SYSTEM COMMANDS					
COMMAND	BYTES	OPCODE [PARAMETERS] B7-B6: en/dsbl B5-B2: cmd B2-B0: parameter		UNITS	DESCRIPTION
MODE HEADER		9A	En.cmd param		System command stem
L_SYS_PTEST_EN	2	9A 81			Enable LENA autonomous performance test at boot (default)
L_SYS_PTEST_DSBL	2	9A 41			Disable LENA autonomous performance test at boot
L_SYS_MODE_PRAM	2	9A 71		-	LENA operational mode set to program RAM (default)
L_SYS_MODE_ROM	2	9A 44	01 0001 00	-	LENA operational mode set to ROM
L_SYS_MODE_HVD	2	9A 45	01 0001 01	-	LENA operational mode set to HV DISABLED
L_SYS_MODE_HVSF	2	9A 46	01 0001 10	-	LENA operational mode set to HV SAFE
L_SYS_MODE_NRML	2	9A 47	01 0001 11	-	LENA operational mode set to NORMAL
L_SYS_HKNRM_EN	2	9A A0		-	Enable NORMAL hk packet transmission
L_SYS_HKNRM_DSBL	2	9A 60		-	Disable NORMAL hk packet transmission
L_SYS_HKQL_EN	2	9A 89	10 0010 01	-	Enable QUICK LOOK hk packet transmission
L_SYS_HKQL_DSBL	2	9A 49	01 0010 01	-	Disable QUICK LOOK hk packet transmission
L_SYS_HKCM_EN	2	9A 8A	10 0010 10	-	Enable COMMAND RECORD hk packet transmission
L_SYS_HKCM_DSBL	2	9A 4A	01 0010 10	-	Disable COMMAND RECORD hk packet transmission
L_SYS_HKDG_EN	2	9A 8B	10 0010 11	-	Enable DIAGNOSTIC hk packet transmission

L_SYS_HKDG_DSBL	2	9A 4B	01 0010 11	-	Disable DIAGNOSTIC hk packet transmission
L_SYS_HKMEM_EN	2	9A A2		-	Enable MEMORY hk packet transmission
L_SYS_HKMEM_DSBL	2	9A 61		-	Disable MEMORY hk packet transmission
L_SYS_INST_RST	2	9A A8	10 1010 00	-	Reset LENA
L_SYS _ERR_RST	2	9A AB	10 1010 11	-	reset all error counters, registers and flags
L_SYS _BIN_EN	2	9A 8D	10 0011 01	-	Enable transmission of Binned science data packet
L_SYS _BIN_DSBL	2	9A 4D	01 0011 01	-	Disable transmission of Binned science data packet
L_SYS _EVENT_EN	2	9A 8E	10 0011 10	-	Enable transmission of Event science data packet
L_SYS _EVENT_ DSBL	2	9A 4E	01 0011 10	-	Disable transmission of Event science data packet
L_SYS _SNGLS_EN	2	9A 8F	10 0011 11	-	Enable transmission of Singles science data packet
L_SYS _SNGLS_ DSBL	2	9A 4F	01 0011 11	-	Disable transmission of Singles science data packet
L_SYS_ROI_SEL	3	9A 4C [0000 $b_3b_2b_1b_0$]	01 0011 00	-	Enable transmission of selected ROI segment(s) indicated by binary pattern [b_n]. “1" in selected field enables segment transfer. “0" disables segment transfer. b_0 - ROI 0 data (default=1) b_1 - ROI 1 data (default=0) b_2 - ROI 2 data (default=0) b_3 - ROI 3 data (default=0)
L_SYS_HKPTS_EN	2	9A B1		-	Enable performace test hk packet transmission
L_SYS_HKPTS_DSBL	2	9A B2		-	Disable performace test hk packet transmission
L_SYS_HKSTR_EN	2	9A 21			Enable transmission of hvps stripchart hk packet
L_SYS_HKSTR_DSBL	2	9A 22			Disable transmission of hvps stripchart hk packet

L_SYS_HKNMA_EN	2	9A 27			Enable transmission of normal-a hk packet
L_SYS_HKNMA_DSBL	2	9A 2D			Disable transmission of normal-a hk packet
L_SYS_UPLD_REQ	3	9A 63 P			Request upload from CIDP block P [0 <= P <= 4]
L_SYS_ISNC_EN	2	9A 95	10 0101 01	-	Enable internal sync signal
L_SYS_ISNC_DSBL	2	9A 55	01 0101 01	-	Disable internal sync signal
L_SYS_HVP_VTHR	7	9A 99 [V_{AA}] [V_{BB}] [V_{CC}] [V_{DD}] [V_{EE}]	10 0110 01	TBD kV/bit TBD kV/bit TBD kV/bit TBD kV/bit TBD kV/bit	Set overvoltage thresholds for high voltage power supplies. Overvoltage limits V for each supply are parameterized, where $0 < V \leq$ FFH. AA – MCP Start BB – MCP Stop CC – Collimator+ DD – Collimator- EE – Optics
L_SYS_NOP	2	9A 00			NOP command.
L_SYS_HVP_ITHR	7	9A 9D [I_{AA}] [I_{BB}] [I_{CC}] [I_{DD}] [I_{EE}]	10 0111 01	TBD kV/bit TBD kV/bit TBD kV/bit TBD kV/bit TBD kV/bit	Set overcurrent thresholds for high voltage power supplies. Overcurrent limits I for each supply are parameterized, where $0 < I \leq$ FFH. AA – MCP Start BB – MCP Stop CC – Collimator+ DD – Collimator- EE – Optics
L_SYS_OVCT_THR	4	9A 13 P1 P0		cnts/sec	Set start rate overcount threshold to 16-bit parameter (0xFF 0xFF default)
L_SYS_RSTR_EN	2	9A C4			Enable LENA autorestart after warm boot

L_SYS_RSTR_DSBL	2	9A C8			Disable LENA autorestart after warm boot (cold boot default)
LSYS_ACQR_EN	2	9A 5A			Enable science data acquistion (default)
LSYS_ACQR_DSBL	2	9A 5C			Disable science data acquisiton
L_SYS_STAT_SAVE	2	9A C1			Save LENA configuration state
L_SYS_STAT_RSTR	2	9A C7			Restore LENA configuration state
L_SYS_DADR_SET	4	9A 35 [$A_3A_2A_1A_0$]			Set 16-bit hex address [A3 A2 A1 A0] of data read by diagnostic register

ROI COMMANDS

COMMAND	BYTES	OPCODE [PARAMETERS]		UNITS	DESCRIPTION
ROI HEADER		D2	sys.param		ROI Command Stem
L_ROI_CNFG_PKG0	6	D2 54 [R_{AA}] [R_{BB}] [CCCC DDDD] [0000 EEFF]	0101 0100	bin no.	Define TOF, Polar, and Energy bin ranges for Region-of-interest 0. R_{AA} = TOF Start Bin, R_{BB} = TOF Stop Bin CCCC = Polar Start Bin, DDDD = Polar Stop Bin EE = Energy Start Bin, FF = Energy Stop Bin
L_ROI_CNFG_PKG1	6	D2 58 [R_{AA}] [R_{BB}] [CCCC DDDD] [0000 EEFF]	0101 1000	bin no.	Define TOF, Polar, and Energy bin ranges for Region-of-interest 1. R_{AA} = TOF Start Bin, R_{BB} = TOF Stop Bin CCCC = Polar Start Bin, DDDD = Polar Stop Bin EE = Energy Start Bin, FF = Energy Stop Bin
L_ROI_CNFG_PKG2	6	D2 66 [R_{AA}] [R_{BB}] [CCCC DDDD] [0000 EEFF]	0110 0110	bin no.	Define TOF, Polar, and Energy bin ranges for Region-of-interest 2. R_{AA} = TOF Start Bin, R_{BB} = TOF Stop Bin CCCC = Polar Start Bin, DDDD = Polar Stop Bin EE = Energy Start Bin, FF = Energy Stop Bin
L_ROI_CNFG_PKG3	6	D2 68 [R_{AA}] [R_{BB}] [CCCC DDDD] [0000 EEFF]	0110 1000	bin no.	Define TOF, Polar, and Energy bin ranges for Region-of-interest 3. R_{AA} = TOF Start Bin, R_{BB} = TOF Stop Bin CCCC = Polar Start Bin, DDDD = Polar Stop Bin EE = Energy Start Bin, FF = Energy Stop Bin

PERFORMANCE TEST COMMANDS

COMMAND	BYTES	OPCODE [PARAMETERS]		UNITS	DESCRIPTION
PERFORMANCE TEST HEADER		56	En.cmd.sply		PTEST command stem
L_TST_LV_EN	2	56 81		-	***Enable low voltage performance test***
L_TST_HV_EN	2	56 41	01 000 000	-	Enable high voltage performance test
L_TST_MSTR_EN	3	56 84 V0		-	Enable MCP start HV power supply test. Parameter V0 is max test voltage
L_TST_MSTR_DSBL	2	56 44		-	Disable MCP start HV power supply test . Parameter V0 is max test voltage
L_TST_MSTP_EN	3	56 95 V0		-	Enable MCP stop HV power supply test. Parameter V0 is max test voltage
L_TST_MSTP_DSBL	2	56 55		-	Disable MCP stop HV power supply test
L_TST_COLP_EN	3	56 96 V0		-	Enable Collimator Positive HV power supply test. Parameter V0 is max test voltage
L_TST_COLP_DSBL	2	56 56		-	Disable Collimator Positive HV power supply test
L_TST_COLN_EN	3	56 87 V0		-	Enable Collimator Negative HV power supply test. Parameter V0 is max test voltage
L_TST_COLN_DSBL	2	56 47		-	Disable Collimator Negative Positive HV power supply test
L_TST_OPT_EN	3	56 88 V0		-	Enable Ion Optics HV power supply test. Parameter V0 is max test voltage
L_TST_OPT_DSBL	2	56 48		-	Disable Ion Optics Positive HV power supply test
L_TST_STR_EN	3	56 99 V0		-	Enable Optics Steering power supply test. Parameter V0 is max test voltage
L_TST_STR_DSBL	2	56 59		-	Disable Optics Steering power supply test

HVPS COMMANDS					
COMMAND	BYTES	OPCODE [PARAMETERS]		UNITS	DESCRIPTION
HVPS HEADER		A5	En.cmd.sply		HVPS command stem
L_HVP_MSTR_EN	2	A5 80	10 000 000	-	Enable or disable MCP Start HV power supply
L_HVP_MSTR_DSBL	2	A5 40	01 000 000	-	Disable MCP Start HV power supply
L_HVP_MSTP_EN	2	A5 81	10 000 001	-	Enable MCP Stop HV power supply
L_HVP_MSTP_DSBL	2	A5 41	01 000 001	-	Disable MCP Stop HV power supply
L_HVP_COLP_EN	2	A5 82	10 000 010	-	Enable Collimator Positive HV power supply
L_HVP_COLP_DSBL	2	A5 42	01 000 100	-	Disable Collimator Positive HV power supply
L_HVP_COLN_EN	2	A5 83	10 000 011	-	Enable Collimator Negative HV power supply
L_HVP_COLN_DSBL	2	A5 43	01 000 011	-	Disable Collimator Negative HV power supply
L_HVP_OPT_EN	2	A5 84	10 000 100	-	Enable Ion Optics HV power supply
L_HVP_OPT_DSBL	2	A5 44	01 000 100	-	Disable Ion Optics HV power supply
L_HVP_GBL SAFE	2	A5 1F	01 010 111	-	limit max HVPS output to 20% of F.S.
L_HVP_GBL_USAFE	2	A5 9F	10 010 111	-	max HVPS outputs are limited to 100% of F.S.
L_HVP_MSTR_ CMD	3	A5 60 [V]	01 100 000	TBD kV/bit	Send voltage command [V_1V_0] hex to MCP Start HV power supply. $0 < V \leq FFH$
L_HVP_MSTP_ CMD	3	A5 61 [V]	01 100 001	TBD kV/bit	Send voltage command [V_1V_0] hex to MCP Stop HV power supply. $0 < V \leq FFH$
L_HVP_COLP_ CMD	3	A5 62 [V]	01 100 010	TBD kV/bit	Send voltage command [V_1V_0] hex to Collimator Positive HV power supply. $0 < V \leq FFH$

L_HVP_COLN_ CMD	3	A5 63 [V]	01 100 011	TBD kV/bit	Send voltage command [V_1V_0] hex to Collimator Negative HV power supply. $0 < V \leq FFH$
L_HVP_OPT_ CMD	3	A5 64 [V]	01 100 100	TBD kV/bit	Send voltage command [V_1V_0] hex to Ion Optics HV power supply. $0 < V \leq FFH$
L_HVP_STR_CMD	3	A5 65 [V]	01 100 101	TBD kV/bit	Send voltage command [V_1V_0] hex to Optics Steering HV power supply. $0 < V \leq FFH$
L_HVP_GBL_OFF	2	A5 6F	01 101 111	-	Execute HVPS shutdown macro (slew to 0V, safe, disable)
L_HVP_SCN_EN	2	A5 D1			Enable steering supply scan.
L_HVP_SCN_DSBL	2	A5 D2			Disable steering supply scan.
L_HVP_SCN_LD	18	A5 D7 P[15] – P[0]			Steering scan table is defined by array P[15] – P[0]. Steering supply steps through 1 command P[n] per spin.

TOF COMMANDS

COMMAND	BYTES	OPCODE	[PARAMETERS]	UNITS	DESCRIPTION
TOF HEADER		B6	en.sys.ssys		TOF command stem
L_TOF_MODE_STST	2	B6 33		-	Enable TOF start-stop mode (default)
L_TOF_MODE_STRT	2	B6 03		-	Enable TOF start-only mode
L_TOF_BIN_STRT1	3	B6 21H $[P_1P_0]$	01 00 0001	nsec	Define start TOF definition for species_1 binning interval. $[P_1P_0]$ - species1 start threshold 0 < threshold ≤ FFH, for all species
L_TOF_BIN_STOP1	3	B6 22H $[P_1P_0]$	01 00 0010	nsec	Define stop definition for species_1 binning interval. $[P_1P_0]$ - species1 start threshold 0 < threshold ≤ FFH
L_TOF_BIN_STRT2	3	B6 23H $[P_1P_0]$	01 00 0011	nsec	Define start TOF definition for species_2 binning interval. $[P_1P_0]$ – species2 start threshold 0 < threshold ≤ FFH
L_TOF_BIN_STOP2	3	B6 24H $[P_1P_0]$	01 00 0100	nsec	Define stop TOF definition for species_2 binning interval. $[P_1P_0]$ – species2 start threshold 0 < threshold ≤ FFH, for all species
L_TOF_BIT_ON	2	B6 91H	10 01 0001	-	Enable TOF built-in-test mode
L_TOF_BIT_OFF	2	B6 51H	01 01 0001	-	Disable TOF built-in-test mode
L_TOF_BIT_STRB	2	B6 52H	01 01 0010	-	Route single strobe to TOF system. Active in BIT mode only.
L_TOF_BIT_DELAY	3	B6 53H $[P_1P_0]$	01 01 0011	-	Define TOF BIT mode delay. Active in BIT mode only. 0 < delay ≤ FFH
L_TOF_TRSH_START	3	B6 61H $[P_1P_0]$	01 10 0001	-	Define TOF CFD start threshold. 0 < threshold ≤ FH
L_TOF_TRSH_STOP	3	B6 62H $[P_1P_0]$	01 10 0010	-	Define TOF CFD stop threshold. 0 < threshold ≤ FH

PSS COMMANDS				
COMMAND	BYTES	OPCODE [PARAMETERS]		DESCRIPTION
PSS HEADER		C7	sys.param	PSS Command Stem
L_PSS_GAIN_LOW	2	C7 11	0001 0001	Set gain of position anodes to LOW gain (default).
L_PSS_GAIN_HIGH	2	C7 12	0001 0010	Set gain of position anodes to HIGH gain.

MEMORY COMMANDS

COMMAND	BYTES	OPCODE [PARAMETERS]		DESCRIPTION
MEMORY ACCESS HEADER		E9	dc.type.rd/wr	Memory Access Command Stem
L_MEM_WORD_RD	6	E9 0A [$A_3A_2A_1A_0$] [$N_3N_2N_1N_0$]	0000 10 10	Read LENA memory space. Transfer [$N_3N_2N_1N_0$] (hex) 16-bit words beginning at 16 bit hex address [$A_3A_2A_1A_0$].
L_MEM_WORD_WR	6+	E9 09 [$A_3A_2A_1A_0$] [$N_3N_2N_1N_0$] (data follows)	0000 10 01	Write to LENA memory space. Transfer [$N_3N_2N_1N_0$] (hex) 16-bit words beginning beginning at 16 bit hex address [$A_3A_2A_1A_0$].
L_MEM_BYTE_RD	6	E9 06 [$A_3A_2A_1A_0$] [$N_3N_2N_1N_0$]	0000 01 10	Read LENA memory space. Transfer [$N_3N_2N_1N_0$] (hex) bytes beginning at 16 bit hex address [$A_3A_2A_1A_0$].
L_MEM_BYTE_WR	6+	E9 05 [$A_3A_2A_1A_0$] [$N_3N_2N_1N_0$] (data follows)	0000 01 01	Write LENA memory space. Transfer [$N_3N_2N_1N_0$] (hex) bytes beginning at 16 bit hex address [$A_3A_2A_1A_0$].
L_MEM_PRAM_RD	6+	***E9 39*** [$A_3A_2A_1A_0$] [$N_3N_2N_1N_0$] (data follows)		Read program ram space. Transfer [$N_3N_2N_1N_0$] (hex) bytes beginning at 16 bit hex address [$A_3A_2A_1A_0$].