private`thetai])^2))))) /
  (√((Sin[VegetationAtten`Private`beta]^2 Sin[VegetationAtten`Private`alpha -
           VegetationAtten`Private`phii]^2 +
       (-Cos[VegetationAtten`Private`alpha - VegetationAtten`Private`phii] ×
          Cos[VegetationAtten`Private`thetai] × Sin[VegetationAtten`Private`beta] -
         Cos[VegetationAtten`Private`beta] × Sin[VegetationAtten`Private`thetai])^2)^2))

--

(Cos[VegetationAtten`Private`alpha] ×
    Sin[VegetationAtten`Private`beta] ((0. + 0. i) - (0.0000187576 - 2.02239 × 10^-6 i)
       Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta]) -
   Cos[VegetationAtten`Private`beta] ((0. + 0. i) - (0.00444877 - 0.000479652 i)
       Cos[VegetationAtten`Private`beta] (-0.00421636 Sin[VegetationAtten`Private`alpha]^2
          Sin[VegetationAtten`Private`beta]^2 + 0.991567 (1 -
            Sin[VegetationAtten`Private`alpha]^2 Sin[VegetationAtten`Private`beta]^2)))) /
  (√((Cos[VegetationAtten`Private`beta]^2 + Cos[VegetationAtten`Private`alpha]^2
       Sin[VegetationAtten`Private`beta]^2)^2))
```

0.568898

Sin[1]

```
Sin[1]
```

```
Table[{i, angle}, {i, 0, 10}, {angle, 0, Pi, 1}]
```

```
{{{0, 0}, {0, 1}, {0, 2}, {0, 3}},
 {{1, 0}, {1, 1}, {1, 2}, {1, 3}}, {{2, 0}, {2, 1}, {2, 2}, {2, 3}},
 {{3, 0}, {3, 1}, {3, 2}, {3, 3}}, {{4, 0}, {4, 1}, {4, 2}, {4, 3}},
 {{5, 0}, {5, 1}, {5, 2}, {5, 3}}, {{6, 0}, {6, 1}, {6, 2}, {6, 3}},
 {{7, 0}, {7, 1}, {7, 2}, {7, 3}}, {{8, 0}, {8, 1}, {8, 2}, {8, 3}},
 {{9, 0}, {9, 1}, {9, 2}, {9, 3}}, {{10, 0}, {10, 1}, {10, 2}, {10, 3}}}
```

```
Table[Attenuation[0.114, 0.114, 1.31,
  1.9 * 10^9, epsilonb, angle, 2 * Pi, 0.013], {angle, 0, Pi, 1}]
Sin[Pi / 8]
```

```
--
```

```
0
```

```
(-Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta]
    ((0. + 0. i) - (0.00287799 - 0.000746146 i) Cos[VegetationAtten`Private`alpha]
       ((-0.508031 + 0.00592524 i) Cos[VegetationAtten`Private`beta]^2 -
          (0.0160619 - 0.0118505 i) (1 - Cos[VegetationAtten`Private`beta]^2))
       Sin[VegetationAtten`Private`beta]) - Sin[VegetationAtten`Private`alpha] ×
    Sin[VegetationAtten`Private`beta] ((0. + 0. i) + (0.00145769 - 0.000396118 i)
       Sin[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])) /
 (√(Cos[VegetationAtten`Private`alpha]^2 Sin[VegetationAtten`Private`beta]^2 +
     Sin[VegetationAtten`Private`alpha]^2 Sin[VegetationAtten`Private`beta]^2)^2)
```

```
-0.0000373838 + 0.0000460901 i
```

```
--
```

```
1
```

```
(-Sin[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta]
    ((0. + 0. i) + (0.00145769 - 0.000396118 i) Sin[VegetationAtten`Private`alpha] ×
       Sin[VegetationAtten`Private`beta]) + (-Cos[VegetationAtten`Private`beta] × Sin[1] -
      Cos[1] × Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])
    ((0. + 0. i) + (0.00287799 - 0.000746146 i) (-Cos[VegetationAtten`Private`beta] × Sin[1] -
         Cos[1] × Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])
       ((-0.508031 + 0.00592524 i) (Cos[1] × Cos[VegetationAtten`Private`beta] -
            Cos[VegetationAtten`Private`alpha] × Sin[1] × Sin[
              VegetationAtten`Private`beta])^2 - (0.0160619 - 0.0118505 i) (1 - (Cos[1] ×
             Cos[VegetationAtten`Private`beta] - Cos[VegetationAtten`Private`alpha] ×
             Sin[1] × Sin[VegetationAtten`Private`beta])^2)))) /
 (√(Sin[VegetationAtten`Private`alpha]^2 Sin[VegetationAtten`Private`beta]^2 +
     (-Cos[VegetationAtten`Private`beta] × Sin[1] - Cos[1] ×
        Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])^2)^2)
```

```
-0.00104306 + 0.000293935 i
```

```
--
2
(-Sin[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta]
    ((0. + 0. i) + (0.00145769 - 0.000396118 i) Sin[VegetationAtten`Private`alpha] ×
       Sin[VegetationAtten`Private`beta]) + (-Cos[VegetationAtten`Private`beta] × Sin[2] -
      Cos[2] × Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])
    ((0. + 0. i) + (0.00287799 - 0.000746146 i) (-Cos[VegetationAtten`Private`beta] × Sin[2] -
         Cos[2] × Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])
       ((-0.508031 + 0.00592524 i) (Cos[2] × Cos[VegetationAtten`Private`beta] -
            Cos[VegetationAtten`Private`alpha] × Sin[2] × Sin[
              VegetationAtten`Private`beta])^2 - (0.0160619 - 0.0118505 i) (1 - (Cos[2] ×
             Cos[VegetationAtten`Private`beta] - Cos[VegetationAtten`Private`alpha] ×
             Sin[2] × Sin[VegetationAtten`Private`beta])^2)))) /
 (√((Sin[VegetationAtten`Private`alpha]^2 Sin[VegetationAtten`Private`beta]^2 +
      (-Cos[VegetationAtten`Private`beta] × Sin[2] - Cos[2] ×
          Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])^2)^2))
-0.00121172 + 0.000335501 i
--
3
(-Sin[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta]
    ((0. + 0. i) + (0.00145769 - 0.000396118 i) Sin[VegetationAtten`Private`alpha] ×
       Sin[VegetationAtten`Private`beta]) + (-Cos[VegetationAtten`Private`beta] × Sin[3] -
      Cos[3] × Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])
    ((0. + 0. i) + (0.00287799 - 0.000746146 i) (-Cos[VegetationAtten`Private`beta] × Sin[3] -
         Cos[3] × Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])
       ((-0.508031 + 0.00592524 i) (Cos[3] × Cos[VegetationAtten`Private`beta] -
            Cos[VegetationAtten`Private`alpha] × Sin[3] × Sin[
              VegetationAtten`Private`beta])^2 - (0.0160619 - 0.0118505 i) (1 - (Cos[3] ×
             Cos[VegetationAtten`Private`beta] - Cos[VegetationAtten`Private`alpha] ×
             Sin[3] × Sin[VegetationAtten`Private`beta])^2)))) /
 (√((Sin[VegetationAtten`Private`alpha]^2 Sin[VegetationAtten`Private`beta]^2 +
      (-Cos[VegetationAtten`Private`beta] × Sin[3] - Cos[3] ×
          Cos[VegetationAtten`Private`alpha] × Sin[VegetationAtten`Private`beta])^2)^2))
-0.000065669 + 0.0000530609 i
{0.0000313042, 0.0000313042, 0.0000313042, 0.0000313042}
Sin[π/8]
```

```
$ContextPath
```

```
{VegetationAtten`, NaturalLanguageLoader`, StreamingLoader`,
 SymbolicMachineLearningLoader`, NeuralNetworks`, IconizeLoader`,
 HTTPHandlingLoader`, PacletManager`, System`, Global`}
```

```
Attenuation[0.037, 0.037, 0.0002, 1.9 * 10 ^ 9, 31 - i * 8, 0, Pi / 4, 420]
```

```
--
```

```
0.156086
```

```
N[1 / 7]
```

```
0.142857
```

```
3.7 / 100
```

```
0.037
```

```
x ^ 2 + y ^ 2 /. x → 1 /. y → 2
```

```
5
```

```
N[Pi / 2]
```

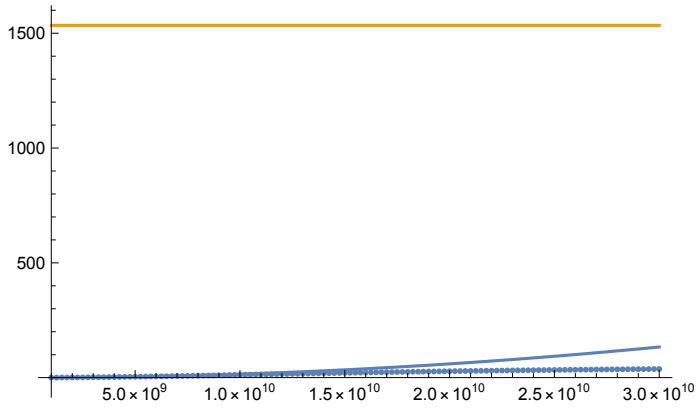
```
1.5708
```

```
epsilonb = 28 - I * 7;
epsilonl[f_] := 3.1686 + (28.938 / (1 + I * (f / 10 ^ 9) / 18)) - I * (0.5672 / (f / 10 ^ 9));
start = 1 * 10 ^ 9;
end = 30 * 10 ^ 9;
step = 0.25 * 10 ^ 9;
li =
  Table[{i, Attenuation[0.114, 0.114, 1.31, i, epsilonb, 0, Pi / 2, Pi / 4, 0.013] +
     Attenuation[0.06, 0.06, 0.99, i, epsilonb, 0, Pi / 2, Pi / 4, 0.073] +
     Attenuation[0.028, 0.028, 0.82, i, epsilonb, 0, Pi / 2, Pi / 2, 0.041] +
     Attenuation[0.007, 0.007, 0.54, i, epsilonb, 0, Pi / 2, Pi / 2, 5.1] +
     Attenuation[0.002, 0.002, 0.12, i, epsilonb, 0, Pi / 2, Pi / 2, 56] +
     Attenuation[0.037, 0.037, 0.0002, i, epsilonl[i], 0, Pi / 2, Pi / 2, 420]},
   {i, start, end, step}];
```

```
Clear[Attenuation]
```

```
fits = FindFormula[li, x, 1, "Error", PerformanceGoal → "Quality"]
Show[Plot[fits, {x, 1 * 10^9, 30 * 10^9}, PlotRange → All], ListPlot[li]]
```

$\{0.051166 + 1.01536 \times 10^{-10}\ x + 1.45033 \times 10^{-19}\ x^2,\ 1534.37\}$




```
nlm = NonlinearModelFit[li, a + Sin[x / c]^2, {a, b, c, d, e}, x]
nlm[{"BestFit", "ParameterTable"}]
Show[Plot[nlm[x], {x, 1 * 10^9, 30 * 10^9}], ListPlot[li]]
```

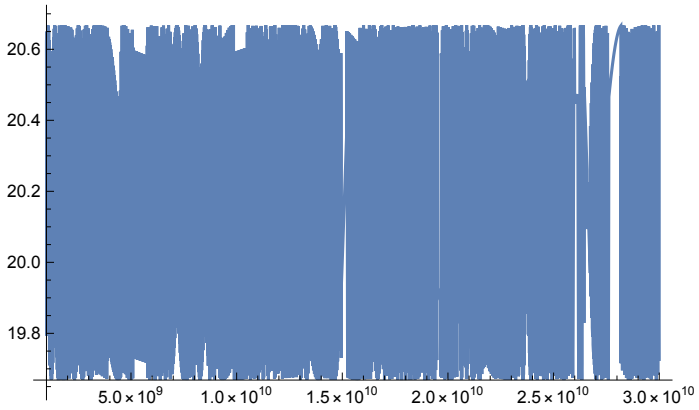
NonlinearModelFit : The step size in the search has become less than the tolerance prescribed by the PrecisionGoal option, but the gradient is larger than the tolerance specified by the AccuracyGoal option. There is a possibility that the method has stalled at a point that is not a local minimum.

FittedModel[$19.6684 + \sin[1.\ x]^2$]

$\{19.6684 + \sin[1.\ x]^2,$

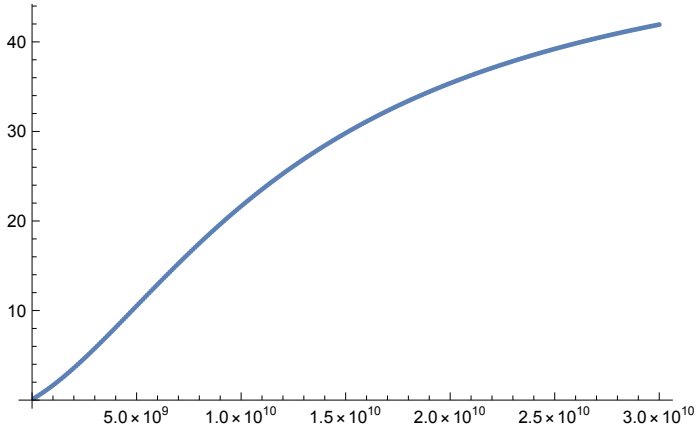
	Estimate	Standard Error	t-Statistic	P-Value
a	19.6684	1.13873	17.2722	2.31753×10^{-33}
b	1.	0.	∞	$0. \times 10^{-308}$
c	1.	9.09891×10^{-11}	1.09903×10^{10}	$1.094959412559185 \times 10^{-1011}$
d	1.	0.	∞	$0. \times 10^{-308}$
e	1.	0.	∞	$0. \times 10^{-308}$

$\}$



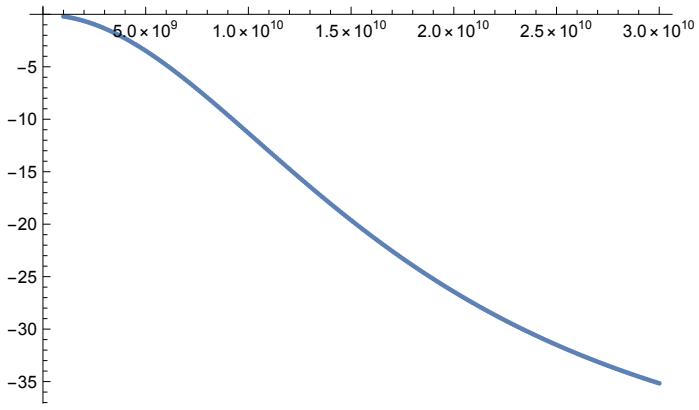

```
Clear[nlm]
```

```
epsilonb = 28 - I * 7;
epsilonl[f_] := 3.1686 + (28.938 / (1 + I * (f / 10^9) / 18)) - I * (0.5672 / (f / 10^9));
start = 0.1 * 10^9;
end = 30 * 10^9;
step = 1 * 10^8;
li = Table[{i,
    Attenuation[0.0025, 0.0025, 0.305, i, epsilonb, 0, Pi / 2, Pi / 2, 10] +
     Attenuation[0.015, 0.015, 2.6162, i, epsilonb, 0, Pi / 2, Pi / 4, 0.01] +
     Attenuation[0.0005, 0.0005, 0.09, i, epsilonb, 0, Pi / 2, Pi / 2, 56] +
     Attenuation[0.001, 0.001, 0.015, i, epsilonl[i], 0, Pi / 2, Pi / 2, 420]
   }
   , {i, start, end, step}];
ListPlot[li]
f = Interpolation[li]
```



InterpolatingFunction[Domain: {{1. ×10^8, 3. ×10^10}} Output: scalar]

```
ListPlot[li]
```



```
Attenuation[0.001, 0.001, 0.015,
 1.9 * 10 ^ 9, epsilonl[1.9 * 10 ^ 9], 0, Pi / 2, Pi / 2, 420]
```

1.74779

```
Sqrt[1 - (0.001 / 0.015) ^ 2]
```

0.997775

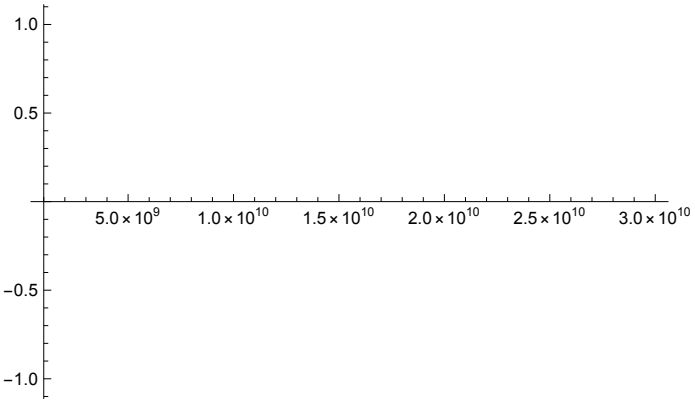
```
N[100 * (1 - 10 ^ (3.5 / 10))]
```

-123.872

```
f[2 * 10 ^ 9]
```

3.58942

```
Plot[f[x], {x, 1 * 10 ^ 9, 30 * 10 ^ 9}]
```



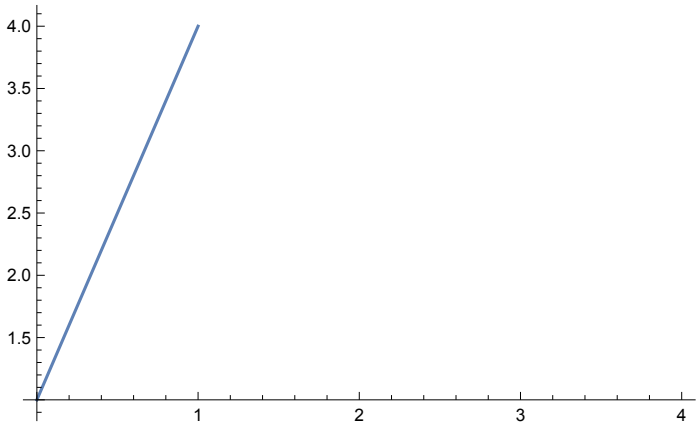

```
FourierSeries[Interpolation[li][x], x, 1]
```

FourierSeries[InterpolatingFunction[Domain: {{1. × 10^9, 3. × 10^10}} Output: scalar][x], x, 1]

```
b = BSplineFunction[{1, 2, 3, 4}]
b[1 * 10 ^ 9]
Plot[b[x], {x, 0, 4}]
```

BSplineFunction[Argument count: 1 Output: scalar]

BSplineFunction[Argument count: 1 Output: scalar][1 000 000 000]




```
li
```

```
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```

```
GeneralizedLinearModelFit[%130, {x}, {x}]
```

FittedModel[$5.53309 + 1.38657 \times 10^{-9} x$]

```
Transpose[%128]
```

```
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```

```
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Write[str, li]
Close[str]
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DeleteFile[str]
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DeleteFile : String or non −empty list of strings is expected at position 1 in DeleteFile [OutputStream [/var /folders /j5/zjbd __c92h76zqc6n0yw0msw0000gn /T/m000001447271 , 3]].

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DeleteFile[
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```
epsilonb = 28 - I * 7;
epsilonl[f_] := 3.1686 + (28.938 / (1 + I * (f / 10^9) / 18)) - I * (0.5672 / (f / 10^9));
start = 0.1 * 10^9;
end = 30 * 10^9;
step = 1 * 10^7;
pine = Table[{i,
    Attenuation[0.0025, 0.0025, 0.305, i, epsilonb, 0, Pi / 2, Pi / 2, 10] +
     Attenuation[0.015, 0.015, 2.6162, i, epsilonb, 0, Pi / 2, Pi / 4, 0.01] +
     Attenuation[0.0005, 0.0005, 0.09, i, epsilonb, 0, Pi / 2, Pi / 2, 56] +
     Attenuation[0.001, 0.001, 0.015, i, epsilonl[i], 0, Pi / 2, Pi / 2, 420]},
   {i, start, end, step}];
oak = Table[{i,
    Attenuation[0.114, 0.114, 1.31, i, epsilonb, 0, Pi / 2, Pi / 4, 0.013] +
     Attenuation[0.06, 0.06, 0.99, i, epsilonb, 0, Pi / 2, Pi / 4, 0.073] +
     Attenuation[0.028, 0.028, 0.82, i, epsilonb, 0, Pi / 2, Pi / 2, 0.041] +
     Attenuation[0.007, 0.007, 0.54, i, epsilonb, 0, Pi / 2, Pi / 2, 5.1] +
     Attenuation[0.002, 0.002, 0.12, i, epsilonb, 0, Pi / 2, Pi / 2, 56] +
     Attenuation[0.037, 0.037, 0.0002, i, epsilonl[i], 0, Pi / 2, Pi / 2, 420]},
   {i, start, end, step}];
Export["pine.txt", pine, "CSV"];
Export["oak.txt", oak, "CSV"];
```

```
Export["test.txt", pine, "CSV"]
```

```
test.txt
```

```
FindFile["test.txt"]
```

```
/Users/michaeldeleo/test.txt
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