Consideration of a new broadband antenna for proximity field testing.

February/ 15/ 2016

The Japanese national committee

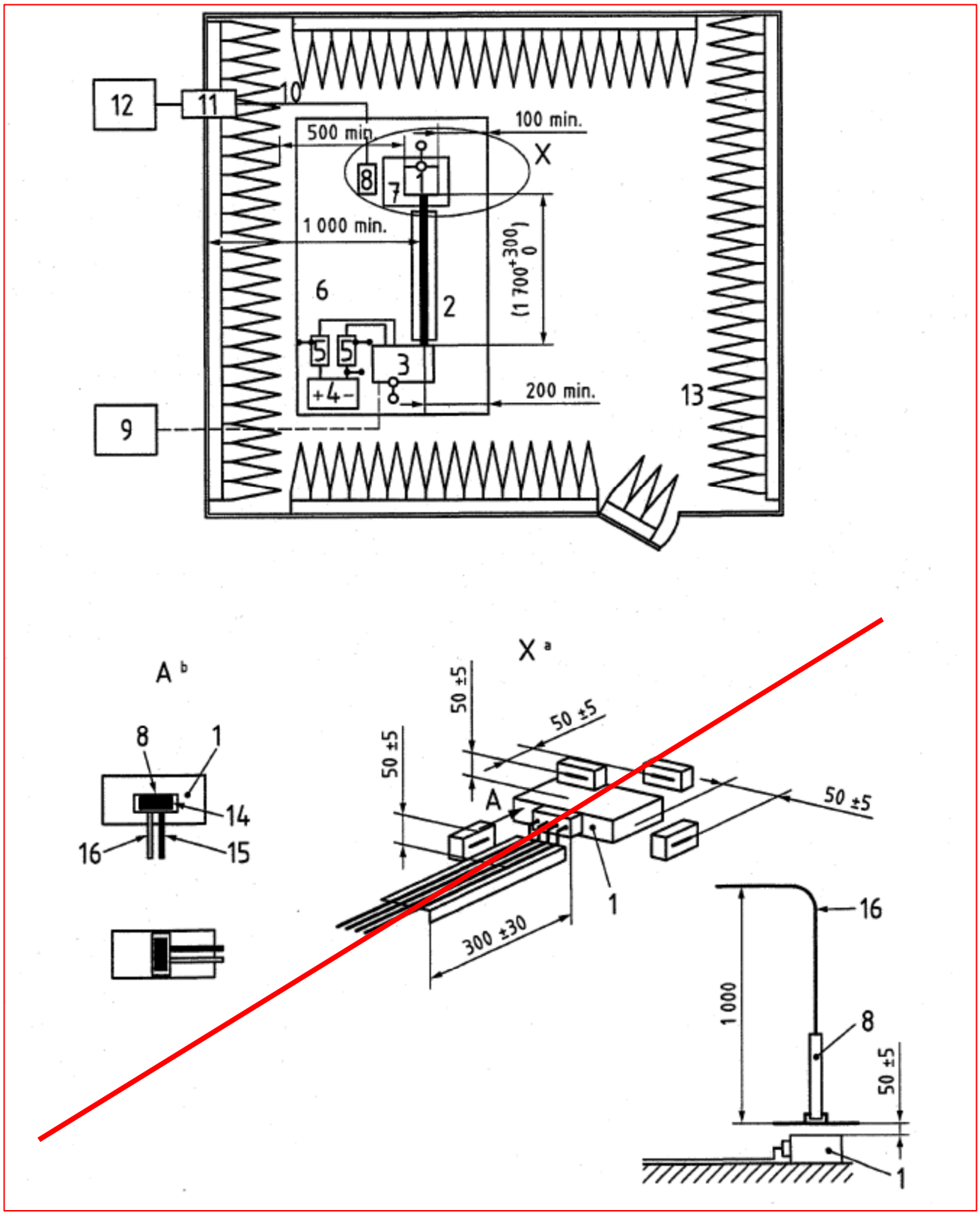
Proximity field test and the required broadband antenna design are already detailed in the ISO 11451-3 and ISO 11452-9 standards. This broadband antenna acts as a dipole antenna. A new broadband antenna structure proposed here acts as a sleeve antenna. The radiation and ground (sleeve) elements are made on a print circuit board. Therefore following features and characteristics are shown.

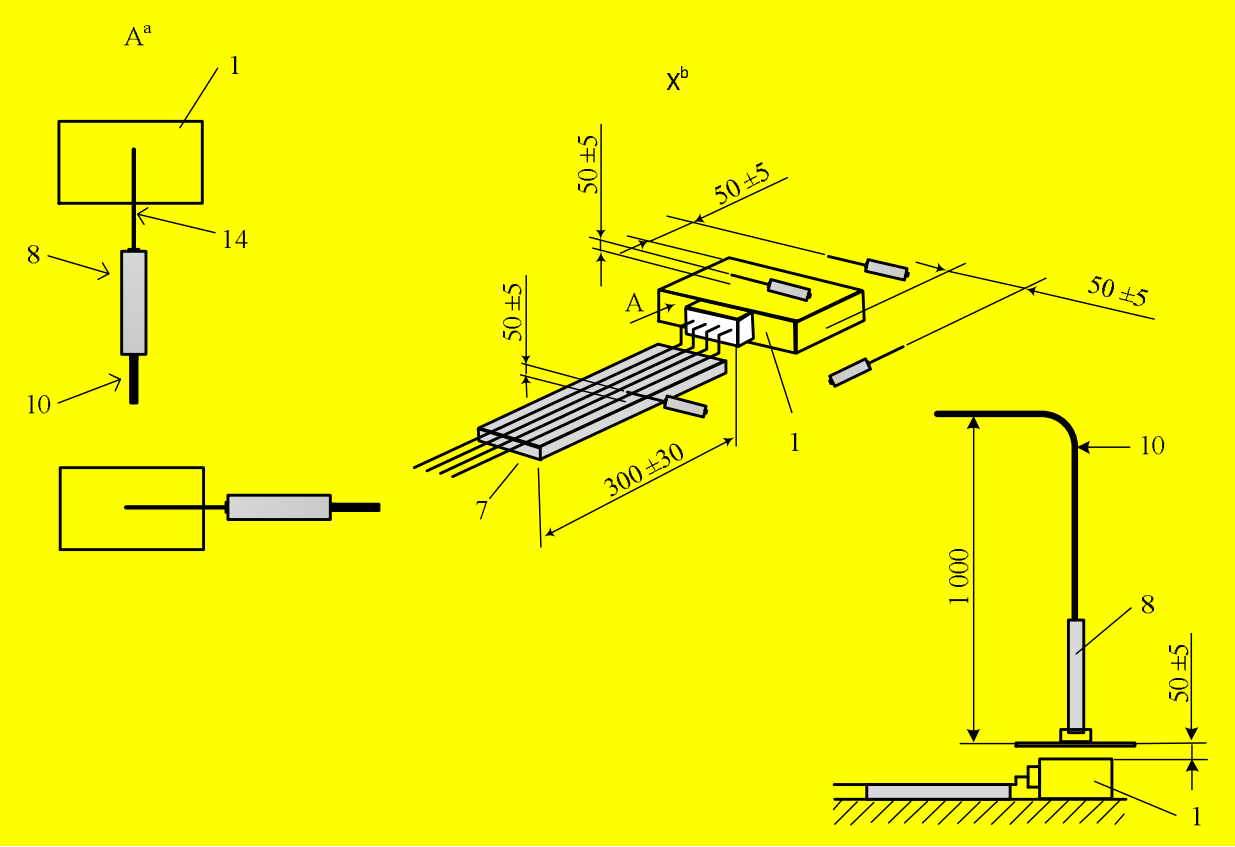
- Small and flat dimension
- Unbalanced transmit structure (no balun transformer)
- Centered distribution of radiated field
- Low VSWR characteristic (≤ 2: 0,7 GHz – 3,2 GHz, ≤ 3,5: 3,2 GHz – 6,0 GHz)

An example of revised ISO 11452-9 standard is attached.
(The highlighted parts are for a proposed draft)

Dimensions in millimeters

Upper view





Key

1 DUT (grounded locally if required in test plan)

2 test harness

3 load simulator (placement and ground connection according to 7.5)

4 power supply (location optional)

5 artificial network (AN)

6 ground plane (bonded to shielded enclosure)

7 low relative permittivity support (εr<1,4)

8 simulated portable transmitter antenna or commercial transmitter

9 stimulation and monitoring system

10 high-quality double-shielded coaxial cable (50 Ω)

11 bulkhead connector

12 RF signal generator, amplifier, directional coupler and power meter for the simulated portable transmitter

13 RF absorber material

14 ~~dipole axis or patch plane~~ radiation element

~~15 insulating support~~

~~16 coaxial cable~~

[a] View A:simulated portable transmitter position for different polarizations

[b] View X:simulated portable transmitter positions(DUT and harness)

Figure1- Example of test set-up

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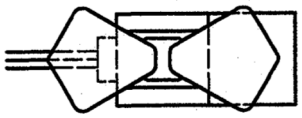
8.3.4 Antenna positioning for coupling to DUT

8.3.4.1 Testing with broadband dipole antennas

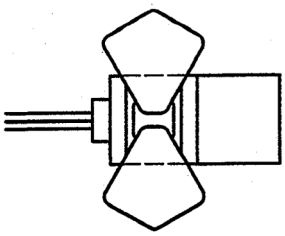
The usable test area of the broadband dipole antenna described in B.2 is 100×100 mm when testing at separation of 50 mm from the DUT to the antenna. It is therefore necessary to move the antenna in steps of 100 mm.

All surfaces of the DUT which are to be tested shall be partitioned to square cells of 100×100 mm. The antenna shall be placed at a distance of 50 mm and the centre of each cell shall be exposed to the centre and the elements of the antenna in two orthogonal orientations (for exposures in total). It is necessary to expose each cell to the centre of the elements of the antenna because the E and H fields are in different places and move with the test frequency.

a) Place the antenna parallel with the DUT harness and aligned with the centre of the first cell and expose the DUT to the stress levels given in the test plan.

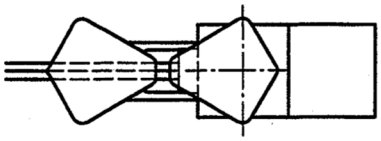


b) Repeat step a) with the antenna rotated 90°.

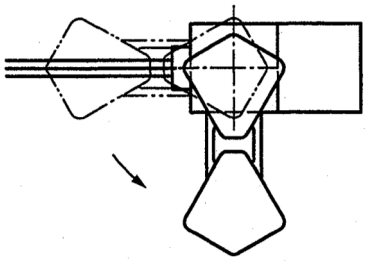


c) Align the antenna with the centre of the next cell and repeat steps a) and b) until all the cells have been exposed to orthogonal orientations of the antenna.

d) Move the antenna back to the first cell. Align the antenna element in the centre of the test cell (edges of the element aligned with the centre of the cell) and expose the DUT to the stress levels given in the test plan.



e) Repeat step d) with the antenna rotated 90°.



f) Repeated steps d) and e) until all cells have been exposed. When testing DUTs with multiple cells, some cells will be exposed to the elements of the antenna when steps a) to c) are performed on an adjacent cell. If this happens, and duplicate testing would result, it is not necessary to carry out steps d) and e). However, if there is any doubt over the effective exposure of cells to the elements of the antenna, steps d) and e) shall nevertheless be repeated.

g) Repeat steps a) to f) for each DUT surface defined in test plan for electromagnetic compatibility (EMC). Testing requires rotation of the DUT such that the surface to be tested is parallel to the ground plane. Material of low permittivity shall be used to support the DUT so that the surface under test is facing upwards, towards the antenna.

8.3.4.2 Testing with other antennas

For each surface of the DUT, place the antenna with its centre at a distance of 50 mm from the DUT's surface (see Figure 1). The axis of the broadband sleeve antenna, monopole, dipole, sleeve or plane of the patch antenna shall be parallel to the surface of the DUT.

The placement of the portable transmitters - at specific position(s) or scanning along the DUT - should be defined in the test plan. Move the portable transmitter along the surface for two orientations (polarizations) of the antenna, parallel to the surface of the DUT.

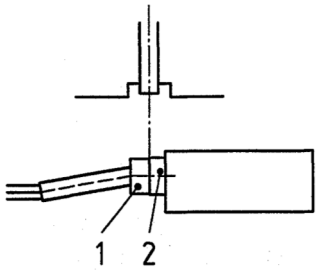
8.3.5 Antenna positioning for coupling to harness

8.3.5.1 Testing with broadband dipole antennas

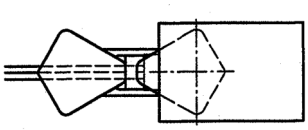
Position the antenna central to the connector under test and parallel to the harness. Align the centre of the antenna with the outermost edge of the DUT connector. Expose the DUT to the test signals specified in the test plan. In cases where the DUT has multiple connectors or connectors that are wider than 100 mm, the test shall be repeated multiple times.

Place the antenna with its centre at a distance of 50 mm from the harness.

Carry out the test by moving the portable transmitter along the harness, in 100 mm increments, for a length of 300 mm, starting at the DUT connector.



Side view



Plan view

8.3.5.2 Testing with other antennas

Place the antenna with its centre at a distance of 50 mm from the harness.

The axis of the antenna shall be parallel to the harness; for a patch antenna, ensure that the polarization of the antenna is parallel to the harness. Alternatively, if the polarization is unknown, perform tests for both polarizations.

Carry out the test by moving the portable transmitter along the harness, in 100 mm increments, for a length of 300 mm, starting at the DUT connector.

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Annex B
(informative)

Examples of simulated portable transmitter antenna

B.1 Introduction

This annex provides details of the miniature broadband antenna, together with examples of other simulated portable transmitter antennas, which can be used to perform the tests according to this International Standard:

— miniature broadband dipole antenna;
— miniature broadband sleeve antenna;
— sleeve antennas;
— monopole antennas.

All dimensions indicated in the figures of this annex are in millimeters.

B.2 Miniature broadband antenna

B.2.1 General

~~The small broadband antenna acts comparably to a symmetrical broadband dipole antenna~~
As their names indicate, the two types of miniature broadband antenna act comparably to a symmetrical dipole antenna and sleeve antenna.
In contrast to an ordinary dipole antenna and sleeve antenna, the radiating elements have been designed especially for wide bandwidth, close distance to the DUT and good field uniformity. Due to the wide frequency coverage, a significant time reduction for testing can be achieved.

B.2.2 Typical characteristics

B.2.2.1 Broadband dipole antenna

Input impedance: 50 Ω
Balun transformation ratio: 1:1
Frequency range: 360-2700 MHz
Radiating element dimensions: 240×109 mm
Maximum power input 20 W
Connector: Type-N female
VSWR characteristic: see Figure B.1

The geometrical characteristics of the miniature broadband dipole antenna for simulated portable

transmitters are indicated in Figure B.2.

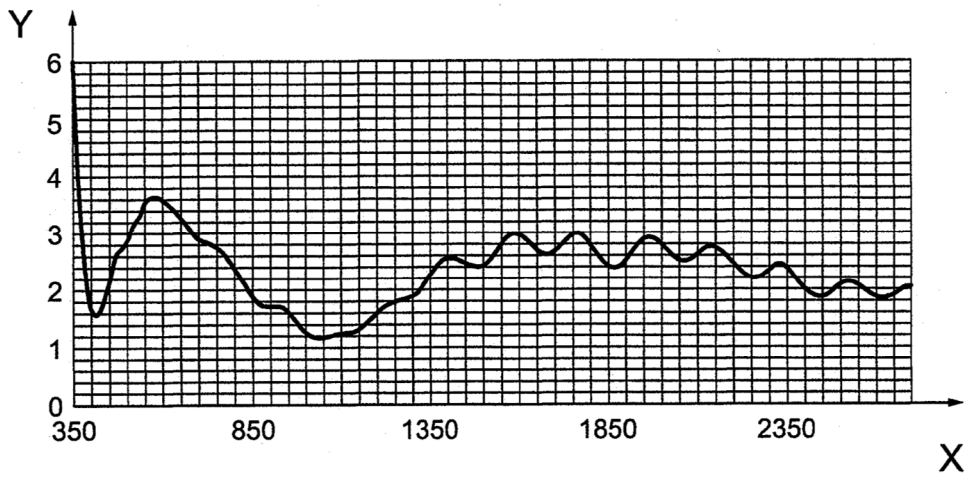
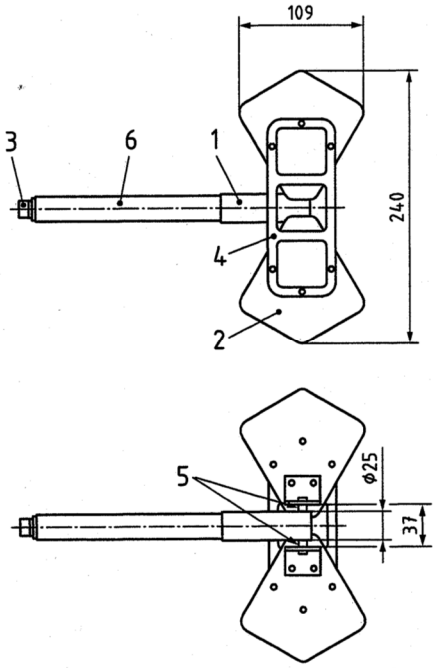


Figure B.1—Typical VSWR characteristics for broadband dipole antenna



Key

1 broadband low loss balun 1:1

2 flat antenna elements

3 N-female connector

4 element fixture and spacing frame (5 MM, non-metallic)

5 symmetrical terminals, M4

6 22 mm tube for handling or fixture

Figure B.2—Construction details of broadband dipole antenna

B.2.2.2 Broadband Sleeve antenna

Input impedance: 50 Ω

Frequency range: 700-6000 MHz

Radiating element dimensions: 186×50 mm

Maximum power input 20 W（700 MHz～3200 MHz）, 15 W(3200 MHz～6000 MHz)

Connector: Type-SMA female

VSWR characteristic: see Figure B.3

The geometrical characteristics of the miniature broadband sleeve antenna for simulated portable transmitters are indicated in Figure B.4.

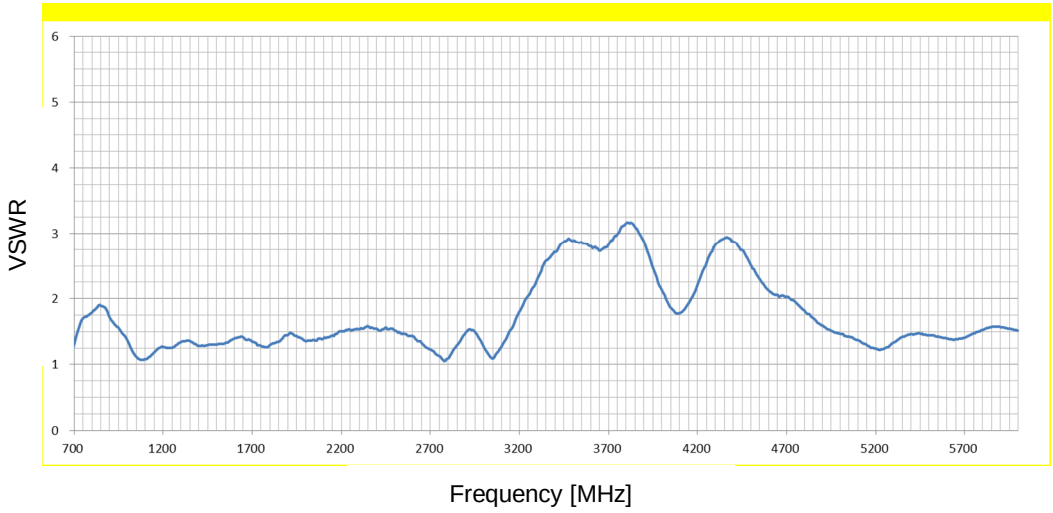
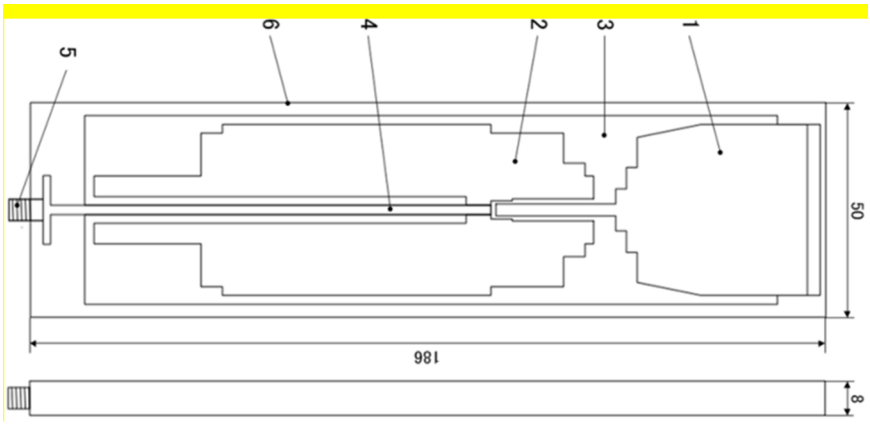


Figure B.3—Typical VSWR characteristics for broadband sleeve antenna



Key

1 radiation element

2 ground element

3 PCB

4 semi-rigid cable

5 SMA-female connector

6 non-metallic case

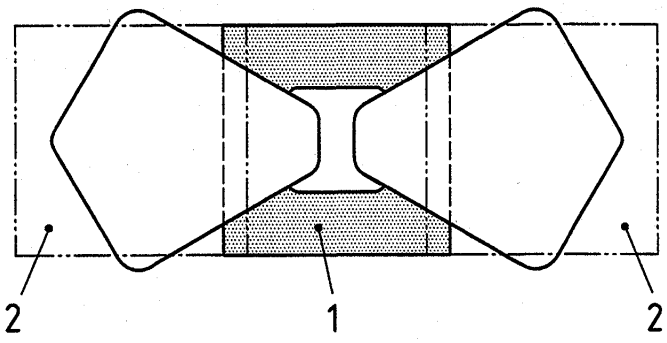
Figure B.4—Construction details of broadband sleeve antenna

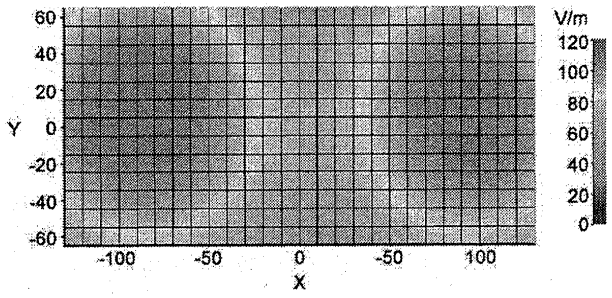
B.2.3 Electric fields generated by the antenna

B.2.3.1 Broadband dipole antenna

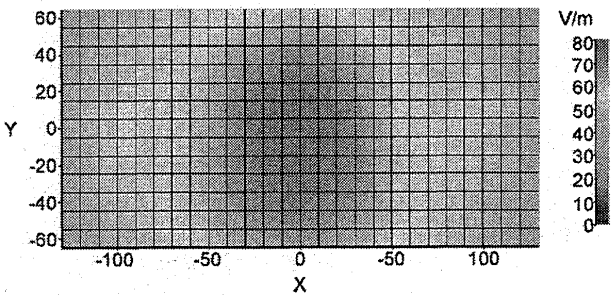
The test antenna has 3 100 x100 mm test zones where field uniformity is better than ±3dB. In the frequency range 360-480 MHz, the E field is concentrated under the elements of the antenna and moves to the centre after 800 MHz. The average field severity is calculated by averaging the field in these zones.

Figure B.3 shows field distribution and peek amplitudes in volts per meter(V/m) for a 1 W net input at a 50 mm distance from the antenna elements. The greenest areas (the mid-grey areas toward the grid edges when viewed in monochrome) show a greater than 6 dB field degradation from the maximum field.

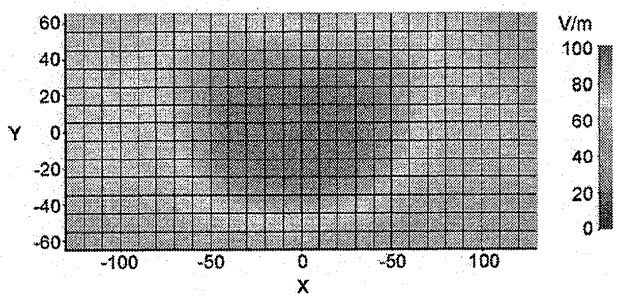




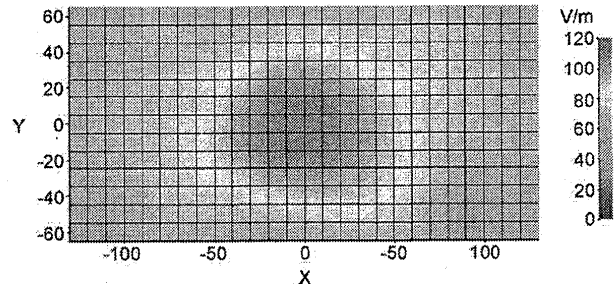
400 MHz; 1 W net; average field strength: 100 V/m



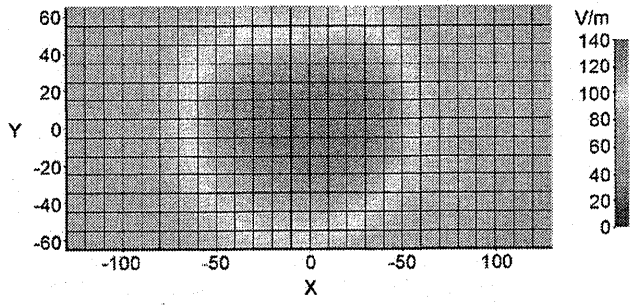
900 MHz; 1 W net input; average field strength: 67 V/m



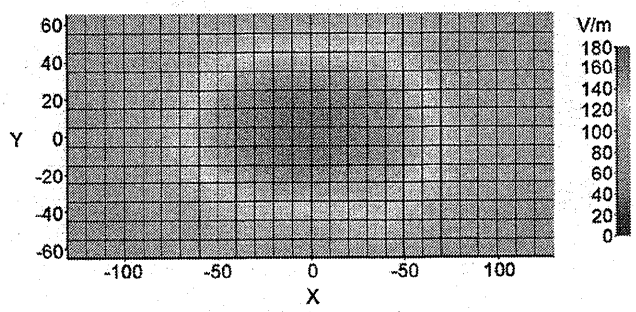
1800 MHz; 1 W net input; average field strength: 84 V/m



2000 MHz; 1 W net input; average field strength: 89V/m



2450 MHz; 1 W net input; average field strength: 114 V/m



2600 MHz; 1 W net input; average field strength: 137 V/m

Key

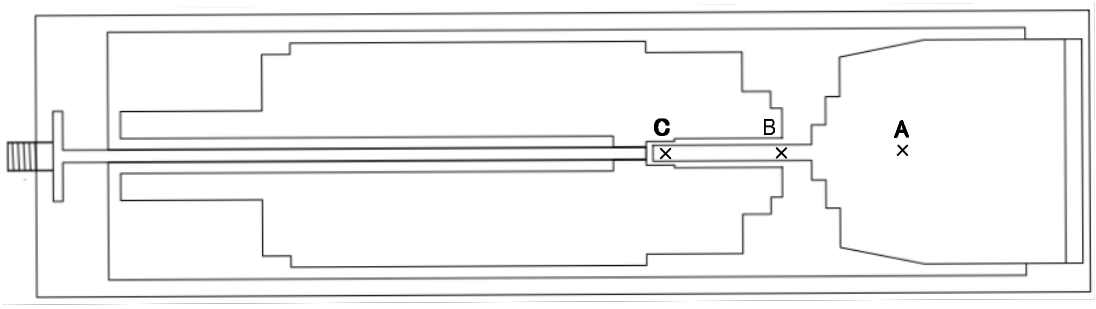
1 uniform E field for 800≦f ≦2700 MHz and uniform H field for 360≦f ≦2700 MHz

2 uniform E field for field 360≦f ≦480 MHz

Figure B.3—E field pattern for the broadband dipole antenna

B.2.3.2 Broadband sleeve antenna

The test antenna has a test zone, along the radiation element, where electric fields are effectively generated. The Figure B.4 shows the maximum field strengths (dBµV/m) for a 1W net power input at a 50 mm distance from the points marked A, B and C.



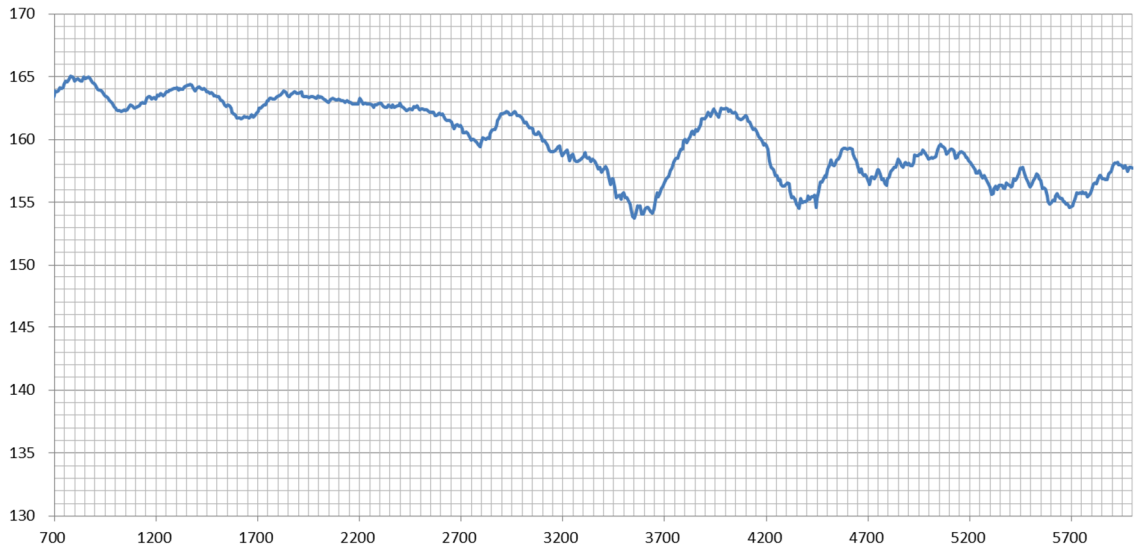


Figure B.4—E field strength for the broadband sleeve antenna