FSI-SAT CW Telemetry Format

作成			
戸波			

改定履歴

本書の改定履歴は、以下の通りである。

改訂履歴			
訂番	日付	内容	作成
0	2022/10/04	初版	戸波
1	2022/10/10	英語に翻訳	神澤

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1. Overview

FSI-SAT has the capability to transmit CW telemetry indicating the satellite's own status.
This CW telemetry is constantly transmitted during operation.
The transmission interval depends on the mode of the satellite.
In the case of " Stationary mode," which is the mode used during normal operations, the transmission interval is approximately 1 minute.

2. Specifications of CW

Downlink frequency	437.175	MHz
Transmit power	100	mW
Length of dots	65	ms
Length of dashes	195	ms
Length of spaces	65	ms
Character spacing	130	ms
Word spacing	260	ms

3. Contents of CW telemetry

An example of CW telemetry in stationary mode is shown below.

0 JS1YJV FSISAT 0 4.19V −0.02A 30.18D TTTEEEEEEEEE

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Reset notice

Indicates whether or not the satellite power supply has a reset notice during telemetry transmission (0: no reset notice, 1: reset notice).

The power supply of FSI-SAT is reset every 48 hours. The reset notice signal is output from 100 s before this reset until just before the reset.

In the above example, the reset notice signal is not output.

② Call sign

Represents the identification signal of a satellite station.

③ Satellite name

Indicates the name of the satellite (FSI-SAT).

④ Satellite mode

The mode of the satellite during telemetry transmission is indicated by a mode number.

The mode numbers of the main modes are as follows

0: Stationary mode
1: Power saving mode
2: Custom mode
3: Stationary mode + AFSK
(CW telemetry transmission followed by AFSK transmission of the same telemetry)
9: Off-the-Air mode (no telemetry is transmitted)
12: Unit 2 AOCS (Attitude and Orbit Control Subsystem) mode

In the above example, the mode of the satellite is " stationary mode ".

⑤ Battery voltage

Indicates battery voltage during telemetry transmission. Unit is V.

The battery voltage is measured by the battery monitoring sensor (INA226). The measured value is transmitted to two decimal places (not rounded).

In the above example, the battery voltage is 4.19 V.

⑥ Battery current

Indicates the battery current during telemetry transmission (positive value: charging, negative value: discharging). Unit is A.

The battery current is measured by the battery monitoring sensor (INA226). The measured value is transmitted to two decimal places (not rounded).

In the above example, the battery current is 0.02 A (discharge).

⑦ Battery temperature

Indicates the battery temperature during telemetry transmission. The unit is ℃.

The battery temperature is measured by a temperature sensor (MCP9700AT-E/TT). The measured value is transmitted to two decimal place (not rounded).

In the above example, the battery temperature is 30.18 ℃.

⑧ Power Switch Status

Indicates the state of the power switch during telemetry transmission.

From left to right, it represents SW1 to SW12 ON/OFF (E: OFF, T: ON). The correspondence between switches and components is as follows.

SW1: Missing Number
SW2: Sub-microcontroller, EEPROM, sun sensor
SW3: Real-time clock
SW4: Magnetic sensor, Gyro sensor
SW5: Magnetic Torquer
SW6: IR receiver module
SW7: SD card
SW8: Missing number
SW9: DDS (Direct Digital Synthesizer)
SW10: AFSK Modem
SW11: NanoPi (Control a multispectral camera)
SW12: Multispectral Camera

In the above example, SW2 (sub-microcontroller, EEPROM, sun sensor), SW3 (real-time clock) are in the ON state.

4. CW telemetry content and transmission interval in each mode

4.1. Stationary mode

An example of CW telemetry in stationary mode is shown below.

0 JS1YJV FSISAT 0 4.19V −0.02A 30.18D TTTEEEEEEEEE

In stationary mode, all telemetry is transmitted. Transmission takes approximately 30 s. After the telemetry is sent, there is a 30 s wait for DTMF commands (no commands can be received while telemetry is being sent).

The interval between telemetry transmissions is 30 + 30 = 60 s.

4.2. Power saving mode

An example of CW telemetry in power saving mode is shown below.

0 JS1YJV 1 4.19V

In power saving mode, only the reset notice, call sign, satellite mode, and battery voltage are transmitted. Transmission takes approximately 15 s. After the telemetry is sent, there is a 60 s wait for DTMF commands (no commands can be received while telemetry is being transmitted).

The interval between telemetry transmissions is 15 + 60 = 75 s.

4.3. Stationary mode + AFSK

An example of CW telemetry in Stationary mode + AFSK is shown below.

0 JS1YJV FSISAT 3 4.19V −0.02A 30.18D TTTEEEEEEEEE

In stationary mode + AFSK, after all telemetry is transmitted in CW, the same telemetry is transmitted in AFSK. After the telemetry is transmitted, a 30 s wait for reception of DTMF commands is performed (no commands can be received while telemetry is being transmitted).

4.4. Custom mode

In custom mode, the content of CW telemetry to be sent and the length of the wait for receiving DTMF commands can be freely set (reset notice is always sent)

4.5. Off-the-Air mode

In Off-the-Air mode, no CW telemetry is transmitted. In this mode, the satellite only waits to receive DTMF commands.

4.6. Other mode

With respect to transmitting CW telemetry and waiting to receive DTMF commands, the operation is the same as in stationary mode.