

APPENDIX D RETURN LOSS&IMPEDANCE MEASUREMENT

Performance Qualification Report For 900MHz SAR Dipole-1

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D900V2
Serial Number: 132
Calibration Date: 2024/09/26

Calibration and Checked By:

Approved By:

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.2	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1724	2024/03/28	2025/03/27
Dosimetric E-field Probes	EX3DV4	7783	2024/04/12	2025/04/11
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2024/05/21	2025/05/20
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/01/16	2025/01/15
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52350001	2024/05/21	2025/05/20
20dBAttenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.6 ~ 20.3℃
Ambient Temperature:	21.8 ~ 23℃
Relative Humidity:	49 ~ 63%
ATM Pressure:	101.3 kPa
Test Date:	2024/09/26

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
900	Head	Return Loss	21.803 dB	22.005 dB	-0.92%	±20%; ≥20dB	Pass
		Real Impedance	49.421 Ω	47.694 Ω	1.727 Ω	≤ 5 Ω	Pass
		Imaginary Impedance	-8.084 Ω	-7.428 Ω	0.656 Ω	≤ 5 Ω	Pass

Liquid Verification Results:

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ (S/m)	ε _r	σ (S/m)	Δε _r	Δσ	
900	Simulated Tissue Liquid Head	39.867	0.975	41.50	0.97	-3.93	0.52	±5

System Accuracy Check Results:

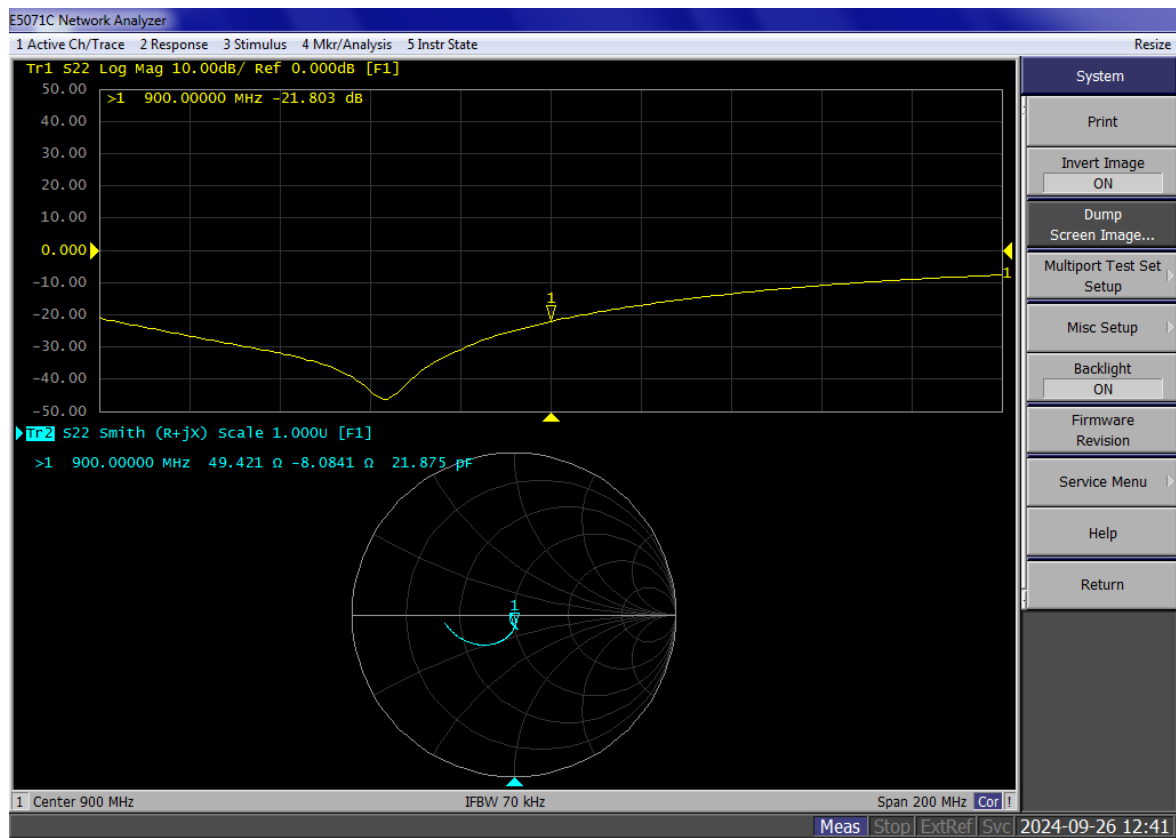
Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
900	Head	100	1g	1.05	10.5	10.8	-2.778	±10
			10g	0.688	6.88	6.93	-0.722	±10

Note:

- Return Loss Deviation = (Measured-Target)/Target×100%
- The target values above please refer to 900MHz dipole calibration certificate (Certificate No .: 23J02Z80061), which was issue by CTTL.

5. Test Plot & System Validation Data:

Dipole, 900MHz, 132



System Performance 900 MHz Head**DUT: Dipole 900 MHz; Type: D900V2; Serial: 132**

Communication System: UID 0, CW (0); Frequency: 900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.975 \text{ S/m}$; $\epsilon_r = 39.867$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7783; ConvF(9.05, 9.05, 9.05) @ 900 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1724; Calibrated: 3/28/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/Head 900MHz Pin=100mW/Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (measured) = 1.49 W/kg

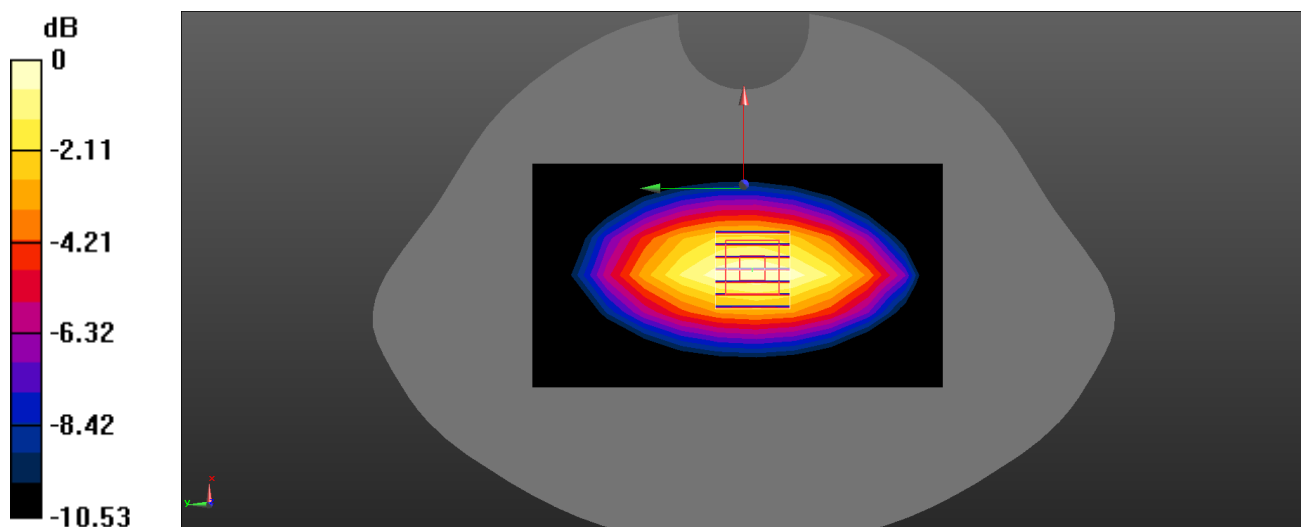
Configuration/Head 900MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 35.34 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.66 W/kg

SAR(1 g) = 1.05 W/kg; SAR(10 g) = 0.688 W/kg

Maximum value of SAR (measured) = 1.44 W/kg



Performance Qualification Report For 900MHz SAR Dipole-2

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D900V2
Serial Number: 132
Calibration Date: 2025/09/25

Calibration and Checked By:

Approved By:

Bob Lu

Luke Jiang

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.4	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1325	2024/10/08	2025/10/07
Dosimetric E-field Probes	EX3DV4	7896	2024/11/07	2025/11/06
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2025/04/29	2026/04/28
Network Analyzer Calibration Kit	50Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/12/04	2025/12/03
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52350001	2025/04/29	2026/04/28
20dBAttenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.5 ~ 20.2℃
Ambient Temperature:	21.3 ~ 22.2℃
Relative Humidity:	55 ~ 62%
ATM Pressure:	100.2 kPa
Test Date:	2025/09/25

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
900	Head	Return Loss	25.425 dB	22.005 dB	13.61%	±20%; ≥20dB	Pass
		Real Impedance	50.323 Ω	47.694 Ω	2.629 Ω	≤5Ω	Pass
		Imaginary Impedance	-5.370 Ω	-7.428 Ω	2.058 Ω	≤5Ω	Pass

Liquid Verification Results:

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ (S/m)	ε _r	σ (S/m)	Δε _r	Δσ	
900	Simulated Tissue Liquid Head	42.774	0.979	41.50	0.97	3.07	0.93	±5

System Accuracy Check Results:

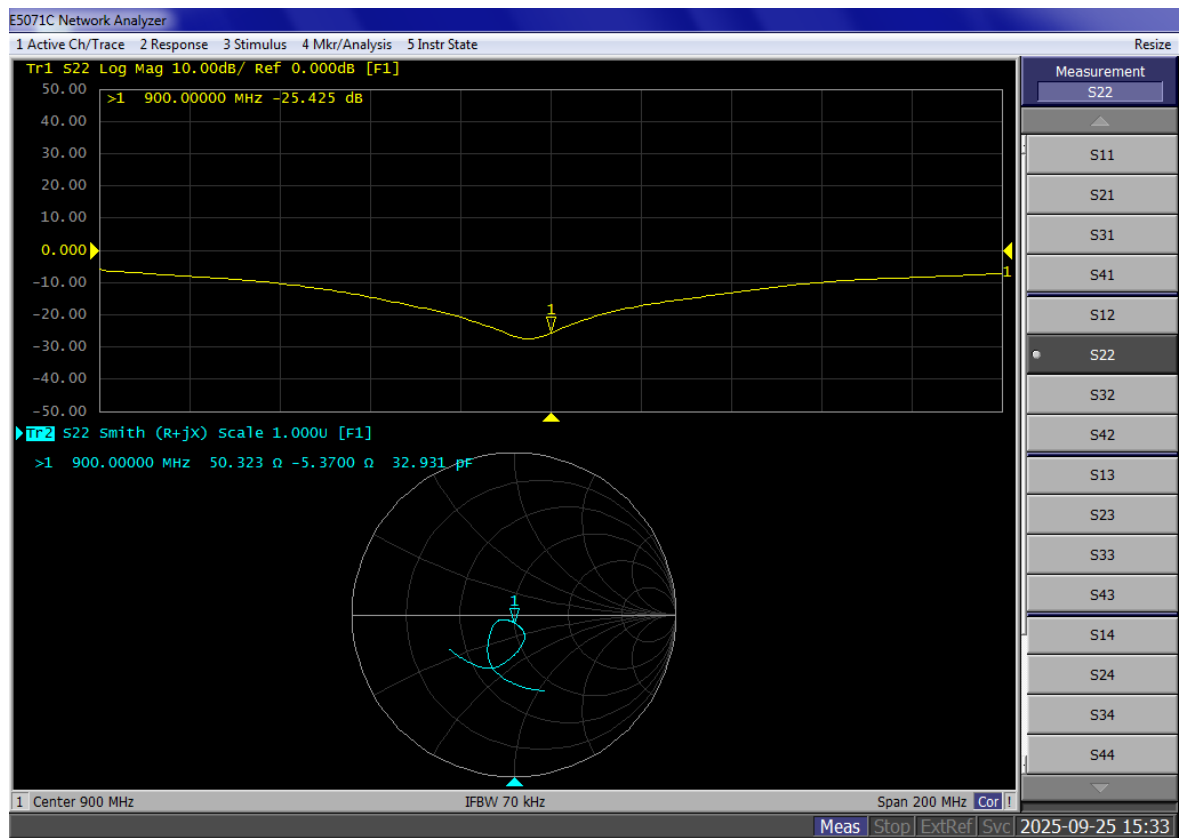
Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
900	Head	100	1g	0.985	9.85	10.8	-8.796	±10
			10g	0.657	6.57	6.93	-5.195	±10

Note:

1. Return Loss Deviation = (Measured-Target)/Target×100%
2. The target values above please refer to 900MHz dipole calibration certificate (Certificate No.: 23J02Z80061), which was issued by CTTL.

5. Test Plot & System Validation Data:

Dipole, 900MHz, 132



System Performance 900 MHz Head**DUT: Dipole 900 MHz; Type: D900V2; Serial: 132**

Communication System: UID 0, CW (0); Frequency: 900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.979 \text{ S/m}$; $\epsilon_r = 42.774$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7896; ConvF(8.08, 8.47, 8.48) @ 900 MHz; Calibrated: 11/7/2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1325; Calibrated: 10/8/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

Configuration/Head 900MHz Pin=100mW/Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (measured) = 1.36 W/kg

Configuration/Head 900MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 34.10 V/m; Power Drift = -0.01 dB

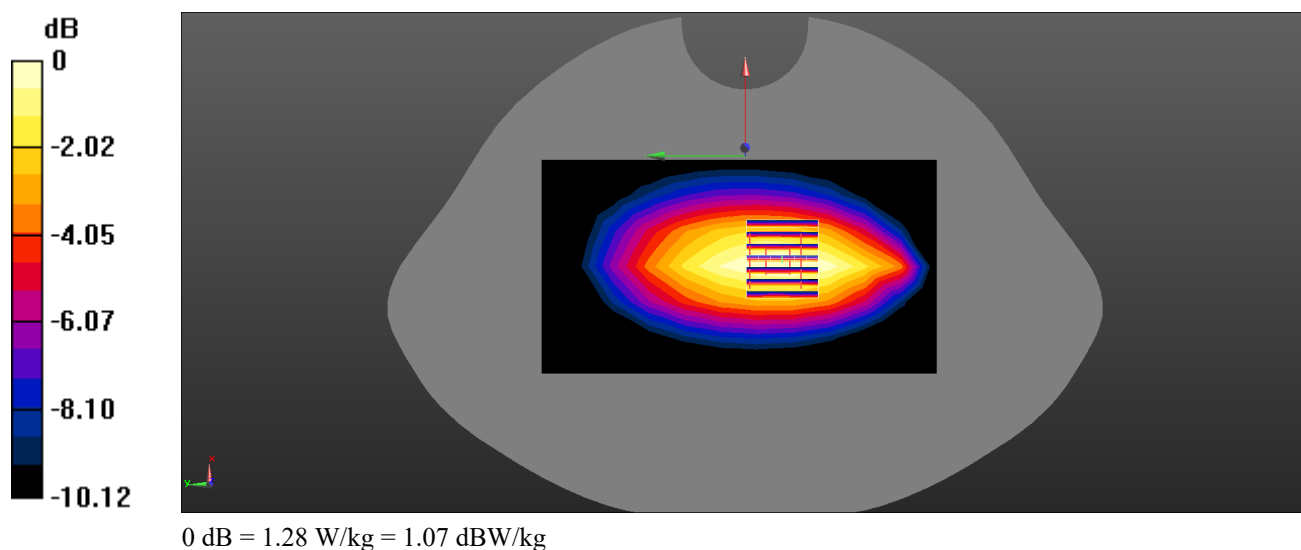
Peak SAR (extrapolated) = 1.42 W/kg

SAR(1 g) = 0.985 W/kg; SAR(10 g) = 0.657 W/kg

Smallest distance from peaks to all points 3 dB below = 17.5 mm

Ratio of SAR at M2 to SAR at M1 = 69.2%

Maximum value of SAR (measured) = 1.28 W/kg



Performance Qualification Report For 3500MHz SAR Dipole-1

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D3500V2
Serial Number: 1113
Calibration Date: 2024/09/26

Calibration and Checked By:

Approved By:

Bob Lu

Luke Jiang

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.2	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1724	2024/03/28	2025/03/27
Dosimetric E-field Probes	EX3DV4	7557	2024/03/26	2025/03/25
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2024/05/21	2025/05/20
Network Analyzer Calibration Kit	50Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/01/16	2025/01/15
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52350001	2024/05/21	2025/05/20
20dB Attenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.6 ~ 20.3℃
Ambient Temperature:	21.8 ~ 23℃
Relative Humidity:	49 ~ 63%
ATM Pressure:	101.3 kPa
Test Date:	2024/09/26

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
3500	Head	Return Loss	21.690 dB	25.749 dB	-15.76%	±20%;≥20dB	Pass
		Real Impedance	51.012 Ω	49.726 Ω	1.286 Ω	≤5Ω	Pass
		Imaginary Impedance	8.282 Ω	5.144 Ω	3.138 Ω	≤5Ω	Pass

Liquid Verification Results:

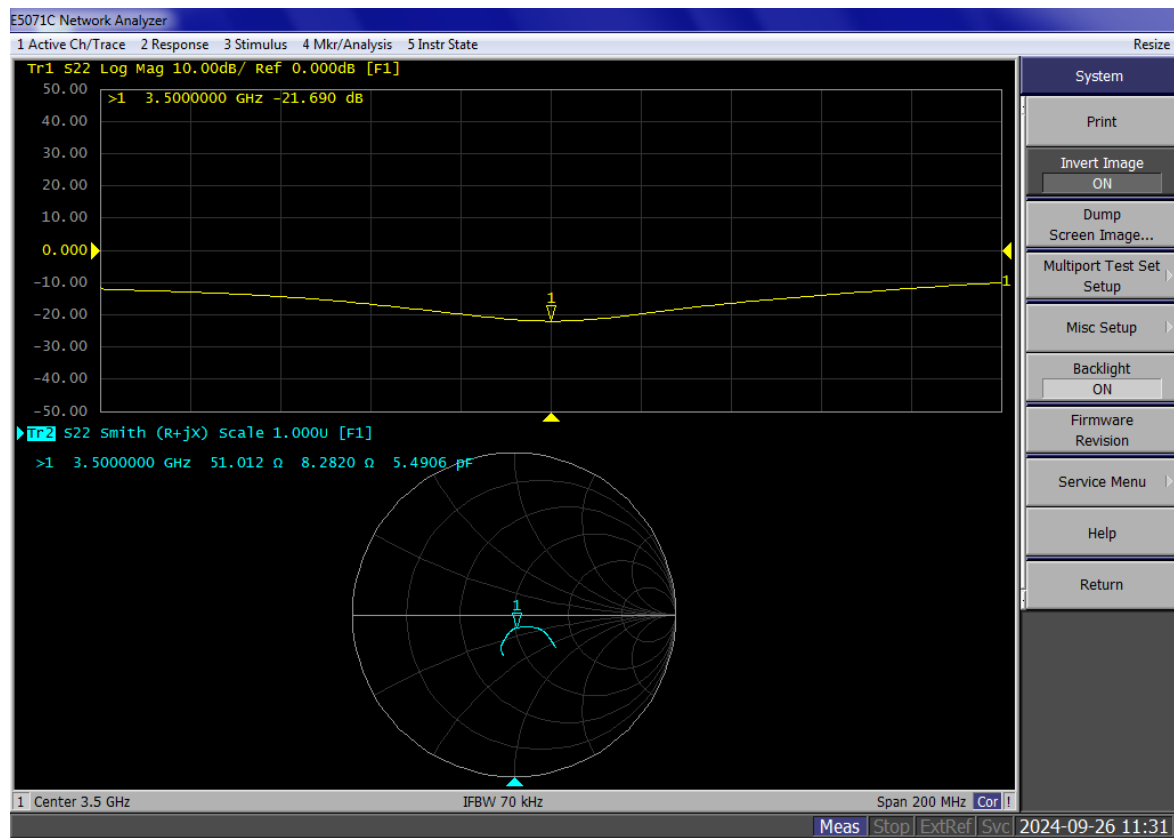
Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ [○] (S/m)	ε _r	σ [○] (S/m)	Δε _r	Δσ [○]	
3500	Simulated Tissue Liquid Head	37.803	2.879	37.90	2.91	-0.26	-1.07	±5

System Accuracy Check Results:

Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
3500	Head	100	1g	6.38	63.8	66.4	-3.916	±10
			10g	2.65	26.5	25.3	4.743	±10

Note:

- Return Loss Deviation = (Measured-Target)/Target×100%
- The target values above please refer to 3500MHz dipole calibration certificate (Certificate No .: 23J02Z80072), which was issue by CTTL.

5. Test Plot & System Validation Data:**Dipole, 3500MHz, 1113**

System Performance 3500 MHz Head**DUT: Dipole 3500 MHz; Type: D3500V2; Serial: 1113**

Communication System: UID 0, CW (0); Frequency: 3500 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 3500$ MHz; $\sigma = 2.879$ S/m; $\epsilon_r = 37.803$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7557; ConvF(6.65, 6.65, 6.65) @ 3500 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1724; Calibrated: 3/28/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/Head 3500MHz Pin=100mW/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 9.65 W/kg

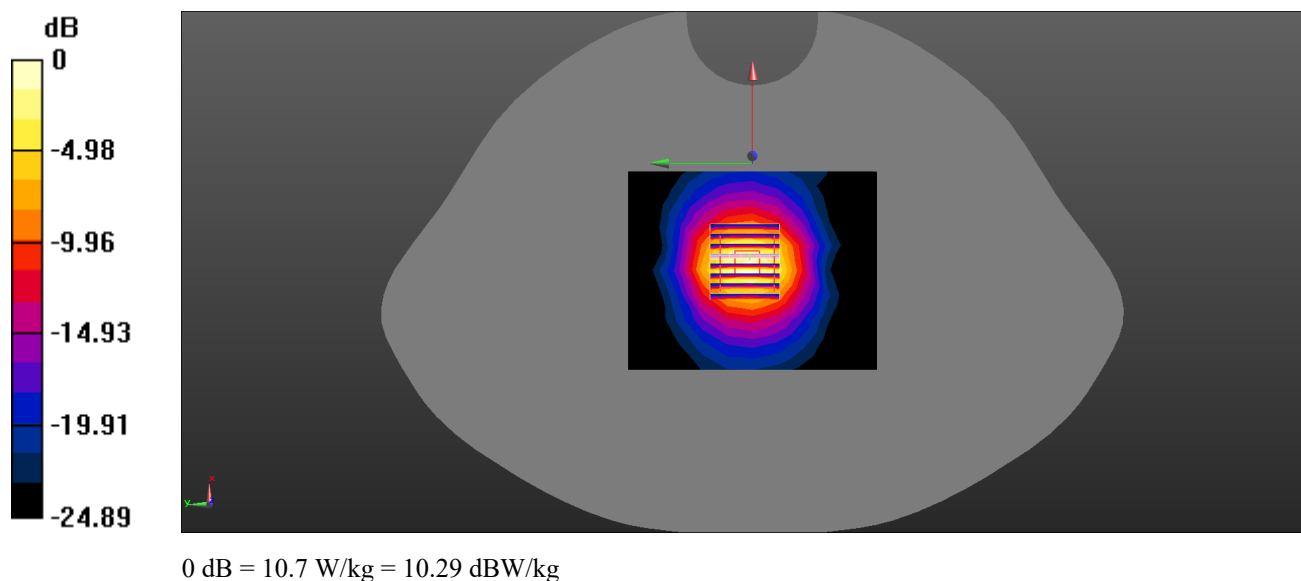
Configuration/Head 3500MHz Pin=100mW/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 47.52 V/m; Power Drift = 0.08dB

Peak SAR (extrapolated) = 13.5 W/kg

SAR(1 g) = 6.38 W/kg; SAR(10 g) = 2.65 W/kg

Maximum value of SAR (measured) = 10.7 W/kg



Performance Qualification Report For 3500MHz SAR Dipole-2

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D3500V2
Serial Number: 1113
Calibration Date: 2025/09/26

Calibration and Checked By:

Approved By:

Bob LuLuke Jiang

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.4	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1325	2024/10/08	2025/10/07
Dosimetric E-field Probes	EX3DV4	7896	2024/11/07	2025/11/06
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2025/04/29	2026/04/28
Network Analyzer Calibration Kit	50Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/12/04	2025/12/03
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52350001	2025/04/29	2026/04/28
20dBAttenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.0 ~ 20.5℃
Ambient Temperature:	21.6 ~ 22.6℃
Relative Humidity:	49 ~ 65%
ATM Pressure:	100.5 kPa
Test Date:	2025/09/26

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
3500	Head	Return Loss	24.669 dB	25.749 dB	-4.194 %	±20%;≥20dB	Pass
		Real Impedance	54.649 Ω	49.726 Ω	4.923 Ω	≤5Ω	Pass
		Imaginary Impedance	3.976 Ω	5.144 Ω	1.168 Ω	≤5Ω	Pass

Liquid Verification Results:

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ' (S/m)	ε _r	σ' (S/m)	Δε _r	Δσ'	
3500	Simulated Tissue Liquid Head	36.624	2.953	37.90	2.91	-3.37	1.48	±5

System Accuracy Check Results:

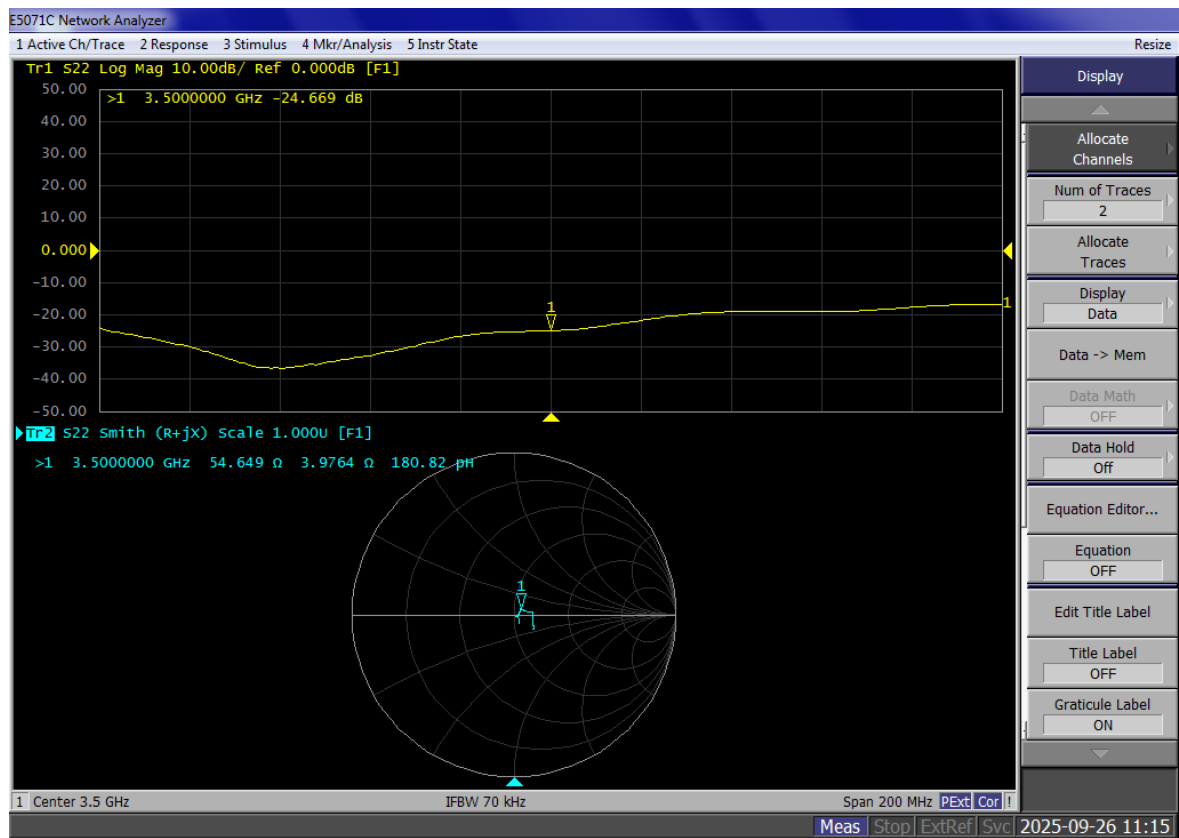
Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
3500	Head	100	1g	6.96	69.6	66.4	4.819	±10
			10g	2.65	26.5	25.3	4.743	±10

Note:

1. Return Loss Deviation = (Measured-Target)/Target×100%
2. The target values above please refer to 3500MHz dipole calibration certificate (Certificate No.: 23J02Z80072), which was issue by CTTL.

5. Test Plot & System Validation Data:

Dipole, 3500MHz, 1113



System Performance 3500 MHz Head**DUT: Dipole 3500 MHz; Type: D3500V2; Serial: 1113**

Communication System: UID 0, CW (0); Frequency: 3500 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 3500$ MHz; $\sigma = 2.953$ S/m; $\epsilon_r = 36.624$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7896; ConvF(5.91, 6.19, 6.2) @ 3500 MHz; Calibrated: 11/7/2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1325; Calibrated: 10/8/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

Configuration/Head 3500MHz Pin=100mW/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 9.94 W/kg

Configuration/Head 3500MHz Pin=100mW/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 52.22 V/m; Power Drift = -0.05 dB

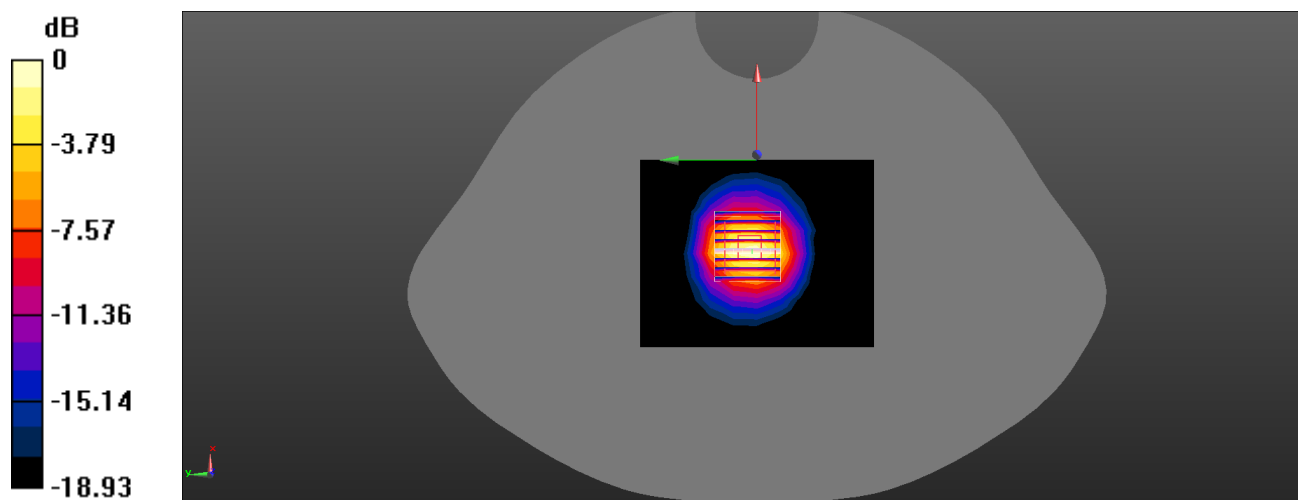
Peak SAR (extrapolated) = 12.5 W/kg

SAR(1 g) = 6.96 W/kg; SAR(10 g) = 2.65 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 81.7%

Maximum value of SAR (measured) = 10.6 W/kg



0 dB = 10.6 W/kg = 10.25 dBW/kg

Performance Qualification Report For 3700MHz SAR Dipole-1

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D3700V2
Serial Number: 1084
Calibration Date: 2024/09/26

Calibration and Checked By:

Approved By:

Bob Lu

Luke Jiang

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.2	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1724	2024/03/28	2025/03/27
Dosimetric E-field Probes	EX3DV4	7557	2024/03/26	2025/03/25
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2024/05/21	2025/05/20
Network Analyzer Calibration Kit	50Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/01/16	2025/01/15
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52370001	2024/05/21	2025/05/20
20dBAttenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.6 ~ 20.3℃
Ambient Temperature:	21.8 ~ 23℃
Relative Humidity:	49 ~ 63%
ATM Pressure:	101.3 kPa
Test Date:	2024/09/26

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
3700	Head	Return Loss	21.247 dB	22.509 dB	-5.61%	±20%;≥20dB	Pass
		Real Impedance	42.779 Ω	43.404 Ω	0.625 Ω	≤5Ω	Pass
		Imaginary Impedance	3.543 Ω	2.341 Ω	1.202 Ω	≤5Ω	Pass

Liquid Verification Results:

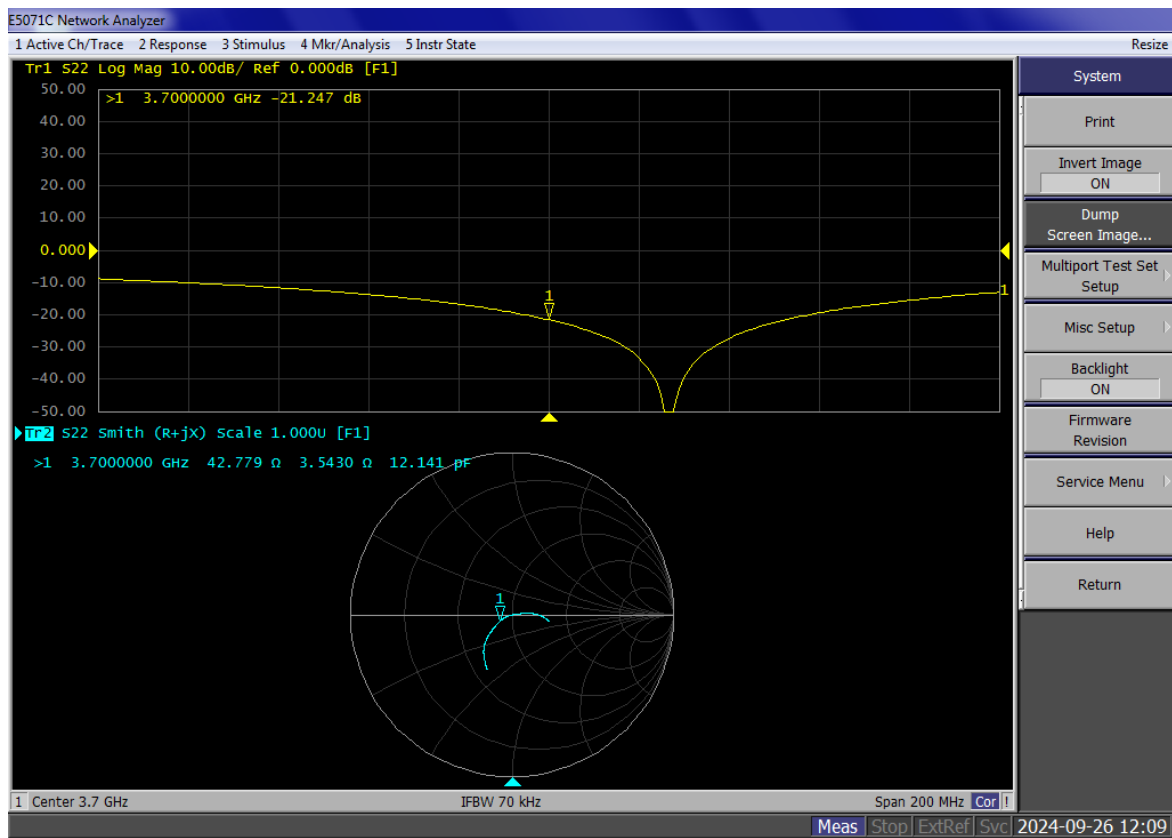
Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ (S/m)	ε _r	σ (S/m)	Δε _r	Δσ	
3700	Simulated Tissue Liquid Head	36.448	3.153	37.70	3.12	-3.32	1.06	±5

System Accuracy Check Results:

Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
3700	Head	100	1g	6.52	65.2	66.7	-2.249	±10
			10g	2.65	26.5	24.3	9.053	±10

Note:

- Return Loss Deviation = (Measured-Target)/Target×100%
- The target values above please refer to 3700MHz dipole calibration certificate (Certificate No .: 23J02Z80074), which was issue by CTTL.

5. Test Plot & System Validation Data:**Dipole, 3700MHz, 1084**

System Performance 3700 MHz Head**DUT: Dipole 3700 MHz; Type: D3700V2; Serial: 1084**

Communication System: UID 0, CW (0); Frequency: 3700 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 3700$ MHz; $\sigma = 3.153$ S/m; $\epsilon_r = 36.448$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7557; ConvF(6.47, 6.47, 6.47) @ 3700 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1724; Calibrated: 3/28/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/Head 3700MHz Pin=100mW/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 11.9 W/kg

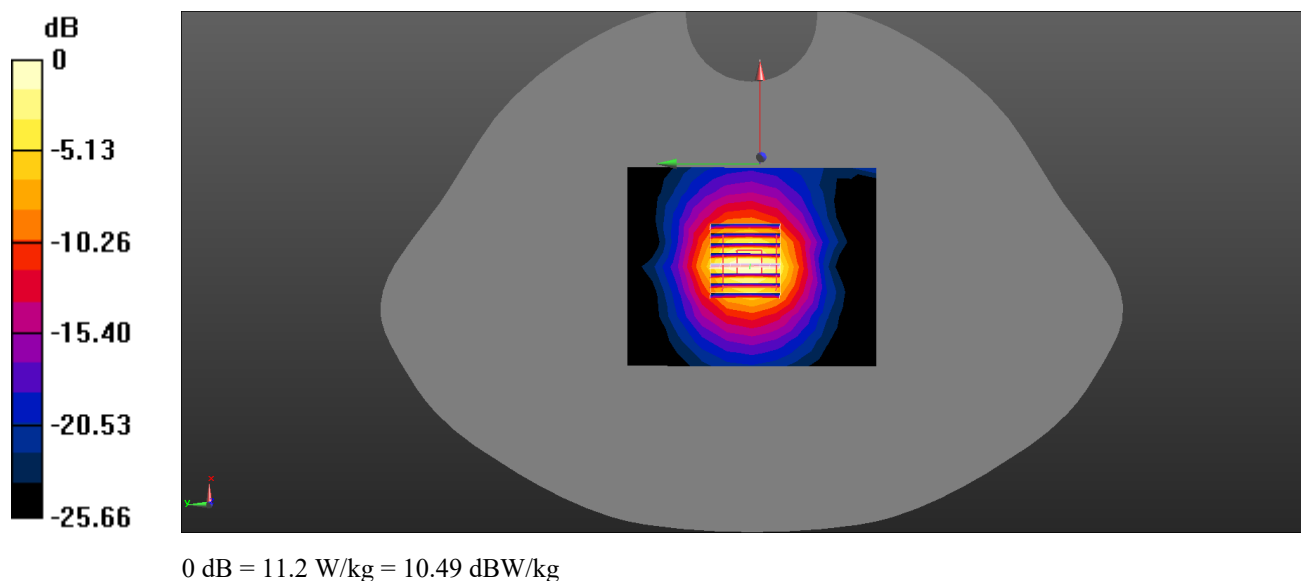
Configuration/Head 3700MHz Pin=100mW/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 51.57 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 14.1 W/kg

SAR(1 g) = 6.52 W/kg; SAR(10 g) = 2.65 W/kg

Maximum value of SAR (measured) = 11.2 W/kg



Performance Qualification Report For 3700MHz SAR Dipole-2

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D3700V2
Serial Number: 1084
Calibration Date: 2025/09/26

Calibration and Checked By:

Approved By:

Bob Lu

Luke Jiang

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.4	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1325	2024/10/08	2025/10/07
Dosimetric E-field Probes	EX3DV4	7896	2024/11/07	2025/11/06
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2025/04/29	2026/04/28
Network Analyzer Calibration Kit	50Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/12/04	2025/12/03
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52350001	2025/04/29	2026/04/28
20dBAttenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.0 ~ 20.5℃
Ambient Temperature:	21.6 ~ 22.6℃
Relative Humidity:	49 ~ 65%
ATM Pressure:	100.5 kPa
Test Date:	2025/09/26

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
3700	Head	Return Loss	21.418 dB	22.509 dB	-4.847%	±20%; ≥20dB	Pass
		Real Impedance	46.309 Ω	43.404 Ω	2.905 Ω	≤5Ω	Pass
		Imaginary Impedance	0.623 Ω	2.341 Ω	1.709 Ω	≤5Ω	Pass

Liquid Verification Results:

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ' (S/m)	ε _r	σ' (S/m)	Δε _r	Δσ'	
3700	Simulated Tissue Liquid Head	37.694	3.067	37.70	3.12	-0.02	-1.70	±5

System Accuracy Check Results:

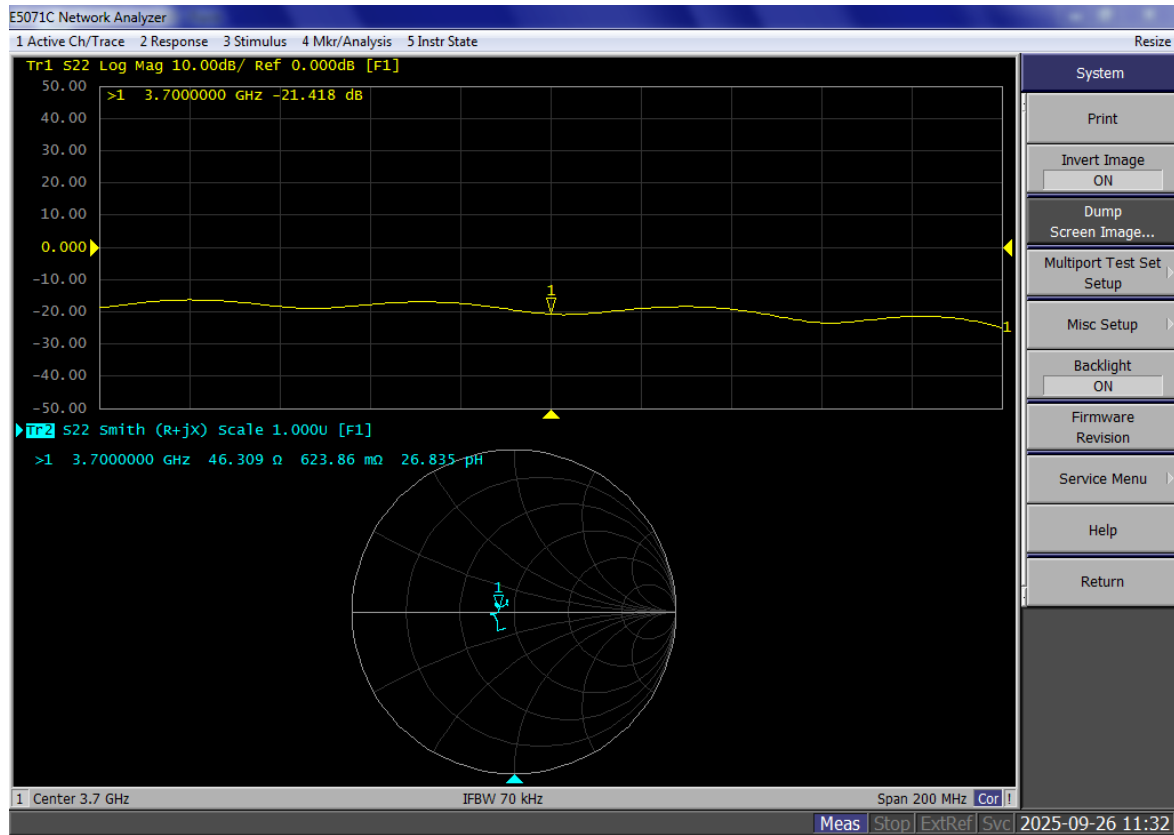
Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
3700	Head	100	1g	6.59	65.9	66.7	-1.199	±10
			10g	2.55	25.5	24.3	4.938	±10

Note:

1. Return Loss Deviation = (Measured-Target)/Target×100%
2. The target values above please refer to 3700MHz dipole calibration certificate (Certificate No.: 23J02Z80074), which was issued by CTTL.

5. Test Plot & System Validation Data:

Dipole, 3700MHz, 1084



System Performance 3700 MHz Head**DUT: Dipole 3700 MHz; Type: D3700V2; Serial: 1084**

Communication System: UID 0, CW (0); Frequency: 3700 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 3700$ MHz; $\sigma = 3.067$ S/m; $\epsilon_r = 37.694$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7896; ConvF(5.92, 6.2, 6.21) @ 3700 MHz; Calibrated: 11/7/2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1325; Calibrated: 10/8/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

Configuration/Head 3700MHz Pin=100mW/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 10.3 W/kg

Configuration/Head 3700MHz Pin=100mW/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 51.22 V/m; Power Drift = -0.10 dB

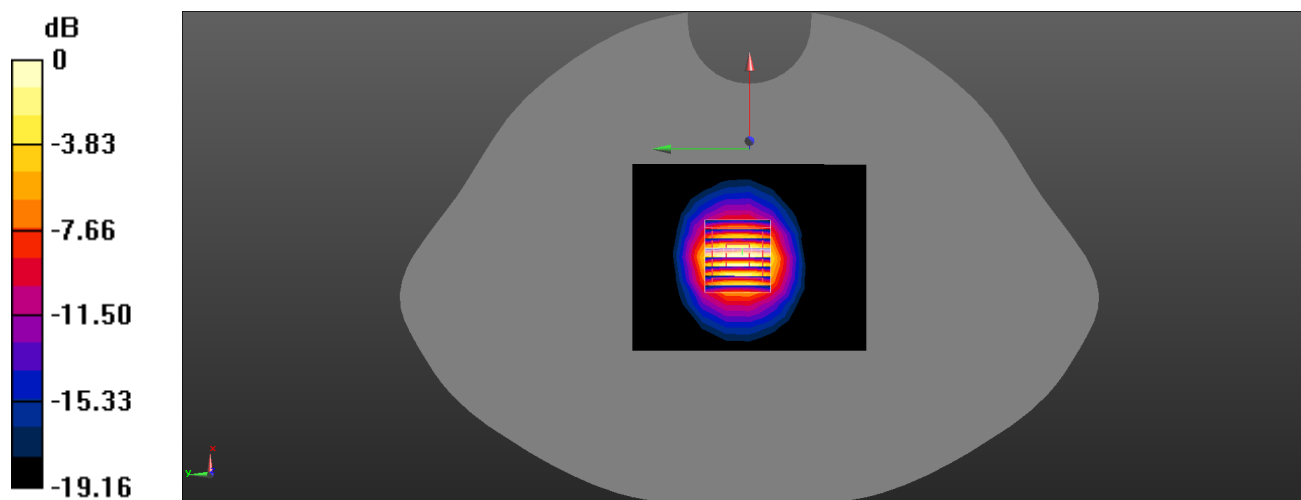
Peak SAR (extrapolated) = 12.1 W/kg

SAR(1 g) = 6.59 W/kg; SAR(10 g) = 2.55 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm

Ratio of SAR at M2 to SAR at M1 = 80.3%

Maximum value of SAR (measured) = 10.1 W/kg



0 dB = 10.1 W/kg = 10.04 dBW/kg

Performance Qualification Report For 3900MHz SAR Dipole-1

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D3900V2
Serial Number: 1058
Calibration Date: 2024/09/26

Calibration and Checked By:

Approved By:

Bob Lu

Luke Jiang

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.2	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1724	2024/03/28	2025/03/27
Dosimetric E-field Probes	EX3DV4	7557	2024/03/26	2025/03/25
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2024/05/21	2025/05/20
Network Analyzer Calibration Kit	50Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/01/16	2025/01/15
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52390001	2024/05/21	2025/05/20
20dBAttenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.6 ~ 20.3℃
Ambient Temperature:	21.8 ~ 23℃
Relative Humidity:	49 ~ 63%
ATM Pressure:	101.3 kPa
Test Date:	2024/09/26

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
3900	Head	Return Loss	21.070 dB	23.417 dB	-10.02%	±20%;≥20dB	Pass
		Real Impedance	50.044 Ω	46.285 Ω	3.759 Ω	≤5Ω	Pass
		Imaginary Impedance	-8.893 Ω	-5.342 Ω	3.551 Ω	≤5Ω	Pass

Liquid Verification Results:

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ (S/m)	ε _r	σ (S/m)	Δε _r	Δσ	
3900	Simulated Tissue Liquid Head	36.794	3.367	37.50	3.33	-1.88	1.11	±5

System Accuracy Check Results:

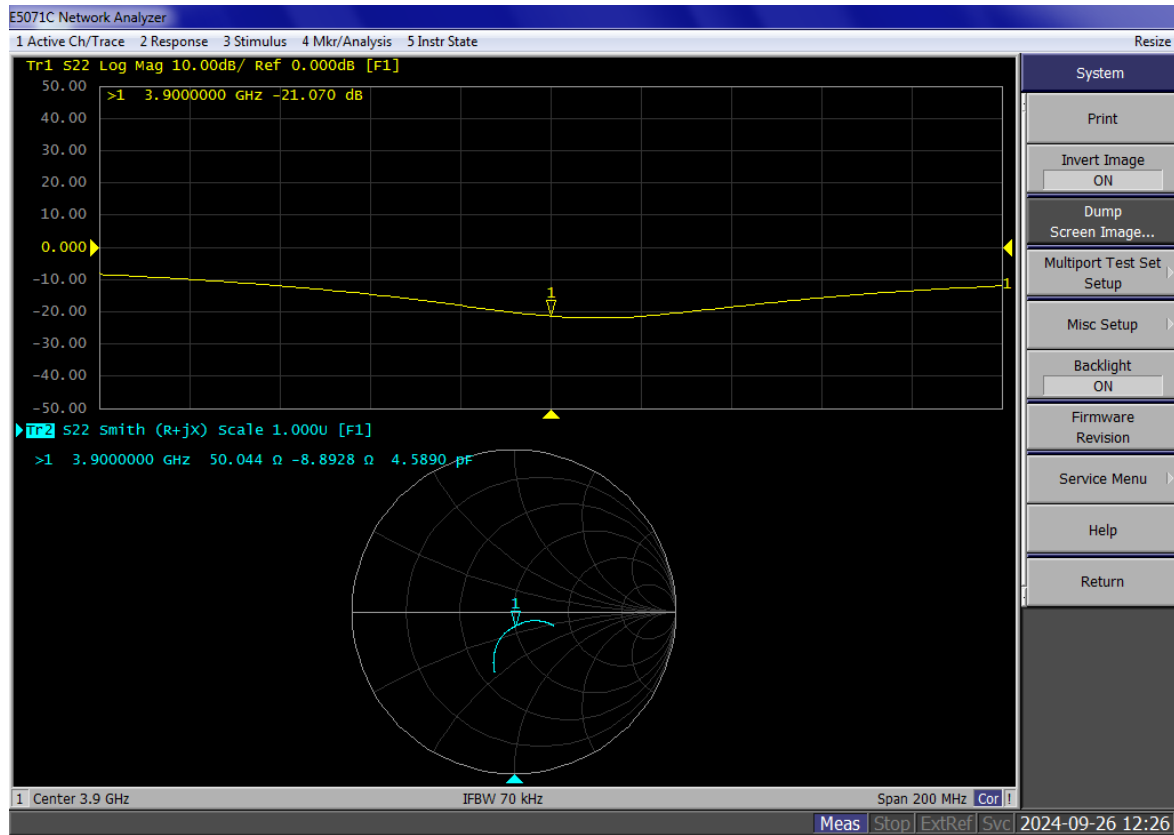
Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
3900	Head	100	1g	6.49	64.9	68.6	-5.394	±10
			10g	2.50	25.0	24.0	4.167	±10

Note:

- Return Loss Deviation = (Measured-Target)/Target×100%
- The target values above please refer to 3900MHz dipole calibration certificate (Certificate No .: 23J02Z80064), which was issue by CTTL.

5. Test Plot & System Validation Data:

Dipole, 3900MHz, 1058



System Performance 3900 MHz Head**DUT: Dipole 3900 MHz; Type: D3900V2; Serial: 1058**

Communication System: UID 0, CW (0); Frequency: 3900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 3900$ MHz; $\sigma = 3.367$ S/m; $\epsilon_r = 36.794$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7557; ConvF(6.37, 6.37, 6.37) @ 3900 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1724; Calibrated: 3/28/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/Head 3900MHz Pin=100mW/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 12.6 W/kg

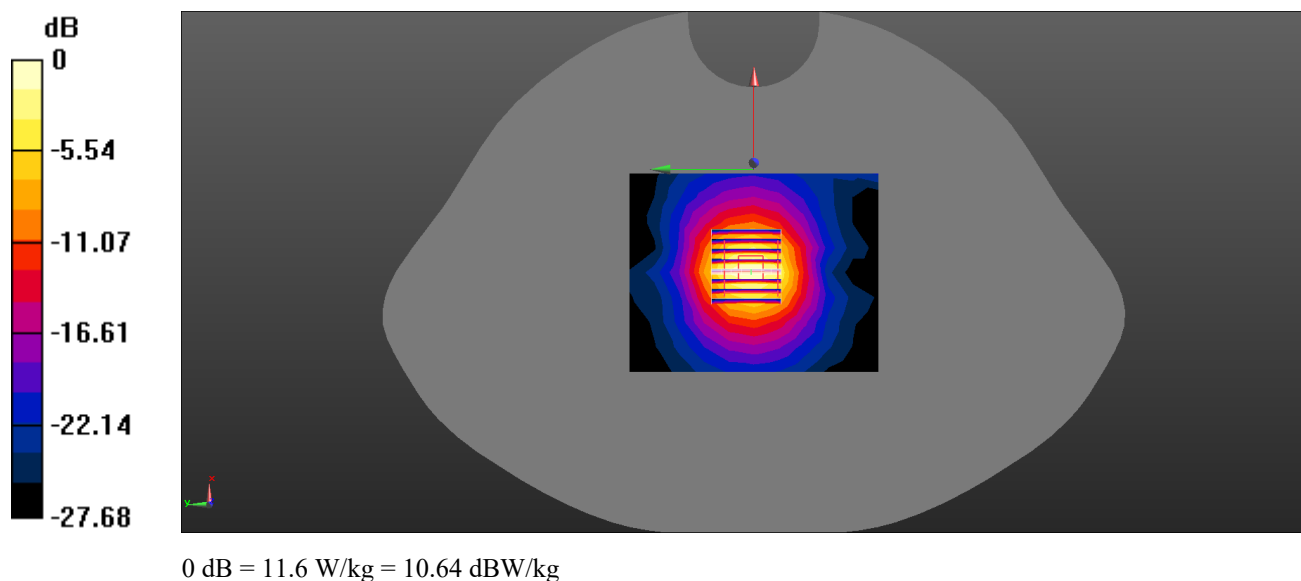
Configuration/Head 3900MHz Pin=100mW/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 48.30 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 15.3 W/kg

SAR(1 g) = 6.49 W/kg; SAR(10 g) = 2.5 W/kg

Maximum value of SAR (measured) = 11.6 W/kg



Performance Qualification Report For 3900MHz SAR Dipole-2

Equipment Details:

Description: Dipole
Manufacturer: Speag
Model Number: D3900V2
Serial Number: 1058
Calibration Date: 2025/09/26

Calibration and Checked By:

Approved By:

Bob LuLuke Jiang

Bob Lu

Luke Jiang

1. Equipment List & Calibration Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.4	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1325	2024/10/08	2025/10/07
Dosimetric E-field Probes	EX3DV4	7896	2024/11/07	2025/11/06
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2025/04/29	2026/04/28
Network Analyzer Calibration Kit	50Ω	51026	NCR	NCR
MXG Analog Signal Generator	N5181A	MY48180408	2024/12/04	2025/12/03
Microwave peak power sensor	MA24418A	12622	NCR	NCR
USB wideband power sensor	U2021XA	MY52350001	2025/04/29	2026/04/28
20dBAttenuator	N/A	N/A	NCR	NCR
Directional Coupler	855673	3307	NCR	NCR

2. Standard Requirements:

Referring to KDB 865664 D01 3.3.2, for dipole calibration, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements:

- 1) When the measured SAR does not deviates from the calibrated SAR value by more than 10%.
- 2) When the most recent return-loss result, measured at least annually, does not deviate by more than 20% from the previous measurement or meeting the required 20 dB minimum return-loss requirement.
- 3) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, does not deviate by more than 5 Ω from the previous measurement.

3. Environmental Conditions:

TSL Temperature:	19.0 ~ 20.5℃
Ambient Temperature:	21.6 ~ 22.6℃
Relative Humidity:	49 ~ 65%
ATM Pressure:	100.5 kPa
Test Date:	2025/09/26

4. Test Results:

Return Loss & Impedance Measurement Results:

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
3900	Head	Return Loss	20.893 dB	23.417 dB	-10.778 %	±20%;≥20dB	Pass
		Real Impedance	41.861 Ω	46.285 Ω	4.424 Ω	≤5Ω	Pass
		Imaginary Impedance	-1.490 Ω	-5.342 Ω	3.852 Ω	≤5Ω	Pass

Liquid Verification Results:

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε _r	σ (S/m)	ε _r	σ (S/m)	Δε _r	Δσ	
3900	Simulated Tissue Liquid Head	37.300	3.397	37.50	3.33	-0.53	2.01	±5

System Accuracy Check Results:

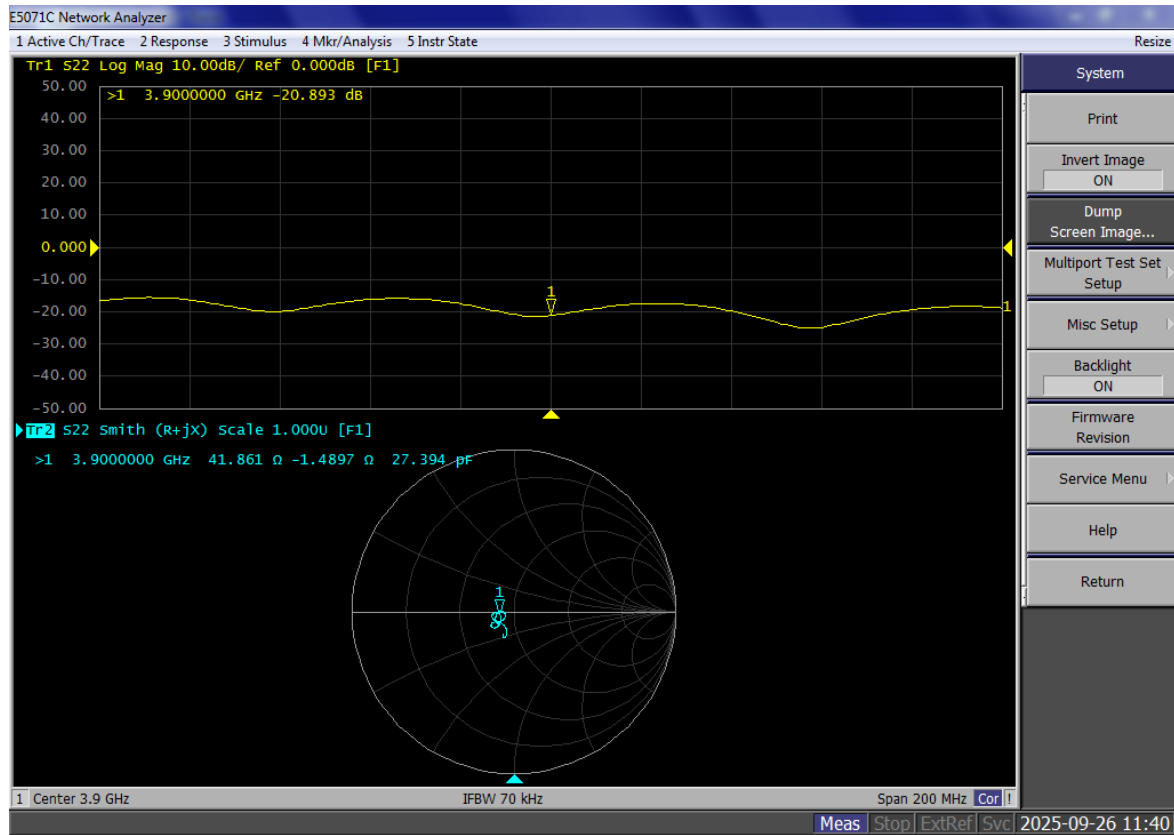
Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
3900	Head	100	1g	6.67	66.7	68.6	-2.770	±10
			10g	2.49	24.9	24.0	3.750	±10

Note:

- Return Loss Deviation = (Measured-Target)/Target×100%
- The target values above please refer to 3900MHz dipole calibration certificate (Certificate No.: 23J02Z80064), which was issue by CTTL.

5. Test Plot & System Validation Data:

Dipole, 3900MHz, 1058



System Performance 3900 MHz Head**DUT: Dipole 3900 MHz; Type: D3900V2; Serial: 1058**

Communication System: UID 0, CW (0); Frequency: 3900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 3900$ MHz; $\sigma = 3.397$ S/m; $\epsilon_r = 37.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7896; ConvF(5.79, 6.07, 6.07) @ 3900 MHz; Calibrated: 11/7/2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1325; Calibrated: 10/8/2024
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

Configuration/Head 3900MHz Pin=100mW/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 10.8 W/kg

Configuration/Head 3900MHz Pin=100mW/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 46.57 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 15.0 W/kg

SAR(1 g) = 6.67 W/kg; SAR(10 g) = 2.59 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 73.2%

Maximum value of SAR (measured) = 11.8 W/kg

