

#### **B.4.4.2.6 Validation of full wave field analyses**

##### **B.4.4.2.6.1 General**

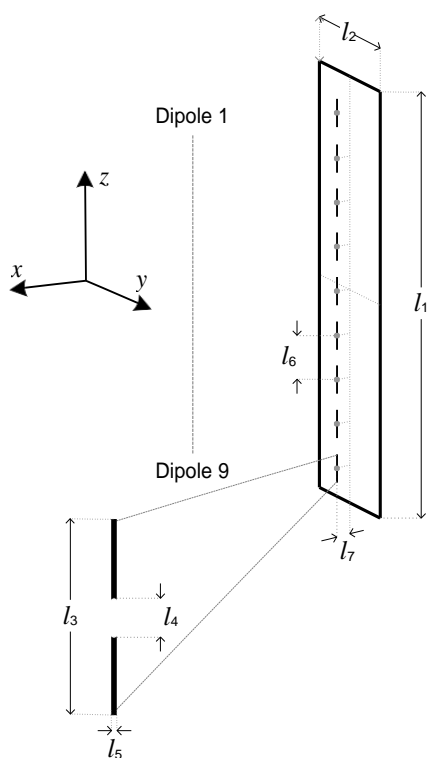
B.4.4.2.6 describes how to validate the correct implementation of full wave field analyses. Before a newly implemented code or commercially available code is used for determining the field strengths from RBS antennas, it shall be validated for the antenna structure to be analysed.

NOTE The mesh size is not explicitly given for the validation examples because the optimal mesh size will differ for different simulation packages. It is the user's responsibility to verify the chosen mesh size, by doing convergence tests.

##### **B.4.4.2.6.2 Validation 1: Antenna with dipole radiators**

Validation 1 shall use the following procedure.

- a) Implement the simple panel RBS antenna, representative of a real RBS antenna, with dipole radiators and excitation parameters as presented in Figure B.25.
- b) The electric field strength values shall be determined along line 1, line 2 and line 3 (see Figure B.26) in the near-field of the antenna for a frequency of 900 MHz and  $\bar{P}_{avg}$  of 80 W.
- c) The determined power density values shall be compared with the reference power density values in Table B.25. If the maximum deviation from the reference results is less than 10 %, then the simulation package has passed the validation.



**Dimensions**

- $l_1$  Reflector length = 2,25 m
- $l_2$  Reflector width = 0,3 m
- $l_3$  Length of a dipole = 0,158 m
- $l_4$  Separation of feed segments = 0,02 m
- $l_5$  Dipole thickness = 0,001 m
- $l_6$  Spacing between the dipole centres = 0,25 m
- $l_7$  Spacing between the dipoles and the reflector = 0,04 m

**Excitation parameters**

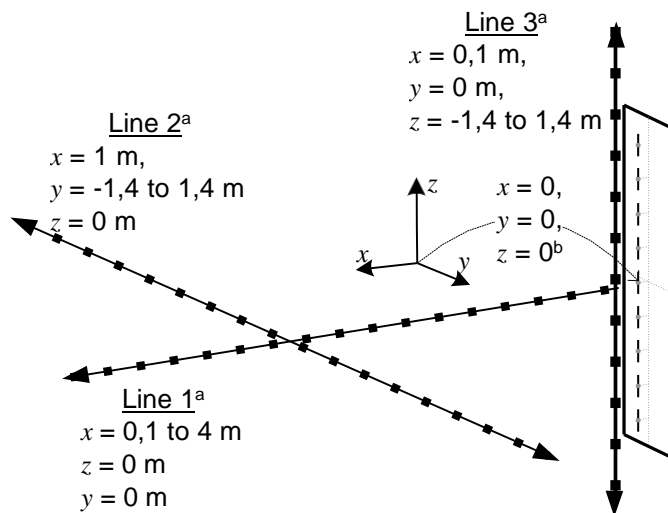
Feed segment	Amplitude (relative to maximum)	Phase (°)
1 and 9	0,582 8	0
2 and 8	0,609 7	0
3 and 7	0,809 0	0
4 and 6	0,949 4	0
5	1,000 0	0

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NOTE 1 The coordinate system origin ( $x = 0, y = 0, z = 0$ ) is at the centre of the middle feed segment.

NOTE 2 The dipole array is in the centre of the reflector plate if viewed directly from the front.

**Figure B.25 – Generic 900 MHz RBS antenna with nine dipole radiators**



<sup>a</sup> Line 1 is along the  $x$ -axis in the main beam direction; Line 2 is parallel to the  $y$ -axis; Line 3 is parallel to the  $z$ -axis (i.e. parallel to the antenna).

<sup>b</sup> The coordinate system origin ( $x = 0, y = 0, z = 0$ ) is at the centre of the middle feed segment.

**Figure B.26 – Line 1, 2 and 3 near-field positions for full wave and ray tracing validation**

**Table B.25 – Validation 1 full wave field reference results**

Power density along Figure B.26 line 1		Power density along Figure B.26 line 2		Power density along Figure B.26 line 3	
Position $x$ (m)	$S$ (W/m <sup>2</sup> )	Position $y$ (m)	$S$ (W/m <sup>2</sup> )	Position $z$ (m)	$S$ (W/m <sup>2</sup> )
0,5	65,8	0	39,4	0	338
1	39,4	± 0,2	37,6	± 0,2	272
1,5	25	± 0,4	32,8	± 0,4	163
2	13,4	± 0,6	26,3	± 0,6	111
2,5	10,7	± 0,8	19,6	± 0,8	105
3	10,4	± 1	13,6	± 1	129
3,5	10,1	± 1,2	9,16	± 1,2	3,77
4	9,44	± 1,4	6,22	± 1,4	0,173