AMSR-E Level-1B(HDF5) product format description

Japan Aerospace Exploration Agency (JAXA)

Contents

1. Introduction

1.1. Purpose

This format description document describes the format of AMSR-E Level1B(HDF5) product at Japan Aerospace Exploration Agency (JAXA). This document described the structure and contents of AMSR-E Level1B(HDF5) product.

1.2. Overview

AMSR-E Level 1B(HDF5) product stores the brightness temperature data, geometric information, radiometric information, land/sea flag and supplemental data.

2. Abstract of the Satellite and Sensor

2.1. Overview of Aqua (EOS-PM: Earth Observation Satellite-PM)

The earth observing satellite Aqua of NASA was launched from the Vandenberg Firing Range in California by a DELTA II Launch vehicle in May 2002. Aqua observes various kinds of physical phenomena related to water and energy circulation from space. Aqua data promoted the research activities for interactions between the atmosphere, oceans and lands, and their effects on climate changes.

These are a lot of derived data from Aqua data such as atmospheric temperature, humidity, clouds and precipitation, earth radiation, snow and sea ice, sea surface temperature, oceanic primary production, and soil water. These collected datasets are expected to promote the further development of research on global environmental changes, as well as improving numerical weather forecasts.

Aqua satellite is shown in Figure 2-1. Its main characteristics and sensor are listed in Table 2-1 and Table 2-2.

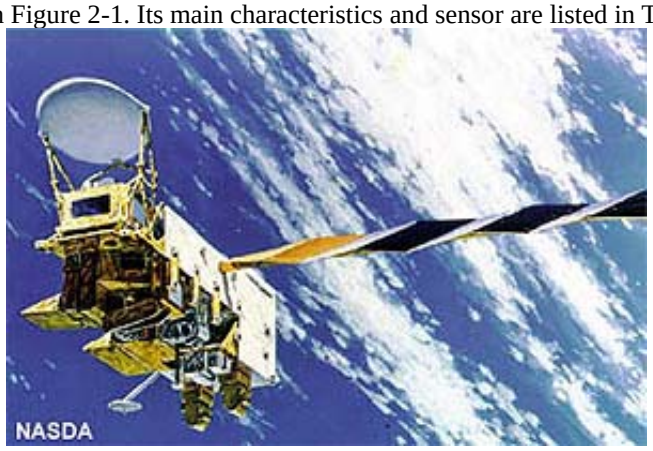


Figure 2-1 Auqa Satellite

Table 2-1 Main characteristics of Aqua

Launch Date		May 4th, 2002
Weight		About 3,000 kg (at launch)
Power		4,444 W (Average)
Life		6 years (Target)
Orbit	Category	Sun-synchronous sub-recurrent orbit
	Altitude	705 km
	Inclination	98 ± 0.1degrees
	Period	98.9 minutes
	Revisit Period	16 days
	Local Sun Time	PM13: 30 ± 15 minutes

Table 2-2 Instruments of Aqua

Instrument		Development organization(Country)	
AMSR-E	Advanced Microwave Scanning Radiometer for EOS	JAXA	(Japan)
AMSU	Advanced Microwave Sounding Unit	NASA	(US)
AIRS	Atmospheric Infrared Sounder	NASA	(US)
CERES	Clouds and the Earth's Radiant Energy System	NASA	(US)
HSB	Humidity Sounder for Brazil	INPE	(Brazil)
MODIS	Moderate Resolution Imaging Spectroradiometer	NASA	(US)

* JAXA: Japan Aerospace Exploration Agency
* NASA: National Aeronautics and Space Administration
* INPE: Institute National de Pesquisas Espaciais

2.2. Overview of AMSR-E

AMSR-E (Advanced Microwave Scanning Radiometer for EOS) has the largest diameter microwave scanning radiometer (about 1.6 meters), and it can observe water relevant data with high resolution. Moreover, AMSR-E observes microwaves instead of optical data, and it can observe from day to night, under any weather condition and less cloud effects. AMSR-E demonstrated advantages and viabilities of microwave-based observation of land and sea under clouds.

AMSR-E measures the radiation from the earth surface or atmosphere. The data obtained by AMSR-E is converted to brightness temperature by the temperature of CSM (Cold Sky Mirror) and HTS (High Temperature noise Source, the radiometric wave absorber). It provided geophysical information relevant to water such as the integrated water vapor, integrated cloud liquid water, precipitation, sea surface wind speed, sea surface temperature, sea ice concentration, snow water equivalent, and soil moisture and so on.

Main characteristics of AMSR-E are shown Table 2-3.

Table 2-3 Main characteristics of AMSR-E

Frequency (GHz)	6.9	10.65	18.7	23.8	36.5	89
Resolution	About 50 km		About 25 km		15 km	5 km
Band Width (MHz)	350	100	200	400	1000	3000
Polarization	Horizontal and Vertical					
Incident Angle	About 55 degrees					
Cross Polarization Characteristics	Under -20 db					
Swath Width	About 1450 km (The scanning width corresponding to the -61 - +61 scan angle range of performance guarantee. In actual operation, the 1600 km of -75 - +75deg.)					
Dynamic Range	2.7-340 K					
Absolute Accuracy	1 K (1-sigma)					
Temperature Resolution	0.3-1 K (1-sigma)					
Quantization bits	12 bits	10 bits				

The AMSR-E reached its limit to maintain the antenna rotation speed necessary for regular observations (40 rotations per minutes), and the radiometer automatically halted its observation and rotation. After observation by the AMSR-E was suspended, JAXA prepared a recovery plan with NASA engineers, and the AMSR-E restarted its observation in slow rotation mode (2 rotations per minute) on December 4, 2012. Although the AMSR-E observation data ins slow rotation mode limited to observation sparse areas, it was used for cross-calibration with the AMSR2 (successor of the AMSR-E) onboard the Global Change Observation Mission-Water “SHIZUKU”(GCOM-W) since its launch on May 18, 2012, in order to produce and provide a consistent and long-term dataset between the AMSR-E and AMSR2 by correcting their differences in sensor properties.

However, the AMSR-E reached its limit to maintain the antenna rotation speed necessary for slow rotation mode (2 rotations per minute) and it automatically halted its observation and rotation at around 2:30 p.m. on December 4, 2015 (JST). JAXA decided to complete operation of the AMSR-E at this time.

2.3. Observation Principal of AMSR-E

An object emits the electromagnetic wave of various wavelengths from its surface in microwave region (1~100GHz). The electromagnetic intensity differs by its physical features, observing frequencies, and so on. Using these characteristics, AMSR-E observes the faint microwave emitted from the earth surface and atmosphere.

AMSR-E main refractor rotates to scan and collect radiation of the microwave from the earth surface or the atmosphere. After the microwave was concentrated with its main reflector, it was distributed to the six receivers. The microwave signals detected by each receiver are amplified and integrated, then converted to the digital count value by an A/D converter. These values are the observation raw data of the level 1 product. Furthermore each receiver observes the microwave of background radiation from the deep space and radiation from the absorber which temperature is controlled for the specific temperature. These data are applied to correct the observation data.

2.4. Observation Geometry

AMSR-E is a conical scan sensor and sweeps the surface of the Earth at about ±75° centered at the direction of the satellite flight. The swath width is about 1450 km[1]. The scanning period is 1.5 sec and the data sampling interval is every 2.6 msec for 6GHz – 36GHz, 1.3 msec for 89GHz and triggered by the antenna rotation. As the result, AMSR-E samples 486 data points for a scan of 89GHz and 243 points for other channels. (Figure 2-2)

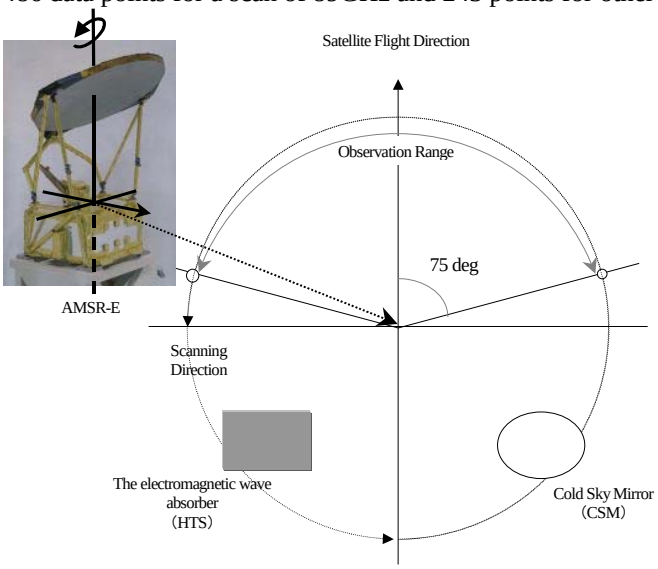


Figure 2-2 Observation Geometry of AMSR-E

[1] 1450km is the scanning width corresponding to the -61 - +61 scan angle range of performance guarantee. In version 4 products, swath width is 1600 km corresponding to actual operation, the -75 - +75deg scan angle range.

3. Explanation of the Product

The level 1B(HDF5) product stores the value of observed microwave radiation from the earth surface and it's geometric information as HDF. The feature of level 1B product are shown below.

- Range of data

  The level 1B(HDF5) is extracted to the range of a half orbit between the south pole ant north pole from level 0 data (Science and GBAD data).

- Observation width

  The range of the observation width is ±61 degrees centered at the flight direction.(See Figure 3-1) 196 data points are observed for each frequency below 89GHz and 392 for 89GHz[2].

- Main storing data
  - Scan time
  - Brightness temperature of the earth surface observation data (with radiometric conversion and correction)
  - Radiometric conversion coefficients
  - Temperature of the high temperature calibrator and the low temperature calibrator
  - Geometric information (position, observation incidence angle, sun azimuth angle, etc.)
  - Quality information
  - Others (the information of the satellite, sensor, and product etc.)

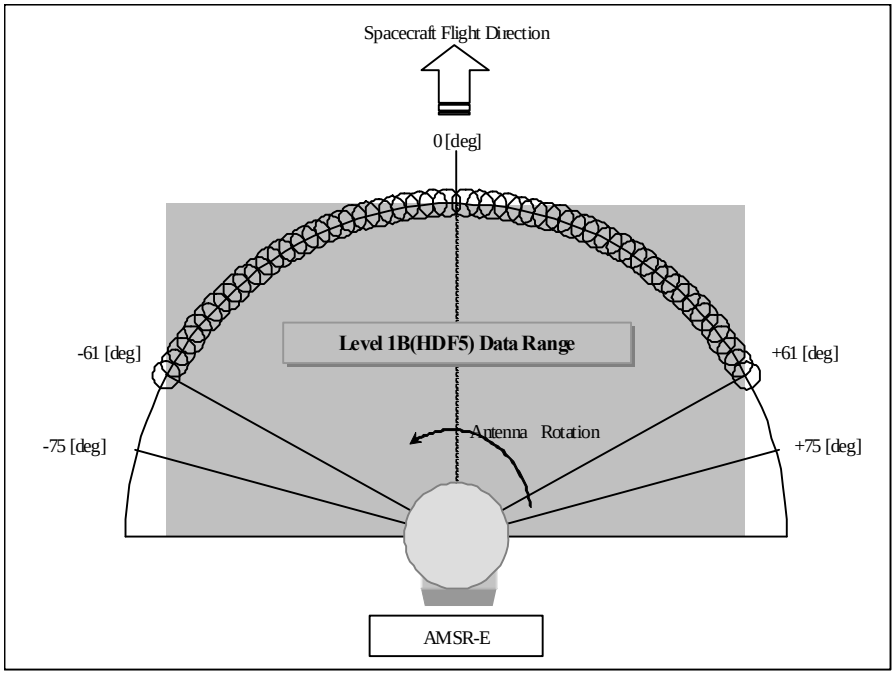


Figure 3-1 the data range of one scan for AMSR-E Level1B(HDF5)

[2] In version 4 products, the range of observation width is corresponding to the ±75 degrees centered at the flight direction, and pixel number is 243 data points are observed for each frequency below 89GHz and 486 for 89GHz.

3.1. Product structure

The logical structure of level 1B(HDF5) product is shown in Table 3-1.

Table 3-1 Logical structure of AMSR-E Level 1B(HDF5) product

Structure		HDF Data	Contents
Header Part	Product Metadata	Attribute	Describe unique information of the product data. (sensor specification, engineering value coefficients, etc.)
Data Part		Dataset	The example of the stored data are shown as below. • Scan time • Brightness temperature of observation data • Calibration data • Supplementary information (positions, orbits, attitudes, coefficients, observation incidence angle, sun azimuth, etc.) • Quality information

In order to share the product structure with the product of AMSR2, there is a data area of 7.3 GHz band which is an observation frequency which does not exist in AMSR-E. Please be aware that data in the 6.9 GHz band before bias correction is stored in this area.

3.2. File structure

The file structure of AMSR-E level 1B(HDF5) product is shown in Figure 3-2. The explanation for the product metadata is shown in Table 3-2. Moreover, the explanation for each item of the data parts shows the data size and the scale factor in Table 3-3.

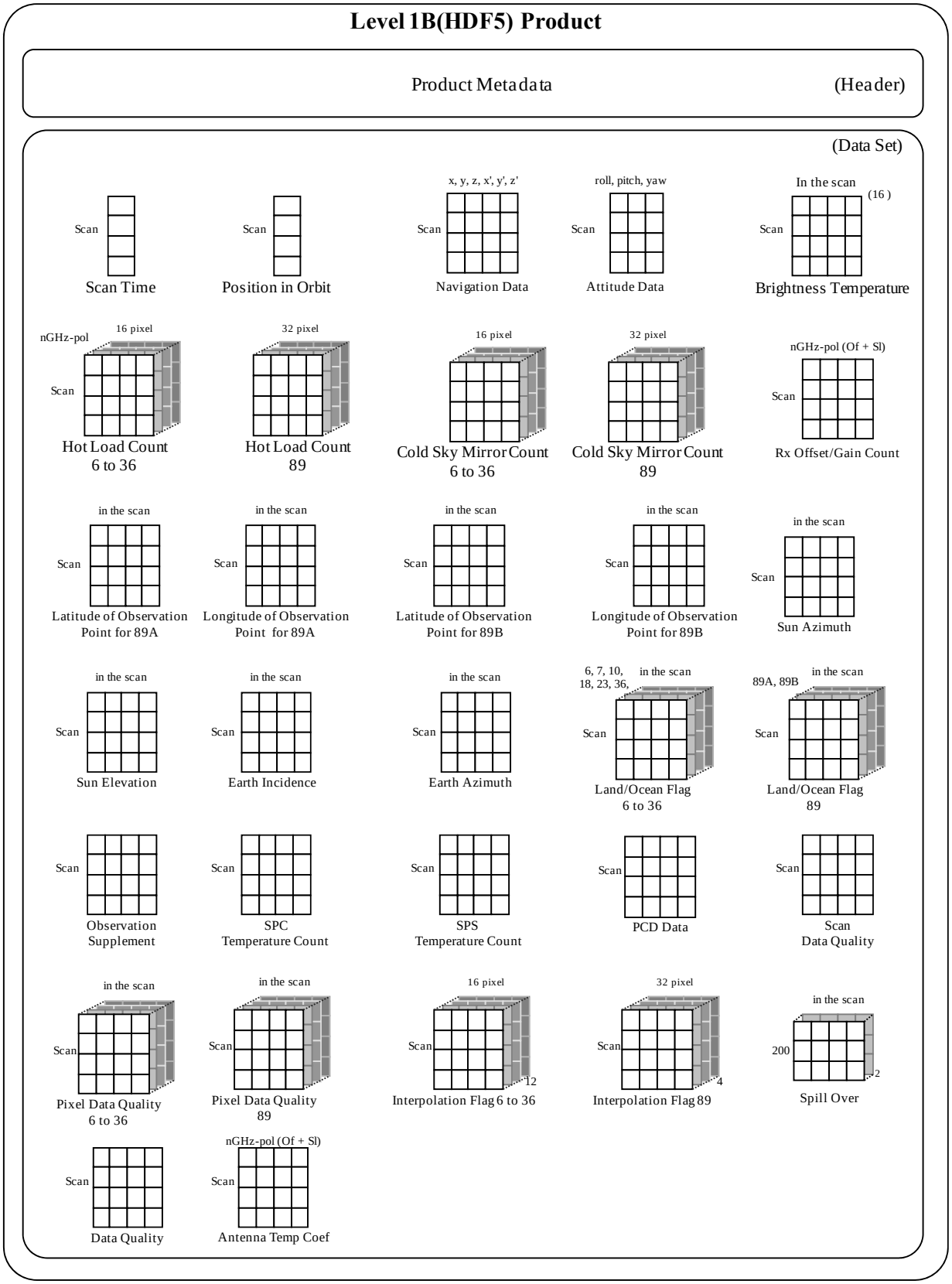


Figure 3-2 AMSR-E level1B(HDF5) product data structure

Table 3-2 Product meta items (1/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
1.	ProductName	Abbreviated name	AMSR-E-L1B	Fixed
2.	GeophysicalName	Geophysical quantity name	Brightness Temperature	Fixed
3.	ProductVersion	Product version	[X] 0~Z	Variable
4.	AlgorithmVersion	Algorithm version	[XXX] 000~999	Variable
5.	ParameterVersion	Parameter version	[XXX] 000~999	Variable
6.	ProductSize_MByte	Product size(MB)	[XXX] 000~999	Variable
7.	GranuleID	Granule ID	[XXXXXXXXXXX]	Variable
8.	Operation	Product kind	Standard	Variable
9.	ProductionDateTime	Product creation time and date (UTC)	[YYYY-MM-DDThh:mm:ss.uuuZ] YYYY: 0000~9999 (year) MM: 01~12 (month) DD: 01~31 (day) hh: 00~23 (hour) mm: 00~59 (minute) ss: 00~59 (second) uuu: 000~999 (millisecond)	Variable
10.	ObservationStartDateTime	Start time and date of observation data (UTC)	[YYYY-MM-DDThh:mm:ss.uuuZ] YYYY: 0000~9999 (year) MM: 01~12 (month) DD: 01~31 (day) hh: 00~23 (hour) mm: 00~59 (minute) ss: 00~59 (second) uuu: 000~999 (millisecond)	Variable

Table 3-2 Product meta items (2/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
11.	ObservationEndDateTime	End time and date of observation data (UTC)	[YYYY-MM-DDThh:mm:ss.uuuZ] YYYY: 0000~9999 (year) MM: 01~12 (month) DD: 01~31 (day) hh: 00~23 (hour) mm: 00~59 (minute) ss: 00~59 (second) uuu: 000~999 (millisecond)	Variable
12.	GringPointLatitude	Latitude of data effective range	83.71,73.23,34.10,-25.31,-84.97,-73.60,-23.13,36.52	Variable
13.	GringPointLongitude	Longitude of data effective range	152.28,91.82,-10.34,-24.72,-39.30,-105.73,-40.70,-27.99	Variable
14.	PGEName	Data processing software name	AMSR-E Reprocessing System	Fixed
15.	InputFileName	Input file name	R1540402SGS0221003170100.RBD, R1540402SGS0221005320100.RBD	Variable
16.	ProcessingCenter	Data processing center	JAXA JSS2	Fixed
17.	ContactOrganizationName	Contact organization name	JAXA Satellite Applications and Operations Center (SAOC) Address:2-1-1,Sengen,Tsukuba-city,Ibaraki,Japan	Fixed
18.	ContactOrganizationTelephone	Contact telephone number	Blank	Fixed
19.	StartOrbitNumber	Start orbit number	1251	Variable
20.	StopOrbitNumber	End orbit number	1251	Variable
21.	EquatorCrossingLongitude	Longitude at the time of equatorial passage	-28.80	Variable
22.	EquatorCrossingDateTime	Time and date of equatorial passage (UTC)	[YYYY-MM-DDThh:mm:ss.uuuZ] YYYY: 0000~9999 (year) MM: 01~12 (month) DD: 01~31 (day) hh: 00~23 (hour) mm: 00~59 (minute) ss: 00~59 (second) uuu: 000~999 (millisecond)	Variable
23.	OrbitDirection	Orbit direction	Descending Ascending	Variable
24.	PassNumber	Pass number of observation start point	[XXX] 0～999	Variable
25.	OrbitDataFileName	Support orbit file name	R1540957SGS0221003170100.RBD	Variable

Table 3-2 Product meta items (3/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
26.	EphemerisMissingDataRate	Missing rate of orbit data	Good	Fixed
27.	AttitudeMissingDataRate	Missing rate of attitude data	Good	Fixed
28.	OrbitDataType	Orbit data type	ELMD	Fixed
29.	PlatformShortName	Platform name	AQUA	Fixed
30.	SensorShortName	Sensor name	AMSR-E	Fixed
31.	NumberOfScans	Number of scan	[XXXXX] 0～99999	Variable
32.	NumberOfMissingScans	Number of missing scans	1	Variable
33.	AntennaRotationVelocity	Velocity of antenna rotation	40.0	Fixed
34.	ECSDataModel	Meta data model name	B.0	Fixed
35.	NumberOfPackets	Number of level 0 packets	31904	Variable
36.	NumberOfInputFiles	Number of input level 0 files	2	Variable
37.	NumberMissingPackets	Number of missing packets	1	Variable
38.	NumberOfGoodPackets	Number of packets	31903	Variable
39.	RecevingCondition	Receiving condition	Blank	Fixed
40.	OverlapScans	Number of overlap scans	30	Fixed
41.	QALocationOfPacketDiscontinuity	Continuity of packet sequence counter	discontinuation	Variable
42.	EphemerisQA	Ephemeris limit check	OK	Variable
43.	AutomaticQAFlag	Limit check by software	Good	Variable
44.	ScienceQualityFlag	Quality flag of calculating geophysical quantity	Blank	Fixed
45.	ScienceQualityFlagExplanation	Explanation of “ScienceQualityFlag”	Blank	Fixed
46.	AutomaticQAFlagExplanation	Explanation of limit check by software	1.MissingDataQA:Less than 20 is available->OK, 2.AntennaRotationQA:Less than 20 is available->OK, 3.HotCalibrationSourceQA:Less than 20 is available->OK, 4.AttitudeDataQA:Less than 20 is available->OK, 5.EphemerisDataQA:Less than 20 is available->OK, 6.QualityofGeometricInformationQA: Less than 0 is available->OK, 7.BrightnessTemperatureQA:Less than 20 is available->OK, All items are OK, 'PASS' is employed	Variable

Table 3-2 Product meta items (4/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
47.	QAPercentMissingData	Number of missing data	0	Variable
48.	QAPercentOutofBoundsData	Percentage of out of bound data(%)	0	Variable
49.	QAPercentParityErrorData	Percentage of parity error data	0	Variable
50.	ProcessingQADescription	Description of the processing error	PROC_COMP	Variable
51.	ProcessingQAAttribute	The attribute name which is abnormal by QA metadata	Blank or NumberofMissingPackets	Variable
52.	GlobalMeteorologicalDataType	Used meteorolical data	Blank	Fixed
53.	AncillaryDataInformation	Information of ancillary data	Blank	Fixed
54.	SatelliteOrbit	The kind of satellite's orbit	Sun-synchronous_sub-recurrent	Fixed
55.	SatelliteAltitude	The altitude of satellite	707.9km	Fixed
56.	OrbitSemiMajorAxis	The orbit semi-major axis	7085.858km	Fixed
57.	OrbitEccentricity	The orbit eccentricity	0.00095	Fixed
58.	OrbitArgumentPerigee	The orbit argument perigee	106.480deg	Fixed
59.	OrbitInclination	The orbit inclination	98.15deg	Fixed
60.	OrbitPeriod	The orbit period	98minutes	Fixed
61.	RevisitTime	Orbit recurrent days	16days	Fixed
62.	AMSRChannel	The kind of AMSR-E Channels	6.925GHz,10.65GHz,18.7GHz,23.8GHz,36.5GHz,89.0GHz-A,89.0GHz-B	Fixed
63.	AMSRBandWidth	Band width of AMSR-E	6G-350MHz,10G-100MHz,18G-200MHz,23G-400MHz, 36G-1000MHz,89GA-3000MHz,89GB-3000MHz	Fixed
64.	AMSRBeamWidth	Beam width of AMSR-E	6G-1.8deg,10G-1.2deg,18G-0.64deg,23G-0.75deg, 36G-0.35deg,89GA-0.15deg,89GB-0.15deg	Fixed
65.	OffNadir	Off-nadir angle	47.0deg : 89GB, 47.5deg : others	Fixed
66.	SpatialResolution	Spatial resolution (Az x El)	6G-43.2kmX75.4km,10G-29.4kmX51.4km,18G-15.7kmX27.4km, 23G-18.1kmX31.5km,36G-8.2kmX14.4km, 89GA-3.7kmX6.5km,89GB-3.5kmX5.9km	Fixed
67.	ScanningPeriod	Scanning period	1.5sec	Fixed
68.	SwathWidth	Swath width	1450km (The scanning width corresponding to the -61 - +61 scan angle range of performance guarantee. In actual operation, the 1600 km of -75 - +75deg.)	Fixed
69.	DynamicRange	Dynamic range	2.7K-340K	Fixed
70.	DataFormatType	Data format type	HDF	Fixed
71.	HDFFormatVersion	HDF format version	Ver5.1.8.3	Fixed
72.	EllipsoidName	Earth ellipse model	WGS84	Fixed
73.	SemiMajorAxisofEarth	Earth equatorial radius	6378.1km	Fixed

Table 3-2 Product meta items (5/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
74.	FlatteningRatioofEarth	Flattening ratio of the earth	0.00335	Fixed
75.	SensorAlignment	Sensor alignment	Rx=0.00000,Ry=0.00000,Rz=0.00000	Fixed
76.	Thermistor1CountRange	Thermistor#1 count rage	Blank	Fixed
77.	Thermistor1ConversionTableD	Thermistor#1 conversion table D	Blank	Fixed
78.	Thermistor1ConversionTableE	Thermistor#1 conversion table E	Blank	Fixed
79.	Thermistor1ConversionTableF	Thermistor#1 conversion table F	Blank	Fixed
80.	Thermistor2CountRange	Thermistor#2 count rage	Blank	Fixed
81.	Thermistor2ConversionTableW4	Thermistor#2 conversion table W4	Blank	Fixed
82.	Thermistor2ConversionTableW3	Thermistor#2 conversion table W3	Blank	Fixed
83.	Thermistor2ConversionTableW2	Thermistor#2 conversion table W2	Blank	Fixed
84.	Thermistor2ConversionTableW1	Thermistor#2 conversion table W1	Blank	Fixed
85.	Thermistor2ConversionTableW0	Thermistor#2 conversion table W1	Blank	Fixed
86.	Thermistor3CountRange	Thermistor#3 count rage	Blank	Fixed
87.	Thermistor3ConversionTableW4	Thermistor#3 conversion table W4	Blank	Fixed
88.	Thermistor3ConversionTableW3	Thermistor#3 conversion table W3	Blank	Fixed
89.	Thermistor3ConversionTableW2	Thermistor#3 conversion table W2	Blank	Fixed
90.	Thermistor3ConversionTableW1	Thermistor#3 conversion table W1	Blank	Fixed
91.	Thermistor3ConversionTableW0	Thermistor#3 conversion table W0	Blank	Fixed
92.	Platinum1CountRange	Platinum#1 count rage	Blank	Fixed
93.	Platinum1ConversionTableW4	Platinum#1 conversion table W4	Blank	Fixed
94.	Platinum1ConversionTableW3	Platinum#1 conversion table W3	Blank	Fixed
95.	Platinum1ConversionTableW2	Platinum#1 conversion table W2	Blank	Fixed

Table 3-2 Product meta items (6/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
96.	Platinum1ConversionTableW1	Platinum#1 conversion table W1	Blank	Fixed
97.	Platinum1ConversionTableW0	Platinum#1 conversion table W0	Blank	Fixed
98.	Platinum2CountRange	Platinum#2 count rage	Blank	Fixed
99.	Platinum2ConversionTableW4	Platinum#2 conversion table W4	Blank	Fixed
100.	Platinum2ConversionTableW3	Platinum#2 conversion table W3	Blank	Fixed
101.	Platinum2ConversionTableW2	Platinum#2 conversion table W2	Blank	Fixed
102.	Platinum2ConversionTableW1	Platinum#2 conversion table W1	Blank	Fixed
103.	Platinum2ConversionTableW0	Platinum#2 conversion table W0	Blank	Fixed
104.	Platinum3ConversionTableW4	Platinum#3 count rage	Blank	Fixed
105.	Platinum3ConversionTableW3	Platinum#3 conversion table W4	Blank	Fixed
106.	Platinum3ConversionTableW2	Platinum#3 conversion table W3	Blank	Fixed
107.	Platinum3ConversionTableW1	Platinum#3 conversion table W2	Blank	Fixed
108.	Platinum3ConversionTableW0	Platinum#3 conversion table W1	Blank	Fixed
109.	ThermistorCountRangeWx	The effective range of the thermistor engineering value conversion factor	60,585,770,872,924,952,961,1023	Fixed
110.	ThermistorConversionTableWa	Thermistor conversion table Wa	0.000000,0.000015,0.000161,0.000618,0.002331,0.011459,0.010101,0.000000	Fixed
111.	ThermistorConversionTableWb	Thermistor conversion table Wb	0.000000,0.056460,-0.109878,-0.819170,-3.801865,-20.783040,-18.212120, 0.000000	Fixed
112.	ThermistorConversionTableWc	Thermistor conversion table Wc	-35.000000,-38.250000,9.220000,284.170000,1582.770000,9480.000000, 8263.350000,90.000000	Fixed
113.	ThermistorConversionTableWd	Thermistor conversion table Wd	0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000	Fixed
114.	Platinum#1CountRangeWx	Platinum#1 count range: Wx	1168,1296,1536,1752,4095	Fixed
115.	Platinum#1CountConversionTableWa	Platinum#1 conversion table: Wa	0.000000,0.000000,0.000000,0.000000,0.000000	Fixed

Table 3-2 Product meta items (7/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
116.	Platinum#1CountConversionTableWb	Platinum#1 conversion table: Wb	0.000000,0.039000,0.042000,0.039000,0.042000	Fixed
117.	Platinum#1CountConversionTableWc	Platinum#1 conversion table: Wc	-35.000000,-80.625000,-84.000000,-80.000000,-84.667000	Fixed
118.	Platinum#1CountConversionTableWd	Platinum#1 conversion table: Wd	0.000000,0.000000,0.000000,0.000000,0.000000	Fixed
119.	Platinum#2CountCountRangeWx	Platinum#2 count range: Wx	272,1536,1792,2032,2288,3248,3712,4095	Fixed
120.	Platinum#2CountConversionTableWa	Platinum#2 conversion table: Wa	0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000	Fixed
121.	Platinum#2CountConversionTableWb	Platinum#2 conversion table: Wb	0.000000,0.078300,0.078000,0.083000,0.078000,0.083000,0.085300,0.000000	Fixed
122.	Platinum#2CountConversionTableWc	Platinum#2 conversion table: Wc	-140.000000,-161.440000,-160.000000,-169.333000,-158.750000,-170.667000, -177.640000,140.000000	Fixed
123.	Platinum#2CountConversionTableWd	Platinum#2 conversion table: Wd	0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000	Fixed
124.	Platinum#3CountCountRangeWx	Platinum#3 count range: Wx	349,1454,2000,2555,3059,3566,4020,4095	Fixed
125.	Platinum#3CountConversionTableWa	Platinum#3 conversion table: Wa	0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000	Fixed
126.	Platinum#3CountConversionTableWb	Platinum#3 conversion table: Wb	0.000000,0.009100,0.009100,0.009100,0.009900,0.009900,0.008500,0.000000	Fixed
127.	Platinum#3CountConversionTableWc	Platinum#3 conversion table: Wc	10.000000,6.845000,6.803800,6.803800,4.719500,4.719500,9.835000,44.000000	Fixed
128.	Platinum#3CountConversionTableWd	Platinum#3 conversion table: Wd	0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000,0.000000	Fixed
129.	CoefficientAvv	Brightness temperature coefficient Avv	6G-1.037,10G-1.032,18G-1.025,23G-1.032,36G-1.029, 89GA-1.025,89GB-1.029	Fixed
130.	CoefficientAhv	Brightness temperature coefficient Ahv	6G--0.003,10G--0.003,18G--0.003,23G--0.004,36G--0.004, 89GA--0.003,89GB--0.004	Fixed
131.	CoefficientAov	Brightness temperature coefficient Aov	6G--0.034,10G--0.029,18G--0.022,23G--0.028,36G--0.024, 89GA--0.022,89GB--0.024	Fixed
132.	CoefficientAhh	Brightness temperature coefficient Ahh	6G-1.037,10G-1.031,18G-1.025,23G-1.034,36G-1.029, 89GA-1.028,89GB-1.031	Fixed
133.	CoefficientAvh	Brightness temperature coefficient Avh	6G--0.003,10G--0.002,18G--0.003,23G--0.006,36G--0.004, 89GA--0.006,89GB--0.006	Fixed
134.	CoefficientAoh	Brightness temperature coefficient Aoh	6G--0.034,10G--0.029,18G--0.022,23G--0.028,36G--0.024, 89GA--0.022,89GB--0.024	Fixed

Table 3-2 Product meta items (8/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
135.	CSMTemperature	Brightness temperature of deep space	6GV-2.800, 6GH-2.800, 10GV-2.800, 10GH-2.800, 18GV-2.800, 18GH-2.800, 23GV-2.800, 23GH-2.800, 36GV-2.800, 36GH-2.800, 89GAV-2.800, 89GAH-2.800, 89GBV-2.800, 89GBH-2.800	Fixed
136.	CoRegistrationParameterA1	Co-registration parameter A1	6G-1.10450, 7G-1.10450, 10G-0.65040, 18G-0.67990, 23G-0.74050, 36G-0.68490	Fixed
137.	CoRegistrationParameterA2	Co-registration parameter A2	6G--1.04960, 7G--1.04960, 10G--0.64760, 18G--0.20170, 23G--0.26610, 36G--0.21810	Fixed
138.	CalibrationCurveCoefficient#1	The radiometric correction coefficient for the 0th order	6GV--0.2099101, 6GH--0.2054645, 10GV--0.0580782, 10GH--0.0103279, 18GV--0.0853578, 18GH--0.0435186, 23GV--0.1288643, 23GH--0.1288643, 36GV--0.0475611, 36GH--0.0536047, 89GAV--0.0278573, 89GAH--0.0447590, 89GBV--0.0273764, 89GBH--0.0316265	Fixed
139.	CalibrationCurveCoefficient#2	The radiometric correction coefficient for the 1st order	6GV-1.0756783, 6GH-1.0740756, 10GV-1.0209393, 10GH-1.0037236, 18GV-1.0307711, 18GH-1.0156885, 23GV-1.0464586, 23GH-1.0464586, 36GV-1.0171470, 36GH-1.0193259, 89GAV-1.0100426, 89GAH-1.0161356, 89GBV-1.0098693, 89GBH-1.0114014	Fixed
140.	CalibrationCurveCoefficient#3	The radiometric correction coefficient for the 2nd order	6GV--0.0002537, 6GH--0.0002483, 10GV--0.0000704, 10GH--0.0000125, 18GV--0.0001022, 18GH--0.0000522, 23GV--0.0001556, 23GH--0.0001556, 36GV--0.0000575, 36GH--0.0000648, 89GAV--0.0000334, 89GAH--0.0000537, 89GBV--0.0000329, 89GBH--0.0000379	Fixed
141.	CalibrationCurveCoefficient#4	The radiometric correction coefficient for the 3rd order	6GV-0.0000000, 6GH-0.0000000, 10GV-0.0000000, 10GH-0.0000000, 18GV-0.0000000, 18GH-0.0000000, 23GV-0.0000000, 23GH-0.0000000, 36GV-0.0000000, 36GH-0.0000000, 89GAV-0.0000000, 89GAH-0.0000000, 89GBV-0.0000000, 89GBH-0.0000000	Fixed
142.	CalibrationCurveCoefficient#5	The radiometric correction coefficient for the 4th order	6GV-0.0000000, 6GH-0.0000000, 10GV-0.0000000, 10GH-0.0000000, 18GV-0.0000000, 18GH-0.0000000, 23GV-0.0000000, 23GH-0.0000000, 36GV-0.0000000, 36GH-0.0000000, 89GAV-0.0000000, 89GAH-0.0000000, 89GBV-0.0000000, 89GBH-0.0000000	Fixed
143.	CalibrationMethod	Calibration method name	RxTemperatureReferenced,SpillOver,CSMInterpolation, Absolute89GPositioning,NonlinearityCorrection	Fixed
144.	HTSCorrectionParameterVersion	Parameter version of the HTS correction	ver0003	Variable

Table 3-2 Product meta items (9/9)

No.	Meta data name	Explanation	Example or Range	Fixed/Variable
145.	SpillOverParameterVersion	Parameter version of the CSM spill over correction	ver0001	Variable
146.	CSMInterpolationParameterVersion	Parameter version of the CSM interpolation correction	ver0001	Variable
147.	Absolute89GPositioningParameterVersion	Parameter version of the correction for the absolute positions of 89GHz	ver0002	Variable

Table 3-3 Data items, size and scaling factor (1/2)

No.	Data	Sample	Bytes/Sample	Type	Bytes/Record	Records	Sum(Bytes)	Scale factor	Units
1.	Scan Time	1	8	double	8	2,040	16,320	1.00	sec
2.	Position in Orbit	1	8	double	8	2,040	16,320	1.00	-
3.	Navigation Data	6	4	float	24	2,040	48,960	1.00	m,m/s
4.	Attitude Data	3	4	float	12	2,040	24,480	1.00	deg
5.	Brightness Temperature (6.9GHz,V)	243	2	unsigned int	486	2,040	991,440	0.01	K
6.	Brightness Temperature (6.9GHz,H)	243	2	unsigned int	486	2,040	991,440	0.01	K
7.	Brightness Temperature (7.3GHz,V)※	243	2	unsigned int	486	2,040	991,440	0.01	K
8.	Brightness Temperature (7.3GHz,H)※	243	2	unsigned int	486	2,040	991,440	0.01	K
9.	Brightness Temperature (10.7GHz,V)	243	2	unsigned int	486	2,040	991,440	0.01	K
10.	Brightness Temperature (10.7GHz,H)	243	2	unsigned int	486	2,040	991,440	0.01	K
11.	Brightness Temperature (18.7GHz,V)	243	2	unsigned int	486	2,040	991,440	0.01	K
12.	Brightness Temperature (18.7GHz,H)	243	2	unsigned int	486	2,040	991,440	0.01	K
13.	Brightness Temperature (23.8GHz,V)	243	2	unsigned int	486	2,040	991,440	0.01	K
14.	Brightness Temperature (23.8GHz,H)	243	2	unsigned int	486	2,040	991,440	0.01	K
15.	Brightness Temperature (36.5GHz,V)	243	2	unsigned int	486	2,040	991,440	0.01	K
16.	Brightness Temperature (36.5GHz,H)	243	2	unsigned int	486	2,040	991,440	0.01	K
17.	Brightness Temperature (89.0GHz-A,V)	486	2	unsigned int	972	2,040	1,982,880	0.01	K
18.	Brightness Temperature (89.0GHz-A,H)	486	2	unsigned int	972	2,040	1,982,880	0.01	K
19.	Brightness Temperature (89.0GHz-B,V)	486	2	unsigned int	972	2,040	1,982,880	0.01	K
20.	Brightness Temperature (89.0GHz-B,H)	486	2	unsigned int	972	2,040	1,982,880	0.01	K
21.	Hot Load Count 6 to 36	192	2	signed int	384	2,040	783,360	1.00	Count
22.	Hot Load Count 89	128	2	signed int	384	2,040	783,360	1.00	Count
23.	Cold Sky Mirror Count 6 to 36	192	2	signed int	384	2,040	783,360	1.00	Count
24.	Cold Sky Mirror Count 89	128	2	signed int	384	2,040	783,360	1.00	Count
25.	Rx Offset_Gain Count	32	2	unsigned int	64	2,040	130,560	1.00	Count
26.	Latitude of Observation Point for 89A	486	4	float	1,944	2,040	3,965,760	1.00	deg
27.	Longitude of Observation Point for 89A	486	4	float	1,944	2,040	3,965,760	1.00	deg
28.	Latitude of Observation Point for 89B	486	4	float	1,944	2,040	3,965,760	1.00	deg
29.	Longitude of Observation Point for 89B	486	4	float	1,944	2,040	3,965,760	1.00	deg
30.	Sun Azimuth	243	2	signed int	486	2,040	991,440	0.01	deg

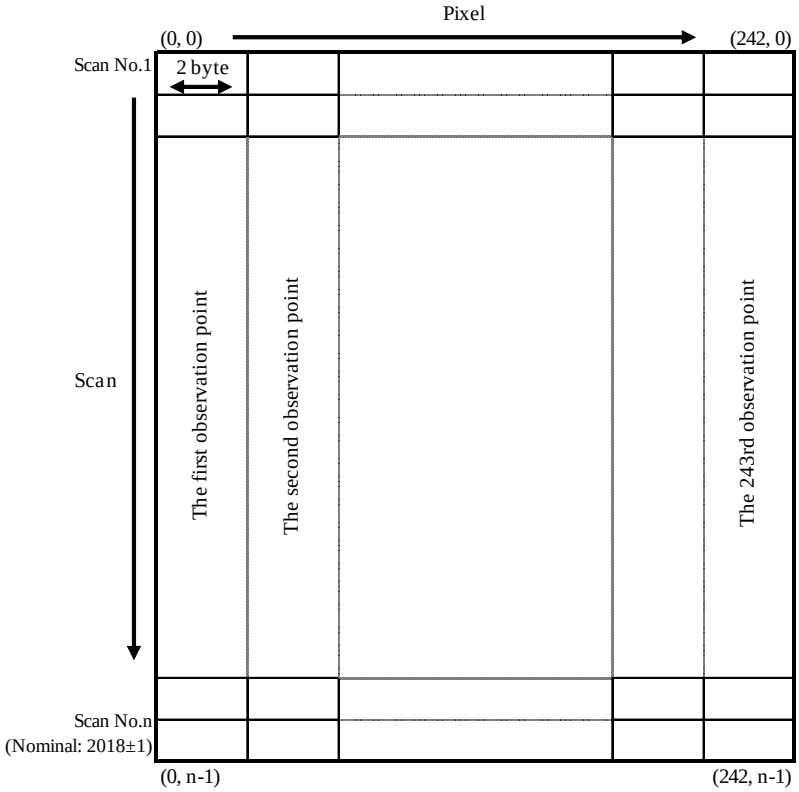
No.	Data	Sample	Bytes/Sample	Type	Bytes/Record	Records	Sum(Bytes)	Scale factor	Units
31.	Sun Elevation	243	2	signed int	486	2,040	991,440	0.01	deg
32.	Earth Incidence	243	2	signed int	486	2,040	991,440	0.01	deg
33.	Earth Azimuth	243	2	signed int	486	2,040	991,440	0.01	deg

Table 3-3 Data items, size and scaling factor (2/2)

No.	Data	Sample	Bytes/Sample	Type	Bytes/Record	Records	Sum(Bytes)	Scale factor	Units
34.	Land_Ocean Flag 6 to 36	1,458	1	unsigned char	1,458	2,040	2,974,320	1.00	%
35.	Land_Ocean Flag 89	972	1	unsigned char	972	2,040	1,982,880	1.00	%
36.	Observation Supplement	248	1	unsigned char	248	2,040	505,920	-	-
37.	SPC Temperature Count	34	2	unsigned int	68	2,040	138,720	1.00	Count
38.	SPS Temperature Count	46	2	unsigned int	92	2,040	187,680	1.00	Count
39.	PCD Data	64	1	unsigned char	64	2,040	130,560	-	-
40.	Scan Data Quality	512	1	unsigned char	512	2,040	104,480	-	-
41.	Pixel Data Quality 6 to 36	486	1	unsigned char	486	2,040	991,440	-	-
42.	Pixel Data Quality 89	486	1	unsigned char	486	2,040	991,440	-	-
43.	Interpolation Flag 6 to 36	192	1	unsigned char	192	2,040	391,680	-	-
44.	Interpolation Flag 89	128	1	unsigned char	128	2,040	261,120	-	-
45.	Spill Over	486	4	float	1,944	2,040	3,965,760	1.00	mV
46.	Antenna Temp Coef(Of+SI)	32	4	float	128	2,040	261,120	1.00	K+K/Cnt
47.	Data Quality	128	4	float	512	2,040	1,044,480	-	-
	Total(Bytes)						56,959,280		
	Total(MB)						***54.32***		

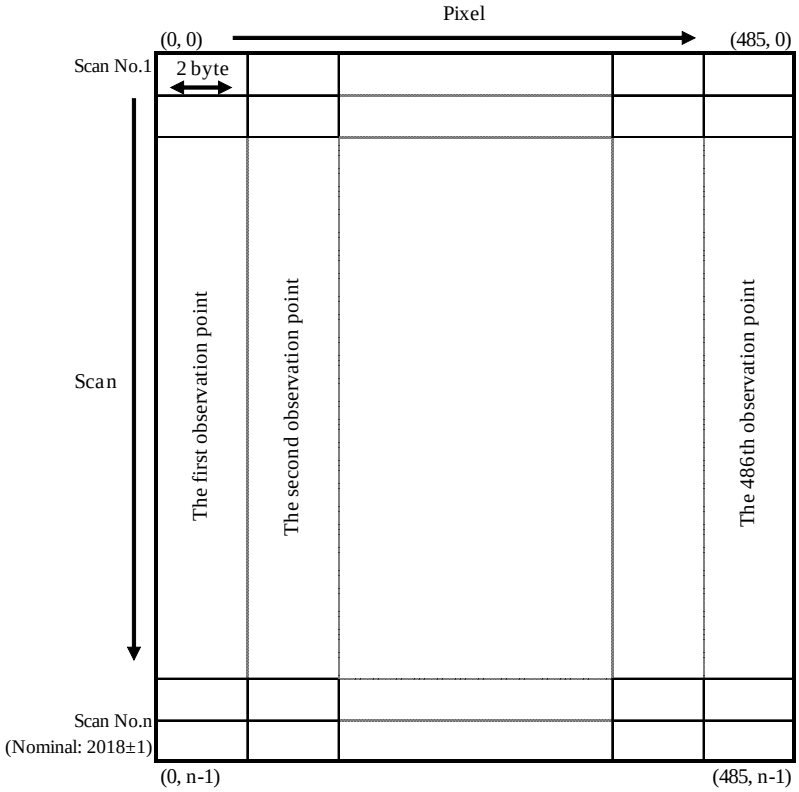
※The areas ‘Brightness Temperature (7.3GHz,V)’ and ‘Brightness Temperature (7.3GHz,H)’ exist for maintaining compatibility with the product of AMSR2. In each area, 'Brightness Temperature (6.9GHz,V)' and 'Brightness Temperature (6.9GHz,H)' data before bias correction are stored.

3.3. Architecture of data



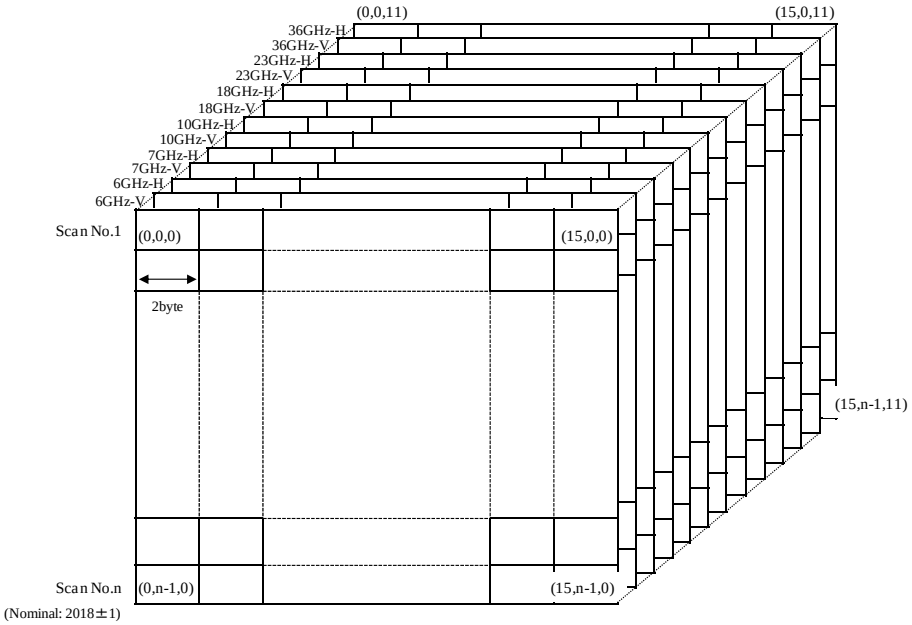
Brightness Temperature(6.9GHz, V)
(6-H, 7-V/H, 10-V/H, 23-V/H, 36-V/H has the same structure)

Note : Data in the 6 GHz band before bias correction is stored in 7-V/H.



Brightness Temperature (89.0GHz-A, V)
(89GHz-A-H, 89B-V/H has the same structure)

Figure 3-3 Structure of Brightness Temperature



Note : The data of 6GHz-V and 6GHz-H are stored in 7GHz-V and 7GHz-H dimension, respectively.

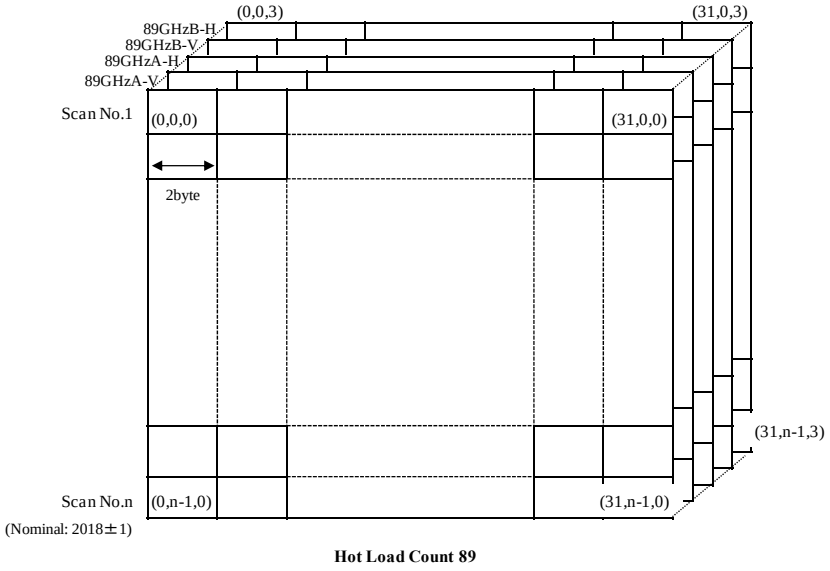
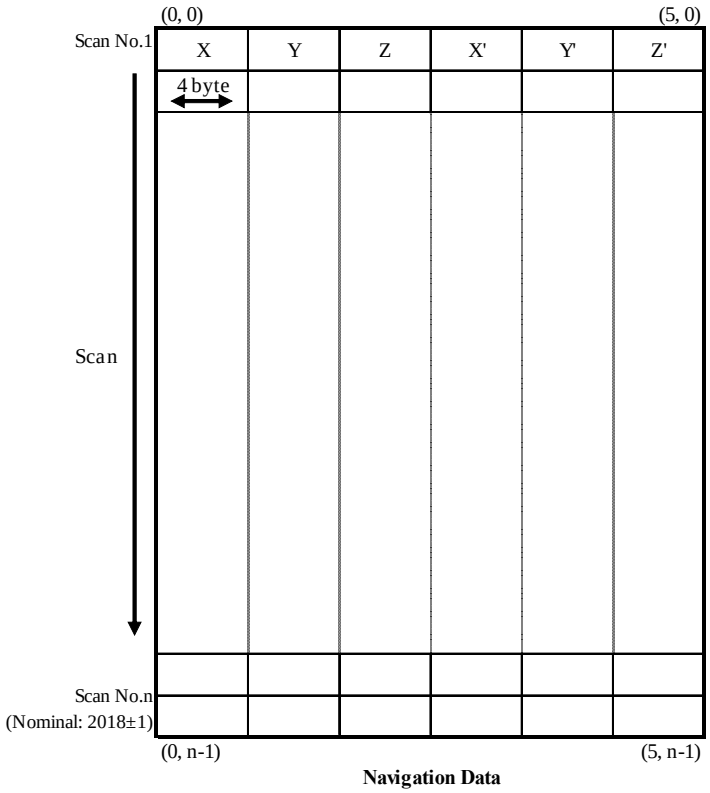


Figure 3-4 Structure of Hot Load Count / Cold Sky Mirror Count



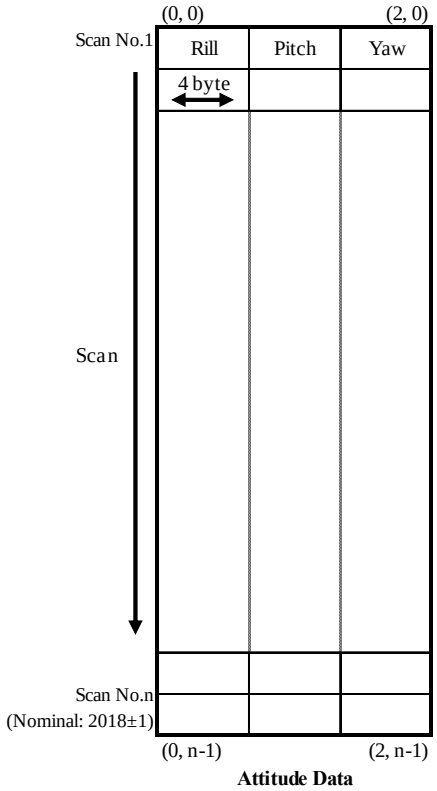


Figure 3-5 Structure of Navigation Data / Attitude Data

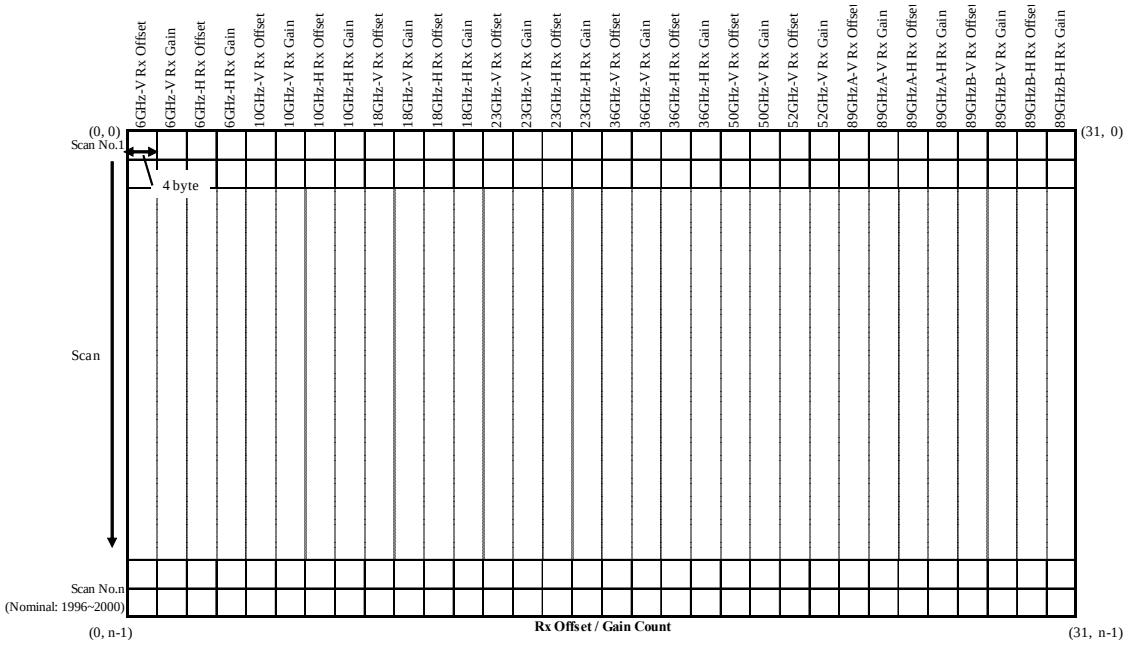
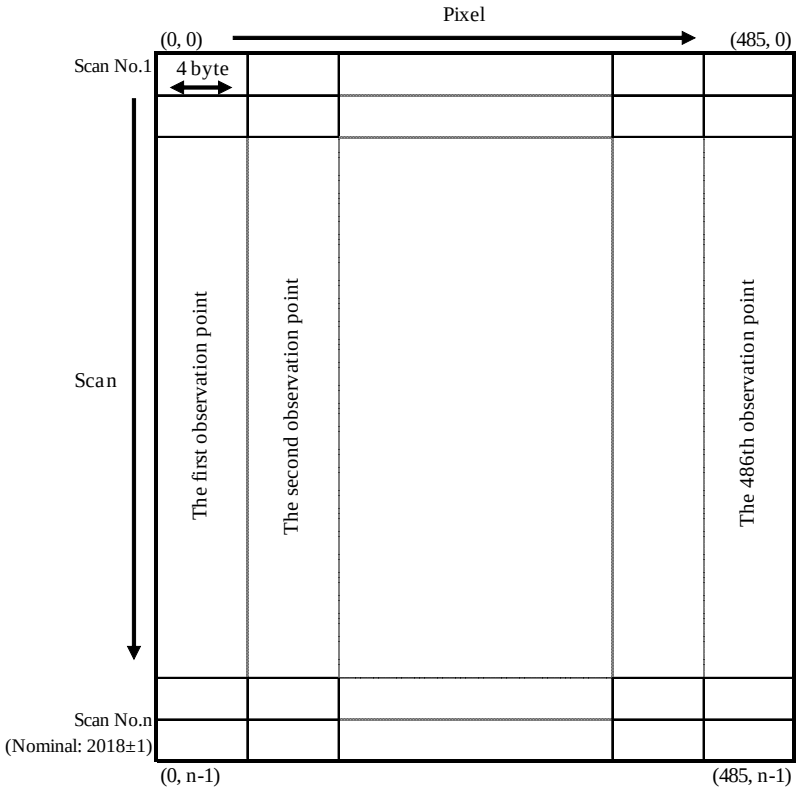
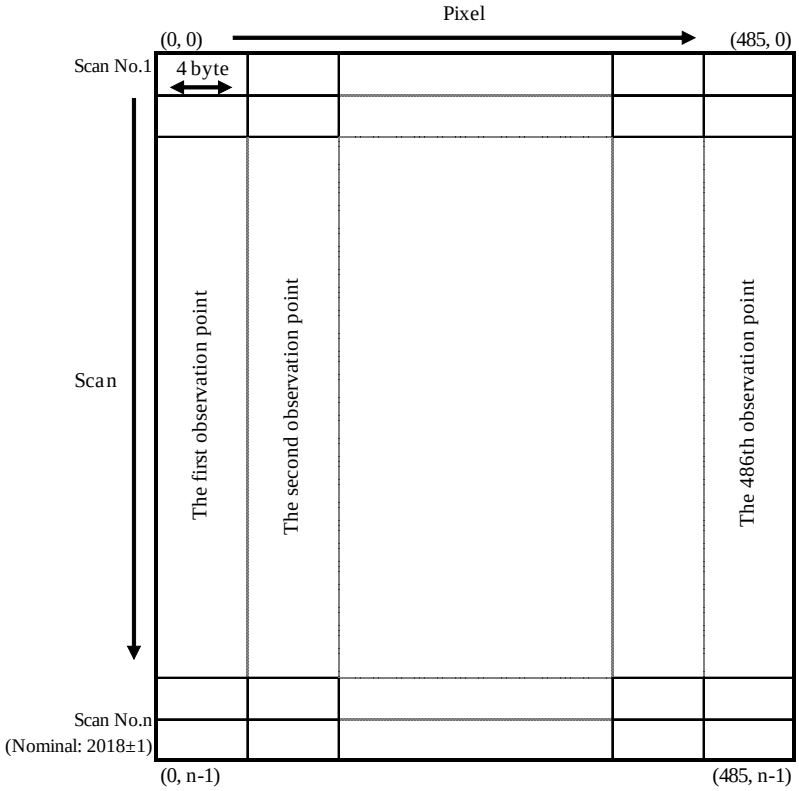


Figure 3-6 Structure of Rx Offset / Gain Count

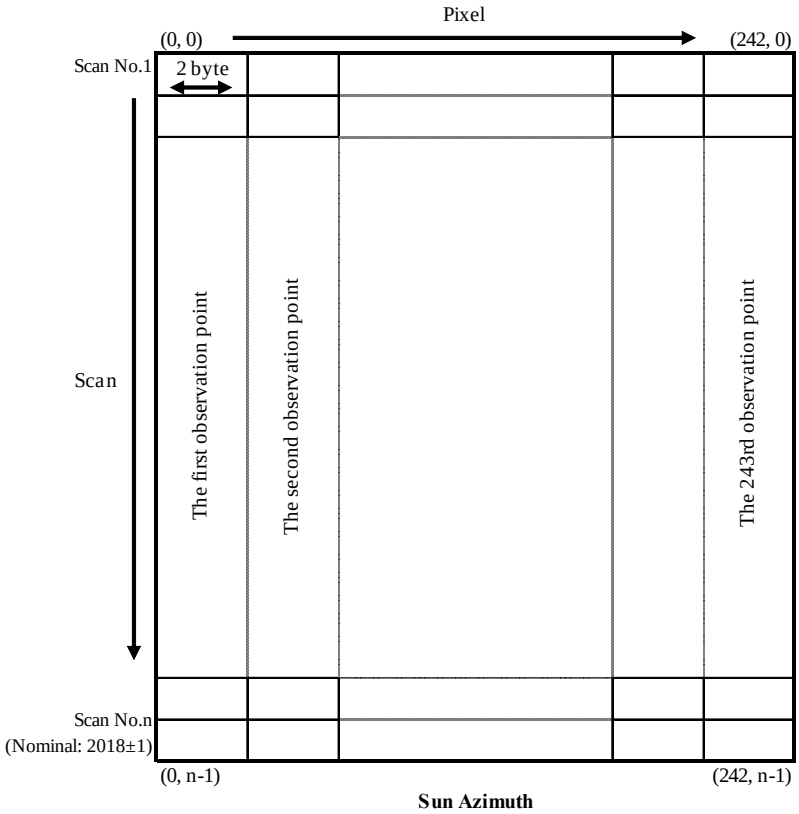


Latitude of Observation Point for 89A
Longitude of Observation Point for 89A
(Latitude and Longitude has the same structure.)



Latitude of Observation Point for 89B
Longitude of Observation Point for 89B
(Latitude and Longitude has the same structure.)

Figure 3-7 Structure of Latitude of Observation Point / Longitude of Observation Point



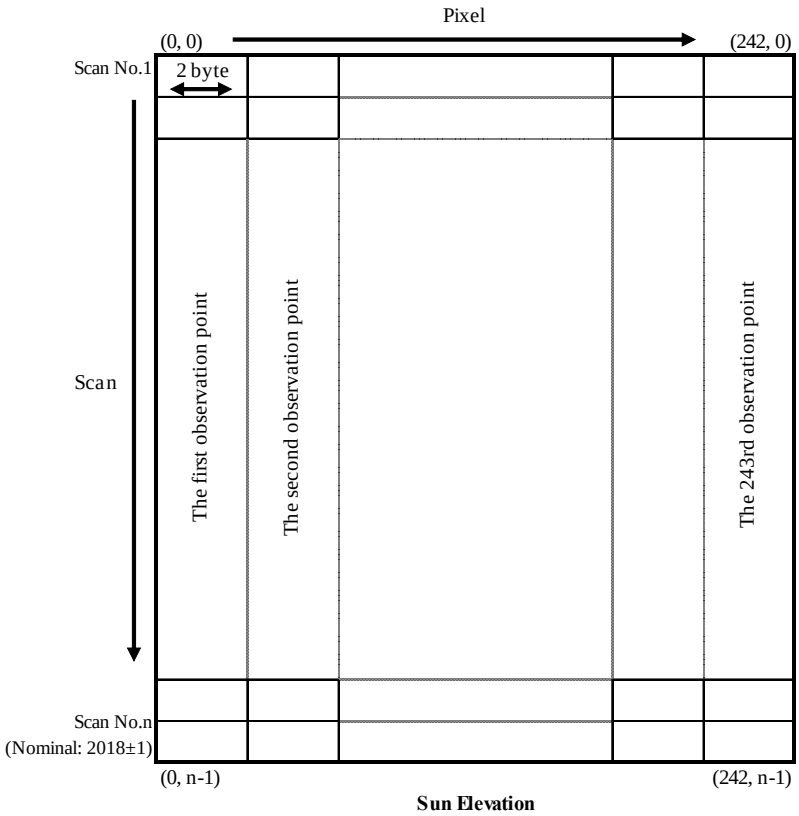
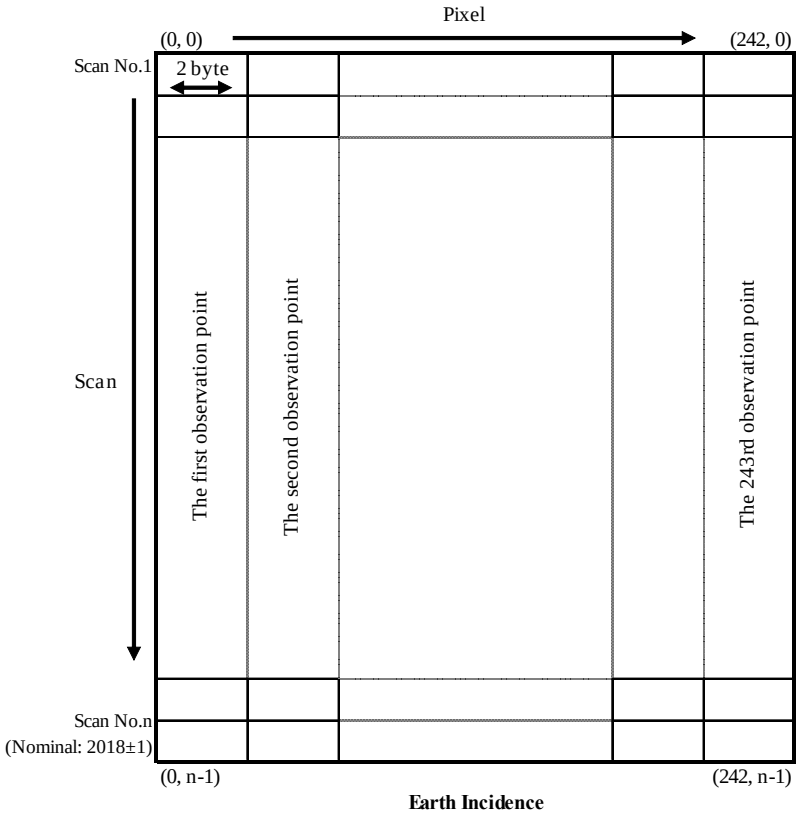


Figure 3-8 Structure of Sun Azimuth / Sun Elevation



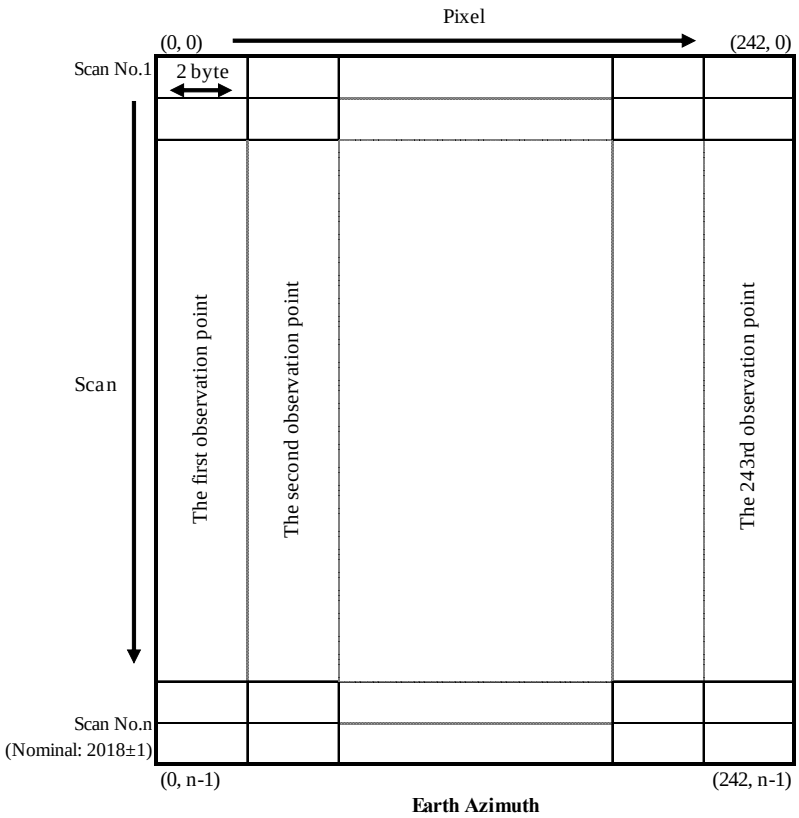
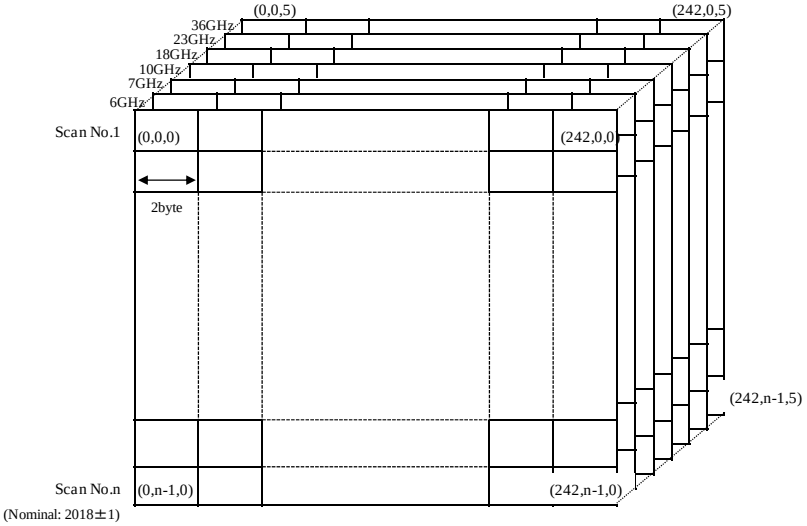


Figure 3-9 Structure of Earth Incidence / Earth Azimuth



Note : The data of 6GHz are stored in 7GHz dimension.

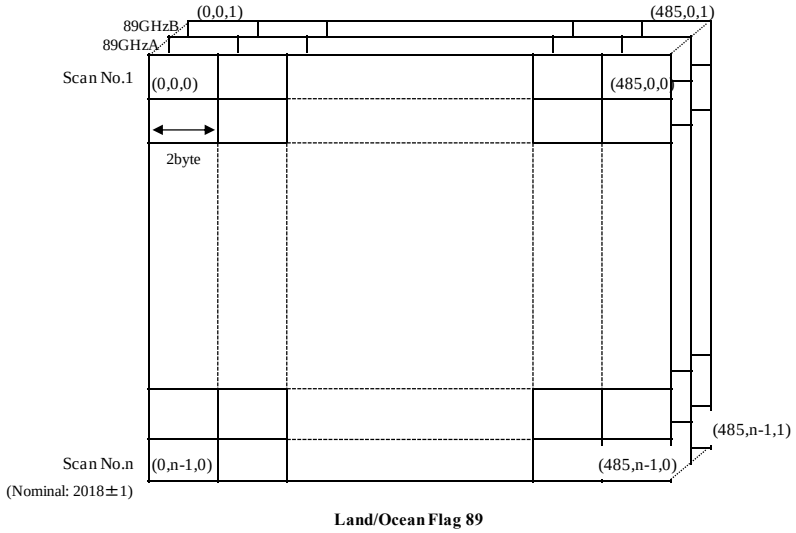
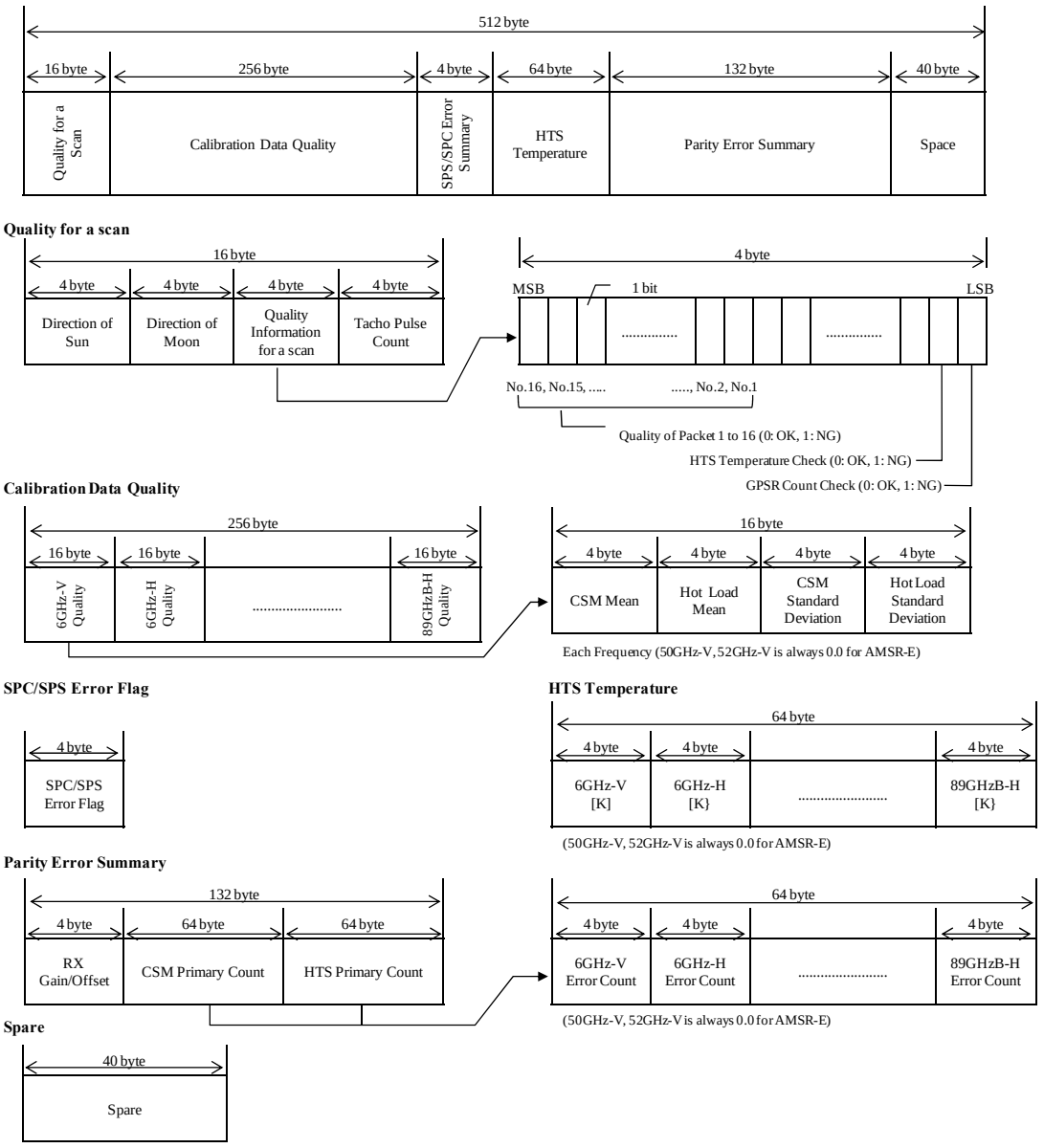
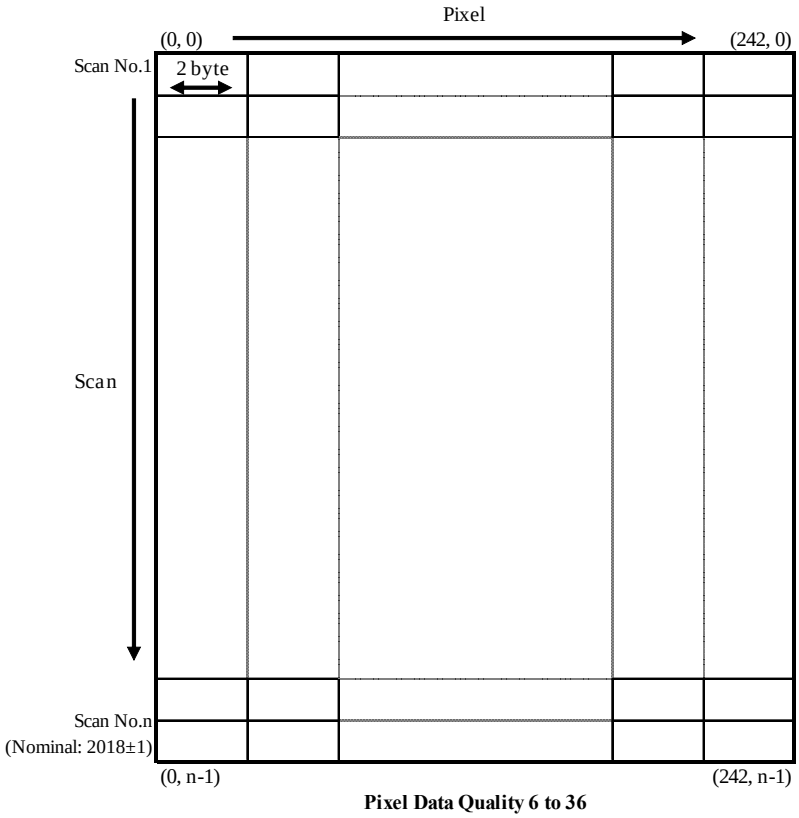


Figure 3-10 Structure of Land_Ocean Flag



Note : The data field assignment inherits the 'Data Quality' content of AMSR-E (HDF4) version. Please note that it is different from AMSR2 product assignment.

Figure 3-11 Structure of Scan Data Quality



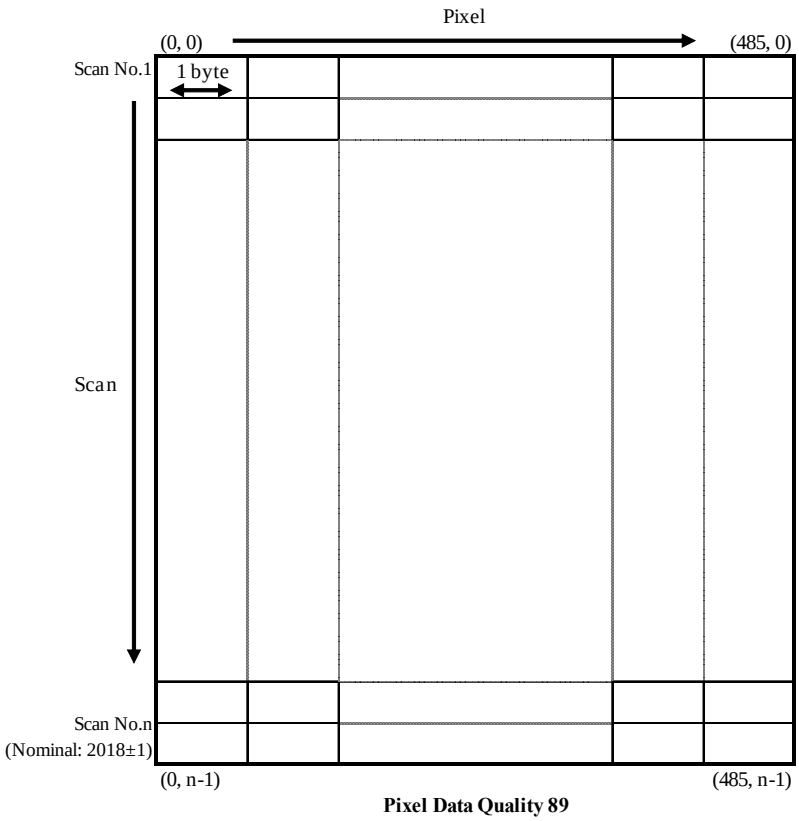
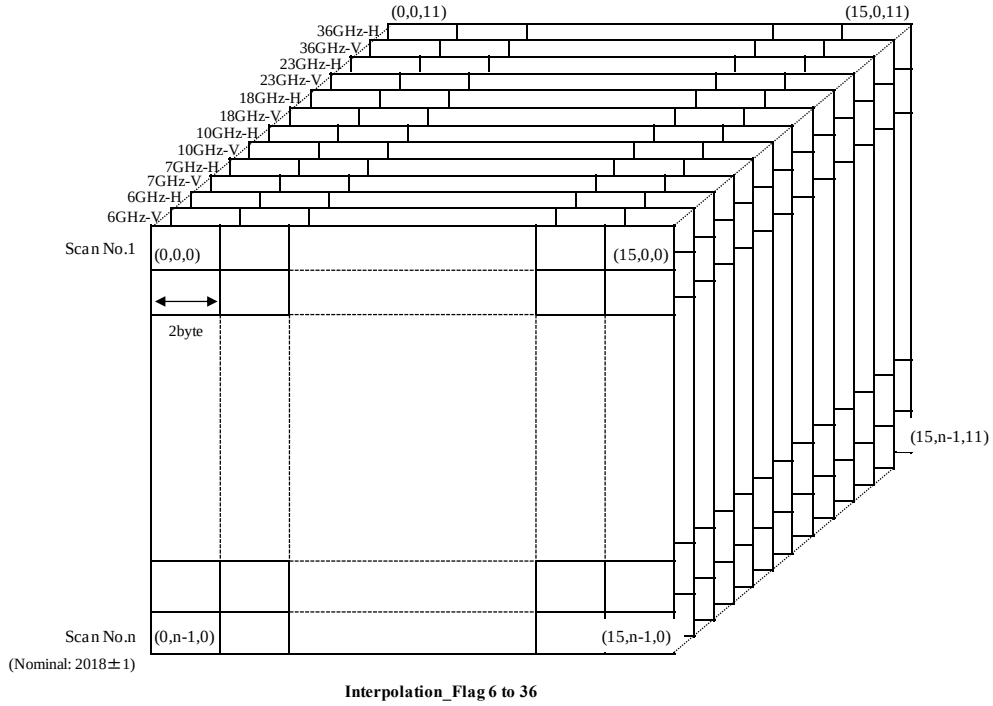


Figure 3-12 Structure of Pixel Data Quality



Note : The data of 6GHz-V and 6GHz-H are stored in 7GHz-V and 7GHz-H dimension, respectively.

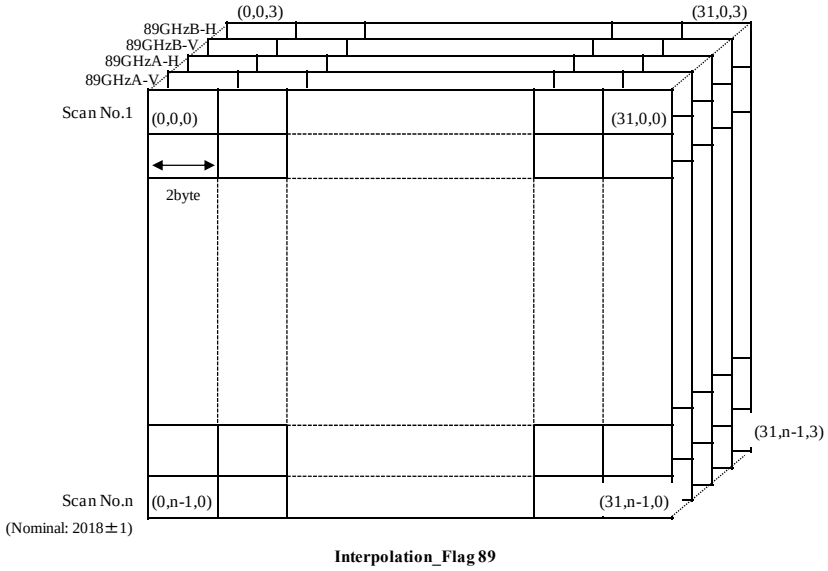
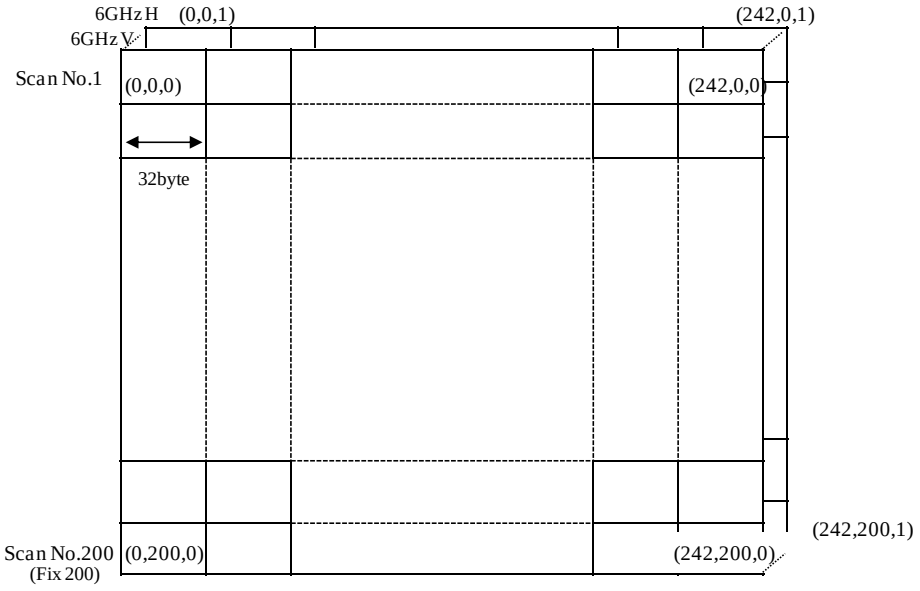


Figure 3-13 Structure of Interpolation_Flag



SpillOver

Figure 3-14 Structure of SpillOver

3.4. Special instruction

3.4.1. Product file name

AMSR-E Level1B(HDF5) product file name is ruled below.

File name = Granule ID + extension [.h5]

Byte Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
AMSR-E	P	M	1	A	M	E		Y	Y	Y	Y	M	M	D	D	H	H	m	m		P	P	P	X		L	L	x	x	K	K	K	r	d	v	a	a	a	p	p	p

Scene ID ← → Product ID

Scene ID

[Satellite] [Sensor] [Observation start time] [Path number] [Orbit direction]

Satellite:	PM1 (Fixed Value)
Sensor:	AME (Fixed Value)
Observation start time:	YYYYMMDDHHmm (UTC)
Path number:	PPP (001 ~ 233)
Orbit direction:	X (A: Ascending, D: Descending)

Product ID

[Process level] [Process kind] [Product ID] [Resolution] [Developer ID] [Product version] [Algorithm version] [Parameter version]

Process level:	LL (L1: Level1)
Process kind:	xx (SG: Standard operation product)
Product ID:	KKK (<L1A> ADN: Digital Number, <L1B> BTB: Brightness Temperature, <L1R> RTB: Brightness Temperature)
Resolution:	r (<L1> R: Raw (Fixed Value))
Developer ID:	d (<L1> _: underscore (Fixed Value))
Product version:	V (0 ~ 9, a ~ z)
Algorithm version:	aaa (000 ~ 999)
Parameter version:	ppp (000 ~ 999)

3.4.2. Definition of the product data range

The data range of AMSR-E L1B(HDF5) product is the half orbit defined as a scene (Figure 3-15) and extended about 30 scans at both ends. The both ends of a half orbit correspond to maximum and minimum latitude of the observation point at the center of the scan.

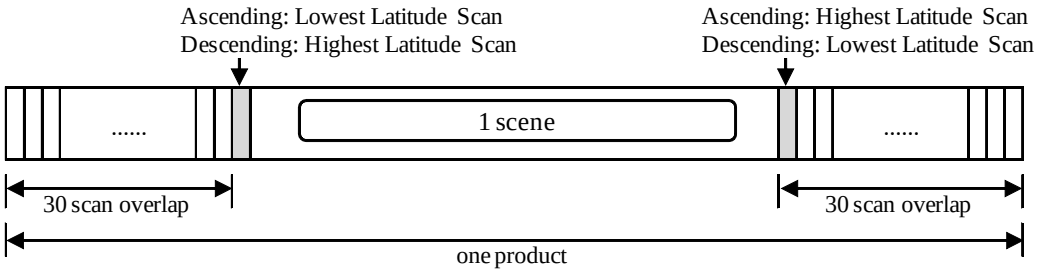


Figure 3-15 Product data range

3.4.3. Coordinate system

AMSR-E Level1B(HDF5) product stores observation position (latitude, longitude) and orbit information of satellite. An observation position is expressed in Greenwich coordinate system (Earth Fixed Coordinate). The range of the east longitude is from 0 to 180 degrees and the range of the west longitude is from 0 to -180 degrees. Similarly, the range of the north latitude is from 0 to 90 degrees, the range of the south latitude is from 0 to -90 degrees. Earth model of WGS84 is adopted for geometric calculation.

3.4.4. Scaling Factor

In order to make data volume small, scaling factors are applied for some floating number in AMSR-E Level1B(HDF5) product. The scaling factor is set for each dataset and stored with the data unit in the attribute information.

4. Data explanation

This chapter shows explanation of each data item of AMSR-E Level 1B(HDF5) product file.

4.1. Product metadata (Attribute)

The following description explains each product metadata item in the AMSR-E L1B(HDF5) product file.

(1) ProductName

Abbreviated name of the product is stored as below.

AMSR-E-L1B: AMSR-E Level1B(HDF5)

(2) GeophysicalName

The geophysical quantity name is stored as below.

Element	Content	Remarks
GeophysicalName	Brightness Temperature	

(3) ProductionVersion

The product version is stored as below.

Element	Missing	Min	Max	unit	Remarks
ProductionVerion	-	0	Z	-	single-digit or alpha-numeral

(4) AlgorithmVersion

The algorithm version is stored as below.

Element	Missing	Min	Max	unit	Remarks
AlgorithmVersion	-	000	999	-	3-digit numeral

(5) ParameterVersion

The parameter version is stored as below.

Element	Missing	Min	Max	unit	Remarks
ParameterVersion	-	000	999	-	3-digit numeral

(6) ProductSize_MByte

The product size is stored as below.

Element	Missing	Min	Max	unit	Remarks
ProductSize_MByte	-	0.0	9999.9	MByte	

(7) GranuleID

The granule ID is stored. Granule ID is unique ID for the product file.

(8) Operation

The product kind is stored as below.

Standard: Standard operation

(9) ProductionDateTime

The product creation time and date is stored.

Element	Format	Remarks
ProductionDateTime	「YYYY-MM-DDThh:mm:ss.uuuZ」 YYYY: XXXX(Year) MM: 01 ~ 12(Month) DD: 01 ~ 31(Day) hh: 00 ~ 23(Hour) mm: 00 ~ 59(Minute) ss: 00 ~ 59(Second) uuu: 000 ~ 999(Millisecond)	When the leap second is updated, “ss” may show 60.

(10) ObservationStartDateTime

The start time and date of observation data is stored.

Element	Format	Remarks
ObservationStartDateTime	「YYYY-MM-DDThh:mm:ss.uuuZ」 YYYY: XXXX(Year) MM: 01 ~ 12(Month) DD: 01 ~ 31(Day) hh: 00 ~ 23(Hour) mm: 00 ~ 59(Minute) ss: 00 ~ 59(Second) uuu: 000 ~ 999(Millisecond)	When the leap second is updated, “ss” may show 60.

(11) ObservationEndDateTime

The end time and date of observation data is stored.

Element	Format	Remarks
ObservationEndDateTime	「YYYY-MM-DDThh:mm:ss.uuuZ」 YYYY: XXXX(Year) MM: 01 ~ 12(Month) DD: 01 ~ 31(Day) hh: 00 ~ 23(Hour) mm: 00 ~ 59(Minute) ss: 00 ~ 59(Second) uuu: 000 ~ 999(Millisecond)	When the leap second is updated, “ss” may show 60.

(12) GringPointLatitude, GringPointLongitude

Tight representative points (latitude and longitude) of the outline for the observation are stored. They are set as a clockwise from the scanning start position, and these positions are observation points of 89GHz A-horn. Since the spatial information in a product cannot be expressed as a rectangle on the equidistant cylindrical projection map, it is expressed in polygon like “G”. The stored data are delimited by comma [,].

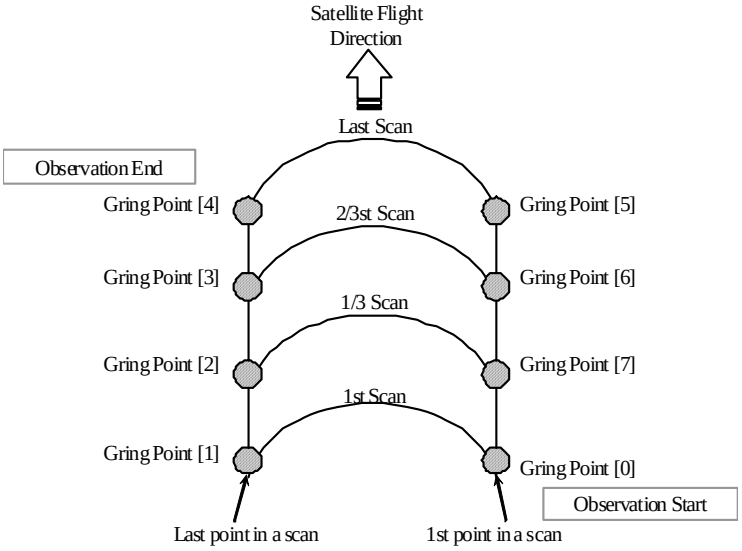


Figure 4-1 The relationship between Gring point and data location

(13) PGEName

The application name is stored.

Element	Content	Remarks
PGEName	[AMSR-E Reprocessing System]	

(14) InputFileName

The input file name are stored. If there are some input files. the stored data are delimited by comma[,].

(15) ProcessingCenter, ContactOrganizationName, ContactOrganizationTelephone

The information of data processing center is stored.

(16) StartOrbitNumber, StopOrbitNumber

The orbit numbers at the observation start and end point in the product file are stored. The orbit number shows total orbit number. this number means integrated value from the Aqua Satellite launch.

Element	Missing	Min	Max	unit	Remarks
StartOrbitNumber	-	0	9999	-	
StopOrbitNumber	-	0	9999	-	

(17) EquatorCrossingLongitude, EquatorCrossingDateTime

The equator crossing longitude , time and date (UTC) are stored. However, if the satellite does not pass through an equator (like near real time product or short product by he lack of observation data), it is filled with "*".

Element	Missing	Min	Max	unit	Remarks
EquatorCrossingLongitude	-	-180.0	180.0	-	

Element	Format	Remarks
EquatorCrossingDateTime	「YYYY-MM-DDThh:mm:ss.uuuZ」 YYYY: XXXX(Year) MM: 01 ~ 12(Month) DD: 01 ~ 31(Day) hh: 00 ~ 23(Hour) mm: 00 ~ 59(Minute) ss: 00 ~ 59(Second) uuu: 000 ~ 999(Millisecond)	When the leap second is updated, "ss" may show 60.

(18) OrbitDirection

The orbit direction at the observation start position is stored.

Element	Format	Remarks
OrbitDirection	[Ascending] or [Descending]	

(19) PassNumber

The pass number at the observation start point is stored.

Element	Missing	Min	Max	unit	Remarks
PassNumber	-	0	233	-	

(20) OrbitDataFileName

If the L1 process used supplemental orbit data file, the orbit file name would be stored. If there are some input files, it would be stored with comma-delimited.

(21) EphemerisMissingDataRate

The rate of the lack with orbit data is stored.

Element	Format	Remarks
EphemerisMissingDataRate	[Good] or [Fair] or [NG]	

(22) AttitudeMissingDataRate

The rate of the lack with attitude data is stored.

Element	Format	Remarks
AttitudeMissingDataRate	[Good] or [Fair] or [NG]	

(23) OrbitDataType

The orbit data type used in L1 process is stored.

Element	Format	Remarks
OrbitDataType	[ELMP]: Predictive orbit data [ELMD]: Definitive orbit data	

(24) PlatformShortName

The satellite name [AQUA] is stored.

(25) SensorShortName

The sensor name [AMSR-E] is stored.

(26) NumberOfScans

The number of scans of the observation data in the product is stored. It contains the additional scans of each 10 scans at start/end part.

Element	Missing	Min	Max	unit	Remarks
NumberOfScans	-9999	0	99999	-	

(27) NumberOfMissingScans

The number of missing scans in the product is stored. Though one scan of AMSR-E consists of 16 packets, it counts one missing scan even if one packet is lost.

Element	Missing	Min	Max	unit	Remarks
NumberOfMissingScans	-9999	0	99999	-	

(28) AntennaRotationVelocity

The rotating velocity of AMSR-E antenna is stored.

Element	Number	Remarks
AntennaRotationVelocity	40.0	Fixed

(29) ECSDataModel

The metadata model name is stored.

(30) NumberOfPackets

The number of packets is stored.

(31) NumberOfInputFiles

The number of input L0 files is stored.

Element	Missing	Min	Max	unit	Remarks
NumberOfInputFiles	-	0	9	-	

(32) NumberMissingPackets

The number of lack packets in the product file is stored.

(33) NumberOfGoodPackets

The number of packets in the product file is stored.

(34) ReceivingCondition

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(35) OverlapScans

The number of one side overlap scans is stored.

Element	Number	Remarks
OverlapScans	30	Fixed

(36) QALocationOfPacketDiscontinuity

The consecutiveness of “Packet Sequence Counter” is stored.

Element	Format	Remarks
QALocationOfPacketDiscontinuity	[Continuation] or [Discontinuatioin]	

(37) EphemerisQA

The quality of satellite orbit and attitude data checked by software is stored. The quality inspection result becomes NG, when either number of following limit check errors exceeds 20% of the data. And it becomes OK in other cases. The calculating with limit check is shown as below.

Check the satellite orbit data:

$$LowerLimit \leqq R \leqq UpperLimit$$

$$R = \sqrt{X^2 + Y^2 + Z^2}$$

Check the satellite attitude data:

$$LowerLimit \leqq Roll, Pitch, Yaw \leqq UpperLmit$$

(38) AutomaticQAFlag

The automatic inspection result of data processing is stored. The items of the automatic inspections are shown in the attribute “AutomaticQAFlagExplanation”. And the following value is stored.

Good: When all check items are in the state of ‘OK’.

Fair: When some check items are in the state of ‘NG’.

NG: When all check items are in the state of ‘NG’.

(39) ScienceQualityFlag

The quality flag is stored when the L2 process calculates geophysical data. In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(40) ScienceQualityFlagExplanation

The explanation of Science QualityFlag is stored. In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(41) AutomaticQAFlagExplanation

The result checked by software automatically is stored.

1.MissingDataQA:Less than 20 is available->OK, 2.AntennaRotationQA:Less than 20 is available->OK, 3.HotCalibrationSourceQA:Less than 20 is available->OK, 4.AttitudeDataQA:Less than 20 is available->OK, 5.EphemerisDataQA:Less than 20 is available->OK, 6.QualityofGeometricInformationQA:Less than 0 is available->OK, 7.BrightnessTemperatureQA:Less than 20 is available->OK, All items are OK, 'PASS' is employed

(42) QAPercentMissingData

The rate of lack scan data is stored.

Element	Missing	Min	Max	unit	Remarks
QAPercentMissingData	-	0	100	%	

(43) QAPercentOutofBoundsData

The percentage of the limit error to all data is stored. It is judges as error when the antenna temperature and brightness temperature exceed the limit value.

Element	Missing	Min	Max	unit	Remarks
QAPercentOutofBoundsData	-	0	100	%	

(44) QAPercentParityErrorData

The percentage of parity error data is stored. It is judged as error whether the parity error flag exists in the raw observation data.

Element	Missing	Min	Max	unit	Remarks
QAPercentParityErrorData	-	0	100	%	

(45) ProcessingQADescription

The error message generated by software is stored. “PROC_COMP” is stored when the software is completed normally.

(46) ProcessingQAAttribute

As he quality information of the processed data, the item name corresponding to the following standard of the anomaly judgment is stored.

NumberOfMissingPackets:	In case of the lack of more than packet.
EphemerisQA:	In case of NG
QAPercentMissingData:	In case of more than 1%
QAPercentOutofBoundsData:	In case of more than 1%
QAPercentParityErrorData:	In case of more than 1%

(47) GlobalMeteorologicalDataType

The meteorological data type used in L2 process is stored. In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(48) AncillaryDataInformation

The ancillary data used in L2 process is stored. In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(49) SatelliteOrbit, SatelliteAltitude, OrbitSemiMajorAxis, OrbitEccentricity, OrbitArgumentPerigee, OrbitInclination, OrbitPeriod, RevisitTime

The characteristics of Aqua satellite are stored.

Element	Content	Remarks
SatelliteOrbit	[Sun-synchronous_sub-recurrent]	Fixed
SatelliteAltitude	[707.9km]	Fixed
OrbitSemiMajorAxis	[7085.858km]	Fixed
OrbitEccentricity	[0.00095]	Fixed
ORbitArgumentPerigee	[106.480deg]	Fixed
OrbitInclination	[98.15deg]	Fixed
OrbitPeriod	[98minutes]	Fixed
RevisitTime	[16days]	Fixed

(50) AMSRChannel, AMSRBandWidth, AMSRBeamWidth, OffNadir, SpatialResolution, ScanningPeriod, SwathWidth, DynamicRange

The characteristics of AMSR-E sensor are stored.

Element	Content	Format	Remarks
AMSRChannel	Observing channels of AMSR-E	[6.925GHz,10.65GHz,18.7GHz,23.8GHz,36.5GHz,89.0GHz-A,89.0GHz-B]	Fixed
AMSRBandWidth	Bandwidth for each frequency	[6G-350MHz,10G-100MHz,18G-200MHz,23G-400MHz,36G-1000MHz,89GA-3000MHz,89GB-3000MHz]	Fixed
AMSRBeamWidth	Beam width for each frequency	[6G-1.8deg,10G-1.2deg,18G-0.64deg,23G-0.75deg,36G-0.35deg,89GA-0.15deg,89GB-0.15deg]	Fixed
OffNadir	The off nadir angle of 89GHz A-horn and 89GHz B-horn	[47.0deg : 89GB, 47.5deg : others]	Fixed
SpatialResolution	Spatial Resolution for each frequency	[6G-43.2kmX75.4km,10G-29.4kmX51.4km,18G-15.7kmX27.4km,23G-18.1kmX31.5km,36G-8.2kmX14.4km,89GA-3.7kmX6.5km,89GB-3.5kmX5.9km]	Fixed
ScanningPeriod	Scanning period	[1.5sec]	Fixed
SwathWidth	Swath width	[1450km]	Fixed
DynamicRange	Dynamic range	[2.7K-340K]	Fixed

(51) DataFormatType, HDFFormatVersion

The format type of the product file are stored.

Element	Content	Format	Remarks
DataFormatType	Format type	[HDF]	Fixed

Element	Content	Format	Remarks
HDFFormatVersion	HDF Version	[Ver5.1.8.3]	Fixed

(52) EllipsoidName, SemiMajorAxisofEarth, FlatteningRatioofEarth

The earth model used in AMSR-E data processing software are stored.

Element	Content	Format	Remarks
EllipsoidName	Earth ellipsoid model	[WGS84]	Fixed
SemiMajorAxisofEarth	Semi major axis of earth	[6378.1km]	Fixed
FlatteningRatioofEarth	Flattening ratio of earth	[0.00355]	Fixed

(53) SensorAlignment

Alignment Value between Aqua body coordinate system and the AMSR-E coordinate system are stored.

Element	Content	Format	Remarks
SensorAlignment	Sensor alignment	[Rx=0.00000,Ry=0.00000,Rz =0.00000]	Fixed

(54) Thermistor1CountRange, Thermistor1ConversionTableD, Thermistor1ConversionTableE, Thermistor1ConversionTableF

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(55) Thermistor2CountRange, Thermistor2ConversionTableW4, Thermistor2ConversionTableW3, Thermistor2ConversionTableW2, Thermistor2ConversionTableW1, Thermistor2ConversionTableW0

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(56) Thermistor3CountRange, Thermistor3ConversionTableW4, Thermistor3ConversionTableW3, Thermistor3ConversionTableW2, Thermistor3ConversionTableW1, Thermistor3ConversionTableW0

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(57) Platinum1CountRange, Platinum1ConversonTableW4, Platinum1ConversonTableW3, Platinum1ConversonTableW2, Platinum1ConversonTableW1, Platinum1ConversonTableW0

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(58) Platinum2CountRange, Platinum2ConversonTableW4, Platinum2ConversonTableW3, Platinum2ConversonTableW2, Platinum2ConversonTableW1, Platinum2ConversonTableW0

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(59) Platinum3ConversonTableW4, Platinum3ConversonTableW3, Platinum3ConversonTableW2, Platinum3ConversonTableW1, Platinum3ConversonTableW0

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(60) Thermistor

The engineering conversion coefficients for the thermistor and those applicable ranges are stored.

Thermistor Count:	Range	Wx	Thermistor conversion table applied range
Thermistor Conversion	Table	Wa	Thermistor conversion coefficients Wa
Thermistor Conversion	Table	Wb	Thermistor conversion coefficients Wb
Thermistor Conversion	Table	Wc	Thermistor conversion coefficients Wc
Thermistor Conversion	Table	Wd	Thermistor conversion coefficients Wd

The formula of conversion from count to engineering value is

$$EngineeringValue[K] = Wa_i \cdot C^2 + Wb_i \cdot C + Wc_i + Wd_i + 273.15$$

C : $Count$

i : $Wx_{i-1} \leqq C \leqq Wx_i$

(61) Platinum#1

The engineering conversion coefficients for the platinum sensor #1 and those applicable ranges are stored.

Platinum#1 Count:	Range	Wx	Platiunm #1 Table applied range
Platinum#1 Conversion	Table	Wa	Platinum #1 conversion coefficients Wa
Platinum#1 Conversion	Table	Wb	Platinum #1 conversion coefficients Wb
Platinum#1 Conversion	Table	Wc	Platinum #1 conversion coefficients Wc
Platinum#1 Conversion	Table	Wd	Platinum #1 conversion coefficients Wd

The conversion formula is the same as that for thermistor.

(62) Platinum#2

The engineering conversion coefficients for the platinum sensor #2 and those applicable ranges are stored.

Platinum#2 Count:	Range	Wx	Platiunm #2 Table applied range
Platinum#2 Conversion	Table	Wa	Platinum #2 conversion coefficients Wa
Platinum#2 Conversion	Table	Wb	Platinum #2 conversion coefficients Wb
Platinum#2 Conversion	Table	Wc	Platinum #2 conversion coefficients Wc
Platinum#2 Conversion	Table	Wd	Platinum #2 conversion coefficients Wd

The conversion formula is the same as that for thermistor.

(63) Platinum#3

The engineering conversion coefficients for the platinum sensor #3 and those applicable ranges are stored.

Platinum#3 Count:	Range	Wx	Platiunm #3 Table applied range
Platinum#3 Conversion	Table	Wa	Platinum #3 conversion coefficients Wa
Platinum#3 Conversion	Table	Wb	Platinum #3 conversion coefficients Wb
Platinum#3 Conversion	Table	Wc	Platinum #3 conversion coefficients Wc
Platinum#3 Conversion	Table	Wd	Platinum #3 conversion coefficients Wd

The conversion formula is the same as that for Thermistor.

(64) CoefficientAvv, CoefficientAhv, CoefficientAov, CoefficientAhh, CoefficientAvh, CoefficientAoh

The conversion coefficients in each frequency are stored for the brightness temperature. The coefficients are used for changing the antenna temperature (Ta) of observation data into the brightness temperature (Tb). Brightness temperature is computed by the following formula, which is different to polarizations.

It is stored blank for the AMSR-E L1B(HDF5) product file.

$$Tbv = Avv \cdot Tav + Ahv \cdot Tah + 2.7\,Aov$$

Tbv: The observation brightness temperature of the vertical polarization.
Tav: The antenna temperature of the vertical polarization.
Tah: The antenna temperature of the horizontal polarization.
Avv: The conversion coefficient of the vertical co-polarization.
Ahv: The conversion coefficient of the vertical cross-polarization.
Aov: The coefficient of the deep space's brightness temperature of the vertical polarization.

$$Tbh = Avh \cdot Tah + Ahh \cdot Tav + 2.7\,Aoh$$

Tbh: The observation brightness temperature of the horizontal polarization.
Tav: The antenna temperature of the vertical polarization.
Tah: The antenna temperature of the horizontal polarization.
Avh: The conversion coefficient of the horizontal cross-polarization.
Ahh: The conversion coefficient of the horizontal co-polarization.
Aoh: The coefficient of the deep space's brightness temperature of the horizontal polarization.

(65) CSMTemperature

The antenna temperature of the deep space is stored for each frequency. The stored value is used as a conversion factor in data processing software.

(66) CoregistrationParameterA1, CoregistrationParameterA2

Then co-registration parameter A1 and A2 are stored for each frequency. The co-registration parameter are used for calculating the position (Latitude ant Longitude) of the observing point for each frequency except 89 GHz. The latitude and longitude of each frequency (except 89GHz) are calculated by the method shown below. The observation position Pt [m] of the m-th point in each scan is calculated by observation position of odd-numbered points (origin 1) P[2m-1] of 89GHz A-horn and observation position of even-numbered points P[m]. The elements of vector of Pt[m], *ex*, *ey* and *ez* are shown in the following formula.

$$ex = \vec{p}_1$$

$$ez = \frac{\vec{P}_1 \times \vec{P}_2}{\left|\vec{P}_1 \times \vec{P}_2\right|}$$

$$ey = ez \times ex$$

$$\cos\theta = \vec{P}_1 \bullet \vec{P}_2$$

$\vec{P}_1$: The vector of observation point $P[2m-1]$

$\vec{P}_2$: The vector of observation point $P[2m]$

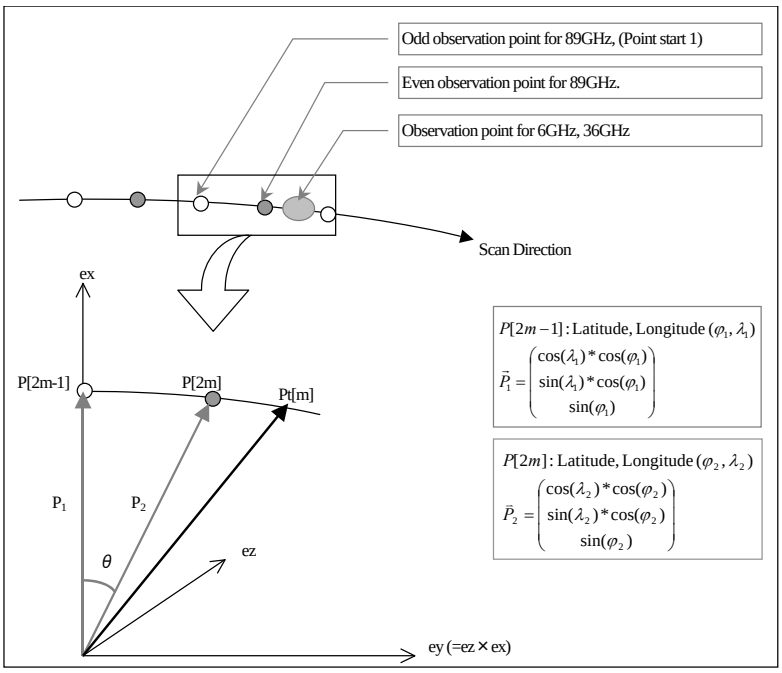


Figure 4-2 the definition of the vector *ex*, *ey*, *ex*

The *ex* is the vector of the odd-numbered observation points of 89GHz A-horn from the earth center, and the *ey* is the rectangular vector to the *ex* in a plane including the next observation point of 89GHz A-horn. And, the *ez* is a rectangular vector to *ex* and *ey*. Here, A1 is defined as the co-registration parameter of the *ex-ey* plane, and A2 is defined as the co-registration parameter of the *ex-ez* plane, then the observation position of frequency except 89GHz is calculated by the following formula.

$$Pt[m] = \cos(A2 \cdot \theta) \cdot \left(\cos(A1 \cdot \theta) \cdot ex + \sin(A1 \cdot \theta) \cdot ey\right) + \sin(A2 \cdot \theta) \cdot ez$$

(67) CalibrationCurveCoefficient#1, CalibrationCurveCoefficient#2, CalibrationCurveCoefficient#3, CalibrationCurveCoefficient#4, CalibrationCurveCoefficient#5

The coefficients of radiometric correction are stored for nonlinear calibration of the antenna temperature in each frequency. Nonlinear calibration is performed by the following formula. The stored data are delimited by comma.

CalibrationCurveCoefficient#1	C0	The coefficient for 0th order
CalibrationCurveCoefficient#2	C1	The coefficient for 1st order
CalibrationCurveCoefficient#3	C2	The coefficient for 2nd order
CalibrationCurveCoefficient#4	C3	The coefficient for 3rd order
CalibrationCurveCoefficient#5	C4	The coefficient for 4th order

Ta = C0 + C1 Ta' + C2 $(Ta')^2$ + C3 $(Ta')^3$ + C4 $(Ta')^4$

Ta : Nonlinear calibrated antenna temperature [K]

Ta' : The antenna temperature calculated with antenna temperature coefficients [K]

* The calculation of antenna temperature with antenna temperature coefficients is shown at Antenna_Temperature_Coef(OF+S1).

(68) CalibrationMethod

The following every adopted calibration methods are stored. When no methods are adopted, the blank is stored.

Target data	Calibration method name	Explanation
HTS Count data	HTUCoefficients	HTS calibration method is chosen one of three.
	ElectromagneticAnalysis	
	RxTemperatureReferenced	
CSM count data	SpillOver	This is used for removing the ground radiation effect on CSM at 6 GHz.
	CSMInterpolation	This is used for removing the moon light effect, the interference of radio frequency, and the stray light from the sun on CSM.
Geometric information	Absolute89GPositioning	This is used for geometric correction of 89GHz.
Antenna temperature	NonlinearityCorrection	This is used for the nonlinear calibration of the antenna temperature.

(69) HTSCorrectionParameterVersion

The version of the parameter file used in order to calibrate the temperature of HTS is stored as 4 characters. The kinds of calibration are shown in CalibrationMethod. When this calibration is not performed, it is filled with "*".

(70) SpillOverParameterVersion

The version of the parameter file used in order to calibrate the ground radiation mixed into the 6 GHz CSM data is stored as 4 characters. When this calibration is not performed, it is filled with "*".

(71) CSMInterpolationParameterVersion

The version of the parameter file used in order to calibration the following items for CSM data is stored as 4 characters. When this calibration is not performed, it is filled with "*".

(72) Absolute89GPositioningParameterVersion

The version of the parameter file used in order to correct the 89GHz position information is stored as 4 characters. When this calibration is not performed, it is filled with "*".

4.2. Data Items

(1) ScanTime

The observation start time of 89GHz A-horn in every scans is stored. This time is a total second (TAI) from 00:00 (UT) on January 1st , 1993.

(2) Position in Orbit

The satellite position on the orbit is stored. The position of the satellite consists of the orbit number and the position from the ascending node. This is expressed in the following formula.

Position_in_Orbit = Total orbit number + Satellite position

Satellite Position = (Scan_Time – Ascending node passage time) / (98.9 * 60.0)

(3) Navigation Data

The satellite position with the WGS84 earth fixed coordinate system is stored. Orbit information is the position and velocity of the satellite corresponding to the observation start time (Scan_Time) of each scan.

(4) Attitude Data

The attitude errors (Roll, Pitch, Yaw) are stored as attitude information corresponding to the observation start time (Scan_Time) of each scan. The coordinate system is a right-hand system that is Roll for the satellite flight direction and Yaw for the earth center direction.

(5) Brightness Temperature(6.9GHz,V)

The observed brightness temperature of 6.9GHz vertical polarization is stored.

* The following values is stored for the abnormal observation data. This is applied for all frequency and polarization.

Scaling factor	0.1 (all frequencies)
Abnormal values	65534: Parity error value , Missing value

(6) Brightness Temperature(6.9GHz,H)

The observed brightness temperature of 6.9GHz horizontal polarization is stored.

(7) Brightness Temperature(7.3GHz,V)

In the AMSR-E level 1B (HDF5) product, the observed brightness temperature of 6.9 GHz vertical polarization before bias correction is stored.

(8) Brightness Temperature(7.3GHz,H)

In the AMSR-E level 1B (HDF5) product, the observed brightness temperature of 6.9 GHz horizontal polarization before bias correction is stored.

(9) Brightness Temperature(10.7GHz,V)

The observed brightness temperature of 10.7GHz vertical polarization is stored.

(10) Brightness Temperature(10.7GHz,H)

The observed brightness temperature of 10.7GHz horizontal polarization is stored.

(11) Brightness Temperature(18.7GHz,V)

The observed brightness temperature of 18.7GHz vertical polarization is stored.

(12) Brightness Temperature(18.7GHz,H)

The observed brightness temperature of 18.7GHz horizontal polarization is stored.

(13) Brightness Temperature(23.8GHz,V)

The observed brightness temperature of 23.8GHz vertical polarization is stored.

(14) Brightness Temperature(23.8GHz,H)

The observed brightness temperature of 23.8GHz horizontal polarization is stored.

(15) Brightness Temperature(36.5GHz,V)

The observed brightness temperature of 36.5GHz vertical polarization is stored.

(16) Brightness Temperature(36.5GHz,H)

The observed brightness temperature of 36.5GHz horizontal polarization is stored.

(17) Brightness Temperature(89.0GHz-A,V)

The observed brightness temperature of 89.0GHz A-horn vertical polarization is stored.

(18) Brightness Temperature(89.0GHz-A,H)

The observed brightness temperature of 89.0GHz A-horn horizontal polarization is stored.

(19) Brightness Temperature(89.0GHz-B,V)

The observed brightness temperature of 89.0GHz B-horn vertical polarization is stored.

(20) Brightness Temperature(89.0GHz-B,H)

The observed brightness temperature of 89.0GHz B-horn horizontal polarization is stored.

(21) Hot Load Count 6 to 36

The observed count value of HTS and polarization is stored for each frequency except 89GHz. The number of observation data for one scan is 16 points.

* The following value is stored for the abnormal observation data. This is applied for all frequency and

polarization.

-32768: Parity error

(22) Hot Load Count 89

The observed count value of HTS and polarization is stored for 89GHz. The number of observation data for one scan is 32 points.

(23) Cold Sky Mirror Count 6 to 36

The observed count value of CSM and polarization is stored for each frequency except 89GHz. The number of observation data for one scan is 16 pints.

* The following value is stored for the abnormal observation data. This is applied for all frequency and polarization.

-32768: Parity error

In the AMSR-E level 1B (HDF5) product, there are 7GHz-V and 7GHz-H regions of observation frequencies which is not present in AMSR-E. Information on 6GHz-V and 6GHz-H is stored in these areas.

(24) Cold Sky Mirror Count 89

The observed count value of CSM and polarization for 89GHz. The number of observation data for one scan is 32 points.

(25) Rx Offset_Gain Count

The gain and offset value for a receiver (RX) of each frequency are stored in every sta.

(26) Latitude of Observation Point for 89A

The latitude of the observation point on the earth surface at 89GHz A-horn is stored.

Data Range: North: 0 to 90 degree / South: 0 to -90 degree

Scaling factor: 1.0

Abnormal value: -9999.99

(27) Longitude of Observation Point for 89A

The longitude of observation point on the earth surface at 89GHz A-horn is stored.

Data Range: -180 to 180 degree

Scaling factor: 1.0

Abnormal value: -9999.99

(28) Latitude of Observation Point for 89B

The latitude of observation point on the earth surface at 89GHz B-horn is stored. The data range and abnormal value are the same as 89GHz A-horn.

(29) Longitude of Observation Point for 89B

The longitude of observation point on the earth surface at 89GHz B-horn is stored. The data range and abnormal value are the same as 89GHz A-horn.

(30) Sun Azimuth

The sun azimuth angle on odd observation point (origin 1) of 89GHz A-horn is stored.

Data Range: -180 to 180 degree

Scaling factor: 0.01

(31) Sun Elevation

The sun elevation angle on odd observation point (origin 1) of 89GHz A-horn is stored.

Data Range: -180 to 180 degree

Scaling factor: 0.01

(32) Earth Incidence

The earth incident angle on odd observation points (origin 1) of 89GHz A-horn is stored. It is the angle between the perpendicular vector of the earth surface and the viewing vector of AMSR-E.

Data Range: 52.4 to 57.54 degree

Scaling factor: 0.01

Offset value: 55.0 degree

Abnormal value -128: The case of observation point error
The case of setting value is less than -180 degree.
127: The case of setting value is more than 180 degree.

(33) Earth Azimuth

The earth azimuth angle on odd observation points (origin 1) of 89GHz A-horn is stored. It is the angle between the north oriented vector on the observation point and the inversed projected viewing vector defined by Figure 4-3.

Data Range: -180.0 to 180.0 degree

Scaling factor: 0.01

Abnormal value: 99999: The case of observation point error

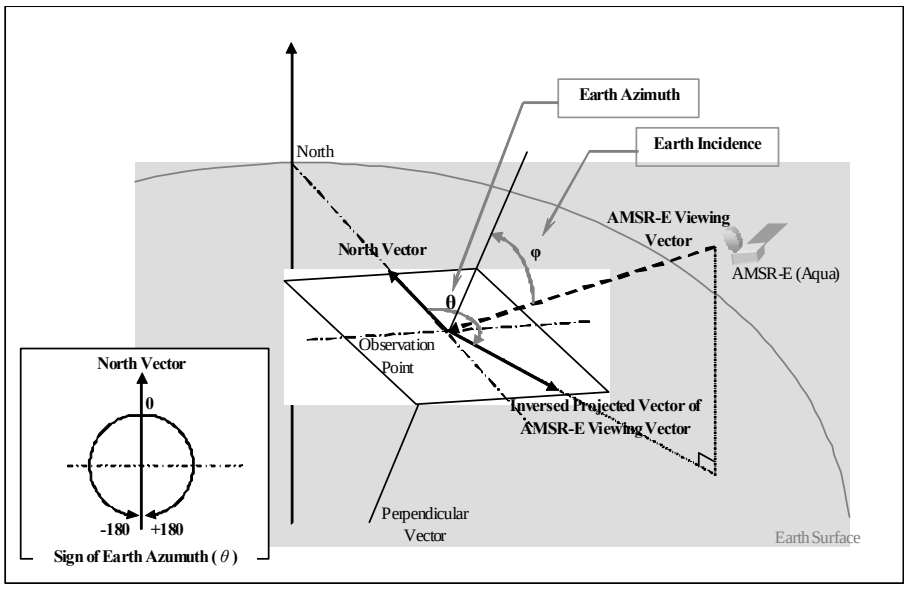


Figure 4-3 The definition of Earth Azimuth and Incidence

(34) Land_Ocean Flag 6 to 36, Land_Ocean_Flag89

The land coverage percentage of the observation footprint of AMSR-E is stored for each frequency.

* The 89GHz land/ocean flag is stored for only odd points of A-horn (origin 1).

* The observation point of each frequency except 89GHz is equivalent of the position that corrected by co-registration parameters. The calculation method is shown in the item “CoRegistrationParameter”.

In the AMSR-E level1B (HDF5) product, there are 7GHz region of observation frequencies not present in AMSR-E. Information on 6GHz is stored in these area.

(35) Observation Supplement

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(36) SPC Temperature Count

In the AMSR-E level 1B (HDF5) product, blank value are stored in this area.

(37) SPS Temperature Count

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(38) PCD Data

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(39) Scan Data Quality

The quality information and supplementary information are stored. The stored data is the same as the “Data Quality”, the data type is binary.

(40) Pixel Data Quality 6 to 36

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(41) Pixel Data Quality 89

In the AMSR-E level 1B (HDF5) product, blank values are stored in this area.

(42) Interpolation Flag 6 to 36

The interpolation flag for CSM data is stored for each frequency except 89GHz. Each flag is corresponded to the correction items shown below.

- Correction for the contamination of the moon reflection
- Correction for the stray light from the sun
- Correction for the radio frequency interference on CSM data

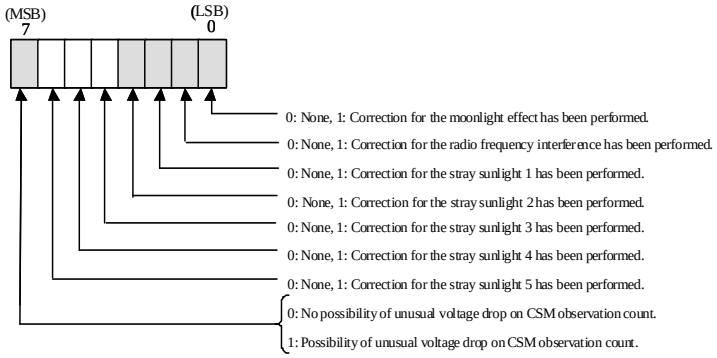


Figure 4-4 The format of the Interpolation Flag

(43) Interpolation Flag 89

The interpolation flag for CSM data is stored for 89GHz.

(44) Spill Over

The observaton voltage of 6GHz before 200 scans is stored from the hear scan of the product. This information is used for calibrating the ground radiation on CSM.

* The abnormal values are shown in below.

-999.0: In case of error on a voltage conversion etc.

0.0: In case of the lack of observation data, parity error, RxOffset/Gain error

(45) Antenna Temp Coef(Of+SI)

The antenna temperature conversion coefficients and polarization are stored for each frequency. The antenna temperature coefficients contain offset-value and slope-value, and these coefficients are used for converting the observed count value into antenna temperature.

$$Ta_{p,l} = Csl_{p,l} * Obs_{p,l} + Cof_{p,l}$$

Ta : *the antenna temperature [K]*

Obs : *the count value of observation data*

Aof : *the antenna temperature conversion coefficient (offset-value)*

Asl : *the antenna temperature conversion coefficient (slope-value)*

(46) Data Quality / Scan Data Quality

The quality information and supplementary information are stored. These correspond to observation data and calculation result in each scan. The stored information is shown below.

1) The sun direction angle form CSM. (Direction of sun) [type: float]

The angle between the viewing vector of CSM and the direction of the sun is stored.

2) The moon direction angle from CAM. (Direction of moon) [type: float]

The angle between the viewing vector of CSM and the direction of the moon is stored.

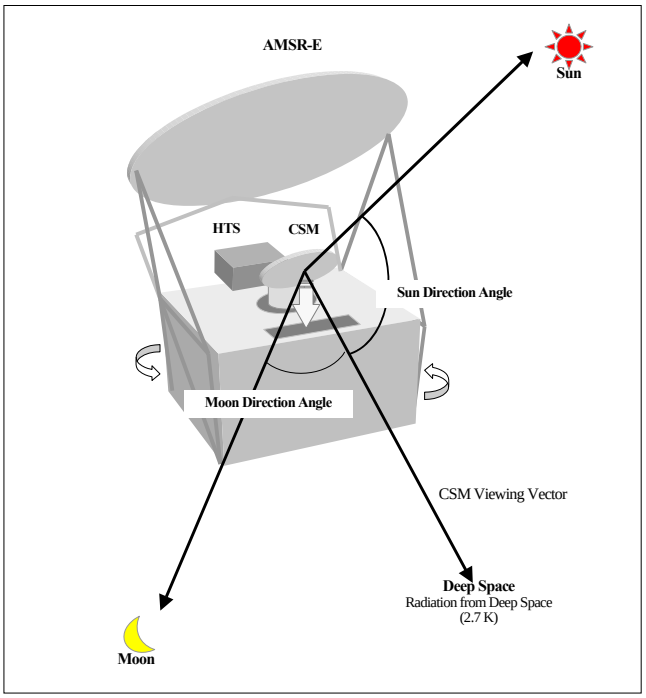


Figure 4-5 The definition of the moon direction angle and the sun direction angle

3) The quality of the scan. (Quality information of the scan)

Flag information for each bit of 32-bits is stored. This flag is set to 0 for normal case, and 1 for error case. The setting of each bit is shown sequentially form LSB (Least Significant Bit).

a) The result of GPSR counts check (1bit)

When the difference of the GPSR counts in about one scan is outside of the range 1.5±1.0(sec) or -6.5±1.0(sec) in engineering value, an error value (1) is set.

b) The result of HTS temperature check (1bit)

When the difference of the HTS temperature is more than 0.5K in engineering value, an error value (1) is set.

c) The condition for each packet (16 bits)

When there are lacks of packets or the code of “DEAD”, which shows the hexadecimal code for the lack packet filled by NASA EDOS, an error value (1) is set. The quality for each 16 packets is set from the 3rd bit LSB to MSB (Most Significant Bit).

4) Tacho pulse count (Tacho pulse count) [type: float]

The angle of average tacho pulse count is stored.

5) Quality of the calibration data (Calibration data quality)

As quality of the calibration source, the statistics of the CSM and HTS are stored in order of 6GHz-V, 6Ghz-H, 10GHz-V, 10GHz-H, 18GHz-V, 18GHz-H, 23GHz-V, 23GHz-H, 36GHz-V, 36GHz-H, 50GHz-V, 52Ghz-V, 89GHz A-horn-V, 89GHz A-horn-H, 89GHz B-horn-V and 89GHz B-horn-H. Detailed statistical information is shown below.

a) The average value of CSM count. (4 bytes) [type: float]

b) the average value of HTS count. (4 bytes) [type: float]

c) The standard deviation of CSM count. (4 bytes) [type: float]

d) The standard deviation of HTS count. (4 bytes) [type: float]

6) SPC, SPS error flag (SPC/SPS error flag) [type: flat]

The check result of the error flag for SPC and SPS that affects observation data is stored. The stored value is shown below.

0: Normal case

1: SPC anomaly case

2: SPS anomaly case

3: Both SPC and SPS anomaly case

7) HTS temperature (HTS temperature) [type: float]

The HTS temperature is stored for each frequency. The stored temperature is the value used for calculation of the coefficients for the antenna temperature conversion. The storing order of each frequency is the same as above 5.

8) Parity error summary (Parity Error Summary)

The sum of the following parity error is stored for each scan.

a) The sum of parity error for RX Offset/Gain of all frequency. [type: float]

b) The sum of parity error for CSM count for each frequency. [type: float]

c) The sum of parity error for HTS count for each frequency. [type: float]

9) Spare

It is filled with 0.