



In Collaboration with

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CALIBRATION LABORATORY

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## DASY/EASY – Parameters of Probe: EX3DV4 – SN:3789

### Basic Calibration Parameters

|                                                          | Sensor X | Sensor Y | Sensor Z | Unc ( $k=2$ ) |
|----------------------------------------------------------|----------|----------|----------|---------------|
| Norm( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.45     | 0.50     | 0.51     | $\pm 10.0\%$  |
| DCP(mV) <sup>B</sup>                                     | 104.9    | 102.3    | 101.3    |               |

### Modulation Calibration Parameters

| UID | Communication System Name |   | A<br>dB | B<br>dB/ $\mu\text{V}$ | C   | D<br>dB | VR<br>mV | Unc <sup>E</sup><br>( $k=2$ ) |
|-----|---------------------------|---|---------|------------------------|-----|---------|----------|-------------------------------|
| 0   | CW                        | X | 0.0     | 0.0                    | 1.0 | 0.00    | 178.8    | $\pm 2.2\%$                   |
|     |                           | Y | 0.0     | 0.0                    | 1.0 |         | 183.9    |                               |
|     |                           | Z | 0.0     | 0.0                    | 1.0 |         | 186.6    |                               |

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution Corresponds to a coverage probability of approximately 95%.

<sup>A</sup> The uncertainties of Norm X, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 4).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.





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### Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750                  | 41.9                               | 0.89                            | 8.81    | 8.81    | 8.81    | 0.40               | 0.80                    | ±12.1%      |
| 835                  | 41.5                               | 0.90                            | 8.53    | 8.53    | 8.53    | 0.18               | 1.20                    | ±12.1%      |
| 1750                 | 40.1                               | 1.37                            | 7.61    | 7.61    | 7.61    | 0.26               | 1.03                    | ±12.1%      |
| 1900                 | 40.0                               | 1.40                            | 7.32    | 7.32    | 7.32    | 0.28               | 1.01                    | ±12.1%      |
| 2000                 | 40.0                               | 1.40                            | 7.40    | 7.40    | 7.40    | 0.23               | 1.14                    | ±12.1%      |
| 2300                 | 39.5                               | 1.67                            | 7.16    | 7.16    | 7.16    | 0.62               | 0.69                    | ±12.1%      |
| 2450                 | 39.2                               | 1.80                            | 6.92    | 6.92    | 6.92    | 0.62               | 0.70                    | ±12.1%      |
| 2600                 | 39.0                               | 1.96                            | 6.79    | 6.79    | 6.79    | 0.66               | 0.69                    | ±12.1%      |

<sup>C</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

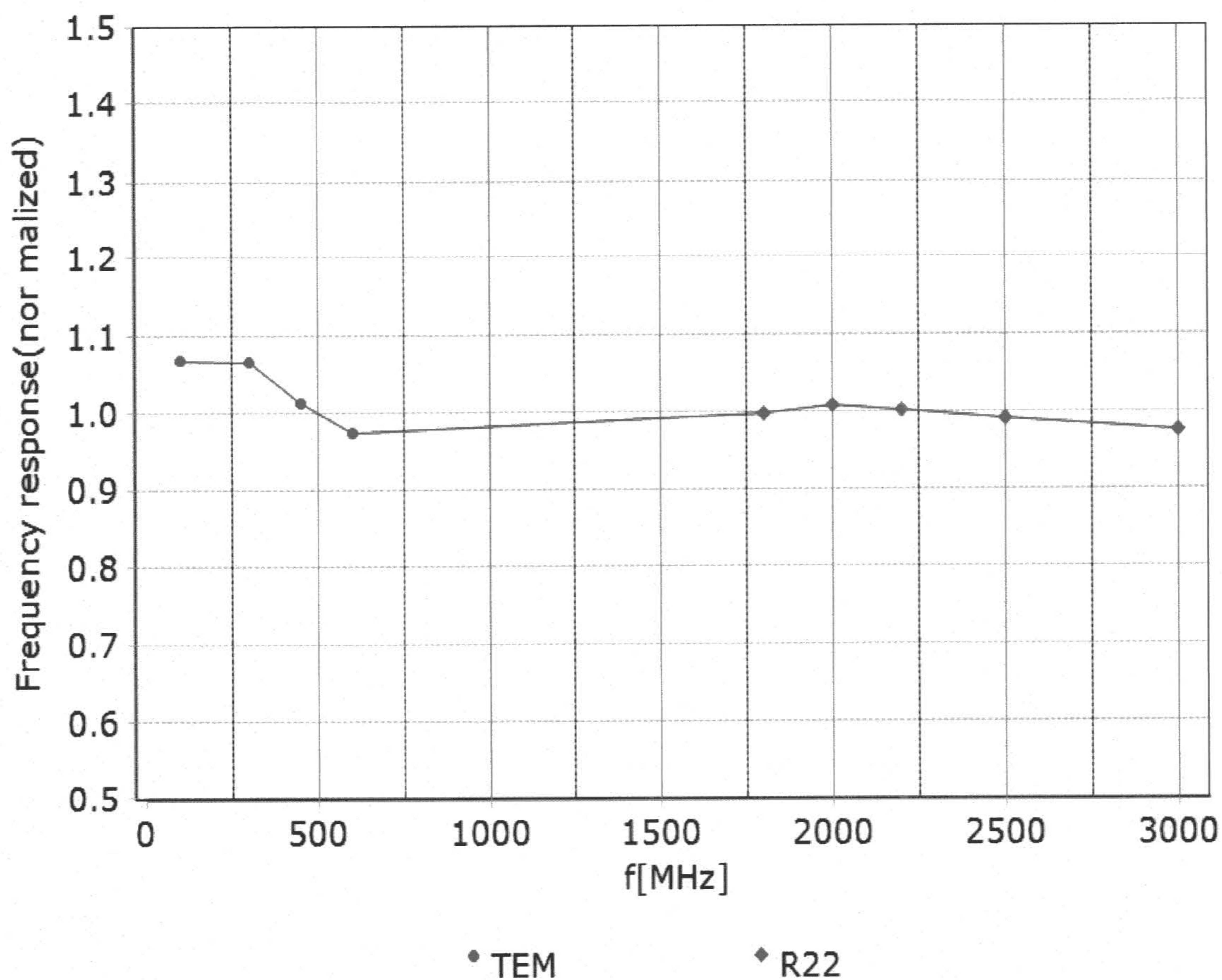




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## Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field:  $\pm 7.4\%$  ( $k=2$ )



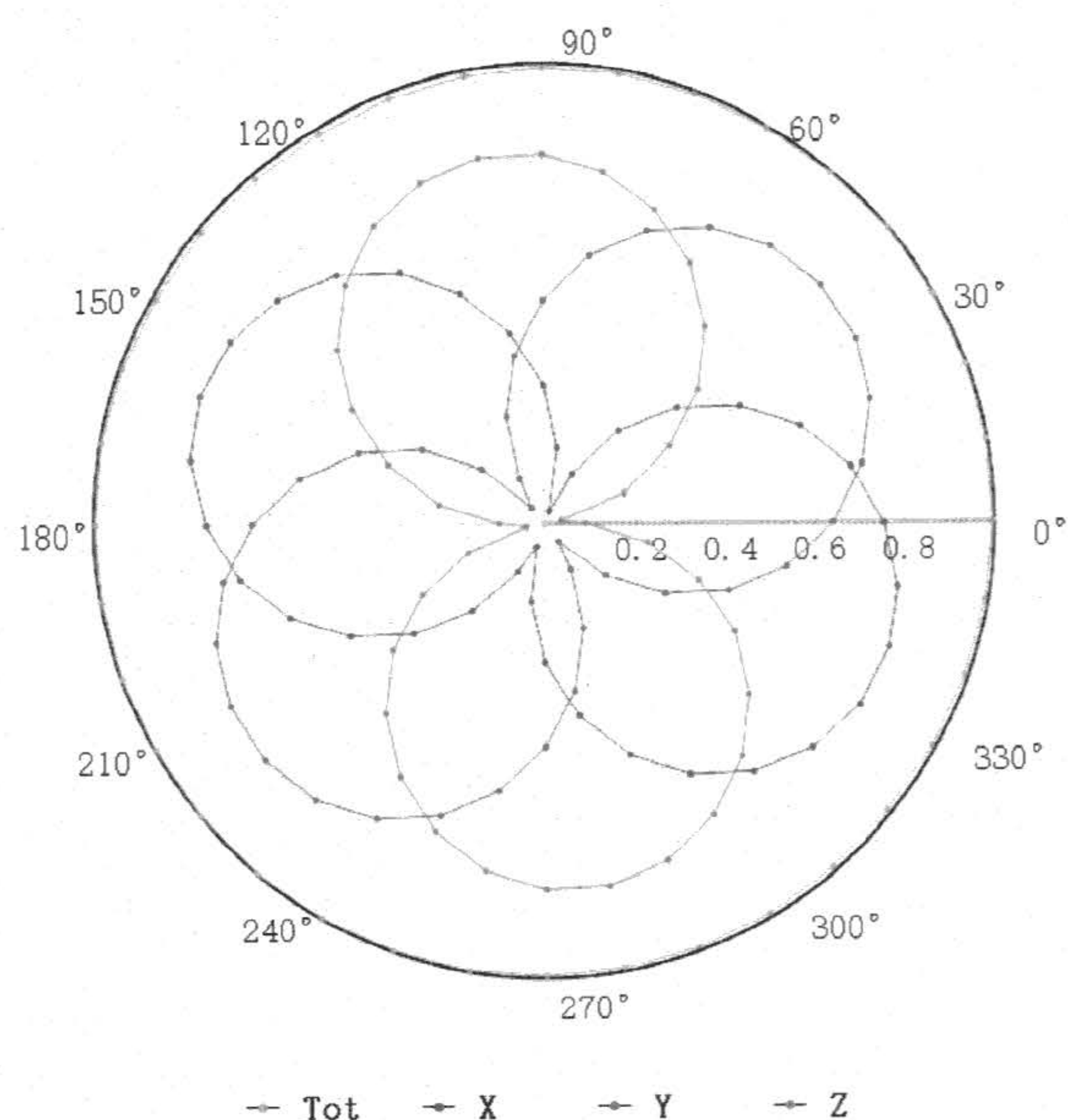


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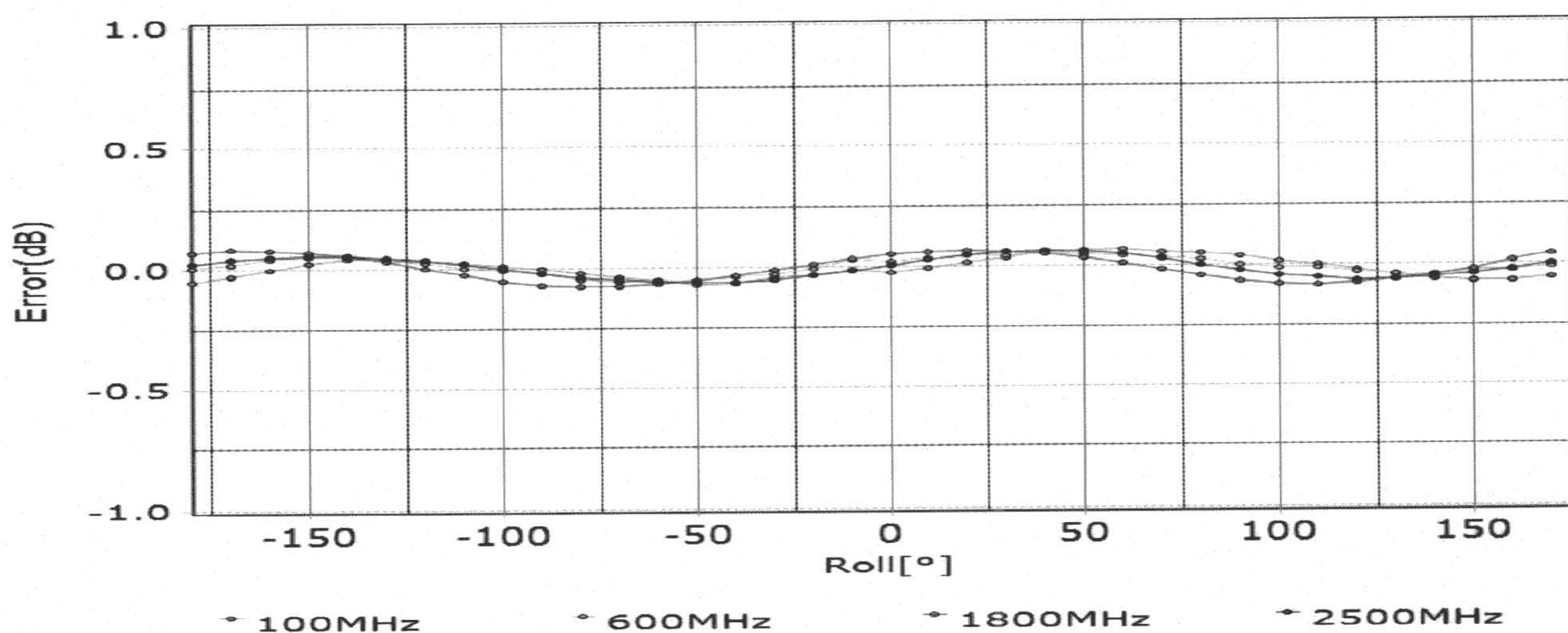
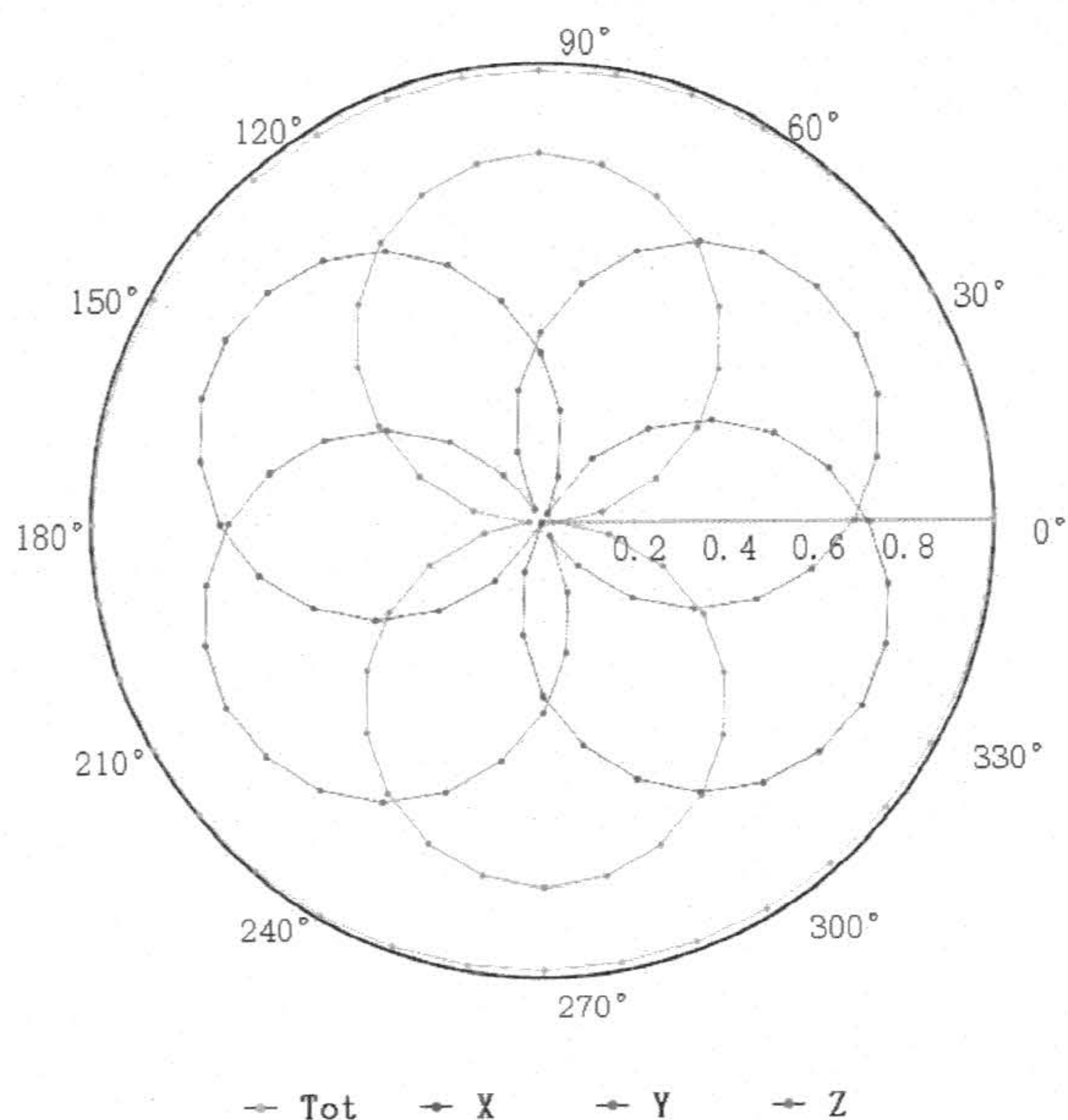
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## Receiving Pattern ( $\Phi$ ), $\theta=0^\circ$

**f=600 MHz, TEM**



**f=1800 MHz, R22**



Uncertainty of Axial Isotropy Assessment:  $\pm 1.2\%$  ( $k=2$ )

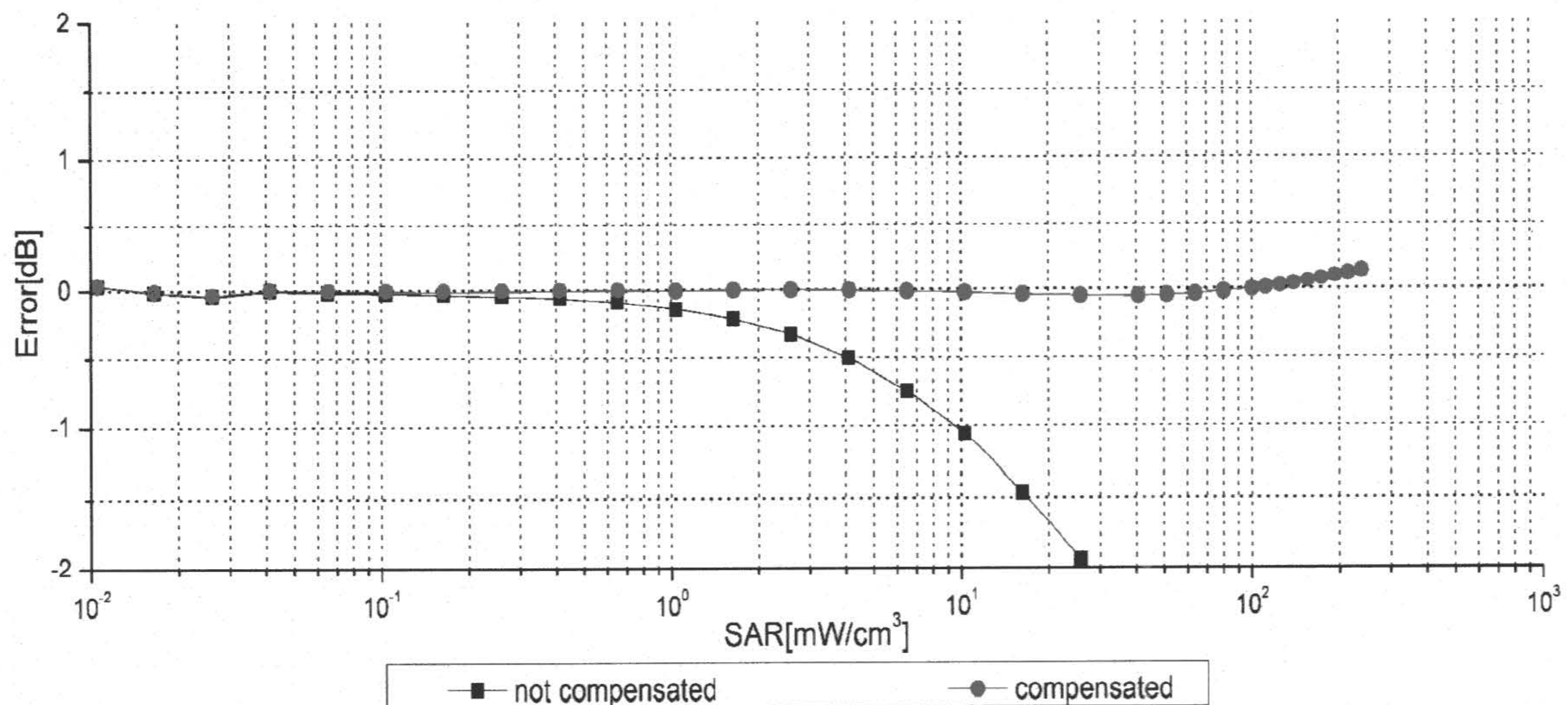
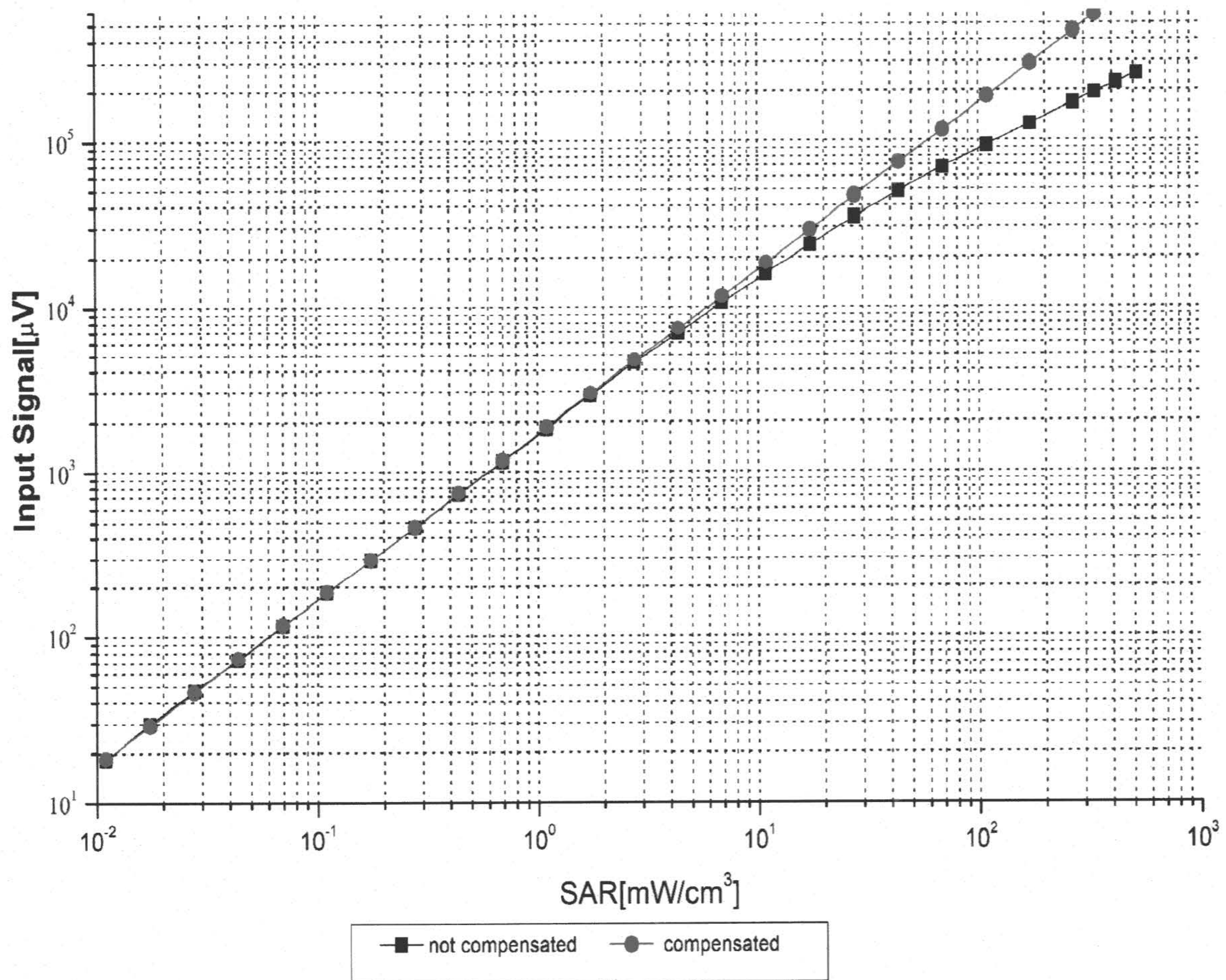




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## Dynamic Range f(SAR<sub>head</sub>) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment:  $\pm 0.9\%$  ( $k=2$ )





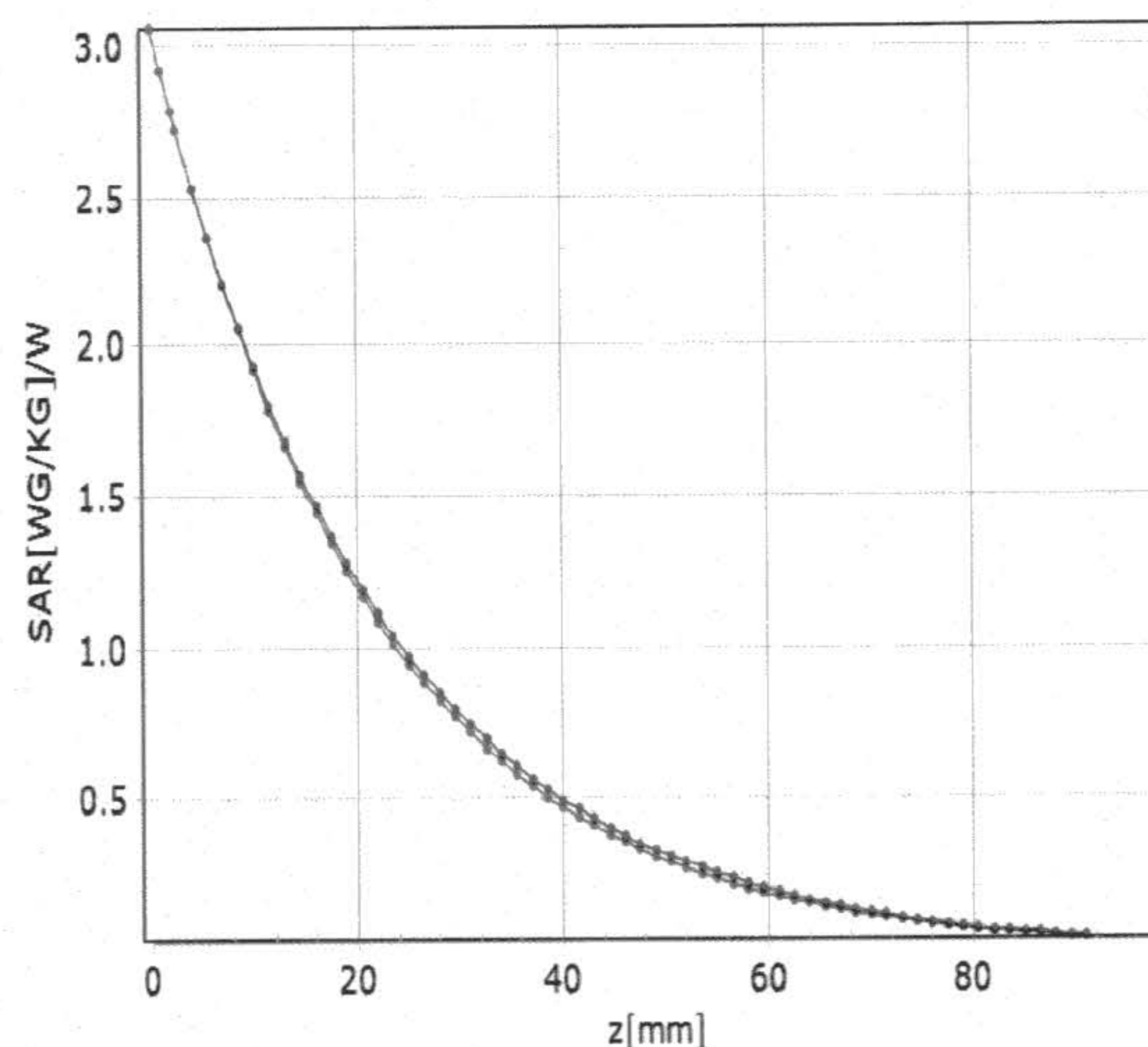
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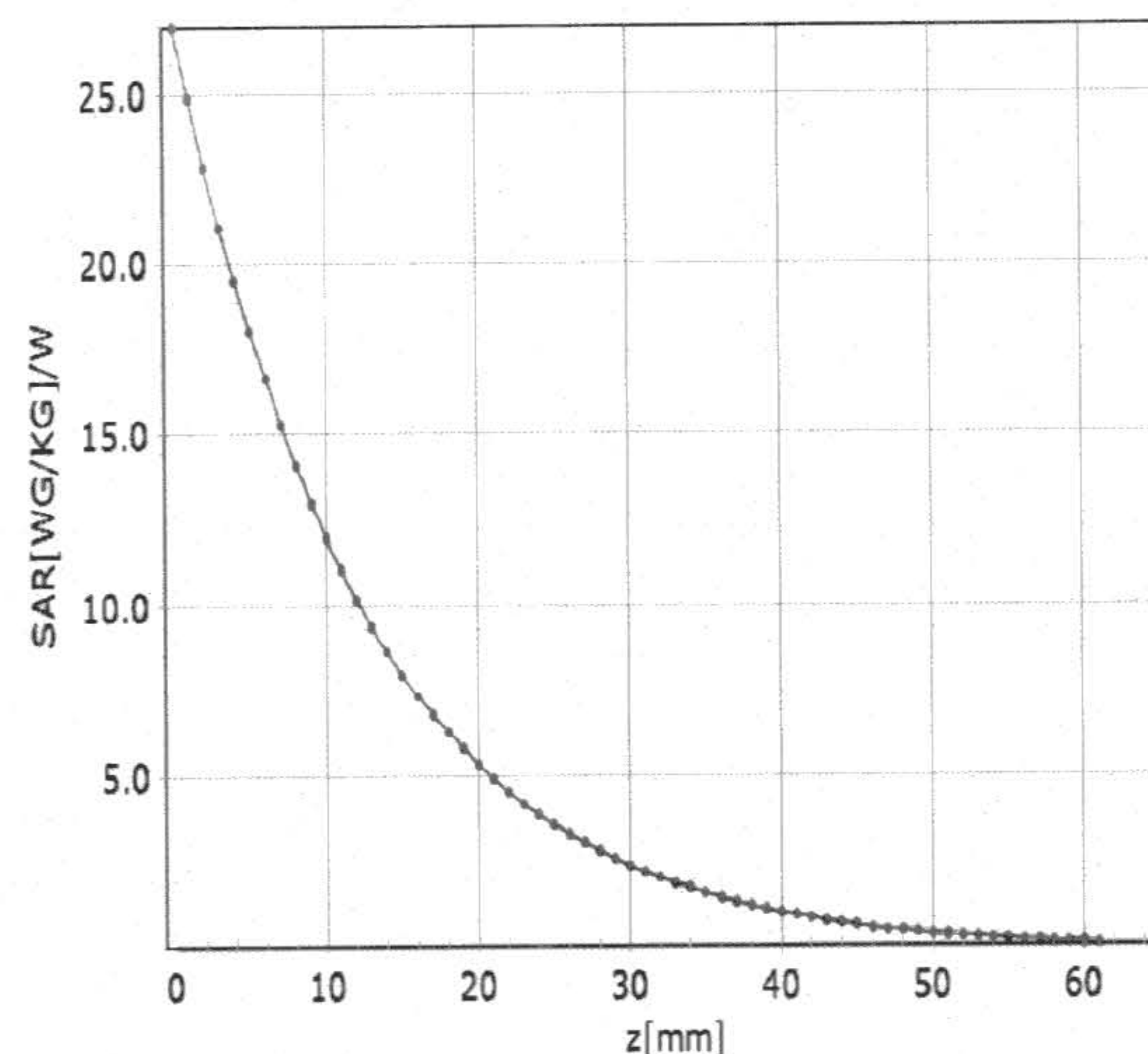
## Conversion Factor Assessment

**f=750 MHz,WGLS R9(H\_convF)**

**f=1750 MHz,WGLS R22(H\_convF)**

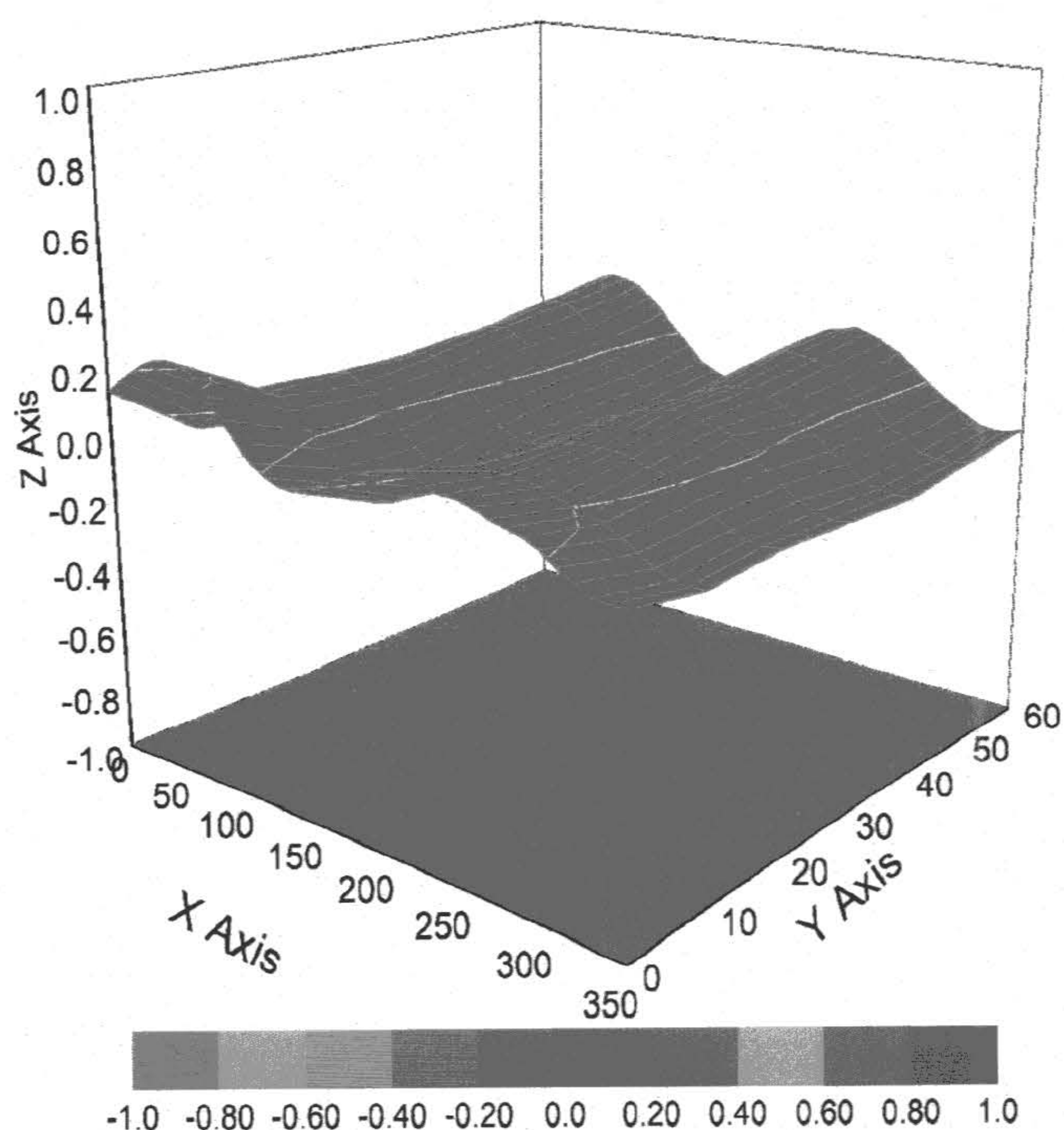


\* analytical \* measured



\* analytical \* measured

## Deviation from Isotropy in Liquid



**Uncertainty of Spherical Isotropy Assessment:  $\pm 3.2\%$  ( $k=2$ )**





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## **DASY/EASY – Parameters of Probe: EX3DV4 – SN:3789**

### **Other Probe Parameters**

|                                                      |                   |
|------------------------------------------------------|-------------------|
| <b>Sensor Arrangement</b>                            | <b>Triangular</b> |
| <b>Connector Angle (°)</b>                           | <b>45.7</b>       |
| <b>Mechanical Surface Detection Mode</b>             | <b>enabled</b>    |
| <b>Optical Surface Detection Mode</b>                | <b>disable</b>    |
| <b>Probe Overall Length</b>                          | <b>337mm</b>      |
| <b>Probe Body Diameter</b>                           | <b>10mm</b>       |
| <b>Tip Length</b>                                    | <b>10mm</b>       |
| <b>Tip Diameter</b>                                  | <b>2.5mm</b>      |
| <b>Probe Tip to Sensor X Calibration Point</b>       | <b>1mm</b>        |
| <b>Probe Tip to Sensor Y Calibration Point</b>       | <b>1mm</b>        |
| <b>Probe Tip to Sensor Z Calibration Point</b>       | <b>1mm</b>        |
| <b>Recommended Measurement Distance from Surface</b> | <b>1.4mm</b>      |



| Dipole D2600V2 SN 1125 |                 |            |                        |                |
|------------------------|-----------------|------------|------------------------|----------------|
| Head Liquid            |                 |            |                        |                |
| Date of Measurement    | Return Loss(dB) | $\Delta$ % | Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 2019-05-20             | -25.7           | /          | 48.9                   | /              |
| 2020-05-20             | -26.6           | 3.50%      | 50.8                   | 1.9 $\Omega$   |