

WEC INSTRUMENT USER MANUAL

CHAPTER 6

NOMINAL OPERATIONS

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Acronyms

See Chapter 1.

6.1 GENERAL INTRODUCTION

WEC modes have been defined for each bit rate allocated to the wave consortium: Normal Bit Rate (NBR), High Bit Rate (HBR for Burst mode BM1, Burst mode BM2, Burst Mode BM3). Table 6.1.1 gives the ESA and WEC terminologies plus the WEC bit rates. If needed, other WEC modes can be programmed.

ESA Terminology	WEC Bit Rate (adjusted)	WEC Modes Possible
Housekeeping VC0 only	298.12	STANDBY or OFF
Science Nominal VC2 - Nominal NM1 - Nominal NM2 - Nominal NM3	5217.17 <i>NM1-3 are identical for WEC</i>	Any WEC NBR Mode
Science Burst VC3 - Burst Mode BM1 - Burst Mode BM2 - Burst Mode BM3	43898.73 91263.15 29458.36	Any WEC HBR Mode BM2-WBD BM3-EFW

Table 6.1.1

Each WEC mode corresponds to a macro command sequence implemented in the DWP memory. Some macros are included in the DWP ROM memory others must be loaded when required. The implementation sub-sections of section 6.4 indicate the macro slot number for macros in the ROM memory, or the command sequence name for macros that must be loaded when required. In nominal operations uploaded macros are always stored in slot 23 for NBR modes and slot 20 for HBR modes.

When needed (for instance for a particular campaign), the modes can be adjusted by specifying parameters to command sequences for uploaded macros, or by additional command sequences to patch a macro or modify the operation of an instrument. Such changes are referred to as “switches” by the WEC operations group. These are changes to a WEC instrument which do not alter the quantity and format of the data being produced by that instrument. Neither do they, in general, alter the physical type of the data being transmitted. Example of switches could be bias current variations to the EFW sensors or changing parameters passed to WBD. Descriptions for each mode are given in the following sub-sections.

The proposed WEC modes are described in sections 6.4.1. to 6.4.18.. Most of them have time structure adjusted to the recurrence of the WHISPER sounder. The time is given in second (s) or in spin periods (sp). In the tables, the terms STAFF-Sc and STAFF-Sa respectively stand for search coils and spectrum analyser. Definitions for the internal instrument configurations are given in section 1.3. Their main characteristics are summarised below.

For the purpose of commanding WEC via JSOC and ESOC the modes OFF and STANDBY are also defined. STANDBY is an intermediate state used when commanding transitions between other modes.

The selection of a particular WEC mode depends first on the bit rate allocated. Once the NBR, HBR and Burst time intervals are known one must take into account the following considerations.

NBR and HBR

Basic modes, to be run approximately 75% of the time, have been defined. They are good compromise between all WEC instruments. They can be used in any of the geophysical regions crossed by the CLUSTER satellites.

Specific modes, giving priority to one WEC instrument, may be operated :

- under external constraints such as the real time coverage of the NASA Deep Space Network (DSN), or status of the PEACE and CIS experiments (see figure 6.2), JSOC is expected to help coordinate this activity.
- upon agreement between the WEC experimenters, for instance as regards to the EFW internal modes which allows the operation of the four probes individually in current mode (to measure density/temperature) or voltage mode (to measure electric field).

A power-on default (and emergency) mode has been defined to yield a reasonable set of scientific data in the event of any of four possible worst case or emergency situations :

- (i) no command link into DWP (perhaps due to a failure),
- (ii) spacecraft power limited (again a safe assumption),
- (iii) low spacecraft bit-rate (the safe assumption),
- (iv) DWP capabilities limited (perhaps due to a radiation damage).

The flowchart used when DWP is switch ON is described in figure 6.1.

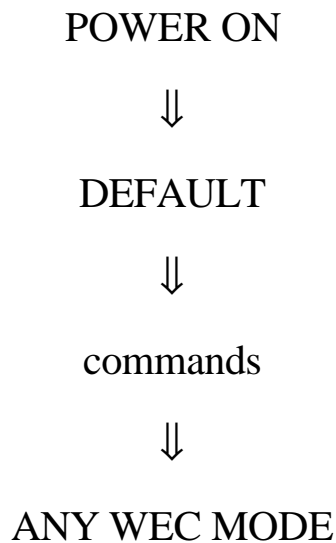


Figure 6.1.1 Flowchart used when DWP is switched ON.

Burst Modes

The BM1 mode selection is a matter of agreement between the WEC experimenters, Burst mode BM2 and BM3 are uniquely defined.

Examples of commands are :

- Configure DWP if necessary,
- Use an onboard ROM macro,
- Modify an onboard ROM macro,
- Generate a new macro,
- Generate an instrument switch, ...

There is no forbidden transition to change to any other WEC mode.

WEC PLANNING OPERATIONS

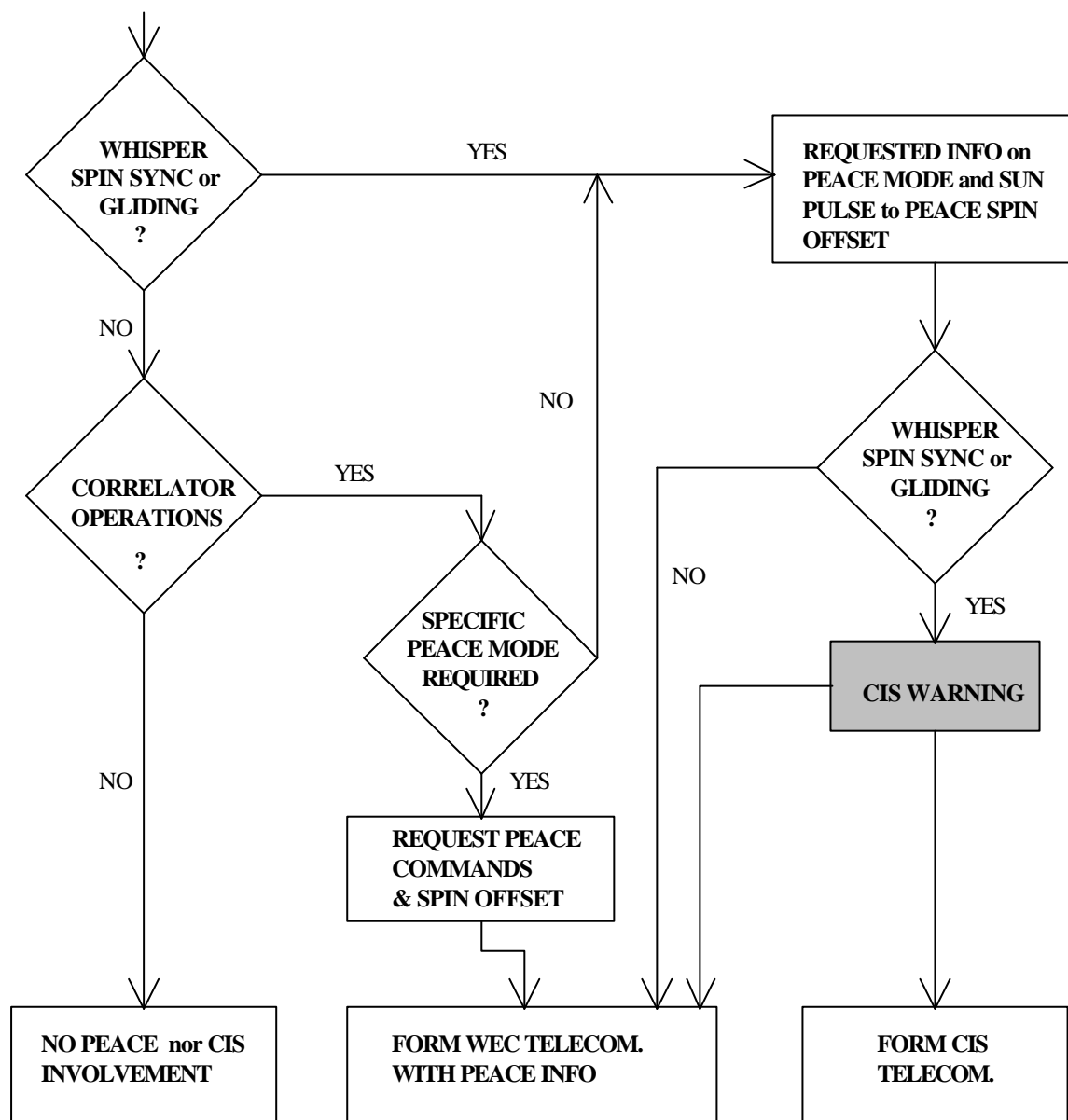


Figure 6.1.2

This scheme describes the logic of WEC/PEACE coordination in planning operations.

- Some correlator operations require a **specific PEACE mode**; all need **information on PEACE operations**.
- Whisper spin SYNC and gliding modes need to adjust to PEACE sequencing, **information on PEACE** is thus required.

- Coordination with CIS (TBD) could consist on a warning from WEC, attached with PEACE information, transmitted to CIS in case WHISPER is in SYNC or gliding mode.

6.2 OPERATIONAL PROCEDURES

The planning and implementation of WEC nominal operations is handled by the Science Working Team (SWT), the WEC Operations Group (WEC-OPS), the Joint Science Operations Centre (JSOC) and the European Space Operations Centre (ESOC). The science working team choose the WEC modes required for each planning period and include this information in the Master Science Plan (MSP).

The WEC operations group define for each allowable mode transition, the set of calls to command sequences that are required to command the transition from the initial mode to the target mode. Note that these modes could be OFF or STANDBY as well as data taking modes. This set of calls to command sequences is termed an Instrument Baseline Mode Definition (IBMD). The current IBMD definitions are available on the JSOC web server at:

<http://jsoc1.bnsc.rl.ac.uk/DOC/ClusterReports/CommInfo/WEC/>

in files `wec_ibmd.lst`, `wec_val.lst`, `wec_henc.lst`. Command sequences are sets of one or more commands together with any necessary time delays. The command sequences for WEC are defined by the WEC operations group and listed in annex OCS1 of the WEC User Manual. JSOC then use the Master Science Plan and the IBMD's to define PI Observation Request (PIOR) files which contain calls to all the command sequences required for each planning period. The WEC operations group may then request changes to the PIOR files and must approve the final version.

The WEC operations group is also responsible for extracting from the PEACE PIOR file information about the PEACE sweep mode and offset, and ensuring that the WEC mode is compatible.

The final version of the PIOR is used to create an Observational Request (OBRQ) file which is sent to ESOC to create the list of commands for uploading to the spacecraft.

It should be noted that for nominal operations nearly all WEC mode transitions are commanded via the STANDBY mode. For example, to start the NBR Basic mode when the experiment is initially off, it is first necessary to use the IBMD for OFF to STANDBY, followed by STANDBY to NBR Basic.

Nearly all the modes defined for nominal operations require a DWP configuration with at least two full speed transputers. A few modes require three full speed transputers. The DWP configuration can only be set during the mode transition from OFF to STANDBY.

The following table lists the modes presently defined for nominal operations planning. The detailed descriptions of most observational modes are in section 6.4.

JSOC name	Section	Description
OFF		WEC powered off
STBY	6.4.1	Standby mode
BM2W	6.4.17	BM2 - Wideband data via DWP
BM3E	6.4.18	BM3 - EFW burst memory dump
BMAN	6.4.15	HBR Angle
BMBA	6.4.8	HBR Basic Mode
BMCA		HBR Calibration
BMCO	6.4.12	HBR Continuously Active Mode
BMCL	6.4.16	HBR Correlator
BMEA	6.4.13	HBR EFW Mode (version A)
BMEB	6.4.13	HBR EFW Mode (version B)
BMLA	6.4.10	HBR Langmuir Mode (version A)
BMLB	6.4.10	HBR Langmuir Mode (version B)
BMLC	6.4.11	HBR Spin Synchronised Gliding (B)
BMLR	6.4.9	HBR Low Recurrence
BMSY	6.4.11	HBR Spin Synchronised Gliding (A)
BMWH	6.4.14	HBR Whisper Mode
NMBA	6.4.2	NBR Basic
NMCA		NBR Calibration
NMCO	6.4.6	NBR Continuously Active Mode
NMLA	6.4.4	NBR Langmuir Mode (version A)
NMLB	6.4.4	NBR Langmuir Mode (version B)
NMLC	6.4.4	NBR Langmuir Mode (version C)
NMLR	6.4.3 and 6.4.7	NBR Low Recurrence
NMSY	6.4.5	NBR Spin Synchronised Mode

In the event that less than two full speed transputers are available then contingency operations applies. The only mode presently defined for contingency operations is the Default Emergency Mode (section 6.4.1) although other modes are certainly possible, depending on exactly what resources are available.

6.3 INTERNAL MODES

The WEC modes are constructed from the internal modes of each WEC experiment. Although those modes are defined in section 1 one recall here their main parameters.

6.3.1 STAFF SA

MODES	Δt between auto-Correl	Δt between Cross-Correl	Field Components	bps
NM1	1 s	4 s	3B, 2E	1696
NM1'b	1 s	4 s	3B	864
NM2-b*	0.5 - 1 s	1 s	3B	1840
NM2-e*	0.5 - 1 s	1 s	1B, 2E	1840
FM1	.125 s	1 s	3B, 2E	7600
FM2	.25 s	1 s	3B, 2E	4528
FM3b	.125 s	1 s	3B	4160
FM3e	.125 s	1 s	1B, 2E	4160
EM	2 s	4 s	3B, 2E	1120
SM	0.5 - 1 s	2 s	3B, 2E	3032

Table 6.3.1

* **NOTE:** Low power modes no longer exist for Staff SA

6.3.2 STAFF-SC:

MODES	bps
NM	928
BM	16480
EMNBR	1216
EMHBR	21760

Table 6.3.2

6.3.3 WBD:

Sensor	Gain mode	Freq. conv.	Bandwidth
WBD0	Ez	Auto	9.5 kHz
WBD1	Ez	Auto	77 kHz
WBD2	Ez	Auto	19 kHz
WBD3	Ez	Auto	77 kHz
WBD4	Ez	Auto	77 kHz
WBD5	Ez	Auto	9.5 kHz

Table 6.3.3

In regard to WBD, with the exception of the WBD5 mode which is used during calibration only, measurements are performed on one Electric component. WBD0 and WBD1 are used during approximately 90% of available DSN coverage to support WEC science objectives. These modes utilise bandwidths of 9.5 kHz and 77 kHz. WBD2, WBD3, and WBD4 are used during the remaining 10% of DSN real-time coverage to support specific WBD science objectives. These modes utilise frequency conversion (respectively : 125 kHz, 125 kHz, and 250 kHz) and the bandwidth are : 19 kHz, 77 kHz, and 77 kHz.

6.3.4 EFW:

	E component*	Langmuir probe	bps
EFW1 - a	2	0	1440
EFW1 - b	1	1	1440
EFW1 - c	1 (+1)	1	1440
EFW1 - d	(1)	2	1440
EFW2 - a	2	0	15040
EFW2 - b	(1)	2	15040
EFW2 - c	1 (+1)	1	15040
EFW3 - a	1	2	22240
EFW3 - b	0	3	22240
EFW3 - c	1 (+1)	1	22240
EFW3 - d	2 (+1)	0	22240
EFW4 - a	0	4	29440
EFW4 - b	4**	0	29440

Not so good s/c pot.

No s/c pot.

Table 6.3.4

* filter bandwidth : 10 Hz, 180 Hz, 4 kHz, 32 kHz, or 50 Hz-8 kHz; for real time telemetry only the 10 Hz and 180 Hz may be used.

** Voltages are measured from probe to satellite

6.3.5 WHISPER

WHISPER elements in Natural mode operations

Element	bpw	FFT	En. Av	Spec Sel	Time resolution		Packet Numb	TM (bps)	Command (Hexa)			
					Ener. (s)	Spec. (s)			WCM W0	WCM W1	WCM W2	WPW
8s duration WEL0	16	256			8	8	1	512	C8	38	60	
25s duration WEL1_a	6	256	On	1/10	0.213	2.15	12	797	CB	10	60	4F
WEL1_b	6	256	Off	2/3	0.013	0.32	77	5622	CB	10	60	41
WEL1_c	6	256	Off	1/3	0.013	0.65	39	3288	CB	10	60	43
WEL1_d	8	512	On	1/6	0.213	1.3	19	3051	CF	10	60	0D
WEL1_e	6	256	On	1/4	0.213	0.85	29	1838	CB	10	60	4C
WEL1_f	8	512	On	1/3	0.213	0.65	39	6215	CF	10	60	0B
WEL1_g	6	128	Off	All	0.013	0.107	232	8464	C6	30	60	40
WEL1_h	6	512	Off	All	0.013	0.107	232	28509	CE	30	60	40
WEL1_i	6	256	Off	1/3	0.013	0.32	77	5622	CA	30	60	43
WEL1_j	6	512	Off	1/6	0.013	1.3	19	3153	CF	10	60	45
100s duration WEL2_a	6	256	On	1/3	0.85	2.6	39	618	CB	60	60	4B
WEL2_b	8	512	On	1/3	0.85	2.6	39	1554	CF	60	60	0B
WEL2_c	8	256	On	1/4	0.85	3.41	29	599	CB	60	60	0C
WEL2_d	8	256	On	1/3	0.85	2.6	39	805	CB	60	60	0B
WEL2_e	6	512	On	1/4	0.85	3.41	29	877	CF	60	60	4C
WEL2_f	6	256	On	1/3	0.43	1.3	77	1220	CA	00	60	4B
13s duration WEL3_a	6	512	On	1/4	0.107	0.43	29	6746	CF	30	60	4C
WEL3_b	8	256	On	1/6	0.053	0.32	39	6286	CA	40	60	0D
WEL3_c	8	128	On	1/3	0.053	0.16	77	6444	C6	40	60	0B
50s duration WEL12a	6	256	Off	All	0.013	0.43	116	4455	CB	00	60	40
WEL12b	6	512	On	1/3	0.213	0.65	77	4657	CE	10	60	4B
Gliding WG10_N (NM)	8	512	On	1/2	0.213	0.427	8	3780*	See Table for Sounding			
WG11_N (BM)	8	512	On	1/8	0.213	1.707	2	945*				

*Under Nominal spin conditions

WHISPER elements in sounding mode operations

(FFT 512)

Elements	bpw	act. bins /sweep	Level	Processing Strategy		TM rates (bps)	Command (Hexa)				
							WCM W0	WCM W1	WCM W2	WCM W3	WPW
3s duration											
WEL4_a	8	477	Med	A	Reduced	2283	AD	12	60	0E	00
WEL4_b	8	477	Med	C	Complete	5195	AD	12	60	0E	12
WEL4_c	8	261	High	B	Reduced	2080	AD	23	60	1E	08
WEL4_d	8	261	High	C	Complete	2891	AD	23	60	1E	12
4s duration											
WEL5_a	8	426	Med	A	Reduced	1544	AD	12	60	61	00
WEL5_b	8	426	Med	D	Reduced	2064	AD	12	60	61	18
WEL5_c	6	426	Med	A	No passive	1032	AD	12	60	61	42
WEL5_d	8	426	Med	C	Complete	3480	AD	12	60	61	12
185s duration											
WEL6_a	8	477	Med	C	Complete	5392	AF	12	60	0E	12
104s duration											
WEL7_a	8	474	Med	D	Reduced	1408	AE	22	60	71	18
WEL7_b	6	474	Med	A	Reduced	852	AE	22	60	71	40
Spin sync.											
WEL8 (SyncA)	8	351	High	C	Complete	1280*	AF	63	60	2F	12
WEL9 (SyncB)	8	432	High	C	Complete	783*	AF	77	60	61	12
Gliding											
WG10_S (NM)	8	477	High	C	No passive	915*	AF	57	60	71	0A12
WG11_S (BM)	8	477	Med	B	No passive	576*	AF	56	60	71	0E0A

*Under Nominal spin conditions

The frequency range of transmission is, commanded by WCMW3 is described in the next table.

Whisper current Frequency tables (Nominal operations : unshaded)

ALL TABLES USED AT A GIVEN TIME ON A GIVEN SATELLITE MUST BE SUCH AS THE (BOTTOM BIN + NUMBER OF BINS + FREQUENCY SLICE) COMBINATION BE UNIQUE OF ITS KIND (If not, the software is unable to recognise the table, and the date calculation of each bin packet fails)

HX	fst	Pulse (ms)	Nmax	N bottom	Number of steps	Bottom bin index	Frequency range (kHz)	Freq slice	Number of bins
04*	4	0.5	27	8	10	43	7.0-27.3	0	120
08*	8	0.5	27	16	6	91	14.8-27.3	0	72
09*	9	1	27	18	10	106	17.3-26.8	0	60
0A*	10	1	27	22	6	130	21.2-26.8	0	36
0B	11 (F)	1	83	4	80	22	3.6-81.5	0	480
0E	14 (F)	0.5/1	82	4	52	22	3.6-81.0	0	477
16	22	0.5	34	12	12	67	10.9-34.2	0	144
1D	29 (F)	0.5/1	50	4	40	22	3.6-49.8	0	285
1E	30 (F)	0.5/1	46	4	32	22	3.6-45.9	0	261
1F	31 (F)	0.5/1	48	6	40	34	5.5-47.9	0	273
26	38	0.5	42	12	16	67	10.9-42.0	1	192
2F	47 (F)	0.5/1	62	5	36	28	4.6-61.5	1	351
3A	58(F)	0.5/1	75	4	40	22	3.6-74.2	1	435
41	65	0.5	59	5	28	25	4.1-58.6	2	336
4B	75 (F)	0.5	71	5	34	25	4.1-70.3	2	408
4D	77 (F)	0.5/1	45	5	21	25	4.1-44.9	2	254
51	81	0.5	67	5	32	25	4.1-66.6	2	384
5E	94 (F)	0.5/1	51	4	36	22	3.6-50.8	2	291
61	97	1	75	5	71	28	4.6-73.7	3	426
61	97	0.5	75	5	36	25	4.1-74.2	3	432
66	102	0.5	74	12	32	67	10.9-73.2	3	384
71	113	1	83	5	79	28	4.6-81.5	3	474
71	113	0.5	83	5	40	25	4.1-81.5	3	480
77	119 (F)	1	82	4	79	22	3.6-80.6	3	474
79	121 (F)	1	78	4	75	22	3.6-76.5	3	450
7B	123 (F)	1	74	4	71	22	3.6-72.7	3	426
7C	124 (F)	1	72	4	69	22	3.6-70.8	3	414

(F) Fix Table

* Short tables, to be used in transparent S mode, meant to observe the complete spectra after transmission

6.3.6 CORRELATOR

The particle correlator has five alternative bit rate modes and also FULL or REDUCED (R suffix) processing modes. The REDUCED mode is intended for use if the processing capacity of DWP is not sufficient to run the full mode. The bit rate modes are listed in the table below.

Mode	Bit Rate	Control Word							
COR0	136	x	0	0	0	x	x	x	x
COR1	272	x	1	0	0	x	x	x	x
COR2	544	x	0	1	1	x	x	x	x
COR3	1088	x	0	1	0	x	x	x	x
COR4	2176	x	0	0	1	x	x	x	x

Table 6.3.5 Bit Rate Modes

Mode	Control Word							
CORn	0	x	x	x	x	x	x	x
CORnR	1	x	x	x	x	x	x	x

Table 6.3.6 Processing Modes

6.4 WEC LEVEL MODES

6.4.1 DEFAULT EMERGENCY MODE

6.4.1.1 Description:

This is an emergency mode which will yield some scientific returns in any Cluster region. This mode assumes the four possible worst cases :

- (i) no command link into DWP,
- (ii) limited spacecraft power,
- (iii) low spacecraft bit rate,
- (iv) DWP capabilities limited.

If these emergency conditions do not apply it should be possible to command WEC experiments into a mode taking into account the actual circumstances. We are in the default mode when no command arrives within 2 minutes from either DWP reset or WEC Power ON.

TIME STRUCTURE

0	3	4	8 s
Whisper	WEL0					
Staff-Sc	ON					
Staff-Sa	NM1					
DWP	ON					
Correl.	OFF					
EFW	ON					
WBD	OFF or ON					

BIT RATE ALLOCATIONS

Whisper	512		
Staff-Sc	1216		
Staff-Sa	1696		
DWP	?		
Correl.	0		
EFW	1440		
WBD	0		

6.4.1.2 Operational constraints:

TBD

6.4.1.3 Resources required:

TBD

6.4.1.4 Implementation

ROM Macro 0

6.4.2 NBR BASIC MODE (NMBA)**6.4.2.1 Description**

WHISPER is active for 3 seconds in a cycle of 28 seconds, EFW in wave mode. This mode is a good compromise between all WEC instruments.

TIME STRUCTURE

0	3	4	28 s
Whisper	WEL4-a or b	WEL1-a				
Staff-Sc	NM					
Staff-Sa	NM1'b		NM1			
DWP	ON					
Correl.	COR0					
EFW	EFW1 - a					
WBD	WBD0 or WBD1					

AVERAGED BIT RATE ALLOCATIONS

Whisper	970		
Staff-Sc	928		
Staff-Sa	1577		
DWP	126		
Correl.*	136		
EFW	1440		
WBD	0		

* depends on the value of the spin period

6.4.2.2 Operational constraints:

None.

6.4.2.3 Resources required:

TBD

6.4.2.4 Implementation

ROM Macro 5

6.4.3 NBR LOW RECURRENCE MODE (NMLR)**6.4.3.1 Description**

Similar to the NBR BASIC except that WHISPER is active 4 seconds in a cycle of 104 seconds. This mode uses the WHISPER transmitter less often.

TIME STRUCTURE

0	3	4	104 s
Whisper	WEL5-a		(WEL2-d or WEL2-a)			
Staff-Sc	NM					
Staff-Sa	NM1'b		NM1 or NM2b or NM2e			
DWP	ON					
Correl.	ON					
EFW	EFW1-a					
WBD	WBD0		or	WBD1		

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b - low power)	
Whisper	846	667	
Staff-Sc	928	928	
Staff-Sa	1664	1802	
DWP	125	146	
Correl.	96	96	
EFW	1440	1440	
WBD	0	0	

NOTE: Low power mode no longer exists for Staff SA

6.4.3.2 Operational constraints:

Agreement between WHISPER and STAFF is required to choose between (a) or (b)

6.4.3.3 Resources required:

TBD

6.4.3.4 Implementation

ROM Macro 2

6.4.4 NBR LANGMUIR MODE (NMLA, NMLB, NMLC)**6.4.4.1 Description:**

This is a mode in which EFW may work in Langmuir mode to look at structure in electron density. The time structure of WHISPER is as in NBR LOW RECURRENCE for NMLA and NMLB. For NLMC, WHISPER stays in gliding mode WG11; WG11 is an alternance of WG11-S and WG11-N elements (see tables in 6.3.5), recurring every 2.125spin period.

TIME STRUCTURE

0	3	4	104 s
Whisper	WEL5-b or WEL5-c		WEL2-b or WEL2-c or WG11			
Staff-Sc	NM					
Staff-Sa	NM1'b		or	NM2b		
DWP	ON					
Correl.	COR0 or OFF					
EFW	EFW1-b, or -c, or -d					
WBD	WBD0		or	WBD1		

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)	(c)
Whisper	1587	625	1521
Staff-Sc	928	928	928
Staff-Sa	864	1840	864
DWP	123	120	
Correl.	136	136	136
EFW	1440	1440	1440
WBD	0	0	

6.4.4.2 Operational constraints:

Agreements are required between all WEC experimenters to operate this mode and to select the WHISPER and STAFF bps. Three full speed transputers required for correlator operations.

6.4.4.3 Resources required:

TBD

6.4.4.4 Implementation

ROM Macro 17 (a and b) and command sequence SWECJ259 (c) see Annex OCSI.

6.4.5 NBR SPIN SYNCHRONISED MODE (NMSY)

6.4.5.1 Description:

WHISPER synchronised with the sampling of the particle experiments. For studies of low energy plasma populations.

TIME STRUCTURE

0	3	4	129 spins*
Whisper	WEL8 or WEL9				
Staff-Sc	NM				
Staff-Sa	NM1'b, or NM-2b				
DWP	ON				
Correl.	COR0 or OFF				
EFW	EFW1 -a, or -b, or -c, or -d				
WBD	WBD0 or WBD1				

*≈8 min 36s

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)	(c)
Whisper*	1280*	783*	783*
Staff-Sc	928	928	944
Staff-Sa	864	1840	1840
DWP	119	143	143
Correl.*	136	136	0

EFW	1440	1440	1440
WBD	0	0	0

* for a spin period = 4s.

6.4.5.2 Operational constraints:

Agreement between all WEC experimenters is required to run that program. Moreover, PEACE and CIS may need to be in the appropriate modes.

6.4.5.3 Resources required:

TBD.

6.4.5.4 Implementation

Command sequence SWECJ204 (a) or SWECJ205 (b and c) see Annex OCSI

6.4.6 NBR CONTINUOUSLY ACTIVE MODE (NMCO)

6.4.6.1 Description:

This mode is mainly devoted to WHISPER to allow a good time resolution in the measurement of electron density of structures and boundaries. EFW may be in Langmuir mode to complement the WHISPER measurements.

TIME STRUCTURE

0	3	4	104 s
Whisper	WEL7-a or WEL7-b					
Staff-Sc	NM					
Staff-Sa	NM1'b		or	NM2b		
DWP	ON					
Correl.	COR0					
EFW	EFW1 -a, or -b, or -c, or -d					
WBD	WBD0		or	WBD5		

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)	
Whisper	1408	852	
Staff-Sc	928	928	
Staff-Sa	864	1840	
DWP	116	140	
Correl.	136	136	
EFW	1440	1440	
WBD	0	0	

6.4.6.2 Operational constraints:

Agreement between all WEC experimenters is required.

6.4.6.3 Resources required:

TBD.

6.4.6.4 Implementation

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6.4.7 NBR WBD MODE (NMLR)**6.4.7.1 Description:**

This mode gives priority to WBD. This is essentially identical to NBR low recurrence but with WBD in any mode (with WBD 5 used for calibration).

TIME STRUCTURE

0	3	4	104 s
Whisper	WEL5-a		(WEL2-d or WEL2-a)			
Staff-Sc	NM					
Staff-Sa	NM1'b		NM1 or NM2b or NM2e			
DWP	ON					
Correl.	ON					
EFW	EFW1-a					
WBD	WBD5					

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b - low power)	
Whisper	846	667	
Staff-Sc	928	928	
Staff-Sa	1664	1802	
DWP	125	146	
Correl.	96	96	
EFW	1440	1440	
WBD	0	0	

6.4.7.2 Operational constraints:

Agreement between all WEC experimenters is required.

6.4.7.3 Resources required:

TBD.

6.4.7.4 Implementation

See NBR Low Recurrence mode

6.4.8 HBR BASIC MODE (BMBA)**6.4.8.1 Description:**

Similar to NBR BASIC in the time structure for WHISPER with other instruments in a generally useful high bit rate mode.

TIME STRUCTURE

0	3	4	28 s
Whisper	WEL4-b or WEL4-d	WEL1-b or WEL1-i				
Staff-Sc	BM					
Staff-Sa	FM 3b		FM2			
DWP	ON					
Correl.	COR2 or OFF					
EFW	EFW-2 a					
WBD	WBD0 or WBD1					

AVERAGED BIT RATE ALLOCATIONS

Whisper	5666		
Staff-Sc	16480		
Staff-Sa	4212		
DWP	954		
Correl.	544		
EFW	15040		
WBD	0		

6.4.8.2 Operational constraints:

Three full speed transputers are required for correlator operation.

6.4.8.3 Resources required:

TBD.

6.4.8.4 Implementation

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6.4.9 HBR LOW RECURRENCE (BMLR)**6.4.9.1 Description:**

Similar to NBR LOW RECURRENCE for the use of WHISPER. Otherwise similar to HBR BASIC.

TIME STRUCTURE

0	3	4	104 s
Whisper	WEL5-d		4 × (WEL1-c, or -d, or -f)			
Staff-Sc	BM					
Staff-Sa	FM3b		FM1 or FM3b or FM3e			
DWP	ON					
Correl.	COR0 or COR0R					
EFW	EFW2-a					
WBD	WBD0		or		WBD1	

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)	(c)
Whisper	3343	3092	6158
Staff-Sc	16480	16480	16480
Staff-Sa	7468	7468	4160
DWP	912	883	959
Correl.	136	136	136
EFW	15040	15040	15040
WBD	0	0	0

6.4.9.2 Operational constraints:

Agreement between WHISPER and STAFF is required. If only two full speed transputers are available then COR0R mode must be used.

6.4.9.3 Resources required:

TBD.

6.4.9.4 Implementation

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6.4.10 HBR LANGMUIR MODE (BMLA and BMLB)**6.4.10.1 Description:**

Based on NBR LANGMUIR and on HBR LOW RECURRENCE.

TIME STRUCTURE

0	3	4	104 s
Whisper	WEL5-d		4 × (WEL1-f)			
Staff-Sc	BM					
Staff-Sa	FM3b		or	FM2		
DWP	ON					
Correl.	COR2					
EFW	EFW2 -b, or -c, or -d					
WBD	WBD0		or	WBD1		

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)	
Whisper	6158	6158	
Staff-Sc	16480	16480	
Staff-Sa	4160	4528	
DWP	959	969	
Correl.	544	544	
EFW	15040	15040	
WBD	0	0	

6.4.10.2 Operational constraints:

Agreements are required between all WEC experimenters to operate this mode and to select the WHISPER and STAFF bps. Three full speed transputers are required to run this mode.

6.4.10.3 Resources required:

TBD.

6.4.10.4 Implementation

Command sequence SWECJ235 see Annex OCSI

6.4.11 HBR SPIN SYNCHRONISED GLIDING (BMSY, BMLC)**6.4.11.1 Description:**

Spin synchronised mode with a full spin period of WHISPER passive before an active 1/8 of a spin period. Thus particle experiments can measure detailed count rates over a full spin without any WHISPER active operations. The spin phase of WHISPER active 'glides' around by 1/8 of a spin per 2 spins. Version A (BMSY) has EFW in E field mode, whereas version B (BMLC, previously known as HBR Langmuir version C) has EFW in langmuir mode.

TIME STRUCTURE

0	3	4	145 spins
Whisper	WEL10				
Staff-Sc	BM				
Staff-Sa	FM3b				
DWP	ON				
Correl.	COR4				
EFW	EFW2 -a, or -b, or -c				
WBD	WBD0		or	WBD1	

AVERAGED BIT RATE ALLOCATIONS

Whisper	4695		
Staff-Sc	16480		
Staff-Sa	4160		
DWP	843		
Correl.	2176		
EFW	15040		
WBD	0		

6.4.11.2 Operational constraints:

Agreement between all WEC experimenters is required to run that program. Moreover, PEACE and CIS may need to be in the appropriate modes. Three full speed tranputers are required to run this mode.

6.4.11.3 Resources required:

TBD.

6.4.11.4 Implementation

Command sequence SWECJ216 see Annex OCSI

6.4.12 HBR CONTINUOUSLY ACTIVE MODE (BMCO)*6.4.12.1 Description:*

Similar to NBR CONTINUOUSLY ACTIVE but appropriate to HBR.

TIME STRUCTURE

0	3	4	200 s
Whisper	WEL6-a (185 s), WEL3-a (13 s), wait(2s)					
Staff-Sc	BM					
Staff-Sa	FM3b					
DWP	ON					
Correl.	COR3 or OFF					
EFW	EFW2 -a, or -b, or -c					
WBD	WBD0 or WBD1					

AVERAGED BIT RATE ALLOCATIONS

Whisper	5430		
Staff-Sc	16480		
Staff-Sa	4160		
DWP	866		
Correl.	1088		
EFW	15040		
WBD	0		

6.4.12.2 Operational constraints:

Agreement between all WEC experimenters is required. Three full speed transputers are required for correlator operations.

6.4.12.3 Resources required:

TBD.

6.4.12.4 Implementation

Command sequence SWECJ212 see Annex OCSI

6.4.13 HBR EFW MODE (BMEA and BMEB)**6.4.13.1 Description:**

No time structure. Priority given to EFW for various SPHERE combination. When HBR EFW3-a is in use some bits are available to WHISPER and STAFF SC. In HBR EFW3-b the correlator can be in a high data rate mode but WHISPER and STAFF SC must be off.

NO TIME STRUCTURE

Whisper	WEL1-e (or OFF)				
Staff-Sc	BM (or OFF)				
Staff-Sa	NM1 (or SM or FM1)				
DWP	ON				
Correl.	COR4, COR1 or COR1R				
EFW	EFW3-a, -b, -c or -d (or EFW4 -a, or -b)				
WBD	WBD0 or WBD1				

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)	(c)
Whisper	1838	0	0
Staff-Sc	16480	0	0
Staff-Sa	1696	3032	7600
DWP	878	554	?
Correl.	272	2176	2176
EFW	22240	29440	29440
WBD	0	0	

6.4.13.2 Operational constraints:

Agreement between all WEC experimenters is required. If only two full speed transputers are available, version (a) must use the COR1R mode.

6.4.13.3 Resources required:

TBD.

6.4.13.4 Implementation

Command sequence SWECJ214 (a) or SWECJ215 (b) see Annex OCSI.

6.4.14 HBR WHISPER MODE (BMWH)**6.4.14.1 Description:**

High time resolution for WHISPER in passive mode. For studies of fine structures. Low recurrence of the density measurement as in HBR LOW RECURRENCE.

TIME STRUCTURE

0	3	4	104 s
Whisper	WEL5-d		4 × (WEL1-g) (or 4 × (WEL1-h))			
Staff-Sc	BM (or NM)					
Staff-Sa	NM1'b		NM1			
DWP	ON					
Correl.	COR3					
EFW	EFW2-a					
WBD	WBD0		or	WBD1		

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)*	
Whisper	8558	27832	
Staff-Sc	16480	928	
Staff-Sa	1664	1664	
DWP	?	?	
Correl.	1088	1088	
EFW	15040	1440	
WBD	0	0	

6.4.14.2 Operational constraints:

Agreement between WHISPER, STAFF, EFW and Correlator is required.

6.4.14.3 Resources required:

TBD.

6.4.14.4 Implementation

Command sequence SWECJ241 see Annex OCSI

6.4.15 HBR ANGLE (BMAN)

6.4.15.1 Description:

Based on HBR LANGMUIR.

TIME STRUCTURE

0	3	4	108 s
Whisper	WEL5-d		8 × (WEL3-b or WEL3-c)			
Staff-Sc	BM					
Staff-Sa	FM3b		or	FM2		
DWP	ON					
Correl.	COR2 or COR2R					
EFW	EFW2 -b, or -c, or -d					
WBD	WBD0		or	WBD1		

AVERAGED BIT RATE ALLOCATIONS

	(a)	(b)*	
Whisper	6275	6517	
Staff-Sc	16480	16480	
Staff-Sa	4160	4528	
DWP	?	?	
Correl.	544	544	
EFW	15040	15040	
WBD	0	0	

* Not yet validated.

6.4.15.2 Operational constraints:

Agreements are required between all WEC experimenters to operate this mode and to select the WHISPER and STAFF bps.

6.4.15.3 Resources required:

TBD.

6.4.15.4 Implementation

Command sequence SWECJ236, see Annex OCSI

6.4.16 HBR Correlator (BMCL)

6.4.16.1 Description:

HBR mode designed to allow use of particle correlator at maximum bit rate.

TIME STRUCTURE

0	3	4	54 s
Whisper	WEL5-d		WEL 12			
Staff-Sc	BM					
Staff-Sa	FM3b		FM2			
DWP	ON					
Correl.	COR4					
EFW	EFW2 -b, or -c, or -d					
WBD	WBD0		or	WBD1		

AVERAGED BIT RATE ALLOCATIONS

	(a)		
Whisper	4290		
Staff-Sc	16480		
Staff-Sa	4395		
DWP			
Correl.	2176		
EFW	15040		
WBD	0		

6.4.16.2 Operational constraints:

Agreements are required between all WEC experimenters to operate this mode. DWP must be configured with 3 full speed transputers.

6.4.16.3 Resources required:

TBD.

6.4.16.4 Implementation

Command sequence SWECJ261, see Annex OCSI.

6.4.17 BM2 WEC NORMAL MODE (BM2W)

6.4.17.1 Description:

This mode is for use when DWP takes WBD data and the s/c is in BM2 mode. Spare bits are allocated to the NBR BASIC mode but with correlator and WHISPER off (for DWP technical reasons). The STAFF data are not compressed. No time structure.

NO TIME STRUCTURE

Whisper	OFF				
Staff-Sc	NM				
Staff-Sa	NM1				
DWP	ON				
Correl.	OFF				
EFW	EFW1-a				
WBD	WBD0 or WBD1 or WB2 or WBD3 or WBD4 or WBD5				

AVERAGED BIT RATE ALLOCATIONS

Whisper	0		
Staff-Sc	1216		
Staff-Sa	1696		
DWP	?		
Correl.	0		
EFW	1440		
WBD	73584		

6.4.17.2 Operational constraints:

This mode is operated each time DWP takes the WDB data and the s/c is in BM2 mode. Three full speed transputers are required if digital filtering is to be done.

6.4.17.3 Resources required:

TBD.

6.4.17.4 Implementation

Command sequence SWECJ202 see Annex OCSI.

6.4.18 BM3 WEC MODE (BM3E)

6.4.18.1 Description:

When the s/c is in BM3, EFW will dump its memory and this mode can be used. It is based on NBR BASIC but with the correlator in its high bit rate mode and EFW providing no real-time data.

TIME STRUCTURE

0	3	4	28 s
Whisper	WEL4-a	WEL1-a				
Staff-Sc	OFF					
Staff-Sa	NM1'b		NM1			
DWP	ON					
Correl.	ON					
EFW	Dump					
WBD	WBD0 or WBD1					

AVERAGED BIT RATE ALLOCATIONS

Whisper	1004		
Staff-Sc	0		
Staff-Sa	1577		
DWP	126		
Correl.	3328		
EFW	22240		
WBD	0		

6.4.18.2 Operational constraints:

This mode is operated each time the s/c is in BM3.

6.4.18.3 Resources required:

TBD.

6.4.18.4 Implementation

Command sequence SWECJ203 see Annex OCSI

