



INSTITUT FÜR
DATENVERARBEITUNGSANLAGEN



TECHNISCHE UNIVERSITÄT
BRAUNSCHWEIG

ROSETTA ROSINA

DPU – S/C Science Data Packets

ROS-TUB-SP-03/2.2

Revision 2.2

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Prepared by
Björn Fiethe

Document Change Record

Rev.	Date	Pages	Description
1.0	20.04.00	All	First Issue
1.1	01.09.00	3	Packet length for D2, R1..3 changed
2.0	19.04.02	All	Completely revised for FS
2.1	20.12.02	3,4,8-	Update HK in science data
2.2	31.10.03	All	Update science types, add compression types

1. Science Data Sets

Each Science Data Set consists of one or several Science Packets defined in 2.
All values are in TM-words (16 bits).

1.1 DFMS

Type No.	Type Ident.	Name	Length	Packet Count	Usage	Description
-	0x00	MCP Leda Mask	256	1	Internal Test	Read Leda Mask bits
-	0x01	MCP Leda Row A	1024	1	Internal Test	Read Leda Row A only
-	0x02	MCP Leda Row B	1024	1	Internal Test	Read Leda Row B only
-	0x03	MCP Leda Peak	2	1	Internal Test	Read Leda Peak Data only
-	0x05	CEM Single Data	4	1	Internal Test	Read CEM Data once
D1	0x81	MCP Leda Dual Raw	2062	2	Test + Calibration	14 HK + 2048 LEDA (A+B)
D7	0x87	MCP Leda 12bit	398	1	12bit data compr.	14 HK + 384 LEDA
D20	0x20	MCP Scan Wavelet Compressed	Max. 26426	Max. 13	Full or single spectrum	X * 14 HK (uncompressed) + Compr. Header + (X * 2048 / C) LEDA (X = no. of scans, C = compr. factor)
D2X	0x22.. 0x2F	MCP Scan LOG Reduction of Bits	Max. 103800	Max. 51	Full or single spectrum	X * 14 HK (uncompressed) + (X * 2048 * N / 32) LEDA (X = no. of scans, N = no. of bits)
D40	0x40	CEM Raw, Average, or Repetitive	Max. 814	1	Single spectrum	14 HK + (4 * Y) CEM (Y = No. of data points)
D42	0x42	FAR Raw, Average, or Repetitive	Max. 414	1	Single spectrum	14 HK + (2 * Y) FAR (Y = No. of data points)
D60	0x60	MCP Scan lossless Compressed	Max. 103800	Max. 51	Full or single spectrum	X * 14 HK (uncompressed) + Compr. Header + (X * 2048 / C) LEDA (X = no. of scans, C = compr. factor)

1.2 RTOF

Type No.	Type Ident.	Name	Length	Packet Count	Usage	Description
R20	0x14	ETS Full Raw	Max. 393385	Max. 193	Test + Calibration	160 HK + 9 Header + X*3 ETS
R21	0x15	ETSL Full Raw	Max. 393385	Max. 193	Test + Calibration	160 HK + 9 Header + X*3 ETSL
R22	0x16	ETS Select Raw	16369	8	300 mass * 18 points	160 HK + 9 Hd. + 16200 ETS
R23	0x17	ETSL Select Raw	16369	8	300 mass * 18 points	160 HK + 9 Hd. + 16200 ETL
R24	0x18	ETS Wavelet Compressed	Max. 98304	Max. 48	Full spectrum	160 HK + 9 Header + Compr. Header + X ETS (depends on compr. factor)
R25	0x19	ETSL Wavelet Compressed	Max. 98304	Max. 48	Full spectrum	160 HK + 9 Header + Compr. Header + X ETSL (depends on compr. factor)
R84	0x54	ETS Lossless Compressed	Max. 393385	Max. 193	Full spectrum	160 HK + 9 Header + Compr. Header + X ETS (depends on compr. factor)
R85	0x55	ETSL Lossless Compressed	Max. 393385	Max. 193	Full spectrum	160 HK + 9 Header + Compr. Header + X ETS (depends on compr. factor)

1.3 COPS

Type No.	Type Ident.	Name	Length	Packet Count	Usage	Description
C1	0x01	Full Pressure	304	1	Detailed Pressure	150 * NG Pressure every 2s

2. Science Packet Definitions

2.1 DFMS Science Packet

Position	Bytes	Bits	Name	Data
000	1		DFMS Science Header	0x84
001	1		Type Identifier	
002	2	15	Last Packet Status	1 = Last Packet
		14..0	Packet Count	0 = First Packet
004	2.. 4092		HK + Science Data	DFMS Science HK data only in first packet

2.2 RTOF Science Packet

Position	Bytes	Bits	Name	Data
000	1		RTOF Science Header	0x88
001	1		Type Identifier	
002	2	15	Last Packet Status	1 = Last Packet
		14..0	Packet Count	0 = First Packet
004	2.. 4092		HK + Science Data	RTOF Science HK data only in first packet

2.3 COPS Science Packet

Position	Bytes	Bits	Name	Data
000	1		COPS Science Header	0x8C
001	1		Type Identifier	
001	2	15	Last Packet Status	1 = Last Packet
		14..0	Packet Count	0 = First Packet
004	4		Dummy word	-
008	4.. 600		Pressure Data	32-bit IEEE Floating Point (bit 31: sign, bit 30..23: exponent, bit 22..0: 1.fraction)

3. Science Housekeeping Definitions

A set of science related HK data is transmitted at the beginning of each Science Data Set.

3.1 DFMS Science HK Data, Length 14 words

Position	Bytes	Bits	Name	Data
000	2		Mass * 100	
002	2		Measurement Mode	
004	2		Voltage flags 1	
		15..14	MG	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13..12	ISB	0 = Off, 1 = Ok, 2 = Low, 3 = High
		11..10	ISP	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	IRP1	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	IRP2	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	ERP	0 = Off, 1 = Ok, 2 = Low, 3 = High
		3..2	FIL 1 Bias	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	FIL 2 Bias	0 = Off, 1 = Ok, 2 = Low, 3 = High
006	2		Voltage flags 2	
		15..14	FIL 1 Emi	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13..12	FIL 2 Emi	0 = Off, 1 = Ok, 2 = Low, 3 = High
		11..10	SLL	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	SLR	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	SES	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	SEB	0 = Off, 1 = Ok, 2 = Low, 3 = High
		3..2	TLL	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	TLR	0 = Off, 1 = Ok, 2 = Low, 3 = High
008	2		Voltage flags 3	
		15..14	VACC Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13	FAR Repeller Enable	0 = Off, 1 = On
		12..0	ESA C DAC	Raw value
010	2		Voltage flags 4	
		15..14	ESS1 Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13..12	ESS2 Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		11..10	RQ Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	MP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	HP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	Z1Q Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		3..2	Z2Q Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	HVFDP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
012	2		Voltage flags 5	
		15	GCU Heater 1	0 = Off, 1 = On
		14	GCU Heater 2	0 = Off, 1 = On
		13	Cover Close	0 = Off, 1 = On
		12	Cover Open	0 = Off, 1 = On
		11..10	MCP Front	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	MCP Back1	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	MCP Back2	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	CEM HV Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High

		3..2	CEM REP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	CEM THR Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
014	2		ESAO DAC	Raw value
016	2		ESAI DAC	Raw value
018	2		MAG Temp	Raw value
020	2		GCU 1 Pout (if active) or Cover Position	Raw value
022	2		GCU 2 Pout (if active) or Motor Position	Raw value
024	2		LEDA or FAR offset setting	Raw value
026	2		Gain Step	

3.2 RTOF Science HK Data, Length 160 words

For correct X,Y values of HK data calculation see RTOF documentation!

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAR101: NRNDR100	1		RTOF Science HK Header	0xC8
		1		MC Data Retpath	
	NRNDR195		7	Cmd Error	0 = Off, 1 = On
	NRNDR101		6..2	Spare	
	NRNDR102		1	ETS Light Path	0 = Off, 1 = On
	NRNDR103		0	ETS Path	0 = Off, 1 = On
002	NRNAR103	2		RTOF HK counter	Counter 0..65535
004	NRNAR104	2		RTOF Cmd counter	Counter 0..65535
006	NRNAR105	2		RTOF Cmd Error counter	Counter 0..65535
008	NRNAR106	2		RTOF Cmd Error position	Hex value
010	NRNAR107	2		RTOF Science counter	Counter 0..65535
012	NRNAR108	2		RTOF Science Error counter	Counter 0..65535
014	NRNAR109	2		RTOF Science Error position	Hex value
016	NRNAR10A	2		RTOF S/W mode	
	NRNDR180		15	Spare	0 = Off, 1 = On
	NRNDR181		14	HK_ET5	0 = Off, 1 = On
	NRNDR182		13	HK_ETL	0 = Off, 1 = On
	NRNDR183		12	HK_GCU_COV	0 = Off, 1 = On
	NRNDR184		11.. 8	RTOF mode	Mode No.
	NRNDR185		7	RMOD_HVOP	0 = Off, 1 = On
	NRNDR186		6	RMOD_ET5	0 = Off, 1 = On
	NRNDR187		5	RMOD_ETL	0 = Off, 1 = On
	NRNDR188		4	RMOD_EX	0 = Off, 1 = On
	NRNDR189		3	RMOD_MCP	0 = Off, 1 = On
	NRNDR18A		2	RMOD_FEC	0 = Off, 1 = On
	NRNDR18B		1	RMOD_COV	0 = Off, 1 = On
	NRNDR18C		0	RMOD_GCU	0 = Off, 1 = On
018	NRNAR10B	2		RTOF S/W status	
	NRNDR18D		15	Function active	0 = Off, 1 = On
	NRNDR18E		14	Set volt active	0 = Off, 1 = On

	NRNDR18F		13	Execution active	0 = Off, 1 = On
	NRNDR190		12	Monitoring	0 = Off, 1 = On
	NRNDR191		11	Spare	0 = Off, 1 = On
	NRNDR192		10	Peakfit	0 = Off, 1 = On
	NRNDR193		9	Spare	0 = Off, 1 = On
	NRNDR194		8..0	RTOF status	Hex value
020	NRNAR10C	2		Mode number	Dec value
022	NRNAR10D	2		Status Bits 1	
	NRNDR106		15	PSU 9kV	0 = Off, 1 = On
	NRNDR107		14	PSU 70V	0 = Off, 1 = On
	NRNDR108		13	PSU Ion MCP	0 = Off, 1 = On
	NRNDR109		12	PSU Gas MCP	0 = Off, 1 = On
	NRNDR10A		11	PSU HM Power	0 = Off, 1 = On
	NRNDR10B		10	PSU Pulser	0 = Off, 1 = On
	NRNDR110		9	ETSL Ram Test Active	0 = Off, 1 = On
	NRNDR111		8	ETSL Ram Test Status	0 = Off, 1 = On
	NRNDR112		7	ETSL Ram Test Data	Dec value
	NRNDR10D		6	ETS Ram Test Active	0 = Off, 1 = On
	NRNDR10E		5	ETS Ram Test Status	0 = Off, 1 = On
	NRNDR10F		4	ETS Ram Test Data	Dec value
	NRNDR10C		3	Cover near open	0 = Off, 1 = On
			2	Cover near close	0 = Off, 1 = On
			1	OS Heat mode	0 = Off, 1 = On
			0	SS Heat mode	0 = Off, 1 = On
24	NRNAR10E	2		ETS/L Lower Read Address	Hex value
26	NRNAR10F	2		ETS/L Upper Read Address	Hex value
28	NRNAR110	2		Status Bits 2	
	NRNDR113		15.. 13	Spare	
	NRNDR196		12	ETSL Lower Range	0 = Off, 1 = On
	NRNDR197		11	ETSL Upper Range	0 = Off, 1 = On
	NRNDR114		10	FEC Fil 2 Gas	0 = Off, 1 = On
	NRNDR115		9	FEC Fil 1 Gas	0 = Off, 1 = On
	NRNDR173		8	FEC Fil 2 Ion	0 = Off, 1 = On
	NRNDR174		7	FEC Fil 1 Ion	0 = Off, 1 = On
	NRNDR116		6	FEC I Status	0 = Ion, 1 = Gas
	NRNDR117		5	FEC EH Ion	0 = Off, 1 = On
	NRNDR118		4	FEC EH Gas	0 = Off, 1 = On
	NRNDR119		3	ETS/L LRA Bit 16	Hex value
	NRNDR11A		2	ETS/L URA Bit 16	Hex value
	NRNDR11B		1	ETS Lower Range	0 = Off, 1 = On
	NRNDR11C		0	ETS Upper Range	0 = Off, 1 = On
030	NRNAR111	2		Sequence number	Dec value
032	NRNAR112	2		MC_FEC_ION_FIHEAT_I	I=value* X [mA]
034	NRNAR113	2		MC_FEC_GAS_FIHEAT_I	I = value * X [mA]
036	NRNAR114	2		MC_FEC_ION_REP_V_#A	V = value * X
038	NRNAR115	2		MC_FEC_ION_REP_V_#B	V = value * X
040	NRNAR116	2		MC_FEC_GAS_REP_V_#A	V = value * X
042	NRNAR117	2		MC_FEC_GAS_REP_V_#B	V = value * X
044	NRNAR118	2		MC_FEC_ION_FIL_V	V = value * X

046	NRNAR119	2		MC_FEC_GAS_FIL_V	V = value * X
048	NRNAR11A	2		MC_FEC_GAS_FIL_I	I = value * X [uA]
050	NRNAR11B	2		MC_FEC_ION_ENT1_V	V = value * X
052	NRNAR11C	2		MC_FEC_ION_ENT1_I	I = value * X [uA]
054	NRNAR11D	2		MC_FEC_GAS_TRAP_V	V = value * X
056	NRNAR11E	2		MC_FEC_HVVG_V	U = value * X [V]
058	NRNAR11F	2		MC_FEC_HEAT_VG_V	U = value * X [V]
060	NRNAR120	2		MC_FEC_TEMP	T = value * X [°C]
062	NRNAR121	2		MC_GCU_POW_#1	V = (value * X) - Y
064	NRNAR122	2		MC_GCU_POW_#2	V = (value * X) + Y
066	NRNAR123	2		MC_GCU_#1_I	V = (value * 366e-6)
068	NRNAR124	2		MC_GCU_#2_I	V = (value * 366e-6)
070	NRNAR125	2		MC_GCU_OUT_PRES_#1	V = (value * 366e-6)
072	NRNAR126	2		MC_GCU_OUT_PRES_#2	V = (value * 366e-6)
074	NRNAR127	2		MC_GCU_TEMP_PIRANI_# 1	V = (value * 366e-6)
076	NRNAR128	2		MC_GCU_TEMP_PIRANI_# 2	V = (value * 366e-6)
078	NRNAR129	2		MC_GEX_TEMP	V = (value * 366e-6)
080	NRNAR12A	2		MC_HM_PW	V = (value * X) + Y
082	NRNAR12B	2		MC_HM_DEL	V = (value * X) + Y
084	NRNAR12C	2		MC_HM_TEMP	V = (value * 366e-6)
086	NRNAR12D	2		MC_MOT_TOR	V = (value * X) + Y
088	NRNAR12E	2		MC_MOT_TEMP	°C = (value * X) + Y
090	NRNAR12F	2		MC Motor Position	
	NRNDR11D		15	Motor On	0 = Off, 1 = On
	NRNDR11E		14	Motor Positioning	0 = Off, 1 = On
	NRNDR11F		13.. 12	Velocity	0 = 5Hz, 1 = 10Hz, 2 = 20Hz, 3 = 40Hz
	NRNDR120		11	Open Switch	0 = Off, 1 = On
	NRNDR121		10	Closed Switch	0 = Off, 1 = On
	NRNDR122		9	Hall Error	0 = Off, 1 = On
	NRNDR123		8	Hall Error Fatal	0 = Off, 1 = On
	NRNDR124		7..0	Motor Position	Dec value
092	NRNAR130	2		MC Power State 2	
	NRNDR125		15	ETSL VDD On	0 = Off, 1 = On
	NRNDR126		14	ETSL VDD Off	0 = Off, 1 = On
	NRNDR127		13	ETSL VCC On	0 = Off, 1 = On
	NRNDR128		12	ETSL VCC Off	0 = Off, 1 = On
	NRNDR129		11	Heater Gas On	0 = Off, 1 = On
	NRNDR12A		10	Heater Gas Off	0 = Off, 1 = On
	NRNDR12B		9	Heater Ion On	0 = Off, 1 = On
	NRNDR12C		8	Heater Ion Off	0 = Off, 1 = On
	NRNDR12D		7	Motor Hall Enable	0 = Off, 1 = On
	NRNDR12E		6	Motor Hall Disable	0 = Off, 1 = On
	NRNDR12F		5	Motor Direction Open	0 = Off, 1 = On
	NRNDR130		4	Motor Direction Close	0 = Off, 1 = On
	NRNDR131		3	Motor Power On	0 = Off, 1 = On
	NRNDR132		2	Motor Power Off	0 = Off, 1 = On
	NRNDR133		1	Motor High Torque On	0 = Off, 1 = On

	NRNDR134		0	Motor High Torque Off	0 = Off, 1 = On
094	NRNAR131	2		MC Pulser State	
	NRNDR135		15	Gas Pulser On	0 = Off, 1 = On
	NRNDR136		14	Gas Pulser Off	0 = Off, 1 = On
	NRNDR137		13	HM Pulser On	0 = Off, 1 = On
	NRNDR138		12	HM Pulser Off	0 = Off, 1 = On
	NRNDR139		11	Ion Pulser On	0 = Off, 1 = On
	NRNDR13A		10	Ion Pulser Off	0 = Off, 1 = On
	NRNDR13B		9..0	Spare	
096	NRNAR132	2		MC Power State 6	
	NRNDR13C		15.. 10	Spare	
	NRNDR13D		9	Disable ETS LU	0 = Off, 1 = On
	NRNDR13E		8	Enable ETS LU	0 = Off, 1 = On
	NRNDR13F		7	ETS VCA On	0 = Off, 1 = On
	NRNDR140		6	ETS VCA Off	0 = Off, 1 = On
	NRNDR141		5	ETS VDD On	0 = Off, 1 = On
	NRNDR142		4	ETS VDD Off	0 = Off, 1 = On
	NRNDR143		3	ETS VCC On	0 = Off, 1 = On
	NRNDR144		2	ETS VCC Off	0 = Off, 1 = On
	NRNDR145		1	ETS VSH/VE On	0 = Off, 1 = On
	NRNDR146		0	ETS VSH/VE Off	0 = Off, 1 = On
098	NRNAR133	2		MC Power State 8	
	NRNDR147		15	GCU 1 On	0 = Off, 1 = On
	NRNDR148		14	GCU 1 Off	0 = Off, 1 = On
	NRNDR149		13	GCU 2 On	0 = Off, 1 = On
	NRNDR14A		12	GCU 2 Off	0 = Off, 1 = On
	NRNDR14B		11	GCU 1 Valve On	0 = Off, 1 = On
	NRNDR14C		10	GCU 1 Valve Off	0 = Off, 1 = On
	NRNDR14D		9	GCU 2 Valve On	0 = Off, 1 = On
	NRNDR14E		8	GCU 2 Valve Off	0 = Off, 1 = On
	NRNDR14F		7	FEC VCC On	0 = Off, 1 = On
	NRNDR150		6	FEC VCC Off	0 = Off, 1 = On
	NRNDR151		5	FEC VDD On	0 = Off, 1 = On
	NRNDR152		4	FEC VDD Off	0 = Off, 1 = On
	NRNDR153		3	FEC Heater VG On	0 = Off, 1 = On
	NRNDR154		2	FEC Heater VG Off	0 = Off, 1 = On
	NRNDR155		1	FEC HV VG On	0 = Off, 1 = On
	NRNDR156		0	FEC HV VG Off	0 = Off, 1 = On
100	NRNAR134	2		MC_ETSL_TEMP	$V = (\text{value} * 366e-6)$
102	NRNAR135	2		MC_ETS_TEMP_CLK	$V = (\text{value} * 366e-6)$
104	NRNAR136	2		MC_ETS_TEMP_DIG	$V = (\text{value} * 366e-6)$
106	NRNAR137	2		PSDC_ELB_I	$V = (\text{value} * X)$
108	NRNAR138	2		PSDC_ELA_I	$V = (\text{value} * X)$
110	NRNAR139	2		PSDC_GR_I	$V = (\text{value} * X)$
112	NRNAR13A	2		PSDC_BP_I	$V = (\text{value} * X)$
114	NRNAR13B	2		PSDC_GR_G	$V = (\text{value} * X)$
116	NRNAR13C	2		PSDC_BP_G	$V = (\text{value} * X)$
118	NRNAR13D	2		HV1_SL_G	$V = (\text{value} * X) + Y$
120	NRNAR13E	2		HV1_A2_G	$V = (\text{value} * X) + Y$

122	NRNAR13F	2		HV1_A1_G	$V = (\text{value} * X) + Y$
124	NRNAR140	2		HV1_SL_I	$V = (\text{value} * X) + Y$
126	NRNAR141	2		HV1_A2_I	$V = (\text{value} * X) + Y$
128	NRNAR142	2		HV1_A1_I	$V = (\text{value} * X) + Y$
130	NRNAR143	2		HV2_P_G	$V = (\text{value} * X) + Y$
132	NRNAR144	2		HV2_P_I	$V = (\text{value} * X) + Y$
134	NRNAR145	2		HV1_D	$V = (\text{value} * X) + Y$
136	NRNAR146	2		HV2_HM3	$V = (\text{value} * X) + Y$
138	NRNAR147	2		HV1_R1	$V = (\text{value} * X) + Y$
140	NRNAR148	2		HV1_R2	$V = (\text{value} * X) + Y$
142	NRNAR149	2		HV1_RL	$V = (\text{value} * X) + Y$
144	NRNAR14A	2		HV1_HM1	$V = (\text{value} * X) + Y$
146	NRNAR14B	2		HV2_HM2	$V = (\text{value} * X) + Y$
148	NRNAR14C	2		HV1_HML	$V = (\text{value} * X) + Y$
150	NRNAR14D	2		HV2_M_I	$V = (\text{value} * X) + Y$
152	NRNAR14E	2		HV2_M_G	$V = (\text{value} * X) + Y$
154	NRNAR14F	2		PSDC_E2_I	$V = (\text{value} * X)$
156	NRNAR150	2		PSDC_Temp_BP_I	TBD
158	NRNAR151	2		PSDC_Temp_BP_G	$T = (\text{value} * X) + Y$ [°C]
160	NRNAR152	2		PSU_Temp_MCP_I	TBD
162	NRNAR153	2		PSU_Temp_MCP_G	TBD
164	NRNAR154	2		PSU_Temp_HV1	$T = (\text{value} * X) + Y$ [°C]
166	NRNAR155	2		PSU_Temp_LVPS	$T = (\text{value} * X) + Y$ [°C]
168	NRNAR156	2		ETSL Status 1	
	NRNDR157		15	ETSL Ion Pulser Status	0 = Off, 1 = On
	NRNDR158		14	ETSL Gas Pulser Status	0 = Off, 1 = On
	NRNDR198		13	ETSL Sync Status	0 = Int, 1 = Ext
	NRNDR159		12	ETSL Calib. Trigger Status	0 = Off, 1 = On
	NRNDR15A		11	ETSL Data Readout Status	0 = Off, 1 = On
	NRNDR15B		10	ETSL Acquisition Status	0 = Off, 1 = On
	NRNDR15C		9	ETSL DTS Status Cancel	0 = Event, 1 = Extraction
	NRNDR15D		8	ETSL DTS Status	0 = Off, 1 = On
	NRNDR15E		7..6	ETSL Input Status	0 = Ion, 1 = Calibrator, 2 = Gas, 3 = Gas
	NRNDR199		5	ETSL Cal. Power Status	0 = Off, 1 = On
	NRNDR19A		4	ETSL ADC HIRM Status	0 = Off, 1 = On
	NRNDR19B		3	ETSL RAM Threshold	0 = Low, 1 = High
	NRNDR19C		2	ETSL FIFO Threshold	0 = Low, 1 = High
	NRNDR19D		1	ETSL Latchup Enabled	1 = Off, 0 = On
	NRNDR19E		0	ETSL Latchup Detected	0 = Off, 1 = On
170	NRNAR197	1		ETSL Status 2	
	NRNDR1B1		7	ETSL ADC Power Status	0 = Off, 1 = On
	NRNDR1B2		6	ETSL ADC Threshold	0 = High, 1 = Low
	NRNDR1B3		5..4	ETSL ML Mode	0 = Adapt, 1 = ML31, 2 = ML63, 3 = ML255
	NRNDR1B4		3..0	Spare	
	NRNDR1B5	1		ETSL Threshold Level	0 = 5.5mV, 1 = 8mV, 2 = 12mV, 3 = 16.7mV, 4 = 20mV, 5 = 23.4mV, 6 = 26.6mV, 7 = 33.4mV
172	NRNAR198	2		ETSL Extraction Delay	$t = (\text{Value} * X) + Y$

174	NRNAR199	2		ETSL ToF	$t = (\text{Value} * X) + Y$
176	NRNAR19A	2		ETSL Cal. Start Delay	$t = (\text{Value} * X) + Y$
178	NRNAR19B	2		ETSL Cal. Pulse Height	$V = (\text{value} * X) + Y$
180	NRNAR19C	2		ETSL Cal. Pulse Width	$t = (\text{value} * X) + Y$
182	NRNAR157	2		ETS Status 1	
	NRNDR15F		15	ETS Ion Pulser Status	0 = Off, 1 = On
	NRNDR160		14	ETS Gas Pulser Status	0 = Off, 1 = On
	NRNDR161		13	ETS Synchronization Status	0 = Int, 1 = Ext
	NRNDR162		12	ETS Calib. Trigger Status	0 = Off, 1 = On
	NRNDR163		11	ETS Data Readout Status	0 = Off, 1 = On
	NRNDR164		10	ETS Acquisition Status	0 = Off, 1 = On
	NRNDR165		9	ETS DTS Status Cancel	0 = Event, 1 = Extraction
	NRNDR166		8	ETS DTS Status	0 = Off, 1 = On
	NRNDR167		7.6	ETS Input Status	0 = Ion, 1 = Calibrator, 2 = Gas, 3 = Gas
	NRNDR168		5	ETS Cal. Power Status	0 = Off, 1 = On
	NRNDR169		4	ETS ADC HIRM Status	0 = Off, 1 = On
	NRNDR16A		3	ETS RAM Threshold	0 = Low, 1 = High
	NRNDR16B		2	ETS FIFO Threshold	0 = Low, 1 = High
	NRNDR16C		1	ETS Latchup Enabled	1 = Off, 0 = On
	NRNDR16D		0	ETS Latchup Detected	0 = Off, 1 = On
184	NRNAR158	1		ETS Status 2	
	NRNDR16E		7	ETS ADC Power Status	0 = Off, 1 = On
	NRNDR16F		6	ETS ADC Threshold	0 = High, 1 = Low
	NRNDR170		5..4	ETS ML Mode	0 = Adapt, 1 = ML31, 2 = ML63, 3 = ML255
	NRNDR171		3..0	Spare	
	NRNDR172	1		ETS Threshold Level	0 = 5.5mV, 1 = 8mV, 2 = 12mV, 3 = 16.7mV, 4 = 20mV, 5 = 23.4mV, 6 = 26.6mV, 7 = 33.4mV
186	NRNAR159	2		ETS Extraction Delay	$t = (\text{Value} * 26.5\text{ns}) + 158.5$
188	NRNAR15A	2		ETS ToF	$t = (\text{Value} * 26.5\text{ns}) + 26.5$
190	NRNAR15B	2		ETS Cal. Start Delay	$t = (\text{Value} * 26.5\text{ns}) + 26.5 + 141$
192	NRNAR15C	2		ETS Cal. Pulse Height	$V = (\text{value} * 2.314 \text{ mV}) + 4.928 \text{ mV}$
194	NRNAR15D	2		ETS Cal. Pulse Width	$t = (\text{value} * 1.2615 \text{ ns}) - 51.728 \text{ ns}$
196	NRNAR15E	2		Sent Commands Counter	
198	NRNAR160: NRNDR1A0	1		RTOF Ext. HK Header	0xE8
	NRNDR1A1	1		Spare	
200	NRNAR161	2		MC_FEC_PVCC_V	$U = \text{value} * 1\text{e-}3 - 0.0156 \text{ [V]}$
202	NRNAR162	2		MC_FEC_MVCC_V	$U = \text{value} * -7\text{e-}4 + 0.003 \text{ [V]}$
204	NRNAR163	2		MC_FEC_PVDD_V	$U = \text{value} * 3.1\text{e-}3 + 0.0497 \text{ [V]}$
206	NRNAR164	2		MC_FEC_MVDD_V	$U = \text{value} * -2.8\text{e-}3 + 0.1508 \text{ [V]}$
208	NRNAR165	2		MC_GCU_TEMP_TANK_#1	$V = (\text{value} * 366\text{e-}6)$
210	NRNAR166	2		MC_GCU_TEMP_TANK_#2	$V = (\text{value} * 366\text{e-}6)$
212	NRNAR167	2		MC_GCU_IN_PRES_#1	$V = (\text{value} * 366\text{e-}6)$
214	NRNAR168	2		MC_GCU_IN_PRES_#2	$V = (\text{value} * 366\text{e-}6)$
216	NRNAR169	2		MC_GEX_PVCC	$V = (\text{value} * 0.001) - 0.0058$
218	NRNAR16A	2		MC_GEX_VD	$V = \text{value} * 0.0083 - 0.0417 \text{ [V]}$
220	NRNAR16B	2		MC_IEX_PVCC	$V = (\text{value} * 0.001) - 0.0058$

222	NRNAR16C	2		MC_IEX_VD	V = value * 0.0083 -0.0417 [V]
224	NRNAR16D	2		MC_HM_PVCA	V = (value * 0.001) -0.0038
226	NRNAR16E	2		MC_HM_VD	V = (value * 0.0083) -0.0478
228	NRNAR16F	2		MC_ETSL_PVCC	V = (value * 0.0011) -0.467
230	NRNAR170	2		MC_ETSL_MVCA	V = (value * -7e-4) +6.1e-3
232	NRNAR171	2		MC_ETSL_PVDD	V = (value * 3.1e-3) -1.26e-2
234	NRNAR172	2		MC_ETSL_MVDD	V = (value * -2.8e-3) +6.8e-3
236	NRNAR173	2		MC_MOT_PVCC	V = (value * 0.0009) -0.0327
238	NRNAR174	2		MC_OMC_SW_OPEN	
240	NRNAR175	2		MC_OMC_SW_CLOSED	
242	NRNAR176	2		MC_HEAT_ION_VG	V = (value * 0.0051) -0.036
244	NRNAR177	2		MC_HEAT_GAS_VG	V = (value * 0.0052) -0.0362
246	NRNAR178	2		MC_ETS_33V	V = (value * 366e-6)
248	NRNAR179	2		MC_ETS_PVCA	V = (value * 366e-6)
250	NRNAR17A	2		MC_ETS_MVCA	V = (value * 366e-6)
252	NRNAR17B	2		MC_ETS_VE	V = value * 0.0014 -0.001 [V]
254	NRNAR17C	2		MC_ETS_PVDD	V = value * 0.0031 -0.0093 [V]
256	NRNAR17D	2		MC_ETS_MVDD	V = value * -0.0032 + 0.1103 [V]
258	NRNAR17E	2		MC_ETS_VSH	V = value * 0.0096 + 0.0747 [V]
260	NRNAR17F	2		MC_ETSL_PVCA	V = (value * 1.1e-3) -0.467
262	NRNAR180	2		MC_Spare	
264	NRNAR181	2		PSU_+5_Val	V = (value * -0.001488)
266	NRNAR182	2		PSU_-5_Val	V = (value * -0.001428)
268	NRNAR183	2		PSU_+15_Val	V = (value * -0.00458)
270	NRNAR184	2		PSU_-15_Val	V = (value * -0.004415)
272	NRNAR185	2		PSU_+24_Val	V = (value * -0.006954)
274	NRNAR186	2		PSU_+8_Val	V = (value * -0.0014792)
276	NRNAR187	2		PSU_+5_Add_Val	V = (value * -0.0014798)
278	NRNAR188	2		PSU_+40_Val	V = (value * -0.0174) -0.4234
280	NRNAR189	2		PSU_+70_Val	V = (value * -0.0107) + 4.173
282	NRNAR18A	2		PSU_+5_Cur	I = value * -0.4383 + 30 [mA]
284	NRNAR18B	2		PSU_-5_Cur	I = value * -0.1508 -28.016 [mA]
286	NRNAR18C	2		PSU_+15_Cur	I = value * -0.1133 -16.502 [mA]
288	NRNAR18D	2		PSU_-15_Cur	I = value * -0.0553 -24.715 [mA]
290	NRNAR18E	2		PSU_+24_Cur	I = value * -0.1285 + 33.042 [mA]
292	NRNAR18F	2		PSU_+40/70_Cur	I = value * -0.0174 -0.4234 [mA]
294	NRNAR190	2		PSU_+5_Add_Cur	I = value * -0.0571 + 3.4918 [mA]
296	NRNAR191	2		PSU_+8_Cur	I = value * -0.0254 + 5.663 [mA]
298	NRNAR192	4		ETSL NOE	
			31.. 25	Spare	
	NRNDR1A5		24.. 17	NOE High value	Dec value
			16.. 9	Spare	
	NRNDR1A6		8..1	NOE Low value	Dec value
	NRNDR1A7		0	NOE Status	0 = Continuous, 1 = NOE
302	NRNAR193	2		ETS NOE High	

			15.. 9	Spare	
	NRNDR1A2		8..1	NOE High value	Dec value
304	NRNAR194	2		ETS NOE Low	
			15.. 9	Spare	
	NRNDR1A3		8..1	NOE Low value	Dec value
	NRNDR1A4		0	NOE Status	0 = Continuous, 1 = NOE
306	NRNAR195	2		Spare 1	
308	NRNAR196	2		Spare 2	
310		4		ETS/L Start time	S/C time in sec.
311		4		ETS/L Stop time	S/C time in sec.
312		2		Dummy	Fill bytes