INTERIM PROCEDURE FOR
THE DETERMINATION OF COMPLIANCE OF
406 MHz BEACONS EQUIPPED WITH A TCXO WITH
COSPAS-SARSAT TYPE APPROVAL REQUIREMENTS
Revision 1 - October 2009

The following procedure is to be used for the purpose of determining the compliance of beacons equipped with a TCXO with the Cospas-Sarsat requirements concerning the beacon medium-term frequency stability (i.e. the slope and residual component). This procedure takes into consideration the compounded effects of the variation of performance between TCXO devices and their potential ageing. It is assumed that both the TCXO and the beacon design contribute to the overall medium-term frequency stability performance of the beacon.

1. Residual Component of the Medium-Term Frequency Stability

Requirements:

a) The residual component of the medium-term frequency stability measured during the temperature gradient test corresponding to the appropriate class of the beacon shall be provided by the manufacturer for the specific oscillator used in the tested beacon prototype.

b) As part of the quality assurance plan, the beacon manufacturer shall provide assurances that all TCXOs used for the production of the beacon model will exhibit a residual component of the medium-term frequency stability no greater than 2.0 ppb, as measured during a temperature gradient test corresponding to the appropriate class of beacon.

The contribution of the beacon design is determined by removing the contribution of the oscillator (on a root-mean-square basis) from the measurement of the beacon medium-term frequency stability residual component provided by the testing laboratory per the following equation:

$$R_{beacon} = \sqrt{R_{tot}^2 - R_{osc}^2}$$

Where: R_{tot} is the value of the residual measured during Cospas-Sarsat type approval testing at a given point of the temperature gradient profile,

R_{osc} is the value provided for the specific oscillator in the beacon prototype at the same point of the temperature gradient profile.

The calculation of R_{beacon} shall be made for every matched data pair in order to find the worst case (i.e. $R_{tot} - R_{osc}$ is a maximum). Beacon manufacturers and the beacon test laboratory shall provide the oscillator (R_{osc}) and the beacon (R_{tot}) performance characteristics in tabulated electronic format (e.g. MS Excel spreadsheet) with data points taken at least once every minute over the temperature gradient test. The test laboratory shall combine and synchronise the data sets in each phase of the temperature gradient profile to match data points.

Note: If R_{osc} is greater than R_{tot}, then allowance may be made for measurement inaccuracies by adding/subtracting the measurement uncertainty contained within document C/S T.008 from R_{tot} and R_{osc} as appropriate.

For example: If the values obtained for R_{tot} = 1.2 ppb and R_{osc} = 1.3 ppb. The C/S T.008 tolerance of ±0.1ppb would in this case be added to R_{tot} and subtracted from R_{osc} ; giving new values for R_{to}= 1.3 ppb and R_{osc} = 1.2 ppb. The interim MTS calculations would then be applied to the revised figures to determine R_{beacon}.

The worst case beacon residual component performance is then recalculated by adding the maximum oscillator contribution (i.e. 2.0 ppb) as follows:

$$R_{beacon\_max} = \sqrt{R_{beacon}^{2} + R_{osc\_max}^{2}}$$

Where: R_{beacon} is the value previously calculated for the beacon contribution, and R_{osc_max} is the maximum oscillator contribution (2.0 ppb).

The performance after five years is estimated by adding an ageing contribution (0.2 ppb). The final value obtained shall be less than the Cospas-Sarsat requirement for the medium-term frequency stability residual (i.e. 3.0 ppb):

$$R_{beacon\_5\_year\_max} = R_{beacon\_max} + 0.2 \leq 3.0 \text{ ppb}$$

2. Positive and Negative Slopes

A similar procedure is used for the evaluation of the positive and negative slopes of the medium-term frequency stability. For each slope the procedure is repeated for the steady state temperature and temperature change portions of the temperature gradient test, as defined in paragraph A.2.4 of document C/S T.007, using the following limits:

- For the positive slope measured during the steady state temperature portion of the temperature gradient test, the maximum contribution of the oscillator shall be 0.7 ppb/min[†]. The Cospas-Sarsat performance requirement is 1.0 ppb/min.

- For the positive slope measured during the temperature change portion of the temperature gradient test, the maximum contribution of the oscillator shall be 1.7 ppb/min[†]. The Cospas-Sarsat performance requirement is 2.0 ppb/min.

- For the negative slope measured during the steady state temperature portion of the temperature gradient test, the maximum contribution of the oscillator shall be -0.7 ppb/min[†]. The Cospas-Sarsat requirement is -1.0 ppb/min.

- For the negative slope measured during the temperature change portion of the temperature gradient test, the maximum contribution of the oscillator shall be -1.7 ppb/min[†]. The Cospas-Sarsat requirement is -2.0 ppb/min.

No ageing factors are to be applied for the calculations of the negative and positive slopes.

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[†] Values provided by TCXO manufacturer in an email to the Secretariat on 23 June 2008.