Cassini T102: Titan Radio Occultation & Bistatic Scattering Observations
June 18, 2014 (DOY-169)
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| Activity | ERT UTC OWLT = 01:15:53 | SCET UTC | PDT ERT - 7 hrs 07:00:00 | Comments |
|---|---|---|---|---|
| Spacecraft is not Earth Pointed | | | | |
| RSSG: Load Predicts (Thermal Stabilization + Baseline) | | | | |
| DSS-34: Start Pre-Cal | 07:05:00 | 05:49:07 | 00:05:00 | Keep antenna at stow after completing the set up activities |
| DSS-43: Start Pre-Cal | 07:10:00 | 05:54:07 | 00:10:00 | Keep antenna at stow after completing the set up activities |
| DSS-34: Switch 43 in B Position | | | | When requested by Radio Science |
| DSS-34 & DSS-43: Start Pre-Cal Bistatic Calibrations | | | | Guided by real-time instructions from Radio Science |
| RSSG: Begin 1 & 16 KHz OL Recording on all Receivers | | | | |
| Start turn to Earth point (T1) | 10:09:18 | 08:53:25 | 03:09:18 | |
| DSS-34 & DSS-43: Beginning Of Track | 10:10:00 | 08:54:07 | 03:10:00 | No S/X downlink detectable |
| RSSG: Begin Recording All Subchannels | 10:10:00 | 08:54:07 | 03:10:00 | |
| S-Band ON | 10:29:21 | 09:13:28 | 03:29:21 | per PEF |
| Ka-Band ON | 10:34:17 | 09:18:24 | 03:34:17 | per PEF |
| SNT Measurement (All Stations) | TBD | | | |
| DSS-34: Switch 43 in A Position | 10:30:00 | 09:14:07 | 03:30:00 | When requested by Radio Science |
| Spacecraft is Earth Pointed | 10:49:17 | 09:33:24 | 03:49:17 | S/X/Ka downlink detectable |
| DSS-43: Begin X-& S-Band 1-Way Acquisition | 10:49:17 | 09:33:24 | 03:49:17 | |
| DSS-34: Begin X- and Ka-Band 1-Way Acquisition | 10:49:17 | 09:33:24 | 03:49:17 | |
| RNG OFF, TLM OFF | 10:49:19 | 09:33:26 | 03:49:19 | Jump in X-band signal level |
| Start Thermal Stabilization Period | 10:49:20 | 09:33:27 | 03:49:20 | |
| RSSG: Enter Open-Loop 1-way Frequency Offsets as Needed | 10:50:00 | 09:34:07 | 03:50:00 | |
| DSS-34: Enable Monopulse | TBD | | | When requested by Radio Science |
| **DSS-43 Transmitter ON, 18 kW, LCP, RAMP, SWEEP** | **12:00:14** | 10:44:21 | 05:00:14 | Start transmitter time = start of 2-way ingress occultation - RTLT |
| End Thermal Stabilization Period / Start T102 Observations | 12:34:18 | 11:18:25 | 05:34:18 | |
| **INGRESS BISTATIC OBSERVATION** | | | | |
| Start 15 minutes free-space baseline | 12:34:33 | 11:18:40 | 05:34:33 | PC/N0 (X34, Ka34, X43, S43) = 48, 48, 54, and 42 dB-Hz |
| **DSS-43 Transmitter OFF** | **12:35:08** | 11:19:15 | 05:35:08 | End transmitter time = End of 2-way Egress occultation - RTLT |
| DSS-34: Disable Monopulse | 12:48:00 | 11:32:07 | 05:48:00 | Keep or clear the offset decision before 12:47:00 |
| End free-space baseline | 12:49:37 | 11:33:44 | 05:49:37 | |
| RSSG: Load Predicts (Ingress Bistatic) | 12:49:38 | 11:33:45 | 05:49:38 | |
| DSS-34 Switch 43 in B Position | 12:49:38 | 11:33:45 | 05:49:38 | When requested by Radio Science |
| Start turn to Titan surface (T2) | 12:49:38 | 11:33:45 | 05:49:38 | Quick loss of S/X/Ka signals |
| Start Bistatic Mini Cal 1 | 12:51:00 | 11:35:07 | 05:51:00 | Radio Science to confirm start time. Must end by12:59:00 |
| End Turn to Titan surface | 12:56:41 | 11:40:48 | 05:56:41 | HGA boresight is pointed to Titan's surface |
| Start Ingress Bistatic Observations | 13:00:43 | 11:44:50 | 06:00:43 | Potential surface echoes |

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| End Ingress Bistatic Observations | 14:26:38 | 13:10:45 | 07:26:38 | |
| Start turn to Earth point (T3) | 14:26:50 | 13:10:57 | 07:26:50 | Carrier signals should re-appear shortly before 14:30:36 |
| RSSG: Load Predicts (Ingress Occultation) | 14:28:30 | 13:12:37 | 07:28:30 | |
| End Turn to Earth Point | 14:30:36 | 13:14:43 | 07:30:36 | PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band |
| **INGRESS-EGRESS OCCULTATION** | | | | |
| DSS-34: Switch 43 in A Position | 14:30:36 | 13:14:43 | 07:30:36 | When requested by Radio Science |
| RSSG: Clear Open-Loop 1-way Frequency Offsets | 14:31:55 | 13:16:02 | 07:31:55 | |
| RSSG: Enter Coherent Frequency Offsets | 14:31:57 | 13:16:04 | 07:31:57 | |
| Start 2-Way Ingress Occultation | 14:32:00 | 13:16:07 | 07:32:00 | |
| DSS-43: Begin X- and S-Band 2-Way Acquisition | 14:32:00 | 13:16:07 | 07:32:00 | |
| DSS-34: Begin X- and Ka-Band 3-Way Acquisition | 14:32:00 | 13:16:07 | 07:32:00 | |
| Top of Ionosphere (~3000 km alt) | 14:32:23 | 13:16:30 | 07:32:23 | |
| DSS-34: Enable Monopulse | TBD | | | When requested by Radio Science |
| Titan's Ionosphere (~1500 km alt) | 14:37:03 | 13:21:10 | 07:37:03 | The ionosphere primarily affects the signal freq/phase |
| DSS-34: Disable Monopulse | 14:39:00 | 13:23:07 | 07:39:00 | Keep or clear the offset decision before 14:38:00 |
| Top of Atmosphere (~200 km alt) | 14:41:06 | 13:25:13 | 07:41:06 | The atmosphere affects signal intensity/frequency/phase |
| Near tropopause (0.001° BA)) | 14:41:12 | 13:25:19 | 07:41:12 | Signal intensity drops quickly in Titan's troposphere |
| Ka-band absorbed (~10 km alt) | 14:42:06 | 13:26:13 | 07:42:06 | Ka-band is absorbed before the signal reaches the surface |
| At Titan's Surface (~2575 km radius) | 14:42:22 | 13:26:29 | 07:42:22 | Loss of S- & X-band signals |
| End tracking ingress occultation | 14:43:53 | 13:28:00 | 07:43:53 | |
| Behind Titan | | | | |
| Titan Closest Approach (C/A) | 14:44:18 | 13:28:25 | 07:44:18 | T102 Live-Update Block (LUB) OD epoch |
| RSSG: Load Predicts (Egress Occultation) | 14:44:30 | 13:28:37 | 07:44:30 | |
| DSS-34: Switch 43 in B Position | 14:44:30 | 13:28:37 | 07:44:30 | When requested by Radio Science |
| Start turn to egress occultation | 14:44:55 | 13:29:02 | 07:44:55 | |
| Start Bistatic Mini Cal 2 | 14:44:56 | 13:29:03 | 07:44:56 | Radio Science to confirm start time. Must end by 14:54:00 |
| End turn to egress occultation | 14:53:18 | 13:37:25 | 07:53:18 | |
| DSS-34: Switch 43 in A Position | 14:54:00 | 13:38:07 | 07:54:00 | When requested by Radio Science |
| Start tracking egress occultation | 14:54:53 | 13:39:00 | 07:54:53 | |
| Monopulse Offsets Decision | | | | Decision to keep/clear the monopulse offsets for egress occultation |
| Behind Titan | | | | |
| At Titan's Surface (~2575 km radius) | 14:56:48 | 13:40:55 | 07:56:48 | S/X signal intensity builds up quickly |
| Ka-band reappears (~10 km alt) | 14:57:05 | 13:41:12 | 07:57:05 | Ka-band signal intensity builds up quickly |
| Near tropopause (0.001° BA) | 14:58:06 | 13:42:13 | 07:58:06 | Signals are back to near full strength |
| Top of Atmosphere (~200 km alt) | 14:58:12 | 13:42:19 | 07:58:12 | PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band |
| DSS-34: Enable Monopulse | 15:00:00 | 13:44:07 | 08:00:00 | When requested by Radio Science |
| Titan's Ionosphere (~1500 km alt) | 15:02:14 | 13:46:21 | 08:02:14 | The ionosphere primarily affects the signal freq/phase |
| DSS-34: Disable Monopulse | 15:06:30 | 13:50:37 | 08:06:30 | Keep or clear the offset decision before 15:05:00 |
| ~Top of Ionosphere (~3000 km alt) | 15:06:53 | 13:51:00 | 08:06:53 | |
| End Egress Earth Occultation | 15:06:54 | 13:51:01 | 08:06:54 | |
| RSSG: Clear Coherent Frequency Offsets | 15:06:54 | 13:51:01 | 08:06:54 | |

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| **EGRESS BISTATIC OBSERVATION** | | | | |
| DSS-43: Begin X- and S-Band 1-Way Acquisition | 15:06:54 | 13:51:01 | 08:06:54 | |
| DSS-34: Begin X- and Ka-Band 1-Way Acquisition | 15:06:54 | 13:51:01 | 08:06:54 | |
| RSSG: Enter Open-Loop 1-way Frequency Offsets as Needed | 15:07:10 | 13:51:17 | 08:07:10 | |
| DSS-34: Switch 43 in B Position | 15:08:20 | 13:52:27 | 08:08:20 | When requested by Radio Science |
| Start Turn to Titan Surface (T4) | 15:08:20 | 13:52:27 | 08:08:20 | Quick loss of the Ka/X/S carrier signals |
| RSSG: Load Predicts (Bistatic Egress) | 15:09:30 | 13:53:37 | 08:09:30 | |
| End Turn to Titan Surface | 15:11:05 | 13:55:12 | 08:11:05 | HGA boresight is pointed to Titan's surface |
| Start Egress Bistatic Observations | 15:12:48 | 13:56:55 | 08:12:48 | Potential weak echo from Ligiea Mare |
| End Egress Bistatic Observations | 16:33:18 | 15:17:25 | 09:33:18 | |
| Start turn to egress baseline (T5) | 16:33:20 | 15:17:27 | 09:33:20 | |
| DSS-34 & 43 SNT Measurement | 16:33:30 | 15:17:37 | 09:33:30 | SNT measurements must end by 16:37:00 |
| RSSG: Load Predicts (Baseline) | 16:36:00 | 15:20:07 | 09:36:00 | |
| End turn to egress baseline | 16:38:35 | 15:22:42 | 09:38:35 | |
| DSS-34: Switch 43 in A Position | 16:38:35 | 15:22:42 | 09:38:35 | When requested by Radio Science |
| DSS-43: Begin X- and S-Band 1-Way Acquisition | 16:38:35 | 15:22:42 | 09:38:35 | |
| DSS-34: Begin X- and Ka-Band 1-Way Acquisition | 16:38:35 | 15:22:42 | 09:38:35 | |
| Start 15 minutes free-space baseline | 16:39:18 | 15:23:25 | 09:39:18 | PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band |
| DSS-34: Enable Monopulse | 16:53:00 | 15:37:07 | 09:53:00 | Allows assessment of Ka-band pointing quality |
| TLM ON, RNG ON | 16:54:12 | 15:38:19 | 09:54:12 | |
| End 15 minutes free-space baseline | 16:54:18 | 15:38:25 | 09:54:18 | PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band |
| End of T102 RSS Observations Period (at Waypoint) | 16:54:18 | 15:38:25 | 09:54:18 | Spececraft starts turning off Earth point |
| DSS-34: Disable Monopulse | 16:54:18 | 15:38:25 | 09:54:18 | At loss of Ka-band Signal |
| S-Band OFF | 16:54:18 | 15:38:25 | 09:54:18 | per PEF |
| Ka-Band OFF | 16:54:20 | 15:38:27 | 09:54:20 | per PEF |
| DSS-34: Switch 43 in B Position | 16:59:00 | 15:43:07 | 09:59:00 | When requested by Radio Science |
| Start Bistatic Mini Cal 3 | 17:00:00 | 15:44:07 | 10:00:00 | Radio Science to confirm start time. Must end by 07:15:00 |
| Start Spacecraft Turn Off Earth Point | 17:15:25 | 15:59:32 | 10:15:25 | |
| DSS-34 & 43: End-of-Track | 17:30:00 | 16:14:07 | 10:30:00 | |
| DSS-34 & 43: Start of Post-Cal | 17:30:00 | 16:14:07 | 10:30:00 | |
| DSS-34 & 43: Start of Post-Cal Bistatic Calibrations | | | | Guided by Real-Time Instructions from RSS Ops-Room |
| RSSG: Continue Recording 1 & 16 KHz Only | | | | Disable recording of all other subchannels on all receivers |
| DSS-34 & 43: End of Post-Cal | 18:30:00 | 17:14:07 | 11:30:00 | |
| RSSG: End 1 & 16 kHz Open-Loop Recordings | | | | |

Times are based on the 110818 reference trajectory and didn't change after the T102 Live Update Block (LUB) OD on 06/06/2014.

Canberra DSS-34 & 43 Related Activities

Behind Titan

Mini Calibration; SNT Measurements