



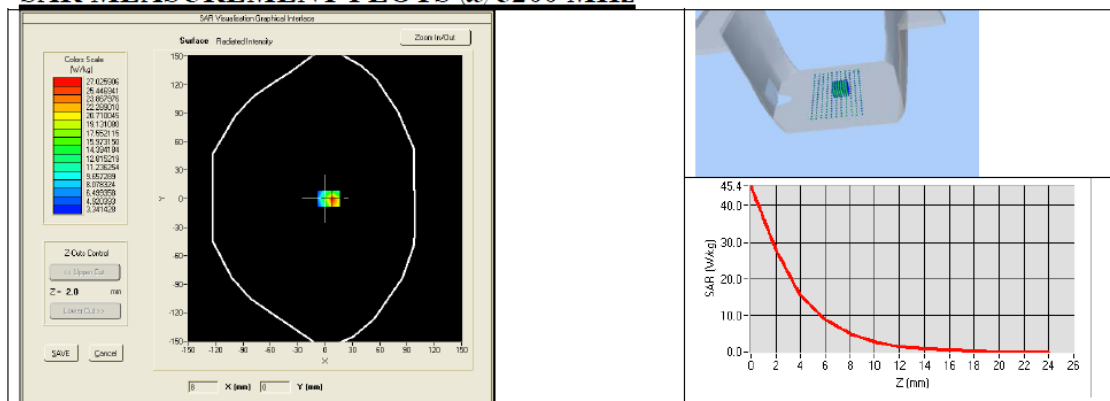
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref. ACR.109.9.18.SATU.A

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values 5200 MHz: eps' :35.64 sigma : 4.67 Head Liquid Values 5400 MHz: eps' :36.44 sigma : 4.87 Head Liquid Values 5600 MHz: eps' :36.66 sigma : 5.17 Head Liquid Values 5800 MHz: eps' :35.31 sigma : 5.31
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency (MHz)	1 g SAR (W/kg)		10 g SAR (W/kg)	
	required	measured	required	measured
5200	159.00	160.94 (16.09)	56.90	55.97 (5.60)
5400	166.40	170.60 (17.06)	58.43	58.93 (5.89)
5600	173.80	175.02 (17.50)	59.97	59.90 (5.99)
5800	181.20	184.13 (18.41)	61.50	62.74 (6.27)

SAR MEASUREMENT PLOTS @ 5200 MHz

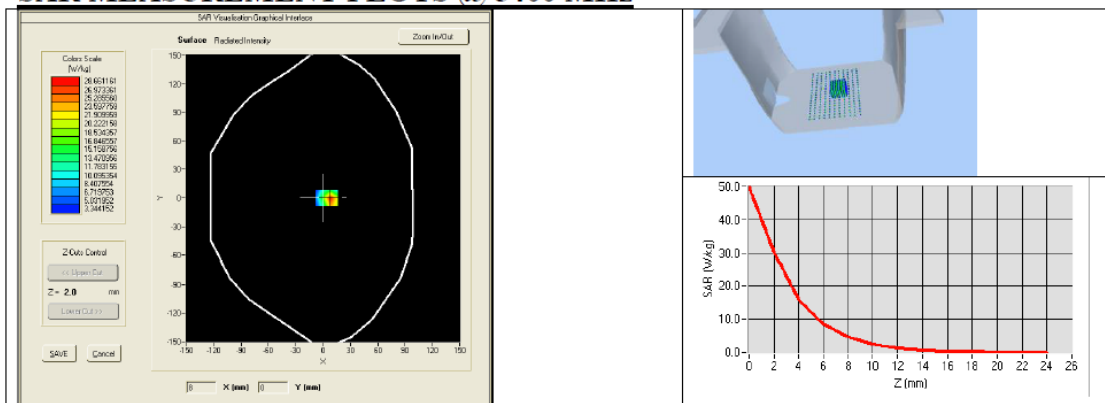




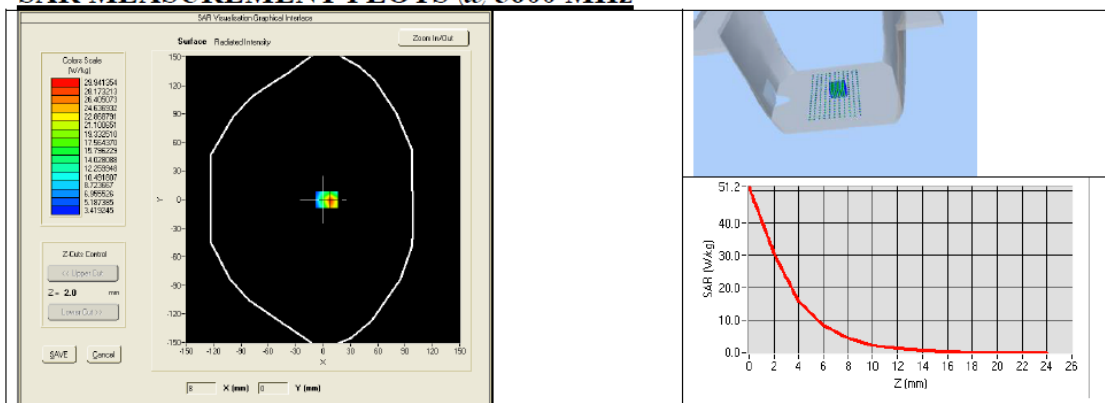
## SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref. ACR.109.9.18.SATU.A

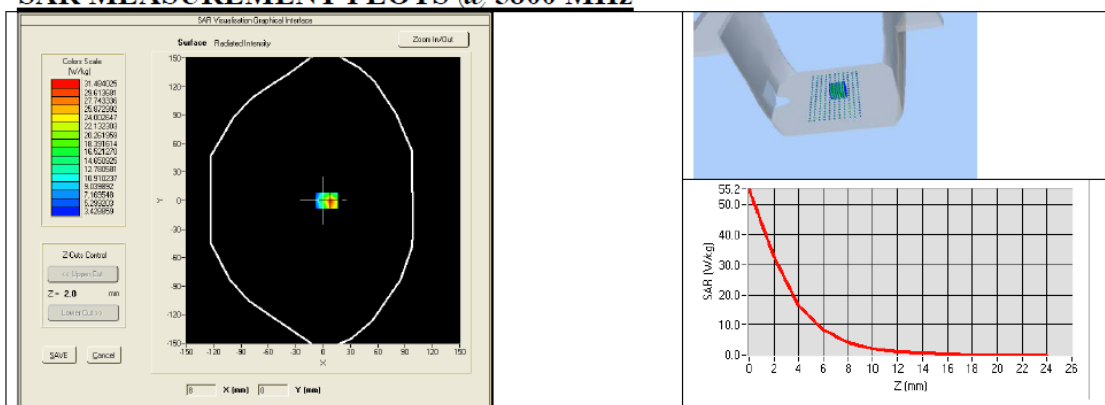
### SAR MEASUREMENT PLOTS @ 5400 MHz



### SAR MEASUREMENT PLOTS @ 5600 MHz



### SAR MEASUREMENT PLOTS @ 5800 MHz





## SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref. ACR.109.9.18.SATU.A

## 7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) S/m	
	required	measured	required	measured
5200	49.0 $\pm$ 10 %	PASS	5.30 $\pm$ 10 %	PASS
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %	PASS	5.53 $\pm$ 10 %	PASS
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %	PASS	5.77 $\pm$ 10 %	PASS
5800	48.2 $\pm$ 10 %	PASS	6.00 $\pm$ 10 %	PASS

## 7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values 5200 MHz: $\epsilon_r'$ :48.64 sigma : 5.51 Body Liquid Values 5400 MHz: $\epsilon_r'$ :46.52 sigma : 5.77 Body Liquid Values 5600 MHz: $\epsilon_r'$ :46.79 sigma : 5.77 Body Liquid Values 5800 MHz: $\epsilon_r'$ :47.04 sigma : 6.10
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

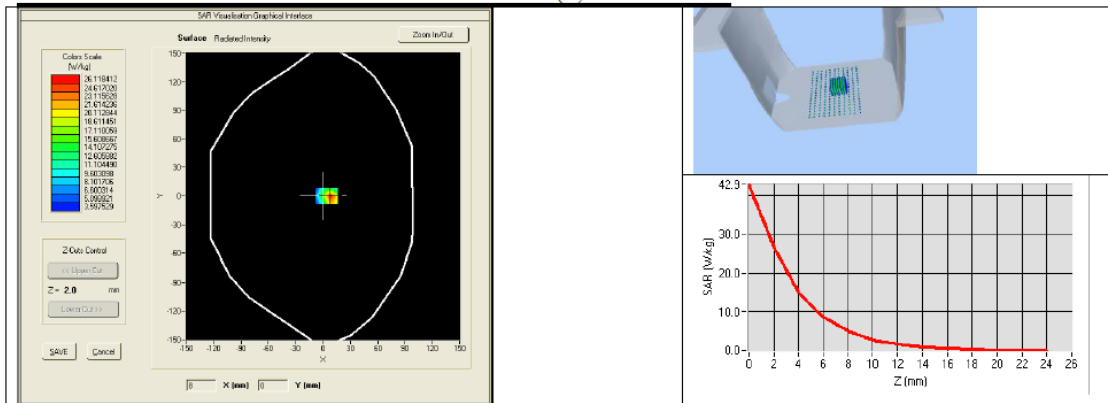
Frequency (MHz)	1 g SAR (W/kg)	10 g SAR (W/kg)
	measured	measured
5200	156.85 (15.68)	55.20 (5.52)
5400	163.97 (16.40)	57.26 (5.73)
5600	166.58 (16.66)	57.87 (5.79)
5800	169.30 (16.93)	58.49 (5.85)



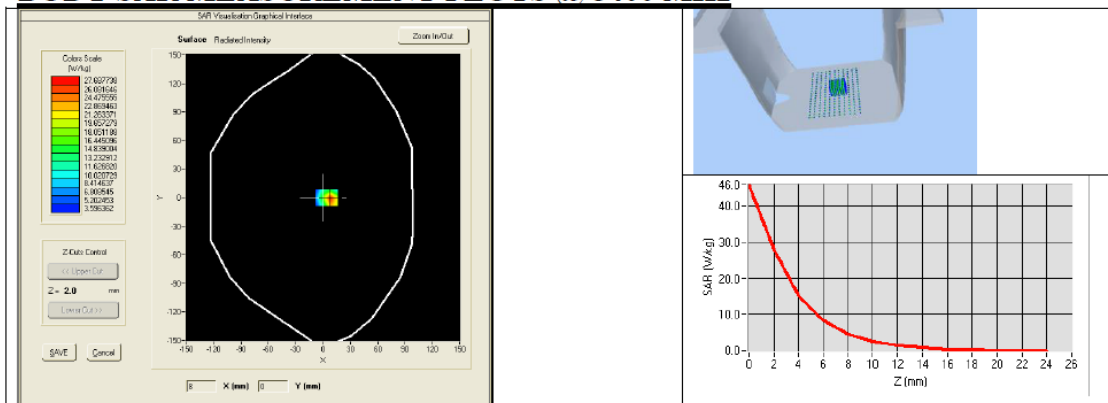
## SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.109.9.18.SATU.A

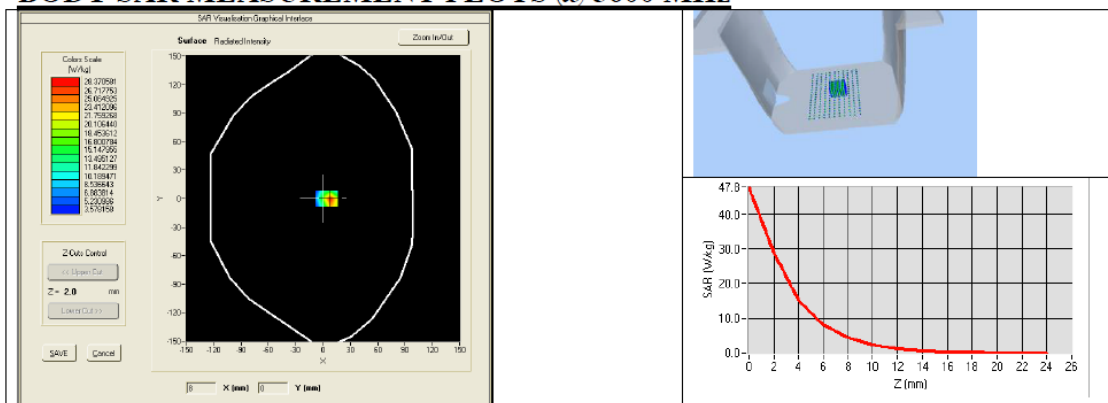
### BODY SAR MEASUREMENT PLOTS @ 5200 MHz



### BODY SAR MEASUREMENT PLOTS @ 5400 MHz



### BODY SAR MEASUREMENT PLOTS @ 5600 MHz

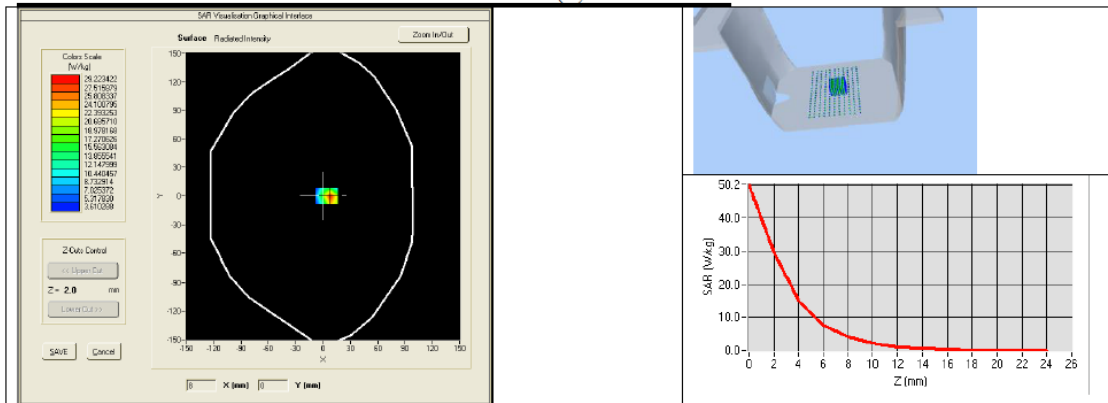




## SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.109.9.18.SATU.A

### BODY SAR MEASUREMENT PLOTS @ 5800 MHz





## SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.109.9.18.SATU.A

## 8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2017	10/2018
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	150798832	11/2017	11/2020



### <Justification of the extended calibration>

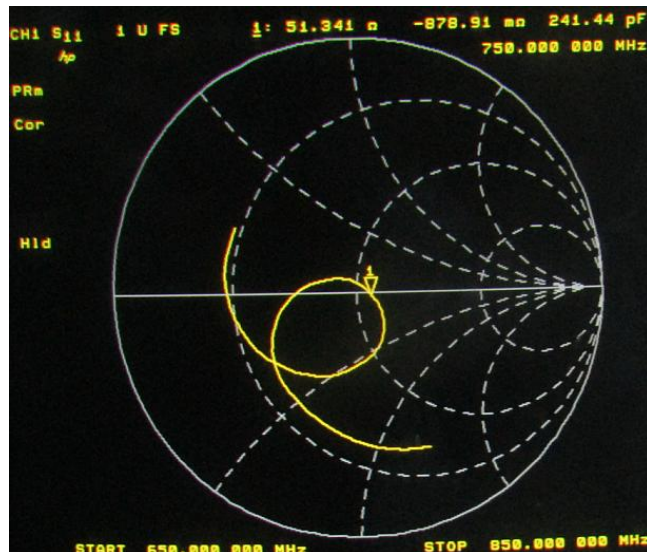
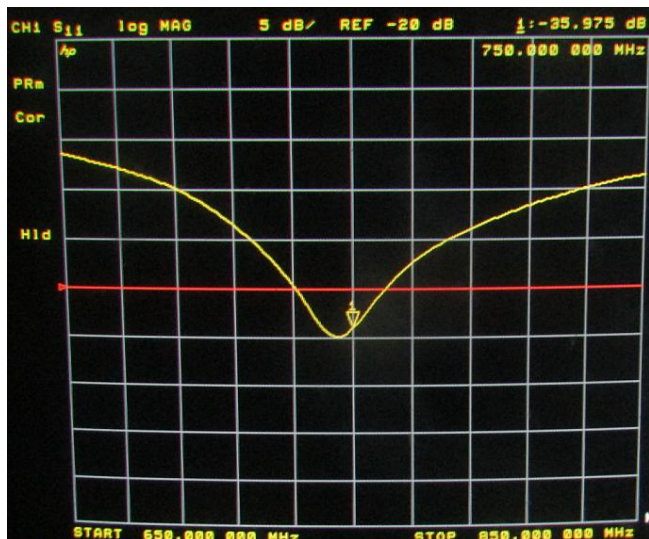
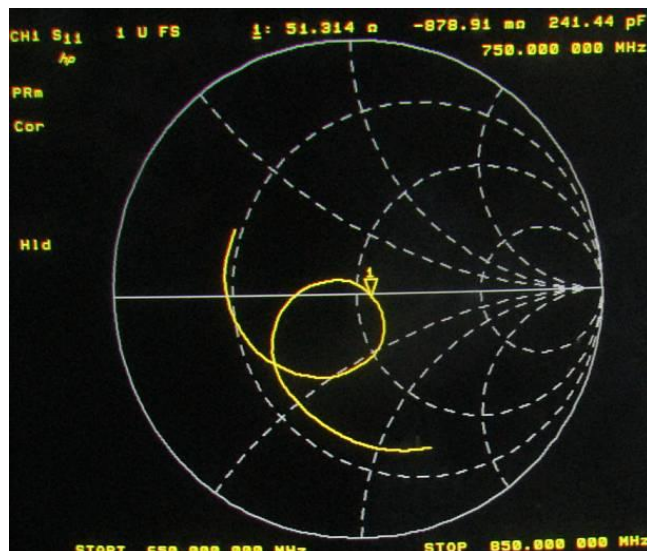
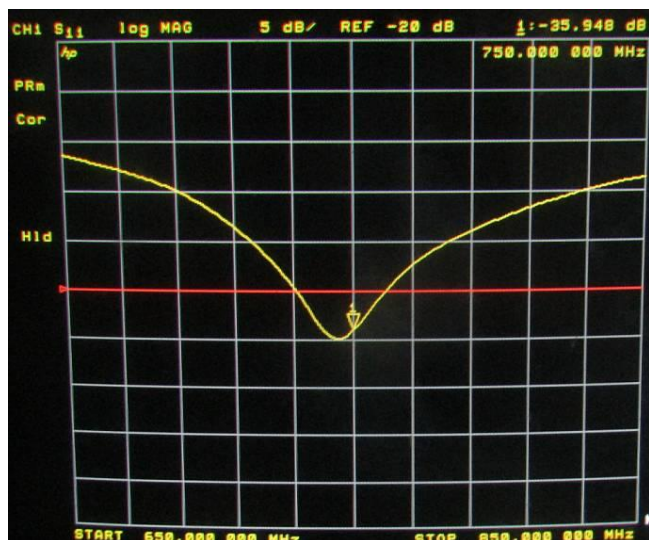
If dipoles are verified in return loss ( $<-20\text{dB}$ , within 20% of prior calibration for below 3GHz, and  $<-8\text{dB}$ , within 20% of prior calibration for 5GHz to 6GHz), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

### <Head 750MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-35.83	-	51.3	-	Apr. 19, 2018
-35.948	0.329	51.314	0.014	Apr. 18, 2019
-35.975	0.405	51.341	0.041	Apr. 17, 2020

The return loss is  $<-20\text{dB}$ , within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

### Dipole Verification Data

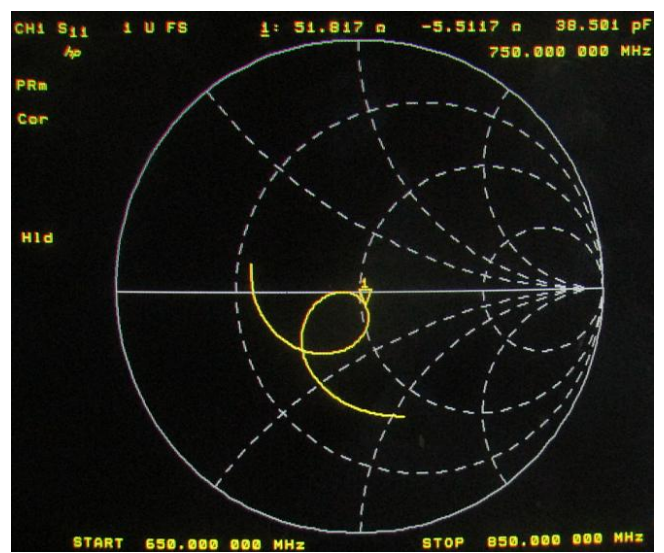
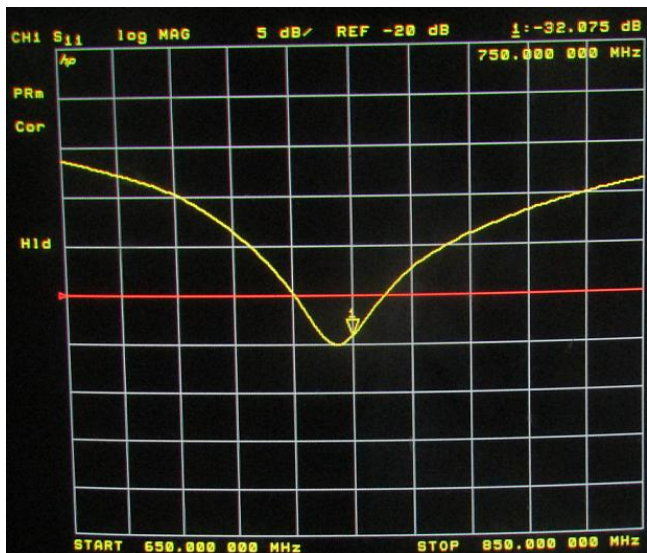
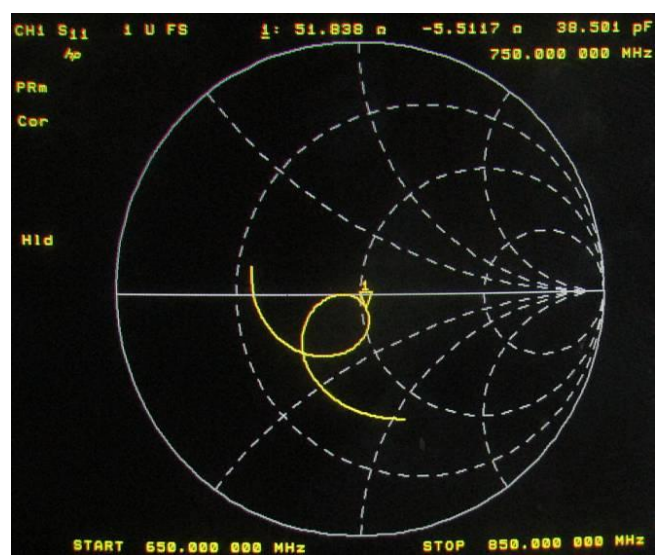
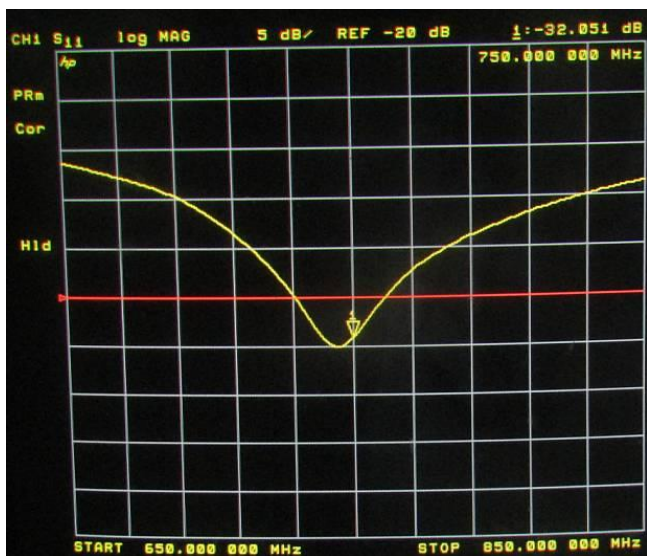


<Body 750MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-32.65	-	50.8	-	Apr. 19, 2018
-32.051	1.835	51.838	1.038	Apr. 18, 2019
-32.075	1.761	51.817	1.017	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



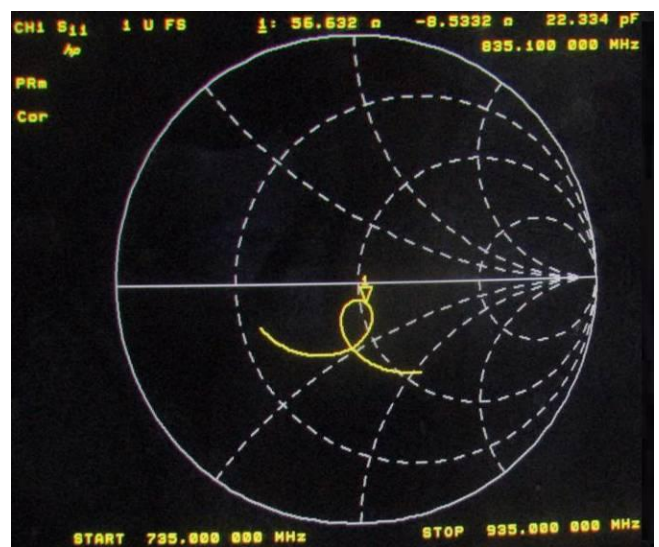
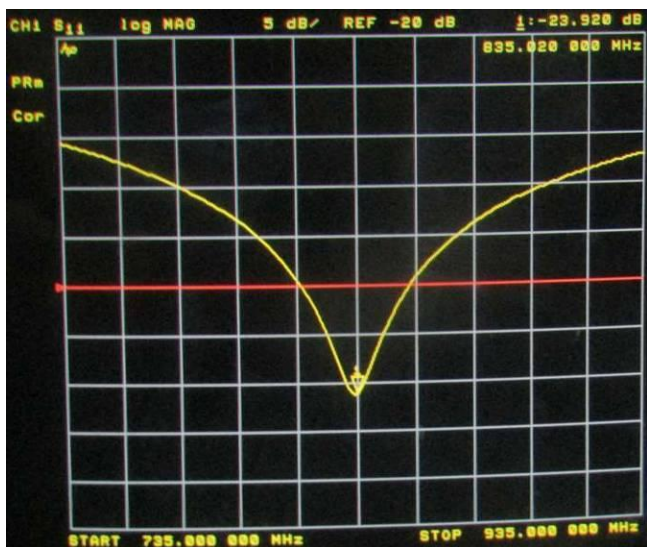
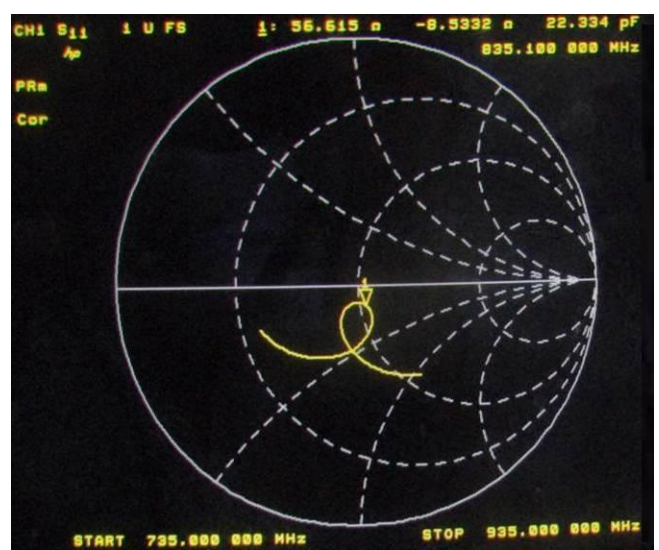
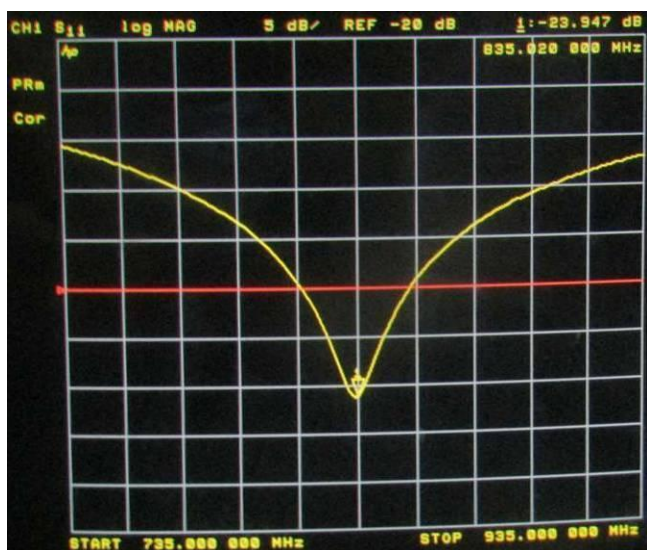


<Head 835MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-23.67	-	56.8	-	Apr. 19, 2018
-23.947	1.17	56.615	0.185	Apr. 18, 2019
-23.920	1.056	56.632	0.168	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data

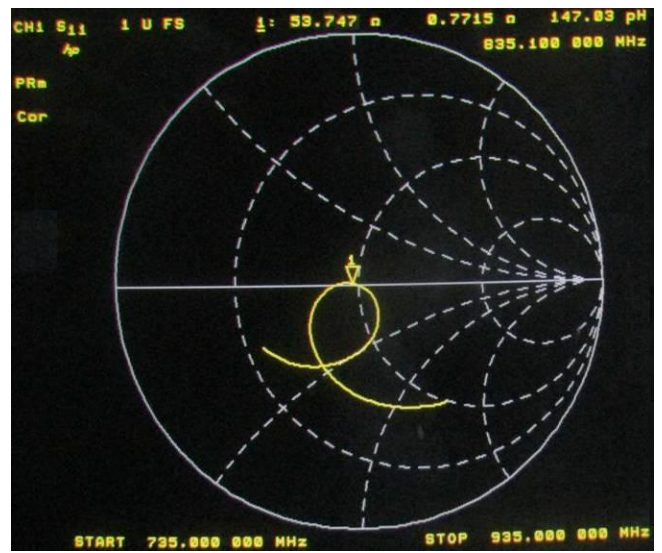
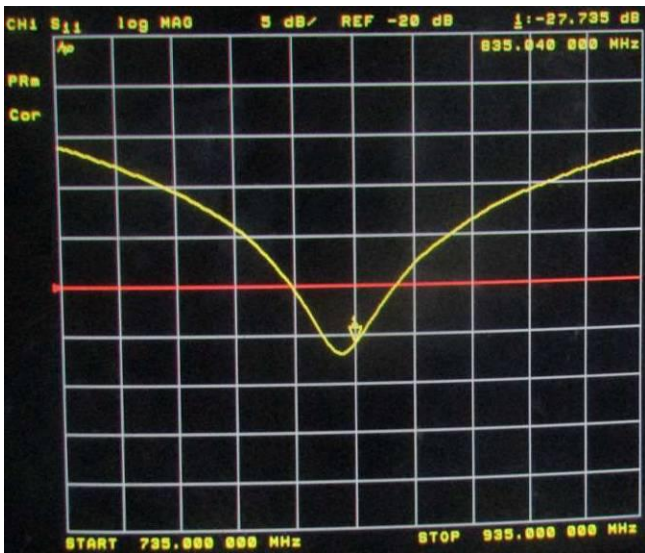
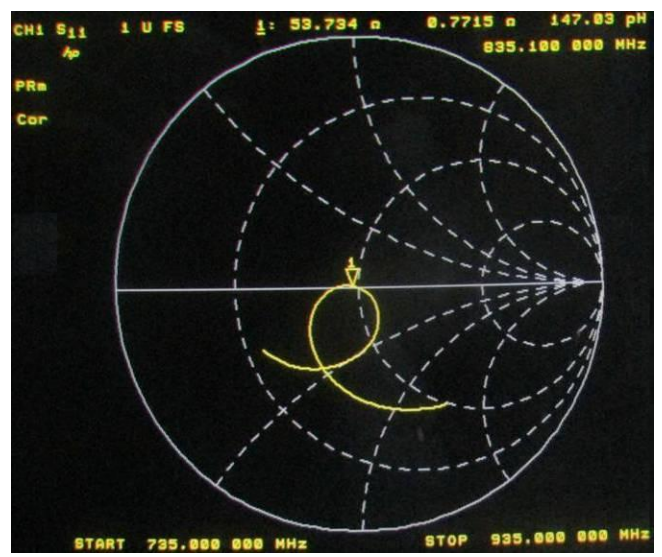
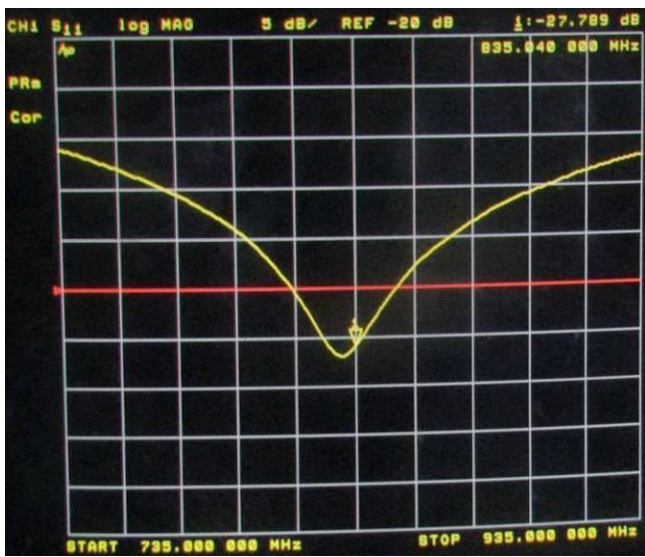


<Body 835MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-27.64	-	53.5	-	Apr. 19, 2018
-27.789	0.54	53.734	0.234	Apr. 18, 2019
-27.735	0.344	53.747	0.247	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



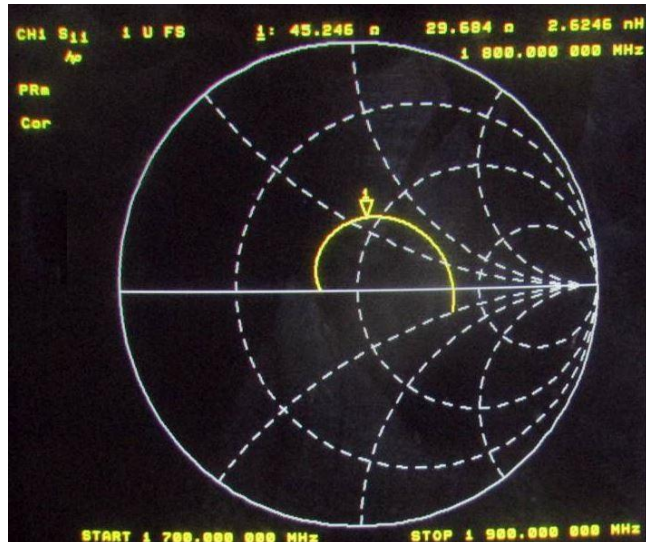
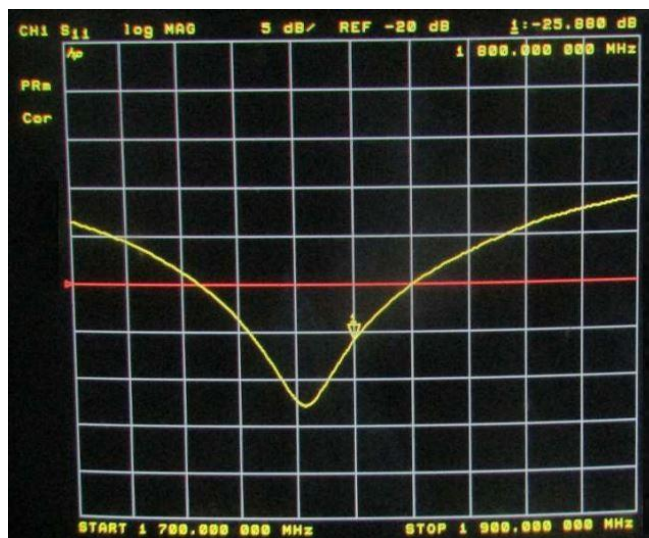
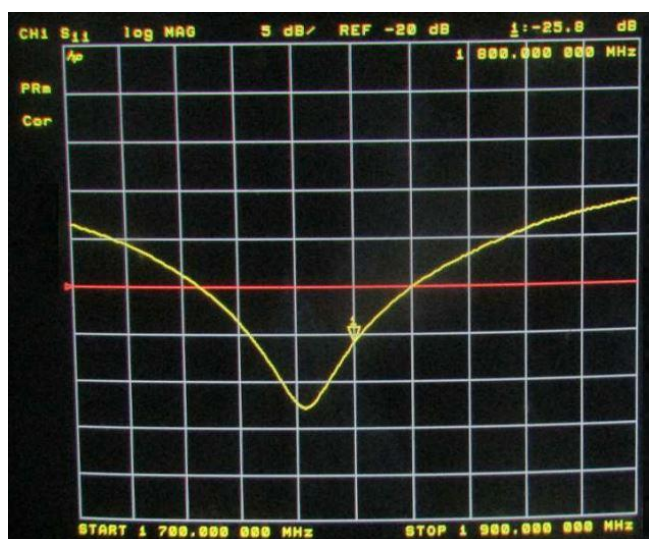


<Head 1800MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-26.62	-	47.3	-	Apr. 19, 2018
-25.8	3.080	45.156	2.144	Apr. 18, 2019
-25.880	2.780	45.246	2.054	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data

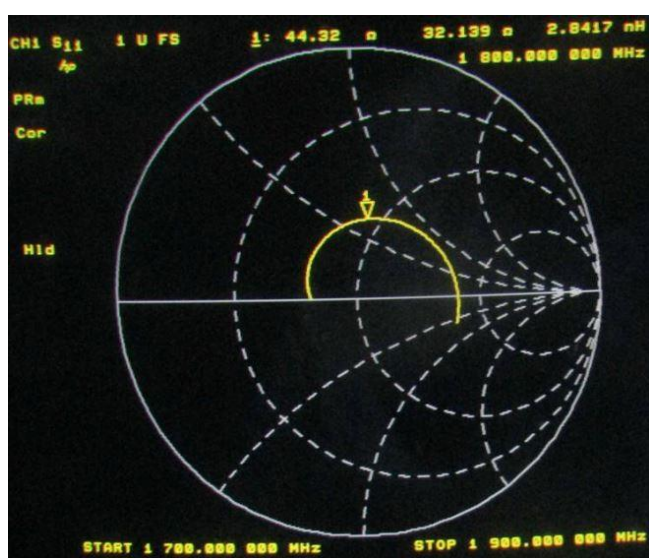
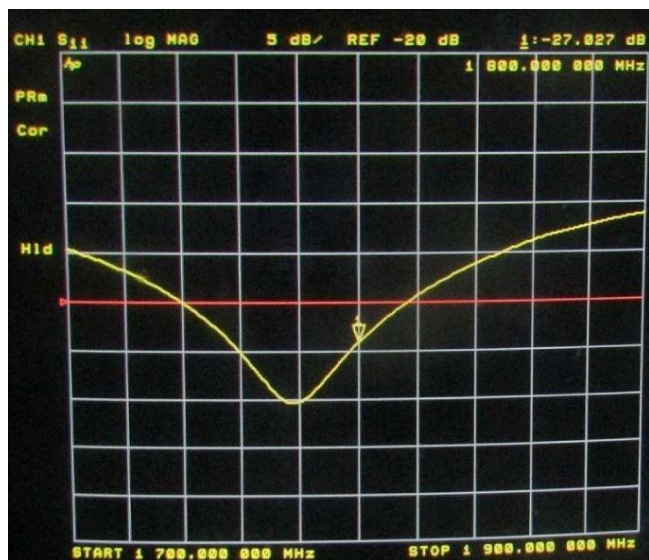
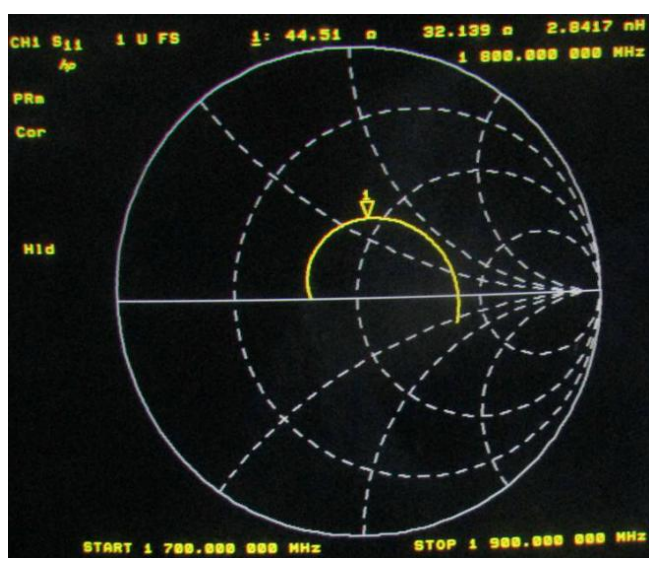
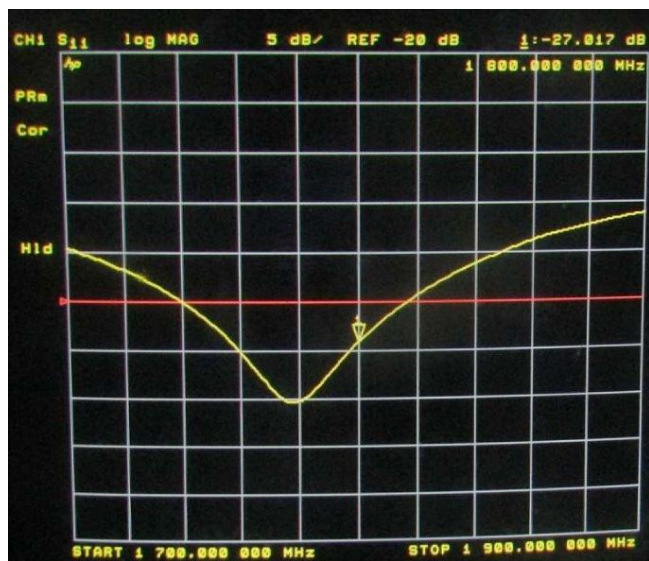


<Body 1800MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-27.86	-	46.2	-	Apr. 19, 2018
-27.017	3.026	44.51	1.69	Apr. 18, 2019
-27.027	2.990	44.32	1.88	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



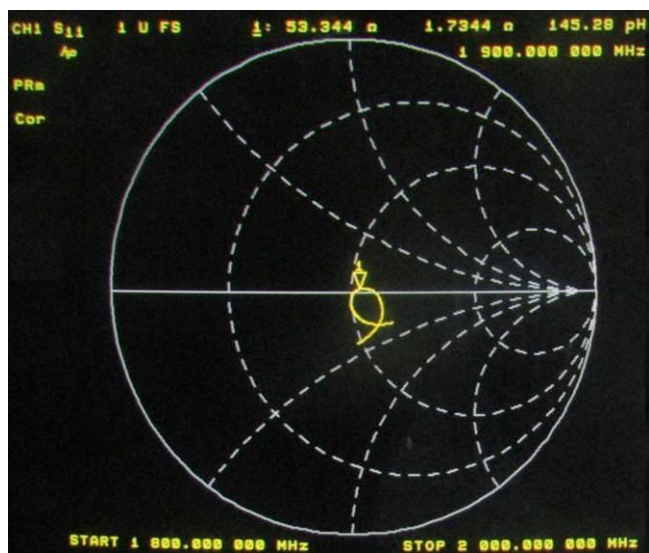
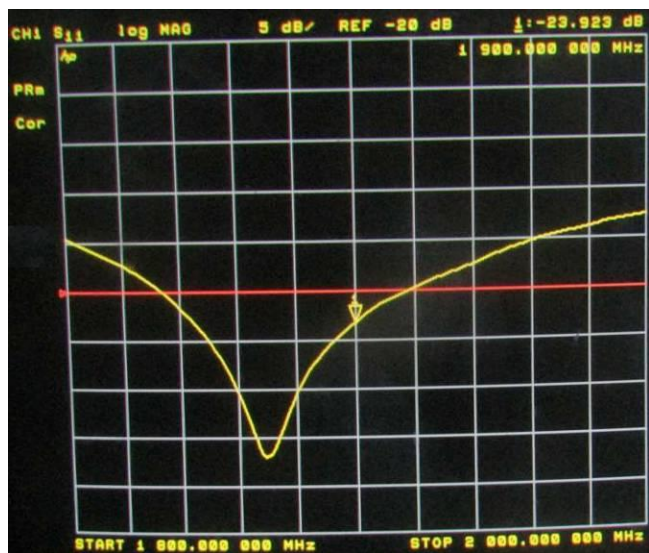
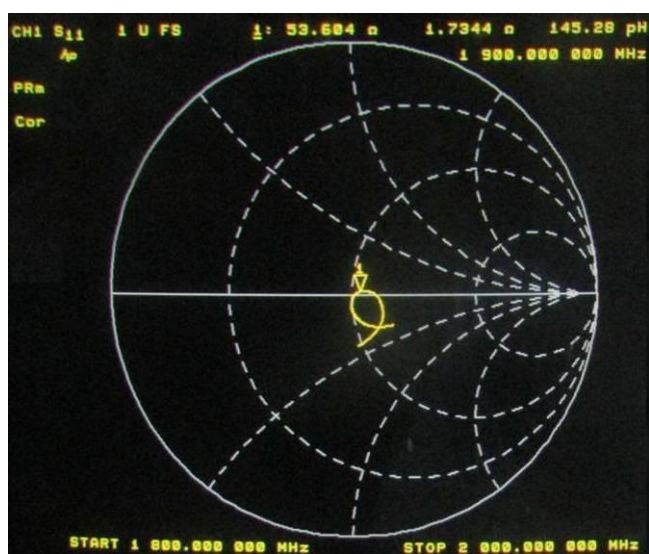
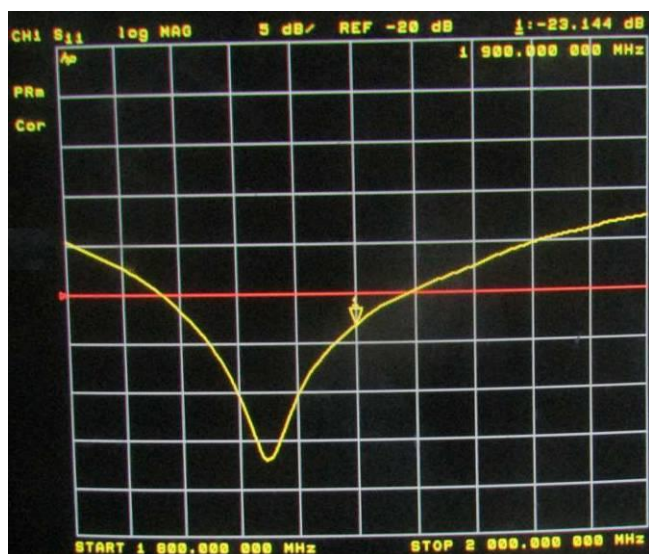


<Head 1900MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-25.15	-	52.6	-	Apr. 19, 2018
-23.144	7.976	53.604	1.004	Apr. 18, 2019
-23.923	4.879	53.344	0.744	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



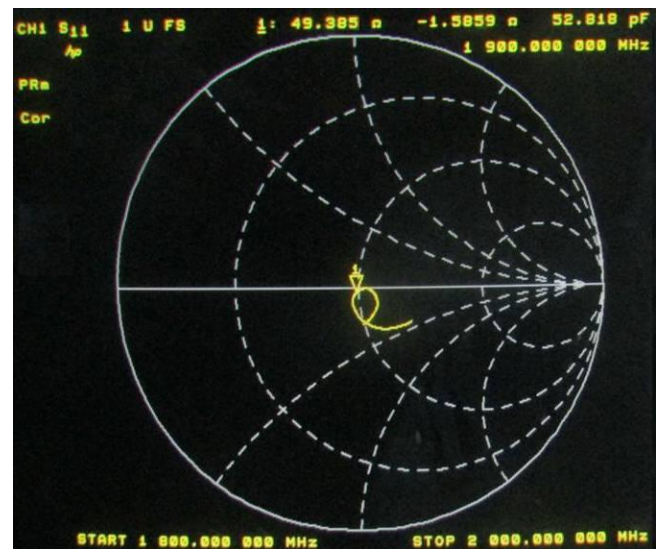
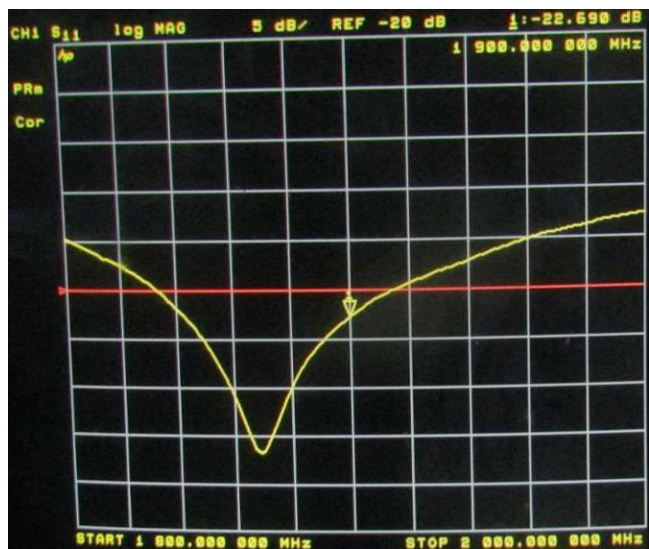
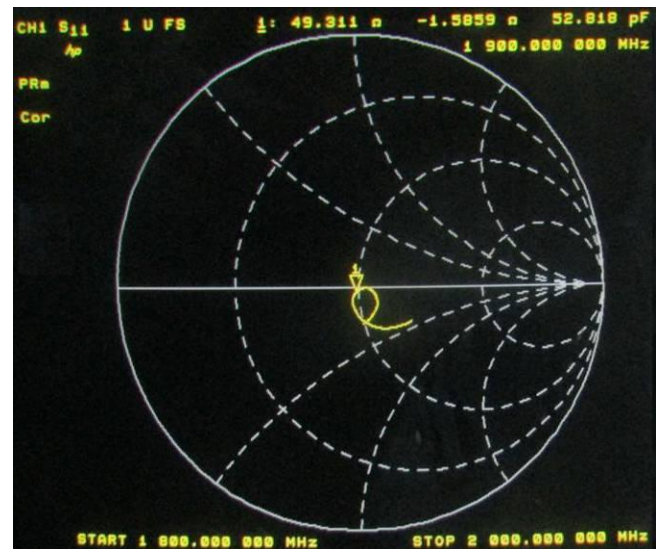
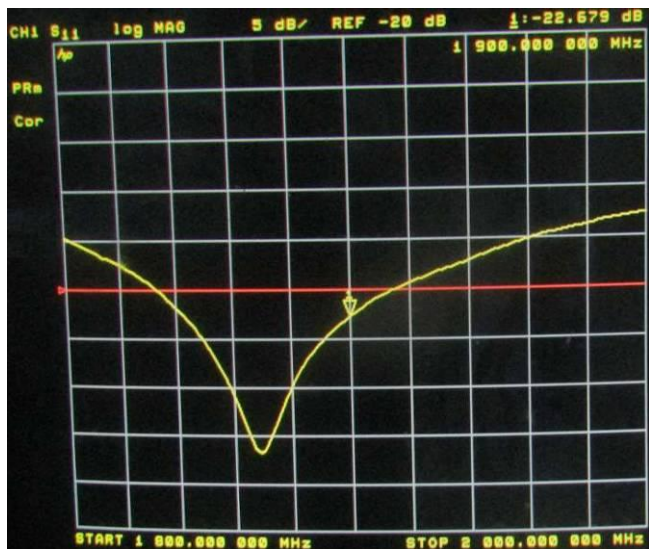


<Body 1900MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-22.99	-	47.6	-	Apr. 19, 2018
-22.679	1.353	49.311	1.711	Apr. 18, 2019
-22.690	1.305	49.385	1.785	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data

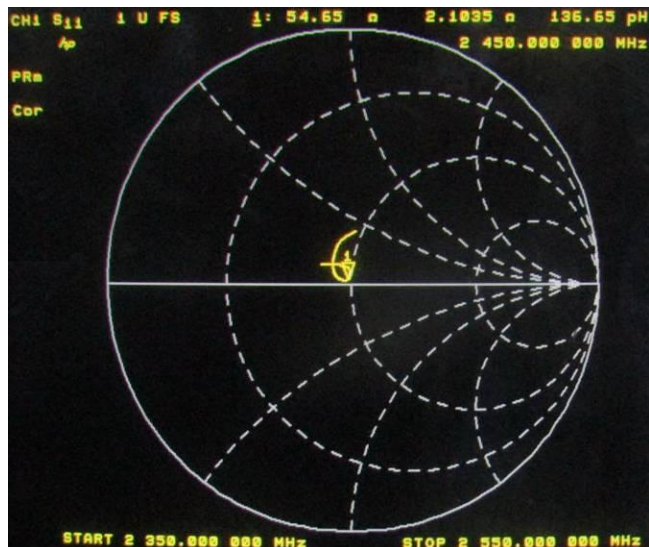
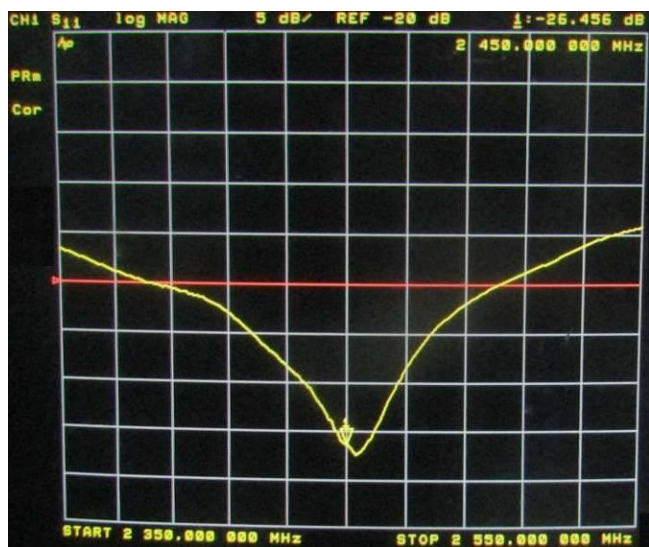
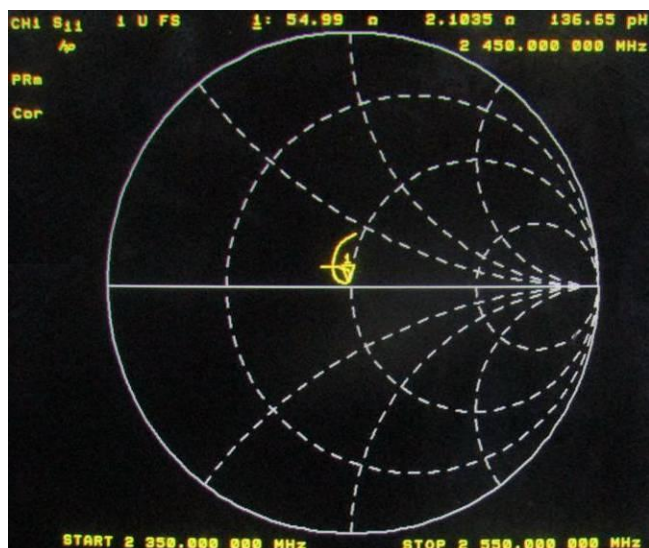
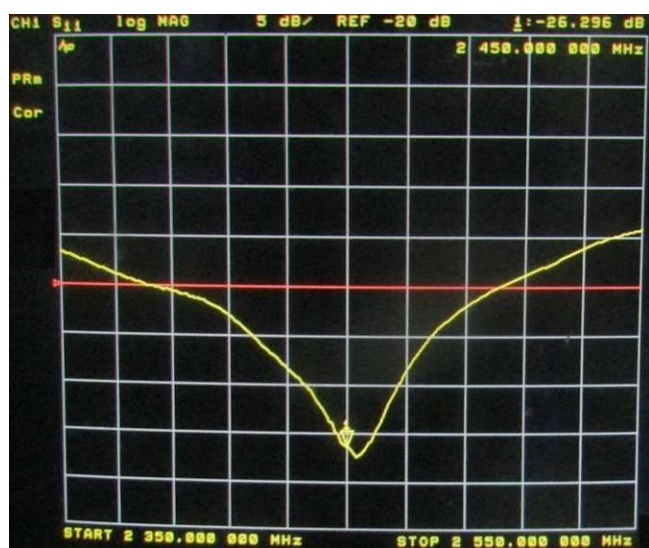


<Head 2450MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-28.15	-	53.9	-	Apr. 19, 2018
-26.296	6.586	54.99	1.09	Apr. 18, 2019
-26.456	6.018	54.65	0.75	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



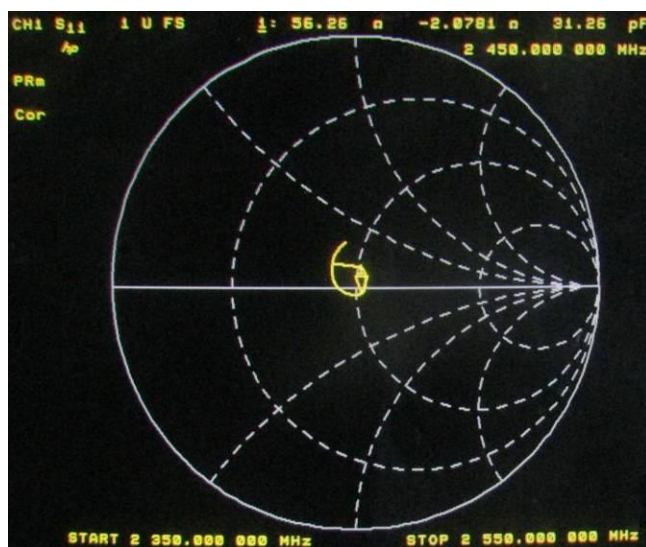
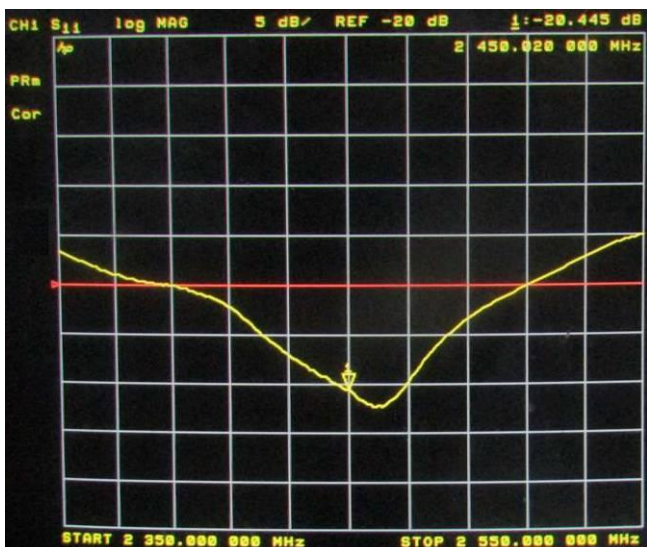
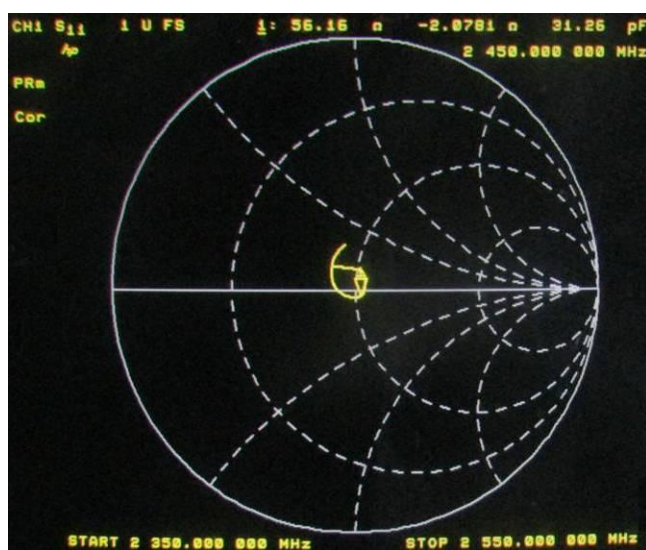
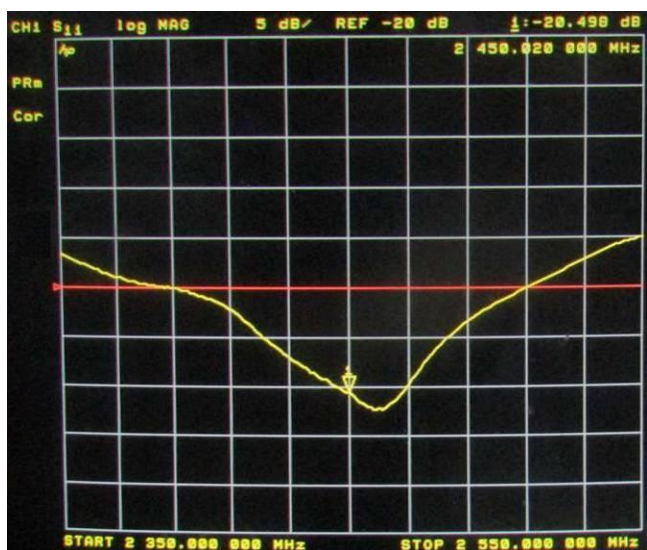


<Body 2450MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-22.99	-	57.6	-	Apr. 19, 2018
-20.498	10.840	56.16	1.44	Apr. 18, 2019
-20.445	11.07	56.26	8.66	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data

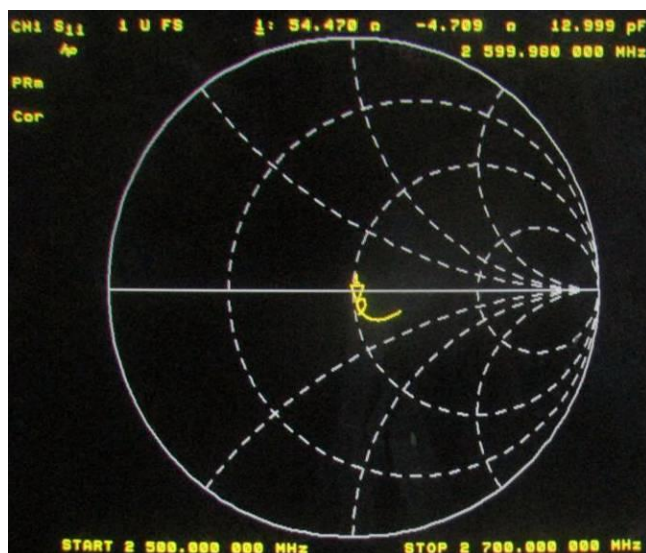
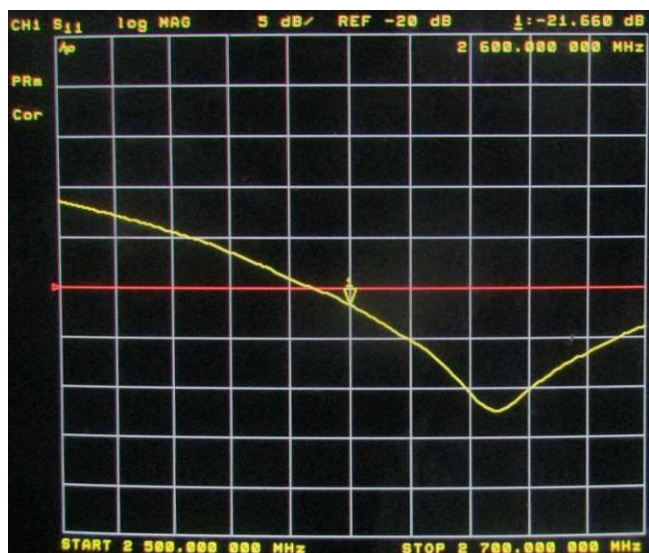
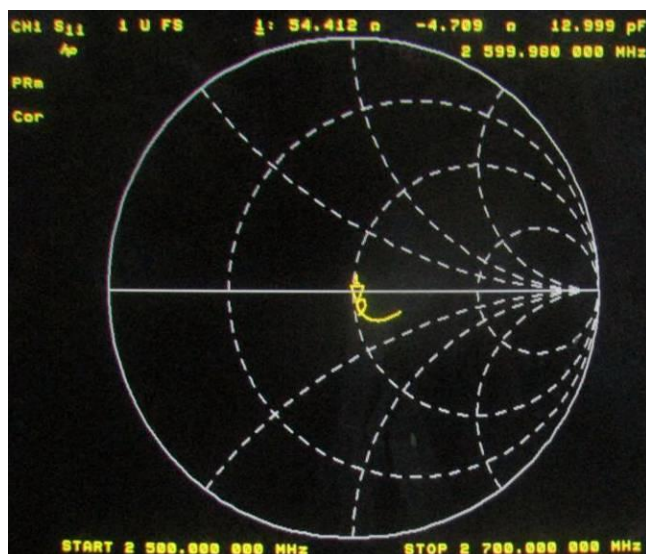
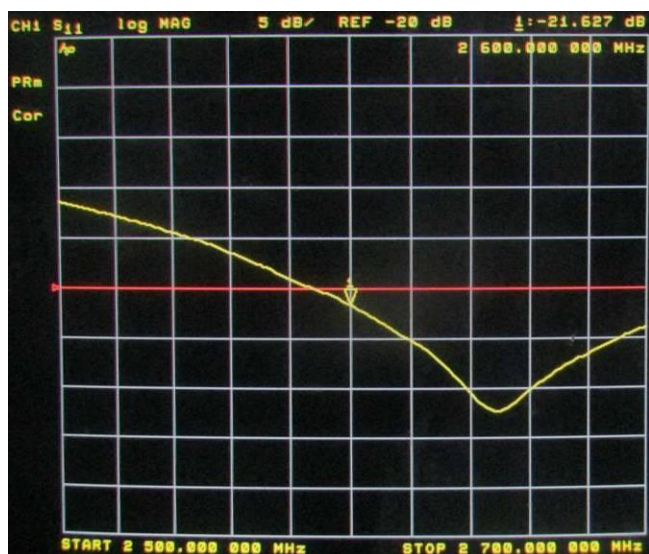


<Head 2600MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-20.85	-	54.9	-	Apr. 19, 2018
-21.627	3.727	54.412	0.488	Apr. 18, 2019
-21.660	3.885	54.470	0.43	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



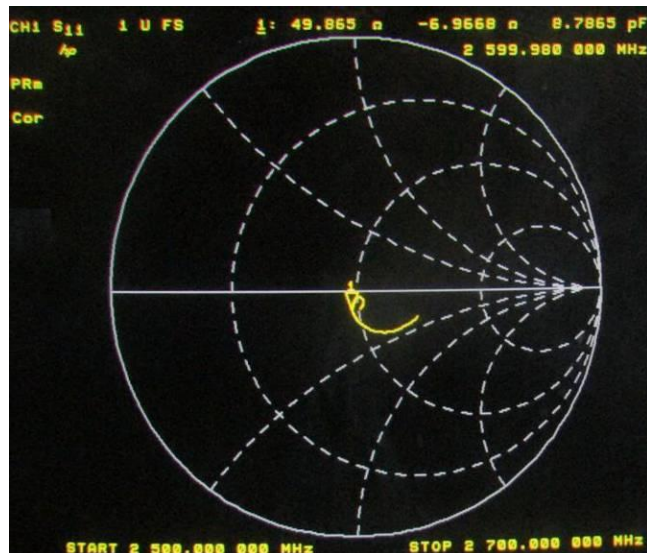
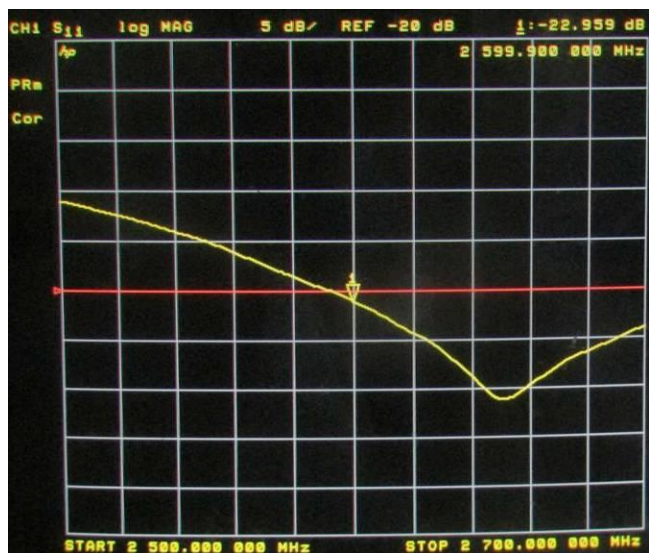
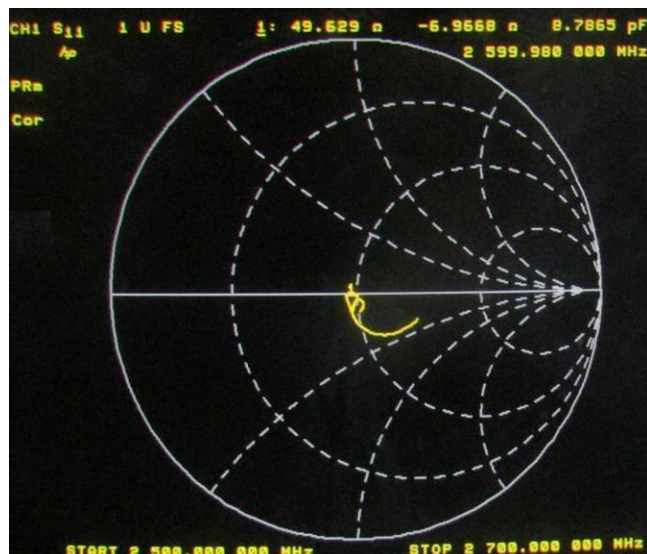
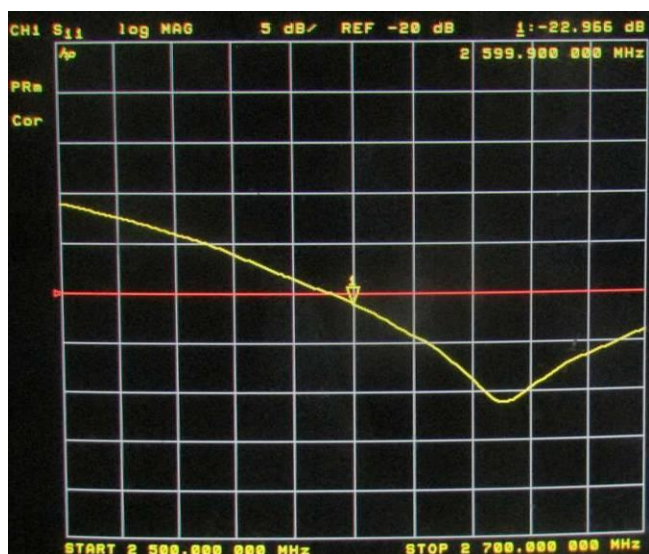


<Body 2600MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-23.23	-	50.6	-	Apr. 19, 2018
-22.966	1.136	49.629	0.971	Apr. 18, 2019
-22.959	1.1666	49.865	0.735	Apr. 17, 2020

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



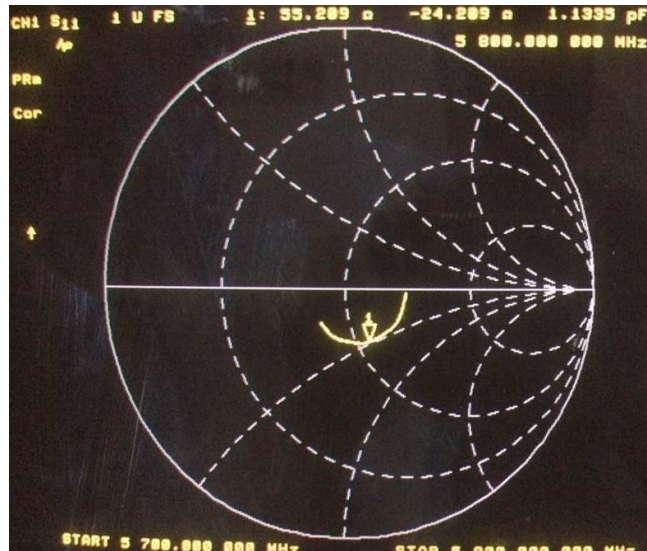
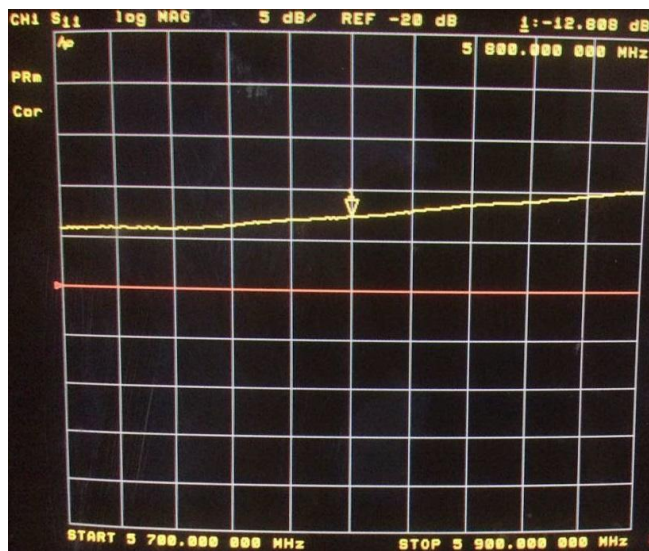
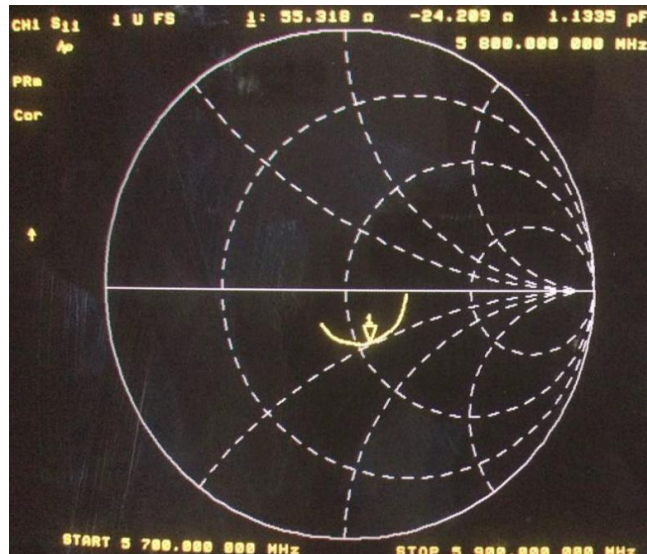
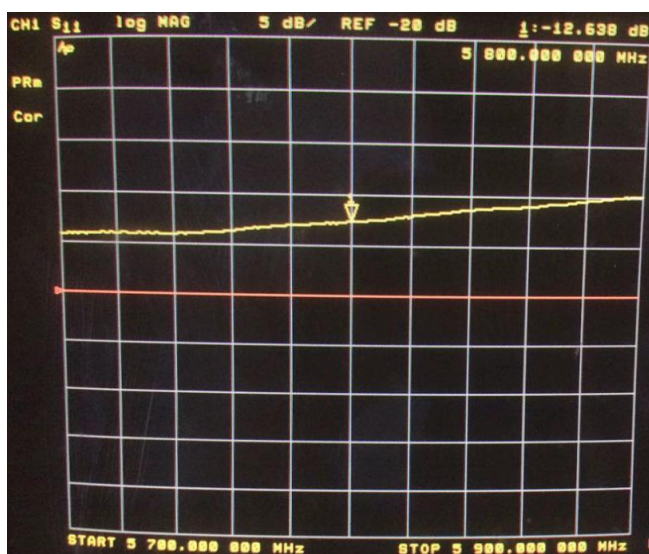


<Head 5800MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-12.03	-	59.85	-	Apr. 19, 2018
-12.638	5.054	55.318	4.532	Apr. 18, 2019
-12.808	6.467	55.209	4.641	Apr. 17, 2020

The return loss is <-8dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data

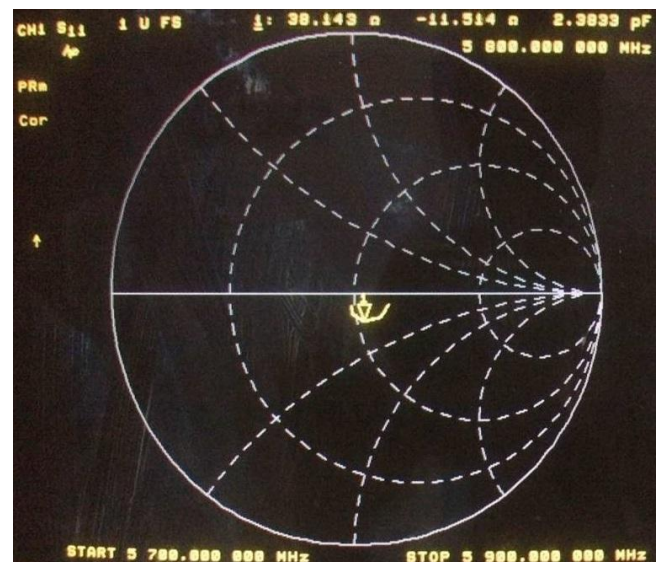
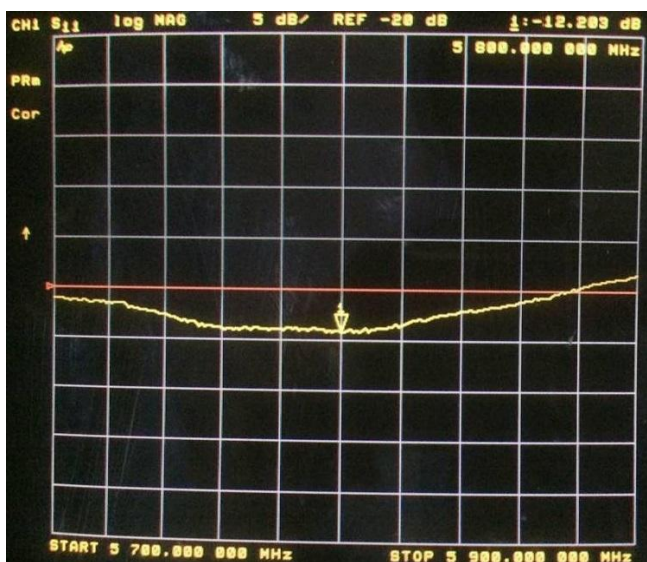
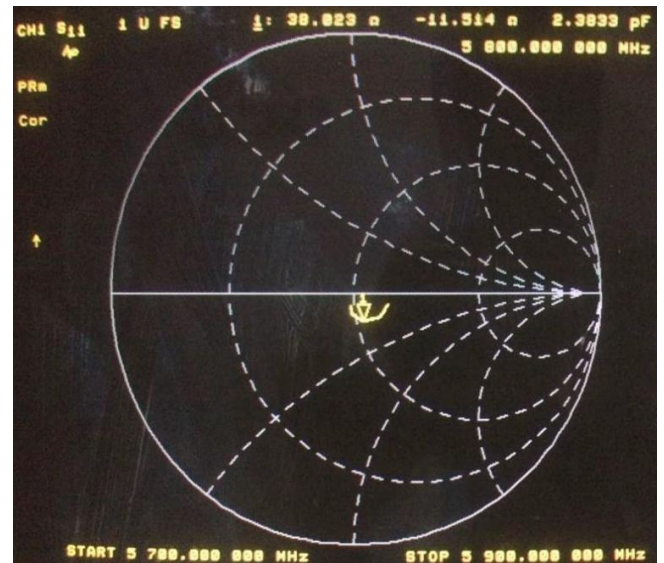
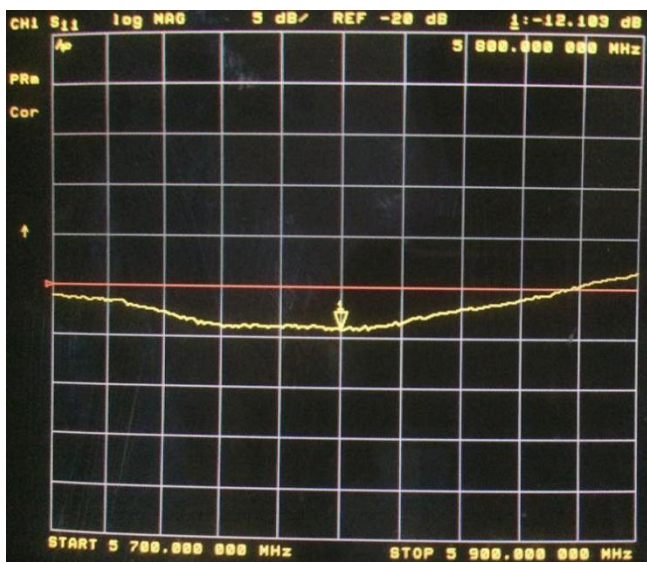


<Body 5800MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-12.37	-	36.66	-	Apr. 19, 2018
-12.103	2.158	38.023	1.363	Apr. 18, 2019
-12.203	1.350	38.143	1.483	Apr. 17, 2020

The return loss is <-8dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



END