# Analysis on Processing Timeline of COMS LHGS Design

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**ABSTRACT:**

This paper analyzes on LHGS (LRIT/HRIT Generation Subsystem) processing timeline for COMS LHGS design. The LHGS shall transmit LRIT/HRIT (Low Rate Information Transmission/ High Rate Information Transmission) data to the users within 15 minutes after the end of the image acquisition. So, this paper performs experiment using MTSAT-1R LRIT/HRIT (11 days) and calculates minimum LHGS processing time. Only HRIT FD (Full Disk) image is considered in this paper because data size of HRIT FD image is the largest. As a result of experiment, COMS LHGS should be able to receive MI Level 1B product within 157 seconds at least.

**KEY WORD**: COMS, LHGS, Timeline, MTSAT-1R

## 1. Introduction

Communication, Ocean, and Meteorological Satellite (COMS) to be launched in year 2008 will be the first Korean multi-purpose geostationary satellite aiming at three major missions, i.e.: communication, ocean, and meteorological applications. The development of systems for the meteorological mission sponsored by the Korea Meteorological Administration (KMA) consists of payloads, ground system, and data processing system. The COMS IDACS (Image Data Acquisition and Control System Specification) provides the capability to process the received raw data (MI and GOCI) and disseminate the processed MI data (LRIT/HRIT) to users via a satellite. The function of LHGS as subsystem of COMS IDACS performs the LRIT/HRIT formatting for user dissemination service. The LHGS shall transmit LRIT/HRIT data to the users within 15 minutes after the end of the image acquisition. So, it is important to analyze timeline of COMS LHGS.

## 2. LHGS Overview

The LHGS performs the LRIT/HRIT formatting for user dissemination service according to the COMS LRIT Mission Specification and COMS HRIT Mission Specification.

Figure 1 shows overall configuration and functionalities of COMS LHGS.

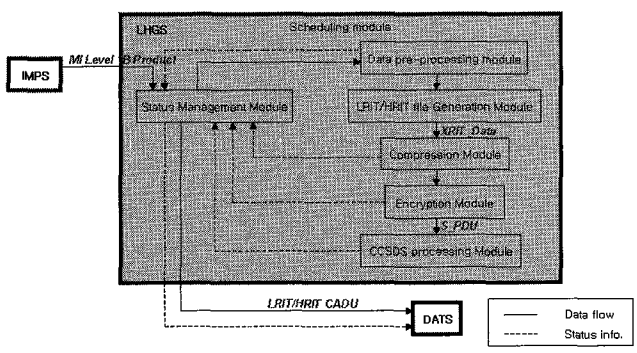


**Figure 1. Overall Configuration of COMS LHGS**

The LHGS receives INRSM output (MI Level 1B block) from the IMPS for LRIT/HRIT data generation.

The data pre-processing module performs the function of handling MI Level 1B product before LHGS file generation. The data pre-processing performs segmentation for FD image and each segmented image is made by the identical size. After segmented image is made, LRIT/HRIT file is also generated for each segmented image.

The LRIT/HRIT file generation module performs the function of LRIT/HRIT file formatting according to COMS LHGS Specification.

The COMS LHGS performs JPEG (Joint Photographic Coding Experts Group) compression for data size by compression module. Lossless JPEG is applied to HRIT, lossy JPEG to LRIT.

The encryption module performs DES (Data Encryption Standard) encryption for security.

The CCSDS (Consultative Committee for Space Data Systems) processing module performs packetizing and adding on RS (Reed-Solomon)-code, randomizing, attaching sync word. The output of CCSDS processing module is LRIT/HRIT CADU.

The status management module has the function monitoring status of each module, input and output of each module and transfer all information related to status to C&M of DATS.

The scheduling module is capable of scheduling LRIT/HRIT generation and transmission to DATS.

## 3. Experiment and Results

This chapter describes experiment and results to acquire LHGS processing time. LHGS processing time shall be considered as LHGS generation time and LHGS transmission time.

Data for experiment is MTSAT-1R LRIT/HRIT (11 days). Only HRIT FD image is considered because data size of HRIT FD image is the largest. HRIT is generated according to COMS HRIT Mission Specification and compressed by lossless JPEG, encrypted by DES.

Overall data for one pass is consists of data of VIS, IR1, IR2, IR3, IR4 channel. Size of HRIT FD image is 11000 X 11000 for VIS channel, 2750 X 2750 for IR channel.

For accuracy, experiment is iterated as 10 times.

### 3.1. Simulation for LHGS Generation Time

LHGS generation time is defined as time which COMS LHGS generates LRIT/HRIT CADU using MI Level 1B product from IMPS.

Maximum value out of 10 iterations for each pass is averaged in this paper for high reliability.

Figure 2 illustrates averaged maximum LHGS generation time of all channel for each segment

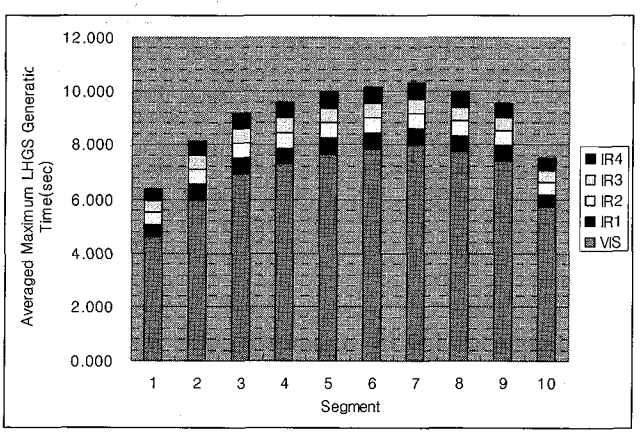


**Figure 2. Averaged Maximum LHGS Generation Time of all channel for Each Segment**

### 3.2. Computation of LHGS Transmission Time

LHGS transmission time is defined as time which LRIT/HRIT CADU of COMS LHGS is transferred to DATS.

LHGS transmission time is calculated as below.

LHGS transmission time= data size/ data rate..... (1)

Similarly, LHGS Maximum transmission time is calculated as below.

LHGS maximum transmission time
=maximum data size/ data rate..... (2)

Maximum data size for each segment is described as Table 1 and data rate of HRIT is less than 3Mbps.

**Table 1. Maximum Data Size for Each Segment**

| Channel / Segment | VIS | IR1 | IR2 | IR3 | IR4 | Total |
|---|---|---|---|---|---|---|
| 1 | 4032 | 312 | 312 | 184 | 300 | 5140 |
| 2 | 7676 | 536 | 528 | 280 | 564 | 9584 |
| 3 | 8900 | 600 | 584 | 352 | 660 | 11096 |
| 4 | 9096 | 620 | 600 | 388 | 652 | 11356 |
| 5 | 9120 | 684 | 664 | 448 | 664 | 11580 |
| 6 | 9416 | 684 | 664 | 440 | 692 | 11896 |
| 7 | 9648 | 628 | 608 | 368 | 692 | 11944 |
| 8 | 9164 | 612 | 600 | 316 | 672 | 11364 |
| 9 | 8260 | 520 | 508 | 284 | 592 | 10164 |
| 10 | 5028 | 316 | 316 | 188 | 360 | 6208 |

[Unit: second]

So, Maximum LHGS transmission time is calculated as Table 2.

**Table 2. Maximum LHGS Transmission Time**

| Segment | Transmission Time |
|---|---|
| 1 | 1.673177 |
| 2 | 3.119792 |
| 3 | 3.611979 |
| 4 | 3.696615 |
| 5 | 3.769531 |
| 6 | 3.872396 |
| 7 | 3.888021 |
| 8 | 3.699219 |
| 9 | 3.308594 |
| 10 | 2.020833 |

[Unit: second]

### 3.3. LHGS Processing Time

Figure 3 is considered for calculation of minimum LHGS processing time.

2nd segment image begins generation at the beginning of 1st segment image transmission to DATS. 3rd segment image also begins generation at the beginning 2nd segment image transmission to DATS. Similarly, other segment images are processed like this.

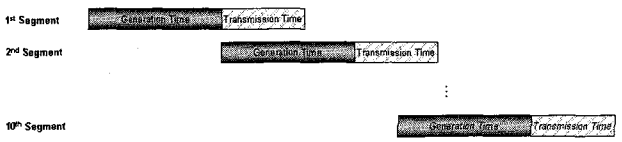


**Figure 3. LHGS Processing Timeline**

So, minimum LHGS processing time is able to be calculated as below.

Maximum LHGS Processing Time
$= \sum_{k=1}^{10}$ Generation Time *for k _ th* segment ..... (3)
+ Transmission Time for 10th segment

Minimum LHGS processing time is calculated as 156.3776 seconds (154.3567 [sec] +2.0208 [sec]) using results from Figure 2 and Table 2

## 4. Conclusions

COMS LHGS should be able to receive MI Level 1B product within 157 seconds at least. That is, COMS LHGS might not generate LRIT/HRIT CADU in less than 157 seconds. That means that equation (3) is constraint of COMS IDACS timeline.

Result about LHGS processing time from this paper is useful to design COMS LHGS and COMS IDACS.

## 5. References

[1] JMA, 2003, JMA HRIT Mission Specific Implementation

[2] KARI, 2006, COMS HRIT Mission Specification

[3] KARI, 2006, COMS LHGS Specification