

Update on New HRIT DCS File Format

Presented by
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New HRIT DCS File Format - Background

- Original LRIT/HRIT File Format specified in 2003-2005.
- New format proposed in September 2017.
- New format accepted and approved in March 2018.
- Implementation began in September 2018, with testing performed in October and November.
- Dual streams became active on December 10TH:
 - Legacy format files on Virtual Channel 31.
 - New format files on Virtual Channel 32.
- New HRIT DCS file format:
 - Reduced message header size (41 versus 70 bytes)
 - Improved DCS message quality statistics.
 - Format specification document and sample files posted on DADDS website.

New and Legacy File Format Comparison

<i>Field Name</i>	<i>Bytes</i>	<i>Format</i>
Block Identifier	1	Integer Unsigned
Block Length Message	2	Integer Unsigned
Sequence Number	3	Integer Unsigned
Message Flags/Baud	1	Bit Mapped
Message ARM Flags	1	Bit Mapped
Corrected Address	4	Hexadecimal
Carrier Start	7	BCD
Message End	7	BCD
Signal Strength X10	2	Integer Unsigned
Frequency Offset X10	2	Integer Signed
Phase Noise X100	2	Integer Unsigned/Bit Mapped
Good Phase X2	1	Integer Unsigned
Channel/Spacecraft	2	Integer Unsigned/Bit Mapped
Source Code	2	ASCII Characters
Source Secondary	2	TBD
Message Data	Var	ASCII or Pseudo-Binary
Block CRC	2	Binary

<i>Field Name</i>	<i>Bytes</i>	<i>Format</i>
Delimiter	2	0x02 0x02
Message Flags	1	Bit Mapped
Message ID Code	1	ASCII
Corrected Address	8	ASCII Hex
Start (Frame) Time	11	ASCII Decimal (Second Rounded)
Msg ARM Code	1	ASCII Char (G,?,M,T,W, etc.)
Signal Strength	2	ASCII Decimal
Frequency Offset	2	ASCII Special
Modulation Index	1	ASCII Character (N,H,L)
Data Quality	1	ASCII Character (N,F,P)
Channel	3	ASCII Decimal
Spacecraft	1	ASCII Character (E,W)
Source Code	2	ASCII Characters
Message Length	5	ASCII Decimal
Message Data	Var	ASCII or Pseudo-Binary
Carrier Start	14	ASCII Decimal
Delimiter	1	ASCII Space (0x20)
Message End	14	ASCII Decimal

- New: 41 bytes of overhead Old: 70 bytes of overhead
- Uses binary fields as much as possible.
- Block identifier and length will allow for backward compatible future variations and/or new features (e.g. system messages).



Changes Made after New Stream was Active

- Once the New File Format Files were being sent in the HRIT transmission, Microcom began updating its DigiRIT LRIT/HRIT receiver to address them.
- In late December 2018, Microcom realized that two pieces of information were overlooked in the original specification.
 - No EOT received at end of DCS message.
 - Phase Modulation Index (Normal, High or Low)
- Microcom notified NOAA of the oversight in January 2019.
 - Microcom was authorized to update the specification and update the HRIT DADDS dissemination process.
 - Work was completed in early February.
- Information was added to existing fields so as to not impact overall header size.
 - No EOT flag added to Message Flags/Baud field.
 - Modulation Index flag bits incorporated with Phase Noise field.
- Revision 1 of specification, along with sample files, posted on DADDS websites in mid-February.

New Format Highlights

- 3-byte sequence number to identify message gaps.
- Abnormal Received Message (ARM) flag byte to identify message problems without having to send inefficient and multiple informational messages.
- Millisecond resolution Carrier Start and Message End Date/Time stamps.
- Improved Message Quality Statistics:
 - Signal Strength to 0.1 dB.
 - Frequency Offset from channel center to 0.1 Hz.
 - Phase Noise in degrees RMS to 0.01°.
 - Good Phase Percentage rounded to 0.5 %.
- DRGS Source Code and future Secondary Source.
- Special Missed Message Block for efficiency.
 - Eliminates header fields (e.g. message quality stats) that are not applicable to a missed DCS message.

Legacy File Format – Pictorial View

DAMS-NT Client r1-60 [Client Test] - [[DigiRIT DCP] [192.168.54.101][4001] Connected]

File Client Window Help

DCP Data (ALL) | DigiRIT Status/DCP Summary

ACTIVE 52,299 << Row 1 of 2500 >>

Slot	Mode	Chan	Baud	PlatformID	Carrier Time	End Time	Msg Dur	Len	Ingest Time	Latency	GDP	PHN	SS	FD	MI	DQ	FLG	ARM
31	---	113E	300	15DDC52C	19/079 17:50:50.509	19/079 17:50:58.446	7.937	270	19/079 17:51:12.070	13.624	---	---	51	+0	N	N	00	---
31	---	37E	300	51809748	19/079 17:50:50.701	19/079 17:50:58.371	7.670	258	19/079 17:51:11.072	12.701	---	---	37	+0	N	N	00	---
31	---	112W	300	F001E38A	19/079 17:50:52.626	19/079 17:50:58.708	6.082	198	19/079 17:51:11.072	12.364	---	---	35	+0	N	N	00	---
31	---	88W	300	CE942122	19/079 17:50:56.294	19/079 17:50:58.694	2.400	62	19/079 17:51:11.072	12.378	---	---	44	+0	N	N	00	---
31	---	72W	300	3351527C	19/079 17:50:54.291	19/079 17:50:57.652	3.361	96	19/079 17:51:11.072	13.420	---	---	43	+0	N	N	00	---
31	---	206W	300	BCC15C4C	19/079 17:50:56.314	19/079 17:50:57.741	1.427	25	19/079 17:51:11.072	13.331	---	---	34	+0	H	N	00	---
31	---	150W	300	3369F052	19/079 17:50:54.311	19/079 17:50:57.610	3.299	96	19/079 17:51:11.072	13.462	---	---	42	+0	N	N	00	---
31	---	148W	300	3361A488	19/079 17:50:54.303	19/079 17:50:57.468	3.165	89	19/079 17:51:11.072	13.604	---	---	43	+0	N	N	00	---
31	---	133E	300	1669452C	19/079 17:50:56.594	19/079 17:50:57.723	1.129	14	19/079 17:51:11.072	13.349	---	---	48	+0	N	N	00	---
31	---	159E	300	33660644	19/079 17:50:54.279	19/079 17:50:57.620	3.341	95	19/079 17:51:11.072	13.452	---	---	38	+0	N	N	00	---
31	---	153E	300	17F222E6	19/079 17:50:51.275	19/079 17:50:57.603	6.328	207	19/079 17:51:11.072	13.469	---	---	41	+0	N	N	00	---

DCP MSG DATA DAPS/DDS DAMS-NT HEX-ASCII APPLY VIEW FULL MSG

20/03/19 17:45	303	327	1.5	7.9	18.52	27	3.75	770	0	13.6	842
20/03/19 17:30	220	319	2.9	5.2	18.04	32	3.75	771	0	13.6	825
20/03/19 17:15	86	357	0.0	7.2	18.10	33	3.75	771	0	13.6	801
20/03/19 17:00	140	338	1.3	9.4	17.30	35	3.75	771	0	13.6	765

Client Test [CPU Usage: 0%] MEMORY [Total: 22,085 KB] [Allocated: 20,181 KB] [Overhead: 1,903 KB] ALLOCATIONS [Total: 77,371] [Allocs/Sec: 1,197]

WINDOWS [CPU Usage: 0%] MEMORY [Commit Size: 32,288 KB] [Working Set: 37,212] UP TIME: 01:35:00 UP SINCE: 19/079 16:16:14 PC UTC: 19/079 17:51:15

- Minimal Message Quality Statistics:
 - Good Phase (GDP), Phase Noise (PHN), and ARM flags not present.
 - Signal Strength to integer dB.
 - Frequency Offset reported in DAPS compressed format with 50 Hz resolution (+/- X, X*50).

New File Format – Pictorial View

DAMS-NT Client r1-60 [Client Test] - [[DigiRIT DCP] [192.168.54.101][4001] Connected]

File Client Window Help

DCP Data (ALL) | DigiRIT Status/DCP Summary

ACTIVE 51,594 << Row 1312 of 2500 >>

Slot	Mode	Chan	Baud	PlatformID	Carrier Time	End Time	Msg Dur	Len	Ingest Time	Latency	GDP	PHN	SS	FD	MI	DQ	FLG	ARM
32	CS1	31E	300	CE392412	19/079 17:40:50.292	19/079 17:40:54.713	4.421	137	19/079 17:41:07.913	13.200	100.0	1.74	46.8	-1.9	N	N	30	---
32	CS1	67E	300	8030C406	19/079 17:40:50.378	19/079 17:40:54.627	4.249	130	19/079 17:41:07.913	13.286	97.0	3.80	36.5	13.9	N	N	30	N
32	CS1	175E	300	4542D4DE	19/079 17:40:45.396	19/079 17:40:54.552	9.156	315	19/079 17:41:07.913	13.361	100.0	1.94	44.0	5.2	N	N	30	---
32	CS2	144W	300	43438394	19/079 17:40:49.598	19/079 17:40:54.323	4.725	149	19/079 17:41:07.913	13.590	100.0	1.38	45.0	-0.8	N	N	30	N.T
32	CS1	164W	300	DD6792D4	19/079 17:40:50.304	19/079 17:40:54.115	3.811	114	19/079 17:41:07.913	13.798	100.0	1.78	46.5	-0.8	N	N	30	---
32	CS2	29E	300	170D008C	19/079 17:40:50.285	19/079 17:40:54.316	4.031	120	19/079 17:41:07.913	13.597	100.0	2.15	39.8	-2.1	N	N	30	N
32	CS2	73E	300	CE163018	19/079 17:40:51.934	19/079 17:40:54.300	2.366	58	19/079 17:41:07.788	13.488	97.0	3.58	38.4	1.0	N	N	30	---
32	CS2	157E	300	17E191F8	19/079 17:40:50.282	19/079 17:40:54.129	3.847	113	19/079 17:41:07.788	13.659	99.5	2.84	36.8	0.6	N	N	30	---
32	CS2	148W	300	3363341E	19/079 17:40:50.280	19/079 17:40:53.849	3.569	102	19/079 17:41:07.788	13.939	100.0	1.86	40.0	-0.8	N	N	30	---
32	CS1	147E	300	335DD5F4	19/079 17:40:50.274	19/079 17:40:53.967	3.693	109	19/079 17:41:07.788	13.821	100.0	1.93	44.5	17.5	N	N	30	---
32	---	161E	300	CE4642CA	19/079 17:38:45.000	19/079 17:38:50.000	---	---	19/079 17:41:07.788	---	---	---	---	---	---	---	---	M

DCP MSG DATA DAPS/DDS DAMS-NT HEX-ASCII APPLY VIEW FULL MSG

PC 10 #15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 :PR 700 #1440 0.00 0.00 :WL 10 #15 1.92 1.86 1.93 1.89 1.91 1.90
1.94 1.90 :BL 13.21

Client Test [CPU Usage: 0%] MEMORY [Total: 20,774 KB] [Allocated: 18,820 KB] [Overhead: 1,954 KB] ALLOCATIONS [Total: 61,876] [Allocs/Sec: 968]
WINDOWS [CPU Usage: 0%] MEMORY [Commit Size: 30,547 KB] [Working Set: 35,635] UP TIME: 01:27:26 UP SINCE: 19/079 16:16:14 PC UTC: 19/079 17:43:40

- Improved Message Quality Statistics:
 - Good Phase (GDP) Percentage
 - (Good: 85-100%, Fair: 70-85%, Poor: 0-70%)
 - Signal Strength to 0.1 dB.
 - Frequency Offset to 0.1 Hz
- ARM Codes and Missing Messages

Transition Comments

- Both legacy and new file format currently active on both GOES-East and GOES-West.
- LRIT on GOES-15 was terminated in February.
- Both streams will be transmitted until May 20, 2019.
 - Allow time for manufactures to make and test updates
 - Allow time for users to deploy updates.
- File type detection:
 - On segregated virtual channels during dual streams.
 - Legacy files have filename of pM-YYDDDHHMMSS-Q.dcs
 - YYDDDHHMMSS is the file date/time in UTC Julian format.
 - Q is an ASCII letter (A to Z) used in the event two files are generated at the same time.
 - New files have filename of pH-YYDDDHHMMSS-Q.dcs
 - H designates the new HRIT file format.
 - Both will use current HRIT Header DCS file type of 130 (0x82).
 - Internal Type field in legacy (DCSD) and new file formats (DCSH).



Transition Termination – May 20, 2019

- Only new file format will be transmitted on HRIT.
- NOAA proposing that the New File Format files will remain on Virtual Channel 32, unless the DCS user community has strong desire to make switch to Virtual Channel 31.

Discussion on desired DCS Virtual Channel to utilize after transition period is complete.



Summary of File/Protocol Changes

- At present only DCS HRIT file format has changed.
 - The header information for each message that is included before the actual DCP message data is the predominate change.
 - The DCP message data is included as received, including with the parity bit intact.
- Officially, the format of the other DCS message dissemination protocols has not changed; DAMS-NT, ~~DOMSAT~~, DDS (aka LRGS/OpenDCS).
- However, to allow DigiRIT users to ultimately ingest and process the better message statistics, Microcom, in conjunction with Cove Software, developed a proposed enhancement to the DAMS-NT protocol.
 - The proposed enhancement has been shared with NOAA and it was decided to present it to the user community here.
 - The proposed enhancement was carefully designed to ensure backward compatibility; i.e. DAMS-NT Clients that have not been updated will ignore the additional information.

Proposed DAMS-NT Protocol Changes

- The additional message quality statistics are appended in ASCII after the DCS Message data and Carrier Times field; essentially in, or before, the “Vendor-Specific Additional Data” section.
extendedstats ::= slvl SP phns SP gdph SP freq SP type [SP armf] CRLF
- Added new Missed Message Block with ...
 - Fixed Start Pattern of MM+CRLF
 - 51-byte header (including Start Pattern)
- Preserves the basic DAMS-NT DCS Message Protocol:
 - 55-byte header remains intact with minor, backward compatible extensions:
 - Still allows definable Start Pattern, but recommends it be SM+CRLF, and prohibits use of MM+CRLF in DCP Message Header.
 - Adds additional flag bit in Message/Error flags to indicate Extended Stats are present (similar to Carrier Times flag).
 - Allows use of DCP Message Interface only.
 - Event, Real-Time Status and Configuration Interfaces are optional.
 - Requirement of Real-Time Status and Configuration Interfaces was eliminated for EDDN, and these are rarely, if ever, used.



Adoption of Proposed DAMS-NT ICD Changes

- While Microcom has proposed the DAMS-NT ICD changes, and asked Cove Software to review the recommendations, it is up to NOAA and the DCS community to formally approve and adopt the changes, and/or suggest modifications.
- Microcom has already implemented these proposed changes in its DigiRIT HRIT receiver, but at this time it should be considered Vendor-Specific Additional Data.
 - Inclusion of Extended Statistics can be enabled and disabled.
 - Inclusion of Missed Message Blocks can be enabled and disabled.
- During a meeting in early March, NOAA expressed interest in taking the lead on the proposed changes.
 - Microcom provided draft of proposed specification changes.
 - Microcom asked to summarize changes at TWG.
 - Draft of proposed changes distributed via email.



Proposed DAMS-NT Changes – Next Steps

- NOAA, DCS Users, and DCS Manufacturers to collectively determine path forward.
- If adopted, should DAMS-NT Servers be updated at WCDA, NSOF, EDDN, etc. to allow improved message statistics to become part of the DDS protocol for LRGS/OpenDCS?

Discussion on proposed DAMS-NT Changes.