

IN-ORBIT PERFORMANCE OF MICROWAVE HUMIDITY SOUNDER (MWHS) OF THE CHINESE FY-3 METEOROLOGICAL SATELLITE

Jing Li, Shengwei Zhang, Jingshan Jiang, Xiaolong Dong
Center for Space Science and Applied Research, Chinese Academy of Sciences
PO Box 8701, Beijing, 100190, China

1. INTRODUCTION

FY-3 (Fengyun, means wind and cloud in Chinese) is the new generation polar-orbit meteorological satellite of China. FY-3A satellite was successfully launched from Taiyuan launch site in Shanxi province of north China, on May 27, 2008. Microwave humidity sounder (MWHS) is one of the main payloads of FY-3, which is a 5-channel short millimeter wave radiometer for atmospheric humidity profile sounding. MWHS started its measurement from June 4, 2008. In this paper, specification parameters and in-orbit test results of MWHS will be provided.

2. DESCRIPTIONS OF THE INSTRUMENT

MWHS is functionally similar to the operating sounder AMSU-B, the operating frequencies of microwave radiometer MWHS are both located in the transparent windows of atmosphere and absorbing lines of water vapor 183.31GHz. But the window channels has only frequency of 150GHz, however AMSU-B has two frequencies of 89 and 150 GHz[1]. Moreover 150GHz has two polarizations of V and H, and 183.31GHz has three channels of $183.31\pm 1\text{GHz}$, $183.31\pm 3\text{GHz}$, $183.31\pm 7\text{GHz}$.

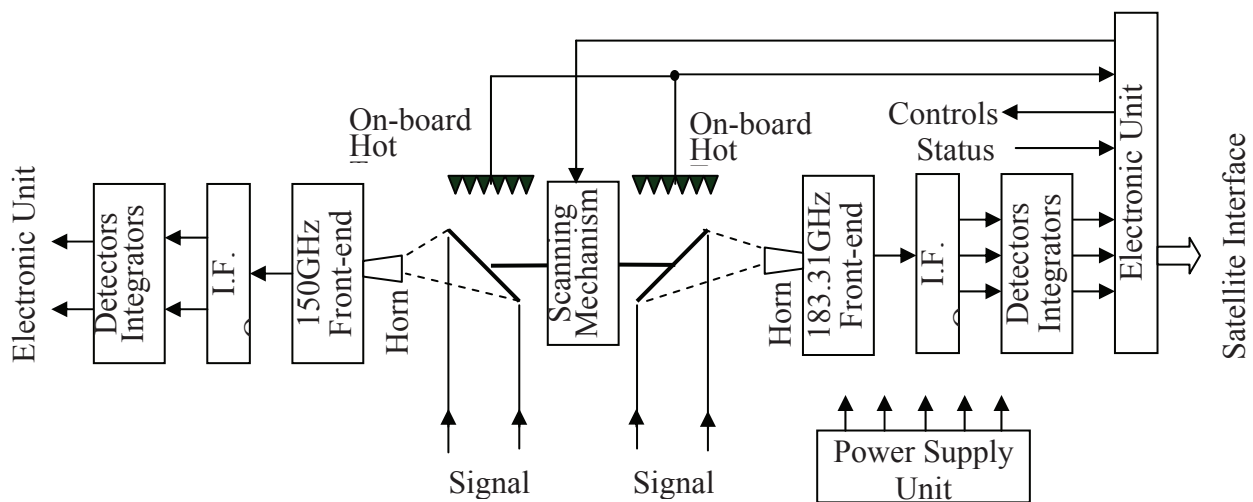


Fig.1 Block diagram of MWHS

MWHS consists of three units: antenna and receiver unit, power supply unit and electronic unit. Fig. 1 shows the block diagram of MWHS. One motor drives two separated 150GHz and 183.31GHz reflectors carrying out cross-tracking scanning. Table-1 and 2 list the specification parameters of MWHS.

Table-1 MWHS Performance Characteristics

Altitude of Orbit (km)	836
Viewing Angle (deg.) From Nadir	± 53.35
Swath Width (km)	2700
Pixels	98 /each scan
Spatial Resolution (kmxkm)	15km (nadir)
On-board Calibration	Hot Target and Cold Space
Poiting Accuracy (deg.)	$\cong 0.1$
Scanning Period	$2.667 \text{ s} \pm 50\text{ms}$
Sensitivity (K)	$\cong 1.2$
Calibration Accuracy (K)	$\cong 1.5$
Data Rate (kbps)	$\cong 7.5$
Mass (kg)	44
Power (W)	60

Table-2 Designed Channel Characteristics of Receivers

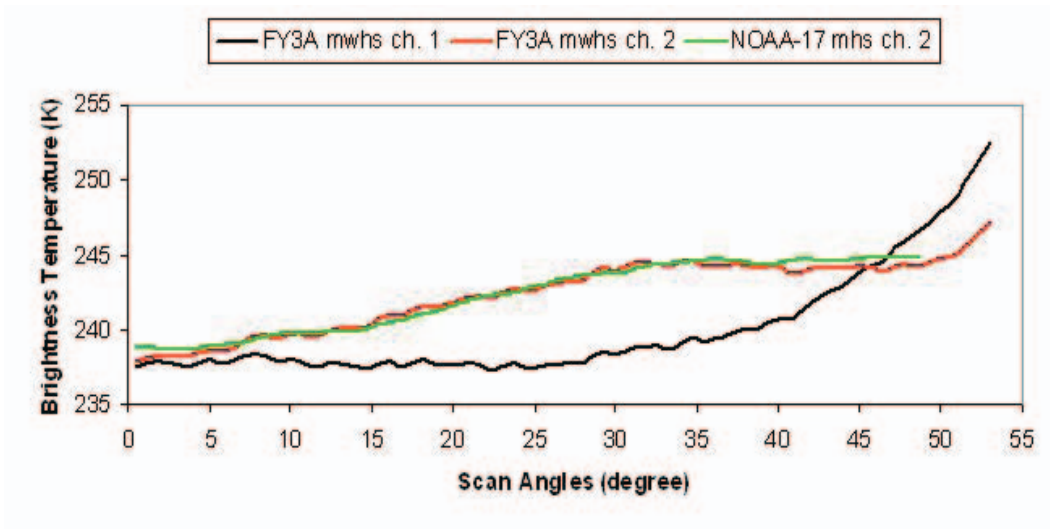
Channel No.	Center Frequency (GHz)	Polarization V/H	Band-Width (MHz)	NE Δ T (K)	LO Precision (MHz)	Antenna Beam Efficiency, %	3dB Beam Width (deg.)	Dynamic Range(K)
1	150	V	1000	1.1	50	≥ 93	1.1	3-340
2	150	H	1000	1.1	50	≥ 93	1.1	3-340
3	183.31 ± 1	H	500	1.2	30	≥ 95	0.9	3-340
4	183.31 ± 3	H	1000	1.1	30	≥ 95	0.9	3-340
5	183.31 ± 7	H	2000	1.2	30	≥ 95	0.9	3-340

3. IN-ORBIT TEST RESULTS OF MWHS

During the in-orbit test phase, specification parameters of MWHS had be tested and evaluated carefully. Table-3 lists the results. Data from MWHS had also been compared with AMSU-B of NOAA-17, which showed good consistency. Fig.2 is the comparison result. More detailed test results and observation results for several typhoon processes will be provided in this paper.

Table-3 Test Results of MWHS

Specification	Channel No.	Designed parameter	Test result
NEdT(K)	1	1.1	0.90
	2	1.1	0.70
	3	1.2	0.86
	4	1.1	0.91
	5	1.2	0.91
Detection voltage dynamic range (V)	1	0—10	4.9-9.5
	2	0—10	3.3-8.0
	3	0—10	4.9-9.5
	4	0—10	2.2-7.0
	5	0—10	4.0-9.6
Average BT error (K) (Global uniform matching area)	1	1.5*	1.3
	2	1.5*	1.4
	3	1.5*	1.5
	4	1.5*	0.9
	5	1.5*	1.1



Biography of the author:

Jing LI, graduated from Ji Lin University, Changchun, Jilin province, and the Graduate University of Chinese Academy of Sciences, Beijing, China, with BE, MS and Ph.D degrees in electrical engineering in 1990, 1994 and 1997, respectively. He is now a research professor and deputy director of National Microwave Remote Sensing Laboratory (NMRS) of Center for Space Science and Applied Research, Chinese Academy of Sciences (CSSAR/CAS).

Dr. Li joined the Laboratory for Microwave Remote Sensing and Information Technologies (MIRIT, now NMRS) in 1997, as a postdoctoral research fellow. He was promoted as associate and full professor in 1999 and 2001, respectively. From 2002 to 2003, he had been a visiting scholar in University of Cologne, Cologne, Germany.

Dr. Li is the chief designer of microwave humidity sounder (MWHS) of China's FY-3 polar orbit meteorological satellite.