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## Change Log

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1.0	24/11/2021	All	First issue

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## 1. Purpose and Scope

The objective of this document is to provide the test plan carried out on v1.3.8 of the DPU ASW and to report the test results. All tests were done at system level.

This document is focused on the ASW test phase carried out on DPU AVM at TAS premises in Turin after its qualification to validate the applicative before installing it on DPU FM units.

## 2. Reference Documents

RD	Title / Author	Document Reference	Issue	Date
0	NISP Acronyms List	EUCL-IAP-LI-1-001	2.0	04/05/2013
1	NI-DPU ASW post QAR Configuration Control – Issues/SPR	EUCL-IBO-TN-7-028	1.1	16/11/2021
2	NI-DPU ASW v1.3.8 – Software Release Notes	EUCL-IBO-TN-7-036	1.0	16/11/2021
3	NI-DPU ASW: blocking communication issue between SCE and DCU	EUCL-IBO-NCR-7-030	1.0	28/09/2021

## 3. Acronyms

See RD0



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## 4. Validation test dedicated to v1.3.8 of DPU ASW

Date and Location

From 10/11/2021 till 12/11/2021 in TAS-I Torino

Tests performed by Eduardo Medinaceli – INAF OAS (on site)  
Anton Zadeja TASI (on site)  
Chiara Sirignano INFN – Pd (remote)

- Setup at TASI used for the tests was a rearrangement of the SOVT1 setup: DPU1 (DPU-EM) using only DCU1 and DPU2 (DPU-EQM) equipped with 8 x SCEs (SCE7 was excluded from the setup because the detection chain was not stable).
- The list of SW interventions on DPU-ASW v1.3.7 implemented in DPU-ASWv1.38 are detailed in RD-1, and RD-2.

### 4.1 Software version

The SW configuration used to perform the tests is as follow:

ICU ASW v 1.9 - DPU ASW 1.3.8 – MIB TA2\_3-17 (that contains NISP\_3-67).

### 4.2 DPU-ASWv1.3.8 Validation Test Plan

pre-requirement:

- Load on DPU's E2PROM image2 DPU-ASWv1.3.8

<u>Sequence</u>	<u>Description</u>	<u>Execution Time Forecast</u>
power up:		
1. SST_01, SST_03	(ICU on)	(15 min)
2. SST_04	(DPU/DCU on)	(3 min) (1 DPU – 1DCU)
exposures:		
3. SST_05	(exposure preparation)	(1 min)
4. SST_11	(SIM exposure)	(5 min)
5. SST_12	(grounded exposure)	(5 min) ( + optional K-sequence)
6. SST_13_01,_02, _03,_04,_05	(engineering modes and calibrations)	(5*5 min)
Dither abort:		
7. send_dither_abort	(Dither abort)	(5 min)
fdirs:		
8. FFT20	(DPU FDIRs)	(15 min)
covers case (1) ALARM_DCU28V, and DCUASW_ALLDCUOFF		
9. Program a Dither with 2 Exp and executed only one	cover case (2) WCD_WD_PROC_EXPIRED*	



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reboot:

**10.** FFT22/CONT\_20\_BOTH\_DPU\_CPU\_RESET (DPU reboot) (10 min)

power down:

**11.** command transition to SAFE (DCUs off) (3 min) (1 DPU -1 DCU)  
 covers case (3)

**12.** SST\_17 (DPUs off) (1 min)

**13.** SST\_18 (ICU off) (1 min)

total time: E2PROM write time +

~ 90 minutes (additional operations between sequences are not considered) +

K-seq time not considered + \*sequence non considered in time budget

### 4.3 Test Results

For case 8, DPU nominal thresholds were modified to trigger FDIRs inducing error injection, for example for the VDDA thresholds of the SCE were set to 39 mA. The following screenshots shows events ALARM\_DCU28V, ALARM\_THRSCCE correctly formatted (including the OBT)

The screenshot shows a network traffic analysis tool window titled 'TMHIST [ccs-s1] 2021\_11\_11T07\_37\_09\_zadeja\_ccs-w11\_RT\_EW317'. The main pane displays a list of packets with columns for Packet ID, SPID, Name, APID, SSC, T, ST, Generation Time, Reception Time, P11, P12, Source, and Description. A selected packet (ID 95088) is highlighted in blue, with its details shown in a lower pane. The description for this packet is 'Report after DPU SW commanded transition'. Below the details, there is a 'Properties' pane showing parameters for NIST8500 through NIST8525, all with 'OK' status. To the right, a hex dump shows the raw data of the packet, including the OBT (0000 00 20 C8 01 00 25 10 05 02 00 00 00 14 43 B2 C9).



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Packet ID	SPID	Name	APID	SSC	T	ST	Generation Time	Reception Time	P11	P12	Source	Description
97294	300502342	N_DPU2LowErr	1312	2140	5	2	1970-01-01T01:28:30.741	2021-11-11T09:11:42.424	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97345	300502342	N_DPU2LowErr	1312	2138	5	2	1970-01-01T01:28:29.744	2021-11-11T09:11:41.059	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97025	300502342	N_DPU2LowErr	1312	2127	5	2	1970-01-01T01:28:12.741	2021-11-11T09:11:23.956	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97019	300502342	N_DPU2LowErr	1312	2125	5	2	1970-01-01T01:28:11.741	2021-11-11T09:11:23.852	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96727	300502342	N_DPU2LowErr	1312	2114	5	2	1970-01-01T01:27:55.740	2021-11-11T09:11:07.909	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96681	300502342	N_DPU2LowErr	1312	2111	5	2	1970-01-01T01:27:54.740	2021-11-11T09:11:06.223	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96460	300502342	N_DPU2LowErr	1312	2104	5	2	1970-01-01T01:27:42.738	2021-11-11T09:10:53.862	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96442	300502342	N_DPU2LowErr	1312	2102	5	2	1970-01-01T01:27:41.738	2021-11-11T09:10:52.873	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
95105	300501328	N_DPUstateSta	1312	2053	5	1	1970-01-01T01:26:30.067	2021-11-11T09:09:41.424	328	0	tmto-dfe	ICU event - SAFE state notification
95104	300503344	N_DPU1MedErr	1312	2054	5	3	1970-01-01T01:26:30.067	2021-11-11T09:09:41.424	344	0	tmto-dfe	Errors triggered by DPU#1 that do not require an FDIR
95088	300502340	N_DPU1LowErr	1312	2051	5	2	1970-01-01T01:26:28.698	2021-11-11T09:09:40.434	340	0	tmto-dfe	Errors triggered by DPU#1 that do not require an FDIR
95088	300502340	N_DPU1LowErr	1312	2049	5	2	1970-01-01T01:26:27.698	2021-11-11T09:09:39.034	340	0	tmto-dfe	Errors triggered by DPU#1 that do not require an FDIR
48077	300501388	N_DPU1TransRp	1312	400	5	1	1970-01-01T00:44:11.088	2021-11-11T08:27:22.239	388	0	tmto-dfe	Report after DPU SW commanded transition

ID	Info	Raw	Eng
NIST8500	OK	340	DPU1_LowSevErr
NIST8542	OK	5189718414307	1970-01-01T01:26:28.718
NIST8543	OK	0	"NO VAL"
NIST8544	OK	0	"NO VAL"
NIST8554	OK	0	"NO VAL"
NIST8556	OK	1	low_critcity
NIST8555	OK	178913281	ALARM_THRSCE
NIST8557	OK	1	"NO VAL"
NIST8525	OK	1	"NO VAL"

Each one of the FDIRs shown before were triggered for all the detectors resulting on NISP system FDIR:

Packet ID	SPID	Name	APID	SSC	T	ST	Generation Time	Reception Time	P11	P12	Source	Description
96298	300501328	N_DPUstateSta	1312	2179	5	1	1970-01-01T01:29:21.067	2021-11-11T09:12:32.284	328	0	tmto-dfe	ICU event - SAFE state notification
96297	300501345	N_DPU1MedErr	1312	2180	5	3	1970-01-01T01:29:21.067	2021-11-11T09:12:32.284	345	0	tmto-dfe	Errors triggered by DPU#2 that do require an FDIR
96280	300502342	N_DPU2LowErr	1312	2177	5	2	1970-01-01T01:29:19.741	2021-11-11T09:12:30.919	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96256	300502342	N_DPU2LowErr	1312	2176	5	2	1970-01-01T01:29:18.741	2021-11-11T09:12:29.909	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96015	300502342	N_DPU2LowErr	1312	2167	5	2	1970-01-01T01:29:06.741	2021-11-11T09:12:17.582	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96005	300502342	N_DPU2LowErr	1312	2165	5	2	1970-01-01T01:29:05.741	2021-11-11T09:12:17.269	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97703	300502342	N_DPU2LowErr	1312	2154	5	2	1970-01-01T01:28:48.741	2021-11-11T09:12:00.519	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97678	300502342	N_DPU2LowErr	1312	2152	5	2	1970-01-01T01:28:47.741	2021-11-11T09:11:58.841	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97364	300502342	N_DPU2LowErr	1312	2140	5	2	1970-01-01T01:28:30.741	2021-11-11T09:11:42.424	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97345	300502342	N_DPU2LowErr	1312	2138	5	2	1970-01-01T01:28:29.741	2021-11-11T09:11:41.059	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97025	300502342	N_DPU2LowErr	1312	2127	5	2	1970-01-01T01:28:12.741	2021-11-11T09:11:23.956	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
97019	300502342	N_DPU2LowErr	1312	2125	5	2	1970-01-01T01:28:11.741	2021-11-11T09:11:23.852	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR
96727	300502342	N_DPU2LowErr	1312	2114	5	2	1970-01-01T01:27:55.740	2021-11-11T09:11:07.909	342	0	tmto-dfe	Errors triggered by DPU#2 that do not require an FDIR

ID	Info	Raw	Eng
NIST8500	OK	345	DPU2_MedSevErr
NIST8542	OK	5360001831055	1970-01-01T01:29:20.001
NIST8543	OK	0	"NO VAL"
NIST8544	OK	0	"NO VAL"
NIST8554	OK	0	"NO VAL"
NIST8556	OK	2	Med_Critcity
NIST8555	OK	230886742	DCU_ALLDCCOFF
NIST8557	OK	1	"NO VAL"
NIST8525	OK	1	"NO VAL"

Instead, errors injected with sequence 9 programming a Dither for which not all the exposure commands were send, the watchdog systems were successfully triggered but the OBT contained in the DPU error table were not correctly retrieved.

*This didn't produce a limitation for the NISP recovery action because the telemetry table send by the ICU reported correctly the OBT. This issue will be discussed in a separate document.*



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## Watchdog End of Exposure

Packet ID	SPID	Name	APID	SSC	T	ST	Generation Time	Reception Time	P11	P12	Source	Description	
573555	300503345	N_DPU2MedErr	1312	7389	5	3	1970-01-01T07:48:49.068	2021-11-10T16:59:33.784	345	0	Intc-dfe	Errors triggered by DPUW2 that do require an FDIR	
573554	300503344	N_DPU1MedErr	1312	7376	5	3	1970-01-01T07:48:31.068	2021-11-10T16:59:33.784	344	0	Intc-dfe	Errors triggered by DPUW1 that do require an FDIR	
573550	300503345	N_DPU2MedErr	1312	3987	5	3	1970-01-01T06:15:29.069	2021-11-10T16:59:33.784	345	0	Intc-dfe	Errors triggered by DPUW2 that do require an FDIR	
573549	300503344	N_DPU1MedErr	1312	3161	5	3	1970-01-01T06:02:15.069	2021-11-10T16:59:33.783	344	0	Intc-dfe	Errors triggered by DPUW1 that do require an FDIR	
573546	300503345	N_DPU2MedErr	1312	2259	5	3	1970-01-01T05:39:17.069	2021-11-10T16:59:33.783	345	0	Intc-dfe	Errors triggered by DPUW2 that do require an FDIR	
521975	0	300503345	N_DPU2MedErr	1312	7389	5	3	1970-01-01T07:48:49.068	2021-11-10T16:11:43.390	345	0	Intc-dfe	Errors triggered by DPUW2 that do require an FDIR
521641	0	300503344	N_DPU1MedErr	1312	7376	5	3	1970-01-01T07:48:31.068	2021-11-10T16:11:25.655	344	0	Intc-dfe	Errors triggered by DPUW1 that do require an FDIR
418243	0	300503345	N_DPU2MedErr	1312	3987	5	3	1970-01-01T06:15:29.069	2021-11-10T14:38:23.529	345	0	Intc-dfe	Errors triggered by DPUW2 that do require an FDIR
403698	0	300503344	N_DPU1MedErr	1312	3161	5	3	1970-01-01T06:02:15.069	2021-11-10T14:25:09.621	344	0	Intc-dfe	Errors triggered by DPUW1 that do require an FDIR
375991	0	300503345	N_DPU2MedErr	1312	2259	5	3	1970-01-01T05:39:17.069	2021-11-10T14:02:11.350	345	0	Intc-dfe	Errors triggered by DPUW2 that do require an FDIR

## Watchdog end of Dither

All 290 errors injected (generated) during the current test session were analysed (including the ones originated from the non-correct setup leading to the exclusion of DPU2-SCE7). Besides for errors coming from the Watchdog system, all the others have correctly saved the OBT in the DPU ERROR\_TAB as well as all the other fields on the table; for example, errors ASW\_FOCALPLANEOFF and SCE\_EHSK (time initialized to 01/01/1970):

DPU-ASW OBT coarse	DPU-ASW OBT fine	Sub system	CMD/ Function ID	Criticality	ASW error code (error name)	Multiplicity	OBT DPU-ASW_ERROR_TAB
00006dce	42b7	0000 (not used)	00eb	0002	0x0a5703f2 (ASW_FOCALPLANEOFF)	0001	01/01/1970 07:48:31
00004dcd	31e1	0006 (DCU7)	00e7	0001	0x073d0005 (SCE_EHSK)	0001	01/01/1970 05:31:57

in the table the driver error (errno) is not shown because is not trapped in any of these two cases.



The comparison of the ICU-OBT and the DPU-OBT is shown in Figure 1, where events from the watchdog systems were excluded:

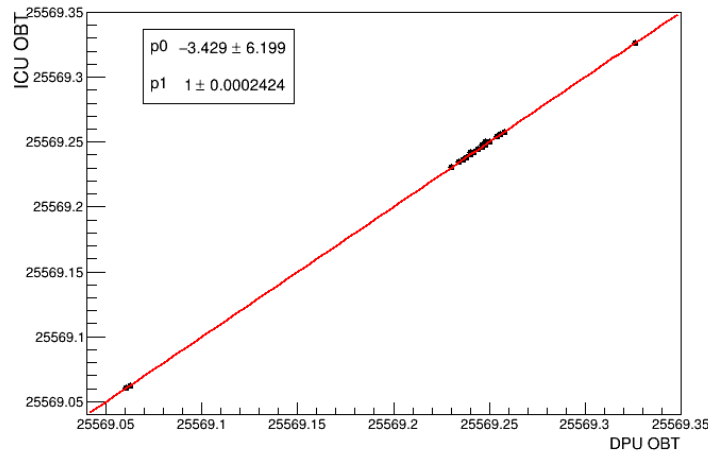


Figure 1, NISP events, OBT comparison between ICU and DPU; the linear fit shows the perfect correlation between these two times.

#### 4.4 Results summary

In the following table are summarized the results of the validation procedures where general features of NISP were tested, **the results are as expected for all cases besides errors generated by the watchdog systems (test ID = 9).**

Test procedure Id	Description	Results
1	ICU ON pre-requirement	OK
2	DPU/DCU power ON	OK
3	Exposure preparation	OK
4	Simulated exposure	OK
5	Grounded exposure (nominal cycle, using Zero Bias)	OK
6	Engineering modes: IPC, KTC, Debug, Raw mode, Compression Verification	OK
7	Dither abort	OK
8	Error injection: ALARM_DCU28V, ALARM_THRSCE, DCUASW_ALLDCUOFF	OK
9	Errors from watchdog systems: WCD_WD_EXP_EXPIRED, WCD_WD_PROC_EXPIRED	NOT OK
10	- CPU_RESET with focal plane OFF - CPU_RESET with focal plane ON	OK
11	ASW_FUNC_TURNOFFFOCALPLANE	OK
12	DPU/DCU power OFF	OK
13	ICU OFF	OK



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Specific tests done at LAM using a dedicated setup used to investigate the new DCU\_ERROR\_REG management are document in EUCL-IBO-TN-7-028-NI-DPU-ASW post QAR Configuration Control Issues/SPR v1.1 [RD-1].

Attached to this document can be found the slides of the dedicated test done at LAM with a dedicated setup (description included) used in the resolution of the 'DCU-SCE communication issue' - RD-3.

## 4.5 Issues found

- (1) related to test ID = 9: failed to get correct time tag for errors from watchdog systems: WCD\_WD\_PROC\_EXPIRED and WCD\_WD\_EXP\_EXPIRED.  
Two out of 181 error injection entries (1.3%) found during the validation tests.
- (2) related to test ID = 10: FFT22/CONT\_20\_BOTH\_DPU\_CPU\_RESET (DPU reboot) reboot executed correctly, restore of nominal operations FAILED because the SCE's flag SCE\_IDLE was not set and SCE commanding was therefore not enabled.

## **Limitations on normal operations**

- (1) none for NISP nominal operations because no functionalities are compromised including error injection (all error parameters are OK), and timing. The OBT of the event associated to the DPU error is correctly reported.
- (2) procedural limitation during the recovery action applied to the CPU reset is needed, in the current implementation the flag SCE\_IDLE is not set, and this flag can be rise by applying command CPU\_DABT (Dither Abort).

Both minor limitations will be discussed in a dedicated NRB.

## **5. Attachments**

In attachment are the following presentations:

- DCUerrorsStrategy.pdf
- DPU-ASW\_ProveOfConcept\_FIFOerrors\_update.pdf
- 1stLAMtestsession.pdf
- 2ndTestSession@LAM.pdf