Prediction of Passive Intermodulation Between Rough Waveguide Flanges based on Fractal Theory

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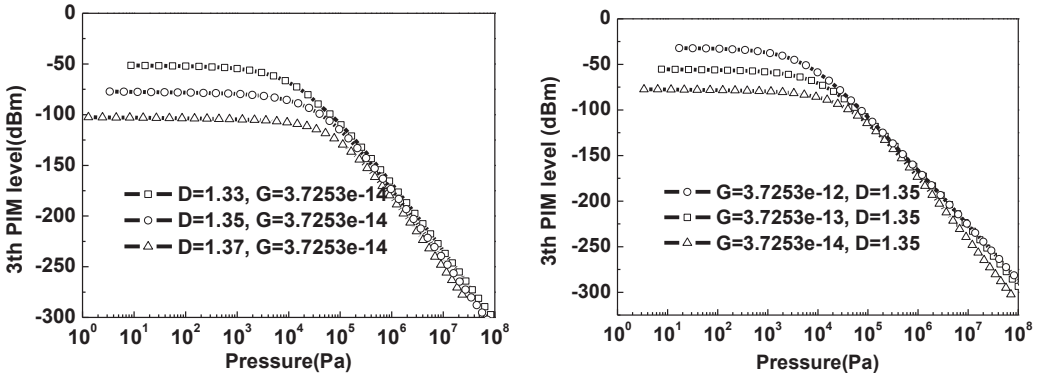
Passive intermodulation (PIM) products are spurious frequency signals generated by nonlinear components and devices. It has an important impact on the performance of multi-carrier communication system in satellites. System performance can be severe degraded once the passive intermodulation products are also transmitted in the reception band.

Contact nonlinearity which occurs because of the contact between two surfaces is considered as one of the important sources of PIM. In fact, when two rough surfaces are brought to be in contact, it is occurred only in a large number of contact spots of different sizes, which make up of the real area of contact.

Both Gaussian distribution and Weibull distribution have been used to describe the topographical characterization of rough surface of the rough waveguide flanges. In this paper, the fractal theory is used to model the surface topography instead of the Gaussian distribution and Weibull distribution. Based on the new model, the 3th PIM level of a rectangular waveguide flange is predicted.



(a) (b)

Fig.1 the predicted results of the 3th PIM level

The PIM level versus pressure with changing the fractal parameter D or G is shown in Fig.1. From which, one can get the conclusion that the PIM level becomes small with the addition of the parameter D. The parameter D shows the dimension of the surface. The larger the value of D is, the smoother the surface is. The smoother the surface is, the smaller the PIM level is. It is noted that as G becomes small, the PIM level also becomes small. The reason is that the smaller the parameter G is, the smoother the surface is. Then it leads to the PIM level decreases.