HFDL

High Frequency Data Link

a.k.a. HF ACARS

Revision date: 17 August 2013

What Is HFDL?
ARINC describes the system as follows: *"High Frequency Data Link (HFDL) is an ACARS communications medium used to exchange data such as Airline Operational Control (AOC) messages, Controller-Pilot Data Link Communication (CPDLC) messages and Automatic Dependent Surveillance (ADS) messages between aircraft end systems and corresponding ground-based HFDL ground stations. Using the unique propagation characteristics of high-frequency radio waves, the ground stations provide data link communications to properly equipped aircraft operating anywhere in the world. The result: pilots can always communicate with someone on the ground."*

After the successful implementation of ACARS (Aircraft Communications Addressing and Reporting System) on VHF in the 1980's, the next step was the implementation of a HF equivalent of this system: HFDL.

ARINC operates HFDL as GLOBALink through a network of 15 stations around the globe. The system is specified in document ARINC 635. The service is known as HFDL (HF Data Link), GLOBALink, and HF ACARS.

Decoding:
HFDL uses phase shift keying (PSK) at data rates of 300, 600, 1200 and 1800 bps. The rate used is dependent on the prevailing propagation conditions. HFDL is based on frequency division multiplexing (FDM) for access to ground station frequencies and time division multiplexing (TDM) within individual communication channels.

Each ground station transmits a frame called a "squitter" every 32 seconds. The squitter frame informs aircraft of the system status, provides a timing reference and provides protocol control. Each ground station has a time offset for its squitters. This allows aircraft to jump between ground stations finding the best one before logging on. When passing traffic, dedicated TDM time slots are used. This prevents two aircraft transmitting at the same time causing data collisions.

Most decoders show the following items. They can often be switched on and off.

PREAM	Preamble information
SPDU	Squitter Protocol Data Units
MPDU	Media Access Protocol Data Units
LPDU	Link Protocol Data Units
BDU	Basic Data Units (Segmented messages fragments)
HFNPDU	Network Data Units, this is probably the most interesting one
HEX	Displays received packets in Hexadecimal (Base 16) notation

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Decoders:

PC-ALE
HOKA various versions
Wavecom various versions
Sorcerer
Multi-PSK
Sigmira

Stations and frequencies

Id	Station	Frequencies
01	San Francisco, CA, USA	2947 4672 5508 6559 8927 10081 11327 13276 17919 21934
02	Molokai, HI, USA	2947 3019 3434 4687 5463 5514 6559 6565 8912 8936 10081 11312 11348 13276 13312 13324 17919 17934 21928 21937
03	Reykjavik, ISL	3116 3900 5720 6712 8977 11184 15025 17985
04	Riverhead, NY, USA	3410 3428 5523 5652 6646 6652 6661 8831 8885 8912 10027 11315 11354 11387 13276 17919 17934 17952 21931 21934
05	Auckland, NZL	3016 3404 5583 6535 8921 10084 11327 13351 17916 21949
06	Hat Yai, THA	3470 4687 5655 6535 8825 10066 13270 17928 21949
07	Shannon, IRL	2998 3455 5547 6532 8843 8942 10081 11384
08	Johannesburg, AFS	3016 4681 8834 13321 21949
09	Barrow, AK, USA	2944 2992 3007 3497 4654 4687 5529 5538 5544 6646 8927 8936 10027 10093 11354 17919 17934 21928 21937
11	Albrook PAN	2902 6589 6589 10063 17901 21940
13	Santa Cruz, BOL	2093 3467 4660 6628 8957 11318 13315 17916 21946 21973 21988 21997
14	Krasnoyarsk, RUS	2878 2905 4679 5622 6596 8886 10087 13321 17912 21990
15	Al Muharraq, BHR	2986 5544 8885 10075 11312 13354 17967 21982
16	Agana, GUM	5451 6652 8927 11288 11306 13312 17919
17	Telde, Gran Canaria, CNR	2905 5589 6529 8948 11348 13303 17928 21955

Sample messages:

[HFNPDU PERFORMANCE]
17:17:48 UTC Flight ID = MAS3 LAT 34 56 1 N LON 64 13 13 E

[HF GROUND STATION CHANGE -> AL MUHARRAQ - BAHRAIN]

[HFNPDU PERFORMANCE]
17:17:54 UTC Flight ID = FDX39 LAT 50 7 33 N LON 59 13 7 E

HACARS mode: 2 Aircraft reg: .VT-IEK
Message label: SA Block id: 0 Msg. no: S74A Flight id: 6E0328
Message content:-
0EH171641VH
----------[15/08/2013 17:18]
[HFNPDU ACARS FM AIR 6E0328 TO GND]
<SOH>2.VT-IEK<NAK>SA0<STX>S74A6E03280EH171641VH<ETX>`g<NUL>

HACARS mode: 2 Aircraft reg: .VH-OQH
Message label: _☐Block id: O [Uplink]

----------[15/08/2013 17:18]
[HFNPDU ACARS FM GND TO AIR F8]
<SOH>2.VH-OQH8_<DEL>O<ETX>oq<NUL>
HACARS mode: 2 Aircraft reg: .VT-INQ
Message label: _☐Block id: N [Uplink]

----------[15/08/2013 17:18]
[HFNPDU ACARS FM GND TO AIR 10]
<SOH>2.VT-INQ0_<DEL>N<ETX>oH<NUL>
HACARS mode: 2 Aircraft reg: .F-HPJC
Message label: _☐Block id: G [Uplink]

----------[15/08/2013 17:18]
[HFNPDU ACARS FM GND TO AIR 1F]
<SOH>2.F-HPJC1_<DEL>G<ETX>
I<NUL>

[HFNPDU PERFORMANCE]
17:18:06 UTC Flight ID = UAE5 LAT 45 52 55 N LON 24 46 49 E

[HFNPDU PERFORMANCE]
17:18:14 UTC Flight ID = UAE720 LAT 19 12 9 N LON 52 12 23 E

HACARS mode: 2 Aircraft reg: .VT-IGX
Message label: 5U Block id: 8 Msg. no: M40A Flight id: 6E0106
Message content:-
01 WXRQ 0106/15 VOBL/VIDP .VT-IGX /TYP 1/STA VIDP/STA /STA
----------[15/08/2013 17:18]
[HFNPDU ACARS FM AIR 6E0106 TO GND]
<SOH>2.VT-IGX<NAK>5U8<STX>M40A6E0106 01 WXRQ 0106/15 VOBL/VIDP .VT-IGX
/TYP 1/STA VIDP/STA /STA <ETX>H<ACK><NUL>

HACARS mode: 2 Aircraft reg: .VT-INQ
Message label: 80 Block id: 1 Msg. no: M39A Flight id: 6E0103
Message content:-
3G01 INIT 0104/15 VOBL/VAPO .VT-INQ/001
----------[15/08/2013 17:18]
[HFNPDU ACARS FM AIR 6E0103 TO GND]
<SOH>2.VT-INQ<NAK>801<STX>M39A6E01033G01 INIT 0104/15 VOBL/VAPO .VT-INQ/001 <ETX>Up<NUL>

HACARS mode: 2 Aircraft reg: .VT-IFR
Message label: Q0 Block id: 8 Msg. no: S89A Flight id: 6E0217

----------[15/08/2013 17:18]
[HFNPDU ACARS FM AIR 6E0217 TO GND]
<SOH>2.VT-IFR<NAK>Q08<STX>S89A6E0217<ETX>Wa<NUL>

HACARS mode: 2 Aircraft reg: .SU-GCH
Message label: Q0 Block id: 4 Msg. no: S54A Flight id: MS0678

----------[15/08/2013 17:18]
[HFNPDU ACARS FM AIR MS0678 TO GND]
<SOH>2.SU-GCH<NAK>Q04<STX>S54AMS0678<ETX>&o<NUL>

[HFNPDU PERFORMANCE]
17:18:50 UTC Flight ID = SIA317 LAT 33 29 25 N LON 68 25 32 E

[HFNPDU PERFORMANCE]
17:18:48 UTC Flight ID = SU1423 LAT 180 0 0 N LON 180 0 0 E

[HFNPDU PERFORMANCE]
17:18:58 UTC Flight ID = IGO198 LAT 21 34 13 N LON 73 7 40 E

HACARS mode: 2 Aircraft reg: .A6-ERD
Message label: H1 Block id: 8 Msg. no: F41A Flight id: EK0720
Message content:-
#M1BPOSN18595E052012,DUDRI,171653,330,TOKRA,175011,MUSAP,M35,09422,386/TS171653,08151385EE

----------[15/08/2013 17:19]
[HFNPDU ACARS FM AIR UAE720 TO GND]
<SOH>2.A6-
ERD<NAK>H18<STX>F41AEK0720#M1BPOSN18595E052012,DUDRI,171653,330,TOKRA,175011,MUSAP,M35,09422,
386/TS171653,08151385EE<ETX><SUB>W<NUL>

HACARS mode: 2 Aircraft reg: .VT-IGX
Message label: RA Block id: J [Uplink]
Message content:-
QUDELOZ6E~1WX UPLINK~ - WX RESPONSE VIDP 151700Z 13005KT 2100 BR SCT030 BKN100 26/25 Q1004 NOSIG=
_ END
----------[15/08/2013 17:19]
[HFNPDU ACARS FM GND TO AIR 6E0106]
<SOH>2.VT-IGX<NAK>RAJ<STX>QUDELOZ6E~1WX UPLINK~
- WX RESPONSE
VIDP 151700Z 13005KT 2100 BR SCT030 BKN100 26/25 Q1004 NOSIG=
<FF><SI>
END
<ETX><DEL>
<NUL>

HACARS mode: 2 Aircraft reg: .SU-GCH
Message label: SA Block id: 5 Msg. no: S56A Flight id: MS0678
Message content:-
0EH171920SH
----------[15/08/2013 17:19]
[HFNPDU ACARS FM AIR MS0678 TO GND]
<SOH>2.SU-GCH<NAK>SA5<STX>S56AMS06780EH171920SH<ETX>Ou<NUL>

[HFNPDU PERFORMANCE]
17:19:34 UTC Flight ID = VPCCH   LAT 15 4 27 N LON 42 38 21 E

[HFNPDU FREQUENCY DATA]
17:19:36 UTC Flight ID = QR0625 LAT 17 9 3 N LON 74 22 5 E

[HFNPDU PERFORMANCE]
17:19:42 UTC Flight ID = SIA305 LAT 45 7 53 N LON 48 26 51 E

[HFNPDU PERFORMANCE]
17:19:46 UTC Flight ID = UAE5   LAT 45 56 28 N LON 24 29 27 E

Sources / further information:

- ARINC www.arinc.com
- Worldwide Utility News club (WUN) archive
- Utility DXers Forum (UDXF) www.udxf.nl
- Wikipedia
- PC-ALE manual
- AMCP/5-DP/1 Manual on the implementation of HFDL
  http://legacy.icao.int/anb/panels/acp/meetings/amcp5/item-1e.pdf