SRN NDA Routine Jupiter EDR CDF Dataset Specification v1.7

Authors

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Citation

Version History

Date	Version	Change record	Authors
2016-06-17	0.1	First Release	B. Cecconi
2016-07-01	0.2	Edit from L. Lamy	L. Lamy
2016-07-05	0.3	VESPA keywords instrument description Instrument description update	B. Cecconi
2016-07-21	0.4	Added time offset variables Introduction update Instrument and Observatory update Calibration description update	B. Cecconi
2016-09-28	0.5	Removed Calibration Sweep Time from header	B. Cecconi
2016-10-04	1.0	Final version 1.0	B. Cecconi L. Lamy
2016-10-06	1.1	RR and LL variable unit fixed	B. Cecconi
2016-12-06	1.2	Fixed header decoding Fixed timestamps in data section Updated Skeleton to v1.2	B. Cecconi
2016-12-23	1.3	Fixed CDF_TIME_TT2000 unit Updated Skeleton to v1.3	B. Cecconi
2017-04-19	1.4	Fixed CDF production script with global attributes (fixed RF filters time changes and exposure time) and data variable names. Fixed typos in this document.	B. Cecconi

2019-04-02	1.5	Fixed typos Jupiter and Sun datasets definitions aligned Added authors	B. Cecconi A. Loh
2019-05-03	1.6	Added CML and Io-Phase global attributes	B . Cecconi A. Loh
2020-09-09	1.7	Added addition VESPA_* keywords with unit values Added spase_DatasetResourceID	B. Cecconi A. Loh
2021-01-08	1.7	Added Citation and DOI	B. Cecconi

Table of Contents

Introduction

The Nançay Decameter Array (NDA) at the Station de Radioastronomie de Nançay (SRN) is a phased array of 144 « Teepee » helicoidal antenna, composed of two sub-arrays of 72 antenna each, sensitive to Right Handed (RH) and Left Handed (LH) circular polarization, respectively [A,B,C]. The « Routine » digital receiver is connected to this array and is observing Jupiter in the decametric range (10 to 40 MHz) since September 1990, recording alternatively a spectrum on a single polarization, every 0.5 sec. For each spectral sweep, the LH array is sampled first, followed by the RH array. The receiver is sampling 401 spectral steps in 350 ms. The spectral step is thus 75 kHz and the temporal sampling step is about 0.87 ms. The internal clock of the receiver cannot provide a better timing accuracy than 10 μs. The spectral bandwidth for each measurement is 30 kHz (– 3 dB filter bandwidth).

This dataset provides EDR (experiment data record) uncalibrated data. The first 400 samples of each sweep are recorded (the 401st sample is lost). The number of spectral sweep is N in the following documentation. The Epoch variable contains the LH sweep start times. LH and RH spectral sweeps are provided in separate variables. In order to reconstruct the observation time of each spectral step for each polarization (with a 10 ms accuracy), two additional variables are provided:

- `Sweep_time_offset_ramp`: a series of 400 offset times (in seconds), to be added to the sweep start time in order to recover the actual time of measurement for each sample of a sweep;
- `RR_sweep_time_offset`: a series of N offset times (in seconds), to be added to each Epoch time in order to get the actual start time of each RH sweep.

The unit of LH and RH spectra are provided in dB. The sample values are proportional to the power in dB[V^2/Hz] measured at the input of the receiver. Value 256 corresponds to 80 dB[V^2/Hz]. It is straightforward to convert RH and LH spectra into dB[V^2/Hz] with a 0.3125 multiplying factor.

Calibration sweeps, regularly acquired every hour are also included in the data. They can be identified with the Status variable:

- Status value = 17 at time of mode switch, before calibration mode. This Status code appears also when switching between attenuation values during the calibration sequences.
- Status value = 0 at the end of the calibration sequence.

In practice, the calibration sweeps are executed as follows. The signal summed up over each bloc of 8 antennas is replaced by the signal of a reference noise diode with delivers a fixed power of 42 dB ENR (or -72 dBm/MHz). This signal is then attenuated by 30 dB, 20 dB, 10 dB and 0 dB and measured over 10 s long exposures for each attenuation factor. The 30 dB attenuation factor approximately corresponds to the mean sky level.

The data are distributed in CDF (Common Data Format). A CDF file is structured with a header section containing the global attributes, and a data section containing the variables and the associated variable attributes [1]. A series of links and documents introducing to CDF is available at NASA PDS/PPI node (Planetary Plasma Interactions node of NASA Planetary Data System) [2].

The selected CDF specifications are compliant with archive quality CDF as defined by ISTP (International Solar Terrestrial Program) [3] and PDS4 (NASA Planetary Data System version 4) [4]. They also contain the required metadata to be compliant with the EPNcore data model, used by the VESPA project for its data distribution protocol EPN-TAP [5].

Metadata description

The global attributes are organized in 4 sections: the ISTP section, the PDS section, the VESPA section and the NDA section. The following items provide the list of global attributes, by section, with their default values and definition.

ISTP section

TITLE

Definition	This attribute is an NSSDC standard global attribute, which is a title for the data set
Value	`SRN NDA Routine Jupiter EDR Dataset`

Project

Definition	This attribute identifies the name of the project and indicates ownership.

Value	`SRN>Station de Radioastronomie de Nancay`
	`OBSPM>Observatoire de Paris`
	`PADC>Paris Astronomical Data Centre`

Discipline

Definition	This attribute describes both the science discipline and subdiscipline. More than one entry is allowed.
Value	`Planetary Physics>Waves`

Data_type

Definition	This attribute identifies the data type of the CDF data set. Both a long name and a short name are given.
Value	`EDR>Experiment Data Record`

Descriptor

Definition	This attribute identifies the name of the instrument or sensor that collected the data
CDF Type	CDF_CHAR
Value	`routine_jup>Routine receiver with Jupiter pointing`

Data_version

Definition	This attribute identifies the version of a particular CDF data file. This is string containing a number (0 padded, on 2 digits), incremented every time the file is updated.
CDF Type	CDF_CHAR

Value   (Updated by script)

Instrument_type
Definition   This attribute is used to facilitate making choices of instrument type through CDAWeb. More than one entry is allowed.
CDF Type   CDF_CHAR
Value   `Radio Telescope`

Logical_file_id
Definition   This attribute stores the name of the CDF file using the naming convention.
CDF Type   CDF_CHAR
Value   (Updated by script)

Logical_source
Definition   This attribute carries source_name, data_type, and descriptor information.
CDF Type   CDF_CHAR
Value   `srn_nda_routine_jup_edr`

Logical_source_description
Definition   This attribute writes out the full words associated with the encrypted Logical_source .
CDF Type   CDF_CHAR
Value   `Jupiter Observations from the Routine receiver of the Nancay Decameter Array at Station de Radioastronomie de Nancay`

File_naming_convention
Definition   This attributes give the file naming convention.
CDF Type   CDF_CHAR
Value   `source_descriptor_type_yyyymmddhhmm_yyyymmddhhmm_ver`

Mission_group
Definition   This attribute has a single value and is used to facilitate making choices of source.
CDF Type   CDF_CHAR
Value   `SRN>Station de Radioastronomie de Nancay`

PI_name
Definition   This attribute value should include first initial and last name.
CDF Type   CDF_CHAR
Value   `L. Lamy`

PI_affiliation
Definition   This attribute value should include a recognizable abbreviation.

CDF Type	CDF_CHAR
Value	LESIA>LESIA, Observatoire de Paris, PSL Research University, CNRS, Sorbonne Universites, Universite de Paris, 92195 Meudon, France
	SRN>Station de Radioastronomie de Nancay, Observatoire de Paris, PSL Research University, CNRS, Universite d'Orleans,18330 Nancay, France

Source_name

Definition	This attribute identifies the mission or investigation that contains the sensors.
CDF Type	CDF_CHAR
Value	SRN_NDA>Nancay Decameter Array

TEXT

Definition	This attribute is an NSSDC standard global attribute, which is a text description of the experiment whose data is included in the CDF. A reference to a journal article(s) or to a World Wide Web page describing the experiment is essential, and constitutes the minimum requirement. A written description of the data set is also desirable. This attribute can have as many entries as necessary to contain the desired information.
CDF Type	CDF_CHAR
Value	The Nancay Decameter Array (NDA) at the Station de Radioastronomie de Nançay (SRN) is a phased array of 144 « Teepee » helicoidal antenna, composed of two sub-arrays of 72 antenna each, sensitive to Right Handed (RH) and Left Handed (LH) circular polarization, respectively. The « Routine » digital receiver is connected to this array and is observing Jupiter in the decametric range (10 to 40 MHz) since September 1990, recording alternatively a spectrum on a single polarization, every 0.5 sec. (more details at: http://www.obs-nancay.fr/reseau-decametrique/)

Generated_by

Definition	This attribute allows for the generating data center/group to be identified.
CDF Type	CDF_CHAR
Value	LESIA>Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique SRN>Station de Radioastronomie de Nancay

Generation_date

Definition	Date stamps the creation of the file using the syntax yyyymmdd

CDF Type	CDF_CHAR
Value	(Updated by script)

LINK_TEXT

Definition	This attribute stores text describing on-line data available at PI or CoI web sites.
CDF Type	CDF_CHAR
Value	`The NDA Routine Jupiter data are available at`

LINK_TITLE

Definition	This attribute stores the title of the web site holding on-line data available at PI or CoI web sites.
CDF Type	CDF_CHAR
Value	`Station de Radioastronomie de Nancay`

HTTP_LINK

Definition	This attribute stores the URL for the PI or CoI web site holding on-line data.
CDF Type	CDF_CHAR
Value	`http://www.obs-nancay.fr`

MODS

Definition	This attribute is an NSSDC standard global attribute which is used to denote the history of modifications made to the CDF data set.
CDF Type	CDF_CHAR
Value	(Updated by script)

Parents

Definition	This attribute lists the parent CDF(S) for files of derived and merged data sets.
CDF Type	CDF_CHAR
Value	(Updated by script)
Note	This is the name of the corresponding raw RT1 file.

Rules_of_use

Definition	Text containing information on, e.g. citability and PI access restrictions. This may point to a World Wide Web page specifying the rules of use.
CDF Type	CDF_CHAR
Value	SRN/NDA observations in open access can be freely used for scientific purposes. Their acquisition, processing and distribution is ensured by the SRN/NDA team, which can be contacted for any questions and/or collaborative purposes. Contact email: contact.nda@obs-nancay.fr

We kindly request the authors of any communications and publications using these data to let us know about them, include minimal citation to the reference below and appropriate acknowledgements whenever needed.

References:
A. Lecacheux, The Nançay Decameter Array: A Useful Step Towards Giant, New Generation Radio Telescopes for Long Wavelength Radio Astronomy, in Radio Astronomy at Long Wavelengths, eds. R. G. Stone, K. W. Weiler, M. L. Goldstein, & J.-L. Bougeret, AGU Geophys. Monogr. Ser., 119, 321, 2000.

Acknowledgements: see the acknowledgement field.

Skeleton_version

Definition	This attribute contains the version number of this dataset description file.
CDF Type	CDF_CHAR
Value	(Updated by script)

Software_version

Definition	This attribute contains the software version number.
CDF Type	CDF_CHAR
Value	(Updated by script)

Software_language

Definition	This is a text attribute containing the software language used for the processing.
CDF Type	CDF_CHAR
Value	`python3`

Time_resolution

Definition	Specifies time resolution of the file
CDF Type	CDF_CHAR
Value	`1 second`

Acknowledgement

Definition	Text string at PI disposal allowing for information on expected acknowledgment if data is citable.
CDF Type	CDF_CHAR
Value	The authors acknowledge the Station de Radioastronomie de Nançay of the Observatoire de Paris (USR 704-CNRS, supported by Universite d'Orleans, OSUC, and Region Centre in France) for

providing access to NDA observations accessible online at
http://www.obs-nancay.fr

Spase_DatasetResourceID

Definition	SPASE Dataset resource ID
CDF Type	CDF_CHAR
Value	`spase://GBO/NumericalData/SRN/NDA/RoutineJupiter/PT1S`

Validate

Definition	Details to be specified. This attribute is written by software for automatic validation of features such as the structure of the CDF file on a simple pass/fail criterion.
CDF Type	CDF_CHAR
Note	(Updated by script)

PDS section

PDS_Observation_start_time

Definition	Observation Start Time in ISO format
CDF Type	CDF_CHAR
Value	(Updated by script)

PDS_Observation_stop_time

Definition	Observation Stop Time in ISO format
CDF Type	CDF_CHAR
Value	(Updated by script)

PDS_Observation_target

Definition	Observation Target Name
CDF Type	CDF_CHAR
Value	`Jupiter`

PDS_Observation_type

Definition	Observation Type
CDF Type	CDF_CHAR
Value	`Radio`

VESPA section

VESPA_dataproduct_type

Definition	Organization of the data product, from enumerated list
CDF Type	CDF_CHAR
Value	`DS>Dynamic Spectrum`

VESPA_target_class

Definition	Type of target, from enumerated list

CDF Type   CDF_CHAR
Value   `planet`

VESPA_target_region

Definition Type of region of interest (possible from UAT:
            http://astrothesaurus.org)
CDF Type   CDF_CHAR
Value   `Aurora`
            `Magnetosphere`

VESPA_feature_name

Definition Secondary name (can be standard name of region of interest)
CDF Type   CDF_CHAR
Value   `Decametric radio emissions (DAM)`

VESPA_instrument_host_name

Definition Observatory or Space Mission name
CDF Type   CDF_CHAR
Value   `SRN>Station de Radioastronomie de Nancay`

VESPA_instrument_name

Definition Instrument or Telescope Name
CDF Type   CDF_CHAR
Value   `NDA>Nancay Decameter Array`

VESPA_receiver_name

Definition Receiver or Channel name
CDF Type   CDF_CHAR
Value   `RoutineJup>Routine Jupiter`

VESPA_time_sampling_step

Definition Time sampling step
CDF Type   CDF_ CHAR
Value   `1.0`

VESPA_time_sampling_step_unit

Definition Unit of time sampling step
CDF Type   CDF_ CHAR
Value   `s`

VESPA_time_exp

Definition Sample integration time
CDF Type   CDF_ CHAR
Value   `0.875`

VESPA_time_exp_unit

Definition	Unit of sample integration time
CDF Type	CDF_ CHAR
Value	`ms`

VESPA_spectral_range_min

Definition	Min spectral range (frequency)
CDF Type	CDF_ CHAR
Value	`10`

VESPA_spectral_range_max

Definition	Max spectral range (frequency)
CDF Type	CDF_ CHAR
Value	`40`

VESPA_spectral_range_unit

Definition	Unit of spectral range
CDF Type	CDF_ CHAR
Value	`MHz`

VESPA_spectral_sampling_step

Definition	Spectral sampling step (frequency)
CDF Type	CDF_CHAR
Value	`75`

VESPA_spectral_sampling_step_unit

Definition	Unit of spectral sampling step (frequency)
CDF Type	CDF_CHAR
Value	`kHz`

VESPA_spectral_resolution

Definition	Spectral observation bandwidth (frequency)
CDF Type	CDF_CHAR
Value	`30`

VESPA_spectral_resolution_unit

Definition	Spectral observation bandwidth (frequency)
CDF Type	CDF_CHAR
Value	`kHz`

VESPA_measurement_type

Definition	A physical characterization of the data, using UCDs (Unified Content Descriptor) as defined by IVOA
CDF Type	CDF_CHAR
Value	`phys.flux.density;em.radio;phys.polarization`

VESPA_access_format

Defintion	File format type, using MIME Types.
CDF Type	CDF_CHAR
Value	`application/x-cdf`

VESPA_bib_reference

Defintion	Bibliographic reference for the dataset, preferably an ADS bibref or a DOI.
CDF Type	CDF_CHAR
Value	`2000GMS...119..321L`

VESPA_target_distance

Definition	Distance to target (in km)
CDF Type	CDF_CHAR
Value	(Updated by script)

VESPA_target_distance_unit

Definition	Unit of distance to target
CDF Type	CDF_CHAR
Value	`km`

VESPA_subobserver_longitude_min

Definition	Minimum CML
CDF Type	CDF_CHAR
Value	(Updated by script)

VESPA_subobserver_longitude_max

Definition	Maximum CML
CDF Type	CDF_CHAR
Value	(Updated by script)

VESPA_subobserver_longitude_unit

Definition	Unit of CML
CDF Type	CDF_CHAR
Value	`deg`

VESPA_subobserver_latitude_min

Definition	Minimum Jovian latitude
CDF Type	CDF_REAL4
Value	(Updated by script)

VESPA_subobserver_latitude_max

Definition	Maximum Jovian latitude
CDF Type	CDF_CHAR
Value	(Updated by script)

VESPA_subobserver_latitude_unit

Definition	Unit of Jovian latitude
CDF Type	CDF_CHAR
Value	`deg`

NDA section

NDA_geographic_longitude

Defintion	Longitude of SRN/NDA on Earth
CDF Type	CDF_CHAR
Unit	degrees
Value	47.380510

NDA_geographic_latitude

Defintion	Latitude of SRN/NDA on Earth
CDF Type	CDF_CHAR
Unit	degrees
Value	2.193226

NDA_geographic_altitude

Defintion	Altitude of the SRN on Earth
CDF Type	CDF_CHAR
Unit	meters
Value	135

NDA_rf_filter_selected

Defintion	Value of the selected RF filter
CDF Type	CDF_CHAR
Unit	N/A
Value	(Updated by script)

NDA_rf_filter_time_change

Defintion	Date of the change of RF filter
CDF Type	CDF_CHAR
Unit	ISO formatted time (UTC)
Value	(Updated by script)

NDA_power_resolution

Defintion	Power resolution (dB per division)
CDF Type	CDF_CHAR
Unit	dB/div
Value	(Updated by script)

NDA_meridian_time

Defintion	Date of Jupiter passing meridian

CDF Type	CDF_CHAR
Unit	ISO formatted time (UTC)
Value	(Updated by script)

NDA_reference_level

Defintion	Reference level (dBm)
CDF Type	CDF_CHAR
Unit	dBm
Value	(Updated by script)

NDA_sweep_duration

Defintion	Duration of spectral sweep
CDF Type	CDF_CHAR
Unit	s
Value	0.35

NDA_header_version

Defintion	Version of the header specification of RT1 file
CDF Type	CDF_CHAR
Unit	N/A
Value	(Updated by script)

NDA_CML_start

Defintion	Value of CML (Jupiter System III longitude of the observer) at the start of observation
CDF Type	CDF_CHAR
Unit	deg
Value	(Updated by script)

NDA_CML_end

Defintion	Value of CML (Jupiter System III longitude of the observer) at the end of observation
CDF Type	CDF_CHAR
Unit	deg
Value	(Updated by script)

NDA_Io_Phase_start

Defintion	Value of Io-Phase as seen from the observer at the start of observation
CDF Type	CDF_CHAR
Unit	deg
Value	(Updated by script)

NDA_Io_Phase_stop

Defintion	Value of Io-Phase as seen from the observer at the end of observation
CDF Type	CDF_CHAR
Unit	deg
Value	(Updated by script)

Data Description

There are seven data variables in each file. Each variable is described below.

Time axis

Name	Epoch
CDF Type	CDF_TIME_TT2000
Unit	nanoseconds after Jan. 1st 2000
Description	UTC time of each spectra.
Dimensions	N

Frequency axis

Name	Frequency
CDF Type	CDF_REAL4
Unit	MHz
Description	Central frequency of each step of the spectral sweep.
Dimensions	400

RH Spectrogram

Name	RR
CDF Type	CDF_UINT1
Unit	dB
Description	Spectrogram measured on the RH-polarized set of antennas.
Dimensions	N x 400

LH Spectrogram

Name	LL
CDF Type	CDF_UINT1
Unit	dB
Description	Spectrogram measured on the LH-polarized set of antennas.
Dimensions	N x 400

Status flag

Name	STATUS
CDF Type	CDF_BYTE

Unit   N/A

Description   Instrument mode value at end of RH and LH sweeps.

Dimensions   N x 2

Sweep Time Offset Ramp

Name   `SWEEP_TIME_OFFSET_RAMP`

CDF Type   CDF_REAL4

Unit   second

Description   Time Offset to be added to the sweep start time to recover the actual time of measurement of each sweep sample.

Dimensions   400

RH Sweep Time Offset

Name   `RR_SWEEP_TIME_OFFSET`

CDF Type   CDF_REAL4

Unit   second

Description   Time Offset to be added to the Epoch time to recover the actual start time of the RH sweep.

Dimensions   N

References

[A] A. Boischot et al., A new high-gain broadband steerable array to study jovian decametric emission, Icarus, 43, 399-407, 1980.

[B] A. Lecacheux, The Nançay Decameter Array: A Useful Step Towards Giant, New Generation Radio Telescopes for Long Wavelength Radio Astronomy, in Radio Astronomy at Long Wavelengths, eds. R. G. Stone, K. W. Weiler, M. L. Goldstein, & J.-L. Bougeret, AGU Geophys. Monogr. Ser., 119, 321, 2000.

[C] **L. Lamy**, P. Zarka, B. Cecconi, L. Klein, S. Masson, L. Denis and A. Coffre, 1977-2017 : 40 years of decametric observations of Jupiter and the Sun with the Nançay decameter array, *in Planetary Radio Emissions VIII,* edited by G. Fischer et al., Austrian Academy of Sciences press, Seggauberg, 2016. `arXiv:1709.03821`

[1] http://cdf.gsfc.nasa.gov
[2] http://ppi.pds.nasa.gov/doc/
[3] http://spdf.gsfc.nasa.gov/istp_guide/istp_guide.html
[4] http://ppi.pds.nasa.gov/doc/cdf/PDS4-Archiving-of-CDF-Files-v3.pdf
[5] https://voparis-confluence.obspm.fr/display/VES/EPNcore+v2

Appendix

RT1 file header versions

The raw data files (RT1 files) header specification changed six times since the start of operations on Sept. 18th, 1990. The header section of the RT1 files consists in a stream of 405 bytes. The header information is written in ASCII characters. In all versions, we find the following information: minimum and maximum observed frequencies, spectral resolution, temporal resolution and intensity scale description. Starting in version 2, the "meridian time" is specified. It is the time when Jupiter crosses the local meridian. Starting in version 5, the RF filter set up and changes are provided. In the last and current version, the meridian crossing date (in addition to the meridian time), the start of observation date and the end of observation time are specified. The specifications of each version are described below.

Header format version 1

- In use for RT1 files from 1990-09-18 to 1990-11-26
- Used header length: 16 bytes (out of 405 bytes)
- Header structure
    - Dummy   1 byte (= 0x15)
    - Frequency min.   (MHz)   2 ASCII characters
    - Frequency max.   (MHz)   2 ASCII characters
    - Freq. resolution   (kHz)   3 ASCII characters
    - Reference Level   (dBm)   3 ASCII characters
    - Sweep Time   (ms)   3 ASCII characters
    - Power Scale   (dB/div)   2 ASCII characters
- Example:

`⌀1040030-1035010⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀`

Header format version 2

- In use for RT1 files from 1990-11-27 to 1994-02-23
- Used header length: 20 bytes (out of 405 bytes)
- Header structure
    - Dummy   1 byte (= 0x15)
    - Frequency min   (MHz)   2 ASCII characters
    - Frequency max   (MHz)   2 ASCII characters
    - F_resolution   (kHz)   3 ASCII characters
    - Reference Level   (dBm)   3 ASCII characters
    - Sweep Time   (ms)   3 ASCII characters
    - Power Scale   (dB/div)   2 ASCII characters
    - Meridian Time   (hour)   2 ASCII characters
    - Meridian Time   (min)   2 ASCII characters
- Example:

`⌀1040030-10350100432⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀`

Header format version 3

- In use for RT1 files from 1994-02-24 to 1999-01-18
- Used header length: 22 bytes (out of 405 bytes)
- Header structure
  - Dummy   1 byte (0x15)
  - Frequency min   (MHz)   2 ASCII characters
  - Frequency max   (MHz)   2 ASCII characters
  - F_resolution   (kHz)   3 ASCII characters
  - Reference Level   (dBm)   3 ASCII characters
  - Dummy   2 bytes (0x20 0x20)
  - Sweep Time   (ms)   3 ASCII characters
  - Power Scale   (dB/div)   2 ASCII characters
  - Meridian Time   (hour)   2 ASCII characters
  - Meridian Time   (min)   2 ASCII characters
- Example:

`⌀0540030-20  350102254⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀`

Header format version 4

- In use for RT1 files from 1999-01-19 to 2000-10-31
- Used header length: 22 bytes (out of 405 bytes)
- Header structure
  - Dummy   1 byte (0x78)
  - Frequency min   (MHz)   2 ASCII characters
  - Frequency max   (MHz)   2 ASCII characters
  - F_resolution   (kHz)   3 ASCII characters
  - Reference Level   (dBm)   3 ASCII characters
  - Sweep Time   (ms)   5 ASCII characters
  - Power Scale   (dB/div)   2 ASCII characters
  - Meridian Time   (hour)   2 ASCII characters
  - Meridian Time   (min)   2 ASCII characters
- Example:

`x1040030-2000350101541⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀⌀`

Header format version 5

- In use for RT1 files from 2000-11-01 to 2009-09-20
- Used header length: 40 bytes (out of 405 bytes)
- Header structure
  - Dummy   1 byte (0x78)
  - Frequency min   (MHz)   2 ASCII characters
  - Frequency max   (MHz)   2 ASCII characters
  - F_resolution   (kHz)   3 ASCII characters
  - Reference Level   (dBm)   3 ASCII characters
  - Sweep Time   (ms)   5 ASCII characters
  - Power Scale   (dB/div)   2 ASCII characters

- o Meridian Time   (hour)   2 ASCII characters
- o Meridian Time   (min)   2 ASCII characters
- o 1st RF Filter   1 ASCII character
- o 1st RF Filter time (hh:mm)   5 ASCII characters
- o 2nd RF Filter   1 ASCII character
- o 2nd RF Filter time (hh:mm)   5 ASCII characters
- o 3rd RF Filter   1 ASCII character
- o 3rd RF Filter time (hh:mm)   5 ASCII characters

o	Meridian Time	(hour)	2 ASCII characters
o	Meridian Time	(min)	2 ASCII characters
o	1st RF Filter		1 ASCII character
o	1st RF Filter time	(hh:mm)	5 ASCII characters
o	2nd RF Filter		1 ASCII character
o	2nd RF Filter time	(hh:mm)	5 ASCII characters
o	3rd RF Filter		1 ASCII character
o	3rd RF Filter time	(hh:mm)	5 ASCII characters

- Example:

`x1040030-2000350100141221:41123:45204:45⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰⦰`

Header format version 6

- In use for RT1 files from 2009-09-22 to now
- Used header length: 64 bytes (out of 405 bytes)
- Header structure

o	Dummy		1 byte (0x78)
o	Frequency min	(MHz)	2 ASCII characters
o	Frequency max	(MHz)	2 ASCII characters
o	F_resolution	(kHz)	3 ASCII characters
o	Reference Level	(dBm)	3 ASCII characters
o	Sweep Time	(ms)	5 ASCII characters
o	Power Scale	(dB/div)	2 ASCII characters
o	Meridian Time	(hour)	2 ASCII characters
o	Meridian Time	(min)	2 ASCII characters
o	1st RF Filter		1 ASCII character
o	1st RF Filter time	(hh:mm)	5 ASCII characters
o	2nd RF Filter		1 ASCII character
o	2nd RF Filter time	(hh:mm)	5 ASCII characters
o	3rd RF Filter		1 ASCII character
o	3rd RF Filter time	(hh:mm)	5 ASCII characters
o	Dummy		1 byte (0x20)
o	Meridian date	(dd/mo/yr)	8 ASCII characters
o	Dummy		1 byte (0x20)
o	Obs. start date	(dd/mo/yr)	8 ASCII characters
o	Dummy		1 byte (0x20)
o	Obs. stop time	(hh:mm)	5 ASCII characters

- Example:

`x1040030-2000350102106217:06000:00000:00 22/09/09 22/09/09 01:06⦰⦰⦰⦰⦰`