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INTERNATIONAL SCIENCE AND TECHNOLOGY INSTITUTE

Consultant Report

Telecommunications Study

for

the North West Cooperative Association, Bamenda

February 1993

By

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1. SUMMARY

This report gives details of a survey carried out to recommend a means of providing telecommunications facilities between the NWCA Head Office in Bamenda and the associated coffee Union Administrative offices.

There are eleven cooperative Unions requiring communications. These are namely:-

(a) Central - Bamenda
(b) Santa
(c) Pinyin
(d) Bali
(e) Moghamo
(f) Mbengwi
(g) Kom (Njinikom)
(h) Ndop
(i) Nso (Kumbo)
(j) Nkambe (Mbiye)
(k) Oku.

Due to its close proximity to Bamenda, Central Union will not be included in the radio system planning.

Various schemes were looked at but with the results of the visual inspection and the map studies it is apparent that the only system which will link all the Unions to Bamenda is one based on the use of High Frequency radio transmitter/receivers.

It is a requirement of the Ministry of Posts and Telecommunications that the proposed system has to have approval from both the Ministry and the security departments. When this approval is given, a frequency will be allocated and a license issued.

Details are given in this report about the license application forms and the various charges levied by the Ministry of Posts and Telecommunications.

The Chief of Sector (Mr. Asanji Clement)- Radio Section - Bamenda receives the local application forms and liases with Yaounde for the allocation of frequencies and licenses (See Licensing Section 5.1)

The installation of the equipment whilst being of a simple nature requires good supervision and direction to give the best possible service to the users.

Once the system is installed and running the maintenance requirements should be quite low and if spare radios and parts are purchased with the main system equipment than the NWCA engineering department could have people trained in 'First line maintenance - i.e changing radios

or fuses etc.

For more technical repairs to the radio equipments the services of the MPT radio section could be sought to recommend a maintenance facility in Bamenda who, if supplied with spare parts, should be quite proficient and economic.

Most users of private Radio systems seem to import there own equipment and do not rely on services in Cameroon. It is usual for suppliers of radio equipments to offer a spare parts package for the repair of their equipments by trained technicians. The radio system recommended in this report offers a simple to operate radio with spares parts packages with which a technician with training could maintain the radio in a satisfactory working condition.

If required, during the procurement and installation phases, the nominated technician could be given "Hands on" training by an engineer carrying out the supervision of the installation of the system. This would allow the nominated technician to see how the equipment at each station is assembled and interconnected plus the necessary testing of the complete works.

The system as proposed will allow each of the Unions to pass to and receive message from the NWCA in Bamenda much quicker than the present system of using vehicles.

2. TERMS OF REFERENCE

The terms of reference are contained in the scope of work agreed for the communications specialist and are as follows:

2.1 GENERAL

To assess, evaluate and make recommendations on the purchase and installations of a telecommunications system to serve the NWCA and relevant Unions.

2.2 SPECIFICALLY

A. Travel to the N. W. Province Cameroon to assess the requirements for a communications system. This will also give the specialist first hand knowledge of the physical and technical problems associated with communications in the N. W. Province.

B. Assess all legal requirements for the set up of a communications system in the N. W. Province.

C. Assess the availability of spare parts, service personnel and the ability of telecommunication companies to service what they sell in Cameroon.

D. Assess, Evaluate and Report on all the systems available on the market which would be applicable to NWCA's needs. Indicate all the important points relevant to each system and provide guidance on which system would be the most appropriate for NWCA given the existing budget. Report on how the most appropriate system should be set up for NWCA in view of the new liberalized coffee market within which NWCA will operate.

3. SURVEY OF LOCATIONS IN NWCA

3.1 INTRODUCTION

A visit was made to the offices of all the Unions in the NWCA between 9/02/1993 and 16/02/1993. In which observations were made at each location to see if mains electricity was available, land was available for mounting an antenna, space was available for locating a radio in the Administrative offices and the surrounding terrain (i.e. Hills etc).

The results of each visit are detailed below:-

3.2 OBSERVATIONS

(i) PINYIN UNION

The Pinyin Administrative offices and processing Mill are located in the same compound. The compound is not connected to the mains electricity supply but has a 50 Kw generator designed to run the Mill. Power to the Administrative offices is only available when processing of coffee is taking place and therefore only in season.

There is ample space to install an antenna for the radio system and to locate the radio.

The site is located in a hollow in the surrounding hills which rise to a minimum of 100 - 150 meters on all sides.

(ii) SANTA UNION

The Santa Union Administrative offices are located along side the main tarred road from Bamenda.

Mains power is available on the site and there is plenty of space to mount an Antenna system and to locate the radio equipment.

From the offices the ground rises in the direction of both Bamenda and Mount Oku.

(iii) MBENGWI UNION

The Administrative offices are located in the same compound as the Mill and stores approximately 4 kilometers outside of Mbengwi town and towards Bali.

As at Pinyin no mains power is available at the Administration offices except on the occasions that the Mill is operating during the season.

There is ample space for locating an Antenna system and for the radio equipment.

From the Union offices high ground was observed to the west.

(iv) MOGHAMO UNION

The Administrative offices are in the same compound as the processing Mill approximately 3 km North of Batibo.

Mains electricity is not connected to the Administrative offices at the present time but Sonel is wired to within 500 metres of the site.

Ample space is available for a radio antenna in the grounds of the compound and there will be no problem locating the radio equipment.

No high ground (hills) was observed in the close foreground to the site.

(v) BALI UNION

The Bali Union Administrative offices are located in the market area of town some distance from the process mill.

Although the offices are wired for mains electricity it is not connected. Power poles are located approximately 500 m from the site and could be connected.

There is plenty of space for both the radio Antenna and the radio equipment.

(vi) KOM UNION (NJINIKOM)

The Kom Union Administrative offices are located at Njinikom.

Mains power electricity is connected to the site of a permanent basis. There is ample space for both the installation of the Antenna system and the radio equipment.

Although the site is situated on High ground it is still below the level of the surrounding hills.

(vii) NKAMBE UNION - MBIYE

The Nkambe Union Administrative offices are located across the road from the process mill at Mbiye.

The Manager told us that Sonel is connected to the process Mill and then to the Administrative offices.

Ample space is available for both the Antenna and radio system.

(viii) NSO UNION

The Nso Union Administrative offices and process mill are located on High ground close to Kumbo.

The Union Administrative offices have both Sonel mains electricity and MPT telephone services connected.

There is ample space for a radio Antenna system and the radio equipment.

(ix) OKU UNION

The Oku Union Administrative offices are located in the same compound as the process Mill at Oku.

The site is connected to the Sonel mains electricity and there is ample space for both an Antenna system and the radio equipment.

The site is in the shadow of Mount Oku which dominate the view to the South and West.

(x) NDOP UNION

The Ndop Union Administrative offices are located in the same compound as the process mill close to Ndop.

The site is not connected to the Sonel Electricity supply but the poles are only approximately 500 m on the road to Ndop.

There is ample space for both the radio Antenna and radio systems.

(xi) CENTRAL UNION

The Central Union Administrative offices and process Mill are located at Mile 2 Bamenda.

Sonel mains electricity and MPT telecommunication services are available on site.

There is ample space for an Antenna system and radio equipment if it was thought necessary.

(xii) NWCA ADMINISTRATIVE HEAD OFFICE BAMENDA

The NWCA is in a 5 story Building in Commercial Avenue Bamenda.

Sonel and MPT services are connected.

An Antenna System could be installed on the roof of the building, and the radio equipment located in an Administrative offices.

4. TELECOMMUNICATIONS NETWORK

4.1 Telecommunication Requirements of NWCA

The Head Office of the NWCA in Bamenda has facilities for telephone, fax and telex to all parts of the Cameroon and outside but most of the Unions are situated in very rural areas usually served by difficult road networks and have no telecommunications facilities at all. (Nso excepted this has a telephone connected).

It has therefore been proposed to provide a telecommunication system linking all the Unions and NWCA using the best or most appropriate system possible.

After discussions initially with the NWCA and Unions it can be said that, in order of preference, the following requirements for a telecommunication system apply:-

(i) At every Union normal Telephone/Fax connected to the MPT network allowing each Union to communicate anywhere in Cameroon.

(ii) Radio communication system linking each Union to the MPT telephone system.

(iii) Private radio system linking each of the Unions to the NWCA Bamenda office.

Telephone/Fax facilities are reasonably good between the main centres of Cameroon but development in the rural areas, where most of the Unions are located, is almost non existent and therefore the first preference would not at the present time be possible.

To provide item (ii) above would require individual radio links and possible repeaters between each Union and Bamenda using VHF or UHF links. Due to the nature of the terrain most paths between the Unions and Bamenda would require 1 or possibly 2 relay repeaters.

As each repeater would have to be housed and supplied with power and, due to it's nature, be in a remote area, the cost per line could not be justified.

Therefore it is proposed that a private radio system linking each of the Unions to Bamenda on a common frequency be supplied.

4.2 PRIVATE RADIO SYSTEM

4.2.1 Summary

It is proposed that a private radio system is provided linking all the Unions and NWCA Bamenda on a common channel.

It is possible that this system could be based on radio equipment in the VHF (Very High Frequency) or HF (High Frequency) bands.

With VHF equipments a direct radio path is essential between the communicating stations or via the two parties communicating and a relay station.

From the attached radio path profiles (appendix I) it can be seen that direct communications between Bamenda and the other Unions is blocked to a greater or lesser extent.

Additionally if it were possible to develop a relay station close to the summit of MT Oku some of the paths from the Unions are blocked (see path profiles of relevant paths).

From a financial point of view a system using VHF plus a repeater would collect extra charges - i.e. the number of charges for links would double, an extra transmitter/receiver would be charged for, VHF annual mile mileage charges are higher.

Additionally on MT Oku a small building would be required with power supply (solar or generators) and antenna structure to clear possible trees growing on top of the mountain.

Additionally maintenance would be very difficult due to access problems and as the whole system would rely on this one repeater long down times could be realised.

To this end it is recommended that the system adopted is ones using the High Frequency Band and without any relay stations.

4.2.2 HF BAND RADIO SYSTEM

With HF Radio systems it is not usual to have to consider obstructions in the straight line radio path as signals from each station will pass over even high obstructions.

Each station is equipped with a transmitter/receiver tuned to the operating frequency as designated by the Ministry of Posts and Telecommunication when the license to operated is issued.

At each station an Antenna and Antenna support system will be installed to give the optimum transmission of the radio signal between the main base station at Bamenda and the respective Unions.

To power the Radios it is proposed that they are driven from the mains electricity with fall back to a rechargeable battery in the event of power failure.

At those Unions without a permanent connection to the Sonel power it is proposed that a small generator is obtained to keep the batteries in a fully charged state.

At those stations not connected to Sonel but with the possibility of connection, this should be considered as a priority.

4.2.3 ANTENNA SYSTEM

High Frequency Antenna systems can be broken down into two main parts namely.

(a) The Antenna
(b) The support System

Due to the fact that the proposed HF Radio system will be a single Frequency system it is proposed that the Antenna be a centre Fed Dipole Tuned to the given Frequency.

At the Unions the Antenna support system would consist of one or two poles 14 - 15 metres high to the top of which the Antenna is attached.

At Bamenda, the Antenna will require only 1 support pole of 12 - 14 meters with the centre of the Antenna supported by the top of the pole and the end arranged in the form of an inverted "V" Shape - See leaflets attached Appendix (iII).

4.2.4 HF RADIO EQUIPMENT

The type of equipment to be utilised on this project should be the simplest to operate so that after switching the equipment on the minimum of tuning should need to be done by the operator.

The equipment should be crystal controlled on the allocated frequency only.

A simple radio/transmitter/receiver is the AEL type 3030 and the costs have been based on budgetary prices obtained from the company. (leaflets attached).

4.2.5 INSTALLATION

The installation of the HF radio equipment consists of the erection of the support poles for the Antenna. The poles should be oriented for best signal to the main station at Bamenda. The Antenna which should have been cut to the correct length is then supported between the poles and the Coaxial cable taken to the radio set location. After connector of the Antenna to the radio the radio is ready for link testings.

As the radio is fully tuned before delivery no adjustments should be required after the set has been on for 10 minutes.

With the necessary equipment a test of the antenna and transmitter power output can be made and any adjustments to the length of the Antenna wires and transmitter output made.

The orientation of the Antenna is such that with the Antenna suspended from two poles the line of the Antenna is across a line between the Union and Bamenda.

At Bamenda all round operation is required so the Antenna suppliers would be suspended on one pole only with the ends of the Antenna brought to within 2 metres of the ground to form an inverted 'V' formation.

5. LICENSING

5.1 INTRODUCTION

All private radio networks are controlled by the Ministry of Posts and Telecommunications of Cameroon.

An application to install and operate a private radio network is submitted to the Chief of Sector- Radio Section, Ministry of Posts and Telecommunications, Bamenda.

The Chief of Sector will then submit the application to Yaounde for approval and allocation of an operating frequency for the network. The procedure up to the issue of the license can take 6 months but the Chief of Sector can request Yaounde to issue a temporary permit to operate for three months prior to the issue of the license.

5.2 THE APPLICATION FORM

The application for a license form N° DT-TST-01 must be completed and submitted in four copies to the Delegation for the Ministry of Posts and Telecommunications in Bamenda.

The form of application also has an additional Annex to as again be completed in quadruplicate. (copies of both forms are attached to this report).

Paragraph "3" to "6" of the application form N° DT-TST-01 deal with the details of the applicant which will be NWCA and are self of explanatory.

Paragraph '7' details the reasons for requiring a Radio network for NWCA and would include justifications such as improving the working of the Unions and improving communications between Bamenda and the Unions. (etc)

PARAGRAPH '8'

This paragraph is only required to be filled in if repeater stations are required but not if only a "High Frequency" system is requested.

PARAGRAPH '9'

This paragraph required a sketch showing the locations of all the stations in the proposed network and the distances between them. It should show which stations require to communicate with each other, in this case Bamenda with the other Unions only.

The sketch is attached to this report on the copy of the application form.

PARAGRAPH '10'

This paragraph lists the station number allocated in Paragraph '9' plus the address of that station.

PARAGRAPH '11'

Details the band of frequencies that the proposed Radio equipment will operate in and the model and mark number of the Radios including the power output of the transmitter.

PARAGRAPH '12'

No.

5.3 LICENSING CHARGES FOR PRIVATE RADIO SYSTEMS

Annual charges for a private Radio system are based on two parts namely:-

(a) A charge for each transmitter/Receiver based on the antenna power of each radio set.

(b) A charge based on the distance between any two stations who require to communicate with each other.

The annual charges as received from the Delegation of the Ministry of Posts and Telecommunications in Bamenda are as follows:-

5.3.1 HIGH FREQUENCY

(a) Antenna Power up to 25 Watts - 5'000/bimestre - 30'000/annum
Antenna Power 25 Watts to 100 Watts - 9'000/bimestre - 54'000/annum.
Antenna Power greater than 100 Watts - 17'000/bimestre -102,000/annum.

(b) DISTANCE BETWEEN STATIONS (CROWFLY)

Up to 25 Km	-	25,000/bimestre	-	150,000/Annum
25km - 50km	-	50,000/bimestre	-	300,000/annum
50km - 100km	-	60,000/bimestre	-	360,000/annum
101km - 200km	-	69,000/bimestre	-	414,000/annum
201km - 500km	-	100,000/birmestre	-	600,000/annum
greater than 500km	-	100,000/birmestre	-	27,000 per additional 300km

5.3.2 VERY HIGH FREQUENCY (VHF)

(a) ANTENNA POWER

The charges are the same as for High Frequency (HF)

(b) DISTANCE

The distance charge for VHF are as follows:-

0 - 10km	200,000 F/annum
11 - 50km	400,000 F/annum
over 50km	700,000 F/annum

5.4 OTHER CHARGES

In addition to the annual charges based on distance and antenna power on Inspection charge of 15,000 francs is charged for each station inspected.

A charge of 10,000 francs CFA is charge on initial application and is non-refundable if the licenses not given.

6. PROPOSED SYSTEM COSTS

6.1 Radio Communications - HF - Annual License Charges and one of Charges

6.1.1 ONE OFF CHARGES

	CFA 000
Application charge for private system	10.00
Examination fees. for operator 11 station @ 10.000	110.00
Inspection for 11 station @ 15,000	165.00
	285.00

6.1.2 ANNUAL CHARGES (HF)

For transmitter Antenna Power not greater than 100w

Main station Bamenda	54.000
10 Out stations at Unions	540.000
	594.000

6.1.2.2 HF CHARGES DISTANCE

DISTANCES	NO OF STATIONS	CHARGE/YEAR STATION	
Up to 25km	4	150,000	600.00
25 to 50km	4	300,000	1200.00
51 to 100km	2	360,000	720.00
			2520.00
TOTAL ANNUAL & ONE OFF			3,399.00
TOTAL ANNUAL			3,114.00

The charges detailed show the annual licensing costs to be 3.114.000 FCFA for the main station and 10 Unions using HF Radio equipment.

If VHF Radio could have been used the annual license fees would rise to at least 5,095,000 FCFA due to the distances charges being higher.

6.2. CAPITAL COSTS OF RADIO EQUIPMENT

6.2.1 HF Radio equipment to consist of radio transmitter/receiver complete with microphone and built in power supply for AC mains or 12 volt DC operation for 11 stations. Dipole antenna tuned to the operating frequency but excluding support poles. (Price based on the type 3030 transmission receiver and AEL SD Antenna).

£28,000

6.2.2 INSTALLATION COSTS

11 Antenna support structured (poles) purchased locally (water pipes).
Installation 2 local technicians and labourer 3 days Bamenda and 1 day each Union
transport/motors etc. say £5,000

6.2.3 MAINTENANCE SPARES

To be held by NWCA engineering section.
1 Radio transmitter/receiver complete
1 set of spare circuit boards
1 set of consumable spares i.e fuses
lamps etc SAY £4,500

6.2.4 GENERATORS AND BATTERIES (LOCAL PURCHASE)

To supply mains electricity to Pinyin and Mbengwi with 1 kw portable generator. Stand by batteries for all stations heavy duty vehicle battery - local purchase @ £5.000

TOTAL COSTS £42.500

TOTAL COSTS & 10% SAY

6.3. MAINTENANCE

Due to the nature of the proposed equipment initial maintenance could be performed by the electrical department of NWCA - (with suitable training). This would include changing the radio if a fault is suspected. For maintenance of the Radio's an AD HOC arrangement can be entered into with the Radio section of MPT who will advise on the radio repairers.

To quantify the required maintenance on an annual basis is difficult but from experience say 1 visit per 6 months and 1
repair per year SAY £5,000

SUMMARY OF COSTS FOR RADIO NETWORK

OPERATING COSTS:

1.	Annual Charges for 11 stations	594,000
2.	Annual HF Distance Charges	2,520,000
3.	Total Annual Charges for 11 stations	3,114,000
4.	Annual Maintenance Costs (approximate)[1]	2,030,000
5.	Total One-Off Charges for 11 stations	285,000
6.	Total Charges for First Year	5,429,000 FCFA

CAPITAL COSTS OF RADIO EQUIPMENT[2]

1.	Radios, Installation, Spares, Generators	17,255,000 FCFA

[1] Pound converted at $1.45 per pound x 280 FCFA

[2] Pound converted at 1.45 dollars per pound. $1 equal to 280 FCFA.

APPENDIX 1

RADIO WAVES - VHF, UHF OR HF

APPENDIX (1)

RADIO WAVES - VHF UHF OR HF

To avoid confusion when using the terms UHF, VHF OR HF with regards to Radio systems or equipments. A very simplified explanation is given below:-

(i) WHAT IS UHF: - Ultra High Frequency - This term refers to any system or equipment operating above 300 megahertz but below microwave Frequency of 1500 megahertz.

(ii) WHAT IS VHF: - Very High Frequency - This term refers to any system or equipment operating above 30 megahertz and below 300 megahertz.

(iii) WHAT IS HF: High Frequency - This term refers to any system or equipment operating above 2 megahertz and below 30 megahertz.

The Radio signals in the three types of transmission UHF, VHF, and HF behave in different ways and possibly can be demonstrated by the following analogy pertaining to Cameroon.

In the HF bands Radio Buea, Yaounde or Douala etc can be received in Bamenda using a small radio with a WHIP antenna even though the signal must cross the high mountain between the transmission and Bamenda.

Conversely when travelling from Douala to Bamenda, the Bamenda FM Radio (VHF) cannot be received on a car radio until one approached Bamenda or you are travelling on high ground.

This means that the signal from FM (VHF) radio stations travels in almost straight lines, if any high mountains are in the way than the station can not be heard.

The TV service operates in the VHF & UHF bands and it is necessary to have Antennas mounted in such a way that they can "SEE" the TV transmitter aerials.

To summarise HF (High Frequency) Radio signals are transmitted in two ways. Firstly a signal can travel in a straight line from the transmitter to a receiver if there is no obstructing high ground (ground wave) but secondly and more importantly the signal is transmitted towards the sky (sky wave) where it is reflected (bounced) off a layer surrounding the earth called the ionosphere back to earth. This allows the signal to go over the high mountains and thus travel greater distances.

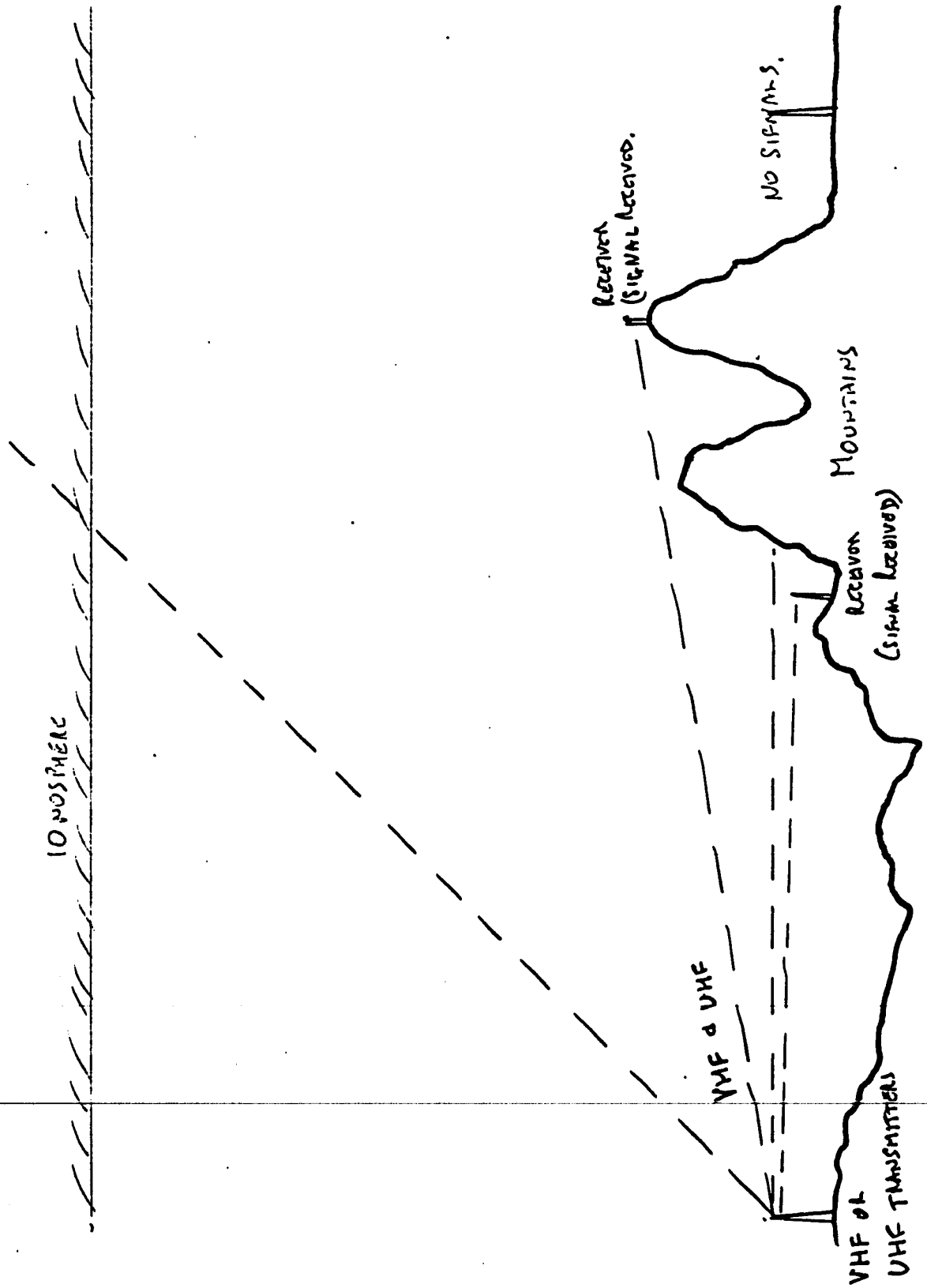
With VHF and UHF the primary transmission travels in almost straight lines and if any high ground is encountered then the signal virtually stops and a receiver at the other side of the

high ground would not hear anything.

Unlike high frequency radio if VHF & UHF signals were aimed at the ionosphere they would not be reflected back to earth but would just go through and disappear - this is due to the much high mission frequencies used.

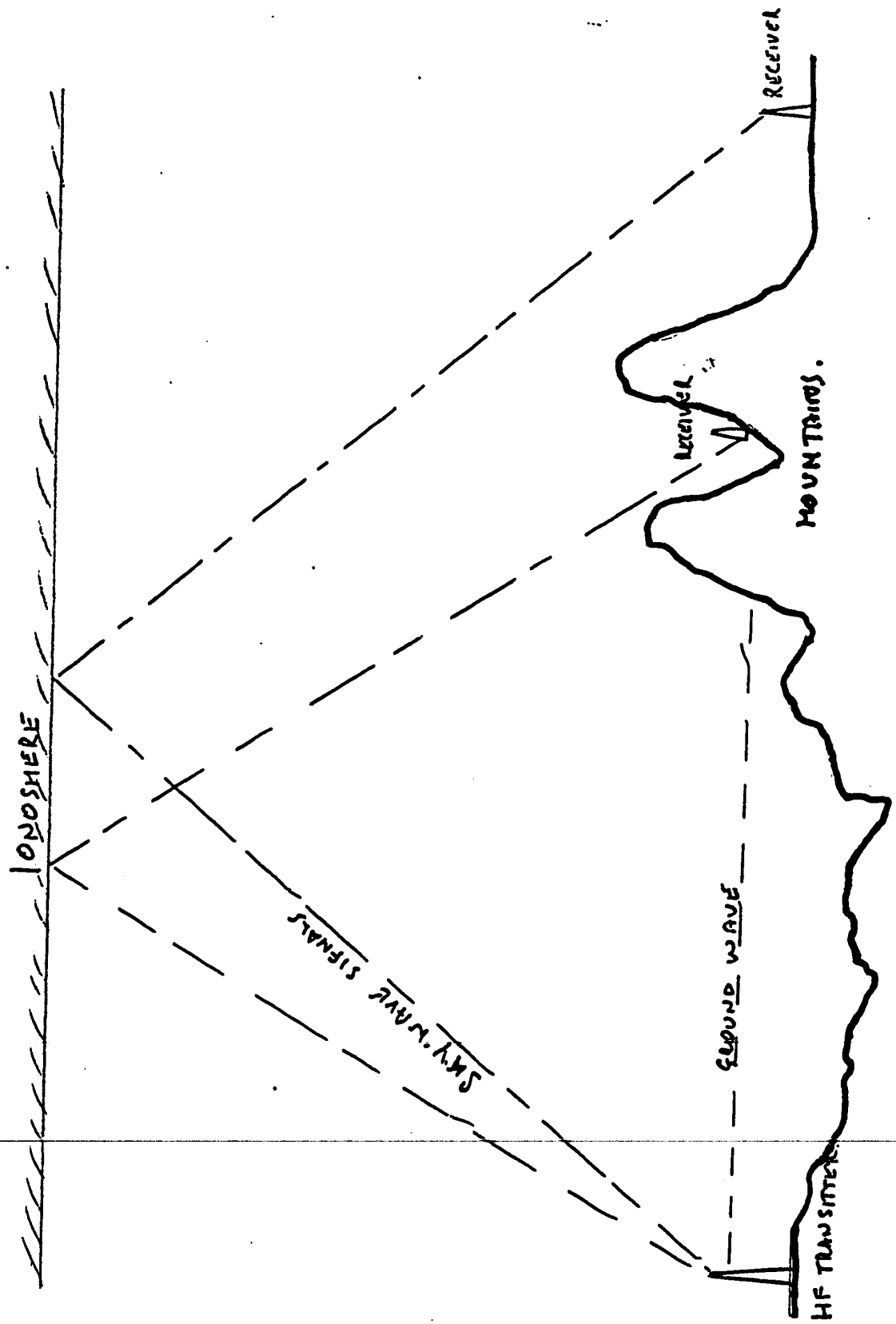
Attached are sketches illustrating these points.

When reading this section it is hoped that the reasons for recommending a system employing High Frequency (HF) Radio equipments to serve the NWCA and its associated cooperative Unions are more apparent.



VHF AND UHF RADIO TRANSMISSIONS

20A



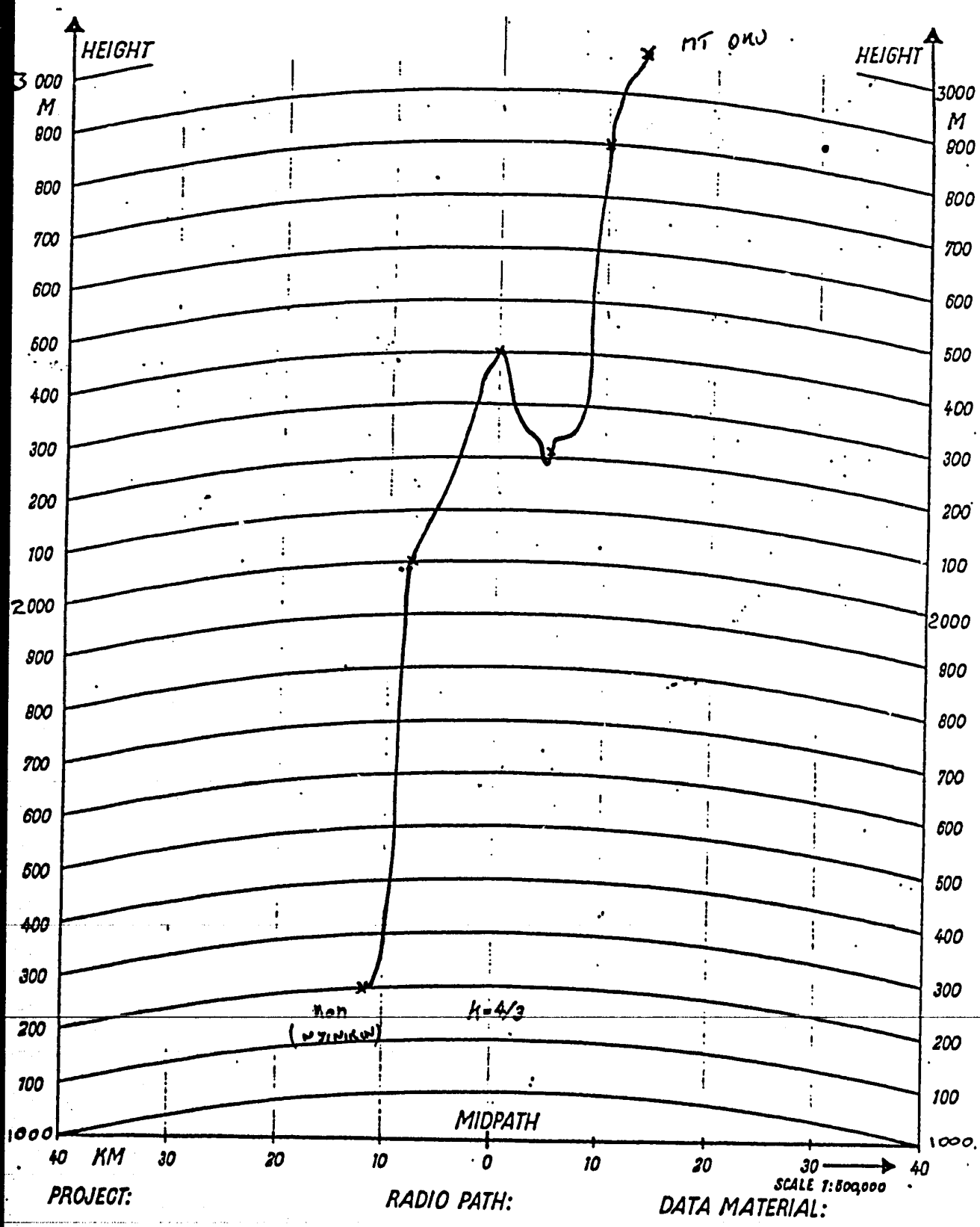
HF (HIGH FREQUENCY) RADIO TRANSMISSION

SKETCH 1

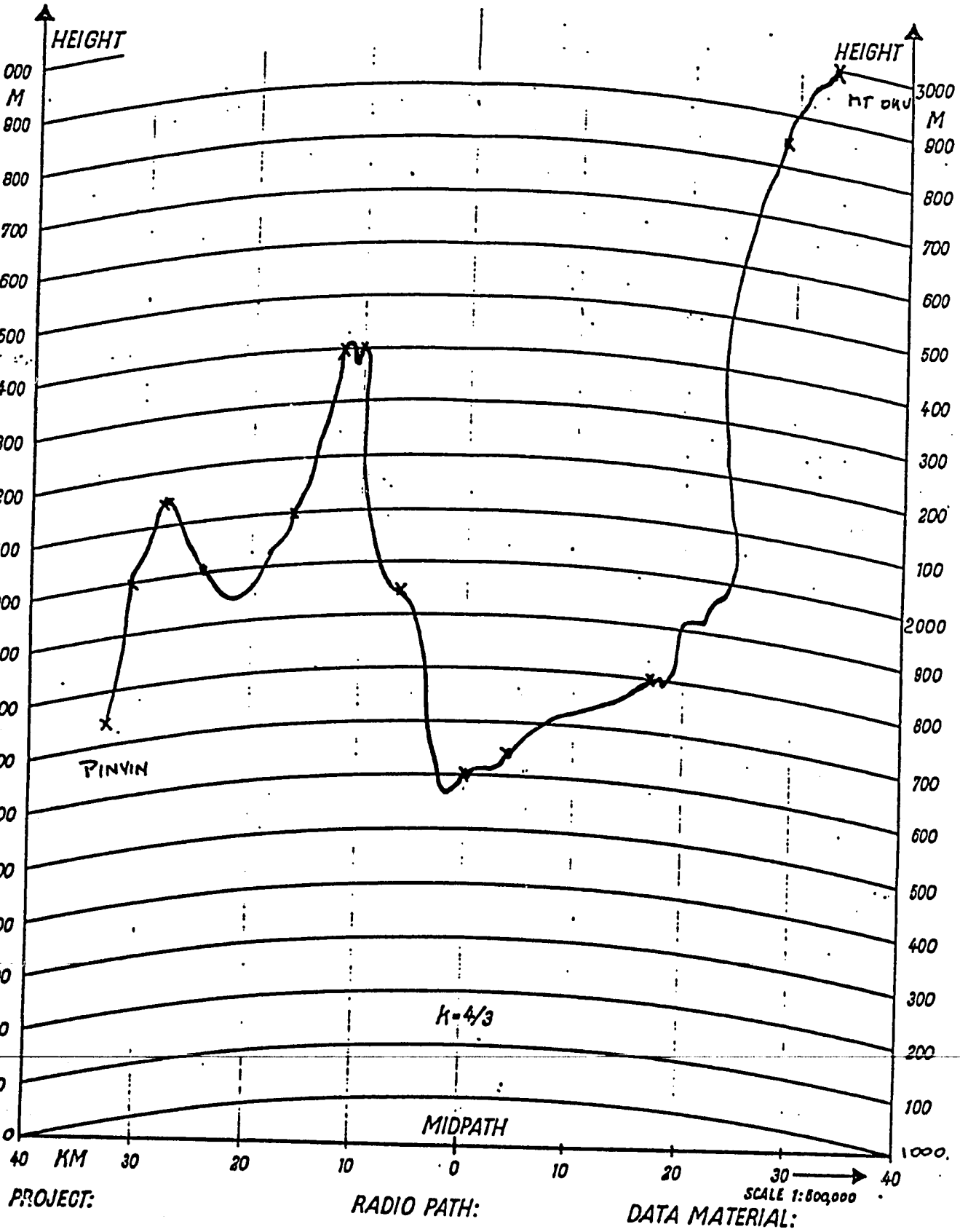
20B

APPENDIX II

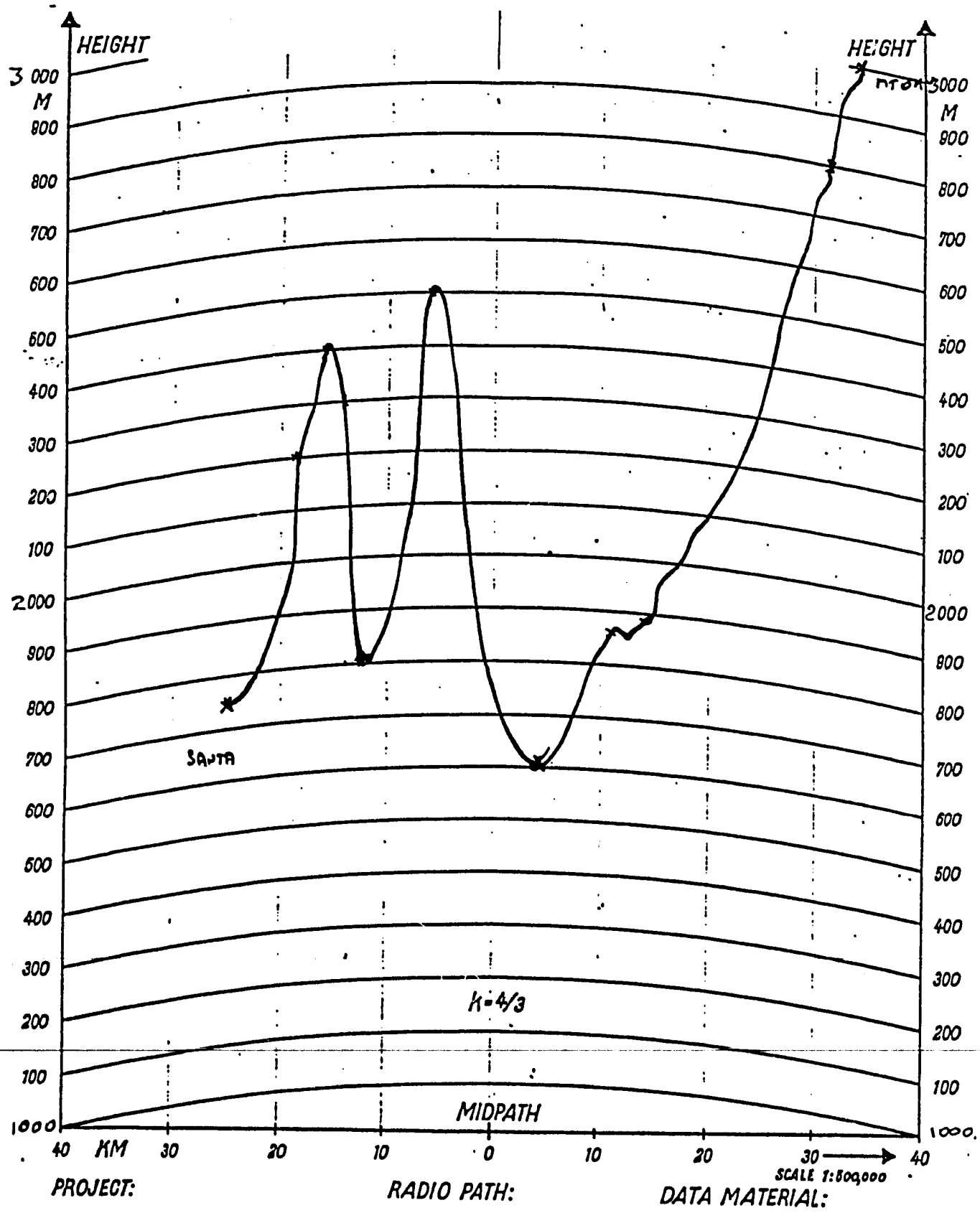
PATH PROFILES



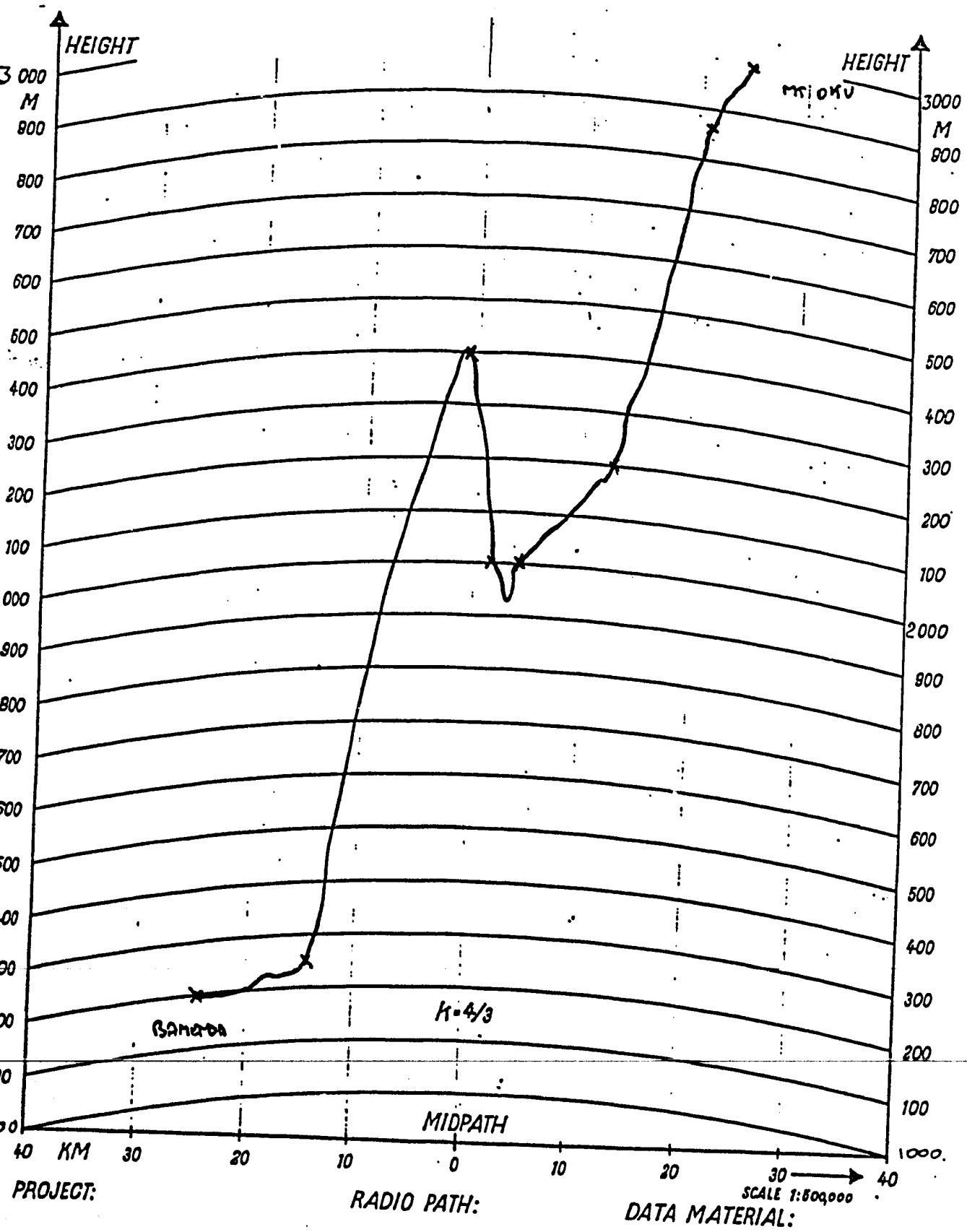
5. PROFILE:- KOM TO MOUNT OKU.



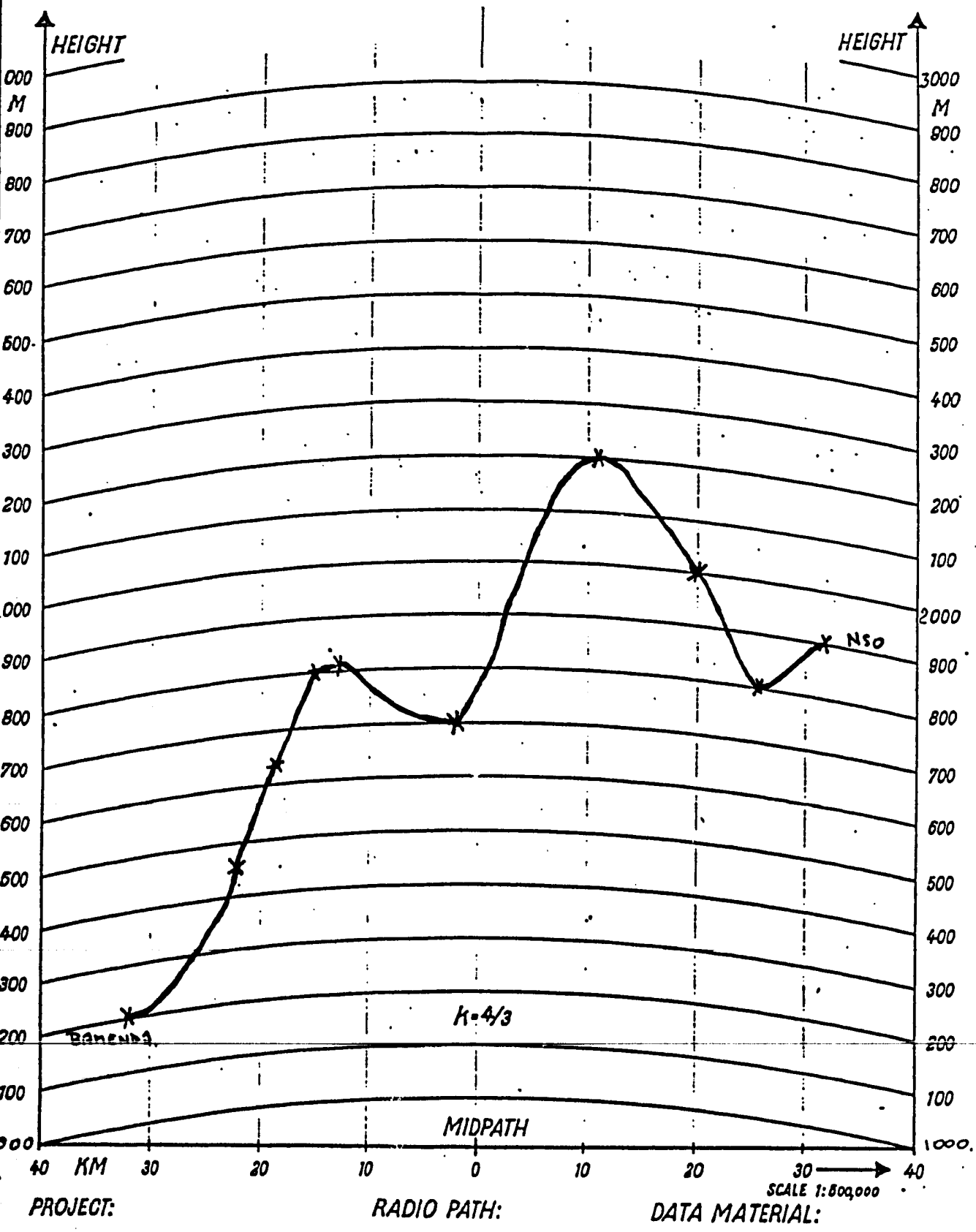
PROFILE: PINVIN TO



13. PROFILE:— SANTA TO MOUNT OKU



PROFILE:— BAMENDA TO MOUNT OKU



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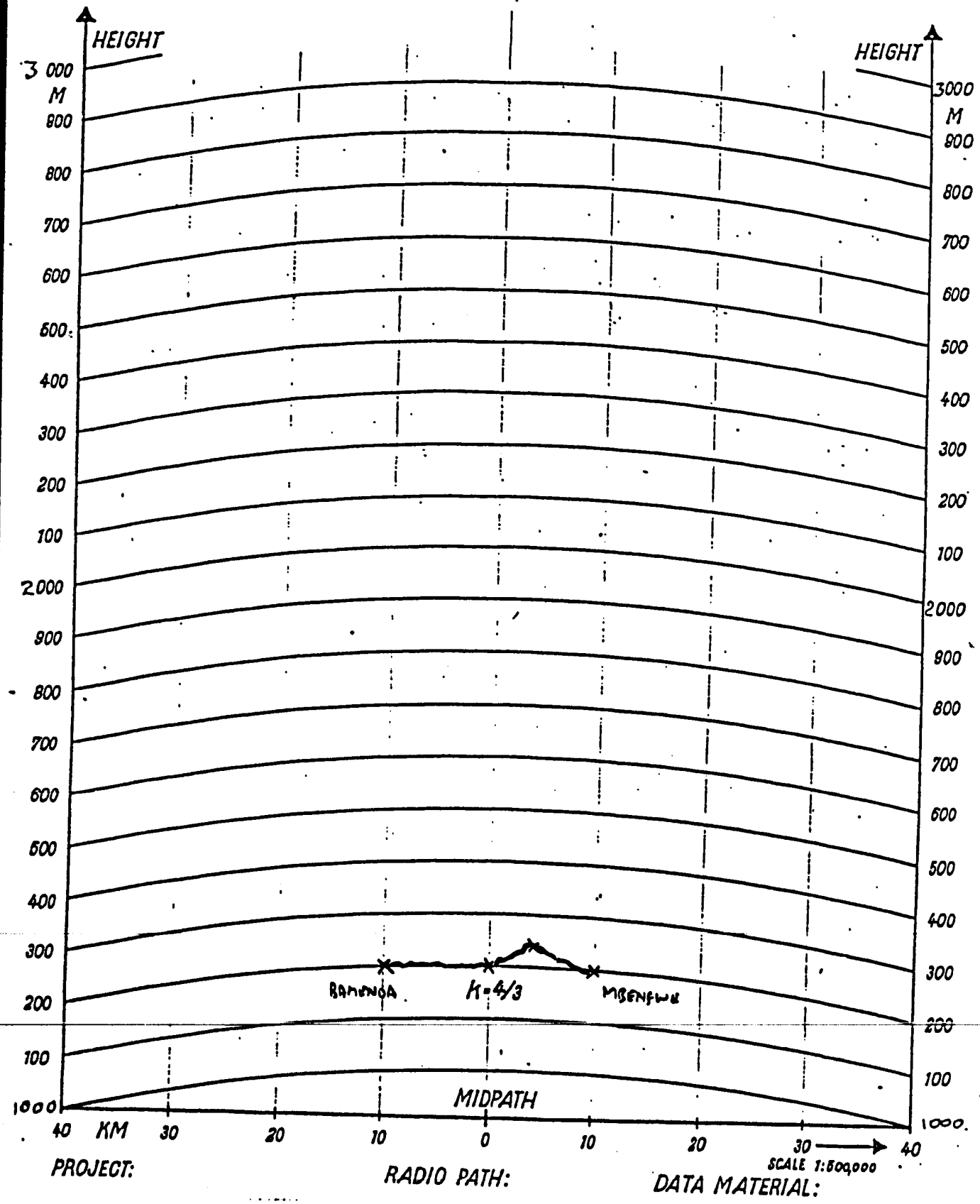
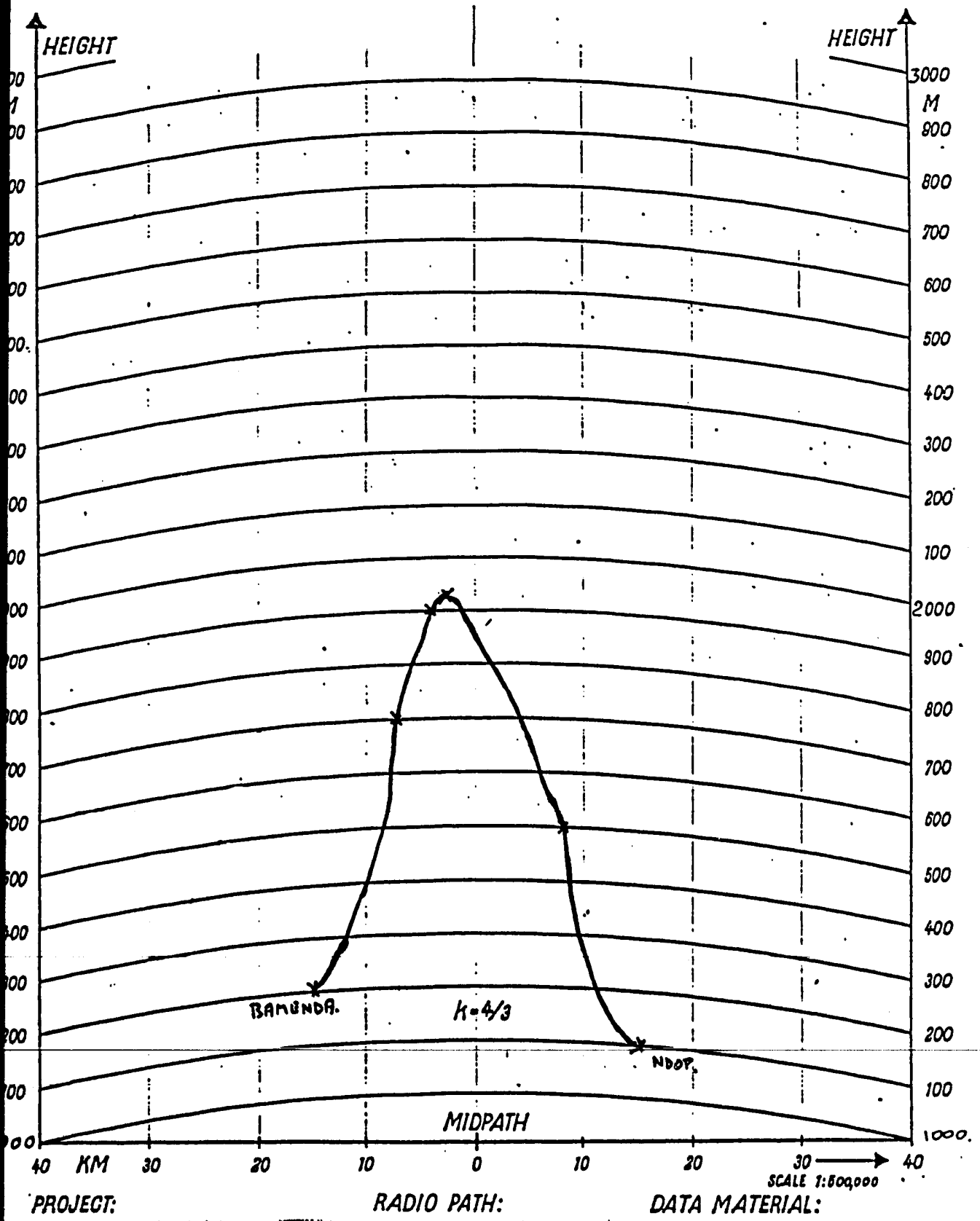
. PROFILE:- BAMENDA TO NSO UNION



10. PROFILE:- BAMENDA TO MBENGWI UNION



PROFILE:- BAMENDA TO NDOP UNION

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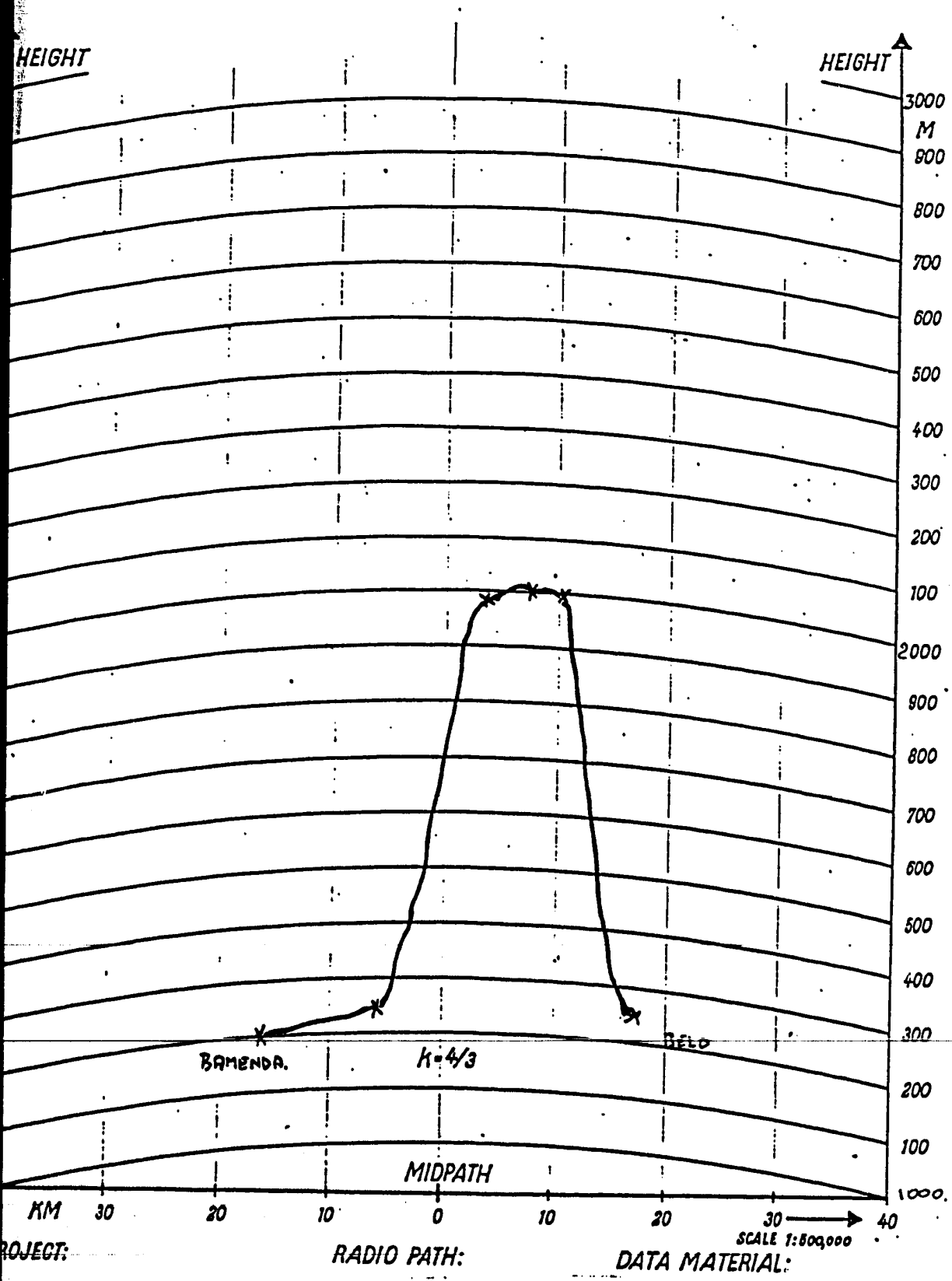
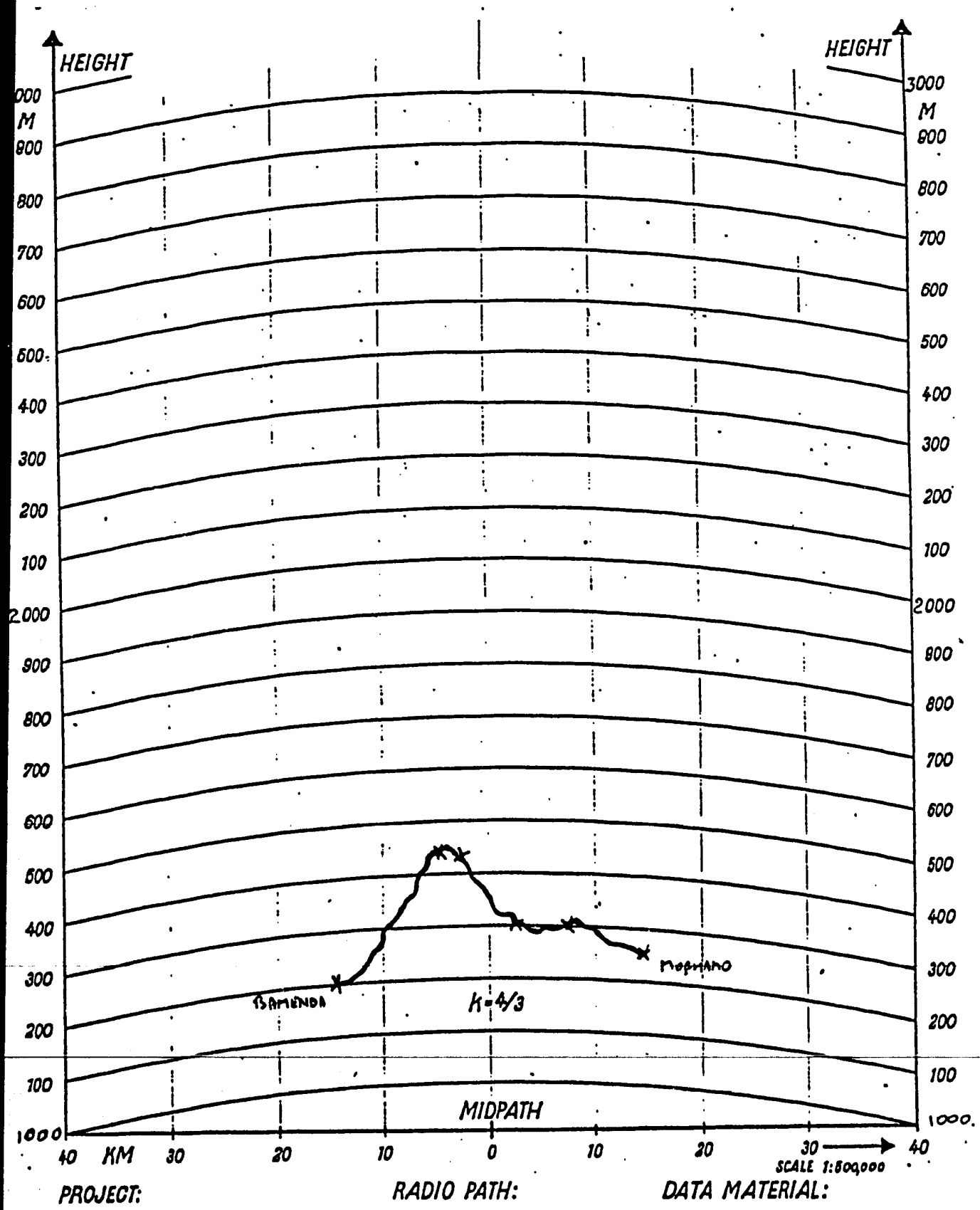
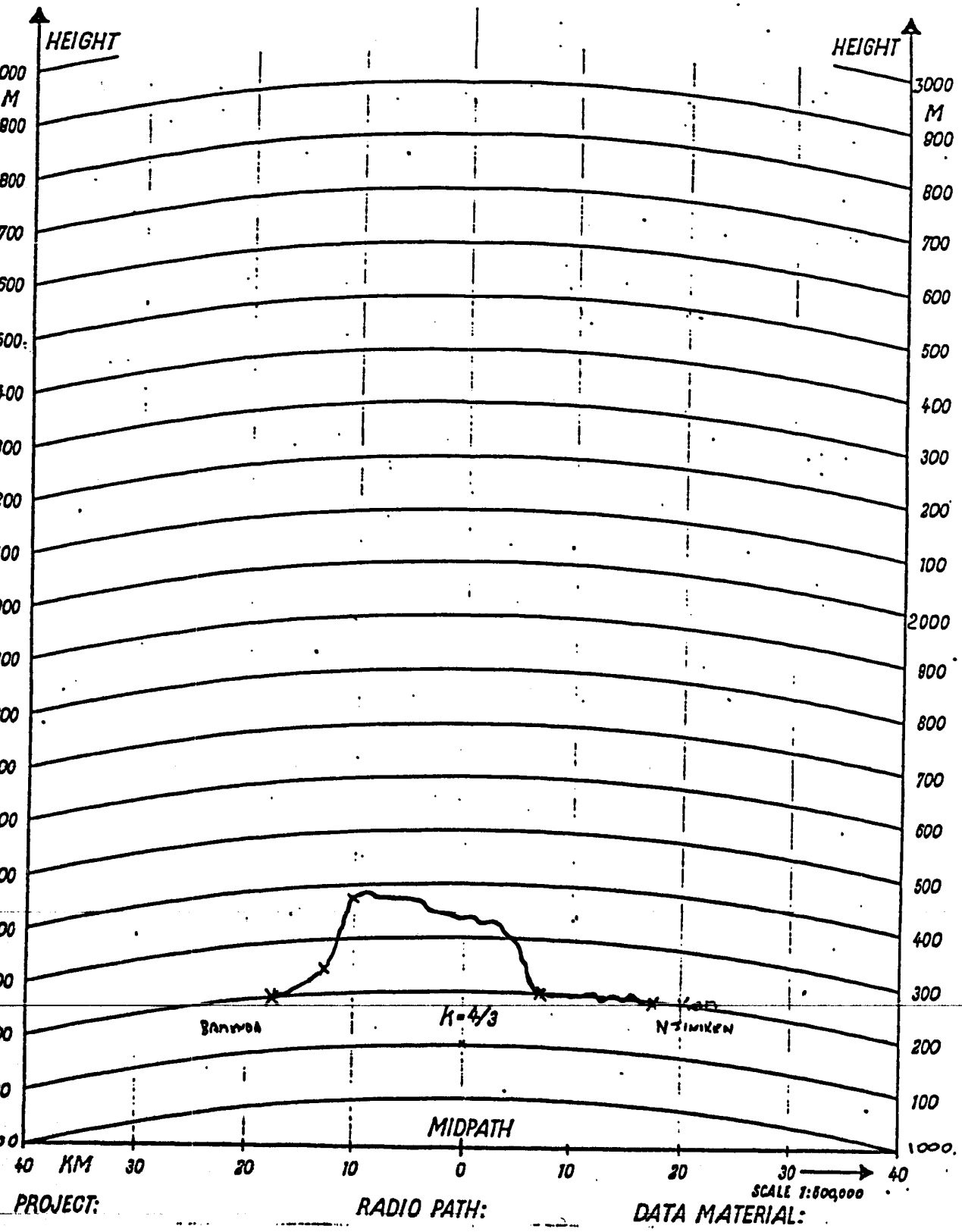


PROFILE:— BAMENDA TO KOM (BELO)
UNION

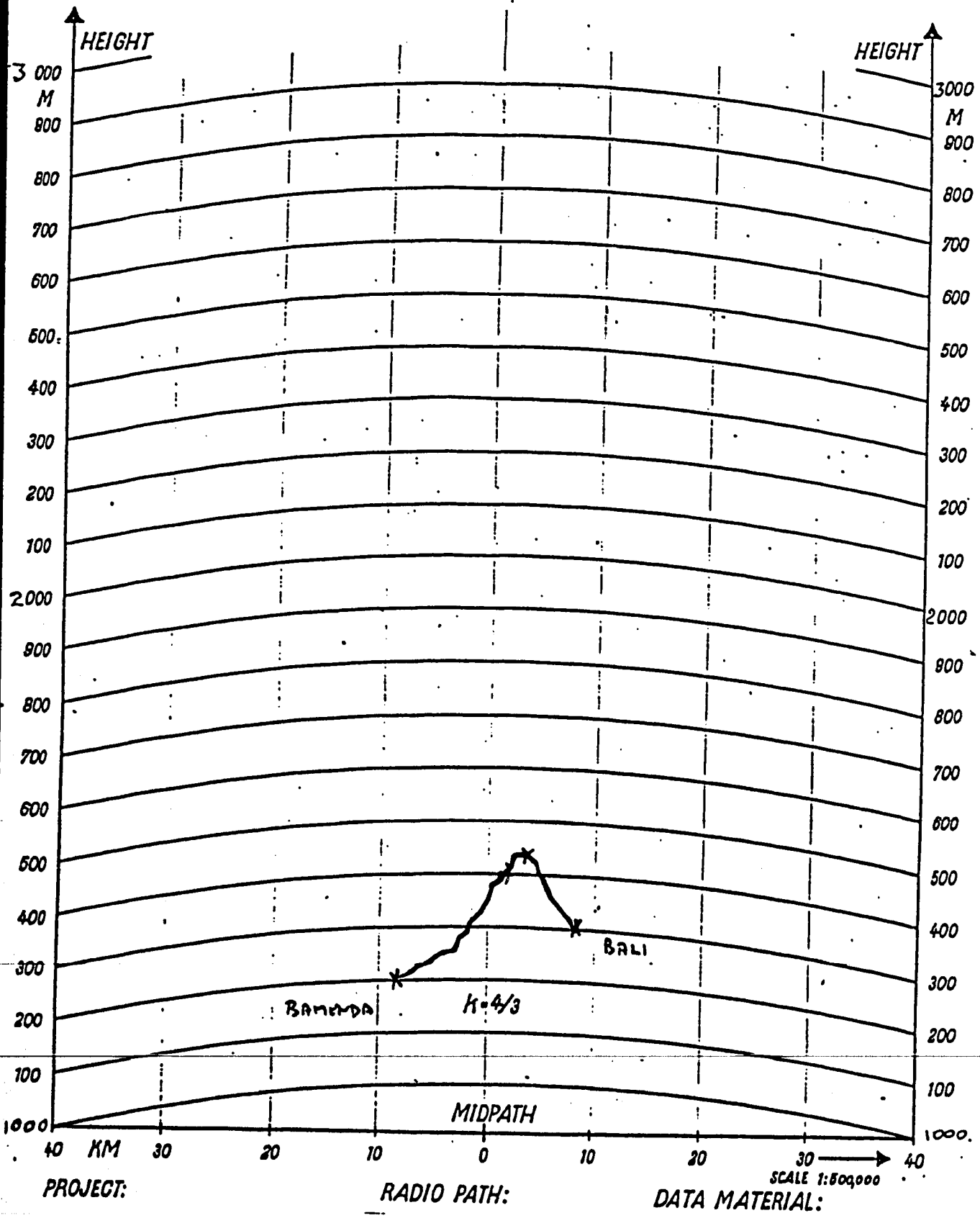


7. PROFILE:- BAMENDA TO MOGHAMO UNION



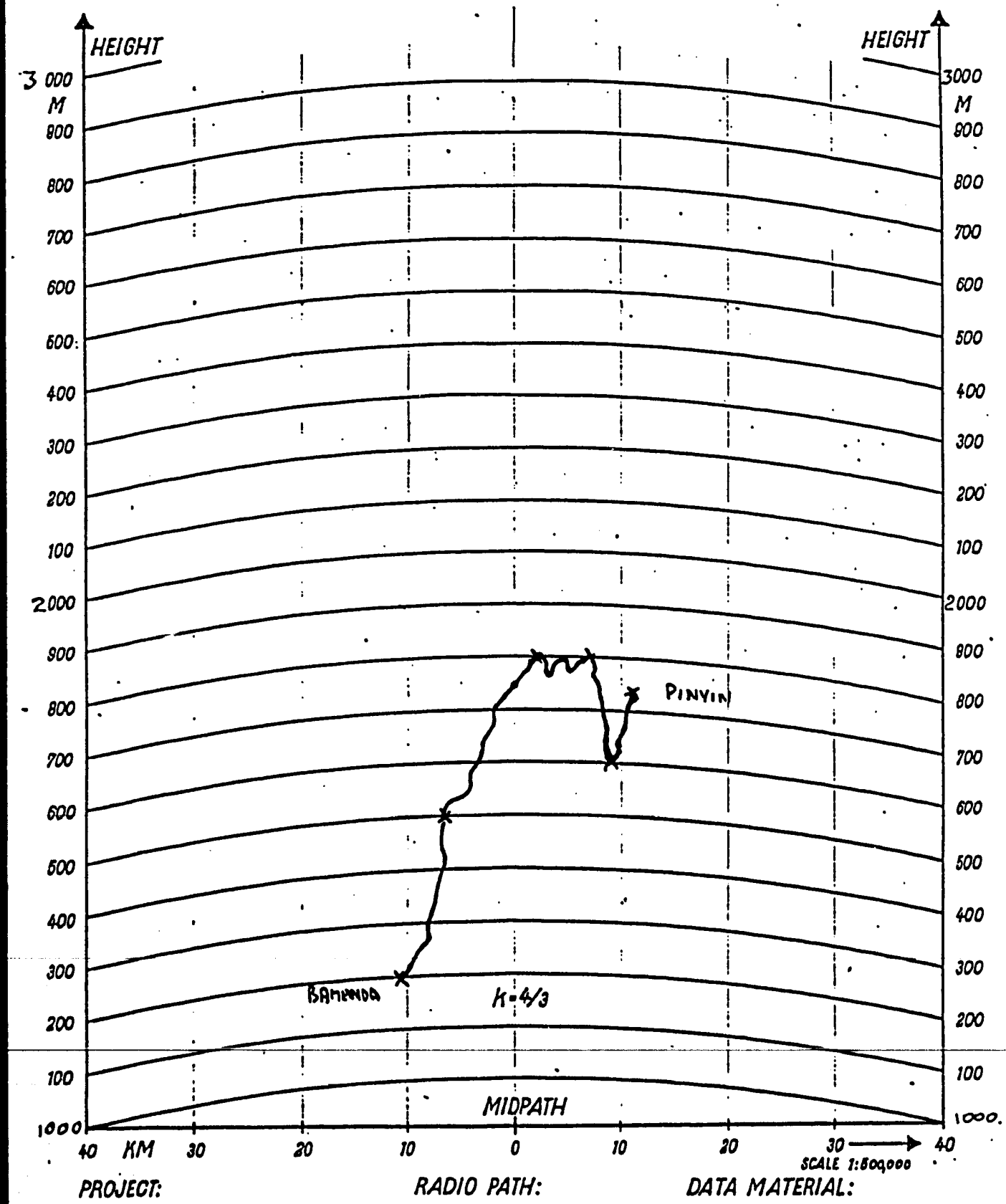
31

PROFILE:- BAMENDA TO KOM (NJINIKOM)
UNION

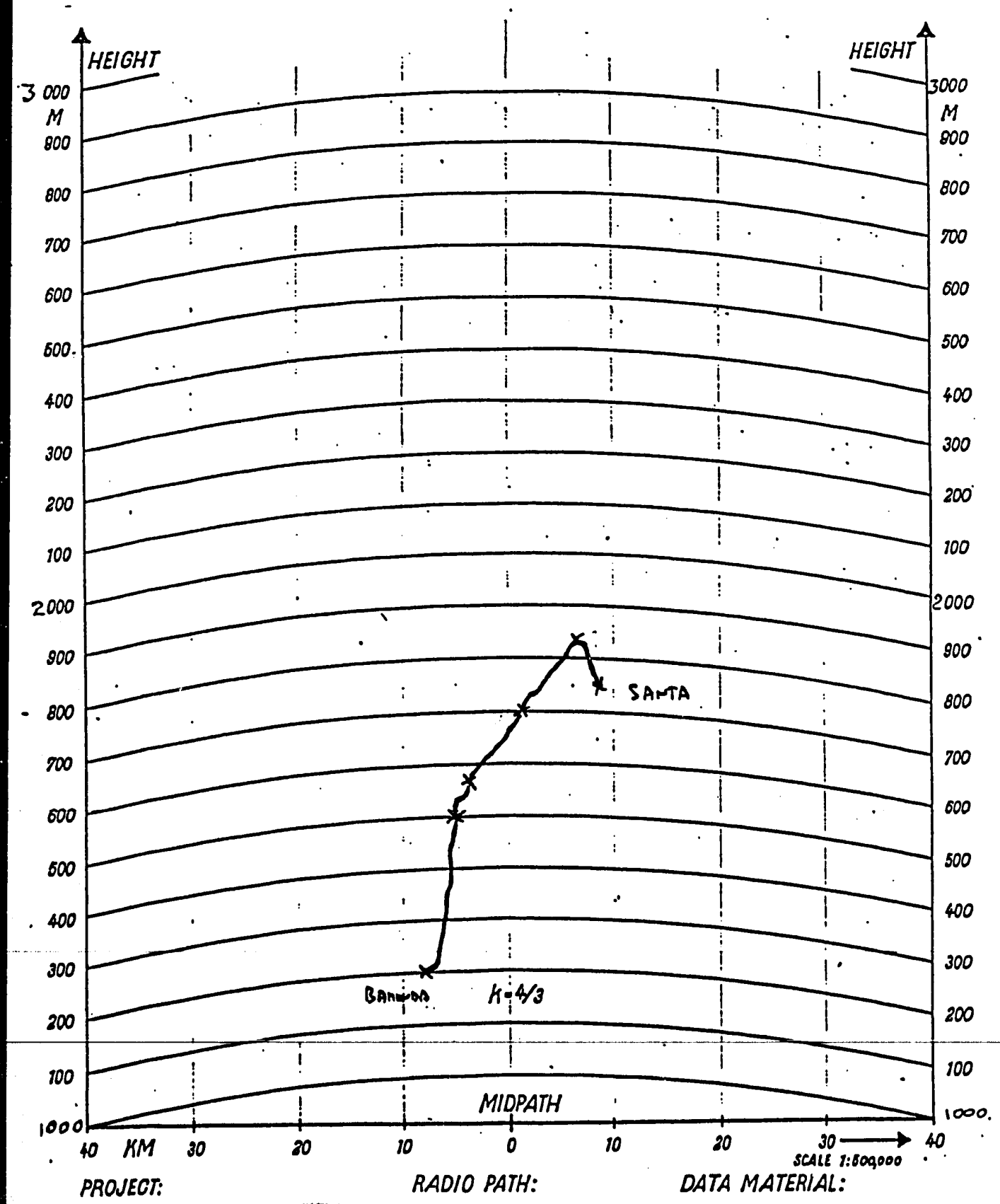


32

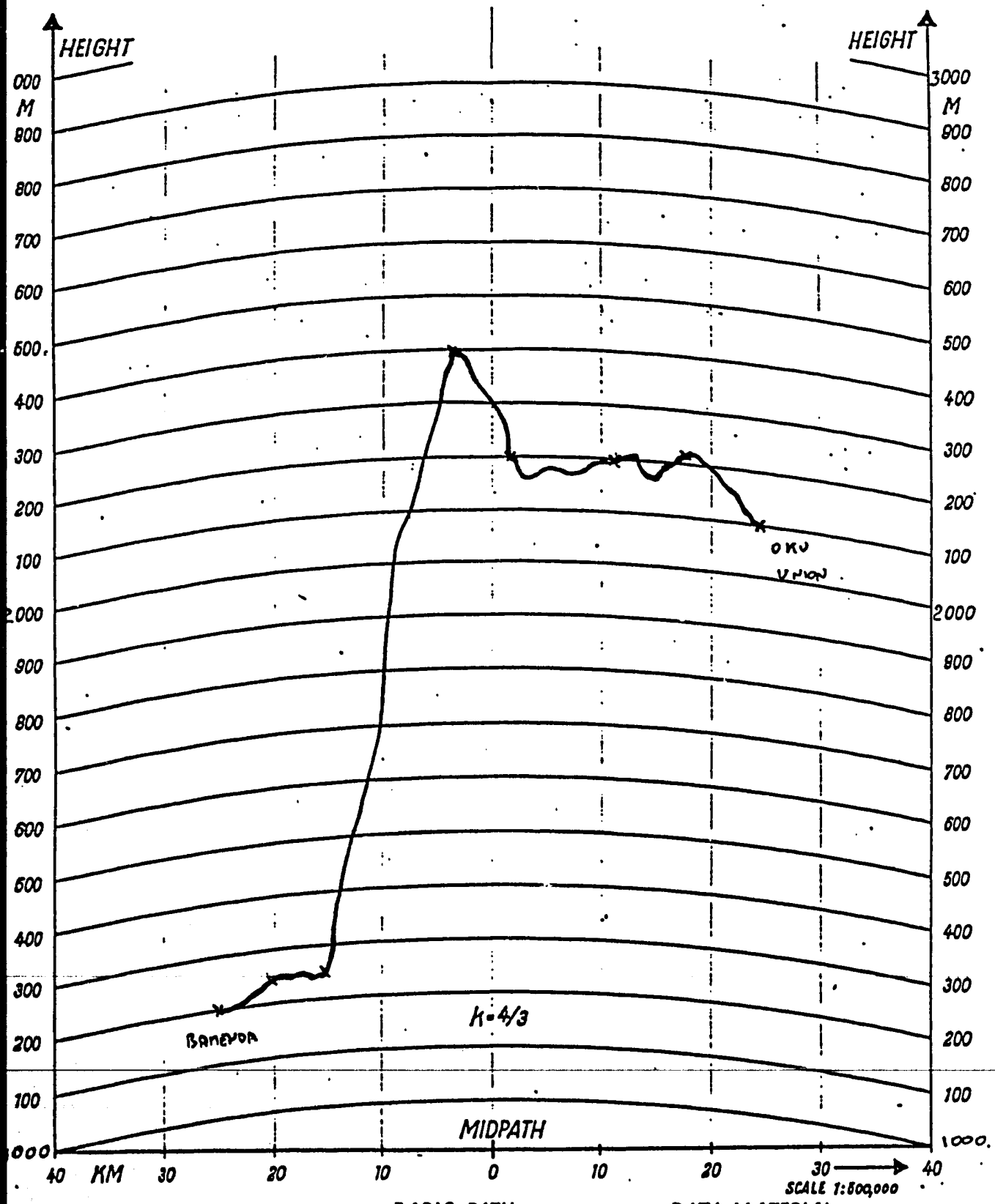
PROFILE:- BAMENDA TO BALI UNION



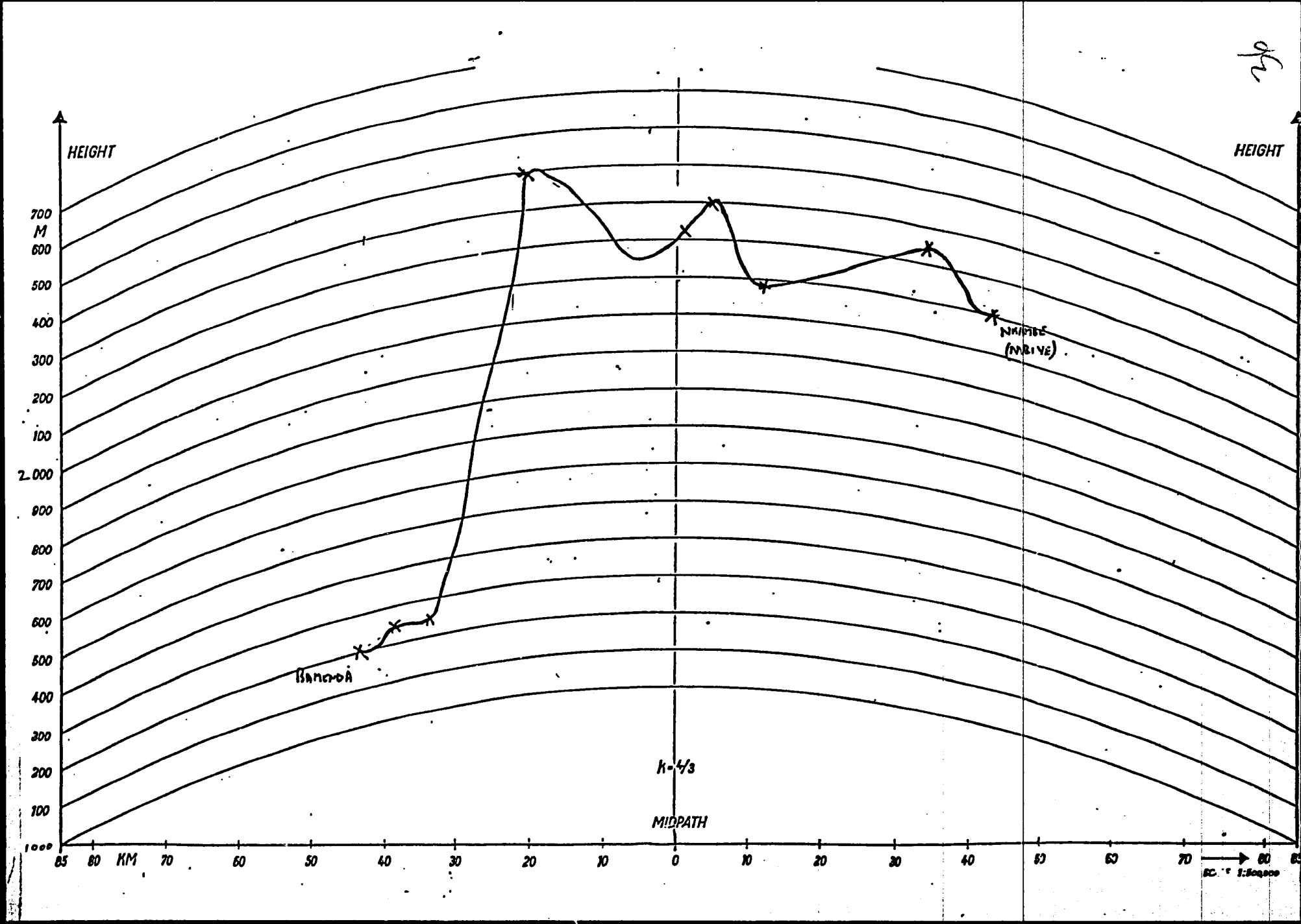
4. PROFILE:- BAMENDA TO PINYIN UNION



3. PROFILE:— BAMENDA TO SANTA UNION



PROFILE:- BAMENDA TO OKU UNION


HEIGHT
HEIGHT
700
M
600
500
400
300
200
100
2000
900
800
700
600
500
400
300
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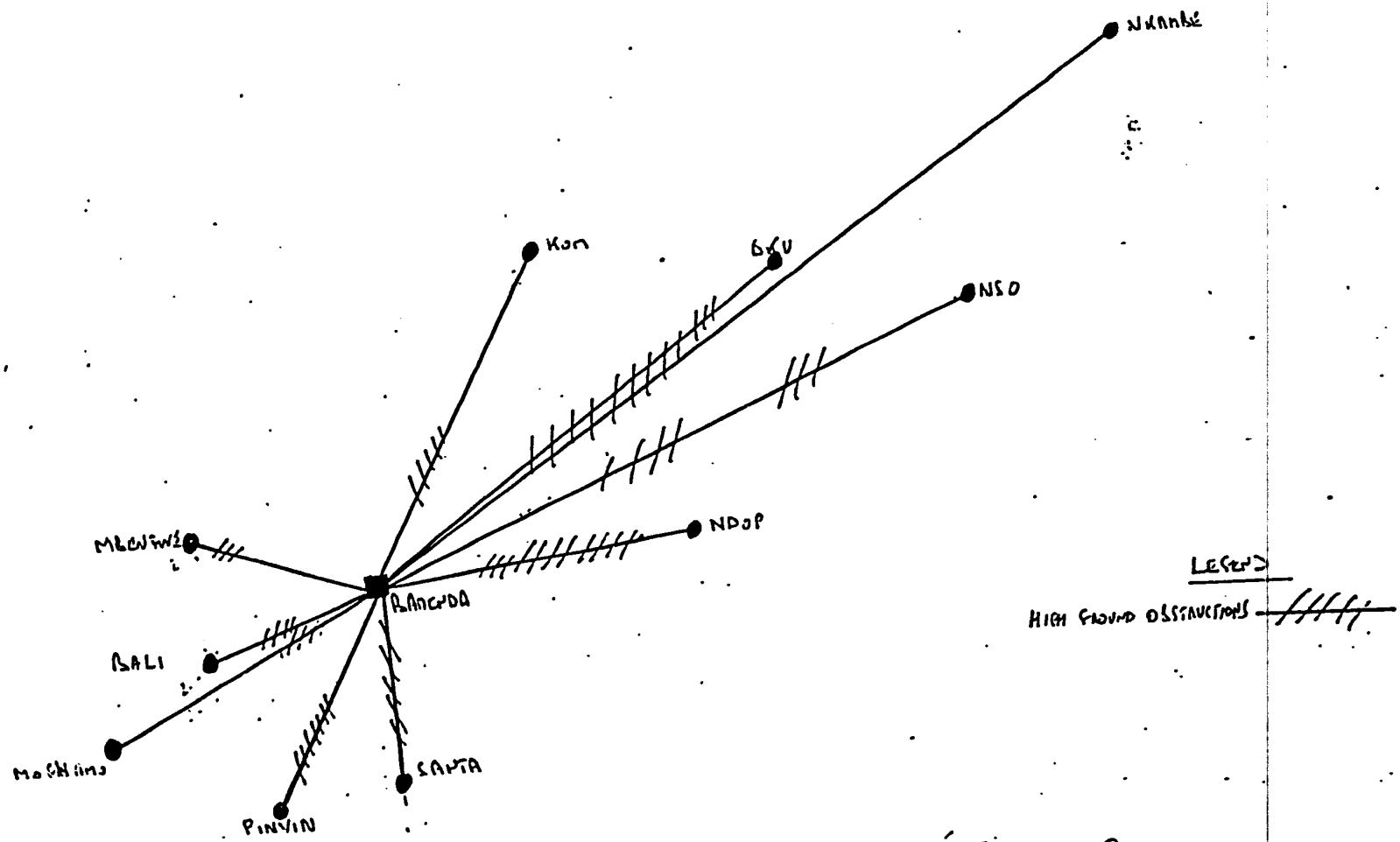
100
1000
85
80
KM
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
K=4/3
MIDPATH
BAMENDA
NKAMBE
(NABIYE)



VHF. PATH PROFILE SUMMARY

SCALE 1: 500 000 APPROX

APPENDIX III

AEL RADIO BROCHURE

AEL ANTENNA

COMMUNICATIONS EQUIPMENT FROM AEL

AEL SD/DT SERIES CENTRE FED DIPOLE BASE STATION ANTENNA SYSTEMS

GENERAL

To complement the AEL range of HF/SSB transceivers a selection of efficient wire dipole antenna systems is available for single and multi-channel operation on up to four pre-tuned frequencies in the 2 to 30 MHz band, in 150 W/500 W and 1 KW power ratings.

Each antenna is supplied with a centre balun transformer to reduce radiation and noise pick-up from the feeder cable, and each dipole element is terminated in a low leakage carbon loaded polypropylene insulator. A 30 m length of 50 ohm UR67 coaxial cable is provided - this is terminated with a PL259 UHF plug for connection to the transceiver.

ANTENNA TYPES

SD - single frequency dipole
DT2 - 2 frequency trap dipole
DT3 - 3 frequency trap dipole
DT4 - 4 frequency trap dipole

An expansion option up to a maximum of eight channels is possible using the 4-way Antenna Remote Switch Unit type ARS. This unit is controlled electronically from the transceiver channel selector switch and will provide automatic selection of a combination of the dipole antennas. The ARS unit may also be used to switch antennas for specific directional requirements on different channels.

CONSTRUCTION

The AEL SD half-wave dipole is electrically resonant at the operating frequency. The DT2, DT3 and DT4 multi frequency antennas ultilise trap sections to isolate the wanted sections of wire to retain half-wave resonance at each frequency. The wire elements are of 14 gauge hard drawn cadmium copper, and the trap sections and balun transformer are each sealed in an epoxy resin impregnated, injection moulded weatherproof encapsulation.

INSTALLATION

The antenna may be suspended horizontally between two suitable 10 m or 15 m masts - such as the AEL 1029 lightweight telescopic series. This will afford predominant radiation at right angles to the axis of the antenna, although this may not be so pronounced at lower frequencies. For omni-directional coverage one mast supporting the dipole centre with the ends brought down to within 2 metres above ground level in an inverted 'V' configuration is recommended.

SPECIFICATION

Frequency range:
2 to 30 MHz

No. of channels:
SD1-1 channel, DT2-2 channels, DT3-3 channels, DT4-4 channels.

Power ratings:
150 W standard - 500 W and 1 KW versions to order.

Construction:
Elements - 14 g hard drawn cadmium copper
Traps/baluns - epoxy resin - encapsulated and weather sealed.

VSWR:
1.5:1 typical at operational height of 10 m/15 m.

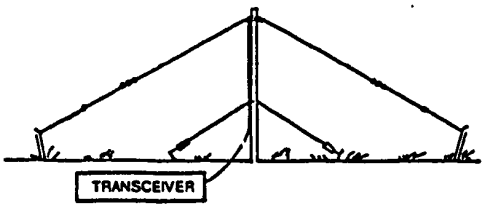
Impedance:
50 ohms unbalanced to 30 m UR67 coaxial cable.

Environmental:
Meets climatic requirements for tropical and desert conditions up to 70°C.

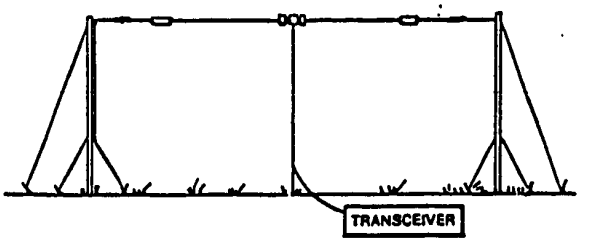
Maximum horizontal span:
234 ft. (71 m) at 2 MHz reducing to 15 ft. at 30 MHz.

Radiation pattern:
As half wave dipole.

Connector:
PL259 fitted as standard - others to order.



Inverted V dipole



Horizontal dipole

AEL COMMUNICATIONS LTD

Gatwick House, Horley, Surrey, RH6 9SU, England.
Telephone: Horley (0293) 785353. Telex: 87180 (AERO G)
Cables: Aerocon Telex Horley. Fax: (0293) 820722

AEL 3030

TECHNICAL SPECIFICATION

General

Frequency range: 2-16 MHz – continuous coverage 2-16 MHz except 3300, 4950, 6600, 8250, 9900, 11,550, 13,200, 14,850 ±5kHz.

Channels: 4 (standard) no restrictions on frequency – 6 (optional) the 2 additional channels must be spaced 1% from 2 of the 4 basic channel frequencies.

Mode of operation: Simplex USB or LSB (A3J) – USB and LSB (optional).

Optional modes: 2 frequency simplex-2 channels only – not available on 6 channel option; CW-DC model or AC model with external power supply; AM-A3H programmed on 1 pre-selected channel.

Ambient temperature range – 10° to +55°C.

Humidity: 95% relative, suitable for marine and tropical service.

Altitude: 5000M.

Controls: Front panel – Audio gain, RF gain, squelch, clarify, channel selector, on/off, USB/LSB; internal – carrier balance, microphone gain, ALC level.

Connectors: Front panel – microphone; rear panel – power connector 6 pin, 12 pin ancillary, antenna SO239.

Indicators: Power on – LED; Transmitter power output – LED.

Power Supplies: DC Model – 13.6V DC negative ground; AC/DC model – 155/230V 50/60Hz or 13.6V DC.

Power Consumption: (13.6V DC): Receive – 100-300mA; Transmit – 12A average, voice operation.

Dimensions: 32 x 29.2 x 10.5 cms approx.

Weight: 4.5 kilos.

Receiver

Sensitivity: 0.5μV for 20dB S+N/N.

Selectivity: –6dB 2.1kHz minimum; 50dB 5kHz typical.

AGC: Less than 3dB change in output for 100dB increase in input above 5μV EMF.

Clarifier: Incremental receiver tuning, connected only in receive mode.

Netting: Internal connection for netting transmitter frequency while in the receive mode.

Squelch: Front panel adjustment of the threshold level.

Audio Output: 4W less than 10% distortion.

Loudspeaker: 7.6cm 4 ohm internal.

Circuit: Single conversion all solid state, 1650kHz IF.

Transmitter

Power Output: 150W PEP*, ±1dB. NOTE: Power output 13.6V DC supply. Internal AC power supply rated for 150W PEP voice only.

Intermodulation Distortion: 150W-24dB 3rd order typical; 100W-30dB 3rd order minimum.

Frequency Stability: Standard – ±005%; Proportional Ovens .0001% or ±20Hz.

Audio Bandwidth: –6dB 400-2600Hz.

Carrier Suppression: –45dB.

Hum and Noise: –40dB.

Harmonic Suppression: –50dB typical, –40dB minimum.

ALC: ±10dB audio increase – power output <+.5dB – intermodulation distortion remains in specification.

Microphone: Gain adjustable for all medium or high output dynamic or ceramic microphones.

Antenna Filter: 5 pole Tchebycheff.

Circuit: Single conversion, 1650kHz IF, all solid state, final amplifier broadbend 2–16MHz.

*The AEL 3030/10S uses a broadband final amplifier covering the range 2-16MHz without tuning. The peak power output over most of this range is 150W. Variations in transformer matching may cause peak power output variations up to 1dB on certain frequencies in the tuning range. Internal adjustment can limit PEP from a minimum of 25 up to 150 watts.

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A long list of innovations and technical refinements have established the AEL 3030 as a leader in the communications world.

The 150 watt PEP solid state wide-band power amplifier – powered direct from 12 volts so no more high voltage power supplies with their inherently higher component failure rate. And even if the aerial is damaged in a storm – it can happen – the AEL 3030 power amplifier is fully VS WR protected.

In applications where output power is limited, the AEL 3030 can be regulated to provide a maximum PEP between 25 and 150 watts.

Excellent receiver sensitivity and signal to noise performance guarantees maximum signal retrieval under poor path conditions.

Outstanding AGC performance reduces operator fatigue and ensures minimum degradation of performance in close proximity to high power transmitters.

Front panel squelch control for silent background during traffic-free periods.

Designed for use under severe environmental conditions –10°C to +55°C.

Separate oscillator for each channel for maximum frequency stability.

Reliable low consumption light emitting diodes (LEDs) to indicate power on and transmit conditions.

Simplicity of operation.

Thermal cut-out on the power amplifier module for protection against inadequate ventilation or sustained transmit operation at high temperature. When the thermostat opens the output power is reduced to 15 watts until the heatsink temperature falls to a safe level.

Clarifier control for receiver fine tuning.

Operates from AC mains 115 volts/230 volts 40-60Hz from built-in power supply unit and from 12 volt DC. For sustained CW operation an external heavy duty AC power supply unit is available.

Automatic level control ensures correct drive and output conditions.

To provide maximum operational flexibility and versatility the following options are available:

Choice of upper and/or lower sideband.

Compatible AM (A3H).

CW operation using external adaptor.

High stability crystal ovens, ±20Hz.

Six channel operation. The extra channels must be adjacent to any two of the four basic channels, and are designated A and B and selected by a separate switch.

Semi-Duplex (two frequency Simplex) operation on any two of the channel frequencies. This is not available with the six channel option.

External heavy duty AC power supply for sustained CW and RTTY applications.

Mobile mounts for easy and convenient under-dash installation.

Anti-vibration mounting.

Automatic reversion from mains power to standby batteries in event of power failure.

Selective calling (single and multi-address CS1 and CS2).

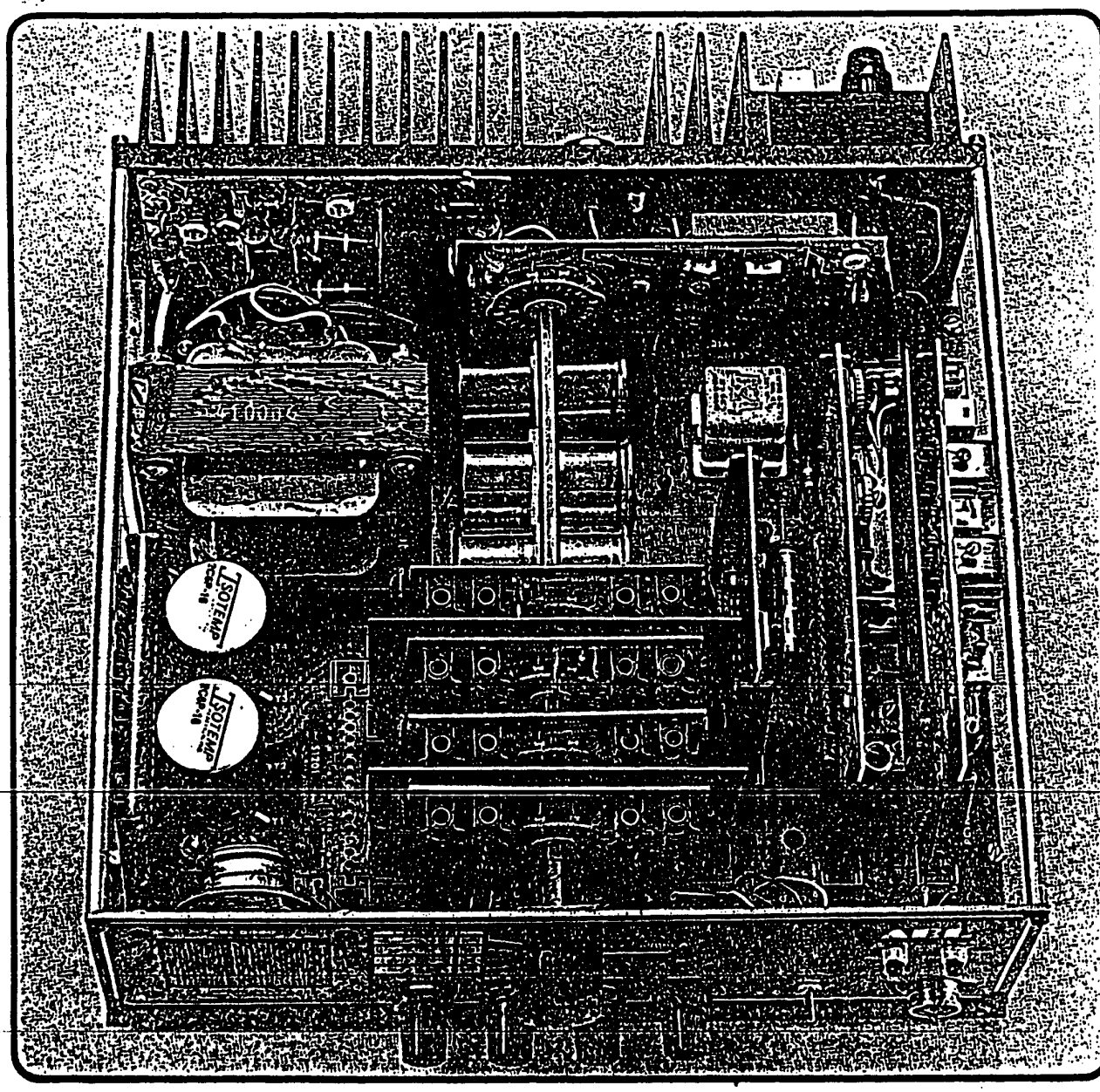
VOX operation.

User applications include:

- Police
- Government departments
- Survey teams
- Flying doctor services
- Port authorities
- Relief organisations
- Civil engineering contractors
- Forestry commissions
- Maritime organisations
- Missionary societies
- Petroleum companies
- Shipping companies

AEL 3030

The AEL 3030 is a compact, fully solid-state 150 watt PEP output transmitter-receiver covering 2-16MHz on 4 or 6 channels. Rugged construction for today's tough environments. Easily accessible for simple maintenance. Up to ten plug-in modules give maximum insurance against loss of service. The advanced technology used in the AEL 3030 provides unmatched efficiency in point to point or mobile communication, minimises size and cost and maximises reliability.



Maintain vital communication links in extreme conditions

FULLY SOLID STATE 150 WATT PEP

HF SSB VOICE TRANSCEIVERS

AEL 3030 AND 3035