

**GLOBAL PRECIPITATION MEASUREMENT  
PRECIPITATION PROCESSING SYSTEM**

**File Specification  
1AGMI**

**Preliminary Version**

November 3, 2016

## 0.1 1AGMI - GMI unpacked packet data

1AGMI contains unpacked packet data from GMI science data from the GMI passive microwave instrument flown on the GPM satellite. Swath S1 has 9 channels which are similar to TRMM TMI (10V 10H 19V 19H 23V 37V 37H 89V 89H). Swath S2 has 4 channels similar to AMSU-B (166V 166H 183+/-3V 183+/-8V). Data for both swaths is observed in the same revolution of the instrument. Swath S3 has ScienceDataHeader. Swath S4 has full rotation for low freq channels (S1). Swath S5 has full rotation for high freq channels (S2).

GMI sample counts.

The S1 channels are:

10.7 GHz vertically-polarized  
10.7 GHz horizontally-polarized  
18.7 GHz vertically-polarized  
18.7 GHz horizontally-polarized  
23.8 GHz vertically-polarized  
36.5 GHz vertically-polarized  
36.5 GHz horizontally-polarized  
89.0 GHz vertically-polarized  
89.0 GHz horizontally-polarized

GMI sample counts.

The S2 channels are:

166.0 GHz vertically-polarized  
166.0 GHz horizontally-polarized  
183.31+/-3 GHz vertically-polarized  
183.31+/-8 GHz vertically-polarized

Earth observations are taken during a segment of the rotation when GMI is looking in the +x direction of the GPM satellite. Since the spacecraft turns around every few weeks, +x may be forward or aft. We define the spacecraft axis v, used in the definition of the variable Sorientation, at the center of this segment and the same as the +x direction.

$32\text{rpm} * 1\text{min}/60\text{s} * 5538\text{s}/\text{orbit} = 2954 \text{ scans / orbit.}$

RELATION BETWEEN THE SWATHS: Swath S2 has the same number of scans and the same number of pixels as Swath S1. Each S1 scan contains 9 channels sampled 221 times along the scan. Each S2 scan contains 4 channels sampled 221 times along the scan. Since the incidence angle of Swath S1 is different than Swath S2, the geolocations of the pixel centers are different.

Dimension definitions:

VH	2	Number of polarizations.
nscan1	var	Typical number of Swath S1 scans in the granule.
nchannel1	9	Number of Swath S1 channels (10V 10H 19V 19H 23V 37V 37H 89V 89H).
npixelev	221	Number of earth view pixels in one scan.
npixelht	221	Number of hot load pixels in one scan.
npixelcs	221	Number of cold sky pixels in one scan.
nscan2	var	Typical number of Swath S2 scans in the granule.
nchannel2	4	Number of Swath S2 channels (166V 166H 183+/-3V 183+/-8V).
npixel3	1	Number of "pixels" in one scan in S3.
npixelfr	500	Number of full rotation earth view pixels in one scan.
nchannel12	13	Number of Swath S1 and S2 channels.
dim2	2	Number.
dim3	3	Number.
dim4	4	Number.
dim5	5	Number.
dim6	6	Number.
dim7	7	Number.
dim8	8	Number.
dim9	9	Number.
dim10	10	Number.
dim11	11	Number.
dim12	12	Number.
GMIxyz	3	x, y, z components in GMI instrument coordinate system.

Figure 1 through Figure 47 show the structure of this product. The text below describes the contents of objects in the structure, the C Structure Header File and the Fortran Structure Header File.

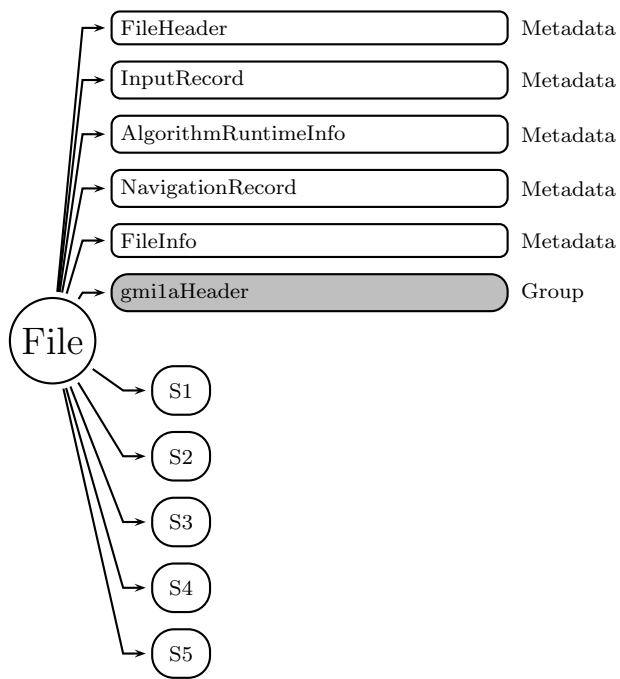


Figure 1: Data Format Structure for 1AGMI, GMI unpacked packet data

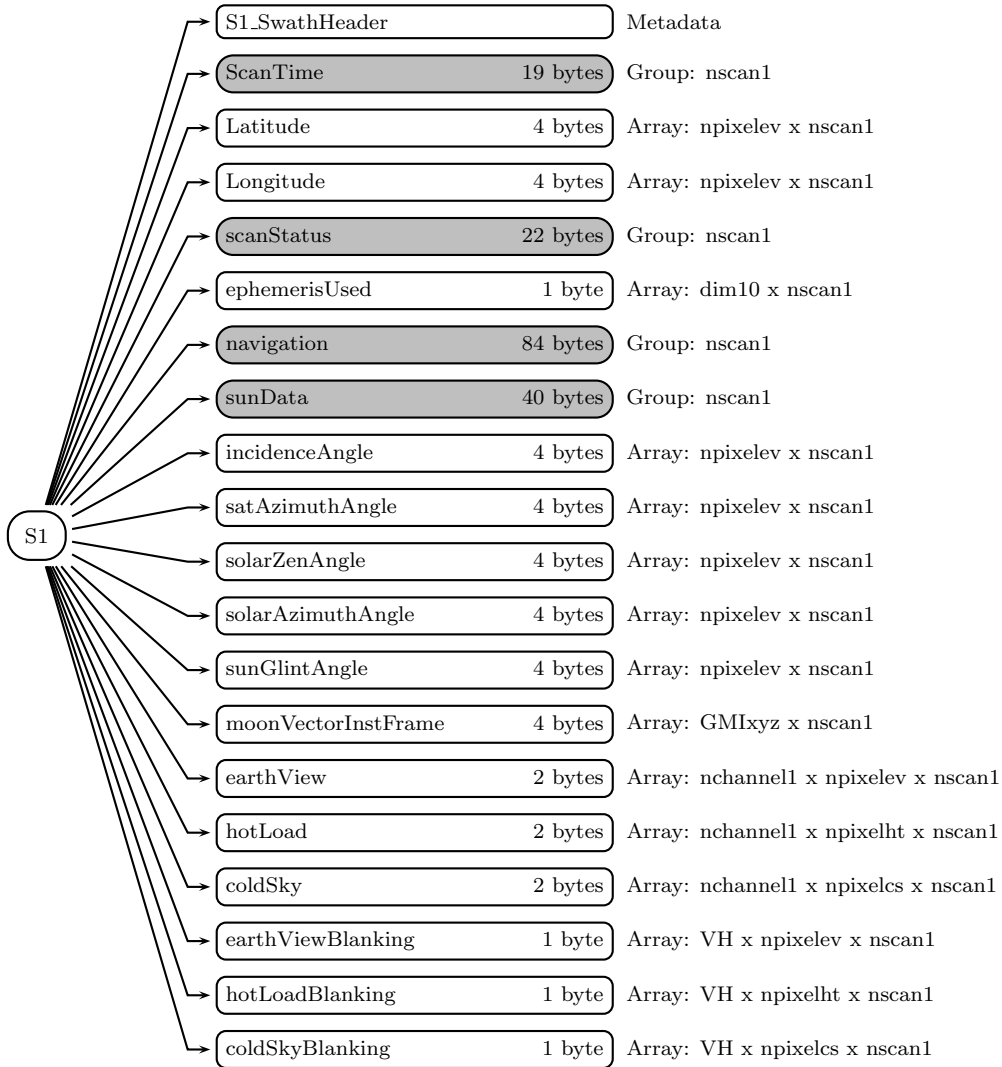


Figure 2: Data Format Structure for 1AGMI, S1

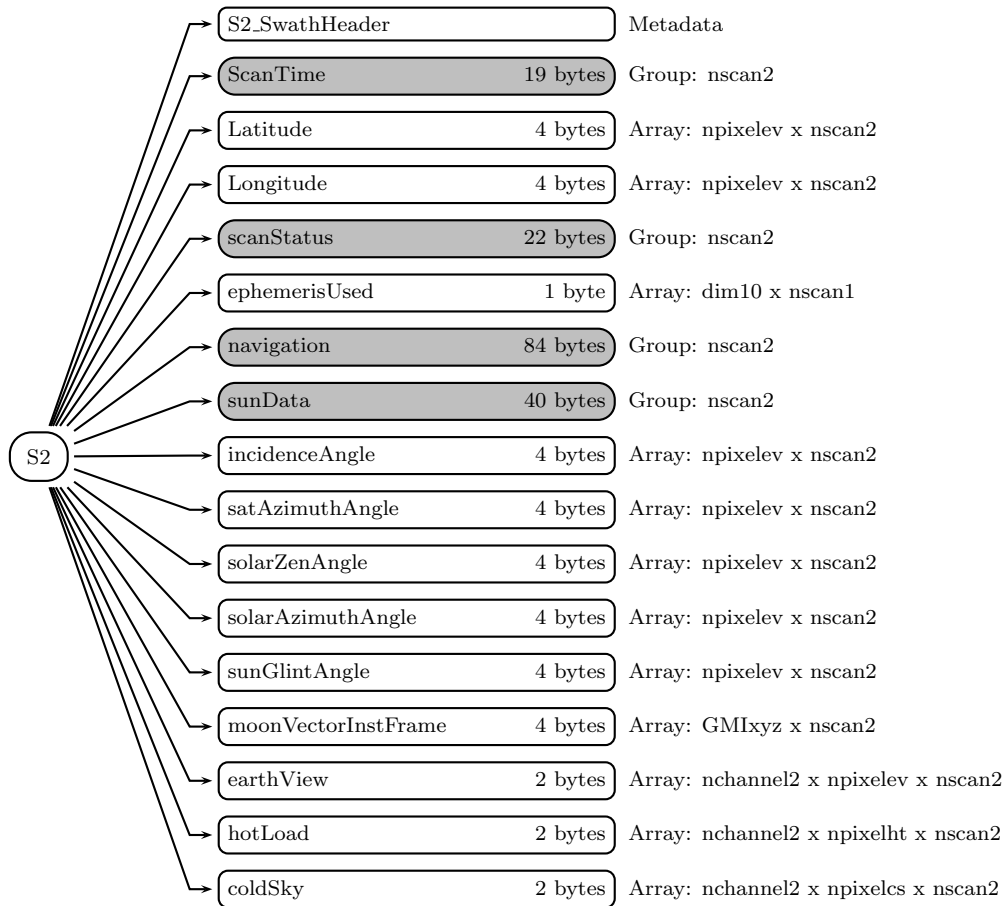
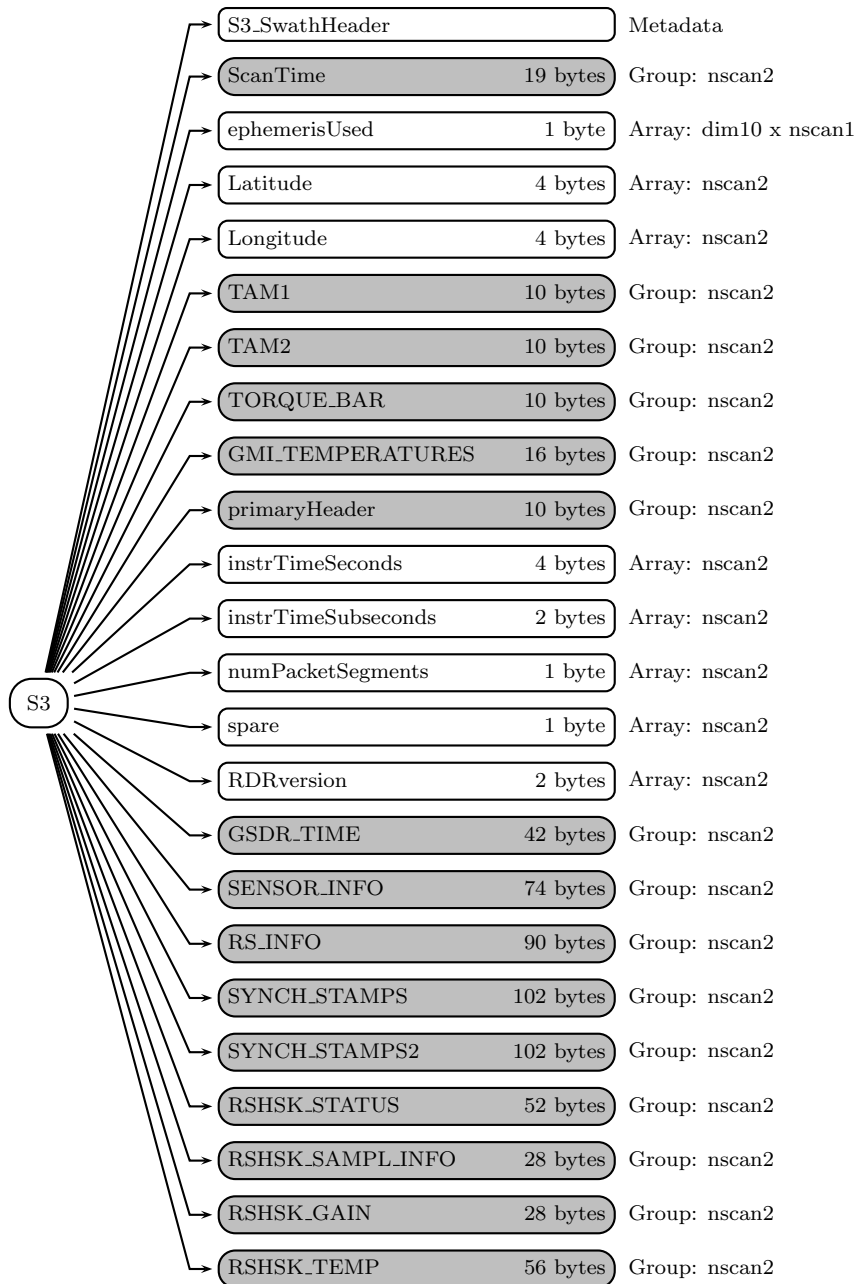


Figure 3: Data Format Structure for 1AGMI, S2



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Figure 4: Data Format Structure for 1AGMI, S3, S3

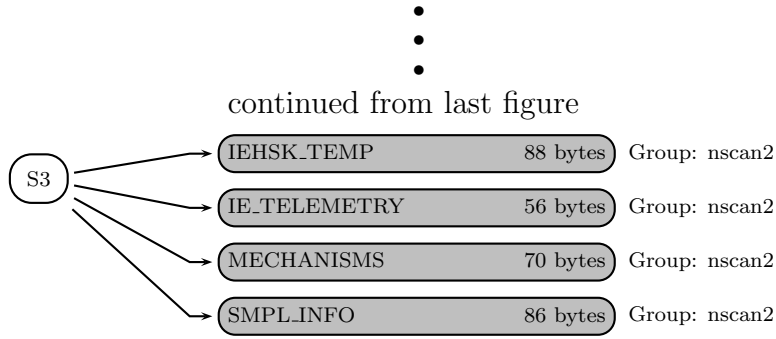


Figure 5: Data Format Structure for 1AGMI, S3

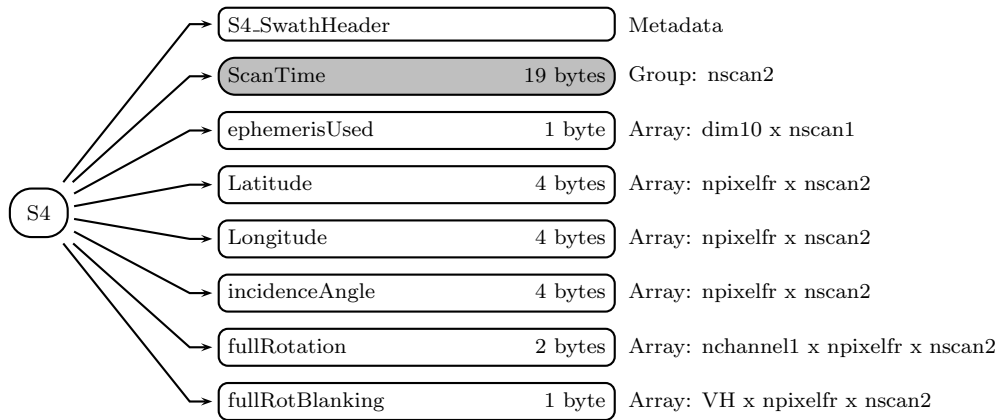


Figure 6: Data Format Structure for 1AGMI, S4

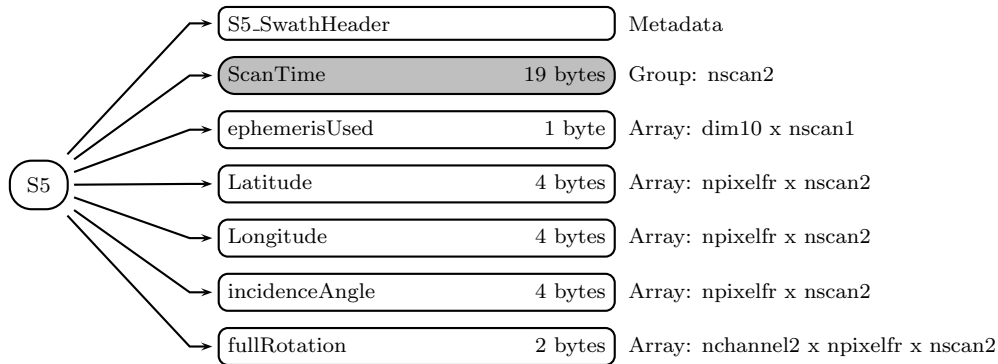


Figure 7: Data Format Structure for 1AGMI, S5

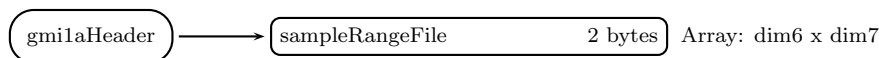


Figure 8: Data Format Structure for 1AGMI, gmi1aHeader



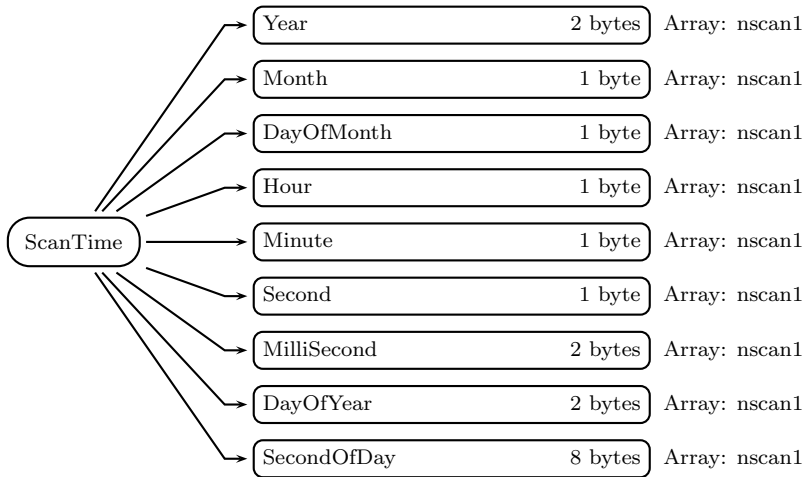


Figure 9: Data Format Structure for 1AGMI, S1, ScanTime

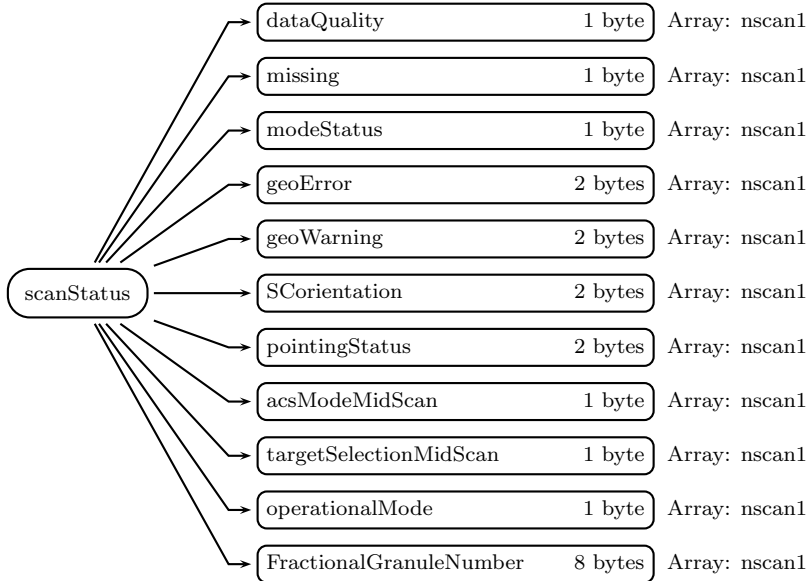


Figure 10: Data Format Structure for 1AGMI, S1, scanStatus

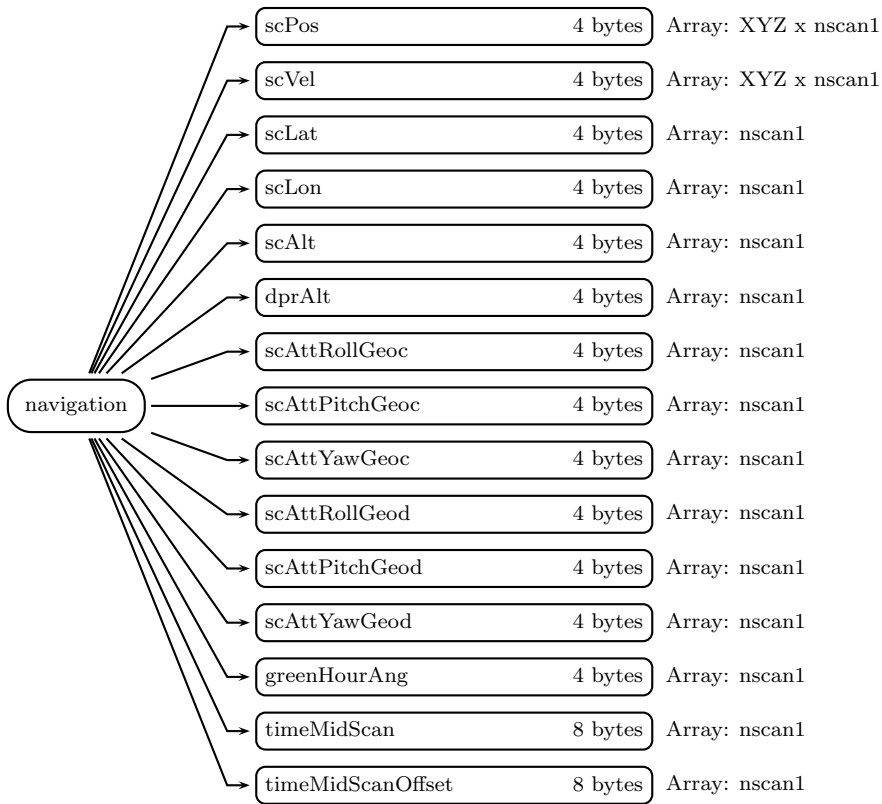


Figure 11: Data Format Structure for 1AGMI, S1, navigation

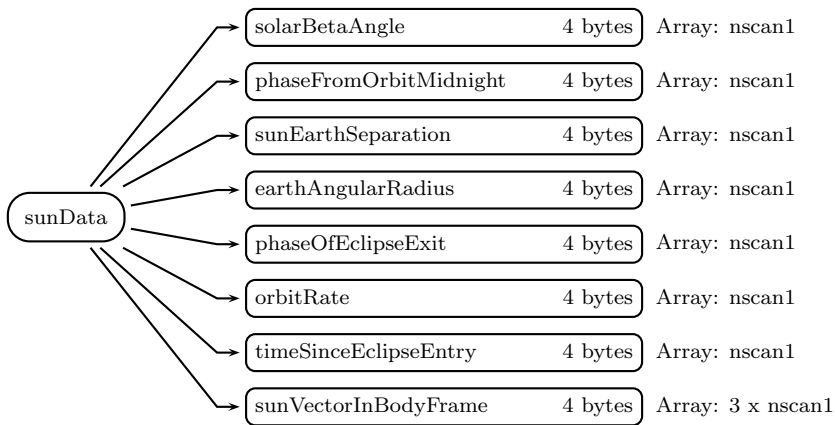


Figure 12: Data Format Structure for 1AGMI, S1, sunData

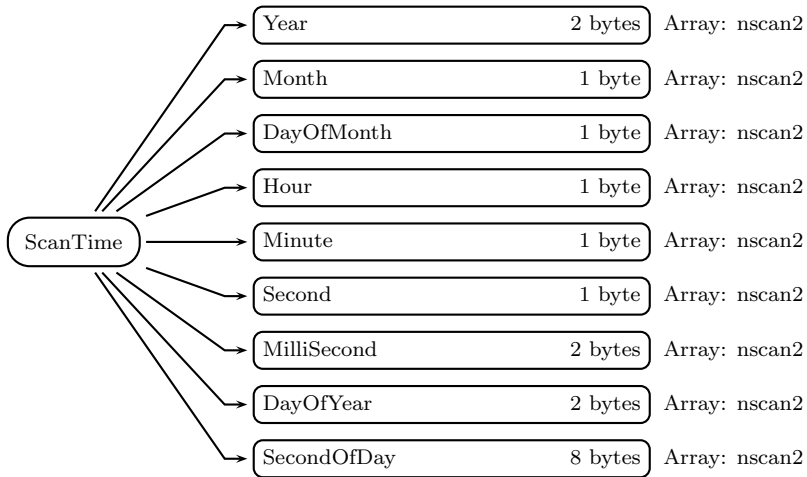


Figure 13: Data Format Structure for 1AGMI, S2, ScanTime

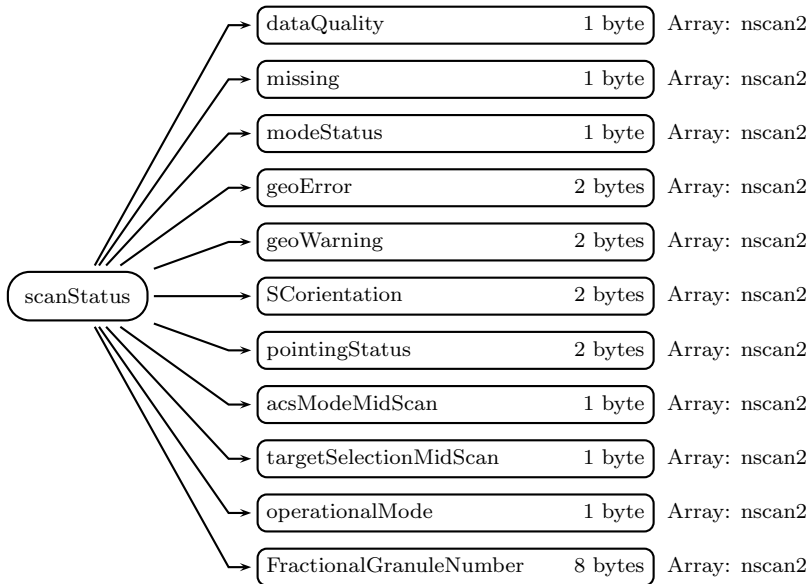


Figure 14: Data Format Structure for 1AGMI, S2, scanStatus

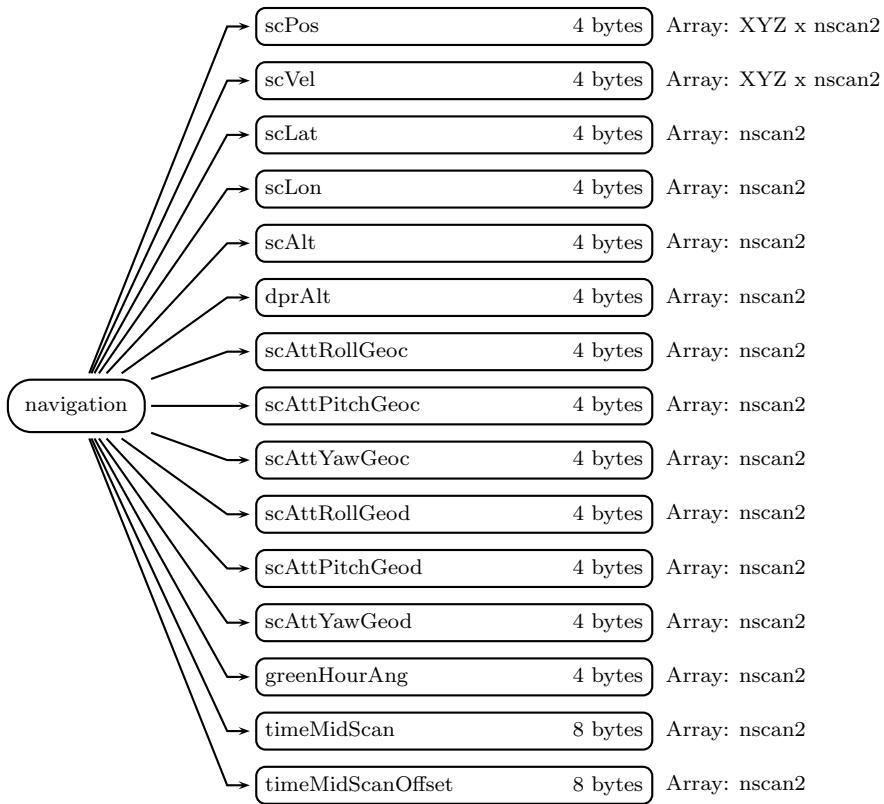


Figure 15: Data Format Structure for 1AGMI, S2, navigation

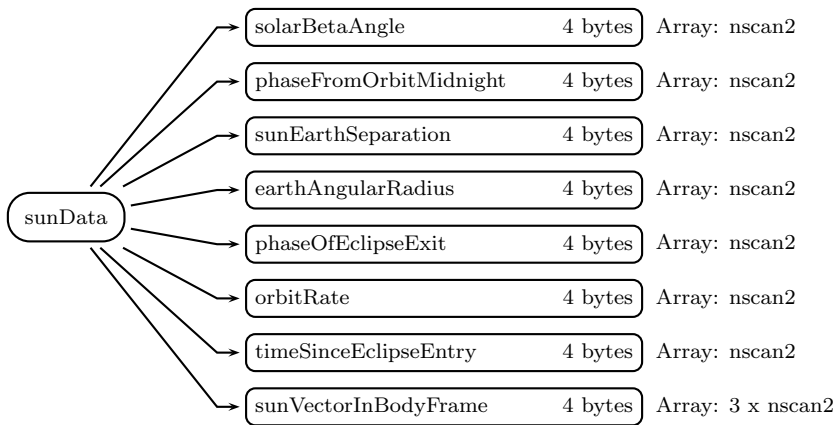


Figure 16: Data Format Structure for 1AGMI, S2, sunData

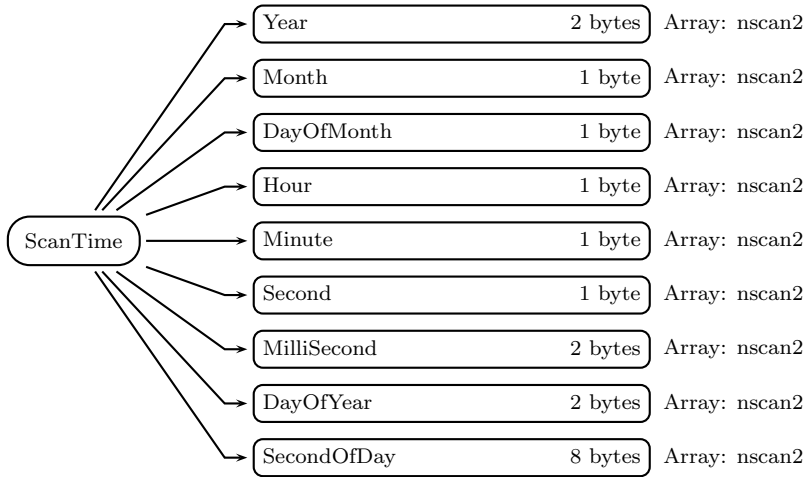


Figure 17: Data Format Structure for 1AGMI, S3, ScanTime

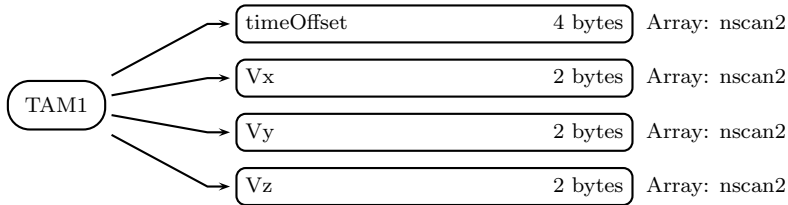


Figure 18: Data Format Structure for 1AGMI, S3, TAM1

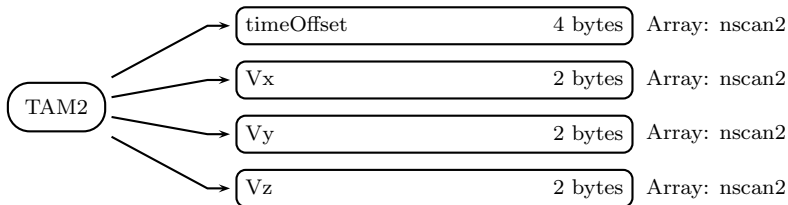


Figure 19: Data Format Structure for 1AGMI, S3, TAM2

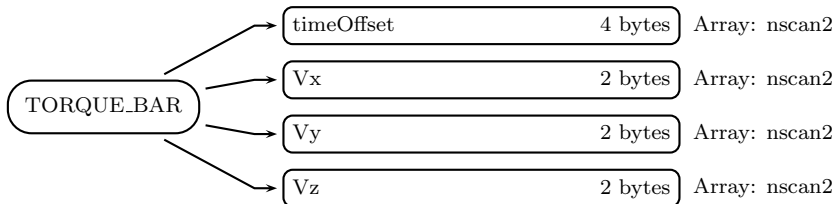


Figure 20: Data Format Structure for 1AGMI, S3, TORQUE\_BAR

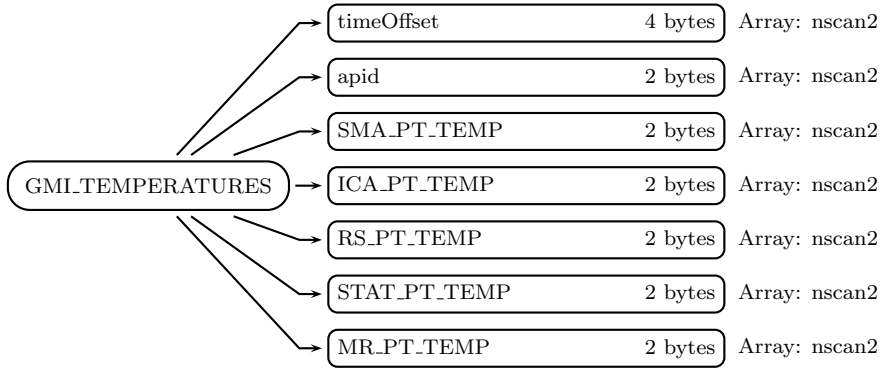


Figure 21: Data Format Structure for 1AGMI, S3, GMI\_TEMPERATURES

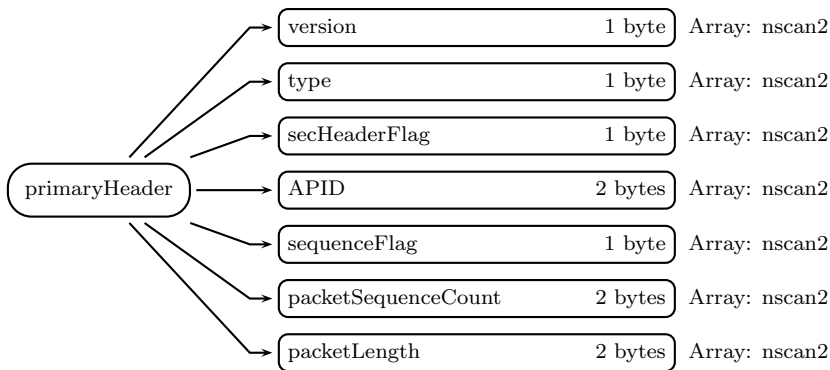


Figure 22: Data Format Structure for 1AGMI, S3, primaryHeader

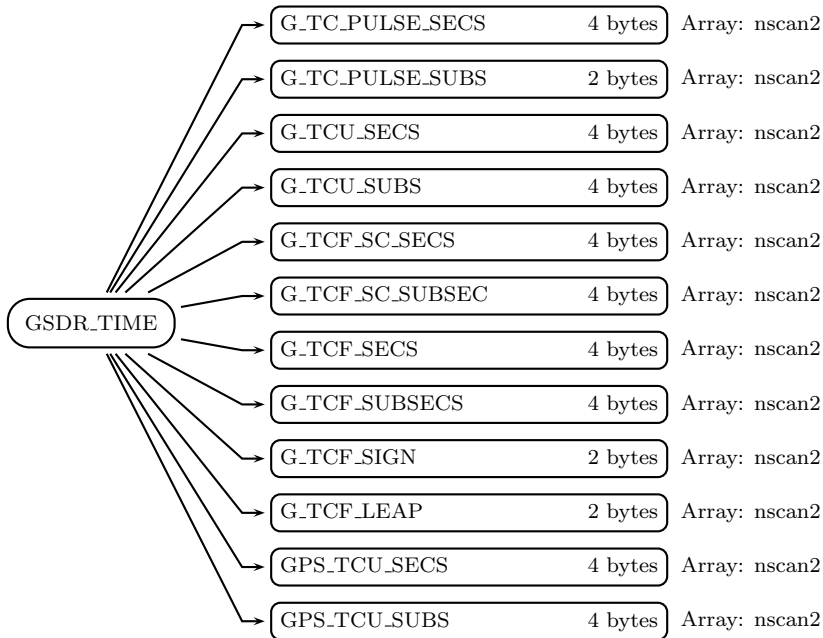
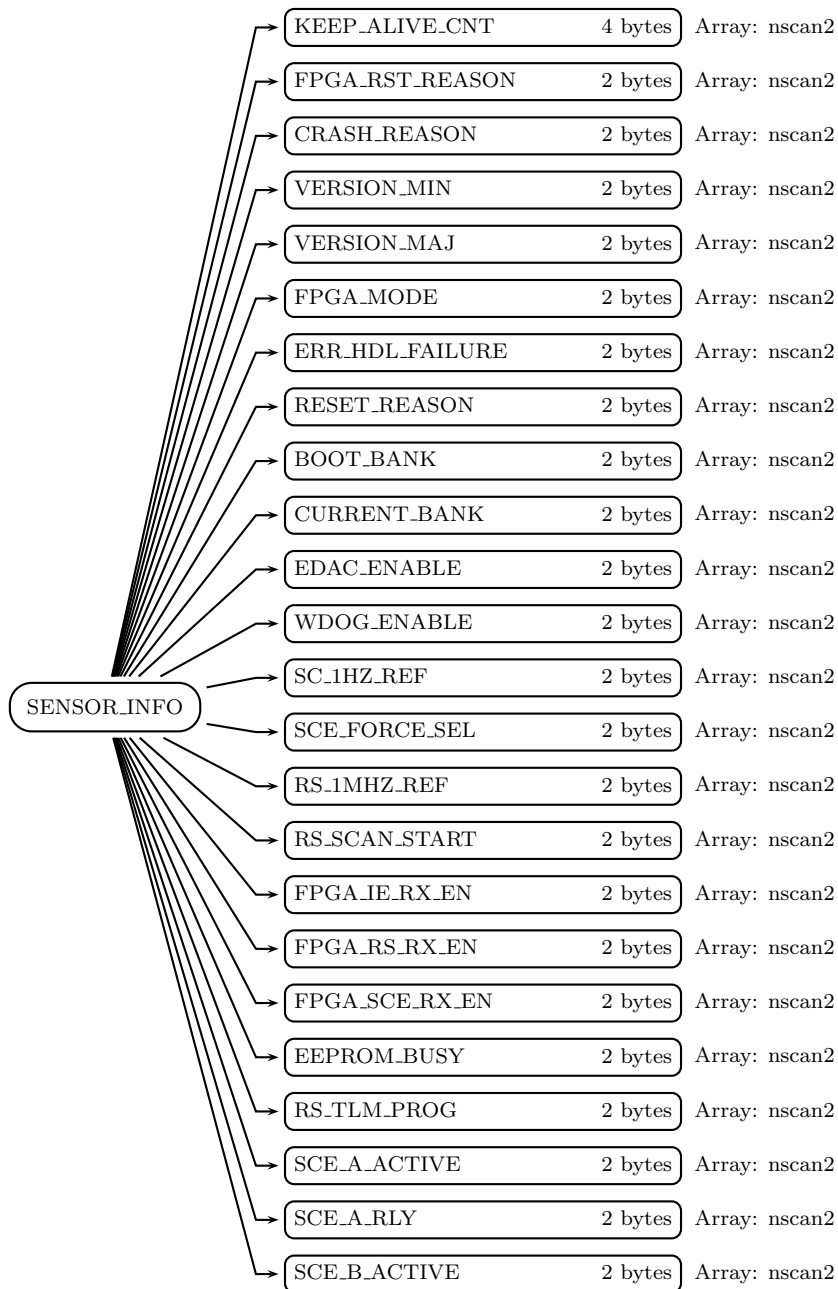


Figure 23: Data Format Structure for 1AGMI, S3, GSDR\_TIME



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Figure 24: Data Format Structure for 1AGMI, SENSOR\_INFO

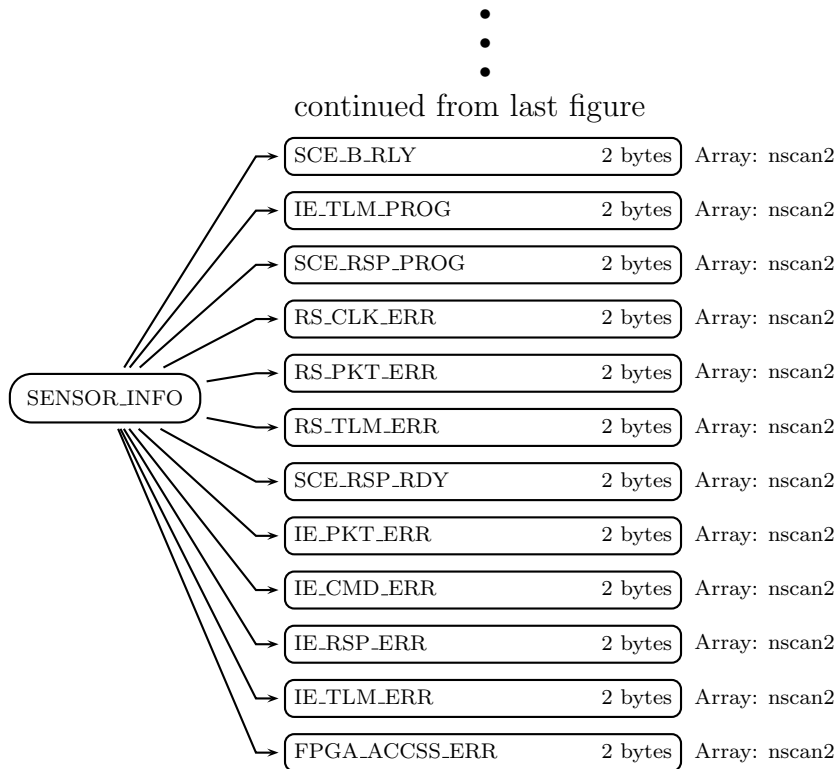
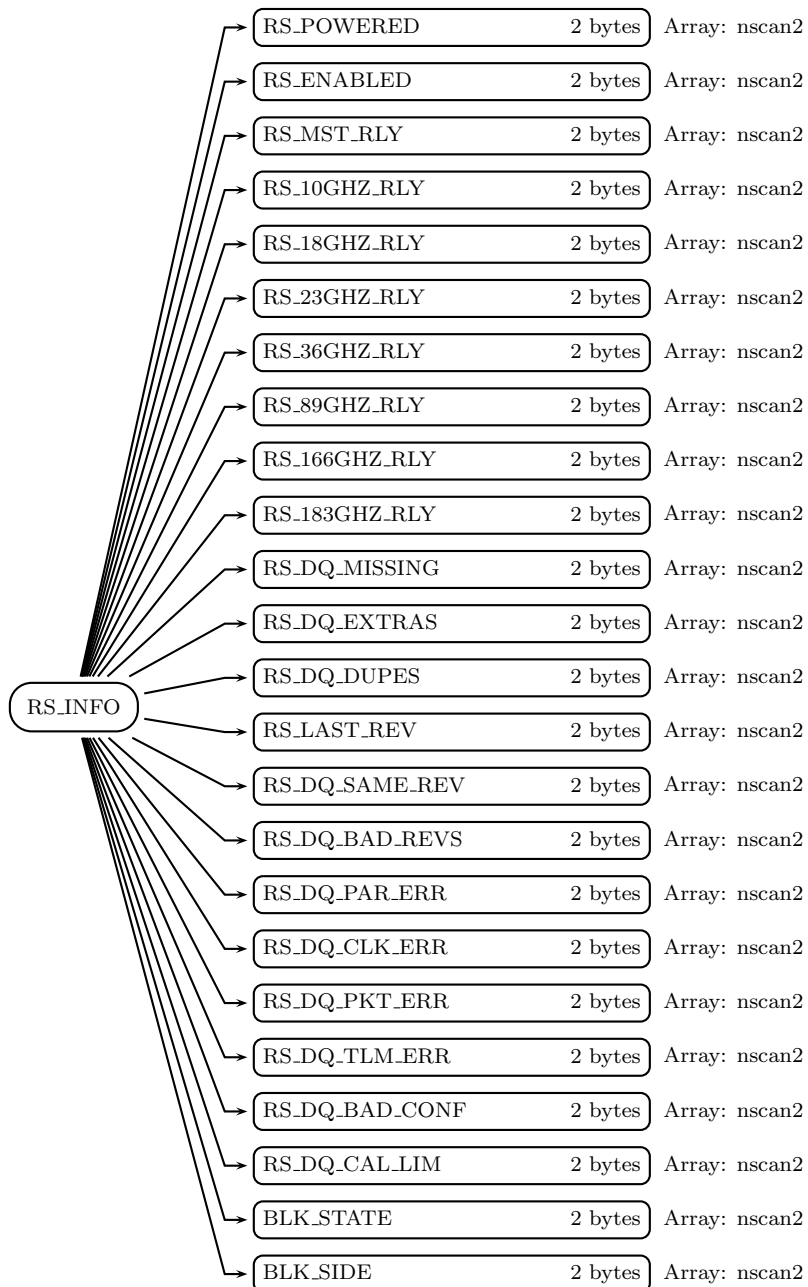


Figure 25: Data Format Structure for 1AGMI, S3, SENSOR.INFO





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Figure 26: Data Format Structure for 1AGMI, RS\_INFO

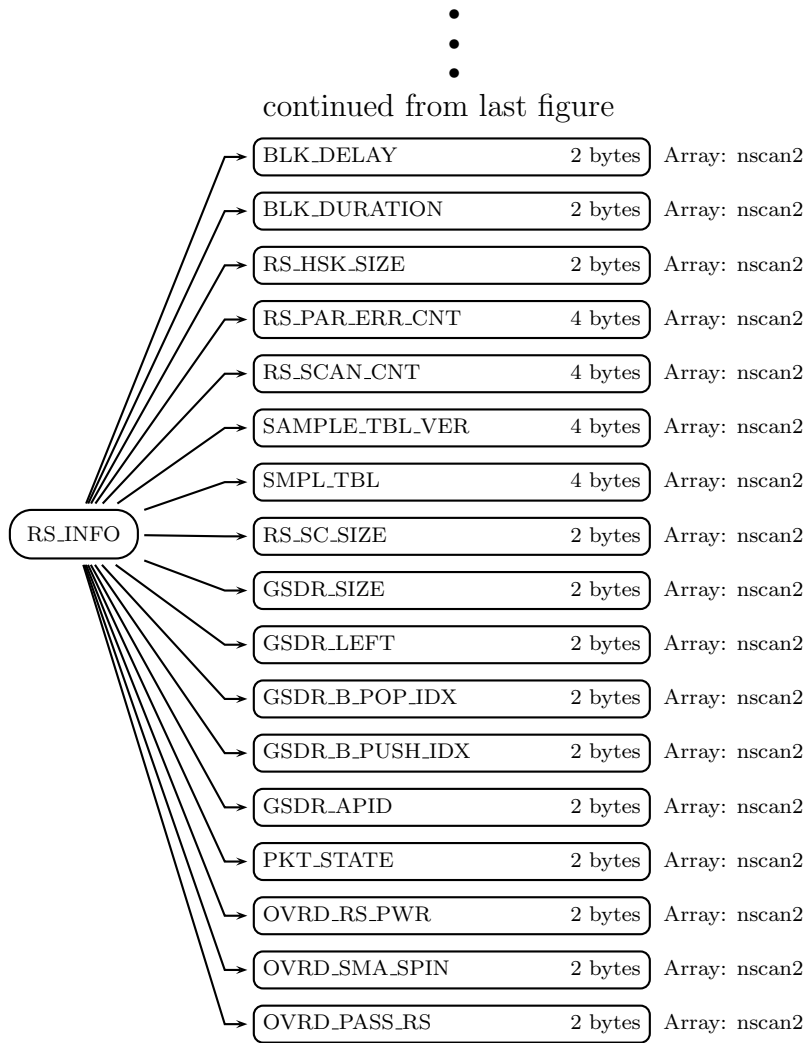
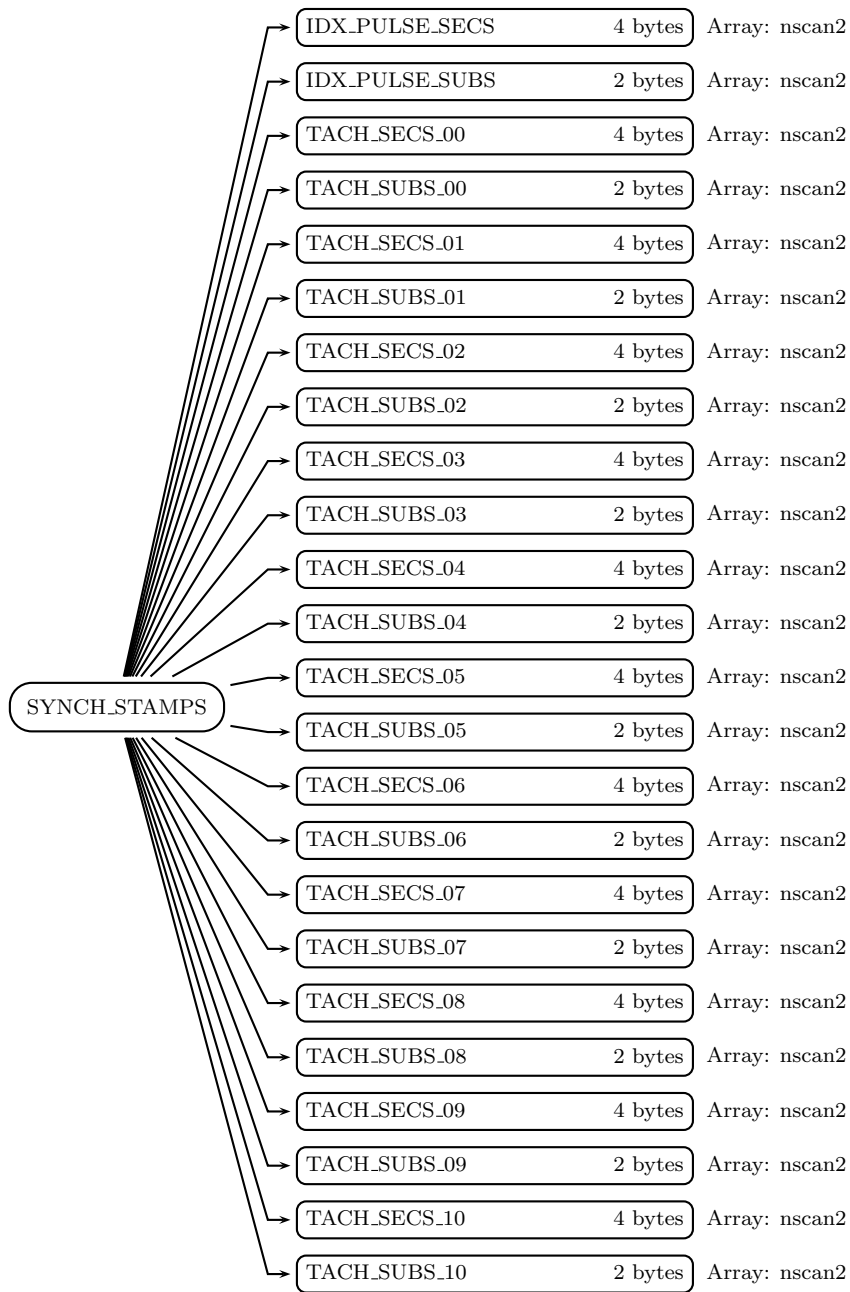


Figure 27: Data Format Structure for 1AGMI, S3, RS\_INFO



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Figure 28: Data Format Structure for 1AGMI, SYNCH\_STAMPS

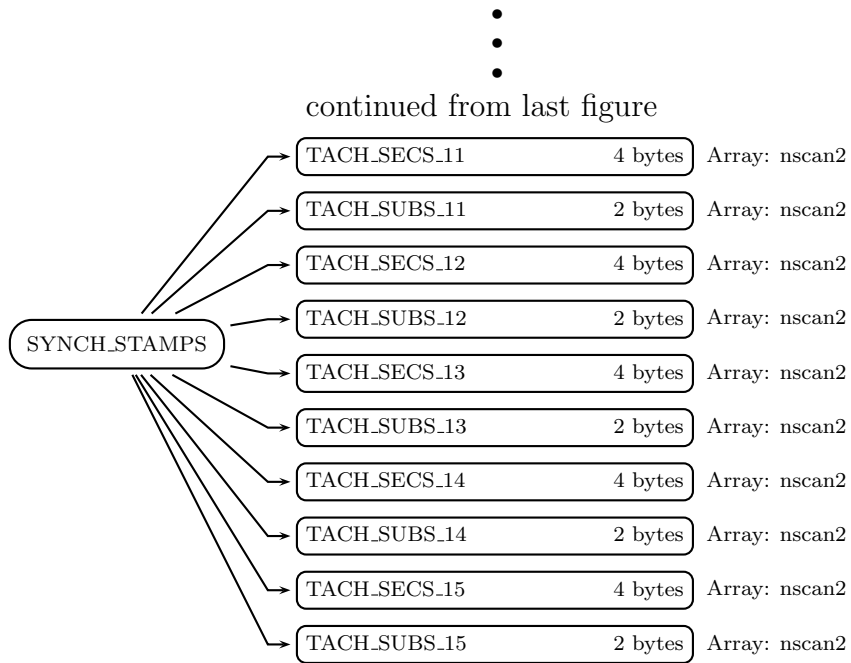
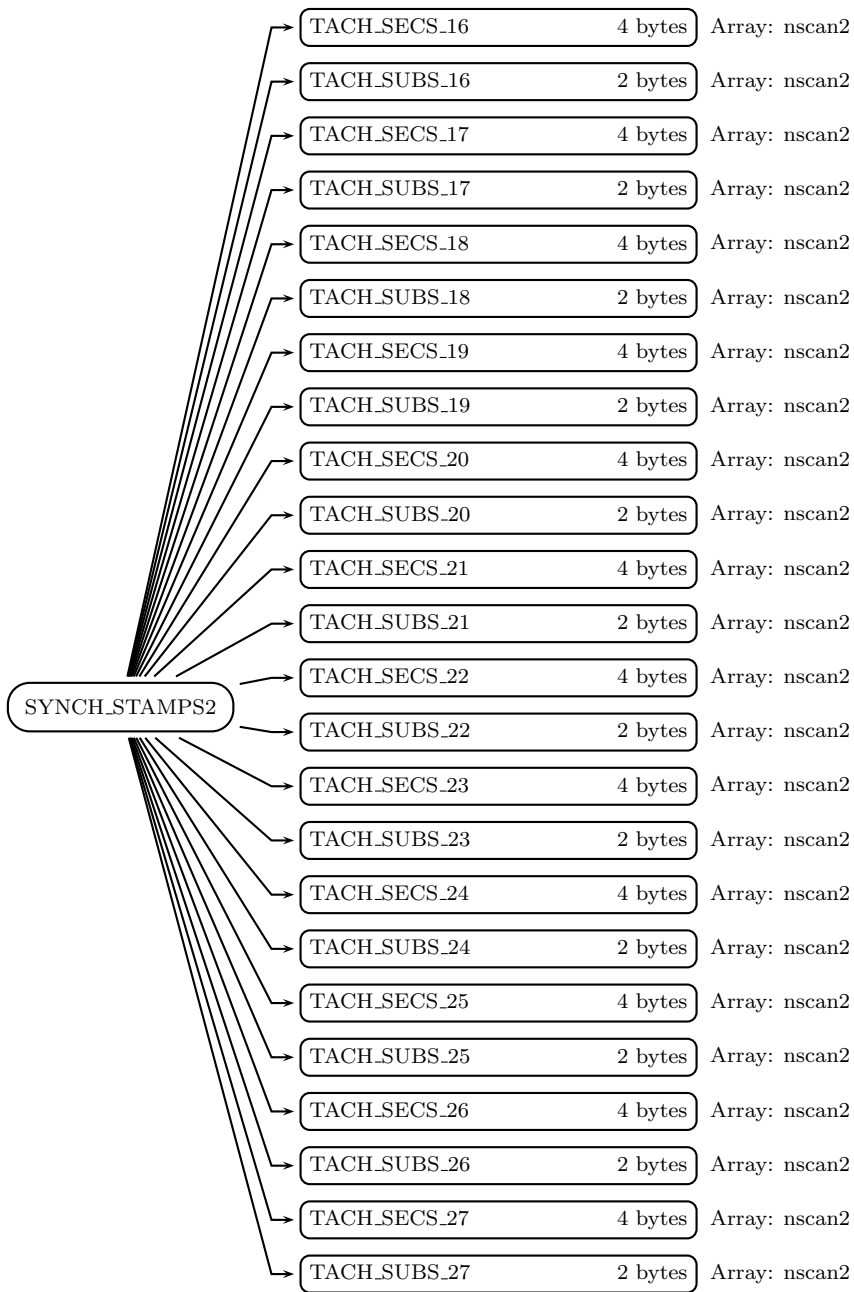


Figure 29: Data Format Structure for 1AGMI, S3, SYNCH\_STAMPS



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Figure 30: Data Format Structure for 1AGMI, SYNCH\_STAMPS2

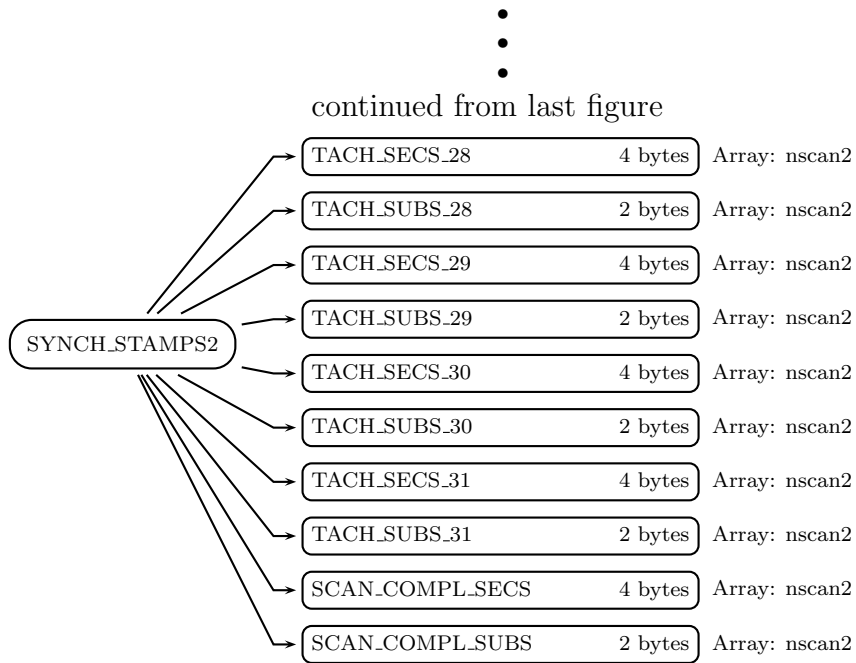
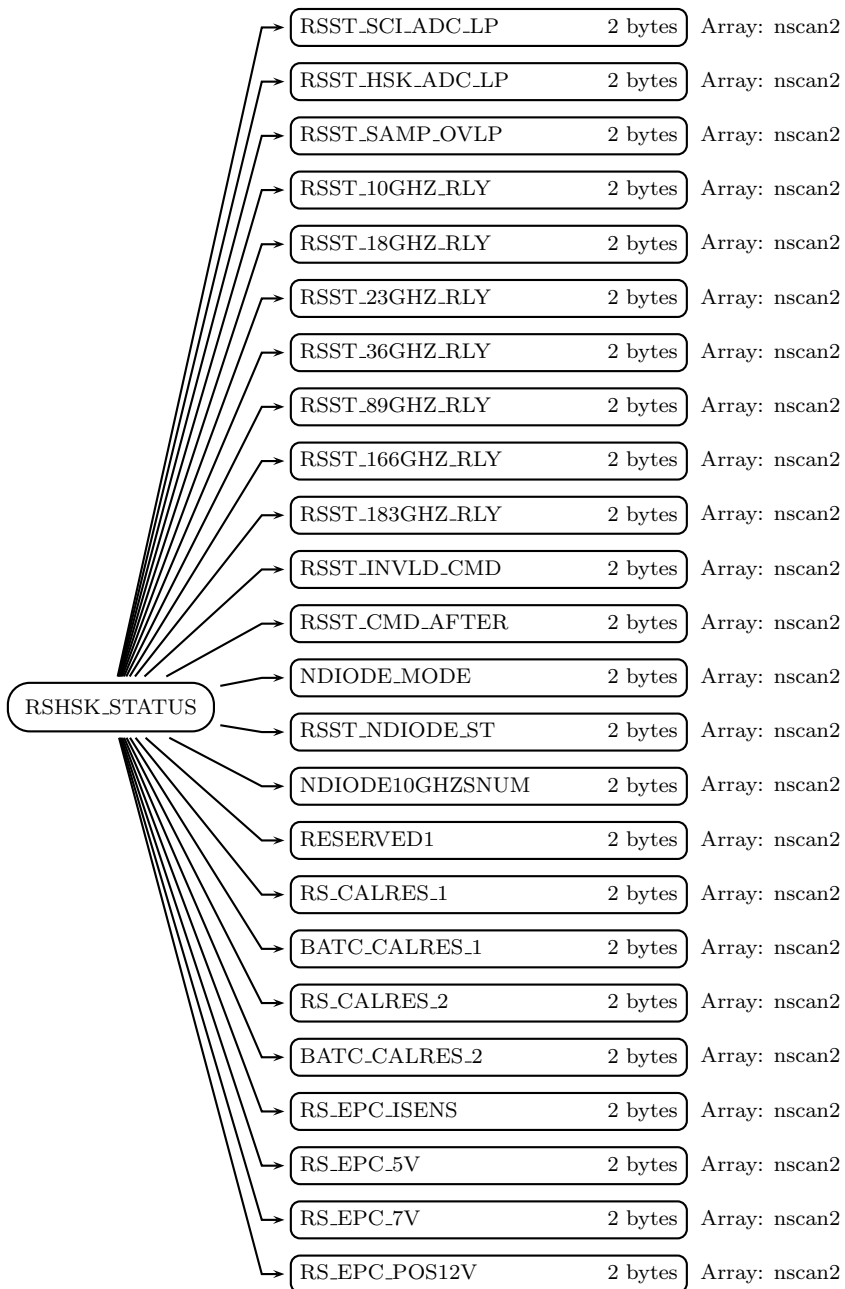


Figure 31: Data Format Structure for 1AGMI, S3, SYNCH\_STAMPS2



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Figure 32: Data Format Structure for 1AGMI, RSHSK\_STATUS

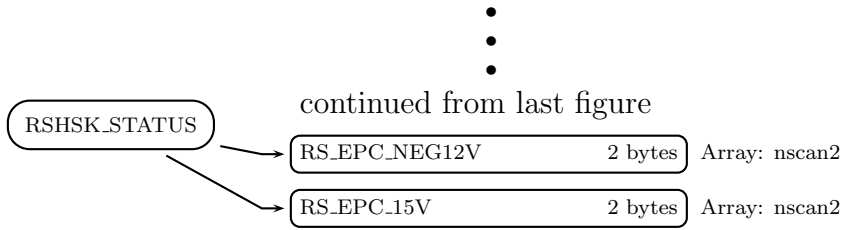


Figure 33: Data Format Structure for 1AGMI, S3, RSHSK\_STATUS

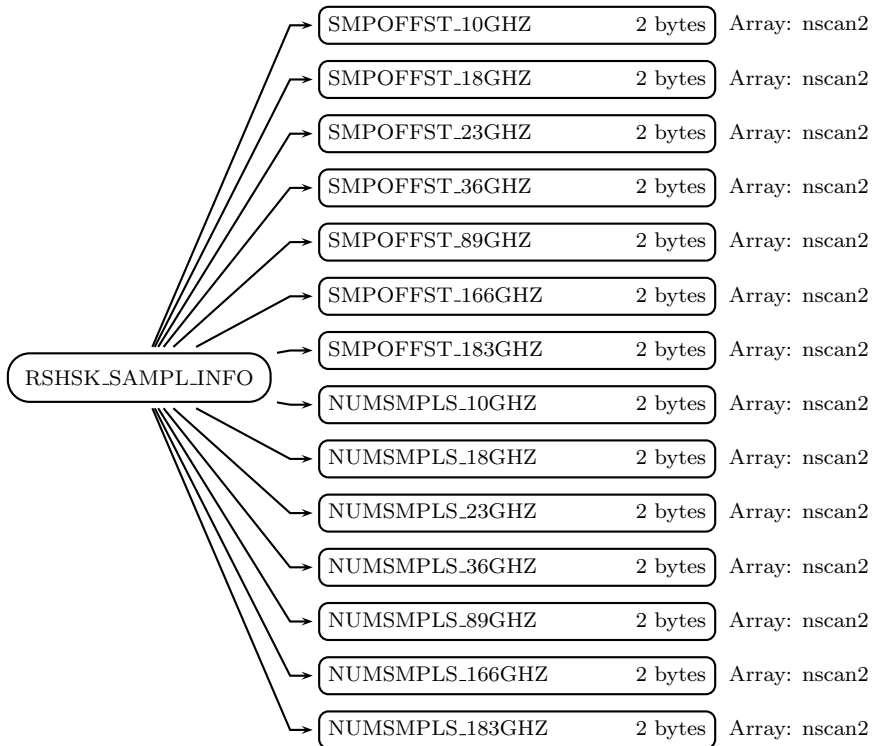


Figure 34: Data Format Structure for 1AGMI, S3, RSHSK\_SAMPL\_INFO



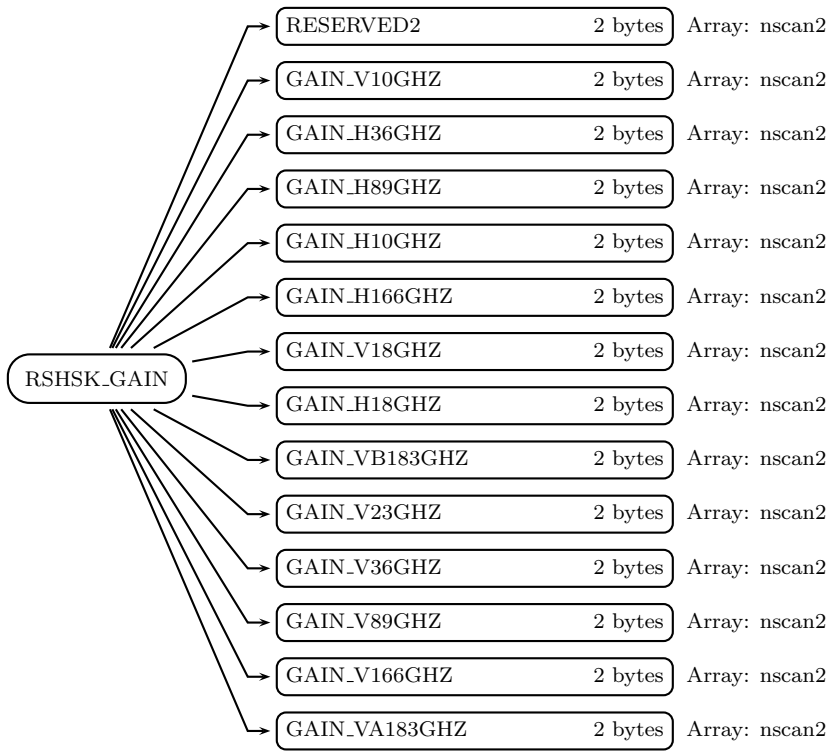
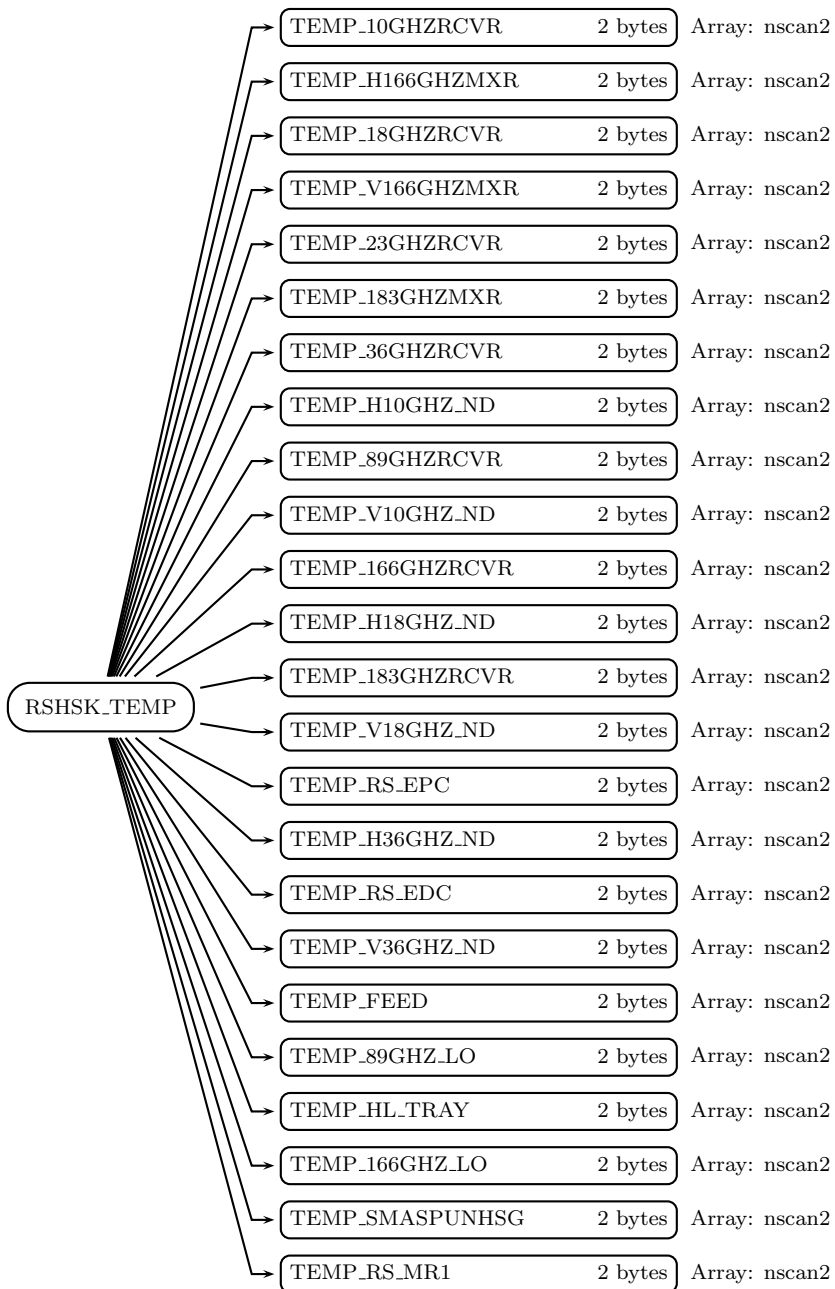


Figure 35: Data Format Structure for 1AGMI, S3, RSHSK\_GAIN



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Figure 36: Data Format Structure for 1AGMI, RSHSK\_TEMP

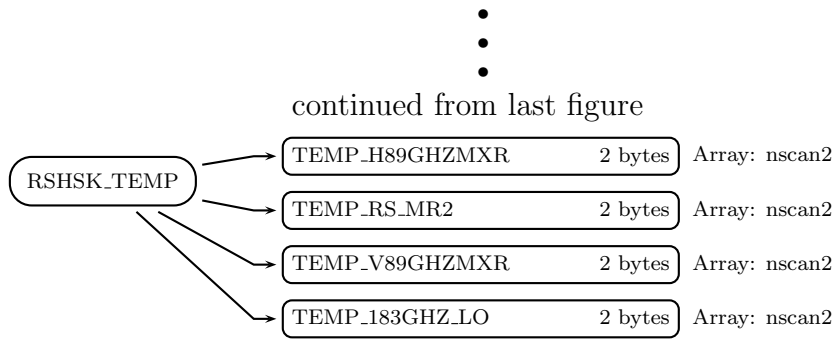
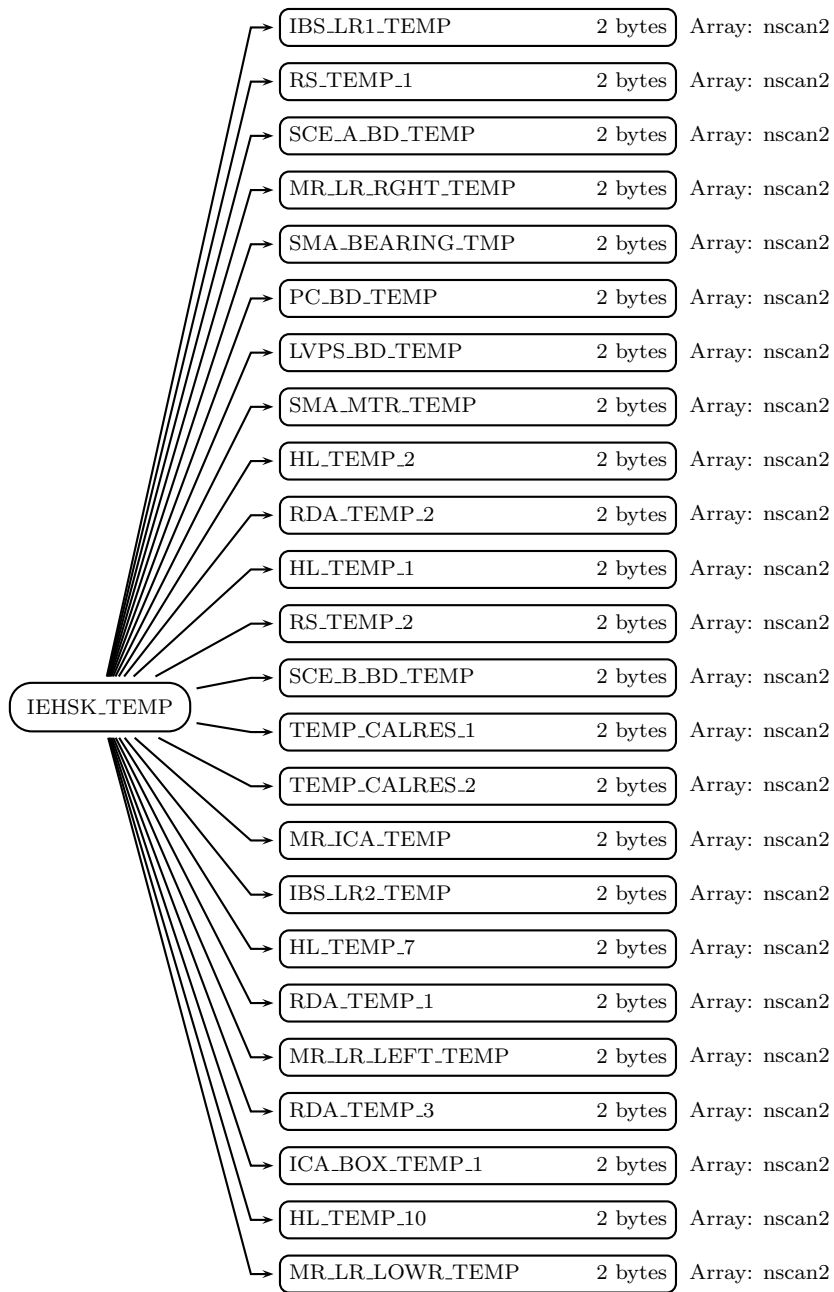


Figure 37: Data Format Structure for 1AGMI, S3, RSHSK\_TEMP



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Figure 38: Data Format Structure for 1AGMI, IEHSK\_TEMP

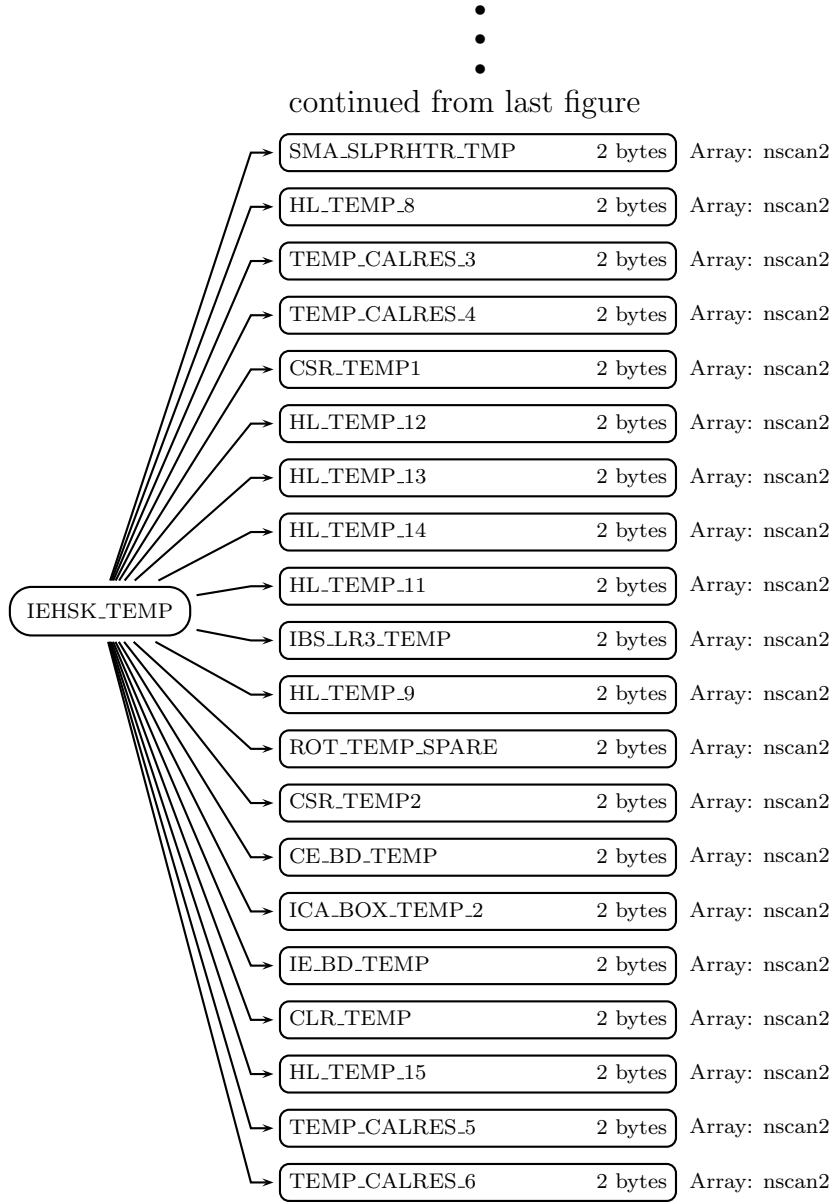
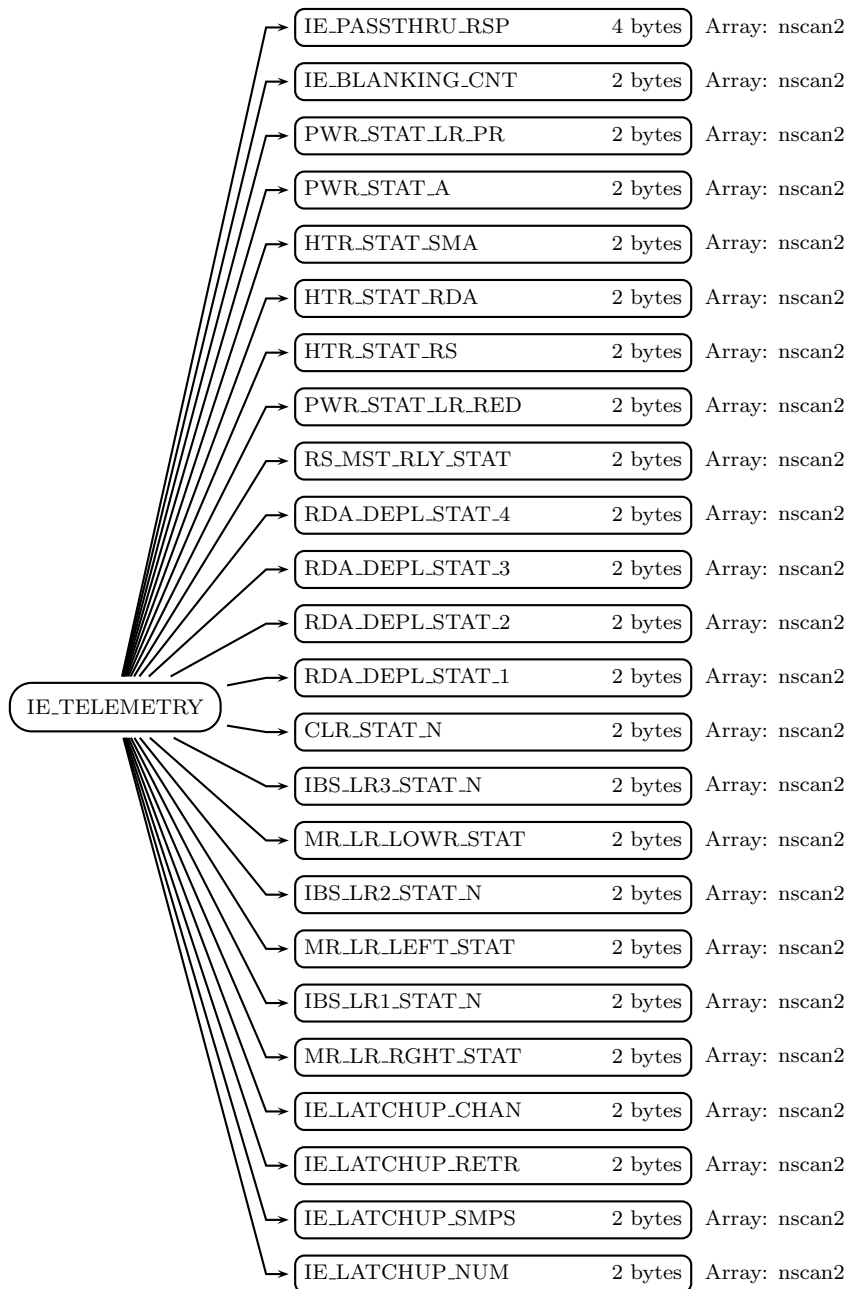


Figure 39: Data Format Structure for 1AGMI, S3, IEHSK\_TEMP



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Figure 40: Data Format Structure for 1AGMI, IE\_TELEMETRY

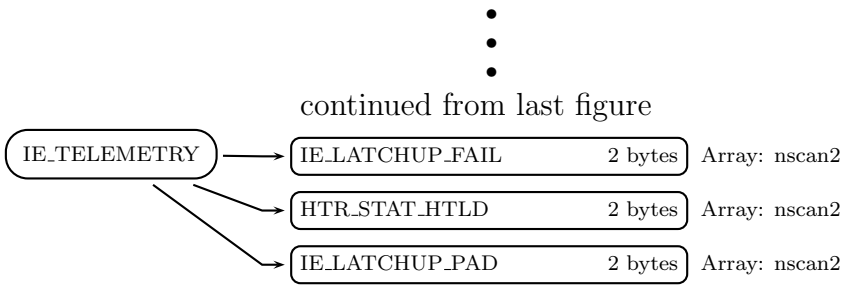
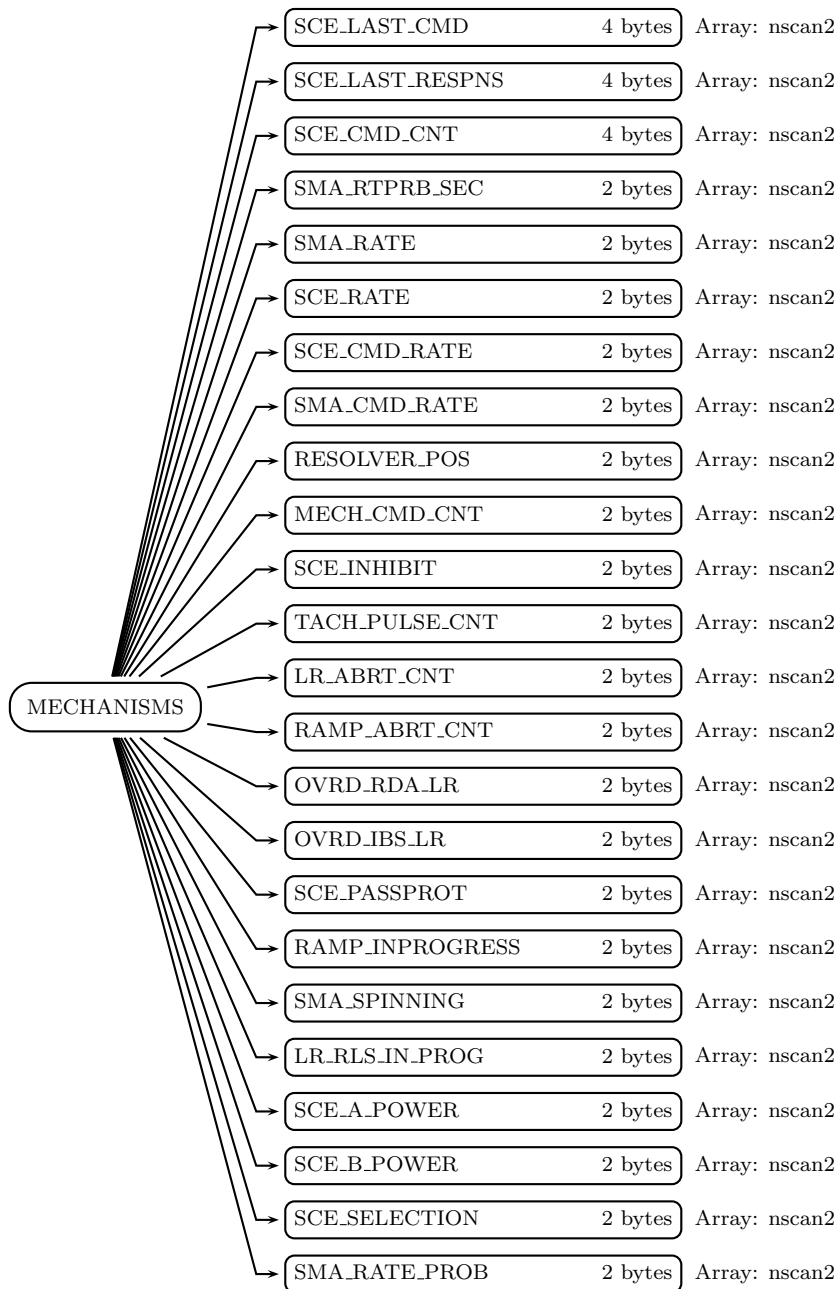


Figure 41: Data Format Structure for 1AGMI, S3, IE\_TELEMETRY



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Figure 42: Data Format Structure for 1AGMI, MECHANISMS



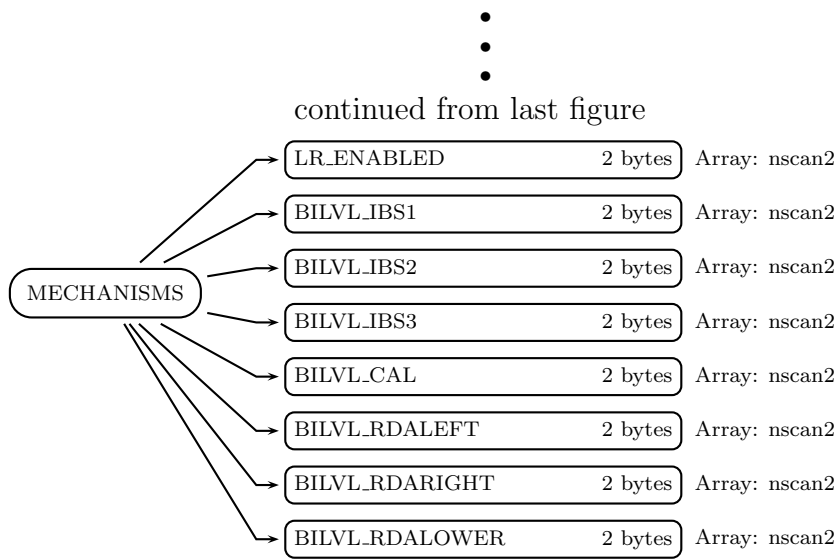


Figure 43: Data Format Structure for 1AGMI, S3, MECHANISMS



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Figure 44: Data Format Structure for 1AGMI, SMPL\_INFO

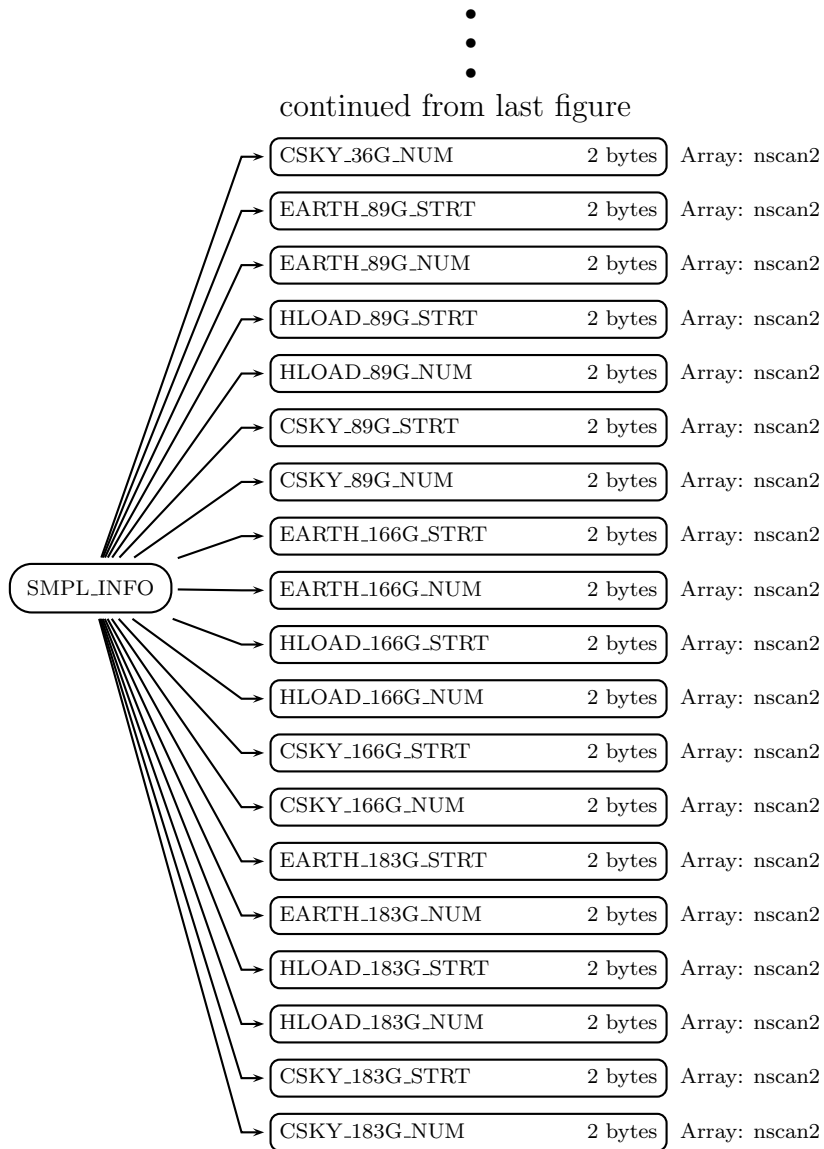


Figure 45: Data Format Structure for 1AGMI, S3, SMPL\_INFO

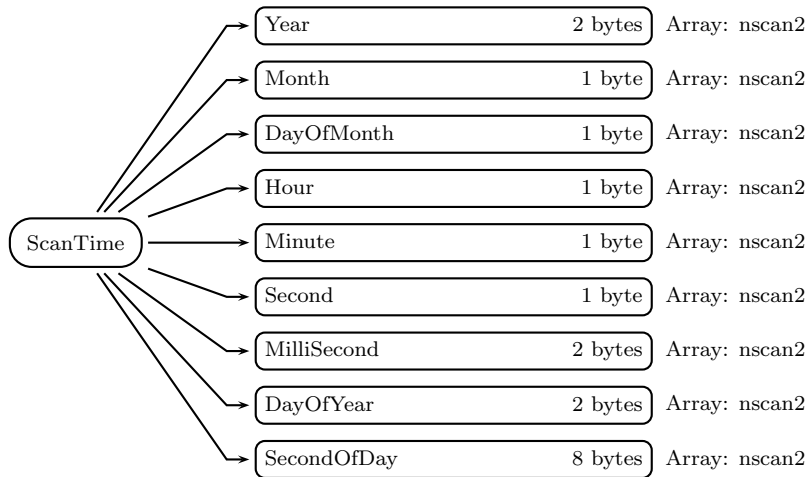


Figure 46: Data Format Structure for 1AGMI, S4, ScanTime

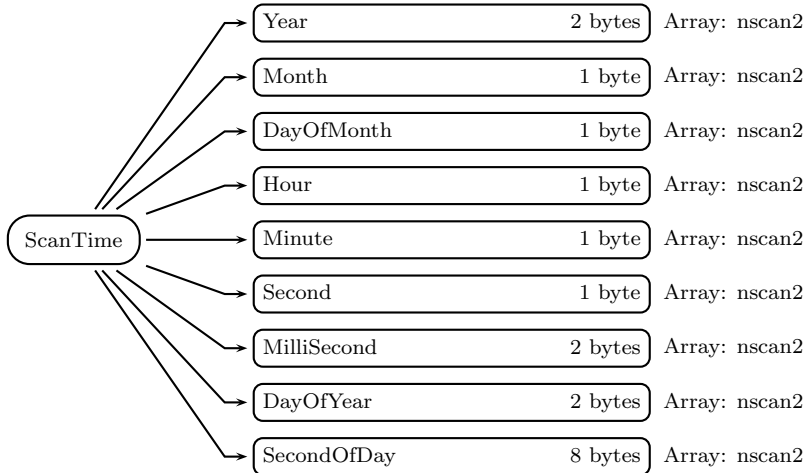


Figure 47: Data Format Structure for 1AGMI, S5, ScanTime

**FileHeader** (Metadata):

FileHeader contains metadata of general interest. This group appears in all data products. See Metadata for GPM Products for details.

**InputRecord** (Metadata):

InputRecord contains a record of input files for this granule. This group appears in Level 1, Level 2, and Level 3 orbital data products. Level 3 time averaged products have the same information separated into 3 groups since they have many inputs. See Metadata for GPM Products for details.

**AlgorithmRuntimeInfo** (Metadata):

AlgorithmRuntimeInfo contains text runtime information written by the algorithm. See Metadata for GPM Products for details.

**NavigationRecord** (Metadata):

NavigationRecord contains navigation metadata for this granule. This group appears in Level 1, Level 2, and Level 3 orbital data products. See Metadata for GPM Products for details.

**FileInfo** (Metadata):

FileInfo contains metadata used by the PPS I/O Toolkit (TKIO). This group appears in all data products. See Metadata for GPM Products for details.

**gmi1aHeader** (Group)

**sampleRangeFile** (2-byte unsigned integer, array size: dim6 x dim7):

The sample range table that was used to subset S1 and S2.

## S1 (Swath)

### **S1\_SwathHeader** (Metadata):

SwathHeader contains metadata for swaths. This group appears in Level 1 and Level 2 data products. See Metadata for GPM Products for details.

### **ScanTime** (Group in S1)

A UTC time associated with the scan.

#### **Year** (2-byte integer, array size: nscan1):

4-digit year, e.g., 1998. Values range from 1950 to 2100 years. Special values are defined as:

-9999 Missing value

#### **Month** (1-byte integer, array size: nscan1):

Month of the year. Values range from 1 to 12 months. Special values are defined as:

-99 Missing value

#### **DayOfMonth** (1-byte integer, array size: nscan1):

Day of the month. Values range from 1 to 31 days. Special values are defined as:

-99 Missing value

#### **Hour** (1-byte integer, array size: nscan1):

UTC hour of the day. Values range from 0 to 23 hours. Special values are defined as:

-99 Missing value

#### **Minute** (1-byte integer, array size: nscan1):

Minute of the hour. Values range from 0 to 59 minutes. Special values are defined as:

-99 Missing value

#### **Second** (1-byte integer, array size: nscan1):

Second of the minute. Values range from 0 to 60 s. Special values are defined as:

-99 Missing value

#### **MilliSecond** (2-byte integer, array size: nscan1):

Thousandths of the second. Values range from 0 to 999 ms. Special values are defined as:

-9999 Missing value

#### **DayOfYear** (2-byte integer, array size: nscan1):

Day of the year. Values range from 1 to 366 days. Special values are defined as:

-9999 Missing value

#### **SecondOfDay** (8-byte float, array size: nscan1):

A time associated with the scan. scanTime\_sec is expressed as the UTC seconds of the day. Values range from 0 to 86400 s. Special values are defined as:

-9999.9 Missing value

#### **Latitude** (4-byte float, array size: npixelev x nscan1):

The earth latitude of the center of the IFOV at the altitude of the earth ellipsoid. Latitude

is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:

-9999.9 Missing value

**Longitude** (4-byte float, array size: npixelelev x nscan1):

The earth longitude of the center of the IFOV at the altitude of the earth ellipsoid. Longitude is positive east, negative west. A point on the 180th meridian has the value -180 degrees. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

## **scanStatus** (Group in S1)

**dataQuality** (1-byte integer, array size: nscan1):

A summary of data quality in the scan. Unless this is 0 (normal), the scan data is meaningless to higher precipitation processing. Bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0, the unsigned integer value is  $2^{**i}$ ).

Bit	Meaning if bit = 1
0	missing
5	geoError is not zero
6	modeStatus is not zero

**missing** (1-byte integer, array size: nscan1):

Indicates whether information is contained in the scan data. The values are:

Bit	Meaning if bit = 1
0	Scan is missing
1	Science telemetry packet missing
2	Science telemetry segment within packet missing
3	Science telemetry other missing
4	Housekeeping (HK) telemetry packet missing
5	Spare (always 0)
6	Spare (always 0)
7	Spare (always 0)

**modeStatus** (1-byte integer, array size: nscan1):

A summary of status modes. If all status modes are routine, all bits in modeStatus = 0. Routine means that scan data has been measured in the normal operational situation as far as the status modes are concerned. modeStatus does not assess geolocation quality. modeStatus is broken into 8 bit flags. Each bit = 0 if the status is routine but the bit = 1 if the status is not routine. Bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0, the unsigned integer value is  $2^{**i}$ ). The non-routine situations follow:

Bit	Meaning if bit = 1
0	Spare (always 0)
1	SCorientation not 0 or 180
2	pointingStatus not 0
3	Spare (always 0)
4	Non-routine operationalMode
5	Spare (always 0)
6	Spare (always 0)
7	Spare (always 0)

**geoError** (2-byte integer, array size: nscan1):

A summary of geolocation errors in the scan. geoError is used to set a bit in dataQuality. A zero integer value of geoError indicates 'good' geolocation. A non-zero value broken down into the bit flags below indicates the specified reason, where bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0 the unsigned integer value is  $2^{*i}$ ).

Bits 0, 4, 5, 8 and 9 are per pixel error flags. If the number of bad pixels (for any of the reasons specified by these flags) is greater than the threshold then bit 7 = 1 and each of these flags is set to 1 if any pixel is bad for that reason. At launch this threshold is zero, so data is flagged if any pixel is bad. If the number of bad pixels is less than or equal to the threshold then bit 7 = 0 and all of these flags are also 0.

Bit	Meaning if bit = 1
0	Latitude limit exceeded for viewed pixel locations
1	Negative scan time, invalid input
2	Error getting spacecraft attitude at scan mid-time
3	Error getting spacecraft ephemeris at scan mid-time
4	Invalid input non-unit ray vector for any pixel
5	Ray misses Earth for any pixel with normal pointing
6	Nadir calculation error for subsatellite position
7	Pixel count with geolocation error over threshold
8	Error in getting spacecraft attitude for any pixel
9	Error in getting spacecraft ephemeris for any pixel
10	Spare (always 0)
11	Spare (always 0)
12	Spare (always 0)
13	Spare (always 0)
14	Spare (always 0)
15	Spare (always 0)

**geoWarning** (2-byte integer, array size: nscan1):

A summary of geolocation warnings in the scan. geoWarning does not set a bit in dataQuality. Warnings indicate unusual conditions. These conditions do not indicate bad geolocation but are flagged as a warning that further review of the data may be



useful. A zero integer value indicates usual geolocation. A non-zero value broken down into the following bit flags indicates the following, where bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0 the unsigned integer value is  $2^{**i}$ ):

Bit	Meaning if bit = 1
0	Ephemeris Gap Interpolated
1	Attitude Gap Interpolated
2	Attitude jump/discontinuity
3	Attitude out of range
4	Anomalous Time Step
5	GHA not calculated due to error
6	SunData (Group) not calculated due to error
7	Failure to calculate Sun in inertial coordinates
8	Fallback to GES ephemeris
9	Fallback to GEONS ephemeris
10	Fallback to PVT ephemeris
11	Fallback to OBP ephemeris
12	Spare (always 0)
13	Spare (always 0)
14	Spare (always 0)
15	Spare (always 0)

**SCorientation** (2-byte integer, array size: nscan1):

The positive angle of the spacecraft vector ( $v$ ) from the satellite forward direction of motion, measured clockwise facing down. We define  $v$  in the same direction as the spacecraft axis  $+X$ , which is also the center of the GMI scan. If SCorientation is not 0 or 180, a bit is set to 1 in modeStatus.

Value	Meaning
0	+X forward (yaw 0)
180	-X forward (yaw 180)
-8000	Non-nominal pointing
-9999	Missing

**pointingStatus** (2-byte integer, array size: nscan1):

pointingStatus is provided by the geo Toolkit. A value of zero means the pointing is good. Non-zero values indicate non-nominal pointing. If pointingStatus is non-zero, a bit in modeStatus is set to 1.

Value	Meaning
0	Nominal pointing in Mission Science Mode
1	GPS point solution stale and PVT ephemeris used
2	GEONS solution stale and GEONS ephemeris used
-8000	Non-nominal mission science orientation
-9999	Missing

**acsModeMidScan** (1-byte integer, array size: nscan1):

acsModeMidScan is provided by the geo Toolkit as taken from Attitude Control System telemetry and is provided in this format for information only.

Value	Meaning
0	LAUNCH
1	RATENULL
2	SUNPOINT
3	GSPM (Gyro-less Sun Point)
4	MSM (Mission Science Mode)
5	SLEW
6	DELTAH
7	DELTAV
-99	UNKNOWN -- ACS mode unavailable

**targetSelectionMidScan** (1-byte integer, array size: nscan1):

targetSelectionMidScan is provided by the geo Toolkit as taken from Attitude Control System telemetry and is provided in this format for information only.

Value	Meaning
0	S/C Z axis nadir, +X in flight direction
1	Flight Z axis nadir, +X in flight direction
2	S/C Z axis nadir, -X in flight direction
3	Flight Z axis nadir, -X in flight direction
4	+90 yaw for DPR antenna pattern calibration
5	-90 yaw for DPR antenna pattern calibration
-99	Missing

**operationalMode** (1-byte integer, array size: nscan1):

Status of the GMI instrument.

Bit	Meaning if bit = 1
0	Receiver status (0=ON, 1=OFF)
1	Spinup Status (0=ON, 1=OFF)

**FractionalGranuleNumber** (8-byte float, array size: nscan1):

The floating point granule number. The granule begins at the Southern-most point of the spacecraft's trajectory. For example, FractionalGranuleNumber = 10.5 means the spacecraft is halfway through granule 10 and starting the descending half of the granule. Values range from 0 to 100000. Special values are defined as:

-9999.9 Missing value

**ephemerisUsed** (1-byte char, array size: dim10 x nscan1):

The ephemeris source used to geolocate the swath. Special values are defined as:

255 Missing value

## navigation (Group in S1)

**scPos** (4-byte float, array size: XYZ x nscan1):

The position vector(m) of the spacecraft in Earth-Centered Earth Fixed (ECEF) Coordinates at the Scan mid-Time (i.e., time at the middle pixel/IFOV of the active scan period). Values range from -10000000 to 10000000 m. Special values are defined as:

-9999.9 Missing value

**scVel** (4-byte float, array size: XYZ x nscan1):

The velocity vector ( $ms^{-1}$ ) of the spacecraft in ECEF Coordinates at the Scan mid-Time. Values range from -10000000 to 10000000 m/s. Special values are defined as:

-9999.9 Missing value

**scLat** (4-byte float, array size: nscan1):

The geodetic latitude (decimal degrees) of the spacecraft at the Scan mid-Time. Values range from -70 to 70 degrees. Special values are defined as:

-9999.9 Missing value

**scLon** (4-byte float, array size: nscan1):

The geodetic longitude (decimal degrees) of the spacecraft at the Scan mid-Time. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAlt** (4-byte float, array size: nscan1):

The altitude (m) of the spacecraft above the Earth Ellipsoid at the Scan mid-Time. Values range from 350000 to 500000 m. Special values are defined as:

-9999.9 Missing value

**dprAlt** (4-byte float, array size: nscan1):

The altitude (m) of the spacecraft above the Earth Ellipsoid at the Scan mid-Time from DPR science telemetry. This is empty in non-DPR products. Values range from 350000 to 500000 m. Special values are defined as:

-9999.9 Missing value

**scAttRollGeoc** (4-byte float, array size: nscan1):

The geocentric satellite attitude Euler roll angle (degrees) at the Scan mid-Time. The order of the components in the file is roll, pitch, and yaw. However, the angles are computed using a 3-2-1 Euler rotation sequence representing the rotation order yaw, pitch, and roll for the rotation from Orbital Coordinates to the spacecraft body coordinates. Orbital Coordinates represent an orthogonal triad in Geocentric Inertial Coordinates where the Z-axis is toward the geocentric nadir, the Y-axis is perpendicular to the spacecraft velocity opposite the orbit normal direction, and the X-axis is approximately in the velocity direction for a near circular orbit. Note this is geocentric, not geodetic, referenced, so that pitch and roll will have twice orbital frequency components due to the onboard control system following the oblate geodetic Earth horizon. Note also that the yaw value will

show an orbital frequency component relative to the Earth fixed ground track due to the Earth rotation relative to inertial coordinates. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttPitchGeoc** (4-byte float, array size: nscan1):

The geocentric satellite attitude Euler pitch angle (degrees) at the Scan mid-Time. . Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttYawGeoc** (4-byte float, array size: nscan1):

The geocentric satellite attitude Euler yaw angle (degrees) at the Scan mid-Time. Values range from -135 to 225 degrees. Special values are defined as:

-9999.9 Missing value

**scAttRollGeod** (4-byte float, array size: nscan1):

The geodetic satellite attitude Euler roll angle (degrees) at the Scan mid-Time. The order of the components in the file is roll, pitch, and yaw. However, the angles are computed using a 3-2-1 Euler rotation sequence representing the rotation order yaw, pitch, and roll for the rotation from Geodetic Coordinates to the spacecraft body coordinates. Geodetic Coordinates represent an orthogonal triad in Geocentric Inertial Coordinates where the Z-axis is toward the geodetic nadir, the Y-axis is perpendicular to the spacecraft velocity opposite the orbit normal direction, and the X-axis is approximately in the velocity direction for a near circular orbit. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttPitchGeod** (4-byte float, array size: nscan1):

The geodetic satellite attitude Euler pitch angle (degrees) at the Scan mid-Time. . Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttYawGeod** (4-byte float, array size: nscan1):

The geodetic satellite attitude Euler yaw angle (degrees) at the Scan mid-Time. Values range from -135 to 225 degrees. Special values are defined as:

-9999.9 Missing value

**greenHourAng** (4-byte float, array size: nscan1):

The rotation angle (degrees) from Geocentric Inertial Coordinates to Earth Fixed Coordinates. Values range from 0 to 360 degrees. Special values are defined as:

-9999.9 Missing value

**timeMidScan** (8-byte float, array size: nscan1):

The Scan mid-Time in GPS Atomic time, namely the seconds since 0000 UTC, 6 Jan 1980. timeMidScan is used as the reference time for the scPos and scVel values. Values range from 0 to 10000000000 s. Special values are defined as:

-9999.9 Missing value

**timeMidScanOffset** (8-byte float, array size: nscan1):

Offset from the secondary header packet time to the timeMidScan. Values range from 0 to 100 s. Special values are defined as:

-9999.9 Missing value

## **sunData** (Group in S1)

**solarBetaAngle** (4-byte float, array size: nscan1):

Sun direction elevation from the orbit plane, positive toward orbit normal which is given by the cross product of the spacecraft position and velocity vectors. Values range from -89.0 to 89.0 degrees. Special values are defined as:

-9999.9 Missing value

**phaseFromOrbitMidnight** (4-byte float, array size: nscan1):

Phase angle of the Sun direction around the orbit plane, with zero phase in the direction of the Earth center from the spacecraft and positive toward the spacecraft velocity direction so the phase increases with time. Zero phase occurs at local orbit midnight, 90 degrees occurs with the spacecraft over the Earth's dawn terminator, 180 degrees occurs at local orbit noon, and -90 degrees occurs with the spacecraft over the Earth's dusk terminator. Values range from -180.0 to 180.0 degrees. Special values are defined as:

-9999.9 Missing value

**sunEarthSeparation** (4-byte float, array size: nscan1):

The separation angle between the Sun and Earth directions from the spacecraft. Values range from 0 to 180.0 degrees. Special values are defined as:

-9999.9 Missing value

**earthAngularRadius** (4-byte float, array size: nscan1):

The angle between the center of the Earth and the horizon edge. The sun is above the Earth horizon when the sunEarthSeparation is greater than the earthAngularRadius. Values range from 69.0 to 80.0 degrees. Special values are defined as:

-9999.9 Missing value

**phaseOfEclipseExit** (4-byte float, array size: nscan1):

The estimated phaseFromOrbitMidnight where the spacecraft leaves the Earth shadow, based on the instantaneous solarBetaAngle and earthAngularRadius. Values range from 0.0 to 80.0 degrees. Special values are defined as:

-9999.9 Missing value

**orbitRate** (4-byte float, array size: nscan1):

The instantaneous angular rate of the spacecraft around the orbit. Values range from 0.064 to 0.07 degrees/s. Special values are defined as:

-9999.9 Missing value

**timeSinceEclipseEntry** (4-byte float, array size: nscan1):

The estimated duration in seconds since the last entry into the Earth's shadow. Values

range from 0 to 5600.0 s. Special values are defined as:

-9999.9 Missing value

**sunVectorInBodyFrame** (4-byte float, array size: 3 x nscan1):

The unit sun vector direction in the TMI instrument body coordinate frame, defined such that +Z is nominally toward the Earth and gives the instrument spin axis, and data is collected nominally centered about the +X direction. Values range from 0 to 1.0. Special values are defined as:

-9999.9 Missing value

**incidenceAngle** (4-byte float, array size: npixelelev x nscan1):

The angle at the center of the IFOV between the antenna boresight vector and the zenith vector normal to the Earth Ellipsoid. Also known as Satellite Zenith Angle. Values range from 0 to 90 degrees. Special values are defined as:

-9999.9 Missing value

**satAzimuthAngle** (4-byte float, array size: npixelelev x nscan1):

The angle clockwise looking down between the local pixel geodetic north and the direction to the satellite. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**solarZenAngle** (4-byte float, array size: npixelelev x nscan1):

The angle between the local pixel geodetic zenith and the direction to the sun. Values range from 0 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**solarAzimuthAngle** (4-byte float, array size: npixelelev x nscan1):

The angle clockwise looking down between the local pixel geodetic north and the direction to the sun. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**sunGlintAngle** (4-byte float, array size: npixelelev x nscan1):

Conceptually, the angle between the sun and the instrument view direction as reflected off the Earth's surface. More specifically, define a Sun Vector from the viewed pixel location on the earth ellipsoid-model surface to the sun. Also define an Inverse Satellite Vector from the pixel to the satellite. Then reflect the Inverse Satellite Vector off the earth's surface at the pixel location to form the Reflected Satellite View Vector. sunGlintAngle is the angular separation between the Reflected Satellite View Vector and the Sun Vector. When sunGlintAngle is zero, the instrument views the center of the specular (mirror-like) sun reflection. Values range from 0 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**moonVectorInstFrame** (4-byte float, array size: GMIxyz x nscan1):

The x, y, z components of the moon vector in the GMI instrument coordinate system. Values are in counts. Special values are defined as:

-9999.9 Missing value

**earthView** (2-byte unsigned integer, array size: nchannel1 x npixelelev x nscan1):

Earth view counts.

Special values are defined as:

0 Missing value

**hotLoad** (2-byte unsigned integer, array size: nchannel1 x npixelht x nscan1):

Hot load counts.

Special values are defined as:

0 Missing value

**coldSky** (2-byte unsigned integer, array size: nchannel1 x npixelcs x nscan1):

Cold sky counts.

Special values are defined as:

0 Missing value

**earthViewBlanking** (1-byte char, array size: VH x npixelev x nscan1):

Earth view blanking counts.

Special values are defined as:

0 Missing value

**hotLoadBlanking** (1-byte char, array size: VH x npixelht x nscan1):

Hot load blanking counts.

Special values are defined as:

0 Missing value

**coldSkyBlanking** (1-byte char, array size: VH x npixelcs x nscan1):

Cold sky blanking counts.

Special values are defined as:

0 Missing value

## **S2** (Swath)

### **S2\_SwathHeader** (Metadata):

SwathHeader contains metadata for swaths. This group appears in Level 1 and Level 2 data products. See Metadata for GPM Products for details.

### **ScanTime** (Group in S2)

A UTC time associated with the scan.

#### **Year** (2-byte integer, array size: nscan2):

4-digit year, e.g., 1998. Values range from 1950 to 2100 years. Special values are defined as:

-9999 Missing value

#### **Month** (1-byte integer, array size: nscan2):

Month of the year. Values range from 1 to 12 months. Special values are defined as:

-99 Missing value

#### **DayOfMonth** (1-byte integer, array size: nscan2):

Day of the month. Values range from 1 to 31 days. Special values are defined as:

-99 Missing value

#### **Hour** (1-byte integer, array size: nscan2):

UTC hour of the day. Values range from 0 to 23 hours. Special values are defined as:

-99 Missing value

#### **Minute** (1-byte integer, array size: nscan2):

Minute of the hour. Values range from 0 to 59 minutes. Special values are defined as:

-99 Missing value

#### **Second** (1-byte integer, array size: nscan2):

Second of the minute. Values range from 0 to 60 s. Special values are defined as:

-99 Missing value

#### **MilliSecond** (2-byte integer, array size: nscan2):

Thousandths of the second. Values range from 0 to 999 ms. Special values are defined as:

-9999 Missing value

#### **DayOfYear** (2-byte integer, array size: nscan2):

Day of the year. Values range from 1 to 366 days. Special values are defined as:

-9999 Missing value



**SecondOfDay** (8-byte float, array size: nscan2):

A time associated with the scan. scanTime\_sec is expressed as the UTC seconds of the day. Values range from 0 to 86400 s. Special values are defined as:

-9999.9 Missing value

**Latitude** (4-byte float, array size: npixlev x nscan2):

The earth latitude of the center of the IFOV at the altitude of the earth ellipsoid. Latitude is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:

-9999.9 Missing value

**Longitude** (4-byte float, array size: npixlev x nscan2):

The earth longitude of the center of the IFOV at the altitude of the earth ellipsoid. Longitude is positive east, negative west. A point on the 180th meridian has the value -180 degrees. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

## **scanStatus** (Group in S2)

**dataQuality** (1-byte integer, array size: nscan2):

A summary of data quality in the scan. Unless this is 0 (normal), the scan data is meaningless to higher precipitation processing. Bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0, the unsigned integer value is  $2^{**i}$ ).

Bit	Meaning if bit = 1
0	missing
5	geoError is not zero
6	modeStatus is not zero

**missing** (1-byte integer, array size: nscan2):

Indicates whether information is contained in the scan data. The values are:

Bit	Meaning if bit = 1
0	Scan is missing
1	Science telemetry packet missing
2	Science telemetry segment within packet missing
3	Science telemetry other missing
4	Housekeeping (HK) telemetry packet missing
5	Spare (always 0)
6	Spare (always 0)
7	Spare (always 0)

**modeStatus** (1-byte integer, array size: nscan2):

A summary of status modes. If all status modes are routine, all bits in modeStatus = 0. Routine means that scan data has been measured in the normal operational situation as far as the status modes are concerned. modeStatus does not assess geolocation quality. modeStatus is broken into 8 bit flags. Each bit = 0 if the status is routine but the bit = 1 if the status is not routine. Bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0, the unsigned integer value is  $2^{*i}$ ). The non-routine situations follow:

Bit	Meaning if bit = 1
0	Spare (always 0)
1	SCorientation not 0 or 180
2	pointingStatus not 0
3	Spare (always 0)
4	Non-routine operationalMode
5	Spare (always 0)
6	Spare (always 0)
7	Spare (always 0)

**geoError** (2-byte integer, array size: nscan2):

A summary of geolocation errors in the scan. geoError is used to set a bit in dataQuality. A zero integer value of geoError indicates 'good' geolocation. A non-zero value broken down into the bit flags below indicates the specified reason, where bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0 the unsigned integer value is  $2^{*i}$ ).

Bits 0, 4, 5, 8 and 9 are per pixel error flags. If the number of bad pixels (for any of the reasons specified by these flags) is greater than the threshold then bit 7 = 1 and each of these flags is set to 1 if any pixel is bad for that reason. At launch this threshold is zero, so data is flagged if any pixel is bad. If the number of bad pixels is less than or equal to the threshold then bit 7 = 0 and all of these flags are also 0.

Bit	Meaning if bit = 1
0	Latitude limit exceeded for viewed pixel locations
1	Negative scan time, invalid input
2	Error getting spacecraft attitude at scan mid-time
3	Error getting spacecraft ephemeris at scan mid-time
4	Invalid input non-unit ray vector for any pixel
5	Ray misses Earth for any pixel with normal pointing
6	Nadir calculation error for subsatellite position
7	Pixel count with geolocation error over threshold
8	Error in getting spacecraft attitude for any pixel
9	Error in getting spacecraft ephemeris for any pixel
10	Spare (always 0)
11	Spare (always 0)
12	Spare (always 0)

- 13 Spare (always 0)
- 14 Spare (always 0)
- 15 Spare (always 0)

**geoWarning** (2-byte integer, array size: nscan2):

A summary of geolocation warnings in the scan. geoWarning does not set a bit in dataQuality. Warnings indicate unusual conditions. These conditions do not indicate bad geolocation but are flagged as a warning that further review of the data may be useful. A zero integer value indicates usual geolocation. A non-zero value broken down into the following bit flags indicates the following, where bit 0 is the least significant bit (i.e., if bit  $i = 1$  and other bits = 0 the unsigned integer value is  $2^{*i}$ ):

- | Bit | Meaning if bit = 1                               |
|-----|--|
| 0   | Ephemeris Gap Interpolated                       |
| 1   | Attitude Gap Interpolated                        |
| 2   | Attitude jump/discontinuity                      |
| 3   | Attitude out of range                            |
| 4   | Anomalous Time Step                              |
| 5   | GHA not calculated due to error                  |
| 6   | SunData (Group) not calculated due to error      |
| 7   | Failure to calculate Sun in inertial coordinates |
| 8   | Fallback to GES ephemeris                        |
| 9   | Fallback to GEONS ephemeris                      |
| 10  | Fallback to PVT ephemeris                        |
| 11  | Fallback to OBP ephemeris                        |
| 12  | Spare (always 0)                                 |
| 13  | Spare (always 0)                                 |
| 14  | Spare (always 0)                                 |
| 15  | Spare (always 0)                                 |

**SCorientation** (2-byte integer, array size: nscan2):

The positive angle of the spacecraft vector ( $v$ ) from the satellite forward direction of motion, measured clockwise facing down. We define  $v$  in the same direction as the spacecraft axis  $+X$ , which is also the center of the GMI scan. If SCorientation is not 0 or 180, a bit is set to 1 in modeStatus.

- | Value | Meaning              |
|-------|----------------------|
| 0     | +X forward (yaw 0)   |
| 180   | -X forward (yaw 180) |
| -8000 | Non-nominal pointing |
| -9999 | Missing              |

**pointingStatus** (2-byte integer, array size: nscan2):

pointingStatus is provided by the geo Toolkit. A value of zero means the pointing is

good. Non-zero values indicate non-nominal pointing. If pointingStatus is non-zero, a bit in modeStatus is set to 1.

Value	Meaning
0	Nominal pointing in Mission Science Mode
1	GPS point solution stale and PVT ephemeris used
2	GEONS solution stale and GEONS ephemeris used
-8000	Non-nominal mission science orientation
-9999	Missing

**acsModeMidScan** (1-byte integer, array size: nscan2):

acsModeMidScan is provided by the geo Toolkit as taken from Attitude Control System telemetry and is provided in this format for information only.

Value	Meaning
0	LAUNCH
1	RATENULL
2	SUNPOINT
3	GSPM (Gyro-less Sun Point)
4	MSM (Mission Science Mode)
5	SLEW
6	DELTAH
7	DELTAV
-99	UNKNOWN -- ACS mode unavailable

**targetSelectionMidScan** (1-byte integer, array size: nscan2):

targetSelectionMidScan is provided by the geo Toolkit as taken from Attitude Control System telemetry and is provided in this format for information only.

Value	Meaning
0	S/C Z axis nadir, +X in flight direction
1	Flight Z axis nadir, +X in flight direction
2	S/C Z axis nadir, -X in flight direction
3	Flight Z axis nadir, -X in flight direction
4	+90 yaw for DPR antenna pattern calibration
5	-90 yaw for DPR antenna pattern calibration
-99	Missing

**operationalMode** (1-byte integer, array size: nscan2):

Status of the GMI instrument.

Bit	Meaning if bit = 1
0	Receiver status (0=ON, 1=OFF)
1	Spinup Status (0=ON, 1=OFF)

**FractionalGranuleNumber** (8-byte float, array size: nscan2):

The floating point granule number. The granule begins at the Southern-most point of the spacecraft's trajectory. For example, FractionalGranuleNumber = 10.5 means the spacecraft is halfway through granule 10 and starting the descending half of the granule. Values range from 0 to 100000. Special values are defined as:

-9999.9 Missing value

**ephemerisUsed** (1-byte char, array size: dim10 x nscan1):

The ephemeris source used to geolocate the swath. Special values are defined as:

255 Missing value

## **navigation** (Group in S2)

**scPos** (4-byte float, array size: XYZ x nscan2):

The position vector(m) of the spacecraft in Earth-Centered Earth Fixed (ECEF) Coordinates at the Scan mid-Time (i.e., time at the middle pixel/IFOV of the active scan period). Values range from -10000000 to 10000000 m. Special values are defined as:

-9999.9 Missing value

**scVel** (4-byte float, array size: XYZ x nscan2):

The velocity vector ( $m s^{-1}$ ) of the spacecraft in ECEF Coordinates at the Scan mid-Time. Values range from -10000000 to 10000000 m/s. Special values are defined as:

-9999.9 Missing value

**scLat** (4-byte float, array size: nscan2):

The geodetic latitude (decimal degrees) of the spacecraft at the Scan mid-Time. Values range from -70 to 70 degrees. Special values are defined as:

-9999.9 Missing value

**scLon** (4-byte float, array size: nscan2):

The geodetic longitude (decimal degrees) of the spacecraft at the Scan mid-Time. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAlt** (4-byte float, array size: nscan2):

The altitude (m) of the spacecraft above the Earth Ellipsoid at the Scan mid-Time. Values range from 350000 to 500000 m. Special values are defined as:

-9999.9 Missing value

**dprAlt** (4-byte float, array size: nscan2):

The altitude (m) of the spacecraft above the Earth Ellipsoid at the Scan mid-Time from DPR science telemetry. This is empty in non-DPR products. Values range from 350000 to 500000 m. Special values are defined as:

-9999.9 Missing value

**scAttRollGeoc** (4-byte float, array size: nscan2):

The geocentric satellite attitude Euler roll angle (degrees) at the Scan mid-Time. The order of the components in the file is roll, pitch, and yaw. However, the angles are computed using a 3-2-1 Euler rotation sequence representing the rotation order yaw, pitch, and roll for the rotation from Orbital Coordinates to the spacecraft body coordinates. Orbital Coordinates represent an orthogonal triad in Geocentric Inertial Coordinates where the Z-axis is toward the geocentric nadir, the Y-axis is perpendicular to the spacecraft velocity opposite the orbit normal direction, and the X-axis is approximately in the velocity direction for a near circular orbit. Note this is geocentric, not geodetic, referenced, so that pitch and roll will have twice orbital frequency components due to the onboard control system following the oblate geodetic Earth horizon. Note also that the yaw value will show an orbital frequency component relative to the Earth fixed ground track due to the Earth rotation relative to inertial coordinates. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttPitchGeoc** (4-byte float, array size: nscan2):

The geocentric satellite attitude Euler pitch angle (degrees) at the Scan mid-Time. . Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttYawGeoc** (4-byte float, array size: nscan2):

The geocentric satellite attitude Euler yaw angle (degrees) at the Scan mid-Time. Values range from -135 to 225 degrees. Special values are defined as:

-9999.9 Missing value

**scAttRollGeod** (4-byte float, array size: nscan2):

The geodetic satellite attitude Euler roll angle (degrees) at the Scan mid-Time. The order of the components in the file is roll, pitch, and yaw. However, the angles are computed using a 3-2-1 Euler rotation sequence representing the rotation order yaw, pitch, and roll for the rotation from Geodetic Coordinates to the spacecraft body coordinates. Geodetic Coordinates represent an orthogonal triad in Geocentric Inertial Coordinates where the Z-axis is toward the geodetic nadir, the Y-axis is perpendicular to the spacecraft velocity opposite the orbit normal direction, and the X-axis is approximately in the velocity direction for a near circular orbit. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttPitchGeod** (4-byte float, array size: nscan2):

The geodetic satellite attitude Euler pitch angle (degrees) at the Scan mid-Time. . Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**scAttYawGeod** (4-byte float, array size: nscan2):

The geodetic satellite attitude Euler yaw angle (degrees) at the Scan mid-Time. Values range from -135 to 225 degrees. Special values are defined as:

-9999.9 Missing value

**greenHourAng** (4-byte float, array size: nscan2):

The rotation angle (degrees) from Geocentric Inertial Coordinates to Earth Fixed Coordinates. Values range from 0 to 360 degrees. Special values are defined as:

-9999.9 Missing value

**timeMidScan** (8-byte float, array size: nscan2):

The Scan mid-Time in GPS Atomic time, namely the seconds since 0000 UTC, 6 Jan 1980. timeMidScan is used as the reference time for the scPos and scVel values. Values range from 0 to 10000000000 s. Special values are defined as:

-9999.9 Missing value

**timeMidScanOffset** (8-byte float, array size: nscan2):

Offset from the secondary header packet time to the timeMidScan. Values range from 0 to 100 s. Special values are defined as:

-9999.9 Missing value

## **sunData** (Group in S2)

**solarBetaAngle** (4-byte float, array size: nscan2):

Sun direction elevation from the orbit plane, positive toward orbit normal which is given by the cross product of the spacecraft position and velocity vectors. Values range from -89.0 to 89.0 degrees. Special values are defined as:

-9999.9 Missing value

**phaseFromOrbitMidnight** (4-byte float, array size: nscan2):

Phase angle of the Sun direction around the orbit plane, with zero phase in the direction of the Earth center from the spacecraft and positive toward the spacecraft velocity direction so the phase increases with time. Zero phase occurs at local orbit midnight, 90 degrees occurs with the spacecraft over the Earth's dawn terminator, 180 degrees occurs at local orbit noon, and -90 degrees occurs with the spacecraft over the Earth's dusk terminator. Values range from -180.0 to 180.0 degrees. Special values are defined as:

-9999.9 Missing value

**sunEarthSeparation** (4-byte float, array size: nscan2):

The separation angle between the Sun and Earth directions from the spacecraft. Values range from 0 to 180.0 degrees. Special values are defined as:

-9999.9 Missing value

**earthAngularRadius** (4-byte float, array size: nscan2):

The angle between the center of the Earth and the horizon edge. The sun is above the Earth horizon when the sunEarthSeparation is greater than the earthAngularRadius. Values range from 69.0 to 80.0 degrees. Special values are defined as:

-9999.9 Missing value

**phaseOfEclipseExit** (4-byte float, array size: nscan2):

The estimated phaseFromOrbitMidnight where the spacecraft leaves the Earth shadow,

based on the instantaneous solarBetaAngle and earthAngularRadius. Values range from 0.0 to 80.0 degrees. Special values are defined as:

-9999.9 Missing value

**orbitRate** (4-byte float, array size: nscan2):

The instantaneous angular rate of the spacecraft around the orbit. Values range from 0.064 to 0.07 degrees/s. Special values are defined as:

-9999.9 Missing value

**timeSinceEclipseEntry** (4-byte float, array size: nscan2):

The estimated duration in seconds since the last entry into the Earth's shadow. Values range from 0 to 5600.0 s. Special values are defined as:

-9999.9 Missing value

**sunVectorInBodyFrame** (4-byte float, array size: 3 x nscan2):

The unit sun vector direction in the TMI instrument body coordinate frame, defined such that +Z is nominally toward the Earth and gives the instrument spin axis, and data is collected nominally centered about the +X direction. Values range from 0 to 1.0. Special values are defined as:

-9999.9 Missing value

**incidenceAngle** (4-byte float, array size: npixelelev x nscan2):

The angle at the center of the IFOV between the antenna boresight vector and the zenith vector normal to the Earth Ellipsoid. Also known as Satellite Zenith Angle. Values range from 0 to 90 degrees. Special values are defined as:

-9999.9 Missing value

**satAzimuthAngle** (4-byte float, array size: npixelelev x nscan2):

The angle clockwise looking down between the local pixel geodetic north and the direction to the satellite. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**solarZenAngle** (4-byte float, array size: npixelelev x nscan2):

The angle between the local pixel geodetic zenith and the direction to the sun. Values range from 0 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**solarAzimuthAngle** (4-byte float, array size: npixelelev x nscan2):

The angle clockwise looking down between the local pixel geodetic north and the direction to the sun. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**sunGlintAngle** (4-byte float, array size: npixelelev x nscan2):

Conceptually, the angle between the sun and the instrument view direction as reflected off the Earth's surface. More specifically, define a Sun Vector from the viewed pixel location on the earth ellipsoid-model surface to the sun. Also define an Inverse Satellite Vector from the pixel to the satellite. Then reflect the Inverse Satellite Vector off the earth's surface at the pixel location to form the Reflected Satellite View Vector. sunGlintAngle is the angular separation between the Reflected Satellite View Vector and the Sun Vector.



When sunGlintAngle is zero, the instrument views the center of the specular (mirror-like) sun reflection. Values range from 0 to 180 degrees. Special values are defined as:

-9999.9 Missing value

**moonVectorInstFrame** (4-byte float, array size: GMIxyz x nscan2):

The x, y, z components of the moon vector in the GMI instrument coordinate system. Values are in counts. Special values are defined as:

-9999.9 Missing value

**earthView** (2-byte unsigned integer, array size: nchannel2 x npixelev x nscan2):

Earth view counts.

Special values are defined as:

0 Missing value

**hotLoad** (2-byte unsigned integer, array size: nchannel2 x npixelht x nscan2):

Hot load counts.

Special values are defined as:

0 Missing value

**coldSky** (2-byte unsigned integer, array size: nchannel2 x npixelcs x nscan2):

Cold sky counts.

Special values are defined as:

0 Missing value

## **S3** (Swath)

**S3\_SwathHeader** (Metadata):

SwathHeader contains metadata for swaths. This group appears in Level 1 and Level 2 data products. See Metadata for GPM Products for details.

**ScanTime** (Group in S3)

A UTC time associated with the scan.

**Year** (2-byte integer, array size: nscan2):

4-digit year, e.g., 1998. Values range from 1950 to 2100 years. Special values are defined as:

-9999 Missing value

**Month** (1-byte integer, array size: nscan2):

Month of the year. Values range from 1 to 12 months. Special values are defined as:

-99 Missing value

**DayOfMonth** (1-byte integer, array size: nscan2):

Day of the month. Values range from 1 to 31 days. Special values are defined as:

-99 Missing value

**Hour** (1-byte integer, array size: nscan2):

UTC hour of the day. Values range from 0 to 23 hours. Special values are defined as:

-99 Missing value

**Minute** (1-byte integer, array size: nscan2):

Minute of the hour. Values range from 0 to 59 minutes. Special values are defined as:

-99 Missing value

**Second** (1-byte integer, array size: nscan2):

Second of the minute. Values range from 0 to 60 s. Special values are defined as:

-99 Missing value

**MilliSecond** (2-byte integer, array size: nscan2):

Thousandths of the second. Values range from 0 to 999 ms. Special values are defined as:

-9999 Missing value

**DayOfYear** (2-byte integer, array size: nscan2):

Day of the year. Values range from 1 to 366 days. Special values are defined as:

-9999 Missing value

**SecondOfDay** (8-byte float, array size: nscan2):

A time associated with the scan. scanTime\_sec is expressed as the UTC seconds of the day. Values range from 0 to 86400 s. Special values are defined as:

-9999.9 Missing value

**ephemerisUsed** (1-byte char, array size: dim10 x nscan1):

The ephemeris source used to geolocate the swath. Special values are defined as:

255 Missing value

**Latitude** (4-byte float, array size: nscan2):

The earth latitude of the center of the IFOV at the altitude of the earth ellipsoid. Latitude is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:

-9999.9 Missing value

**Longitude** (4-byte float, array size: nscan2):

The earth longitude of the center of the IFOV at the altitude of the earth ellipsoid. Longitude is positive east, negative west. A point on the 180th meridian has the value

-180 degrees. Values range from -180 to 180 degrees. Special values are defined as:  
-9999.9 Missing value

### **TAM1** (Group in S3)

**timeOffset** (4-byte float, array size: nscan2):

Time offset between magnetometer and scan time. Values range from -100 to 100 s.  
Special values are defined as:

-9999.9 Missing value

**Vx** (2-byte unsigned integer, array size: nscan2):

Magnetometer one vector, x component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

**Vy** (2-byte unsigned integer, array size: nscan2):

Magnetometer one vector, y component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

**Vz** (2-byte unsigned integer, array size: nscan2):

Magnetometer one vector, z component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

### **TAM2** (Group in S3)

**timeOffset** (4-byte float, array size: nscan2):

Time offset between magnetometer and scan time. Values range from -100 to 100 s.  
Special values are defined as:

-9999.9 Missing value

**Vx** (2-byte unsigned integer, array size: nscan2):

Magnetometer two vector, x component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

**Vy** (2-byte unsigned integer, array size: nscan2):

Magnetometer two vector, y component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

**Vz** (2-byte unsigned integer, array size: nscan2):

Magnetometer two vector, z component. Values range from 0 to 65535 count. Special

values are defined as:  
65535 Missing value

## **TORQUE\_BAR** (Group in S3)

**timeOffset** (4-byte float, array size: nscan2):

Time offset between torque bar and scan time. Values range from -100 to 100 s. Special values are defined as:

-9999.9 Missing value

**Vx** (2-byte unsigned integer, array size: nscan2):

Torque bar vector, x component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

**Vy** (2-byte unsigned integer, array size: nscan2):

Torque bar vector, y component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

**Vz** (2-byte unsigned integer, array size: nscan2):

Torque bar vector, z component. Values range from 0 to 65535 count. Special values are defined as:

65535 Missing value

## **GMI\_TEMPERATURES** (Group in S3)

**timeOffset** (4-byte float, array size: nscan2):

Time offset between thermistors and scan time. Values range from -100 to 100 s. Special values are defined as:

-9999.9 Missing value

**apid** (2-byte unsigned integer, array size: nscan2):

APID. 0 is the missing value.

**SMA\_PT\_TEMP** (2-byte unsigned integer, array size: nscan2):

SMA\_PT\_TEMP. 0 is the missing value.

**ICA\_PT\_TEMP** (2-byte unsigned integer, array size: nscan2):

ICA\_PT\_TEMP. 0 is the missing value.

**RS\_PT\_TEMP** (2-byte unsigned integer, array size: nscan2):

RS\_PT\_TEMP. 0 is the missing value.

**STAT\_PT\_TEMP** (2-byte unsigned integer, array size: nscan2):  
STAT\_PT\_TEMP. 0 is the missing value.

**MR\_PT\_TEMP** (2-byte unsigned integer, array size: nscan2):  
MR\_PT\_TEMP. 0 is the missing value.

### **primaryHeader** (Group in S3)

**version** (1-byte integer, array size: nscan2):

**type** (1-byte integer, array size: nscan2):

**secHeaderFlag** (1-byte integer, array size: nscan2):

**APID** (2-byte integer, array size: nscan2):

**sequenceFlag** (1-byte integer, array size: nscan2):

**packetSequenceCount** (2-byte integer, array size: nscan2):

**packetLength** (2-byte unsigned integer, array size: nscan2):

**instrTimeSeconds** (4-byte unsigned integer, array size: nscan2):

**instrTimeSubseconds** (2-byte unsigned integer, array size: nscan2):

**numPacketSegments** (1-byte integer, array size: nscan2):

**spare** (1-byte integer, array size: nscan2):

**RDRversion** (2-byte integer, array size: nscan2):

### **GSDR\_TIME** (Group in S3)

**G\_TC\_PULSE\_SECS** (4-byte unsigned integer, array size: nscan2):  
GMI Instrument Time Code Pulse Timestamp (Seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TC\_PULSE\_SUBS** (2-byte unsigned integer, array size: nscan2):  
GMI Instrument Time Code Pulse Timestamp (Sub-Seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TCU\_SECS** (4-byte unsigned integer, array size: nscan2):  
S/C Time Code Update (Seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TCU\_SUBS** (4-byte unsigned integer, array size: nscan2):  
S/C Time Code Update (Sub-Seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TCF\_SC\_SECS** (4-byte unsigned integer, array size: nscan2):  
Time Correlation Factor spacecraft timestamp (Seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TCF\_SC\_SUBSEC** (4-byte unsigned integer, array size: nscan2):  
Time Correlation Factor spacecraft timestamp (Sub-seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TCF\_SECS** (4-byte unsigned integer, array size: nscan2):  
Time Correlation Factor (Seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TCF\_SUBSECS** (4-byte unsigned integer, array size: nscan2):  
Time Correlation Factor (Sub-seconds) \*/ Special values are defined as:  
0 Missing value

**G\_TCF\_SIGN** (2-byte unsigned integer, array size: nscan2):  
Time Correlation Factor (Sign) \*/ Special values are defined as:  
0 Missing value

**G\_TCF\_LEAP** (2-byte unsigned integer, array size: nscan2):  
Time Correlation Factor (Leap Seconds) \*/ Special values are defined as:  
0 Missing value

**GPS\_TCU\_SECS** (4-byte unsigned integer, array size: nscan2):  
S/C Time Code Update in GPS time (Seconds) \*/ Special values are defined as:  
0 Missing value

**GPS\_TCU\_SUBS** (4-byte unsigned integer, array size: nscan2):  
S/C Time Code Update in GPS time (Sub-Seconds) \*/ Special values are defined as:  
0 Missing value

## SENSOR\_INFO (Group in S3)

**KEEP\_ALIVE\_CNT** (4-byte unsigned integer, array size: nscan2):

Keep Alive Counter \*/ Special values are defined as:

0 Missing value

**FPGA\_RST\_REASON** (2-byte unsigned integer, array size: nscan2):

Reason for last reset \*/ Special values are defined as:

0 Missing value

**CRASH\_REASON** (2-byte unsigned integer, array size: nscan2):

Reason for last crash \*/ Special values are defined as:

0 Missing value

**VERSION\_MIN** (2-byte unsigned integer, array size: nscan2):

GMI FSW minor version number \*/ Special values are defined as:

0 Missing value

**VERSION\_MAJ** (2-byte unsigned integer, array size: nscan2):

GMI FSW major version number \*/ Special values are defined as:

0 Missing value

**FPGA\_MODE** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**ERR\_HDL\_FAILURE** (2-byte unsigned integer, array size: nscan2):

Error Handler Failure Flag \*/ Special values are defined as:

0 Missing value

**RESET\_REASON** (2-byte unsigned integer, array size: nscan2):

Reason for last reset \*/ Special values are defined as:

0 Missing value

**BOOT\_BANK** (2-byte unsigned integer, array size: nscan2):

EEPROM Bank of last reboot \*/ Special values are defined as:

0 Missing value

**CURRENT\_BANK** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**EDAC\_ENABLE** (2-byte unsigned integer, array size: nscan2):

EDAC enable \*/ Special values are defined as:

0 Missing value

**WDOG\_ENABLE** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**SC\_1HZ\_REF** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**SCE\_FORCE\_SEL** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**RS\_1MHZ\_REF** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**RS\_SCAN\_START** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**FPGA\_IE\_RX\_EN** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**FPGA\_RS\_RX\_EN** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**FPGA\_SCE\_RX\_EN** (2-byte unsigned integer, array size: nscan2):

FPGA CNTL Special values are defined as:

0 Missing value

**EEPROM\_BUSY** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**RS\_TLM\_PROG** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**SCE\_A\_ACTIVE** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**SCE\_A\_RLY** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**SCE\_B\_ACTIVE** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**SCE\_B\_RLY** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value



**IE\_TLM\_PROG** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**SCE\_RSP\_PROG** (2-byte unsigned integer, array size: nscan2):

SCE response in progress. \*/ Special values are defined as:

0 Missing value

**RS\_CLK\_ERR** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**RS\_PKT\_ERR** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**RS\_TLM\_ERR** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**SCE\_RSP\_RDY** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**IE\_PKT\_ERR** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**IE\_CMD\_ERR** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**IE\_RSP\_ERR** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

**IE\_TLM\_ERR** (2-byte unsigned integer, array size: nscan2):

IE Tlm Error FPGA status bit \*/ Special values are defined as:

0 Missing value

**FPGA\_ACCSS\_ERR** (2-byte unsigned integer, array size: nscan2):

FPGA STAT Special values are defined as:

0 Missing value

## **RS\_INFO** (Group in S3)

**RS\_POWERED** (2-byte unsigned integer, array size: nscan2):

RS Power \*/ Special values are defined as:

0 Missing value

**RS\_ENABLED** (2-byte unsigned integer, array size: nscan2):  
RS Science Enabled \*/ Special values are defined as:  
0 Missing value

**RS\_MST\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS Master Relay \*/ Special values are defined as:  
0 Missing value

**RS\_10GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS 10GHz Relay \*/ Special values are defined as:  
0 Missing value

**RS\_18GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS 18GHz Relay \*/ Special values are defined as:  
0 Missing value

**RS\_23GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS 23GHz Relay \*/ Special values are defined as:  
0 Missing value

**RS\_36GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS 36GHz Relay \*/ Special values are defined as:  
0 Missing value

**RS\_89GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS 89GHz Relay \*/ Special values are defined as:  
0 Missing value

**RS\_166GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS 166GHz Relay \*/ Special values are defined as:  
0 Missing value

**RS\_183GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
RS 183GHz Relay \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_MISSING** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Missing samples) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_EXTRAS** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Extra samples) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_DUPES** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Duplicate samples) \*/ Special values are defined as:  
0 Missing value

**RS\_LAST\_REV** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Latest Revolution) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_SAME\_REV** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Revolution bit not changing) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_BAD\_REVS** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Inconsistent Revolutions) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_PAR\_ERR** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Parity Error) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_CLK\_ERR** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Clock Error) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_PKT\_ERR** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Packet Error) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_TLM\_ERR** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Telemetry Error) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_BAD\_CONF** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Mismatched configuration) \*/ Special values are defined as:  
0 Missing value

**RS\_DQ\_CAL\_LIM** (2-byte unsigned integer, array size: nscan2):  
RS Data Quality indicator (Calibration Limits) \*/ Special values are defined as:  
0 Missing value

**BLK\_STATE** (2-byte unsigned integer, array size: nscan2):  
Blanking State \*/ Special values are defined as:  
0 Missing value

**BLK\_SIDE** (2-byte unsigned integer, array size: nscan2):  
Blanking Side \*/ Special values are defined as:  
0 Missing value

**BLK\_DELAY** (2-byte unsigned integer, array size: nscan2):  
Blanking Delay \*/ Special values are defined as:  
0 Missing value

**BLK\_DURATION** (2-byte unsigned integer, array size: nscan2):  
Blanking Duration \*/ Special values are defined as:  
0 Missing value

**RS\_HSK\_SIZE** (2-byte unsigned integer, array size: nscan2):  
The number of RS Housekeeping samples \*/ Special values are defined as:  
0 Missing value

**RS\_PAR\_ERR\_CNT** (4-byte unsigned integer, array size: nscan2):  
Number of RS parity errors \*/ Special values are defined as:  
0 Missing value

**RS\_SCAN\_CNT** (4-byte unsigned integer, array size: nscan2):  
Number of RS scans \*/ Special values are defined as:  
0 Missing value

**SAMPLE\_TBL\_VER** (4-byte unsigned integer, array size: nscan2):  
Sample table version \*/ Special values are defined as:  
0 Missing value

**SMPL\_TBL** (4-byte unsigned integer, array size: nscan2):  
Sample Table Pointer \*/ Special values are defined as:  
0 Missing value

**RS\_SC\_SIZE** (2-byte unsigned integer, array size: nscan2):  
The number of science samples \*/ Special values are defined as:  
0 Missing value

**GSDR\_SIZE** (2-byte unsigned integer, array size: nscan2):  
The size of the latest GSDR \*/ Special values are defined as:  
0 Missing value

**GSDR\_LEFT** (2-byte unsigned integer, array size: nscan2):  
GSDR Remainder \*/ Special values are defined as:  
0 Missing value

**GSDR\_B\_POP\_IDX** (2-byte unsigned integer, array size: nscan2):  
GSDR Buffer Pool Index (Pop) \*/ Special values are defined as:  
0 Missing value

**GSDR\_B\_PUSH\_IDX** (2-byte unsigned integer, array size: nscan2):  
GSDR Buffer Pool Index (Push) \*/ Special values are defined as:  
0 Missing value

**GSDR\_APID** (2-byte unsigned integer, array size: nscan2):  
GSDR Apid \*/ Special values are defined as:  
0 Missing value

**PKT\_STATE** (2-byte unsigned integer, array size: nscan2):  
Packetizing State \*/ Special values are defined as:  
0 Missing value

**OVRD\_RS\_PWR** (2-byte unsigned integer, array size: nscan2):  
Override RS Power Check \*/ Special values are defined as:  
0 Missing value

**OVRD\_SMA\_SPIN** (2-byte unsigned integer, array size: nscan2):  
Override SMA Spinning Check \*/ Special values are defined as:  
0 Missing value

**OVRD\_PASS\_RS** (2-byte unsigned integer, array size: nscan2):  
Override RS Passthru protection indicator. \*/ Special values are defined as:  
0 Missing value

## **SYNCH\_STAMPS** (Group in S3)

**IDX\_PULSE\_SECS** (4-byte unsigned integer, array size: nscan2):  
Index Pulse (Seconds) \*/ Special values are defined as:  
0 Missing value

**IDX\_PULSE\_SUBS** (2-byte unsigned integer, array size: nscan2):  
Index Pulse (Sub-Seconds) \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_00** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 0 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_00** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 0 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_01** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 1 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_01** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 1 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_02** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 2 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_02** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 2 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_03** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 3 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_03** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 3 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_04** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 4 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_04** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 4 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_05** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 5 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_05** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 5 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_06** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 6 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_06** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 6 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_07** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 7 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_07** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 7 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_08** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 8 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_08** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 8 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_09** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 9 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_09** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 9 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_10** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 10 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_10** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 10 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_11** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 11 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_11** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 11 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_12** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 12 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_12** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 12 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_13** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 13 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_13** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 13 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_14** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 14 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_14** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 14 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_15** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 15 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_15** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 15 \*/ Special values are defined as:  
0 Missing value

## **SYNCH\_STAMPS2** (Group in S3)

**TACH\_SECS\_16** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 16 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_16** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 16 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_17** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 17 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_17** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 17 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_18** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 18 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_18** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 18 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_19** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 19 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_19** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 19 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_20** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 20 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_20** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 20 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_21** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 21 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_21** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 21 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_22** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 22 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_22** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 22 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_23** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 23 \*/ Special values are defined as:  
0 Missing value



**TACH\_SUBS\_23** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 23 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_24** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 24 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_24** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 24 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_25** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 25 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_25** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 25 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_26** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 26 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_26** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 26 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_27** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 27 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_27** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 27 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_28** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 28 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_28** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 28 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_29** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 29 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_29** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 29 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_30** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 30 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_30** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 30 \*/ Special values are defined as:  
0 Missing value

**TACH\_SECS\_31** (4-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Seconds 31 \*/ Special values are defined as:  
0 Missing value

**TACH\_SUBS\_31** (2-byte unsigned integer, array size: nscan2):  
Tachometer Pulse Subseconds 31 \*/ Special values are defined as:  
0 Missing value

**SCAN\_COMPL\_SECS** (4-byte unsigned integer, array size: nscan2):  
Scan Complete Time Tag Seconds \*/ Special values are defined as:  
0 Missing value

**SCAN\_COMPL\_SUBS** (2-byte unsigned integer, array size: nscan2):  
Scan Complete Time Tag Subseconds \*/ Special values are defined as:  
0 Missing value

## **RSHSK\_STATUS** (Group in S3)

**RSST\_SCI\_ADC\_LP** (2-byte unsigned integer, array size: nscan2):  
RS Science channel latchup \*/ Special values are defined as:  
0 Missing value

**RSST\_HSK\_ADC\_LP** (2-byte unsigned integer, array size: nscan2):  
RS Housekeeping channel ADC latchup \*/ Special values are defined as:  
0 Missing value

**RSST\_SAMP\_OVLP** (2-byte unsigned integer, array size: nscan2):  
Sample offset overlap \*/ Special values are defined as:  
0 Missing value

**RSST\_10GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
10 GHz relay status \*/ Special values are defined as:  
0 Missing value

**RSST\_18GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
18 GHz relay status \*/ Special values are defined as:  
0 Missing value

**RSST\_23GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
23 GHz relay status \*/ Special values are defined as:  
0 Missing value

**RSST\_36GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
36 GHz relay status \*/ Special values are defined as:  
0 Missing value

**RSST\_89GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
89 GHz relay status \*/ Special values are defined as:  
0 Missing value

**RSST\_166GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
166 GHz relay status \*/ Special values are defined as:  
0 Missing value

**RSST\_183GHZ\_RLY** (2-byte unsigned integer, array size: nscan2):  
183 GHz relay status \*/ Special values are defined as:  
0 Missing value

**RSST\_INVLD\_CMD** (2-byte unsigned integer, array size: nscan2):  
Invalid command received \*/ Special values are defined as:  
0 Missing value

**RSST\_CMD\_AFTER** (2-byte unsigned integer, array size: nscan2):  
Command received after scan start \*/ Special values are defined as:  
0 Missing value

**NDIODE\_MODE** (2-byte unsigned integer, array size: nscan2):  
RS Configuration of Noise Diode Mode \*/ Special values are defined as:  
0 Missing value

**RSST\_NDIODE\_ST** (2-byte unsigned integer, array size: nscan2):  
Noise diode state during the scan \*/ Special values are defined as:  
0 Missing value

**NDIODE10GHZSNUM** (2-byte unsigned integer, array size: nscan2):  
RS Configuration of Noise Diode Start Sample Number \*/ Special values are defined as:  
0 Missing value

**RESERVED1** (2-byte unsigned integer, array size: nscan2):  
Unused item \*/ Special values are defined as:  
0 Missing value

**RS\_CALRES\_1** (2-byte unsigned integer, array size: nscan2):  
RS Calibration Resistor for RS telemetry num 1 \*/ Special values are defined as:  
0 Missing value

**BATC\_CALRES\_1** (2-byte unsigned integer, array size: nscan2):  
RS Calibration Resistor for BATC telemetry num 1 \*/ Special values are defined as:  
0 Missing value

**RS\_CALRES\_2** (2-byte unsigned integer, array size: nscan2):  
RS Calibration Resistor for BATC telemetry num 2 \*/ Special values are defined as:  
0 Missing value

**BATC\_CALRES\_2** (2-byte unsigned integer, array size: nscan2):  
RS Calibration Resistor for BATC telemetry num 2 \*/ Special values are defined as:  
0 Missing value

**RS\_EPC\_ISENS** (2-byte unsigned integer, array size: nscan2):  
Receiver Subsystem EPC Current Sense \*/ Special values are defined as:  
0 Missing value

**RS\_EPC\_5V** (2-byte unsigned integer, array size: nscan2):  
EPC 5V Telemetry \*/ Special values are defined as:  
0 Missing value

**RS\_EPC\_7V** (2-byte unsigned integer, array size: nscan2):  
EPC 7V Telemetry \*/ Special values are defined as:  
0 Missing value

**RS\_EPC\_POS12V** (2-byte unsigned integer, array size: nscan2):  
EPC +12V Telemetry \*/ Special values are defined as:  
0 Missing value

**RS\_EPC\_NEG12V** (2-byte unsigned integer, array size: nscan2):  
EPC -12V Telemetry \*/ Special values are defined as:  
0 Missing value

**RS\_EPC\_15V** (2-byte unsigned integer, array size: nscan2):  
EPC 15V Telemetry \*/ Special values are defined as:  
0 Missing value

## **RSHSK\_SAMPL\_INFO** (Group in S3)

**SMPOFFST\_10GHZ** (2-byte unsigned integer, array size: nscan2):  
RS-Reported Sample Offset for the 10GHz Channels (4us) \*/ Special values are defined  
as:  
0 Missing value

**SMPOFFST\_18GHZ** (2-byte unsigned integer, array size: nscan2):  
RS-Reported Sample Offset for the 18 GHz Channels (4us) \*/ Special values are defined  
as:  
0 Missing value

**SMPOFFST\_23GHZ** (2-byte unsigned integer, array size: nscan2):  
RS-Reported Sample Offset for the 23 GHz Channel (4us) \*/ Special values are defined  
as:  
0 Missing value

**SMPOFFST\_36GHZ** (2-byte unsigned integer, array size: nscan2):  
RS-Reported Sample Offset for the 36 GHz Channels (4us) \*/ Special values are defined

as:

0 Missing value

**SMPOFFST\_89GHZ** (2-byte unsigned integer, array size: nscan2):

RS-Reported Sample Offset for the 89 GHz Channels (4us) \*/ Special values are defined

as:

0 Missing value

**SMPOFFST\_166GHZ** (2-byte unsigned integer, array size: nscan2):

RS-Reported Sample Offset for the 166 GHz Channels (4us) \*/ Special values are defined

as:

0 Missing value

**SMPOFFST\_183GHZ** (2-byte unsigned integer, array size: nscan2):

RS-Reported Sample Offset for the 183 GHz Channels (4us) \*/ Special values are defined

as:

0 Missing value

**NUMSMPLS\_10GHZ** (2-byte unsigned integer, array size: nscan2):

RS Configuration of Number of Samples for the 10 GHz channels \*/ Special values are defined as:

0 Missing value

**NUMSMPLS\_18GHZ** (2-byte unsigned integer, array size: nscan2):

RS Configuration of Number of Samples for the 10 GHz channels \*/ Special values are defined as:

0 Missing value

**NUMSMPLS\_23GHZ** (2-byte unsigned integer, array size: nscan2):

RS Configuration of Number of Samples for the 10 GHz channels \*/ Special values are defined as:

0 Missing value

**NUMSMPLS\_36GHZ** (2-byte unsigned integer, array size: nscan2):

RS Configuration of Number of Samples for the 10 GHz channels \*/ Special values are defined as:

0 Missing value

**NUMSMPLS\_89GHZ** (2-byte unsigned integer, array size: nscan2):

RS Configuration of Number of Samples for the 10 GHz channels \*/ Special values are defined as:

0 Missing value

**NUMSMPLS\_166GHZ** (2-byte unsigned integer, array size: nscan2):

RS Configuration of Number of Samples for the 166 GHz channels \*/ Special values are defined as:

0 Missing value

**NUMSMPLS\_183GHZ** (2-byte unsigned integer, array size: nscan2):

RS Configuration of Number of Samples for the 183 GHz channels \*/ Special values are

defined as:

0 Missing value

## **RSHSK\_GAIN** (Group in S3)

**RESERVED2** (2-byte unsigned integer, array size: nscan2):

Unused item \*/ Special values are defined as:

0 Missing value

**GAIN\_V10GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 10 GHz V-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_H36GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 36 GHz H-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_H89GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 89 GHz H-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_H10GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 10 GHz H-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_H166GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 166 GHz H-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_V18GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 18 GHz V-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_H18GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 18 GHz H-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_VB183GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 183.31 +/- Special values are defined as:

0 Missing value

**GAIN\_V23GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 23 GHz V-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_V36GHZ** (2-byte unsigned integer, array size: nscan2):

RS-reported gain setting for the 36 GHz V-pol channel \*/ Special values are defined as:

0 Missing value

**GAIN\_V89GHZ** (2-byte unsigned integer, array size: nscan2):  
RS-reported gain setting for the 89 GHz V-pol channel \*/ Special values are defined as:  
0 Missing value

**GAIN\_V166GHZ** (2-byte unsigned integer, array size: nscan2):  
RS-reported gain setting for the 166 GHz V-pol channel \*/ Special values are defined as:  
0 Missing value

**GAIN\_VA183GHZ** (2-byte unsigned integer, array size: nscan2):  
RS-reported gain setting for the 183.31 +/- Special values are defined as:  
0 Missing value

## **RSHSK\_TEMP** (Group in S3)

**TEMP\_10GHZRCVR** (2-byte unsigned integer, array size: nscan2):  
10 GHz Box Receiver Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_H166GHZMXR** (2-byte unsigned integer, array size: nscan2):  
166 H GHz Mixer Pre-Amp Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_18GHZRCVR** (2-byte unsigned integer, array size: nscan2):  
18 GHz Box Receiver Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_V166GHZMXR** (2-byte unsigned integer, array size: nscan2):  
166 V GHz Mixer Pre-amp Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_23GHZRCVR** (2-byte unsigned integer, array size: nscan2):  
23 GHz Box Receiver Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_183GHZMXR** (2-byte unsigned integer, array size: nscan2):  
183 GHz Mixer Pre-amp Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_36GHZRCVR** (2-byte unsigned integer, array size: nscan2):  
36 GHz Box Receiver Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_H10GHZ\_ND** (2-byte unsigned integer, array size: nscan2):  
10 GHz H-pol Noise Diode Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_89GHZRCVR** (2-byte unsigned integer, array size: nscan2):  
89 GHz Box Receiver Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_V10GHZ\_ND** (2-byte unsigned integer, array size: nscan2):  
10 GHz V-pol Noise Diode Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_166GHZRCVR** (2-byte unsigned integer, array size: nscan2):  
166 GHz Box Receiver Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_H18GHZ\_ND** (2-byte unsigned integer, array size: nscan2):  
18 GHz H-pol Noise Diode Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_183GHZRCVR** (2-byte unsigned integer, array size: nscan2):  
183 GHz Box Receiver Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_V18GHZ\_ND** (2-byte unsigned integer, array size: nscan2):  
18 GHz V-pol Noise Diode Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_RS\_EPC** (2-byte unsigned integer, array size: nscan2):  
Receiver Subsystem EPC Box Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_H36GHZ\_ND** (2-byte unsigned integer, array size: nscan2):  
36 GHz H-pol Noise Diode Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_RS\_EDC** (2-byte unsigned integer, array size: nscan2):  
Receiver Subsystem EDC Box Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_V36GHZ\_ND** (2-byte unsigned integer, array size: nscan2):  
36 GHz V-pol Noise Diode Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_FEED** (2-byte unsigned integer, array size: nscan2):  
Feedhorn Assembly Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_89GHZ\_LO** (2-byte unsigned integer, array size: nscan2):  
89 GHz Local Oscillator Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_HL\_TRAY** (2-byte unsigned integer, array size: nscan2):  
Hot Load tray temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_166GHZ\_LO** (2-byte unsigned integer, array size: nscan2):  
166 GHz Local Oscillator Temperature \*/ Special values are defined as:  
0 Missing value



**TEMP\_SMASPUNHSG** (2-byte unsigned integer, array size: nscan2):

Temp SMA spun HSG \*/ Special values are defined as:

0 Missing value

**TEMP\_RS\_MR1** (2-byte unsigned integer, array size: nscan2):

Main Reflector Temperature read by RS num 1 \*/ Special values are defined as:

0 Missing value

**TEMP\_H89GHZMXR** (2-byte unsigned integer, array size: nscan2):

Temp H89GHZMXR \*/ Special values are defined as:

0 Missing value

**TEMP\_RS\_MR2** (2-byte unsigned integer, array size: nscan2):

Main Reflector Temperature read by RS num 2 \*/ Special values are defined as:

0 Missing value

**TEMP\_V89GHZMXR** (2-byte unsigned integer, array size: nscan2):

Temp V89GHZMXR \*/ Special values are defined as:

0 Missing value

**TEMP\_183GHZ\_LO** (2-byte unsigned integer, array size: nscan2):

183 GHz Local Oscillator Temperature \*/ Special values are defined as:

0 Missing value

## **IEHSK\_TEMP** (Group in S3)

**IBS\_LR1\_TEMP** (2-byte unsigned integer, array size: nscan2):

IBS Launch Restraint 1 temperature \*/ Special values are defined as:

0 Missing value

**RS\_TEMP\_1** (2-byte unsigned integer, array size: nscan2):

Receiver Subsystem Temperature num 1 \*/ Special values are defined as:

0 Missing value

**SCE\_A\_BD\_TEMP** (2-byte unsigned integer, array size: nscan2):

SCE A Board Temperature \*/ Special values are defined as:

0 Missing value

**MR\_LR\_RGHT\_TEMP** (2-byte unsigned integer, array size: nscan2):

Main Reflector Right Launch Restraint Temperature \*/ Special values are defined as:

0 Missing value

**SMA\_BEARING\_TMP** (2-byte unsigned integer, array size: nscan2):

SMA Bearing Temperature \*/ Special values are defined as:

0 Missing value

**PC\_BD\_TEMP** (2-byte unsigned integer, array size: nscan2):

Power Controller Board Temperature \*/ Special values are defined as:

0 Missing value

**LVPS\_BD\_TEMP** (2-byte unsigned integer, array size: nscan2):  
Low Voltage Power Supply Board Temperature \*/ Special values are defined as:  
0 Missing value

**SMA\_MTR\_TEMP** (2-byte unsigned integer, array size: nscan2):  
SMA Motor Temperature \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_2** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 2 \*/ Special values are defined as:  
0 Missing value

**RDA\_TEMP\_2** (2-byte unsigned integer, array size: nscan2):  
RDA Temperature num 2 \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_1** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 1 \*/ Special values are defined as:  
0 Missing value

**RS\_TEMP\_2** (2-byte unsigned integer, array size: nscan2):  
Receiver Subsystem Temperature num 2 \*/ Special values are defined as:  
0 Missing value

**SCE\_B\_BD\_TEMP** (2-byte unsigned integer, array size: nscan2):  
SCE B Board Temperature \*/ Special values are defined as:  
0 Missing value

**TEMP\_CALRES\_1** (2-byte unsigned integer, array size: nscan2):  
ICA IE Telemetry Calibration Resistor num 1 \*/ Special values are defined as:  
0 Missing value

**TEMP\_CALRES\_2** (2-byte unsigned integer, array size: nscan2):  
ICA IE Telemetry Calibration Resistor num 2 \*/ Special values are defined as:  
0 Missing value

**MR\_ICA\_TEMP** (2-byte unsigned integer, array size: nscan2):  
Main Reflector temperature read by the ICA \*/ Special values are defined as:  
0 Missing value

**IBS\_LR2\_TEMP** (2-byte unsigned integer, array size: nscan2):  
IBS Launch Restraint 2 temperature \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_7** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 3 \*/ Special values are defined as:  
0 Missing value

**RDA\_TEMP\_1** (2-byte unsigned integer, array size: nscan2):  
RDA Temperature num 1 \*/ Special values are defined as:  
0 Missing value

**MR\_LR\_LEFT\_TEMP** (2-byte unsigned integer, array size: nscan2):  
Main Reflector Left Launch Restraint Temperature \*/ Special values are defined as:  
0 Missing value

**RDA\_TEMP\_3** (2-byte unsigned integer, array size: nscan2):  
RDA Temperature num 3 \*/ Special values are defined as:  
0 Missing value

**ICA\_BOX\_TEMP\_1** (2-byte unsigned integer, array size: nscan2):  
ICA Box Temperature num 1 \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_10** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 10 \*/ Special values are defined as:  
0 Missing value

**MR\_LR\_LOWR\_TEMP** (2-byte unsigned integer, array size: nscan2):  
Main Reflector Lower Launch Restraint Temperature \*/ Special values are defined as:  
0 Missing value

**SMA\_SLPRHTR\_TMP** (2-byte unsigned integer, array size: nscan2):  
SMA Slip Ring Heater Temperature \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_8** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 8 \*/ Special values are defined as:  
0 Missing value

**TEMP\_CALRES\_3** (2-byte unsigned integer, array size: nscan2):  
ICA IE Telemetry Calibration Resistor num 3 \*/ Special values are defined as:  
0 Missing value

**TEMP\_CALRES\_4** (2-byte unsigned integer, array size: nscan2):  
ICA IE Telemetry Calibration Resistor num 4 \*/ Special values are defined as:  
0 Missing value

**CSR\_TEMP1** (2-byte unsigned integer, array size: nscan2):  
Cold Sky Reflector Temperature \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_12** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 12 \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_13** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 13 \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_14** (2-byte unsigned integer, array size: nscan2):  
Hot Load Temperature num 14 \*/ Special values are defined as:  
0 Missing value

**HL\_TEMP\_11** (2-byte unsigned integer, array size: nscan2):

Hot Load Temperature num 11 \*/ Special values are defined as:

0 Missing value

**IBS\_LR3\_TEMP** (2-byte unsigned integer, array size: nscan2):

IBS Launch Restraint 3 temperature \*/ Special values are defined as:

0 Missing value

**HL\_TEMP\_9** (2-byte unsigned integer, array size: nscan2):

Hot Load Temperature num 9 \*/ Special values are defined as:

0 Missing value

**ROT\_TEMP\_SPARE** (2-byte unsigned integer, array size: nscan2):

Spare Temperature (Rotational Side) \*/ Special values are defined as:

0 Missing value

**CSR\_TEMP2** (2-byte unsigned integer, array size: nscan2):

Cold Sky Reflector temperature 2 \*/ Special values are defined as:

0 Missing value

**CE\_BD\_TEMP** (2-byte unsigned integer, array size: nscan2):

CE Board Temperature \*/ Special values are defined as:

0 Missing value

**ICA\_BOX\_TEMP\_2** (2-byte unsigned integer, array size: nscan2):

ICA Box Temperature num 2 \*/ Special values are defined as:

0 Missing value

**IE\_BD\_TEMP** (2-byte unsigned integer, array size: nscan2):

Interface Electronics Board Temperature \*/ Special values are defined as:

0 Missing value

**CLR\_TEMP** (2-byte unsigned integer, array size: nscan2):

CLR Temperature \*/ Special values are defined as:

0 Missing value

**HL\_TEMP\_15** (2-byte unsigned integer, array size: nscan2):

Hot Load Temperature num 15 \*/ Special values are defined as:

0 Missing value

**TEMP\_CALRES\_5** (2-byte unsigned integer, array size: nscan2):

ICA IE Telemetry Calibration Resistor num 5 \*/ Special values are defined as:

0 Missing value

**TEMP\_CALRES\_6** (2-byte unsigned integer, array size: nscan2):

ICA IE Telemetry Calibration Resistor num 6 \*/ Special values are defined as:

0 Missing value

## **IE\_TELEMETRY** (Group in S3)

**IE\_PASSTHRU\_RSP** (4-byte unsigned integer, array size: nscan2):  
The response to the last pass through command. \*/ Special values are defined as:  
0 Missing value

**IE\_BLANKING\_CNT** (2-byte unsigned integer, array size: nscan2):  
Number of blanking output pulses since last tlm cycle. \*/ Special values are defined as:  
0 Missing value

**PWR\_STAT\_LR\_PR** (2-byte unsigned integer, array size: nscan2):  
Power Controller Special values are defined as:  
0 Missing value

**PWR\_STAT\_A** (2-byte unsigned integer, array size: nscan2):  
Operational Power A status \*/ Special values are defined as:  
0 Missing value

**HTR\_STAT\_SMA** (2-byte unsigned integer, array size: nscan2):  
Operational heater status for the SMA \*/ Special values are defined as:  
0 Missing value

**HTR\_STAT\_RDA** (2-byte unsigned integer, array size: nscan2):  
Operational heater status for the RDA \*/ Special values are defined as:  
0 Missing value

**HTR\_STAT\_RS** (2-byte unsigned integer, array size: nscan2):  
Receiver Subsystem operational heater \*/ Special values are defined as:  
0 Missing value

**PWR\_STAT\_LR\_RED** (2-byte unsigned integer, array size: nscan2):  
Redundant Launch Restraint status \*/ Special values are defined as:  
0 Missing value

**RS\_MST\_RLY\_STAT** (2-byte unsigned integer, array size: nscan2):  
Receiver Subsystem Master Relay status \*/ Special values are defined as:  
0 Missing value

**RDA\_DEPL\_STAT\_4** (2-byte unsigned integer, array size: nscan2):  
Reflector Deployment Assembly deployment status num 4 \*/ Special values are defined  
as:  
0 Missing value

**RDA\_DEPL\_STAT\_3** (2-byte unsigned integer, array size: nscan2):  
Reflector Deployment Assembly deployment status num 3 \*/ Special values are defined  
as:  
0 Missing value

**RDA\_DEPL\_STAT\_2** (2-byte unsigned integer, array size: nscan2):  
Reflector Deployment Assembly deployment status num 2 \*/ Special values are defined  
as:  
0 Missing value

**RDA\_DEPL\_STAT\_1** (2-byte unsigned integer, array size: nscan2):  
 Reflector Deployment Assembly deployment status num 1 \*/ Special values are defined as:  
 0 Missing value

**CLR\_STAT\_N** (2-byte unsigned integer, array size: nscan2):  
 Calibration Launch Restraint Status \*/ Special values are defined as:  
 0 Missing value

**IBS\_LR3\_STAT\_N** (2-byte unsigned integer, array size: nscan2):  
 Instrument Bay Structure Launch Restraint \*/ Special values are defined as:  
 0 Missing value

**MR\_LR\_LOWR\_STAT** (2-byte unsigned integer, array size: nscan2):  
 Main Reflector Lower Launch Restraint \*/ Special values are defined as:  
 0 Missing value

**IBS\_LR2\_STAT\_N** (2-byte unsigned integer, array size: nscan2):  
 Instrument Bay Structure Launch Restraint \*/ Special values are defined as:  
 0 Missing value

**MR\_LR\_LEFT\_STAT** (2-byte unsigned integer, array size: nscan2):  
 Main Reflector Left Launch Restraint \*/ Special values are defined as:  
 0 Missing value

**IBS\_LR1\_STAT\_N** (2-byte unsigned integer, array size: nscan2):  
 Instrument Bay Structure Launch Restraint \*/ Special values are defined as:  
 0 Missing value

**MR\_LR\_RGHT\_STAT** (2-byte unsigned integer, array size: nscan2):  
 Main Reflector Right Launch Restraint \*/ Special values are defined as:  
 0 Missing value

**IE\_LATCHUP\_CHAN** (2-byte unsigned integer, array size: nscan2):  
 Indicates the telemetry sample which observed the last \*/ Special values are defined as:  
 0 Missing value

**IE\_LATCHUP\_RETR** (2-byte unsigned integer, array size: nscan2):  
 Number of Retries \*/ Special values are defined as:  
 0 Missing value

**IE\_LATCHUP\_SMPS** (2-byte unsigned integer, array size: nscan2):  
 Number of Samples with Latchup. \*/ Special values are defined as:  
 0 Missing value

**IE\_LATCHUP\_NUM** (2-byte unsigned integer, array size: nscan2):  
 Number of Latchups Detected \*/ Special values are defined as:  
 0 Missing value

**IE\_LATCHUP\_FAIL** (2-byte unsigned integer, array size: nscan2):  
 Latchup Failure. \*/ Special values are defined as:  
 0 Missing value

**HTR\_STAT\_HTLTD** (2-byte unsigned integer, array size: nscan2):  
Operational heater status for the Hot Load \*/ Special values are defined as:  
0 Missing value

**IE\_LATCHUP\_PAD** (2-byte unsigned integer, array size: nscan2):  
PADDING \*/ Special values are defined as:  
0 Missing value

## MECHANISMS (Group in S3)

**SCE\_LAST\_CMD** (4-byte unsigned integer, array size: nscan2):  
Last command sent to the SCE. \*/ Special values are defined as:  
0 Missing value

**SCE\_LAST\_RESPNS** (4-byte unsigned integer, array size: nscan2):  
Response from the SCE of the last command sent \*/ Special values are defined as:  
0 Missing value

**SCE\_CMD\_CNT** (4-byte unsigned integer, array size: nscan2):  
Total number of cmds to the SCE. \*/ Special values are defined as:  
0 Missing value

**SMA\_RTPRB\_SEC** (2-byte unsigned integer, array size: nscan2):  
The time since the beginning of the rate problem. 20 seconds to \*/ Special values are defined as:  
0 Missing value

**SMA\_RATE** (2-byte unsigned integer, array size: nscan2):  
The ICA calculated rotational rate of the SMA in integer scaled rpm \*/ Special values are defined as:  
0 Missing value

**SCE\_RATE** (2-byte unsigned integer, array size: nscan2):  
The SMA rotational rate reported by the SCE \*/ Special values are defined as:  
0 Missing value

**SCE\_CMD\_RATE** (2-byte unsigned integer, array size: nscan2):  
Last rate value commanded to the SCE. Used for rate limits \*/ Special values are defined as:  
0 Missing value

**SMA\_CMD\_RATE** (2-byte unsigned integer, array size: nscan2):  
Last rate value commanded to the SCE, converted to integer \*/ Special values are defined as:  
0 Missing value

**RESOLVER\_POS** (2-byte unsigned integer, array size: nscan2):  
The resolver position reported by the SCE \*/ Special values are defined as:  
0 Missing value

**MECH\_CMD\_CNT** (2-byte unsigned integer, array size: nscan2):  
Number of commands received by the Mechanisms CSC \*/ Special values are defined as:  
0 Missing value

**SCE\_INHIBIT** (2-byte unsigned integer, array size: nscan2):  
Indicator that commanding to the SCE is inhibited \*/ Special values are defined as:  
0 Missing value

**TACH\_PULSE\_CNT** (2-byte unsigned integer, array size: nscan2):  
Array indexer for tach pulses \*/ Special values are defined as:  
0 Missing value

**LR\_ABORT\_CNT** (2-byte unsigned integer, array size: nscan2):  
The number of launch restraint release procedures that have been \*/ Special values are defined as:  
0 Missing value

**RAMP\_ABORT\_CNT** (2-byte unsigned integer, array size: nscan2):  
The number of ramp procedures that have been aborted. \*/ Special values are defined as:  
0 Missing value

**OVRD\_RDA\_LR** (2-byte unsigned integer, array size: nscan2):  
Flag indicating the RDA launch restraints order protection is \*/ Special values are defined as:  
0 Missing value

**OVRD\_IBS\_LR** (2-byte unsigned integer, array size: nscan2):  
Flag indicating the IBS launch restraints order protection is \*/ Special values are defined as:  
0 Missing value

**SCE\_PASSPROT** (2-byte unsigned integer, array size: nscan2):  
Flag indicating the RDA launch restraints order protection is \*/ Special values are defined as:  
0 Missing value

**RAMP\_INPROGRESS** (2-byte unsigned integer, array size: nscan2):  
A SMA speed modification procedure is in progress. \*/ Special values are defined as:  
0 Missing value

**SMA\_SPINNING** (2-byte unsigned integer, array size: nscan2):  
Indicator of whether SMA is spinning, based on speed \*/ Special values are defined as:  
0 Missing value



**LR\_RLS\_IN\_PROG** (2-byte unsigned integer, array size: nscan2):  
 Reports state of launch release fire command \*/ Special values are defined as:  
 0 Missing value

**SCE\_A\_POWER** (2-byte unsigned integer, array size: nscan2):  
 FSW status of SCE A Card power \*/ Special values are defined as:  
 0 Missing value

**SCE\_B\_POWER** (2-byte unsigned integer, array size: nscan2):  
 FSW status of SCE B Card power \*/ Special values are defined as:  
 0 Missing value

**SCE\_SELECTION** (2-byte unsigned integer, array size: nscan2):  
 The current SCE selection setting. \*/ Special values are defined as:  
 0 Missing value

**SMA\_RATE\_PROB** (2-byte unsigned integer, array size: nscan2):  
 This field indicates the SMA is out of rate tolerances. \*/ Special values are defined as:  
 0 Missing value

**LR\_ENABLED** (2-byte unsigned integer, array size: nscan2):  
 This tlm point indicates that one of launch restraint power buses is \*/ Special values are defined as:  
 0 Missing value

**BILVL\_IBS1** (2-byte unsigned integer, array size: nscan2):  
 A bilevel to control the Limits Monitor CSU. \*/ Special values are defined as:  
 0 Missing value

**BILVL\_IBS2** (2-byte unsigned integer, array size: nscan2):  
 A bilevel to control the Limits Monitor CSU. \*/ Special values are defined as:  
 0 Missing value

**BILVL\_IBS3** (2-byte unsigned integer, array size: nscan2):  
 A bilevel to control the Limits Monitor CSU. \*/ Special values are defined as:  
 0 Missing value

**BILVL\_CAL** (2-byte unsigned integer, array size: nscan2):  
 A bilevel to control the Limits Monitor CSU. \*/ Special values are defined as:  
 0 Missing value

**BILVL\_RDALEFT** (2-byte unsigned integer, array size: nscan2):  
 A bilevel to control the Limits Monitor CSU. \*/ Special values are defined as:  
 0 Missing value

**BILVL\_RDARIGHT** (2-byte unsigned integer, array size: nscan2):  
 A bilevel to control the Limits Monitor CSU. \*/ Special values are defined as:  
 0 Missing value

**BILVL\_RDALOWER** (2-byte unsigned integer, array size: nscan2):  
 A bilevel to control the Limits Monitor CSU. \*/ Special values are defined as:  
 0 Missing value

## SMPL\_INFO (Group in S3)

**SMPL\_INFO\_VALID** (2-byte unsigned integer, array size: nscan2):

Sample Table Valid \*/ Special values are defined as:

0 Missing value

**EARTH\_10G\_STRT** (2-byte unsigned integer, array size: nscan2):

Earth viewing start (10GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_10G\_NUM** (2-byte unsigned integer, array size: nscan2):

Earth viewing samples (10GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_10G\_STRT** (2-byte unsigned integer, array size: nscan2):

Hot Load start (10GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_10G\_NUM** (2-byte unsigned integer, array size: nscan2):

Hot Load samples (10GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_10G\_STRT** (2-byte unsigned integer, array size: nscan2):

Cold Sky start (10GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_10G\_NUM** (2-byte unsigned integer, array size: nscan2):

Cold Sky samples (10GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_18G\_STRT** (2-byte unsigned integer, array size: nscan2):

Earth viewing start (18GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_18G\_NUM** (2-byte unsigned integer, array size: nscan2):

Earth viewing samples (18GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_18G\_STRT** (2-byte unsigned integer, array size: nscan2):

Hot Load start (18GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_18G\_NUM** (2-byte unsigned integer, array size: nscan2):

Hot Load samples (18GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_18G\_STRT** (2-byte unsigned integer, array size: nscan2):

Cold Sky start (18GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_18G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Cold Sky samples (18GHz) \*/ Special values are defined as:  
0 Missing value

**EARTH\_23G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Earth viewing start (23GHz) \*/ Special values are defined as:  
0 Missing value

**EARTH\_23G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Earth viewing samples (23GHz) \*/ Special values are defined as:  
0 Missing value

**HLOAD\_23G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Hot Load start (23GHz) \*/ Special values are defined as:  
0 Missing value

**HLOAD\_23G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Hot Load samples (23GHz) \*/ Special values are defined as:  
0 Missing value

**CSKY\_23G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Cold Sky start (23GHz) \*/ Special values are defined as:  
0 Missing value

**CSKY\_23G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Cold Sky samples (23GHz) \*/ Special values are defined as:  
0 Missing value

**EARTH\_36G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Earth viewing start (36GHz) \*/ Special values are defined as:  
0 Missing value

**EARTH\_36G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Earth viewing samples (36GHz) \*/ Special values are defined as:  
0 Missing value

**HLOAD\_36G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Hot Load start (36GHz) \*/ Special values are defined as:  
0 Missing value

**HLOAD\_36G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Hot Load samples (36GHz) \*/ Special values are defined as:  
0 Missing value

**CSKY\_36G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Cold Sky start (36GHz) \*/ Special values are defined as:  
0 Missing value

**CSKY\_36G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Cold Sky samples (36GHz) \*/ Special values are defined as:  
0 Missing value

**EARTH\_89G\_STRT** (2-byte unsigned integer, array size: nscan2):

Earth viewing start (89GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_89G\_NUM** (2-byte unsigned integer, array size: nscan2):

Earth viewing samples (89GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_89G\_STRT** (2-byte unsigned integer, array size: nscan2):

Hot Load start (89GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_89G\_NUM** (2-byte unsigned integer, array size: nscan2):

Hot Load samples (89GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_89G\_STRT** (2-byte unsigned integer, array size: nscan2):

Cold Sky start (89GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_89G\_NUM** (2-byte unsigned integer, array size: nscan2):

Cold Sky samples (89GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_166G\_STRT** (2-byte unsigned integer, array size: nscan2):

Earth viewing start (166GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_166G\_NUM** (2-byte unsigned integer, array size: nscan2):

Earth viewing samples (166GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_166G\_STRT** (2-byte unsigned integer, array size: nscan2):

Hot Load start (166GHz) \*/ Special values are defined as:

0 Missing value

**HLOAD\_166G\_NUM** (2-byte unsigned integer, array size: nscan2):

Hot Load samples (166GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_166G\_STRT** (2-byte unsigned integer, array size: nscan2):

Cold Sky start (166GHz) \*/ Special values are defined as:

0 Missing value

**CSKY\_166G\_NUM** (2-byte unsigned integer, array size: nscan2):

Cold Sky samples (166GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_183G\_STRT** (2-byte unsigned integer, array size: nscan2):

Earth viewing start (183GHz) \*/ Special values are defined as:

0 Missing value

**EARTH\_183G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Earth viewing samples (183GHz) \*/ Special values are defined as:  
0 Missing value

**HLOAD\_183G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Hot Load start (183GHz) \*/ Special values are defined as:  
0 Missing value

**HLOAD\_183G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Hot Load samples (183GHz) \*/ Special values are defined as:  
0 Missing value

**CSKY\_183G\_STRT** (2-byte unsigned integer, array size: nscan2):  
Cold Sky start (183GHz) \*/ Special values are defined as:  
0 Missing value

**CSKY\_183G\_NUM** (2-byte unsigned integer, array size: nscan2):  
Cold Sky samples (183GHz) \*/ Special values are defined as:  
0 Missing value

## S4 (Swath)

### S4\_SwathHeader (Metadata):

SwathHeader contains metadata for swaths. This group appears in Level 1 and Level 2 data products. See Metadata for GPM Products for details.

### ScanTime (Group in S4)

A UTC time associated with the scan.

**Year** (2-byte integer, array size: nscan2):  
4-digit year, e.g., 1998. Values range from 1950 to 2100 years. Special values are defined as:  
-9999 Missing value

**Month** (1-byte integer, array size: nscan2):  
Month of the year. Values range from 1 to 12 months. Special values are defined as:  
-99 Missing value

**DayOfMonth** (1-byte integer, array size: nscan2):  
Day of the month. Values range from 1 to 31 days. Special values are defined as:  
-99 Missing value

**Hour** (1-byte integer, array size: nscan2):  
UTC hour of the day. Values range from 0 to 23 hours. Special values are defined as:  
-99 Missing value

**Minute** (1-byte integer, array size: nscan2):

Minute of the hour. Values range from 0 to 59 minutes. Special values are defined as:  
-99 Missing value

**Second** (1-byte integer, array size: nscan2):

Second of the minute. Values range from 0 to 60 s. Special values are defined as:  
-99 Missing value

**MilliSecond** (2-byte integer, array size: nscan2):

Thousandths of the second. Values range from 0 to 999 ms. Special values are defined as:  
-9999 Missing value

**DayOfYear** (2-byte integer, array size: nscan2):

Day of the year. Values range from 1 to 366 days. Special values are defined as:  
-9999 Missing value

**SecondOfDay** (8-byte float, array size: nscan2):

A time associated with the scan. scanTime\_sec is expressed as the UTC seconds of the day. Values range from 0 to 86400 s. Special values are defined as:  
-9999.9 Missing value

**ephemerisUsed** (1-byte char, array size: dim10 x nscan1):

The ephemeris source used to geolocate the swath. Special values are defined as:  
255 Missing value

**Latitude** (4-byte float, array size: npixelfr x nscan2):

The earth latitude of the center of the IFOV at the altitude of the earth ellipsoid. Latitude is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:  
-9999.9 Missing value

**Longitude** (4-byte float, array size: npixelfr x nscan2):

The earth longitude of the center of the IFOV at the altitude of the earth ellipsoid. Longitude is positive east, negative west. A point on the 180th meridian has the value -180 degrees. Values range from -180 to 180 degrees. Special values are defined as:  
-9999.9 Missing value

**incidenceAngle** (4-byte float, array size: npixelfr x nscan2):

The angle at the center of the IFOV between the antenna boresight vector and the zenith vector normal to the Earth Ellipsoid. Also known as Satellite Zenith Angle. Values range from 0 to 90 degrees. Special values are defined as:  
-9999.9 Missing value

**fullRotation** (2-byte unsigned integer, array size: nchannel1 x npixelfr x nscan2):

Full rotation counts.

Special values are defined as:

0 Missing value

**fullRotBlanking** (1-byte char, array size: VH x npixelfr x nscan2):

Full rotation blanking counts.

Special values are defined as:

0 Missing value

## **S5** (Swath)

**S5\_SwathHeader** (Metadata):

SwathHeader contains metadata for swaths. This group appears in Level 1 and Level 2 data products. See Metadata for GPM Products for details.

### **ScanTime** (Group in S5)

A UTC time associated with the scan.

**Year** (2-byte integer, array size: nscan2):

4-digit year, e.g., 1998. Values range from 1950 to 2100 years. Special values are defined as:

-9999 Missing value

**Month** (1-byte integer, array size: nscan2):

Month of the year. Values range from 1 to 12 months. Special values are defined as:

-99 Missing value

**DayOfMonth** (1-byte integer, array size: nscan2):

Day of the month. Values range from 1 to 31 days. Special values are defined as:

-99 Missing value

**Hour** (1-byte integer, array size: nscan2):

UTC hour of the day. Values range from 0 to 23 hours. Special values are defined as:

-99 Missing value

**Minute** (1-byte integer, array size: nscan2):

Minute of the hour. Values range from 0 to 59 minutes. Special values are defined as:

-99 Missing value

**Second** (1-byte integer, array size: nscan2):

Second of the minute. Values range from 0 to 60 s. Special values are defined as:

-99 Missing value

**MilliSecond** (2-byte integer, array size: nscan2):

Thousandths of the second. Values range from 0 to 999 ms. Special values are defined as:  
-9999 Missing value

**DayOfYear** (2-byte integer, array size: nscan2):

Day of the year. Values range from 1 to 366 days. Special values are defined as:  
-9999 Missing value

**SecondOfDay** (8-byte float, array size: nscan2):

A time associated with the scan. scanTime\_sec is expressed as the UTC seconds of the day. Values range from 0 to 86400 s. Special values are defined as:  
-9999.9 Missing value

**ephemerisUsed** (1-byte char, array size: dim10 x nscan1):

The ephemeris source used to geolocate the swath. Special values are defined as:  
255 Missing value

**Latitude** (4-byte float, array size: npixelfr x nscan2):

The earth latitude of the center of the IFOV at the altitude of the earth ellipsoid. Latitude is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:  
-9999.9 Missing value

**Longitude** (4-byte float, array size: npixelfr x nscan2):

The earth longitude of the center of the IFOV at the altitude of the earth ellipsoid. Longitude is positive east, negative west. A point on the 180th meridian has the value -180 degrees. Values range from -180 to 180 degrees. Special values are defined as:  
-9999.9 Missing value

**incidenceAngle** (4-byte float, array size: npixelfr x nscan2):

The angle at the center of the IFOV between the antenna boresight vector and the zenith vector normal to the Earth Ellipsoid. Also known as Satellite Zenith Angle. Values range from 0 to 90 degrees. Special values are defined as:  
-9999.9 Missing value

**fullRotation** (2-byte unsigned integer, array size: nchannel2 x npixelfr x nscan2):

Full rotation counts.

Special values are defined as:

0 Missing value

## C Structure Header file:

```
#ifndef _TK_1AGMI_H_
#define _TK_1AGMI_H_
```



```

#ifndef _L1AGMI_S5_
#define _L1AGMI_S5_

typedef struct {
    SCANTIME ScanTime;
    unsigned char ephemerisUsed[10];
    float Latitude[500];
    float Longitude[500];
    float incidenceAngle[500];
    unsigned short fullRotation[500][4];
} L1AGMI_S5;

#endif

#ifndef _L1AGMI_S4_
#define _L1AGMI_S4_

typedef struct {
    SCANTIME ScanTime;
    unsigned char ephemerisUsed[10];
    float Latitude[500];
    float Longitude[500];
    float incidenceAngle[500];
    unsigned short fullRotation[500][9];
    unsigned char fullRotBlanking[500][2];
} L1AGMI_S4;

#endif

#ifndef _L1AGMI_S3_SMPL_INFO_
#define _L1AGMI_S3_SMPL_INFO_

typedef struct {
    unsigned short SMPL_INFO_VALID;
    unsigned short EARTH_10G_STRT;
    unsigned short EARTH_10G_NUM;
    unsigned short HLOAD_10G_STRT;
    unsigned short HLOAD_10G_NUM;
    unsigned short CSKY_10G_STRT;
    unsigned short CSKY_10G_NUM;
    unsigned short EARTH_18G_STRT;
    unsigned short EARTH_18G_NUM;
    unsigned short HLOAD_18G_STRT;
}

```

```

    unsigned short HLOAD_18G_NUM;
    unsigned short CSKY_18G_STRT;
    unsigned short CSKY_18G_NUM;
    unsigned short EARTH_23G_STRT;
    unsigned short EARTH_23G_NUM;
    unsigned short HLOAD_23G_STRT;
    unsigned short HLOAD_23G_NUM;
    unsigned short CSKY_23G_STRT;
    unsigned short CSKY_23G_NUM;
    unsigned short EARTH_36G_STRT;
    unsigned short EARTH_36G_NUM;
    unsigned short HLOAD_36G_STRT;
    unsigned short HLOAD_36G_NUM;
    unsigned short CSKY_36G_STRT;
    unsigned short CSKY_36G_NUM;
    unsigned short EARTH_89G_STRT;
    unsigned short EARTH_89G_NUM;
    unsigned short HLOAD_89G_STRT;
    unsigned short HLOAD_89G_NUM;
    unsigned short CSKY_89G_STRT;
    unsigned short CSKY_89G_NUM;
    unsigned short EARTH_166G_STRT;
    unsigned short EARTH_166G_NUM;
    unsigned short HLOAD_166G_STRT;
    unsigned short HLOAD_166G_NUM;
    unsigned short CSKY_166G_STRT;
    unsigned short CSKY_166G_NUM;
    unsigned short EARTH_183G_STRT;
    unsigned short EARTH_183G_NUM;
    unsigned short HLOAD_183G_STRT;
    unsigned short HLOAD_183G_NUM;
    unsigned short CSKY_183G_STRT;
    unsigned short CSKY_183G_NUM;
} L1AGMI_S3_SMPL_INFO;

#endif

#ifdef _L1AGMI_S3_MECHANISMS_
#define _L1AGMI_S3_MECHANISMS_

typedef struct {
    unsigned int SCE_LAST_CMD;
    unsigned int SCE_LAST_RESPNS;

```

```

    unsigned int SCE_CMD_CNT;
    unsigned short SMA_RTPRB_SEC;
    unsigned short SMA_RATE;
    unsigned short SCE_RATE;
    unsigned short SCE_CMD_RATE;
    unsigned short SMA_CMD_RATE;
    unsigned short RESOLVER_POS;
    unsigned short MECH_CMD_CNT;
    unsigned short SCE_INHIBIT;
    unsigned short TACH_PULSE_CNT;
    unsigned short LR_ABRT_CNT;
    unsigned short RAMP_ABRT_CNT;
    unsigned short OVRD_RDA_LR;
    unsigned short OVRD_IBS_LR;
    unsigned short SCE_PASSPROT;
    unsigned short RAMP_INPROGRESS;
    unsigned short SMA_SPINNING;
    unsigned short LR_RLS_IN_PROG;
    unsigned short SCE_A_POWER;
    unsigned short SCE_B_POWER;
    unsigned short SCE_SELECTION;
    unsigned short SMA_RATE_PROB;
    unsigned short LR_ENABLED;
    unsigned short BILVL_IBS1;
    unsigned short BILVL_IBS2;
    unsigned short BILVL_IBS3;
    unsigned short BILVL_CAL;
    unsigned short BILVL_RDALEFT;
    unsigned short BILVL_RDARIGHT;
    unsigned short BILVL_RDALOWER;
} L1AGMI_S3_MECHANISMS;

```

```
#endif
```

```
#ifndef _L1AGMI_S3_IE_TELEMETRY_
#define _L1AGMI_S3_IE_TELEMETRY_

```

```

typedef struct {
    unsigned int IE_PASSTHRU_RSP;
    unsigned short IE_BLANKING_CNT;
    unsigned short PWR_STAT_LR_PR;
    unsigned short PWR_STAT_A;
    unsigned short HTR_STAT_SMA;
}

```

```

unsigned short HTR_STAT_RDA;
unsigned short HTR_STAT_RS;
unsigned short PWR_STAT_LR_RED;
unsigned short RS_MST_RLY_STAT;
unsigned short RDA_DEPL_STAT_4;
unsigned short RDA_DEPL_STAT_3;
unsigned short RDA_DEPL_STAT_2;
unsigned short RDA_DEPL_STAT_1;
unsigned short CLR_STAT_N;
unsigned short IBS_LR3_STAT_N;
unsigned short MR_LR_LOWR_STAT;
unsigned short IBS_LR2_STAT_N;
unsigned short MR_LR_LEFT_STAT;
unsigned short IBS_LR1_STAT_N;
unsigned short MR_LR_RGHT_STAT;
unsigned short IE_LATCHUP_CHAN;
unsigned short IE_LATCHUP_RETR;
unsigned short IE_LATCHUP_SMPS;
unsigned short IE_LATCHUP_NUM;
unsigned short IE_LATCHUP_FAIL;
unsigned short HTR_STAT_HTLD;
unsigned short IE_LATCHUP_PAD;
} L1AGMI_S3_IE_TELEMETRY;

```

```
#endif
```

```
#ifndef _L1AGMI_S3_IEHSK_TEMP_
#define _L1AGMI_S3_IEHSK_TEMP_

```

```

typedef struct {
    unsigned short IBS_LR1_TEMP;
    unsigned short RS_TEMP_1;
    unsigned short SCE_A_BD_TEMP;
    unsigned short MR_LR_RGHT_TEMP;
    unsigned short SMA_BEARING_TMP;
    unsigned short PC_BD_TEMP;
    unsigned short LVPS_BD_TEMP;
    unsigned short SMA_MTR_TEMP;
    unsigned short HL_TEMP_2;
    unsigned short RDA_TEMP_2;
    unsigned short HL_TEMP_1;
    unsigned short RS_TEMP_2;
    unsigned short SCE_B_BD_TEMP;

```

```

    unsigned short TEMP_CALRES_1;
    unsigned short TEMP_CALRES_2;
    unsigned short MR_ICA_TEMP;
    unsigned short IBS_LR2_TEMP;
    unsigned short HL_TEMP_7;
    unsigned short RDA_TEMP_1;
    unsigned short MR_LR_LEFT_TEMP;
    unsigned short RDA_TEMP_3;
    unsigned short ICA_BOX_TEMP_1;
    unsigned short HL_TEMP_10;
    unsigned short MR_LR_LOWR_TEMP;
    unsigned short SMA_SLPRHTR_TMP;
    unsigned short HL_TEMP_8;
    unsigned short TEMP_CALRES_3;
    unsigned short TEMP_CALRES_4;
    unsigned short CSR_TEMP1;
    unsigned short HL_TEMP_12;
    unsigned short HL_TEMP_13;
    unsigned short HL_TEMP_14;
    unsigned short HL_TEMP_11;
    unsigned short IBS_LR3_TEMP;
    unsigned short HL_TEMP_9;
    unsigned short ROT_TEMP_SPARE;
    unsigned short CSR_TEMP2;
    unsigned short CE_BD_TEMP;
    unsigned short ICA_BOX_TEMP_2;
    unsigned short IE_BD_TEMP;
    unsigned short CLR_TEMP;
    unsigned short HL_TEMP_15;
    unsigned short TEMP_CALRES_5;
    unsigned short TEMP_CALRES_6;
} L1AGMI_S3_IEHSK_TEMP;

```

```
#endif
```

```
#ifndef _L1AGMI_S3_RSHSK_TEMP_
#define _L1AGMI_S3_RSHSK_TEMP_

```

```
typedef struct {
    unsigned short TEMP_10GHZRCVR;
    unsigned short TEMP_H166GHZMXR;
    unsigned short TEMP_18GHZRCVR;
    unsigned short TEMP_V166GHZMXR;

```

```

    unsigned short TEMP_23GHZRCVR;
    unsigned short TEMP_183GHZMXR;
    unsigned short TEMP_36GHZRCVR;
    unsigned short TEMP_H10GHZ_ND;
    unsigned short TEMP_89GHZRCVR;
    unsigned short TEMP_V10GHZ_ND;
    unsigned short TEMP_166GHZRCVR;
    unsigned short TEMP_H18GHZ_ND;
    unsigned short TEMP_183GHZRCVR;
    unsigned short TEMP_V18GHZ_ND;
    unsigned short TEMP_RS_EPC;
    unsigned short TEMP_H36GHZ_ND;
    unsigned short TEMP_RS_EDC;
    unsigned short TEMP_V36GHZ_ND;
    unsigned short TEMP_FEED;
    unsigned short TEMP_89GHZ_LO;
    unsigned short TEMP_HL_TRAY;
    unsigned short TEMP_166GHZ_LO;
    unsigned short TEMP_SMASPUNHSG;
    unsigned short TEMP_RS_MR1;
    unsigned short TEMP_H89GHZMXR;
    unsigned short TEMP_RS_MR2;
    unsigned short TEMP_V89GHZMXR;
    unsigned short TEMP_183GHZ_LO;
} L1AGMI_S3_RSHSK_TEMP;

```

```
#endif
```

```
#ifndef _L1AGMI_S3_RSHSK_GAIN_
#define _L1AGMI_S3_RSHSK_GAIN_

```

```
typedef struct {
    unsigned short RESERVED2;
    unsigned short GAIN_V10GHZ;
    unsigned short GAIN_H36GHZ;
    unsigned short GAIN_H89GHZ;
    unsigned short GAIN_H10GHZ;
    unsigned short GAIN_H166GHZ;
    unsigned short GAIN_V18GHZ;
    unsigned short GAIN_H18GHZ;
    unsigned short GAIN_VB183GHZ;
    unsigned short GAIN_V23GHZ;
    unsigned short GAIN_V36GHZ;

```

```

        unsigned short GAIN_V89GHZ;
        unsigned short GAIN_V166GHZ;
        unsigned short GAIN_VA183GHZ;
    } L1AGMI_S3_RSHSK_GAIN;

#endif

#ifndef _L1AGMI_S3_RSHSK_SAMPL_INFO_
#define _L1AGMI_S3_RSHSK_SAMPL_INFO_

typedef struct {
    unsigned short SMPOFFST_10GHZ;
    unsigned short SMPOFFST_18GHZ;
    unsigned short SMPOFFST_23GHZ;
    unsigned short SMPOFFST_36GHZ;
    unsigned short SMPOFFST_89GHZ;
    unsigned short SMPOFFST_166GHZ;
    unsigned short SMPOFFST_183GHZ;
    unsigned short NUMSMPLS_10GHZ;
    unsigned short NUMSMPLS_18GHZ;
    unsigned short NUMSMPLS_23GHZ;
    unsigned short NUMSMPLS_36GHZ;
    unsigned short NUMSMPLS_89GHZ;
    unsigned short NUMSMPLS_166GHZ;
    unsigned short NUMSMPLS_183GHZ;
} L1AGMI_S3_RSHSK_SAMPL_INFO;

#endif

#ifndef _L1AGMI_S3_RSHSK_STATUS_
#define _L1AGMI_S3_RSHSK_STATUS_

typedef struct {
    unsigned short RSST_SCI_ADC_LP;
    unsigned short RSST_HSK_ADC_LP;
    unsigned short RSST_SAMP_OVLP;
    unsigned short RSST_10GHZ_RLY;
    unsigned short RSST_18GHZ_RLY;
    unsigned short RSST_23GHZ_RLY;
    unsigned short RSST_36GHZ_RLY;
    unsigned short RSST_89GHZ_RLY;
    unsigned short RSST_166GHZ_RLY;
    unsigned short RSST_183GHZ_RLY;
}

```

```

    unsigned short RSST_INVLD_CMD;
    unsigned short RSST_CMD_AFTER;
    unsigned short NDIODE_MODE;
    unsigned short RSST_NDIODE_ST;
    unsigned short NDIODE10GHZSNUM;
    unsigned short RESERVED1;
    unsigned short RS_CALRES_1;
    unsigned short BATC_CALRES_1;
    unsigned short RS_CALRES_2;
    unsigned short BATC_CALRES_2;
    unsigned short RS_EPC_ISENS;
    unsigned short RS_EPC_5V;
    unsigned short RS_EPC_7V;
    unsigned short RS_EPC_POS12V;
    unsigned short RS_EPC_NEG12V;
    unsigned short RS_EPC_15V;
} L1AGMI_S3_RSHSK_STATUS;

```

```

#endif

```

```

#ifdef _L1AGMI_S3_SYNCH_STAMPS2_
#define _L1AGMI_S3_SYNCH_STAMPS2_

```

```

typedef struct {
    unsigned int TACH_SECS_16;
    unsigned short TACH_SUBS_16;
    unsigned int TACH_SECS_17;
    unsigned short TACH_SUBS_17;
    unsigned int TACH_SECS_18;
    unsigned short TACH_SUBS_18;
    unsigned int TACH_SECS_19;
    unsigned short TACH_SUBS_19;
    unsigned int TACH_SECS_20;
    unsigned short TACH_SUBS_20;
    unsigned int TACH_SECS_21;
    unsigned short TACH_SUBS_21;
    unsigned int TACH_SECS_22;
    unsigned short TACH_SUBS_22;
    unsigned int TACH_SECS_23;
    unsigned short TACH_SUBS_23;
    unsigned int TACH_SECS_24;
    unsigned short TACH_SUBS_24;
    unsigned int TACH_SECS_25;

```



```

    unsigned short TACH_SUBS_25;
    unsigned int TACH_SECS_26;
    unsigned short TACH_SUBS_26;
    unsigned int TACH_SECS_27;
    unsigned short TACH_SUBS_27;
    unsigned int TACH_SECS_28;
    unsigned short TACH_SUBS_28;
    unsigned int TACH_SECS_29;
    unsigned short TACH_SUBS_29;
    unsigned int TACH_SECS_30;
    unsigned short TACH_SUBS_30;
    unsigned int TACH_SECS_31;
    unsigned short TACH_SUBS_31;
    unsigned int SCAN_COMPL_SECS;
    unsigned short SCAN_COMPL_SUBS;
} L1AGMI_S3_SYNCH_STAMPS2;

```

```
#endif
```

```
#ifndef _L1AGMI_S3_SYNCH_STAMPS_
#define _L1AGMI_S3_SYNCH_STAMPS_

```

```

typedef struct {
    unsigned int IDX_PULSE_SECS;
    unsigned short IDX_PULSE_SUBS;
    unsigned int TACH_SECS_00;
    unsigned short TACH_SUBS_00;
    unsigned int TACH_SECS_01;
    unsigned short TACH_SUBS_01;
    unsigned int TACH_SECS_02;
    unsigned short TACH_SUBS_02;
    unsigned int TACH_SECS_03;
    unsigned short TACH_SUBS_03;
    unsigned int TACH_SECS_04;
    unsigned short TACH_SUBS_04;
    unsigned int TACH_SECS_05;
    unsigned short TACH_SUBS_05;
    unsigned int TACH_SECS_06;
    unsigned short TACH_SUBS_06;
    unsigned int TACH_SECS_07;
    unsigned short TACH_SUBS_07;
    unsigned int TACH_SECS_08;
    unsigned short TACH_SUBS_08;
}

```

```

    unsigned int TACH_SECS_09;
    unsigned short TACH_SUBS_09;
    unsigned int TACH_SECS_10;
    unsigned short TACH_SUBS_10;
    unsigned int TACH_SECS_11;
    unsigned short TACH_SUBS_11;
    unsigned int TACH_SECS_12;
    unsigned short TACH_SUBS_12;
    unsigned int TACH_SECS_13;
    unsigned short TACH_SUBS_13;
    unsigned int TACH_SECS_14;
    unsigned short TACH_SUBS_14;
    unsigned int TACH_SECS_15;
    unsigned short TACH_SUBS_15;
} L1AGMI_S3_SYNCH_STAMPS;

#endif

#ifndef _L1AGMI_S3_RS_INFO_
#define _L1AGMI_S3_RS_INFO_

typedef struct {
    unsigned short RS_POWERED;
    unsigned short RS_ENABLED;
    unsigned short RS_MST_RLY;
    unsigned short RS_10GHZ_RLY;
    unsigned short RS_18GHZ_RLY;
    unsigned short RS_23GHZ_RLY;
    unsigned short RS_36GHZ_RLY;
    unsigned short RS_89GHZ_RLY;
    unsigned short RS_166GHZ_RLY;
    unsigned short RS_183GHZ_RLY;
    unsigned short RS_DQ_MISSING;
    unsigned short RS_DQ_EXTRAS;
    unsigned short RS_DQ_DUPES;
    unsigned short RS_LAST_REV;
    unsigned short RS_DQ_SAME_REV;
    unsigned short RS_DQ_BAD_REVS;
    unsigned short RS_DQ_PAR_ERR;
    unsigned short RS_DQ_CLK_ERR;
    unsigned short RS_DQ_PKT_ERR;
    unsigned short RS_DQ_TLM_ERR;
    unsigned short RS_DQ_BAD_CONF;

```

```

    unsigned short RS_DQ_CAL_LIM;
    unsigned short BLK_STATE;
    unsigned short BLK_SIDE;
    unsigned short BLK_DELAY;
    unsigned short BLK_DURATION;
    unsigned short RS_HSK_SIZE;
    unsigned int RS_PAR_ERR_CNT;
    unsigned int RS_SCAN_CNT;
    unsigned int SAMPLE_TBL_VER;
    unsigned int SMPL_TBL;
    unsigned short RS_SC_SIZE;
    unsigned short GSDR_SIZE;
    unsigned short GSDR_LEFT;
    unsigned short GSDR_B_POP_IDX;
    unsigned short GSDR_B_PUSH_IDX;
    unsigned short GSDR_APID;
    unsigned short PKT_STATE;
    unsigned short OVRD_RS_PWR;
    unsigned short OVRD_SMA_SPIN;
    unsigned short OVRD_PASS_RS;
} L1AGMI_S3_RS_INFO;

```

```
#endif
```

```

#ifndef _L1AGMI_S3_SENSOR_INFO_
#define _L1AGMI_S3_SENSOR_INFO_

```

```

typedef struct {
    unsigned int KEEP_ALIVE_CNT;
    unsigned short FPGA_RST_REASON;
    unsigned short CRASH_REASON;
    unsigned short VERSION_MIN;
    unsigned short VERSION_MAJ;
    unsigned short FPGA_MODE;
    unsigned short ERR_HDL_FAILURE;
    unsigned short RESET_REASON;
    unsigned short BOOT_BANK;
    unsigned short CURRENT_BANK;
    unsigned short EDAC_ENABLE;
    unsigned short WDOG_ENABLE;
    unsigned short SC_1HZ_REF;
    unsigned short SCE_FORCE_SEL;
    unsigned short RS_1MHZ_REF;

```

```

    unsigned short RS_SCAN_START;
    unsigned short FPGA_IE_RX_EN;
    unsigned short FPGA_RS_RX_EN;
    unsigned short FPGA_SCE_RX_EN;
    unsigned short EEPROM_BUSY;
    unsigned short RS_TLM_PROG;
    unsigned short SCE_A_ACTIVE;
    unsigned short SCE_A_RLY;
    unsigned short SCE_B_ACTIVE;
    unsigned short SCE_B_RLY;
    unsigned short IE_TLM_PROG;
    unsigned short SCE_RSP_PROG;
    unsigned short RS_CLK_ERR;
    unsigned short RS_PKT_ERR;
    unsigned short RS_TLM_ERR;
    unsigned short SCE_RSP_RDY;
    unsigned short IE_PKT_ERR;
    unsigned short IE_CMD_ERR;
    unsigned short IE_RSP_ERR;
    unsigned short IE_TLM_ERR;
    unsigned short FPGA_ACCSS_ERR;
} L1AGMI_S3_SENSOR_INFO;

```

```
#endif
```

```

#ifndef _L1AGMI_S3_GSDR_TIME_
#define _L1AGMI_S3_GSDR_TIME_

```

```

typedef struct {
    unsigned int G_TC_PULSE_SECS;
    unsigned short G_TC_PULSE_SUBS;
    unsigned int G_TCU_SECS;
    unsigned int G_TCU_SUBS;
    unsigned int G_TCF_SC_SECS;
    unsigned int G_TCF_SC_SUBSEC;
    unsigned int G_TCF_SECS;
    unsigned int G_TCF_SUBSECS;
    unsigned short G_TCF_SIGN;
    unsigned short G_TCF_LEAP;
    unsigned int GPS_TCU_SECS;
    unsigned int GPS_TCU_SUBS;
} L1AGMI_S3_GSDR_TIME;

```

```

#endif

#ifndef _PRIMARYHEADER_
#define _PRIMARYHEADER_

typedef struct {
    signed char version;
    signed char type;
    signed char secHeaderFlag;
    short APID;
    signed char sequenceFlag;
    short packetSequenceCount;
    unsigned short packetLength;
} PRIMARYHEADER;

#endif

#ifndef _L1AGMI_S3_GMI_TEMPERATURES_
#define _L1AGMI_S3_GMI_TEMPERATURES_

typedef struct {
    float timeOffset;
    unsigned short apid;
    unsigned short SMA_PT_TEMP;
    unsigned short ICA_PT_TEMP;
    unsigned short RS_PT_TEMP;
    unsigned short STAT_PT_TEMP;
    unsigned short MR_PT_TEMP;
} L1AGMI_S3_GMI_TEMPERATURES;

#endif

#ifndef _L1AGMI_S3_TORQUE_BAR_
#define _L1AGMI_S3_TORQUE_BAR_

typedef struct {
    float timeOffset;
    unsigned short Vx;
    unsigned short Vy;
    unsigned short Vz;
} L1AGMI_S3_TORQUE_BAR;

#endif

```

```

#ifndef _L1AGMI_S3_TAM2_
#define _L1AGMI_S3_TAM2_

typedef struct {
    float timeOffset;
    unsigned short Vx;
    unsigned short Vy;
    unsigned short Vz;
} L1AGMI_S3_TAM2;

#endif

#ifndef _L1AGMI_S3_TAM1_
#define _L1AGMI_S3_TAM1_

typedef struct {
    float timeOffset;
    unsigned short Vx;
    unsigned short Vy;
    unsigned short Vz;
} L1AGMI_S3_TAM1;

#endif

#ifndef _L1AGMI_S3_
#define _L1AGMI_S3_

typedef struct {
    SCANTIME ScanTime;
    unsigned char ephemerisUsed[10];
    float Latitude;
    float Longitude;
    L1AGMI_S3_TAM1 TAM1;
    L1AGMI_S3_TAM2 TAM2;
    L1AGMI_S3_TORQUE_BAR TORQUE_BAR;
    L1AGMI_S3_GMI_TEMPERATURES GMI_TEMPERATURES;
    PRIMARYHEADER primaryHeader;
    unsigned int instrTimeSeconds;
    unsigned short instrTimeSubseconds;
    signed char numPacketSegments;
    signed char spare;
    short RDRversion;
}

```

```

L1AGMI_S3_GSDR_TIME GSDR_TIME;
L1AGMI_S3_SENSOR_INFO SENSOR_INFO;
L1AGMI_S3_RS_INFO RS_INFO;
L1AGMI_S3_SYNCH_STAMPS SYNCH_STAMPS;
L1AGMI_S3_SYNCH_STAMPS2 SYNCH_STAMPS2;
L1AGMI_S3_RSHSK_STATUS RSHSK_STATUS;
L1AGMI_S3_RSHSK_SAMPL_INFO RSHSK_SAMPL_INFO;
L1AGMI_S3_RSHSK_GAIN RSHSK_GAIN;
L1AGMI_S3_RSHSK_TEMP RSHSK_TEMP;
L1AGMI_S3_IEHSK_TEMP IEHSK_TEMP;
L1AGMI_S3_IE_TELEMETRY IE_TELEMETRY;
L1AGMI_S3_MECHANISMS MECHANISMS;
L1AGMI_S3_SMPL_INFO SMPL_INFO;
} L1AGMI_S3;

```

```

#endif

```

```

#ifndef _L1AGMI_S2_SUNDATA_
#define _L1AGMI_S2_SUNDATA_

```

```

typedef struct {
    float solarBetaAngle;
    float phaseFromOrbitMidnight;
    float sunEarthSeparation;
    float earthAngularRadius;
    float phaseOfEclipseExit;
    float orbitRate;
    float timeSinceEclipseEntry;
    float sunVectorInBodyFrame[3];
} L1AGMI_S2_SUNDATA;

```

```

#endif

```

```

#ifndef _L1AGMI_S2_SCANSTATUS_
#define _L1AGMI_S2_SCANSTATUS_

```

```

typedef struct {
    signed char dataQuality;
    signed char missing;
    signed char modeStatus;
    short geoError;
    short geoWarning;
    short Sorientation;

```

```

    short pointingStatus;
    signed char acsModeMidScan;
    signed char targetSelectionMidScan;
    signed char operationalMode;
    double FractionalGranuleNumber;
} L1AGMI_S2_SCANSTATUS;

```

```
#endif
```

```
#ifndef _L1AGMI_S2_
#define _L1AGMI_S2_

```

```

typedef struct {
    SCANTIME ScanTime;
    float Latitude[221];
    float Longitude[221];
    L1AGMI_S2_SCANSTATUS scanStatus;
    unsigned char ephemerisUsed[10];
    NAVIGATION navigation;
    L1AGMI_S2_SUNDATA sunData;
    float incidenceAngle[221];
    float satAzimuthAngle[221];
    float solarZenAngle[221];
    float solarAzimuthAngle[221];
    float sunGlintAngle[221];
    float moonVectorInstFrame[3];
    unsigned short earthView[221][4];
    unsigned short hotLoad[221][4];
    unsigned short coldSky[221][4];
} L1AGMI_S2;

```

```
#endif
```

```
#ifndef _L1AGMI_S1_SUNDATA_
#define _L1AGMI_S1_SUNDATA_

```

```

typedef struct {
    float solarBetaAngle;
    float phaseFromOrbitMidnight;
    float sunEarthSeparation;
    float earthAngularRadius;
    float phaseOfEclipseExit;
    float orbitRate;

```



```

        float timeSinceEclipseEntry;
        float sunVectorInBodyFrame[3];
} L1AGMI_S1_SUNDATA;

#endif

#ifndef _NAVIGATION_
#define _NAVIGATION_

typedef struct {
    float scPos[3];
    float scVel[3];
    float scLat;
    float scLon;
    float scAlt;
    float dprAlt;
    float scAttRollGeoc;
    float scAttPitchGeoc;
    float scAttYawGeoc;
    float scAttRollGeod;
    float scAttPitchGeod;
    float scAttYawGeod;
    float greenHourAng;
    double timeMidScan;
    double timeMidScanOffset;
} NAVIGATION;

#endif

#ifndef _L1AGMI_S1_SCANSTATUS_
#define _L1AGMI_S1_SCANSTATUS_

typedef struct {
    signed char dataQuality;
    signed char missing;
    signed char modeStatus;
    short geoError;
    short geoWarning;
    short SCorientation;
    short pointingStatus;
    signed char acsModeMidScan;
    signed char targetSelectionMidScan;
    signed char operationalMode;

```

```

    double FractionalGranuleNumber;
} L1AGMI_S1_SCANSTATUS;

#endif

#ifndef _SCANTIME_
#define _SCANTIME_

typedef struct {
    short Year;
    signed char Month;
    signed char DayOfMonth;
    signed char Hour;
    signed char Minute;
    signed char Second;
    short MilliSecond;
    short DayOfYear;
    double SecondOfDay;
} SCANTIME;

#endif

#ifndef _L1AGMI_S1_
#define _L1AGMI_S1_

typedef struct {
    SCANTIME ScanTime;
    float Latitude[221];
    float Longitude[221];
    L1AGMI_S1_SCANSTATUS scanStatus;
    unsigned char ephemerisUsed[10];
    NAVIGATION navigation;
    L1AGMI_S1_SUNDATA sunData;
    float incidenceAngle[221];
    float satAzimuthAngle[221];
    float solarZenAngle[221];
    float solarAzimuthAngle[221];
    float sunGlintAngle[221];
    float moonVectorInstFrame[3];
    unsigned short earthView[221][9];
    unsigned short hotLoad[221][9];
    unsigned short coldSky[221][9];
    unsigned char earthViewBlanking[221][2];

```

```

        unsigned char hotLoadBlanking[221][2];
        unsigned char coldSkyBlanking[221][2];
    } L1AGMI_S1;

```

```

#endif

```

```

#ifndef _L1AGMI_SWATHS_
#define _L1AGMI_SWATHS_

```

```

typedef struct {
    L1AGMI_S1 S1;
    L1AGMI_S2 S2;
    L1AGMI_S3 S3;
    L1AGMI_S4 S4;
    L1AGMI_S5 S5;
} L1AGMI_SWATHS;

```

```

#endif

```

```

#ifndef _L1AGMI_GMI1AHEADER_
#define _L1AGMI_GMI1AHEADER_

```

```

typedef struct {
    unsigned short sampleRangeFile[7][6];
} L1AGMI_GMI1AHEADER;

```

```

#endif

```

```

#endif

```

## Fortran Structure Header file:

```

STRUCTURE /L1AGMI_S5/
    RECORD /SCANTIME/ ScanTime
    CHARACTER ephemerisUsed(10)
    REAL*4 Latitude(500)
    REAL*4 Longitude(500)
    REAL*4 incidenceAngle(500)
    INTEGER*2 fullRotation(4,500)
END STRUCTURE

```

```

STRUCTURE /L1AGMI_S4/
    RECORD /SCANTIME/ ScanTime

```

```
CHARACTER ephemerisUsed(10)
REAL*4 Latitude(500)
REAL*4 Longitude(500)
REAL*4 incidenceAngle(500)
INTEGER*2 fullRotation(9,500)
CHARACTER fullRotBlanking(2,500)
END STRUCTURE
```

```
STRUCTURE /L1AGMI_S3_SMPL_INFO/
  INTEGER*2 SMPL_INFO_VALID
  INTEGER*2 EARTH_10G_STRT
  INTEGER*2 EARTH_10G_NUM
  INTEGER*2 HLOAD_10G_STRT
  INTEGER*2 HLOAD_10G_NUM
  INTEGER*2 CSKY_10G_STRT
  INTEGER*2 CSKY_10G_NUM
  INTEGER*2 EARTH_18G_STRT
  INTEGER*2 EARTH_18G_NUM
  INTEGER*2 HLOAD_18G_STRT
  INTEGER*2 HLOAD_18G_NUM
  INTEGER*2 CSKY_18G_STRT
  INTEGER*2 CSKY_18G_NUM
  INTEGER*2 EARTH_23G_STRT
  INTEGER*2 EARTH_23G_NUM
  INTEGER*2 HLOAD_23G_STRT
  INTEGER*2 HLOAD_23G_NUM
  INTEGER*2 CSKY_23G_STRT
  INTEGER*2 CSKY_23G_NUM
  INTEGER*2 EARTH_36G_STRT
  INTEGER*2 EARTH_36G_NUM
  INTEGER*2 HLOAD_36G_STRT
  INTEGER*2 HLOAD_36G_NUM
  INTEGER*2 CSKY_36G_STRT
  INTEGER*2 CSKY_36G_NUM
  INTEGER*2 EARTH_89G_STRT
  INTEGER*2 EARTH_89G_NUM
  INTEGER*2 HLOAD_89G_STRT
  INTEGER*2 HLOAD_89G_NUM
  INTEGER*2 CSKY_89G_STRT
  INTEGER*2 CSKY_89G_NUM
  INTEGER*2 EARTH_166G_STRT
  INTEGER*2 EARTH_166G_NUM
  INTEGER*2 HLOAD_166G_STRT
```

```
INTEGER*2 HLOAD_166G_NUM
INTEGER*2 CSKY_166G_STRT
INTEGER*2 CSKY_166G_NUM
INTEGER*2 EARTH_183G_STRT
INTEGER*2 EARTH_183G_NUM
INTEGER*2 HLOAD_183G_STRT
INTEGER*2 HLOAD_183G_NUM
INTEGER*2 CSKY_183G_STRT
INTEGER*2 CSKY_183G_NUM
END STRUCTURE
```

```
STRUCTURE /L1AGMI_S3_MECHANISMS/
INTEGER*4 SCE_LAST_CMD
INTEGER*4 SCE_LAST_RESPNS
INTEGER*4 SCE_CMD_CNT
INTEGER*2 SMA_RTPRB_SEC
INTEGER*2 SMA_RATE
INTEGER*2 SCE_RATE
INTEGER*2 SCE_CMD_RATE
INTEGER*2 SMA_CMD_RATE
INTEGER*2 RESOLVER_POS
INTEGER*2 MECH_CMD_CNT
INTEGER*2 SCE_INHIBIT
INTEGER*2 TACH_PULSE_CNT
INTEGER*2 LR_ABRT_CNT
INTEGER*2 RAMP_ABRT_CNT
INTEGER*2 OVRD_RDA_LR
INTEGER*2 OVRD_IBS_LR
INTEGER*2 SCE_PASSPROT
INTEGER*2 RAMP_INPROGRESS
INTEGER*2 SMA_SPINNING
INTEGER*2 LR_RLS_IN_PROG
INTEGER*2 SCE_A_POWER
INTEGER*2 SCE_B_POWER
INTEGER*2 SCE_SELECTION
INTEGER*2 SMA_RATE_PROB
INTEGER*2 LR_ENABLED
INTEGER*2 BILVL_IBS1
INTEGER*2 BILVL_IBS2
INTEGER*2 BILVL_IBS3
INTEGER*2 BILVL_CAL
INTEGER*2 BILVL_RDALEFT
INTEGER*2 BILVL_RDARIGHT
```

```
    INTEGER*2 BILVL_RDALOWER  
END STRUCTURE
```

```
STRUCTURE /L1AGMI_S3_IE_TELEMETRY/
```

```
    INTEGER*4 IE_PASSTHRU_RSP  
    INTEGER*2 IE_BLANKING_CNT  
    INTEGER*2 PWR_STAT_LR_PR  
    INTEGER*2 PWR_STAT_A  
    INTEGER*2 HTR_STAT_SMA  
    INTEGER*2 HTR_STAT_RDA  
    INTEGER*2 HTR_STAT_RS  
    INTEGER*2 PWR_STAT_LR_RED  
    INTEGER*2 RS_MST_RLY_STAT  
    INTEGER*2 RDA_DEPL_STAT_4  
    INTEGER*2 RDA_DEPL_STAT_3  
    INTEGER*2 RDA_DEPL_STAT_2  
    INTEGER*2 RDA_DEPL_STAT_1  
    INTEGER*2 CLR_STAT_N  
    INTEGER*2 IBS_LR3_STAT_N  
    INTEGER*2 MR_LR_LOWR_STAT  
    INTEGER*2 IBS_LR2_STAT_N  
    INTEGER*2 MR_LR_LEFT_STAT  
    INTEGER*2 IBS_LR1_STAT_N  
    INTEGER*2 MR_LR_RGHT_STAT  
    INTEGER*2 IE_LATCHUP_CHAN  
    INTEGER*2 IE_LATCHUP_RETR  
    INTEGER*2 IE_LATCHUP_SMPS  
    INTEGER*2 IE_LATCHUP_NUM  
    INTEGER*2 IE_LATCHUP_FAIL  
    INTEGER*2 HTR_STAT_HTLD  
    INTEGER*2 IE_LATCHUP_PAD
```

```
END STRUCTURE
```

```
STRUCTURE /L1AGMI_S3_IEHSK_TEMP/
```

```
    INTEGER*2 IBS_LR1_TEMP  
    INTEGER*2 RS_TEMP_1  
    INTEGER*2 SCE_A_BD_TEMP  
    INTEGER*2 MR_LR_RGHT_TEMP  
    INTEGER*2 SMA_BEARING_TMP  
    INTEGER*2 PC_BD_TEMP  
    INTEGER*2 LVPS_BD_TEMP  
    INTEGER*2 SMA_MTR_TEMP  
    INTEGER*2 HL_TEMP_2
```

```

INTEGER*2 RDA_TEMP_2
INTEGER*2 HL_TEMP_1
INTEGER*2 RS_TEMP_2
INTEGER*2 SCE_B_BD_TEMP
INTEGER*2 TEMP_CALRES_1
INTEGER*2 TEMP_CALRES_2
INTEGER*2 MR_ICA_TEMP
INTEGER*2 IBS_LR2_TEMP
INTEGER*2 HL_TEMP_7
INTEGER*2 RDA_TEMP_1
INTEGER*2 MR_LR_LEFT_TEMP
INTEGER*2 RDA_TEMP_3
INTEGER*2 ICA_BOX_TEMP_1
INTEGER*2 HL_TEMP_10
INTEGER*2 MR_LR_LOWR_TEMP
INTEGER*2 SMA_SLPRHTR_TMP
INTEGER*2 HL_TEMP_8
INTEGER*2 TEMP_CALRES_3
INTEGER*2 TEMP_CALRES_4
INTEGER*2 CSR_TEMP1
INTEGER*2 HL_TEMP_12
INTEGER*2 HL_TEMP_13
INTEGER*2 HL_TEMP_14
INTEGER*2 HL_TEMP_11
INTEGER*2 IBS_LR3_TEMP
INTEGER*2 HL_TEMP_9
INTEGER*2 ROT_TEMP_SPARE
INTEGER*2 CSR_TEMP2
INTEGER*2 CE_BD_TEMP
INTEGER*2 ICA_BOX_TEMP_2
INTEGER*2 IE_BD_TEMP
INTEGER*2 CLR_TEMP
INTEGER*2 HL_TEMP_15
INTEGER*2 TEMP_CALRES_5
INTEGER*2 TEMP_CALRES_6
END STRUCTURE

STRUCTURE /L1AGMI_S3_RSHK_TEMP/
  INTEGER*2 TEMP_10GHZRCVR
  INTEGER*2 TEMP_H166GHZMXR
  INTEGER*2 TEMP_18GHZRCVR
  INTEGER*2 TEMP_V166GHZMXR
  INTEGER*2 TEMP_23GHZRCVR

```

```

INTEGER*2 TEMP_183GHZMXR
INTEGER*2 TEMP_36GHZRCVR
INTEGER*2 TEMP_H10GHZ_ND
INTEGER*2 TEMP_89GHZRCVR
INTEGER*2 TEMP_V10GHZ_ND
INTEGER*2 TEMP_166GHZRCVR
INTEGER*2 TEMP_H18GHZ_ND
INTEGER*2 TEMP_183GHZRCVR
INTEGER*2 TEMP_V18GHZ_ND
INTEGER*2 TEMP_RS_EPC
INTEGER*2 TEMP_H36GHZ_ND
INTEGER*2 TEMP_RS_EDC
INTEGER*2 TEMP_V36GHZ_ND
INTEGER*2 TEMP_FEED
INTEGER*2 TEMP_89GHZ_LO
INTEGER*2 TEMP_HL_TRAY
INTEGER*2 TEMP_166GHZ_LO
INTEGER*2 TEMP_SMASPUNHSG
INTEGER*2 TEMP_RS_MR1
INTEGER*2 TEMP_H89GHZMXR
INTEGER*2 TEMP_RS_MR2
INTEGER*2 TEMP_V89GHZMXR
INTEGER*2 TEMP_183GHZ_LO
END STRUCTURE

STRUCTURE /L1AGMI_S3_RSHSK_GAIN/
INTEGER*2 RESERVED2
INTEGER*2 GAIN_V10GHZ
INTEGER*2 GAIN_H36GHZ
INTEGER*2 GAIN_H89GHZ
INTEGER*2 GAIN_H10GHZ
INTEGER*2 GAIN_H166GHZ
INTEGER*2 GAIN_V18GHZ
INTEGER*2 GAIN_H18GHZ
INTEGER*2 GAIN_VB183GHZ
INTEGER*2 GAIN_V23GHZ
INTEGER*2 GAIN_V36GHZ
INTEGER*2 GAIN_V89GHZ
INTEGER*2 GAIN_V166GHZ
INTEGER*2 GAIN_VA183GHZ
END STRUCTURE

STRUCTURE /L1AGMI_S3_RSHSK_SAMPL_INFO/

```



```
INTEGER*2 SMPOFFST_10GHZ
INTEGER*2 SMPOFFST_18GHZ
INTEGER*2 SMPOFFST_23GHZ
INTEGER*2 SMPOFFST_36GHZ
INTEGER*2 SMPOFFST_89GHZ
INTEGER*2 SMPOFFST_166GHZ
INTEGER*2 SMPOFFST_183GHZ
INTEGER*2 NUMSMPLS_10GHZ
INTEGER*2 NUMSMPLS_18GHZ
INTEGER*2 NUMSMPLS_23GHZ
INTEGER*2 NUMSMPLS_36GHZ
INTEGER*2 NUMSMPLS_89GHZ
INTEGER*2 NUMSMPLS_166GHZ
INTEGER*2 NUMSMPLS_183GHZ
END STRUCTURE
```

```
STRUCTURE /L1AGMI_S3_RSHSK_STATUS/
```

```
INTEGER*2 RSST_SCI_ADC_LP
INTEGER*2 RSST_HSK_ADC_LP
INTEGER*2 RSST_SAMP_OVLP
INTEGER*2 RSST_10GHZ_RLY
INTEGER*2 RSST_18GHZ_RLY
INTEGER*2 RSST_23GHZ_RLY
INTEGER*2 RSST_36GHZ_RLY
INTEGER*2 RSST_89GHZ_RLY
INTEGER*2 RSST_166GHZ_RLY
INTEGER*2 RSST_183GHZ_RLY
INTEGER*2 RSST_INVLD_CMD
INTEGER*2 RSST_CMD_AFTER
INTEGER*2 NDIODE_MODE
INTEGER*2 RSST_NDIODE_ST
INTEGER*2 NDIODE10GHZSNUM
INTEGER*2 RESERVED1
INTEGER*2 RS_CALRES_1
INTEGER*2 BATC_CALRES_1
INTEGER*2 RS_CALRES_2
INTEGER*2 BATC_CALRES_2
INTEGER*2 RS_EPC_ISENS
INTEGER*2 RS_EPC_5V
INTEGER*2 RS_EPC_7V
INTEGER*2 RS_EPC_POS12V
INTEGER*2 RS_EPC_NEG12V
INTEGER*2 RS_EPC_15V
```

END STRUCTURE

STRUCTURE /L1AGMI\_S3\_SYNCH\_STAMPS2/

INTEGER\*4 TACH\_SECS\_16  
INTEGER\*2 TACH\_SUBS\_16  
INTEGER\*4 TACH\_SECS\_17  
INTEGER\*2 TACH\_SUBS\_17  
INTEGER\*4 TACH\_SECS\_18  
INTEGER\*2 TACH\_SUBS\_18  
INTEGER\*4 TACH\_SECS\_19  
INTEGER\*2 TACH\_SUBS\_19  
INTEGER\*4 TACH\_SECS\_20  
INTEGER\*2 TACH\_SUBS\_20  
INTEGER\*4 TACH\_SECS\_21  
INTEGER\*2 TACH\_SUBS\_21  
INTEGER\*4 TACH\_SECS\_22  
INTEGER\*2 TACH\_SUBS\_22  
INTEGER\*4 TACH\_SECS\_23  
INTEGER\*2 TACH\_SUBS\_23  
INTEGER\*4 TACH\_SECS\_24  
INTEGER\*2 TACH\_SUBS\_24  
INTEGER\*4 TACH\_SECS\_25  
INTEGER\*2 TACH\_SUBS\_25  
INTEGER\*4 TACH\_SECS\_26  
INTEGER\*2 TACH\_SUBS\_26  
INTEGER\*4 TACH\_SECS\_27  
INTEGER\*2 TACH\_SUBS\_27  
INTEGER\*4 TACH\_SECS\_28  
INTEGER\*2 TACH\_SUBS\_28  
INTEGER\*4 TACH\_SECS\_29  
INTEGER\*2 TACH\_SUBS\_29  
INTEGER\*4 TACH\_SECS\_30  
INTEGER\*2 TACH\_SUBS\_30  
INTEGER\*4 TACH\_SECS\_31  
INTEGER\*2 TACH\_SUBS\_31  
INTEGER\*4 SCAN\_COMPL\_SECS  
INTEGER\*2 SCAN\_COMPL\_SUBS

END STRUCTURE

STRUCTURE /L1AGMI\_S3\_SYNCH\_STAMPS/

INTEGER\*4 IDX\_PULSE\_SECS  
INTEGER\*2 IDX\_PULSE\_SUBS  
INTEGER\*4 TACH\_SECS\_00

```
INTEGER*2 TACH_SUBS_00
INTEGER*4 TACH_SECS_01
INTEGER*2 TACH_SUBS_01
INTEGER*4 TACH_SECS_02
INTEGER*2 TACH_SUBS_02
INTEGER*4 TACH_SECS_03
INTEGER*2 TACH_SUBS_03
INTEGER*4 TACH_SECS_04
INTEGER*2 TACH_SUBS_04
INTEGER*4 TACH_SECS_05
INTEGER*2 TACH_SUBS_05
INTEGER*4 TACH_SECS_06
INTEGER*2 TACH_SUBS_06
INTEGER*4 TACH_SECS_07
INTEGER*2 TACH_SUBS_07
INTEGER*4 TACH_SECS_08
INTEGER*2 TACH_SUBS_08
INTEGER*4 TACH_SECS_09
INTEGER*2 TACH_SUBS_09
INTEGER*4 TACH_SECS_10
INTEGER*2 TACH_SUBS_10
INTEGER*4 TACH_SECS_11
INTEGER*2 TACH_SUBS_11
INTEGER*4 TACH_SECS_12
INTEGER*2 TACH_SUBS_12
INTEGER*4 TACH_SECS_13
INTEGER*2 TACH_SUBS_13
INTEGER*4 TACH_SECS_14
INTEGER*2 TACH_SUBS_14
INTEGER*4 TACH_SECS_15
INTEGER*2 TACH_SUBS_15
END STRUCTURE
```

```
STRUCTURE /L1AGMI_S3_RS_INFO/
  INTEGER*2 RS_POWERED
  INTEGER*2 RS_ENABLED
  INTEGER*2 RS_MST_RLY
  INTEGER*2 RS_10GHZ_RLY
  INTEGER*2 RS_18GHZ_RLY
  INTEGER*2 RS_23GHZ_RLY
  INTEGER*2 RS_36GHZ_RLY
  INTEGER*2 RS_89GHZ_RLY
  INTEGER*2 RS_166GHZ_RLY
```

```

INTEGER*2 RS_183GHZ_RLY
INTEGER*2 RS_DQ_MISSING
INTEGER*2 RS_DQ_EXTRAS
INTEGER*2 RS_DQ_DUPES
INTEGER*2 RS_LAST_REV
INTEGER*2 RS_DQ_SAME_REV
INTEGER*2 RS_DQ_BAD_REVS
INTEGER*2 RS_DQ_PAR_ERR
INTEGER*2 RS_DQ_CLK_ERR
INTEGER*2 RS_DQ_PKT_ERR
INTEGER*2 RS_DQ_TLM_ERR
INTEGER*2 RS_DQ_BAD_CONF
INTEGER*2 RS_DQ_CAL_LIM
INTEGER*2 BLK_STATE
INTEGER*2 BLK_SIDE
INTEGER*2 BLK_DELAY
INTEGER*2 BLK_DURATION
INTEGER*2 RS_HSK_SIZE
INTEGER*4 RS_PAR_ERR_CNT
INTEGER*4 RS_SCAN_CNT
INTEGER*4 SAMPLE_TBL_VER
INTEGER*4 SMPL_TBL
INTEGER*2 RS_SC_SIZE
INTEGER*2 GSDR_SIZE
INTEGER*2 GSDR_LEFT
INTEGER*2 GSDR_B_POP_IDX
INTEGER*2 GSDR_B_PUSH_IDX
INTEGER*2 GSDR_APID
INTEGER*2 PKT_STATE
INTEGER*2 OVRD_RS_PWR
INTEGER*2 OVRD_SMA_SPIN
INTEGER*2 OVRD_PASS_RS
END STRUCTURE

```

```

STRUCTURE /L1AGMI_S3_SENSOR_INFO/
INTEGER*4 KEEP_ALIVE_CNT
INTEGER*2 FPGA_RST_REASON
INTEGER*2 CRASH_REASON
INTEGER*2 VERSION_MIN
INTEGER*2 VERSION_MAJ
INTEGER*2 FPGA_MODE
INTEGER*2 ERR_HDL_FAILURE
INTEGER*2 RESET_REASON

```

```

INTEGER*2 BOOT_BANK
INTEGER*2 CURRENT_BANK
INTEGER*2 EDAC_ENABLE
INTEGER*2 WDOG_ENABLE
INTEGER*2 SC_1HZ_REF
INTEGER*2 SCE_FORCE_SEL
INTEGER*2 RS_1MHZ_REF
INTEGER*2 RS_SCAN_START
INTEGER*2 FPGA_IE_RX_EN
INTEGER*2 FPGA_RS_RX_EN
INTEGER*2 FPGA_SCE_RX_EN
INTEGER*2 EEPROM_BUSY
INTEGER*2 RS_TLM_PROG
INTEGER*2 SCE_A_ACTIVE
INTEGER*2 SCE_A_RLY
INTEGER*2 SCE_B_ACTIVE
INTEGER*2 SCE_B_RLY
INTEGER*2 IE_TLM_PROG
INTEGER*2 SCE_RSP_PROG
INTEGER*2 RS_CLK_ERR
INTEGER*2 RS_PKT_ERR
INTEGER*2 RS_TLM_ERR
INTEGER*2 SCE_RSP_RDY
INTEGER*2 IE_PKT_ERR
INTEGER*2 IE_CMD_ERR
INTEGER*2 IE_RSP_ERR
INTEGER*2 IE_TLM_ERR
INTEGER*2 FPGA_ACCSS_ERR
END STRUCTURE

STRUCTURE /L1AGMI_S3_GSDR_TIME/
  INTEGER*4 G_TC_PULSE_SECS
  INTEGER*2 G_TC_PULSE_SUBS
  INTEGER*4 G_TCU_SECS
  INTEGER*4 G_TCU_SUBS
  INTEGER*4 G_TCF_SC_SECS
  INTEGER*4 G_TCF_SC_SUBSEC
  INTEGER*4 G_TCF_SECS
  INTEGER*4 G_TCF_SUBSECS
  INTEGER*2 G_TCF_SIGN
  INTEGER*2 G_TCF_LEAP
  INTEGER*4 GPS_TCU_SECS
  INTEGER*4 GPS_TCU_SUBS

```

END STRUCTURE

STRUCTURE /PRIMARYHEADER/

BYTE version  
BYTE type  
BYTE secHeaderFlag  
INTEGER\*2 APID  
BYTE sequenceFlag  
INTEGER\*2 packetSequenceCount  
INTEGER\*2 packetLength

END STRUCTURE

STRUCTURE /L1AGMI\_S3\_GMI\_TEMPERATURES/

REAL\*4 timeOffset  
INTEGER\*2 apid  
INTEGER\*2 SMA\_PT\_TEMP  
INTEGER\*2 ICA\_PT\_TEMP  
INTEGER\*2 RS\_PT\_TEMP  
INTEGER\*2 STAT\_PT\_TEMP  
INTEGER\*2 MR\_PT\_TEMP

END STRUCTURE

STRUCTURE /L1AGMI\_S3\_TORQUE\_BAR/

REAL\*4 timeOffset  
INTEGER\*2 Vx  
INTEGER\*2 Vy  
INTEGER\*2 Vz

END STRUCTURE

STRUCTURE /L1AGMI\_S3\_TAM2/

REAL\*4 timeOffset  
INTEGER\*2 Vx  
INTEGER\*2 Vy  
INTEGER\*2 Vz

END STRUCTURE

STRUCTURE /L1AGMI\_S3\_TAM1/

REAL\*4 timeOffset  
INTEGER\*2 Vx  
INTEGER\*2 Vy  
INTEGER\*2 Vz

END STRUCTURE

```

STRUCTURE /L1AGMI_S3/
  RECORD /SCANTIME/ ScanTime
  CHARACTER ephemerisUsed(10)
  REAL*4 Latitude
  REAL*4 Longitude
  RECORD /L1AGMI_S3_TAM1/ TAM1
  RECORD /L1AGMI_S3_TAM2/ TAM2
  RECORD /L1AGMI_S3_TORQUE_BAR/ TORQUE_BAR
  RECORD /L1AGMI_S3_GMI_TEMPERATURES/ GMI_TEMPERATURES
  RECORD /PRIMARYHEADER/ primaryHeader
  INTEGER*4 instrTimeSeconds
  INTEGER*2 instrTimeSubseconds
  BYTE numPacketSegments
  BYTE spare
  INTEGER*2 RDRversion
  RECORD /L1AGMI_S3_GSDR_TIME/ GSDR_TIME
  RECORD /L1AGMI_S3_SENSOR_INFO/ SENSOR_INFO
  RECORD /L1AGMI_S3_RS_INFO/ RS_INFO
  RECORD /L1AGMI_S3_SYNCH_STAMPS/ SYNCH_STAMPS
  RECORD /L1AGMI_S3_SYNCH_STAMPS2/ SYNCH_STAMPS2
  RECORD /L1AGMI_S3_RSHSK_STATUS/ RSHSK_STATUS
  RECORD /L1AGMI_S3_RSHSK_SAMPL_INFO/ RSHSK_SAMPL_INFO
  RECORD /L1AGMI_S3_RSHSK_GAIN/ RSHSK_GAIN
  RECORD /L1AGMI_S3_RSHSK_TEMP/ RSHSK_TEMP
  RECORD /L1AGMI_S3_IEHSK_TEMP/ IEHSK_TEMP
  RECORD /L1AGMI_S3_IE_TELEMETRY/ IE_TELEMETRY
  RECORD /L1AGMI_S3_MECHANISMS/ MECHANISMS
  RECORD /L1AGMI_S3_SMPL_INFO/ SMPL_INFO
END STRUCTURE

```

```

STRUCTURE /L1AGMI_S2_SUNDATA/
  REAL*4 solarBetaAngle
  REAL*4 phaseFromOrbitMidnight
  REAL*4 sunEarthSeparation
  REAL*4 earthAngularRadius
  REAL*4 phaseOfEclipseExit
  REAL*4 orbitRate
  REAL*4 timeSinceEclipseEntry
  REAL*4 sunVectorInBodyFrame(3)
END STRUCTURE

```

```

STRUCTURE /L1AGMI_S2_SCANSTATUS/
  BYTE dataQuality

```

```

    BYTE missing
    BYTE modeStatus
    INTEGER*2 geoError
    INTEGER*2 geoWarning
    INTEGER*2 SCorientation
    INTEGER*2 pointingStatus
    BYTE acsModeMidScan
    BYTE targetSelectionMidScan
    BYTE operationalMode
    REAL*8 FractionalGranuleNumber
END STRUCTURE

STRUCTURE /L1AGMI_S2/
    RECORD /SCANTIME/ ScanTime
    REAL*4 Latitude(221)
    REAL*4 Longitude(221)
    RECORD /L1AGMI_S2_SCANSTATUS/ scanStatus
    CHARACTER ephemerisUsed(10)
    RECORD /NAVIGATION/ navigation
    RECORD /L1AGMI_S2_SUNDATA/ sunData
    REAL*4 incidenceAngle(221)
    REAL*4 satAzimuthAngle(221)
    REAL*4 solarZenAngle(221)
    REAL*4 solarAzimuthAngle(221)
    REAL*4 sunGlintAngle(221)
    REAL*4 moonVectorInstFrame(3)
    INTEGER*2 earthView(4,221)
    INTEGER*2 hotLoad(4,221)
    INTEGER*2 coldSky(4,221)
END STRUCTURE

STRUCTURE /L1AGMI_S1_SUNDATA/
    REAL*4 solarBetaAngle
    REAL*4 phaseFromOrbitMidnight
    REAL*4 sunEarthSeparation
    REAL*4 earthAngularRadius
    REAL*4 phaseOfEclipseExit
    REAL*4 orbitRate
    REAL*4 timeSinceEclipseEntry
    REAL*4 sunVectorInBodyFrame(3)
END STRUCTURE

STRUCTURE /NAVIGATION/

```



```

REAL*4 scPos(3)
REAL*4 scVel(3)
REAL*4 scLat
REAL*4 scLon
REAL*4 scAlt
REAL*4 dprAlt
REAL*4 scAttRollGeoc
REAL*4 scAttPitchGeoc
REAL*4 scAttYawGeoc
REAL*4 scAttRollGeod
REAL*4 scAttPitchGeod
REAL*4 scAttYawGeod
REAL*4 greenHourAng
REAL*8 timeMidScan
REAL*8 timeMidScanOffset
END STRUCTURE

STRUCTURE /L1AGMI_S1_SCANSTATUS/
  BYTE dataQuality
  BYTE missing
  BYTE modeStatus
  INTEGER*2 geoError
  INTEGER*2 geoWarning
  INTEGER*2 SCorientation
  INTEGER*2 pointingStatus
  BYTE acsModeMidScan
  BYTE targetSelectionMidScan
  BYTE operationalMode
  REAL*8 FractionalGranuleNumber
END STRUCTURE

STRUCTURE /SCANTIME/
  INTEGER*2 Year
  BYTE Month
  BYTE DayOfMonth
  BYTE Hour
  BYTE Minute
  BYTE Second
  INTEGER*2 MilliSecond
  INTEGER*2 DayOfYear
  REAL*8 SecondOfDay
END STRUCTURE

```

```

STRUCTURE /L1AGMI_S1/
  RECORD /SCANTIME/ ScanTime
  REAL*4 Latitude(221)
  REAL*4 Longitude(221)
  RECORD /L1AGMI_S1_SCANSTATUS/ scanStatus
  CHARACTER ephemerisUsed(10)
  RECORD /NAVIGATION/ navigation
  RECORD /L1AGMI_S1_SUNDATA/ sunData
  REAL*4 incidenceAngle(221)
  REAL*4 satAzimuthAngle(221)
  REAL*4 solarZenAngle(221)
  REAL*4 solarAzimuthAngle(221)
  REAL*4 sunGlintAngle(221)
  REAL*4 moonVectorInstFrame(3)
  INTEGER*2 earthView(9,221)
  INTEGER*2 hotLoad(9,221)
  INTEGER*2 coldSky(9,221)
  CHARACTER earthViewBlanking(2,221)
  CHARACTER hotLoadBlanking(2,221)
  CHARACTER coldSkyBlanking(2,221)
END STRUCTURE

```

```

STRUCTURE /L1AGMI_SWATHS/
  RECORD /L1AGMI_S1/ S1;
  RECORD /L1AGMI_S2/ S2;
  RECORD /L1AGMI_S3/ S3;
  RECORD /L1AGMI_S4/ S4;
  RECORD /L1AGMI_S5/ S5;
END STRUCTURE

```

```

STRUCTURE /L1AGMI_GMI1AHEADER/
  INTEGER*2 sampleRangeFile(6,7)
END STRUCTURE

```