

A Custom Multi-Channel RF Distribution Module For FLASH2020+ RF Reference Generation System

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Abstract

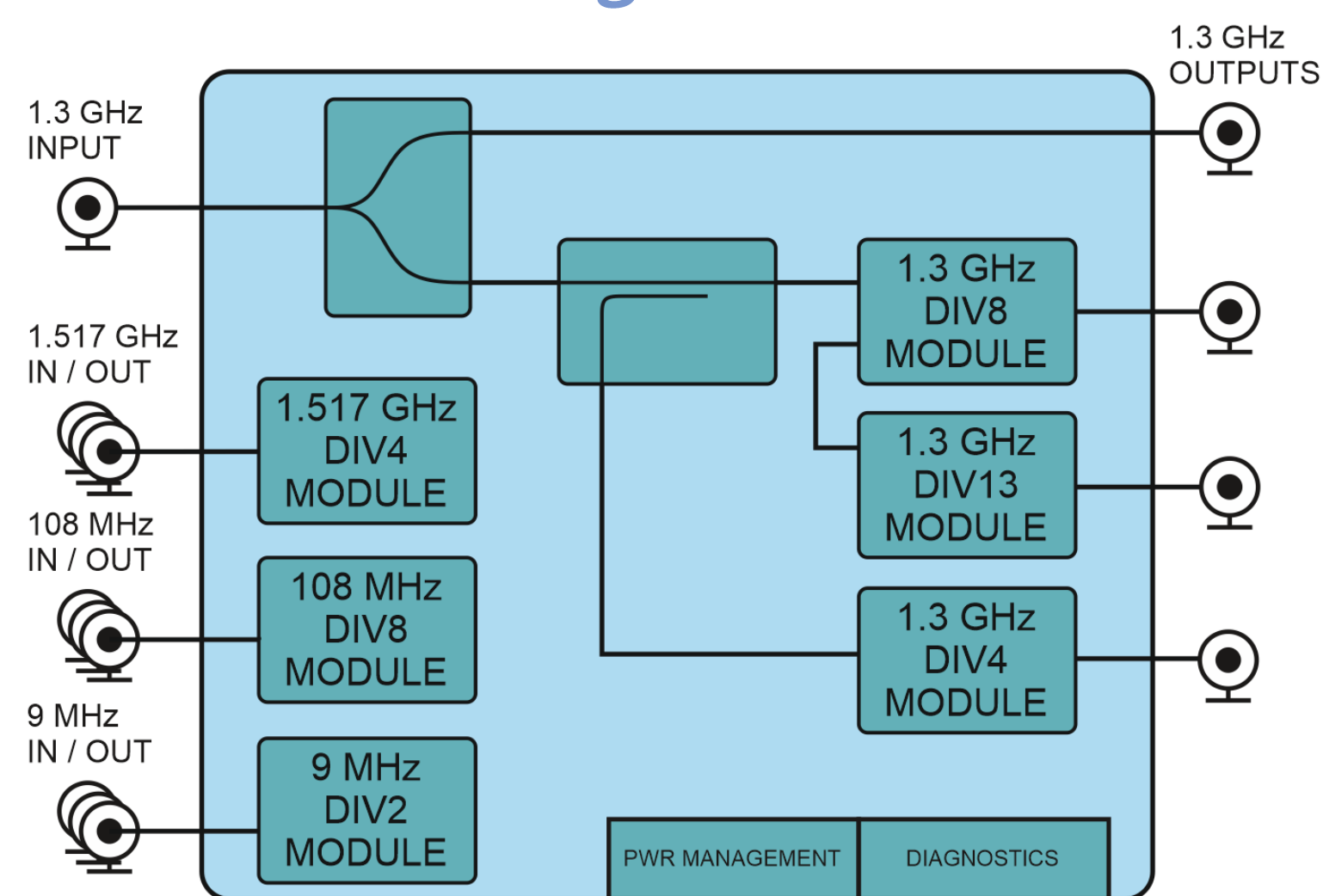
The new RF phase reference generation system was designed and installed to ensure proper and reliable operation of the linac upgraded in the FLASH2020+ program. It synthesizes ultra-stable and ultra-low phase noise RF signals at 9, 108, 1300, and 1517 MHz frequencies. These signals are then routed via coaxial cables to all the system endpoints along the linac. This task required the development of a custom high-power, multi-channel RF distribution module. The contribution presents the designed distribution box that delivers RF reference signals in over 40 channels and provides constant monitoring and diagnostics of the signals, module status, and connected RF loads status. The presented devices have been installed for over a year in the FLASH facility and proved the reliable work and outstanding parameters.

Design requirements

Presented FLASH DISM module must meet following requirements:

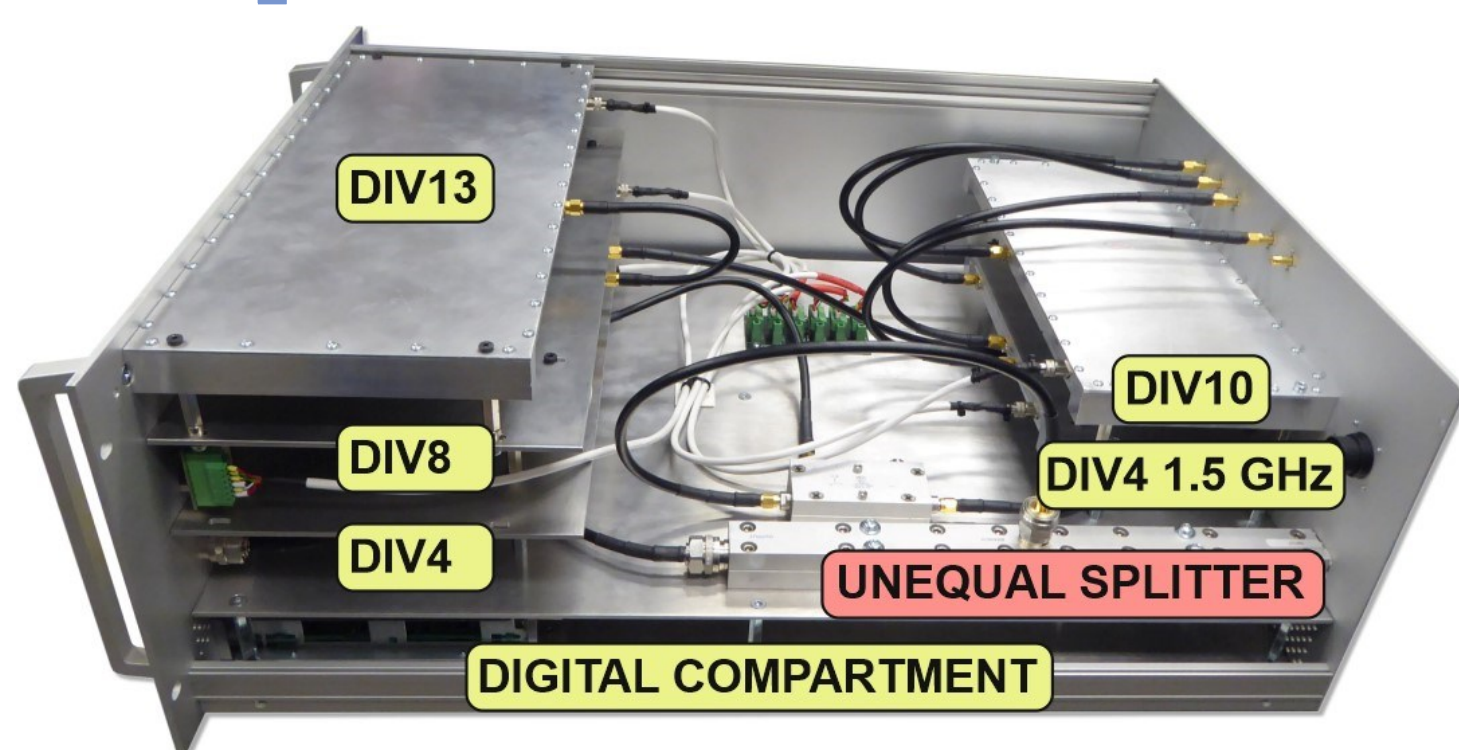
- 25 x 1.3 GHz RF outputs, +20 to +26 dBm each.
- 1 x 1.3 GHz RF high power output, +44 dBm.
- 10 x 108.(3) MHz RF outputs, +10 to +23 dBm each.
- 4 x 1516.(6) MHz RF outputs, +17 dBm each.
- 1 x 9 MHz LF output, 5 Vpp at 50 Ohm load.
- Hermetic housings with potential thermal stabilization upgrade.
- Modules designed for ease of assembly, service and repairs.
- Remote diagnostics and full compatibility with DESY DOOCS system.

General block diagram



FLASH DISM 19" distribution module block diagram

Module photos

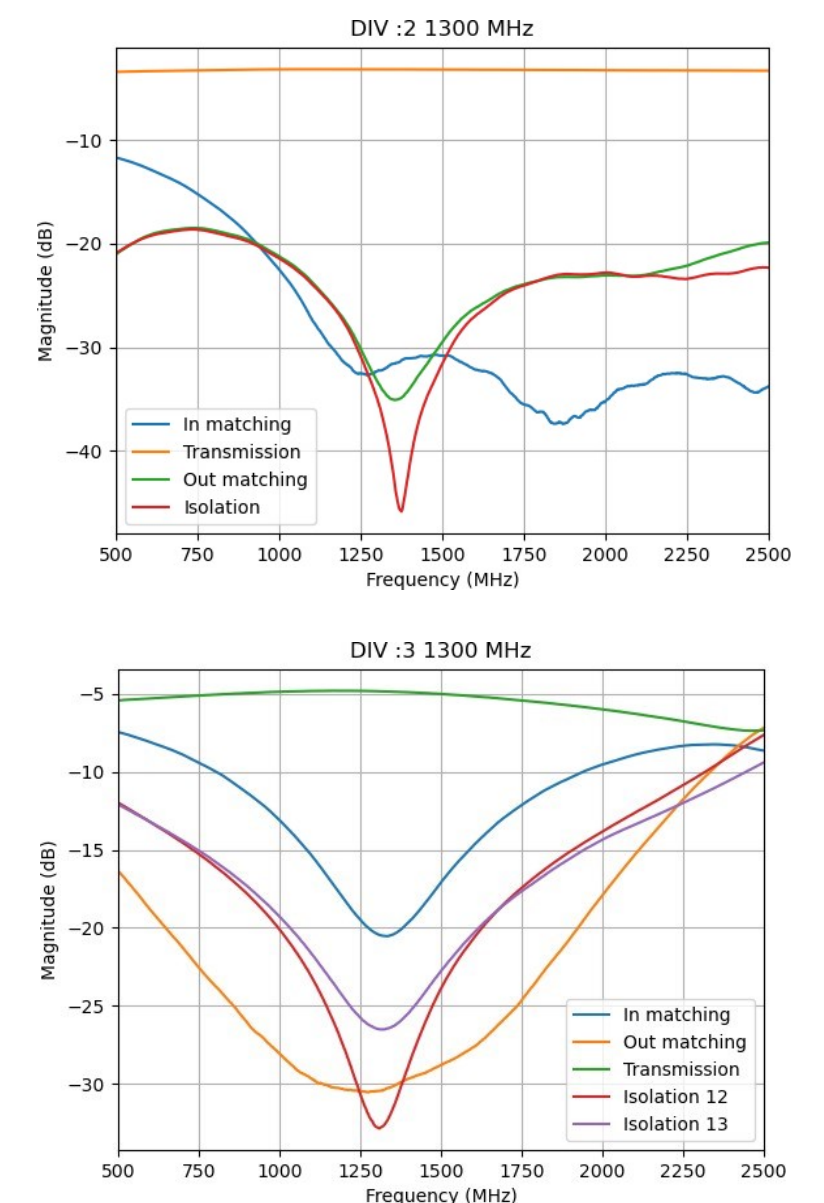
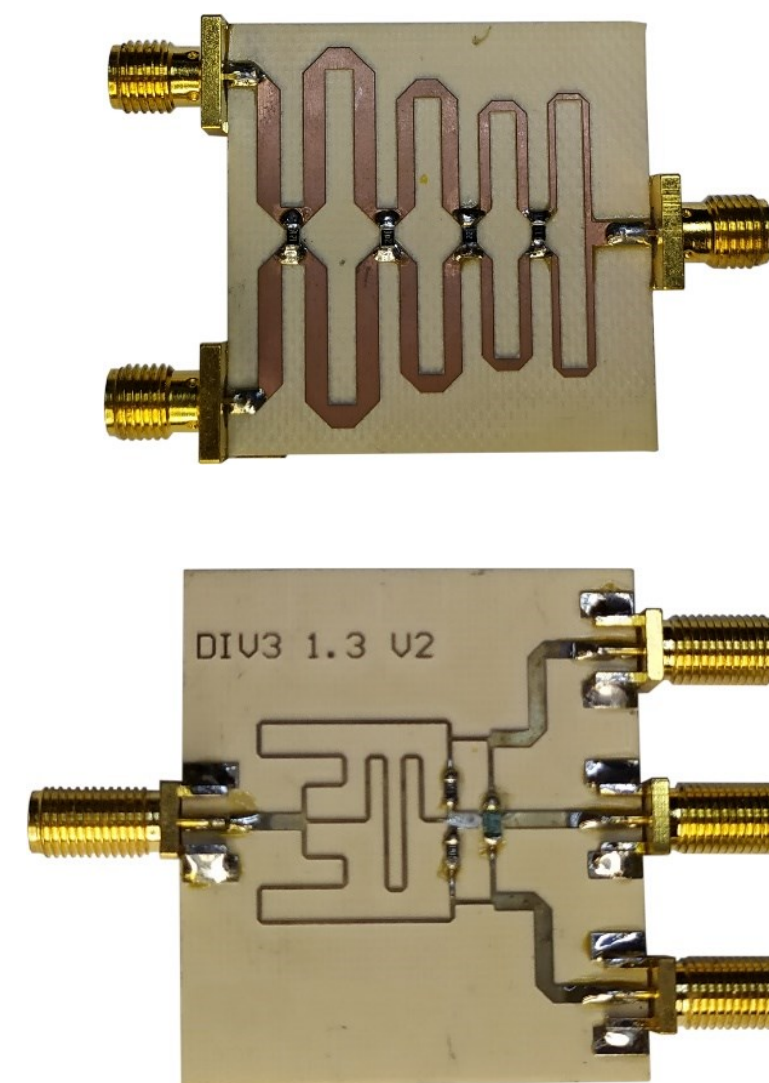


FLASH DISM 19" module internal structure

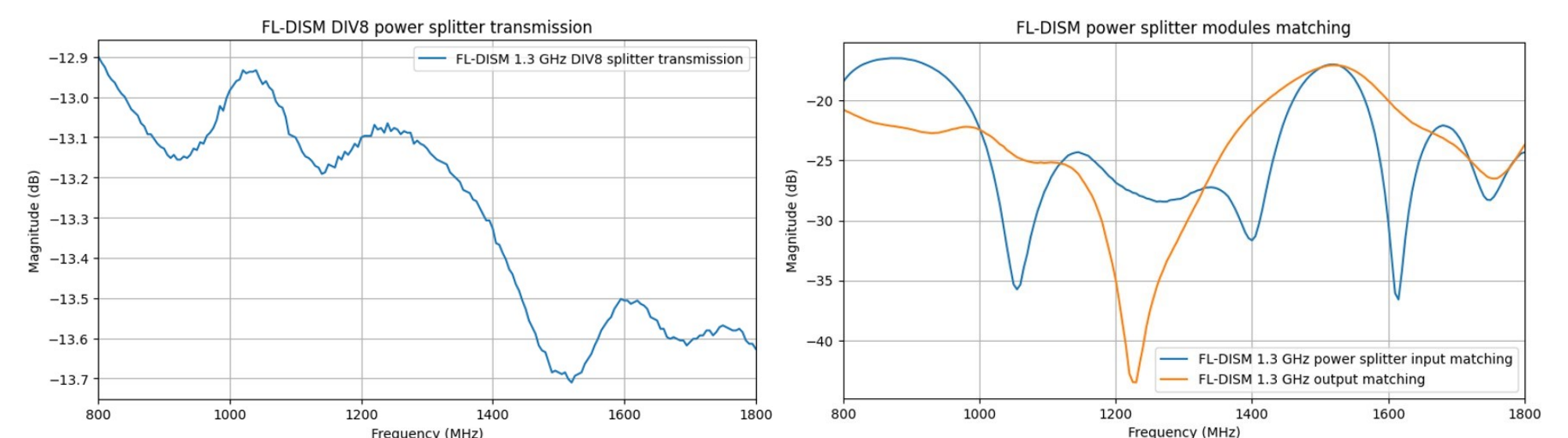
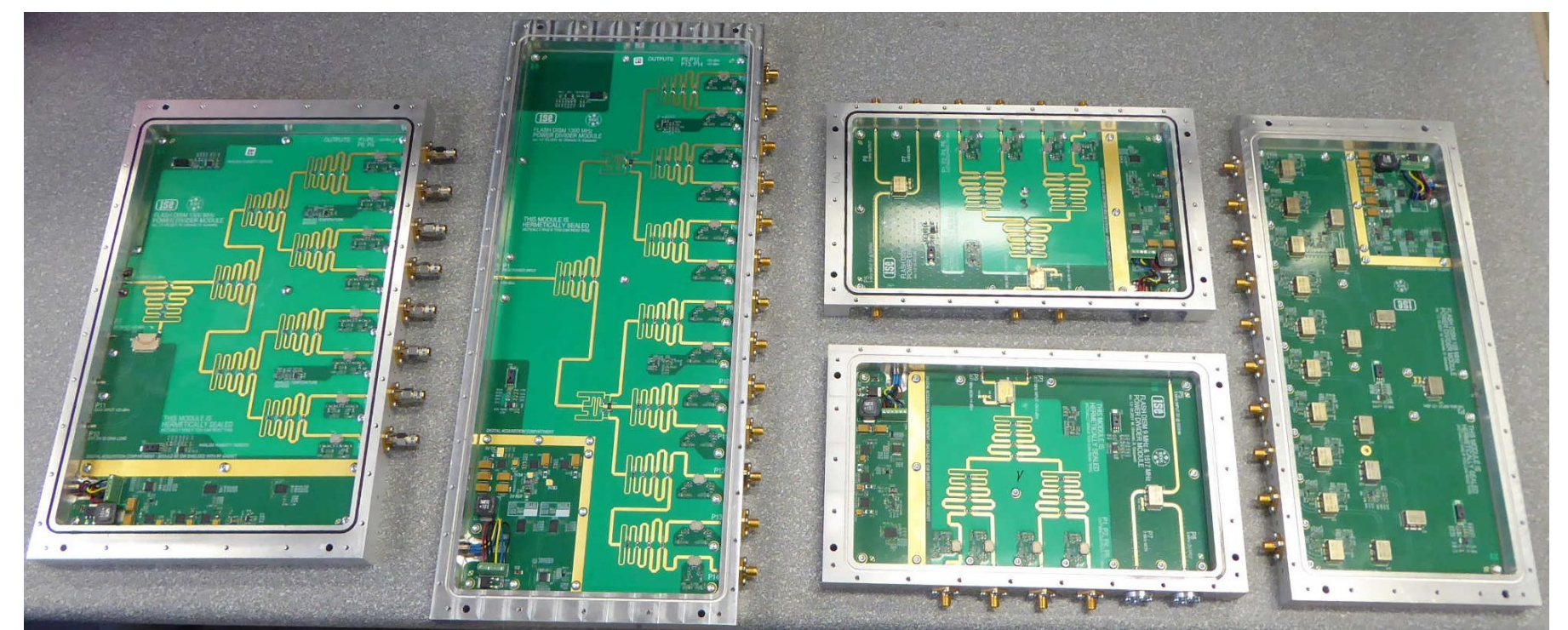
FLASH DISM 19" module with visible DIV modules



Design & Test results



Basic FLASH DISM DIV modules multi-stage divider cells – DIV2 and DIV3 prototypes and their test results.



Manufactured hermetic DISM DIV modules and their test results

References

1. S.B. Cohn, A Class of Broadband Three-Port TEM-Mode Hybrids, IEEE Transactions on Microwave Theory and Techniques, 1968
2. E.J. Wilkinson, An N-Way Hybrid Power Divider, IRE Transactions on Microwave Theory and Techniques, 1960
3. M. Urbanski, et.al., An upgraded universal frequency divider module for the new FLASH2020+ RF reference generation system, IPAC'23 – 14th International Particle Accelerator Conference, 2023
4. M. Urbanski, et.al., FLASH2020+ RF Reference Generation System Upgrade Status, Low Level RF Workshop 2022 (LLRF22), 2022

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