F8794

KANNAD 406 AF-COMPACT

PART NUMBER S1840501-01

TECHNICAL PRESENTATION

First Issue : NOV 20/2006
Revision : B
REF: DOC06004

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Please report to our customer support:
E-mail: support.sar@martec.fr
Tel.: +33 (0)2 97 02 49 00

KANNAD 406 AF-COMPACT
TECHNICAL PRESENTATION

LIST OF REVISIONS

Rev	Date	Pages	Description of modifications
A	NOV 20/2006		First issue
B	SEP 22/2007	2	Add of Pack part number (P/N S1840501-02)
			Antenna purchased separately (not as part of Kit)
			P/N DIN-12 and SUB-D 9 connectors, Note packs P/N suppressed
			Figure 2 modified
		4	Reference to FAA TSO-C91a suppressed
		5	Duration of 48 hours suppressed for digital message transmission
		7	PR550 replaced by PR600
		8	Duration of 121.5 MHz transmission: suppression of reference to new batteries
			406 MHz stopped after 48 hours replaced by is continuing beyond 48 hours.
			Add of a note to clarify useful life and expiry date of batteries
		9	Test result displayed after «about 3 seconds» replaced by «about a few seconds»
		9	PR550 replaced by PR600
		10	The following text: When this mode is selected, the ELT starts transmission: on 121.5 MHz immediately (continuous transmission for a minimum duration of 48 hours), on 406 MHz after 50 seconds (406 burst every 50 sec for 48 hours). Is modified as follows: When this mode is selected, the ELT starts transmitting after 50 seconds: on 406 MHz (one 406 MHz burst every 50 seconds); on 121.5 MHz (continous transmission between each 406 MHz burst).
			PR550 replaced by PR600
		12	121.5 +/- 0.003 MHz replaced by 121.5 +/- 0.006 MHz
			37 dBm +/- 2 dB (minimum 3W, maximum 8 W) replaced by 5 W (37 dBm ± 2 dB)
		13	Modification of environmental category according to DDP
		15	PR550 replaced by PR600
			BINDER reference for J1 mating connector suppressed

Rev	Date	Pages	Description of modifications
		17	Add of mention «or equivalent» for Radiall reference to J2 mating connector
		21	Figure 10: all references to RCP buzzer suppressed.
		22	The following text: this test must only be carried within the first 5 minutes of any hour. Do not exceed 30 seconds of transmission. Is modified as follows: This check shall only be conducted during the first five minutes of any UTC, (co-ordinated universal time) hour, and restricted in duration to not more than five seconds. Be sure to notify any nearby control tower of your intentions.
			Add of (Aircraft VHF receiver may be used) to «This test must be carried out with a VHF receiver».
			The following text: Listen to the 121.5 MHz "sweep tone". Stop transmission. Is modified as follows: Listen to the two 121.5 MHz "sweep tones" during not more than the first five seconds then stop transmission
			End of § 6.2.3.2, the following note as been added: IMPORTANT: Do not allow test duration to exceed 5 seconds. If the ELT operates for approximately 50 seconds, a 406 MHz signal is transmitted and is considered valid by the satellite system.
		23	Add of PR600 reference
		24	ETSO approved, TSO-c91a reference suppressed
			Add of transmitters tests reports references according to DDP
		25	Add of environmental tests reports references according to DDP
			Add of § 8.3 List of deviations, § 8.4 Means of compliance
		26	Suppression of «valid agreement for KANNAD ELTs maintenance» for PART or FAR 145 maintenance stations
		30	Suppression of Production Agreement Specifications
			Suppression of labelling references
			Add of CS-ETSO approval references

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1. GENERAL

1.1. Background

1.1.1. COSPAS-SARSAT system

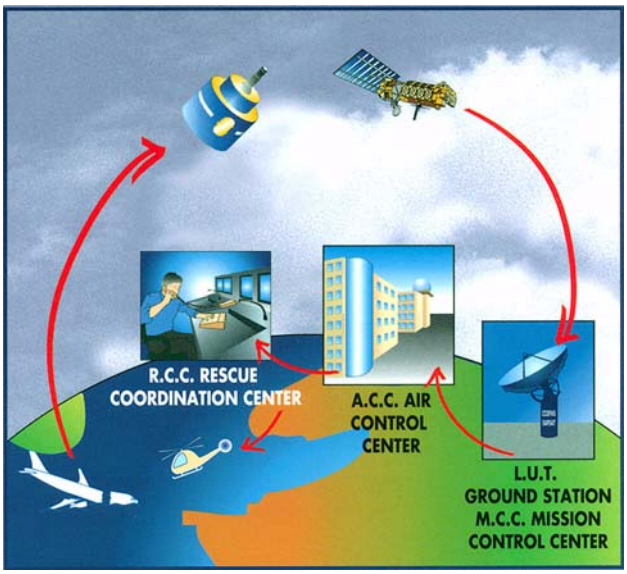
Launched in the early eighties by the four founder countries (Canada, France, Russia, USA), the COSPAS-SARSAT system provides satellite aid to search and rescue (SAR) operations for maritime, aeronautical and terrestrial vehicles anywhere in the world.

It uses distress beacons fitted on mobiles and a constellation of LEO and GEO satellites which relay the 121.5 signal and process the 406 MHz signal to ground stations (LUT) where the beacon positions are determined (with a precision of 10 NM with 121.5 signal and less than 2 NM with 406 signal).

Several types of beacons are designed to match the various applications of the COSPAS-SARSAT system:

- EPIRB (Emergency Position Indicating Radio Beacon) for maritime applications.
- ELT (Emergency Locator Transmitter) for aeronautical applications.
- PLB (Personal Locator Beacon) for land expeditions.

Figure 1: COSPAS-SARSAT system



1.1.2. ELT system

The KANNAD 406 AF-COMPACT belongs to the AF type of ELTs which are permanently attached to an aircraft. The KANNAD 406 AF-COMPACT is designed to be installed on fixed wing aircraft or helicopters.

The KANNAD 406 AF-COMPACT is supplied in a Pack: Part Number S1840501-02.

The KANNAD 406 AF-COMPACT Pack (P/N S1840501-02) is composed of:

(1) a transmitter (P/N S1840501-01);

(2) a mounting bracket (P/N S1840502-01);

(3) an RC200 remote control panel (P/N S1820513-11);

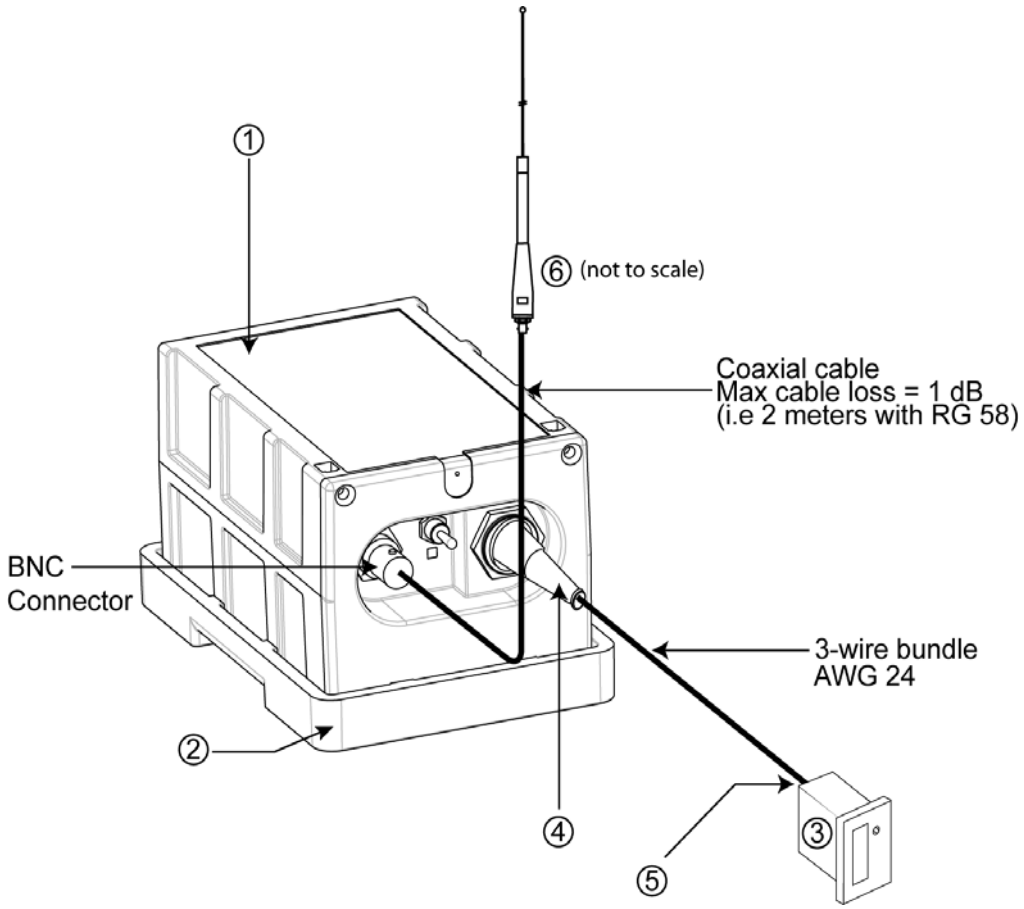
(4) a DIN-12 connector (P/N S1820514-03);

(5) a SUB D 9 Pts Female connector (P/N S1840506-01).

The outside whip (P/N 0141013) antenna is purchased separately.

The transmitter and bracket are installed in the aircraft near the tail. The outside antenna is mounted on the fuselage near the tail. The remote control panel is installed in the cockpit and connected to the ELT with a 3-wire bundle (not supplied).

Figure 2: ELT system description



This document is a technical presentation of KANNAD 406 AF-COMPACT transmitter P/N S1840501-01 to be installed on an aircraft or helicopter.

Refer to relevant document for information on remote control panel, antenna, programming and testing equipment.

1.2. List of acronyms

AA ..... Airworthiness Authorities
AD ..... Automatic Deployable
AF ..... Automatic Fixed
AP ..... Automatic Portable
ATC ..... Air Traffic Control
BFE ..... Buyer Furnished Equipment
BNC ..... Bayonet Nut Connector
BPS ..... Bits Per Second
CS-ETSO ..... Certification Specification for ETSO
CSN ..... Cospas Sarsat Number
CS144 ..... Cospas Sarsat 144 bits Interface Module
DDP ..... Declaration of Design and Performance
DGAC ..... Direction Générale de l'Aviation Civile (France)
DIN ..... Deutches Institut für Normung
DONGLE ..... Connector Plug with Serial Memory Module
EASA ..... European Aviation Safety Agency
EEPROM ..... Electrically Erasable Programmable Read Only Memory
ELT ..... Emergency Locator Transmitter
EPIRB ..... Emergency Position Indicating Radio Beacon
ETSO ..... EuropeanTechnical Standard Order
FAA ..... Federal Aviation Administration
FAR ..... Federal Aviation Rules
FEE ..... Fiche d'Evolution d'Equipement
FH ..... Flight Hours
FMS ..... Flight Management System
GEO ..... Geostationary Earth Orbit
GPS ..... Global Positioning System
GSAC ..... Groupement pour la Sécurité Aviation Civile
IATA ..... International Air Transport Association
ICAO ..... International Civil Aviation Organisation
JAA ..... Joint Airworthiness Authorities
JAR ..... Joint Airworthiness Rules
LED ..... Light Emitting Diode
LEO ..... Low Earth Orbit
LRU ..... Line Replaceable Unit
LUT ..... Local User Terminal
MTBF ..... Mean Time Between Failure
MTBUR ..... Mean Time Between Unscheduled Removal
MSN ..... Mainframe Serial Number
PLB ..... Personal Locator Beacon
P/N ..... Part Number
QAC ..... Qualification Aviation Civile
RAM ..... Random Access Memory
RCP ..... Remote Control Panel

S.....Survival
SAR..... Search And Rescue
SB .....Service Bulletin
SFACT .....Service de la Formation Aéronautique et du Contrôle Technique
SMM..... Serial Memory Module
TCAS .....Traffic Collision Avoidance System
TCCA .....Transport Canada Civil Aviation
TBC.....To Be Confirmed
TBD.....To Be Determined
TSO.....Technical Standard Order
XPDR .....Transponder

2. APPLICABLE DOCUMENTS

The study of older generation ELT failures has enabled a better understanding of the environmental conditions of a crash. All these environment studies resulted in the writing of new specifications for ELT by both RTCA (Radio Technical Commission for Aeronautics) and EUROCAE (EURopean Organisation for Civil Aviation Equipment).

Their work is published in RTCA DO183/204 and EUROCAE ED62 documents.

This has given birth to a new generation of ELTs. The main differences with the older generation are better mechanical characteristics, severe specifications for automatic activation and identification of the aircraft with the introduction of the "406 MHz frequency".

Reference	Title
RTCA DO-182	"Emergency Locator Transmitter (ELT) Equipment Installation and Performance"
RTCA DO-183	"MOPS for Emergency Locator Transmitters. Automatic Fixed, Automatic Portable, Automatic deployable, Survival Operating on 121.5 and 243.0 Megahertz"
RTCA DO-204	"MOPS 406 MHz Emergency Locator Transmitters (ELT)"
RTCA DO-160E EUROCAE ED14E	"Environmental conditions and test procedures for airborne equipment"
ETSO 2C91a	ETSO "Emergency Locator Transmitter (ELT) equipment"
ETSO 2C126	ETSO "406 MHz Emergency Locator Transmitter (ELT)"
FAA TSO-C126	"406 MHz Emergency Locator Transmitter (ELT)"
EUROCAE ED62	"MOPS for aircraft Emergency Locator Transmitters (121,5/243 MHz and 406 MHz)"
COSPAS-SARSAT C/S T.001	"Specification for COSPAS-SARSAT 406 MHz distress beacons"
COSPAS-SARSAT C/S G.005	"COSPAS-SARSAT guidelines on 406 MHz beacon coding, registration and type approval"
COSPAS-SARSAT C/S G.004	"COSPAS-SARSAT glossary"
IATA A45	"International Air Transport Association (IATA) Dangerous Goods Regulation, section A45"

3. DESIGN FEATURE

3.1. General

The KANNAD 406 AF-COMPACT belongs to the AF type of ELTs which are permanently attached to an aircraft.

3.2. Mechanical design

The KANNAD 406 AF-COMPACT is made of moulded plastic (light yellow, RAL 1018) with excellent mechanical resistance.

The housing is designed to be easily handled and one hand activated.

The front panel of 406 AF-COMPACT has the following features:

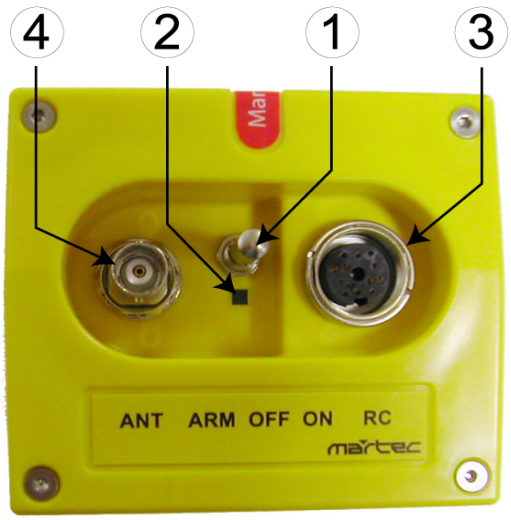
(1) Arm / On / Off switch,

(2) Visual Indicator (red),

(3) Female DIN 12 socket to connect an RCP, a programming dongle, a maintenance dongle, or a programming equipment.

(4) BNC connector used to connect the transmitter to an outside antenna.

Figure 3: Front face description



3.3. Working principle

The KANNAD 406 AF-COMPACT can be activated either automatically when the crash occurs (thanks to a shock sensor) or manually (thanks to a switch on the transmitter itself or on a Remote Control Panel).

The KANNAD 406 AF-COMPACT is designed to transmit on two frequencies (121.5 and 406 MHz). The 121.5 MHz emergency frequency is mainly used for homing in the final stages of the rescue operations. The 406 MHz frequency is used by the COSPAS-SARSAT satellites for precise pinpointing and identification of the aircraft in distress.

3.3.1. Transmitter

Once activated, the transmitter operates continuously on 121.5 MHz with a minimum output power of 100 mW (400 mW max.). The modulation (3K20A3X) is an audio frequency sweeping downwards from 1420 Hz to 490 Hz with a repetition rate of 3 Hz. The AM modulation factor is over 85%.

During operation, a digital message is transmitted on 406.028 MHz every 50 seconds. The minimum output power on 406 MHz is 3 W (8W max.).

The KANNAD 406 AF-COMPACT can transmit a 112-bit short message on 406 MHz .

Bi-phase modulation at 400 bps enables transmission of all relevant identification information to the COSPAS-SARSAT satellites in 440 ms (Modulation type 16K0G1D).

3.3.1.1. Technology

The KANNAD 406 AF-COMPACT transmitter is an integrated design and not a standard 121.5 MHz transmitter with 406 MHz upgrade module. Indeed, the main advantage of this configuration is that it uses a single antenna connector and coaxial cable.

All components used in the KANNAD 406 AF-COMPACT are of the latest technology in order to bring maximum performance with minimum power consumption.

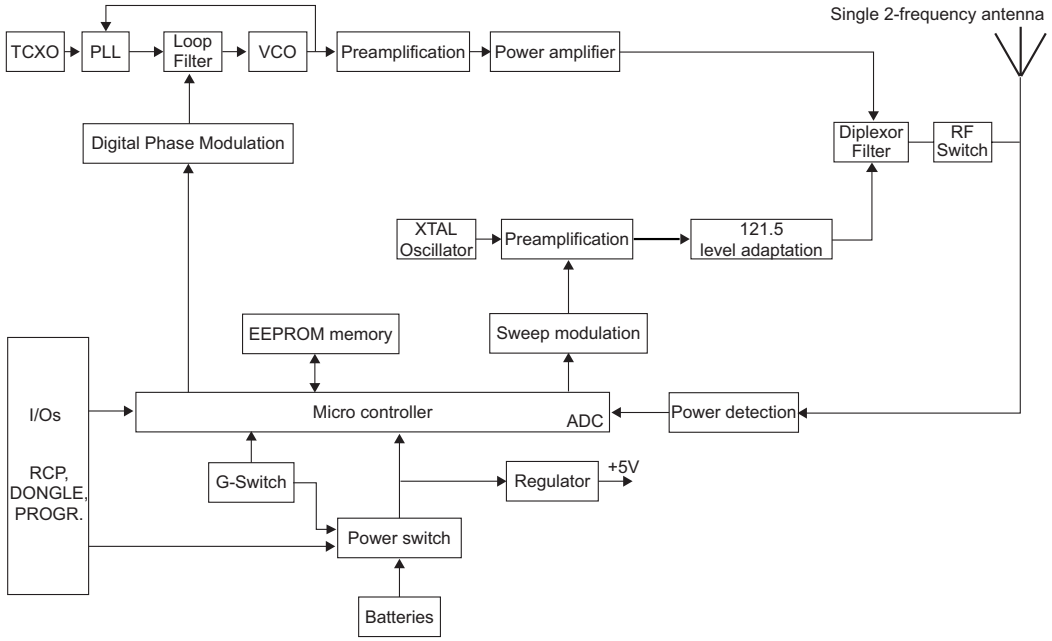
Surface Mounted Components improve mechanical resistance to shocks and vibrations.

3.3.1.2. Architecture

The transmitter is driven by a HCMOS micro-controller (68HC705P6DW) that manages the PLL, amplitude and phase signal modulation as well as I/Os.

The great stability of the 406 MHz carrier (0,002 parts/million/100 ms) is given by an TCXO (Temperature Controlled Crystal Oscillator).

Figure 4: Block diagram of KANNAD 406 AF-COMPACT transmitter



3.3.2. Digital message transmission

One of the major improvements of the new generation of ELTs is the transmission of the aircraft in distress' identification within the 406 digital message.

3.3.2.1. Protocols

The KANNAD 406 AF-COMPACT is fully compatible with the transmission protocols specified by the

COSPAS-SARSAT C/S G005 document :

- Serial Identification Number ("Cospas-Sarsat Number of the ELT or serial number from an allocated segment or serial number given by the local authority)
- Aircraft 24 bit address (ICAO number of the aircraft, also used for MODE S XPDR or TCAS).
- Aircraft Operator Designator + serial number up to 4096.
- Aircraft Nationality and Registration Marking also called "tail number" (up to 7 alphanumeric characters).

3.3.2.2. Programming

Programming of the identification number can be carried out either via an interface with a PC running Windows software (PR600) or with a " Dongle" (Connector with Serial Memory Module).

Computer Interface

The ELT is connected to a PC computer, running Windows® software, via a special computer interface.

At the beginning of the self-test sequence, the ELT tries to establish an asynchronous serial link. If the PC software replies correctly, the identification is downloaded to the ELT. This operation takes less than 2 minutes and does not require any hardware operation.

Programming and maintenance dongles (option)

To facilitate maintenance operations especially in the case of removal and/or exchange, the KANNAD 406 AF-COMPACT offers pin-programming capabilities as an option.

Instead of installing the DIN 12 connector for connection to the Remote Control Panel, a special connector with a small Serial Memory Module called "Programming Dongle" is installed.

This Programming Dongle remains attached to the aircraft even if the ELT is removed.

When an unprogrammed ELT is installed, connected to this Programming Dongle and switched to "ARM", the ELT automatically updates its own memory with the identification data contained in the Programming Dongle memory.

When the ELT is removed from the aircraft, it keeps its identification data.

However, if the removal is not due to distress purposes, this might be a problem with regards to COSPAS-SARSAT system integrity because two ELTs (the removed one and the replacement one) will have the same identification data. This is why MARTEC SERPE-IESM developed another type of Dongle called "Maintenance Dongle" that enables resetting of the ELT's identification information of the ELT. A Maintenance Dongle looks like a DIN 12 connector with a Serial Memory Module and a red "Remove Before Flight" streamer. Its memory contains a specific maintenance code (country, manufacturer, serial number) recognized by COSPAS-SARSAT as "not on board". Any transmission in the shop during maintenance procedure will not involve Search And Rescue operation.

As a rule, if the programming dongle option is chosen, the aircraft operator shall equip:

- each aircraft in operation with a "Programming Dongle",
- each spare ELT with a "Maintenance Dongle".

3.3.2.3. Reliability of the "pin-programming" function

Several safeguards have been incorporated to ensure that the ID code transmitted is correct even in extreme condition should the Dongle be damaged during data transfer.

One of the safeguards concerns the internal memory organisation:

- MC: EEPROM that contains the maintenance code ("SI" + 5 last digits of the CSN),
- TC: EEPROM that contains the code to be transmitted,
- TX: RAM that contains the code transmitted once the ELT is activated.

Once activated, TC is copied into TX and the ELT detects if programming and testing equipment is connected.

- If no programming and testing equipment is detected, the beacon tries to read a Serial Memory Module by testing the synchronous serial link.
- If a Maintenance Dongle is detected, the content of MC is copied into TC and into TX.
- If a Programming Dongle is detected, its content is copied into TC and into TX.

The above procedure is performed during self-test.

3.3.3. Shock sensor (G-Switch)

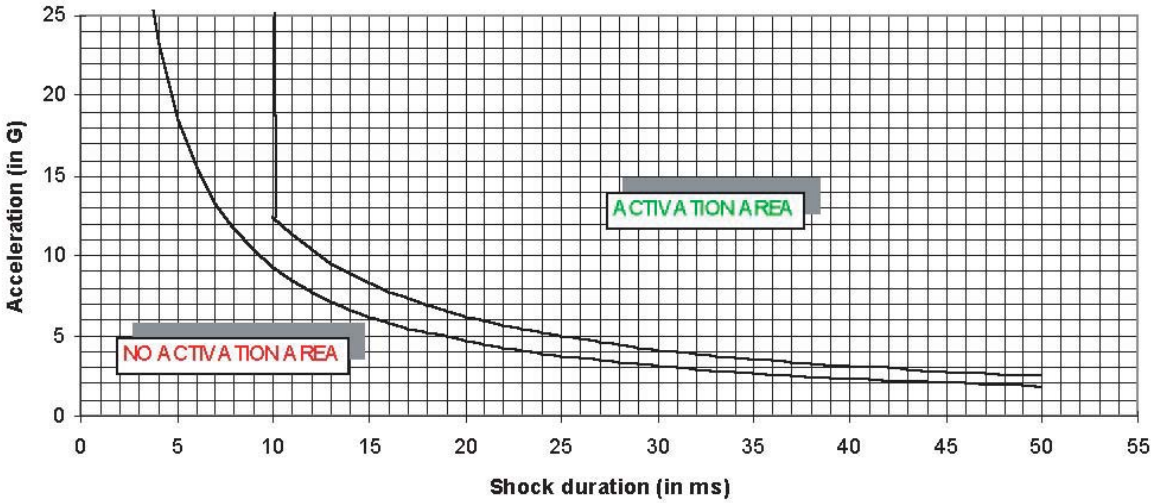
The shock sensors (also called G-switch) equipping old automatic ELTs are the cause of a large number of false alarms.

Important work in the study of aircraft crashes (study made by the "Crash Research Institute") has evaluated the typical acceleration profiles involved.

While older generation of G-Switches trigger with an acceleration threshold, the new generation takes into account both acceleration and shock duration.

The G-Switch trigger complies with EUROCAE specifications. RTCA specifications with regards to G-Switch activation threshold are slightly different from EUROCAE specifications. Considering that it provides an equivalent level of safety, a TSO was granted with a deviation in compliance with FAR 21.609 procedures.

Figure 5: Activation curve according to EUROCAE standard



3.3.4. Power supply

KANNAD 406 AF-COMPACT is self-powered by a $LiMnO_2$ two-element battery pack, P/N S1840510-01.

The duration of the 121.5 transmission is over 48 hours at -20°C with new batteries.

Unlike other ELTs, the 406 MHz transmission of KANNAD 406 AF-COMPACT is not stopped after 24 hours and 406 MHz transmission is continuing beyond 48 hours.

The transmitter battery expiry date is fixed at 6 years after manufacture. If no activation of the ELT occurs during the battery lifetime, it shall be replaced every 6 years(See note below).

NOTE: The useful life time of batteries is twelve (12) years. To be in compliance with FAR regulations, they have to be replaced every (6) years when 50 percent of their useful life has expired.

The Remote Control Panel is also energized by this battery pack.

3.4. Working modes

The KANNAD 406 AF-COMPACT has 4 different modes:

- Off.
- Self-test (temporary mode).
- Armed (standby mode to enable automatic activation by the shock sensor or by the remote control panel).
- On (transmission).

Transmission is effective if the beacon is activated (either manually on the ELT control panel, remotely by the "ON" button on the remote control panel or automatically by the shock sensor).

3.4.1. Off

The ELT is off when the switch is in the "OFF" position.

No part of the ELT is energized.

This mode must be selected when the ELT is removed from the aircraft.

3.4.2. Self-Test

The self-test mode is a temporary mode (max duration 15 sec) in which the ELT checks the main characteristics of the transmitter (Battery voltage, 406 MHz transmission power, VCO locking, Programming) and enables digital communication with programming and testing equipment.

This mode is selected:

- when switching from "OFF" to "ARM",
- when switching to "RESET / TEST" on the Remote Control Panel (provided that the switch of the ELT is in position "ARM"),
- when switching to "ON" prior to transmission.

The buzzer operates during the self-test procedure.

After about a few seconds, the test result is displayed on the visual indicator as follows:

- One long flash indicates valid test.
- A series of short flashes indicates false test result.

The number of flashes indicates the type of failure:

- 3 + 1 = LOW BATTERY VOLTAGE.
- 3 + 2 = LOW TRANSMISSION POWER.
- 3 + 3 = FAULTY VCO LOCKING (Faulty frequency).
- 3 + 4 = NO ID NUMBER.

It is recommended to test the ELT regularly in order to detect any possible failure:

- after installation;
- the first flight of each month;
  Note: self-test must be performed regularly by a pilot or maintenance personnel from the cockpit (remote control panel) but should not be performed more than once a week,
- at every maintenance operation.

Each self-test consumes energy from the battery. Should self-tests be carried out more often than the maximum allowed, the battery life-time might be shorter than specified.

The number of self-tests carried out is recorded. This information is available when the ELT is connected to a programming and testing equipment (PR600).

3.4.3. Armed

In order to enable activation by the G-Switch or with the Remote Control Panel, the ELT must be in standby mode with the switch in the "ARM" position.

This mode is mandatory during flight. The ELT should remain in the "ARM" position except when all the time except when the aircraft is parked for a long period or for maintenance.

The Remote Control Panel is energized by the ELT when switched to "ARM".

3.4.4. On

This mode is selected:

- manually by switching to "ON",
- by switching the Remote Control Panel switch to "ON" (provided that the ELT switch is in the "ARM" position),
- when a crash occurs (provided that the ELT switch is the "ARM" position.

When this mode is selected, the ELT starts transmitting:

- on 406 MHz (one 406 MHz burst every 50 seconds);
- on 121.5 MHz (continous transmission between each 406 MHz burst).

The red visual indicator on the ELT (and red led annunciator on the remote control) flashes and the buzzer operates.

In case of accidental activation, the ELT can be reset either by switching it to "OFF" or by switching to "RESET" on the Remote Control Panel.

The number of 406 bursts transmitted is recorded. This information is available when the ELT is connected to programming and test equipment (PR600).

4. TECHNICAL CHARACTERISTICS

4.1. Mechanical characteristics

The ELT housing is to be installed on a Mounting Bracket (P/N S1840502-01).

4.1.1. Material

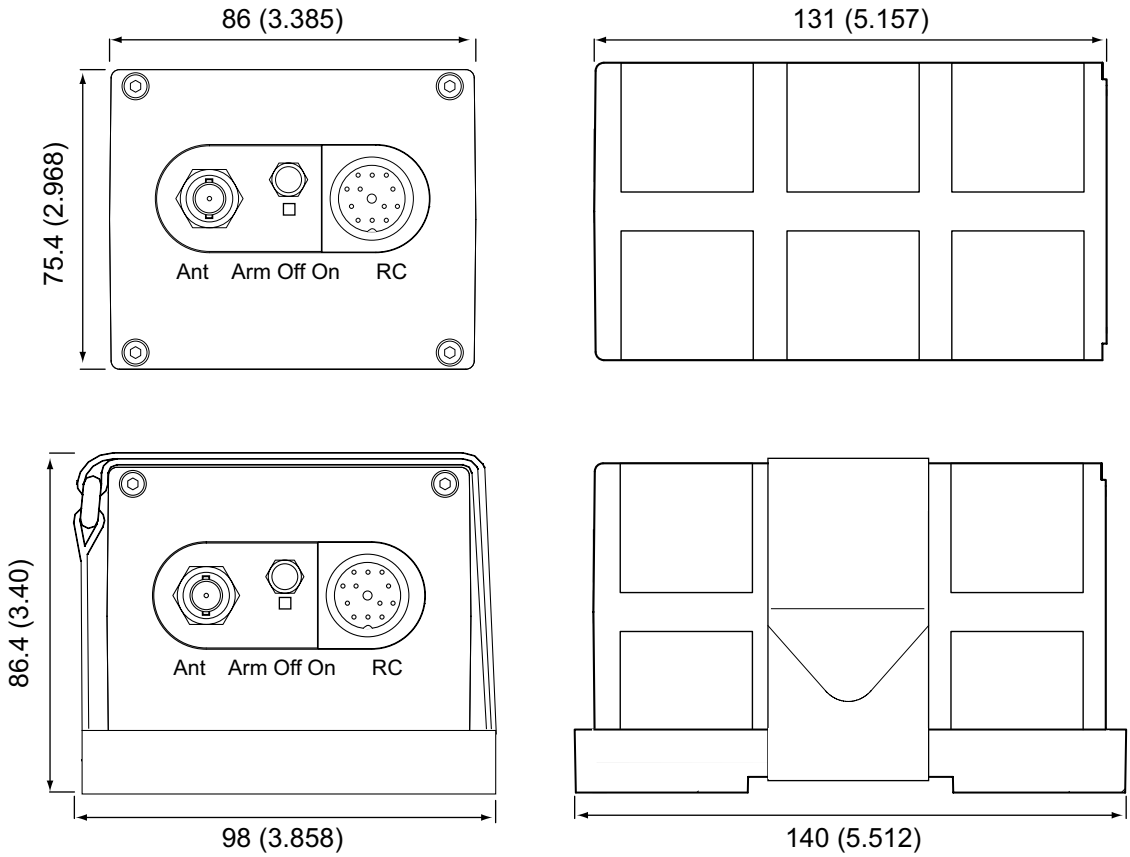
- Material: Plastic.
- Treatment: Light yellow color compound (RAL 1018), Fire classification M0.

4.1.2. Overall dimensions

Outline dimensions: 131 x 86 x 75.4 mm (5.157 x 3.385 x 2.968 inches).Outline dimensions (with mounting bracket and strap): 140 x 98 x 86.4 mm (5.512 x 3.858 X 3.40 inches).

Figure 6: Overall Dimensions

Note: all dimensions are in millimeters
(inches in brackets)



4.1.3. Weight

Including bracket and batteries:

- Typical: 850 gr. (1.873 lb)).
- MAX.: 875 gr. (1.929 lb).

4.1.4. Crash sensor (G-Switch)

- Type: Mechanical.
- Relevant specification: EUROCAE ED62, threshold: 4.5 ± 0.5 ft./s.
- Reference: P/N 0125808 (MARTEC Serpe-Iesm).

4.2. Electrical performances

121.5 MHz Transmitter	
Frequencies	121.5 +/- 0.006 MHz
Output power	100 to 400 mW (20 to 26 dBm)
Duty cycle	Continuous except during 406 transmission (500 ms every 50s)
Modulation type (Class of transmission)	3K20A3X
Modulation rate	AM of 85 % minimum
Modulation signal	Decreasing sweep from 1420 to 490 Hz
Repetition frequency	Approx. 3 Hz
Transmission duration	Over 48 hours at -20°C

406.028 MHz Transmitter	
Frequencies	406.028 +/-0.001 MHz
Output power	5 W (37 dBm ± 2 dB)
Data encoding (Class of transmission)	16K0G1D (Biphase L encoding)
Transmission duration	440 ms (short message) every 50 s.
Repetition period	47.5 to 52.5 s
Speed of transmission	400 bps +/-1%
Frame synchronization	0 0001 1111, 0 1101 0000 (during self test)
Transmission duration	Over 48 hours at -20°C

Batteries	
Battery replacement kit reference	S1840510-01
Transmitter power supply	$LiMnO_2$ two-element battery
Replacement	Every 6 years

4.3. Environmental characteristics

Qualification Tests Title	ED-62 references (when applicable)	DO-160	
		Section	Category
Temperature / Altitude Operating temperature Storage temperature Altitude	§ 4.4.1.3 / ED-62 -20°C to +55°C -55°C to +85°C 35 000 ft.	4	C1
Low Temperature Activation	§ 4.4.1.1 / ED-62		
High Temperature Activation	§ 4.4.1.2 / ED-62		
Low Temperature Operation	§ 4.6.1 / ED-62		
High Temperature Operation	§ 4.6.2 / ED-62		
Temperature variation	§ 4.6.3 / ED-62	5	As per ED-62
Thermal shock	§ 4.6.4 / ED-62		
Humidity		6	A
Shock	§ 4.5.7.3 / ED-62 500 G for 4 ms each axis, 100 G for 23 ms each axis	7	As per ED-62
Crash Safety	§ 4.5.7.2 / ED-62		As per ED-62
Penetration	§ 4.5.8 5 KG fall from 0.15 meter		As per ED-62
Crush	§ 4.5.10 / ED-62 455 kg - 5 minutes		As per ED-62
Vibration	Section 8 / DO-160E 5 Hz to 14 Hz: 2a = 5.1 mm (a = amplitude), 14 Hz to 45 Hz: γ = 2 G (γ = acceleration) 45 Hz to 55 Hz: 2a = 0.49mm, 55 Hz à 2000 Hz: γ = 3 G, Speed: 1 octave / min.	8	S(YLMC)
Explosion proofness		9	E
Waterproofness		10	Y
Magnetic effect		15	Z
Induced signal susceptibility		19	ZC
Radio frequency susceptibility	§ 3.2.10 / ED62	20	As per ED-62
Radio frequency emission		21	B
Fire, Flammability	§ 4.5.11 / ED-62 AVGAS flame / 15 seconds	26	As per ED-62
Fire protection	§ 2.3 / ED-62 CS-ETSO: CS-25.153		

4.4. Reliability

MTBF in transmission mode calculated according to MIL HDBK-217F: **TBD**

5. INTERFACES

5.1. Controls and connectors

The KANNAD 406 AF-COMPACT front panel consists of:

(1) 3-position switch ON/OFF/ARM;

(2) High intensity red visual indicator;

(3) J1: DIN 12 socket for connection to Remote Control Panel, dongle or programming equipment;

(4) J2: BNC connector for the antenna.

The red visual indicator gives an indication on the working mode of the beacon:

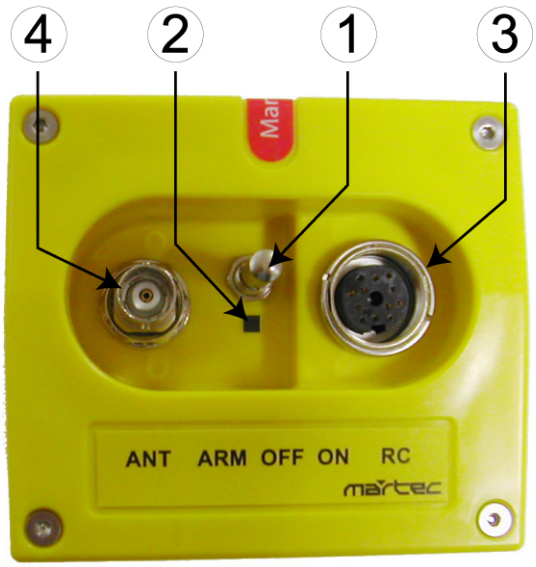
- after the self test, short flashes indicate the self test failed, one long flash indicates that the self test is OK,
- 2 flashes per second during 121.5 transmission,
- long flash during 406 transmission.

An internal buzzer gives aural information on the working mode of the beacon:

- continuous tone during the self test procedure,
- 2 beeps per second during 121.5 transmission,
- silence during 406 transmission.

NOTE: The operation of the remote control led annunciator (when RCP is connected) is identical to that of the ELT.
The remote control buzzer (when connected) "beeps" continuously as soon as the ELT is activated and whatever the operating mode (self test, 121.5 transmission, 406 transmission) may be.

Figure 7: Front Panel



5.2. Electrical Interface

The KANNAD 406 AF-COMPACT is a standalone system. There is no connection to the aircraft power supply.

When installed on board, the ELT is connected:

- to a Remote Control Panel (option) via a DIN12 connector or a programming dongle (option);
- to an outside antenna via a BNC connector.

The DIN12 connector is also used to connect programming and test equipment.

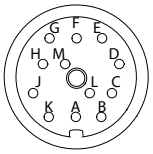
5.2.1. J1

This connector is dedicated for connection to the Remote Control Panel, to the Programming or Maintenance Dongles, and/or to the programming equipment (PR600).
The required wires are AWG24.

Receptacle		
Supplier	**Designation - P/N**	**Remarks**
Standard designation	DIN 45321 - FEMALE - 12 PTS	
MARTEC Serpe-Iesm	0126839	
BINDER	680-4-09-0332-80-12	

Mating connector reference info		
Supplier	**Designation - P/N**	**Remarks**
Standard designation	DIN 45321 - MALE - 12 PTS	
MARTEC Serpe-Iesm	S18 20 514-01	Programming Dongle (DIN 12 connector with Serial Memory Module)
MARTEC Serpe-Iesm	S18 20 514-03	DIN 12 connector without Serial Memory Module

Table 1: J1 Pin-Out

J1	PIN	Signal Name	Destination	Direction
Viewed from Front Face 	J1-A	RCP TEST/RESET/ON	RCP	IN
	J1-B	DONGLE RX	SMM / PGM	IN
	J1-C	DONGLE CS	SMM	OUT
	J1-D	DONGLE SK	SMM	OUT
	J1-E	DONGLE TX	SMM / PGM	OUT
	J1-F	DONGLE ALE2P	SMM	OUT
	J1-G	RCP COMMON	RCP	OUT
	J1-H	RCP BUZZER	Not used	
	J1-J	RCP LED	RCP	OUT
	J1-K	N/C		
	J1-L	DONGLE GND	SMM / PGM	OUT
	J1-M	N/C		

RCP: Remote Control Panel

SMM: Serial Memory Module (Dongle or GPS interface)

PGM: Programming and testing equipment

N/C: Not connected

5.2.2. J2

Connector J2 is used to connect the outside antenna through a 50 Ohm coaxial cable.

IMPORTANT: The length of the coaxial cable should not exceed 2 meters (6 ft) for a standard RG58 or equivalent coaxial cable. If the distance between the transmitter and the outside antenna exceeds 2 meters, a special low loss cable should be used to keep attenuation less than 1 dB.

Receptacle		
Supplier	**Designation - P/N**	**Remarks**
Standard designation	BNC FEMALE PLUG	Waterproof
MARTEC SERPE-IESM	0126234	
RADIALL	R141254	

Mating connector reference info		
Supplier	**Designation - P/N**	**Remarks**
Standard designation	BNC MALE	Waterproof
MARTEC SERPE-IESM	0126167	
RADIALL	R141007	or equivalent

Pin-out			
PIN	**Signal Name**	**Destination**	**Direction**
J2	RF OUT	ANTENNA	OUT

6. INSTALLATION AND ACCEPTANCE TEST PROCEDURE

6.1. Installation

6.1.1. Bracket

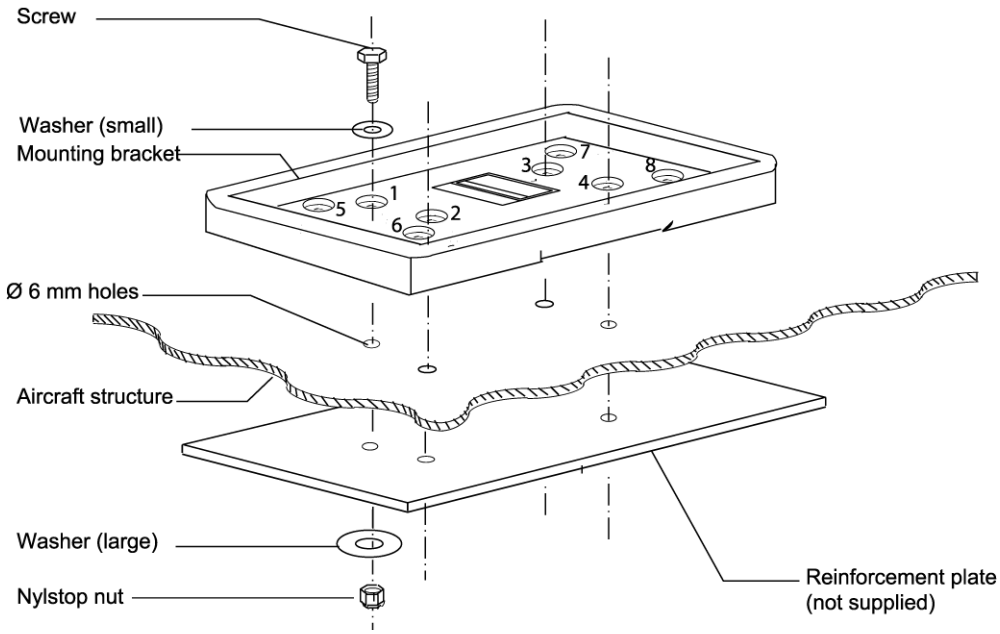
The KANNAD 406 AF-COMPACT is installed on board the aircraft on a mounting bracket (P/N S1840502-01).

A Velcro strap is provided to attach the ELT to the bracket.

The mounting bracket attaches to the aircraft structure with 4 x TH M5 screws, 8 washers and 4 nylstop nuts.

The bracket is qualified to hold the ELT during a 500 G shock for 4 ms. Any modification of the mounting invalidates the ETSO and TSO qualification and requires new certification of the installation.

Figure 8: bracket installation



6.1.2. Installation recommendations

"The location of the ELT shall be chosen to minimize the potential for inadvertent activation, damage by impact, fire and contact by passengers or baggage" (RTCA DO-183)

"The ELT must be attached to the aircraft in such a manner that the probability of damage to the transmitter in the event of a crash impact is minimized." (FAR 91.207)

"The ELT shall be mounted to primary aircraft load-carrying structures such as trusses, bulkheads, longerons, spars, or floor beams (not aircraft skin). The mounts shall have a maximum static local deflection no greater than 2.5 mm (0.1 inch) when a force of 450 Newton (100 lbf) is applied to the mount in the most flexible direction. Deflection measurements shall be made with reference to another part of the airframe not less than 0.3 meters (1 foot) nor more than 1.0 meter (3 feet) from the mounting location)." (RTCA-DO183)

The precise location of the ELT on board is to be determined according to the aircraft manufacturer's instructions.

The ELT control panel should be easily accessible to connect the outside antenna and the remote control panel and to check the ELT good operation (controls and lights).

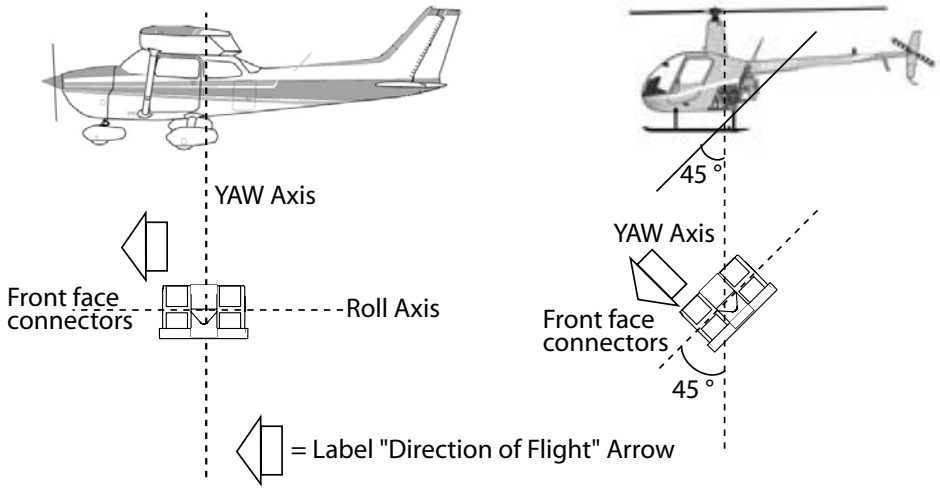
If no remote control panel is installed, "ELT controls and displays installed for in-flight use shall be readily accessible from the pilot's normal seated position. The pilot shall have an unobstructed view of displayed data when in the normal seated position." (RTCA DO-183).

The ELT shall not be installed within 60cm (2 ft) of a compass or flux gate.

6.1.3. KANNAD 406 AF-COMPACT installation

The KANNAD 406 AF-COMPACT can beinstalled onboard fixed wing aircraft or helicopters.

Figure 9: KANNAD 406 AF-COMPACT installation



Fixed wings:
The G-Switch sensor axis shall be pointed to sense the primary crash pulse along the longitudinal axis of the aircraft. Consequently, the KANNAD 406 AF-COMPACT shall be mounted with the arrow of the "Direction of Flight" label pointed towards the front of the aircraft,

Helicopters:
The standard version of the KANNAD 406 AF-COMPACT may be installed on a helicopter. The ELT unit should be mounted:

- with the front face connectors pointing downwards at a 45° angle to the yaw axis;
- **and** with "Direction of Flight" arrow towards the front of the helicopter.

6.2. Acceptance Test Procedure

Perform the following test:

(1) ELT operational tests,

(2) RCP operational tests,

(3) 406 and 121.5 MHz transmission tests (optional).

6.2.1. ELT operational tests

6.2.1.1. Installation without programming dongle:

- Connect DIN12 to J1 and outside antenna to J2,
- Switch the ELT from OFF to ARM,
- Check that the Self-Test result is OK (one long flash on visual indicator).

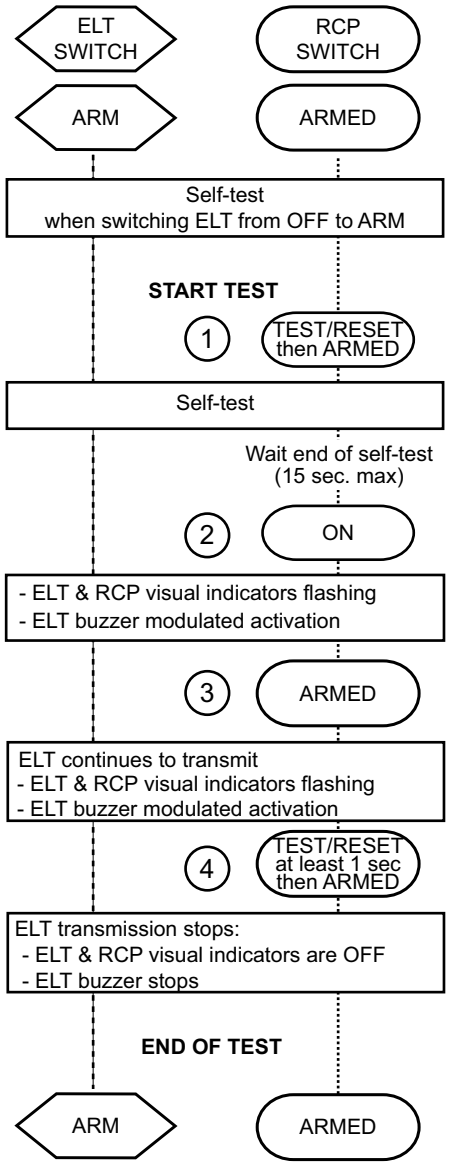
6.2.1.2. Installation with "Programming Dongle":

- Connect the outside antenna to J2,
- Switch the ELT from OFF to ARM,
- Check that the Self-Test fails (3+4 flashes on visual indicator).
- If not, connect a maintenance dongle to J1:
  - Switch the ELT from OFF to ARM,
  - Check that the Self-Test fails (3+4 flashes on visual indicator),
  - Remove the maintenance dongle from J1.
- Connect the "Programming Dongle" to J1
- Switch the ELT from OFF to ARM:
  the buzzer operates during the whole self-test procedure, after a few seconds the visual indicator displays the result.
- Check that the Self-Test result is OK (one long flash on visual indicator).

6.2.2. RCP operational tests

Check correct operation of RCP LED annunciator and external buzzer by switching ELT and RCP as described in the sequential procedure below (with ELT switch in the "ARM" position).

Figure 10: RCP LED and buzzer operation



<u>IMPORTANT:</u> From step 1 to step 2, before switching the RCP to ON, wait for the end of the self-test.

6.2.3. 406 and 121 MHz transmission tests

NOTE: These tests are optional.

6.2.3.1. 406 MHz transmission test

This test must be carried out with a COSPAS-SARSAT decoder.

- Perform self-test (Press RESET and TEST on the RCP or switch ELT from OFF to ARM).
- Check with the COSPAS-SARSAT decoder that, ***except for the 5th and the 6th digits***, the decoded message is identical to the programmed message.

NOTE: The message transmitted during self-test sequence always begins with FF FE ***D0*** whereas a "real" message begins with FF FE ***2F***.
Example of message programmed in ELTas sent during self-test sequence:
*FF FE **2F** 53 C3 24 97 38 0B A6 0F D0 F5 20*
Example of same message decoded by SARTECH ARG5410:
*FF FE **D0** 53 C3 24 97 38 0B A6 0F D0 F5 20*

6.2.3.2. 121 MHz transmission test

IMPORTANT: This check shall only be conducted during the first five minutes of any UTC, (co-ordinated universal time) hour, and restricted in duration to not more than five seconds. Be sure to notify any nearby control tower of your intentions.

This test must be carried out with a VHF receiver (Aircraft VHF receiver may be used).

- Tune VHF receiver to 121.5 MHz,
- Start transmission:
  - either on ELT: ON position,
  - or on the RCP: ON position (the ELT shall be in ARM position),
- Listen to the two 121.5 MHz "sweep tones" **during not more than the first five seconds** then stop transmission(see important notice below).
  - either on ELT: OFF or ARM position,
  - or on the Remote Control Panel: press TEST and RESET (the ELT shall be in ARM position).

IMPORTANT: Do not allow test duration to exceed 5 seconds. If the ELT operates for approximately 50 seconds, a 406 MHz signal is transmitted and is considered valid by the satellite system.

7. COMPATIBILITY

7.1. Compatibility list

Remote control panels	P/N	Supplier
RC200	S1820513-11	MARTEC SERPE-IESM

ELT - RCP Connectors	P/N	Supplier
PROGRAMMING DONGLE	S1820514-01	MARTEC SERPE-IESM
MAINTENANCE DONGLE	S1820514-02	MARTEC SERPE-IESM
DIN 12 CONNECTOR (without SMM)	S1820514-03	MARTEC SERPE-IESM

Antenna	P/N	Supplier
ANT200 (whip antenna)	0141013	MARTEC SERPE-IESM

Programming and testing equipment	P/N	Supplier
PR600 including programming software	1201570	MARTEC SERPE-IESM
COSPAS-SARSAT DECODER BT100AVTRIPLE	0140956	WS TECHNOLOGY

7.2. Evolutions

List of Equipment Change Sheets (ECS or FEE), description of modifications, date and references.

Not applicable

8. QUALIFICATION

8.1. Approvals

The KANNAD 406 AF-COMPACT transmitter is approved by COSPAS-SARSAT to ensure compatibility with the satellite system (reference to COSPAS-SARSAT type approval in §11.3).

Airworthiness approval is the responsibility of EASA.

ETSO 2C126, 2C91a.

TSO-c126 (pending).

8.2. Test reports

8.2.1. Transmitter tests

Tests performed by TUV certified laboratoratory

121.5 MHz TRANSMITTER	DO 183	DO 204	ED62	Test Report Index
Operating life	§ 2.2.1	N/A	§ 3.1.6	RM615291-02 Issue 2
Operating frequencies	§ 2.2.2.1	N/A	§ 3.1.1	RM615291-02 Issue 2
Modulation characteristics	§ 2.2.2.2	N/A	§ 3.1.2	RM615291-02 Issue 2
Modulation duty cycle	§ 2.2.2.3	N/A	§ 3.1.2	RM615291-02 Issue 2
Transmitter duty cycle	§ 2.2.2.4	N/A		RM615291-02 Issue 2
Peak effective radiated power	§ 2.2.2.5	N/A	§ 3.1.5	RM615291-02 Issue 2
Automatic Crash Activation	§ 2.2.3	N/A	§ 3.1.9	RM615291-02 Issue 2
Antenna Radiation Characteristics	§ 2.2.4	N/A		RM615291-02 Issue 2
Radio Frequency Intermodulation	§ 2.2.7	N/A	§ 3.1.7	RM615291-02 Issue 2

406 MHz TRANSMITTER	DO 183	DO 204	ED62	Test Report Index
Transmitted frequency	N/A	§ 2.2.2.1	§ 3.2.1	RM615291-01 Issue 4
Digital message generator	N/A	§ 2.2.2.2	§ 3.2.2	RM615291-01 Issue 4
Modulation	N/A	§ 2.2.2.3	§ 3.2.3	RM615291-01 Issue 4
Transmitter output power	N/A	§ 2.2.2.4	§ 3.2.5	RM615291-01 Issue 4
Voltage standing wave ratio	N/A	§ 2.2.2.5	§ 3.2.6	RM615291-01 Issue 4
Maximum Continuous Transmission	N/A	§ 2.2.2.6	§ 3.2.8	RM615291-01 Issue 4
Spurious emissions	N/A	§ 2.2.2.7	§ 3.2.9	RM615291-01 Issue 4
Operational life requirements	N/A	§ 2.2.2.8	§ 3.2.12	RM615291-01 Issue 4

8.2.2. Environmentatl tests

Qualification Tests Title	Report reference / Date	Laboratory
Temperature / Altitude	R022-REF-07-102310/2/A Ed.0	EMITECH
Low Temperature Activation	R022-REF-07-102310/2/A Ed.0	EMITECH
High Temperature Activation	R022-REF-07-102310/2/A Ed.0	EMITECH
Low Temperature Operation	75901256 Report 01 Issue 1	TUV
High Temperature Operation	75901256 Report 01 Issue 1	TUV
Temperature variation	75901256 Report 01 Issue 1	TUV
Humidity	R022-REF-07-102310/2/A Ed.0	EMITECH
Shock	R022-REF-07-102310/3/A Ed.0	EMITECH
Crash safety	R022-REF-07-102310/3/A Ed.0	EMITECH
Penetration	R022-REF-07-102310/2/A Ed.0	EMITECH
Crush	R022-REF-07-102310/3/A Ed.0	EMITECH
Vibration	R022-REF-07-102310/3/A Ed.0	EMITECH
Explosion proofness	RQ-06-60229-1-A	EMITECH
Waterproofness	R022-REF-07-102310/2/A Ed.0	EMITECH
Magnetic effect	R012-07-102354-2 Ed.0	EMITECH
Induced signal susceptibility	R012-07-102354-2 Ed.0	EMITECH
Radio frequency susceptibility	R012-07-102354-2 Ed.0	EMITECH
Radio frequency emission	R012-07-102354-2 Ed.0	EMITECH
Fire, Flammability	M-07/7050143/P2/A	EMITECH
Fire protection	M-06/6020185/P1-F4 / 27/10/06	CEAT
Intermodulation	DOC07132A July 20/2007	MARTEC Serpe-Iesm

8.3.List of deviations

(1) Shift of index of Standard ED14B to ED14E.

(2) Suppression of 243 MHz Homing Transmission.

(3) 3.Compliance to Cospas-Sarsat (T012 Issue 1) request for a frequency shift towards 406.028 ± 0.001MHz.

8.4.Means of compliance

(1) 1.ED62 §2.13.1 Flame Test applied to the sole ELT Kannad 406 AF-Compact, with the exclusion of either cable or antenna Dayton Granger ELT10-773.

(2) 2.Replacement of the ED62 §2.3 Fire Protection Test procedure, according to Martec Qualification Plan DOC05271B as regards the ELT material [CS25.853 Apx F / Part I / (a) / 1 / (i)].

(3) 3.ED62 §4.5.8.5-Group-B Penetration Test applied to all faces of the {ELT + Mounting Bracket} with the exception of the ELT - Front Panel.

(4) 4.ED62 §4.5.10.1-Group-B Crush Test applied to all faces of the { ELT + Mounting Bracket } with the exception of the ELT - Front Panel.

9. MANUFACTURING

9.1. Quality Assurance

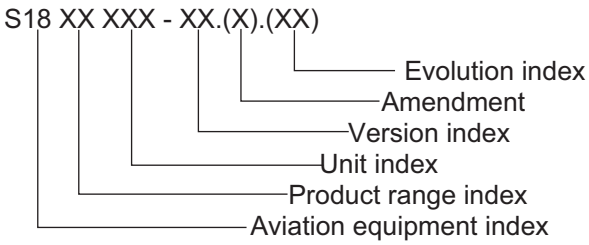
All aviation equipment manufactured by MARTEC SERPE-IESM are covered by the PART21-Subpart G, Production Agreement number FR.21G.0132 delivered by the French Civil Aviation Authority, and design is covered by Subpart O. It is GSAC's responsibility to periodically review compliance of the production process with Production Agreement Specifications.

The Quality Control integrity of the equipment is attested by the issuance of the Certificate of Airworthiness for export (EASA Form 1).

9.2. P/N structure

All series equipment are described in the production management system by an assembly number including sub-assemblies or components.

The assembly numbers are designated as follows:



The "Part Number" (P/N) corresponds to the first 10 digits of the assembly number.

S18 XX XXX - XX

In case of equipment evolution, if "Form Fit Function" is altered, the Version index is modified.

If not, either Amendment or evolution index will be increased depending on the level of demonstration required by the Airworthiness Authority to validate the modification.

As a consequence, all series equipment having the same Part Number are fully interchangeable.

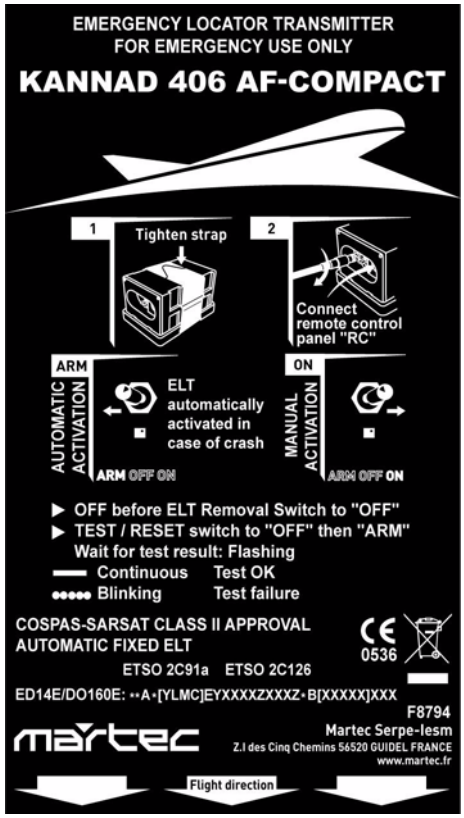
9.3. Marking

9.3.1. Name plate

Marking on the upper side of the housing gives information on:

- Part Number (P/N),
- Amendment (AMDT),
- Serial Number (S/N),
- Qualification Certificates (references of),
- Manufacturer name,
- Manufacturer code,
- Manufacturer details,
- Brief description of LED sequence.

Figure 11: Name plates and instructions marking

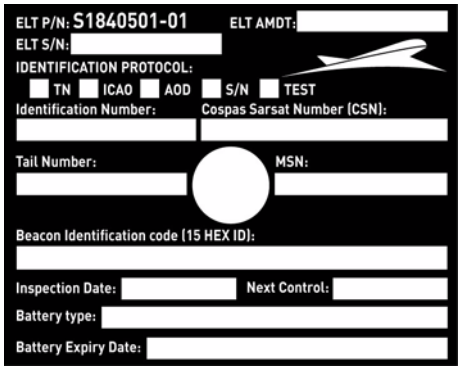


9.3.2. Identification and maintenance marking

The identification and maintenance markings give information on the battery (type, expiry date), the identification data programmed in the ELT (protocol, Identification number, Hexadecimal transcription of the Beacon Identification code) and and the aircraft registration (Tail number).

The identification and maintenance markings are updated by the maintenance station at:

- each battery change,
- each change of identification data.

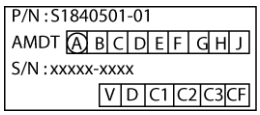


Marking on the lower part of the name plate, enables determination of the status of the equipment and some of its sub-assemblies. It gives information on (from top to bottom):

- P/N,
- Amendment,
- S/N: Serial number composed of manufacturing order (seven digits) + a dash + the order number in the manufacturing order (four digits), i.e xxxxxxx-xxxx,
- The number of evolutions since the production release,

Control Status (V = visual inspection, D = burn-in, C = control according to procedure XXX, CF = final control).

Figure 12: Example of production stamp



9.4. Programming

The ELTs are programmed in our factory:

- with a maintenance code if the distributor or the aircraft operator is equipped with programming equipment. Once installed the "Programming Data Sheet" shall be returned duly completed to MARTEC Serpe-Iesm, who is responsible for keeping its database up-to-date.
- with the aircraft identification data if neither the distributor nor the operator are equipped with programming equipment. In this case, the order must be sent with the "Programming Data Sheet" duly completed.

In any case, the operator is responsible for registration of his ELT with the "COSPAS-SARSAT point of contact for 406 Mhz beacon registration matters". The list is available upon request.

10.MAINTENANCE POLICY

The periodic inspection can only be carried out by an accredited PART or FAR 145 maintenance station.

10.1. Scheduled maintenance (recommendation only)

10.1.1. Periodic inspection

Note: (if required by the relevant Civil Aviation Authority).

Some Civil Aviation Authorities may require the ELT be tested periodically. In this case, MARTEC Serpe-Iesm recommends recommends checking the following:

- Proper installation.
- Operation of the controls and crash sensor.
- Transmitted signals.
- Battery corrosion.
  Note: Due to the technology used for our beacon and battery pack, any risks of corrosions beween two battery replacements can be excluded. However if this inspection is required by Civil Aviation Authority, this check is detailed in the installation and operation manual DOC06006.

This maintenance operation can be carried out without specific tools except a 50 ohm load and the VHF tune receiver of the aircraft.

10.1.2. Every 6 years

Testing of the following elements and parameters is mandatory every 6 years together with the battery replacement.

- Visual control of the housing and accessories
- Operation of the controls and crash sensor.
- Measurement of 406 and 121.5 MHz output power and frequencies.
- Verification of digital message (coding).

This maintenance operation can be carried out with at least a Cospas-Sarsat decoder capable of measuring output powers and frequencies, a 50 ohm load and the VHF tune receiver of the aircraft.

10.2. Battery replacement

Battery replacement is mandatory:

- after more than 1 hour of real transmission (cumulated duration),
- before or at the battery expiry date.

IMPORTANT: **Only original battery pack supplied with battery kit P/N S1840510-01 must be installed. The battery shall not be charged, thrown in fire, or short-circuited. It contains Lithium and is subject to special procedure before disposal.**

All necessary parts for battery replacement are available in:

- Battery Replacement Kit, BT200: P/N S1840510-01.

11.RELATED DOCUMENTATION

11.1. Files

Document	Reference	Distribution
Declaration of Design and Performance	DOC05268	ON REQUEST
Installation Manual / Operation Manual / Inspection Log	DOC06006	WITH EQUIPMENT
Component Maintenance Manual with Illustrated Parts List	DOC06005 25-63-03	WITH MAINTENANCE TRAINING
Programming data sheet	DIM00300	ON REQUEST
Sales leaflet	DOC06151	ON REQUEST

11.2. Drawings

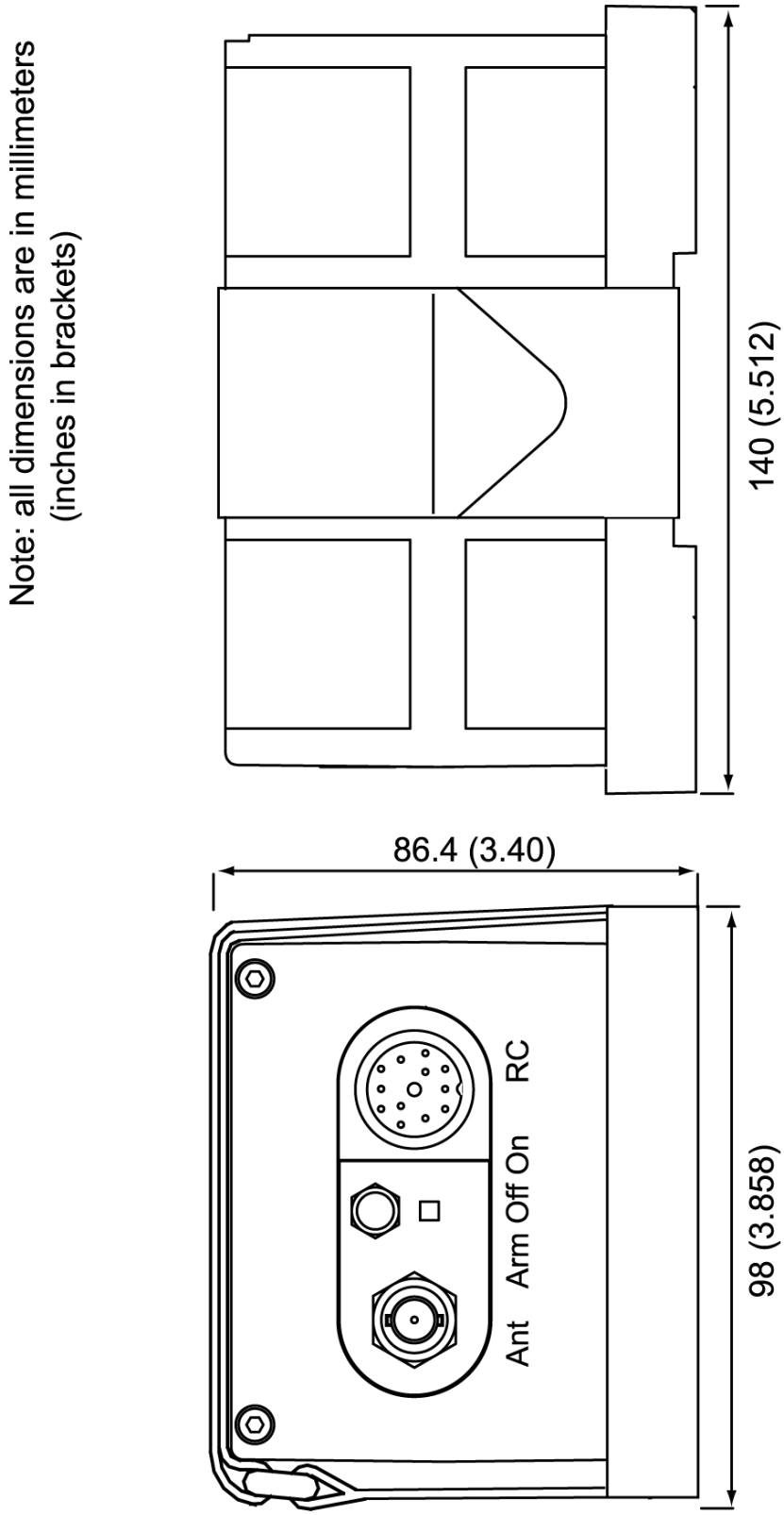
Document	Reference	Distribution
Outline Drawing	See Annex 1.	ATTACHED
Drilling mask	See Annex 2.	ATTACHED
Wiring diagram	See Annex 3.	ATTACHED
DIN 45321-12 receptacle	S18 20 4 14	ON REQUEST
DIN 45321-12 plug (mating connector)	S18 20 4 15	ON REQUEST

11.3. Qualification certificates

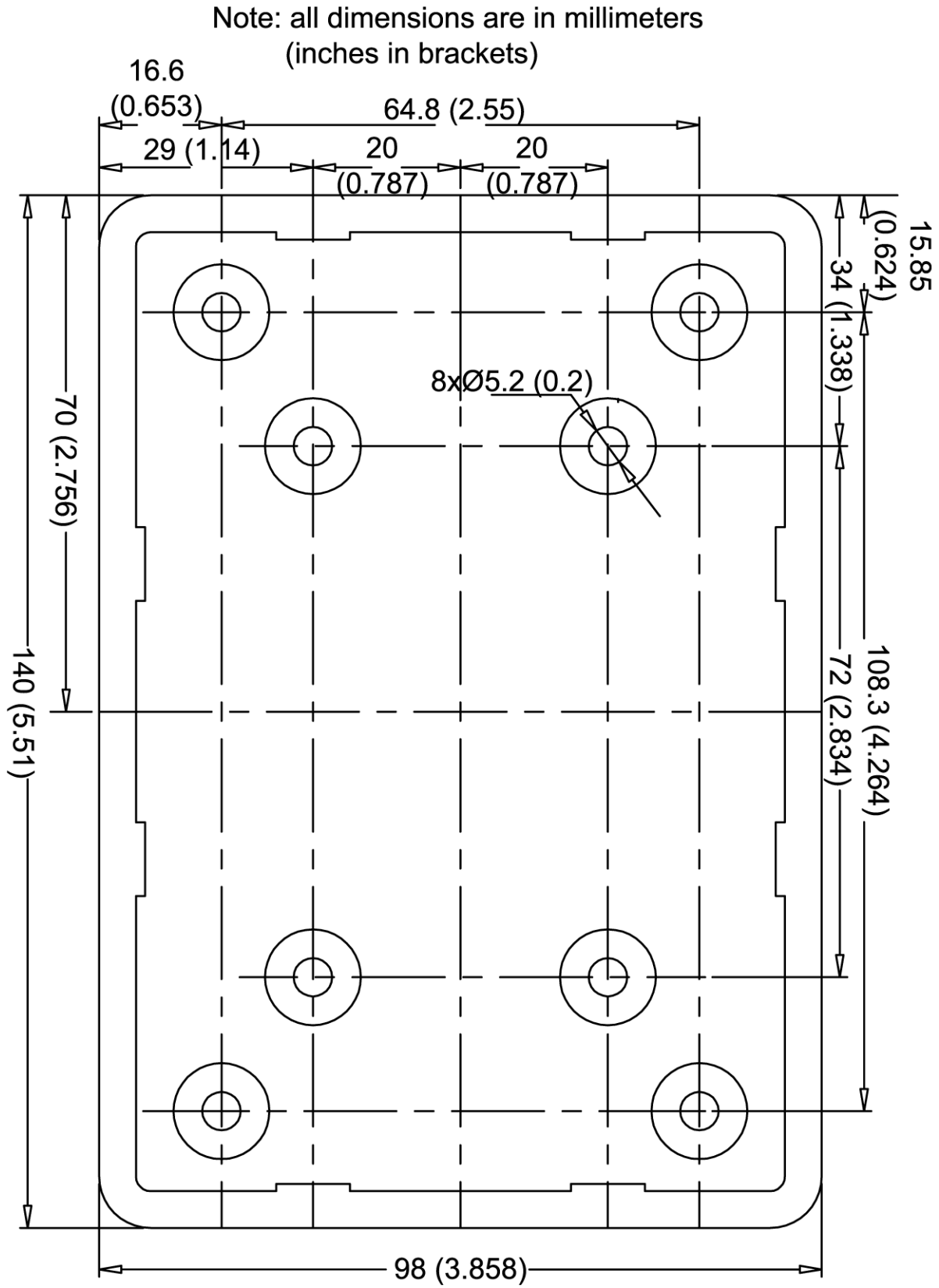
Document	Reference	Distribution
Production Agreement certificates (PRT21G)	FR21G.0132	ON REQUEST
Design Agreement certificates (PRT21G)	AP 058	ON REQUEST
COSPAS-SARSAT Type approval	N° 167	ON REQUEST
CS-ETSO 2C126, 2C91a	EASA.210.218	ON REQUEST

12.ANNEXES

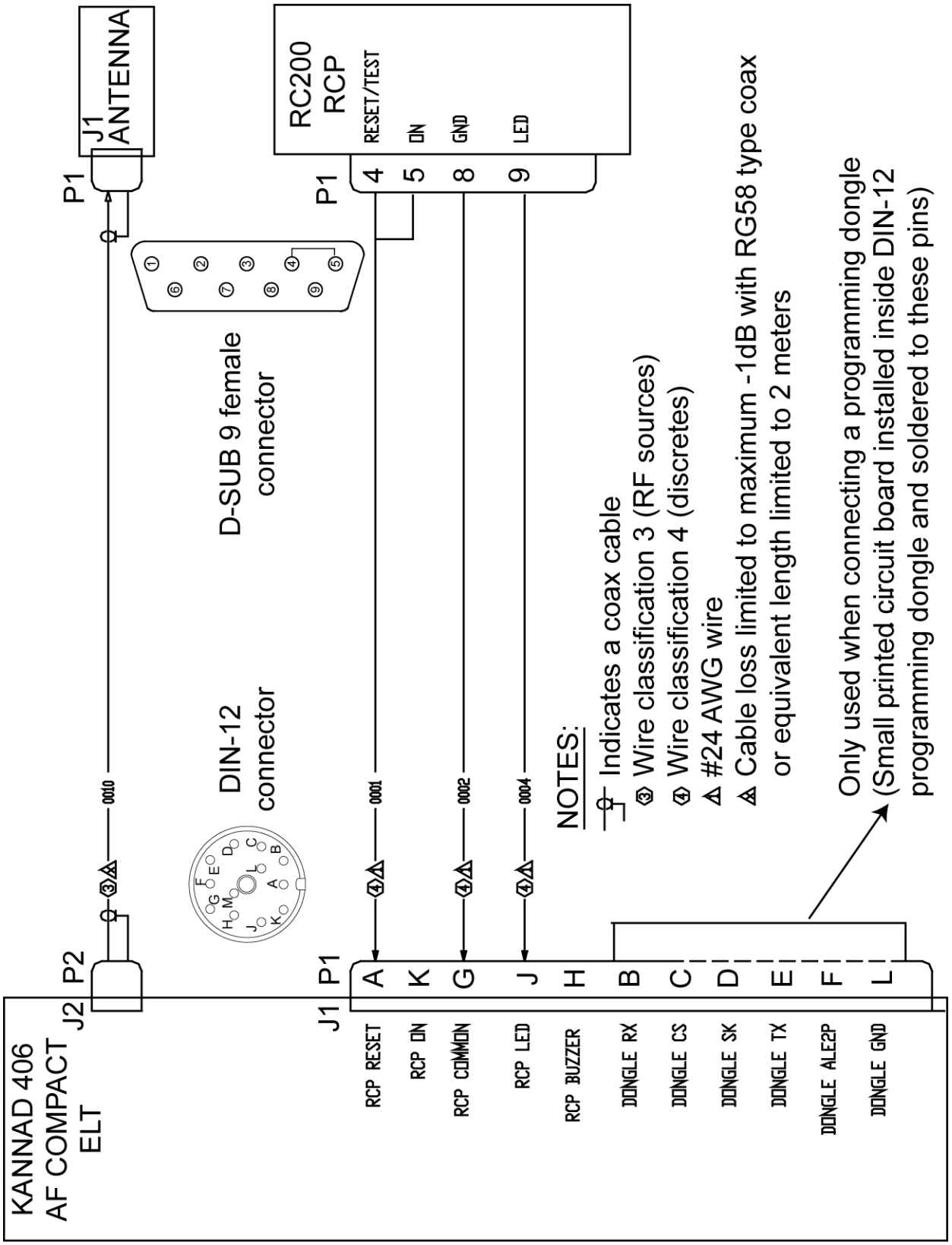
Annex 1.Outline Drawing



Annex 2.Drilling Mask



Annex 3.Wiring diagram



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