NRC-CNRC

SVLBI Space Radio Telescope
Log Input to
the Canadian (S2) Correlator

DRAO-RPCS3000 Rev. 1.4

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Introduction

The purpose of this document is to define extensions to the file formats described in the document: "Alternative Log Input to the VLBA Correlator for Space VLBI Observations[1]" to support S2 operations at Space VLBI command and tracking stations and the Canadian (S2) Correlator. These extensions are necessary so that work may proceed on record-site log generation software, ISAS log generation/integration software and on correlator-site software.

Background

The Romney document ("Alternative Log Input to the VLBA Correlator for Space VLBI Observations") provides an extensive pre-amble describing various elements of Space VLBI mission operations that will not be duplicated here. This memo will assume that the reader fully understands the Romney document pre-amble and will therefore only define the syntax and semantics of the log file to support the S2. Also, it can generally be stated that there will be no change to the general syntax of the "SNAP-like" file format -- only small S2-specific syntax and semantic changes are required in order to support S2 operations. All entries into the log files are assumed to be ASCII.

File Format

The general file format is described in the Romney document. All entries (except where noted) are repeated here for completeness -- some of them may be direct copies from the Romney document (also noted where applicable). Note that (normally) the logs originating from the command station will be merged with the logs originating at the tracking stations by the Spacecraft Operations Group (SOG) into a single correlator input log file on an experiment (i.e. "OBSCODE") basis. This is what normally should be done for operational consistency although correlator log reading software will be more general.

Comments

Comments may appear anywhere in the Command Station or Tracking Station originating log entries. They are recognized by a double-quote character (") immediately following the time tag. The comment continues until the next newline ('\n') character.

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[1] July 1, 1996, Jonathan D. Romney, National Radio Astronomy Observatory, Socorro, New Mexico

Spacecraft Operations Group (SOG) Originating Log Entries

yydddhhmmssxx/BBC<code>/`<frequency>,<dummy>,<usb-bw>,<lsb-bw>,<polarization>`

<code> BaseBand Converter ID code. For purposes of the S2 log specification, it is a single alphanumeric character and it must match the `<code>` parameter in the tracking station `CONNECT` entry.

Comment: Since the `CONNECT` entry is produced by the ground tracking stations, some convention for the **<code>** parameters must be established. It is suggested that the channel ID given in the SRT schedule be used. This is syntactically equal to the same entry in the Romney document.

<frequency> Total ("signed sum") local oscillator frequency, in MHz, of all frequency conversions between RF and the final baseband(s) delivered by this converter.

<dummy> Unused positional parameter.

<usb-bw> Filter bandwidth, in MHz, applied to the USB channel delivered by this converter.

<lsb-bw> Filter bandwidth, in MHz, applied to the LSB channel delivered by this converter.

<polarization> State of polarization of the RF signal processed through this channel, either **L** for left-circular or **R** for right-circular.

Comment: There must be one BBC entry for each active baseband converter.

Comment: Some of the information required for this entry is specified implicitly via the CNFIG configuration code in the SRT schedule.

yydddhhmmssxx/FORM/<mode>,<rate>

<mode> This specifies the record mode for S2's at U.S.-NRAO, U.S.-NASA or Japanese tracking stations. At U.S.-NRAO tracking stations, for VSOP, the only valid value is: **8n16-2**. At U.S.-NASA tracking stations, for VSOP, the only valid value is: **8d16-2**. At Japanese tracking stations, for VSOP, the only valid value is **16v8-2**.

<rate> Actual sampled data rate, in Msamples/sec. This may already be encoded in the **<mode>** but is included here for syntactic compatibility and completeness.

Comment: For VSOP modes at both U.S.-NRAO, U.S.-NASA, and Japanese tracking stations **<rate>** should be specified as 32. Note that when tracking station data is played back at S2 or VSOP correlators, the above record modes will be accompanied with playback modes that *differ* -- this is due to differences in the tracking station data form and correlator data input specifications. At the Canadian Correlator, for record modes of **8d16-2**, **8n16-2**, and **16v8-2** the corresponding playback mode is **32x4-2**. At the VSOP (Mitaka) correlator (or tape copier), for record modes **8d16-2**, **8n16-2**, and **16v8-2** the

corresponding playback mode is **16v8-2**. This is summarized in the following table:

Tracking Station Type	Tracking Station REC mode	Canadian Correlator PB mode	VSOP Correlator/ Tape Copier PB mode
U.S.-NASA	8d16-2	32x4-2	16v8-2
U.S.-NRAO	8n16-2	32x4-2	16v8-2
Japanese	16v8-2	32x4-2	16v8-2

S2 RECord and Corresponding PlayBack Modes

Comment: For optimum performance and reliability, barrel rolling should always be enabled for S2 recording.

yyddhhmmssxx/OBSCODE/<code>

<code> The "observation code" assigned to the observations which follow. The code must consist of exactly *five* alphanumeric characters. For VSOP, the first character must be the letter **V**.

Comment: It is expected that the SOG will assign observation codes to facilitate proposal handling, reviewing, and scheduling. A given proposal may result in one or more, potentially many, "observations", each a contiguous time interval during which the spacecraft is dedicated to the goals of that proposal, and each having a unique OBSCODE. (Observation: the Canadian S2 correlator will create "jobs" based on these codes -- mission elements with like OBSCODEs will be part of the same "job".) This is identical to the same entry in the Romney document.

yyddhhmmssxx/SOURCE/<name>

<name> Name of the source being observed. *The name string must be given exactly as it appears in the SRT Schedule* and should not exceed twelve characters. It may not contain any blanks (including leading or trailing blanks) or commas.

Comments: Only the name of the source is required. The SNAP command response also includes the source position (and epoch) used by the Field System, and these may be included within the format rules of this specification. The Canadian S2 correlator will get the source coordinates from a separate database. This is identical to the same entry in the Romney document.

Tracking Station Originating Log Entries

The tracking stations'[2] log entries are concentrated on the recording performed there. If required, they may include any of the entries listed in the preceeding "*Spacecraft Operations Group Originating Log Entries*" section. In order to establish the correct instrumental context, the `TSID` entry which indicates the beginning of a new tracking session must be followed by new `VSN`, `CONNECT`, and `HEAD` entries (in arbitrary order), before any `ST` entry occurs. `FLAG` conditions in effect when a `TSID` entry is encountered are cancelled, and must be re-issued if they apply in the new tracking session.

yydddhhmmssxx/CONNECT/<code>,<first-stream>

<code> Baseband Channel code specified in SOG originating BBC entry.

<first-stream> The first S2 data stream assigned to this channel. This can be a number ranging from 0 to 15 inclusive. When using 2 bits per sample, this shall be the "SIGN" or most significant bit of each 2 bit sample. For VSOP, the **<first-stream>** entry *for the first channel* should be set to 0.

Comments: There must be a CONNECT entry for each active channel. The correlator will assume that "VLBA style" bit encoding of SIGN and MAGnitude bits is used. The VLBA style encoding is defined in the following table:

SIGN bit (MSB)	**MAG** bit (LSB)	**Value**
1	1	most pos (+3)
1	0	(+1)
0	1	(-1)
0	0	most neg (-3)

VLBA Style 4 Level Bit Encoding

yydddhhmmssxx/ET/

Comment: ET is issued when the tape motion stops. This is identical to the same entry in the Romney document.

yydddhhmmssxx/FLAG/<severity-code>,<condition-code>,<explanation>

<severity-code> Integer specifying the severity of the flagged condition. The flagged condition is taken to begin at the time of the log entry if the severity code is non-zero. A zero severity code indicates that a previously flagged condition ends at the time of the log entry.

<condition-code> Integer specifying the flagged condition.

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[2] A.K.A. "Telemetry Stations" in Romney's document.

<explanation> String, enclosed in double quotes ("...") explaining the flagged condition for human readers of the log.

Comment: A dictionary of Codes and Explanations will be maintained by the IMOG in a separate document. Separate sets of codes must be implemented for flags issued by the SOG and by the ground tracking stations. It is suggested that a block of codes be allocated for S2-specific conditions. One possibility (Novikov) is that S2 codes start at 400.

yydddhhmmssxx/HEAD/<mode>,<group>,<dummy>

<mode> The S2 recording "mode". This must be the same as the **<mode>** in the FORM entry of the SOG originating log (e.g. **8d16-2**). The correlator must derive the required playback mode.

<group> The S2 group. Acceptable values are **0** through **7**. This is the transport group that the tapes were plugged into at record time. For full-bandwidth recording as with VSOP (128 Mbps) this is always **0**.

<dummy> This is not required for the S2 and can be ommitted or can be anything.

Comment: Even though "HEAD" is a bit of a misnomer for the S2, it is somewhat related to an S2 transport.

yydddhhmmssxx/ST/<direction>,<speed>

<direction> Direction of tape motion. For the S2 this must always be **FOR**[3].

<speed> This is the VHS tape speed and can be one of **LP** or **SLP**. **LP** gives the highest recording quality and **SLP** provides up to 50% longer recording times (up to 8.5 hours of continuous recording at 128 Mbps -- although normally for VSOP 6 hour and 2 minute recording will be used). This information is not required by the correlator (but may be given to the user of the data).

Comment: ST must be issued when tape motion starts. This is ALWAYS for a record operation. In order to minimize loss of source data, tape motion should start 2 to 2.5 minutes before the S2 is expected to record valid satellite data.

yydddhhmmssxx/TAPE/<dummy>,<position>

<dummy> Unused positional parameter, any alphanumeric (non-whitespace) string is acceptable.

<position> The tape position in seconds of record time since the beginning of tape (BOT). This is the approximate tape position when this command is issued. The correlator will use the **ST** and **TAPE** timestamps ("time tags") to determine a

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[3]For highest efficiency, once "fresh" tapes are plugged into an S2-RT, recording continues (with zero or more stops) until the tape is no longer required (or EOT is reached) at which point they are ejected. i.e. partially used tapes *should* never be plugged into the S2 at record time because a potentially lengthy *re-position* will have to be done in order to determine what the current position is.

"playback start time". If, for some reason, the tape position is unknown, then this is set to **-1000**.

Comment: TAPE must be issued before each ST. For the S2, it is not necessary to issue a TAPE after an ET (although this must be accepted by the correlator). Also, tape positions other than 0 are undefined on fresh, blank tapes so the only valid position for the first recording on a fresh tape set is 0.

yydddhhmmssxx/TSID/<station>,<spacecraft>

<station> Identification code of the tracking station originating subsequent entries, as used in the SRT Schedule.

<spacecraft> Identification code of the Space VLBI spacecraft whose data are being recorded, as used in the SRT Schedule.

Comment: TSID ***must be the first entry at the beginning of each new tracking session included in the log file***. This is identical to the same entry in the Romney document.

yydddhhmmssxx/VSN/<tape-id>,<recorder>

<tape-id> The tape id[4]. This must be the same tape id that is encoded in the S2 "Tape id" field on the recorded tapes. Maximum 20 characters. The tape id is not enclosed in double quotes.

<recorder> The number of the tape recorder unit at the tracking station on which the tape is mounted. This is simply the S2-RT serial number.

Comment: The **<tape-id>** must be issued whenever recording begins on a new set of tapes that are to be sent to the correlator. It is strongly suggested (for compatibility with the Canadian S2 correlator and general international S2 VLBI compatibility) that the **<tape-id>** follow the format defined in the referenced document (DRAO-RPCS3001).

References

Romney, J. D., "*Alternative Log Input to the VLBA Correlator for Space VLBI Observations*", July 1, 1996.

Carlson, B. R., "*S2 VLBI 'Tape ID' and 'User Info Field' Format Requirements for Canadian (S2) Correlator Operational Compatibility*", DRAO-RPCS3001 Rev. 1.1, July 30, 1996.

[4]Refer to document DRAO-RPCS3001.