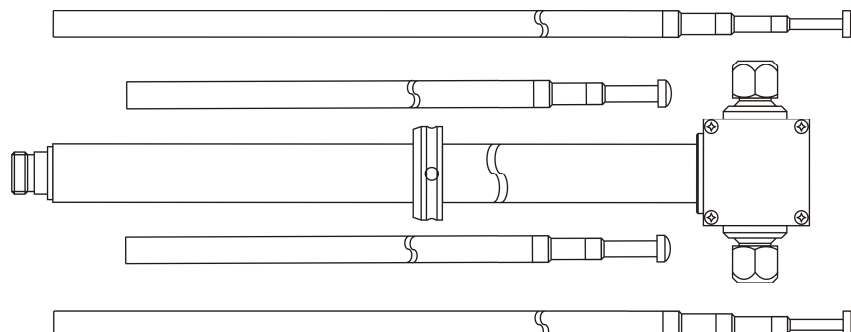


## Halbwellen - Messdipol Half - Wave Tuned Dipole Antenna



### Beschreibung:

Ein abgestimmter Halbwellen-Dipol gilt als Referenz für die Messung von Feldstärken und die Erzeugung definierter VHF-Felder. Durch die sehr weit gehende Definition aller Daten ist ein vielseitiger Einsatz in der HF-Technik gegeben.

Statt der zwei Satz ausziehbarer Teleskopstäbe können auch Bikonus-Elemente wie BBA 9106 oder BBAL 9136 bzw. Faltbikonus-Elemente FBAL 9178 oder FBAB 9177 verwendet werden. Die Verwendung der o.g. Konus-Elemente (bitte gesondert bestellen) erlaubt den breitbandigen Einsatz des 1:1-Baluns auch ohne frequenzabhängige Elementlängen-Anpassung.

Die Hauptanwendung der VHA 9103 ist die Emissionsmessung bei EMV-Messungen. Aufgrund der hohen Symmetrie, hochgenauer Kalibrierung, einer hervorragenden Verarbeitung und der geringen Verluste hat sich der VHA 9103 Balun in den letzten Jahrzehnten zu einem Marktführer entwickelt

Für die Erzeugung von Feldstärken für Immunitätsprüfungen sollten die 4:1 Halter / Baluns VHBA 9123 (50 W), VHBC 9133 (1 kW), VHBD 9134 (2.4 kW) oder VHBD 9134-4 (4 kW) verwendet werden, da diese bei tiefen Frequenzen wesentlich effektiver und belastbarer sind.

Zur Beurteilung der Eigenschaften des Messgeländes (normierte Felddämpfung) werden die Präzisionsdipole VHAP und UHAP empfohlen.

Wie die Mehrzahl der Schwarzbeck-Antennen wird die VHA 9103 an ihrem 22 mm Rohr mit Rastring befestigt, z.B. am Isolierstoff-Antennenwagen der zerlegbaren Antennen-Mastanlage Typ AM 9104. Der Rastring ermöglicht das Einrasten in vertikaler und horizontaler Dipollage.

### Description:

*A tuned Half-Wave Dipole Antenna is considered as a reference for the measurement of field strength and for the generation of defined VHF electromagnetic fields (up to 10 watts erp).*

*Instead of using 2 sets of telescopic elements, biconical elements like BBA 9106 or BBAL 9136 or collapsible biconical elements like FBAL 9178 or FBAB 9177 may be inserted. Thanks to the conical elements (order separately) the 1:1 Balun / Holder can be used as broadband antenna without a frequency dependent extension length adjustment*

*VHA 9103's main application is emission measurement at emc-tests. The high degree of symmetry, the accurate calibration data, an outstanding workmanship and low losses let VHA 9103 become a leading balun on the antenna market.*

*For the generation of high fieldstrengths we recommend to use the 4:1 baluns / holders VHBA 9123 (50 W), VHBC 9133 (1 kW) VHBD 9134 (2.4 kW) or VHBD 9134-4 (4 kW), they offering a superior effectivity and power rating, especially in the low frequency range.*

*The evaluation of test site performance (normalised site attenuation) should be done using the precision dipoles VHAP and UHAP.*

*Like most Schwarzbeck antennas VHA 9103 is mounted at its 22 mm tube with indexing ring for horizontal and vertical polarisation, e.g. when inserted in the movable antenna holding box of the detachable mast system model AM 9104 for antenna heights from 0.4 to 4 m.*

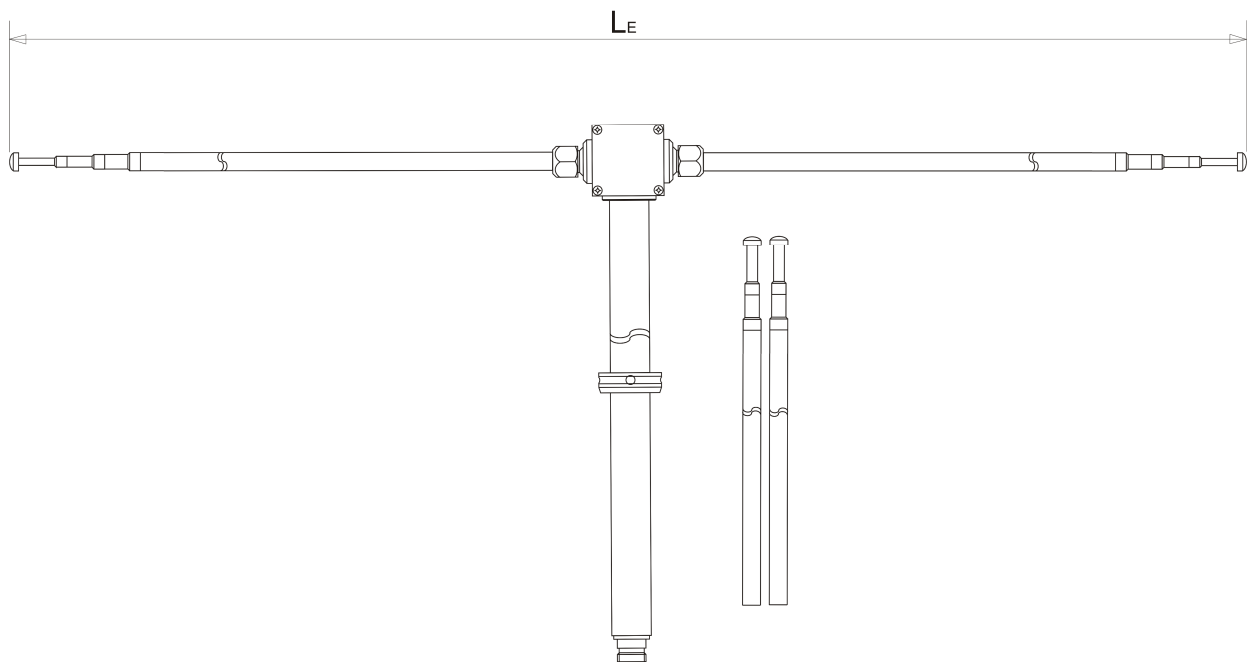
Am Ende des 22 mm Rohres ist eine Qualitäts-N-Buchse eingebaut. Dort wird im Regelfall das 10 m lange Koaxialkabel mit N-Steckern (Typ AK 9513) angeschlossen, dessen Dämpfungsverlauf über der Frequenz bekannt ist.

Der Halbwellendipol UHA 9105 stellt die Ergänzung der VHA im oberen Frequenzbereich (300-1000 MHz) dar.

*At the rear end of VHA 9103 a female N-connector of high quality provides contact to the 10 m long coaxial antenna cable AK 9513. The cable loss is documented for correcting field-strength or e.r.p. calculation.*

*The half-wave dipole UHA 9105 can be regarded as the frequency extension of VHA in the upper frequency range (300-1000 MHz).*

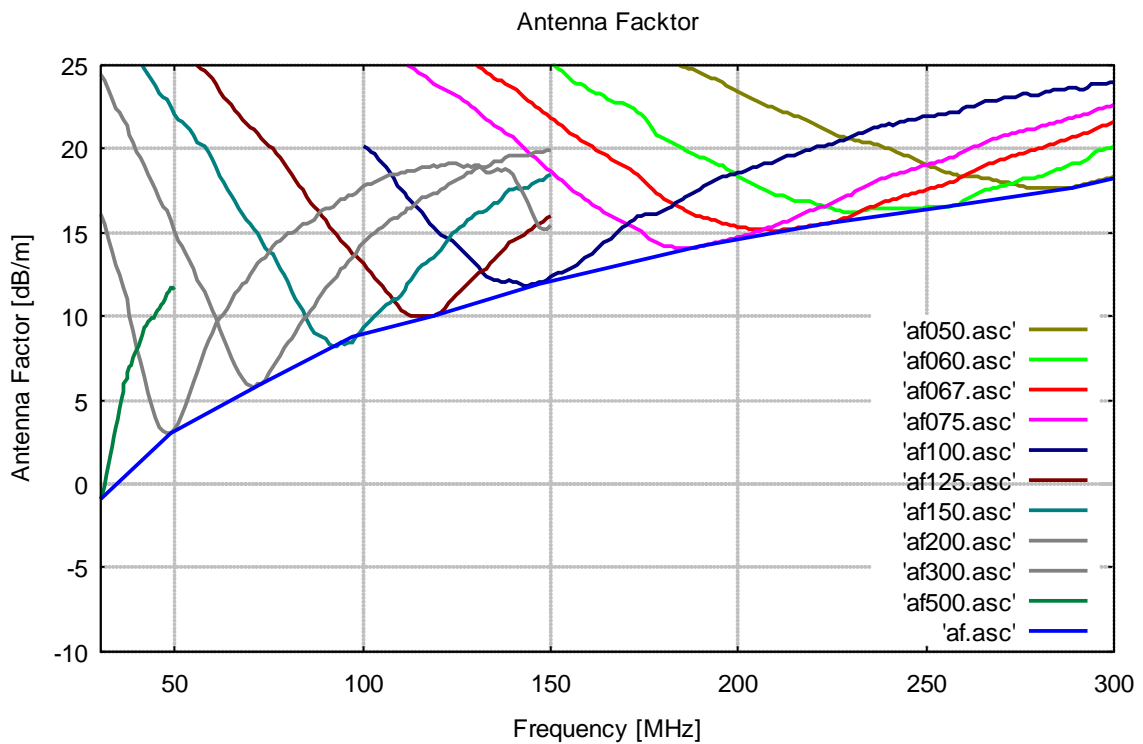
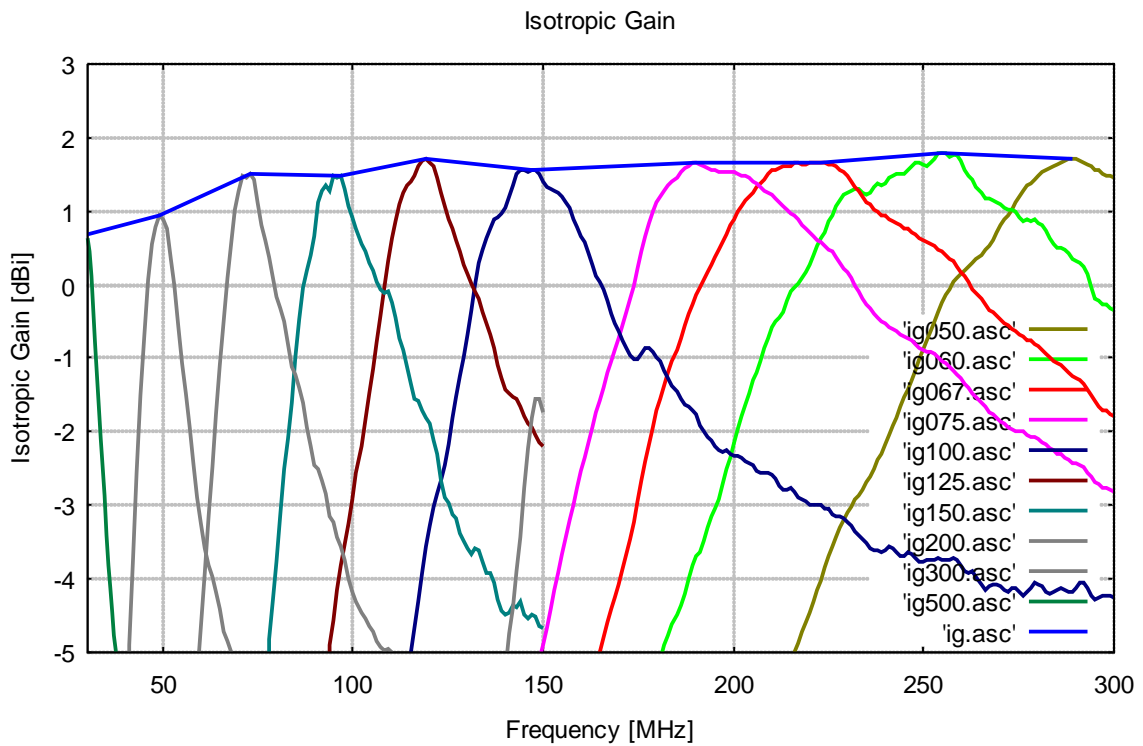
| Technische Daten:                          |                        | Specifications:                    |
|--|------------------------|------------------------------------|
| Frequenzbereich:                           | 30 - 300 MHz           | Frequency Range:                   |
| Bereich der Element-Auszugslängen:         | 0.485 / 5.00 m         | Dipole Element Extension range:    |
| Empfohlene Auszugslängen:                  | 0.47 ... 0.5 $\lambda$ | Recommended Extension length:      |
| Dämpfung der Halterung mit Sy.-Übertrager: | 0.25...0.6 dB          | Holder and Balun Attenuation:      |
| Antennenfaktoren an 50 $\Omega$            | -2.1... +18.2dB/m      | Antenna Factors acr. 50 $\Omega$ : |
| Antennengewinn über Isotropstrahler:       | typ.: +1.5 dBi         | Antenna Gain over Isotropic:       |
| Max. Belastbarkeit (Senden):               | 10 W                   | Max. Power rating:                 |
| 3-dB-Öffnungswinkel in E-Ebene:            | 78 °                   | Half Power Beamwidth, E-Plane:     |
| Länge:                                     | 530 mm                 | Length:                            |
| Gewicht:                                   | 930 g                  | Weight:                            |
| Anschluß:                                  | N - female             | Connector:                         |



| Elementlänge          | Halbwellenresonanz             | Frequenz des maximalen Gewinns   | Isotropgewinn         | Antennenfaktor        | Bandbreite bei 0.5 dB Gewinnreduktion   | Bandbreite bei 1 dB Gewinnreduktion   |
|-----------------------|--------------------------------|----------------------------------|-----------------------|-----------------------|---|---------------------------------------|
| <i>Element Length</i> | <i>Half-wave resonance</i>     | <i>Frequency of maximum gain</i> | <i>Isotropic Gain</i> | <i>Antenna Factor</i> | <i>Bandwidth with 0.5 dB gain decay</i> | <i>Bandwidth with 1 dB gain decay</i> |
| <b>L<sub>E</sub></b>  | <b>f<math>\lambda</math>/2</b> | <b>f g<sub>i,max</sub></b>       | <b>g<sub>i</sub></b>  | <b>AF</b>             | <b>B[-0.5 dB]</b>                       | <b>B[-1 dB]</b>                       |
| [m]                   | [MHz]                          | [MHz]                            | [dBi]                 | [dB/m]                | [MHz]                                   | [MHz]                                 |
| 5.00                  | 30                             | 29.50                            | 0.67                  | -1.05                 | 28.5 - 31                               | 28 - 31.5                             |
| 3.00                  | 50                             | 49.00                            | 0.95                  | 3.08                  | 47 - 51                                 | 46 - 53                               |
| 2.00                  | 75                             | 73.00                            | 1.50                  | 5.98                  | 69 - 75                                 | 68 - 77                               |
| 1.50                  | 100                            | 97.00                            | 1.49                  | 8.47                  | 91 - 100                                | 89 - 102                              |
| 1.25                  | 120                            | 119.00                           | 1.70                  | 10.03                 | 113 - 123                               | 110 - 126                             |
| 1.00                  | 150                            | 147.00                           | 1.56                  | 12.01                 | 140 - 157                               | 135 - 161                             |
| 0.75                  | 200                            | 190.00                           | 1.65                  | 14.15                 | 180 - 212                               | 177 - 221                             |
| 0.67                  | 224                            | 223.00                           | 1.67                  | 15.52                 | 203 - 235                               | 198 - 248                             |
| 0.60                  | 250                            | 255.00                           | 1.80                  | 16.55                 | 232 - 265                               | 225 - 281                             |
| 0.50                  | 300                            | 289.00                           | 1.71                  | 17.72                 | 275 - 321                               | 269 - 350                             |

Da bei praktischen Messungen stets mit unerwünschten Reflexionen zu rechnen ist, wurden die Tabellenwerte durch mehrfache Mittelwertbildung (verschiedene Abstände, verschiedene Winkel im Richtdiagramm der H-Ebene, Höhenvariation) ermittelt. Für optimale Ergebnisse sollte insbesondere ein möglichst kleiner, reflexionsarmer Mastadapter / Mast verwendet werden

*Since unwanted reflections are apparent in all practical applications, the tabular values have been determined using a multiple averaging technique (different distances, different angles of the H-plane pattern, height variation). To obtain best measurement results the mast / adapter should be as small as possible*



| Total Element Length: 5 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dBi          | dB/m        |
| 20.00                     | -14.45       | 10.70       |
| 20.50                     | -13.58       | 10.04       |
| 21.00                     | -12.58       | 9.24        |
| 21.50                     | -11.51       | 8.38        |
| 22.00                     | -10.51       | 7.58        |
| 22.50                     | -9.47        | 6.74        |
| 23.00                     | -8.49        | 5.94        |
| 23.50                     | -7.62        | 5.26        |
| 24.00                     | -6.83        | 4.66        |
| 24.50                     | -6.05        | 4.06        |
| 25.00                     | -5.21        | 3.39        |
| 25.50                     | -4.32        | 2.68        |
| 26.00                     | -3.40        | 1.92        |
| 26.50                     | -2.43        | 1.12        |
| 27.00                     | -1.56        | 0.41        |
| 27.50                     | -0.85        | -0.14       |
| 28.00                     | -0.33        | -0.51       |
| 28.50                     | 0.19         | -0.87       |
| 29.00                     | 0.53         | -1.07       |
| 29.50                     | 0.67         | -1.05       |
| 30.00                     | 0.63         | -0.86       |
| 30.50                     | 0.44         | -0.53       |
| 31.00                     | 0.11         | -0.06       |
| 31.50                     | -0.37        | 0.56        |
| 32.00                     | -0.78        | 1.10        |
| 32.50                     | -1.23        | 1.69        |
| 33.00                     | -1.66        | 2.25        |
| 33.50                     | -2.09        | 2.81        |
| 34.00                     | -2.49        | 3.34        |
| 34.50                     | -2.88        | 3.86        |
| 35.00                     | -3.41        | 4.51        |
| 35.50                     | -3.81        | 5.04        |
| 36.00                     | -4.12        | 5.47        |
| 36.50                     | -4.45        | 5.92        |
| 37.00                     | -4.77        | 6.35        |
| 37.50                     | -4.98        | 6.69        |
| 38.00                     | -5.17        | 6.98        |
| 38.50                     | -5.22        | 7.15        |
| 39.00                     | -5.46        | 7.50        |
| 39.50                     | -5.60        | 7.76        |
| 40.00                     | -5.70        | 7.96        |

| Total Element Length: 3 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dBi          | dB/m        |
| 40.00                     | -5.86        | 8.12        |
| 41.00                     | -4.90        | 7.37        |
| 42.00                     | -3.72        | 6.40        |
| 43.00                     | -2.55        | 5.44        |
| 44.00                     | -1.51        | 4.60        |
| 45.00                     | -0.70        | 3.99        |

| Total Element Length: 3 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dBi          | dB/m        |
| 46.00                     | 0.06         | 3.42        |
| 47.00                     | 0.55         | 3.12        |
| 48.00                     | 0.79         | 3.05        |
| 49.00                     | 0.95         | 3.08        |
| 50.00                     | 0.90         | 3.30        |
| 51.00                     | 0.75         | 3.62        |
| 52.00                     | 0.36         | 4.18        |
| 53.00                     | -0.02        | 4.73        |
| 54.00                     | -0.54        | 5.41        |
| 55.00                     | -1.06        | 6.09        |
| 56.00                     | -1.48        | 6.66        |
| 57.00                     | -1.93        | 7.27        |
| 58.00                     | -2.46        | 7.95        |
| 59.00                     | -2.89        | 8.53        |
| 60.00                     | -3.26        | 9.05        |
| 61.00                     | -3.60        | 9.53        |
| 62.00                     | -3.81        | 9.88        |
| 63.00                     | -3.98        | 10.19       |
| 64.00                     | -4.17        | 10.52       |
| 65.00                     | -4.41        | 10.89       |
| 66.00                     | -4.72        | 11.33       |
| 67.00                     | -4.85        | 11.60       |
| 68.00                     | -5.05        | 11.92       |
| 69.00                     | -5.11        | 12.10       |
| 70.00                     | -5.36        | 12.48       |

| Total Element Length: 2 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dBi          | dB/m        |
| 55.00                     | -7.77        | 12.80       |
| 56.00                     | -6.99        | 12.17       |
| 57.00                     | -6.45        | 11.79       |
| 58.00                     | -5.99        | 11.47       |
| 59.00                     | -5.33        | 10.97       |
| 60.00                     | -4.63        | 10.41       |
| 61.00                     | -3.93        | 9.86        |
| 62.00                     | -3.14        | 9.21        |
| 63.00                     | -2.48        | 8.69        |
| 64.00                     | -1.77        | 8.12        |
| 65.00                     | -1.09        | 7.57        |
| 66.00                     | -0.51        | 7.13        |
| 67.00                     | 0.10         | 6.64        |
| 68.00                     | 0.57         | 6.30        |
| 69.00                     | 1.02         | 5.97        |
| 70.00                     | 1.27         | 5.85        |
| 71.00                     | 1.49         | 5.75        |
| 72.00                     | 1.45         | 5.92        |
| 73.00                     | 1.50         | 5.98        |
| 74.00                     | 1.44         | 6.16        |
| 75.00                     | 1.11         | 6.61        |
| 76.00                     | 0.82         | 7.01        |

| Total Element Length: 2 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dB           | dB/m        |
| 77.00                     | 0.61         | 7.34        |
| 78.00                     | 0.37         | 7.69        |
| 79.00                     | 0.10         | 8.07        |
| 80.00                     | -0.17        | 8.45        |
| 81.00                     | -0.32        | 8.71        |
| 82.00                     | -0.49        | 8.98        |
| 83.00                     | -0.82        | 9.42        |
| 84.00                     | -1.11        | 9.82        |
| 85.00                     | -1.21        | 10.02       |
| 86.00                     | -1.40        | 10.31       |
| 87.00                     | -1.61        | 10.62       |
| 88.00                     | -1.93        | 11.04       |
| 89.00                     | -2.21        | 11.41       |
| 90.00                     | -2.45        | 11.75       |
| 91.00                     | -2.50        | 11.90       |
| 92.00                     | -2.65        | 12.14       |
| 93.00                     | -2.84        | 12.43       |
| 94.00                     | -3.14        | 12.83       |
| 95.00                     | -3.22        | 12.99       |
| 96.00                     | -3.43        | 13.30       |
| 97.00                     | -3.55        | 13.50       |
| 98.00                     | -3.74        | 13.79       |
| 99.00                     | -4.01        | 14.14       |
| 100.00                    | -4.19        | 14.41       |
| 101.00                    | -4.31        | 14.62       |
| 102.00                    | -4.45        | 14.85       |
| 103.00                    | -4.54        | 15.01       |
| 104.00                    | -4.63        | 15.19       |
| 105.00                    | -4.71        | 15.35       |
| 106.00                    | -4.85        | 15.58       |
| 107.00                    | -4.93        | 15.74       |
| 108.00                    | -4.98        | 15.87       |
| 109.00                    | -4.96        | 15.93       |
| 110.00                    | -5.00        | 16.05       |

| Total Element Length: 1.5 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dB           | dB/m        |
| 89.00                       | 0.39         | 8.82        |
| 90.00                       | 0.66         | 8.64        |
| 91.00                       | 1.11         | 8.29        |
| 92.00                       | 1.27         | 8.22        |
| 93.00                       | 1.36         | 8.23        |
| 94.00                       | 1.28         | 8.40        |
| 95.00                       | 1.48         | 8.29        |
| 96.00                       | 1.45         | 8.42        |
| 97.00                       | 1.49         | 8.47        |
| 98.00                       | 1.29         | 8.75        |
| 99.00                       | 1.08         | 9.05        |
| 100.00                      | 0.92         | 9.30        |
| 101.00                      | 0.77         | 9.54        |
| 102.00                      | 0.56         | 9.83        |
| 103.00                      | 0.44         | 10.03       |
| 104.00                      | 0.30         | 10.26       |
| 105.00                      | 0.20         | 10.45       |
| 106.00                      | 0.04         | 10.68       |
| 107.00                      | -0.06        | 10.86       |
| 108.00                      | -0.12        | 11.01       |
| 109.00                      | -0.10        | 11.06       |
| 110.00                      | -0.25        | 11.30       |
| 111.00                      | -0.44        | 11.56       |
| 112.00                      | -0.74        | 11.94       |
| 113.00                      | -0.89        | 12.17       |
| 114.00                      | -1.11        | 12.46       |
| 115.00                      | -1.36        | 12.79       |
| 116.00                      | -1.55        | 13.06       |
| 117.00                      | -1.58        | 13.17       |
| 118.00                      | -1.70        | 13.35       |
| 119.00                      | -1.82        | 13.55       |
| 120.00                      | -1.90        | 13.70       |
| 121.00                      | -2.11        | 13.98       |
| 122.00                      | -2.30        | 14.25       |
| 123.00                      | -2.65        | 14.67       |
| 124.00                      | -2.89        | 14.98       |
| 125.00                      | -2.96        | 15.12       |
| 126.00                      | -3.12        | 15.34       |
| 127.00                      | -3.17        | 15.47       |
| 128.00                      | -3.39        | 15.76       |
| 129.00                      | -3.49        | 15.92       |
| 130.00                      | -3.60        | 16.10       |
| 131.00                      | -3.66        | 16.22       |
| 132.00                      | -3.58        | 16.22       |
| 133.00                      | -3.62        | 16.31       |
| 134.00                      | -3.77        | 16.53       |
| 135.00                      | -3.93        | 16.76       |
| 136.00                      | -3.91        | 16.80       |
| 137.00                      | -4.05        | 17.00       |
| 138.00                      | -4.28        | 17.30       |
| 139.00                      | -4.44        | 17.52       |
| 140.00                      | -4.48        | 17.62       |

| Total Element Length: 1.5 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dB           | dB/m        |
| 75.00                       | -6.18        | 13.90       |
| 76.00                       | -5.90        | 13.74       |
| 77.00                       | -5.39        | 13.34       |
| 78.00                       | -4.83        | 12.89       |
| 79.00                       | -4.28        | 12.45       |
| 80.00                       | -3.77        | 12.05       |
| 81.00                       | -3.12        | 11.51       |
| 82.00                       | -2.51        | 11.01       |
| 83.00                       | -2.09        | 10.69       |
| 84.00                       | -1.61        | 10.31       |
| 85.00                       | -0.99        | 9.80        |
| 86.00                       | -0.48        | 9.39        |
| 87.00                       | -0.05        | 9.06        |
| 88.00                       | 0.19         | 8.92        |

| Total Element Length: 1.25 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 90.00                        | -6.41        | 15.71       |
| 91.00                        | -5.96        | 15.37       |
| 92.00                        | -5.54        | 15.04       |
| 93.00                        | -5.23        | 14.82       |
| 94.00                        | -4.89        | 14.58       |
| 95.00                        | -4.56        | 14.33       |
| 96.00                        | -4.16        | 14.03       |
| 97.00                        | -3.83        | 13.79       |
| 98.00                        | -3.54        | 13.58       |
| 99.00                        | -3.25        | 13.39       |
| 100.00                       | -2.92        | 13.14       |
| 101.00                       | -2.55        | 12.86       |
| 102.00                       | -2.19        | 12.58       |
| 103.00                       | -1.84        | 12.32       |
| 104.00                       | -1.49        | 12.05       |
| 105.00                       | -1.14        | 11.78       |
| 106.00                       | -0.78        | 11.51       |
| 107.00                       | -0.43        | 11.24       |
| 108.00                       | -0.04        | 10.93       |
| 109.00                       | 0.32         | 10.65       |
| 110.00                       | 0.64         | 10.41       |
| 111.00                       | 0.87         | 10.26       |
| 112.00                       | 1.09         | 10.12       |
| 113.00                       | 1.24         | 10.04       |
| 114.00                       | 1.35         | 10.01       |
| 115.00                       | 1.40         | 10.03       |
| 116.00                       | 1.49         | 10.02       |
| 117.00                       | 1.60         | 9.98        |
| 118.00                       | 1.68         | 9.98        |
| 119.00                       | 1.70         | 10.03       |
| 120.00                       | 1.66         | 10.14       |
| 121.00                       | 1.60         | 10.28       |
| 122.00                       | 1.45         | 10.50       |
| 123.00                       | 1.26         | 10.76       |
| 124.00                       | 1.06         | 11.03       |
| 125.00                       | 0.89         | 11.27       |
| 126.00                       | 0.77         | 11.46       |
| 127.00                       | 0.60         | 11.69       |
| 128.00                       | 0.46         | 11.90       |
| 129.00                       | 0.28         | 12.15       |
| 130.00                       | 0.14         | 12.36       |
| 131.00                       | 0.01         | 12.56       |
| 132.00                       | -0.09        | 12.72       |
| 133.00                       | -0.20        | 12.89       |
| 134.00                       | -0.37        | 13.13       |
| 135.00                       | -0.53        | 13.35       |
| 136.00                       | -0.69        | 13.58       |
| 137.00                       | -0.85        | 13.80       |
| 138.00                       | -1.08        | 14.09       |
| 139.00                       | -1.28        | 14.36       |
| 140.00                       | -1.42        | 14.56       |
| 141.00                       | -1.48        | 14.68       |
| 142.00                       | -1.53        | 14.79       |

| Total Element Length: 1.25 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 143.00                       | -1.56        | 14.89       |
| 144.00                       | -1.67        | 15.06       |
| 145.00                       | -1.78        | 15.22       |
| 146.00                       | -1.89        | 15.39       |
| 147.00                       | -1.95        | 15.52       |
| 148.00                       | -2.04        | 15.66       |
| 149.00                       | -2.14        | 15.82       |
| 150.00                       | -2.19        | 15.94       |

| Total Element Length: 1 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dBi          | dB/m        |
| 110.00                    | -6.48        | 17.53       |
| 111.00                    | -6.18        | 17.31       |
| 112.00                    | -5.87        | 17.07       |
| 113.00                    | -5.57        | 16.85       |
| 114.00                    | -5.28        | 16.64       |
| 115.00                    | -5.02        | 16.45       |
| 116.00                    | -4.68        | 16.19       |
| 117.00                    | -4.30        | 15.89       |
| 118.00                    | -3.92        | 15.58       |
| 119.00                    | -3.57        | 15.30       |
| 120.00                    | -3.29        | 15.09       |
| 121.00                    | -3.02        | 14.90       |
| 122.00                    | -2.84        | 14.78       |
| 123.00                    | -2.66        | 14.68       |
| 124.00                    | -2.45        | 14.54       |
| 125.00                    | -2.18        | 14.34       |
| 126.00                    | -1.82        | 14.05       |
| 127.00                    | -1.53        | 13.82       |
| 128.00                    | -1.24        | 13.60       |
| 129.00                    | -0.98        | 13.41       |
| 130.00                    | -0.69        | 13.19       |
| 131.00                    | -0.35        | 12.91       |
| 132.00                    | -0.00        | 12.63       |
| 133.00                    | 0.29         | 12.40       |
| 134.00                    | 0.47         | 12.29       |
| 135.00                    | 0.64         | 12.19       |
| 136.00                    | 0.77         | 12.12       |
| 137.00                    | 0.89         | 12.07       |
| 138.00                    | 0.92         | 12.10       |
| 139.00                    | 0.96         | 12.12       |
| 140.00                    | 1.05         | 12.10       |
| 141.00                    | 1.20         | 12.01       |
| 142.00                    | 1.34         | 11.92       |
| 143.00                    | 1.50         | 11.83       |
| 144.00                    | 1.55         | 11.84       |
| 145.00                    | 1.56         | 11.89       |
| 146.00                    | 1.53         | 11.97       |
| 147.00                    | 1.56         | 12.01       |
| 148.00                    | 1.55         | 12.08       |
| 149.00                    | 1.50         | 12.18       |



| Total Element Length: 1 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dBi          | dB/m        |
| 150.00                    | 1.40         | 12.35       |
| 151.00                    | 1.33         | 12.47       |
| 152.00                    | 1.29         | 12.57       |
| 153.00                    | 1.28         | 12.64       |
| 154.00                    | 1.25         | 12.72       |
| 155.00                    | 1.21         | 12.82       |
| 156.00                    | 1.12         | 12.96       |
| 157.00                    | 1.05         | 13.09       |
| 158.00                    | 0.90         | 13.29       |
| 159.00                    | 0.79         | 13.46       |
| 160.00                    | 0.65         | 13.65       |
| 161.00                    | 0.57         | 13.79       |
| 162.00                    | 0.42         | 13.99       |
| 163.00                    | 0.26         | 14.20       |
| 164.00                    | 0.12         | 14.39       |
| 165.00                    | 0.05         | 14.52       |
| 166.00                    | -0.06        | 14.68       |
| 167.00                    | -0.22        | 14.89       |
| 168.00                    | -0.39        | 15.12       |
| 169.00                    | -0.53        | 15.31       |
| 170.00                    | -0.64        | 15.47       |
| 171.00                    | -0.77        | 15.65       |
| 172.00                    | -0.87        | 15.80       |
| 173.00                    | -0.97        | 15.95       |
| 174.00                    | -1.01        | 16.04       |
| 175.00                    | -1.01        | 16.09       |
| 176.00                    | -0.93        | 16.06       |
| 177.00                    | -0.87        | 16.05       |
| 178.00                    | -0.86        | 16.09       |
| 179.00                    | -0.92        | 16.19       |
| 180.00                    | -0.98        | 16.30       |
| 181.00                    | -1.05        | 16.43       |
| 182.00                    | -1.16        | 16.58       |
| 183.00                    | -1.28        | 16.75       |
| 184.00                    | -1.38        | 16.90       |
| 185.00                    | -1.46        | 17.02       |
| 186.00                    | -1.55        | 17.16       |
| 187.00                    | -1.62        | 17.28       |
| 188.00                    | -1.65        | 17.35       |
| 189.00                    | -1.71        | 17.45       |
| 190.00                    | -1.77        | 17.57       |
| 191.00                    | -1.91        | 17.76       |
| 192.00                    | -1.99        | 17.88       |
| 193.00                    | -2.06        | 17.99       |
| 194.00                    | -2.11        | 18.09       |
| 195.00                    | -2.19        | 18.21       |
| 196.00                    | -2.26        | 18.32       |
| 197.00                    | -2.28        | 18.38       |
| 198.00                    | -2.26        | 18.41       |
| 199.00                    | -2.31        | 18.51       |
| 200.00                    | -2.32        | 18.56       |
| 201.00                    | -2.34        | 18.62       |
| 202.00                    | -2.36        | 18.69       |

| Total Element Length: 1 m |              |             |
|---------------------------|--------------|-------------|
| Frequency                 | Gain(Isotr.) | Ant.-Factor |
| MHz                       | dBi          | dB/m        |
| 203.00                    | -2.40        | 18.77       |
| 204.00                    | -2.44        | 18.86       |
| 205.00                    | -2.45        | 18.90       |
| 206.00                    | -2.52        | 19.01       |
| 207.00                    | -2.55        | 19.09       |
| 208.00                    | -2.56        | 19.15       |
| 209.00                    | -2.57        | 19.19       |
| 210.00                    | -2.58        | 19.25       |
| 211.00                    | -2.64        | 19.34       |
| 212.00                    | -2.73        | 19.48       |
| 213.00                    | -2.80        | 19.58       |
| 214.00                    | -2.78        | 19.61       |
| 215.00                    | -2.77        | 19.64       |
| 216.00                    | -2.82        | 19.73       |
| 217.00                    | -2.89        | 19.84       |
| 218.00                    | -2.91        | 19.90       |
| 219.00                    | -2.95        | 19.98       |
| 220.00                    | -3.00        | 20.07       |

| Total Element Length: 0.75 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 145.00                       | -6.18        | 19.63       |
| 146.00                       | -5.92        | 19.43       |
| 147.00                       | -5.67        | 19.24       |
| 148.00                       | -5.40        | 19.03       |
| 149.00                       | -5.15        | 18.83       |
| 150.00                       | -4.90        | 18.64       |
| 151.00                       | -4.66        | 18.46       |
| 152.00                       | -4.41        | 18.26       |
| 153.00                       | -4.16        | 18.08       |
| 154.00                       | -3.91        | 17.88       |
| 155.00                       | -3.66        | 17.69       |
| 156.00                       | -3.42        | 17.50       |
| 157.00                       | -3.21        | 17.35       |
| 158.00                       | -2.99        | 17.18       |
| 159.00                       | -2.77        | 17.02       |
| 160.00                       | -2.54        | 16.84       |
| 161.00                       | -2.35        | 16.71       |
| 162.00                       | -2.15        | 16.56       |
| 163.00                       | -1.94        | 16.41       |
| 164.00                       | -1.74        | 16.25       |
| 165.00                       | -1.57        | 16.13       |
| 166.00                       | -1.39        | 16.01       |
| 167.00                       | -1.20        | 15.88       |
| 168.00                       | -1.04        | 15.77       |
| 169.00                       | -0.89        | 15.67       |
| 170.00                       | -0.73        | 15.56       |
| 171.00                       | -0.55        | 15.43       |
| 172.00                       | -0.38        | 15.31       |
| 173.00                       | -0.20        | 15.18       |
| 174.00                       | -0.01        | 15.04       |



| Total Element Length: 0.75 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 175.00                       | 0.22         | 14.86       |
| 176.00                       | 0.44         | 14.69       |
| 177.00                       | 0.66         | 14.52       |
| 178.00                       | 0.84         | 14.39       |
| 179.00                       | 1.00         | 14.28       |
| 180.00                       | 1.12         | 14.21       |
| 181.00                       | 1.20         | 14.17       |
| 182.00                       | 1.28         | 14.14       |
| 183.00                       | 1.35         | 14.11       |
| 184.00                       | 1.41         | 14.11       |
| 185.00                       | 1.46         | 14.10       |
| 186.00                       | 1.53         | 14.08       |
| 187.00                       | 1.58         | 14.07       |
| 188.00                       | 1.62         | 14.08       |
| 189.00                       | 1.65         | 14.10       |
| 190.00                       | 1.65         | 14.15       |
| 191.00                       | 1.64         | 14.20       |
| 192.00                       | 1.62         | 14.27       |
| 193.00                       | 1.59         | 14.34       |
| 194.00                       | 1.56         | 14.41       |
| 195.00                       | 1.56         | 14.46       |
| 196.00                       | 1.54         | 14.52       |
| 197.00                       | 1.53         | 14.58       |
| 198.00                       | 1.52         | 14.63       |
| 199.00                       | 1.53         | 14.67       |
| 200.00                       | 1.53         | 14.71       |
| 201.00                       | 1.51         | 14.78       |
| 202.00                       | 1.49         | 14.84       |
| 203.00                       | 1.49         | 14.88       |
| 204.00                       | 1.45         | 14.96       |
| 205.00                       | 1.40         | 15.05       |
| 206.00                       | 1.37         | 15.12       |
| 207.00                       | 1.33         | 15.21       |
| 208.00                       | 1.28         | 15.30       |
| 209.00                       | 1.25         | 15.37       |
| 210.00                       | 1.22         | 15.44       |
| 211.00                       | 1.17         | 15.54       |
| 212.00                       | 1.12         | 15.62       |
| 213.00                       | 1.08         | 15.70       |
| 214.00                       | 1.02         | 15.80       |
| 215.00                       | 0.97         | 15.90       |
| 216.00                       | 0.94         | 15.97       |
| 217.00                       | 0.89         | 16.06       |
| 218.00                       | 0.81         | 16.18       |
| 219.00                       | 0.76         | 16.27       |
| 220.00                       | 0.72         | 16.35       |
| 221.00                       | 0.65         | 16.46       |
| 222.00                       | 0.61         | 16.54       |
| 223.00                       | 0.59         | 16.60       |
| 224.00                       | 0.54         | 16.68       |
| 225.00                       | 0.47         | 16.79       |
| 226.00                       | 0.44         | 16.87       |
| 227.00                       | 0.37         | 16.97       |

| Total Element Length: 0.75 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 228.00                       | 0.30         | 17.08       |
| 229.00                       | 0.23         | 17.19       |
| 230.00                       | 0.17         | 17.28       |
| 231.00                       | 0.08         | 17.41       |
| 232.00                       | -0.01        | 17.54       |
| 233.00                       | -0.09        | 17.66       |
| 234.00                       | -0.19        | 17.79       |
| 235.00                       | -0.26        | 17.90       |
| 236.00                       | -0.32        | 18.00       |
| 237.00                       | -0.40        | 18.11       |
| 238.00                       | -0.46        | 18.21       |
| 239.00                       | -0.49        | 18.28       |
| 240.00                       | -0.52        | 18.34       |
| 241.00                       | -0.57        | 18.43       |
| 242.00                       | -0.60        | 18.50       |
| 243.00                       | -0.62        | 18.55       |
| 244.00                       | -0.67        | 18.63       |
| 245.00                       | -0.71        | 18.71       |
| 246.00                       | -0.72        | 18.76       |
| 247.00                       | -0.76        | 18.83       |
| 248.00                       | -0.81        | 18.92       |
| 249.00                       | -0.85        | 18.99       |
| 250.00                       | -0.88        | 19.06       |
| 251.00                       | -0.90        | 19.12       |
| 252.00                       | -0.92        | 19.17       |
| 253.00                       | -0.94        | 19.22       |
| 254.00                       | -0.98        | 19.30       |
| 255.00                       | -1.03        | 19.38       |
| 256.00                       | -1.07        | 19.45       |
| 257.00                       | -1.11        | 19.52       |
| 258.00                       | -1.16        | 19.61       |
| 259.00                       | -1.21        | 19.70       |
| 260.00                       | -1.28        | 19.80       |
| 261.00                       | -1.35        | 19.90       |
| 262.00                       | -1.41        | 20.00       |
| 263.00                       | -1.48        | 20.10       |
| 264.00                       | -1.53        | 20.18       |
| 265.00                       | -1.60        | 20.29       |
| 266.00                       | -1.67        | 20.39       |
| 267.00                       | -1.73        | 20.48       |
| 268.00                       | -1.77        | 20.55       |
| 269.00                       | -1.81        | 20.63       |
| 270.00                       | -1.86        | 20.71       |
| 271.00                       | -1.90        | 20.78       |
| 272.00                       | -1.93        | 20.84       |
| 273.00                       | -1.97        | 20.91       |
| 274.00                       | -1.99        | 20.97       |
| 275.00                       | -1.99        | 21.00       |
| 276.00                       | -2.00        | 21.04       |
| 277.00                       | -2.05        | 21.12       |
| 278.00                       | -2.06        | 21.16       |
| 279.00                       | -2.06        | 21.19       |
| 280.00                       | -2.10        | 21.26       |

| Total Element Length: 0.75 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 281.00                       | -2.14        | 21.34       |
| 282.00                       | -2.18        | 21.40       |
| 283.00                       | -2.22        | 21.48       |
| 284.00                       | -2.26        | 21.55       |
| 285.00                       | -2.29        | 21.60       |
| 286.00                       | -2.31        | 21.66       |
| 287.00                       | -2.35        | 21.72       |
| 288.00                       | -2.39        | 21.80       |
| 289.00                       | -2.42        | 21.86       |
| 290.00                       | -2.44        | 21.90       |
| 291.00                       | -2.46        | 21.96       |
| 292.00                       | -2.49        | 22.02       |
| 293.00                       | -2.55        | 22.11       |
| 294.00                       | -2.62        | 22.21       |
| 295.00                       | -2.68        | 22.29       |
| 296.00                       | -2.72        | 22.37       |
| 297.00                       | -2.77        | 22.44       |
| 298.00                       | -2.77        | 22.48       |
| 299.00                       | -2.79        | 22.52       |
| 300.00                       | -2.81        | 22.58       |

| Total Element Length: 0.67 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 189.00                       | -0.27        | 16.01       |
| 190.00                       | -0.15        | 15.95       |
| 191.00                       | -0.04        | 15.88       |
| 192.00                       | 0.06         | 15.82       |
| 193.00                       | 0.16         | 15.77       |
| 194.00                       | 0.26         | 15.72       |
| 195.00                       | 0.37         | 15.65       |
| 196.00                       | 0.49         | 15.58       |
| 197.00                       | 0.59         | 15.51       |
| 198.00                       | 0.69         | 15.47       |
| 199.00                       | 0.80         | 15.39       |
| 200.00                       | 0.90         | 15.34       |
| 201.00                       | 0.98         | 15.31       |
| 202.00                       | 1.06         | 15.27       |
| 203.00                       | 1.15         | 15.22       |
| 204.00                       | 1.21         | 15.20       |
| 205.00                       | 1.26         | 15.19       |
| 206.00                       | 1.33         | 15.16       |
| 207.00                       | 1.38         | 15.16       |
| 208.00                       | 1.43         | 15.15       |
| 209.00                       | 1.50         | 15.13       |
| 210.00                       | 1.55         | 15.12       |
| 211.00                       | 1.56         | 15.14       |
| 212.00                       | 1.58         | 15.16       |
| 213.00                       | 1.62         | 15.17       |
| 214.00                       | 1.62         | 15.21       |
| 215.00                       | 1.62         | 15.25       |
| 216.00                       | 1.65         | 15.26       |
| 217.00                       | 1.65         | 15.30       |
| 218.00                       | 1.63         | 15.36       |
| 219.00                       | 1.64         | 15.39       |
| 220.00                       | 1.66         | 15.41       |
| 221.00                       | 1.65         | 15.46       |
| 222.00                       | 1.66         | 15.49       |
| 223.00                       | 1.67         | 15.52       |
| 224.00                       | 1.66         | 15.56       |
| 225.00                       | 1.63         | 15.63       |
| 226.00                       | 1.63         | 15.67       |
| 227.00                       | 1.61         | 15.73       |
| 228.00                       | 1.56         | 15.82       |
| 229.00                       | 1.52         | 15.90       |
| 230.00                       | 1.48         | 15.98       |
| 231.00                       | 1.40         | 16.09       |
| 232.00                       | 1.33         | 16.20       |
| 233.00                       | 1.27         | 16.30       |
| 234.00                       | 1.19         | 16.42       |
| 235.00                       | 1.13         | 16.51       |
| 236.00                       | 1.09         | 16.59       |
| 237.00                       | 1.03         | 16.69       |
| 238.00                       | 0.98         | 16.78       |
| 239.00                       | 0.95         | 16.84       |
| 240.00                       | 0.93         | 16.90       |
| 241.00                       | 0.89         | 16.97       |

| Total Element Length: 0.67 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 161.00                       | -5.75        | 20.11       |
| 162.00                       | -5.56        | 19.97       |
| 163.00                       | -5.36        | 19.82       |
| 164.00                       | -5.16        | 19.68       |
| 165.00                       | -4.99        | 19.56       |
| 166.00                       | -4.80        | 19.42       |
| 167.00                       | -4.60        | 19.27       |
| 168.00                       | -4.42        | 19.15       |
| 169.00                       | -4.25        | 19.03       |
| 170.00                       | -4.07        | 18.90       |
| 171.00                       | -3.87        | 18.75       |
| 172.00                       | -3.67        | 18.60       |
| 173.00                       | -3.45        | 18.43       |
| 174.00                       | -3.22        | 18.25       |
| 175.00                       | -2.95        | 18.03       |
| 176.00                       | -2.67        | 17.80       |
| 177.00                       | -2.40        | 17.58       |
| 178.00                       | -2.16        | 17.39       |
| 179.00                       | -1.93        | 17.20       |
| 180.00                       | -1.72        | 17.05       |
| 181.00                       | -1.55        | 16.93       |
| 182.00                       | -1.38        | 16.80       |
| 183.00                       | -1.20        | 16.67       |
| 184.00                       | -1.04        | 16.55       |
| 185.00                       | -0.89        | 16.45       |
| 186.00                       | -0.72        | 16.33       |
| 187.00                       | -0.55        | 16.21       |
| 188.00                       | -0.40        | 16.10       |

| Total Element Length: 0.67 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 242.00                       | 0.86         | 17.04       |
| 243.00                       | 0.84         | 17.09       |
| 244.00                       | 0.80         | 17.17       |
| 245.00                       | 0.77         | 17.24       |
| 246.00                       | 0.75         | 17.29       |
| 247.00                       | 0.72         | 17.35       |
| 248.00                       | 0.68         | 17.43       |
| 249.00                       | 0.64         | 17.50       |
| 250.00                       | 0.60         | 17.58       |
| 251.00                       | 0.57         | 17.64       |
| 252.00                       | 0.55         | 17.70       |
| 253.00                       | 0.53         | 17.75       |
| 254.00                       | 0.49         | 17.83       |
| 255.00                       | 0.44         | 17.91       |
| 256.00                       | 0.40         | 17.98       |
| 257.00                       | 0.36         | 18.06       |
| 258.00                       | 0.31         | 18.14       |
| 259.00                       | 0.25         | 18.24       |
| 260.00                       | 0.18         | 18.34       |
| 261.00                       | 0.11         | 18.44       |
| 262.00                       | 0.03         | 18.55       |
| 263.00                       | -0.06        | 18.68       |
| 264.00                       | -0.12        | 18.77       |
| 265.00                       | -0.20        | 18.88       |
| 266.00                       | -0.28        | 19.00       |
| 267.00                       | -0.34        | 19.09       |
| 268.00                       | -0.38        | 19.16       |
| 269.00                       | -0.43        | 19.25       |
| 270.00                       | -0.48        | 19.33       |
| 271.00                       | -0.53        | 19.41       |
| 272.00                       | -0.56        | 19.47       |
| 273.00                       | -0.61        | 19.55       |
| 274.00                       | -0.64        | 19.62       |
| 275.00                       | -0.67        | 19.68       |
| 276.00                       | -0.70        | 19.74       |
| 277.00                       | -0.76        | 19.83       |
| 278.00                       | -0.77        | 19.88       |
| 279.00                       | -0.80        | 19.93       |
| 280.00                       | -0.84        | 20.00       |
| 281.00                       | -0.89        | 20.08       |
| 282.00                       | -0.93        | 20.15       |
| 283.00                       | -0.98        | 20.24       |
| 284.00                       | -1.03        | 20.32       |
| 285.00                       | -1.06        | 20.38       |
| 286.00                       | -1.10        | 20.45       |
| 287.00                       | -1.15        | 20.53       |
| 288.00                       | -1.20        | 20.61       |
| 289.00                       | -1.24        | 20.68       |
| 290.00                       | -1.27        | 20.74       |
| 291.00                       | -1.31        | 20.81       |
| 292.00                       | -1.36        | 20.89       |
| 293.00                       | -1.43        | 20.99       |
| 294.00                       | -1.51        | 21.10       |

| Total Element Length: 0.67 m |              |             |
|------------------------------|--------------|-------------|
| Frequency                    | Gain(Isotr.) | Ant.-Factor |
| MHz                          | dBi          | dB/m        |
| 295.00                       | -1.59        | 21.20       |
| 296.00                       | -1.65        | 21.30       |
| 297.00                       | -1.70        | 21.38       |
| 298.00                       | -1.72        | 21.43       |
| 299.00                       | -1.75        | 21.49       |
| 300.00                       | -1.79        | 21.56       |
| 301.00                       | -1.82        | 21.61       |
| 302.00                       | -1.84        | 21.66       |
| 303.00                       | -1.85        | 21.70       |
| 304.00                       | -1.87        | 21.75       |
| 305.00                       | -1.90        | 21.81       |
| 306.00                       | -1.93        | 21.86       |
| 307.00                       | -1.94        | 21.90       |
| 308.00                       | -1.96        | 21.96       |
| 309.00                       | -1.99        | 22.01       |
| 310.00                       | -1.99        | 22.04       |
| 311.00                       | -1.99        | 22.07       |
| 312.00                       | -2.01        | 22.11       |
| 313.00                       | -2.02        | 22.15       |
| 314.00                       | -2.01        | 22.17       |
| 315.00                       | -2.01        | 22.20       |
| 316.00                       | -2.02        | 22.23       |
| 317.00                       | -2.03        | 22.27       |
| 318.00                       | -2.04        | 22.30       |
| 319.00                       | -2.04        | 22.34       |
| 320.00                       | -2.04        | 22.36       |
| 321.00                       | -2.04        | 22.39       |
| 322.00                       | -2.04        | 22.42       |
| 323.00                       | -2.05        | 22.45       |
| 324.00                       | -2.06        | 22.49       |
| 325.00                       | -2.06        | 22.52       |
| 326.00                       | -2.06        | 22.54       |
| 327.00                       | -2.07        | 22.58       |
| 328.00                       | -2.06        | 22.60       |
| 329.00                       | -2.04        | 22.60       |
| 330.00                       | -2.03        | 22.62       |

| Total Element Length: 0.6 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 180.00                      | -5.25        | 20.57       |
| 181.00                      | -5.07        | 20.44       |
| 182.00                      | -4.91        | 20.33       |
| 183.00                      | -4.76        | 20.23       |
| 184.00                      | -4.62        | 20.14       |
| 185.00                      | -4.48        | 20.04       |
| 186.00                      | -4.36        | 19.97       |
| 187.00                      | -4.21        | 19.86       |
| 188.00                      | -4.00        | 19.70       |
| 189.00                      | -3.82        | 19.57       |
| 190.00                      | -3.69        | 19.48       |
| 191.00                      | -3.63        | 19.47       |

| Total Element Length: 0.6 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 192.00                      | -3.48        | 19.37       |
| 193.00                      | -3.31        | 19.24       |
| 194.00                      | -3.16        | 19.13       |
| 195.00                      | -3.04        | 19.06       |
| 196.00                      | -2.92        | 18.98       |
| 197.00                      | -2.72        | 18.83       |
| 198.00                      | -2.50        | 18.65       |
| 199.00                      | -2.35        | 18.55       |
| 200.00                      | -2.15        | 18.39       |
| 201.00                      | -1.97        | 18.25       |
| 202.00                      | -1.79        | 18.12       |
| 203.00                      | -1.62        | 17.99       |
| 204.00                      | -1.47        | 17.88       |
| 205.00                      | -1.30        | 17.75       |
| 206.00                      | -1.19        | 17.69       |
| 207.00                      | -1.04        | 17.58       |
| 208.00                      | -0.87        | 17.46       |
| 209.00                      | -0.72        | 17.34       |
| 210.00                      | -0.58        | 17.24       |
| 211.00                      | -0.49        | 17.20       |
| 212.00                      | -0.45        | 17.20       |
| 213.00                      | -0.37        | 17.16       |
| 214.00                      | -0.21        | 17.04       |
| 215.00                      | -0.08        | 16.94       |
| 216.00                      | -0.03        | 16.93       |
| 217.00                      | 0.01         | 16.94       |
| 218.00                      | 0.10         | 16.89       |
| 219.00                      | 0.18         | 16.85       |
| 220.00                      | 0.28         | 16.79       |
| 221.00                      | 0.41         | 16.70       |
| 222.00                      | 0.52         | 16.62       |
| 223.00                      | 0.63         | 16.56       |
| 224.00                      | 0.72         | 16.50       |
| 225.00                      | 0.87         | 16.39       |
| 226.00                      | 0.95         | 16.35       |
| 227.00                      | 1.07         | 16.27       |
| 228.00                      | 1.15         | 16.23       |
| 229.00                      | 1.22         | 16.20       |
| 230.00                      | 1.24         | 16.22       |
| 231.00                      | 1.27         | 16.22       |
| 232.00                      | 1.29         | 16.24       |
| 233.00                      | 1.29         | 16.28       |
| 234.00                      | 1.26         | 16.34       |
| 235.00                      | 1.23         | 16.41       |
| 236.00                      | 1.26         | 16.42       |
| 237.00                      | 1.32         | 16.40       |
| 238.00                      | 1.37         | 16.39       |
| 239.00                      | 1.36         | 16.43       |
| 240.00                      | 1.37         | 16.45       |
| 241.00                      | 1.45         | 16.41       |
| 242.00                      | 1.49         | 16.40       |
| 243.00                      | 1.50         | 16.43       |
| 244.00                      | 1.50         | 16.47       |

| Total Element Length: 0.6 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 245.00                      | 1.51         | 16.49       |
| 246.00                      | 1.55         | 16.49       |
| 247.00                      | 1.61         | 16.46       |
| 248.00                      | 1.65         | 16.46       |
| 249.00                      | 1.65         | 16.49       |
| 250.00                      | 1.63         | 16.55       |
| 251.00                      | 1.62         | 16.59       |
| 252.00                      | 1.66         | 16.59       |
| 253.00                      | 1.71         | 16.57       |
| 254.00                      | 1.80         | 16.51       |
| 255.00                      | 1.80         | 16.55       |
| 256.00                      | 1.78         | 16.60       |
| 257.00                      | 1.74         | 16.68       |
| 258.00                      | 1.77         | 16.69       |
| 259.00                      | 1.77         | 16.71       |
| 260.00                      | 1.68         | 16.84       |
| 261.00                      | 1.57         | 16.99       |
| 262.00                      | 1.47         | 17.12       |
| 263.00                      | 1.43         | 17.19       |
| 264.00                      | 1.33         | 17.32       |
| 265.00                      | 1.25         | 17.43       |
| 266.00                      | 1.18         | 17.54       |
| 267.00                      | 1.17         | 17.58       |
| 268.00                      | 1.14         | 17.65       |
| 269.00                      | 1.12         | 17.70       |
| 270.00                      | 1.09         | 17.76       |
| 271.00                      | 1.05         | 17.83       |
| 272.00                      | 1.01         | 17.90       |
| 273.00                      | 1.02         | 17.92       |
| 274.00                      | 0.98         | 18.00       |
| 275.00                      | 0.91         | 18.10       |
| 276.00                      | 0.85         | 18.19       |
| 277.00                      | 0.88         | 18.19       |
| 278.00                      | 0.87         | 18.23       |
| 279.00                      | 0.88         | 18.26       |
| 280.00                      | 0.83         | 18.33       |
| 281.00                      | 0.80         | 18.39       |
| 282.00                      | 0.73         | 18.50       |
| 283.00                      | 0.62         | 18.63       |
| 284.00                      | 0.56         | 18.73       |
| 285.00                      | 0.50         | 18.82       |
| 286.00                      | 0.50         | 18.85       |
| 287.00                      | 0.47         | 18.91       |
| 288.00                      | 0.42         | 18.99       |
| 289.00                      | 0.34         | 19.09       |
| 290.00                      | 0.31         | 19.16       |
| 291.00                      | 0.30         | 19.19       |
| 292.00                      | 0.25         | 19.28       |
| 293.00                      | 0.14         | 19.42       |
| 294.00                      | -0.04        | 19.63       |
| 295.00                      | -0.18        | 19.79       |
| 296.00                      | -0.23        | 19.88       |
| 297.00                      | -0.26        | 19.94       |

| Total Element Length: 0.6 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 298.00                      | -0.28        | 19.99       |
| 299.00                      | -0.31        | 20.04       |
| 300.00                      | -0.35        | 20.11       |
| 301.00                      | -0.39        | 20.18       |
| 302.00                      | -0.47        | 20.29       |
| 303.00                      | -0.51        | 20.36       |
| 304.00                      | -0.51        | 20.38       |
| 305.00                      | -0.50        | 20.40       |
| 306.00                      | -0.53        | 20.47       |
| 307.00                      | -0.57        | 20.53       |
| 308.00                      | -0.57        | 20.56       |
| 309.00                      | -0.55        | 20.57       |
| 310.00                      | -0.58        | 20.62       |
| 311.00                      | -0.62        | 20.70       |
| 312.00                      | -0.61        | 20.71       |
| 313.00                      | -0.62        | 20.76       |
| 314.00                      | -0.68        | 20.84       |
| 315.00                      | -0.74        | 20.92       |
| 316.00                      | -0.77        | 20.98       |
| 317.00                      | -0.76        | 21.00       |
| 318.00                      | -0.79        | 21.06       |
| 319.00                      | -0.81        | 21.10       |
| 320.00                      | -0.82        | 21.14       |
| 321.00                      | -0.83        | 21.18       |
| 322.00                      | -0.83        | 21.21       |
| 323.00                      | -0.87        | 21.27       |
| 324.00                      | -0.89        | 21.32       |
| 325.00                      | -0.92        | 21.38       |
| 326.00                      | -0.94        | 21.43       |
| 327.00                      | -0.95        | 21.46       |
| 328.00                      | -1.00        | 21.54       |
| 329.00                      | -0.98        | 21.55       |
| 330.00                      | -0.92        | 21.51       |
| 331.00                      | -0.84        | 21.45       |
| 332.00                      | -0.85        | 21.50       |
| 333.00                      | -0.91        | 21.58       |
| 334.00                      | -0.99        | 21.69       |
| 335.00                      | -1.06        | 21.78       |
| 336.00                      | -1.11        | 21.85       |
| 337.00                      | -1.06        | 21.84       |
| 338.00                      | -0.99        | 21.79       |
| 339.00                      | -1.00        | 21.83       |
| 340.00                      | -1.04        | 21.89       |
| 341.00                      | -1.08        | 21.95       |
| 342.00                      | -1.06        | 21.96       |
| 343.00                      | -1.02        | 21.95       |
| 344.00                      | -1.00        | 21.95       |
| 345.00                      | -1.01        | 21.99       |
| 346.00                      | -1.07        | 22.07       |
| 347.00                      | -1.10        | 22.13       |
| 348.00                      | -1.12        | 22.17       |
| 349.00                      | -1.13        | 22.21       |
| 350.00                      | -1.16        | 22.26       |

| Total Element Length: 0.6 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 351.00                      | -1.16        | 22.29       |
| 352.00                      | -1.18        | 22.33       |
| 353.00                      | -1.18        | 22.36       |
| 354.00                      | -1.20        | 22.40       |
| 355.00                      | -1.17        | 22.39       |
| 356.00                      | -1.19        | 22.44       |
| 357.00                      | -1.23        | 22.50       |
| 358.00                      | -1.26        | 22.56       |
| 359.00                      | -1.30        | 22.62       |
| 360.00                      | -1.34        | 22.68       |

| Total Element Length: 0.5 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 210.00                      | -5.73        | 22.39       |
| 211.00                      | -5.58        | 22.29       |
| 212.00                      | -5.46        | 22.20       |
| 213.00                      | -5.35        | 22.13       |
| 214.00                      | -5.23        | 22.06       |
| 215.00                      | -5.11        | 21.98       |
| 216.00                      | -5.01        | 21.92       |
| 217.00                      | -4.88        | 21.83       |
| 218.00                      | -4.72        | 21.71       |
| 219.00                      | -4.60        | 21.63       |
| 220.00                      | -4.47        | 21.54       |
| 221.00                      | -4.32        | 21.42       |
| 222.00                      | -4.16        | 21.31       |
| 223.00                      | -4.02        | 21.21       |
| 224.00                      | -3.85        | 21.08       |
| 225.00                      | -3.69        | 20.95       |
| 226.00                      | -3.55        | 20.85       |
| 227.00                      | -3.43        | 20.77       |
| 228.00                      | -3.30        | 20.67       |
| 229.00                      | -3.19        | 20.61       |
| 230.00                      | -3.10        | 20.55       |
| 231.00                      | -3.01        | 20.50       |
| 232.00                      | -2.93        | 20.46       |
| 233.00                      | -2.86        | 20.43       |
| 234.00                      | -2.78        | 20.38       |
| 235.00                      | -2.69        | 20.33       |
| 236.00                      | -2.60        | 20.28       |
| 237.00                      | -2.50        | 20.22       |
| 238.00                      | -2.39        | 20.14       |
| 239.00                      | -2.29        | 20.08       |
| 240.00                      | -2.18        | 20.01       |
| 241.00                      | -2.04        | 19.90       |
| 242.00                      | -1.92        | 19.82       |
| 243.00                      | -1.80        | 19.73       |
| 244.00                      | -1.67        | 19.64       |
| 245.00                      | -1.54        | 19.55       |
| 246.00                      | -1.42        | 19.46       |
| 247.00                      | -1.29        | 19.37       |

| Total Element Length: 0.5 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 248.00                      | -1.16        | 19.27       |
| 249.00                      | -1.02        | 19.17       |
| 250.00                      | -0.89        | 19.07       |
| 251.00                      | -0.75        | 18.96       |
| 252.00                      | -0.62        | 18.87       |
| 253.00                      | -0.49        | 18.78       |
| 254.00                      | -0.37        | 18.68       |
| 255.00                      | -0.25        | 18.60       |
| 256.00                      | -0.15        | 18.53       |
| 257.00                      | -0.06        | 18.48       |
| 258.00                      | 0.03         | 18.43       |
| 259.00                      | 0.10         | 18.38       |
| 260.00                      | 0.15         | 18.37       |
| 261.00                      | 0.19         | 18.36       |
| 262.00                      | 0.24         | 18.34       |
| 263.00                      | 0.30         | 18.32       |
| 264.00                      | 0.35         | 18.30       |
| 265.00                      | 0.41         | 18.28       |
| 266.00                      | 0.48         | 18.24       |
| 267.00                      | 0.54         | 18.21       |
| 268.00                      | 0.61         | 18.17       |
| 269.00                      | 0.70         | 18.11       |
| 270.00                      | 0.81         | 18.04       |
| 271.00                      | 0.88         | 18.00       |
| 272.00                      | 0.94         | 17.97       |
| 273.00                      | 1.02         | 17.92       |
| 274.00                      | 1.12         | 17.85       |
| 275.00                      | 1.19         | 17.81       |
| 276.00                      | 1.28         | 17.76       |
| 277.00                      | 1.35         | 17.72       |
| 278.00                      | 1.39         | 17.71       |
| 279.00                      | 1.44         | 17.70       |
| 280.00                      | 1.49         | 17.67       |
| 281.00                      | 1.54         | 17.65       |
| 282.00                      | 1.57         | 17.66       |
| 283.00                      | 1.58         | 17.67       |
| 284.00                      | 1.61         | 17.67       |
| 285.00                      | 1.63         | 17.68       |
| 286.00                      | 1.66         | 17.69       |
| 287.00                      | 1.69         | 17.69       |
| 288.00                      | 1.71         | 17.70       |
| 289.00                      | 1.71         | 17.72       |
| 290.00                      | 1.71         | 17.76       |
| 291.00                      | 1.69         | 17.80       |
| 292.00                      | 1.66         | 17.86       |
| 293.00                      | 1.64         | 17.91       |
| 294.00                      | 1.61         | 17.98       |
| 295.00                      | 1.57         | 18.04       |
| 296.00                      | 1.55         | 18.10       |
| 297.00                      | 1.51         | 18.17       |
| 298.00                      | 1.49         | 18.22       |
| 299.00                      | 1.47         | 18.26       |
| 300.00                      | 1.46         | 18.30       |

| Total Element Length: 0.5 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 301.00                      | 1.48         | 18.32       |
| 302.00                      | 1.47         | 18.35       |
| 303.00                      | 1.46         | 18.38       |
| 304.00                      | 1.46         | 18.41       |
| 305.00                      | 1.45         | 18.45       |
| 306.00                      | 1.44         | 18.49       |
| 307.00                      | 1.43         | 18.53       |
| 308.00                      | 1.43         | 18.56       |
| 309.00                      | 1.44         | 18.58       |
| 310.00                      | 1.41         | 18.63       |
| 311.00                      | 1.38         | 18.69       |
| 312.00                      | 1.38         | 18.73       |
| 313.00                      | 1.35         | 18.78       |
| 314.00                      | 1.33         | 18.82       |
| 315.00                      | 1.32         | 18.87       |
| 316.00                      | 1.30         | 18.91       |
| 317.00                      | 1.28         | 18.96       |
| 318.00                      | 1.25         | 19.02       |
| 319.00                      | 1.23         | 19.06       |
| 320.00                      | 1.22         | 19.10       |
| 321.00                      | 1.20         | 19.15       |
| 322.00                      | 1.18         | 19.20       |
| 323.00                      | 1.15         | 19.25       |
| 324.00                      | 1.14         | 19.29       |
| 325.00                      | 1.13         | 19.33       |
| 326.00                      | 1.13         | 19.36       |
| 327.00                      | 1.14         | 19.37       |
| 328.00                      | 1.15         | 19.39       |
| 329.00                      | 1.14         | 19.43       |
| 330.00                      | 1.14         | 19.45       |
| 331.00                      | 1.12         | 19.50       |
| 332.00                      | 1.09         | 19.55       |
| 333.00                      | 1.07         | 19.60       |
| 334.00                      | 1.07         | 19.63       |
| 335.00                      | 1.04         | 19.68       |
| 336.00                      | 0.99         | 19.76       |
| 337.00                      | 0.96         | 19.81       |
| 338.00                      | 0.94         | 19.86       |
| 339.00                      | 0.91         | 19.92       |
| 340.00                      | 0.90         | 19.95       |
| 341.00                      | 0.90         | 19.98       |
| 342.00                      | 0.88         | 20.02       |
| 343.00                      | 0.84         | 20.08       |
| 344.00                      | 0.81         | 20.14       |
| 345.00                      | 0.79         | 20.18       |
| 346.00                      | 0.77         | 20.24       |
| 347.00                      | 0.75         | 20.28       |
| 348.00                      | 0.74         | 20.32       |
| 349.00                      | 0.71         | 20.37       |
| 350.00                      | 0.69         | 20.41       |
| 351.00                      | 0.68         | 20.45       |
| 352.00                      | 0.68         | 20.48       |
| 353.00                      | 0.66         | 20.52       |

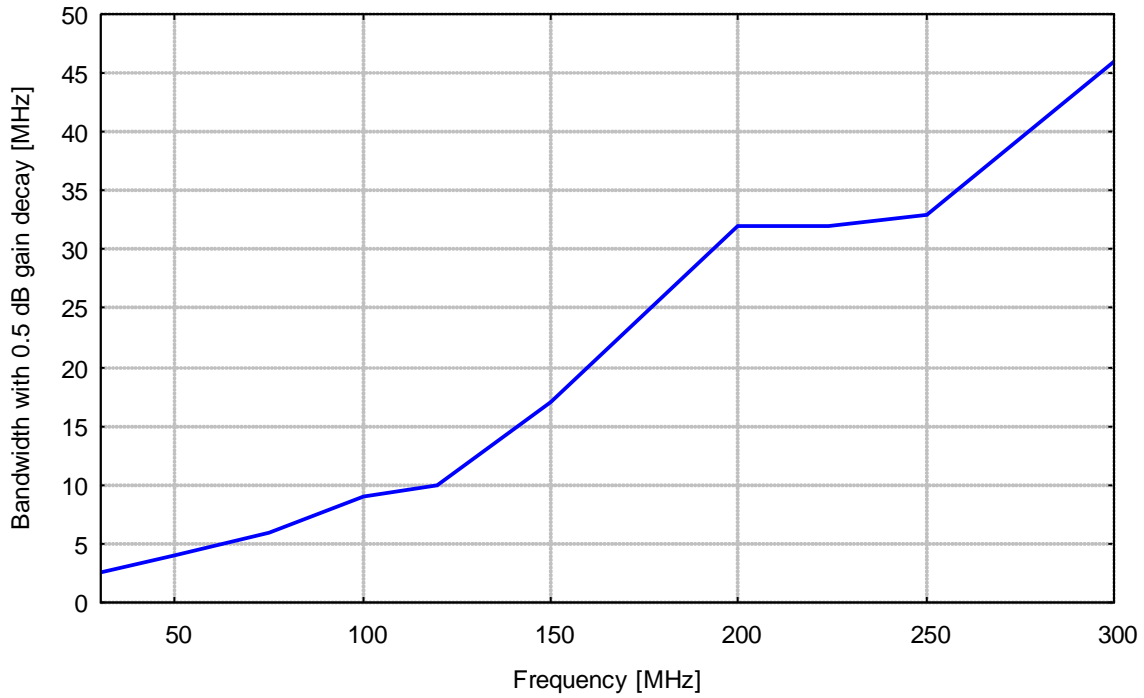
| Total Element Length: 0.5 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 354.00                      | 0.65         | 20.55       |
| 355.00                      | 0.64         | 20.59       |
| 356.00                      | 0.62         | 20.63       |
| 357.00                      | 0.59         | 20.69       |
| 358.00                      | 0.58         | 20.72       |
| 359.00                      | 0.57         | 20.75       |
| 360.00                      | 0.55         | 20.79       |
| 361.00                      | 0.53         | 20.84       |
| 362.00                      | 0.50         | 20.89       |
| 363.00                      | 0.47         | 20.95       |
| 364.00                      | 0.44         | 21.00       |
| 365.00                      | 0.41         | 21.06       |
| 366.00                      | 0.37         | 21.12       |
| 367.00                      | 0.30         | 21.22       |
| 368.00                      | 0.22         | 21.32       |
| 369.00                      | 0.16         | 21.41       |

| Total Element Length: 0.5 m |              |             |
|-----------------------------|--------------|-------------|
| Frequency                   | Gain(Isotr.) | Ant.-Factor |
| MHz                         | dBi          | dB/m        |
| 370.00                      | 0.11         | 21.48       |
| 371.00                      | 0.06         | 21.55       |
| 372.00                      | 0.01         | 21.63       |
| 373.00                      | -0.06        | 21.71       |
| 374.00                      | -0.11        | 21.79       |
| 375.00                      | -0.16        | 21.86       |
| 376.00                      | -0.18        | 21.90       |
| 377.00                      | -0.20        | 21.95       |
| 378.00                      | -0.25        | 22.02       |
| 379.00                      | -0.30        | 22.09       |
| 380.00                      | -0.33        | 22.15       |





Bandwidth with 0.5 dB gain decay



Bandwidth with 1 dB gain decay

