

SIGMA (KHUSAT-03)

지상국 소프트웨어 설명서

(SIGMA Ground station software description)

(Ver. P0.1)

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Revision history

Revision	Description	Author	Date
1	Original Document	Hyojeong Lee	2018.01.10
2			
3			
4			

List of abbreviations and acronyms

SIGMA – Scientific cubesat with Instruments for Global Magnetic field and rAdiation

KHUSAT – Kyung Hee University SATellite

SSR/KHU – School of Space Research / Kyung Hee University

GS – Ground Station

TNC – Transport Network Control

SDR – Software Defined Radio

UHF – Ultra High Frequency

USB – Upper Side-Band

BPSK – Binary Phase Shift Keying

TMP – Telemetry Monitoring Program

HK – HouseKeeping

IIB – Instrument Interface Board

OBC – On Board Computer

TEPC – Tissue Equivalent Proportional Counter

MAG –MAGnetometer

1. SIGMA Cubesat data communication

Figure 1 is shown the diagram of sigma communication system. SIGMA is communicated with Antenna and Receiver in Ground station of KyunHee University. We use software which are SDR#, Sound modem and TMP (Telemetry Monitoring Program). Table 1 is the specification of SIGMA communication information. The downlink equipment is shown figure 2.

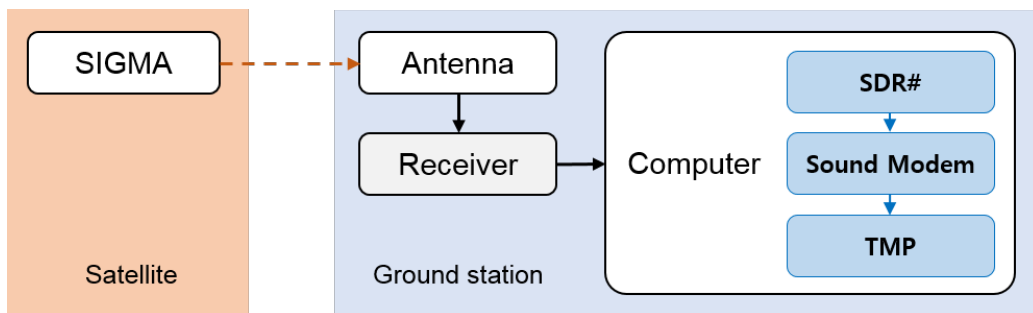
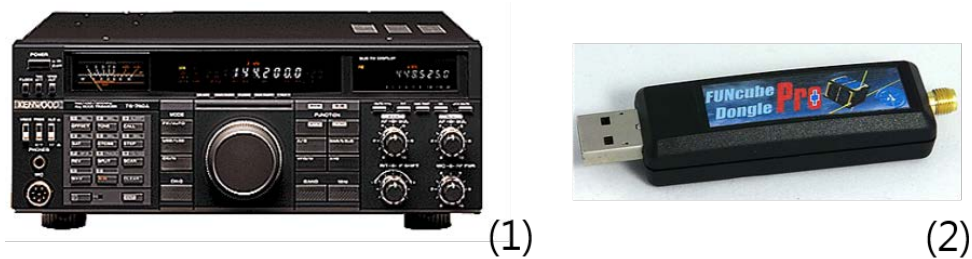


Figure 1. SIGMA communication system (Downlink)

Table 1. Specification of SIGMA communication information

Specification	Value
Frequency	435.780 MHz (UHF)
Satellite Power	500 mW (27 dBm)
Modulation	USB / BPSK (Scrambling polynomial: $X^{17} + X^{12} + 1$)
Transfer rate	9600 bps
Protocol	AX.25
Antenna polarization	Linear



2. Data downlink equipments (1) Transceiver TS-790A, (2) Funcube dongle pro+

2. SIGMA CubeSat data

SIGMA has three kind of data which are Beacon, HK (Housekeeping), and Science data. The operation scenario will be changed according to operation situation.

- Beacon
 - The Beacon has to include this message 'SIGMA KHUSAT03 SIGMA'
 - period 90 sec
 - (30 sec : beacon interval 1sec,
 - At the end of beacon, the recent housekeeping data is attached,
 - 60 sec wait)

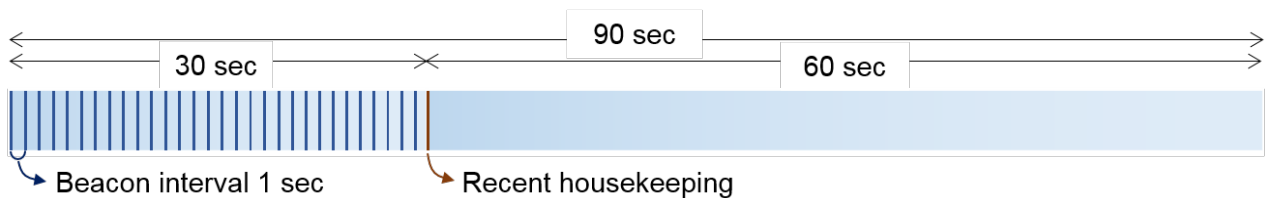


figure 3. SIGMA beacon interval

- HK:
 - This is status information of SIGMA. This data only send from commend of the ground station.
 - Data interval is about 100 ms
 - It will check only TMP software
- Science:
 - SIGMA has 2 payloads which are magnetometer and TEPC. This data include these science

data.

- Data interval is about 100 ms
- It will check only TMP software

3. Ground station software

Table is shown the Ground station software link. You can get the all software through the link.

Table 2. Ground station software link

Software	Price	OS	Download website
SDR#	Freeware	Window	http://airspy.com/download/
Sound modem	Freeware	Window	SIGMA version: http://khusat.khu.ac.kr/?page_id=1779
TMP	Freeware	Window	http://khusat.khu.ac.kr/?page_id=1779
HRD	\$99.95 (30 day free trial)	Window (No run XP)	http://ham-radio-deluxe.com/downloads.html
Oritron	Freeware	Window	http://www.stoff.pl/

❖ **TMP (Telemetry monitoring program)**

TMP is a software that is shown the current information of SIGMA cubesat through the Sound modem. Figure 4 is shown TMP software.

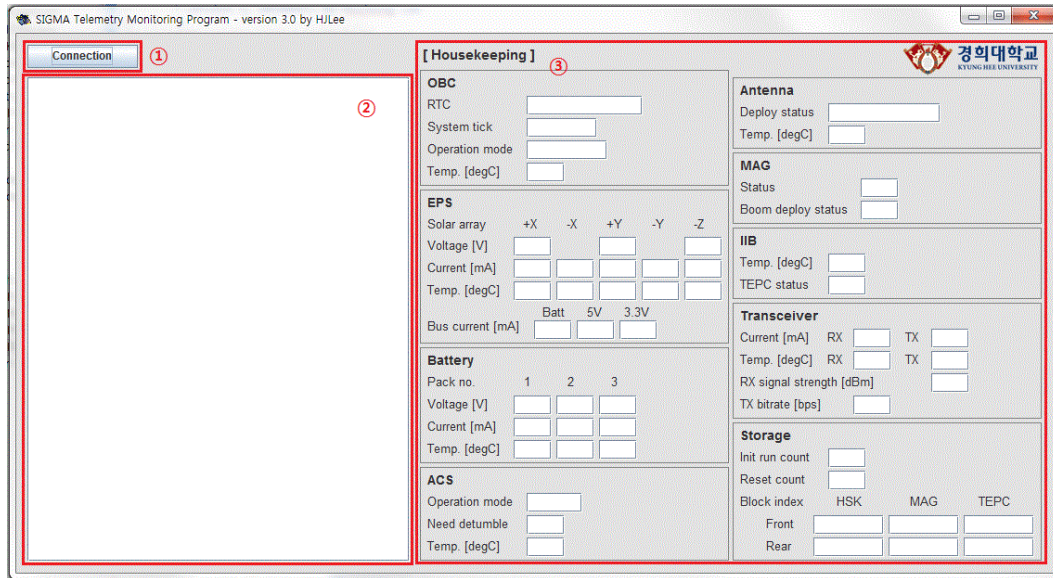


Figure 4. TMP 프로그램

- ① when you runs Sound modem than you can press "connection" in the TMP. If you press it과 before run Sound Modem, it makes malfunction. When it connects, "connection" will be changed to "Disconnection". TMP folder creates one txt file that has all data from SIGMA Cubesat. (Example: 20170519_1730_Raw.txt)
- ② when you get the beacon data you can see the output signal data. ('SIGMA KHUSAT03 SIGMA').
- ③ If you get any HK data, you get see here.

4. Appendix

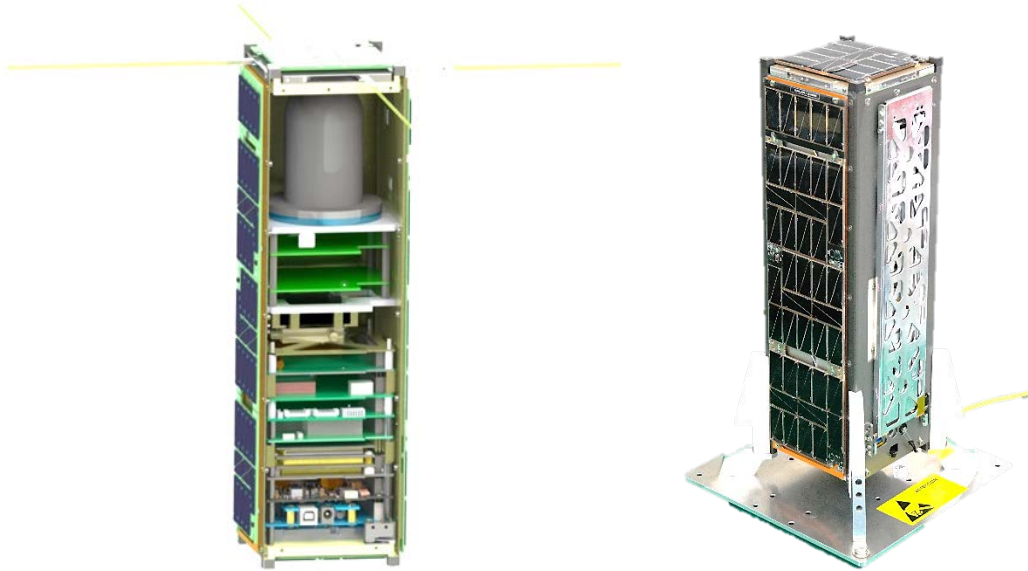


그림 3. SIGMA 위성

표 3. SIGMA Cubesat specification

List	Detail
Mission orbit	Sun-Synchronous Altitude: 500 km, Inclination: 98 degree
Life time	3 month
Weight	3.6 kg
Power consumption	4.0 W
Primary payload	TEPC (Tissue Equivalent Proportional Counter) Range: 0.2 ~ 300 keV/um LET Resolution: 23.5% @5.4 MeV
Secondary payload	MAG (A miniaturized fluxgate MAGnetometer) Range: ± 65536 nT Resolution: ~ 0.1 nT
Communication	VHF (Uplink), UHF (Downlink)

- 관련 문의 (Q&A)

E-mail: khusat@khu.ac.kr

- 웹사이트 정보 (Website information)

Website	Address
Homepage	http://khusat.khu.ac.kr/?page_id=50 (KHUSAT-03)
Flicker	https://www.flickr.com/photos/136146290@N06/
Facebook	https://www.facebook.com/khucinema/
Naver blog	https://blog.naver.com/cubesat