

Product Manufacturing Specification

Receiver Unit 2 High  
RCU2H

PCB nr.: 03120

	Organisatie / Organization	Datum / Date
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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		Verzoek tot Offerte LOFAR2.0 Modules	
AD-2	012033		Annex-A Pakket van Eisen LOFAR2.0 Modules	

## 1.3 Reference documents (RD)

Ref.nr.	Document number	Rev.	Title	File name
RD-1	EDW00067	3.1	SCHEMATIC RCU2.0 HIGH BAND LOFAR 2.0_PCB-03120	EDW00067.pdf
RD-2	PPL00055	3.1	PPL RCU2.0 HIGH BAND LOFAR 2.0_PCB-03120	PPL_RCU2H_20220408.xlsx
RD-3	PSF00171	3.3	PSF RCU2.0 HIGH BAND LOFAR 2.0_PCB-03120	PSF00171_RCU2.0_HIGH_LOFAR_2.0.pdf
RD-4	PPD00069	3.2	PPD RCU2.0 LOW BAND LOFAR 2.0_PCB-03120	rcu2_hb_rev3_20220408.tgz
RD-5	PAD00052	0.4	PAD RCU2.0 LOW BAND LOFAR 2.0_PCB-03120	PAD00052_RCU2H.pdf
RD-6	TPR00024	1.0	TPR RCU2H, LOFAR 2.0, PCB-03120	TPR00024_RCU2H.pdf
RD-7	015372-01	01	Mechanical drawing RCU2H module	M-BOM_RCU2H_R1_08-03-2022.xlsm
RD-8	015372-01	01	Mechanical BOM	015372-01_RCU2H.pdf

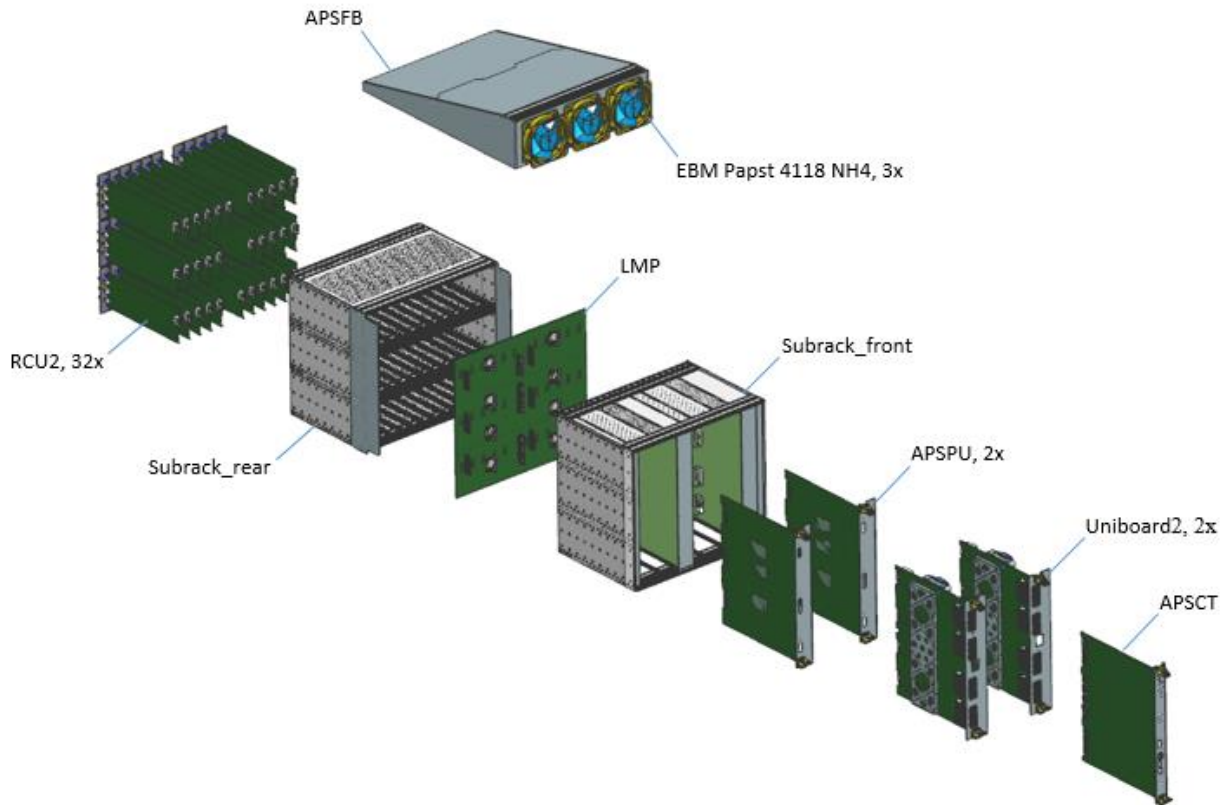


## 1.4 List of Terms and acronyms

ANSI	American National Standards Institute
AOI	Automated Optical Inspection
APS	Antenna Processing Subrack
APSCT	Antenna Processing Subrack Clock and Translator
APSFB	Antenna Processing Subrack Fan Box
BOM	Bill Of Material
ESD	Electro Static Discharge
IPC	Association Connecting Electronics Industries
HBA	High Band Antenna
HBAT	High Band Antenna Tiles, array of 16 HBA's.
LMP	LOFAR2 Midplane
LOFAR	Low Frequency Array
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
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
SMD	Service Mount Devices
SPI	Solder Paste Inspection
VtO	Verzoek tot Offerte (request for quotation)

## 2 Functional description

The **Receiver Unit 2 High (RCU2H)** is the input module for the high-band antenna 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 APS and the position of the RCU2H modules.



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

Each RCU2H module has three input channels which are connected to the High Band Antenna Tiles (HBAT) in the field by coaxial cables. The main function of the RCU2H is to perform amplification (gain) of the 110 to 270 MHz incoming signal, performing various RF filtering and finally digitize the signal with a 200 MSPS 14 bit Analog to Digital converter (ADC) for further processing in the digital processing module (UniBoard2). The digital signals between the RCU2H and the UniBoard2 modules are connected via the LOFAR2 midplane (LMP). DC power and control to the RCU2H modules are also distributed by the LMP. DC power and control to each of the HBAT in the field are enabled by the RCU2H module. A high band subrack contains 32 RCU2H modules suitable to process 96 HBAT signals. Since the HBAT system is using 48 dual polarised antenna tiles, one high band subracks is required in a Dutch LOFAR2.0 station. International LOFAR stations using 96 dual polarised tiles and therefore require two high band subracks. A schematic diagram of the RCU2H is provided in Schematic RCU2H [RD-1]. In Figure 2, a photo of the RCU2H PCBA is shown.

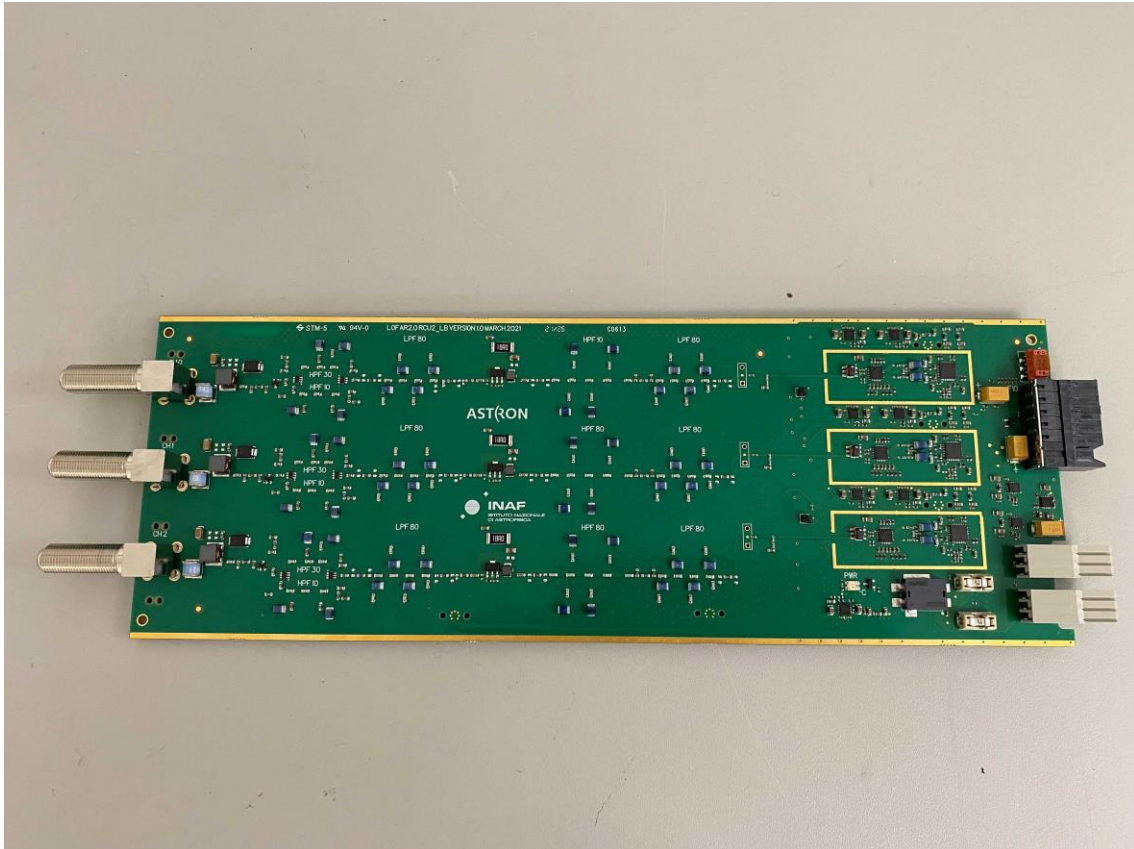


Figure 2 Photo of the RCU2H PCBA.

### 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 IPC-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 RCU2H is a double sided multilayer rigid organic printed circuit board with blind and buried vias. The design includes via in pad technology and press-fit connectors. More information about the PCB is provided in the RCU2H 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 RCU2H Production Test Procedure [RD-6].

### 3.2 RCU2H assembly quality requirements and standards

The main assembly of the RCU2H 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 RCU2H module [RD-7] and the mechanical BOM [RD-8]. Assembly details, including special requirements about the alignment of three coaxial F-connectors at the front of the RCU2H, are provided in the RCU2\_HB 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).

The during the assembly process inspections like SPI, AOI, AXI are advised or have to be performed. More details on the inspections and test are provided in in RCU2H Production Test Procedure [RD-6].

### 3.3 Functional test

A functional test of the RCU2H 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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