

EX3DV4 - SN:7783

March 12, 2025 (Additional SMC)

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ^E $k = 2$
10983	AAC	5G NR DL (CP-OFDM, TM 3.1, 40 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.31	±9.6
10984	AAB	5G NR DL (CP-OFDM, TM 3.1, 50 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.42	±9.6
10985	AAC	5G NR DL (CP-OFDM, TM 3.1, 40 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.54	±9.6
10986	AAB	5G NR DL (CP-OFDM, TM 3.1, 50 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.50	±9.6
10987	AAC	5G NR DL (CP-OFDM, TM 3.1, 60 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.53	±9.6
10988	AAB	5G NR DL (CP-OFDM, TM 3.1, 70 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.38	±9.6
10989	AAC	5G NR DL (CP-OFDM, TM 3.1, 80 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.33	±9.6
10990	AAB	5G NR DL (CP-OFDM, TM 3.1, 90 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.52	±9.6
11003	AAA	5G NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	10.24	±9.6
11004	AAA	5G NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	10.73	±9.6
11005	AAA	5G NR DL (CP-OFDM, TM 3.1, 25 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.70	±9.6
11006	AAA	5G NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.55	±9.6
11007	AAA	5G NR DL (CP-OFDM, TM 3.1, 40 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.46	±9.6
11008	AAA	5G NR DL (CP-OFDM, TM 3.1, 50 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.51	±9.6
11009	AAA	5G NR DL (CP-OFDM, TM 3.1, 25 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.76	±9.6
11010	AAA	5G NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.95	±9.6
11011	AAA	5G NR DL (CP-OFDM, TM 3.1, 40 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.96	±9.6
11012	AAA	5G NR DL (CP-OFDM, TM 3.1, 50 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.68	±9.6
11013	AAB	IEEE 802.11be (320 MHz, MCS1, 99pc duty cycle)	WLAN	8.47	±9.6
11014	AAB	IEEE 802.11be (320 MHz, MCS2, 99pc duty cycle)	WLAN	8.45	±9.6
11015	AAB	IEEE 802.11be (320 MHz, MCS3, 99pc duty cycle)	WLAN	8.44	±9.6
11016	AAB	IEEE 802.11be (320 MHz, MCS4, 99pc duty cycle)	WLAN	8.44	±9.6
11017	AAB	IEEE 802.11be (320 MHz, MCS5, 99pc duty cycle)	WLAN	8.41	±9.6
11018	AAB	IEEE 802.11be (320 MHz, MCS6, 99pc duty cycle)	WLAN	8.40	±9.6
11019	AAB	IEEE 802.11be (320 MHz, MCS7, 99pc duty cycle)	WLAN	8.29	±9.6
11020	AAB	IEEE 802.11be (320 MHz, MCS8, 99pc duty cycle)	WLAN	8.27	±9.6
11021	AAB	IEEE 802.11be (320 MHz, MCS9, 99pc duty cycle)	WLAN	8.46	±9.6
11022	AAB	IEEE 802.11be (320 MHz, MCS10, 99pc duty cycle)	WLAN	8.36	±9.6
11023	AAB	IEEE 802.11be (320 MHz, MCS11, 99pc duty cycle)	WLAN	8.09	±9.6
11024	AAB	IEEE 802.11be (320 MHz, MCS12, 99pc duty cycle)	WLAN	8.42	±9.6
11025	AAB	IEEE 802.11be (320 MHz, MCS13, 99pc duty cycle)	WLAN	8.37	±9.6
11026	AAB	IEEE 802.11be (320 MHz, MCS0, 99pc duty cycle)	WLAN	8.39	±9.6

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

13 Annex C – Probe Calibration Certificates



In Collaboration with
TTL s p e a g
CALIBRATION LABORATORY

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校准
CALIBRATION
CNAS L0573



Client **BACL**
Certificate No: **24J02Z000121**

CALIBRATION CERTIFICATE

Object: **D2450V2 - SN: 1005**

Calibration Procedure(s): **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

Calibration date: **March 27, 2024**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No. J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No. J23X04183)	May-24
ReferenceProbeEX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG, No. Z23-60161)	Mar-24
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No. 24J02Z80002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24

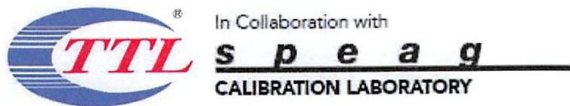
	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: March 31, 2024

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: 24J02Z000121

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

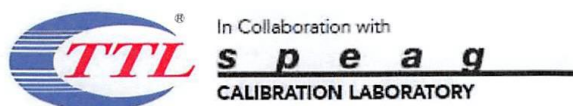
Additional Documentation:

- c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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



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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

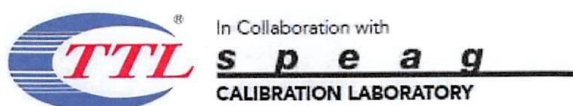
Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.9 $\pm$ 6 %	1.82 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.5 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg $\pm$ 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7Ω+ 1.88jΩ
Return Loss	- 32.2dB

General Antenna Parameters and Design

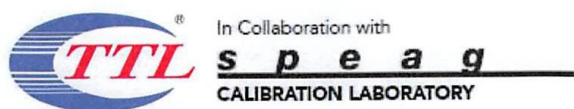
Electrical Delay (one direction)	1.063 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 2024-03-27

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 1005

Communication System: UID 0, CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.822$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.68, 7.68, 7.68) @ 2450 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 105.2 V/m; Power Drift = 0.02 dB

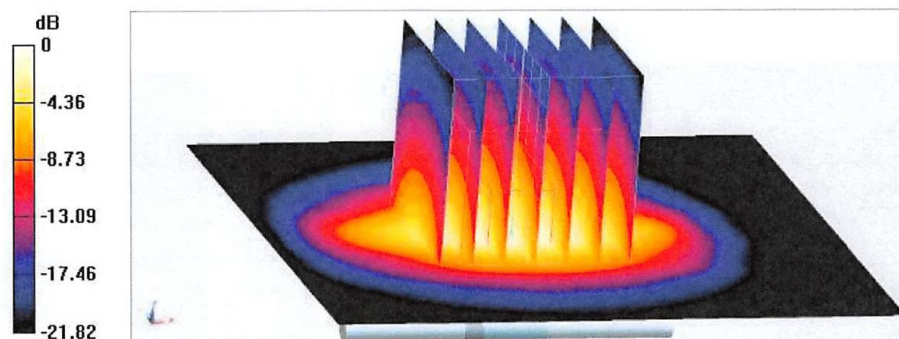
Peak SAR (extrapolated) = 27.9 W/kg

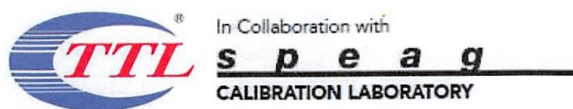
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.19 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 48.7%

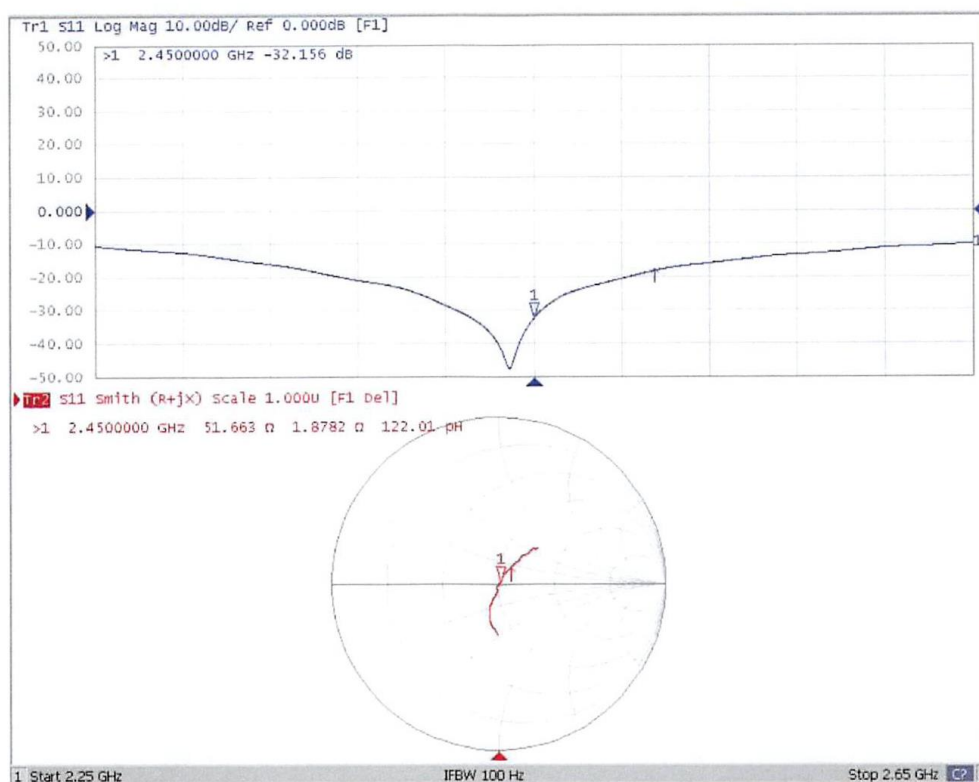
Maximum value of SAR (measured) = 22.6 W/kg





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Impedance Measurement Plot for Head TSL



14 Annex D – Liquid and System Validation

; Name : DAK 3.5 Head 24.01 deg.C 2025-Dec-03 18:08:45						
; Date : 2025-Dec-03 18:08:45						
; Temperature(C) : 24.01						
; Probe : DAK 3.5						
; Network Analyzer : Keysight ENA						
MHz	RefIR	RefII	EpsR	EpsI	Sigma	TanD
2400	0.363	-0.6629	39.6245	12.3616	1.6505	0.312
2402	0.3626	-0.663	39.6223	12.3594	1.6512	0.3119
2402	0.3626	-0.663	39.622	12.3594	1.6513	0.3119
2402	0.3626	-0.663	39.6217	12.3593	1.6513	0.3119
2402	0.3626	-0.663	39.6214	12.3592	1.6513	0.3119
2402	0.3625	-0.6631	39.6211	12.3591	1.6514	0.3119
2402	0.3625	-0.663	39.6209	12.359	1.6514	0.3119
2402	0.3625	-0.663	39.6206	12.3591	1.6515	0.3119
2402	0.3625	-0.663	39.6204	12.3591	1.6515	0.3119
2402	0.3625	-0.663	39.6203	12.359	1.6515	0.3119
2402	0.3625	-0.663	39.6202	12.3591	1.6516	0.3119
2402	0.3625	-0.6631	39.6201	12.3591	1.6516	0.3119
2402	0.3624	-0.6631	39.6199	12.3592	1.6517	0.3119
2402	0.3624	-0.6631	39.6198	12.3594	1.6518	0.3119
2402	0.3624	-0.6631	39.6197	12.3595	1.6518	0.312
2402	0.3624	-0.6631	39.6195	12.3595	1.6519	0.312
2412	0.3602	-0.6639	39.5978	12.347	1.6564	0.3118
2412	0.3602	-0.6639	39.5973	12.3473	1.6565	0.3118
2412	0.3602	-0.6639	39.5969	12.3475	1.6566	0.3118
2412	0.3602	-0.6639	39.5966	12.3477	1.6566	0.3118
2412	0.3601	-0.6639	39.5963	12.348	1.6567	0.3118
2412	0.3601	-0.6639	39.5962	12.348	1.6568	0.3118
2412	0.3601	-0.6639	39.5959	12.3481	1.6568	0.3119
2412	0.3601	-0.6639	39.5957	12.3481	1.6569	0.3119
2412	0.3601	-0.6639	39.5956	12.3479	1.6569	0.3119
2412	0.36	-0.6639	39.5955	12.3477	1.6569	0.3118
2412	0.36	-0.6639	39.5956	12.3474	1.6569	0.3118
2412	0.36	-0.6639	39.5957	12.3471	1.6569	0.3118
2412	0.36	-0.6639	39.5959	12.3468	1.6569	0.3118
2412	0.36	-0.6639	39.5962	12.3463	1.6569	0.3118
2412	0.36	-0.664	39.5964	12.3459	1.6569	0.3118
2412	0.36	-0.664	39.5966	12.3456	1.6569	0.3118
2412	0.36	-0.664	39.5968	12.3452	1.6569	0.3118
2437	0.3535	-0.6653	39.5431	12.3726	1.6771	0.3129

2437	0.3535	-0.6653	39.5431	12.3728	1.6772	0.3129
2437	0.3535	-0.6653	39.5431	12.3732	1.6773	0.3129
2437	0.3535	-0.6653	39.5431	12.3733	1.6773	0.3129
2437	0.3535	-0.6653	39.5431	12.3734	1.6774	0.3129
2437	0.3534	-0.6653	39.543	12.3734	1.6774	0.3129
2437	0.3534	-0.6653	39.543	12.3735	1.6775	0.3129
2437	0.3534	-0.6654	39.543	12.3735	1.6775	0.3129
2437	0.3534	-0.6653	39.5429	12.3735	1.6776	0.3129
2437	0.3534	-0.6653	39.5427	12.3736	1.6776	0.3129
2437	0.3534	-0.6654	39.5426	12.3737	1.6777	0.3129
2437	0.3533	-0.6653	39.5424	12.3739	1.6777	0.3129
2437	0.3533	-0.6654	39.5422	12.3742	1.6778	0.3129
2437	0.3533	-0.6653	39.5422	12.3745	1.6779	0.3129
2437	0.3533	-0.6654	39.5421	12.3747	1.678	0.3129
2437	0.3533	-0.6654	39.542	12.3748	1.678	0.313
2440	0.3527	-0.6655	39.5406	12.3785	1.6799	0.3131
2440	0.3527	-0.6655	39.5406	12.3783	1.6799	0.3131
2440	0.3526	-0.6655	39.5408	12.3781	1.68	0.313
2440	0.3526	-0.6655	39.5409	12.3779	1.68	0.313
2440	0.3526	-0.6655	39.5411	12.3776	1.68	0.313
2440	0.3526	-0.6655	39.5413	12.3772	1.68	0.313
2440	0.3526	-0.6655	39.5415	12.3768	1.6799	0.313
2440	0.3526	-0.6656	39.5418	12.3764	1.6799	0.313
2440	0.3525	-0.6656	39.542	12.3759	1.6799	0.313
2440	0.3525	-0.6656	39.5421	12.3756	1.6799	0.313
2440	0.3525	-0.6656	39.5422	12.3753	1.6799	0.313
2440	0.3525	-0.6656	39.5422	12.3753	1.68	0.313
2440	0.3525	-0.6656	39.5421	12.3752	1.68	0.313
2440	0.3524	-0.6656	39.5419	12.3754	1.6801	0.313
2440	0.3524	-0.6656	39.5417	12.3756	1.6801	0.313
2440	0.3524	-0.6656	39.5415	12.376	1.6802	0.313
2440	0.3524	-0.6656	39.5413	12.3764	1.6803	0.313
2450	0.3498	-0.6663	39.5386	12.3839	1.6876	0.3132
2450	0.3498	-0.6663	39.5387	12.384	1.6876	0.3132
2450	0.3497	-0.6663	39.5391	12.3839	1.6877	0.3132
2450	0.3497	-0.6663	39.5394	12.3837	1.6877	0.3132
2450	0.3497	-0.6663	39.5397	12.3833	1.6877	0.3132
2450	0.3497	-0.6664	39.5401	12.383	1.6877	0.3132
2450	0.3497	-0.6664	39.5404	12.3826	1.6877	0.3132
2450	0.3496	-0.6664	39.5407	12.3822	1.6877	0.3132
2450	0.3496	-0.6664	39.5408	12.3819	1.6877	0.3131
2450	0.3496	-0.6664	39.5409	12.3818	1.6877	0.3131

2450	0.3496	-0.6664	39.541	12.3817	1.6877	0.3131
2450	0.3496	-0.6664	39.5409	12.3817	1.6878	0.3131
2450	0.3496	-0.6664	39.5407	12.3818	1.6878	0.3131
2450	0.3496	-0.6664	39.5404	12.3821	1.6879	0.3131
2450	0.3495	-0.6664	39.54	12.3824	1.688	0.3132
2462	0.3467	-0.6672	39.5183	12.3798	1.6953	0.3133
2462	0.3467	-0.6672	39.518	12.3799	1.6953	0.3133
2462	0.3467	-0.6672	39.5176	12.3799	1.6954	0.3133
2462	0.3467	-0.6672	39.5172	12.3799	1.6954	0.3133
2462	0.3466	-0.6672	39.5167	12.38	1.6955	0.3133
2462	0.3466	-0.6672	39.5162	12.38	1.6955	0.3133
2462	0.3466	-0.6672	39.5157	12.38	1.6956	0.3133
2462	0.3466	-0.6672	39.5152	12.38	1.6956	0.3133
2462	0.3466	-0.6672	39.5146	12.38	1.6957	0.3133
2462	0.3466	-0.6672	39.5141	12.38	1.6957	0.3133
2462	0.3466	-0.6672	39.5137	12.3799	1.6957	0.3133
2462	0.3466	-0.6672	39.5133	12.3798	1.6958	0.3133
2462	0.3466	-0.6672	39.5131	12.3797	1.6958	0.3133
2462	0.3465	-0.6672	39.5128	12.3796	1.6958	0.3133
2462	0.3465	-0.6672	39.5127	12.3795	1.6959	0.3133
2480	0.3423	-0.6685	39.4736	12.371	1.7064	0.3134
2480	0.3423	-0.6685	39.4737	12.3709	1.7065	0.3134
2480	0.3423	-0.6685	39.4738	12.3709	1.7065	0.3134
2480	0.3423	-0.6685	39.4738	12.3708	1.7065	0.3134
2480	0.3423	-0.6685	39.4737	12.3707	1.7066	0.3134
2480	0.3422	-0.6685	39.4736	12.3708	1.7066	0.3134
2480	0.3422	-0.6685	39.4734	12.3708	1.7067	0.3134
2480	0.3422	-0.6685	39.4731	12.3709	1.7067	0.3134
2480	0.3422	-0.6685	39.4729	12.371	1.7068	0.3134
2480	0.3422	-0.6685	39.4727	12.3711	1.7068	0.3134
2480	0.3422	-0.6685	39.4724	12.3711	1.7069	0.3134
2480	0.3422	-0.6685	39.4722	12.3712	1.7069	0.3134
2480	0.3422	-0.6685	39.4719	12.3712	1.707	0.3134
2480	0.3421	-0.6685	39.4717	12.3712	1.707	0.3134
2480	0.3421	-0.6685	39.4716	12.3712	1.7071	0.3134
2480	0.3421	-0.6685	39.4714	12.3712	1.7071	0.3134
2480	0.3421	-0.6685	39.4714	12.3713	1.7072	0.3134
2500	0.3371	-0.6698	39.4296	12.3755	1.7212	0.3139