Amateur
radio information

society for out-of-frame
education

SPACEMANIC

Contents

Basic information

NORAD ID: TBD

Callsing: 9A0CC

UHF Downlink frequency: 436.775 MHz +/- Doppler shift

VHF Downlink frequency: 145.975 MHz +/- Doppler shift

Modulation: GFSK, CW

Encoding: G3RUH 9k6 baud

Morse: 20 WPM

Protocols: AX.25, Morse

Transmitting power: 1W (30dBm)

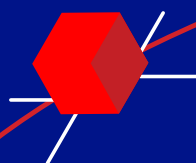**Onboard antenna:** Dipole

Antenna polarization: Linear

Launch

NET December 2024 / Falcon 9 / Bandwagon 2

Orbital parameters / Preliminary TLE

Orbit: 550 km Inc: 45°

TBD

Message types

1. AX.25 TRX beacon packet
2. AX.25 OBC beacon packet
3. AX.25 PSU beacon packet
4. AX.25 Magnetometers beacon packet
5. AX.25 Solar beacon packet
6. AX.25 AstroTron beacon packet
7. AX.25 message
8. CW data beacon
9. Ground Station communication

The transmission period is following:
OBC/PSU/MGS/SOL/ATR AX.25 beacon every 90s (UHF)
TRX UHF AX.25 beacon every 90s
TRX UHF AX.25 message every 270s
TRX UHF Morse beacon every 180s

There are offsets applied between transmissions.

Example of decoded AX.25 TRX beacon packets

Data in AX.25 TRX beacon packet values are comma-separated.

```
1:Fm 9A0CC To CQ [16:20:29R] [AA] [+++++++]
U,659,1746404,74,0,2854,3008,2787,0,,0,87,95,0
```

Explanation:

1. Beacon identification [U - UHF, V - VHF]
2. Uptime since reset [s]
3. Uptime total [s]
4. Radio boot count
5. RF segment reset count
6. Radio MCU act. temperature [0.01°C]
7. RF chip act. temperature [0.01°C]
8. RF power amplifier act. temperature [0.01°C]
9. Digipeater forwarded message count
10. Last digipeater user sender's callsign [ASCII, 6 spaces
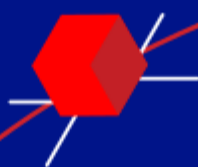
means nobody yet]

11. RX data packets (AX25 with CRC matched, includes CSP and digipeater packets)

12. TX data packets (includes CSP and digipeater packets)

13. Actual RSSI, ((value / 2) – 134) [dBm]

14. Value of RSSI when carrier detected – after preamble ((value / 2) – 134) [dBm]

Example of decoded AX.25 OBC beacon packet

OBC packet is a packet created by Eddie Onboard Computer including selected interesting values. Values are comma separated.

```
1:Fm 9A0CC To CQ [16:20:22R] [AA] [+++++++]
OBC,140,653,20942,8251,2749,6024
```

Explanation:

1. OBC - Packet identification
2. rst - Boot count
3. uptime - Uptime [s]
4. uptimeTot - Total uptime [s]
5. bat - Analog measured battery level [mV]
6. tempMCU - MCU temperature [0.01°C]
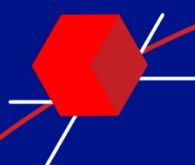7. freemem - Remaining storage space

Example of decoded AX.25 PSU beacon packet

PSU packet is created by the OBC. Values are comma separated.

```
1:Fm 9A0CC To CQ [16:20:46R] [AA] [+++++++]
PSU,26,678,1688514,8197,2771,2520,210,113,7d,1,95
```

Explanation:

1. PSU – Packet identification
2. rst – PSU reset number

3. uptime – Current uptime since last reset [s]

4. totalUptime - Total uptime cumulative [s]

5. bat – Battery voltage [mV]

6. tempSys – System temperature [0.01°C]

7. tempBat – Battery temperature [0.01°C]

8. curIn – Battery current in [mA]

9. curOut– Battery current out [mA]

10. chStat – Bit-Masked channel status *

11. sysState – System state **

12. gndWdt - Remaining ground watchdog timer [h]

* Bit 0 - Channel 0, 0/1 - Off/On (channels from 0 to 6)
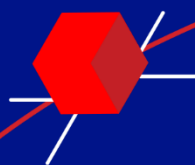** 1 - Okay, 2 - Power saving, 3 - Power critical

Example of decoded AX.25 MGS beacon packet

MGS payload packet is created by the OBC. Values are comma separated.

```
1:Fm 9A0CC To CQ [16:20:45R] [AA] [++++++] MGS,2980,2640,-
1730,1537,-5458,50,33,52,2900,2628,12941,-5515,-11457,-
55,163,-89
```

Explanation:

1. MGS – Packet identification

2. tempIntMag - Internal magnetometer temperature [0.01°C]

3. tempIntGyr - Internal gyroscope temperature [0.01°C]

4. xIntMag - Internal magnetometer X axis value

5. yIntMag - Internal magnetometer Y axis value

6. zIntMag - Internal magnetometer Z axis value

7. xIntGyr - Internal gyroscope X axis value

8. yIntGyr - Internal gyroscope Y axis value

9. zIntGyr - Internal gyroscope Z axis value

10. tempExtMag - External magnetometer temperature [0.01°C]

11. tempExtGyr - External gyroscope temperature [0.01°C]

12. xExtMag - External magnetometer X axis value

13. yExtMag - External magnetometer Y axis value

14. zExtMag - External magnetometer Z axis value
15. xExtGyr - External gyroscope X axis value
16. yExtGyr - External gyroscope Y axis value
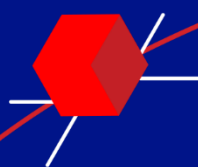17. zExtGyr - External gyroscope Z axis value

Example of decoded AX.25 SOL beacon packet

SOL payload packet is created by the OBC. Values are comma separated.

```
1:Fm 9A0CC To CQ [16:21:09R] [AA] [+++++++]
SOL,2531,2600,2393,2525,2556,2568,138,135,133,136,137,135
```

Explanation:

1. SOL - Packet identification
2. tempZP - Temperature on Z+ panel [0.01°C]
3. tempXP - Temperature on X+ panel [0.01°C]
4. tempYP - Temperature on Y+ panel [0.01°C]
5. tempZN - Temperature on Z- panel [0.01°C]
6. tempXN - Temperature on X- panel [0.01°C]
7. tempYN - Temperature on Y- panel [0.01°C]
8. diodeZP - Photodiode measurement on Z+ panel [ADC value]
9. diodeXP - Photodiode measurement on X+ panel [ADC value]
10. diodeYP - Photodiode measurement on Y+ panel [ADC value]
11. diodeZN - Photodiode measurement on Z- panel [ADC value]
12. diodeXN - Photodiode measurement on Z- panel [ADC value]
13. diodeYN - Photodiode measurement on Z- panel [ADC value]

Example of decoded AX.25 ATR beacon packet

ATR payload packet is created by the OBC. Values are comma separated.

```
1:Fm 9A0CC To CQ [16:23:24R] [AA] [+++++++]
ATR,2,0,283,292,291,327,258,255,233
```

Explanation:

1. ATR - Packet identification
2. id - Master device ID
3. defective - Number of defective devices
4. rst1 - Resets of device no. 1
5. rs2 - Resets of device no. 2
6. rst3 - Resets of device no. 3
7. uptime1 - Uptime of deivce no. 1
8. uptime2 - Uptime of deivce no. 2
9. uptime3 - Uptime of deivce no. 3
10. checksum

Example of decoded AX.25 message beacon packet

```
1:Fm 9A0CC To CQ [16:20:49R] [AA] [+++++++] CROCUBE AX.25
test message for radio amateurs: Hello Space!
```
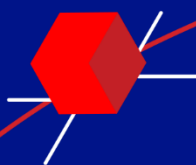
Example of CW data beacon

Every CW beacon stars with "de 9a0cc = " and ends with "ar".

```
de 9a0cc = u5433r126t29p30 ar
```

Explanation:

1. Total uptime [min] (u5433 = Uptime 5433 minute)
2. Reset number (r126 = 126 resets of radio)
3. Temp MCU [°C] (t29 = 29 degree of Celsius on DL radio MCU)
4. Temp Radio PA [°C] (p30 = 30 degree of Celsius on DL radio PA)

Recommended TNC modem setup:

PACLEN 255
TXDELAY 15
MYCALL [Your callsign]
UNPROTO CQ (or callsign)