

## CHAPTER 17

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| <b>A17.0 - AUXILIARY RADIO-LOCATING<br/>DEVICE TRANSMITTER TEST</b> |
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| <p><b>17.1 - ELECTRICAL AND FUNCTIONAL TEST OF 121,5 MHZ<br/>AT CONSTANT TEMPERATURE</b></p> |
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### 17.1 TEST SPECIFICATIONS AND PROGRAMME

Following Section A17.0 of RTCM Recommended Standards for 406 MHz Satellite EPIRBs (Version 2.0 Feb 5, 1997) :

- Perform following measurements the spurious and harmonic emissions measurements for the 406 MHz and 121.5 MHz signals  
at the minimum, maximum, and ambient temperatures .
- Control, respectively, that measurements not exceed the limits given in Figure 2-1(406 MHz Spectrum Mask)  
and Figure 2-5 (121.5 MHz Spectrum Mask)

**Note :** These tests are performed during the COSPAS-SARSAT Type Approval tests (chapter 12)

### 17.2 EQUIPMENT UNDER TEST

Beacon Unit : 2/2  
Name : JOTRON  
Type : TRON 40GPS  
Number : 7001

### 17.3 TEST SITE

Toulouse Space Center (CST) - INTESPACE Laboratory.

### 17.4 TEST EQUIPMENT

- Climatic chamber : CLIMATS F.C.H. – Type: Austral 137H60/1,5E - S/N: S4880.
- Argos - Cospas/Sarsat Test Bench

## 17.5. RESULTS OF HOMING TRANSMITTER TESTS

Beacon Unit : 2/2  
 Name : JOTRON  
 Type : TRON 40GPS  
 Number : 7001

|                                                         |                              |  | T min.<br>- 20° C | T amb.<br>22° C | T max<br>+ 55° C |
|---------------------------------------------------------|------------------------------|--|-------------------|-----------------|------------------|
| 1 - OPERATING LIFETIME AT MINIMUM TEMPERATURE           | 50H<br>(48 h + 2 h lifetime) |  | > 75 h            |                 |                  |
| 2 - CARRIER FREQUENCY                                   | * 121500 kHz ± 5 kHz         |  | 121.501           | 121.5007        | 121.501          |
| 3 - PEAK ENVELOPE OUTPUT POWER<br>( into 50 Ohms load ) | ** 14 dBm + 6/- 2 dBm        |  | 24.8 dBm          | 23.6 dBm        | 22.2 dBm         |
| 4 - TRANSMITTE DUTY CYCLE                               | continuous                   |  | Cont.             | Cont.           | Cont.            |
| 5 - MODULATION FREQUENCY                                | 300 to 1 600 Hz              |  | 380 to 1560       | 380 to 1560     | 380 to 1560      |
| 6 - MODULATION DUTY CYCLE                               | 33 % - 55 %                  |  | 48 %              | 49 %            | 49 %             |
| 7 - MODULATION FACTOR                                   | > 0,85                       |  | .90               | .92             | .93              |
| 8 - SWEEP REPETITION RATE                               | 2 Hz - 4 Hz                  |  | 2.6 Hz            | 2.6 Hz          | 2.6 Hz           |
| 9 - HOMING TRANSMISSION CODING                          | * Bit 112 = 1                |  | 1                 | 1               | 1                |

\* See data and graphs of results on chapter 12 “ Cospas-Sarsat Type Approval Tests Report ”

\*\* See spectrum measurement results reported in chapter 10

## **17.2- HOMING RADIATED OUTPUT POWER ON UUT 2/3**

## 1 - ADMINISTRATION

- 1.1 WORK ORDER : Reference : M2393-RTCM
- 1.2 TEST TEAM : A. BENEZET (INTESPACE)  
J. COMMENGES (INTESPACE)
- 1.3 SCHEDULE : 9-10 march 2000

## 2 - PURPOSE

The radiation tests of the dedicated radio beacon are performed in INTESPACE EMC Laboratory in compliance with the test methods described in Section A17.0 of RTCM Recommended Standards for 406 MHz Satellite EPIRBs (Version 2.0 Feb 5,1997) .

Following tested frequency : 121.5 MHz.

## 3 - RADIO BEACON IDENTIFICATIONS

- Manufacturer : JOTRON
- Model N° : TRON 40GPS
- Serial N° : 7000
- Antenna : Internal

## 4 - TEST SITE DESCRIPTION

Tests are performed in an anechoic chamber (size 16 m x 10 m x 11 m) .  
Walls, ceiling and doors are lined with EMERSON CUMING foams VHP 36 and VHP 26 type.  
The EPIRB is placed as shown on figures n° 1 and n° 2 next pages .

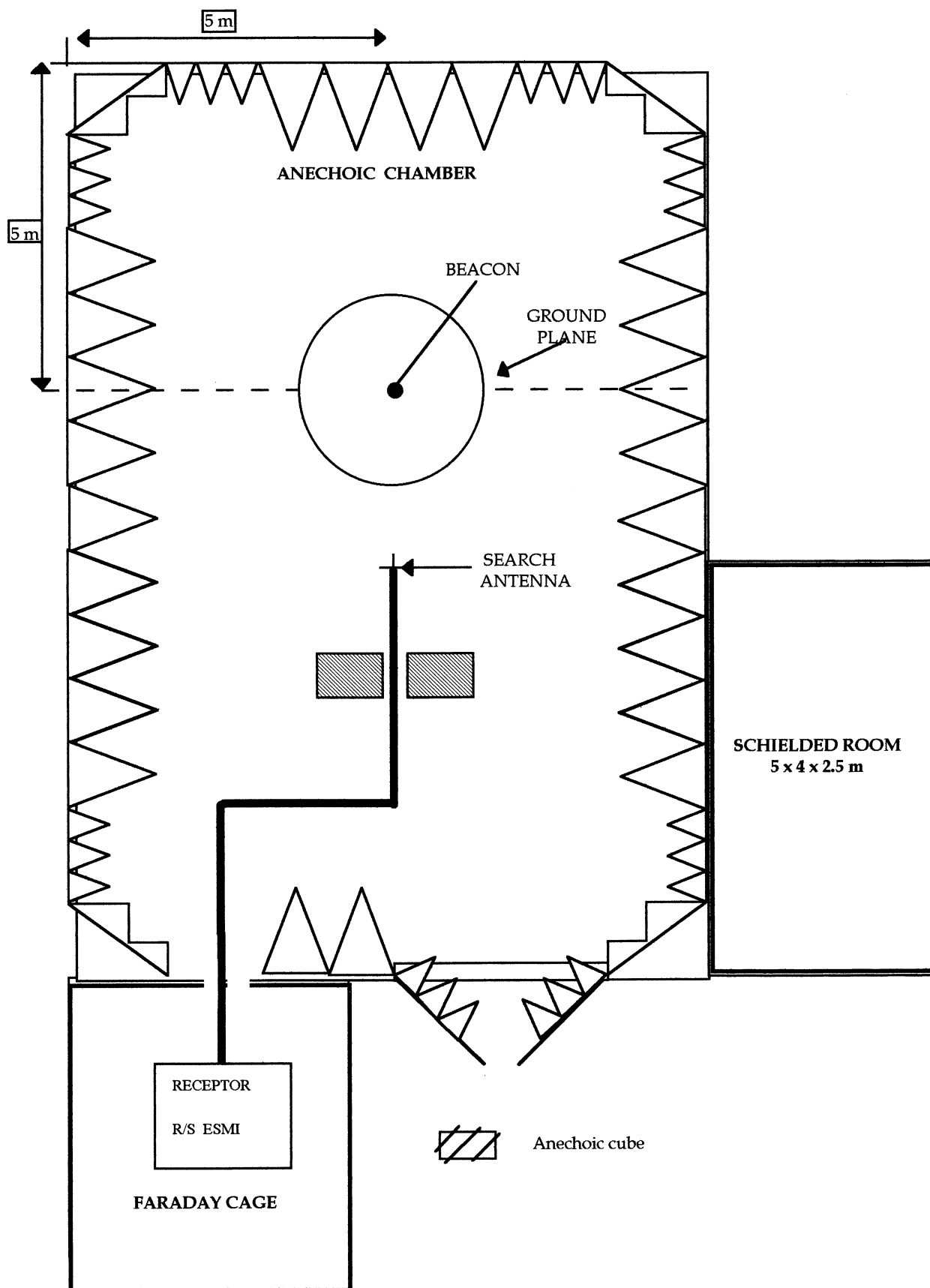
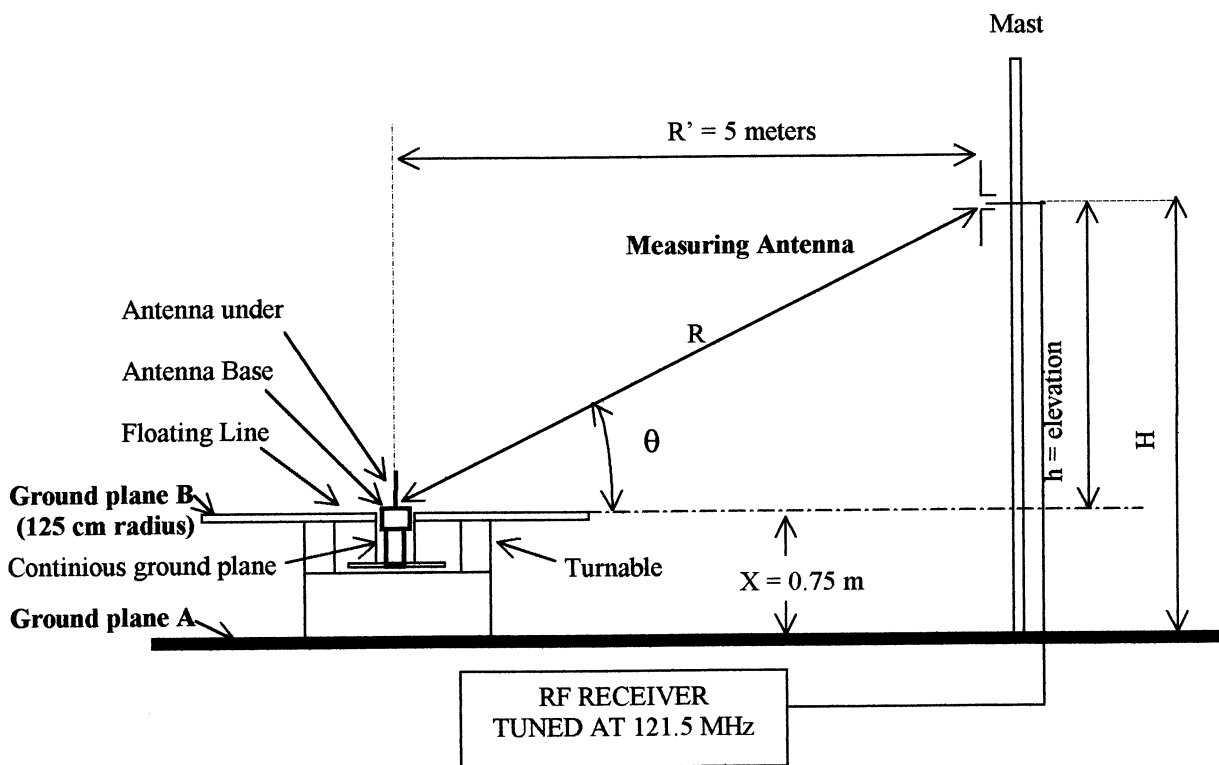


FIGURE 1



**FIGURE 2 :** Equipement Test Set Up For BEACON Antenna Test  
(For BEACON designed for normal operation in water, ex: EPIRB)

## 5 - TEST METHOD

According Section A17.3 of RTCM Recommended Standards for 406 MHz Satellite EPIRBs (Version 2.0 Feb 5,1997) following measurements are performed :

- 1/ The elevation angle between 5° and 20° which produces a maximum gain is determined with the EUT at an arbitrary azimuth .
- 2/ The PEP is measured and the elevation angle is noted ( between 5° to 20° ) and is remain fixed for the remainder of the test .
- 3/ The remaining 12 measurements of PERP is obtained by rotating the EUT in increments of 30° ± 3°. For each measurements the EUT PERP is computed using the following equation :

$$\text{PERP} = \text{LOG}^{-1} [(P_{\text{REC}} - G_{\text{REC}} + L_c + L_p)/10] \quad (\text{Equation A})$$

Where :

$P_{\text{rec}}$  = Measured Power level from spectrum analyzer (dBm)

$G_{\text{rec}}$  = Antenna gain of search antenna (dB)

$L_c$  = Receive system attenuator and cable loss (dB)

$L_p$  = Free space propagation loss (dB)

- 4/ The median value of PERP is compared to the specified PERP to be in the range 25 mW to 100 mW ( 14 dBm to 20 dBm)

## 6 - TEST MEASUREMENT EQUIPMENTS

### SEARCH ANTENNA

- 121.5 MHz test : EMCO Dipole - 3121 C - DB2 - S/N 763

### SPECTRUM ANALYSER

- R/S ESMI

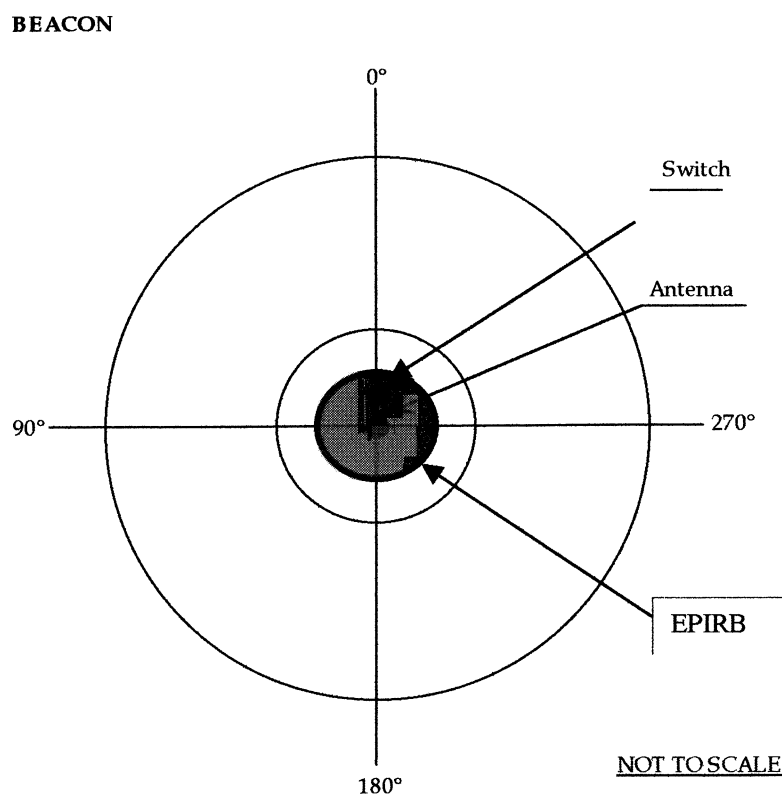
### CABLES

- 20 m cable SUCOFLEX type 100 - cable loss at 121.5 MHz : 1.7 dB

## 7 - EPIRB MECHANICAL SET UP

EPIRB 0° axis identified by the antenna position (see next figure ) is the rotation center of azimuth angle.

A conductive aluminium paper is used to assure a good conductivity between beacon float level and the ground plane.



## 8- TESTS OPERATIONS AND RESULTS

### 8.1 Determination of elevation angle $\theta$ which produces a maximum gain :

$$\theta = 19.8^\circ$$

### 8.2 Determination of Free Space Propagation Loss ( $L_p$ ) :

$$L_p = 20\log(F_0) + 20\log(R) - 27.6 \text{ dB}$$

$$F_0 = 121.5 \text{ MHz}$$

$$R = 5.31 \text{ m (for an elevation angle } \theta = 19.8^\circ, \text{ figure 2 )}$$

$$L_p = 28.6 \text{ dB}$$

### 8.3 Determination of Search Antenna Gain ( $G_{\text{rec}}$ ) :

$$G_{\text{rec}} = 20\log(F_0) - (AF - G_m) - 29.8 \text{ dB}$$

$$F_0 = 121.5 \text{ MHz}$$

$$AF = \text{Reference Gain of Search Antenna} = 10.9 \text{ dB}$$

$$G_m = \text{Directivity gain of the Search Antenna}$$

$$\text{With } \theta = 19.8^\circ, G_m = 20 \log \frac{\cos(90^\circ \sin \theta)}{\cos \theta} = 0.76 \text{ dB}$$

$$29.8 \text{ dB} = \text{Free Space Constant}$$

$$G_{\text{rec}} = 1.75 \text{ dB}$$

### 8.4 Receive System Attenuator and Cable Loss ( $L_c$ ) :

$$L_c = 1.7 \text{ dB}$$

#### 8.4 Measurement results :

Following the Equation (A), 13 value of EUT PERP are computed at 19.8 ° of elevation angle

| <b>Azimut Angle</b> | <b>P<sub>rec</sub><br/>Measured Power level (dBm)</b> | <b>PERP<br/>(dBm)</b> |
|---------------------|-------------------------------------------------------|-----------------------|
| 0                   | - 12.1                                                | 16.45                 |
| 30                  | -12.2                                                 | 16.35                 |
| 60                  | -12.4                                                 | 16.15                 |
| 90                  | -12.1                                                 | 16.45                 |
| 120                 | -12.2                                                 | 16.35                 |
| 150                 | -11.9                                                 | 16.65                 |
| 180                 | -12.0                                                 | 16.55                 |
| 210                 | -12.0                                                 | 16.55                 |
| 240                 | -11.7                                                 | 16.85                 |
| 270                 | -11.7                                                 | 16.85                 |
| 300                 | -11.7                                                 | 16.85                 |
| 330                 | -11.7                                                 | 16.85                 |
| <b>Mean value</b>   | <b>-11.97</b>                                         | <b>16.6 dBm</b>       |

The PERP measured and computed are in conformance with specification required :

$$14 \text{ dBm} \leq \text{PERP} \leq 20 \text{ dBm}$$