



*Deep Space Network*

# DSN Telecommunications Link Design Handbook

---

Prepared by:

Approved by:

Signature Provided                      07/03/2018  
Christine Chang                              Date

Signature Provided                      07/03/2018  
Timothy Pham                              Date  
DSN Communication System Chief Engineer

Released by:

Signature Provided                      07/03/2018  
DSN Document Release                      Date

DSN No. **810-005**  
Issue Date: July 03, 2018  
JPL D-19379

Jet Propulsion Laboratory  
California Institute of Technology

*Users must ensure that they are using the current version in DSN Telecommunications Link Design Handbook  
website: <http://deepspace.jpl.nasa.gov/dsndocs/810-005>*

**This page intentionally left blank**

## *Document Change Log*

<b>Rev.</b>	<b>Issue Date</b>	<b>Modules Affected</b>	<b>Change Summary</b>
Initial	3/1/70	All	New document.
A	10/1/70	All	Complete revision.
B	4/15/72	All	Complete revision.
C	—	All	Complete revision.
D	2/15/75	All	New modular format first appeared.
E	1/15/2001	All	Title changed from DSN Flight Project Interface Design Handbook; all modules renumbered and revised or reformatted. Volume 2 deleted as proposed capabilities are now led within the modules of this revision. Modules not related to telecommunications link design have been deleted from this document and will be incorporated in a new document, 810-007, DSMS Mission Interface Design Handbook.
Change 1	2/10/2003	105, 202, 205	Added monthly weather statistics for all frequency bands to module 105, Added discussion of one-way Doppler error and X-Up/SDown Solar Phase Scintillation errors to module 202. Provided characteristics of new DSMS command equipment in module 205.
Change 2	6/13/2003	207, 301	Added concatenated codes, QPSK/OQPSK, and improved turbo code information to module 207, Identified 11-m subnet as non-operational, expressed geodetic coordinates in WGS84 ellipsoid and added DSS 55 to module 301.
Change 3	8/18/2003	101, 305, 901	Documents new feedcone at DSS 63, L-band at all 70-m stations, and S-band low noise cone at DSS 43. Provided information on test support. Added information and corrected Glossary.
Change 4	2/10/2004	104, 301	Provided latest capability and performance information for all BWG stations. Corrected locations of DSS-26, 54, and 55. Provides final receive and transmit masks for DSS-55.
Change 5	3/31/2004	101A, 208, 214, 304	Corrects Figures 1 and 5 in module 101, Rev. A. Corrects Figures 3 and 17 in module 208. Adds module 214, Pseudo-noise and Regenreative Ranging, and module 304, Frequency and Timing.
Change 6	7/15/2004	210	Provides capabilities of Delta Differential One-way Ranging in the DSN.

***Document Change Log (Continued)***

<b>Rev.</b>	<b>Issue Date</b>	<b>Modules Affected</b>	<b>Change Summary</b>
Change 7	10/7/2004	206, 302, 901A	Adds overview of telemetry and antenna positioning capability. Revises Glossary to accommodate new and revised modules.
Change 8	5/9/05	212	Provides capabilities of telemetry equipment installed in the DSN 26-m subnet stations.
Change 9	8/10/05	104, 106	Provides revised X-band and new Ka-band capability for DSS-34. Adds module 106, Solar Corona and Solar Wind Effects.
Change 10	10/21/05	106, 301B, 901B	Corrects errors in module 106, provides revised location, coverage and horizon mask for recently relocated DSS-65, and updates Glossary.
Change 11	2/20/06	203	Incorporate changes resulting from improvements in sequential ranging implementation.
Change 12	5/26/06	105B, 107, 305A	Provides new weather models and methods of calculating system temperature, Adds a radio source catalog. Updates capabilities of test facilities.
Change 13	8/25/06	101B, 211	Revises 70-m module to be consistent with module 105B and to delete DSS-43 S-band Ultracone. Adds description of wideband VLBI capabilities.
Change 14	4/2/07	103A, 203A	Revises 34-m HEF module to be consistent with module 105B and to be DSS-45 & DSS-65 S-band uplink capability. Restores information on recommended range of <i>Pr/N0</i> to module 203.
Change 15	9/15/08	103A, 104B, 201, 206A, 301C	Revises 34-m HEF module to provide measured S-band uplink performance. Modifies 34-m BWG module to document current status of K and Ka-band implementation, Modifies frequency assignments module to be 26-GHz band. Modifies Coverage and Telemetry General Information modules to document effects of decommissioned antennas and 26GHz.
Change 16	9/18/08	104C, 208	Adds antenna performance at 26 GHz. Revises coding module and deletes obsolete code types.
Change 16.5	5/18/2009	104D, 208A	Revises antenna performance at 26 GHz for DSS 24,-34, and 54. Adds Low Density Parity-Check (LDPC) codes as a proposed capability.
Change 17	8/1/2009	105C	Updates weather models for the 26-GHz support capability. Removes references to all 26-m stations.

***Document Change Log (Continued)***

<b>Rev.</b>	<b>Issue Date</b>	<b>Modules Affected</b>	<b>Change Summary</b>
Change 18	9/15/2009	101C, 102, 104E, 105D, 204, 212, 213	Updates the 400-kW S-band uplink capability and its supported frequency range. Revises DSS-54 and DSS-55 G and T information. Removes the document modules and all references to the decommissioned 26-m stations.
Change 19	10/31/2009	203C, 206B, 305B, 901D	Revises these document modules to reflect organizational changes and to eliminate references to the 26-m subnet stations.
Change 20	12/15/2009	201B, 205B, 301E, 302A	Revises these document modules to reflect organizational changes and to eliminate references to the 26-m subnet stations.
Change 21	4/1/2010	Introductory Materials, 001A	Revises introductory materials (Cover & Title pages, Change Log, Foreword, Table of Contents) and Module 001A with up-to-date information and to reflect organizational changes.
Change 22	6/1/2010	Introductory Materials, 104F, 205C, 209A, 301F, 302B	Revises these document modules to reflect organizational changes.
Change 23	9/30/2010	Introductory Materials, 106B, 202B, 304A	Revises these document modules to reflect organizational changes.
Change 24	4/29/2011	Introductory Materials, 101D, 107A, 211A, 901E	Revises introductory materials and Module 101D, 107A, 211A with up-to-date information.
Change 25	3/22/2012	Introductory Materials, 301G, 901F	Revises introductory materials and Module 301G with updated information. Revises the abbreviation list on Module 901F.
Change 26	10/17/2012	Introductory Materials, 301H	Revises introductory materials and Module 301H with updated information for DSS-54 and DSS-55.
Change 27	03/12/2013	Introductory Materials, 104G, 208B	Revises introductory materials. Revises 104G and 208B with up-to-date information.
Change 28	04/08/2013	Introductory Materials, 107B	Revises introductory materials. Revises 107B with up-to-date information.
Change 29	09/18/2013	Introductory Materials, 101E	Revises introductory materials. Revises 101E with up-to-date information.

Change 30	06/12/2014	Introductory Materials, 301I	Revises introductory materials. Revises 301I with up-to-date information.
Change 31	08/01/2014	Introductory Materials, 103C	Revises introductory materials. Revises 103C with up-to-date information.
Change 32	09/10/2014	Introductory Materials, 301J	Revises introductory materials. Revises 301J with up-to-date information.
Change 33	12/15/2014	Introductory Materials, 107C, 201C, 205D, 304B	Revises introductory materials. Revises 107C, 201C, 205D, 304B with up-to-date information.
Change 34	02/09/2015	Introductory Materials, 209B, 210A, 211B, 302C	Revises introductory materials. Revises 209B, 210A, 211B, and 302C with up-to-date information.
Change 35	04/01/2015	Introductory Materials, 104H	Revises introductory materials. Revises 104H with up-to-date information.
Change 36	08/05/2015	Introductory Materials, 101F	Revises introductory materials. Revises 101F with up-to-date information.
Change 37	10/22/2015	Introductory Materials, 105E, 107D	Revises introductory materials. Revises 105E and 107D with up-to-date information.
Change 38	10/28/2015	Introductory Materials, 214A	Revises introductory materials. Revises 214A with up-to-date information.
Change 39	09/13/2016	Introductory Materials, 301K	Revises introductory materials. Revises 301K with up-to-date information.
Change 40	11/17/2016	Introductory Materials, 205E, 209C	Revises introductory materials. Revises 205E and 209C with up-to-date information.
Change 41	02/10/2017	Introductory Materials, 104I, 210B, 211C, 302D, 901G	Revises introductory materials. Revises 104I, 210B, 211C, 302D, and 901G with up-to-date information.
Change 42	05/03/2017	Introductory Materials, 206C	Revises introductory materials. Revises 206C with up-to-date information.
Change 43	0/12/2018	Introductory Materials, 104J	Revises introductory materials. Revises 104J with up-to-date information.

Change 44	07/03/2018	Introductory Materials, 211D, 301L	Revises introductory materials. Revises 211D with up-to-date information. Revises 301L with up-to-date information.
--------------	------------	--	---

## ***Foreword***

This modular handbook has been approved by the Deep Space Network (DSN) Project Office and is provided as a source of technical information for all flight projects using the DSN. It provides information useful to flight projects contemplating the design of hardware and software, with reasonable assurance that the resulting project telecommunications interfaces will be compatible with the established or planned DSN configurations.

The handbook is primarily concerned with performance parameters of equipment that supports the forward and return telecommunications link interfaces between spacecraft and the DSN. The handbook consists of modules that present technical information applicable to the current DSN configuration and preliminary information applicable to future DSN configurations. The modules will be revised to reflect new capabilities when these new capabilities have been planned and budgeted for by the DSN Project Office.

For matters of interpretation or questions concerning this handbook, contact the Deep Space Network Project Office, Organization 920, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, California, 91109.