

RESEARCH DEPARTMENT

**U.H.F. TRANSMITTING AERIAL FOR THE SUTTON COLDFIELD
TELEVISION STATION**

Technological Report No. RA-3/2
UDC 621.396.712 1967/19

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for Head of Research Department

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INTRODUCTION

A u.h.f. transmitting aerial for the Birmingham area has been built as a topmast on the existing 218 m (715 ft) mast at Sutton Coldfield. Space for this aerial was provided by rebuilding the Band I aerial on the support column of the mast¹. The new aerial, which came into service on 4th October 1965, replaced a temporary aerial on a 46 m (150 ft) tower.

Subsequently it was found that in certain areas at ranges up to about 8 km (5 miles) reception was unsatisfactory owing to inadequate v.r.p. gap-filling. Selected changes to the distribution feeder lengths were made on 6th-7th July 1966 in order to improve the gapfilling². This report describes the performance of the aerial in the latter condition.

SUMMARY OF INSTALLATION

- Site: The site is 13 km (8 miles) north-east of Birmingham, grid reference SK/113003, height 169 m (555 ft) a.o.d.
- Support Structure: The support structure consists of a 218 m (715 ft) stayed mast. Up to a height of 185 m (610 ft) the mast is of triangular cross-section with a side of 2.75 m (9 ft); above this height the cross-section is circular with a diameter of 2 m (6 ft 6 in.). The mast is provided with three sets of stays, on bearings of 0°, 120° and 240° ETN.
- General Arrangement: See Fig. 1.
- Channels: The aerial is designed to radiate on four channels simultaneously. The BBC channels are 40 and 46 of which the former is used for the opening service. The ITA channels are 43 and 50.
- Channels 40, 43 and 46 have zero offset and Channel 50 has negative offset.
- Aerial: The aerial comprises eight tiers each of four 4λ panels fed with nominally equal amplitude currents in phase rotation, to give a total radiating length varying between 27.0λ and 30.5λ over the operating bandwidth. The panels are offset by 85.5 mm (3.375 in.) on a square of 660 mm (26 in.) side and are supported by a load-bearing glass-fibre cylinder of 1.52 m (5 ft) diameter. The panels in tier 8 (the lowest tier) are set

forward by 61 mm (2.4 in.) and are tilted downwards by 8° . Fig. 2 shows the arrangement of the panels inside the glass-fibre cylinder and Fig. 3 shows the construction of each panel.

The mean height of the aerial is 226.3 m (742 ft 6 in.) a.g.l.

Feeders:

The arrangement of the distribution feeder is shown schematically in Fig. 4. Each half of the aerial is connected to the transmitter by a feeder type F. and G. 6.1/8-50.

Power:

Two 25 kW vision transmitters and two 5 kW sound transmitters will be provided for each channel; at present only those for Channel 40 have been installed. Each transmitter will be run at the power required to give the maximum effective radiated power (e.r.p.) permitted under the Stockholm Agreement, namely 1000 kW.

The service opened with one vision and one sound transmitter fed into each half aerial but in December 1965 one vision and one sound transmitter (run at full power) were arranged to feed the whole aerial to avoid differences between the modulation characteristics of the vision transmitters. At a later date a diplexer and splitting transformer will be installed. Similarly, two- and four-channel combining units will be added later, as required.

Templet and horizontal radiation pattern (h.r.p.):

The h.r.p. was required to be omnidirectional with a maximum e.r.p. not exceeding 1000 kW. The specified tolerance on the h.r.p. uniformity was ± 2 dB. The h.r.p.s at the vision carrier frequency of each operating channel which are shown in Figs. 5-8 have been computed from measurements of the amplitudes and phases of the feeds to each panel made subsequent to 7th July 1966.

Vertical radiation pattern (v.r.p.)

The v.r.p. was specified to be gapfilled and the maximum of radiation to be tilted 0.5° below the horizontal. Gapfilling is achieved by means of a phase distribution of the feed currents over the length of the aerial together with a physical tilt downwards of the panels in Tier 8. The v.r.p.s obtained for each face, shown in Figs. 9-16, were computed from measurements of the amplitudes and phases of the feeds to the aerial panels, taken subsequent to 7th July 1966.

Gain:

Channel	40	43	46	50
	dB	dB	dB	dB
Mean intrinsic gain	15.2	15.3	15.5	15.7

Aerial:

<u>Deduct aerial losses</u>									
Gapfilling	0.7		0.7		1.5		1.0		
Distribution feeder	0.5		0.5		0.5		0.5		
Distribution transformer	0.1		0.1		0.1		0.1		
Power in balancer load	<u>0.1</u>	<u>1.4</u>	<u>0.1</u>	<u>1.4</u>	<u>0.1</u>	<u>2.2</u>	<u>0.1</u>	<u>1.7</u>	
Mean net gain		13.8		13.9		13.3			14.0

Deduct other losses

Main feeder, 224 m (735 ft) F & G 6.1/8 - 50	1.3	1.4	1.4	1.4
Feeder ground run	0.2	0.2	0.2	0.2
Diplexer	0.1	0.1	0.1	0.1
Splitting transformer	<u>0.1</u> <u>1.7</u>	<u>0.1</u> <u>1.8</u>	<u>0.1</u> <u>1.8</u>	<u>0.1</u> <u>1.8</u>
Mean effective gain	<u>12.1</u>	<u>12.1</u>	<u>11.5</u>	<u>12.2</u>
H.R.P. maximum/mean ratio	2.3	2.9	2.6	2.0
Maximum effective gain	<u>14.4</u>	<u>15.0</u>	<u>14.1</u>	<u>14.2</u>

Programme feed:

G.P.O. link

ACKNOWLEDGMENTS

The mechanical and electrical design, construction and setting to work of the aerial were carried out by the Marconi Co. Ltd. The contracting authority was the BBC Transmitter Planning and Installation Department who also carried out the modifications to the distribution feeder.

REFERENCES

1. "New Band I transmitting aerial for the Sutton Coldfield television station", Research Department Technological Report No. E-112, Serial No. 1964/80.
2. Research Department Technical Memorandum in preparation.
3. Detailed information on the construction and dimensions of the aerial is given on the following drawings held by Transmitter Planning and Installation Department:

Band V Panel Aerial: Marconi drawing T80-2295
 Distribution transformer: Marconi drawing T80-3901
 Assembly: Marconi drawing BT02-8240 sheets 1 and 2

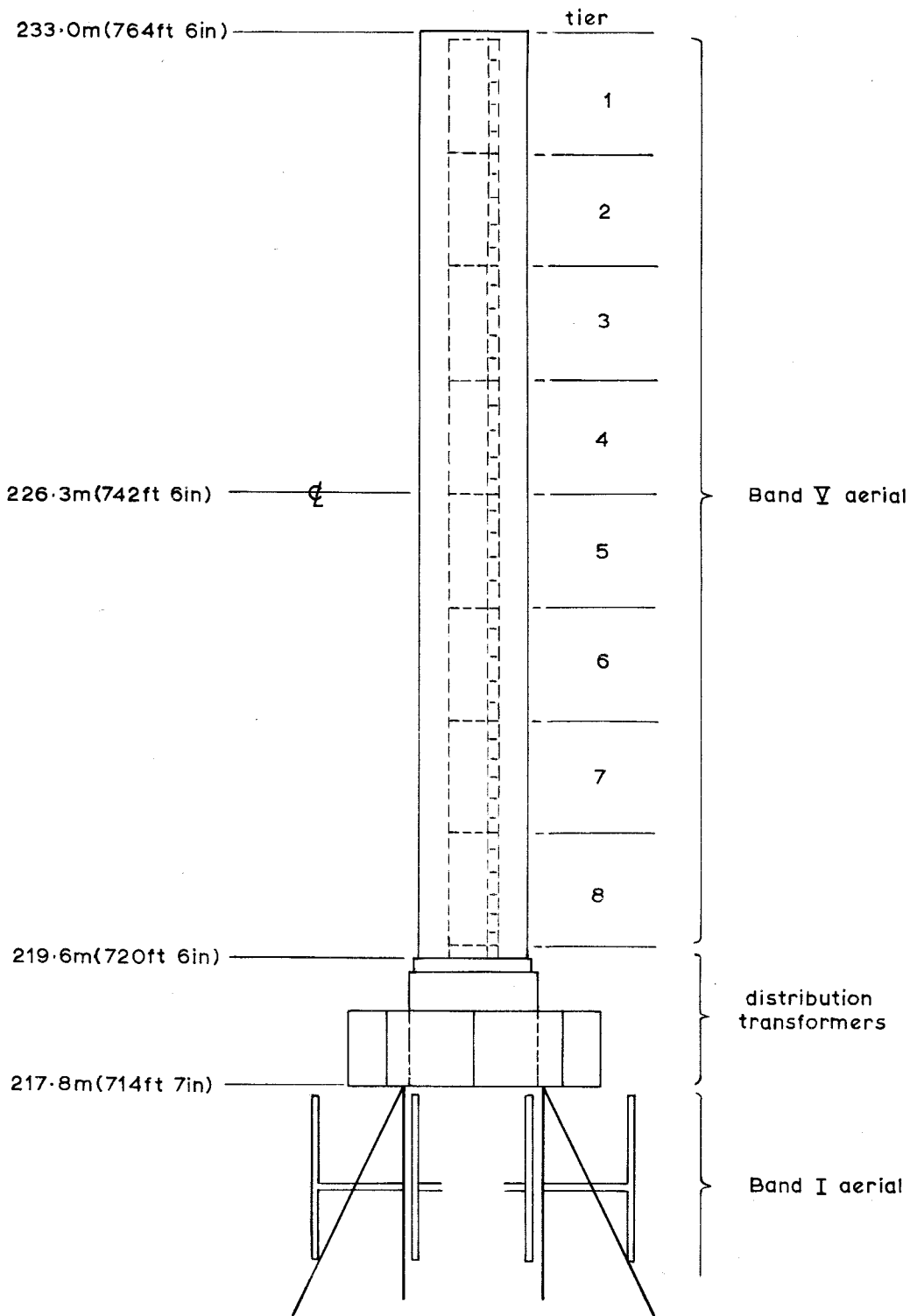


Fig. 1. General arrangement of aerial on mast

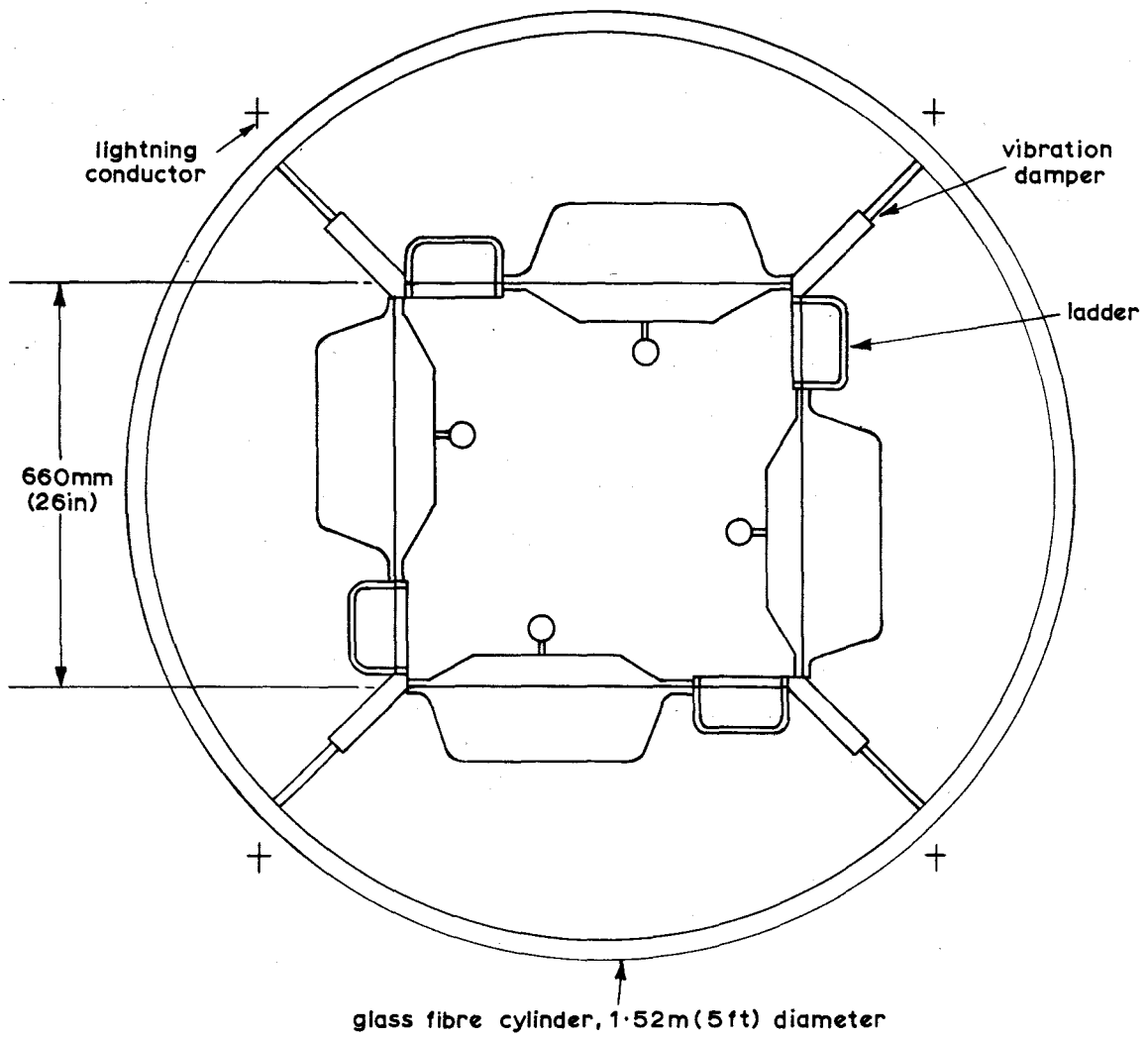


Fig. 2. Arrangement of aerial panels.

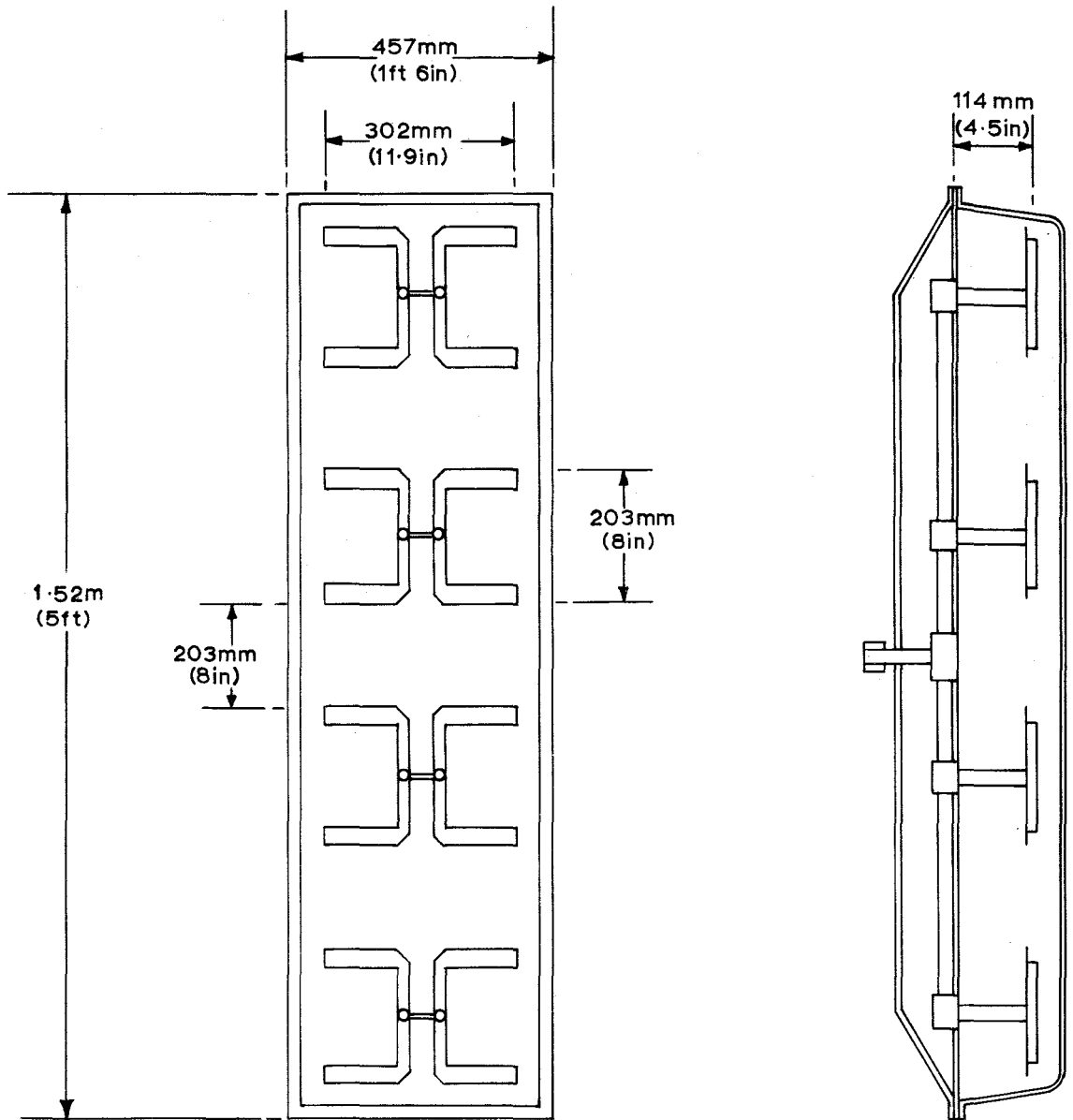


Fig. 3. Construction of single panel.

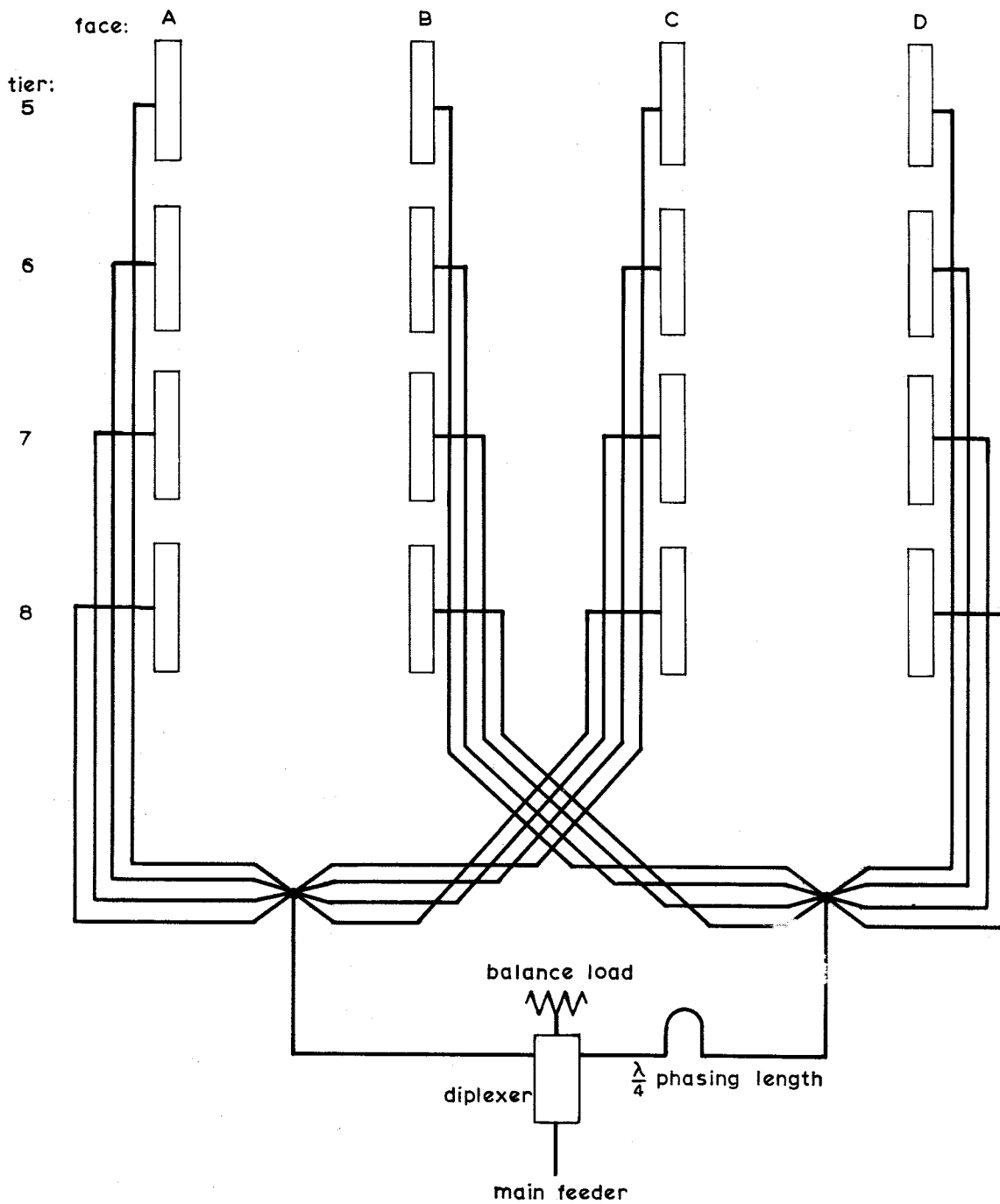


Fig. 4. Schematic arrangement of distribution feeder.
(lower half aerial)

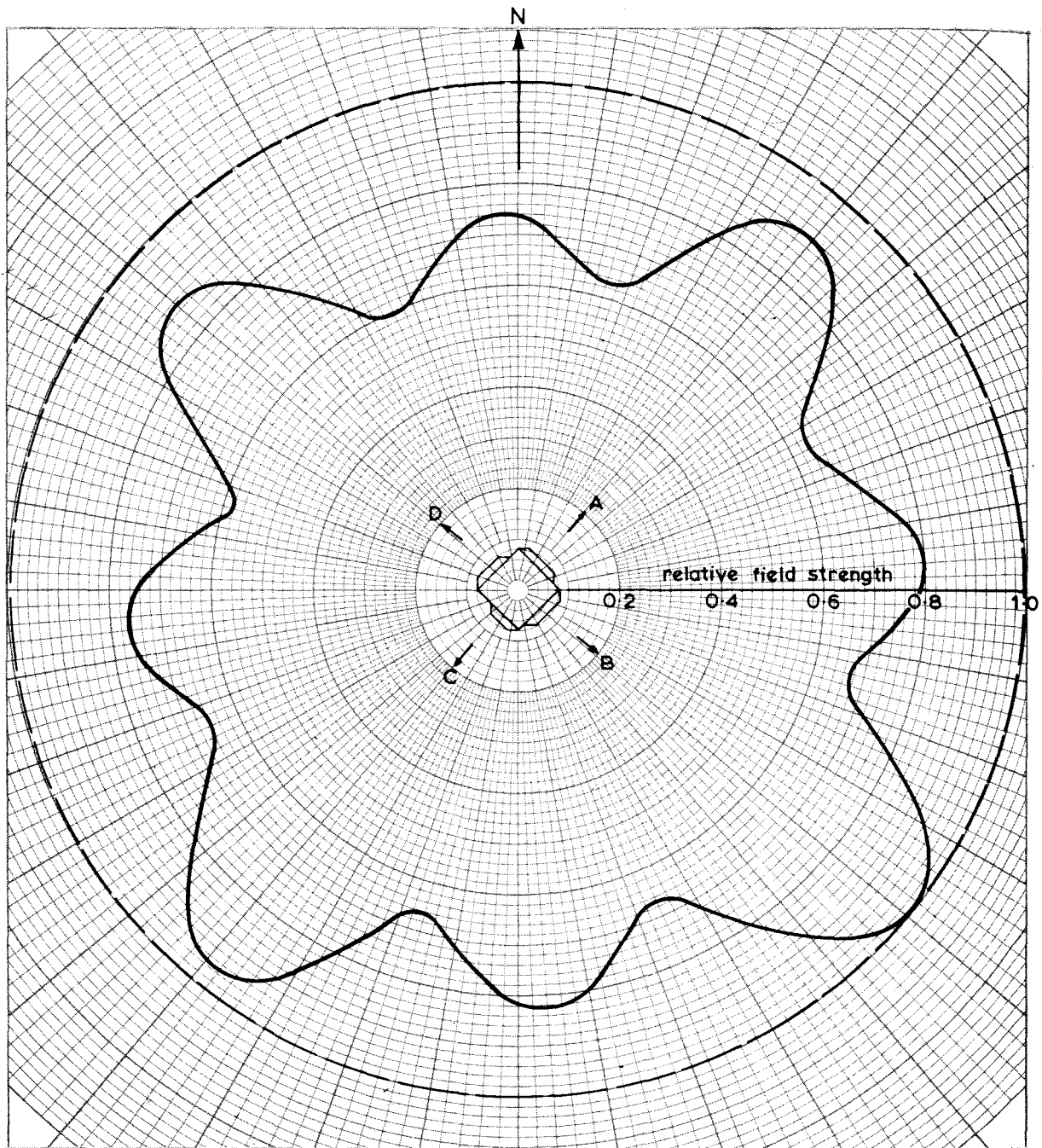


Fig. 5. Horizontal radiation pattern: Channel 40

HORIZONTAL POLARIZATION

Vision carrier 623.25 MHz, Sound carrier 629.25 MHz

Mean effective gain: 12.1dB

Peak vision transmitter power: 2x18kW

Mean E.R.P.: 585kW

————— Stockholm E.R.P. limit

Unit field corresponds to an E.R.P. of 1000kW

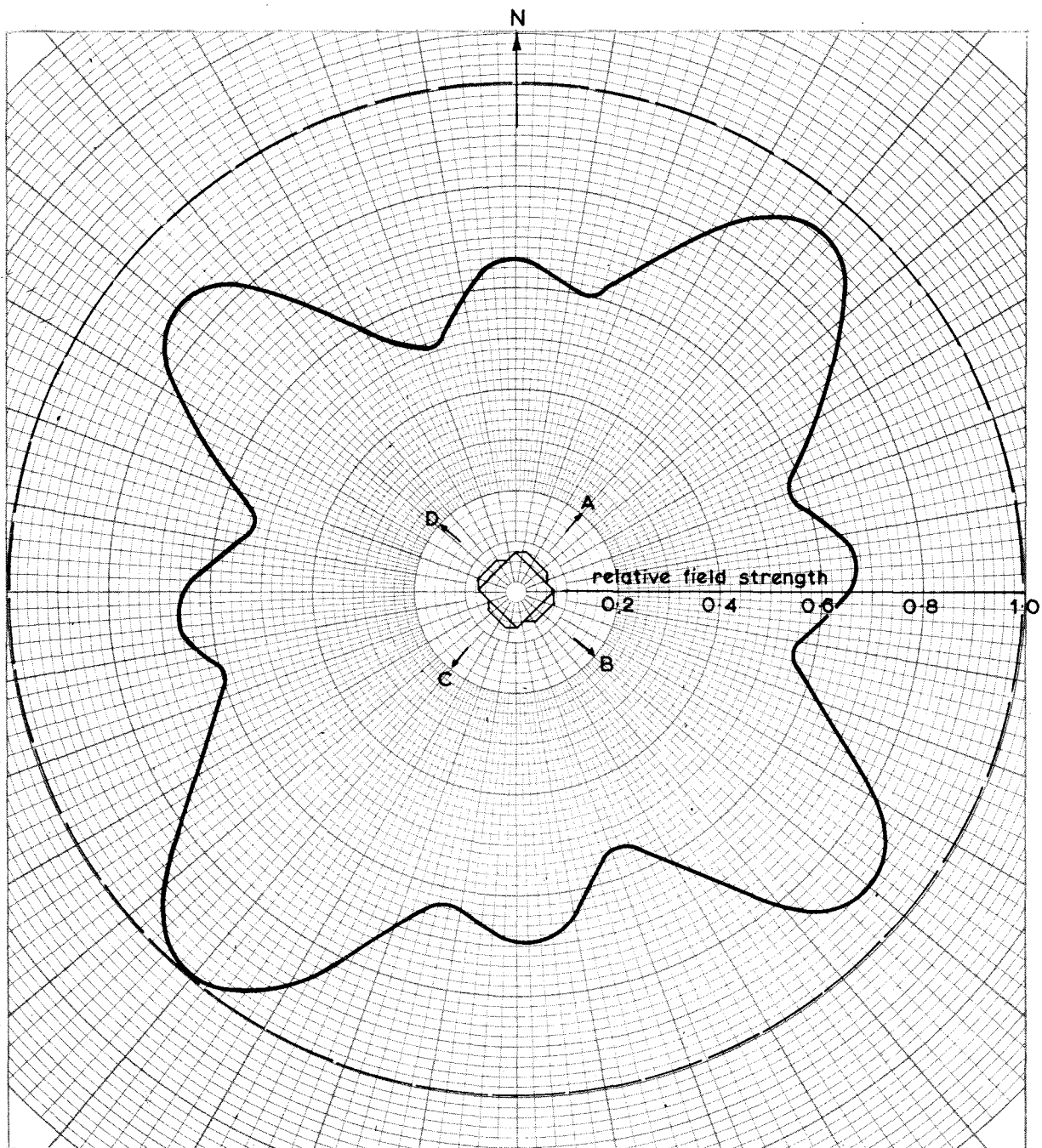


Fig. 6. Horizontal radiation pattern: Channel 43
HORIZONTAL POLARIZATION

Vision carrier 647.25MHz, Sound carrier 653.25MHz

Mean effective gain: 12.1dB

Peak vision transmitter power: 2x16kW

Mean E.R.P. 515kW

———— Stockholm E.R.P. limit

Unit field corresponds to an E.R.P. of 1000kW

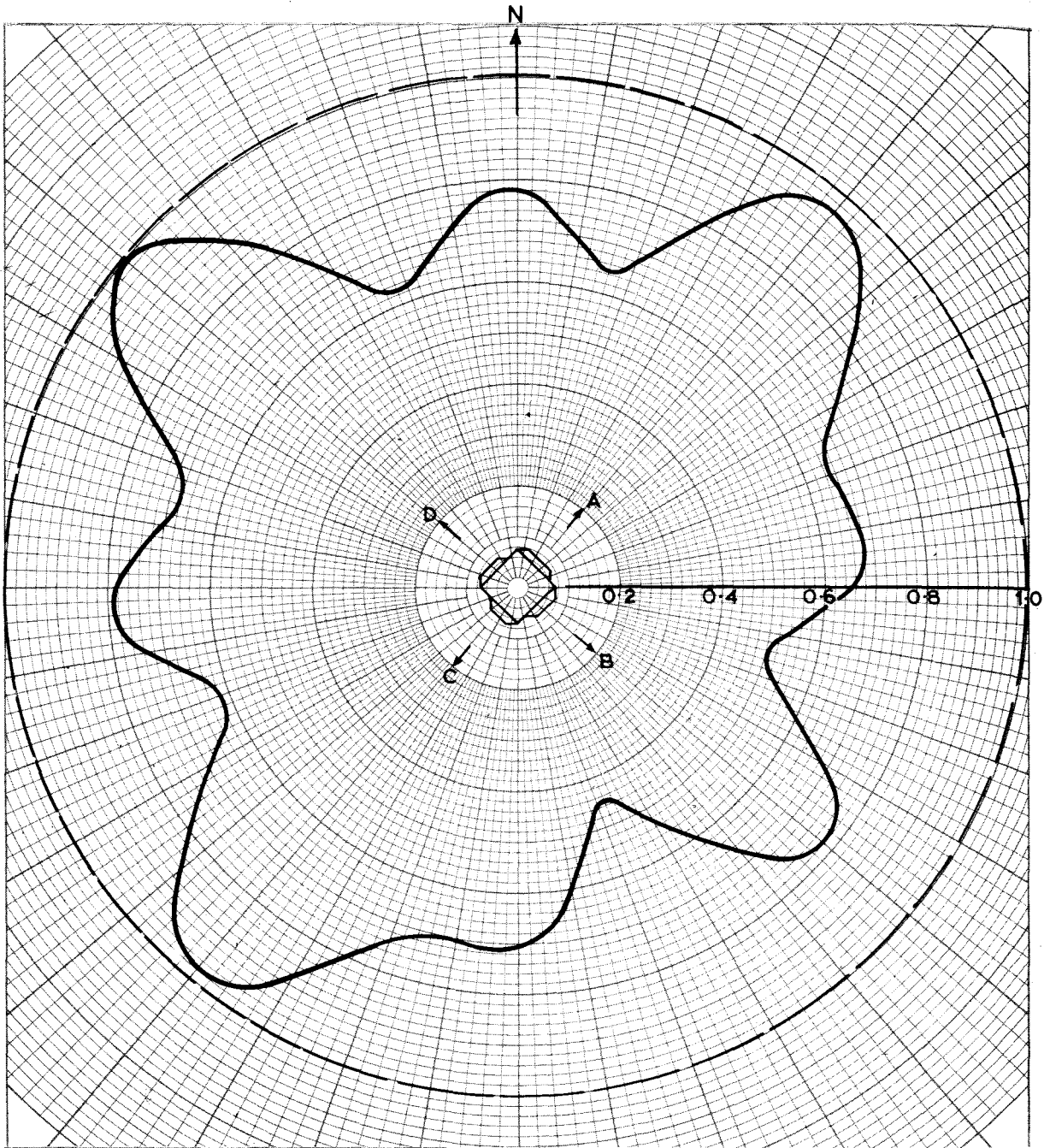


Fig.7. Horizontal radiation pattern: Channel 46

HORIZONTAL POLARIZATION

Vision carrier 671.25MHz, Sound carrier 677.25MHz

Mean effective gain: 11.5dB

Peak vision transmitter power: 2x20kW

Mean E.R.P.: 555kW

————— Stockholm E.R.P. limit

Unit field corresponds to an E.R.P. of 100kW

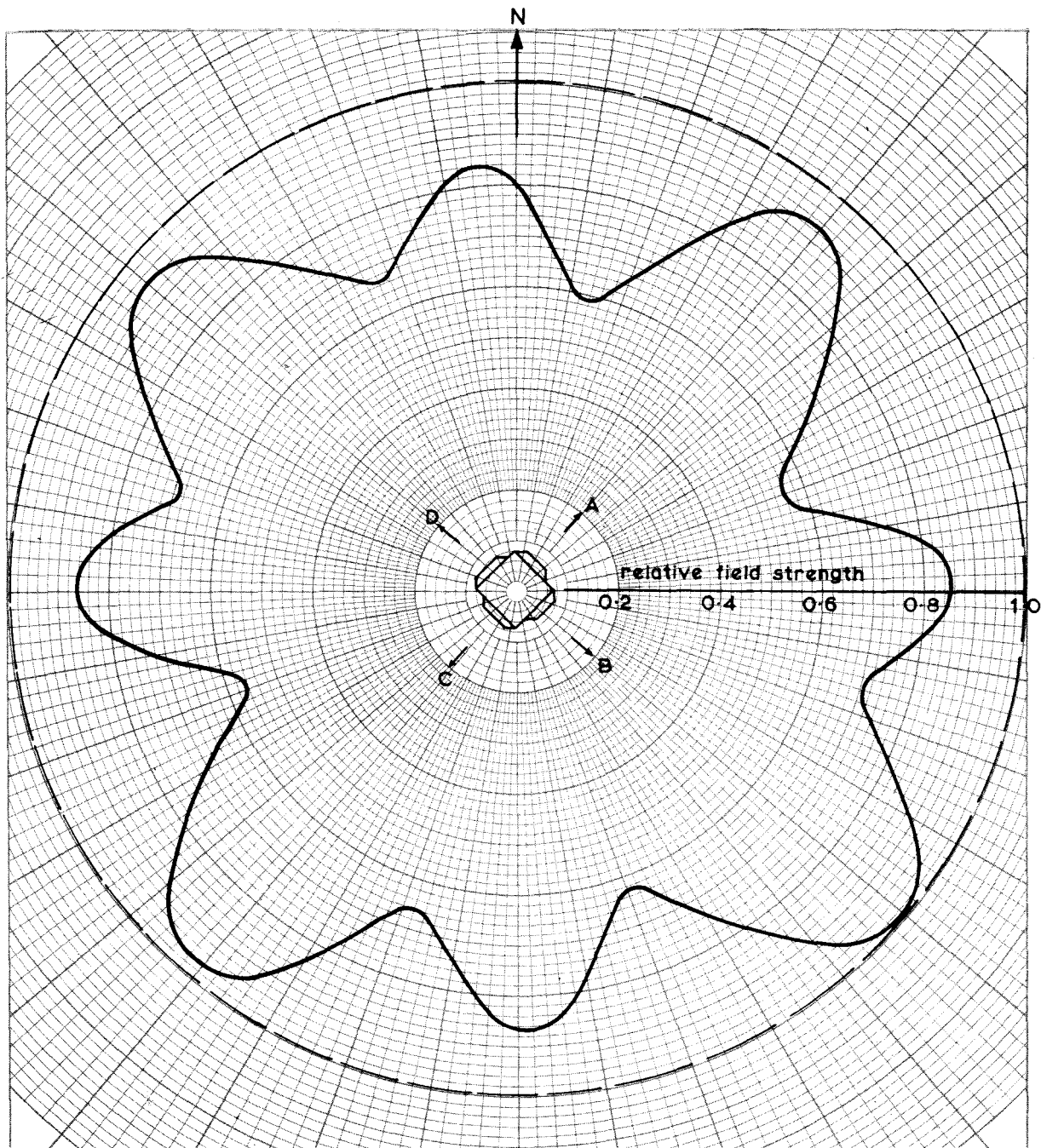


Fig. 8. Horizontal radiation pattern: Channel 50

HORIZONTAL POLARIZATION

Vision carrier 703.25MHz, Sound carrier 709.25MHz

Mean effective gain: 12.2dB

Peak vision transmitter power: 2x19kW

Mean E.R.P.: 625kW

————— Stockholm E.R.P. limit

Unit field corresponds to an E.R.P. of 1000kW

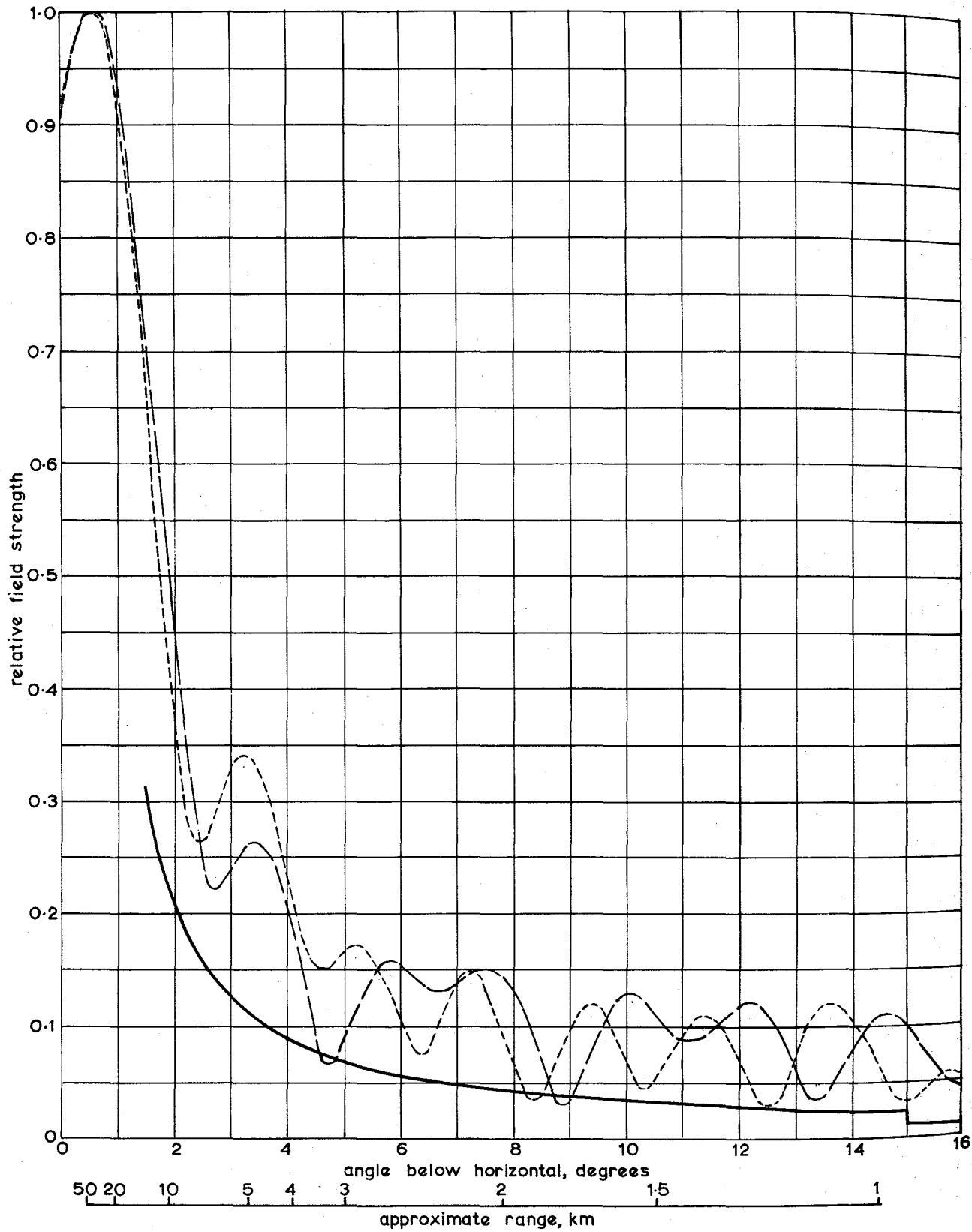


Fig.9. Vertical radiation pattern on bearing 40° E.T.N. (face A) : BBC

- Channel 40 (BBC 2)
- - - Channel 46 (BBC 1)
- Specified minimum field

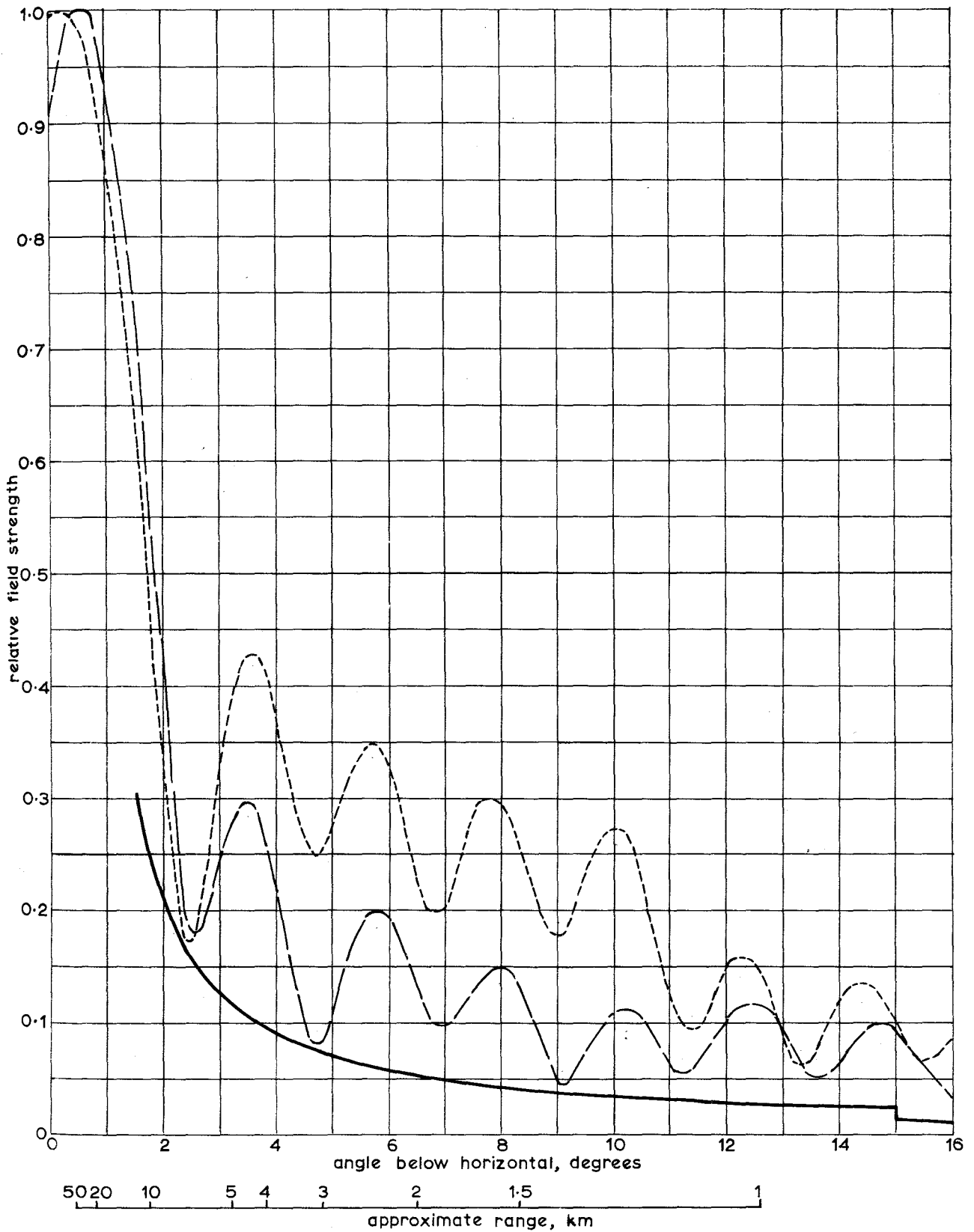


Fig. 10. Vertical radiation pattern on bearing 130° E.T.N. (face B): BBC

- Channel 40 (BBC 2)
- Channel 46 (BBC 1)
- Specified minimum field

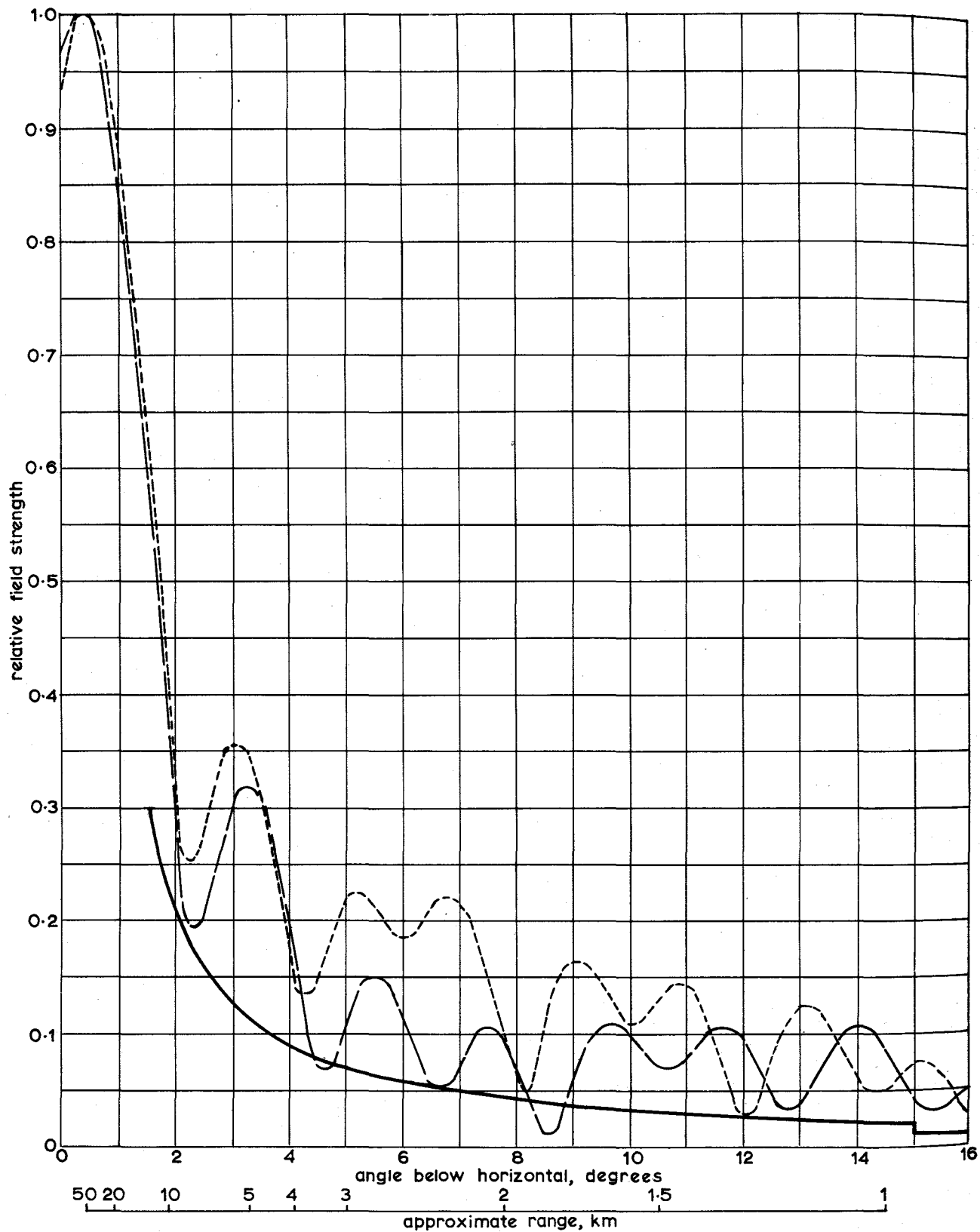


Fig.13. Vertical radiation pattern on bearing 40° E.T.N.(face A): ITA

- Channel 43 (ITA)
- - - - - Channel 50 (ITA)
- Specified minimum field

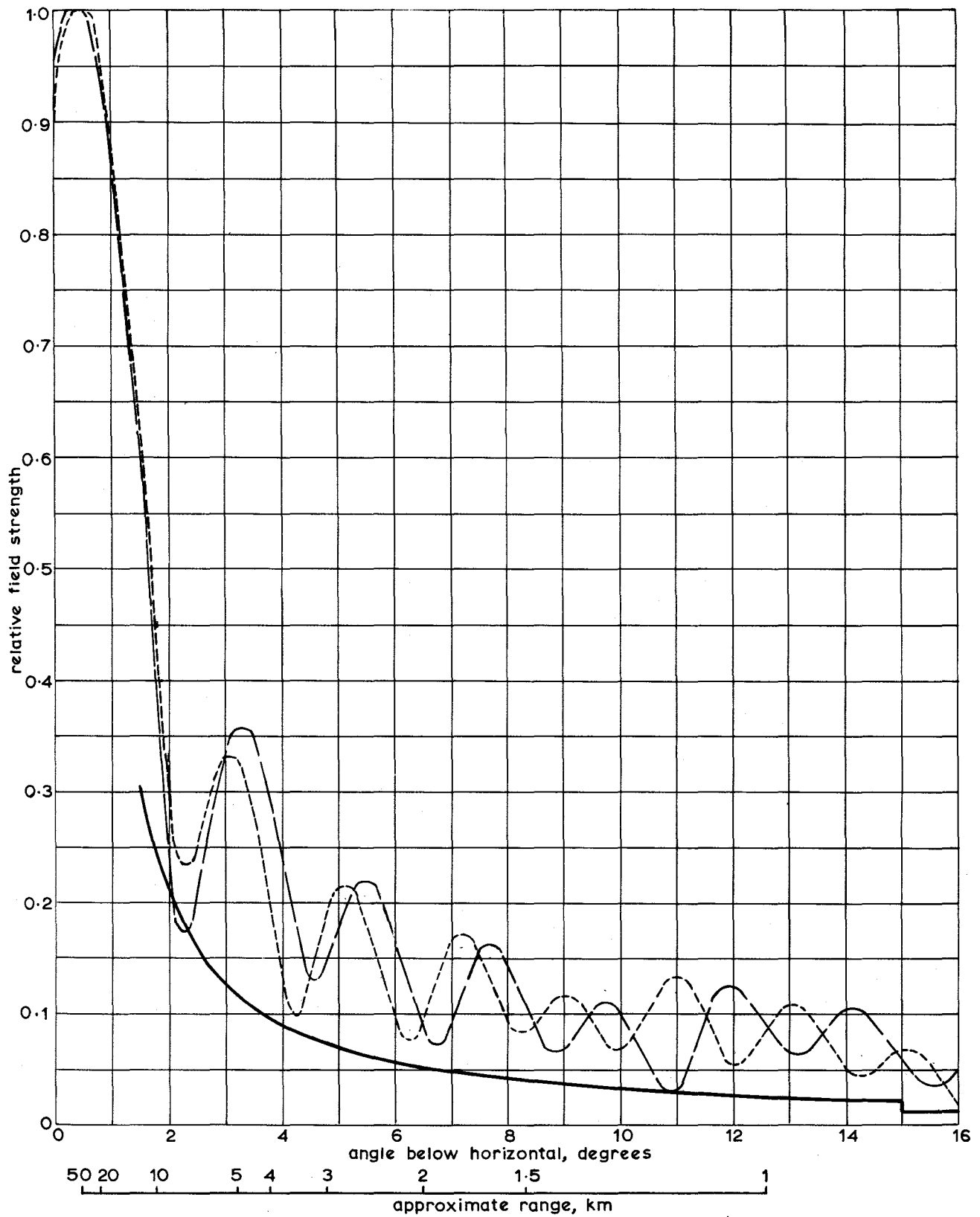


Fig.14. Vertical radiation pattern on bearing 130° E.T.N.(face B):ITA

- Channel 43 (ITA)
- - - - - Channel 50 (ITA)
- Specified minimum field

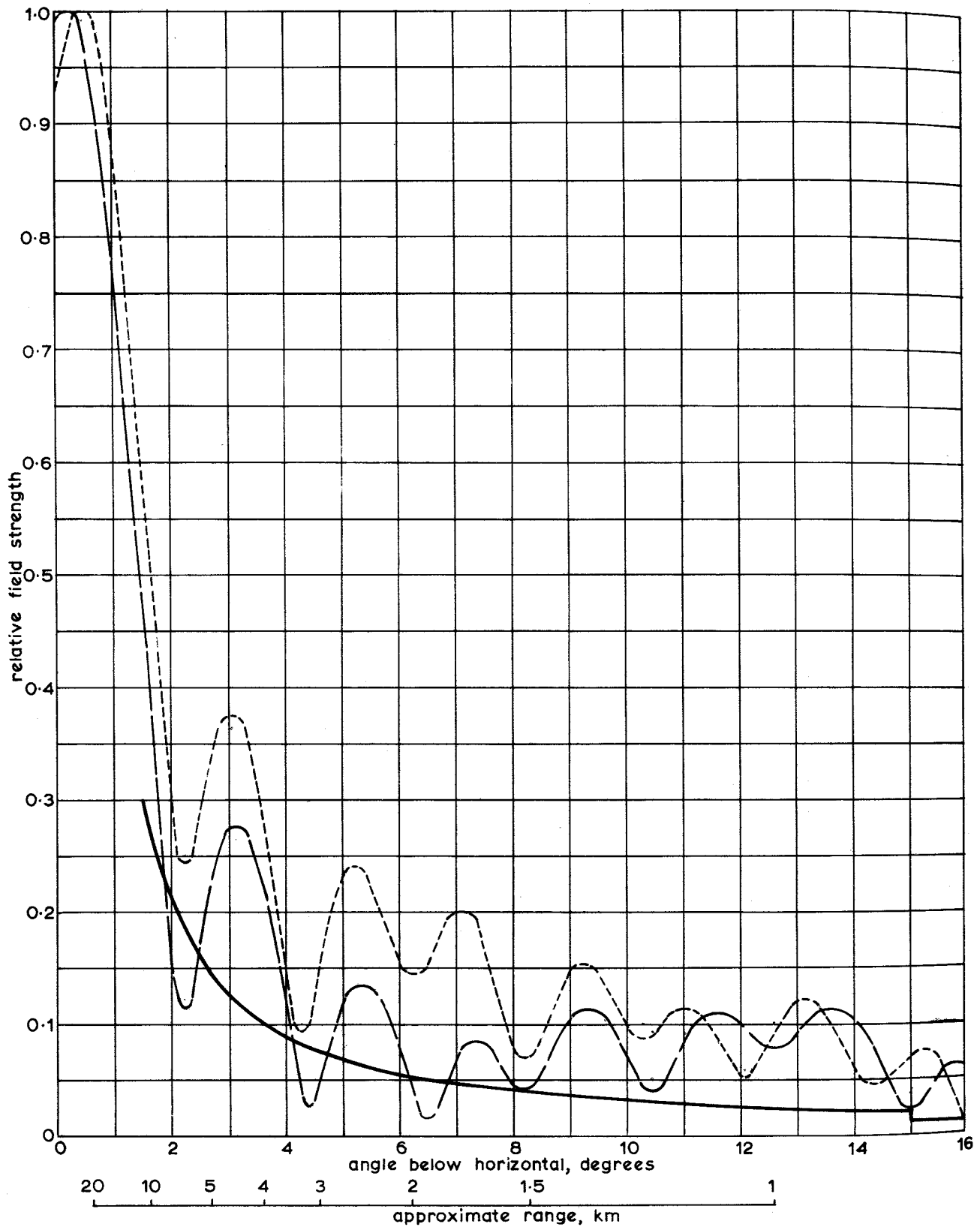


Fig. 15. Vertical radiation pattern on bearing 220° E.T.N. (face C):ITA

- Channel 43 (ITA)
- Channel 50 (ITA)
- Specified minimum field

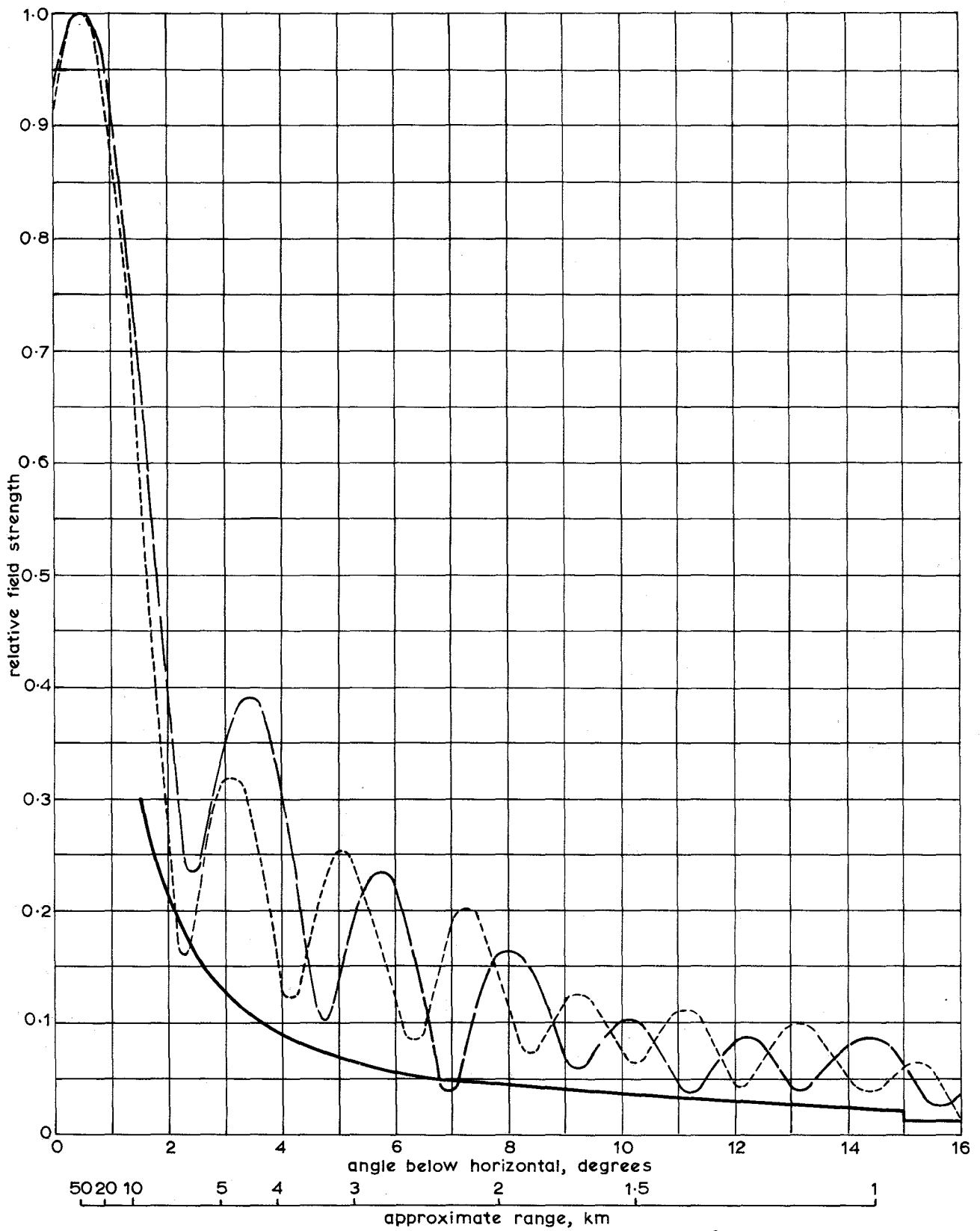


Fig. 16. Vertical radiation pattern on bearing 310° E.T.N.(face D):ITA

- Channel 43 (ITA)
- - - Channel 50 (ITA)
- Specified minimum field