



MEMORANDUM FOR: The JPSS Program Record
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SUBJECT: NOAA-20 ATMS TDR provisional maturity status and public release
DATE: 1/23/2018

Provisional maturity status declaration for ATMS TDR & SDR

Maturity Review Date: 1/04/2018
Effective Date: 1/23/2018
Operational System: IDPS with ATMS PCT 006

1. Background:

The Joint Polar Satellite System-1 (JPSS-1) was successfully launch on November 18, 2017 and renamed NOAA-20 after reaching the polar orbit. Eleven days after launch, on November 28, 2017, the NOAA-20 Advanced Technology Microwave Sounder (ATMS) was activated and started to collect science data. Like the Suomi National Polar-orbiting Partnership (S-NPP) ATMS, NOAA-20 ATMS is a cross-track scanning radiometer with 22 channels at frequencies ranging from 23 to 183 GHz, permitting the measurements of the atmospheric temperature and moisture profiles under most weather conditions. Temperature Data Record (TDR) is the antenna temperature of the passive microwave radiometer (i.e., ATMS), and the Sensor Data Record (SDR) is the brightness temperature. The ATMS SDR conversion from the TDR uses an affine relationship derived from the pre-launch antenna-pattern measurements (and will eventually include pitchover maneuver analysis).

The ATMS SDR team for both ATMS TDR and SDR products consists of experts from NOAA, NASA, MIT Lincoln Laboratory, Colorado State University, and industry partners Northrop Grumman and Raytheon. The team has worked intensively for post-launch instrument performance optimization and ATMS SDR/TDR pre- and post-launch calibration and validation.

NOAA-20 ATMS TDR and SDR data product was declared beta maturity on December 11, 2017 after the preliminary data quality check.

2. Provisional maturity stage definition:

- 1) Product performance has been demonstrated through analysis of a large, but still limited (i.e. not necessarily globally or seasonally representative) number of independent measurements obtained from selected locations, time periods, or field campaign efforts.
- 2) Product analyses are sufficient for qualitative, and limited quantitative, determination of

product fitness-for-purpose.

- 3) Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists.
- 4) Product is recommended for potential operational use (user decision) and in scientific publications after consulting product status documents.

3. Justifications for declaring ATMS TDR/SDR data products provisional maturity:

After NOAA-20 ATMS beta maturity on December 11, 2017, ATMS SDR team members continued the assessment and analysis of both ATMS on-orbit normal scanning data, including ATMS science RDR, telemetry RDR, diagnostic RDR, TDR, SDR, and GEO data products, and special post-launch tests (PLT) data. Based on the nearly thirty days of continuous study and monitoring of ATMS data, the following assessments of the ATMS instrument and data products are given:

- 1) Space view profile #1 was chosen as the optimal space view profile;
- 2) On-orbit NEAT is well-characterized and shows slightly better performance than S-NPP;
- 3) Temperature stabilization has been checked and demonstrates the expected low gain drift;
- 4) Effective FOV (EFOV) size, antenna pattern, and earth sidelobes evaluations have been performed using roll maneuver data;
- 5) Geolocation accuracy was assessed based on less than one month on-orbit data and shows better accuracy than S-NPP;
- 6) Inter-comparison results between NOAA-20 and S-NPP ATMS indicate relatively lower antenna temperatures (TDR) in NOAA-20;
- 7) Striping noise was evaluated and shows significant improvement compared to S-NPP;
- 8) Channel correlation assessment results indicate much lower correlations in NOAA-20 than that in S-NPP;
- 9) Environmental characterization data is analyzed;
- 10) Noise characterization data (i.e., power spectra) was analyzed and results are comparable with pre-launch TVAC data;
- 11) PCT was updated (006) to correct artifacts identified in beta maturity data products. It has been submitted for operational implementation in early January 2018. The correction includes TDR to SDR conversion coefficients, upper limits for V-band PLO voltage health status monitoring for both Side-A and Side-B, and spaceViewresolverCounts for space view profile #2 at FOV 99;
- 12) Errors and artifacts in the data products after beta maturity were documented;
- 13) All data products are sufficient for qualitative or limited quantitative assessments and for potential operational use;
- 14) NOAA MIRS team has generated and analyzed offline NOAA-20 total precipitable water EDR products and is satisfied with the preliminary EDR accuracy.

The detailed justifications for declaring ATMS TDR and SDR provisional maturity are attached. The following table summarizes the ATMS on-orbit NEAT (highlighted red) and



Read-me for Data Users

specification (black text). The instrument effective field-of-view size, requirements and on-orbit results from roll maneuver data (highlighted red) are also provided (specification in black text).

Ch.	Center Freq. (MHz)	Pol	NOAA-20 NEAT (K)	NOAA-20 IEFOV (Deg)
1	23800	QV	0.7 (0.23)	6.3 (5.41)
2	31400	QV	0.8 (0.27)	6.3 (5.61)
3	50300	QH	0.9 (0.31)	3.3 (2.54)
4	51760	QH	0.7 (0.22)	3.3 (2.55)
5	52800	QH	0.7 (0.22)	3.3 (2.52)
6	53596±115	QH	0.7 (0.23)	3.3 (2.46)
7	54400	QH	0.7 (0.22)	3.3 (2.43)
8	54940	QH	0.7 (0.22)	3.3 (2.40)
9	55500	QH	0.7 (0.23)	3.3 (2.39)
10	57290.344(f_0)	QH	0.75 (0.32)	3.3 (2.42)
11	$f_0 \pm 217$	QH	1.2 (0.44)	3.3 (2.44)
12	$f_0 \pm 322.2 \pm 48$	QH	1.2 (0.46)	3.3 (2.47)
13	$f_0 \pm 322.2 \pm 22$	QH	1.5 (0.69)	3.3 (2.52)
14	$f_0 \pm 322.2 \pm 10$	QH	2.4 (0.97)	3.3 (2.55)
15	$f_0 \pm 322.2 \pm 4.5$	QH	3.6 (1.58)	3.3 (2.57)
16	88200	QV	0.5 (0.22)	3.3 (2.53)
17	165500±925	QH	0.6 (0.32)	2.2 (1.86)
18	183310±7000	QH	0.8 (0.35)	2.2 (1.83)
19	183310±4500	QH	0.8 (0.36)	2.2 (1.83)
20	183310±3000	QH	0.8 (0.41)	2.2 (1.85)
21	183310±1800	QH	0.8 (0.42)	2.2 (1.86)

22	183310±1000	QH	0.9 (0.58)	2.2 (1.87)
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4. ATMS provisional maturity TDR & SDR data product caveats

The following caveats are offered to provisional product users:

- 1) TDR (and therefore SDR) data contain noticeable striping in terms of NWP O-B field, particularly in temperature sounding channels. However, the striping index is lower than that of S-NPP and the striping noise is still within the requirements of ATMS channel noise (NE Δ T).
- 2) Anomalies and data outages will be tracked at the NOAA STAR Website.

5. Path forward

The team will move forward to perform the following work to promote the ATMS TDR and SDR data product to the validated maturity by L+6M days:

- 1) Assess ATMS data products after the operational implementation of PCT version 006. The operational implementation of PCT 006 is on January 23, 2018 from orbit 940;
- 2) Continue to monitor ATMS instrument stability and performance, as well as TDR/SDR data quality;
- 3) Analyze lunar intrusion data to determine the optimal lunar intrusion mitigation plan;
- 4) Analyze pitch maneuver data;
- 5) Analyze data for potential Ka-transmitter and heater EMI issues. Preliminary analysis indicates that the pre-launch re-work have been effective.
- 6) Characterize the instrument performance following the NOAA-20 ATMS Calibration/Validation Plan

Additional information is available in the ATMS Algorithm Theoretical Basis Document (ATBD) and provisional maturity review briefing, which can be accessed at:

<https://www.star.nesdis.noaa.gov/jpss/Docs.php>

NOAA-20 ATMS Spectral Response Function (SRF) Dataset:

https://www.star.nesdis.noaa.gov/jpss/documents/ATMS_SRF/J1-ATMS_SRFs_X.zip

Pre-operational NOAA-20 ATMS near real time status and performance monitoring password protected web page is available using the following URL at:

https://www.star.nesdis.noaa.gov/icvs-beta/status_J01_ATMS.php

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