Responses to the reviewers' comments and summary of changes.

We have carefully considered the remarks of the reviewers. In the following, you can find a detailed description of the changes we have made in response to their comments.

Blue = reviewers' comments

Red = authors' changes/comments

Associate Editor

Reviewer #1

This study presents one Ka-band three-stage PA for 5G communications, implemented in a 150-nm GaN-on-SiC technology and adopts a Doherty architecture. It contains some interesting points in this field. Some moderate revisions are required.

1. Section 1 is for Introduction of the background; it is inappropriate to include any figure technically in this section;

Thank you for your comment. A new section providing more insight into Doherty operation has been added (new Section 2), which includes the above-mentioned figure.

2. For Fig. 3, why it is 28 rather than other possible values could be further explained, for the range from 200 to 600 μm, broader/narrower would be better could be explained, the joint occurs at the gate width of 300, if there is any way to optimize the value (higher/lower than 300) could be further analyzed in detail;

The operating frequency has been chosen within the FR2 5G band licensed bandwidth. As far as figure 3 is concerned, the real part of the optimum load is not appreciably affected by the frequency and only the imaginary part of the optimum load must be tuned according to the operating frequency. For the sake of completeness, this piece of information has been reported in the revised manuscript.

Finally, as described in the manuscript, the optimum transistor width is that one (i.e., 400 μm) that provides an optimum load of around 100 Ohm, which avoids the need for an output matching network, thus improving the performance in terms of output power and efficiency.

3. In Fig. 4, regarding the area of “3.1 mm x 2.5 mm”, larger/smaller would be better could be explained reasonably;
The total die size is set by the passive networks used for this design.

4. Regarding the frequency modeling, the one of silicon optical sensor with frequency simulation like doi: 10.1088/1361-6439/abf333 could be included as well.
Thank you for your comment. We adopted the frequency modeling provided by the technology supplier.

5. in Fig. 9, what the superiority of over 30 samples is could be further explained, also why it is 30 rather than other possible values could be explained reasonably.
Actually, all the available samples (i.e., 30 samples) were tested to extract the statistical parameters. For the sake of clarity, this piece of information has been added to the revised manuscript.

Reviewer #2

Dear authors, these are my comments about this research work.

The Ka-band Doherty power amplifier implemented on a 150nm 184 GaN-on-SiC technology relies on a booming technology in 4G-5G, however. No particular implementation is shown to validate its functionality as LTE implementations towards 5G.

1. The validation of a power amplifier requires figures of merit, mainly the AM/AM and AM-PM distortion curves, as well as S parameters that indicate the performance of the device.
Thank you for your comment. The measured S parameters have been included in the revised manuscript.

2. Doherty architectures contain various references in the state of the art of works developed, a comparative study is required to validate the amplifier developed in the Introduction section.

A new section providing more insight into Doherty operation has been added (new Section 2), which includes further references.

3. In relation to extensive electromagnetic (EM) simulations, the methodology used for this purpose is not seen.

For the sake of completeness, more details about the performed EM simulations have been included in the revised manuscript.

4. Figure 11. Normalized power spectrum measured at POUT,AVG = 19 dBm. It shows a spectral regrowth in the adjacent bands, what is the reason for this low performance?

As reported in the experimental result, the achieved linearity performance with the 5G NR modulated signal is in line with the state of the art.

5. In Figure 9. Distribution of the saturated output power over 30 samples, the relationship of the power acquired with the number of samples obtained is not described.

Thank you for your comment. Actually, all the available samples (i.e., 30 samples) were tested to extract the statistical parameters reported in the manuscript. For the sake of clarity, this piece of information has been added to the revised manuscript.

6. Figure 2. Simplified schematic of the proposed Ka-band DPA was only simulated? Or in which stages the simulation and implementation part differ?

The simplified schematic is reported to simplify the description of the adopted topology. The fabricated PA has been fully simulated. Extensive EM simulations were performed to extract the s-parameters of the passive network and the extracted s-parameter models were embedded in the circuital simulations. For the sake of completeness, this comment has been added to the revised manuscript.

7. I consider that the section on the development and review of the existing literature requires a better effort to validate the contribution of this developed work.

As reported in Section 4, the designed DPA is aimed at providing the best tradeoff between performance parameters such as power density, saturated gain, and PAE. Indeed, as shown

in Table 1, the designed DPA exhibits the highest FoM compared with the most recent works in GaN technology. This is achieved thanks to the adopted design guidelines described in section 3 and by carefully accounting for all the layout parasitic effects through extensive electromagnetic simulations, as has been reported in the revised manuscript.

Best Regards

Reviewer #3

The article “A Ka-band Doherty Power Amplifier in a 150-nm GaN-on-SiC Technology for 5G Applications” by Alessandro Parisi et al. presents the design and experimental results of a Ka-band power amplifier for 5G communications, which uses a Doherty architecture and a GaN-on-SiC technology. The power amplifier achieves a small signal gain of around 30 dB at 27 GHz, while delivering a saturated output power of 32 dBm with a power added efficiency (PAE) of 26% and 18% at peak and 6-dB output power back-off, respectively. The article also compares the performance of the proposed power amplifier with the state-of-the-art Ka-band GaN works and shows that it offers the best trade-off between power density, saturated gain, and PAE.

The paper is overall interesting and comprehensive, and therefore, it is ready for publication as is.

Thank you for your comment.

One comment can be considered as a Minor revision: The GaN wafer’s specifications and the devices’ general parameters should be depicted.

The GaN wafer’s specifications and the devices’ general parameters are reported at the beginning of section 2 (from row 68 to row 76 of the manuscript).