

## Technical Guide



## **ANNEX A**

# **THE HOT BIRD™ SATELLITE SYSTEM**

June 7, 1999

# CONTENTS

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<b>1.</b>	<b>Introduction .....</b>	<b>1</b>
<b>2.</b>	<b>The Satellites .....</b>	<b>1</b>
<b>3.</b>	<b>Frequency Plan .....</b>	<b>2</b>
<b>4.</b>	<b>Satellite coverages .....</b>	<b>6</b>
<b>5.</b>	<b>Azimuth, Elevation and Polarisation Angles .....</b>	<b>7</b>
<b>6.</b>	<b>Contact Details .....</b>	<b>16</b>

# 1. Introduction

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EUTELSAT entertainment TV services are concentrated at the geostationary orbital location of 13° East. Services are provided by means of similar satellites collocated at this position, which are referred to as the “HOT BIRD™” satellites<sup>1</sup>.

This annex contains a summary of those technical characteristics of the HOT BIRD™ satellites that are relevant for reception of FM and digital television, audio and data services from the 13° East orbital position.

Additional technical information concerning existing and planned EUTELSAT satellites at other orbital positions can be found in the “EUTELSAT Satellite Handbook”, copies of which are available on request.

# 2. The Satellites

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The principal technical characteristics of the HOT BIRD™ satellites are given in *Table 1*.

There are five operational HOT BIRD™ spacecraft at the 13° East orbital location. They are collocated sufficiently close together to be indistinguishable to a ground terminal equipped with a small (e.g. 60 cm) receive antenna.

Satellite	No. of Active Transponders	Transponder Bandwidths (MHz)	Operating Frequency Band(s) <sup>a</sup>
HOT BIRD™ 1	16	36	11.20 - 11.55 GHz
HOT BIRD™ 2	20	33	11.70 - 12.10 GHz
HOT BIRD™ 3	20	33, 49.5	12.10 - 12.50 GHz
HOT BIRD™ 4	20	33, 36, 46.5	10.70 - 10.97 GHz 12.60 - 12.75 GHz
HOT BIRD™ 5	22	33, 36, 72	10.95 - 11.22 GHz 11.55 - 11.70 GHz 12.50 - 12.62 GHz

**Table 1: The HOT BIRD™ satellites located at 13 degrees East**

a. Under nominal operating conditions

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1. HOT BIRD™ is a trade mark of EUTELSAT.

Frequency re-use is achieved through the use of two linear orthogonal polarisations, which are denoted “X” and “Y”. In most receive locations the states “X” and “Y” correspond approximately to the local horizontal and vertical planes respectively.

The HOT BIRD™ 1 satellite provides a total of 16 operational transponders, each with a bandwidth of 36 MHz.

The HOT BIRD™ 2, HOT BIRD™ 3, HOT BIRD™ 4 and HOT BIRD™ 5 satellites each provide a total of 20 operational transponders over their lifetime. HOT BIRD™ 5 can operate a further two transponders in the first few years of satellite operation. Most of these transponders have a usable bandwidth of 33 MHz, although there are also a number of higher bandwidth (mainly 36 MHz) channels.

The five HOT BIRD™ satellites together provide a total of 98 active transponders, utilising the whole of the 10.70 - 12.75 GHz downlink frequency band. Some of these transponders are assigned to traditional FM TV and other analogue services, while others carry digital TV and radio transmissions.

All of the HOT BIRD™ satellites except HOT BIRD™ 1 carry “backup” transponders that can be used to replace operational transponders on other HOT BIRD™ satellites in the unlikely event of an in-orbit failure. These transponders are not normally used and are therefore not explicitly described in this annex.

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## 3. Frequency Plan

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The downlink frequency plan of the HOT BIRD™ satellite system is illustrated in *Figure 1, page 8*.

*Table 2* gives the centre frequency, the downlink polarisation and the nominal (approximately -1 dB) bandwidth for each transponder in tabular form. It also identifies the satellite that supports transponder operation under nominal operating conditions. The transponders are listed in ascending order of downlink centre frequency.

The system comprises mainly “narrowband” satellite transponders, with a nominal bandwidth of either 33 MHz or 36 MHz. Such transponders would normally accommodate a single analogue or digital TV carrier.

Four “wideband” satellite transponders are also provided. Two of these have a nominal bandwidth of 72 MHz, one has a nominal bandwidth of 46.5 MHz and one has a nominal bandwidth of 49.5 MHz. These wideband transponders can accommodate one analogue or digital TV carrier as well as additional carriers.

The nominal channel spacing for two adjacent co-polar narrowband channels is 38.36 MHz for 33 MHz transponders and 41.5 MHz for 36 MHz transponders. The nominal channel spacing for two adjacent cross-polar narrowband channels is one half of the co-polar channel spacing. The channel spacing for two adjacent 72 MHz wideband co-polar transponders is 83.33 MHz. These values are adjusted in certain instances, notably at the edges of the satellite operating frequency bands.

Transponder 110 on HOT BIRD™ 4 and Transponders 90, 91 and 92 on HOT BIRD™ 5 can be configured to provide Skyplex<sup>2</sup> services. In this configuration the carrier transmitted by the satellite will be a digital MCPC carrier that conforms to the DVB-S standard. As far as reception is concerned, it will be identical in format to a digital MCPC carrier transmitted via any other non-Skyplex transponder, which has been multiplexed on the ground.

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2. *Different digital television programmes are usually combined (multiplexed) on the ground prior to transmission via satellite as a single digital TV carrier. Skyplex is a system for multiplexing the different digital television programmes on-board the satellite instead of on the ground. This provides advantages for certain broadcasters/ service providers (e.g. independent uplinks to the satellite).*

Centre Frequency (GHz)	Transponder No.	Nominal Bandwidth (MHz)	Downlink Polarisation	Satellite
10.719 180	110	33	Y	<i>HOT BIRD™4</i>
10.727 130	111	46.5	X	
10.757 540	112	33	Y	
10.775 080	113	36	X	
10.795 900	114	33	Y	
10.815 080	115	33	X	
10.834 260	116	33	Y	
10.853 440	117	33	X	
10.872 620	118	33	Y	
10.891 800	119	33	X	
10.910 980	120	33	Y	
10.930 160	121	33	X	
10.949 340	122	33	Y	
10.971 410	123	36	X	
10.992 160	124	36	Y	
11.012 910	125	36	X	
11.033 660	126	36	Y	
11.054 410	127	36	X	
11.075 160	128	36	Y	
11.095 910	129	36	X	
11.116 660	130	36	Y	
11.158 330	131	72	X	
11.179 080	132	72	Y	
11.220 750	1	36	X	<i>HOT BIRD™ 1</i>
11.241 500	2	36	Y	
11.262 250	3	36	X	
11.283 000	4	36	Y	
11.303 750	5	36	X	
11.324 500	6	36	Y	
11.345 250	7	36	X	
11.366 000	8	36	Y	
11.386 750	9	36	X	
11.407 500	10	36	Y	
11.428 250	11	36	X	
11.449 000	12	36	Y	
11.471 410	13	36	X	
11.492 160	14	36	Y	
11.512 910	15	36	X	
11.533 660	16	36	Y	
11.565 740	153	33	X	<i>HOT BIRD™ 5</i>
11.584 920	154	33	Y	
11.604 100	155	33	X	
11.623 280	156	33	Y	
11.642 460	157	33	X	
11.661 640	158	33	Y	
11.680 820	159	33	X	
11.727 480	50	33	Y	<i>HOT BIRD™ 2</i>
11.746 660	51	33	X	
11.765 840	52	33	Y	
11.785 020	53	33	X	
11.804.200	54	33	Y	

**Table 2: Satellite Transponder Characteristics**

Centre Frequency (GHz)	Transponder No.	Nominal Bandwidth (MHz)	Downlink Polarisation	Satellite	
11.823 380	55	33	X		
11.842 560	56	33	Y		
11.861 740	57	33	X		
11.880 920	58	33	Y		
11.900 100	59	33	X		
11.919.280	60	33	Y		
11.938 460	61	33	X		
11.957 460	62	33	Y		
11.976 820	63	33	X		
11.996 000	64	33	Y		
12.015 180	65	33	X		
12.034 360	66	33	Y		
12.053 540	67	33	X		
12.072 720	68	33	Y		
12.091 900	69	33	X		
12.111 080	70	33	Y		<i>HOT BIRD™ 3</i>
12.130 260	71	33	X		
12.149 440	72	33	Y		
12.168 620	73	33	X		
12.187 800	74	33	Y		
12.206 980	75	33	X		
12.226 160	76	33	Y		
12.245 340	77	33	X		
12.264 520	78	33	Y		
12.283 700	79	33	X		
12.302 880	80	33	Y		
12.322 060	81	33	X		
12.341 240	82	33	Y		
12.360 420	83	33	X		
12.379 600	84	33	Y		
12.398 780	85	33	X		
12.417 960	86	33	Y		
12.437 140	87	33	X		
12.465 910	88	49.5	Y		
12.475 500	89	33	X		
12.519 840	90	33	Y	<i>HOT BIRD™ 5</i>	
12.539 020	91	33	X		
12.558 200	92	33	Y		
12.577 380	93	33	X		
12.596 560	94	33	Y		
12 615 740	95	33	X	<i>HOT BIRD™ 4</i>	
12 634 920	96	33	Y		
12 654 100	97	33	X		
12 673 280	98	33	Y		
12 692 460	99	33	X		
12 713 280	100	33	Y		
12 730 820	101	33	X		

**Table 2: Satellite Transponder Characteristics (continued)**

## 4. Satellite coverages

The HOT BIRD™ satellite system provides a number of broadcast coverages. These have been designed to offer a range of geographical coverage areas and radiated power (EIRP) levels. The characteristics of the HOT BIRD™ coverages are given in *Table 3*. The coverages themselves are illustrated in *Figure 2* to *Figure 5*.

Coverage	Provided On	Transponders	Saturated EIRP (inner contour)	Typical Coverage
SuperWidebeam	HOT BIRD™ 1	all	49 dBW	<i>Figure 2</i>
Superbeam	HOT BIRD™ 2 - 5	all	53 dBW	<i>Figure 3</i>
Widebeam	HOT BIRD™ 2 - 5	all	50 dBW	<i>Figure 4</i>
Steerable	HOT BIRD™ 3, 4 (16 transponders)	70 - 75, 77, 88 111 - 118	49 dBW	<i>Figure 5</i>

**Table 3: HOT BIRD™ Coverages**

The SuperWidebeam coverage is provided by HOT BIRD™ 1 and thus applies for Transponders 1 to 16.

All other transponders can be operated with either Superbeam coverage or Widebeam coverage, the choice being made independently on a transponder-by-transponder basis.

Eight channels on each of the HOT BIRD™ 3 and HOT BIRD™ 4 satellites can also be independently switched to a steerable coverage. This allows broadcasting services to be developed in geographical areas that fall outside of the SuperWidebeam, Widebeam and Superbeam fixed coverage area. For example, *Figure 5* shows the Steerable beam positioned over the Middle East region.

Details of the current geographical positioning of the steerable beam and the services that it provides can be obtained from EUTELSAT.

Note that the contours shown in each of the coverages of *Figure 2* to *Figure 5* correspond to “saturated” EIRP values<sup>3</sup>. In some cases the EIRP level for a given TV transmission may be less than the saturated EIRP value, depending upon the transponder’s operational configuration. This is typically the case for wideband transponders that accommodate more than one carrier.

3. The power radiated by the transponder when it is operated at its maximum output power level (with its on-board high power amplifier operated at “saturation”).



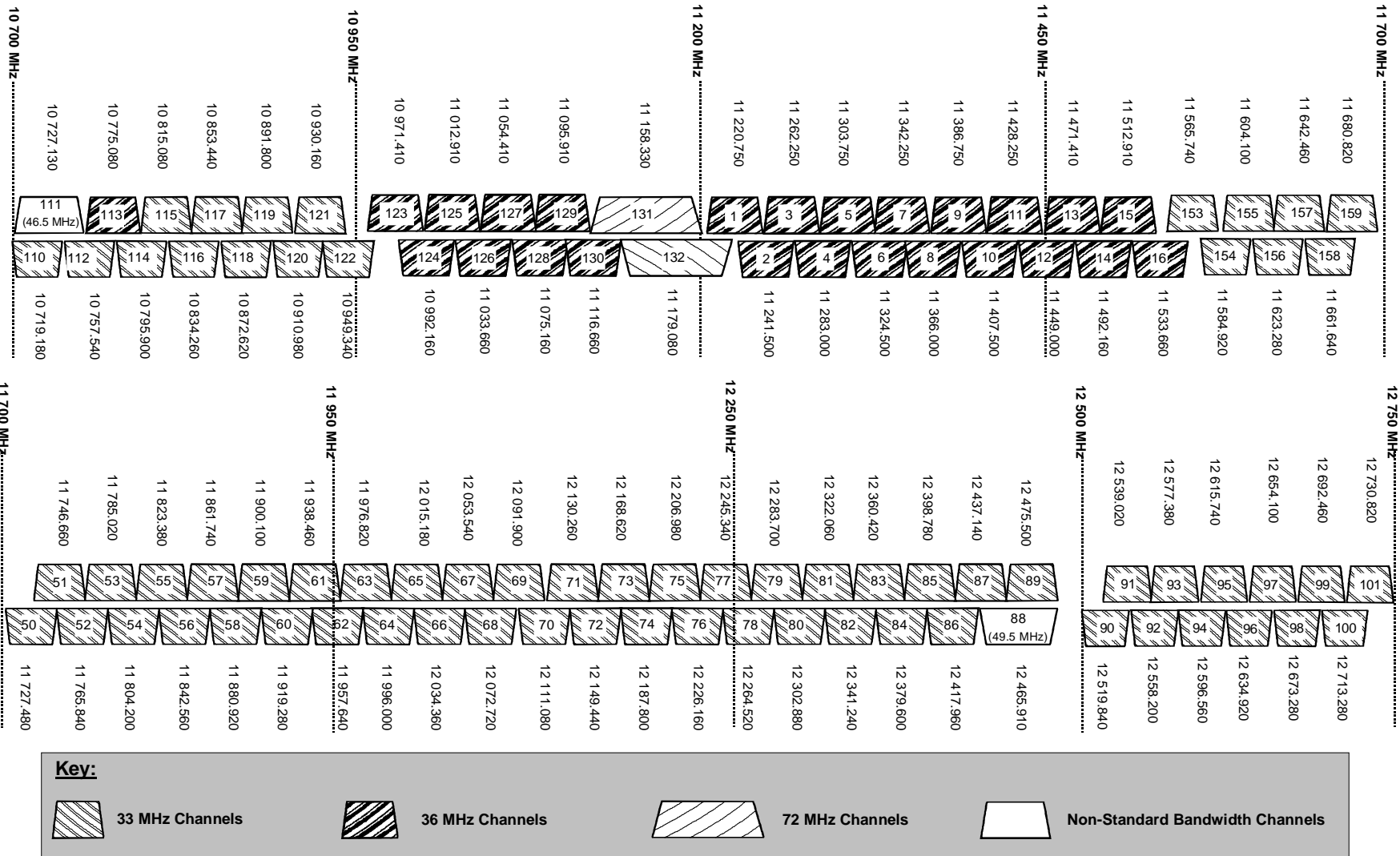
## 5. Azimuth, Elevation and Polarisation Angles

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*Figure 6* is a chart showing the azimuth angle to the HOT BIRD™ satellites. The azimuth angle is measured in the local horizontal plane and is positive in a clockwise direction from true north. The directions east and south thus correspond to azimuth values of 90° and 180° respectively.

*Figure 7* is a chart showing the elevation angle to the HOT BIRD™ satellites. The elevation angle is measured in the local vertical plane containing the satellite and is expressed relative to the local horizontal plane. A value of zero would mean that the antenna is pointed towards the local horizon.

*Figure 8* is a chart showing the polarisation angle for the HOT BIRD™ satellites. This is the angle between the local vertical and the vertical (Y) polarisation plane. A positive value means rotation in a clockwise direction from the local vertical when looking towards the satellite.



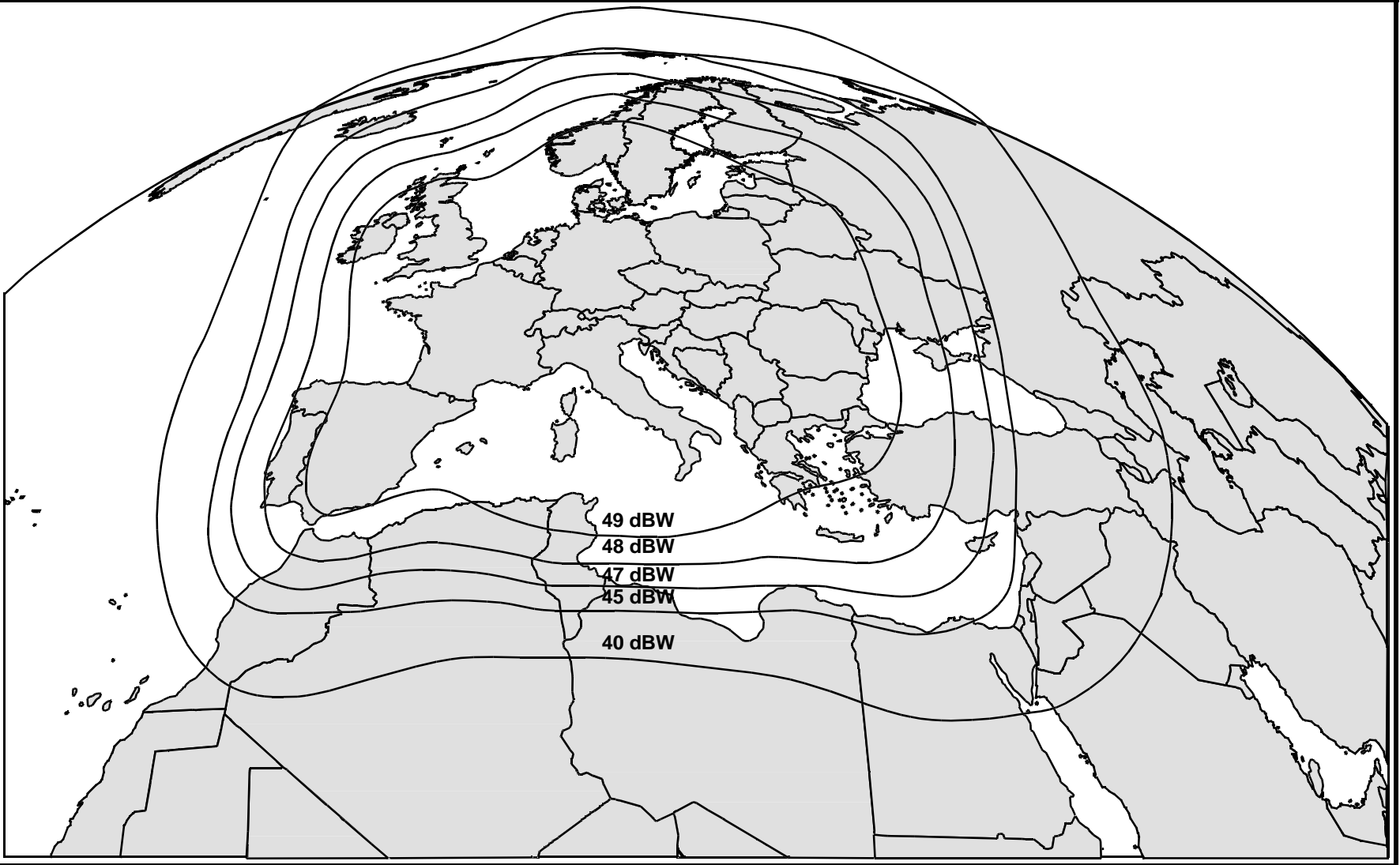


Figure 2 : Transponders 1 - 16 (HOT BIRD™ 1, HOT BIRD™ Super-Widebeam Coverage)

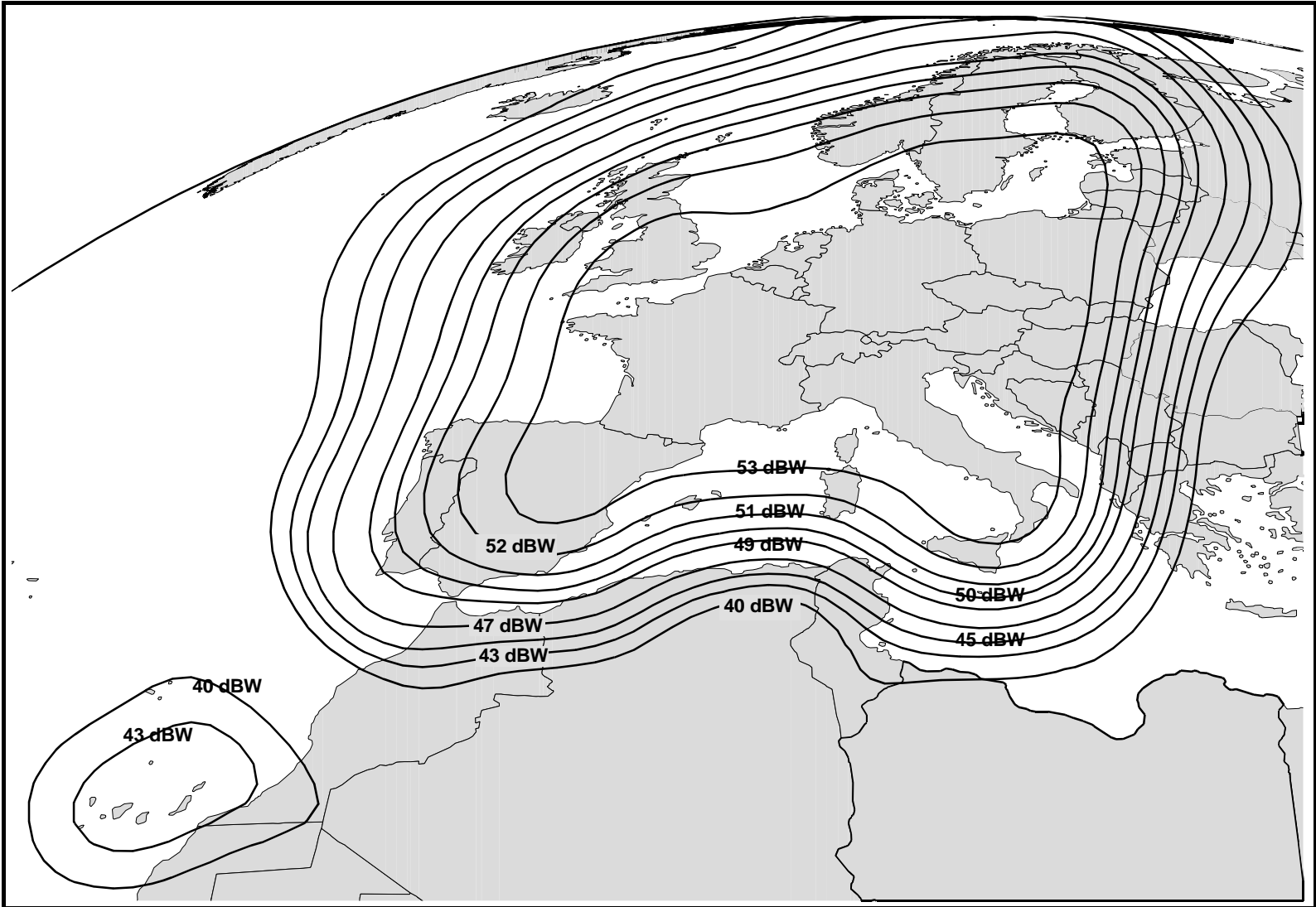


Figure 3 : Transponders 50 - 159 (HOT BIRD™ 2, 3, 4, 5 Superbeam Coverage)

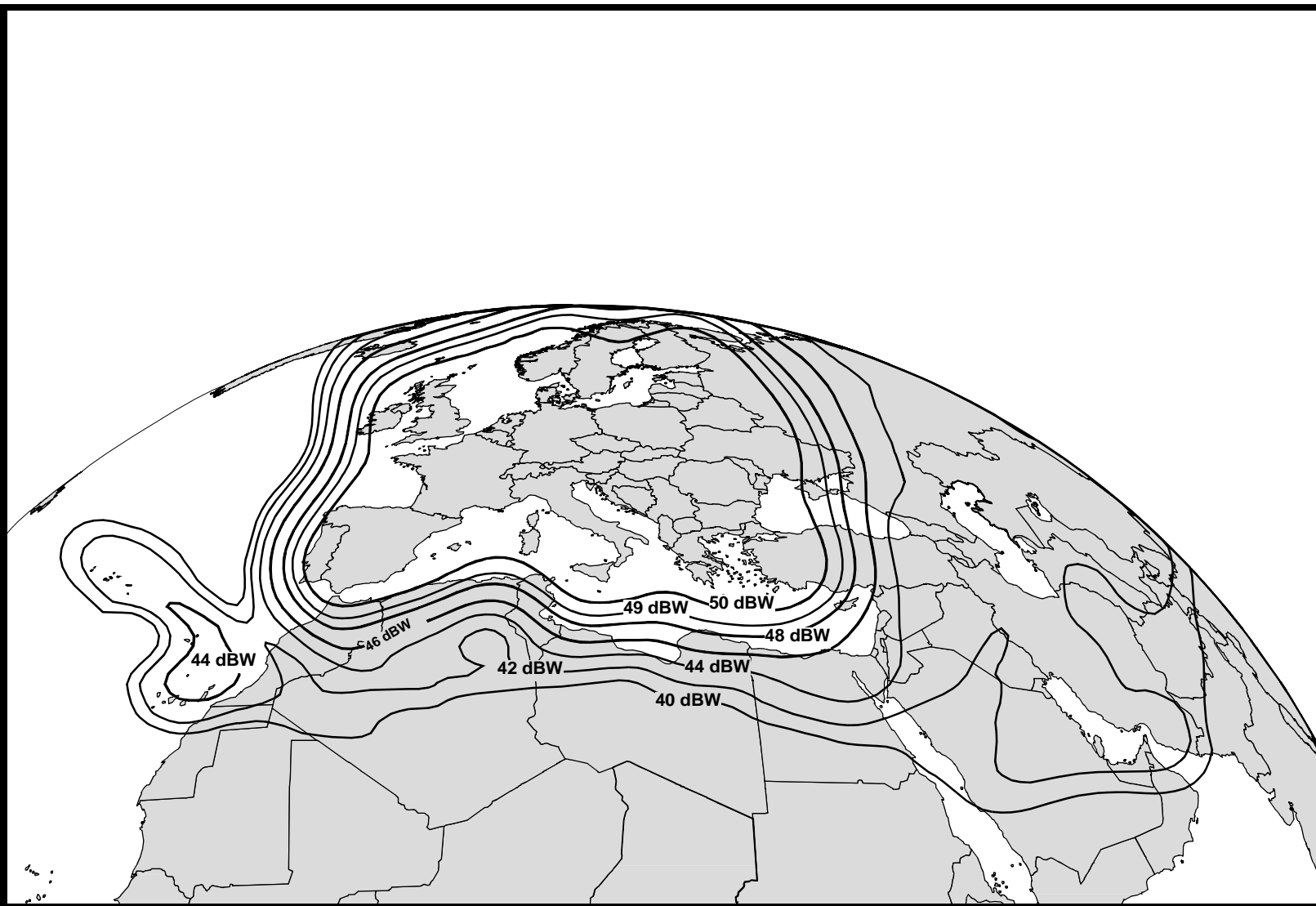


Figure 4 : Transponders 50 - 159 (HOT BIRD™2, 3, 4, 5 Widebeam Coverage)



**Figure 5 : Example of Steerable Beam Coverage (HOT BIRD™ 3, 4)**

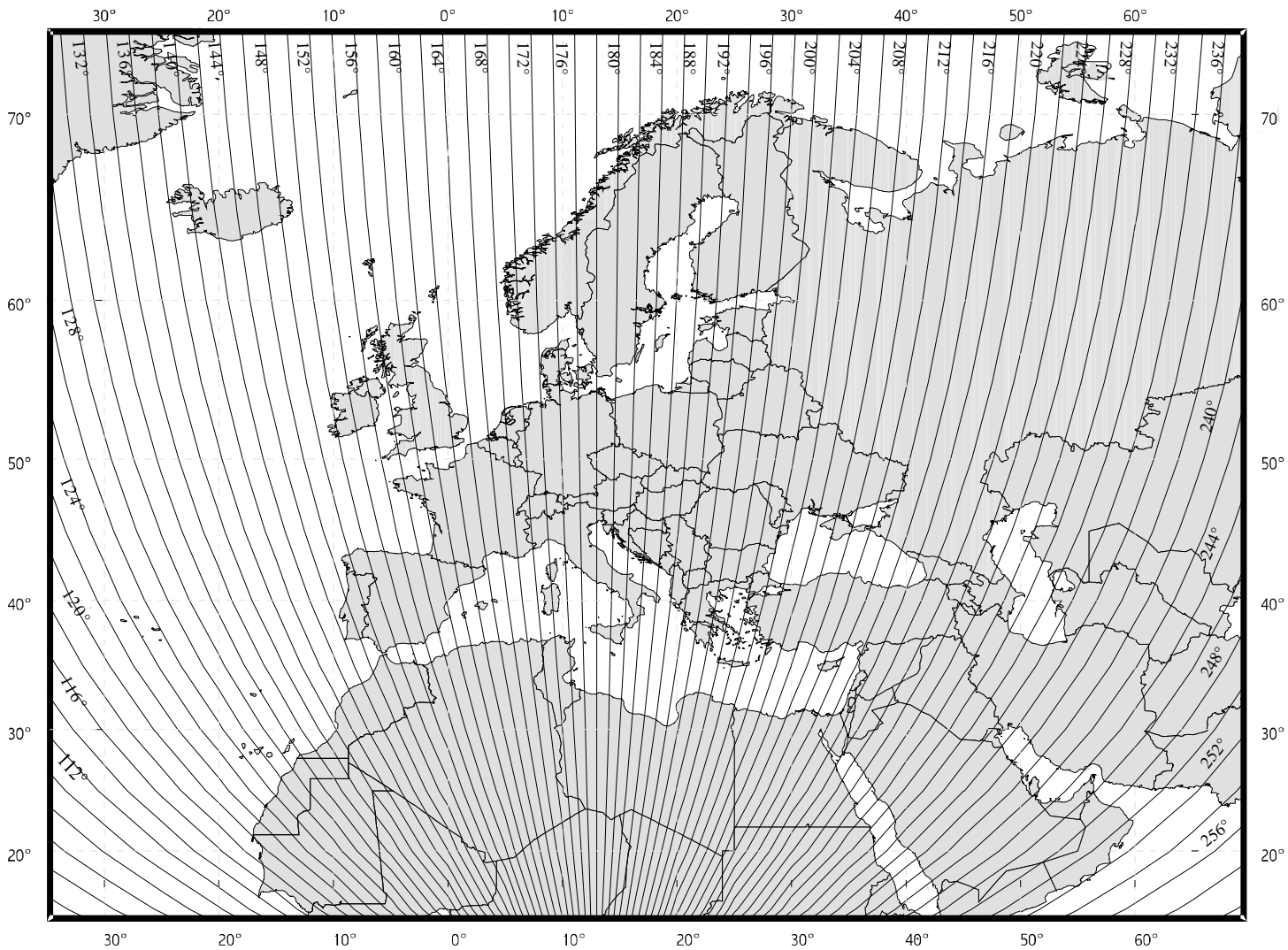
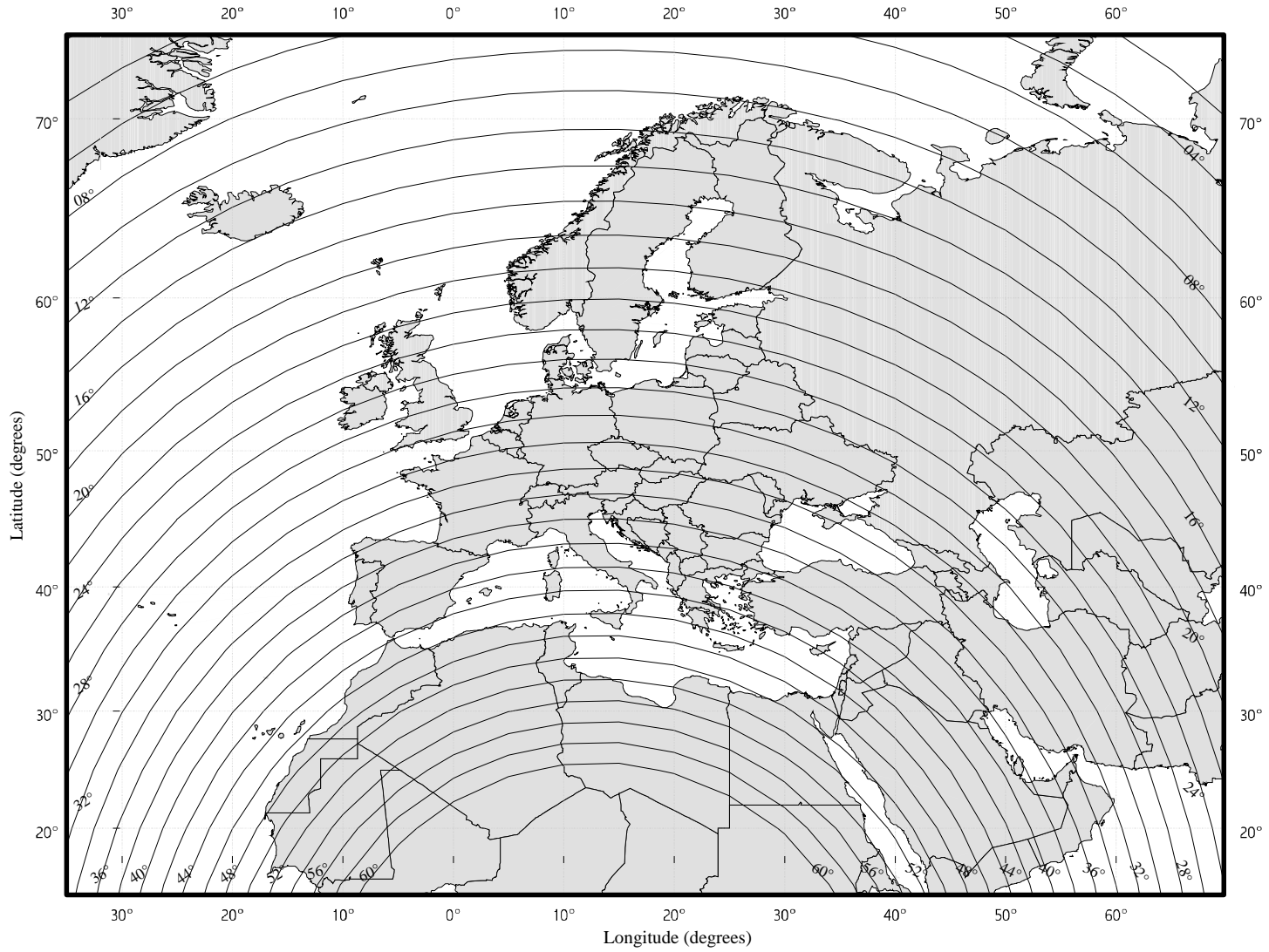
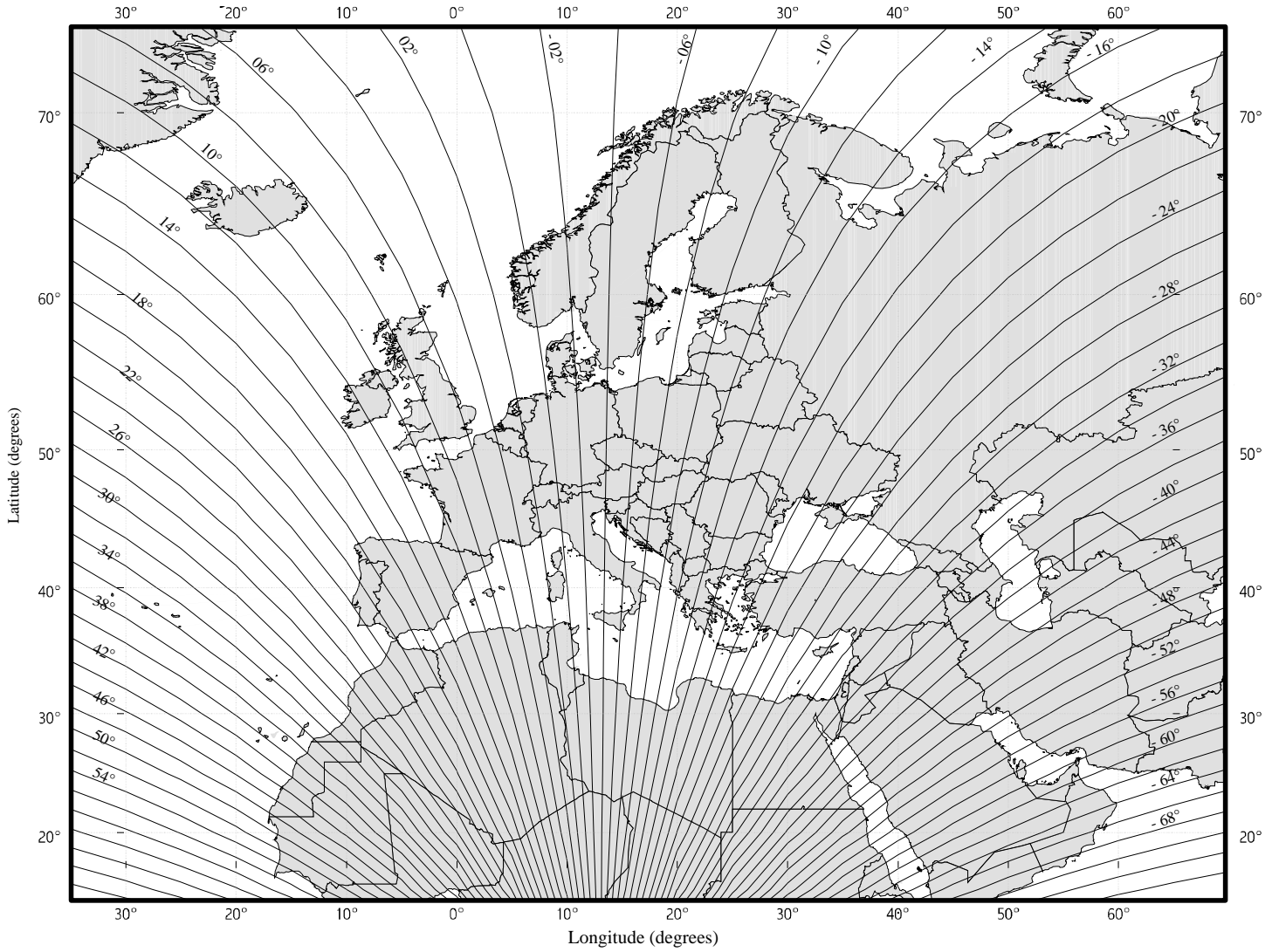


Figure 6 : Azimuth Chart for the 13° East Orbital Position



**Figure 7 : Elevation Chart for the 13° East Orbital Position**





**Figure 8 : Polarisation Angle Chart for the 13° East Orbital Position**

## 6. Contact Details

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