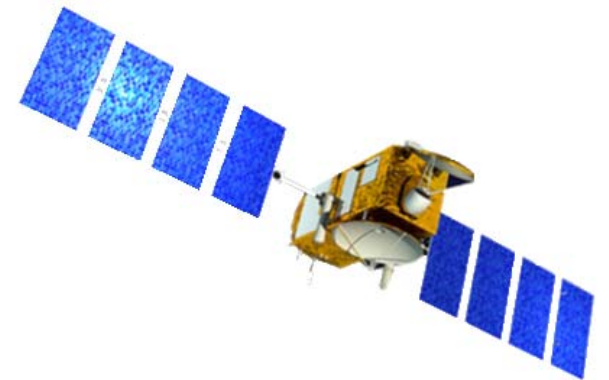




CENTRE NATIONAL D'ÉTUDES SPATIALES



In flight data from CARMEN2 / MEX experiment: SEE on memories

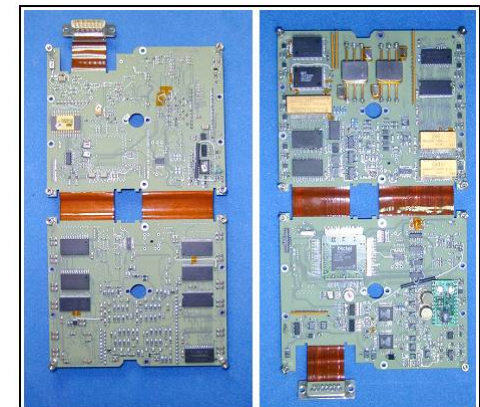
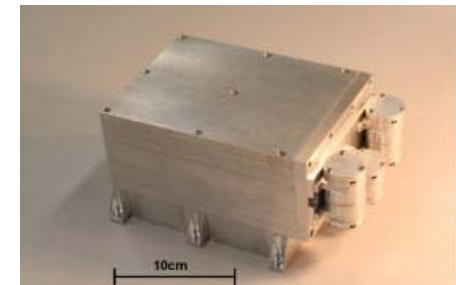
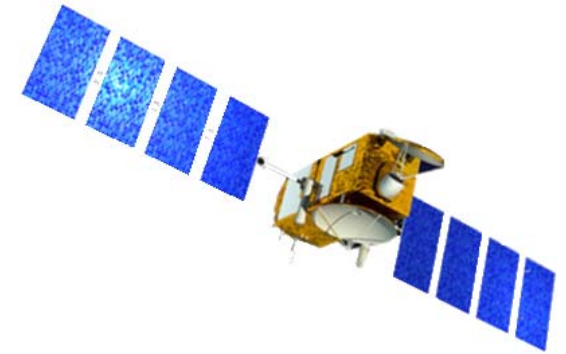


JASON 2:

- Launched in June 22 2008
- 1336km, 66°
- Severe proton environment

CARMEN2:

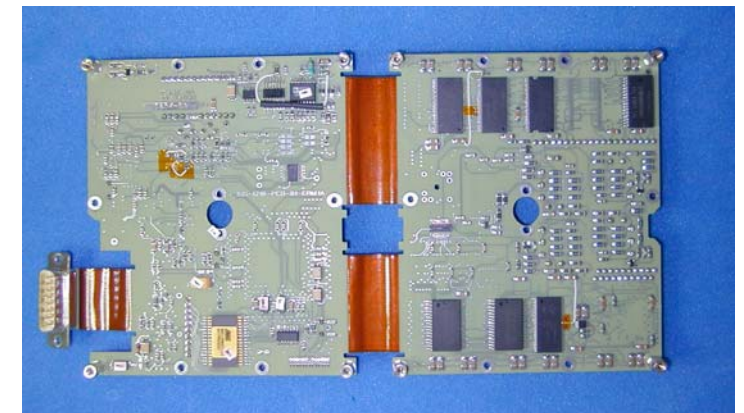
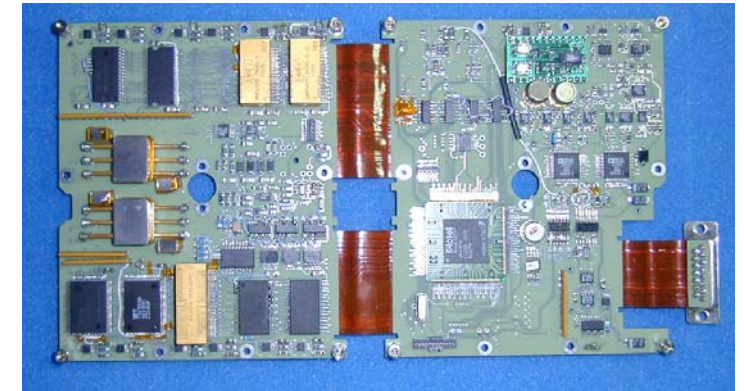
- Detectors : measurements of particles' flux
- MEX (Experiment Module) is dedicated to the study of effects of space radiation environment on various electronic devices.
 - ◆ Single Event (SEB, SEL, SET, SEU)
 - ◆ Cumulative effects (TID, DDD)



SRAMs, SSRAMs et SDRAMs are tested (pattern 5A5A)

Results between July 16 2008 and February 25 2011

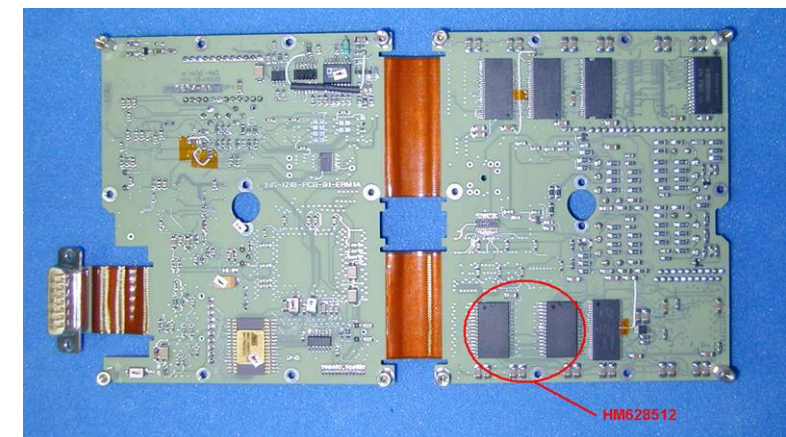
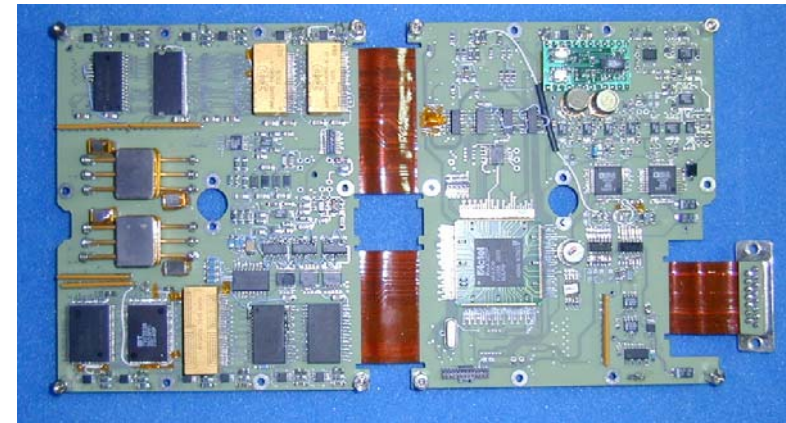
<i>Référence des DUT</i>	<i>Fonction</i>	<i>Nombre de DUT/MEX</i>
HITACHI HM628512C	SRAM 512k*8	2 *
SAMSUNG KM6840000A	SRAM 512k*8	2 *
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2 #
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2



* Some errors related to a timing problem.

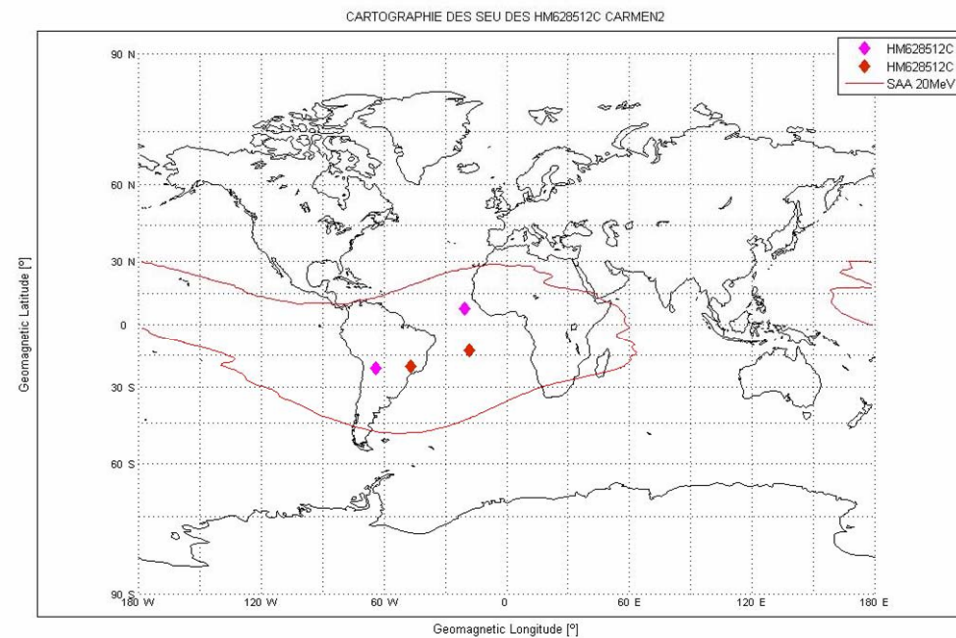
A few errors are due to an initialization problem.

Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2

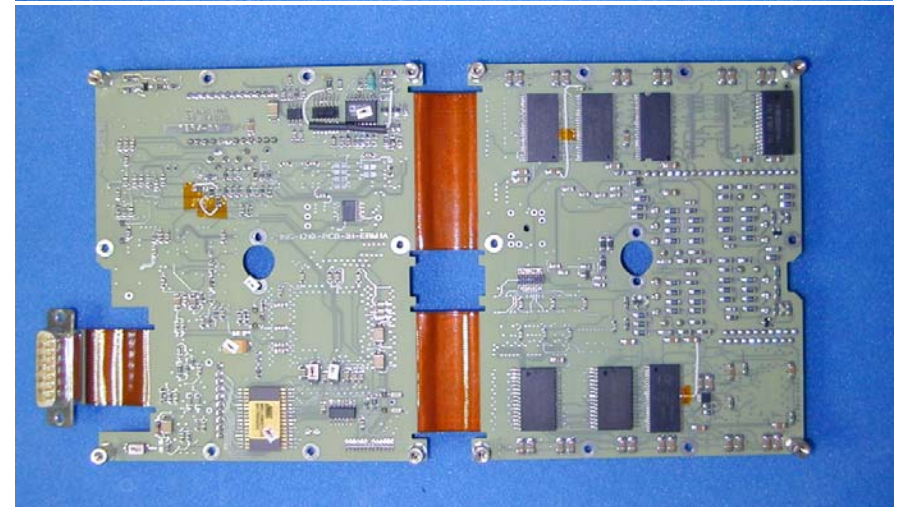
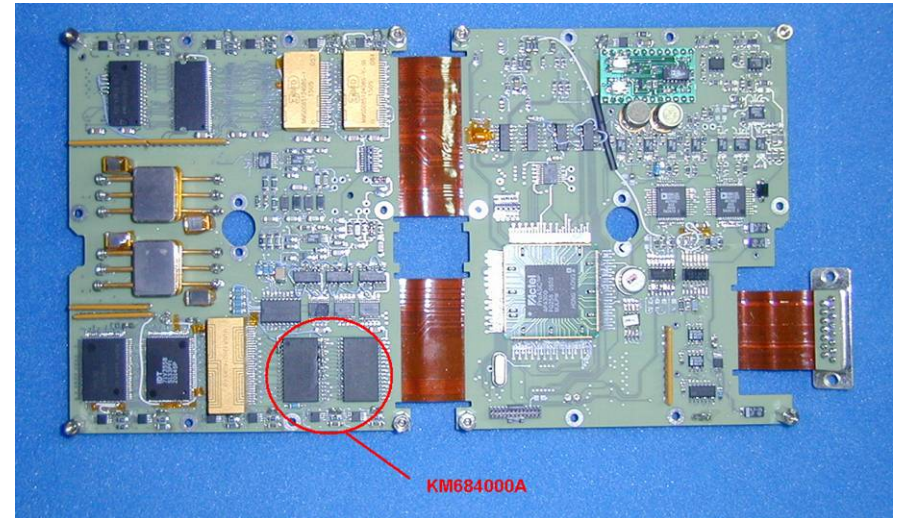


HM628512C 1 : 2 SEU

HM628512C 2 : 2 SEU

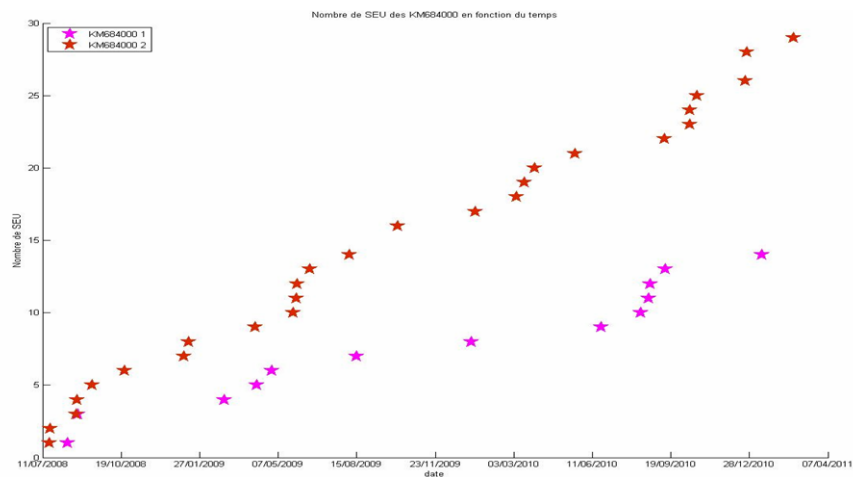


Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2

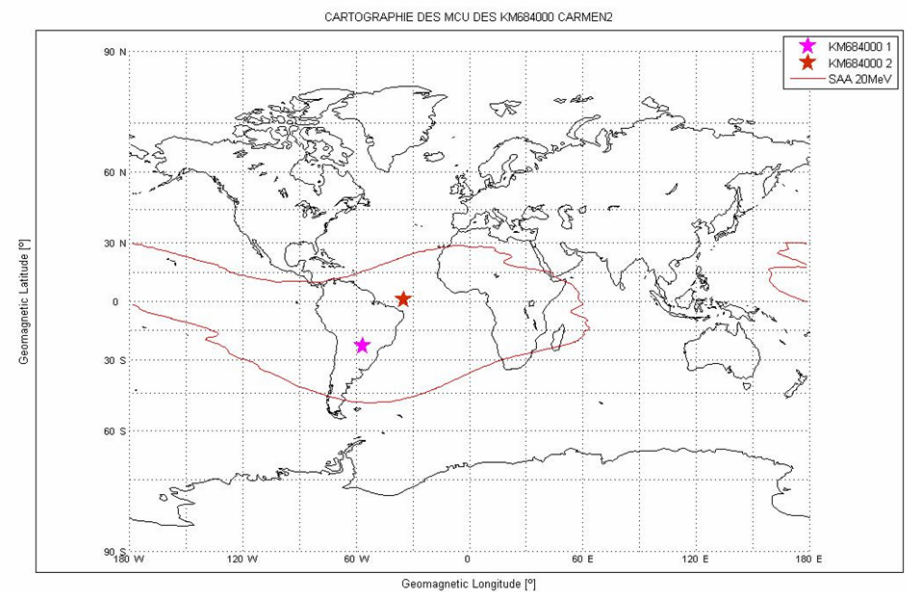
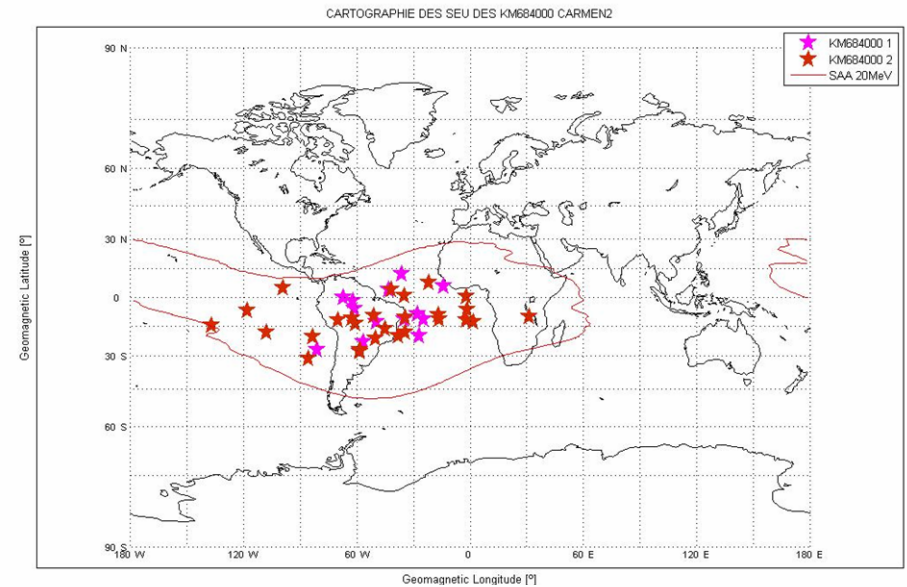


KM684000 1: 13 SEU, 0 MBU, 1 MCU

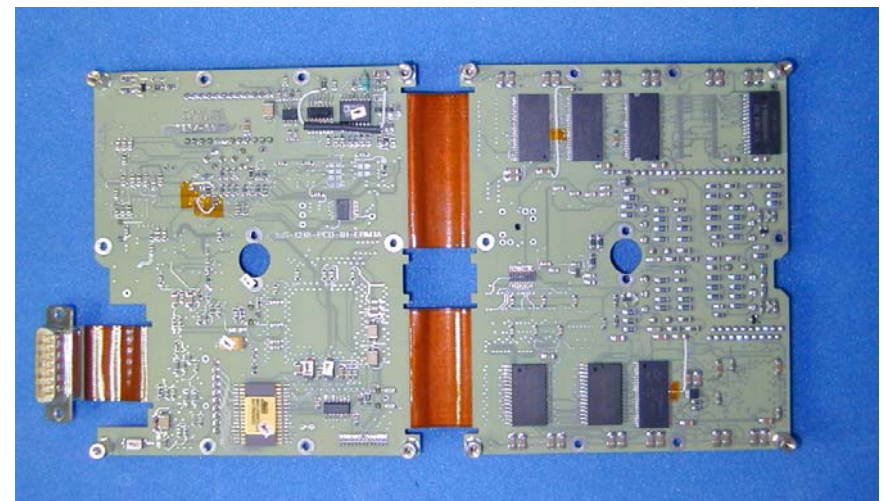
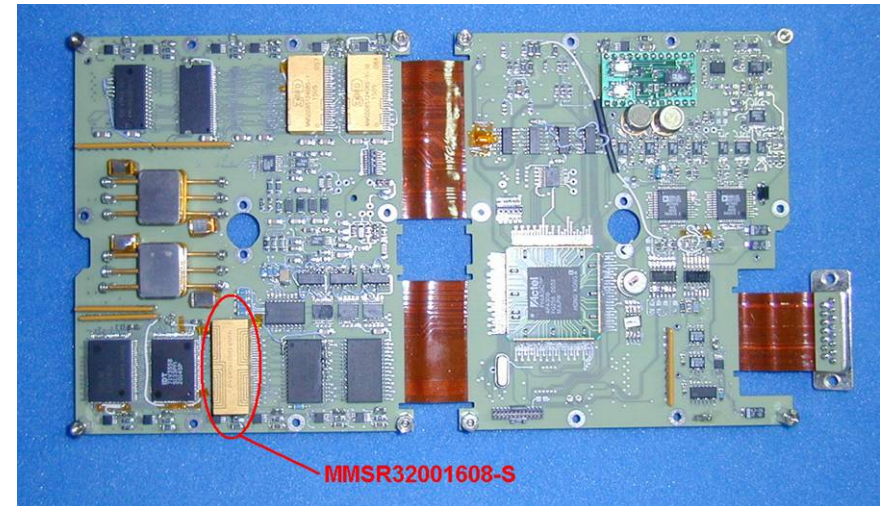
KM684000 2: 28 SEU, 0 MBU, 1 MCU



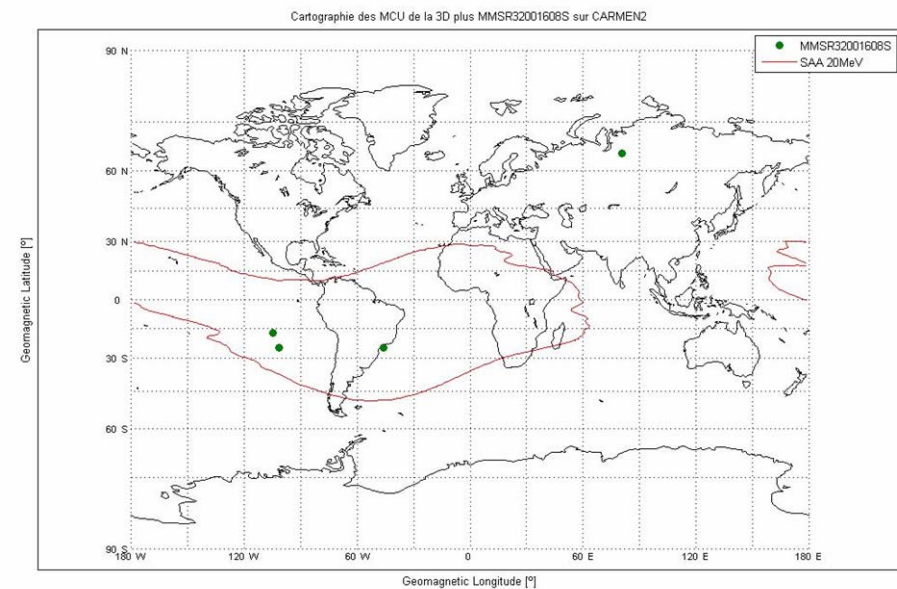
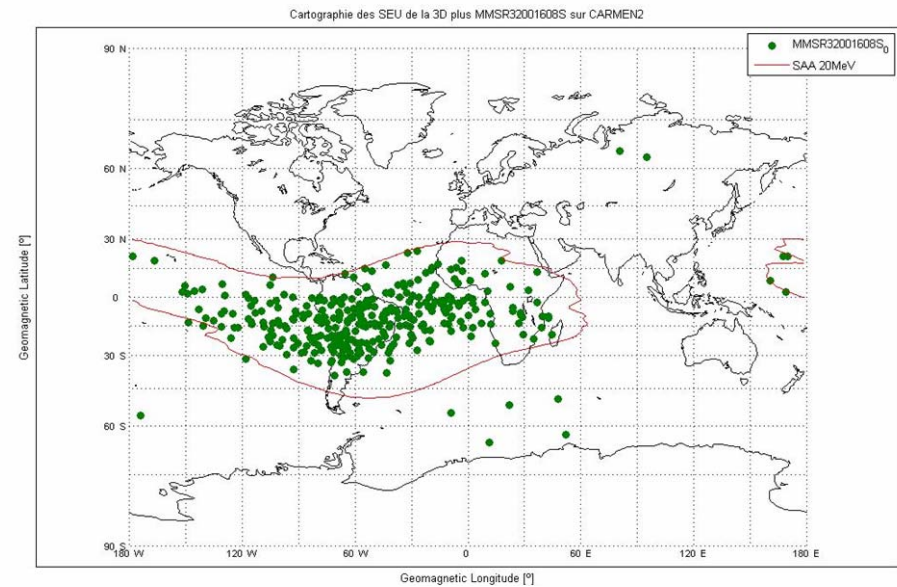
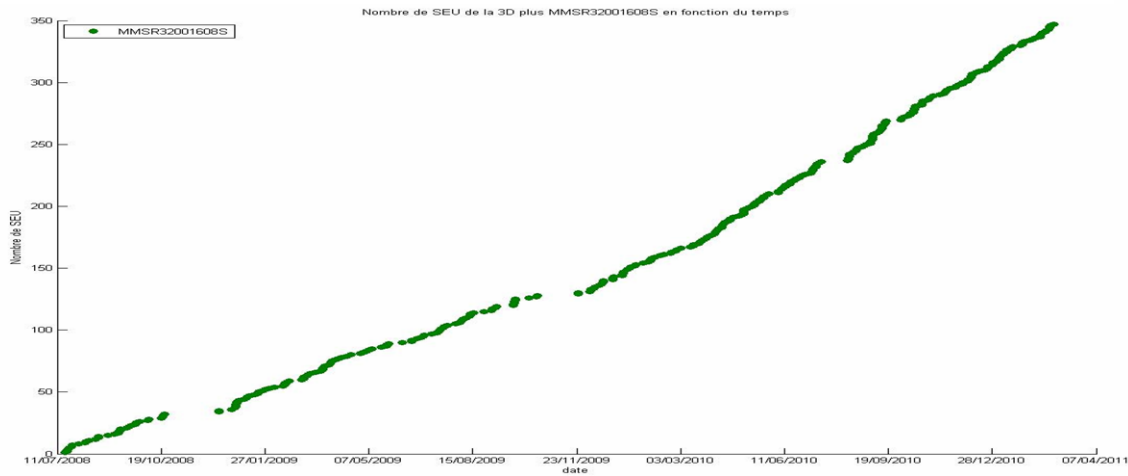
For all SEU detected, all mask errors have the same probability to occur.



Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2



- 349 SEU on the MMSR32001608
- 0 MBU
- 4 MCU , multiplicity 2



- All events correspond to a change of state from 1 to 0

2 % :

													X
--	--	--	--	--	--	--	--	--	--	--	--	--	---

34 % :

												X		
--	--	--	--	--	--	--	--	--	--	--	--	---	--	--

31 % :

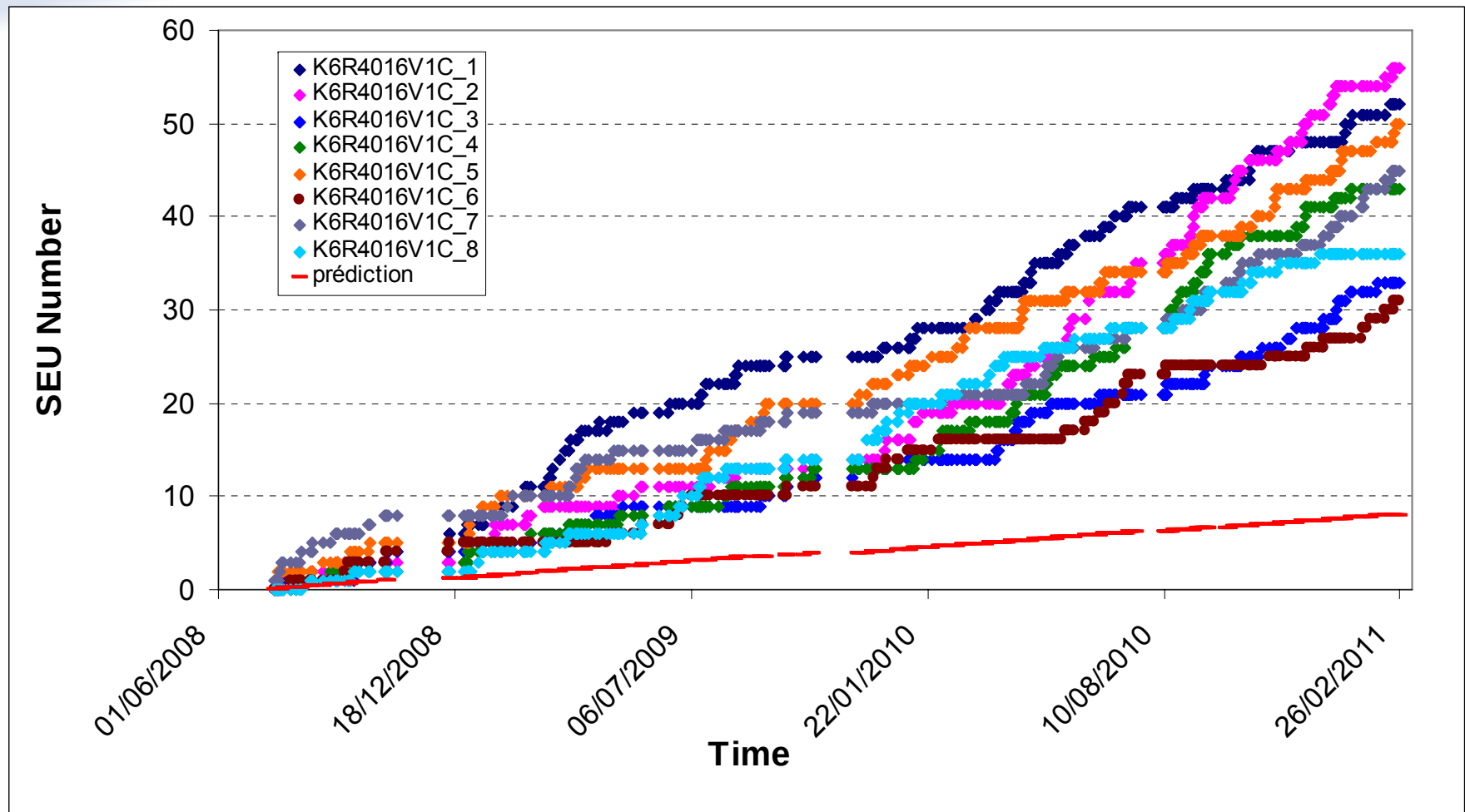
											X			
--	--	--	--	--	--	--	--	--	--	--	---	--	--	--

33 % :

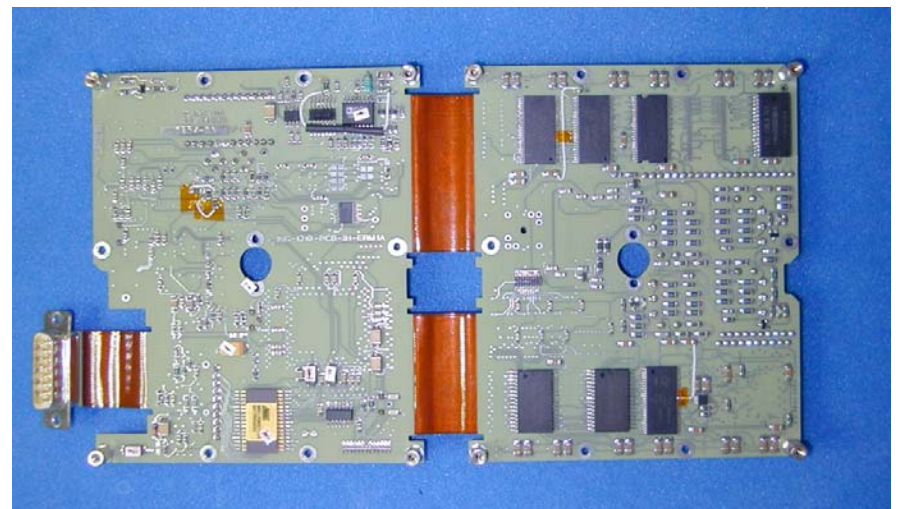
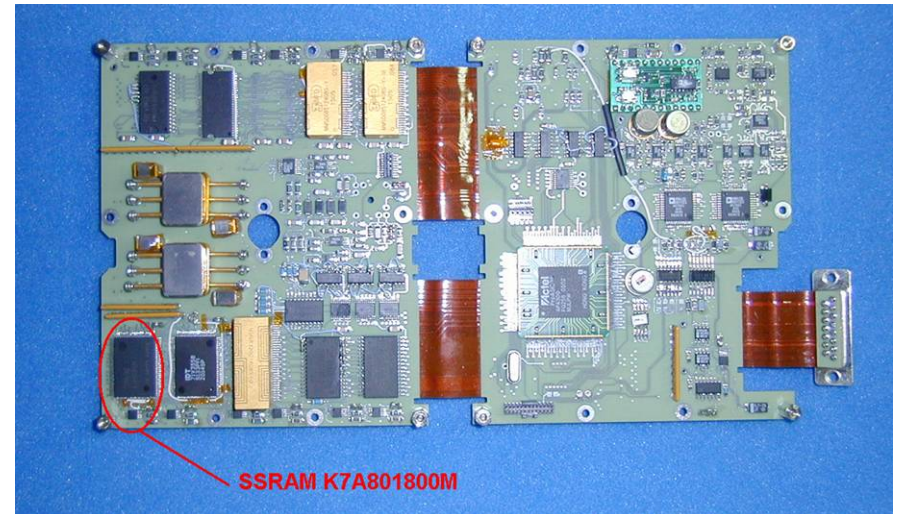
								X					
--	--	--	--	--	--	--	--	---	--	--	--	--	--



=> This results are under investigation

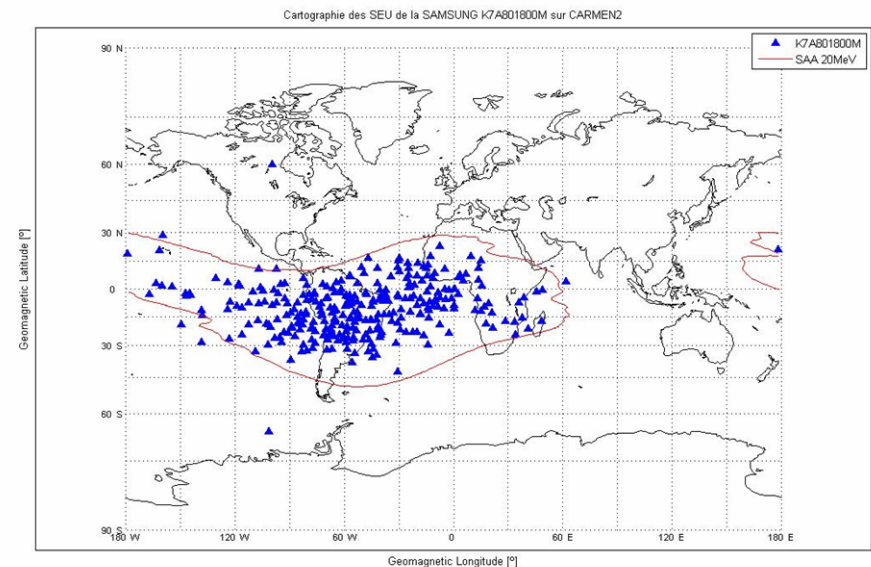
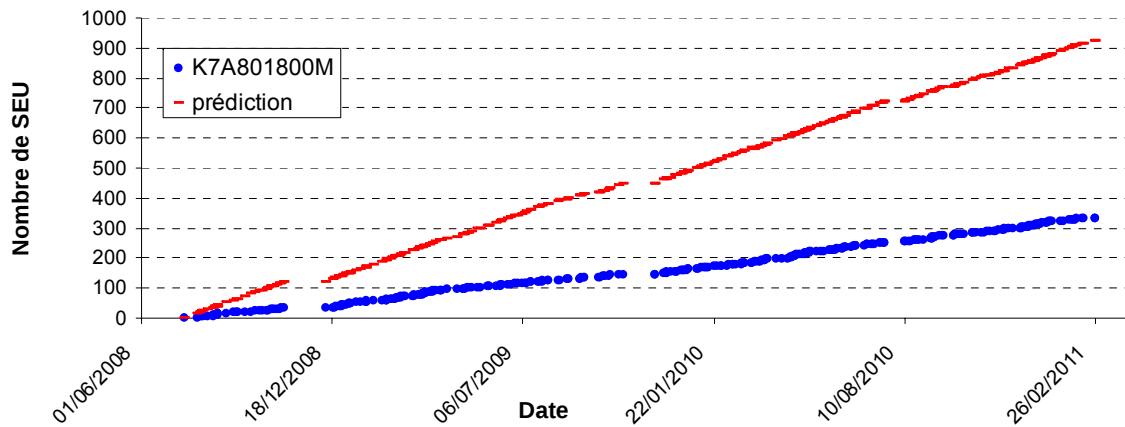


Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2



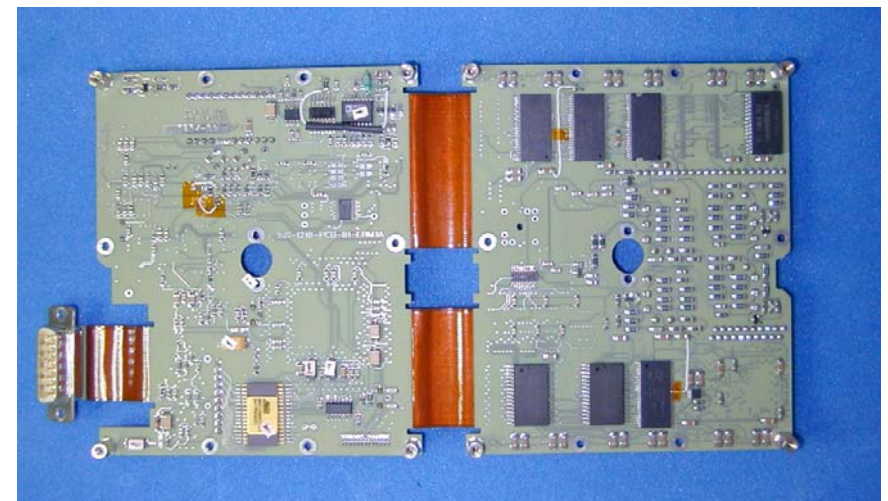
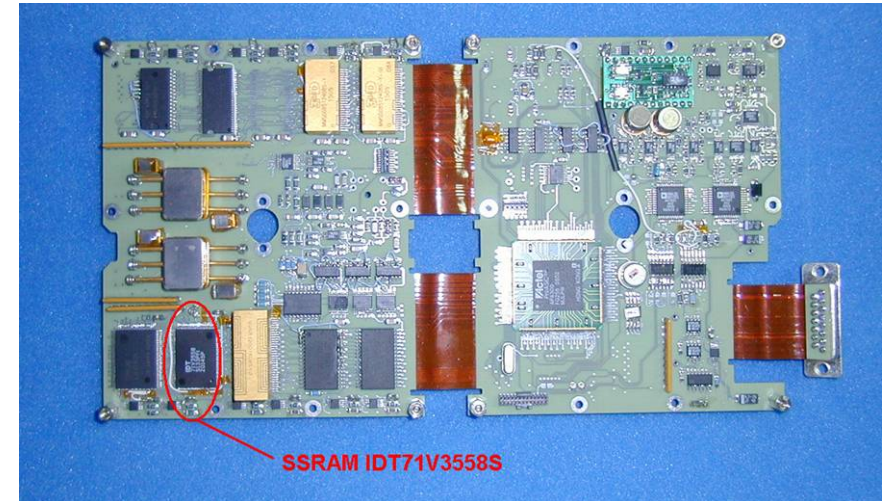
334 SEU ; 0 MBU

Nombre de SEU de K7A801800M en fonction du temps



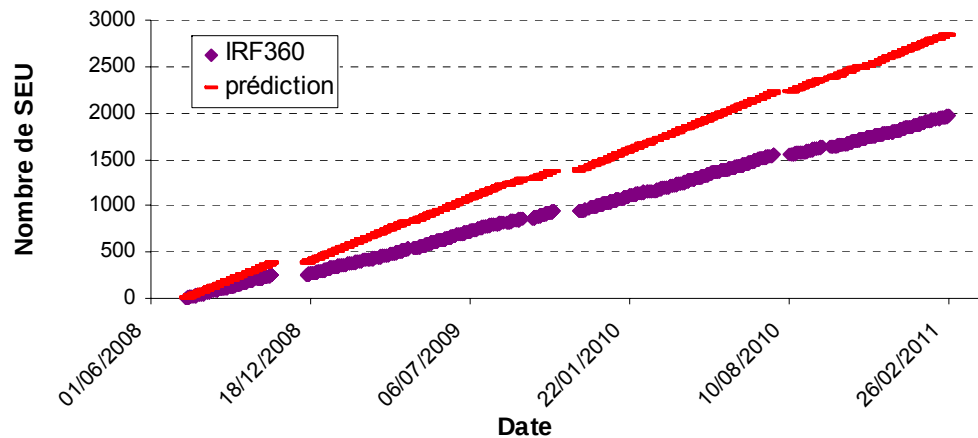
All events correspond to a change of state from 1 to 0.
All error patterns have the same probability to occur.

Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2



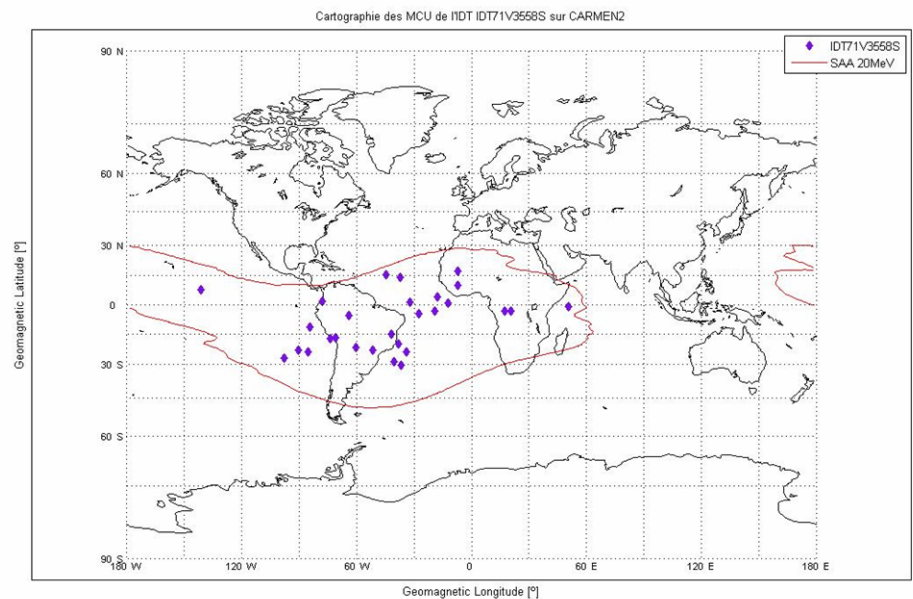
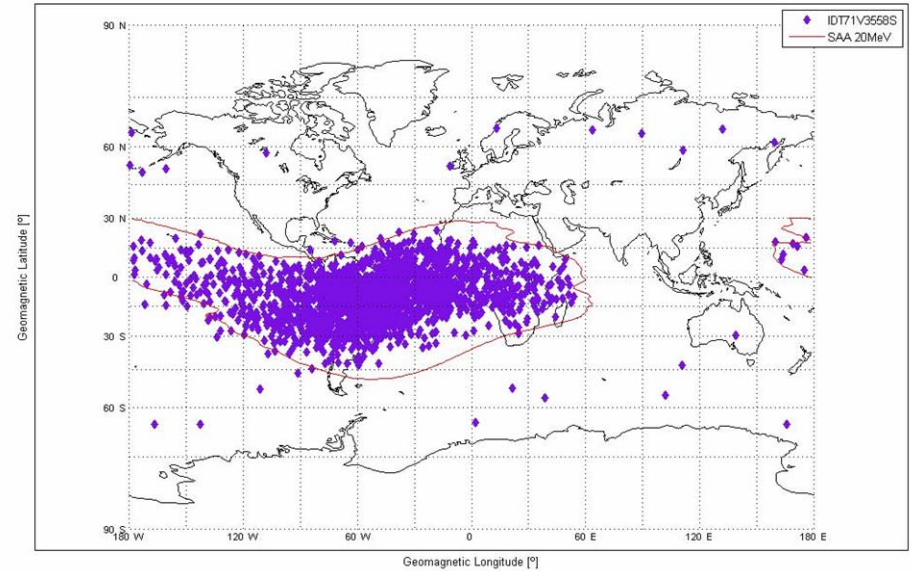
1970 SEU
28 MCU

Nombre de SEU de IDT 71V558S en fonction du temps

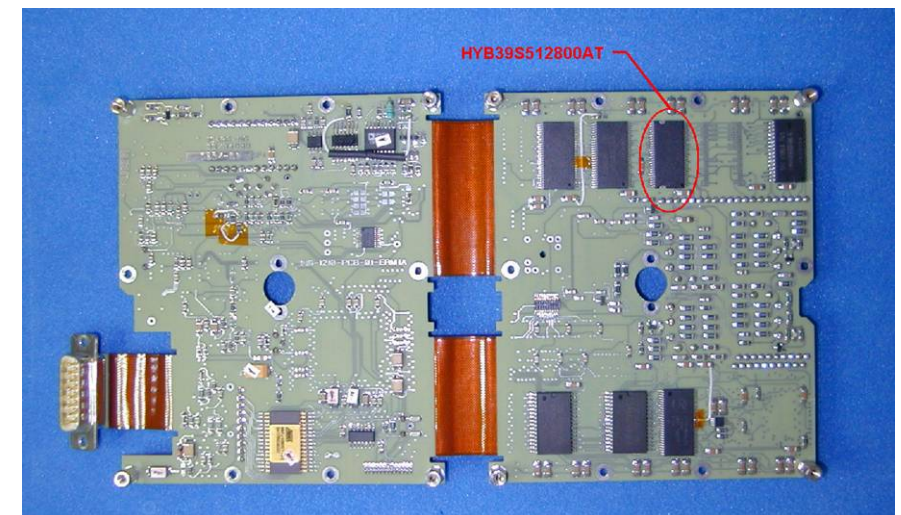
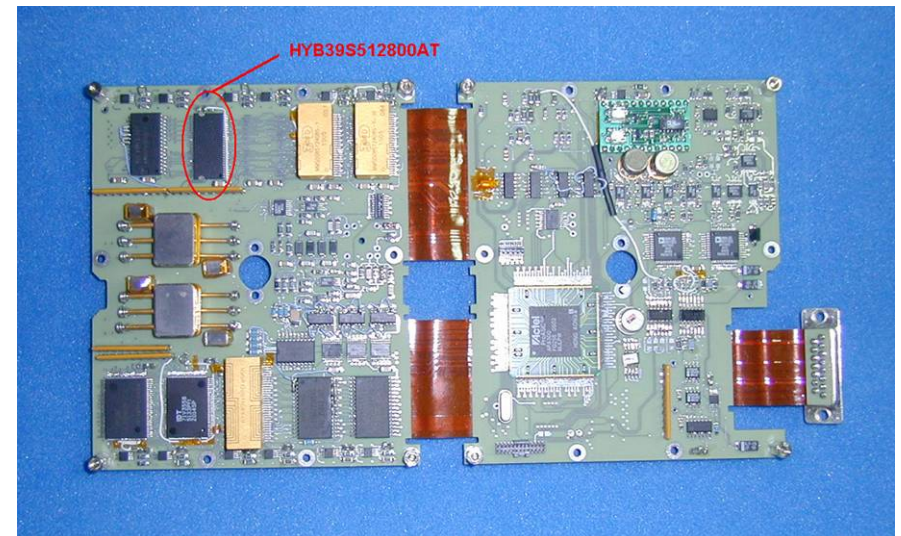


99.8 % of events corresponding to a change of state from 1 to 0.

0.2 % of events corresponding to a change of state from 0 to 1.

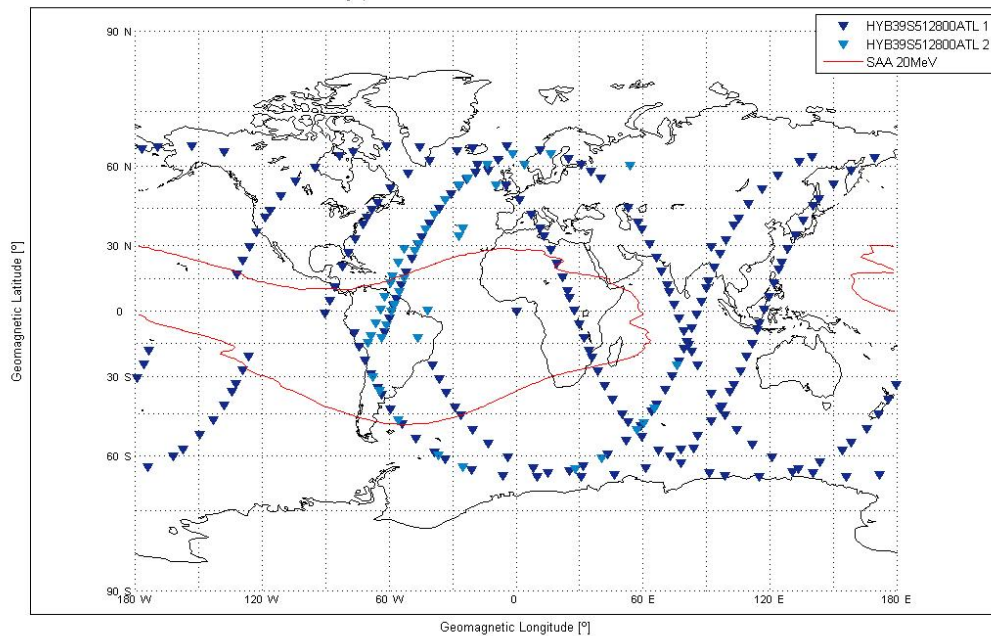


Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2

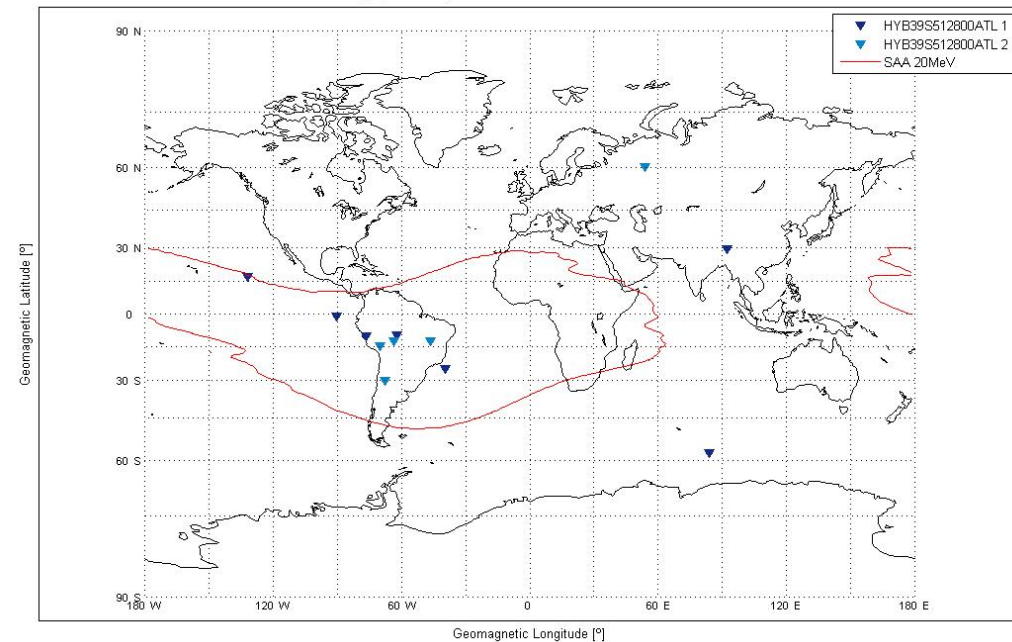


HYB39S512800AT 1 : 7 SEFI
HYB39S512800AT 2 : 5 SEFI

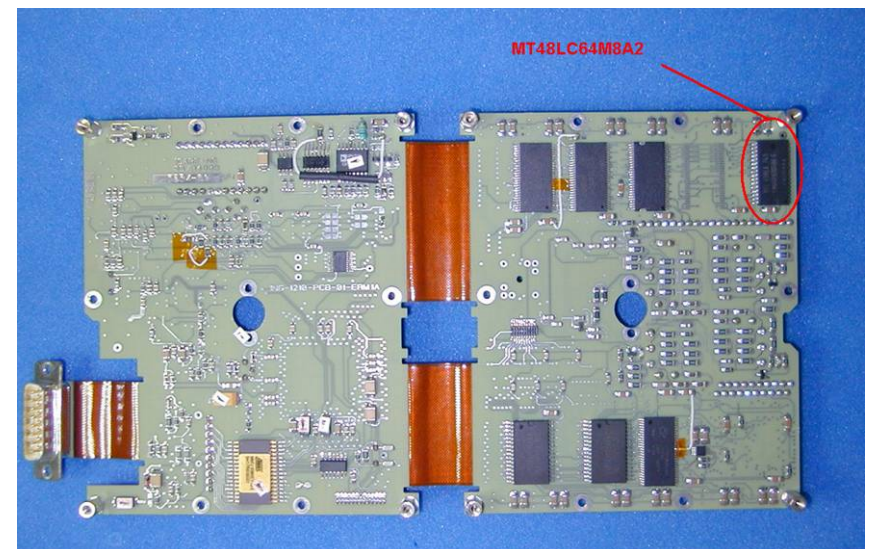
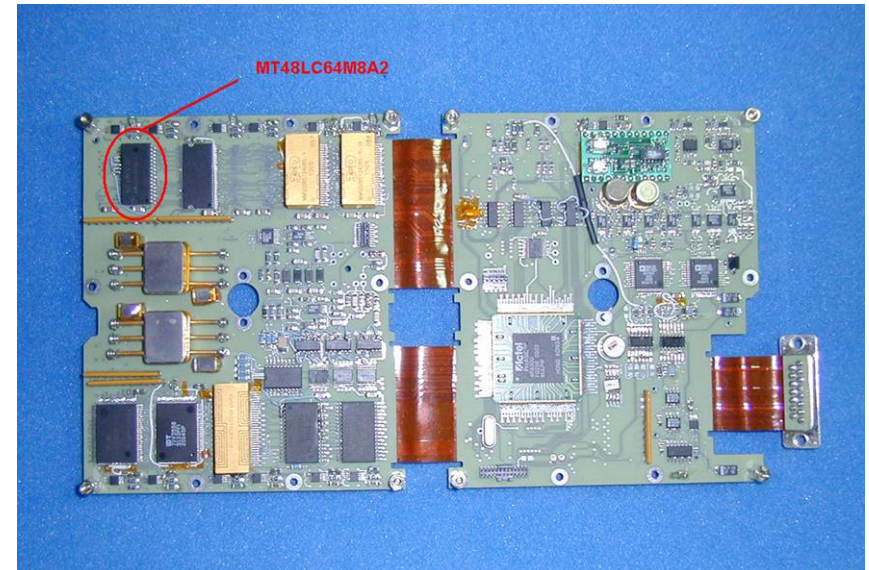
Cartographie des SEU des Infineon HYB39S512800ATL sur CARMEN2



Cartographie des départ de SEFI des HYB39S512800ATL CARMEN2

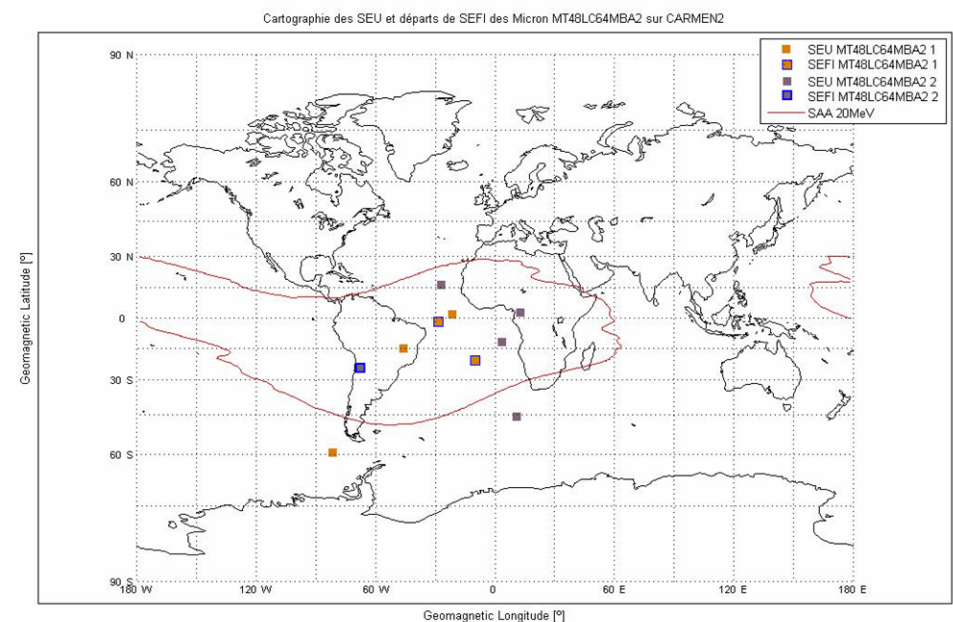
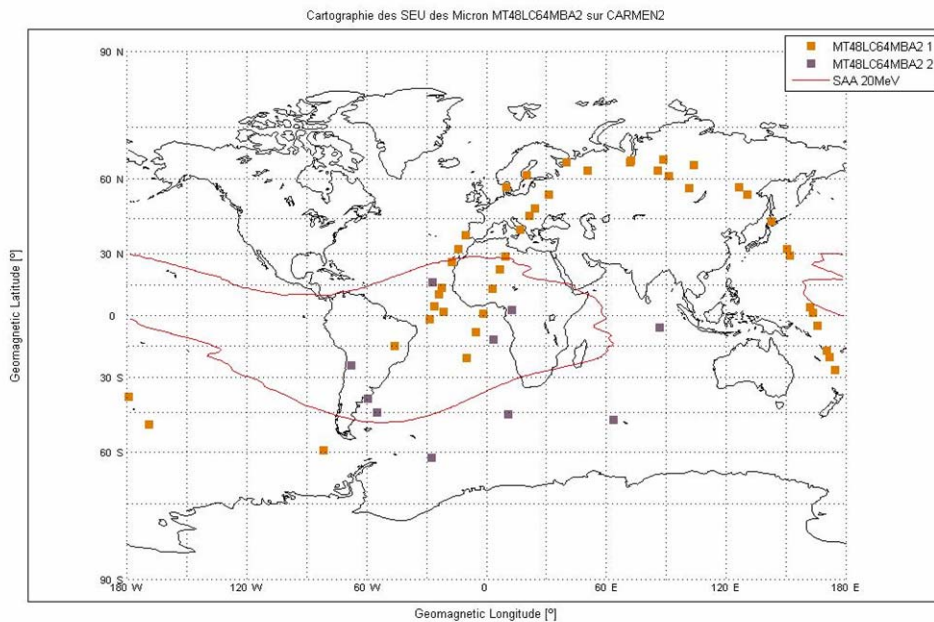


Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MM5D08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2

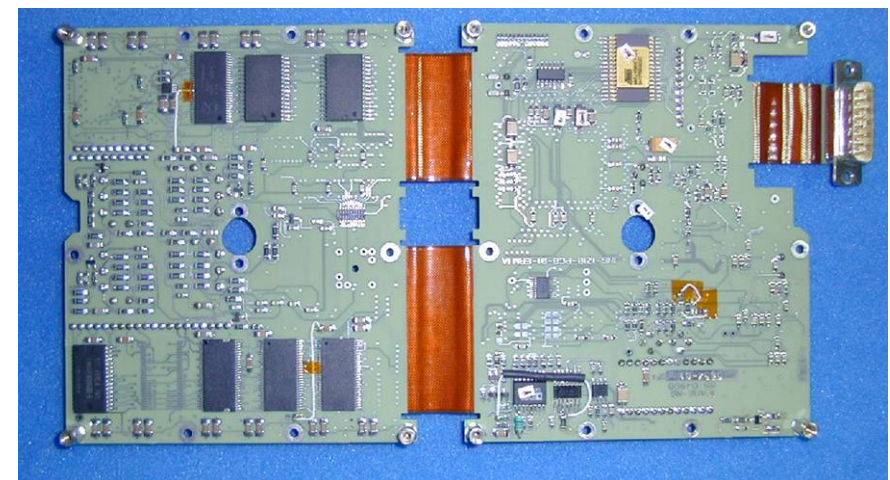
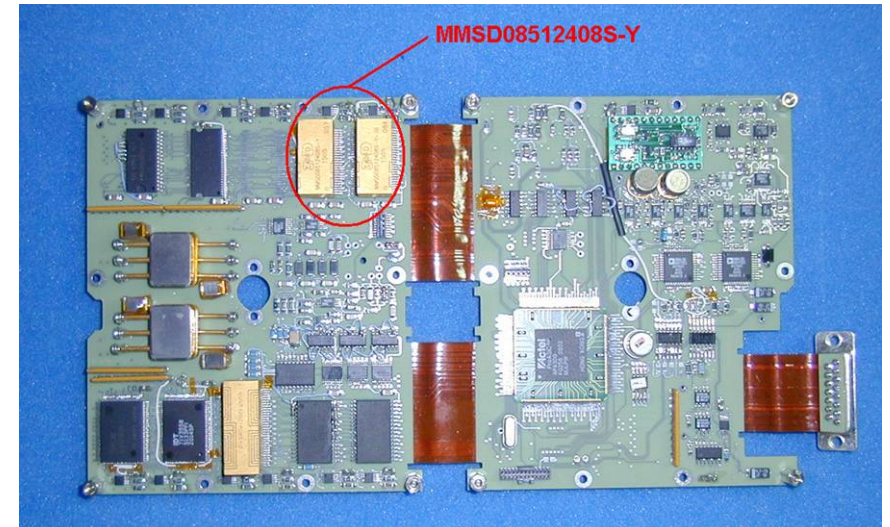


MT48LC64M8A2 1 : 3 SEU ; 2 SEFI

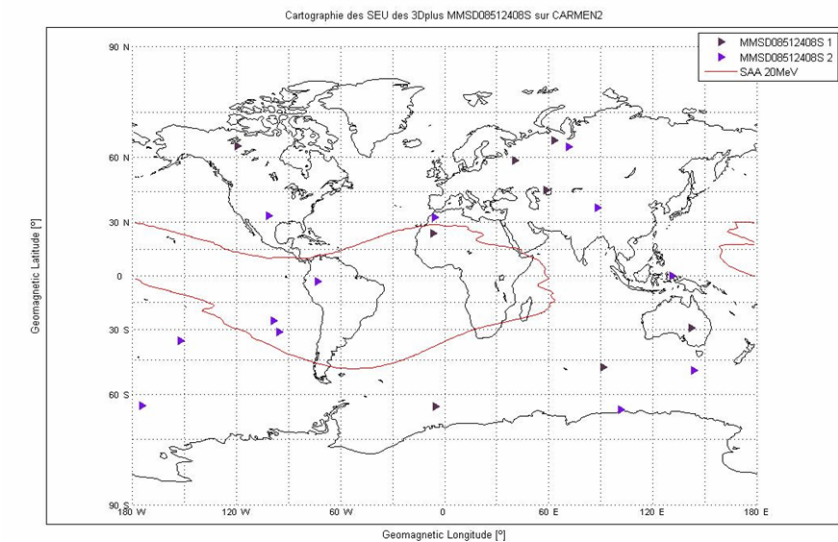
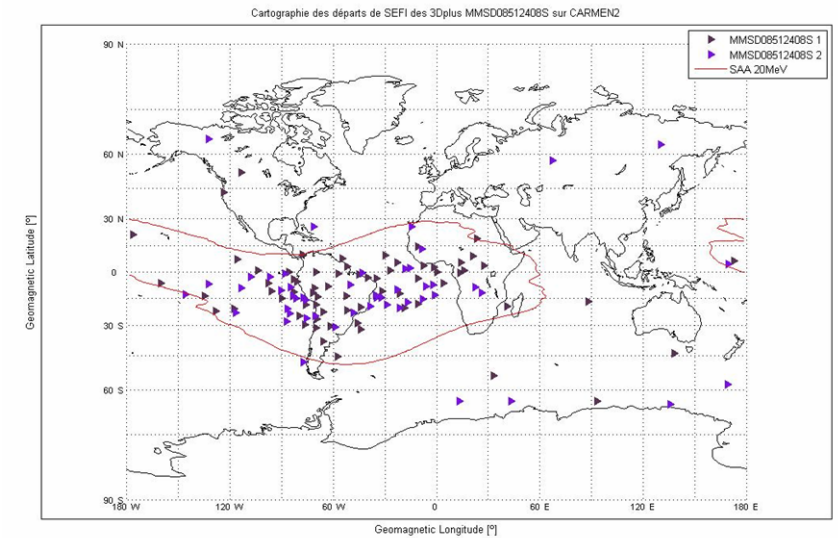
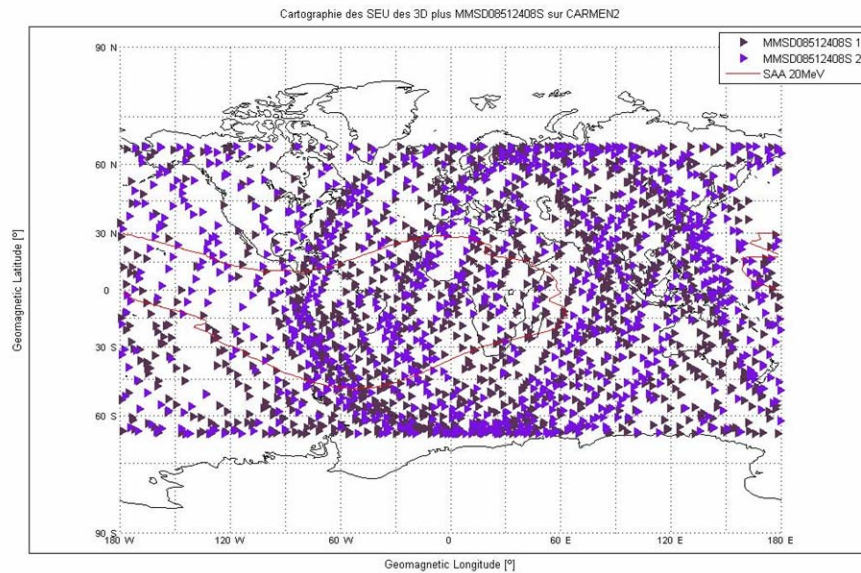
MT48LC64M8A2 2 : 3 SEU ; 1 SEFI



Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2



MMSD08512408S-Y 1 : 69 SEFI ; 8 SEU
MMSD08512408S-Y 2 : 50 SEFI ; 12 SEU



MMSD08512408S-Y 2:

2 non-permanent stuck bit :

- same Elpida die

- same error mask:

x			
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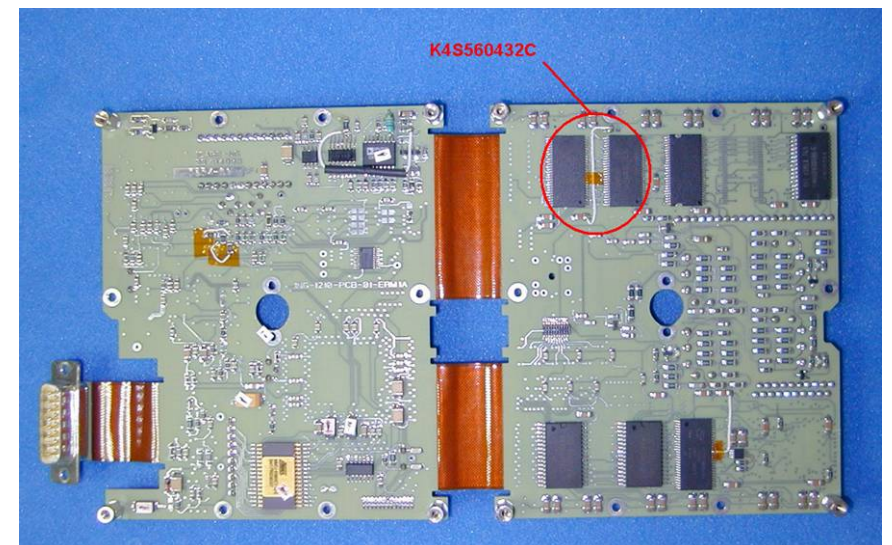
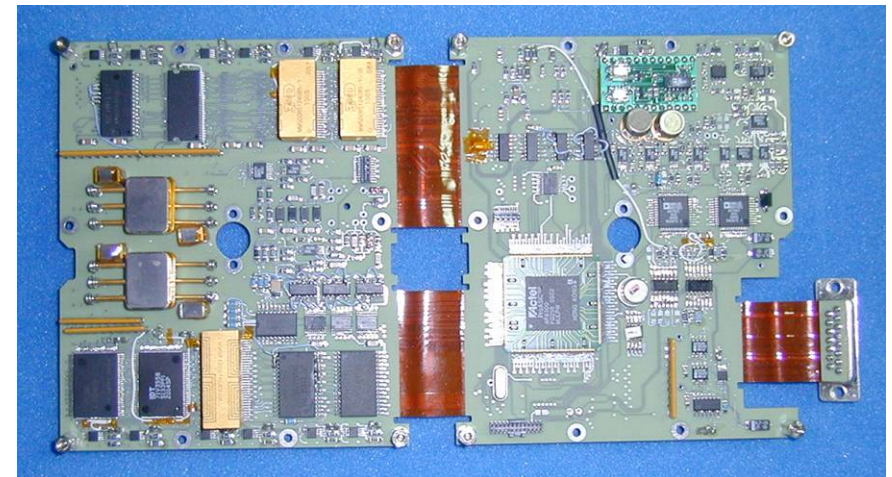
Address :
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01100110101101010110100101101000

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20/11/2010 18:34:37
22/11/2010 18:47:29
26/11/2010 19:13:16
12/12/2010 03:34:09
16/12/2010 07:49:33
24/12/2010 18:01:06
28/12/2010 17:08:59
30/12/2010 21:22:56
31/12/2010 08:43:30

Address :
66B56168
01100110101101010110000101101000

18/10/2010 19:02:04
03/11/2010 02:40:16
05/11/2010 22:56:55
21/11/2010 09:18:55
23/11/2010 22:55:00
26/11/2010 05:11:37
29/11/2010 19:32:35
01/12/2010 05:21:26
01/12/2010 07:44:22
04/12/2010 00:01:33
08/12/2010 08:27:20
16/12/2010 07:49:33
20/12/2010 21:36:25
28/12/2010 10:24:42
29/12/2010 08:32:44
03/12/2011 01:43:20
07/12/2011 15:30:11
16/12/2011 12:27:04

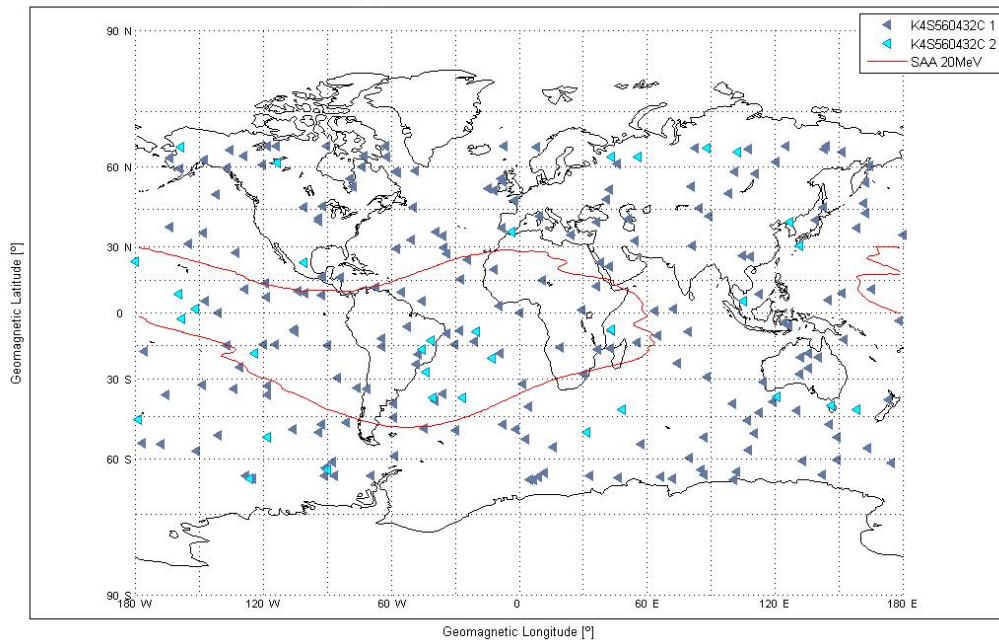
Référence des DUT	Fonction	Nombre de DUT/MEX
HITACHI HM628512C	SRAM 512k*8	2
SAMSUNG KM6840000A	SRAM 512k*8	2
3D+ MMSR32001608-S	SRAM 1M*32	1
SAMSUNG K7A81800M 6	SSRAM 512k*16	1
IDT IDT71V3558S133PSI	SSRAM 512k*16	1
INFINEON HYB39S512800AT	SDRAM 64M*8	2
MICRON MT48LC64M8A2	SDRAM 64M*8	2
3D+ MMSD08512408S-Y	SDRAM 512M*8	2
SAMSUNG K4S560432C	SDRAM 64M*4	2
SAMSUNG KM44V16004B	DDRAM 16M*4	2



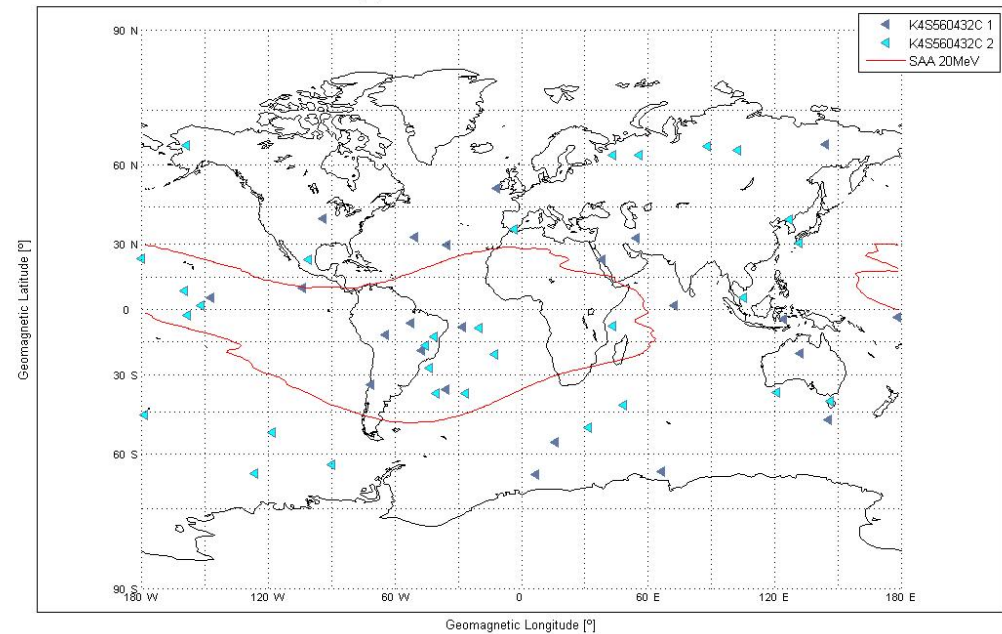
K4S560432C 1 : 23 SEU

K4S560432C 2 : 30 SEU

Cartographie des SEU des SAMSUNG K4S560432C sur CARMEN2



Cartographie des SEU des SAMSUNG K4S560432C sur CARMEN2



K4S560432C 1 : 2 non-permanent stuck bit :

- same error mask
- change of state from 1 to 0

X 113

Address :
20F1F3F5
(00100000111100011111001111110101

05/09/2009 10:06
07/09/2009 20:17
08/09/2009 14:26
22/09/2009 03:01
23/09/2009 01:06
.
.
.
14/02/2011 12:33
15/02/2011 08:39
17/02/2011 02:50
21/02/2011 15:19
21/02/2011 19:20

X 75

Address:
20F1F3F5
00100000111100011111001111110101

06/09/2009 07:48
25/09/2009 01:49
30/09/2009 00:21
05/10/2009 06:25
.
.
.
04/01/2011 15:28
06/01/2011 10:26
08/01/2011 15:12
03/02/2011 11:28

K4S560432C 2 : 1 non-permanent stuck bit :

- change of state from 1 to 0

Address :	{	06/03/2009 23:54
23D83D05		26/05/2009 12:18
(00100011110110000011110100000101)		19/06/2009 13:34

CARMEN 1

- SAC-D Satellite
- Launch planned for July 2011
- 660km, 98° : Polar Orbit

Same as CARMEN 2

CARMEN 3

- JASON3 Satellite
- Launch planned for December 2013.
- Orbit close to JASON2

Bug Correction

New devices :

KM684000 => Cypress (90nm)

HM628512 => BSI

CARMEN 4

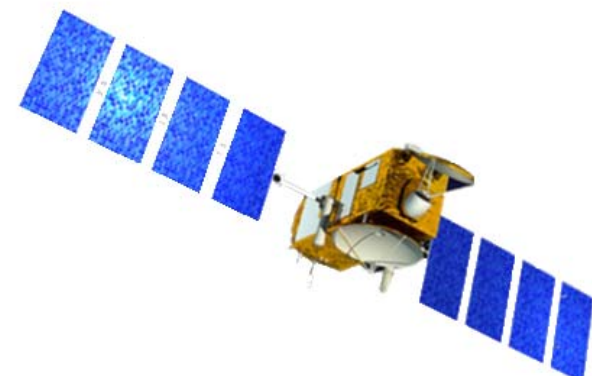
- Geostationary GSAT-4R Satellite
- **CANCELED**



CENTRE NATIONAL D'ÉTUDES SPATIALES



Thank you for your attention



QCAD 28/03/2011