

RTU PROD EXT: FSMOT AND GIM MODULE DEVELOPMENT

FINAL ESA PRESENTATION

JUNE 2024



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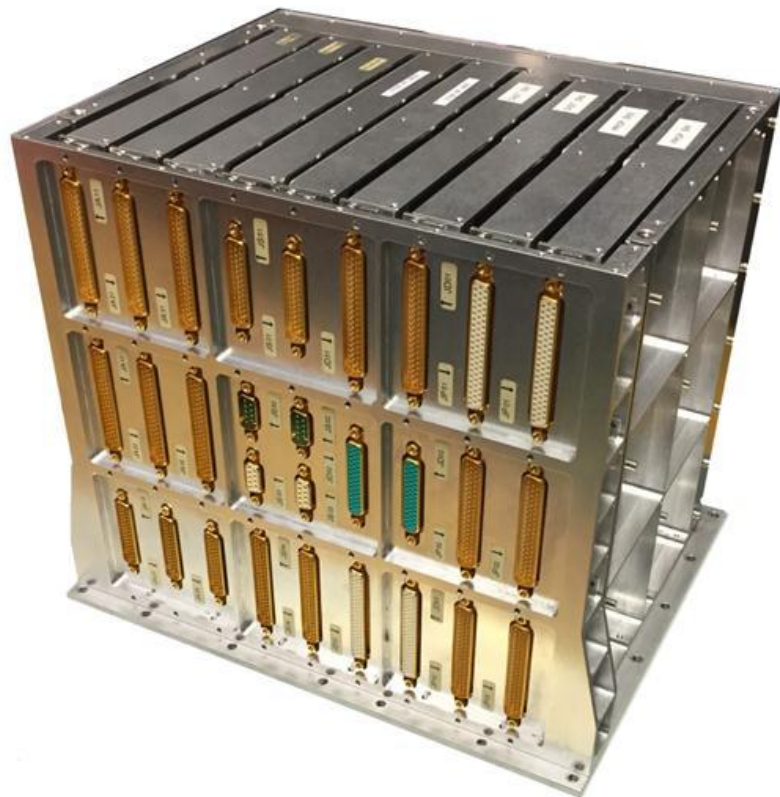
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RTU PRODUCT LINE

/// Remote Terminal Unit

/// Avionic equipment for medium power satellites

- / OBC INTERFACE + POWER INPUT
- / AOCS (RW + MTB DRIVING + C/FSS + MAG + STR)
- / PROPULSION (LV + THR + PT)
- / DISTRIBUTION (USERS + HEATERS + PYRO)
- / MOTOR (MICRO STEP + DC DRIVING + SENSORS : SG + POT + RS)
- / TELEMETRIES ACQUISITION (ASM-BDM + TSM-BSM)
- / TELECOMMANDS GENERATION (HPC)
- / DIGITAL COMMUNICATION (SBDL (IN & OUT) + SYNC + ML16/DS16)



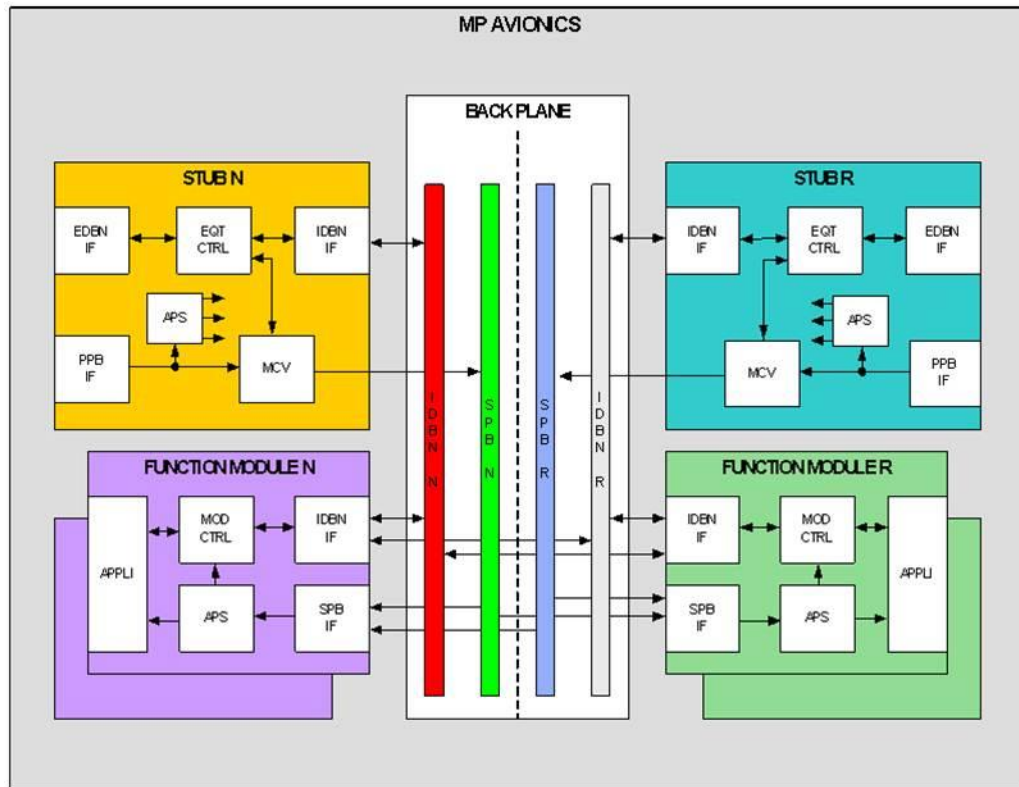
ELECTRICAL ARCHITECTURE

/// STUB is the controller of the unit. It is the power input for other modules and the communication interface with OBC.

/// All modules are interconnected through backplane.

/// STUB communicates with all other modules. They do not communicate with other module than STUB.

/// Redundancy can be implemented within the unit.



PORTFOLIO

/// Existing modules

- / STUB
- / AOCS
- / DIST
- / MSMOT
- / PROP

/// Missing ones

- / FSMOT
- / GIM

/// Goal of RTU Prod Ext project: develop, manufacture and validate the missing 2 modules

FSMOT: MODULE DEFINITION

/// FSMOT driver and sensors

/ 2 FSMOT DRIVER

- 2 phases and 3 phases stepper motors compatible
- SW configurable for DC motors

/ 6 SELECTABLE DRIVING OUTPUTS PER DRIVER

/ REQUIRED PROTECTIONS (OCP, OVP, SURGE,...)

/ 2*12 POT SENSORS

/ 2*6 RESET SWITCHES

/// Standard interfaces

/ 30 TSM / BSM ACQUISITION LINES

/// Miscellaneous

/ INTERNAL COMMUNICATION AND CONTROLLER

/ INTERNAL PROTECTIONS

/ HOUSEKEEPING TELEMETRIES

FSMOT MAIN REQUIRED PERFORMANCES

/// Motor driving

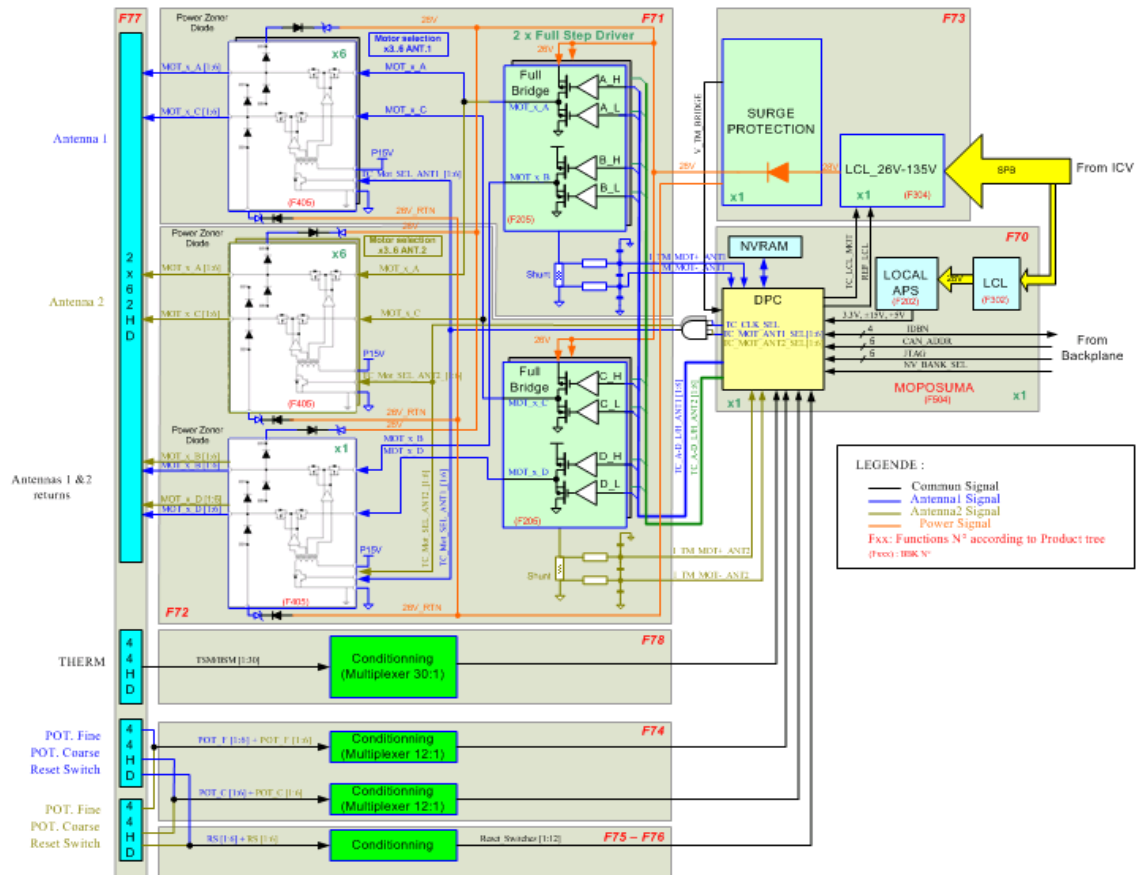
- / DRIVING VOLTAGE: 24,0 V - 28,6 V
- / COIL RESISTANCE : 39 OHM < R_{COIL} < 171 OHM
- / COIL INDUCTANCE : 5 MH < L_{COIL} < 390 MH
- / MEASURE AND REPORT MOTOR CURRENT
- / STEP DURATION : 1 MS < T_{STEP} < 1 S
- / DUTY-CYCLE: 10 % - 100 %

/// Pot acquisition

- / RANGE:
 - Coarse : 10 kOhms < R < 110 kOhms
 - Fine : 5 kOhms < R < 22 kOhms
- / ACCURACY:
 - Coarse : < 1 % FS
 - Fine : < 0,3 % FS
- / DEAD ZONE DETECTION

/// RS acquisition

FSMOT BLOCK DIAGRAM



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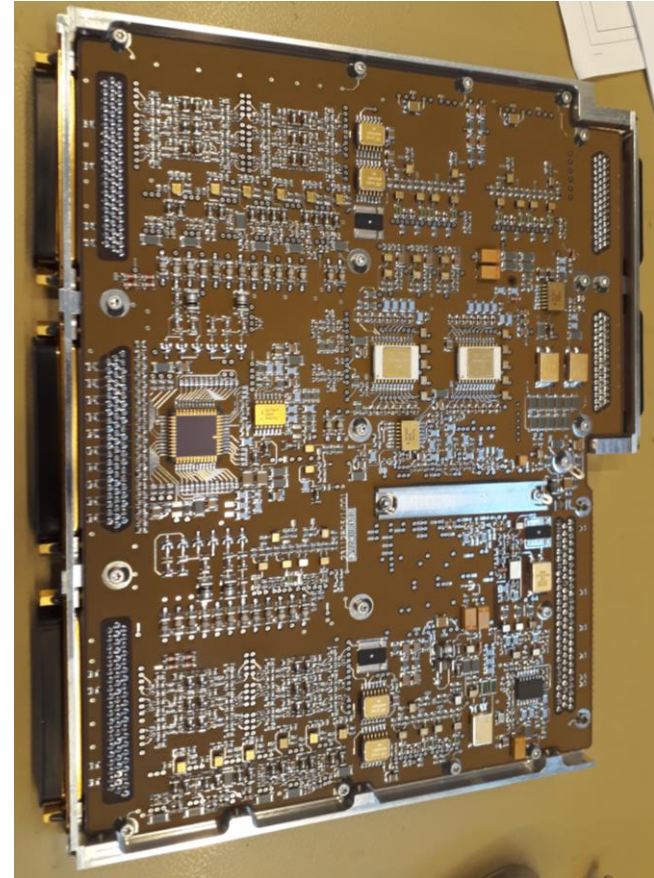
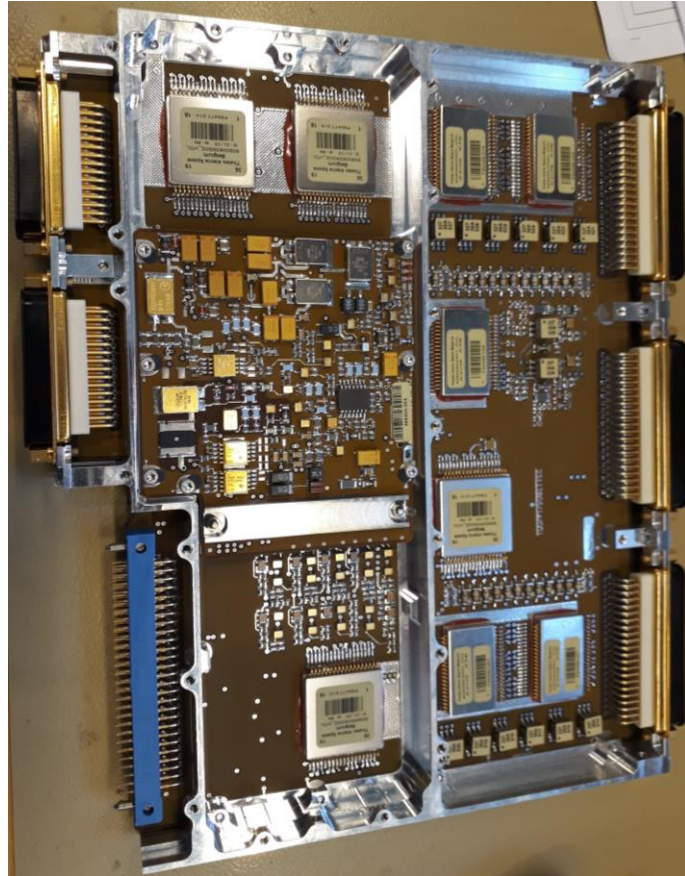
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FSMOT PICTURE



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FSMOT STATUS

/// EM:

- / MANUFACTURED
- / TESTED IN LAB AND DEBUG
- / ATE TESTING COMPLETED
- / INTEGRATED IN THE UNIT
- / DELIVERED TO CUSTOMER IN THE FRAME OF ESPRIT / LUNAR LINK PROJECT FOR INTEGRATION IN ATB

/// EQM:

- / MANUFACTURED
- / TESTED AT MODULE LEVEL
- / INTEGRATED IN THE UNIT
- / QUALIFICATION ONGOING

/// Flight models (PFM and FM2)

- / MANUFACTURED
- / TESTED AT MODULE LEVEL
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FSMOT: MAIN TEST RESULTS

/// All measured performances in line with analysis results

/// Limited non compliance with requirements

/ TSM ACCURACY NOT ALWAYS MET OVER FULL RESISTANCE RANGE

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FSMOT : NEXT STEPS

/// Rework the PCB layout to embed all repairs

/// Use for futur projects

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GIM: MODULE DEFINITION

/// General purpose switched lines

/ 32 LINES

/ POWER DISTRIBUTION (28 V)

/ HPC GENERATION (HV & HC)

/ LCL PROTECTED

/// Standard interfaces

/ 90 TSM / BSM ACQUISITION LINES

- Thermistors
- Thermocouple
- Cross-strapable BSM

/ 32 ASM ACQUISITION LINES

/ 2 CSS ACQUISITION LINES

/// Miscellaneous

/ INTERNAL COMMUNICATION AND CONTROLLER

/ INTERNAL PROTECTIONS

/ HOUSEKEEPING TELEMETRIES

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GIM MAIN REQUIRED PERFORMANCES

/// Compatibility with standard specifications of all implemented interfaces.

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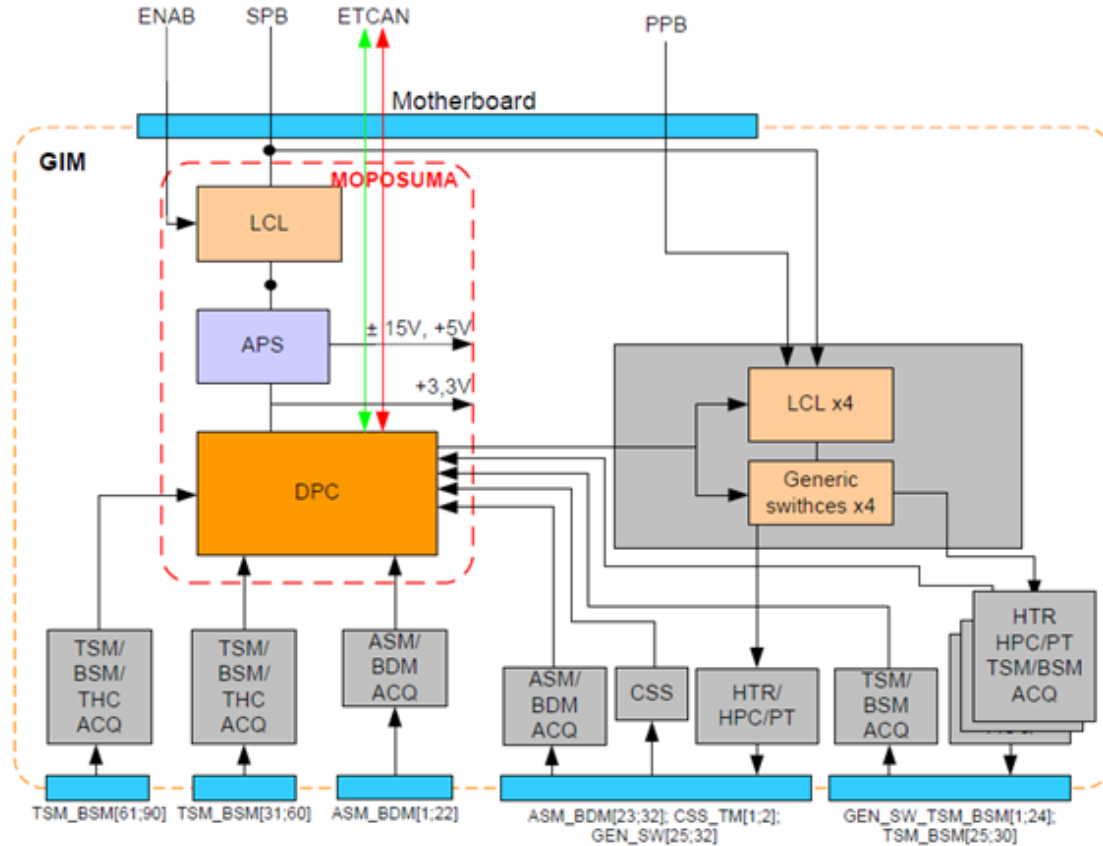
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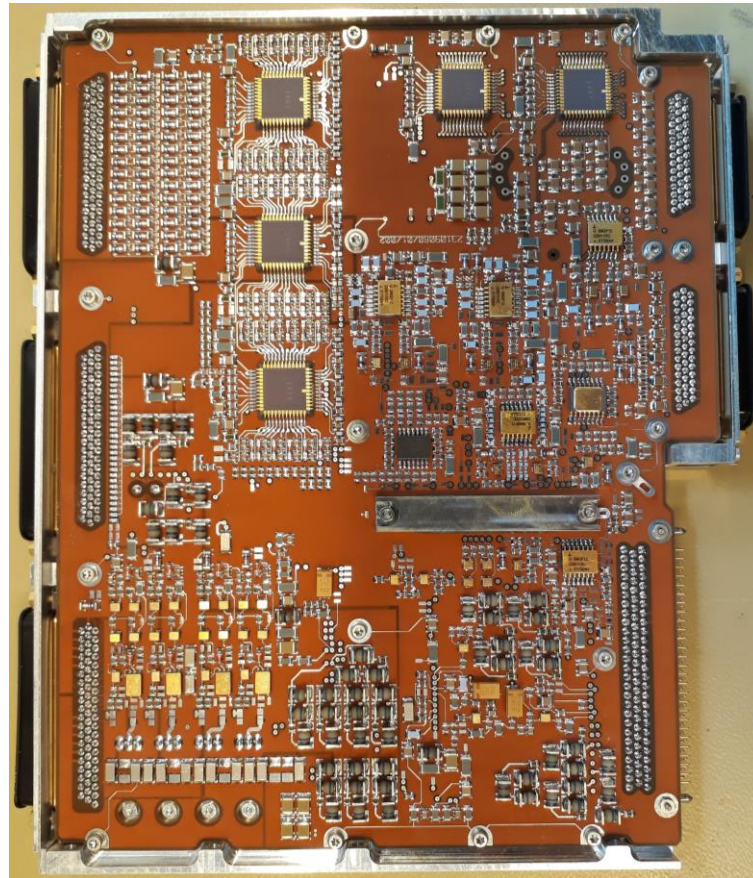
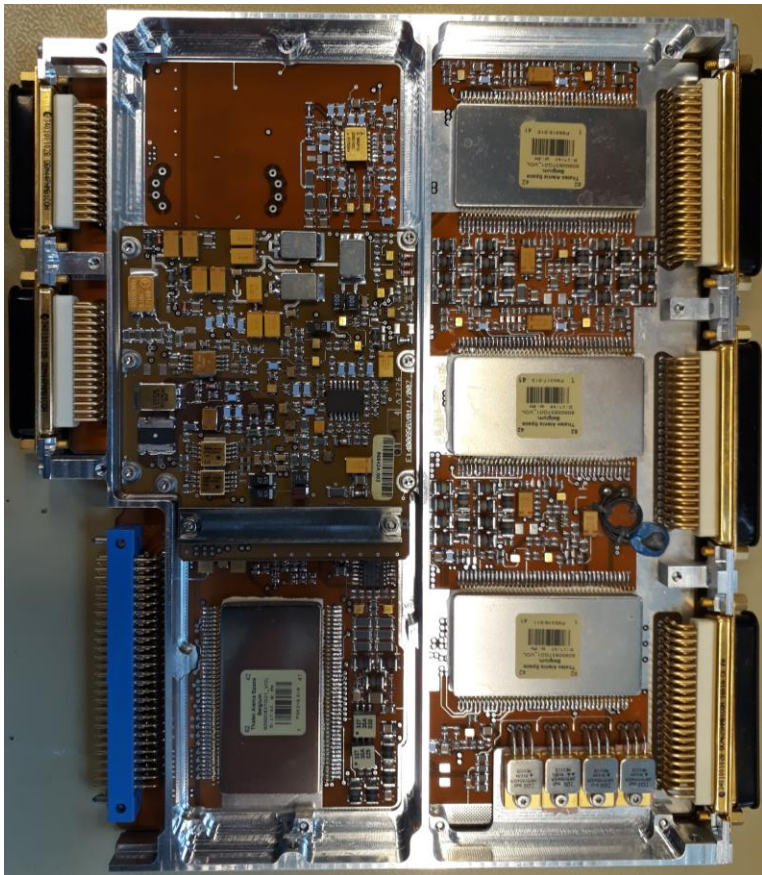
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GIM BLOCK DIAGRAM



GIM PICTURE



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GIM MAIN TEST RESULTS

/// All measured performances inline with analysis results

/// Limited non compliance with requirements

! TSM ACCURACY NOT ALWAYS MET OVER FULL RESISTANCE RANGE

! ASM ACCURACY NOT ALWAYS MET OVER FULL VOLTAGE RANGE

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CONCLUSION

- /// Both FSMOT and GIM modules have been designed on existing and new building blocks with the aim to immediately arrive at a flight compatible design.
- /// Therefore, the design took all flight-related constraints into account to allow for immediate and direct transfer to flight grade manufacturing. The EM prototypes that were built have been tested at extended temperature range and all flight-related analyses have been performed, serving as direct input to the CDR of the first-use project, being RIDU ESPRIT / Lunar Link.
- /// The exact PCB routing has been used for FM manufacturing within that project and the EM prototypes have even been transferred to RIDU ESPRIT / Lunar Link to serve in the EM RIDU, successfully in use for more than a year now. This was only possible due to the achieved functional and physical compliance of the EM prototypes with the target application.
- /// The RTU portfolio extension was successful and immediately found its application in a first flight project.

QUESTION?

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Révisions	Log of change - Description	Date
001		XX Mars 2019

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