



ANNEX A

MANUFACTURER SUPPLIED INFORMATION

Exhibit 5v – Self-test indication of insufficient battery energy

C/S T.007 Issue 5 Revision 7 June 2021 section 5.v

technical information for characterisation of the self-test indication of insufficient battery energy to be provided as per Table F-E.5:

- *Minimum Duration of Continuous Operation (C_{CO}), which is declared by the manufacturer in the type-approval application form, Annex G of document C/S T.007, as the Operating Lifetime;*
- *Full Battery Pack Capacity (C_{BP}), which is defined as the duration in hours that a beacon with a fresh battery pack will continuously operate for in the worst-case operating mode (i.e. operating mode that draws the highest current from the battery) until it the beacon fails to meet C/S T.001 requirements;*
- *Capacity corresponding to the Pre-Operational Losses (C_{PO}), which is defined as the duration in hours required to deplete the fresh battery by the value corresponding to the Calculated Battery Pack Pre-Discharge (L_{CDC}) of the Table F-E.2 * by operating the beacon in the worst-case operating mode;*
- *Spare battery pack capacity at ambient temperature (C_{SP-AMB}), which corresponds to the battery energy that could remain after the beacon with a pre-discharged battery has been operated in the worst-case mode at minimum temperature for the duration of the declared minimum continuous operation. C_{SP-AMB} may be calculated as the Full Battery Pack Capacity (C_{BP}) deducted by the sum of the Capacity of Pre-Operational Losses (C_{PO}) and the Minimum Duration of Continuous Operation (C_{CO}). The value of C_{SP-AMB} shall be declared by the beacon manufacturer or measured by the test facility; and*
- *Description of conditions and specification of criteria that shall be met to trigger the indication of Potentially Insufficient Battery Energy (PIE) during self-test.*

Table F-E.5: Indication of Insufficient Battery Energy

Parameter	Units	Declared by beacon manufacturer	Verified and evaluated by accepted test facility	Notes
Minimum duration of continuous operation (Cco)	hours	54h10 (406Mhz + 121.5Mhz to cover both op life scenarios)		Cco is declared in Annex G as "Operating Lifetime". Cco is required for the test. Minimum duration of continuous operation (Cco)
Full Battery Pack Capacity (CBP)	hours	80h20		If needed to calculate CSP-AMB
Battery Pre-Operational Losses (CPO)	hours	4h30 (0.9A.h @200mA outside the beacon)		Corresponds to LCDC, as defined in the Table F-E.2
Spare Battery Capacity at ambient temperature (CSP-AMB)	hours	21h40		CSP-AMB is required for the test, and shall be defined by testing (see Footnote 4 to section A.3.6.2.2), or by calculation, as follows: $CSP-AMB = CBP - (CPO + CCO)$
Criteria and conditions to trigger PIE indication		Remaining capacity $\leq CCO$ (As described above)	-	Description of PIE criteria and conditions to be met to trigger PIE indication. Use a separate sheet if needed
Step-1: battery pack discharge	hours	Discharge battery for 4 hours @200mA outside the beacon		Battery discharge shall correspond to: CPO - 30 minutes, or the value declared by the beacon manufacturer less 30 minutes
Step-1: beacon conditions (if applicable)		-		Description of conditions recreated during the Step-1 for which the PIE criteria is not met
Step-1: observations of self-test indication		Green LED on SELF-TEST		Test facility observations of self-test indication: time, duration, type of indication
Step-2: battery pack discharge	hours	Run beacon in Manual ON mode for 22h40		Total battery discharge shall correspond to: CPO + CSP-AMB + 30 minutes or the value declared by the beacon manufacturer plus 30 minutes
Step-2: beacon conditions (if applicable)		-		Description of conditions recreated during the Step-2 for which the PIE criteria is met
Step-2: observations of distinct PIE indication		SELF-TEST With error: Red LED 3 + 3 flashes		Test facility observations of PIE indication: time, duration, type of indication

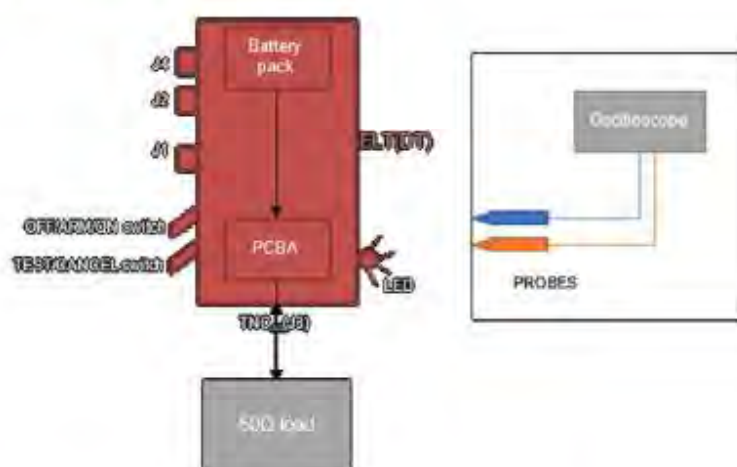
Exhibit 5j-i – Protection Against Continuous Transmission

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j. Statements and descriptions, complete with diagrams as necessary, to demonstrate that the design:

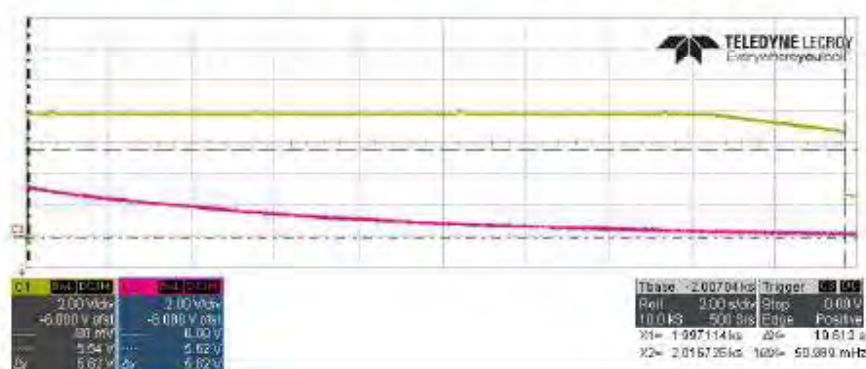
i. Provides protection against continuous transmission (see section A.3.4)

This test aims at checking that the ELT(DT) limits any inadvertent continuous 406MHz transmission to a maximum of 45 seconds.



A specific firmware is used to set the 406MHz signal continuously transmitting.

On the screenshot below, the 406MHz signal driver is checked (C1 yellow curve)



Conclusion:

The 406MHz signal driver stops transmitting after 19.612 sec even if the 406MHz transmission is continuously forced

The beacon design provides protection against continuous transmission (see section A.3.4)

Exhibit 5j-ii – Self-test Characteristics

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j. Statements and descriptions, complete with diagrams as necessary, to demonstrate that the design:

ii. provides protection from repetitive self-test mode transmissions (see section A.3.6.1),

Protection against repetitive self-tests

The beacon can perform three different self-test sequences:

1. an automatic check called EBIT
2. a short duration standard self-test, and
3. a long duration GNSS self-test on the internal position device

EBIT

The EBIT sequence is initiated by pressing, holding, then releasing the TEST button less than 5 seconds. The FPGA monitors the duration of the TEST button presses; looking for firm, continuous requests, thus avoiding accidental self-tests. Once EBIT is initiated the beacon executes a linear code function that runs just once. During EBIT, beacon integrity is checked but no RF transmissions occurs. It is not possible to restart the EBIT function during the test sequence

When entering in EBIT mode, the TEST LED single flash confirms that EBIT has been initiated. If EBIT has passed the TEST LED flashes green for 3 seconds. If EBIT fails, then the TEST LED flashes in red 3 times then N times, depending the defect. After completing the self-test indications, the beacon returns in ARM mode.

Self-test

The self-test sequence is initiated by pressing, holding, then releasing the TEST button after 5 seconds and less than 10 seconds. The FPGA monitors the duration of the TEST button presses; looking for firm, continuous requests, thus avoiding accidental self-tests. Once self-test is initiated the beacon executes a linear code function that runs just once. The RF transmissions can occur only once per self-test. It is not possible to restart the self-test function during the test sequence.

When entering in self-test mode, the TEST LED double flash confirms that self-test has been initiated and 406MHz burst will be emitted. If self-test has passed the TEST LED flashes green for 3 seconds. If self-test fails, then the TEST LED flashes in red 3 times then N times, depending the defect. After completing the self-test indications, the beacon returns in ARM mode.

GNSS Self-test

The GNSS self-test sequence is initiated by pressing, holding the TEST button for more than 10 seconds. The FPGA monitors the duration of the TEST button presses; looking for firm, continuous requests, thus avoiding accidental GNSS self-tests. Once GNSS self-test is initiated the beacon executes a linear code function that runs just once. The



RF transmissions can occur only once per GNSS self-test. It is not possible to restart the self-test function during the test sequence.

When entering in GNSS self-test mode, the TEST LED triple flash confirms that GNSS self-test has been initiated. The beacon checks if the number of GNSS self-tests limit have been reached. If the limit is reached, the beacon indicates a specific red flash pattern on the TEST LED.

When a position fix is acquired, a 406 MHz transmission is sent containing the encoded location. If no position is acquired in 180 seconds (+10 seconds of TEST button pressing) after GNSS self-test sequence, a 406MHz transmission is sent, containing the default position.

After 406MHz transmission, GNSS self-test result is displayed on TEST LED in the same way than self-test: 3 seconds solid green for test OK, and 4 red flashes + N flashes when test is KO.

After completing the GNSS self-test indications, the beacon returns in ARM mode.



ANNEX B

BATTERY CURRENT MEASUREMENT COMPARISON BETWEEN ULTIMA-DT-05 AND ULTIMA-DT-06

		Battery Current Measurements – ULTIMA-DT-06 (Document 75957724)	Battery Current Measurements – ULTIMA-DT-05 (Document 75954288)	% Difference between Battery Current Measurements on ULTIMA-DT-05 and ULTIMA-DT-06
A1	1. OFF	-3.672E-08	-1.050E-07	-65.03
A2	2. ARMED disabled mode (including periodic EBIT)	-7.909E-08	1.950E-04	-100.04
A3	3. ARMED enabled mode	-4.789E-08	1.870E-04	-100.03
A4	4. ARMED – WITHOUT 28V supply	9.086E-08	3.230E-05	-99.72
A5	5. EUT activation from ARINC429 Interface (label 202) ONLY 406MHz (T0 to T1 = T0+6h10) - NO GNSS SIGNAL	N/T	116.69	N/A
A6	6. EUT activation from ARINC429 Interface (label 202) ONLY 406MHz (T0 to T1 = T0+6h10) - GNSS SIGNAL	N/T	115.16	N/A
A7	7. EUT activation WITH 28V power supply loss ONLY 406MHz (T0 to T1 = T0+6h10) - NO GNSS SIGNAL	N/T	116.95	N/A
A8	8. EUT activation from Activation with Crash Sensor 406MHz + 121.5MHz - NO GNSS SIGNAL	122.9	122.69	0.17
A9	9. EUT 121.5MHz after 24hours of beacon operation - NO GNSS SIGNAL	26.18	28.78	-9.03
A10	10. EUT activation from beacon front panel control 406MHz + 121.5MHz - NO GNSS SIGNAL	121.38	125.29	-3.12
A11	11. EUT activation from Remote Control Panel (RC820) 406MHz + 121.5MHz - NO GNSS SIGNAL	121.49	125.69	-3.34
A12	12. Self-test activation from beacon front panel control	N/T	64.98	N/A
A13	13. Self-test from beacon from Remote Control Panel (RC820)	62.39	64.8	-3.72
A15	15. GNSS Self-test from beacon front panel control – NO GNSS SIGNAL	28.41	30.38	-6.48
A16	16. GNSS Self-test from beacon front panel control – GNSS SIGNAL	60.71	62.04	-2.14
A17	17. Cancellation message from beacon front panel control (after EUT activation from beacon front panel control)	N/T	136.97	N/A
A18	18. Cancellation message from ARINC429 Interface (label 202) (after EUT activation from ARINC429 Interface (label 202))	141.12	139.17	1.40
A19	19. EUT activation from beacon front panel control 406MHz + 121.5MHz - NO GNSS SIGNAL and REMOVING 28V just after beacon manual activation	122.23	124.34	-1.70