AMSAT-DL Symposium
16. Mai 2009

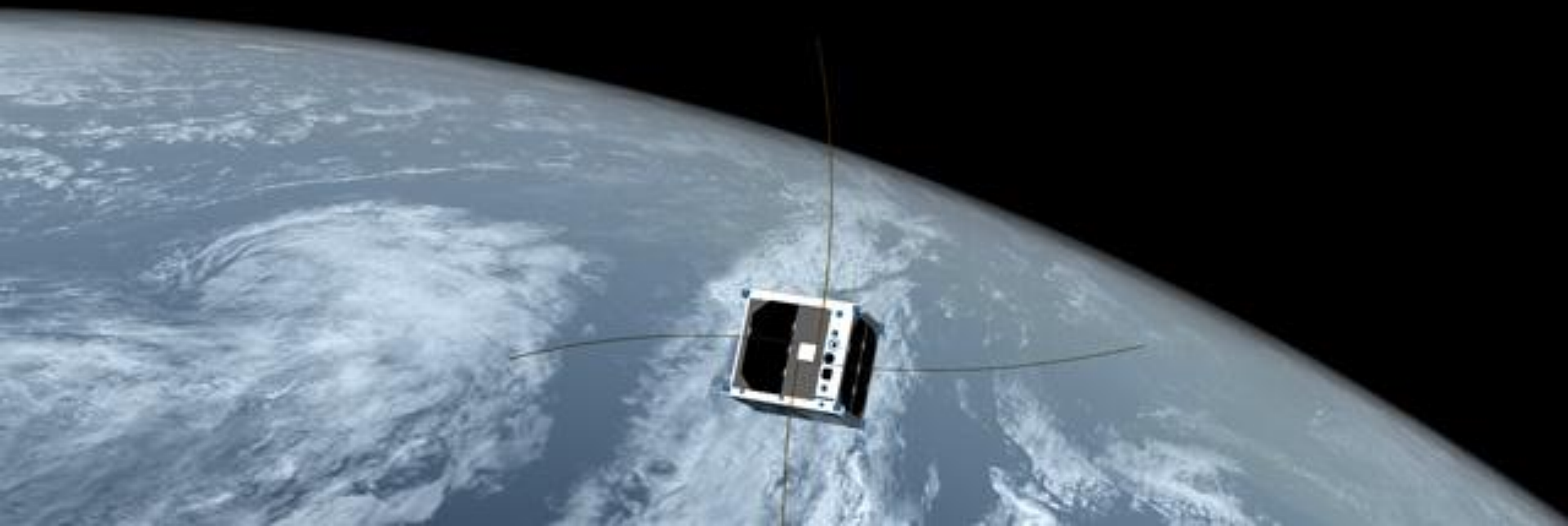
Mike Rupprecht, DK3WN

TELEMETRIE DER CUBESATS, NANOSATS, PICOSATS ETC.

Was ist Telemetrie?

Wikipedia:

Telemetrie (= Fernmessung) bezeichnet die Übertragung von Messwerten eines am Messort befindlichen Messfühlers (Sensor) zu einer räumlich getrennten Stelle.



Telemetriewerte

- Spannung
- Strom
- Temperatur

- Leistung
- Strahlung
- S-Meter
- Zähler
- Statuswerte

z.B.: SEEDS

Li-Ion Batt Voltage : 4,12 V	CW Intervall : 3
Bus Voltage : 5,00 V	Command Status : 64
Solar Cell 1 Current : 0,78 mA	Switch : 1 (ON)
Solar Cell 2 Current : 0,55 mA	Battery : 3
Solar Cell 3 Current : 0,00 mA	Batt Voltage > 4.2 Volts)
Solar Cell 4 Current : 0,00 mA	Shunt Circuit : 4
Solar Cell 5 Current : 0,78 mA	MPU reset (EPS) : 0
Solar Cell 6 Current : 233,49 mA	MPU reset (FMR) : 1
Li-Ion Battery 1 : -4,18 °C	MPR Reset (C+DH) : 1
Li-Ion Battery 2 : -2,01 °C	MPU Reset (CW) : 1
Transmitter : -6,38 °C	CW transmission : 6773
Receiver : -8,74 °C	Uplink Count : 37

Aktive Satelliten

- AO-7
- LO-19
- IO-26
- AO-27
- FO-29
- NO-44
- GO-32
- AO-51
- CUTE-I
- XI-IV
- XI-V
- DELFI-C³
- CUTE1.7
- SEEDS
- COMPASS-1
- AAUSAT-II
- PRISM
- STARS
- KKS-1
- CP-4 (6)
- GeneSat-1
- QuakeSat

Modulation

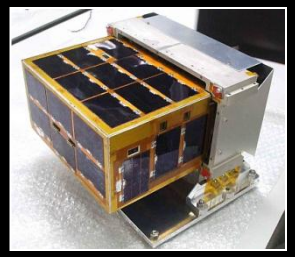
CW	CUTE, SEEDS, KKS-1, FO-29, XI-V
AFSK 1k2	AO-27, GeneSat, SEEDS
FSK 9k6	AO-51, GO-32
BPSK 1k2	IO-26, AO-16, DELFI-C^3
MSK 1k2	AAUSat-II
MSK 4k8	COMPASS-1

Modulation

CW	CUTE, SEEDS, KKS-1, FO-29, XI-V
AFSK 1k2	AO-27, GeneSat, SEEDS
FSK 9k6	AO-51, GO-32
BPSK 1k2	IO-26, AO-16, DELFI-C^3
MSK 1k2	AAUSat-II
MSK 4k8	COMPASS-1

CUTE 1.7+APD-II

CW Telemetrie



437.275 MHz, CW

```
hihi de jq1ytc digi on cute 88cbadb639262363533e17
hihi de jq1ytc digi on cute 87ccaeb6392622645c3617
hihi de jq1ytc digi on cute 87cbadbc39262365623d17
hihi de jq1ytc digi on cute 87cbadb1392523c6573b17
hihi de jq1ytc digi on cute 87ccadb7392622666d3b17
hihi de jq1ytc digi on cute 87ccaeb239262367643d17
hihi de jq1ytc digi on cute 87cbadac39262367573a17
hihi de jq1ytc digi on cute 87cbaeb0392623675d3717
hihi de jq1ytc digi on cute 87cbaeb0392623685b3917
hihi de jq1ytc digi on cute 87cbaeae392623685a3917
```

CUTE 1.7+APD-II

CW Telemetrie Format

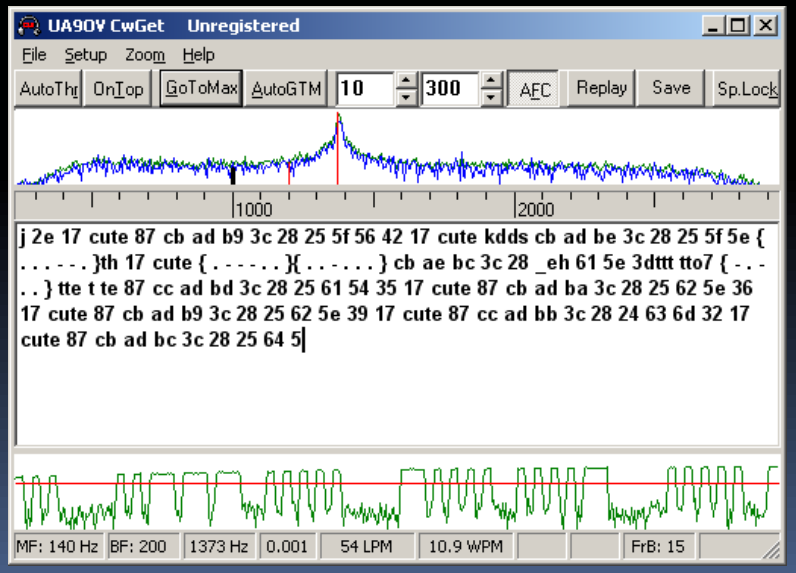
CUTE AAAAAA BB CC DD EE FF GG HH II JJ KK LL

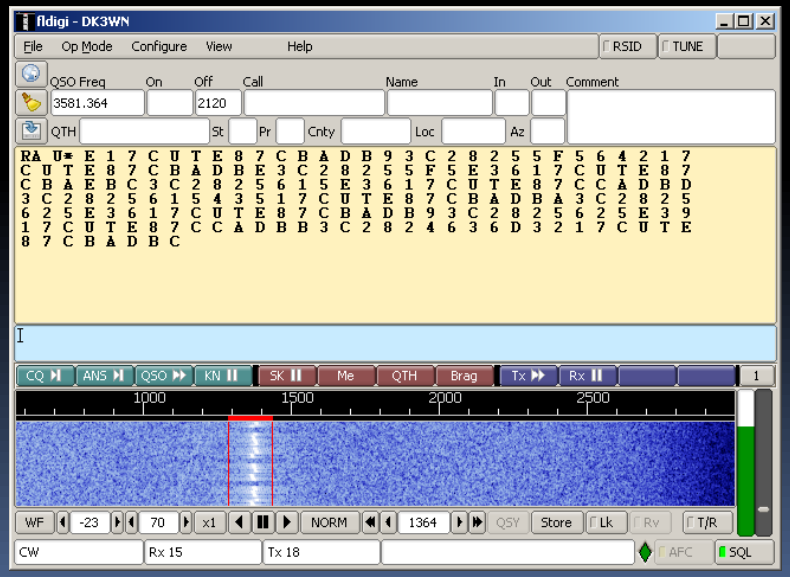
AA	DTMF Command 24bit / 6 char
BB	3.3V 0.0241568 * N [V]
CC	5V 0.0241568 * N [V]
DD	Battery Voltage 0.0241568 * N [V]
EE	Main Bus Voltage 0.0362352 * N [V]
FF	Satellite Status bit
GG	Temperature Comm Board (0.0120784 * N - 0.424)/0.00625 [°C]
HH	Temperature Battery (0.0120784 * N - 0.424)/0.00625 [°C]
II	Battery Current (0.0109116 * N) - 1.3967 [A]
JJ	144MHz S-Meter 0.795968 * N - 171.5 [dBm]
KK	1.2GHz S-Meter 0.214996 * N - 151.9 [dBm]
LL	FET status

CUTE 1.7+APD-II

Dekodierung

- Hardware OHREN (CW)
- Software fldigi, CwGet, MixW usw.

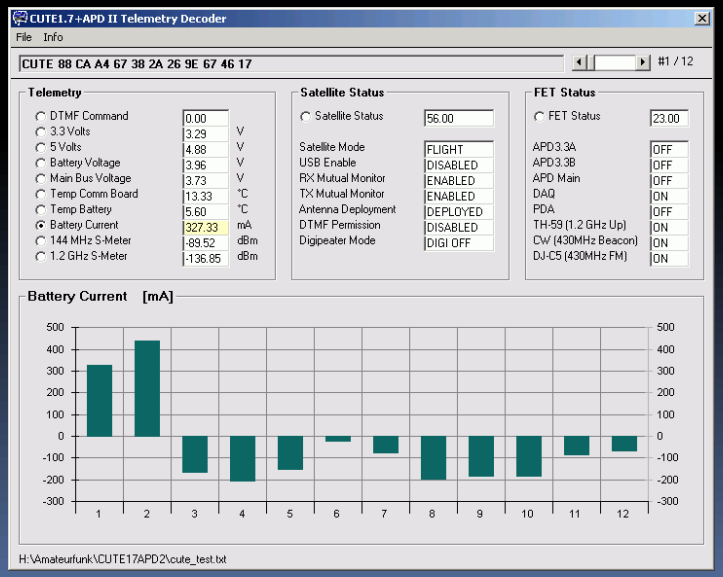


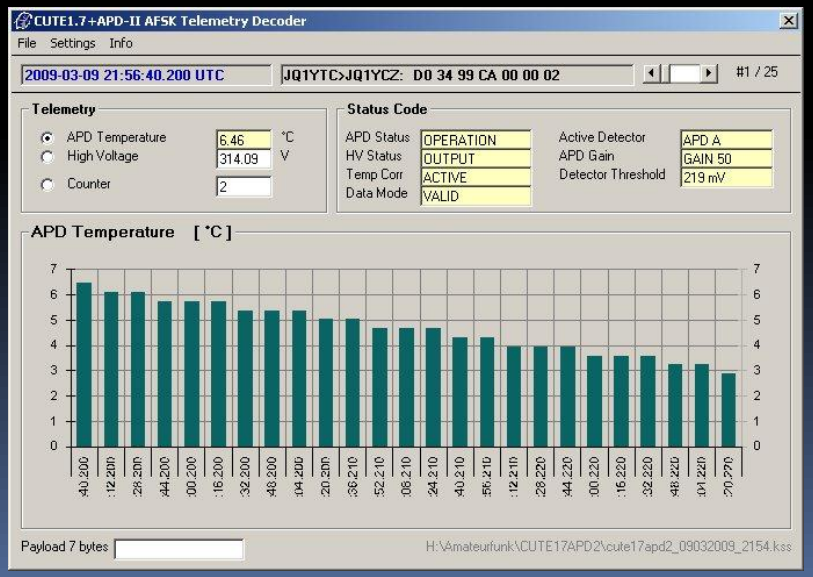


CUTE 1.7+APD-II

Telemetrie-Software – DK3WN

- Input: TXT (CW) oder KISS File (AFSK)
- Output: TLM (ASCII)





CUTE 1.7+APD-II

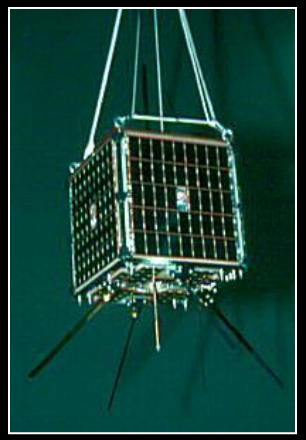
Reports

- E-Mail: cute1.7_receive@lss.mes.titech.ac.jp
- Internet: http://lss.mes.titech.ac.jp/ssp/cute1.7
- Project Blog: http://lss.mes.titech.ac.jp/ssp/cute1.7/blog/
- QSL Karte:

  Cute-1.7 + APD project team, Room 554,
  Ishikawadai 1st building,
  Tokyo Institute of Technology
  2-12-1 Ookayama, Meguro-ku, Tokyo
  152-8552
  JAPAN

AO-27

1k2 AFSK Telemetrie



436.795 MHz, FM

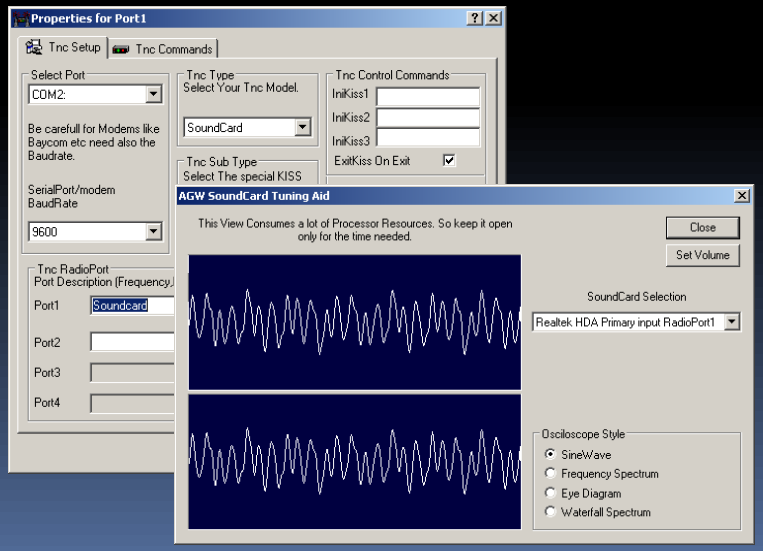
- kein UI-Frame
- RAW KISS Format

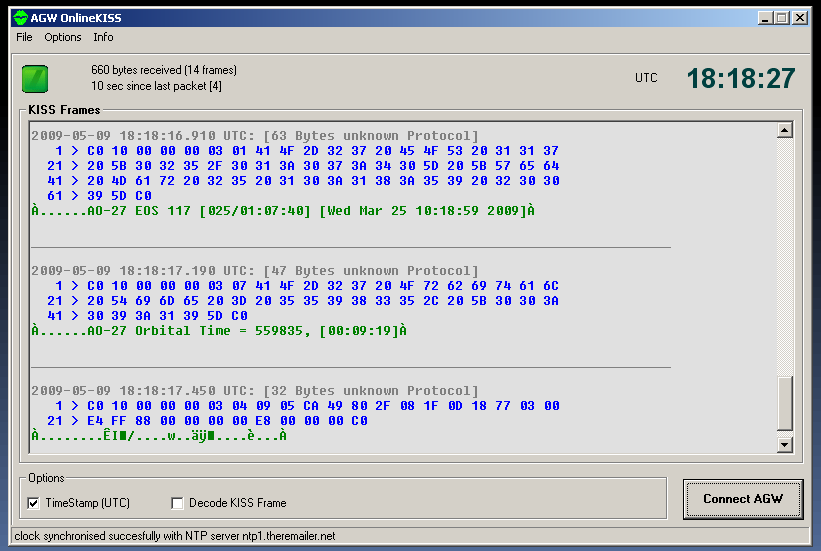
```
[134 Bytes KISS Frame (without CRC)]
  1 > C0 00 00 00 00 03 02 30 7F A4 47 00 5D 01 08 02 62 03 17 04
 21 > 9B 05 39 06 03 07 00 08 57 09 00 0A 98 0B FF 0C 01 0D 00 0E
 41 > 00 0F 35 10 04 11 61 12 08 13 00 14 8D 15 8C 16 80 17 88 18
 61 > 88 19 70 1A 79 1B 77 1C 68 1D 7D 1E 27 1F 73 20 5A 21 74 22
 81 > 92 23 04 24 0F 25 9D 26 03 27 4A 28 4F 29 00 2A 18 2B 0C 2C
101 > 01 2D 91 2E 10 2F 92 30 91 31 88 32 11 33 00 34 8D 35 8C 36
121 > 8D 37 89 50 57 51 00 52 1F 53 00 FF 04 C0
```

AO-27

1k2 AFSK Dekodierung

- Hardware — TNC (KISS Mode)
- Software — AGW Packet Engine + AGW_ONLINEKISS





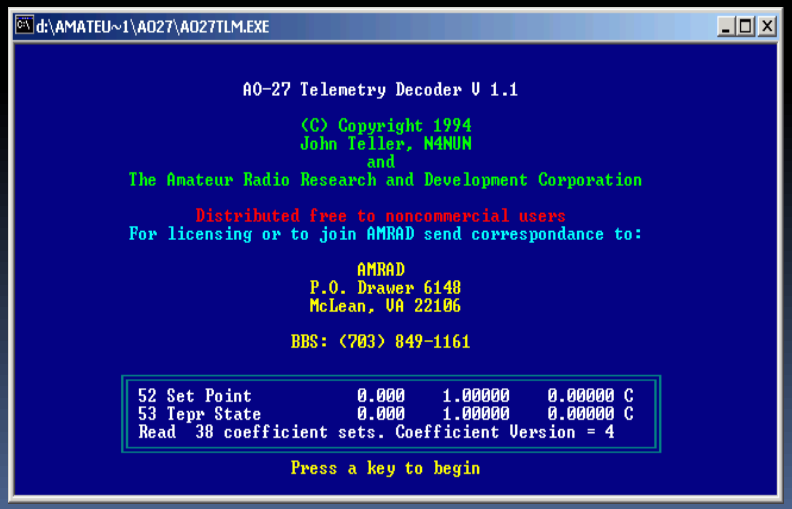
AO-27

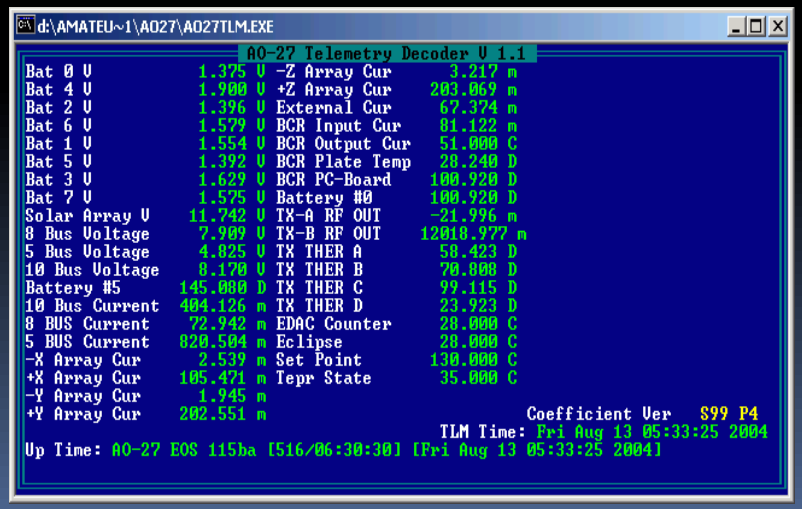
Telemetrie-Software - AO27TLM

Das "Original" - AO27TLM.EXE - Version 1.1 (Februar 1994)

Autor: John Teller, N4NUN - DOS Modus

- TNC im KISS Mode

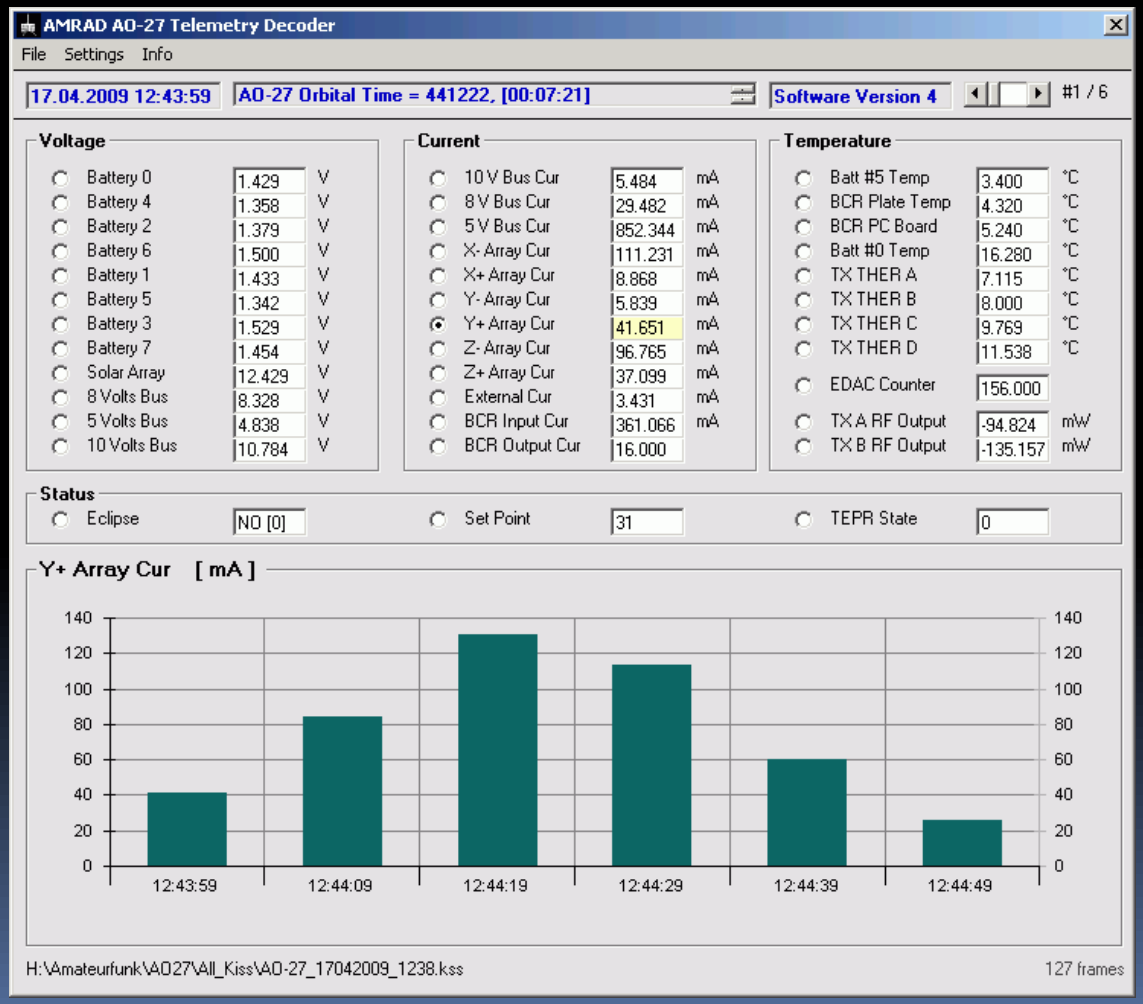




AO-27

Telemetrie-Software – DK3WN

- Input: KISS File
- Output: CSV und TLM (ASCII) File



AO-27

Telemetrie-Daten

- Allgemeine Informationen
- Hardware Status
- Software Status
- TOPR
- Telemetrie
- WOD

AO-27 Daten

allgemeine Informationen / HW

- [INF] AO-27 Orbital Time = 445726, [00:07:25]
- [INF] TX Mode Set to 2
- [INF] Changed TOPRState to 2

- [HWS] Timestamp: 20.04.2009 14:39:29 –
- [HWS] RXAART: 082F80 TXAART: 180D1F
- BCAART: 000377 ModemAART: 88FFE4
- [HWS] TXC Exciter ON
- [HWS] TXC 5V HPA ON

AO-27 Daten

TOPR Status (Transmitter Operation)

- TOPR State 1: 20 Digital Med
  NO Uplink ==> 500mW 436.797MHz AFSK Downlink
- TOPR State 2: 420 Analogue Med
  ==> 145.850MHz Uplink <==> 500mW 436.797MHz Downlink
- TOPR State 3: 60 Digital Med
  ==> NO Uplink ==> 500mW 436.797MHz AFSK Downlink
- TOPR State 4: 1417 OFF
- TOPR State 5: 60 OFF
- TOPR State 6: 20 OFF
- TOPR State 7: 20 OFF

AO-27 Daten

Telemetrie

Battery 0	: 1.404	V	Y+ Array Cur	: 125.693	mA
Battery 4	: 1.350	V	Z- Array Cur	: 91.028	mA
Battery 2	: 1.371	V	Z+ Array Cur	: 29.154	mA
Battery 6	: 1.496	V	External Cur	: 1.847	mA
Battery 1	: 1.458	V	BCR Input Cur	: 319.493	mA
Battery 5	: 1.329	V	BCR Output Cur	: 16.000	
Battery 3	: 1.529	V	BCR Plate Temp	: 3.400	°C
Battery 7	: 1.454	V	BCR PC Board	: 5.240	°C
Solar Array	: 11.193	V	Batt #0 Temp	: 15.360	°C
8 Volts Bus	: 8.328	V	TX A RF Output	: -74.449	mW
5 Volts Bus	: 4.850	V	TX B RF Output	: -111.610	mW
10 Volts Bus	: 10.722	V	TX THER A	: 6.231	°C
Batt #5 Temp	: 3.400	°C	TX THER B	: 7.115	°C
10 V Bus Cur	: 5.484	mA	TX THER C	: 8.000	°C
8 V Bus Cur	: 29.482	mA	TX THER D	: 11.538	°C
5 V Bus Cur	: 841.732	mA	EDAC Counter	: 140.000	
X- Array Cur	: 3.837	mA	Eclipse	: NO [0]	
X+ Array Cur	: 15.262	mA	Set Point	: 31	
Y- Array Cur	: 5.839	mA	TEPR State	: 0	

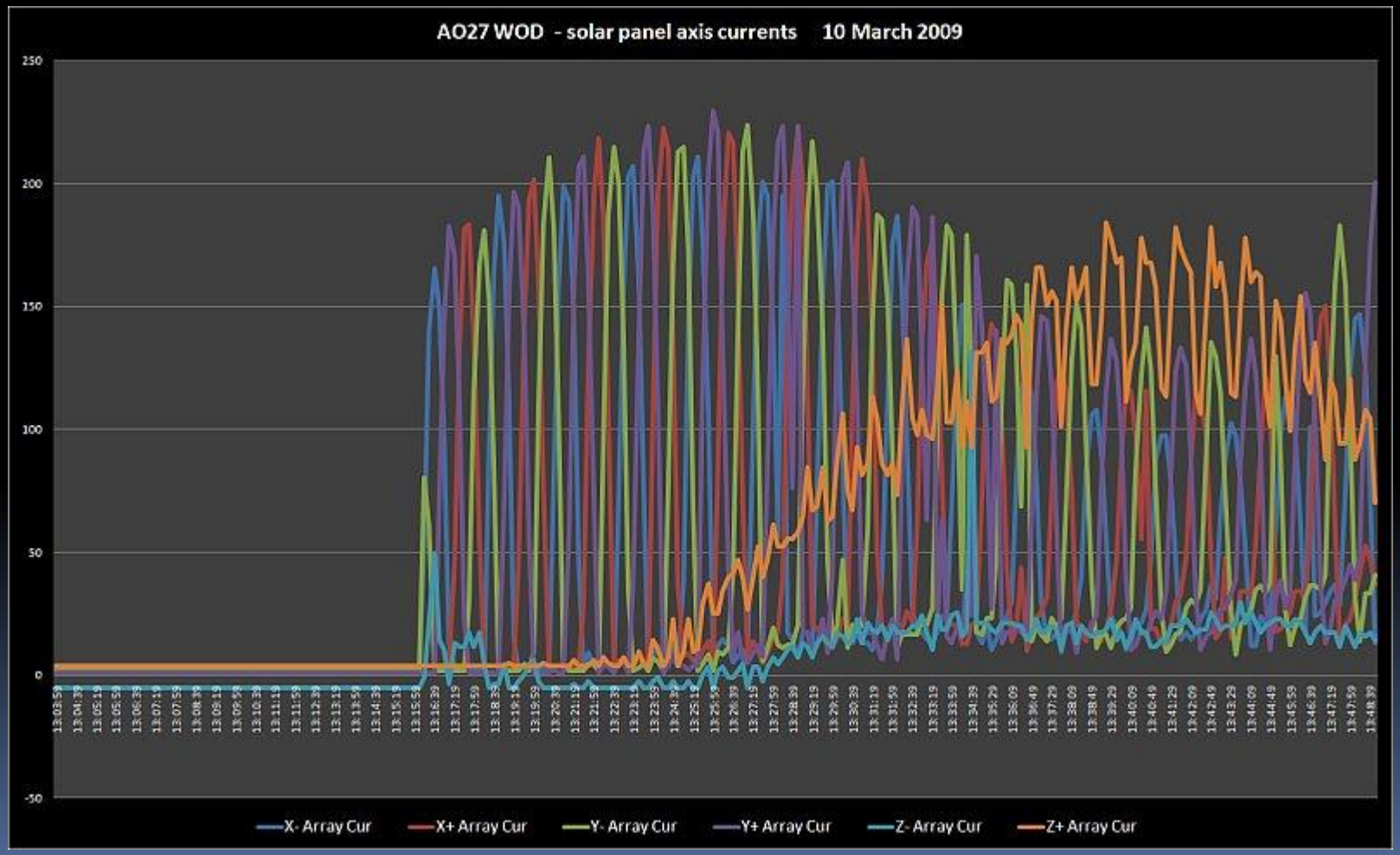
AO-27 Daten

Whole Orbit Data

```
[WOD]        20.04.2009 14:16:19  [12]  8C 00 40 08 06 38 0D 51 2E 9C
[WOD]        20.04.2009 14:16:29  [12]  90 00 21 09 05 47 0B 67 38 9C
[WOD]        20.04.2009 14:16:39  [12]  90 00 06 10 06 48 08 6D 33 9C

[WOD]        20.04.2009 14:16:49  [12]  8E 00 07 1B 08 48 0D 6A 38 9B
[WOD]        20.04.2009 14:16:59  [12]  90 00 04 39 09 36 10 5E 33 9C
[WOD]        20.04.2009 14:17:09  [12]  8D 00 07 4E 09 18 0B 44 38 9C

[WOD]        20.04.2009 14:17:19  [12]  89 00 05 53 0B 03 0B 40 2D 9C
[WOD]        20.04.2009 14:17:29  [12]  8B 00 08 46 24 06 09 4A 38 9C
[WOD]        20.04.2009 14:17:39  [12]  90 00 07 33 44 18 0B 62 30 9C

[WOD]        20.04.2009 14:17:49  [12]  90 00 0F 53 50 08 0C 67 2F 9C
[WOD]        20.04.2009 14:17:59  [12]  8E 00 1E 04 48 08 10 62 2E 9C
[WOD]        20.04.2009 14:18:09  [12]  90 00 37 05 38 09 10 5F 31 9C
```

AO-27 Daten

Whole Orbit Data Auswertung



AO-27
Reports

- KISS File per e-mail an Michael J. Wyrick
  - n3uc@arrl.net
- Internet: www.ao27.org

IO-26

1k2 PSK Telemetrie

435.790 MHz, USB

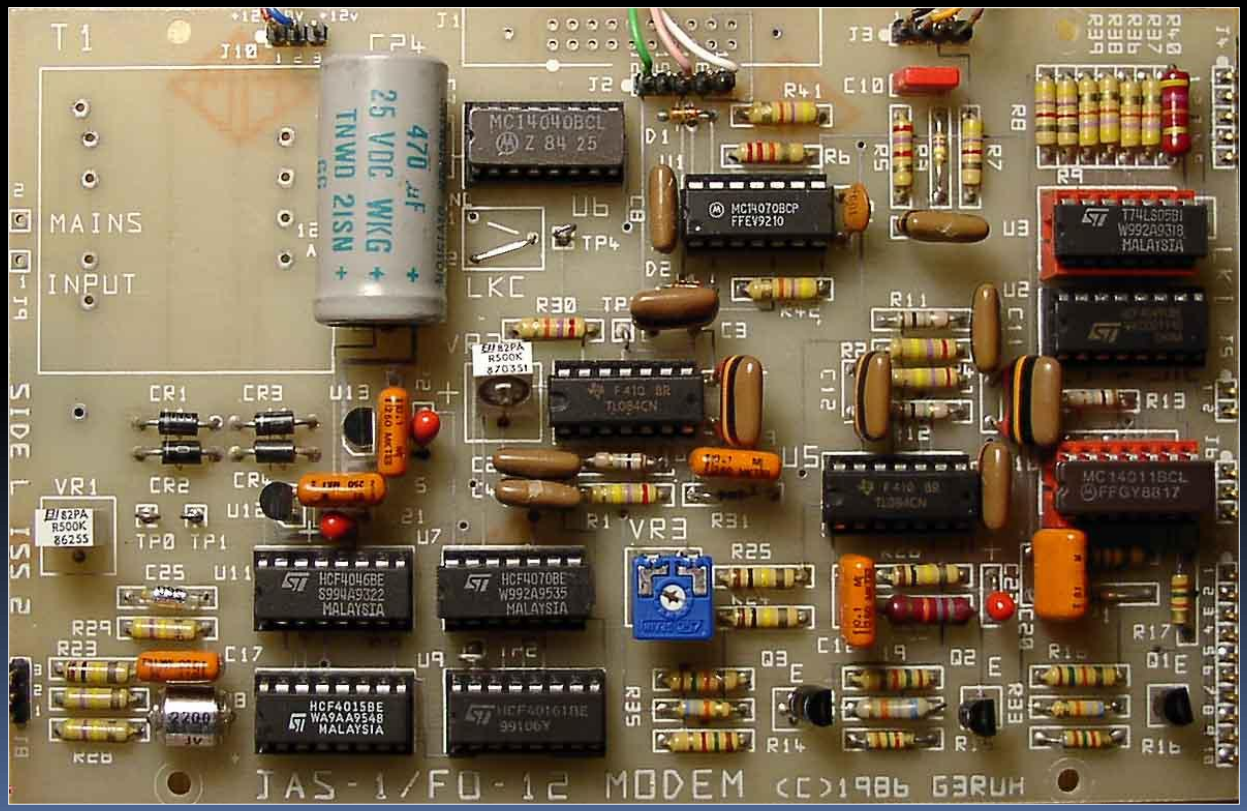
- UI-Frame (MBL Mode)
- Daten im KISS Format
- Burst von 5 Frames

```
ctrl: 3 {UI}  PID: F0 {No L3}  Total Frame Bytes: 34
from ITMSAT to MBLCTL:
   1 > 54 94 E3 48 00 78 01 00 02 68 03 09 04 98 05 BC 06 C6
```

IO-26

1k2 PSK Dekodierung

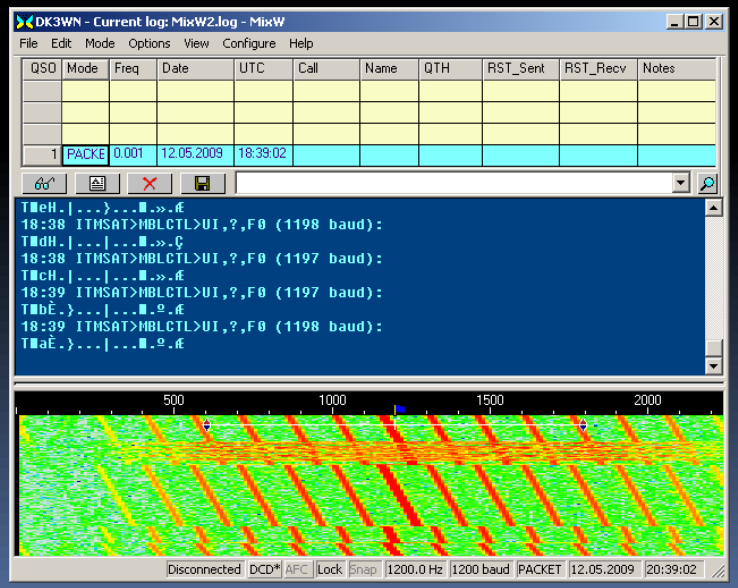
- Hardware PSK Modem (G3RUH)

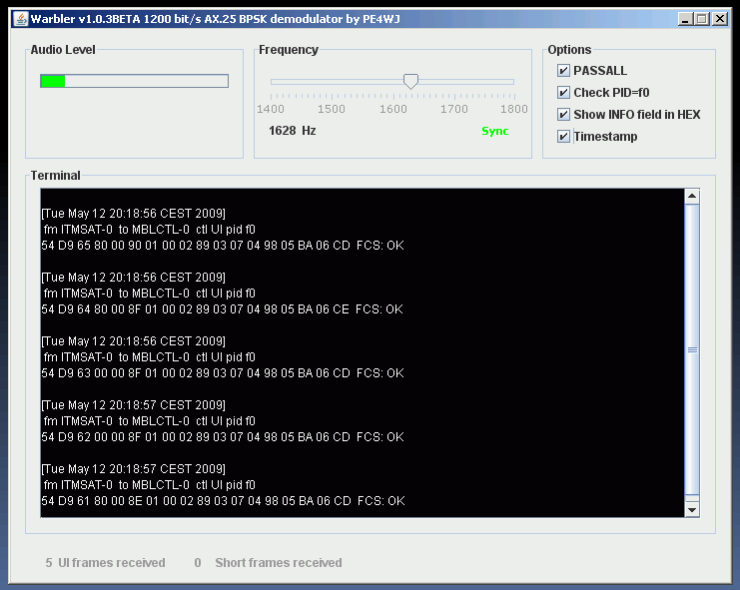


IO-26

1k2 PSK Dekodierung

- Software zur Generierung eines KISS Files
  - MixW mit KISS-Terminalemulation
  - Terminalsoftware (hyperterm, ONLINE_KISS)
  - WARBLER (Wouter, PE4WJ)

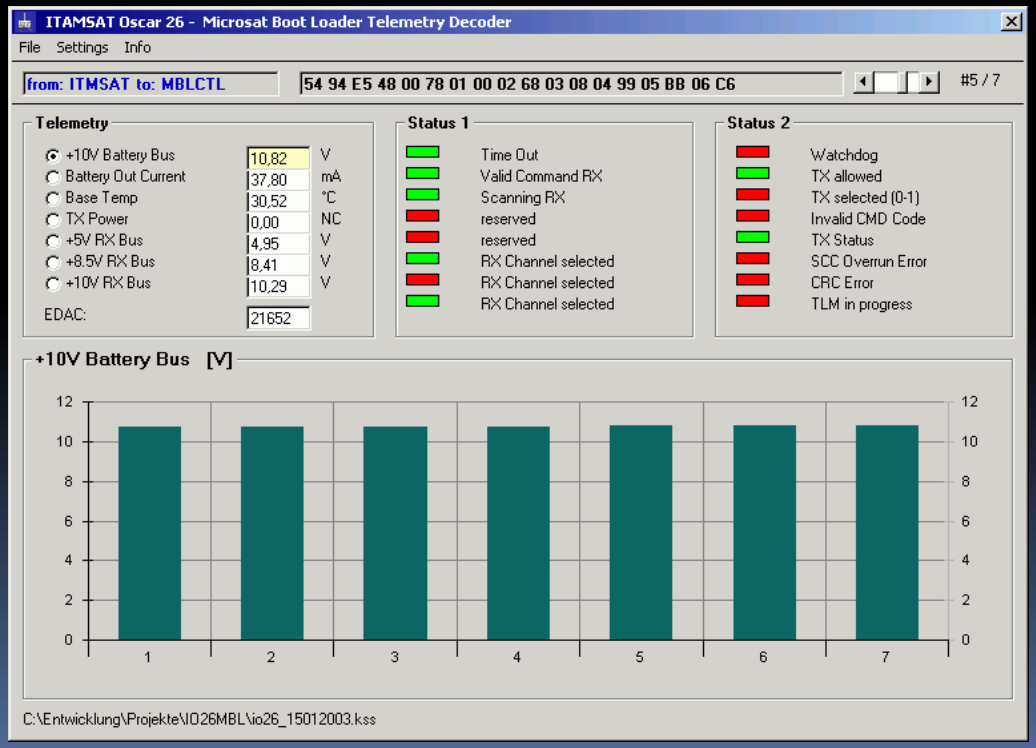




IO-26

Telemetrie-Software – DK3WN

- Input: KISS File
- Output: CSV und TLM (ASCII) File



IO-26
Reports

KISS oder CSV File per e-mail an

- Mark L. Hammond, N8MH
  - marklhammond@gmail.com
- Internet: ☹

COMPASS

4k8 MSK Telemetrie

437.405 MHz, FM

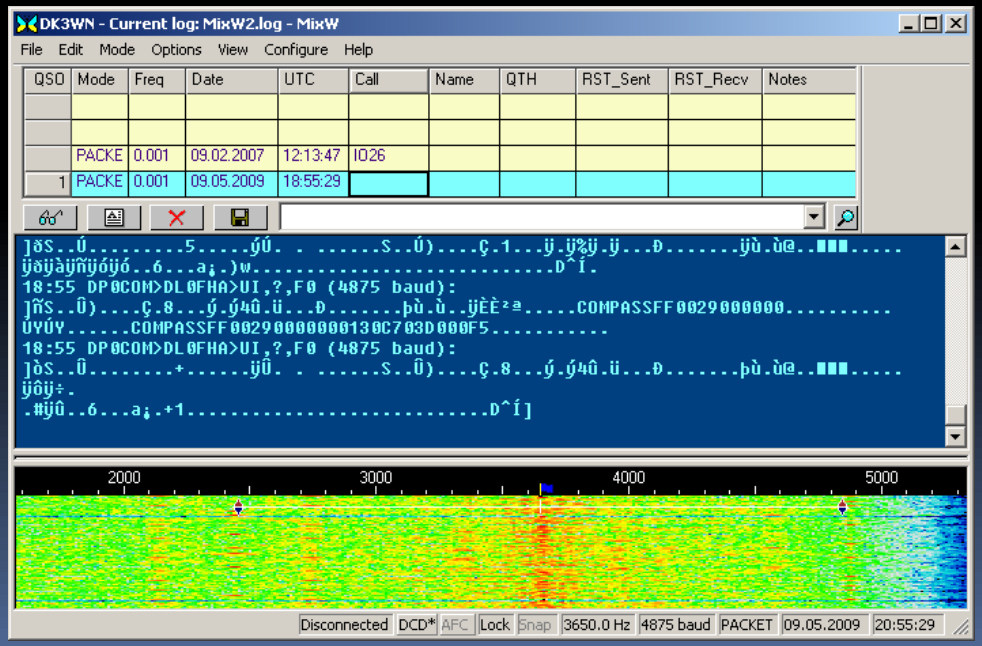
- 2 UI-Frames (Housekeeping)
- Daten im KISS Format

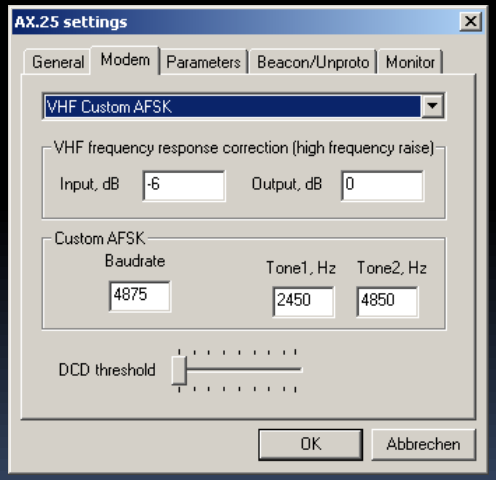
```
ctrl: 3   PID: F0 {UI}   134 Payload Bytes
from DP0COM to DL0FHA:
  1 > 1A 4C 53 00 01 3F 29 00 00 00 03 9E 66 27 00 00 00 D1 00 DA
 21 > 00 7A 00 54 87 00 3A D9 00 0C 00 05 00 1B 00 00 FF FF FF FE
 41 > FE FE E2 A4 B2 B2 01 02 00 01 00 43 4F 4D 50 41 53 53 36 3D
 61 > 30 30 30 30 30 30 38 39 30 30 14 00 00 00 00 01 01 01 00 00
 81 > 4C 1A 4C 1A 00 00 00 00 00 00 43 4F 4D 50 41 53 53 36 3D 30
101 > 30 30 30 30 30 38 39 30 30 30 30 30 30 39 40 36 36 43 43 30
121 > 30 46 46 00 00 00 00 00 00 00 00 00 00 00
```

COMPASS 4k8

MSK Dekodierung

- Hardware — MSK Modem (FX469)
- Software — MixW mit KISS-TNC Emulation
  VHF Custom AFSK Mode

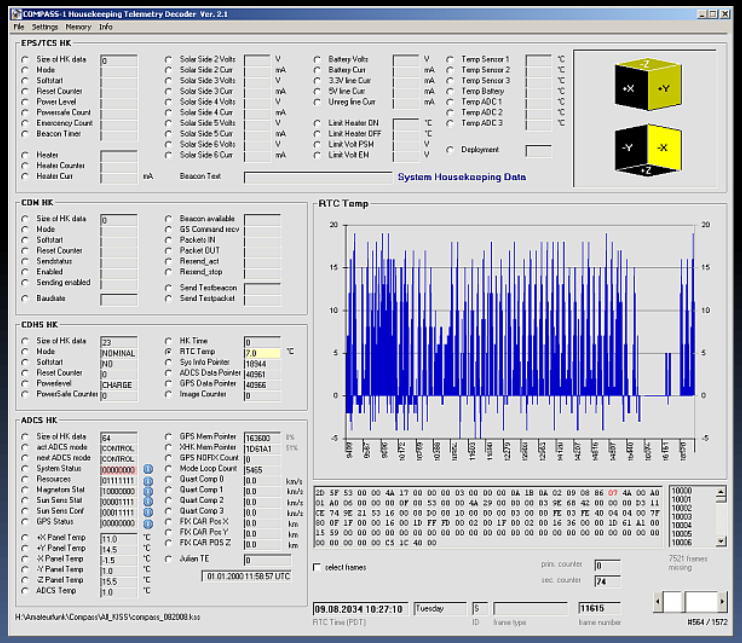


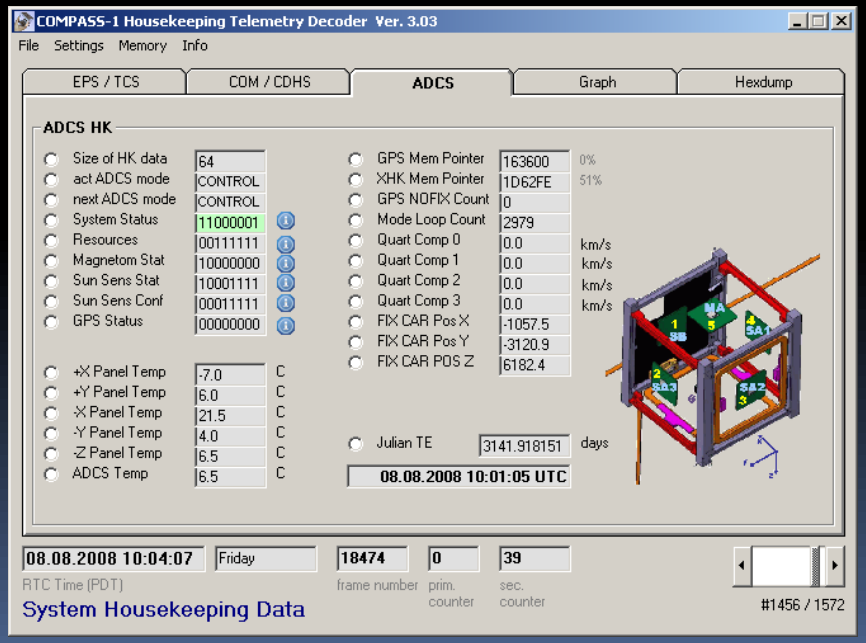


COMPASS

Telemetrie-Software - DK3WN

- Input: KISS File
- Output: CSV und TLM (ASCII) File
- ONLINE Version verfügbar (COMPASSONLINE)





COMPASS
Reports

CW reports, KISS Files per e-mail an:

- COMPASS Team
  - compass1cubesat@googlemail.com
- Mike, DK3WN
  - dk3wn@amsat.org

- Internet: www.cubesat.de

- QSL-Karte

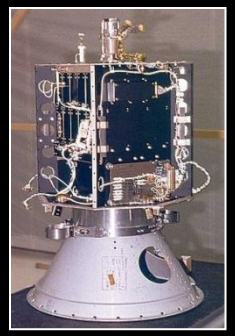
  COMPASS ONE
  c/o Thomas Hoevelmann
  Hasencleverstr. 32
  D-52222 Stolberg

Aktive Satelliten und Telemetrie

ganz kurz auf einem Blick

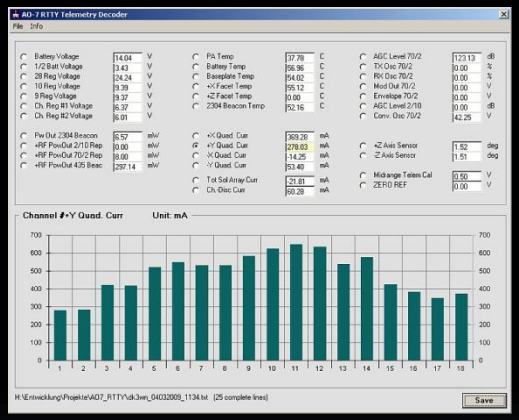
- AO-7
- LO-19
- IO-26
- AO-27
- FO-29
- NO-44
- GO-32
- AO-51
- CUTE-I
- XI-IV
- XI-V
- DELFI-C³
- CUTE1.7
- SEEDS
- COMPASS-1
- AAUSAT-II
- PRISM
- STARS
- KKS-1
- CP-4 (6)
- GeneSat-1
- QuakeSat

AO-7



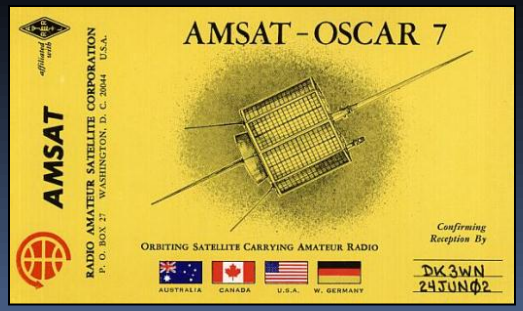
145.972 MHz, CW (Mode)

```
hihi
180 180 180 180 252 252 252 252
324 324 324 324 496 496 496 496
568 568 568 560 696 696 696 696
hihi
180 180 180 180 252 252 252 252
324 324 324 324 496 496 443 497
540 560 568 568 696 696 696 696
```



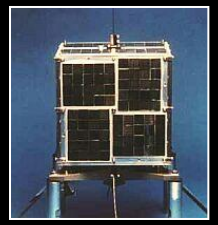
435.100 MHz, RTTY (Mode D)

```
-01100-04247-01100-04247-01100-04247-01100-04247-01100-04247
-01100-04247-01100-04247-01100-04247-01100-04247-01100-04247
-00369-01630-02889-03897-04836-05175-06638-07905-00000-09895
-10000-11773-12340-13716-14603-15937-16426-17398-10000-19123
-20484-21629-22887-23906-24855-25168-26649-27861-20000-29888
-30000-31000-32000-33487-34000-35239-36266-37266-30000-39256
-40501-41655-42854-43915-44878-45164-46663-47851-40000-49919
-50000-51766-52331-53009-54000-55000-56000-57000-50000-59853
```



http://www.planetemily.com/ao7/

LO-19



437.126 MHz, CW

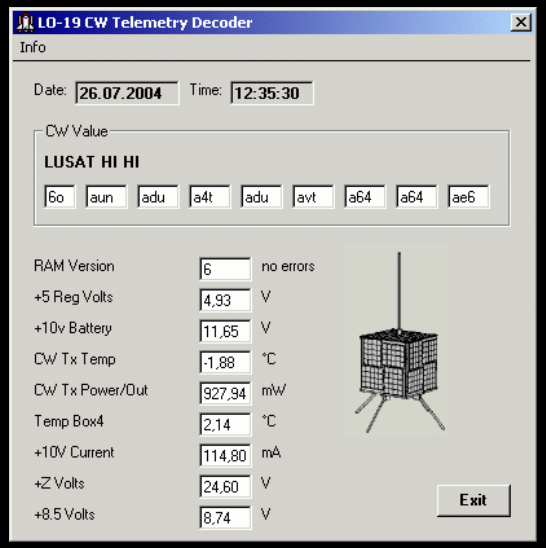
CW-Bake vom 15.04.2009, 1555UTC

Fehlerhafte Zeichen seit Oktober 2008

```
lusat hihi ao *va a*e tnd *nt tnv adu avd ae6
lusat hihi ao *va a*e tnd *nt tnv adu a4a ae6
lusat hihi ao *va a*4 tnb *nt tnu adu a4u ae6
lusat hihi ao *va a*4 tnb *nt tnu adv a4a ae6
lusat hihi ao *va a*4 tnb *nt tna adv a4u ae6
```

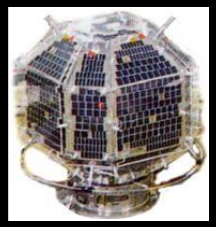
CW-Bake vom 11.04.2008, 1618UTC

```
lusat hihi ao ava abu tb4 anv tbt anv avd ae6
lusat hihi ao ava abu tb4 anv tbt anv avd ae6
lusat hihi ao ava abu tb4 anv t6n anv avn ae6
lusat hihi ao ava abv tb4 anv t6n anv avn ae6
lusat hihi ao ava abu tb4 anv t6n an4 avn ae6
```



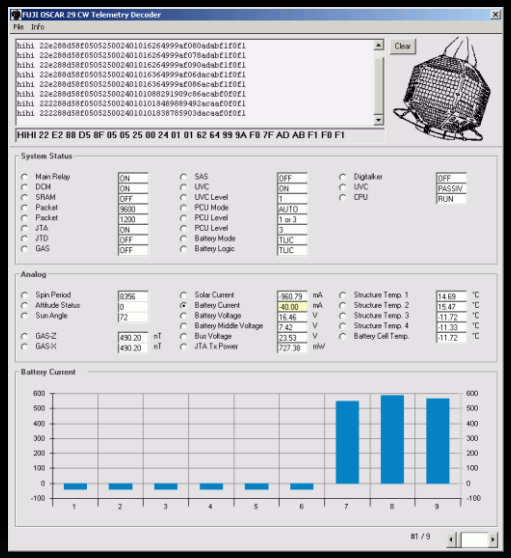
http://www.lusat.com.ar/

FO-29



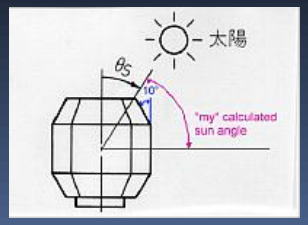
435.795 MHz, CW (Mode JA)

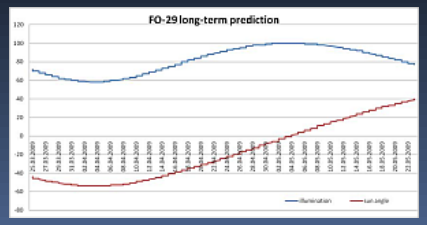
```
hihi 22e288d58f050525002401016d639797f091f2aff3f5f2
hihi 22e288d58f0505250024010170639797f077f2aff3f4f2
hihi 22e288d58f050525002401016e639797f094f1aff3f4f2
hihi 22e288d58f050525002401016c639797f092f1aef3f4f2
hihi 22e288d58f050525002401016a639797f07ff1aef3f4f2
```



Untersuchung Sonnenwinkel

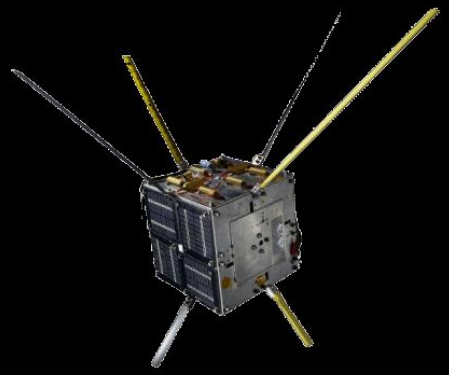
- *Mineo, JE9PEL und John, G7HIA*
- Langzeitauswertung im März 2009
- Wert konstant seit 2007
- Telemetriefehler





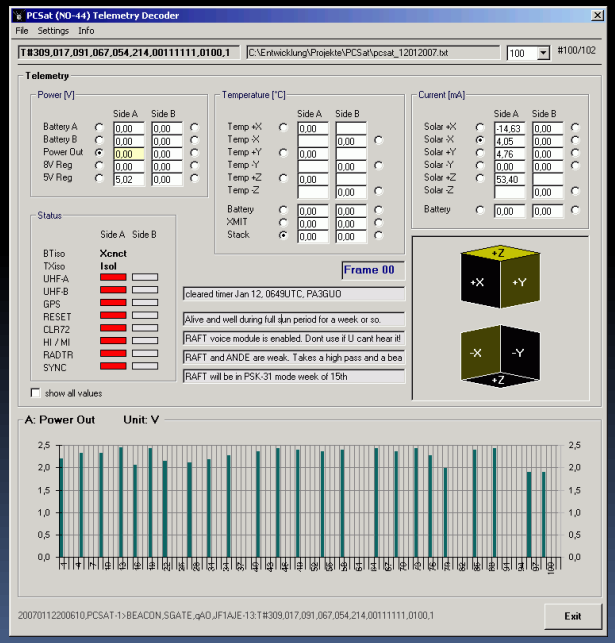
http://www.jarl.or.jp/English/5_Fuji/

NO-44



145.825 MHz, FM 1k2 AFSK

```
T#041,019,119,068,026,214,00110111,0100,1
      Side A: Current +X      -13.25 mA
      Side A: Current +Z      102.62 mA
      Side A: Current +Y      5.42 mA
      Side A: Current -X      -12.91 mA
T#042,111,106,112,123,214,00110111,0101,1
      Side A: Temp +Y         18.19 °C
      Side A: Temp Batt A     16.48 °C
      Side A: Temp XMIT A     18.53 °C
      Side A: Temp +Z         22.28 °C
T#043,112,105,053,117,214,00110111,0110,1
      Side A: Temp +X         18.53 °C
      Side A: Temp Stack A    16.14 °C
      Side A: Current -Y      -6.71 mA
      Side A: Current Batt A  44.47 mA
T#044,162,162,078,215,214,00110111,0111,1
      Side A: Batt A          15.94 V
      Side A: Batt B          15.92 V
      Side A: Power Out       2.43 V
      Side A: 8V Reg          7.65 V
```



http://pcsat.aprs.org

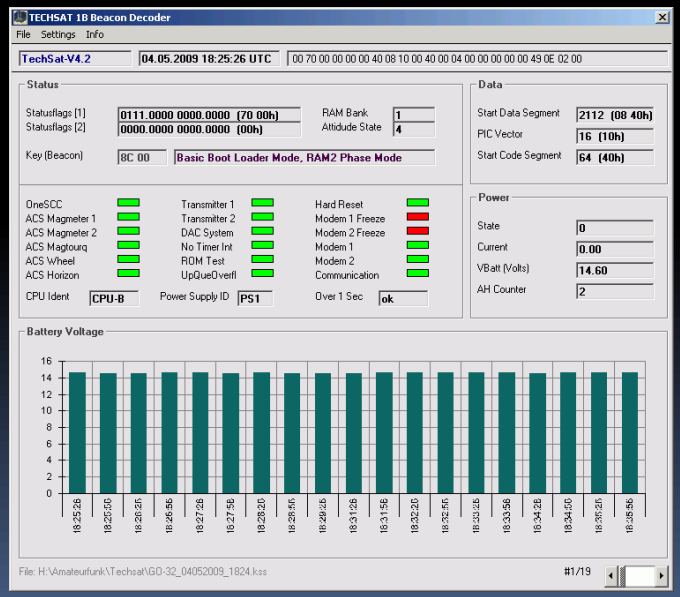
http://www.usna.edu/Users/aero/bruninga/pcsat.html

GO-32

435.325 MHz, FM 9k6 FSK

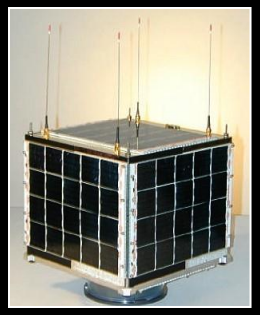
```
[19.04.2009 17:29:46] [BEACON] TechSat-V4.2 700000000040081000400004000000000440E0300
[19.04.2009 17:30:16] [BEACON] TechSat-V4.2 700000000040081000400004000000000005C0E0300
[19.04.2009 17:30:46] [BEACON] TechSat-V4.2 700000000040081000400004000000000500E0300
[19.04.2009 17:31:16] [BEACON] TechSat-V4.2 700000000040081000400004000000000400E0300
```

```
[06.04.2009 16:15:31] [TELEM ]

[#152] Ch 2007: REG_BUS_5V: 5.02 V
[#154] Ch 2020: ENG_I_5V_PS1: 0.53 A
[#154] Ch 2021: ENG_I_5V_PS2: -0.13 A
[#155] Ch 2046: I_UNREG_12V_1: 0.45 A
[#156] Ch 81  : TLM_W_WHEEELI: -26319
[#158] Ch 81  : TLM_W_WHEEELI: -26318
[#160] Ch 81  : TLM_W_WHEEELI: -26316
[#162] Ch 81  : TLM_W_WHEEELI: -26315
```



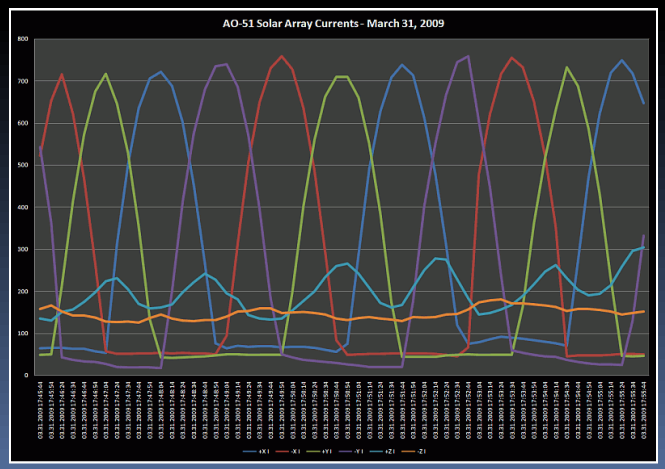
http://asri.technion.ac.il/new_site_php/techsat/

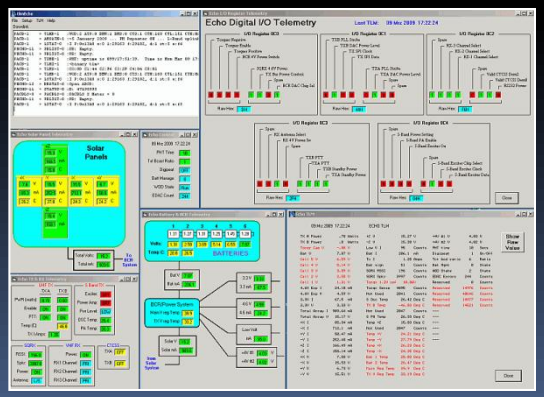
AO-51



435.150 MHz, FM 9k6 FSK

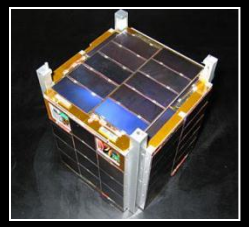
```
2009-03-09 15:39:33.390 UTC: Open ABCD:
2009-03-09 15:39:34.710 UTC: PACBLS S Meter = 0
2009-03-09 15:39:46.390 UTC: PB: Empty..
2009-03-09 15:39:49.650 UTC: C0:0D C1:44 C2:F6 C3:2F C4:04 C5:01
2009-03-09 15:39:49.770 UTC: WOD:2 ATP:0 BMW:1 BMS:0 CTS:1 CTN:168 CTL:152 CTE:Mon Mar 16 00:35:18 2009
2009-03-09 15:39:58.180 UTC: PHT: uptime is 099/16:10:59. Time is Mon Mar 09 15:41:44 2009.
2009-03-09 15:40:00.020 UTC: WOD:2 ATP:0 BMW:1 BMS:0 CTS:1 CTN:168 CTL:152 CTE:Mon Mar 16 00:35:18 2009
2009-03-09 15:40:00.100 UTC: I P:0x13A8 o:0 l:29163 f:29182, d:1 st:5 e:d5.
2009-03-09 15:40:48.180 UTC: PHT: uptime is 099/16:11:49. Time is Mon Mar 09 15:42:34 2009.
2009-03-09 15:40:49.870 UTC: WOD:2 ATP:0 BMW:1 BMS:0 CTS:1 CTN:168 CTL:152 CTE:Mon Mar 16 00:35:18 2009
2009-03-09 15:41:05.420 UTC: B: 47196735.
```





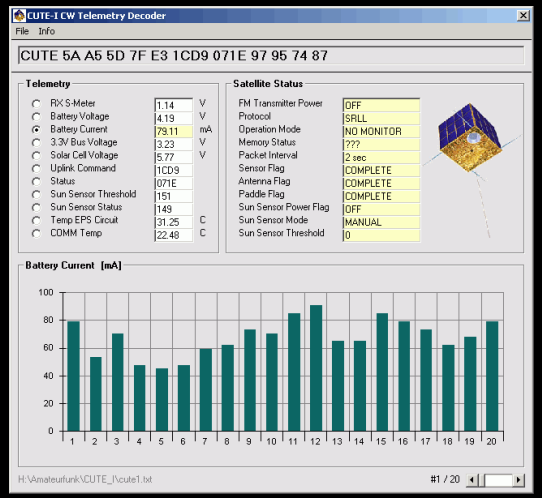
http://www.amsat.org/amsat-new/echo/

CUTE-I



436.8375 MHz, CW

```
cute 59a56e7fd566a4071a706f727f
cute 53a56e7fd366a4071a706f737f
cute 4ba56d80d766a4071a716f737f
cute 4fa56c7fdf66a4071a70706f7f
```



CUTE-I recovered!

Hiroki Ashida: CUTE-I recovered! Thank you very much for your cooperation. We have two steps to execute commands. First, we have to send a "confirmation command" and if it is accepted, 4bytes (character 11 to 14) of CW telemetry change to specific characters.

```
> cute 6ca54e80da39aa07306f6f7ab3 -> 39aa
```

Then, we can send a "execute command" to execute the command. If no commands are received, those characters are "ffff".
For this several days, CUTE-I was unable to keep its command. While we transmit "confirmation commands",
CW telemetry is always "ffff"(=command empty) as can be seen in your report.

```
> cute 6fa55c80d5ffff4720fcfe7bb3
```

So, I restarted the Comm. MPU of CUTE-I last night. Though I couldn't confirm the results, your report told me that the operation was success.

```
> cute 6ca54e80da39aa07306f6f7ab3
```

http://lss.mes.titech.ac.jp/ssp/cubesat/

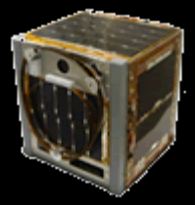
XI-IV

436.8475 MHz, CW

```
UT1 WWW.SPACE.T.U-TOKYO.AC.JP
UT2 49BC8D
UT3 F8B80058
UT4 33425C
UT5 220740
UT6 7777777747
UT1 WWW.SPACE.T.U-TOKYO.AC.JP
UT2 49BCFB
UT3 F8B80039
UT4 304256
UT5 087030
UT6 7777767748
UT1 WWW.SPACE.T.U-TOKYO.AC.JP
UT2 49BD69
UT3 F838004B
UT4 30356D
UT5 400000
UT6 9999999930
```

http://www.space.t.u-tokyo.ac.jp/cubesat/

XI-V



437.465 MHz, CW

```
xiv1 cf37ab
xiv2 7bb80039
xiv3 343c93
xiv4 0b010c010114
xiv5 af8c91947e97
xiv6 97e7419340
xiv7 for-earth-peace.harmony—
xiv1 cf384be
xiv2 7bb8004c
xiv3 353b92
xiv4 010620010104
xiv5 9494988f79afat
xiv6 96e740923
xiv7 everybody-s-heart-is-one.
```

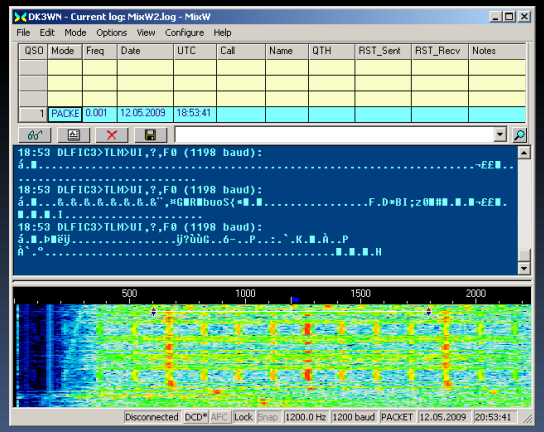
http://www.space.t.u-tokyo.ac.jp/cubesat/

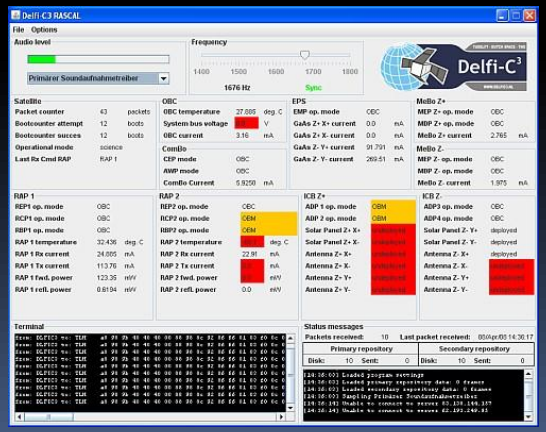
DELFI-C³

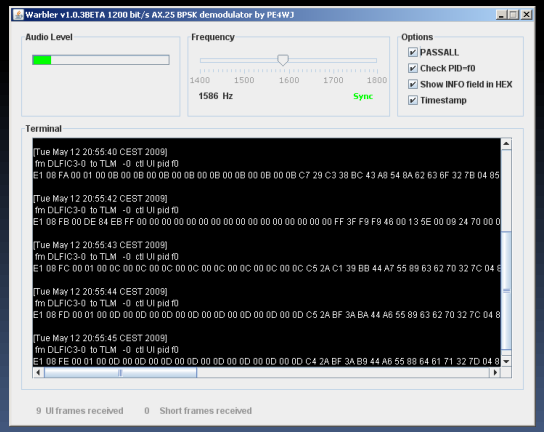
145.879 MHz, USB 1k2 BPSK

- Science Modus
- aktiv im Sonnenlicht

```
from: DLFIC3 to TLM: a8 98 9b 40 40 40 00 88 98 8c 92 86 66 01 03 f0 e1 08 86 00 01 00 99 04 8b 04
     94 04 9f 03 a4 02 a7 01 a9 00 ab 08 6c 08 78 07 80 07 8b 05 90 04 94 02 97 00 99 4c 22 4a 4e
     47 5f 40 6e 35 77 26 7f 13 85 02 8a 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7f a7 95
     b4 8c 81 36 41 8b 00 47 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

from: DLFIC3 to TLM: a8 98 9b 40 40 40 00 88 98 8c 92 86 66 01 03 f0 e1 08 87 00 de 84 f5 ff 00 00
     00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ff 3f f8 f8 48 03 37 2a 00 0a 20 80 c0 03 39 80 54
     03 00 f7 01 f0 02 00 dd 03 b0 17 00 68 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
     00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 8c 81 37 40 8b
     00 47 00
```







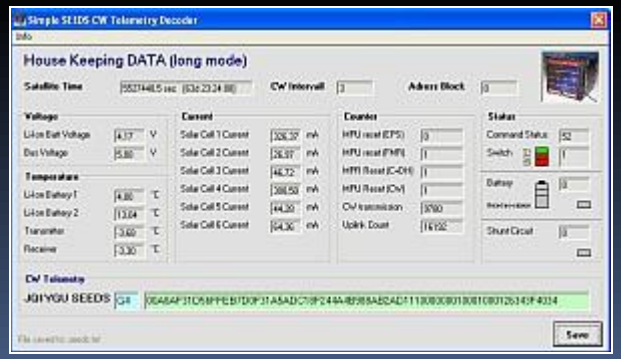
http://www.delfic3.nl/

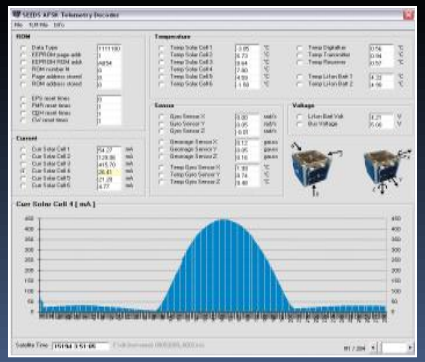
SEEDS

437.485 MHz, CW und FM 1k2 AFSK

```
jq1ygu seeds g4 00485c37d2cffedd70080000000008007ac8aabac06211100000001000100011 6bd174034
jq1ygu seeds g4 00486000d3affe00710f000000ec8143ad4a95aceb2f110000000100010001 16be174030
```

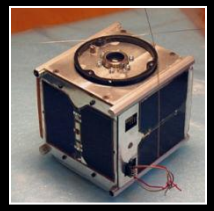
```
[95 Bytes KISS Frame (without CRC)] ctrl: 3 PID: F0 {UI} 76 Payload Bytes
from JQ1YGU to JQ1YGV:
1  > F9 73 2B 5C 20 32 2E A4 38 2D 30 01 2D 01 36 01 31 31 3A 31
21 > 0A 08 0A 0C 0A 56 0A 97 0A 68 0A CC C0 05 05 08 08 08 07 05
41 > 04 05 05 06 0C 96 0F FB 07 9C 08 09 07 F7 07 79 08 44 08 01
61 > 09 03 09 06 07 F2 08 60 08 8C 08 B3 08 D8 09 1F
```





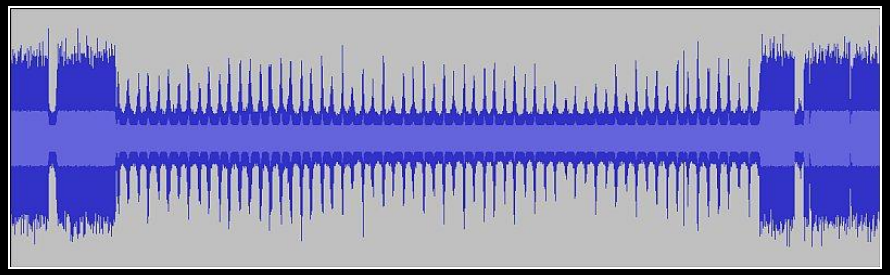
http://cubesat.aero.cst.nihon-u.ac.jp

AAUSat-II



437.432 MHz, FM 1k2 MSK

```
c:\Entwicklung\decoder_demo.exe
50 bytes read from file
50 bytes read from file
50 bytes read from file
50 bytes read from file
9 bytes read from file
209 ax25 bytes read from ring buffer
Checksum mismatch, raw_length 186
Last uplink RSSI -172.000000 dBm
Last uplink HFERR -73.000000 kHz
Last uplink callsign: Oz2CUB
77 77 77 2e 61 61 b5 73  61 74 69 69 2e 61 61 75   www.aa.s atii.aau
2e 64 6b 24 2d 20 4f 5a  32 43 55 42 0a 42 61 74   .dk$-.OZ 2CUB.Bat
3a 38 2e 34 56 0a 53 57  3a 44 46 4c 0b 4c 41 53   :8.4V.SW :DFL.LAS
5c 20 48 41 4d 3a 2d 2d  2d 2d 2d 2d 0a 44 65 6e   \.HAM:-- ----.Den
20 4f 62 65 6c 73 6b 65  20 46 61 6d 69 6c 69 65   .Obelske .Familie
66 6f 6e 64 20 0a 1e 00  00 00 78 00 00 00 78 00   fond.... ..x...x.
00 00 6d a9 6a a9 9d 18  5c 18 00 a8 01 23 01 7e   ..m.j... \....#.~
03 be 00 ba 00 e8 03 75  01 bf 00 b9 03 af 03 55   .......u .......U
01 07 03 2a 03 66 03 72  03 7e 03 05 01 3e 03 7a   ...*.f.r .~...>.z
03 86 03 92 03 00 00 00  00 00 00 00 00 00 00 00   ........ ........
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ........ ........
00 00 03 00 00 26 00 00  00 00                     .....&.. ..

Command ID: 0x7777
Drücken Sie eine beliebige Taste . . .
```



Total number of radio amateurs: 5

Total number of frames received: > 1200

```
Auswählen c:\Entwicklung\demodulator.exe
 494. Block: 1024 Bytes (gesamt 505856 Bytes)
 495. Block: 1024 Bytes (gesamt 506880 Bytes)
 496. Block: 1024 Bytes (gesamt 507904 Bytes)
 497. Block: 1024 Bytes (gesamt 508928 Bytes)
 498. Block: 1024 Bytes (gesamt 509952 Bytes)
 499. Block: 1024 Bytes (gesamt 510976 Bytes)
 500. Block: 1024 Bytes (gesamt 512000 Bytes)
 501. Block: 1024 Bytes (gesamt 513024 Bytes)
 502. Block: 1024 Bytes (gesamt 514048 Bytes)
 503. Block: 1024 Bytes (gesamt 515072 Bytes)
 504. Block: 1024 Bytes (gesamt 516096 Bytes)
 505. Block: 1024 Bytes (gesamt 517120 Bytes)
 506. Block: 1024 Bytes (gesamt 518144 Bytes)
 507. Block: 1024 Bytes (gesamt 519168 Bytes)
 508. Block: 1024 Bytes (gesamt 520192 Bytes)
 509. Block: 1024 Bytes (gesamt 521216 Bytes)
 510. Block: 1024 Bytes (gesamt 522240 Bytes)
 511. Block: 1024 Bytes (gesamt 523264 Bytes)
 512. Block: 1024 Bytes (gesamt 524288 Bytes)
 513. Block:  268 Bytes (gesamt 524556 Bytes)

Zum Beenden Taste <ENTER> druecken!
```

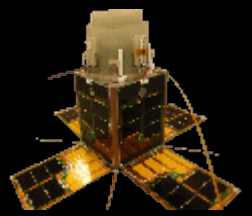
active stations:

1. DK3WN
2. JA6PL
3. OZ1LMC
4. W0RKP
5. SQ5FNQ
6. OZ5TG

Demodulator © Martin Laabs, DM1EF

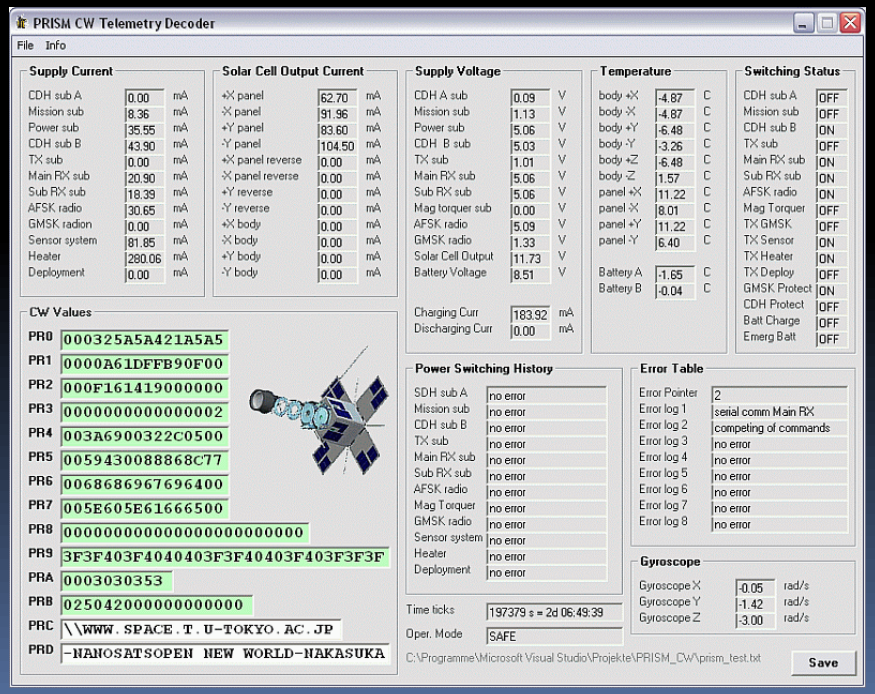
http://aausatii.space.aau.dk/

PRISM



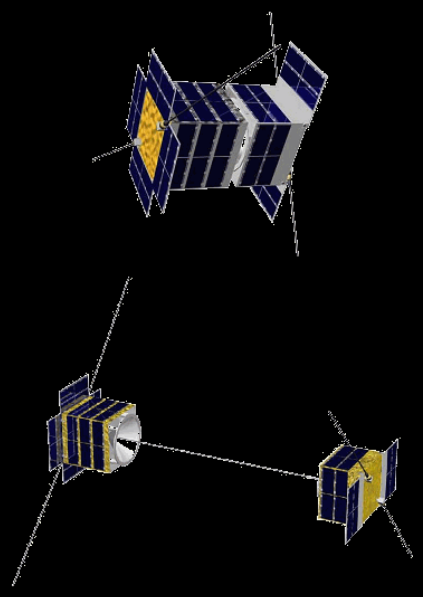
437.425 MHz, CW und 9k6 GMSK (nur über JA)

```
2009-02-28 09:42:20.420 UTC: [93 Bytes KISS Frame (without CRC)]
  1 > 16 3C 48 34 0C 81 79 42 ED 9E 63 77 64 74 32 2D 36 01 53 26
 21 > 10 06 01 8C 7D 31 CB 3E DF A0 CF F9 14 D0 C1 10 B8 4B 72 44
 41 > 65 58 65 BF DD 63 FD 3A 7F BB 57 7B 12 D1 EE 65 DC 17 69 8D
 61 > 94 71 BF 01 C9 FC 7F F8 9F 3B 09 0D 0A 00
```



http://www.space.t.u-tokyo.ac.jp/prism/

STARS



KU: 437.305 MHz, CW

```
hello, world
m3 a9 24 26 21
m5 2d ff 3a ff
```

KAI: 437.4275 MHz, CW

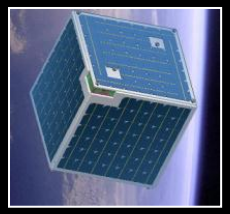
```
hello, world.
r2 09 e7 6a ff
m3 79 bb ad ac
r4 22 00 00 35
m5 2e 72 0c 7a
r6 00 05 00 10
```

KU: 437.485 - KAI: 437.465 FM 1k2 AFSK (nur über JA)

```
06:47 JR5YBN>JR5YBP>UI,R,F0:
DMTMS43 009988 00 +8A321 -20DAF -00259 21F 208 212 1FE 21E 20B 0A7 02E 110
06:47 JR5YBN>JR5YBP>UI,R,F0:
DMTMS43 009989 00 +B881C -1EBE8 -00230 21D 202 218 1F4 252 1EF 0AE 030 110
06:47 JR5YBN>JR5YBP>UI,R,F0:
DMTMS43 009990 00 +FDEE3 -105C1 -0011D 21C 1FC 214 1FC 25D 1F0 0C4 035 100
06:47 JR5YBN>JR5YBP>UI,R,F0:
DMTMS43 009992 00 +5C5BF -0C521 -000D3 21B 1F7 213 202 231 1F6 0C2 034 11C
```

http://stars1.eng.kagawa-u.ac.jp/

KKS-1



437.385 MHz, CW

SAFE MODE

```
1 hello this is kks-1
2 jq1yyy this is kks-1
3 377 065 000 368 s-1
4 09/01/30 00:39:24
```

MODE 0

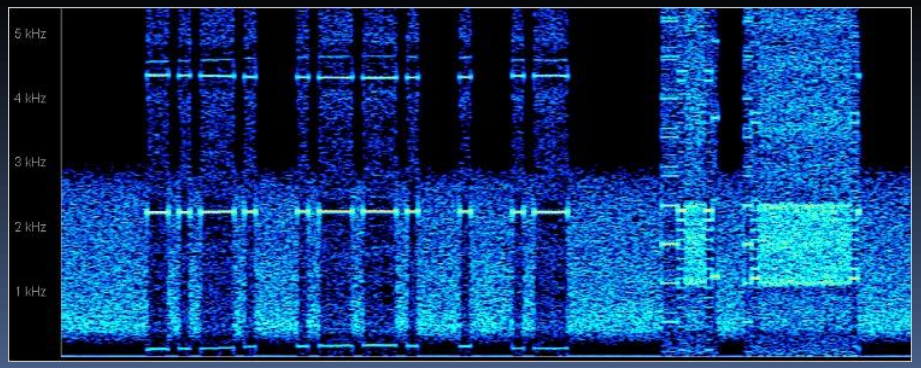
```
1 hello this is kks-1
2 8-52-11 minami-senjyuarakawa-kutokyo-to japan
3 tokyo metropolitan college of industrial technology
kks-1 project tokyo metropolitan college of industrialtechnoe
5 jq1yyy
6 09/01/25 23:58:00
```

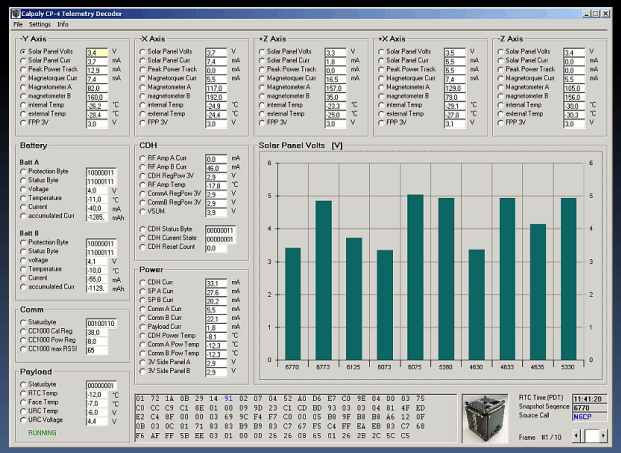
http://www.kouku-k.ac.jp/~kks-1/

CP-4 / CP-6

437.322 MHz, USB 1k2 AFSK

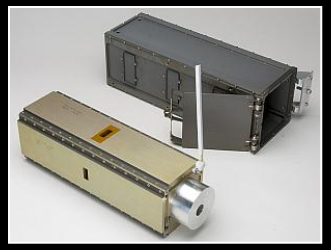
```
ctrl: 3 {UI} PID: F0 {No L3} Total Frame Bytes: 23
from N6CP to N6CP:
1 > 04 43 4F 4D 4D 20 41 .
COMM A

ctrl: 3 {UI} PID: F0 {No L3} Total Frame Bytes: 115
from N6CP to N6CP:
1  > 01 CF 02 02 2F 1E BB 02 05 03 77 88 4E 57 C0 C1 02 00 02 9E
21 > 9F 70 6E C2 BB 06 04 08 BE 43 58 5F BD BF 48 3B 03 AA 6B 21
41 > 1D C5 BA 0C 09 02 82 72 38 39 C0 00 05 B8 5A B8 B8 B6 11 10
61 > 0A 03 0A 01 63 72 6E B9 B9 8B C7 6A FD FC FF 5D ED 8B C7 6B
81 > FD F9 FF BC EF 03 01 00 00 26 26 08 64 01 30 33 2B 00 02
```





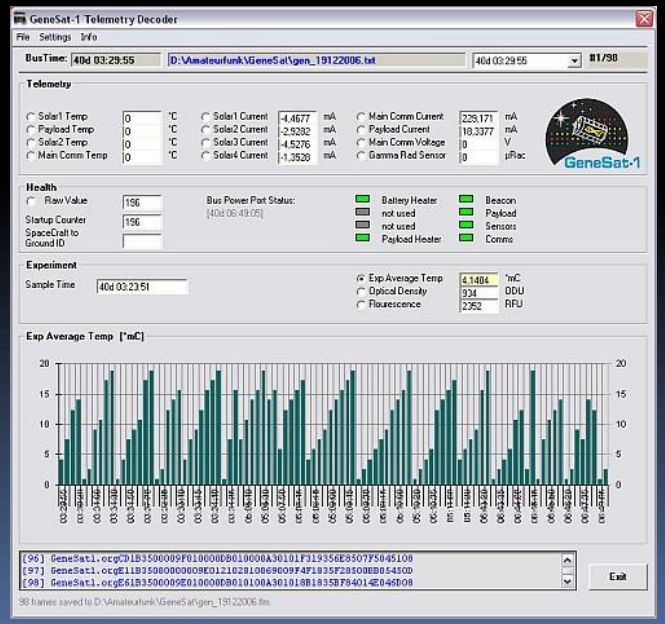
http://polysat.calpoly.edu/

GeneSat-1



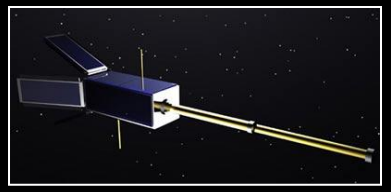
437.067 MHz, FM 1k2 AFSK

```
GeneSat1.org3863320000110100 00EC010000A30101000000000AF00000000
GeneSat1.org3D633200000100020003002400680010000000000B000000000
GeneSat1.org65633200000100000000000680069000100000000000B800000000
GeneSat1.org6A633200000E010000EB010000A30110000000000000B900000000
```



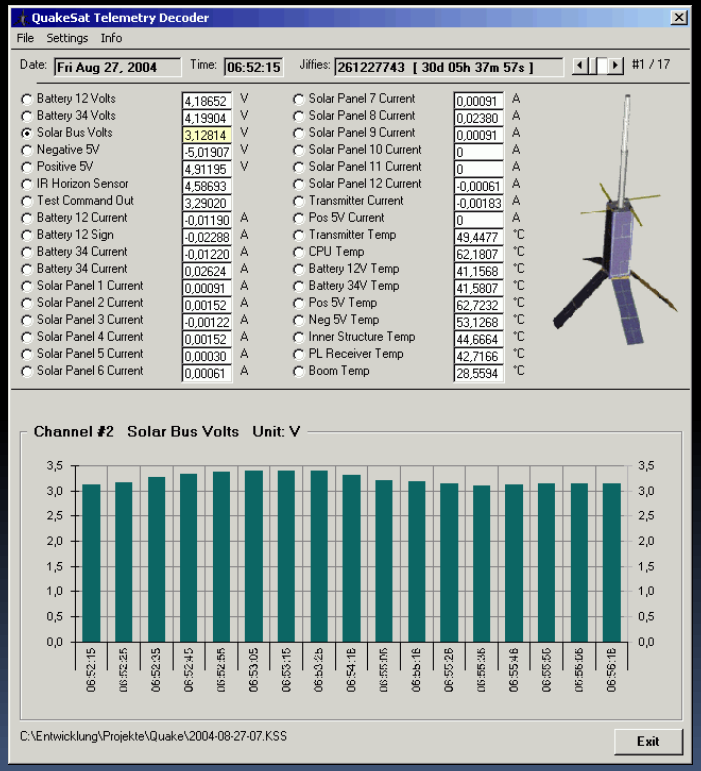
http://genesat1.engr.scu.edu/

QuakeSat



436.675 MHz, FM 9k6 FSK

```
ctrl: 3 {UI} PID: BB {UNKNOWN} Total Frame Bytes: 274
from KD7OVB to QST :
1   > 51 75 61 6B 65 53 61 74 20 53 61 74 20 4A 61 6E 20 20 32 20
21  > 30 31 3A 32 34 3A 33 32 20 31 39 38 38 0D 0A 00 59 87 8B 00
41  > 91 35 BA 35 58 28 D2 BF F1 3E C3 01 31 2A AE 00 97 FF 90 00
61  > 6C FF FA FE 2B FF FB FE 2A FF 0F FF 3C FF 12 FF B8 FF 0F FF
81  > 21 FF C4 FF EA FF 0D FE 23 FF 73 0B CB 0E E4 09 EA 09 CB 0E
101 > C4 0C 89 0D 0A 20 0D 0A 33 07 08 BD 07 00 00 4C EF 04 40 78
121 > A0 04 40 F8 20 04 40 48 D2 01 40 05 00 00 00 E8 D4 01 40 03
141 > 00 00 00 B4 82 04 08 6C 28 01 40 0F 53 8E 07 0F 53 8E 07 DB
161 > DC FD FF BF D0 26 01 40 47 86 04 08 03 00 00 00 28 6A 04 40
181 > C8 9C 04 40 48 D2 01 40 74 61 DF 03 E0 FD FF BF 48 D2 01 40
201 > A8 CD 04 40 F8 20 04 40 48 D2 01 40 28 6A 04 40 48 D2 01 40
221 > 03 00 00 00 84 83 04 08 6C 28 01 40 8E FF 77 01 8E FF 77 01
241 > 10 FE FF BF D0 26 01 40 29 86 04 08 39 28 0B 40 18 00 00
QuakeSat Sat Jan 2 01:24:32 1988
```

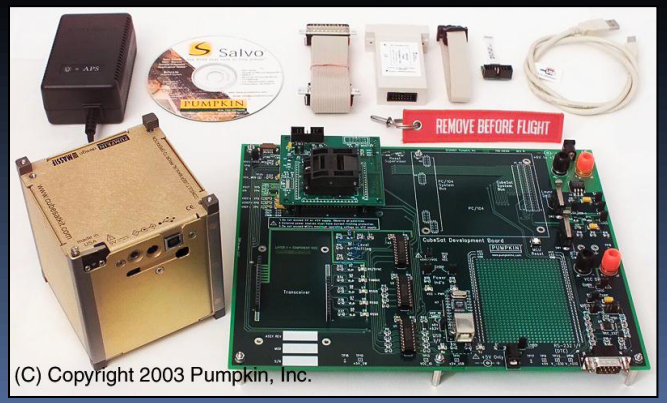


http://www.quakefinder.com/

Resonanz auf Cubesats

Uni vs AMSAT

- Projekte von Universitäten/Schulen
- Industrie -> Payload = Sponsor
- Anzahl der Cubesat Projekte steigt enorm
- Amateurfunkfrequenzen
- Modulationsart vs. Resonanz
- Modulationsart vs. Datendurchsatz
- Potential der Funkamateure nutzen
- Veröffentlichung von Telemetrie
- Öffentlichkeitsarbeit
- Gegenseitiger Kontakt



Resonanz auf Cubesats
am Beispiel

DELFI-C³

- 1k2 BPSK
- Soundkartensoftware (RASCAL)
- Einbindung AMSAT
- 172 aktive Stationen (320 registrierte)
- Öffentlichkeitsarbeit (Webseite, Blog etc.)

Resonanz auf Cubesats

DELFI-C³

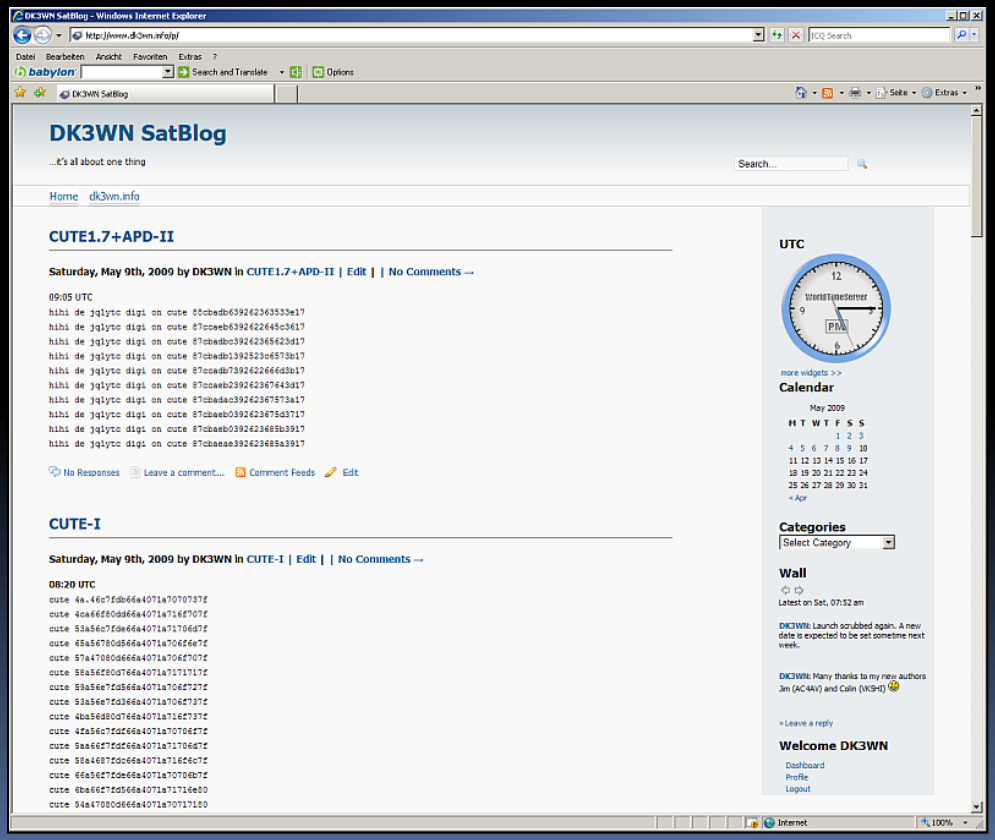
Total number of registered radio amateurs:	323	
Total number of frames received:	618561	approx. 88.48 MB
Total number of active registered stations:	172	53.25 % of 323

12 most active stations:

1.	delfiground_backup	88461 frames	14.3 %
2.	delfiground_primary	72982 frames	11.8 %
3.	guest	42600 frames	6.89 %
4.	ZL2BX	36067 frames	5.83 %
5.	JA0CAW	34480 frames	5.57 %
6.	PA0DLO	34294 frames	5.54 %
7.	PE1ITR	23933 frames	3.87 %
8.	OH8MBN	22210 frames	3.59 %
9.	VE4NSA	17584 frames	2.84 %
10.	PB0AHX	15631 frames	2.53 %
11.	WA4SCA	15185 frames	2.45 %
12.	PI4TUE	13898 frames	2.25 %

DK3WN SatBlog

www.dk3wn.info/p



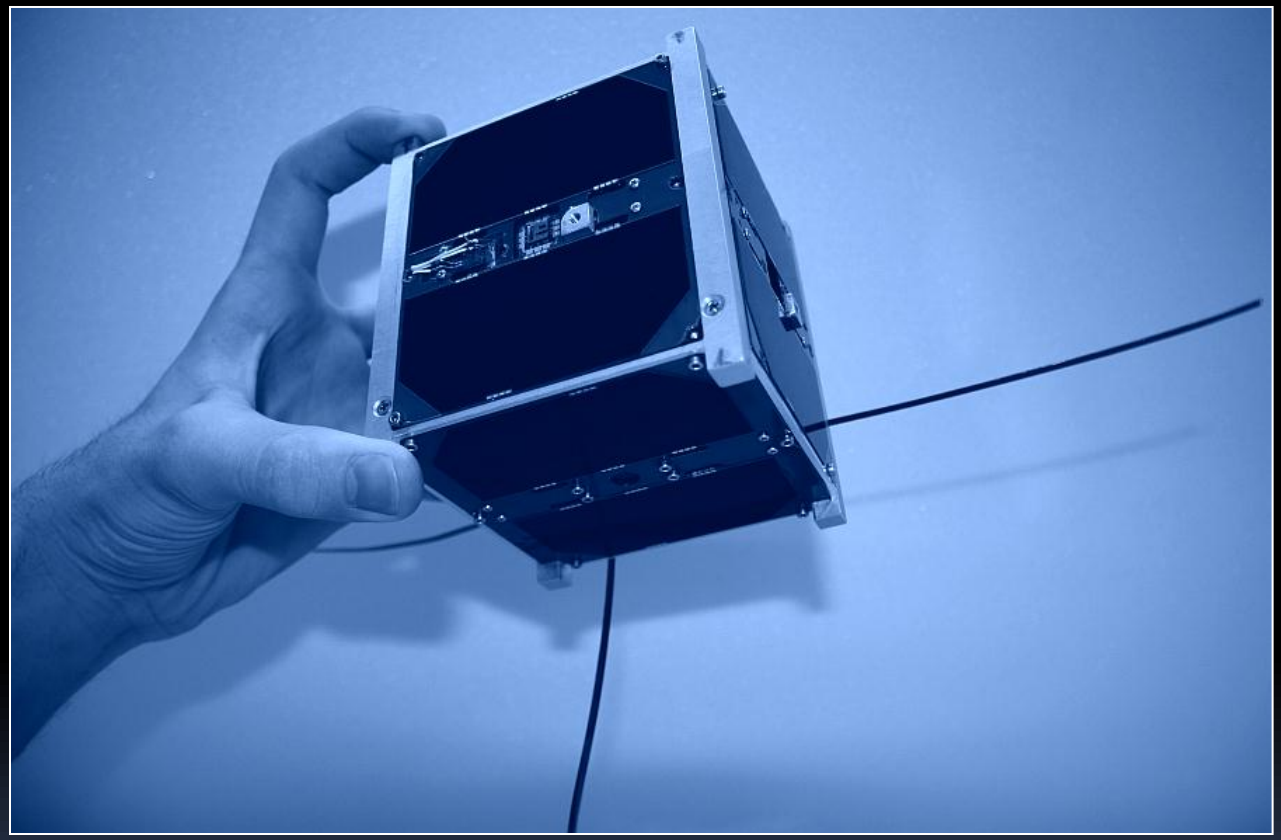
Autoren:

Mike, DK3WN
Colin, VK5HI
Jim, AC4AV

regelmässige Reporte:

ZL2BX, NH7WN, W1ICW, N8MH, JA6PL, JA1GDE, JA0CAW, JE1CVL, JE9PEL, ST2NH, PA3GUO
...

Vielen Dank für die Aufmerksamkeit !



COMPASS-1

73' de Mike