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1. INTRODUCTION

1.1. Purpose

The purpose of this document is to provide a full description of the TC/TM Database provided to ESA for the Qualification Model (EQM) of **EPIC PN Camera System (EPCS)**, in order to support possible users. This document will become a section of the EPCS User Manual.

1.2. Acronyms

CCD	Charge Coupled Device
EPCE	EPIC PN Control Electronics
EPCH	EPIC PN Camera Head
EPCS	EPIC PN Camera System
EPDH	EPIC PN Data Handling
EPEA	EPIC PN Event Analyzer
EPIC	European Photon Imaging Camera
EPVC	EPIC PN Voltage Converter
EQM	Engineering and Qualification Model
EST	EPIC System Team
HK	Housekeeping
MFN	Master Function Number
PREF	Parameter Reference
TC	Telecommand packet
TM	Telemetry packet
TPN	Telemetry Packet Number
XMM	X-Ray Multi-Mirror Mission

1.3. Applicable Documents

All the documents listed in this Section shall be applicable to the extent agreed upon by ESA and the EPIC P.I.. In case of conflict between this document and the documents listed here below, precedence shall be given to the listed documents. When no issue number is specified, the latest issue published before the date of issuance of this document shall be considered.

RS-PX-0028	Issue 5.0	XMM Operations Interface Requirements Document, ESA
RS-PX-0032	Issue 5.4	Packet Structure Definition, ESA
EPIC-EST-SP-002	Issue 3	EPCS Electrical I/F Specification, EST
XM-TN-DOR-0111	Issue 2	XMM Satellite Database Users Manual, DORNIER

1.4. Reference Documents

All the documents listed in this Section shall be considered as a guideline to the extent established in this document. In case of conflict between this document and the documents listed here below, precedence shall be given to this document. When no issue number is specified, the latest issue published before the date of issuance of this document shall be considered.

EPIC-MPE-LI-ED/002 Issue 2.2 XMM-EPIC Housekeeping List, MPE

EPIC-MPE-LI-ED/003 Issue 2.2 XMM-EPIC Command List, MPE

EPIC-MPE-LI-ED/019 Analogue Housekeeping Conversion Parameters for EPIC PN EM, MPE

EPIC-TAI-SP-003 Issue 5 Software Requirement Specification for the EPIC PN Event Analyser (EPEA), IAAT

2. DATABASE CONTENT

2.1. General Structure

The database of the EPCS is compiled according to the requirements specified in AD 1, which sets even the identification conventions for the TC/TM packets and parameters.

The format of the above items is specified in AD 2.

The database environment, which is realized with ACCESS 7.0 for Windows 95, is provided by Dornier: its data structure is fully described in AD 4.

2.2. TC Data Package

2.2.1. TC packets

146 TC packets are defined for the EPCS, with Master Function Numbers ranging from F0001 to F0195 (49 PREF numbers are not used).

2.2.2. TC parameters

171 TC parameters are defined for EPCS, with Parameter Reference Numbers ranging from F0001 to F0174 (PREFs F0055, 0056, 0057 and 0096 are not used).

The TC parameter identified as "FIX" is used to identify all the fixed data (bit, byte, words, etc.) within a TC packet data field : its width can be set depending on the specific data and its value is constant (the data value). Several FIX parameters can be present within the same TC data field.

2.3. TM Data Package

2.3.1. TM packets

53 TM packets are defined for the EPCS, with Telemetry Packet Numbers ranging from 50001 to 50904: TPNs 50014, 50018 and 50019 are not used; TPNs 50x04, with x=0-9, identify the 10 different Unsuccessful Command Acceptance packets; TPNs 50x05, with x=0-3, identify the 4 different Unsuccessful Command Execution packets.

2.3.2. TM parameters

The EPCS database includes 882 TM parameters: 805 parameters are related to the periodic HK packets, whereas other 67 parameters are used in sporadic TM packets. Remaining parameters are spares or fillers.

Main HK parameters

In the Main HK TM Packet (TPN 50001), with periodicity of 8 s, there are 489 parameters: their PREFs range from F1001 to F1490 (PREF 1126 is not used).

In the parameter name, the first one or two characters identify the parameter origin. As general rule, parameters are numbered following their position order within the TM packet. Here below both the parameter sources and their PREF ranges are reported:

- A0 EPEA quadrant 0 F1295-1339, 1483-84
- A1 EPEA quadrant 1 F1340-84, 1485-86
- A2 EPEA quadrant 2 F1385-1429, 1487-88
- A3 EPEA quadrant 3 F1430-74, 1489-90
- C EPCE F1053-1110, 1133-67, 1204, 1273-94, 1475-82
- D EPDH F1001-52
- E Engineering CCD parameters F1205-64
- H EPCH F1111-1132, 1265-70
- V EPVC F1168-1203, 1271-72

In the TC packet structures, for each TC parameter it is possible to insert the associated TM Verification Parameter (if any): for TC parameters which affect the EPEA, only related A0 HK parameters are inserted, but it is intended that also the corresponding A1, A2 and A3 parameters are to be considered in the same way. The same holds for the End Effect Verification TM Parameters.

Additional HK parameters

In the Additional HK TM Packet (TPN 50002), with periodicity of 64 s, there are 316 parameters. As general rule, parameters are numbered following their position order within the TM packet. They are numbered with the following scheme :

- A0 EPEA quadrant 0 F1501-46, 1579
- A1 EPEA quadrant 1 F1601-46, 1679
- A2 EPEA quadrant 2 F1701-46, 1779
- A3 EPEA quadrant 3 F1801-46, 1879
- E0 Engineering CCD quadrant 0 F1547-78
- E1 Engineering CCD quadrant 1 F1647-78
- E2 Engineering CCD quadrant 2 F1747-78
- E3 Engineering CCD quadrant 3 F1847-78

For TC parameters which affect Ax or Ex HK parameters, only A0/E0 parameter are inserted as TM Verification Parameter, but it is intended that also the corresponding parameters for the other 3 quadrants are to be considered in the same way. The same holds for the End Effect Verification TM Parameters.

Aperiodic TM parameters

Parameters to be used in sporadic TM packets are identified by PREF ranging from F2001 to 2067.

Spare and filler parameters

TM parameters F1902-10 are spare parameters of various widths, which are defined in order to represent not meaningful sections of the TM packet data field: they are variable, since it is expected that these packet area can assume any value.

The TM parameter identified as "FIX" is used to identify all the fixed data (bit, byte, words, etc.) within a TM packet data field: its width can be set depending on the specific data and its value is constant

2.4. Aliases

For the EPCS database 61 aliases have been defined, with reference numbers ranging from 5000 to 5060. They are used just in TC/TM parameters of Type Code PTC = 2; the parameters of this type which are not associated to any alias are counters.

The following aliases are partially or fully defined in the "Remarks", since it was not possible to define raw values higher than 255: 5024, 5036, 5040, 5056, 5057.

2.5. Calibration Curves

For the EPCS database 88 calibration curves have been defined. They are used just in TC/TM parameters of Type Code PTC = 3 ; the parameters of this type which are not associated to any curve are counters.

Calibration Reference Numbers have been assigned according to the parameter source, as reported hereafter :

- C, H 5001-5011
- V 5101-5110
- E0/1/3 5201-5232
- E2 5301-5332
- D 5401-5403

2.6. Condition Parameters

24 Condition Parameters have been defined, with PREF ranging from X5000 to X5023.