

Publishable executive summary

The acronym TARGET stands for “Top Amplifier Research Groups in a European Team”. It is a Network of Excellence within FP6 that brings together 49 research groups consisting of about 170 researchers and 70 doctoral students coming from 15 EU member countries and 1 associated country. The aim of TARGET is to overcome the fragmentation of European research in the field of microwave power amplifiers for broadband wireless access by creating progressive and durable integration of research capacities of the network partners. Ultimately, European technology and research in the fields of active power devices beyond CMOS, of the characterisation and simulation of materials and devices, of amplifier design and linearisation, and in the field of broadband transmitter system design shall attain a leading role in the world. This integration is pursued with the aim to

- Create a durable co-operative network
- Establish a virtual centre of excellence
- Stimulate and co-ordinate world-class research.

These general project goals were broken down to more tangible project objectives. These objectives are listed in the left half of Fig. 1-1 and they are met by the joint programme of activities, where each objective corresponds to one work package or to one work package group. Furthermore, these work packages can be mapped on the three strands of activities of the joint programme of activities, namely “integration”, “dissemination”, and “jointly executed research programme”, as illustrated by Fig. 1-1, too.

PROJECT OBJECTIVE	→	WORK PACKAGE		
1.2 Internal discussion forum	➔	WP 1.4 TARGET TUTORIALS		Integration
	➔	WP 1.6 TARGET MEETINGS		
1.3 Exchange programme	➔	WP 1.5 TARGET EXCHANGE		
2.1 Software pool	➔	WP 1.2 TARGET POOLS		
2.2 Virtual lab	➔	WP 1.3.1 TARGET LAB SETUP		
	➔	WP 1.3.2 TARGET LAB EXTENSION		
1.1 Electronic platform	➔	WP 1.1 TARGET INTRANET		
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	➔	WP 3.3 TARGET ONLINE		Dissemination
2.3 Summer schools	➔	WP 3.2 TARGET SUMMER SCHOOLS		
2.4 Tutorials	➔	WP 3.1 TARGET SPECIAL EVENTS		
2.5 IPRs	➔	WP 3.5 TARGET TRANSFER & SERVICES		
3.4 Links to groups outside Europe	➔	WP 3.4 TARGET LIAISON		
3.1 Common research programme	➔	WP 2.1 TARGET QUICKSHOT	➔ Short Term Prototyping Modelling	Jointly executed research programme
3.2 Co-ordinate research efforts	➔	WP 2.2 TARGET CLASSIC	➔	
	➔	WP 2.3 TARGET FUTURE		
3.5 Review and quality assessment	➔	WP 2.4 TARGET STRATEGY		
	➔	WP 2.5 TARGET SCIENTIFIC CO-ORDINATION		
Management	➔	WP 4.1 TARGET CO-ORDINATION		Management
	➔	WP 4.2 TARGET NET-ADMIN		

Fig. 1-1: Project objectives and corresponding work packages

Executive Summary



The TARGET network maps the needs of microwave power amplifier and transmitter design seamlessly onto its consortium, as depicted in Fig. 1-2. The consortium consists of semiconductor foundries, of academic labs, and of system manufacturers, where the industrial partners are mostly associated members. It is exactly this combination of top players in the field of broadband wireless access which will generate decisive impulses to European research and the development of technology.



Fig. 1-2: The TARGET consortium

During the second year of TARGET a total of 33 work packages in the fields of integration, joint research, dissemination of knowledge, and of network management were active.

The figures given in Table 1-1 were defined as the main indicators of success for creating a co-operative network and the figures in Table 1-2 are the main indicators of success for creating a virtual centre of excellence, respectively.

Table 1-1: Indicators of success for creating a co-operative network

CRITERION	Months 1 – 24 planned	Months 1 – 24 achieved
Intranet downloads (software, data...)	105	1
Number of internal workshops by all WPs	35	60
Number of tutorials	11	9
Number of exchange visits	30	25

Table 1-2: Indicators of success for creating a virtual centre of excellence

CRITERION	Months 1 – 24 planned	Months 1 – 24 achieved
Software tools shared and improved	9	2
Number of joint (virtual) labs	6	9
Offer of external services	6	7
Summer and winter schools	2	3
Special events at international conferences	3	12

TARGET follows a well-designed methodology to integrate research in the field of microwave power amplifiers for broadband wireless access. As a general principle, it uses research itself for the purpose of achieving a desire to integrate among the participants. In the following only a few highlights are presented to illustrate the scientific progress achieved in year 2 of TARGET.

The main objective of the work package group QUICK SHOT Modelling was to develop a systematic procedure for RF non-linear model validation. The first work package concentrated on the procedure itself. The second work package focused on the modelling of transistors. Considering that the partners have diverse experiences, it was decided to subdivide the participants over five clusters, each working on a different device technology: low-power pHEMTs, medium-power pHEMTs, SiGe HBTs, GaN HEMTs, and LD MOS devices. In each case, samples were offered. The third work package concentrated on the modelling of amplifier circuits. The original intention was to consider black-box modelling only, but due to the expertises of the participating partners, it was decided to broaden it to equivalent circuit based or design-based modelling.

In order to evaluate and compare several models' abilities to predict the measured transistor behaviour, metrics, or error functions were defined. Essentially, these metrics are calculated as (weighted) sums of absolute deviations of a particular model's prediction and of actually measured value. Summation is performed over all bias points under consideration. As final outcome, metric results of in total 21 models were calculated, providing – for the first time – an objective basis for model verification and comparison.

One remarkable result could be achieved by WP 2.2.D.1 Amplifier Design Overview by designing a C-Band second harmonic tuned microwave power amplifier. The active device is a GaN HEMT with 1mm gate periphery (10x100µm gate fingers), fabricated by Selex-SI. A second generation Angelov model based on DC, pulsed I/V and bias-dependent small-signal S-parameters was used for the design of the amplifier. The centre frequency adopted for the PA design is $f_0=5.5\text{GHz}$, while a Class AB bias condition, resulting in a 20% of maximum achievable output current, was selected in order to prevent wrong harmonic current phase generation. The input and output networks were implemented by microstrip lines on alumina substrate ($\epsilon_r = 9.8$, thickness = 381µm).

Measurement results of output power and drain efficiency are compared with state of the art C-Band amplifiers, as shown in Fig. 1-3.

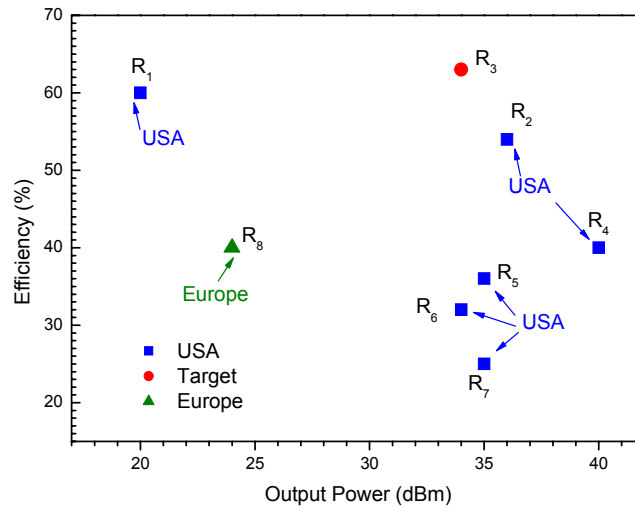


Fig. 1-3: Results obtained by TARGET co-operation (R₃) compared with state of the art C-Band amplifiers.

Spreading of knowledge undoubtedly is one of the main goals of a NoE. During year 2 this goal was mainly achieved by publishing 32 joint TARGET journal papers and 131 conference contributions. TARGET was well presented at all three major microwave conferences, i.e. at the 2005 IEEE MTT-S International Microwave Symposium in Long Beach, CA, the European Microwave Week in Paris, France, and the Asia-Pacific Microwave Conference in Suzhou, China. Additionally, we started to offer 7 TARGET courses and the services of our 9 virtual labs.

Our network includes also activities which are directed at a wider audience and will thus impact the public understanding of scientific and technological issues related to amplifier research. In particular, activities such as TARGET INTERNET, TARGET SPECIAL EVENTS, TARGET SUMMER SCHOOLS, TARGET LIAISON and TARGET ONLINE & PR address an audience that encompasses not just the research scholar.

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