



International Committee on
Global Navigation Satellite Systems

PPP interoperability task force (3PITF)

Co-Chairs Update

Rui Hirokawa (Mitsubishi Electric)

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September 29, 2021

ICG-15 Joint Working Group Session (S, B, C & D invited)



ICG International Committee on
Global Navigation Satellite Systems

Scope of 3PITF based on ICG-14 Recommendation 14S-2

- The ICG will establish a Task Force within the WG-S Interoperability Subgroup, with participation from WG's B and D.
- Australia, Japan and the EU will provide the co-chairs of the Task Force.
- The Task Force will draft a work plan focused on the objective of improving the interoperability of Precise Point Positioning (PPP) services.

Specifically, the Task Force will:

- Coordinate with the ICAO Navigation Systems Panel and the SBAS providers Interoperability Working Group in the ongoing discussions and work of the Task Force
- Concentrate on establishing the foundational documents, baseline definitions and assumptions to develop common terminology on basic parameters for PPP service provision/broadcast
- Encourage the publication and dissemination of PPP signal and system information
- Seek answers from Service Providers (governmental and commercial) to the questions formulated at the 1st PPP Workshop and follow-on issues identified by the Task Force



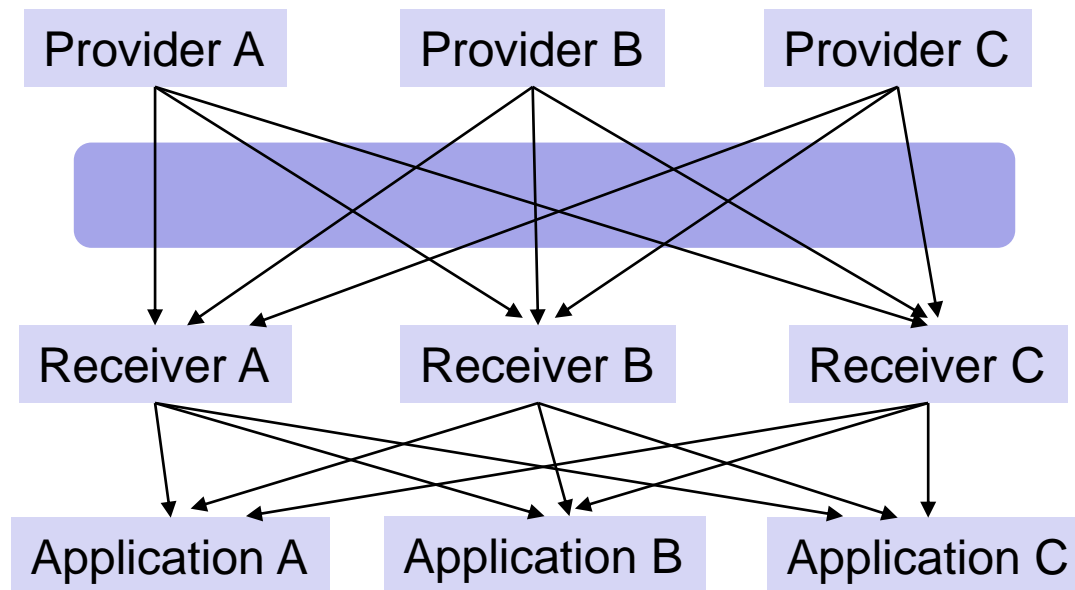
Activities in 3PITF

- 3PITF has established, the three co-chairs was selected from Australia/EU/Japan.
- Questions formulated in 1st PPP Workshop were answered by the major participants of 3PITF, and the actions are agreed.
- Based on the defined action, the co-chairs prepared and distributed the template containing information about the PPP services, requested the service providers to fill-In the templates.
- The planned 2nd PPP Workshop was postponed because of COVID-19.



Identification of interoperability issues

- When multiple open PPP services are available, it increases the development and support effort of receiver and application providers.
- In 1st PPP WS, the interoperability issues were indicated (NRCAN, ESA/EC, ...)
- Common understanding of terminology and methodology is important.



- Common format definition
- Signal plan
- Consistency in model and metadata (phase-windup, attitude, coordinates,...)
- Authentication and integrity

- Compatibilities of performance parameters
- Integrity parameters



Scope of 3PITF based on ICG-14 Recommendation 14S-2

- The interoperability issues can be categorized in OSI layers.
- The parameters to describe characteristics of each system are defined for each layer in the template.

OSI layers

Application

Presentation

Session

Transport

Network

Data-link

Physical

Components

PPP-RTK

PPP

RTCM-SSR

Compact SSR

SPARTN

RTCM-3

QZS L6

Galileo HAS

LPP

GNSS

MSS

Wi-Fi

LTE/5G

- Performance index
- Consistency in model and metadata

- Common format definition
- Authentication and integrity

- Signal design



Templates: Application Layer

Layer	Parameters	Japan	European Union	Geoscience Australia, Land Information New Zealand	China	Russia
Application	Service Name	QZSS Centimeter Level Augmentation Service (CLAS)	Galileo High Accuracy Service (HAS)	PPP Via SouthPAN (PVS)		
	Operator	Cabinet of Office, Japan	European Union	Geoscience Australia, Land Information New Zealand		
	Status (In Operational, development ...)	In operational (since November 2018)	Development	Development (initial capability in 2022)		
	Technology (PPP,PPP-AR,PPP-RTK,...)	For Sample		PPP-Float		
	Service Area	Japan (430,000 km ²)	Global	Australian and New Zealand Exclusive Economic Zones		
	Positioning Accuracy [cm] (95%)	12cm horizontal, 24cm vertical (kinematic) 6cm horizontal, 12cm vertical (static)	20 cm horizontal, 40 cm vertical	15 cm		
	Convergence Time [s] (95%)	60sec	300sec	40 minutes		

Templates: Presentation layer

Layer	Parameters	Japan	European Union	Geoscience Australia, Land Information New Zealand	China	Russia
Present ation	Message Format (RTCM, CSSR, other,...)	Compact SSR	Own format	TBD		
	Fixed or variable length	Variable	Variable	TBD		
	Multi-GNSS, multi-signals	GPS(L1CA,L2P,L2C,L5) + Galileo(E1b,E5b)+ QZSS(L1CA,L2C,L5)	GPS (L1CA, L2C, L5) + Galileo(E1, E5a, E5b, E5, E6)	GPS (L1-C/A, L5) + GAL (E1, E5a)		
	Satellite selection (mask)	Yes	Yes	Yes		
	Orbit and Clock correction	Yes	Yes	Yes		
	Code bias	Yes	Yes	Yes		
	Phase bias			TBD		
	URA			No		
	Ionospheric correction (STEC,VTEC)	Yes (STEC)	Yes TBC	No		
	Tropospheric correction	Yes	No	No		
	Grid definition	(Yes) TBC	Yes TBC	No		
	Integrity	Basic	No TBC	No		
	Authentication	(Yes) TBC	Yes TBC	No		
	Efficiency	8.5 bps/sat, 0.24 bps/sat/grid	448 bps/sat	TBD bps/sat		
Extensibility	Yes TBC	Yes				

For Sample

Templates: Session, Transport, Network, Data-link layers

Layer	Parameters	Japan	European Union	Geoscience Australia, Land Information New Zealand	China	Russia
Session	Consistency check for ephemeris update	Using IOD-SSR	Using IOD Set ID	Yes		
	Satellite grouping	No	Yes	No		
Transport	Framing design	Preamble+payload+error correction	Preamble+payload+error correction	Preamble+payload+error correction		
	Check sum or error correction	Reed-Solomon (255,223)	CRC at 1-second page level; High Parity Vertical Reed-Solomon at message level.	TBD (16-bits per word available)		
	System alert	Yes	N/A	No		
	Generator id	Yes	N/A	No		
Network	Signal	For Sample		TBD		
Data-link	Frequency band	1278.75MHz	1278,75 MHz	1,207.14 MHz		
	Signal power	-156.82 dBW for 2ch	-153 dBW ... -158.25 dBW	-158 dBW		
	Spectrum	42.0MHz	10 MHz (double-sided)	20.460 MHz		
	Data modulation	CSK	BPSK	TBD		
	Data rate	2,000bps	492 bps	500 bps		
	Chip rate	5.115Mcps for 2ch	5.115 Mcps	TBD		
	Spectrum code	KASAMI	Memory Codes	TBD		
	Modulation	BPSK	BPSK-5	BPSK		



Action Items on WG-S Meeting (Sep. 27)

- ICG service providers are to provide updates to the 3PITF contact list.
- ICG system providers are to complete the template.
- Members are to decide on definitions for the fields in the PPP template at the next in-person meeting in early 2022.
- Members are to identify commercial services available in their countries.
- 3PITF co-chairs are to extend an invite to open commercial services to a future workshop (after the next meeting).



Current contact list for 3PITF

Surname	First Name	Organisation	Country
Reynolds	Simon	Geoscience Australia	Australia
Larin	Igor		Russia
Silv	Igor		Russia
Liu	Cheng	China Satellite Navigation Project Center	China
Nie	Xin	China Academy of Space Technology	China
Fernandez-Hernandez	Ignacio	European Commission	Europe
Blonski	Daniel	European Space Agency	Europe
Hahn	Jörg	European Space Agency	Europe
Babu	R	Indian Space Research Organisation	India
Ashishkshukla		Indian Space Research Organisation	India
Hirokawa	Rui	Mitsubishi Electric Corporation	Japan
Kogure	Satoshi	Cabinet Office	Japan
Collett	David	Land Information New Zealand	New Zealand
Auerbach	Jeffery	US State Department	USA
Choy	Suelynn	Royal Melbourne Institute of Technology	FIG



Plan for 3PITF meeting

- 2nd 3PITF meeting (virtual) 2022 Q1
- 2nd PPP Workshop (virtual or in-person) 2022 Q2

