

Riometer Records of 30 MHz Cosmic Noise
at Syowa Station, Antarctica
in 1970

Isao SHIRO and Toshirou SAKAMOTO
(Radio Research Laboratories, Koganei-shi, Tokyo)

1. Introduction

The observation of 30 MHz cosmic radio noise with a standard riometer (relative ionospheric opacity meter) has been carried out at Syowa Station, Antarctica since February 1966 by representatives from the Radio Research Laboratories.

This report has been prepared in order to make the data available to ionospheric physicists. The records covering the period from January 1 to December 31, 1970 are deposited at the Radio Research Laboratories.

Inquiries about the contents of this report should be addressed to :

Radio Research Laboratories
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	69.6° S	77.1° E

3. Observers

January 1970

Yasusada OTA (Radio Research Laboratories)

February to December 1970

Isao SHIRO (Radio Research Laboratories)

Toshirou SAKAMOTO (Radio Research Laboratories)

4. Method of measurement

The standard riometer at 30 MHz with 3.5 kHz bandwidth is connected to a vertically directed five-element Yagi antenna, which is designed to match the 50 ohm coaxial transmission line.

The noise power output is recorded with a pen recorder of 1mm/min paper speed, and the standard noise with power of 0, 1, 2, 3 and 4 dB levels is introduced into the receiver once a day as the calibration.

The time indicated on this record is the meridian time at 45° E in longitude (U.T. + 3 hours).

5. Remarks

The power observed in riometer is not identical with the cosmic noise power itself, but it should be taken into account of ionospheric absorption effects.

If the ionosphere is in a quiet state, the diurnal variation of the cosmic noise power is easily reduced. However, several complicated variations take place because of seasonal and diurnal variations and short-time abnormal absorptions in the ionosphere.

On account of movement of the earth, the time (local time) when the same radio source passed the zenith gets earlier by about 4 minutes day after day and is restored to the original state in a year because of the difference between solar and sidereal times.

In Fig.1 shows the monthly range of time of the maximum value (in solid lines) of diurnal variation of cosmic noise power on quiet days, and the time of the minimum value (in broken lines). The range is mainly due to the time difference mentioned above.

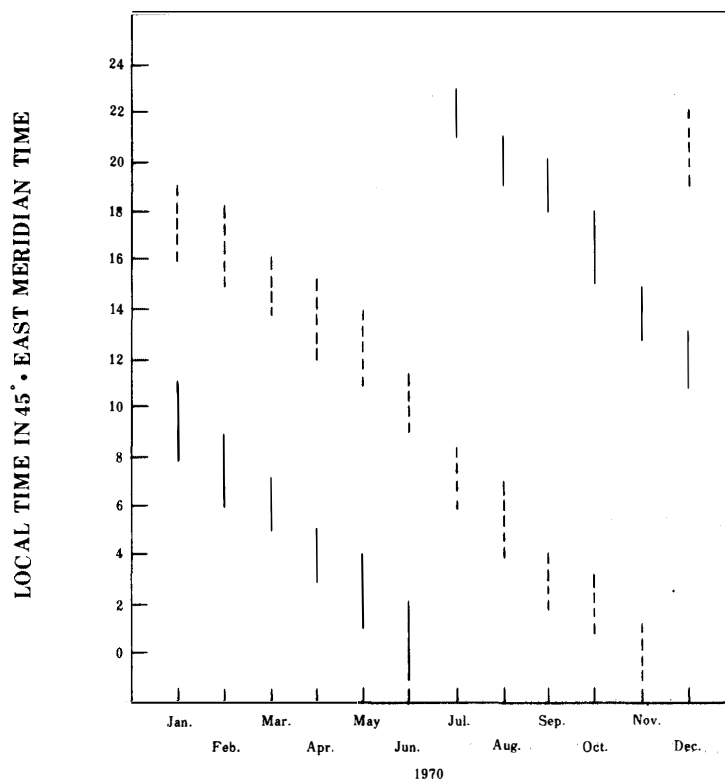


Fig. 1. Monthly range of the maximum values (————) and the minimum values (-----) of cosmic noise power at Syowa Station.

JAN 1970

1

2

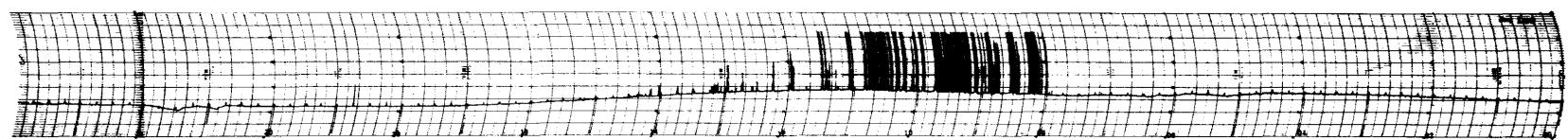
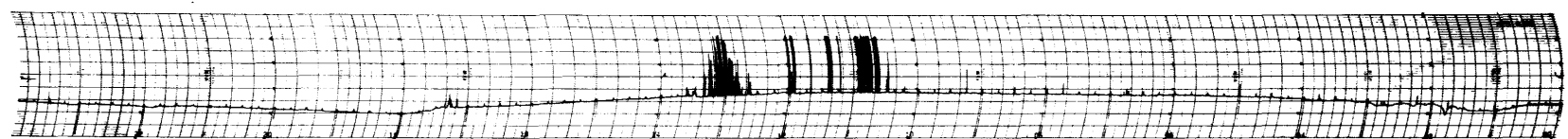
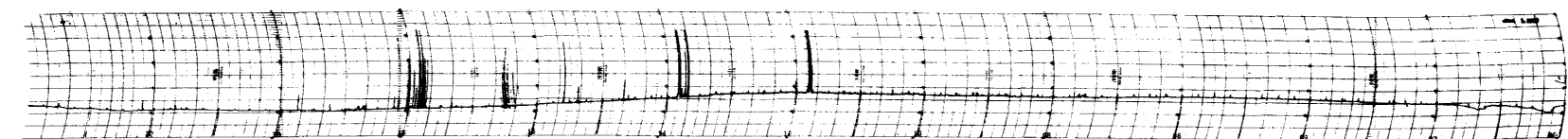
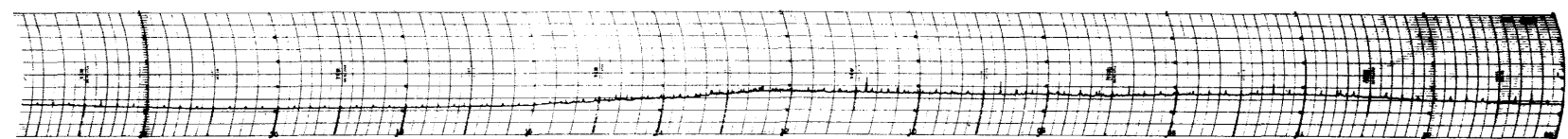
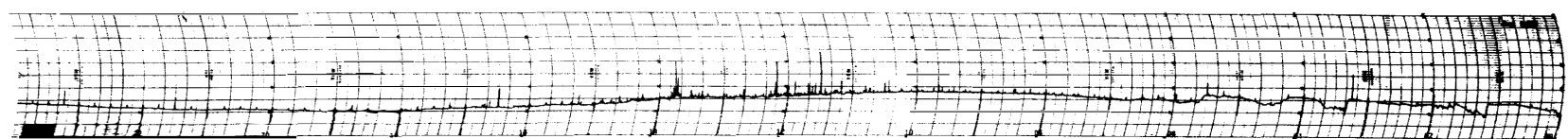
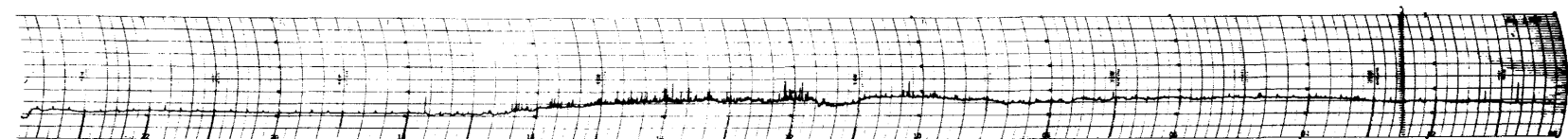
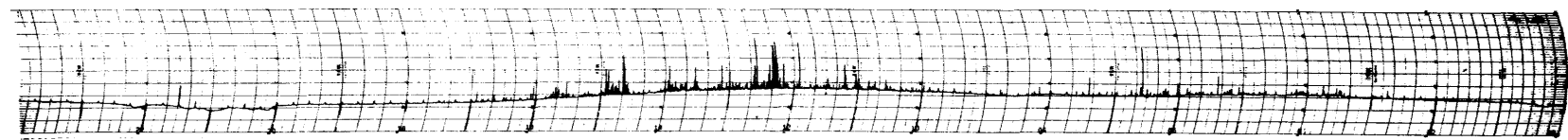
3

4

5

6

7



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

JAN 1970

8

9

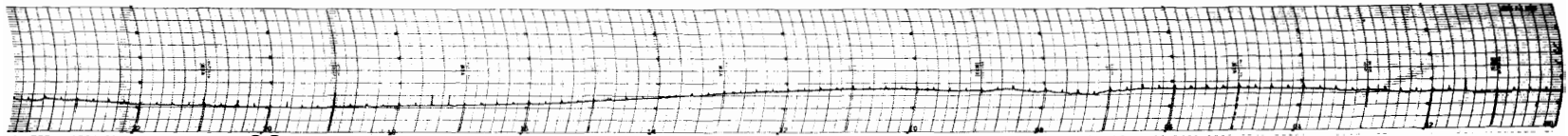
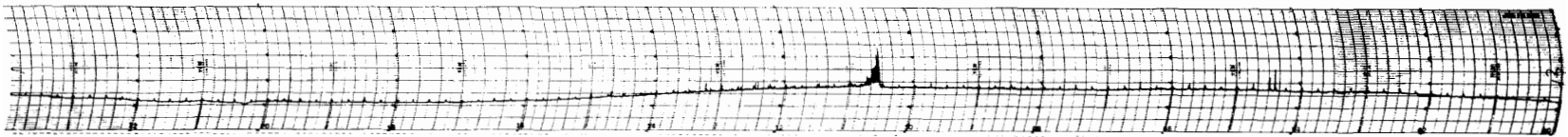
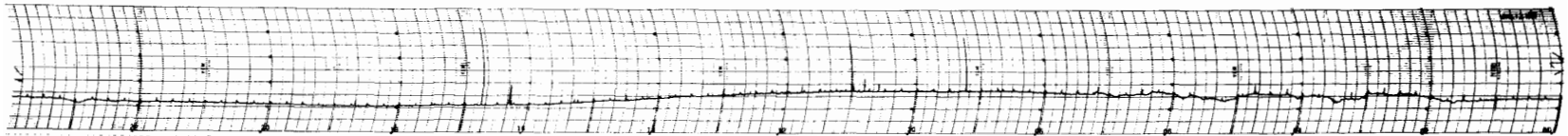
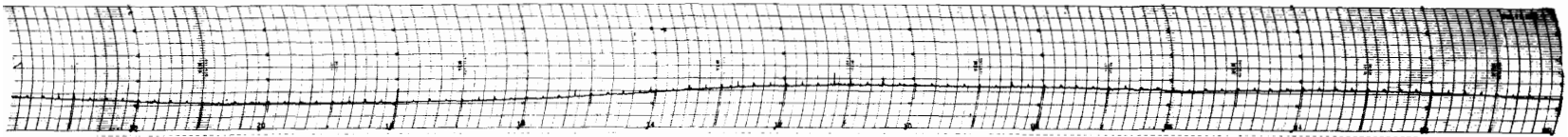
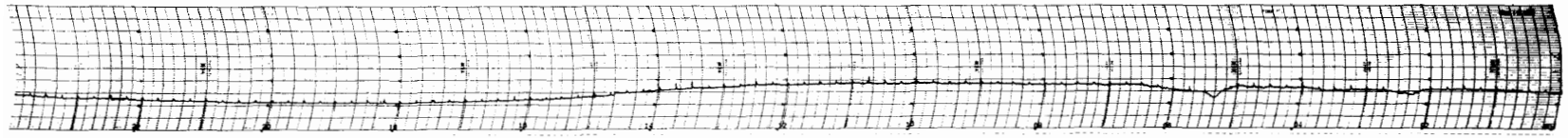
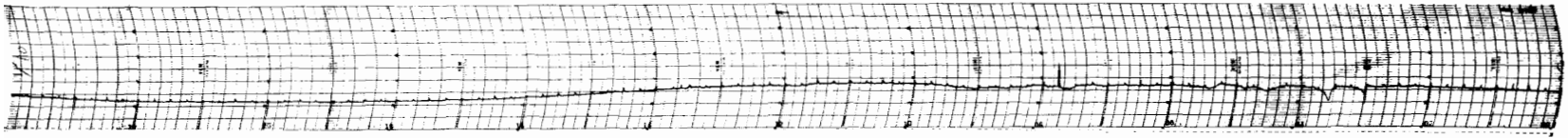
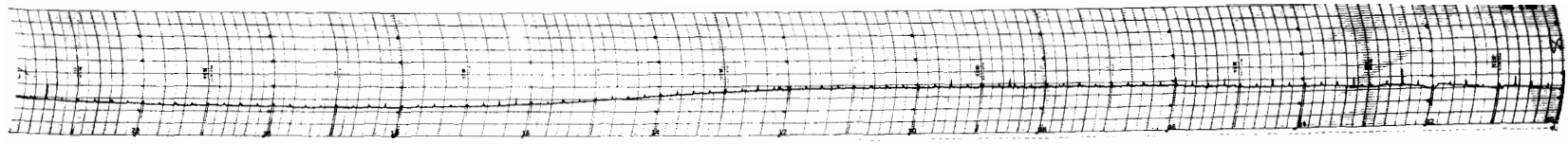
10

11

12

13

14



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

JAN 1970

15

16

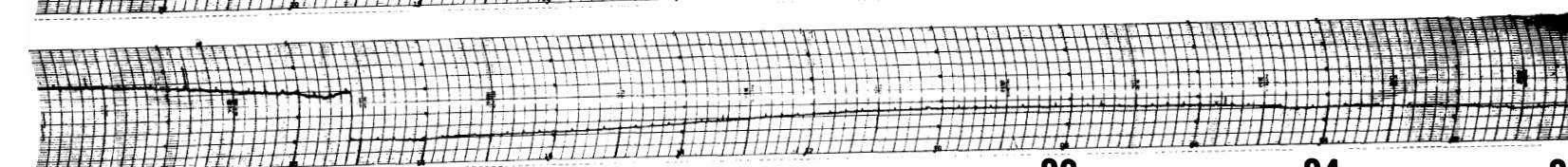
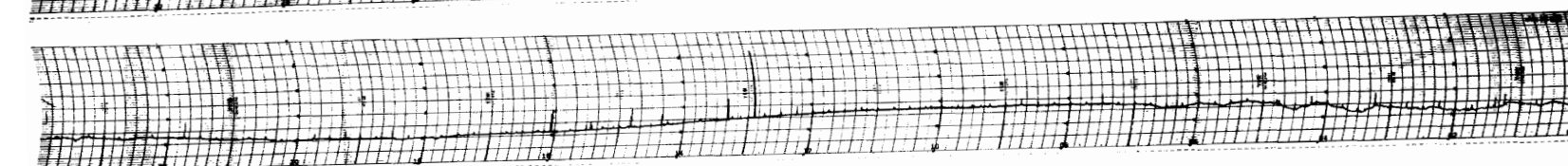
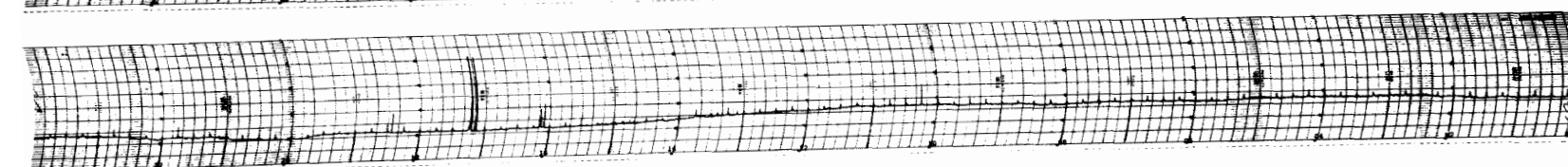
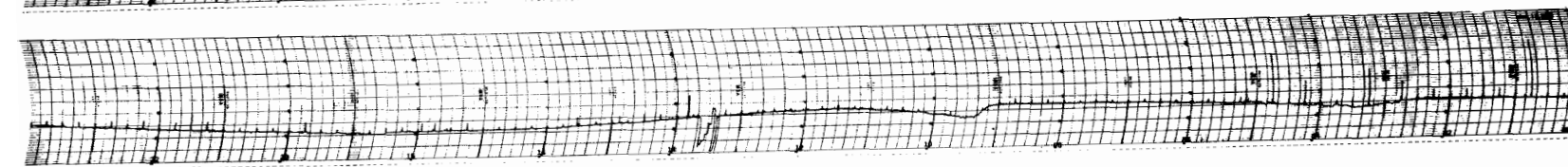
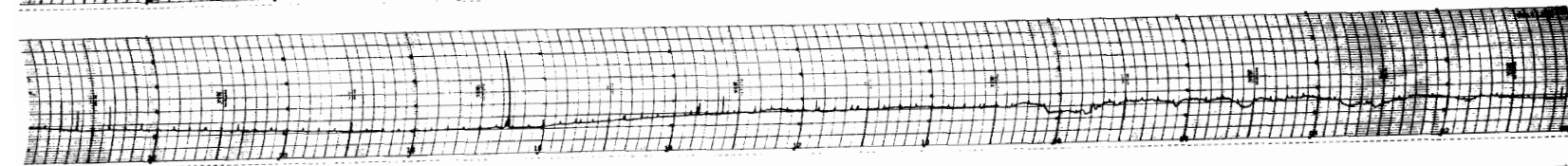
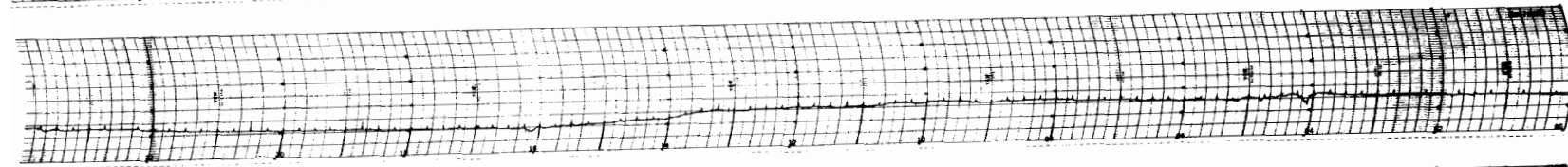
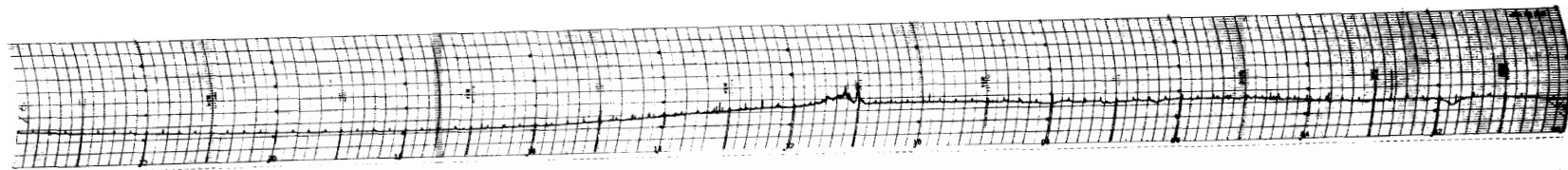
17

18

19

20

21

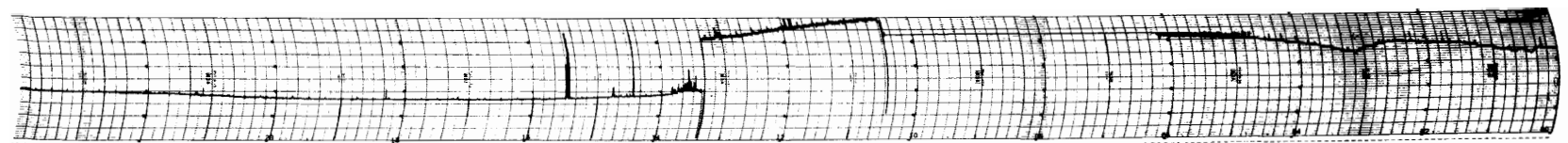


24 20 16 12 08 04 00

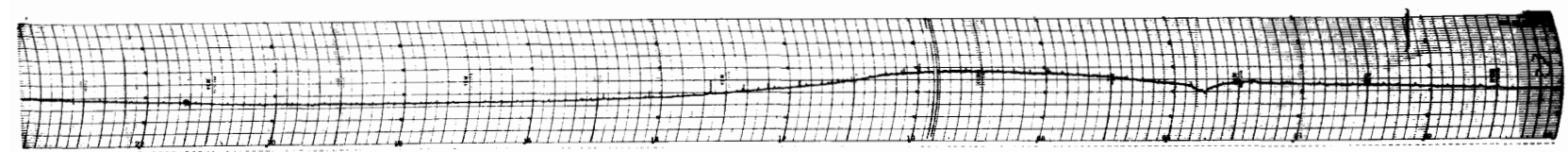
45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

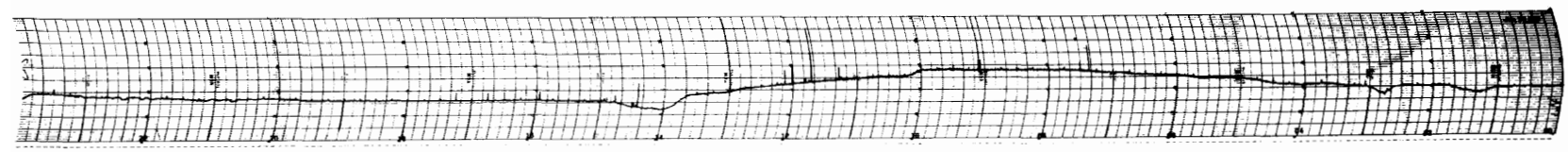
JAN 1970



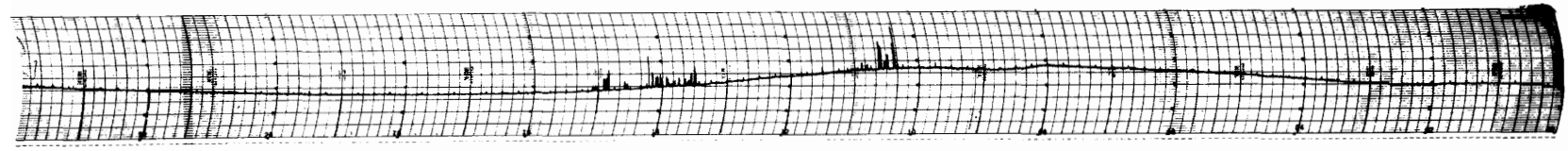
22



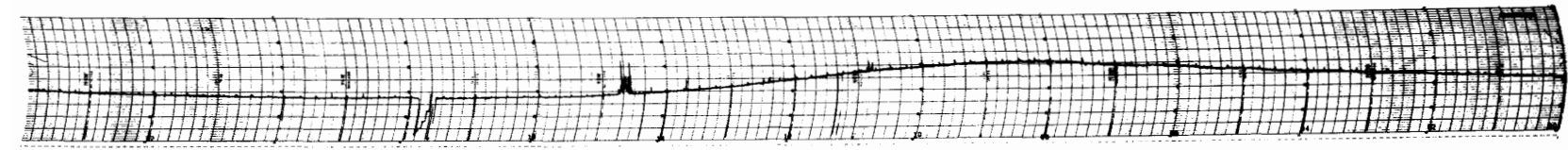
23



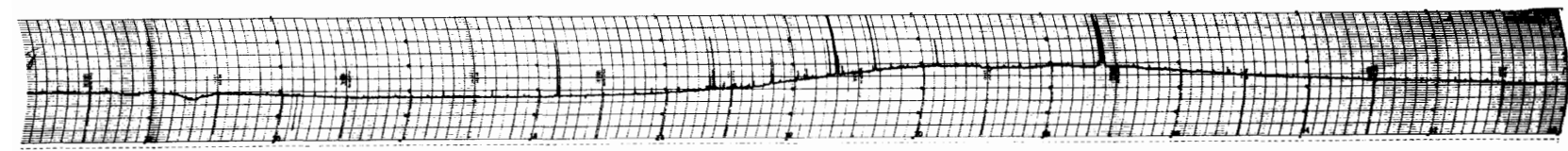
24



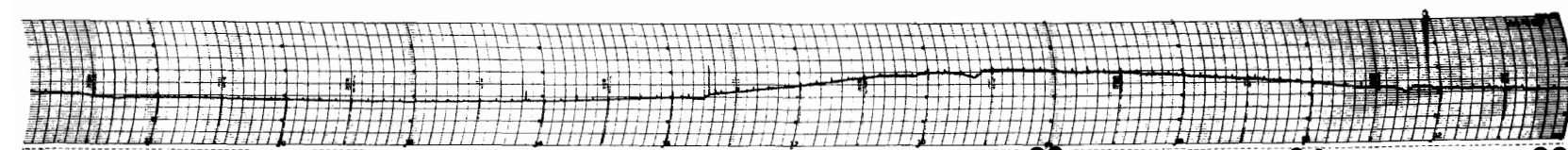
25



26



27



28

24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

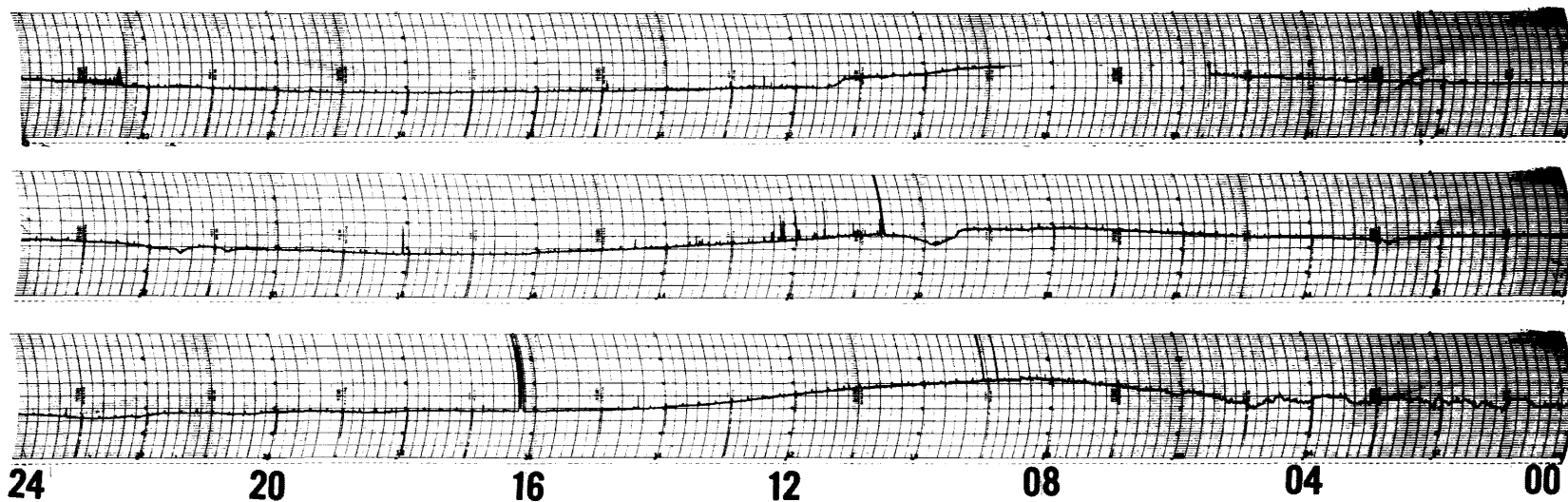
30 MHz COSMIC NOISE

JAN 1970

29

30

31



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

- 21: 19^h00^m equipment test
- 22: ~13^h23^m HF cable replaced
- 29: 05^h38^m ~08^h45^m failure of equipment

FEB 1970

1

2

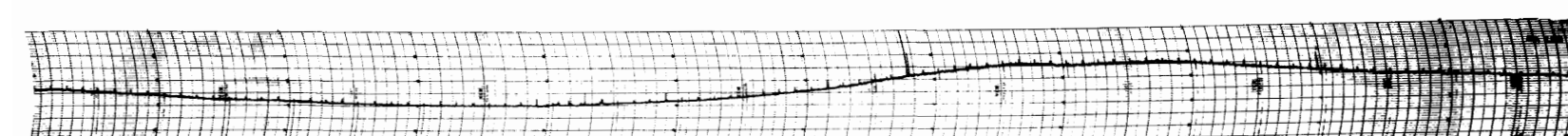
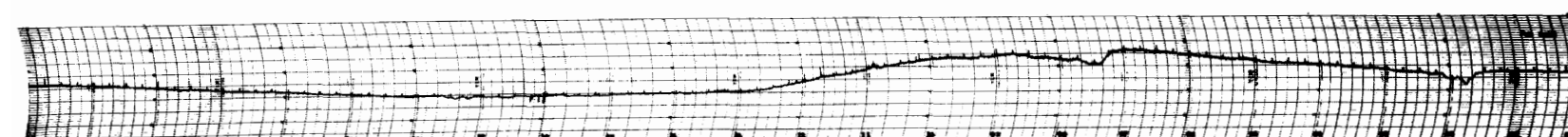
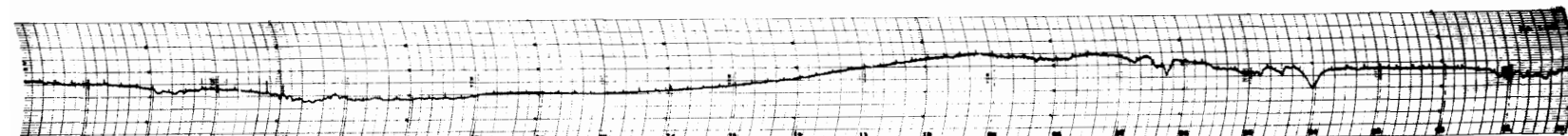
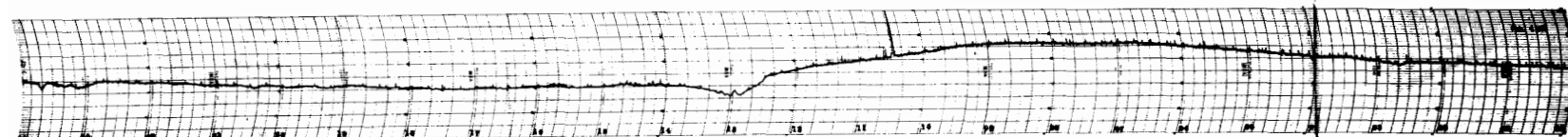
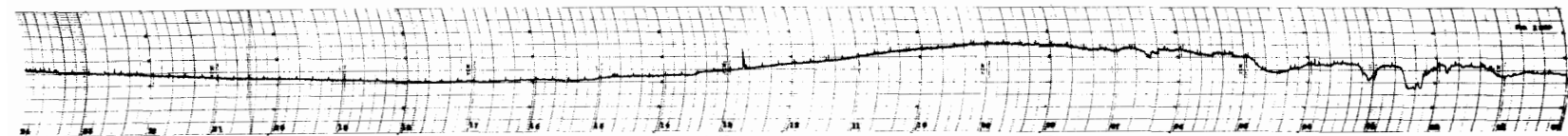
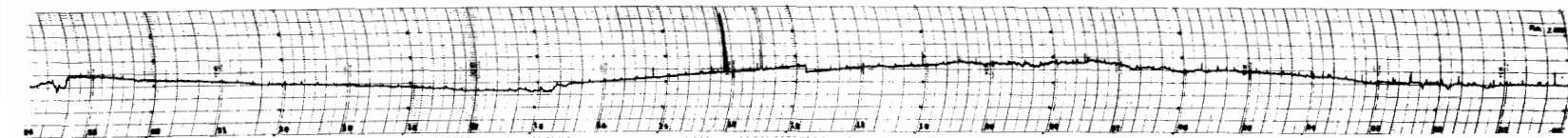
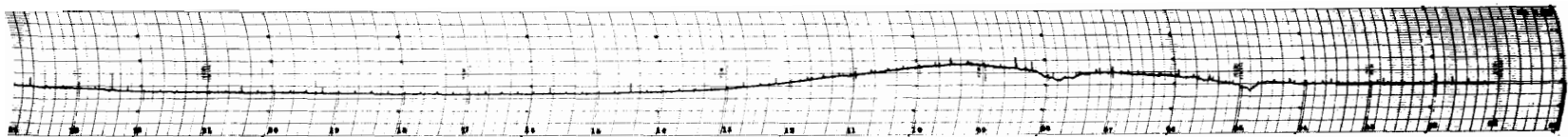
3

4

5

6

7



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

FEB 1970

8

9

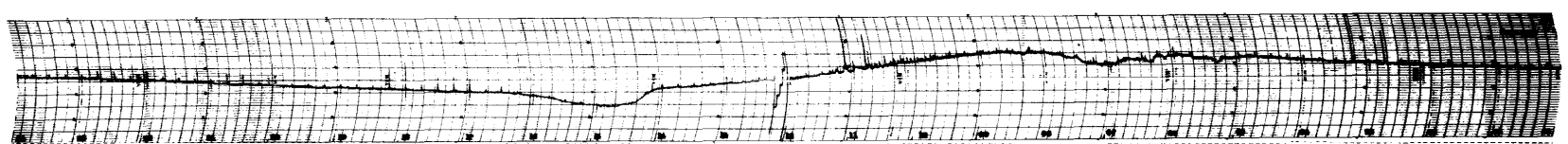
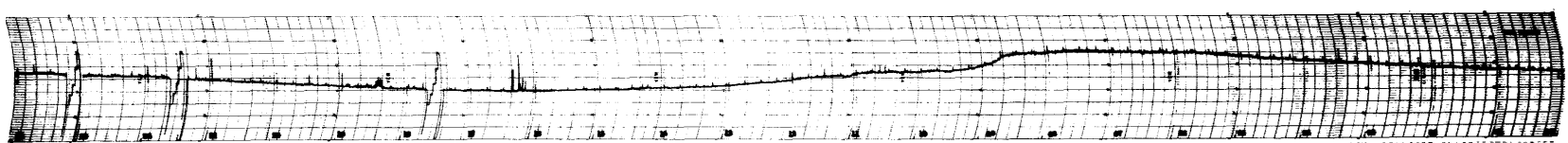
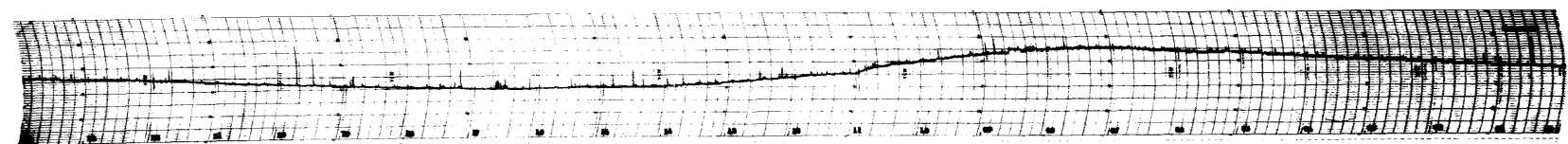
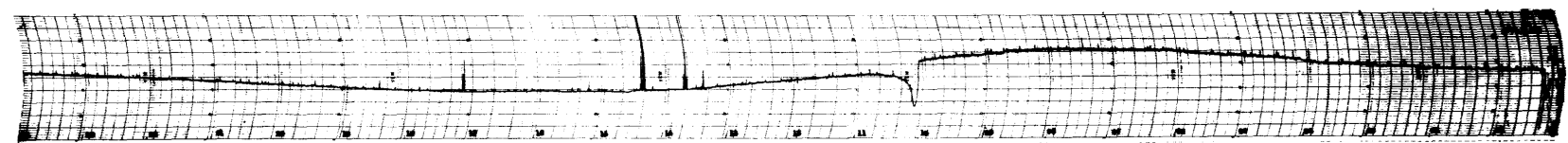
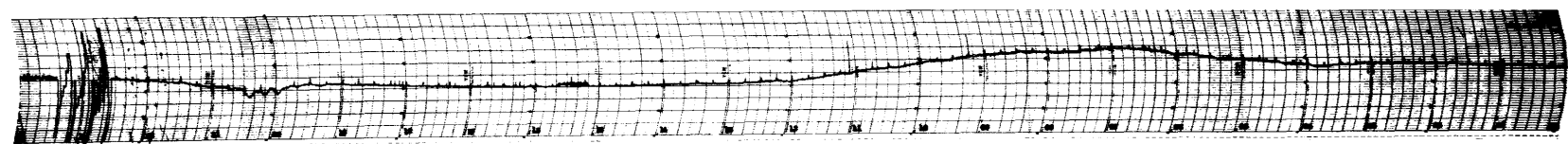
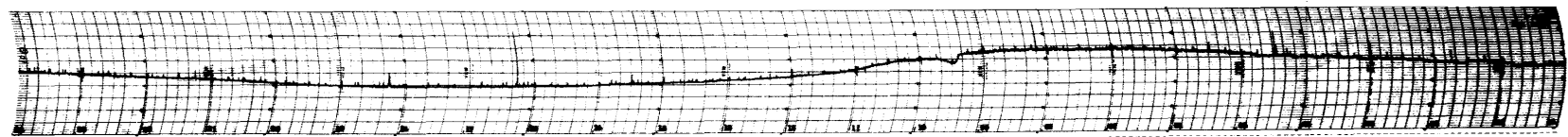
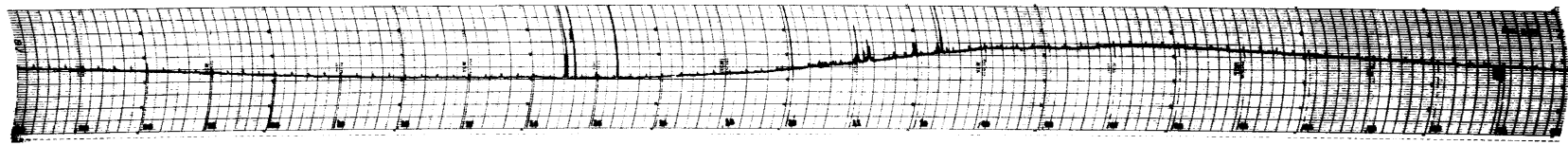
10

11

12

13

14



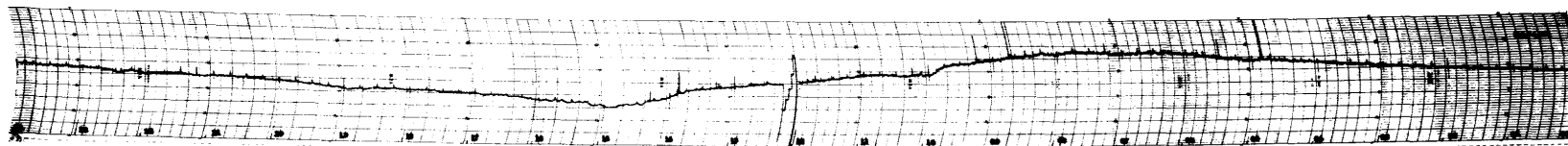
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

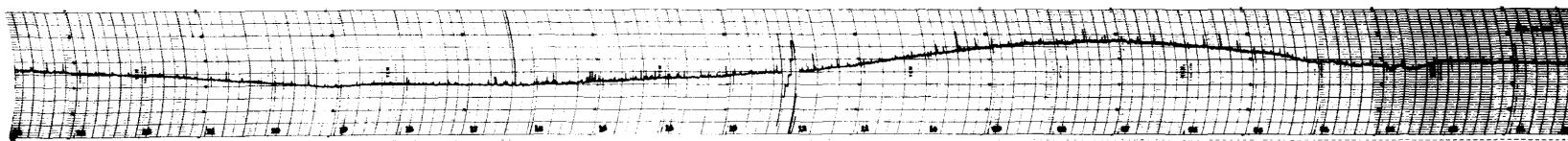
30 MHz COSMIC NOISE

FEB 1970

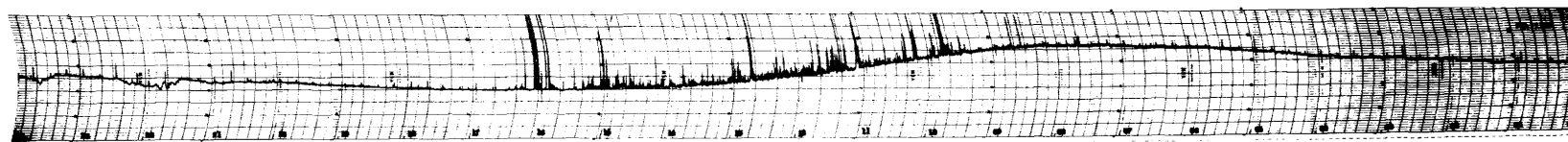
15



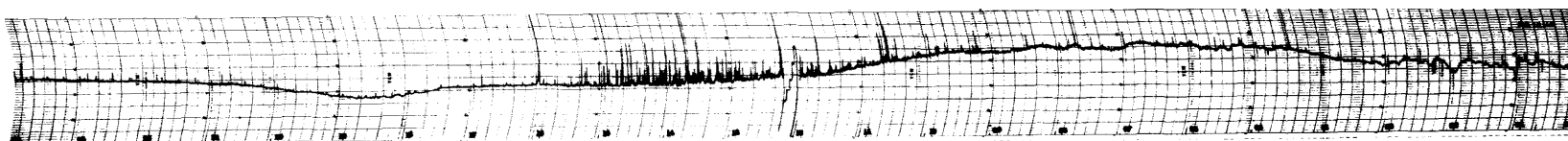
16



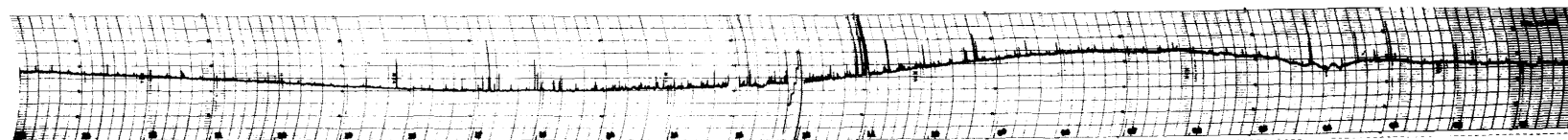
17



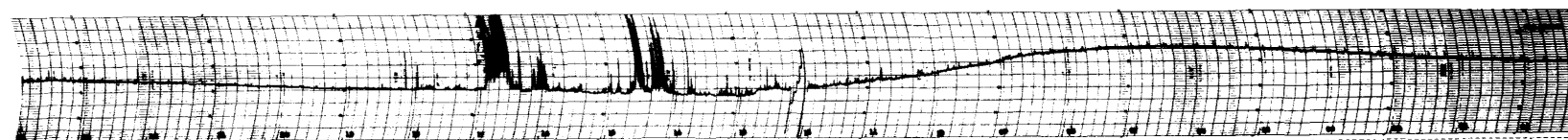
18



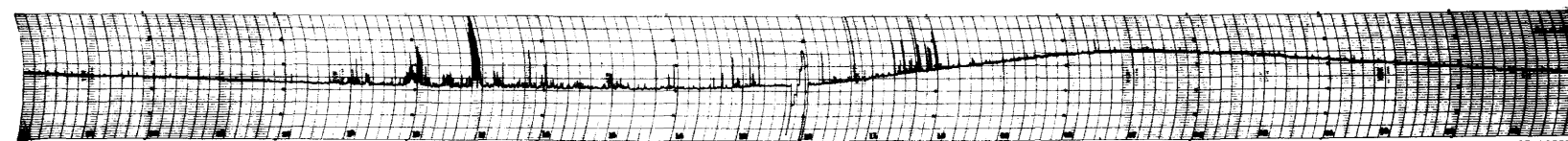
19



20



21

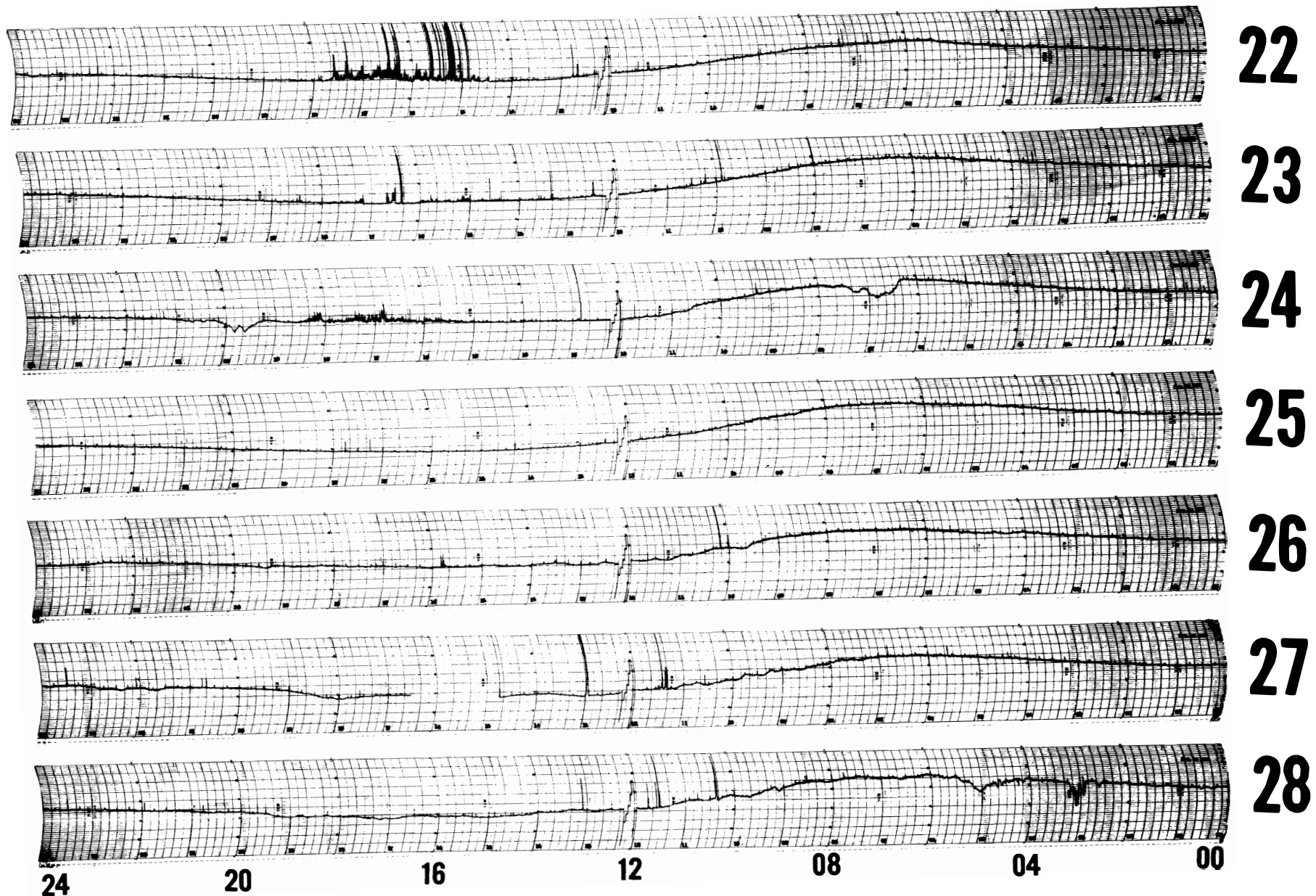


24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

FEB 1970



22

23

24

25

26

27

28

24

20

16

12

08

04

00

45° EAST MERIDIAN TIME IN HOURS

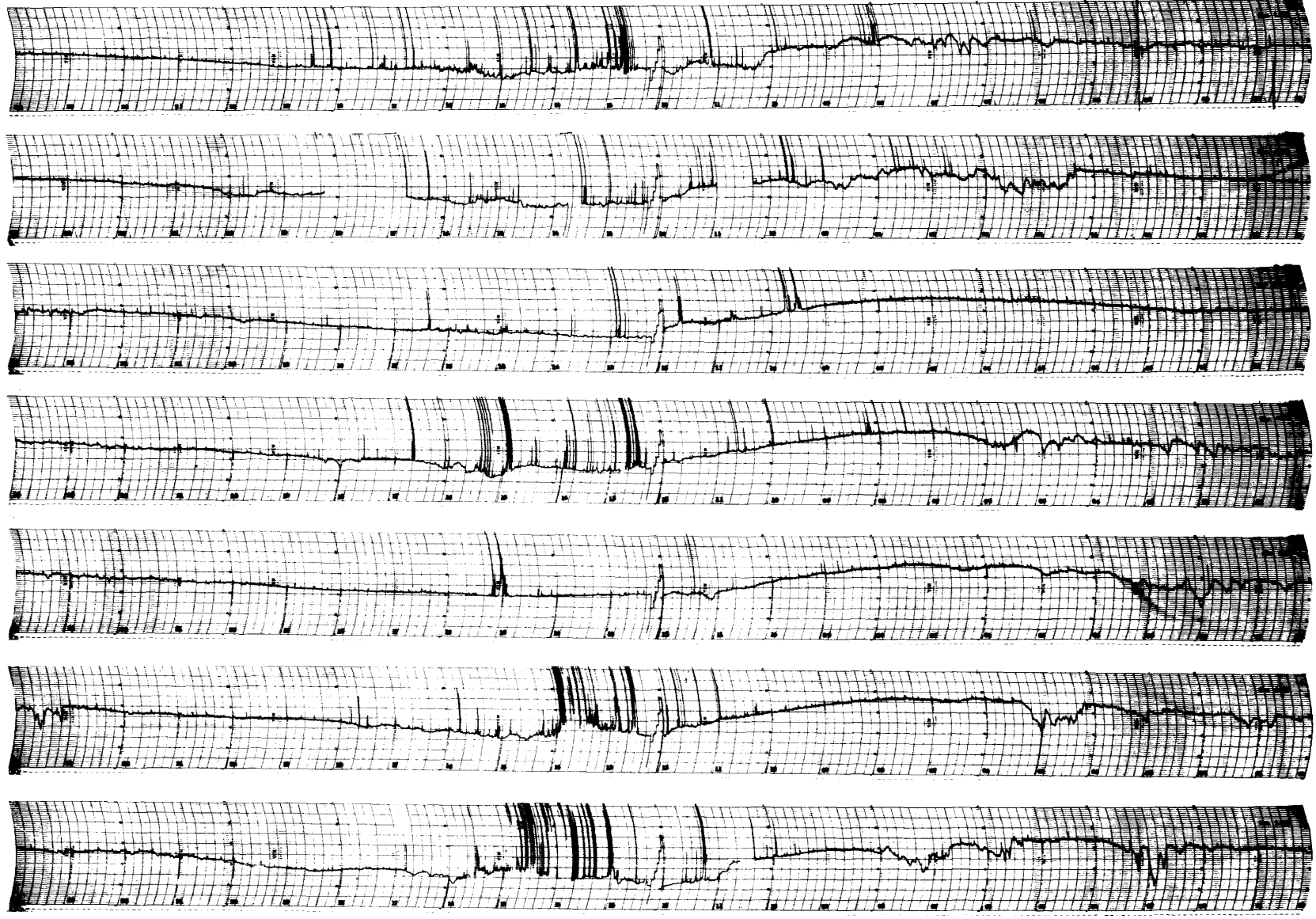
30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

- 1: 00^h 00^m ~ 01^h 10^m failure of equipment
- 2: 11^h 52^m equipment test
- 10: 22^h 35^m ~ 23^h 25^m calibration test
- 27: 14^h 45^m ~ 16^h 32^m interferences

MAR 1970

1
2
3
4
5
6
7



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

MAR 1970

8

9

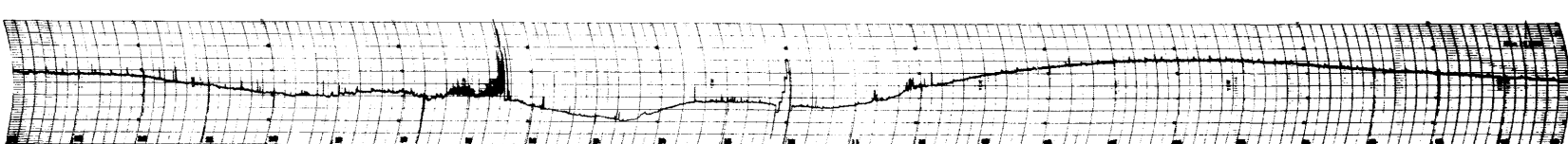
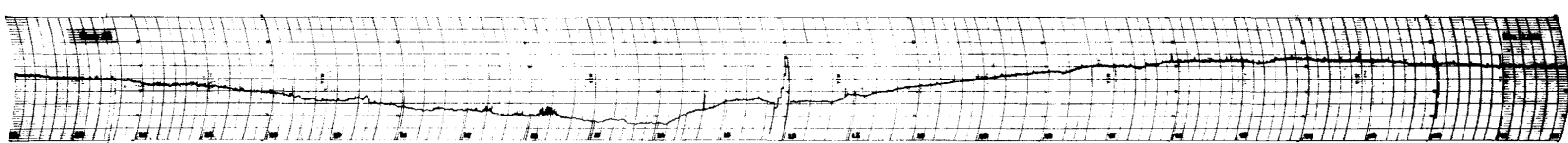
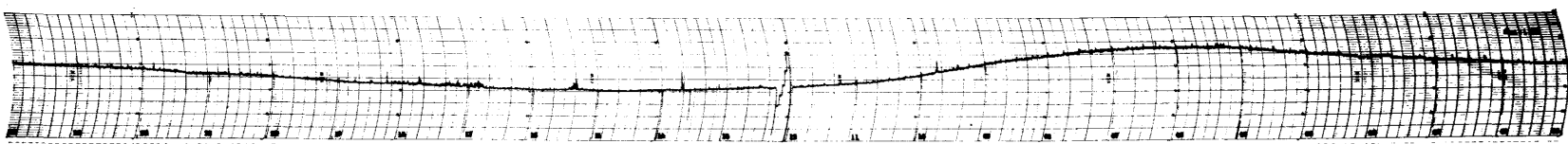
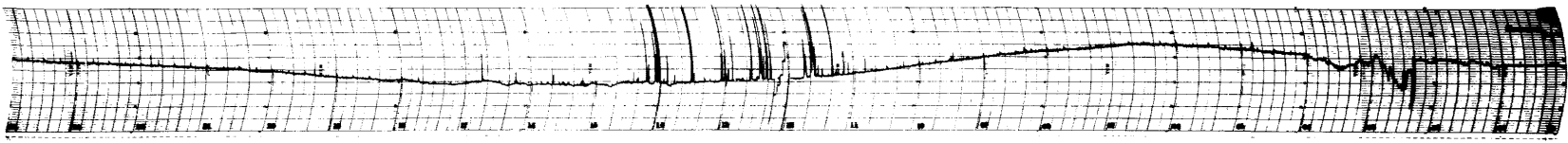
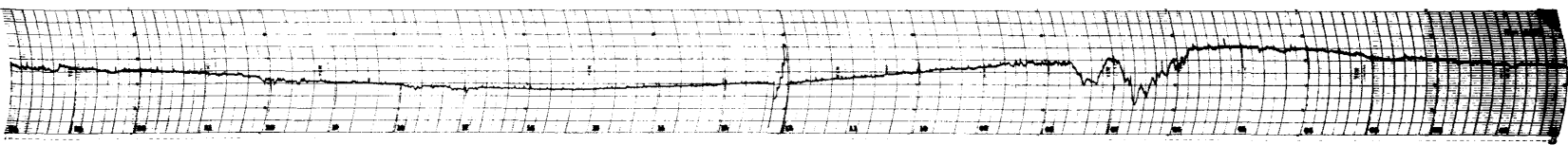
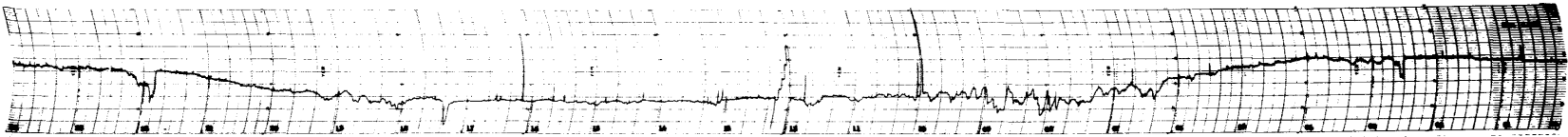
10

11

12

13

14



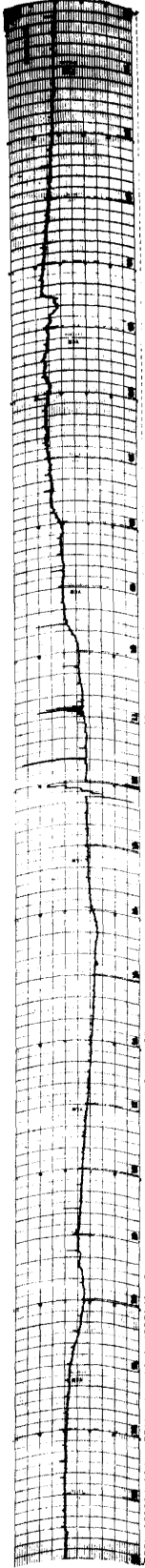
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

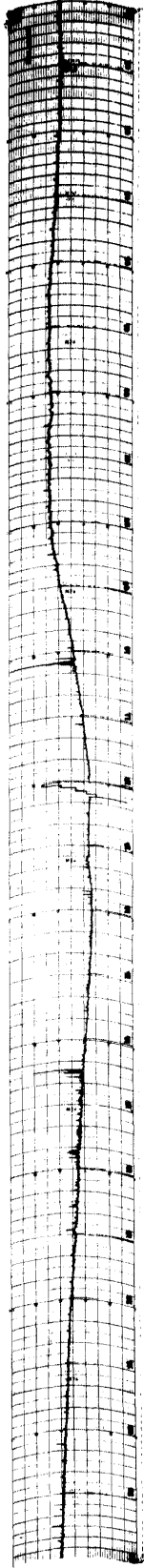
30 MHz COSMIC NOISE

MAR 1970

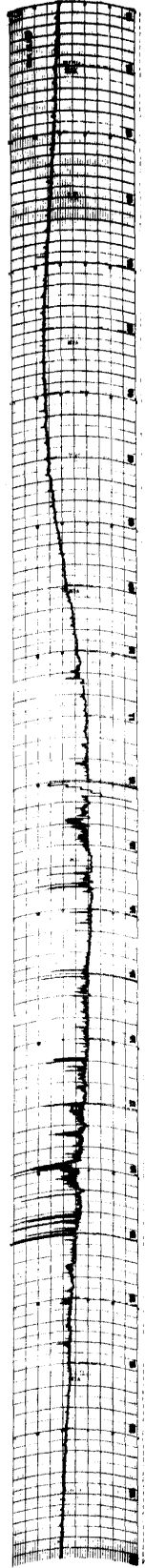
15



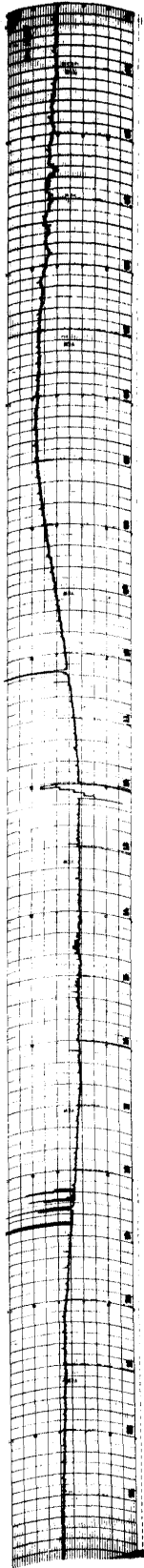
16



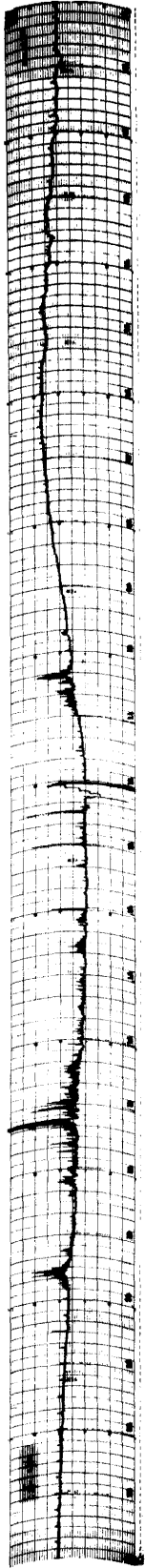
17



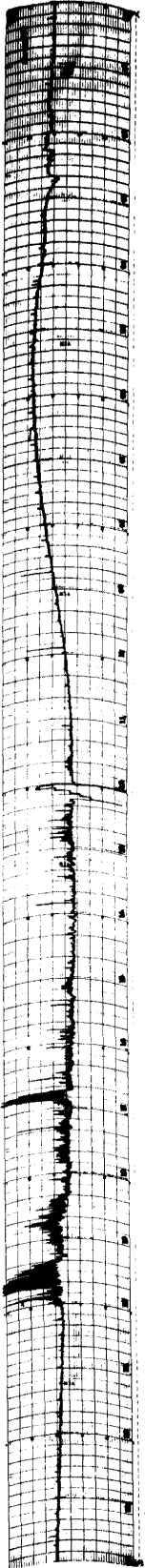
18



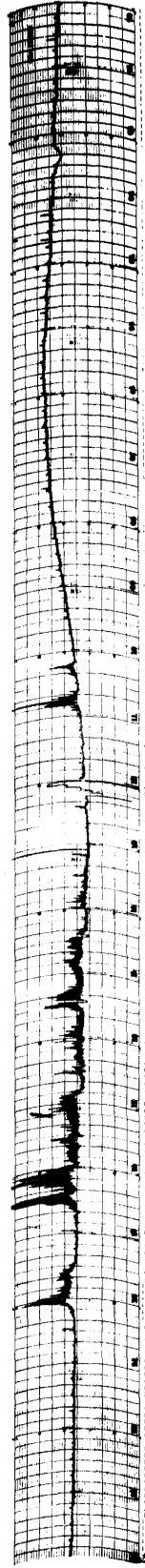
19



20



21



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

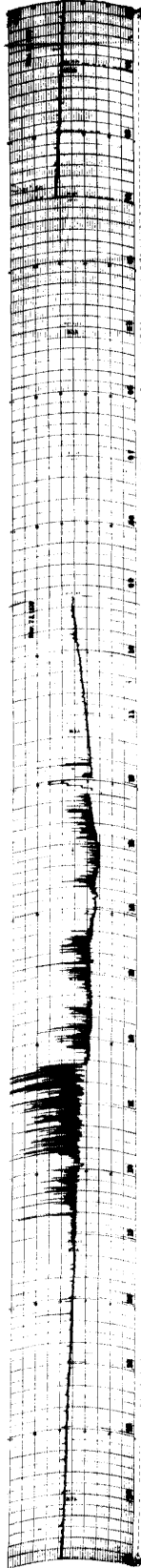
30 MHz COSMIC NOISE

MAR 1970

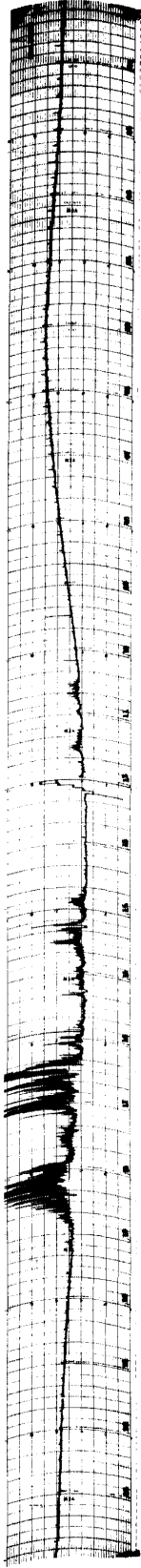
22



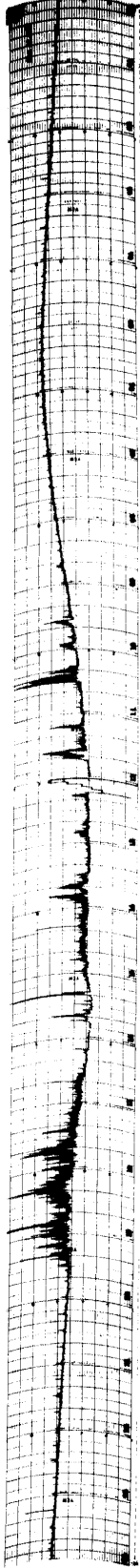
23



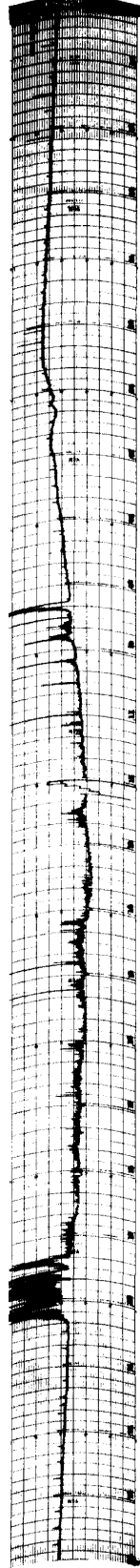
24



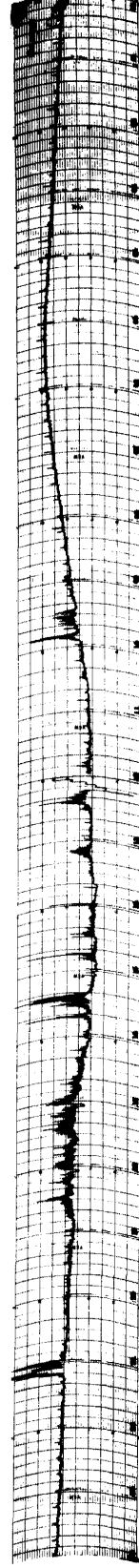
25



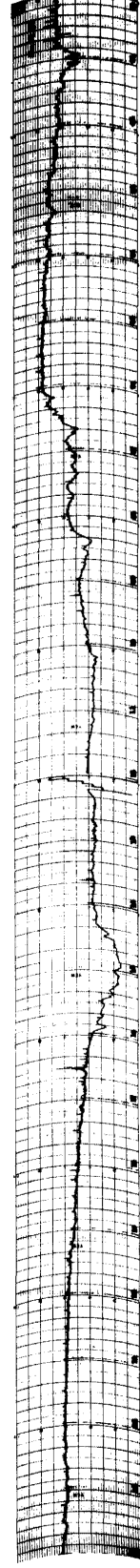
26



27



28

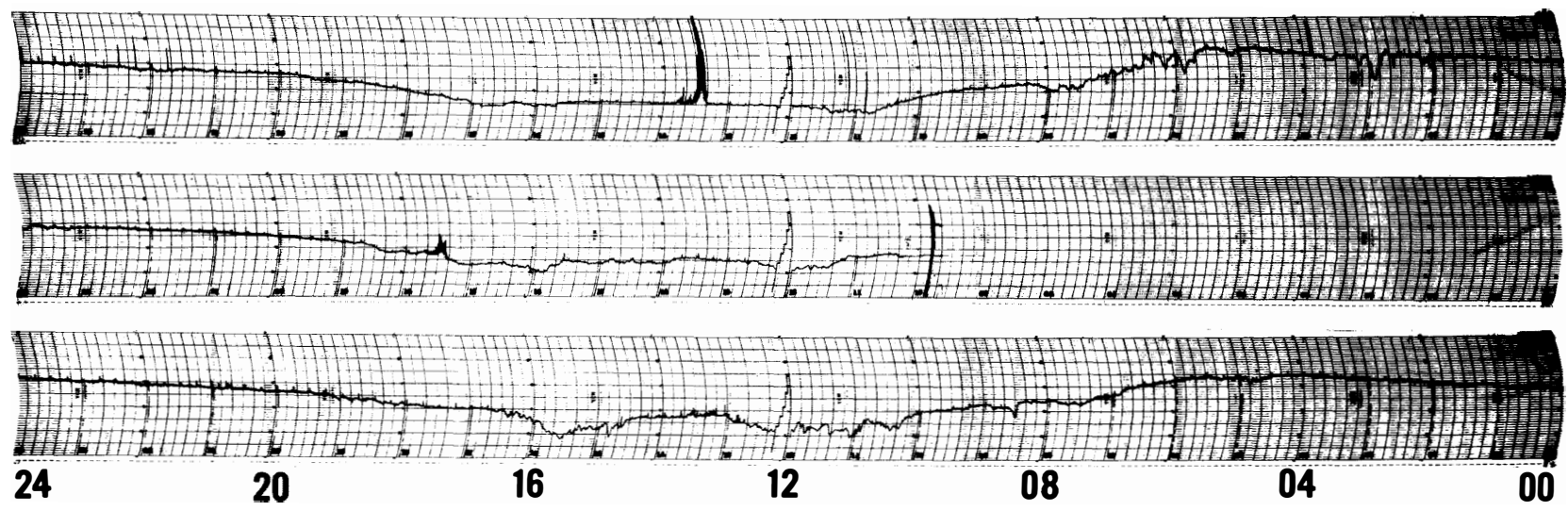


24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

MAR 1970

29
30
31



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

- 2: 10^h20^m ~ 11^h00^m interferences
- 13^h30^m ~ 13^h45^m \simeq
- 16^h45^m ~ 18^h15^m \simeq
- 7: 13^h00^m ~ 15^h00^m \simeq
- 23: 03^h00^m ~ 09^h10^m failure of equipment
- 30: 00^h00^m ~ 10^h13^m \simeq

APR 1970

1

2

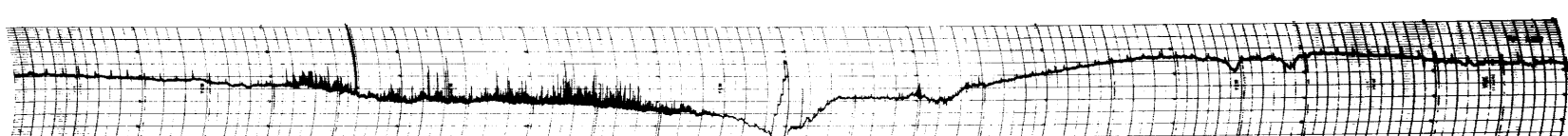
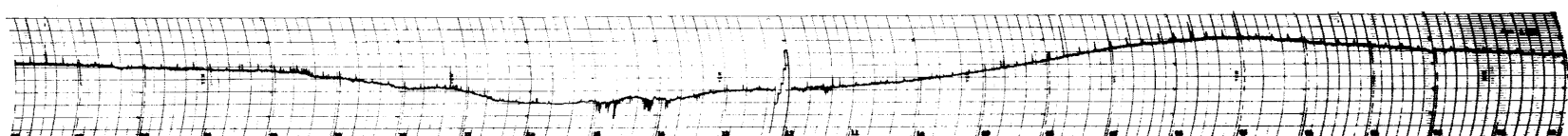
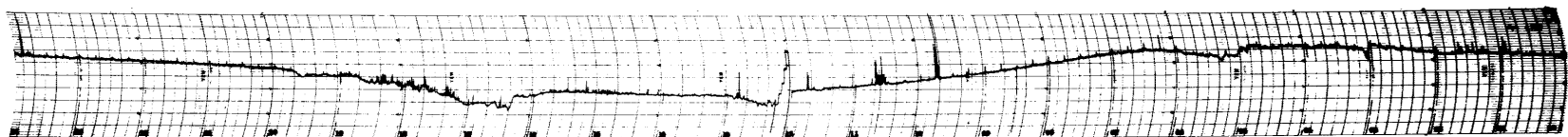
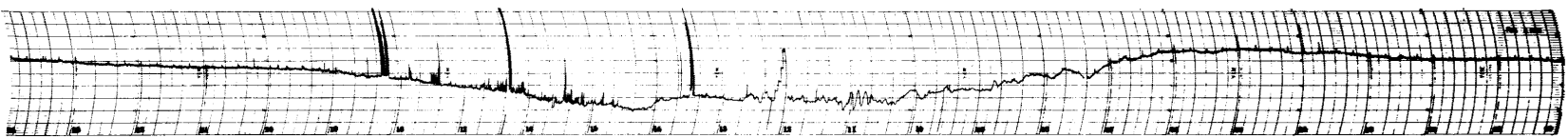
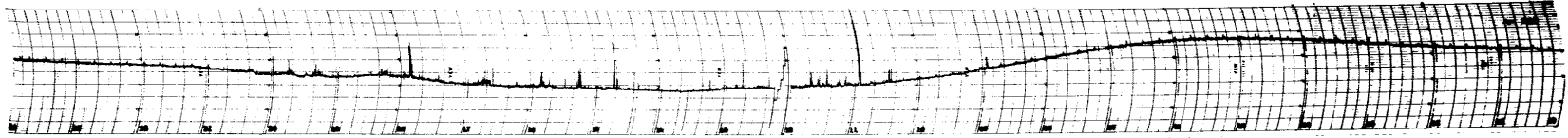
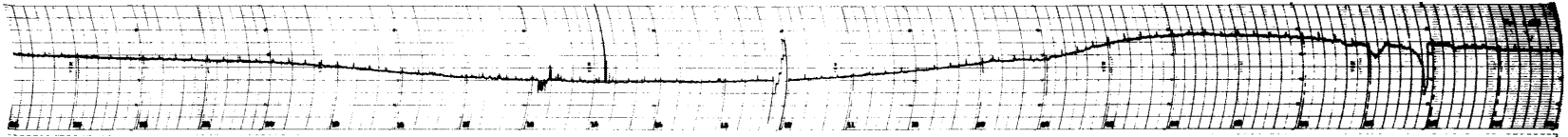
3

4

5

6

7

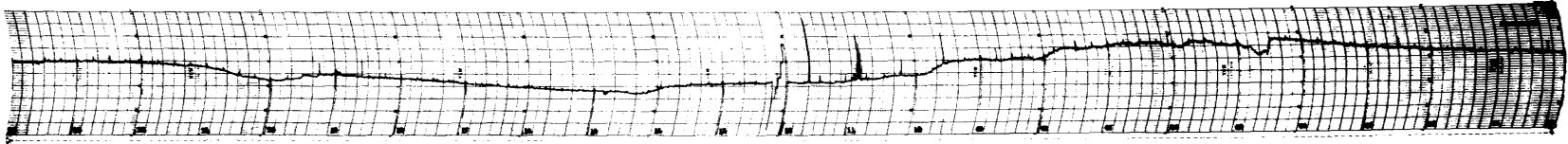


24 20 16 12 08 04 00

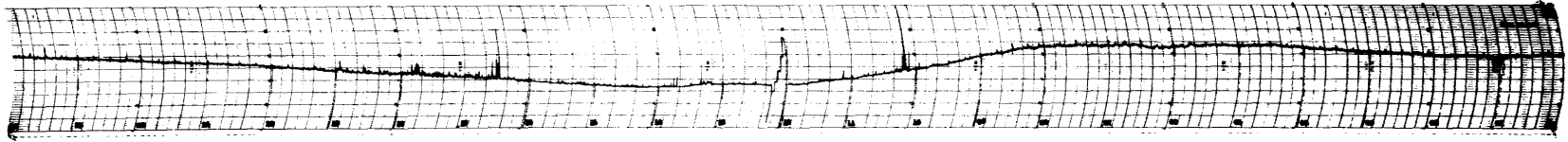
45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

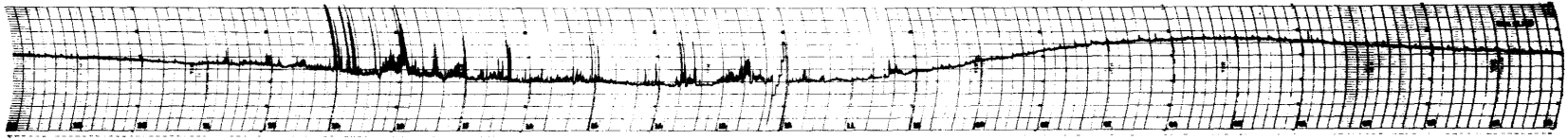
MAR 1970



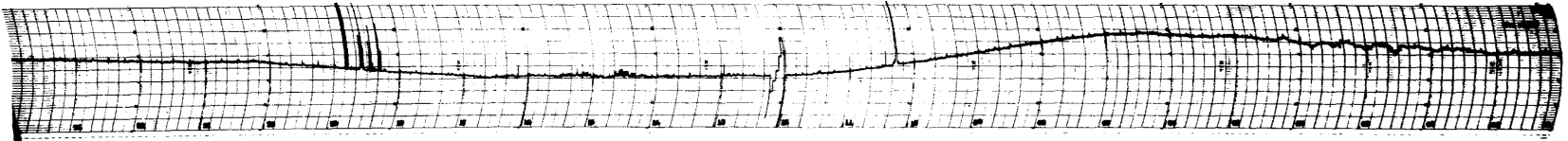
15



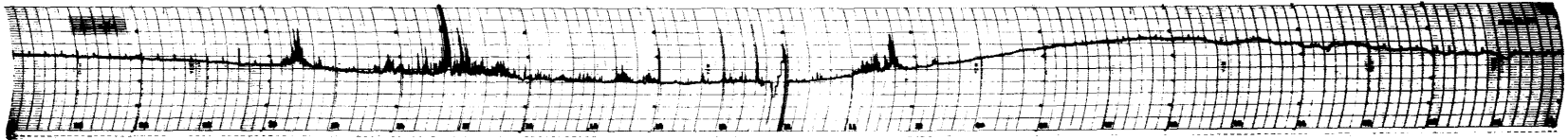
16



17



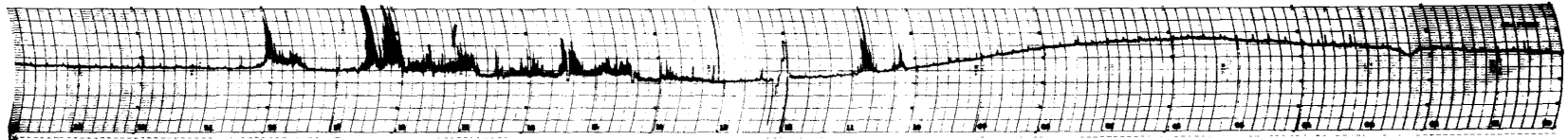
18



19



20



21

24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

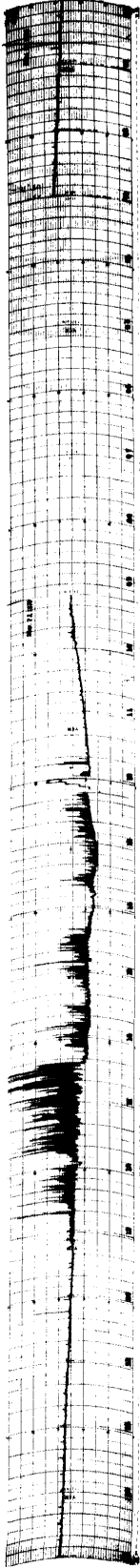
30 MHz COSMIC NOISE

MAR 1970

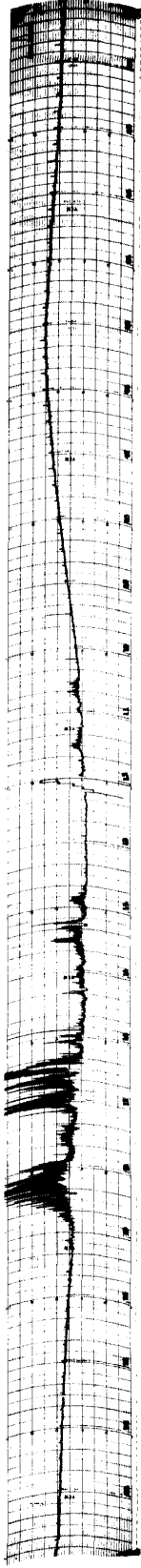
22



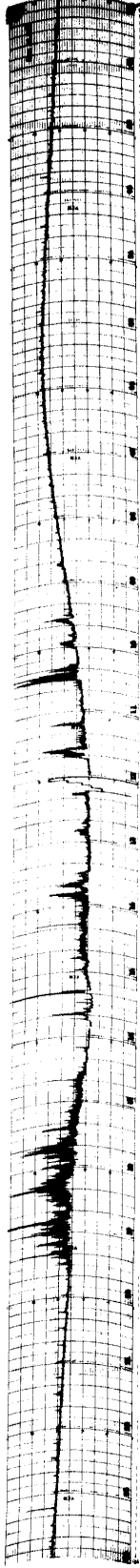
23



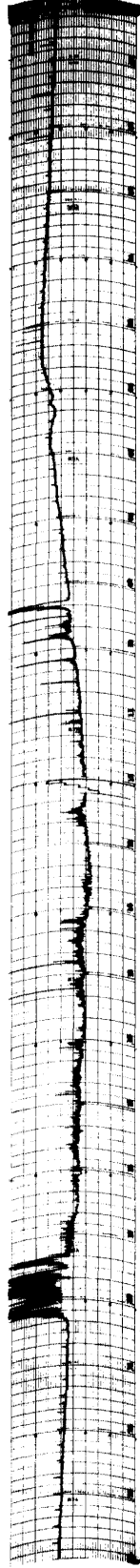
24



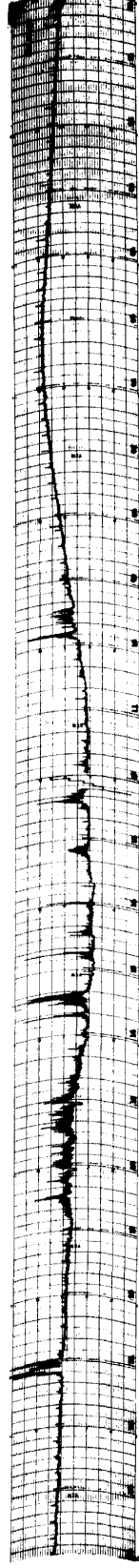
25



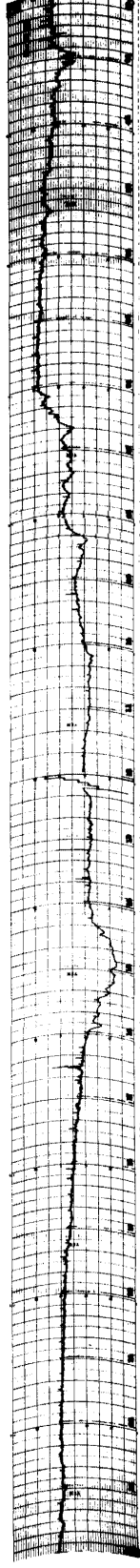
26



27



28



24 20 16 12 08 04 00

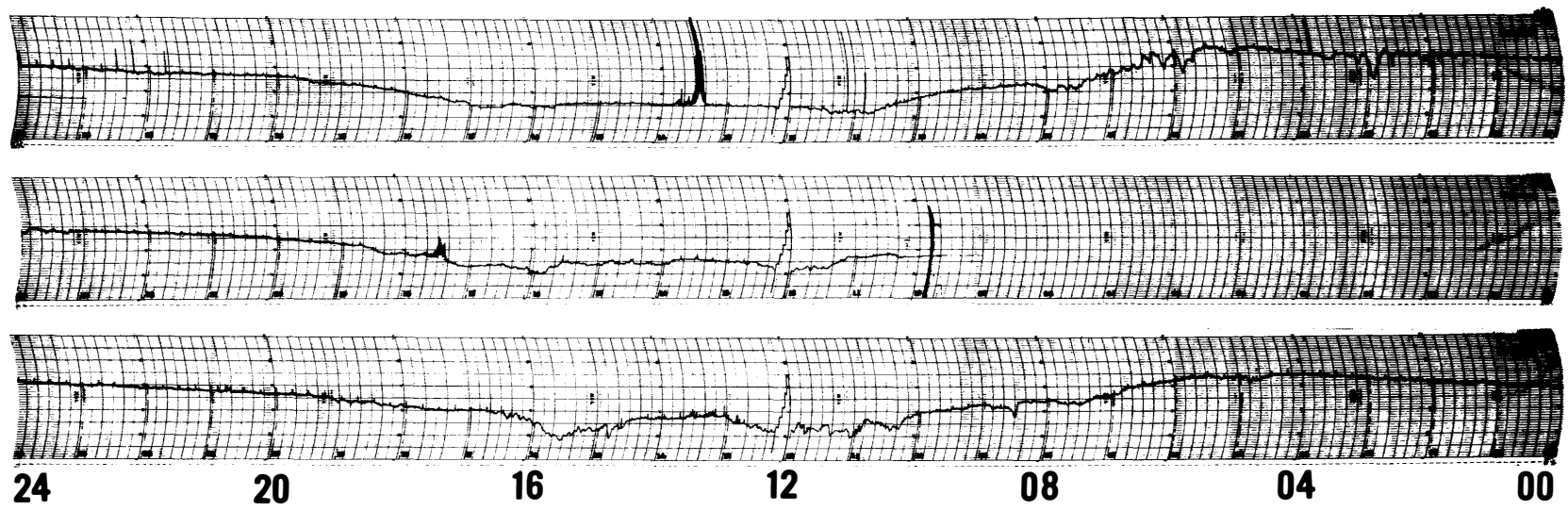
45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

MAR 1970

29

30

31



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

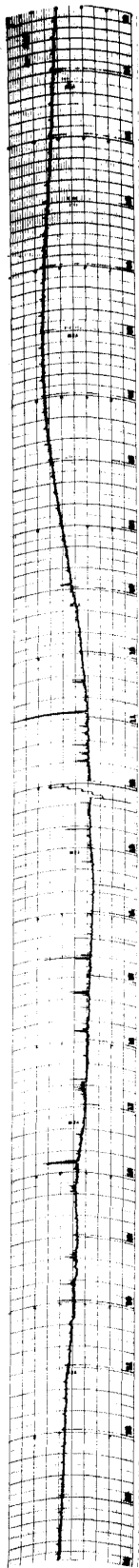
- 2: 10^h20^m ~ 11^h00^m interferences
- 13^h30^m ~ 13^h45^m ∕
- 16^h45^m ~ 18^h15^m ∕
- 7: 13^h00^m ~ 15^h00^m ∕
- 23: 03^h00^m ~ 09^h10^m failure of equipment
- 30: 00^h00^m ~ 10^h13^m ∕

APR 1970

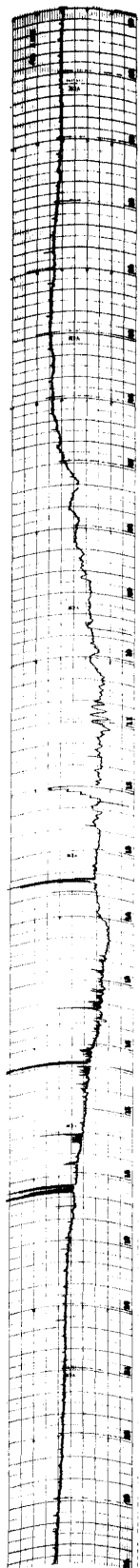
1



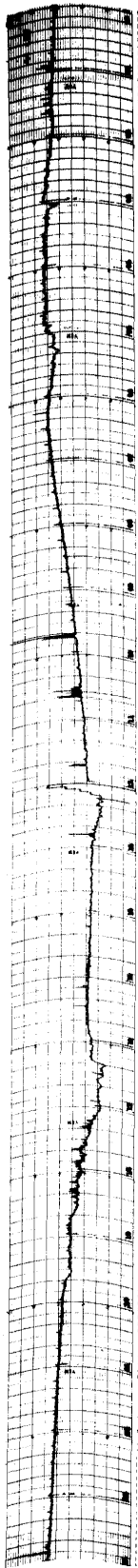
2



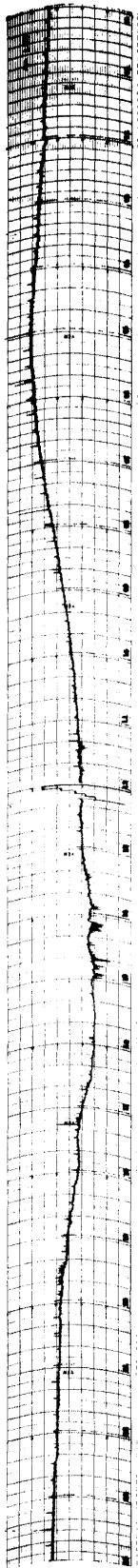
3



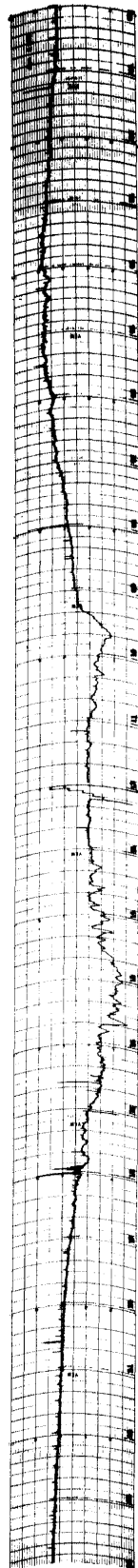
4



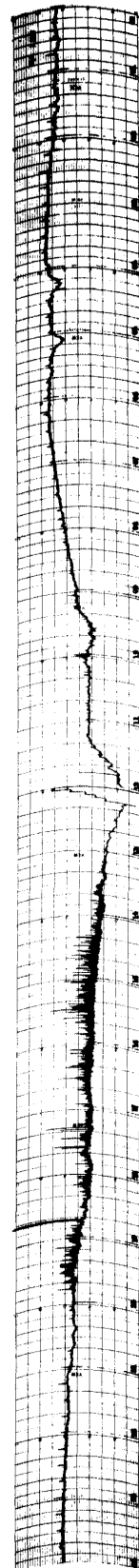
5



6



7

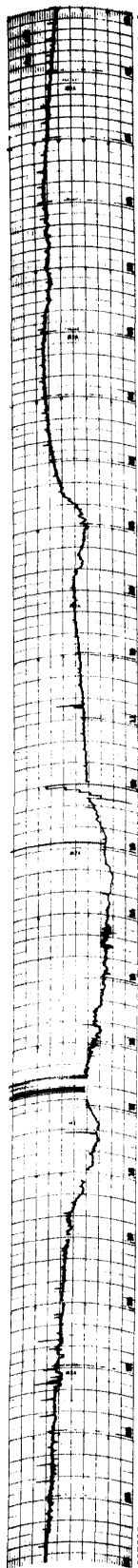


24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

APR 1970

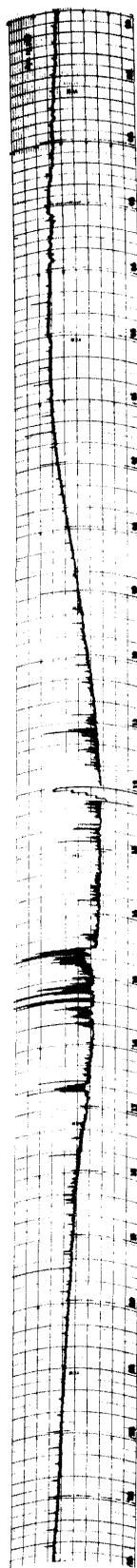
8



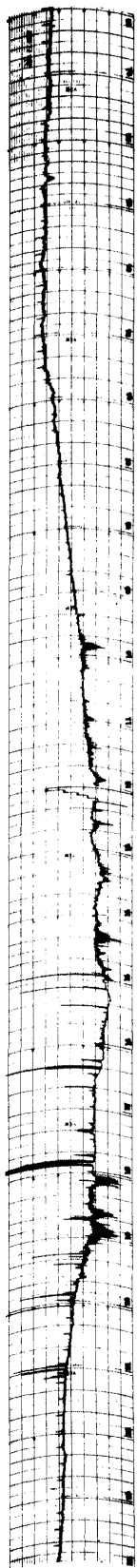
9



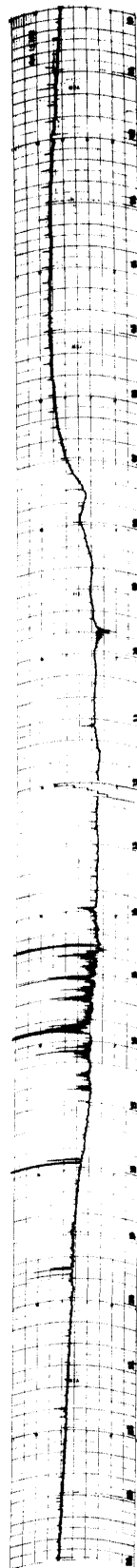
10



11



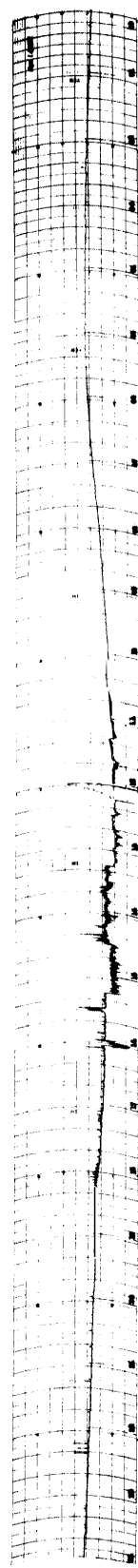
12



13



14



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

APR 1970

15

16

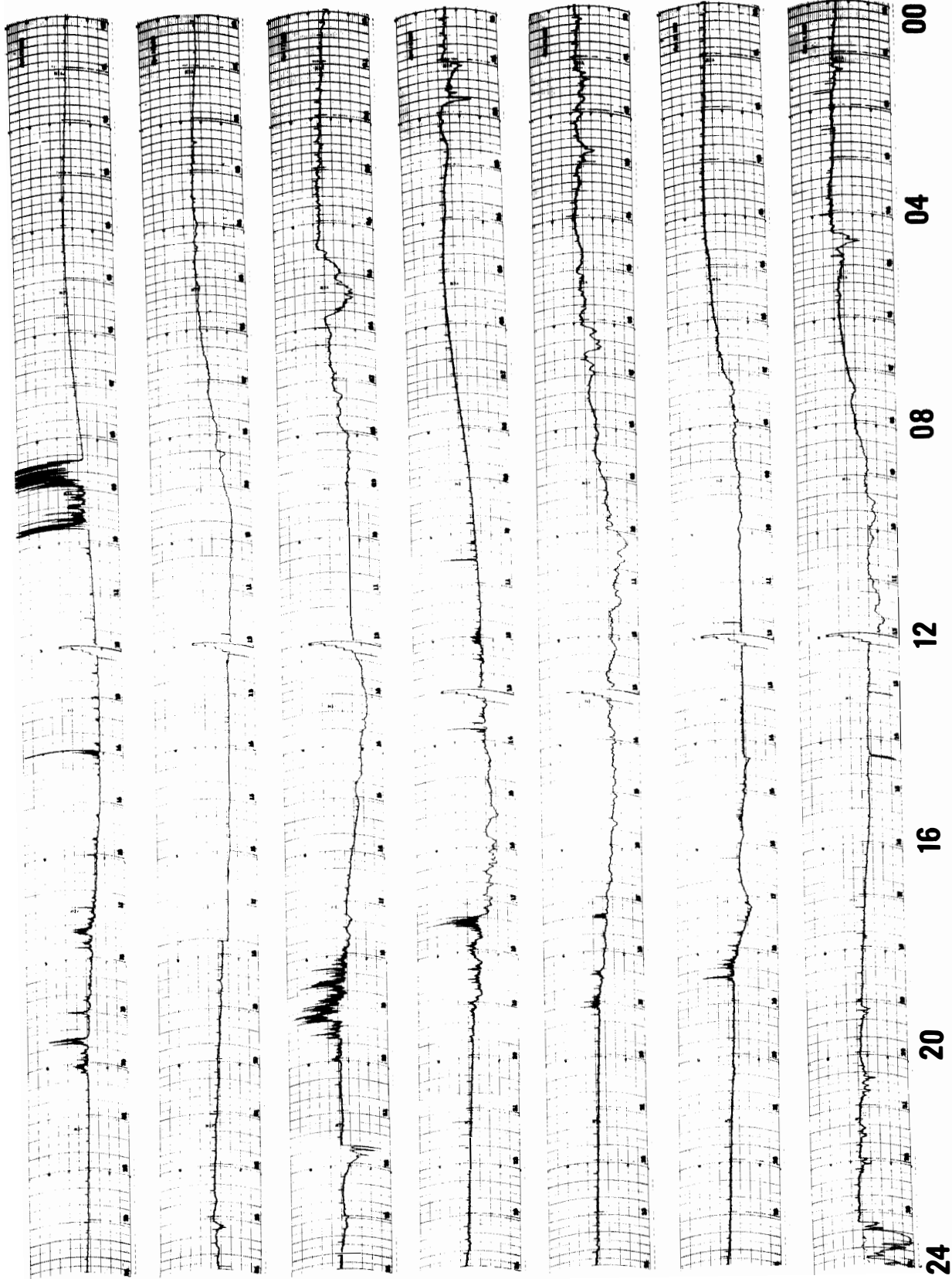
17

18

19

20

21

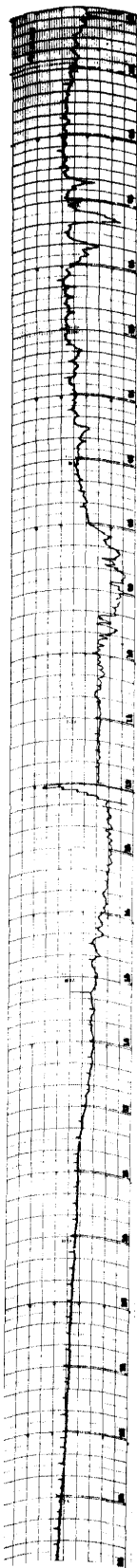


30 MHz COSMIC NOISE

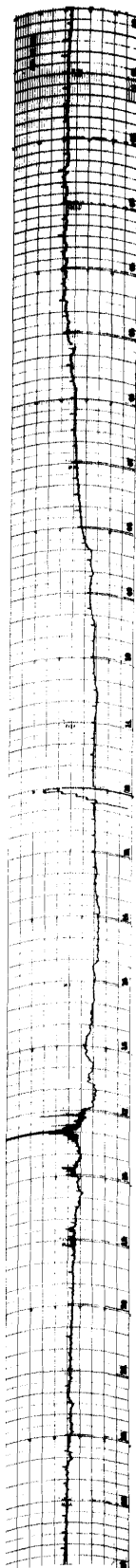
45° EAST MERIDIAN TIME IN HOURS

APR 1970

22



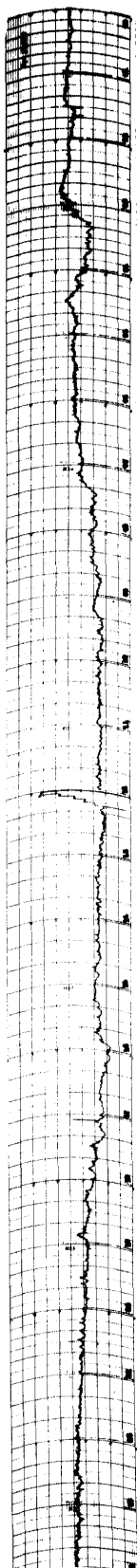
23



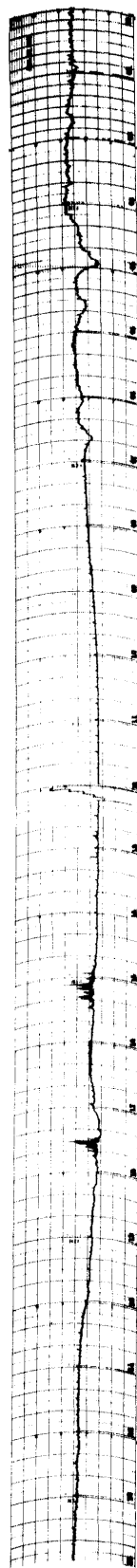
24



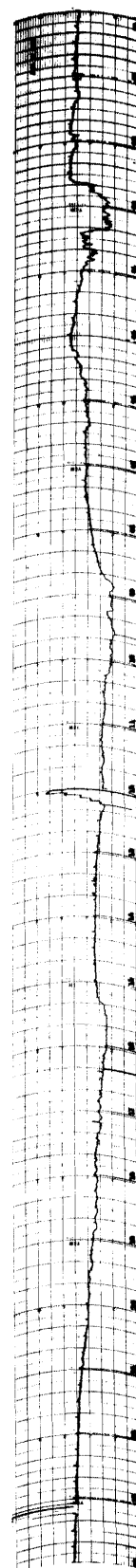
25



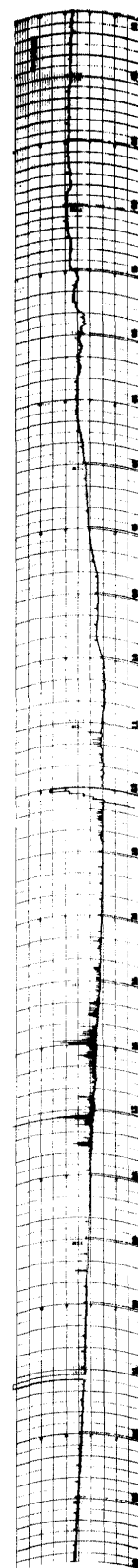
26



27



28



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

APR 1970

29

30



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

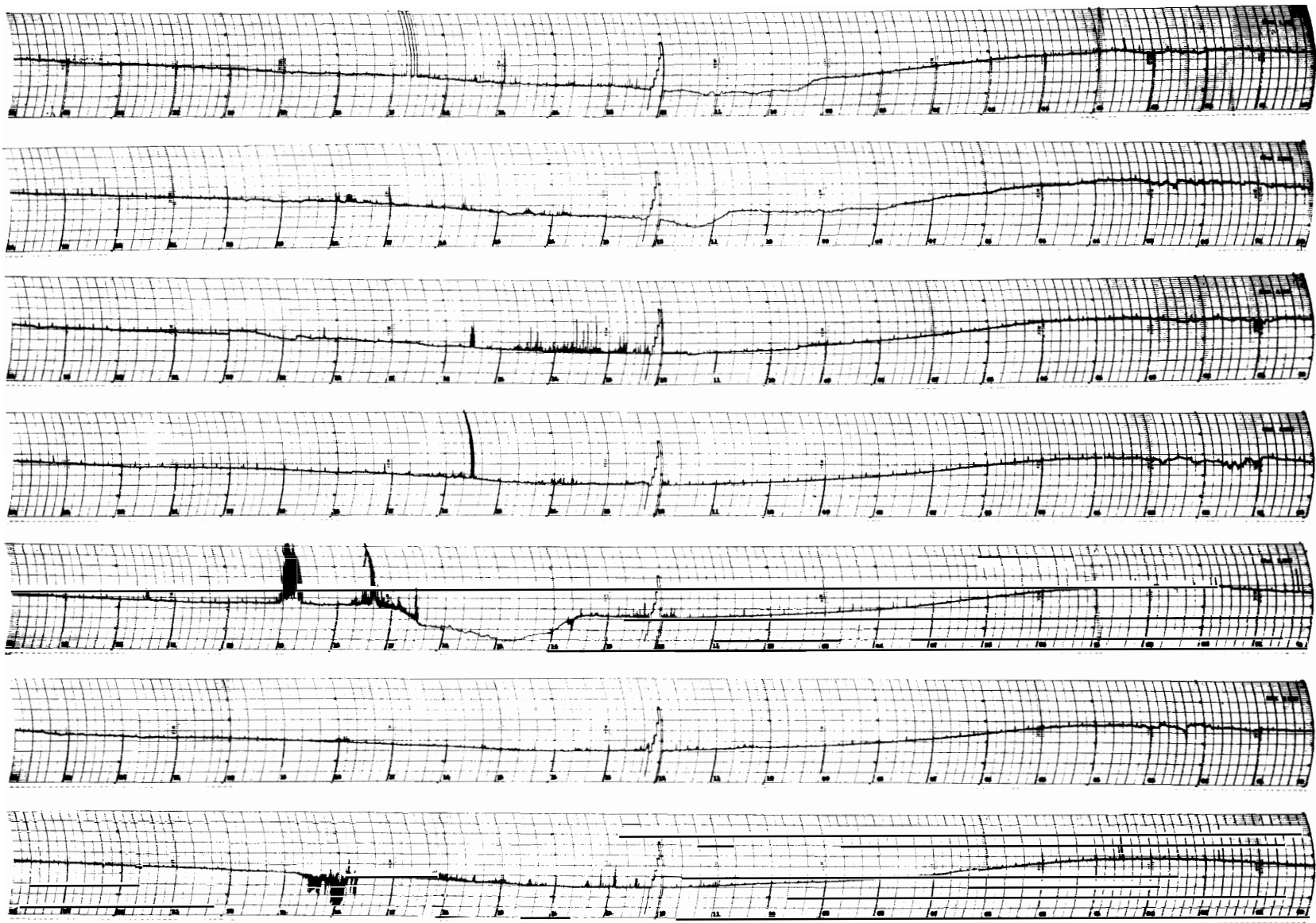
Cosmic noise level obscured or equipment malfunction.

13: 12^h20^m ~ 15^h00^m equipment test

16: 17^h50^m

MAY 1970

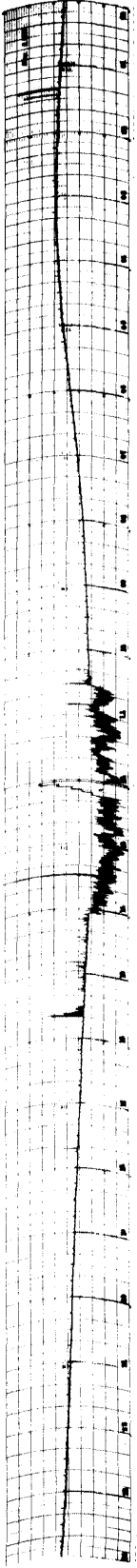
1
2
3
4
5
6
7



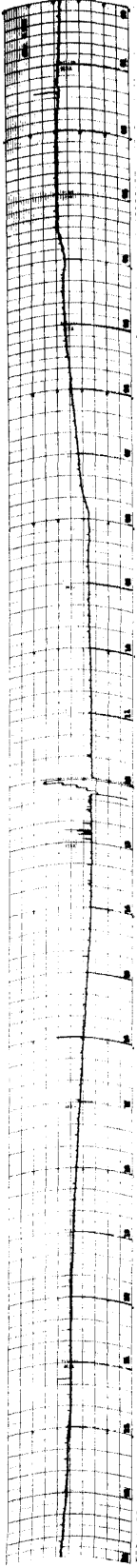
24 20 16 12 08 04 00
45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

MAY 1970

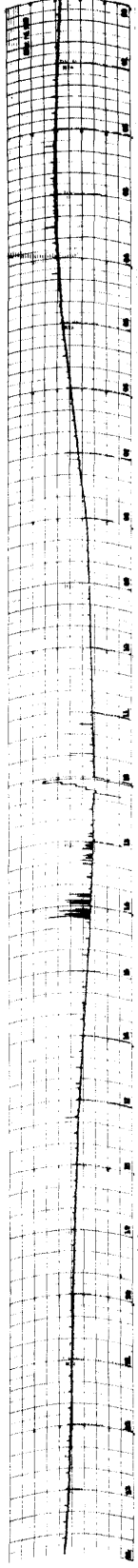
8



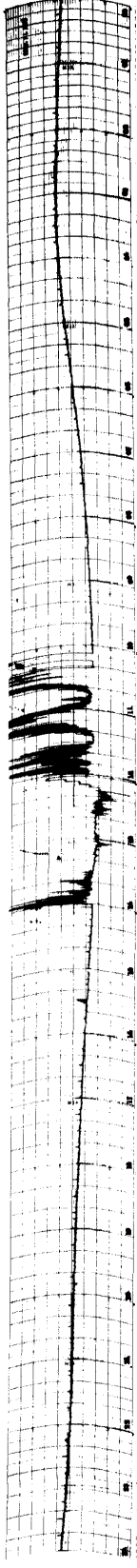
9



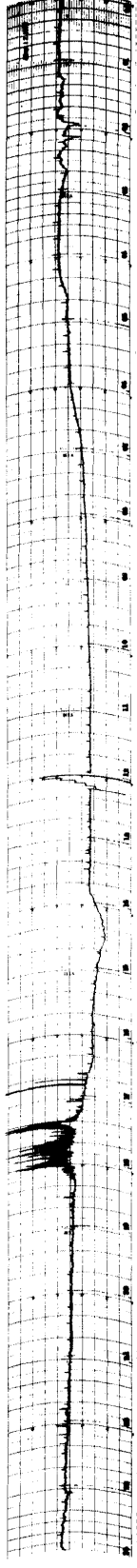
10



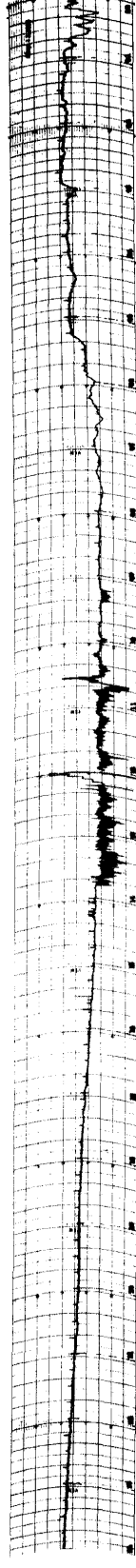
11



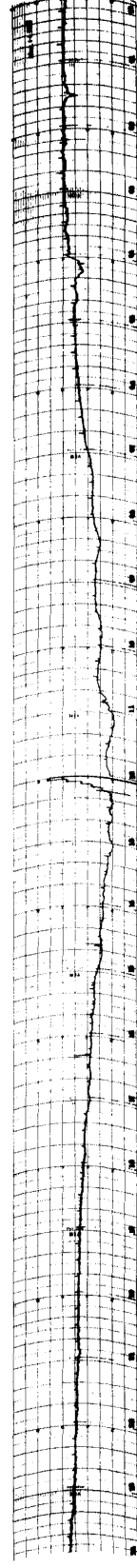
12



13



14



24 20 16 12 08 04 00

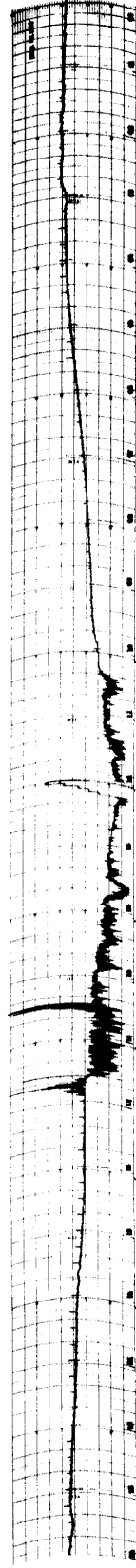
45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

MAY 1970

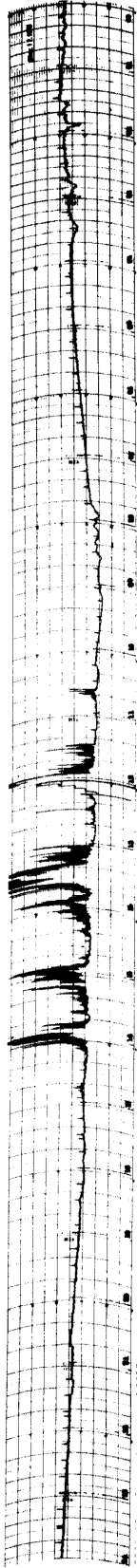
15



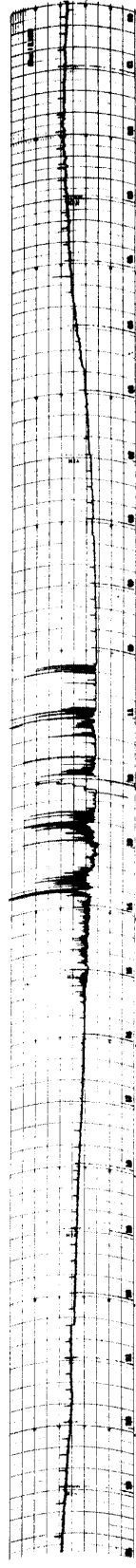
16



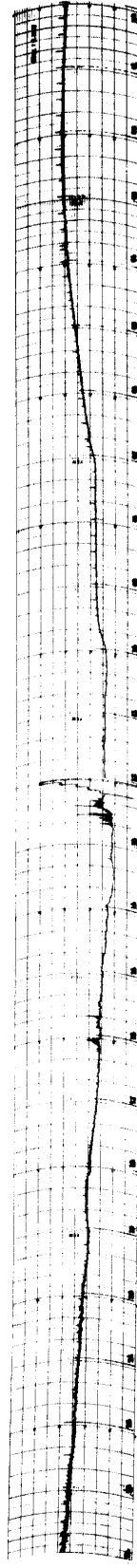
17



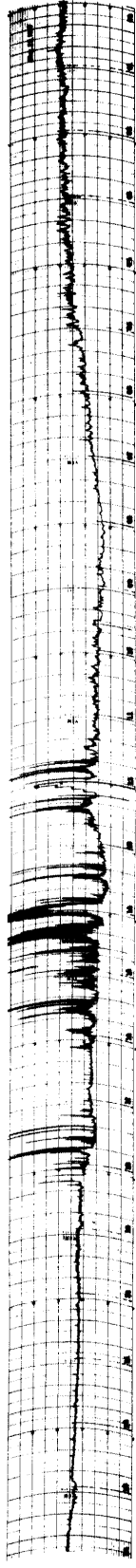
18



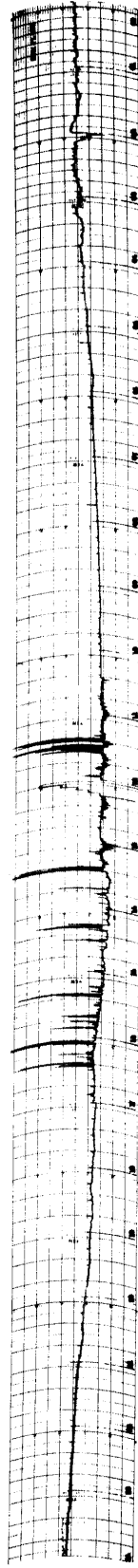
19



20



21



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

MAY 1970

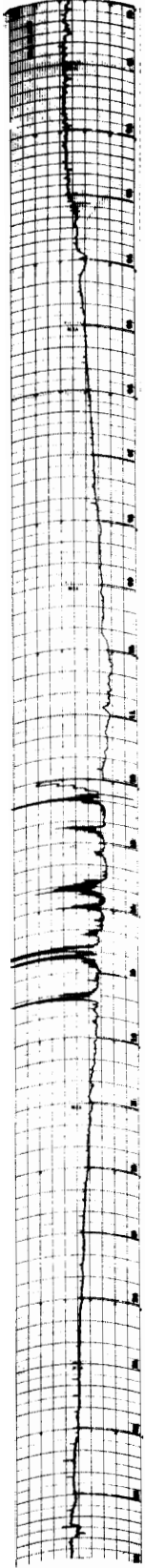


45° EAST MERIDIAN TIME IN HOURS

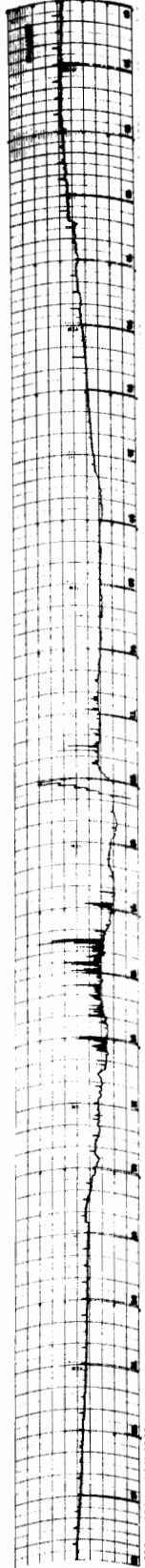
30 MHz COSMIC NOISE

MAY 1970

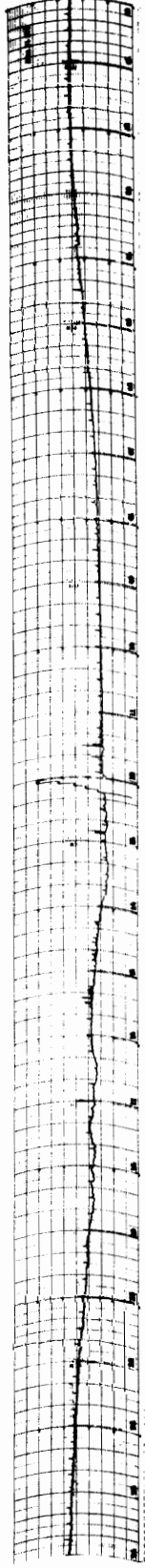
29



30



31



24 20 16 12 08 04 00
45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

JUN 1970

1

2

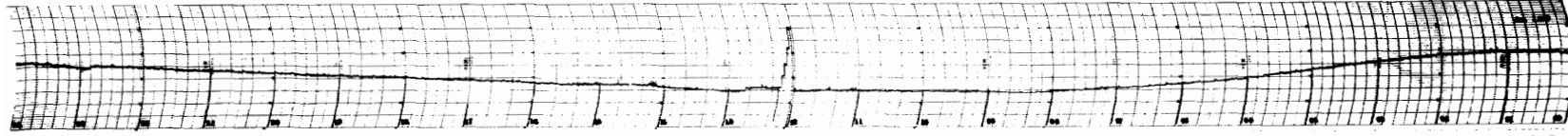
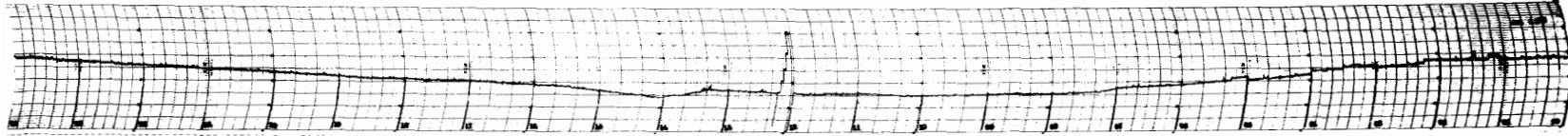
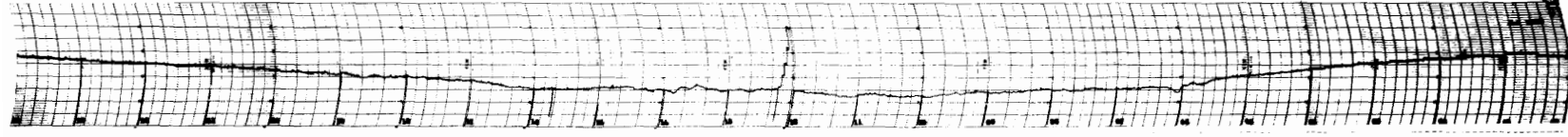
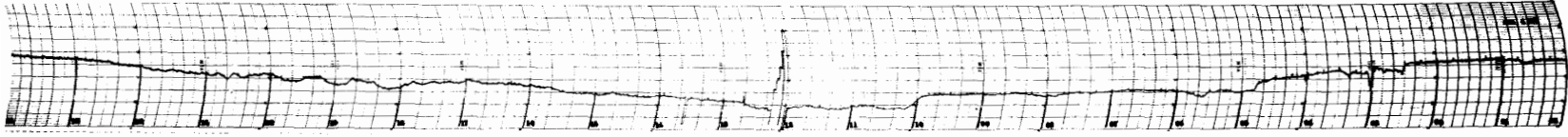
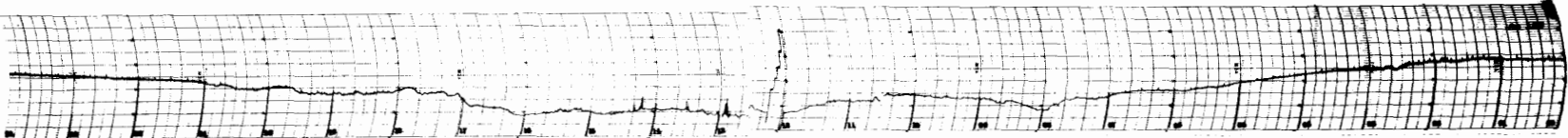
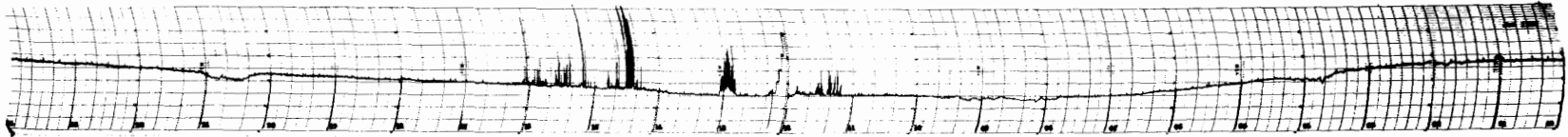
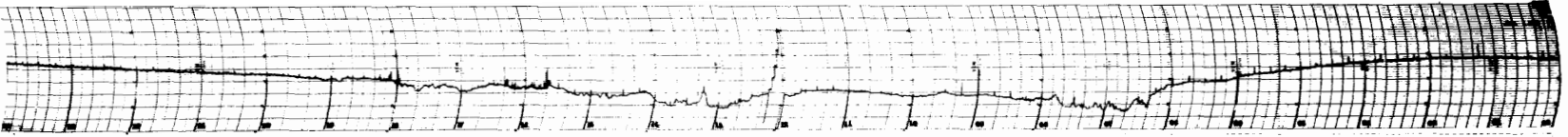
3

4

5

6

7

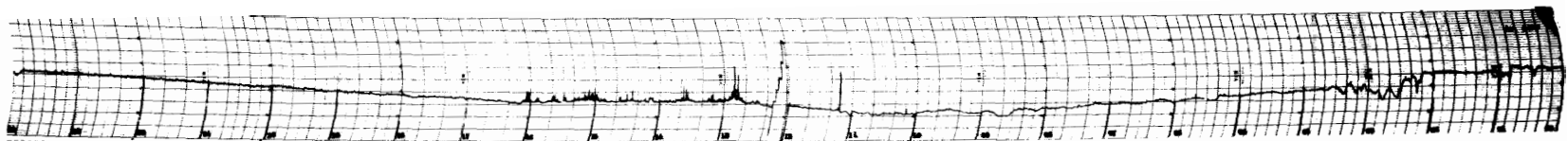


24 20 16 12 08 04 00

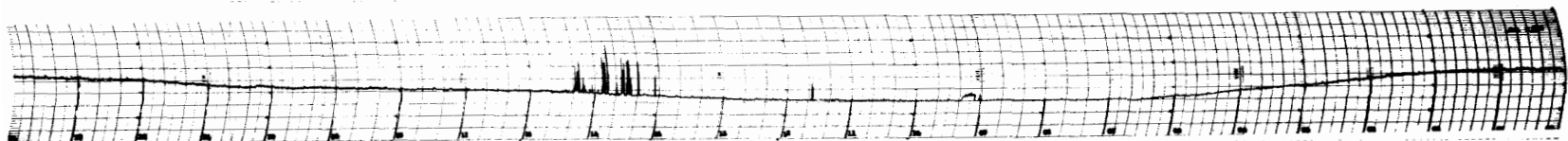
45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

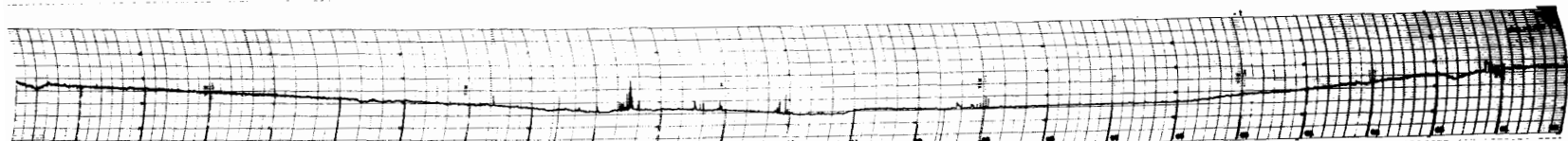
JUN 1970



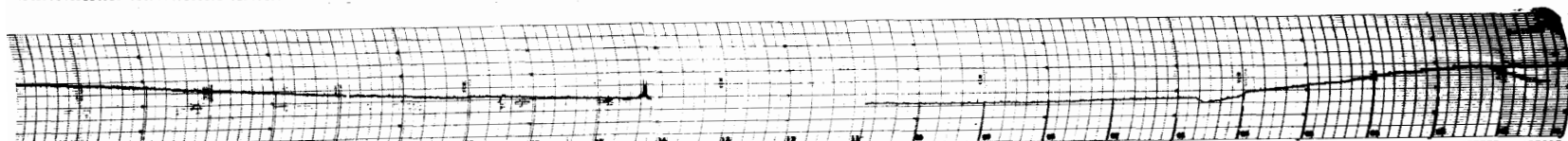
8



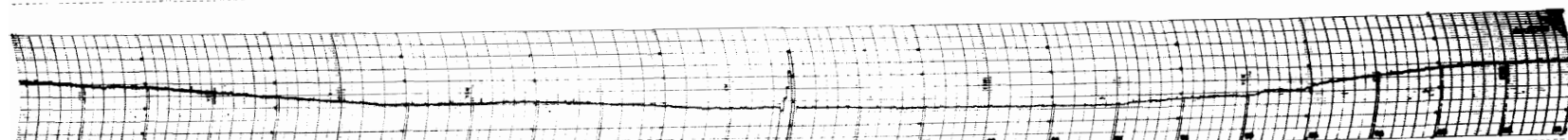
9



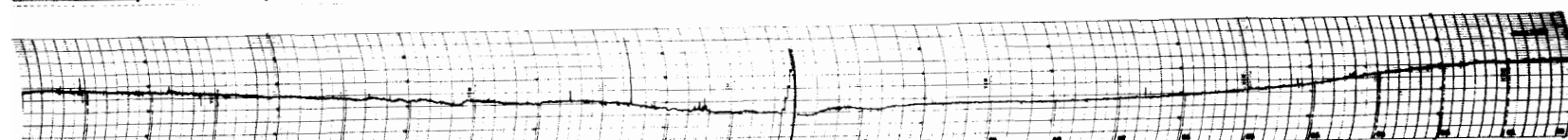
10



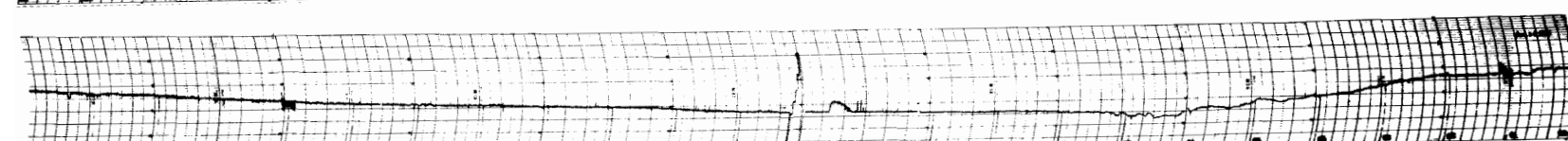
11



12



13



14

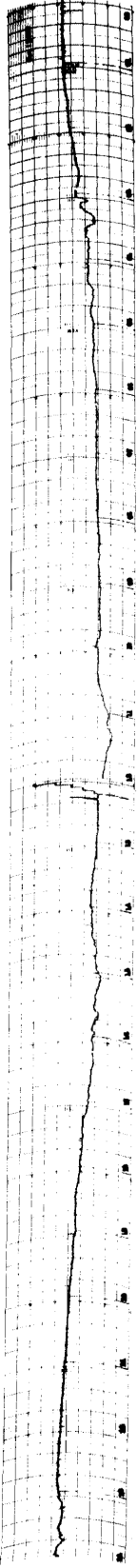
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

JUN 1970

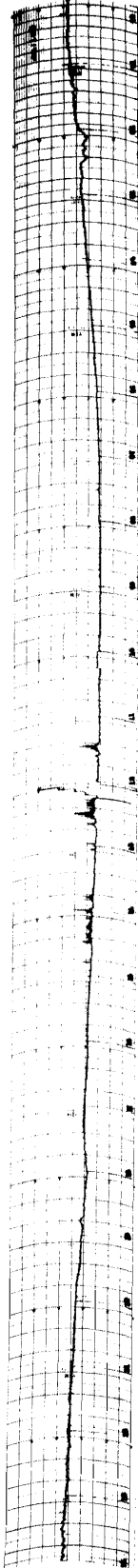
15



16



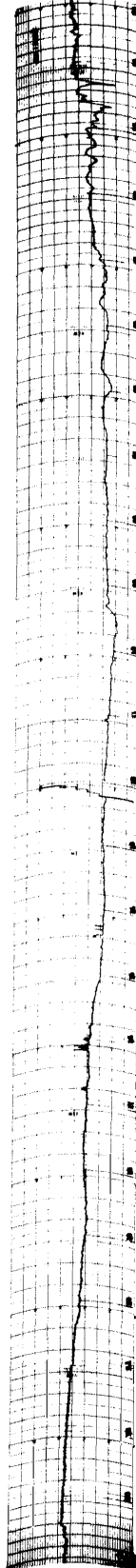
17



18



19



20



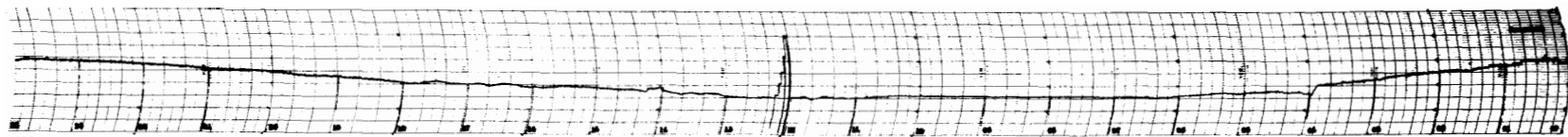
21



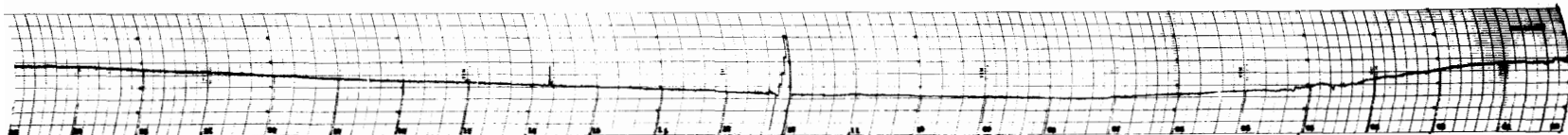
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

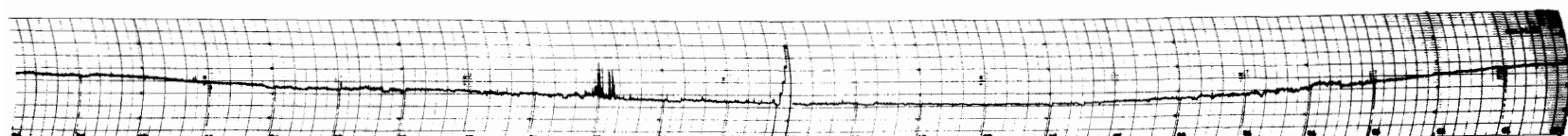
JUN 1970



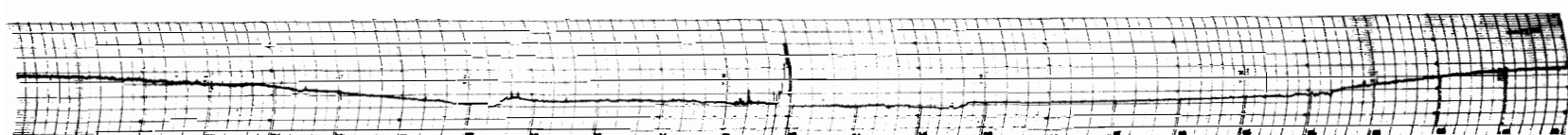
22



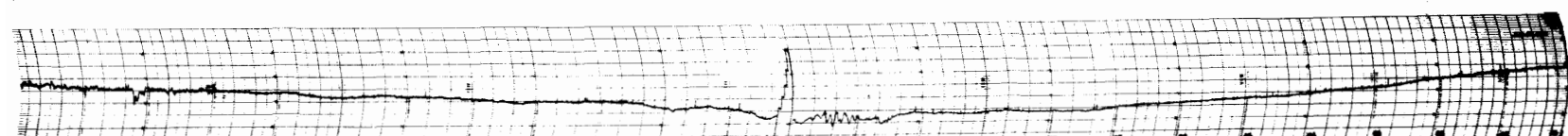
23



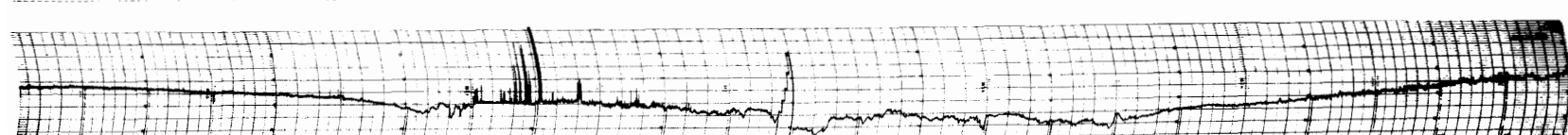
24



25



26



27



28

24 20 16 12 08 04 00

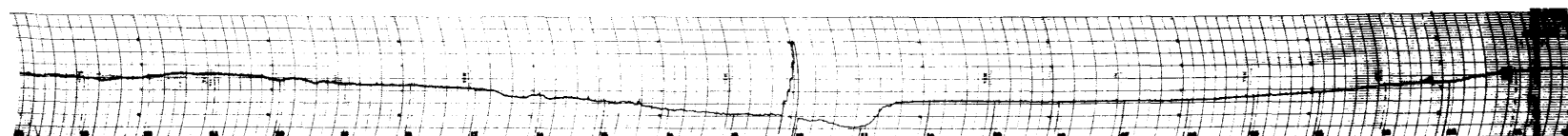
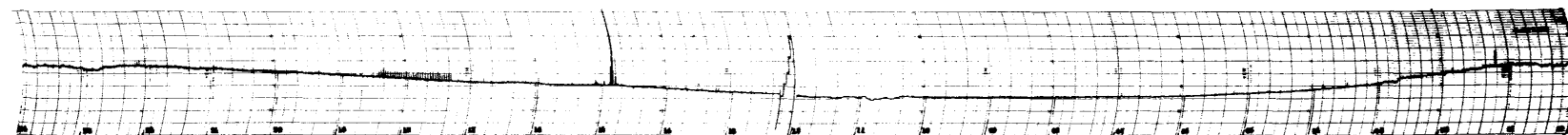
45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

JUN 1970

29

30



24

20

16

12

08

04

00

45° EAST MERIDIAN TIME IN HOURS

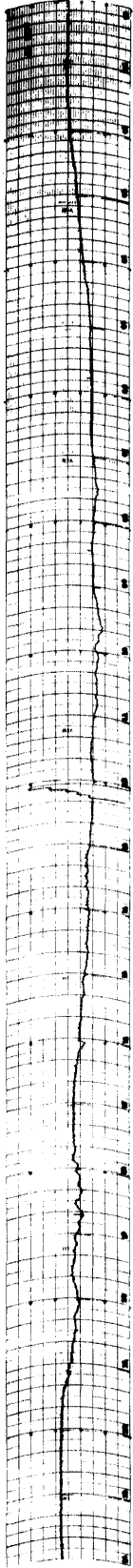
30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

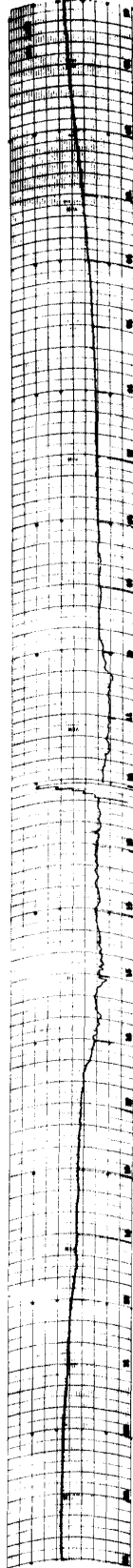
11: 10^h50^m ~ 14^h10^m failure of equipment

JUL 1970

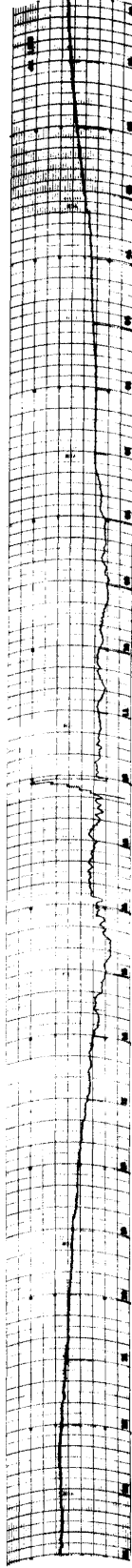
1



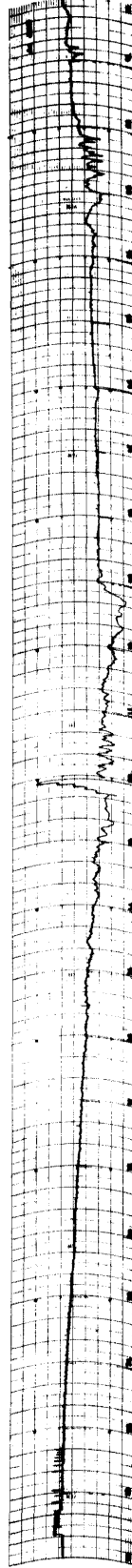
2



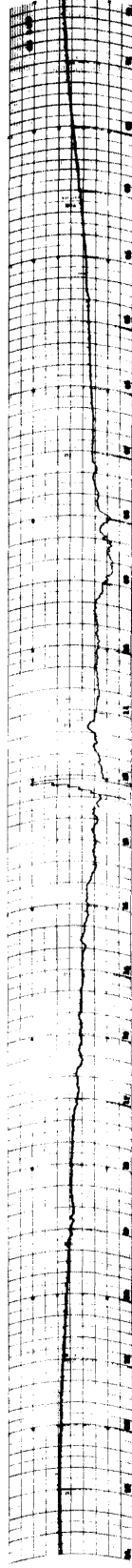
3



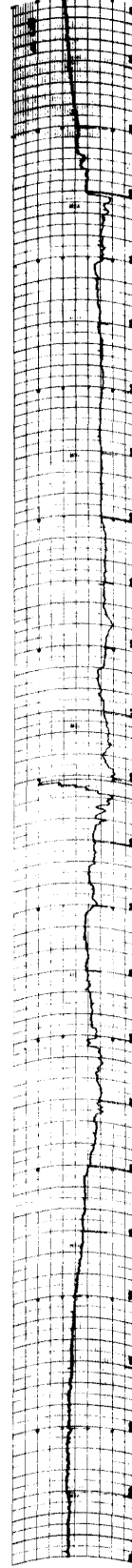
4



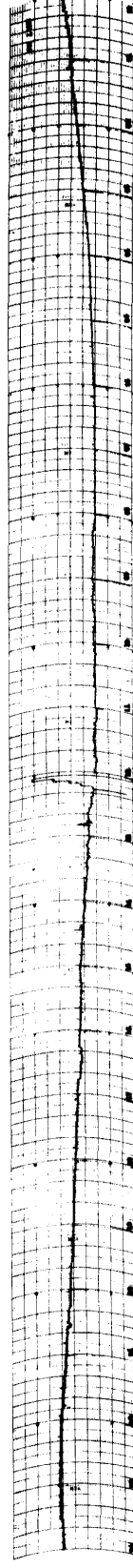
5



6



7



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

JUL 1970

8

9

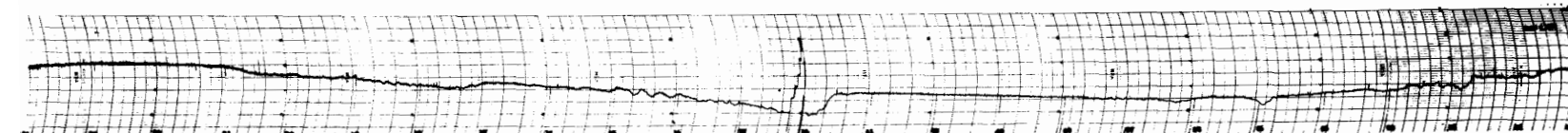
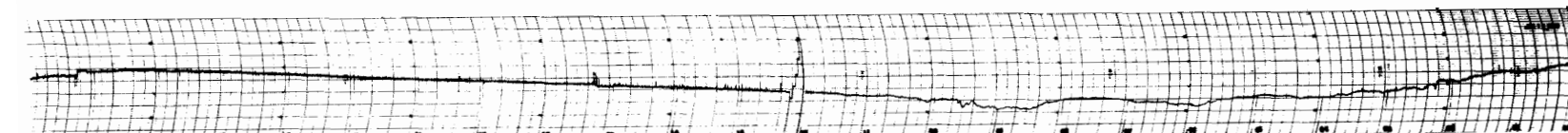
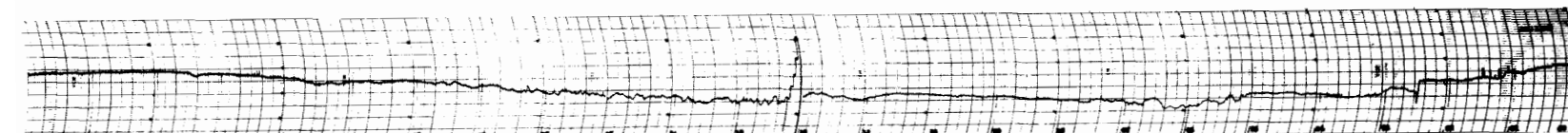
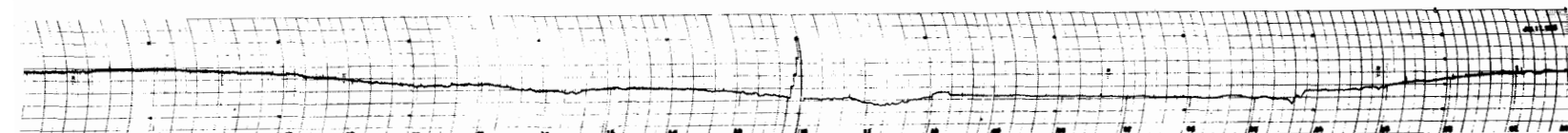
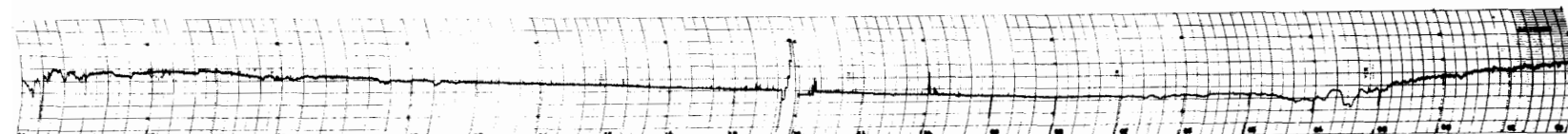
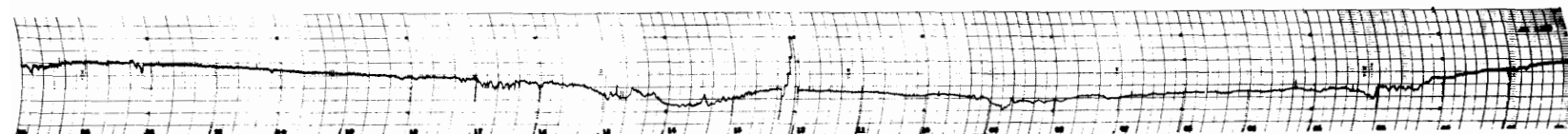
10

11

12

13

14



24

20

16

12

08

04

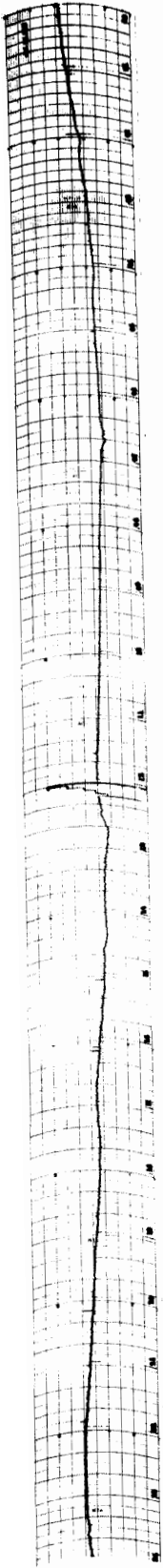
00

45° EAST MERIDIAN TIME IN HOURS

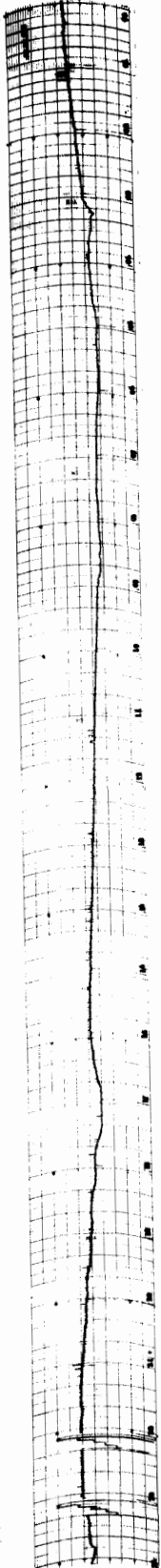
30 MHz COSMIC NOISE

JUL 1970

15



16



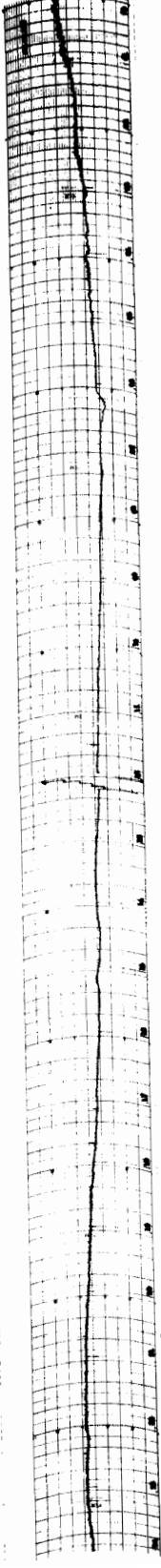
17



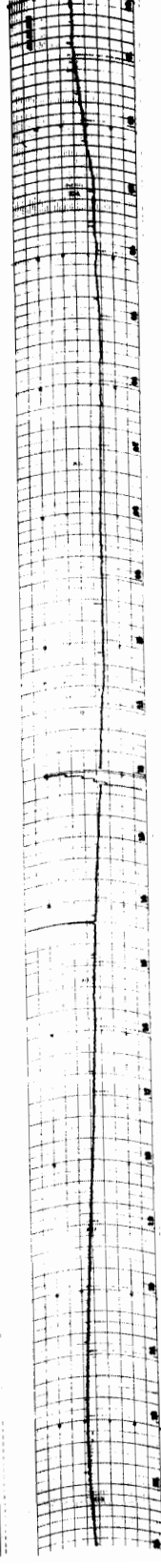
18



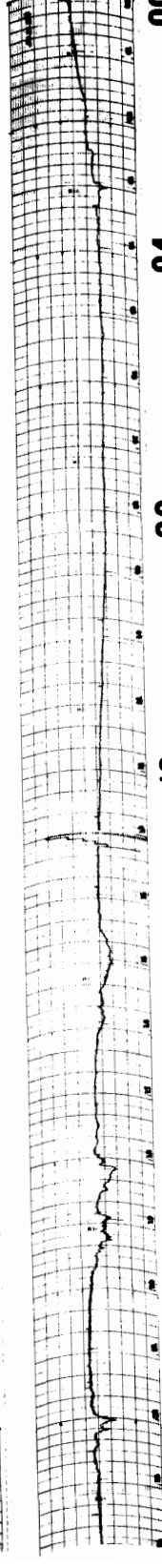
19



20



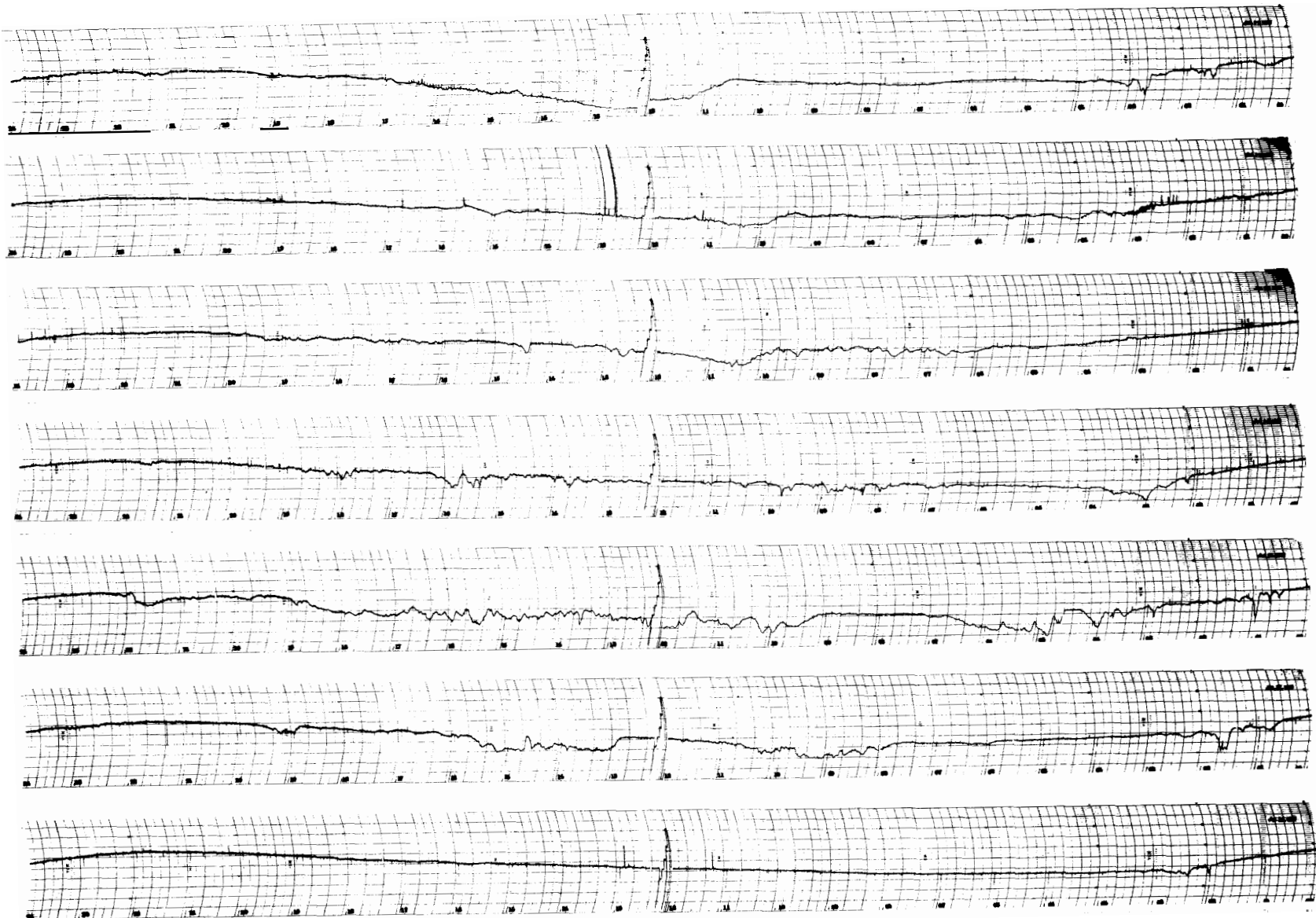
21



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

JUL 1970



22

23

24

25

26

27

28

24 20 16 12 08 04 00
45° EAST MERIDIAN TIME IN HOURS

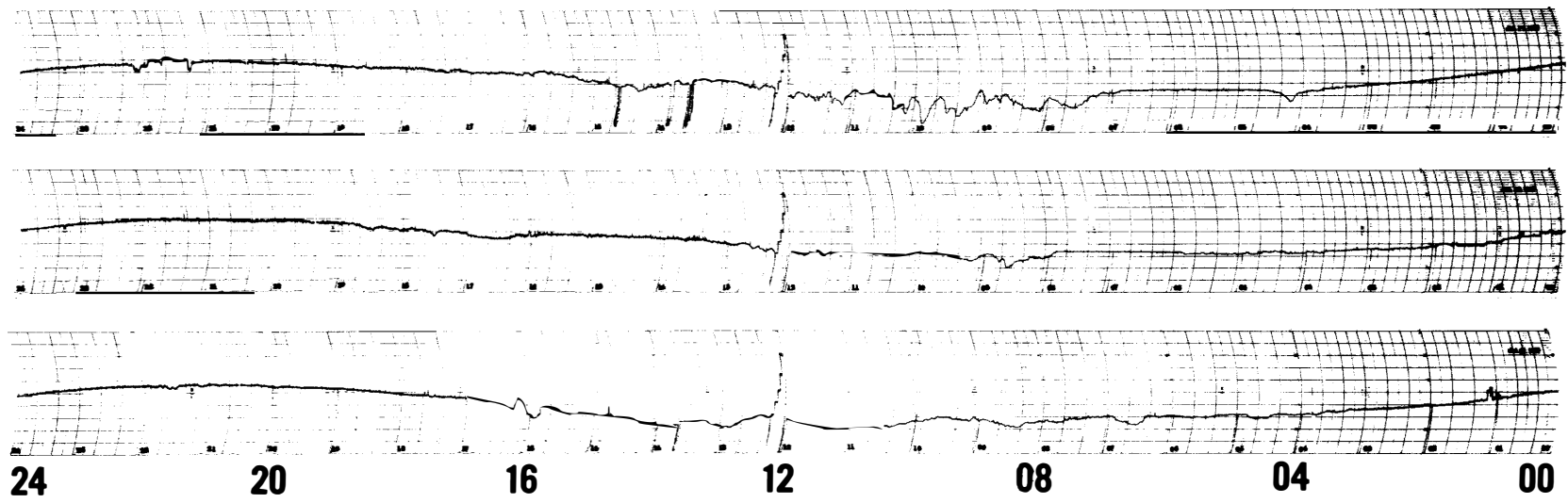
30 MHz COSMIC NOISE

JUL 1970

29

30

31



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.
16: 22^h 00^m ~ 22^h 15^m calibration test
23^h 00^m ~ 23^h 15^m "

AUG 1970

1

2

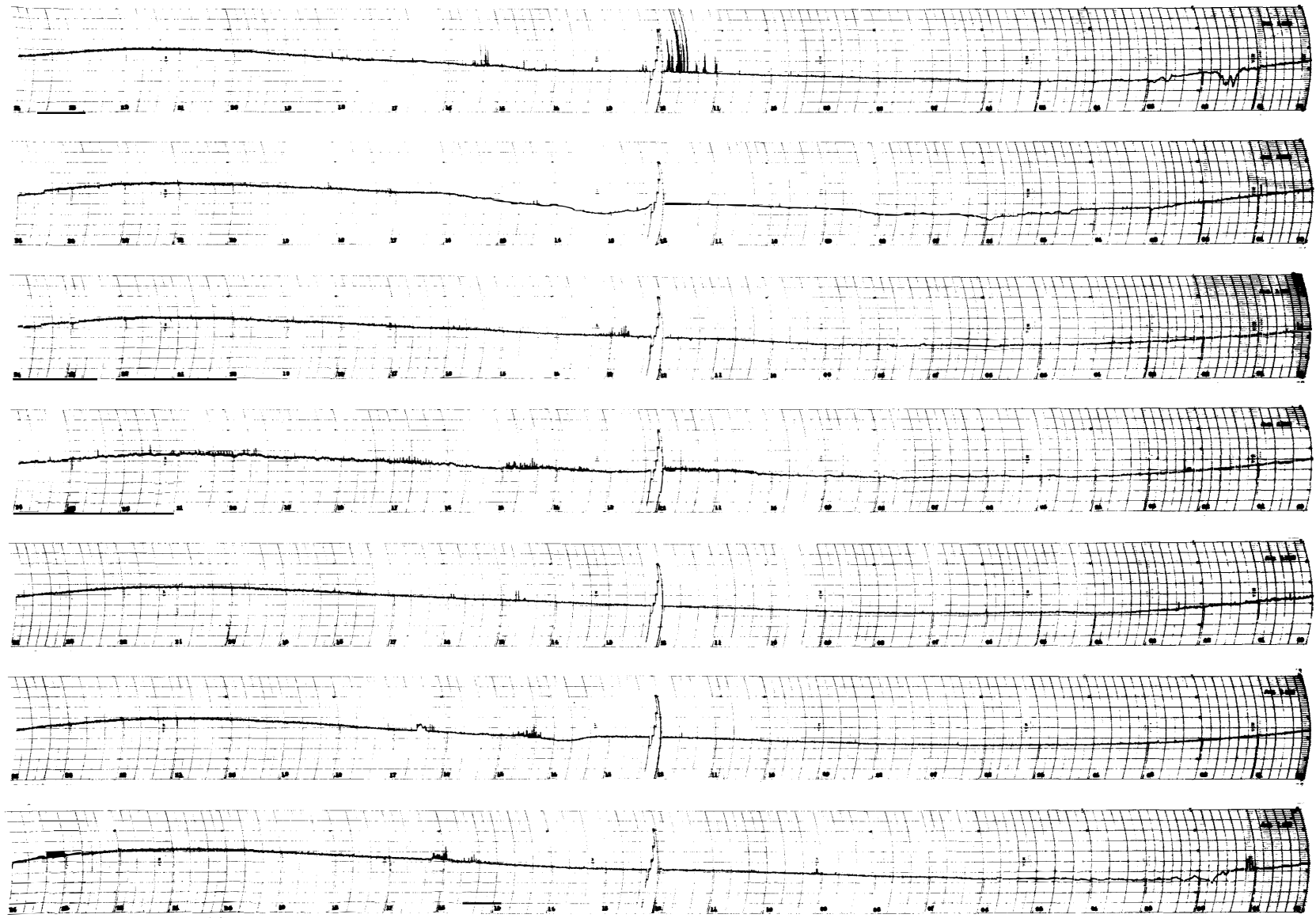
3

4

5

6

7



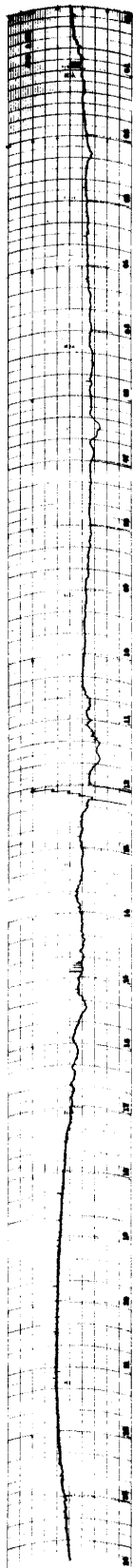
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

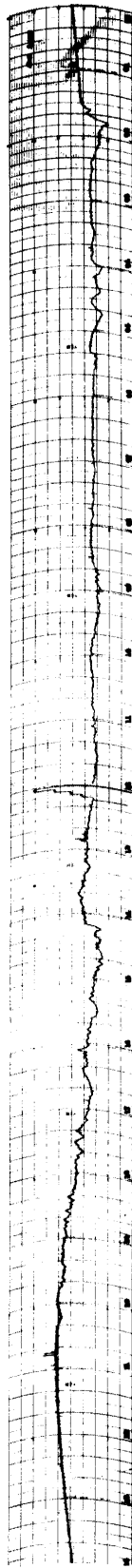
30 MHz COSMIC NOISE

AUG 1970

8



9



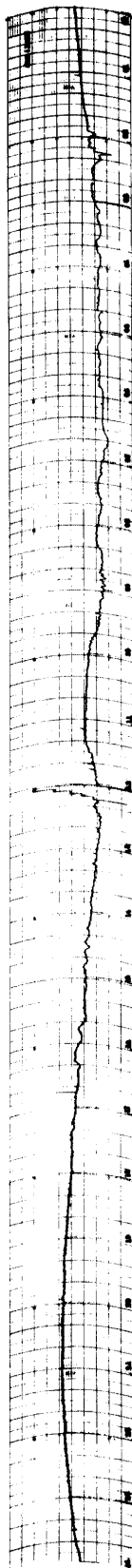
10



11



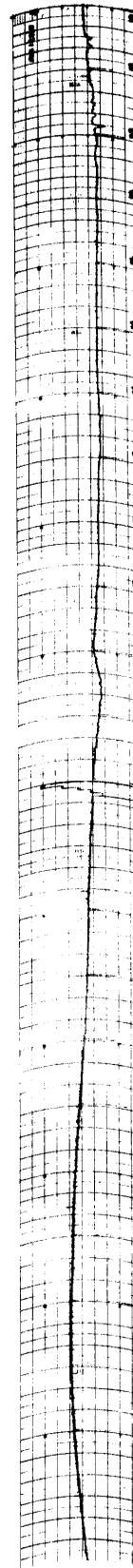
12



13



14



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

AUG 1970

15



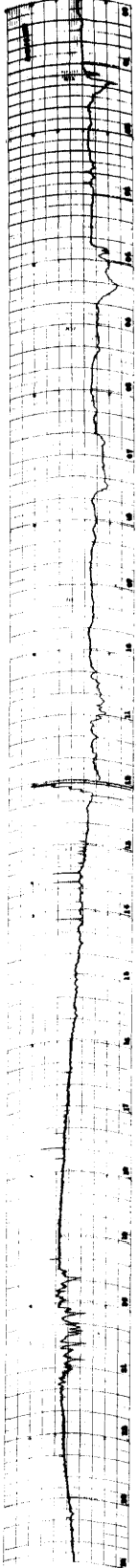
16



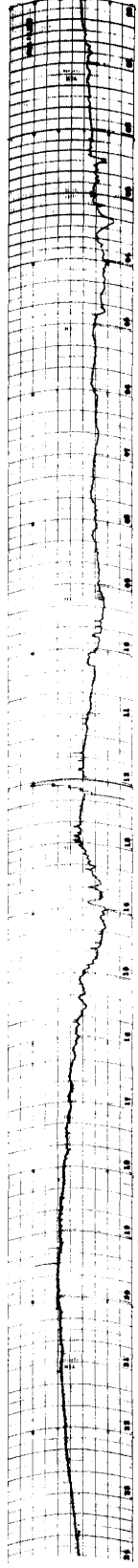
17



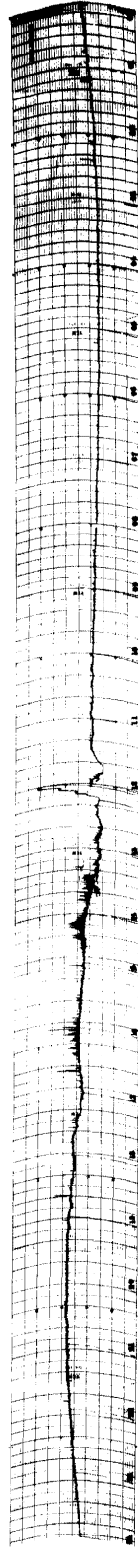
18



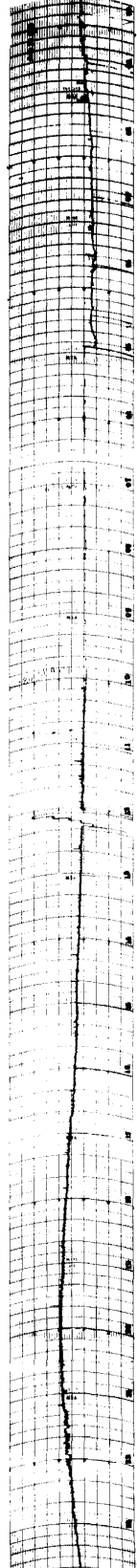
19



20



21



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

AUG 1970

22

23

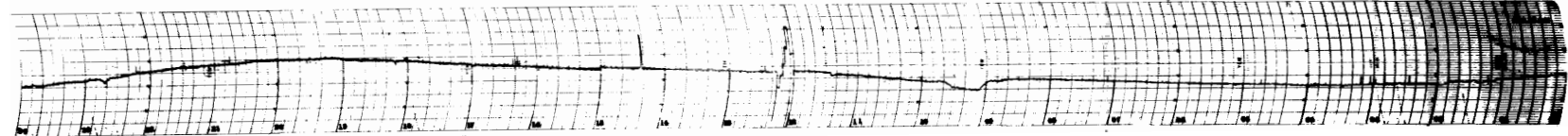
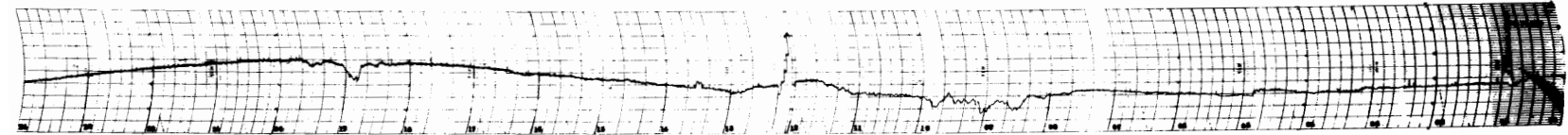
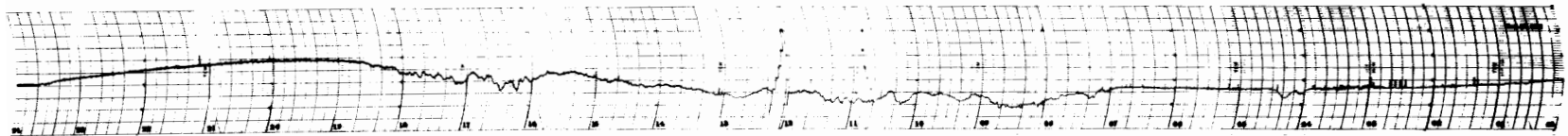
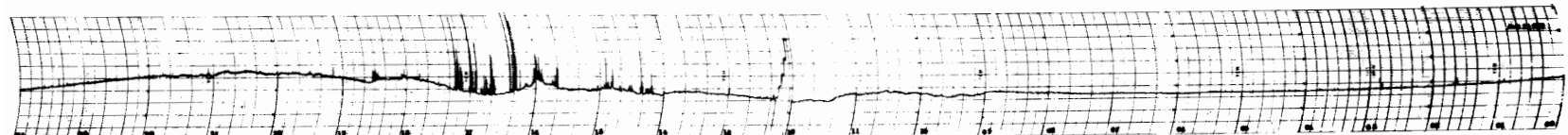
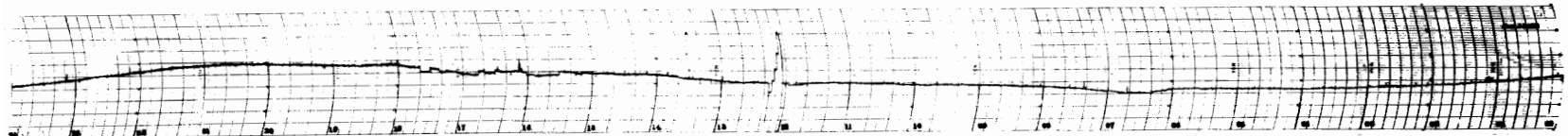
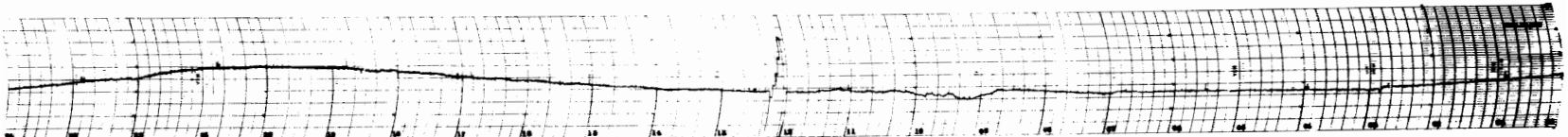
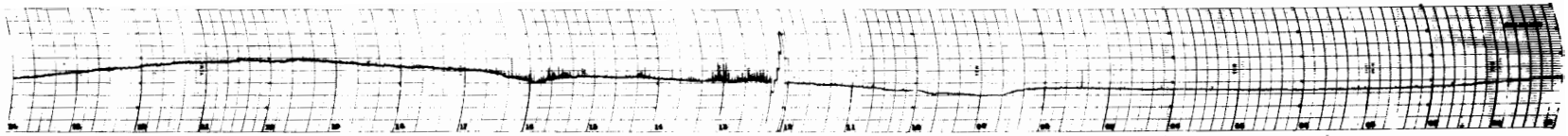
24

25

26

27

28



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

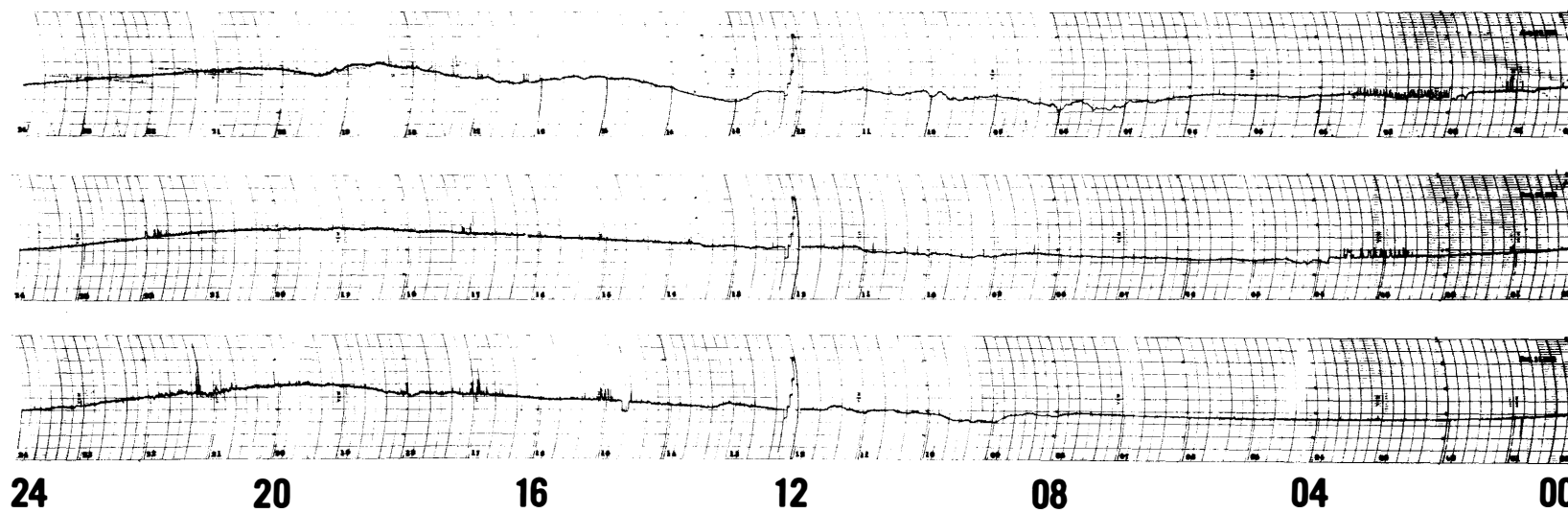
30 MHz COSMIC NOISE

AUG 1970

29

30

31



24

20

16

12

08

04

00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.

21: 05^h00^m ~ 10^h10^m failure of equipment

SEP 1970

1
2
3
4
5
6
7



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

SEP 1970

8

9

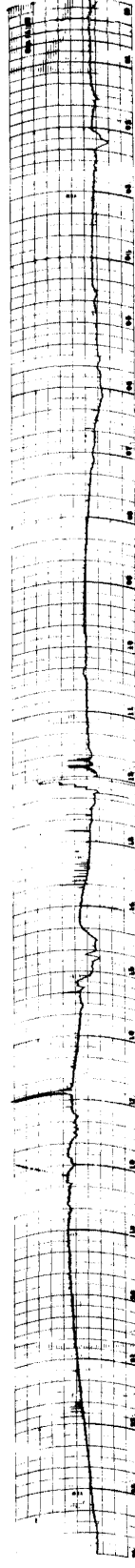
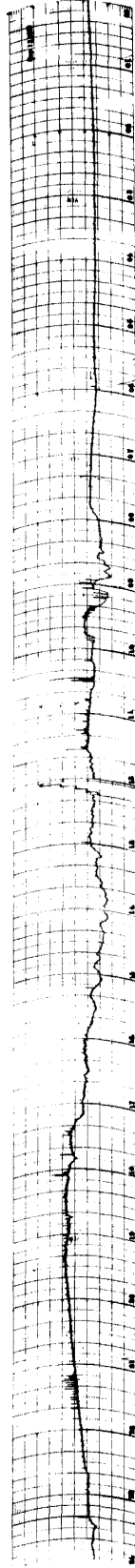
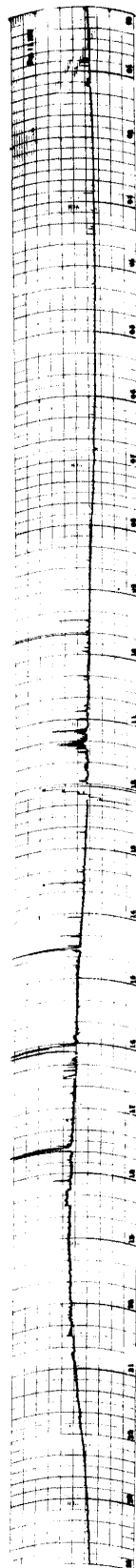
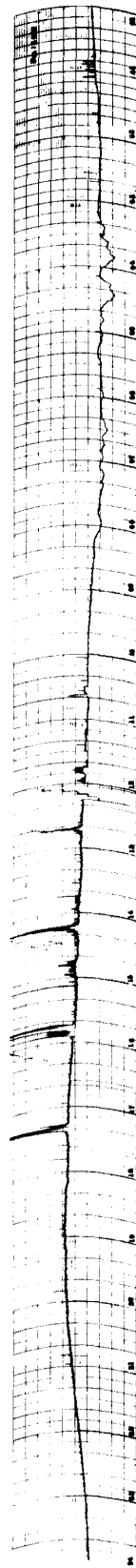
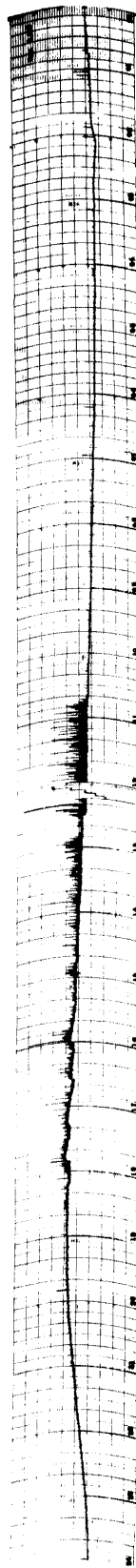
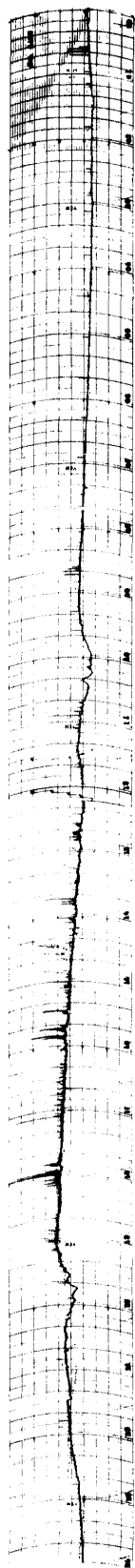
10

11

12

13

14

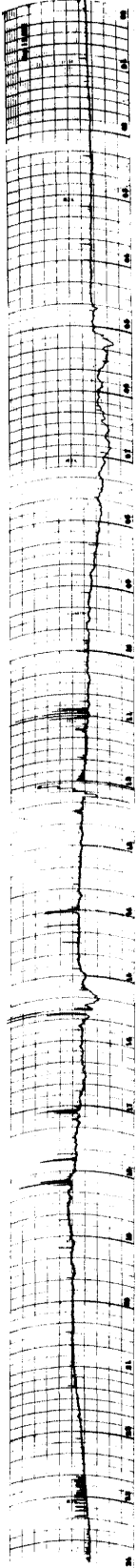


24 20 16 12 08 04 00

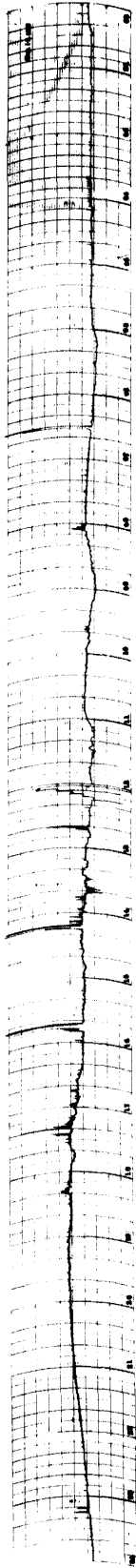
45° EAST MERIDIAN TIME IN HOURS 30 MHZ COSMIC NOISE

SEP 1970

15



16



17



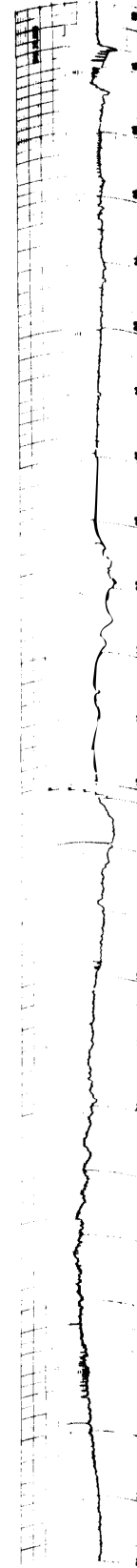
18



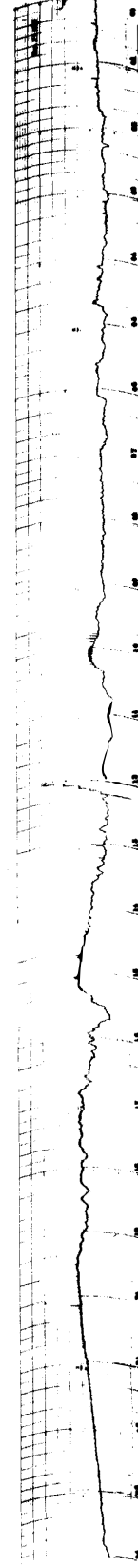
19



20



21



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

SEP 1970

22



23



24



25



26



27

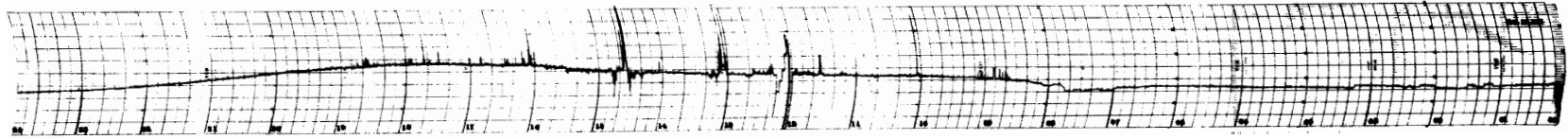
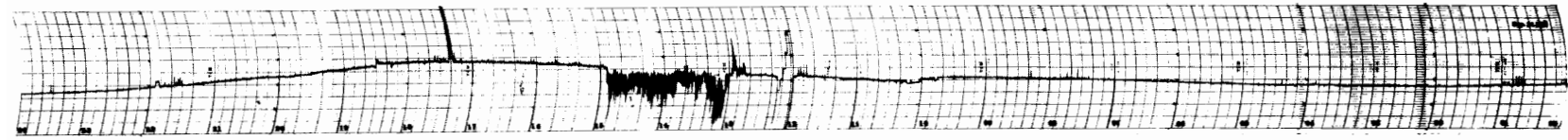


28



24 00 04 08 12 16 20

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

29

30

SEP 1970

OCT 1970

1

2

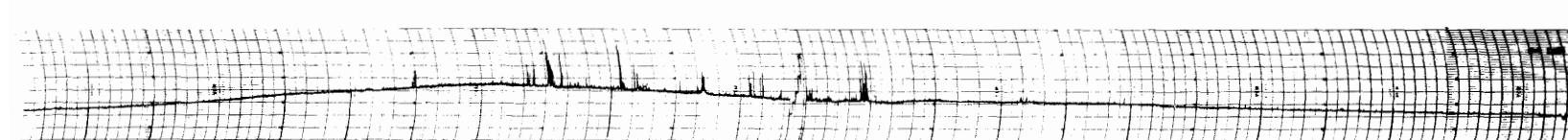
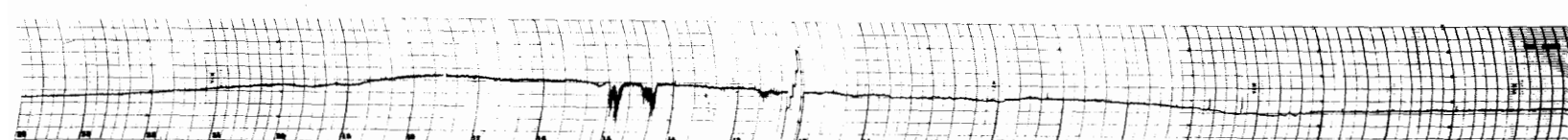
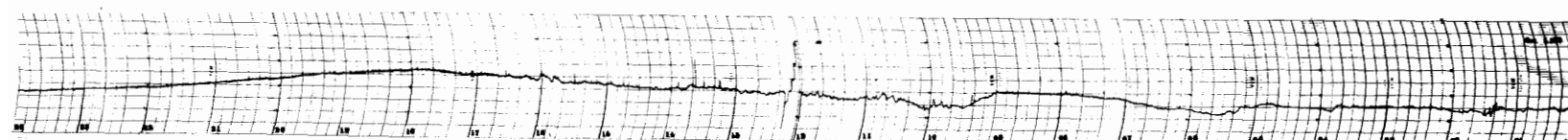
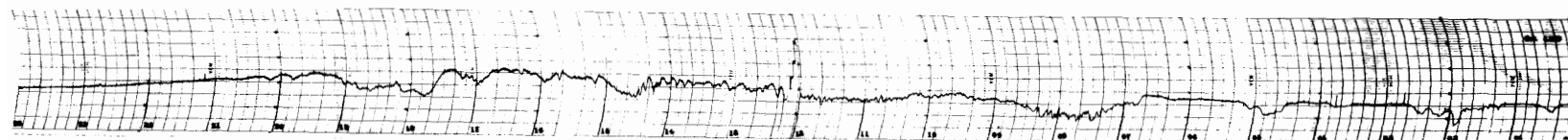
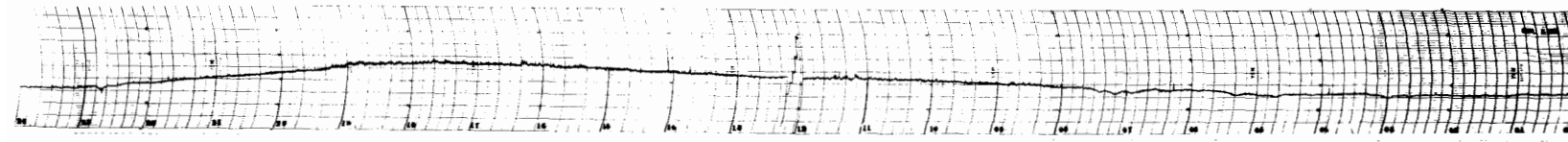
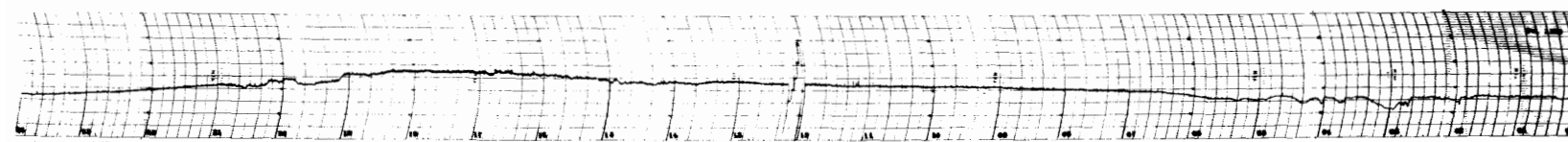
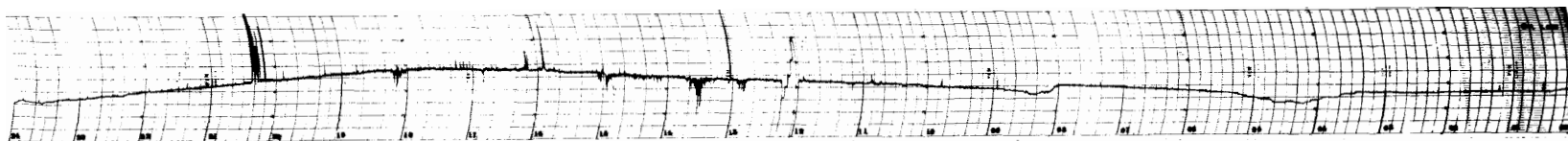
3

4

5

6

7



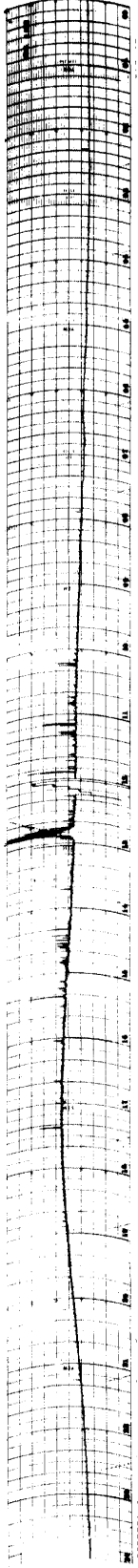
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

OCT 1970

8



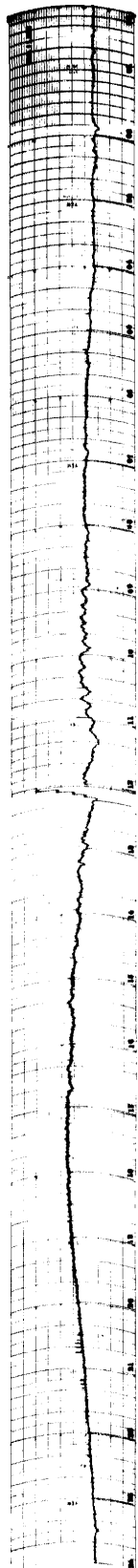
9



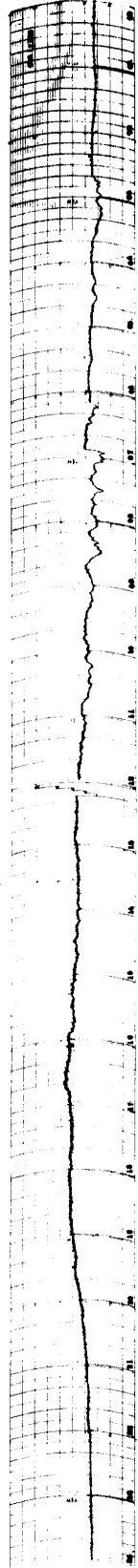
10



11



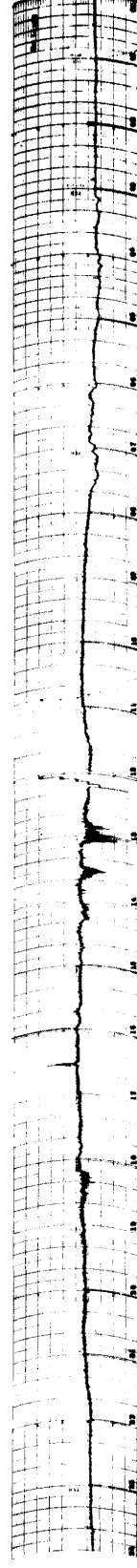
12



13



14



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHZ COSMIC NOISE

OCT 1970

15

16

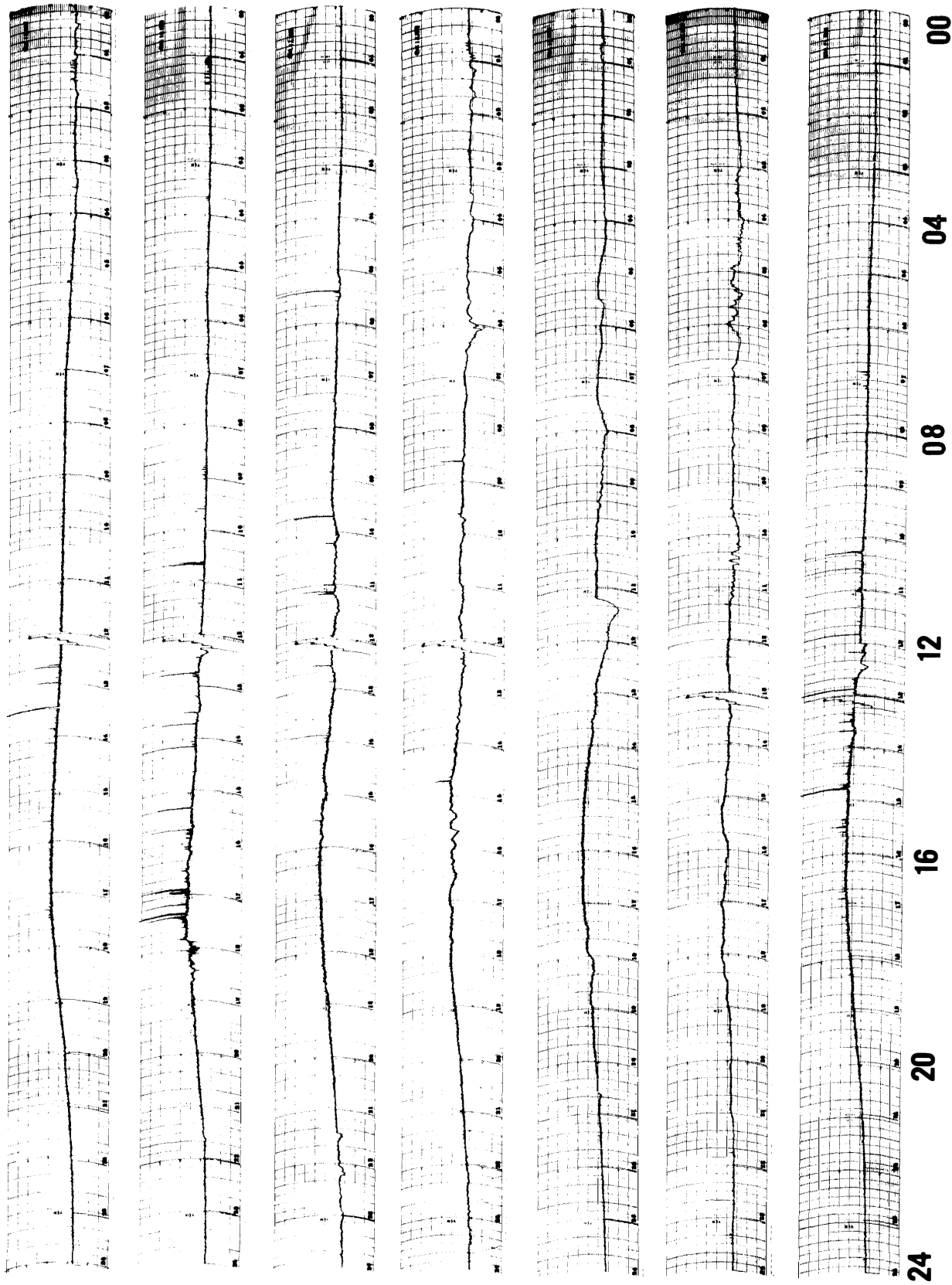
17

18

19

20

21



30 MHz COSMIC NOISE

45° EAST MERIDIAN TIME IN HOURS

24

20

16

12

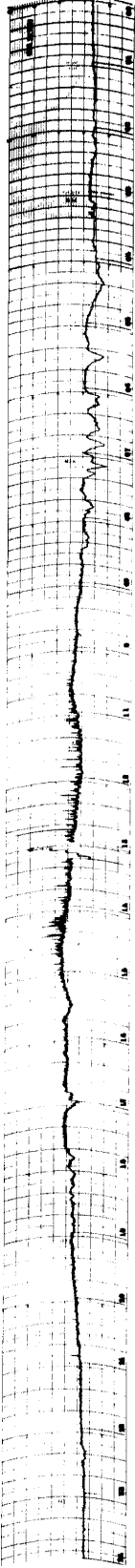
08

04

00

OCT 1970

22



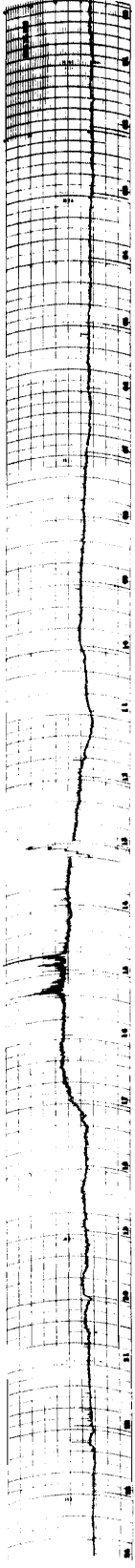
23



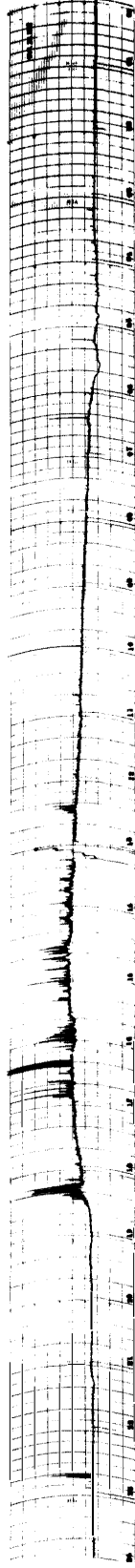
24



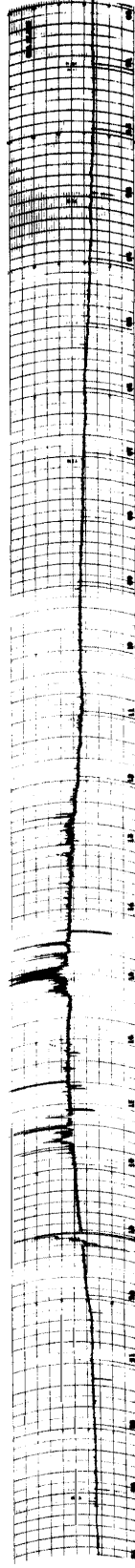
25



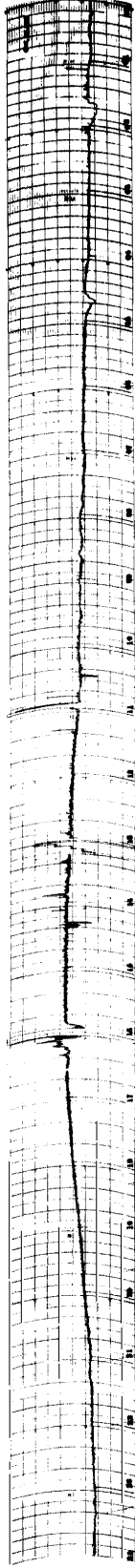
26



27



28



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

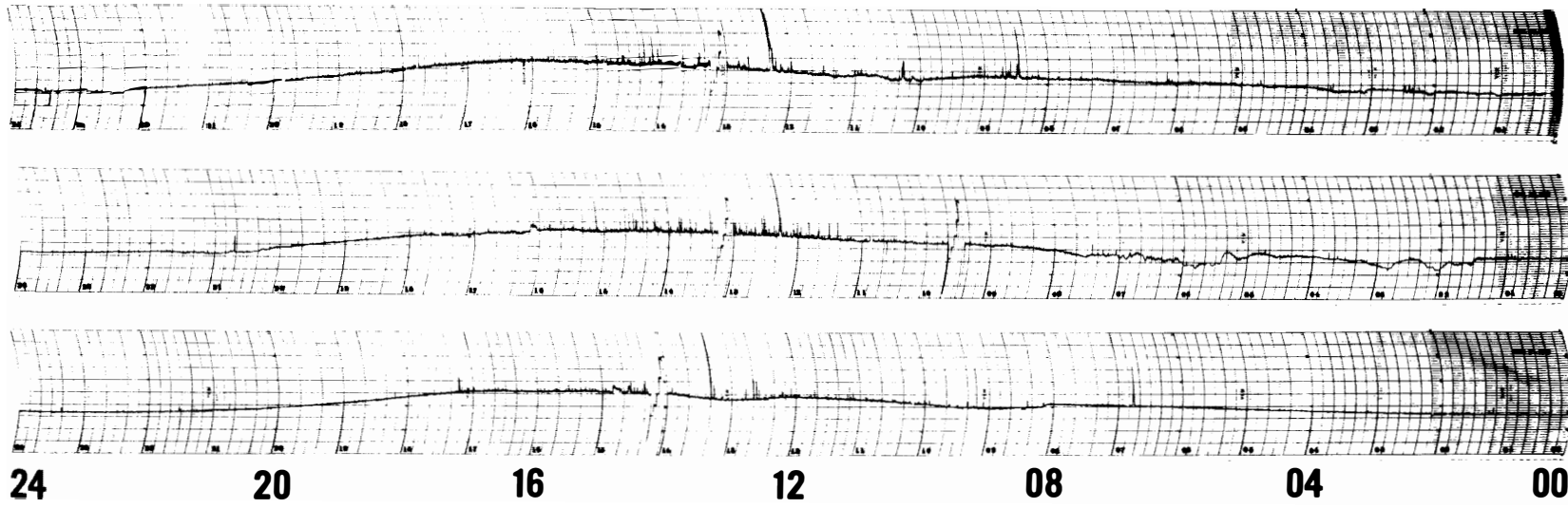
30 MHZ COSMIC NOISE

OCT 1970

29

30

31



24 20 16 12 08 04 00

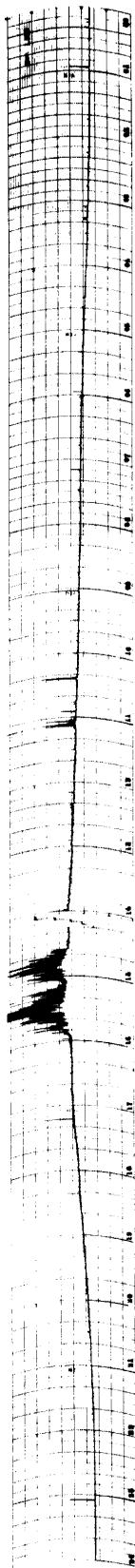
45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

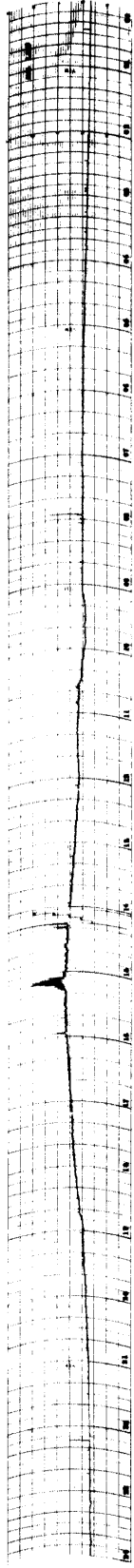
Cosmic noise level obscured or equipment malfunction.
30: 09^h25^m ~ 09^h40^m calibration test

NOV 1970

1



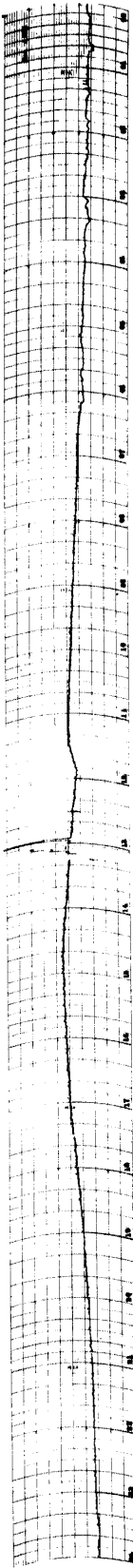
2



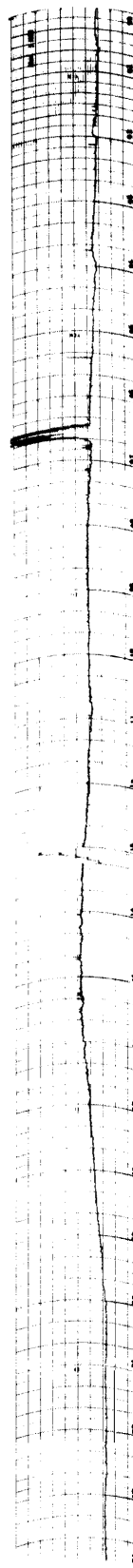
3



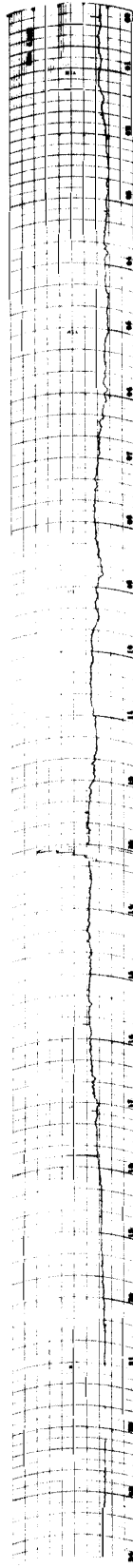
4



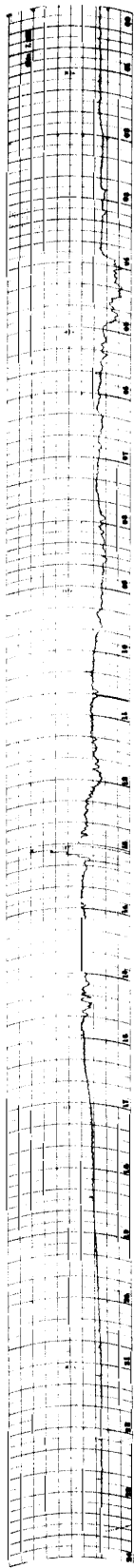
5



6



7



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

NOV 1970

8

9

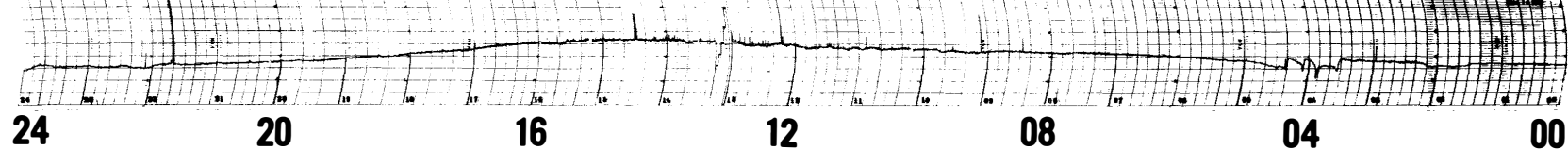
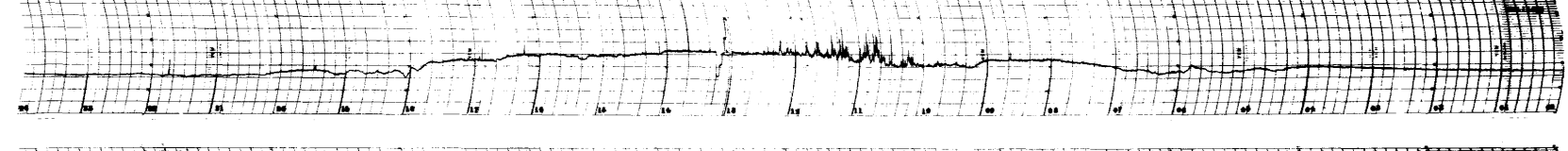
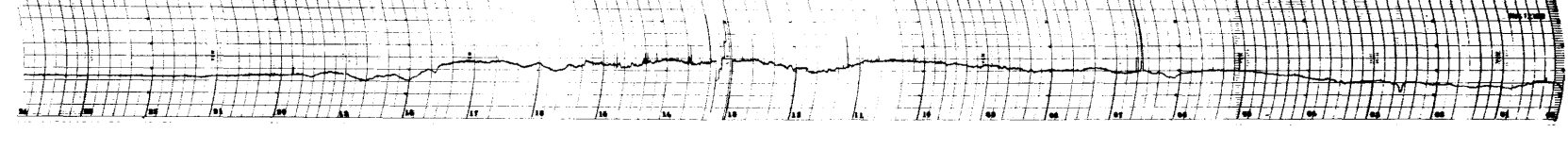
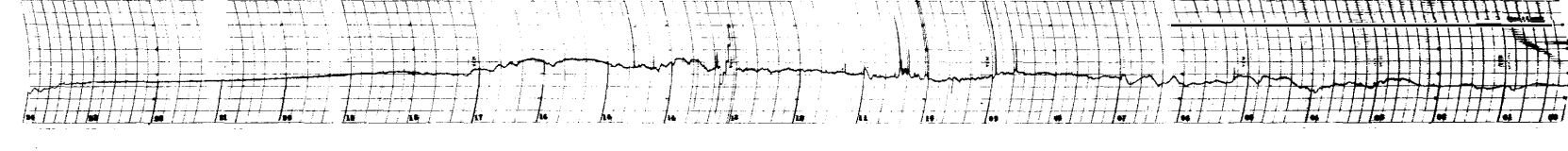
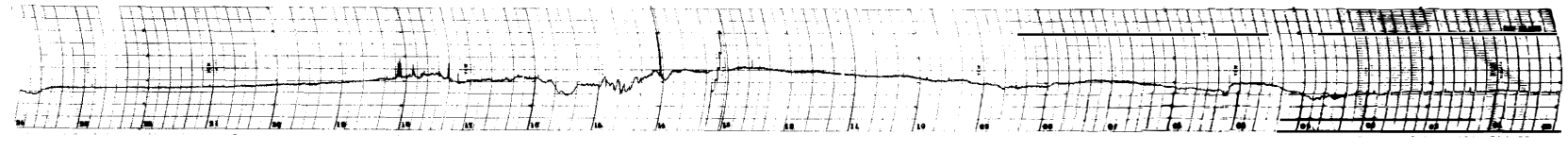
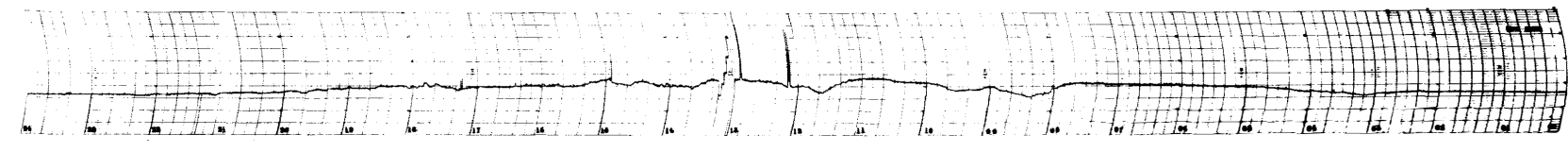
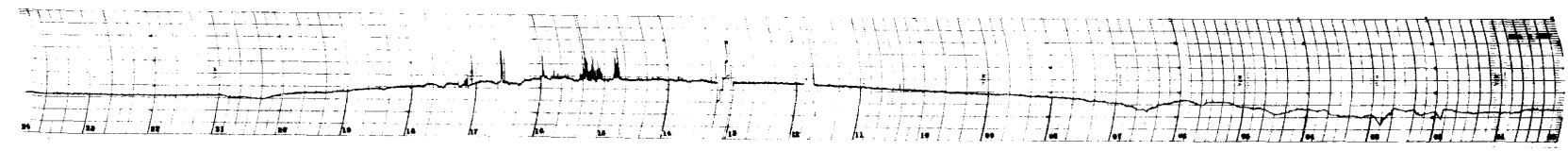
10

11

12

13

14



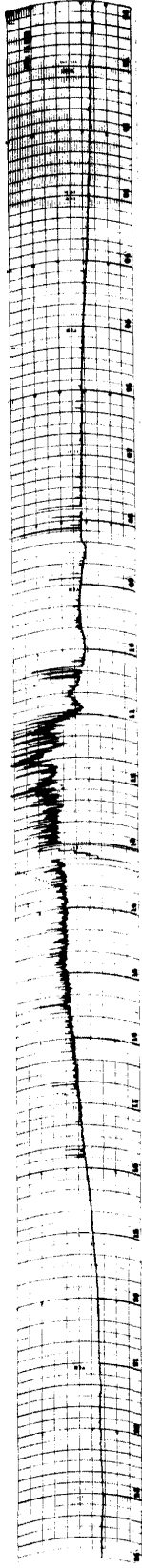
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

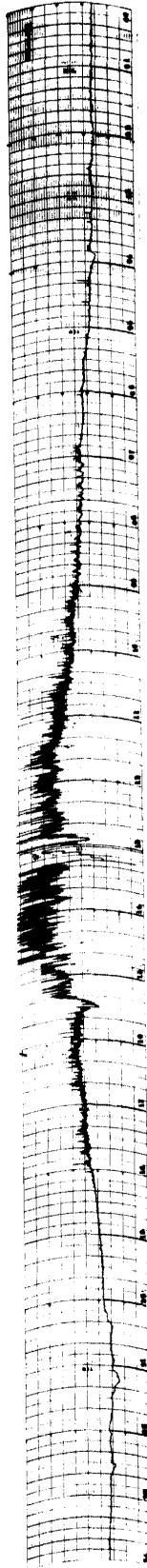
30 MHz COSMIC NOISE

NOV 1970

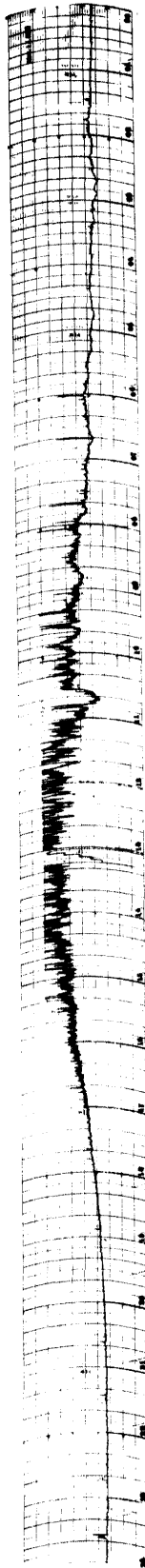
15



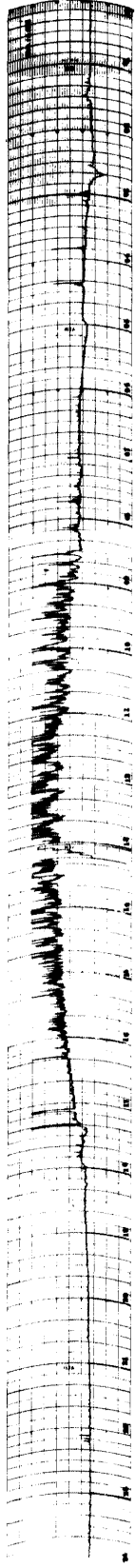
16



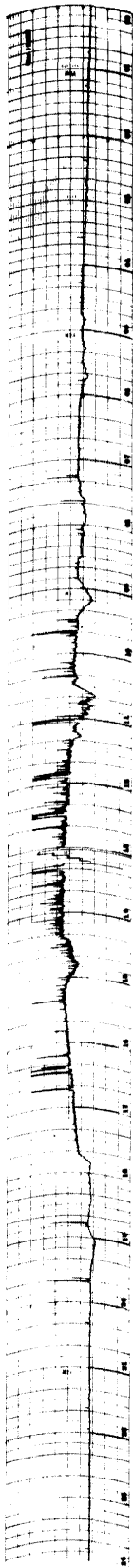
17



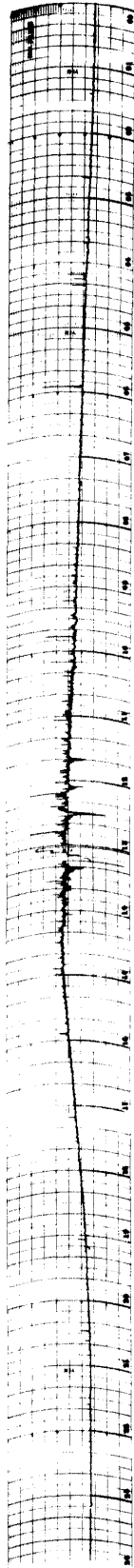
18



19



20



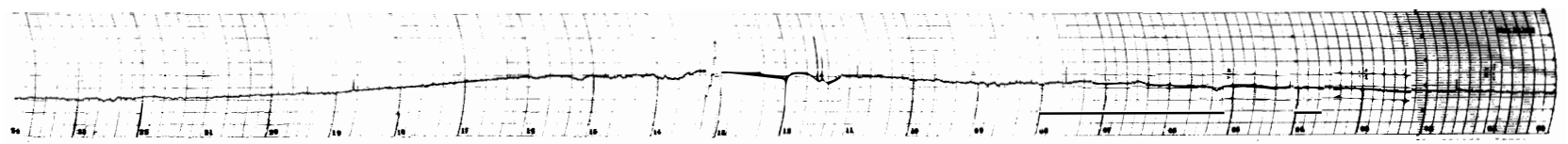
21



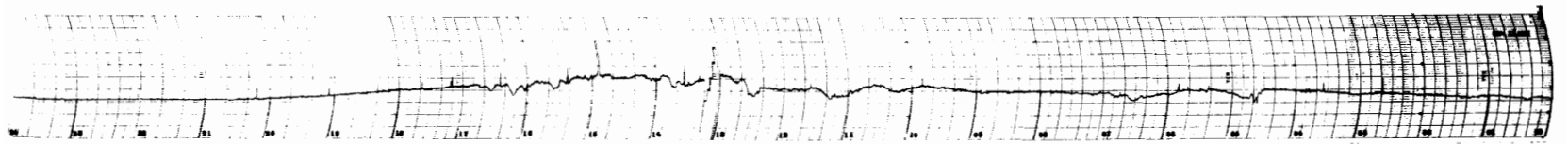
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

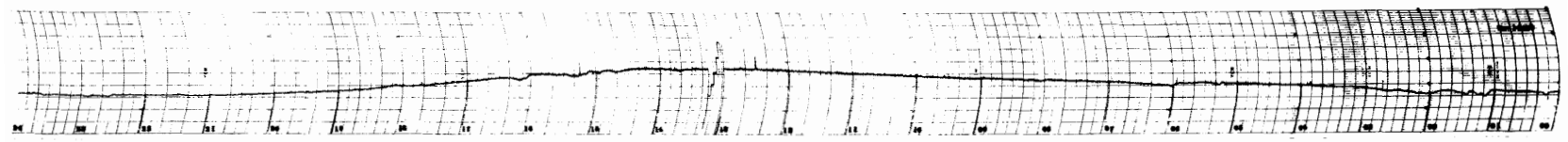
NOV 1970



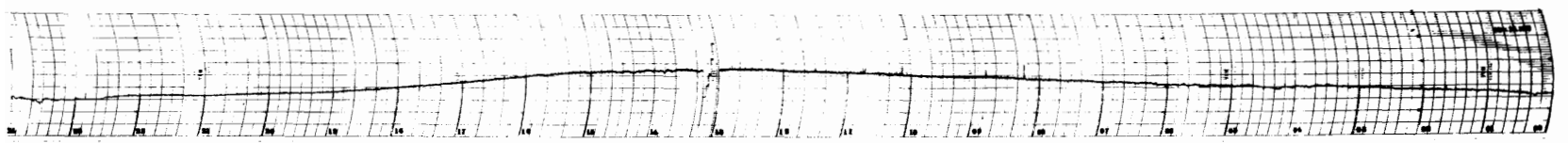
22



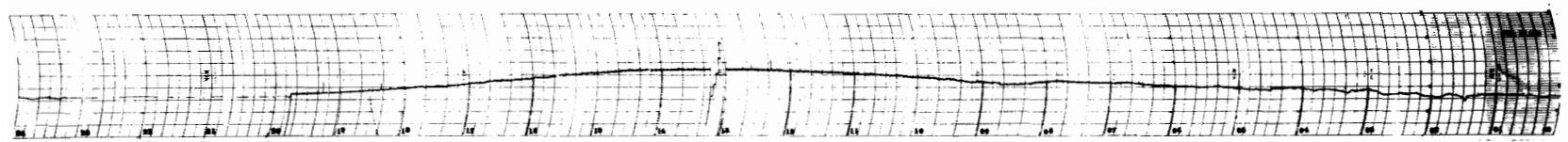
23



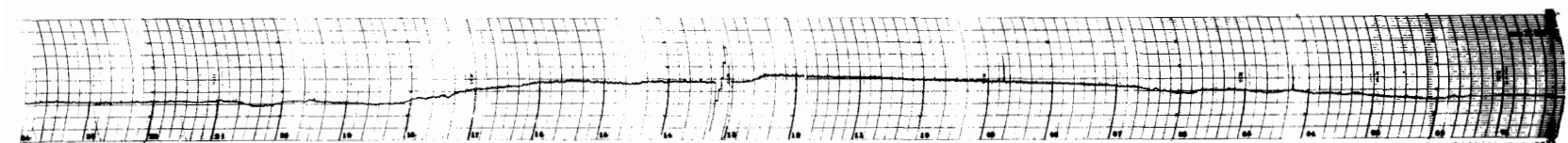
24



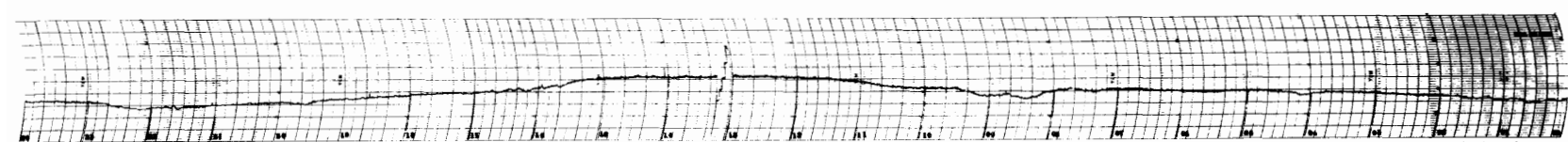
25



26



27

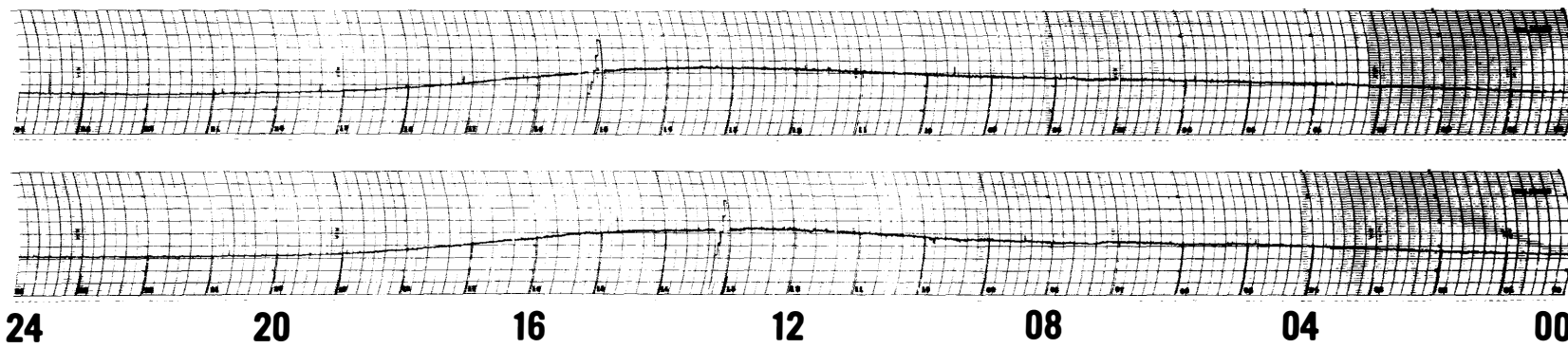


28

24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE



29
30

NOV 1970

45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

Cosmic noise level obscured or equipment malfunction.
 6: 21^h 00^m ~ 22^h 35^m failure of equipment
 26: 19^h 45^m ~ 23^h 12^m "

DEC 1970

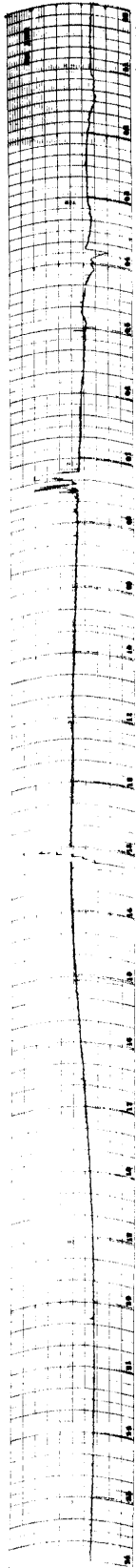
1



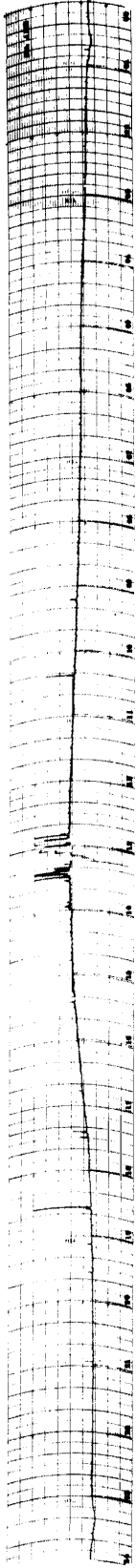
2



3



4



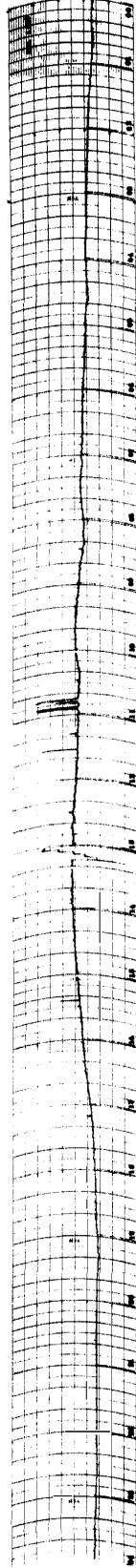
5



6



7



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHZ COSMIC NOISE

DEC 1970

8
9
10
11
12
13
14



45° EAST MERIDIAN TIME IN HOURS

30 MHz COSMIC NOISE

DEC 1970

15

16

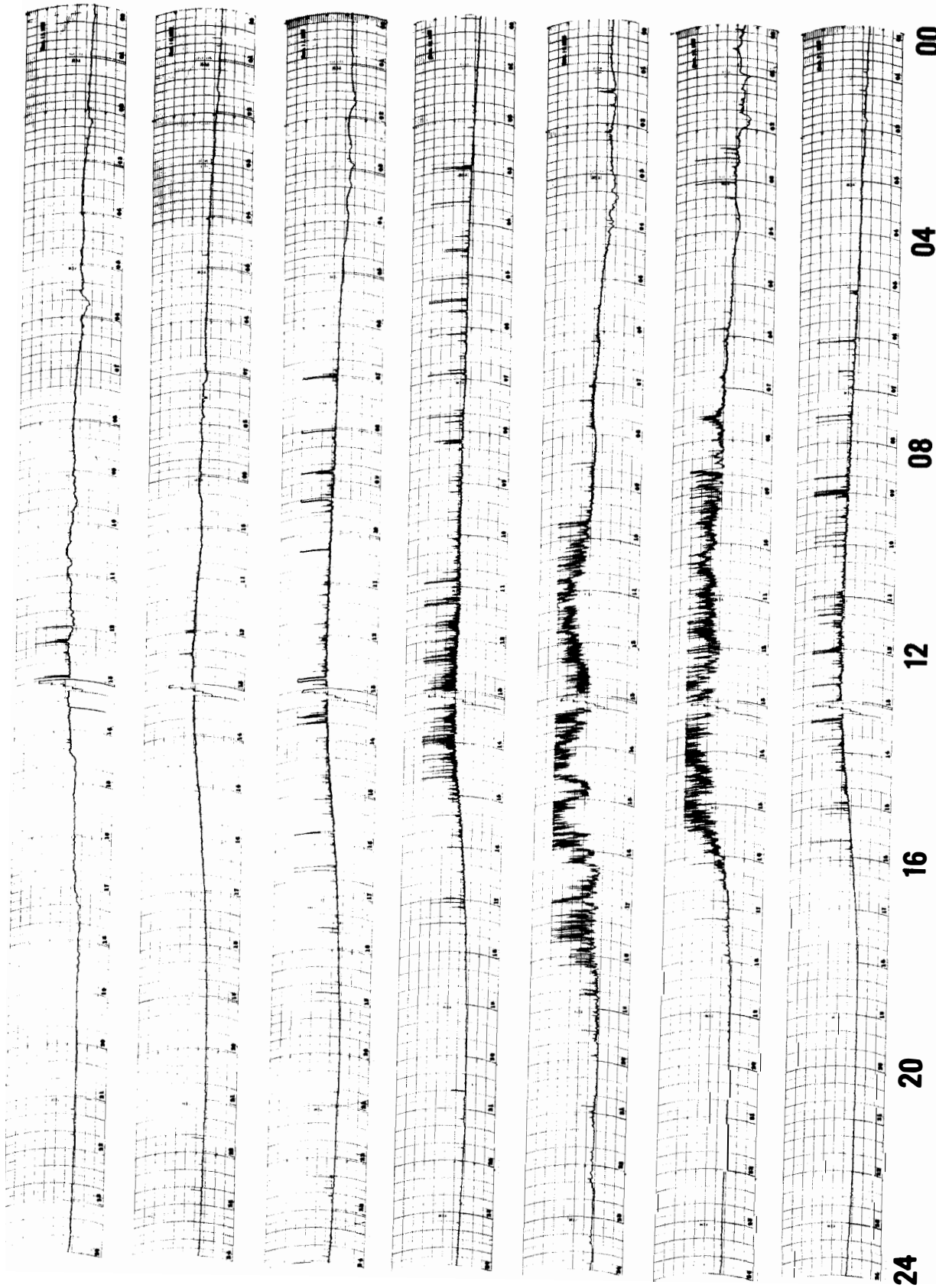
17

18

19

20

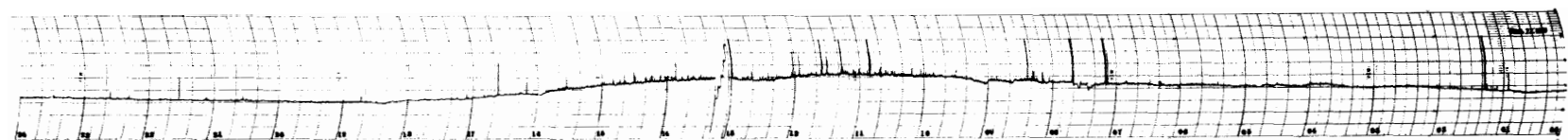
21



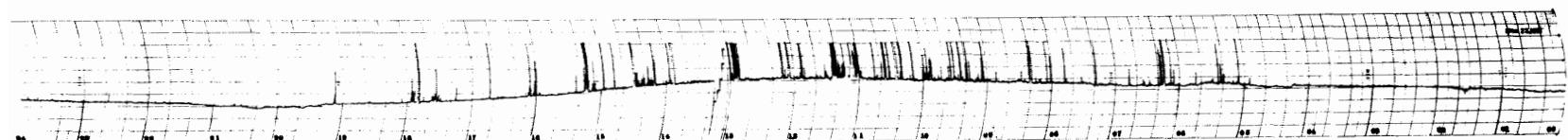
24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE

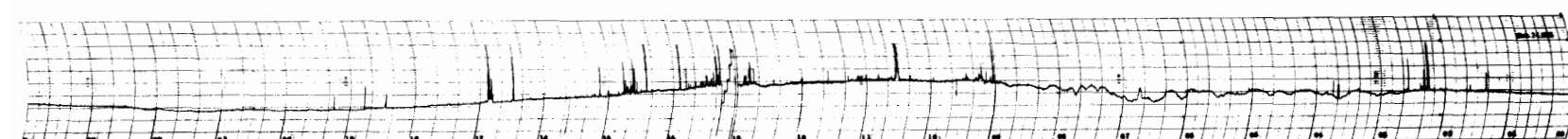
DEC 1970



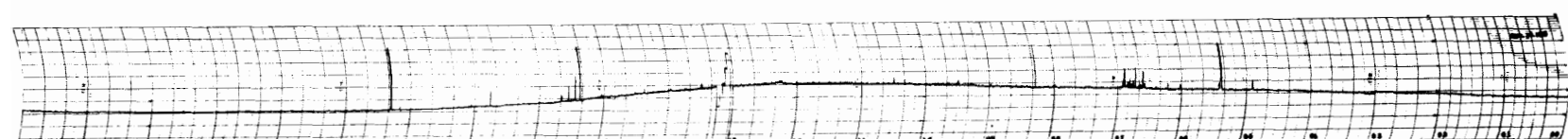
22



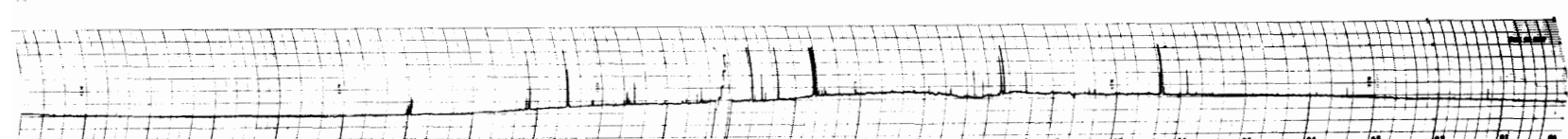
23



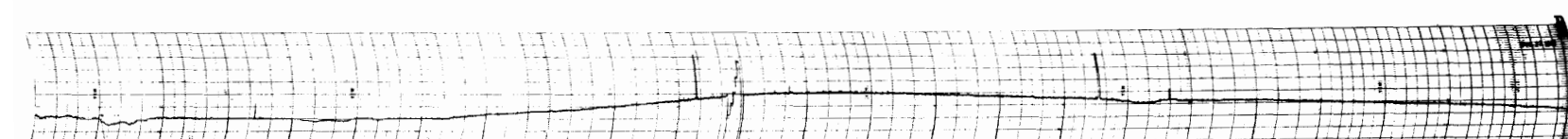
24



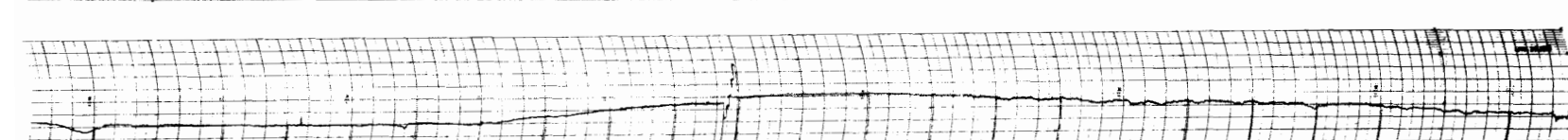
25



26



27



28

24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS

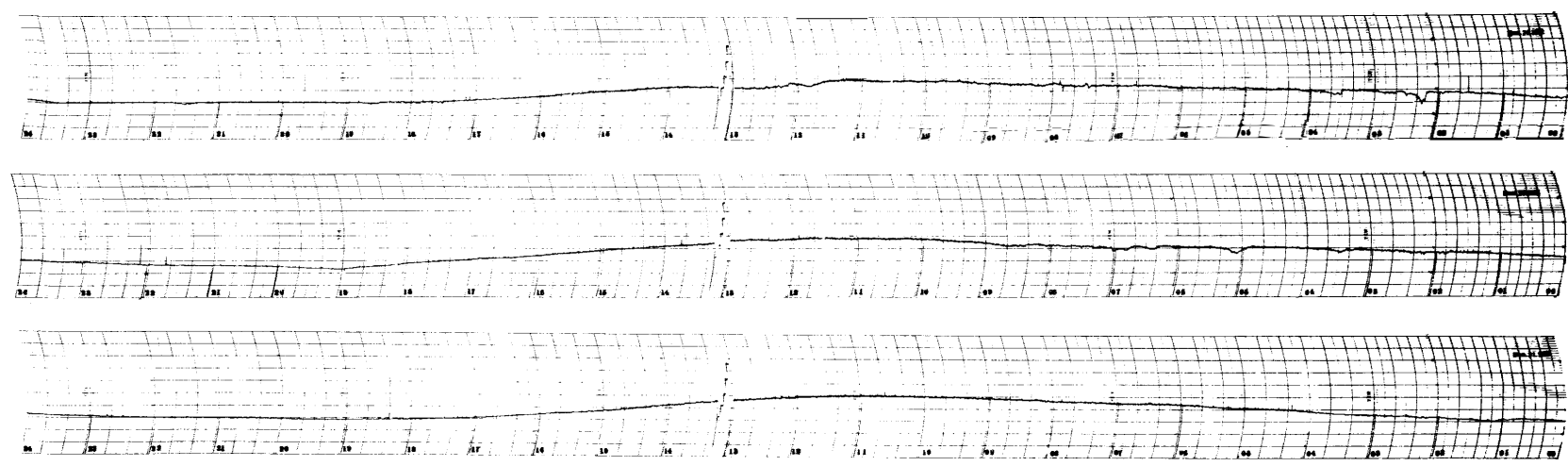
30 MHz COSMIC NOISE

DEC 1970

29

30

31



24 20 16 12 08 04 00

45° EAST MERIDIAN TIME IN HOURS 30 MHz COSMIC NOISE