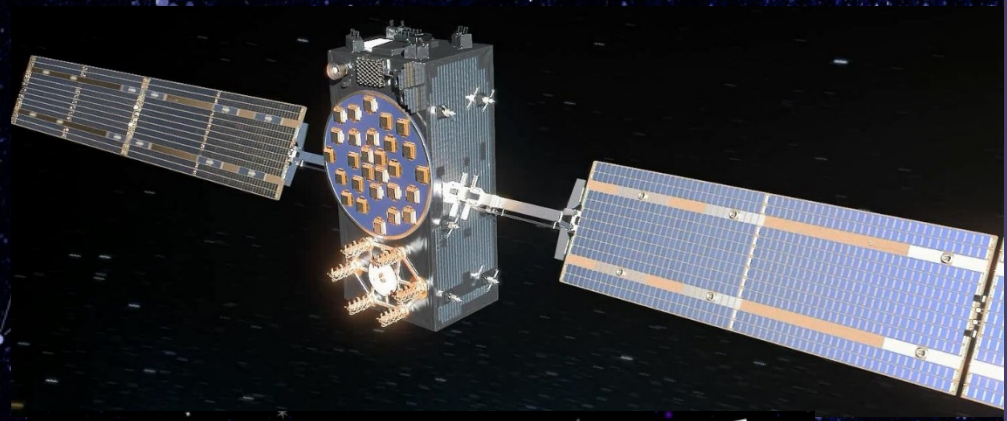
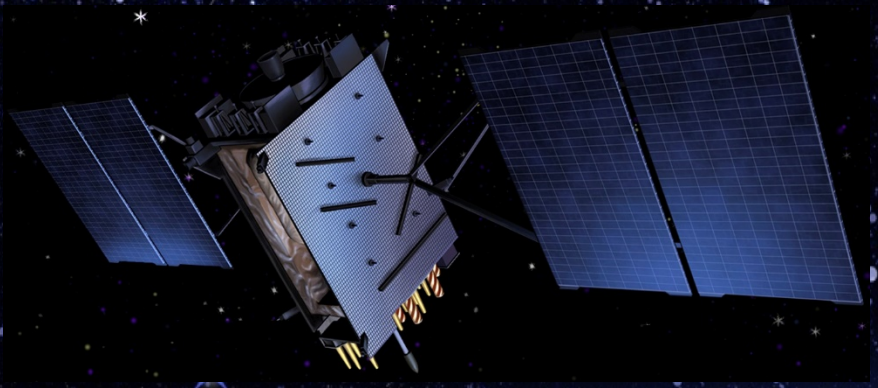
RESCUE OF **46 500**
PERSONS ASSISTED
SINCE 1982

1753 PERSONS IN 395 MARITIME EVENTS IN 2017





COSPAS-SARSAT

PRESENTATION TO BEACON MANUFACTURERS WORKSHOP

BEACON TYPE APPROVAL UPDATES

ERIC HARPELL
TECHNICAL OFFICER

Type Approval Process Update Since May 2017

- Changes to documents T.001 and T.007 at JC-31 and as approved at CSC-59.
- Description of the changes from EWG-1/2018 as approved at CSC-60, (focus on the "red-line" documents from the website for that description (T.001/T.007/T.008)).
- Describe the "new" marked-up tracking that has been introduced and published as documents are approved.

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Type Approval Process Update Since May 2017

- Describe the “new” process for test facility recertification from document C/S T.008.
- Introduce the “Minor Beacon Changes” Basecamp Project
- Introduce the “T.001/T.007” Basecamp Project

Type Approval Process Update Since May 2017

- Changes to document C/S T.001 from JC-31 as approved at CSC-59
- Changes to document C/S T.001 from EWG-1/2018 as approved at CSC-60

COSPAS SARSAT

Main C/S T.001-related amendments Approved at CSC-59

Para 2.2.1 Repetition Period

For ELT(DT)s the value of the repetition period shall be:

a) 5 seconds + 0.0 / - 0.2 seconds during the first ~~30~~ *120* seconds after beacon activation; ~~and~~

b) 10 seconds + 0.0 / - 0.2 seconds between 120 seconds and 300 seconds after beacon activation; and

c) after the first ~~30~~ *300* seconds after beacon activation until the beacon is deactivated the period shall be randomised around a mean value of 28.5 seconds, so that time intervals between transmissions are randomly distributed on the interval 27.0 to 30.0 seconds.

Main C/S T.001-related amendments Approved at CSC-59 (Topics)

- Amendments in document C/S T.001
  - Auxiliary Radio Locating Device in Section 4.5.3
  - Controls for Beacon Self-test and Activation in Sections 4.5.4 and 4.5.6
  - RLS Operating Cycle (6 hours) in Section 4.5.7.2.1
  - Confirm RLM in Section 4.5.7.4
  - Country Code in Section A1.2.3
  - Editorial changes in Annex A
  - Reserve FGB “Protocol” for SGBs in Table A2.1

COSPAS SARSAT

Main C/S T.001-related amendments Approved at CSC-59 (Topics)

- ELT(DT) Related Amendments in document C/S T.001
  - Repetition Rate change in Section 2.2.1
  - Cancellation Message clarification in Section 3.3
  - ELT(DT) Navigation Device Requirements in Section 4.5.5.6
  - Define Requirements for Crash Survivable ELT(DT) 4.5.10 (+five subsections)

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Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

- EWG-1/2018 was conducted from the 10th to 16th of April 2018 and made the following recommendation to the Council (See EWG-1/2018/Report, section 8.15):

  "The Experts Working Group RECOMMENDED that the Council, at its earliest opportunity, approve the proposed amendments to document "Specification for Cospas-Sarsat 406 MHz Distress Beacons" as provided at Annex 5 to this Report as document C/S T.001, Issue 4 - Draft Revision 3."

- This decision by the Council to approve this document was communicated to participants and interested organizations by letter CS18/142/F400/F500, signed by the Council chair and dated 10 August 2018.

COSPAS SARSAT

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

- At CSC-59, the Council requested the Secretariat to produce "marked-up" versions of the approved C/S documents in addition to the final approved versions.
- For the version of document C/S T.001 approved at CSC-60, the Secretariat has placed on the Cospas-Sarsat website a (with markup) version of the approved document which is available under the version history pulldown.
- The website interface is shown on the next slide
- An example of the changes as approved for this version of document T.001 are shown as an extraction from the "with markup" version on the following slide (and a complete set is available in the backup slides).

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

System Documents

Show instructions

export selection as a ZIP file

C/S T.000 Series - Technical

C/S T.000 Series - Technical

Filter: search this table Reset

select all	C/S Ref.	File	Document Title	Issue	Revision	Dated	Archives
	C/S T.001	English	Specification for Cospas-Sarsat 406 MHz Distress Beacons	4	3	June 2018	▲

- **Specification for Cospas-Sarsat 406 MHz Distress Beacons (with markup), issue 4, revision 3.**
  Dated: June 2018
  Available file(s):English
- **Specification for Cospas-Sarsat 406 MHz Distress Beacons, issue 4, revision 2.**
  Dated: Feb 2018
  Available file(s):English

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

4.5 Operational Requirements

4.5.1 Duration of Continuous Operation

The minimum duration of continuous operation shall be at least 24 hours* at any temperature throughout the specified operating temperature range.

The minimum duration of continuous operation for the ELT(DT) to meet the ICAO GADSS requirement at any temperature throughout the specified operating temperature range shall *be* ~~be 20‡ hours~~ *370 minutes.*

* For installations meeting IMO GMDSS requirements, a minimum operating lifetime of 48 hours at any temperature throughout the specified operating temperature range is necessary.

~~‡ This duration is based on the ICAO requirement for the ELT(DT) to transmit for the maximum duration of the flight.~~ *This duration is based on ICAO standards for Extended Diversion Time operations (EDTO) and the maximum diversion time capability of exhisting aircraft types, as of April 2018.*

Main C/S T.001-related amendments Approved at CSC-60 (Topics)

- Amendments in document C/S T.001
  - Derivation of M_{Offset} in Section 4.5.7.2.2
  - Add reference for CRC Calculation
  - Add CRC example in Annex B

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Main C/S T.001-related amendments Approved at CSC-60 (Topics)

- ELT(DT) Related Amendments in document C/S T.001
  - 370 min duration of minimum operation change in Section 4.5.1
  - Allow proprietary GNSS sentences in Section 4.5.7.1
  - Add External Power Source for ELT(DT) Section 4.5.11

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Type Approval Process Update Since May 2017

- Changes to document C/S T.007 from JC-31 as approved at CSC-59
- Changes to document C/S T.007 from EWG-1/2018 as approved at CSC-60

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Main C/S T.007-related amendments Approved at CSC-59

Para 2.2 Testing

[…]

These tests will determine if beacons comply with this document, with the "Specification for Cospas-Sarsat 406 MHz Distress Beacons" (C/S T.001), and with the document "Cospas-Sarsat 406 MHz Frequency Management Plan" (C/S T.012).

Type approval testing shall be conducted at accepted Cospas-Sarsat test facilities unless stated otherwise in this document.

Tests conducted in *accepted test facilities during type-approval testing, and in* beacon manufacturing facilities during development of new beacon models or production unit testing must not cause harmful interference to the operational Cospas-Sarsat system. The level of 406 MHz emissions from beacon manufacturing facilities should be less than -51 dBW in an area immediately external to the manufacturers' facility. The -51 dBW is equivalent to a power flux density of -37.4 dB (W/m2) or a field intensity of 11.6 dB (V/m).

Main C/S T.007-related amendments Approved at CSC-59 (Topics)

- Amendments in document C/S T.007
  - A number of editorial changes in sections:
    - 2.2, 3.2, 5, 6.4.1, 6.4.2, 6.7, 6.9, A.3.9.2, Annex F, Annex G, Annex H, Annex L, Annex M
  - Review of Type Approval Application in Section 2.3
  - Type Approval Certificate in Section 2.4
  - Letter of Compatibility in Section 2.5
  - Test Units in Section 4.3
  - Test Conditions in Section 4.4

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Main C/S T.007-related amendments Approved at CSC-59 (Topics)

- Amendments in document C/S T.007
  - Test Report in Section 4.7
  - Technical Data in Section 5
    - Electronic forms
    - National User Protocol
    - Potential Insufficient Energy
    - Various Manufacturer declarations
  - Beacon Changes Description in Section 6.2
  - Request for an Additional TAC process in Section 6.12

Main C/S T.007-related amendments Approved at CSC-59 (Topics)

- Amendments in document C/S T.007
  - General “Guidelines” in Section A.1
  - Add a footnote defining float line in Section A.2.1
  - Beacon Coding Software in Section A.2.8
  - Testing Self Test-Mode in Section A.3.6.1
  - New PIE Test in Section A.3.6.2
  - Testing GNSS Self-Test Mode in Section A.3.6.1
  - Position Data Encoding in Section A.3.8.7

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Main C/S T.007-related amendments Approved at CSC-59 (Topics)

- Amendments in document C/S T.007
  - M_{Offset} in Section A.3.8.8.1
  - UTC Test in Section A.3.8.8.2
  - Testing of Controls in Section A.3.10.1 and A.3.10.2

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Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

- EWG-1/2018 was conducted from the 10th to 16th of April 2018 and made the following recommendation to the Council (See EWG-1/2018/Report, section 7.1.10):

  "The Experts Working Group RECOMMENDED that the Council, at its earliest opportunity, approve the proposed amendments to document "Cospas-Sarsat 406 MHz Distress Beacon Type-Approval Standard", provided at Annex 6 to this Report as document C/S T.007, Issue 5 - Draft Revision 2."

- This decision by the Council to approve this document was communicated to participants and interested organizations by letter CS18/142/F400/F500, signed by the Council chair and dated 10 August 2018.

COSPAS SARSAT

Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

- At CSC-59, the Council requested the Secretariat to produce "marked-up" versions of the approved C/S documents in addition to the final approved versions.
- For the version of document C/S T.007 approved at CSC-60, the Secretariat has placed on the Cospas-Sarsat website a (with markup) version of the approved document which is available under the version history pulldown.
- An example of the changes as approved for this version of document T.007 are shown as an extraction from the "with markup" version on the following slide (and a complete set is available in the backup slides).

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Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

4.4 Test Conditions

Tests shall be conducted by test facilities accepted by Cospas-Sarsat, unless allowed otherwise herein. It is advisable that the manufacturer, or his representative, witness the tests.

The tests shall be carried out on the test beacon with its own power source and without any additional thermal shielding around the beacon that might prevent it from being exposed to the specified test temperature. However, shields and deflectors inside the chamber designed to prevent the beacon from being exposed to temperatures lower or higher than the specified test temperature are permitted. In cases, when such additional shields and deflectors are used in thermal chambers, this shall be documented with photographs and reflected in the test reports.

See 22 Slides in Backup Material

~~If the ELT(DT) has an external power source that is used to power it or some parts of it when it is in the ARMED mode of operation, as defined in section 4.5.6.1 of document C/S T.001, this power source shall be set to the minimum voltage of the external power source, as specified by the beacon manufacturer during testing.~~ *If the ELT(DT) has an external power source, as defined in section 4.5.11 of document C/S T.001, that is used to power the main beacon electronics when it is in the ON or ARMED mode of operation, as defined in section 4.5.6.1 of document C/S T.001, the beacon shall be tested as per section A.2.10.* For ELT(DT)s where tests refer to the beacon under test being 'off' or 'deactivated' or being 'turned on for 15 minutes prior to the start of a test', these conditions shall be taken to mean that the ELT(DT) is in its ARMED mode of operation.

Main C/S T.007-related amendments Approved at CSC-60 (Topics)

- Amendments in document C/S T.007
  - A number of editorial changes in sections:
    - Sections 6.12, A.3.8.8.1, A.3.8.8.2, A.3.9.2,
    - Table D.5, F.2
    - Pages F-6, F-10, F-11, G-2
  - Test Conditions for External Power in Section 4.4
  - Testing ELT(DT) External Power in Section A.2.10
  - Encoded Position Data Update Interval in Section A.3.8.3
  - GNSS Simulations in Section K.2.2, K.2.3, and K.3

Main C/S T.008-related amendments from EWG-1/2018 Approved at CSC-60

- EWG-1/2018 was conducted from the 10th to 16th of April 2018 and made the following recommendation to the Council (See EWG-1/2018/Report, section 5.16):

"The Experts Working Group RECOMMENDED that the Council:

a) note that in the proposed amendments recommended to document C/S T.008, partial re-certification would be required for those existing accepted test facilities wishing to extend their capabilities to perform type approval testing on C/S T.001-compliant ELT(DT)s and/or SGBs; and

b) at its earliest opportunity approve the draft amendments to document "Cospas-Sarsat Acceptance of 406 MHz Beacon Type Approval Test Facilities" as provided at Annex 7 to this Report as document C/S T.008, Issue 3 - Draft Revision 1."

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Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

- This decision by the Council was communicated to participants and interested organizations by letter CS18/142/F400/F500, signed by the Council chair and dated 10 August 2018. Of particular interest to this group was its final paragraph, stating:

"Additionally, with respect to new section 2.5 of document C/S T.008, Issue 3 - Revision 1, which addresses an "Acceptance Process for Approved Test Facilities Wishing to Extend their Test Capabilities", the Council at CSC-60 further decided that testing of C/S T.001-compliant ("first-generation beacon" or "FGB" based) ELT(DT)s, and all testing of second-generation beacons ("SGBs"), will be considered as "extended capabilities", requiring partial recertification in accordance with section 2.5 for accepted test facilities wishing to extend their capabilities to perform such type approval testing."

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Type Approval Process Update Since May 2017

2.5 Acceptance Process for Approved Test Facilities Wishing to Extend their Test Capabilities

~~[this section is under development]~~

Extended capabilities are the ability to test either different generations of beacon or new features and capabilities added to beacons. These extended capabilities are reflected in new type approval standards or changes to existing type approval standards that are determined by the Council to be significant enough that a recertification of the test facility is required to ensure that they can satisfactorily perform the necessary additional testing requirements.

For those accepted Cospas-Sarsat test facilities already holding an accreditation to perform type-approval testing of documents C/S T.001/T.015/T.018-compliant beacons and wishing to extend type-approval testing capabilities the acceptance process shall be as follows:

a) the test facility would submit its application form (see Annex D) specifying what capabilities are to be added plus any relevant technical data (see section 3.2) needed to extend test capabilities to the Secretariat;

b) the submission would then be reviewed by the Secretariat and Parties' technical experts (technical team). This technical team will determine which, if any, type approval tests from the appropriate document listed in section 1.3 need to be conducted based on the desired capabilities to be added to the currently approved capabilities of the test facility;

c) the type approval tests determined by the technical team are then performed on a test beacon provided by the applicant or borrowed from Cospas-Sarsat;

d) an on-site technical visit may be conducted by one or more of the technical team members to observe tests being performed, including antenna tests;

e) if the test beacon has not previously been tested, either at another already approved test facility, or at facilities designated by the Cospas-Sarsat Parties, the beacon would subsequently be tested by one of these facilities;

f) upon completion of the tests, test reports will be written and sent to the Secretariat by the applicant, and by the approved test facility or facilities designated by the Cospas-Sarsat Parties, as applicable. The reports will be reviewed by the technical team and their findings will be provided to the applicant, to the Cospas-Sarsat Parties and to the Joint Committee for review and recommendations to the Council;

g) if anomalies are detected in the test data, and the technical team identifies specific necessary modifications to the facility's testing procedures during the review, the test facility may be asked to perform modified tests;

h) The technical team may also propose corresponding clarifications to the applicable Cospas-Sarsat document listed in section 1.3 to the next Joint Committee meeting for review and recommendation to the Council; and

i) if the documentation demonstrates that the test facility meets the Cospas-Sarsat requirements, the Cospas-Sarsat Parties may grant interim acceptance of the facility until the formal review by the Joint Committee and Council has been completed.

Type Approval Process Update Since May 2017

3.8 Retention of Test Facility Acceptance

The retention of test facility acceptance is the responsibility of the test facility. This will be accomplished by supplying to the Cospas-Sarsat Secretariat:

- a letter submitted annually by May stating their intention to retain *their* Cospas-Sarsat acceptance and confirming that their test facility continues to meet *the* Cospas-Sarsat requirements *for which they were previously accepted;*
- *a list attached to the letter that would include the following technical data:*
  - *a) a list of any additional test equipment required including, serial number and model number;*
  - *b) test equipment calibration reports for any additional test equipment showing traceability to National Standards;*
  - *c) a description of any new software to be used;*
  - *d) a copy of any new technical procedures they intend to use during approval testing; and*
  - *e) a list of the actual test facility measurement uncertainties for the new procedures / equipment*; and
- a reassessment of the facility's Quality Assurance Programme by a national accreditation organization every five years.

Certified Test Facilities

There are five accepted beacon test facilities certified for T.001 beacons as shown on the Cospas-Sarsat website:

- Cospas-Sarsat Beacon Certification Facility, Fort Huachuca, AZ, USA
- Test Center MAYAK BINCOS , Moscow, Russia
- Test Center “TC NIIR”, Moscow, Russia
- Testing center "Omega“, Sevastopol, Ukraine
- TÜV SÜD Product Service, Fareham, Hampshire, UK

Type Approval Process Update Since May 2017

- Two Basecamp Projects have been created to support the development of FGB related amendments
- “Minor Beacon Changes” Basecamp Project
- “T.001/T.007” Basecamp Project
- Anyone interested in being added to these two projects are invited to email the Cospas-Sarsat Secretariat and request access to the projects of interest

Type Approval Process Update Since May 2017

Beacon Minor Changes

Chair: TBD

Invite more people
19 people on this project

Catch up
on recent changes

3 Discussions **5 Files** Add the first: To-do list Text document Event

Latest project updates

Jun 13 You gave Thomas access to the project: Beacon Minor Changes
Jun 4 Chris H. commented on EWG-1/2018 Related Information
Jun 1 You commented on EWG-1/2018 Related Information

See all updates

Discussions

Post a new message

Watch a quick video about Discussions

Chris H.	**EWG-1/2018 Related Information** - Hi Eric, Thanks for the update, the plan is to spend some time on this subject during the RTCM TAW meeting next Wednesday June 13.	Jun 4	3
Eric H.	**JC-31 Action Item (JC-31/AI.13)** - Extract of JC-31 Report on Minor Beacon Changes	Mar 15	1
Eric H.	**JC-31 Papers, CSC-59 Papers** - These are the papers related to this group. From CSC-59 SR POLICY FOR MINOR BEACON CHANGES 4.3.28 The Council NOTED from document CSC-	Mar 15	

Files

Add files

Watch a quick video about Files

Type Approval Process Update Since May 2017

T.001/T.007

Invite more people
21 people on this project

Catch up
on recent changes

8 Discussions **6 Files** Add the first: To-do list Text document Event

Latest project updates

Sep 17 You commented on Outstanding JC-31 Action Items relevant to RTCM SC110 and TAW
Sep 17 You commented on Duration of Continuous Operation vs Operating Lifetime
Sep 17 You commented on Request to clarify T.001, section 4.5.4

See all updates

Discussions

Post a new message

Watch a quick video about Discussions

Eric H.	**Outstanding JC-31 Action Items relevant to RTCM...** - Status Update: JC-31/AI.7 Development of the TAC allocation Concept -> See JC-32/3/14 (Sec) JC-31/AI.11 Programming devices -> See JC-	Sep 17	1
Eric H.	**Duration of Continuous Operation vs Operating...** - This matter has been addressed in Paper JC-32/3/16. Regards, Eric	Sep 17	1
Eric H.	**Request to clarify T.001, section 4.5.4** - This issue has been added to paper JC-32/3/16 on page 1 of Attachment 1. Regards, Eric	Sep 17	4
Eric H.	**New Versions of T.001 and T.007 have been posted** - We have made some minor corrections to the electronic forms to correct errors that were identified through	Aug 16	2
Andryey Z.	**Minor Updates to document C/S T.007** - Dear colleagues, In addition to the amendments listed in Eric's email, the following technical edits were applied to both documents: C/S T.007, Issue 5 - Draft	May 18	6

COSPAS SARSAT

For More Information

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Back-up Slides

COSPAS SARSAT

Main C/S T.001-related amendments Approved at CSC-59

Para 2.2.1 Repetition Period

For ELT(DT)s the value of the repetition period shall be:

a) 5 seconds + 0.0 / - 0.2 seconds during the first ~~30~~ *120* seconds after beacon activation; ~~and~~

b) 10 seconds + 0.0 / - 0.2 seconds between 120 seconds and 300 seconds after beacon activation; and

c) after the first ~~30~~ *300* seconds after beacon activation until the beacon is deactivated the period shall be randomised around a mean value of 28.5 seconds, so that time intervals between transmissions are randomly distributed on the interval 27.0 to 30.0 seconds.

Main C/S T.001-related amendments Approved at CSC-59

Para 3.3 Cancellation Message (ELT(DT) only)

When the ELT(DT) is deactivated the ELT(DT) shall *transmit the first cancellation messages within* ~~*[5]*~~ *seconds, and* transmit *a total of* 10 identical cancellation messages ~~transmitted~~ at intervals of 10 seconds ±0.5 seconds, after which time the beacon shall cease transmitting. In the case the ELT(DT) is activated (e.g., triggered) during the cancellation sequence, the beacon shall terminate the cancellation transmission sequence and reinitiate the alert sequence per section 2.2.1.

The content of the Cancellation Message is documented in Annex A, section A3.3.8 and table A11.

Main C/S T.001-related amendments Approved at CSC-59

Para 4.5.3 Auxiliary Radio Locating Device

~~The distress beacon may incorporate an auxiliary* radio locating device at another frequency (121.5 MHz, 9 GHz SART, etc.) which is compatible with existing radio locating equipment.~~

The transmission of the 406 MHz satellite signal shall take precedence over any Radio-Locating Signals. Homing signal types should be momentarily interrupted, delayed, rescheduled, or eliminated according to the relevant standard for each type, in order to ensure that homing signals are not transmitted at the same time as the 406-MHz signal to satellites.

The distress beacon may transmit radio-locating signals in compliance with appropriate national or international standards. The inclusion of any Radio-Locating Signals within a beacon and the prioritization of these Radio-Locating Signals is the responsibility of the appropriate national or international bodies.

Any such radio-locating device must satisfy all the national performance standards applicable to radio-locating devices at the selected frequency.

~~* Any such auxiliary radio locating device must satisfy all the national performance standards applicable to radio locating devices at the selected auxiliary frequency.~~

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Main C/S T.001-related amendments Approved at CSC-59

Para 4.5.4 Beacon Self Test Mode

[…]

The complete self-test transmission must be limited to one burst only *regardless of the duration of activation of the self-test control*. The maximum duration of the self-test mode transmission should be 440 ms (+1%) for a short message and 520 ms (+1%) for a long message. If a 440 ms transmission is used for beacons encoded with the long format messages, it is recommended that the message be truncated without changing the format flag bit.

[…]

The self-test function shall perform an internal check and provide distinct indication that:

a) […]

d) the beacon battery may not have sufficient energy to support beacon operation for the declared operating lifetime*.

* Self-test indication of insufficient battery energy shall commence prior to the point, at which the residual battery energy is less than the energy required to support the minimum duration of continuous operation, as declared by the beacon manufacturer.

COSPAS SARSAT

Main C/S T.001-related amendments Approved at CSC-59

Para 4.5.4 Beacon Self Test Mode (Continued)

[…]

Location protocol beacons which provide for the transmission of an encoded position in a GNSS self-test message shall:

a) activate the GNSS self-test mode via a distinct operation from the normal self test mode, but the GNSS self-test mode may be activated via the same self test switch(es) or operation provided that it shall require a separate, deliberate action by the user that would limit the likelihood of inadvertent activation, and shall not result in more than a single self-test burst *regardless of the duration of activation of the GNSS self-test control*;

[…]

f) provide an automatic termination of GNSS self-test mode, irrespective of the switch position, immediately after completion of the GNSS self-test cycle and indication of the test results; and

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Main C/S T.001-related amendments Approved at CSC-59

Para 4.5.5.6 ELT(DT) Navigation Device Requirements

[…]

The initial position transmitted in the first burst may be obtained from either the internal navigation device or from the external navigation device input. The transmission in the beacon message of this external source of position is only subsequently allowed if the internal GNSS receiver is not able to produce a valid encoded position less than 2 seconds before the burst. If position data is available from both sources, within 2 seconds before the burst, then the location produced by the internal GNSS receiver has the priority over the external source of data*. ~~Subsequently all future positions shall only be obtained from the internal navigation device*.~~

[…]

* The internal navigation device or even the entire ELT(DT) may be powered by an external source prior to its activation in order to comply with this requirement, but must be powered solely by the ELT(DT)'s internal power source immediately after activation of the ELT(DT). *The ELT(DT) shall have its own integral or internal power source. However, when available, the ELT(DT) may use aircraft electrical power source during transmission after its activation. ELT(DT) system minimum duration of continuous operation shall however be demonstrated with the ELT(DT) own internal/integral power source.*

COSPAS SARSAT

Main C/S T.001-related amendments Approved at CSC-59

Para 4.5.6 Beacon Activation

The beacon should be designed to prevent inadvertent activation.

After activation, the beacon shall not transmit a 406 MHz distress message until at least one repetition period (as defined in section 2.2.1) has elapsed. *Thereafter the beacon shall not transmit more frequently than the minimum repetition period (as defined in section 2.2.1) regardless of the duration of activation of any controls or the activation of any combination of controls. Once activated and transmitting the activation of any control other than the 'Off' or 'Reset' controls shall not stop the beacon from transmitting or result in inverted frame sync (self-test) mode.*

[…]

Main C/S T.001-related amendments Approved at CSC-59

Para 4.5.7.2.1 Operation Cycle

c) after the first 30 minutes, utilise UTC time to activate the GNSS receiver with the following schedule until the beacon is deactivated *or 6 hours has elapsed*~~the beacon battery has expired~~;

[…]

The GNSS receiver in the beacon continues with this operation mode until 6 hours has elapsed~~the expiration of the battery even if a Type 1 RLM has been received~~.

For instance, if the beacon transmitted an RLS protocol at 03.17h UTC, then the GNSS receiver would remain active until at least 03.47h UTC or until the beacon is deactivated if it is deactivated before that time. It would then re-activate at 04:00+Moffset and remain active until at least 04.00+Moffset+15 or until the beacon is deactivated and it would then reactivate again at 05:00+Moffset until 05.00+Moffset+15. The scheme continues until 6 hours has elapsed~~the battery has expired or the beacon is deactivated~~.

Main C/S T.001-related amendments Approved at CSC-59

Para 4.5.7.4 Confirmation of a Return-Link Message Receipt

[…]

Once the beacon has received an Acknowledgement Type-1 RLM or a Test RLM and has acknowledged the RLM receipt, the GNSS Receiver shall continue to function as required by section 4.5.7.2.1 unless the beacon is coded as a "Type-1 only capable" RLS beacon as defined in section A.3.3.7.3. In this specific case only, the GNSS receiver may revert to operating as defined within Section 4.5.5.4, taking into account the time elapsed between the moment of activation and the moment when the Type-1 RLM message is received, until either the beacon is deactivated or the beacon performance ceases to meet specification due to battery depletion.

Example:

A beacon is activated at 9:00. It transmits emergency signals for 2 hours and 30 minutes. During the period from 11:00 to 11:15 it receives a Type-1 RLM Acknowledgement. The GNSS receiver could then revert to operating in accordance to the requirements for internal GNSS receiver without the RLS capability which specifies that, for the first 6 hours after beacon activation, the navigation device shall attempt location update at least once every 30 minutes.

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Para 4.5.10 ELT(DT)s Specifically Designed to Withstand a Crash Impact (and Sub-sections)

4.5.10 ELT(DT)s Specifically Designed to Withstand a Crash Impact

4.5.10.1 Introduction

Potentially there may be ELT(DT)s that have additional functionality, as defined by National Administrations and/or Aviation Authorities, which are designed to:

1) function both prior to a crash and after a crash, and withstand crash impact conditions;

2) be activated in-flight or by crash;

3) have homing and locating signals; and/or

4) have extended operating life.

If there is a conflict between the requirements of this section and any other section of this document, then this section takes precedence.

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Para 4.5.10 ELT(DT)s Specifically Designed to Withstand a Crash Impact (Continued)

4.5.10.2 Beacon Hex ID

The Hex ID of the ELT(DT) shall not change from when activated in flight compared to when operating after a crash.

4.5.10.3 Burst Repetition Period (with Crash Detection)

If the ELT(DT) includes a crash detection function, within 5 seconds of a crash the ELT(DT) shall restart the transmission schedule for an ELT(DT) as if the ELT(DT) had just been activated.

4.5.10.4 Duration of Continuous Operation

The minimum duration of continuous operation for this type of ELT(DT) shall be at least 24 hours at any temperature throughout the specified operating temperature range. This is to be understood to mean the total operating time which is a combination of the time prior to a crash and post-crash.

4.5.10.5 Homing and Locating Signals

The inclusion or otherwise of one or more homing signals in the ELT(DT) and the activation and duration of any homing signal transmissions are the responsibility of national administrations.

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Main C/S T.001-related amendments Approved at CSC-59

Para A1.2.3 Country Code

A1.2.3 Country Code

Bits 27 36 designate a three digit decimal country code number expressed in binary notation. Country codes are based on the International Telecommunication Union (ITU) Maritime Identification Digit (MID) country code available on the ITU website (*http://www.itu.int/en/ITU-R/terrestrial/fmd/Pages/mid.aspx*).~~www.itu.int/cgi-bin/htsh/glad/cga_mids.sh~~ ~~).~~

National administrations allocated more than one MID code may opt to use only one of these codes. However, when the 6 trailing digits of a MMSI are used to form the unique beacon identification, the country code shall always correspond to the first 3 digits of the MMSI code. *This coding method should be used only if the first 3 digits (MID) forming part of a unique 9-digit code of ship station identity correspond to the 3 digit country code encoded in bits 27 to 36.*

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Para A1.3 Protocol Codes

Figure A1: Data Fields of the Short Message Format

	Bit Synchronization	Frame Synchronization	First Protected Data Field (PDF-1)				BCH-1	Non-Protected Data Field
Unmodulated Carrier (160 ms)	Bit Synchronization Pattern	Frame Synchronization Pattern	Format Flag	Protocol Flag	Country Code	Identification Data ~~or Identification plus Position Data~~	21-Bit BCH Code	Emergency Code/ National Use or Supplement. Data
Bit No.	1-15	16-24	25	26	27-36	37-85	86-106	107-112
	15 bits	9 bits	1 bit	1 bit	10 bits	49 bits	21 bits	6 bits

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Para A1.3 Protocol Codes

[…]

A2-B: Standard, ~~Location and~~ National, *RLS and ELT(DT) Location* Protocols (F=1,P=0) long message

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Para A2.1 Structure of User Protocols

Add line describing SGBs to Figure

Figure A3: Bit Assignment for the First Protected Data Field (PDF-1) of User Protocols

[…]

8. SGB PROTOCOL (Reserved for SGB – but not transmitted)								
Bits	*25*	*26*	*27 36*	*37*		*39*	*40*	*85*
.....	*...*	*1*	*Country Code*	*1*	*0*	*1*	*As Defined in C/S T.018 (46 bits)*	

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Para A2.2 Maritime User Protocol

[…]

This code enables 6 characters to be encoded using 36 bits (6x6 = 36). This data will be right justified with a modified-Baudot space (100100) being used where no character exists. If all characters are digits, the entry is interpreted as the trailing 6 digits of the MMSI. *This coding method should be used only if the first 3 digits (MID) forming part of a unique 9-digit code of ship station identity correspond to the 3 digit country code encoded in bits 27 to 36.*

[…]

Main C/S T.001-related amendments Approved at CSC-59

Para A2.5.2 Aircraft 24-bit Address

[…]

Bits 44-67 are a 24-bit binary number assigned to the aircraft. Bits 68-73 contain the 6-bit specific ELT number, in binary notation with the least significant bit on the right, which is an order number of the ELT in the aircraft*, where "000000" indicates the first ELT on the aircraft coded with this protocol and "000001", "000010", "000011", etc., identify additional ELTs, all coded with the Aircraft 24-bit Address User protocol.* ~~*or default to "0" when only one ELT is carried; the*~~ *The* purpose of this specific number is to produce different 15 Hex numbers containing the same 24-bit address.

Main C/S T.001-related amendments Approved at CSC-59

Para A3.3.7 RLS Location Protocol (see Figure A10)

Add footnote to section.

A3.3.7.3 The 26 bits available in PDF-2 are defined as follows:

[…]

b) bits 109 to 114: RLS Data

[…]

- bit 110: Capability to process manually generated RLM (e.g., Type-2)* :

"1": Manually generated RLM (such as Acknowledgement Type-2) accepted by this beacon,

"0": Manually generated RLM (such as Acknowledgement Type-2) not requested and not accepted by this beacon.

[…]

* The condition bit 109 = "0" and bit 110 = "0" is an invalid condition; at least one of these two bits must always be a "1".

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

- EWG-1/2018 was conducted in from the 10th to 16th of April 2018 and made the following recommendation to the Council (See EWG-1/2018/Report, section 8.15):

  "The Experts Working Group RECOMMENDED that the Council, at its earliest opportunity, approve the proposed amendments to document "Specification for Cospas-Sarsat 406 MHz Distress Beacons" as provided at Annex 5 to this Report as document C/S T.001, Issue 4 - Draft Revision 3."

- This decision by the Council to approve this document was communicated to participants and interested organizations by letter CS18/142/F400/F500, signed by the Council chair and dated 10 August 2018.

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

4.5 Operational Requirements

4.5.1 Duration of Continuous Operation

The minimum duration of continuous operation shall be at least 24 hours* at any temperature throughout the specified operating temperature range.

The minimum duration of continuous operation for an ELT(DT) to meet the ICAO GADSS requirement at any temperature throughout the specified operating temperature range shall *be* ~~be 20‡ hours.~~*370 minutes.*

---

* For installations meeting IMO GMDSS requirements, a minimum operating lifetime of 48 hours at any temperature throughout the specified operating temperature range is necessary.

‡ ~~This duration is based on the ICAO requirement for the ELT(DT) to transmit for the maximum duration of the flight.~~ *This duration is based on ICAO standards for Extended Diversion Time operations (EDTO) and the maximum diversion time capability of exhisting aircraft types, as of April 2018.*

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

ON - The ELT(DT) has been either activated automatically and/or has been manually activated and is transmitting 406 MHz signals in full compliance with the ELT(DT) requirements in this specification.

RESET – The ELT(DT) is deactivated and ceases transmitting distress alerts and instead transmits a sequence of cancellation messages as defined by section 3.3. Upon completion of the cancellation message sequence, the ELT(DT) reverts to the ARMED condition. The ELT(DT) can only be deactivated as defined above.

4.5.7 RLS Beacon Requirements

Beacons with a Return Link Service (RLS) function shall support message encoding with the RLS Location Protocol and National Location Test Protocol, and shall meet the following additional requirements.

4.5.7.1 GNSS Receiver

The RLS beacon shall contain an internal GNSS Receiver capable of receiving and decoding Return Link Messages (RLMs) from a Cospas-Sarsat recognised Return Link Service Provider (RLSP) and of providing these messages to the beacon in an IEC 61162-1 compliant sentence, *or in an equivalent proprietary sentence defined by the GNSS-receiver manufacturer*.

The following Return Link Messages have been defined to date:

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

4.5.7.2.2 Derivation of M_{offset}

The value of M_{offset} per each beacon is computed from the beacon 15 Hex ID, where the ~~27~~ *19* bits containing the coarse position of the beacon are considered to be filled with default bits. More specifically:

$$M_{offset} = \textbf{BIN2DEC}(\textbf{CRC16}(\text{Beacon 15 Hex ID in Binary})) \textbf{ mod } 60$$

Where BIN2DEC and CRC16 are functions performing the conversion of binary number to a decimal number and the CRC-16 of a stream of bits with polynomial x16+x15+x2+1 respectively. The CRC-16 is used to obtain a uniform distribution of M_{offset}.

An example calculation of M_{offset} is shown in Figure B.3 in Annex B.

Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

4.5.10.4 Duration of Continuous Operation

The minimum duration of continuous operation for this type of ELT(DT) shall be at least 24 hours at any temperature throughout the specified operating temperature range. This is to be understood to mean the total operating time which is a combination of the time prior to a crash and post-crash.

4.5.10.5 Homing and Locating Signals

The inclusion or otherwise of one or more homing signals in the ELT(DT) and the activation and duration of any homing signal transmissions are the responsibility of national administrations.

4.5.11 External Power Source for ELT(DT)s

The ELT(DT) shall have its own integral or internal power source. However, when available, the ELT(DT) may use the external aircraft electrical power source. An ELT(DT) shall comply with all applicable requirements regardless of power source. In addition, the ELT(DT) performance shall not be impacted by switching between power sources.

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Main C/S T.001-related amendments from EWG-1/2018 Approved at CSC-60

ANNEX B: BCH *AND CRC* CALCULATION*S*

B3 SAMPLE M_{offset} CALCULATIONS AND CRC-CODE

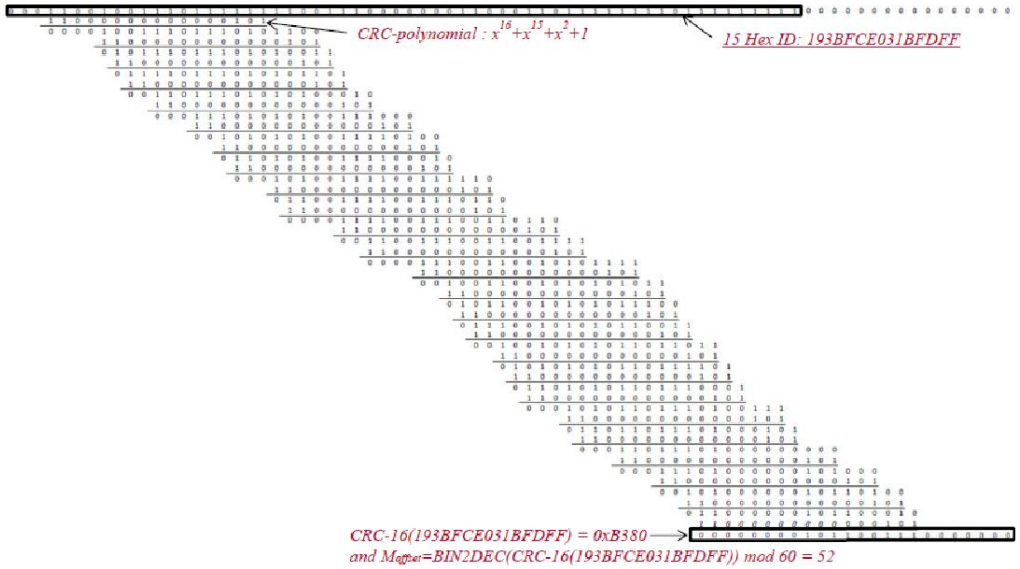

Figure B3: Sample M_{offset} Calculation

Type Approval Process Update Since May 2017

- Changes to document C/S T.007 from JC-31 as approved at CSC-59
- Changes to document C/S T.007 from EWG-1/2018 as approved at CSC-60

Main C/S T.007-related amendments Approved at CSC-59

Para 2.2 Testing

[…]

These tests will determine if beacons comply with this document, with the "Specification for Cospas-Sarsat 406 MHz Distress Beacons" (C/S T.001), and with the document “Cospas-Sarsat 406 MHz Frequency Management Plan” (C/S T.012).

Type approval testing shall be conducted at accepted Cospas-Sarsat test facilities unless stated otherwise in this document.

Tests conducted in *accepted test facilities during type-approval testing, and in* beacon manufacturing facilities during development of new beacon models or production unit testing must not cause harmful interference to the operational Cospas-Sarsat system. The level of 406 MHz emissions from beacon manufacturing facilities should be less than -51 dBW in an area immediately external to the manufacturers’ facility. The -51 dBW is equivalent to a power flux density of -37.4 dB (W/m2) or a field intensity of 11.6 dB (V/m).

Main C/S T.007-related amendments Approved at CSC-59

Para *2.3* *Review of Type-Approval Application*

Further to completion of type approval testing at a Cospas-Sarsat accepted test facility, a type approval application package comprising a technical report on type-approval testing and supporting technical data listed in section 5 of this document shall be submitted to the Secretariat for review.

The Cospas-Sarsat Secretariat will reviews the type-approval application package to verify and establish that:

a) the technical data and documentation submitted by the beacon manufacturer provide sufficient information about beacon design and its features, details of the intended operational scenarios, and that they comply with the requirements of this document;

b) the scope of type-approval testing and test procedures correspond to the requirements of this document; and

c) the results of type-approval testing provide sufficient evidence that the beacon complies with the requirements of the "Specification for Cospas-Sarsat 406 MHz Distress Beacons" (C/S T.001), and of "Cospas-Sarsat 406 MHz Frequency Management Plan" (C/S T.012).

The Secretariat should normally provide results of the review to the beacon manufacturer within approximately 30 calendar days. Once all requirements have been successfully addressed by the applicant, a summary report will be provided to the Cospas-Sarsat Parties for final approval.

Main C/S T.007-related amendments Approved at CSC-59

Para 2.4 Type Approval Certificate

Upon the successful completion of the type-approval review, a Cospas-Sarsat Type Approval Certificate (see sample in Annex M) will be issued by the Cospas Sarsat Secretariat, on behalf of the Cospas-Sarsat Council (CSC), to the manufacturer of each 406 MHz distress beacon model that is successfully tested at an accepted Cospas-Sarsat test facility. All manufacturers are encouraged to obtain a Cospas-Sarsat Type Approval Certificate for each of their beacon models. The Secretariat will treat manufacturer's proprietary information in confidence.

Cospas-Sarsat will typically issue a unique TAC number for each beacon model. The approved beacon models associated with a TAC number are documented by the Secretariat and identified on the Cospas-Sarsat web-site.

Main C/S T.007-related amendments Approved at CSC-59

Para 2.5 Letter of Compatibility (New Section)

2.5 Letter of Compatibility

At times, at the request of Cospas-Sarsat Participants, beacons could be designed to meet specific user needs while not meeting some of the Cospas-Sarsat operational requirements, e.g., the minimum duration of continuous operation, as reflected in the Cospas-Sarsat beacon specification, document C/S T.001. When such beacon models satisfy all other requirements in document C/S T.001, as verified in accordance with the type approval standard in document C/S T.007, Cospas-Sarsat may consider issuing a letter of compatibility (LOC) in lieu of a Cospas-Sarsat Type Approval Certificate (See document C/S P.011 for further details).

Cospas-Sarsat will issue a unique TAC number (from the 700 series of TACs) to each beacon model that is approved under a LOC. The approved beacon models associated with a TAC number are documented by the Secretariat and identified on the Cospas-Sarsat web-site.

Main C/S T.007-related amendments Approved at CSC-59

Para 3.2 Cospas-Sarsat Accepted Test Facilities

Certain test facilities are accepted by Cospas-Sarsat to perform Cospas-Sarsat type approval tests, as described in document C/S T.008. Accepted test facilities are entitled to perform tests on any 406 MHz distress beacon for the purpose of having a Cospas-Sarsat Type Approval Certificate issued by the Secretariat. A list of Cospas-Sarsat accepted test facilities is maintained by the Cospas Sarsat Secretariat.

Following successful testing of a beacon, the *technical report on type-approval testing and the* technical information listed in section 5 of this document should be submitted to the Cospas Sarsat Secretariat *for review by the Secretariat and the Parties*, so that *an approval and, if applicable, a* Cospas Sarsat Type Approval Certificate can be issued to the beacon manufacturer.

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Para 4.3 Test Units

[…]

If a beacon is to receive certification for location protocols and non-location protocols~~, the unit used for the tests listed in section A.2 shall be coded with one of the location protocols.~~ :

It should be noted that ~~t:T~~he test unit subjected to the Cospas Sarsat tests remains the property of the manufacturer. All information marked as proprietary shall be treated as such.

~~a) the organization performing the Cospas-Sarsat tests bears no responsibility for either the manufacturer's personnel or equipment;~~

~~b) the manufacturer shall certify that the units submitted for test contain no hazardous components. The testing organization may choose not to test units that it regards as hazardous; and~~

~~c) test units shall normally stay at the test facility for the full duration of type approval testing, however in situations when modification or repair of the test units is required at the manufacturer's facility, this shall be properly documented by the test facility and reflected in the test report.~~

~~If a beacon is to receive certification for several protocol types, means of changing message coding shall be provided by the beacon manufacturer. Alternatively, this can be satisfied with additional test units.~~

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Para 4.3 Test Units (Continued)

[…]

- *a full type-approval testing shall be conducted with a location-protocol encoded test beacon,*
- *a test beacon encoded with a short-format message shall be subjected to the Digital Message test (test parameter TP-2), Digital Message Generator test (TP-3), Modulation test (TP-4), Self-test Mode test (TP-8a), Beacon Coding Software test (TP-16).*

RLS-capable beacons shall allow message encoding with RLS Location Test Protocol and National Location Test Protocol, with the RLS Location Test Protocol to be used only for the Satellite Qualitative tTest and the Position Acquisition Time and Position Accuracy Test~~test~~, and ~~NLP~~ National Location Test Protocol to be used for all other on-air tests.

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Para 4.4 Test Conditions

[…]

During type-approval testing, certain beacon characteristics are measured and test parameters evaluated over a period of 15 minutes by making 18 successive measurements of the 406 MHz signal during this period. The measurement interval and the number of measurements shall if necessary be extended to cover all beacon ancillary devices operating conditions (e.g. homing transmitter(s) turning on and off, GNSS receiver powered on and off, voice-transceivers in receive and transmit etc.).

Test facilities shall perform analysis of the beacon design and modes of operation to define the measurement interval and include this information in the test report.

Approved measurement methods are described in Annexes A, B, C, D and E of this document, although other appropriate methods may be used by the testing authority to perform the measurements. These shall be fully documented in a technical report along with the test results.

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Para 4.7 Test Report

g) Photographs of beacon during radiation tests in all tested configurations (if applicable); ~~and~~

h) List of measurement equipment with indication of test and calibration due date and information about the actual test facility measurement accuracies for all test parameter

i) Details of non-standard test configurations, including technical drawings, photos and description.

Results of tests performed by a beacon manufacturer (e.g., current measurements, position data encoding, beacon coding software, or other additional tests) shall include the data required by items a) to h) of this section, as applicable, be submitted in a test report, and must contain the equivalent content as required in Appendix G to Annex F (Part F.7), as applicable, but is not restricted to the precise format of the Part F.7. Test facilities shall check the manufacturers' test reports to ensure that all necessary information is provided in consistency with Annex G (Part G.1) and other technical documentation.

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Para 5 Technical Data

Beacon manufacturers are required to provide* technical data indicated below as part of their type approval application. This technical data is used to determine the appropriate test configurations and procedures. It is therefore expected that the technical data will be provided to the accepted test facility prior to type approval testing to ensure that appropriate test procedures are used.

The technical data submitted to the Cospas-Sarsat Secretariat shall include the following:

[…]

d) a list and descriptions of all automatic and manually selectable operation modes, description of beacon working cycle phases and durations*, justification of the measurement interval*, and analysis supported by results of battery current measurements, provided as per Table F-E.1, that identifies:

** The type-approval application form and other forms (e.g., Change-Notice form, Quality Assurance Plan, etc.), included in the Annexes of this document, shall be completed, signed and submitted, or, alternatively, this information may be provided using the electronic format and procedures as available on the Cospas Sarsat website.*

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Para 5 Technical Data (Continued)

[…]

e) the beacon operating instructions and */or* other owner manuals~~, if available, and a technical data sheet,~~ describing the:

[…]

g) the technical data sheet for the battery cells used in the beacon indicating nominal cell capacity and self-discharge rate over the declared battery replacement period and the declared battery shelf-life, and the electric diagram of the beacon's battery pack;

[…]

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Para 5 Technical Data (Continued)

[…]

h) copy of the beacon markings and labels *(for all beacon models and additional names)* indicating, as per C/S T.001 section ~~3.5.8~~*4.5.8*:

i. beacon model name, beacon manufacturer, and C/S TAC number, ,

ii. beacon 15-HEX ID,

iii. operating temperature range (e.g., -20°C to +55°C), ~~and~~

iv. minimum duration of continuous operation (e.g., 24 hours),

v. an indication if the beacon is equipped with RLS functionality, and

vi. labelling of the RLS indicator (if applicable);

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Para 5 Technical Data (Continued)

[…]

~~k)~~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),

~~i. meets the frequency stability requirements over 5 years (see section A.3.5),~~

~~iii.~~ii. provides protection from repetitive self-test mode transmissions

(see section A.3.6.1),

~~iv.~~iii. ensures that the self-test messages (except for GNSS self-test) have default values encoded in position fields, at all times and irrespective of the navigation data input, ~~and~~

[…]

v. *for beacon models that are intended to be encoded with the National-User protocol (long format), provides for bits 1 to 106 to remain fixed after beacon activation, and bits 107 onwards to be updated not more frequently than once every 20 minutes, and describe conditions which may cause changes to the message content.*

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Para 5 Technical Data (Continued)

~~t)~~*s) a detailed description of the associated beacon design feature shall be provided if* the temperature within the declared operating temperature range, at which the shortest duration of continuous beacon operation is expected, as declared in Annex G, and if this is not the minimum operating temperature~~, a detailed description of this beacon design feature~~; ~~and~~

t) a statement and description of any known non-compliances, if any are declared in Annex G;

u) a statement from the beacon manufacturer that the test samples are aligned in 406 MHz conducted output power levels to within 0.3 dB of each other if multiple beacon samples are provided for type approval testing; and

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Para 5 Technical Data (Continued)

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 (CCO), 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 (CBP), 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 (CPO), 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 (LCDC) of the Table F-E.2 by operating the beacon in the worst-case operating mode;*

** LCDC - as defined in Appendix E to Annex F of document C/S T.007, and include among others battery capacity losses due to self-discharge, self-tests, GNSS self-tests and operation of the beacon circuitry while in the stand-by mode.*

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Para 5 (v) Technical Data (Continued)

- *Spare battery pack capacity at ambient temperature (CSP-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. CSP-AMB may be calculated as the Full Battery Pack Capacity (CBP) deducted by the sum of the Capacity of Pre-Operational Losses (CPO) and the Minimum Duration of Continuous Operation (CCO). The value of CSP-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.*

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Para 6.2 Changes to Type Approved Beacons

The manufacturer must advise the Cospas-Sarsat Secretariat (see Annex H) of any changes to the design or production of the beacon or power source, which might affect beacon electrical performance. All tests for demonstrating the performance of modified beacons shall be conducted at a Cospas-Sarsat accepted test facility unless specifically stated otherwise in this document.

The manufacturer shall provide sufficient information for the scope of the changes, including a brief description of the modifications and indication of the beacon sub-systems, modules, functions and characteristics affected by the change.

[…]

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Para 6.4.1 Inclusion or Removal of an Internal Navigation Device

[…]

For the variant without the internal navigation device, the beacon manufacturer shall submit *to the Cospas-Sarsat Secretariat,* technical information per Section 5, excluding items ~~"a" (part G.2),~~ "n" and "o".

Para 6.4.2 Change to Internal Navigation Device

[…]

Beacon manufacturer shall submit, *to the Cospas-Sarsat Secretariat,* technical information per Section 5, excluding items ~~"a" (part G.2),~~ "i", "j (i-iii)", ~~"n"~~ and "o".

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Para 6.7 Alternative Model Names for a Type Approved Beacon

If a beacon manufacturer wishes to have the type approved beacon designated under an alternative name (e.g., agent/distributor's name or model number), ~~Annex II and~~ Annex I of this document shall be completed and sent to the Secretariat.

The beacon manufacturer shall also submit technical data per Section 5, items “a” (part G.1 only), “e”, “f”, ” “h”, “m” , “q” and “r”.

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Para 6.9 Change of Beacon Manufacturer

In case of a transfer of ownership / manufacturing rights for the type-approved beacon model to another organisation, or a change of beacon manufacturer's name, an official letter shall be submitted to the Secretariat indicating:

[…]

For each beacon model concerned, the new beacon manufacturer shall also complete and submit *Annex L* ~~Annex H~~ and *the* technical data per Section 5, items "a" (part G.1 only), "e", "f", "h", "m", "q" and "r".

Main C/S T.007-related amendments Approved at CSC-59

Para 6.12 New Section

6.12 Request for an Additional TAC Number

In the case that additional serial numbers are required to encode a unique identification with the Serial User Protocol or Standard Serial Location Protocol, the manufacture shall submit a letter to the Cospas-Sarsat Secretariat that includes:*

d) manufacturer information

e) a request for an additional TAC number;

f) TAC number of the original type approval;

g) the TAC number(s) (including suffix) and associated model name(s) of beacons which are currently in production;

h) the date at which the depletion of the available serial numbers is anticipated;

i) declaration that the design is unchanged from the approved model(s) and that the Quality Assurance Plan remains valid for the beacon models to be manufactured under newly requested TAC, or, if modifications to the approved beacon model(s) has occurred, provide an updated Annex H and Annex L.

** Additional TAC request may also apply to RLS and ELT(DT) beacon IDs after production of RLS and ELT(DT) beacons commence.*

Main C/S T.007-related amendments Approved at CSC-59

Para A.1 GENERAL

[…]

A suggested sequence for performing the tests described herein is shown in Table F.1 of Annex F, but the tests may be performed in any other convenient sequence. However, it is *recommended that at the start of the type-approval testing, the test facilities:*

- *confirm that the beacon manufacturer has provided a statement (section 5, part u) that the test beacons 406 MHz transmitters are aligned in power or, alternatively, verify (only possible if all test beacons are provided with a suitable conducted test interface) this by testing;*
- *verify that homer-transmitter output power and duty cycle settings correspond to the maximum values declared in Annex G;*
- *conduct measurements of battery current;*
- *perform an analysis of operating modes and system configurations, and define the beacon mode to be used for type approval testing; and*
- *define the measurement interval for electrical tests listed in section A.2.1.*

Main C/S T.007-related amendments Approved at CSC-59

Para A.2.1 Electrical and Functional Tests at Constant Temperature (test no. 1 to 8 in Table F.1)

The tests specified in para. A.3.1 through para. A.3.3 (except A.3.2.2.3, antenna tests) are performed after the beacon under test, while turned off (except for ELT(DT)s which shall be in the ARMED mode), has stabilized for a minimum of 2 hours* at laboratory ambient temperature, at the specified minimum operating temperature, and at the maximum operating temperature. Except for testing in the self-test mode (per paragraph A.3.6), the beacon is then allowed to operate for 15 minutes before measurements are started, except for ELT(DT)s, for which measurements shall commence immediately after the ELT(DT) has been activated. The following parameters shall be measured at each of the three constant temperatures:

[…]

** For beacons with weight of 2 kg and more, the manufacturer shall perform factory tests to define the time of the temperature stabilisation inside the beacon. iIf needed, a typical soaking time of two hours for all conductive tests shall be increased accordingly.*

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Para A.2.6 Beacon Antenna Test (test no. 15 in Table F.1)

The beacon antenna test, described in section A.3.2.2.3 and Annex B, shall be performed at the ambient temperature of the test facility and a correction factor shall be applied to the data to calculate the radiated power at minimum temperature at the end of the operating lifetime. This test shall be performed using the non-modified test beacon, including the navigation antenna, if applicable. For all tested configurations, photos of the test set-up shall be included in the report.

For testing of EPIRBs and other beacon types intended for operation while floating in water, position of floatation line shall be verified by placing a fully-packaged test beacon in fresh water (i.e., domestic tap water).

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Para A.2.8 Beacon Coding Software (test no. 16 in Table F.1)

[…]

For RLS-enabled beacons check the correct operation of the RLS Indicator for the RLS message protocol.

For beacons encoded with National-User (long format) protocol, verify that bits 1 to 106 remain fixed at all times after beacon activation, and bits 107 onwards are updated not more frequently than once every 20 minutes, by changing conditions declared by the beacon manufacturer (see section 5, technical data item "j-(v)".

The content of the complete digital message for both operational and self-test transmissions (including bits 1-24) shall be included in the test report as per Appendix D to Annex F.

[…]

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Para A.3.1.1 First Burst Delay and Repetition Period

[…]

As specified in section 4.5.6 of C/S T.001, the FBD value shall not be less than 47.5 seconds for all beacon types, except for ELTs when activated automatically by G-switch / deformation, and *for* ELT(DT)s, for which the value of FBD shall not exceed:

i. *15 seconds -* for ELTs activated by G-switch/deformation ~~15 seconds~~, and

ii. *5 seconds -* for ELT(DT)s ~~5 seconds~~.

[…]

For ELT(DT)s the repetition period, TR, between the beginnings of two successive transmissions (see Figure A.2) shall be randomised over the range of 27.0 to 30.0 seconds after the first 300 seconds of activation. During the first ~~30~~ 120 seconds, the repetition period shall be 5.0 seconds (+0/ -0.2s) without randomisation. *Between 120 seconds and 300 seconds , the repetition period shall be 10 seconds (+0/ -0.2s) without randomization.* The results of the repetition period measurements during the first ~~30~~ 300 seconds shall be recorded in Table F.1. At least 18 successive measurements shall be made after the first ~~30~~ 300 seconds of activation. […]

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Para A.3.6.1 Testing the Self-Test Mode (Add to the end of this section)

The self-test mode(s) shall be tested to verify that any transmission is limited to one self-test burst only.

For beacons with interface to external navigation device or for beacons that have an internal GNSS receiver that is capable for independent operation, the self-test mode test at ambient temperature shall be performed as follows. During the test, a navigation signal shall be provided and sufficient time shall be allowed for position acquisition to be obtained by an internal GNSS receiver or for position data to be acquired from the external navigation device, prior to initiating a self-test.

All beacons capable of transmitting encoded location data shall be subjected to the self-test navigation test scripts contained in Annex D.

Design data shall be provided on protection against repetitive self-test mode transmissions.

Observations and results of the Self-test Mode test shall be recorded in the Table F-E.3, and reflected in the Summary of test results table, Table F-1.

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Para A.3.6.2. Add new sections (Continued)

Step-1: Verification of the Self-Test Indication of Sufficient Battery Energy

As applicable to the beacon design, discharge a fresh battery by operating a beacon in the worst-case operating mode at ambient temperature for the duration corresponding to CPO, or by the amount indicated by the beacon manufacturer, as their criteria for triggering PIE less 30 minutes, if this is different to CPO, and/or make sure that the criteria to generate the PIE indication is not yet met.

At ambient temperature, activate the test beacon in a self-test mode. Observe the beacon indication. The test is passed successfully, if during the self-test, the test beacon does not provide a distinct indication of insufficient battery energy (PIE indication), or (if this feature is supported by the beacon design) the test beacon provides a distinct indication of sufficient energy.

Note: If applicable to the beacon design and implementation of PIE indication, the sub-criteria for the absence of PIE indication can be achieved, e.g., by performing less than the maximum recommended number of self-tests, and/or less than the maximum number of GNSS self-tests, or by creating other PIE indication conditions declared by a beacon manufacturer (see section 5, item ”u”).

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Para A.3.6.2. Add new sections (Continued)

Step-2: Verification of the Self-Test Indication of Insufficient Battery Energy

After completion of Step-1, further discharge the beacon battery, and/or make sure that, as applicable to the test beacon design, the criteria for the PIE indication is now fully met.

Note 1: The required battery discharge can be achieved by operating the test beacon in the worst-case operating mode at ambient temperature until the residual battery energy corresponds to CCO + 30 minutes (i.e., the total discharge of a fresh battery will correspond to the value of CPO + CSP-AMB + 30 minutes) , or until the amount of the residual battery energy indicated by the beacon manufacturer as their criteria for triggering PIE indication plus [30] minutes, if this amount is different from CCO. Alternatively, if a different method of assessing PIE has been implemented by the manufacturer, the necessary conditions for PIE indication can be achieved in that way, for example, by performing the remaining number of self-tests and GNSS self-tests to reach the declared maximum numbers.

At ambient temperature, activate the beacon in the self-test mode. Observe test beacon indication. The test is passed successfully, if during the self-test the beacon provides a distinct indication of insufficient battery energy.

Note 2: The means to discharge the battery may be as defined by the manufacturer, this may, for example, be achieved by activating the beacon for the required period of time, or by running multiple self-tests, or by running GNSS self-tests, etc.

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Para A.3.6.2. Add new sections (Continued)

A.3.6.2.3 Reporting Results of PIE Indication Test

Record the test results/observations of PIE indication in the Table F-E.5 and reflect the test results in the Table F-1, Test Parameter 8(a): Self-Test Mode.

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Para A.3.6.3 Testing the GNSS Self-Test Mode

A.3.6.3 Testing the GNSS Self-Test Mode

~~In addition~~ If a GNSS self-test mode is provided, the encoded location shall be checked against the known location to the accuracy defined in C/S T.001 paragraph 4.5.5.3 for the applicable protocols *or paragraph 4.5.5.6 for ELT(DT)s*. The format flag bit shall be reported. The GNSS self-test mode(s) shall be tested to verify that any transmission is limited to one self-test burst only. If a GNSS self-test is provided for, it shall be verified that inadvertent activation of this mode is precluded.

The GNSS self-test mode shall be tested at ambient temperature to verify that:

a) inadvertent activation of GNSS self-test mode is precluded;

b) it is limited in duration (all location protocol beacons) and number of GNSS self-test transmissions (beacons with internal navigation devices powered by primary battery only);

c) a distinct indication of successful completion or failure of the GNSS self-test is provided *and for ELT(DT)s the beacon transmits a single self-test message with the correct encoded location;*

d) a separate distinct indication that the limited number of GNSS self-test attempts has been attained is provided immediately after GNSS self-test mode activation and without transmission of a test message or further GNSS receiver current drain; and

e) the GNSS self-test mode terminates automatically, irrespective of the switch position, immediately after completion of the GNSS self-test cycle and indication of the test results.

Observations and results of the GNSS Self-test Mode test shall be recorded in the Table F-E.4, and reflected in the Summary of test results table, Table F-1.

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Para A.3.6.3 Testing the GNSS Self-Test Mode

A.3.6.3 Testing the GNSS Self-Test Mode (Continued)

[…]

e) the GNSS self-test mode terminates automatically, irrespective of the switch position, immediately after completion of the GNSS self-test cycle and indication of the test results.

Observations and results of the GNSS Self-test Mode test shall be recorded in the Table F-E.4, and reflected in the Summary of test results table, Table F-1.

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Para A.3.8.7 Position Data Encoding

This test ~~is~~ *may be* conducted by *using a GNSS simulator*, or by* substituting the output of the navigation device with ~~test scripts~~ data input, which replicate the location information provided in Table D.1 for the User-Location protocol, Table D.2 for the Standard Location Protocol, Table D.3 for the National Location, Tables D.4 for the ELT(DT) and the RLS Location protocols and Table D.5 for the RLS Location protocol.

[…]

** If a GNSS simulator is used the internal data line from the GNSS device to the beacon must be monitored to ensure the correct position information is being provided to the beacon*

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Para A.3.8.8.1 M_{offset} Test

[…]

a) that within 5 seconds *of the beacon transmitting an initial RLS request through the RLS Location Protocol or RLS Location Test Protocol* there is a visual indication of an RLS request;

[…]

e) monitor the GNSS Receiver and ensure that it remains in active mode for a period of at least 30 minutes after beacon activation*, or, for beacons only capable of processing Type-1 RLMs, until such time as the conditions in g) below are met,* after which time it may turn off, or remain on, or turn on and off one or more times;

[…]

g) monitor bits 109 to 114 in the next 406 MHz transmitted message after the RLS indicator changes state and ensure that bits 109 to 114 change to '101001', *after which time, for beacons only capable of processing Type-1 RLMs, the test may be stopped and the beacon turned off for a minimum period of 15 minutes before commencing the next test.*

Note, that for beacons only capable of processing Type-1 RLMs tests h) to k) inclusive below do not apply,;

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Para A.3.8.8.2 UTC Test

[…]

a) that within 5 seconds *of the beacon transmitting an initial RLS request through the RLS Location Protocol or RLS Location Test Protocol* there is a visual indication of an RLS request;

[…]

m) monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes. *or, for beacons only capable of processing Type-1 RLMs , until such time as the conditions in test o) below are met, at which point the GNSS receiver may turn off*;

[…]

o) monitor bits ~~107 to 112~~*109 to 114* in the next 406 MHz transmitted message after the RLS indicator changes state and ensure that bits 109 to 114 change to '101001', after which time the test may be stopped and the beacon turned off.

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Para A.3.9.2 Cancellation Message Tests

When performing the tests identified in Table A.2 the transmissions from the ELT(DT) shall be monitored. The ELT(DT) shall transmit a Cancellation Message each time that it is deactivated (i.e., at the initiation of Tests 5, 7, 11, 13, 18a, 19, 24a and 2, *as specified in Table A.2*). The Cancellation Message shall be checked to ensure that it meets the following:

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Para A.3.10 Testing Operator Controls

A.3.10.1 Testing Self-Test Controls

To determine if a beacon malfunctions, and begins to transmit more than one self-test transmission as required by document C/S T.001, section 4.5.4, it shall be tested, at ambient temperature only, in the following way.

a) For beacons that have a common self-test and GNSS self-test control, or other functions, where the only differentiation between these modes of operation is the amount of time that the control is operated, establish the minimum time interval from initial activation of the control until the initiation of the GNSS self-test or other functions, 'X seconds'. Apply test i) below but only maintain the control in the self-test activation mode for X-1 seconds and then release it. Then apply test ii), as detailed below.

b) For beacons where either self-test function is initiated by the release of the control, rather than by its activation, the following tests shall be conducted as stated, except that there shall be no self-test transmissions from the beacon while the control is activated and no more than a single self-test transmission when the control is released.

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Para A.3.10 Testing Operator Controls

A.3.10.1 Testing Self-Test Controls (Continued)

[…]

c) For all other beacons:

i. the self-test controls shall be operated and where possible maintained in the self-test activation mode (e.g. if the self-test is activated by a push button, then this shall be held down) for a period of at least 2 minutes longer than the specified maximum duration of the self-test. During this time it shall be ascertained that there is a single self-test transmission and that the beacon returns to its rest state on completion of the self-test cycle, even if the self-test control is still engaged.

ii. If the beacon is equipped with a GNSS self-test mode then this mode shall be activated and where possible maintained in this condition for a period of at least 5 minutes longer than the maximum time duration of the GNSS self-test as defined by the manufacturer. During this time it shall be ascertained that there is no more than a single self-test transmission and that the beacon returns to its rest state on completion of the GNSS self-test cycle, even if the GNSS self-test control is still engaged.

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Para A.3.10.2 Testing Operational Controls

A.3.10.2 Testing Operational Controls

To determine if a beacon malfunctions and begins to transmit more frequently than is required by C/S T.001 Sections 2.2.1 and 4.5.6, it shall be tested, at ambient temperature only, in the following way:

a) All manual operational controls designed to activate the beacon (e.g. On, Remote On, etc.) shall be activated and where possible maintained in an operational mode (e.g., if the On function is activated by a push button, then this shall be held down) for a period of at least 3 minutes longer than the manufacturer declared time to transmit the first 406 MHz distress message.

b) Where possible, both the self-test control(s) and the operational controls shall be activated together and be maintained in this condition for a period of at least 3 minutes longer than the manufacturer declared time to transmit the first 406 MHz distress message:

i. by activating the self-test / GNSS self-test and after approximately 2 seconds also activating the operational control(s),

ii. by activating the operational control(s) and after approximately 5 seconds also activating the self-test / GNSS self-test;

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Para A.3.10.2 Testing Operational Controls

[…]

c) *For beacons with an automatic means of beacon activation (e.g., water activation, G-switch, etc.), tests a) and b) above shall be repeated once the beacon has first been activated by the automatic means.*

The beacon shall be turned off between each test. In all conditions it shall be ascertained that the beacon does not transmit more than one self-test burst and does not transmit distress bursts more frequently than the repetition period defined in C/S T.001 Section 2.2.1. In addition during test b) ii) above, it shall be ascertained that the beacon continues to remain in the 'on' condition and instead does not activate the self-test function and transmit a self-test burst.

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Various Updates to Annexes:

ANNEX F: BEACON TYPE APPROVAL TEST RESULTS

- Table F.1: Overall Summary of 406 MHz Beacon Test Results

New Tables

- Table F-E.3: Self-test Mode Actions and Indications (*)
- Table F-E.4: GNSS Self-test Mode Actions and Indications (for Beacons With Internal GNSS)
- Table F-E.5: Indication of Insufficient Battery Energy

Update to Table

- Table F-F.1: Check-List of Technical Data Provided by Beacon Manufacturer

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New: *Appendix H to Annex F Guidelines for recording and rounding of the measurement results*

1) The final quantitative value of the parameter (Table F.1 C / S T.007) should be recorded in the same format as the specification.

2) The accuracy of the measurement results and the accuracy of the calculations during processing of the measurement results should be consistent with the required accuracy of the obtained estimate of the measured value.

3) The error of estimation of the measured parameter should be expressed using no more than two significant digits after decimal point.

4) Two significant digits after decimal point in the measurement error of the measured value should be retained:

a. for accurate measurements;

b. if the first digit is not more than three.

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New: *Appendix H to Annex F Guidelines for recording and rounding of the measurement results*

5) The number of digits in the intermediate results and calculations in the processing of measurements should be at least two more than in the final result.

a. *Note: All measurement results, calculations recorded in the report specified in Appendix F.7 of C / S T.007 should be represented using two more digits than in Table F.1.*

6) The error in the intermediate calculations should be expressed using not more than three significant digits after decimal point.

7) The retained significant digit in the error of the measured value evaluation when rounding is increased by one if the discarded digit of the lower-order digit is greater than or equal to five, and does not change if it is less than five.

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Update to Forms:

ANNEX G: APPLICATION FOR A COSPAS SARSAT 406 MHZ BEACON TYPE APPROVAL CERTIFICATE

ANNEX H: CHANGE NOTICE FORM

ANNEX L: BEACON QUALITY ASSURANCE PLAN

ANNEX M: COSPAS-SARSAT 406 MHZ BEACON TYPE APPROVAL CERTIFICATE (SAMPLE)

Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

- EWG-1/2018 was conducted in from the 10th to 16th of April 2018 and made the following recommendation to the Council (See EWG-1/2018/Report, section 7.1.10):

  "The Experts Working Group RECOMMENDED that the Council, at its earliest opportunity, approve the proposed amendments to document "Cospas-Sarsat 406 MHz Distress Beacon Type-Approval Standard", provided at Annex 6 to this Report as document C/S T.007, Issue 5 - Draft Revision 2."

- This decision by the Council to approve this document was communicated to participants and interested organizations by letter CS18/142/F400/F500, signed by the Council chair and dated 10 August 2018.

Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

4.4 Test Conditions

Tests shall be conducted by test facilities accepted by Cospas-Sarsat, unless allowed otherwise herein. It is advisable that the manufacturer, or his representative, witness the tests.

The tests shall be carried out on the test beacon with its own power source and without any additional thermal shielding around the beacon that might prevent it from being exposed to the specified test temperature. However shields or deflectors inside the chamber designed to prevent the beacon from being exposed to temperatures lower or higher than the specified test temperature are permitted. In cases, when such additional shields and deflectors are used in thermal chambers, this shall be documented with photographs and reflected in the test reports.

~~If the ELT(DT) has an external power source that is used to power it or some parts of it when it is in the ARMED mode of operation, as defined in section 4.5.6.1 of document C/S T.001, this power source shall be set to the minimum voltage of the external power source, as specified by the beacon manufacturer during testing.~~ *If the ELT(DT) has an external power source, as defined in section 4.5.11 of document C/S T.001, that is used to power the main beacon electronics when it is in the ON or ARMED mode of operation, as defined in section 4.5.6.1 of document C/S T.001, the beacon shall be tested as per section A.2.10.* For ELT(DT)s where tests refer to the beacon under test being 'off' or 'deactivated' or being 'turned on for 15 minutes prior to the start of a test', these conditions shall be taken to mean that the ELT(DT) is in its ARMED mode of operation.

Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

6.12 Request for an Additional TAC Number

In the case that additional serial numbers are required to encode a unique identification with the Serial User Protocol or Standard Serial Location Protocol*, the manufacture shall submit a letter to the Cospas-Sarsat Secretariat that includes:

a) manufacturer information

b) a request for an additional TAC number;

c) TAC number of the original type approval;

d) the TAC number(s) and associated model name(s) of beacons which are currently in production;

e) the date at which the depletion of the available serial numbers is anticipated; *and*

f) declaration that the design is unchanged from the approved model(s) and that the Quality Assurance Plan remains valid for the beacon models to be manufactured under newly requested TAC, or, if modifications to the approved beacon model(s) ~~has~~*have* occurred, provide ~~an updated~~ Annex H and *the updated* Annex L.

Main C/S T.007-related amendments from EWG-1/2018 Approved at CSC-60

A.2.10 Testing ELT(DT)s Capable of Operating with External Power Source

A.2.10.1 Additional Testing Required for ELT(DT) with External Power Source

ELT(DT)s capable of operating with an external power source shall be subjected to the additional testing, while being powered by an external power source, as follows:

a) transmitter power output tests as per sections A.3.2.2.1 and A.3.2.2.2;

b) digital message test as per section A.3.1.4;

c) digital message generator tests as per sections A.3.1, A.3.1.1, A.3.1.2, and A.3.1.3;

d) modulation test as per section A.3.2.3;

e) 406 MHz transmitted frequency test as per section A.3.2.1, excluding medium-term stability (MTS);

f) spurious emissions test as per section A.3.2.2.4;

g) 406 MHz VSWR check as per section A.3.3;

h) navigation test as per section K.2.3; and

i) satellite qualitative test as per section A.2.5 of this document.

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For tests (a) through (g) above, the tests shall be done in worst-case conditions (e.g., temperature range as per beacon class, power source voltage conditions as declared by the beacon manufacturer in the technical details as per section 5 and Annex G) in order to demonstrate compliance with Cospas-Sarsat requirements.

For tests (h) and (i) above, the tests shall be done in worst-case power source voltage conditions as declared by the beacon manufacturer in the technical details as per section 5 and Annex G in order to demonstrate compliance with Cospas-Sarsat requirements.

If the transmitter power output measured at ambient temperature has changed by more than 0.5 dB compared to the results obtained from the equivalent test of the beacon powered by its own battery, and to ensure compliance with EIRP requirements, a re-calculation of EIRP levels (Table F-B.1) and analysis of $EIRP_{min/max}$ shall be made, taking into account the difference between the output power levels measured at ambient temperature for the beacon powered from the its own internal/integral battery and from the external power source ($P_{t\ AMB\text{-}ext}$). For evaluation of $EIRP_{min/max\ EOL}$, the value of $EIRP_{Loss}$ shall be calculated as the difference between the output power levels measured at ambient ($P_{t\ AMB\text{-}ext}$) and minimum temperatures ($P_{t\ MIN\text{-}ext}$) for the beacon powered from the external power source.

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A.2.10.2 Additional Testing for Switching Between Power Sources

For an ELT(DT) with an external power source the following tests shall be run twice. Each test shall be performed for at least five minutes with external power followed by a transition to battery power and performed for at least five minutes with no external power. The first test shall be performed when the transition to battery power does not occur during a beacon transmission and the second test shall ensure that the transition to battery power occurs during a burst transmission.

a) transmitter power output tests as per sections A.3.2.2.1 and A.3.2.2.2;

b) digital message test as per section A.3.1.4;

c) digital message generator tests as per sections A.3.1, A.3.1.1, A.3.1.2, and A.3.1.3;

d) modulation test as per section A.3.2.3;

e) 406 MHz transmitted frequency test as per section A.3.2.1, excluding medium-term stability (MTS);

f) spurious emissions test as per section A.3.2.2.4; and

g) navigation test as per section K.2.3.

All tests above shall be done at ambient temperature under worst-case power source voltage conditions (as declared by the beacon manufacturer in the technical details as per section 5 and Annex G) in order to demonstrate compliance with Cospas-Sarsat requirements.

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If a beacon is capable of returning to external power after a transition to battery power the entire procedure above shall be repeated with the transition in the opposite direction.

When the transition between power sources occurs during a burst transmission the beacon is not required to comply to Cospas-Sarsat requirement for that burst. However, in all cases, whether the transition occurs during or between burst transmissions, the repetition period shall not be impacted by the transition between power sources.

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A.3.8.3 Encoded Position Data Update Interval *

[…]

in accordance with the requirements of C/S T.001 4.5.5.4 and as declared by the manufacturer in their location data update scheme‡.

For ELT(DT)s change the navigation signal *provided to the internal navigation device* (by using a GNSS RF simulator) ~~at a speed of up to 1,000 km/h (277.8 m/s) in the horizontal plane and from -100m to 11,000m above sea level in altitude~~ in accordance with Annex K. Activate the ELT(DT), *as defined in Annex K,* and monitor the encoded 3D positions provided by the ELT(DT) while running the simulator scenario in Annex K, then deactivate the beacon.

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Accurately (to a resolution of better than 0.1 second) log the position provided to the beacon and the commencement of beacon transmissions vs time. For each burst from the ELT(DT) compute the 3D position provided by the signal to the beacon at the commencement of the burst ($P(t_0)$) and at the point 2 seconds before the commencement of the burst ($P(t_0-2)$). Check that in each instance the 3D encoded location transmitted by the ELT(DT) is within 200 metres in the horizontal plane and within 700 metres in altitude of at least one simulated location between the two above computed positions (i.e. ($P(t_0)$) and ($P(t_0-2$~~))).~~ *))), except during the final transition in the Annex K scenario (which in effect simulates a rapid deceleration resulting from an impact).* Also check that bits 113 and 114 in the digital message are correctly set for location freshness.

If the ELT(DT) can accept navigation data from an external navigation device input as well as its own internal navigation device, then the above test shall be repeated *while sending location data through the external navigation interface and over the air to the internal navigation device at the same time. The location data that shall be sent is described in Annex K* ~~*with the external navigation device input disconnected*~~. All results, ~~*except for that from the first burst,*~~ shall meet the above requirements (i.e., horizontal accuracy, vertical accuracy and location freshness *as well as the source position requirements as defined in section 4.5.5.6 of C/S T.001).*

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A.3.8.8 RLM Reception Verification

In all the manufacturer's declared operational configurations in Annex G, activate the beacon with the RLS Location Test Protocol. Check if the beacon indicates reception of the Test RLM message as indicated in document C/S T.001 Section 4.5.7.3.

A.3.8.8.1 M_{offset} Test

[…]

Ensure that the beacon is correctly coded with the RLS Location Test Protocol as per C/S –T.007 Annex C. Carry out a self-test and ensure that the encoded 15 Hex ID is '*193BFCE031BFDFF*~~193BE08CBF81FE0~~'.

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g) monitor bits 109 to 114 in the next 406 MHz transmitted message after the RLS indicator changes state and ensure that bits 109 to 114 change to '101001', after which time, for beacons only capable of processing Type-1 RLMs, the test may be stopped and the beacon turned off for a minimum period of 15 minutes before commencing the next test~~.~~;

Note, that for beacons only capable of processing Type-1 RLMs tests h) to k) inclusive below do not apply~~;~~.

h) monitor the GNSS Receiver and ensure that it turns on at ~~39~~ *52* minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again at 11:~~39~~ *52* +/- 5 seconds);~~.~~

Note *that* ~~39~~ *52* minutes equates to the Moffset value for~~,~~ the encoded 15 Hex ID;

~~h)~~*i)* monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes after which time it may turn off, or remain on, or turn on and off one or more times;

~~i)~~*j)* monitor the GNSS Receiver for a further hour and ensure that it turns on at ~~39~~ *52* minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again this time at 12:~~39~~ *52* +/- 5 seconds); and

~~j)~~*k)* monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes, after which time the test may be stopped and the beacon turned off. Leave the beacon turned off for a minimum period of 15 minutes before commencing the next test.

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A.3.8.8.2 UTC Test

[…]

With the equipment and beacon test set up as in A.3.8.8.1 above, ~~T~~*t*urn the beacon on at any time between 5 minutes and 20 minutes past any natural hour (e.g. between 09:05

h) monitor the GNSS Receiver and ensure that it turns on at ~~39~~ *52* minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again at 11:~~39~~ *52* +/- 5 seconds). Note ~~39~~ *52* minutes equates to the M_{offset} value for the encoded 15 Hex ID, while this test ensures that the internal clock within the beacon is functioning correctly in the absence of UTC;

i) monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes after which time it may turn off, or remain on, or turn on and off one or more times;

j) monitor the beacon transmitted signal and ensure that it still contains the location of the beacon to within 500 m accuracy and that bits 109 to 114 in the 406 MHz transmitted message are still '100001';

k) monitor the GNSS Receiver for a further hour and ensure that it turns on at ~~39~~ *52* minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again this time at 12:~~39~~ *52* +/- 5 seconds);

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A.3.9.2 Cancellation Message Tests

When performing the tests identified in Table A.2 ~~below~~ the transmissions from the ELT(DT) shall be monitored. The ELT(DT) shall transmit a Cancellation Message each time that it is deactivated (i.e., at the initiation of Tests 5, 7, 11, 13, 18a, 19, 24a and 2, as specified in Table A.2). The Cancellation Message shall be checked to ensure that it meets the following:

a) transmitter nominal frequency, as per para. A.3.2.1.1;

b) transmitter power output, as per para. A.3.2.2.1;

c) digital message content, as per para. A.3.1.4 and C/S T.001 Section A3.3.8.5 and Figure A11;

d) the modulation parameters, as per para. A.3.2.3;

e) first cancellation transmitted message occurs within ~~[~~5~~]~~ seconds of deactivation;

f) there are 10 cancellation messages transmitted at intervals of 10 seconds +/- 0.5 seconds; and

g) After transmitting 10 cancellation messages the ELT(DT) ceases transmitting.

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Table D.5: RLS Location Protocol Procedure Additional Scripts

Script	Expected Result	Actual Result	Pass/Fail (√ or x)
1. Ensure that the beacon is correctly coded as per C/S T.007 Annex C. Carry out a self-test.	Ensure that the encoded 15 Hex ID is '193BFCE031BFDFF'	Hex ID =	
3. Provide an IEC 61162-1 RLM sentence *or an equivalent proprietary RLM sentence defined by the GNSS-receiver manufacturer* as the navigation input to the beacon with the following data: 15 Hex ID = 193BFCE031BFDFF Message Type = 1 UTC Time = any valid random	Ensure that a different indication of receipt of an RLS request acknowledgement is provided within 5 seconds of the application of the RLM sentence. Bits 109 to 114 are '101001'	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	

Note: a similar change was made in 4 other places in this table.

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Parameters to be Measured	Range of Specification	Units	Test Results	Comments
9. Thermal Shock*				
10. Operating Lifetime at Minimum Temperature†				
- Duration except for ELT(DT)	> 24	hrs	_____hours at T_{min} = _____°C	
- Duration for ELT(DT)	> ~~20~~*370*	~~hrs~~*mins*	_____~~hours~~ *minutes* at T_{min} = _____°C	
- transmit frequency nominal value	C/S T.001	MHz		
- transmit frequency short term stability	< 2x10-9	/100ms		

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Parameters to be Measured	Range of Specification	Units	Test Results	Comments
- default position data transmitted after 10 minutes without valid position data (for ELT(DT)) - information provided on protection against erroneous position encoding into the beacon message	Correct	√ √		
18. Return Link Service (RLS)				
h) GNSS Receiver reactivation time	*52* ~~39~~ minutes +/- 5 seconds past next natural hour	min		
i) GNSS Receiver on time	≥ 15 minutes after reactivation	min		
j) GNSS Receiver reactivation time	*52* ~~39~~ minutes +/- 5 seconds past next natural hour	min		

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Parameters to be Measured	Range of Specification	Units	Test Results	Comments
- A.3.8.8.2 UTC Test				
h) GNSS Receiver reactivation time	~~39~~ *52* minutes +/- 5 seconds past next natural hour	min		
i) GNSS Receiver on time	≥ 15 minutes after reactivation	min		
j) Transmitted message valid location Message Bits 109 to 114	≤ 500m of actual beacon location 100001	m N/A	 Pass / Fail	
k) GNSS Receiver reactivation time	*52* ~~39~~ minutes +/- 5 seconds past next natural hour	min		

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F.6 APPENDIX F TO ANNEX F: CHECK-LIST OF TECHNICAL DATA PROVIDED BY BEACON MANUFACTURER

Table F-F.1: Check-List of Technical Data Provided by Beacon Manufacturer

Tick (√) to indicate submission of items	Applicable C/S T.007 requirement	Description of technical information item	File name, title of document, page, section, where the item is located
		~~and Excel file~~	
	5(j-i)	Design: protection against continuous transmission	
	~~5(j-ii)~~	~~Design: frequency 5-year frequency stability~~	
	5(j-~~i~~iii)	Design: protection against repetitive self-test	
	5(j-~~iv~~*iii*)	Design: self-test default values	
	5(j-*i*v)	Design: protection against GNSS receiver faulty operation	
	5(j-v)	*Statement and description on National-User protocol (long format) message encoding*	
	5(k)	Matching network	
	5(l)	Antenna cable type and maximum RF-losses	
	5(n-*i*)	GNSS receiver operating cycle and battery current	
	5(n-*ii*)	Internal GNSS receiver and antenna data sheets	
	5(n-iii)	*Description of internal GNSS receiver cold start*	
	5(o)	Interface with external navigation device	
	5(p-i)	External ancillary devices: technical data sheets	
	5(p-ii)	External ancillary devices: details of electrical connections	
	5(q)	Description of differences between beacon model variants	
	5(r)	Check-list	
	5(s)	Statement on worst-case operating temperature	
	5(t)	Statement on known non-compliances	
	5(u)	*Statement on power alignment for units submitted for TA testing*	
	5(~~u~~*v*)	Self-test indication of insufficient battery energy (Table F-E.5)	

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Beacon Characteristics

Characteristic	Specification
Operating frequency (406 MHz operating channel = 406.xxx)	*406.*_ _ _MHz
Operating temperature range	T_{min} =_____ T_{max} =_____
Temperature, at which minimum duration of continuous operation is expected (Submit C/S T.007 Section 5, part s, if applicable)	T_{min} ☐ ~~OR~~ *or* Other (__°C)
Operating lifetime	_____ ~~Hours~~ *hours / minutes*

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K.2.2 GNSS Constellations

The GNSS ~~Simulator~~ *simulator* shall be configured to operate with the constellations declared by the ELT(DT) manufacturer that the GNSS ~~Receiver~~ *receiver* is configured to accept (this could be a single constellation or multiple constellations). Each constellation shall be configured as an optimized constellation based upon the official published information on that constellation (e.g. GPS – 24 satellites in Orbital Planes A1-4, B1-4, C1-4, D1-4, E1-4 and F1-4, Glonass – 24 satellites in Orbital Planes 1 (Slots 1-8), 2 (Slots 9-16) and 3 (Slots 17-24) and Galileo – 24 satellites in Orbital Planes A (Slots 01-08), B (Slots 01-08) and C (Slots 01-08). Additional or spare satellites in any constellation shall not be included. Each constellation shall be configured to commence testing at 00:00 UTC on January 1, 2017 and the start position for each test shall be at Latitude 13.283 degrees North, Longitude 40.917 degrees East and Altitude -100 m. The simulator output shall be set such that the signal level received by the antenna of the GNSS ~~Receiver~~ *receiver* under test is within +/- 2dB of the nominal signal level at the earth's surface for that constellation. No SBAS satellite augmentation such as WAAS or EGNOS shall be employed and no interference shall be superimposed on the GNSS signals.

The signal to be injected into the external navigation input (if applicable) shall be in the format of a defined navigation signal that is compliant with a recognized interface standard (such as IEC 61162-1 or an ARINC label). The start position for the external navigation input signal shall be at Latitude 12.283 degrees North, Longitude 41.917 degrees East and Altitude +100 m. The signal shall commence testing at 00:00 UTC on January 1, 2017.

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K.2.3 ELT(DT)

The ELT(DT) under test, including its GNSS ~~Receiver~~ *receiver* and related GNSS ~~Antenna~~*antenna*, shall be configured in a set up representative of a typical installation on board an aircraft. The GNSS ~~Antenna~~ *antenna* shall be mounted in the centre of a superstructure of at least $1m^2$ representative of the aircraft fuselage. *The ELT(DT) shall be mounted below the superstructure and* ~~T~~*t*he cabling between the GNSS*/ELT* ~~Antenna~~ *antenna(s)* and the ELT(DT) shall be the maximum length specified by the manufacturer. If the ELT(DT) can accept navigation data from an external navigation device as well as from its own internal navigation device, then the test shall be performed twice. Firstly, ~~-~~with the GNSS ~~Simulator~~ *simulator* signals being fed ~~*to both inputs (*~~over the air to the GNSS*/ELT antenna(s)* ~~Antenna~~ *and, if applicable, with the external navigation device input disconnected,* ~~*and via a cable to the ELT(DT) external input),*~~ and secondly *with the GNSS simulator signals being fed over the air to the GNSS/ELT antenna(s) and* with the ELT(DT) external *GNSS* input *fed with an input signal as defined in K.2.2* above~~disconnected (over the air signals only)~~. *During this second test after 6 minutes and 10 seconds remove the GNSS simulator signals fed over the air for a total time period of 3 minutes and 10 seconds and then restart the signals.* If the GNSS ~~Receiver~~ *receiver* and/or the ELT(DT) is normally powered such that it is in the 'Armed' mode of operation prior to activation of the ELT(DT) then it shall be configured in this mode ~~for 15 minutes~~ immediately ~~prior~~ *after* ~~to~~ the commencement of the following test to ensure that it has initialised and has a valid location.

Note: For ELT(DT) equipped with ARINC429 sentences decoding, the GNSS simulator may be~~*is*~~ *replaced by an ARINC429 simulator to feed the signal to the ELT(DT) external GNSS input.*

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K.3 GNSS SIMULATOR SCENARIO

The GNSS Simulator shall be programmed to perform a flight pattern that complies with the one provided in the csv file in document C/S T.007 starting at a simulated time of 00:00 UTC on 01/01/2018, which could be summarized as follows: ~~The GNSS Simulator shall be programmed to perform a flight pattern that approximates to the following~~

a) ~~fifteen seconds~~*five minutes* of stationary (static position*) with the beacon in "ARMED" mode and then approximately 15 seconds before the end of this time turn the ELT(DT) to the "ON" mode*;

b) accelerate due North at a rate of ~~4.63~~*5.55* m/s^2 for 60 seconds in a straight line, while climbing 5,000 m;

c) apply a constant *horizontal speed* ~~velocity~~ of ~~278~~*333* m/s for 36 seconds in a straight line, while climbing a further 5,000 m;

d) level out and at a constant ~~total velocity~~ *horizontal speed* of ~~278~~*333* m/s simulate a bank of 45 degrees to the left and a turn of 6 degrees per second for one minute;

e) at the same *horizontal speed* ~~velocity~~ remove the bank and turn and then simulate a bank of 45 degrees to the right and a turn of 6 degrees per second for one minute;

f) remove the bank and turn and then decelerate at a rate of *2.77*~~2.31~~ m/s^2 for 120 seconds, while descending 5,000 m while performing a left turn of 12 degrees per second;

g) level out, remove the turn and then accelerate at a rate of *2.77*~~2.31~~ m/s^2 for 60 seconds in a straight line, while climbing 5,000 m;

h) level out and apply a constant *horizontal speed* ~~velocity~~ of ~~157~~*166* m/s for 90 seconds, while descending 10,000 m; and

i) finally apply 60 seconds of stationary position again.

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Note - the above trajectory and aircraft attitude shall be implemented such that:

a) The satellites used at the start of the simulation shall be those that are above 5 degrees elevation at the location of the simulation based upon its start time. As the aircraft direction and attitude changes during the simulation (i.e. climbs, banks, descends etc) the horizon shall be considered to change with the aircraft movement, such that the satellites in view change accordingly. For example if the aircraft was heading due north and climbing at an angle of 30 degrees, then any satellites to the North below 35 degrees elevation would be excluded from the simulation, while satellites due South should take into account the earth's horizon, and satellites at other points around the compass would be included or excluded accordingly on the same basis.

b) discontinuities between the various phases of the trajectory are limited to a maximum acceleration of 100 m/s^2. Apart from the final transition phase, which in effect simulates the aircraft crashing, where the change in instantaneous acceleration shall be infinite.

The CSV file provided in document C/S T.007 containing the data for the above scenario shall be used to program the GNSS simulator and provide the navigation device input(s) for these tests.

K.4 RESULTS

Ensure that the results obtained comply with C/S T.007 Annex A.3.8.3.

- END OF ANNEX K –