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INTERNAL DOCUMENT 138

I.O.S.

Kinnairds Head Waverider Installation Diary

by

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NATURAL ENVIRONMENT RESEARCH COUNCIL

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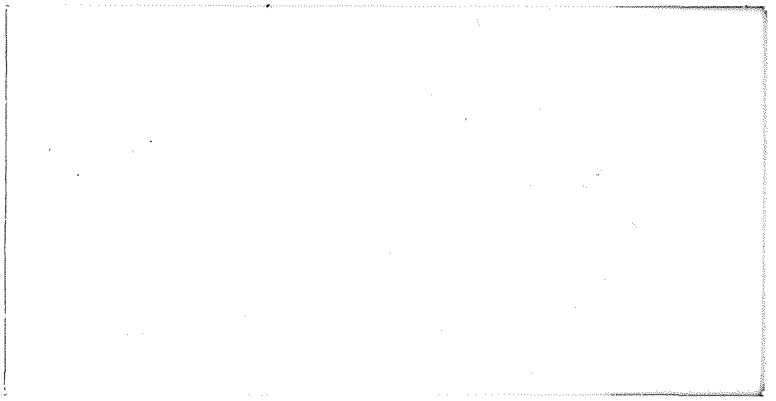

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Institute of Oceanographic Sciences
Crossway
Taunton
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THE KINNAIRDS HEAD WAVERIDER INSTALLATION

A diary of site instrumentation 1979-1981

INTRODUCTION

The receiving site for this installation is at Quarry Head, Rosehearty, Aberdeenshire. The equipment is in a hut which is operated by the RAF as part of the Air Weapons Range. The civilian in charge of the range, Mr B Thompson, carries out the necessary tape changes at fortnightly intervals, and checks the equipment daily.

The Waverider buoys are deployed by Wimpey under contract to IOS and are calibrated by them using the facilities at the National Maritime Institute.

THE KINNAIRDS HEAD WAVERIDER INSTALLATION DIARY

Date

19.10.79 Waverider 67191 deployed, calibration (20.9.79) of 1.8656 Hz per metre. Calibrated under supervision of IOS. Transmission frequency 27.015 MHz.

25.10.79 Receiving system installed and commissioned.

System consisted

a) Two C & S Loop Antennae - Endfire in area of high signal strength.

b) Eddystone receiver Inv No 1026. Received freq 27.015 MHz.

c) Demodulation System - Demod board S No 006 (Frequency response attached at end of diary.)

d) Microdata logger Inv No 1036.

e) Cassette system logger, with signal strength on 3 rd track. Logger and demodulation calibration: 18.6 Hz gave 1.000 volt.

System frequently out of lock due to interference. (Received signal ~30 μV - interference up to 300 μV).

21.11.79 Buoy lost from station - last records received on tape. Site personnel could not give us this information, as buoy was so frequently out of lock.

Nov 1979 Permission obtained for transmission frequency of 29.725 MHz.

16.1.80 Waverider 67327/7 deployed. Calibration (20.9.79) of 1.8894 Hz per metre. Calibrated under IOS supervision. Transmission frequency 29.725 MHz.

17-18.1.80 Receiver installed for 29.725 MHz. Receiver was GEC Synthesising Type Inv No 749. Same demod board (S No 006) as previously. Signal strength ~5 μV.

28.1.80 Buoy found at Scrabster.

8.2.80 Microdata logger 1036 reported to be logging header data incorrectly - No N in headers.

23.2.80 Waverider 6710 deployed. Calibration (13.2.80) of 1.7722 Hz per metre. Transmission frequency 29.725 MHz.

25.2.80 Microdata 1036 replaced by Microdata 1061. GEC receiver replaced by Eddystone Ser No 455. (Receiving system will now still operate during power cuts.) Alarm light system installed. Light will continue flashing if buoy is out of lock for more than 24 hours. Demod board Ser No 006 still in use. Calibration is 18.6 Hz gives 1.000 volt. Received signal strength~3 μV.

2.3.80 Analysis of recorded data shows that about 30% is being lost because of interference.

10.4.80 Field strength plot made at receiving site. Signal strength at front loop - 6.5 μV and 4 μV at rear. Area of high signal strength found parallel to the cliff edge, and approx half a wavelength in from it.

Receiving system checked, and found to be operating correctly.

2.5.80 Alarm light flashing at receiver. Wimpey notified that buoy was adrift.

14.5.80 Wimpey told to change buoy antenna length to 180 cm before deployment.

9.6.80 Waverider 67327/7 deployed. Calibration (13.2.80) of 1.8635 Hz per metre.

18-19.6.80 Aerial system changed at receiving site to 4 broadside array, with loops in areas of high signal strength. New receiver fitted - Eddystone Inv No 927, with additional integral Rf amplifier. Demod board S No 006. Output from aerial system was ~ 1 μV. (That from 2 loop system was 0.6 μV.)

System calibrated. 18.6 Hz (10 metres) gave 0.9988 volts.

1.7.80	Alarm light flashing at receiver. Wimpey notified.
25.7.80	Waverider 6710 deployed. Calibration (10.6.80) of 1.778 Hz per metre.
	Received signal strength about 12 μVolts.
8.9.80	Alarm light flashing at receiver. Wimpey notified.
4.10.80	Waverider 67327/7 deployed. Calibration (7.8.80) of 1.8607 Hz per metre. Receiver did not lock signal for full record lengths.
21.10.80	Site visited. Receiver returned. Signal strength less than 1 μVolt.
21.11.80	Buoy out of lock for long periods.
27.11.80	Alarm light at receiver system flashing. Wimpey notified, and asked to send IOS the buoy roof hatches, before deployment.
13.12.80	Waverider 67549/7 deployed. Calibration (4.12.80) of 1.8467 Hz per metre. This buoy modified to give higher output power, switching every 3 hours. Signal from this buoy not received. On recovery (8.1.81), it was found to have a defective integrated circuit in the switching circuit.
18.12.80	Site visited to check system, and incorporate modifications to synchronize logging system with buoy transmissions. No signals received at all during site visit!
8.1.81	Waverider 677551/7 deployed. Calibration (4.12.80) of 1.8505 Hz per metre. Roof hatch modified by IOS for continuous transmission at maximum permitted output power.
8.1.81	Site visited. Logger changed to frequency logging. Received signal strength $\sim$30 μV. Logger day number not incrementing.

8.1.81 Frequency logging gives 64 x Nominal 1.86 counts per metre, when logged at 0.5 sec intervals. Movement of buoy upwards gives decrease in logged counts. (Frequency response attached at end of diary.)

5.5.81 Waverider 67551/7 recovered, as signal strength slowly falling.

Waverider 67550/7 deployed. Calibration (1.5.81) of 1.8575 Hz per metre. Roof hatch checked by IOS before deployment - no modifications made. It appeared that a standard buoy should give adequate signal strength if properly set up. The previous buoy was modified to give 4 times output power, and gave signal strength of 30 μVolts. So a standard buoy should give 15 μVolts. It would seem that buoys giving less than 10 μVolts had not been set up correctly by Wimpey, who had no previous experience of operation on 29 MHz band.

19.5.81 Received signal strength~17 μVolt. Day number now incrementing. Receiving and logger calibration checked. (NB Frequency logging.)

29.5.81 Signal strength low (0.3 μVolt). Phase lock intermittent. Wimpeys asked to replace buoy. Presumed buoy was adrift.

4.6.81 Waverider deployed. Calibration ( ) of Hz per metre. Roof hatch checked by IOS.

8.6.81 Received signal strength ~ 12 μVolt.

10.6.81 Alarm light flashing. Contacted Bruce Booty - Wormley (Contracts) to find out how much money was left on the contract. Asked him to inform WESC that we might overrun on costs. Wimpey told to prepare buoy, but to wait until costings were known before deployment.

25.6.81 Wimpey were asked to deploy buoy. J Humphery checked again with Don Bax (Wimpey) on their deployment and moorings.

8.7.81 Waverider deployed. Calibration ( )
of Hz per metre. Roof hatch checked by IOS.

9.7.81 Received signal strength ~15 μVolt. Logger and receiver calibration as per specification for frequency logging.

FREQUENCY LOGGING OF WAVE DATA

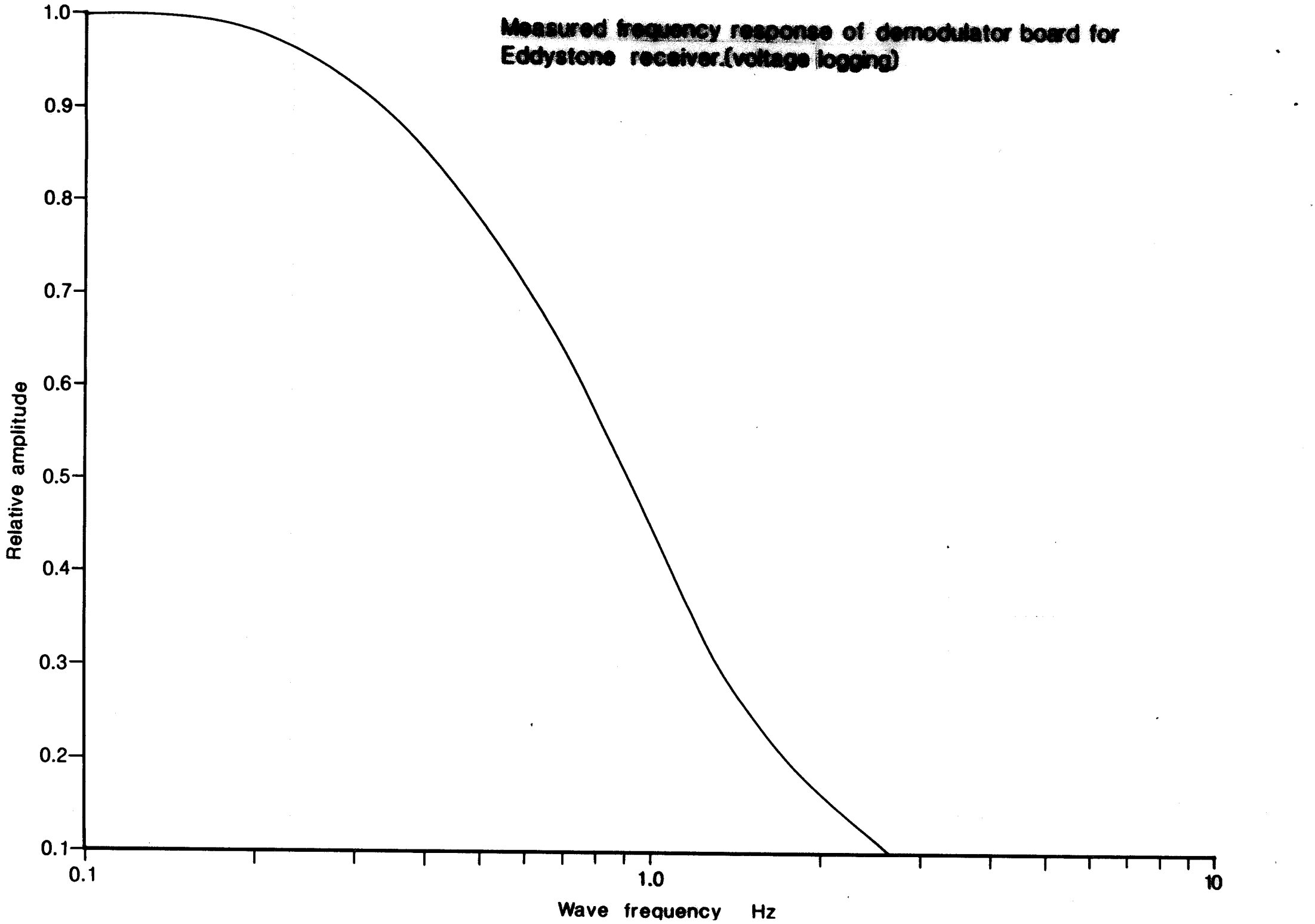
The Waverider signal is received using an Eddystone radio. The 259 Hz Waverider modulation frequency is recovered from the noisy audio signal using a phase locked loop. The signal frequency is also multiplied by 128 in the loop, and is subtracted from a fixed frequency of 128 times 290 Hz, thus giving an output of (290-259) 128 Hz for zero waveheight. Logging takes place every 0.5 second, so the count in 0.5 seconds is 1984 for zero waveheight.

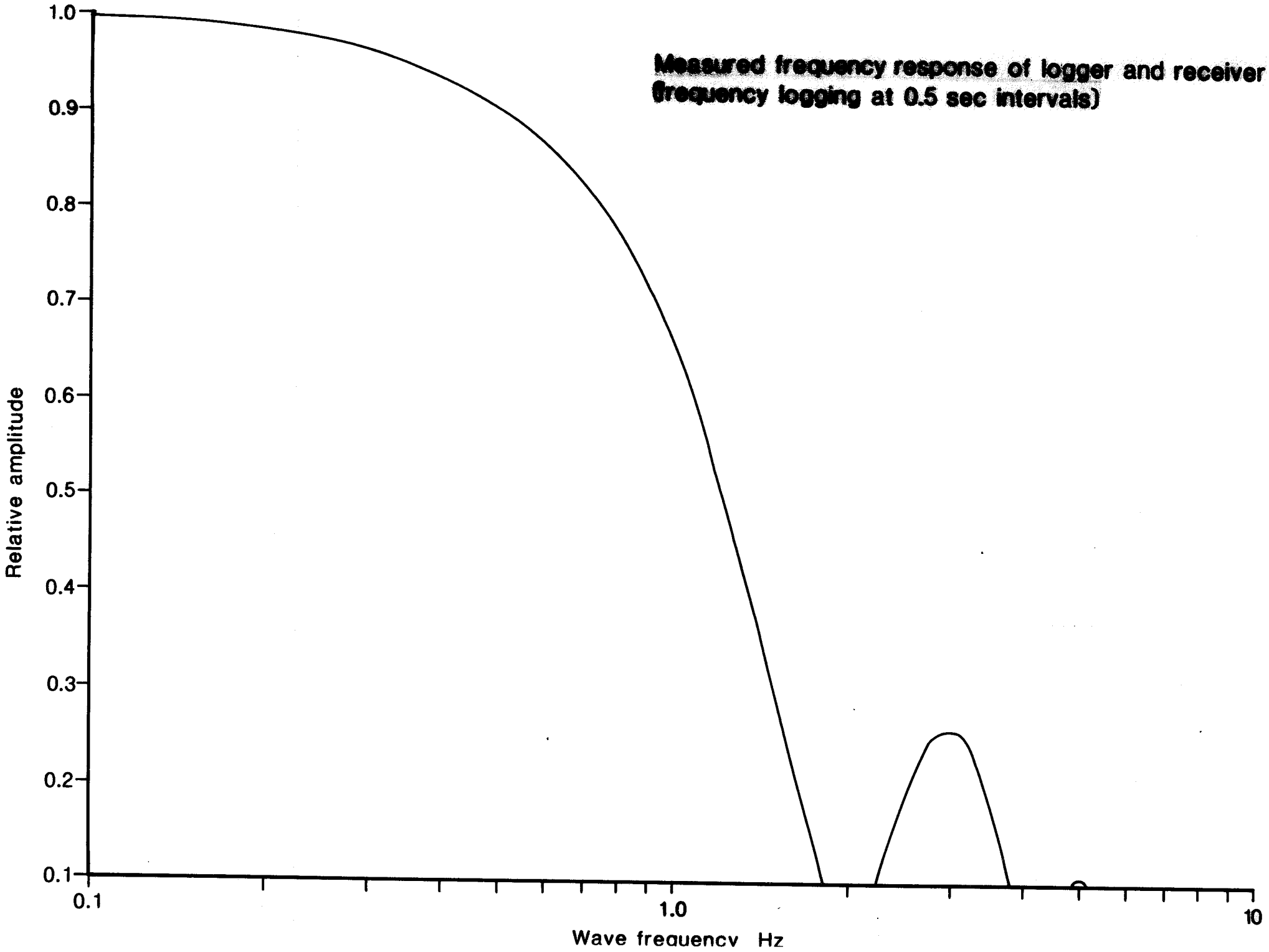
The buoy has a calibration of 1.86 Hz/metre with an increase in frequency corresponding to an upward motion of the buoy. As the Waverider frequency is subtracted from a higher fixed frequency, the logged number of counts will decrease with upward motion of the buoy. The logged count will change by -1.86 x 64 count per metre for upward motion.

To make data processing simpler, the logger records a sign (+ or -) before each data point. These have no arithmetic meaning, and are used purely as Channel identities.

The frequency response of the system is determined by the time over which the frequency is counted (0.5 sec) and is of the form $\frac{\sin x}{x}$. This will be slightly modified at high frequencies by the response of the phase locked loop.

The appropriate response graphs are attached.


Measured frequency response of demodulator board for Eddystone receiver.(voltage logging)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Relative amplitude
0.1
1.0
10
Wave frequency Hz


Measured frequency response of logger and receiver
(frequency logging at 0.5 sec intervals)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Relative amplitude
0.1
1.0
10
Wave frequency Hz