

Space to Ground Interface Control Document i0.1

UPRA TDM-7 Mission

Table of Contents

Table of Contents	2
Purpose of the Document	3
Introduction	3
Physical Layer	3
Data link Layer	3
Packet structure	3
Preamble	3
Sync Word	4
Header	4
Payload	4
CRC	4
Transfer Layer	5
Beacon	5
Beacon structure	5
Appendix A	6
Korábbi teszt alatt vett mintacsomag	6
Errata	7

Purpose of the Document

The purpose of this document is to provide a brief description of the RF downlink used in the UPRA TDM-7 mission to support cooperation with external ground stations.

Introduction

UPRA TDM-7 mission is using the UPRA-COM.RF69HCW COM subsystem as the main communication device. The COM is based on the Semtec sx1231H integrated transceiver chip. In this mission only the downlink is activated and is used to transmit Beacon packets. In the following sections the communication layer structure and the detailed packet description will be introduced. In the Appendix, a previous test result is detailed while the Errata shows the known issues with communication.

Physical Layer

Carrier Wave Frequency	333040 kHz
Modulation	FSK
Bitrate	625 bps
Deviation	2 kHz

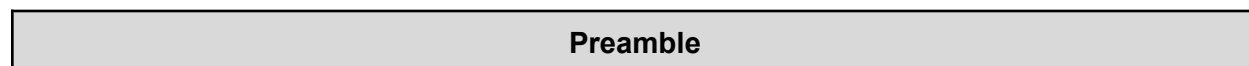
Data link Layer

Packet structure

Preamble	Sync Word	Header	Payload	CRC*
3 bytes	2 bytes	4 bytes	60 bytes	2 bytes

*optional

Preamble



0xAA	0xAA	0xAA
------	------	------

Sync Word

Sync Word	
0x2D	0x64

Header

Currently, commanding the balloon is not permitted from external ground station, hence only the header for telemetr packets is described here. However the addressing and multiple target mode is not fully implemented yet.

Header (TX)			
Packet Length ¹	Address ²	Device ID ³	CTL Byte ⁴
0x40	0x02	0x01	0x00

¹ - Packet length for the TDM-7 mission is fix 64 bytes

² - Fixed for TDM-7

³ - Fixed for TDM-7

⁴ - ACK Control, reserved for future applications, fixed 0x00 for TDM-7

Payload

Message data. See in details in the [Transfer Layer](#) section.

CRC

CRC-16 is added by the TCVR chip. Optional feature, enabled in TDM-7.

Transfer Layer

Beacon

The beacon contains the basic telemetry and tracking information of the balloon. A beacon is transmitted in every 15 seconds, every transmission contains two identical packets in case of data loss.

Beacon structure

```
$$CCCCC,iii,hhmmss,(+/-)xxxx.xxx,(+/-)xxxxx.xxx,aaaaa,eeee,ooo,rrr
```

Segment	Description	Comment
\$\$	START bytes	
CCCCC	callsign	(7 karakter)
iii	Message ID*	
hhmmss	GPS time (UTC)	(hh-hours, mm-minutes, ss-seconds)
(+/-)xxxx.xxx	latitude	(NMEA format)
(+/-)xxxxx.xxx	longitude	(NMEA format)
aaaaa	altitude [m]	
eeee	external temperature [0.1 °C]	tized fokban van megadva
ooo	OBC module temperature [°C]	egész fokban van megadva
rrr	COM module temperature [°C]	egész fokban van megadva

Example:

```
$$HA3PL__,033,090333,+4728.402,+01903.659,00129,0221,045,004
```

Appendix A

Korábbi teszt alatt vett mintacsomag

Hex:

400201002424484133504C5F5F2C3332302C3333363637372C2B393530302E3030302C2B31
383838382E3030302C30303030302C303231322C3032312C303237

ASCII:

@ \$\$HA3PL__,320,336677,+9500.000,+18888.000,00000,0212,021,027

Parszolt:

k=15

Call: HA3PL__,

ID: 320

Time: 336677

Lat: +9500.000

Lon: +18888.000

Alt: 0

Ext: +21.2

OBC: +2.1

COM: +2.7

Megjegyzés:

A korábbi leírásból kimaradt a "Header", ezért a payload elején megjelenik a "Header" négy bájta.

A korábbi leírásban az OBC és a COM hőmérséklet, hibásan, tized foknak lett definiálva, Ez valójában egész fok.

Errata

A legutóbbi repülés előtti teszteredmények alapján a Sync Word random változik.