COSPAS-SARSAT
SYSTEM MONITORING
AND REPORTING

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COSPAS SARSAT

COSPAS-SARSAT SYSTEM MONITORING AND REPORTING

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1. INTRODUCTION

1.1 Overview and Background

The Cospas-Sarsat System forms an integral part of search and rescue capabilities throughout the world. The elements of the System, provided by a number of countries, consist of Cospas and Sarsat LEOSAR satellites with Search and Rescue Repeaters (SARR) and Search and Rescue Processors (SARP) payloads, GEOSAR satellites, Local User Terminals (LUTs), Mission Control Centres (MCCs) and 406 MHz beacons.

To ensure coherent and reliable System operation, performance standards and monitoring procedures are required to determine if all System elements are operating in the desired manner. In addition to this routine and periodic System monitoring, Cospas-Sarsat implemented a Quality Management System (QMS). The procedure for continuous monitoring and objective assessment of the System described in section 2 of this document is an integral part of the QMS.

If anomalies are detected in System operation, procedures for the notification of anomalies and for reporting on System performance provide all those involved in Cospas-Sarsat related activities, including Space Segment Providers, LUT/MCC operators, SAR services, national authorities and, when appropriate, manufacturers of Cospas-Sarsat equipment and the users of Cospas-Sarsat emergency beacons, with the necessary information so that corrective action can be taken.

1.2 Objectives

The Cospas-Sarsat Quality Policy, as provided in section 4 of document C/S P.015 “Cospas-Sarsat Quality Manual”, states that Cospas-Sarsat is committed to maintaining a System that provides accurate, timely and reliable distress alert and location data. To ensure the quality of alert data, Cospas-Sarsat shall maintain and continually improve its QMS and will endeavour to:

- maintain focus on search and rescue requirements; and
- understand and apply internationally recognised quality management principles.

Cospas-Sarsat is committed to a philosophy of quality and, to that end, will continue to facilitate the development of the skills of System providers and customers to:

- operate and utilize the System to its full potential; and
- endeavour to meet the Cospas-Sarsat quality objectives.

The purpose of System monitoring is:

a) to detect anomalies in the performance of System elements; and

b) to ensure the integrity and the validity of data provided to SAR services.

To achieve the general objective of System monitoring and to maintain high quality System operations as described above, abnormal conditions must be identified by the Space Segment Providers and by each operator of Ground Segment equipment commissioned in the Cospas-Sarsat System. This also requires that, whenever possible, the detection of anomalies be performed automatically by the LUT or the MCC. Detected anomalies should be notified as appropriate to operators of Space Segment and Ground Segment elements. In addition, the evolution of System performance must be assessed to avoid unacceptable degradations and be reported as required.

1.3 Scope of Document

This document details the elements of the System which should be monitored, how such monitoring should be performed, and the applicable standards. It describes the procedures to be followed when anomalies are detected in the operation of the System's elements. This document also addresses the reporting requirements on System status and operations and the QMS operating and monitoring requirements.

1.4 General Description

1.4.1 Monitoring Cospas-Sarsat Space and Ground Segments

The System monitoring procedures described in this document are designed to provide each Space Segment and Ground Segment operator with efficient tools for the quality control of System operations. For each System element, the baseline performance is established during the commissioning of Ground Segment elements and during the post-launch testing of satellite payloads. They are re-established periodically to serve as references for the detection of anomalies.

The monitoring of individual elements of the Cospas-Sarsat System (Space Segment units, Ground Segment equipment or distress beacons) is the responsibility of the provider of that element or the Administration authorising the use of the beacon.

Upon signature of the Standard Letter of Notification of Association with the International Cospas-Sarsat Programme as a Ground Segment Provider (document C/S P.002), all Operators of Cospas-Sarsat equipment agree to ensure that the data provided to SAR services is reliable and that the System is operating at its optimum performance level. Specifically, signatories assume the responsibility to:

a) adhere to the technical specifications and operating procedures set by the Council for the purpose of ensuring adequate System performance;

b) endeavour to deliver, in accordance with procedures agreed with the Council, distress alert and location information received through the Cospas-Sarsat Space Segment to appropriate search and rescue authorities; and

c) provide, as agreed with the Council, appropriate performance data in order to confirm compatibility of its Ground Segment equipment with the System.

Therefore, in the course of conducting normal Cospas-Sarsat operations, LUT/MCC operators should endeavour to verify that the System is operating normally and be alerted about degraded System performance or abnormal conditions. Section 2 of this document provides a QMS methodology for continuous monitoring and objective assessment of System status.

The function described in section 3 is referred to as "System" monitoring. It should be performed routinely, as part of the monitoring activities of individual Ground Segment elements. When anomalies are detected by a Space Segment or a Ground Segment operator, a notification message is sent to all interested Cospas-Sarsat operators. Annex D provides further tools for MCC self-monitoring.

1.4.2 Monitoring Cospas-Sarsat Distress Beacons

The monitoring of distress beacon performance is an important part of the overall Cospas-Sarsat System monitoring since the beacon initiates the distress alert and its good performance is essential for the success of the SAR operation. This monitoring should be performed by all Administrations world-wide.

Cospas-Sarsat distress beacons are designed to operate with the Cospas-Sarsat satellite system and Cospas-Sarsat defined a specific type approval procedure for these beacons. This is complemented by the definition of a comprehensive monitoring programme developed to assist Administrations in ensuring their reliable performance.

1.4.3 Reporting on System Status and Operations

The integrity of the Cospas-Sarsat System is the result of routine monitoring activities performed individually by each Space Segment and Ground Segment Provider. However, to ensure System integrity, the long term evolution of System performance should be assessed by gathering statistical information on the status and operation of the System elements and reporting this data, together with the detected anomalies, for every twelve-month period.

1.5 Reference Documents

a. C/S A.001 "Cospas-Sarsat Data Distribution Plan"

b. C/S A.002 "Cospas-Sarsat Mission Control Centres Standard Interface Description"

c. C/S A.005 "Cospas-Sarsat Mission Control Centre (MCC) Performance Specification and Design Guidelines"

d. C/S A.006 "Cospas-Sarsat Mission Control Centre Commissioning Standard"

e. C/S P.015 "Cospas-Sarsat Quality Manual"

f. C/S S.007 "Handbook of Beacon Regulations"

g. C/S T.001 "Specification for Cospas-Sarsat 406 MHz Distress Beacons"

h. C/S T.002 "Cospas-Sarsat LEOLUT Performance Specification and Design Guidelines"

i. C/S T.003 "Description of the Cospas-Sarsat Space Segment"

j. C/S T.005 "Cospas-Sarsat LEOLUT Commissioning Standard"

k. C/S T.006 "Cospas-Sarsat Orbitography Network Specification"

l. C/S T.007 "Cospas-Sarsat 406 MHz Distress Beacon Type Approval Standard"

m. C/S T.009 "Cospas-Sarsat GEOLUT Performance Specification and Design Guidelines"

n. C/S T.010 "Cospas-Sarsat GEOLUT Commissioning Standard"

- END OF SECTION 1 -

2. METHODOLOGY AND PROCEDURES FOR CONTINUOUS MONITORING AND OBJECTIVE ASSESSMENT OF COSPAS-SARSAT SYSTEM STATUS

2.1 Introduction

The Cospas-Sarsat Quality Management System (QMS) objectives stated at section 7 of the document C/S P.015 "Cospas-Sarsat Quality Manual" are to:

- ensure that Cospas-Sarsat consistently provides accurate, timely and reliable distress alert and location information to search and rescue authorities, and
- continually improve the overall Cospas-Sarsat System Performance.

In order to accomplish these objectives, Cospas-Sarsat has decided to develop and implement a procedure for continuous monitoring and objective assessment of the status of System components, to include:

- detailed monitoring procedures and data transmission requirements,
- tools based on a standard set of requirements for the analysis of data,
- standard evaluation criteria and assessment methodology, and
- standard reporting procedures and follow-up actions.

2.2 Methodology

The status of System components shall be monitored on a continuous basis using 406 MHz transmissions of known orbitography and reference beacons. The transmissions of selected orbitography beacons, received by LEOSAR satellites for each orbit, shall be processed and sent by each LEOLUT to its associated MCC, in accordance with document C/S T.002. The associated MCC shall send messages for the selected orbitography beacons to the appropriate nodal MCC in accordance with procedures defined in document C/S A.001 "Cospas-Sarsat Data Distribution Plan".

Each GEOLUT shall send alert messages to its associated MCC every 20 minutes for selected orbitography or reference beacon transmissions in the GEO satellite footprint, in accordance with document C/S T.009. The associated MCC shall send messages for the selected orbitography beacons to the appropriate nodal MCC, in accordance with procedures defined in document C/S A.001.

Nodal MCCs shall run an automated data analysis daily and an assessment procedure on the basis of Cospas-Sarsat standard evaluation criteria. This assessment may result in various follow-up actions, including:

- warnings addressed to the responsible provider or operator of a non-conforming System component,
- modifications to the status statements of System components posted on the Cospas-Sarsat website, and
- suppression of unreliable data from non-conforming System components.

The performance and status of orbitography and reference beacons used for the monitoring and assessment procedure shall be periodically re-evaluated and confirmed by the Cospas-Sarsat Participants responsible for their operation.

The same orbitography / reference beacon should not be used for both Doppler location accuracy assessment and orbit updates.

2.3 Monitoring Procedures and Data Transmission Requirements

The procedures and data transmission requirements described in this section concern the minimum System-wide monitoring and assessment process performed in accordance with Cospas-Sarsat Quality Management System (QMS) requirements. Space and Ground Segment Providers or Operators can perform any additional monitoring and assessment procedure that is deemed appropriate for their own QMS requirements.

2.3.1 LEOLUT Data Requirements

LEOLUTs commissioned in the Cospas-Sarsat System shall process the global and local mode data which result from the McMurdo (primary ID - ADC268F8E0D3780 or if the primary beacon is not available, alternative ID - ADC268F8E0D3730) and Longyearbyen (ID - A0234BF8A7335D0) orbitography beacon transmissions, as received during all passes of all operational LEOSAR satellites. The alert and location data obtained for the McMurdo and Longyearbyen orbitography beacons shall be forwarded via the associated MCC to the nodal MCC of the DDR.

If combined LEO/GEO processing has been implemented at a LEOLUT, the alert message provided for the McMurdo and Longyearbyen orbitography beacons shall not include combined LEO/GEO processing data.

MCCs shall not merge or suppress redundant alert data received from multiple LEOLUTs for the McMurdo and Longyearbyen orbitography beacons. All alert messages received from operational LEOLUTs for these beacons shall be forwarded to the appropriate nodal MCC. Nodal MCCs shall include alert messages in QMS LEOLUT availability and location accuracy analysis regardless of the Doppler Position Footprint Validation specified in Figure B.2 of document C/S A.002 “Cospas-Sarsat Mission Control Centres Standard Interface Description”. In a contingency situation MCCs shall not transmit QMS data to the back-up nodal MCC.

2.3.2 GEOLUT Data Requirements

GEOLUTs commissioned in the Cospas-Sarsat System shall produce for every 20 minute time slot starting from the hour, one alert message for the transmissions of the designated orbitography and reference beacons in the GEOSAR satellite footprint.

MCCs shall not suppress redundant alert data received from multiple GEOLUTs for the designated beacons. All alert messages received from GEOLUTs for these beacons shall be forwarded to the appropriate nodal MCC. In a contingency situation MCCs shall not transmit QMS data to the back-up nodal MCC.

The orbitography / reference beacons to be used in each GEOSAR satellite footprint for the data collection and assessment process are:

- Toulouse time reference beacon (ID - 9C600 00000 00001) for GEOLUTs in the MSG satellite footprint,
- Edmonton reference beacon (ID - A79EE E26E3 2E1D0) for GEOLUTs in the GOES East and GOES West satellite footprints, and
- Kerguelen reference beacon for GEOLUTs (ID - 9C7FEC2AACD3590) in the INSAT satellite footprint.

Note: An alternative orbitography or reference beacon may be designated in each GEOSAR satellite footprint for the purpose of this monitoring procedure. However, the selected reference beacons should meet specific performance requirements and be adequately monitored by the provider, in accordance with the relevant sections (to be developed) of the document C/S T.006 "Cospas-Sarsat Orbitography Network Specification".

2.3.3 Orbitography / Reference Beacon Unavailability

If a designated QMS orbitography / reference beacon becomes non-operational (as declared in a SIT 605 message by the MCC responsible for the beacon), then the QMS continuous monitoring process will no longer use that beacon.

If a beacon used for GEOSAR QMS monitoring becomes non-operational and an alternative beacon is designated (as specified in section 2.3.2) and is operational, then:

a) the MCC responsible for the alternative beacon shall declare in a SIT 605 message that the alternative designated beacon is to be used for GEOSAR QMS monitoring;

b) GEOLUTs shall send alert messages for the alternative designated beacon instead of the non-operational beacon to the associated MCC;

c) MCCs shall send alert messages for the alternative designated beacon instead of the non-operational beacon to the associated nodal MCC; and

d) nodal MCCs shall perform GEOSAR QMS monitoring using the alternative designated beacon instead of the non-operational beacon.

If a beacon used for GEOSAR QMS monitoring becomes non-operational and no alternative designated beacon is operational, then the GEOSAR QMS monitoring process shall be suspended by the associated nodal MCC until a designated beacon is returned to service.

If a beacon used for LEOSAR QMS monitoring becomes non-operational (as declared in a SIT 605 message by the MCC responsible for the beacon) and an alternative designated beacon for that beacon (as specified in section 2.3.1) is operational, then:

a) the MCC responsible for the alternative beacon shall declare in a SIT 605 message that the alternative designated beacon is to be used for LEOSAR QMS monitoring;

b) LEOLUTs shall send alert messages for the alternative designated beacon instead of the non-operational beacon to the associated MCC;

c) MCCs shall send alert messages for the alternative designated beacon instead of the non-operational beacon to the associated nodal MCC; and

d) nodal MCCs shall perform LEOSAR QMS monitoring using the alternative designated beacon instead of the non-operational beacon.

If a beacon used for LEOSAR QMS monitoring becomes non-operational, no alternative designated beacon (as specified in section 2.3.1) is operational and another designated beacon is operational, then all nodal MCCs shall perform LEOSAR QMS monitoring using the remaining designated QMS beacon only. If no designated beacon is operational, then all LEOSAR QMS monitoring shall be suspended until a designated beacon is returned to service.

2.4 Data Analysis

The data analysis requirements are described in section 6 of document C/S A.005 "Cospas-Sarsat Mission Control Centre (MCC) Performance Specification and Design Guidelines". The requested data analysis results in the production on a daily basis of:

- availability ratios for each LEOLUT / LEOSAR satellite combination and each GEOLUT in a GEOSAR satellite footprint, and
- accuracy ratios for each LEOLUT / LEOSAR satellite combination.

The LEOLUT availability and accuracy ratios are calculated daily, using data collected over the three consecutive days that precede the computation (Day -3, 00:00 UTC to Day -1, 24:00 UTC). The GEOLUT availability ratio is computed daily using data collected during the day that precedes the computation (Day -1, 00:00 to 24:00 UTC). Details of the calculations are provided in document C/S A.005.

2.5 Evaluation Criteria, Assessment Procedure and Follow-up Actions

2.5.1 Assessment Methodology and Status Tables

A set of evaluation criteria is used to determine, on the basis of the availability and accuracy ratios described in section 2.4, the status of a LUT / satellite combination, i.e. the conformity of alert data from a given LUT when processing data from a given satellite.

If the appropriate evaluation criteria are met the status of the LUT is shown as "Green" (i.e., in conformity) in the appropriate status table posted on the Cospas-Sarsat website.

If the appropriate evaluation criteria are not met, notification is sent to the Ground Segment Provider responsible for the non-conforming LUT via a SIT 605 message and the status is shown as "Red" (i.e., non-conforming) in the appropriate status table on the Cospas-Sarsat website.

Templates of the status tables for LEOLUTs and GEOLUTs are provided below in Tables 2.1a, 2.1b and 2.2. On a daily basis, the nodal MCC shall update the "Last Update" date on the Cospas-Sarsat website for each status table to confirm that the LEOLUT, GEOLUT and MCC status depicted is correct.

Table 2.1a: Template for the LEOLUT Availability Table

	SARSAT X	SARSAT Y	SARSAT N	COSPAS X	COSPAS Y	COSPAS N
LEOLUT 1	R	R	R	R	R	R
LEOLUT 2	R	G	R	G	G	R
LEOLUT 3	R	G	G	G	G	G
LEOLUT N	R	G	G	G	G	G

Table 2.1b: Template for the GEOLUT Availability Table

	GEOSAT X	GEOSAT Y	GEOSAT N
GEOLUT 1	**G**	n/a	n/a
GEOLUT 2	n/a	**G**	n/a
GEOLUT N	n/a	n/a	**G**

Table 2.2: Template for the LEOLUT Accuracy Table

	SARSAT X	SARSAT Y	SARSAT N	COSPAS X	COSPAS Y	COSPAS N
LEOLUT 1	**R**	**R**	**R**	**R**	**R**	**R**
LEOLUT 2	**R**	**G**	**R**	**G**	**G**	**G**
LEOLUT 3	**R**	**G**	**G**	**G**	**G**	**G**
LEOLUT N	**R**	**G**	**G**	**G**	**G**	**G**

Table 2.1a shows that LEOLUT 1 availability ratios are poor ("Red" status) for all LEOSAR satellites. LEOLUT 1 availability ratios are constantly below the Cospas-Sarsat availability requirement and the LEOLUT should be considered not operational.

All LEOLUTs on Table 2.1a show a non-conforming "Red" status for the Sarsat X satellite. This indicates that the Sarsat X satellite or payload does not satisfy the availability requirement of the Cospas-Sarsat System. However, it is important to note that no alert data is suppressed on the basis of a "Red" non-conforming availability status.

Table 2.2 shows that LEOLUT 1 provides no location data for all LEOSAR satellites, or unreliable location data that are suppressed by the nodal MCC in accordance with the procedures described in section 2.5.4.

In Table 2.2, Sarsat X shows a "Red" status for all LEOLUTs: no reliable location data can be derived from Sarsat X and this data is therefore suppressed, or the Sarsat X payload is not operational and provides no data to any LEOLUT in the System.

Table 2.2 also indicates that LEOLUT 2 does not provide reliable location data when tracking Sarsat N and the Doppler location in the alert messages is suppressed in accordance with the procedure described at section 2.5.4. The corresponding availability status for the LEOLUT2 / Sarsat N combination in Table 2.1a is also shown as non-conforming (Red).

2.5.2 LEOLUT Availability Assessment, Status Reporting and Follow-Up Actions

The LEOLUT availability ratio shall be greater than or equal to 80 %.

If this availability criterion is met, the status of the LEOLUT(i) / LEOSAT(j) combination shown in the LEOLUT availability table posted on the Cospas-Sarsat website is "Green" (see Table 2.1a: Template for the LEOLUT and GEOLUT Availability Table).

If this availability criterion is not met, the nodal MCC shall notify the associated MCC, using the SIT 915 message template provided at Annex E.

If the availability criterion is met after a SIT 915 (warning) message was sent for the previous reporting period, no message should be sent to confirm the return to conformity.

If the availability ratio for LEOLUT(i) and LEOSAT(j), computed as described in section 2.4 over a 3 day period, remains constantly below the availability criterion for 4 successive days, LEOLUT(i) shall be declared non-conforming in respect of LEOSAT(j). The nodal MCC shall:

- inform all MCCs and the Cospas-Sarsat Secretariat using a SIT 605 message (see sample at Annex E), and
- update the LEOLUT availability table posted on the Cospas-Sarsat website for the LEOLUT / LEOSAT combination to “Red”.

If the LEOLUT non-conformity is corrected, the availability status for the LEOLUT / LEOSAT combination shall be returned to "Green" as soon as the availability criterion is met. The nodal MCC shall:

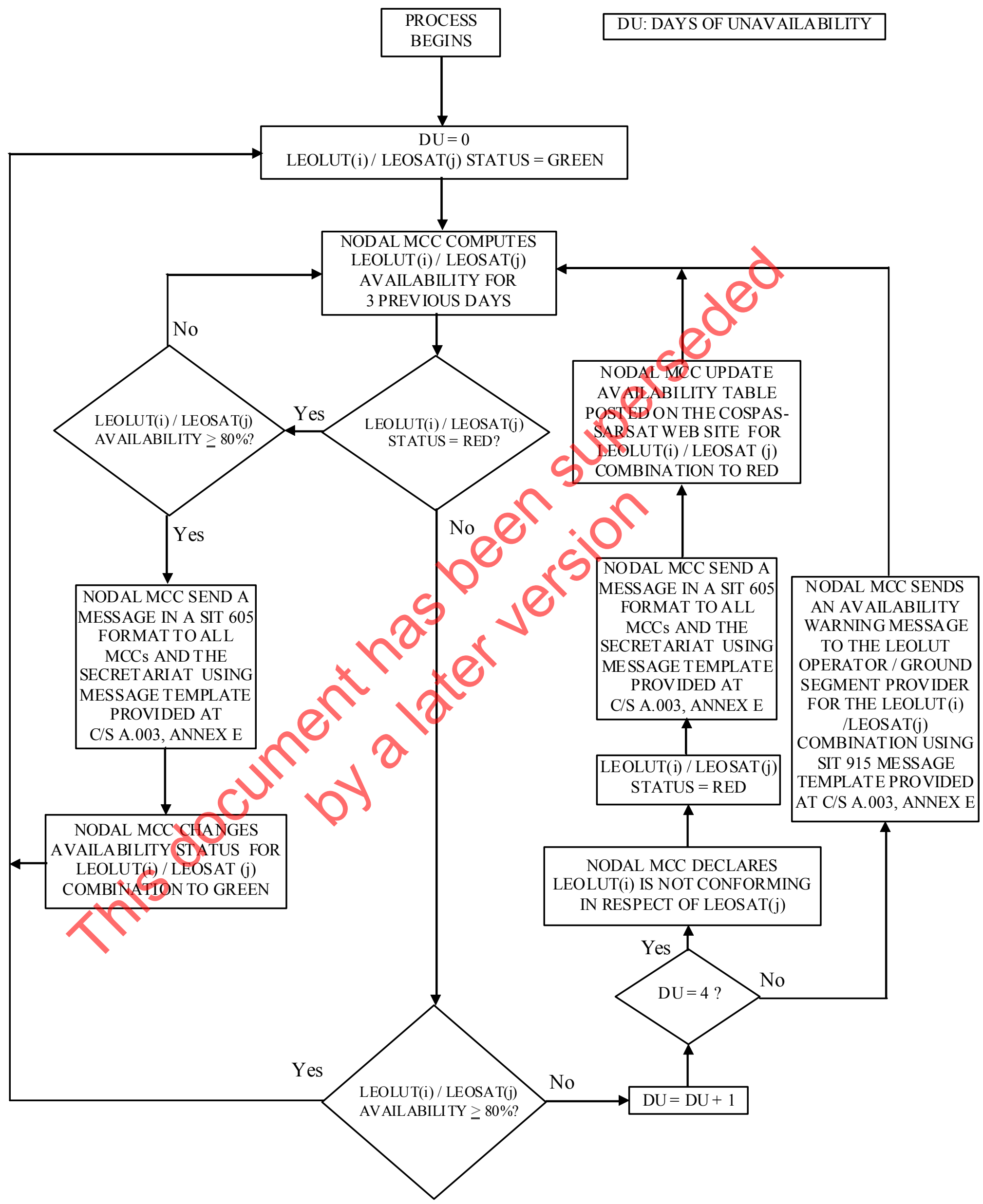
- inform all MCCs and the Cospas-Sarsat Secretariat using a SIT 605 message (see sample at Annex E), and
- update the LEOLUT availability table posted on the Cospas-Sarsat website.

The process described above is depicted in Figure 2.1.

Note: It is recognised that the 3-day data requirement to compute the availability ratio may introduce a 3-day latency after the LEOLUT non-conformity is corrected. This latency is considered acceptable in the case of LEOLUT availability, noting that:

- no data is suppressed as a consequence of the "Red" availability status, and
- the "Red" availability status for a LEOLUT / LEOSAT combination does not affect the availability status of other LEOSAT combinations for the same LEOLUT.

Figure 2.1: LEOLUT Availability Assessment, Status Reporting and Follow-Up Actions



2.5.3 GEOLUT Availability Assessment, Status Reporting and Follow-Up Actions

The GEOLUT availability ratio shall be greater than or equal to 80 %.

If this availability criterion is met, the status of the GEOLUT(i) / GEOSAT(j) combination shown in the GEOLUT availability table posted on the Cospas-Sarsat website is “Green” (see Table 2.1b: Template for the GEOLUT Availability Table).

If this availability criterion is not met, the nodal MCC shall notify the associated MCC, using the SIT 915 message template provided at Annex E.

If the availability criterion is met after a SIT 915 (warning) message was sent for the previous reporting period, no message should be sent to confirm the return to conformity.

If during a period of 4 successive days, the availability ratio for the GEOLUT remains constantly below the availability criterion, the GEOLUT shall be declared non-conforming. The nodal MCC shall:

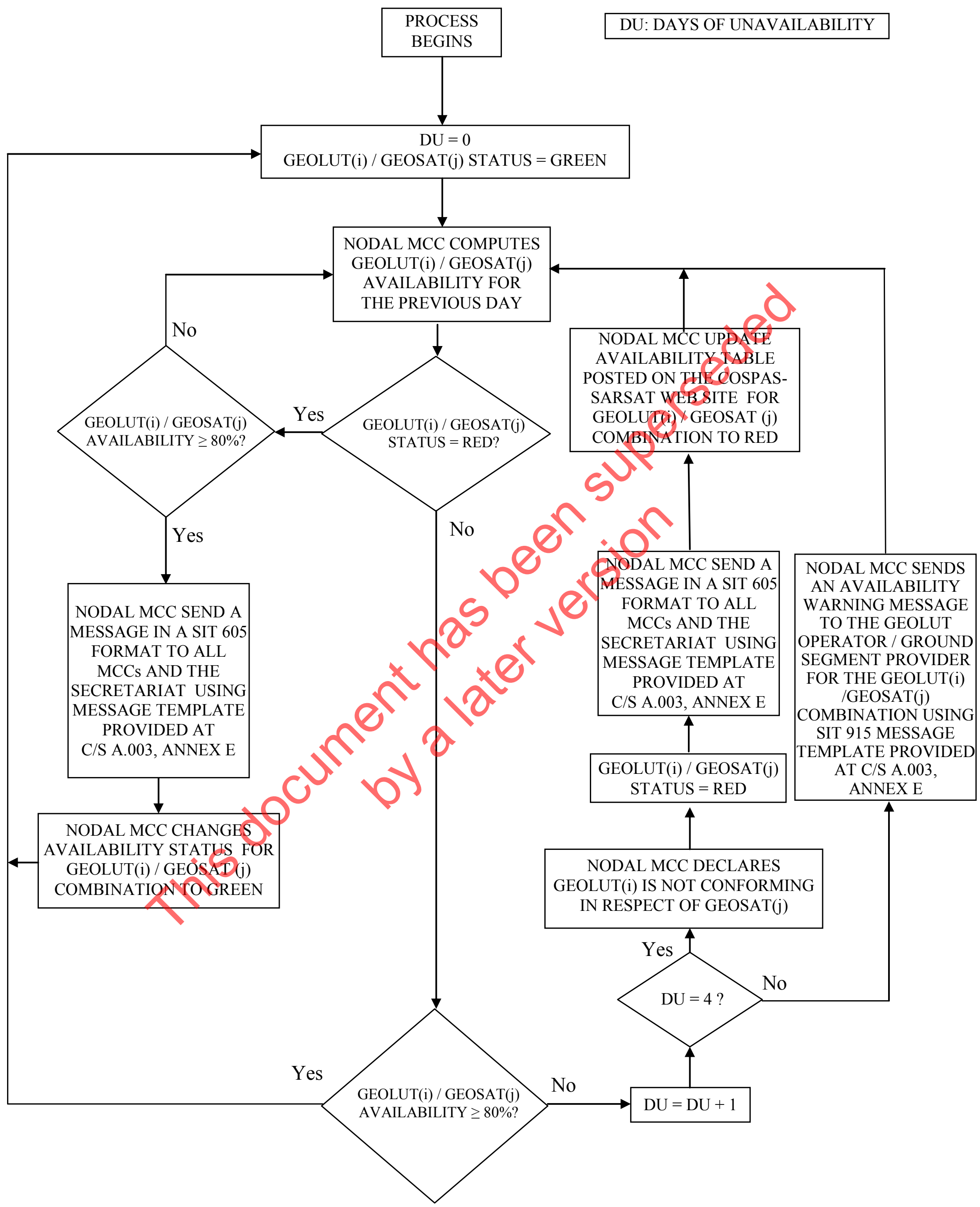
- inform all MCCs and the Cospas-Sarsat Secretariat using a SIT 605 message (see sample at Annex E), and
- update the GEOLUT availability table posted on the Cospas-Sarsat website for the GEOLUT / GEOSAT combination to “Red”.

If the GEOLUT non-conformity is corrected the availability status for the GEOLUT / GEOSAT combination shall be returned to "Green" as soon as the availability criterion is met. The nodal MCC shall:

- inform all MCCs and the Cospas-Sarsat Secretariat using a SIT 605 message (see sample at Annex E), and
- update the GEOLUT availability table posted on the Cospas-Sarsat website.

The process described above is depicted in Figure 2.2.

Figure 2.2: GEOLUT Availability Assessment, Status Reporting and Follow-Up Actions



2.5.4 LEOLUT Location Accuracy Assessment, Status Reporting and Follow-Up Actions

2.5.4.1 Location Accuracy Warning

The 5 km accuracy ratio shall be greater than or equal to 95%.

The 10 km accuracy ratio shall be greater than or equal to 98%.

If these two criteria are met, the status of the LEOLUT(i) / LEOSAT(j) combination shown in the LEOLUT accuracy table posted on the Cospas-Sarsat website is "Green" (see Table 2.2: Template for the LEOLUT Accuracy Table).

If either of these two criteria is not met the nodal MCC shall notify the associated MCC, using the SIT 915 message template provided at Annex E. The status of the LEOLUT(i) / LEOSAT(j) combination shown in the LEOLUT accuracy table posted on the Cospas-Sarsat website is not changed.

If these two criteria are met after a SIT 915 (warning) message was sent for the previous reporting period, no message should be sent to confirm the return to conformity.

2.5.4.2 Unreliable Alert Data Filtering

If the 5 km accuracy ratio falls below 60% and/or the 20 km accuracy ratio falls below 80%, (i.e. R.5 (i,j) < 0.6 and/or R.20 (i,j) < 0.8) for a LEOLUT(i) / LEOSAT(j) combination, the nodal MCC shall:

- process alert messages provided by LEOLUT(i) when processing LEOSAT(j) based only on the 406 MHz beacon message - the Doppler solution data shall not be distributed[1],
- inform all MCCs and the Secretariat using the SIT 605 message template provided at C/S A.003, Annex E,
- update the LEOLUT accuracy table posted on the Cospas-Sarsat website to show a “Red” accuracy status for the LEOLUT / LEOSAT combination, and
- update the LEOLUT availability table to show a “Red” availability status for the LEOLUT / LEOSAT combination.

2.5.4.3 Resuming Green Accuracy Status

If the LEOLUT non-conformity is corrected, as soon as the LEOLUT(i) / LEOSAT(j) accuracy ratios for 5 km (R.5 (i,j)) and 10 km (R.10 (i,j)) meet respectively the 95% and 98% accuracy criteria, the nodal MCC shall:

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[1] Each MCC in the Central Data Distribution Region must also perform this function to avoid the exchange of unreliable location data amongst themselves.

- inform all MCCs and the Secretariat using the SIT 605 message template provided at C/S A.003, Annex E,
- resume the distribution of Doppler solution data provided by LEOLUT(i) when processing LEOSAT(j)2,
- update the LEOLUT accuracy table posted on the Cospas-Sarsat website to show a "Green" accuracy status for the LEOLUT / LEOSAT combination, and
- provided the corresponding availability ratio is also met, update the LEOLUT availability table on the Cospas-Sarsat website to show a "Green" availability status for the LEOLUT / LEOSAT combination.

Note: It is recognised that the 3-day data requirement to compute the accuracy ratio may introduce a 3-day latency for resuming Doppler location data distribution after the LEOLUT nonconformity is corrected. This latency is considered acceptable, noting that:

- the "Red" status for a LEOLUT / LEOSAT combination does not affect the accuracy and availability status of other LEOSAT combinations for the same LEOLUT,
- Doppler location data suppression is implemented after several days of warning and on the basis of continuous evidence of very serious deficiencies concerning the reliability of this location data, therefore, sufficient evidence of a return to conformity must be available, and
- the 3-day latency does not impact the case of LEOLUT returning to normal operation after a total interruption of operation (e.g. for maintenance), as the accuracy ratio computed on a single day of location accuracy data should indicate conformity with the accuracy ratio requirements.

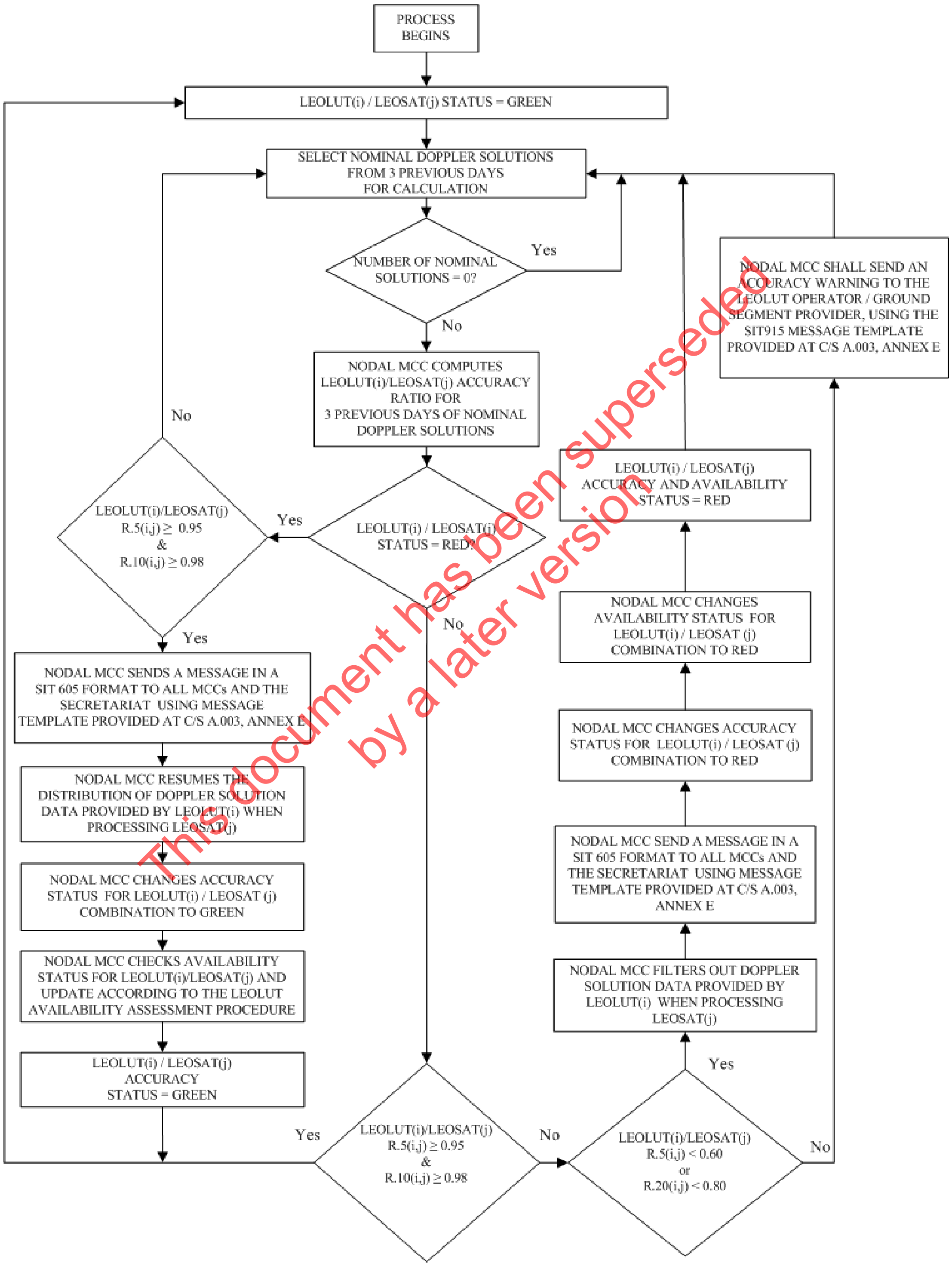
The process described above is depicted in Figure 2.3.

2.5.4.4 LEOLUT Location Accuracy Processing with No QMS Alert Data

If no QMS alert data is received for a LUT/satellite pair then the current location accuracy status should be maintained until alert data becomes available and the normal QMS analysis process allows assessment of the status.

[2] Each MCC in the Central Data Distribution Region must also resume the distribution of Doppler solution data upon reception of the SIT 605 message from the nodal MCC.

Figure 2.3: LEOLUT Location Accuracy Assessment, Status Reporting and Follow-Up Actions



2.5.5 MCC Availability

MCCs' operational or non-operational status is shown on the Cospas-Sarsat website in the MCC status table illustrated at Table 2-3.

When an MCC requires back-up, the nodal MCC shall update the MCC status table posted on the Cospas-Sarsat website. A SIT 605 message shall be sent to all MCCs and the Cospas-Sarsat Secretariat confirming the backed-up status of the failed MCC.

The website MCC status table shall be updated by the nodal MCC as soon as the failed MCC returns to normal operations. The back-up MCC shall inform all MCCs and the Secretariat of the change of status of the failed MCC, using a SIT 605 message.

The nodal MCC shall update daily the "Last Report Date" on the Cospas-Sarsat website for the MCC status table to indicate the time at which the MCC status was last assessed. In addition, the nodal MCC shall provide the time of the last MCC status change in the "Comments" column per MCC.

Table 2.3: Template for the MCC Status Table

MCC	OPERATIONAL	BACKED UP	COMMENTS
MCC 1	√		
MCC 2		√	Temporary back-up by MCC 3
MCC 3	√		
MCC 4	√		
MCC N	√		

- END OF SECTION 2 -

3. SYSTEM SELF-MONITORING

This section describes the self-monitoring methodology for the ground and space segments of the Cospas-Sarsat System.

The continuous monitoring described in section 2 provides an objective method to monitor LEOLUT location accuracy and LUT/MCC availability on an ongoing basis. However this does not replace the need for periodic detailed analysis of each element of the Cospas-Sarsat System. This section describes the various performance parameters. For the LEOSAR system, they are generally estimated with reference to a standard pass of a satellite over a beacon (i.e., a pass with a maximum beacon to satellite elevation angle of at least 8°) or for satellite passes over LEOLUTs at elevation angles over 5°.

3.1 Ground Segment Self-Monitoring

Ground Segment operators should monitor the performance of the LEOSAR and GEOSAR elements of the Cospas-Sarsat system. This self-monitoring should be performed by analyzing a set of parameters that address issues indicative of the overall performance of the system. Monitoring of these performance parameters can identify system anomalies that have the potential of degrading system performance and lead to non-conformity in LEOLUT and GEOLUT availability and LEOLUT accuracy. Timely identification and correction of these anomalies ensures system integrity.

Some of the performance parameters described below are measured against baseline values. These baseline values should be measured when each Ground Segment component is installed, or whenever there is any significant change to the relevant parts of the Space Segment or Ground Segment.

In addition, document C/S A.005 "Cospas-Sarsat MCC Performance Specification and Design Guidelines", requires an MCC to monitor additional System elements in its national ground segment including LUT/MCC communication networks, the MCC itself and connections to external communication networks.

3.1.1 LEOSAR System Performance Parameters

The LEOSAR performance parameters are organized into two tiers. Tier one performance parameters are those parameters that every ground segment operator should monitor because of their direct relationship to alert data accuracy, timeliness and reliability. Tier one performance parameters include:

a) LEOSAR System Timing

b) Sarsat SARP Time Calibration Accuracy

c) Sarsat SARP Frequency Calibration Accuracy

d) Sarsat SARR Frequency Calibration Accuracy

e) LEOSAR Satellite Orbit Data Accuracy

Tier two performance parameters are those parameters that should be checked by ground segment operators that have the necessary tools to perform this monitoring. Tier two performance parameters include:

a) Received Downlink Power Level

b) Loss of Carrier Lock

c) SARP Throughput

d) PDS Data Recovery Rate

e) Number of Single Point Alerts

f) SARP Bit Error Rate

g) SARR Bit Error Rate

h) Pass Scheduling Accuracy

The following sections provide a detailed description of these performance parameters. In addition Annex D provides a summary of these performance parameters and can be used by ground segment operators as a quick reference for the operational self-monitoring of the LEOSAR system.

3.1.1.1 LEOSAR System Timing

The LEOSAR System Timing is measured from the end of a satellite pass until the time when an incident alert is sent to an RCC or SPOC.

Indicator
The ability to transmit the incident alert data generated by a LEOLUT to the appropriate RCC or SPOC within a shorter time of the end of a satellite pass indicates an improved capability in the system to maintain the level of service required by the objective.

Rationale
This performance parameter ensures that the LEOSAR System Timing information is routinely verified and distributed.

Definitions
The LEOSAR System Timing measures the time from the end of a LEOSAR satellite pass over a LEOLUT to the time when the incident alert message is sent to the appropriate RCC or SPOC by the National MCC.

TLOS = Time of Loss of Signal of the LEOSAR satellite at the LEOLUT.

TMCCTX = Time when the MCC transmits the incident alert message to the selected destination.

The LEOSAR System Timing is then:

LST = (TMCCTX - TLOS)

Metric(s)
The LEOSAR System Timing is measured in seconds.

Reporting Criterion
If the LEOSAR System Timing is more than twenty minutes (1200 seconds) for any incident alert, then a System Anomaly notification message should be generated.

Data Collection Process
Every time the MCC transmits an incident alert message based on a LEOSAR detection, it should determine the LEOSAR System Timing associated with that alert.

Data Verification Process
The LEOSAR System Timing should be computed automatically by each MCC, using the data available to it from the LUT. This data is not normally verified by the Operator.

Relevant Documents
C/S A.005, C/S T.002

Action
If a LEOSAR System Timing anomaly is reported, the MCC operator should check on the LUT and MCC processing times associated with the alert. If there is no problem with the actual processing time, then the MCC operator should check on the time required for communication of the incident alert data at various stages in the processing of the alert.

Comments
The Cospas-Sarsat alert notification time is the time elapsed from beacon activation until the first alert message is delivered to the appropriate RCC. However, this alert notification time includes:

- the waiting time until a satellite passes over the beacon and transmits the beacon data to a LUT; and
- the MCC to RCC communication times, which are not specific to the Cospas-Sarsat system and cannot be easily measured.

Therefore, to assess the Cospas-Sarsat system performance, the LEOSAR System Timing is defined above as the time elapsed from the end of the pass on which the beacon was detected until the alert data is ready for transmission from a Cospas-Sarsat MCC to the appropriate RCC or SPOC.
In the 406 MHz system, the LEOSAR System Timing does not include the waiting time or the satellite storage time. These times can be:

- estimated by MCCs on the basis of statistics of real transmissions;
- measured by analyzing the results of a system exercise; or
- estimated by computer simulations using an analytical model describing the satellite constellation, the Cospas-Sarsat LUT/MCC network, and a specific geographical distribution of beacons.

The LEOSAR System Timing does include the LUT processing time, the LUT/MCC data transfer time, and the MCC processing time.

3.1.1.2 Sarsat SARP Time Calibration Accuracy

The SARP Time Calibration Data Accuracy reports when the SARP Time Calibration Data for a Sarsat LEOSAR satellite changes by an amount that is larger than the established criterion.

Indicator
The fewer times the SARP Time Calibration Data Accuracy reports an anomaly, the better the quality of the calibration data that is available to the system, and the more accurate the beacon location estimates produced by the system.

Rationale:
This performance parameter ensures that the SARP Time Calibration Data for each Sarsat LEOSAR satellite is monitored to determine when the system has difficulty maintaining this data.

Metric(s)
The SARP Time Calibration Data Accuracy is measured in seconds.

Reporting Criterion
The criterion for a SARP Time Calibration Data Accuracy anomaly is ten milliseconds.
If (DRTIME > 0.010), then a SARP Time Calibration anomaly should be reported.

Data Collection Process:
Every time the Sarsat LEOSAR satellite SARP Calibration Data are upgraded in the system, the LEOLUT or the MCC should propagate the old SARP Rollover Time to the time of the new SARP Time Calibration data, and should compare the resulting SARP Rollover time values. If the values differ by more than the specified criteria, then the LEOLUT should report a SARP Time Calibration Data Accuracy anomaly to the host MCC.

Data Verification Process
The SARP Calibration Data Accuracy should be checked by each LEOLUT or MCC whenever new SARP Calibration Data is received by that system. This data is not normally verified by the Operator.

Relevant Documents
C/S A.005, C/S T.002, C/S T.003

Action
If a SARP Calibration Data Accuracy anomaly is detected from a single LUT for all satellites, the LUT operator should review the SARP Calibration data and SARP Calibration processing on that LUT.
If a SARP Calibration Data Accuracy anomaly is detected from a single satellite for all LUTs, the LUT operator should review the SARP Calibration data for that satellite.

<u>Comments</u>
This performance measure provides information about the reliability of the Sarsat LEOSAR satellite SARP Calibration Data processing in the Cospas-Sarsat system. This information assists in the understanding of the accuracy of the beacon location estimates generated by the Cospas-Sarsat system.

The SARP Calibration Data applies only to the Sarsat LEOSAR satellites. The Cospas LEOSAR satellites report the beacon message time and frequency in a different format, and do not require any SARP Calibration Data.

3.1.1.3 Sarsat SARP Frequency Calibration Accuracy

The SARP Frequency Calibration Data Accuracy reports when the SARP Frequency Calibration Data for a Sarsat LEOSAR satellite changes by an amount that is larger than the established criterion.

<u>Indicator</u>
The fewer times the SARP Frequency Calibration Data Accuracy performance parameter reports an anomaly, the better the quality of the calibration data that is available to the system, and the more accurate the beacon location estimates produced by the system.

<u>Rationale</u>
This performance parameter ensures that the SARP Frequency Calibration Data for each Sarsat LEOSAR satellite is monitored to determine when the system has difficulty maintaining this data.

<u>Definitions</u>
The SARP Calibration Data for a Sarsat LEOSAR satellite are the data values that describe the internal operation of the Search and Rescue Processor (SARP) on-board the satellite. This data is used to compute the time each beacon message is received at the satellite, and the received frequency of each beacon message. This SARP Calibration Data consists of the timer Rollover Time and the frequency of the Ultra-Stable Oscillator (USO) in the SARP instrument (refer to the Description of the Payloads Used in the Cospas-Sarsat LEOSAR system, document C/S T.003, for a more complete description of the Sarsat SARP Calibration).

USOO = USO frequency in previous SARP Calibration data.
USON = USO frequency in new SARP Calibration data.

The USO frequency difference is then:

DUSO = | USON – USOO |

<u>Metric(s)</u>
The SARP Frequency Calibration Data Accuracy is expressed in Hertz.

Reporting Criterion
The criterion for the SARP Frequency Calibration Data Accuracy is 0.05 Hz. If (DUSO > 0.05), then a SARP Time Calibration anomaly should be reported by the MCC.

Data Collection Process
Every time the Sarsat LEOSAR satellite SARP Calibration Data are upgraded in the system, the LEOLUT or the MCC should compare the old USO Frequency to the new USO Frequency. If the values differ by more than the specified criteria, then a SARP Frequency Calibration Data Accuracy anomaly should be reported by the host MCC.

Data Verification Process
The SARP Calibration Data Accuracy should be checked by each LEOLUT or MCC whenever new calibration data is received by that system. This data is not normally verified by the Operator.

Relevant Documents
C/S A.005, C/S T.002, C/S T.003

Action
If a SARP Calibration Data Accuracy anomaly is detected from a single LUT for all satellites, the LUT operator should review the SARP Calibration data and SARP Calibration processing on that LUT.
If a SARP Calibration Data Accuracy anomaly is detected from a single satellite for all LUTs, the LUT operator should review the SARP Calibration data for that satellite.

Comments
The SARP Calibration Data applies only to the Sarsat LEOSAR satellites. The Cospas LEOSAR satellites report the beacon message time and frequency in a different format, and do not require any SARP Calibration Data.

3.1.1.4 Sarsat SARR Frequency Calibration Accuracy

The Sarsat SARR Frequency Calibration Data Accuracy reports when the SARR Frequency Calibration Data for a LEOSAR satellite changes by an amount that is larger than the established criterion.

Indicator
The fewer times the SARR Frequency Calibration Data Accuracy performance parameter reports an anomaly, the better the quality of the calibration data that is available to the system, and the more accurate the beacon location estimates produced by the Combined LEO-GEO processing.

Rationale
This performance parameter ensures that the SARR Frequency Calibration Data for each LEOSAR satellite is monitored to determine when the system has difficulty maintaining this data.

Definitions
The SARR Frequency Calibration Data Accuracy (SFCDA) for a LEOSAR satellite describes the stability of the SAR Repeater on-board the satellite. This data is used to calibrate the received frequency of each beacon message, for the Combined LEO-GEO Processing in a LEOLUT. This SARR Calibration Data is the measured frequency offset of the data received through the SAR Repeater on the satellite (refer to MF# 64, defined in Annex B of C/S A.002).

SFO = Received frequency in previous SARR Calibration data
SFN = Received frequency in new SARR Calibration data
SFCDA = | SFN – SFO |

Metric(s)
The SARR Frequency Calibration Data Accuracy is expressed in Hertz.

Reporting Criterion
The criterion for the SARR Frequency Calibration Data Accuracy is 1.0 Hz.
If (SFCDA > 1.0), then a SARR Time Calibration anomaly should be reported by the MCC.

Data Collection Process
Every time the LEOSAR satellite SARR Frequency Calibration Data are upgraded in the system, the LEOLUT or the MCC should compare the old SARR Frequency to the new SARR Frequency. If the values differ by more than the specified criteria, then a SARR Frequency Calibration Data Accuracy anomaly should be reported by the host MCC.

Data Verification Process
The SARR Frequency Calibration Data Accuracy should be checked by each LEOLUT or MCC whenever new calibration data is received by that system. This data is not normally verified by the Operator.

Relevant Documents
C/S A.002, C/S A.005, C/S T.002

Action
If a SARR Calibration Data Accuracy anomaly is detected from a single LUT for all satellites, the LUT operator should review the SARR Calibration data and SARR Calibration processing on that LUT.
If a SARR Calibration Data Accuracy anomaly is detected from a single satellite for all LUTs, the LUT operator should review the SARR Calibration data for that satellite.

Comments

The SARR Calibration data is only produced by a LEOLUT that has a calibrated reference beacon within the local footprint of the LEOSAR satellites while they are being tracked by the LEOLUT. This data is normally measured by the Canadian LUTs and distributed through the Cospas-Sarsat system by the Canadian MCC once a week. The anomaly criterion is based on the assumption that each change of the SARR Frequency Calibration Data will be within a week or less of the previous update. If there is a longer period of time between updates, then the magnitude of the change may be larger than the criterion value.

3.1.1.5 Sarsat Orbit Data Accuracy

The Orbit Data Accuracy reports when the orbital data for a LEOSAR satellite changes by an amount that is larger than the established criterion.

Indicator

The fewer times the Orbit Data Accuracy reports an anomaly, the better the quality of the orbit ephemeris data that is available to the system, and the more accurate the beacon location estimates produced by the system.

Rationale:

This performance parameter ensures that the orbit data for each LEOSAR satellite is monitored to determine when the system has difficulty maintaining this data.

Definitions

The orbital elements of a LEOSAR satellite are the data values that describe the orbital path of the satellite and the position of the satellite at a specified time. These orbital elements consist of an Epoch Time and six numerical data values. In the definition below, the Earth-Fixed format is used for the comparison of the orbital elements. (The data values may be specified in any of a number of data formats, and other formats may be used internally in the system to store this information; the details of the formats that are actually used are irrelevant to the validation of this Performance Measure.)

EPOCHO = Epoch time of previous orbital elements

EPOCHN = Epoch time of new orbital elements

POS(i)O = Satellite position vector based on old orbital elements, propagated forward to the time EPOCHN

POS(i)N = Satellite position vector based on new orbital elements, at time EPOCHN

VEL(i)O = Satellite velocity vector based on old orbital elements, propagated forward to the time EPOCHN

VEL(i)N = Satellite velocity vector based on new orbital elements, at time EPOCHN

DPOS = SquareRoot (Sum (POS(i)O - POS(i)N $)^2$)

DVEL = SquareRoot (Sum (VEL(i)O - VEL(i)N $)^2$)

Metric(s)

The Orbit Accuracy is measured as both position accuracy and velocity accuracy:

- The position accuracy is measured in kilometres.
- The velocity accuracy is measured in meters per second.

Reporting Criterion

The criteria for the generation of an Orbit Accuracy anomaly on the position and velocity vectors are five kilometres and five meters per second, respectively.

If (DPOS > 5.0) or if (DVEL > 5.0), then an anomaly should be reported by the MCC.

Data Collection Process

Every time the LEOSAR satellite orbital elements are upgraded in the system, the LEOLUT or the MCC should propagate the old orbit data to the time of the new orbit data, and should compare the resulting position and velocity vectors. If the vectors differ by more than the specified criteria, then an Orbit Data Accuracy anomaly should be reported by the host MCC.

Data Verification Process:

The Orbit Data Accuracy should be checked by each LEOLUT or MCC whenever new orbit data is received by that system. This data is not normally verified by the Operator.

Relevant Documents

C/S A.005, C/S T.002

Action

If an Orbit Data Accuracy anomaly is detected from a single LEOLUT for all satellites, the LEOLUT operator should review the Orbit data and Orbit data processing on that LEOLUT.

Comments

As noted in the LEOLUT Specification and Design Guidelines, "in the event of a scheduled satellite manoeuvre (as described in document C/S A.001), the LEOLUT may not be able to maintain accurate orbital elements. When such an event changes the satellite position by more that two kilometres since the previously tracked pass, this accuracy requirement is waived ...." (C/S T.002, paragraph 5.1.3)

In the event of a scheduled satellite manoeuvre, the requirement that the LEOLUT should generate a System anomaly notification message is also waived.

This performance parameter provides information about the reliability of the LEOSAR satellite orbital data processing in the Cospas-Sarsat system. This information assists in the understanding of the accuracy of the beacon location estimates generated by the Cospas-Sarsat system.

3.1.1.6 Received Downlink Power Level

The Received Downlink Power Level is maintained separately for each combination of satellite and LUT ground station.

Indicator
If the power level of the 1544.5 MHz satellite downlink signal received by the LUT increases, then the system is better able to receive and decode the beacon messages in the signal.

Rationale
This performance parameter provides for the monitoring of the satellite downlink signal and ensures that the quality of the satellite signal will be monitored regularly. It also provides data to assist with the detection of interfering signals in the downlink frequency band.

Definitions
The Downlink Power is measured in dB, using the AGC value at the LUT receiver; it is assessed separately for each combination of satellite and LUT. For the LEOSAR system, the measurement is made for each satellite pass above five degrees elevation, and for the GEOSAR system the measurement is made over each one-hour period.

MRP = Maximum Received Power

The Baseline Value is assessed on the basis of measurements made over a one-week period of normal system operation. It is computed as ten dB lower than the average over this period:

BMRP = Average (MRP) – 10

Metric(s)
The Received Downlink Power Level is measured in decibels (dB).

Reporting Criterion
If the Received Downlink Power Level is less than the Baseline Value (as indicated above), then a System anomaly notification message should be generated.

Data Collection Process
The LUT should monitor the downlink signal at all times when it is tracking a satellite, and record the AGC level at regular intervals. The level corresponding to the maximum signal level over each observation period should then be converted to dB. If the level is below the baseline, then an anomaly should be reported.

Data Verification Process
The Downlink Power Level data should be processed independently by each LUT; it is not verified by the Operator.

Relevant Documents
C/S A.005, C/S T.002, C/S T.009

Action
If a Received Downlink Signal Power Level anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.

If a Received Downlink Signal Power Level anomaly is detected from a single satellite for all LUTs, the LUT operator should report this to the MCC responsible for coordination with the satellite operator.

3.1.1.7 Loss of Carrier Lock

The Loss of Carrier Lock is maintained separately for each combination of satellite and LUT ground station.

Indicator
When the duration of Loss of Carrier Lock is reduced, that indicates that the downlink signal is being received better at the LUT, and the LUT will be better able to extract beacon messages and measure the time and frequency of each message.

Rationale
This performance parameter provides for the monitoring of the LEOSAR satellite downlink signal and ensures that the quality of the satellite signal will be monitored regularly.

Definitions
The Loss of Carrier Lock is assessed separately for each combination of satellite and LUT. For the LEOSAR system, the measurement is made for each satellite pass while the satellite is above five degrees elevation, and for the GEOSAR system the measurement is made over each one-hour period.

DCLL = Total Duration of Losses of Carrier Lock

The Baseline Value is assessed on the basis of measurements made over a one-week period of normal system operation. It is computed as ten percent higher than the average over this period:

BCLL = 1.1 * (Average duration of Loss of Carrier Lock per Pass)

Metric(s)
The duration of Loss of Carrier Lock is measured in seconds.

Reporting Criterion
If the Loss of Carrier Lock on any satellite pass is greater than the Baseline Value (as indicated above), then a System anomaly notification should be generated.

Data Collection Process
The LUT should monitor the downlink signal at all times when it is tracking a satellite, and record every Loss of Carrier Lock. After every LEOSAR satellite pass, or every hour for a GEOLUT, the LUT should determine the cumulative duration of loss of lock. If the value is greater than the baseline, then an anomaly should be reported.

Data Verification Process
The Loss of Carrier Lock data should be processed independently by each LUT; it is not verified by the MCC Operator.

Relevant Documents
C/S A.005, C/S T.002, C/S T.009

Action
If a Loss of Carrier Lock anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.
If a Loss of Carrier Lock anomaly is detected from a single satellite for all LUTs, the LUT operator should report this to the MCC responsible for coordination with the satellite operator.

3.1.1.8 SARP Throughput

The SARP Throughput is the percentage of the number of expected messages from the system reference beacons actually received in the PDS during a LEOSAR satellite pass over a reference beacon. It is maintained separately for each combination of LEOSAR satellite and LEOLUT ground station.

Indicator
When the SARP Throughput improves, it shows that the system is better able to receive and process the distress beacon data and to generate the necessary incident alerts.

Rationale
This performance ensures that each LUT monitors the data received from the known reference beacons, and reports whenever it does not receive the expected data.

Definitions
#EXP = Number of messages expected from a reference beacon on a given pass. (This is based on the known position of the beacon and the known satellite orbital data. Annex D, Table D.2 lists the number of measurements expected from a beacon at various positions relative to the over-flying satellite.)
#RCV = Number of messages received from the beacon on the actual satellite pass.
The throughput is then the percentage of the expected messages that are actually received by the LUT:
THRU = 100 * #RCV / #EXP

Metric(s)
The SARP Throughput is expressed as a percentage of the number of messages that are expected to be received by the LUT.

Reporting Criterion
The criterion for issuing a SARP Throughput anomaly report is 70%: If (THRU < 70%), then a System anomaly notification message should be generated.

Data Collection Process
Every time a LUT processes data from a LEOSAR satellite that has passed over a reference beacon since the last pass tracked by that LUT, it should compute and verify the SARP Throughput.

Data Verification Process
The SARP Throughput should be computed by each LEOLUT, using the data it receives from the LEOSAR satellites. This data is not normally verified by the Operator.

Relevant Documents
C/S T.002

Action
If a SARP Throughput anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.
If a SARP Throughput anomaly is detected from a single satellite for all LUTs, the LUT operator should report this to the MCC responsible for coordination with the satellite operator.

3.1.1.9 PDS Data Recovery Rate

The PDS Data Recovery Rate is the percentage of expected data from the Processed Data Stream (PDS) signal from the satellite SARP processors that is actually recovered during a LEOSAR satellite pass. It is maintained separately for each combination of LEOSAR satellite and LEOLUT ground station.

Indicator
When the PDS Data Recovery Rate increases, the LUT is better able to reliably receive and process the beacon signals through that channel, and to generate the incident alert data required by the system.

Rationale
This performance parameter ensures that each LUT monitors the data received from the on-board SARP instruments on each LEOSAR satellite, and reports whenever it does not receive the expected data.

Definitions
#EXP = Number of messages expected in the PDS from the SARP instrument on a given LEOSAR satellite pass. (This is based on the known position of the LEOLUT and the known satellite orbital data and SARP downlink signal characteristics, and computed for the time while the satellite is more than 5º elevation above the local horizon.)
#RCV = Number of messages received from the SARP on the actual satellite pass.
The PDS Data Recovery Rate is then the percentage of PDS messages actually received by the LEOLUT, over the satellite pass:

DRR = 100 * #RCV / #EXP

Metric(s)
The PDS Data Recovery Rate is expressed as a percentage of the total number of PDS messages expected to be received by the LEOLUT over the satellite pass.

Data Collection Process
For every pass of a LEOSAR satellite with an operational SARP instrument that is tracked by a LEOLUT, the LUT should compute the duration of the time that the satellite will be above 5º elevation, and from that should calculate the number of PDS beacon messages that it expects to receive during the pass. At the pass, the LUT should count the number of PDS messages actually received, and it should compute and verify the PDS Data Recovery Rate.

Data Verification Process
The PDS Data Recovery Rate should be computed by each LEOLUT, using the data it receives from the LEOSAR satellites. This data is not normally verified by the Operator.

Relevant Documents
C/S T.002, C/S T.003

Action
If a PDS Data Recovery Rate anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.
If a PDS Data Recovery Rate anomaly is detected from a single satellite for all LUTs, the LUT operator should report this to the MCC responsible for coordination with the satellite operator.

3.1.1.10 Number of Single Point Alerts

The Number of Single-Point Alerts is measured over a one-day period, and is maintained separately for each combination of LEOSAR satellite and LEOLUT ground station.

Indicator
When the Number of Single-Point Alerts detected by a LEOLUT decreases, it demonstrates that the LUT is processing the beacon messages better, and the capability of the system to cope with the actual volume of active beacons is improving.

Rationale
This performance parameter ensures that each LUT monitors the data received through the LEOSAR satellites, and reports how frequently it receives a Single-Point Alert. This is significant, since a Single-Point Alert does not provide enough data to enable the LUT to compute a location estimate.

Definitions
#SPA = Number of Single-Point Alerts detected by the LEOLUT on each satellite pass.
#SPD = Number of Single-Point Alerts detected by the LEOLUT in one day.
The baseline criterion for a Number of Single-Point Alerts is 50 % above the measured daily average:

BSPD = 1.5 * (Average of #SPD over a week or more of normal operation)

Metric(s)
The Number of Single-Point Alerts is measured as an actual count of Single-Point Alerts per day.

Reporting Criterion
If (#SPD > BSPD), then an anomaly should be reported by the MCC.

Data Collection Process
Every time a LUT processes data from a pass of a LEOSAR satellite, it should report the Number of Single-Point Alerts detected to the host MCC.

Data Verification Process
The Number of Single-Point Alerts should be accumulated by the MCC for each combination of LEOSAR satellite and LEOLUT, using the data received from the LEOLUT. This data is not normally verified by the Operator.

Relevant Documents
C/S A.005, C/S T.002

Action
If a Number of Single-Point Alerts anomaly is detected by all LUTs and all satellites that are monitoring a selected geographical region, the LUT operator should determine whether there may actually be a large number of beacons activated and generating single-point alerts within the region.
If a Number of Single-Point Alerts anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.
If a Number of Single-Point Alerts anomaly is detected from a single satellite for all LUTs, the LUT operator should report this to the MCC responsible for coordination with the satellite operator.

3.1.1.11 SARP Bit Error Rate

The SARP Bit Error Rate, based on nominal solutions for known beacons. It is maintained separately for each combination of LEOSAR satellite and LEOLUT ground station.

Indicator
When the SARP Bit Error Rate decreases, the LUT is demonstrating an improved capability to receive the beacon signals through the SARP data channel.

Rationale
This performance parameter ensures that each LUT monitors the data received from the LEOSAR satellites, and reports the bit error rate of the data received through the SARP data channel.

Definitions
A reference beacon is one of the Orbitography or Reference beacons operated by the Cospas-Sarsat participants.
A nominal solution is a solution that is computed from measurements of more than three beacon transmissions, with the Time of Closest Approach spanned by the data and with the Cross-Track Angle between 1° and 20°.
#BITS = Number of data bits in the first protected data field of the beacon message, including both the data bits and the BCH code bits.
#ERR = Number of correctable bit errors reported by the BCH code processing of those messages.
The Bit Error rate is then:
BERR = #ERR / #BITS
The baseline Bit Error Rate is 30% above the measured average:
BBERR = 1.3 * (Average bit error rate over one week of normal operation)

Metric(s)
The Bit Error Rate is measured as the fraction of the total number of bits analysed.

Reporting Criterion
If the BERR exceeds the baseline (as defined above), then a Bit Error Rate anomaly should be reported by the MCC.

Data Collection Process
The LEOLUT should compute the SARP Bit Error Rate for every message that is received through the SARP data channel and that is used to generate a nominal solution for any of the known reference beacons, and should report it to the host MCC at the end of each satellite pass.
The MCC should maintain the SARP Bit Error Rate statistics for each combination of LEOSAR satellite and LEOLUT. If the SARP Bit Error Rate for any satellite pass exceeds the baseline value, then an anomaly should be reported to the Nodal MCC.

<u>Data Verification Process</u>
The SARP Bit Error Rate data should be accumulated by the MCC for each combination of LEOSAR satellite and LEOLUT, using the data received from the LEOLUT. This data is not normally verified by the MCC Operator.

<u>Relevant Documents</u>
C/S A.005, C/S T.002

<u>Action</u>
If a Bit Error Rate anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.
If a Bit Error Rate anomaly is detected from a single satellite for all LUTs, the LUT operator should report this to the MCC responsible for coordination with the satellite operator.

3.1.1.12 SARR Bit Error Rate

The SARR Bit Error Rate is based on nominal solutions for known beacons. It is maintained separately for each combination of LEOSAR satellite and LEOLUT ground station.

<u>Indicator</u>
When the SARR Bit Error Rate decreases, the LUT is demonstrating an improved capability to receive the beacon signals through the SARR data channel.

<u>Rationale</u>
This performance parameter ensures that each LUT monitors the data received from the LEOSAR satellites, and reports the bit error rate of the data received through the SARR channel.

<u>Definitions</u>
A reference beacon is one of the Orbitography or Reference beacons operated by the Cospas-Sarsat participants.
A nominal solution is a solution that is computed from measurements of more than three beacon transmissions, with the Time of Closest Approach spanned by the data and with the Cross-Track Angle between 1° and 20°.

#BITS = Number of data bits in the first protected data field of the beacon message, including both the data bits and the BCH code bits.

#ERR = Number of correctable bit errors reported by the BCH code processing of those messages.

The Bit Error rate is then: BERR = #ERR / #BITS
The baseline Bit Error Rate is 30% above the measured average:

BBERR = 1.3 * (Average bit error rate over one week of normal operation)

<u>Metric(s)</u>
The Bit Error Rate is measured as the fraction of the total number of bits analysed.

Reporting Criterion
If the BERR exceeds the baseline (as defined above), then a Bit Error Rate anomaly should be reported by the MCC.

Data Collection Process
The LEOLUT should compute the SARR Bit Error Rate for every message that is received through the SARR data channel and that is used to generate a nominal solution for any of the known reference beacons, and should report it to the host MCC at the end of each satellite pass.
The MCC should maintain the SARR Bit Error Rate statistics for each combination of LEOSAR satellite and LEOLUT. If the SARR Bit Error Rate for any satellite pass exceeds the baseline value, then an anomaly should be reported to the Nodal MCC.

Data Verification Process
The SARR Bit Error Rate data should be accumulated by the MCC for each combination of LEOSAR satellite and LEOLUT, using the data received from the LEOLUT. This data is not normally verified by the MCC Operator.

Relevant Documents
C/S A.005, C/S T.002

Action
If a Bit Error Rate anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.
If a Bit Error Rate anomaly is detected from a single satellite for all LUTs, the LUT operator should report this to the MCC responsible for coordination with the satellite operator.

3.1.1.13 Pass Scheduling Accuracy

The Pass Scheduling Accuracy is maintained separately for each combination of LEOSAR satellite and LEOLUT ground station.

Indicator
The lower the gap that the Pass Scheduling Accuracy Quality Indicator reports show between the predicted time of Acquisition of Signal (AOS) or Loss of Signal (LOS) of a LEOSAR satellite pass and the actual time of the event, then the better the LUT satellite reception equipment is working. Alternately, it may indicate that the LUT has better orbit ephemeris data for the satellites.
Note that the LUT may not predict the times of AOS or LOS at the horizon, so it is not an indicator of a problem if the actual reception begins before the predicted time of AOS, or if it continues beyond the predicted time of LOS.

Rationale
This performance parameter ensures that each LUT is monitored to determine when the LUT does not track a LEOSAR satellite pass as scheduled.

Definitions

A scheduled pass is a LEOSAR satellite pass over the LEOLUT that was included in the pass tracking schedule of that LUT.

TAOSP = Predicted time of Acquisition of Signal of the satellite over the LUT.
TLOSP = Predicted time of Loss of Signal of the satellite over the LUT.
TAOSA = Actual time of Acquisition of Signal of the satellite over the LUT.
TLOSA = Actual time of Loss of Signal of the satellite over the LUT.
TAOSOFF = TAOSA - TAOSP
TLOSOFF = TLOSA - TLOSP

Metric(s)

The Pass Scheduling Accuracy is measured in seconds.

Reporting Criterion

The criterion for an anomaly is two seconds; if TAOSOFF is greater than two seconds or if TLOSOFF is less than minus two seconds, then a Pass Scheduling Accuracy anomaly should be reported by the MCC.

Data Collection Process

On each scheduled LEOSAR satellite pass, the LEOLUT should note when the signal is first received from the LEOSAR satellite and when the signal is last received from the satellite, and should compare these times with the predicted times of AOS and LOS. If the time offsets do not meet the specified criteria, then the LEOLUT should report a Pass Scheduling Accuracy anomaly to the host MCC.

Data Verification Process

The Pass Scheduling Accuracy should be checked by each LEOLUT on every scheduled LEOSAR satellite pass.

Relevant Documents

C/S A.005, C/S T.002

Action

If a Pass Scheduling Accuracy anomaly is detected from all LUTs for all satellites, the MCC operator should review the satellite pass schedule processing.
If a Pass Scheduling Accuracy anomaly is detected from a single LUT for all satellites, the LUT operator should review the satellite receive equipment and processing.
If a Pass Scheduling Accuracy anomaly is detected from a single satellite for all LUTs, the LUT operator should review the satellite orbital element and pass scheduling data for that satellite.

3.1.2 GEOSAR System Performance Parameters

The GEOSAR performance parameters are organized into two tiers. Tier one performance parameters are those parameters that every GEOSAR ground segment operator should monitor because of their direct relationship to alert data accuracy, timeliness and reliability. Tier one performance parameters include:

a) GEOSAR System Timing

b) GEOSAR Rate of Reception of Beacon Messages

c) GEOSAR Frequency Stability of Beacon Transmissions

Tier two performance parameters are those parameters that should be checked by ground segment operators who have the necessary tools to perform this monitoring. Tier two performance parameters include:

a) Carrier to Noise Ratio

b) GEOSAR Bit Error Rate

The following sections provide a detailed description of these performance parameters. In addition, Annex D provides a summary of these performance parameters, and can be used by ground segment operators as a quick reference for the operational self-monitoring of the GEOSAR system.

3.1.2.1 GEOSAR System Timing

The GEOSAR System Timing is measured from the time of the first message received for this integration of the beacon signal until the time when the incident alert is sent to an RCC or SPOC.

Indicator
A reduced time to transmit the incident alert data generated by a GEOLUT to the appropriate RCC or SPOC indicates a greater system ability to maintain the level of service required of the system.

Rationale
This Performance Parameter ensures that the GEOSAR System Timing information is routinely verified and reviewed.

Definitions
The GEOSAR System Timing measures the time from the first reception of a beacon message from a GEOSAR satellite to the time when a National MCC sends the resulting incident alert message to the appropriate RCC or SPOC.

TDET= The time when the first message of the integration that decoded the beacon message was received at the GEOLUT from the GEOSAR satellite, as reported in the incident alert message.

TMTX = The time when the responsible MCC transmits the incident alert message to the selected destination.

The GEOSAR System Timing is then:

GT = (TMTX – TDET)

Metric

The GEOSAR System Timing is expressed in seconds.

Reporting Criterion

If the GEOSAR System Timing is more than thirty minutes (1800 seconds) for any incident alert, then a Quality Management anomaly report is generated.

Data Collection Process

For each GEOSAR alert message transmitted by an MCC to an RCC or SPOC, the MCC determines the GEOSAR System Timing associated with that alert.

Data Verification Process

The GEOSAR System Timing is computed automatically by each MCC, using the data available to it in the SIT message. This data is not normally verified by the Operator.

Relevant Documents

C/S A.003, C/S A.005, C/S T.009

Action

If a GEOSAR System Timing anomaly is reported, MCC personnel should check on the LUT and MCC processing times associated with the alert. If there is no problem associated with the actual processing time, then MCC personnel should check on the time required for communication of the incident alert data at various stages in the processing of the alert.

Comments

The GEOSAR System Timing is an assessment of the entire GEOSAR system. It is not an assessment of the performance of the GEOSAR satellite, the GEOLUT, the MCC, or the individual communications links that comprise the system.

3.1.2.2 GEOSAR Rate of Reception of Beacon Messages

The GEOSAR Rate of Reception of Beacon Messages is a measure of the ability of the GEOSAR system to detect and extract messages from known reference beacons and from distress beacons. It is maintained for selected beacons with the operational combination of satellite and LUT ground station.

The beacons that are used for the monitoring of the Rate of Reception of Beacon Messages must be beacons that remain active for a significant length of time. System reference beacons are ideal for this purpose. However, any operational beacon may be used, as long as it has continued to be active for a period of at least eight hours. In order to ensure beacon stability, the data should not be used for any beacon during the first one hour after activation.

Indicator
If the Rate of Reception of Beacon Messages at the LUT increases, this indicates that the system is better able to receive and decode the beacon messages in the signal.

Rationale
This performance parameter provides for the monitoring of the beacon messages transmitted through the satellite, and ensures that the quality of the satellite signal will be monitored regularly. It also provides data to assist with the detection of malfunctioning beacons and of interfering signals, in both the uplink and the downlink frequency bands.

Definitions
The Rate of Reception of Beacon Messages is measured by taking the count of the messages sent by the GEOLUT to the MCC as a percentage of the total number of messages transmitted by the beacon over the measurement period (based on the known repeat rate of the beacon); it is assessed separately for each selected beacon with the operational combination of satellite and LUT. This measurement is made over each four-hour period.

Any beacon that remains active for a period of eight hours or more may be selected for the measurement of this performance indicator. A reference beacon is one of the Orbitography or Reference beacons operated by the Cospas-Sarsat participants, as listed in C/S A.001. The period from one message transmission to the next is listed, for each reference beacon, in C/S A.001. For any other beacon, the period between transmissions is specified in C/S T.001 as 50 seconds.

The monitoring period normally lasts four hours.

DUR = Duration of the monitoring period (in seconds)

PER = The period between transmissions of the selected beacon (in seconds)

The number of messages expected during the monitoring period is an integer:

#EXP = INT (1 + DUR / PER)

The number of messages actually received at the GEOLUT is:

#RCV = The actual received message count for the monitoring period

The Rate of Reception of Beacon Messages is then:

RRATE = 100 * #RCV / #EXP

Metric
The Rate of Reception of Beacon Messages is measured as a percentage of the total number of messages transmitted by the beacon during the monitoring period.

Reporting Criterion
If the Rate of Reception of Beacon Messages is less than 75% or greater than 105%, then a System anomaly notification message should be generated.

Data Collection Process
The GEOLUT extracts all beacon messages from the downlink signal at all times while it is operational. This Performance Indicator is computed by monitoring the messages received at the MCC from the selected beacons during the normal operation of the system.

Data Verification Process
The Rate of Reception of Beacon Messages data should be processed independently by the MCC for each LUT; it is not verified by the Operator.

Relevant Documents
C/S A.005, C/S T.001, C/S T.006, C/S T.009

Action
If the Rate of Reception of Beacon Messages is below the established baseline for a significant number of beacons, the LUT operator should review the satellite receive equipment and processing; if no problem is found, MCC personnel should report the anomaly to the MCC responsible for coordination with the reference beacon operator and with the satellite instrument provider, to assist in determining if there is a problem with those components of the system.

If the Rate of Reception of Beacon Messages is out of range for any operational beacon, the MCC personnel should notify the beacon owner, to determine if there has been a beacon malfunction. A beacon malfunction may result in excessive drain on the beacon's battery, and a failure during a subsequent distress incident.

3.1.2.3 GEOSAR Frequency Stability of Beacon Transmissions

The GEOSAR Frequency Stability of Reference Beacon Transmissions is maintained for selected beacons with the operational combination of satellite and LUT ground station.

Indicator
When the GEOSAR Frequency Stability of Beacon Transmissions is improved, that indicates that the downlink signal is being received better at the LUT, and the LUT will be better able to extract beacon messages and measure the time and frequency of each message.

Rationale
This performance parameter provides for the monitoring of the GEOSAR satellite uplink and downlink signals, and ensures that the quality of the GEOSAR data will be monitored regularly.

Definitions
Any beacon that remains active for a period of eight hours or more may be selected for the measurement of this performance indicator. A reference beacon is one of the Orbitography or Reference beacons operated by the Cospas-Sarsat Participants, as listed in C/S A.001.

For each selected beacon, the measurement is made over each four-hour period.
FRM = Measured frequency of each transmission received from the beacon
FRAV = Average of all measured frequencies over the monitoring period

The GEOSAR Frequency Stability of Beacon Transmissions is then:
MAXFD = Maximum difference of any measured frequency from the average

Metric
The GEOSAR Frequency Stability of Beacon Transmissions is measured in Hertz.

Reporting Criterion
If the GEOSAR Frequency Stability of Beacon Transmissions over any monitoring period is greater than 2.0 Hz for a reference beacon or greater than 5.0 Hz for an operational distress beacon, then a System anomaly notification should be generated.

Data Collection Process
The GEOLUT extracts all beacon messages from the downlink signal at all times while it is operational. This Performance Indicator is computed by monitoring the messages from the selected beacons during normal operation of the system. The GEOSAR Frequency Stability of Beacon Transmissions is computed by the MCC after every four hours of GEOLUT reception from the beacon. If the value exceeds the criterion, then an anomaly should be reported.

Data Verification Process
The GEOSAR Frequency Stability of Beacon Transmissions data should be processed independently by the MCC for each LUT; it is not verified by the MCC Personnel.

Relevant Documents
C/S A.005, C/S T.006, C/S T.009

Action
If a GEOSAR Frequency Stability of Beacon Transmissions anomaly is detected, the LUT operator should review the satellite receive equipment and processing; if no problem is found, MCC personnel should follow up on the beacon involved. For a reference beacon, the MCC personnel should report the anomaly to the MCC responsible for coordination with the reference beacon operator or with the satellite operator, to assist in determining if there is a problem with those components of the system. For an operational beacon, the MCC personnel should report the anomaly to the owner of the beacon, since an unstable transmit frequency may result in reduced accuracy of the Doppler location processing during a distress incident.

Comments
The criterion of 2.0 Hz is based on the GEOLUT Commissioning Standard. This is based on the assumption that all reference beacons will be sufficiently stable to achieve this criterion. For operational beacons, which have a lower specification for frequency stability, a criterion of 5.0 Hz is proposed.

3.1.2.4 Carrier to Noise Ratio

The GEOSAR Carrier to Noise Ratio (CNR) is based on integrated beacon messages for selected Orbitography or Reference beacons. It is maintained for each identified reference beacon, for the operational combination of satellite and LUT ground station.

Indicator

When the GEOSAR Carrier to Noise Ratio increases, the LUT is demonstrating an improved capability to receive the beacon signals through the GEOSAR data channel. If the CNR decreases, it is an indication that the quality of the signal has degraded, or that there is more noise in the environment.

Rationale

This performance parameter ensures that each GEOLUT operator monitors the data received from the GEOSAR satellites, and reports the Carrier to Noise Ratio of the data received through the downlink channel.

Definitions

A reference beacon is one of the Orbitography or Reference beacons operated by the Cospas-Sarsat participants. One or more such beacons should be selected for this monitoring at each GEOLUT. A successful integration is a message that has satisfied the requirements for the integration of a valid beacon message, as defined in document C/S T.009.

CNRB = the ratio of the strength of the downlink carrier signal to the ambient noise level in each beacon message received by the GEOLUT and sent to the MCC.

#MSG = the number of beacon messages received from the selected beacon by the GEOLUT during the monitoring period.

(The actual algorithm for computing the CNR is to be determined by the GEOLUT manufacturer. As long as a consistent algorithm is used, the details of how it is computed need not defined in this specification.)

The average Carrier to Noise Ratio performance indicator is then:

ACNRB = SUM(CNRB) / #MSG

Since the C/N_0 is in decibels, a logarithmic value, the method for taking the average entails taking the inverse log of each value, computing the average of the resulting values, and computing the log of the resulting average.

The baseline Carrier to Noise Ratio is 20% below the measured average over a week of normal operation:

BCNR = 0.8 * (Average CNRB over one week of normal operation)

To establish the baseline, administrations should consult with other GEOLUT operators to ensure that the baseline is consistent with the performance of other GEOLUTs under similar circumstances (for example, the same models of beacon, satellite, and GEOLUT).

Metric
The Carrier to Noise Ratio is measured, in dB-Hz, as the average of the ratio of the carrier strength to the ambient noise level in the downlink signal received by the GEOLUT during each monitoring period.

Reporting Criterion
If the ACNRB is less than the baseline value (as defined above), then a Carrier to Noise Ratio anomaly should be reported by the MCC.

Data Collection Process
The GEOLUT should compute the GEOSAR Carrier to Noise Ratio for every valid message that is received through a GEOSAR satellite from any selected beacon, and should report the average CNR for each selected beacon to the host MCC.

The MCC should maintain the GEOSAR Carrier to Noise Ratio statistics for each selected beacon for each combination of GEOSAR satellite and GEOLUT. If the GEOSAR Carrier to Noise Ratio for any combination is less than the baseline value for that combination, then an anomaly should be reported.

Data Verification Process
The GEOSAR Carrier to Noise Ratio data should be accumulated by the MCC for each selected beacon for each combination of GEOSAR satellite and GEOLUT, using the data received from the GEOLUT. This data is not normally verified by the MCC Operator.

Relevant Documents
C/S A.005, C/S A.006, C/S T.009

Action
If a Carrier to Noise Ratio anomaly is detected, the LUT operator should review the satellite receive equipment and processing. The ambient noise environment should also be reviewed. Data should be analyzed for different beacons for the same satellite and for different satellites for the same beacon, as possible, in order to determine if the problem is due to the satellite or the beacon.

If the Carrier to Noise Ratio is consistently lower for a particular satellite, then the anomaly should be reported to the MCC responsible for coordination with the satellite instrument provider, so that the satellite performance can be reviewed, to determine if there is any problem with the satellite.

If a reference beacon shows a consistent anomaly, notify the reference beacon operator via its associated MCC.

Comments
The GEOSAR Carrier to Noise Ratio performance indicator, as noted above, is to be determined by the manufacturer of the GEOLUT equipment used by each Cospas-Sarsat Ground Segment Provider. The details of the computation of the Carrier to Noise Ratio are not specified here; as long as a consistent algorithm is used in each GEOLUT, the comparison of the data with the baseline value should bring any anomaly to the attention of the MCC personnel.

3.1.2.5 GEOSAR Bit Error Rate

The GEOSAR Bit Error Rate is based on integrated beacon messages for selected beacons. It is maintained for each identified reference beacon, for the operational combination of satellite and LUT ground station.

Indicator
When the GEOSAR Bit Error Rate decreases, the LUT is demonstrating an improved capability to receive the beacon signals through the GEOSAR data channel.

Rationale
This performance parameter ensures that each LUT monitors the data received from the GEOSAR satellites, and reports the bit error rate of the data received through the downlink channel.

Definitions
A reference beacon is one of the Orbitography or Reference beacons operated by the Cospas-Sarsat participants. A successful integration is a message that has satisfied the requirements for the integration of a valid beacon message, as defined in document C/S T.009.

#BITS = Number of data bits in the first protected data field of the beacon message, including both the data bits and the BCH code bits.
#ERR = Number of correctable bit errors reported by the BCH code processing of those messages.

The Bit Error rate for each message is then: BERGSAR = #ERR / #BITS.

The number of messages analysed over the four-hour monitoring period is #MSG.

The average Bit Error Rate performance indicator is then:
ABERGSAR = SUM(BERGSAR) / #MSG

The baseline Bit Error Rate is 30% above the measured average:
BBERR = 1.3 * (Average bit error rate over one week of normal operation)

To establish the baseline, administrations should consult with other GEOLUT operators to ensure that the baseline is consistent with the performance of other GEOLUTs under similar circumstances (for example, the same models of beacon, satellite, and GEOLUT).

Metric
The Bit Error Rate is measured as the fraction of the total number of bits analysed during each monitoring period.

Reporting Criterion
If the ABERGSAR exceeds the baseline (as defined above), then a Bit Error Rate anomaly should be reported by the MCC.

Data Collection Process
The GEOLUT should compute the GEOSAR Bit Error Rate for every valid message that is received through a GEOSAR satellite from any selected beacon, and should report it to the host MCC.

The MCC should maintain the GEOSAR Bit Error Rate statistics for each combination of GEOSAR satellite and GEOLUT. If the GEOSAR Bit Error Rate for any system exceeds the baseline value, then an anomaly should be reported.

Data Verification Process
The GEOSAR Bit Error Rate data should be accumulated by the MCC for each combination of GEOSAR satellite and GEOLUT, using the data received from the GEOLUT. This data is not normally verified by the MCC Operator.

Relevant Documents
C/S A.005, C/S T.006, C/S T.009

Action
If a Bit Error Rate anomaly is detected, the LUT operator should review the satellite receive equipment and processing. The ambient noise environment should also be reviewed. Data should be analyzed for different beacons for the same satellite and for different satellites for the same beacon, as possible, in order to determine if the problem is due to the satellite or the beacon.

If the Bit Error Rate is consistently higher for a particular satellite, then the anomaly should be reported to the MCC responsible for coordination with the satellite instrument provider, so that the satellite performance can be reviewed, to determine if there is any problem with the satellite.

If a reference beacon shows a consistently anomaly, notify the reference beacon operator via its associated MCC.

Comments
The GEOSAR Bit Error Rate performance indicator, as defined above, is not a true bit error rate, but it is a reasonable estimate with the available data. This Bit Error Rate performance indicator is measured at the operational elevation of the GEOSAR satellite, as seen from the GEOLUT. For a more complete assessment of the significance of the Bit Error Rate, it is necessary to consider the carrier to noise ratio of the signals from each beacon that is measured. The Bit Error Rate performance indicator is an assessment of the entire GEOSAR system; it is not an assessment of

the performance of the individual beacons, the GEOSAR satellite, the GEOLUT, or the MCC.

3.1.3 MCC Self-Monitoring

The document C/S A.005 "Cospas-Sarsat MCC Performance Specification and Design Guidelines", requires an MCC to monitor the following System elements in its national ground segment: LUTs, LUT/MCC communication networks, the MCC itself and connections to external communication networks.

a. Baseline requirements

In order to achieve this objective, the MCC shall be provided with the necessary information, including that described in sections 3.1.1 and 3.1.2 concerning the LEOLUT self-monitoring and the GEOLUT self-monitoring, and in section 3.1.3.1 which concerns LUT/MCC and external communication networks.

Ground Segment Providers are encouraged to make arrangements with national RCCs and SPOCs in their service area to assess periodically the effectiveness of Cospas-Sarsat alert data distribution. This can be achieved by cooperation between MCCs and SPOCs or RCCs to ensure that sufficient feed-back information is provided by SAR services.

Anomalies in the MCC operations should be detected by the MCC itself whenever possible, in particular to avoid distributing unreliable or corrupted data. If such detection fails, the other MCCs with which it communicates in accordance with the "Cospas-Sarsat Data Distribution Plan" (C/S A.001), should endeavour to detect these anomalies and should notify the observed anomalies to the transmitting MCC.

b. Monitoring of MCC Operations

An MCC's compliance with the above requirements can be verified by:

- analysing an associated LUT's performance parameters described in sections 3.1.1 and 3.1.2, or receiving the appropriate status information and warnings generated at the LUT level; and
- monitoring of its communication links with its LUTs, its national RCCs and associated SPOCs, and with other MCCs as described in section 3.1.3.1.

3.1.3.1 LUT/MCC Communication Links Monitoring

(i) Link Failures

The MCC should monitor communication links between the MCC and its associated LUTs, which should achieve 100% availability. MCCs which do not have automatic detection of link failure should be kept aware of each satellite-pass processed by the LEOLUT and monitor the time delay between the forecasted loss of signal at the LEOLUT and the reception of alert data from that pass. If no data is received at LOS + 30 minutes, the MCC should verify the availability of the communication link.

In addition MCCs should monitor the following quality indicator to detect any anomalies in the LUT/MCC links: LUT/MCC data transfer time.

(ii) Integrity of Data

The MCC shall verify the integrity of alert data it receives, which includes monitoring:

- the number of received alerts with reference to the number of alerts sent by the LUT and/or the sequence of messages, and
- the percentage of messages received from the LUTs with format errors and/or out of range data.

Any significant discrepancy of these parameters should be detected and the anomaly corrected, or appropriate actions should be undertaken at MCC level to eliminate the corrupted data from the alert data distributed to SAR services.

3.1.3.2 MCC to MCC Communication Links

(i) Link Failures

Communication link failures observed by an MCC shall be notified to the corresponding MCC with a view to:

- correcting the anomaly, or
- switching to available back-up links.

(ii) Integrity of Data

Any detected loss of messages exchanged between MCCs should be notified to the transmitting MCC and investigated. However, such loss may remain unnoticed, depending on the communication link protocol, and the assessment of communication link performance may require periodic testing.

All MCCs should monitor the percentage of messages received with format errors or out-of-range data for each communication link and report to the originating MCC, as appropriate.

3.1.3.3 MCC to RCC/SPOC Communication Links

(i) Link Failures

Communication link failures observed by an MCC shall be notified to the corresponding RCC/SPOC and alternative alert data distribution procedures should be used, as appropriate.

(ii) MCC/SPOC Communication Test

The purpose of the following test is to identify to IMO and ICAO SPOCs that are non-responsive to Cospas-Sarsat distress alert messages. Each MCC shall perform a monthly communication test with each SPOC in its service area. The test shall include a transmission of a test message from the MCC to the SPOC and an acknowledgement of the message by the SPOC/RCC operator (i.e. an automatic acknowledgement is not acceptable) to the MCC. However, MCC-SPOC communication links that have been successfully used operationally at least once (with the messages acknowledged by a SPOC/RCC operator) during the month may be reported as already tested.

A successful communication test requires that the manual acknowledgement from the SPOC/RCC be received within 30 minutes and the test message should clearly reflect this requirement. The test should be undertaken at various times throughout the day.

(iii) Reporting of MCC/SPOC Communication Tests

Each MCC should report results of the MCC/SPOC communication test to the Cospas-Sarsat Secretariat, who will provide a summary report to IMO COMSAR as part of the annual Cospas-Sarsat status report.

MCCs should report on a monthly basis (after each communication test) using the format provided at Annex I to this document. All reports should be focused on non-functionality, but a report should be submitted even if all communication tests are successful.

3.2 Space Segment Self-Monitoring

The general health of the spacecraft is routinely monitored by the spacecraft provider, using telemetry data, to detect out-of-specification conditions.

Information on anomalies which could significantly degrade System performance or limit the operation of a SAR payload will be provided to all Ground Segment operators via the MCC network and to the Cospas-Sarsat Secretariat, in accordance with the procedures defined in the "Cospas-Sarsat Data Distribution Plan" (C/S A.001). When notified of a change in status of any of the payloads, the Secretariat will update the Space Segment Status on the Cospas-Sarsat website and in document C/S A.001.

Any Ground Segment operator who detects anomalies in the performance of the Space Segment during routine System monitoring activities, and has confirmed that such anomalies are not due to its Ground Segment equipment, shall inform the relevant Space Segment Provider. Analysis of Space Segment anomalies will be coordinated among the relevant Space Segment Providers and possible corrective action (e.g. switch to back-up payload) will be taken, as appropriate.

Information on anomalies which could significantly degrade System performance, that are detected during tests and confirmed by the relevant Space Segment Provider, will be provided to all Ground Segment operators via the MCC network, in accordance with the procedures defined in the "Cospas-Sarsat Data Distribution Plan" (C/S A.001).

3.3 Monitoring of System Performance Related to SARP and SARR/MSG Instruments

This test activity allows the monitoring, on an annual basis, of the performance of Cospas-Sarsat satellite instruments commissioned by CNES.

The monitoring is performed either directly with operational data, or with test data using specific test scripts generated by the Toulouse beacon simulator and replicating appropriate distress beacon messages.

The monitoring concerns the SARP instruments onboard operational Sarsat satellites, and the SARR instruments onboard operational MSG satellites. It consists of repeating a significant part of the initial commissioning tests.

3.3.1 SARR/MSG Monitoring

Data used for evaluating the GEOSAR system performance are retrieved from the Ankara GEOLUT for MSG-1 satellite and from the Toulouse GEOLUT for MSG-2 satellite.

Table 1 provides a synthesis of system performance assessed for the SARR/MSG instruments.

Table 3.1: Synthesis of SARR/MSG System Performance

Parameter	MSG-x	MSG-y
Throughput at 37 dBm		
Processing Threshold (37 dBm)		
Processing Performance (32 dBm)		

- Throughput measured at 37 dBm: probability to retrieve a valid message for each single transmitted message, i.e. the ratio of the number of received valid messages over the number of transmitted messages. The throughput is calculated with the data available from test T-1 (see document C/S R.011).

- Processing Threshold: the value of beacon power for which the GEOLUT is able to provide a valid message for each beacon event 99% of the time (see test T-1 in document C/S R.011). The specification is 37 dBm.

- Processing Performance: the value of beacon power for which the GEOLUT is able to provide a valid message for each beacon event in less than 5 minutes 95 % of the time (see test T-2 in document C/S R.011). The specification is 32 dBm.

3.3.2 SARP Monitoring

Data used for evaluating LEOSAR system performance are retrieved from the Toulouse LEOLUTs.

Tables 2 and 3 provide a synthesis of the system performance assessed for the SARP instruments.

The assessment of the "Threshold for a 75% access probability" parameter is optional. Tests with a variable EIRP will not be performed in case of schedule difficulties when implementing the yearly monitoring.

When available, the location performance derived from both SARP and SARR instruments are also evaluated and provided.

Table 3.2: Synthesis of SARP System Performance (Frequency Parameters)

Satellite	USO Mean Frequency	USO Frequency Drift/Day	Frequency Bandwidth
Sxx			
…..			
Syy			

- USO Mean Frequency: mean frequency of the onboard Ultra-Stable Oscillator, calculated as the average value of the USO frequency measurements provided by the LEOLUT over a 2-month period. The instrument specification is 10 MHz +/- 5 Hz for SARP-3 and 5,203,205 Hz +/-2.5 Hz for SARP-2.

- USO Frequency Drift/Day: this parameter is calculated also using the USO frequency measurements provided by the LEOLUT over a 2-month period; it is the standard deviation of the observed drifts, reduced to a one-day duration. The USO frequency Drift/Day thus calculated cannot be directly compared to the instrument specification (Drift/Day less than 1 MHz for SARP-3 and 0.5 MHz for SARP-2) due to ground segment contribution, but is expected to be lower than 15 MHz.

- Frequency Bandwidth: this parameter is derived from the histogram of frequencies measured for all the beacons (operational + test beacons) over a 3-day period. The specification is 80 kHz [406.010 – 406.090 MHz] for SARP-3 and 40 kHz [406.010 – 406.050 MHz] (Mode 2) for SARP-2.

Table 3.3: Synthesis of SARP System Performance

	Sxx	….	….	….	Syy
Dating accuracy (10 ms)					
Instrument sensitivity (- 131/- 134 dBm)					
Dynamic range (23/29 dB)					
Probability to provide a valid solution (95 %)					
Access probability (75%)					
Probability to retrieve a complete message					
Probability of Doppler processing					
Probability to provide a location better than 5 km - SARP (95%) SARP/SARR (95%)					
Accuracy of Doppler location - SARP SARP/SARR					
Ellipse error mean radius - SARP SARP/SARR					
Threshold for a 75 % access probability (optional test)					

- Dating accuracy: this parameter is calculated using the dates of the Toulouse orbitography beacon bursts provided by the LEOLUT. More precisely, it is the standard deviation of the dating error observed for all the bursts of the Toulouse beacon over a 1-week period. The system specification is 10 ms (see document C/S T.003).

- Instrument sensitivity: this parameter is derived from the histogram of the levels (in dBm) received on-board the instrument for all beacons (operational + test beacons) over a 3-day period. The sensitivity is the lower level plotted on the histogram. The instrument specification is -131 dBm for SARP-2 and -134 dBm for SARP-3.

- Dynamic range: this parameter is also derived from the histogram of the levels (in dBm) received on-board the instrument for all beacons (operational + test beacons) over a 3-day period. The dynamic range is the difference between the higher and the lower levels plotted on the histogram. The instrument specification is 23 dB for SARP-2 and 29 dB for SARP-3.

- Probability to provide a valid solution: the specification is a probability better than 95% to provide a valid solution (15 Hex identification provided) for a beacon transmitting with a 37 dBm output power (with a whip antenna) and for satellites passes with elevation above 5°. The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator over a 2-day period.

- Access probability or throughput: this is the probability to retrieve a valid message for each single transmitted message in the same conditions as above. The specification is 75% at 37 dBm (see document C/S T.002). The expected value is higher than 90%. The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator over a 2-day period.

- Probability to retrieve a complete message: this is the probability to retrieve a complete message for each transmitted message in the same conditions as above. There are no specifications for this parameter. The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator over a 2-day period.

- Probability of Doppler processing: this is the probability to retrieve at least 4 messages per pass, in the same conditions as above. The specification is 95% at 37 dBm (see document C/S T.002). The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator over a 2-day period.

- Probability to provide a Doppler location with an accuracy better than 5 km: the specification is a probability better than 95% to provide a Doppler location with an accuracy better than 5 km for a beacon transmitting with a 37 dBm output power (with a whip antenna) and for satellites passes with elevation above 5°. The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator over a 2-day period. When available, the location performance derived from both SARP and SARR instruments is also provided.

- Accuracy of Doppler location: average value of the error made when processing the location. The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator over a 2-day period. When available, the location accuracy derived from both SARP and SARR instruments is also provided.

- Ellipse error mean radius: the average value of the ellipse error radius parameter provided by the LEOLUT. The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator over a 2-day period. When available, the ellipse error mean radius derived from both SARP and SARR instruments is also provided.

- Threshold for a 75% access probability (optional parameter): the value of beacon power for which the LEOLUT is able to provide a valid message for each beacon event 75% of the time. The expected value is about 23 dBm. The statistical analysis is done through beacon messages transmitted with the Toulouse beacon simulator with variable emission powers over a 1-day period.

- END OF SECTION 3 -

4. BEACON PERFORMANCE MONITORING

4.1 Description of Beacon Monitoring

Beacon monitoring and reporting consists of two parts:

- monitoring of beacon performance and reporting anomalies to interested parties, and
- monitoring of non-distress beacon activations, or operational false alerts, and determining the cause of activation.

Beacon anomalies include:

- non-activation of beacons in distress situations, or in circumstances where a beacon should have been automatically activated,
- anomalies related to actual beacon activation, and
- anomalies detected during mandatory or routine inspections of installations by responsible authorities.

Administrations should monitor beacon anomalies and exchange information with other Administrations who have type-approved the same type of beacon (see document C/S S.007). This exchange of information should be done as soon as practical and contain data that is useful in determining if the anomaly is a local problem or a global concern.

Operational false alerts may have a variety of origins and their elimination is of interest to all users. Distress alert statistics should identify the cause of operational false alerts. Each operational false alert should be categorised as being caused either by beacon mishandling, beacon malfunction, mounting failure, environmental conditions, or unknown circumstances.

4.2 Beacon Monitoring Requirements

All Cospas-Sarsat Participants should monitor the operation of beacons to determine the number of beacon anomalies or operational false alerts such as listed below:

All information should be recorded by Administrations, and reported as provided for in Annex B to this document.

4.2.1 Anomalies

- non-activation of beacon in distress situation or in circumstances where it should have been automatically activated;
- non-detection or location of an active beacon;

- beacons transmitting repeatedly in the self-test mode; and
- other anomalies detected during manufacturers' testing or inspection performed by Administrations on equipment installed on board ships or aircraft.

4.2.2 Miscoded Beacons

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4.2.3 Operational false alerts, in the following categories

- Beacon mishandling: activations which were caused by the mishandling of the beacon by its user/owner;
- Beacon malfunctions: activations caused by beacon (electronics including battery) malfunctions;
- Mounting failures: activations which were caused by mounting failures or release mechanism malfunctions;
- Environmental conditions: activations caused by extreme weather conditions;
- Voluntary activation: non-declared tests (voluntary activation of beacon for test, without preliminary information or agreement of authorities) malicious activations, etc.; and
- Unknown: confirmed beacon activations where the cause could not be determined or no feedback information was received from the SAR authorities.

4.2.4 Notification of Beacon Anomalies

All Cospas-Sarsat Participants should work with appropriate national Authorities to reduce the number of beacon anomalies. In this purpose, one or more of the following individuals and/or organisations should be notified when a beacon anomaly is detected:

a) Beacon Owner: The owner/user should be notified of the problem and the importance of having the beacon serviced, as well as the potential for the beacon not working correctly when required. The owner/user may be contacted using identification information embedded in the beacon (e.g., radio call sign, tail number, MMSI, etc.), the registration information if the beacon is registered, or using the manufacturer to trace the owner.

b) Beacon Manufacturer: The manufacturer of the beacon should be notified of the problem. The manufacturer can be traced through the information embedded in the beacon message (e.g., C/S Type Approval Number), or through the registration information. The manufacturer can then detect systemic problems and take preventive and/or corrective action as necessary.

c) National Type Approval Authority: The national type approval authority, or mandating authority, should be notified so that it may track beacon malfunctions and take appropriate action if required.

d) Cospas-Sarsat: Cospas-Sarsat Participants should be notified in accordance with the format in Annex E so that they may make appropriate recommendations concerning the type approval of the affected beacon model(s).

Since the determination of the cause of false alerts is totally dependent on the feed-back information received from national RCCs and SPOCs, national Administrations should encourage their RCCs and SPOCs to provide timely information which describes the cause and disposition of each beacon activation, when an alert is received from their associated MCC.

- END OF SECTION 4 -

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5. INTERFERENCE MONITORING

5.1 Effects of Interference on the System

The 406 MHz band has been allocated by the International Telecommunication Union (ITU) for distress alerting using low power emergency position indicating radiobeacons: nevertheless there are unauthorised signal sources in various areas of the world radiating signals in the 406.0 - 406.1 MHz band which interfere with the Cospas-Sarsat System. These sources are not 406 MHz beacons, but operate either in the 406 MHz band or at some other frequency and produce spurious emissions in the 406 MHz band.

Interferers degrade the performance of the on-board 406 MHz SAR processor (SARP) and reduce the probability of detecting real beacon messages. In the case of Sarsat satellites, interferers also degrade the signal relayed by the on-board 406 MHz repeaters (SARR) and mask actual beacon messages. A few strong interferers (i.e. > 5 Watts) located in an area about the size of a continent can virtually jam the satellites and prevent distress beacons in that area from being located.

Unless immediate steps are taken to locate and remove these unauthorised interference transmissions, lives could be lost when strong interferers mask the 406 MHz distress signals.

Conventional land-based interference monitoring methods are not suitable for an international satellite system providing global coverage. Fortunately, the Cospas-Sarsat satellite system itself can be used to detect and locate many of the interference sources world-wide, if the interference signals are monitored at suitably equipped earth receiving stations (i.e. LEOLUTs with 406 MHz interference monitoring capability).

5.2 Means of Monitoring 406 MHz Interference

Sarsat satellites have 406 MHz repeaters for retransmitting emissions received from Earth in the band 406.0-406.1 MHz. As a result, the time/frequency pairs of interference emissions can be measured at LEOLUTs specially equipped to perform this processing. 406 MHz interferers generally transmit continuous signals for a long period of time as compared to the short, one-half second beacon bursts. These near continuous signals produce a Doppler curve which is used to compute the interferer location. Unlike the processing of distress beacon emissions, no identification code can be extracted from an interfering signal, since its modulation, if any, would not be in the correct format. Emissions from a single interference source must be identified by location.

The coverage area for processing unauthorised emissions is limited to the reception area of the LEOLUT. Therefore, a network of interference monitoring LEOLUTs at selected locations is desirable in order to provide an interference monitoring capability over a larger area. Annex C shows the location and coverage area of LEOLUTs currently monitoring 406 MHz interference.

5.3 Suppression of 406 MHz Interference

The following actions have been taken by the ITU or Cospas-Sarsat regarding 406 MHz interference:

a) the ITU has set up a framework for protecting the 406 MHz band as described in Recommendation ITU-R SM.1051-2 "Priority of Identifying and Eliminating Harmful Interference in the Band 406-406.1 MHz";

b) the ITU has requested countries participating in Cospas-Sarsat to monitor the 406 MHz band for interference;

c) the ITU has developed forms for the "Information report concerning interference" and the "Feedback report concerning the interference source". These report forms are shown in Annex C;

d) the Cospas-Sarsat Council encourages countries/territories installing new LEOLUTs to incorporate an option in their LEOLUTs for monitoring 406 MHz interference and to utilise this capability routinely;

e) the Cospas-Sarsat Council has approved LEOLUT specifications which include optional 406 MHz repeater processing for interference monitoring;

f) the Cospas-Sarsat Council has requested the Secretariat to provide information on 406 MHz interference to user organizations, such as IMO and ICAO, including the list and locations of interference sources reported by Cospas-Sarsat Participants; and

g) the Cospas-Sarsat Council has agreed a form for reporting persistent 406 MHz interferers. This form is shown in Annex C and includes the data required by c) above.

5.4 Notification of 406 MHz Interference

Ground Segment operators are encouraged to provide monthly interference reports on persistent interferers to the Cospas-Sarsat Secretariat using the reporting format as presented in Annex C at Table C.1, and to provide reports to the ITU in accordance with their national procedures and the ITU requirements. Ground Segment operators are encouraged to extend their reporting to the entire geographic area of visibility of their LEOLUTs, and not to limit themselves to their MCC service area. An interferer is persistent when it has been detected by 10% or more of the available Sarsat satellite passes at or above a 5 degree elevation angle (measured from the interference source) and when it has been observed by the reporting

MCC no less than 10 times (10 distinct satellite passes) per month over the reporting period. Table C.1 in Annex C provides more details on reporting criteria.

A persistent interferer case should remain open and should continue to be reported until there are no emissions for a period of 60 days. After that time the case should be considered closed.

When an interferer significantly degrades System performance, Ground Segment operators are also encouraged to inform the search and rescue authorities in the area where the interferer is located.

- END OF SECTION 5 -

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6. REPORTING ON SYSTEM STATUS AND PERFORMANCE

6.1 Scope and Objectives of Reporting

Cospas-Sarsat is an evolving system, partly through changes in technology, and also as more countries become associated with the Programme (as User States or Ground Segment Providers), or simply make use of the System. It is therefore essential to assemble basic information for keeping track of the evolution of the System and its world-wide performance and use, in order to form the necessary basis for future planning activities in Cospas-Sarsat.

The status of the System (including Space Segment, Ground Segment and beacons), and a summary of its performance and the history of detected anomalies, should be reported by all Participants, as appropriate, for every twelve-month period, in accordance with the format provided in section B-1 of Annex B to this document. These reports, after being aggregated by the Secretariat into a single document, are reviewed by the Joint Committee and submitted to the Council. The annual reports therefore form the basis used for updating the operational System documents (e.g. C/S A.001) and also such widely distributed documents as the "Cospas-Sarsat System Data" and "Information Bulletin".

6.2 Space Segment

Information on the Space Segment status and its operation is to be provided only by the Space Segment Providers.

Such information should cover:

- operational spacecraft,
- 406 MHz payloads,
- other payloads when applicable (e.g. 406 MHz repeaters),
- the readiness and launch schedule of new spacecraft and payloads,
- occurrences of almost identical orbital paths of any two satellites, and
- significant events affecting the Space Segment, e.g. changes in payload configuration of operational satellites, periodic software resets (watchdog timeouts).

All Participants should be kept informed of the current status of the Space Segment. In order to accomplish this, Space Segment Providers shall inform all Ground Segment operators whenever there is a change to the status of any SAR payload as soon as possible. A change in status can be the commissioning (with or without limitations), de-commissioning, or change in configuration of a SAR payload. The Secretariat should also be notified of the change in status. The Secretariat will update C/S A.001 and distribute the update to all Participants on an annual basis. In addition the Secretariat will update the space segment status on the Cospas-Sarsat website.

6.3 Ground Segment

6.3.1 MCCs and LUTs

The annual reports should cover the operational status of LUTs for the 406 MHz processed frequency band, and of MCCs, including communication links. Information on the availability of Ground Segment equipment should also be reported as defined in section 6.3.3. It is important that information on the upgrading of existing MCCs and LUTs, and about the implementation of MCCs and LUTs by new participating countries is included.

Such developments may have an impact on other Ground Segment Providers, and the information is vital for planning an orderly evolution of the MCC communication network.

For the same reasons, reports from MCC operators should also include information on the number of 406 MHz beacon signals reported to RCCs within the MCC service area.

6.3.2 Other Ground Segment Sub-Systems

The annual reports should include information on the status and performance of sub-systems such as orbitography and reference beacons and the Sarsat time reference beacon.

Malfunctioning orbitography and reference beacons should be reported in almost real-time.

6.3.3 Calculation of LUT/MCC Availability

Availability (A) is expressed as a percentage and is calculated by dividing the amount of operational time (OT) by the time required to be in operation (OTR). The time required to be in operation (OTR), expressed in hours, is 24 times the number of days in the reporting period inclusive of all maintenance downtime. The operational time (OT) is OTR minus the system downtime (DT) reported in hours. Downtime is that period of time when a system fails to perform its basic functions as described below. Therefore, availability (A) is calculated as:

$$A = (OT/OTR) * 100 = (1 - (DT/OTR)) * 100$$

6.3.3.1 MCC System Availability

MCC system availability measures the probability of an MCC performing all its basic functions of receiving and processing LUT/MCC data and communicating with other MCCs as presented in Figure 6.1. An MCC's basic functions are described in Cospas-Sarsat Mission Control Centre (MCC) Performance Specification and Design Guidelines (C/S A.005). Specifically, a Cospas-Sarsat MCC must be able to:

a. receive and process (e.g., validate, geosort, filter) all alert and system data from national LUTs and foreign MCCs in accordance with Cospas-Sarsat Data Distribution Plan (C/S A.001) and Cospas-Sarsat Standard Mission Control Centre Interface Description (C/S A.002);

b. monitor the Cospas-Sarsat System in accordance with Cospas-Sarsat System Monitoring and Reporting (C/S A.003);

c. archive and retrieve alert data and information; and

d. maintain communications links.

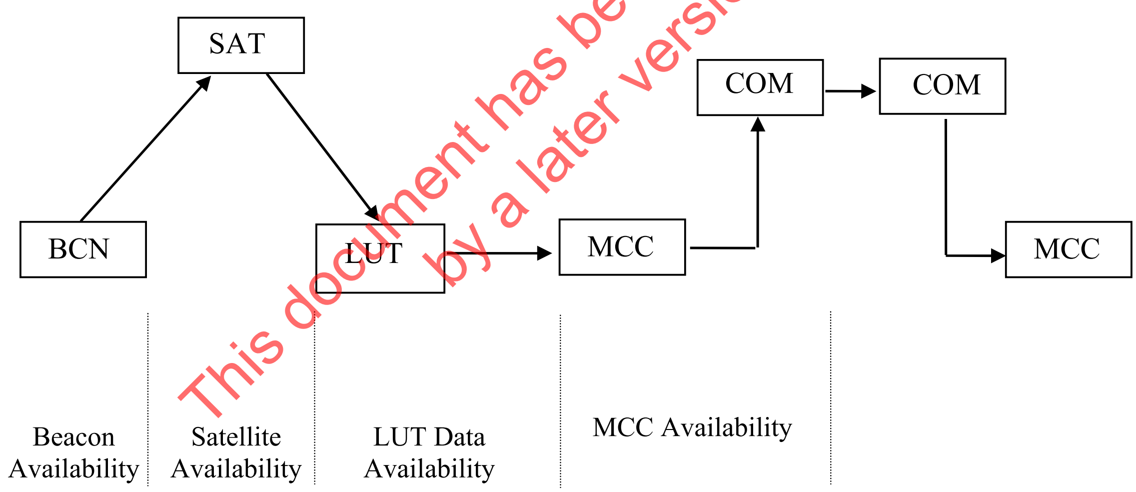

Figure 6.1: System Availability

6.3.3.2 LEOLUT Data Availability

LEOLUT data availability measures the probability of receiving complete and accurate LEOLUT data at the MCC as shown in Figure 6.1. Whenever LEOLUT data is not received at the MCC, downtime is measured from LOS of the last successful satellite pass to AOS of the next successful satellite pass. Part of LEOLUT data availability is a LEOLUT's ability to perform basic functions. The basic functions of LEOLUTs are those specified in Cospas-Sarsat Local User Terminal Performance Specification and Design Guidelines (C/S T.002) and national requirements. If any basic function or requirement is not performed by the LEOLUT and the function has an impact on the operational data to the SAR forces, the LEOLUT data should be considered unavailable.

The LEOLUT's basic functions are further described as the capability to:

a. maintain ephemeris, acquire, track and receive the downlink signal from Cospas-Sarsat satellites;

b. demodulate 406 MHz repeated (as required) and 406 MHz processed data stream channel (PDS) signals;

c. maintain and update the required time and frequency references;

d. process 406 MHz PDS data in the format specified in Cospas-Sarsat Space Segment Description (C/S T.003);

e. decode and error correct 406 MHz PDS data;

f. process 406 MHz repeated (as required) signals;

g calculate Doppler positions for all 406 MHz signals;

h. provide the data (required by C/S A.002) and an interface to national MCCs; and

i. raise alarms and warnings for any anomalous condition.

6.3.3.3 GEOLUT Data Availability

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6.3.4 Determining the Status of Operational Ground Segment Equipment

The status of Ground Segment equipment, as reported by the respective Ground Segment operators, is compiled annually and presented by the Secretariat in widely distributed documents such as the "Cospas-Sarsat System Data" and "Information Bulletin". To ensure that these reports reflect the true status of the Cospas-Sarsat System, there is a requirement to identify those components of the System which have reached full operational capability (FOC) but no longer function, or could cause adverse effects on System operations. System components which are so identified are to be considered as commissioned, but not operational.

In addition, System components should not continue to be operated in an initial operation capability (IOC) status for a period greater than one year. If Ground Segment equipment does not attain FOC status within one year, then it is to be considered as under development. Additional information on extended operation of equipment in an IOC status is contained in the documents C/S T.005 (LEOLUT commissioning), C/S T.010 (GEOLUT commissioning) and C/S A.006 (MCC commissioning).

6.3.4.1 Procedure for Determining the Status of Operational Ground Segment Equipment

In addition to the annual reports submitted by Ground Segment operators, several other methods can be used for determining equipment status. These include:

- periodic monitoring by Ground Segment operators as described in section 3,
- periodic tests on a regional or global level, or
- reporting of anomalies by nodal MCCs (as part of their regular System monitoring, including daily QMS objective monitoring as described in section 2).

An annual system test of alert processing will be conducted in January of each year, as described in Annex J. Each Ground Segment operator should report on their ground segment processing and, in addition, each nodal MCC should review the results of the performance of the ground segment processing in their DDR based on the traffic flow that was observed. Ground Segment operators and nodal MCC operators should report results of the test in Section 1.2.5 of the Report on System Status and Operations as per Annex B, indicating whether the expected processing described in Tables J.2 and J.3 successfully occurred and giving details on any failures.

The Joint Committee, using the information provided as noted above and the guidelines described below, will review the status of all commissioned Ground Segment equipment on an annual basis and present their recommendations to the Council.

Figure 6.2 presents an overview of the procedure to be used for determining and reporting the status of Cospas-Sarsat Ground Segment equipment. The figure depicts activities involved for equipment which is operational in either an IOC or FOC status. As shown in Figure 6.2, for example, equipment that has been downgraded to a "commissioned, not operational" status will have to undergo some limited retesting prior to reintegration into the System in an FOC status and reported in System documentation as fully operational.

6.3.4.2 Guidelines for Determining the Status of Operational Ground Segment Equipment

If there is a problem with a particular Ground Segment component that is noted from System or QMS monitoring, a Participant's annual report, or from periodic exercises, careful consideration should be used when making a determination of its status and each case should be reviewed considering the following general guidelines:

- the effect of the problem on SAR operations,
- the expected duration of the problem,
- the impact on the integrity of the Cospas-Sarsat System, and
- the impact on other Ground Segment equipment.

For example, if an MCC consistently provides an invalid value for a field in distress alert messages which is not required for message processing, there is probably a negligible impact on SAR forces. In cases such as this, no change in the equipment status would probably be necessary as the mission of the System is not affected.

The expected duration of the problem also has to be determined. A situation where equipment does not meet specifications for a short period may be acceptable. However, equipment failing to operate according to specifications for long durations should be declared as “commissioned, not operational”. Similar to the impact on SAR operations, the impact on the integrity and credibility of the System should also be considered in the reporting of System status.

Consideration should be given to the status of implementation of system changes reported by each Ground Segment operator in its annual report as per Annex B, section 1.4, in particular the status of critical changes, to assist in determining the status of the operation Ground Segment equipment.

Lastly, the impact of a problem in the equipment of one Ground Segment operator on the equipment of other operators should be considered. The failure to follow prescribed specifications by one Ground Segment operator should not negatively impact on others.

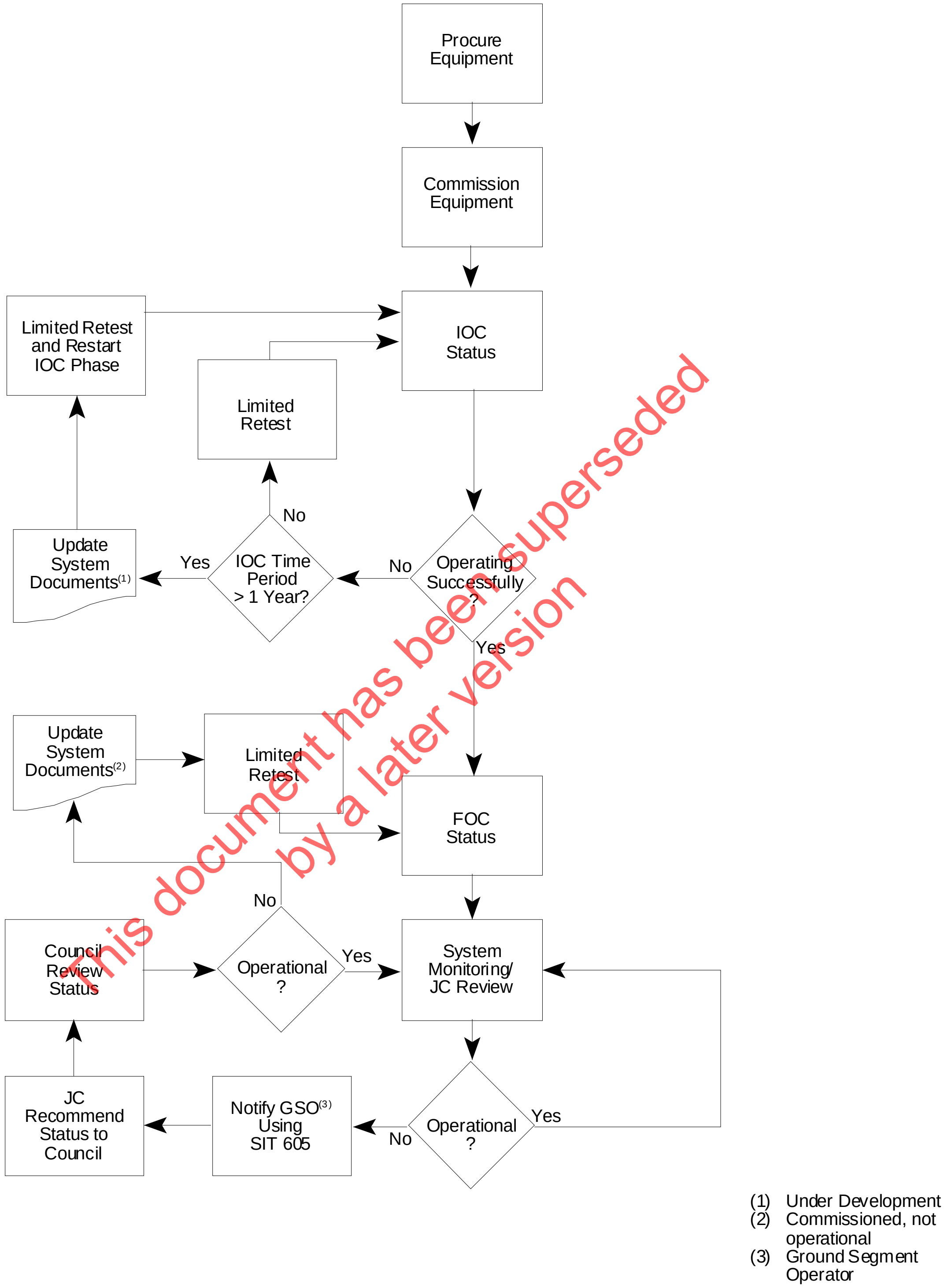

Figure 6.2: Operational Status of Ground Segment Equipment

6.4 Beacon Population

It is essential to regularly update beacon population figures (maritime, aeronautical, landmobile and test), as well as national forecasts of beacon populations over a 5 year period, in order to assess in due time any future adjustments which might be required in the ground segment capacity. The beacon population should be assessed in accordance with the Cospas-Sarsat definitions for EPIRBs, ELTs and PLBs. For similar reasons, changes in the national regulatory situation should be reported, including the possible impact on beacon population forecasts.

Each Cospas-Sarsat Participant should also provide the list of nationally approved beacon models to the Secretariat. This list will be maintained by the Secretariat for distribution to Cospas-Sarsat Participants. Administrations participating in Cospas-Sarsat will thereby have access to additional information about the performance of beacons type approved in their country but used in other areas.

Each Cospas-Sarsat Participant should include a narrative summary of beacon anomalies in its annual report for inclusion in the Cospas-Sarsat Report on System Status and Operations.

All Cospas-Sarsat Participants should provide a summary of their 406 MHz carriage requirements regulations, coding, registration requirements, etc to the Secretariat for inclusion in document C/S S.007, Handbook of Beacon Regulations.

6.5 False Alert Rate

The false alert rate should be calculated in three ways, i.e., one percentage to show the false alert rate as a function of the beacon population, a second percentage to show the false alert rate as a function of total alerts transmitted to SAR authorities, and a third series of percentages to show false alert rates as a function of specific beacon models. The procedures for calculating each of the three false alert rates are described below.

6.5.1 False Alert Rate as a Function of Beacon Population

The false alert rate as function of the total beacon population can be viewed as a method of tracking false alerts from a Cospas-Sarsat System perspective. The rate should be calculated by dividing the number of false alerts and undetermined alerts occurring world-wide with the reporting Participant's country code(s), by the estimated total beacons with the Participant's country code(s), as reported at section 1.3.1 of the Report on System Status and Operations provided at Annex B. This calculation is recommended to be provided for each type of beacon (EPIRBs, ELTs and PLBs).

6.5.2 False Alert Rate as a Function of the Total Number of Alerts

The false alert rate calculated as a function of the total number of alerts can be viewed as representing the SAR response perspective. This rate should be calculated by dividing the number of false alerts and undetermined alerts transmitted to SAR authorities in the reporting Participants service area, by the number of total alerts transmitted to the SAR authorities in the service area. The data for this calculation is provided in section 2.1 of the Report at Annex B.

6.5.3 False Alert Rates as a Function of Beacon Model

The false alert rate for each beacon model is used as a first step for identifying possible problems with specific variants of beacon models. This rate is calculated by dividing the number of false alerts attributed to a given beacon model variant (e.g. beacon model, type and activation method) transmitted to SAR authorities in the reporting Participant's service area, by the estimated total number of beacons of that model, type and activation method with the Participant's country code. Participants are encouraged to conduct further analysis on those models which exhibit high false alert rates with a view to identifying their causes. Caution is advised in drawing conclusions in respect of possible beacon problems from this data since experience has shown that false alerts can be caused by factors not related to beacon design.

A hypothetical example for reporting these statistics is provided below at Table 6.1.

Table 6.1: Example for Reporting False Alert Rate by Beacon Model

Model Name	TAC	Beacon Type / Activation Method	Estimated Number of Beacons	Number of False Alerts	False Alert Rate
ModelA	300	ELT / Manual	100	2	2.0%
ModelA	300	ELT / Auto	200	25	12.5%
ModelB	321	EPIRB / Manual	20	1	5.0%

6.6 Interference

Experience has shown that interference is a threat to System integrity and that eliminating it is a long-term effort. In order that Cospas-Sarsat can ascertain the global status of interference at 406 MHz, it is necessary that LEOLUT operators who perform routine monitoring of interference in the 406 MHz band report on a monthly basis to the Secretariat and to ITU as specified in section 5. The Secretariat should summarise data on persistent interference in its annual report on System status and operations and present this information to international organizations (IMO, ICAO and ITU) on an annual basis.

6.7 406 MHz Beacon Message Processing Anomalies

Processing anomalies which occur during 406 MHz beacon message processing may have a detrimental impact on System integrity. In an effort to minimise this negative impact, MCC operators should collect and analyse processing anomalies as a function of all MCC processed messages, with a view to determining which type of alerts are a source of the anomalies. The analysis of processing anomalies should be reported according to the guidelines provided at Annex G.

6.8 Distress Incident Report of SAR Events Assisted by Cospas-Sarsat Information

To assess the effectiveness of the contribution being made by the Cospas-Sarsat System to search and rescue world-wide, information on distress incidents should be provided by MCCs on a quarterly basis, in the format given at Annex B, section B-2.

6.9 Collecting and Reporting Data for SAR Event Analysis

On occasions, Cospas-Sarsat may be asked to provide information on the performance of the System in respect of specific search and rescue events. The Cospas-Sarsat Council has approved a procedure for interested parties to request this information from Cospas-Sarsat, this procedure is provided at Annex H.

Annex H also provides guidelines to Ground Segment operators for collecting and reporting the necessary data to the Cospas-Sarsat Secretariat for analysis. All data should be accompanied with a covering letter that summarises the information provided. The letter should also provide a narrative description of the status of the operator's Ground Segment equipment during the time period of the event analysis.

Ground Segment operators may, on an annual basis, undertake a SAR event analysis of an incident of their choosing and report their findings to the Joint Committee.

- END OF SECTION 6 -

ANNEXES TO

THE DOCUMENT

COSPAS-SARSAT

SYSTEM MONITORING

AND REPORTING

(C/S A.003)

ANNEX A

A. EXPLANATION OF TERMS AND ACRONYMS USED IN C/S A.003

A.1 DEFINITIONS OF TERMS

Calibration Factor: System data provided to LEOLUT operators by Space Segment Providers for the calibration of LEOLUTs, as defined in document C/S A.003.

Processing Anomaly: An alert message produced by the Cospas-Sarsat System which either should not have been generated or which provided incorrect information. Anomalous alert messages can either be filtered by the System, in which case they are not forwarded to SAR authorities, or unfiltered, in which case they are forwarded to SAR authorities, and may be a cause of false alerts.

Nature of Cospas-Sarsat Distress Alert Data:

a) Distress Alert

Cospas-Sarsat distress alert received by SAR authorities where an actual or potential distress situation exists. Distress alerts should be designated by RCCs as one of the following categories:

Only alert: Cospas-Sarsat was the unique source of information (alerting and locating).

First alert: Cospas-Sarsat was the source of the first alert received by SAR forces on the distress situation.

Supporting data: Cospas-Sarsat provided alert and/or location data which was used by SAR services in support of the search and rescue operation.

Data not used in SAR: Cospas-Sarsat provided alert and/or location data which was not used by SAR services in support of the search and rescue.

b) False Alert

Cospas-Sarsat distress alert received by SAR authorities when no distress situation actually exists, and a notification of distress should not have resulted. Operational false alerts are false alerts resulting from beacon activations.

c) Undetermined

Those beacon activations reported to the RCCs, for which the SAR organizations within the MCC service area have not returned SAR incident data, or the source of the signal could not be determined.

Number of 406 MHz beacon activations reported to RCCs/SPOCs within the MCC service area: The total number of alerts with location and those detect-only alerts which have been properly validated by the MCCs. Real and image positions count as only one alert. Those 406 MHz beacons seen on multiple passes, possibly with both location and detect-only alerts, are counted as only one event.

Performance Parameter: LUT and MCC processing results from one or several satellite passes, as specified in document C/S A.003, characterise the quality of alert data provided to SAR services.

Quality Indicator: LUT and MCC processing results from one or several satellite passes, as specified in document C/S A.003, characterize the performance of Space or Ground Segment sub-systems (e.g. a satellite SARR and SARP instruments, a LUT, a MCC or an orbitography beacon).

Reporting: Providing on an annual basis, a summary of the status of System elements and their performance during the reporting period, as defined in document C/S A.003.

Baseline Criteria: Established performance criteria against which the measurement results of performance parameters and quality indicators should be compared to assess the performance of Space and Ground Segment elements.

Expected Number of Points: The number of 406 MHz data points (also referred to as bursts) that should be detected on any one pass of a satellite over a beacon. The number of points is dependent on satellite altitude and cross track angle. See Annex D for reference table of expected number of points using 0^{o} or 5^{o} horizons.

A.2 LIST OF ACRONYMS

AGC	Automatic Gain Control
AOS	Acquisition of Signal
COSPAS	Satellite system for search vessels in distress (Russia)
C/S	Cospas-Sarsat
CTA	Cross Track Angle
DA0	Date (epoch) of reset to zero of Sarsat-SARP time counter
dB	Decibel
DDP	Cospas-Sarsat Data Distribution Plan (C/S A.001)
ELT	Emergency Locator Transmitter
EPIRB	Emergency Position Indicating Radio Beacon
FCal	Frequency calibration (Sarsat only)
GEOLUT	Local User Terminal in a GEOSAR System
GEOSAR	Geostationary Satellite System for Search and Rescue
GEOSAT	GEOSAR satellite
ID	Identification
ITU	International Telecommunication Union
km	Kilometre
LEOSAR	Low Earth Orbiting (LEO) satellite system for SAR
LEOSAT	LEOSAR satellite
LEOLUT	Local User Terminal in a LEOSAR System
LEO/GEO	Combining LEOSAR data with GEOSAR data in a LEOLUT to produce Doppler locations
LOS	Loss of Signal
LUT	Local User Terminal
MCC	Mission Control Centre
MHz	Megahertz
PDS	Processed Data Stream
PLB	Personal Locator Beacon
QMS	Quality Management System
RCC	Rescue Coordination Centre
SAR	Search and Rescue
SARP	Search and Rescue Processor
SARSAT	Search and Rescue Satellite-Aided Tracking System
SARR	Search and Rescue Repeater
SDV	standard deviation
SIT	Subject Indicator Type
SPOC	SAR Point of Contact
SRR	SAR Region
TBD	To Be Determined
TCA	Time of Closest Approach
TCal	Time Calibration (Sarsat only)
USO	Ultra Stable Oscillator
UTC	Coordinated Universal Time
WF	Window Flag

- END OF ANNEX A -

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ANNEX B

B. SYSTEM STATUS AND OPERATIONS AND DISTRESS INCIDENT REPORT FORMATS

B-1 FORMAT OF REPORT ON SYSTEM STATUS AND OPERATIONS

Date of report:	dd mmm yyyy
Origin:	country name
Time period:	1 January to 31 December yyyy

1 SYSTEM STATUS AND DEVELOPMENT SCHEDULE

1.1 Space Segment

1.1.1 Status of operational spacecraft

1.1.2 Status of payloads

1.1.3 Readiness and launch schedule of new spacecraft / payloads

1.1.4 Report on significant events (changes in payload configuration of operational satellites, etc.)

1.2 Ground Segment

1.2.1 LUT operational status

1.2.2 MCC operational status

1.2.3 Other Ground Segment sub-systems (orbitography network, time reference beacons, etc.)

1.2.4 Schedule of new Ground Segment equipment installation / commissioning

1.2.5 Results of System test per Annex J of document C/S A.003.

LUT/MCC REPORTING FORMAT
JANUARY 20XX SYSTEM TEST RESULTS

Test Ref. No.	<LUT Name and Code>	<LUT Name and Code>	<LUT Name and Code>
1	G	G	G
2	G	G	G
3	G	G	G
4	G	G	G
5	G	G	G
6	R	R	R
…	G	G	G
13	NOT UPLINKED		
...	G	G	G
18			
19			
20	SUPRESSED AT LEOLUT		
...	G	G	G
28	G	G	G

Notes (example):

1. Test Ref. No.6 - LUTs 1234, 1235 and 1236
   30 Hex message was not received as expected – Manufacturer advised and awaiting feedback

NODAL MCC REPORTING FORMAT
JANUARY 20XX SYSTEM TEST RESULTS

Test Ref. No.	<MCC Name and Code>	<MCC Name and Code>	<MCC Name and Code	<MCC Name and Code>
1	G	G	G	G
2	G	G	G	G
3	G	G	G	G
4	G	G	G	G
5	G	G	Y	Y
6	G	G	Y	Y
7	G	G	Y	Y
8	G	G	Y	Y
9	G	G	G	G
10	Y	G	G	G
11	G	Y	G	Y
12	G	G	G	G
13	NOT UPLINKED			
...	G	G	G	G
21	G	G	G	R
...	G	G	G	G
24	G	Y	G	G
...	G	G	G	G
28	G	G	G	G

Notes (example):

1. Test Ref. No.21- XXMCC
   Alert data was not received at the nodal MCC and believed to have been lost in the AFTN communication network

1.3 Beacon Population

1.3.1 Percentage of detected beacons with own country code that are registered

Registration rate calculated using: time of detection / end of year (select one)

Beacons	Number of Detections	Number of Detected Beacons that are Registered	Registration Rate (%)
EPIRBs			
ELTs			
PLBs			
SSAS Beacons			
Total			

Note: Specify if the registration rate is calculated based on the registration status at end of year (standard) or time of detection.

1.3.2 Beacon population

Beacon Population = Registered / Registration Rate (%) * 100

Non- registered = Beacon Population - Registered

Beacons	Registered	Registration Rate (%)	Beacon Population	Non-registered
EPIRBs				
ELTs				
PLBs				
SSAS Beacons				
Test Beacons		NA		NA
Total				

Evaluation of new beacons used as a replacement ....

1.3.3 Changes in regulatory status

1.3.4 Update of the beacon population forecast:

Year / Beacons	2015	2020
ELTs		
EPIRBs		
PLBs		
SSAS beacons		

1.4 Status of Implementation of System Changes
(Details of approved System changes are provided on annual report form by the Secretariat, available on the web at www.cospas-sarsat.int)

Number and Report Reference	Description of Change (Type) (see Note 1)	Criticality (see Note 2)	Implementation Date	Implementation Status	System Document

Note 1: Corrective, Adaptive, Enhancement, Optional
Note 2: Routine, Critical, Optional

2. SYSTEM OPERATIONS

2.1 Number of Beacon Activations Reported to RCCs/SPOCs within the MCC Service Area

ALERT CLASSIFICATIONS	EPIRB	ELT	PLB	Sub-Total	Total
Distress alerts					
False alerts					
Unfiltered processing anomalies					
Operational false alerts [1] (beacon activations)					
Beacon mishandling					
Beacon malfunction					
Mounting failure					
Environmental conditions					
Voluntary activation					
Unknown					
Undetermined					
TOTAL					

Note 1: See Appendix B.1 for classifications of Cospas-Sarsat alerts and Appendix B.2 for examples of operational false alerts associated with each classification.

2.2 LUT/MCC Availability

Availability is expressed as a percentage and is calculated by dividing the amount of time in operation by the time required to be in operation. See section 6.3.3 for complete instructions.

a. MCC system availability

b. LUT data availability

2.3 Report on Significant Events or Anomalies during Period of Operation

2.4 Report on Beacon Anomalies

a. Non-activation of beacons. Attach a narrative report for each case presented.

b. Operational false alerts. Where possible, provide the data according to Appendix B.1 in order to better track the false alert problem.

c. Other beacon anomalies. Where possible, provide the 15 hexadecimal beacon identifier, the beacon type, the country code, first and last detection, average repetition rate, and calculated frequency.

2.5 False Alert Rate

2.5.1 Cospas-Sarsat System operation perspective

false alerts + undetermined alerts world-wide with Participant's country code(s)
= --
estimated total number of beacons with Participant's country code(s)

	Number of false alerts + undetermined alerts world-wide	Estimated number of beacons	False alert rate (%)
EPIRB			
ELT			
PLB			
Totals			

2.5.2 SAR response perspective (see section 2.1)

false alerts + undetermined transmitted to RCCs/SPOCs in Participants service area
= --
total number of alerts transmitted to RCCs/SPOCs in Participants service area

Number of false alerts + undetermined alerts transmitted to SPOCs	Total number of alerts	False alert rate (%)

2.5.3 False alert rate by beacon model

Model Name (1)	**TAC (2)**	**Beacon Type / Activation Method (3)**	**Estimated Number of Beacons (4)**	**Number of False Alerts**	**False Alert Rate**

Notes:
1. Beacon model name.
2. Cospas-Sarsat Type Approval Certificate Number.
3. Beacon type and activation method (e.g. EPIRB/Automatic, ELT/Manual, etc.). Each combination of beacon model / activation method should be reported on a separate line.
4. Estimated total number of beacons of that model, type and activation method with Participant's country code(s).

2.6 Report on Educational and Regulatory Actions to Reduce False Alerts

Provide a summary of actions undertaken by the Participant working with their national Administrations, and with the Administrations of the SRRs within its MCC service area as applicable, to reduce the number of false alerts and to reduce the impact of false alerts.

2.7 Report on MCC Back-up Procedure Test Results

Provide a summary of test results undertaken by the MCC operator according to the existing back-up procedures and agreements.

B-2 FORMAT OF DISTRESS INCIDENT REPORT FOR DOCUMENTATION OF SAR EVENTS AND PERSONS RESCUED

a) Date of incident (dd / mm / yyyy):

b) Location of incident - latitude, longitude (degrees – minutes):

c) Location of incident (text description):

d) Type of incident (aviation, maritime, land):

e) Type of beacon (EPIRB, ELT, PLB):

f) Beacon Hex ID:

g) Beacon Frequency:
- 406.025 MHz ☐
- 406.028 MHz ☐
- 406.037 MHz ☐
- 406.040 MHz ☐

h) Is beacon registered? Y / N

i) Identification / type of vehicle craft involved:

j) Vehicle name:

k) Vessel / Aircraft flag:

l) Call sign:

g) Number of persons:
- involved ....
- rescued ....

h) Nature of Cospas-Sarsat alert data (see Annex A of document C/S A.003):
- only alert ☐
- first alert ☐
- supporting data ☐
- data not used in SAR ☐

e) Details of incident:

APPENDIX B.1 - CLASSIFICATION OF COSPAS-SARSAT ALERTS

Alerts Received By SAR Authorities

- False Alerts
- Distress Alerts
- Undetermined

False Alerts:

Unfiltered Processing Anomalies

Beacon Activations
(Operational False Alerts)

- Beacon Mishandling
  - Improper installation procedure / location
  - Improper testing and maintenance
  - Improper use
  - Improper disposal of beacon
- Beacon Malfunction
  - Faulty activation switch, i.e., gravity activated, magnetic, mercury, or crash
  - Water ingress
  - Transmitting distress signal while in test position
  - Electronics malfunction
- Mounting Failure
  - Strap or bracket failure
  - Release mechanism malfunction
  - Faulty mounting magnet for externally mounted ELT
- Environmental Conditions
  - Extreme weather conditions
- Voluntary Activation
  - Non-declared tests
  - Malicious activations
- Unknown
  (Confirmed Beacon Activations)
  - No feedback received on why beacon was activated
  - Investigation into beacon activation cause was inconclusive

APPENDIX B.2 - EXAMPLES OF OPERATIONAL FALSE ALERTS

Beacon Mishandling

Improper installation procedure / location

Exposed to sea action or ship's work, beacon activated by sea spray or wave, crewman bumped beacon, equipment struck beacon, beacon installed upside down, improperly placing beacon into bracket.

Improper testing and maintenance

Failure to follow proper testing procedures, negligence, poor beacon testing instructions, aircraft in situ test, left beacon in "on" position too long. Inspection by authorised inspector: accidental activation during vessel equipment inspection.

Repair by owner (usually unauthorised) or authorised facility: causing damage to beacon, activation during battery change, changing of hydrostatic release while servicing beacon.

Improper removal from bracket: inspection, test, cleaning, or safe keeping without switching off.

Beacon shipped to / by retailer, owner, repair facility (in transit): shipped while armed, improperly packed, improperly marked, rough handling.

Maintenance of craft: mechanical, electronic, wash down, painting, winterization.

Beacon stored improperly: stored while armed.

Improper use

Illegal activation: hoax, vandalism, theft.

Accidental activation: owner or SAR authorities report accidental activation and no further information.

Demonstration / test not co-ordinated with Cospas-Sarsat / SAR authorities: training, exercise, product demonstration using on position instead of test.

Improper disposal of beacon

Beacon sold with craft for scrap, discarded as trash, abandoned.

Beacon Malfunction

Faulty activation switch, i.e., gravity activated, magnetic, mercury, or crash

Hard landing, excessive craft vibration.

Water ingress

Water leakage due to manufacturing defect, cracked casing, faulty seal.

Transmitting distress signal while in test position

Transmitted non-inverted frame sync while in test mode.

Electronics malfunction

Non-GPS electronics malfunction.

Mounting Failure

Strap or bracket failure

Strap failure, mounting bolts sheared, retainer pin broken, beacon fell out of bracket.

Release mechanism malfunction

Premature release of hydrostatic release.

Faulty mounting magnet for externally mounted ELT

Switch magnets not effective.

Environmental Conditions

Extreme weather conditions

Hurricane / cyclone conditions, vessel knocked down, aircraft overturned, heavy seas, ice build-up.

Voluntary Activations

Non-declared tests

Malicious activations

Unknown (Confirmed Beacon Activations)

No feedback received on why beacon activated

Investigation into beacon activation cause was inconclusive

- END OF ANNEX B -

ANNEX C

C. 406 MHz INTERFERENCE MONITORING AND REPORTING

C.1 STATUS OF LEOLUT MONITORING CAPABILITIES

The following Cospas-Sarsat LEOLUTs are capable of monitoring 406 MHz interference, using special equipment in the LEOLUT, in conjunction with the 406 MHz repeater on Sarsat satellites. The coverage area of LEOLUTs performing 406 MHz routine interference monitoring is shown at Figure C.1.

LEOLUTs		COMMENTS *
Algeria:	Ouargla Algiers **	Routine monitoring Routine monitoring
Argentina:	El Palomar Rio Grande	Routine monitoring Routine monitoring
Australia:	Albany Bundaberg	Routine monitoring Routine monitoring
Brazil:	Brasilia Manaus Recife	Routine monitoring Routine monitoring Routine monitoring
Canada:	Churchill Edmonton Goose Bay Ottawa (Test facility)	Routine monitoring Routine monitoring Routine monitoring Available
Chile:	Easter Island Punta Arenas Santiago	Available Available Routine monitoring
China (P.R.):	Beijing	Routine monitoring
France:	Toulouse	Routine monitoring
Greece:	Penteli	Routine monitoring
Hong Kong, China:	Hong Kong	Routine monitoring
India:	Bangalore Lucknow	Routine monitoring Routine monitoring
Indonesia:	Jakarta	Periodic monitoring
Italy:	Bari	Routine monitoring
ITDC:	Keelung	Available
Japan:	Gunma	Routine monitoring
Korea (Rep.of):	Incheon	Routine monitoring
New Zealand:	Wellington	Routine monitoring
Nigeria:	Abuja	Routine monitoring

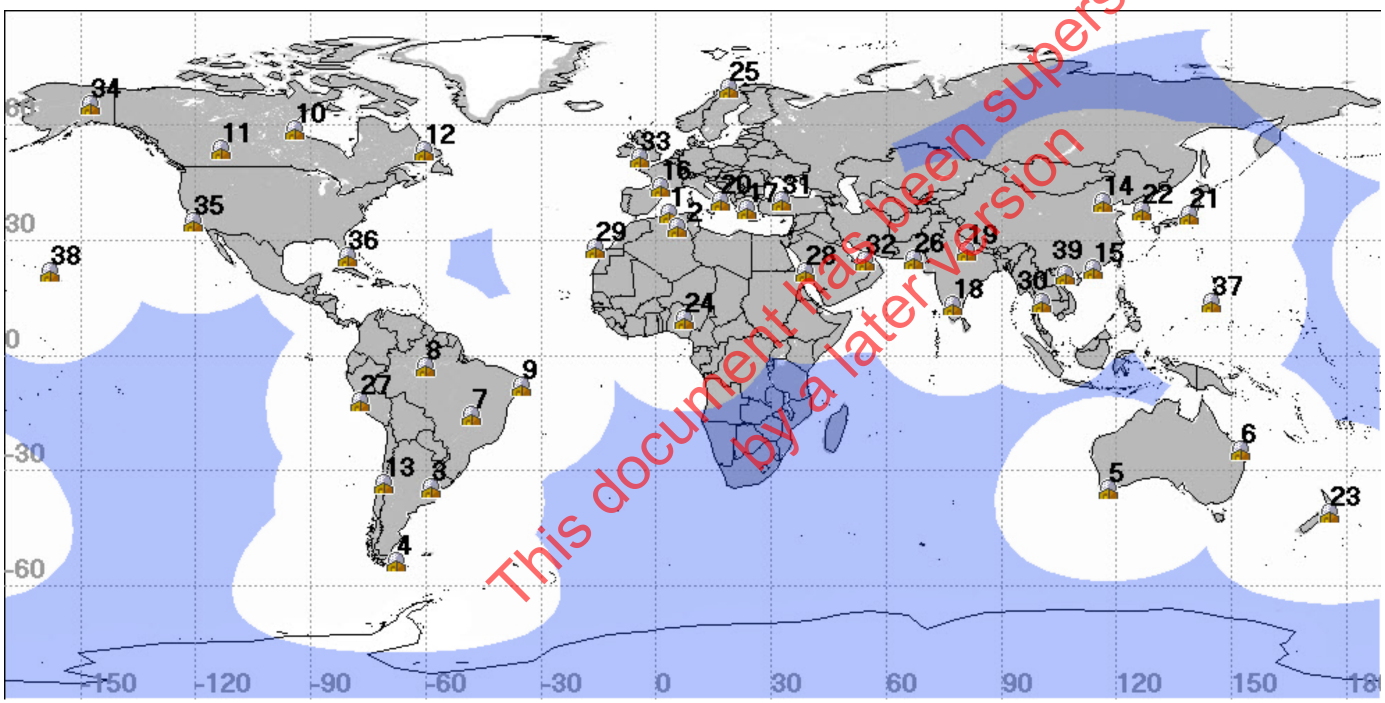
LEOLUTs		COMMENTS *
Norway:	Spitsbergen	Available
	Tromsoe	Routine monitoring
Pakistan:	Karachi	Routine monitoring
Peru:	Callao	Routine monitoring
Russia:	Nakhodka	Available
Saudi Arabia:	Jeddah	Routine monitoring
Singapore:	Singapore	Periodic monitoring
South Africa:	Cape Town	Periodic monitoring
Spain:	Maspalomas	Routine monitoring
Thailand:	Bangkok	Routine monitoring
Turkey:	Ankara	Routine monitoring
UAE:	Abu Dhabi	Routine monitoring
UK:	Combe Martin	Routine monitoring
USA:	Alaska	Routine monitoring
	California	Routine monitoring
	Florida	Routine monitoring
	Guam	Routine monitoring
	Hawaii	Routine monitoring
Vietnam:	Haiphong	Routine monitoring

Notes: * Periodic monitoring: the LEOLUT can be set by the MCC operator to a special operating mode to check for 406 MHz interference periodically as needed.

Routine monitoring: the LEOLUT automatically monitors each scheduled Sarsat satellite pass above 5° for 406 MHz interference.

** Temporarily not operational.

Figure C.1: Coverage Area of LEOLUTs Performing 406 MHz Routine Interference Monitoring



NOTES

LUTs:

1 Algiers, Algeria *
2 Ouargla, Algeria *
3 El Palomar, Argentina
4 Rio Grande, Argentina
5 Albany, Australia
6 Bundaberg, Australia
7 Brasilia, Brazil
8 Manaus, Brazil
9 Recife, Brazil
10 Churchill, Canada
11 Edmonton, Canada
12 Goose Bay, Canada
13 Santiago, Chile
14 Beijing, China
15 Hong Kong, China
16 Toulouse, France
17 Penteli, Greece
18 Bangalore, India
19 Luchnow, India
20 Bari, Italy
21 Gunma, Japan
22 Incheon, Korea
23 Wellington, New Zealand
24 Abuja, Nigeria
25 Tromsoe, Norway
26 Karachi, Pakistan
27 Callao, Peru
28 Jeddah, Saudi Arabia
29 Maspalomas, Spain
30 Bangkok, Thailand
31 Ankara, Turkey
32 Abu Dhabi, UAE
33 Combe Martin, UK
34 Alaska, USA
35 California, USA
36 Florida, USA
37 Guam
38 Hawaii, USA
39 Haiphong, Vietnam

Satellite:
Altitude - 850 km,
Elevation angle - 5 deg

Note: * - Temporarily not operational.

C.2 ITU INTERFERENCE REPORT FORMS (from Recommendation ITU-R SM.1051-2)

C.2.1 Information report concerning interference

a) Mean latitude and longitude

b) Probable search radius from mean location. Country. Nearest city

c) Frequencies

d) Number of observations (total and number since last report)

e) First and last date of occurrences

f) Modulation characteristics

g) Times and days-of-week of occurrences

h) Other details

C.2.2 Feedback report concerning the interference source

a) Latitude and longitude

b) Fundamental frequency of offending source (this may be outside the band)

c) Type of equipment

d) Cause of interference

e) Action taken

Table C.1: 406 MHz Interference Report Format [1]

Reporting Period (DD Month – DD Month YY)

Part 1

Site ID Number [2]	Location				Search Area (probable search radius from mean location) (km) [8]	Mean Latitude (d°, 100^{th} of d°)	Mean Longitude (d°, 100^{th} of d°)	Mean Detected Freq. (MHz) [9]	Modulation Charact [3]	Impact on System [4]	Monthly Detection Ratio [5,6] (minimum reported: xx%)	Dates of Observations		Times and Days of Week of Occurrences				Number of Observations (number since last report and total)		Other Details [10]
	Country	Nearest City	Direction from Nearest City	Distance (km)								First Date	Last Date	Date	Day of Week	Start Time	End Time	Current Period [6] (minimum reported: nn/month)	Total	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MID 123456	Text	Text	NE,W, SW, etc.	nn	nn	±nn.nn	±nnn.nn	406.nnn	N/ME/PE	H/M/L	0.nn	YYMM DD	YYMM DD	YYMM DD	Sn, Mo, Tu, etc.	HH: MM	HH: MM	nn	Nnnn	Text
MID 123457																				
etc.																				

Note: See next page.

(Cont.)

Part 2 (see Note 7)

Status (open/closed) 1-opn, 0-clsd	Location (Confirmed)				Narrative, including the identification of the source, as available							
	Country	Nearest City	Latitude (d°, 1000th of d°)	Longitude (d°, 1000th of d°)	Type of Equipment	Assigned Frequency (MHz)	Assigned Frequency Band (MHz)	Class of Emission	Power Characteristics	Cause of Interference	Action Taken	Other Data
22	23	24	25	26	27	28	29	30	31	32	33	34
1	Text	Text	±nn.nnn	±nnn.nnn								
0												

Notes:

1. Reporting should be provided in Excel format on a monthly basis. Minimum data is required for the following columns: 1, 2, 3, 6, 7, 8, 9, 13, 14, 19 and 20. Fields for which data is not available can be left blank.
2. Site ID number consists of two parts: 3-digit country code according to ITU MID code of the country of reporting authority plus 6 digits, assigned by the authority to the site. The reporting MCC should label a given interferer with the same Site ID in consecutive reports.
3. Type of modulation of main carrier: **N** – emission of unmodulated carrier, **ME**- emission of modulated carrier, **PE**- emission of pulses (data optional for Part 1, supplied in case of availability).
4. **H**igh: Reducing throughput of reference beacon in case of mutual visibility by 50% and more, **M**edium – by 25-50%, **L**ow –less than 25%.
5. Monthly detection ratio DR = N1/(N1+N2), where: N1 – number of passes over emitter at/above 5 degrees, with at least 1 location; N2 – number of passes over emitter at/over 5 degrees, with no location.
6. Interferers with DR $\geq$ 0.1 and with no less than 10 separate observations (10 distinct satellite passes) per month by the reporting MCC over the current reporting period are the ones that should normally be reported. However, given the different levels of interference in various parts of the world, MCCs may adjust their reporting criteria in order to keep the number of interferers reported at a reasonable level. The criteria used shall be indicated in the report (header of columns 12 and 19). An interferer that remains below the chosen reporting criteria over a given reporting period may still be reported in order to ensure continuity with previous reports. MCCs are encouraged to use their judgment to ensure the continuity of the content of their reports over time and to give a meaningful account of the interferers located in their region.
7. These items depend on feedback report concerning interference source. This is normally provided after the site has been closed and emissions have been stopped.
8. The radius of the Search Area (column 6) may be computed using the standard deviations of latitude and longitude.
9. Mean Detected Frequency (column 9): When more than one frequency is observed, the frequency nearest to the current operational band(s) is to be reported. Other frequencies will be listed in Other Details (column 21).
10. Other Details (column 21): Include in separate attachment, as needed.

- END OF ANNEX C -

ANNEX D

D. PERFORMANCE PARAMETERS FOR SYSTEM SELF-MONITORING

Table D.1: LEOSAR System Performance Parameters

Performance Parameter		Criteria	Anomaly	Conditions	Comments
3.1.1.1	**LEOSAR System Timing**	20 min	PT > 1200	Processing time for each incident alert reported	PT = (TMTX – TLOS) TMTX = Time of MCC transmission TLOS = Time of Loss of Signal
3.1.1.6	**Received Down-link Power Level**	Baseline – 10dB	MRP < B. – 10dB	Measured at elevations above 5º from the LEOLUT (See note 1)	MRP = Maximum Received Power at LEOLUT receiver, based on AGC value (See note 2)
3.1.1.7	**Loss of Carrier Lock**	Baseline + 10%	DCL > B + 10%	Measured at elevations above 5º from the LEOLUT (See note 1)	DCL = duration (above five degrees) when carrier lock is not maintained (See note 2)
3.1.1.8	**SARP Throughput**	70%	THRU < 70%	Standard pass over orbitography or reference beacon (See note 1)	THRU = #REC / #EXP Data points from Ref. Beacon #REC = Number received #EXP = Number expected
3.1.1.9	**406 MHz PDS Data Recovery Rate**	80%	DRR < 80%	Measured at elevations above 5º from the LEOLUT (See note 1)	DRR = #REC / #EXP #REC = Number received #EXP = Number expected
3.1.1.10	**Number of Single Point Alerts**	Baseline + 50%	#SPA > B. + 50%	Average per satellite during one day of operation (See note 3)	#SPA=number of single point alerts (See note 2)
3.1.1.11	**SARP Bit Error Rate**	Baseline + 30%	ABERSAR P > B. + 30%	Measured on PDS beacon messages received during each pass (See note 1)	ABERSARP = average bit error rate in SARP messages, measured as defined in paragraph 3.1.1.11 of C/S A.003 (See note 2)
3.1.1.12	**SARR Bit Error Rate**	Baseline + 30%	ABERSAR R > B + 30%	Measured on SARR beacon messages received during each pass (See note 1)	ABERSARR = average bit error rate in SARR messages, measured as defined in paragraph 3.1.1.12 of C/S A.003 (See note 2)
3.1.1.13	**Pass Scheduling Accuracy**	2 seconds	AAOS > PAOS+ 2 ALOS < PLOS – 2	For every predicted satellite pass (See note 1)	AAOS = actual AOS of pass ALOS = actual LOS of pass PAOS = predicted AOS PLOS = predicted LOS

<u>Notes</u>:

(1) These Performance Parameters shall be measured and reported separately for each combination of LEOSAR satellite and LEOLUT.

(2) The baseline value for each of these Performance Parameters shall be measured over a period of at least one week of normal system operation.

(3) This Performance Parameter shall be measured on each LEOSAR satellite pass over the LEOLUT, and shall be checked daily. An anomaly shall be reported for any day when the Parameter value exceeds the criterion.

.

Table D.1: LEOSAR System Performance Parameters (Cont.)

Calibration Factor		Criteria	Anomaly	Conditions	Comments
3.1.1.2	**Sarsat SARP TCAL**	10 ms	EDAO > 10 ms	For each SARP TCAL update (See note 5)	(See note 1)
3.1.1.3	**Sarsat SARP FCAL**	.05 Hz	EUSO > .05 Hz	For each SARP FCAL update (See note 5)	(See note 2)
3.1.1.4	**Sarsat & Cospas SARR Frequency Calibration**	1 Hz	EFR > 1 Hz	For each SARR FCAL update (See note 5)	(See note 3)
3.1.1.5	**Sarsat & Cospas Orbit Vectors**	5 km 5 m/sec	POFFS > 5 km VOFFS > 5 m/sec	For each orbit data update (See note 5)	(See note 4)

Notes:

(1) Sarsat Time Calibration Calculation: EDA0 = | DA0n-DA0o |

DA0 = rollover time, seconds
DA0n = DA0 at present check
DA0o = DA0 at previous check + 2^N*k*N_f/Fro
k = Number of rollovers from previous to present check
N = 23 for SARP-2 and SARP-3
N_f = 99360 for SARP-2, N_f = 200000 for SARP-3
Fro = USO frequency at previous check, Hz

(2) Sarsat SARP Frequency Calibration Calculation: EUSO = | Frn – Fro | / Nd

Fro = USO frequency at previous check, Hz
Frn = USO frequency at present check, Hz
Nd = # days from previous to present check

(3) Sarsat SARR Frequency Calibration Calculation: EFR = | OF_N – OF_O | / Nd

OF_O = frequency offset at previous check, Hz
OF_N = frequency offset at present check, Hz
Nd = # days from previous to present check

(4) Orbit Vector Calibration Calculation: AOFFS = | PoAOS – PnAOS | / Nd
LOFFS = | PoLOS – PnLOS | / Nd

PoAOS = AOS computed with previous orbit vectors
PnAOS = AOS computed with present orbit vectors
PoLOS = LOS computed with previous orbit vectors
PnLOS = LOS computed with present orbit vectors
Nd = # days from previous to present check

If the satellite has recently performed an orbit manoeuvre, then no Orbit Vector Calibration Calculation anomaly should be reported.

(5) These Calibration Factors shall be measured and reported separately for each combination of LEOSAR satellite and LEOLUT

Table D.2: GEOSAR System Performance Parameters

Performance Parameter		**Criteria**	**Anomaly**	**Conditions**	**Comments**
3.1.2.1	GEOSAR System Timing	30 min	GT > 1800	Processing time for each incident alert reported	GT = (TMTX – TDET) TMTX = Time of MCC transmission TDET = Time of initial detection

3.1.2.2	GEOSAR Rate of Reception of Beacon Messages	75%	RRATE < 75%		#EXP = Number of expected messages
					#RCV = Number of received messages
					RRATE = 100* #EXP / #RCV
					(See note 1)

3.1.2.3	GEOSAR Frequency Stability of Beacon Transmissions	2.0 Hz (Ref) 5.0 Hz (distress)	MAXFD > 2.0 or MAXFD > 5.0		MAXFD = Maximum difference of measured beacon frequency from average (See note 1)
3.1.2.4	GEOSAR Carrier to Noise Ratio	Baseline - 20%	ACNRB < B - 20%	(See note 2)	ACNRB = Average Carrier to Noise Ratio in GEOSAR messages from the selected beacon (See note 1)
3.1.2.5	GEOSAR Bit Error Rate	Baseline + 30%	ABERGSAR > B + 30%	(See note 2)	ABERGSAR = Average bit error rate in GEOSAR messages (See note 1)

Notes:

(1) These Performance Parameters shall be measured over a period of four hours of system operation.

(2) The baseline value for this Performance Parameter shall be measured over a period of at least one week of normal system operation.

Table D.3: Number of Points Transmitted by a Distress Beacon during a Satellite Pass

CTA (Beacon to Satellite)	Max Elevation Angle Cospas/ Sarsat	Cospas Satellites (1000 km Altitude)				Sarsat Satellites (850 km Altitude)			
		0 Degree Horizon		5 Degrees Horizon		0 Degree Horizon		5 Degrees Horizon	
		Duration of Pass (min)	No. of Points	Duration of Pass (min)	No. of Points	Duration of Pass (min)	No. of Points	Duration of Pass (min)	No. of Points
0	90.0/90.0	17.6	21	14.9	17	16.0	19	13.4	16
1	82.6/81.5	17.6	21	14.9	17	16.0	19	13.4	16
2	75.4/73.3	17.5	21	14.8	17	16.0	19	13.4	16
3	68.6/65.7	17.5	20	14.8	17	15.9	19	13.3	15
4	62.2/58.7	17.4	20	14.7	17	15.9	19	13.2	15
5	56.4/52.5	17.3	20	14.6	17	15.8	18	13.1	15
6	51.1/46.9	17.2	20	14.5	17	15.7	18	13.0	15
7	46.3/42.0	17.1	20	14.3	17	15.6	18	12.8	15
8	42.0/37.7	17.0	20	14.2	16	15.4	18	12.6	15
9	38.1/33.8	16.8	20	14.0	16	15.2	18	12.4	14
10	34.6/30.0	16.7	19	13.7	16	15.1	18	12.2	14
11	31.4/27.4	16.5	19	13.5	16	14.8	17	11.9	14
12	28.5/24.6	16.2	19	13.2	15	14.6	17	11.6	13
13	25.9/22.2	16.0	19	12.9	15	14.3	17	11.2	13
14	23.5/19.9	15.7	18	12.6	15	14.0	16	10.9	13
15	21.3/17.8	15.4	18	12.2	14	13.7	16	10.4	12
16	19.2/15.9	15.1	18	11.7	14	13.3	16	9.9	11
17	17.3/14.1	14.7	17	11.2	13	12.9	15	9.4	11
18	15.6/12.5	14.3	17	10.7	12	15.5	14	8.7	10
19	13.9/10.9	13.9	16	10.1	12	12.0	14	8.0	9
20	12.3/9.4	13.4	16	9.4	11	11.5	13	7.1	8
21	10.8/8.1	12.9	15	8.6	10	10.9	13	6.1	7
22	9.4/6.8	12.3	14	7.7	9	10.5	12	4.7	5
23	8.1/5.5	11.7	13	6.6	7	9.4	11	2.6	3
24	6.8/4.3	10.9	13	5.2	6	8.5	10	NA	NA
25	5.6/3.2	10.1	12	3.0	3	7.5	8	NA	NA
26	4.4/2.1	9.2	11	NA	NA	6.2	7	NA	NA
27	3.3/1.0	8.1	9	NA	NA	4.5	5	NA	NA
28	2.2/0.0	6.7	8	NA	NA	0.6	0	NA	NA
29	1.1/NA	5.0	5	NA	NA	NA	NA	NA	NA
30	0.1/NA	1.6	1	NA	NA	NA	NA	NA	NA

Note: * = For orbitography beacons, multiply number of points by 1.6.

- END OF ANNEX D -

ANNEX E

E. ANOMALY NOTIFICATION MESSAGES

The System anomaly notification message is transmitted according to the guidance contained in section 3.1.1 of this document and section 3.7 of Cospas-Sarsat Data Distribution Plan (C/S A.001). For messages to be transmitted to all MCCs, use SIT 605 format. For messages to be transmitted to specific MCCs, use SIT 915 format.

Example of System Anomaly Message to all MCCs:

/00001 00000/2270/94 123 1845

/605/xxx0 (where xxx is the MCC to which this message is transmitted)

/SYSTEM ANOMALY NOTIFICATION MESSAGE

(include narrative text here to describe System anomaly concerning performance paramerters, quality indicators, or calibration factors)

/LASSIT

/ENDMSG

Example of System Anomaly Message to a specific MCC or Ground Segment Provider:

/00001 00000/2270/94 123 1845

/915/3660

/SYSTEM ANOMALY NOTIFICATION MESSAGE

(include narrative text here to describe System anomaly concerning performance parameters, quality indicators, or calibration factors)

/LASSIT

/ENDMSG

E.1 LEOLUT AVAILABILITY STATUS MESSAGES

E.1.1 - SIT 915 Warning Message

[DATE: HHHH UTC, DD MONTH YEAR]
FROM: XXMCC
TO: YYMCC
SUBJECT: LEOLUT AVAILABILITY STATUS WARNING MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING LEOLUT AND SATELLITE COMBINATION IS NOT MEETING THE REQUISITE AVAILABILITY CRITERION FOR THE 3 DAY PERIOD ENDING AT XXXX UTC, DD MONTH YEAR.

LEOLUT [NAME & ID] AND SATELLITE [ID] [AVAILABILITY: XX PERCENT]
LEOLUT [NAME & ID] AND SATELLITE [ID] [AVAILABILITY: XX PERCENT]
ETC

2. REQUEST A CHECK FOR THE CAUSE OF THE REDUCED AVAILABILITY.

REGARDS

E.1.2 - SIT 605 Status Message (Advising non-conformity)

[DATE: HHHH UTC, DD MONTH YEAR]
FROM: XXMCC
TO: ALL MCCS

SUBJECT: LEOLUT AVAILABILITY NON-CONFORMITY STATUS MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING LEOLUT AND SATELLITE COMBINATION(S) IS NOT MEETING THE REQUISITE AVAILABILITY CRITERION FOR THE 3 DAY PERIOD ENDING AT XXXX UTC, DD MONTH YEAR.

LEOLUT [NAME & ID] AND SATELLITE [ID]
LEOLUT [NAME & ID] AND SATELLITE [ID]
ETC

2. THE CORRESPONDING CHANGE HAS BEEN MADE TO THE COSPAS-SARSAT WEBSITE.

REGARDS

E.1.3 - SIT 605 Status Message
(Advising return to normal operations)

[DATE: HHHH UTC, DD MONTH YEAR]

FROM: XXMCC
TO: ALL MCCS
SUBJECT: LEOLUT AVAILABILITY CONFORMITY STATUS MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING LEOLUT AND SATELLITE COMBINATION AVAILABILITY HAS RETURNED TO NORMAL AS OF DATE: XXXX UTC, DD MONTH YEAR.

LEOLUT [NAME & ID] AND SATELLITE [ID]
LEOLUT [NAME & ID] AND SATELLITE [ID]
ETC

2. THE CORRESPONDING CHANGE HAS BEEN MADE TO THE COSPAS-SARSAT WEBSITE.

REGARDS

Note: Reference to XXMCC will be the nodal MCC supporting the MCC responsible for the LEOLUT.

E.2 GEOLUT AVAILABILITY STATUS MESSAGES

E.2.1 - SIT 915 Warning Message

[DATE: HHHH UTC, DD MONTH YEAR]
FROM: XXMCC
TO: YYMCC
SUBJECT: GEOLUT AVAILABILITY STATUS WARNING MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING GEOLUT AND SATELLITE COMBINATION(S) IS NOT MEETING THE REQUISITE AVAILABILITY CRITERION FOR THE 1 DAY PERIOD ENDING AT XXXX UTC, DD MONTH YEAR.

GEOLUT [NAME & ID] AND SATELLITE [ID] [AVAILABILITY: XX PERCENT]
GEOLUT [NAME & ID] AND SATELLITE [ID] [AVAILABILITY: XX PERCENT]
ETC

2. REQUEST A CHECK FOR THE CAUSE OF THE REDUCED AVAILABILITY.

REGARDS

E.2.2 - SIT 605 Status Message (Advising non-conformity)

[DATE: HHHH UTC, DD MONTH YEAR]
FROM: XXMCC
TO: ALL MCCS

SUBJECT: GEOLUT AVAILABILITY NON-CONFORMITY STATUS MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING GEOLUT AND SATELLITE COMBINATION(S) IS NOT MEETING THE REQUISITE AVAILABILITY CRITERION FOR THE 1DAY PERIOD ENDING AT XXXX UTC, DD MONTH YEAR.

GEOLUT [NAME & ID] AND SATELLITE [ID]
GEOLUT [NAME & ID] AND SATELLITE [ID]
ETC

2. THE CORRESPONDING CHANGE HAS BEEN MADE TO THE COSPAS-SARSAT WEBSITE.

REGARDS

E.2.3 - SIT 605 Status Message
(Advising return to normal operations)

[DATE: HHHH UTC, DD MONTH YEAR]

FROM: XXMCC
TO: ALL MCCS
SUBJECT: GEOLUT AVAILABILITY CONFORMITY STATUS MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING GEOLUT AND SATELLITE COMBINATION AVAILABILITY HAS RETURNED TO NORMAL AS OF DATE: XXXX UTC, DD MONTH YEAR.

GEOLUT [NAME & ID] AND SATELLITE [ID]
GEOLUT [NAME & ID] AND SATELLITE [ID]
ETC

2. THE CORRESPONDING CHANGE HAS BEEN MADE TO THE COSPAS-SARSAT WEBSITE.

REGARDS

Note: Reference to XXMCC will be the nodal MCC supporting the MCC responsible for the GEOLUT.

E.3 LEOLUT ACCURACY STATUS MESSAGES

E.3.1 - SIT 915 Warning Message

[DATE: HHHH UTC, DD MONTH YEAR]
FROM: XXMCC
TO: YYMCC

SUBJECT: LEOLUT LOCATION ACCURACY STATUS WARNING MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING LEOLUT AND SATELLITE COMBINATION(S) IS NOT MEETING THE REQUISITE LOCATION ACCURACY CRITERION AT XXXX UTC, DD MONTH YEAR.

LEOLUT [NAME & ID] AND SATELLITE [ID]
[THE PERFORMANCE FOR THIS COMBINATION IS R.5: xx PERCENT, R.10: yy PERCENT]

LEOLUT [NAME & ID] AND SATELLITE [ID]
[THE PERFORMANCE FOR THIS COMBINATION IS R.5: xx PERCENT, R.10: yy PERCENT]

ETC

2. REQUEST A CHECK FOR THE CAUSE OF REDUCED LOCATION ACCURACY.

REGARDS

E.3.2 - SIT 605 Status Message
(Advising non-conformity)

[DATE: HHHH UTC, DD MONTH YEAR]
FROM: XXMCC
TO: ALL MCCS

SUBJECT: LEOLUT LOCATION ACCURACY NON-CONFORMITY STATUS MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING LEOLUT AND SATELLITE COMBINATION IS NOT MEETING THE REQUISITE LOCATION ACCURACY CRITERION AS AT XXXX UTC, DD MONTH YEAR.

LEOLUT [NAME & ID] AND SATELLITE [ID]
[THE PERFORMANCE FOR THIS COMBINATION IS R.5: xx PERCENT, R.20: yy PERCENT]

LEOLUT [NAME & ID] AND SATELLITE [ID]
[THE PERFORMANCE FOR THIS COMBINATION IS R.5: xx PERCENT, R.20: yy PERCENT]

2. THE CORRESPONDING CHANGES TO THE LOCATION ACCURACY AND AVAILABILITY STATUS HAVE BEEN MADE TO THE COSPAS-SARSAT WEBSITE AND DOPPLER SOLUTION DATA FOR THE LEOLUT AND SATELLITE COMBINATION(S) IS (ARE) BEING SUPPRESSED.

REGARDS

E.3.3 - SIT 605 Status Message
(Advising return to normal operations)

[DATE: HHHH UTC, DD MONTH YEAR]
FROM: XXMCC
TO: ALL MCCS

SUBJECT: LEOLUT LOCATION ACCURACY CONFORMITY STATUS MESSAGE

1. IN ACCORDANCE WITH COSPAS-SARSAT QMS PLEASE BE ADVISED THAT THE FOLLOWING LEOLUT AND SATELLITE COMBINATION LOCATION ACCURACY [AND AVAILABILITY] HAS RETURNED TO NORMAL AS AT XXXX UTC, DD MONTH YEAR.

LEOLUT [NAME & ID] AND SATELLITE [ID]
LEOLUT [NAME & ID] AND SATELLITE [ID]
ETC

2. THE CORRESPONDING CHANGE HAS BEEN MADE TO THE COSPAS-SARSAT WEBSITE AND DOPPLER SOLUTION DATA FOR THE ABOVE COMBINATION LEOLUT AND SATELLITE IS NO LONGER BEING SUPPRESSED.

REGARDS

Note: Reference to XXMCC will be the nodal MCC supporting the MCC responsible for the LEOLUT.

- END OF ANNEX E -

ANNEX F

F. PERFORMANCE MEASURES FOR THE COSPAS-SARSAT STRATEGIC PLAN

Performance Measures are numbered by Goal and Objective e.g. PM 1.2 relates to Goal 1, Objective 2

PM 1.1 Performance Measure: **Delivery of distress alerts to appropriate SPOCs**

Goal and Objective:

Goal 1 - Continuous and Effective System Operations.

Objective 1 - Deliver distress alerts to the appropriate SPOCs.

Indicator: Percentage of monthly MCC to SPOC communication link tests that succeed.

Rationale: Enables more effective coordination of SAR and helps to support IMO and ICAO SAR plans.

Definitions: Appropriate SPOC means a SPOC that:

- is identified based on SAR plans and in consultation with administrations, and
- is listed in the data distribution plan.

"Success" means that at least one message sent to a SPOC by its associated MCC is acknowledged by the SPOC operator within 30 minutes. Tests are performed monthly.

Metric(s): Percentage = the number of SPOCs with successful monthly communication tests with its associated MCC / the number of SPOCs tested.

Data Collection Process: Results of monthly SPOC test are sent from the MCC to the Secretariat, using the format defined in document C/S A.003. The test results include an indication of whether the SPOC operator provided a manual acknowledgement of the message within 30 minutes.

Reporting Schedule: The Secretariat reports annually to the Joint Committee, the Council, ICAO and IMO.

Data Verification Process: MCCs shall report test results in a database format to ensure that test results per communications path are tabulated properly. The Secretariat will review test results over time to look for reporting anomalies.

Relevant Documents: C/S A.003, C/S A.001 and C/S A.002.

Resources Required: Estimate about 4 hours per month per MCC to test and report on about 25 SPOC communication paths. (The time required will vary by MCC depending on number of SPOC communications paths to be tested.) This time estimate includes verification that new communications paths are added to the test and obsolete paths are removed from the test.

Comments:

PM 1.2 Performance Measure: Alert location accuracy

Goal and Objective:

Goal 1 - Continuous and Effective System Operations.

Objective 2 - Maintain or improve location accuracy.

Indicator: Percentage of Doppler solutions accurate to within 5 km.

Rationale: Accurate locations reduce search time which allows more lives to be saved.

Definitions: The indicator is based on the accuracy of all Doppler solutions provided by LEOLUTs for reference beacons as specified in C/S A.003.

Metric(s): Percentage = number of Doppler locations within 5 km / total number of Doppler locations * 100.

Data Collection Process: Data is sent by MCCs to the associated nodal MCC as part of QMS monitoring specified in document C/S A.003. Nodal MCCs report quarterly to the Secretariat in an Excel/database format, for each LUT and satellite pair, the total number of Doppler locations and the number of Doppler locations within 5 km.

Reporting Schedule: Secretariat reports annually to Joint Committee and Council.

Data Verification: Nodal MCC to ensure that the sample size for each LUT and satellite pair does not exceed the number of available passes.

Relevant Documents: C/S T.002 and C/S A.003.

Resources Required: Nodal MCCs to develop an automated and/or manual procedure to extract required location accuracy data in an Excel/database format. Estimate about 4 days effort to develop an automated data extraction procedure and 2 hours quarterly for an analyst to provide the required data to the Secretariat.

Comments: The summary data provided to the Secretariat can be reviewed by satellite (for all LUTs) and LUT (for all satellites) to identify long-term performance issues for specific satellites or LUTs.

PM 2.4 Performance Measure: Implementation status of QMS continuous monitoring processes

Goal and Objective:

Goal 2 - A Comprehensive Management Structure to Support System Evolution and Ensure Program Continuity.

Objective 4 - Establish a Quality Management System.

Indicator: Percentage of Ground Segment Providers that have successfully implemented QMS continuous monitoring.

Rationale: The implementation of QMS continuous monitoring processes is a key element in accomplishing the Cospas-Sarsat quality objective to ensure Cospas-Sarsat consistently provides accurate, timely and reliable distress alert and location information to search and rescue authorities. QMS monitoring allows Cospas-Sarsat to automatically assess the performance status of LUTs and MCCs, thereby encouraging higher performance standards and the full implementation of other QMS requirements.

Definitions: To be counted as having "Successfully implemented the QMS continuous monitoring processes," a Ground Segment provider must ensure that the required data as defined in C/S A.003 for their LUT(s) and MCC, is regularly and reliably transmitted to the appropriate nodal MCC. In addition, a nodal MCC must collect and analyze data to determine the status of a Ground Segment component (LUT or MCC) as specified in C/S A.003, and report results on the QMS status board on the website.

Metric(s):
The number of MCCs routinely providing QMS continuous monitoring results on the QMS status board, divided by the total number of MCCs at FOC status.

Data Collection Process:
Data is obtained through observation of the QMS status board on the website.

Reporting Schedule: Secretariat reports on an annual basis to Council.

Data Verification and Validation Process: Not applicable.

Relevant Documents: C/S A.003, C/S P.015 and C/S A.005.

Resources Required:
Approximately 2 hours annually for the Secretariat to complete the report.

Comments:

PM 4.3 Performance Measure: Cospas-Sarsat assisted SAR events

Goal and Objective:

Goal 4 - Participants, Users and Customers use and operate the System to its full potential.

Objective 3 - Ensure Participants' awareness of the System and Programme to realize their full potential.

Indicators:
1. **Number of SAR events annually where Cospas-Sarsat assisted.**
2. **Number of SAR events annually where Cospas-Sarsat provided the only alert.**

Rationale:
Cospas-Sarsat's purpose is to assist in the saving of lives; this measure is directly related to that purpose. Rescue of persons in distress is a critical concern of Cospas-Sarsat's stakeholders, customers and users. Therefore, this measure will demonstrate the relevance of the Cospas-Sarsat System.

Definitions:
A Cospas-Sarsat assisted event is defined as any situation in which persons are in distress, and SAR authorities acknowledged that the Cospas-Sarsat System assisted SAR operations by providing the only alert, first alert or supporting data in that SAR event. Cospas-Sarsat provided the only alert is defined as any situation in which persons are in distress, and SAR authorities acknowledged that the Cospas-Sarsat System provided the only alert.

Metric(s): Number of SAR events reported annually by MCCs where Cospas-Sarsat provided assistance. Number of SAR events reported annually by MCCs where Cospas-Sarsat provided the only alert.

Data Collection Process: Based on feedback provided by SAR authorities, MCCs report the number of SAR events to the Secretariat on a quarterly basis.

Reporting Schedule: The Secretariat reports annually to the Joint Committee, Council, IMO and ICAO.

Data Verification Process: MCCs should verify data provided by SAR authorities. The Secretariat distributes a draft of the annual report at the JC and asks for comments. MCCs should then check their own numbers in conjunction with SAR events map.

Relevant Documents: C/S A.003 and C/S R.007.

Resources Required: Reporting procedure is already in place and data are available in the Annual Report on System Status and Operations.

Comments: Most of this data will be collected by agencies that are not a part of the Cospas-Sarsat System.

- END OF ANNEX F -

ANNEX G

G. DATA COLLECTION FOR ANALYSIS OF 406 MHz BEACON MESSAGE PROCESSING ANOMALIES

Reporting Period (DD Month YY – DD Month YY): ______________
Reporting MCC: ______________
Total number of processed messages (NNNNN): ______________
Number of single point LEOSAR message processing anomalies: ______________
Number of GEOSAR message processing anomalies: ______________
Number of single point LEOSAR processing anomalies filtered: ______________
Number of GEOSAR processing anomalies filtered: ______________

The tabular structure outlined below can be used to assist Ground Segment operators track the data required to derive the number of processed messages, processing anomalies and filtered processing anomalies to be reported (see above). This table, if used, would provide a foundation for more detailed analysis if required. Along with this table, the following data may be useful in analysing message processing anomalies:

a) Calculated Doppler location for both A and B solutions

b) Bias frequency as measured by the LEOLUT and/or GEOLUT

c) LUT solution data, including time, frequency of data points used

d) Dot plots

e) Beacon information
 - beacon manufacturer and model
 - beacon transmit frequency
 - beacon EIRP and antenna characteristics

f) Characterisation data/analysis conducted on interferers and the event.

Table G.1: Data Collection for Analysis of 406 MHz Beacon Message Processing Anomalies

Beacon Message Received	Beacon Message Transmitted	No of Points/ Integration	LUT	Satellite	Processing Channels	Day and Time of Beacon Msg received	Visibility Time (LEO)	MCC Ref No	Reason for not Passing MCC Validation	Location Data, Lat	Location Data, Long	Number of Corrected Errors in the Message	Approx Power (dBm)	Approx C/N_0 (dB)	Cause	Message Filtered
1	2*	3	4	5	6	7	8	9*	10	11*	12*	13*	14*	15*	16*	17*
30 Hex	30 Hex	nn	nnnn	S,C,G,I	$n^{1)}$	Hr/Min/ Year/ Month/ Day	min	nnnn	$n^{2)}$	±nn°nn′ (+=N, -=S)	±nnn°nn′ (+=E, -=W)	0/1/2	nn	nn	$a^{3)}$	Y/N

Note: * represents optional fields in the table

Table Entry Codes

1)	1	SARP
	2	SARR
	3	GEOSAR
2)	0	Passed MCC validation
	1	Country code <200, >780, or unallocated country code between 200 and 780
	2	Protocol code
	3	Baudot characters
	4	Binary coded decimal fields
	5	Encoded latitude and longitude
	6	Beacons whose message indicate the use of SART 9 GHz homer#
	7	Non-assigned Cospas-Sarsat type approval number
	8	Wrong BCH
	9	Other nationally defined
	10	Supplementary data bits
3)	H	High bit error rate
	C	Synchronisation errors
	I	Interference
	L	GEOLUT or LEOLUT not performing to specification
	S	Satellite payload instruments not performing to specification
	B	Beacon not performing to specification
	M	MCC not performing to specification

At the time that this table was created there were no Cospas-Sarsat type approved beacons which used the 9 GHz SART transponder as their only homing device. Consequently, at least one MCC filters alert messages which indicate that this type of beacon is used.

- END OF ANNEX G -

ANNEX H

H. COLLECTING AND REPORTING DATA FOR SAR EVENT ANALYSIS

H.1 PROCEDURE FOR COLLECTING COSPAS-SARSAT DATA ON SAR INCIDENTS

The Cospas-Sarsat Council agreed the following procedure for collecting Cospas-Sarsat data on particular SAR incidents (see CSC-15 SR Annex 5). Further rationale for conducting SAR analyses can be found in section 10 of document C/S P.015 "Cospas-Sarsat Quality Manual".

H.1.1 Any Representative of a Cospas-Sarsat Participating Country with direct interest in a particular SAR incident, or representatives from international organisations with responsibilities on SAR matters (ICAO and IMO), may discuss with the Chair of the Council, either directly or through the Secretariat, the need for collecting data concerning particular SAR incidents from one or several Ground Segment operators.

H.1.2 Administrations from countries not participating in the Cospas-Sarsat System should address any requests for Cospas-Sarsat data on SAR incidents to one of the Cospas-Sarsat Ground Segment Providers, ICAO or IMO. Any such request should be conveyed immediately to the Chairperson of the Council, directly or through the Secretariat.

H.1.3 The Council Chair, if satisfied that it would be appropriate, will instruct the Secretariat to ask the appropriate MCC operators to provide the required data.

H.1.4 The Secretariat will collate all relevant data provided by the Cospas-Sarsat MCCs.

H.1.5 The Council Chair, after consultation with other Parties' Representatives, will establish an ad-hoc group of experts from the MCC operators involved. The group will analyse the available Cospas-Sarsat data, either by correspondence or as a splinter group during a regular Cospas-Sarsat meeting. They will forward their conclusions to the Secretariat for distribution to, and consideration by, the Parties and the MCC operators involved.

H.1.6 Their conclusions /recommendations shall be reviewed by the Council (or by the Parties if the matter is urgent) along with any further comments from the MCC operators involved The Chair of the Council will direct the Secretariat on the release of the collected Cospas-Sarsat incident data, the conclusions of the analysis by the Cospas-Sarsat experts and/or any official Cospas-Sarsat comments, to the requesting Cospas-Sarsat Participant or the responsible international organisation (ICAO or IMO), as appropriate.

H.2 DATA TO BE COLLECTED AND REPORTED

A general description of the data to be provided to the Secretariat for SAR event analysis is included below. All data is to be provided as available in the specific Ground Segment equipment, when possible the data should be provided in an electronic format, preferably as comma delimited text files or Microsoft Access database tables, accompanied by a description of the data format provided.

The following narrative information should be provided:

H.2.1 General

a) status of associated Ground Segment equipment during time of event, including the status as declared under QMS;

b) status of Space Segment equipment during time of event (Space Segment Providers);

c) orbitography beacon throughput/accuracy during time of event (France, USA, and others as possible);

d) 15 character beacon hexadecimal identification(s) for beacon(s) associated with SAR event;

e) list of other SAR incidents detected/reported during the time period of analysis

f) status of interference detected during the time period of analysis.

H.2.2 MCC Data to be Collected and Reported for SAR Incident Investigated

a) input and output messages from/to other MCCs;

b) formatted input from associated LUTs; and

c) registration information for the beacon, including that the beacon was not registered, if applicable.

H.2.3 LEOLUT Data to be Collected and Reported

a) pass schedule and tracking result summary for requested period;

b) dot plots, as available, (.bmp, .jpg, or .pcx formats if possible) for LEOLUTs capable of local-mode reception of beacon associated with SAR event; and

c) solution information such as time of data points received and used, as available.

H.2.4 GEOLUT Data to be Collected and Reported

a) time of first and last detection for specific beacon ID;

b) average frequency bias of beacon transmissions; and

c) any noted anomalies or irregularities with beacon transmission or processing.

- END OF ANNEX H -

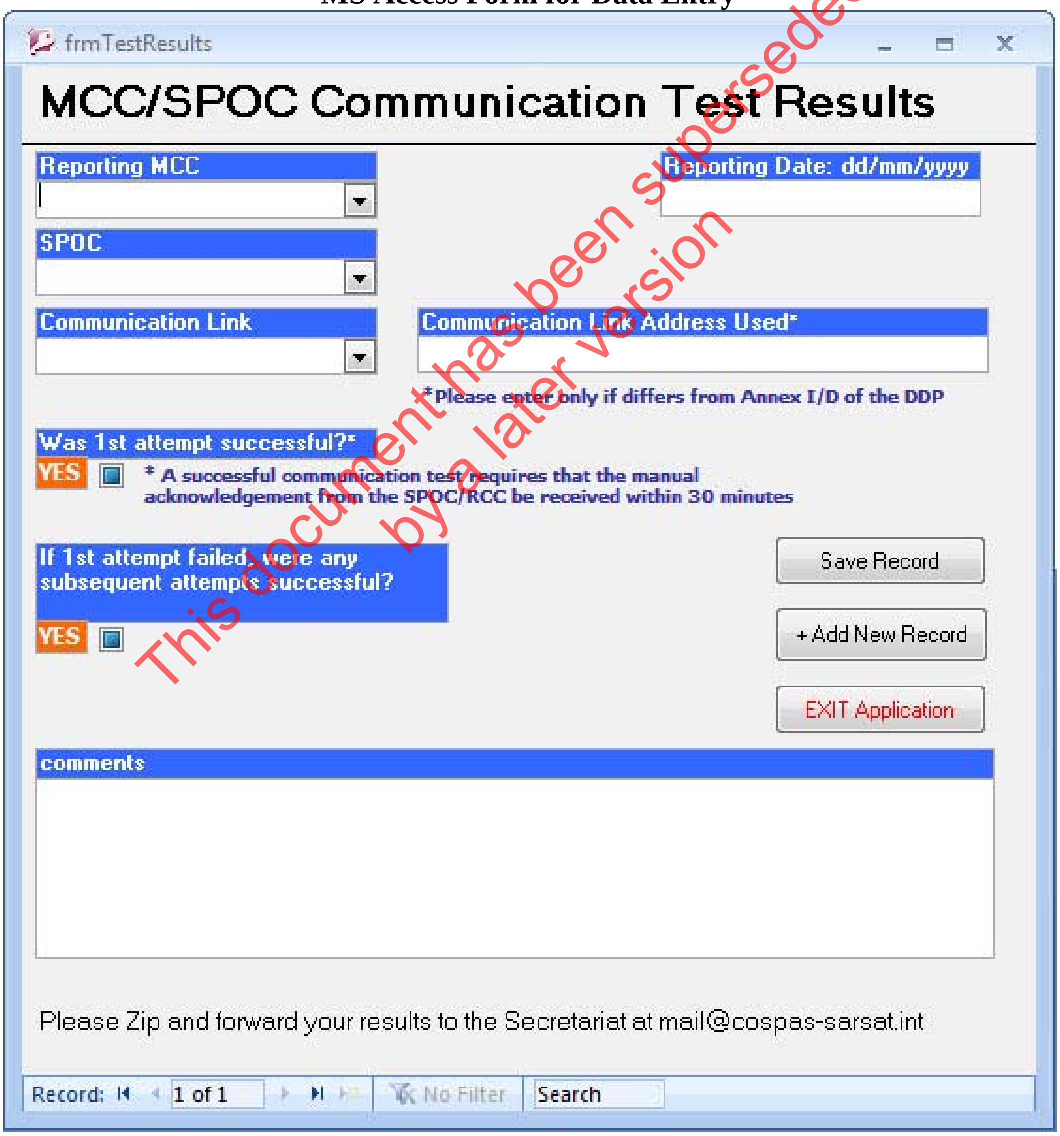
ANNEX I

I. REPORTING OF MCC/SPOC COMMUNICATION TEST

NOTE: **Please submit by email as an MS Access document to mail@cospas-sarsat.int.**
An MS Access template is available at www.cospas-sarsat.org

Table I.1: Monthly Report on Success of MCC Messages Sent to SPOCs
(Period: Month - Year)

MS Access Form for Data Entry



- END OF ANNEX I -

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ANNEX J

J. COSPAS-SARSAT GROUND SEGMENT SYSTEM TEST

The following System test will be conducted to help confirm the operational status of commissioned LEOLUTs, GEOLUTs and MCCs in the Cospas-Sarsat System.

Table J.1 identifies the test messages that will be transmitted by a beacon signal simulator generator or test beacon. Operational beacons are used to allow LEOLUTs, GEOLUTs and MCCs to automatically transmit specific data through the System without requiring modifications. A country is specified under the column "Test Bcn" when the test requires that the message be transmitted from a specific geographical location. For LEOSAR testing a single LEOSAR satellite shall be used for receiving all test signals. The satellite selected shall have a fully functional SARP and SARR.

Table J.2 identifies expected LEOLUT and MCC processing and Table J.4 identifies the expected MCC message distribution based on the solutions produced by LEOLUTs, with no GEOLUT data being available to the MCC. Table J.3 identifies possible GEOLUT and MCC processing, assuming no LEOLUT data being available at the MCC. MCC processing may differ from the results depicted in Tables J.2 and J.3 and still conform to Cospas-Sarsat specifications in the following conditions:

Data for a specific test is reported to the MCC from another satellite prior to the expected satellite (e.g. GEOSAR data is reported prior to expected LEOSAR data).

Global data is processed by the MCC in a different order than it was transmitted, for a series of tests involving the same beacon ID.

Combined LEO/GEO processing generates a Doppler location from two (2) transmitted bursts.

In such instances the Ground Segment operator should analyse the MCC output to confirm MCC processing.

GEOLUT processing might differ from the information presented in Table J.3 and still conform to Cospas-Sarsat specifications in the following conditions:

Multiple uplink bursts for a specific test do not result in confirmed beacon messages, due to the nature of the GEOLUT integration process.

The uplinked data for a specific test is outside the footprint of the GEOSAR satellite tracked by a GEOLUT (e.g. a GEOLUT tracks GOES-West, which can not detect data uplinked from Toulouse).

A GEOLUT sends invalid data to the MCC in accordance with section 4.2.5 of document C/S T.009.

In such cases the GEOLUT operators should analyse the received results to evaluate their correctness.

The Test Coordinator may change the country codes used to test SSAS beacons, provided that:

the Test Coordinator submits the proposed country code changes prior to the Joint Committee meetings along with the resultant changes to Tables J.1 through J.4 of document C/S A.003, Annex J,

there is at least one country represented from each Data Distribution Region (DDR),
both the countries that are affected by the change and their host nodal MCC agree to the proposed change during the test planning phase,

all MCCs are notified of the changes prior to the test and are provided with a list of the new 406 beacon messages that will be used, and

all MCCs are provided with changes to Tables J.1 through J.4 that apply for that test.

Table J.1: List of 406 MHz Test Messages to be Generated by Beacon Simulator to Support System Level Test

Ref. Num Test Bcn	(Pass) Date/ Time	Transmitted 30 Hex Code; Default 15 Hex Id, bits 26-85 (9 bit Frame Synchronisation)	Number of Bursts; Transmit Freq.	Comments
1	(1) TBD	CC7478A69A69A68C0D498FE0FF0F61 98E8D34D34D34D1	1 406.025	Test Objectives : LUT, MCC beacon message validation. Two (2) bit errors at bits 44, 48. Invalid country code.
2	(1) TBD	96E9B93089C14CDE5215B781000D6D 2DD37261138299B	1 406.025	Test Objectives : LUT, MCC beacon message validation. Spare protocol code in bits 37-40.
3 USA	(1) TBD	96EA0000D8894D7CAD91F79F3C0010 2DD40001BF81FE0	10 406.025	Test Objectives: LUT, MCC beacon message validation. USA National Location Protocol coded beacon with invalid encoded position in PDF-1 and default encoded position in PDF-2.
4 USA	(1) TBD	56E30E1A4324920310DBC000000000 ADC61C348649240	2 406.025	Test Objectives: LUT, MCC beacon message validation. 4 bit errors in BCH-1 (bits 103-106). LUT filtering bad points for Doppler processing.
		56E30E1A4324920310DBC000000000	1 406.029	Same Id as above. Frequency changed.
		56E30E1A4324920310DBC000000000	4 406.025	Same Id as above. Frequency changed.
		56E30E1A4324920310DBC000000000	1 406.029	Same Id as above. Frequency changed.
		56E30E1A4324920310DBC000000000	2 406.025	Same Id as above. Frequency changed.
5 USA	(1) TBD	96E20000007FDFFC4AE03783E0F66C 2DC4000000FFBFF	10 406.025	Test Objectives: MCC.Processing. USA EPIRB with Doppler position in Greenbelt, no encoded position.

Ref. Num Test Bcn	(Pass) Date/ Time	Transmitted 30 Hex Code; Default 15 Hex Id, bits 26-85 (9 bit Frame Synchronisation)	Number of Bursts; Transmit Freq.	Comments
6 FRANCE	(2) TBD	96E20000002B803713C8F78E010D07 2DC4000000FFBFF	1 406.025	Test Objectives: LEO/GEO LUT combined processing. MCC Processing. USA EPIRB with Encoded position in Toulouse, no Doppler position.
		96E20000002B803713C8F78E010D07	1 406.026	Same Id as above. Frequency changed.
7 USA	(3) TBD	96E2000000272998994637012 61BF1 2DC4000000FFBFF	2 406.025	Test Objectives: MCC Ambiguity Resolution. USA EPIRB with Encoded position in Greenbelt, no Doppler position.
8 USA	(4) TBD	96E200000026A99CDA28B780230987 2DC4000000FFBFF	2 406.025	Test Objectives: MCC Post Ambiguity Resolution. USA EPIRB with Encoded position near Greenbelt, no Doppler position.
9 FRANCE	(1) TBD	8E340000002B803231B3F68C421815 1C68000000FFBFF	3 406.028	Test Objectives: LUT Beacon Message Processing, MCC Ambiguity Resolution. French ELT with Encoded and Doppler positions in Toulouse. Encoded position is (43.551, 1.466)
		8E340000002B803231B3F68E011E5C 1C68000000FFBFF	3 406.028	Encoded position updated to (43.559, 1.482)
10 FRANCE	(2) TBD	8E3401000026A999F853B683E0F00E 1C68000000FFBFF	1 406.028	Test Objectives: LUT Beacon Message Processing, MCC Post Ambiguity Resolution. French ELT with Encoded position in Greenbelt and Doppler position in Toulouse. Default encoded position in PDF-2. Encoded position (38.50, 76.75) is outside the LEO satellite footprint. One (1) bit error at bit 48 in PDF-1.
		8E3401000027299DBB3D3601261D99 1C68000000FFBFF	2 406.028	Encoded position updated to (38.996, 76.851.) One (1) bit error at bit 48 in PDF-1 and two (2) bit errors at bits 141 and 143 in BCH-2.
		8E3401000027299DBB3D3601261D93 1C68000000FFBFF	1 406.028	One (1) bit error at bit 48 in PDF-1.

Ref. Num Test Bcn	**(Pass) Date/ Time**	**Transmitted 30 Hex Code; Default 15 Hex Id, bits 26-85 (9 bit Frame Synchronisation)**	**Number of Bursts; Transmit Freq.**	**Comments**
11	(1) TBD	8E361100007FDFFDD859F683E0FC0E 1C6C000000FFBFF	1 406.025	Test Objectives: LUT beacon message validation, MCC no Doppler processing. French EPIRB with default encoded position in PDF-1. No Doppler or encoded position present. Two (2) bit errors at bits 44 and 48 in PDF-1. Two (2) bit errors at bit 133 and 134 in BCH-2.
		8E360011107FDFFDD859C600000075 1C6C000000FFBFF	1 406.025	Three (3) bit errors at bits 52, 56 and 60 in PDF-1. Fixed bits 107-110 are invalid.
12 FRANCE	(2) TBD	8E360000002B80368171368E011E5C 1C6C000000FFBFF	2 406.025	Test Objective: MCC Encoded position processing. Encoded position in Toulouse.
13 USA	(3) TBD	0E360000007FDFFE20FAF683E0F00E 1C6C000000FFBFF	2 406.025	Test Objectives: LUT Doppler processing beacon validation, MCC Position Conflict and three point Doppler processing. Doppler position in Greenbelt. Short message with no errors and superfluous data in bits 113 – 144.
		0E360000007FDFFE20FAF683E0FC0E 1C6C000000FFBFF	1 406.025	Short message with superfluous data in bits 113 – 144.
14 FRANCE	(4) TBD	8E360000007FDFFDD859D683E0FE29 1C6C000000FFBFF	10 406.025	Test Objective: MCC beacon message validation, beacon message matching and Ambiguity Resolution. MCC should use Doppler position to resolve ambiguity despite an error in fixed bit 107. The standard location protocol beacon message does not conform to fixed bit requirements (bits 107 – 110). Doppler position in Toulouse.
15 USA	(1) TBD	96E8000007815201C84BB4810007CB 2DD000003F81FE0	4 406.037	Test Objective: LUT beacon message validation. MCC Position Conflict Processing. Doppler position in Greenbelt, encoded position in Florida (30, -82). Complete confirmed beacon message.
		96E8000007815201C84BB4810F0255 2DD000003F81FE0	1 406.037	Encoded position updated to (30, -82.003)
		96E8000007815201C84BB4810F0241 2DD000003F81FE0	1 406.037	Two (2) bit errors at bits 140 and 142 in BCH-2.
		96E8000007815201C84BB4810F0253 2DD000003F81FE0	1 406.037	Two (2) bit errors at bits 142 and 143 in BCH-2.

Ref. Num Test Bcn	(Pass) Date/ Time	Transmitted 30 Hex Code; Default 15 Hex Id, bits 26-85 (9 bit Frame Synchronisation)	Number of Bursts; Transmit Freq.	Comments
16 USA	(2) TBD	96E8000007815201C84BB4810007CB 2DD000003F81FE0	4 406.037	Test Objective : LUT beacon message validation. MCC Ambiguity Resolution. Doppler position in Greenbelt, encoded position in Florida (30, -82). Complete confirmed beacon message.
		96E8000007815201C84BB4810F0255 2DD000003F81FE0	3 406.037	Encoded position updated to (30, -82.003).
17	(1) TBD	D6E10E1A4324920458B9D555555555 ADC21C348649240	2 406.022	Test Objective: MCC beacon message validation. USA Orbitography beacon with a pattern of “01” in the long message. No bit errors.
18	(1) TBD	96E400000026E9985C84F683E0F00E 2DC8000000FFBFF	1 406.025	Test Objective: LUT beacon message validation. USA Standard Location Protocol ELT with encoded position (38.750, -76.750) in PDF-1 and PDF-2. Three (3) bit errors at bits 88, 96 and 104 in BCH-1.
		96E411110026E9995D85F683E0F00E 2DC8000000FFBFF	1 406.027	USA Standard Location Protocol ELT with encoded position (38.750, -76.750) in PDF-1 and PDF-2. Four (4) bit errors at bits 44, 48, 52 and 56 in PDF-1.
		96E411101026E9995D85F683E0F00E 2DC8000000FFBFF	1 406.025	USA Standard Location Protocol ELT with encoded position (38.856,-76.750) in PDF-1 and PDF-2. Four (4) bit errors at bits 44, 48, 52 and 60 in PDF-1.
19	(1) TBD	8E38540009B54CE1D106371408066B 1C7000003F81FE0	1 406.025	Test Objective: LUT beacon message validation. French National Location Protocol ELT with encoded position (38.856, -76.931). Three (3) bit errors at bits 42, 44 and 46 in PDF-1.
20	(1) TBD	D6E6C0000000000A7E0CAFE0FF0146 ADCD80000000001 (0 1101 0000)	6 406.027	Test Objective: LUT beacon message validation for LUTs in local coverage area of test beacon. USA Serialized User Aircraft Address coded beacon with no encoded position. The last 8 bits of the frame synchronization are inverted.

Ref. Num Test Bcn	(Pass) Date/ Time	Transmitted 30 Hex Code; Default 15 Hex Id, bits 26-85 (9 bit Frame Synchronisation)	Number of Bursts; Transmit Freq.	Comments
21 FRANCE	(1) TBD	96EB0000492E031219DC370D300F1D 2DD60000BF81FE0	1 406.017	Test Objective: LUT beacon message processing, Doppler processing with bad frequency. MCC distribution based on encoded position. USA National Location Protocol PLB with encoded position (36.76; 3.08) in Algeria.
		96EB0000492E031219DC370D300F1D 2DD60000BF81FE0	1 406.022	Same Id as above. Frequency changed.
		96EB0000492E031219DC370D300F1D 2DD60000BF81FE0	1 406.027	Same Id as above. Frequency changed.
		96EB0000492E031219DC370D300F1D 2DD60000BF81FE0	1 406.032	Same Id as above. Frequency changed.
22 USA	(1)	BFC0270F000002CA2F4015FFFFFFFE 7F804E1E0000059	5 406.022	Test Objective: MCC beacon message validation. Doppler position in Greenbelt. Multiple invalid beacon messages which decode as an orbitography beacon.
23 FRANCE	(1) TBD	ABDCF423F0A1C2520276F69F400819 57B9E847E0FFBFF	6 406.037	Test Objective: SSAS Processing Argentina Country Code - Doppler position in Toulouse, encoded position in South Africa (-33.881, 18.500)
24 FRANCE	(1) TBD	A37C5161502B4036D69136CA420129 46F8A2C2A0FFBFF	6 406.037	Test Objective: SSAS Processing – Thailand Country Code - Doppler position in Toulouse, encoded location in Toulouse
25 FRANCE	(1) TBD	99CCBDE3102BC03083033630822F69 33997BC620FFBFF	6 406.037	Test Objective: SSAS Processing – China Country Code – Doppler Position in Toulouse, encoded location in the Toulouse
26 USA	(1) TBD	A5DCA2C2A098D3095DCB7681E9B0B3 4BB9458540FFBFF	6 406.037	Test Objective: SSAS Processing Algeria Country Code - Doppler in USA, encoded location in Australia (-24.758, 152.412)
27 USA	(1) TBD	8F4C87A23026E99AB3EC36BAE6A5B7 1E990F4460FFBFF	6 406.037	Test Objective: SSAS Processing – the Netherlands Country Code - Doppler Position in USA, encoded location in USA
28 USA	(1) TBD	911C6C81C026E99DAF0F3696258F9E 2238D90380FFBFF	6 406.037	Test Objective: SSAS Processing Russia Country Code - Doppler Position in USA, encoded location in USA

Table J.2: Expected LEOLUT and MCC Processing for System Level Test

Ref. Num	Message to be Transmitted by LEOLUT (Default 15 Hex Id, bits 26-85)	Doppler Position	Encoded Position	Comments
1	CC7469A69A69A68C0D498FFFFFFFFF (98E8D34D34D34D1)	n/a	n/a	LEOLUT corrects two bit errors and sends corrected message to MCC. Bits 113 to 144 are set to all "1" because PDF-2 is not confirmed. MCC Action code: Sw0 + Invalid Data -> AW0. MCC suppresses message distribution because the country code is invalid and there is only one burst (DDP, Table III/B.5).
2	96E9B93089C14CDE5215B7FFFFFFFF 2DD37261138299B	n/a	39.000 N 76.900 W	LEOLUT sends unconfirmed complete message with bits 113 - 144 all set to 1 to MCC. MCC Action code: Sw0 + Invalid Data -> AW0. MCC suppresses message distribution due to spare protocol code (DDP, Table III/B.5)
3	96EA0000D8894D7CAD91F79F3C0010 (2DD40001BF81FE0)	38.995 N 76.851 W	98.123 N 77.500 W	LEOLUT sends confirmed complete message to MCC. MCC Action code: Sw0 + I2 -> AW2. MCC sends SIT 125 alert based on the "A" and "B" Doppler positions. Even though the encoded position is invalid there are two or more points available for processing (DDP, Table III/B.5 and Table III/B.6)
4	56E30E1A4324920310DBC0FFFFFFFF (ADC61C348649240)	38.995 N 76.851 W	n/a	LEOLUT sends invalid confirmed message with bits 113 - 144 all set to 1 to MCC. MCC ignores bits beyond short message. MCC Action code: Sw0 + I2 -> AW2. MCC sends SIT 125 alert based on the "A" and "B" Doppler positions. Even though there are 4 bit errors in the message there are two or more matching points available for processing (DDP, Table III/B.3).
5	96E20000007FDFFC4AE03783E0F66C (2DC4000000FFBFF)	38.995 N 76.851 W	n/a	LEOLUT sends confirmed complete message to MCC. MCC Action code: Sw0 + I2 -> AW2. MCC sends SIT 125 alert based on the "A" and "B" Doppler positions.
6	96E20000002B803713C8F78E010D07 (2DC4000000FFBFF)	n/a	43.559 N 1.483 E	LEOLUT sends confirmed complete message to MCC. Frequency difference between the two points prevents combined LEO/GEO LUT processing. MCC Action code: Sw2 + I3 -> AW4. MCC sends SIT 123 alert based on the encoded position (DDP, Figure III/B.2 and Figure III/B.3).
7	96E2000000272998994637012 61BF1 (2DC4000000FFBFF)	n/a	38.995 N 76.851 W	LEOLUT sends confirmed complete message to MCC. MCC Action code: Sw4 + I3 -> AW7. MCC sends SIT 124 alert based on the match of the encoded position and previous Doppler position. (DDP, Figure III/B.2 and Figure III/B.3).
8	96E200000026A99CDA28B780230987 (2DC4000000FFBFF)	n/a	38.500 N 76.800 W	LEOLUT sends confirmed complete message to MCC. MCC Action code: Sw7 + I3 -> Ct0. MCC filters this alert because ambiguity has been resolved.(DDP, Figure III/B.2 and Figure III/B.3). MCC should also note the position conflict to previous locations.
9	8E340000002B803231B3F68E011E5C (1C68000000FFBFF)	43.559 N 1.482 E	43.559 N 1.482 E	LEOLUT sends updated, confirmed complete message for Standard Location Protocol beacon to MCC. MCC Action code: Sw0 + I7 -> AW7. MCC sends SIT 127 alert based on the match of the encoded and Doppler positions (DDP, Figure III/B.2 and Figure III/B.3)
10	8E3400000027299DBB3D36FFFFFFFF (1C68000000FFBFF)	43.559 N 1.482 E	39.000 N 76.750 W (invalid)	LEOLUT sends valid long message to MCC; however, bits 113 to 144 are set to all "1" because PDF-2 is not confirmed. The encoded position is invalid because it is outside the LEO satellite footprint (DDP, Annex III/B.1.4). MCC Action code: Sw7 + I2--> Ct0. MCC filters this alert because ambiguity has been resolved.(DDP, Figure III/B.2 and Figure III/B.3).

Ref. Num	Message to be Transmitted by LEOLUT (Default 15 Hex Id, bits 26-85)	Doppler Position	Encoded Position	Comments
11	8E360000007FDFFDD859F6FFFFFFFF (1C6C000000FFBFF)	n/a	n/a	LEOLUT corrects beacon message from burst number one and sends corrected valid message to MCC, however, bits 113 to 144 are set to all "1" because PDF-2 is not confirmed. MCC Action code: Sw0 + I1 -> AW1. MCC sends SIT 122 alert based on the country code of the beacon (DDP, Figure III/B.2 and Figure III/B.3).
12	8E360000002B80368171368E011E5C (1C6C000000FFBFF)	n/a	43.559 N 1.482 E	LEOLUT sends confirmed complete beacon message to MCC. MCC Action code: Sw1 + I3 -> AW3. MCC sends SIT 122 alert based on the encoded position (DDP, Figure III/B.2 and Figure III/B.3).
13	0E360000007FDFFE20FAF600000000 (1C6C000000FFBFF)	38.995 N 76.851 W	n/a	LEOLUT computes Doppler location, and sends most recent valid message with bits 113 to 144 set to all "0" to MCC MCC Action code: Sw3 + I2 -> AW4. MCC sends SIT 126 based on the "A" and "B" Doppler positions. (DDP, Figure III/B.2 and Figure III/B.3)
14	8E360000007FDFFDD859D6FFFFFFFF (1C6C000000FFBFF)	43.559 N 1.482 E	n/a	LEOLUT sends invalid beacon message to MCC with bits 113 to 144 set to all "1". MCC Action code: Sw4 + I2 -> AW7. MCC sends SIT 127 alert based on the match of the Doppler positions. (DDP, Figure III/B.2 and Figure III/B.3).
15	96E8000007815201C84BB4810007CB 2DD000003F81FE0	38.995 N 76.851 W	30.000 N 82.000 W	LEOLUT sends the first message (only complete confirmed message) to MCC and computes Doppler position. MCC Action code: Sw0 + I4 -> AW4. MCC sends SIT 126 alert based on the "A" and "B" Doppler positions and the encoded position. (DDP, Figure III/B.2 and Figure III/B.3)
16	96E8000007815201C84BB4810F0255 2DD000003F81FE0	38.995 N 76.851 W	30.000 N 82.003 W	LEOLUT sends the updated, confirmed complete message to MCC and computes Doppler position. MCC Action code: Sw4 + I4 -> AW6. MCC sends SIT 127 alert based on the match of the Doppler positions. (DDP, Figure III/B.2 and Figure III/B.3).
17	D6E10E1A4324920458B9D555555555 (ADC21C348649240)	n/a	n/a	LEOLUT sends orbitography beacon message without correcting the long message. MCC suppresses message distribution because beacon type is orbitography.
18	n/a	n/a	n/a	LEOLUT suppresses beacon alert because no valid message exists and no match available for invalid messages.
19	n/a	n/a	n/a	LEOLUT suppresses beacon alert because message has 3 bit errors and is not confirmed.
20	n/a	n/a	n/a	LEOLUT suppresses beacon messages due to the inverted frame synchronization.
21	96EB0000492E031219DC370D300F1D (2DD60000BF81FE0)	n/a	36.76 N 3.08 E	LEOLUT sends confirmed complete message to MCC. No Doppler location is calculated due to bad frequency. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the encoded position (DDP, Figure III/A.7, Figure III/B.2 and Figure III/B.3).
22	BFC0270F000002CA2F4015FFFFFFFF 7F804E1E0000059	38.995 N 76.851 W	N/A	LEOLUT performs invalid beacon message processing, and provides Doppler location at Greenbelt. Ground segment equipment should not suppress the alert. MCC Action code: Sw0 + I2 -> AW2. MCC sends SIT 125 alert based on the "A" and "B" Doppler positions; even though there are uncorrectable bit errors in the PDF-1 there are two or more matching points available for processing (DDP, Table III/B.3). Due to uncorrectable bit errors in PDF-1, no processing is based on beacon message.

Ref. Num	Message to be Transmitted by LEOLUT (Default 15 Hex Id, bits 26-85)	Doppler Position	Encoded Position	Comments
23	ABDCF423F0A1C2520276F69F400819 (57B9E847E0FFBFF)	43.559 N 1.482 E	33.881S 18.500E	LEOLUT sends complete confirmed message to the MCC. The encoded position is invalid because it is outside the LEO satellite footprint (DDP, Annex III/B.1.4) MCC Action code: Sw0 + I2 -> AW2. MCC sends SIT 125 alert based on the routing procedures for SSAS alerts
24	A37C5161502B4036D69136CA420129 (46F8A2C2A0FFBFF)	43.559 N 1.482 E	43.560N 1.467E	LEOLUT sends complete confirmed message to the MCC. MCC Action code: Sw0 + I7 -> AW7. MCC sends SIT 127 alert based on the routing procedures for SSAS alerts
25	99CCBDE3102BC03083033630822F69 (33997BC620FFBFF)	43.559 N 1.482 E	43.548N 1.464E	LEOLUT sends complete confirmed message to the MCC. MCC Action code: Sw0 + I7 -> AW7. MCC sends SIT 127 alert based on the routing procedures for SSAS alerts
26	A5DCA2C2A098D3095DCB7681E9B0B3 4BB9458540FFBFF	38.995 N 76.851 W	24.758S 152.412E	LEOLUT sends complete confirmed message to the MCC. The encoded position is invalid because it is outside the LEO satellite footprint (DDP, Annex III/B.1.4) MCC Action code: Sw0 + I2 -> AW2. MCC sends SIT 125 alert based on the routing procedure for SSAS alerts
27	8F4C87A23026E99AB3EC36BAE6A5B7 (1E990F4460FFBFF)	38.995 N 76.851 W	38.996N 76.861W	LEOLUT sends complete confirmed message to the MCC. MCC Action code: Sw0 + I7 -> AW7. MCC sends SIT 127 alert based on the routing procedures for SSAS alerts
28	911C6C81C026E99DAF0F3696258F9E 2238D90380FFBFF	38.995 N 76.851 W	38.84 N 76.84 W	LEOLUT sends complete confirmed message to the MCC. MCC Action code: Sw0 + I7 -> AW7. MCC sends SIT 127 alert based on the routing procedures for SSAS alerts

Table J.3: Expected GEOLUT and MCC Processing For System Level Test

Ref. Num	Message to be Transmitted by GEOLUT (Default 15 Hex Id, bits 26-85)	Encoded Position	Comments
1	CC7469A69A69A68C0D498FFFFFFFFF (98E8D34D34D34D1)	n/a	GEOLUT corrects two bit errors and sends unconfirmed message with bits 113-114 all set to 1 to MCC. <u>MCC Action code</u>: Sw0 + Invalid Data -> AW0. MCC suppresses message distribution because the country code is invalid and there is only one burst (DDP, Table III/B.5)
2	96E9B93089C14CDE5215B7FFFFFFFF 2DD37261138299B	39.000 N 76.900 W	GEOLUT sends unconfirmed complete message with bits 113 - 144 all set to 1 to MCC. <u>MCC Action code</u>: Sw0 + Invalid Data -> AW0. MCC suppresses message distribution due to spare protocol code (DDP, Table III/B.5)
3	96EA0000D8894D7CAD91F7FFFFFFFF or 96EA0000D8894D7CAD91F79F3C0010 (2DD40001BF81FE0)	98.133 N 77.500 W or 98.123 N 77.500 W	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to MCC. <u>MCC Action code</u>: Sw0 + Invalid Data -> AW0. MCC suppresses message distribution because the encoded position is invalid and there is no Doppler location (DDP, Table III/B.54 and Table III/B.6)
4	n/a	n/a	GEOLUT does not generate an alert due to uncorrectable PDF-1 bit errors
5	96E20000007FDFFC4AE037FFFFFFFF or 96E20000007FDFFC4AE03783E0F66C (2DC4000000FFBFF)	n/a	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to MCC. <u>MCC Action code</u>: Sw0 + I1 -> AW1. MCC sends SIT 122 alert based on the encoded country code**.**
6	96E20000002B803713C8F7FFFFFFFF or 96E20000002B803713C8F78E010D07 (2DC4000000FFBFF)	43.500 N 1.500 E or 43.559 N 1.483 E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to MCC. <u>MCC Action code</u>: Sw1 + I3 -> AW3. MCC sends SIT 122 alert based on the encoded position (DDP, Figure III/B.2 and Figure III/B.3).
7	96E2000000272998994637FFFFFFFF or 96E200000027299899463701261BF1 (2DC4000000FFBFF)	39.000 N 76.750 W or 38.995 N 76.851 W	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to MCC. <u>MCC Action code</u>: Sw3 + I3 -> AW3. MCC sends SIT 123 alert based on the conflict of the encoded position with previous position. (DDP, Figure III/B.2 and Figure III/B.3).

Ref. Num	Message to be Transmitted by GEOLUT (Default 15 Hex Id, bits 26-85)	Encoded Position	Comments
8	96E200000026A99CDA28B7FFFFFFFF or 96E200000026A99CDA28B780230987 (2DC4000000FFBFF)	38.500 N 76.750 W or 38.500 N 76.800 W	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to MCC. MCC Action code: Sw3 + I3 -> AW3. MCC sends a SIT 123 (406 MHz position conflict – encoded location information only) because location is greater than 50 km from previous location information. (DDP, Figure III/B.2 and Figure III/B.3).
9	8E340000002B803231B3F6FFFFFFFF or 8E340000002B803231B3F68C421815 or 8E340000002B803231B3F68E011E5C (1C68000000FFBFF)	43.500 N 1.500 E or 43.551 N 1.466 E or 43.559 N 1.482 E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message for Standard Location Protocol beacon to MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the encoded positions (DDP, Figure III/B.2 and Figure III/B.3).
10	8E3400000027299DBB3D36FFFFFFFF (1C68000000FFBFF)	39.000 N 76.750 W (invalid)	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 message to MCC. MCC Action code: Sw3 + I1 -> AW0 or Sw3 + I3 -> AW3 depending on whether the encoded position is within the GEO satellite footprint (DDP, Annex III/B.1). The MCC only sends the alert (AW3) when the encoded position is within the GEO satellite footprint. (DDP, Figure III/B.2 and Figure III/B.3).
11	8E360000007FDFFDD859F6FFFFFFFF (1C6C000000FFBFF)	n/a	GEOLUT corrects beacon message and sends corrected valid message to MCC, however, bits 113 to 144 are set to all “1" because PDF-2 is not confirmed. MCC Action code: Sw0 + I1 -> AW1. MCC sends SIT 122 alert based on the country code of the beacon (DDP, Figure III/B.2 and Figure III/B.3).
12	8E360000002B8036817136FFFFFFFF or 8E360000002B80368171368E011E5C (1C6C000000FFBFF)	43.500 N 1.500 E or 43.559 N 1.482 E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete beacon message to MCC. MCC Action code: Sw1 + I3 -> AW3. MCC sends SIT 122 alert based on the encoded position (DDP, Figure III/B.2 and Figure III/B.3).
13	0E360000007FDFFE20FAF600000000 (1C6C000000FFBFF)	n/a	GEOLUT sends unconfirmed or confirmed complete message with bits 113 to 144 set to all “0" to MCC MCC Action code: Sw3 + I1 -> AW0. MCC sends no alert. (DDP, Figure III/B.2 and Figure III/B.3).
14	n/a	n/a	GEOLUT does not generate an alert due to invalid beacon message.
15	96E8000007815201C84BB4810007CB or 96E8000007815201C84BB4FFFFFFFF (2DD000003F81FE0)	30.000 N 82.000 W	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the encoded position. (DDP, Figure III/B.2 and Figure III/B.3).

Ref. Num	Message to be Transmitted by GEOLUT (Default 15 Hex Id, bits 26-85)	Encoded Position	Comments
16	96E8000007815201C84BB4810007CB or 96E8000007815201C84BB4810F0255 (2DD000003F81FE0)	30.000 N 82.000 W or 30.000 N 82.003 W	GEOLUT sends, if confirmed, the updated complete message to the MCC. MCC Action code: Sw3 + I3 -> AW0. MCC sends no alert. (DDP, Figure III/B.2 and Figure III/B.3).
17	D6E10E1A4324920458B9D555555555 (ADC21C348649240)	n/a	GEOLUT sends orbitography beacon message without correcting the long message. MCC suppresses message distribution because beacon type is orbitography.
18	n/a	n/a	GEOLUT suppresses beacon alert because no valid message exists.
19	n/a	n/a	GEOLUT suppresses beacon alert because message has 3 bit errors and is not confirmed.
20	n/a	n/a	GEOLUT suppresses beacon messages due to the inverted frame synchronization.
21	96EB0000492E031219DC37FFFFFFFF or 96EB0000492E031219DC370D300F1D (2DD60000BF81FE0)	36.76667 N 3.086667 E or 36.76 N 3.08 E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 based on the encoded position (DDP, Figure III/A.7, Figure III/B.2 and Figure III/B.3).
22	n/a	n/a	GEOLUT does not generate an alert due to uncorrectable PDF-1 bit errors.
23	ABDCF423F0A1C2520276F6FFFFFFFF (57B9E847E0FFBFF) or ABDCF423F0A1C2520276F69F400819	33.881S 18.500E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the country code (SSAS procedure)
24	A37C5161502B4036D69136FFFFFFFF (46F8A2C2A0FFBFF) or A37C5161502B4036D69136CA420129	43.560N 1.467E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the country code (SSAS procedure)
25	99CCBDE3102BC030830336FFFFFFFF (33997BC620FFBFF) or 99CCBDE3102BC03083033630822F69	43.548N 1.464E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the country code (SSAS procedure)

Ref. Num	Message to be Transmitted by GEOLUT (Default 15 Hex Id, bits 26-85)	Encoded Position	Comments
26	A5DCA2C2A098D3095DCB7681E9B0B3 or A5DCA2C2A098D3095DCB76FFFFFFFF	24.758S 152.412E	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the country code (SSAS procedure)
27	8F4C87A23026E99AB3EC36FFFFFFFF (1E990F4460FFBFF) or 8F4C87A23026E99AB3EC36BAE6A5B7	38.996N 76.861W	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the country code (SSAS procedure)
28	911C6C81C026E99DAF0F3696258F9E or 911C6C81C026E99DAF0F369FFFFFFF	38.84N 76.84W	GEOLUT sends unconfirmed message with bits 113 - 144 all set to 1 or confirmed complete message to the MCC. MCC Action code: Sw0 + I3 -> AW3. MCC sends SIT 122 alert based on the country code (SSAS procedure)

Table J.4: Specific MCC Processing for Messages Transmitted in System Level Test Reference Numbers 1 - 5

Receiving MCC	Destination MCC[1] / SIT Number				
	Test Reference Number				
	1	2	3	4	5
AEMCC	Suppress	Suppress	SPMCC/125	SPMCC/125	SPMCC/125
ALMCC	Suppress	Suppress	SPMCC/125	SPMCC/125	SPMCC/125
ARMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
ASMCC	Suppress	Suppress	AUMCC/125	AUMCC/125	AUMCC/125
AUMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
BRMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
CHMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
CMC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
CMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
CNMCC	Suppress	Suppress	JAMCC/125	JAMCC/125	JAMCC/125
FMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
GRMCC	Suppress	Suppress	FMCC/125	FMCC/125	FMCC/125
HKMCC	Suppress	Suppress	JAMCC/125	JAMCC/125	JAMCC/125
IDMCC	Suppress	Suppress	AUMCC/125	AUMCC/125	AUMCC/125
INMCC	Suppress	Suppress	CMC/125	CMC/125	CMC/125
ITMCC	Suppress	Suppress	FMCC/125	FMCC/125	FMCC/125
JAMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
KOMCC	Suppress	Suppress	JAMCC/125	JAMCC/125	JAMCC/125
NMCC	Suppress	Suppress	FMCC/125	FMCC/125	FMCC/125
NIMCC	Suppress	Suppress	SPMCC/125	SPMCC/125	SPMCC/125
PAMCC	Suppress	Suppress	CMC/125	CMC/125	CMC/125
PEMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
SAMCC	Suppress	Suppress	SPMCC/125	SPMCC/125	SPMCC/125
SIMCC	Suppress	Suppress	AUMCC/125	AUMCC/125	AUMCC/125
SPMCC	Suppress	Suppress	USMCC/125	USMCC/125	USMCC/125
TAMCC	Suppress	Suppress	JAMCC/125	JAMCC/125	JAMCC/125
THMCC	Suppress	Suppress	AUMCC/125	AUMCC/125	AUMCC/125
TRMCC	Suppress	Suppress	FMCC/125	FMCC/125	FMCC/125
UKMCC	Suppress	Suppress	FMCC/125	FMCC/125	FMCC/125
USMCC	Suppress	Suppress	NAT. PROC.	NAT. PROC.	NAT. PROC.
VNMCC	Suppress	Suppress	JAMCC/125	JAMCC/125	JAMCC/125

(1) Only the correct MCC destination is listed, an alert to the image position may also be generated.

Reference Numbers 6 - 10 (Table J.4 cont.)

Receiving MCC	Destination MCC[(1)] / SIT Number				
	Test Reference Number				
	6	7	8	9	10
AEMCC	SPMCC/123	SPMCC/124	Suppress	SPMCC/127	Suppress
ALMCC	SPMCC/123	SPMCC/124	Suppress	SPMCC/127	Suppress
ARMCC	USMCC/123	USMCC/124	Suppress	USMCC/127	Suppress
ASMCC	AUMCC/123	AUMCC/124	Suppress	AUMCC/127	Suppress
AUMCC	FMCC/123	USMCC/124 FMCC/124	Suppress	FMCC/127	Suppress
BRMCC	USMCC/123	USMCC/124	Suppress	USMCC/127	Suppress
CHMCC	USMCC/123	USMCC/124	Suppress	USMCC/127	Suppress
CMC	FMCC/123	USMCC/124 FMCC/124	Suppress	FMCC/127	Suppress
CMCC	USMCC/123	USMCC/124	Suppress	USMCC/127	Suppress
CNMCC	JAMCC/123	JAMCC/124	Suppress	JAMCC/127	Suppress
FMCC	NAT. PROC.	USMCC/124 NAT. PROC.	Suppress	NAT. PROC.	Suppress
GRMCC	FMCC/123	FMCC/124	Suppress	FMCC/127	Suppress
HKMCC	JAMCC/123	JAMCC/124	Suppress	JAMCC/127	Suppress
IDMCC	AUMCC/123	AUMCC/124	Suppress	AUMCC/127	Suppress
INMCC	CMC/123	CMC/124	Suppress	CMC/127	Suppress
ITMCC	FMCC/123	FMCC/124	Suppress	FMCC/127	Suppress
JAMCC	FMCC/123	USMCC/124 FMCC/124	Suppress	FMCC/127	Suppress
KOMCC	JAMCC/123	JAMCC/124	Suppress	JAMCC/127	Suppress
NMCC	FMCC/123	FMCC/124	Suppress	FMCC/127	Suppress
NIMCC	SPMCC/123	SPMCC/124	Suppress	SPMCC/127	Suppress
PAMCC	CMC/123	CMC/124	Suppress	CMC/127	Suppress
PEMCC	USMCC/123	USMCC/124	Suppress	USMCC/127	Suppress
SAMCC	SPMCC/123	SPMCC/124	Suppress	SPMCC/127	Suppress
SIMCC	AUMCC/123	AUMCC/124	Suppress	AUMCC/127	Suppress
SPMCC	FMCC/123	USMCC/124 FMCC/124	Suppress	JAMCC/127	Suppress
TAMCC	JAMCC/123	JAMCC/124	Suppress	JAMCC/127	Suppress
THMCC	AUMCC/123	AUMCC/124	Suppress	AUMCC/127	Suppress
TRMCC	FMCC/123	FMCC/124	Suppress	FMCC/127	Suppress
UKMCC	FMCC/123	FMCC/124	Suppress	FMCC/127	Suppress
USMCC	FMCC/123	FMCC/124 NAT. PROC.	Suppress	FMCC/127	Suppress
VNMCC	JAMCC/123	JAMCC/124	Suppress	JAMCC/127	Suppress

(1) Only the correct MCC destination is listed, an alert to the image position may also be generated.

Reference Numbers 11 - 15 (Table J.4 cont.)

Receiving MCC	Destination MCC(1) / SIT Number				
	Test Reference Number				
	11	12	13	14	15
AEMCC	SPMCC/122	SPMCC/122	SPMCC/126	SPMCC/127	SPMCC/126
ALMCC	SPMCC/122	SPMCC/122	SPMCC/126	SPMCC/127	SPMCC/126
ARMCC	USMCC/122	USMCC/122	USMCC/126	USMCC/127	USMCC/126
ASMCC	AUMCC/122	AUMCC/122	AUMCC/126	AUMCC/127	AUMCC/126
AUMCC	FMCC/122	FMCC/122	USMCC/126	USMCC/127 FMCC/127	USMCC/126
BRMCC	USMCC/122	USMCC/122	USMCC/126	USMCC/127	USMCC/126
CHMCC	USMCC/122	USMCC/122	USMCC/126	USMCC/127	USMCC/126
CMC	FMCC/122	FMCC/122	USMCC/126	USMCC/127 FMCC/127	USMCC/126
CMCC	USMCC/122	USMCC/122	USMCC/126	USMCC/127	USMCC/126
CNMCC	JAMCC /122	JAMCC /122	JAMCC/126	JAMCC/127	JAMCC/126
FMCC	NAT.PROC.	NAT.PROC.	USMCC/126	USMCC/127 NAT.PROC.	USMCC/126
GRMCC	FMCC/122	FMCC/122	FMCC/126	FMCC/127	FMCC/126
HKMCC	JAMCC/122	JAMCC/122	JAMCC/126	JAMCC/127	JAMCC/126
IDMCC	AUMCC/122	AUMCC/122	AUMCC/126	AUMCC/127	AUMCC/126
INMCC	CMC/122	CMC/122	CMC/126	CMC/127	CMC/126
ITMCC	FMCC/122	FMCC/122	FMCC/126	FMCC/127	FMCC/126
JAMCC	FMCC/122	FMCC/122	USMCC/126	USMCC/127 FMCC/127	USMCC/126
KOMCC	JAMCC/122	JAMCC/122	JAMCC/126	JAMCC/127	JAMCC/126
NMCC	FMCC/122	FMCC/122	FMCC/126	FMCC/127	FMCC/126
NIMCC	SPMCC/122	SPMCC/122	SPMCC/126	SPMCC/127	SPMCC/126
PAMCC	CMC/122	CMC/122	CMC/126	CMC/127	CMC/126
PEMCC	USMCC/122	USMCC/122	USMCC/126	USMCC/127	USMCC/126
SAMCC	SPMCC/122	SPMCC/122	SPMCC/126	SPMCC/127	SPMCC/126
SIMCC	AUMCC/122	AUMCC/122	AUMCC/126	AUMCC/127	AUMCC/126
SPMCC	FMCC/122	FMCC/122	USMCC/126	FMCC/127 USMCC/127	USMCC/126
TAMCC	JAMCC/122	JAMCC/122	JAMCC/126	JAMCC/127	JAMCC/126
THMCC	AUMCC/122	AUMCC/122	AUMCC/126	AUMCC/127	AUMCC/126
TRMCC	FMCC/122	FMCC/122	FMCC/126	FMCC/127	FMCC/126
UKMCC	FMCC/122	FMCC/122	FMCC/126	FMCC/127	FMCC/126
USMCC	FMCC/122	FMCC/122	NAT. PROC.	FMCC/127 NAT. PROC.	NAT. PROC.
VNMCC	JAMCC/122	JAMCC/122	JAMCC/126	JAMCC/127	JAMCC/126

(1) Only the correct MCC destination is listed, an alert to the image position may also be generated.

Reference Numbers 16 - 22 (Table J.4 cont.)

Receiving MCC	Destination MCC[(1)] / SIT Number				
	Test Reference Number				
	16	17	18 - 20	21	22
AEMCC	SPMCC/127	Suppress	N/A	SPMCC/122	SPMCC/125
ALMCC	SPMCC/127	Suppress	N/A	NAT.PROC	SPMCC/125
ARMCC	USMCC/127	Suppress	N/A	USMCC/122	USMCC/125
ASMCC	AUMCC/127	Suppress	N/A	AUMCC/122	AUMCC/125
AUMCC	USMCC/127	Suppress	N/A	SPMCC/122	USMCC/125
BRMCC	USMCC/127	Suppress	N/A	USMCC/122	USMCC/125
CHMCC	USMCC/127	Suppress	N/A	USMCC/122	USMCC/125
CMC	USMCC/127	Suppress	N/A	SPMCC/122	USMCC/125
CMCC	USMCC/127	Suppress	N/A	USMCC/122	USMCC/125
CNMCC	JAMCC/127	Suppress	N/A	JAMCC/122	JAMCC/125
FMCC	USMCC/127	Suppress	N/A	SPMCC/122	USMCC/125
GRMCC	FMCC/127	Suppress	N/A	FMCC/122	FMCC/125
HKMCC	JAMCC/127	Suppress	N/A	JAMCC/122	JAMCC/125
IDMCC	AUMCC/127	Suppress	N/A	AUMCC/122	AUMCC/125
INMCC	CMC/127	Suppress	N/A	CMC/122	CMC/125
ITMCC	FMCC/127	Suppress	N/A	FMCC/122	FMCC/125
JAMCC	USMCC/127	Suppress	N/A	SPMCC/122	USMCC/125
KOMCC	JAMCC/127	Suppress	N/A	JAMCC/122	JAMCC/125
NMCC	FMCC/127	Suppress	N/A	FMCC/122	FMCC/125
NIMCC	SPMCC/127	Suppress	N/A	SPMCC/122	SPMCC/125
PAMCC	CMC/127	Suppress	N/A	CMC/122	CMC/125
PEMCC	USMCC/127	Suppress	N/A	USMCC/122	USMCC/125
SAMCC	SPMCC/127	Suppress	N/A	SPMCC/122	SPMCC/125
SIMCC	AUMCC/127	Suppress	N/A	AUMCC/122	AUMCC/125
SPMCC	USMCC/127	Suppress	N/A	ALMCC/122	USMCC/125
TAMCC	JAMCC/127	Suppress	N/A	JAMCC/122	JAMCC/125
THMCC	AUMCC/127	Suppress	N/A	AUMCC/122	AUMCC/125
TRMCC	FMCC/127	Suppress	N/A	FMCC/122	FMCC/125
UKMCC	FMCC/127	Suppress	N/A	FMCC/122	FMCC/125
USMCC	NAT. PROC	Suppress	N/A	SPMCC/122	NAT. PROC.
VNMCC	JAMCC/127	Suppress	N/A	JAMCC/122	JAMCC/125

(1) Only the correct MCC destination is listed, an alert to the image position may also be generated.

Specific MCC Processing for Messages Transmitted in System Level Test
(Table J.4 cont.)

Receiving MCC	Destination MCC/SIT Number					
	Test Reference Number					
	23	24	25	26	27	28
AEMCC	SPMCC/125	SPMCC/127	SPMCC/127	SPMCC/125	SPMCC/127	SPMCC/127
ALMCC	SPMCC/125	SPMCC/127	SPMCC/127	Natl Proc	SPMCC/127	SPMCC/127
ARMCC	Natl Proc	USMCC/127	USMCC/127	USMCC/125	USMCC/127	USMCC/127
ASMCC	AUMCC/125	AUMCC/127	AUMCC/127	AUMCC/125	AUMCC/127	AUMCC/127
AUMCC	USMCC/125	THMCC/127	JAMCC/127	SPMCC/125	FMCC/127	CMC/127
BRMCC	USMCC/125	USMCC/127	USMCC/127	USMCC/125	USMCC/127	USMCC/127
CHMCC	USMCC/125	USMCC/127	USMCC/127	USMCC/125	USMCC/127	USMCC/127
CMC	USMCC/125	AUMCC/127	JAMCC/127	SPMCC/125	FMCC/127	Natl Proc
CMCC	USMCC/125	USMCC/127	USMCC/127	USMCC/125	USMCC/127	USMCC/127
CNMCC	JAMCC/125	JAMCC/127	Natl Proc	JAMCC/125	JAMCC/127	JAMCC/127
FMCC	USMCC/125	AUMCC/127	JAMCC/127	SPMCC/125	Natl Proc	CMC/127
GRMCC	FMCC/125	FMCC/127	FMCC/127	FMCC/125	FMCC 127	FMCC/127
HKMCC	JAMCC/125	JAMCC/127	JAMCC/127	JAMCC/125	JAMCC/127	JAMCC/127
IDMCC	AUMCC/125	AUMCC/127	AUMCC/127	AUMCC/125	AUMCC/127	AUMCC/127
INMCC	CMC/125	CMC/127	CMC/127	CMC/125	CMC/127	CMC/127
ITMCC	FMCC/125	FMCC/127	FMCC/127	FMCC/125	FMCC 127	FMCC/127
JAMCC	USMCC/125	AUMCC/127	CNMCC/127	SPMCC/125	FMCC/127	CMC/127
KOMCC	JAMCC/125	JAMCC/127	JAMCC/127	JAMCC/125	JAMCC/127	JAMCC/127
NMCC	FMCC/125	FMCC/127	FMCC/127	FMCC/125	FMCC 127	FMCC/127
NIMCC	SPMCC/125	SPMCC/127	SPMCC/127	SPMCC/125	SPMCC/127	SPMCC/127
PAMCC	CMC/125	CMC/127	CMC/127	CMC/125	CMC/127	CMC/127
PEMCC	USMCC/125	USMCC/127	USMCC/127	USMCC/125	USMCC/127	USMCC/127
SAMCC	SPMCC/125	SPMCC/127	SPMCC/127	SPMCC/125	SPMCC/127	SPMCC/127
SIMCC	AUMCC/125	AUMCC/127	AUMCC/127	AUMCC/125	AUMCC/127	AUMCC/127
SPMCC	USMCC/125	AUMCC/127	JAMCC/127	ALMCC/125	FMCC/127	CMC/127
TAMCC	JAMCC/125	JAMCC/127	JAMCC/127	JAMCC/125	JAMCC/127	JAMCC/127
THMCC	AUMCC/125	Natl Proc	AUMCC/127	AUMCC/125	AUMCC/127	AUMCC/127
TRMCC	FMCC/125	FMCC/127	FMCC/127	FMCC/125	FMCC 127	FMCC/127
UKMCC	FMCC/125	FMCC/127	FMCC/127	FMCC/125	FMCC/127	FMCC/127
USMCC	ARMCC/125	AUMCC/127	JAMCC/127	SPMCC/125	FMCC/127	CMC/127
VMMCC	JAMCC/125	JAMCC/127	JAMCC/127	JAMCC/125	JAMCC/127	JAMCC/127

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