REVIEW MEETING #1

WP4 : MARKETING & BUSINESS DEVELOPMENT

Lead Beneficiary : CIDETE

2020, November 3rd

SMARTEC

WP4 : Marketing & Business development

Dissemination part

- **Web site created**
  → https://project-smartec.com/

- **Public part**
  - Overview of SMARTEC project & description of work
  - Description of consortium
  - Dissemination part (flyers, papers, conferences, workshops …)
- **Private part accessible only for partners**
  - Upload of templates (presentation, deliverables …)
  - Download of deliverables, presentations of meetings, minutes of meetings …
  - Data exchanges capability between partners (heavy files datas)

WP4 : Marketing & Business development

Dissemination part

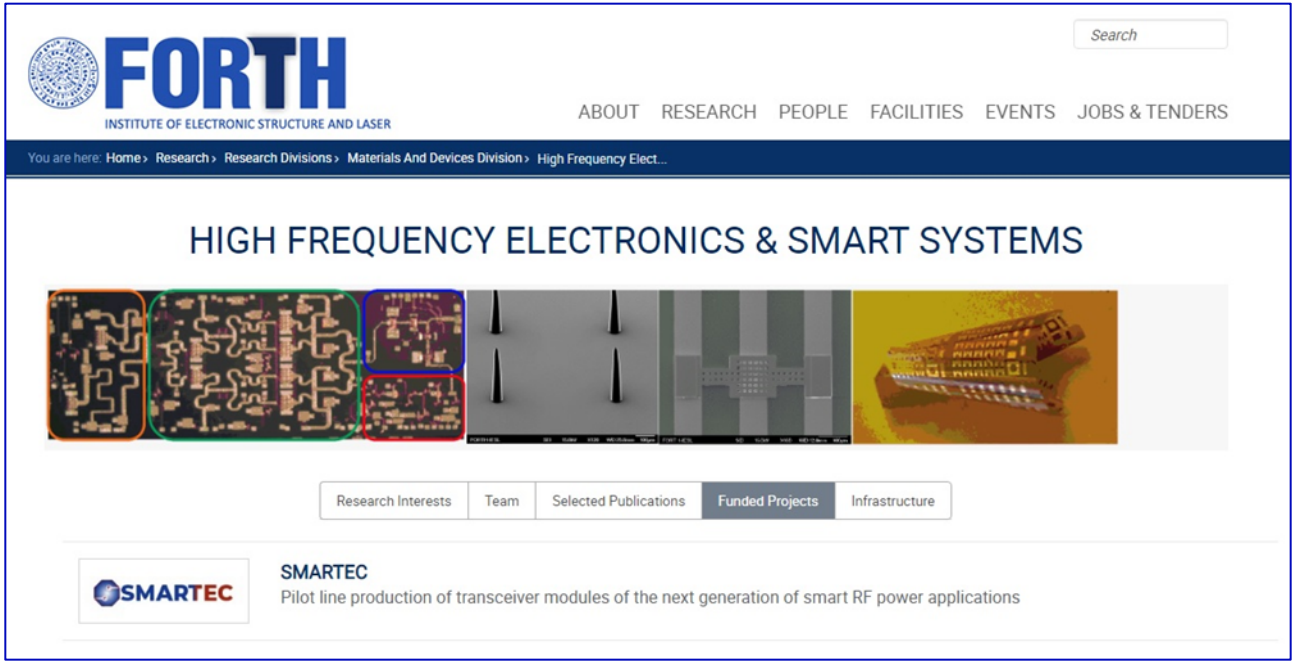
- Creation of flyer available on SMARTEC website for partners exhibitions within conferences, workshops …
- Article submission for MEMS2021 (2021 January 25-29) : Decision by November 30th 2020.
  "Field emission induced harmonic generation during high power operation of rf mems: An Analytical Approach",

- **RF Microtech is bronze sponsor of the IEEE Radar Conference, Florence, Italy, 21-25 September 2020 (https://www.radarconf20.org/)**
  - Virtual conference (due to covid)
  - Virtual booth promoting SMARTEC project using the flyer

- **Limitation of dissemination due to Covid-19**
  - Expositions and fairs that were foreseen, like the EuMW, have been postponed to 2021 due to the Covid pandemic

SMARTEC website (@ FORTH)

SMARTEC is hosted at the portal platform of the Institute of Electronic Structure and Laser (IESL) at https://www.iesl.forth.gr/en/project/smartec



- Co nsor tiu m restr icte d -

SMARTEC outreach activities/Television

TV program: "DE FACTO" of Creta Channel (https://tvcreta.gr/shows/de-facto/)

Date: 11th October 2019

Participants: Mr. S. Metaxas (journalist/host), Prof. Spiros Anastasiadis (Director of IESL/ FORTH)

The banner at the bottom of the screen writes in Greek "FORTH pioneers a global radar application" (Google translation).

The program started with SMARTEC, analysing its objectives, the support of the EU, its huge potential for Europe and its importance for the local and national economy

Photos used after the permissions of Mr. Metaxas and Prof. Anastasiadis

Monthly common seminars between MRG/IESL/FORTH staff and personnel from the Physics and Material Science departments of University of Crete

Date: Friday 31/7/2020 at 9.30am

Location: 1st floor seminar room, Physics building, University of Crete

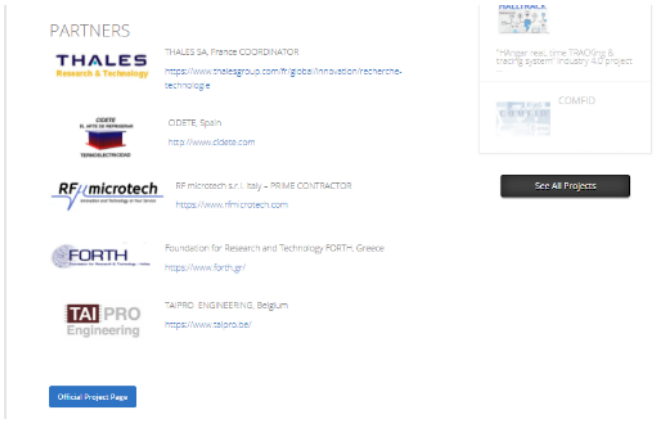
Title: "RF-MEMS Capacitive Switches"

Speaker: SMARTEC Senior Post doctoral fellow Dr. Loukas Michalas.

Dr. Michalas, an RF MEMS expert and a senior member of the SMARTEC team, introduced to the audience RF MEMS and the SMARTEC project

Dissemination

- **SMARTEC activity is advertised on the company website, with a dedicated Project Page and periodic News**



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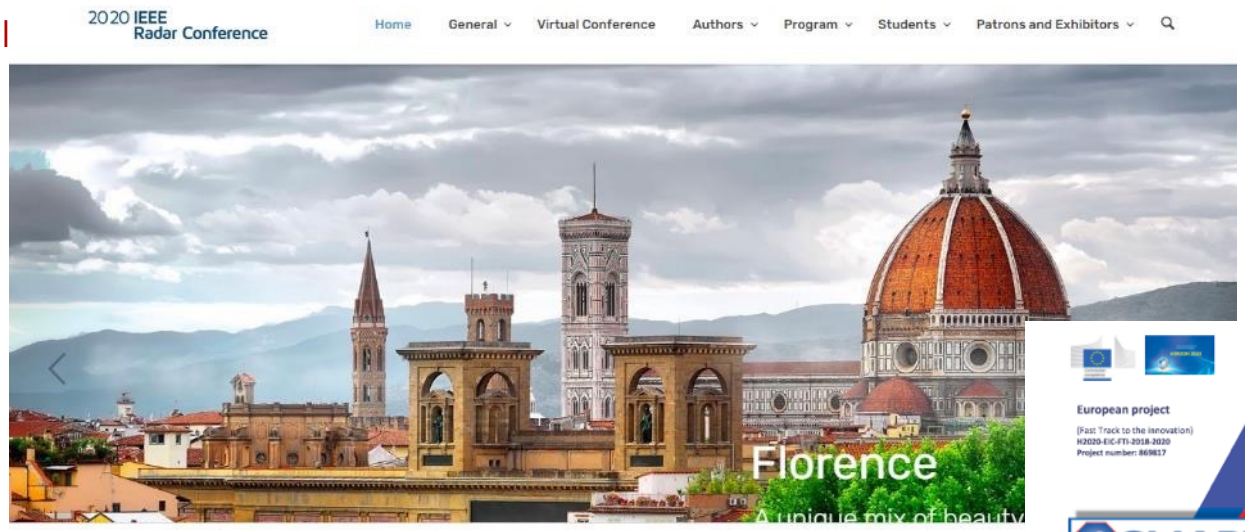
Dissemination (2)



Smartec flyer was showed in the RFM virtual booth

Main corporate sponsor: LEONARDO

Platinum sponsor: HENSOLDT

Gold sponsor: esa, RHEINMETALL

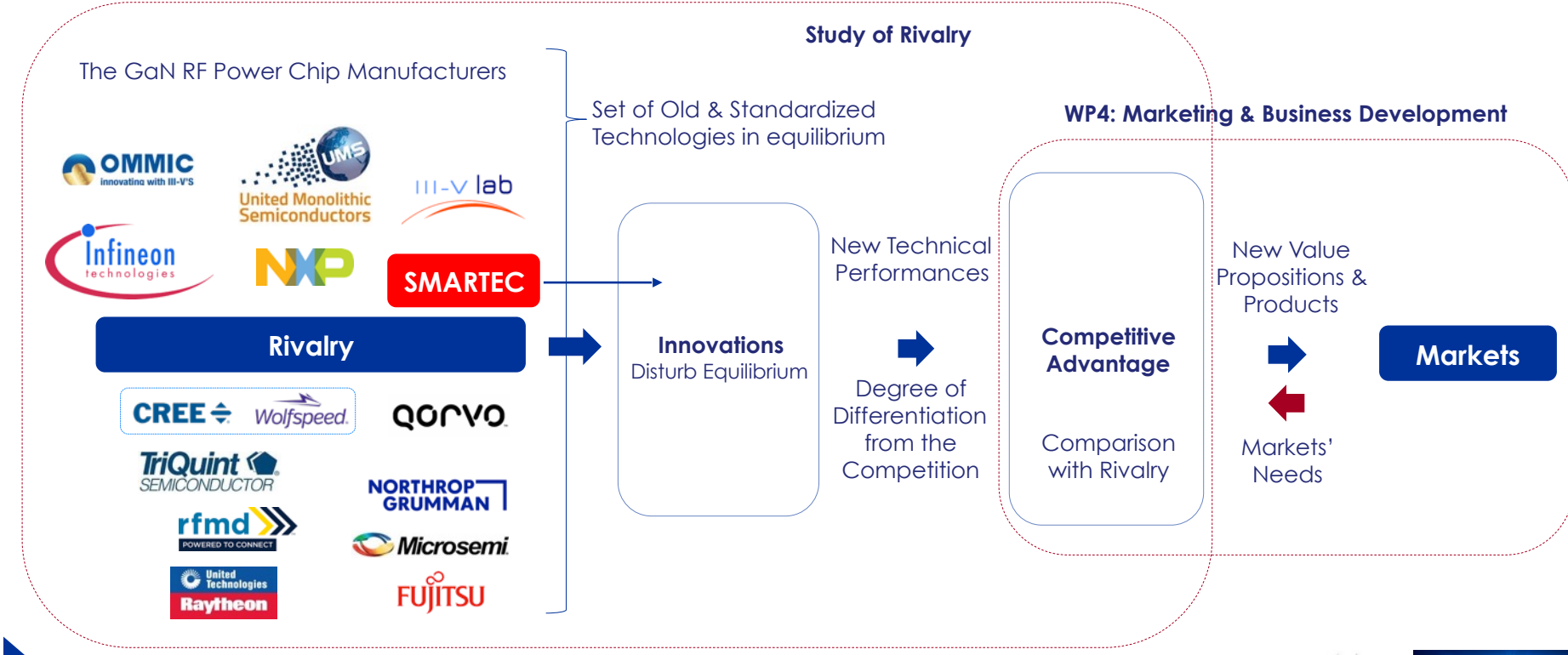
Silver sponsor: e-geos, ELETTRONICA GROUP, IDS GeoRadar

Bronze sponsor: ApisSus, aresys, ELDES, RF microtech

Rivalry Study – The Basis of Marketing Strategy

The importance of Competitive Advantage

In Progress



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What have we done already ?

Understand the GaN Chip Manufacturing Rivalry

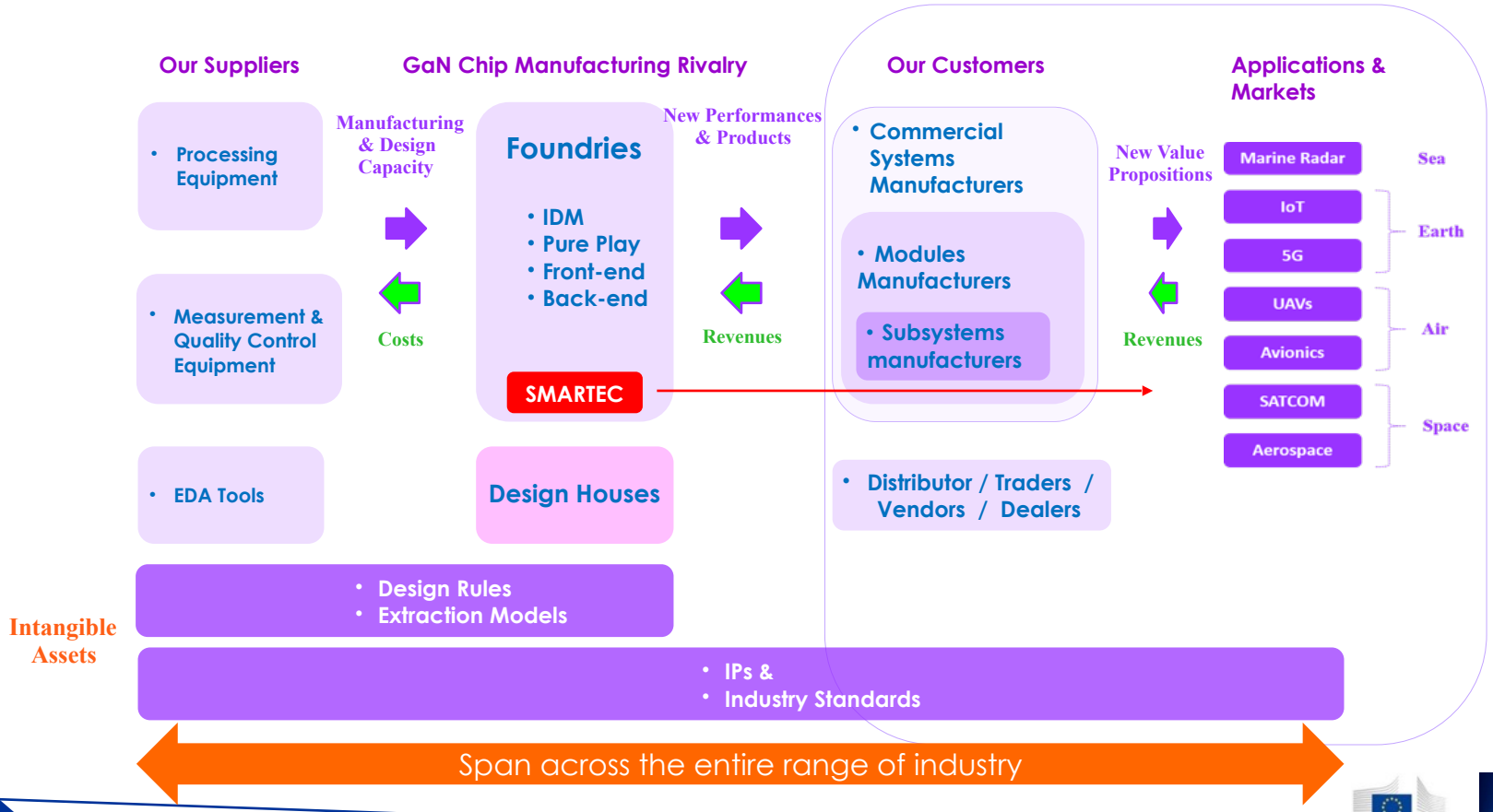
◣Better define SMARTEC's Competitive Advantage
◣Position the Pilot in the Rivalry

Continuous Process

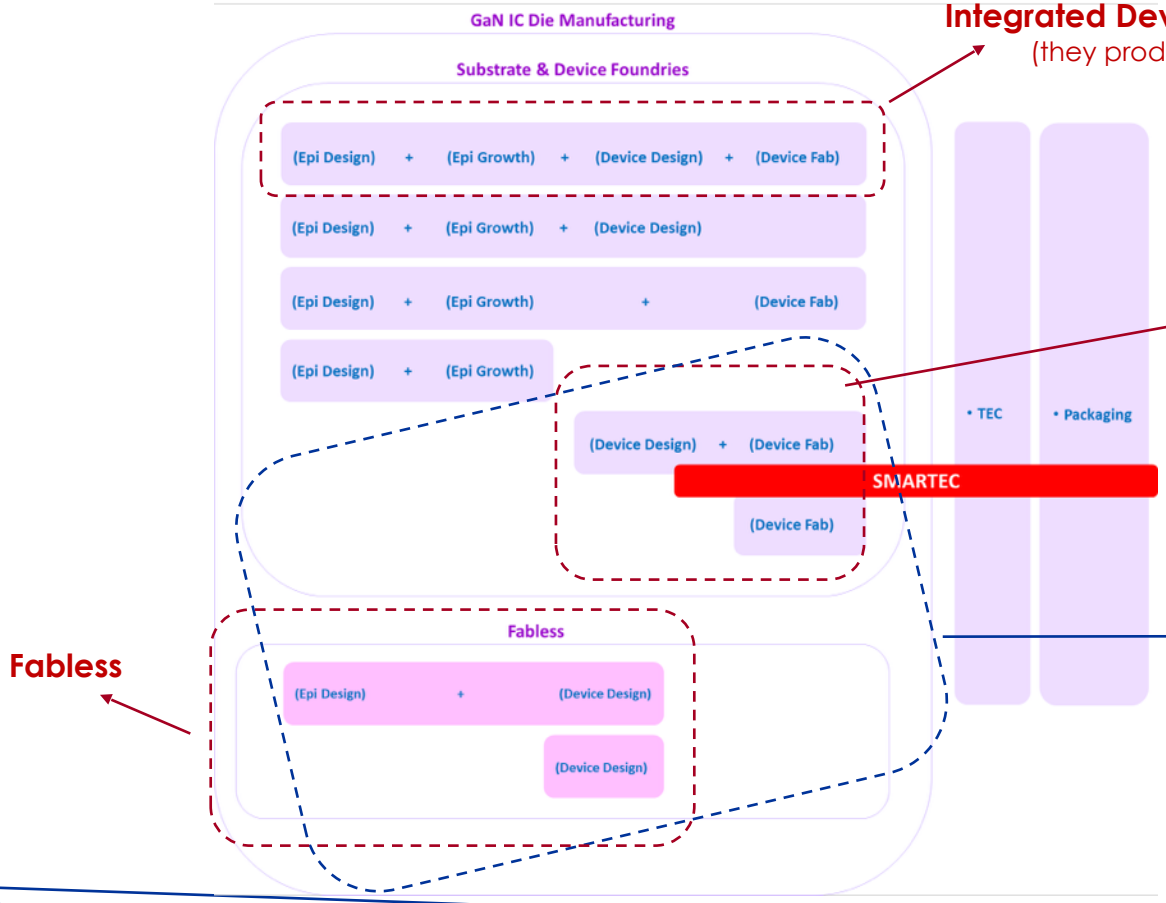
Need to answer the following questions:

1. Find out who are they and where they sell ?
2. Understand the dominant Foundry Business Models in the market
3. Find out their Alliances, Mergers & Acquisitions
4. Find out their Market Power & Dominant Positions in Specific Markets
5. Understand their Technology & Product Portfolio
6. Understand Pilot's Technological Competitive Advantage over rivalry → How Different are we …?
7. Do we need their technology to commercialize ours?
8. Do we need anyone to become a Strategic Partner?

GaN & Non-GaN RF Power Industry Value Chain



Understanding Foundry Business Models



Integrated Device Manufacturers (IDMs)
(they produce their own products)

"Pure-Play" Foundries
(Initial model for the pilot)

"Fabless – Foundry" Alliance Model
(possible favorable future model for the pilot)

Fabless

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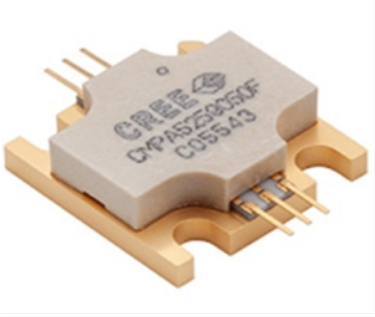
Our Competitive Advantage - How different are we?

A continuous process…

in progress

Competitor - i



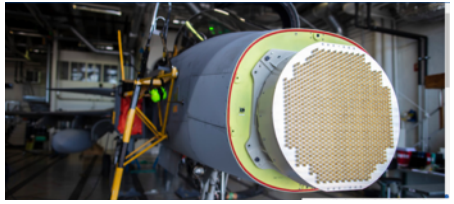
Product Series & Numbers	⟷	Adopted Industrial Standards
Patents & Inventive Steps	⟷	SMARTEC's Inventive Steps
Performance Ranges (usually published)	⟷	Applications addressed KPIs
Technical & Performance Comparison with SMARTEC	⟷	How much better SMARTEC Competes in the different Markets ?

SMARTEC's Technical Competitive Advantage over Specific Competing Product(s)

Tabulation of competitors' technology portfolio (patent, product and value proposition) for comparison with pilot's product

Over 200 – Legal Entities in the RF / Power Industry

Some do not have GaN Patents by use GaN Tech



Saab - Ericsson

91 have GaN Patents

Patent Search key words

- GaN MMICs
- RF MEMS
- Low Noise Amplifier
- High Power Amplifier
- Transistor
- Coplanar
- Monolithic
- Vias
- Back-End
- Microwave
- RF Power
- Switch
- Transceiver
- Integrated Chip
- Package

Classification

> 4000 Patents

- Technology Portfolio of Competitors
- Direct Threatening our Inventive Step(s)
- Sources of New Ideas → Future Products
- Sources of Licensing
- Irrelevant

Study them

EPO US WO

TW KR CN JP

Translations Problems

In Progress

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Marketing Strategy Overview

Opportunities Identification within the initial target markets

1. **Commercial Avionics:**
   - emphasis on Weather Radars
   - the ADS-B Opportunity

- **Marine Radars:**
  - emphasis on leisure vessels
  - the Opportunity of *"High Resolution & Fast Response Radars"*

Opportunities Identification in New Markets

- **SATCOM / Space**
- **Beyond 5G/6G**

Focus Marketing Strategy Actions

- **Networking for Business Information**

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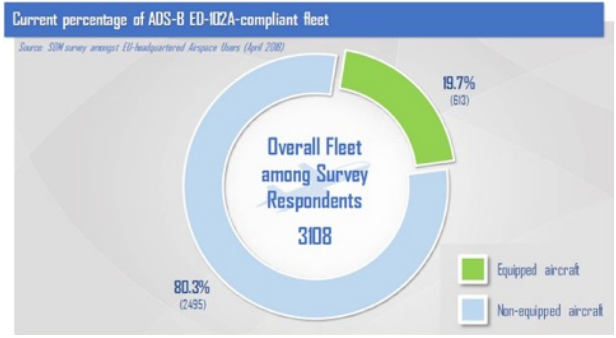
Marketing Strategy-Commercial Avionics

Weather Radars

- SMARTEC remains focused on Weather Radars, addressing air traffic management problems

The ADS-B Opportunity Drivers

Automatic **D**ependent **S**urveillance - **B**roadcast



ADS-B "non-compliance"

- New EU air traffic surveillance regulation (EU) 2020/587 "forces" ADS-B technology adoption
- 80% of the mainline fleet in European sky is not yet compliant with this regulation

SMARTEC's

- The continuous increase of global number of passengers & the connectivity of destinations enhance the concentration of aircrafts, thus the need of ADS-B systems adoption

TRX front end offers **higher frequency and power** with GaN technology & **fast switching RF MEMS**. These properties translate into better *spatial resolution*, improved *range of detection & fast* information flow for ADS-B systems

Marketing Strategy - Marine Radars

Maritime Traffic Surveillance Market

- emphasis on leisure vessels

"High Resolution & Fast Response Radars": The Opportunity Drivers

- The increasing larger number of sea vessels/objects with small & ultra-small dimensions
- The cost of vessel collision liabilities (insurance costs)
- The entire economic cost of piracy (mainly based on the use of very small vessels)

© Fraunhofer FHR

SMARTEC's TRX front end of:

a) **higher power** (diminishes the attenuated due water absorption, increasing the detection range) b) **higher frequency** (that enhances the resolution and the ability to detect efficiently and swiftly smaller vessels (e.g. inflatable boats).

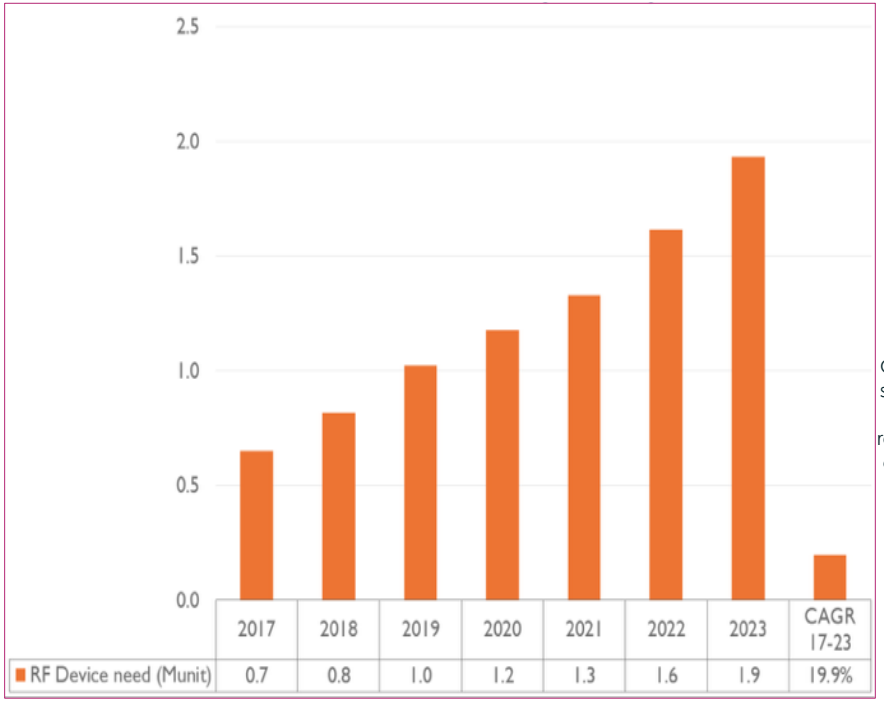
Marketing Strategy - SATCOM/Space

Space Industry Needs for:

- nano-satellites that require **miniaturized radar devices** for *earth observation*,
- Radars of **high resolution (high frequency)** *for debris detection*
- Radars of **long-range capability (high power)** to detect from distance gases, water reservoirs and/or explore weather conditions of planets.

SMARTEC front end

fully satisfies the technological requirements of high power & high frequency



Estimation of the RF GaN devices needs per year for satcom market. (Source: Yole Development)

Marketing Strategy

Beyond 5G/6G Market

Future Market Needs:

- High Power and
- High Frequency, exceeding in the future 100GHz

Industry's Technical Barrier:

As far as the switches in the transceiver modules of the front ends are concerned, there is a critical value around 50GHz that the PIN and FET type switches fail to deliver the required isolation.

The Technical Solution:

SMARTEC *The only viable solution for such a high frequency front end will be RF MEMS.*

foresees a long-term business opportunity since its front end is **the only current technology** that incorporates GaN for high power and RF MEMS for high frequency.

Focus Actions for better Marketing Strategy

Networking for Business Information

Planned for the future

Exhibitions - Trade Fairs

Direct contact with Real Market Actors

Customer Discovery & Validation

Learn Real Market & Customer Needs

Attract Investors

Optimize Value Propositions

Recruit Personnel

Prototype Demonstration

1. **Segment our Customers in Specific Groups and Study further their Needs**
2. **Build *Customized Value Propositions*.**
3. **Investigate the Distribution Channels for our products in specific markets**
4. **Define a Specific Promotion & Pricing Strategy.**

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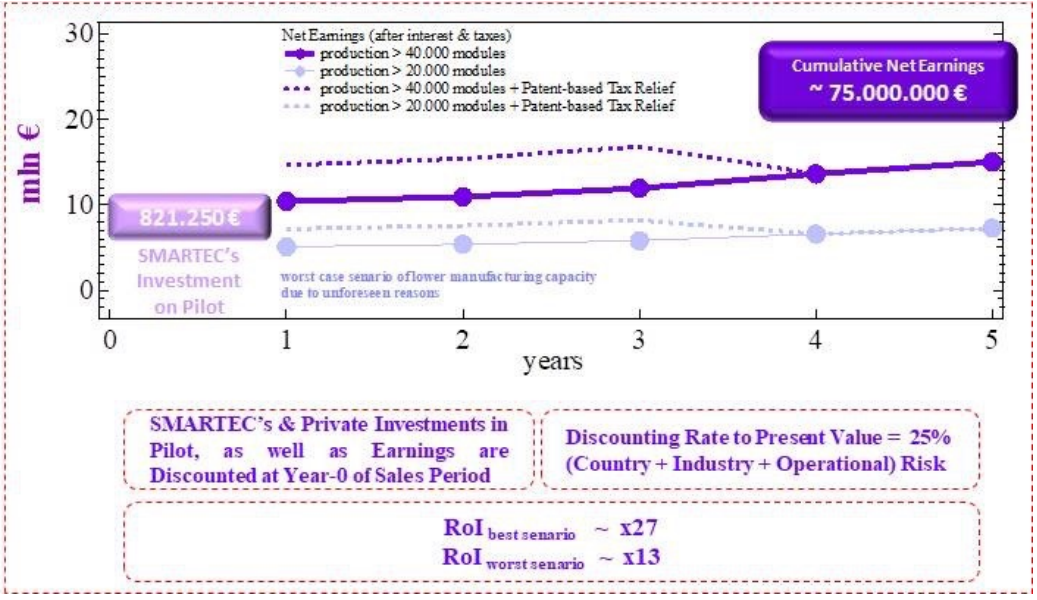
Pilot's Revised Business Plan

5-Year Financial Plan:

- *Annual Tax Down Payment* in Greece has reduced from 100% to 55%,
  → **pilot's Liquidity increase**

- Latest Greek tax law permits deductibility of profits based on sales of patent-protected products in the first three years of sales.
  → **pilot's Net Earnings increase**



old (dashed line) and updated estimated net earnings after interest and taxes (best- and worst-case scenario)

Investment in New Key Resour

- Lobbying with Region of Crete: for funding raising from Greece's Structural & Regional Funds.
- New structural funds in Greece will strongly focus on innovation actions.

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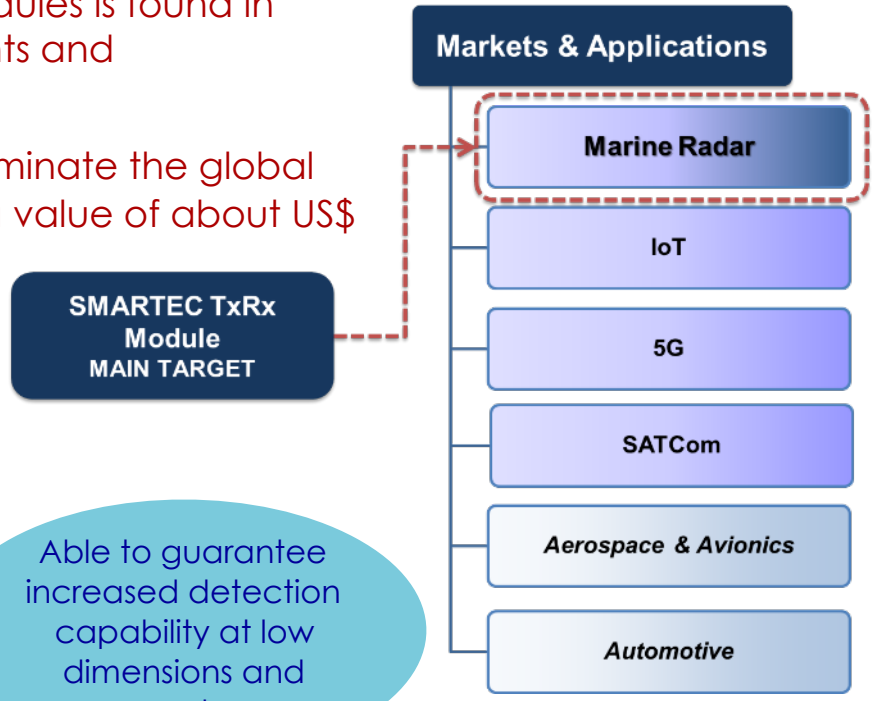
RFM Main Target Market

RF Microtech product based on SMARTEC TxRx modules is found in the marine radars area, in particular for luxury yachts and recreational boats

Only the X-Band Radar segment is expected to dominate the global market in the next ten years period and to reflect a value of about US$ 600 Mln by the end of 2027



Main factors hampering the marine radar market

- High R&D design costs
- Lack of reliable technologies for TxRx modules

Able to guarantee increased detection capability at low dimensions and costs

- Co nsor tiu m restr icte d -

X band AESA Radar main needs

- Ensure a certain power output (determined by the power requirement of the Radar)

  GaN-based Power Amplifier MMIC has better power output as compared to the conventional GaAs-based approach

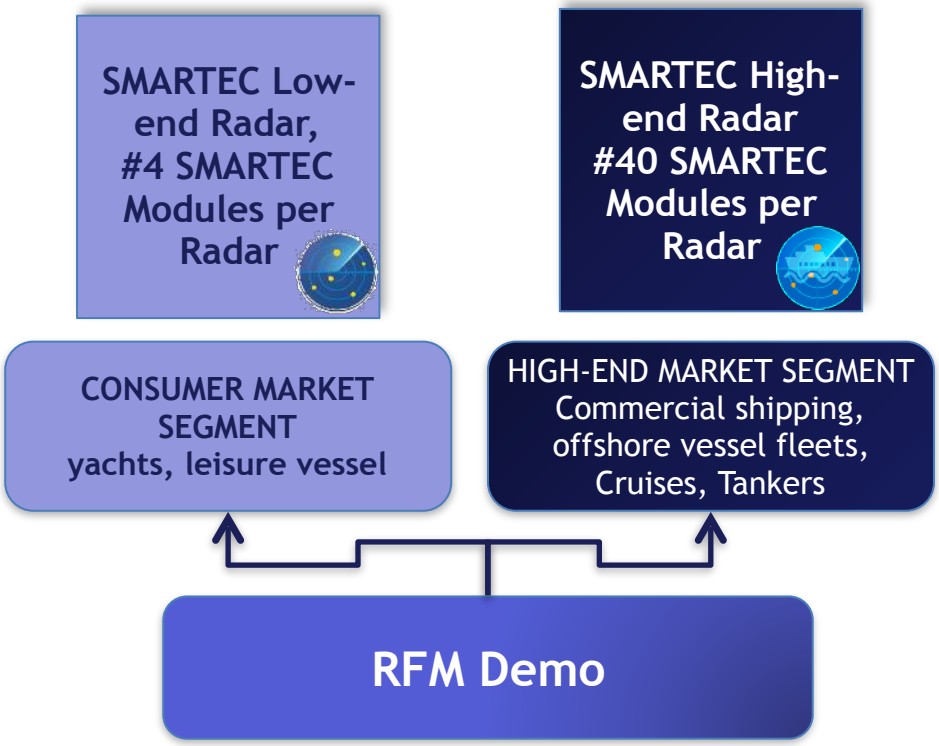
- Connector-less modules for less form factor and wheight

- Achieve consistent performance and qualification by lowering system temperature and noise figure

- Design for high reliability and availability. The use of non-ITAR BOM is crucial

- Ensure low development and series production costs. Surface mount technology better than chip and wire-bond assembly processes

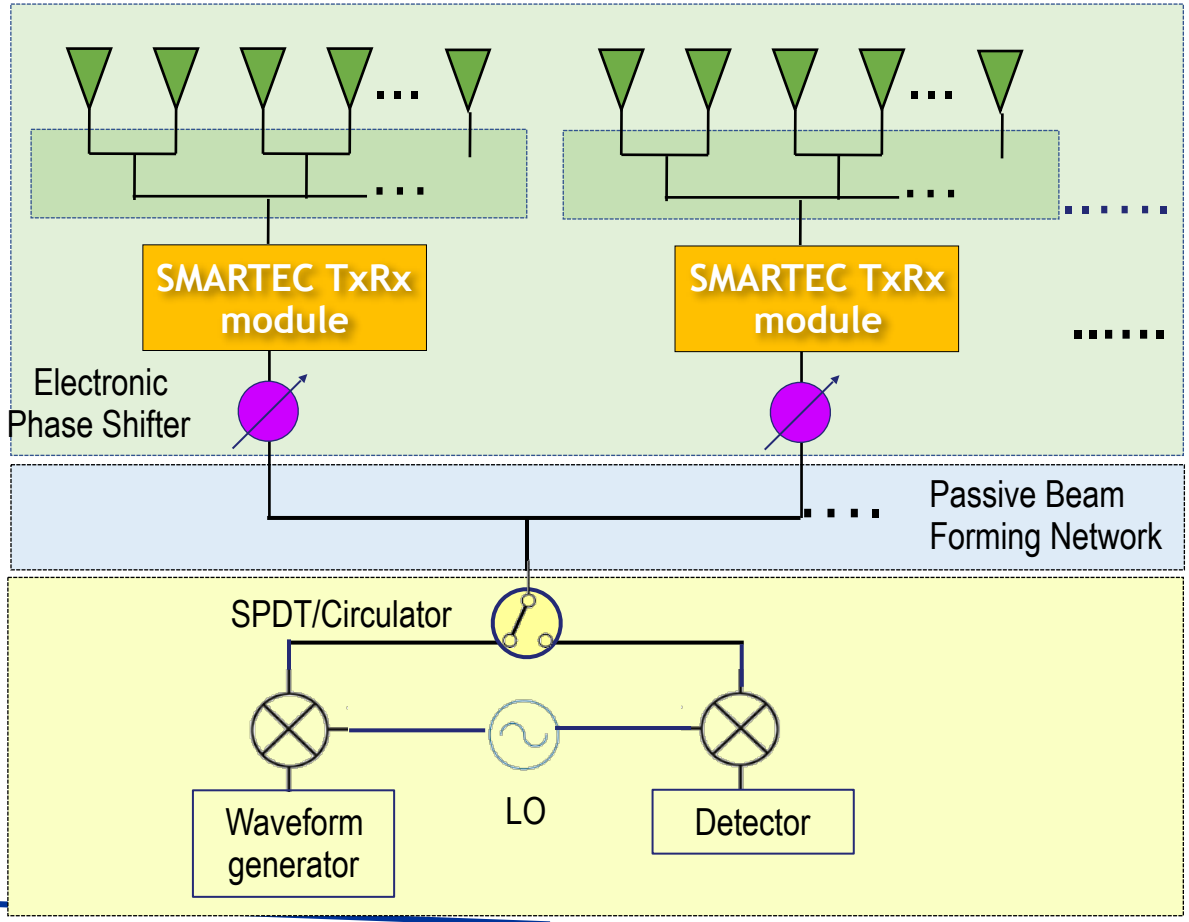
Identified X-band marine radars applications for SMARTEC



Key SMARTEC module advantages:

- **High compactness**: the high miniaturization of SMARTEC module will allow to accommodate a large number of modules
- **Low Costs**
- **High Power Handling**

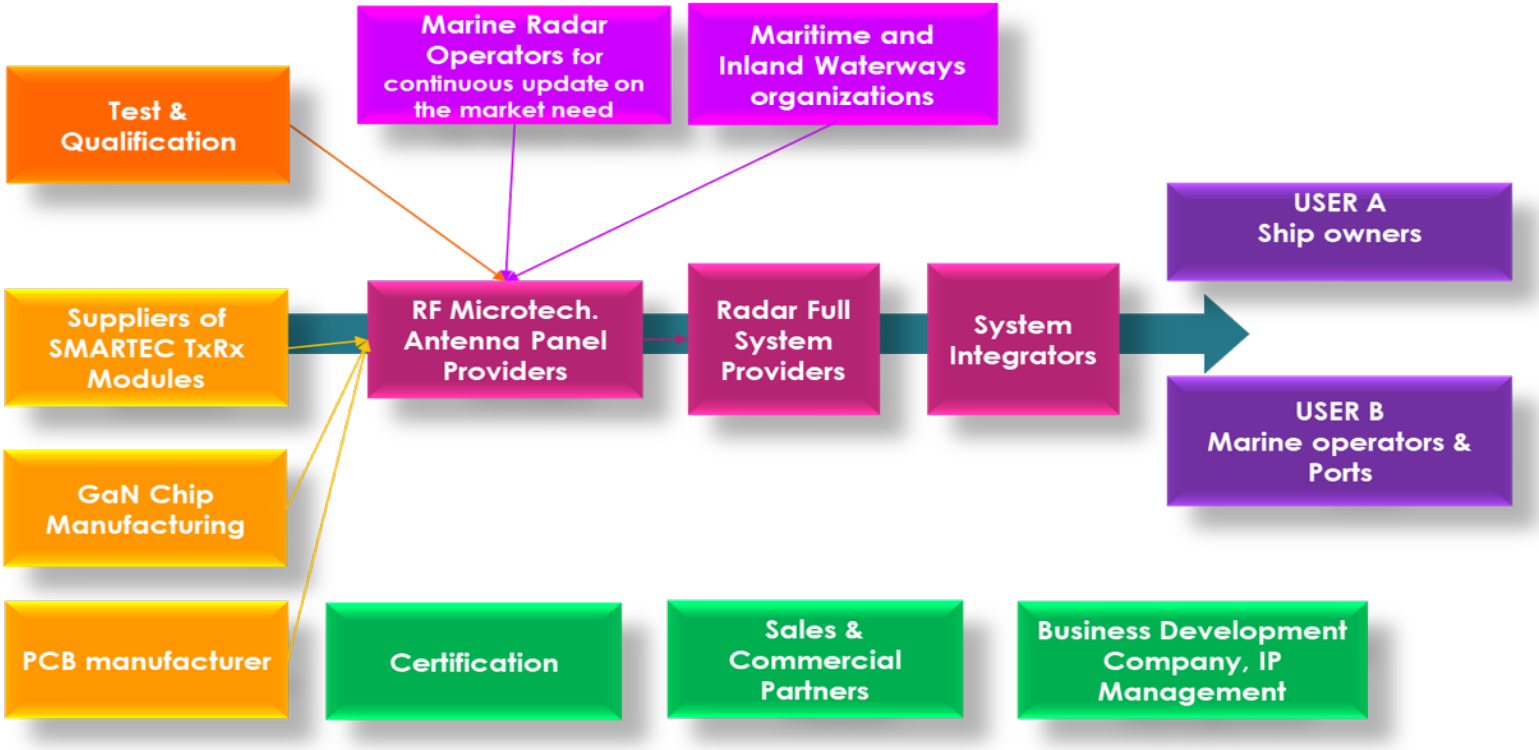
Smartec RFM Marine radar architecture



Increasing the number of TxRX modules per radar, it is possible to obtain:

- The transmitted RF power is distributed through the antenna in many small HPA → **More uniform RF power and heat distribution**
- Low signal loss between the radiating elements and LNAs (**increased SNR**)

Value chain and key players of the SMARTEC developement

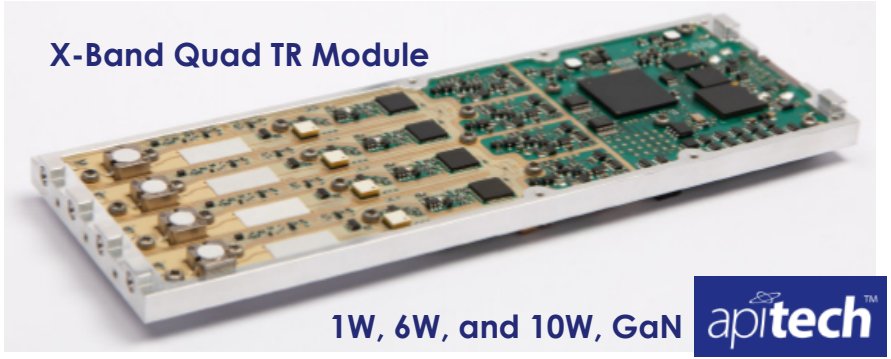


Some example of T/R module in the market

Power 5W class (GaN)

The lightweight, low-cost Cyient X-Band TRM

https://www.cyient.com/blog/aerospace-defense/how-x-band-transmit-receive-modules-are-impacting-the-aesa-radar-market



https://f.hubspotusercontent10.net/hubfs/5942715/RF2M-UK/QTRM%20Datasheet.pdf

Maximum GaAs MMIC PA output:15W
Output power of TRM: 12W
Replacing GaAs with GaN: 50W

http://www.ncsist.org.tw/eng/csistdup/products/product.aspx?product_Id=279&catalog=41

AESA radar

https://buy.garmin.com/en-US/US/p/692084#specs

Leonardo Tests New, Larger Osprey 50 AESA Radar

https://www.defaiya.com/news/International%20News/North%20America/2019/12/26/leonardo-tests-new-larger-osprey-50-aesa-radar

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Radars

	GMR Fantom 124/126	GMR 56 / 54	GMR 2526 / 1226 xHD2	GMR 2524 / 1224 / 424 xHD2	GMR Fantom 24 / 18	GMR 24 xHD / 18 xHD	GMR 18HD+
							
Transmit Power	120W	120W	25kW / 12kW / 6kW	25kW / 12kW / 6kW / 4kW	40W	4kW	4kW
Dimensions (diameter)	1928 mm (Fantom 126) 1328 mm (Fantom 124)	1928 mm (Fantom 56) 1328 mm (Fantom 54)	1923 mm	1310 mm	645 mm (Fantom 24) 508 mm (Fantom 18)	645 mm (24 xHD) 508 mm (18 xHD)	508 mm
Rotation Speed (revolutions/min)	24 & 48	24 & 48	24 & 48	24 & 48	24 & 48	24 & 48	24
Weight	23,6 kg (Fantom 126) 21,3 (Fantom 124)	23,6 kg (Fantom 56) 21,3 (Fantom 54)	29 kg	28,1	9,5 kg (Fantom 24) 7,7 kg (Fantom 18)	9,5 kg (24 xHD) 7,7 kg (18 xHD)	7,7 kg
Horizontal Beamwidth	1.25° (Fantom 126) 1.8° (Fantom 124)	1.25° (Fantom 56) 1.8° (Fantom 54)	1.1°	1.8°	3.7° (Fantom 24) 5.2° (Fantom 18)	3.5° (24 xHD) 5.2° (18 xHD)	5.2°
Vertical Beamwidth	23°	23°	23°	23°	25°	25°	25°
Maximum/Minimum Range	96 nm / 6 m (Fantom 126) 72NM / 6 m (Fantom 124)	96 nm / 6 m (Fantom 56) 72NM / 6 m (Fantom 54)	96 nm / 20 m (2526) 72 NM / 20 m (1226)	96 nm / 20 m (2524) 72 NM / 20 m (1224/424)	48 nm / 6 m	48 nm / 20 m	36 nm / 20 m
Waterproof According to Standard	IPX6	IPX6	IPX6	IPX6	IPX7	IPX7	IPX7
Power Supply	10-32 V	10-32 V	10-32 V	10-32 V	10-32 V	11 - 35V	10.5-35 V
Power Consumption (typical)	80 W	80 W	100 W (25 kW), 90 W (12 kW),	100 W (25 kW), 90 W (12 kW),	18.1-24.4 W (dependent on range	30 W	33.5 W
Power Consumption (standby)	10 W	10 W	20 W	20 W	3 W	12 W	14 W
Temperature Range	-15 to 55C	-15 to 55C	-15 to 55C	-15 to 55C	-15 to 55C	-15 to 70C	-15 to 60C
Guard Zone with Alarm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cable Length	15 m	15 m	15 m	15 m	15 m	15 m	15 m
Polarization	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal
Trails	Heading-corrected, Adjustable	Heading-corrected, Adjustable	Adjustable	Adjustable	Heading-corrected, Adjustable	Adjustable	Adjustable
Dual Range	Yes	Yes	Yes	Yes	Yes	Yes	No

System Integrators

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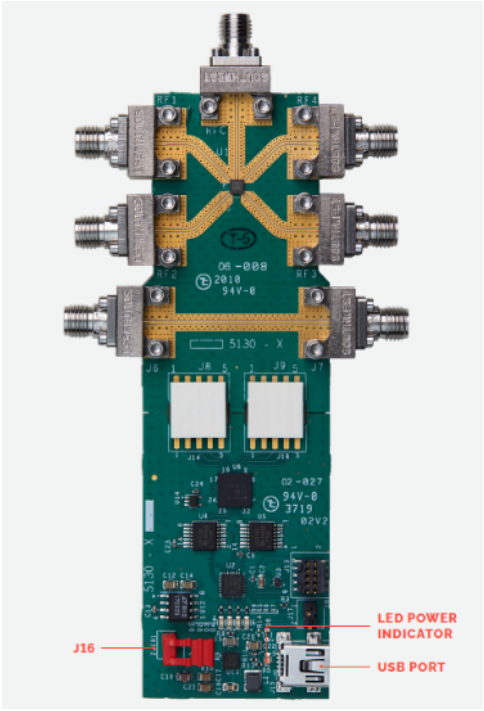
New High Power RF MEMS

SMARTEC

menlomicro



MM5130
DC to 18GHz SP4T

FEATURES

- DC to 18 GHz Frequency Range
- 25 W (CW), 150 W (Pulsed) Max Power Handling
- Low On-State Insertion Loss: 0.3 dB @ 6.0 GHz
- High Linearity, IIP3 > 85 dBm
- 25dB Isolation @ 6.0 GHz
- High Reliability > 3.0 Billion Switching Operations
- 2.5 mm x 2.5 mm WLCSP Package

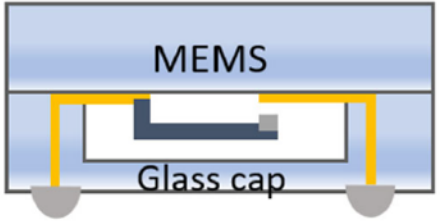
APPLICATIONS

- Switched Filter Banks and Tunable Filters
- High Power RF Front Ends
- Low-Loss Switch Matrices
- RF EM Relay Replacement

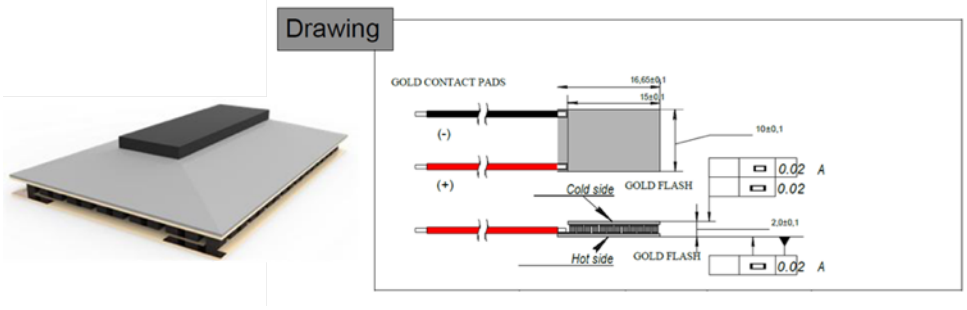
MARKETS

- Defense and Aerospace
- Test and Measurement Systems
- Wireless Infrastructure

Wafer level Package



Exploitation plan revision



CIDETE's New Technology & New Product Development (post-SMARTEC period)

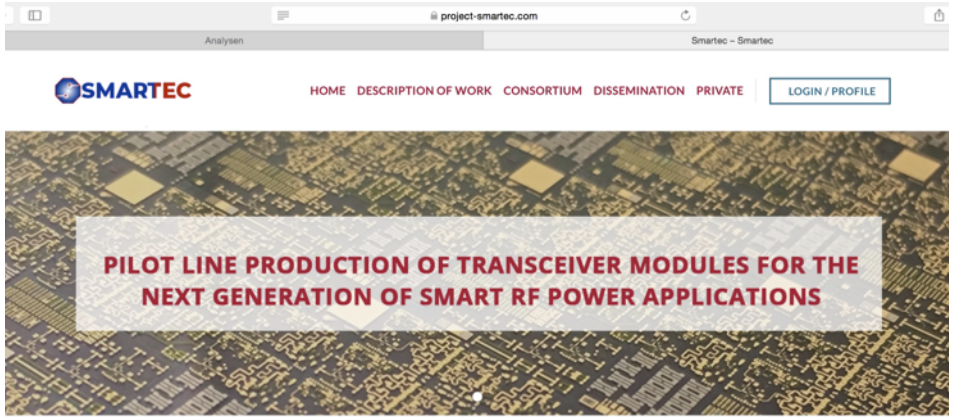
New products will be developed from CIDETE *on the basis on the TEC design for the SMARTEC trx module*.
These products aim specific markets and applications.

TAIPRO ENGINEERING

has started commercial and marketing approaches for flip chip activities. These flip chip technic fits, in particular, very well with all RF applications.
We already have identified 6 potentials customer coming from 4 different countries (Belgium, France, Germany & Sweden).

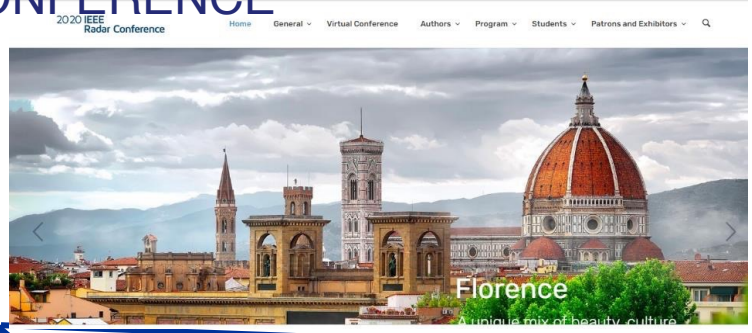
WP 4 CONCLUSIONS

FLYER



WEB PAGE, page on different home pages

CONFERENCE



TV, Seminars

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WP 4 CONCLUSIONS

X band expected to be business case
Identified marine applications:

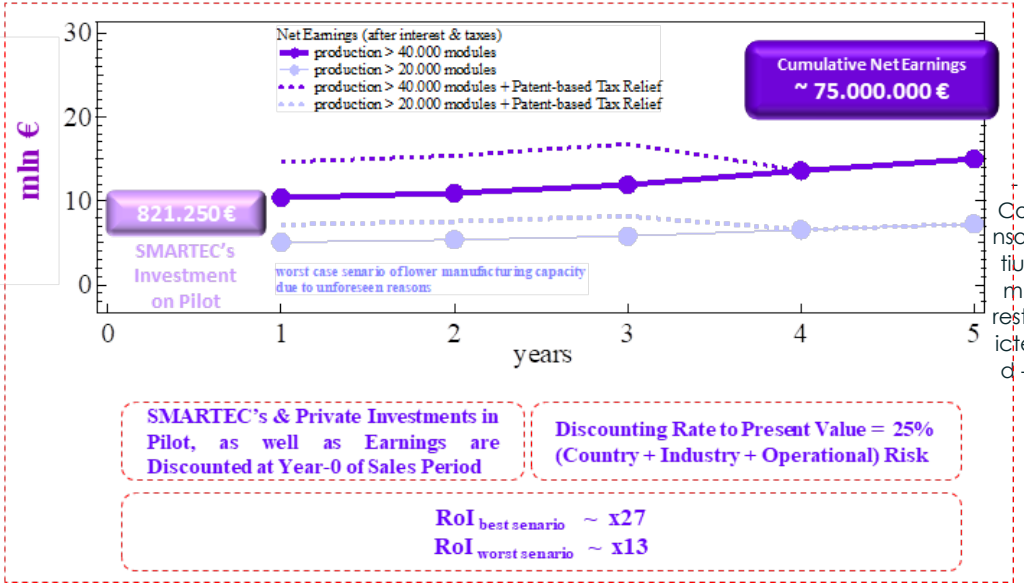
SMARTEC Low-end Radar, #4 SMARTEC Modules per Radar

SMARTEC High-end Radar #40 SMARTEC Modules per Radar

CONSUMER MARKET SEGMENT
yachts, leisure vessel

HIGH-END MARKET SEGMENT
Commercial shipping, offshore vessel fleets, Cruises, Tankers

RFM Demo



revised 5 years plan: estimated net earnings