

SARSAT Beacon Manufacturer's Workshop

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Regulatory Changes & Type Approval Changes

Antenna Test Facility Inaccuracy, Rechargeable Batteries

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Antenna Test Facility Inaccuracy

- C/S T.007 allows C/S T.008 accuracy allowances to be added to type approval test facility measurements
- C/S adds C/S T.008 error allowance to out of spec measurement by type approval test facilities
- Most critical C/S T.008 parameter is EIRP; RF link margin and detection probabilities are dependent on the EIRP
- C/S T.008 accuracy spec for antenna EIRP is ± 3 dB
- C/S assumes the error is the maximum allowable magnitude and in a favorable direction and applies the error to raise out-of-spec measurements to make them “compliant”



Worst Case EIRP Example

- To save money and reduce battery size , beacon produced with an EIRP of +26 dBm at some elevations
- Test facility, due to measurement inaccuracy, measures at +29 dBm at the same elevations during type approval tests
- C/S applies T.008 error allowance of +3 dB to raise the EIRP measurement to +32 dBm and thus pass.
- C/S type approves a beacon with an EIRP 6 dB below spec
- For comparison, NASA GOES requires any measurement error to be applied in the unfavorable direction; if a parameter spec is +32 dBm and the test equipment measurement accuracy is ± 3 dB, the test must measure the parameter at $\geq +35$ dBm to ensure the spacecraft meets the parameter spec. Unlike the C-S approach, this guarantees spec compliance



JC-26 Action

- Secretariat paper JC-26/5/29 proposed elimination of T.008 Annex A Table A.1 accuracy requirements for EIRP and antenna gain
- Concern was that this could reduce beacon EIRP 's and detections
- JC to investigate type approval antenna/EIRP test facilities measurement accuracies (TWG-26/AI.3)
- Recommended new language for T.007: “for the beacon antenna test results (Table F-B.1 and Table F-B.3) the allowance cannot exceed a maximum uncertainty of **1 dB applied to no more than 4 measurement points** (Table F-B.1) or 2 measurement points (Table F-B.3)”.
- JC to consider changes to T.007 and T.008 based on measurement accuracies at the type approval sites



Issues

- EPG confirmed no measurement accuracy information available except for vendor measurement accuracy of test equipment.
- No test or test equipment exists for determining measurement accuracy at test sites, especially for EIRP and antenna gain.
- Should C/S develop a test antenna and calibrate the gain/ EIRP with reference to national standards(i.e. test at NIST facilities) in C/S configuration?



Li Ion Batteries- JC History

- 2009-C/S interim spec (LIRB) approved
- 2010- Type approval changed to letter of compatibility; USA identified numerous concerns- most still un-addressed
- 2011- no changes
- 2012- USA proposed changes
 - Limit application to Li Ion batteries (JC agreed what that means)
 - Measuring capacity using a realistic pulsed discharge profile – was not accepted
 - Move away from relying upon the Arrhenius equation for accelerated lifetime testing (relates chemical reaction rate to temperature) – was not accepted (adopted by RTCA in new small and medium Li ion spec)
- JC-26 action item (TWG-26/AI.7)
 - Continue investigations, report test results
 - Investigate battery capacity using realistic pulsed currents vs. equivalent constant current
 - Investigate RTCA method (per JC-26/5/28) to determine irreversible **storage/standby** losses

USA issues at CSC-43



- Storage fade (sum of reversible and irreversible battery losses over time) of Li-Ion rechargeable batteries is greater than fade of non-rechargeable batteries
- Diligence of users in maintaining rechargeable batteries
- Reduced reliability likely for beacons with rechargeable batteries;
- Mounting of Rechargeable ELTs and EPIRBs since they might require more frequent removal and inspection
- Time of last charge and number of charge cycles are hard to verify
- Chances increase of activations lasting less than 24 hours
- Potential increases for beacon activations that last for less than 24 hours
- Cospas-Sarsat use of 1.65 as a safety factor does not account for temperature



RTCM action on Li Ion batteries

- Feb 2012- Breitling presented plans to RTCM and announced plans to request a C-S letter of compatibility this year
- May 2012- Breitling proposed that RTCM modify its PLB spec to allow Li Ion rechargeable batteries; RTCM is considering whether to create a new class of PLBs for watches with rechargeable batteries
- September outcome??



Next steps

- Li Ion battery tests needed to understand performance in SAR environments
- Suitable testing by other entities is not expected
- Distress alerting for SAR is unique from other applications
- NASA recommends that RTCM and/or interested beacon manufacturers take the lead in this investigation



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