APMP.T-S6

APMP SUPPLEMENTARY COMPARISON OF INDUSTRIAL PLATINUM RESISTANCE THERMOMETER FOR RANGE –50 °C TO 400 °C

Final Report

Prepared by

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1. Introduction

After the completion of the supplementary comparison APMP.T-S3-3 coordinated by NIMT in 2004, it was evidenced that a follow-up comparison may be beneficial to some participants. As a result, in 2009, the National Metrology Laboratory, Malaysia (NML-SIRIM) had agreed to coordinate the supplementary comparison APMP.T-S6 for temperature ranges –50 °C to 400 °C using Platinum Resistance Thermometers. The APMP.T-S6 supplementary comparison was done with the National Measurement Institute, Australia (NMIA) and the Korea Research Institute of Standards and Science (KRISS) as co-pilot laboratories. This comparison was opened to all APMP members and particularly the Developing Economy Countries members to consolidate/improve their Calibration and Measurement Capabilities CMC.

Due to an unexpectedly large number of participants, three loops (A, B and C) of measurement were run in parallel to shorten the circulation time. For each loop, a metal sheath Platinum Resistance Thermometer (PRT) was used as an artefact. The pilot and the co-pilot laboratories, each was responsible to provide and characterise a PRT artefact before circulation: NML-SIRIM for loop A, NMIA for loop B and KRISS for loop C. The APMP.T-S6 started from July 2009 and completed in April 2011.

This report lists the details of the participants, the artefacts and the measurement schedule. Measurement instructions can be found in the protocol (see Appendix A). The before and after ice point resistances of each artefact as measured by each participant were plotted to keep track of the stability of the artefact throughout the circulation. For comparison purposes, raw data submitted were normalised, when necessary, to the appropriate nominal temperature as specified by the protocol.

Due to some inconsistencies in the data submitted by the pilot laboratory SIRIM, only data from the co-pilot labs KRISS and NMIA were used as the reference. Thus, for each loop, normalised data from all participants in the loop were compared with the average of KRISS-NMIA data for that loop.

2. Participants

Table 1 list the name and contact details of the staff member at each participating laboratory.

Participant Labs	Contact Person	Phone	Fax/email
NMIA	Mong-Kim Ho	+612 8467 3572	+612 8467 3719 kim.nguyen@measurement.gov.au
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SIRIM	Hafidzah Othman Nurulaini Md Ali	+603 8778 1665 +60387781740	+603 8778 1661 hafidzah_othman@sirim.my aini@sirim.my

Participant Labs	Contact Person	Phone	Fax/email
KRISS	Dr.Inseok Yang Yong-Gyoo Kim	+82 42 868 5772	+82 42 868 5831 iyang@kriss.re.kr
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NMC, A*STAR	Wang Li Fan Yan Neoh Boon Kwee	+65 62791962	+65 62791996 wang_li@nmc.a-star.edu.sg fan_yan@nmc.a-star.edu.sg
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Table 1: Details of Participants

3. Artefacts

The artefacts belonging to NML-SIRIM, NMIA and KRISS were 3 of 100- Ω PRTs, one artefact per loop. NML-SIRIM, NMIA and KRISS had calibrated the artefacts before and after circulation depending on the circulating loop where their IPRT was used. Table 2 listed details of the artefacts.

PRT	Loop A	Loop B	Loop C
S/No	935-14-95	1142	W86/8
Model	-	8928	-
Maker	Isotech	Leeds & Northrup	KRISS
Supplier	NML-SIRIM	NMIA	KRISS
4-wire	Yes	Yes	Yes
Metal sheath	Yes	Yes	Yes
Length / mm	400	420	600
Diameter / mm	6	6.4	6.4
Terminals	Spade	Spade	Spade

Table 2: Details of Artefacts

4. Schedule

Considerable delays in circulation occurred due to difficulties experienced in Customs clearance of the artefacts and the expiration of the ATA Carnets, resulting in the recall of the artefacts and the re-issued of the Carnets. The rescheduled comparison affects laboratory internal activities contributing to the delay.

The planed and actual schedule for each loop were listed in Table 3, 4 and 5.

(A) Participating Lab	Schedule (Planed)	Schedule(Actual)
NML-SIRIM MALAYSIA	Before 24 July 2009	Dispatch on 21 July
NIMT THAILAND	27 July-14 Aug 2009	3 Aug 2009 – 10 Aug 2009
NMISA SOUTH AFRICA	17 Aug-4 Sept 2009	13 Aug 2009 - 31 Aug 2009
NIS EGYPT	7 Sept-25 Sept 2009	8 Oct 2009 – 25 Oct 2009
NSCL SYRIA	28 Sept- 16 Oct 2009	5 Nov 2009 – 22 Nov 2009
JNMI JORDAN	19 Oct -6 Nov 2009	9 Dec 2009 - 30 Dec 2009
NMIA AUSTRALIA	9 Nov -27 Nov 2009	14 Jan 2010 – 19 Mar 2010
NML-SIRIM MALAYSIA	-	2 April 2010 – 22 April 2010
KRISS SOUTH KOREA	30 Nov-18 Dec 2009	14 May 2010 – 16 June 2010
NML-SIRIM MALAYSIA	After 18 Dec 2009	Received on 23 June 2010

Table 3: Artefact Circulation for Loop A

(B) Participating Lab	Schedule (Planed)	Schedule (Actual)
NMIA AUSTRALIA	Before 24 July 2009	Dispatch before 13 Aug 2009
NISIT PAPUA NEW GUINEA	27 July-14 Aug 2009	13 Aug 2009 – 5 Sept 2009
NIM CHINA	17 Aug-4 Sept 2009	16 Sept 2009 - 20 Nov 2009
CMS TAIWAN	7 Sept-25 Sept 2009	-
NML-SIRIM MALAYSIA	28 Sept- 16 Oct 2009	3 Dec 2009 – 28 Jan 2009
KRISS SOUTH KOREA	19 Oct -6 Nov 2009	19 Feb 2009 - 10 Mar 2009
BSTI BANGLADESH	9 Nov -27 Nov 2009	5 May 2010 – 16 July 2010
NMIA AUSTRALIA	-	2 Oct 2010 –28 Nov 2010
CMS TAIWAN	7 Sept-25 Sept 2009	30 Nov 2010 -24 March 2011
NMIA AUSTRALIA	After 27 Nov 2009	Received on April 2011

Table 4: Artefact Circulation for Loop B

(C) Participating Lab	Schedule (Planed)	Schedule (Actual)
KRISS SOUTH KOREA	Before 24 July 2009	Dispatch on 16 July
KIM-LIPI INDONESIA	27 July-14 Aug 2009	28 July 2009 – 14 Sept 2009
NMC,A*STAR SINGAPORE	17 Aug-4 Sept 2009	19 Aug 2009 - 8 Sept 2009
NML-SIRIM MALAYSIA	7 Sept-25 Sept 2009	11 Sept 2009 – 6 Oct 2009
VMI VIETNAM	28 Sept- 16 Oct 2009	14 Oct 2009 – 30 Oct 2009
ITDI PHILIPHINES	19 Oct -6 Nov 2009	1 Mar 2010 – 7 April 2010
KRISS SOUTH KOREA	-	13 May 2010 – 17 May 2010
NMIA AUSTRALIA	9 Nov -4 Dec 2009	20 May 2010 -7 July 2010
KRISS SOUTH KOREA	After 4 Dec 2009	Received on 2 Aug 2010

Table 5: Artefact Circulation for Loop C

5. Measurement Procedures

Before circulation was commenced, each artefact was subjected to an annealing process to stabilize and was then characterized by the responsible pilot/co-pilot laboratory. Upon arrival, artefact ice points as received were measured and reported to the pilot lab for stability checking. The artefacts were then annealed at 420 °C until the change in the R(IP) was less than 5 mK. Measurements were carried out by participants in accordance with local practice. The majority of the participants were able to perform the comparison at the requested test temperatures of (0, –50, –30, 0, 100, 200, 300, 400, 0) °C.

For the following three laboratories, the test temperature ranges were somewhat limited:

1) CMS-Taiwan and NIM-China : –50 °C to 300 °C.
2) NISIT-Papua New Guinea : –30 °C to 200 °C.
3) ITDI-Philippines : –30 °C to 300 °C.

In addition to the test temperatures specified in the protocol, NISIT submitted results at 50 °C and 150 °C. Although these results are listed in Table 16, they were not used in the analysis.

6. Artefacts stability

The initial and final ice point resistance measured by each laboratory were plotted in Figure 1, 2 and 3 to detect any changed in the behaviour of the artefacts due to shipment and thermal cycling. Instead of R(IP)s, some participants submitted R(WTP)s and the data were corrected to R(IP)s at 0 mA.

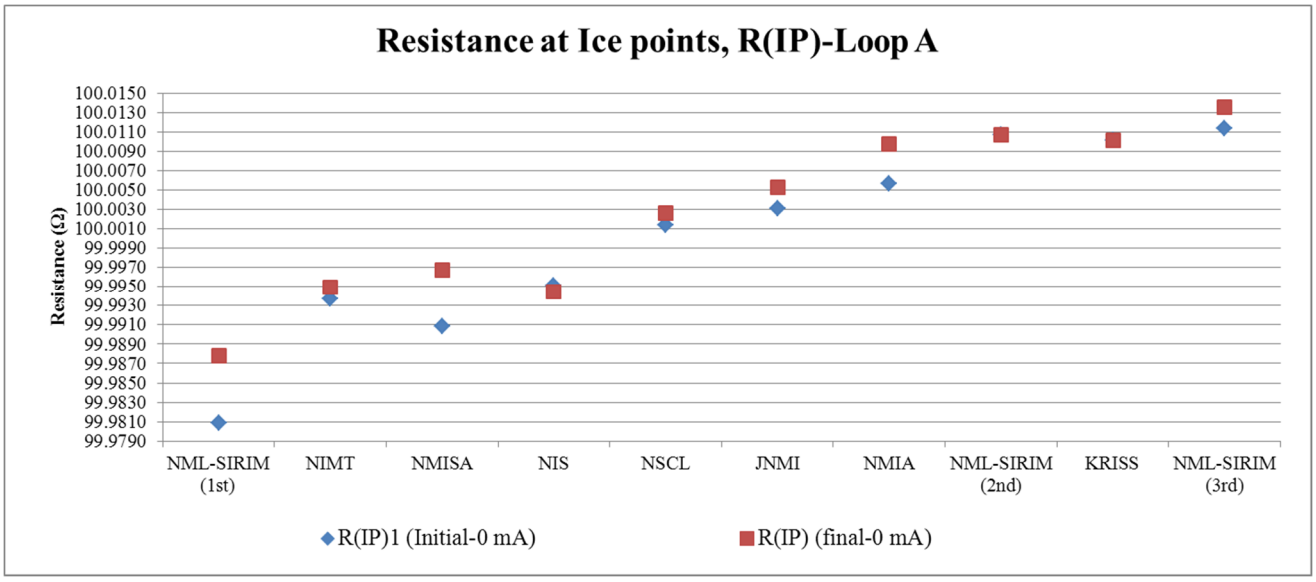


Figure 1: Loop A, ice point instability ±0.0164 Ω

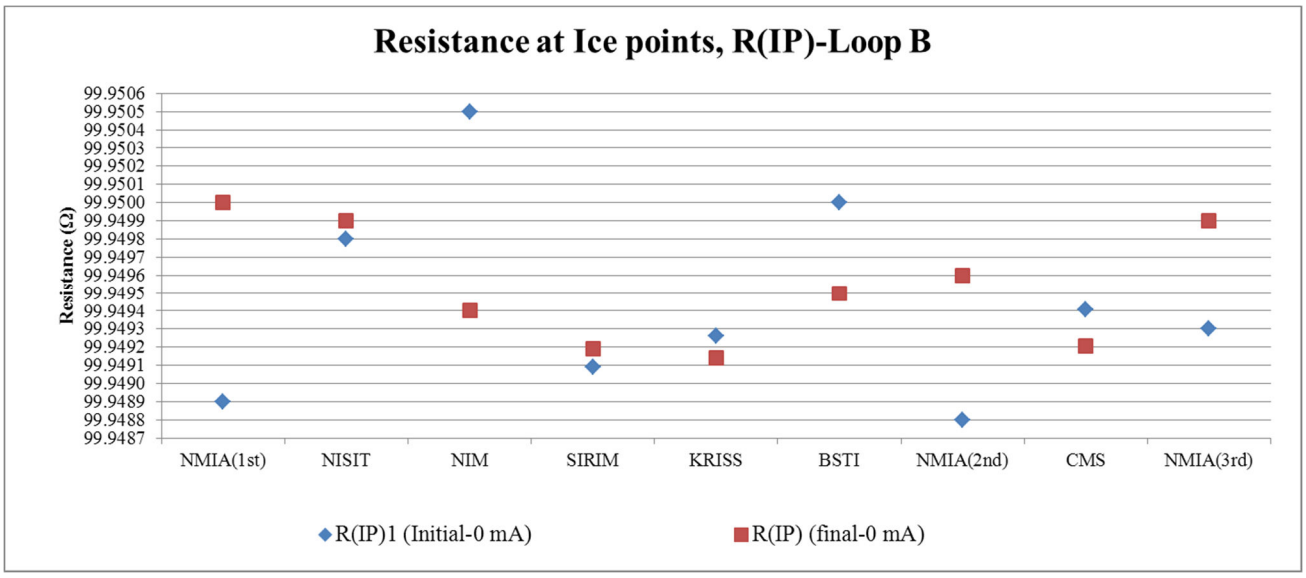


Figure 2: Loop B, ice point instability ±0.0008 Ω

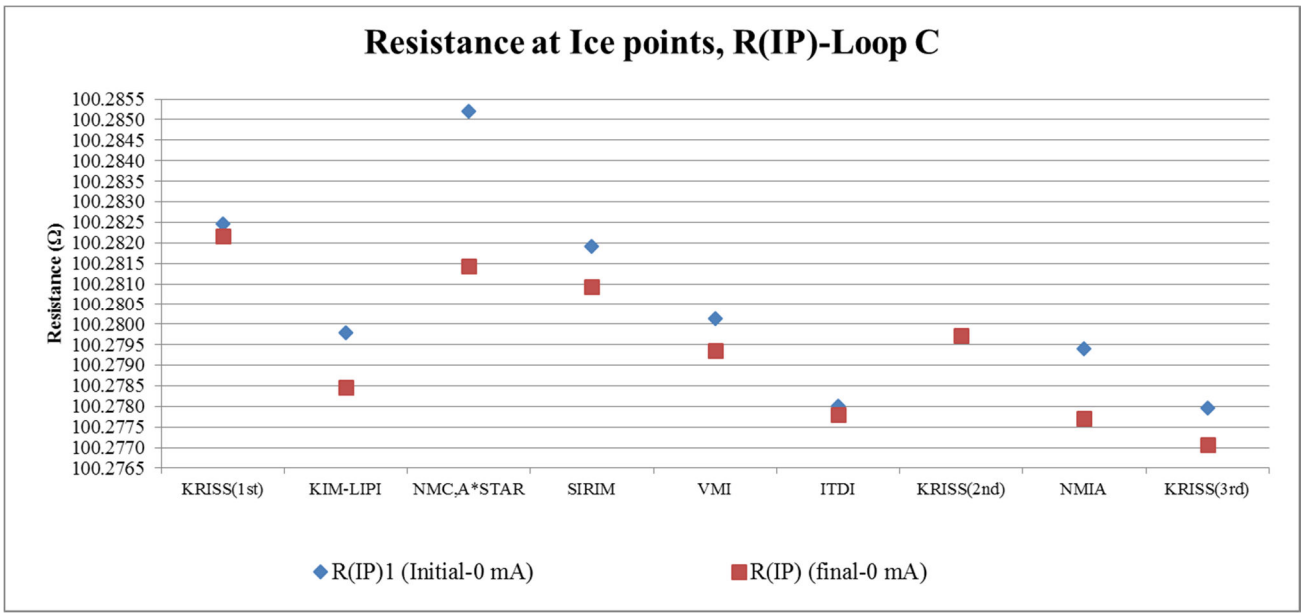


Figure 3: Loop C, ice point instability ±0.0041 Ω

7. Data Submissions

Tables 6 to 31 list the measurement data and their associated uncertainties obtained from participants without any manipulation from NML-SIRIM.

Loop A

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0040	99.9883	0.008	2.00	200	0.999986
-50	-50.0035	80.2770	0.034	2.00	200	0.802853
-30	-30.0001	88.2015	0.034	2.00	200	0.882105
Ice point	0.0040	99.9897	0.008	2.00	200	1.000000
100	100.0451	138.5339	0.024	2.00	200	1.385482
200	200.0012	175.8695	0.031	2.00	200	1.758876
300	300.1184	212.1120	0.026	2.00	440	2.121339
400	400.1303	247.1724	0.026	2.00	440	2.471979
Ice Point	0.0040	99.9897	0.008	2.00	200	1.000000

Table 6: NML ,SIRIM- Malaysia(Before circulation)

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0025	99.994347	0.012	2.00	150	1.00006
-50	-49.9975	80.278042	0.011	2.00	150	0.80288
-30	-30.006	88.202399	0.013	2.00	150	0.88206
Ice point	0.0026	99.989731	0.01	2.00	150	1.00002
100	100.0012	138.50926	0.015	2.00	150	1.38526
200	200.0015	175.86362	0.014	2.00	150	1.75885
300	300.0106	212.07952	0.022	2.00	150	2.12105
400	400.0172	247.1652	0.021	2.00	150	2.47195
Ice Point	0.0002	99.98965	0.012	2.00	150	1.00002

Table 7: NIMT-Thailand

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Water Triple Point	0.0100	100.0039	0.0003	2.00	280	-
-50	-49.5980	80.4469	0.005	2.14	240	0.804480
-30	-30.4021	88.0496	0.008	2.28	240	0.880508
Water Triple Point	0.0100	100.0011	0.0003	2.00	280	-
Water Triple Point	0.0100	100.0029	0.0003	2.00	280	-
100	100.0570	138.5442	0.003	2.00	225	1.385448
200	200.1127	175.9220	0.003	2.00	225	1.759228
300	298.2884	211.4786	0.006	2.00	200	2.114796
400	401.9715	247.8449	0.008	2.00	200	2.478461
Water Triple Point	0.0100	100.0039	0.0003	2.00	280	-

Table 8: NMISA-South Africa

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	-0.018	99.997092	0.0095	2.00	250	1
-50	-48.2581	80.332272	0.0142	2.00	280	0.8033461
-30	-29.2128	88.244596	0.0142	2.00	280	0.8824716
Ice point	-0.0197	99.99501	0.0117	2.00	250	1
100	100.1289	138.6042	0.014	2.00	280	1.3861112
200	199.897	175.861	0.0133	2.00	280	1.7586978
300	299.7918	212.0379	0.0163	2.00	280	2.1204848
400	399.5821	247.04482	0.0163	2.00	280	2.4705715
Ice Point	-0.0292	99.99649	0.0095	2.00	250	1

Note : Only 1 sample of uncertainty budget was submitted and k=2 was used based on the table. The uncertainty budget for all values were not included in the submission .

Table 9: NIS-Egypt

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.000	100.0056	0.012	2.00	400	1
-50	-50.058	80.2679	0.021	2.00	185	0.802634
-30	-30.069	88.1831	0.021	2.00	185	0.881782
Ice point	0.000	100.0035	0.017	2.00	400	0.999979
100	100.185	138.6028	0.044	2.00	250	1.385950
200	200.534	176.0899	0.044	2.00	280	1.760801
300	300.483	212.276	0.045	2.00	250	2.122641
400	400.087	247.2173	0.047	2.00	250	2.472034
Ice Point	0.000	100.0062	0.012	2.00	400	1.000006

Table 10: NSCL-Syria

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.000	100.007114	0.016	2.00	200	1
-50	-50.007	80.2887197	0.058	2.00	200	0.802840531
-30	-30.028	88.2029946	0.040	2.00	200	0.881978680
Ice point	0.000	100.005813	0.016	2.00	200	1
100	99.986	138.532975	0.040	2.00	200	1.385228431
200	199.972	175.889486	0.044	2.00	200	1.758766222
300	300.003	212.116325	0.060	2.00	200	2.121008115
400	399.990	247.188786	0.062	2.00	200	2.471707076
Ice Point	0.000	100.007314	0.016	2.00	200	1

Table 11: JNMI-Jordan

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0	-	0.013	2.11	300	1.0000000000
-50	-50	-	0.013	2.11	300	0.8028812550
-30	-30	-	0.013	2.11	300	0.8820938136
Ice point	0	-	0.013	2.11	300	1.0000000000
100	100	-	0.013	2.11	300	1.3852516800
200	200	-	0.013	2.11	300	1.7588172800
300	300	-	0.013	2.11	300	2.1209306800
400	400	-	0.013	2.11	300	2.4716884800
Ice Point	0	-	0.013	2.11	300	1.0000000000

Table 12: NMI-Australia

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0000	100.0124	0.0059	1.96	200	1.000000
-50	-49.9975	80.2989	0.0066	1.96	250	0.802890
-30	-30.0020	88.2184	0.0072	1.96	250	0.882075
Ice point	0.0020	100.0123	0.0059	1.96	200	0.999999
100	99.9997	138.5394	0.0072	1.96	250	1.385222
200	199.9923	175.8997	0.0095	1.96	250	1.758779
300	300.0009	212.1166	0.0132	1.96	250	2.120903
400	399.9973	247.1947	0.0152	1.96	250	2.471640
Ice Point	-0.0002	100.0127	0.006	1.96	200	1.000003

Table 13: KRISS-South Korea

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0040	100.0126	0.013	2.00	200	0.999965
-50	-49.9700	80.3066	0.035	2.00	200	0.802937
-30	-30.0465	88.1982	0.035	2.00	200	0.881840
Ice point	0.0040	100.0126	0.013	2.00	200	1.000000
100	100.8920	138.8509	0.038	2.00	200	1.388285
200	200.3965	176.0492	0.043	2.00	200	1.760208
300	300.0662	212.0849	0.040	2.00	440	2.120508
400	399.9943	247.1300	0.040	2.00	440	2.470902
Ice Point	0.0040	100.0161	0.013	2.00	200	1.000000

Table 14: NML ,SIRIM- Malaysia(After circulation)

Loop B

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0	-	0.006	2.09	300	1
-50	-50	-	0.006	2.09	300	0.802655645
-30	-30	-	0.006	2.09	300	0.881956928
Ice point	0	-	0.006	2.09	300	1
100	100	-	0.009	1.99	300	1.38571922
200	200	-	0.009	1.99	300	1.75973512
300	300	-	0.011	2.07	300	2.12226502
400	400	-	0.011	2.07	300	2.47342352
Ice Point	0	-	0.006	2.09	300	1

Table 15 : NMI-Australia (Before Circulation)

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0	99.9506	0.023	3.95	200	1
-30	-29.977	88.162	0.034	2.02	200	0.882048
Ice point	0	99.9498	0.021	3.23	200	0.999992
50*	50.007	119.3721	0.033	2.03	200	1.194312
100	100.0104	138.493	0.048	2.01	200	1.385604
150*	150.0608	157.3552	0.048	2.01	200	1.57433
200	200.0709	175.9026	0.048	2.01	200	1.759896
Ice Point	0	99.9513	0.021	3.33	200	1.000007
* Not required by the protocol.						

Table 16: NISIT-Papua New Guinea

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0000	99.9492	0.005	2.00	250	1.000000
-50	-50.0000	80.2226	0.010	2.00	220	0.802640
-30	-30.0000	88.1503	0.010	2.00	220	0.881950
Ice point	0.0000	99.9484	0.005	2.00	250	1.000000
100	100.0000	138.5026	0.010	2.00	220	1.385730
200	200.0000	175.8865	0.013	2.00	220	1.759760
300	300.0000	212.1214	0.015	2.00	220	2.122300
400	-	-	-	-	-	-
Ice Point	0.0000	99.9494	0.005	2.00	250	1.000010

Table 17: NIM-China

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0040	99.9499	0.006	2.00	200	0.999998
-50	-50.1095	80.1789	0.033	2.00	200	0.802190
-30	-30.0486	88.1299	0.033	2.00	200	0.881739
Ice point	0.0040	99.9501	0.006	2.00	200	1.000000
100	100.0657	138.5271	0.027	2.00	200	1.385962
200	200.0185	175.8928	0.034	2.00	200	1.759807
300	300.3357	212.2066	0.029	2.00	440	2.123126
400	400.2771	247.2672	0.029	2.00	440	2.473906
Ice Point	0.0040	99.9501	0.006	2.00	200	1.000000

Table 18: NML ,SIRIM- Malaysia

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	-0.001	99.9501	0.0053	1.96	200	0.999 996
-50	-49.996	80.2250	0.0055	1.96	250	0.802 647
-30	-30.001	88.1510	0.0056	1.96	250	0.881 948
Ice point	0.000	99.9486	0.0053	1.96	200	0.999 981
100	99.999	138.5030	0.0060	1.96	250	1.385 717
200	199.993	175.8845	0.0077	1.96	250	1.759 718
300	299.999	212.1207	0.0114	1.96	250	2.122 259
400	400.009	247.2230	0.0127	1.96	250	2.473 456
Ice Point	-0.001	99.9500	0.0053	1.96	200	0.999 996

Table 19: KRISS-South Korea

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.016	99.95002	0.071	2.25	300	1
-50	-49.739	80.32679	0.035	2.25	300	0.803670000
-30	-29.781	88.22981	0.068	2.23	300	0.882740000
Ice point	0.016	99.95143	0.033	2.09	300	1
100	100.199	138.57405	0.033	2.06	300	1.386410000
200	200.014	175.8704	0.043	2.11	300	1.759560000
300	299.311	211.5241	0.041	2.00	230	2.116270000
400	400.746	247.1282	0.077	2.17	230	2.472480000
Ice Point	0.017	99.9471	0.074	2.13	300	1

Table 20: BSTI-Bangladesh

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0	-	0.007	2.01	300	1
-50	-50	-	0.007	2.01	300	0.802649834
-30	-30	-	0.007	2.01	300	0.881953788
Ice point	0	-	0.007	2.01	300	1
100	100	-	0.007	2.01	300	1.38572525
200	200	-	0.007	2.01	300	1.75974560
300	300	-	0.007	2.01	300	2.12228185
400	400	-	0.007	2.01	300	2.47344800
Ice Point	0	-	0.007	2.01	300	1

Table 21: NMI-Australia (mid circulation)

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	-0.001	99.9498	0.008	1.96	200	1.000005118
-50	-50.001	80.2239	0.009	1.96	200	0.802646002
-30	-30.001	88.1511	0.009	1.96	200	0.881958199
Ice point	-0.002	99.9487	0.008	1.96	200	0.999994112
100	100.007	138.5080	0.017	1.96	200	1.385781973
200	199.993	175.8832	0.055	1.96	200	1.759724205
300	299.995	212.1197	0.064	1.96	200	2.122272874
400	-	-	-	-	-	-
Ice Point	-0.002	99.9494	0.008	1.96	200	1.000000770

Table 22: CMS-Taiwan

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0	-	0.007	2.01	300	1
-50	-50	-	0.007	2.01	300	0.802653390
-30	-30	-	0.007	2.01	300	0.881955498
Ice point	0	-	0.007	2.01	300	1
100	100	-	0.007	2.01	300	1.38572396
200	200	-	0.007	2.01	300	1.75974216
300	300	-	0.007	2.01	300	2.12227156
400	400	-	0.007	2.01	300	2.47342976
Ice Point	0	-	0.007	2.01	300	1

Table 23: NMI-Australia (after circulation)

Loop C

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0008	100.2851	0.0054	1.96	200	1.000003
-50	-50.0014	80.4857	0.0056	1.96	250	0.802571
-30	-29.9974	88.4454	0.0057	1.96	250	0.881942
Ice point	0.0012	100.2853	0.0054	1.96	200	1.000005
100	100.001	138.9757	0.0060	1.96	250	1.385810
200	200.0047	176.4925	0.0077	1.96	250	1.759913
300	300.0017	212.8552	0.0115	1.96	250	2.122507
400	399.9904	248.0802	0.0135	1.96	250	2.473757
Ice Point	-0.0004	100.2845	0.0054	1.96	200	0.999997

Table 24: KRISS-South Korea (before circulation)

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	-0.006	100.2815	0.02	2.00	400	1.000011
-50	-50.219	80.4375	0.02	2.00	400	0.802125
-30	-30.077	88.4082	0.02	2.00	400	0.881610
Ice point	0.002	100.2804	0.02	2.00	400	1.000000
100	99.882	138.9273	0.02	2.00	400	1.385389
200	199.695	176.3745	0.04	2.00	400	1.758813
300	299.504	212.6747	0.04	2.00	400	2.120800
400	399.268	247.8266	0.04	2.00	400	2.471336
Ice Point	-0.001	100.2793	0.02	2.00	400	0.999989

Table 25: KIM,LIPI-Indonesia

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0000	100.2847	0.002	2.00	300	1.000000
-50	-50.0024	80.4857	0.005	2.00	300	0.802572
-30	-30.0078	88.4405	0.005	2.00	300	0.881895
Ice point	0.0000	100.2846	0.002	2.00	300	1.000000
100	99.9996	138.9736	0.006	2.00	300	1.385796
200	199.9986	176.4901	0.006	2.00	300	1.759897
300	300.0096	212.8575	0.007	2.00	300	2.122540
400	400.0020	248.0841	0.007	2.00	300	2.473808
Ice Point	0.0000	100.2841	0.002	2.00	300	1.000000

Table 26: NMC,A*STAR-Singapore

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0.0040	100.2839	0.004	2.00	200	1.000006
-50	-50.0374	80.4678	0.033	2.00	200	0.802404
-30	-30.0473	88.4205	0.033	2.00	200	0.881707
Ice point	0.0040	100.2833	0.004	2.00	200	1.000000
100	100.0252	138.9828	0.023	2.00	200	1.385901
200	199.9644	176.4747	0.030	2.00	200	1.759761
300	300.0777	212.9027	0.025	2.00	440	2.123012
400	400.0475	248.1167	0.025	2.00	440	2.474156
Ice Point	0.0040	100.2833	0.004	2.00	200	1.000000

Table 27: NML ,SIRIM- Malaysia

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Water Triple Point	0.01	100.28636	0.00431	1.96	260	1.000042
-50	-49.9871	80.492241	0.01095	1.96	260	0.802658
-30	-30.0165	88.435588	0.01419	1.96	260	0.881868
Water Triple Point	0.01	100.286248	0.00432	1.96	260	1.000041
100	100.0702	138.998862	0.01908	1.96	260	1.386079
200	199.9681	176.474186	0.0129	1.96	260	1.759778
300	299.9969	212.846183	0.02232	1.96	260	2.122475
400	399.9925	248.075573	0.01797	1.96	260	2.473778
Water Triple Point	0.01	100.285797	0.00417	1.96	260	1.000037

Table 28: VMI-Vietnam

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	-0.005	100.28	0.015	2.00	200	0.9999718
-30	-30.1125	88.3964	0.025	2.00	300	0.8814706
Ice point	-0.005	100.28	0.015	2.00	200	0.9999718
100	99.924	138.9429	0.03	2.00	350	1.3855100
200	199.888	176.4447	0.03	2.00	350	1.7594710
300	299.788	212.7733	0.035	2.00	350	2.1217318
Ice Point	-0.007	100.2798	0.015	2.00	200	0.99997010

Table 29: ITDI-Philiphines

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	0	-	0.009	2.06	300	1.000000000
-50	-50	-	0.009	2.06	300	0.802586413
-30	-30	-	0.009	2.06	300	0.881918629
Ice point	0	-	0.009	2.06	300	1.000000000
100	100	-	0.009	2.06	300	1.385806700
200	200	-	0.009	2.06	300	1.759901600
300	300	-	0.009	2.06	300	2.122541500
400	400	-	0.009	2.06	300	2.473844000
Ice Point	0	-	0.009	2.06	300	1.000000000

Table 30: NMI-Australia

Nominal Test Temperature (°C)	Standard Reading* (t °C)	PRT Resistance at the Test Temperature [R(t°C)ohm] at 1 mA	Uncertainty of Measurement (°C)	k	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
Ice Point	-0.001	100.2797	0.0053	1.96	200	0.999 998
-50	-49.992	80.4852	0.0062	1.96	250	0.802 605
-30	-30.000	88.4390	0.0061	1.96	250	0.881 921
Ice point	-0.002	100.2790	0.0053	1.96	200	0.999 991
100	100.002	138.9680	0.0061	1.96	250	1.385 809
200	199.989	176.4789	0.0084	1.96	250	1.759 863
300	299.998	212.8424	0.0115	1.96	250	2.122 482
400	400.001	248.0718	0.0137	1.96	250	2.473 793
Ice Point	-0.002	100.2793	0.0054	1.96	200	0.999 994

Table 31: KRISS-South Korea (after circulation)

8. Data Analysis

8.1 Callendar Van Dusen (CVD) fitting for each set of results

Excepted for NMIA, the data submitted by participants were not the resistance ratio W of the artefact measured at the exact specified nominal temperatures, but at the temperatures near such points. To make corrections from W at actual measurement temperature to W at nominal temperature ($t_{nominal}$), dW/dt at $t_{nominal}$ needed to be determined. Least square fitting using Callendar Van Dusen (CVD) equations as defined below (Eqs.1 and 2) were performed to each set of data submitted by different participants.

Loop A	CVD coefficients		
	A	*B*	*C*
A, SIRIM, before	3.9101796E-03	-5.7860704E-07	-9.8101600E-12
A, NIMT	3.9090529E-03	-5.7359849E-07	-1.3777551E-11
A, NMISA	3.9091488E-03	-5.7522419E-07	-1.2739226E-11
A, NIS	3.9135035E-03	-5.8472890E-07	-4.0248395E-10
A, NSCL	3.9092370E-03	-5.7507435E-07	-1.3588472E-11
A, JNMI	3.9096632E-03	-5.7599845E-07	-1.1730186E-11
A, NMIA	3.9092733E-03	-5.7537370E-07	-1.2225863E-11
A, KRISS	3.9091582E-03	-5.7532373E-07	-1.2730458E-11
A, SIRIM, after	3.9081575E-03	-5.7753715E-07	-1.9107421E-11
Loop B	CVD coefficients		
	A	*B*	*C*
B, NMIA, before	3.9140766E-03	-5.7653694E-07	-1.1227230E-11
B, NISIT	3.9131157E-03	-5.7470682E-07	-3.7725308E-11
B, NIM	3.9150979E-03	-5.8049429E-07	-8.6482422E-12
B, SIRIM	3.9146074E-03	-5.8103046E-07	-1.0855965E-11
B, KRISS	3.9141178E-03	-5.7664499E-07	-1.2428670E-11
B, BSTI	3.9138459E-03	-6.0099195E-07	-1.0689133E-11
B, NMIA, mid	3.9141289E-03	-5.7651951E-07	-1.1428580E-11
B, CMS	3.9152360E-03	-5.8110138E-07	-7.5372673E-12
B, NMIA, after	3.9141326E-03	-5.7664098E-07	-1.1226237E-11
Loop C	CVD coefficients		
	A	*B*	*C*
C, KRISS, before	3.9147578E-03	-5.7600026E-07	-1.3684548E-11
C, KIM-LIPI	3.9151576E-03	-5.7656235E-07	8.8136232E-12
C, NMC, A*STAR	3.9147431E-03	-5.7589238E-07	-1.3541691E-11
C, SIRIM	3.9147885E-03	-5.7458571E-07	-1.5357408E-11
C, VMI	3.9147087E-03	-5.7583553E-07	-1.2290744E-11
C, ITDI	3.9156349E-03	-5.8016275E-07	-2.6394776E-11
C, NMIA	3.9147537E-03	-5.7563552E-07	-1.3366523E-11
C, KRISS, after	3.9147601E-03	-5.7603209E-07	-1.3958078E-11

Table 32: CVD coefficients for each laboratory

$$W = R(t)/R(0\ °C) = 1 + At + Bt^2, (t \geq 0\ °C) \quad (1)$$

$$W = R(t)/R(0\ °C) = 1 + At + Bt^2 + Ct^3(t - 100), (t < 0\ °C) \quad (2)$$

For this, each set of results was fitted to Eqs. 1 and 2, and the coefficients of the least squares fittings are shown in Table 32.

Based on the CVD coefficients in Table 32, dW/dt at $t_{nominal}$ can be calculated for data from each participating laboratory using the derivative of Eqs. 1 and 2 as follows:

$$dW/dt = A + 2Bt, (t \geq 0\ °C) \quad (3)$$

$$dW/dT = A + 2Bt + 3Ct^2(t - 100) + Ct^3, (t < 0\ °C) \quad (4)$$

The results are shown in Table 33. Due to the existence of the obvious outliers, the median value S_{med} of dW/dt was calculated and used. The median value S_{med} was also compared to S_{avg}, the value averaged over four (or five in case of loop B) dW/dt values from pilot and co-pilot laboratories. The difference between S_{med} and S_{avg} did not exceed 0.04 % of either of the values. Therefore, either of the values can be used without causing significant additional uncertainty contribution. Uncertainty of the S_{med}, $u(S_{med})$, was calculated as $u(S_{med}) = 1.858/\sqrt{n-1} \times \text{MAD}$, where MAD = med$\{|Si - S_{med}|\}$, and n was number of the data points used to evaluate S_{med}. (Muller, *J. Res. Natl. Inst. Stand. Technol*. **105**, 551 (2000)). The uncertainty of the median $u(S_{med})$ corresponds to at most 0.02 % of S_{med}.

Loop A	dW/dt at $t_{nominal}$					
$t_{nominal}$, °C	-50	-30	100	200	300	400
A, SIRIM, before	0.003 980	0.003 949	0.003 794	0.003 679	0.003 563	0.003 447
A, NIMT	0.003 984	0.003 949	0.003 794	0.003 680	0.003 565	0.003 450
A, NMISA	0.003 983	0.003 948	0.003 794	0.003 679	0.003 564	0.003 449
A, NIS	0.004 475	0.004 101	0.003 797	0.003 680	0.003 563	0.003 446
A, NSCL	0.003 984	0.003 949	0.003 794	0.003 679	0.003 564	0.003 449
A, JNMI	0.003 982	0.003 949	0.003 794	0.003 679	0.003 564	0.003 449
A, NMIA	0.003 982	0.003 948	0.003 794	0.003 679	0.003 564	0.003 449
A, KRISS	0.003 983	0.003 948	0.003 794	0.003 679	0.003 564	0.003 449
A, SIRIM, after	0.003 990	0.003 950	0.003 793	0.003 677	0.003 562	0.003 446
S_{med}	0.003 983	0.003 949	0.003 794	0.003 679	0.003 564	0.003 449
S_{avg}	0.003 984	0.003 949	0.003 794	0.003 679	0.003 563	0.003 448
$u(S_{med})/ S_{med}$, %	0.017	0.003	0.002	0.003	0.003	0.005
Loop B	dW/dt at $t_{nominal}$					
$t_{nominal}$, °C	-50	-30	100	200	300	400
B, NMIA, before	0.003 986	0.003 953	0.003 799	0.003 683	0.003 568	0.003 453
B, NISIT	0.004 018	0.003 962	0.003 798	0.003 683	0.003 568	0.003 453
B, NIM	0.003 984	0.003 953	0.003 799	0.003 683	0.003 567	0.003 451
B, SIRIM	0.003 986	0.003 954	0.003 798	0.003 682	0.003 566	0.003 450
B, KRISS	0.003 987	0.003 953	0.003 799	0.003 683	0.003 568	0.003 453
B, BSTI	0.003 987	0.003 954	0.003 794	0.003 673	0.003 553	0.003 433
B, NMIA, mid	0.003 986	0.003 953	0.003 799	0.003 684	0.003 568	0.003 453
B, CMS	0.003 983	0.003 953	0.003 799	0.003 683	0.003 567	0.003 450
B, NMIA, after	0.003 986	0.003 953	0.003 799	0.003 683	0.003 568	0.003 453
S_{med}	0.003 986	0.003 953	0.003 799	0.003 683	0.003 568	0.003 453

S_{avg}	0.003 986	0.003 953	0.003 799	0.003 683	0.003 568	0.003 452
$u(S_{med})/ S_{med}$, %	0.020	0.004	0.004	0.005	0.003	0.010
Loop C	dW/dt at $t_{nominal}$					
$t_{nominal}$, °C	-50	-30	100	200	300	400
C, KRISS, before	0.003 989	0.003 954	0.003 800	0.003 684	0.003 569	0.003 454
C, KIM-LIPI	0.003 962	0.003 946	0.003 800	0.003 685	0.003 569	0.003 454
C, NMC, A*STAR	0.003 989	0.003 954	0.003 800	0.003 684	0.003 569	0.003 454
C, SIRIM	0.003 991	0.003 955	0.003 800	0.003 685	0.003 570	0.003 455
C, VMI	0.003 988	0.003 954	0.003 800	0.003 684	0.003 569	0.003 454
C, ITDI	0.004 007	0.003 960	0.003 800	0.003 684	0.003 568	0.003 452
C, NMIA	0.003 989	0.003 954	0.003 800	0.003 684	0.003 569	0.003 454
C, KRISS, after	0.003 990	0.003 955	0.003 800	0.003 684	0.003 569	0.003 454
S_{med}	0.003 989	0.003 954	0.003 800	0.003 684	0.003 569	0.003 454
S_{avg}	0.003 990	0.003 955	0.003 800	0.003 685	0.003 569	0.003 454
$u(S_{med})/ S_{med}$, %	0.019	0.006	0.001	0.001	0.001	0.001

Table 33: dW/dt at $t_{nominal}$ for each laboratory

8.2 Adjusted W at nominal temperature

By using S_{med} = Median$\{dW/dt\}$ calculated in Table 33, the adjusted W at $t_{nominal}$ can be calculated using the equation below.

$$W(t_{\text{nominal}}) = W(t) - [S_{\text{med}} \times (t - t_{\text{nominal}})] = W(t) - \Delta W. \quad (5)$$

For Loop A

-50 °C	t	W	(t- $t_{nominal}$) /mK	ΔW	$W(t_{nominal})$
SIRIM	-50.0035	0.802 853	-3.5	-0.000 014	0.802 867
NIMT	-49.9975	0.802 880	2.5	0.000 010	0.802 870
NMISA	-49.598	0.804 480	402.0	0.001 601	0.802 879
NIS	-48.2581	0.803 346	1741.9	0.006 938	0.796 408
NSCL	-50.058	0.802 634	-58.0	-0.000 231	0.802 865
JNMI	-50.007	0.802 841	-7.0	-0.000 028	0.802 868
NMIA	-50	0.802 881	0.0	0.000 000	0.802 881
KRISS	-49.9975	0.802 890	2.5	0.000 010	0.802 880
SIRIM	-49.97	0.802 937	30.0	0.000 119	0.802 818
-30 °C	t	W	(t- $t_{nominal}$) /mK	ΔW	$W(t_{nominal})$
SIRIM	-30.0001	0.882 105	-0.1	0.000 000	0.882 105
NIMT	-30.006	0.882 060	-6.0	-0.000 024	0.882 084
NMISA	-30.4021	0.880 508	-402.1	-0.001 588	0.882 096
NIS	-29.2128	0.882 472	787.2	0.003 109	0.879 363
NSCL	-30.069	0.881 782	-69.0	-0.000 272	0.882 054
JNMI	-30.028	0.881 979	-28.0	-0.000 111	0.882 089
NMIA	-30	0.882 094	0.0	0.000 000	0.882 094
KRISS	-30.002	0.882 075	-2.0	-0.000 008	0.882 083
SIRIM	-30.0465	0.881 840	-46.5	-0.000 184	0.882 024

100 °C	***t***	***W***	**(*t*- $t_{nominal}$) /mK**	**delta *W***	***W*($t_{nominal}$)**
SIRIM	100.0451	1.385 482	45.1	0.000 171	1.385 311
NIMT	100.0012	1.385 260	1.2	0.000 005	1.385 255
NMISA	100.057	1.385 448	57.0	0.000 216	1.385 232
NIS	100.1289	1.386 111	128.9	0.000 489	1.385 622
NSCL	100.185	1.385 950	185.0	0.000 702	1.385 248
JNMI	99.986	1.385 228	-14.0	-0.000 053	1.385 282
NMIA	100	1.385 252	0.0	0.000 000	1.385 252
KRISS	99.9997	1.385 222	-0.3	-0.000 001	1.385 223
SIRIM	100.892	1.388 285	892.0	0.003 384	1.384 901
200 °C	***t***	***W***	**(*t*- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
SIRIM	200.0012	1.758 876	1.2	0.000 004	1.758 872
NIMT	200.0015	1.758 850	1.5	0.000 006	1.758 844
NMISA	200.1127	1.759 228	112.7	0.000 415	1.758 813
NIS	199.897	1.758 698	-103.0	-0.000 379	1.759 077
NSCL	200.534	1.760 801	534.0	0.001 965	1.758 836
JNMI	199.972	1.758 766	-28.0	-0.000 103	1.758 869
NMIA	200	1.758 817	0.0	0.000 000	1.758 817
KRISS	199.9923	1.758 779	-7.7	-0.000 028	1.758 807
SIRIM	200.3965	1.760 208	396.5	0.001 459	1.758 749
300 °C	***t***	***W***	**(*t*- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
SIRIM	300.1184	2.121 339	118.4	0.000 422	2.120 917
NIMT	300.0106	2.121 050	10.6	0.000 038	2.121 012
NMISA	298.2884	2.114 796	-1711.6	-0.006 100	2.120 896
NIS	299.7918	2.120 485	-208.2	-0.000 742	2.121 227
NSCL	300.483	2.122 641	483.0	0.001 721	2.120 920
JNMI	300.003	2.121 008	3.0	0.000 011	2.120 997
NMIA	300	2.120 931	0.0	0.000 000	2.120 931
KRISS	300.0009	2.120 903	0.9	0.000 003	2.120 900
SIRIM	300.0662	2.120 508	66.2	0.000 236	2.120 272
400 °C	***t***	***W***	**(*t*- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
SIRIM	400.1303	2.471 979	130.3	0.000 449	2.471 530
NIMT	400.0172	2.471 950	17.2	0.000 059	2.471 891
NMISA	401.9715	2.478 461	1971.5	0.006 800	2.471 661
NIS	399.5821	2.470 572	-417.9	-0.001 441	2.472 013
NSCL	400.087	2.472 034	87.0	0.000 300	2.471 734
JNMI	399.99	2.471 707	-10.0	-0.000 034	2.471 742
NMIA	400	2.471 688	0.0	0.000 000	2.471 688
KRISS	399.9973	2.471 640	-2.7	-0.000 009	2.471 649
SIRIM	399.9943	2.470 902	-5.7	-0.000 020	2.470 922

For loop B

-50 °C	t	W	$(t - t_{nominal})$ /mK	ΔW	$W(t_{nominal})$
NMIA	-50	0.802 656	0.0	0.000 000	0.802 656
NISIT					
NIM	-50	0.802 640	0.0	0.000 000	0.802 640
SIRIM	-50.1095	0.802 190	-109.5	-0.000 436	0.802 626
KRISS	-49.996	0.802 647	4.0	0.000 016	0.802 631
BSTI	-49.739	0.803 670	261.0	0.001 040	0.802 630
NMIA	-50	0.802 650	0.0	0.000 000	0.802 650
CMS	-50.001	0.802 646	-1.0	-0.000 004	0.802 650
NMIA	-50	0.802 653	0.0	0.000 000	0.802 653
-30 °C	t	W	$(t - t_{nominal})$ /mK	ΔW	$W(t_{nominal})$
NMIA	-30	0.881 957	0.0	0.000 000	0.881 957
NISIT	-29.977	0.882 048	23.0	0.000 091	0.881 957
NIM	-30	0.881 950	0.0	0.000 000	0.881 950
SIRIM	-30.0486	0.881 739	-48.6	-0.000 192	0.881 931
KRISS	-30.001	0.881 948	-1.0	-0.000 004	0.881 952
BSTI	-29.781	0.882 740	219.0	0.000 866	0.881 874
NMIA	-30	0.881 954	0.0	0.000 000	0.881 954
CMS	-30.001	0.881 958	-1.0	-0.000 004	0.881 962
NMIA	-30	0.881 955	0.0	0.000 000	0.881 955
100 °C	t	W	$(t - t_{nominal})$ /mK	ΔW	$W(t_{nominal})$
NMIA	100	1.385 719	0.0	0.000 000	1.385 719
NISIT	100.0104	1.385 604	10.4	0.000 040	1.385 564
NIM	100	1.385 730	0.0	0.000 000	1.385 730
SIRIM	100.0657	1.385 962	65.7	0.000 250	1.385 712
KRISS	99.999	1.385 717	-1.0	-0.000 004	1.385 721
BSTI	100.199	1.386 410	199.0	0.000 756	1.385 654
NMIA	100	1.385 725	0.0	0.000 000	1.385 725
CMS	100.007	1.385 782	7.0	0.000 027	1.385 755
NMIA	100	1.385 724	0.0	0.000 000	1.385 724
200 °C	t	W	$(t - t_{nominal})$ /mK	ΔW	$W(t_{nominal})$
NMIA	200	1.759 735	0.0	0.000 000	1.759 735
NISIT	200.0709	1.759 896	70.9	0.000 261	1.759 635
NIM	200	1.759 760	0.0	0.000 000	1.759 760
SIRIM	200.0185	1.759 807	18.5	0.000 068	1.759 739
KRISS	199.993	1.759 718	-7.0	-0.000 026	1.759 744
BSTI	200.014	1.759 560	14.0	0.000 052	1.759 508
NMIA	200	1.759 746	0.0	0.000 000	1.759 746
CMS	199.993	1.759 724	-7.0	-0.000 026	1.759 750
NMIA	200	1.759 742	0.0	0.000 000	1.759 742
300 °C	t	W	$(t - t_{nominal})$ /mK	ΔW	$W(t_{nominal})$
NMIA	300	2.122 265	0.0	0.000 000	2.122 265

NISIT					
NIM	300	2.122 300	0.0	0.000 000	2.122 300
SIRIM	300.3357	2.123 126	335.7	0.001 198	2.121 928
KRISS	299.999	2.122 259	-1.0	-0.000 004	2.122 263
BSTI	299.311	2.116 270	-689.0	-0.002 458	2.118 728
NMIA	300	2.122 282	0.0	0.000 000	2.122 282
CMS	299.995	2.122 273	-5.0	-0.000 018	2.122 291
NMIA	300	2.122 272	0.0	0.000 000	2.122 272
400 °C	***t***	***W***	**(*t*- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
NMIA	400	2.473 424	0.0	0.000 000	2.473 424
NISIT					
NIM					
SIRIM	400.2771	2.473 906	277.1	0.000 957	2.472 949
KRISS	400.009	2.473 456	9.0	0.000 031	2.473 425
BSTI	400.746	2.472 480	746.0	0.002 576	2.469 904
NMIA	400	2.473 448	0.0	0.000 000	2.473 448
CMS					
NMIA	400	2.473 430	0.0	0.000 000	2.473 430

For loop C:

-50 °C	***t***	***W***	**(*t*- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
KRISS	-50.0014	0.802 571	-1.4	-0.000 006	0.802 577
KIM LIPI	-50.219	0.802 125	-219.0	-0.000 874	0.802 999
NMC, A*STAR	-50.0024	0.802 572	-2.4	-0.000 010	0.802 582
SIRIM	-50.0374	0.802 404	-37.4	-0.000 149	0.802 553
VMI	-49.9871	0.802 658	12.9	0.000 051	0.802 607
ITDI					
NMIA	-50	0.802 586	0.0	0.000 000	0.802 586
KRISS	-49.992	0.802 605	8.0	0.000 032	0.802 573
-30 °C	***t***	***W***	**(*t*- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
KRISS	-29.9974	0.881 942	2.6	0.000 010	0.881 932
KIM LIPI	-30.077	0.881 610	-77.0	-0.000 304	0.881 914
NMC, A*STAR	-30.0078	0.881 895	-7.8	-0.000 031	0.881 926
SIRIM	-30.0473	0.881 707	-47.3	-0.000 187	0.881 894
VMI	-30.0165	0.881 868	-16.5	-0.000 065	0.881 933
ITDI	-30.1125	0.881 471	-112.5	-0.000 445	0.881 915
NMIA	-30	0.881 919	0.0	0.000 000	0.881 919
KRISS	-30.000	0.881 921	0.0	0.000 000	0.881 921

100 °C	***t***	***W***	**(t- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
KRISS	100.001	1.385 810	1.0	0.000 004	1.385 806
KIM LIPI	99.882	1.385 389	-118.0	-0.000 448	1.385 837
NMC, A*STAR	99.9996	1.385 796	-0.4	-0.000 002	1.385 798
SIRIM	100.0252	1.385 901	25.2	0.000 096	1.385 805
VMI	100.0702	1.386 079	70.2	0.000 267	1.385 812
ITDI	99.924	1.385 510	-76.0	-0.000 289	1.385 799
NMIA	100	1.385 807	0.0	0.000 000	1.385 807
KRISS	100.002	1.385 809	2.0	0.000 008	1.385 801
200 °C	***t***	***W***	**(t- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
KRISS	200.0047	1.759 913	4.7	0.000 017	1.759 896
KIM LIPI	199.695	1.758 813	-305.0	-0.001 124	1.759 937
NMC, A*STAR	199.9986	1.759 897	-1.4	-0.000 005	1.759 902
SIRIM	199.9644	1.759 761	-35.6	-0.000 131	1.759 892
VMI	199.9681	1.759 778	-31.9	-0.000 118	1.759 896
ITDI	199.888	1.759 471	-112.0	-0.000 413	1.759 884
NMIA	200	1.759 902	0.0	0.000 000	1.759 902
KRISS	199.989	1.759 863	-11.0	-0.000 041	1.759 904
300 °C	***t***	***W***	**(t- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
KRISS	300.0017	2.122 507	1.7	0.000 006	2.122 501
KIM LIPI	299.504	2.120 800	-496.0	-0.001 770	2.122 570
NMC, A*STAR	300.0096	2.122 540	9.6	0.000 034	2.122 506
SIRIM	300.0777	2.123 012	77.7	0.000 277	2.122 735
VMI	299.9969	2.122 475	-3.1	-0.000 011	2.122 486
ITDI	299.788	2.121 732	-212.0	-0.000 757	2.122 488
NMIA	300	2.122 542	0.0	0.000 000	2.122 542
KRISS	299.998	2.122 482	-2.0	-0.000 007	2.122 489
400 °C	***t***	***W***	**(t- $t_{nominal}$) /mK**	**Δ*W***	***W*($t_{nominal}$)**
KRISS	399.9904	2.473 757	-9.6	-0.000 033	2.473 790
KIM LIPI	399.268	2.471 336	-732.0	-0.002 528	2.473 864
NMC, A*STAR	400.002	2.473 808	2.0	0.000 007	2.473 801
SIRIM	400.0475	2.474 156	47.5	0.000 164	2.473 992
VMI	399.9925	2.473 778	-7.5	-0.000 026	2.473 804
ITDI					
NMIA	400	2.473 844	0.0	0.000 000	2.473 844
KRISS	400.001	2.473 793	1.0	0.000 003	2.473 790

Table 34: Corrected W at $t_{nominal}$ for each laboratory

8.3 Analysis of each loop

Because the numbers of the participating laboratories (16) were large, it was necessary to conduct the comparison in three concurring loops (A, B and C) to reduce the time required to complete the comparison. As NML-SIRIM, NMIA and KRISS participated in all three loops, their data were to be served as the links to combine the groups. Prior to the detailed analysis for each loop, it was noted that

(i) Loop A PRT artefact experienced an unexpected and significant upward drift of about 80 mK from SIRIM -*before* in July 2009 to SIRIM-*after* in June 2010.

(ii) In the Loop A, SIRIM-*after* results were different from the SIRIM-*before* results, ranging from 12 mK at −50 °C to 170 mK at 400 °C. They were also significantly different from those of the immediate preceding KRISS (with the largest difference of ~ 210 mK at 400 °C). One possible cause for this substantial difference might be an abrupt change in the artefact at SIRIM-*after*. However, the 5 mK change in the ice point resistance between KRISS and SIRIM-*after* was not sufficient to support the hypothesis of a sudden change in the artefact.

Also, a preliminary analysis showed that some of NML-SIRIM data were inconsistent with those of NMIA and KRISS. Therefore, only NMIA and KRISS data were used as the link.

In some instances, the uncertainty in the data submission (Tables 6 to 31) was larger than the uncertainty shown in the detailed uncertainty budget submitted by the same participant (Appendix B). This was regarded as due to the rounding-up or rounding-off of the uncertainty which is often done for convenience when issuing calibration reports and the rounding was within a reasonable range. In these cases, we regarded the uncertainty in the data submission as the official uncertainty claimed of the measurement from the participant, and we used them in the analysis.

NOTE: For NIS, the uncertainties indicated in the data submission (Table 9) and the detailed uncertainty budget (Appendix B) are inconsistent. We contacted NIS to clarify the issue but received no respond. Thus, for analysis in this draft, we used the uncertainties in Table 9 for NIS results.

For laboratories in loop A, the link W was calculated by

$$W_{\mathrm{A,link}} = \frac{1}{2}(W_{\mathrm{A,NMIA}} + W_{\mathrm{A,KRISS}}). \tag{6}$$

The uncertainty of $W_{\mathrm{A,link}}$ in temperature, $u(t_{\mathrm{A,link}})$, was calculated using the uncertainties of $u(t_{\mathrm{A,NMIA}})$ and $u(t_{\mathrm{A,KRISS}})$, treating them as independent:

$$u(t_{\mathrm{A,link}}) = \frac{1}{2}\sqrt{u^2(t_{\mathrm{A,NMIA}}) + u^2(t_{\mathrm{A,KRISS}})}. \tag{7}$$

For SIRIM which had two measurements in loop A (before and after the circulation of the artifact), the resistance ratio W was obtained by averaging the two measurements:

$$W_{\mathrm{A,SIRIM}} = \frac{1}{2}(W_{\mathrm{A,SIRIM-before}} + W_{\mathrm{A,SIRIM-after}}). \tag{8}$$

The uncertainty of $W_{\mathrm{A,SIRIM}}$ in temperature was calculated by averaging the two uncertainties:

$$u(t_{\mathrm{A,SIRIM}}) = \frac{1}{2}\left[u(t_{\mathrm{A,SIRIM}}) + u(t_{\mathrm{A,SIRIM}})\right]. \tag{9}$$

Here we assumed that the two SIRIM uncertainties from before and after the circulation of the artifact in loop A were completely correlated. Then the temperature deviation of participant i in loop A (including NMIA, KRISS and SIRIM) from $t_{\mathrm{A,link}}$ was calculated as

$$X_{\mathrm{A},i} = t_{\mathrm{A},i} - t_{\mathrm{A,link}} = (W_{\mathrm{A},i} - W_{\mathrm{A,link}})/(dW/dt). \tag{10}$$

From $X_{A,i}$ of each participant, simple mean, median and weighted mean were calculated:

$$< X >_{\mathrm{A,simple}} = \sum \frac{X_{A,i}}{n}, \tag{11}$$

$$< X >_{\mathrm{A,median}} = \mathrm{Median}\{X_{A,i}\}, \tag{12}$$

$$< X >_{\mathrm{A,weighted}} = \frac{\sum X_{A,i} u^{-2}(t_{A,i})}{\sum u^{-2}(t_{A,i})}. \tag{13}$$

Then, the uncertainty of $<X>_{\mathrm{A,simple}}$ and $<X>_{\mathrm{A,weighted}}$ were calculated as

$$u^2_{\mathrm{A,simple}} = \sum \frac{u^2(t_{A,i})}{n^2}, \tag{14}$$

$$u^2_{\mathrm{A,weighted}} = \frac{1}{\sum u^{-2}(t_{A,i})}. \tag{15}$$

Then we calculated the *Birge* ratio R_B (Kacker, Dalta and Parr, *Metrologia*, **39**, 279 (2002)) to check if the submitted uncertainties were appropriate and consistent with the spread of the data obtained.

$$R_B = \sqrt{\sum \frac{(X_{A,i} - <X>_{\mathrm{A,weighted}})^2 \times u^{-2}(t_{A,i})}{(n-1)}} \tag{16}$$

If R_B was less than certain criterion then the spread of $X_{A,i}$ was within the uncertainties $u(t_{A,i})$, and if greater than the criterion, then the spread was larger than expected from the submitted uncertainties, i.e. at least one value was submitted with an underestimated uncertainty. A statistical criterion for R_B for n data points was given by:

$$R_B < \sqrt{1 + \sqrt{8/(n-1)}}. \tag{17}$$

Therefore, if R_B does not satisfy the above criterion, the data $X_{A,i}$ which contributes the largest to R_B was excluded. This procedure was repeated until R_B satisfies the criterion given by Eq. 17. After this "Birge ratio procedure" the following data in the loop A were excluded:

- SIRIM results at 300 °C and 400°C
- NIS results at (−50, −30, 100, 200, 300, 400) °C (ie., all temperature points)
- NIMT results at 400 °C

The final simple mean, median and weighted mean was then calculated excluding these outliners. Table 35 shows the spreadsheet that presents the analysis for the loop A.

The analysis for loops B and C was performed similarly. For loop B, the link W was calculated by

$$W_{\mathrm{B,link}} = \frac{1}{2}(W_{\mathrm{B,NMIA}} + W_{\mathrm{B,KRISS}}), \tag{18}$$

where $W_{\mathrm{B,NMIA}}$ was the average of the three measurements of NMIA (before, mid and after the circulation of artifact) in loop B:

$$W_{\mathrm{B,NMIA}} = \frac{1}{3}(W_{\mathrm{B,NMIA-before}} + W_{\mathrm{B,NMIA-mid}} + W_{\mathrm{B,NMIA-after}}) \tag{19}$$

and

$$u^2(t_{\mathrm{B,link}}) = \frac{1}{2}\left[u^2(t_{\mathrm{B,NMIA}}) + u^2(t_{\mathrm{B,KRISS}})\right] \tag{20}$$

$$u(t_{\mathrm{B,NMIA}}) = \frac{1}{3}\left[u(t_{\mathrm{B,NMIA-before}}) + u(t_{\mathrm{B,NMIA-mid}}) + u(t_{\mathrm{B,NMIA-after}})\right]. \quad (21)$$

After the Birge ratio procedure the following data in the loop B were excluded:

- SIRIM results at 300 °C and 400°C
- BSTI results at 300 °C and 400°C

Because there were only four participants in loop B who submitted the result at 400 °C, and among them SIRIM and BSTI results were excluded, the results at 400 °C in loop B are only from NMIA and KRISS. Table 36 shows the spreadsheet that presented the analysis for the loop B.

For loop C, the link *W* was calculated by

$$W_{\mathrm{C,link}} = \frac{1}{2}(W_{\mathrm{C,NMIA}} + W_{\mathrm{C,KRISS}}), \quad (22)$$

where $W_{\mathrm{C,KRISS}}$ was the average of the two measurements of KRISS (before and after the circulation of artifact) in loop C:

$$W_{\mathrm{C,KRISS}} = \frac{1}{2}(W_{\mathrm{C,KRISS-before}} + W_{\mathrm{C,KRISS-after}}) \quad (23)$$

and

$$u^2(t_{\mathrm{C,link}}) = \frac{1}{2}\left[u^2(t_{\mathrm{C,NMIA}}) + u^2(t_{\mathrm{C,KRISS}})\right], \quad (24)$$

$$u(t_{\mathrm{C,KRISS}}) = \frac{1}{2}\left[u(t_{\mathrm{C,KRISS-before}}) + u(t_{\mathrm{C,KRISS-after}})\right]. \quad (25)$$

After the Birge ratio procedure the following data in the loop C were excluded:

- SIRIM results at 300 °C and 400°C

KIM-LIPI result at –50 °C also showed discrepancy from other participants. When asked to check any error in the data submission without informing where the discrepancy occurred (following the procedure in CIPM MRA-D-05 “Measurement comparisons in the context of the CIPM MRA”), KIM-LIPI identified an error in the result at –50 °C, stating that an un-calibrated reference thermometer was used at that temperature, and withdrew the data submission at –50 °C. Therefore, it was excluded in the subsequent analysis. Table 37 showed the spreadsheet that presented the analysis for the loop C.

We note here that in the analysis of each loop, the magnitude of the weighted mean after exclusion of outliers did not exceed 2 mK. This showed the robustness of the analysis. If the weighted mean among the participants, instead of the simple mean of NMIA and KRISS results, was used to define the linkage of each loop, the result would not change significantly considering that the measurement uncertainty of the relevant PRT artefact is much larger than 2 mK.

Loop A																		
Participants	**-50 °C**	***U*/mK**	***k***	**-30 °C**	***U*/mK**	***k***	**100 °C**	***U*/mK**	***k***	**200 °C**	***U*/mK**	***k***	**300 °C**	***U*/mK**	***k***	**400 °C**	***U*/mK**	***k***
A,dW/dT	0.003 983			0.003 949			0.003 794			0.003 679			0.003 564			0.003 449		
A, SIRIM, before	**0.802 867**	**34**	**2.00**	**0.882 105**	**34**	**2.00**	**1.385 311**	**24**	**2.00**	**1.758 872**	**31**	**2.00**	**2.120 917**	**26**	**2.00**	**2.471 530**	**26**	**2.00**
A, NIMT	0.802 870	11	2.00	0.882 084	13	2.00	1.385 255	15	2.00	1.758 844	14	2.00	2.121 012	22	2.00	2.471 891	21	2.00
A, NMISA	0.802 879	5	2.14	0.882 096	8	2.28	1.385 232	3	2.00	1.758 813	3	2.00	2.120 896	6	2.00	2.471 661	8	2.00
A, NIS	0.796 408	14	2.00	0.879 363	14	2.00	1.385 622	14	2.00	1.759 077	13	2.00	2.121 227	16	2.00	2.472 013	16	2.00
A, NSCL	0.802 865	21	2.00	0.882 054	21	2.00	1.385 248	44	2.00	1.758 836	44	2.00	2.120 920	45	2.00	2.471 734	47	2.00
A, JNMI	0.802 868	58	2.00	0.882 089	40	2.00	1.385 282	40	2.00	1.758 869	44	2.00	2.120 997	60	2.00	2.471 742	62	2.00
A, NMIA*	**0.802 881**	**13**	**2.11**	**0.882 094**	**13**	**2.11**	**1.385 252**	**13**	**2.11**	**1.758 817**	**13**	**2.11**	**2.120 931**	**13**	**2.11**	**2.471 688**	**13**	**2.11**
A, KRISS*	**0.802 880**	**7**	**1.96**	**0.882 083**	**7**	**1.96**	**1.385 223**	**7**	**1.96**	**1.758 807**	**10**	**1.96**	**2.120 900**	**13**	**1.96**	**2.471 649**	**15**	**1.96**
A, SIRIM, after	**0.802 818**	**35**	**2.00**	**0.882 024**	**35**	**2.00**	**1.384 901**	**38**	**2.00**	**1.758 749**	**43**	**2.00**	**2.120 272**	**40**	**2.00**	**2.470 922**	**40**	**2.00**
A ,SIRIM	**0.802 842**			**0.882 065**			**1.385 106**			**1.758 810**			**2.120 595**			**2.471 226**		
$W_{A,link}$	0.802 881			0.882 088			1.385 237			1.758 812			2.120 915			2.471 669		
(SIRIM-KRISS)/mK	**-9**			**-5**			**-31**			**1**			**-86**			**-123**		
(NMIA-KRISS)/mK	**0**			**3**			**8**			**3**			**9**			**11**		
$X_{A,i}$	$X_{A,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{A,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{A,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{A,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{A,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{A,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk
A, SIRIM, before	**-3**	**17**	**34**	**4**	**17**	**34**	**19**	**12**	**24**	**16**	**16**	**31**	**1**	**13**	**26**	**-40**	**13**	**26**
A, NIMT	-3	6	11	-1	7	13	5	8	15	9	7	14	27	11	22	64	11	21
A, NMISA	0	2	5	2	4	7	-1	2	3	0	2	3	-5	3	6	-2	4	8
A, NIS	-1625	7	14	-690	7	14	101	7	14	72	7	13	87	8	16	100	8	16
A, NSCL	-4	11	21	-9	11	21	3	22	44	7	22	44	1	23	45	19	24	47
A, JNMI	-3	29	58	0	20	40	12	20	40	15	22	44	23	30	60	21	31	62
A, NMIA*	**0**	**6**	**12**	**1**	**6**	**12**	**4**	**6**	**12**	**1**	**6**	**12**	**4**	**6**	**12**	**6**	**6**	**12**
A, KRISS*	**0**	**3**	**7**	**-1**	**4**	**7**	**-4**	**4**	**7**	**-1**	**5**	**10**	**-4**	**7**	**13**	**-6**	**8**	**16**
A, SIRIM, after	**-16**	**18**	**35**	**-16**	**18**	**35**	**-89**	**19**	**38**	**-17**	**22**	**43**	**-180**	**20**	**40**	**-217**	**20**	**40**
A,SIRIM	**-10**	**17**	**35**	**-6**	**17**	**35**	**-35**	**16**	**31**	**-1**	**19**	**37**	**-90**	**17**	**33**	**-129**	**17**	**33**
$t_{A,link}$ /mk	**0**	**4**	**7**	**0**	**4**	**7**	**0**	**4**	**7**	**0**	**4**	**8**	**0**	**5**	**9**	**0**	**5**	**10**
Simple mean	-3	5	10	-2	4	9	-2	5	10	4	5	11	8	7	13	8	8	16
Median	-3			-1			3			1			3			6		
Weighted mean	-1	2	3	0	2	4	-2	1	3	1	1	3	-2	2	5	0	3	6
No. of Lab	7			7			7			7			6			5		
Birge ratio	0.30			0.47			1.07			0.59			1.43			0.83		
Birge Criterion	1.47			1.47			1.47			1.47			1.50			1.55		

LAB*	Values used to calculate loop reference
Numerical	Anomalous value - excluded after Birge ratio test

Table 35: Result of analysis for Loop A

Loop B																		
Participants	**-50 °C**	***U* /mK**	***k***	**-30 °C**	***U* /mK**	***k***	**100 °C**	***U* /mK**	***k***	**200 °C**	***U* /mK**	***k***	**300 °C**	***U* /mK**	***k***	**400 °C**	***U* /mK**	***k***
B,dW/dT	0.003 986			0.003 953			0.003 799			0.003 683			0.003 568			0.003 453		
B,NMIAbefore	**0.802 656**	**6**	**2.09**	**0.881 957**	**6**	**2.09**	**1.385 719**	**9**	**1.99**	**1.759 735**	**9**	**1.99**	**2.122 265**	**11**	**2.07**	**2.473 424**	**11**	**2.07**
B,NISIT				0.881 957	34	2.02	1.385 564	48	2.01	1.759 635	48	2.01						
B,NIM	0.802 640	10	2.00	0.881 950	10	2	1.385 730	10	2.00	1.759 760	13	2.00	2.122 300	15	2			
B,SIRIM	0.802 626	33	2.00	0.881 931	33	2	1.385 712	27	2.00	1.759 739	34	2.00	2.121 928	29	2	2.472 949	29	2.00
B,KRISS*	**0.802 631**	**6**	**1.96**	**0.881 952**	**6**	**1.96**	**1.385 721**	**6**	**1.96**	**1.759 744**	**8**	**1.96**	**2.122 263**	**11**	**1.96**	**2.473 425**	**13**	**1.96**
B,BSTI	0.802 630	35	2.25	0.881 874	68	2.23	1.385 654	33	2.06	1.759 508	43	2.11	2.118 728	41	2	2.469 904	77	2.17
B,NMIAmid	**0.802 650**	**7**	**2.01**	**0.881 954**	**7**	**2.01**	**1.385 725**	**7**	**2.01**	**1.759 746**	**7**	**2.01**	**2.122 282**	**7**	**2.01**	**2.473 448**	**7**	**2.01**
B,CMS	0.802 650	9	1.96	0.881 962	9	1.96	1.385 755	17	1.96	1.759 750	55	1.96	2.122 291	64	1.96			
B,NMIAafter	**0.802 653**	**7**	**2.01**	**0.881 955**	**7**	**2.01**	**1.385 724**	**7**	**2.01**	**1.759 742**	**7**	**2.01**	**2.122 272**	**7**	**2.01**	**2.473 430**	**7**	**2.01**
B,NMIA*	**0.802 653**			**0.881 955**			**1.385 723**			**1.759 741**			**2.122 273**			**2.473 434**		
$W_{B,link}$	**0.802 642**			**0.881 954**			**1.385 722**			**1.759 742**			**2.122 268**			**2.473 429**		
(SIRIM-KRISS)/mK	**-1.15**			**-5.27**			**-2.21**			**-1.33**			**-93.71**			**-137.78**		
(NMIA-KRISS)/mK	**5.49**			**0.84**			**0.51**			**-0.79**			**2.91**			**2.63**		
$X_{B,i}$	$X_{B,i}$ /mK	***u*/mK**	***U*(*k* = 2) /mk**	$X_{B,i}$ /mK	***u*/mK**	***U*(*k* = 2) /mk**	$X_{B,i}$ /mK	***u*/mK**	***U*(*k* = 2) /mk**	$X_{B,i}$ /mK	***u*/mK**	***U*(*k* = 2) /mk**	$X_{B,i}$ /mK	***u*/mK**	***U*(*k* = 2) /mk**	$X_{B,i}$ /mK	***u*/mK**	***U*(*k* = 2) /mk**
B,NMIAbefore	**4**	**3**	**6**	**1**	**3**	**6**	**-1**	**5**	**9**	**-2**	**5**	**9**	**-1**	**5**	**11**	**-2**	**5**	**11**
B,NISIT				1	17	34	-41	24	48	-29	24	48						
B,NIM	-1	5	10	-1	5	10	2	5	10	5	7	13	9	8	15			
B,SIRIM	-4	17	33	-6	17	33	-2	14	27	-1	17	34	-95	15	29	-139	15	29
B,KRISS*	**-3**	**3**	**6**	**0**	**3**	**6**	**0**	**3**	**6**	**0**	**4**	**8**	**-1**	**6**	**11**	**-1**	**7**	**13**
B,BSTI	-3	16	31	-20	30	61	-18	16	32	-64	20	41	-992	21	41	-1021	35	71
B,NMIAmid	**2**	**3**	**7**	**0**	**3**	**7**	**1**	**3**	**7**	**1**	**3**	**7**	**4**	**3**	**7**	**5**	**3**	**7**
B,CMS	2	5	9	2	5	9	9	9	17	2	28	56	6	33	65			
B,NMIAafter	**3**	**3**	**7**	**0**	**3**	**7**	**1**	**3**	**7**	**0**	**3**	**7**	**1**	**3**	**7**	**0**	**3**	**7**
B,NMIA*	**3**	**3**	**7**	**0**	**3**	**7**	**0**	**4**	**8**	**0**	**4**	**8**	**1**	**4**	**8**	**1**	**4**	**8**
$t_{B,link}$ **/mk**	0	**2**	4	0	**2**	4	0	**2**	5	0	**3**	6	0	**3**	7	0	**4**	8
Simple mean	-1	4	8	-3	6	12	-7	5	10	-12	7	13	4	9	17	0	4	8
Median	-2			0			0			0			4			0		
Weighted mean	0	2	4	0	2	4	0	2	4	-1	2	5	2	3	6	1	3	7
No. of Lab	6			7			7			7			4			2		
Birge ratio	0.60			0.37			0.96			1.40			0.66			0.34		
Birge Criterion	1.50			1.47			1.47			1.47			1.62			1.96		

LAB*	Values used to calculate loop reference
Numerical	Anomalous value - excluded after Birge ratio test

Table 36: Result of analysis for Loop B

Loop C																		
Participants	**-50 °C**	***U*/mK**	***k***	**-30 °C**	***U*/mK**	***k***	**100 °C**	***U*/mK**	***k***	**200 °C**	***U*/mK**	***k***	**300 °C**	***U*/mK**	***k***	**400 °C**	***U*/mK**	***k***
C,dW/dT	0.003 989			0.003 954			0.003 800			0.003 684			0.003 569			0.003 454		
C,KRISSbefore	**0.802 577**	**6**	**1.96**	**0.881 932**	**6**	**1.96**	**1.385 806**	**6**	**1.96**	**1.759 896**	**8**	**1.96**	**2.122 501**	**12**	**1.96**	**2.473 790**	**14**	**1.96**
C,KIM LIPI	0.802 999	20	2.00	0.881 914	20	2.00	1.385 837	20	2.00	1.759 937	40	2.00	2.122 570	40	2.00	2.473 864	40	2.00
C,NMC, A*STAR	0.802 582	5	2.00	0.881 926	5	2.00	1.385 798	6	2.00	1.759 902	6	2.00	2.122 506	7	2.00	2.473 801	7	2.00
C,SIRIM	0.802 553	33	2.00	0.881 894	33	2.00	1.385 805	23	2.00	1.759 892	30	2.00	2.122 735	25	2.00	2.473 992	25	2.00
C,VMI	0.802 607	11	1.96	0.881 933	14	1.96	1.385 812	19	1.96	1.759 896	13	1.96	2.122 486	22	1.96	2.473 804	18	1.96
C,ITDI				0.881 915	25	2.00	1.385 799	30	2.00	1.759 884	30	2.00	2.122 488	35	2.00			
C,NMIA*	**0.802 586**	**9**	**2.06**	**0.881 919**	**9**	**2.06**	**1.385 807**	**9**	**2.06**	**1.759 902**	**9**	**2.06**	**2.122 542**	**9**	**2.06**	**2.473 844**	**9**	**2.06**
C,KRISSafter	**0.802 573**	**6**	**1.96**	**0.881 921**	**6**	**1.96**	**1.385 801**	**6**	**1.96**	**1.759 904**	**8**	**1.96**	**2.122 489**	**12**	**1.96**	**2.473 790**	**14**	**1.96**
C,KRISS*	**0.802 575**			**0.881 926**			**1.385 804**			**1.759 900**			**2.122 495**			**2.473 790**		
$W_{C,link}$	**0.802 581**			**0.881 922**			**1.385 805**			**1.759 901**			**2.122 518**			**2.473 817**		
(SIRIM-KRISS)/mK	**-5**			**-8**			**0**			**-2**			**67**			**59**		
(NMIA-KRISS)/mK	**3**			**-2**			**1**			**1**			**13**			**16**		
$X_{C,i}$	$X_{C,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{C,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{C,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{C,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{C,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk	$X_{C,i}$ /mK	*u*/mK	*U*(*k* = 2) /mk
C,KRISSbefore	**-1**	**3**	**6**	**2**	**3**	**6**	**0**	**3**	**6**	**-1**	**4**	**8**	**-5**	**6**	**12**	**-8**	**7**	**14**
C,KIM LIPI				-2	10	20	8	10	20	10	20	40	15	20	40	14	20	40
C,NMC, A*STAR	0	3	5	1	3	5	-2	3	6	0	3	6	-4	4	7	-5	4	7
C,SIRIM	-7	17	33	-7	17	33	0	12	23	-2	15	30	61	13	25	51	13	25
C,VMI	6	6	11	3	7	14	2	10	19	-1	7	13	-9	11	23	-4	9	18
C,ITDI				-2	13	25	-2	15	30	-5	15	30	-8	18	35			
C,NMIA*	**1**	**4**	**9**	**-1**	**4**	**9**	**0**	**4**	**9**	**0**	**4**	**9**	**7**	**4**	**9**	**8**	**4**	**9**
C,KRISSafter	**-2**	**3**	**6**	**0**	**3**	**6**	**-1**	**3**	**6**	**1**	**4**	**8**	**-8**	**6**	**12**	**-8**	**7**	**14**
C,KRISS*	**-1**	**3**	**6**	**1**	**3**	**6**	**0**	**3**	**6**	**0**	**4**	**8**	**-7**	**6**	**12**	**-8**	**7**	**14**
$t_{C,link}$ /mk	**0**	**3**	**5**	**0**	**3**	**5**	**0**	**3**	**5**	**0**	**3**	**6**	**0**	**4**	**7**	**0**	**4**	**8**
Simple mean	0	4	7	-1	4	7	1	3	7	0	4	9	-1	5	10	1	5	10
Median	0			-1			0			0			-5			-4		
Weighted mean	0	2	3	1	2	3	0	2	4	0	2	4	-1	2	5	-1	2	5
No. of Lab	5			7			7			7			6			5		
Birge ratio	0.68			0.31			0.44			0.27			1.06			1.30		
Birge Criterion	1.55			1.47			1.47			1.47			1.50			1.55		

LAB*	Values used to calculate loop reference
Numerical	Anomalous value - excluded after Birge ratio test

Table 37: Result of analysis for Loop C

8.4 Linking loops A, B and C

Using the linkage from NMIA and KRISS for all three loops, the temperature deviation from participants from different loops, $X_{A,i}$, $X_{B,j}$, and $X_{C,k}$ can be compared.

The final simple mean ($< X >_{\text{simple}}$), median ($< X >_{\text{median}}$) and weighted mean ($< X >_{\text{weighted}}$) were calculated among $X_{A,i}$, $X_{B,j}$, and $X_{C,k}$ similarly to Eqs. 11 to 13.

However, NML-SIRIM, NMIA and KRISS were presented in all three loops. Therefore, the representative value X_i and its uncertainty in temperature $u(t_i)$ for each of the three pilot laboratories were calculated by taking a simple mean from the data of each loops. For NML-SIRIM,

$$X_{\text{SIRIM}} = \frac{1}{3}(X_{\text{A,SIRIM}} + X_{\text{B,SIRIM}} + X_{\text{C,SIRIM}}) \tag{26}$$

$$u(t_{\text{SIRIM}}) = \frac{1}{3}\left[u(t_{\text{A,SIRIM}}) + u(t_{\text{B,SIRIM}}) + u(t_{\text{C,SIRIM}})\right] \tag{27}$$

Here, we assume that the measurements of SIRIM in the three loops were completely correlated. Similarly we calculated the simple mean to obtain the values X_{NMIA} and X_{KRISS} and their uncertainties. For other participants, $X_i = X_{\text{Loop},i}$ (Loop = A or B or C).

Table 38 lists the temperature deviations X_i from the link value for each participant. The average values$< X >_{\text{simple}}$, $< X >_{\text{median}}$ and $< X >_{\text{weighted}}$ were also calculated and listed. However, when evaluating the uncertainty of the overall simple and weight means, additional uncertainty term should be added. This was because the deviations were calculated from the link values of different loops, therefore the uncertainty of the linkage needs to be added. The uncertainties of the simple mean and weighted mean were

$$u^2_{\text{simple}} = \sum \frac{u^2(t_i)}{n^2} + u^2\left(t_{\text{A,link}}\right) + u^2\left(t_{\text{B,link}}\right) + u^2\left(t_{\text{C,link}}\right) \tag{28}$$

and

$$u^2_{\text{weighted}} = \frac{1}{\sum u^{-2}(t_i)} + u^2\left(t_{\text{A,link}}\right) + u^2\left(t_{\text{B,link}}\right) + u^2\left(t_{\text{C,link}}\right) \tag{29}$$

Also, similarly to what had been done for each loop, we performed the Birge ratio procedure to exclude outliers. After the Birge procedure the following data were excluded:

- SIRIM results at 300 °C and 400°C
- NIS results at (−50, −30, 100, 200, 300, 400) °C (ie., all temperature points)
- NIMT result at 400 °C
- BSTI results at 300 °C and 400°C

The final exclusions comprise all the excluded results from the analysis of each loop. Therefore, this coincidence showed the consistency and the robustness of the Birge ratio procedure. The final Birge ratio along with the simple mean, median and weighted mean after the exclusion of outliers are shown in Table 38.

Comparison reference value (CRV)

It was agreed among pilot laboratories that the weighted mean and its uncertainty was to be used as the Comparison Reference Value CRV. Therefore, we denoted

$$X_{\mathrm{CRV}} = < X >_{\mathrm{weighted}}, \tag{30}$$

$$u_{\mathrm{CRV}} = u_{\mathrm{weighted}}. \tag{31}$$

8.5 Deviations from CRV

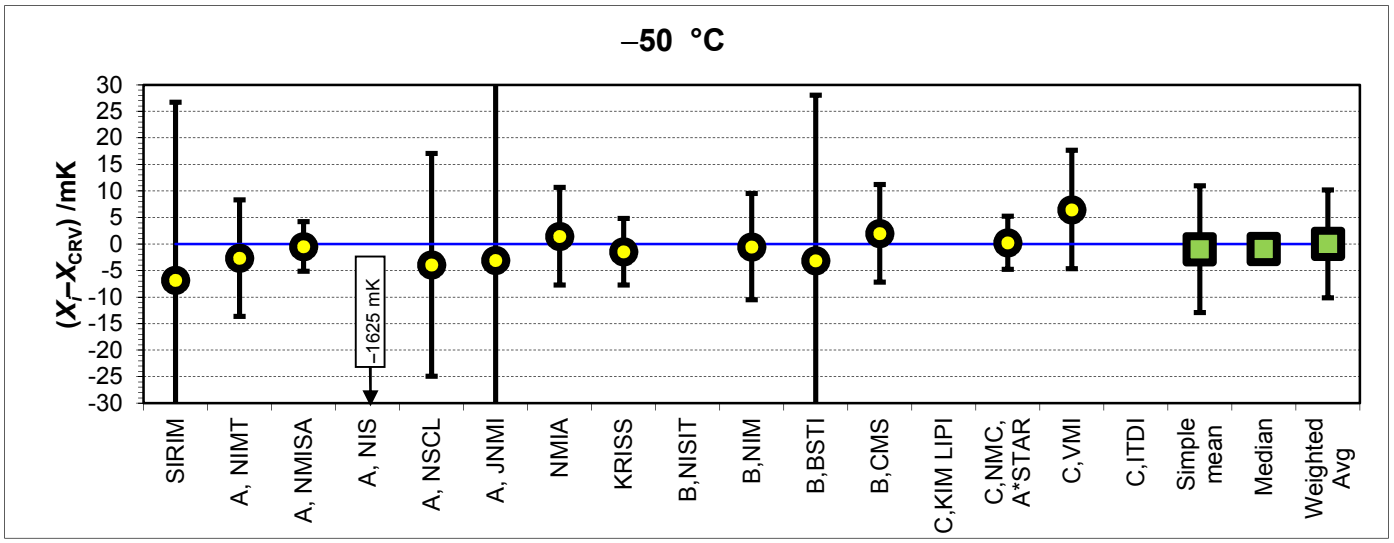
In Table 38, X_{CRV} and its uncertainty at each comparison temperature are calculated. The deviations (X_i–X_{CRV}) of each participant from the CRV were listed in Table 39. Figure 4 shows X_i–X_{CRV} for each participant; and the deviation of the simple mean and median from X_{CRV}. The uncertainty bars represented the expanded uncertainty (k = 2) of each participant. The uncertainties bars of the simple mean and weighted mean also represented the expanded uncertainty.

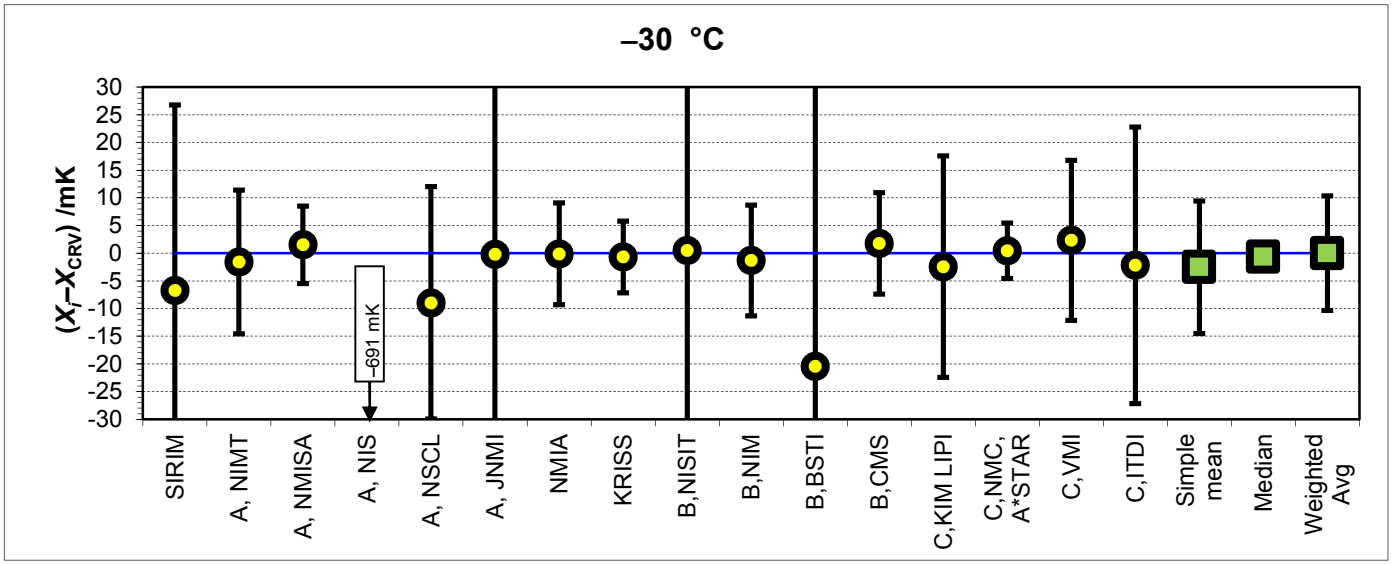
Deviation from link values	–50 °C		–30 °C		100 °C		200 °C		300 °C		400 °C	
Participants	X_i (mK)	$U(k=2)$/mK	X_i (mK)	$U(k=2)$/mK	X_i (mK)	$U(k=2)$/mK	X_i (mK)	$U(k=2)$/mK	X_i (mK)	$U(k=2)$/mK	X_i (mK)	$U(k=2)$/mK
Loop A link	0	7	0	7	0	7	0	8	0	9	0	10
Loop B link	0	4	0	4	0	5	0	6	0	7	0	8
Loop C link	0	5	0	5	0	5	0	6	0	7	0	8
SIRIM	-7	34	-6	34	-12	27	-1	34	-42	29	-72	29
A, NIMT	-3	11	-1	13	5	15	9	14	27	22	64	21
A, NMISA	0	5	2	7	-1	3	0	3	-5	6	-2	8
A, NIS	-1625	14	-690	14	101	14	72	13	87	16	100	16
A, NSCL	-4	21	-9	21	3	44	7	44	1	45	19	47
A, JNMI	-3	58	0	40	12	40	15	44	23	60	21	62
NMIA	**1**	**9**	**0**	**9**	**1**	**10**	**0**	**10**	**4**	**10**	**5**	**10**
KRISS	**-1**	**6**	**0**	**6**	**-1**	**7**	**0**	**9**	**-4**	**12**	**-5**	**14**
B,NISIT			1	34	-41	48	-29	48				
B,NIM	-1	10	-1	10	2	10	5	13	9	15		
B,BSTI	-3	31	-20	61	-18	32	-64	41	-992	41	-1021	71
B,CMS	2	9	2	9	9	17	2	56	6	65		
C,KIM LIPI			-2	20	8	20	10	40	15	40	14	40
C,NMC, A*STAR	0	5	1	5	-2	6	0	6	-4	7	-5	7
C,VMI	6	11	3	14	2	19	-1	13	-9	23	-4	18
C,ITDI			-2	25	-2	30	-5	30	-8	35		
Simple mean	-1	12	-2	12	-2	12	-3	14	1	17	5	19
Median	-1		0		1		0		1		1	
Weighted mean (CRV)	**0**	10	**0**	10	**-1**	10	**0**	12	**-2**	14	**-2**	16
Number of Labs	12		15		15		15		12		8	
Birge ratio	0.48		0.38		0.80		1.01		1.14		0.82	
Birge criterion	1.36		1.33		1.33		1.33		1.36		1.44	

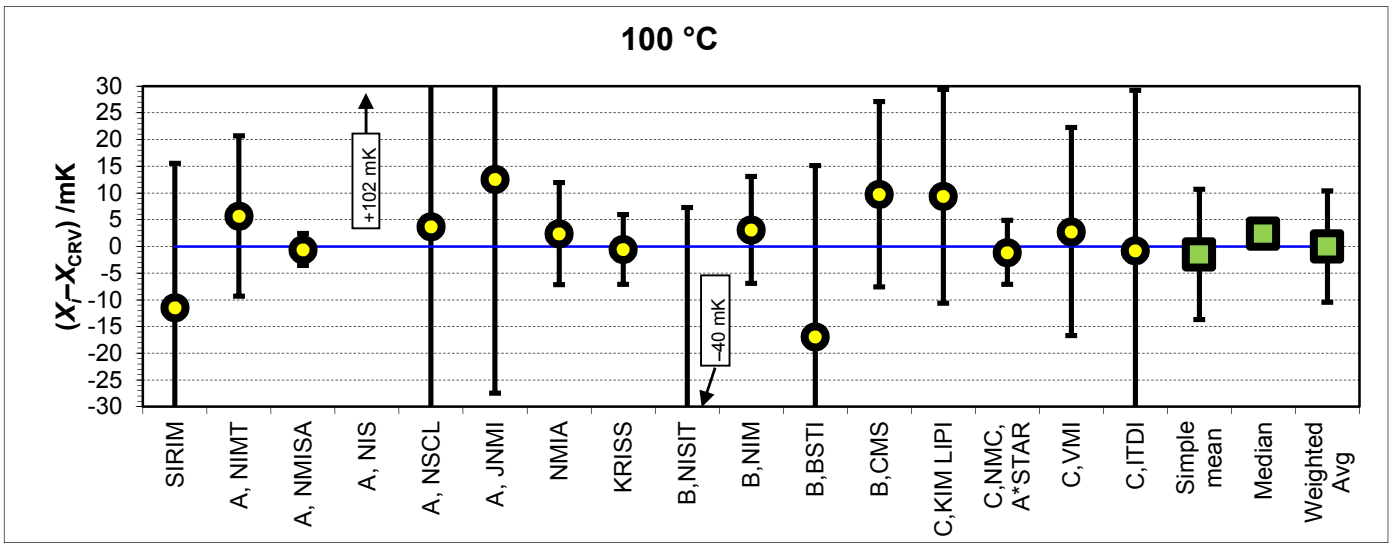
Table 38: Result analysis after linking 3 loops

Deviation from CRV	–50 °C		–30 °C		100 °C		200 °C		300 °C		400 °C	
Participants	$X_i - X_{CRV}$ (mK)	$U_i(k=2)$/mK	$X_i - X_{CRV}$ (mK)	$U_i(k=2)$/mK	$X_i - X_{CRV}$ (mK)	$U_i(k=2)$/mK	$X_i - X_{CRV}$ (mK)	$U_i(k=2)$/mK	$X_i - X_{CRV}$ (mK)	$U_i(k=2)$/mK	$X_i - X_{CRV}$ (mK)	$U_i(k=2)$/mK
CRV		**10**		**10**		**10**		**12**		**14**		**16**
SIRIM	-7	34	-7	34	-11	27	-2	34	-40	29	-71	29
A, NIMT	-3	11	-2	13	6	15	8	14	29	22	66	21
A, NMISA	0	5	2	7	-1	3	0	3	-4	6	-1	8
A, NIS	-1625	14	-691	14	102	14	72	13	89	16	101	16
A, NSCL	-4	21	-9	21	4	44	6	44	3	45	20	47
A, JNMI	-3	58	0	40	13	40	15	44	25	60	23	62
NMIA	1	9	0	9	2	10	0	10	6	10	7	10
KRISS	-1	6	-1	6	-1	7	-1	9	-3	12	-3	14
B,NISIT			0	34	-40	48	-30	48				
B,NIM	0	10	-1	10	3	10	4	13	11	15		
B,BSTI	-3	31	-20	61	-17	32	-64	41	-990	41	-1019	71
B,CMS	2	9	2	9	10	17	2	56	8	65		
C,KIM LIPI			-2	20	9	20	9	40	16	40	15	40
C,NMC, A*STAR	0	5	0	5	-1	6	0	6	-2	7	-3	7
C,VMI	7	11	2	14	3	19	-2	13	-8	23	-2	18
C,ITDI			-2	25	-1	30	-5	30	-7	35		
Simple mean	-1	12	-3	12	-1	12	-4	14	3	17	7	19
Median	-1		-1		2		0		3		3	
Weighted Avg	0	10	0	10	0	10	0	12	0	14	0	16
Number of Labs	12		15		15		15		12		8	
Birge ratio	0.48		0.38		0.80		1.01		1.14		0.82	
Birge criterion	1.36		1.33		1.33		1.33		1.36		1.44	

Table 39: Temperature deviation ($X_i - X_{CRV}$) of each participant. The uncertainties listed are the expanded uncertainty ($k = 2$) for each participants.


–50 °C
(X_I–X_CRV) /mK
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
–1625 mK
SIRIM
A, NIMT
A, NMISA
A, NIS
A, NSCL
A, JNMI
NMIA
KRISS
B,NISIT
B,NIM
B,BSTI
B,CMS
C,KIM LIPI
C,NMC, A*STAR
C,VMI
C,ITDI
Simple mean
Median
Weighted Avg


–30 °C
(X_I–X_CRV) /mK
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
–691 mK
SIRIM
A, NIMT
A, NMISA
A, NIS
A, NSCL
A, JNMI
NMIA
KRISS
B,NISIT
B,NIM
B,BSTI
B,CMS
C,KIM LIPI
C,NMC, A*STAR
C,VMI
C,ITDI
Simple mean
Median
Weighted Avg


100 °C
(X_I–X_CRV) /mK
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
+102 mK
–40 mK
SIRIM
A, NIMT
A, NMISA
A, NIS
A, NSCL
A, JNMI
NMIA
KRISS
B,NISIT
B,NIM
B,BSTI
B,CMS
C,KIM LIPI
C,NMC, A*STAR
C,VMI
C,ITDI
Simple mean
Median
Weighted Avg

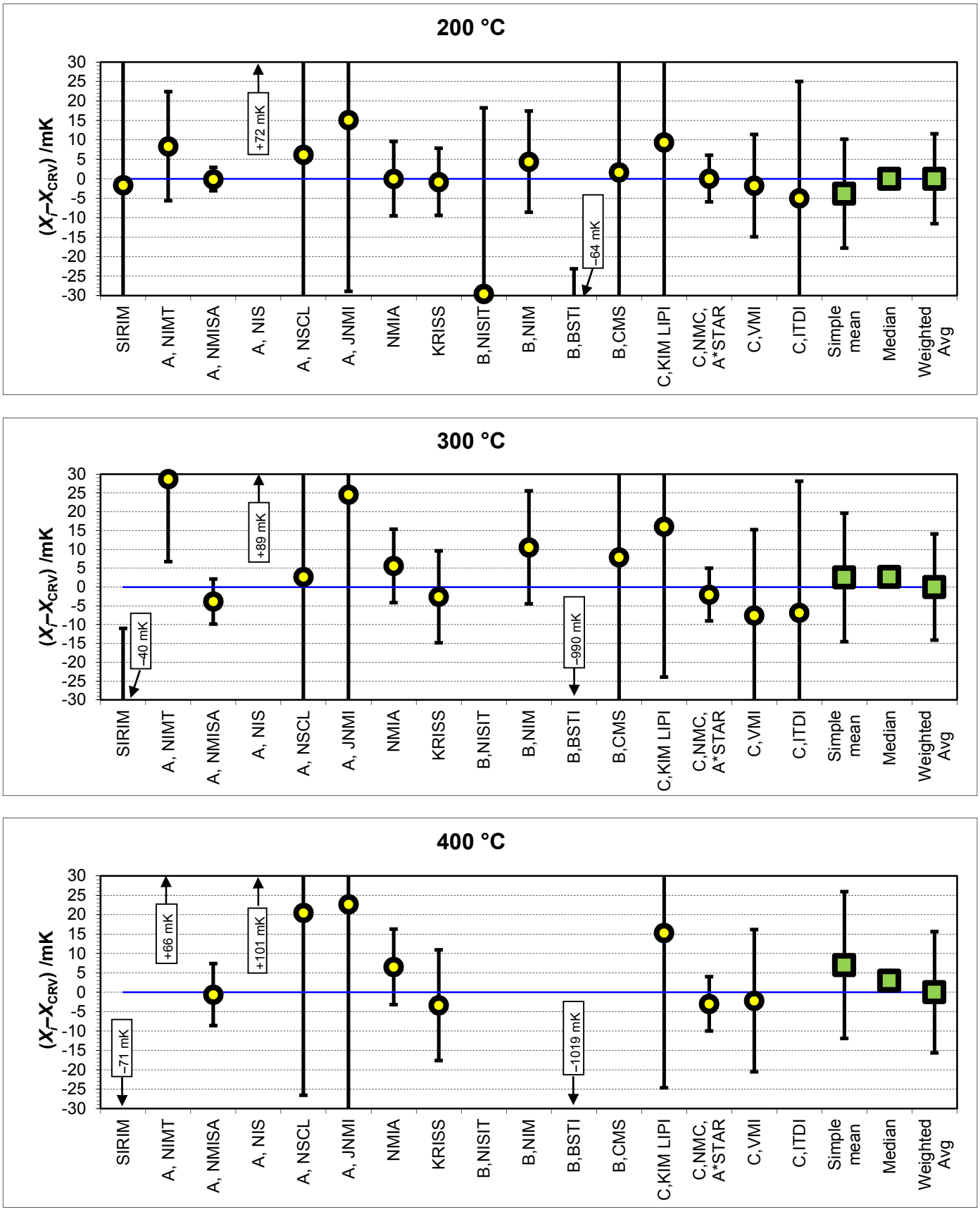


Figure 4: Temperature deviation (X_i–X_{CRV}) of each participant. The uncertainty bars represented the expanded uncertainty (k = 2).

8.6. En numbers

To identify significant discrepancies amongst the data submitted by the participants, measurement performance had been assessed on the basis of En number for each measurement. The E_n numbers were calculated as follows:

$$E_n = \frac{X_i - X_{\mathrm{CRV}}}{\sqrt{U_i^2(k=2) + U_{\mathrm{CRV}}^2(k=2)}} \tag{32}$$

The E_n number for the comparison for each lab was summarized in Table 40. Those with $|E_n| > 1$ were in bold red font.

Participants	−50 °C	−30 °C	100 °C	200 °C	300 °C	400 °C
SIRIM	-0.19	-0.19	-0.40	-0.05	**-1.24**	**-2.15**
A, NIMT	-0.18	-0.09	0.31	0.46	**1.10**	**2.52**
A, NMISA	-0.04	0.12	-0.05	-0.01	-0.25	-0.03
A, NIS	**-93.06**	**-39.32**	**5.86**	**4.06**	**4.12**	**4.48**
A, NSCL	-0.17	-0.38	0.08	0.14	0.06	0.41
A, JNMI	-0.05	0.00	0.30	0.33	0.40	0.35
NMIA	0.11	-0.01	0.17	0.00	0.33	0.35
KRISS	-0.12	-0.05	-0.04	-0.05	-0.14	-0.16
B,NISIT	---	0.01	-0.83	-0.60	---	---
B,NIM	-0.03	-0.09	0.21	0.25	0.51	---
B,BSTI	-0.09	-0.33	-0.50	**-1.51**	**-22.84**	**-14.03**
B,CMS	0.15	0.13	0.48	0.03	0.12	---
C,KIM LIPI	---	-0.11	0.42	0.23	0.38	0.36
C,NMC, A*STAR	0.02	0.04	-0.09	0.00	-0.13	-0.17
C,VMI	0.43	0.13	0.13	-0.10	-0.28	-0.09
C,ITDI	---	-0.08	-0.02	-0.16	-0.18	---

Table 40: E_n number of each measurement from participants.

APPENDIX A : PROTOCOL

APMP.T-S6
THE PROTOCOL FOR APMP SUPPLEMENTARY COMPARISON OF INDUSTRIAL PLATINUM RESISTANCE THERMOMETER, (IPRT) FOR RANGE -50 °C TO 400 °C.

1. INTRODUCTION

This Industrial Platinum Resistance Thermometer, IPRT supplementary comparison is a follow-up to the APMP.T-S3-03 that had been coordinated by the National Institute of Metrology Thailand, NIMT in 2004. This program will benefit to NMIs of developing economy countries (DEC), however other interested APMP NMIs are invited to participate as well. The objectives of the program are to provide the participating laboratories (i) the means for comparing their measurement results, (ii) recognition of CMCs and (iii) capabilities/ technical improvement particularly for those already participated in the APMP.T-S3-03. This supplementary comparison in general follows the directions set out in the "Guidelines for CIPM key comparison" modified by the CIPM in October 2003.

Three units of IPRTs with approximately nominal resistance value 100 ohm at ice point are chosen as the artefacts for the comparison and the measurement temperature range is within –50 °C to 400 °C. The comparison will be run in 3 parallel loops: A, B and C. The technical document and instructions, which given below, should be followed by participants.

The measurement results obtained will be evaluated and reported to the participating laboratories by National Metrology Laboratory, NML-SIRIM as pilot lab with assistance from the two co-pilot labs; Korea Research Institute of Standards and Science (KRISS) and the National Measurement Institute of Australia (NMIA).

2. COORDINATOR

The coordinator/pilot lab of this program is Mrs. Hafidzah Othman of SIRIM Berhad. All correspondence and enquiries should be addressed to her at:

Pilot lab:

National Metrology Laboratory (NML-SIRIM)
SIRIM Berhad
Lot PT 4803, Bandar Baru Salak Tinggi
43900 Sepang
Selangor.
Malaysia.
Contact Person: Hafidzah Othman
E-mail: ***hafidzah@sirim.my***
Phone: +603-87781665
Fax: +603-87781661

Co-Pilot lab:

Korea Research Institute of Standards and Science (KRISS)
1 Doryong-dong, Yuseong-gu,
Daejeon, 305-340,
SOUTH KOREA.
Contact Person: Dr.Inseok Yang / Dr. Yong-Gyoo Kim
E-mail: ***iyang@kriss.re.kr***
Phone: +82 42 868 5772
Fax: +82 42 868 5831

Co-pilot lab:

National Measurement Institute, Australia (NMIA)
Bradfield Rd, West Lindfield NSW,
2070 Australia
Contact Person: Mrs. Mong-Kim Nguyen/ Dr Mark John Ballico
E-mail: ***kim.nguyen@measurement.gov.au***
Phone: +612 8467 3572
Fax: +612 8467 3719

3. PARTICIPATING LABORATORIES

There are 16 participating laboratories for the IPRT comparison program. Please refer to Section 7 Calibration Schedule for details of participants.

4. ARTEFACTS

The artifacts belonging to NML-SIRIM, NMIA and KRISS are 3 of 100- Ω PRTs, one artefact per loop. NML-SIRIM, NMIA and KRISS will calibrate the artefacts before, during and after circulation depending on the circulating loop where their IPRT is used.

PRT	**Loop A**	**Loop B**	**Loop C**
S/No	935-14-95	1142	W86/8
Model	-	8928	-
Maker	Isotech	Leeds & Northrup	KRISS
Supplier	NML-SIRIM	NMIA	KRISS
4-wire	Yes	Yes	Yes
Metal sheath	Yes	Yes	Yes
Length / mm	400	420	600
Diameter / mm	6	6.4	6.4
Terminals	Spade	Spade	Spade

5. PHOTO OF ARTEFACT

Photo 1: Loop A artefact

Photo 2: Loop B artefact

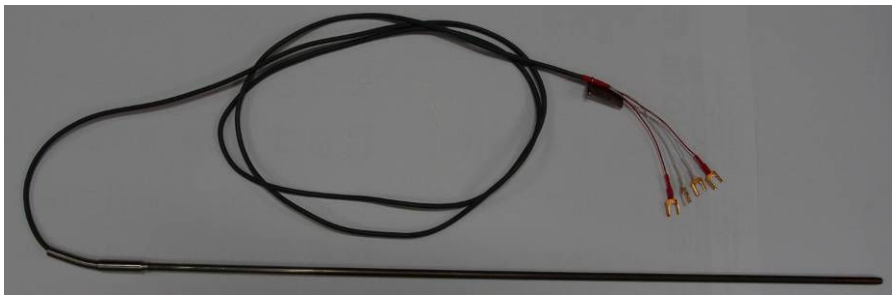


Photo 3: Loop C artefact

6. APPARATUS

6.1 All participating laboratories should have calibration enclosure/furnace with enough working space and depth. The evidence of their instability and inhomogeneity should be available.

6.2 All participating laboratories should prepare at least one SPRT to be used as the reference standard thermometer. To save time, it is important for participants to prepare the calibrated reference thermometer before the arrival of the artefact.

7. CALIBRATION SCHEDULE

The IPRT Comparison has been organized to run in 3 loops: A, B and C. See Figure 1 and Tables 1-3 for routing and schedule. Each lab is given approximately 3 weeks for measurement and transportation (2 weeks measurement, 1 week transportation). The IPRT artefact should be shipped in its original case by airfreight from the host laboratory to the next participating laboratory. Each participant is responsible for Customs Carnet clearance, insurance and transportation cost to ship the artifact to the next laboratory.

If there is delay in measurement, the participating lab has to inform NML–SIRIM immediately so that the schedule can be modified if necessary. If unable to meet the planned schedule, participating lab should inform NML-SIRIM before the arrival of the artefact to decide on a more convenient time so that the artefact can be sent to the next participating lab without further delay.

Figure 1: Circulation in 3 loops.

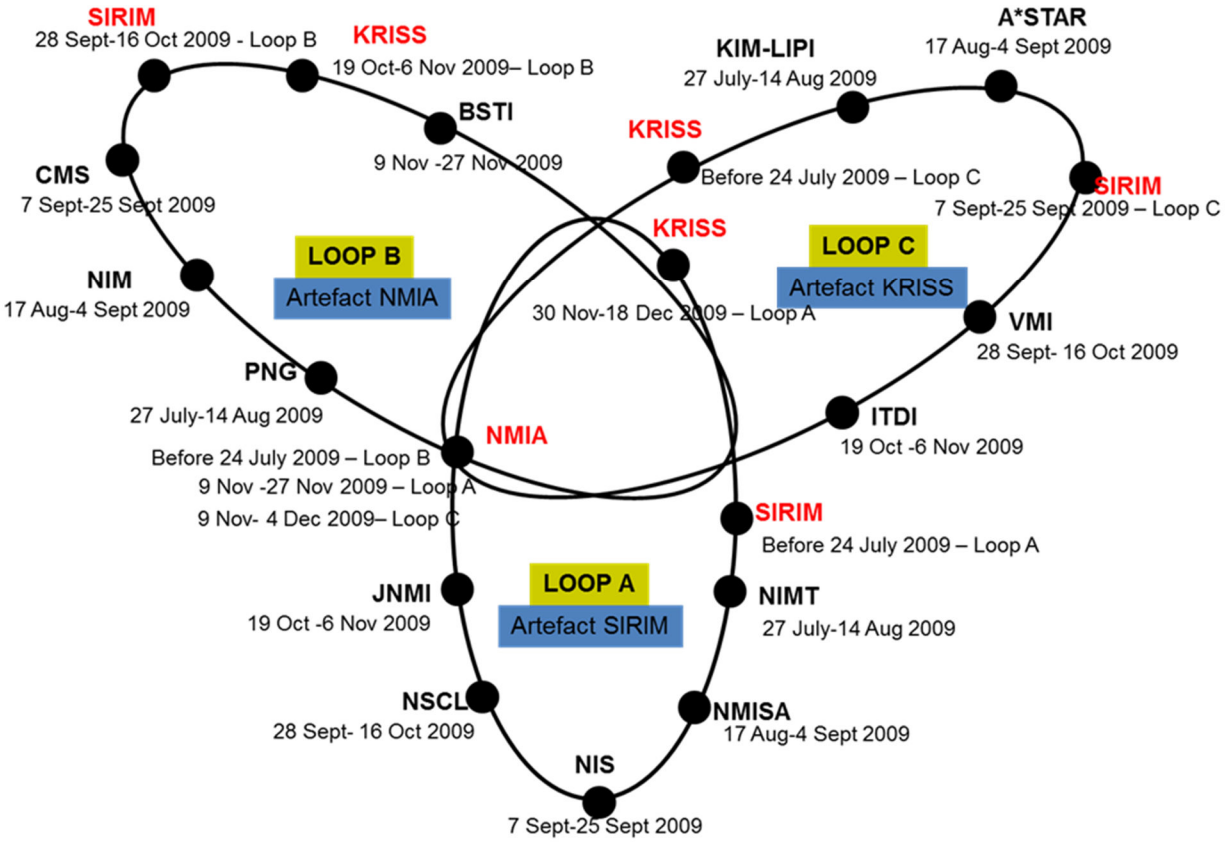


Table 1: Circulation Schedule for loop A

Date	Participant Labs	Address	Contact Person	Phone	Fax/email
Before to 24 July 09	SIRIM	Lot PT 4803, Bandar Baru Salak Tinggi 43900 Sepang MALAYSIA	Hafidzah Othman Nurulaini Md Ali	+603 8778 1665 +603 8778 1740/ 1742	+603 8778 1661 hafidzah_othman@sirim.my aini@sirim.my
27 July 09 to 14 Aug 09	NIMT	3/5 Moo 3 Technopolis, Klong V, Klong Luang, Pathumthani 12120, THAILAND	Mr. Uthai Norranim Ms. Charuayrat Yaokulbodee	+662 577 5100	+662 577 5092 uthai@nimt.or.th temp@nimt.or.th
17 Aug 09 to 4 Sept 09	NMISA	CSIR Campus, Meiring Naude Road, 0184 Brummeria, Pretoria, SOUTH AFRICA.	Hans Liedberg Deona Jonker	+27 12 841 4458	+27 12 841 2753 hliedber@nmisa.org
7 Sept 09 to 25 Sept 09	NIS	Tersa St. El Haram El Giza, P.O Box 136, Code 12211 El Giza, EGYPT.	Dr. Khalid Mohamed Ali Dr. Mohamed Gamal Ahmed	+20 2 33867451	+20 2 33867451 Khalidali@nis.sci.eg
28 Sept 09 to 16 Oct 09	NSCL	Syria-Damascus, P.O Box 30116, SYRIA.	Dr. Naser HARBA	+963 11 221 6760	+963 11 511 7539 nscl@nscl.sy
19 Oct 09 to 6 Nov 09	JNMI	Royal Scientific Society RSS, Al Tarawneh Street , P.O Box 1438 Al-Jubaiha, 11941 Jordan	Fawaz Al-Labadi Mustafa Fuad Flaifel	00962-6-5344701	00962-6-5348796 jnmi@rss.gov.jo mflaifel@rss.gov.jo
9 Nov 09 to 27 Nov 09	NMIA	Bradfield Rd, West Lindfield NSW 2070 AUSTRALIA.	Mong-Kim Nguyen	+612 8467 3572	+612 8467 3719 kim.nguyen@measurement.gov.au
30 Nov 09 to 18 Dec 09	KRISS	1 Doryong-dong, Yuseong-gu, Daejeon, 305-340, SOUTH KOREA.	Dr.Inseok Yang Yong-Gyoo Kim	+82 42 868 5772	+82 42 868 5831 iyang@kriss.re.kr
21 Dec 09 - onwards	SIRIM	Lot PT 4803, Bandar Baru Salak Tinggi 43900 Sepang MALAYSIA.	Hafidzah Othman Nurulaini Md Ali	+603 8778 1665 +603 8778 1740/ 1742	+603 8778 1661 hafidzah_othman@sirim.my aini@sirim.my

Table 2: Circulation Schedule for loop B

Date	Participant Labs	Address	Contact Person	Phone	Fax/email
Before to 24 July 09	NMIA	Bradfield Rd, West Lindfield NSW 2070 AUSTRALIA.	Mong-Kim Nguyen	+612 8467 3572	+612 8467 3719 kim.nguyen@measurement.gov.au
27 July 09 to 14 Aug 09	PNG	PO Box 3042, Boroko, National Capital District,PNG.Portion 414 Tabari Place Boroko, NCD, PAPUA NEW GENUINE	Mr.Victor Gabi Mr. Cholai Tau	(675) 323 1852	(675) 323 8793 vgabi@nisit.gov.pg ctau@nisit.gov.pg
17 Aug 09 to 4 Sept 09	NIM	Bei San Huan Dong Lu No 18, Beijing 100013, CHINA.	Zhang Zhe	+8610 64218637	+8610 64525114 zhangzh@nim.ac.cn
7 Sept 09 to 25 Sept 09	CMS	RM. B34, Building 16, 321, Sec 2, Kuang Fu Rd, Hsinchu, Taiwan, 300, R.O.C.	Ms.Shu-Fei Tsai Ms.Hsin-Yi Ko	+886-3-5732129	+886-3-5726445 Shu-Fei_Tsai@itri.org.tw
28 Sept 09 to 16 Oct 09	SIRIM	Lot PT 4803, Bandar Baru Salak Tinggi 43900 Sepang MALAYSIA.	Hafidzah Othman Nurulaini Md Ali	+603 8778 1665 +603 8778 1740/ 1742	+603 8778 1661 hafidzah_othman@sirim.my aini@sirim.my +603 8778 1661
19 Oct 09 to 6 Nov 09	KRISS	1 Doryong-dong, Yuseong-gu, Daejeon, 305-340, SOUTH KOREA.	Dr.Inseok Yang Yong-Gyoo Kim	+82 42 868 5772	+82 42 868 5831 iyang@kriss.re.kr
9 Nov 09 to 27 Nov 09	BSTI	116/A, Tejgaon Industrial Area, Dhaka -1208 BANGLADESH.	Dr. Lutfur Rabby	+9131 1581	+988 0008 rabby_l@yahoo.com.au
30 Nov 09 - onwards	NMIA	Bradfield Rd, West Lindfield NSW 2070 AUSTRALIA.	Mong-Kim Nguyen	+612 8467 3572	+612 8467 3719 kim.nguyen@measurement.gov.au

Table 3: Circulation Schedule for loop C

Date	Participant Labs	Address	Contact Person	Phone	Fax/email
Before to 24 July 09	KRISS	1 Doryong-dong, Yuseong-gu, Daejeon, 305-340, SOUTH KOREA.	Dr.Inseok Yang Yong-Gyoo Kim	+82 42 868 5772	+82 42 868 5831 iyang@kriss.re.kr
27 July 09 to 14 Aug 09	KIM-LIPI	Kompleks Puspiptek, Serpong-Tangerang, Banten, Indonesia 15314	Dr Akhmad Sulaeman Aditya Achmadi	+6221 756052	+6221 7560064 Akhmadsulaeman@yahoo.com asulaeman@kim.lipi.go.id aditya@kim.lipi.go.id
17 Aug 09 to 4 Sept 09	A*STAR	1, Science Park Drive, Singapore 118221	Kho Hao Yuan	+65 62791962	+65 62791996 kho_hao_yuan@nmc.a-star.edu.sg
7 Sept 09 to 25 Sept 09	SIRIM	Lot PT 4803, Bandar Baru Salak Tinggi 43900 Sepang MALAYSIA.	Hafidzah Othman Nurulaini Md Ali	+603 8778 1665 +603 8778 1740/ 1742	+603 8778 1661 hafidzah_othman@sirim.my aini@sirim.my +603 8778 1661
28 Sept 09 to 16 Oct 09	VMI	Vietnam Metrology Institute. Number 8, Hoang Quoc Viet Road, Cau Giay District, Hanoi Vietnam	Vu Quang Cuong Pham Thanh Binh	+844 836 1872 /3242	+844 756 4260 templab_vmi@yahoo.com
19 Oct 09 to 6 Nov 09	ITDI	DOST Compund, General Santos Ave., Bicutan, Taguig City, 1631 Metro Manila, Philippines	Aurora V. Kimura	+837 3167 / 837 2071 ext 2260/2199	+837 3167 / 837 2071 ext 2272 rorychibi@yahoo.com avkimura@dost.gov.ph phy6_i_lyk@yahoo.com
9 Nov 09 to 4 Dec 09	NMIA	Bradfield Rd, West Lindfield NSW 2070 AUSTRALIA.	Mong-Kim Nguyen	+612 8467 3572	+612 8467 3719 kim.nguyen@measurement.gov.au
7 Dec 09 - onwards	KRISS	1 Doryong-dong, Yuseong-gu, Daejeon, 305-340, SOUTH KOREA.	Dr.Inseok Yang Yong-Gyoo Kim	+82 42 868 5772	+82 42 868 5831 iyang@kriss.re.kr

9. INSTRUCTIONS TO PARTICIPANT LABORATORIES

All participating labs should read the instructions carefully before proceed with the calibration, participating laboratories should complete the preliminary works outline below before calibration started.

9.1 ARTEFACT

The audit pack contains:

9.1.1 One nominal 100 ohm Industrial Platinum Resistance Thermometer (IPRT)

9.1.2 One set of Technical Document which consists of List of Participating Laboratories, Instructions To Participant Laboratories, Calibration Schedule & Result Sheets

9.1.3 Receipt Form (Appendix A)

9.1.4 Dispatch Form (Appendix B)

The case should then be tightly placed (cannot move at all) inside the box using the foam material that has come along with the box.

9.2 RECEIPT OF AUDIT PACK

9.2.1 Upon receipt of the audit pack, please unpack the box. Please check for any defects on the artefact. Please note down the defects and inform NML-SIRIM by completing the attached Receipt Form and fax or e-mail to Mrs. Hafidzah Othman. If there is any damage, NML-SIRIM will advise of what to proceed.

Please make copies of the result sheets for recording data. Do not use the originals.

9.2.2 Please perform initial check for connection wire configuration, insulation leakage etc.

9.2.3 If no defect on the artefact, participant should measure the resistance value of the PRT at Ice Point or water triple point using 1 mA current and 1.414 mA sensing current as per Preliminary Measurement. The resistance value at Ice Point must be reported to NML-SIRIM before proceed with calibration.

10. CALIBRATION PROCEDURE

10.1 PRELIMINARY MEASUREMENT

a. Measure the resistance value of the IPRT at the ice point (IP) or water triple point (WTP) using 1mA and √2 (1.414 mA) sensing current and report the initial $R(IP)_1$ value to NML-SIRIM for further instruction. **All IP/WTP value reported to NML-SIRIM should be corrected for self-heating effect and expressed in terms of the standards ohm.**

b. NML SIRIM will calculate the change in $R(IP)_1$ after transit and will advise the laboratory of next step to be taken.

c. Anneal the artefact to maximum test temperature (420 °C) for 2 hours, re-measure and report the corrected ice point, $R(IP)_2$ value to NML-SIRIM.

d. If $R(IP)_1 \geq R(IP)_2$ and:
$R(IP)_1 - R(IP)_2 \leq 2$ mΩ, proceed to calibration as in 10.2

$R(IP)_1 - R(IP)_2 \geq 2$ mΩ, contact NML-SIRIM for further instruction on

annealing procedure.

If $R(IP)_2 \geq R(IP)_1$, no further annealing is required, proceed to calibration as

in 10.2.

e. Repeat step (c) until the difference in subsequence R(IP)s is less than 2 mΩ.

10.2 CALIBRATION PROCEDURE

a. Calibrate the IPRT according to the laboratory's normal calibration practice. The artefact should be calibrated from the lowest to the highest calibration point of the range. The IPRT calibration is obtained by comparison method at the following test temperatures:
Temperature point: 0 °C, -50 °C, -30 °C, 0 °C, 100 °C, 200 °C, 300 °C, 400°C and 0 °C.

b. Ensure that the IPRT is sufficiently immersed to minimise conduction error. The immersion should be minimum 200 mm below the liquid surface. The immersion depth and measurement result shall be recorded in the result sheets accompanying the artefact. The conduction error component shall be added in the Uncertainty analysis.

c. The difference in ice-point or water triple point reading obtained by step 10.2a is the hysteresis (thermal cycling stability) in the uncertainty budget.

d. If participant using R(WTP), then they must convert R(WTP) in the Calibration Result Table to R(IP) before calculating R(t)/R(0 °C).

e. The final value of the ice point corrected as per step 10.2a shall be reported to NML-SIRIM.

f. The actual environment conditions during measurement shall be recorded.

10.3 REPORTING THE CALIBRATION RESULTS

The completed measurement result sheet and uncertainty budget should be submitted by the participating laboratory to the coordinator NML-SIRIM within 2 weeks after completing the measurement.

10.4 AFTER COMPLETION OF MEASUREMENT

Once measurement is completed, laboratories are requested to pack the artefact the same way as it was received. Advise the next laboratory in the circulation schedule of the arrival of the artefact. Forward the artefact by airfreight to the next participant.

Please ensure that the artefact arrive the next laboratory before the date in the schedule. Please refer the schedule accordingly. Complete and send the artefact dispatch form to NML-SIRIM.

10.5 EVALUATION OF RESULTS

NML- SIRIM with assistance by NMIA and KRISS will evaluate the results and produce a report on the comparison.

11. RESULT SHEET

FOR THE IPRT CALIBRATION FROM -50°C TO 400°C,
SERIAL NUMBER:

Name of the Laboratory : _____

Telephone : _____

Fax : _____

Date of receipt : _____

Condition of artefact when received:_____

_____

Date of Measurement : _____

Remarks : _____

Environment of the Laboratory During calibration : Temperature : (_____ ±_____) °C

Humidity : (_____ ±_____) %rh

Other pre-condition preparation work conducted:

Immersion Depth : _____ mm

Initial check Resistance Value at Ice point or WTP : _____Ω at 1 mA

_____Ω at 1.414 mA

_____Ω at 0 mA

Final check Resistance Value at Ice point or WTP : _____Ω at 1 mA

_____Ω at 1.414 mA

_____Ω at 0 mA

CALIBRATION RESULTS:

Nominal Test Temperature (°C)	Standard Reading*			PRT Resistance at the Test Temperature			Uncertainty of Measurement (°C)	Immersion Depth (mm)	Resistance Ratio R(t °C) / R(0°C)**
	(t °C)	std. dev	n	[R(t°C)ohm] at 1 mA	std.dev	n			
Ice Point									
-50									
-30									
Ice point									
100									
200									
300									
400									
Ice Point									

* : As measured by the reference thermometer

** : To calculate R(t) /R(0 °C), use the measured resistances at the same current (probably 1 mA). Please ensure not to calculate $R(t)_{1\ mA}$ / $R(0\ °C)_{0\ mA}$.

11.1 UNCERTAINTY BUDGET TABLE

This is the proposed uncertainty of measurement to be tabulated. Other components can be added wherever necessary. The following uncertainties of measurement in the following table have been calculated by comparison against a Standard Platinum Resistance Thermometer (SPRT) as a reference standard.

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A					
Drift of PRT at Ice point (Ω)	B					
Self Heating of PRT (Ω)	B					
Calibration of indicator (Ω or °C)	B					
Drift of indicator (Ω or °C)	B					
Conduction error (Ω or °C)	B					
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A					
Calibration of SPRT / PRT (°C)	B					
Drift of SPRT / PRT (°C)	B					
Calibration of indicator (Ω or °C)	B					
Drift of indicator (Ω or °C)	B					
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B					
Radial uniformity of enclosure / furnace (°C)	B					
Instability of enclosure / furnace (°C)	B					
Function						
Interpolation function (°C)	B					
Combined standard uncertainty, u_c						
Coverage factor, k						
Expanded uncertainty, U						

11.2 INSTRUMENTS USED IN THE IPRT CALIBRATION

Item	Description	Model	S/N	Traceability

11.3 ADDITIONAL REMARKS ON THE CALIBRATION

11.4 PERSON IN CHARGE

CALIBRATED BY: _____

(NAME)

DATE OF CALIBRATION: _____

CHECKED BY: _____

(NAME)

DATE: _____

RECEIPT FORM

In order to monitor the progress of the comparison, we kindly ask the participating laboratory, upon receipt of the audit pack, to fill in one **RECEIPT FORM** and fax/email it to:

MRS. HAFIDZAH OTHMAN
National Metrology Laboratory
SIRIM Berhad
Lot PT 4803, Bandar Baru Salak Tinggi
43900 Sepang
Selangor.
Malaysia.
E-mail: hafidzah@sirim.my

Tel: +603-87781665
Fax: +603-87781661

Thank you for your cooperation.

The audit pack was received on _____(date)

After inspection, are the contents of the pack damaged? _____ (Yes/ No)

If yes,

Is it serious? _____ (Yes/ No)

Are the contents still suitable for use? _____ (Yes/ No)

Describe the damage:

_____

_____

_____

Remarks or other observations:

_____

_____

_____

Participating Laboratory : _____

Contact Person : _____

Tel : _____

DISPATCH FORM

In order to monitor the progress of the comparison, we kindly ask the participating laboratory, upon completion of the calibration, to fill in one **DISPATCH FORM** and fax/email it to:

MRS. HAFIDZAH OTHMAN
National Metrology Laboratory
SIRIM Berhad
Lot PT 4803, Bandar Baru Salak Tinggi
43900 Sepang
Selangor.
Malaysia.
E-mail: hafidzah@sirim.my

Tel: +603-87781665
Fax: +603-87781661

also, fax this dispatch form to the next participating laboratory (refer to calibration schedule).

Thank you for your cooperation.

The audit pack was dispatched on _____ (date)

The contents of the audit pack has been inspected after return from our laboratory and was found to be in good condition _____ (Yes /No)

Please give details of any problems:

_____

_____

_____

_____

Participating Laboratory: _____

Contact Person : _____

Tel : _____

Fax : _____

Shipping agent : _____

Name : _____

Tel : _____

APPENDIX B : UNCERTAINTY BUDGET

Loop A

1. NML ,SIRIM- Malaysia(Before circulation)

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0018	normal	2	1	0.0018
Drift of PRT at Ice point (°C)	B	0.0035	rectangular	60	1	0.0020
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0001
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.004				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.008				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0018	normal	2	1	0.0018
Drift of PRT at Ice point (°C)	B	0.0035	rectangular	60	1	0.0020
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0001
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0030	rectangular	60	1	0.0012
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.017				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.034				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0018	normal	2	1	0.0018
Drift of PRT at Ice point (°C)	B	0.0035	rectangular	60	1	0.0020
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0001
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0020	rectangular	60	1	0.0012
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.017				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.034				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0052	normal	3	1	0.0052
Drift of PRT at Ice point (°C)	B	0.0035	rectangular	60	1	0.0020
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0001
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.012				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.024				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0052	normal	3	1	0.0052
Drift of PRT at Ice point (°C)	B	0.0035	rectangular	60	1	0.0020
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0001
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.015				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.031				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0052	normal	3	1	0.0052
Drift of PRT at Ice point (°C)	B	0.0035	rectangular	60	1	0.0020
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0001
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.013				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.026				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0052	normal	3	1	0.0052
Drift of PRT at Ice point (°C)	B	0.0035	rectangular	60	1	0.0020
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0001
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.013				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.026				

2. NIMT-Thailand

0 °C First

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (±)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty ± (°C)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00047	normal	1	2.9	0.0014	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.0007	normal	1	2.9	0.002	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0009	normal	1	1	0.0009	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0.0001	normal	2	1	0.0001	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0	rectangular	SQRT(3)	1	0	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0003	normal	2	2.9	0.0004	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.001	rectangular	SQRT(3)	2.9	0.0017	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.9	0.0047	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0	rectangular	SQRT(3)	1	0	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0.0001	rectangular	SQRT(3)	1	0	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.002	rectangular	SQRT(3)	1	0.0014	∞
uc	-	Combinded standard uncertainty		normal			0.006	> 200
U	-	Expanded uncertainty		normal (k= ...)			0.012	2

-50 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (±)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty ± (°C)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00058	normal	1	2.6	0.0015	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.0005	normal	1	2.6	0.0013	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0015	normal	1	1	0.0015	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0.0003	normal	2	1	0.0002	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0.001	rectangular	SQRT(3)	1	0.0006	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0002	normal	2	2.6	0.0003	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.0008	rectangular	SQRT(3)	2.6	0.0012	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.6	0.0043	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0.002	rectangular	SQRT(3)	1	0.0012	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0.001	rectangular	SQRT(3)	1	0.0008	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.002	rectangular	SQRT(3)	1	0.0012	∞
uc	-	Combinded standard uncertainty		normal			0.005	> 200
U	-	Expanded uncertainty		normal (k= ...)			0.011	2

-30 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (+)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty + (°C)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00051	normal	1	2.6	0.0013	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.00039	normal	1	2.6	0.001	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0011	normal	1	1	0.0011	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0.0003	normal	2	1	0.0002	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0.001	rectangular	SQRT(3)	1	0.0006	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0003	normal	2	2.6	0.0003	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.00088	rectangular	SQRT(3)	2.6	0.0013	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.6	0.0041	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0.002	rectangular	SQRT(3)	1	0.0012	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0.001	rectangular	SQRT(3)	1	0.0006	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.007	rectangular	SQRT(3)	1	0.0039	∞
uc	-	Combinded standard uncertainty		normal			0.006	> 200
U	-	Expanded uncertainty		normal (k= ...)			0.013	2

0 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (+)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty + (oC)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00069	normal	1	2.6	0.0018	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.00075	normal	1	2.6	0.0019	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0007	normal	1	1	0.0007	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0	normal	2	1	0.0001	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0	rectangular	SQRT(3)	1	0	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0003	normal	2	2.6	0.0004	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.001	rectangular	SQRT(3)	2.6	0.0015	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.6	0.0041	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0	rectangular	SQRT(3)	1	0	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0	rectangular	SQRT(3)	1	0.0001	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.002	rectangular	SQRT(3)	1	0.0009	∞
uc	-	Combinded standard uncertainty		normal			0.005	>200
U	-	Expanded uncertainty		normal (k= ...)			0.01	2

100 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (+)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty + (oC)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00047	normal	1	2.6	0.0012	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.00021	normal	1	2.6	0.0006	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0008	normal	1	1	0.0008	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0.002	normal	2	1	0.001	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0.002	rectangular	SQRT(3)	1	0.0009	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0004	normal	2	2.6	0.0005	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.00139	rectangular	SQRT(3)	2.6	0.0021	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.6	0.0043	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0.002	rectangular	SQRT(3)	1	0.001	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0.001	rectangular	SQRT(3)	1	0.0008	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.009	rectangular	SQRT(3)	1	0.005	∞
uc	-	Combinded standard uncertainty		normal			0.007	> 200
U	-	Expanded uncertainty		normal (k= ...)			0.015	2

200 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (+)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty + (oC)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00107	normal	1	2.7	0.0029	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.00093	normal	1	2.7	0.0025	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0016	normal	1	1	0.0016	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0.002	normal	2	1	0.001	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0.002	rectangular	SQRT(3)	1	0.0012	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0005	normal	2	2.7	0.0007	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.00176	rectangular	SQRT(3)	2.7	0.0027	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.7	0.0043	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0.001	rectangular	SQRT(3)	1	0.0005	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0.002	rectangular	SQRT(3)	1	0.0009	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.003	rectangular	SQRT(3)	1	0.0016	∞
uc	-	Combinded standard uncertainty		normal			0.007	> 200
U	-	Expanded uncertainty		normal (k= ...)			0.014	2

300 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (+)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty + (oC)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00109	normal	1	2.9	0.003	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.00132	normal	1	2.9	0.0036	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0049	normal	1	1	0.0049	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0.002	normal	2	1	0.001	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0.002	rectangular	SQRT(3)	1	0.0012	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0006	normal	2	2.9	0.0009	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.00212	rectangular	SQRT(3)	2.9	0.0034	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.9	0.0044	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0.004	rectangular	SQRT(3)	1	0.0024	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0.007	rectangular	SQRT(3)	1	0.0043	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.008	rectangular	SQRT(3)	1	0.0047	∞
uc	-	Combinded standard uncertainty		normal			0.011	> 200
U	-	Expanded uncertainty		normal (k= ...)			0.022	2

400 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (+)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty + (oC)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00076	normal	1	2.9	0.0022	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.00114	normal	1	2.9	0.0033	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0028	normal	1	1	0.0028	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0.002	normal	2	1	0.001	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0.002	rectangular	SQRT(3)	1	0.0012	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0007	normal	2	2.9	0.0011	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.00247	rectangular	SQRT(3)	2.9	0.0042	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.9	0.0047	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0.002	rectangular	SQRT(3)	1	0.0009	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0.011	rectangular	SQRT(3)	1	0.0064	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.005	rectangular	SQRT(3)	1	0.0027	∞
uc	-	Combinded standard uncertainty		normal			0.011	> 200
U	-	Expanded uncertainty		normal (k= ...)			0.021	2

0 °C

Symbol (ui)	Type	Source of Uncertainty	Uncertainty Value (+)	Probability Distribution	Divisor	Sensitivity Coefficient (ci)	Standard Uncertainty + (oC)	Degrees of Freedom
$u\delta(R_{UUC\_FIT})$	A	Scatter of UUC fitted curve (ohm)	0.00046	normal	1	2.6	0.0012	26
$u\delta(R_{UUC})$	A	Resistance Reading of UUC (ohm)	0.00041	normal	1	2.6	0.0011	26
$u\delta(t_S)$	A	Temperature Reading of Working Standard[SPRT/PRT] (°C)	0.0009	normal	1	1	0.0009	26
$u\delta(t_{Cal\_S})$	B	Calibration of Working Standard[SPRT/PRT](°C)	0	normal	2	1	0.0001	∞
$u\delta(t_{Drift\_S})$	B	Drift of Working Standard since last calibration[SPRT/PRT] (°C)	0	rectangular	SQRT(3)	1	0	∞
$u\delta(R_{Cal\_I})$	B	Calibration of Indicator (ohm)	0.0003	normal	2	2.6	0.0004	∞
$u\delta(R_{Drift\_I})$	B	Drift of indicator since last calibration (ohm)	0.001	rectangular	SQRT(3)	2.6	0.0015	∞
$u\delta(R_{hys})$	B	Drift of UUC at iced point /(°C) (ohm)	0.0056	rectangular	2SQRT(3)	2.6	0.0041	∞
$u\delta(t_{Inhom\_A})$	B	Uniformity of liquid bath (°C)	0	rectangular	SQRT(3)	1	0	∞
$u\delta(t_{Insta})$	B	Instability of liquid bath (°C)	0	rectangular	SQRT(3)	1	0.0001	∞
$u\delta(t_{Func})$	B	Interpolation Function (°C)	0.006	rectangular	SQRT(3)	1	0.0036	∞
uc	-	Combinded standard uncertainty		normal			0.006	>200
U	-	Expanded uncertainty		normal (k= ...)			0.012	2

3. NMISA-South Africa

0 °C

Quantity	Type	Uncertainty contribution Ui	Probability distribution	Degrees of freedom	Sensitivity coefficient ci	Standard uncertainty u(x)	u(x)^4/d.o.f.
Contribution of PRT (artefact)							
PRT reading (Ω)	A						
Drift of PRT at ice point (Ω)	B						
Self-heating of PRT (Ω)	B						
Calibration of indicator (Ω or °C)	B						
Drift of indicator (Ω or °C)	B						
Conduction error (Ω or °C)	B	0.00008	1.73	500	1.00	0.00005	1.E-20
Contribution of reference standard							
SPRT / PRT reading (°C)	A						
Calibration of SPRT / PRT (°C)	B	0.00010	2.00	500	1.00	0.00005	1.E-20
Drift of SPRT / PRT (°C)	B						
Calibration of indicator (Ω or °C)	B						
Drift of indicator (Ω or °C)	B						
Contribution of temperature source							
Axial uniformity of enclosure / furnace (°C)	B						
Radial uniformity of enclosure / furnace (°C)	B						
Instability of enclosure / furnace (°C)	B						
Function							
Interpolation function (°C)	B						
Other							
Uncertainty of WTP: artefact	B						
Drift of reference PRT at ice point	B						
Uncertainty of WTP: reference PRT	B						
Temperature coefficient of reference resistor	B	0.00001	1.73	500	2.51	0.00001	9.E-23
Combined standard uncertainty, uc						0.00007	
Coverage factor, k						2	2.E-20
Expanded uncertainty, U						0.00014	

-50 °C

Quantity	Type	Uncertainty contribution Ui	Probability distribution	Degrees of freedom	Sensitivity coefficient ci	Standard uncertainty u(x)	u(x)^4/d.o.f.
Contribution of PRT (artefact)							
PRT reading (Ω)	A						
Drift of PRT at ice point (Ω)	B	-0.00140	1.73	500	1.97	-0.00160	1.E-14
Self-heating of PRT (Ω)	B						
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	2.47	0.00003	3.E-20
Drift of indicator (Ω or °C)	B						
Conduction error (Ω or °C)	B						
Contribution of reference standard							
SPRT / PRT reading (°C)	A						
Calibration of SPRT / PRT (°C)	B	0.00062	2.00	500	1.00	0.00031	2.E-17
Drift of SPRT / PRT (°C)	B	0.00059	1.73	500	1.00	0.00034	3.E-17
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	9.68	0.00013	7.E-18
Drift of indicator (Ω or °C)	B						
Contribution of temperature source							
Axial uniformity of enclosure / furnace (°C)	B						
Radial uniformity of enclosure / furnace (°C)	B	0.00074	1.73	500	1.00	0.00043	7.E-17
Instability of enclosure / furnace (°C)	B	0.00176	1.00	5	1.00	0.00176	2.E-12
Function							
Interpolation function (°C)	B						
Other							
Uncertainty of WTP: artefact	B	0.00030	2.00	500	0.80	0.00012	4.E-19
Drift of reference PRT at ice point	B	0.00000	1.73	500	7.73	0.00000	1.E-25
Uncertainty of WTP: reference PRT	B	0.00030	2.00	500	0.80	0.00012	4.E-19
Temperature coefficient of reference resistor	B	0.00001	1.73	500	1.97	0.00001	3.E-23
Combined standard uncertainty, uc						0.00247	
Coverage factor, k						2.14	2.E-12
Expanded uncertainty, U						0.00528	

-30 °C

Quantity	Type	Uncertainty contribution Ui	Probability distribution	Degrees of freedom	Sensitivity coefficient ci	Standard uncertainty u(x)	u(x)^4/d.o.f.
Contribution of PRT (artefact)							
PRT reading (Ω)	A						
Drift of PRT at ice point (Ω)	B	-0.00140	1.73	500	2.19	-0.00177	2.E-14
Self-heating of PRT (Ω)	B						
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	2.48	0.00003	3.E-20
Drift of indicator (Ω or °C)	B						
Conduction error (Ω or °C)	B						
Contribution of reference standard							
SPRT / PRT reading (°C)	A						
Calibration of SPRT / PRT (°C)	B	0.00051	2.00	500	1.00	0.00026	8.E-18
Drift of SPRT / PRT (°C)	B	0.00048	1.73	500	1.00	0.00028	1.E-17
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	9.74	0.00013	7.E-18
Drift of indicator (Ω or °C)	B						
Contribution of temperature source							
Axial uniformity of enclosure / furnace (°C)	B						
Radial uniformity of enclosure / furnace (°C)	B	0.00074	1.73	500	1.00	0.00043	7.E-17
Instability of enclosure / furnace (°C)	B	0.00274	1.00	5	1.00	0.00274	1.E-11
Function							
Interpolation function (°C)	B						
Other							
Uncertainty of WTP: artefact	B	0.00030	2.00	500	0.88	0.00013	6.E-19
Drift of reference PRT at ice point	B	0.00000	1.73	500	8.57	0.00000	2.E-25
Uncertainty of WTP: reference PRT	B	0.00030	2.00	500	0.88	0.00013	6.E-19
Temperature coefficient of reference resistor	B	0.00001	1.73	500	2.19	0.00001	5.E-23
Combined standard uncertainty, uc						0.00332	
Coverage factor, k						2.28	1.E-11
Expanded uncertainty, U						0.00758	

100 °C

Quantity	Type	Uncertainty contribution Ui	Probability distribution	Degrees of freedom	Sensitivity coefficient ci	Standard uncertainty u(x)	u(x)^4/d.o.f.
Contribution of PRT (artefact)							
PRT reading (Ω)	A						
Drift of PRT at ice point (Ω)	B	0.00051	1.73	500	3.60	0.00105	2.E-15
Self-heating of PRT (Ω)	B						
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	2.59	0.00003	4.E-20
Drift of indicator (Ω or °C)	B						
Conduction error (Ω or °C)	B						
Contribution of reference standard							
SPRT / PRT reading (°C)	A						
Calibration of SPRT / PRT (°C)	B	0.00111	2.00	500	1.00	0.00056	2.E-16
Drift of SPRT / PRT (°C)	B	0.00172	1.73	500	1.00	0.00100	2.E-15
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	10.14	0.00014	9.E-18
Drift of indicator (Ω or °C)	B						
Contribution of temperature source							
Axial uniformity of enclosure / furnace (°C)	B						
Radial uniformity of enclosure / furnace (°C)	B	0.00080	1.73	500	1.00	0.00046	9.E-17
Instability of enclosure / furnace (°C)	B	0.00044	1.00	2	1.00	0.00044	2.E-14
Function							
Interpolation function (°C)	B						
Other							
Uncertainty of WTP: artefact	B	0.00030	2.00	500	1.39	0.00021	4.E-18
Drift of reference PRT at ice point	B	0.00000	1.73	500	14.12	0.00001	5.E-23
Uncertainty of WTP: reference PRT	B	0.00030	2.00	500	1.39	0.00021	4.E-18
Temperature coefficient of reference resistor	B	0.00001	1.73	500	3.60	0.00002	4.E-22
Combined standard uncertainty, uc						0.00171	
Coverage factor, k						2	2.E-14
Expanded uncertainty, U						0.00341	

200 °C

Quantity	Type	Uncertainty contribution Ui	Probability distribution	Degrees of freedom	Sensitivity coefficient ci	Standard uncertainty u(x)	u(x)^4/d.o.f.
Contribution of PRT (artefact)							
PRT reading (Ω)	A						
Drift of PRT at ice point (Ω)	B	0.00051	1.73	500	4.73	0.00138	7.E-15
Self-heating of PRT (Ω)	B						
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	2.67	0.00004	4.E-20
Drift of indicator (Ω or °C)	B						
Conduction error (Ω or °C)	B						
Contribution of reference standard							
SPRT / PRT reading (°C)	A						
Calibration of SPRT / PRT (°C)	B	0.00096	2.00	500	1.00	0.00048	1.E-16
Drift of SPRT / PRT (°C)	B	0.00079	1.73	500	1.00	0.00046	9.E-17
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	10.46	0.00014	1.E-17
Drift of indicator (Ω or °C)	B						
Contribution of temperature source							
Axial uniformity of enclosure / furnace (°C)	B						
Radial uniformity of enclosure / furnace (°C)	B	0.00080	1.73	500	1.00	0.00046	9.E-17
Instability of enclosure / furnace (°C)	B	0.00016	1.00	2	1.00	0.00016	3.E-16
Function							
Interpolation function (°C)	B						
Other							
Uncertainty of WTP: artefact	B	0.00030	2.00	500	1.77	0.00027	1.E-17
Drift of reference PRT at ice point	B	0.00000	1.73	500	18.55	0.00002	2.E-22
Uncertainty of WTP: reference PRT	B	0.00030	2.00	500	1.77	0.00027	1.E-17
Temperature coefficient of reference resistor	B	0.00001	1.73	500	4.73	0.00003	1.E-21
Combined standard uncertainty, uc						0.00166	
Coverage factor, k						2	8.E-15
Expanded uncertainty, U						0.00332	

300 °C

Quantity	Type	Uncertainty contribution Ui	Probability distribution	Degrees of freedom	Sensitivity coefficient ci	Standard uncertainty u(x)	u(x)^4/d.o.f.
Contribution of PRT (artefact)							
PRT reading (Ω)	A						
Drift of PRT at ice point (Ω)	B	0.00051	1.73	500	5.90	0.00172	2.E-14
Self-heating of PRT (Ω)	B						
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	2.75	0.00004	5.E-20
Drift of indicator (Ω or °C)	B						
Conduction error (Ω or °C)	B						
Contribution of reference standard							
SPRT / PRT reading (°C)	A						
Calibration of SPRT / PRT (°C)	B	0.00084	2.00	500	1.00	0.00042	6.E-17
Drift of SPRT / PRT (°C)	B	0.00119	1.73	500	1.00	0.00069	4.E-16
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	10.79	0.00015	1.E-17
Drift of indicator (Ω or °C)	B						
Contribution of temperature source							
Axial uniformity of enclosure / furnace (°C)	B						
Radial uniformity of enclosure / furnace (°C)	B	0.00430	1.73	500	1.00	0.00248	8.E-14
Instability of enclosure / furnace (°C)	B	0.00013	1.00	2	1.00	0.00013	1.E-16
Function							
Interpolation function (°C)	B						
Other							
Uncertainty of WTP: artefact	B	0.00030	2.00	500	2.14	0.00032	2.E-17
Drift of reference PRT at ice point	B	0.00002	1.73	500	23.13	0.00022	5.E-18
Uncertainty of WTP: reference PRT	B	0.00030	2.00	500	2.14	0.00032	2.E-17
Temperature coefficient of reference resistor	B	0.00001	1.73	500	5.90	0.00003	3.E-21
Combined standard uncertainty, uc						0.00317	
Coverage factor, k						2	9.E-14
Expanded uncertainty, U						0.00635	

400 °C							
Quantity	Type	Uncertainty contribution Ui	Probability distribution	Degrees of freedom	Sensitivity coefficient ci	Standard uncertainty u(x)	u(x)^4/d.o.f.
Contribution of PRT (artefact)							
PRT reading (Ω)	A						
Drift of PRT at ice point (Ω)	B	0.00051	1.73	500	7.11	0.00207	4.E-14
Self-heating of PRT (Ω)	B						
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	2.84	0.00004	5.E-20
Drift of indicator (Ω or °C)	B						
Conduction error (Ω or °C)	B						
Contribution of reference standard							
SPRT / PRT reading (°C)	A						
Calibration of SPRT / PRT (°C)	B	0.00130	2.00	500	1.00	0.00065	4.E-16
Drift of SPRT / PRT (°C)	B	0.00256	1.73	500	1.00	0.00148	9.E-15
Calibration of indicator (Ω or °C)	B	0.00003	2.00	41	11.15	0.00015	1.E-17
Drift of indicator (Ω or °C)	B						
Contribution of temperature source							
Axial uniformity of enclosure / furnace (°C)	B						
Radial uniformity of enclosure / furnace (°C)	B	0.00430	1.73	500	1.00	0.00248	8.E-14
Instability of enclosure / furnace (°C)	B	0.00097	1.00	2	1.00	0.00097	4.E-13
Function							
Interpolation function (°C)	B						
Other							
Uncertainty of WTP: artefact	B	0.00030	2.00	500	2.50	0.00038	4.E-17
Drift of reference PRT at ice point	B	0.00002	1.73	500	27.87	0.00026	1.E-17
Uncertainty of WTP: reference PRT	B	0.00030	2.00	500	2.50	0.00038	4.E-17
Temperature coefficient of reference resistor	B	0.00001	1.73	500	7.11	0.00004	6.E-21
Combined standard uncertainty, uc						0.00379	
Coverage factor, k						2	6.E-13
Expanded uncertainty, U						0.00758	

4. NIS-Egypt

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0002	normal	10	2.5	0.0001
Drift of PRT at Ice point (Ω)	B	0.002	rectangular	∞	2.5	0.0014
Self Heating of PRT (Ω)	B	0.005	rectangular	∞	2.5	0.0036
Calibration of indicator (Ω or °C)	B	0	rectangular	∞	2.5	0
Drift of indicator (Ω or °C)	B	0	rectangular	∞	2.5	0.0003
Conduction error (Ω or °C)	B	0	rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.0002	normal	10	1	0.0001
Calibration of SPRT / PRT (°C)	B	0.002	rectangular	∞	1	0.001
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	∞	1	0.0001
Calibration of indicator (Ω or °C)	B	0	rectangular	∞	11.6	0.0007
Drift of indicator (Ω or °C)	B	0	rectangular	∞	11.6	0.0013
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0141	rectangular	∞	1	0.0107
Radial uniformity of enclosure / furnace (°C)	B	0.0087	rectangular	∞	1	0.0050
Instability of enclosure / furnace (°C)	B	0.0316	rectangular	∞	1	0.022
Function						
Interpolation function (°C)	B	0.0035	rectangular	∞	1	0.002
Combined standard uncertainty, u_c		0.0254				
Coverage factor, k		2				
Expanded uncertainty, U (°C)		0.0508				

5. NSCL-Syria

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						0.00263913
PRT Reading (Ω)	A	0	Normal	201	1	0
Drift of PRT at Ice point (Ω)	B	0.0023	Rectangular	∞	0.2886751	0.0007
Self Heating of PRT (Ω)	B	0.0027	Rectangular	∞	0.2886751	0.0008
Calibration of indicator (Ω)	B	0.001	Rectangular	∞	0.5	0.0005
Drift of indicator (Ω)	B	0.001	Rectangular	∞	0.5773503	0.0006
Conduction error (Ω)	B	0.004	Rectangular	∞	0.5773503	0.0023
Contribution of Reference Standard						0.005
SPRT / PRT Reading (°C)	A	0	Normal	201	1	0
Calibration of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5	0.003
Drift of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5773503	0.0035
Calibration of indicator (°C)	B	0.0025	Rectangular	∞	0.5	0.0013
Drift of indicator (°C)	B	0.0025	Rectangular	∞	0.5773503	0.0014
Contribution Temperature Source						0.0065
Axial uniformity of enclosure / furnace (°C)	B	0.013	Rectangular	∞	0.2886751	0.0038
Radial uniformity of enclosure / furnace (°C)	B	0.013	Rectangular	∞	0.2886751	0.0038
Instability of enclosure / furnace (°C)	B	0.013	Rectangular	∞	0.2886751	0.0038
Function						0.0006
Interpolation function (°C)	B	0.001	Rectangular		0.5773503	0.0006
Combined standard uncertainty for temperature measurement (°C)						0.00819934
Combined standard uncertainty for temperature measurement (Ohm)						0.00327974
Combined standard uncertainty, uc (Ohm)		0.004209711				
Coverage factor, *k*		2				
Expanded uncertainty, *U (Ohm)*		0.008419422				
Expanded uncertainty, *U (°C)*		0.021048555				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						0.00263913
PRT Reading (Ω)	A	0	Normal	201	1	0
Drift of PRT at Ice point (Ω)	B	0.0023	Rectangular	∞	0.2886751	0.0007
Self Heating of PRT (Ω)	B	0.0027	Rectangular	∞	0.2886751	0.0008
Calibration of indicator (Ω)	B	0.001	Rectangular	∞	0.5	0.0005
Drift of indicator (Ω)	B	0.001	Rectangular	∞	0.5773503	0.0006
Conduction error (Ω)	B	0.004	Rectangular	∞	0.5773503	0.0023
Contribution of Reference Standard						0.005
SPRT / PRT Reading (°C)	A	0	Normal	201	1	0
Calibration of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5	0.003
Drift of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5773503	0.0035
Calibration of indicator (°C)	B	0.0025	Rectangular	∞	0.5	0.0013
Drift of indicator (°C)	B	0.0025	Rectangular	∞	0.5773503	0.0014
Contribution Temperature Source						0.0065
Axial uniformity of enclosure / furnace (°C)	B	0.013	Rectangular	∞	0.2886751	0.0038
Radial uniformity of enclosure / furnace (°C)	B	0.013	Rectangular	∞	0.2886751	0.0038
Instability of enclosure / furnace (°C)	B	0.013	Rectangular	∞	0.2886751	0.0038
Function						0.0006
Interpolation function (°C)	B	0.001	Rectangular		0.5773503	0.0006
Combined standard uncertainty for temperature measurement (°C)						0.00819934
Combined standard uncertainty for temperature measurement (Ohm)						0.00319774
Combined standard uncertainty, uc (Ohm)		0.00414615				
Coverage factor, *k*		2				
Expanded uncertainty, *U (Ohm)*		0.008292299				
Expanded uncertainty, *U (°C)*		0.021262305				

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						0.00127737
PRT Reading (Ω)	A	0	Normal	189	1	0
Drift of PRT at Ice point (Ω)	B	0.0023	Rectangular	∞	0.2886751	0.0007
Self Heating of PRT (Ω)	B	0.0027	Rectangular	∞	0.2886751	0.0008
Calibration of indicator (Ω)	B	0.001	Rectangular	∞	0.5	0.0005
Drift of indicator (Ω)	B	0.001	Rectangular	∞	0.5773503	0.0006
Conduction error (Ω)	B	0	Rectangular	∞	0.5773503	0
Contribution of Reference Standard						0.0043
SPRT / PRT Reading (°C)	A	0	Normal	189	1	0
Calibration of SPRT / PRT (°C)	B	0.005	Rectangular	∞	0.5	0.0025
Drift of SPRT / PRT (°C)	B	0.005	Rectangular	∞	0.5773503	0.0029
Calibration of indicator (°C)	B	0.0025	Rectangular	∞	0.5	0.0013
Drift of indicator (°C)	B	0.0025	Rectangular	∞	0.5773503	0.0014
Contribution Temperature Source						0.0025
Axial uniformity of enclosure / furnace (°C)	B	0.005	Rectangular	∞	0.2886751	0.0014
Radial uniformity of enclosure / furnace (°C)	B	0.005	Rectangular	∞	0.2886751	0.0014
Instability of enclosure / furnace (°C)	B	0.005	Rectangular	∞	0.2886751	0.0014
Function						0.0006
Interpolation function (°C)	B	0.001	Rectangular		0.5773503	0.0006
Combined standard uncertainty for temperature measurement (°C)						0.00498122
Combined standard uncertainty for temperature measurement (Ohm)						0.00194267
Combined standard uncertainty, uc (Ohm)		0.002325005				
Coverage factor, *k*		2				
Expanded uncertainty, *U (Ohm)*		0.00465001				
Expanded uncertainty, *U (°C)*		0.011923102				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						0.00266927
PRT Reading (Ω)	A	0.0004	Normal	85	1	0.0004
Drift of PRT at Ice point (Ω)	B	0.0023	Rectangular	∞	0.2886751	0.0007
Self Heating of PRT (Ω)	B	0.0027	Rectangular	∞	0.2886751	0.0008
Calibration of indicator (Ω)	B	0.001	Rectangular	∞	0.5	0.0005
Drift of indicator (Ω)	B	0.001	Rectangular	∞	0.5773503	0.0006
Conduction error (Ω)	B	0.004	Rectangular	∞	0.5773503	0.0023
Contribution of Reference Standard						0.0051
SPRT / PRT Reading (°C)	A	0.001	Normal	85	1	0.001
Calibration of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5	0.003
Drift of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5773503	0.0035
Calibration of indicator (°C)	B	0.0025	Rectangular	∞	0.5	0.0013
Drift of indicator (°C)	B	0.0025	Rectangular	∞	0.5773503	0.0014
Contribution Temperature Source						0.02
Axial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Instability of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Function						0.0006
Interpolation function (°C)	B	0.001	Rectangular		0.5773503	0.0006
Combined standard uncertainty for temperature measurement (°C)						0.02063926
Combined standard uncertainty for temperature measurement (Ohm)						0.00784292
Combined standard uncertainty, uc (Ohm)		0.008284708				
Coverage factor, *k*		2				
Expanded uncertainty, *U (Ohm)*		0.016569417				
Expanded uncertainty, *U (°C)*		0.043603728				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						0.00275772
PRT Reading (Ω)	A	0.0008	Normal	102	1	0.0008
Drift of PRT at Ice point (Ω)	B	0.0023	Rectangular	∞	0.2886751	0.0007
Self Heating of PRT (Ω)	B	0.0027	Rectangular	∞	0.2886751	0.0008
Calibration of indicator (Ω)	B	0.001	Rectangular	∞	0.5	0.0005
Drift of indicator (Ω)	B	0.001	Rectangular	∞	0.5773503	0.0006
Conduction error (Ω)	B	0.004	Rectangular	∞	0.5773503	0.0023
Contribution of Reference Standard						0.0051
SPRT / PRT Reading (°C)	A	0.001	Normal	102	1	0.001
Calibration of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5	0.003
Drift of SPRT / PRT (°C)	B	0.006	Rectangular	∞	0.5773503	0.0035
Calibration of indicator (°C)	B	0.0025	Rectangular	∞	0.5	0.0013
Drift of indicator (°C)	B	0.0025	Rectangular	∞	0.5773503	0.0014
Contribution Temperature Source						0.02
Axial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Instability of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Function						0.0006
Interpolation function (°C)	B	0.001	Rectangular		0.5773503	0.0006
Combined standard uncertainty for temperature measurement (°C)						0.02063926
Combined standard uncertainty for temperature measurement (Ohm)						0.00763653
Combined standard uncertainty, uc (Ohm)		0.008119209				
Coverage factor, *k*		2				
Expanded uncertainty, *U (Ohm)*		0.016238417				
Expanded uncertainty, *U (°C)*		0.043887614				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						0.00279001
PRT Reading (Ω)	A	0.0003	Normal	129	1	0.0003
Drift of PRT at Ice point (Ω)	B	0.0023	Rectangular	∞	0.2886751	0.0007
Self Heating of PRT (Ω)	B	0.0027	Rectangular	∞	0.2886751	0.0008
Calibration of indicator (Ω)	B	0.0015	Rectangular	∞	0.5	0.0008
Drift of indicator (Ω)	B	0.0015	Rectangular	∞	0.5773503	0.0009
Conduction error (Ω)	B	0.004	Rectangular	∞	0.5773503	0.0023
Contribution of Reference Standard						0.0061
SPRT / PRT Reading (°C)	A	0.001	Normal	129	1	0.001
Calibration of SPRT / PRT (°C)	B	0.007	Rectangular	∞	0.5	0.0035
Drift of SPRT / PRT (°C)	B	0.007	Rectangular	∞	0.5773503	0.004
Calibration of indicator (°C)	B	0.0038	Rectangular	∞	0.5	0.0019
Drift of indicator (°C)	B	0.0038	Rectangular	∞	0.5773503	0.0022
Contribution Temperature Source						0.02
Axial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Instability of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Function						0.0006
Interpolation function (°C)	B	0.001	Rectangular		0.5773503	0.0006
Combined standard uncertainty for temperature measurement (°C)						0.02093131
Combined standard uncertainty for temperature measurement (Ohm)						0.00732596
Combined standard uncertainty, uc (Ohm)		0.00783925				
Coverage factor, *k*		2				
Expanded uncertainty, *U (Ohm)*		0.0156785				
Expanded uncertainty, *U (°C)*		0.044795714				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						0.00311689
PRT Reading (Ω)	A	0.001	Normal	106	1	0.001
Drift of PRT at Ice point (Ω)	B	0.0023	Rectangular	∞	0.2886751	0.0007
Self Heating of PRT (Ω)	B	0.0027	Rectangular	∞	0.2886751	0.0008
Calibration of indicator (Ω)	B	0.002	Rectangular	∞	0.5	0.001
Drift of indicator (Ω)	B	0.002	Rectangular	∞	0.5773503	0.0012
Conduction error (Ω)	B	0.004	Rectangular	∞	0.5773503	0.0023
Contribution of Reference Standard						0.0081
SPRT / PRT Reading (°C)	A	0.002	Normal	106	1	0.002
Calibration of SPRT / PRT (°C)	B	0.009	Rectangular	∞	0.5	0.0045
Drift of SPRT / PRT (°C)	B	0.009	Rectangular	∞	0.5773503	0.0052
Calibration of indicator (°C)	B	0.005	Rectangular	∞	0.5	0.0025
Drift of indicator (°C)	B	0.005	Rectangular	∞	0.5773503	0.0029
Contribution Temperature Source						0.02
Axial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Instability of enclosure / furnace (°C)	B	0.04	Rectangular	∞	0.2886751	0.0115
Function						0.0006
Interpolation function (°C)	B	0.001	Rectangular		0.5773503	0.0006
Combined standard uncertainty for temperature measurement (°C)						0.02159089
Combined standard uncertainty for temperature measurement (Ohm)						0.00755681
Combined standard uncertainty, uc (Ohm)		0.008174376				
Coverage factor, *k*		2				
Expanded uncertainty, *U (Ohm)*		0.016348751				
Expanded uncertainty, *U (°C)*		0.046710718				

6. JNMI-Jordan

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.003	Normal	9	2.5	0.0028
Drift of PRT at Ice point (Ω)	B	0.00042	Rectangular	I	2.5	0.0006
Self Heating of PRT (Ω)	B	0.002	Rectangular	I	2.5	0.0029
Calibration of indicator (°C)	B	0.008	Normal	I	1	0.004
Drift of indicator (°C)	B	0.008	Rectangular	I	1	0.0046
Conduction error (°C)	B	0.003	Rectangular	I	1	0.0017
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.006	Normal	9	1	0.0022
Calibration of SPRT / PRT (°C)	B	0.01	Normal	I	1	0.005
Drift of SPRT / PRT (°C)	B	0.005	Rectangular	I	1	0.0029
Calibration of indicator (°C)	B	0.01	Normal	I	1	0.005
Drift of indicator (°C)	B	0.01	Rectangular	I	1	0.0058
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (°C)	B	0.02	Rectangular	I	1	0.0115
Radial uniformity of enclosure /furnace (°C)	B	0.02	Rectangular	I	1	0.0115
Instability of enclosure / furnace (°C)	B	0.035	Rectangular	I	1	0.0202
Function						
Interpolation function (°C)	B	0.002	Rectangular	I	1	0.0012
Combined standard uncertainty, uc		0.029				
Coverage factor, *k*		2				
Expanded uncertainty, *U (oC)*		0.058				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.004	Normal	9	2.5	0.0037
Drift of PRT at Ice point (Ω)	B	0.00042	Rectangular	I	2.5	0.0006
Self Heating of PRT (Ω)	B	0.002	Rectangular	I	2.5	0.0029
Calibration of indicator (°C)	B	0.008	Normal	I	1	0.004
Drift of indicator (°C)	B	0.008	Rectangular	I	1	0.0046
Conduction error (°C)	B	0.003	Rectangular	I	1	0.0017
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.011	Normal	9	1	0.004
Calibration of SPRT / PRT (°C)	B	0.002	Normal	I	1	0.001
Drift of SPRT / PRT (°C)	B	0.005	Rectangular	I	1	0.0029
Calibration of indicator (°C)	B	0.01	Normal	I	1	0.005
Drift of indicator (°C)	B	0.01	Rectangular	I	1	0.0058
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (°C)	B	0.01	Rectangular	I	1	0.0058
Radial uniformity of enclosure /furnace (°C)	B	0.005	Rectangular	I	1	0.0029
Instability of enclosure / furnace (°C)	B	0.025	Rectangular	I	1	0.0144
Function						
Interpolation function (°C)	B	0.002	Rectangular	I	1	0.0012
Combined standard uncertainty, uc		0.02				
Coverage factor, *k*		2				
Expanded uncertainty, *U (°C)*		0.04				

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0003	Normal	9	2.5	0.0003
Drift of PRT at Ice point (Ω)	B	0.00042	Rectangular	I	2.5	0.0006
Self Heating of PRT (Ω)	B	0.002	Rectangular	I	2.5	0.0029
Calibration of indicator (°C)	B	0.008	Normal	I	1	0.004
Drift of indicator (°C)	B	0.008	Rectangular	I	1	0.0046
Conduction error (°C)	B	0.003	Rectangular	I	1	0.0017
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A					
Calibration of SPRT / PRT (°C)	B					
Drift of SPRT / PRT (°C)	B					
Calibration of indicator (°C)	B					
Drift of indicator (°C)	B					
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (°C)	B	0.005	Rectangular	I	1	0.0029
Radial uniformity of enclosure /furnace (°C)	B					
Instability of enclosure / furnace (°C)	B					
Function						
Interpolation function (°C)	B					
Combined standard uncertainty, uc		0.008				
Coverage factor, *k*		2				
Expanded uncertainty, *U (°C)*		0.016				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0007	Normal	9	2.5	0.0006
Drift of PRT at Ice point (Ω)	B	0.00042	Rectangular	I	2.5	0.0006
Self Heating of PRT (Ω)	B	0.002	Rectangular	I	2.5	0.0029
Calibration of indicator (°C)	B	0.008	Normal	I	1	0.004
Drift of indicator (°C)	B	0.008	Rectangular	I	1	0.0046
Conduction error (°C)	B	0.003	Rectangular	I	1	0.0017
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.002	Normal	9	1	0.0007
Calibration of SPRT / PRT (°C)	B	0.002	Normal	I	1	0.001
Drift of SPRT / PRT (°C)	B	0.005	Rectangular	I	1	0.0029
Calibration of indicator (°C)	B	0.012	Normal	I	1	0.006
Drift of indicator (°C)	B	0.012	Rectangular	I	1	0.0069
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (°C)	B	0.01	Rectangular	I	1	0.0058
Radial uniformity of enclosure /furnace (°C)	B	0.005	Rectangular	I	1	0.0029
Instability of enclosure / furnace (°C)	B	0.025	Rectangular	I	1	0.0144
Function						
Interpolation function (°C)	B	0.002	Rectangular	I	1	0.0012
Combined standard uncertainty, uc		0.02				
Coverage factor, *k*		2				
Expanded uncertainty, *U (°C)*		0.04				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0006	Normal	9	2.5	0.0006
Drift of PRT at Ice point (Ω)	B	0.00042	Rectangular	I	2.5	0.0006
Self Heating of PRT (Ω)	B	0.002	Rectangular	I	2.5	0.0029
Calibration of indicator (°C)	B	0.008	Normal	I	1	0.004
Drift of indicator (°C)	B	0.008	Rectangular	I	1	0.0046
Conduction error (°C)	B	0.003	Rectangular	I	1	0.0017
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.003	Normal	9	1	0.0011
Calibration of SPRT / PRT (°C)	B	0.002	Normal	I	1	0.001
Drift of SPRT / PRT (°C)	B	0.005	Rectangular	I	1	0.0029
Calibration of indicator (°C)	B	0.015	Normal	I	1	0.0075
Drift of indicator (°C)	B	0.015	Rectangular	I	1	0.0087
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (°C)	B	0.01	Rectangular	I	1	0.0058
Radial uniformity of enclosure /furnace (°C)	B	0.005	Rectangular	I	1	0.0029
Instability of enclosure / furnace (°C)	B	0.025	Rectangular	I	1	0.0144
Function						
Interpolation function (°C)	B	0.002	Rectangular	I	1	0.0012
Combined standard uncertainty, uc		0.022				
Coverage factor, *k*		2				
Expanded uncertainty, *U (°C)*		0.044				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0005	Normal	9	2.5	0.0005
Drift of PRT at Ice point (Ω)	B	0.00042	Rectangular	I	2.5	0.0006
Self Heating of PRT (Ω)	B	0.002	Rectangular	I	2.5	0.0029
Calibration of indicator (°C)	B	0.009	Normal	I	1	0.0045
Drift of indicator (°C)	B	0.009	Rectangular	I	1	0.0052
Conduction error (°C)	B	0.003	Rectangular	I	1	0.0017
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.003	Normal	9	1	0.0011
Calibration of SPRT / PRT (°C)	B	0.015	Normal	I	1	0.0075
Drift of SPRT / PRT (°C)	B	0.015	Rectangular	I	1	0.0087
Calibration of indicator (°C)	B	0.018	Normal	I	1	0.009
Drift of indicator (°C)	B	0.018	Rectangular	I	1	0.0104
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (°C)	B	0.02	Rectangular	I	1	0.0115
Radial uniformity of enclosure /furnace (°C)	B	0.015	Rectangular	I	1	0.0087
Instability of enclosure / furnace (°C)	B	0.03	Rectangular	I	1	0.0173
Function						
Interpolation function (°C)	B	0.002	Rectangular	I	1	0.0012
Combined standard uncertainty, uc		0.03				
Coverage factor, *k*		2				
Expanded uncertainty, *U (°C)*		0.06				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0007	Normal	9	2.5	0.0006
Drift of PRT at Ice point (Ω)	B	0.00042	Rectangular	I	2.5	0.0006
Self Heating of PRT (Ω)	B	0.002	Rectangular	I	2.5	0.0029
Calibration of indicator (°C)	B	0.009	Normal	I	1	0.0045
Drift of indicator (°C)	B	0.009	Rectangular	I	1	0.0052
Conduction error (°C)	B	0.003	Rectangular	I	1	0.0017
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.003	Normal	9	1	0.0011
Calibration of SPRT / PRT (°C)	B	0.015	Normal	I	1	0.0075
Drift of SPRT / PRT (°C)	B	0.015	Rectangular	I	1	0.0087
Calibration of indicator (°C)	B	0.02	Normal	I	1	0.01
Drift of indicator (°C)	B	0.02	Rectangular	I	1	0.0115
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (°C)	B	0.02	Rectangular	I	1	0.0115
Radial uniformity of enclosure /furnace (°C)	B	0.015	Rectangular	I	1	0.0087
Instability of enclosure / furnace (°C)	B	0.03	Rectangular	I	1	0.0173
Function						
Interpolation function (°C)	B	0.002	Rectangular	I	1	0.0012
Combined standard uncertainty, uc		0.031				
Coverage factor, *k*		2				
Expanded uncertainty, *U (°C)*		0.062				

7. NMI-Australia

Quantity	Type	Unit	Uncertainty contribution	k	Sensitivity Coefficient	Degree of Freedom	Standard Uncertainty	nu(i)
Contribution of PRT(Artefact)								
1.PRT reading (noise)	A		included in 15					
2.Drift of PRT at IP	B	mK	6	3.46	2.8	8	4.86	69.47727
3.SelfHeat of PRT	B		0.00005	2	2500	2	0.06	7.63E-06
4.Calibration of indicator	B	Ohm	232	2.02	0.003	40	0.34	0.000352
5.Drift of indicator								
6.Conduction error	B	mK	0.1	1.73	1	2	0.06	5.58E-06
Contribution of Reference Standard								
7.SPRT reading (noise)	A		included in 15					
8.Calibration of SPRT	B	mK	1	2	1	59	0.50	0.001059
9.Drift of PRT	B	mK	0.8	3.46	2.8	8	0.65	0.021958
10.Calibration of indicator	B	Ohm	58	2.02	0.01	40	0.29	0.00017
11.Drift of indicator								
Contribution of Temperature Source								
12.Uniformity of enclosure	B	mK	4	2	1	59	2.00	0.271186
13.Interpolation function	B	mK	4.39	1.73	1	12	2.54	3.455353
14. IcePoint Purity	B	mK	0.6	2.04	2.8	31	0.82	0.014837
Nu Effective								17.27531
Combined standard uncertainty		mK					5.96	
Coverage factor							2.11	
Expanded uncertainty		mK					12.58	

8. KRISS-South Korea

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.1	t	99	1	0.1
Drift of PRT at Ice point (mK)	B	1.9	rectangular	∞	1	1.9
Self Heating of PRT (mK)	B	0.6	normal	∞	1	0.6
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0	t	199	1	0
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0	normal	∞	1	0
Instability of enclosure / furnace (mK)	B	0.2	normal	∞	1	0.2
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3				
Coverage factor, k		1.96				
Expanded uncertainty, U *(mK)*		5.9				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.5	t	99	1	0.5
Drift of PRT at Ice point (mK)	B	1.5	rectangular	∞	1	1.5
Self Heating of PRT (mK)	B	0.5	normal	∞	1	0.5
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	1.4	t	199	1	1.4
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3.4				
Coverage factor, k		1.96				
Expanded uncertainty, U *(mK)*		6.6				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.5	t	99	1	0.5
Drift of PRT at Ice point (mK)	B	1.7	rectangular	∞	1	1.7
Self Heating of PRT (mK)	B	0.5	normal	∞	1	0.5
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	2	t	199	1	2
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3.7				
Coverage factor, k		1.96				
Expanded uncertainty, U *(mK)*		7.2				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.5	t	99	1	0.5
Drift of PRT at Ice point (mK)	B	2.6	rectangular	∞	1	2.6
Self Heating of PRT (mK)	B	0.8	normal	∞	1	0.8
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.7	t	199	1	0.7
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	0.3	normal	∞	1	0.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3.7				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		7.2				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.5	t	99	1	0.5
Drift of PRT at Ice point (mK)	B	3.3	rectangular	∞	1	3.3
Self Heating of PRT (mK)	B	1	normal	∞	1	1
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	1.6	t	199	1	1.6
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	1.4	normal	∞	1	1.4
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	1.4	normal	∞	1	1.4
Function						
Interpolation function (mK)	B	0.1	normal	∞	1	0.1
Combined standard uncertainty, u_c		4.9				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		9.5				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.9	t	99	1	0.9
Drift of PRT at Ice point (mK)	B	4	rectangular	∞	1	4
Self Heating of PRT (mK)	B	1.2	normal	∞	1	1.2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	1.9	t	199	1	1.9
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		6.7				
Coverage factor, k		1.96				
Expanded uncertainty, U *(mK)*		13.2				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	1.6	t	99	1	1.6
Drift of PRT at Ice point (mK)	B	4.6	rectangular	∞	1	4.6
Self Heating of PRT (mK)	B	1.4	normal	∞	1	1.4
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	3.2	t	199	1	3.2
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		7.7				
Coverage factor, k		1.96				
Expanded uncertainty, U *(mK)*		15.2				

9. NML,SIRIM-Malaysia (after circulation)

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0030	normal	2	1	0.0030
Drift of PRT at Ice point (°C)	B	0.0088	rectangular	60	1	0.0051
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.007				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.013				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0030	normal	2	1	0.0030
Drift of PRT at Ice point (°C)	B	0.0088	rectangular	60	1	0.0051
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0030	rectangular	60	1	0.0012
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.018				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.035				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0030	normal	2	1	0.0030
Drift of PRT at Ice point (°C)	B	0.0088	rectangular	60	1	0.0051
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0020	rectangular	60	1	0.0012
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.018				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.035				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0152	normal	3	1	0.0152
Drift of PRT at Ice point (°C)	B	0.0088	rectangular	60	1	0.0051
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.019				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.038				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0152	normal	3	1	0.0152
Drift of PRT at Ice point (°C)	B	0.0088	rectangular	60	1	0.0051
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.022				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.043				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0152	normal	3	1	0.0152
Drift of PRT at Ice point (°C)	B	0.0088	rectangular	60	1	0.0051
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.020				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.040				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (v_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0152	normal	3	1	0.0152
Drift of PRT at Ice point (°C)	B	0.0088	rectangular	60	1	0.0051
Self Heating of PRT(°C)	B	0.0050	rectangular	60	1	0.0029
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.020				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.040				

Loop B

1. NMI-Australia (Before circulation)

From -50 deg C to 80 deg C

Quantity	Type	Unit	Uncertainty contribution	k	Sensitivity Coefficient	Degree of Freedom	Standard Uncertainty	nu(i)
Contribution of PRT(Artefact)								
1.PRT reading (noise)	A		included in 15					
2.Drift of PRT at IP	B	mK	0.3	3.46	1.4	8	0.12	2.71E-05
3.SelfHeat of PRT	B		0.00003	2	2500	2	0.04	9.89E-07
4.Calibration of indicator	B	Ohm	232	2.02	0.003	40	0.34	0.000352
5.Drift of indicator								
6.Conduction error	B	mK	0.1	1.73	1	2	0.06	5.58E-06
Contribution of Reference Standard								
7.SPRT reading (noise)	A		included in 15					
8.Calibration of SPRT	B	mK	1	2	1	59	0.50	0.001059
9.Drift of PRT	B	mK	0.46	3.46	1.4	8	0.19	0.00015
10.Calibration of indicator	B	Ohm	58	2.02	0.01	40	0.29	0.00017
11.Drift of indicator								
Contribution of Temperature Source								
12.Uniformity of enclosure	B	mK	2	2	1	59	1.00	0.016949
13.Interpolation function	B	mK	4	1.73	1	12	2.31	2.38163
14. IcePoint Purity	B	mK	0.6	2.04	1.4	31	0.41	0.000927
Nu Effective								20.52743
Combined standard uncertainty		mK					2.65	
Coverage factor							2.09	
Expanded uncertainty		mK					5.53	

From 80 deg C to 200 deg C

Quantity	Type	Unit	Uncertainty contribution	k	Sensitivity Coefficient	Degree of Freedom	Standard Uncertainty	nu(i)
Contribution of PRT(Artefact)								
1.PRT reading (noise)	A		included in 15					
2.Drift of PRT at IP	B	mK	1.3	3.46	1.9	8	0.71	0.032463
3.SelfHeat of PRT	B		0.00003	2	2500	2	0.04	9.89E-07
4.Calibration of indicator	B	Ohm	232	2.02	0.003	40	0.34	0.000352
5.Drift of indicator								
6.Conduction error	B	mK	0.1	1.73	1	2	0.06	5.58E-06
Contribution of Reference Standard								
7.SPRT reading (noise)	A		included in 15					
8.Calibration of SPRT	B	mK	1	2	1	59	0.50	0.001059
9.Drift of PRT	B	mK	0.38	3.46	1.9	8	0.21	0.000237
10.Calibration of indicator	B	Ohm	58	2.02	0.01	40	0.29	0.00017
11.Drift of indicator								
Contribution of Temperature Source								
12.Uniformity of enclosure	B	mK	6.65	2	1	59	3.33	2.071641
13.Interpolation function	B	mK	4	1.73	1	12	2.31	2.38163
14. IcePoint Purity	B	mK	0.6	2.04	1.9	31	0.56	0.003146
Nu Effective								69.9452
Combined standard uncertainty		mK					4.21	
Coverage factor							1.99	
Expanded uncertainty		mK					8.40	

From 200 deg C to 420 deg C

Quantity	Type	Unit	Uncertainty contribution	k	Sensitivity Coefficient	Degree of Freedom	Standard Uncertainty	nu(i)
Contribution of PRT(Artefact)								
1.PRT reading (noise)	A		included in 15					
2.Drift of PRT at IP	B	mK	2.3	3.46	2.9	8	1.93	1.726271
3.SelfHeat of PRT	B		0.00003	2	2500	2	0.04	9.89E-07
4.Calibration of indicator	B	Ohm	232	2.02	0.003	40	0.34	0.000352
5.Drift of indicator								
6.Conduction error	B	mK	0.1	1.73	1	2	0.06	5.58E-06
Contribution of Reference Standard								
7.SPRT reading (noise)	A		included in 15					
8.Calibration of SPRT	B	mK	1	2	1	59	0.50	0.001059
9.Drift of PRT	B	mK	0.38	3.46	2.9	8	0.32	0.001286
10.Calibration of indicator	B	Ohm	58	2.02	0.01	40	0.29	0.00017
11.Drift of indicator								
Contribution of Temperature Source								
12.Uniformity of enclosure	B	mK	3.5	2	1	59	1.75	0.158965
13.Interpolation function	B	mK	7.2	1.73	1	12	4.16	25.0014
14. IcePoint Purity	B	mK	0.6	2.04	2.9	31	0.85	0.017073
Nu Effective								23.94862
Combined standard uncertainty		mK					5.04	
Coverage factor							2.07	
Expanded uncertainty		mK					10.42	

2. NISIT-Papua New Guinea

IP1	ice point components	Initial Ice point						
	units are in Deg C							
	Component	vi	ki	ci	Ui	ui	ui^2	*ci*ui^4/vi*
A	*Contribution of PRT(artefact)*							
1	PRT reading (type A)	80	1	2.73	0.00000481	0.0000131	1.72E-10	1.01E-21
2	Drift of PRT at icepoint	10	1.73	2.73	0.00000227	0.00000358	1.28E-11	4.48E-23
3	Self heating of the IPRT	3	3	1	0.0005	0.000167	2.78E-08	2.57E-16
4	Drift of the Bridge indicator (DUT Port)	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
5	Resistance Bridge Calibration (indicator)	60	2	1	0.0008	0.0004	0.00000016	4.27E-16
6	Mean reading for Ro (type A)	80	1	10.1	0	0	0	0
7	Mean reading for Rt (type A)	80	1	12	0	0	0	0
8								
B	*Contribution of the Standard*							
1	SPRT reading (scatter) Type A	80	1	1	0	0	0	0
2	Calibration of the SPRT	60	2	1	0.0004	0.0002	0.00000004	2.67E-17
3	Drift of the SPRT	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
4	Drift of the Bridge (SPRT port)	3	1.73	1	0.001	0.000578	3.34E-07	3.72E-14
5	Calibration of the Bridge indicator(port)	60	2	1	0.0008	0.0004	0.00000016	4.27E-16
C	*Contribution of the temperature source*							
1	Axial Uniformity of the enclosure	10	2	1	0.001	0.0005	0.00000025	6.25E-15
2	Redial uniformity of the enclosure	10	2	1	0.001	0.0005	0.00000025	6.25E-15
3	Instability of the enclosure	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
D	*Function*							
1	Interpolation function	2	1.73	1	0.01	0.00578	0.0000334	5.58E-10
E	*Rounding of the final result*	100	1.73	1	0.0005	0.000289	8.35E-08	6.98E-17
		uc	veff	k	U95			
		0.0059	2.1904	3.9508	0.0234			

	units are in Deg C			TP	-30	50	100	150	200
	Component	vi	ki	ci	Ui	Ui	Ui	Ui	Ui
A	*Contribution of PRT(artefact)*								
1	PRT reading (type A)	80	1	1	0.000154	0.0000212	0.000313	0.0000532	0.000247
2	Drift of PRT at icepoint	10	1.73	2.73	0.0015	0.0015	0.0015	0.0015	0.0015
3	Self Heating of the IPRT	3	3	1	0.0005	0.0005	0.0005	0.0005	0.0005
4	Drift of the Bridge indicator (DUT Port)	3	1.73	1	0.0005	0.0005	0.0005	0.0005	0.0005
5	Resistance Bridge Calibration (indicator)	60	2	1	0.0008	0.0008	0.0008	0.0008	0.0008
6	Mean reading for Ro (type A)	80	1	10.1	0.0000517	0.0000517	0.0000517	0.0000517	0.0000517
7	Mean reading for Rt (type A)	80	1	12	0.0000405	0.0000405	0.0000405	0.0000405	0.0000405
B	*Contribution of the Standard*								
1	SPRT reading (scatter) Type A	80	1	1	0.000344	0.0000545	0.000549	0.000554	0.000603
2	Calibration of the SPRT	60	2	1	0.0004	0.0015	0.0015	0.0015	0.0015
3	Drift of the SPRT	3	1.73	1	0.0005	0.0005	0.0005	0.0005	0.0005
4	Drift of the Bridge (SPRT port)	3	1.73	1	0.001	0.001	0.001	0.001	0.001
5	Calibration of the Bridge indicator(port)	60	2	1	0.0008	0.0008	0.0008	0.0008	0.0008
C	*Contribution of the temperature source*								
1	Axial Uniformity of the enclosure	10	2	1	0.02	0.02	0.03	0.03	0.03
2	Redial uniformity of the enclosure	10	2	1	0.005	0.005	0.01	0.01	0.01
3	Instability of the enclosure	3	1.73	1	0.005	0.001	0.005	0.005	0.005
D	*Function*								
1	Interpolation function	2	1.73	1	0.01	0.01	0.01	0.01	0.01
E	*Rounding of the final result*	1	1.73	1	0.0005	0.0005	0.0005	0.0005	0.0005
				uc	0.0166	0.0162	0.0238	0.0238	0.0238
				veff	42.9	38.8	54.1	54.1	54.2
				k	2.02	2.03	2.01	2.01	2.01
				U95	0.034	0.033	0.048	0.048	0.048

IP2	ice point components	Second Ice Point						
	units are in Deg C			TP				
	Component	vi	ki	ci	Ui	ui	ui^2	***ci*ui^4/vi***
A	*Contribution of PRT(artefact)*							
1	PRT reading (type A)	80	1	2.73	0.00000491	0.0000134	1.8E-10	1.1E-21
2	Drift of PRT at icepoint	10	1.73	2.73	0.0015	0.00237	0.0000056	8.57E-12
3	Self heating of the IPRT	3	3	1	0.0005	0.000167	2.78E-08	2.57E-16
4	Drift of the Bridge indicator (DUT Port)	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
5	Resistance Bridge Calibration (indicator)	60	2	1	0.0008	0.0004	0.00000016	4.27E-16
6	Mean reading for Ro (type A)	80	1	10.1	0	0	0	0
7	Mean reading for Rt (type A)	80	1	12	0	0	0	0
8								
B	*Contribution of the Standard*							
1	SPRT reading (scatter) Type A	80	1	1	0.00000502	0.00000502	2.52E-11	7.94E-24
2	Calibration of the SPRT	60	2	1	0.0004	0.0002	0.00000004	2.67E-17
3	Drift of the SPRT	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
4	Drift of the Bridge (SPRT port)	3	1.73	1	0.001	0.000578	3.34E-07	3.72E-14
5	Calibration of the Bridge indicator(port)	60	2	1	0.0008	0.0004	0.00000016	4.27E-16
C	*Contribution of the temperature source*							
1	Axial Uniformity of the enclosure	10	2	1	0.001	0.0005	0.00000025	6.25E-15
2	Redial uniformity of the enclosure	10	2	1	0.001	0.0005	0.00000025	6.25E-15
3	Instability of the enclosure	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
D	*Function*							
1	Interpolation function	2	1.73	1	0.01	0.00578	0.0000334	5.58E-10
E	*Rounding of the final result*	100	1.73	1	0.0005	0.000289	8.35E-08	6.98E-17
		uc	veff	k	U95			
		0.0064	2.9039	3.2355	0.0206			

IP3	ice point components	Final Ice Point						
	units are in Deg C			TP				
	Component	vi	ki	ci	Ui	ui	ui^2	ci*ui^4/vi
A	*Contribution of PRT(artefact)*							
1	PRT reading (type A)	80	1	1	0.00000429	0.00000429	0.00000429	4.23E-24
2	Drift of PRT at icepoint	10	1.73	2.73	0.00000227	0.00000358	1.28E-11	4.48E-23
3	Self heating of the IPRT	3	3	1	0.0005	0.000167	2.78E-08	2.57E-16
4	Drift of the Bridge indicator (DUT Port)	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
5	Resistance Bridge Calibration (indicator)	60	2	1	0.0008	0.0004	0.00000016	4.27E-16
6	Mean reading for Ro (type A)	80	1	10.1	0	0	0	0
7	Mean reading for Rt (type A)	80	1	12	0	0	0	0
8								
B	*Contribution of the Standard*							
1	SPRT reading (scatter) Type A	80	1	1	0.00000321	0.00000321	1.03E-11	1.33E-24
2	Calibration of the SPRT	60	2	1	0.0004	0.0002	0.00000004	2.67E-17
3	Drift of the SPRT	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
4	Drift of the Bridge (SPRT port)	3	1.73	1	0.001	0.000578	3.34E-07	3.72E-14
5	Calibration of the Bridge indicator(port)	60	2	1	0.0008	0.0004	0.00000016	4.27E-16
C	*Contribution of the temperature source*							
1	Axial Uniformity of the enclosure	10	2	1	0.001	0.0005	0.00000025	6.25E-15
2	Redial uniformity of the enclosure	10	2	1	0.001	0.0005	0.00000025	6.25E-15
3	Instability of the enclosure	3	1.73	1	0.0005	0.000289	8.35E-08	2.33E-15
D	*Function*							
1	Interpolation function	2	1.73	1	0.01	0.00578	0.0000334	5.58E-10
E	*Rounding of the final result*	100	1.73	1	5.00E-04	0.000289	8.35E-08	6.98E-17
		uc	veff	k	U95			
		0.0063	2.7607	3.3356	0.0209			

3. NIM-China

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0000642	normal		2.6	0.0002
Drift of PRT at Ice point (Ω)	B	0.00124	uniform		2.6	0.0018
Self Heating of PRT (Ω)	B	0.00009	----		2.6	0.0002
Calibration of indicator (Ω)	B	0.0000001	normal		2.6	0
Drift of indicator (Ω)	B	0.0006	uniform		2.6	0.0009
Conduction error (Ω)	B	0	uniform		2.6	0
Contribution of Reference Standard						
Reproducibility of the triple point of water (°C)	B	0.0004	normal		1	0.0004
Drift of indicator (°C)	B	0	uniform		1	0
Calibration of indicator (Ω)	B	0	normal			0
Conduction error (°C)	B	0	uniform		1	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0	---			0
Radial uniformity of enclosure / furnace (°C)	B	0	uniform		1	0
Instability of enclosure / furnace (°C)	B	0	arc sine		1	0
Function						
Interpolation function (°C)	B	0	----			0
Combined standard uncertainty, u_c		0.0021				
Coverage factor, k		2				
Expanded uncertainty, U		0.005				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0000974	normal		2.5	0.0002
Drift of PRT at Ice point (Ω)	B	0.00124	uniform		2.5	0.0018
Self Heating of PRT (Ω)	B	----	----			0
Calibration of indicator (Ω)	B	0.0000001	normal		2.5	0
Drift of indicator (Ω)	B	0.0005	uniform		2.5	0.0008
Conduction error (Ω)	B	0.00001	uniform		2.5	0
Contribution of Reference Standard						
SPRT Reading (°C)	A	0.0003	normal		1	0.0003
Calibration of SPRT (°C)	B	0.0018	normal		1	0.0018
Reproducibility of the triple point of water (°C)	B	0.0004	normal		1	0.0004
Stability of SPRT (°C)	B	0.001	uniform		1	0.0006
Drift of indicator (°C)	B	0.0012	uniform		1	0.0007
Calibration of indicator (Ω)	B	0.0000001	normal		2.5	0
Conduction error (°C)	B	0.001	uniform		1	0.0006
Contribution Temperature Source						
Axial uniformity of enclosure (°C)	B	0	---			0
Radial uniformity of enclosure (°C)	B	0.004	uniform		1	0.0023
Instability of enclosure (°C)	B	±0.002	arc sine		1	0.0028
Function						
Interpolation function (°C)	B	0	----			0
Combined standard uncertainty, u_c		0.0047				
Coverage factor, k		2				
Expanded uncertainty, U		0.01				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0000476	normal		2.5	0.0001
Drift of PRT at Ice point (Ω)	B	0.00124	uniform		2.5	0.0018
Self Heating of PRT (Ω)	B	----	----			0
Calibration of indicator (Ω)	B	0.0000001	normal		2.5	0
Drift of indicator (Ω)	B	0.0005	uniform		2.5	0.0007
Conduction error (Ω)	B	-0.00018	uniform		2.5	-0.0003
Contribution of Reference Standard						
SPRT Reading (°C)	A	0.0003	normal		1	0.0003
Calibration of SPRT (°C)	B	0.0025	normal		1	0.0025
Reproducibility of the triple point of water (°C)	B	0.0004	normal		1	0.0004
Stability of SPRT (°C)	B	0.001	uniform		1	0.0006
Drift of indicator (°C)	B	0.0012	uniform		1	0.0007
Calibration of indicator (Ω)	B	0.0000001	normal		2.5	0
Conduction error (°C)	B	0.001	uniform		1	0.0006
Contribution Temperature Source						
Axial uniformity of enclosure (°C)	B	0	---			0
Radial uniformity of enclosure (°C)	B	0.004	uniform		1	0.0023
Instability of enclosure (°C)	B	±0.002	arc sine		1	0.0028
Function						
Interpolation function (°C)	B	0	----			0
Combined standard uncertainty, u_c		0.005				
Coverage factor, k		2				
Expanded uncertainty, U		0.01				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0000757	normal		2.6	0.0002
Drift of PRT at Ice point (Ω)	B	0.00124	uniform		2.6	0.0019
Self Heating of PRT (Ω)	B	----	----			0
Calibration of indicator (Ω)	B	0.0000001	normal		2.6	0
Drift of indicator (Ω)	B	0.0008	uniform		2.6	0.0013
Conduction error (Ω)	B	0.0003	uniform		2.6	0.0005
Contribution of Reference Standard						
SPRT Reading (°C)	A	0.0002	normal		1	0.0002
Calibration of SPRT (°C)	B	0.0019	normal		1	0.0019
Reproducibility of the triple point of water (°C)	B	0.0004	normal		1	0.0004
Stability of SPRT (°C)	B	0.001	uniform		1	0.0006
Drift of indicator (°C)	B	0.0021	uniform		1	0.0012
Calibration of indicator (Ω)	B	0.0000001	normal		2.6	0
Conduction error (°C)	B	0.001	uniform		1	0.0006
Contribution Temperature Source						
Axial uniformity of enclosure (°C)	B	0	---			0
Radial uniformity of enclosure (°C)	B	0.004	uniform		1	0.0023
Instability of enclosure (°C)	B	±0.002	arc sine		1	0.0028
Function						
Interpolation function (°C)	B	0	----			0
Combined standard uncertainty, u_c		0.005				
Coverage factor, k		2				
Expanded uncertainty, U		0.01				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i) (°C)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0000798	normal		2.7	0.0002
Drift of PRT at Ice point (Ω)	B	0.00124	uniform		5.4	0.0039
Self Heating of PRT (Ω)	B	----	----			0
Calibration of indicator (Ω)	B	0.0000001	normal		2.7	0
Drift of indicator (Ω)	B	0.0011	uniform		2.7	0.0016
Conduction error (Ω)	B	0.00017	uniform		2.7	0.0003
Contribution of Reference Standard						
SPRT Reading (°C)	A	0.0001	normal		1	0.0001
Calibration of SPRT (°C)	B	0.0025	normal		1	0.0025
Reproducibility of the triple point of water (°C)	B	0.0004	normal		2	0.0008
Stability of SPRT (°C)	B	0.001	uniform		2	0.0012
Drift of indicator (°C)	B	0.0027	uniform		1	0.0016
Calibration of indicator (Ω)	B	0.0000001	normal		2.7	0
Conduction error (°C)	B	0.001	uniform		1	0.0006
Contribution Temperature Source						
Axial uniformity of enclosure (°C)	B	0	---			0
Radial uniformity of enclosure (°C)	B	0.004	uniform		1	0.0023
Instability of enclosure (°C)	B	±0.002	arc sine		1	0.0028
Function						
Interpolation function (°C)	B	0	----			0
Combined standard uncertainty, u_c		0.0065				
Coverage factor, k		2				
Expanded uncertainty, U		0.013				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i) (°C)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000696	normal		2.8	0.0019
Drift of PRT at Ice point (Ω)	B	0.00124	uniform		6.9	0.005
Self Heating of PRT (Ω)	B	----	----			0
Calibration of indicator (Ω)	B	0.0000001	normal		2.8	0
Drift of indicator (Ω)	B	0.0013	uniform		2.8	0.002
Conduction error (Ω)	B	0.00017	uniform		2.8	0.0003
Contribution of Reference Standard						
SPRT Reading (°C)	A	0.0003	normal		1	0.0003
Calibration of SPRT (°C)	B	0.0008	normal		1	0.0008
Reproducibility of the triple point of water (°C)	B	0.0004	normal		2.5	0.001
Stability of SPRT (°C)	B	0.001	uniform		2.5	0.0014
Drift of indicator (°C)	B	0.0033	uniform		1	0.0019
Calibration of indicator (Ω)	B	0.0000001	normal		2.8	0.0003
Conduction error(°C)	B	0.001	uniform		1	0.0006
Contribution Temperature Source						
Axial uniformity of enclosure (°C)	B	0	---			0
Radial uniformity of enclosure (°C)	B	0.004	uniform		1	0.0023
Instability of enclosure (°C)	B	±0.002	arc sin		1	0.0028
Function						
Interpolation function (°C)	B	0	----			0
Combined standard uncertainty, u_c		0.0073				
Coverage factor, k		2				
Expanded uncertainty, U		0.015				

4. NML,SIRIM-Malaysia

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0026	normal	2	1	0.0026
Drift of PRT at Ice point (°C)	B	0.0005	rectangular	60	1	0.0003
Self Heating of PRT(°C)	B	0.0025	rectangular	60	1	0.0014
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00058
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.003				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.006				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0026	normal	2	1	0.0026
Drift of PRT at Ice point (°C)	B	0.0005	rectangular	60	1	0.0003
Self Heating of PRT(°C)	B	0.0025	rectangular	60	1	0.0014
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0020	rectangular	60	1	0.0012
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.017				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.033				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0026	normal	2	1	0.0026
Drift of PRT at Ice point (°C)	B	0.0005	rectangular	60	1	0.0003
Self Heating of PRT(°C)	B	0.0025	rectangular	60	1	0.0014
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0030	rectangular	60	1	0.0012
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.017				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.033				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0090	normal	3	1	0.0090
Drift of PRT at Ice point (°C)	B	0.0005	rectangular	60	1	0.0003
Self Heating of PRT(°C)	B	0.0025	rectangular	60	1	0.0014
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.014				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.027				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0090	normal	3	1	0.0090
Drift of PRT at Ice point (°C)	B	0.0005	rectangular	60	1	0.0003
Self Heating of PRT(°C)	B	0.0025	rectangular	60	1	0.0014
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.017				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.034				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0090	normal	3	1	0.0090
Drift of PRT at Ice point (°C)	B	0.0005	rectangular	60	1	0.0003
Self Heating of PRT(°C)	B	0.0025	rectangular	60	1	0.0014
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.015				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.029				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0090	normal	3	1	0.0090
Drift of PRT at Ice point (°C)	B	0.0005	rectangular	60	1	0.0003
Self Heating of PRT(°C)	B	0.0025	rectangular	60	1	0.0014
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.015				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.029				

5. KRISS-South Korea

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.1	t	99	1	0.1
Drift of PRT at Ice point (mK)	B	1.4	rectangular	∞	1	1.4
Self Heating of PRT (mK)	B	0.2	normal	∞	1	0.2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0	t	199	1	0
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0	normal	∞	1	0
Instability of enclosure / furnace (mK)	B	0.2	normal	∞	1	0.2
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		2.7				
Coverage factor, k		1.96				
Expanded uncertainty, U		5.3				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.2	t	99	1	0.2
Drift of PRT at Ice point (mK)	B	1.1	rectangular	∞	1	1.1
Self Heating of PRT (mK)	B	0.2	normal	∞	1	0.2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.5	t	199	1	0.5
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		2.8				
Coverage factor, k		1.96				
Expanded uncertainty, U		5.5				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.3	t	99	1	0.3
Drift of PRT at Ice point (mK)	B	1.2	rectangular	∞	1	1.2
Self Heating of PRT (mK)	B	0.2	normal	∞	1	0.2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.2	t	199	1	0.2
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		2.8				
Coverage factor, k		1.96				
Expanded uncertainty, U		5.6				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.2	t	99	1	0.2
Drift of PRT at Ice point (mK)	B	1.9	rectangular	∞	1	1.9
Self Heating of PRT (mK)	B	0.3	normal	∞	1	0.3
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0	t	199	1	0
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	0.3	normal	∞	1	0.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3				
Coverage factor, k		1.96				
Expanded uncertainty, U		6				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.2	t	99	1	0.2
Drift of PRT at Ice point (mK)	B	2.5	rectangular	∞	1	2.5
Self Heating of PRT (mK)	B	0.4	normal	∞	1	0.4
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.5	t	199	1	0.5
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	1.4	normal	∞	1	1.4
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	1.4	normal	∞	1	1.4
Function						
Interpolation function (mK)	B	0.1	normal	∞	1	0.1
Combined standard uncertainty, u_c		4				
Coverage factor, k		1.96				
Expanded uncertainty, U		7.7				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.9	t	99	1	0.9
Drift of PRT at Ice point (mK)	B	3	rectangular	∞	1	3
Self Heating of PRT (mK)	B	0.5	normal	∞	1	0.5
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.4	t	199	1	0.4
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		5.8				
Coverage factor, k		1.96				
Expanded uncertainty, U		11.4				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	2.3	t	99	1	2.3
Drift of PRT at Ice point (mK)	B	3.4	rectangular	∞	1	3.4
Self Heating of PRT (mK)	B	0.6	normal	∞	1	0.6
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.9	t	199	1	0.9
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		6.5				
Coverage factor, k		1.96				
Expanded uncertainty, U		12.7				

6. BSTI-Bangladesh

t (°C)	0	-50	-30	0	100	200	300	400	0
δti (°C)	0.01635	-49.7288	-29.7813	0.0161	100.199	200.01375	299.3107	400.746	0.0166
error δti (mK)	-2.00	2.00	2.00	-2.00	-2.40	-5.00	-5.00	-5.00	-2.00
U(δti stdmean) (mK)	0.56	1.76	0.57	0.79	4.50	2.87	7.40	5.67	18.26
U(δti cal) (mK)	7.50	7.50	7.50	7.50	7.50	10.00	15.00	15.00	7.50
U(δti drift) (mK)	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35
U(δti resol) (mK)	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
U(δti immers) (mK)	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
U(δtbath homog) (mK	4.04	4.04	4.04	4.04	4.04	4.04	4.04	4.04	4.04
U(δtbath stab) (mK)	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89
Rti (°C)	-0.09433	-49.9549	-29.9532	-0.1057	100.177	200.036	298.5684	400.1027	-0.0934
U(δRti stdmean) (mK	29.71	10.72	26.71	11.58	10.63	15.50	8.91	30.58	27.50
U(δRti immers) (mK)	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
U(δRti resol) (mK)	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
U(δRti hyster) (mK)	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Ucombined (mK)	31.70	15.49	28.90	16.02	15.98	20.35	20.61	35.47	34.81
Veff	11.67	39.21	12.35	32.94	45.16	26.73	210.42	16.28	21.15
k (95%)	2.25	2.25	2.23	2.09	2.06	2.11	2	2.17	2.13
Uexp (0C) (mK)	71.32	34.85	64.46	33.49	32.91	42.94	41.22	76.97	74.15

7. NMI-Australia (Mid circulation)

Quantity	Type	Unit	Uncertainty contribution	k	Sensitivity Coefficient	Degree of Freedom	Standard Uncertainty	nu(i)
Contribution of PRT(Artefact)								
1.PRT reading (noise)	A		included in 15					
2.Drift of PRT at IP	B	mK	1.8	3.46	2.9	8	1.51	0.647571
3.SelfHeat of PRT	B		0.00002	2	2500	2	0.03	1.95E-07
4.Calibration of indicator	B	Ohm	232	2.02	0.003	40	0.34	0.000352
5.Drift of indicator								
6.Conduction error	B	mK	0.1	1.73	1	2	0.06	5.58E-06
Contribution of Reference Standard								
7.SPRT reading (noise)	A		included in 15					
8.Calibration of SPRT	B	mK	1	2	1	59	0.50	0.001059
9.Drift of PRT	B	mK	0.27	3.46	2.9	8	0.23	0.000328
10.Calibration of indicator	B	Ohm	58	2.02	0.01	40	0.29	0.00017
11.Drift of indicator								
Contribution of Temperature Source								
12.Uniformity of enclosure	B	mK	3	2	1	59	1.50	0.085805
13.Interpolation function	B	mK	3.43	1.73	1	12	1.98	1.287689
14. IcePoint Purity	B	mK	0.6	2.04	2.9	31	0.85	0.017073
Nu Effective								46.03457
Combined standard uncertainty		mK					3.11	
Coverage factor							2.01	
Expanded uncertainty		mK					6.27	

8.CMS-Taiwan

ICE POINT-I Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.001474187**	--	**∞**	**1**	**0.001474187**
PRT Reading	--	**0.000073**	--	∞		**0.000073**
L&N Readouts	A	0	t	16		0
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.001404264**	Rectangular	500000		**0.001404264**
Self Heating of PRT	B	**0.000442651**	Rectangular	500000		**0.000442651**
Contribution of Reference Standard	--	**0.002930887**	--	**∞**	**-1**	**0.002930887**
SPRT / PRT Reading	--	**0.000073**	--	∞		**0.000073**
SPRT Readouts	A	0	t	17		0
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0005**	Rectangular	500000		**0.0005**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000885**	Rectangular	500000	**1**	**0.000885**
Calibration of standard resistor	**B**	**0.000033**	Rectangular	500000	**1**	**0.000033**
Ambient temperature effect on standard resistor	**B**	**0.001129**	Rectangular	500000	**1**	**0.001129**
Contribution of Temperature Source	**B**	**0.000494245**	--	**∞**	**1**	**0.000494245**
Axial uniformity of enclosure /furnace	B	0.000283	Rectangular	500000		0.000283
Radial uniformity of enclosure /furnace	B	0.000283	Rectangular	500000		0.000283
Instability of enclosure / furnace	B	0.00029	Rectangular	500000		0.00029
Combined standard uncertainty, u_c	(°C)	0.0036				
Effective degrees of freedom, ν_{eff}		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.008				

-50 ℃ Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.001477845**	--	**∞**	**1**	**0.001477845**
PRT Reading	--	**0.000127**	--	∞		**0.000127**
L&N Readouts	A	0.000104	t	18		0.000104
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.001404264**	Rectangular	500000		**0.001404264**
Self Heating of PRT	B	**0.000442651**	Rectangular	500000		**0.000442651**
Contribution of Reference Standard	--	**0.002932558**	--	**∞**	**-1**	**0.002932558**
SPRT / PRT Reading	--	**0.000123**	--	∞		**0.000123**
SPRT Readouts	A	0.000099	t	28		0.000099
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0005**	Rectangular	500000		**0.0005**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000707**	Rectangular	500000	**1**	**0.000707**
Calibration of standard resistor	**B**	**0.000033**	Rectangular	500000	**1**	**0.000033**
Ambient temperature effect on standard resistor	**B**	**0.001129**	Rectangular	500000	**1**	**0.001129**
Contribution of Temperature Source	**B**	**0.002802622**	--	**∞**	**1**	**0.002802622**
Axial uniformity of enclosure /furnace	B	0.001116	Rectangular	500000		0.001116
Radial uniformity of enclosure /furnace	B	0.001673	Rectangular	500000		0.001673
Instability of enclosure / furnace	B	0.001952	Rectangular	500000		0.001952
Combined standard uncertainty, u c	(°C)	0.0045				
Effective degrees of freedom, νeff		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.009				

-30 ℃ Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.001509125**	--	**∞**	**1**	**0.001509125**
PRT Reading	--	**0.000331**	--	∞		**0.000331**
L&N Readouts	A	0.000323	t	17		0.000323
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.001404264**	Rectangular	500000		**0.001404264**
Self Heating of PRT	B	**0.000442651**	Rectangular	500000		**0.000442651**
Contribution of Reference Standard	--	**0.002934075**	--	**∞**	**-1**	**0.002934075**
SPRT / PRT Reading	--	**0.000155**	--	∞		**0.000155**
SPRT Readouts	A	0.000137	t	8		0.000137
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0005**	Rectangular	500000		**0.0005**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000779**	Rectangular	500000	**1**	**0.000779**
Calibration of standard resistor	**B**	**0.000033**	Rectangular	500000	**1**	**0.000033**
Ambient temperature effect on standard resistor	**B**	**0.001129**	Rectangular	500000	**1**	**0.001129**
Contribution of Temperature Source	**B**	**0.002764585**	--	**∞**	**1**	**0.002764585**
Axial uniformity of enclosure /furnace	B	0.001404	Rectangular	500000		0.001404
Radial uniformity of enclosure /furnace	B	0.001684	Rectangular	500000		0.001684
Instability of enclosure / furnace	B	0.001684	Rectangular	500000		0.001684
Combined standard uncertainty, u c	(°C)	0.0045				
Effective degrees of freedom, νeff		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.009				

ICE POINT-II Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.001474187**	--	**∞**	**1**	**0.001474187**
PRT Reading	--	**0.000073**	--	∞		**0.000073**
L&N Readouts	A	0	t	26		0
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.001404264**	Rectangular	500000		**0.001404264**
Self Heating of PRT	B	**0.000442651**	Rectangular	500000		**0.000442651**
Contribution of Reference Standard	--	**0.002930887**	--	**∞**	**-1**	**0.002930887**
SPRT / PRT Reading	--	**0.000073**	--	∞		**0.000073**
SPRT Readouts	A	0	t	26		0
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0005**	Rectangular	500000		**0.0005**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000885**	Rectangular	500000	**1**	**0.000885**
Calibration of standard resistor	**B**	**0.000033**	Rectangular	500000	**1**	**0.000033**
Ambient temperature effect on standard resistor	**B**	**0.001129**	Rectangular	500000	**1**	**0.001129**
Contribution of Temperature Source	**B**	**0.000494245**	--	**∞**	**1**	**0.000494245**
Axial uniformity of enclosure /furnace	B	0.000283	Rectangular	500000		0.000283
Radial uniformity of enclosure /furnace	B	0.000283	Rectangular	500000		0.000283
Instability of enclosure / furnace	B	0.00029	Rectangular	500000		0.00029
Combined standard uncertainty, u_c	(°C)	0.0036				
Effective degrees of freedom, ν_{eff}		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.008				

100 ℃ Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.00151364**	--	**∞**	**1**	**0.00151364**
PRT Reading	--	**0.000351**	--	∞		**0.000351**
L&N Readouts	A	0.000343	t	26		0.000343
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.00140426**	Rectangular	500000		**0.00140426**
Self Heating of PRT	B	**0.00044265**	Rectangular	500000		**0.00044265**
Contribution of Reference Standard	--	**0.00294158**	--	**∞**	**-1**	**0.00294158**
SPRT / PRT Reading	--	**0.000261**	--	∞		**0.000261**
SPRT Readouts	A	0.000251	t	26		0.000251
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0005**	Rectangular	500000		**0.0005**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000616**	Rectangular	500000	**1**	**0.000616**
Calibration of standard resistor	**B**	**0.000055**	Rectangular	500000	**1**	**0.000055**
Ambient temperature effect on standard res	**B**	**0.001897**	Rectangular	500000	**1**	**0.001897**
Contribution of Temperature Source	**B**	**0.0076531**	--	**∞**	**1**	**0.0076531**
Axial uniformity of enclosure / furnace	B	0.00432	Rectangular	500000		0.00432
Radial uniformity of enclosure /	B	0.005761	Rectangular	500000		0.005761
Instability of enclosure / furnace	B	0.002592	Rectangular	500000		0.002592
Combined standard uncertainty, u_c	(°C)	0.0086				
Effective degrees of freedom, ν_{eff}		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.017				

200 ℃ Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.001605458**	--	**∞**	**1**	**0.001605458**
PRT Reading	--	**0.00064**	--	∞		**0.00064**
L&N Readouts	A	0.000636	t	20		0.000636
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.001404264**	Rectangular	500000		**0.001404264**
Self Heating of PRT	B	**0.000442651**	Rectangular	500000		**0.000442651**
Contribution of Reference Standard	--	**0.002984716**	--	**∞**	**-1**	**0.002984716**
SPRT / PRT Reading		**0.000569**		∞		**0.000569**
SPRT Readouts	A	0.000564	t	26		0.000564
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0005**	Rectangular	500000		**0.0005**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000785**	Rectangular	500000	**1**	**0.000785**
Calibration of standard resistor	**B**	**0.000055**	Rectangular	500000	**1**	**0.000055**
Ambient temperature effect on standard resistor	**B**	**0.001897**	Rectangular	500000	**1**	**0.001897**
Contribution of Temperature Source	**B**	**0.027311673**	--	**∞**	**1**	**0.027311673**
Axial uniformity of enclosure /furnace	B	0.009805	Rectangular	500000		0.009805
Radial uniformity of enclosure /furnace	B	0.023769	Rectangular	500000		0.023769
Instability of enclosure / furnace	B	0.00921	Rectangular	500000		0.00921
Combined standard uncertainty, u_c	(°C)	0.0276				
Effective degrees of freedom, ν_{eff}		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.055				

300 ℃ Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.00159221**	--	**∞**	**1**	**0.00159221**
PRT Reading	--	**0.000606**	--	∞		**0.000606**
L&N Readouts	A	0.000601	t	26		0.000601
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.001404264**	Rectangular	500000		**0.001404264**
Self Heating of PRT	B	**0.000442651**	Rectangular	500000		**0.000442651**
Contribution of Reference Standard	--	**0.00312998**	--	**∞**	**-1**	**0.00312998**
SPRT / PRT Reading	--	**0.000502**	--	∞		**0.000502**
SPRT Readouts	A	0.000496	t	21		0.000496
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0011**	Rectangular	500000		**0.0011**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000948**	Rectangular	500000	**1**	**0.000948**
Calibration of standard resistor	**B**	**0.000055**	Rectangular	500000	**1**	**0.000055**
Ambient temperature effect on standard resistor	**B**	**0.001897**	Rectangular	500000	**1**	**0.001897**
Contribution of Temperature Source	**B**	**0.032386366**	--	**∞**	**1**	**0.032386366**
Axial uniformity of enclosure /furnace	B	0.014411	Rectangular	500000		0.014411
Radial uniformity of enclosure /furnace	B	0.028208	Rectangular	500000		0.028208
Instability of enclosure / furnace	B	0.006746	Rectangular	500000		0.006746
Combined standard uncertainty, u_c	(°C)	0.0326				
Effective degrees of freedom, ν_{eff}		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.064				

ICE POINT-III Quantity	Type	Uncertainty Contribution u_i (°C)	Probability Distribution	Degrees of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty $u(x_i)$ (°C)
Contribution of PRT (Artifact)	--	**0.001474338**	--	∞	**1**	**0.001474338**
PRT Reading	--	**0.000076**	--	∞		**0.000076**
L&N Readouts	A	0.000023	t	26		0.000023
PRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Drift of PRT at Ice point	B	**0.001404264**	Rectangular	500000		**0.001404264**
Self Heating of PRT	B	**0.000442651**	Rectangular	500000		**0.000442651**
Contribution of Reference Standard	--	**0.002930887**	--	∞	**-1**	**0.002930887**
SPRT / PRT Reading	--	**0.000073**	--	∞		**0.000073**
SPRT Readouts	A	0	t	26		0
SPRT Resolution from F700A	B	0.000072	Rectangular	500000		0.000072
Calibration of SPRT / PRT	B	**0.0005**	Rectangular	500000		**0.0005**
Drift of SPRT / PRT	B	**0.002887**	Rectangular	500000		**0.002887**
Calibration of bridge	**B**	**0.000498**	Rectangular	500000	**1**	**0.000498**
Drift of standard resistor	**B**	**0.000885**	Rectangular	500000	**1**	**0.000885**
Calibration of standard resistor	**B**	**0.000033**	Rectangular	500000	**1**	**0.000033**
Ambient temperature effect on standard resistor	**B**	**0.001129**	Rectangular	500000	**1**	**0.001129**
Contribution of Temperature Source	**B**	**0.000494245**	--	∞	**1**	**0.000494245**
Axial uniformity of enclosure /furnace	B	0.000283	Rectangular	500000		0.000283
Radial uniformity of enclosure /furnace	B	0.000283	Rectangular	500000		0.000283
Instability of enclosure / furnace	B	0.00029	Rectangular	500000		0.00029
Combined standard uncertainty, u_c	(°C)	0.0036				
Effective degrees of freedom, ν_{eff}		∞				
Coverage factor, k		1.96				
Expanded uncertainty, U	(°C)	0.008				

9. NMI-Australia (after circulation)

From -50 deg C to 80 deg C

Quantity	Type	Unit	Uncertainty contribution	k	Sensitivity Coefficient	Degree of Freedom	Standard Uncertainty	nu(i)
Contribution of PRT(Artefact)								
1.PRT reading (noise)	A		included in 15					
2.Drift of PRT at IP	B	mK	1.8	3.46	2.9	8	1.51	0.647571
3.SelfHeat of PRT	B		0.00002	2	2500	2	0.03	1.95E-07
4.Calibration of indicator	B	Ohm	232	2.02	0.003	40	0.34	0.000352
5.Drift of indicator								
6.Conduction error	B	mK	0.1	1.73	1	2	0.06	5.58E-06
Contribution of Reference Standard								
7.SPRT reading (noise)	A		included in 15					
8.Calibration of SPRT	B	mK	1	2	1	59	0.50	0.001059
9.Drift of PRT	B	mK	1.66	3.46	2.9	8	1.39	0.468414
10.Calibration of indicator	B	Ohm	58	2.02	0.01	40	0.29	0.00017
11.Drift of indicator								
Contribution of Temperature Source								
12.Uniformity of enclosure	B	mK	2.5	2	1	59	1.25	0.04138
13.Interpolation function	B	mK	2.84	1.73	1	12	1.64	0.605212
14. IcePoint Purity	B	mK	0.6	2.04	2.9	31	0.85	0.017073
Nu Effective								52.30058

Combined standard uncertainty	mK	3.11
Coverage factor		2.01
Expanded uncertainty	mK	6.23

Loop C

1. KRISS-South Korea (Before circulation)

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.3	t	99	1	0.3
Drift of PRT at Ice point (mK)	B	1.3	rectangular	∞	1	1.3
Self Heating of PRT (mK)	B	0.6	normal	∞	1	0.6
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.5	t	199	1	0.5
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0	normal	∞	1	0
Instability of enclosure / furnace (mK)	B	0.2	normal	∞	1	0.2
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		2.8				
Coverage factor, k		1.96				
Expanded uncertainty, U		5.4				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.3	t	99	1	0.3
Drift of PRT at Ice point (mK)	B	1	rectangular	∞	1	1
Self Heating of PRT (mK)	B	0.5	normal	∞	1	0.5
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.7	t	199	1	0.7
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		2.9				
Coverage factor, k		1.96				
Expanded uncertainty, U		5.6				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.3	t	99	1	0.3
Drift of PRT at Ice point (mK)	B	1.1	rectangular	∞	1	1.1
Self Heating of PRT (mK)	B	0.5	normal	∞	1	0.5
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.7	t	199	1	0.7
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		2.9				
Coverage factor, k		1.96				
Expanded uncertainty, U		5.7				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.3	t	99	1	0.3
Drift of PRT at Ice point (mK)	B	1.8	rectangular	∞	1	1.8
Self Heating of PRT (mK)	B	0.8	normal	∞	1	0.8
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.3	t	199	1	0.3
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	0.3	normal	∞	1	0.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3.1				
Coverage factor, k		1.96				
Expanded uncertainty, U		6				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.3	t	99	1	0.3
Drift of PRT at Ice point (mK)	B	2.3	rectangular	∞	1	2.3
Self Heating of PRT (mK)	B	1	normal	∞	1	1
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.3	t	199	1	0.3
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	1.4	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	1.4	normal	∞	1	0.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3.9				
Coverage factor, k		1.96				
Expanded uncertainty, U		7.7				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	1.1	t	99	1	1.1
Drift of PRT at Ice point (mK)	B	2.8	rectangular	∞	1	2.8
Self Heating of PRT (mK)	B	1.2	normal	∞	1	1.2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.7	t	199	1	0.7
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		5.9				
Coverage factor, k		1.96				
Expanded uncertainty, U		11.5				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	1.2	t	99	1	1.2
Drift of PRT at Ice point (mK)	B	3.2	rectangular	∞	1	3.2
Self Heating of PRT (mK)	B	1.4	normal	∞	1	1.4
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	3.2	t	199	1	3.2
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		6.9				
Coverage factor, k		1.96				
Expanded uncertainty, U		13.5				

2. KIM,LIPI-Indonesia

-50 °C up to 0 °C

Quantity	Type	Uncertainty Contribution u (x_i)	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (y_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000069	t-student	49	2.5	0.000024
Drift of PRT at Ice point (Ω)	B	0.0011	Rectangular	50	2.5	0.0016
Self Heating of PRT (Ω)	B	0.0042	Rectangular	50	2.5	0.0061
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Conduction error (Ω or °C)	B	0	Rectangular	50	1	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00022	t-student	49	1	0.000031
Calibration of SPRT / PRT (°C)	B	0.004	Normal	50	1	0.002
Drift of SPRT / PRT (°C)	B	0.0008	Rectangular	50	1	0.00046
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.004	Rectangular	50	1	0.0023
Radial uniformity of enclosure / furnace (°C)	B	0.004	Rectangular	50	1	0.0023
Instability of enclosure / furnace (°C)	B	0.002	Rectangular	50	1	0.0012
Function						
Interpolation function (°C)	B	0.0025	t-student	12.5	1	0.00125
Combined standard uncertainty, u_c		0.0076				
Coverage factor, k		2				
Expanded uncertainty, U		0.015				

0 °C up to 100 °C

Quantity	Type	Uncertainty Contribution u (x_i)	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (y_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000069	t-student	49	2.5	0.000024
Drift of PRT at Ice point (Ω)	B	0.0011	Rectangular	50	2.5	0.0016
Self Heating of PRT (Ω)	B	0.0042	Rectangular	50	2.5	0.0061
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Conduction error (Ω or °C)	B	0	Rectangular	50	1	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00022	t-student	49	1	0.000031
Calibration of SPRT / PRT (°C)	B	0.004	Normal	50	1	0.002
Drift of SPRT / PRT (°C)	B	0.0008	Rectangular	50	1	0.00046
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.004	Rectangular	50	1	0.0023
Radial uniformity of enclosure / furnace (°C)	B	0.004	Rectangular	50	1	0.0023
Instability of enclosure / furnace (°C)	B	0.002	Rectangular	50	1	0.0012
Function						
Interpolation function (°C)	B	0.001	t-student	12.5	1	0.0005
Combined standard uncertainty, u_c						0.0075
Coverage factor, k						2
Expanded uncertainty, U						0.015

100 °C up to 300 °C

Quantity	Type	Uncertainty Contribution u (x_i)	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (y_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000069	t-student	49	2.5	0.000024
Drift of PRT at Ice point (Ω)	B	0.0011	Rectangular	50	2.5	0.0016
Self Heating of PRT (Ω)	B	0.0042	Rectangular	50	2.5	0.0061
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Conduction error (Ω or °C)	B	0	Rectangular	50	1	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00022	t-student	49	1	0.000031
Calibration of SPRT / PRT (°C)	B	0.004	Normal	50	1	0.002
Drift of SPRT / PRT (°C)	B	0.0008	Rectangular	50	1	0.00046
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.02	Rectangular	50	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.02	Rectangular	50	1	0.0115
Instability of enclosure / furnace (°C)	B	0.01	Rectangular	50	1	0.0058
Function						
Interpolation function (°C)	B	0.001	t-student	12.5	1	0.0005
Combined standard uncertainty, u_c						0.0186
Coverage factor, k						2
Expanded uncertainty, U						0.037

300 °C up to 400 °C						
Quantity	Type	Uncertainty Contribution u (xi)	Probability Distribution	Degree of Freedom (νi)	Sensitivity Coefficient (ci)	Standard Uncertainty u (yi)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000069	t-student	49	2.5	0.000024
Drift of PRT at Ice point (Ω)	B	0.0011	Rectangular	50	2.5	0.0016
Self Heating of PRT (Ω)	B	0.0042	Rectangular	50	2.5	0.0061
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Conduction error (Ω or °C)	B	0	Rectangular	50	1	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00022	t-student	49	1	0.000031
Calibration of SPRT / PRT (°C)	B	0.004	Normal	50	1	0.002
Drift of SPRT / PRT (°C)	B	0.0008	Rectangular	50	1	0.00046
Calibration of indicator (Ω or °C)	B	0.00025	Normal	∞	1	0.00013
Drift of indicator (Ω or °C)	B	0.00005	Rectangular	50	1	0.000029
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.03	Rectangular	50	1	0.0173
Radial uniformity of enclosure / furnace (°C)	B	0.01	Rectangular	50	1	0.0058
Instability of enclosure / furnace (°C)	B	0.002	Rectangular	50	1	0.0012
Function						
Interpolation function (°C)	B	0.001	t-student	12.5	1	0.0005
Combined standard uncertainty, u_c						0.0195
Coverage factor, k						2
Expanded uncertainty, U						0.039

3. NMC, A*STAR-Singapore

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (νi)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (xi)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.00003	-	59	2.5	0.000075
Drift of PRT at Ice point (Ω)	B	0	Rectangular	∞	2.5	0
Self Heating of PRT (Ω)	B	0	Rectangular	∞	2.5	0
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0	-	59	1	0
Calibration of SPRT / PRT (°C)	B	0	Normal	∞	1	0
Drift of SPRT / PRT (°C)	B	0	Rectangular	∞	1	0
Calibration of indicator (Ω or °C)	B	0	Normal	∞	10	0
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0	Rectangular	∞		0
Radial uniformity of enclosure / furnace (°C)	B	0	Rectangular	∞	1	0
Instability of enclosure / furnace (°C)	B	0	Rectangular	∞	1	0
Function						
Interpolation function (°C)	B	0	Rectangular	∞	1	0
Combined standard uncertainty, u_c	0.000409					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00082					

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.00013	-	119	2.5	0.000325
Drift of PRT at Ice point (Ω)	B	0.0008	Rectangular	∞	2.5	0.001155
Self Heating of PRT (Ω)	B	0.00003	Rectangular	∞	2.5	0.000043
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00055	-	119	1	0.00055
Calibration of SPRT / PRT (°C)	B	0.002	Normal	∞	1	0.001
Drift of SPRT / PRT (°C)	B	0.0005	Rectangular	∞	1	0.000289
Calibration of indicator (Ω or °C)	B	0.0001	Normal	∞	1	0.00005
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞		0.000866
Radial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Instability of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Function						
Interpolation function (°C)	B	0.001	Rectangular	∞	1	0.000577
Combined standard uncertainty, u_c	0.002361					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00472					

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.00021	-	119	2.5	0.000525
Drift of PRT at Ice point (Ω)	B	0.0008	Rectangular	∞	2.5	0.001155
Self Heating of PRT (Ω)	B	0.000021	Rectangular	∞	2.5	0.00003
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00055	-	119	1	0.00055
Calibration of SPRT / PRT (°C)	B	0.002	Normal	∞	1	0.001
Drift of SPRT / PRT (°C)	B	0.0005	Rectangular	∞	1	0.000289
Calibration of indicator (Ω or °C)	B	0.0001	Normal	∞	1	0.00005
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞		0.000866
Radial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Instability of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Function						
Interpolation function (°C)	B	0.001	Rectangular	∞	1	0.000577
Combined standard uncertainty, u_c	0.002396					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00479					

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.00004	-	59	2.5	0.0001
Drift of PRT at Ice point (Ω)	B	0.00011	Rectangular	∞	2.5	0.000159
Self Heating of PRT (Ω)	B	0	Rectangular	∞	2.5	0
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0	-	59	1	0
Calibration of SPRT / PRT (°C)	B	0	Normal	∞	1	0
Drift of SPRT / PRT (°C)	B	0	Rectangular	∞	1	0
Calibration of indicator (Ω or °C)	B	0	Normal	∞	10	0
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0	Rectangular	∞		0
Radial uniformity of enclosure / furnace (°C)	B	0	Rectangular	∞	1	0
Instability of enclosure / furnace (°C)	B	0	Rectangular	∞	1	0
Function						
Interpolation function (°C)	B	0	Rectangular	∞	1	0
Combined standard uncertainty, u_c	0.000443					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00089					

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.00036	-	119	2.5	0.0009
Drift of PRT at Ice point (Ω)	B	0.0008	Rectangular	∞	2.5	0.001155
Self Heating of PRT (Ω)	B	0.00001	Rectangular	∞	2.5	0.000014
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00092	-	119	1	0.00092
Calibration of SPRT / PRT (°C)	B	0.002	Normal	∞	1	0.001
Drift of SPRT / PRT (°C)	B	0.001	Rectangular	∞	1	0.000577
Calibration of indicator (Ω or °C)	B	0.0001	Normal	∞	1	0.00005
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞		0.000866
Radial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Instability of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Function						
Interpolation function (°C)	B	0.0012	Rectangular	∞	1	0.000693
Combined standard uncertainty, u_c	0.002686					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00537					

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.00036	-	119	2.5	0.0009
Drift of PRT at Ice point (Ω)	B	0.001	Rectangular	∞	2.5	0.001443
Self Heating of PRT (Ω)	B	0.00001	Rectangular	∞	2.5	0.000014
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.0009	-	119	1	0.0009
Calibration of SPRT / PRT (°C)	B	0.002	Normal	∞	1	0.001
Drift of SPRT / PRT (°C)	B	0.001	Rectangular	∞	1	0.000577
Calibration of indicator (Ω or °C)	B	0.0001	Normal	∞	1	0.00005
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞		0.000866
Radial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Instability of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Function						
Interpolation function (°C)	B	0.0012	Rectangular	∞	1	0.000693
Combined standard uncertainty, u_c	0.002816					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00563					

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.00019	-	119	2.5	0.000475
Drift of PRT at Ice point (Ω)	B	0.0012	Rectangular	∞	2.5	0.001732
Self Heating of PRT (Ω)	B	0.00002	Rectangular	∞	2.5	0.000029
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00072	-	119	1	0.00072
Calibration of SPRT / PRT (°C)	B	0.0025	Normal	∞	1	0.00125
Drift of SPRT / PRT (°C)	B	0.001	Rectangular	∞	1	0.000577
Calibration of indicator (Ω or °C)	B	0.0001	Normal	∞	1	0.00005
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞		0.000866
Radial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Instability of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Function						
Interpolation function (°C)	B	0.0012	Rectangular	∞	1	0.000693
Combined standard uncertainty, u_c	0.002921					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00584					

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.0001	-	119	2.5	0.00025
Drift of PRT at Ice point (Ω)	B	0.0014	Rectangular	∞	2.5	0.002021
Self Heating of PRT (Ω)	B	0.00001	Rectangular	∞	2.5	0.000014
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00034	-	119	1	0.00034
Calibration of SPRT / PRT (°C)	B	0.0025	Normal	∞	1	0.00125
Drift of SPRT / PRT (°C)	B	0.001	Rectangular	∞	1	0.000577
Calibration of indicator (Ω or °C)	B	0.0001	Normal	∞	1	0.00005
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞		0.000866
Radial uniformity of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Instability of enclosure / furnace (°C)	B	0.0015	Rectangular	∞	1	0.000866
Function						
Interpolation function (°C)	B	0.0012	Rectangular	∞	1	0.000693
Combined standard uncertainty, u_c	0.003009					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00602					

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0	-	59	2.5	0
Drift of PRT at Ice point (Ω)	B	0.0006	Rectangular	∞	2.5	0.000866
Self Heating of PRT (Ω)	B	0	Rectangular	∞	2.5	0
Calibration of indicator (Ω or °C)	B	0.0003	Normal	∞	2.5	0.000375
Drift of indicator (Ω or °C)	B	0.0001	Rectangular	∞	2.5	0.000144
Conduction error (Ω or °C)	B	0	Rectangular	∞	2.5	0
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0	-	59	1	0
Calibration of SPRT / PRT (°C)	B	0	Normal	∞	1	0
Drift of SPRT / PRT (°C)	B	0	Rectangular	∞	1	0
Calibration of indicator (Ω or °C)	B	0	Normal	∞	1	0
Drift of indicator (Ω or °C)	B	0	Rectangular	∞	10	0
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0001	Rectangular	∞		0.000058
Radial uniformity of enclosure / furnace (°C)	B	0	Rectangular	∞	1	0
Instability of enclosure / furnace (°C)	B	0	Rectangular	∞	1	0
Function						
Interpolation function (°C)	B	0	Rectangular	∞	1	0
Combined standard uncertainty, u_c	0.000956					
Coverage factor, *k*	2					
Expanded uncertainty, *U*	0.00191					

4. NML,SIRIM-Malaysia

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0009	normal	2	1	0.0009
Drift of PRT at Ice point (°C)	B	0.0015	rectangular	60	1	0.0009
Self Heating of PRT(°C)	B	0.0023	rectangular	60	1	0.0013
Resolution of indicator (°C)	B	0.0003	rectangular	60	1	0.0001
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.00029
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.002				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.004				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0009	normal	2	1	0.0009
Drift of PRT at Ice point (°C)	B	0.0015	rectangular	60	1	0.0009
Self Heating of PRT(°C)	B	0.0023	rectangular	60	1	0.0013
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0030	rectangular	60	1	0.0017
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.017				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.033				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0009	normal	2	1	0.0009
Drift of PRT at Ice point (°C)	B	0.0015	rectangular	60	1	0.0009
Self Heating of PRT(°C)	B	0.0023	rectangular	60	1	0.0013
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.00000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Radial uniformity of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Instability of enclosure / furnace (°C)	B	0.0020	rectangular	60	1	0.0012
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.016				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.033				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0051	normal	3	1	0.0051
Drift of PRT at Ice point (°C)	B	0.0015	rectangular	60	1	0.0009
Self Heating of PRT(°C)	B	0.0023	rectangular	60	1	0.0013
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.011				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.023				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0051	normal	3	1	0.0051
Drift of PRT at Ice point (°C)	B	0.0015	rectangular	60	1	0.0009
Self Heating of PRT(°C)	B	0.0023	rectangular	60	1	0.0013
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Radial uniformity of enclosure / furnace (°C)	B	0.0100	rectangular	60	1	0.0058
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.015				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.030				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0051	normal	3	1	0.0051
Drift of PRT at Ice point (°C)	B	0.0015	rectangular	60	1	0.0009
Self Heating of PRT(°C)	B	0.0023	rectangular	60	1	0.0013
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0000	rectangular	60	1	0.000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.013				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.025				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (°C)	A	0.0051	normal	3	1	0.0051
Drift of PRT at Ice point (°C)	B	0.0015	rectangular	60	1	0.0009
Self Heating of PRT(°C)	B	0.0023	rectangular	60	1	0.0013
Resolution of indicator (°C)	B	0.0005	rectangular	60	1	0.0003
Drift of indicator (°C)	B	-	-	-	-	-
Conduction error (°C)	B	-	-	-	-	-
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	Include in PRT Reading	-	-	-	-
Calibration of SPRT / PRT (°C)	B	0.0010	normal	60	1	0.0005
Drift of SPRT / PRT (°C)	B	0.0005	rectangular	60	1	0.0000
Resolution of indicator (°C)	B	0.00005	rectangular	60	1	0.00003
Drift of indicator (Ω or °C)	B	-	-	-	-	-
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Radial uniformity of enclosure / furnace (°C)	B	0.0000	rectangular	60	1	0.0000
Instability of enclosure / furnace (°C)	B	0.0200	rectangular	60	1	0.0115
Function						
Interpolation function (°C)	B	-	-	-	-	-
Combined standard uncertainty, u_c		0.013				
Coverage factor, k		2.00				
Expanded uncertainty, U (°C)		0.025				

5. VMI-Vietnam

1. Test Temperature: +0.01 ^{0}C (TPW)

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000001	normal	29	2.5	0.003
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40
Self Heating of PRT (Ω)	B	0.000766	rectangular	infinitive	2.5	1.92
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A		normal	29	1.0	
Calibration of SPRT / PRT (°C)	B	0.00025	normal	50	1.0	0.25
Drift of SPRT / PRT (°C)	B		rectangular	infinitive	1.0	
Calibration of indicator (°C)	B		normal	50	1.0	
Drift of indicator (Ω or °C)	B		rectangular	infinitive	1.0	
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Radial uniformity of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Instability of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Function						
Interpolation function (°C)	B	0.00006	normal	infinitive	1.0	0.06
Combined standard uncertainty, u_c		2.2				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		4.31				

2. Test Temperature: - 50 ^{0}C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000365	normal	29	2.5	0.91
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40
Self Heating of PRT (Ω)	B	0.000234	rectangular	infinitive	2.5	0.59
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.001	normal	29	1.0	1.00
Calibration of SPRT / PRT (°C)	B	0.001	normal	50	1.0	1.00
Drift of SPRT / PRT (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Calibration of indicator (°C)	B	0.0005	normal	50	1.0	0.5
Drift of indicator (Ω or °C)	B	0.00115	rectangular	infinitive	1.0	1.15

Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.00289	rectangular	infinitive	1.0	2.89
Radial uniformity of enclosure / furnace (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Instability of enclosure / furnace (°C)	B	0.00401	rectangular	infinitive	1.0	4.01
Function						
Interpolation function (°C)	B	0.00087	normal	infinitive	1.0	0.87
Combined standard uncertainty, u_c		5.59				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		10.95				

3. Test Temperature: - 30 ^{0}C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000153	normal	29	2.5	0.38
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40
Self Heating of PRT (Ω)	B	0.000551	rectangular	infinitive	2.5	1.38
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00044	normal	29	1.0	0.44
Calibration of SPRT / PRT (°C)	B	0.001	normal	50	1.0	1.00
Drift of SPRT / PRT (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Calibration of indicator (°C)	B	0.0005	normal	50	1.0	0.50
Drift of indicator (Ω or °C)	B	0.00115	rectangular	infinitive	1.0	1.15
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.00289	rectangular	infinitive	1.0	2.89
Radial uniformity of enclosure / furnace (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Instability of enclosure / furnace (°C)	B	0.00401	rectangular	infinitive	1.0	4.01
Function						
Interpolation function (°C)	B	0.00468	normal	infinitive	1.0	4.68
Combined standard uncertainty, u_c		7.24				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		14.19				

4. Test Temperature: + 0.01 ^{0}C (TPW)

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000001	normal	29	2.5	0.003
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40

Self Heating of PRT (Ω)	B	0.000769	rectangular	infinitive	2.5	1.92
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A		normal	29	1.0	
Calibration of SPRT / PRT (°C)	B	0.00025	normal	50	1.0	0.25
Drift of SPRT / PRT (°C)	B		rectangular	infinitive	1.0	
Calibration of indicator (°C)	B		normal	50	1.0	
Drift of indicator (Ω or °C)	B		rectangular	infinitive	1.0	
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Radial uniformity of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Instability of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Function						
Interpolation function (°C)	B	0.00006	normal	infinitive	1.0	0.06
Combined standard uncertainty, u_c		2.21				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		4.32				

5. Test Temperature: 100 ^{0}C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000131	normal	29	2.5	0.33
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40
Self Heating of PRT (Ω)	B	0.000766	rectangular	infinitive	2.5	1.92
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00046	normal	29	1.0	0.46
Calibration of SPRT / PRT (°C)	B	0.001	normal	50	1.0	1.00
Drift of SPRT / PRT (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Calibration of indicator (°C)	B	0.0005	normal	50	1.0	0.50
Drift of indicator (Ω or °C)	B	0.00115	rectangular	infinitive	1.0	1.15
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.00289	rectangular	infinitive	1.0	2.89
Radial uniformity of enclosure / furnace (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Instability of enclosure / furnace (°C)	B	0.00462	rectangular	infinitive	1.0	4.62
Function						
Interpolation function (°C)	B	0.00756	normal	infinitive	1.0	7.56
Combined standard uncertainty, u_c		9.73				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		19.08				

6. Test Temperature: 200 ^{0}C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000279	normal	29	2.5	0.70
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40
Self Heating of PRT (Ω)	B	0.001137	rectangular	infinitive	2.5	2.84
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00051	normal	29	1.0	0.51
Calibration of SPRT / PRT (°C)	B	0.001	normal	50	1.0	1.00
Drift of SPRT / PRT (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Calibration of indicator (°C)	B	0.0005	normal	50	1.0	0.50
Drift of indicator (Ω or °C)	B	0.00115	rectangular	infinitive	1.0	1.15
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.00289	rectangular	infinitive	1.0	2.89
Radial uniformity of enclosure / furnace (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Instability of enclosure / furnace (°C)	B	0.00462	rectangular	infinitive	1.0	4.62
Function						
Interpolation function (°C)	B	0.00098	normal	infinitive	1.0	0.98
Combined standard uncertainty, u_c		6.58				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		12.90				

7. Test Temperature: 300 ^{0}C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000325	normal	29	2.5	0.81
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40
Self Heating of PRT (Ω)	B	0.001553	rectangular	infinitive	2.5	3.88
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00099	normal	29	1.0	0.99
Calibration of SPRT / PRT (°C)	B	0.001	normal	50	1.0	1.00
Drift of SPRT / PRT (°C)	B	0.00029	rectangular	infinitive	1.0	0.29
Calibration of indicator (°C)	B	0.0005	normal	50	1.0	0.50
Drift of indicator (Ω or °C)	B	0.00115	rectangular	infinitive	1.0	1.15
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	0.00289	rectangular	infinitive	1.0	2.89

Radial uniformity of enclosure / furnace (°C)	B	0.00058	rectangular	infinitive	1.0	0.58
Instability of enclosure / furnace (°C)	B	0.00577	rectangular	infinitive	1.0	5.77
Function						
Interpolation function (°C)	B	0.0082	normal	infinitive	1.0	8.20
Combined standard uncertainty, u_c		11.39				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		22.32				

8. Test Temperature: 400 ^{0}C

Quantity	Type	Uncertainty Contribution U_i/k	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000435	normal	29	2.5	1.09
Drift of PRT at Ice point (Ω)	B	0.00016	rectangular	infinitive	2.5	0.4
Self Heating of PRT (Ω)	B	0.001503	rectangular	infinitive	2.5	3.75
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26
Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A	0.00157	normal	29	1	1.57
Calibration of SPRT / PRT (°C)	B	0.001	normal	50	1	1
Drift of SPRT / PRT (°C)	B	0.00029	rectangular	infinitive	1	0.29
Calibration of indicator (°C)	B	0.0005	normal	50	1	0.5
Drift of indicator (°C)	B	0.00115	rectangular	infinitive	1	1.15
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B	2.89	rectangular	infinitive	1.0	2.89
Radial uniformity of enclosure / furnace (°C)	B	0.58	rectangular	infinitive	1.0	0.58
Instability of enclosure / furnace (°C)	B	5.77	rectangular	infinitive	1	5.77
Function						
Interpolation function (°C)	B	4.53	normal	infinitive	1	4.53
Combined standard uncertainty, u_c		9.17				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (m K)*		17.97				

9. Test Temperature: + 0.01 ^{0}C (TPW)

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)=c_i*U_i/k (mK)
Contribution of PRT (Artefact)						
PRT Reading (Ω)	A	0.000000	normal	29	2.5	0.00
Drift of PRT at Ice point (Ω)	B	0.000161	rectangular	infinitive	2.5	0.40
Self Heating of PRT (Ω)	B	0.000734	rectangular	infinitive	2.5	1.84
Calibration of indicator (Ω)	B	0.000104	normal	50	2.5	0.26

Drift of indicator (Ω)	B	0.000346	rectangular	infinitive	2.5	0.87
Conduction error (Ω)	B	0.00014	rectangular	infinitive	2.5	0.35
Contribution of Reference Standard						
SPRT / PRT Reading (°C)	A		normal	29	1.0	
Calibration of SPRT / PRT (°C)	B	0.00025	normal	50	1.0	0.25
Drift of SPRT / PRT (°C)	B		rectangular	infinitive	1.0	
Calibration of indicator (°C)	B		normal	50	1.0	
Drift of indicator (Ω or °C)	B		rectangular	infinitive	1.0	
Contribution Temperature Source						
Axial uniformity of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Radial uniformity of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Instability of enclosure / furnace (°C)	B		rectangular	infinitive	1.0	
Function						
Interpolation function (°C)	B	0.00006	normal	infinitive	1.0	0.06
Combined standard uncertainty, u_c		2.13				
Coverage factor, *k*		1.96				
Expanded uncertainty, *U (mK)*		4.17				

10.ITDI-Philiphines

UNCERTAINTY BUDGET TABLE, Calibration Point: *ice point*

Source of Uncertainty	**Type**	**Uncertainty Value**	**Probability Distribution**	**Divisor**	**Sensitivity Coefficient**	**Standard Uncertainty, (°C)**
Scatter of UUC fitted curve (Ω)	A	-0.9 mOhm	normal	1.73	2.50	-1.31 mK
Resistance Reading of UUC (Ω)	A	0.38 mOhm	normal	1.00	2.50	0.95 mK
Temperature Reading of Standard[SPRT] °C	A	0.99 mK	normal	1.00	1.00	0.99 mK
Calibration of Standard [SPRT] °C	B	2.00 mK	normal	2.00	1.00	1.00 mK
Drift of Standard since last calibration [SPRT] °C	B	0.00 mK	rectangular	1.73	1.00	0.00 mK
Calibration of Indicator (Ω)	B	0.01 mOhm	normal	2.00	10.00	0.03 mK
Drift of Indicator since last calibration (Ω)	B	0.01 mOhm	rectangular	1.73	10.00	0.03 mK
Drift of UUC at ice point /°C	B	-1.48 mK	rectangular	1.73	1.00	-0.86 mK
Calibration Uncertainty of UUT Indicator	B	0.01 mOhm	normal	2.00	2.50	0.01 mK
Drift of of UUT Indicator since last calibration	B	0.01 mOhm	rectangular	1.73	2.50	0.01 mK
Self-Heating (SPRT)	B	4.00 mK	rectangular	1.73	1.00	2.31 mK
Self-Heating (IPRT)	B	10.00 mK	rectangular	1.73	1.00	5.78 mK
Uniformity of Bath-Axial (°C)	B	1.00 mK	rectangular	1.73	1.00	0.58 mK
Uniformity of Bath-Radial (°C)	B	1.00 mK	rectangular	1.73	1.00	0.58 mK
Instability of bath- (°C)	B	1.00 mK	rectangular	1.73	1.00	0.58 mK
Interpolation Function (°C)	B	3.85 mK	rectangular	1.73	1.00	2.23 mK
Combined Standard Uncertainty	-		normal			**7.07 mK**
Expanded Uncertainty	-		normal(k=2)			**14.22 mK**

UNCERTAINTY BUDGET TABLE, Calibration Point: ***-30 °C***

Source of Uncertainty	Type	Uncertainty Value	Probability Distribution	Divisor	Sensitivity Coefficient	Standard Uncertainty, (°C)
Scatter of UUC fitted curve (Ω)	A	0.0 mOhm	normal	1.73	2.50	0.00 mK
Resistance Reading of UUC (Ω)	A	0.72 mOhm	normal	1.00	2.50	1.80 mK
Temperature Reading of Standard[SPRT] °C	A	1.50 mK	normal	1.00	1.00	1.50 mK
Calibration of Standard [SPRT] °C	B	2.00 mK	normal	2.00	1.00	1.00 mK
Drift of Standard since last calibration [SPRT] °C	B	0.00 mK	rectangular	1.73	1.00	0.00 mK
Calibration of Indicator (Ω)	B	0.01 mOhm	normal	2.00	10.00	0.03 mK
Drift of Indicator since last calibration (Ω)	B	0.01 mOhm	rectangular	1.73	10.00	0.03 mK
Drift of UUC at ice point /°C	B	-1.48 mK	rectangular	1.73	1.00	-0.86 mK
Calibration Uncertainty of UUT Indicator	B	0.01 mOhm	normal	2.00	2.50	0.01 mK
Drift of of UUT Indicator since last calibration	B	0.01 mOhm	rectangular	1.73	2.50	0.01 mK
Self-Heating (SPRT)	B	4.00 mK	rectangular	1.73	1.00	2.31 mK
Self-Heating (IPRT)	B	10.00 mK	rectangular	1.73	1.00	5.78 mK
Uniformity of Bath-Axial (°C)	B	8.50 mK	rectangular	1.73	1.00	4.91 mK
Uniformity of Bath-Radial (°C)	B	8.00 mK	rectangular	1.73	1.00	4.62 mK
Instability of bath- (°C)	B	5.00 mK	rectangular	1.73	1.00	2.89 mK
Interpolation Function (°C)	B	3.85 mK	rectangular	1.73	1.00	2.23 mK
Combined Standard Uncertainty	-		normal			**10.23 mK**
Expanded Uncertainty	-		normal(k=2)			**20.56 mK**

UNCERTAINTY BUDGET TABLE, Calibration Point: ***100 °C***

Source of Uncertainty	Type	Uncertainty Value	Probability Distribution	Divisor	Sensitivity Coefficient	Standard Uncertainty, (°C)
Scatter of UUC fitted curve (Ω)	A	3.7 mOhm	normal	1.73	2.50	5.34 mK
Resistance Reading of UUC (Ω)	A	0.43 mOhm	normal	1.00	2.50	1.09 mK
Temperature Reading of Standard[SPRT] °C	A	1.47 mK	normal	1.00	1.00	1.47 mK
Calibration of Standard [SPRT] °C	B	2.00 mK	normal	2.00	1.00	1.00 mK
Drift of Standard since last calibration [SPRT] °C	B	0.00 mK	rectangular	1.73	1.00	0.00 mK
Calibration of Indicator (Ω)	B	0.01 mOhm	normal	2.00	10.00	0.03 mK
Drift of Indicator since last calibration (Ω)	B	0.01 mOhm	rectangular	1.73	10.00	0.03 mK
Drift of UUC at ice point /°C	B	-1.48 mK	rectangular	1.73	1.00	-0.86 mK
Calibration Uncertainty of UUT Indicator	B	0.01 mOhm	normal	2.00	2.50	0.01 mK
Drift of of UUT Indicator since last calibration	B	0.01 mOhm	rectangular	1.73	2.50	0.01 mK
Self-Heating (SPRT)	B	4.00 mK	rectangular	1.73	1.00	2.31 mK
Self-Heating (IPRT)	B	10.00 mK	rectangular	1.73	1.00	5.78 mK
Uniformity of Bath-Axial (°C)	B	1.50 mK	rectangular	1.73	1.00	0.87 mK
Uniformity of Bath-Radial (°C)	B	1.00 mK	rectangular	1.73	1.00	0.58 mK
Instability of bath- (°C)	B	4.00 mK	rectangular	1.73	1.00	2.31 mK
Interpolation Function (°C)	B	3.85 mK	rectangular	1.73	1.00	2.23 mK
Combined Standard Uncertainty	-		normal			**9.15 mK**
Expanded Uncertainty	-		normal(k=2)			**18.38 mK**

UNCERTAINTY BUDGET TABLE, Calibration Point: ***200 °C***

Source of Uncertainty	Type	Uncertainty Value	Probability Distribution	Divisor	Sensitivity Coefficient	Standard Uncertainty, (°C)
Scatter of UUC fitted curve (Ω)	A	-3.7 mOhm	normal	1.73	2.50	-5.34 mK
Resistance Reading of UUC (Ω)	A	0.87 mOhm	normal	1.00	2.50	2.17 mK
Temperature Reading of Standard[SPRT] °C	A	2.04 mK	normal	1.00	1.00	2.04 mK
Calibration of Standard [SPRT] °C	B	2.00 mK	normal	2.00	1.00	1.00 mK
Drift of Standard since last calibration [SPRT] °C	B	0.00 mK	rectangular	1.73	1.00	0.00 mK
Calibration of Indicator (Ω)	B	0.01 mOhm	normal	2.00	10.00	0.03 mK
Drift of Indicator since last calibration (Ω)	B	0.01 mOhm	rectangular	1.73	10.00	0.03 mK
Drift of UUC at ice point /°C	B	-1.48 mK	rectangular	1.73	1.00	-0.86 mK
Calibration Uncertainty of UUT Indicator	B	0.01 mOhm	normal	2.00	2.50	0.01 mK
Drift of of UUT Indicator since last calibration	B	0.01 mOhm	rectangular	1.73	2.50	0.01 mK
Self-Heating (SPRT)	B	4.00 mK	rectangular	1.73	1.00	2.31 mK
Self-Heating (IPRT)	B	10.00 mK	rectangular	1.73	1.00	5.78 mK
Uniformity of Bath-Axial (°C)	B	6.00 mK	rectangular	1.73	1.00	3.46 mK
Uniformity of Bath-Radial (°C)	B	5.50 mK	rectangular	1.73	1.00	3.18 mK
Instability of bath- (°C)	B	12.00 mK	rectangular	1.73	1.00	6.93 mK
Interpolation Function (°C)	B	3.85 mK	rectangular	1.73	1.00	2.23 mK
Combined Standard Uncertainty	-		normal			**12.36 mK**
Expanded Uncertainty	-		normal(k=2)			**24.85 mK**

UNCERTAINTY BUDGET TABLE, Calibration Point: ***300 °C***

Source of Uncertainty	Type	Uncertainty Value	Probability Distribution	Divisor	Sensitivity Coefficient	Standard Uncertainty, (°C)
Scatter of UUC fitted curve (Ω)	A	1.2 mOhm	normal	1.73	2.50	1.78 mK
Resistance Reading of UUC (Ω)	A	3.53 mOhm	normal	1.00	2.50	8.83 mK
Temperature Reading of Standard[SPRT] °C	A	9.46 mK	normal	1.00	1.00	9.46 mK
Calibration of Standard [SPRT] °C	B	2.00 mK	normal	2.00	1.00	1.00 mK
Drift of Standard since last calibration [SPRT] °C	B	0.00 mK	rectangular	1.73	1.00	0.00 mK
Calibration of Indicator (Ω)	B	0.01 mOhm	normal	2.00	10.00	0.03 mK
Drift of Indicator since last calibration (Ω)	B	0.01 mOhm	rectangular	1.73	10.00	0.03 mK
Drift of UUC at ice point /°C	B	-1.48 mK	rectangular	1.73	1.00	-0.86 mK
Calibration Uncertainty of UUT Indicator	B	0.01 mOhm	normal	2.00	2.50	0.01 mK
Drift of of UUT Indicator since last calibration	B	0.01 mOhm	rectangular	1.73	2.50	0.01 mK
Self-Heating (SPRT)	B	4.00 mK	rectangular	1.73	1.00	2.31 mK
Self-Heating (IPRT)	B	10.00 mK	rectangular	1.73	1.00	5.78 mK
Uniformity of Bath-Axial (°C)	B	8.00 mK	rectangular	1.73	1.00	4.62 mK
Uniformity of Bath-Radial (°C)	B	6.00 mK	rectangular	1.73	1.00	3.46 mK
Instability of bath- (°C)	B	13.00 mK	rectangular	1.73	1.00	7.51 mK
Interpolation Function (°C)	B	3.85 mK	rectangular	1.73	1.00	2.23 mK
Combined Standard Uncertainty	-		normal			**17.49 mK**
Expanded Uncertainty	-		normal(k=2)			**35.15 mK**

11.NMI-Australia

Quantity	Type	Unit	Uncertainty contribution	k	Sensitivity Coefficient	Degree of Freedom	Standard Uncertainty	nu(i)
Contribution of PRT(Artefact)								
1.PRT reading (noise)	A		included in 15					
2.Drift of PRT at IP	B	mK	1	3.46	2.8	8	0.81	0.053609
3.SelfHeat of PRT	B		0.00006	2	2500	2	0.08	1.58E-05
4.Calibration of indicator	B	Ohm	232	2.02	0.003	40	0.34	0.000352
5.Drift of indicator								
6.Conduction error	B	mK	0.1	1.73	1	2	0.06	5.58E-06
Contribution of Reference Standard								
7.SPRT reading (noise)	A		included in 15					
8.Calibration of SPRT	B	mK	1	2	1	59	0.50	0.001059
9.Drift of PRT	B	mK	0.39	3.46	2.8	8	0.32	0.00124
10.Calibration of indicator	B	Ohm	58	2.02	0.01	40	0.29	0.00017
11.Drift of indicator								
Contribution of Temperature Source								
12.Uniformity of enclosure	B	mK	4	2	1	59	2.00	0.271186
13.Interpolation function	B	mK	6.02	1.73	1	12	3.48	12.21857
14. IcePoint Purity	B	mK	0.6	2.04	2.8	31	0.82	0.014837
Nu Effective								25.79865
Combined standard uncertainty		mK					4.24	
Coverage factor							2.06	
Expanded uncertainty		mK					8.74	

12.KRISS-South Korea (after circulation)

0 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.2	t	99	1	0.2
Drift of PRT at Ice point (mK)	B	1.3	rectangular	∞	1	1.3
Self Heating of PRT (mK)	B	0.6	normal	∞	1	0.6
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0	t	199	1	0
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0	normal	∞	1	0
Instability of enclosure / furnace (mK)	B	0.2	normal	∞	1	0.2
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		2.7				
Coverage factor, k		1.96				
Expanded uncertainty, U		5.3				

-50 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	1.3	t	99	1	1.3
Drift of PRT at Ice point (mK)	B	1	rectangular	∞	1	1
Self Heating of PRT (mK)	B	0.5	normal	∞	1	0.5
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.9	t	199	1	0.9
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0.1	normal	∞	1	0.1
Combined standard uncertainty, u_c		3.2				
Coverage factor, k		1.96				
Expanded uncertainty, U		6.2				

-30 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.7	t	99	1	0.7
Drift of PRT at Ice point (mK)	B	1.1	rectangular	∞	1	1.1
Self Heating of PRT (mK)	B	0.5	normal	∞	1	0.5
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	1.1	t	199	1	1.1
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Radial uniformity of enclosure /furnace (mK)	B	0.2	normal	∞	1	0.2
Instability of enclosure / furnace (mK)	B	1.1	normal	∞	1	1.1
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3.1				
Coverage factor, k		1.96				
Expanded uncertainty, U		6.1				

100 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	0.3	t	99	1	0.3
Drift of PRT at Ice point (mK)	B	1.8	rectangular	∞	1	1.8
Self Heating of PRT (mK)	B	0.8	normal	∞	1	0.8
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.6	t	199	1	0.6
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	0.3	normal	∞	1	0.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		3.1				
Coverage factor, k		1.96				
Expanded uncertainty, U		6.1				

200 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	1.1	t	99	1	1.1
Drift of PRT at Ice point (mK)	B	2.3	rectangular	∞	1	2.3
Self Heating of PRT (mK)	B	1	normal	∞	1	1
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	1.3	t	199	1	1.3
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	1.4	normal	∞	1	1.4
Radial uniformity of enclosure /furnace (mK)	B	0.3	normal	∞	1	0.3
Instability of enclosure / furnace (mK)	B	1.4	normal	∞	1	1.4
Function						
Interpolation function (mK)	B	0.1	normal	∞	1	0.1
Combined standard uncertainty, u_c		4.3				
Coverage factor, k		1.96				
Expanded uncertainty, U		8.4				

300 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	1	t	99	1	1
Drift of PRT at Ice point (mK)	B	2.8	rectangular	∞	1	2.8
Self Heating of PRT (mK)	B	1.2	normal	∞	1	1.2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	0.9	t	199	1	0.9
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		5.9				
Coverage factor, k		1.96				
Expanded uncertainty, U		11.5				

400 °C

Quantity	Type	Uncertainty Contribution U_i	Probability Distribution	Degree of Freedom (ν_i)	Sensitivity Coefficient (c_i)	Standard Uncertainty u (x_i)
Contribution of PRT (Artefact)						
PRT Reading (mK)	A	2.3	t	99	1	2.3
Drift of PRT at Ice point (mK)	B	3.2	rectangular	∞	1	3.2
Self Heating of PRT (mK)	B	1.4	normal	∞	1	1.4
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Conduction error (mK)	B	0	-			0
Contribution of Reference Standard						
SPRT / PRT Reading (mK)	A	2.8	t	199	1	2.8
Calibration of SPRT / PRT (mK)	B	1	normal	∞	1	1
Drift of SPRT / PRT (mK)	B	2	normal	∞	1	2
Calibration of indicator (mK)	B	0.3	normal	∞	1	0.3
Drift of indicator (mK)	B	0	-			0
Contribution Temperature Source						
Axial uniformity of enclosure /furnace (mK)	B	3.2	normal	∞	1	3.2
Radial uniformity of enclosure /furnace (mK)	B	1.7	normal	∞	1	1.7
Instability of enclosure / furnace (mK)	B	2.3	normal	∞	1	2.3
Function						
Interpolation function (mK)	B	0	normal	∞	1	0
Combined standard uncertainty, u_c		7				
Coverage factor, k		1.96				
Expanded uncertainty, U		13.7				

APPENDIX C : LABORATORY EQUIPMENT

Loop A

1. NML ,SIRIM- Malaysia(Before circulation)

Item	Description	Model	S/N	Traceability
1.	Standard Platinum Resistance Thermometer 25.5 Ω	YSI/8163-QC	H 92S4699	NMI-AUSTRALIA
2.	Standard Platinum Resistance Thermometer 25.5 Ω	NIM/Low Temperature	6500	NMI-AUSTRALIA
3.	Precision Thermometry Bridge	ASL/F17A	1157-6/302	NML-SIRIM
4.	Precision Thermometry Bridge	ASL/F18	1279-5/129	NML-SIRIM
5.	Standard Resistor	Tinsley/5683A	269768	NML-SIRIM
6.	Alcohol Temperature Bath	Hart Scientific/7138	A48012	NML-SIRIM
7.	Water Bath	Heto/KB25	9209956	NML-SIRIM
8.	Oil Bath	Heto/JH03	452385	NML-SIRIM
9.	Furnace	Carbolite/TZF 12/75	5/99/1137	NML-SIRIM

2. NIMT-Thailand

Item	Description	Model	S/N	Traceability
1.	SPRT	5187SA	280419	NMIA
2.	SPRT	5681	1522	NIMT
3.	SPRT	935-14-77	66	NIMT
4.	Super-Thermometer II	1590	97045	NIMT
5.	Super-Thermometer II	1590	A74392	NIMT
6.	Calibration Bath	7381	A85180	NIMT
7.	Calibration Bath	6331	A83211	NIMT
8.	Calibration Bath	6055	A0B037	NIMT

3. NMISA-South Africa

Item	Description	Model	S/N	Traceability
1.	Water triple point cell	A11	2035	NMISA
2.	Water triple point cell	5901A	1181	NMISA
3.	Standard PRT	162CE	4203	NMISA
4.	Standard PRT	8167-25	1827488	NMISA
5.	Standard PRT	5187SA	269581	NMISA
6.	Resistance bridge	F18	1208-1/105	NMISA
7.	Standard resistor	5685A	243519	NMISA
8.	Stirred liquid bath	CB217	8609571	
9.	Stirred liquid bath	915L	161371/2	
10.	Stirred liquid bath	JH02	87091113	

4. NIS-Egypt

Item	Description	Model	S/N	Traceability
1.	SPRT 25.5 ohm	Tinsley 5137SA	228855	NIS, Egypt
2.	Resistance bridge	Tinsley SENATOR 5840D	267620	
3.	Alcohol Bath (-80°C to 5°C)	Fluke 7381	A74121	NIS, Egypt
4.	Oil Bath (95°C to 200°C)	Hart 6054	77006	NIS, Egypt
5.	Salt Bath (205°C to 420°C)	Hart 6055	78015	NIS, Egypt

5. NSCL-Syria

Item	Description	Model	S/N	Traceability
1.	Platinum Resistance Thermometer	5626	2080	NIST
2.	Digital thermometer Readout	1529	A71419	NSCL (DC-Lab)
3.	Ultra Low Temperature bath	7380	A18076	NSCL (TH-Lab)
4.	Silicon Oil Bath	TPU/ O / 21	3856-3	NSCL (TH-Lab)
5.	Niter Bath	TPU / N / 21	3856-2	NSCL (TH-Lab)
6.	Ice Point Bath	SY-12	N / A	NSCL (TH-Lab)

6. JNMI-Jordan

Item	Description	Model	S/N	Traceability
1.	Standard Platinum Resistance Thermometer	935-14-77E	201	NPL/UK
2.	Standard Platinum Resistance Thermometer	935-14-77E	204	KRISS/Korea
3.	Digital Readout (Black Stack)	1560/2560	A57207/ A57823	NIST/USA
4.	Reference Resistor	742 A-100	8998009	KRISS/Korea
5.	Resistance Bridge	8508A-01	900151153	----------
6.	Ethanol Bath	915-LW	25269/2	----------
7.	Oil Bath	Hydra	25269/3	----------
8.	Salt Bath	6045		----------

7. NMI-Australia

Item	Description	Model	S/N	Traceability
1.	AC bridge	ASL F700	735004560	
2			10754/01	
3.			1111-2-276	
4.	Reference Resistor		RRS1	NMIA
5.			FR4 009841/02	NMIA
6			RRS2	NMIA
6.	SPRT	Hart Scientific	1632	NMIA
7.		Hart Scientific	1635	NMIA
8.		L&N	1810368	NMIA
9.		Chino	RS072-04	NMIA
10.		Chino	RS076-06	NMIA
11.		Chino	RS104-09	NMIA
12.		CSIRO-NML	B112	NMIA
13.		CSIRO-NML	378-S899	NMIA
14.	Enclosure	NMIA	Cryostat	
15.		Isotech	Alcohol	
16.		CSIRO-NML	Water Bath	
17.		Hart Scientific	Oil bath	
18.		Hart Scientific	Salt bath	

8. KRISS-South Korea

Item	Description	Model	S/N	Traceability
1.	Standard Platinum Resistance Thermometer	Rosemount 162CE	4053	Fixed point calibration at KRISS
2.	Resistance ratio bridge	ASL F700	1349 001 453	Tested at KRISS
3.	Standard resistor	Guildline 7334-100	69975	Calibrated at KRISS
4.	Low temperature bath	Hart 7080	A8C106	Tested at KRISS
5.	Ice point bath	Home-made	-	Tested at KRISS
6.	Liquid bath (100 °C)	Hart 7012	67028	Tested at KRISS
7.	Liquid bath (200 °C)	Hart 6022	66032	Tested at KRISS
8.	Salt bath (~ 400 °C)	Hart 6055	A5B076	Tested at KRISS

9. NISIT-Papua New Guinea

Item	Description	Model	S/N	Traceability
1.	SPRT-ISOTECH METAL SHEATHED	670SH/25 OHM	4	REPORT NUMBER RN 080046 CALIBRATED 16TH MAY 2008 BY NMI AUSTRALIA
2.	RESISTANCE BRIDGE-ISOTECH MICROK	MICROK 800	07-P010 27518/2	CERT NO 07-09-37 CALIBRATED 10TH SEP 2007 BY ISOTECH NTPL

10. NIM-China

Item	Description	Model	S/N	Traceability
1.	Standard Platinum Resistance Thermometer	WZPB	94813	NIM
2.	Standard Platinum Resistance Thermometer	CST6601	68832	NIM
3.	resistance bridge	1590	A54280	NIM
4.	resistance bridge	1590	A6B367	NIM
5.	thermostatic bath (oil)	HPS-300A	8001654	NIM
6.	Thermostatic bath(alcohol)	7381	A6B107	NIM
7.	water triple point bath(water triple point cell)	NIM-1	NIM-1-207	NIM
8.	Anneal furnace	NIM-T-AN	8002	NIM
9.	hygrothermograph	M288-CTH	B14	NIM

11. BSTI-Bangladesh

Item	Description	Model	S/N	Traceability
1.	25 Ω Standard Platinum Resistance Thermometer	ISOTECH 909Q	909Q/1518	NTPL (UKAS 0175)
2.	True Temperature Indicator	TTI - 7+	271150/1	NTPL (UKAS 0175)
3.	Parallel Tube Liquid Bath	ISOTECH 915	271221-1	NML-BSTI
4.	Fluidized Calibration Bath	ISOTECH 875	271221-2	NML-BSTI
5.	Precision Thermometer Bridge	584000	011325/09	NML-BSTI
6.	Selector Switch	5840S-10T	010776/04	NML-BSTI
7.	Flake-Ice-Maker	FIM95A	110387675	
8.	Dewar Vessel	-	-	

12. CMS-Taiwan

Item	Description	Model	S/N	Traceability
1.	Precision Thermometry BridgeFor calibration IPRT	F700A	S148 S158	--
2.	Oil bathTo provide the calibration temperature source from 100 °C to 300 °C	JH01	93051656	--
3.	Water bathTo provide the calibration temperature source from -50 °C to -30 °C	7381	--	--
4.	Dewar vesselTo provide the steady ambient temperature of ice point (IP) for calibration IPRT	--	--	--
5.	AC/DC Standard resistanceFor calibration IPRT (IP, -50 °C, -30 °C, IP, 100 °C, 200 °C, 300 °C, IP)	5685A	262466	NML/ROC
6.	Standard platinum resistance thermometerTo calibration the IPRT	R800-2	RS095-04	NML/ROC
7.	Precision Thermometry BridgeFor measurement TPW of IPRT	F18	--	--
8.	AC/DC Standard resistanceFor measurement TPW of IPRT	5685A	260927	NPL/UK
9.	TPW cellsFor measurement of TPW of IPRT	5901A	1084	--
10.	Thermostatic bathTo provide a steady ambien	TMV-700	91MML00690-1	--

13. KIM,LIPI-Indonesia

Item	Description	Model	S/N	Traceability
1	Ice Bath	Fluke - Hart Scientific/7911A2	A76050	
2	Silicon Oil Bath	Fluke - Hart Scientific/6331	A76183	
3	Silicon Oil Bath	Fluke - Hart Scientific/7321	A76103	
4	Halo Carbon Liquid Bath	Fluke - Hart Scientific/7380	A77127	
5	Salt Bath	Fluke - Hart Scientific/6055	A76092	
6	Temperature/Resistance Indicator	Fluke - Hart Scientific/1590	A3A225	KIM-LIPI
7	SPRT	Chino/R800-2	RS955-11	KIM-LIPI

14. NMC,A*STAR-Singapore

Item	Description	Model	S/N	Traceability
1.	MI Bridge	6010A	920303	National Standards
2.	ASL Bridge	F700	1349-008/460	National Standards
3.	Tinsley Standard Platinum Resistance Thermometer	5187SA	250303	National Standards
4.	Tinsley Standard Platinum Resistance Thermometer	5187SA	275053	National Standards
5.	Heto Alcohol Bath	KB-25	496905-B	National Standards
6.	Heto Oil Bath	KB-12	91112034	National Standards
7.	Hart Scientific Salt Bath	6055	93019	National Standards

15. VMI-Vietnam

Item	Description	Model	S/N	Traceability
1.	SPRT Hart Scientific	5681	1357	VMI
2.	SPRT Hart Scientific	5681	1248	VMI
3.	ASL Resistance Bridge F900	AS2-J-D	005844/03	NPL
4.	Hart Scientific Super Thermometer II	1590	A11118	VMI
5.	Tinsley Standard Resistor 300 ohm	5685A	66960/03	VMI
6.	Tinsley Standard Resistor 100 ohm	5685A	6960/14	VMI
7.	Hart Scientific triple point of water cell	5901	9-1153	NIST
8.	Hart Scientific Deep Bath	7381	A4A020	VMI
9.	Isotech Oil Bath	915 H	18915/1	VMI
10.	Hart Scientific Salt Bath	6055	A4B065	VMI

16. ITDI-Philiphines

Item	Description	Model	S/N	Traceability
1.	SPRT	Isotech/670	58	KRISS- Korea
2.	Thermometer Readout	Hart Scientific/Chub E4 1529	A5B965	KRISS-Korea