Update on New HRIT DCS File Format

Presented by

Microcom Design, Inc.

April 2019

μcom

MICROCOM ENVIRONMENTAL

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

Field Name	*Bytes*	*Format*
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

Field Name	*Bytes*	*Format*
Delimiter	2	0x02 0x02
Message Flags	1	Bit Mapped
Message ID Code	1	ASCII
Corrected Address	8	ACSII 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).

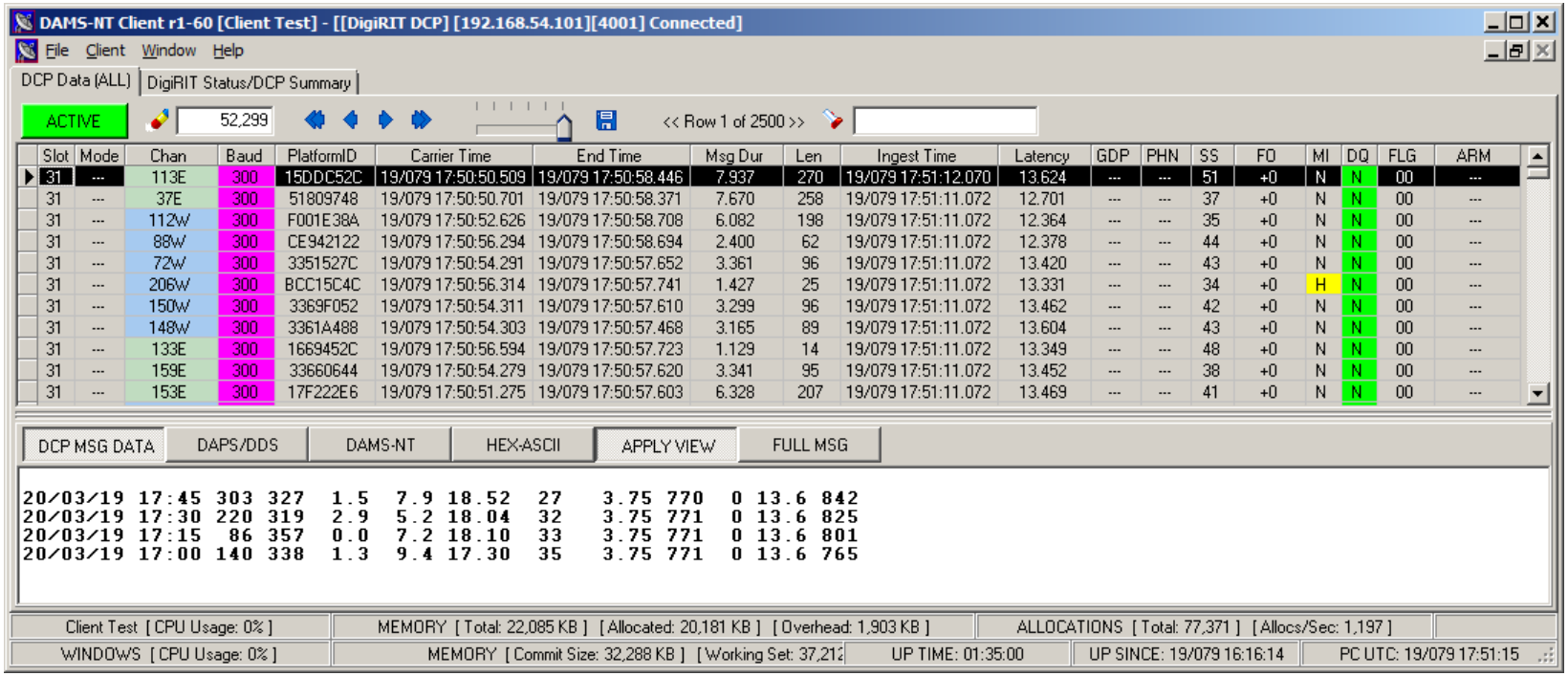
Changes Made after New Stream was Active

- 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 Nosie field.
- Revision 1 of specification, along with sample files, posted on DADDS websites in mid-February.

New Format Highlights

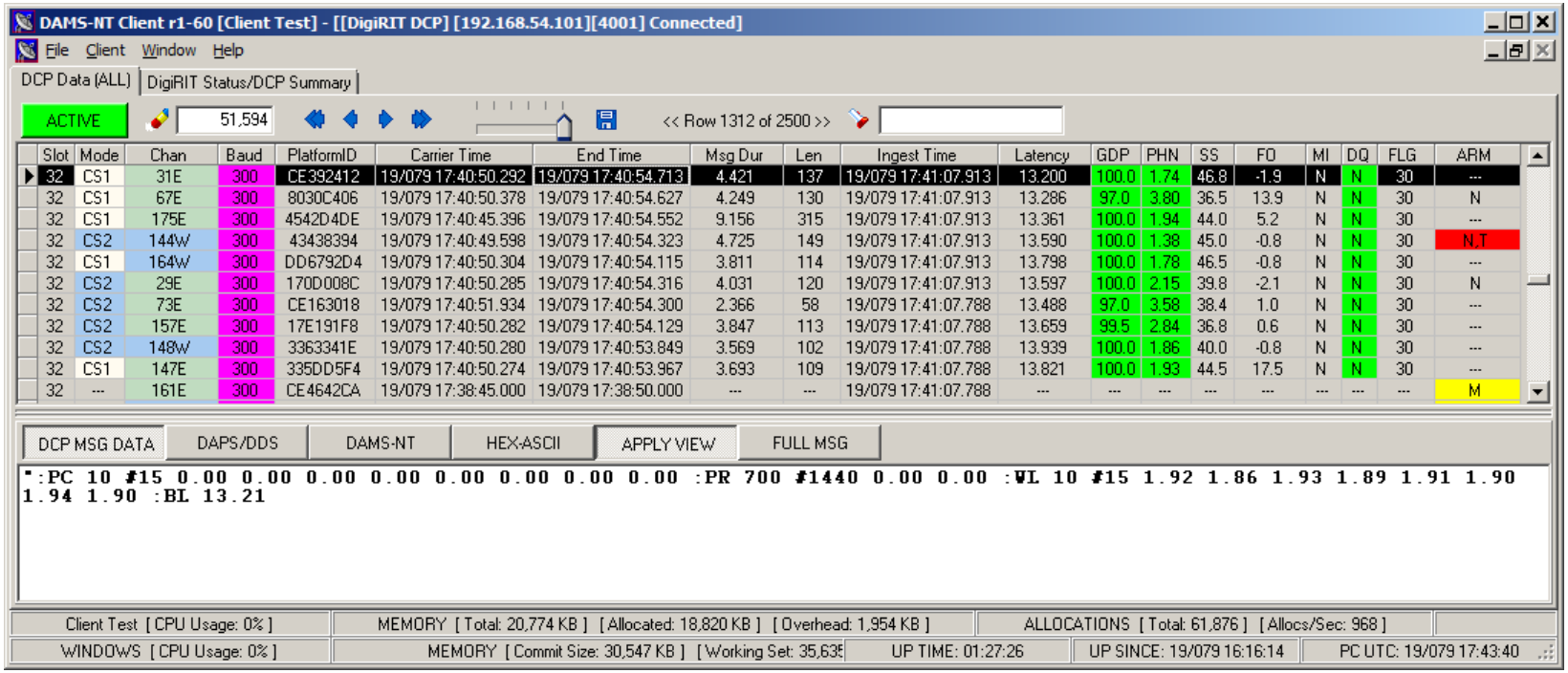
- 3-byte sequence number to identify message gaps.
- Abnormal Received Message (ARM) flag byte to identify message problems without having to send inefficient and multiple informational messages.
- Millisecond resolution Carrier Start and Message End Date/Time stamps.
- Improved Message Quality Statistics:
  - 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



- 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



- 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 compatibly; 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.