SKA1-MID Continuous Product Integration Flowchart

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1 Introduction

1.1 Purpose of the Document

This document describes the products for integration and the stages of integration of these products at the early integration environments for the SKA1-MID Telescope. The process of integration of evolving versions of products at the Prototype System Integration (PSI) Facility, the System Integration Test Facility (ITF) and on to the on-site Array Assemblies, is being planned in the Continuous Integration Flowchart, a snapshot of which is shown in this document.

The master CI-Flowchart Spreadsheet is a live document that should be consulted for the most recent information. A snapshot is provided herein and a copy of the spreadsheet provided as Annexure A.

This version is only showing the early stages of integration (up to AA0.5) and serves as an input into the MID AIV Plan.

1.2 Scope of the Document

The document predominantly describes system Level-1 Integration. It describes Hardware and Software Products according to the Work Breakdown Structure for Tier 1 Contractors, delivering Level 2 and Level 3 Products, according to the Product Breakdown Structure (PBS). The early integration environments are SAFe®, PSI Facility, System ITF and the first on-site Array Assembly, AA0.5.

The document does not show in any detail lower Level-2 and Level-3 integration, the Infrastructure build process or the Dish integration AIV process, which are described in their own plans, for example [RD10] for Dish AIV. These integrations are part of Tier 1 contracts that are not the responsibility of the AIV team.

2 Integration Environments

The are three integration environments that are covered by this document, each of which are described below.

2.1 SAFe® Software

The Scaled Agile Framework (SAFe®) environment is used by software developers working in Agile Release Train teams to incrementally develop, integrate and test software in an agile, continuous manner. Observation Management and Control (OMC) and Science Data Processing (SDP) software is developed in this environment prior to deployment to a site. The AIV team participates in the 3 monthly Program Increment (PI) cycles to prioritise features required for the Telescope.

The virtual software integration platform is referred to as SKAMPI (SKA Minimum Viable Product Integration) which is used to facilitate software deployment to all environments.

2.2 Prototype System Integration Facility (PSI)

The MID PSI is a laboratory environment facility and is associated with the CSP Correlator/Beamformer (CBF) development. It provides an ad hoc development integration platform for use by the SAFe teams and Product Contractors to perform early prototype software and hardware integration as part of their development work. The PSI may also be used as a platform to perform supplier and FAT tests, using interfaces provided by other validated prototypes or emulators. It is expected that the PSI will largely be run by the CSP integrator and the SKAO software team. Refer to the PSI General Framework document, [RD21][RD21].

Although not part of the formal system AIV process, planned prototype product integrations at the PSI are shown in this document to ensure that there are no gaps in the system integration process. As part of the Services Agile Release Train, the MID-AIV SAFe® team, Atlas, has been defining the first system integration and tests at the PSI for the period PI13 to PI15. This is shown in the PSI MID System Integration Test 1 Confluence page, [RD22]. The first system under test and interfaces for this is shown in Figure 1.

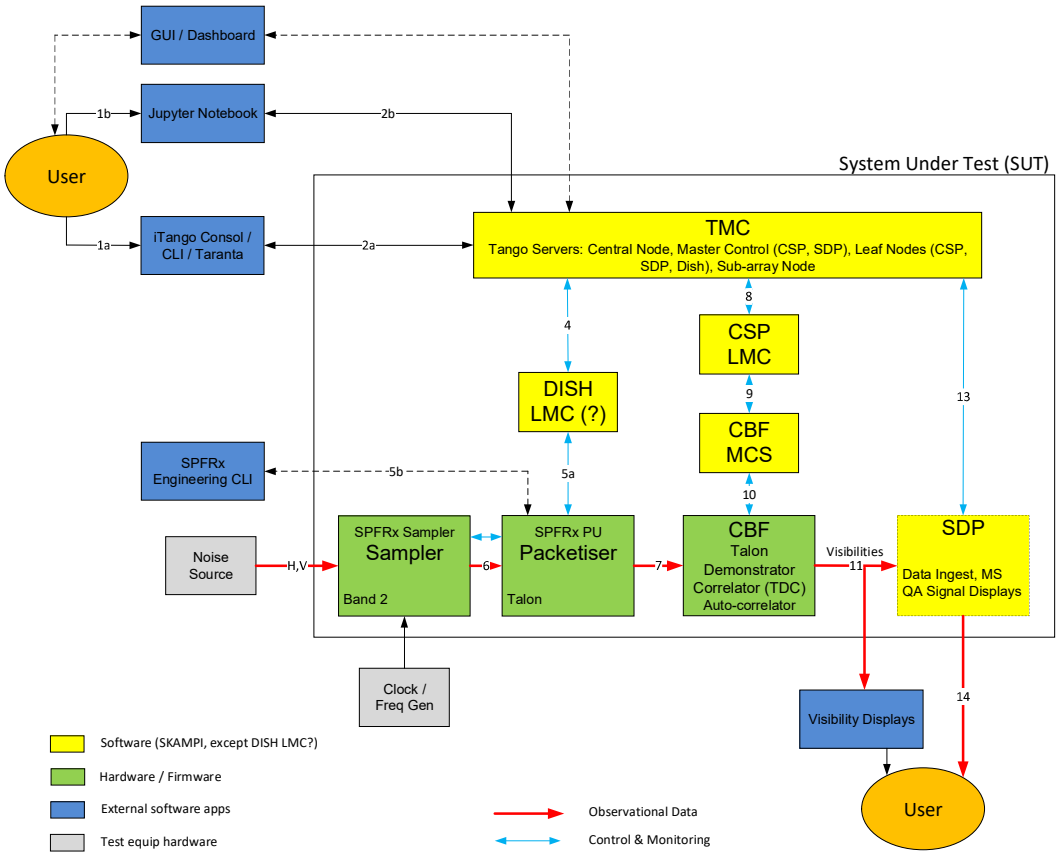

Figure 1: Block Diagram and Interfaces for First System Under Test at the PSI

The block diagram for a possible complete PSI system under test is shown in Figure 2.

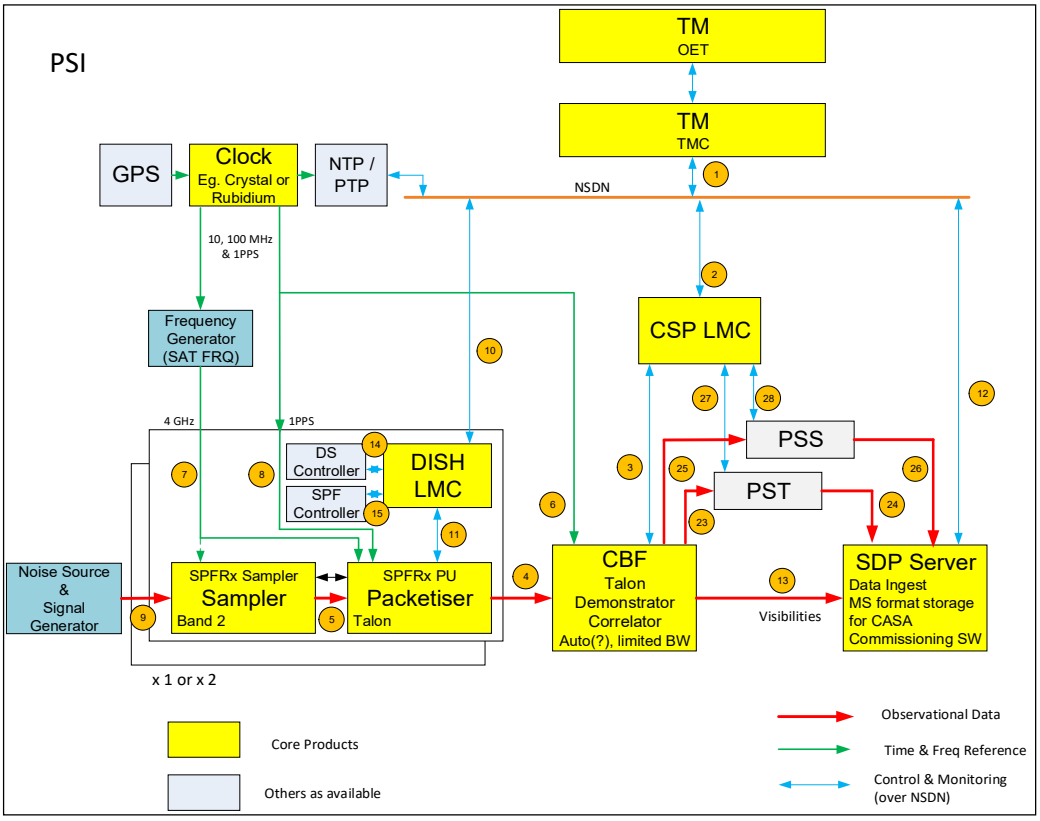

Figure 2: Block Diagram and Interfaces for Products at the PSI

The numbers in cricles show interface numbers referrred to in Table 1.

2.3 Integration Test Facility (ITF)

The MID ITF is a laboratory environment facility located in Cape Town where a representative line up of Telescope products is to be assembled. This allows integration and interface testing and a degree of system level testing and verification to be performed, prior to deployment of the actual site products to the remote Karoo Telescope site. This allows easier and earlier identification of issues in a user friendly environment.

Refer to [RD19] [RD19] for the ITF Establishment Plan. Refer to the ITF Test Procedures, [RD13], [RD14] for a prelimary description of Verification Events, Test Equipment and Test Procedures in the ITF. The ITF is also described in the Roll-out Plan, [RD5].

The block diagram for the ITF system under test is shown in Figure 3. It is not the intention to send live Dish data from site to the ITF.

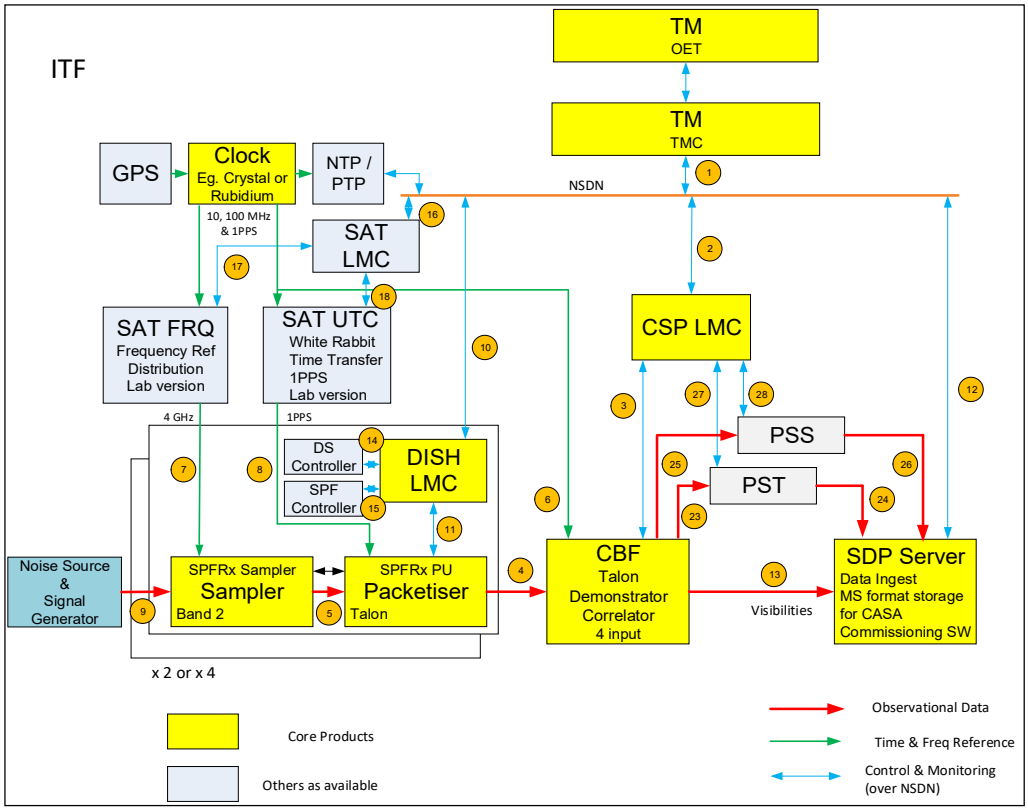

Figure 3: Block Diagram and Interfaces for Products at the ITF

2.4 On-Site Telescope Array Assemblies

As described in the Roll-out Plan, [RD5], the on-site Telescope is deployed in a staged process from AA0.5, AA1, AA2, AA3 and AA4, with increasing number of Dishes and modes of operation. This document currently only describes integration for AA0.5.

Refer to the AA1 Test Procedures, [RD15], [RD16] for a prelimary description of Verification Events, Test Equipment and Test Procedures relevant for AA0.5 and AA1.

The block diagram for the AA0.5 and AA1 is shown in Figure 4.

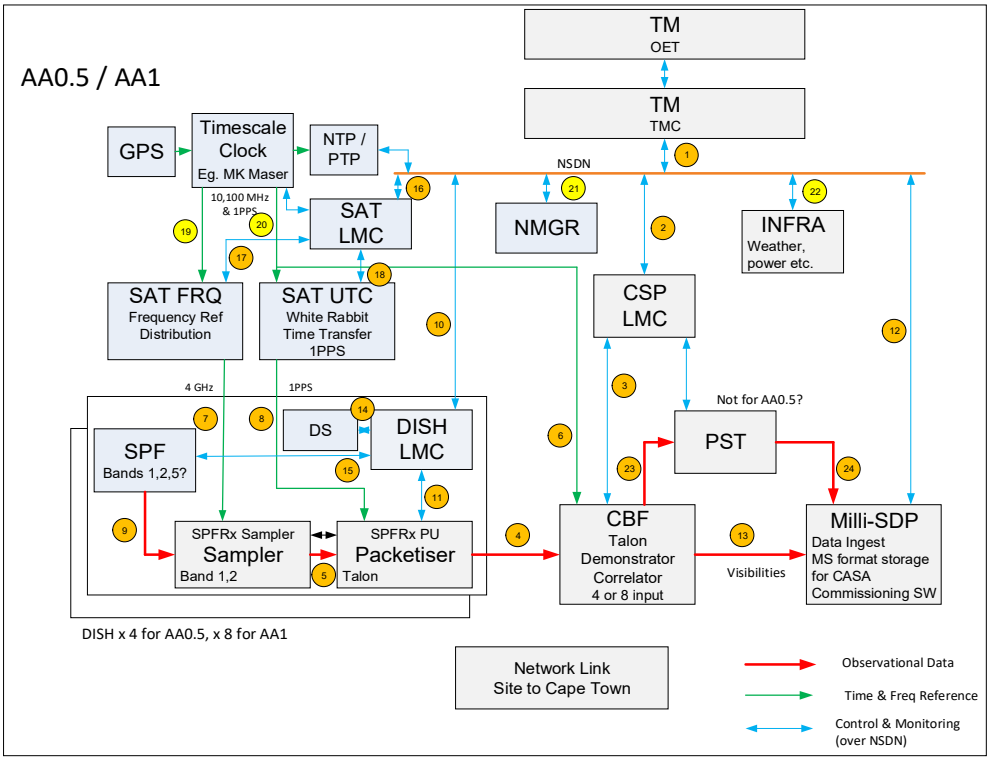

Figure 4: Block Diagram and Interfaces for Products at AA0.5 and AA1

3 Continuous Integration Flow Chart

The Continuous Integration Plan is currently in the form of a spreadsheet and continually evolving, [AD1]. It describes integration of hardware and software products according to the Work Breakdown Structure for Tier 1 Contractors delivering Level 2 and Level 3 products, according to the Product Breakdown Structure (PBS). The two main sections are Products and Schedule.

3.1 Products

The Products page provides a description of the evolving versions of each product expected for each stage, with the currently estimated delivery dates expected, as negotiated with product suppliers. This should match the information in the Integrated Product Schedule (IPS) and a constant synchronisation with the IPS is required.

The product versions are shown as V1, V2, V3 etc. and are estimated descriptions of major versions required for each product, showing the deployment location for each . The version numbers do not correspond specifically in order to PSI, ITF AA0.5 locations and differ from product to product.

Colour coding is used to show:

- Red text: Product item supply to be discussed and agreed.
- Orange date text: Critical targeted delivery dates for products that drive the schedule.
- Blue text: Prototype products.
- Brown text: Pre-production products.

Refer to the Product Delivery Issues to be Resolved Confluence page, [RD23] for a list of issues relating to product delivery derived from items marked in red in this sheet.

The current version of the Product Versions sheet is shown in Figure 5. Further detail in hidden columns should be viewed on the spreadsheet.

3.2 Integration Schedule

The Schedule page provides an estimated schedule showing the flow of products for each of the different versions identified, for integration at the PSI, ITF and on-site AA0.5. This is shown in time by year quarters and PIs. The schedule also indicates relevant product factory and site acceptance test points (FAT and SAT). This is provided for information only – the master schedule is the Integrated Project Schedule (IPS), which has been consulted in preparing this document.

Colour coding is used to show:

- Red schedule box: Critical path driving schedule.

Planned Integration Events for testing interfaces between Level-2 and Level-3 products at each location are indicated. Interfaces, as per the existing Element ICDs, to be partially tested at each stage are shown in Table 1. The numbers correspond to interface numbers in the block diagrams.
The current version of the CI Flowchart is shown on the Schedule sheet is shown in Figure 6.

PRODUCT	Work Package WBS Number	V1			V2			V3			V4			V5		
		Features / Capabilities	Location	Date Required / PI#	Features / Capabilities	Location	Date Required / PI#	Features / Capabilities	Location	Date Required / PI#	Features / Capabilities	Location	Date Required / PI#	Features / Capabilities	Location	Date Required / PI#
SAFe SOFTWARE																
Telescope Manager (TM)																
OMC Telescope Monitoring & Control (TMC) SW	01.04.02.05	Refer to OMC Roadmap.	SKAMPI	Mar 2021 PI9	Refer to OMC Roadmap: MVP deployed on PSI hardware. Configure and monitor CBF TDC. Taranta Dashboard. Run integration tests. Refer to Roll-out Plan for list of capabilities for ITF / AA0.5. OMC roadmap towards this to be prioritised: 1. Configuration for observation (Dish, CSP CBF, SDP) 2. Monitor sensors, alarms. Display alarms, health, SW & FW versions. 3. Scripting interface, programmable GUIs 4. Logging, archiving 5. Sub-arrays 6. Control Dish Pointing / Pointing Model. 7. Calculate Delays per Dish / Delay Model	SKAMPI	Sept 2021 PI11	Refer to OMC Roadmap: MVP deployed on PSI hardware. Configure and monitor CBF TDC. Taranta Dashboard. Run integration tests. Refer to Roll-out Plan for list of capabilities for ITF / AA0.5. OMC roadmap towards this to be prioritised: 1. Configuration for observation (Dish, CSP CBF, SDP) 2. Monitor sensors, alarms. Display alarms, health, SW & FW versions. 3. Scripting interface, programmable GUIs 4. Logging, archiving 5. Sub-arrays 6. Control Dish Pointing / Pointing Model. 7. Calculate Delays per Dish / Delay Model Grey = not required at PSI	PSI	January 2022 PI13	Refer to OMC Roadmap. Refer to Roll-out Plan for list of capabilities for ITF / AA0.5. OMC roadmap towards this to be prioritised: 1. Configuration for observation (Dish, CSP CBF, SDP) 2. Monitor sensors, alarms. Display alarms, health, SW & FW versions. 3. Scripting interface, programmable GUIs 4. Logging, archiving 5. Sub-arrays 6. Control Dish Pointing / Pointing Model. 7. Calculate Delays per Dish / Delay Model	ITF	Sept 2022 PI15	Refer to OMC Roadmap. Refer to Roll-out Plan for list of capabilities for ITF / AA0.5. OMC roadmap towards this to be prioritised: 1. Configuration for observation (Dish, CSP, SDP) 2. Monitor sensors, alarms. Display alarms, health, SW & FW versions. 3. Scripting interface, programmable GUIs 4. Logging, archiving 5. Sub-arrays 6. Control Dish Pointing / Pointing Model. 7. Calculate Delays per Dish / Delay Model 8. Control Tied Array Beamforming (boresite).	AA0.5	Feb 2023 PI17
OMC Observatory Science Operations (OSO) SW	01.04.02.04	MVP. OET scripting interface	SKAMPI	Mar 2021 PI9	MVP. OET scripting interface. ODT / ODA ability to create and save simple observing scripts and SB definitions. Sensitivity calculator?	SKAMPI	Sept 2021 PI11	MVP. OET scripting interface. ODT / ODA ability to create and save simple observing scripts and SB definitions. Sensitivity calculator?	PSI	January 2022 PI13	OET scripting interface. ODT / ODA ability to create and save simple observing scripts and SB definitions. Sensitivity calculator?	ITF	Sept 2022 PI15	OET scripting interface. ODT / ODA ability to create and save simple observing scripts and SB definitions. Sensitivity calculator?	AA0.5	Feb 2023 PI17
LMCs																
DISH LMC SW	01.04.02.08.02		Qual Dish, SKAMPI	Mar 2021 PI9	Include SPFRx control for PSI	PSI, Qual Dish	PI14	Include SPFRx, DS (emulated), SPF (emulated) control for PSI	PSI, Dish	PI15	Include SPFRx, DS (emulated), SPF (emulated) control for ITF	ITF, Dish	PI16		Dish, AA0.5	
MeerKAT Dish LMC SW	01.04.02.08.03															
CSP LMC SW	01.04.02.08.04		SKAMPI	Mar 2021 PI9	Configure and monitor CBF TDC.	PSI	PI13	Configure and monitor CBF TDC.	ITF	PI16	Configure and monitor CBF TDC.	AA0.5		Configure and monitor CBF TDC.	AA0.5	
SAT LMC SW	01.04.02.08.05	For STFR FRQ control	ITF			AA0.5										
Network Manager SW	01.04.02.10		AA0.5													
INFRA SA (LMC?) SW	01.04.02.08.01		AA0.5													
Science Data Processing (SDP)																
SDH&P Science Data Processing (SDP) SW	01.04.01.04	Refer to SDP Roadmap	SKAMPI	Mar 2021 PI9	Refer to SDP Roadmap for SDP PSI MVP: Demonstration of a minimal SDP system tested in an integration environment capable of being controlled by an operator (with advanced knowledge of the SKA system) without developer intervention. 1. Basic workflow execution (via Tango subarray interface) 2. Basic visibility receive workflow (using spead2 over UDP) Single node operation, ~4 stations/dishes, ~10k channels Data are written to MSv2 CBF data stream emulator for testing 3. Basic QA display for real-time baseline spectrum plots (ie. total-intensity autocorrelation spectrum) 4. SDP errors and logs to diagnose system behaviour via a suitable operator interface 5. SDP deployed and tested as part of the system prototype (using SKAMPI) in a suitable staging environment or preferrably at the LOW and/or MID PSI	SKAMPI / PSI	Sept 2021 PI11	Refer to SDP Roadmap for Establishing Initial Set of SDP Workflows: V2 and: 1. Individual visibilities auto and cross correlation signal displays 2. Simulation tools and scripts for generating SKA1 MID with DDE effects 3. Simple real-time calibration for MID Pointing 4. Spectral line and continuum batch (offline) imaging including: Imaging Deconvolution DDE Grey = not required at PSI	PSI	January 2022 PI13	Refer to SDP Roadmap for AA0.5 Operational System. As per Roll-out Plan list of capabilities for SDP at ITF: 1. Data visibilities ingest 2. Commissioning and AIV support 3. QA metrics, signal displays 4. MS format storage for CASA 5. Basic TM C&M Tango interface 6. Real time calibration in support of MID pointing 7. Basic continuum and spectral line imaging	ITF	Nov 2022 PI16	Refer to SDP Roadmap for AA0.5 Operational System. As per Roll-out Plan list of capabilities for SDP at AA0.5 / AA1: 1. Data visibilities ingest 2. Commissioning and AIV support 3. QA metrics, signal displays 4. MS format storage for CASA 5. Basic TM C&M Tango interface 6. Real time calibration in support of MID pointing 7. Basic continuum and spectral line imaging 8. Real time calibration in support of MID tied-array Beamforming (boresite) Deployed on milli-SDP hardware.	AA0.5	Apr 2023 PI18
Non Imaging Processing																
Pulsar Timing (PST) SW	01.04.01.06															
Pusar Search (PSS) SW	01.04.01.05															
Enabling / Support (Hidden below)																
HARDWARE																
TM OMC Computing HW	01.02.07.04	PSI server (provided by?)	PSI	Feb 2022 PI13	ITF server (provided by?)	ITF	Oct 2022 PI16	Server	AA0.5, CPF	April 2023 PI18						
SDP Computing HW (Compute & Preservation)	01.02.07.01	PSI server (provided by?)	PSI	Mar 2022 PI13	ITF server (provided by?)	ITF	Nov 2022 PI16	Milli-SDP	AA0.5, CPF	July 2023 PI19						
CSP - integrated by CSP Integrator	01.02.04.01															
Correlator / Beamformer (CBF) SW, FW & HW	01.02.04.02	Early non functional interface test system, Control and monitoring interface.	PSI	Jan 2022 PI13	Talon Demonstrator Correlator (TDC) MVP, auto-correlator only?, 200MHz BW, coarse channelisation	PSI	May 2022 PI14	** TDC, 4 input, 200 (possibly 800 MHz) BW, Bands 1 & 2, coarse channelisation (16k channels). Possibly, 1 boresight PST tied array beam, 200MHz BW. Prioritise Band 5 functionality ahead of beam?	ITF	Dec 2022 PI16	** TDC, 4 input (possibly 8 input?), 200 (possibly 800 MHz) BW, Bands 1 & 2, coarse channelisation (16k channels). Possibly, 1 boresight PST tied array beam, 200MHz BW. Prioritise Band 5 functionality ahead of beam? (Same as ITF Correlator?).	AA0.5 CPF	Feb 2023 PI17	** TDC, 8 input, 800MHz BW, Band 1 & 2, coarse channelisation (16k channels per freq slice). 1 boresight PST tied array beam, 400 MHz BW. Band 5 support.	AA1 CPF	January 2024
CSP LMC HW	01.02.07.04		PSI			PSI			ITF			AA0.5 CPF				
PST Computing HW	01.02.07.03															
PSS Computing HW	01.02.07.02															

Networks	01.02.01.02.07.08?															
Networks Fibre Cabling & Connectivity in MID CPF (Activity)	01.02.01.02.07.10	For AA0.5 ODF / patch panel to CBF, TM, SDP, NSDN connectivity. SAT CPF fibre connectivity?	AA0.5	Jan 2023												
Networks NSDN	01.02.01.02.07.03	Lab version.1 or 2 switches / routers with network interconnect to TM & SDP servers, LMCs (CSP, Dish). VPN and internet connections for remote access. (Provided by ?). Who Provides PTP?	PSI	Feb 2022	Lab version.1 or 2 switches / routers with network interconnect to TM & SDP servers, LMCs (CSP, Dish, SAT). VPN and internet connections for remote access. (Provided by Networks Contractor?). Who Provides PTP?	ITF	Sep 2022	Network for Control & Monitoring from TM to LMCs (Dish, CSP SAT, NMGR), SDP. Includes 4 x Dish side installation. Who Provides PTP?	AA0.5 CPF, Dish	Feb 2023						
Networks DDBH	01.02.01.02.07.01															
Networks CPF-SPC (Site to CT)	01.02.01.02.07.04	Link Site to Cape Town. Existing MeerKAT link? Assumes CBF, SDP in CPF.														
Networks NMGR HW	01.02.01.02.07.09	Required for NSDN?	AA0.5	Apr 2023												
SAT - integrated by SAT Integrator	01.02.03.0X?															
SAT Timescale (Clocks)	01.02.03.02	Crystal or Rubidium clock with GPS reference, 100 MHz & 1PPS outputs and NTP/PTP. (Provided by PSI owner?)	PSI	February 2022	Crystal or Rubidium clock with GPS reference, 100 MHz & 1PPS outputs and NTP/PTP. Distribution amplifiers. (Provided by AIV or Clocks contractor)?	ITF	Oct 2022	First on site clock system using MeerKAT maser.	AA0.5 CPF	Apr 2023						
SAT STFR FRQ	01.02.03.04.01	Signal generator for 4GHz sample clock. (Provided by PSI owner)	PSI	February 2022	Lab version distribution to 2 Digitisers. Possibly just use signal generator, splitter and electrical to optical converter?	ITF	Oct 2022	** Lab system distribution to 4 Dishes. RM integrated into Digitisers. With freq offset available. Use fibre reels for distance?	ITF	Jan 2023	** Pre-production system to 4 Dishes. RM integrated into Digitisers.	AA0.5 CPF, Dish	Apr 2023			
SAT STFR UTC	01.02.03.04.02	1PPS from clock.	PSI	February 2022	Lab version to 2 or 4 Digitisers. 1PPS via White Rabbit (if necessary to test) or direct from clock. Use fibre reels for distance? Distribution amplifier.	ITF	Oct 2022	White Rabbit 1 PPS to 4 Dishes.	AA0.5 CPF, Dish	Apr 2023						
SAT LMC HW	01.02.07.07		ITF?	Sep 2022		AA0.5	May 2023									
DISH (incl SPFRx) - integrated by DISH AIV PSC	01.02.02.02															
SPFRx (Digitiser)	01.02.02.02.07	*2 x prototype Digitisers and 1 bench top version available from Sep 2021, pre ECP (no integrated freq dist), for sharing. One to qualification dish, one to Sweden.* 1 x prototype Sampler and Packetiser, Band 2. Pre-ECP non integrated freq dist.	Qual Dish / Sweden	September 2021	1 (or possibly 2) x prototype Sampler and Packetiser, Band 2. Pre-ECP, no integrated freq dist. Sampler to Packetiser fibre inter-connect provided?	PSI	January 2022	2 x prototype qualification Sampler and Packetiser, Band 2. Post-ECP with integrated freq dist. Sampler to Packetiser fibre inter-connect provided?	ITF	Sep 2022	*Update 19.11.20, from BL, proposal for contract: 4 pre-production Digitisers to System ITF Jan 2023. 4 more pre-production Digitisers to Dish AIV for AA0.5 May 2023.* *22.6.21: Delayed to April 2023?* ** 4 x pre-production Sampler and Packetiser, Band 2. Fibre inter-connect?	ITF	Apr 2023	*Update 19.11.20, from BL, proposal for contract: 4 pre-production Digitisers to Dish AIV for AA0.5 May 2023.* *22.6.21: Delayed to July 2023?* ** 4 x pre-production Sampler and Packetiser, Band 2, Band 1. Band 5 support.	Dish AA0.5	July 2023
Sampler B12(3)	01.02.02.02.07.01	1 x prototype Digitiser, Band 2. Pre-ECP, no integrated freq dist.	Qual Dish / Sweden	September 2021	1 x prototype Digitiser, Band 2. Pre-ECP, no integrated freq dist.	PSI	January 2022	2 x prototype Swedish qualifaction units. Post-ECP with integrated freq dist, Band 2.	ITF	Sep 2022	** 4 x pre-production Sampler, Band 2.	ITF	Apr 2023	** 4 x pre-production Sampler, Band 2, Band 1.	Dish AA0.5	July 2023
Sampler B(4)5	01.02.02.02.07.02	Will not be ready. Use analogue down converter to B1 Sampler.	Qual Dish	Feb 2022	Will not be ready.	ITF		Will not be ready. Use analogue down converter to B1 Sampler.	Dish AA0.5	May 2023						
RxPU (Packetiser)	01.02.02.02.07.03	1 x prototype Packetiser, pre ECP, Band 2. Talon.	Qual Dish / Sweden	September 2021	1 x prototype Packetiser, pre ECP, Band 2. Talon.	PSI	January 2022	2 x prototype qualification Packetiser, post ECP, Band 2. Talon.	ITF	Aug 2022	** 4 x pre-production Packetiser, Band 2, Band 1. Talon.	ITF	Feb 2023	** 4 x pre-production Packetiser, Band 2, Band 1. Talon.	Dish AA0.5	May 2023
DISH (excl SPFRx) - integrated and tested by DISH AIV PSC (using DVS)																
DISH LMC HW	01.02.02.02.08	Ongoing with DISH.	Qual Dish, PSI	Nov 2021		ITF	Sep 2022									
Dish Structure (DS)	01.02.02.02.01	MPI Qualification Dish. Ongoing with DISH.	Qual Dish			Dish										
DS Controller / Emulator		DS Controller / Emulator for PSI. To emulate DS states & modes and pointing behaviour (maybe?) (provided by?)	PSI	Apr 2022	DS Controller / Emulator for ITF. To emulate DS states & modes and pointing behaviour. (provided by?)	ITF	Jan 2023									
SPF Band 1	01.02.02.02.02	Prototype qualifcation version. Ongoing with DISH.	Qual Dish			Dish										
SPF Band 2	01.02.02.02.03	Pre-production versions. Ongoing with DISH.	Qual Dish			Dish										
SPF Band (34)5	01.02.02.02.04	Prototype on Qualification Dish	Qual Dish	Jan 2022	2 or 4 x Band 5. Required for high freq Dish / AA0.5 testing	Dish	Mar 2023									
B5 to B1 Analogue Downconverter			Qual Dish	March 2022		Dish	Mar 2023									
SPF Vacuum	01.02.02.02.05	Ongoing with DISH.	Qual Dish			Dish										
SPF Helium (Cryo)	01.02.02.02.06	Ongoing with DISH.	Qual Dish			Dish										
SPF Controller	01.02.02.02.10	Ongoing with DISH.	Qual Dish			Dish										
SPF Controller / Emulator		SPF Controller / Emulator for ITF. To emulate SPF states & modes (maybe?). (provided by?)	PSI	May 2022	SPF Controller / Emulator for ITF. To emulate SPF states & modes. (provided by?)	ITF	Jan 2023									
Dish Fibre Network	01.02.02.02.09	Ongoing with DISH.	Qual Dish			Dish										
MeerKAT Integration	01.02.02.03															
MeerKAT Dish LMC HW	01.02.07.04??															
MeerKAT Dish																
INFRA SA																
Local Infrasructure (LINFRA) (for Networks, SAT)	??	Fibre, patch panels etc for PSI (Provided by ?)	PSI	Feb 2022	Fibre, patch panels etc for ITF (Provided by ?)	ITF	Sep 2022	Fibre, ODF, patch panels etc, for AA0.5 to 4 Dishes. Includes KAPB fibre eg. Correlator to ODF? SAT fibre, ODF patch panels?	AA0.5 CPF, Dish	Jan 2023						
Power & Fibre Reticulation	01.02.01.02.07.05	At least for AA0.5 Dishes	AA0.5													
Antenna Foundation	01.02.01.02.07.07	At least for AA0.5 Dishes	AA0.5													
Weather Stations	01.02.01.02.05.01	At least 1 in core	AA0.5													
Site Power	01.02.01.02.08.01	Sufficient for AA0.5 array and KAPB	AA0.5, KAPB													
Buiding Management System	01.02.01.02.10		AA0.5, KAPB													

Figure 5: Product Versions for Delivery at early Stages

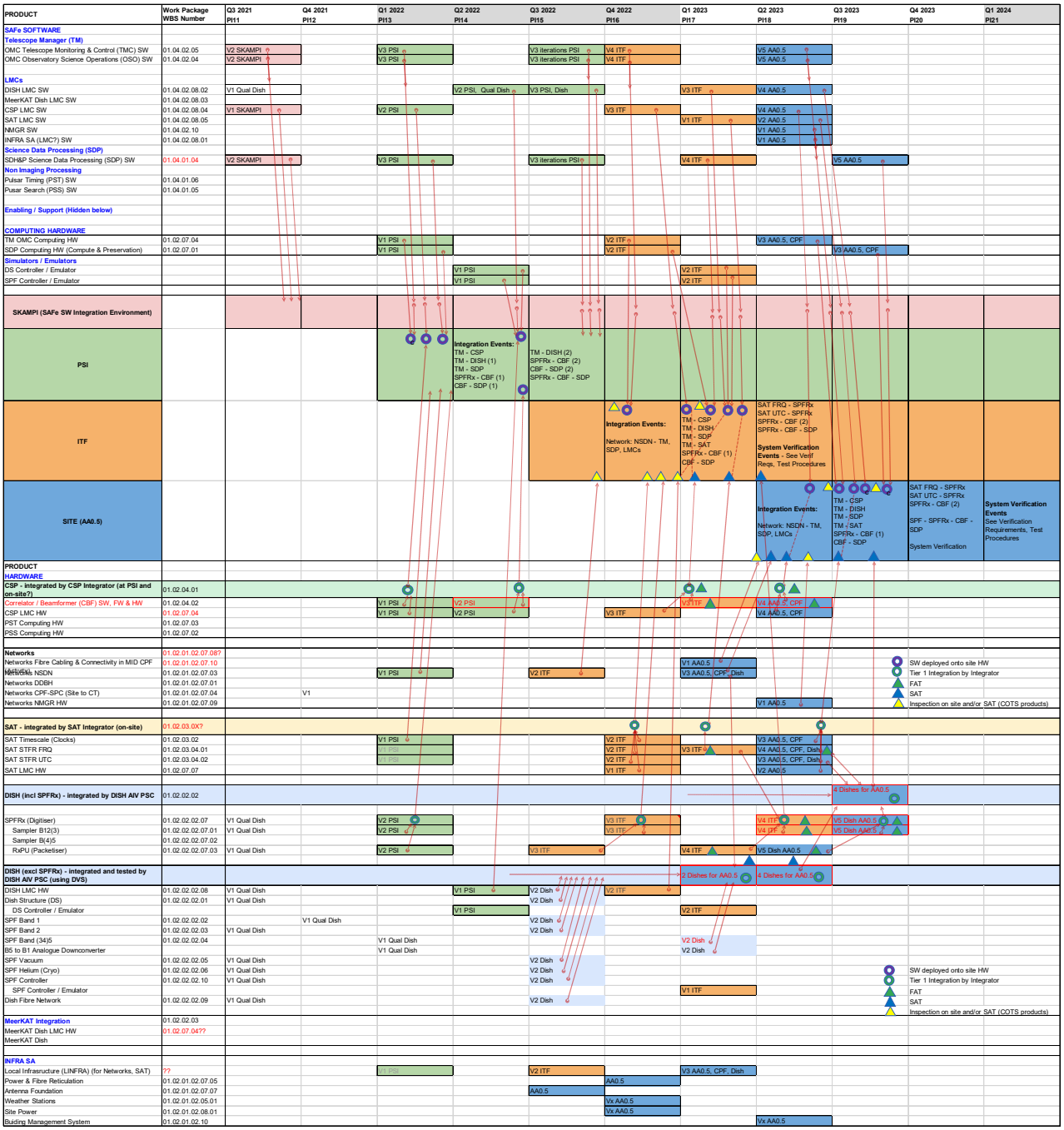

Figure 6: Product Delivery and Integration Schedule Flow for early stages, incorporating Integration Events

Table 1: ICD Interfaces to be Tested

ICD	Interface	Products / Function	Number	PSI	ITF	AA0.5
SADT/SAT - TM SKA-TEL-SKO-0000153						
	I.S1M.TM_SADT.001	TM - SADT.NMGR	21		?	Y
	I.S1M.TM_SADT.002	TM - SAT.LMC	16		?	Y
	I.S1M.TM_SADT.003	TM - SADT.NSDN	1	Y	Y	Y
	I.S1M.TM_SADT.004	TM - SADT Timing			?	Y
SADT/SAT - DISH 300-000000-026						
	I.S1M.SADT_DSH.001	Physical layer DSH-CSP	4	?	?	Y
	I.S1M.SADT_DSH.002a	SAT.STFR.FRQ - SPFRx	7		Y	Y
	I.S1M.SADT_DSH.002b	SAT.STFR.UTC - SPFRxPU	8		Y	Y
	I.S1M.SADT_DSH.003a	NSDN Switch - DISH LMC HW	10		Y	Y
	I.S1M.SADT_DSH.003b	NSDN Switch - Laptop				Y
	I.S1M.SADT_DSH.004	LINFRA - Dish Structure				Y
	I.S1M.SADT_DSH.005a	NSDN Switch - SPFRxPU for LMC data	11	?	Y	Y
	I.S1M.SADT_DSH.005b	NSDN Switch - SPFRxPU for PTP		?	Y	Y
	I.S1M.SADT_DSH.006a	NSDN Switch - Dish Structure, for LMC data DS Controller	14		Y	Y
	I.S1M.SADT_DSH.006b	NSDN Switch - Dish Structure, for PTP DS Controller			Y	Y
	I.S1M.SADT_DSH.006c	NSDN Switch - Dish Structure, for PTP DS PDU				Y
	I.S1M.SADT_DSH.007	Outer Array Pedestal Terminal Node Equipment - DS				Y
	I.S1M.SADT_DSH.008a	SAT.STFR.FRQ - DS				Y
	I.S1M.SADT_DSH.008b	SAT.STFR.UTC - DS				Y
	I.S1M.SADT_DSH.009	NSDN Switch - SPFRx Controller			Y	Y
SADT/SAT - CSP 300-000000-023						
	I.S1M.SADT_CSP.001	NSDN - CSP.LMC	2	?	Y	Y
	I.S1M.SADT_CSP.002	NSDN - CSP.CBF PTP		?	Y	Y
	I.S1M.SADT_CSP.003	SAT.Timescale - CSP.CBF 1PPS	6	No longer required?		
	I.S1M.SADT_CSP.004	SAT.Timescale - CSP.CBF 100MHz	6	No longer required?		
	I.S1M.SADT_CSP.005	CSP-SDP - CSP.CBF			?	?
	I.S1M.SADT_CSP.006	CSP-SDP - CSP.PSS				
	I.S1M.SADT_CSP.007	CSP-SDP - CSP.PST				
	I.S1M.SADT_CSP.009	DDBH - CSP.CBF				
	I.S1M.SADT_CSP.010	LINFRA - CSP.CBF				Y
SADT - SDP 300-000000-025						
	I.S1M.SADT_SDP.001	NSDN - SDP LMC	12	?	?	Y
	I.S1M.SADT_SDP.002	NSDN - SDP for PTP		?	Y	Y
	I.S1M.SADT_SDP.003	CSP-SDP - SDP Visibility	13	?	?	?
	I.S1M.SADT_SDP.004	CSP-SDP - SDP Pulsar Search				
	I.S1M.SADT_SDP.005	CSP-SDP - SDP Pulsar Timing				
	I.S1M.SADT_SDP.006	External Delivery				
	I.S1M.SADT_SDP.008	CSP-SDP - SDP VLBI				
TM - DISH SKA-TEL-SKO-0000150						
	I.S1M.TM_DSH.001		1, 10	Y	Y	Y
TM - CSP 300-000000-021						
	I.S1M.CSP_TM.001		1, 2	Y	Y	Y
TM - SDP 300-000000-029						
	I.S1M.SDP_TM.001	Control and Monitoring	1, 12	Y	Y	Y
	I.S1M.SDP_TM.002	Telescope State Information & Telescope Configuration			?	Y
	I.S1M.SDP_TM.003	Science Events				Y
	I.S1M.SDP_TM.004	QA				Y
DISH - CSP SKA-TEL-SKO-0000124						
	I.S1M.DSH_CSP.001	SPFRxPU - CBF Layer 3 and above	4	Y	Y	Y
	I.S1M.DSH_CSP.002	SPFRxPU - CBF Layer 2	4	Y	Y	Y
CSP - SDP 300-000000-002						
	I.S1M.SDP_CSP.001	Visibility Data	13	Y	Y	Y
	I.S1M.SDP_CSP.002	Pulsar Search and Transient Data				
	I.S1M.SDP_CSP.003	Pulsar Timing	24		?	Y
	I.S1M.SDP_CSP.004	Transient Buffer				

3.3 Test Schedule

A preliminary test plan schedule example , based on required integration tests and those identified in the Test Procedures, [RD13], [RD14], [RD15], [RD16] is shown in Table 2. The sequence and structure of these will change as more detail becomes available.

Table 2: Test Plan Schedule

Phase	ITF SUT	type	Test description	Requirement ID	Test procedure reference	External instruments
Q4/2022	SDP-TM (I.S1M.SDP_TM.001)	IF	Sanity check of all tango devices	N/A	N/A	N/A
	DISHLMC-TM(I.S1M.TM_DSH.001)	IF	Sanity chech of all tango devices	N/A	N/A	N/A
Q1/2023	TM-CSP(I.S1M.CSP_TM.001)	IF	Sanity chech of all tango devices	N/A	N/A	N/A
	TM-SAT	IF	Sanity chech of all tango devices	N/A	N/A	N/A
	SPFRx-CBF(1) (I.S1M.DSH_CSP.001)	IF	Signal Chain test	N/A	N/A	N/A
		L1	Signal Displays Verification Test	113: Signal Displays MID	SKA-TEL-AIV-2510000 P23	SG
		L1	Signal Chain test	17: Channelisation	SKA-TEL-AIV-2510000 P49	SG
		L1	Signal Chain test	19: Channelisation Stability MID	SKA-TEL-AIV-2510000 P49	SG
		Others	Signal Chain test	C.3: RF Chain and Correlator Linearity	SKA-TEL-AIV-2510000 P49	SG
	CBF-SDP	IF	Signal Chain test	N/A	N/A	N/A
		L1	Signal Displays Verification Test	113: Signal Displays MID	SKA-TEL-AIV-2510000 P23	SG
			TBD			
Q2/2023	SAT.FRQ-SPFRx	IF	Signal Chain test	N/A	N/A	N/A
	SAT.UTC-SPFRx	IF	Signal Chain test	N/A	N/A	N/A
	SPFRx-CBF(2) (I.S1M.DSH_CSP.001)	IF	Signal Chain test	N/A	N/A	N/A
		L1	Signal Chain test	17: Channelisation	SKA-TEL-AIV-2510000 P49	SG
		L1	Signal Chain test	19: Channelisation Stability MID	SKA-TEL-AIV-2510000 P49	SG
		Others	Signal Chain test	C.3: RF Chain and Correlator Linearity	SKA-TEL-AIV-2510000 P49	SG
	SPFRx- CBF-SDP	IF	Signal Chain test	N/A	N/A	N/A
	End-to-End		TBD			

A References

A.1 Applicable Documents

The following documents are applicable to the extent stated herein. In the event of conflict between the contents of the applicable documents and this document, **the applicable documents** shall take precedence.

[AD1] "SKA1-MID Continuous Integration Plan", spreadsheet "MID Products for System Integration"

[AD2] SKA-TEL-SKO-0000120, SKA1 Configuration Management Plan

A.2 Reference Documents

The following documents are referenced in this document. In the event of conflict between the contents of the referenced documents and this document, **this document** shall take precedence.

[RD1] D. Gammon and R.T. Lord, "Integration & Verification Plan for SKA1_MID", SKA-TEL-AIV-2430001.

[RD2] R.T. Lord, D. Gammon and M. Hayes, "SKA Phase 1 System (Level 1) Verification Requirements", SKA-TEL-AIV-1420003.

[RD3] R.T. Lord, D. Gammon and M. Hayes, "SKA Phase 1 System (Level 1) Verification Requirements Spreadsheet", SKA-TEL-AIV-1420004.

[RD4] R.T. Lord, "SKA1 Telescope Roll-Out Strategy", SKA-TEL-AIV-1410004.

[RD5] R.T. Lord and D. Gammon, "Roll-Out Plan for SKA1_MID", SKA-TEL-AIV-2410001.

[RD6] R.T. Lord, T. Cheetham, A. Schinckel and A. MacLeod, "SKA1 Integration Test Facility (ITF)", SKA-TEL-AIV-1100004.

[RD7] R.T. Lord and A. MacLeod, "Product Hand-Over Process", SKA-TEL-AIV-1450001.

[RD8] N. Ebbendorf, "AIV Safety Management Plan", SKA-TEL-AIV-1470001.

[RD9] R.T. Lord and A. MacLeod, "EMC Control Plan for AIV", SKA-TEL-AIV-1480001.

[RD10] T. Kusel, "SKA Dish Element Integration and Verification Plan", SKA-TEL-DSH-0000024.

[RD11] G. van der Merwe, "SKA1 Dish Qualification Model (SDQM) Integration and Verification Plan (I&VP)", 301-000000-007.

[RD12] Scaled Agile Framework (SAFe), http://www.scaledagileframework.com

[RD13] "Test Procedures for Verification Event: ITF MID - Functional and Performance Capabilities (VE.M.ITF.2)", SKA-TEL-AIV-2510000.

[RD14] "Test Procedures for Verification Event: ITF MID - Non-Functional (VE.M.ITF.3)", SKA-TEL-AIV-2510001.

[RD15] "Test Procedures for Verification Event: AA1 MID - Functional and Performance Capabilities (VE.M.AA.1.2)", SKA-TEL-AIV-2510002.

[RD16] "Test Procedures for Verification Event: AA1 MID - Non-Functional (VE.M.AA.1.3)", SKA-TEL-AIV-2510003.

[RD17] "Test Procedures for Verification Event: AA2 MID - Functional and Performance Capabilities (VE.M.AA.2.2)", SKA-TEL-AIV-2510004.

[RD18] "Test Procedures for Verification Event: AA2 MID - Non-Functional (VE.M.AA.2.3)", SKA-TEL-AIV-2510005.

[RD19] J. Obiebi, "SKA ITF Establishment Plan", SKA-TEL-SKO-0000857.

[RD20] J. Obiebi, "System ITF Test Environment Product Requirements Specification", SKA-TEL-SKO-0001662.

[RD21] R. Anthony, "SKA1 Prototype System Integration (PSI) General Framework", SKA-TEL-SKO-0001756.

[RD22] PSI MID System Integration Test 1 Confluence page.

[RD23] Product Deleivery Issues to be Resolved Confluence Page

LIST OF ABBREVIATIONS

AA .....Array Assembly
AD .....Applicable Document
AIV .....Assembly, Integration and Verification
CBF.....Correlator/Beamformer
CSP.....Central Signal Processor
FAT.....Factory Acceptance Test
ICD.....Interface Control Document
ITF .....Integration Test Facility
OMC.....Observation Management and Control
PBS.....Product Breakdown Structure
PI .....Program Increment
PSI .....Prototype System Integration
RD .....Reference Document
SAT.....Site Acceptance Test
SDP .....Science Data Processing
SKA .....Square Kilometre Array
SKAO .....SKA Observatory

DOCUMENT HISTORY

Revision	Date Of Issue	Engineering Change Number	Comments
01	2021-11-26		Initital Release

DOCUMENT SOFTWARE

	Package	Version	Filename
Word processor	MS Word	Office 365	SKAO-TEL-0001876-01_SKA1-MID Continuous Product Integration Flowchart.docx
Block diagrams			
Other			

ORGANISATION DETAILS

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