Internal delay calibration at KRISS

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Revision 1.0, June 1, 2017
Revision 1.1, June 6, 2017
Revision 1.2, Aug. 16, 2017

CAL-ID: 1017-2017

1 Introduction

KRISS and NICT performed their first G2 calibration campaign with the NICT traveling receiver at KRISS. The period of the calibration at KRISS was from April 19 to 23, 2017. Table 1 shows the receivers and antennas used for the calibration.

Table 1: List of receivers and antennas.

System	*Receiver*	*Antenna*	*Remark*
NC01	Septentrio PolaRx2 TR	ASHTECH 701933-02 Rev A	Master
NC4S	Septentrio PolaRx4 TR Pro	AeroAntenna AT1675-120SW	Backup
NC4C	Septentrio PolaRx4 TR Pro	NovAtel GPS-703-GGG	Traveling
KRT1	PikTime TTS-4	Javad RingAnt-G3T	
KRG1	Dicom GTR-51	NovAtel GPS-703-GGG	
KRZ1	ASHTECH Z12T	ASHTECH 701945C_M	KRIS/KR01

We performed a common clock measurement based on "BIPM guidelines for GNSS calibration" [1] and calculated the common clock differences (CCDs) from RINEX files since all the receivers were geodetic-type receivers. "concerto v4" (c4) was used as the analysis software [2].

The internal delays of the NICT reference and traveling receivers were calibrated by BIPM [3] as shown in Table 2.

The internal delays of the KRISS receivers with respect to the NICT reference receivers were calculated from the values in Tables 2 and 7, and Table 3 shows the results of these calculations. The results of KRG1 (Dicom GTR-51) show differences from the a priori values. In addition, we subtracted the antenna cable delay of 193.1 ns from the calibration results because CABDLY was not present in the RINEX files of KRG1 in this measurement. We estimated the uncertainty of this calibration using equation 1.

$$U_{CAL} = \sqrt{U_{ref}^2 + U_{cal}^2} \tag{1}$$

Table 2: Internal delays of the reference receivers (all values in ns).

Sys.	*Date*	*REF*	*CAB*	*C1*	*P1*	*P2*	U_{CAL}
NC01	2017.03	408.2	213.4	221.4	218.3	222.4	2.3
NC4S	2017.03	314.6		278.2	276.8	276.3	2.3
NC4C	2017.04	540.8	157.5	56.4	54.9	53.3	2.3

Table 3: Internal delays of the KRISS receivers (all values in ns).

Sys.	*Ref.*	*REF*	*CAB*	*C1*	*P1*	*P2*	U_{CAL}
KRT1	Ave.	102.7	193.2	**-36.7**	**-38.1**	**-41.5**	2.9
	NC01			-36.75	-38.13	-41.62	
	NC4S			-36.65	-37.97	-41.34	
KRG1	Ave.	109.6	193.1	**-36.5**	**-38.6**	**-40.7**	
				(-9.9)	(-6.0)	(-4.4)	2.9
	NC01			-9.91	-6.03	-4.52	
	NC4S			-9.82	-5.87	-4.23	
KRZ1	Ave.	139.1	182.6	**304.7**	**304.0**	**312.7**	2.9
	NC01			304.62	303.96	312.55	
	NC4S			304.72	304.12	312.84	

Where U_{ref} is the uncertainty of the reference receiver, given in Table 2, and U_{cal} is the total uncertainty of this calibration, given in Table 8.

2 Results of raw data processing

Table 4 shows the average CCDs between the traveling receiver and each reference or target receiver, and Figures 1 to 7 show raw plots and the time deviation of each CCD. We used single difference observations of each code (C1, P1, and P2) between receivers, and solved the receiver clock offsets every 1 h. The raw plots show the estimated CCDs as receiver clock offsets.

Table 4: Summary of the raw calibration results (all values in ns).

Pair	*Date*	*CCD (C1)*	U_a	*CCD (P1)*	U_a	*CCD (P2)*	U_a
NC4C - NC01	57832 - 57854	-353.834	0.2	-352.286	0.1	-358.062	0.2
NC4C - NC4S	57832 - 57854	-290.743	0.2	-290.830	0.2	-291.714	0.2
NC4C - KRT1	57862 - 57866	-66.012	0.3	-66.198	0.3	-64.307	0.2
NC4C - KRG1	57862 - 57866	-195.489	0.2	-200.945	0.2	-204.056	0.2
NC4C - KRZ1	57862 - 57866	-360.424	0.4	-361.331	0.3	-371.527	0.2
NC4C - NC01	57870 - 57879	-353.469	0.2	-351.962	0.2	-357.583	0.3
NC4C - NC4S	57870 - 57879	-290.366	0.2	-290.497	0.2	-291.564	0.1

3 Calibration results

Table 5 shows the ΔSYSDLY values for the traveling receiver with respect to the reference receivers. These values were calculated using equation (2).

$$\Delta\text{SYSDLY}_{A-B} = \text{CCD}_{A-B} + \text{REFDLY}_A - \text{REFDLY}_B \tag{2}$$

"No" in Table 5 indicates the measurement period at NICT, where No. 1 denotes preliminary

Table 5: Computed ΔSYSDLY values for the traveling systems with respect to reference receivers. (all values in ns)

Pair	*No*	REF_T	REF_R	*C1 (ns)*		*P1 (ns)*		*P2 (ns)*	
				CCD	ΔSYS	*CCD*	ΔSYS	*CCD*	ΔSYS
NC4C - NC01	1	540.8	408.2	-353.83	-221.23	-352.29	-219.69	-358.06	-225.46
NC4C - NC01	2	540.1	408.2	-353.47	-221.57	-351.96	-220.06	-357.58	-225.57
		Misclosure			0.33		0.38		0.22
		Mean			-221.40		-219.87		-225.57
NC4C - NC4S	1	540.8	314.6	-290.74	-64.54	-290.83	-64.63	-291.71	-65.51
NC4C - NC4S	2	540.1	314.6	-290.37	-64.87	-290.50	-65.00	-291.56	-66.06
		Misclosure			0.32		0.37		0.55
		Mean			-64.70		-64.81		-65.79

measurements and No. 2 denotes closure measurements.

Table 6 shows the ΔSYSDLY values for the KRISS receivers with respect to the traveling receiver. *Note* (∗1): GTR-51 with the REFDLY_V value introduced a priori.

Table 6: Computed ΔSYSDLY values for the visited systems with respect to the traveling system (all values in ns).

Pair	REF_T	REF_V	*C1 (ns)*		*P1 (ns)*		*P2 (ns)*	
			CCD	ΔSYS	*CCD*	ΔSYS	*CCD*	ΔSYS
NC4C - KRT1	250.8	102.74	-66.01	82.05	-66.20	81.86	-64.31	83.75
NC4C - KRG1	250.8	∗1	-195.49	55.31	-200.95	49.86	-204.06	46.74
NC4C - KRZ1	250.8	139.1	-360.42	-248.72	-361.33	-249.63	-371.53	-259.83

Table 7 shows the ΔINTDLY values for the KRISS receivers with respect to the reference receivers. ΔSYSDLY in Table 7 was obtained from equation (3) and ΔINTDLY was obtained from equation (4).

$$\Delta\text{SYSDLY}_{V-R} = \Delta\text{SYSDLY}_{T-R} - \Delta\text{SYSDLY}_{T-V} \tag{3}$$

$$\Delta\text{INTDLY}_{V-R} = \Delta\text{SYSDLY}_{V-R} - \text{CABDLY}_V + \text{CABDLY}_R + \Delta_T \tag{4}$$

Here Δ_T is the difference between the antenna cable delays of the traveling receiver at NICT (157.5 ns) and KRISS (182.6 ns) because we used another antenna cable for the traveling receiver at KRISS.

$$\Delta_T = \text{CABDLY}_T^{KRISS} - \text{CABDLY}_T^{NICT} \tag{5}$$

Note (∗2): GTR-51 with CAVDLY_V value introduced a priori.

Table 7: Computed ΔINTDLY values for the visited systems with respect to the reference receivers (all values in ns).

Pair	CAB_V	CAB_R	Δ_T	*C1 (ns)*		*P1 (ns)*		*P2 (ns)*	
				ΔSYS	ΔINT	ΔSYS	ΔINT	ΔSYS	ΔINT
KRT1 - NC01	193.2	213.4	25.1	-303.45	-258.15	-301.73	-256.43	-309.32	-264.02
KRG1 - NC01	∗2	213.4	25.1	-276.71	-38.21	-269.73	-31.23	-272.32	-33.82
KRZ1 - NC01	182.6	213.4	25.1	27.32	83.22	29.76	29.76	34.25	90.15
KRT1 - NC4S	193.2	0.0	25.1	-146.75	-314.85	-146.67	-314.77	-149.54	-317.64
KRG1 - NC4S	∗2	0.0	25.1	-120.02	-94.92	-114.67	-89.57	-112.53	-87.43
KRZ1 - NC4S	182.6	0.0	25.1	184.02	26.52	184.82	27.32	194.04	36.54

4 Uncertainty estimation

Table 8 shows the uncertainty of the calibration. The method of estimating the uncertainty is the same as that in [3]. However, we append $u_{b,23}$ and $u_{b,24}$ for the antenna cable delay of the traveling receiver because we used different cables at the reference and visited laboratories.

Revision history

Revision 1.0 Initial release.

Revision 1.1 Fixed a mistake of the KRT1 REFDLY value.

Revision 1.2 Wrote cleary the final (averaged) results, and added true INTDLY for KRG1. Specified calibration identifier of this trip.

References

[1] BIPM guidelines for GNSS calibration V3.2 15/02/2016.

[2] T.Gotoh, et al, Proc. 21th EFTF and IFCS, pp.1188—1193, 2007.

[3] Continuity of GPS "INTDLY" values of Group 1 geodetic receivers in successive Group 1 trips, GP/TM266, V1: 18 January 2017.

Table 8: Uncertainty contributions.

Uncertainty	*Value C1/P1 (ns)*	*Value P2 (ns)*	*Value P1 - P2 (ns)*	*Value P3 (ns)*	*Description*
$u_a(T-R)$	0.20	0.20	0.28		CCD (traveling - reference)
$u_a(T-V)$	0.30	0.20	0.36		CCD (traveling - visited)
u_a	0.36	0.28	0.46	0.80	
Misclosure					
$u_{b,1}$	0.40	0.40	0.20		Observed misclosure
Systematic components related to CCD					
$u_{b,11}$	0.05	0.05	0.05		Position error at reference
$u_{b,12}$	0.05	0.05	0.05		Position error at visited
$u_{b,13}$	0.30	0.30	0.40		Multipath at reference
$u_{b,14}$	0.30	0.30	0.40		Multipath at visited
Link from the traveling system to the local UTC(k)					
$u_{b,21}$	0.50	0.50	0.00		REFDLY_T (at reference)
$u_{b,22}$	0.50	0.50	0.00		REFDLY_T (at visited)
$u_{b,23}$	0.50	0.50	0.00		CABDLY_T (at reference)
$u_{b,24}$	0.50	0.50	0.00		CABDLY_T (at visited)
$u_{b,TOT}$	1.16	1.16	0.60	1.48	
Link from the reference system to its local UTC(k)					
$u_{b,31}$	0.50	0.50	0.00		REFDLY_R
Link from the visited system to its local UTC(k)					
$u_{b,32}$	0.50	0.50	0.00		REFDLY_V
$u_{b,SYS}$	1.36	1.36	0.60	1.65	
u_{CAL}				1.83	

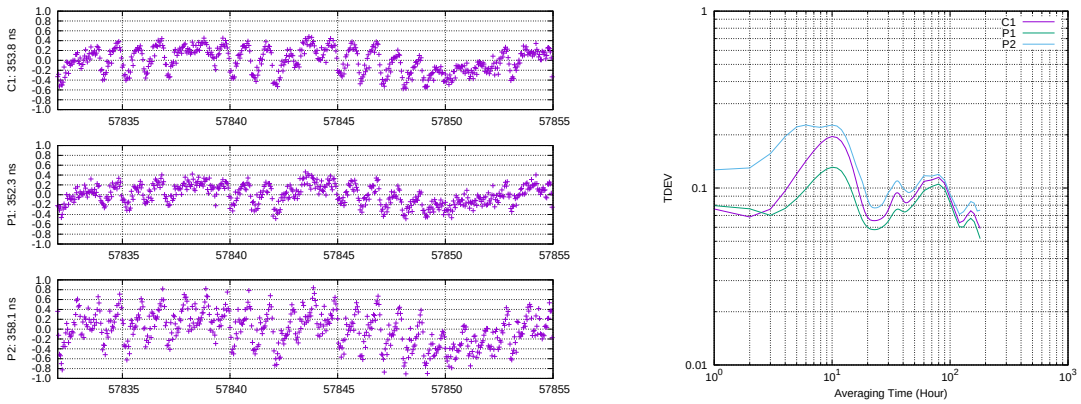


Figure 1: Common clock differences between NC4C and NC01 (preliminary).

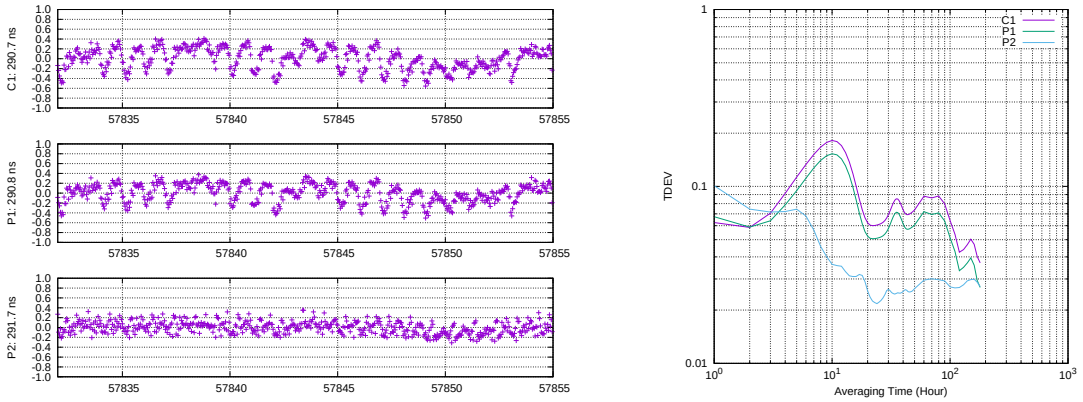


Figure 2: Common clock differences between NC4C and NC4S (preliminary).

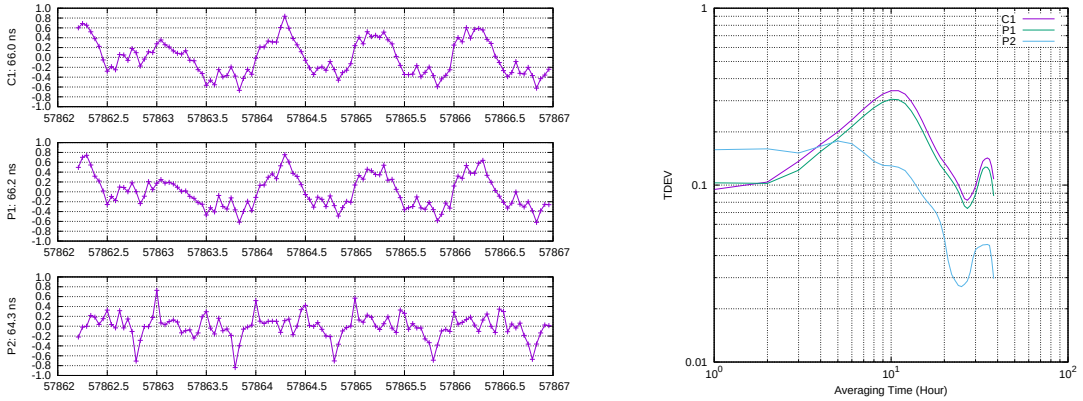


Figure 3: Common clock differences between NC4C and KRT1.

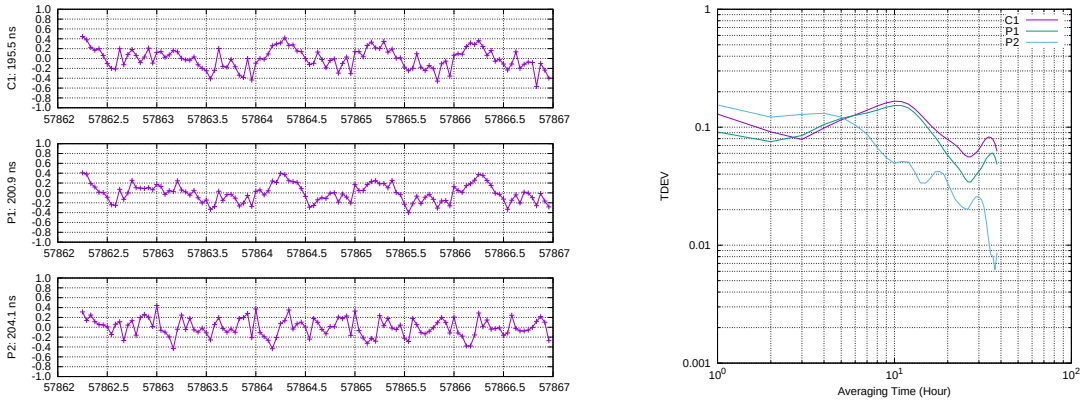


Figure 4: Common clock differences between NC4C and KRG1.

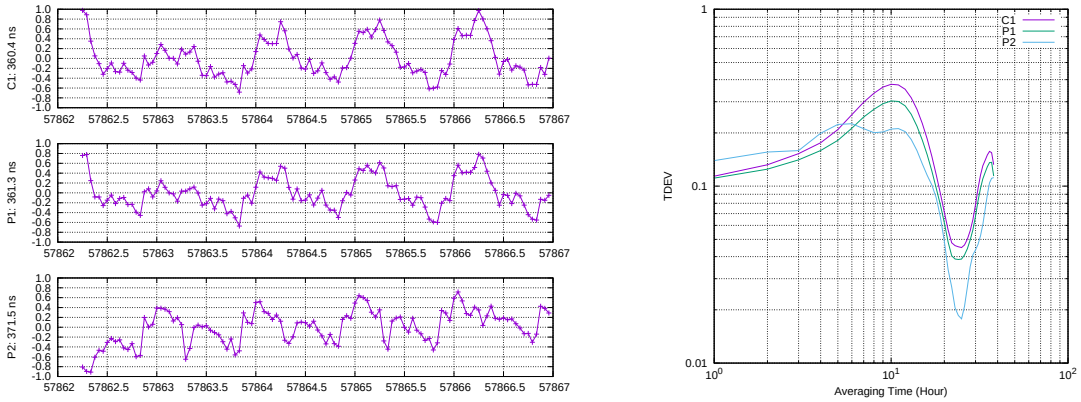


Figure 5: Common clock differences between NC4C and KRZ1.

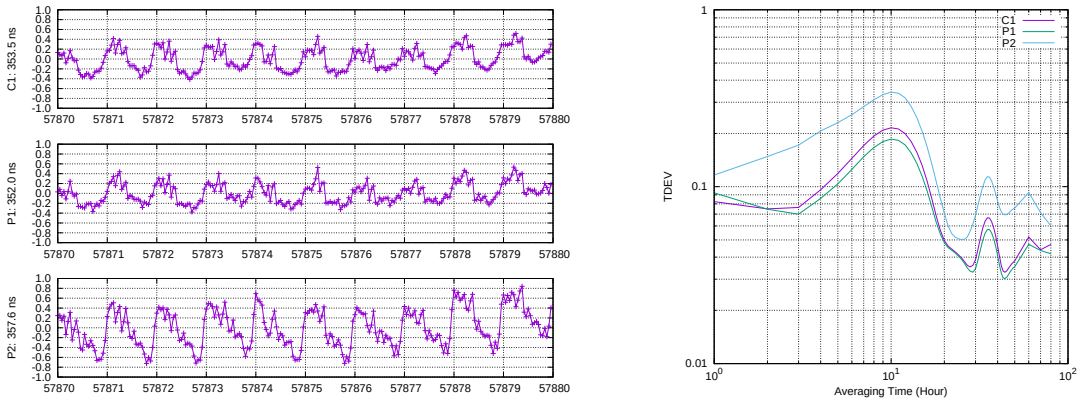


Figure 6: Common clock differences between NC4C and NC01 (closure).

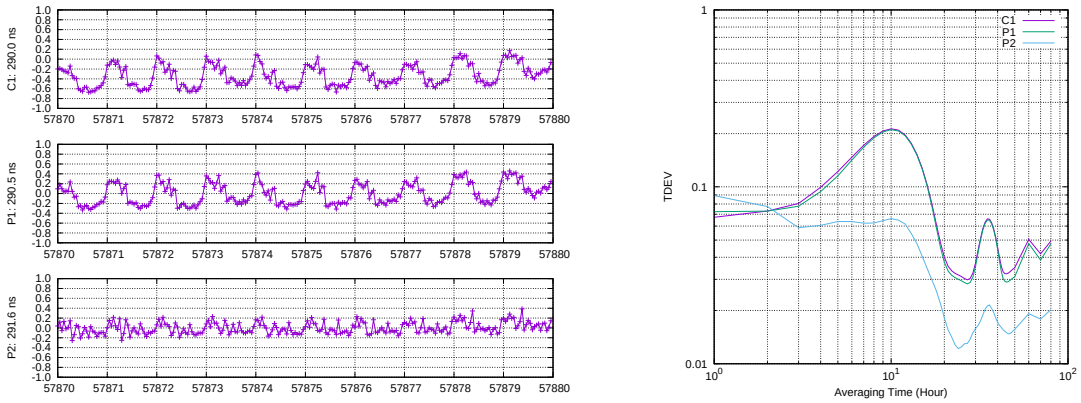


Figure 7: Common clock differences between NC4C and NC4S (closure).

Annex A - Information Sheet

(to be repeated for each calibrated system)

Laboratory:	NICT
Date and hour of the beginning of measurements:	**Mar. 20, 2017 0h UTC**
Date and hour of the end of measurements:	**Apr. 11, 2017 24h UTC**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	NC01	NC4C
• Receiver maker and type: Receiver serial number:	Septentrio PolaRx2 TR S/N: 1354 Rev A	Septentrio PolaRx4 TR Pro S/N: 3102270
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	FUJIKURA 8D-SFA-LITE Phase stabilised: No	FUJIKURA 5D-SFA-LITE Phase stabilised: No
Length outside the building /m:		
• Antenna maker and type: Antenna serial number:	ASHTECH 701933-02 Rev A CRN21999080101	NovAtel GPS-703-GGG S/N: 01018146
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	165.1 ns	406.8 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	234.4 ns 165.1 + 234.4 + 8.7 = 408.2 ns	134.0 ns 406.8 + 134.0 = 540.8 ns
• Antenna cable delay:	213.4 ns	157.5 ns
Splitter delay (if any):		
Additional cable delay (if any):		

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	221.4 ns (C1), 218.3 ns (P1), 222.4 ns (P2)
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	213.4 ns
• REF DLY /ns:	408.2 ns
• Coordinates reference frame:	
Latitude or X /m:	-3942091.48 m
Longitude or Y /m:	3368258.70 m
Height or Z /m:	3701996.21 m

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	Yes
Set temperature value and uncertainty:	24 degC
Set humidity value and uncertainty:	40 %

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

(to be repeated for each calibrated system)

Laboratory:	NICT
Date and hour of the beginning of measurements:	**Mar. 20, 2017 0h UTC**
Date and hour of the end of measurements:	**Apr. 11, 2017 24h UTC**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	NC4S	NC4C
• Receiver maker and type: Receiver serial number:	Septentrio PolaRx4 TR Pro S/N: 3102252	Septentrio PolaRx4 TR Pro S/N: 3102270
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	FUJIKURA 8D-SFA-LITE Phase stabilised: No	FUJIKURA 5D-SFA-LITE Phase stabilised: No
Length outside the building /m:		
• Antenna maker and type: Antenna serial number:	AeroAntenna AT1675-120SW S/N: 5411	NovAtel GPS-703-GGG S/N: 01018146
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	166.4 ns	406.8 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	148.2 ns 166.4 + 148.2 = 314.6 ns	134.0 ns 406.8 + 134.0 = 540.8 ns
• Antenna cable delay:		157.5 ns
Splitter delay (if any):		
Additional cable delay (if any):		

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	278.2 ns (C1), 276.8 ns (P1), 276.3 ns (P2)
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	
• REF DLY /ns:	314.6 ns
• Coordinates reference frame:	
Latitude or X /m:	-3942091.42 m
Longitude or Y /m:	3368261.97 m
Height or Z /m:	3701993.35 m

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	Yes
Set temperature value and uncertainty:	24 degC
Set humidity value and uncertainty:	40 %

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

(to be repeated for each calibrated system)

Laboratory:	KRISS
Date and hour of the beginning of measurements:	**Apr. 19, 2017 5h UTC**
Date and hour of the end of measurements:	**Apr. 23, 2017 24h UTC**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	KRT1	NC4C
• Receiver maker and type: Receiver serial number:	PikTime system TTS4 S/N: 141	Septentrio PolaRx4 TR Pro S/N: 3102270
1 PPS trigger level /V:	0.5 V	
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ1-50A Phase stabilised: No	Andrew FSJ1-50A Phase stabilised: No
Length outside the building /m:	Approx. 30 m	Approx. 30 m
• Antenna maker and type: Antenna serial number:	Javad RingAnt-G3T S/N: 00642	NovAtel GPS-703-GGG S/N: 01018146
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	107.9 ns	111.3 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	57.3 ns (Frq. corr.: -5.2 ns) 107.9 - 5.2 = 102.7 ns	139.5 ns 111.3 + 139.5 = 250.8 ns
• Antenna cable delay:	193.2 ns	182.6 ns
Splitter delay (if any):		
Additional cable delay (if any):		

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	-94.25 ns (C1), -7.13 ns (P1), -14.97 ns (P2)
• INT DLY (GLONASS) /ns:	-604.14 ns (C1), 16.43 ns (P1), 26.97 ns (P2)
• CAB DLY /ns:	193.20 ns
• REF DLY /ns:	102.74 ns (107.91 + -5.17 ns)
• Coordinates reference frame:	
Latitude or X /m:	-3120374.70 m
Longitude or Y /m:	4085237.19 m
Height or Z /m:	3763089.22 m

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	
Set temperature value and uncertainty:	
Set humidity value and uncertainty:	

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

(to be repeated for each calibrated system)

Laboratory:	KRISS
Date and hour of the beginning of measurements:	**Apr. 19, 2017 5h UTC**
Date and hour of the end of measurements:	**Apr. 23, 2017 24h UTC**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	KRG1	NC4C
• Receiver maker and type: Receiver serial number:	Dicom GTR-51 S/N: 1506131	Septentrio PolaRx4 TR Pro S/N: 3102270
1 PPS trigger level /V:	0.5 V	
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ1-50A Phase stabilised: No	Andrew FSJ1-50A Phase stabilised: No
Length outside the building /m:	Approx. 30 m	Approx. 30 m
• Antenna maker and type: Antenna serial number:	NovAtel GPS-703-GGG NEG14300024	NovAtel GPS-703-GGG S/N: 01018146
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	109.6 ns	111.3 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)		139.5 ns 111.3 + 139.5 = 250.8 ns
• Antenna cable delay:	193.1 ns	182.6 ns
Splitter delay (if any):		
Additional cable delay (if any):		

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	-26.6 ns (C1), -32.6 ns (P1), -36.3 ns (P2)
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	0.0 ns
• REF DLY /ns:	109.6 ns
• Coordinates reference frame:	
Latitude or X /m:	-3120373.73 m
Longitude or Y /m:	4085238.06 m
Height or Z /m:	3763089.30 m

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	
Set temperature value and uncertainty:	
Set humidity value and uncertainty:	

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

(to be repeated for each calibrated system)

Laboratory:	KRISS
Date and hour of the beginning of measurements:	**Apr. 19, 2017 5h UTC**
Date and hour of the end of measurements:	**Apr. 23, 2017 24h UTC**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	KRZ1 (KRIS/KR01)	NC4C
• Receiver maker and type: Receiver serial number:	Ashtech Z12T RT920013103	Septentrio PolaRx4 TR Pro S/N: 3102270
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ1-50A Phase stabilised: No	Andrew FSJ1-50A Phase stabilised: No
Length outside the building /m:	Approx. 30 m	Approx. 30 m
• Antenna maker and type: Antenna serial number:	Ashtech ASH701945C_M CR620011501	NovAtel GPS-703-GGG S/N: 01018146
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	111.7 ns	111.3 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	11.6 111.7 + 11.6 + 15.8 = 139.1 ns	139.5 ns 111.3 + 139.5 = 250.8 ns
• Antenna cable delay:	182.6 ns	182.6 ns
Splitter delay (if any):		
Additional cable delay (if any):		

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	310.3 ns (P1), 320.5 ns (P2)
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	182.6 ns
• REF DLY /ns:	123.3 ns
• Coordinates reference frame:	
Latitude or X /m:	-3120375.12 m
Longitude or Y /m:	4085235.56 m
Height or Z /m:	3763090.62 m

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	
Set temperature value and uncertainty:	
Set humidity value and uncertainty:	

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

(to be repeated for each calibrated system)

Laboratory:	NICT
Date and hour of the beginning of measurements:	**Apr. 27, 2017 0h UTC**
Date and hour of the end of measurements:	**May. 6, 2017 24h UTC**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	NC01	NC4C
• Receiver maker and type: Receiver serial number:	Septentrio PolaRx2 TR S/N: 1354 Rev A	Septentrio PolaRx4 TR Pro S/N: 3102270
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	FUJIKURA 8D-SFA-LITE Phase stabilised: No	FUJIKURA 5D-SFA-LITE Phase stabilised: No
Length outside the building /m:		
• Antenna maker and type: Antenna serial number:	ASHTECH 701933-02 Rev A CRN21999080101	NovAtel GPS-703-GGG S/N: 01018146
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	165.1 ns	406.8 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	234.4 ns 165.1 + 234.4 + 8.7 = 408.2 ns	133.3 ns 406.8 + 133.3 = 540.1 ns
• Antenna cable delay:	213.4 ns	157.5 ns
Splitter delay (if any):		
Additional cable delay (if any):		

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	221.4 ns (C1), 218.3 ns (P1), 222.4 ns (P2)
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	213.4 ns
• REF DLY /ns:	408.2 ns
• Coordinates reference frame:	
Latitude or X /m:	-3942091.48
Longitude or Y /m:	3368258.70
Height or Z /m:	3701996.21

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	Yes
Set temperature value and uncertainty:	24 degC
Set humidity value and uncertainty:	40 %

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

(to be repeated for each calibrated system)

Laboratory:	NICT
Date and hour of the beginning of measurements:	**Mar. 20, 2017 0h UTC**
Date and hour of the end of measurements:	**Apr. 11, 2017 24h UTC**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	NC4S	NC4C
• Receiver maker and type: Receiver serial number:	Septentrio PolaRx4 TR Pro S/N: 3102252	Septentrio PolaRx4 TR Pro S/N: 3102270
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	FUJIKURA 8D-SFA-LITE Phase stabilised: No	FUJIKURA 5D-SFA-LITE Phase stabilised: No
Length outside the building /m:		
• Antenna maker and type: Antenna serial number:	AeroAntenna AT1675-120SW S/N: 5411	NovAtel GPS-703-GGG S/N: 01018146
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	166.4 ns	406.8 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	148.2 ns 166.4 + 148.2 = 314.6 ns	133.3 ns 406.8 + 133.3 = 540.1 ns
• Antenna cable delay:		157.5 ns
Splitter delay (if any):		
Additional cable delay (if any):		

Data used for the generation of CGGTTS files

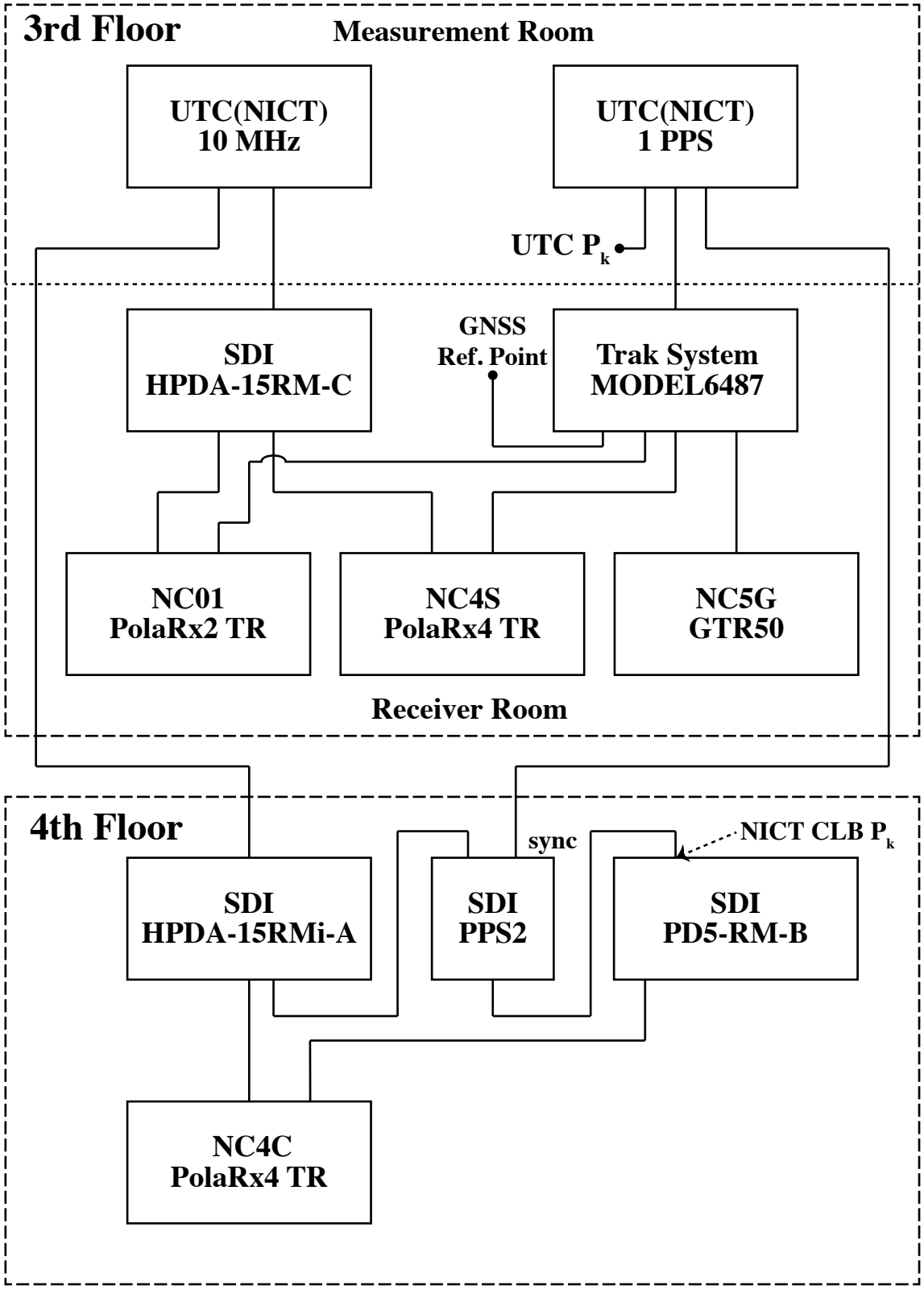
• INT DLY (GPS) /ns:	278.2 ns (C1), 276.8 ns (P1), 276.3 ns (P2)
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	
• REF DLY /ns:	314.6 ns
• Coordinates reference frame:	
Latitude or X /m:	-3942091.42
Longitude or Y /m:	3368261.97
Height or Z /m:	3701993.35

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	Yes
Set temperature value and uncertainty:	24 degC
Set humidity value and uncertainty:	40 %

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

Diagram of the experiment set-up:



Hookup diagram of UTC(KRIS) & KSF(Korea Standard Frequency)