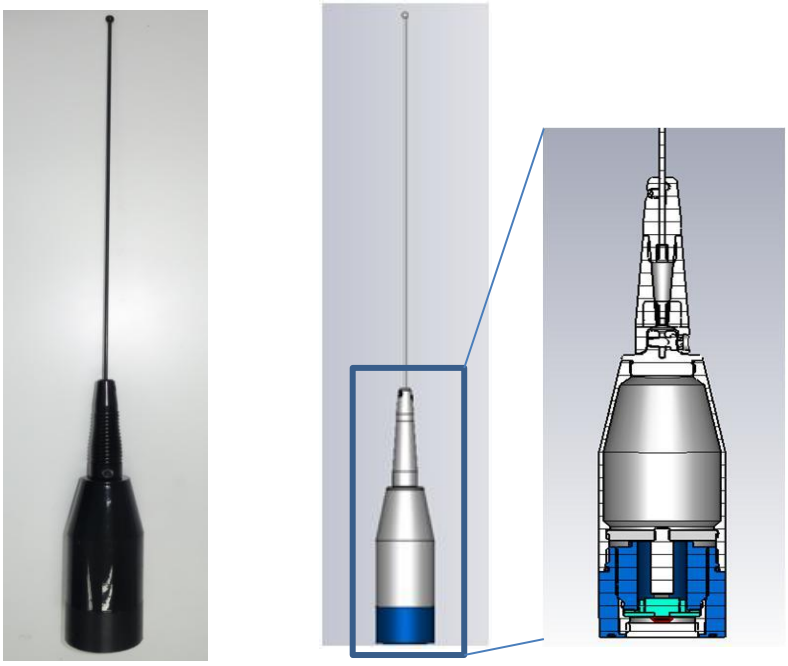
MOTOROLA SOLUTIONS

Validation of the numerical AN000131A01 antenna model per IEC/IEEE 62704-2

The numerical antenna model validation was performed according to Clause 6.1 of the IEC/IEEE 62704-2 standard. Accordingly, a 1070 mm diameter ground plane model was used with the antenna mounted in the center to calculate the electric and magnetic field values along a vertical line parallel to the antenna axis, at 20 cm separation distance from it.
A high resolution FIT (Finite Integration Technique) based simulation with minimum mesh size of 0.79 mm was conducted using CST Microwave Studio® (CST MWS) software to generate the reference field values at test points equally spaced along the vertical line, with 10 mm step up to a height of 590 mm above the ground plane, which is higher than the antenna tip (554 mm above the ground plane surface).

The physical antenna comprises a fully metal structure with a thick base element spaced by a plastic part from the ground plane. A picture of the antenna is shown below alongside with the cross section of its CAD model view that illustrates the internal details of the structure.

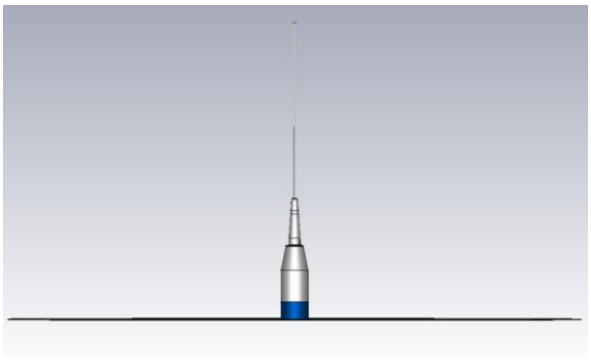


The reference antenna model was designed based on the CAD model that was imported in CST MWS. The FIT CST simulations were performed with adaptive mesh refinement until the convergence of S-parameters at the antenna feeding port reached the preset level of 2e-2 (-34 dB),* and near electric and magnetic field values along the vertical line were exported in text format. The same setup was

* The convergence criterion for S-parameters was defined as the maximum deviation of the absolute value of the complex difference of the S-parameters between two subsequent passes

simulated to compute the field values using XFDTD code with the same maximum resolution of the FDTD grid that was used in subsequent exposure compliance simulations as required by the IEC/ IEEE 62704-2.

The figures below illustrate the CST MWS (FEM) and XFDTD antenna models. The red dot in the latter represents the location of the lumped inductor.



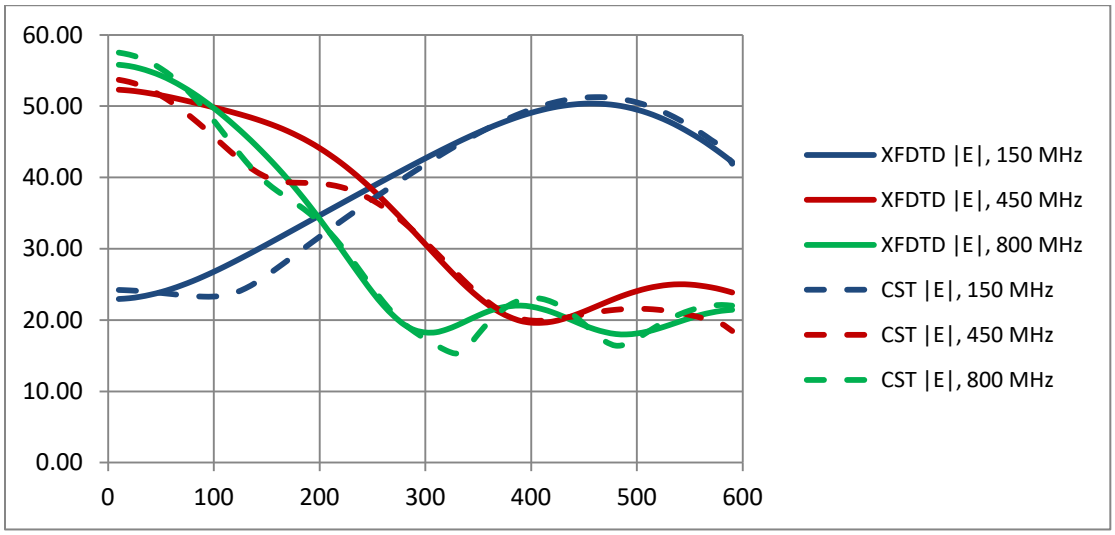
CST MWS model of the AN000131A01 antenna

XFDTD model of the AN000131A01 antenna

Finally, the electric and magnetic field values computed at 150 MHZ, 450 MHz, and 800 MHz with XFDTD were compared to the reference values computed using high resolution CST model and the deviation was evaluated according to equation (7) of the IEC/IEEE 62704-2 standard to quantify the uncertainty contribution of the numerical antenna model, resulting in **11.5% in VHF, 23.2% in UHF, and 8.4% in 7/800 MHz bands**.

The plots below illustrate the magnitudes of electric and magnetic fields along the vertical line, at 20 cm from the antenna axis, computed using CST MWS (FEM) and XFDTD codes, and normalized to 1.0 W net input power at 150 MHz, 450 MHz, and 800 MHz.

Electric field magnitude



Magnetic field magnitude