Analysis of the performance of the Microwave Imager Radiometer for MetOp Second Generation

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In the framework of the Phase A study for MetOp Second Generation mission (MetOp-SG), CORISTA developed an instrument performance model for MicroWave Imager (MWI) that is currently studied for MetOp-SG... The corresponding algorithms have been implemented by means of dedicated software aimed to analyze the performance of the MWI.. MWI is a conically scanning microwave radiometer, consisting of 28 channels and covering frequency range from 18 GHz up to 183 GHz. Analysis tool was developed for instrument channels as well as overall system performance parameters. The software tools were developed in MatLab language.

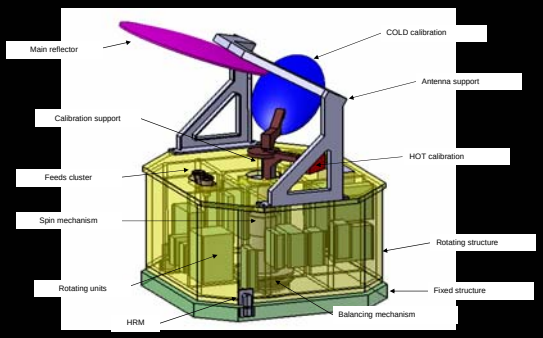
MWI is an instrument included into the METOP SG Phase-A/B1 ESA study and consists in a conical scan passive radiometric imager. The MWI instrument will rotates continuously about an axis parallel to the local spacecraft vertical with an active portion of the scan of ~±65 deg centred on the fore (or afterward) direction of the spacecraft and the antenna system will view the Earth scene with a nearly constant incidence angle of about 53 deg

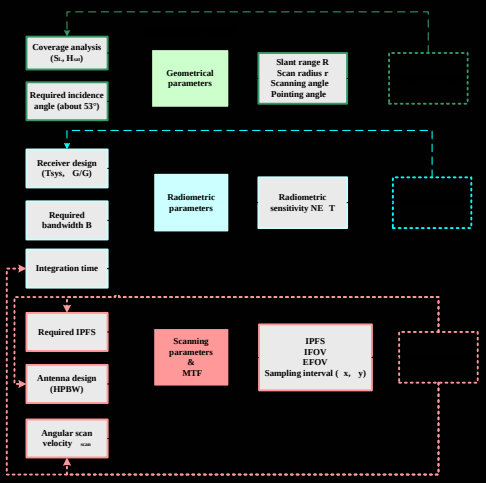
A general schematic block diagram of the instrument is shown in Figure 1-2 (TBC). while a mechanical layout is presented in Figure 1-3.

A fixed rod through the scan assembly emerges above the rotating drum upper plane providing off axis mechanical support in a fixed position for the two calibration targets that consist in a small reflector and a hot blackbody load, which once per rotation illuminates the feed horns obscuring them from the view of main reflector.

The calibration targets, Cold Calibration Reflector (CCR) and Hot Load (HL), are accommodated in such a way that the CCR is constantly pointing to the deep space in the opposite side of Sun direction.

The structural design and the adopted materials of the rotating assembly shall be such to optimize the stiffness to mass ratio and minimize the in orbit mechanical and thermal distortions.





Starting from input parameters which identify the radiometer configuration, the software calculates the MWI main performance parameters. These include total instrument sensitivity (NEDT), accuracy and geometric figures. The software can evaluate the performance of an instruments having up to 45 channels. It is possible to distinguish between imaging and sounding channels. Both the two points and the four points calibration of the instruments can be deeply investigated. Also the mismatch and the non linear behavior of the receiver have been taken into account. Some parameters can be changed in real time (see red boxes in the performance configuration settings window) allowing an on line trade off analysis. An example of the parameters calculated by the software is reported in the following table.

Centre Frequency [GHz]	36.5
Pre_detection Bandwidth [MHz]	1000
Receiver temperature [K]	353
Sensitivity (Linear part) [K]	0.3218
Sensitivity Requirement G [K]	0.5
Sensitivity Requirement R [K]	0.6
Measurement Sensitivity contribution [K]	0.2902
Hot calibration Sensitivity contribution [K]	0.1383
Cold calibration Sensitivity contribution [K]	0.0136
Hot temperature accuracy contribution [K]	0.1738
Cold temperature accuracy contribution [K]	0.2999
Brightness Temperature Accuracy [K]	0.3991
Accuracy Requirement [K]	0.5
Integration time [msec]	5
IFOV [Km]	20
IFOV Requirement [Km]	20