

Product Manufacturing Specifications

Antenna Processing Subrack Clock and Translator (APSCT)

PCB nr.: 03116

	Organisatie / Organization	Datum / Date
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This publication is part of the project DUPLLO with project number 175.2017.012 of the research program "Investerings NWO-groot" which is (partly) financed by the Dutch Research Council (NWO).

Doc.nr.: PMS00044
Rev: 1.0
Date: 11-03-2022
Class.:

Distribution list:

Group:	Others:
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Document history:

Revision	Date	Chapter / Page	Modification / Change
0.1	19-01-2022	-	Creation
0.2	31-01-2022		Update EMC components
0.3	11-2-2022		Update
0.4	17-02-2022		Update
1.0	11-03-2022		Final

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1 Introduction

1.1 Document Scope

This document is the Product Manufacturing Specification (PMS) and is intended for PCB assembly manufacturers and test facilities. It describes the manufacturing specification for a complete PCB assembly, production and handling quality and if applicable a final functional test.

A functional description of the assembly is presented in section 2. Specific information and specification for this assembly can be found in the underlying documents shown in section 1.2. In section 3 the quality requirements and specifications are mentioned. References to general documents related to this module can be found in section 1.3. These documents are available upon request from the manufacturer.

1.2 Applicable documents (AD)

Ref.nr.	Document number	Rev.	Title	File name
AD-1	012032	1.0	Verzoek tot Offerte LOFAR2.0 Modules	
AD-2	012033	1.0	Annex-A Pakket van Eisen LOFAR2.0 Modules	

1.3 Reference documents (RD)

Ref.nr.	Document number	Rev.	Title	File name
RD-1	EDW00059	3.0	Schematic APSCT	EDW00059.pdf
RD-2	PPL00051	3.02	PPL APSCT, CLOCK AND TRANSLATOR LOFAR 2.0 PCB-03116	PPL00051_APSCT_20220309.xlsx
RD-3	PSF00167	3.0	PSF APSCT, CLOCK AND TRANSLATOR LOFAR 2.0 PCB-03116	PSF00167__APSCT_LOFAR_2_0_PCB_03116.pdf
RD-4	PPD00064	3.0	PPD APSCT, CLOCK AND TRANSLATOR LOFAR 2.0 PCB-03116	apsct_180222.tgz
RD-5	PAD00054	1.0	PAD APSCT, CLOCK AND TRANSLATOR LOFAR 2.0 PCB-03116	PAD00054_APSCT.pdf
RD-6	TPR00019	1.0	TPR APSCT, CLOCK AND TRANSLATOR LOFAR 2.0 PCB-03116	TPR00019_APSCT.pdf
RD-7	014974/01	01	Mechanical drawing APSCT module	014974-01_APSCT.pdf
RD-8	014974/01	01	Mechical BOM APSCT module	M-BOM_APSCT_R1_04-02-2022.xlsm

1.4 List of Terms and acronyms

ANSI	American National Standards Institute
AOI	Automated Optical Inspection
APS	Antenna Processing Subrack
APSCT	Antenna Processing Subrack Clock and Translator
APSF	Antenna Processing Subrack Fan Box
BOM	Bill Of Material
ESD	Electro Static Discharge
IPC	Association Connecting Electronics Industries
LMP	LOFAR2 Midplane
LOFAR	Low Frequency Array
OPC UA	OPC Unified Architecture
PO	Purchase Order
PCB	Printed Circuit Board
PMS	Product Manufacturing Specification
RCU2	Receiver Unit 2
RCU2H	Receiver Unit 2 High
RCU2L	Receiver Unit 2 Low
RoHS	Restriction of Hazardous Substances
SMD	Service Mount Devices
SPI	Solder Paste Inspection
VtO	Verzoek tot Offerte (request for quotation)

2 Functional description

The **Antenna Processing Subrack Clock and Translator (APSCT)** is one of the central boards in the Antenna Processing Subrack (APS) for the LOFAR2.0 station. In this subrack, 96 antenna signals are combined to form a station beam on the sky to which the station is most sensitive. Figure 1 shows an exploded view of the LOFAR2.0 Antenna Processing Subrack (APS) and location of the APSCT board.

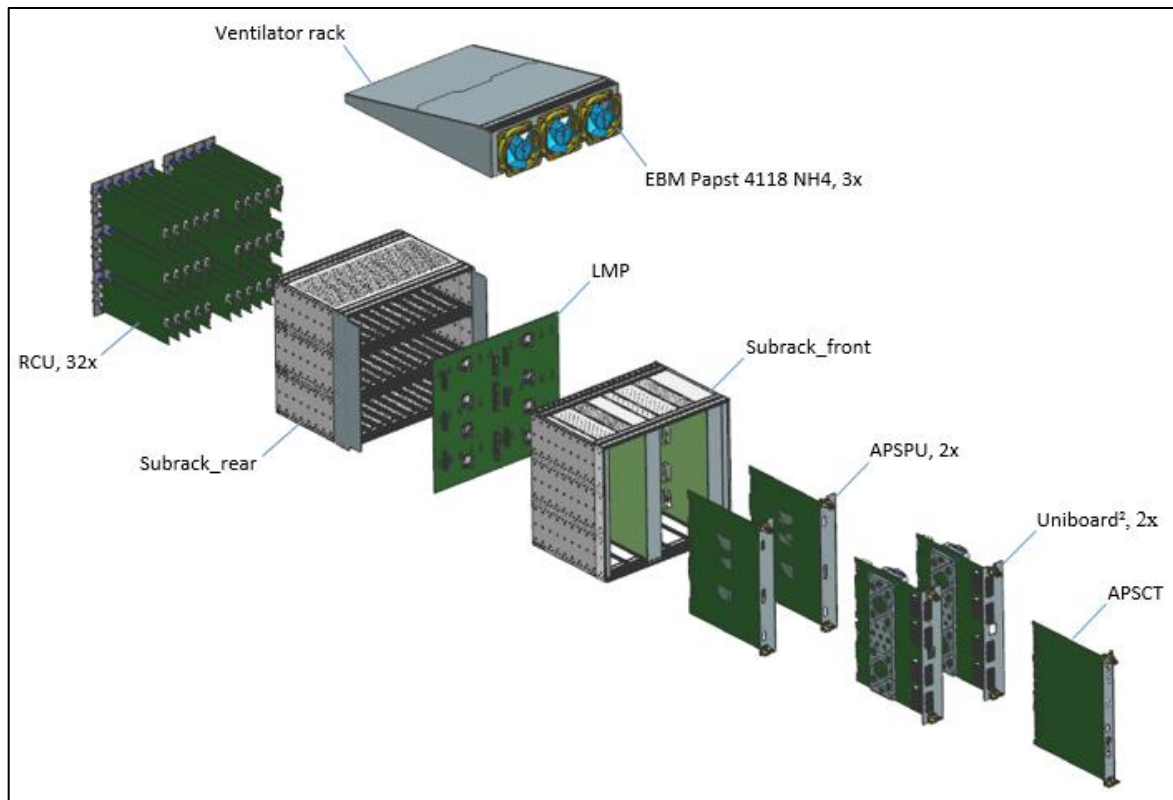


Figure 1 Picture of the boards in the Antenna Processing Subrack.

On the APST the 200 MHz sampling clock for the receiver units and the processing board is synchronized to a 10 MHz reference clock from the input. This clock is buffered for 32 receiver units and 2 processing boards.

Besides clock distribution the hardware monitor and control within an APS is implemented on the APST as well. For this purpose, a Raspberry Pi computer module is used to translate low-level I2C communication to an OPC-UA communication interface. The I2C communication is used to communicate with the hardware monitor and control points on products like the receiver units and UniBoard2's and the OPC-UA communication interface is used by the software layers in station control. A schematic diagram of the APST is provided in Schematic APST [RD-1].

In Figure 2, a 3D drawing of the APST is shown. With on the right side the clock distribution parts and on the left side the hardware monitoring parts including the Raspberry Pi compute module.

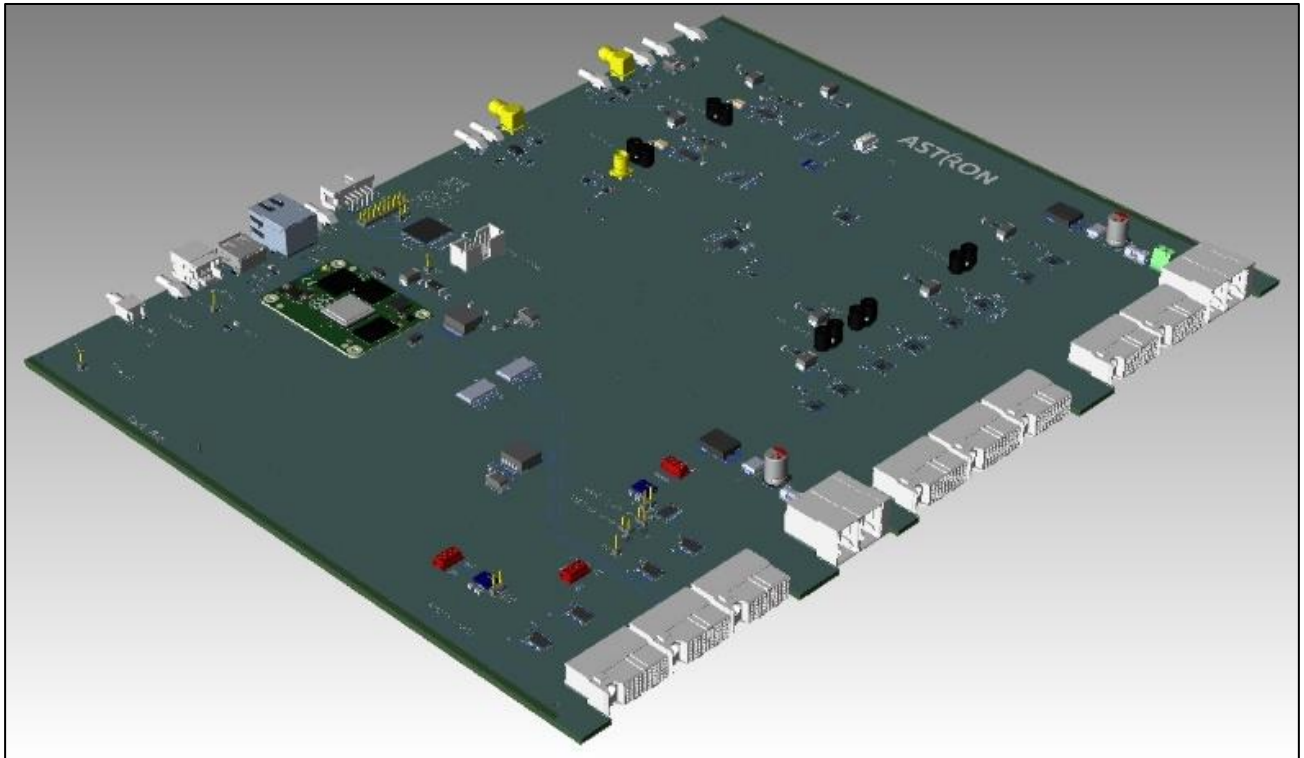


Figure 2 3D drawing of the APSCT PCBA.

3 General technical assembly requirements and specifications

Unless otherwise specified in the VtO [AD-1], the assembly will be complete and carried out according to good workmanship and quality. The work will involve but not limited to the following responsibilities:

- Inspection of incoming design files for manufacturing.
- Component purchase according to the BOM provided in [RD-2] (both electrical and mechanical parts).
- Proposing alternative components in case of obsolescence, long lead time and/or economical reason. Since not all parts can be replaced by alternatives, like components in a sensitive analogue filter, ASTRON engineers keep final control as to whether an alternative component may be used.
- Purchase of PCB according to the provided design files [RD-4] and PCB specification form [RD-3] (a preferred supplier maybe demanded).
- Component assembly including in-line quality tests.
- Module assembly.
- Functional test according to provided test specifications.

The following standards are applicable for the PCB production and the assembly process including purchase and handling:

- ISO 9001
- For the PCB design the following IPC standards have been used:
 - o IIPC-2221B, Class 2 Dedicated Service Electronic Products Level B, Moderate Design Producibility-Standard
 - o IPC-2222B, Type 4, Multilayer Printed Board with blind and buried vias
 - o IPC-7351, Level B Moderate Design Producibility-Standard

3.1 PCB quality requirements and standards

The APSCT is a double sided multilayer rigid organic printed circuit board without blind and buried vias. The design includes via in pad technology and press-fit connectors. More information about the PCB is provided in the APSCT PCB specification form. [RD-3]

The following standards are applicable for the PCB production process including purchase and handling:

- IPC-A-600, Class 2
- IPC-6011
- IPC-6012
- IPC-SM-840
- IPC-SM-4100

The bare PCB board has to pass PCB electrical test (isolation, shorts and conductance) as provided by the APSCT Production Test Procedure [RD-6].

3.2 APSCT assembly quality requirements and standards

The main assembly of the APSCT require SMD assembly technology. The board connectors are press-fit type connectors and require special press-fit tooling. Further mechanical assembly is required for the screw-on type mechanical parts such as the board front panel, more information about the mechanical parts is provided in the mechanical drawing of the APSCT Front panel [RD-7].

Assembly details are provided in the APSCT Product Assembly Document [RD-5].

The following standards are applicable for the PCB production process including purchase and handling:

- IPC-A-610, Class 2
- RoHS directives, 2011/65/EU
- ANSI/ESD-S-20.20 (ESD prevention)
- ANSI/EIA-471 (ESD symbol and labels)
- JESDD625-A (ESD handling devices)
- Other applicable IPC norms specifically related to the product

All components must be RoHS compliant unless specifically stated otherwise in the product BOM. In case RoHS components are not available an alternative option must be discussed with the project manager (see section 4).

Assembly process inspections like SPI, AOI are advised or must be performed. More details on the inspections and test are provided in the APSCT Production Test Procedure [RD-6].

3.3 Functional test

A functional test of the APSCT assembly is required. ASTRON will provide the requirements and specification for the test and the test setup. These requirements are detailed in the board test documentation, [RD-6]. The manufacturer must specify the test- and test facility options to carry out such a functional test. ASTRON designers will assist where special test equipment or test jigs are not available at the manufacturer. Such a request for support must be clearly stated in the manufacturer quotation.

3.4 Acceptance

ASTRON will only accept PCB assemblies as specified in the Annex-A of the VtO [AD-2] and underlying documents. Incomplete or non-functional items will be subject for negotiation.

4 Information and Communication

Detailed information is provided in the VtO [AD-1].



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