

# SAR Dipole

## Performance Measurement Report

ISSUED BY  
Shenzhen BALUN Technology Co., Ltd.



FOR  
Validation Dipoles



Tested by:   
Zong Liyao  
(Engineer)

Approved by:   
Liao Jianming  
(Technical Director)

Report No.: LW-SZ1960012-701  
EUT Type: SAR Validation Dipole  
Model Name: D750V3, D835V2, D1750V2  
D1900V2, D2450V2, D2600V2  
D5GHzV2  
Brand Name: Speag

Test Conclusion: Pass  
Test Date: Mar. 12, 2019 ~ Jul. 13, 2019  
Date of Issue: Jul. 19, 2019

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# 1 GENERAL INFORMATION

## 1.1 Introduction

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDB 865664 D01 for reference dipoles used for SAR measurement system validations. Instead of the typical annual calibration recommended by measurement standards, the reference dipoles were demonstrated that the SAR target, impedance and return loss have remain stable, so the longer calibration interval is acceptable.

## 1.2 General Description for Equipment under Test (EUT)

|              |                          |
|--------------|--------------------------|
| EUT Type     | DASY 5 Reference Dipoles |
| Manufacturer | Speag                    |

| Parameter                        | EUT 1     | EUT 2     | EUT 3     | EUT 4     | EUT 5     | EUT 6     | EUT 7     |
|----------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Model                            | D750V3    | D835V2    | D1750V2   | D1900V2   | D2450V2   | D2600V2   | D5GHzV2   |
| Frequency                        | 750 MHz   | 835 MHz   | 1750 MHz  | 1900 MHz  | 2450MHz   | 2600 MHz  | 5GHz-6GHz |
| Serial Number                    | SN 1055   | SN 4d187  | SN 1130   | SN 5d193  | SN 952    | SN 1095   | SN 1200   |
| Product Condition<br>(New/ Used) | Used      | Used      | Used      | Used      | Used      | Used      | Used      |
| Last Cal. Date                   | 2017/6/26 | 2017/6/26 | 2017/7/01 | 2017/6/30 | 2017/3/21 | 2017/7/10 | 2017/6/29 |
| Current meas.<br>Date            | 2019/6/11 | 2019/6/11 | 2019/6/12 | 2019/6/12 | 2019/3/12 | 2019/6/12 | 2019/6/13 |

1.3EUT Photos

|                                                                                      |  |
|--------------------------------------------------------------------------------------|--|
| D750V3                                                                               |  |
|    |  |
| D835V2                                                                               |  |
|   |  |
| D1750V2                                                                              |  |
|  |  |
| D1900V2                                                                              |  |
|  |  |

D2600V2



D2450V2



D5GHzV2





## 2 DIPOLE IMPEDANCE AND RETURN LOSS

The dipoles are designed to have low return loss when presented against a flat phantom at the specified distance. A Vector Network Analyser was used to perform a return loss measurement on the specific dipole when in the measurement location against the phantom and the distance was specified by the manufacturer with a special, low loss and low relative permittivity spacer.

The impedance was measured at the SMA-connector with the network analyser.

The measurement of verification with return loss should not deviate by more than 20% and minimum of 20 dB of the return loss, and the impedance (real or imaginary parts) should not deviate by more than 5 Ohms from the previous measurement using network analyzer.

Note:

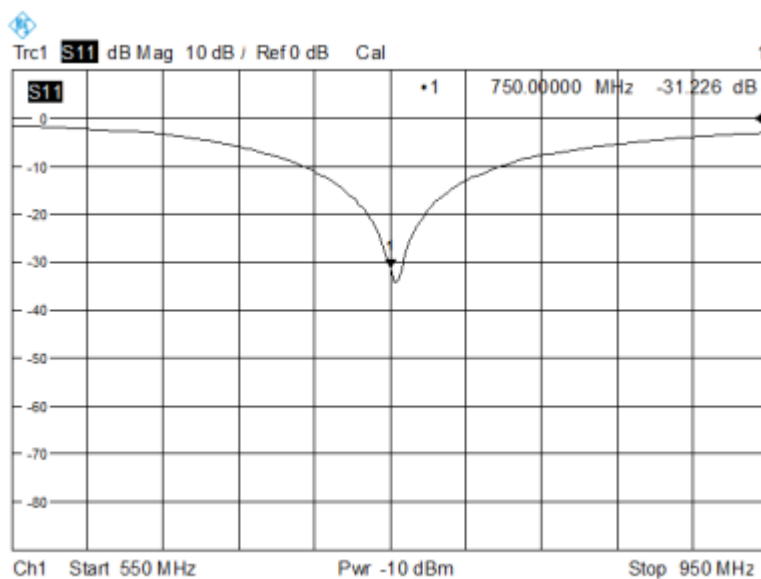
The "Previous Meas." in the following table refer to dipoles or other equivalent RF sources calibration reports.

## 2.1 D750V3

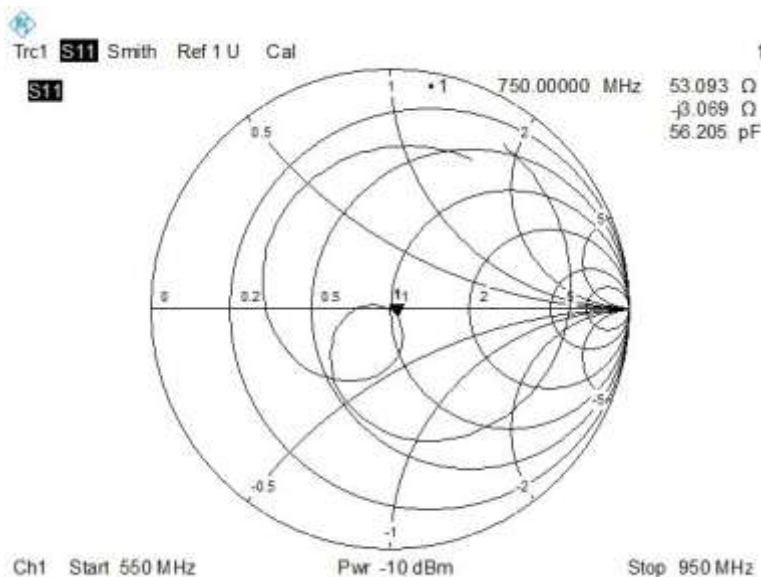
### RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

| Meas. Results   | Current Meas.                      | Previous Meas.                     | Max. Deviation              |
|-----------------|------------------------------------|------------------------------------|-----------------------------|
| Return Loss(dB) | -31.226                            | -30.728                            | 1.6%                        |
| Impedance       | 53.093 $\Omega$ - 3.069 j $\Omega$ | 52.793 $\Omega$ - 3.016 j $\Omega$ | 0.3 $\Omega$<br>(Real part) |

#### Return Loss



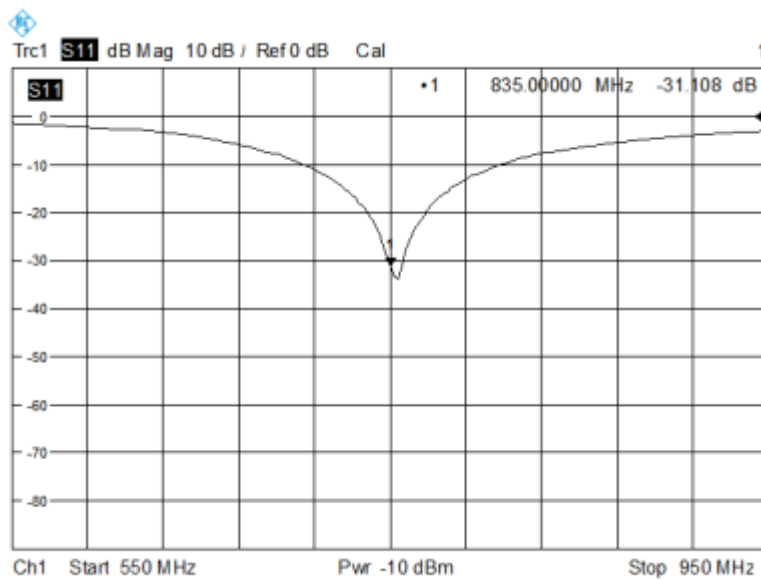
#### Impedance



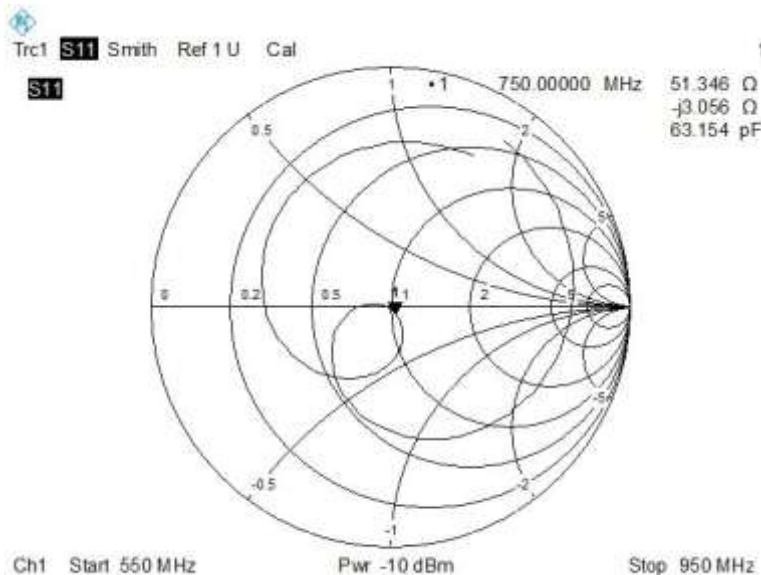
# RETURN LOSS AND IMPEDANCE IN BODY LIQUID

| Meas. Results   | Current Meas.                      | Previous Meas.                     | Max. Deviation                 |
|-----------------|------------------------------------|------------------------------------|--------------------------------|
| Return Loss(dB) | -31.108                            | -30.881                            | 0.7%                           |
| Impedance       | 51.346 $\Omega$ - 3.056 j $\Omega$ | 51.921 $\Omega$ - 3.131 j $\Omega$ | -0.575 $\Omega$<br>(Real part) |

## Return Loss



## Impedance

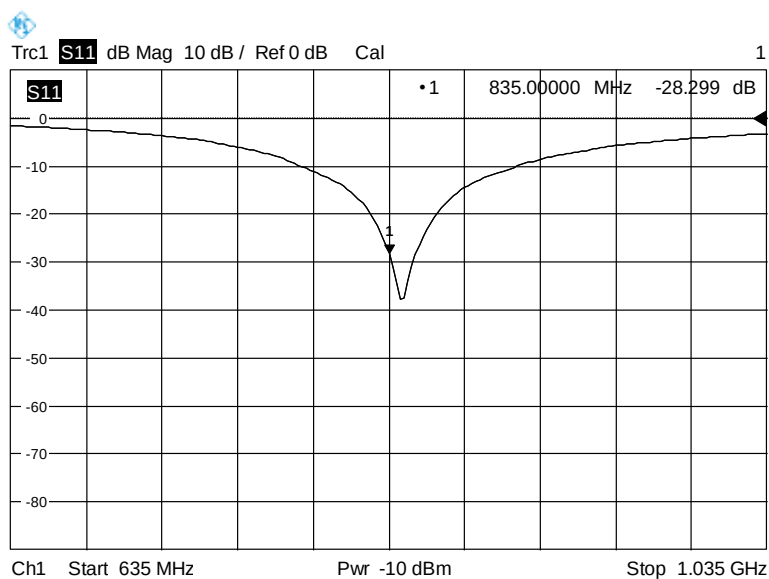


## 2.2 D835V2

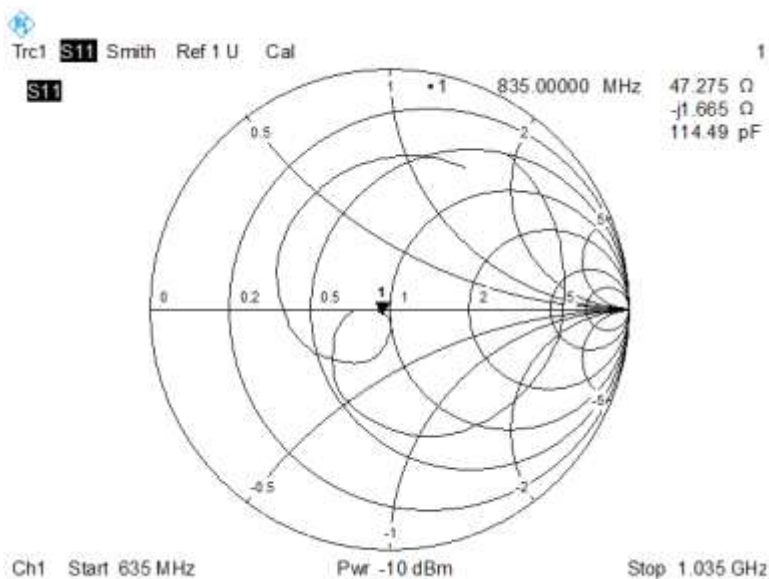
### RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

| Meas. Results   | Current Meas.                 | Previous Meas.                | Max. Deviation                |
|-----------------|-------------------------------|-------------------------------|-------------------------------|
| Return Loss(dB) | 28.299                        | -29.391                       | -3.715%                       |
| Impedance       | $47.275\Omega - 1.665j\Omega$ | $48.614\Omega - 2.557j\Omega$ | $-1.339\Omega$<br>(Real part) |

#### Return Loss



#### Impedance

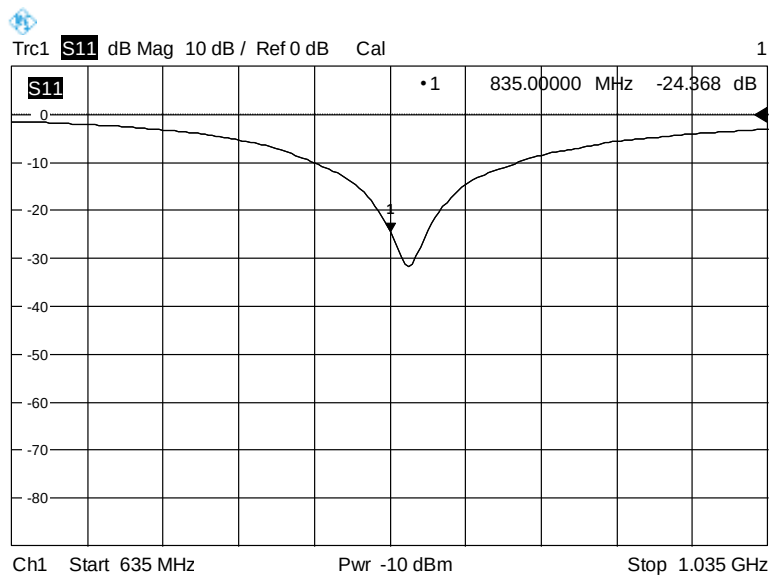




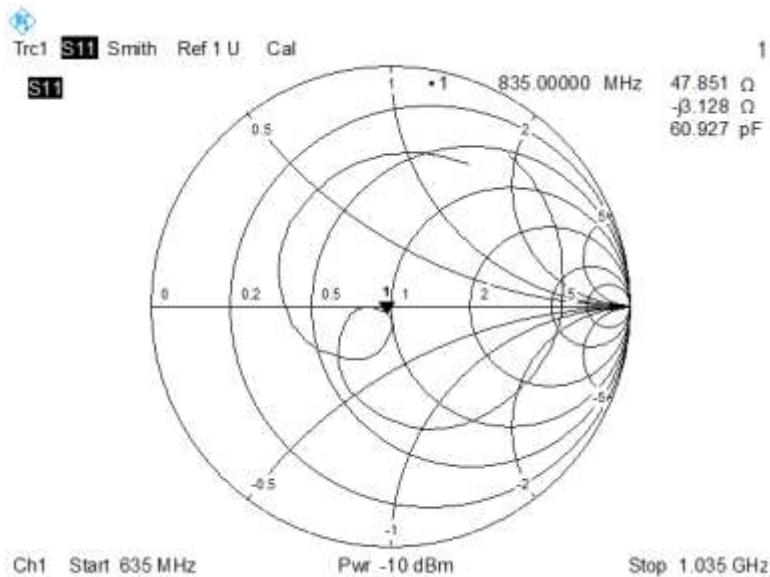
# RETURN LOSS AND IMPEDANCE IN BODY LIQUID

| Meas. Results   | Current Meas.                      | Previous Meas.                     | Max. Deviation                |
|-----------------|------------------------------------|------------------------------------|-------------------------------|
| Return Loss(dB) | -24.368                            | -25.430                            | -4.2%                         |
| Impedance       | 47.851 $\Omega$ - 3.128 j $\Omega$ | 46.544 $\Omega$ - 3.507 j $\Omega$ | 1.307 $\Omega$<br>(Real part) |

## Return Loss



## Impedance

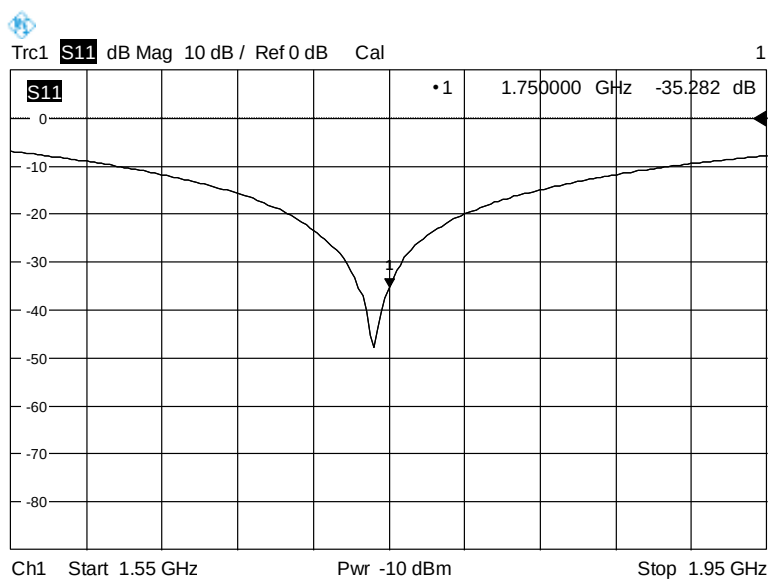


## 2.33.3 D1750V2

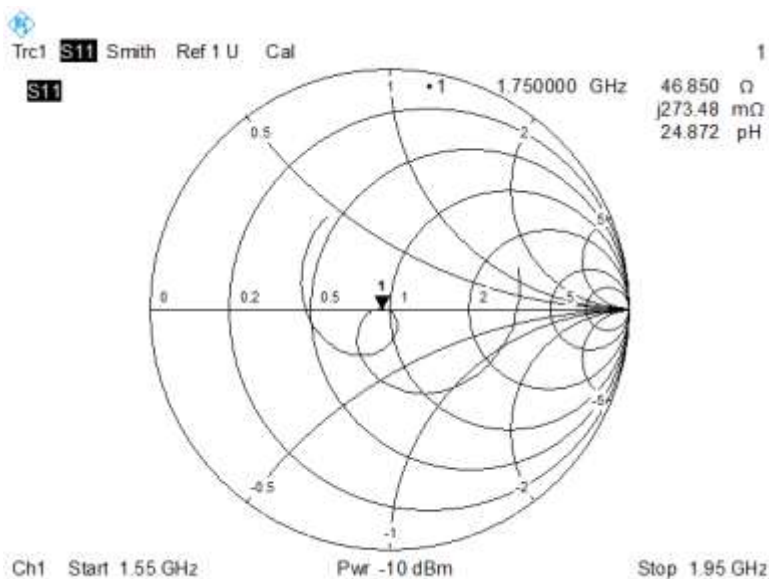
### RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

| Meas. Results   | Current Meas.                        | Previous Meas.                        | Max. Deviation                      |
|-----------------|--------------------------------------|---------------------------------------|-------------------------------------|
| Return Loss(dB) | -35.282                              | -34.478                               | 2.3%                                |
| Impedance       | 46.850 $\Omega$ +0.273<br>j $\Omega$ | 48.643 $\Omega$ - 1.407<br>j $\Omega$ | -1.793 $\Omega$<br>(Imaginary part) |

#### Return Loss



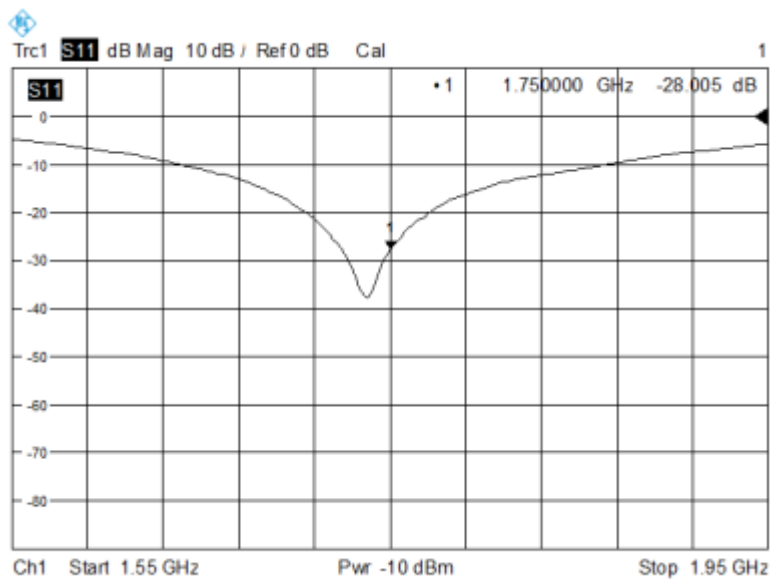
#### Impedance



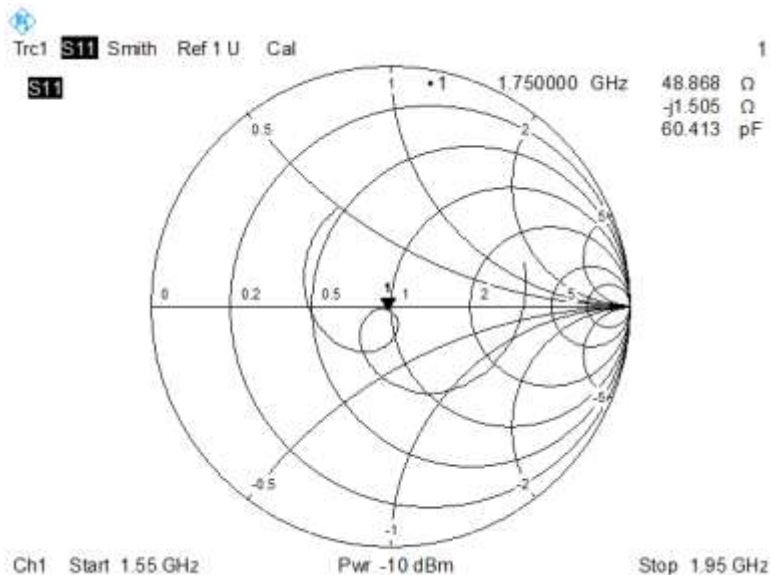
# RETURN LOSS AND IMPEDANCE IN BODY LIQUID

| Meas. Results   | Current Meas.                      | Previous Meas.                     | Max. Deviation                 |
|-----------------|------------------------------------|------------------------------------|--------------------------------|
| Return Loss(dB) | -28.005                            | -27.872                            | 0.5%                           |
| Impedance       | 48.868 $\Omega$ - 1.505 j $\Omega$ | 46.763 $\Omega$ + 0.612 j $\Omega$ | -2.117 $\Omega$<br>(Real part) |

## Return Loss



## Impedance

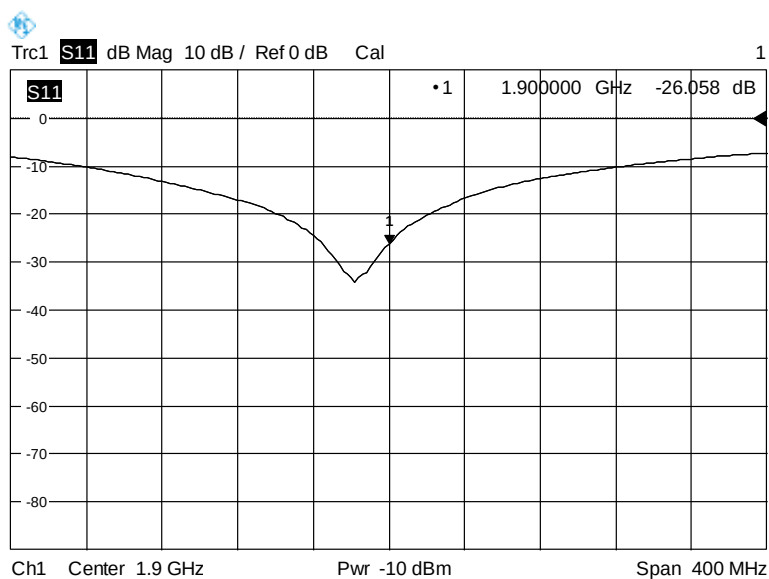


## 2.4D1900V2

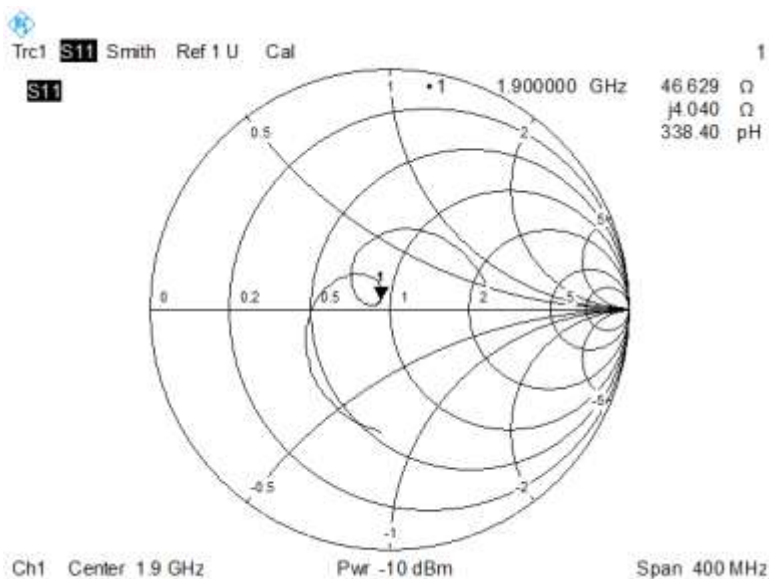
### RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

| Meas. Results   | Current Meas.                         | Previous Meas.                        | Max. Deviation                 |
|-----------------|---------------------------------------|---------------------------------------|--------------------------------|
| Return Loss(dB) | -26.058                               | -25.822                               | 0.9%                           |
| Impedance       | 46.629 $\Omega$ + 4.040<br>j $\Omega$ | 48.893 $\Omega$ + 5.253<br>j $\Omega$ | -2.264 $\Omega$<br>(Real part) |

#### Return Loss



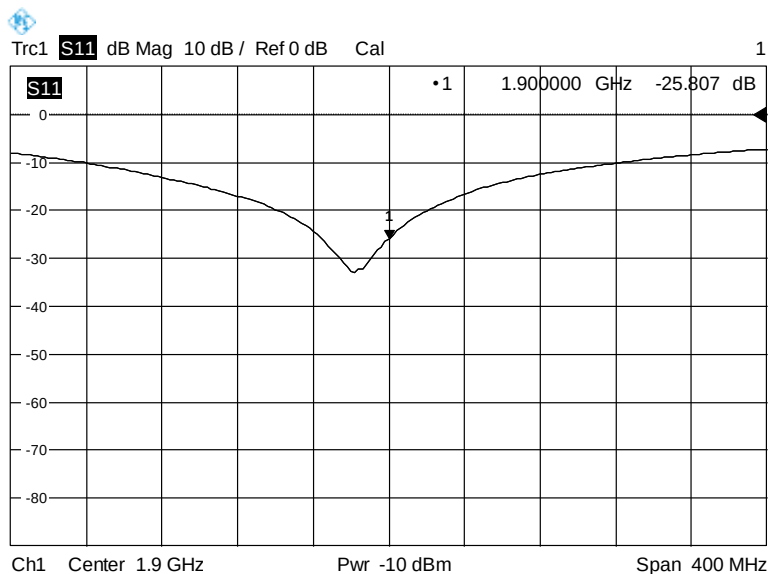
#### Impedance



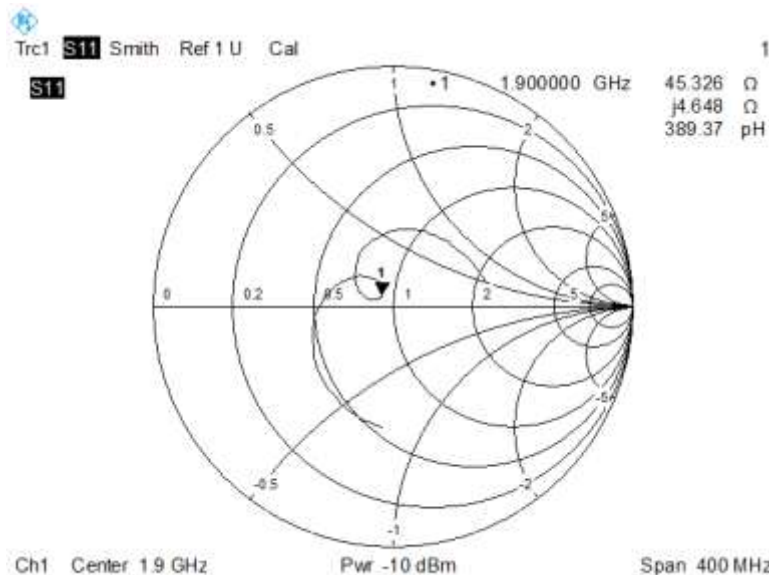
# RETURN LOSS AND IMPEDANCE IN BODY LIQUID

| Meas. Results   | Current Meas.                         | Previous Meas.                        | Max. Deviation                 |
|-----------------|---------------------------------------|---------------------------------------|--------------------------------|
| Return Loss(dB) | -25.807                               | -24.513                               | 5.3%                           |
| Impedance       | 45.326 $\Omega$ + 4.648<br>j $\Omega$ | 46.749 $\Omega$ + 4.221<br>j $\Omega$ | -1.423 $\Omega$<br>(Real part) |

## Return Loss



## Impedance

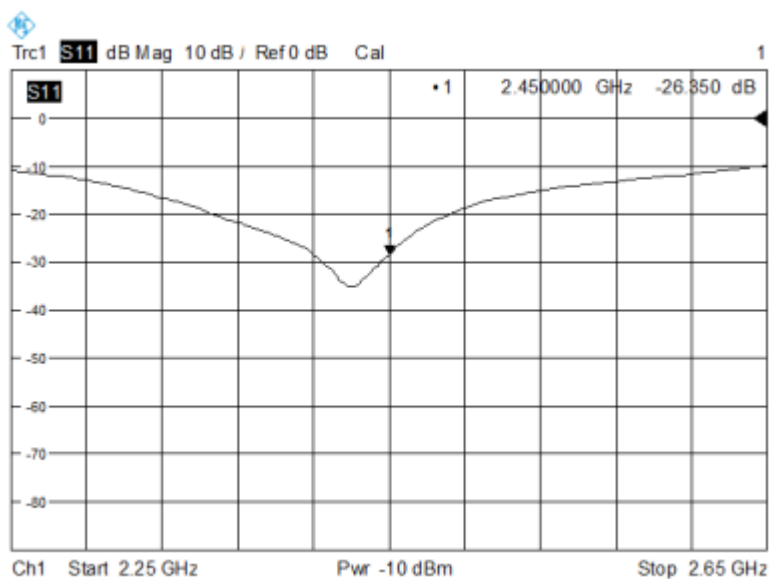


## 2.5D2450V2

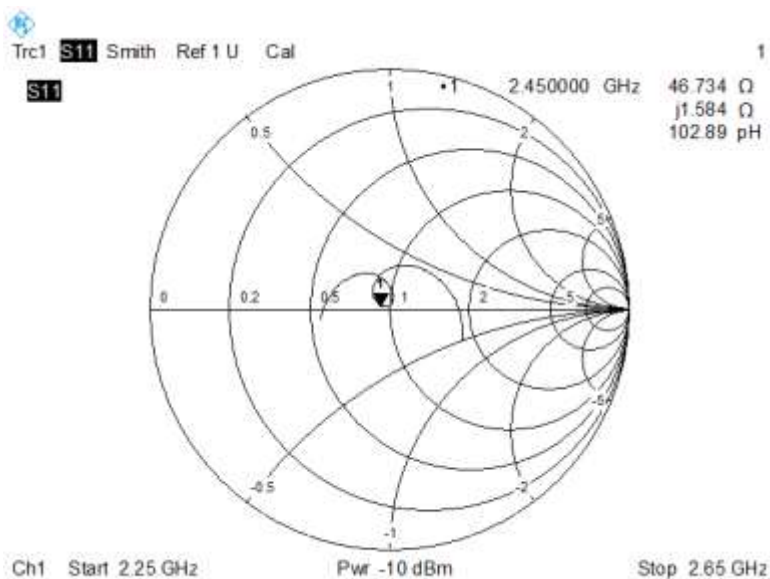
### RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

| Meas. Results   | Current Meas.                    | Previous Meas.                   | Max. Deviation                |
|-----------------|----------------------------------|----------------------------------|-------------------------------|
| Return Loss(dB) | -26.350                          | -28.271                          | -6.8%                         |
| Impedance       | 46.7 $\Omega$ + 1.584 j $\Omega$ | 49.7 $\Omega$ + 1.669 j $\Omega$ | 3.011 $\Omega$<br>(Real part) |

#### Return Loss



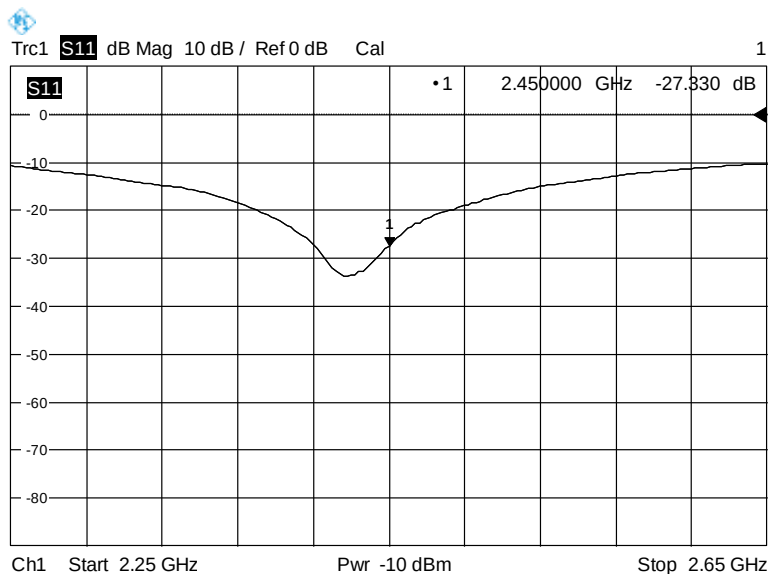
#### Impedance



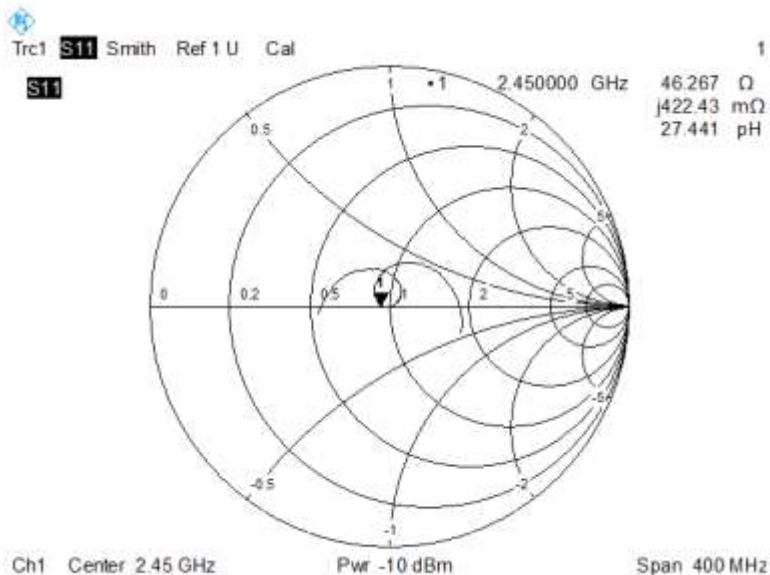
# RETURN LOSS AND IMPEDANCE IN BODY LIQUID

| Meas. Results    | Current Meas.                    | Previous Meas.                   | Max. Deviation                     |
|------------------|----------------------------------|----------------------------------|------------------------------------|
| Return Loss (dB) | -27.330                          | -27.205                          | -0.5%                              |
| Impedance        | 46.3 $\Omega$ + 0.422 j $\Omega$ | 46.8 $\Omega$ + 1.658 j $\Omega$ | 1.236 $\Omega$<br>(Imaginary part) |

## Return Loss



## +Impedance

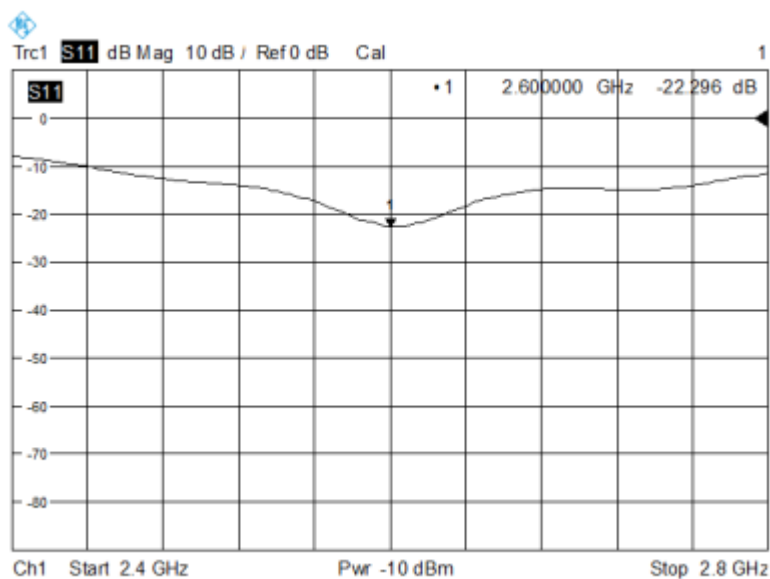


## 2.6 D2600V2

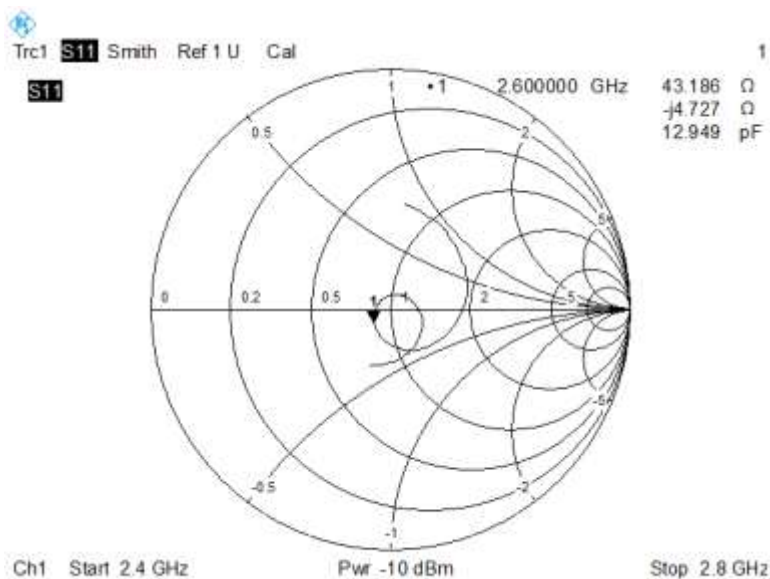
### RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

| Meas. Results   | Current Meas.                        | Previous Meas.                       | Max. Deviation                 |
|-----------------|--------------------------------------|--------------------------------------|--------------------------------|
| Return Loss(dB) | -22.296                              | -22.192                              | 0.5%                           |
| Impedance       | 43.186 $\Omega$ -4.727<br>j $\Omega$ | 46.754 $\Omega$ -7.288<br>j $\Omega$ | -3.568 $\Omega$<br>(Real part) |

#### Return Loss



#### Impedance

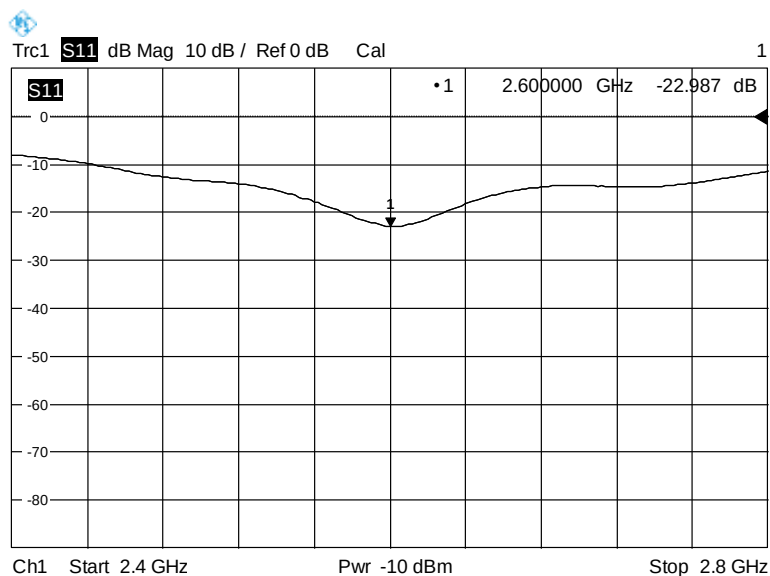




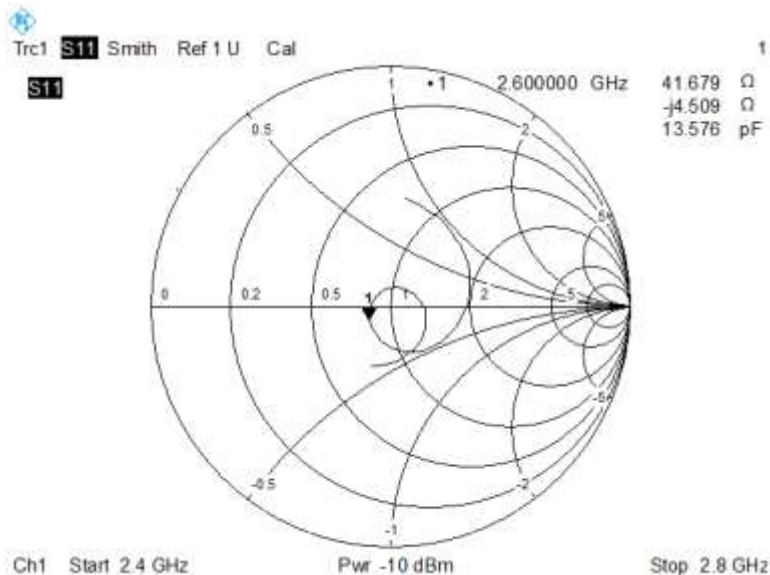
# **RETURN LOSS AND IMPEDANCE IN BODY LIQUID**

| Meas. Results   | Current Meas.                        | Previous Meas.                       | Max. Deviation                 |
|-----------------|--------------------------------------|--------------------------------------|--------------------------------|
| Return Loss(dB) | -22.987                              | -21.794                              | 5.5%                           |
| Impedance       | 41.679 $\Omega$ -4.509<br>j $\Omega$ | 46.334 $\Omega$ -5.883<br>j $\Omega$ | -4.655 $\Omega$<br>(Real part) |

## **Return Loss**

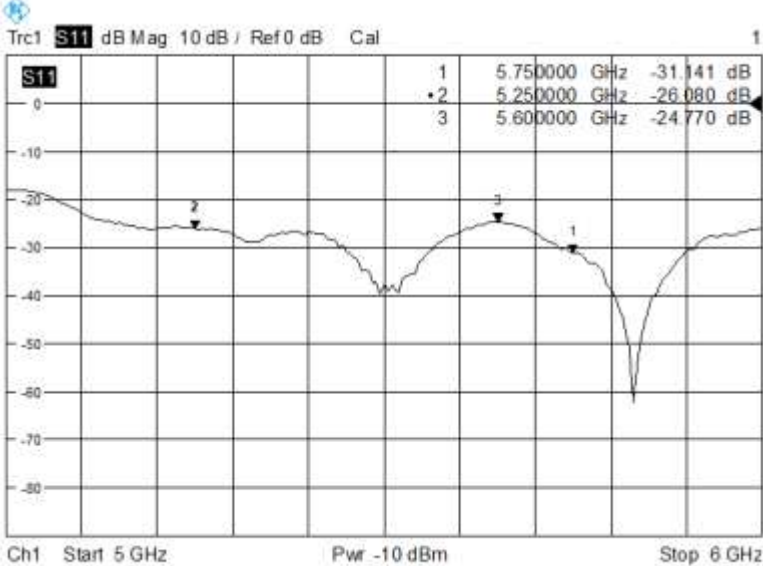


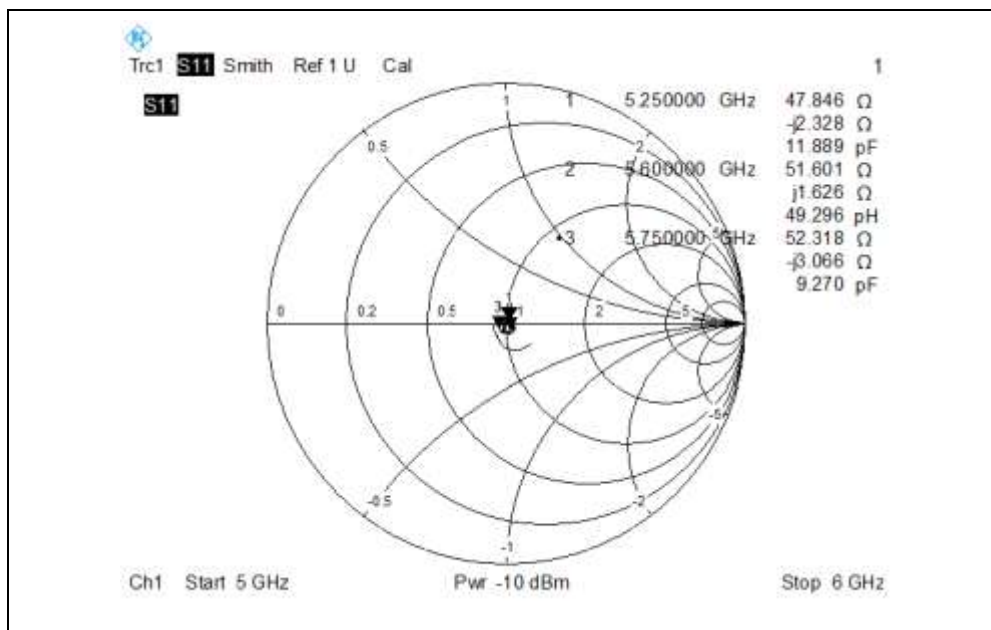
## **Impedance**



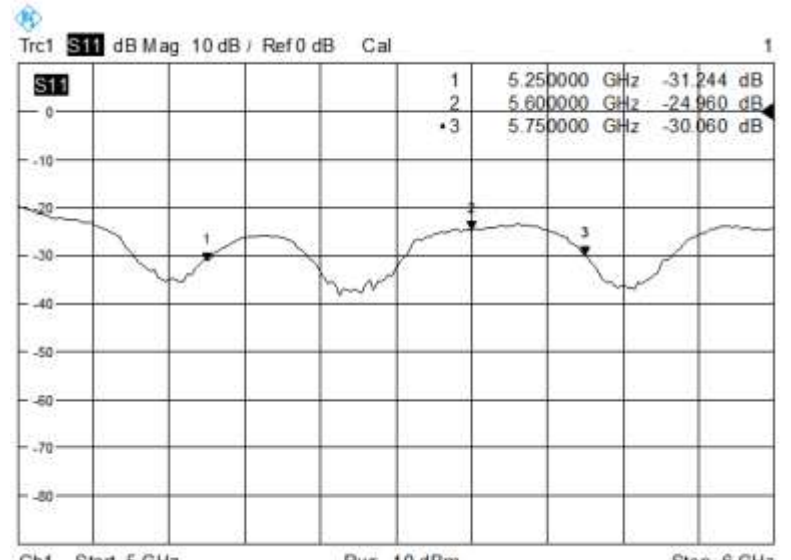
## 2.7 D5GHzV2

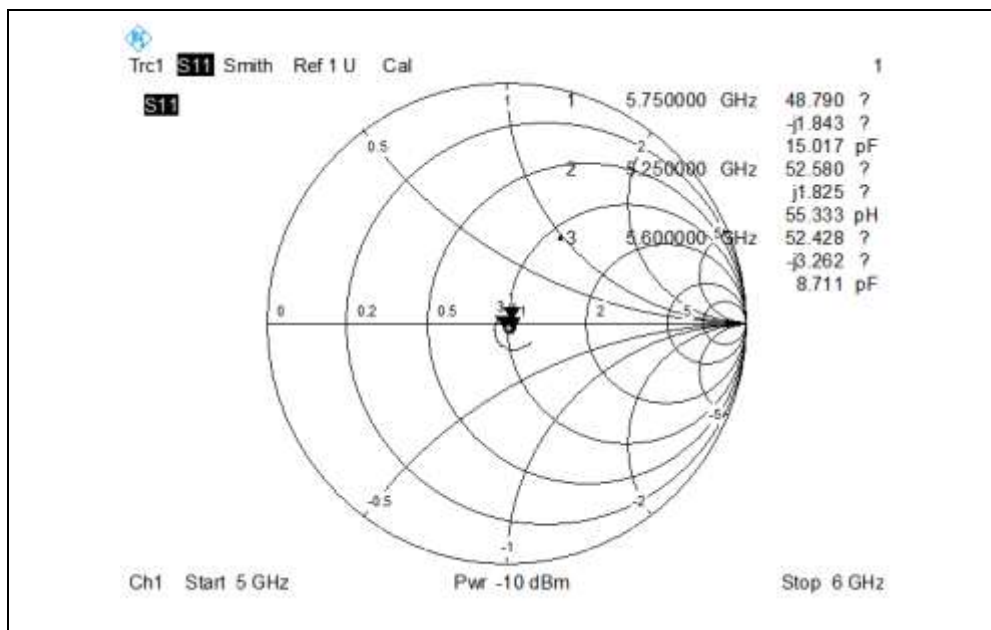
### RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

| Meas. Results                                                                                                                                                                                                                                                              | Current Meas.                        | Previous Meas.                       | Max. Deviation                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------------|
| 5250 MHz                                                                                                                                                                                                                                                                   |                                      |                                      |                                         |
| Return Loss(dB)                                                                                                                                                                                                                                                            | -26.080                              | -25.052                              | 4.1%                                    |
| Impedance                                                                                                                                                                                                                                                                  | 47.846 $\Omega$ -2.328<br>j $\Omega$ | 47.735 $\Omega$ -4.621<br>j $\Omega$ | 2.293 $\Omega$<br>(Imaginary n<br>part) |
| 5600 MHz                                                                                                                                                                                                                                                                   |                                      |                                      |                                         |
| Return Loss(dB)                                                                                                                                                                                                                                                            | -24.770                              | -26.377                              | -6.1%                                   |
| Impedance                                                                                                                                                                                                                                                                  | 51.601 $\Omega$ -1.626<br>j $\Omega$ | 54.525 $\Omega$ +2.142<br>j $\Omega$ | -2.924 $\Omega$<br>(Real part)          |
| 5750 MHz                                                                                                                                                                                                                                                                   |                                      |                                      |                                         |
| Return Loss(dB)                                                                                                                                                                                                                                                            | -31.141                              | -29.503                              | 5.6%                                    |
| Impedance                                                                                                                                                                                                                                                                  | 52.318 $\Omega$ -3.066<br>j $\Omega$ | 51.171 $\Omega$ -3.278<br>j $\Omega$ | 1.147 $\Omega$<br>(Real part)           |
| Return Loss                                                                                                                                                                                                                                                                |                                      |                                      |                                         |
|  <p>Trc1 S11 dB Mag 10 dB / Ref 0 dB Cal</p> <p>1 5.750000 GHz -31.141 dB<br/>2 5.250000 GHz -26.080 dB<br/>3 5.600000 GHz -24.770 dB</p> <p>Ch1 Start 5 GHz Pwr -10 dBm Stop 6 GHz</p> |                                      |                                      |                                         |
| Impedance                                                                                                                                                                                                                                                                  |                                      |                                      |                                         |



## RETURN LOSS AND IMPEDANCE IN BODY LIQUID

| Meas. Results                                                                                                                                                                                                                                                              | Current Meas.                        | Previous Meas.                        | Max. Deviation                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------|------------------------------------------|
| 5250 MHz                                                                                                                                                                                                                                                                   |                                      |                                       |                                          |
| Return Loss(dB)                                                                                                                                                                                                                                                            | -31.244                              | -30.483                               | 2.5%                                     |
| Impedance                                                                                                                                                                                                                                                                  | 48.790 $\Omega$ -1.843<br>j $\Omega$ | 47.975 $\Omega$ -2.840<br>j $\Omega$  | 0.997 $\Omega$<br>(Imaginary n<br>part)  |
| 5600 MHz                                                                                                                                                                                                                                                                   |                                      |                                       |                                          |
| Return Loss(dB)                                                                                                                                                                                                                                                            | -24.96                               | -24.636                               | 1.3%                                     |
| Impedance                                                                                                                                                                                                                                                                  | 52.580 $\Omega$ +1.825<br>j $\Omega$ | 54.321 $\Omega$ + 3.910<br>j $\Omega$ | -2.085 $\Omega$<br>(Imaginary n<br>part) |
| 5750 MHz                                                                                                                                                                                                                                                                   |                                      |                                       |                                          |
| Return Loss(dB)                                                                                                                                                                                                                                                            | -30.060                              | -29.774                               | 1.0%                                     |
| Impedance                                                                                                                                                                                                                                                                  | 52.428 $\Omega$ -3.262<br>j $\Omega$ | 51.737 $\Omega$ -2.126<br>j $\Omega$  | -1.136 $\Omega$<br>(Imaginary n<br>part) |
| Return Loss                                                                                                                                                                                                                                                                |                                      |                                       |                                          |
|  <p>Trc1 S11 dB Mag 10 dB / Ref 0 dB Cal</p> <p>1 5.250000 GHz -31.244 dB<br/>2 5.600000 GHz -24.960 dB<br/>3 5.750000 GHz -30.060 dB</p> <p>Ch1 Start 5 GHz Pwr -10 dBm Stop 6 GHz</p> |                                      |                                       |                                          |
| Impedance                                                                                                                                                                                                                                                                  |                                      |                                       |                                          |



--END OF REPORT--