叠加双菱天线（12.9dBi）

本文摘自Dragoslav Dobričić, YU1AW先生的《2.4GHz抛物面天线的高效馈源》

激情无线（lijiqing）翻译

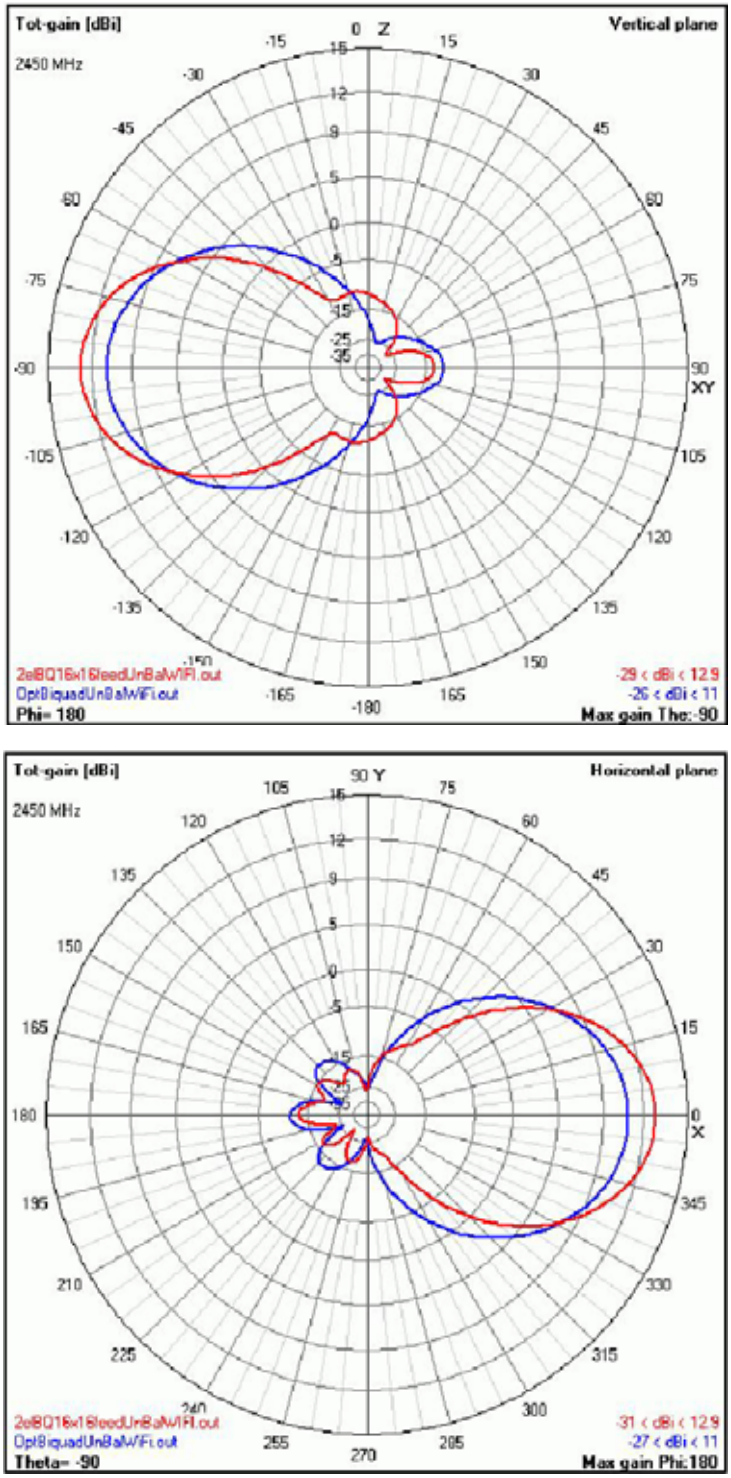

Fig. 5. Horizontal and vertical diagrams of optimal bi-quad and 2 element bi-quad feed

图。5。最佳双菱天线和叠加双菱馈源天线的水平和垂直方向图

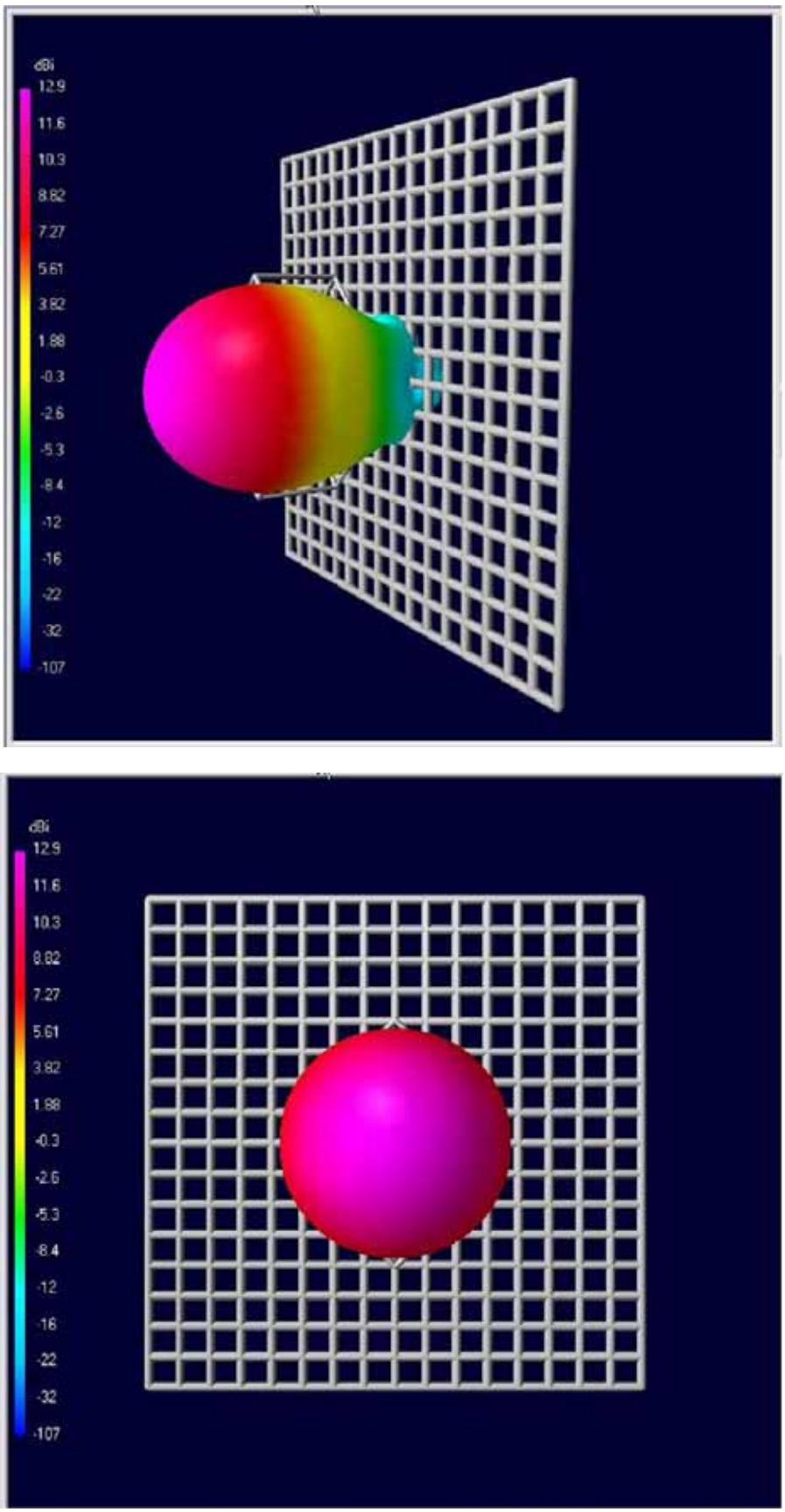

Fig. 6. Side and front view of 2-element bi-quad feed diagrams

图。6。叠加双菱馈源天线的侧视和前视方向图

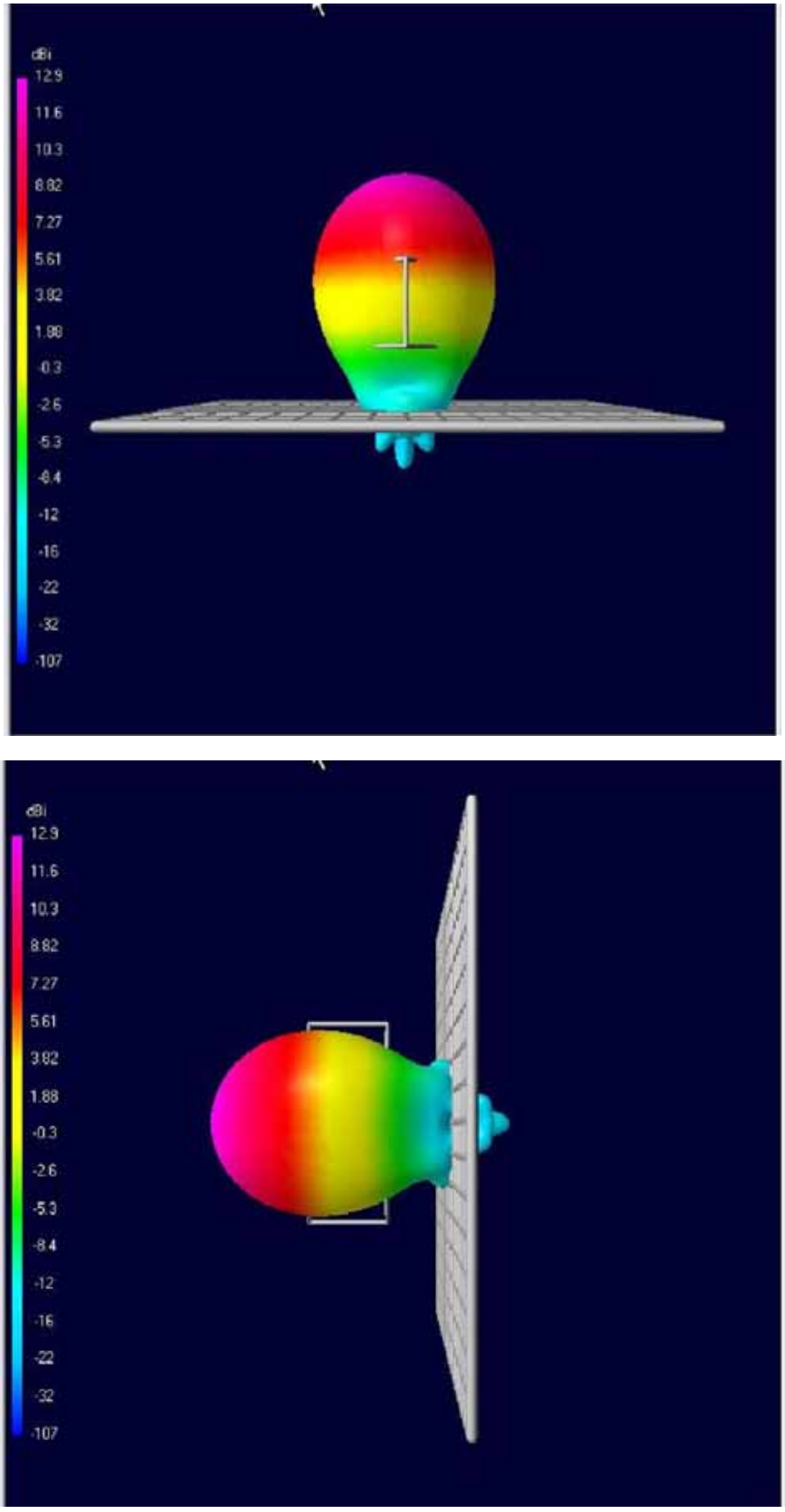

Fig. 7. Horizontal and vertical diagram of 2-element bi-quad feed

图。6。叠加双菱馈源天线的水平和垂直方向图

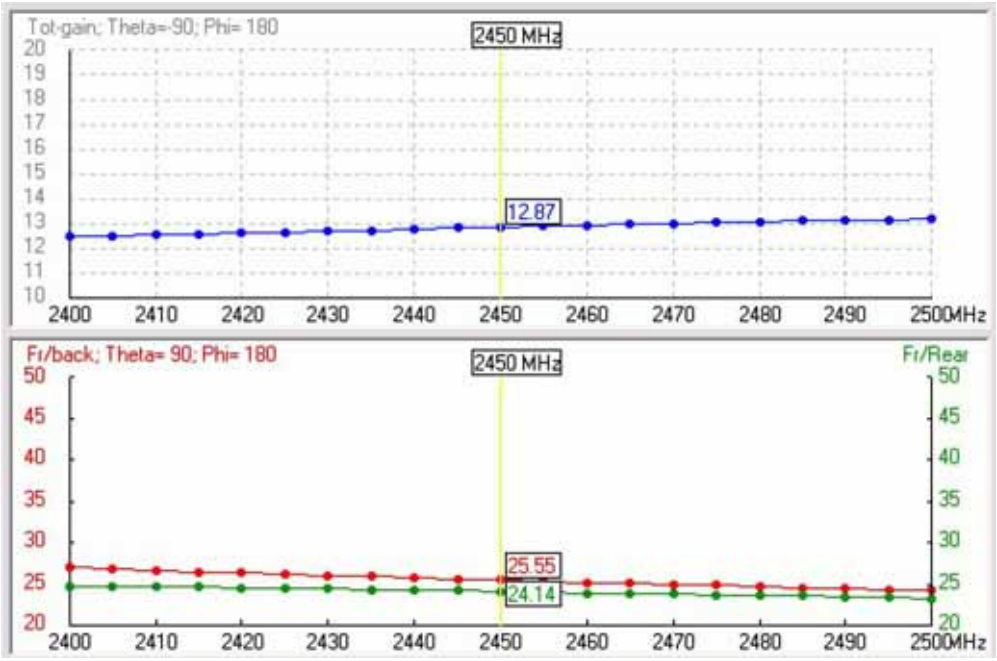

Fig. 8. Gain, F/B and F/R of 2 el. bi-quad feed for different frequencies

图。8。不同频率的叠加双菱馈源天线的增益、F/B 和 F/R

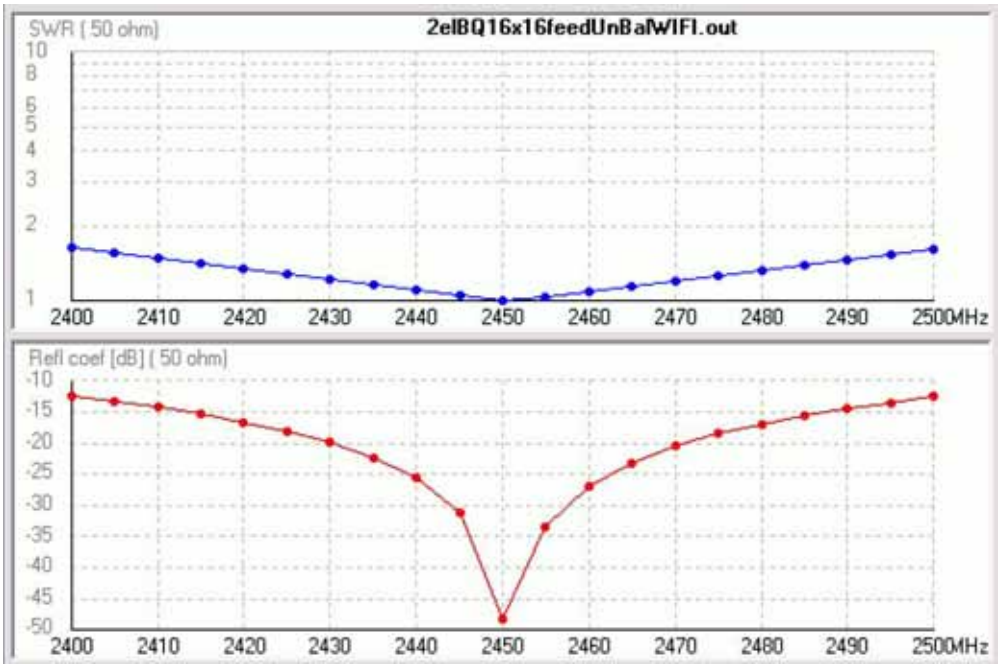

Fig. 9. SWR and Reflection coefficient of 2 el. bi-quad feed for different frequencies

图。9。不同频率的叠加双菱馈源天线的驻波比和反射系数

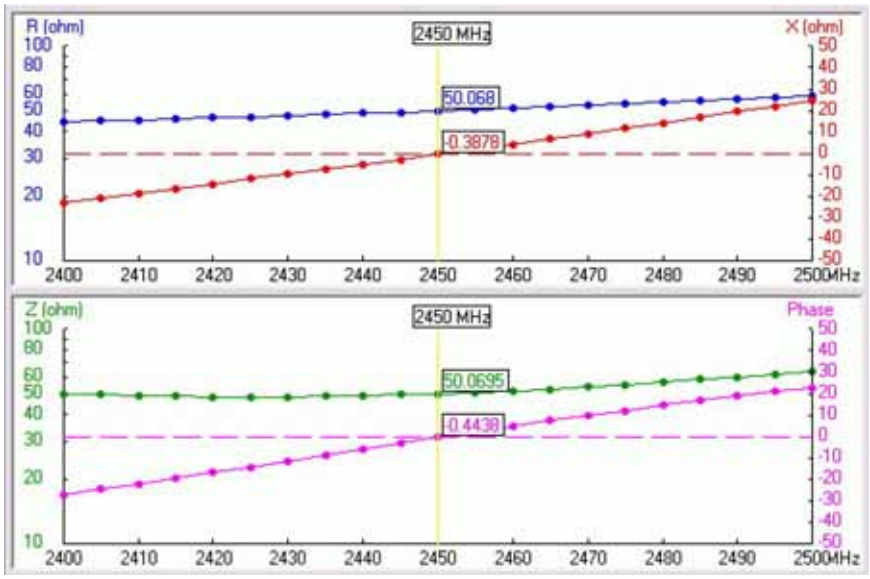

Fig. 10. Input impedance of 2 el. bi-quad feed for different frequencies

图。10。不同频率的叠加双菱馈源天线的输入阻抗

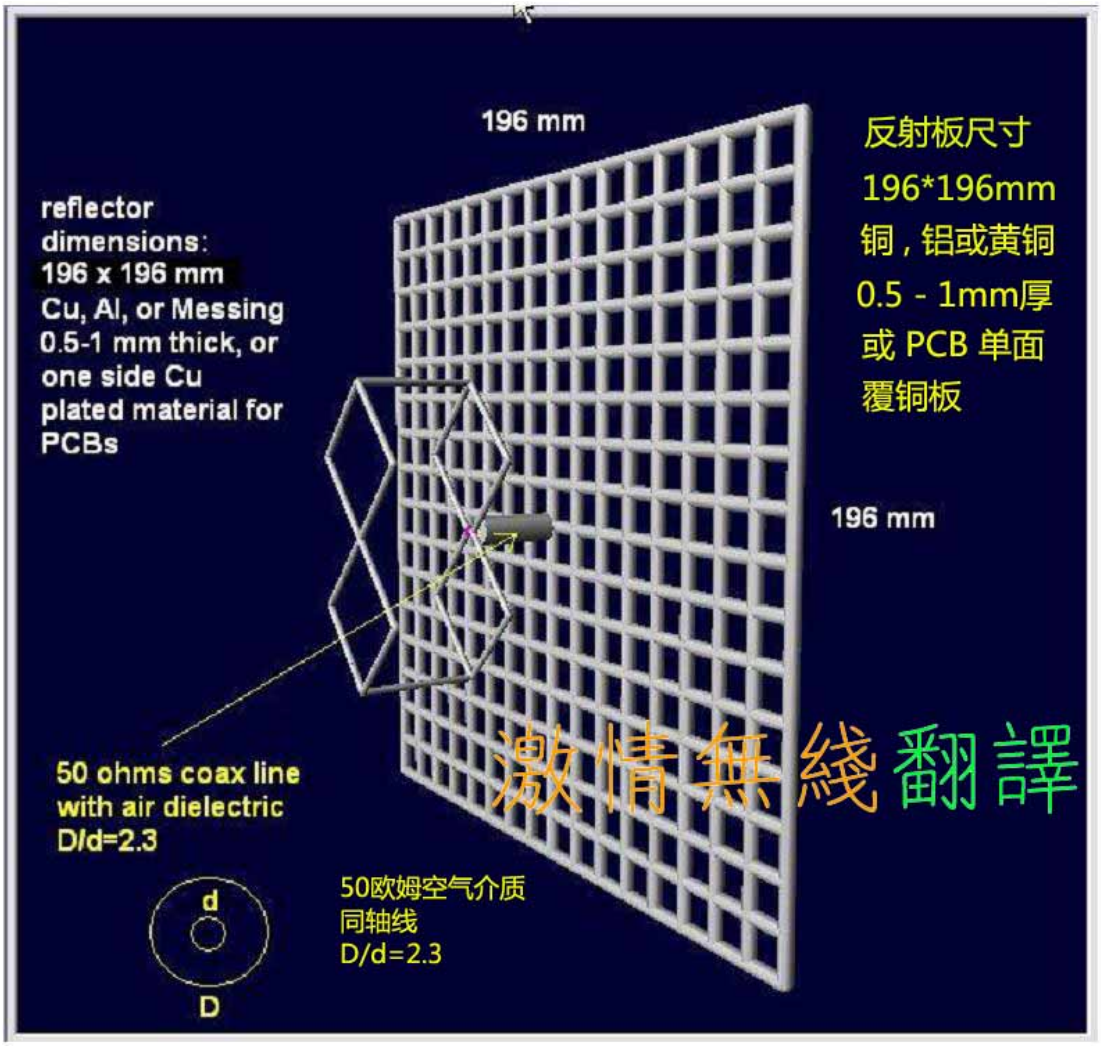

Fig. 11. Look-out of 2 el. bi-quad feed with reflector dimensions

图。11。叠加双菱馈源天线反射板的尺寸

Fig. 12. Distances between elements

图。12。振子之间的距离

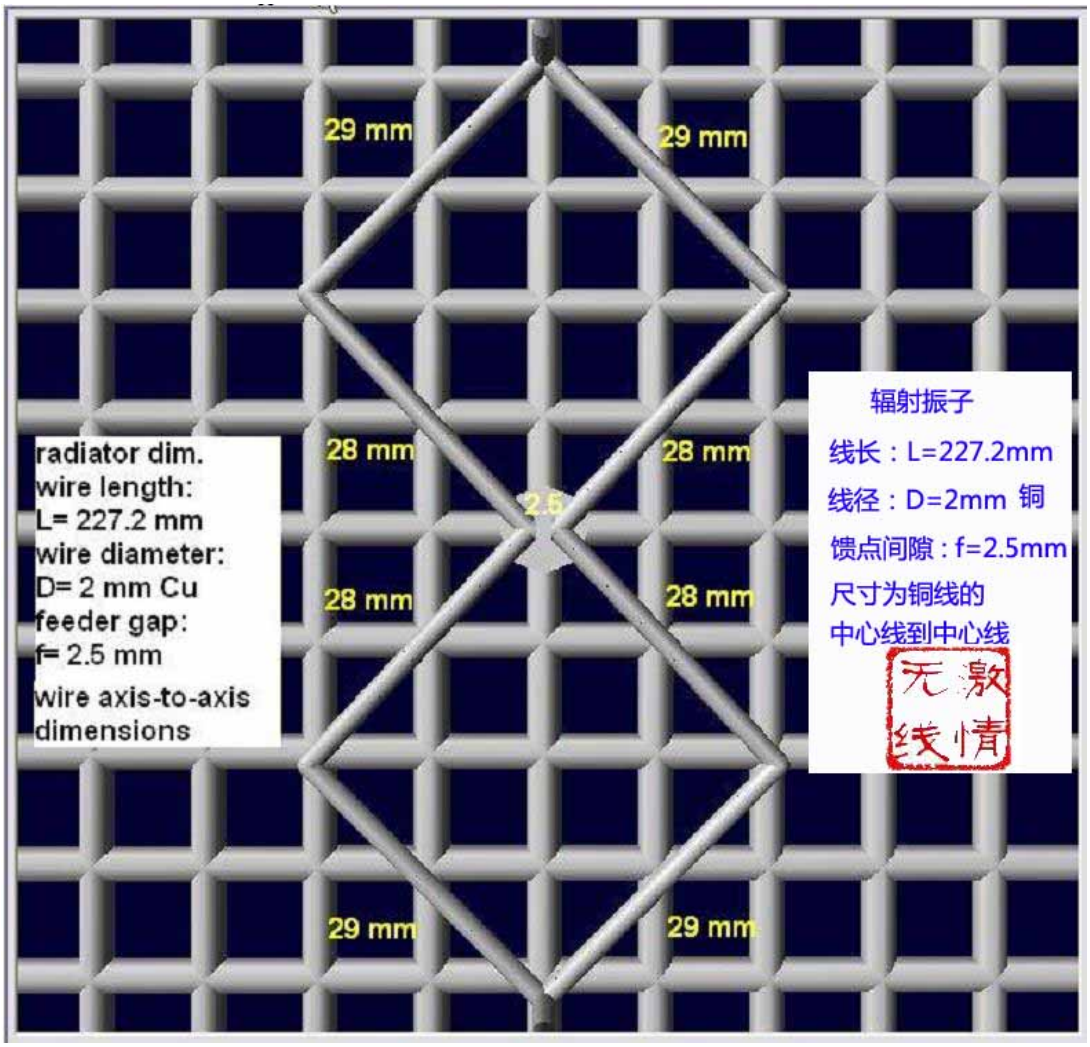

Fig. 13. Radiator element dimensions

图。13。辐射振子的尺寸

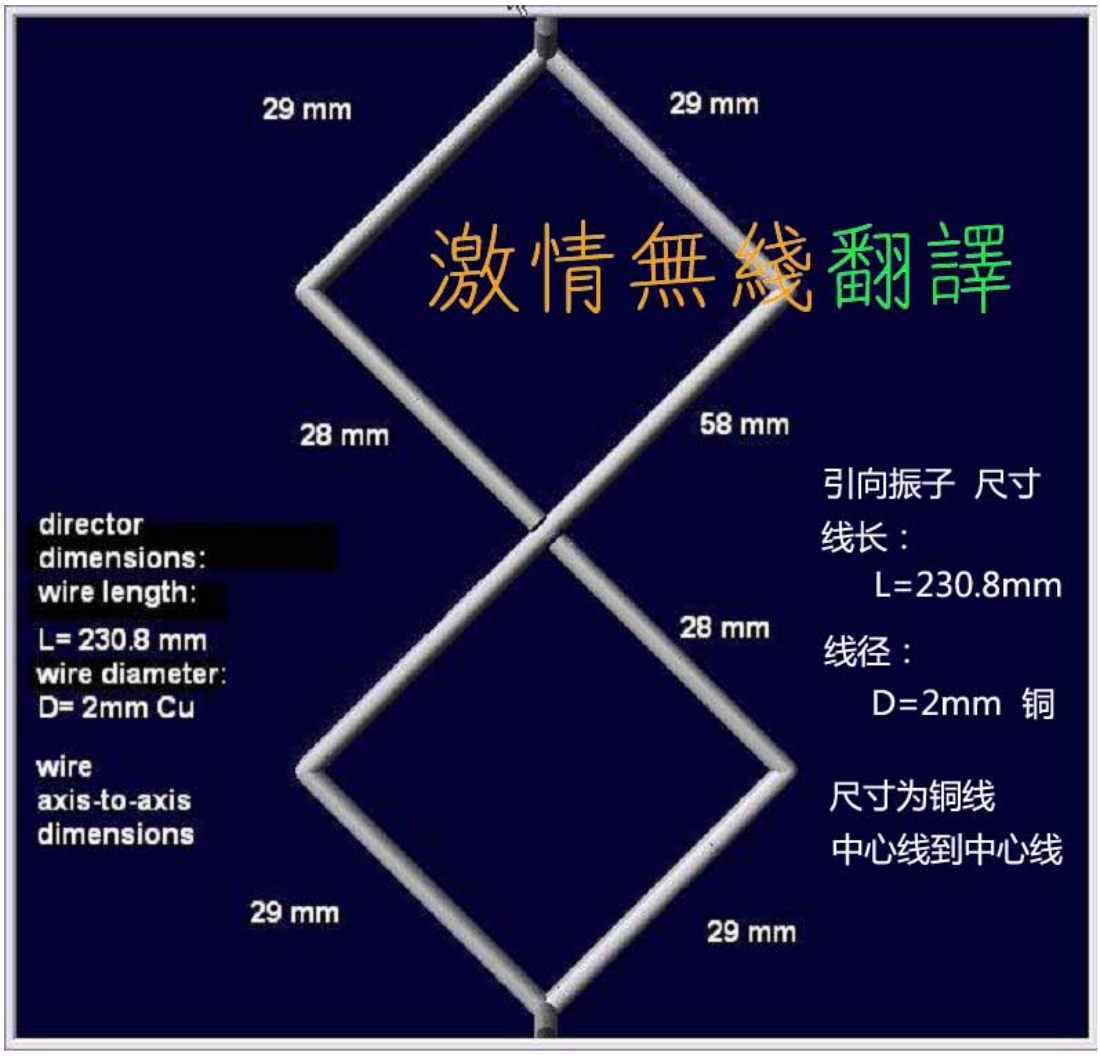

Fig. 14. Director element dimensions

图。14。引向振子的尺寸

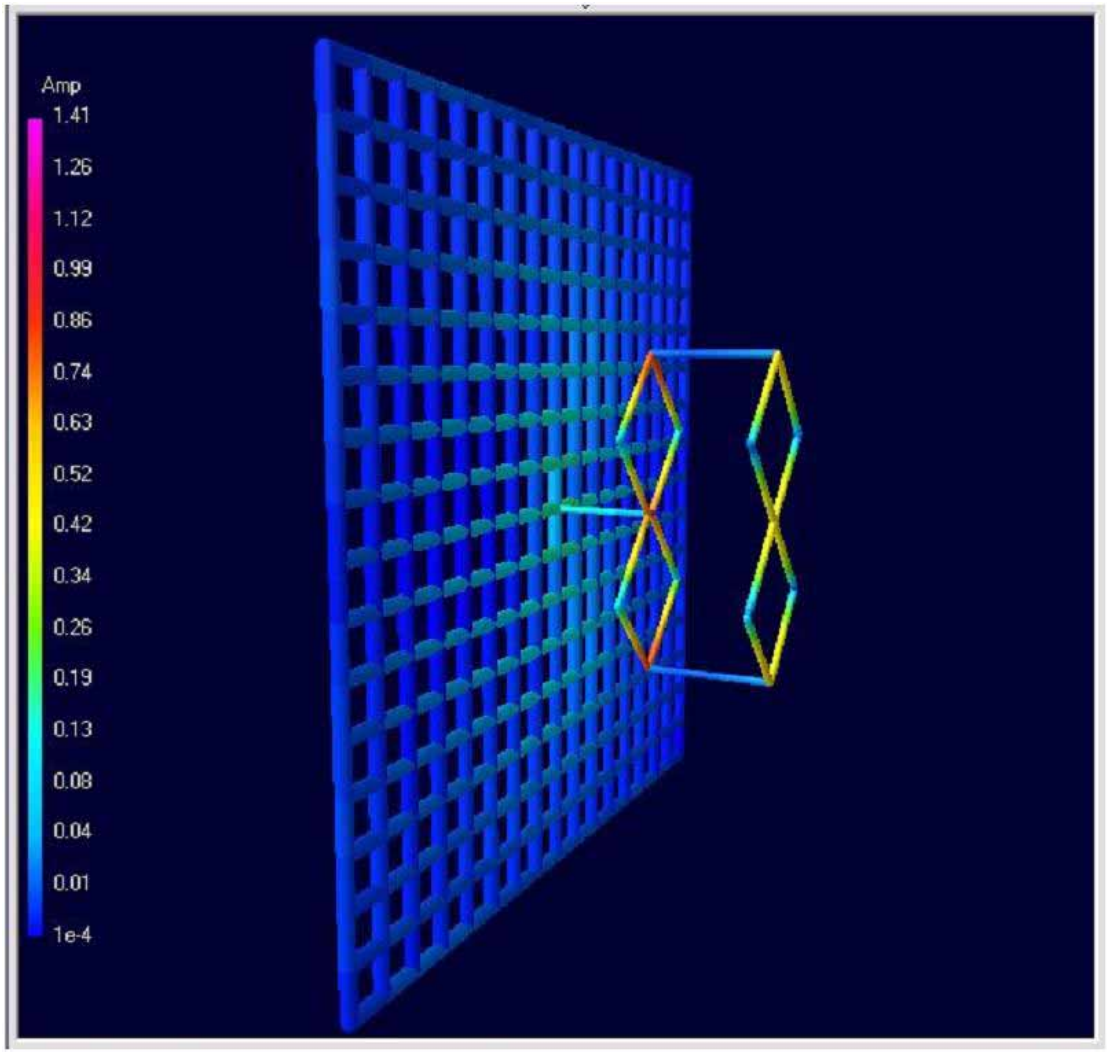

Fig. 15. Currents in 2 el. bi-quad feed with 100 W power input
图。15。100瓦功率输入时叠加双菱馈源天线的电流分布

Mechanical construction of the antenna
天线的机械结构

The radiator and director are made of two pieces of copper wire, with a diameter 2-2.3 mm and a total length of 227.2 mm for the radiator and 230.8 mm for the director. Each piece of wire is folded in a little different way, as shown in pictures. The radiator is folded as in a common bi-quad, i.e., in the way that the ends of the wire come in the center of the element and join perpendicularly. The director is folded as one usually writes number 8, i.e. in the way that the ends of the wire come in the center from the same course but from the different aim, i.e., under the angle of 180 degrees. Before bending, one should measure and cut off very precisely the needed length of wire, and then measure and mark spots where the wire will be folded perpendicularly.

辐射振子和引向振子是由两段直径2-2.3毫米的铜线制成，辐射振子全长

227.2毫米，引向振子全长230.8毫米。两段铜线弯折的方式小有不同，如图所示。辐射振子是弯折一个共同的双菱，即，线的两端相会在振子中心，垂直相接。引向振子的弯折是像人们通常书写8字那样，即，电线的末端从相同的路径来到中心，但是来自不同的目标，即，180度角。弯折之前，应该测量并切断需要的非常精确的长度，然后测量和做出标记，在标记处弯折成直角。

Director wire ends are soldered together in the center of figure-8 shaped director element. Reflector surface may be made of copper or brass tin. It is possible to use one-sided copper clad epoxy substrate for PCBs. Two carriers (or supports) of the director element, length 30.9 mm, are also made of copper wire, diameter 2 mm. They are soldered directly to the elements, as shown in picture. This solution made building easier and ensured good mechanical stability of the whole antenna.

引向振子铜线的两端在数字8的中间焊接在一起。反射板表面可用铜或锡黄铜制作。也可以使用PCB单面环氧基覆铜板。引向振子的两个承重柱（或支撑柱），长30.9毫米，也用铜线制成，直径2毫米。他们直接焊接在振子上，如图所示。该解决方案使制作更加容易，并确保整个天线良好的机械稳定性。

It is important to keep in mind that dimensions in the pictures are given from axis to axis of wires! Dimensions from surface to surface of wire are less by 2 mm! The distance between the radiator and the reflector is given from the axis of wire to the reflector surface! From the surface of the radiator wire to the surface of reflector, the distance is less by 1 mm, i.e. 26.2 mm! In the same way, wires that connect the radiator and the director are given as the axis distance of these two-elements. To reach this distance, the wires that connect them have to be cut off shorter for 2 mm, i.e. 30.9 mm!

重要的是要记住，图片中的尺寸都是从铜线的中心线到中心线的距离！如果尺寸是从铜线表面到表面，要少2毫米！辐射振子和反射板之间的距离，是从铜线中心线到反射板表面！如果从辐射振子铜线表面到反射板表面，距离要少1毫米，即26.2毫米！同样，连接辐射振子和引向振子的铜线，给出的是两个振子中心线之间的距离。为了达到这个距离，连接它们的铜线，必须切短2毫米，即，30.9毫米了！

Feeding
馈电

Feeding the bi-quad can be accomplished in several ways. The radiator can be installed to a coaxial cable made of copper wire and a small copper or brass tube, whose diameters are in approximately ratio 1:2.3 to give a 50-ohm characteristic impedance. For example, standard copper wire with a diameter of 2.3 mm and a copper tube with inner diameter 5 mm work well. The 5.5 mm diameter hole is drilled on the reflector and the tube is soldered well to the reflector around whole circumference on the front side of the reflector. The wire that will be the central coax conductor and that is connected to the radiator should be soldered to the connector, and then the connector is soldered or screwed to the backside of the reflector.

双菱天线的馈电方式有几种。辐射振子可以安装在同轴电缆上。同轴电缆

用铜线和一个铜管或黄铜管制成，其直径比大约是1:2.3，给出50欧姆的特性阻抗。例如，标准铜线直径2.3毫米，铜管内径5毫米，工作得很好。在反射板上钻一个5毫米直径的孔，铜管要和反射板焊接良好，铜管周围的一圈都要和反射板前面焊接良好。该铜线将做为同轴线的中心导体焊接到辐射振子，另一端焊接到连接器，然后把连接器焊接或拧在反射器的背面。

Also, instead of complete air coax, one can solder only the tube through which coax cable without its outer plastic jacket comes in tightly, so that outer conductor rests tightly to the inner wall of the tube. After that, the braid is soldered well to the both sides of the tube. If you use cable with larger diameter that is stiff enough, or semi-rigid cable, only the end of the cable without its outer plastic jacket can be pulled through reflector and soldered to the reflector surface at the place where the cable passes through the reflector.

此外，代替完整的空气同轴电缆，可以只焊接铜管，把同轴电缆（不带外面的塑料绝缘层）穿进铜管，使其外导体紧紧贴在铜管的内壁上。然后，把屏蔽层的编织物良好地焊接在铜管的两端。如果您使用的铜线直径较大，有足够的硬度，或是半刚性电缆线，只需把不带塑料护套的电缆穿过反射板，在穿过反射板的位置，把电缆的屏蔽层焊接在反射板表面。

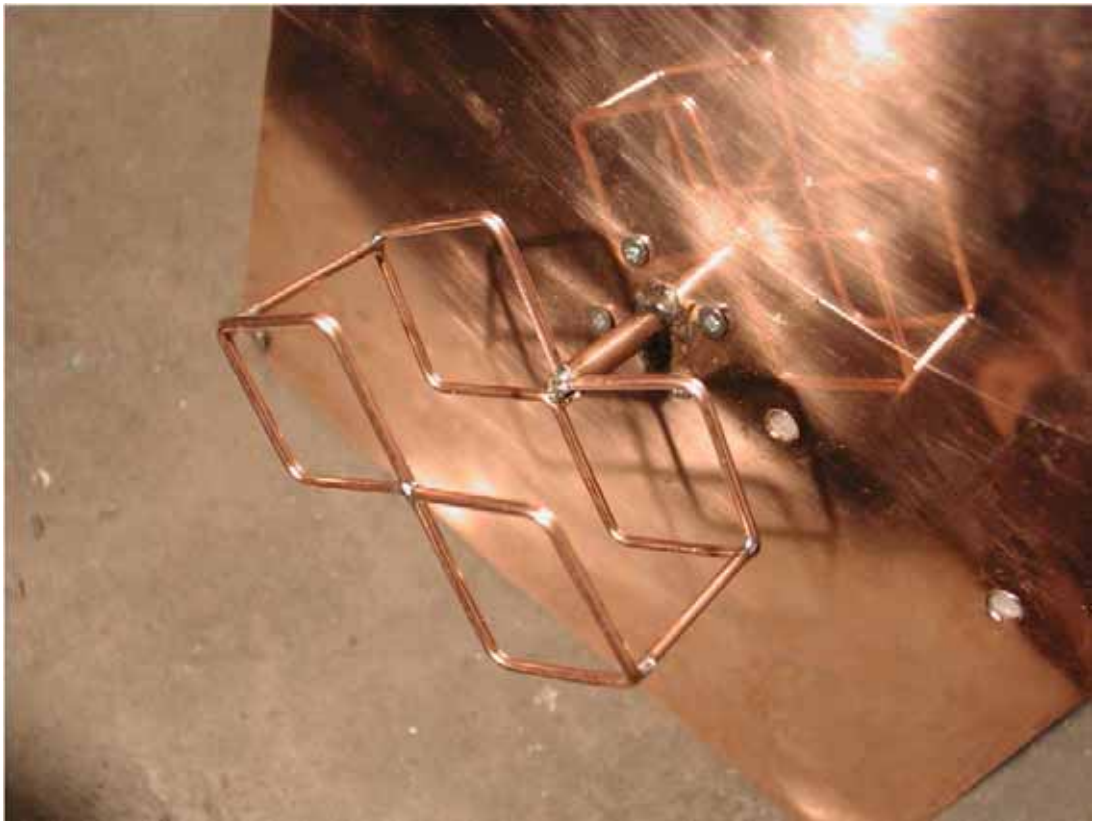

Fig. 20. Outlook of built 2 el. bi-quad feed antenna

图。20。制作完成的叠加双菱馈源天线

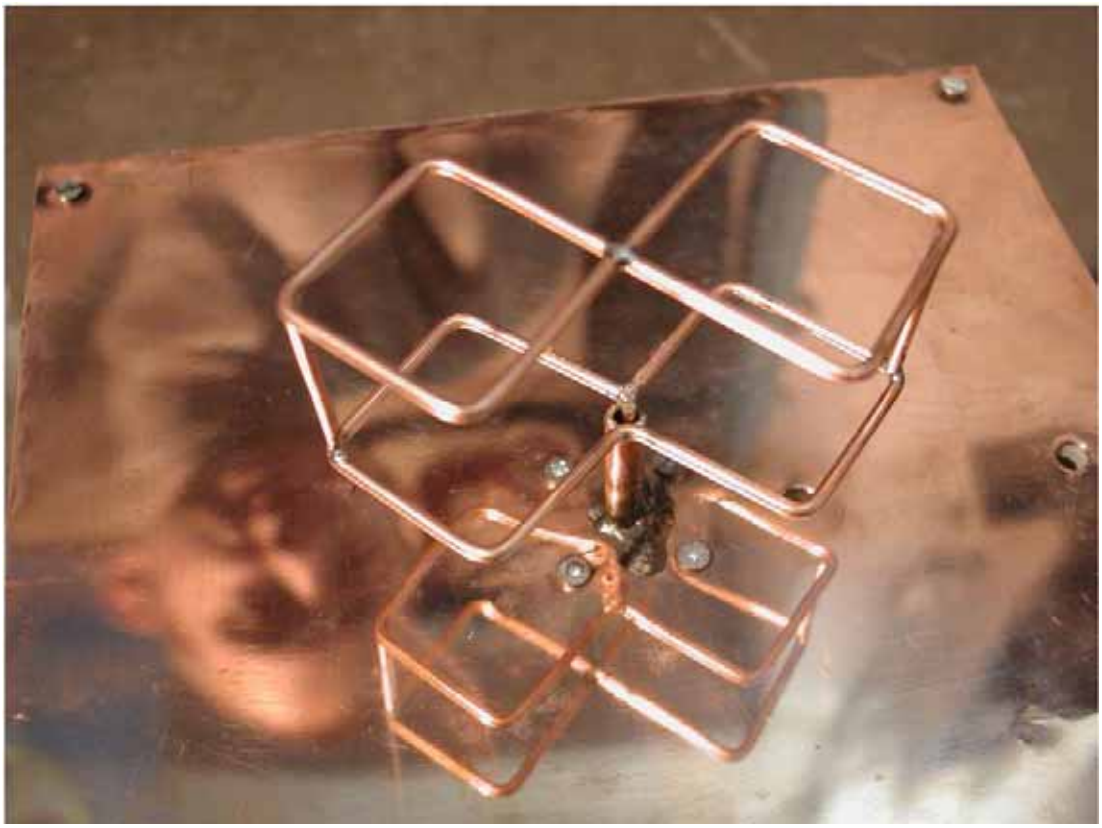

Fig. 21. Feeding of 2 el. bi-quad feed antenna

图。21。叠加双菱馈源天线的馈电

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