RIOMETER RECORDS OF 30 MHz COSMIC NOISE

AT SYOWA STATION, ANTARCTICA IN 1987

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1. Introduction

Observations of cosmic radio noise with a standard riometer (relative ionospheric opacity meter) at 30 MHz have been carried out at Syowa Station, Antarctica, since February 1966 by members of the Communications Research Laboratory. A report has been prepared which includes hourly values and chart records of cosmic noise absorption observed during the period from January 1 to December 31, 1987. Copies of the data are available to users on request. The request should be addressed to:

Communications Research Laboratory
Ministry of Posts and Telecommunications
2-1, Nukui-Kitamachi 4-chome, Koganei-shi
Tokyo 184, Japan.

2. Location

Syowa Station			
Geographic		Geomagnetic	
Latitude	Longitude	Latitude	Longitude
69°00'S	39°35' E	-70.0°	80.2°

3. Observer

Koji INAMORI (Communications Research Laboratory)

4. Instrumentation

The receiver of the riometer which has a center frequency of 30 MHz and a band width of 3.5 kHz is connected to a vertically directed five-element Yagi antenna whose elements are oriented in the east-west direction. The antenna is designed to match a 50 ohm coaxial transmission line (8D-2V) of 80 m in length.

The noise power output is recorded on a strip chart recorder with a 1mm/min chart speed. Noise power levels of 0,1,2,3 and 4 dB from a reference noise diode are also recorded once a day at 8h in 45° EMT (Eastern Meridian Time: UT + 3 hours).

The receiver was replaced by a new one with a band width of 7.5 kHz at 20h EMT on January 17, 1987.

5. Remarks

The cosmic noise power level shows a remarkable sidereal diurnal variation caused by the passage of the cosmic radio source across the zenith. On account of the revolution of the earth, the time (local time) when the same cosmic radio source passes the zenith becomes earlier by about 4 min from day to the next and returns to its initial state after a year. If the ionosphere is in a quiet condition, the diurnal variation of the cosmic noise power is easily extracted from the chart recordings.

The hourly values of ionospheric absorption given in the CNA (Cosmic Noise Absorption) tables are the deviations (in dB) of cosmic noise intensity from the reference sidereal diurnal variation. The reference sidereal diurnal variation is determined from the diurnal variations on several selected quiet days in each month.

On the strip chart, cosmic noise intensity (indicated by C) and also geomagnetic H-component at Syowa Station (indicated by H) are recorded. The H-component increases upward in the figure and the calibration signal, the vertical bar, at each hour denotes a depression by 200 nT. Note that the cosmic noise intensity increases upward in the figure until 20h EMT on January 17,1987 but downward after that time.

Bibliography relevant to

RIOMETER RECORDS OF 30 MHz COSMIC NOISE AT SYOWA STATION, ANTARCTICA (1)

Observation period	Observers	Literature JARE Data Reports		
		Volume	Pages	Year
Feb. 1967 - Feb. 1968	Ose, M. Nishimuta, I.	2 (Ionosphere 1)	62	1968
Feb. 1968 - Jan. 1969	Ishizawa, K.	7 (Ionosphere 3)	65	1970
1969	Ota, Y.	8 (Ionosphere 4)	74	1970
1970	Shiro, I. Sakamoto, T.	14 (Ionosphere 5)	62	1971
1971	Ogata, T. Ose, M.	18 (Ionosphere 7)	62	1972
1972	Isozaki, S. Miyazaki, S.	20 (Ionosphere 8)	76	1973
1973	Nishimuta, I. Yabuuma, H.	24 (Ionosphere 11)	74	1974
1974	Yamazaki, I. Shiro, I.	29 (Ionosphere 13)	84	1975
1975	Sugiuchi, H. Komiya, N.	35 (Ionosphere 15)	84	1976
1976	Ose, M. Yamakoshi, A. Sasaki, T.	41 (Ionosphere 17)	87	1977
1977	Ose, M. Nishiyama, N. Sakamoto, J.	46 (Ionosphere 19)	82	1978
1978	Ose, M. Igarashi, K. Tsuzurahara, S.	51 (Ionosphere 20)	86	1979
1979	Ose, M. Ojima, S. Komiya, N.	56 (Ionosphere 22)	84	1980
1980	Ose, M. Nozaki, K.	70 (Ionosphere 26)	97	1982
1981	Ose, M. Kurihara, N.	80 (Ionosphere 27)	94	1983
(cont.)				

Bibliography relevant to

RIOMETER RECORDS OF 30 MHz COSMIC NOISE AT SYOWA STATION, ANTARCTICA (2)

Observation period	Observers	Literature JARE Data Reports		
		Volume	Pages	Year
1982	Kuratani, Y. Igarashi, K.	87 (Ionosphere 29)	86	1984
1983	Kuratani, Y. Yamazaki, I. Tanaka, T.	99 (Ionosphere 31)	93	1985
1984	Kuratani, Y. Yamamoto, S.	112(Ionosphere 33)	95	1986
1985	Kuratani, Y. Maeno, H.	122(Ionosphere 35)	94	1987
1986	Maeno, H. Suzuki, A.	133(Ionosphere 37)	96	1988

Table 1. 30 MHz cosmic noise absorption (in dB) at the first minute of each hour.

SYOWA STATION — 45° EAST MERIDIAN TIME (U.T. + 3 hours) — January 1987

	Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	1	0.1		0.1	0.2	0.1		0.2	0.2		0.1		0.2						0.5	0.2			0.2		
	2	0.1	0.2	0.1	0.1		0.2	0.1	0.1	0.1				0.6		0.1	0.2			0.2	0.1				
	3				0.1	0.1				0.1	0.5	0.2						0.4	0.5	0.5	0.5	0.3	0.2		
	4		0.1	0.2																	0.1	0.1			
	5													0.2											
	6	0.2									0.1	0.1	0.1				0.2				C	C	C	C	C
	7	C	C	C	C	C	C	C	C	C															
	8		0.5	0.1																	0.1				
	9		0.2		0.2							0.1								0.5	0.1				
*	10																								
	11																							0.4	
	12			0.1	0.3			0.2		0.7	0.2														
	13		0.1			0.2		0.1																	
	14										0.1		0.3	0.1	0.4	0.4	0.1	0.5	0.5		0.4	0.2	0.1	0.1	
	15														C	C	C	C							
	16												0.1	C	C	C	C	C	C						
	17																		C	C					
	18			1.0	0.1	0.4	0.2														C	C	C		0.4
*	19																								
	20										0.2	0.7													
	21	0.2				0.7	0.5					0.2				0.2						0.3	0.3		
	22		0.2		0.5																				
	23		0.2						0.2										C		0.1				
	24				0.1	0.5	0.1																		
	25									0.9	0.1														
	26						0.3	0.1																	
	27										0.1				0.3	0.1									
	28						0.2	0.3																	
	29					0.2	0.2	0.5																	
*	30																								
	31						0.2		0.1		0.1														
	Mean	0.02	0.05	0.05	0.05	0.07	0.06	0.05	0.02	0.06	0.04	0.04	0.02	0.03	0.02	0.02	0.01	0.03	0.05	0.04	0.04	0.03	0.02	0.01	0.01

Open spaces without figures correspond to quiet level

* : Quiet day
C Failure of equipment

SYOWA STATION　　45° EAST MERIDIAN TIME (U.T. + 3 hours)　　February 1987

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1						0.1	0.2	0.2	0.1	0.1	0.7	0.5	0.2											
2				0.1																				
3																								
4																								
5																								
6				0.1		0.1	0.1	0.1																
7				0.4																				
8		0.2	0.1		0.2			0.3			0.1													
9																								
10		0.1	0.5	0.1	0.1	0.2																		
11					0.3																			
12					0.4	0.2	0.1					0.4												
13							0.2	0 1																
14																								
15																								
16						0.2	0.2										0.3	0.1						
17									0.1															
18					0.1	0.5																		
19		0.7	0.1	0.1																				
20						0.2																		
21			0.2	0.2	0.3	0.5		0 4			0.2	1.2	0.3											
22		0.1		0.4	0.2	0.2	0.6	0.2	0.5	0.3	0.1		0.7	0.4	0.2	0 3	0.2							
23		0.2	0.5	0.6	0.9	0.7	0.1	0.7	0.2		0.1	0 2			0.3		0.1	0.1	0.7	0.2		0.1		
24																								
25		0.2	0.1		0.9	0.3														0.1				
26					0.2	0.1	0 1	0.1																
27													0.4	0.3										
28	0.1	0.1		0.2		0.2				0.3	0.2	0.3		0 3	0 3	0.2	0.1							
29																								
30																								
31																								
Mean	0 01	0.05	0.05	0.07	0.12	0.12	0.05	0.07	0.03	0.02	0.05	0.09	0.05	0.03	0.02	0.01	0.02	0.01	0.02	0 01		0.01		

* * *
* *

Open spaces without figures correspond to quiet level　　*　Quiet day

SYOWA STATION 45° EAST MERIDIAN TIME (U.T. + 3 hours) March 1987

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1		0.2	1.2	0.2				0.2		0.1												0.2		0.2
2			0.2	0.1	0.1																			
3								0.3	0.2															
4	0.1	0.2	0.2	0.2	0.5	0.1																		
5		0.1	0.2			0.1		0.4	1.0							0.2	0.1							
6	0.1	0.2	0.2	0.2	0.5	0.5					0.1	0.5	0.2	0.2										
7	0.1	0.1	0.3	0.2	0.2	0.4	0.5	0.2	0.2		0.3	1.2	0.8	0.3	0.5	0.2		0.8	0.2	0.1				
8	0.1		0.2			0.5	0.2				0.2							0.1	0.1	0.1	0.1			
9						0.2	0.5	0.1	0.5	0.2														
10													0.2	0.2	0.1				0.1					
11						C					0.3	0.3	0.2											
12						0.1	0.7			0.1		0.1				0.1	0.1							
13			0.5	0.2																		0.1		
14									0.1	0.9														
15				0.1				0.1		0.1	0.1													
16				0.5	0.2	0.1	0.1					0.2	0.3											
17				0.2	0.2		0.2		0.6	0.6	0.5													
18					0.1	0.1			0.2															
19		0.5	0.9	0.4	0.2	0.4	0.3	1.1																
20																								
21																		C						0.1
22				1.1	0.6										0.1	0.1								
23	0.2	0.7			0.1																			
* 24																								
* 25																								
26				0.1		0.1	0.1	0.1										C						
27							0.1		0.2	0.2	0.1	0.3	0.2	0.1		0.5	0.2	0.2						
28						0.3	1.0					0.1	0.1	0.1	0.4	0.1		0.2	0.2	0.2				
29										0.1	1.3	0.2	0.3			0.1								
30																								
31								0.5	0.7	0.1	0.1													
Mean	0.01	0.06	0.12	0.11	0.08	0.09	0.11	0.09	0.11	0.07	0.09	0.09	0.07	0.02	0.03	0.04	0.01	0.04	0.01	0.01	0.01	0.01		0.01

Open spaces without figures correspond to quiet level

* : Quiet day
C : Failure of equipment

SYOWA STATION — 45° EAST MERIDIAN TIME (U.T + 3 hours) — April 1987

	Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	1			0 5	0.8	1.0	1.1	0.5	0.8		0.5	0.5	0.2		0.2				C						
	2							0.3	0.5	0 2	0.1		0.1		0.2										
	3																0.2		C						
*	4																								
	5					0.1	0.2		0.1	0.2		0.1							C						
	6	0.5	0.2	0.1					0.7	0.1															
	7							1.0	0.2	0.1	1.4	0.8	0.7	0.2											
	8									0.4	0.1	0.2	0.2	0.4		0.3									
	9				0.3	0.1										0.1									
	10							0.8	0.1	0.1	0.5	0.4	0.1												
	11									0.2	0.7	0.2	0.2	0 1	0.5	0.5	0.2	0.3	0.2						
	12				0.1					0.5	1.0	0 5	0.2												
	13						0.1																		
*	14																								
	15																		C						
	16												0 2						C						
*	17																								
	18			0 1	0.1																				
	19											0.1	0.1	0.1	0.2	0 2									
	20								0.1	0.2	0.2	0.3	0.4	0.7	0.3	0.5	0.3	0.1	0.2	0.1					
	21									0.2	0.2		0.2												
	22		C	C	C	C	C	C																	
	23		C	C	C	C	C		0.4	0.1		C	C												
	24			C	C	C						0.1					0.2	0 4	0 4	0.5					
	25		C	C	C	C	C																		
	26			C	C	C	C																		
	27		C								1 1	0.8	0.8	0 5		0.2	1.0	0.5	0.2						
* *	28			0.1	0.4	0.5																			
*	29																								
	30																								
	31																								
	Mean	0.01	0.01	0.03	0 06	0.06	0 05	0.09	0.09	0.07	0.19	0.13	0 11	0 06	0 04	0 06	0 06	0.04	0.04	0.02					

Open spaces without figures correspond to quiet level

* Quiet day
C Failure of equipment

SYOWA STATION 45 EAST MERIDIAN TIME (U.T. + 3 hours) May 1987

	Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
*	1																								
	2												0.1			0.1					0.1	0.1			
	3													0.1	0.4	0.9	0.4								
	4										0.4	0.7		0.1	0.1										
	5						0.1	0.1	0.1					0.2	0.2	0.2	0.1								
	6																								0.1
	7	0.2	0.9	0.2	0.2	0.2	0.1	0.2	0.2																
	8							0.1	0.5	0.1															
*	9																								
	10													0.2	0.2	0.1	1.0	0.2	0.3	0.7	0.1				
	11																								
	12																								
	13													0.6	0.2										
	14		0.1	0.1	0.1	0.2	0.3	0.1											C	0.5	0.8	0.6	0.1		
	15																								
*	16																								
*	17																								
*	18																								
*	19																								
*	20																								
	21						0.2																		
	22																								
	23	0.2																							
	24				0.5	0.1	0.2	0.1	0.5	0.2	0.2		0.2	0.2	0.5	1.2	0.3	0.2	0.5		0.2				
	25		0.2	1.7	0.7	1.3	1.0	1.2	0.7	0.9	1.3	0.2	0.2	0.5	0.6	0.8	0.5	0.5	0.4	0.1	0.4	0.2	0.2		0.3
	26																0.1	0.2							
	27						0.5	0.2		0.2	0.6	0.7	0.7	0.2	0.1	0.7	0.5	0.8	0.1		0.3				
	28	0.1		0.1								0.2		0.2	0.2										
	29	0.2		1.7	1.0	0.7	1.5	1.0	0.7	0.3	0.5	0.2	0.3	1.5	1.5	1.1	0.8			0.3					
	30														0.2				0.3	0.7	0.5				0.1
	31								0.2	0.2		0.4	0.2		0.1	0.5	0.4	0.2	0.1						
	Mean	0.02	0.03	0.12	0.08	0.08	0.12	0.09	0.09	0.06	0.09	0.07	0.05	0.12	0.13	0.18	0.13	0.06	0.05	0.07	0.07	0.02	0.01		0.01

Open apaces without figures correspond to quiet level

* . Quiet day
C : Failure of equipment

SYOWA STATION 45 EAST MERIDIAN TIME (U.T + 3 hours) June 1987

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1			0.1	0.2	0.2											0.1	0.3	0.1	0.2	0.1				
2				0.3	0.2	0.2			0.7	0.5		0.2	0.2	0.5	0.7	0.5		0.1	0.1					
3																								
4												0.3	0.4	0.3			0.2	0.2	0.2					
5					0.2	0.1																		
6		0.5	0.2								0.1	0.4	0.7	0.5	0.4	0.2	0.1	0.7				0.1		
7			0.2		0.2	1.5	0.6	0.1							0.5	0.5	0.1			0.2			0.5	
8			1.2	0.2							0.2	0.5	0.2	0.3	0.3	0.1								
9																								
10				0.3	0.5	0.2																		
11																								
12									0.1	0.6	0.3	0.1	0.2	0.6	0.4	0.2	0.3	0.1		0.1				
13				0.1						0.2								0.2					0.2	
14											0.1	0.6	0.4	0.5										
15																								
16												0.3	0.3											0.2
17						0.3																		C
18	C	C	C	C	C	C	C	C	C	C	C	C	C	C										
19				0.2	1.0	0.8	0.5	0.6	0.9	0.4	0.2	0.7	1.5	1.3	0.6	0.1	0.6	0.5						
20		0.2			0.2																			0.2
21																								
22																								
23																								
24																								
25																								
26					0.2																			
27																								
28								0.6	0.5	0.2														
29							0.2																	
30																								
31																								
Mean		0.02	0.05	0.04	0.09	0.10	0.04	0.04	0.07	0.06	0 03	0.10	0.13	0.13	0.09	0.05	0.05	0.06	0.01	0.01		0.01	0.02	0.01

* * * * *

Open spaces without figures correspond to quiet level

* Quirt day
C Failure of equipment

SYOWA STIATION 45° EAST MERIDIAN TIME (U.T. + 3 hours) July 1987

	Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
*	1									0.3	0.2														
	2												0.1												
	3																								
	4							0.2																	
	5																								
* *	6																								
*	7							0.1	0.3										0.1			0.1			
	8							0.2	0.5	0.2	0.5	0.5		0.5	0.2										
	9			0.2	0.1																				
	10					0.2	0.5	0.5					0.2			0.2	0.5	0.4	0.1	0.8	0.3		0.2		
	11					0.1			0.4			0.7	0.7	0.3									0.1	0.1	
	12											0.1	1.0	0.2	0.7	0.2	0.1		0.1						
	13																								
	14										0.2														
	15			0.5	0.1	0.1										0.5	0.4	0.3							
	16	0.3	1.0	0.6	1.7	0.7	0.9	0.1	0.1	0.3	0.6	0.2		1.5	1.8	1.3	0.8	0.1			0.3		0.1		
	17	0.1	0.5	0.5	0.5	0.5	0.1	0.3	0.2	1.4	0.2	0.2	0.2		0.3	0.1		2.0	0.5	0.1	0.2		0.3		
	18	0.3	0.4	1.0	0.7	1.0	0.2	0.2	0.8	0.5	0.5	0.9	0.7	0.2		0.2	0.3	0.8	0.2	0.3	0.2		0.3	0.2	
	19					0.2	0.5			0.2	0.4					0.5	1.2	0.4		0.5	0.1	0.7			
	20			0.5	0.1	0.2			0.6	0.1															
	21		0.3	0.2	0.2	0.5						0.2	1.1	0.8	0.8	0.5	0.3	0.2							
	22									0.1		1.2	0.7	0.3	0.2										
	23		0.2	0.1																					
*	24																								
	25				0.4					0.7	0.3	0.1				0.8	0.2								
	26			0.2	0.2																				
	27							0.5	0.3																
	28							0.4	0.1							0.2	0.5	0.4	0.2	0.2	0.1				
	29		0.1	0.1			0.6	0.2	0.5	1.2	0.1	2.3	0.8		0.2	0.5	0.6	1.1	0.2	0.1	0.5				
	30						0.5				0.3	0.3	0.1			0.2	0.2	0.1	0.2	0.5	0.5				
	31		0.2	0.4	0.5	0.8	0.3		0.5	0.1	0.2	1.1	0.4			0.2	0.1	0.1							
	Mean	0.02	0.08	0.13	0.14	0.13	0.11	0.08	0.13	0.16	0.11	0.25	0.19	0.12	0.13	0.17	0.16	0.19	0.05	0.08	0.07	0.02	0.03	0.01	

Open spaces without figures correspond to quiet level

* : Quiet day

SYOWA STATION 45° EAST MERIDIAN TIME (U.T. + 3 hours) August 1987

	Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
*	1						0.5	0.3	0.2	1.0	0.3				0.4	0.5	0.5								
	2				0.1		0.7						0.1							0.2	0.1				
	3									0.2						0.7	0.1								
	4										0.3	0.2													
	5					0.3	0.3		0.2	0.5	0.1	0.2	1.5	1.0	0.4		0.5	0.8	0.5						
	6								0.2			0.5	0.7	0.5	0.2	0.2		0.5	0.1		0.2				
	7			0.2																					
	8							0.1								0.2				1.6	1.1	0.3			0.2
	9				0.3	0.2				0.2	0.1		0.1						0.9	1.0		0.3			
*	10																								
*	11																								
	12					0.5			0.2	0.3	0.1	0.8	0.3	0.2	0.1	0.2									
	13	0.4	1.4	0.8	0.5	0.2		0.2	0.7		1.0	0.1	0.5	2.7	2.2	1.3	0.7	0.2	0.2	0.2					
	14			0.3	0.5	0.6				1.3	0.5	0.1			0.6	1.2	0.5		1.0	0.2			0.5		0.2
	15	0.5	0.7	0.5	0.5	0.5				0.5	0.5		1.3	2.2	2.0	2.4	1.4	1.0	0.5	0.2	0.5	0.2			0.3
	16	0.5	0.9	0.2	0.3	0.5		0.5		0.5	0 7	1.2	1.3	0.5	1.5	1.3	1.0	1.0	0.5	0.2	0.5	0.5			
	17				0.3		0.3	0.2																	
	18			0.3					0.3	0.3	0.5				0.2	0.1									
	19						0.1	0.3	0.3	0.2			0 4	0.4	0.2		0.2	0.2		1.2	0.9	0.2				
	20			0.3	0.4	0.1				0.2	0.2	0.4	0.3			0.2	0.5	0.3	0.2	0.6			0.2		
	21					0.6	0.5	0.5				0.4	0.2												
	22							0.8																	
	23								0.5					0.5	0.7	0.2		0.5						0.4	0.4
	24	0.2						0.2	0.1									0.3	0.3		0.2				
	25			0.5										0.5	0.8	1 0	3.8	1.0			0.1	0.2	0.3	0.3	0.2
	26	0.2	0.5				1 8	1.6	0.2	1.5	0.8	0.2	0.5	1.0	1.1	0.5	0.8	1.0	0.7	0.4					0.1
	27		0.4			0.1	0.9	0.2	0.2		1.0	0 3	0.4	0.4	1.3	1.2	1.4	1.1	1.4	0.6	0.2	0.1			
	28										0.5	0.5	0.5	0.5	0.2	0.2	0.9	1.0	0.1	0.2					0.1
	29			2.4	0.2	0.1	0.5	0.5				0.2	0.5	0.4	0.1	0.2	0.3	0.3	0.1					0.1	0.2
	30	0.1		0.2	0.1	0.1							1.2	0.2		0.3		0.7	0.8	0.1					
	31							0.2	0.2	0.6	0.5	0.7	2.3	1.0	0.2	0.2	0.7					0.3			
	Mean	0.06	0.12	0.18	0.10	0.12	0.18	1.18	0.10	0 23	0.22	0.18	0.39	0.38	0.39	0.39	0 42	0.31	0.23	0.21	0.12	0.06	0.03	0.02	0.05

Open spaces without figures correspond to quiet level

* : Quiet day

SYOWA STATION 45° EAST MERIDIAN TIME (U.T. + 3 hours) September 1987

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1		0.1	0.6	1.0	1.4	0.7	0.1	0.5		0.3	0.7	0.7	0.9	0.8	0.8	0.7	1.1	0.5	0.2	0.1				0.1
2	0.3	0.8		0.2	0.2		0.6	0.4		1.0	1.2	0.3	0.9	0.2	0.5		1.0	0.3	0.5					
3												1.5	0.7	0.2										
4							0.4	0.5	0.2						0.1			0.4						
5			0.1	0.4				0.1			1.0	0.3	0.2		0.1	0.2	0.1							
6							0.3									0.2	0.5	C	0.2					
7																		0.2	0.4		0.5			
8		0.5	0.5	0.9	0.2			0.1							0.1						0.3		0.2	
9						0.3	0.1	0.4	0.1			0.5	1.3	0.3	0.5			0.3	0.2					
10																								
11		0.2			0.8	0.5			0.4	0.1	0.1		0.7	1.2	0.7	0.1	0.3							0.2
12	0.2	0.5				0.1		0.1	0.7	0.5	0.3	0.2	0.5	1.3	1.0	0.5	0.2	0.2	1.3		0.5			0.5
13		0.3	1.1		1.3	1.2	0.3	1.4	0.2	0.7						0.1			0.4					
14	0.2	0.6	0.5	1.1	0.4	1.5	0.9	0.9	0.1	0.9	0.2	0.2	1.5	0.5	0.5	0.3	0.5		0.4	0.2	0.2			
15	0.2	0.1	0.4	0.4	1.1	0.1	0.1		0.2	1.3	0.8		1.9	1.4	0.8	1.0	0.3	C	1.0		0.1			0.2
16	0.3	0.7	0.2	0.9	0.5	0.7	0.4		0.5	0.4	0.5	0.3	0.3	0.2	1.0	0.5	0.2						0.2	0.9
17	0.5	1.2	0.7	0.5	0.5	0.2	0.1		1.5	1.5	0.3	0.2	2.0		1.2	1.0	0.3	0.9	0.8	0.6		0.2	0.6	1.5
18	1.5	0.6	1.3	0.9	0.5	0.3	0.3	0.5	0.3	0.4	0.5	1.0	1.0	1.2	1.0	1.0	0.9	0.2	0.4	0.4	0.2	0.2		
19					0.2	0.5	0.5																	
20														0.2	0.2	0.2			0.4	0.1	0.2	0.2		0.2
21															0.7	0.1		0.7	1.5	0.2				
22							0.2	0.9	1.3	1.0	0.3	0.7	0.7	0.2	0.1		0.3	0.2	0.2		0.8	0.5		0.2
23	0.4	1.2	1.9	0.8	0.4	1.0	0.5	0.1	0.2	0.3	1.3	1.3	0.6	0.2	0.1	0.1	0.1	0.1						
24						0.5	1.2	0.9	0.4	1.0	0.9	0.9	0.5	0.4	2.4	0.9	0.6	0.3	0.8	0.2	0.3			1.4
25																								
26	0.7	0.1	1.4	0.2	0.2		0.1		0.1	0.2		0.4	1.1	0.5	0.5	0.3	0.1	0.8	0.1					
* 27																								
28	0.2				0.4	0.3	0.2									0.3	0.5	0.2	0.1					
29		0.1			0.5	0.5	0.5	1.0	0.5					0.5	0.5	0.3	1.2	0.4	0.2					
30		0.5	0.9	0.1	0.5	1.0	1.0	1.0	0.5	0.2	2.0	1.9	0.7	1.0	1.2	1.4	1.2	0.1	0.9	0.2		0.5		0.2
31																								
Mean	0.15	0.25	0.32	0.24	0.30	0.31	0.26	0.29	0.24	0.32	0.33	0.34	0.51	0.34	0.46	0.30	0.31	0.20	0.33	0.06	0.10	0.05	0.03	0.18

Open spaces without figures correspond to quiet level

* Quiet day
C · Failure of equipment

SYOWA STATION — 45° EAST MERIDIAN TIME (U.T. + 3 hours) — October 1987

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1		0.4	0.1	0.4	0.9	0.9	0.3		0.3	0.1	0.5	0.5	0.5		1.5	0.6	0.4	0.3	0.3					
2	0.2	0.2	0.3	0.1		C	0.1	0.4	0.4		0.2	0.2	0.1			0.5	1.1	0.1			0.1			
3									0.5	0.2	0.7	0.8	0.2	0.1		0.5	0.1	0.5		0.1	0.4	0.1		0.8
4								0.3	0.5			1.3	0.5	0.3	0.1	0.9	1.5	0.2		0.2				
5										0.2	0.1	0.2		0.2	0.2	0.5			0.2					
6		0.1	0.1	0.4																				
7																0.2		1.1	1.8					
8					0.2	0.2	0.7							0.5			0.2	0.1		0.4	0.3			
* 9																								
10			0.1	0.3	0.2	0.2																		
11							0.2	0.4	0.4	0.4	0.5		0.2		0.2	0.1				0.3	0.2		0.6	0.7
12	0 1																				0.1			
13				0.7	0.5	1.0	0 4	0.1		0.6	0.6		0.2	C	0.3		0.5							
14		0 7	0.3	1.6	1.0	0.2	0.2	0.6	0.5		2.1	3.0	2.0	0.8	0.6	2.0	1.2		1.4	0.5				0.2
15			0.7	0.8	0.9	0.7		0.8	0 8	0.5	0.5	1.3	2.6	0.6	2.0	1.4	1 5							
16			0.4		0.5		0 6	0.5		0.8	1.8	1.0	0.4				1.0	0.2	0.5	0.3	0.8			
17				0.1	0.5	0.5	0.1	0.1		0.5	0.3			0.3	1.7	0.5	0.7	1.3	2.2					
18		0 2	0.1	0.2	0 8	0.2								0 2			0.2	0.2						
19			0 1														0 5	0.7	0.2					
20																0.2			0.2	0.4	0.9			
21		0.5	0.3		0.5	0.2	0.1	0.4	0.5	0.8	0.2	0.2						0.1	0 3	0.2				0.4
22		0.3	0 3																					
23					0.2	0.2	0.1	0.1	0.1	1.0	0.3								0.2		0.3	0.4		
24							0.2				0.4	0 2			0.5	0.6	0.4	0.3	0.2	0.3				
25	0.5				0.5	0.5	0.7		0.2	1.9	0.5	0.1	0.9	1.0	0 5	0.4	0.1	0 6	0.5					
26		0.1		0.3	0.2			0 1	1 1	0.2	0.2	0.2	1.3	1.2	1.2	0 5	0.2	1.2						
27			0.2	0.2	0.4	0.2	0.6	1.3	1.0	0.2	1.8	1.0	0.3	1.6	0.5	0.3	2.3	1.5	0.5					
28				2.2	1.5	0.2	0.7			1.5	2.5	0.9	1.6	0.9	1.9	0.5	0.2	0.2	0 2					0.8
29	0.2			0.5	0.8	0.4	0.2	0 1	0.2	0.2	0.1	0.8	0.5		0.2	1.0	1.0	0.2	0.4					
30		0 1		0.5	0.5	1.1	0.5	0.9	0.3	1.0	0 5	0.2	0.5	1.9	2.0	1.5	0.2	0.5	0.6	0.5	0.2			
31										0.3			0.4	0.4	1.5	0.3	0 5		0 2	0.4	0.3		0.2	0.1
Mean	0.03	0.08	0.09	0.26	0 32	0.22	0 18	0.19	0.21	0.33	0.44	0 38	0.39	0.33	0 48	0 40	0 44	0.30	0.31	0.11	0.11	0 01	0.02	0.09

Open spaces without figures correspond to quiet level

* Quiet day
C Failure of equipment

SYOWA STATION 45° EAST MERIDIAN TIME (U.T. + 3 hours) November 1987

	Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	1			0.2		0.2	0.5	1.2	0.7	0.1			0.2		0.3	0.1				0.2	0.2				
	2						0.3	0.2	0.2	0.2	0.2	0.1	0.7	0.7	0.1					0.5	1.5				0.7
	3	0.1							0.1				0.4	0.3										0.2	
	4	0.7	0.4	0.5	0.3	0.5	0.2	0.2																	
	5					0.1																		0.3	
	6		0.1	0.2					0.2	0.9	0.3						0.2				0.1				
*	7																								
	8							0.2		0.1					0.4										
	9																								
	10		0.1	0.2	0.5	0.3	0.2					0.2					0.3								
	11		0.1	0.1				0.2	0.6	0.3	0.9	0.3	0.1		0.3	0.1									
	12		0.2	0.5	0.7	0.2			0.1				0.8	0.4	0.6			0.5							
	13		0.2	0.1			0.6	0.5	1.0	0.6	0.1	0.7	0.5	0.7		0.1	1.0	1.2		0.5					
	14		0.6	0.2	0.3	0.7	0.3	0.5	0.5	1.3	0.5			0.5	0.3	C		1.0	1.7	1.4	0.2				0.5
	15	0.2	0.4	0.3	0.4		0.7	0.2		0.2			0.4	0.3				0.3	0.1			0.4	0.1		
	16			0.8	0.5	0.6	0.5	0.1	0.1	0.1	0.5		0.1									0.6		0.2	0.2
*	17					0.2																			
	18		0.1							0.5	0.1														0.3
	19	0.1		0.2	0.2					0.4	0.1				0.1		0.2								
	20			0.1	0.1				0.3	0.2	0.1	0.5	0.5								0.5	0.5	0.1	0.2	
	21			0.1	0.1	0.1	0.7		0.2		0.8	0.4													
	22				0.3				0.4	0.3		0.3						0.2	0.2						
	23	0.1	0.2		0.2			0.5	0.2				0.7	0.5	0.1	0.3	0.1	0.3	0.2					0.8	0.2
	24		0.1		0.2	1.0	0.4	0.5	0.7		0.1	1.5	1.0	0.3	0.9	2.4	0.4	0.2							
	25		0.3	0.1	0.7	0.7	0.3				0.5	1.0	0.2			0.1	0.2				0.2				
	26	0.5			0.4	0.2	0.7	0.4	0.5	0.2	1.2	0.1	0.1	0.1		0.5	0.1	0.3	0.7	1.0	0.5				
	27				0.7	0.6	0.3	1.3	0.8	1.0	0.2	0.4	0.4	0.4	0.5	0.1	1.1		0.5						
	28				0.1							0.1	0.1				1.0								
	29		0.3	0.5	0.1																				
	30																0.5								0.2
	31																								
	Mean	0.05	0.10	0.13	0.19	0.18	0.19	0.20	0.22	0.21	0.18	0.18	0.20	0.14	0.12	0.12	0.17	0.13	0.11	0.12	0.10	0.05	0.01	0.05	0.07

Open spaces without figures correspond to quiet level

* : Quiet day
C : Failure of equipment

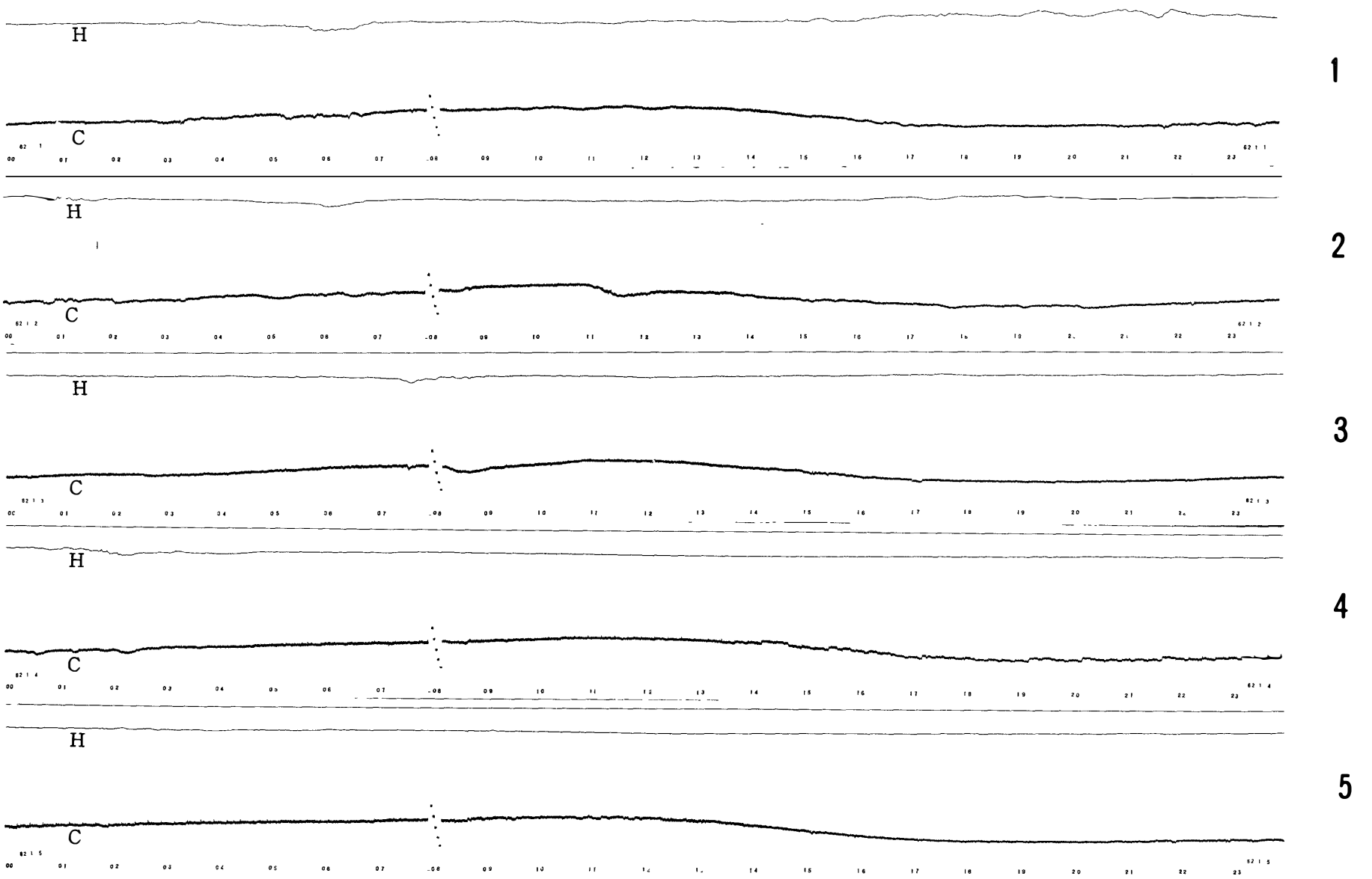
SYOWA STATION — 45° EAST MERIDIAN TIME (U.T. + 3 hours) — December 1987

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	0.8	0.5	0.3																					0.5
2	0.2	0 2	0.2	0.1						0.7										0.3		0.5		
3																								0.5
4		0.2																						
5			0.3	0.5		0.1	0.2						0.3						0.1					
6																								
7	0.3	0 7																						
8																								
9																								
10	0.5							0.2										0.1		0.3	0.1			
11	0.7				0.5		0.5	0.2																
12	0.4	0 2	0 1	0.3	0.2		0 5	0.4	0.1	0.6						0.4					0.2			
13																								
14																								
15	0.3													C	C	C				0.7				
16					0 5	0.2	0.3	0.5			0.5	2.0	1.9	C	C	0.5	0.7							
17		0.1	0 9	0.2	0.3	0.1	0 3	0.3	0 3	0.2				C	C		0.1		0.5					
18		0 2	1.2	0.1		0.2	0.3	0.4					0.5											
19				0.2	0.2				0.5							0.2	0.6		0.2					
20									0.2															
21								0.2	0.3											0.2				
22					0.1				0 2	0.2	0.8	0.2			0 2	0 2	0 1	0 5	0.2				0.1	
23	0 1				0.4	0 4			0.5	0.2										0.1				
24							0.1																	
25								0 2		0.3	0.2		0.4	0.1										
26		0.2		0.2			0.3	0 5								0.1								
27				0.2	0 2	0.2																		
28			0.3																					0.1
29		0 4					0.2																	
30																								
31																								
Mean	0.10	0.08	0.10	0.05	0 07	0.03	0 08	0.09	0.06	0 07	0.04	0.07	0 08	0.01	0 01	0.04	0.05	0 01	0.03	0.05	0.01	0.01	0.01	0.03

* *

Open spaces without figures correspond to quiet level

* Quiet day
C Failure of equipment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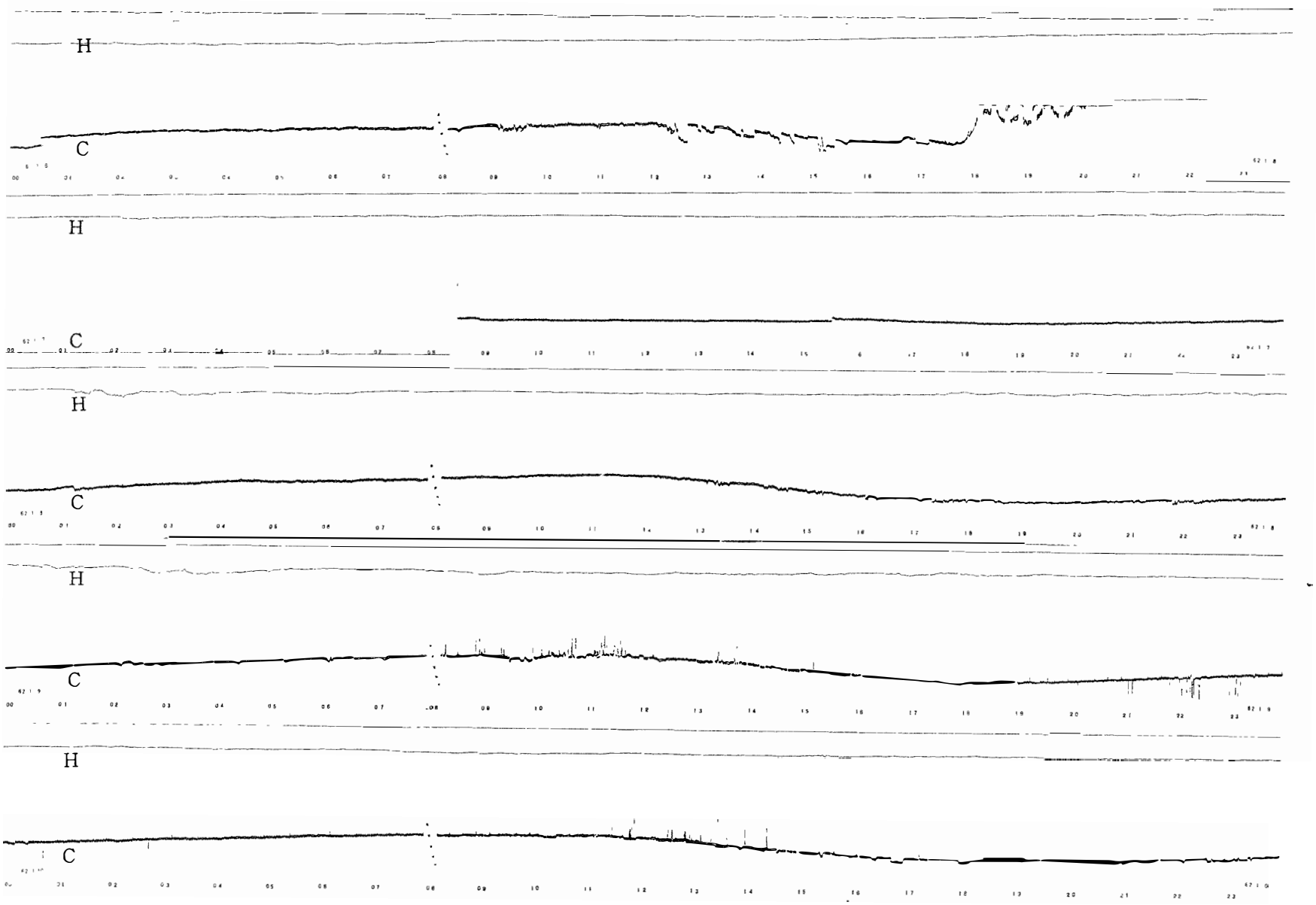
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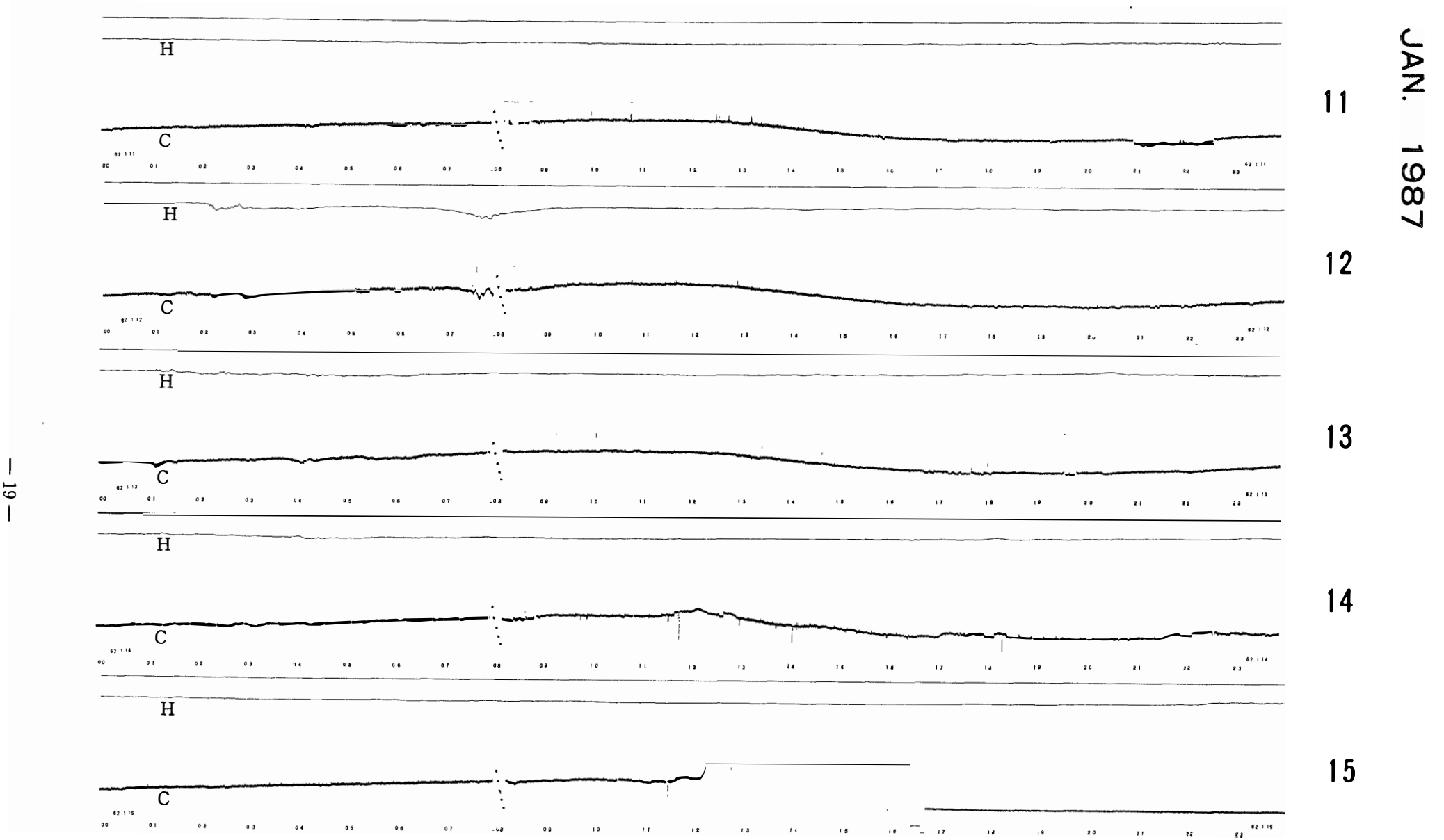
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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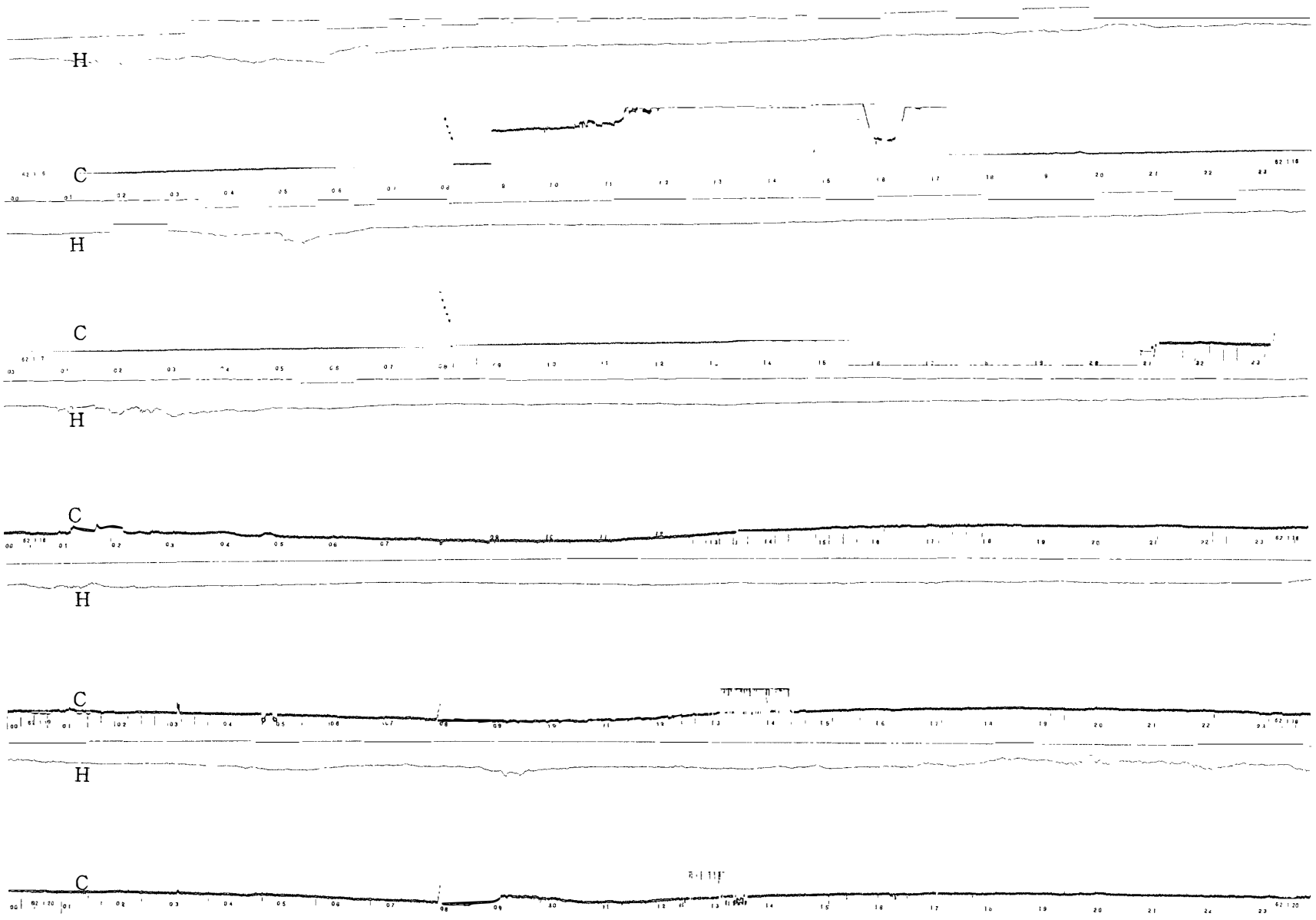
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

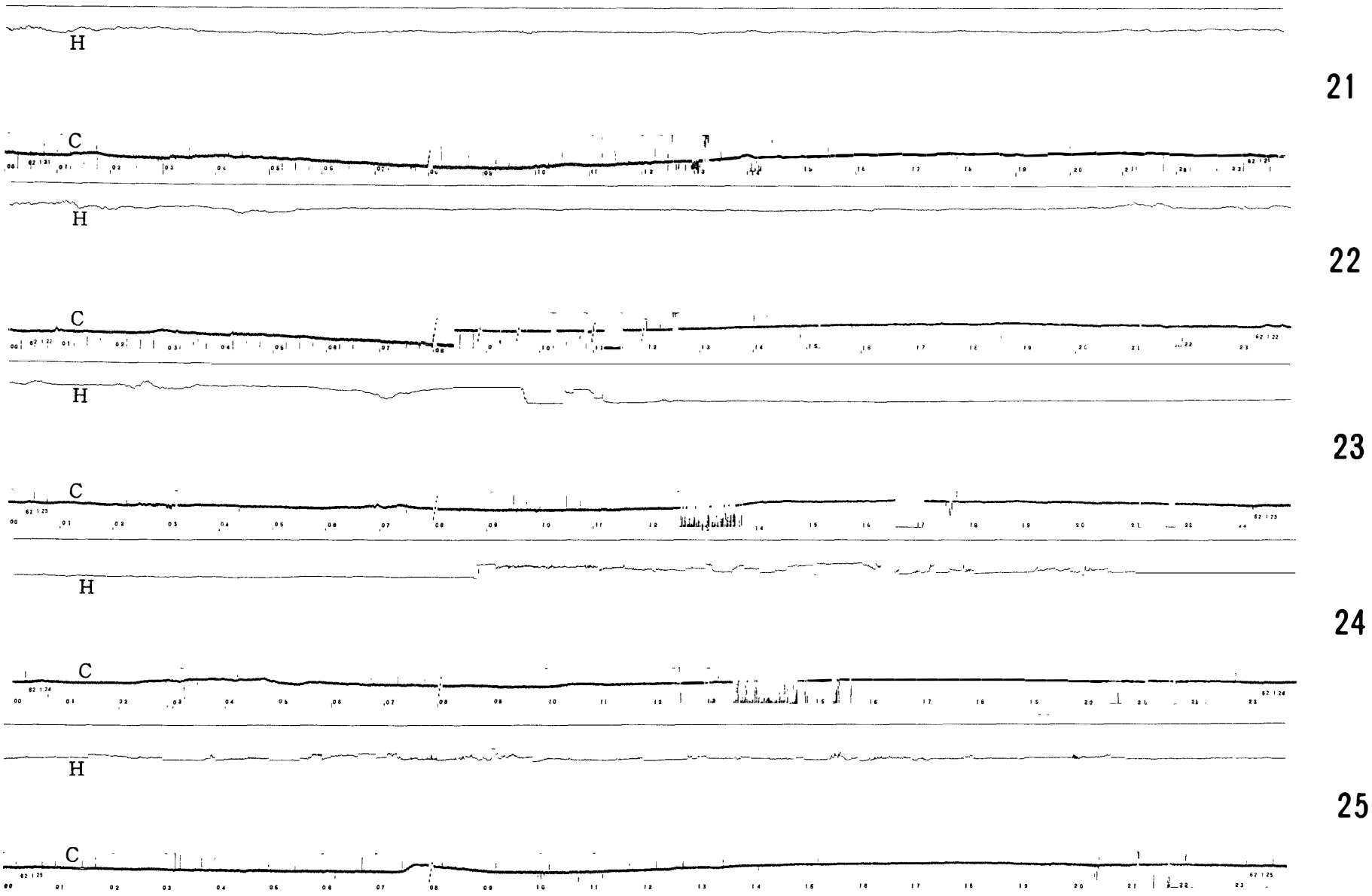


00 04 08 12 16 20 24

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

JAN. 1987


JAN. 1987
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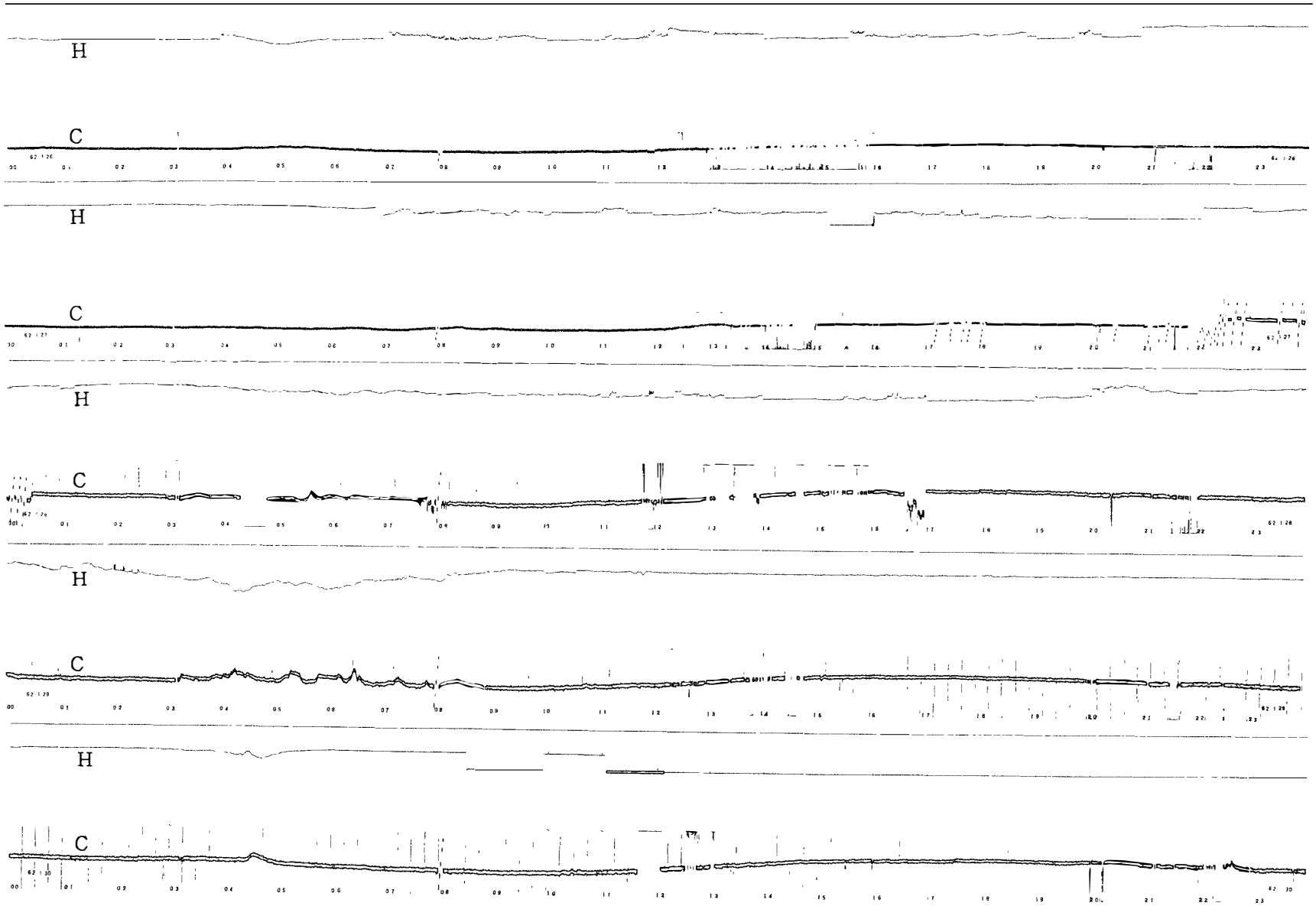
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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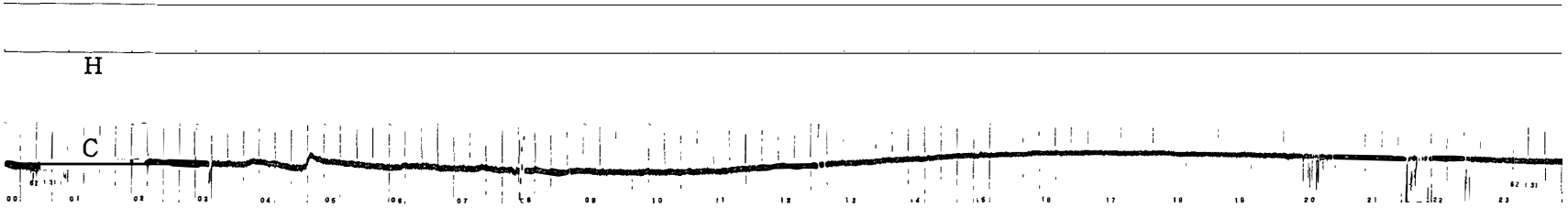
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



31

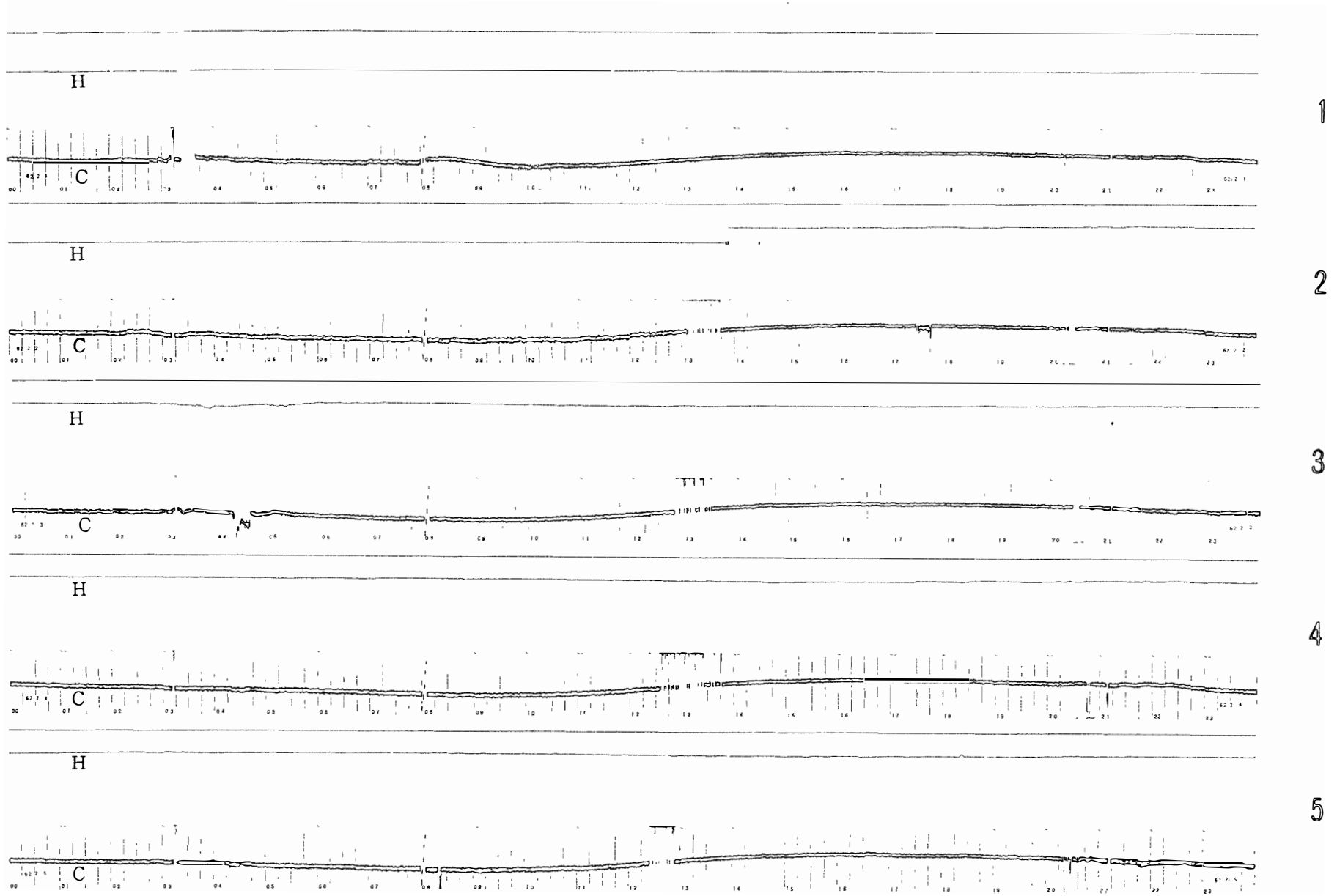
JAN. 1987

00 04 08 12 16 20 24

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

January	6	1810 -	Failure of equipment
	7	0834	"
	15	1215 - 1645	"
	16	1125 - 1722	"
	17	1535 - 2120	"
	22	1112 - 1134	"
	23	1640 - 1712	"
	28	0425 - 0453	"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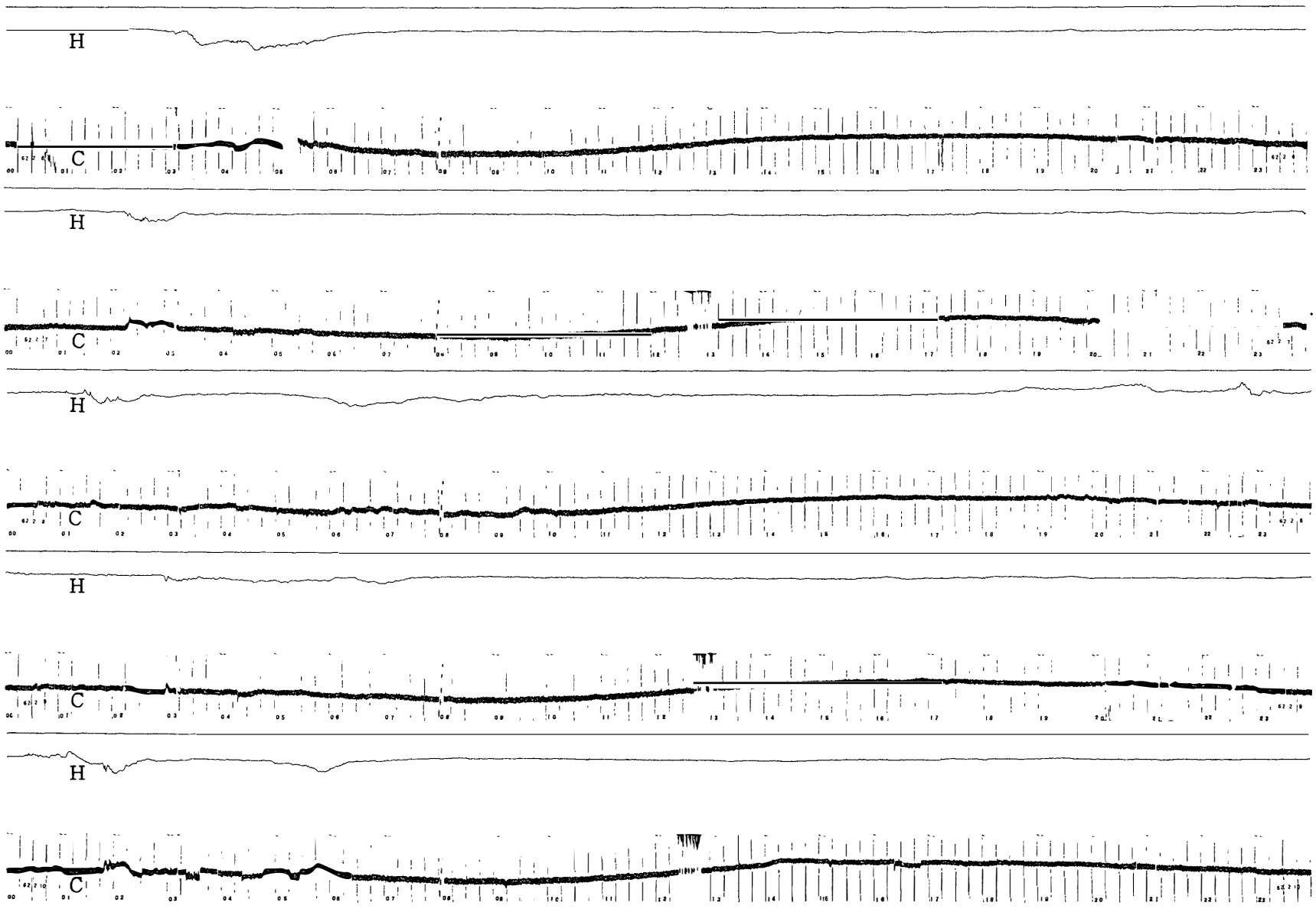
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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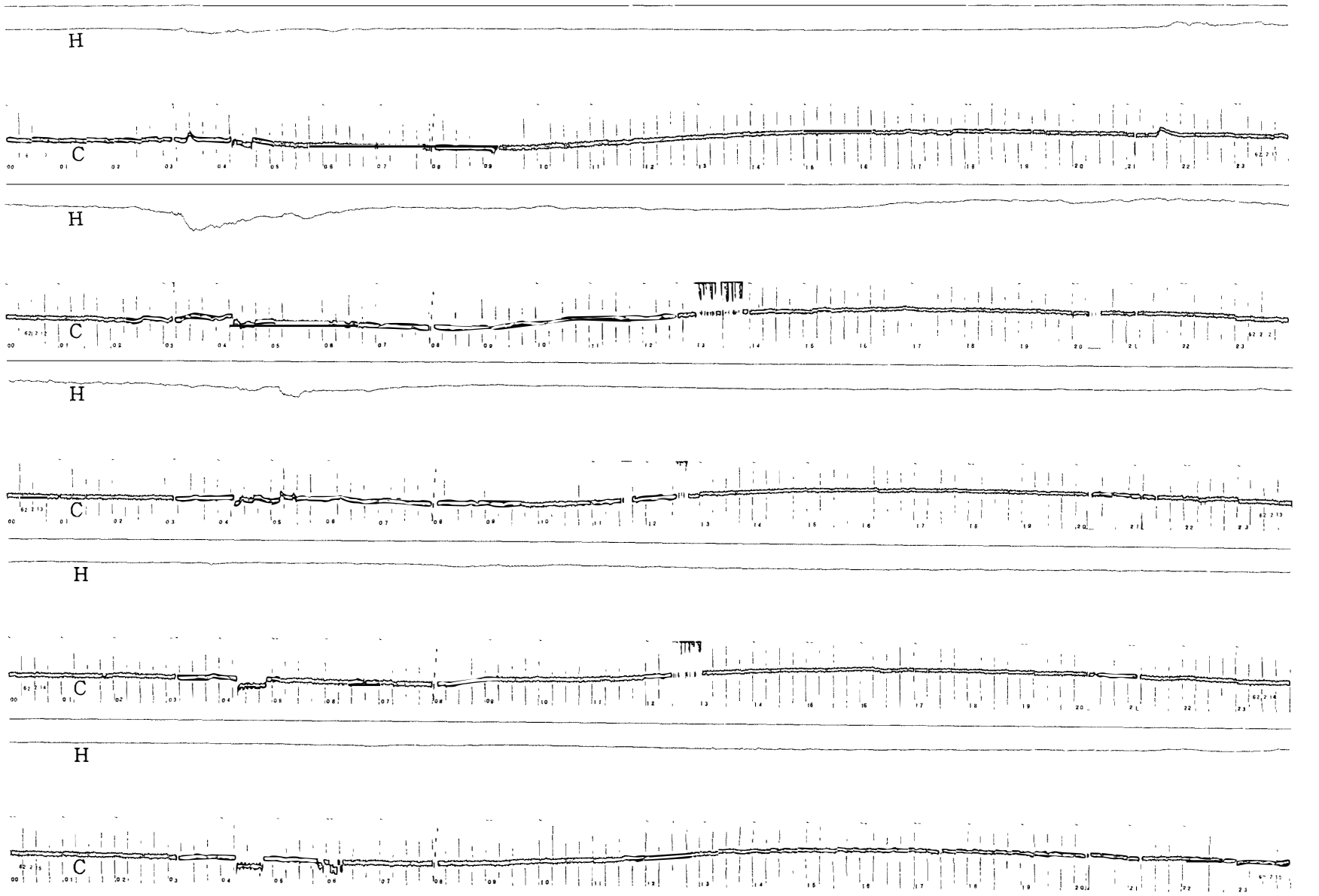
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

FEB. 1987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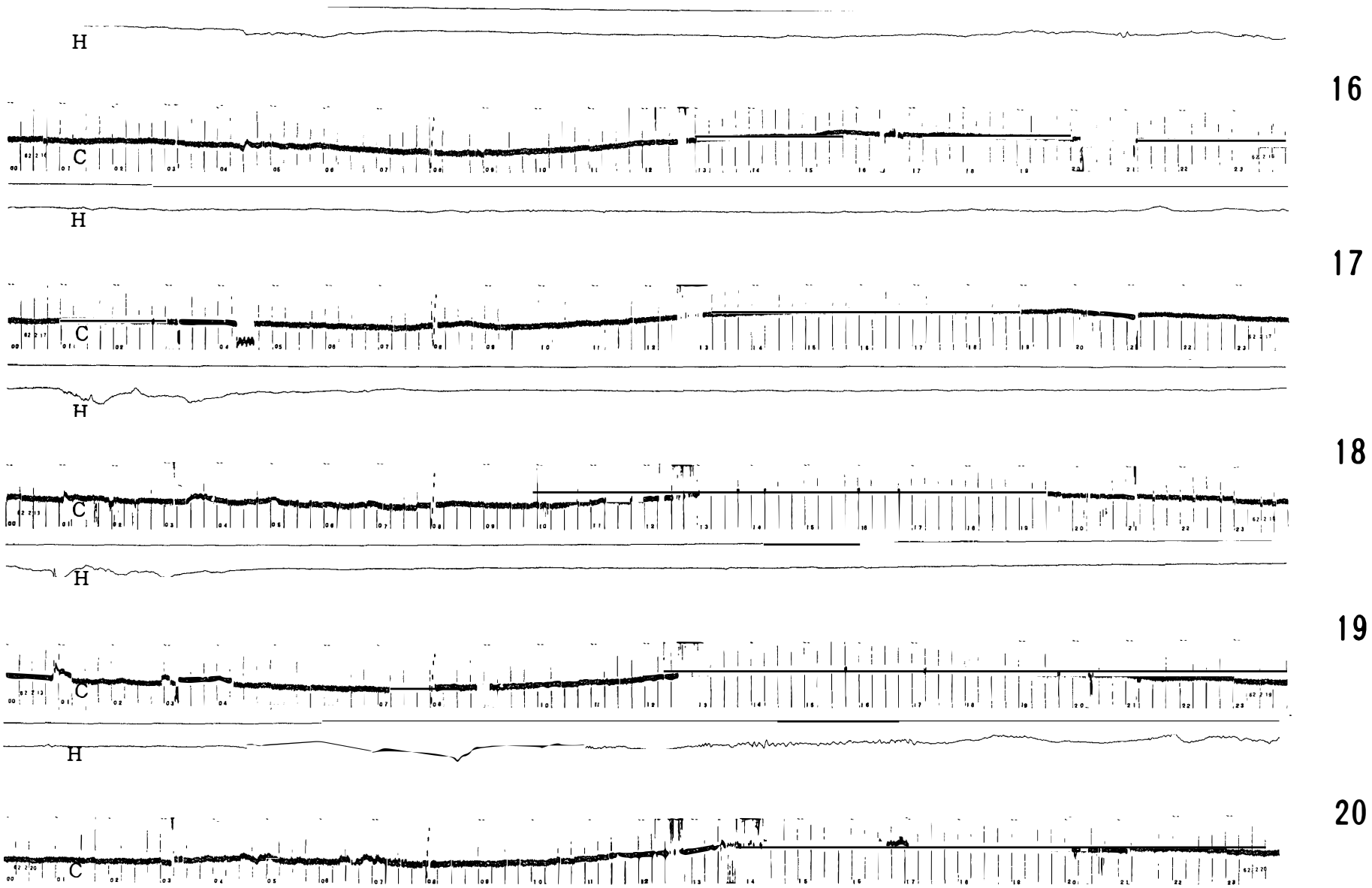
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

FEB. 1987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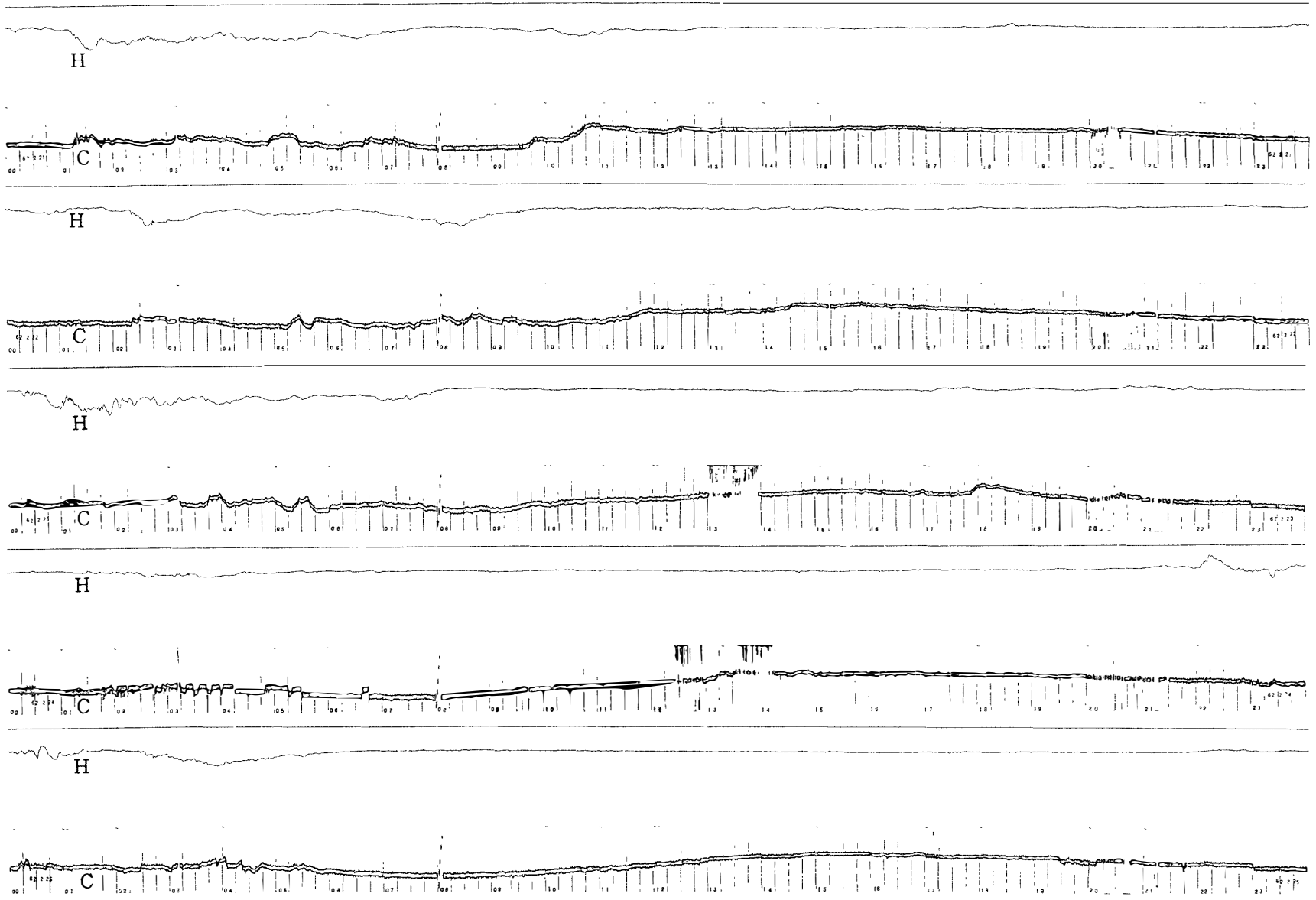
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE
FEB. 1987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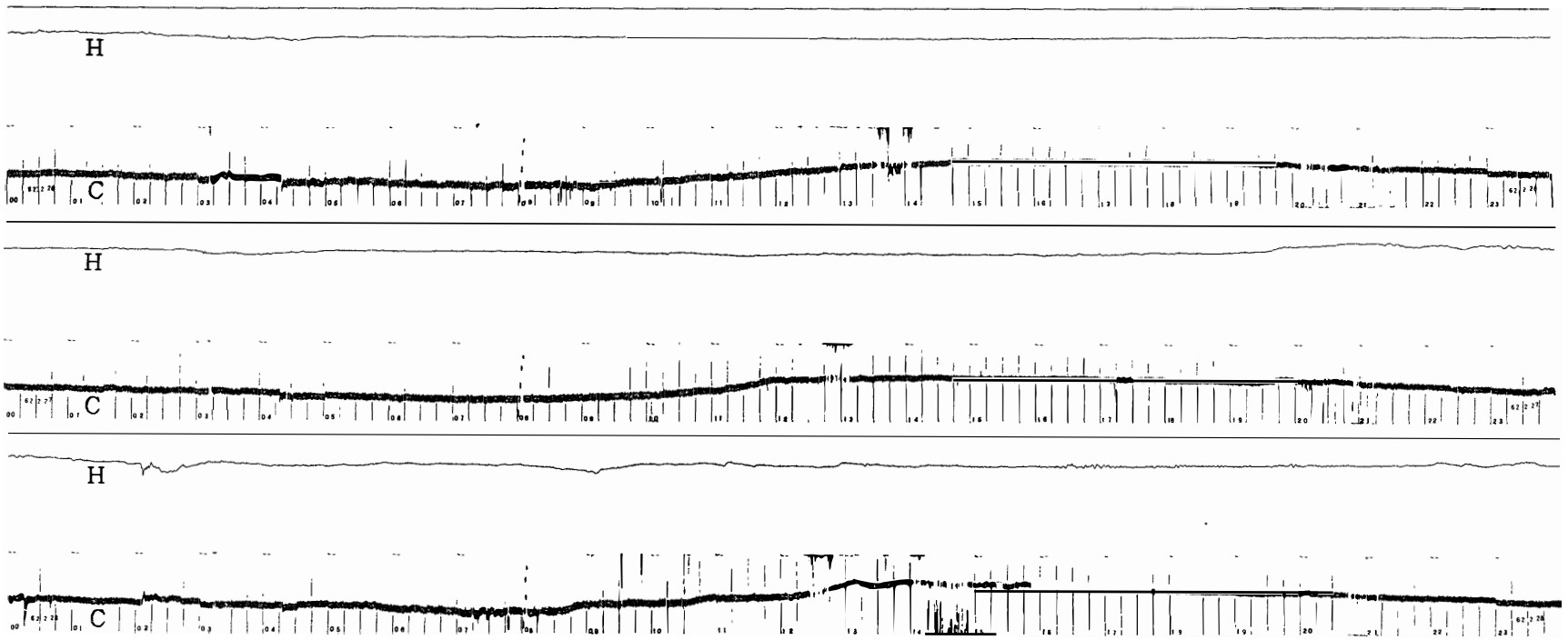
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



FEB. 1987

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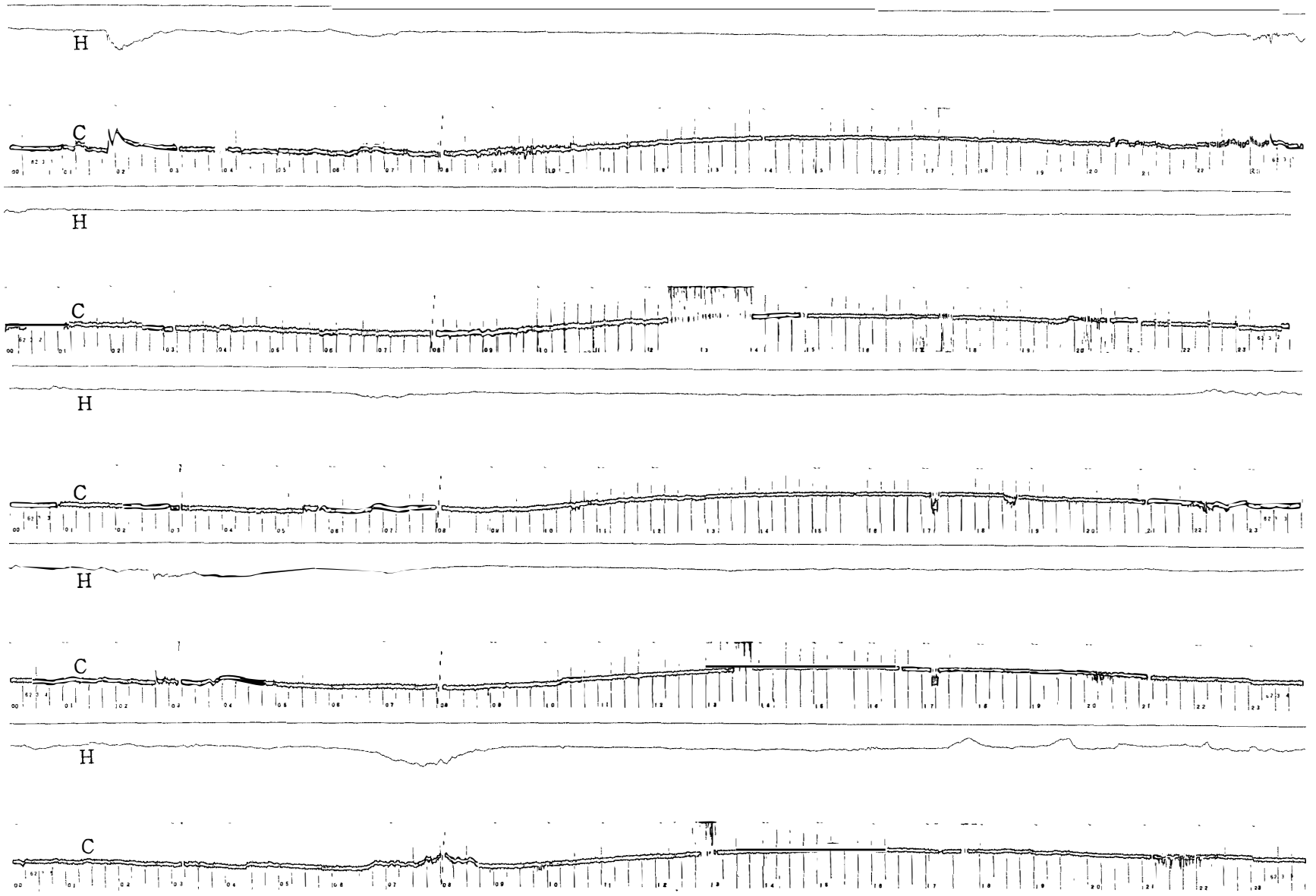
00 04 08 12 16 20 24

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE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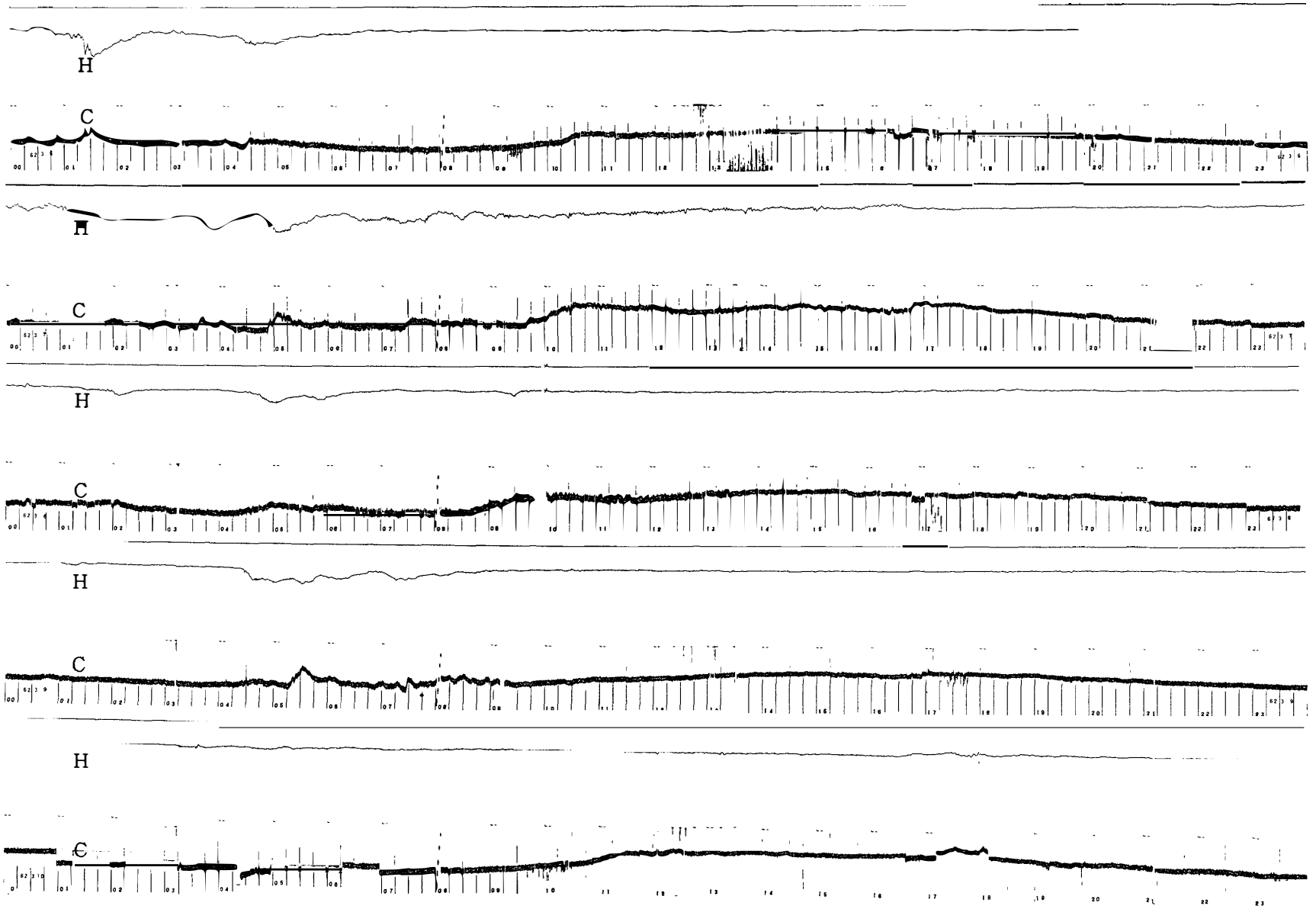
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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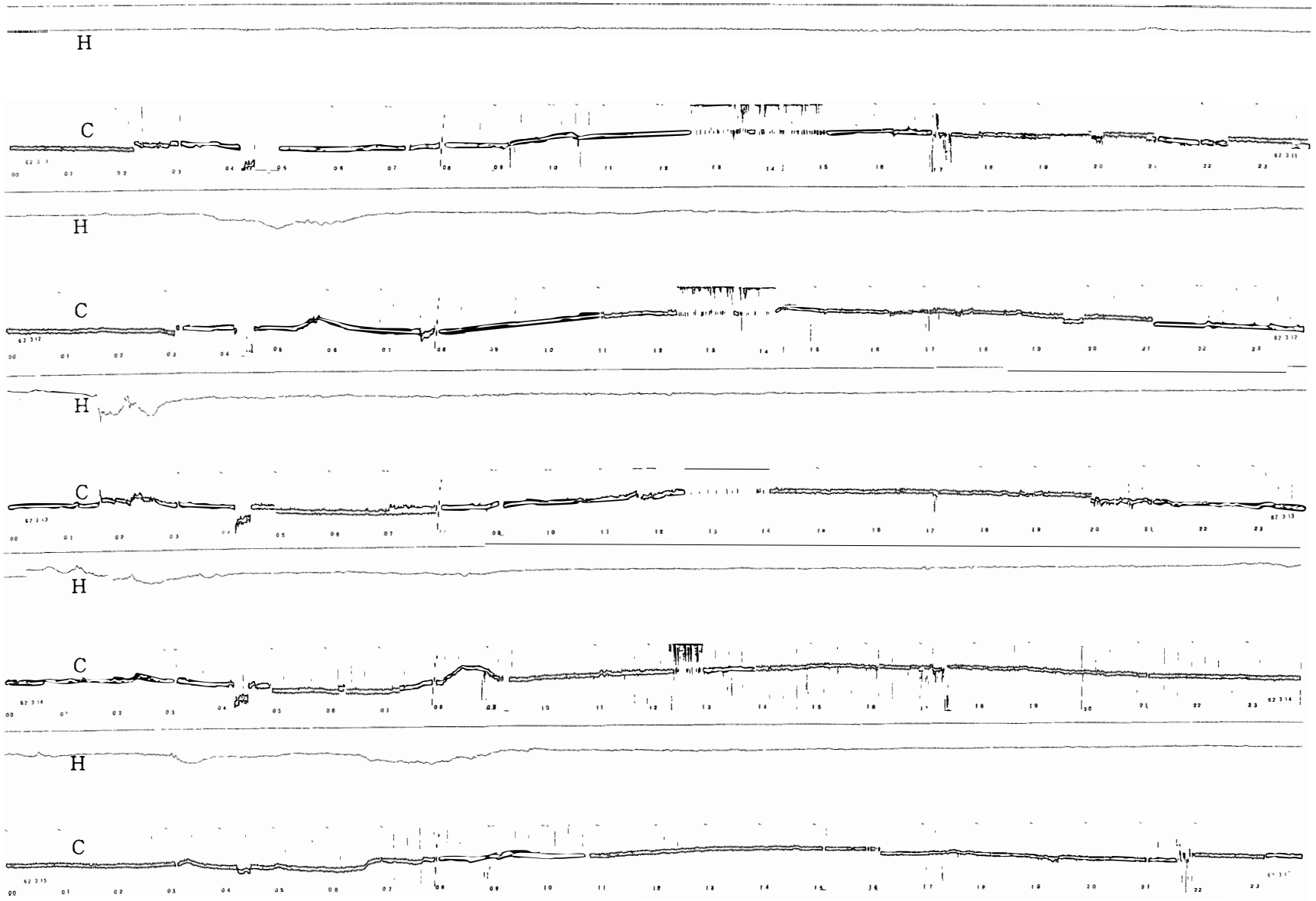
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



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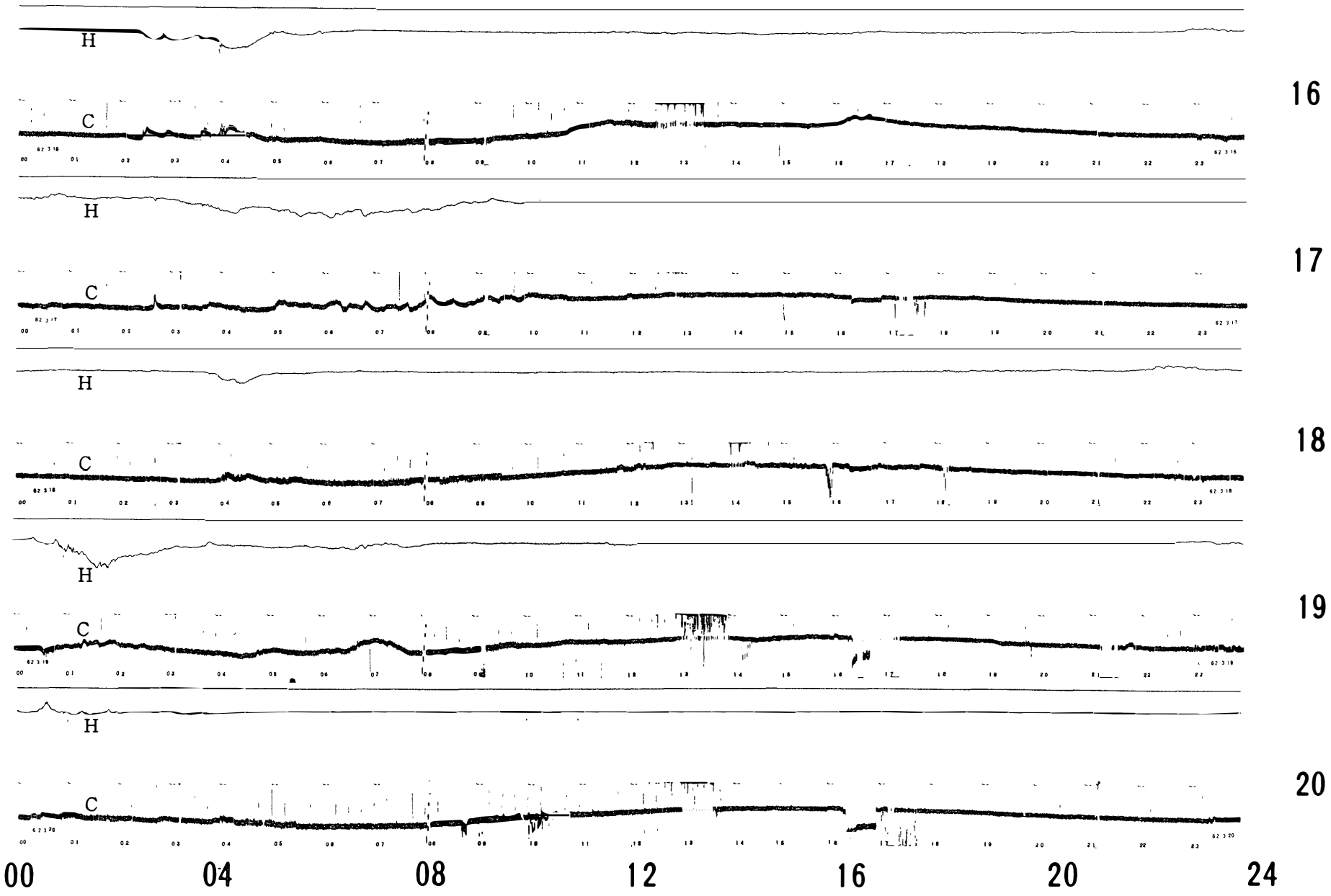
45° EAST MERIDIAN TIME IN HOURS

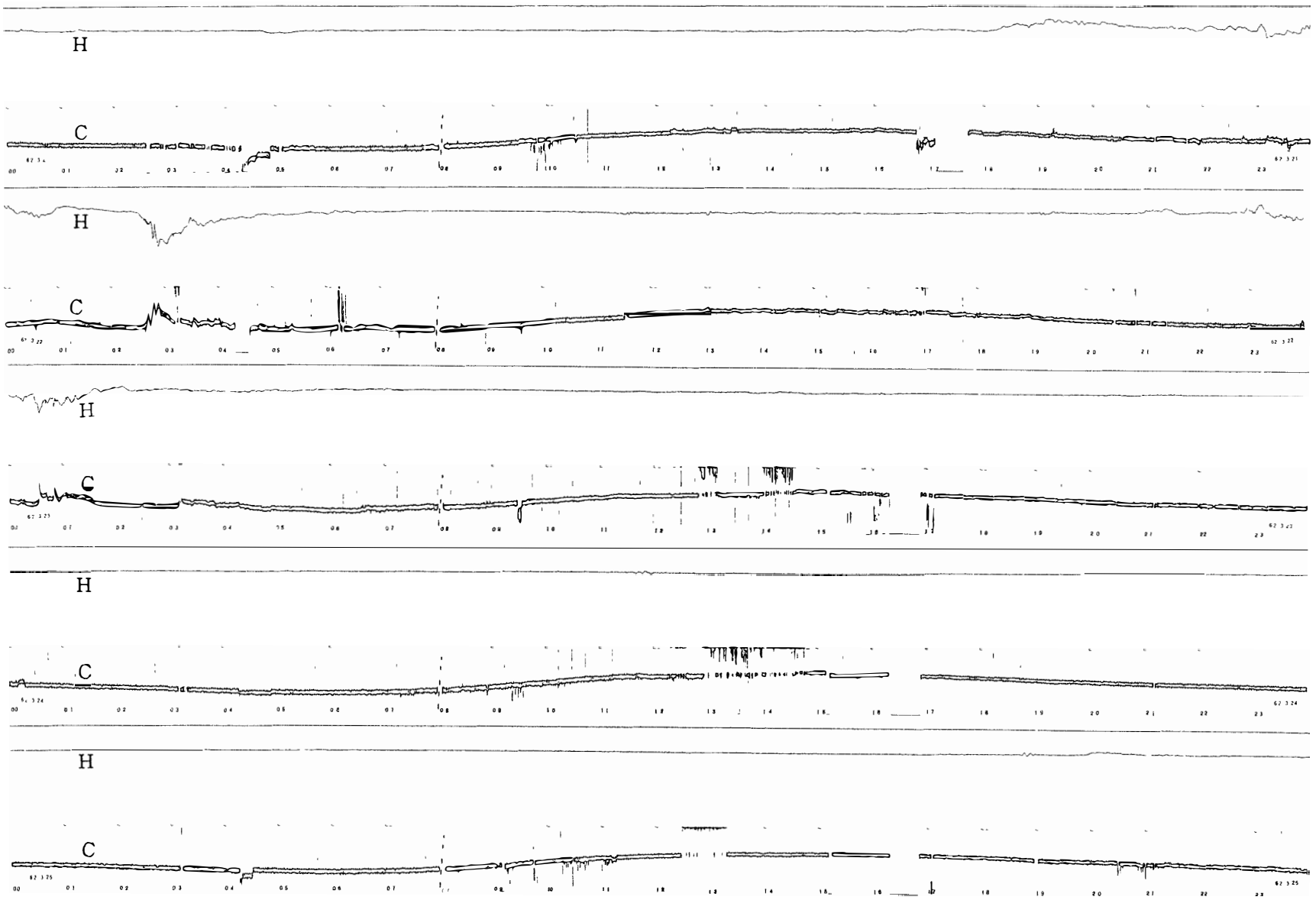
30 MHz COSMIC NOISE



MAR. 1987

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE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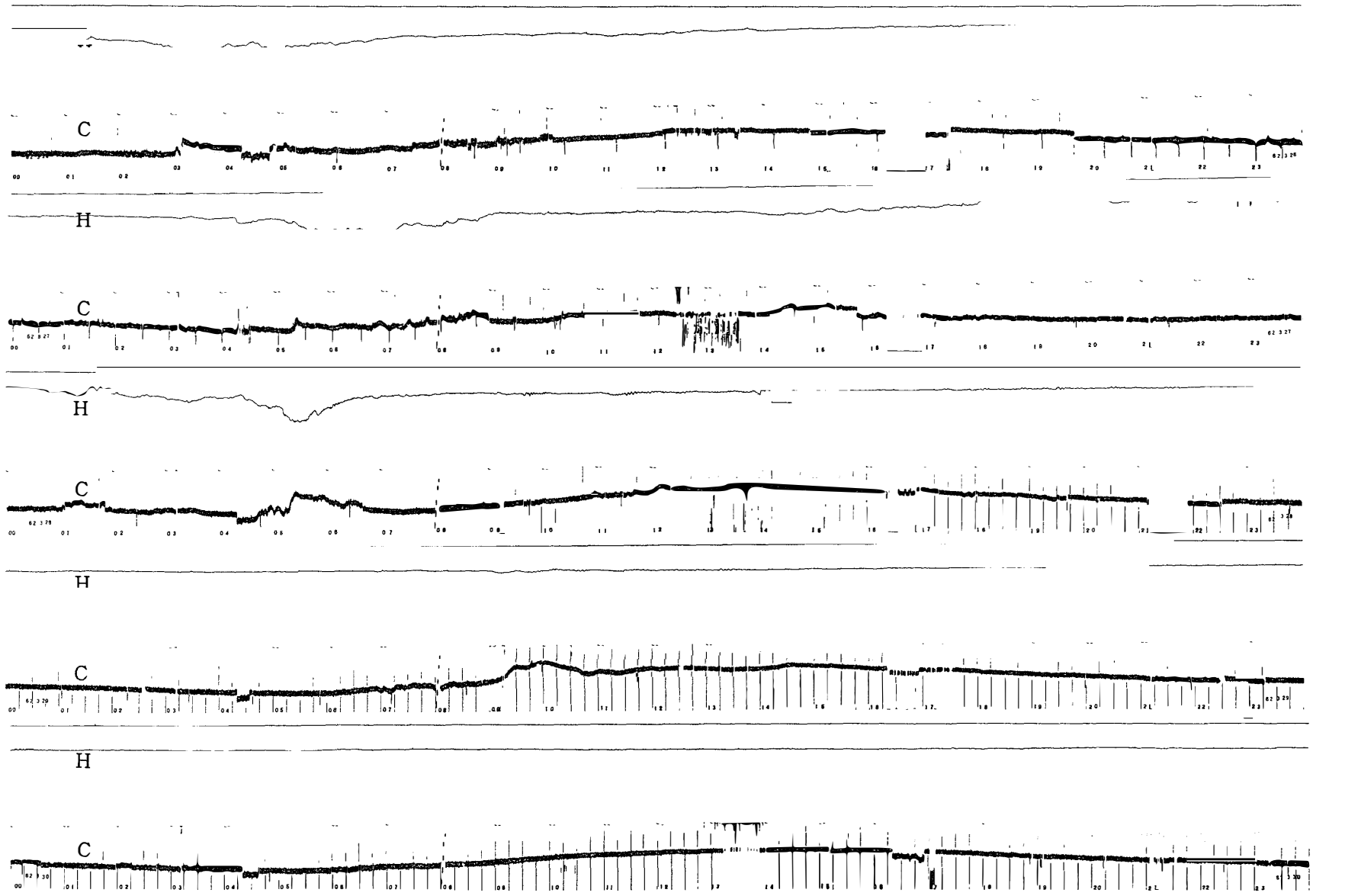
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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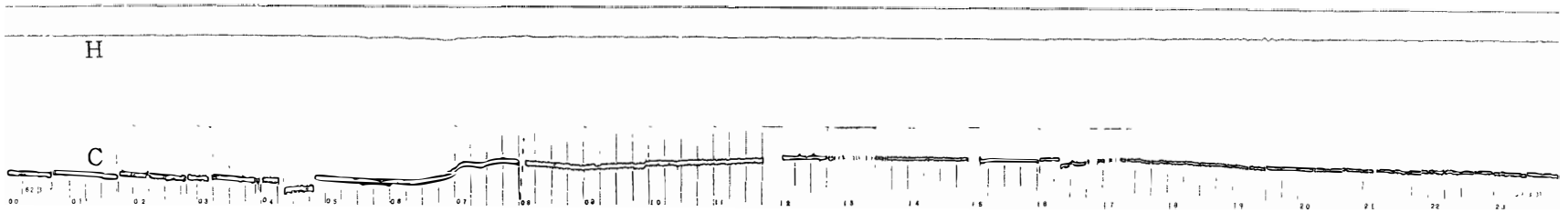
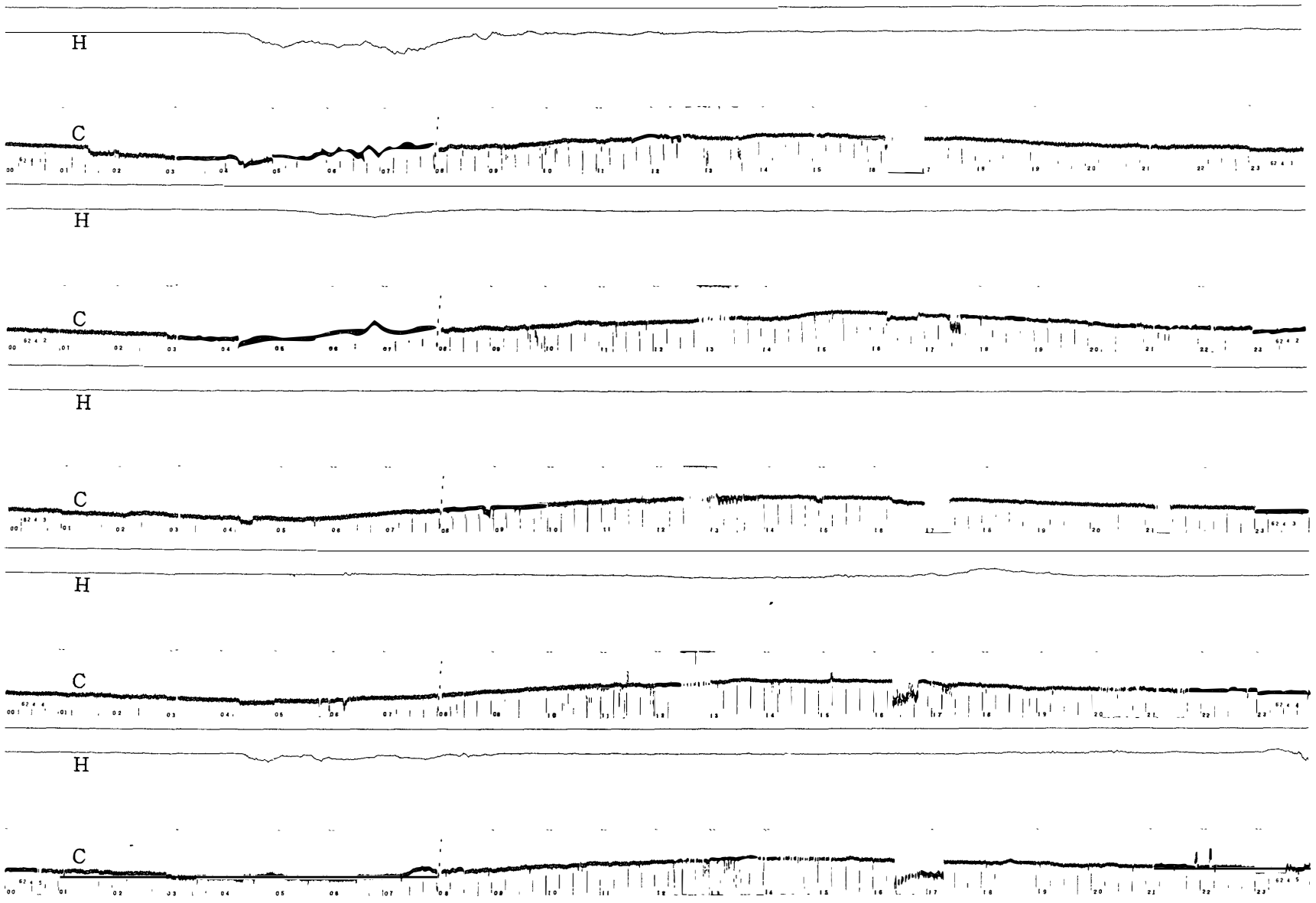
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



Cosmic noise level obscured or equipment malfunction.

March	11	0418 - 0502	Failure of equipment
	21	1648 - 1745	"
	24	1620 - 1655	"
	25	1620 - 1651	"
	26	1620 - 1703	"
	27	1620 - 1659	"
	28	2110 - 2155	"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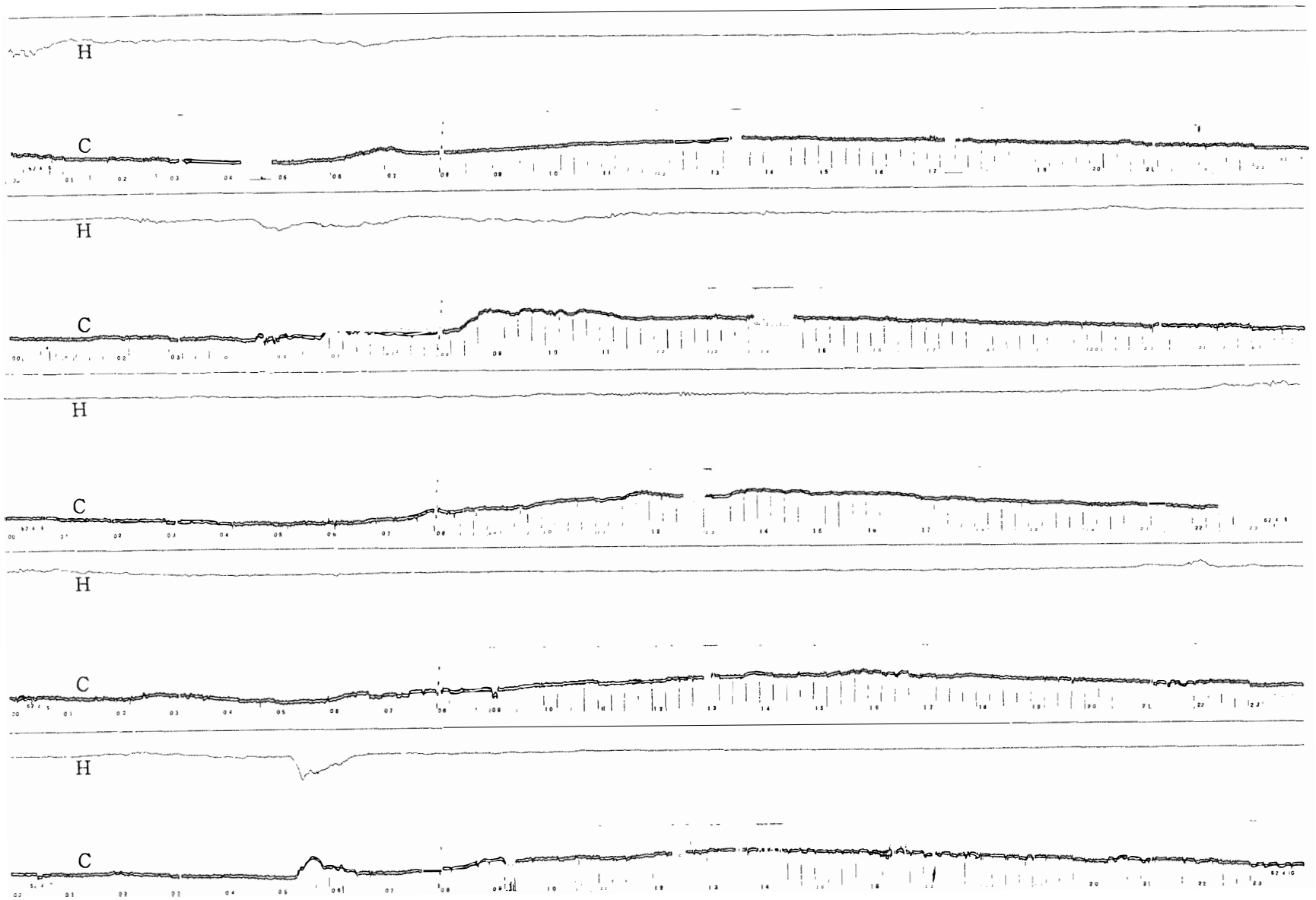
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

APR. 1987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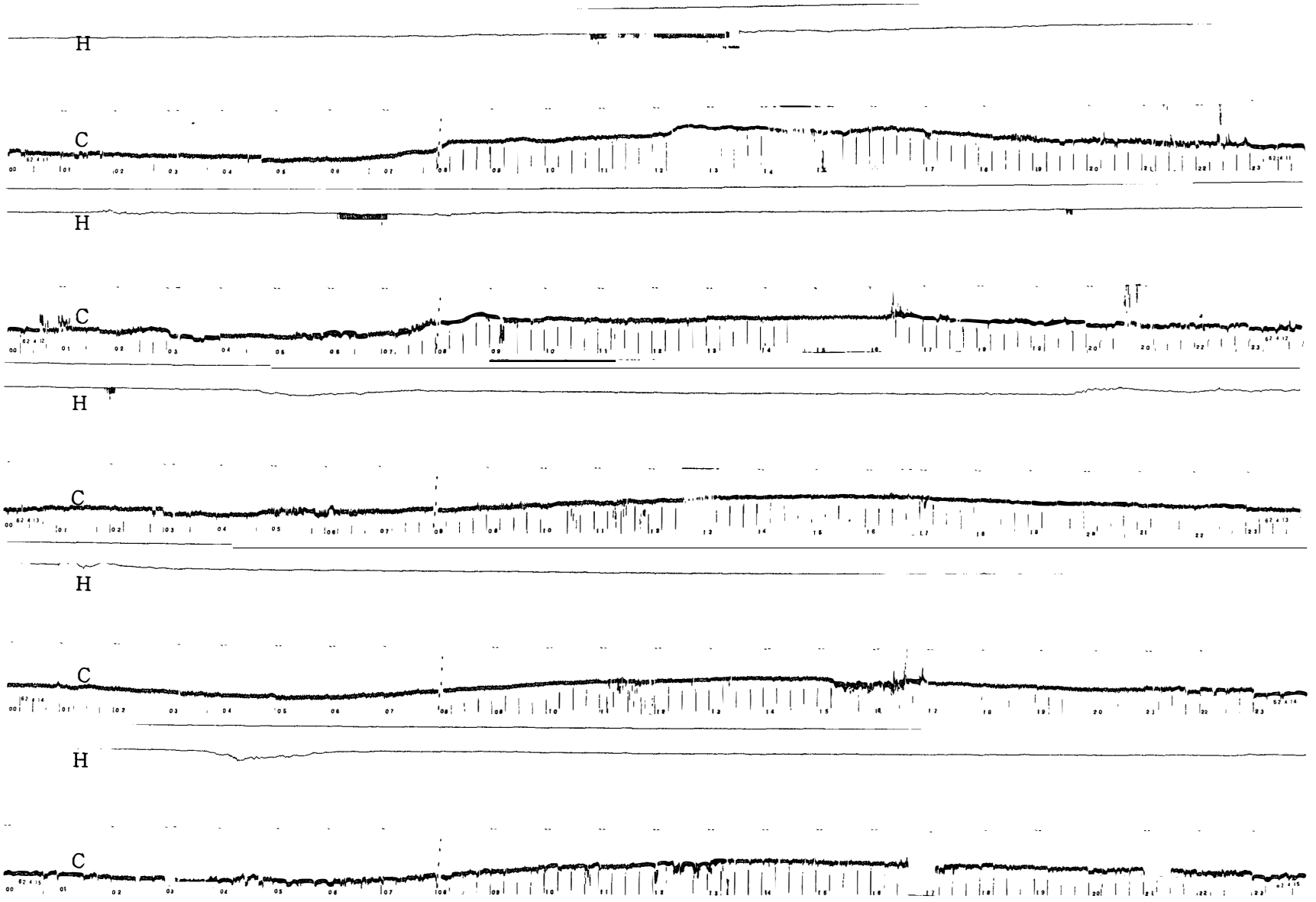
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

APR. 1987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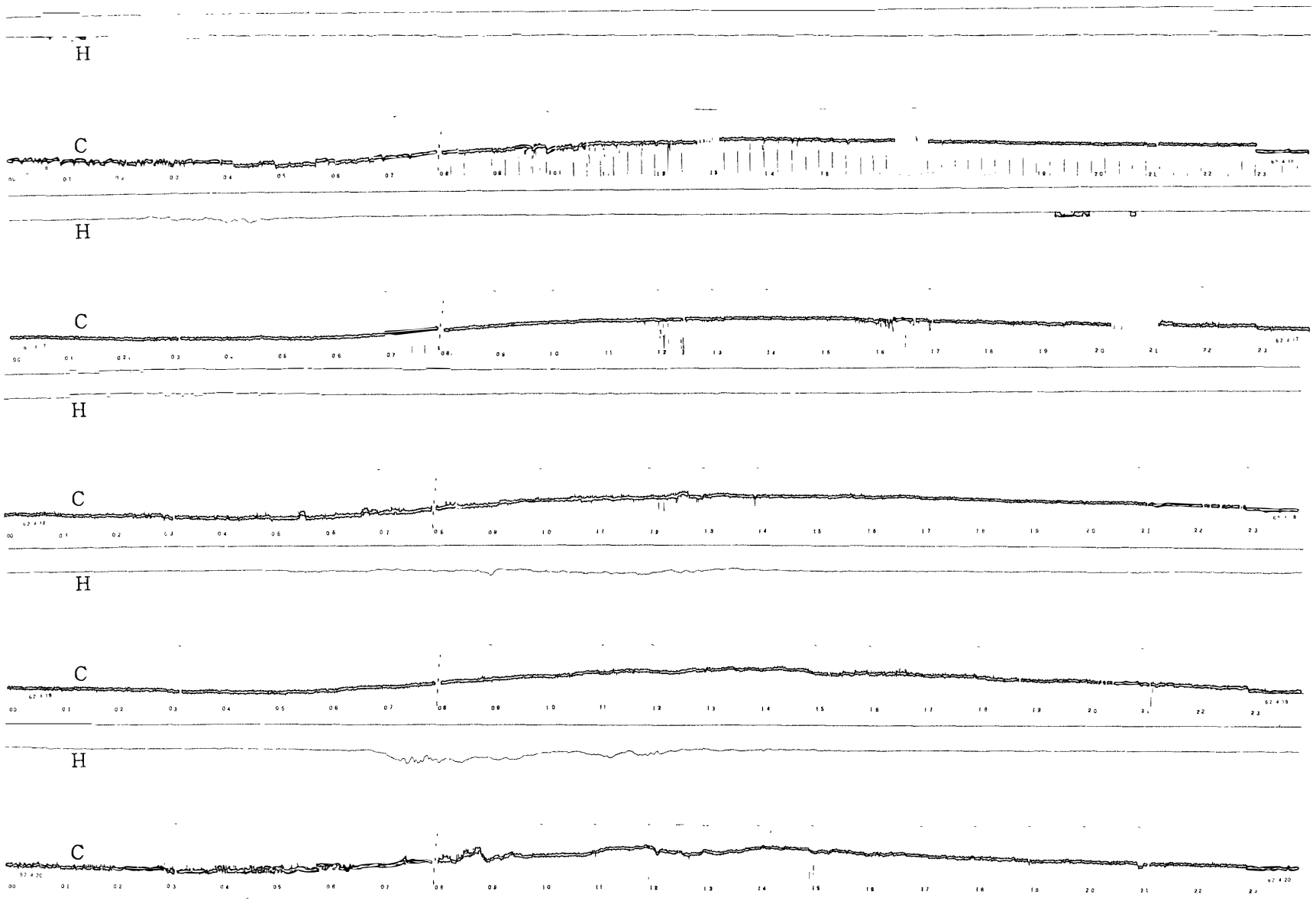
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

APR. 1987

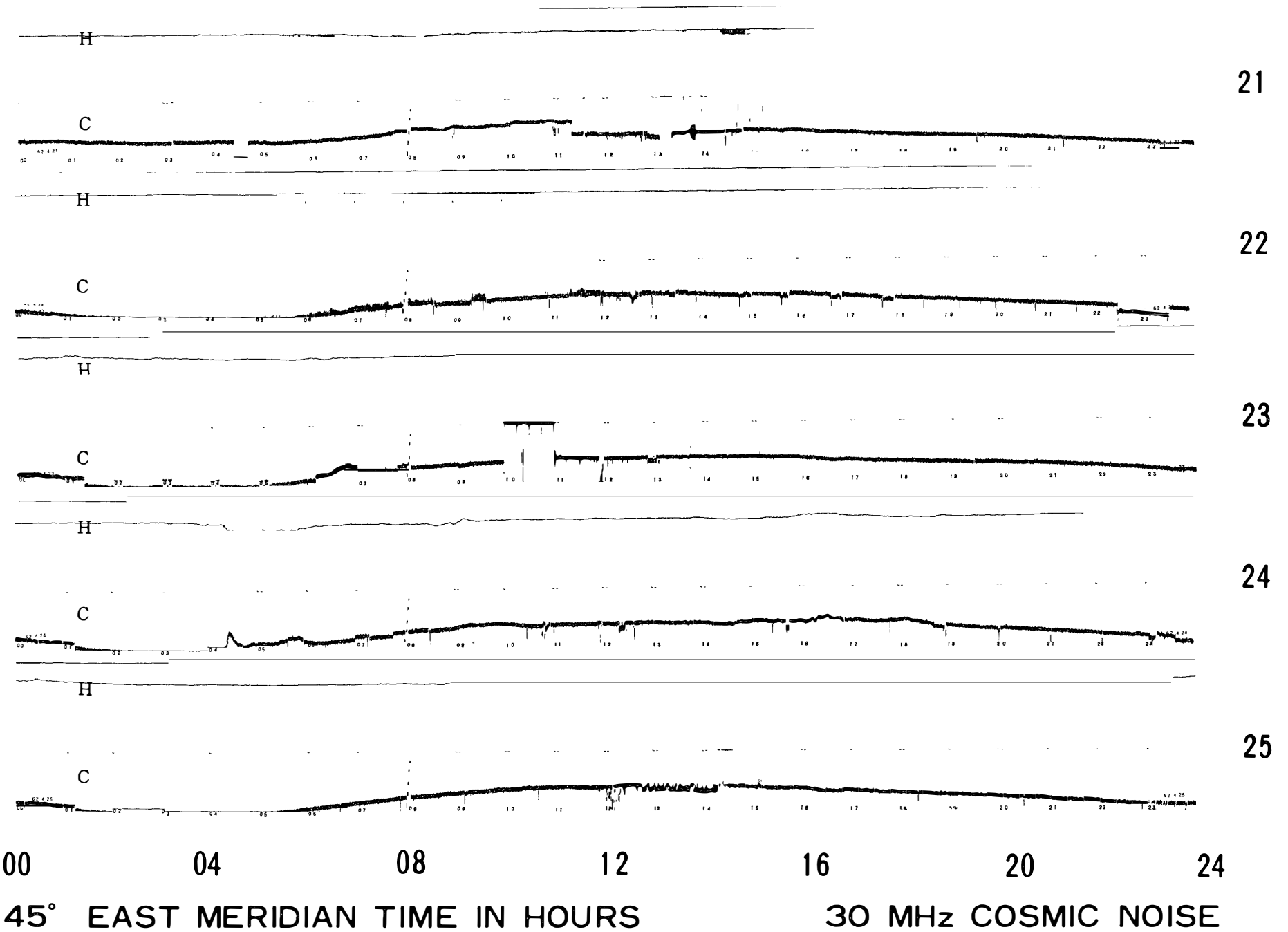


00 04 08 12 16 20 24

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

APR. 1987


APR 1987
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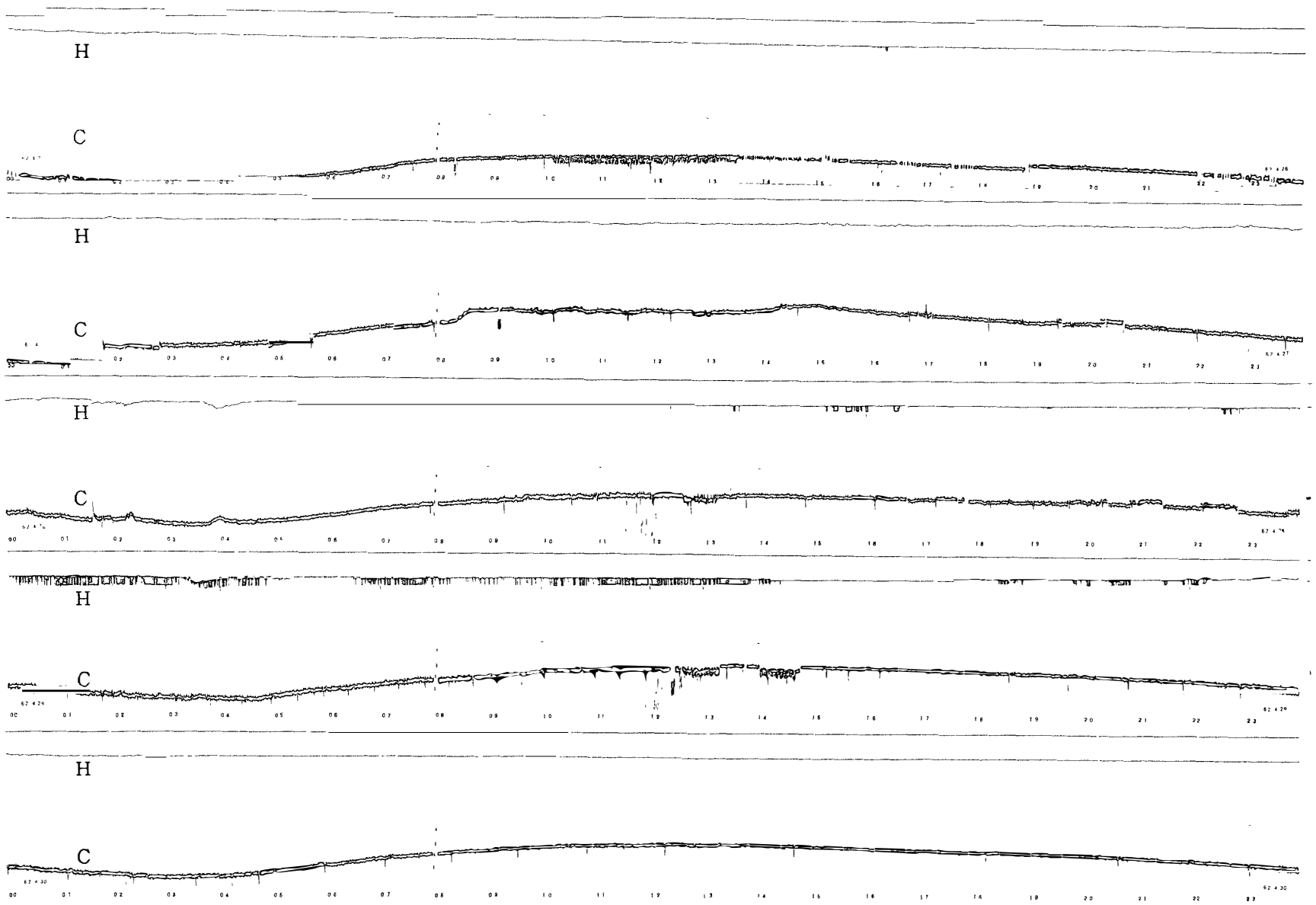
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

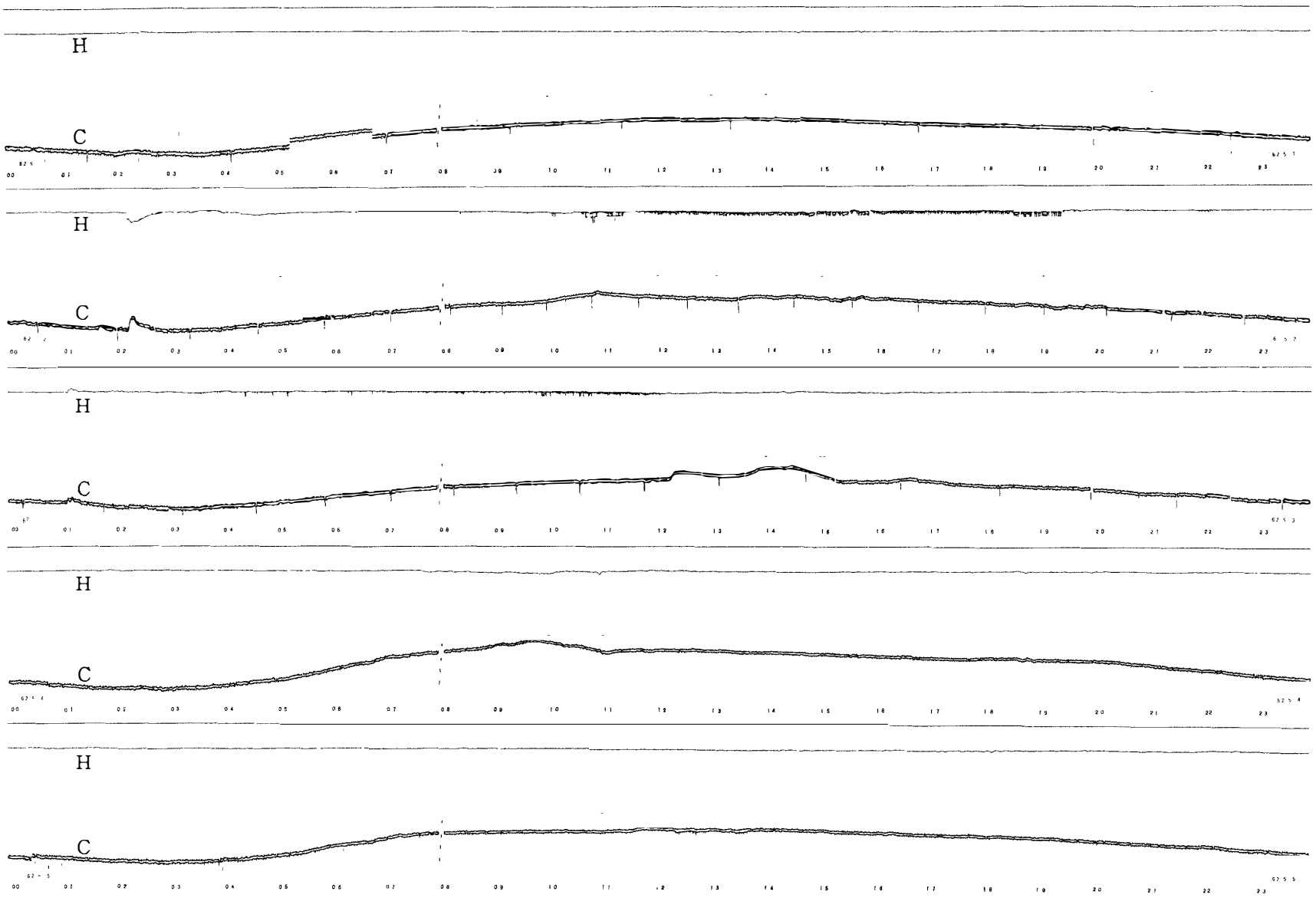


45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

April	1	1620 - 1705	Failure of equipment
	3	1657 - 1725	"
	3	2110 - 2127	"
	5	1620 - 1720	"
	6	0420 - 0455	"
	15	1642 - 1712	"
	16	1623 - 1700	"
	21	0428 - 0446	"
	22	0030 - 0615	"
	23	0100 - 0530	"
	23	0958 - 1102	"
	24	0110 - 0450	"
	25	0050 - 0550	"
	26	0110 - 0540	"
	27	0030 - 0150	"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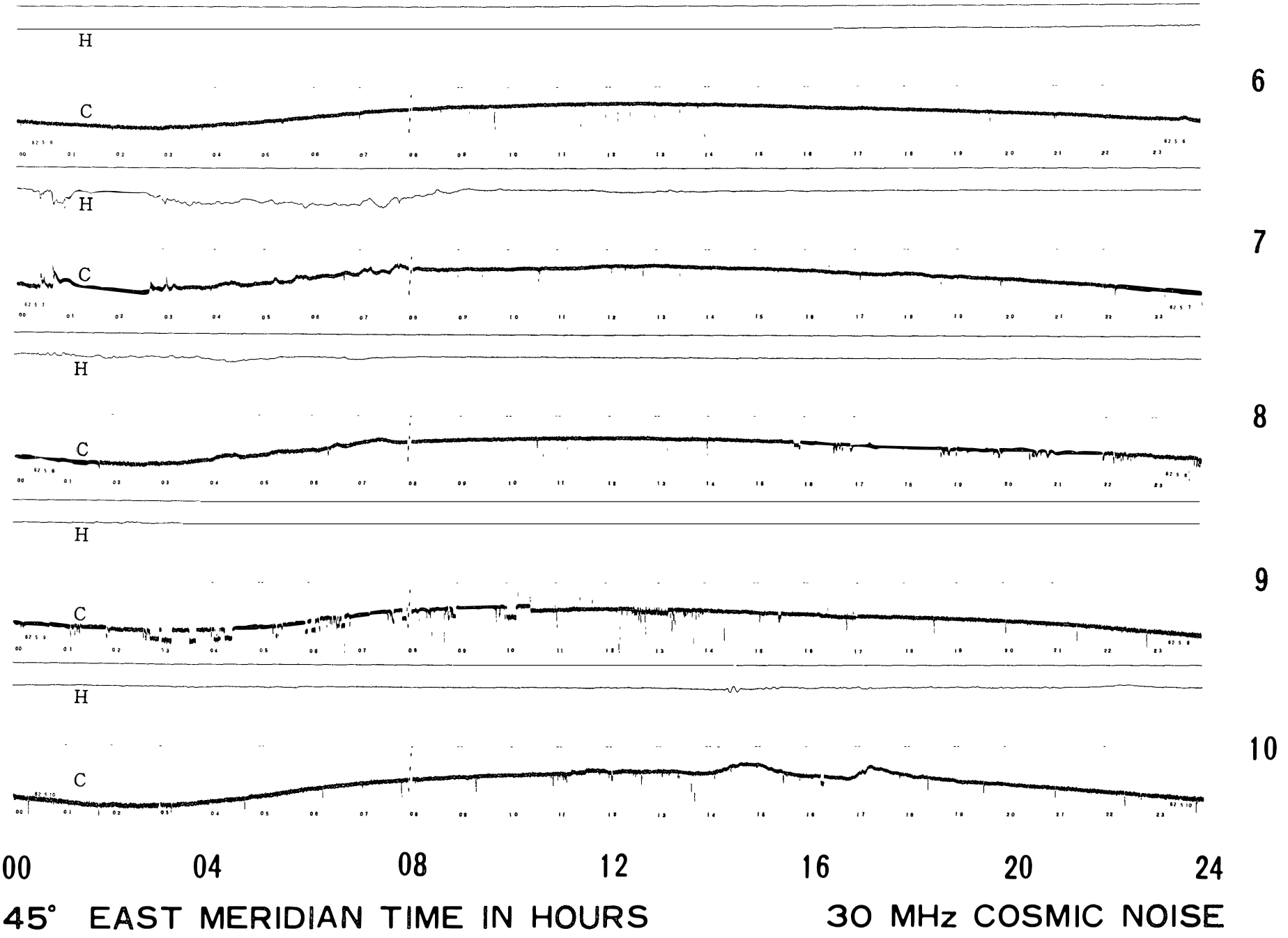
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

MAY 1987


MAY 1987
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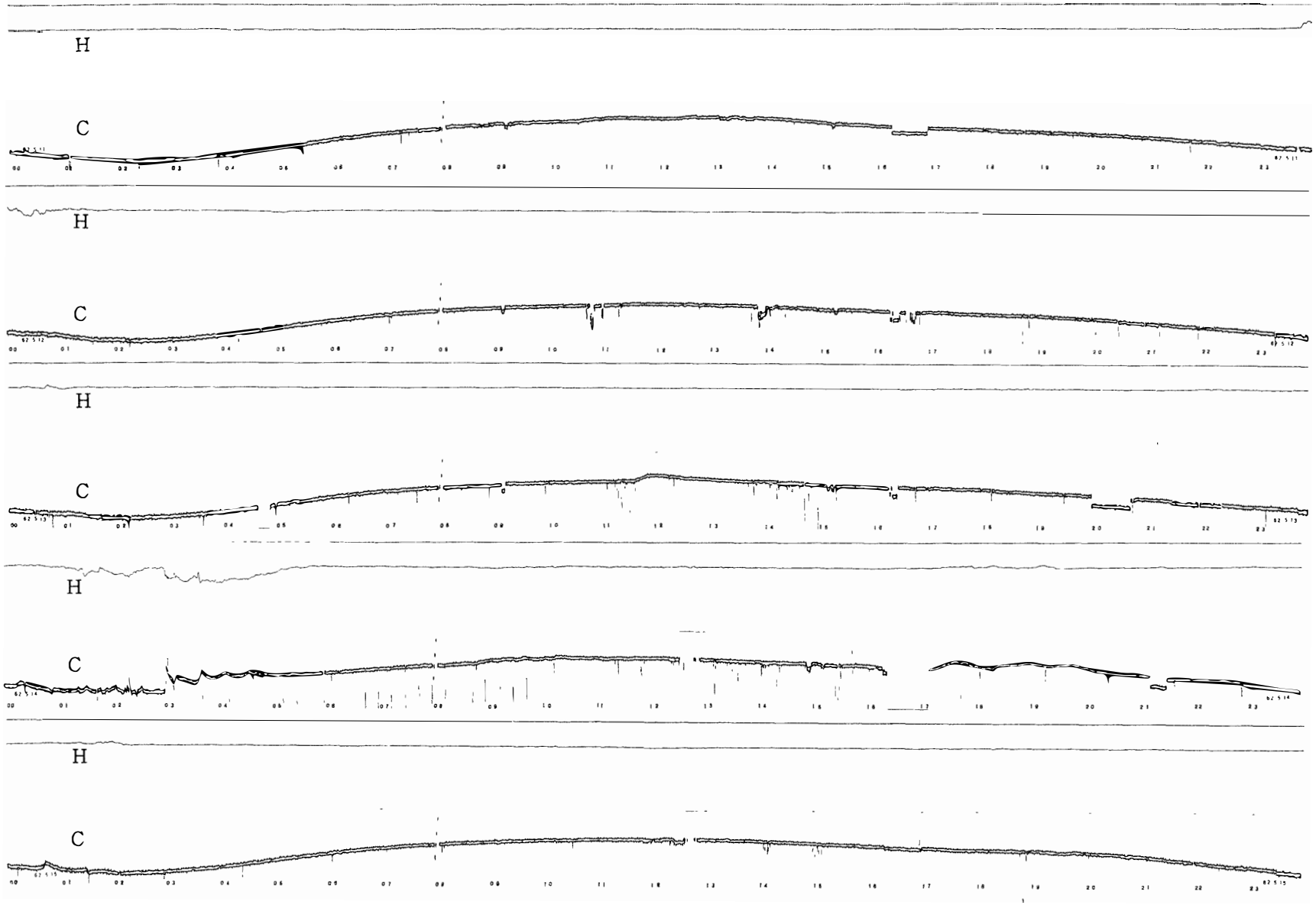
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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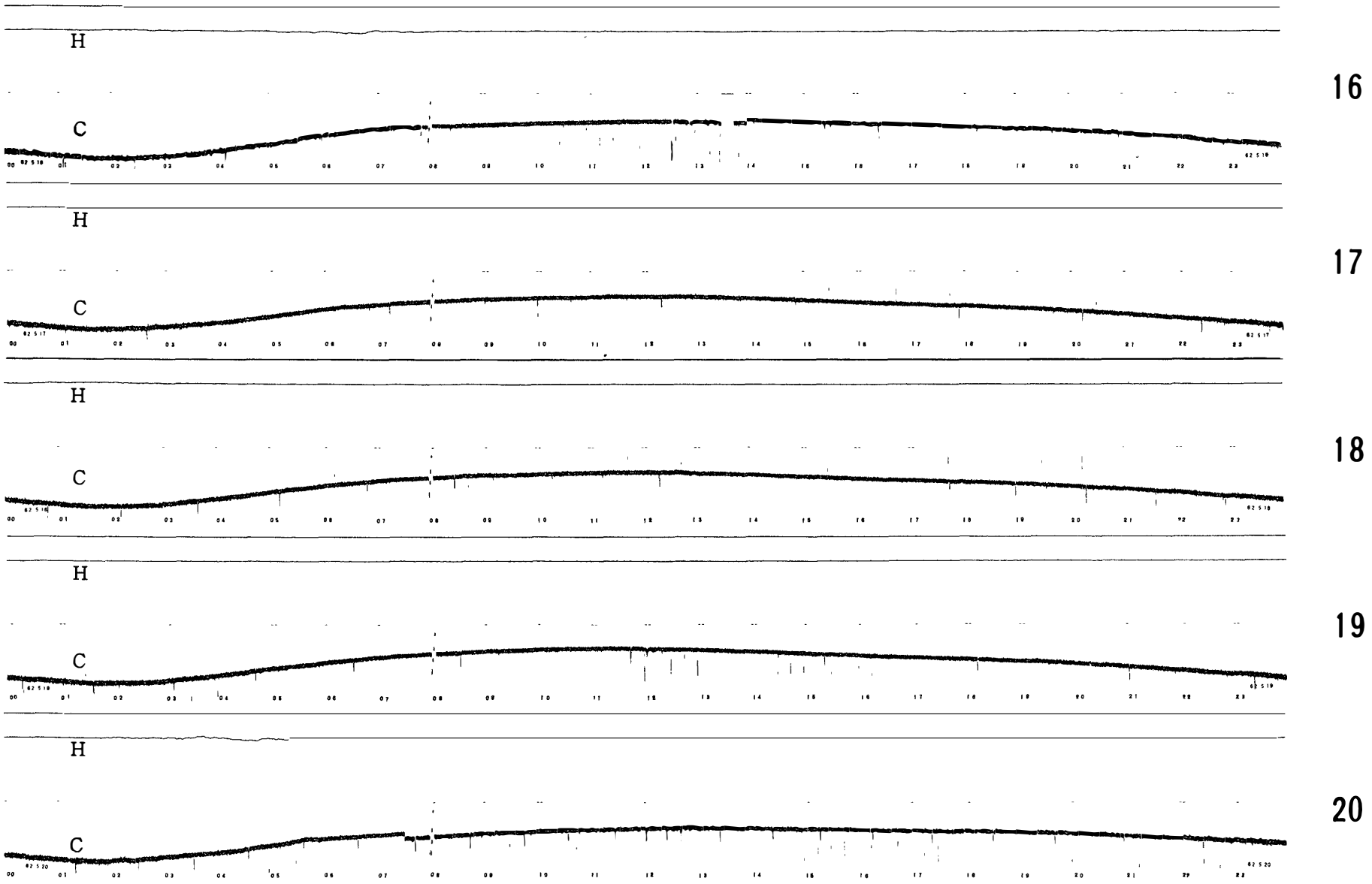
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

MAY 1987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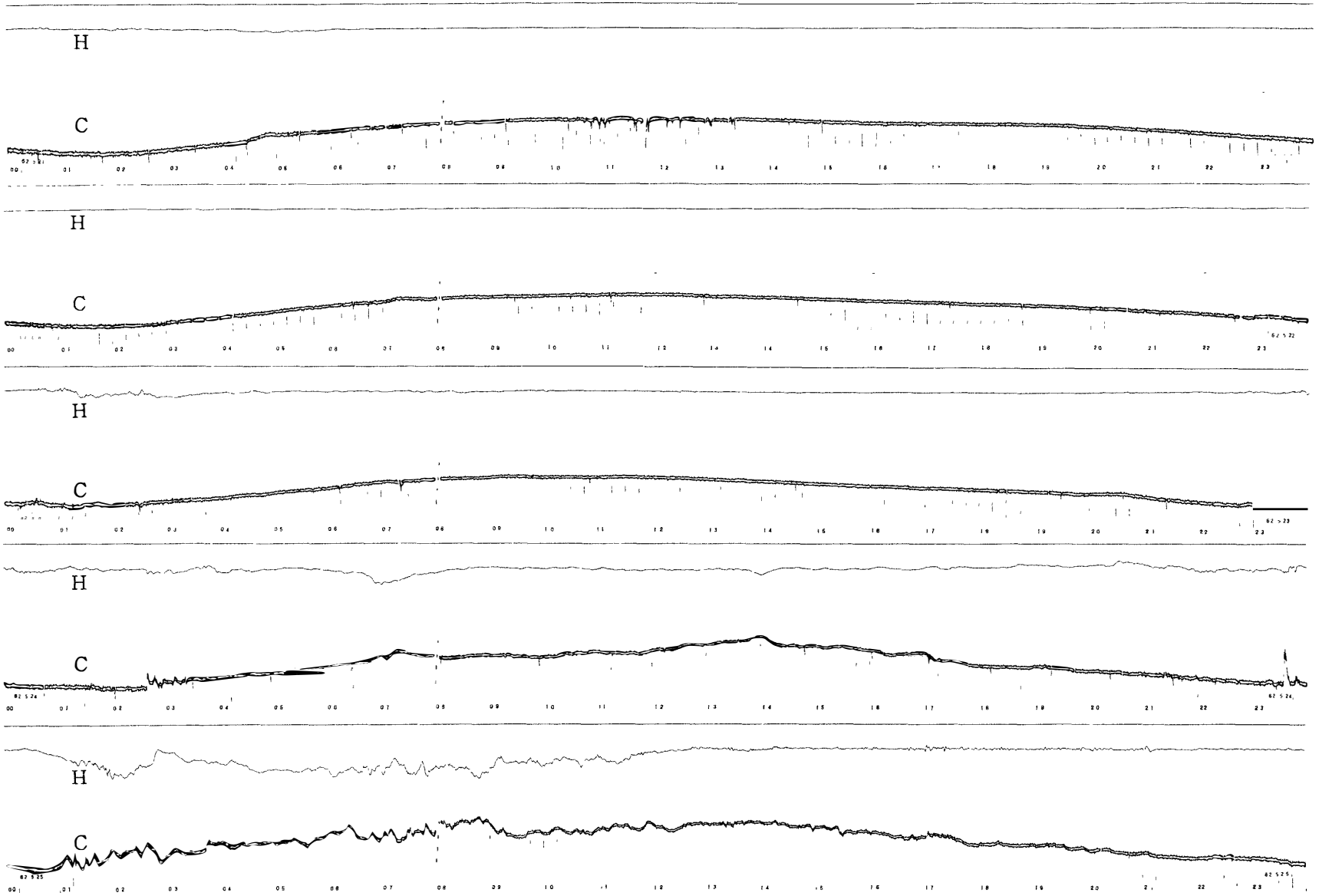
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

MAY 1987

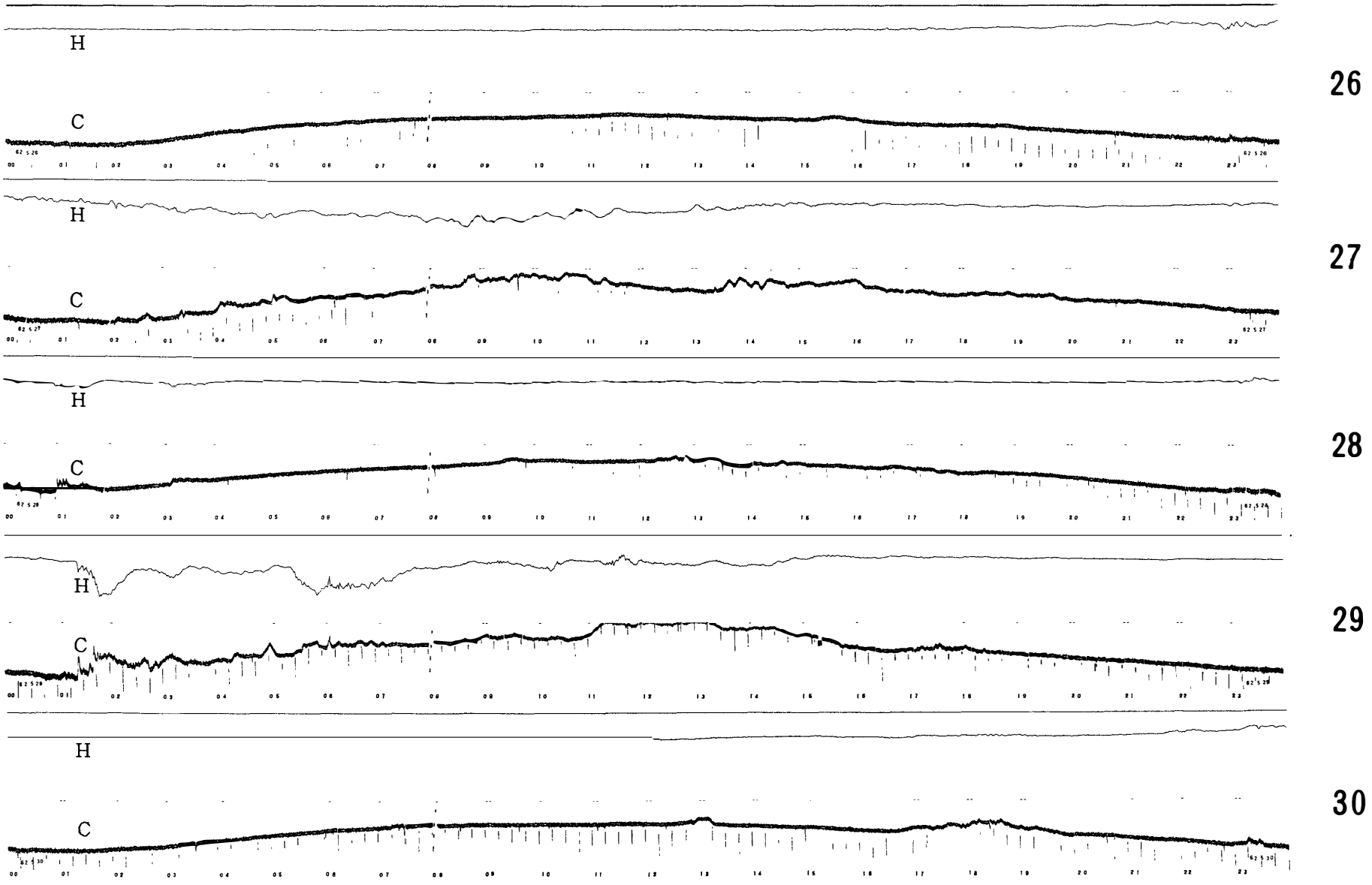
MAY 1987



00 04 08 12 16 20 24

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE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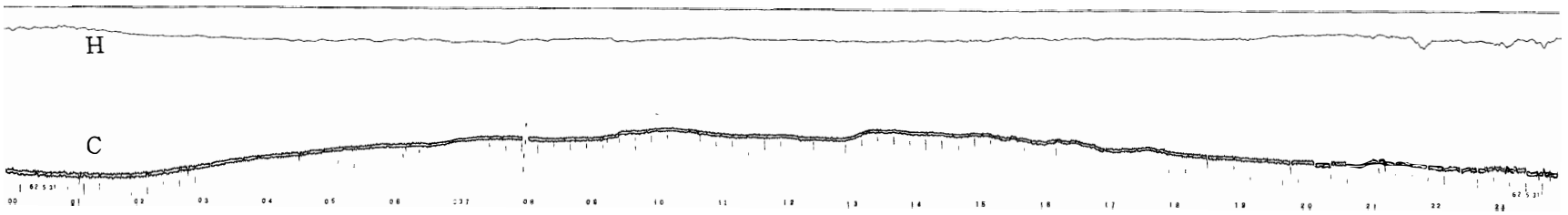
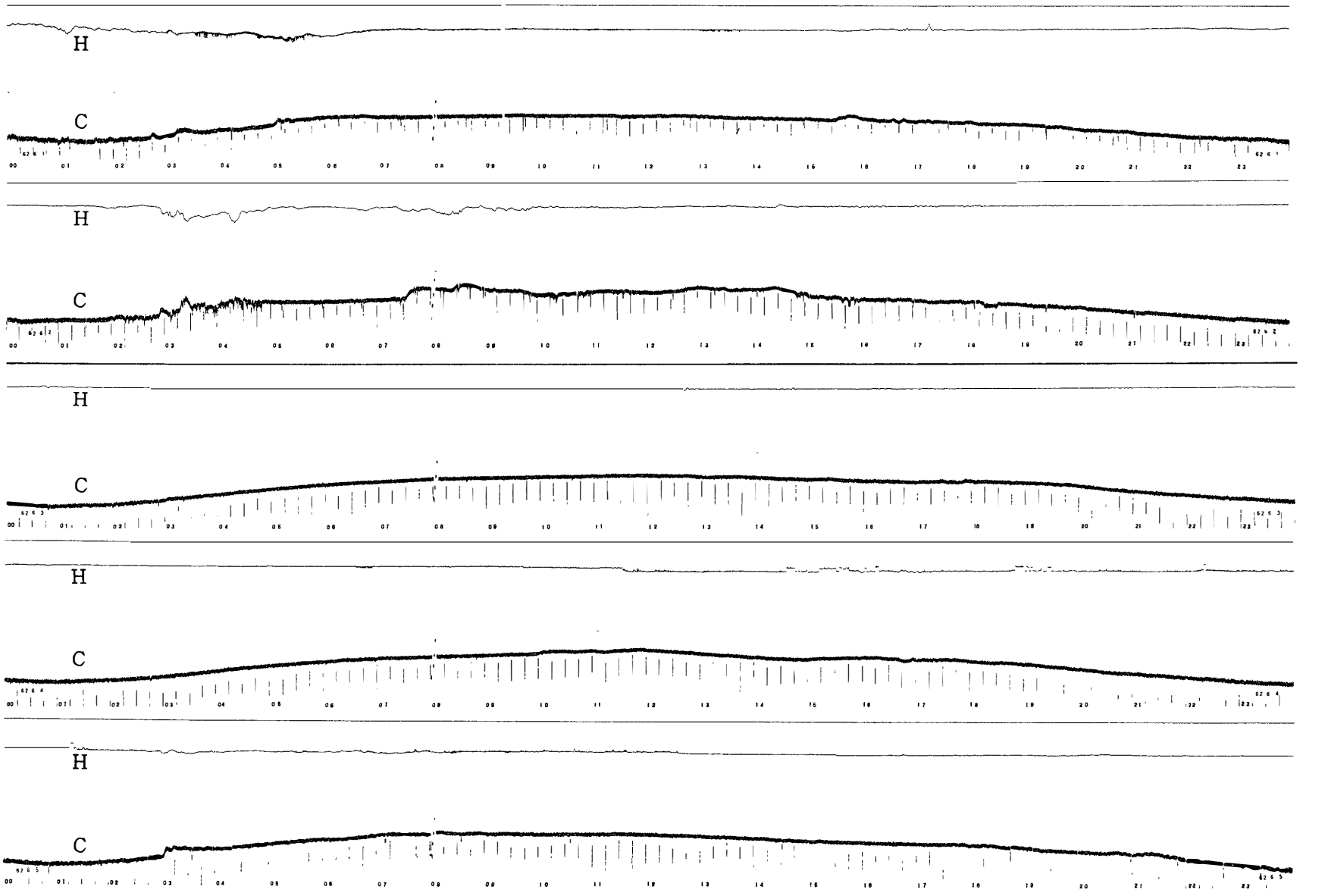
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



Cosmic noise level obscured or equipment malfunction.

May	14 1620 - 1710	Failure of equipment


JUNE 1987
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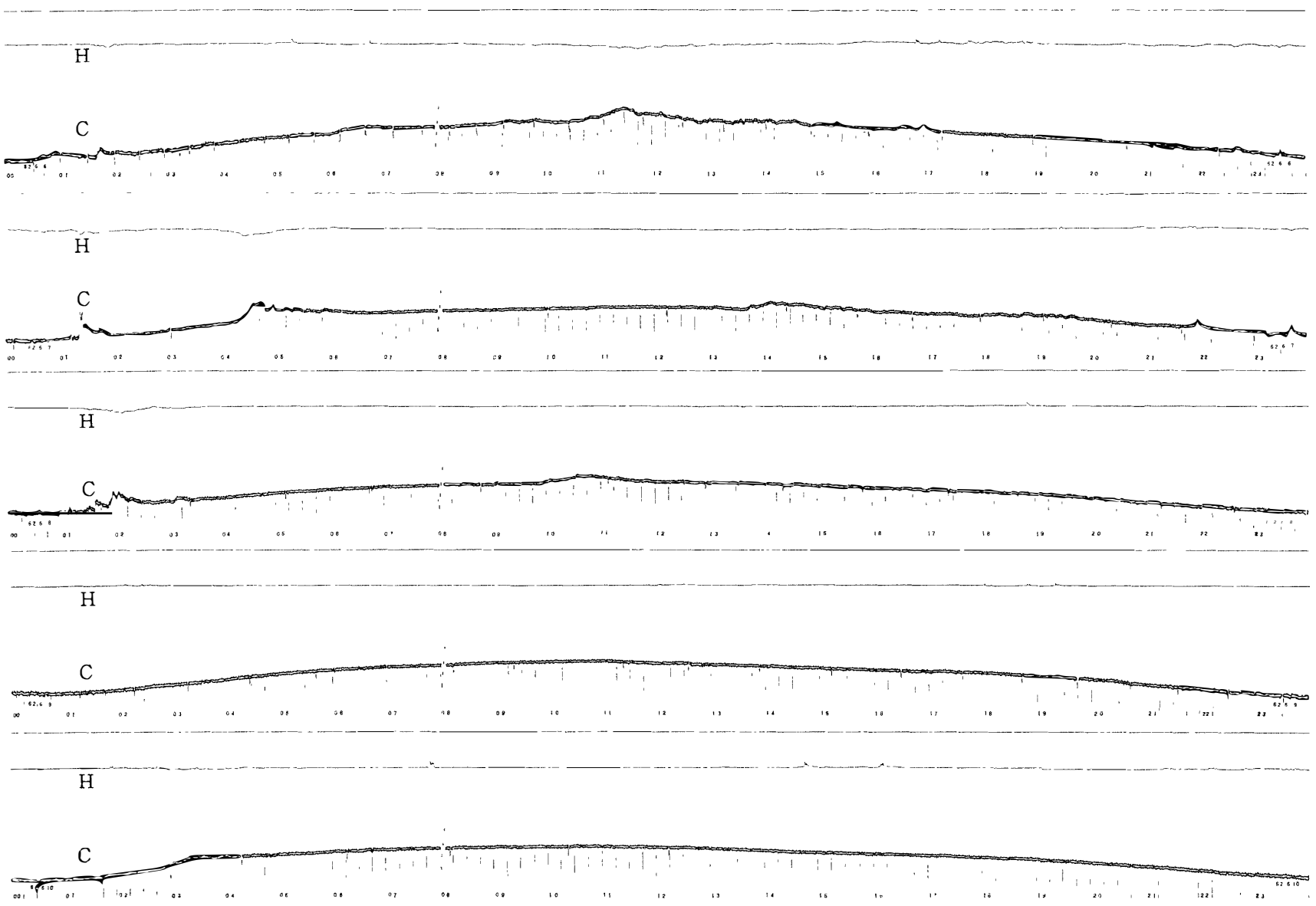
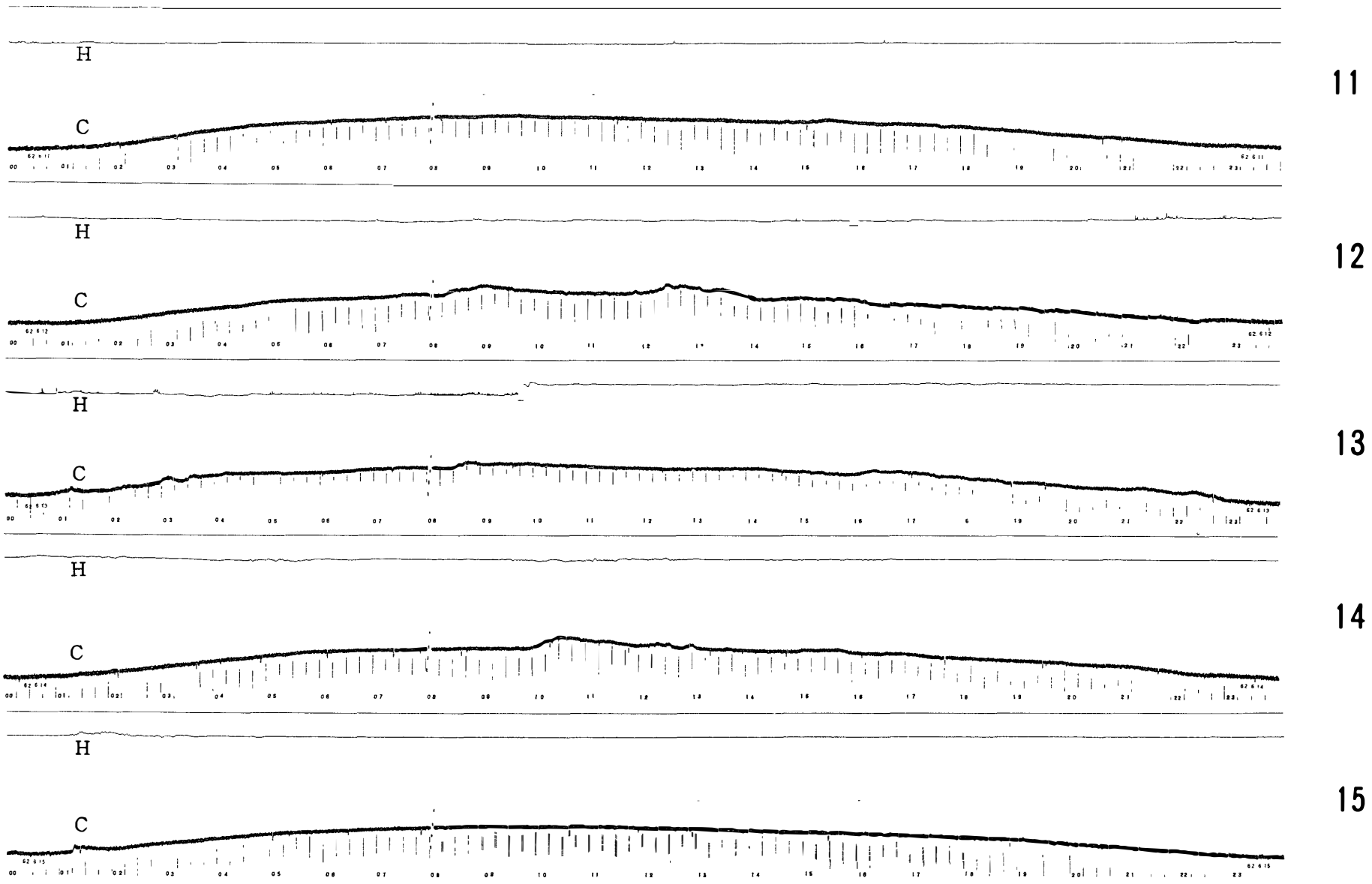
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



JUNE 1987

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE


JUNE 1987
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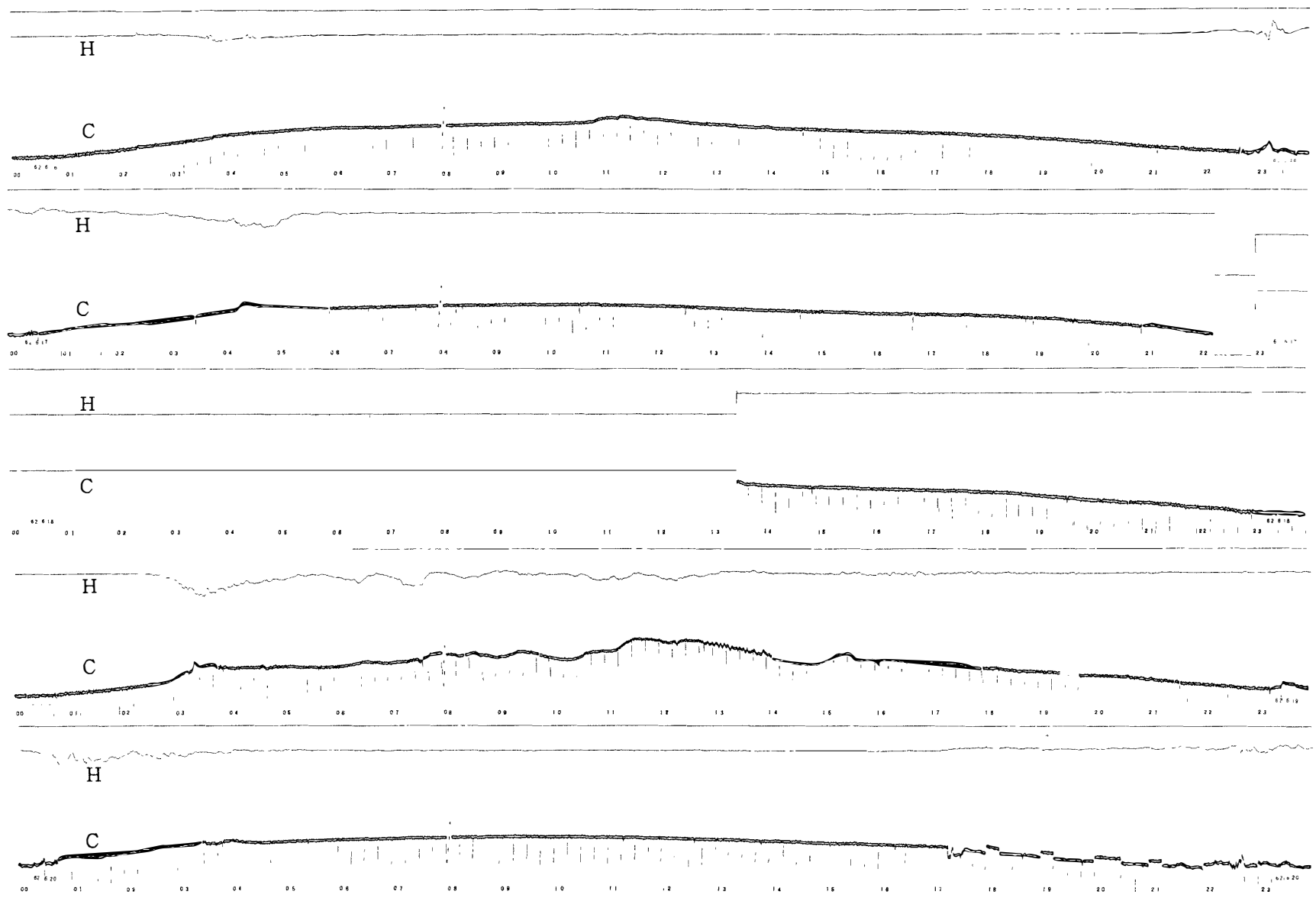
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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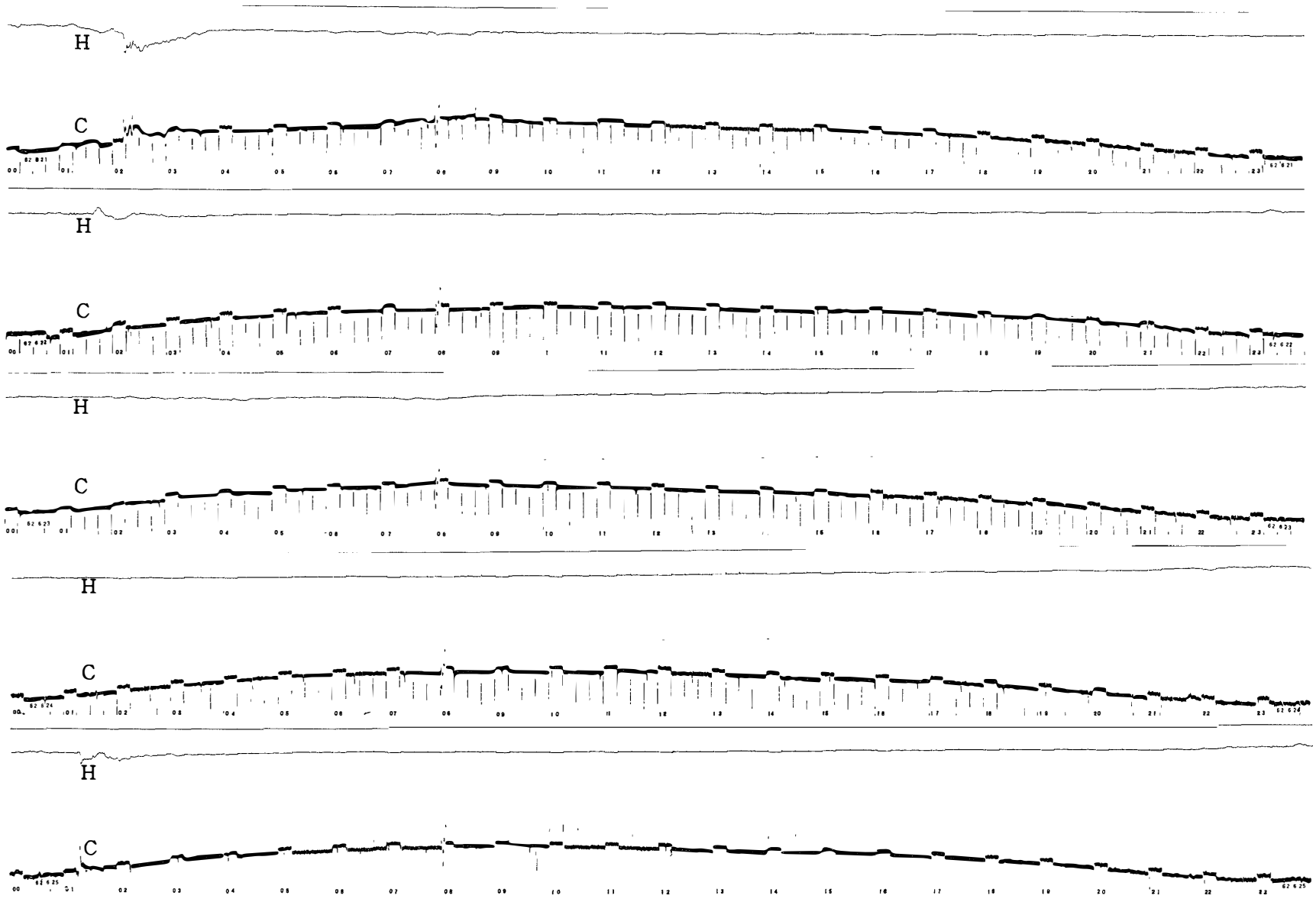
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

JUNE 1987



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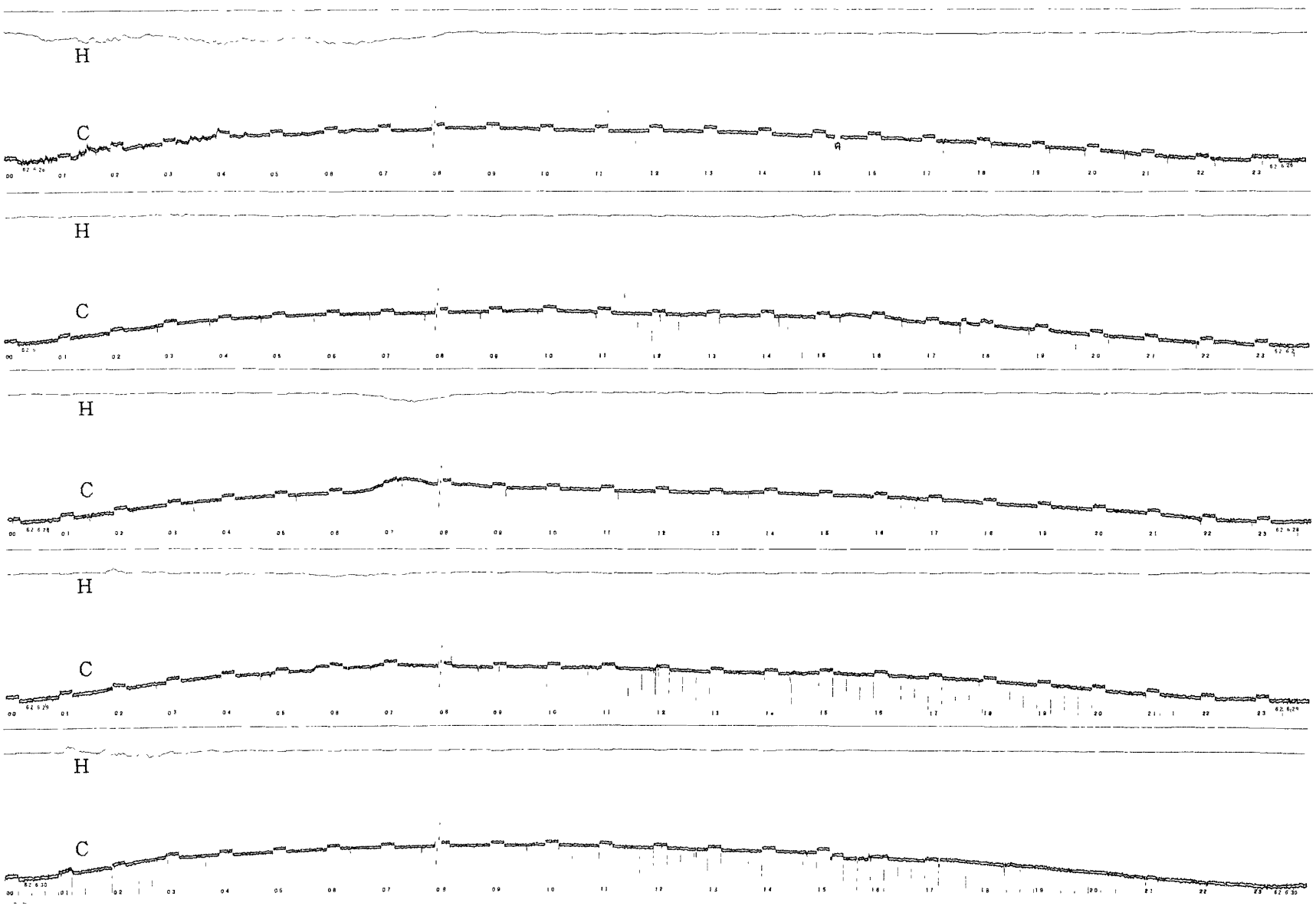
45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

JUNE 1987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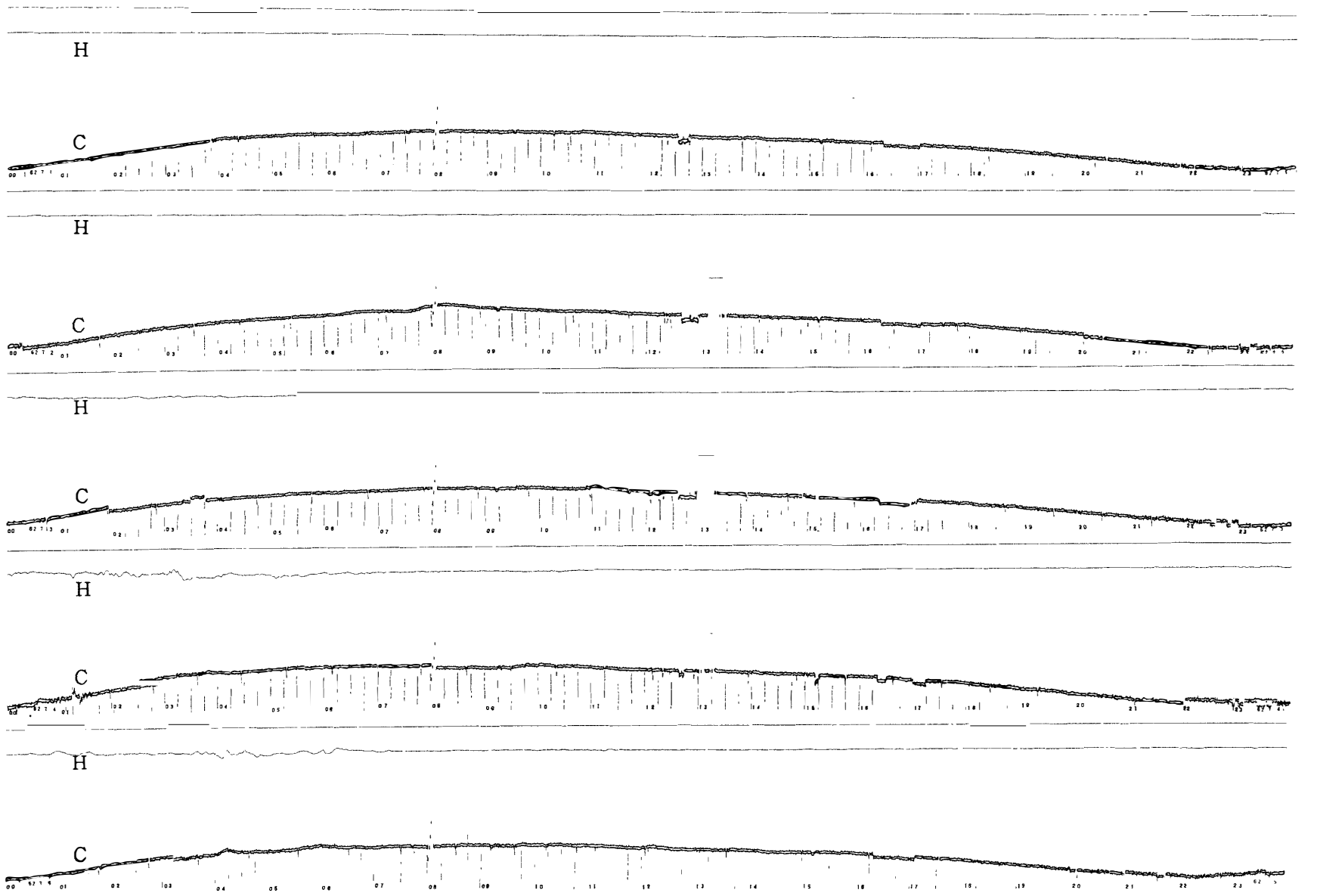
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

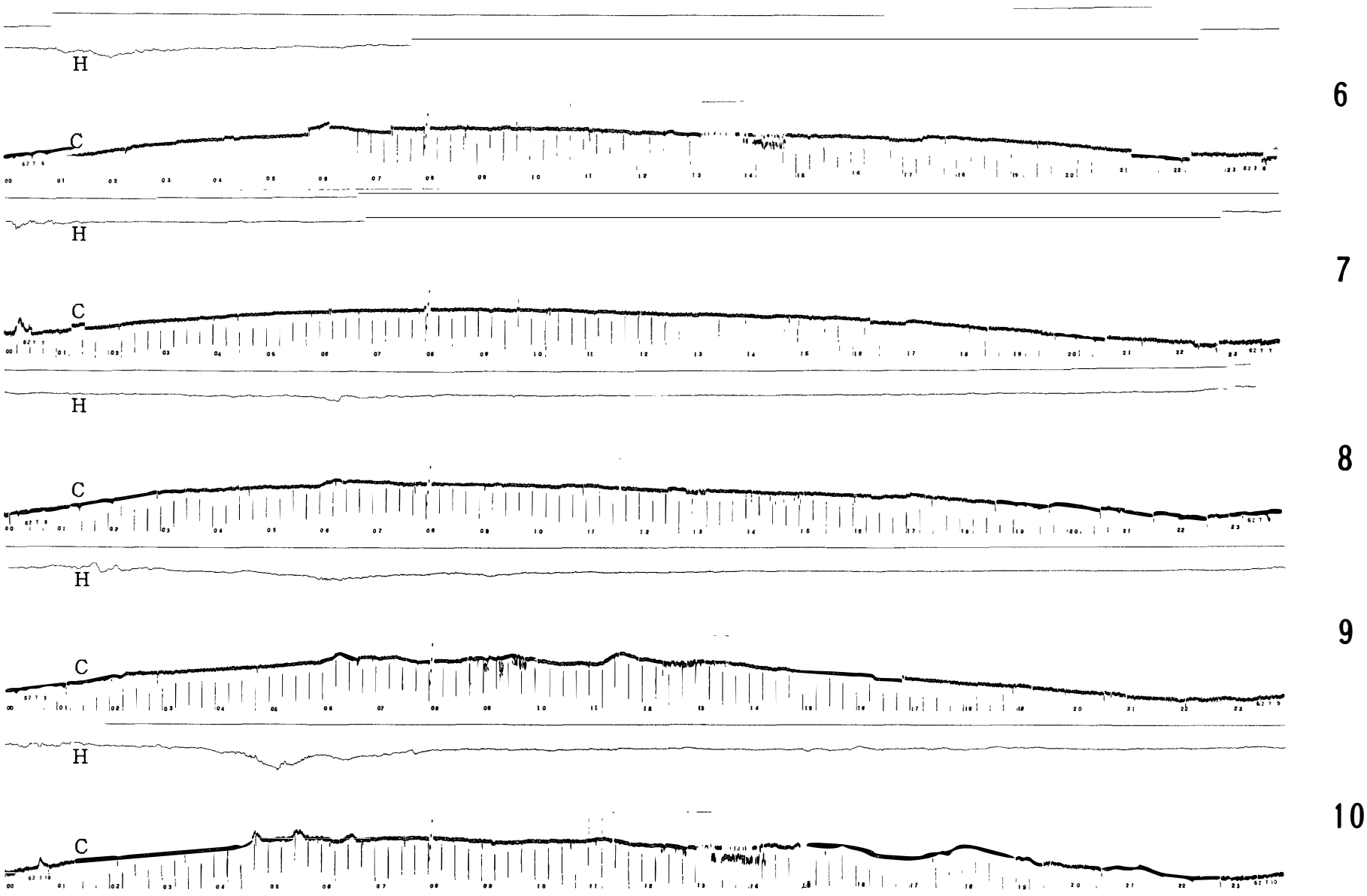
June	1	0905 - 0923	Failure of equipment
	17	2220 -	"
	18	1332	"



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

JULY 1987


JULY 1987
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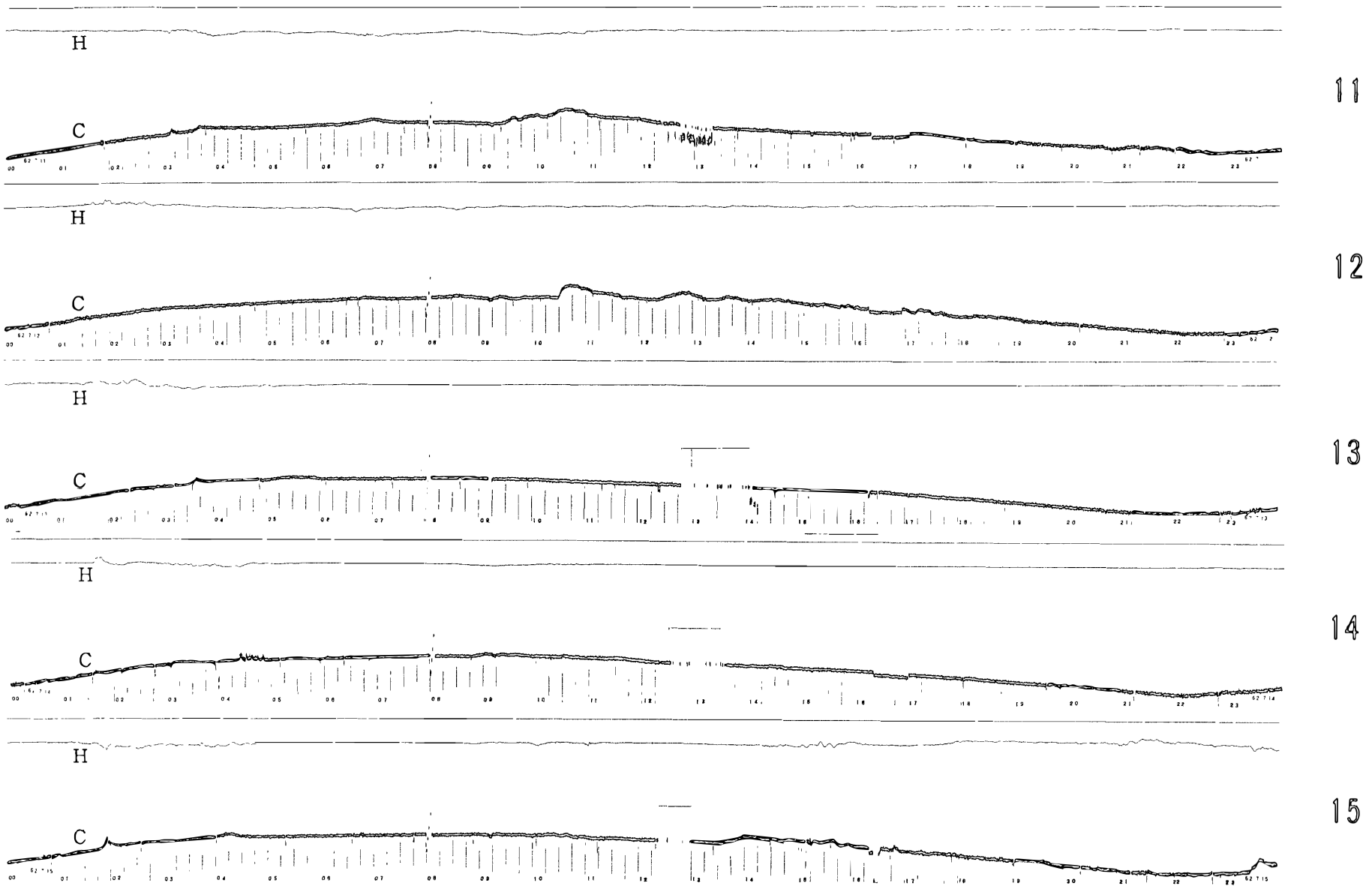
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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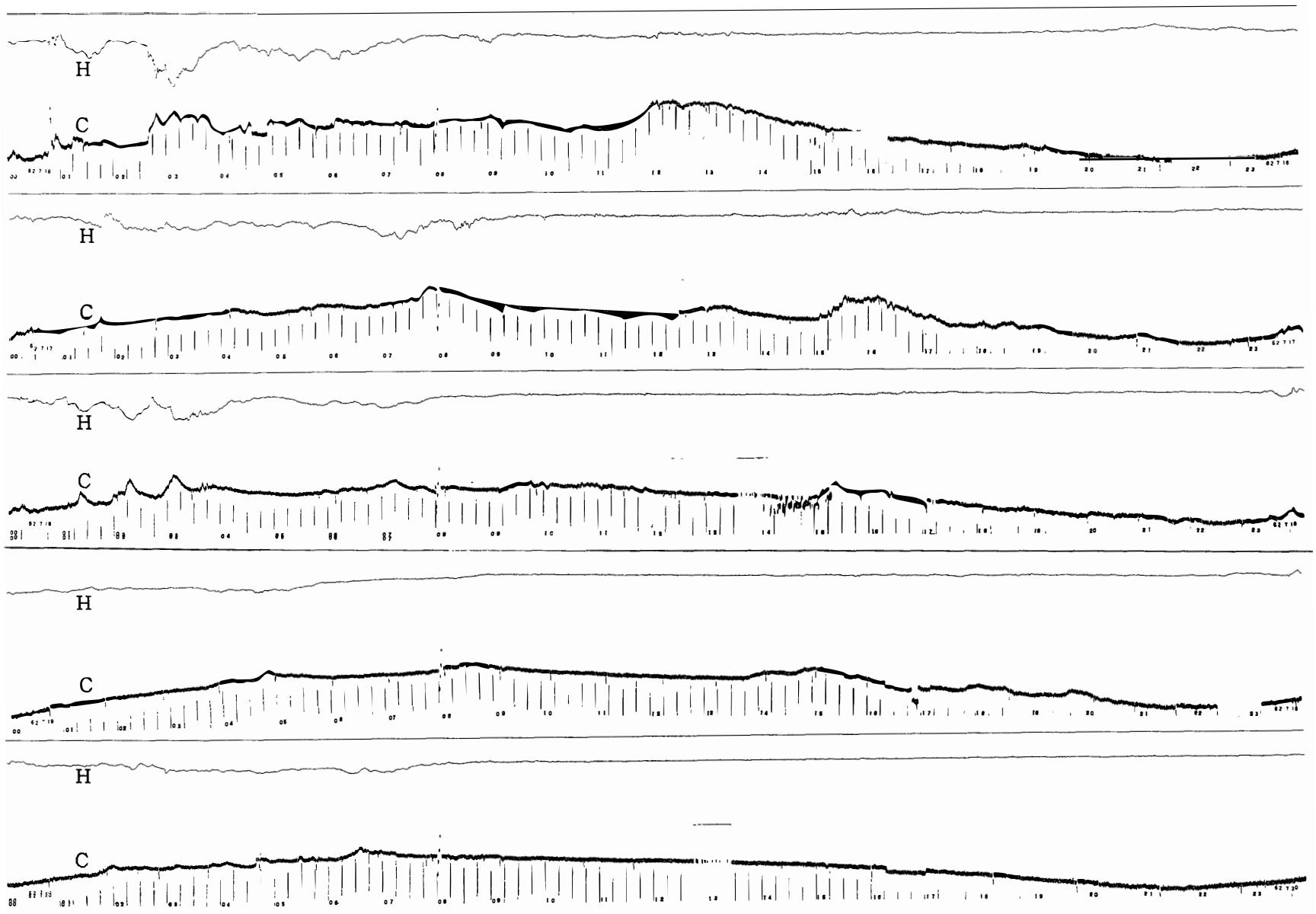
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

JULY 1987


JULY 1987
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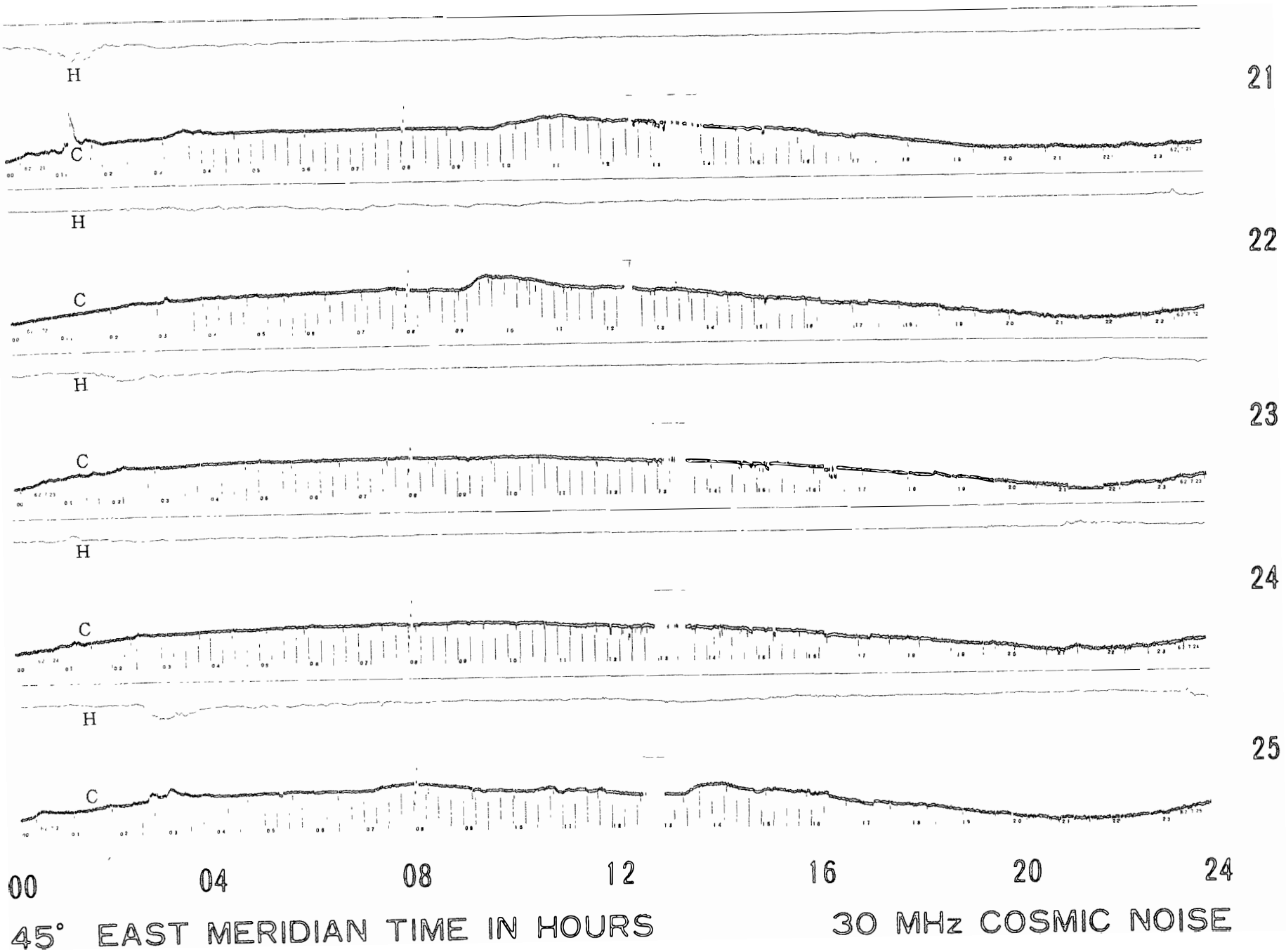
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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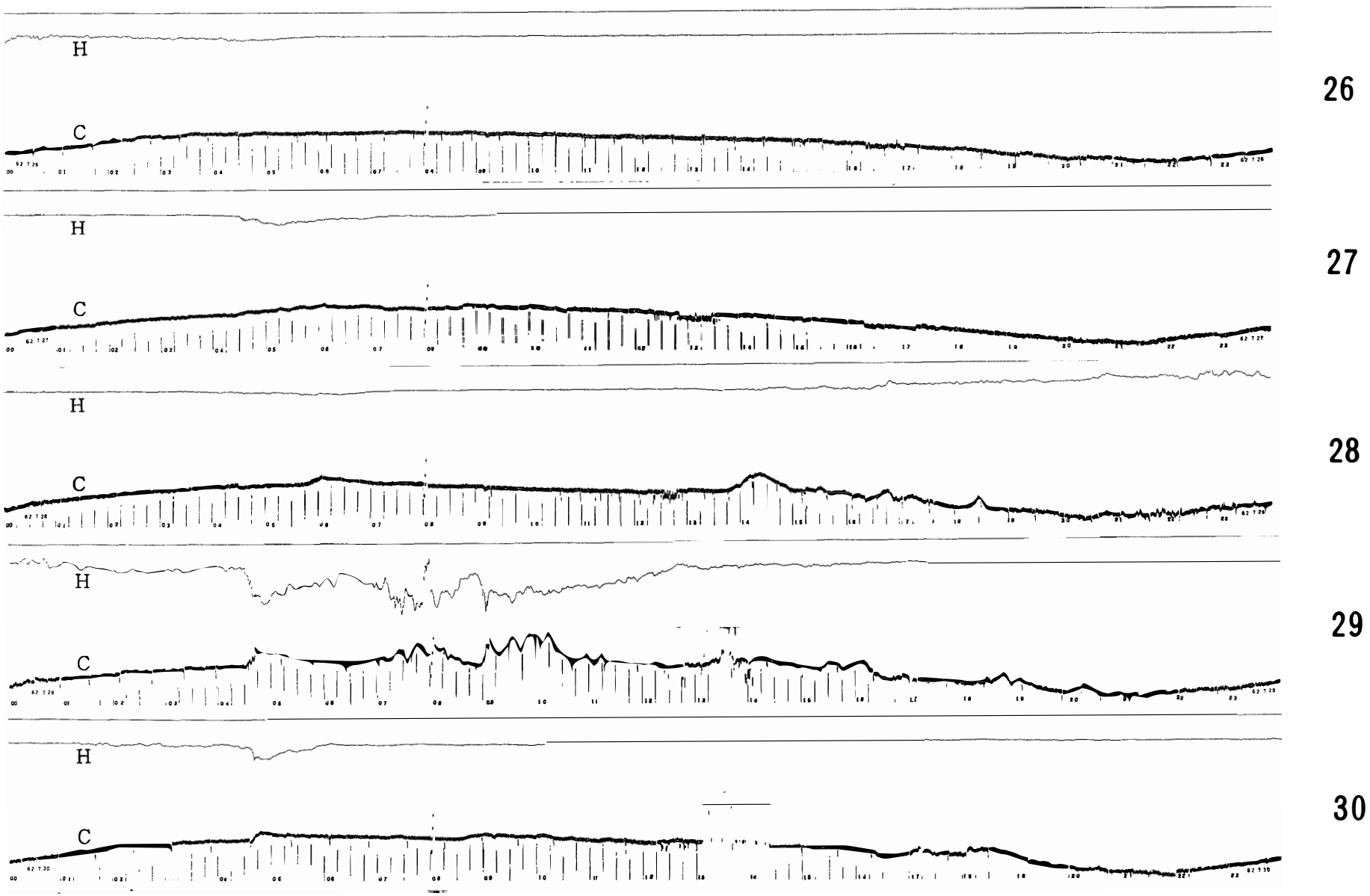
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE


JULY 1987
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45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

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45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

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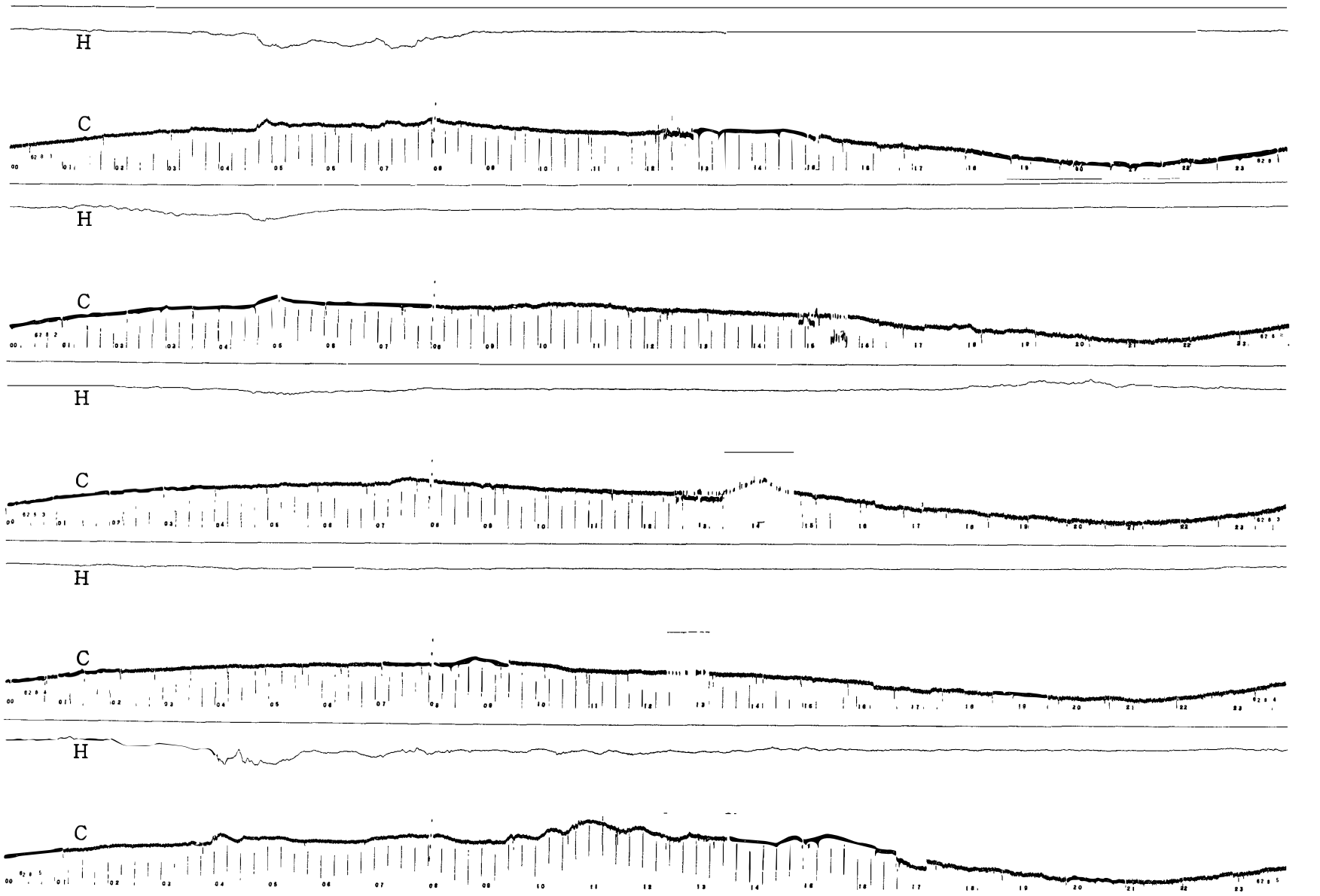
JULY 1987


AUG. 1987
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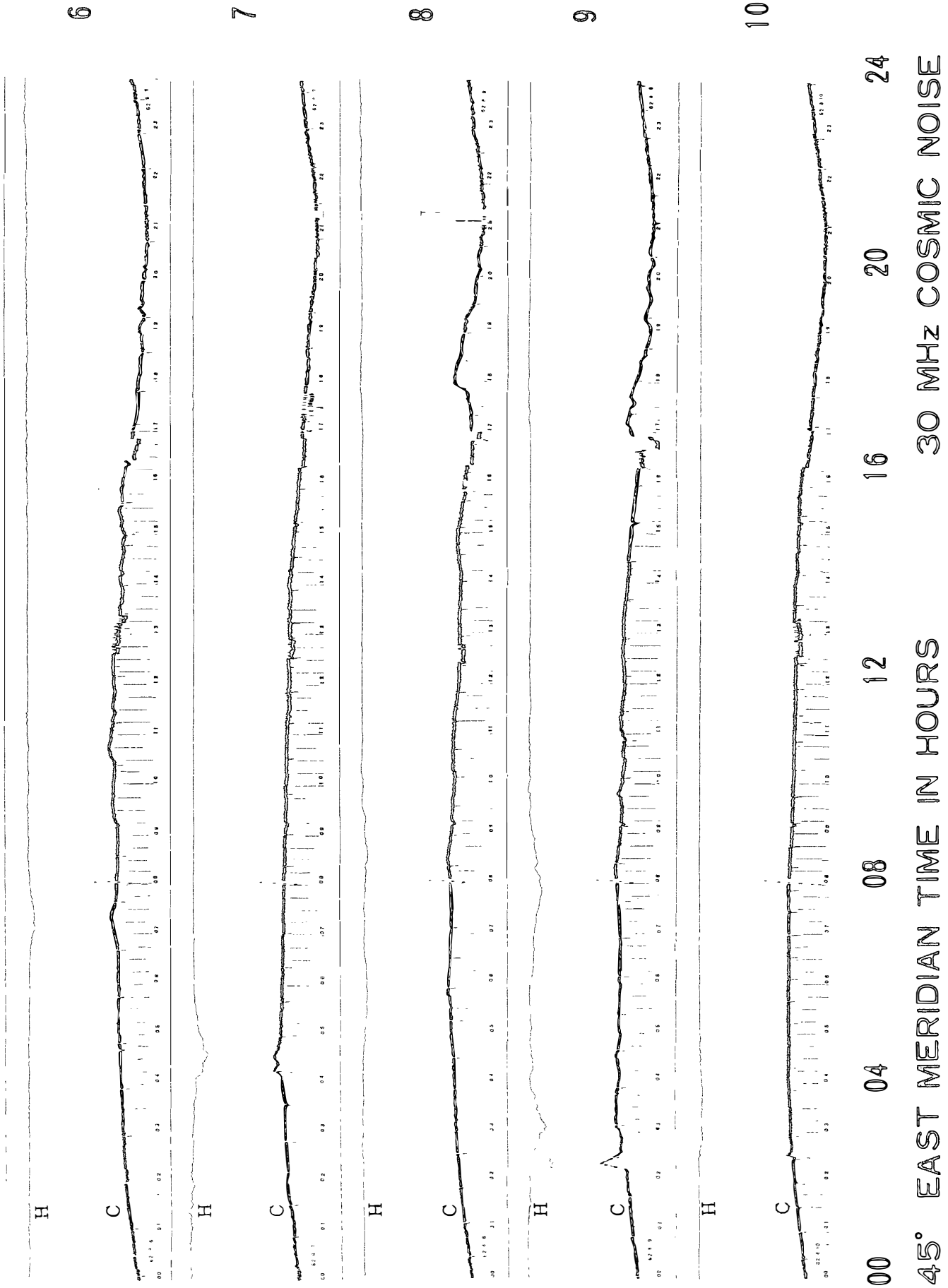
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

AUG. 1987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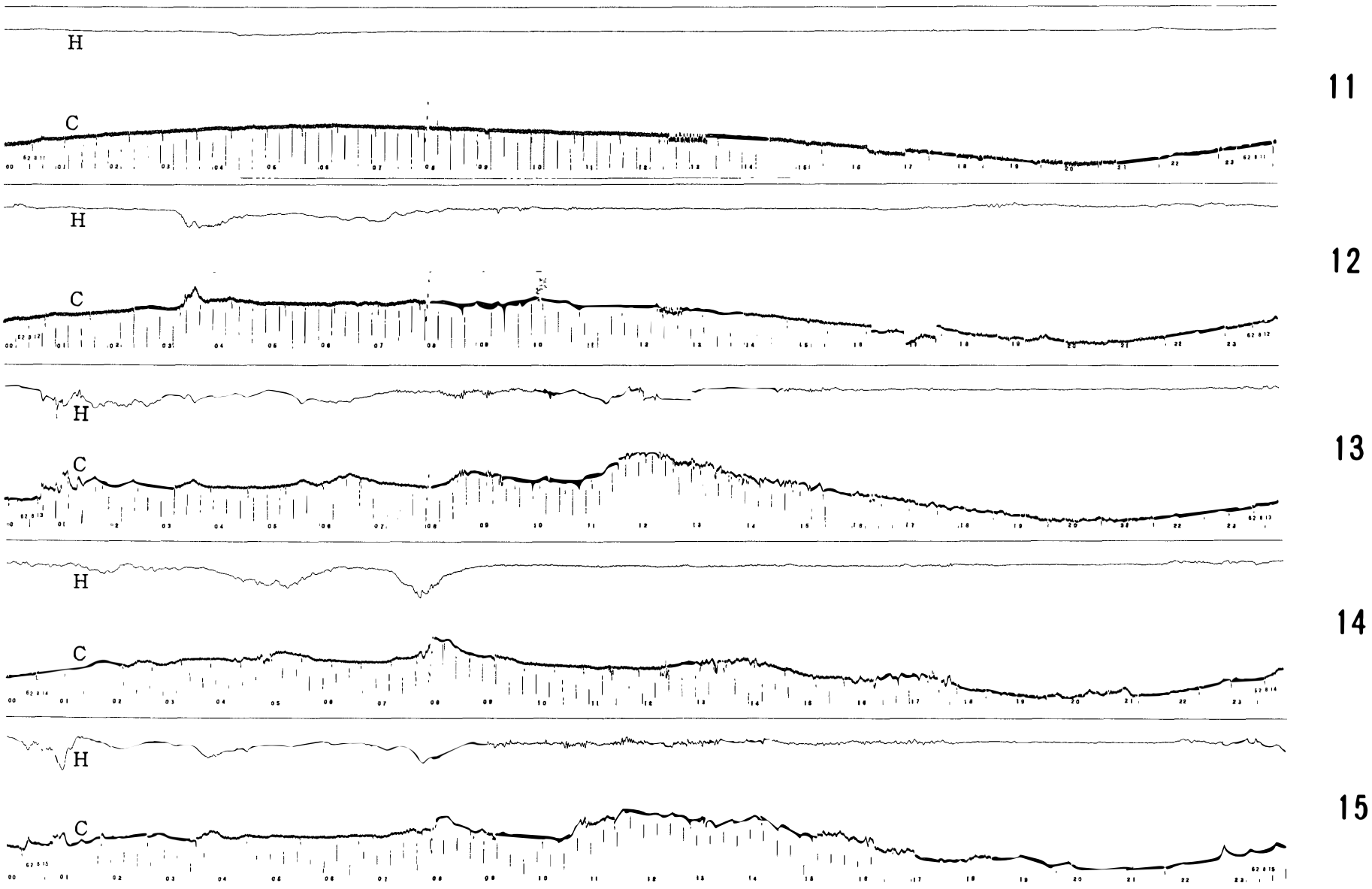
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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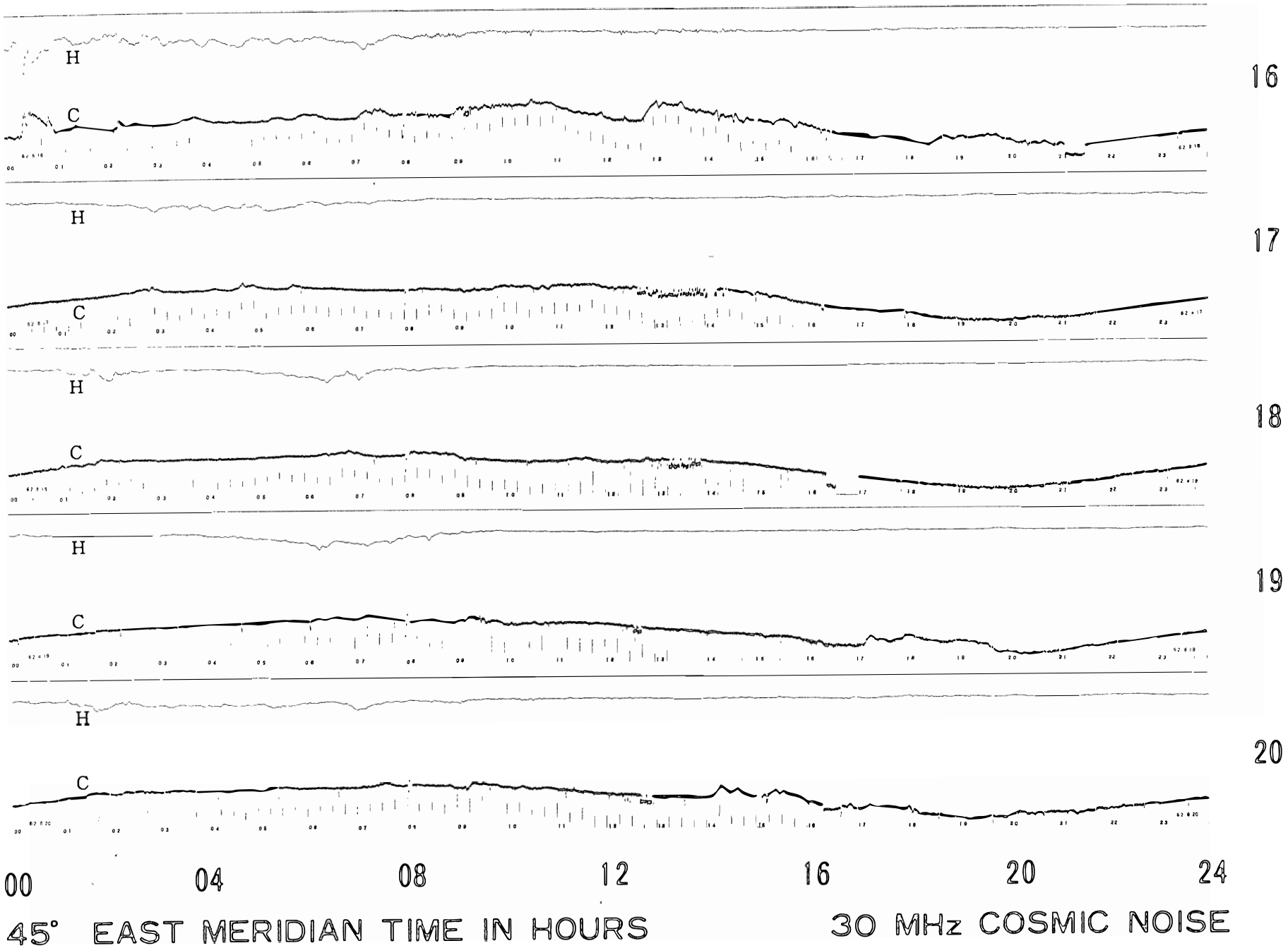
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE


AUG. 1987
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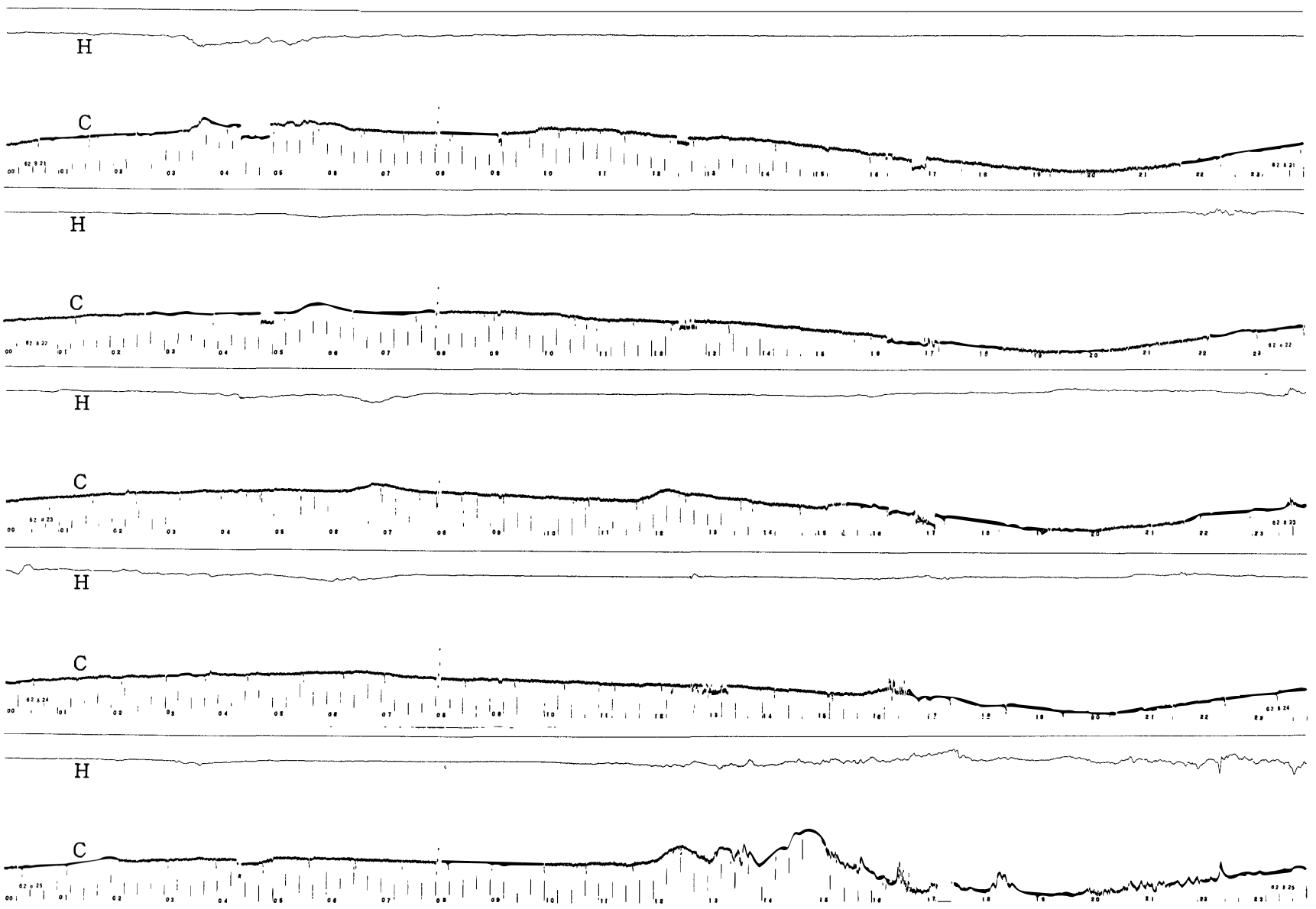
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



AUG. 1987

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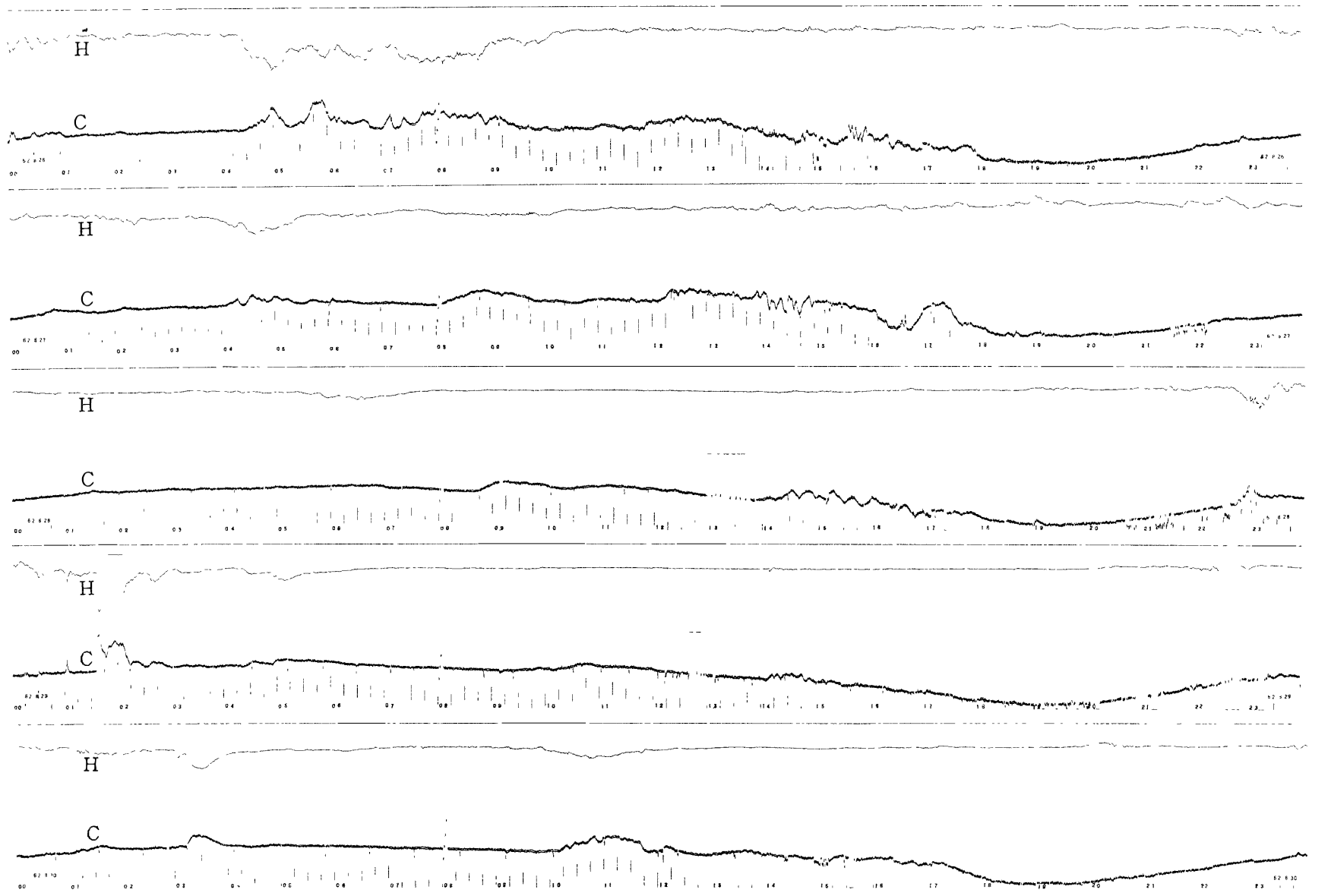
45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE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45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

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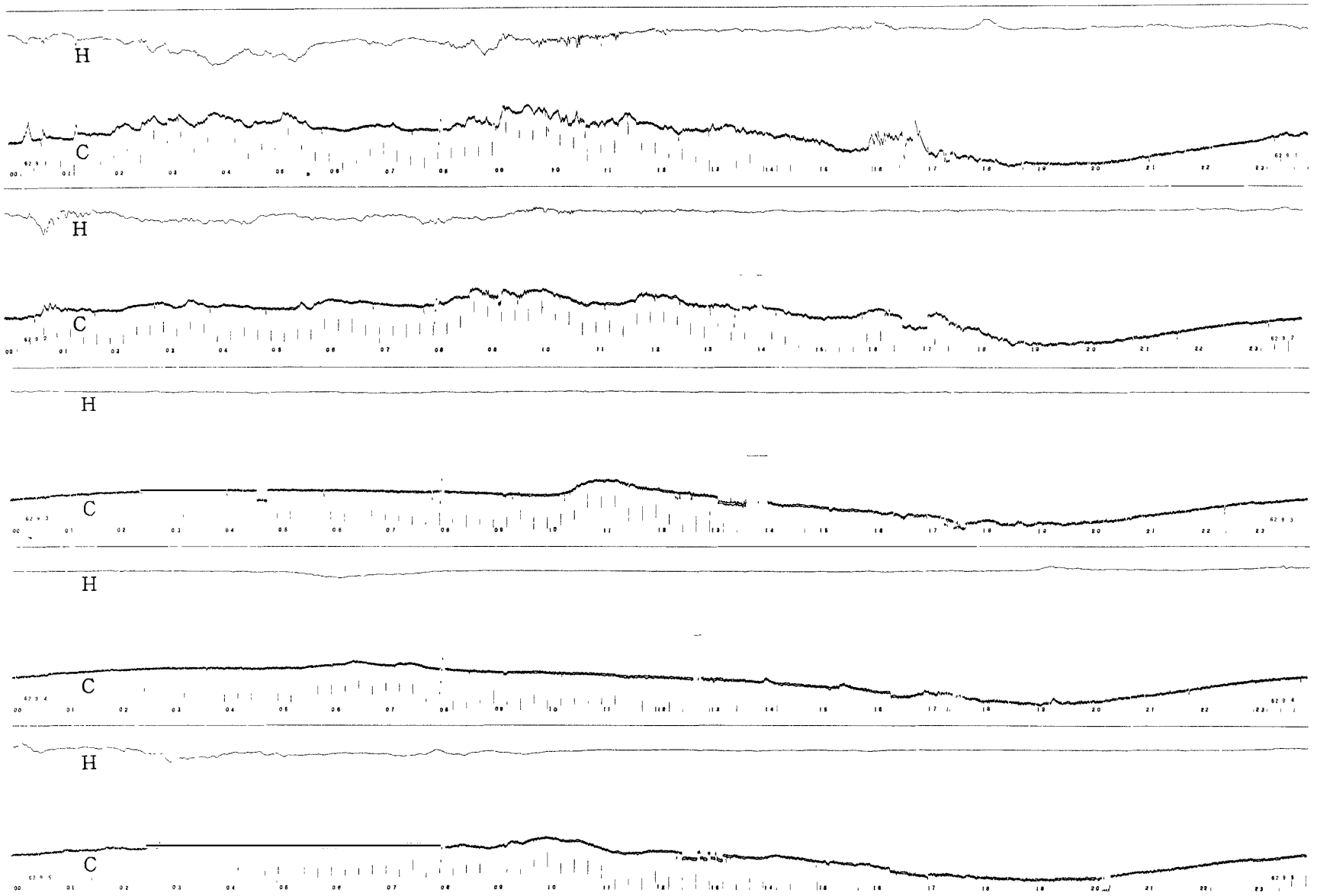
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

AUG. 31 1987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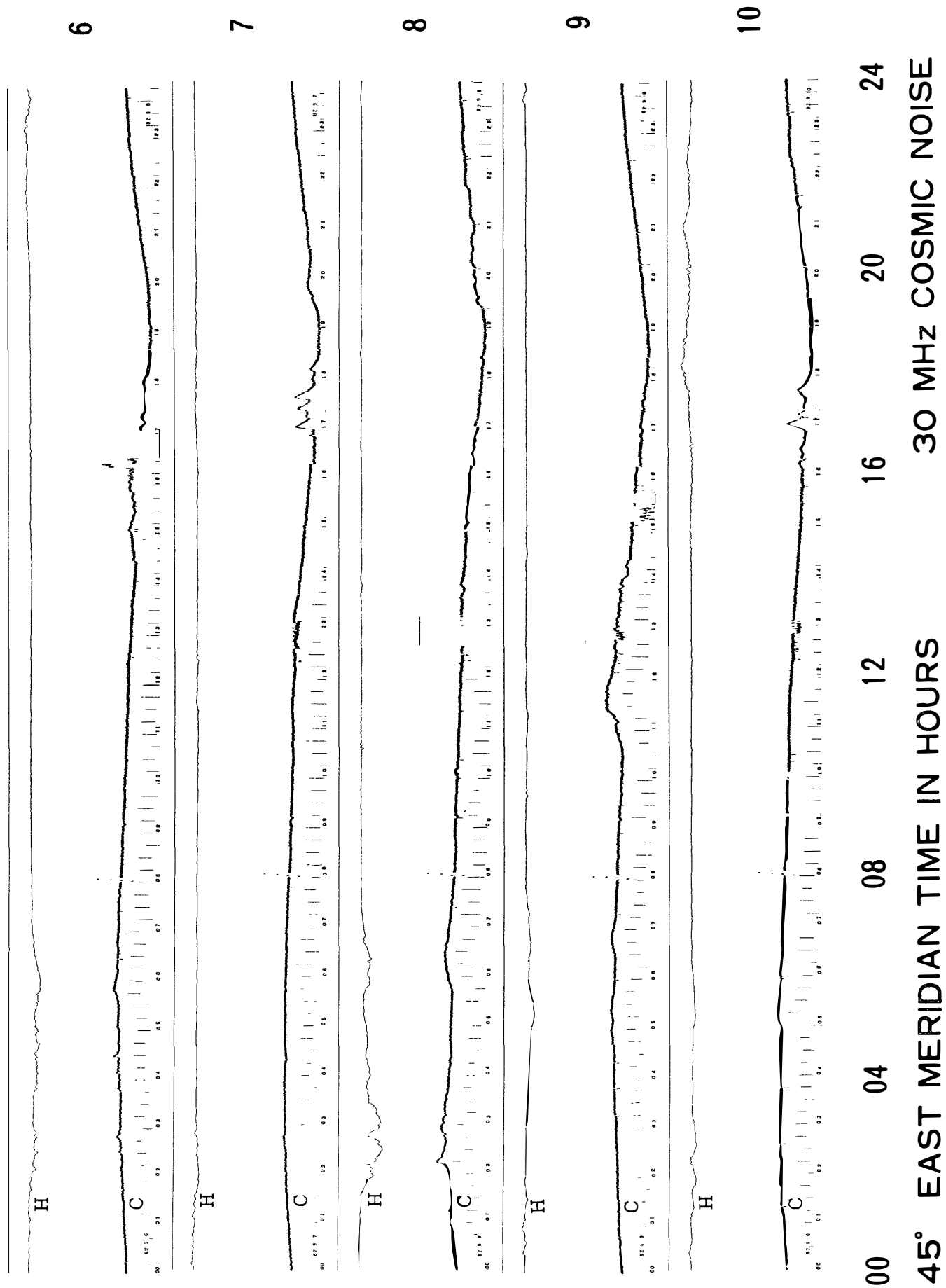
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

SEP. 1987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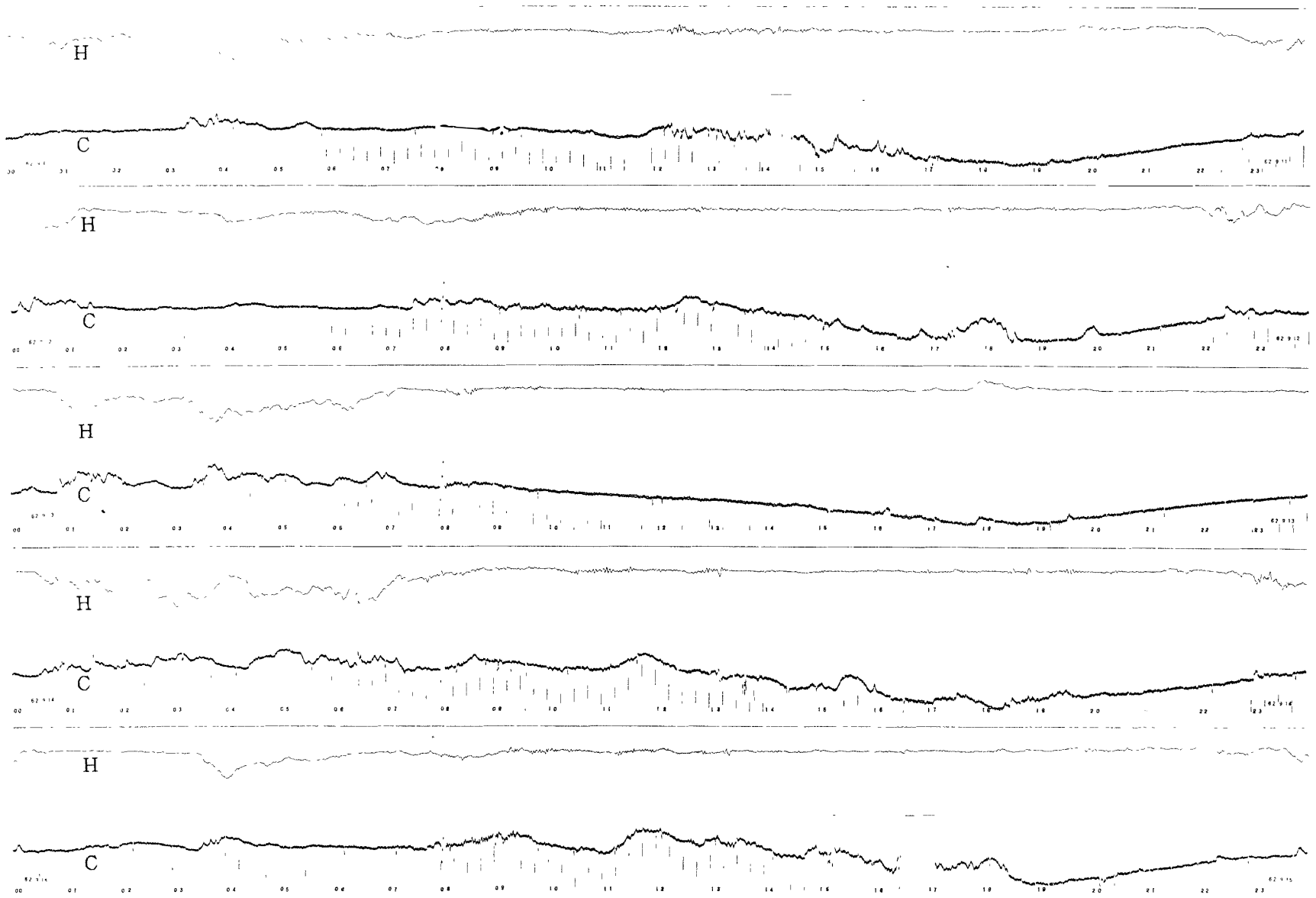
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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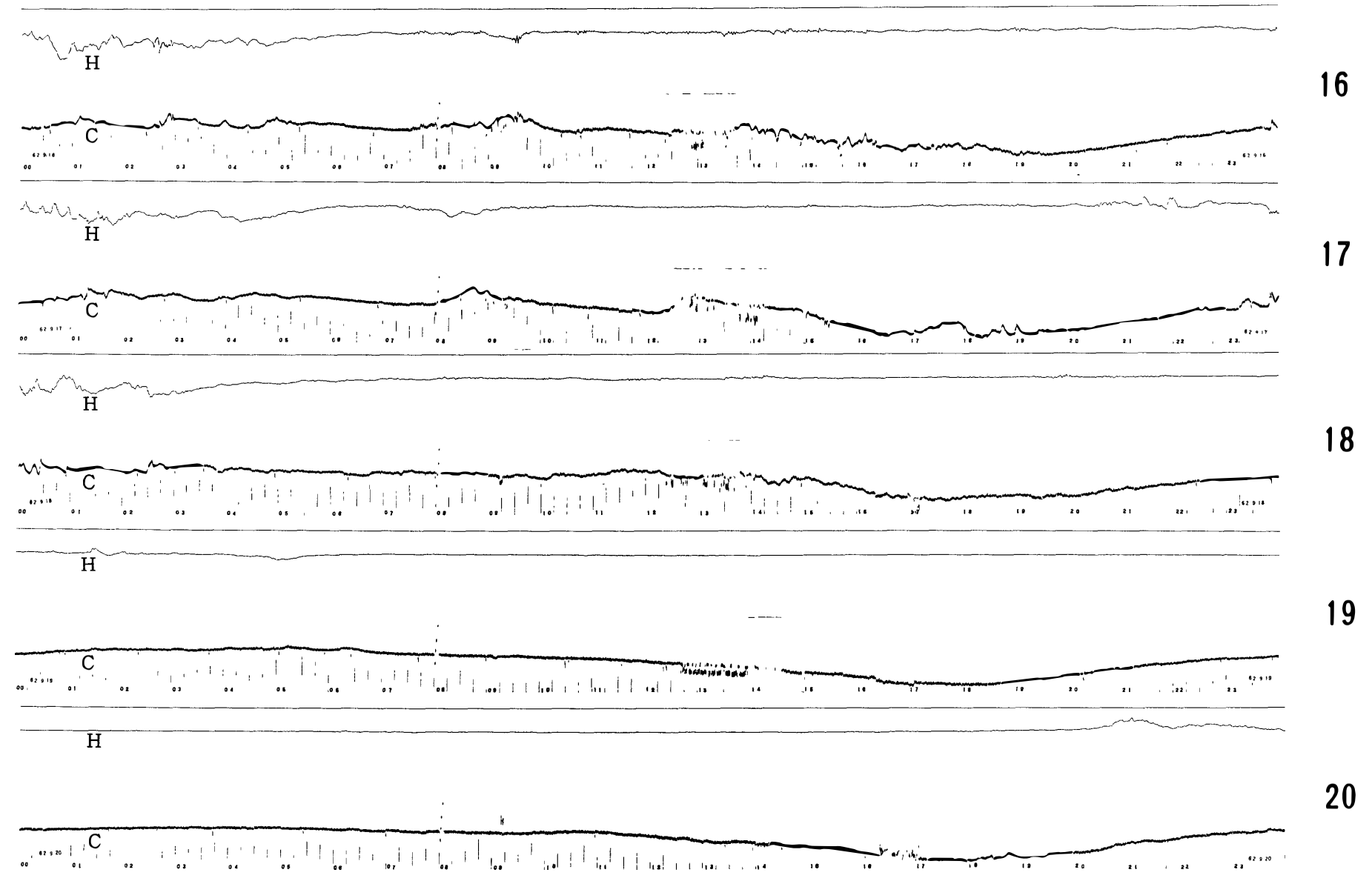
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

SEP. 1987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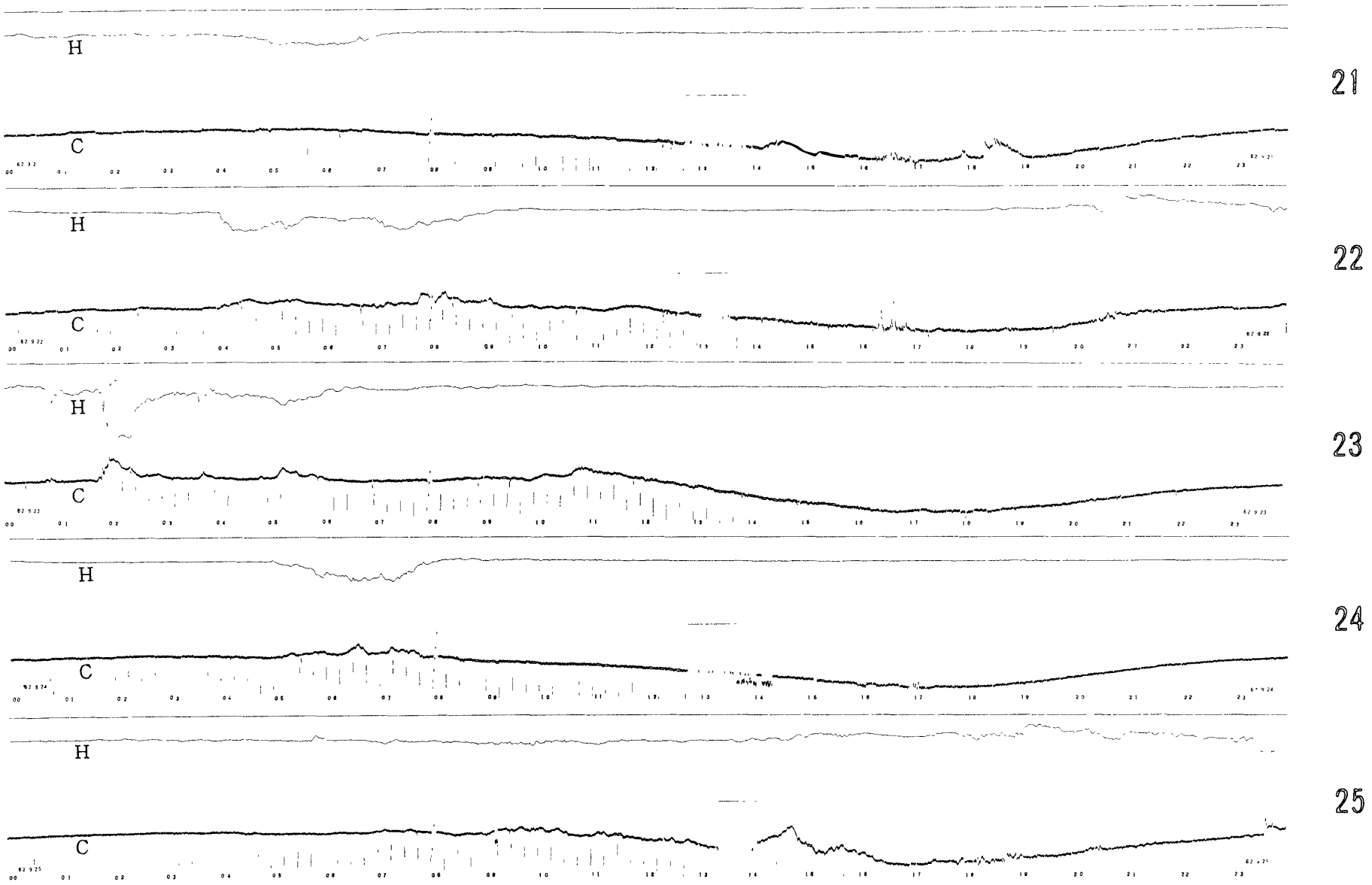
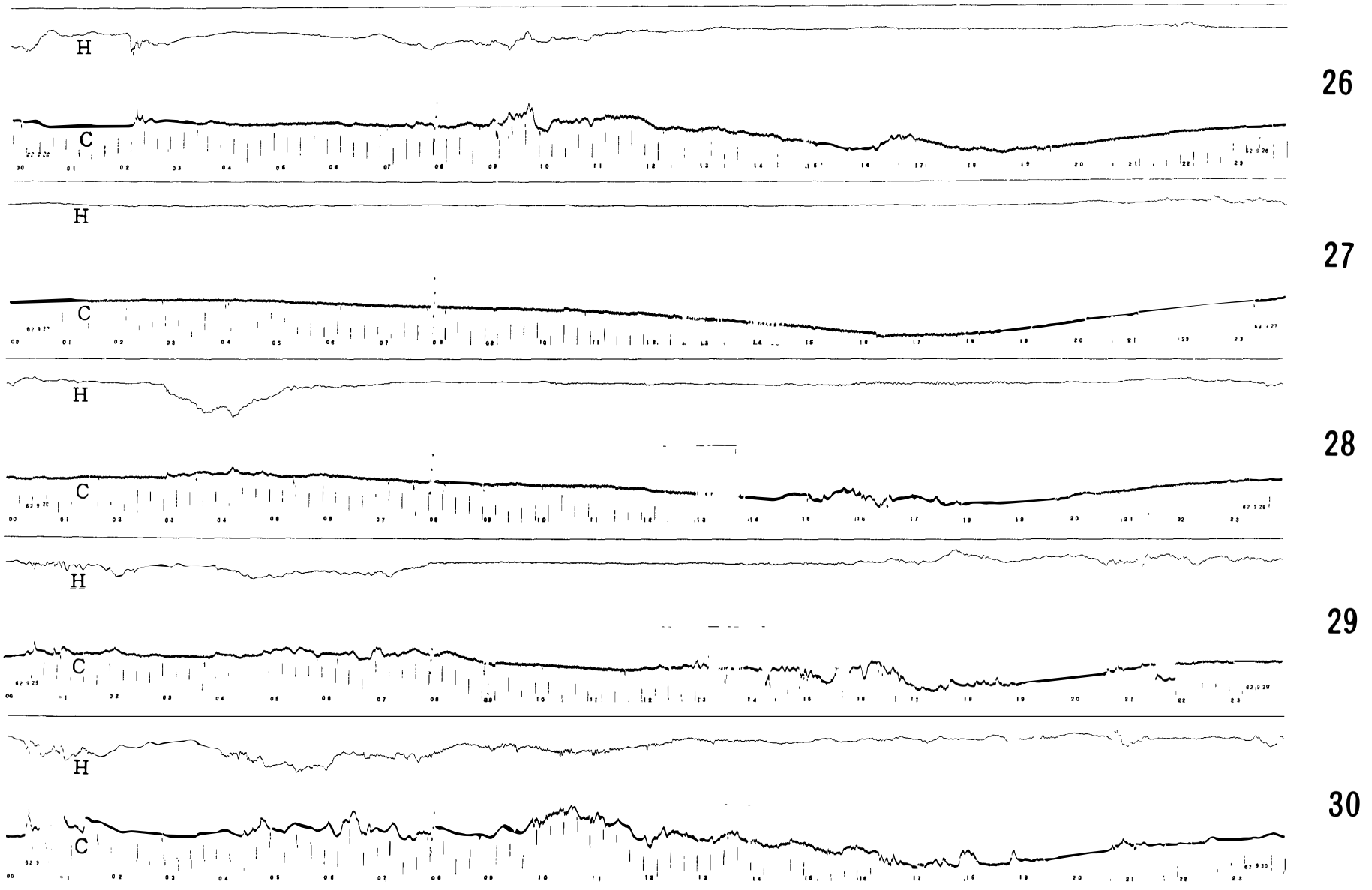
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE


SEP. 1987
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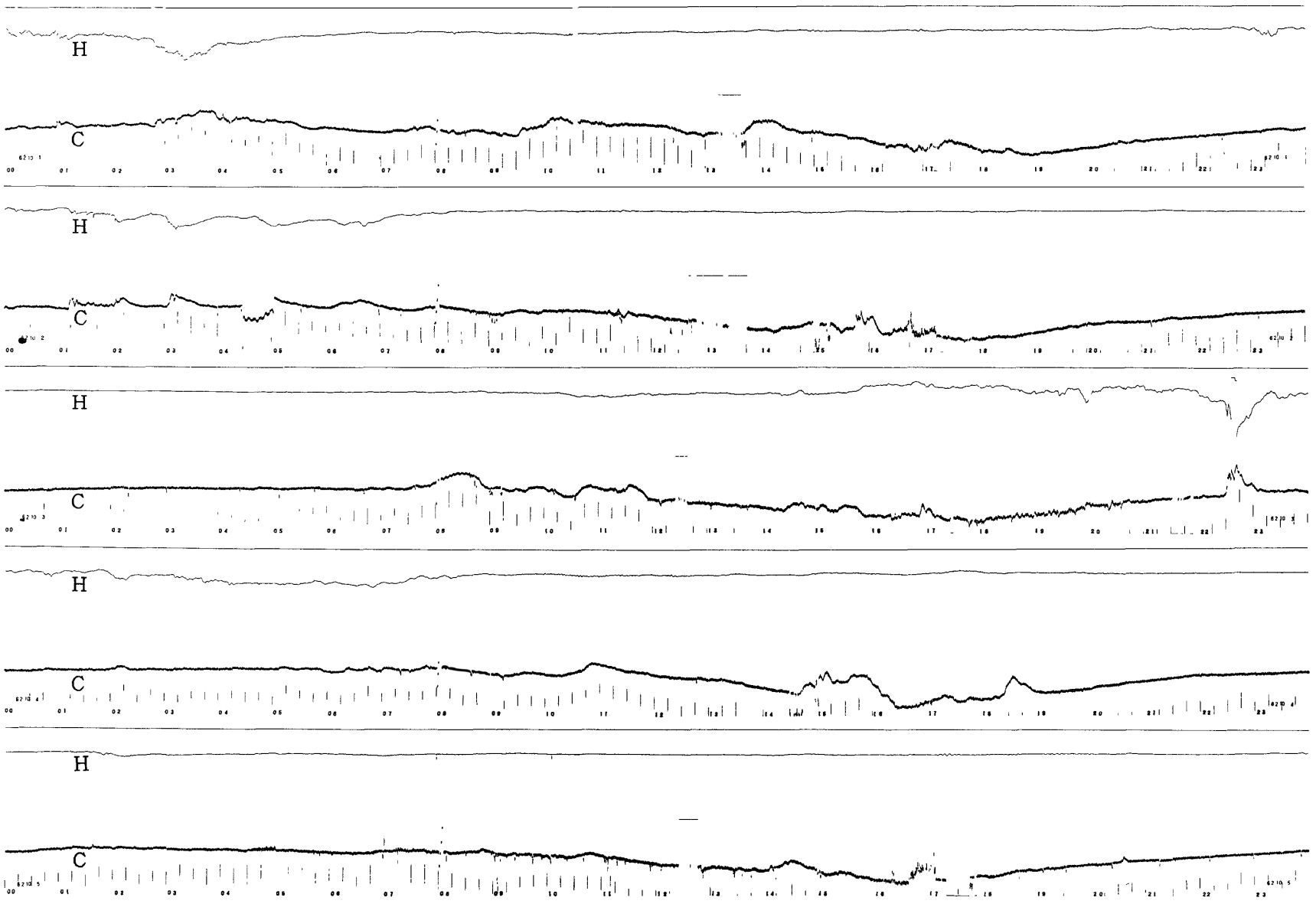
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

September 6 1635 - 1700 Failure of equipment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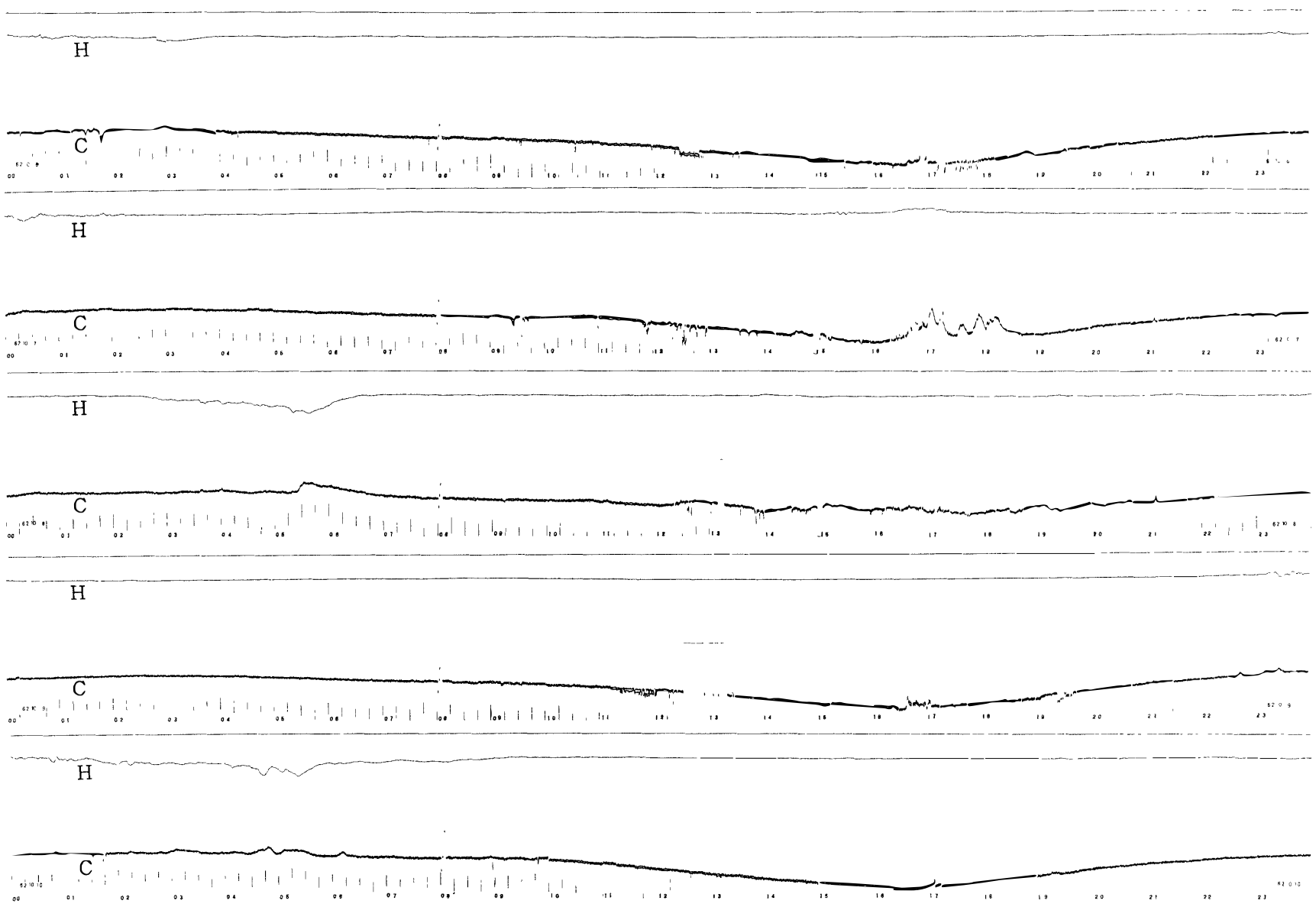
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

OCT. 1987

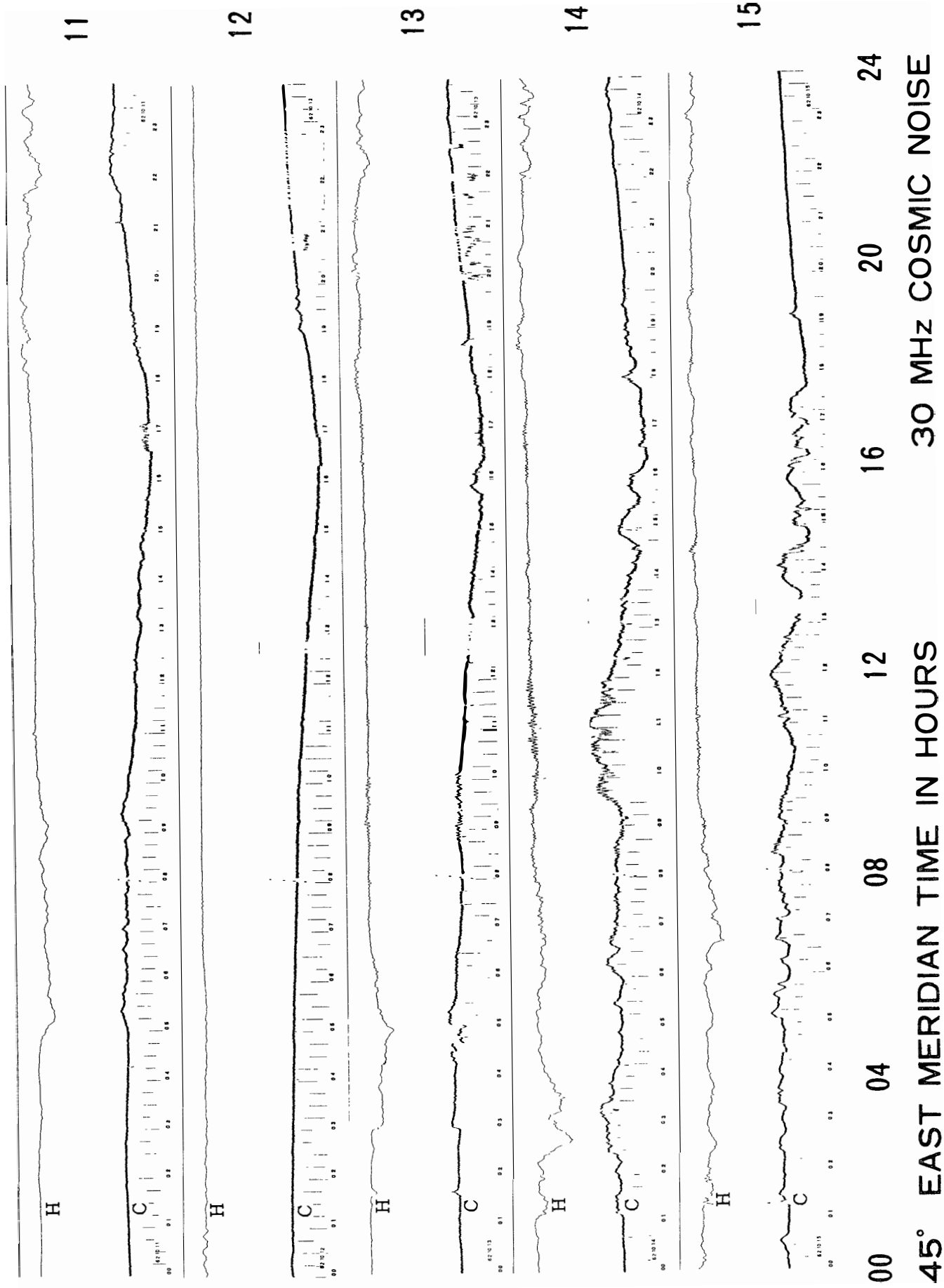


OCT. 1987

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

OCT. 1987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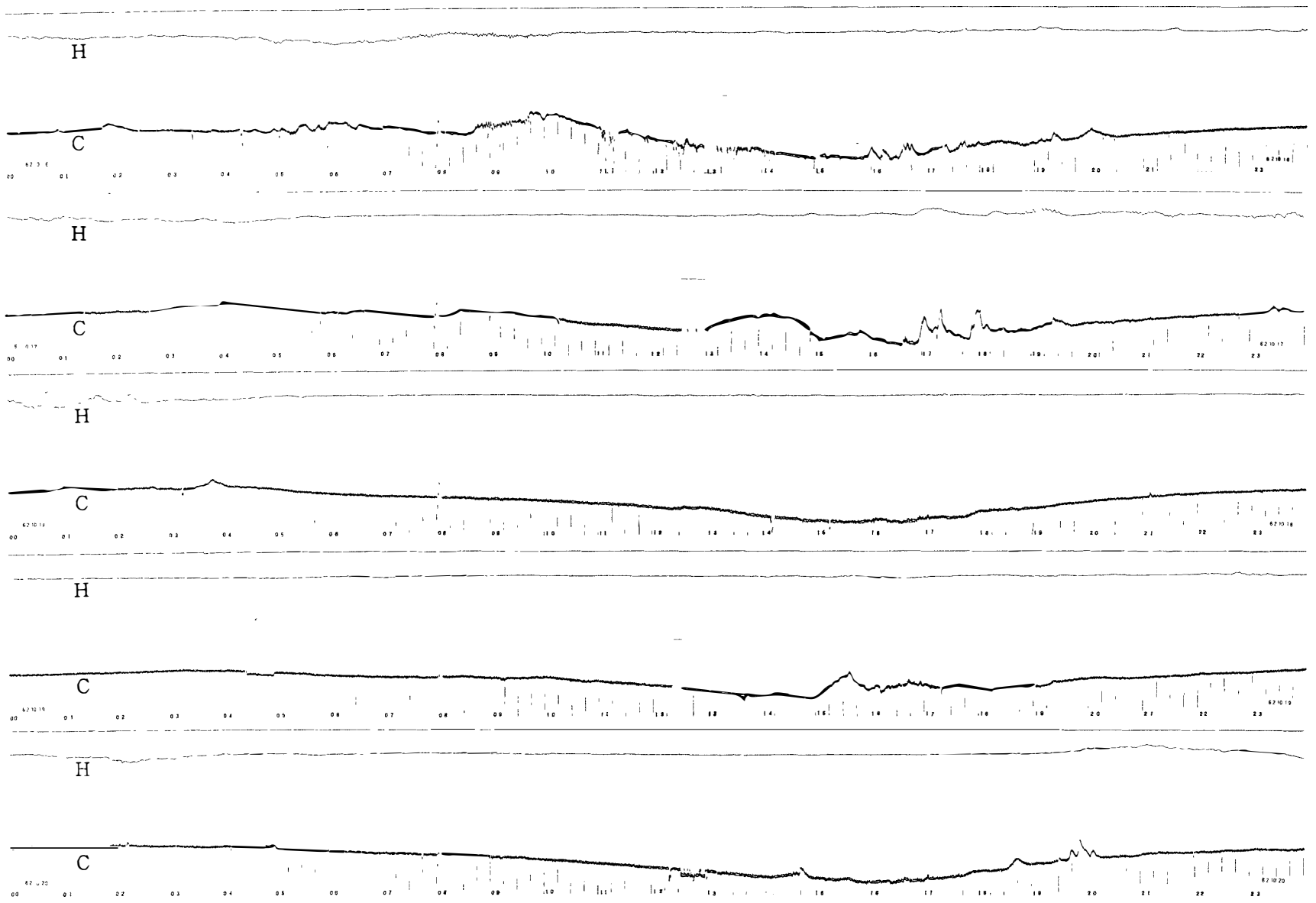
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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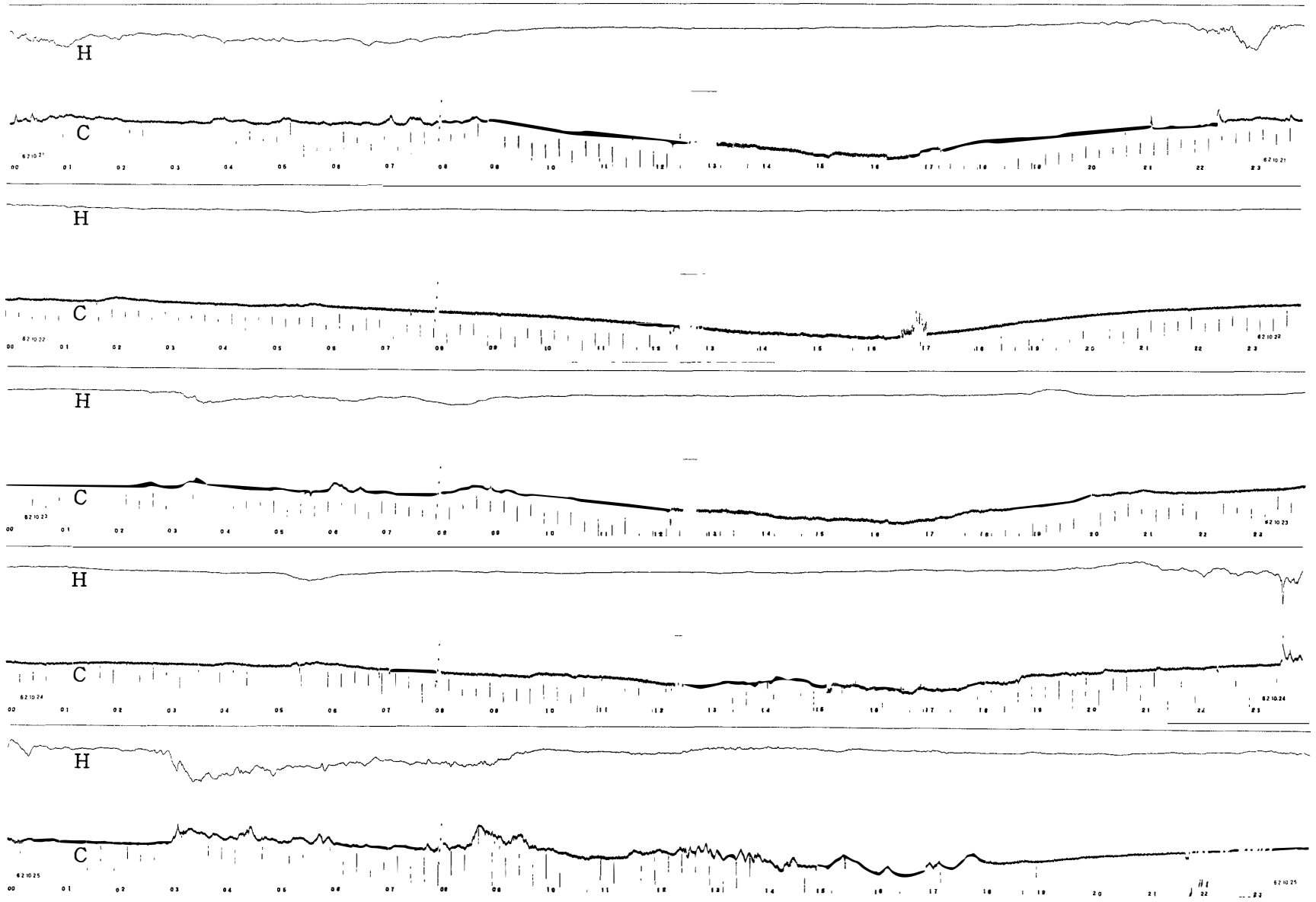
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

OCT. 1987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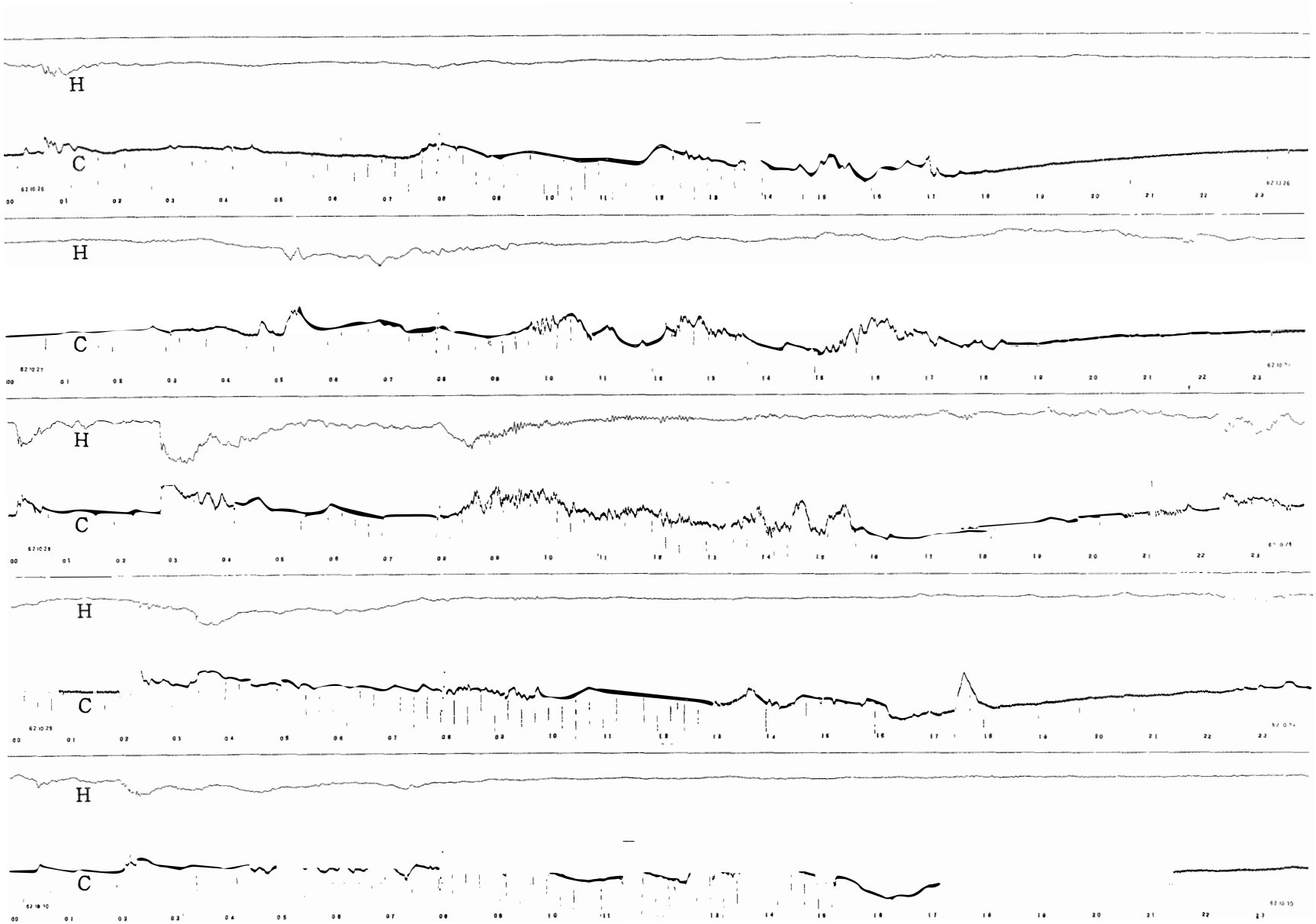
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

OCT. 1987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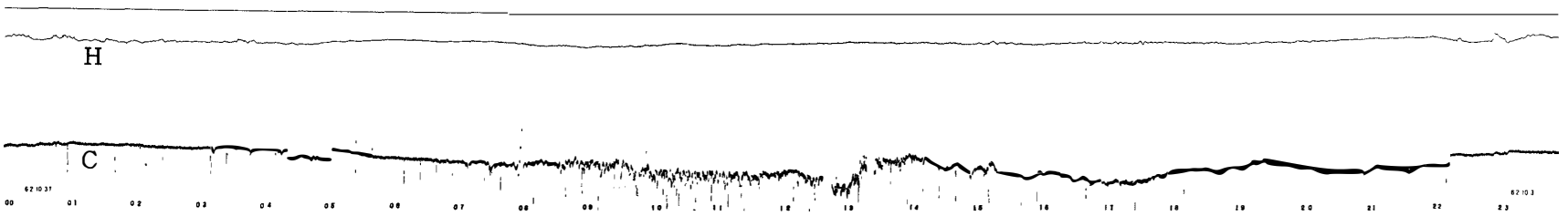
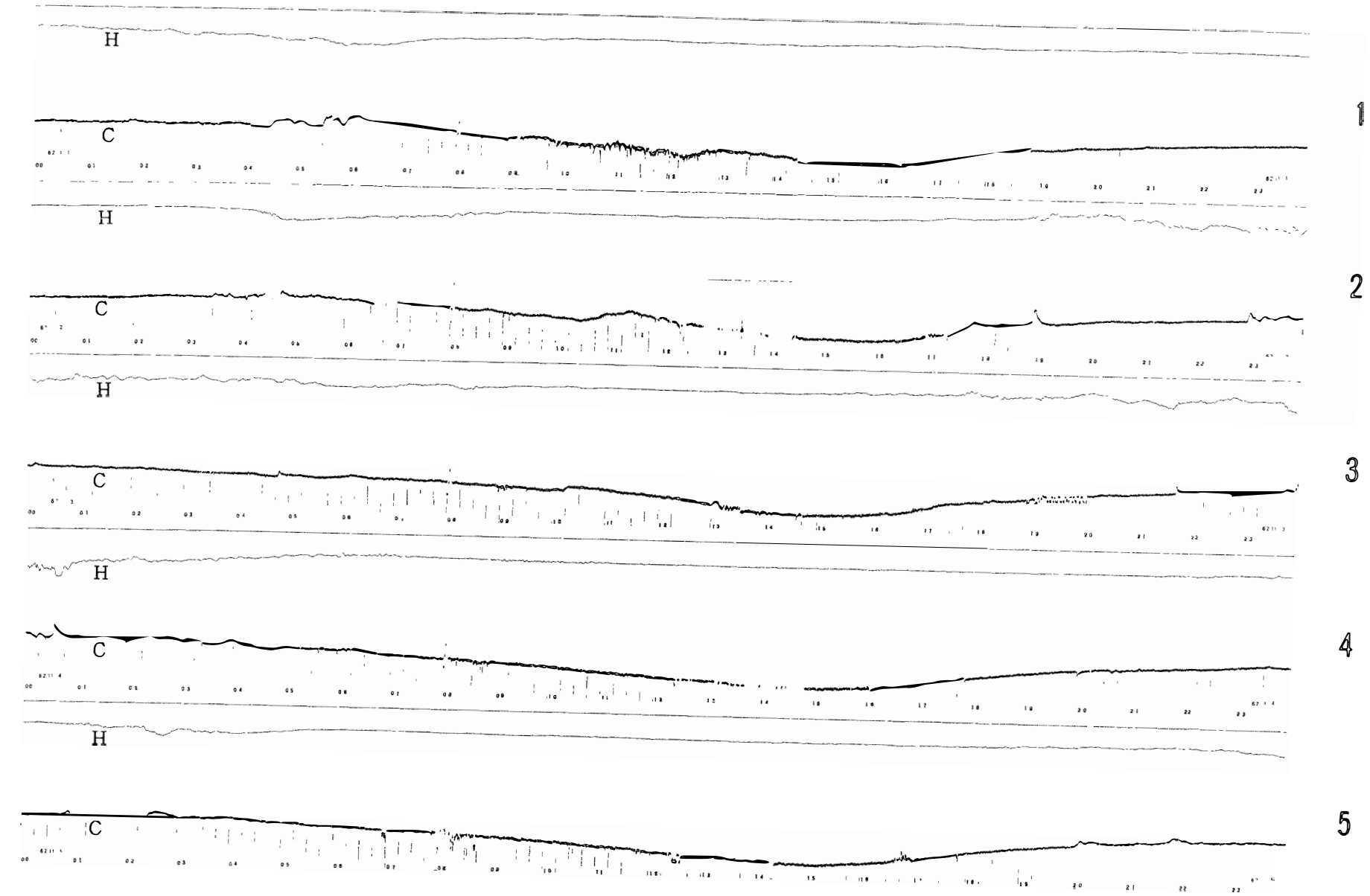
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

31



Cosmic noise level obscured or equipment malfunction.

October	2	0428 - 0503	Failure of equipment
	13	1230 - 1315	"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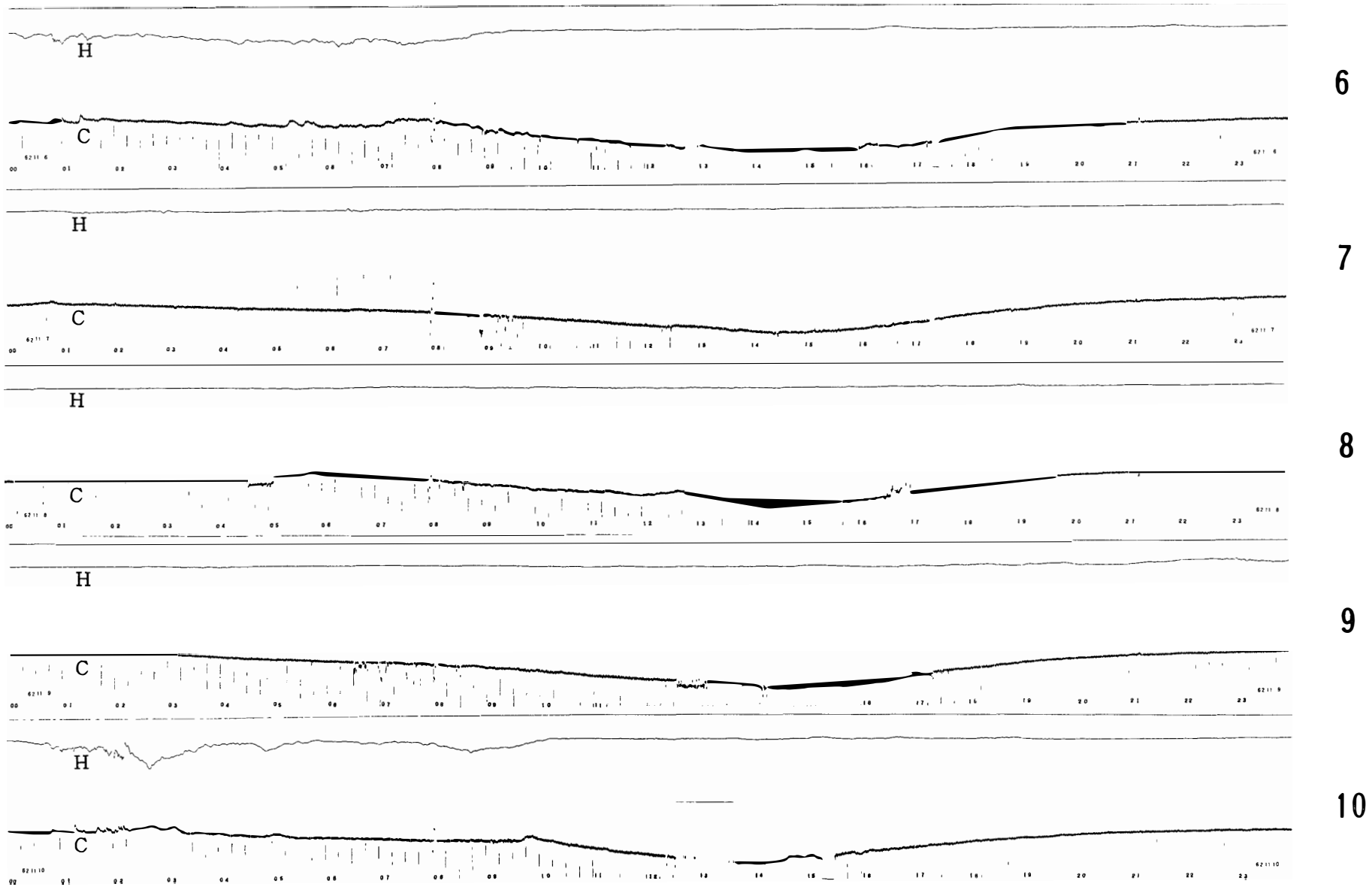
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

NOV. 1987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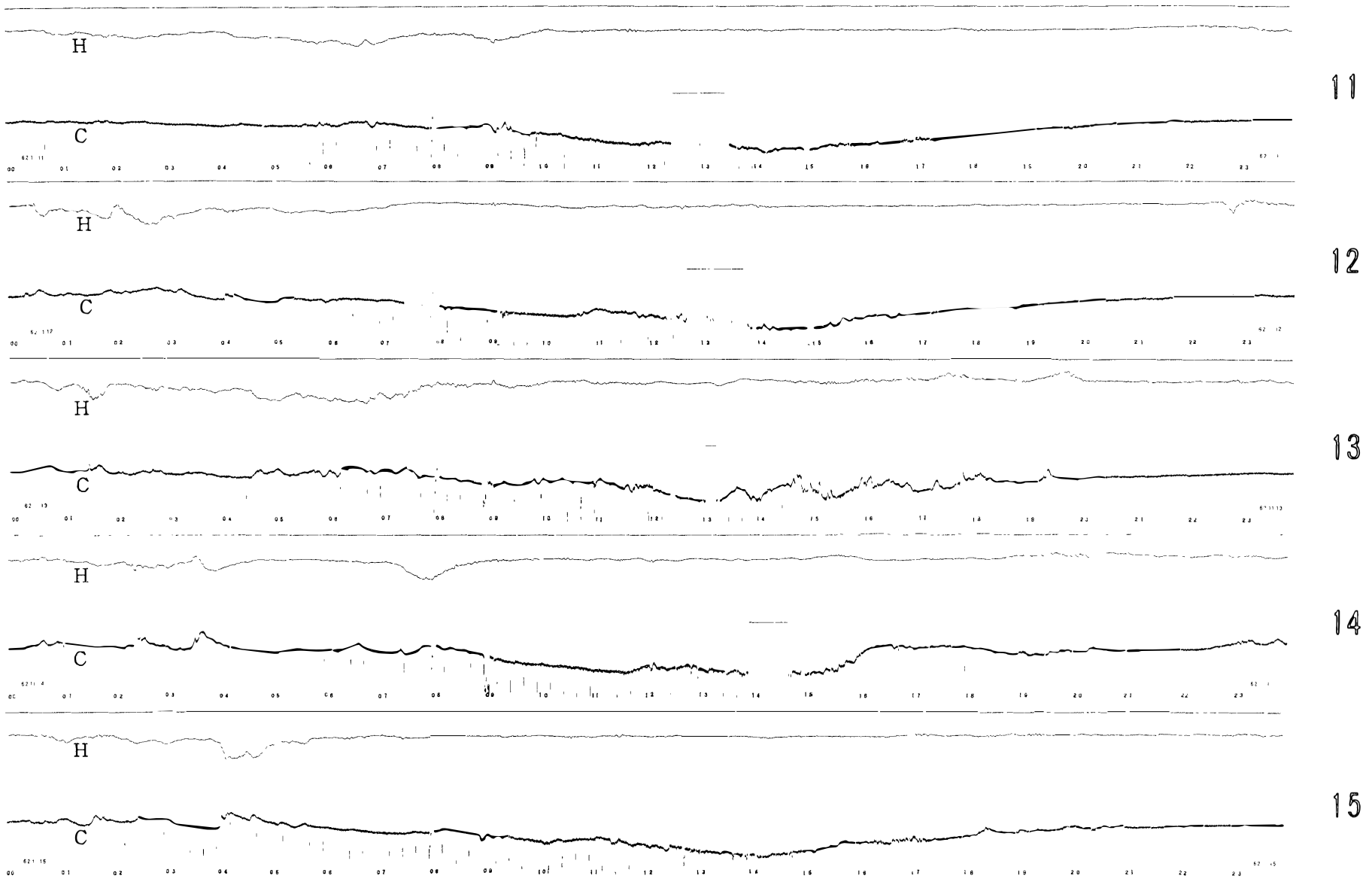
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

NOV. 1987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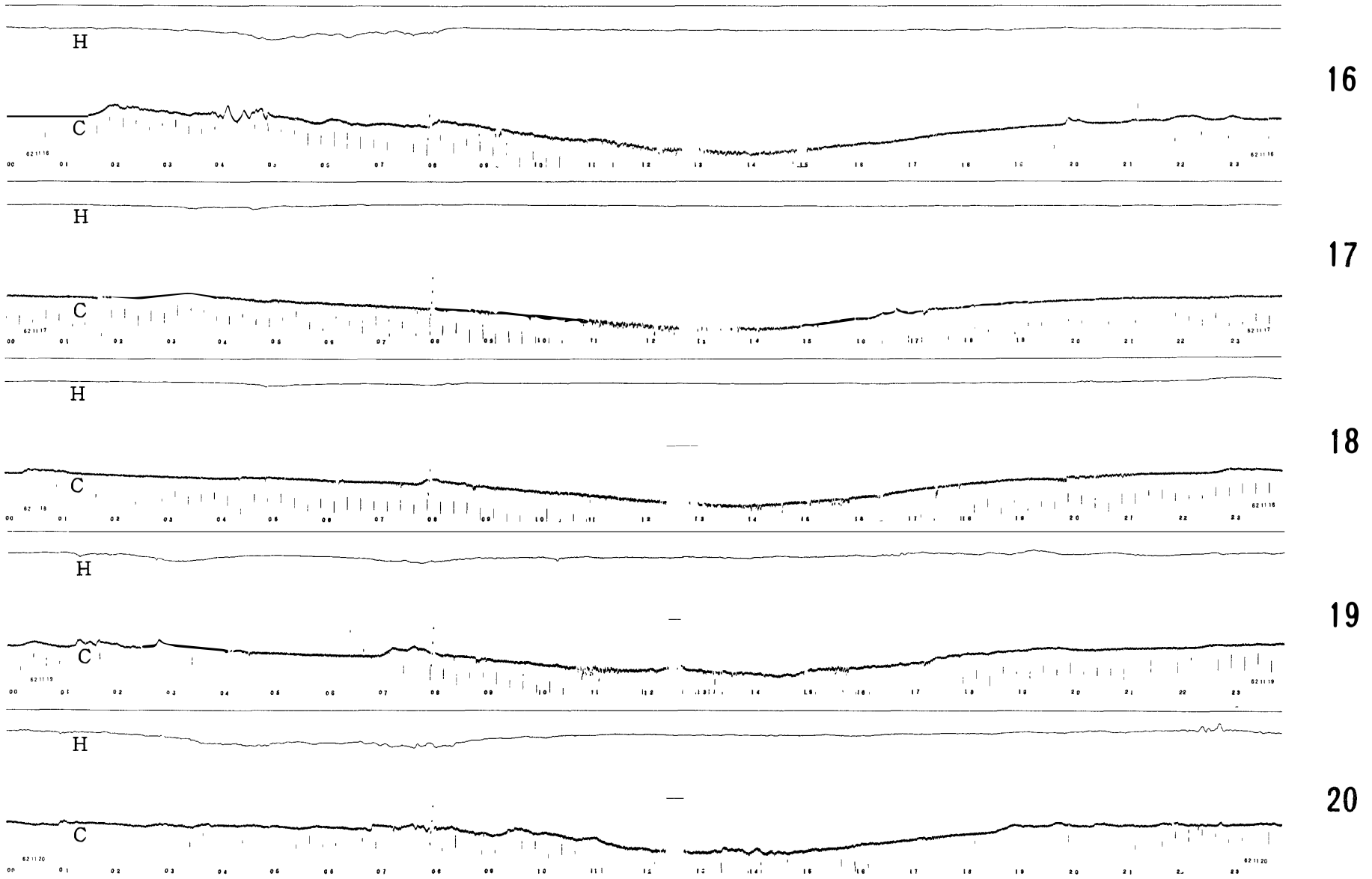
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

NOV. 1987


NOV. 1987
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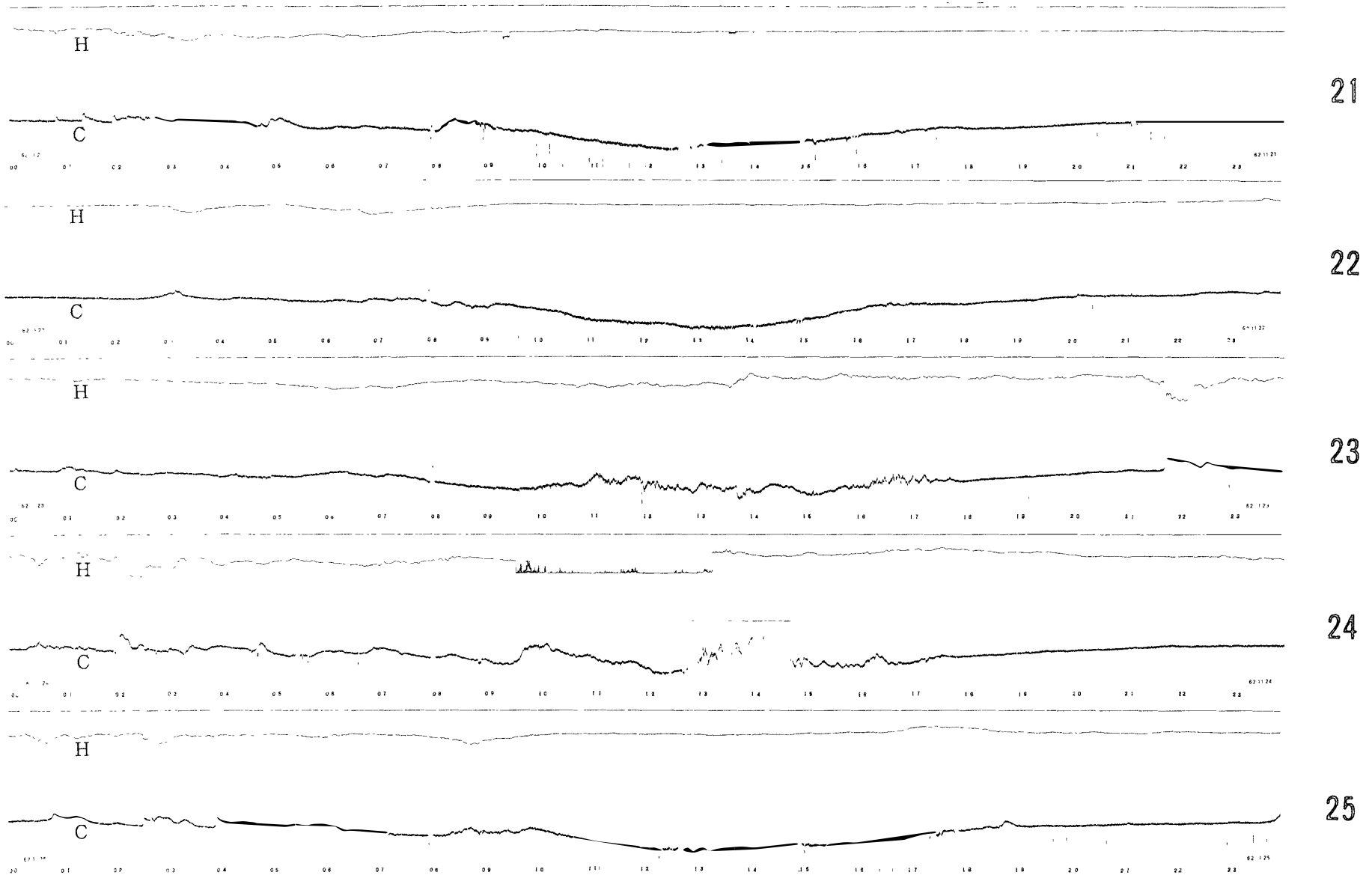
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE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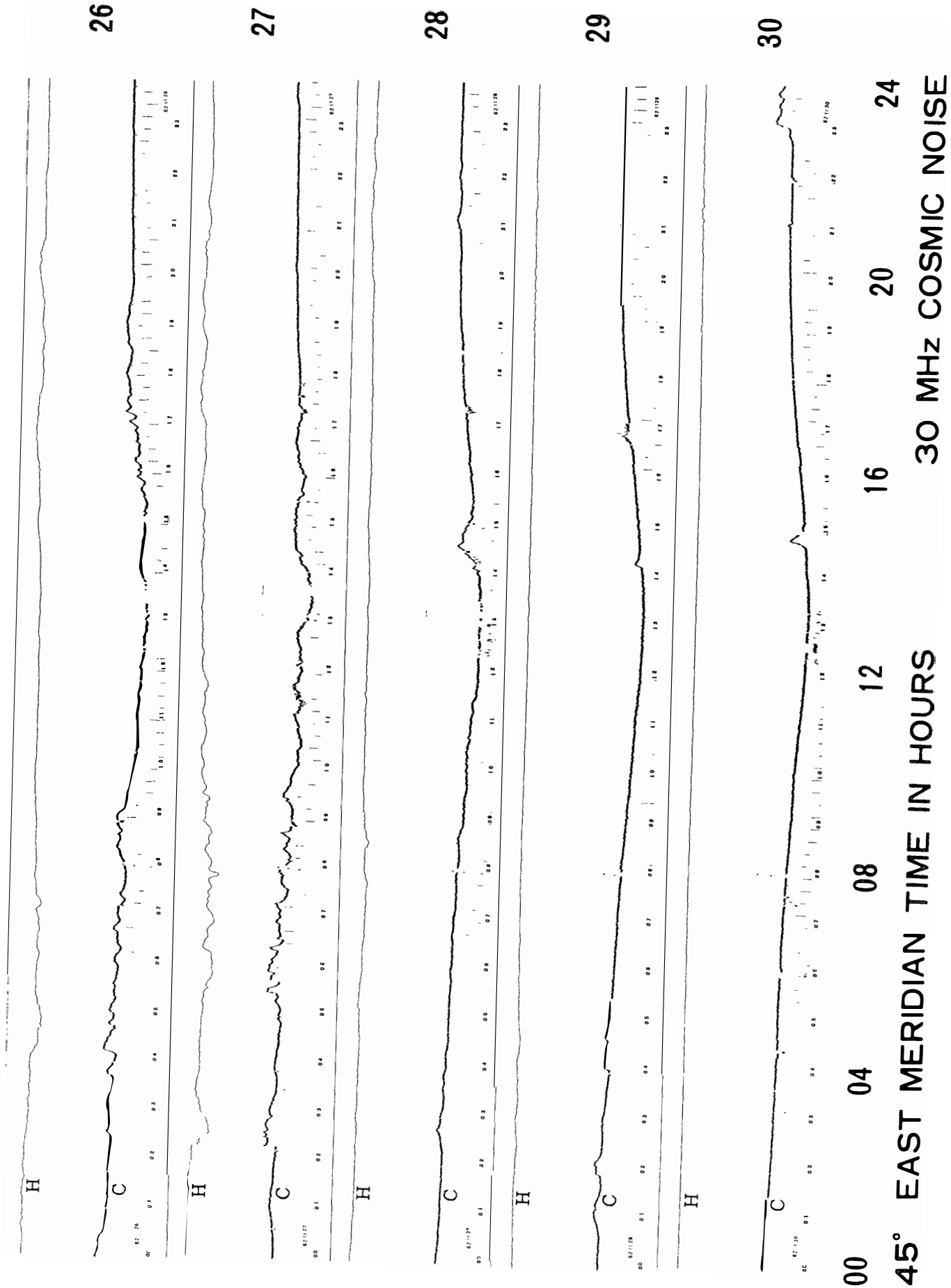
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

NOV. 1987

NOV. 1987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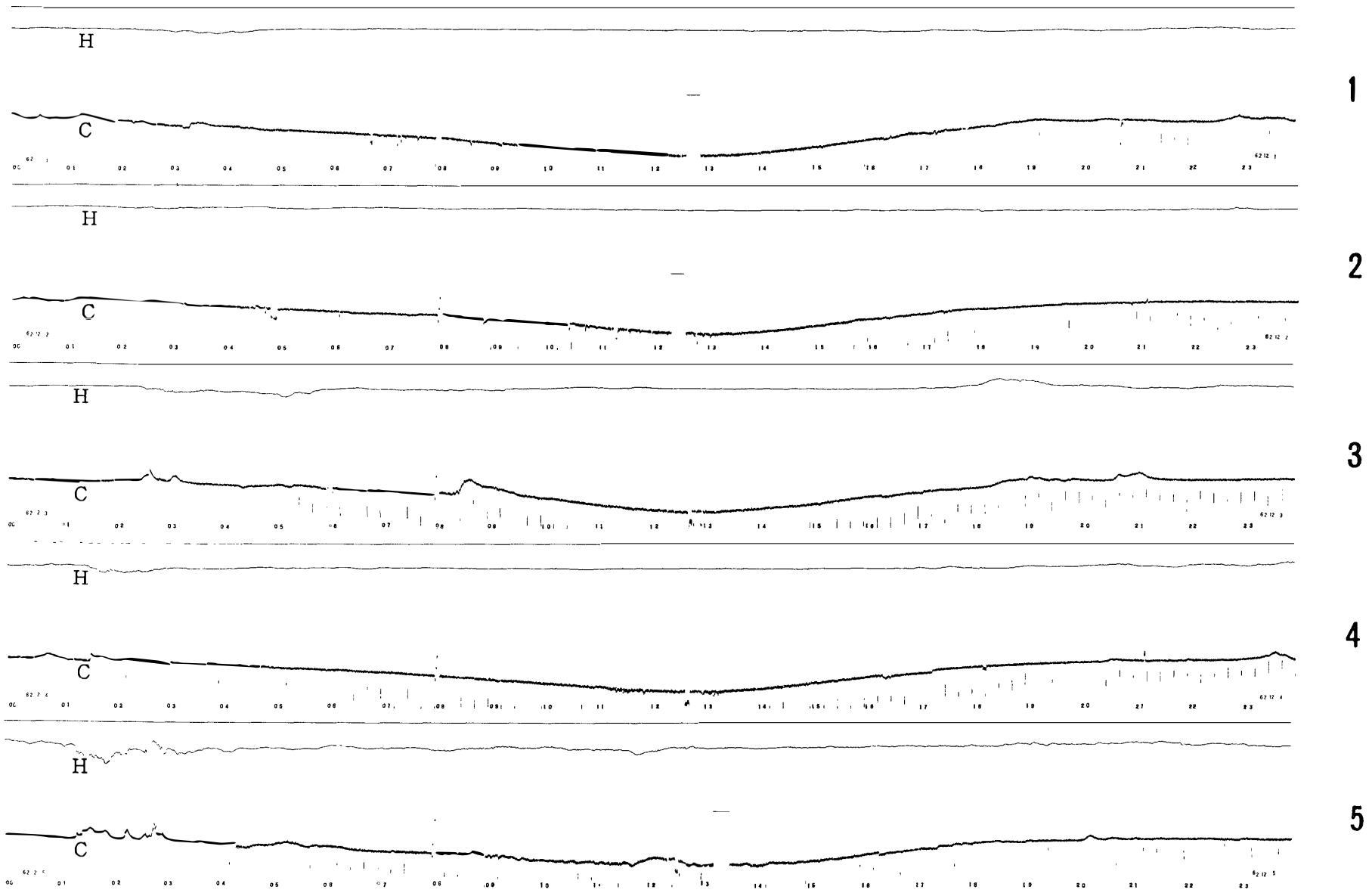
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

November 14 1358 - 1448 Failure of equipment


DEC. 1987
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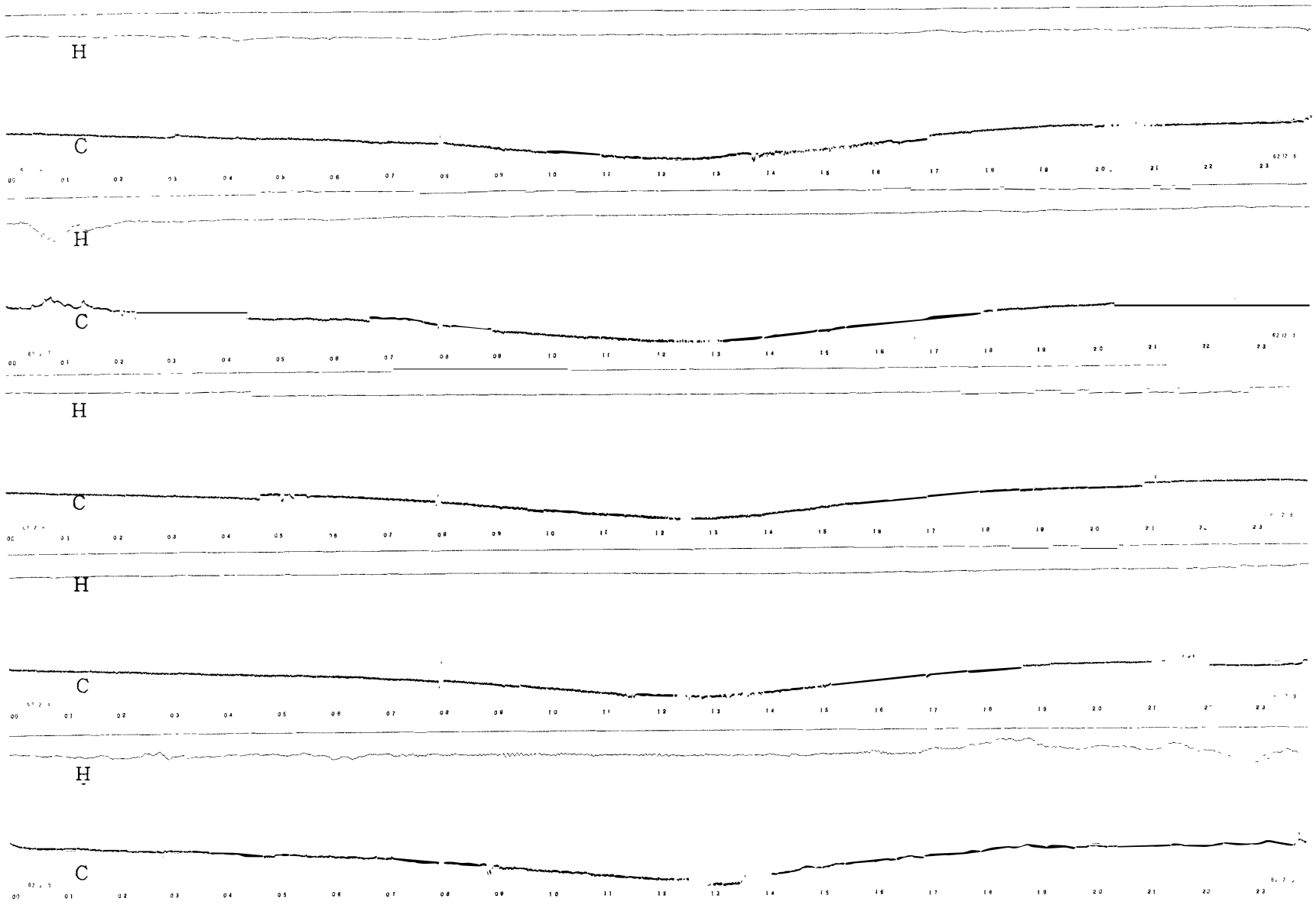
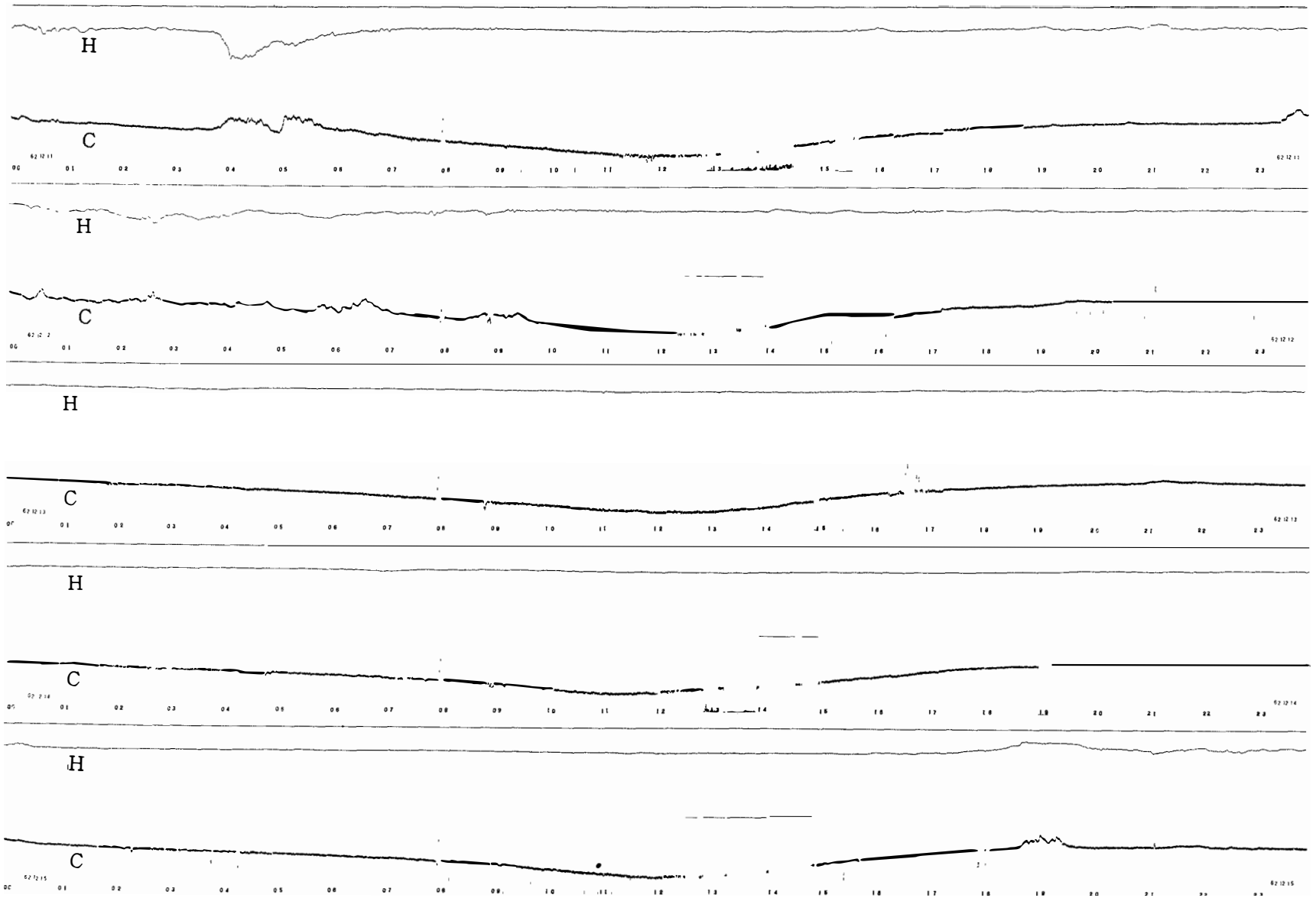
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

DEC. 1987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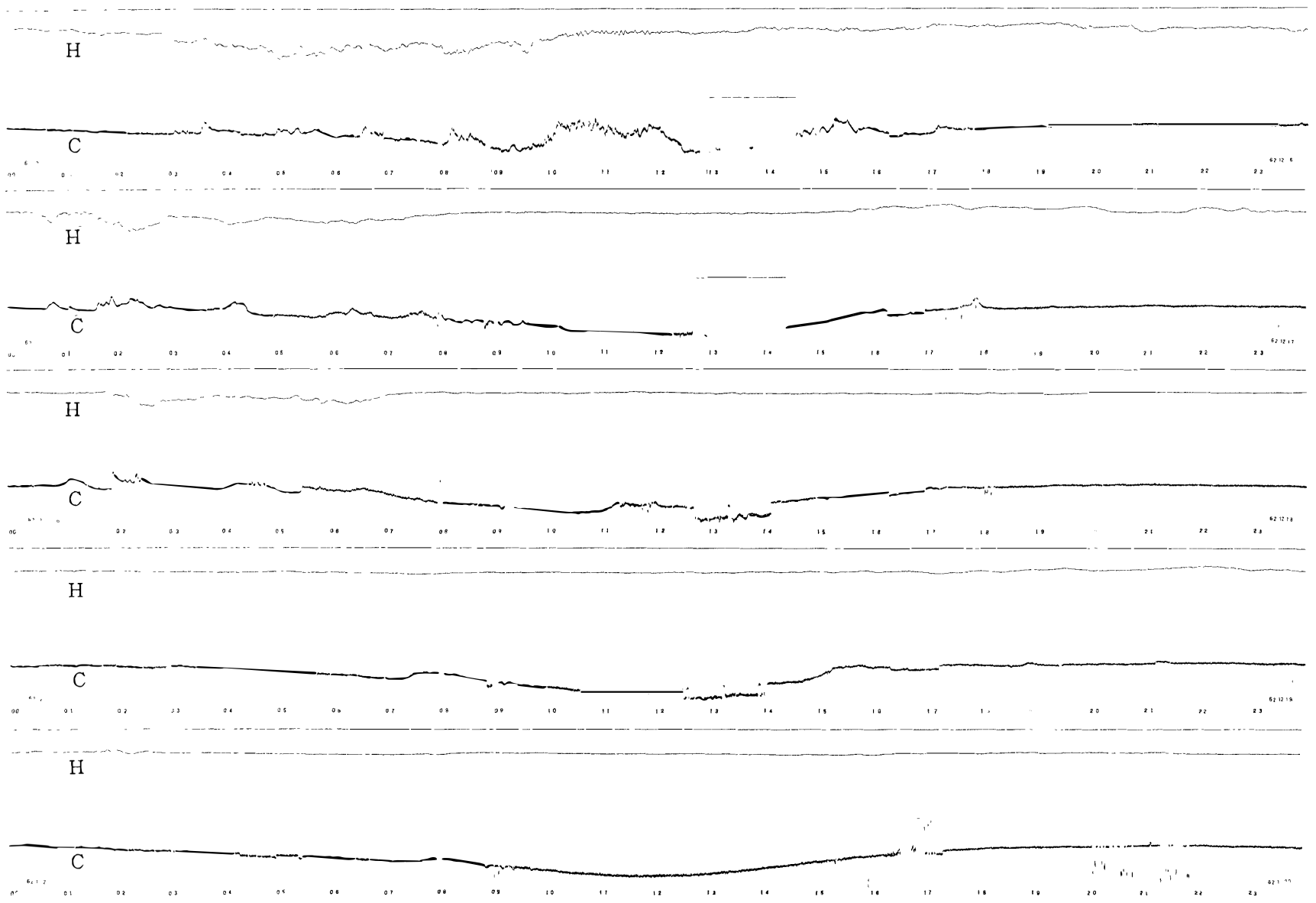
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

DEC. 1987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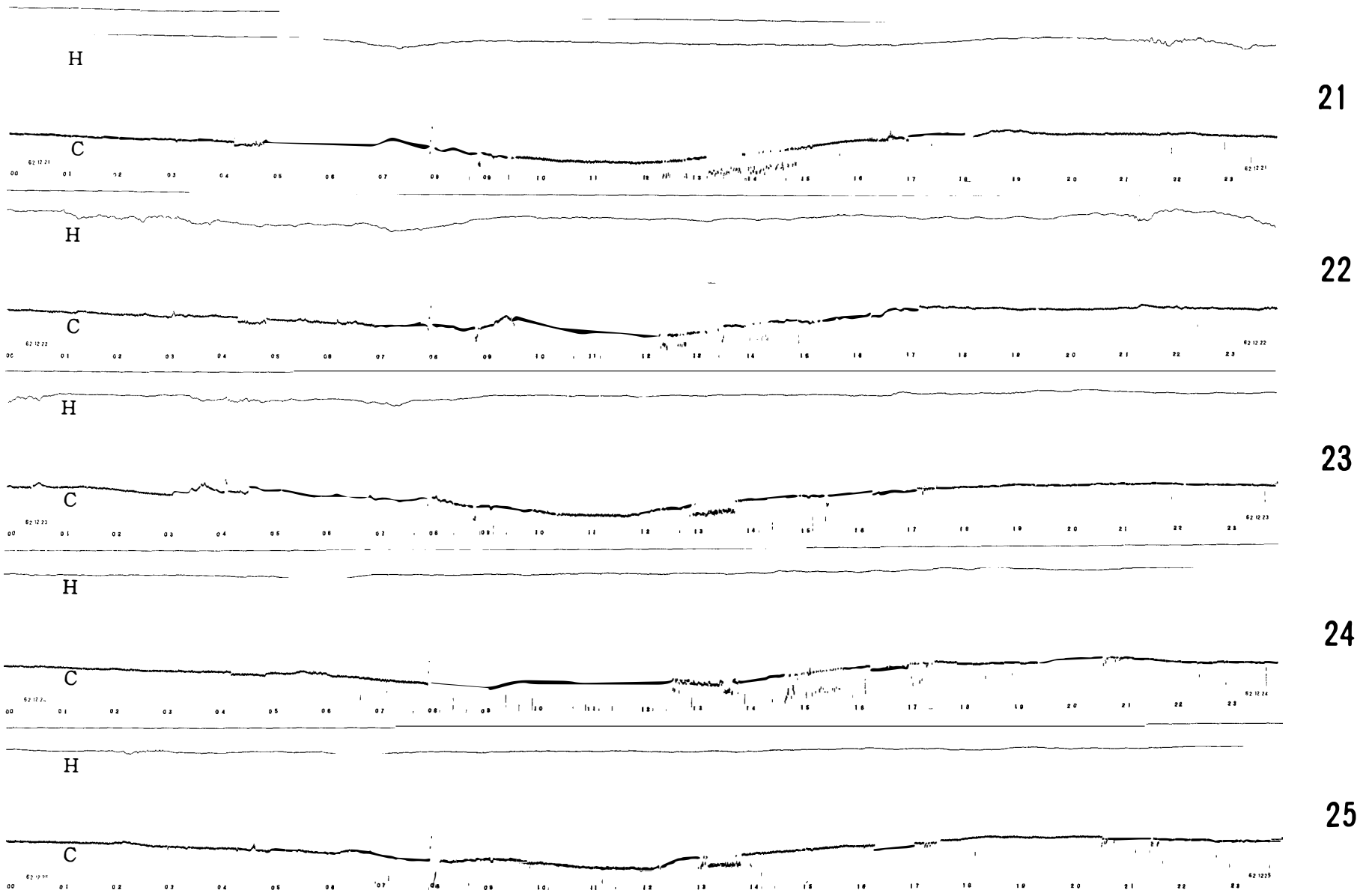
45° EAST MERIDIAN TIME IN HOURS
30 MHz COSMIC NOISE

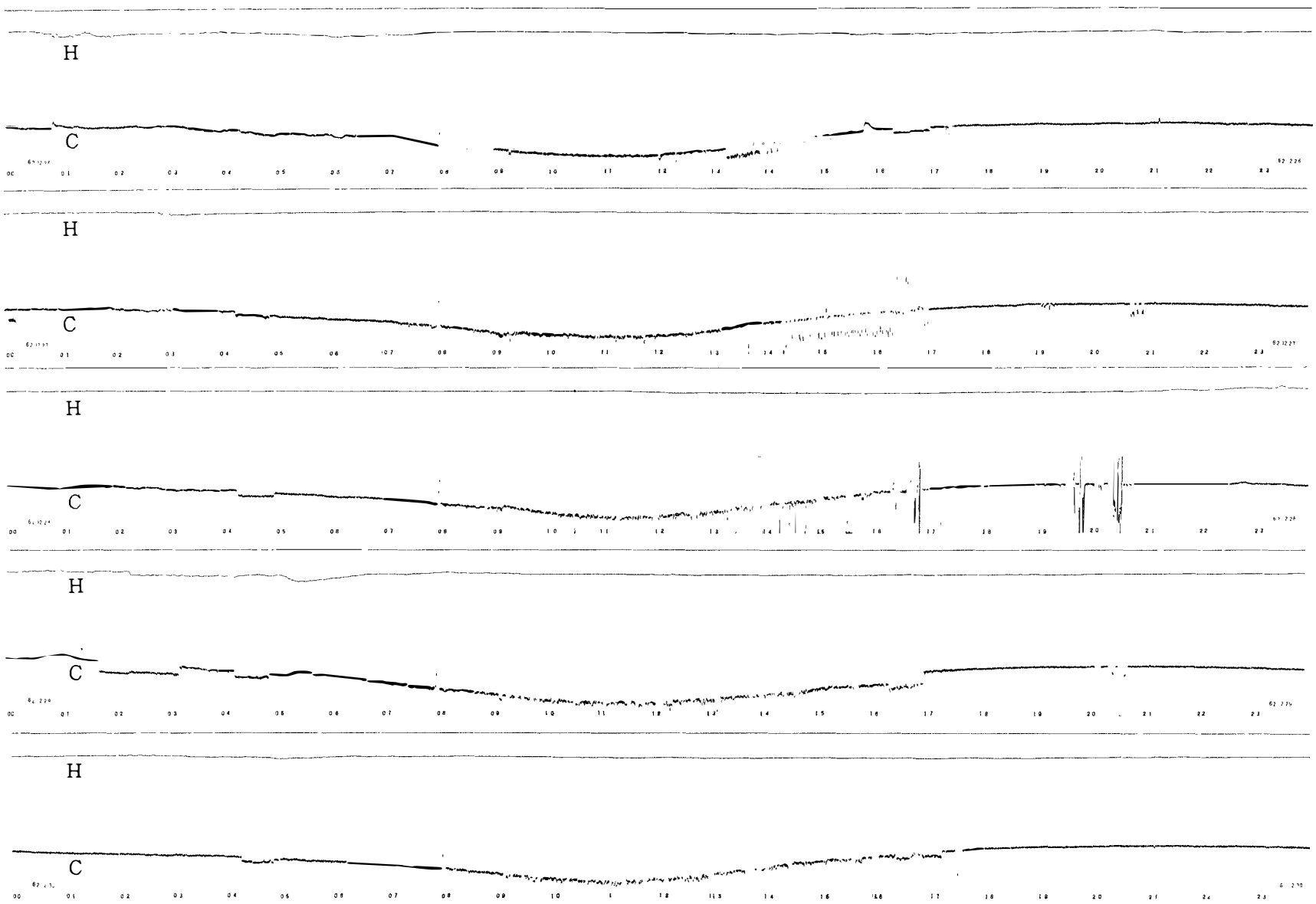
DEC. 1987

DEC. 1987



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

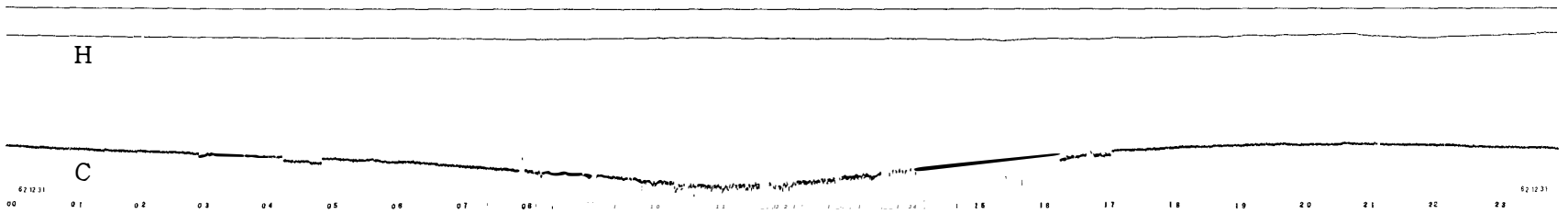


45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

DEC. 1987

31



00 04 08 12 16 20 24

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

December 15 1235 - 1455 Failure of equipment

16 1235 - 1440 "

17 1250 - 1430 "