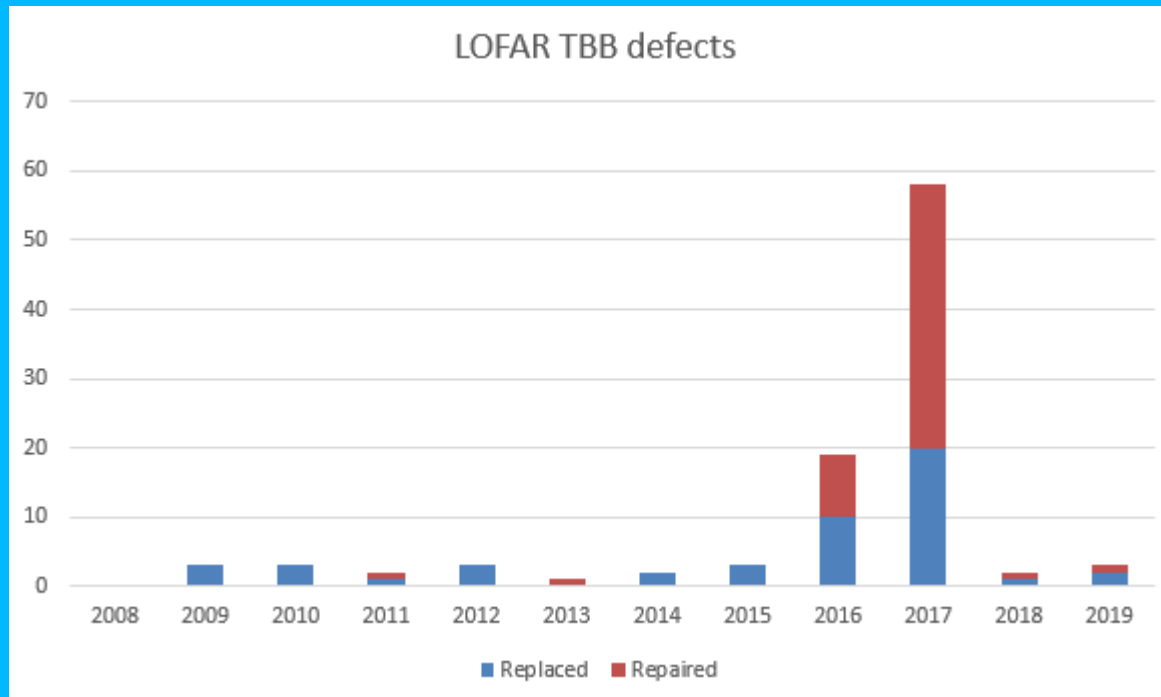




LOFAR Maintenance 2019

Amsterdam 6-11-2019
Henri Meulman

Preventive Maintenance (TBB)



4 fans per TBB

6 TBB per NL station and 12 per ILT station

38 NL stations and 14 ILT stations

Total = $4 * (228 + 168) = 1584$ fans

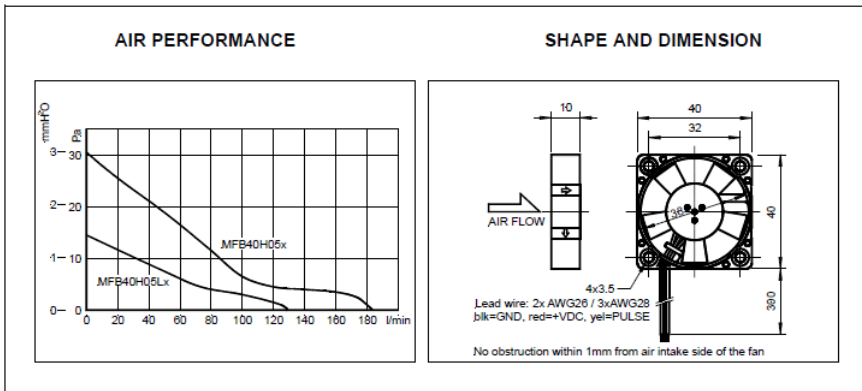
Preventive Maintenance (TBB)

SEPA[®] BRUSHLESS FAN

MFB40H05, MFB40H05L, MFB40H05A, MFB40H05LA

HIGH RELIABILITY FAN

AUTOMOTIVE FAN



PERFORMANCE

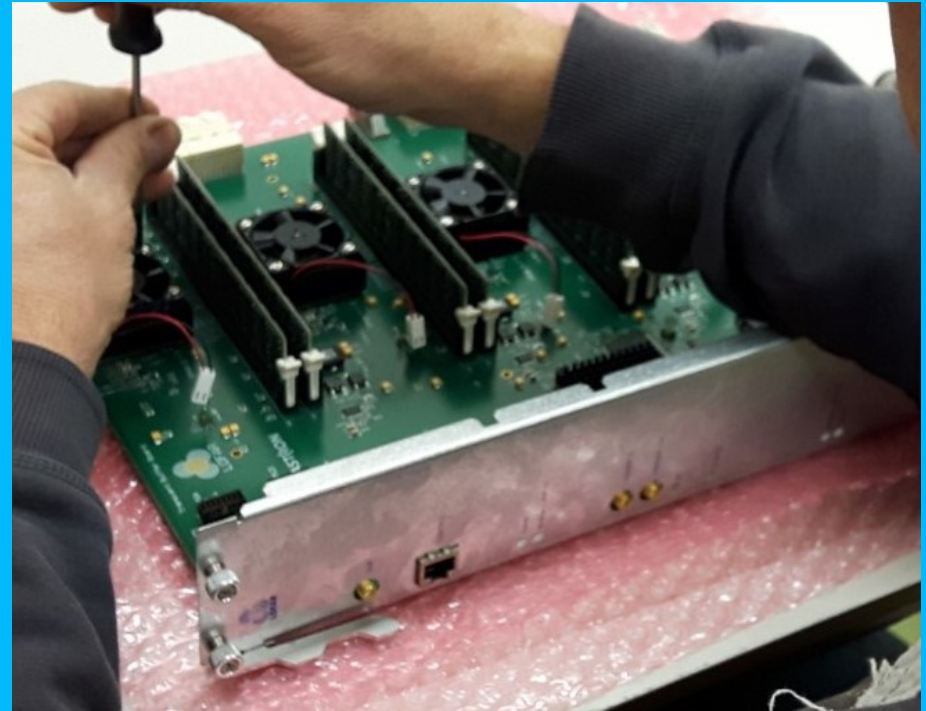
		MFB40H05L MFB40H05LA	MFB40H05 MFB40H05A
Operating Voltage	[V]	4.5 ... 5.0 ... 5.5	
Typ. Operating Current	[mA]	50	90
Max. Start Current	[mA]	90	250
Max. Air Flow	[l/min - m ³ /h]	130 - 7.8	184 - 11.0
Max. Air Pressure	[mmH ₂ O - Pa]	1.5 - 14.4	3.1 - 30.5
Typ. Noise @ 1m	[dB(A)]	19	24
Operating Temperature	[°C]	-40/+80 (85 for 3 hours max.)	
Life Expectancy L ₁₀ /MTBF	[h]	95000/280000	
Rotor Speed	[RPM]	3800	5800
Bearing System		ball bearings ZZ	
Weight	[g]	13	
Pulse Output (...A)		...A: 2 Pulses / Rev.	
Packing Quantity	[PCs]	50 - 100 - 500	

95000 hours = 10.8 year

LOFAR maintenance 2019

Preventive Maintenance (TBB)

TBB: 1584 fans



LOFAR maintenance 2019

Preventive Maintenance (TBB)

TBB: 1584 fans

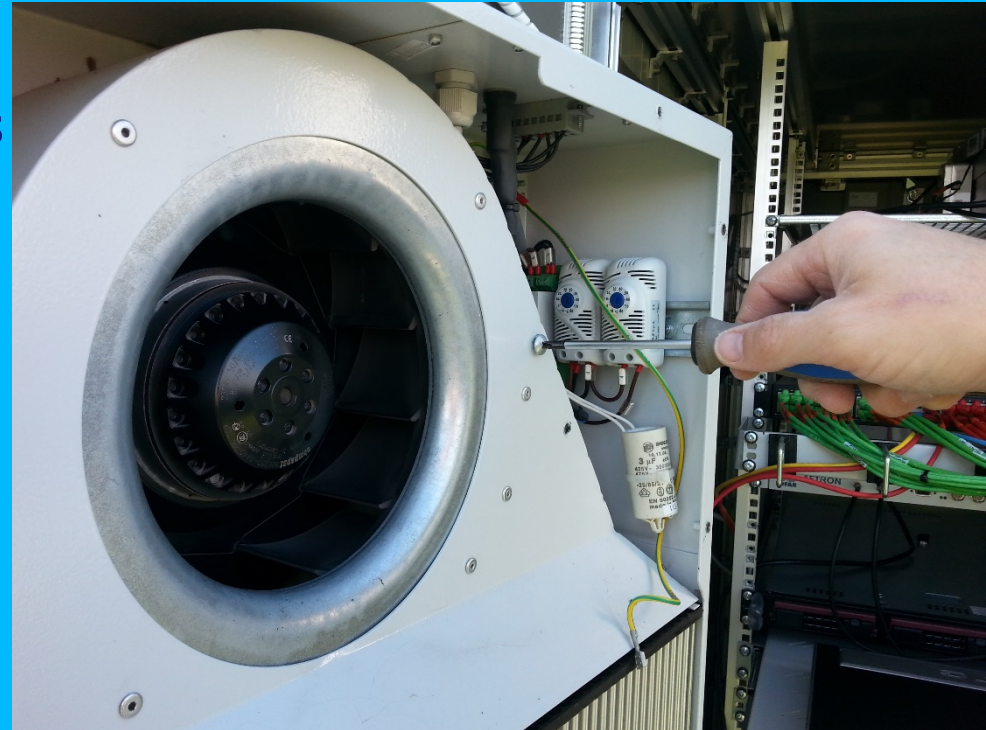
Sub-rack: 594 fans



LOFAR maintenance 2019

Preventive Maintenance (TBB)

TBB:	1584 fans
Sub-rack:	594 fans
AC fans:	456 fans



LOFAR maintenance 2019

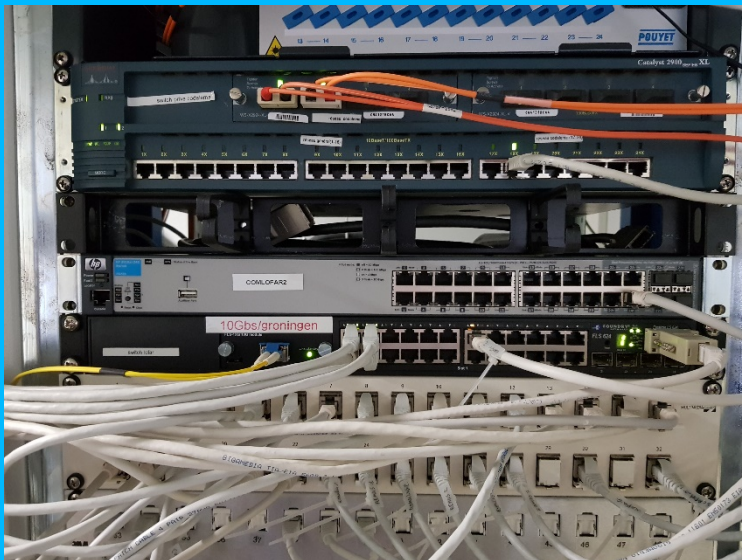
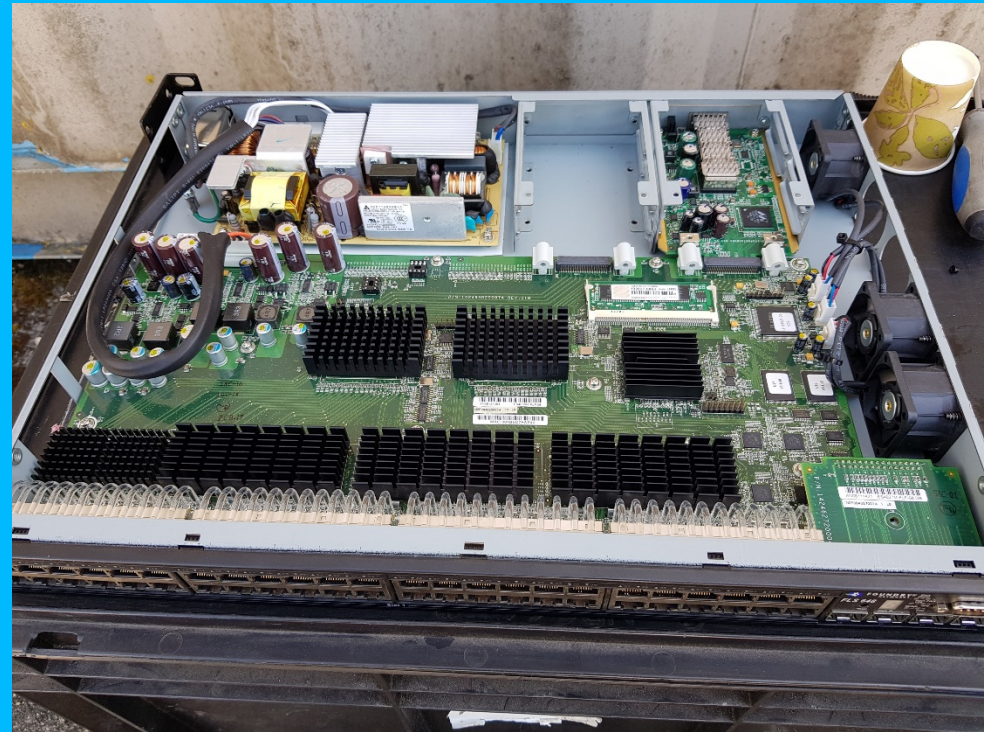
Preventive Maintenance (TBB)

TBB: 1584 fans

Sub-rack: 594 fans

AC fans: 456 fans

Network switch: 240 fans



LOFAR maintenance 2019

Preventive Maintenance (TBB)

TBB: 1584 fans

Sub-rack: 594 fans

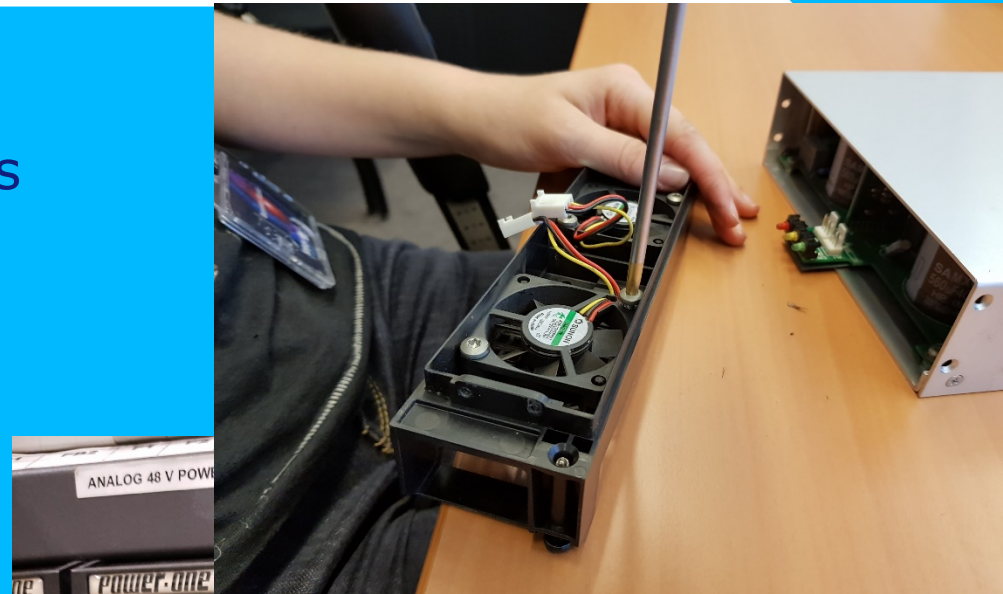
AC fans: 456 fans

Network switch: 240 fans

PowerOne module: 604 fans

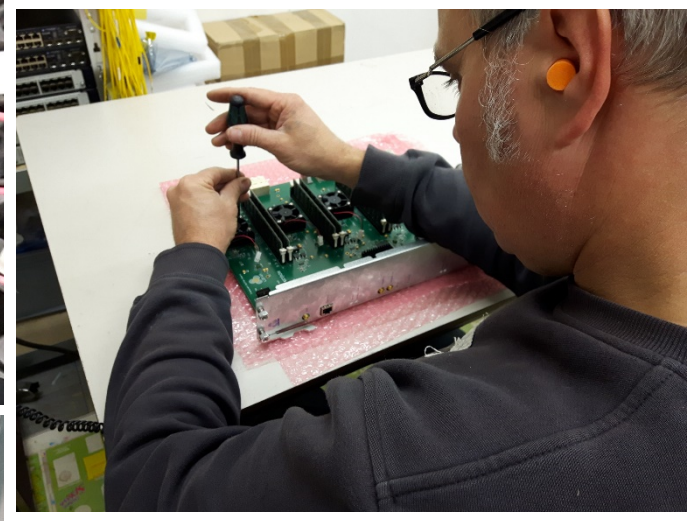
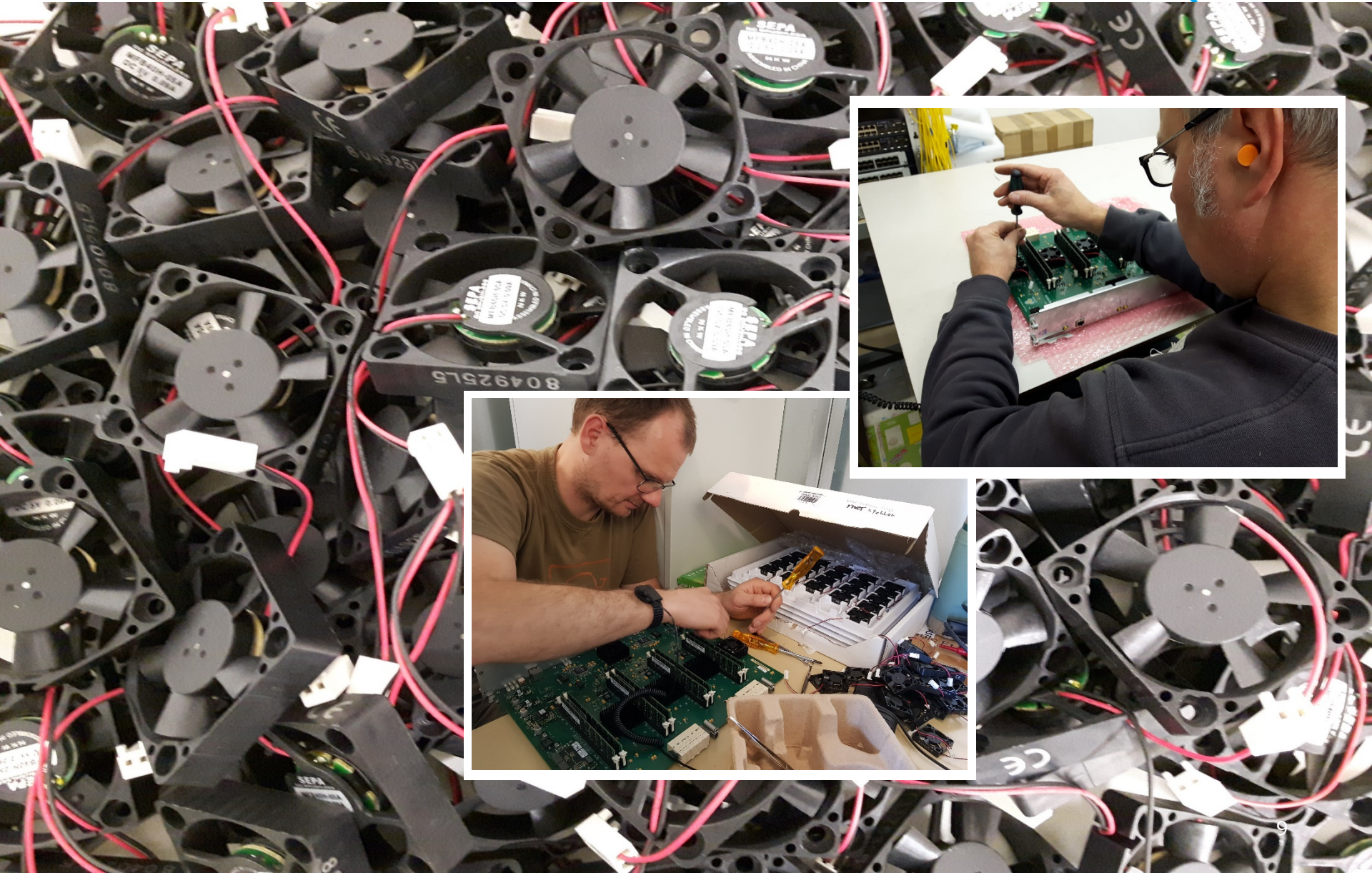
Total 3478

Extra 84 fans at NAA stations



LOFAR maintenance 2019

ASTRON



LOFAR maintenance 2019



Planning Fan exchange

File Edit View Insert Format Data Tools Add-ons Help Last edit was made on October 16 by Peter Gruppen

100% £ % .0 .00 123 Arial 10 B I U A

	A	B	C	D	E	F	G	H	I	J	K	L
1				Subrack fans vervangen		AC fans vervangen	TBB fans vervangen	Network switch fans vervangen	SyncOptics Check	PowerOne fans	Clicksons enabled	SPU's
4	CS001		7-12-2009	8-9-2016		16-10-2017	7-11-2017					
5	CS002		11-9-2009	1-9-2016		9-5-2018	6-12-2017	9-5-2018				
6	CS003		21-9-2009	1-9-2016		3-10-2018	6-12-2017	3-10-2018	3-10-2018		3-10-2018 tot 5-2-2019	
7	CS004		21-9-2009	1-9-2016		11-9-2017	6-12-2017	3-10-2018	3-10-2018			
8	CS005		5-10-2009	1-9-2016		14-3-2017	6-12-2017	20-3-2018				
9	CS006		29-9-2009	8-9-2016		4-7-2017	6-12-2017					
10	CS007		29-9-2009	8-9-2016		4-10-2018	6-12-2017	4-10-2018	4-10-2018		4-10-2018 tot 5-2-2019	
11	CS011		8-9-2010	8-9-2016		8-9-2018	30-5-2018	30-5-2018	30-5-2018			
12	CS013		15-10-2010	8-9-2016		6-6-2018	6-6-2018	6-6-2018	6-6-2018			
13	CS017		14-6-2010	14-9-2016	TBB3 mem	25-6-2018	25-6-2018	25-6-2018	25-6-2018			
14	CS021		12-10-2009	14-9-2016	TBB3 mem	29-8-2017	7-11-2017					
15	CS024		11-11-2009	14-9-2016		25-10-2017	7-11-2017					
16	CS026		22-6-2010	14-9-2016	TBB0 temp, TBB2 mem	26-7-2017	8-10-2019	8-10-2019	8-10-2019			
17	CS028		29-7-2010	14-9-2016		8-5-2018	8-5-2018	8-5-2018				
18	CS030		2-9-2009	14-9-2016		18-7-2018	18-7-2018	18-7-2018	18-7-2018		18-7-2018 tot 6-8-2019	
19	CS031		30-9-2010	14-9-2016		19-10-2017	7-11-2017					
20	CS032		4-11-2009	14-9-2016		2-11-2017	7-11-2017					
21	CS101		29-4-2010	8-9-2016		5-11-2018	5-11-2018	5-11-2018	5-11-2018		5-11-2018 tot 6-8-2019	
22	CS103		17-11-2009	8-9-2016		19-9-2017	15-10-2019	15-10-2019	15-10-2019			
23	CS201		3-6-2010	28-9-2016		20-9-2017	7-11-2017					
24	CS301		20-10-2009	28-9-2016	TBB0,2 temp	26-1-2017	7-11-2017					
25	CS302		23-4-2009	8-9-2016		26-10-2017	23-9-2019	23-9-2019	23-9-2019			
26	CS401		23-10-2009	28-9-2016		9-10-2018	9-10-2018	9-10-2018	9-10-2018		9-10-2018 tot 6-8-2019	
27	CS501		29-10-2009	28-9-2016	TBB 4 temp	20-9-2018	7-11-2017	20-9-2018	20-9-2018		20-9-2018 tot 6-8-2019	
28	RS106		10-7-2009	26-9-2016		21-9-2018	18-9-2019	2017	18-9-2019			
29	RS205		24-11-2009	26-9-2016		16-3-2017	2-10-2019	2-10-2019	2-10-2019			
30	RS208		14-8-2009	19-9-2016		15-3-2017	3-10-2019	3-10-2019	3-10-2019			
31	RS210		5-7-2013	19-9-2016	Tbb0 temp. Temperatuur pieken. Trip is	5-6-2018	5-6-2018	5-6-2018	5-6-2018			
32	RS305			26-9-2016	TBB4 temp	26-6-2018	26-6-2018	26-6-2018	26-6-2018		26-6-2018 tot 6-8-2019	
33	RS306		1-12-2009	26-9-2016		4-11-2018	4-11-2018	4-11-2018	4-11-2018		4-11-2018 tot 6-8-2019	
34	RS307		22-5-2009	21-9-2016		21-9-2016						
35	RS310			19-9-2016	TBB0 Ver, TBB 1,5 mem. Temperatuur	22-5-2017	29-8-2019	29-8-2019	29-8-2019			
36	RS406		8-7-2010	21-9-2016		15-5-2018	15-5-2018	15-5-2018				
37	RS407			21-9-2016		8-11-2018	8-11-2018	8-11-2018	8-11-2018		8-11-2018 tot 27-8-2019	
38	RS409			19-9-2016		16-7-2018	16-7-2018	16-7-2018	16-7-2018		16-7-2018 tot 28-8-2019	
39	RS503		23-6-2009	26-9-2016	TBB1,3 temp	19-9-2018	19-9-2018	19-9-2018	19-9-2018		19-9-2018 tot 6-8-2019	
40	RS508		21-5-2010	21-9-2016		15-6-2017						
41	RS509			21-9-2016	TBB0 ver	25-9-2017	16-9-2019	16-9-2019	16-9-2019			

LOFAR maintenance 2019



Preventive Maintenance (Fan exchange)

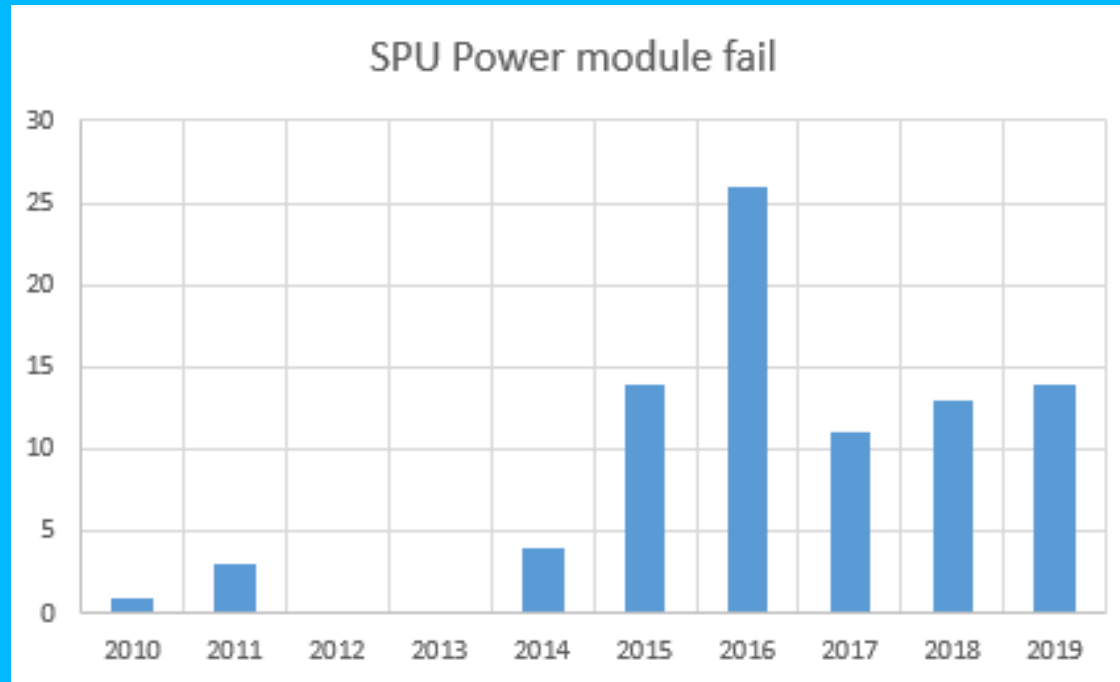
Planning Fan exchange ☆

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

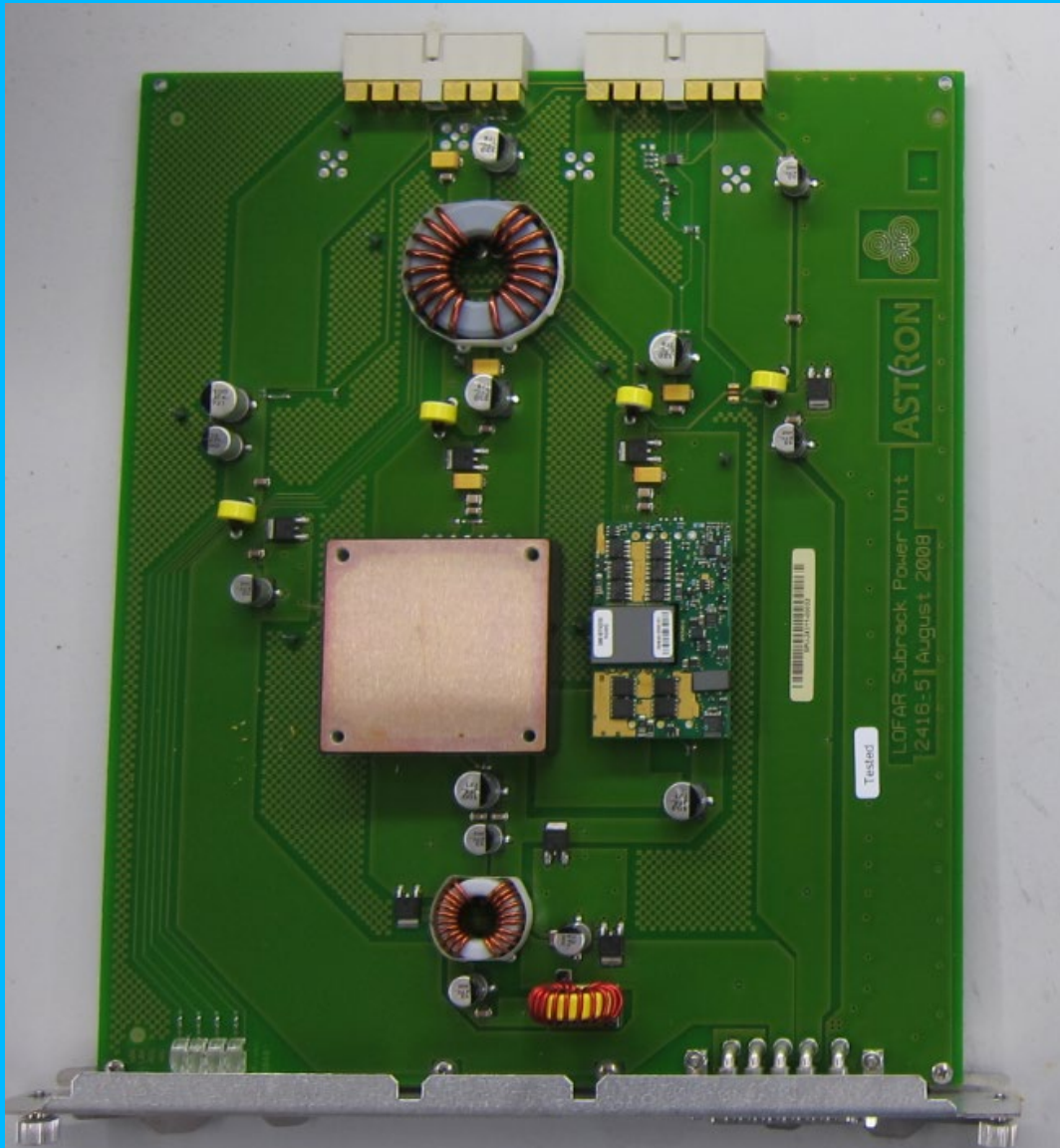
100% £ % .00 .00 123 Arial 10 B I U A

	A	B	C	D	E	F	G	H	I	J	K	L
1				Subrack fans vervangen		AC fans vervangen	TBB fans vervangen	Network switch fans vervangen	SyncOptics Check	PowerOne fans	Clicksons enabled	SPU's
42	DE601		10-9-2009	11-5-2017		11-5-2017	19-4-2018	19-4-2018			na	
43	DE602		7-11-2007	16-10-2018		na	16-10-2018	16-10-2018		16-10-2018	na	28-5-2019
44	DE603		7-11-2007	14-6-2018	TBB10 temp	na	14-6-2018	14-6-2018			na	
45	DE604		22-10-2010	12-9-2016		na	5-7-2018	5-7-2018			na	
46	DE605		27-6-2011	18-10-2018		na	18-10-2018	18-10-2018		18-10-2018	na	
47	FR606		8-10-2010	21-6-2017		na	17-4-2018	17-4-2018		14-5-2019	na	14-5-2019
48	SE607		16-9-2011	30-5-2017		na	17-9-2019	17-9-2019		17-9-2019	na	17-9-2019
49	UK608		5-11-2010	25-6-2019		na	25-6-2019	25-6-2019		25-6-2019	na	25-6-2019
50	DE609		9-12-2014	11-4-2017		na	9-12-2022	9-12-2022		9-12-2022	na	4-9-2019
51	PL610		22-1-2016	22-1-2024		na	22-1-2024	22-1-2024		22-1-2024	na	
52	PL611		29-1-2016	29-1-2024	TBB3,4 mem	na	29-1-2024	29-1-2024		29-1-2024	na	
53	PL612		19-1-2016	19-1-2024	TBB3 mem	na	19-1-2024	19-1-2024		19-1-2024	na	
54	IE613		15-7-2017	15-7-2025	TBB2 temp, TBB8 mem	na	15-7-2025	15-7-2025		15-7-2025	na	4-4-2019
55	LV614		15-8-2019	15-8-2027		na	15-8-2027	15-8-2027		15-8-2027	na	
56	CS023NAA				10.151.50.53	Al een hele tijd geen ping						
57	RS106NAA	Valtermond			10.151.134.53	9-7-2019	na	9-7-2019	na	na	na	
58	RS107NAA	Bij Sellingen			10.151.135.53	22-8-2019	na	22-8-2019	na	na	na	
59	RS206NAA	t Haantje			10.151.150.53	2-7-2019	na	2-7-2019	na	na	na	
60	RS207NAA	Nieuw Dordrecht/Klazinaveen			10.151.151.53	2-7-2019	na	2-7-2019	na	na	na	
61	RS208NAA	Schoonebeek			10.151.152.53	9-7-2019	na	9-7-2019	na	na	na	
62	RS306NAA	Ellertshaar			10.151.166.53	20-8-2019	na	20-8-2019	na	na	na	
63	RS307NAA	Oldeveen	22-5-2009		10.151.167.53	8-5-2019	na	8-5-2019	na	na	na	
64	RS406NAA	Gieten			10.151.182.53	20-8-2019	na	20-8-2019	na	na	na	
65	RS408NAA	Zuidvelde			10.151.184.53	Afgebroken 2019!						
66	RS411NAA	Gasteren			10.151.187.53	22-8-2019	na	22-8-2019	na	na	na	
67	RS507NAA	Alteveer			10.151.199.53	Staat uit						
68	RS508NAA	t Waar (nieuwolda)			10.151.200.53	16-7-2019	na	16-7-2019	na	na	na	
69	RS509NAA	Oudeschip			10.151.201.53	16-7-2019	na	16-7-2019	na	na	na	

Preventive Maintenance (SPU)

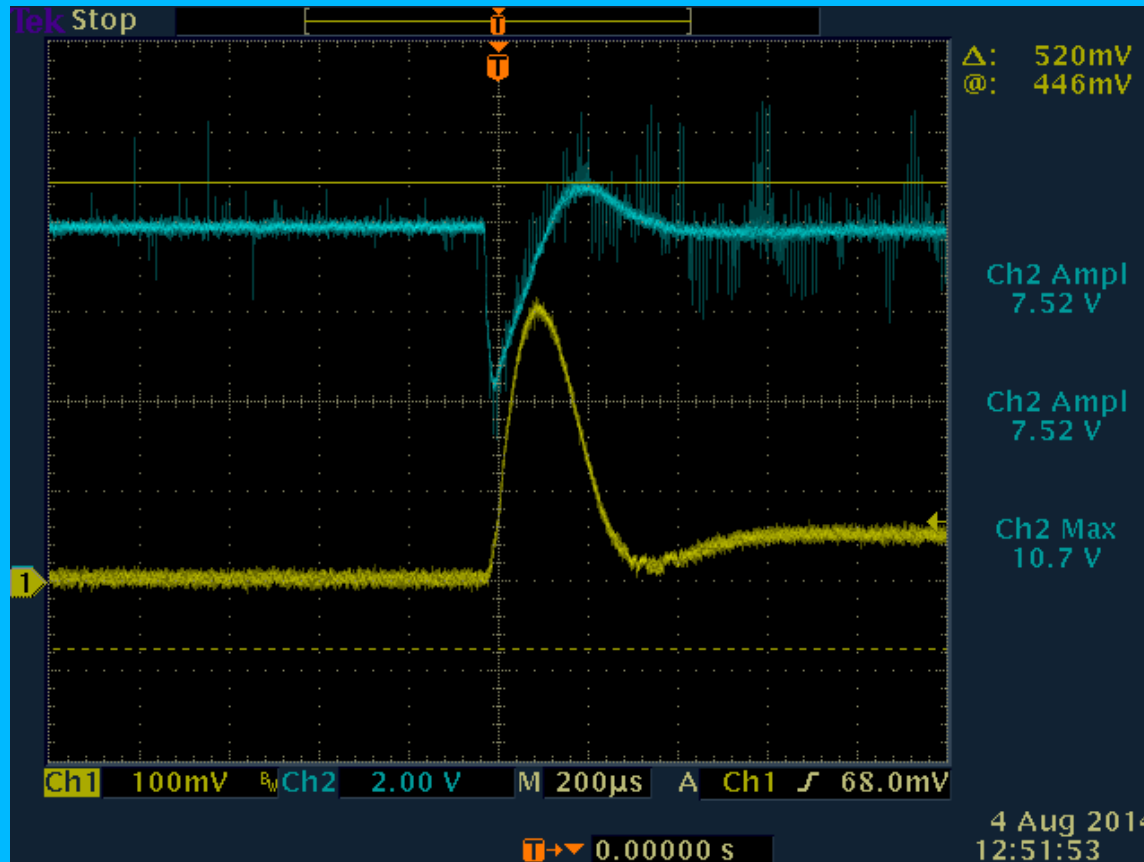


3 SPU boards per NL station and 6 per ILT station
38 NL stations and 14 ILT stations
Total = 114 + 84 = 198 SPU boards



SPU with old 8 Volt power module

Preventive Maintenance (SPU)

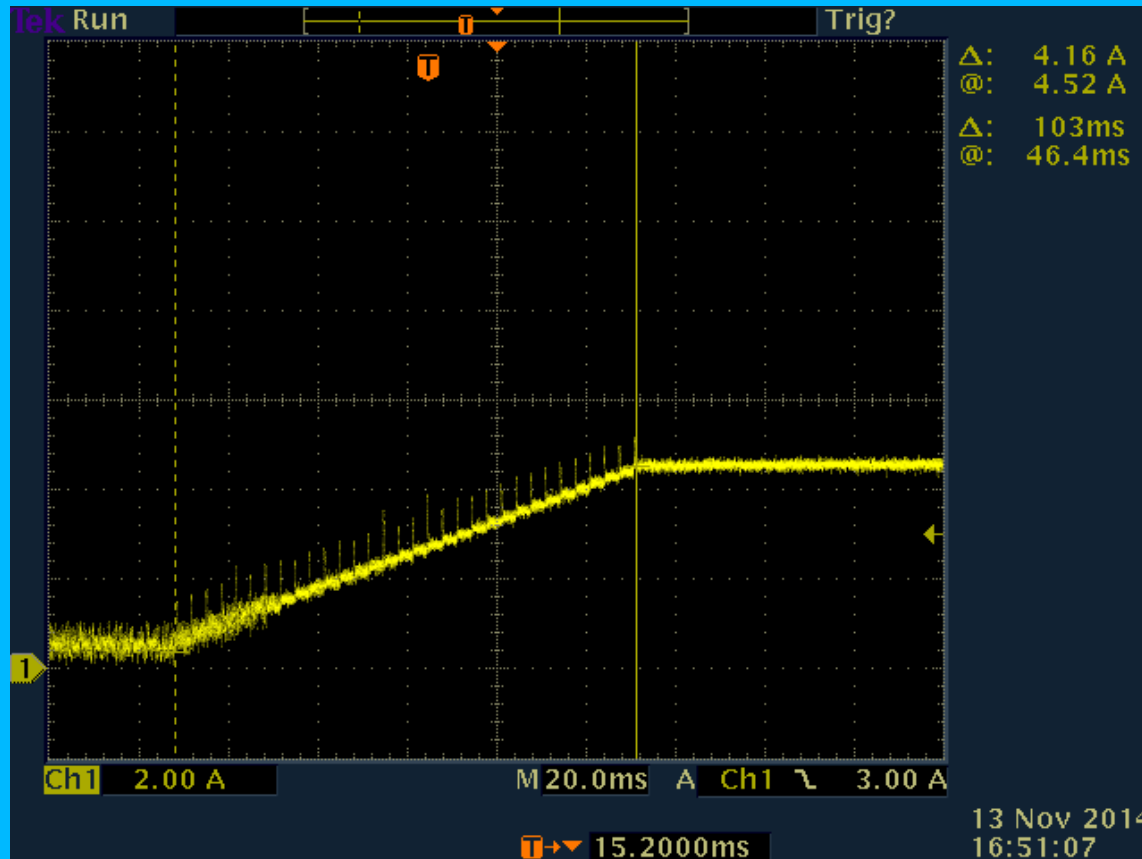


Mode 0 --> 3
yellow Iout, blue Vout,

Iout= 4.3A nominal peak 30A
Vout= 8V nominal dip 4V
T=400-500uS

Spec = 29A

Preventive Maintenance (SPU)



Switch on RCU's sequential
(3.3 mS per RCU)

Mode 0 --> 3
yellow Iout,

Preventive Maintenance (SPU)

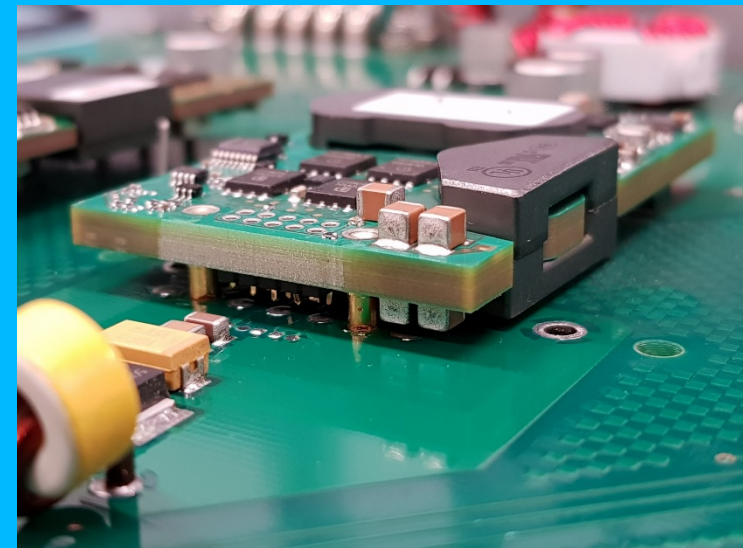
Input voltage	Measured 48V	Spec 36-75Vdc
Output voltage	8V	7.2-13.2Vdc
Output current(Max)	21A (Mode3)	29.2A
Output Power(Max)	168W	350W
MTBF	52000h	1900000h
Efficiency	Measured 79% @ 21A	Spec 88% @ 29.2A



Artesyn BFR350 power module

Preventive Maintenance (SPU)

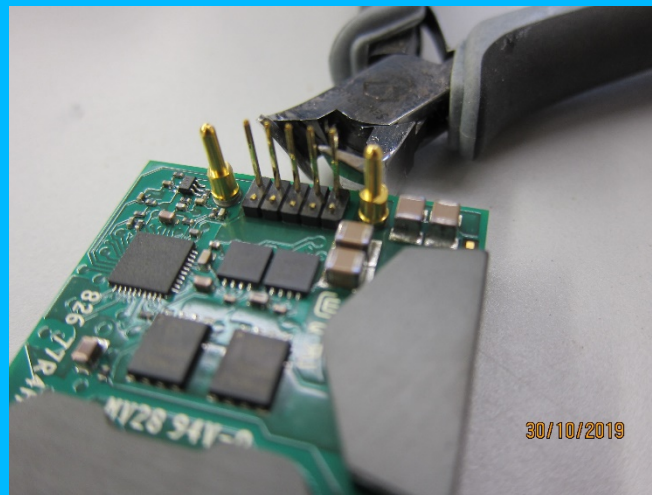
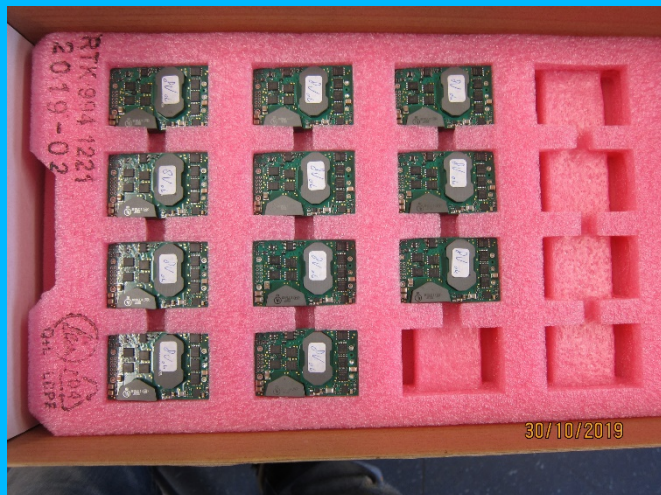
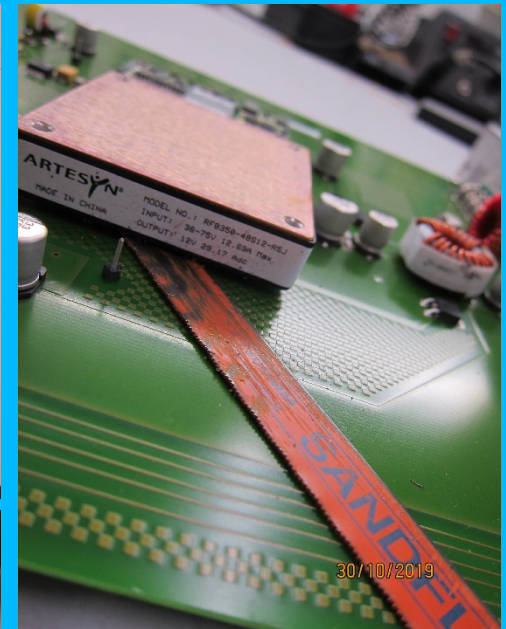
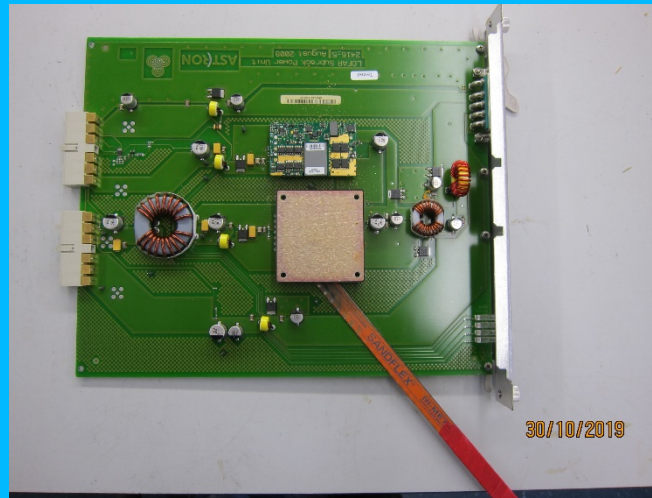
Input voltage	Measured 48V	RFB350 36-75Vdc	BMR458 36-75Vdc
Output voltage	8V	7.2-13.2Vdc	8-13.2Vdc
Output current(Max)	21A (Mode3)	29.2A	50A
Output Power(Max)	168W	350W	600W
MTBF	52000h	1900000h	8100000h
Efficiency	Measured 79% @ 21A	RFB350 88% @ 29.2A	BMR458 97% @ 30A



Flex BMR458 power module

LOFAR maintenance 2019

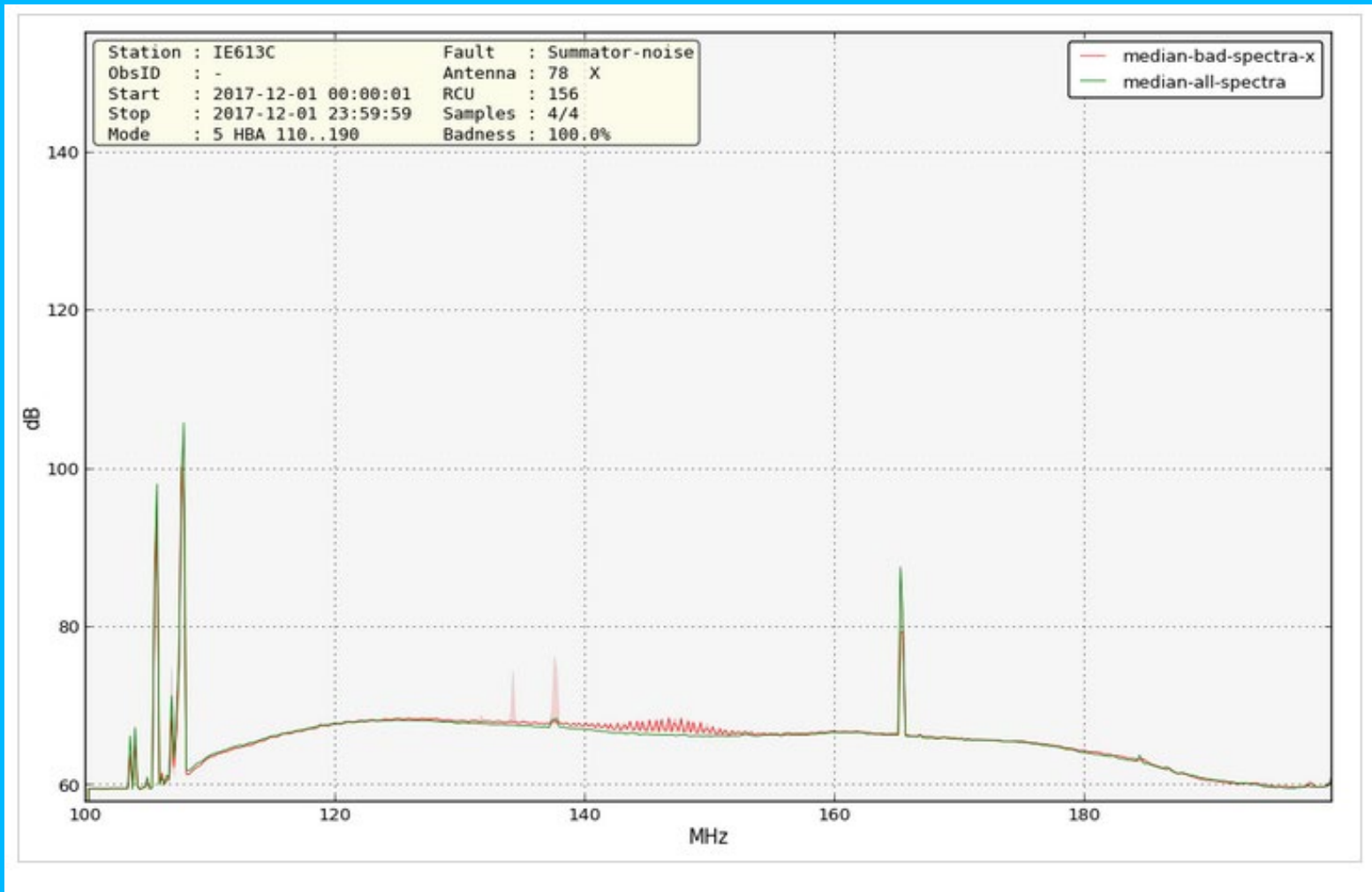
Preventive Maintenance (SPU Refurbishing)



LOFAR maintenance 2019

Preventive Maintenance (SPU)

RFI from the PowerOne



LOFAR maintenance 2019



Preventive Maintenance (SPU)

Planning Fan exchange ☆

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

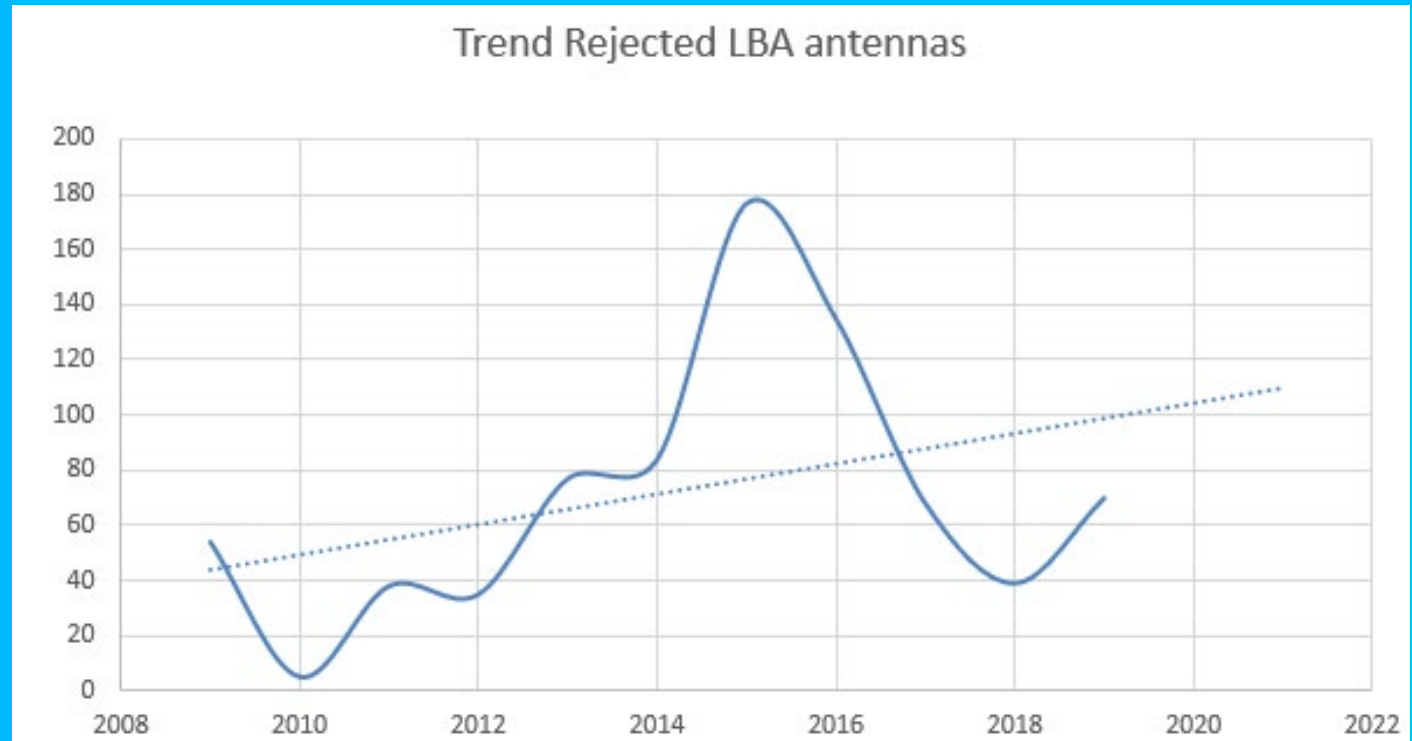
100% £ % .00 .00 123 Arial 10 B I U A

	A	B	C	D	E	F	G	H	I	J	K	L
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42	DE601		10-9-2009	11-5-2017		11-5-2017	19-4-2018	19-4-2018			na	
43	DE602		7-11-2007	16-10-2018		na	16-10-2018	16-10-2018		16-10-2018	na	28-5-2019
44	DE603		7-11-2007	14-6-2018	TBB10 temp	na	14-6-2018	14-6-2018			na	
45	DE604		22-10-2010	12-9-2016		na	5-7-2018	5-7-2018			na	
46	DE605		27-6-2011	18-10-2018		na	18-10-2018	18-10-2018		18-10-2018	na	
47	FR606		8-10-2010	21-6-2017		na	17-4-2018	17-4-2018		14-5-2019	na	14-5-2019
48	SE607		16-9-2011	30-5-2017		na	17-9-2019	17-9-2019		17-9-2019	na	17-9-2019
49	UK608		5-11-2010	25-6-2019		na	25-6-2019	25-6-2019		25-6-2019	na	25-6-2019
50	DE609		9-12-2014	11-4-2017		na	9-12-2022	9-12-2022		9-12-2022	na	4-9-2019
51	PL610		22-1-2016	22-1-2024		na	22-1-2024	22-1-2024		22-1-2024	na	
52	PL611		29-1-2016	29-1-2024	TBB3,4 mem	na	29-1-2024	29-1-2024		29-1-2024	na	
53	PL612		19-1-2016	19-1-2024	TBB3 mem	na	19-1-2024	19-1-2024		19-1-2024	na	
54	IE613		15-7-2017	15-7-2025	TBB2 temp, TBB8 mem	na	15-7-2025	15-7-2025		15-7-2025	na	4-4-2019
55	LV614		15-8-2019	15-8-2027		na	15-8-2027	15-8-2027		15-8-2027	na	
56	CS023NAA				10.151.50.53	Al een hele tijd geen ping						
57	RS106NAA	Valtermond			10.151.134.53	9-7-2019	na	9-7-2019	na	na	na	
58	RS107NAA	Bij Sellingen			10.151.135.53	22-8-2019	na	22-8-2019	na	na	na	
59	RS206NAA	t Haantje			10.151.150.53	2-7-2019	na	2-7-2019	na	na	na	
60	RS207NAA	Nieuw Dordrecht/Klazinaveen			10.151.151.53	2-7-2019	na	2-7-2019	na	na	na	
61	RS208NAA	Schoonebeek			10.151.152.53	9-7-2019	na	9-7-2019	na	na	na	
62	RS306NAA	Ellertshaar			10.151.166.53	20-8-2019	na	20-8-2019	na	na	na	
63	RS307NAA	Oldeveen	22-5-2009		10.151.167.53	8-5-2019	na	8-5-2019	na	na	na	
64	RS406NAA	Gieten			10.151.182.53	20-8-2019	na	20-8-2019	na	na	na	
65	RS408NAA	Zuidvelde			10.151.184.53	22-8-2019	na	22-8-2019	na	na	na	na
66	RS411NAA	Gasteren			10.151.187.53	22-8-2019	na	22-8-2019	na	na	na	
67	RS507NAA	Alteveer			10.151.199.53	16-7-2019	na	16-7-2019	na	na	na	na
68	RS508NAA	t Waar (niewolda)			10.151.200.53	16-7-2019	na	16-7-2019	na	na	na	
69	RS509NAA	Oudeschip			10.151.201.53	16-7-2019	na	16-7-2019	na	na	na	

LOFAR maintenance 2019

LBA repairs summer 2019

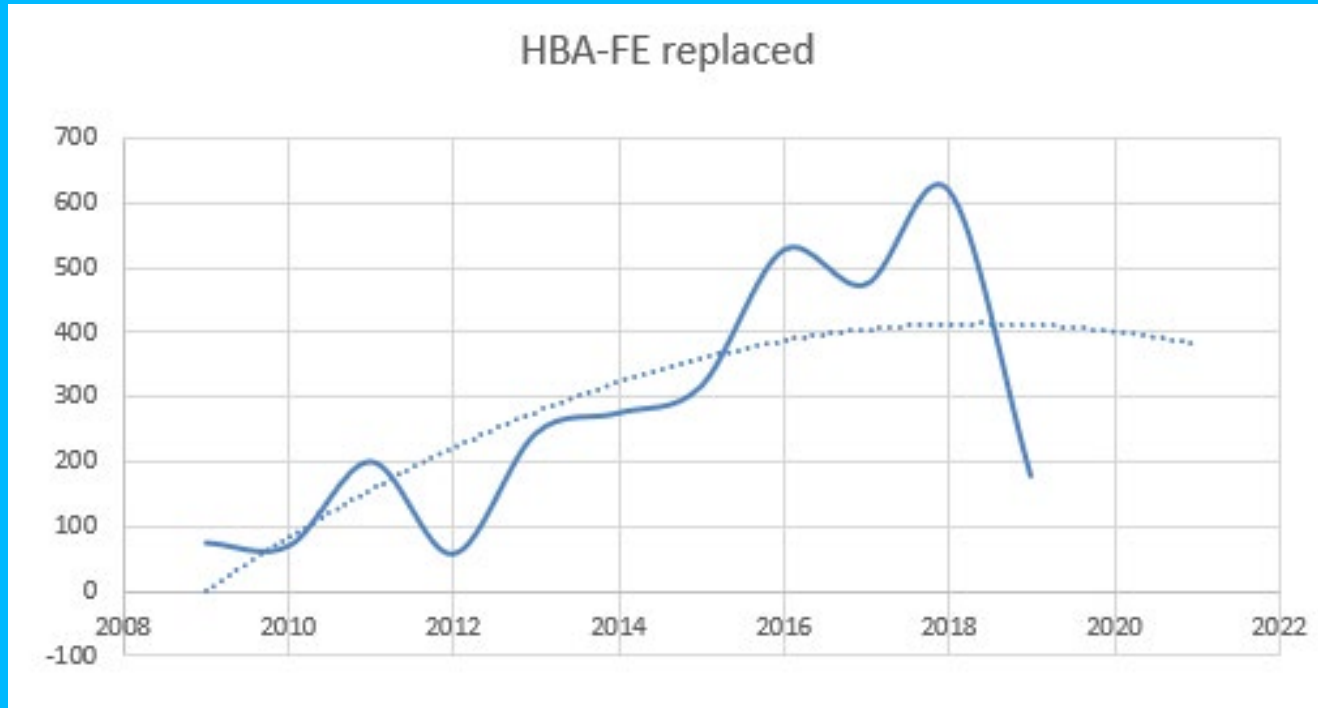
Year	Replaced LBA's
2009	54
2010	5
2011	38
2012	35
2013	77
2014	84
2015	177
2016	135
2017	68
2018	39
2019	70
Totaal	839



LOFAR maintenance 2019

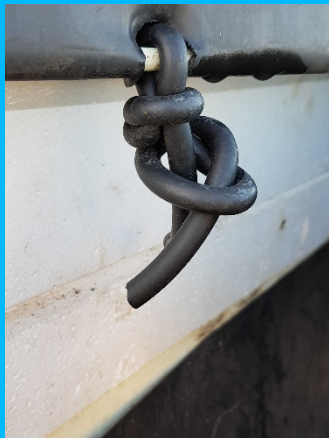
HBA Repairs

Year	Replaced HBA-FE's
2009	75
2010	70
2011	200
2012	58
2013	244
2014	275
2015	316
2016	526
2017	473
2018	619
2019	178
Total	3034



LOFAR maintenance 2019

Wind! CS103



LOFAR maintenance 2019

A badger on CS103



LOFAR maintenance 2019

A Badger on CS103



ACTIE

Pe gootdrain, d = 100>125 mm, 1
Artikelnr. 15002819

Diameter	100 tot 125 mm	✓ Werkdagen voor
Lengte	300 cm	volgende werkdag
Kleur	zwart	✓ Op voorraad in
Materiaal	hdpe	

▶ Alle specificaties

Uitvoeringen

d = 100-125 mm

Consumentenprijs incl. BTW per lengte(s)

€24,28 **€ 19,50** [Log in voor uw eigen prijs](#)

Aantal

1 [+](#) [-](#) [Op favorieten](#)

[▶ Grote afbeelding](#)

LOFAR maintenance 2019

a Marten on RS106



The end

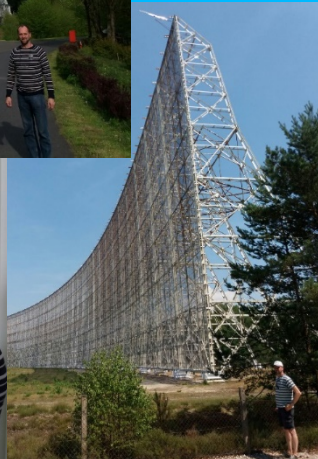
ASTRON



Bye Bye

LOFAR maintenance 2019

Thanks a lot, Henri!



LOFAR maintenance 2019

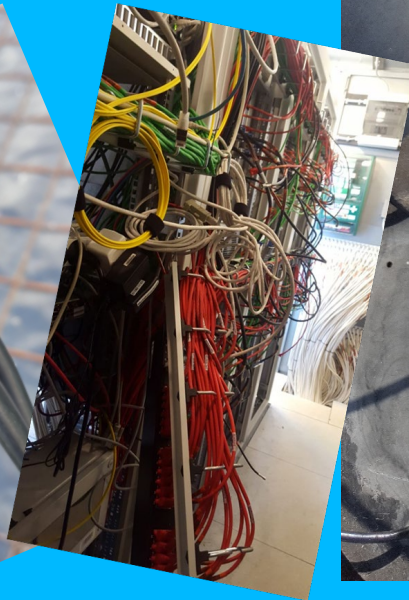
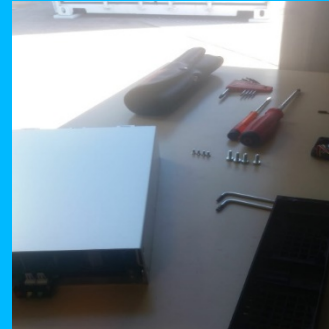
ILT visits 2019

- FR606 Nancay
- DE602 Garchin
- UK608 Chilbolton
- DE609 Nordersted
- SE607 Onsala



What did we do?

- Replaced a lot of fans
- Regular LBA HBA maintenance





We hope to see you (on site) in 2020 !