

TTC chain 1 health check
File: H_CRP_TTC_T1HC.xls
Author: E. Picallo



Procedure Summary

Objectives

This procedure describes the steps needed to verify that the XPND1 communicates on the 1553 Bus and that the reported telemetry is as expected to be executed only when the downlink is active via TX2 and TWTA2.

Summary of Constraints

Downlink active via TX2 and TWTA2.
Expected XPND1 setting if the last programmed values were nominal operational Tx configuration for MBR (related to XPND Configuration Register 1 and 2):

- RNG modulation index = 0.6;
- TM modulation index = 1.2;
- Coherent and Ranging modulator = OFF;
- Output power level = - 4dBm;
- Ext.ref. & Int.bit pattern generator = OFF;

The Analogue TM Register should read values similar to the corresponding Analogue telemetries.

The Extra TM Register should read the following values:

- Telemetry counter = increasing;
- Transponder Status = TM mode Active;
- Squelsh Status = OFF (assuming U/L swept in narrow range);
- Rx Lock status = Locked (assuming U/L sweep in narrow range);

Spacecraft Configuration

Start of Procedure

CDMU in default configuration.
Downlink active via TX2 and TWTA2.
XPND 1 LCL ON and configured "OFF and "INVALID" on SDB
RX2 TC rate = 4kbps, RX1 TC rate = 125bps.
Chain 2 marked as "in use" in UIU table.

End of Procedure

CDMU in default configuration.
Downlink active via TX2 and TWTA2.
XPND 1 LCL ON and configured "OFF and "INVALID" on SDB
RX2 TC rate = 4kbps, RX1 TC rate = 125bps.
Chain 2 marked as "in use" in UIU table.

Reference File(s)

Input Command Sequences

Output Command Sequences

HFRT1HC

Referenced Displays

ANDs GRDs SLDs

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ZAZ7I999 (None)
 ZAZ7J999
 ZAZ39999
 ZAZ7N999
 ZAD1L999

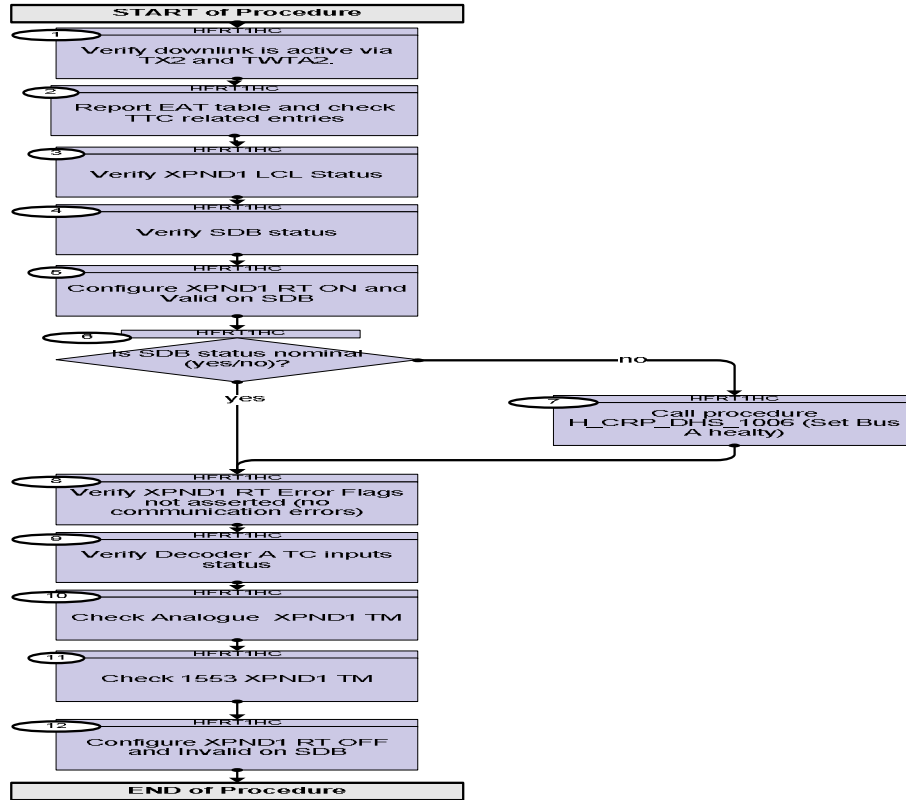
Configuration Control Information

DATE	FOP ISSUE	VERSION	MODIFICATION DESCRIPTION	AUTHOR	SPR REF
19/11/09	3	1	Created	E. Picallo	

TTC chain 1 health check
 File: H_CRP_TTC_T1HC.xls
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Procedure Flowchart Overview



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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
Beginning of Procedure				
TC Seq. Name : HFRT1HC (TTC 1 health check) TTC chain 1 health check TimeTag Type: N Sub Schedule ID: <input type="checkbox"/>				
1		Verify downlink is active via TX2 and TWTA2.		Next Step: 2
		Verify Tx1 Status Telemetry TX1 ON-OFF Stat RMB15442	= OFF	AND=ZAZ7I999
		Verify TWT1 Status Telemetry TWT1_ONOFF_STS RMB09439	= OFF	AND=ZAZ7J999
		Verify TX2 Status Telemetry TX2 ON-OFF Stat RMB16442	= ON	AND=ZAZ7I999
		Verify TWT2 Status Telemetry TWT2_ONOFF_STS RMB10439	= ON	AND=ZAZ7J999
2		Report EAT table and check TTC related entries		Next Step: 3
		Execute Telecommand ReptEvtActTable TC Control Flags : GBM IL DSE --Y -- -- Subsch. ID : 10 Det. descr. : TEMPLATE Report The contents of the event/action table TC(19,6)	DCT86170	
		Check that the following EAT entries status (entries may be disabled if FDIR recovery triggered and redundancy not re-established): EventID Event Description 0x00A1 XPND2_NOT_VIT_RT_INV 0x9218 EPC1_HelixCur_OutHi_Lim 0x9219 EPC2_HelixCur_OutHi_Lim 0x9228 EPC1_HelixCur_OutLo_Lim 0x9229 EPC2_HelixCur_OutLo_Lim 0x921A XPND1 RX Failure 0x921B XPND2 RX Failure		
		Check that the following EAT entries is disabled: EventID Event Description 0x00A0 XPND1_NOT_VIT_RT_INV		

TTC chain 1 health check
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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		0x9200 RFDNSW1_Not_In_PosB_Fail 0x9201 RFDNSW1_Not_In_PosA_Fail 0x9202 RFDNSW2_Not_In_PosB_Fail 0x9203 RFDNSW2_Not_In_PosA_Fail 0x9204 RFDNSW3_Not_In_PosB_Fail 0x9205 RFDNSW3_Not_In_PosA_Fail 0x9206 RFDNSW4_Not_In_PosB_Fail 0x9207 RFDNSW4_Not_In_PosA_Fail		
3		Verify XPND1 LCL Status		Next Step: 4
		Verify Telemetry Xpnd1Tx_L23_S WM12D565	= ON	AND=ZAZ7I999
		Verify Telemetry Xpnd1Tx_L23_I WM109565	>= 0.3 A <= 0.4 A	AND=ZAZ7I999
		Note: To perform the health check is necessary that LCL23 is switch ON (nominal status). If the LCL23 status is OFF (non nominal status eg. due to LCL trip-off) perform a failure analysis investigation before proceeding to switch LCL23 ON*. * In order to switch LCL23 back on after a trip-off , is necessary first to re-inforce the switch LCL23 OFF via telecommand.		
4		Verify SDB status		Next Step: 5
		Verify Telemetry Active_Bus_A_B DEFJ1160	= BUS_A	AND=ZAZ39999
		Verify Telemetry BusA_HealthySts DEFJ2160	= Healthy	AND=ZAZ39999
		Verify Telemetry BusB_HealthySts DEFJ3160	= Healthy	AND=ZAZ39999
		Verify Telemetry SDB_FDIR DEFJ4160	= ENABLED	AND=ZAZ39999
5		Configure XPND1 RT ON and Valid on SDB		Next Step: 6
5.1		Set XPND1 RT ON and Valid		☐

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Telecommand ConfigureSDBFDIR Command Parameter(s) : RTA DH011161 XPND 1 M0 DH030161 Update status M1 DH031161 Ignore Flag M2 DH032161 Ignore Flag M3 DH033161 Ignore Flag M4 DH034161 Update status M5 DH035161 Ignore Flag M6 DH036161 Ignore Flag M7 DH037161 Ignore Flag F0 DH018161 ON F1 DH019161 Alive F2 DH020161 Well TC F3 DH021161 Well TM F4 DH022161 Valid F5 DH023161 Non-vital F6 DH024161 NOMINAL F7 DH025161 ON M12 DH051161 Ignore Flag M_C DH043161 Ignore CNT M8 DH038161 Ignore Flag M9 DH039161 Ignore Flag M10 DH040161 Ignore Flag M11 DH041161 Ignore Flag F12 DH050161 ENABLED CNT DH042161 LoopCnt1 F8 DH026161 Bus A F9 DH027161 Healthy F10 DH028161 Healthy F11 DH029161 ENABLED TC Control Flags : GBM IL DSE --Y -- -- Subsch. ID : 10 Det. descr. : Configure SDB FDIR	DC005161	
5.2		Verify XPND1 status on the 1553 S/C bus		<input type="checkbox"/>
		Verify Telemetry XPND1On_Off DEFCEG160	= ON	AND=ZAZ7I999
		Verify Telemetry XPND1Val_Inval DEFCK160	= Valid	AND=ZAZ7I999
6		Is SDB status nominal (yes/no)?		Next Step: no 7 yes 8
6.1		SDB nominal status		<input type="checkbox"/>

TTC chain 1 health check
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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Verify Telemetry Active_Bus_A_B DEFJ1160	= BUS_A	AND=ZAZ39999
		Verify Telemetry BusA_HealthySts DEFJ2160	= Healthy	AND=ZAZ39999
		Verify Telemetry BusB_HealthySts DEFJ3160	= Healthy	AND=ZAZ39999
6.2		SDB non nominal status (contignecy case)		<input type="checkbox"/>
		IF XPND1 RT does not response on BUS A but does it on BUS B		
		Verify Telemetry Active_Bus_A_B DEFJ1160	= BUS_B	AND=ZAZ39999
		Verify Telemetry BusA_HealthySts DEFJ2160	= Unhealthy	AND=ZAZ39999
		Verify Telemetry BusB_HealthySts DEFJ3160	= Healthy	AND=ZAZ39999
7		Call procedure H_CRP_DHS_1006 (Set Bus A healty)		Next Step: 8
8		Verify XPND1 RT Error Flags not asserted (no communication errors)		Next Step: 9
8.1		Verify XPND1 Response Status Word		<input type="checkbox"/>
		<p>The XPND RT reports the following error flags in the Response Status Words via 1553 bus:</p> <ul style="list-style-type: none"> - RT message error bit: set by the RT upon detection of an error in the message or an illegal message identification. - RT busy bit: indicates that the RT or subsystem is unable to move data to or from the subsystem in compliance with the BC command. - RT terminal flag bit: indicates a RT fault condition. <p>These RT error bits are not supported by DLL FDIR mechanisms. Thus, if a permanent error is reported on one of these bits, this could indicate a failure in the XPND.</p> <p>Note: The XPND assert the subsystem error flag while TM acquisitions are being performed.</p>		
		<p>The following DIDs are available for XPND1:</p> <p>DID_XPND_1_SA11_RSP_STS_WORD DID_XPND_1_SA30_RSP_STS_WORD</p>		

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		<p>The value of the error bits is kept in all the above mentioned DIDs. In case of <u>permanent failures</u> this means that, for example, if DID_XPND_1_SA11_RSP_STS_WORD is indicating a RT message error condition, the same error will be reported in all the other DIDs for response status words.</p> <p>Then, it is enough to check only one of these Status Words. The parameters below correspond to: DID_XPND_1_SA11_RSP_STS_WORD</p>		
		Verify XPND1 RT message error bit status Telemetry MsgErr DEYR2161	= 0 <dec>	AND=ZAZ7N999
		Verify XPND1 RT busy bit status Telemetry Busy DEYR6161	= 0 <dec>	AND=ZAZ7N999
		Verify XPND1 subsystem error flag status Telemetry SubSys DEYR7161	= 1 <dec>	AND=ZAZ7N999
		Verify XPND1 RT terminal flag bit status Telemetry Term DEYR9161	= 0 <dec>	AND=ZAZ7N999
8.2		Verify XPND1 Local message Status Word		□
		Local message Status Word (MSW)		
		Verify Loopback command sync error Telemetry LoopCmdSync DE4VA161	= 0 <dec>	AND=ZAD1L999
		Verify Loopback data sync error Telemetry LoopDatSync DE4VB161	= 0 <dec>	AND=ZAD1L999
		Verify Loopback manchester error Telemetry LoopManch DE4VC161	= 0 <dec>	AND=ZAD1L999
		Verify Loopback parity error Telemetry LoopPar DE4VD161	= 0 <dec>	AND=ZAD1L999
		Verify Loopback word count error Telemetry LoopWdCnt DE4VE161	= 0 <dec>	AND=ZAD1L999
		Verify response 1 expected Telemetry Rsp1Expd DE4VF161	= 1 <dec>	AND=ZAD1L999
		Local message Status Word (LSW)		
		Verify Response 1 status sync error Telemetry Rsp1StsSync DE4VG161	= 0 <dec>	AND=ZAD1L999
		Verify Response 1 data sync error Telemetry Rsp1DatSync DE4VH161	= 0 <dec>	AND=ZAD1L999
		Verify Response 1 Manchester error Telemetry Rsp1Manch DE4VJ161	= 0 <dec>	AND=ZAD1L999
		Verify Response 1 parity error Telemetry Rsp1Par DE4VK161	= 0 <dec>	AND=ZAD1L999

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Verify Response 1 word count error Telemetry Rsp1WdCnt DE4VL161	= 0 <dec>	AND=ZAD1L999
		Verify Response 1 store Data word Telemetry Rsp1Words DE4VM161	= 4 <dec>	AND=ZAD1L999
		Verify Response 2 expected Telemetry Rsp2Expd DE4VN161	= 0 <dec>	AND=ZAD1L999
		Verify Response 2 status sync error Telemetry Rsp2StsSync DE4VP161	= 0 <dec>	AND=ZAD1L999
		Verify Response 2 Manchester error Telemetry Rsp2Manch DE4VR161	= 0 <dec>	AND=ZAD1L999
		Verify Response 2 parity error Telemetry Rsp2Par DE4VS161	= 0 <dec>	AND=ZAD1L999
		Verify Response 2 word count error Telemetry Rsp2WdCnt DE4VT161	= 0 <dec>	AND=ZAD1L999
9		Verify Decoder A TC inputs status		Next Step: 10
		Verify TC0 Status Decoder A Telemetry TC0_Status_A DEEP7160		(None)
		Verify TC1 Status Decoder A Telemetry TC1_Status_A DEEP6160		(None)
		The TC Active status TM provides the information that the following conditions are meet: - Rx Demodulator locked on uplink carrier and - Rx Demodulator locked on uplink subcarrier i.e. it is the logic AND of Carrier Lock Status and Squelch Status Telemetry TC0_Status_A is Active if XPND1 Rx hsa a valid signal to Decoder A TC1_Status_A is Active if XPND2 Rx has a valid signal to Decoder A		
10		Check Analogue XPND1 TM		Next Step: 11
		Verify RX1 AGC Level Telemetry XPD1_RX1_AGC_LV RMB09442	>= -141.0 dbmW	AND=ZAZ7I999
		Verify RX1 PLL SPE Telemetry XPD1_RX1_PLL_SP RMB11442	<= 130.0 kHz >= -130.0 kHz	AND=ZAZ7I999
		Verify Tx1 RF Output Power Telemetry XPD1_RF1_OUT_PW RMB13442	<= -13.0 dbmW	AND=ZAZ7I999
		Verify Rxl TC bit rate Telemetry RX1 125-4K Stat RMB17442	= 125 bps	AND=ZAZ7I999

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Verify Rx1 temperature Telemetry RX1_TEMP RMB02442		AND=ZAZ7I999
11		Check 1553 XPND1 TM		Next Step: 12
		Verify XPND1 status X1 Status - XS RMB22442	= TM mode active	AND=ZAZ7I999
		Verify Low Rate-1 status Telemetry X1 LowRate-1 MD RMB30442	= OFF	AND=ZAZ7I999
		Verify Low Rate-2 status Telemetry X1 LowRate-2 MD RMB31442	= OFF	AND=ZAZ7I999
		Verify Medium Rate Modulator status Telemetry X1 MedRate-MRM RMB29442	= ON	AND=ZAZ7I999
		Verify High Rate status Telemetry X1 HIRateMD-HRM RMB28442	= OFF	AND=ZAZ7I999
		Verify Ranging Modulator status Telemetry X1 Rang MOD-RM RMB27442		AND=ZAZ7I999
		Verify Coherent Mode status Telemetry X1 Coher MOD-CM RMB26442		AND=ZAZ7I999
		Verify Ranging Modulation Index Telemetry X1 RNGMD ID-RMI RMB32442	= 0.6 rad	AND=ZAZ7I999
		Verify Telemetry Modulation Index Telemetry X1 TM MD ID-TMI RMB33442	= 1.2 rad	AND=ZAZ7I999
		Verify Power level at transmitter output Telemetry X1 OutPowLevSet RMB35442	= -4 dbmW	AND=ZAZ7I999
		Verify Internal Bit Pattern Generator status Telemetry X1 IntBitPatGen RMB34442	= OFF	AND=ZAZ7I999
		Verify External Reference status Telemetry X1 Ext Ref - ER RMB25442	= OFF	AND=ZAZ7I999
		Verify Receiver lock status Telemetry X1 Rx Lock - RL RMB24442		AND=ZAZ7I999
		Verify RX AGC Level Telemetry X1 AGC TMUpInk RMB20442	>= -141.00 dbmW	AND=ZAZ7I999
		Verify PLL Phase Error Telemetry X1 RX PLL PhErr RMB19442	<= 130.00 kHz >= -130.00 kHz	AND=ZAZ7I999
		Verify Squelch Status Telemetry X1 SqlchSt - SS RMB23442		AND=ZAZ7I999
		Verify Tx1 TC Bit Rate Telemetry X1 TcBitRateTCB RMB61442	= Low	AND=ZAZ7I999

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch																																																																																																																				
12		Configure XPND1 RT OFF and Invalid on SDB		Next Step: END																																																																																																																				
12.1		Set XPND1 RT OFF and Invalid		<input type="checkbox"/>																																																																																																																				
		Execute Telecommand <p style="text-align: center;">ConfigureSDBFDIR</p> Command Parameter(s) : <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%;">RTA</td> <td style="width: 15%;">DH011161</td> <td style="width: 15%;">XPND 1</td> </tr> <tr> <td></td> <td>M0</td> <td>DH030161</td> <td>Update status</td> </tr> <tr> <td></td> <td>M1</td> <td>DH031161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M2</td> <td>DH032161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M3</td> <td>DH033161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M4</td> <td>DH034161</td> <td>Update status</td> </tr> <tr> <td></td> <td>M5</td> <td>DH035161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M6</td> <td>DH036161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M7</td> <td>DH037161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>F0</td> <td>DH018161</td> <td>OFF</td> </tr> <tr> <td></td> <td>F1</td> <td>DH019161</td> <td>Alive</td> </tr> <tr> <td></td> <td>F2</td> <td>DH020161</td> <td>Well TC</td> </tr> <tr> <td></td> <td>F3</td> <td>DH021161</td> <td>Well TM</td> </tr> <tr> <td></td> <td>F4</td> <td>DH022161</td> <td>Invalid</td> </tr> <tr> <td></td> <td>F5</td> <td>DH023161</td> <td>Non-vital</td> </tr> <tr> <td></td> <td>F6</td> <td>DH024161</td> <td>NOMINAL</td> </tr> <tr> <td></td> <td>F7</td> <td>DH025161</td> <td>ON</td> </tr> <tr> <td></td> <td>M12</td> <td>DH051161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M_C</td> <td>DH043161</td> <td>Ignore CNT</td> </tr> <tr> <td></td> <td>M8</td> <td>DH038161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M9</td> <td>DH039161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M10</td> <td>DH040161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>M11</td> <td>DH041161</td> <td>Ignore Flag</td> </tr> <tr> <td></td> <td>F12</td> <td>DH050161</td> <td>ENABLED</td> </tr> <tr> <td></td> <td>CNT</td> <td>DH042161</td> <td>LoopCnt1</td> </tr> <tr> <td></td> <td>F8</td> <td>DH026161</td> <td>Bus A</td> </tr> <tr> <td></td> <td>F9</td> <td>DH027161</td> <td>Healthy</td> </tr> <tr> <td></td> <td>F10</td> <td>DH028161</td> <td>Healthy</td> </tr> <tr> <td></td> <td>F11</td> <td>DH029161</td> <td>ENABLED</td> </tr> </table> <p>TC Control Flags :</p> <p style="text-align: center;">GBM IL DSE --Y -- ---</p> <p>Subsch. ID : 10 Det. descr. : Configure SDB FDIR</p>		RTA	DH011161	XPND 1		M0	DH030161	Update status		M1	DH031161	Ignore Flag		M2	DH032161	Ignore Flag		M3	DH033161	Ignore Flag		M4	DH034161	Update status		M5	DH035161	Ignore Flag		M6	DH036161	Ignore Flag		M7	DH037161	Ignore Flag		F0	DH018161	OFF		F1	DH019161	Alive		F2	DH020161	Well TC		F3	DH021161	Well TM		F4	DH022161	Invalid		F5	DH023161	Non-vital		F6	DH024161	NOMINAL		F7	DH025161	ON		M12	DH051161	Ignore Flag		M_C	DH043161	Ignore CNT		M8	DH038161	Ignore Flag		M9	DH039161	Ignore Flag		M10	DH040161	Ignore Flag		M11	DH041161	Ignore Flag		F12	DH050161	ENABLED		CNT	DH042161	LoopCnt1		F8	DH026161	Bus A		F9	DH027161	Healthy		F10	DH028161	Healthy		F11	DH029161	ENABLED	DC005161	
	RTA	DH011161	XPND 1																																																																																																																					
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	M12	DH051161	Ignore Flag																																																																																																																					
	M_C	DH043161	Ignore CNT																																																																																																																					
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12.2		Verify XPND1 status on the 1553 S/C bus		<input type="checkbox"/>																																																																																																																				
		Verify Telemetry <p style="text-align: center;">XPND1On_Off</p> <p style="text-align: center;">DEF CG160</p>	= OFF	AND=ZAZ7I999																																																																																																																				
		Verify Telemetry <p style="text-align: center;">XPND1Val_Inval</p> <p style="text-align: center;">DEF CK160</p>	= Invalid	AND=ZAZ7I999																																																																																																																				
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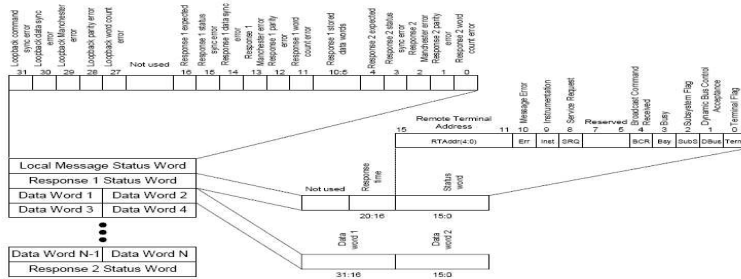


Figure 6-15 Bus Controller response block

DW Name	Telemetry Name	DW	Significant BITS								Telemetry Value
			MSB							LSB	
Analogue TM Register	PLL Phase Error	00	S	S	S	S	S	S	S	S	binary value (*)
	AGLC TLM/Uplink Level	00	S	S	S	S	S	S	S	S	binary value (*)
Extra TM Register	Telemetry counter	01	S	S	S	S	S	x	x	x	binary value (*)
	Transponder Status	01					x	x	x	x	0 = OFF, 1 = ON (**)
	Squelch Status	01					x	x	x	x	0 = OFF, 1 = ON
	Rx Lock	01					x	x	x	x	0 = No locked, 1 = Locked
Configuration Register 1	TC Bit Rate	02	x	S							0 = Low, 1 = High
	External Reference	02	x	S							0 = OFF, 1 = ON
	Coherent Mode	02	x	S							0 = OFF, 1 = ON
	Ranging MOD	02	x	S							0 = OFF, 1 = ON
	High Rate MOD (GMSK)	02	x		S						0 = OFF, 1 = ON
	Medium Rate MOD (PCM (SP-L)/PM)	02	x		S						0 = OFF, 1 = ON
	Low Rate-1 MOD (PCM (NRZ-L)/PSK/PM MOD)	02	x		S						0 = OFF, 1 = ON
	Low Rate-2 MOD (PCM (NRZ-L)/PSK/PM MOD)	02	x		S						0 = OFF, 1 = ON
	RNG MOD Index	02	x				S	S		binary value (*)	
	TM MOD Index	02	x				S	S	S	binary value (*)	
Configuration Register 2	Internal Bit Pattern Generator	03	S	x	x	x	x	x	x	x	0 = OFF, 1 = ON
	Output Power Level Set	03	x	x	x	x	x	x	x	S	binary value (*)