SYNERGY SYSTEMS, LLC
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15 January 2014
Revision L - 16 March 2019

Oncore Receiver - 1024 Week Roll-Over Dates

Except as noted, all receivers were manufactured by Motorola

Disclaimer – This App-Note was originally created on January 15, 2014 in anticipation of the first 8 channel VP Oncore receivers reaching their internal, 1024 week limit later in that year. Subsequent revisions included additional Motorola Oncore products. During the process of compiling this data**,** it became clear that the most accurate way to define a specific receiver's 1024 week roll-over date, is to issue the binary @@Cj Receiver ID Command to the specific receiver of interest and observe the "Software Date." Add 1024 weeks to that number to derive the roll-over date. In some cases (notes on last page) **even the Software Date returned by the @@Cj Receiver message is not always accurate!**

Summary - The following information was partially derived from the original Motorola Firmware Release App-Notes. If information was not available from Motorola, roll-over dates were determined either by customer inputs or testing of various Oncore receivers in Synergy's tech-support lab.

When it is not possible to query the receiver directly, this App-Note is intended to be **used as a guide only** for the various Oncore receiver's roll-over dates. Differences from the listed "Software Date" in the tables below, have been noticed for Motorola's internal customers and house accounts (like iDEN and OnStar, etc.) and those who purchased Receivers through domestic and international distributors. In addition, many Oncore receivers have been re-flashed to upgrade receiver features over the years. Those receivers, usually with the letter "R" placed anywhere in the part number, are not included here.

Motorola's published App-Notes did not always include VP, GT, GT+, UT, UT+, M12 and M12+ Oncore firmware "Base Dates" that matched the receiver's assigned Software Date as shown in the receivers @@Cj ID message. Firmware dates for the GT+ navigation receivers were not always announced in Motorola's firmware update App Notes, so, where available, the dates listed in the table below are from engineering samples. Because of the above, and some firmware App-Notes not released by Motorola, this Oncore receiver Week Roll-Over information is presented as guide only.

Note that an Oncore receiver's 1024 Week Roll-Over date is completely separate from the NavStar GPS Satellite constellation's GPS End of Week (EOW) Roll-Over coming on April 6, 2019. A GPS World article on the first, 1999 GPS EOW is here: http://gauss2.gge.unb.ca/gpsworld/gpsworld.november98.pdf. Notes for April 6 2019 are here: https://www.gps.gov/cgsic/meetings/2017/powers.pdf and here: https://ics-cert.us-cert.gov/sites/default/files/documents/Memorandum_on_GPS_2019.pdf

Motorola either did not test, or did not disseminate test results for distribution, on any of the PVT-6, Basic, VP, UT\UT+, GT\GT+ or M12+ receivers for the April 2019 GPS End of Week roll-over.

Details - All Motorola Oncore series GPS receivers, contain an internal, 1024 week counter that is based on the receiver's firmware compile date. A receiver's "Software Date," as displayed in the receiver's @@Cj ID Message, were defined by Motorola's software engineering staff. The Software Date, starting on row 6 column 16 of the below Receiver ID matrix, should reflect the firmware's final compile date from which a week roll-over date can be calculated but deviations from this standard have been noted.

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The response is output as a 25 column by 12 row array. General format is as shown below:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	@	@	C	j	cr	lf	C	O	P	Y	R	I	G	H	T		1	9	9	1	-	2	0	0	X
2		M	O	T	O	R	O	L	A		I	N	C	.	cr	lf	S	F	T	W		P	/	N	
3	#		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	cr	lf	S	O	F	T	W	A
4	R	E		V	E	R		#	X	X	X	X	X	X	X	X	X	X	X	X	cr	lf	S	O	F
5	T	W	A	R	E			R	E	V		#	X	X	X	X	X	X	X	X	X	X	X	cr	lf
6	S	O	F	T	W	A	R	E		D	A	T	E			X	X	X	X	X	X	X	X	X	X
7	X	cr	lf	M	O	D	E	L		#					X	X	X	X	X	X	X	X	X	X	X
8	X	X	X	X	cr	lf	H	D	W	R		P	/	N		#		X	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X	cr	lf	S	E	R	I	A	L		#				X	X	X	X	X
10	X	X	X	X	X	X	X	X	X	X	cr	lf	M	A	N	U	F	A	C	T	U	R		D	A
11	T	E			X	X	X	X	X	X	X	X	X	cr	lf										
12																	C*	cr	lf						

*C = Hex checksum
Message Length 294 bytes

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An example of firmware date confusion can be seen with UT+ v3.2. The observed "Software Date" on a Synergy sample using the @@Cj Receiver ID command, shows 8/23/2000 but Motorola's "Oncore Technical Application Note" says the Default year changed to 1/1/2000. Issuing the @@Cj Receiver ID Command to the specific receiver of interest is the only reliable way to determine the 1024 week roll-over date. Always believe the receiver being tested!

As stated above, the best method of determining a receiver's actual 1024-week roll-over date is to use the @@Cj Receiver ID command and observe the response. Add 1024 weeks to the observed date to reveal the receiver's 1024 Week Roll-Over date. A simple to use date Calculator is here:

https://www.timeanddate.com/date/dateadded.html?m1=8&d1=1&y1=2000&type=add&ay=&am=&aw=1024&ad=&rec=

OEM receivers later than the PVT-6, Basic Oncore and VP Oncore (i.e. GT+, UT+, M12+) do not have the capability of permanently setting the base year date (epoch) due to the lack of on-board, non-volatile flash memory. Review the individual Oncore receiver Firmware Release Notes for details here: http://synergy-gps.com/support/motorola-legacy-products/

An estimated Roll-Over date is used (below) when a publish date and\or a physical GPS board sample was not available to test. Here are the Oncore GPS Receiver Week Roll-Over dates reported by the Motorola App Note, the @@Cj message, and Synergy or customer Oncore receiver engineering samples:

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Oncore Product	CH	Part Number	Motorola Release Note Date	Firmware Date	Roll-Over Date (or estimate)
PVT-6 Timing\Nav 2.1	6	PVT602N323	(Not Published)	11/24/1992	7/10/2012
Basic Oncore	6	A1xx2xPxx6	(Not Published)	1/20/1994	9/5/2013
XT Timing\Nav v5.1	6	A1xxxxxxx1	(Not Published)	2/23/1994	10/9/2013
XT\Nav v8.4	6	A1xxxxBxx5	(Not Published)	7/13/1995	2/26/2015
VP Timing\Nav v6.0	6	B1xxxxxxx1	(Not Published)	4/20/1994	12/4/2013
VP Timing\Nav v8.1	8	B3xxxxxxx3	3/1995	3/1/1995	10/15/2014
VP Timing\Nav v8.4	8	B4xxxPxxx5	8/1995	7/13/1995	2/26/2015
VP Timing\Nav v8.8	8	B4xxxxxxx4	10/1996	8/6/1996	3/22/2016

Oncore Product	CH	Part Number	Motorola Release Note Date	Firmware Date	Roll-Over Date (or estimate)
VP Timing\Nav v8.8	8	B8xxxxxxx5	10/1996	8/6/1996	3/22/2016
VP Timing\Nav v10.0	8	B8xxxxxxx6	11/1997	12/28/1997	8/13/2017
VP Timing\Nav v10.1	8	B8xxxxxxx7	(Not Published)	11/25/1998	7/11/2018

Oncore Product	CH	Part Number	Motorola Release Note Date	Firmware Date	Roll-Over Date (or estimate)
UT Timing v1.3	8	R1xxxAxxxx1	7/1996	9/12/1996	4/28/2016
UT Timing v2.2	8	R1xxxNxxx4	(Not Released)	4/24/1998	12/8/2017
UT+ Timing v2.0	8	R5xxxUxxxx1	11/1997	11/7/1997	6/23/2017
UT+ Timing v2.2	8	R5xxxUxxxx2	5/1998	4/24/1998	12/8/2017
UT+ Timing v3.0	8	R5xxxUxxxx3	1/1999	12/18/1998	8/3/2018
UT+ Timing v3.1	8	R5xxxUxxxx4	4/1999	5/28/1999	1/11/2019
UT+ Timing v3.2	8	R5xxxUxxxx5	10/2/2000	8/23/2000	4/8/2020

Oncore Product	CH	Part Number	Motorola Release Note Date	Firmware Date	Roll-Over Date (or estimate)
GT Navigation v1.3	8	R1xxNxxxx2	7/1996	9/12/1996	4/28/2016
GT Navigation v1.6	8	R1xxxNxxx4	3/1997	2/22/1997	2/22/2016
GT+ Navigation v1.7	8	R1xxxNxxx5	8/1997	(Not Available)	3/17/2017 - e
GT+ Navigation v2.01	8	R3xxxGxxx1 R4xxxGxxx1	11/1997	12/8/1997	7/24/2017
GT+ Navigation v2.2	8	R3xxxGxxx2 R4xxxGxxx2 R6xxxGxxx2	8/1998	1/1/1998	8/17/2017 - e
GT+ Navigation v3.0	8	R3xxxGxxx3	5/2000	5/1/2000	12/16/2019

Notes: 1. No firmware date available, e = estimate based on Release Note date (1st of month)
2. Motorola's Firmware Note for the GT+ v2.2 firmware update lists a Default Date of January 1, 1998 but the Motorola Firmware App-Note is dated much later at "8/98" giving a low confidence that the roll-over date is correct.

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Oncore Product	C H	Part Number	Motorola Release Note Date	Firmware Date	Roll-Over Date Estimated
SL Timing v2.2	8	R6xxxGxxx2	8/1998	1/1/1998	8/17/2017
SL Timing v3.2		R6xxxGxxx2	10/2/2000	1/1/2000	8/17/2019

Oncore Product	C H	Part Number	Motorola Release Note Date	Firmware Date	Roll-Over Date (or estimate)
M12 Navigation v1.0	12	P1xxTxxNx1*	10/1999	(Not Available)	5/17/2019 - e
M12 Navigation v1.2	12	P1xxTxxNx1*	12/1999	(Not Available)	7/17/2019 - e
M12 Navigation v1.3	12	P1xxTxxNx2	3/2000**	3/13/2000	10/28/2019
M12 Navigation v1.4	12	P1xxTxxNx3	11/2000	(Not Available)	6/17/2020 - e
M12+ Navigation v1.7	12	P2xxTxxNx4	4/2002	(Not Available)	11/15/21 - e
M12+ Navigation v1.8	12	P2xxTxxNx5	5/2002	5/15/2002	12/29/2021
M12+ Navigation v1.9	12	P2x3TxxTx6	5/2004	5/4/2004	12/19/2023
M12+ Timing v2.0	12	P2x3TxxTx1	(Not Released)	8/14/2002	3/30/2022
M12+ Timing v2.1	12	P2x3TxxTx2	10/30/2003	4/16/2003	11/30/2022

* No model Number change between M12 firmware versions 1.0 and 1.2
** Motorola Firmware App Note incorrectly published 3/1999
e = If no firmware date published, or available from a test sample, an estimate based on the first day of the Release Note month (which may be off by +/- a couple of months!).

Firmware v1.7 marked the beginning of the M12+ Series receivers (there was not an M12 receiver with v1.7). Unfortunately, Motorola did not make a distinction between the M12 and M12+ receivers in their "M12 Oncore Firmware Version History" App-Note:
http://synergy-gps.com/wp-content/uploads/2018/11/m12-nav-firmware-history-v1.5.pdf

Notes: 1. Other, commercially released, Motorola Oncore OEM GPS timing receivers, with different version numbers and firmware dates, were produced between 1992 and 2005. Those special part numbers were reserved for Motorola's internal automotive group, Motorola's iDEN cellular products group and volume customers such as GM OnStar. Because firmware for these products was customized for the application, the firmware dates will not match those above.

2. Some of Motorola's volume receiver users were assigned special receiver and firmware part numbers for VP, UT+, M12 and M12+ Oncore Navigation or Timing receivers. The 1024 Week Roll-Over for those receivers must be calculated using the firmware date reported in the @@Cj message. **Motorola either did not test, or did not publish a test for distribution, on any of the VP, UT\UT+, GT\GT+ or M12+ receivers for the April 2019 GPS End of Week roll-over.**

A Work-Around for Oncore receivers past their 1024 week - (a) With the receiver powered off, disconnect the GPS antenna (b) power-on the receiver and set the date and time (for PVT-6 and VP Oncore models the receiver must be in idle mode and the @@Ab GMT offset set first) (c) Connect the GPS antenna (set the PVT-6 and VP Oncore receivers to Fix Mode) and allow the receiver to acquire a 3-D fix and download an Almanac (about 13 minutes). The time and date should now be correct. Follow this procedure every time the receiver is power-cycled.

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Information in the tables above is based on several sources thought to be reliable but not guaranteed in any way: (1) Motorola firmware release notes were noted for the various Oncore GPS receivers (2) Observed firmware dates were derived from engineering samples at Synergy or (3) supplied by customers.

Firmware Release Notes do not reflect the actual software date unless specifically mentioned in the note itself. In some cases, the VP Oncore engineering samples made available for this study may have been re-flashed and may contain a Firmware Date other than the original date established at the factory.

In collating the above information, Synergy has reviewed Motorola's documentation made available as App-Notes and Firmware Release Notes received from a period of 1992 through 2005. Many of he GT+ Oncore firmware dates were not included in Motorola's release Notes. If users of Motorola's legacy receivers have accurate firmware roll-over dates for any of the above receivers, please forward it to oemtecg@synergy-gps.com for inclusion in this App Note.

iLotus M12M Oncore 12 channel GPS Receivers

The first timing and navigation boards produced by iLotus were RoHS 5 of 6. In 2007, iLotus started producing RoHS 6 of 6 timing and navigation boards with different part numbers as shown below. The firmware dates were the same for both 5 of 6 and 6 of 6 models.

the M12M receivers were tested by iLotus in 2013 for the GPS Satellite System End of Week (EOW) April 2019 Week Rollover (different from the subject of GPS receiver week roll-over discussed above). They performed normally as expected with no user intervention. Please request iLotus M12M GPS End of Week roll-over report from oeminfo@synergy-gps.com.

Oncore Products By iLotus	Part Number	Electronic ID	Release Note Date	Firmware Date	Roll-Over Date
M12M Timing	IL-GPS-0010-A	P2xxTxxTx1	5/2/2006	5/4/2005	12/18/2024
M12M Navigation	IL-GPS-0020-A	P2xxTxxNx1	5/2/2006	5/4/2005	12/18/2024
M12M Timing	IL-GPS-0010-B	P3xxTxxTx1	6/1/2007	9/6/2006	4/22/2026
M12M Navigation	IL-GPS-0020-B	P3xxTxxNx1	6/1/2007	9/6/2006	4/22/2026

iLotus M12M Oncore GPS receivers – The first timing and navigation boards produced in 2006 by iLotus were RoHS 5 of 6. In 2007, iLotus started producing RoHS 6 of 6 timing and navigation boards with different part numbers (shown above). Firmware dates were the same for both 5 of 6 and 6 of 6 models.

Historical Note - Synergy's distribution contract with Motorola was terminated when their GPS Division was sold in June of 2005 to two entities. The navigation portion went to Continental in Germany and the timing part went to SiRF Technologies in San Jose, CA. Motorola selected iLotus of Singapore, an approved CM for Motorola products, to produce their new M12M GPS receiver for use by other Motorola Divisions and to Synergy Systems, LLC for general distribution.

In the intervening years, Synergy has provided continued support including technical assistance for migrating to the Motorola designed M12M GPS receivers produced by iLotus, and Synergy's SSR Series Multi-GNSS boards. End of life and transition support has included top level testing of various receivers for the NavStar Constellation's April 6, 2019 GPS End of Week (EOW) Roll-Over *but not for confirmation of the roll-over dates of the individual receivers* (PVT-6, VP, GT\GT+, UT\UT+, M12\M12+) as outlined in this App-Note.

Additional, more in-depth receiver testing is available when required from testing agencies with satellite simulators. For example, testing of specific receiver parameters like confirming exact GPS receiver roll-over dates (when Motorola documentation is not sufficient). In those cases, we recommend contacting our engineering partner of twenty years, Rick Hambly at CNS Systems Inc. http://www.cnssys.com.

Rick, an expert in precision timing applications, has provided versions of his CNS Clocks to the world-wide radio astronomy community, NASA and others for over twenty years. He can be contacted at (410) 987-7835 or Rick@cnssys.com for a discussion of test needs and a quotation for testing work.

Note - 2 March 2019 - Motorola's "Oncore Technical Application Note" for UT+ firmware release v3.2 dated 10/2/2000 incorrectly noted item 3 "Default year changed to 1/1/2000. the actual year, as indicated by several UT+ GPS receiver samples is August 23, 2000. The UT+ section of the week roll-over table above has been corrected for the UT+ with v3.2 firmware. The actual roll-over date will be 8 April 2020.

10 March 2019 – Added CNS Systems, Inc. as a source for additional receiver testing and consultation

15 March 2019 – Added (1) the roll-over date of January 11, 2019 for the UT+ model number R5xxxUxxx4 with v3.1 firmware. (2) roll-over date of February 26, 2015 for the XT Oncore model number A1xxxxBxx5. (3) roll-over date of February 26, 2015 for the VP\B4 Oncore model number B4xxxPxxx5.

16 March 2019 – Recent testing indicated that even the "normally reliable" @@Cj Receiver ID message does not always return a Software Date that coincides with Motorola's published material or the information in the @@Cj Receiver ID message itself. For example, this UT+ receiver should have rolled-over in August of 2018 but it is still working normally as of March 14, 2019:

UT+ Timing v3.0	8	R5xxxUxxxx3	1/1999	12/18/1998	8/3/2018

Also Added (missing until now):

UT+ Timing v3.1	8	R5xxxUxxxx4	4/1999	5/28/1999	1/11/2019

Added two more links for explanation of the NavStar GPS Satellite constellation's GPS End of Week (EOW) Roll-Over coming on April 6, 2019

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