Project

The project **KERAMIS** aims at the development of innovative and inexpensive components for future applications in multimedia satellite communications. The principle of operation and potential benefit for satellite-based systems will be demonstrated.

The rationale of the project is to exploit the possibility of integrating passive and active components in **LTCC** (**L**ow **T**emperature **C**ofired **C**eramic) multi-layer structures, and by minimising the complexity of the semiconducting components.

LTCC technology offers a number of benefits such as low-cost production and assembly, compact size, and hermetic sealing, which are of utmost importance for satellite-based applications.

Three technological milestones for Ka-band satellite applications used for the down-link are under development:

1. **Solid state power amplifier.**
2. **Frequency synthesiser, realised as a voltage controlled oscillator.**
3. **Reconfigurable 4x4 switch matrix.**

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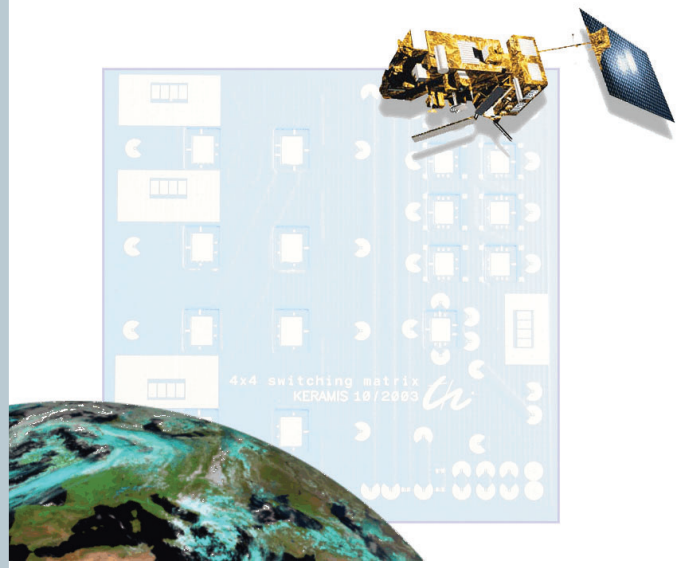
KERAMIS

Ceramic Microwave Circuits for Satellite Communications



(**Kera**mische **Mi**krowellenschaltkreise für die **S**atellitenkommunikation)

Consortium:

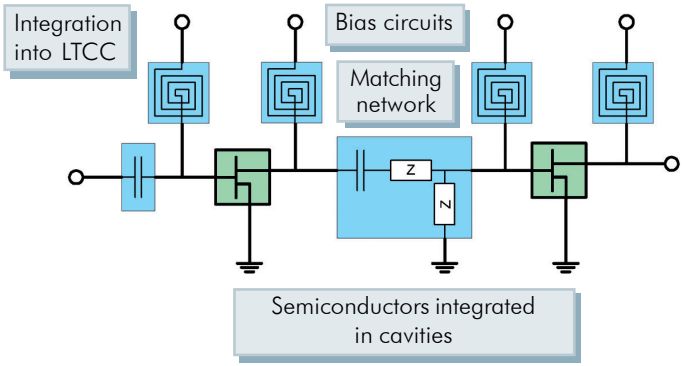
RHe MICROSYSTEMS
TECHNISCHE UNIVERSITÄT ILMENAU
IMST
MSE
TUHH Technische Universität Hamburg-Harburg
TESAT SPACECOM

Solid State Power Amplifier (SSPA)

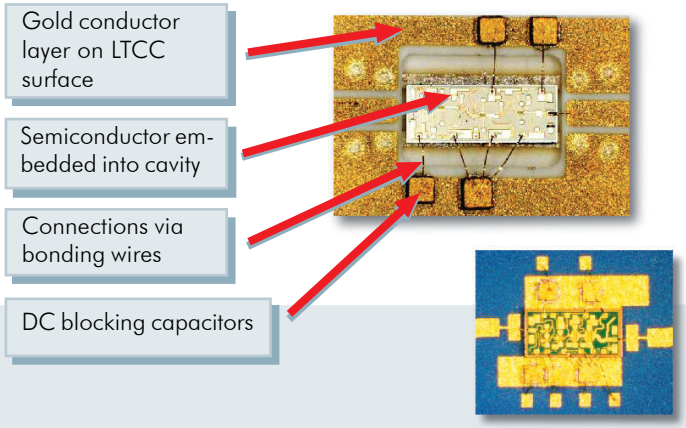
Characteristics:

- Frequency: 18 to 21 GHz
- Output power: ~ 30 dBm
- Semiconductor chips and integrated circuits embedded into LTCC
- Integration of passive structures into LTCC
- Heat dissipation over thermal vias

Simplified design with single transistor chips on LTCC:

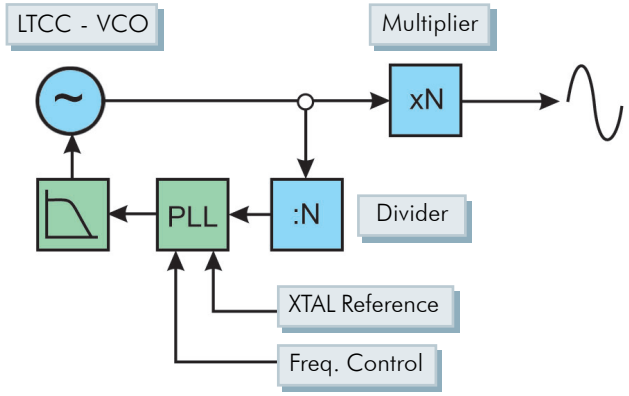


Example of an IC on LTCC substrate:



20 GHz LTCC Synthesiser

Concept:



Low cost LTCC packages provide passively integrated functions as well as hermetic encapsulation for the low noise synthesiser. The frequency control is accomplished by combining on-chip-systems such as dividers and multipliers with external logic, PLL devices and surface mount components. Compact systems are realised by implementing various functions in LTCC multichip modules that are assembled on a common motherboard.

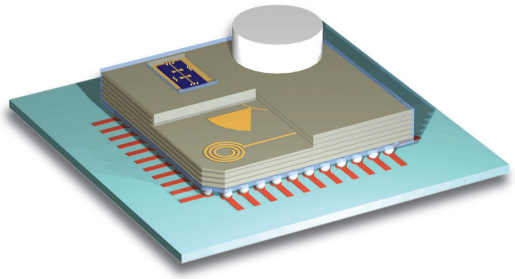
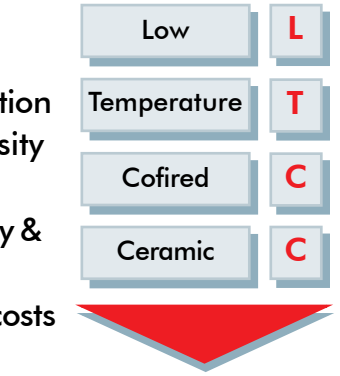


Illustration of a passively integrated signal source based on LTCC technolgy

Reconfigurable Switch Matrix

Requirements for innovative satellite-based communication systems:

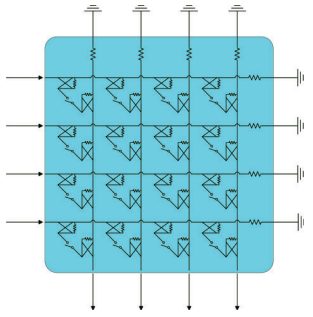
- Light-weight, hermetically sealed
- Low power consumption
- High functional density
- Modular structure
- High reconfigurability & reliability
- Low manufacturing costs

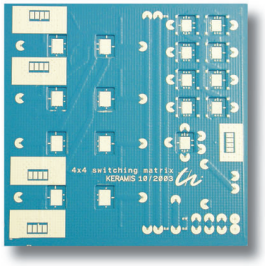


These specifications can be met favourably using LTCC technology.

A switch matrix provides digitally controllable signal paths for adaptation, reconfiguration, and functional multiplexing.

Its functionality and small size are representative of the needs of satellite-based communication systems.





Schematic switch matrix, photograph of LTCC test chip (2 x 2 inches)