Annex 6

Coding instructions for antenna diagrams in the Land Mobile Service

Coding instructions for antenna diagrams

1 General

1.1 For the description of the characteristics of antenna diagrams for the co-ordination procedure a character string consisting of three digits, two letters and two digits is used in accordance with CEPT Recommendation T/R 25-08.

The character string is structured as follows:

000	xx	00
1st - 3rd character	4th - 5th character	6th - 7th character

This string has to be transmitted in one block: 000XX00.

1.2 This string will be used

1.2.1 for the description of the characteristics of an antenna belonging to the Administration preparing the co-ordination request, and

1.2.2 for the illustration of the characteristics of an antenna belonging to another Administration when evaluating that Administration's co-ordination request.

1.3 Generally the horizontal diagram shall be considered under 9XH. If there is an elevation in the vertical diagram, the angle of the elevation shall be listed under position 9B of the co-ordination request. The vertical diagram shall be described in the same manner as the horizontal diagram and shall be listed under 9XV.

1.4 Appendices 1 and 2 of this Annex contain graphical illustrations for nine typical groups of antenna diagrams which are representative of the types of antenna used in practice. They are identified by the following two-letter codes: EA, EB, EC, DE, KA, LA, CA, CB, and CC. The formulas for the graphical illustrations are given in Appendix 3, Appendix 4 and Appendix 5 contain the descriptions of the V - type and W - type antenna diagrams. Appendices 6 and 8 contain graphical illustrations of TA and Px type antenna diagrams (vertical diagrams for antennas with electrical tilt), the formulas are given in Appendix 7.

1.5 If the parameter 9XV (vertical antenna diagram) is TA antenna code then it means 3D antenna radiation pattern is electrically tilted and tilt is given in field 9B. For Px antenna codes (antenna with electrical and mechanical tilt) the electrical tilt is given in the antenna code and the field 9B contains the mechanical elevation.

1.6 For every station, only one antenna type should be defined, valid in all directions where other countries may be affected.

2 Composition of the string for the typical groups of antenna diagrams

2.1 For the diagrams of groups EA, EB, EC, DE and LA (Appendix 1), the following data have to be coded in the string:

1st - 3rd character: These characters describe the angle range of a directional diagram for which the radiated power has decreased to 50% of its maximum value. This angle has to be determined once from the direction of the maximum gain to that direction which represents 50 % of the radiated power (in the diagram $1/\sqrt{2} = 0.707$ of the field strength). Example: 030 for an angle of 30 degrees.

4th - 5th character: These characters describe the group of the antenna diagram, e.g. EA, EB, etc. For omni directional antennas, ND shall be used.

6th - 7th character: These characters describe the circle enveloping the side lobes not contained within the basic pattern defined by the first five characters. The two characters can be derived from the attenuation indicated by this circle in the antenna diagram, multiplied by 100. If only the front-to-back ratio (f:b ratio) is given, these digits can be calculated by using the equation:

$$two\ digits = 10^{2-\frac{\text{f:b ratio}}{20}} \qquad \text{(f:b ratio in dB)}$$

2.2 For the antenna diagrams of groups CA, CB, CC and KA (Appendix 2) the following data have to be coded in the string:

1st - 3rd character: These characters do not describe an angle, as in 2.1 for the antenna diagrams mentioned above. Instead these digits describe the notch factor. They can be derived from the values of the attenuation in the antenna diagram, multiplied by 100.

4th - 5th character: These characters describe the group of the antenna diagram, eg. CA, CB, etc.

6th - 7th character: For antenna types with or without insignificant side lobes, these digits have the value 00. If the side lobes exceed the diagram lines described by the digits 1 - 3, the greatest side lobe has to be considered. In this case the digits 6 – 7 are calculated in the same manner as described under item 2.1, digits 6 – 7.

2.3 For the diagrams of group TA the following data have to be coded in the string:

1st - 3rd character: These characters describe the angle range multiplied by 10 of a directional diagram for which the radiated power has decreased to 50% of its maximum value. This angle has to be determined once from the direction of the maximum gain to that direction which represents 50 % of the radiated power (in the diagram $1/\sqrt{2} = 0.707$ of the field strength). Example: 300 for an angle of 30 degrees.

4th - 5th character: These characters describe the group of the antenna diagram, e.g. TA.

6th - 7th character: These characters describe the circle enveloping the side lobes not contained within the basic pattern defined by the first five characters. The two characters can be derived from the attenuation indicated by this circle in the antenna diagram, multiplied by 100. If only the front-to-back ratio (f:b ratio) is given, these digits can be calculated by using the equation:

$$two\ digits = 10^{2-\frac{\text{f:b ratio}}{20}}$$ (f:b ratio in dB)

2.4 For the diagrams of group **P**x the following data have to be coded in the string:

1st - 3rd character: These characters describe the angle range multiplied by 10 of a directional diagram for which the radiated power has decreased to 50% of its maximum value. This angle has to be determined once from the direction of the maximum gain to that direction which represents 50 % of the radiated power (in the diagram $1/\sqrt{2} = 0.707$ of the field strength). Example: 300 for an angle of 30 degrees.

4th character: This character describes an electrically and mechanically tilted antenna.

5th character: This character describes the electrical tilt of the antenna in coded form (A=0°, B=-1°, ..., Z=-25°)

6th - 7th character: These characters describe the circle enveloping the side lobes not contained within the basic pattern defined by the first five characters. The two characters can be derived from the attenuation indicated by this circle in the antenna diagram, multiplied by 100. If only the front-to-back ratio (f:b ratio) is given, these digits can be calculated by using the equation:

$$two\ digits = 10^{2-\frac{\text{f:b ratio}}{20}}$$ (f:b ratio in dB)

2.5 For all the diagrams shown in the figures of Appendices 1 and 2, lines other than those drawn in the diagram are permitted, such that they do not exceed the edge of the outmost diagram. Example: For antenna type EA, only angles of 65 degrees, 45 degrees, 30 degrees and 15 degrees have been marked but any other angle between 0 and 65 degrees is permitted.

3 Forming a character string from a given antenna diagram

3.1 For an omni directional antenna, the string is expressed by 000ND00.

3.2 For other antenna types, the diagram to be drawn is compared with the diagrams given in Appendices 1 and 2. The character string shall be based on the diagram in these Appendices that most closely resembles the diagram to be described. The numeric values of the attenuation factor can be found in the tables in Appendices 1 and 2. The attenuation represented by the resulting antenna type must not exceed

the real antenna attenuation by more than 1 dB in the direction of any of the affected countries. In other directions there is no limit.

3.3 Antenna types CA, CB, CC, and DE have several main beams. In these cases the procedure as described in 2.1 and 2.2 is applied. However a character string needs to be given for only one of the main lobes.

4 Deriving an antenna diagram from a given character string

4.1 The two-letter code indicates the antenna type.

4.2 The half-power angle, side lobe and notch attenuation may be derived from the digits in the character string.

4.3 For other angles worst case attenuation values can be taken from the tables in Appendices 1 and 2 or be calculated using the following equation:

attenuation factor (dB) = 20 * log (numeric value in the diagram)

The range of this value is always between 0 and 1