

Department of the Interior
U.S. Geological Survey

**LANDSAT THEMATIC MAPPER
RAW COMPUTER COMPATIBLE
DATA FORMAT CONTROL BOOK**

Version 1

November 2003



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DATA FORMAT CONTROL BOOK**

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Executive Summary

This Data Format Control Book (DFCB) provides the U.S. Geological Survey (USGS) and the Landsat International Ground Stations (IGS) with a clear and concise reference document to assist in the generation, archival, validation, and exchange of Landsat Thematic Mapper (TM) Raw Computer Compatible (RCC) data.

This document is under the control of the Landsat Configuration Control Board (LCCB). Landsat Configuration Change Requests (LCCR) to this document, as well as supportive material justifying the proposed changes, should be submitted to the Mission Management Office (MMO), located at the USGS/EROS Data Center (EDC) near Sioux Falls, South Dakota.

Document History

Document Number	Document Version	Publication Date	Change Number	Keywords
L7-DFCB-06.1	Version 1	November 25, 2003	LCCR 174	Original

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Section 1 Raw Computer Compatible Data Format

The TM RCC data format is comprised of wideband data downlinked from either the Landsat 4 (L4) or Landsat 5 (L5) spacecraft and stored on tape media. This format supports either single or multiple L4/5 downlinks stacked on a single tape media. L4 ceased acquiring data in August 1993 due to failures of the onboard data transmitters. The L4 has since been decommissioned; however, this document provides formatting instructions for both L4 and L5 TM data.

1.1 Wideband Data

The L4/5 science payload data from the Thematic Mapper (TM) instrument is referred to as “wideband data.” Onboard the spacecraft, the image data, along with ancillary attitude and ephemeris data, are organized into a single data stream format. The serial data does not have to be byte-aligned. Data from the Multispectral Scanner (MSS) instrument (not currently in use) is also multiplexed onto a separate data stream format. These two formats are then multiplexed and transmitted to a ground receiving station using Unbalanced Quadrature Phase Shift Keying (UQPSK) modulation. The inphase (“I”) component contains the TM data at 85 MBPS, and the quadrature component (“Q”) contains the MSS data at 15 MBPS. Because the MSS is not operational, only the data from TM is present in the downlink (D/L), which degenerate into BPSK at 85 MBPS.

In early 2002, the USGS determined that in Scan Angle Monitor (SAM) mode, the L5 TM sensor’s scan mirror turn-around time had increased to the point in which the scan mirror could no longer maintain synchronization with the calibration shutter. In response to this problem, the USGS transitioned L5 to bumper mode in April 2002. While in bumper mode, the L5 TM sensor does not attempt to align successive scans during operations. Ground stations receiving bumper mode data shall not correct these misalignments either before or during the generation of TM RCC data. TM RCC data collected in bumper mode shall contain the original scan misalignments as collected from L5.

For the purposes of generating the L4/5 archive and exchange format, it is necessary to provide the data file(s) in a computer compatible byte format. When reconstructing the serial data stream to generate TM RCC data, the data must conform to the specifications of the Landsat D (Landsat 4/5) DFCB, Volume V, Payload (Reference Document 2).

1.2 Writing Raw CC Data to Tape Media

Single L4/5 Downlink

Each L4/5 D/L file is written using the UNIX tar command. The following example illustrates the UNIX commands to write a single contact to tape media:

```
tar -cvfK /dev/rmt/tpsxxxxnrnsv L5TB2003116140053EDC012I00.data
```

This example command will create a tar file for a single downlink and will not rewind the tape, so a second file can be appended to the tape media appropriately. See Section 2.1 for RCC file naming conventions.

Multiple L4/5 Downlinks

When recording multiple D/Ls to tape media, the single D/L process outlined previously shall be followed. After the first D/L is written to tape media, the second and any subsequent D/Ls shall be written to tape using the tar command sequence specified for a single D/L. For example, five separate D/Ls, when written to tape, will result in five separate tar files on the same tape media. Each D/L data file must be contained on a single tape; spanning data files across multiple tapes is not permitted. See Section 2.1 for RCC file naming conventions.

Section 2 File Naming Convention

2.1 Raw CC Data File Naming Convention

This section outlines the RCC data file naming convention. The RCC data file naming convention is as follows:

The RCC file name format is VNIMYYYYDOYHHMMSSGSICDIAVV.data

Parameter	Filename Positions	Description
Vehicle Series	V	"L" for Landsat
Vehicle Number	N	"4" for Landsat 4 and "5" for Landsat 5
Instrument	I	"T" for TM
Sensor Mode	M	"T" for SAM mode, "B" for Bumper Mode
Year	YYYY	The year the TM data were downlinked by the spacecraft
Day of Year	DOY	Julian day of year the TM data were downlinked by the spacecraft
Hour	HH	GMT hour of day the TM data were downlinked by the spacecraft
Minute	MM	Minute of hour the TM data were downlinked by the spacecraft
Second	SS	Second of the minute the TM data were downlinked by the spacecraft
Ground Station Identifier	GSI	Ground station identifier of the station the spacecraft downlinked the TM data to
Capture Device Identifier	CDI	"C" = Alpha or numeric character "D" = Alpha or numeric character "I" = Either an alpha or numeric character may be used for stations receiving single downlinks. Stations receiving dual downlinks shall ensure the "I" position is a unique numeric character (0-9).
AQPSK Channel	A	Channel identifier: "I" for TM RCC files
VV	Version	2-digit file version number (starting with 01). Any ground station not participating in versioning data will always use 00.
.data	.data	".data" = File extension for the raw wideband data in binary format. Required.

Table 2-1: Raw Computer Compatible Data File Naming Convention Parameters

2.2 RCC File Names Examples

The contents of the transmittal tape media containing a single downlink should resemble the following.

<u>RCC File Name</u>	<u>File size in bytes</u>
L5TB2003116140053EDC012I00.data	6165626880

The contents of the transmittal tape media containing three separate downlinks should resemble the following.

<u>RCC File Name</u>	<u>File size in bytes</u>
L5TT1990214123458EDC011I00.data	6249512960
L5TT1995116140053EDC012I00.data	3165626880
L5TB2003120142515EDC011I01.data	5918162944

Appendix A Abbreviations and Acronyms

AQPSK	Asynchronous Quadrature Phase Shift Keying
BPSK	Bi Phase Shift Keying
CDI	Capture Device Identifier
DFCB	Data Format Control Book
D/L	Downlink
EDC	EROS Data Center
EROS	Earth Resource Observing Systems
GMT	Greenwich Mean Time
GSI	Ground Station Identifier
I	I Channel
IC	International Cooperator
IGS	International Ground Station
ITSS	Information Technology and Scientific Services
L4	Landsat 4
L5	Landsat 5
LCCB	Landsat Configuration Control Board
LCCR	Landsat Configuration Change Request
MBPS	Megabits per second
MMO	Mission Management Office
MOU	Memorandum Of Understanding
MSS	Multispectral Scanner
Q	Q Channel
RCC	Raw Computer Compatible
TM	Thematic Mapper
USGS	U.S. Geological Survey
UQPSK	Unbalanced Quadrature Phase-Shift Keying
UNIX	Bell Laboratories trademark for operating system language and time-sharing

References

1. Memorandum of Understanding (MOU) Between the US Government and International Cooperators. Revision 2. August 2002.
2. SVS-10126. Landsat D Data Format Control Book. Volume V – Payload.
3. Landsat 7 Data Exchange Implementation Plan.
4. Landsat 7 Data Quality Validation Plan Between the U.S. Geological Survey and the International Ground Stations.