

PCB Production Specification

APSPU LOFAR 2.0

PCB nr.: 03117

	Organisatie / Organization	Datum / Date
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Date: 24-03-2022  
Class.:

## Distribution list:

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Group:	Others:
Gijs Schoonderbeek Sieds Damstra	N. Ebbendorf A. v. Duin H. Meulman

## Document history:

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Revision	Date	Chapter / Page	Modification / Change
0.1	29-03-2021	-	Creation
1.0	29-04-2021	-	Production version
1.1	18-01-2022	-	Update tender version
1.2	31-01-2022	-	Update EMC components
2.0	22-02-2022	-	Last changes for Tender documentation
2.1	11-03-2022	-	Update after review

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# 1 Introduction

## 1.1 Document Scope

This document presents technical PCB production specification for the APSPU, Power Unit for Antenna Processing Subrack for LOFAR 2.0. This APSPU is part of the project DUPLO (with project number 175.2017.012 of the research program "Investeringen NWO-groot" which is (partly) financed by the Dutch Research Council (NWO).

For all specification is the **ODB++ DATA IS LEADING**

## 1.2 Applicable documents (AD)

Ref.nr.	Document number	Rev.	Title	File name
AD.1	PPD00067	1.0	PCB Production data APSPU (ODB++ file)	apspu_22022022.tgz

## 1.3 Reference documents (RD)

Ref.nr.	Document number	Title	Author
RD.1	PMS00046	PMS APSPU, ANT. PROC. SUBRACK POWER UNIT	G.W. Schoonderbeek

## 1.4 List of Terms and acronyms

BOM	Bill Of Material
IPC	Association Connecting Electronics Industries
PCB	Printed Circuit Board

# 2 IPC Quality Requirements

The board have the following IPC requirements:

IPC requirement	Comment
IPC 2222B	Board type 3 (Multilayer Printed Board without blind and/or buried vias)
IPC 2221A	Performance Class 2 (Dedicated Service Electronic Products). Reducibility Level B (High Design Complexity - Standard)
IPC A-600	Class 2 (Dedicated Service Electronic Products)
IPC SM-840	Solder Resist
IPC 4101	Laminate Material



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### 3 Specifications

PCB nr.	03117-01
Title	APSPU
Number of Layers	6
Size of the PCB	292 X 366.66 (mm) +/- 0.1 mm
Placement components	SMD Top/Bottom, Through-hole Top/Bottom
Number of signal layers	4
Number of plane layers	2
Number of Non-signal layers	2 (mask)
Silkscreen	top and bottom (user layer)
Number of Pins	1467
Number of Nets	104
Number of Components	474
Number of Vias	2727
Vias filling	1089 Yes, via in pad is used. Holes < 0.4mm are filled and capped.
Total number of Trough Holes	3466
Smallest hole diameter	0.3 mm Through Hole (finished size)
Smallest route size	0.15mm
Smallest Isolation / clearance	0.15mm
PCB material and type	See Drawing Notes
Material thickness	Total 2.4mm
Copper thickness	See master drawing
Etch Tolerance	10%
Via Plating	Through: >20um
Finishing	Gold (ENIG)
Impedance trace on layer	See section appendix
<b>Hole tolerances</b>	See drill drawing.
Reports	<b>All reports showing correct production</b> have to be delivered. <b>See Master Drawing notes pag. 6</b>
PCB Testing	Electrical test (open circuit/short circuit)



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## 4 List of Files

ODB++	apspu_22022022.tgz
Statistics	On request

## 5 Filled & capped via

The via's should be filled according **IPC4761 TYPE VII** via (filled and capped via), see Figure 1

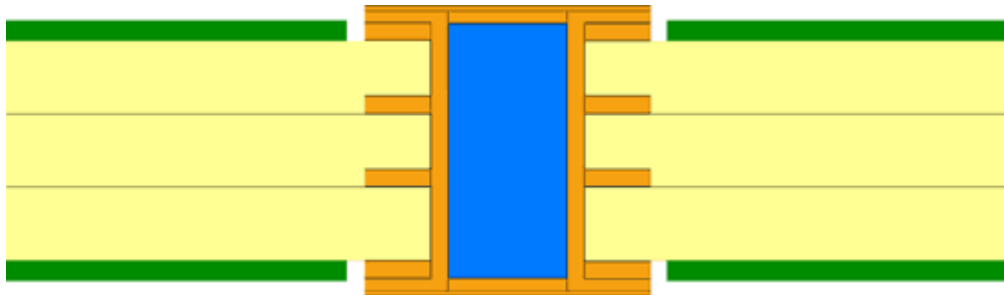


Figure 1 Filled and capped via

## 6 General

For technical information contact can be made with;

Designer: *Gijs Schoonderbeek (ASTRON)*  
 Phone; (+31) (0)521 595 110  
 E-mail; [schoonderbeek@astron.nl](mailto:schoonderbeek@astron.nl)



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## Manufacture notes

1 2 3 4 5 6 7 8

A  
B  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L

A  
B  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L

MASTER DRAWING NOTES

PCB Specifications

- [1] Fabricate boards in accordance with IPC6011 / IPC6012 CLASS
- [2] Finished boards must meet quality and conformance testing and inspection as specified
- [3] Drill boards using drill data, drill pattern and hole schedule.  
Hole locations may vary within 0.125mm max. about true position.
- [4] All holes are plated through unless noted otherwise.  
Minimum copper plating in plated holes to be 25um.  
Maximum copper plating in plated holes to be 50um.
- [5] Plating primary and secondary side: ENIG
- [6] Minimum annular ring:  
internal: 20um  
external: 25um
- [7] Bow and twist shall not exceed 0.75% measured in accordance with IPC-TM Method 2.4.22.
- [8] All via's with < 0.35mm holes shall be filled and capped
- [9] Differential pair impedance tolerance less than 10%
- [10] Construction to be soldermask over bare copper (SMOBC)  
Apply to primary and secondary sides in accordance with IPC-SM-840 (Class T).
- [11] Soldermask thickness 5um min. / 30um maximal.
- [12] Soldermask to be light green in color and transparent.
- [13] PCB Repairs: Repairs of damaged traces is not permitted.
- [14] Non-Functional pads can be removed.

Testing


- [15] All bare boards shall be electrically tested using CAD generated netlist data.  
Electrical testing shall follow the guidelines established by IPC-ET-652.  
Guidelines and requirements for electrical testing of unpopulated printed boards.
- [16] Each production panel shall pass a thermal test in accordance IPC-TM-650 Method 2.6.27 for a reflow temperature of 260 deg C.
- [17] For each production batch the line impedance of controlled impedance lines (100 Ohm and or 50 Ohm) on all impedance layers shall be tested in accordance IPC-TM-650 Method 2.5.5.7.

Other

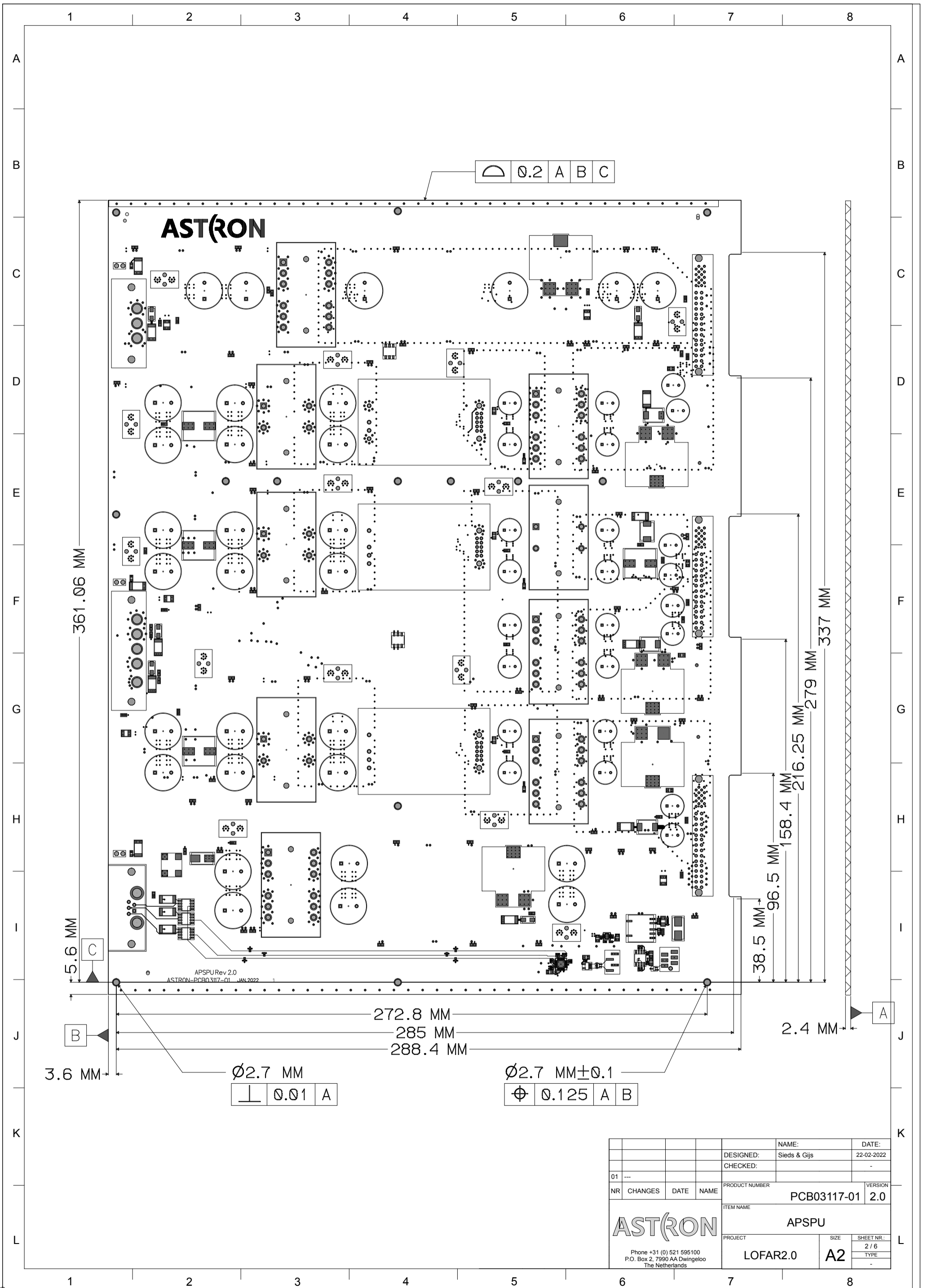
- [18] Board fabricator shall apply serial number, date code and UL Marking at the indicated location on the primary side.

Assembly Specifications

- [19] All boards shall be assembled according IPC-A-612 Class 2 specification for Type 2 Class 2 boards

				DESIGNED:	NAME:	DATE:
				CHECKED:	Sieds & Gijs	22-02-2022
01	---					
NR	CHANGES	DATE	NAME	PRODUCT NUMBER	VERSION	
				PCB03117-01	2.0	
				ITEM NAME		
				APSPU		
Phone +31 (0) 521 595100 P.O. Box 2, 7990 AA Dwingeloo The Netherlands				PROJECT	SIZE	SHEET NR.:
				LOFAR2.0	A2	1 / 6
					TYPE	
					-	

1 2 3 4 5 6 7 8



**ASTRON**

361.06 MM

337 MM

5.6 MM

272.8 MM  
285 MM  
288.4 MM

2.4 MM

3.6 MM

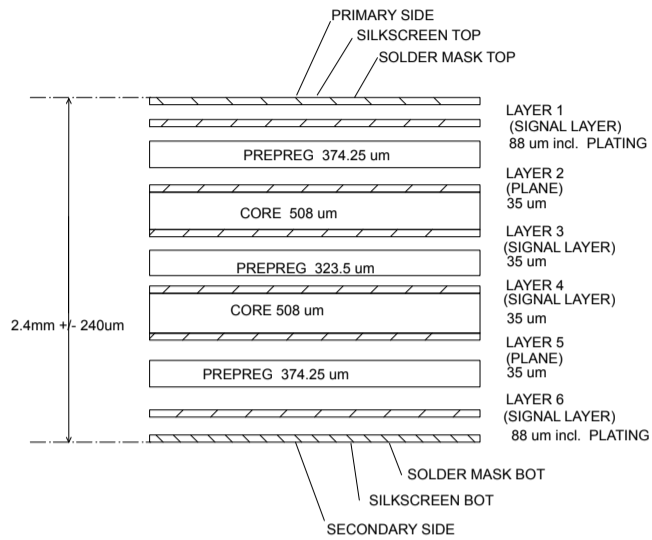
⊥ 0.01 A

∅2.7 MM ± 0.1  
∅ 0.125 A B

38.5 MM  
96.5 MM  
158.4 MM  
216.25 MM  
279 MM

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ASTRON-PCB03117-01 JAN 2022

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01	---				
NR	CHANGES	DATE	NAME	PRODUCT NUMBER	VERSION
				PCB03117-01	2.0
				ITEM NAME	
				APSPU	
Phone +31 (0) 521 595100 P.O. Box 2, 7990 AA Dwingeloo The Netherlands				PROJECT	SIZE
				LOFAR2.0	A2
				SHEET NR.:	2 / 6
				TYPE	-

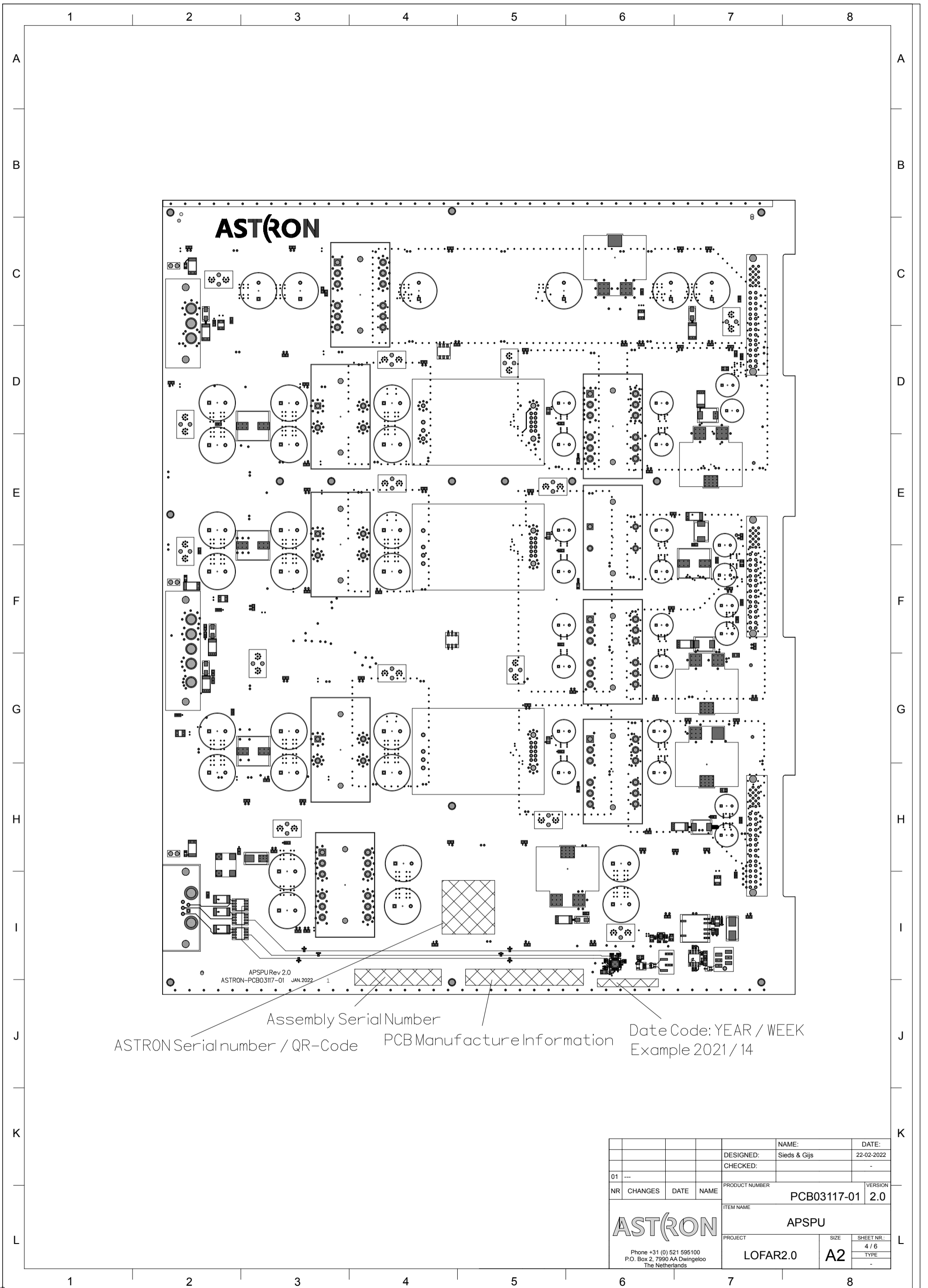


ARTWORK	DWG No.	REV LEVEL	Cu	Nom. Finished Line Width
Silkscreen Top	PCB03117-01	-		
Solder Mask Top	PCB03117-01	-		
Top layer (layer 1)	PCB03117-01	-	88um	0.2 mm
Layer 2	PCB03117-01	-	35 um	0.2 mm
Layer 3	PCB03117-01	-	35 um	0.2 mm
Layer 4	PCB03117-01	-	35 um	0.2 mm
Layer 5	PCB03117-01	-	35 um	0.2 mm
Bottom Layer (Layer 8)	PCB03117-01	-	88 um	0.2 mm
Solder Mask Bottom	PCB03117-01	-		
Silkscreen Bottom	PCB03117-01	-		
NC-Drill data 1-6	PCB03117-01	-		

**PCB Material Specifications**

Specification	Minimal	Typical	Maximal	Unit
Dk 1 GHz	3.6	4.2	4.7	
Df 1GHz	0.02			
Tg	173			C
Td	340			
CTE Z-axis Pre-Tg			45	ppm/ C
CTE Z-axis Post-Tg			255	ppm/ C
CTI	175V (Class 3)			
Flammability	UL 94 V-0			

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01	---					
NR	CHANGES	DATE	NAME	PRODUCT NUMBER	PCB03117-01	VERSION
						2.0
				ITEM NAME		
				APSPU		
Phone +31 (0) 521 595100 P.O. Box 2, 7990 AA Dwingeloo The Netherlands				PROJECT	SIZE	SHEET NR.:
				LOFAR2.0	A2	3 / 6
				TYPE		



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APSPU Rev 2.0  
 ASTRON-PCB03117-01 JAN.2022 1

ASTRON Serialnumber / QR-Code      Assembly Serial Number      PCB Manufacture Information      Date Code: YEAR / WEEK  
 Example 2021 / 14

				DESIGNED:	Sieds & Gijs	DATE:	22-02-2022
				CHECKED:			-
01	---			PRODUCT NUMBER		VERSION	
NR	CHANGES	DATE	NAME	PCB03117-01		2.0	
				ITEM NAME			
				APSPU			
Phone +31 (0) 521 595100 P.O. Box 2, 7990 AA Dwingeloo The Netherlands				PROJECT		SIZE	SHEET NR.:
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						TYPE	
						-	

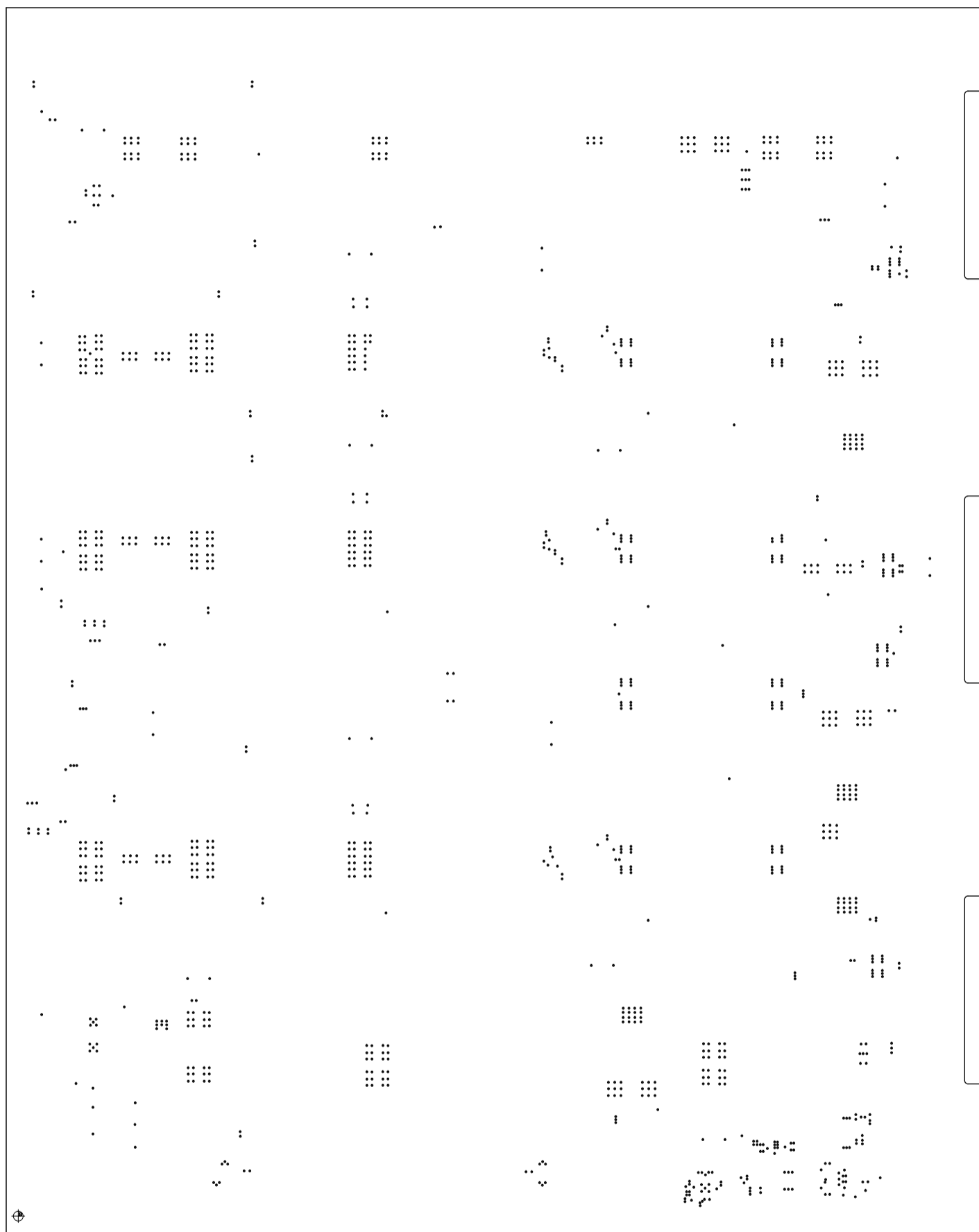



Optional Assembly Manufacture Information

PCB Manufacture Information

				DESIGNED:	NAME:	DATE:
				CHECKED:	Sieds & Gijs	22-02-2022
01 ---						
NR	CHANGES	DATE	NAME	PRODUCT NUMBER	VERSION	
				PCB03117-01	2.0	
 Phone +31 (0) 521 595100 P.O. Box 2, 7990 AA Dwingeloo The Netherlands				ITEM NAME		
				APSPU		
PROJECT				SIZE	SHEET NR.:	
LOFAR2.0				A2	5 / 6	
					TYPE	
					-	

# Filled Vias



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				CHECKED:	Sieds & Gijs	22-02-2022
01 ---						
NR	CHANGES	DATE	NAME	PRODUCT NUMBER	VERSION	
				PCB03117-01	2.0	
				ITEM NAME		
				APSPU		
Phone +31 (0) 521 595100 P.O. Box 2, 7990 AA Dwingeloo The Netherlands				PROJECT	SIZE	SHEET NR.:
				LOFAR2.0	A2	6 / 6
					TYPE	
					-	