

Cassini T101: Titan Radio Occultation & Bistatic Scattering Observations

May 17, 2014 (DOY-137)

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Activity	ERT UTC OWLT = 01:14:08	SCET UTC	PDT ERT - 7 hrs	Comments
Spacecraft is not Earth Pointed				
RSSG: Load Predicts (Thermal Stabilization + Baseline)	09:40:00	08:25:52	02:40:00	
DSS-34: Start Pre-Cal	10:05:00	08:50:52	03:05:00	Keep antenna at stow after completing the set up activities
DSS-43: Start Pre-Cal	10:10:00	08:55:52	03:10:00	Keep antenna at stow after completing the set up activities
DSS-34: Switch 43 in B Position	TBD			When requested by Radio Science
DSS-34 & DSS-43: Start Pre-Cal Bistatic Calibrations	TBD			Guided by real-time instructions from Radio Science
RSSG: Begin 16 KHz Open-Loop Recording on all Receivers				
Ka-Band ON	11:26:29	10:12:21	04:26:29	per PEF
RSSG: Begin Recording All Subchannels	12:50:00	11:35:52	05:50:00	
DSS-43: Begin-of-Track	13:10:00	11:55:52	06:10:00	No S/X downlink detectable
DSS-34: Begin-of-Track	13:10:00	11:55:52	06:10:00	No Ka/X downlink detectable
SNT Measurement (All Stations)				
Start turn to Earth point (T1)	13:11:23	11:57:15	06:11:23	
DSS-34: Switch 43 in A Position	13:15:00	12:00:52	06:15:00	When requested by Radio Science
Spacecraft is Earth Pointed	13:21:23	12:07:15	06:21:23	X/Ka downlink detectable
DSS-43: Begin X-Band 1-Way Acquisition	13:21:23	12:07:15	06:21:23	
DSS-34: Begin X- and Ka-Band 1-Way Acquisition	13:21:23	12:07:15	06:21:23	
RNG OFF, TLM OFF	13:21:24	12:07:16	06:21:24	Jump in X-band signal level
S-Band ON	13:31:25	12:17:17	06:31:25	per PEF
DSS-43: Begin S-Band 1-Way Acquisition	13:31:25	12:17:17	06:31:25	
Start Thermal Stabilization Period	13:31:25	12:17:17	06:31:25	
DSS-34: Enable Monopulse	TBD			When requested by Radio Science
DSS-43 Transmitter ON, 18 kW, LCP, RAMP, SWEEP	14:46:11	13:32:03	07:46:11	Start transmitter time = start of 2-way ingress occultation - RTLTL
End on Thermal Stabilization	15:16:07	14:01:59	08:16:07	
INGRESS BISTATIC OBSERVATION				
Start 15 minutes free-space baseline	15:16:08	14:02:00	08:16:08	PC/N0 (X34, Ka34, X43, S43) = 48, 48, 54, and 42 dB-Hz
DSS-43 Transmitter OFF	15:21:17	14:07:09	08:21:17	End transmitter time = End of 2-way Egress occultation - RTLTL
DSS-34: Disable Monopulse	15:28:00	14:13:52	08:28:00	Keep or clear the offset decision before 15:27:00
End free-space baseline	15:31:39	14:17:31	08:31:39	
RSSG: Load Predicts (Ingress Bistatic)	15:31:40	14:17:32	08:31:40	
DSS-34 Switch 43 in B Position	15:31:40	14:17:32	08:31:40	When requested by Radio Science
Start turn to Titan surface (T2)	15:31:40	14:17:32	08:31:40	Quick loss of S/X/Ka signals

Start Bistatic Mini Cal 1	15:32:00	14:17:52	08:32:00	Radio Science to confirm start time. Must end by 15:41:00
End Turn to Titan surface	15:42:20	14:28:12	08:42:20	HGA boresight is pointed to Titan's surface
Start Ingress Bistatic Observations	15:43:11	14:29:03	08:43:11	Potential surface echoes
End Ingress Bistatic Observations	17:08:52	15:54:44	10:08:52	
Start turn to Earth point (T3)	17:08:55	15:54:47	10:08:55	Carrier signals should re-appear shortly before 17:13:48
RSSG: Load Predicts (Occultation)	17:11:00	15:56:52	10:11:00	
End Turn to Earth Point	17:13:48	15:59:40	10:13:48	PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band
INGRESS-EGRESS OCCULTATION				
DSS-34: Switch 43 in A Position	17:13:48	15:59:40	10:13:48	When requested by Radio Science
RSSG: Clear Open-Loop Frequency Offsets	17:14:23	16:00:15	10:14:23	
RSSG: Enter Coherent Frequency Offsets	17:14:25	16:00:17	10:14:25	
Start 2-Way Ingress Occultation	17:14:27	16:00:19	10:14:27	
DSS-43: Begin X- and S-Band 2-Way Acquisition	17:14:27	16:00:19	10:14:27	
DSS-34: Begin X- and Ka-Band 3-Way Acquisition	17:14:27	16:00:19	10:14:27	
Start 2-Way Ingress Occultation Baseline	17:15:03	16:00:55	10:15:03	
Top of Ionosphere (~3000 km alt)	17:15:07	16:00:59	10:15:07	
DSS-34: Enable Monopulse	TBD			When requested by Radio Science
Titan's Ionosphere (~1500 km alt)	17:20:02	16:05:54	10:20:02	The ionosphere primarily affects the signal freq/phase
DSS-34: Disable Monopulse	17:22:00	16:07:52	10:22:00	Keep or clear the offset decision before 17:21:00
Top of Atmosphere (~200 km alt)	17:24:21	16:10:13	10:24:21	The atmosphere affects signal intensity/frequency/phase
Near tropopause (0.001° BA))	17:24:28	16:10:20	10:24:28	Signal intensity drops quickly in Titan's troposphere
Ka-band absorbed (~10 km alt)	17:25:24	16:11:16	10:25:24	Ka-band is absorbed before the signal reaches the surface
At Titan's Surface (~2575 km rad)	17:25:39	16:11:31	10:25:39	Loss of S- & X-band signals
Behind Titan				
Titan Closest Approach (C/A)	17:26:23	16:12:15	10:26:23	T101 Live-Update Block (LUB) OD epoch
DSS-34: Switch 43 in B Position	17:27:30	16:13:22	10:27:30	When requested by Radio Science
Start Bistatic Mini Cal 2	17:28:00	16:13:52	10:28:00	Radio Science to confirm start time. Must end by 17:37:00
DSS-34: Switch 43 in A Position	17:37:00	16:22:52	10:37:00	When requested by Radio Science
Monopulse Offsets Decision				Decision to keep/clear the monopulse offsets for egress occultation
Behind Titan				
At Titan's Surface (~2575 km rad)	17:39:13	16:25:05	10:39:13	S/X signal intensity builds up quickly
Ka-band reappears (~10 km alt)	17:39:31	16:25:23	10:39:31	Ka-band signal intensity builds up quickly
Near tropopause (0.001° BA)	17:40:36	16:26:28	10:40:36	Signals are back to near full strength
Top of Atmosphere (~200 km alt)	17:40:43	16:26:35	10:40:43	PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band
DSS-34: Enable Monopulse	17:43:00	16:28:52	10:43:00	When requested by Radio Science
Titan's Ionosphere (~1500 km alt)	17:45:01	16:30:53	10:45:01	The ionosphere primarily affects the signal freq/phase
~Top of Ionosphere (~2900 km alt)	17:49:32	16:35:24	10:49:32	
DSS-34: Disable Monopulse	17:49:20	16:35:12	10:49:20	Keep or clear the offset decision before 17:48:00
End Egress Earth Occultation	17:49:33	16:35:25	10:49:33	

RSSG: Clear Coherent Frequency Offsets	17:49:33	16:35:25	10:49:33	
EGRESS BISTATIC OBSERVATION				
DSS-43: Begin X- and S-Band 1-Way Acquisition	17:49:33	16:35:25	10:49:33	
DSS-34: Begin X- and Ka-Band 1-Way Acquisition	17:49:33	16:35:25	10:49:33	
DSS-34: Switch 43 in B Position	17:51:25	16:37:17	10:51:25	When requested by Radio Science
Start Turn to Titan Surface (T4)	17:51:25	16:37:17	10:51:25	Quick loss of of the Ka/X/S carrier signals
RSSG: Load Predicts (Bistatic Egress)	17:53:00	16:38:52	10:53:00	
End Turn to Titan Surface	17:55:13	16:41:05	10:55:13	HGA boresight is pointed to Titan's surface
Start Egress Bistatic Observations	17:55:53	16:41:45	10:55:53	Potential weak echo from Ligiea Mare
End Egress Bistatic Observations	19:15:23	18:01:15	12:15:23	
Start turn to egress baseline (T5)	19:15:25	18:01:17	12:15:25	
DSS-34 & 43 SNT Measurement	19:16:00	18:01:52	12:16:00	SNT measurements must end by 19:20:00
RSSG: Load Predicts (Baseline)	19:18:00	18:03:52	12:18:00	
End turn to egress baseline	19:20:15	18:06:07	12:20:15	
DSS-34: Switch 43 in A Position	19:20:15	18:06:07	12:20:15	When requested by Radio Science
Start 15 minutes free-space baseline	19:21:23	18:07:15	12:21:23	PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band
DSS-34: Enable Monopulse	19:35:00	18:20:52	12:35:00	Allows assessment of Ka-band pointing quality
End 15 minutes free-space baseline	19:36:16	18:22:08	12:36:16	PC/N0 ~ 54, 48, & 42 dB-Hz for X-, Ka-, S-Band
TLM ON, RNG ON	19:36:17	18:22:09	12:36:17	
End of T101 RSS Observations Period (at Waypoint)	19:36:23	18:22:15	12:36:23	Spececraft starts turning off Earth point
DSS-34: Disable Monopulse	19:36:23	18:22:15	12:36:23	At loss of Ka-band Signal
DSS-34: Switch 43 in B Position	19:36:30	18:22:22	12:36:30	When requested by Radio Science
Start Bistatic Mini Cal 3	19:37:00	18:22:52	12:37:00	Radio Science to confirm start time. Must end by 19:45:00
DSS-34 & 43: End-of-Track	19:45:00	18:30:52	12:45:00	
DSS-34 & 43: Start of Post-Cal	19:45:00	18:30:52	12:45:00	
DSS-34 & 43: Start of Post-Cal Bistatic Calibrations				Guided by Real-Time Instructions from RSS Ops-Room
RSSG: Continue Recording 16 KHz Only				Disable recording of all other subchannels on all receivers
S-Band OFF	19:49:23	18:35:15	12:49:23	per PEF
Ka-Band OFF	19:49:25	18:35:17	12:49:25	per PEF
DSS-34 & 43: End of Post-Cal	20:45:00	19:30:52	13:45:00	
RSSG: End 16 KHz Open-Loop Recordings	20:50:00	19:35:52	13:50:00	

Times are based on the T101 Live Update Block (LUB) OD on 05/07/2014 with OTM-379 modeled

Canberra DSS-34 & 43 Related Activities

Behind Titan

Mini Calibration; SNT Measurements