

## BAB V

### KESIMPULAN

1. Jarak yang seimbang atau *distance resonance* agar tidak terjadinya *elektromagnetically coupled* dan rugi-rugi/*loss* antar elemen peradiasi, maka didapatkan jarak antar elemen adalah sekitar  $\frac{3}{4} \lambda_g$ . Didapatkan dimensi ukuran antena mikrostrip yaitu 300mm x 160mm, sehingga masih ada space untuk body satelit dimana ukuran pada dinding body satelit mikro LAPAN adalah 450mm x 270mm.
2. Dari hasil simulasi rancang bangun antena mikrostrip array empat elemen patch bujur sangkar polarisasi circular, untuk *Bandwidth* pada *Return Loss* sebesar 126 MHz dengan nilai batas frekuensi tertinggi 2,3117 GHz dan batas frekuensi terendah 2,1857 GHz, jangkauan *bandwidth* tersebut untuk frekuensi S-Band (2,2 GHz – 2,3 GHz) terlampaui. Dan untuk *VSWR* 1 sampai 2 diperoleh dari hasil simulasi terendah adalah 1,204 dicapai pada frekuensi resonansi 2,25 GHz dan untuk nilai 1,649 di frekuensi cut off 2,3 GHz. Nilai Impedansi masukan terhadap kondisi rangkaian dalam keadaan mismatch adalah sebesar 45,369  $\Omega$ . Nilai *Axial Ratio* terendah adalah 0,5771 dB dicapai pada frekuensi resonansi 2,25 GHz, besarnya bandwidth (Narrowband) axial ratio yang diperoleh adalah 37,3 MHz. Untuk nilai *gain* yang didapatkan adalah sebesar 9,398 dB (PPC\_Ephi) dengan arah sudut 0 derajat, dimana untuk nilai total power radiasi yang dihasilkan maksimum directivity (PPC\_TPwr) adalah 11,31 dB dengan lebar berkas (*beamwidth*)

$36,2^\circ$  dengan *magnitude*  $\leq 3$  dB ke arah kiri  $-18,4^\circ$ , sedangkan *magnitude*  $\leq 3$  dB ke arah kanan  $17,8^\circ$ .

3. *Beamwidth* hasil rancangan susun empat elemen mengecil dibandingkan rancangan elemen tunggal dikarenakan terjadinya sidelobe pada rancangan *array linear* empat elemen, untuk syarat nilai *Axial ratio* untuk polarisasi circular telah tercapai yaitu di bawah 3 dB. Untuk hasil yang terbaik dari penelitian ini adalah peningkatan gain yang telah tercapai yaitu  $> 8$  dB yang mampu memperlihatkan kinerja melebihi dari antena helical yang digunakan pada saat ini. Data hasil simulasi dan pengukuran, pergeseran frekuensi resonansi terjadi dari 2,25 GHz pada hasil simulasi bergeser menjadi 2,28 GHz pada hasil pengukuran dengan nilai persentase pergeseran 1,33%.

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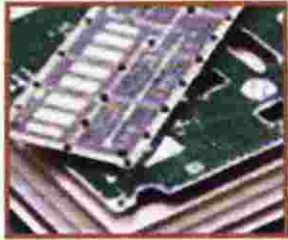




# **LAMPIRAN 1**

**SPESIFIKASI SUBSTRAT**





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**High Frequency  
Circuit Materials**

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**DATA**  
RT1.5880

## **RT/duroid® 5880**

### **Glass Microfiber Reinforced Polytetrafluoroethylene Composite**

RT/duroid® 5880 glass microfiber reinforced PTFE composite is designed for exacting stripline and microstrip circuit applications.

Glass reinforcing microfibers are randomly oriented to maximize benefits of fiber reinforcement in the directions most valuable to circuit producers and in the final circuit application.

The dielectric constant of RT/duroid 5880 laminates is uniform from panel to panel and is constant over a wide frequency range. Its low dissipation factor extends the usefulness of RT/duroid 5880 to Ku-band and above.

RT/duroid 5880 laminate is easily cut, sheared and machined to shape. It has excellent dimensional stability and is resistant to all solvents and reagents, hot or cold, normally used in etching printed circuits or in plating edges and holes.

Normally supplied as a laminate with electrodeposited copper of 1/4 to 2 ounces/ ft.<sup>2</sup> on both sides, RT/duroid 5880 composites can also be clad with rolled copper foil for more critical electrical applications. Cladding with aluminum, copper or brass plate may also be specified.

When ordering RT/duroid 5880 laminates, it is important to specify dielectric thickness, tolerance, rolled or electrodeposited copper foil, and weight of copper foil required.

(See reverse for product data)

# RT/duroid 5880 Properties:

| PROPERTY   | TYPICAL VALUE          |               |          | DIRECTION   | UNITS           | CONDITION            | TEST METHOD               |
|--|------------------------|---------------|----------|-------------|-----------------|----------------------|---------------------------|
| Dielectric Constant, $\epsilon_r$  | 2.20                   |               |          | Z           | ---             | C24/23/50            | 1 MHz IPC-TM-650 2.5.5.3  |
|  | 2.20 $\pm$ 0.02 spec.  |               |          | Z           |                 | C24/23/50            | 10 GHz IPC-TM-650 2.5.5.5 |
| Dissipation Factor, $\tan \delta$  | 0.0004                 |               |          | Z           | ---             | C24/23/50            | 1 MHz IPC-TM-650 2.5.5.3  |
|  | 0.0009                 |               |          | Z           |                 | C24/23/50            | 10 GHz IPC-TM-650 2.5.5.5 |
| Volume Resistivity   | $2 \times 10^7$        |               |          | Z           | Mohm cm         | C93/35/90            | ASTM D257                 |
| Surface Resistivity  | $3 \times 10^8$        |               |          | Z           | Mohm            | C93/35/90            | ASTM D257                 |
| Tensile Modulus  | Test at 23 C           | Test at 100 C |          | X<br>Y      | MPa (kpsi)      | A                    | ASTM D638                 |
|  | 1070 (156)             | 450 (65)      | 380 (55) |             |                 |                      |                           |
|  | 860 (125)              |               |          |             |                 |                      |                           |
| ultimate stress  | 29 (4.2)               | 20 (2.9)      |          | X           | MPa (kpsi)      | A                    | ASTM D695                 |
|  | 27 (3.9)               | 18 (2.6)      |          | Y           |                 |                      |                           |
| ultimate strain  | 6.0                    | 7.2           |          | X           | %               | A                    | ASTM D695                 |
|  | 4.9                    | 5.8           |          | Y           |                 |                      |                           |
| Compressive Modulus  | 710 (103)              | 500 (73)      |          | X<br>Y<br>Z | MPa (kpsi)      | A                    | ASTM D695                 |
|  | 710 (103)              | 500 (73)      |          |             |                 |                      |                           |
|  | 840 (136)              | 670 (97)      |          |             |                 |                      |                           |
| ultimate stress  | 27(3.9)                | 22 (3.2)      |          | X           | MPa (kpsi)      | A                    | ASTM D695                 |
|  |                        | 21(3.1)       |          | Y           |                 |                      |                           |
|  | 52 (7.5)               | 43 (6.3)      |          | Z           |                 |                      |                           |
| ultimate strain  | 8.5                    | 8.4           |          | X           | %               | A                    | ASTM D695                 |
|  | 7.7                    | 7.8           |          | Y           |                 |                      |                           |
|  | 12.5                   | 17.6          |          | Z           |                 |                      |                           |
| Deformation Under Load   | Test at 150 C<br>1.0   |               |          | Z           | %               | 24 hr/14 MPa (2kpsi) | ASTM D621                 |
| Water Absorption<br>Thickness = 0.8 mm (0.031)<br>Thickness = 1.6 mm (0.062) | 0.9(0.02)<br>13(0.015) |               |          |             | mg (%)          | D24/23               | ASTM D570                 |
| Specific Gravity   | 2.2                    |               |          |             |                 |                      | ASTM D792                 |
| Heat Distortion Temperature  | >260 (>500)            |               |          | XY          | C (F)           | 1.82 MPa (264 psi)   | ASTM D648                 |
| Specific Heat  | 0.96 (0.23)            |               |          |             | J/gK (BTU/lb/F) |                      | Calculated                |
| Thermal Conductivity   | 0.20                   |               |          | Z           | W/mK            |                      | ASTM C518                 |
| Thermal Expansion  | X                      | Y             | Z        | <<<         | mm/m            |                      | ASTM D3386<br>(10K/min)   |
|  | -6.1                   | -8.7          | -18.7    |             |                 |                      |                           |
|  | -0.9                   | -1.8          | -6.9     |             |                 |                      |                           |
|  | -0.5                   | -0.9          | -4.5     |             |                 |                      |                           |
|  | 1.1                    | 1.5           | 8.7      |             |                 |                      |                           |
|  | 2.3                    | 3.2           | 26.3     |             |                 |                      |                           |
|  | 3.8                    | 5.5           | 69.5     |             |                 |                      |                           |

If unit given first with other frequently used units in parentheses  
References: Internal TR's 1430, 2224, 2854. Test were at 23°C unless otherwise noted  
Typical values should not be used for specification limits.

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ISO 9002 CERTIFIED



**High Frequency Laminates: Standard Thickness, Tolerance and Panel Sizes**

| Grade   | Dielectric Constant   | Standard Dielectric Thickness   | Standard Panel Sizes  |
|---|---|---|---|
| RT/duroid® 5870<br>RT/duroid 5880   | 2.33<br>2.20  | 0.005" (0.127mm) ±0.0005"<br>0.010" (0.254mm) ±0.0007"<br>0.015" (0.381mm) ± 0.001"<br>0.020" (0.508mm) ±0.001"<br>0.031" (0.787mm) ± 0.001"<br>0.062" (1.570mm) ± 0.002"<br>0.125" (3.170mm) ± 0.004"  | 18" X 12" (457 X 305mm)<br>18" X 24" (457 X 305mm)<br>18" X 36" (457 X 914mm)<br>18" X 48" (457 X 1.219m)   |
| RT/duroid 5880LZ  | 1.96  | 0.010" (0.256mm) ± 0.001<br>0.020" (0.508mm) ± 0.001<br>0.025" (0.625mm) ± 0.001<br>0.030" (0.762mm) ± 0.002<br>0.040" (1.026mm) ± 0.002<br>0.050" (1.270mm) ± 0.003<br>0.100" (2.540mm) ± 0.004<br>Other thicknesses available in 10 mil increments. | 12" X 18" (305 X 457mm)<br>24" X 18" (610 X 457mm)<br>24" X 54" (610 X 1.37m)                               |
| RT/duroid 6002<br>*RT/duroid 6202   | 2.94<br>*2.90 (0.005")<br>*2.98 (0.010")<br>*3.00 (0.015")<br>*2.90 (0.020/0.030) | 0.005" (0.127mm) ± 0.0005"<br>0.010" (0.254mm) ± 0.0007"<br>0.020" (0.508mm) ± 0.001"<br>0.030" (0.762mm) ± 0.0015"<br>0.060" (1.524 mm) ± 0.002"<br>0.120" (3.048mm) ± 0.004"  | 12" X 18" (305 X 457mm)<br>24" X 18" (610 X 457mm)<br>24" X 54" (610 X 1.37m)                               |
| RT/duroid 6006  | 6.15  | 0.010" (0.254mm) ±0.001"  | 10" X 10" (254 X 254mm)   |
| RT/duroid 6010LM  | 10.2<br>10.5<br>10.8  | 0.025" (0.625mm) ± 0.001"<br>0.050" (1.270mm) ± 0.002"<br>0.075" (1.905mm) ±0.004"<br>0.100" (2.540mm) ±0.005"  | 10" X 20" (254 X 508mm)<br>20" X 20" (508 X 508 mm)<br>18" X 12" (457.2 X 305mm)<br>18" X 24" (457 X 305mm) |
| /duroid material available claddings: 1/4 oz. (9µm), 1/2 oz (17µm), 1 oz (35µm), 2 oz (70µm) electrodeposited copper foil 1/2 oz (17µm), 1 oz (35µm), 2 oz (70µm) rolled copper foil. Thick metal cladding on aluminum, brass and copper are available. |   |   |   |
| TMM®3   | 3.27  | 0.015" (0.381mm) ± 0.0015"<br>0.020" (0.508mm) ± 0.0015"  | 18" X 12" (457 X 305mm)<br>18" X 24" (457 X 610mm)  |
| TMM4  | 4.50  | 0.030" (0.762mm) ± 0.0015"<br>0.060" (1.524mm) ± 0.0015"<br>0.125" (3.175mm) ± 0.0015"  |   |
| TMM6  | 6.00  | 0.015" (0.381mm) ± 0.0015"  |   |
| TMM10   | 9.20  | 0.025" (0.635mm) ± 0.0015"<br>0.050" (1.270mm) ± 0.0015"  |   |
| TMM10i  | 9.80  | 0.075" *1.905 mm) ± 0.0015"   |   |
| TMM13i  | 12.80   | 0.100" (2.540 mm) ± 0.0015"   |   |
| TM material available claddings: 1/4 oz. (9µm), 1/2 oz (17µm), 1 oz (35µm), 2 oz (70µm) electrodeposited copper foil. Thick metal cladding on aluminum and brass are available.-  |   |   |   |
| ULTRALAM® 2000  | 2.40<br>2.45<br>2.48<br>2.50<br>2.55  | 0.004" (102 mm) ± 0.0004<br>0.0101" (0.257mm) ± 0.009<br>0.0147" (0.373mm) ±0.001<br>0.0190" (0.483mm) ±0.001<br>0.0300" (0.762mm) ±0.001   | 18" X 12" (457 X 305mm)<br>18" X 24" (457 X 610mm)<br>18" X 36" (457 X 915mm)<br>18" X 48" (457 X 1.219m)   |
| TRALAM 2000 material available claddings: 1/4 oz. (9µm), 1/2 oz (17µm), 1 oz (35µm), 2 oz (70µm) electrodeposited copper foil, 1/2 oz., 1 and 2 oz rolled copper foil. Thick metal cladding on aluminum, brass and copper are available.                |   |   |   |



| Grade   | Dielectric Constant | Standard Dielectric Thickness   | Standard Panel Sizes  |
|---|---------------------|---|---|
| RO3000™   | 3.00                | 0.005" (0.13mm) ± 0.0005<br>0.010" (0.25mm) ± 0.0007<br>0.020" (0.50mm) ± 0.001   | 12" X 18" (305 x 457mm)<br>24" X 18" (610 X 457mm)<br>24" X 36" (610 X 915mm)                               |
| RO4000™   | 3.5                 | 0.030" (0.75mm) ± 0.0015<br>0.060" (1.52mm) ± 0.003   |   |
| RO6000™   | 6.15                | 0.005" (0.13mm) ± 0.0005<br>0.010" (0.25mm) ± 0.0007  |   |
| RO7000™   | 10.2                | 0.025" (0.64mm) ± 0.001<br>0.050" (1.27mm) ± 0.002  |   |
| RO8000™   | 3.02                | 0.010" (0.25mm) ± 0.0007<br>0.020" (0.50mm) ± 0.001<br>0.030" (0.75mm) ± 0.0015<br>0.060" (1.52mm) ± 0.003  |   |
| RO9000™   | 6.15                | 0.025" (0.64mm) ± 0.001   |   |
| RO9000™   | 10.2                | 0.050" (1.27mm) ± 0.002   |   |
| RO series material available claddings: 1/2oz (17µm) (35µm) or 2 oz (70µm) electrodeposited copper foil |                     |   |   |
| RO3003™<br>RO3600™  | 3.38<br>6.15        | 0.008" (0.203mm) ± 0.0010<br>0.012" (0.305mm) ± 0.0010<br>0.016" (0.406mm) ± 0.0015<br>0.020" (0.508mm) ± 0.0015<br>0.032" (0.813mm) ± 0.0020<br>0.060" (1.524mm) ± 0.0040                              | 12" X 18" (305 X 457mm)<br>24" X 18" (610 X 457mm)<br>24" X 36" (610 X 915mm)<br>48" X 36" (1.244m X 915mm) |
| RO508™  | 3.48                | 0.0066" (0.168mm) ± 0.0007<br>0.010" (0.25 mm) ± 0.0010<br>0.0133" (0.338mm) ± 0.0015<br>0.0166" (0.422mm) ± 0.0015<br>0.020" (0.51mm) ± 0.0015<br>0.030" (0.76mm) ± 0.0020<br>0.060" (1.52mm) ± 0.0040 |   |
| RO508 PREPREG   | 3.30                | 0.0036" (0.091mm)   | 24" X 18" (610 X 457mm)   |
|   | 3.54                | 0.004" (0.102mm)  |   |
| RO508 PREPREG   | 3.52                | 0.004" (0.102mm)  | 24" X 18" (610 X 457mm)   |

| Grade                | Dielectric Constant | Standard Dielectric Thickness  | Standard Panel Sizes                                 |
|----------------------|---------------------|--|--|
| RO3000 Antenna Grade | 3.00                | 0.030 (0.762mm) ± 0.0015<br>0.060 (1.524mm) ± 0.003                              | 24" X 18" (610mm X 477<br>24 X 54" ( 610mm X 1.37m)  |
| RO4000 Antenna Grade | 3.00                | 0.0307 (0.780mm) ± 0.015<br>0.0407 (1.034mm) ± 0.002<br>0.0607 (1.542mm) ± 0.003 | 24 X 18 (610 X 457mm)<br>48 X 36" (1.224m X 0.915mm) |
|                      |                     |  |  |

Information contained in this Product Selector Guide is intended to assist you in designing with Rogers' laminates. It is not intended to create any warranties, express or implied, including any warranty of merchantability or fitness for a particular application. The user should determine the suitability of Rogers' circuit materials for each application.

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The background features a large, faint watermark of the Universitas Darma Persada logo. The logo is a yellow sunburst shape with a central shield. The shield is divided into four quadrants: top-left is white, top-right is red, bottom-left is white, and bottom-right is red. In the center of the shield is a white emblem depicting a figure holding a staff. The text 'UNIVERSITAS DARMA PERSADA' is written in a circular path around the shield, with a small star on the right side.

# **LAMPIRAN2**

**HASIL PENGUKURAN  
RETURN LOSS & VSWR**



!CSV A.01.01

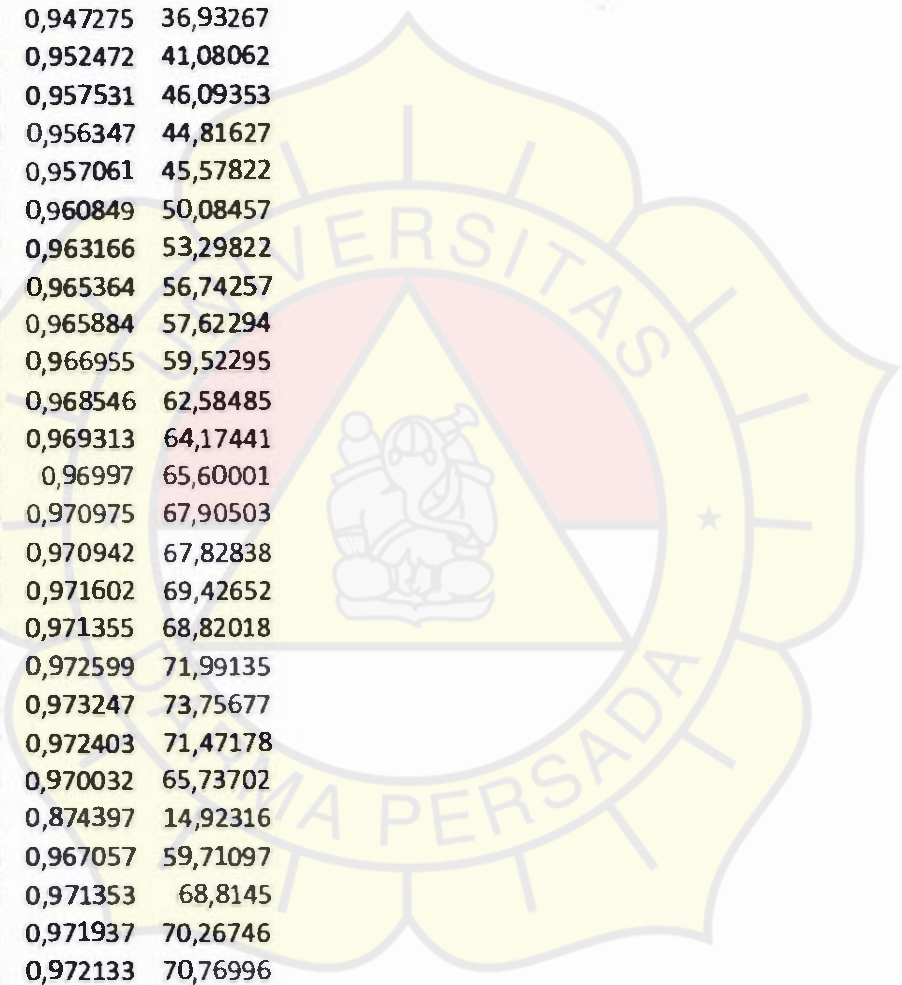
!Agilent Te N5230C MY490006 A.08.50.10

!Agilent N5230C: A.08.50.10

!Date: Thu July 26 2012 10:23:24

BEGIN CH1\_DATA

| Freq(Hz) | S11(DB)  |          | VSWR     |
|----------|----------|----------|----------|
| 1E+09    | -0,39239 | 0,95583  | 44,27932 |
| 1,01E+09 | -0,44691 | 0,949848 | 38,87906 |
| 1,02E+09 | -0,46222 | 0,948176 | 37,59191 |
| 1,03E+09 | -0,46808 | 0,947536 | 37,1215  |
| 1,04E+09 | -0,47431 | 0,946857 | 36,63429 |
| 1,05E+09 | -0,46934 | 0,947399 | 37,02209 |
| 1,06E+09 | -0,47048 | 0,947275 | 36,93267 |
| 1,07E+09 | -0,42295 | 0,952472 | 41,08062 |
| 1,08E+09 | -0,37694 | 0,957531 | 46,09353 |
| 1,09E+09 | -0,38769 | 0,956347 | 44,81627 |
| 1,1E+09  | -0,3812  | 0,957061 | 45,57822 |
| 1,11E+09 | -0,3469  | 0,960849 | 50,08457 |
| 1,12E+09 | -0,32597 | 0,963166 | 53,29822 |
| 1,13E+09 | -0,30618 | 0,965364 | 56,74257 |
| 1,14E+09 | -0,3015  | 0,965884 | 57,62294 |
| 1,15E+09 | -0,29188 | 0,966955 | 59,52295 |
| 1,16E+09 | -0,2776  | 0,968546 | 62,58485 |
| 1,17E+09 | -0,27072 | 0,969313 | 64,17441 |
| 1,18E+09 | -0,26483 | 0,96997  | 65,60001 |
| 1,19E+09 | -0,25584 | 0,970975 | 67,90503 |
| 1,2E+09  | -0,25613 | 0,970942 | 67,82838 |
| 1,21E+09 | -0,25024 | 0,971602 | 69,42652 |
| 1,22E+09 | -0,25244 | 0,971355 | 68,82018 |
| 1,23E+09 | -0,24132 | 0,972599 | 71,99135 |
| 1,24E+09 | -0,23554 | 0,973247 | 73,75677 |
| 1,25E+09 | -0,24307 | 0,972403 | 71,47178 |
| 1,26E+09 | -0,26428 | 0,970032 | 65,73702 |
| 1,27E+09 | -1,16583 | 0,874397 | 14,92316 |
| 1,28E+09 | -0,29096 | 0,967057 | 59,71097 |
| 1,29E+09 | -0,25246 | 0,971353 | 68,8145  |
| 1,3E+09  | -0,24724 | 0,971937 | 70,26746 |
| 1,31E+09 | -0,24548 | 0,972133 | 70,76996 |
| 1,32E+09 | -0,25898 | 0,970624 | 67,08201 |
| 1,33E+09 | -0,27001 | 0,969392 | 64,34327 |
| 1,34E+09 | -0,27889 | 0,968402 | 62,295   |
| 1,35E+09 | -0,29672 | 0,966415 | 58,55102 |
| 1,36E+09 | -0,31016 | 0,964921 | 56,01435 |
| 1,37E+09 | -0,31883 | 0,963959 | 54,49206 |
| 1,38E+09 | -0,33285 | 0,962404 | 52,1968  |
| 1,39E+09 | -0,33913 | 0,961708 | 51,23059 |
| 1,4E+09  | -0,36594 | 0,958745 | 47,4784  |
| 1,41E+09 | -0,38753 | 0,956365 | 44,83433 |
| 1,42E+09 | -0,41215 | 0,953657 | 42,15688 |



|          |          |          |          |
|----------|----------|----------|----------|
| 1,43E+09 | -0,42736 | 0,951989 | 40,65729 |
| 1,44E+09 | -0,45231 | 0,949259 | 38,41572 |
| 1,45E+09 | -0,47684 | 0,946582 | 36,44026 |
| 1,46E+09 | -0,45455 | 0,949013 | 38,22592 |
| 1,47E+09 | -0,48262 | 0,945952 | 36,00415 |
| 1,48E+09 | -0,53805 | 0,939934 | 32,29683 |
| 1,49E+09 | -0,59524 | 0,933766 | 29,1961  |
| 1,5E+09  | -0,58846 | 0,934495 | 29,53191 |
| 1,51E+09 | -0,40025 | 0,954965 | 43,41007 |
| 1,52E+09 | -0,49645 | 0,944447 | 35,00155 |
| 1,53E+09 | -0,5055  | 0,943463 | 34,37516 |
| 1,54E+09 | -0,51101 | 0,942865 | 34,0051  |
| 1,55E+09 | -0,49769 | 0,944312 | 34,91444 |
| 1,56E+09 | -0,49328 | 0,944791 | 35,2261  |
| 1,57E+09 | -0,48962 | 0,94519  | 35,48942 |
| 1,58E+09 | -0,48784 | 0,945384 | 35,61915 |
| 1,59E+09 | -0,46752 | 0,947598 | 37,16647 |
| 1,6E+09  | -0,46622 | 0,94774  | 37,27025 |
| 1,61E+09 | -0,46589 | 0,947776 | 37,2964  |
| 1,62E+09 | -0,46259 | 0,948136 | 37,56236 |
| 1,63E+09 | -0,45342 | 0,949137 | 38,32118 |
| 1,64E+09 | -0,45556 | 0,948903 | 38,1413  |
| 1,65E+09 | -0,4564  | 0,948812 | 38,07134 |
| 1,66E+09 | -0,44792 | 0,949738 | 38,79142 |
| 1,67E+09 | -0,45261 | 0,949226 | 38,39029 |
| 1,68E+09 | -0,45324 | 0,949157 | 38,33659 |
| 1,69E+09 | -0,46334 | 0,948054 | 37,50136 |
| 1,7E+09  | -0,47777 | 0,94648  | 36,36939 |
| 1,71E+09 | -0,48266 | 0,945948 | 36,00114 |
| 1,72E+09 | -0,49389 | 0,944725 | 35,18281 |
| 1,73E+09 | -0,52206 | 0,941666 | 33,28558 |
| 1,74E+09 | -0,54806 | 0,938852 | 31,7073  |
| 1,75E+09 | -0,59479 | 0,933814 | 29,21782 |
| 1,76E+09 | -0,69025 | 0,923607 | 25,18054 |
| 1,77E+09 | -1,05023 | 0,886112 | 16,56113 |
| 1,78E+09 | -3,13912 | 0,696697 | 5,594064 |
| 1,79E+09 | -1,7504  | 0,817486 | 9,958047 |
| 1,8E+09  | -1,20691 | 0,870271 | 14,4167  |
| 1,81E+09 | -1,21698 | 0,869263 | 14,29783 |
| 1,82E+09 | -1,46412 | 0,844878 | 11,89305 |
| 1,83E+09 | -1,07283 | 0,883809 | 16,21299 |
| 1,84E+09 | -1,08766 | 0,882301 | 15,9925  |
| 1,85E+09 | -1,18048 | 0,872923 | 14,73851 |
| 1,86E+09 | -1,27623 | 0,863353 | 13,63627 |
| 1,87E+09 | -1,3716  | 0,853925 | 12,69163 |
| 1,88E+09 | -1,47614 | 0,84371  | 11,7967  |
| 1,89E+09 | -1,66194 | 0,825853 | 10,48455 |
| 1,9E+09  | -1,91095 | 0,802514 | 9,127293 |
| 1,91E+09 | -2,16658 | 0,779239 | 8,059579 |
| 1,92E+09 | -2,34827 | 0,763109 | 7,442694 |



|          |          |          |          |
|----------|----------|----------|----------|
| 1,93E+09 | -2,5085  | 0,749161 | 6,973237 |
| 1,94E+09 | -2,65647 | 0,736506 | 6,59031  |
| 1,95E+09 | -2,92175 | 0,714353 | 6,001644 |
| 1,96E+09 | -3,22947 | 0,689488 | 5,440973 |
| 1,97E+09 | -3,29023 | 0,684682 | 5,342793 |
| 1,98E+09 | -3,25237 | 0,687673 | 5,403535 |
| 1,99E+09 | -3,18066 | 0,693373 | 5,522578 |
| 2E+09    | -3,18214 | 0,693255 | 5,52008  |
| 2,01E+09 | -3,3258  | 0,681883 | 5,286995 |
| 2,02E+09 | -3,55114 | 0,664421 | 4,959844 |
| 2,03E+09 | -3,54808 | 0,664654 | 4,963997 |
| 2,04E+09 | -3,422   | 0,674373 | 5,141991 |
| 2,05E+09 | -3,41546 | 0,674881 | 5,151589 |
| 2,06E+09 | -3,56029 | 0,663721 | 4,947441 |
| 2,07E+09 | -3,82431 | 0,64385  | 4,615608 |
| 2,08E+09 | -4,172   | 0,618586 | 4,243646 |
| 2,09E+09 | -4,42052 | 0,601138 | 4,014262 |
| 2,1E+09  | -4,66264 | 0,584612 | 3,814777 |
| 2,11E+09 | -4,9612  | 0,564859 | 3,596208 |
| 2,12E+09 | -5,33011 | 0,541371 | 3,36082  |
| 2,13E+09 | -5,67403 | 0,520353 | 3,169736 |
| 2,14E+09 | -6,00291 | 0,501019 | 3,008172 |
| 2,15E+09 | -6,20422 | 0,489541 | 2,91804  |
| 2,16E+09 | -6,25435 | 0,486724 | 2,896537 |
| 2,17E+09 | -6,5496  | 0,470457 | 2,776843 |
| 2,18E+09 | -7,38547 | 0,427294 | 2,492192 |
| 2,19E+09 | -8,72273 | 0,366322 | 2,156179 |
| 2,2E+09  | -10,1028 | 0,312508 | 1,909124 |
| 2,21E+09 | -10,9106 | 0,284755 | 1,796246 |
| 2,22E+09 | -11,8579 | 0,255331 | 1,685758 |
| 2,23E+09 | -13,2126 | 0,218458 | 1,559044 |
| 2,24E+09 | -14,7399 | 0,183233 | 1,44868  |
| 2,25E+09 | -17,1862 | 0,138258 | 1,320881 |
| 2,26E+09 | -19,1881 | 0,109798 | 1,246681 |
| 2,27E+09 | -19,5527 | 0,105285 | 1,235348 |
| 2,28E+09 | -19,8442 | 0,10181  | 1,226701 |
| 2,29E+09 | -20,3088 | 0,096508 | 1,213633 |
| 2,3E+09  | -19,1582 | 0,110177 | 1,247637 |
| 2,31E+09 | -17,9891 | 0,126051 | 1,288464 |
| 2,32E+09 | -17,0206 | 0,14092  | 1,328072 |
| 2,33E+09 | -16,0749 | 0,157128 | 1,37284  |
| 2,34E+09 | -16,2965 | 0,153171 | 1,361753 |
| 2,35E+09 | -17,3167 | 0,136196 | 1,31534  |
| 2,36E+09 | -16,7785 | 0,144902 | 1,338914 |
| 2,37E+09 | -15,1242 | 0,175303 | 1,425134 |
| 2,38E+09 | -13,5323 | 0,210566 | 1,533459 |
| 2,39E+09 | -12,7136 | 0,231376 | 1,602054 |
| 2,4E+09  | -11,224  | 0,274663 | 1,757339 |
| 2,41E+09 | -9,0125  | 0,354303 | 2,097429 |
| 2,42E+09 | -7,32636 | 0,430211 | 2,510073 |





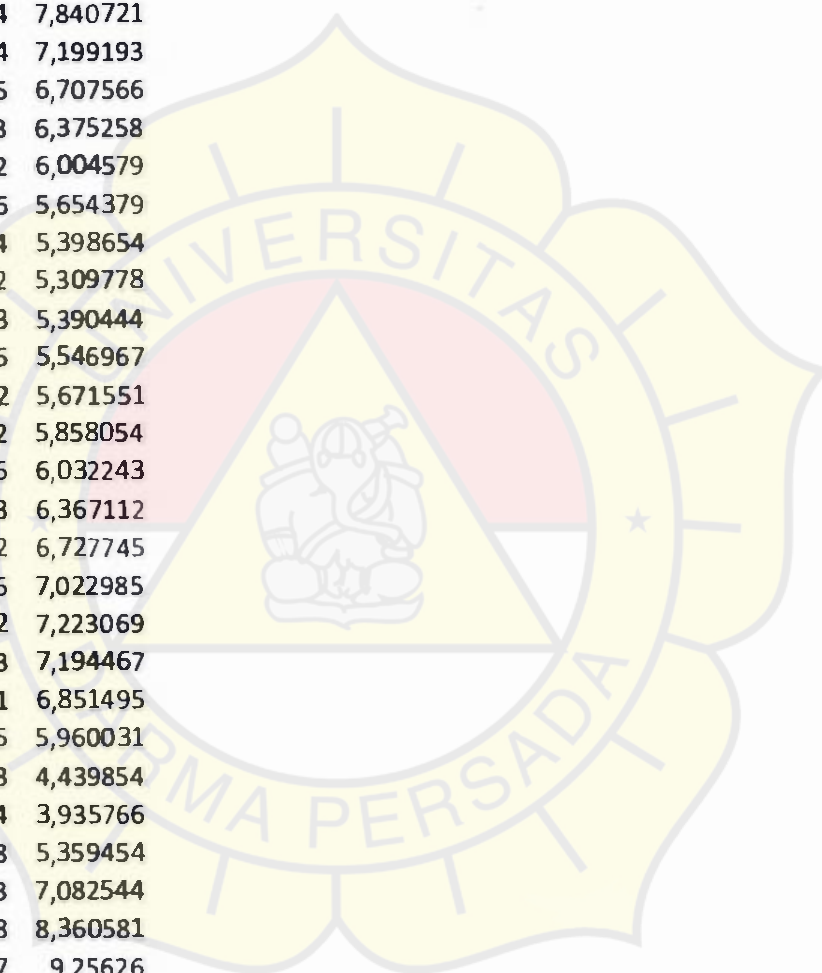
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|----------|----------|----------|----------|
| 2,43E+09 | -6,42259 | 0,477387 | 2,826923 |
| 2,44E+09 | -5,63193 | 0,522882 | 3,191835 |
| 2,45E+09 | -4,78552 | 0,5764   | 3,721436 |
| 2,46E+09 | -4,10749 | 0,623197 | 4,307811 |
| 2,47E+09 | -3,52211 | 0,666645 | 4,999613 |
| 2,48E+09 | -3,14467 | 0,696252 | 5,584402 |
| 2,49E+09 | -2,97962 | 0,709609 | 5,887269 |
| 2,5E+09  | -2,69857 | 0,732945 | 6,48909  |
| 2,51E+09 | -2,41246 | 0,75749  | 7,247088 |
| 2,52E+09 | -2,17641 | 0,778359 | 8,023584 |
| 2,53E+09 | -1,98912 | 0,795323 | 8,771517 |
| 2,54E+09 | -1,89605 | 0,803892 | 9,198441 |
| 2,55E+09 | -1,83491 | 0,80957  | 9,50254  |
| 2,56E+09 | -1,70732 | 0,82155  | 10,20765 |
| 2,57E+09 | -1,59495 | 0,832248 | 10,92235 |
| 2,58E+09 | -1,5195  | 0,839508 | 11,46171 |
| 2,59E+09 | -1,46345 | 0,844943 | 11,89847 |
| 2,6E+09  | -1,42389 | 0,8488   | 12,2275  |
| 2,61E+09 | -1,36176 | 0,854894 | 12,78302 |
| 2,62E+09 | -1,3142  | 0,859587 | 13,24373 |
| 2,63E+09 | -1,27495 | 0,86348  | 13,64987 |
| 2,64E+09 | -1,28884 | 0,862101 | 13,50332 |
| 2,65E+09 | -1,38121 | 0,852981 | 12,60371 |
| 2,66E+09 | -1,62252 | 0,82961  | 10,73778 |
| 2,67E+09 | -2,46127 | 0,753245 | 7,105206 |
| 2,68E+09 | -7,34939 | 0,429072 | 2,503069 |
| 2,69E+09 | -5,92433 | 0,505573 | 3,045083 |
| 2,7E+09  | -2,17381 | 0,778591 | 8,033077 |
| 2,71E+09 | -1,50195 | 0,841206 | 11,59492 |
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| 2,73E+09 | -1,65688 | 0,826335 | 10,51642 |
| 2,74E+09 | -1,07988 | 0,883092 | 16,10743 |
| 2,75E+09 | -0,94612 | 0,896797 | 18,37931 |
| 2,76E+09 | -0,89609 | 0,901977 | 19,40344 |
| 2,77E+09 | -0,83998 | 0,907822 | 20,69724 |
| 2,78E+09 | -0,808   | 0,911172 | 21,51536 |
| 2,79E+09 | -0,7704  | 0,915124 | 22,56377 |
| 2,8E+09  | -0,74998 | 0,917278 | 23,17736 |
| 2,81E+09 | -0,74486 | 0,917819 | 23,33642 |
| 2,82E+09 | -0,7465  | 0,917646 | 23,28539 |
| 2,83E+09 | -0,74396 | 0,917914 | 23,36474 |
| 2,84E+09 | -0,75778 | 0,916455 | 22,93924 |
| 2,85E+09 | -0,7511  | 0,917159 | 23,14272 |
| 2,86E+09 | -0,74565 | 0,917736 | 23,31187 |
| 2,87E+09 | -0,75325 | 0,916933 | 23,07699 |
| 2,88E+09 | -0,77198 | 0,914958 | 22,51775 |
| 2,89E+09 | -0,77256 | 0,914896 | 22,50067 |
| 2,9E+09  | -0,78396 | 0,913696 | 22,17401 |
| 2,91E+09 | -0,78701 | 0,913376 | 22,08834 |
| 2,92E+09 | -0,79662 | 0,912365 | 21,82204 |



|          |          |          |          |
|----------|----------|----------|----------|
| 2,93E+09 | -0,81102 | 0,910855 | 21,43533 |
| 2,94E+09 | -0,85015 | 0,90676  | 20,45013 |
| 2,95E+09 | -0,88533 | 0,903095 | 19,6388  |
| 2,96E+09 | -0,89664 | 0,90192  | 19,3915  |
| 2,97E+09 | -0,92568 | 0,898909 | 18,78423 |
| 2,98E+09 | -0,95101 | 0,896292 | 18,285   |
| 2,99E+09 | -0,97348 | 0,893976 | 17,86372 |
| 3E+09    | -1,01402 | 0,889813 | 17,15099 |
| 3,01E+09 | -1,02694 | 0,888491 | 16,93581 |
| 3,02E+09 | -1,04993 | 0,886142 | 16,56576 |
| 3,03E+09 | -1,07195 | 0,883898 | 16,22628 |
| 3,04E+09 | -1,09809 | 0,881242 | 15,84102 |
| 3,05E+09 | -1,12336 | 0,878682 | 15,48563 |
| 3,06E+09 | -1,16424 | 0,874557 | 14,94344 |
| 3,07E+09 | -1,17529 | 0,873445 | 14,80342 |
| 3,08E+09 | -1,17461 | 0,873514 | 14,81199 |
| 3,09E+09 | -1,18843 | 0,872125 | 14,64025 |
| 3,1E+09  | -1,23167 | 0,867793 | 14,12783 |
| 3,11E+09 | -1,36808 | 0,854272 | 12,72417 |
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| 3,14E+09 | -1,20245 | 0,870717 | 14,46999 |
| 3,15E+09 | -1,21514 | 0,869447 | 14,31948 |
| 3,16E+09 | -1,23778 | 0,867184 | 14,0584  |
| 3,17E+09 | -1,26254 | 0,864715 | 13,78362 |
| 3,18E+09 | -1,27863 | 0,863115 | 13,61077 |
| 3,19E+09 | -1,28583 | 0,8624   | 13,53488 |
| 3,2E+09  | -1,31437 | 0,85957  | 13,24202 |
| 3,21E+09 | -1,33155 | 0,857872 | 13,07187 |
| 3,22E+09 | -1,37936 | 0,853163 | 12,62051 |
| 3,23E+09 | -1,54468 | 0,837078 | 11,2758  |
| 3,24E+09 | -2,20004 | 0,776244 | 7,938298 |
| 3,25E+09 | -4,65671 | 0,585011 | 3,819409 |
| 3,26E+09 | -3,0625  | 0,70287  | 5,731065 |
| 3,27E+09 | -1,67302 | 0,824801 | 10,41556 |
| 3,28E+09 | -1,30194 | 0,860801 | 13,36794 |
| 3,29E+09 | -1,14031 | 0,87697  | 15,25616 |
| 3,3E+09  | -1,05914 | 0,885203 | 16,42211 |
| 3,31E+09 | -1,00401 | 0,890839 | 17,3216  |
| 3,32E+09 | -0,98668 | 0,892619 | 17,62519 |
| 3,33E+09 | -0,99616 | 0,891645 | 17,4579  |
| 3,34E+09 | -0,98614 | 0,892675 | 17,63491 |
| 3,35E+09 | -0,9821  | 0,893089 | 17,70722 |
| 3,36E+09 | -0,97158 | 0,894172 | 17,89866 |
| 3,37E+09 | -0,96517 | 0,894832 | 18,01714 |
| 3,38E+09 | -0,96296 | 0,89506  | 18,05843 |
| 3,39E+09 | -0,9811  | 0,893192 | 17,72523 |
| 3,4E+09  | -0,98419 | 0,892875 | 17,66979 |
| 3,41E+09 | -0,98765 | 0,892519 | 17,60788 |
| 3,42E+09 | -0,9853  | 0,892761 | 17,6499  |



|          |          |          |          |
|----------|----------|----------|----------|
| 3,43E+09 | -0,99438 | 0,891827 | 17,48897 |
| 3,44E+09 | -1,0261  | 0,888577 | 16,94968 |
| 3,45E+09 | -1,07063 | 0,884033 | 16,24628 |
| 3,46E+09 | -1,10717 | 0,880322 | 15,71147 |
| 3,47E+09 | -1,13899 | 0,877103 | 15,27382 |
| 3,48E+09 | -1,20173 | 0,870791 | 14,47875 |
| 3,49E+09 | -1,2845  | 0,862532 | 13,54882 |
| 3,5E+09  | -1,39194 | 0,851929 | 12,507   |
| 3,51E+09 | -1,49991 | 0,841404 | 11,61062 |
| 3,52E+09 | -1,60001 | 0,831763 | 10,88801 |
| 3,53E+09 | -1,69849 | 0,822386 | 10,26034 |
| 3,54E+09 | -1,82538 | 0,810459 | 9,551803 |
| 3,55E+09 | -2,01069 | 0,793351 | 8,678237 |
| 3,56E+09 | -2,22772 | 0,773774 | 7,840721 |
| 3,57E+09 | -2,42872 | 0,756074 | 7,199193 |
| 3,58E+09 | -2,60933 | 0,740515 | 6,707566 |
| 3,59E+09 | -2,74756 | 0,728823 | 6,375258 |
| 3,6E+09  | -2,92029 | 0,714472 | 6,004579 |
| 3,61E+09 | -3,10492 | 0,699446 | 5,654379 |
| 3,62E+09 | -3,25538 | 0,687434 | 5,398654 |
| 3,63E+09 | -3,31118 | 0,683032 | 5,309778 |
| 3,64E+09 | -3,26045 | 0,687033 | 5,390444 |
| 3,65E+09 | -3,16637 | 0,694515 | 5,546967 |
| 3,66E+09 | -3,09531 | 0,70022  | 5,671551 |
| 3,67E+09 | -2,99477 | 0,708372 | 5,858054 |
| 3,68E+09 | -2,90665 | 0,715596 | 6,032243 |
| 3,69E+09 | -2,75113 | 0,728523 | 6,367112 |
| 3,7E+09  | -2,60138 | 0,741192 | 6,727745 |
| 3,71E+09 | -2,49048 | 0,750716 | 7,022985 |
| 3,72E+09 | -2,42059 | 0,756782 | 7,223069 |
| 3,73E+09 | -2,43034 | 0,755933 | 7,194467 |
| 3,74E+09 | -2,55371 | 0,745271 | 6,851495 |
| 3,75E+09 | -2,94254 | 0,712645 | 5,960031 |
| 3,76E+09 | -3,98094 | 0,632343 | 4,439854 |
| 3,77E+09 | -4,51266 | 0,594794 | 3,935766 |
| 3,78E+09 | -3,27975 | 0,685508 | 5,359454 |
| 3,79E+09 | -2,46926 | 0,752553 | 7,082544 |
| 3,8E+09  | -2,08781 | 0,786338 | 8,360581 |
| 3,81E+09 | -1,88411 | 0,804997 | 9,25626  |
| 3,82E+09 | -1,74308 | 0,818175 | 9,99957  |
| 3,83E+09 | -1,66464 | 0,825597 | 10,46767 |
| 3,84E+09 | -1,61727 | 0,830112 | 10,77243 |
| 3,85E+09 | -1,5912  | 0,832607 | 10,94794 |
| 3,86E+09 | -1,5641  | 0,835208 | 11,13653 |
| 3,87E+09 | -1,56791 | 0,834843 | 11,10968 |
| 3,88E+09 | -1,5649  | 0,835132 | 11,13093 |
| 3,89E+09 | -1,58135 | 0,833552 | 11,01573 |
| 3,9E+09  | -1,60305 | 0,831471 | 10,86742 |
| 3,91E+09 | -1,66924 | 0,825159 | 10,43899 |
| 3,92E+09 | -1,7161  | 0,82072  | 10,15572 |





|          |          |          |          |
|----------|----------|----------|----------|
| 3,93E+09 | -1,77338 | 0,815326 | 9,829881 |
| 3,94E+09 | -1,84861 | 0,808294 | 9,432665 |
| 3,95E+09 | -1,93064 | 0,800697 | 9,034956 |
| 3,96E+09 | -2,06086 | 0,788782 | 8,468894 |
| 3,97E+09 | -2,19244 | 0,776923 | 7,965517 |
| 3,98E+09 | -2,29613 | 0,767703 | 7,609674 |
| 3,99E+09 | -2,46022 | 0,753336 | 7,108208 |
| 4E+09    | -2,63439 | 0,738381 | 6,644696 |

END



The logo of Universitas Islam Darma Persada is a large, light yellow emblem with a scalloped border. It features a central shield with a red and white diagonal design and a small figure in the center. The text 'UNIVERSITAS ISLAM DARMA PERSADA' is written around the inner circle of the emblem.

# **LAMPIRAN 3**

**\*HASIL PENGUKURAN \*  
SMITH CHART**

BEGIN CH1\_DATA

Freq(Hz),S11(REAL),S11(IMG),S12(REAL),S12(IMG),S21(REAL),S21(IMG),S22(REAL),S22(IMG)

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101000000,-0.92636418,0.16504043,-5.8143396e-006,-2.5972354e-006,-3.274266e-006,2.4726139e-006,0.99948913,-0.025701387
102000000,-0.83321786,0.43146554,1.8974993e-006,1.7395952e-005,1.353777e-005,5.5844334e-006,0.99950677,-0.02540393
103000000,-0.67052388,0.65541708,7.0599816e-007,1.5025639e-007,-1.714978e-005,-8.0197578e-006,0.99977708,-0.0257162
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108000000,0.43079981,0.84611857,-1.3046562e-005,-3.4982611e-007,-3.6750723e-006,-3.4821462e-006,0.99975824,-0.026836883
109000000,0.59210473,0.74233532,-2.0747295e-005,4.6897567e-006,1.2067561e-005,-5.6486529e-006,0.99894774,-0.026815524
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END



The background features a large, semi-transparent watermark logo of Universitas Darmasasmi. The logo is a yellow flower-like shape with a central emblem depicting a figure and a book. The text 'UNIVERSITAS DARMASASMI' is written around the perimeter of the logo.

# **LAMPIRAN 4**

**\* HASIL PENGUKURAN \*  
AXIAL RATIO DI FREKUENSI  
RESONANSI 2,28 GHZ**

| DG  | LHCP   | RHCP   | Axial ratio [dB] |
|-----|--------|--------|------------------|
| 0   | -41,38 | -20,48 | 1,570453785      |
| 10  | -59,03 | -23,25 | 0,282411619      |
| 20  | -49,32 | -34,97 | 3,370915273      |
| 30  | -48,42 | -35,21 | 3,858376732      |
| 40  | -44,59 | -35,5  | 6,371302527      |
| 50  | -41,26 | -45,15 | 13,14139796      |
| 60  | -41,39 | -43,24 | 19,48620069      |
| 70  | -44,82 | -40,64 | 12,53876404      |
| 80  | -47,36 | -40,91 | 8,992468983      |
| 90  | -49,22 | -41,71 | 7,802771887      |
| 100 | -48,81 | -41,91 | 8,460576366      |
| 110 | -48,50 | -41,85 | 8,750793436      |
| 120 | -47,61 | -41,95 | 10,04051736      |
| 130 | -45,65 | -47,28 | 20,5785723       |
| 140 | -41,51 | -48,88 | 7,947822253      |
| 150 | -42,06 | -58,46 | 2,649683889      |
| 160 | -44,03 | -45,37 | 22,27199338      |
| 170 | -40,88 | -43,27 | 17,28348976      |
| 180 | -38,78 | -43,44 | 11,63408057      |
| 190 | -42,58 | -44,88 | 17,61287557      |
| 200 | -50,52 | -49,16 | 22,14382781      |
| 210 | -48,58 | -52,97 | 12,12978753      |
| 220 | -52,35 | -47,51 | 11,32074251      |
| 230 | -48,14 | -45,91 | 17,87831671      |
| 240 | -46,06 | -47,03 | 25,0704719       |
| 250 | -43,88 | -53,32 | 6,097988707      |
| 260 | -45,99 | -54,49 | 6,865387463      |
| 270 | -49,72 | -56,61 | 8,47194191       |
| 280 | -55,01 | -66,54 | 4,718961896      |
| 290 | -50,68 | -50,84 | 40,714732        |
| 300 | -46,27 | -41,85 | 12,07309419      |
| 310 | -44,52 | -35,96 | 6,813108486      |
| 320 | -45,43 | -35,22 | 5,542970993      |
| 330 | -48,56 | -38,53 | 5,667354297      |
| 340 | -42,38 | -25,61 | 2,537569592      |
| 350 | -38,76 | -20,83 | 2,216625817      |
| 360 |        |        |                  |

## CURRICULUM VITAE

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### PENDIDIKAN:

1. SD N13, Jakarta Lulus 1998
2. SLTP N193, Jakarta Lulus 2001
3. SMK N 26 Pembangunan, Jakarta Lulus 2005

