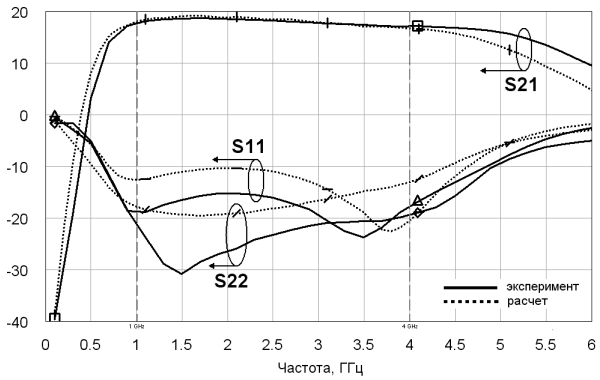


*Рис. 3. Электрические параметры усилителя.*

*Fig. 3. Electrical parameters of the amplifier*

## III. Заключение

Выполненная работа включает полный цикл разработки и производства GaAs pHEMT МИС сверхширокополосного усилителя на основе гетероструктурного материала. Совпадение расчетных и экспериментальных характеристик говорит об адекватности моделей пассивных и активных элементов, а также подхода, используемых при разработке.

## IV. Список литературы


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# GaAs pHEMT MMIC OF THE ULTRA BROADBAND AMPLIFIER


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*Abstract* — There is an example of ultra broadband amplifier MMIC design based on GaAs pHEMT process. Operating frequency band is 1-4 GHz, gain is 18 dB, noise factor is lesser 2.6 dB, input/output reflection factor is less - 15 dB, unipolar power is + 5 V, consumption current is 50 mA, chip dimension is 2.5 x 1.5 x 0.1 mm.


## I. Introduction

Designing of GaAs MMIC broadband amplifiers for relatively "low" frequency range one prefers using MESFET connection circuit with parallel voltage feedback [1]. Changing feedback parameters and MESFET total gate width one can simplify input/output and interstage match circuits to reduce chip dimensions. It is important to say about a problem of blocking capacitors' implementation in auto bias circuits at unipolar MMIC power. Taking into consideration these factors one should do amplifier calculation according to the following peculiarities: as an active element model in every stage one should use MESFET with blocking capacitor in a source circuit; optimization of MESFET parameters, blocking capacitor geometry and feedback value should be done taking into account after operating frequency band stability. Using electromagnetic analysis of passive circuit element topology one can have simple and original design of blocking capacitors in the source circuit.

## II-III. Main Part

Calculation of the amplifier is done according to joint match methodology [2, 3]. MMIC electric circuit is in the Fig. 1. The amplifier consists of two MESFET stages with deep parallel voltage feedback. To expand the operating frequency band one uses complex feedback in stages consisting of a series connected resistor, an inductor and a capacitor. Total gate width of every MESFET is 600 μm. As a result of feedback optimization it was allowed excluding interstage match circuit and simplifying input/output match circuits. Supply voltage in every stage is done through the source inductor with addition of a parallel connected resistor to exclude parasitic resonance after operating frequency band.

The chips were manufactured on pHEMT heterostructures of Taiwan producing with Micran Co. MMIC processing line using contact photolithography in deep UV range. It allows providing 0.35 μm gate length. Chip topology on wafers is shown on Fig. 2.

The measurement of radio-frequency parameters was accomplished directly on a wafer with probe station Suss Microtech PM5 and vector network analyzer Wiltron 37369A. Typical electrical characteristics are shown in Fig. 3.

## III. Conclusion

Accomplished work includes complete cycle of GaAs pHEMT MMIC ultra broadband amplifier design and manufacture based on heterostructural material. Coincidence of calculated and experimental characteristics indicates model adequacy of passive and active elements and approach used in designing.




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