

SAFTEY OF FLIGHT TEST PROCEDURE for <LRU/SYSTEM Name> for <Platform Name>

Issue/Rev No: 01/00 Date of Release: 8 Feb 2025



	Document No.					
<design< td=""><td>Issue No./ Rev No. :</td><td><00X></td><td></td><td>lssi Da^r</td><td>ue te :</td><td><dd mm="" yyyy=""></dd></td></design<>	Issue No./ Rev No. :	<00X>		lssi Da ^r	ue te :	<dd mm="" yyyy=""></dd>
AGENCY	Copy No. :	01 of N		No Pa	. of ges :	< total no .of pages >
10002	Document		□Secr	et		Confidential
	Classification :		□Rest	ricte	ed 🗆	Unrestricted
Title:					Project/Sy	stem :
SAFTEY C	OF FLIGHT TEST PRO	DCEDU	RE		<system p<="" td=""><td>roject Name></td></system>	roject Name>
of <lru module="" name=""> for</lru>				LRU/Syste	m Part No.	
<pre></pre>				<no.></no.>		
				Critical Level		
						
	Name & Designation				Signature	
Prepared By	<design name="" rep=""> <agency name=""></agency></design>	, < De	esignatic	on>		
Deviewed De	<project leader="" nam<br=""><agency name=""></agency></project>	ie>, <de< td=""><td>esignatic</td><td>on></td><td></td><td></td></de<>	esignatic	on>		
Reviewed By	<awg hod="" nam<br="" qa=""><agency name=""></agency></awg>	G/QA HOD Name>, <designation> ncy Name></designation>				
Approved for Release By <project leader="" name="">, <designation> <design agency=""> <officer_name>, <designation> RCMA <name></name></designation></officer_name></design></designation></project>						
<design &="" address="" firm="" name=""></design>						

Checked By	Approved By	Doc No. <	Documen	t number
		Issue	Revision	Date
			Page	e No: 2 of 36

Disclaimer:

This document is a guidance document. Applicable section / table rows may be considered. Any additional details may be added. Any not applicable section/ table rows may be deleted. The template is very general and vary with process to process followed by Development Agency. The document may be fine-tuned with the TAA for finalization.

Checked By	Approved By	Doc No. <	Docume	ent number
		Issue	Revisio	on Date
			Ра	ge No: 3 of 36

Document Copy Distribution List

Copy No.	DESIGNATION OF THE COPY	ORGANISATION/DEPARTMENT
	HOLDER	
01	Design Group Head	Design Agency
02	RD	RCMA
03	RD	ORDAQA
04	HOD	QC/ AWG, Design agency
05	Coordinator	Customer

Amendment History

Issue	Issue Date	Brief	Change	Affected	Affected	Change Effective
No.		Description	Request	Pages	Section	From
		of	Ref.			
		Amendment				
001		Initial Issue	NA	NA		All
002						Unit sl.no. <aaa> or</aaa>
						Hw mod xx/ Sw ver
						x.x

Checked By	Approved By	Doc No. <	Document	number
		Issue	Revision	Date
			Page	No: 4 of 36

TABLE OF CONTENTS

1	Introduction	7
2	Purpose and Scope	7
3	System Description	7
4	Applicable Documents	7
5	Standards Reference	8
6	SOF Test Applicability	8
6.1	SOF Test Sequence	15
7	SOF test procedure:	16
7.1 7.2 7.2.1 7.2.2 7.2.3 7.3 7.3 7.3.1 7.3.2 7.3.3 7.4	Physical (Initial Visual) Examination COTS Screening Test High Temperature storage (stabilization bake) test Thermal shock Test Power Burn-In Environment Stress Screening (ESS) Tests: Pre-Thermal Vibration: Thermal Cycling Post-Thermal Vibration: Initial Ambient checks	16 16 17 17 17 17 18 19 19
7.5	Continuous Run	20
7.6	Power Supply Tests	20
7.6.1	Transfer operation test:	20
7.6.2	Reverse polarity protection test:	20
7.6.3	Emergency operation test:	21
7.0.4	Over voltage surge (Transient) test:	21
7.0.5	Under voltage surge (Transient) test.	21
7.6.7	Power failure test	$\frac{21}{22}$
7.6.8	Voltage distortion Spectrum	22
7.6.9	Ripple test	23
7.6.10	Starting voltage transient	23
7.7	EMI-EMC Tests	23
7.8	Vibration tests	23
7.8.1	Initial Resonance Search	24
7.8.2	Endurance test	24
7.8.3	Final Resonance check	26
7.9	CATH	26
7.10	Shock	28
7.11	Acceleration Test	29
/.12	SHOCK (Crash Safety)	30
1.13	kapia Decompression:	30

Checked By	Approved By	Doc No. <	Document	number
		Issue	Revision	Date
			Page	No: 5 of 36

ANNE	NNEXURE – II Compliance Report				
ANNE	XURE-I: Test sheets	35			
7.16	Final Ambient check:	32			
7.15	Gunfire Vibration	32			
7.14	Explosive Atmosphere Test:	31			

List of Acronyms:

Give all the Acronyms used in this specification Alphabetically

Checked By	Approved By	Doc No. <	Documen	t number
		Issue	Revision	Date
			Page	e No: 6 of 36

1 Introduction

Brief introduction to the overall functions of the system. (Not more than 1 page)

2 **Purpose and Scope**

This document establishes the Safety of flight Test Procedure for evaluating the performance of *System Name> <Part No.>* for *<platform>*.

The various stakeholders in the project are as follows:

Design Agency	<dlrl, barc="" etc="" hal,="" rci,=""></dlrl,>
Development Agency	<hal, bel,="" ecil="" etc=""></hal,>
Manufacturing Agency	<hal, bdl,="" bel,="" ecil,="" eliora="" etc=""></hal,>
Acquirer	<ada, ardc="" etc="" rwrdc,=""></ada,>
User	<iaf, army="" aviation,="" coast="" etc="" guard="" in,=""></iaf,>
Certification agency	<cemilac, etc="" rcma(hyd)=""></cemilac,>
Production Quality Control Agency	<ordaqa, etc="" msqaa,="" raqas=""></ordaqa,>

3 System Description

<Give a brief overview of system, project, for which this SOF testing is applicable. If FTP is not available for this system, describe the test setup covering simulators/ATE/Function generator / Testjigs/Oscilloscopes/Test Equipments connected to UUT that shall be used to verify the specifications and functionality of the UUT. Indicate the test setup in a figure>.

4 Applicable Documents

<All the applicable documents of the system such as Approved Tech spec, ICD, FTP, SOFT, MDI, BOM, aircraft environmental map etc., along with the document number, issue number and date of approval to be given here>

	Checked By	Approved By	Doc No. <	Document	number
			Issue	Revision	Date
	Page	No: 7 of 36			

5 Standards Reference

<All the related standards like MIL, DO, JSS Standards and CEMILAC Directives etc., on which the tests are based, should be given here>

1. The CEMILAC Directive no : Ref No: CEMILAC / 5390 / AW / 4 / Directives, Issue – 01, Dated: 13 Feb 2015

6 SOF Test Applicability

Sl. No	TEST AND	SEVERITY	Remarks
	STANDARD		
1.	Physical	Weight, Dimensions and compliance of unit	
	Inspection	with respect to engineering standards and	
		applicable drawings.	
2.	COTS screening on	1) High temperature storage (stabilization	1) 24 Hrs Duration
	PCBs	bake)	After test UUT testing
	• PCB and UUT words are	At +85°C bake the PCB	at Ambient.
	interchangeable	2) Thermal Shock	2) UUT OFF condition
		Stabilized low temp -40°C for 30 min.	If any components fail,
	Ref :	Stabilized High temp +85°C for 30 min.	the baking and thermal
	CEMILAC/5390/1 Dated 10-01-2014	2 min transfer operation 1 cycle. 10 such	shock should be
		cycles	repeated on
	Sec 2.2, 2.4 and 2.6		component.
		3) Power Burn in test	
		At maximum rated operating temp PCB	3) Last 3 Hrs should be
		shall be maintained with power ON for	defect free.
		components with those which have	In case failure observed
		undergone bake and thermal shock.	during 46/ 47/48 Hrs.
			expose PCB for further
			3Hrs.
3.	ESS	1) Pre-vibration	1) Pre and post
		2) Thermal Cycling (10 cycles)	vibration duration is
		3) Post vibration	5min.

Checked By	Approved By	Doc No. <document number<="" th=""><th>number</th></document>		number
		Issue	Revision	Date
			Page	No: 8 of 36

							2)	The la	st 3 cycles of	
							the	rmal c	ycling should	ł
							be o	defect	free.	
							3) I	Pre an	d post	
							vib	ration	duration is	
							5m	in.		
4.	Initial An	nbient	FTP at nom	inal voltage						
	Checks									
5.	Continuo	us Run	Verification	n of Unit operati	on through	out the	4 h	rs		
			period at an	nbient temperatu	ure.					
6.	Power Su	pply		DC	AC		a)F	unctic	nal checks	
@	Variation		a) Norma	l Steady State			(at	least	30 min)	
	MIL-STD	-704F	LDC 102	V	108 - 11	8V& 7H7				
	Table IV	Fig 13, 15		v	SAC 102					
	(DC)		h))/oltaga	SAC 106, 107		, 107 &	b) Not less than 5mir operation at each frequency.		ss than 5min	
	Table I F	ig. 3,5,6	LDC 103	3	108				y.	
	(AC)		Table –	II						
			c)Total Rig	SAC 1		& 105	c)N	ot les each te	s than 30 min est condition.	1
			LDC 104 T	able II	Voltage and frequency modulation					
			d)Normal	Voltago			d)T	he tra m 20 t	nsients are	
	Fig. 14 (D	C)	transient.	voltage			end and to 18 in low		to 18 in low	
	Fig. 4 (AC	C)	LDC-105		Voltage	and	enc	1.		
			LDC -105-I Test condi	II tions AA-RR	frequen	су				
					transien	ts	e) #	‡ cont	inued	
			e)Transfer	operation:	Table-II	A-L	ope	eratio	n without	
			Table-II	1			on	user r	eq.	
					100 - 12	5V &				
	Sec 5 3 2 3		f) Abnorm	al Steady	380 - 42	0 Hz.	t) L	DC-30 t case	1 s 30 min	
		-	LDC-301		SAC 301	Table III	ope	eratio	n in min.	
<u> </u>		Check	ed Bv	Approve	d Bv	Doc No. <	Docu	ment	number	1
			1		1		Rev	vision	Date	-
						13346	Nev	131011	Date	_
								Page	No: 9 of 36	-

							Page	No: 10 of 36
						Issue	Revision	Date
		Check	ked By	Approved	Ву	Doc No. <	Document	number
	Ref: CEMILA AW / 4 / I	C / 5390 / Directives,	* 5 Hz t	to 500Hz and bac	k to 5Hz	@0.5g	*Rotary	wing
7.	Vibration		a) Resonat	nce search:			a) Unit (DFF
							snould no	ot cause
			m) Reverse LDC-602 Ta	polarity ble-I	SAC 603		m) Phase	reversal
			l) Power Fa Table LDC-6	ilure: 601-I and II	SAC 601 Table-II /	A-to-D		
			k) Starting v LDC-501 Ta Test conditi	voltage transient Ible-III on AA	t		k) Test to 5 times.	be repeated
			J)Emergen 16V (DC)* LDC-401 Ta	cy Operation: * able –II	SAC 40: Table-	L 	j) ** If re user. 12V for 15 mi engine st	quired by ' DC operatior n. during art.
			I) Combine LDC-302 Ta (LLL to NNI	d voltage surge: ble –IV N)	SAC 30 OO con	2 Table III dition.	I) LDC-30 Test case times.	2 s repeated 5
			LDC-302 Ta	able –IV (GGG	AA-00, I	111-ININ		
			h)Under v 0V for 7 se 20V till 100	oltage surge: c) sec	0V for 7 : 100V till SAC 302	sec 100 sec Table III	h) LDC-30 Test case times.)2 s repeated 5
			g) Over vo 50V for 0.0 Reduce to 31.5V till 1 LDC-302 Ta to FFF)	Itage surge: 05s 31.5V in 7.7s 00 s able –IV (AAA	180V for Reduce t in 6.9s 125V till SAC 302 AA-GG	r 0.05s o 124.5V 100 s Table III	g) LDC-30 Test case times.)2 s repeated 5
	Sec 5.1		Table –I & Min : 30m Operation	ll inutes				

Page No: 11 of 36

	Section 2.	5.7.2	30 min @ N	/lax Alti	tude	*ON	1)	The	condition of	
			30 min ram	p to GN	D Altitude	ON		TOF	I and low	
			30 min Ran	30 min Ramp from TOL to $+43^{\circ}$ C				press	sure can be	
			And RH from Ambient to 95% RH ON				remo	oved based on	1	
			$1 Hr + 43^{\circ}$	1Hr +43°C 95%RH (*last 30 min) *ON				the p	olatform	
			30 min Ran	np from	$+43^{\circ}C$ to TOH			requ	irement.	
			And RH fro	om 95%	to Ambient		2)	If CA	ATH is done	
			1Hr @ TOP	I and R	H 30%	* ON		then	tests 14,15, 1	.6
			10 min ram	p from T	TOH to TSH	OFF		& 17	' need not be	
			2Hr soak @	TSH		OFF		done	2.	
			10 min ram	p from T	FSH to TOH	OFF	TS	H-Hig	h Storage	
			1Hr Soak @	DOH		OFF	Ter	mp.		
			1Hr Soak @	9 TOH(*	*last 30 min)	*ON	TS	L-Lov	v Storage	
			30 min ram	p to Ma	x Altitude	ON	Ter	mp.		
			1Hr @ TOP	H and M	ax Altitude	*ON	ТО	H-Hig	gh Operating	
			30 Min ram	p from			Ter	np.		
			TOH to Am	nbient ar	nd		ТО	L-Lov	w Operating	
			Max Altitud	le to GN	ID Altitude	ON	Tei	mp.		
9.	Functiona	al Shock	20g sawtoo	th/15g h	alf sine,		3 sl	hocks	in each of 6	
			11mSec Pu	lse widtl	h		dire	ection	S.	
							Un	it ON.		
10.	Accelerat	ion	Stru	ct -A/c	Heli		The	e Unit	should be in	
			Fore 3.0)g	4.0g		OF	F con min	dition. along eac	۰h
			Aft 9.	0g	4.0g		dire	ection	along cae	/11
			Up 13	.5g	10.5g					
			Down 4.5	5g	4.5g		Th	nis t rriad	est can b)e
			Lat(L) 6.0)g	6.0g		up	unit		.κ
			Lat(\mathbf{R}) 6.	0g	6.0g		1			
11.	11. Shock (Crash Safety)		40g saw too	oth/30g 1	half sine		3 sl	hocks	in each of 6	
	Ref:		11mSec Pu	lse widtl	h		dire	ection	S.	
		Check	ed By	A	pproved By	Doc No. <	Docu	ment	number]
						Issue	Rev	vision	Date	
										-
								Page	No: 12 of 36	1

	CEMILAC / 5390 / AW / 4 / Directives, Issue – 01, Dated: 13 Feb 2015 Section 2.5.10.1			Unit OFF. This test can be done on mock up unit.
12.	Rapid Decompression	Temp=Ambient, Altitude=Ground		Hold at Max Alt for 10
	MIL-STD-810G sec 4.5.4 Page 505.5-6	Adjust chamber pressure to Altitude=2.5H Reduce the pressure to Altitude=Ceiling A In not more than 15 seconds, Hold for 10 Come to ambient conditions with pressure 10m/s and temperature rate 3°C/min.	Km Alt. min e rate	Min. Unit ON
13.	Explosive	N-hexane reagent grade fuel to be used. 3	.8%	An explosive test shall
	Atmosphere	fuel by volume in test atmosphere. (Air to	1	be carried out to
		vapour ration of 8.33 by weight)		determine the ability of
		Altitude : (maximum ceiling altitude) or 4	0000	the equipment to either
		ft + 2000 ft. reduce at 100 Mts/ min to Ambient		operate in fuel – air
		ground altitude.		atmosphere without
		Temperature: 71 °C (Highest operating temp)		causing ignition and /
		Verify the explosiveness of the vapour mi	xture	or for verifying
		by trying to ignite a sample in another cha	umber	containment of an
		or use calibrated explosive gas meter.		explosive or burning
		Attempt operation of the equipment at 400	000 ft.	reaction of encased unit
		Note the altitude at start of correct operation	on.	
		At ground altitude conduct performance c	heck.	
14.	Gunfire Shock	As per distance 0-180 cm, $2.2 - 0.034 \text{ g}^2/$	Hz	7 min/axis. Unit ON.
				This can be carried out
				on Mock-up.
15.	High Temperature	6 Hr Soak @ Ambient	OFF	24 Hr cycle
	Storage cum operation	3Hr ramp from Ambient to TOH	OFF	3 such cycles.
	x · · · · · · · · ·	2Hr Soak @ TOH	OFF	TSH-High Storage
		2Hr30 min ramp TOH to TSH	OFF	Temp.
		2Hr Soak @ TSH	OFF	TOH-High Operating

Checked By	Approved By	Doc No. <document number<="" th=""><th>number</th></document>		number
		Issue	Revision	Date
			Page	No: 13 of 36

		1Hr 30 min Ramp TSH to TOH	OFF	Temp.
		2Hr Soak @ TOH	ON	
		3Hr Soak @ TOH (Last 30 min)	*ON	
		3Hr ramp from TOH to Ambient	ON	
16.	Low Temperature	Ambient	ON	1 cycle.
	Storage cum	3 [°] c/Minute ramp from Ambient to TSL	OFF	TSL-Low Storage
	operation	2Hr Soak @ TSL	OFF	Temp.
		3 [°] c/Minute ramp TSL to TOL	OFF	TOL-Low Operating
		1Hr Soak @ TOL	OFF	Temp.
		1Hr Soak @ TOL	ON	
		3 [°] c/Minute ramp TOL to Ambient	ON	
17.	Humidity	$30 \ ^{0}$ C to $60 \ ^{0}$ C in 2 Hrs with 95% RH		3 cycles.
		Soak at $+60$ ⁰ C for 6 Hrs with 95% RH		Unit OFF.
		(This is the most severe humid condition)		Unit ON during last 30
		Mil-std 810G sec 2.3.2 c)		min of the last cycle.
		+60 0 C to +30 0 C in 8 Hrs with 85% RH		
		Soak at $+30$ ⁰ C for 8 Hrs with 95% RH		
18.	Low Pressure	Ambient Alt pressure (performance Chec	k)	1 cycle.
		switch OFF the unit.		
		Ramp from Ambient to Max Alt pressure	@ 10	*Performance check
		min/sec.		during last 30 min.
		2Hr @ Max Alt pressure	*ON	
		Ramp from Max Alt to Ambient pressure	@ 10	
		min/sec		
19.	EMI/EMC	CE101, 102,106		Unit ON.
	MIL-STD-461F	RE101,102, 103		
		(Either CE106 or RE103, as applicable)		
			6	
20.	Final Integration	Integration of the Unit with external inter	taces	
		and verification of functional requirement	ts.	

Checked By	Approved By	Doc No. <document number<="" th=""><th>number</th></document>		number
		Issue	Revision	Date
			Page	No: 14 of 36

21.	SW IV & V	Verification of S/W by independent team as per	
		applicable Standard.	

Note: If CATH test is carried out, High temperature, Humidity, Low temperature and altitude tests need not be done.

6.1 SOF Test Sequence

The SOF test clearance consists of the following tests:

- 1. Initial visual examination
- 2. Measurement of weight and physical parameters
- 3. COTS screening test
- 4. Environmental Stress Screening (ESS)
- 5. Initial Ambient checks
- 6. Continuous run test
- 7. Environmental and EMI/EMC tests are in the order as shown in the table below.

Sl. no.	Test	Preferable sequence to carry out the test
1.	Power supply variation	Before all other, since component changes are
2.	EMI/EMC	expected
3.	Vibration	After Power supply variation
4.	Gunfire shock	After Vibration, mechanical and thermal shock
5.	Acceleration	After high temp
6.	Crash safety	After high temp
7.	High Temp	After dynamic tests
8.	Low temp	After dynamic tests
9.	Low Pressure	After dynamic tests
10.	САТН	Before Humidity
11.	Humidity	After dynamic tests.
12.	Explosive Atmosphere	After fungus, humidity, salt fog
13.	Rapid decompression	After climatic tests
14.	Functional shock	After vibration and thermal tests

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revisio	n Date	
			Pa	ge No: 15 of 36	

The procedure for each of the above tests is indicated in the section 7.0. Qualification test clearance shall be obtained based on the compilation of test report and preparation of compliance chart.

7 SOF test procedure:

7.1 Physical (Initial Visual) Examination

- a) The Unit shall be examined along with components and modules to determine the compliance with requirements of Engineering Standards and applicable drawings as per MDI document.
- b) The equipment shall be inspected for type/part number, serial number etc.
- c) The Unit and sub-modules shall be examined visually and any damage or fault noted should be reflected in the physical inspection report. This may include defects in construction, presence of foreign bodies, moisture, dust etc., and corrosion of materials/ finish distortion or mechanical imperfection.
- d) The weight and dimensions shall be measured and recorded as specified in the Technical specifications.

Any item, which does not meet this requirement, shall be rejected and recorded.

7.2 COTS Screening Test

The following tests are carried out as per "Screening Procedure for COTS components", "Appendix A" to CEMILAC/5390/1 Dated: 10th Jan 2004" PART B.

7.2.1 High Temperature storage (stabilization bake) test

Temperature: $+85^{\circ}C \pm 5^{\circ}C$

Duration: 24 Hours

Power: OFF

Test Procedure: Check the performance of the module in standalone mode. Keep the module in a thermal chamber. Set the temperature of the chamber to +85°C and bake it for 24 Hours without energizing the module. Check the performance of the module after the bake test as per Annexure *<give test sheet reference>*

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revisio	n Date	
			Pa	ge No: 16 of 36	

7.2.2 Thermal shock Test

Low Temperature: -40°C± 5°C Duration: 30 minutes

High Temperature: +85°C± 5°C Duration: 30 minutes

Number of cycles: 10

Transfer time: 2 minutes

Operation: OFF condition

Test Procedure: Place the module in a chamber which is maintained at a temperature of $+85^{\circ}$ C and keep it for 30 minutes, change the module to a cold chamber which is maintained at a temperature of -40° C and keep it for 30 minutes. Repeat the process 10 times. Check the performance of the module after the thermal shock test as per *<give test sheet reference>*

7.2.3 Power Burn-In

Temperature: The highest operating temperature TOH of UUT.

Duration: 48Hrs

In case of component failure, the components to be replaced with the components which have undergone baking and thermal shock. If the failure occurs during $46^{\text{th}}/47^{\text{th}}/48^{\text{th}}$ Hrs, then the repaired unit is subjected to 3Hrs extra after completion of 48Hrs to confirm the adequacy of the repair.

7.3 Environment Stress Screening (ESS) Tests:

7.3.1 Pre-Thermal Vibration:

The pre thermal vibration is to be carried out in all the three axes as per following specifications and profile in figure 1.

Frequency	Level
20 Hz to 80 Hz	3 db/Octave rise (+ 3 dB/Oct)
80 Hz to 350 Hz	0.04 g² /Hz
50 Hz to 2 K Hz	3 dB/Octave roll off (-3 dB/Oct)

Duration: 5 Min/ Axis

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		lssue	Revision	Date	
			Page	No: 17 of 36	



Figure 1: ESS Vibration profile

Test setup: The UUT is mounted on the vibration with similar fixture as in the platform.

Test Procedure:

Fix the mounting plate on the vibration stand. Fix the UUT on the plate with the help of suitable tools. Switch ON the equipment and Apply random vibration for 5 min in 3 axes with equipment in ON condition. Verify and record parameters in test sheets <*give test sheet reference* >

7.3.2 Thermal Cycling

Severity: -40°C to +65°C as per Fig (Thermal Cycling profile)

Test setup: The UUT shall be kept inside the temperature chamber.

Test Procedure and performance:

Thermal cycling consists of 10 nos. of COLD-HOT cycles as per figure 2. The last three cycles should be defect free. The procedure for thermal cycling is as follows.

- (a) The equipment shall be kept in calibrated temperature chamber.
- (b) With unit in OFF condition, raise the chamber temperature to $+65^{\circ}$ C.
- (c) Soak the unit to this temperature for 60 minutes.
- (d) Lower the chamber temperature to -40° C.
- (e) Soak the unit to this temperature for 60 minutes.
- (f) Switch ON the unit.

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revision	Date	
			Page	No: 18 of 36	

- (g) Monitor and record parameters.
- (h) Raise the chamber temperature to $+65^{\circ}$ C.
- (i) Soak the unit to this temperature for 60 minutes.
- (j) Monitor and record parameters.
- (k) Switch off the unit.

Above steps (d) to (k) constitute one cycle. Remaining cycles have to be carried out same as above.

(I)Rate of change of temperature: During thermal cycling, the rate of change of temperature shall be at the rate of min 5° C/ minute.

Verify and record parameters in test sheets < give test sheet reference>



Figure 2: Thermal cycle profile

7.3.3 Post-Thermal Vibration:

Same as Sec 7.3.1.

7.4 Initial Ambient checks

The equipment shall be tested for complete performance / functional checks exercising the software residing in the equipment at nominal power supply voltages at ambient temperature. Any defects observed during inspection / performance checks shall be recorded and necessary corrective action initiated to eliminate the same.

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revision	Date	
			Page	No: 19 of 36	

7.5 Continuous Run

Temperature: Ambient temperature

Duration: 4 Hours

Power: ON

Test Procedure:

The equipment shall be kept powered 'ON' continuously for 4 hours at ambient temperature with nominal power supply voltage. Performance Checks are to be carried out during the test. On completion of burn-in, the equipment shall be subjected to visual examination and Check the performance of the module and record the parameters as per < *give test sheet reference* > **Note-2**: The 4 hours duration has been arrived at by considering the approximate maximum trial duration of single flight of aircrafts and helicopters. This may be tailored for 1.5 times the

maximum mission duration.

Check the performance of the module at 5th hours period and record the parameters as per < give test sheet reference >

7.6 **Power Supply Tests**

Power supply tests are as per MIL-STD-704F.

7.6.1 Transfer operation test:

During transfer operation test,

- Set supply voltage to 28V DC followed by
- Switch Power supply to zero volts for a period of 50msec followed by switch back to 28V.

<Specify whether the unit is expected to continue operation during the power supply micro-cut or reset-and-restart is allowed>. The transfer of operation voltage test must be performed as per the MIL-STD-704-8 LDC201.

7.6.2 Reverse polarity protection test:

During the reverse polarity protection test, reverse the negative and positive connections of the 28 V power supply to the unit. The unit shall not be damaged. Check the performance after correcting the connections. The reverse polarity test must be performed as per the Mil-Std 704-8 LDC 602.

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revision	Date	
			Page	No: 20 of 36	

7.6.3 Emergency operation test:

Set the power supply at 16VDC (Emergency condition) and carry out the selected functional checks at extreme voltages as per FTP/ATP for at least 10 minutes and record the parameters as per *<give test sheet reference>*. The emergency operation test must be performed as per the MIL-STD-704-8 LDC401.

7.6.4 Steady State Normal and Abnormal Voltage tests:

1. Connect the UUT and the power supplies for the readiness of the test.

2. Set the supply voltage to 22VDC and carry out the selected functional checks as per *<give test sheet reference>* at extreme voltages as per FTP/ATP for at least 30 minutes. Repeat the test with 29VDC. The steady state normal voltage test must be performed as per the MIL-STD-704-8 LDC102. The normal voltage transients should be carried as per LDC 105.

3. Set the supply voltage to 20VDC and carry out the selected functional checks as per *<give test sheet reference>* at extreme voltages as per FTP/ATP for at least 30 minutes. Repeat the test with 31.5VDC. The steady state abnormal voltage test must be performed as per the MIL-STD-704-8 LDC301.

7.6.5 Over voltage surge (Transient) test:

During over voltage test vary the supply voltage from 28VDC to 50 VDC. Hold at 50 V for 50 ms, bring it back to 31.5V in 7.7s and hold it at 31.5V as shown in figure 3. Carry out the selected functional checks at steady state voltage as per FTP/ATP and record the desired parameters as per *<give test sheet reference>*. The over voltage surge test must be performed as per the MIL-STD-704-8 LDC302.

7.6.6 Under voltage surge (Transient) test:

During Under voltage test vary the supply voltage from 28VDC to 0V within less than 1 ms, and hold it for 7sec and in less than 1 ms bring it to 20VDC as shown in the figure 3. Unit shall not be damaged. Carry out the selected functional checks at extreme voltages as per FTP/ATP and record the desired parameters. The under voltage surge test must be performed as per the MIL-STD-704-8 LDC302.

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revision	Date	
			Page	No: 21 of 36	

7.6.7 Power failure test:

The power failure test must be conducted to see the unit functionality under failure conditions. The test must be performed as per the MIL-STD-704-8 LDC601. Figure 3

Test Condition	Duration of Power Failure
А	100 msec
В	500 msec
С	3 seconds
D	7 seconds

TABLE LDC601-II. Test conditions for power failures.





7.6.8 Voltage distortion Spectrum

This is to verify whether the equipment operates and maintains specified performance when subjected to voltage distortion of frequencies and amplitudes. The test must be performed as per Mil-Std 704-8 LDC 103.

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revisior	Date	
			Pag	e No: 22 of 36	

7.6.9 Ripple test

Sl. no.	Test	Applied to	Frequency Range
1.	CE101	Power leads	30 Hz to 10 kHz
2.	CE102	Power leads	10 kHz to 10 MHz
3.	CE106 *	Antenna Terminals	10 kHz to 40 GHz
4.	RE101	Magnetic field	30 Hz to 100 kHz
5.	RE102	Electric field	10 kHz to 18 GHz
6.	RE103 *	Spurious and harmonics	10 kHz to 40 GHz

This is to verify whether the equipment operates and maintains specified performance when subjected to voltage having ripples. The test must be performed as per Mil-Std 704-8 LDC 104.

7.6.10 Starting voltage transient

This is to verify whether the equipment operates and maintains specified performance when the unit is started and transients are expected. The test must be performed as per Mil-Std 704-8 LDC 501.

7.7 EMI-EMC Tests

The following EMI/EMC measurements shall be as part of full qualification tests. There shall be no repetition of these tests on subsequent models of the equipment, unless the equipment is redesigned or major modification is carried out.

The list of EMI/EMC tests to be conducted on the unit are given in Table 1 as per MIL-STD-461F.

<The tests sl.no. 1, 3, 5, 6, 7, 8, 9, 13, 15, 16 and 18 are applicable selectively. Depending on the applicability, these tests may be removed from the table>

Table 1: EMI/ EMC applicable tests

* - Either CE106 or RE103 may be carried out as applicable

7.8 Vibration tests

This test shall be carried out to verify the capability of equipment to meet the vibration stresses. This test consists of three parts:

- i. Initial Resonance Test
- ii. Endurance Vibration Test
- iii. Final Resonance Test

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revision	Date	
			Page	No: 23 of 36	

7.8.1 Initial Resonance Search

Initial Resonance test shall be carried out as per Table-2. After completion of this test carry out the performance checks.

Equipment	Resonance Search at 0.5g from 5 Hz to 500 Hz with equipment in 'OFF'
mounted on	condition shall be carried out. The test will be conducted with the test item
Rotary Wing	mounted as is in the platform. Record the resonance frequencies (ratio > 2)
Platform	observed. These frequencies should not coincide with the platform
	fundamental frequencies and their harmonics.
Equipment	Resonance search at 0.5g from 5 Hz to 2000 Hz with equipment in 'OFF'
mounted on	condition shall be carried out. The test will be conducted with the test item
Fixed Wing	mounted as is in the platform. Record the resonance frequencies (ratio > 2)
Aircraft	observed. These frequencies should not coincide with the platform
	fundamental frequencies and their harmonics.

Table-2: Resonance Tests

7.8.2 Endurance test

Vibration endurance test shall be 15 minutes per axis in all three axes.

- i. For Rotary wing aircraft the profile shall be as per Figure-4. The values of W₀, W₁, f_x, A₁...A₄ shall_be derived from TABLE 514.5C-IV of MIL-STD-810F.
- ii. For Fixed wing Propeller aircraft the profile shall be as per Figure-5. The values of L_0 , f_x , shall be derived from Table 514.5C-II.of MIL-STD-810F.
- iii. For Fixed wing Jet aircraft the profile shall be as per Figure-6.

The equipment shall be kept ON during the endurance vibration test with performance checks. On completion of the vibration test the complete performance checks shall be carried out







7.8.3 Final Resonance check

Final resonance search (similar to Initial Resonance search) shall be carried out after endurance test, even if there was no resonance found during initial resonance search. Any deviation (more than 10%) in the resonances from the initial resonance search or any resonance noticed should be recorded and corrective action taken to eliminate the same. At the end of the vibration test, Visual Examination and Performance Check shall be carried out.

7.9 CATH

This test shall be carried out to verify the capability of the equipment to meet the combined effect of the temperature, humidity and altitude. The equipment shall be subjected to this combined

Checked By	Approved By	Doc No. <	Documen	t number
		Issue	Revisior	Date
			Pag	e No: 26 of 36

environment as shown in **Figure - 7** below for 01 (one) cycle. High and Low Temperature (TOH, TOL, TSH, TSL) and Altitude (Max Alt) severity levels shall be decided based on the equipment specification / platform / field data. The equipment shall be powered 'ON' during the test and Performance checks carried out as shown in profile. At the end of the test carry out Visual Examination and Performance Checks.

Note-6: The Combined Temperature / Humidity / Altitude test shown in **Figure - 7** is for a typical fighter aircraft. For propeller aircraft/helicopters with very low Rate of Climb/Rate of Descent; the altitude, temperatures may be tailored based on the platform requirements and the requirement of combined high temperature/low pressure may be removed.

Note-7: Though, the combined Temperature / Humidity / Altitude test is the recommended method for avionics equipment, in case of non-availability of CATH facility, then temperature, altitude and humidity tests may be carried out separately as per the profiles given at Figure 8,9 10 & 11. (Figure shown constitute one cycle each). 03 such cycles each shall be carried out for high temperature and humidity test. One cycle each shall be carried out for low temperature and altitude test.



7.10 Shock

This test shall be carried out to verify the capability of the equipment to meet the mechanical shock requirements of the platform. The equipment shall be subjected to three shocks each of 20g saw tooth / 15g half sine pulse of 11 milliseconds duration in all six directions in ON condition.

Checked By	Approved By	Doc No. <	Document	number
		Issue	Revision	Date
			Page	No: 28 of 36

At the end of the shock test Visual Examination and Performance Check shall be carried out. The mounting arrangement / assembly shall be intact and equipment shall perform without degradation.

7.11 Acceleration Test

The severity levels are as given below:

ACCELERATION LEVEL	STRUCI	TURAL
	Aircraft	Helicopter
Fore	3.0g	4.0g
Aft	9.0g	4.0g
Lat (L)	6.0g	6.0g
Lat(R)	6.0g	6.0g
Up	13.5g	10.5g
Down	4.5g	4.5g

- 1 Directions with respect to the aircraft axis.
- 2 If mounting orientation of the equipment in the aircraft is not known, test shall be done at maximum value in all directions.
- 3 For other platforms Refer MIL-STD-810 or actual platform requirements.

Duration: One min dwell in each direction after following the centrifuge stabilization.

Direction: Three mutually perpendicular axes in two opposite directions along each axis.

Test Procedure:

- 1. After the UUT is mounted on the acceleration test setup, bring the centrifuge to the speed required to induce the specified g level. Maintain this g level for at least one minute after the centrifuge rpm has stabilized.
- 2. Stop the centrifuge and inspect the UUT for structural deformities/ cracks etc.
- 3. Repeat steps 1 & 2 for the remaining five test directions
- 4. Upon completing the tests in the six test directions, remove the UUT from the centrifuge and perform physical inspection and operational check.

Verify and record parameters in test sheets <*Refer the test sheets* >

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		Issue	Revision	Date	
			Page	No: 29 of 36	

7.12 SHOCK (Crash Safety)

This test shall be carried out on cockpit and cabin mounted equipment to verify the capability of the equipment to withstand the Shock (Crash Safety). A mock-up of the equipment may be used for this test. The equipment shall be subjected to one shock each of 40g saw tooth / 30g half sine pulse of 11 milliseconds duration in all six directions in OFF condition. At the end of the shock test visual Examination shall be carried out. The mounting arrangement / assembly shall be intact

Direction: Three mutually perpendicular axes in two opposite directions along each axis.

Test Procedure:

- 1. Install the UUT on acceleration test setup and bring the centrifuge to the speed required to induce the specified g level above. Maintain this g level for at least one minute after the centrifuge rpm has stabilized.
- 2. Stop the centrifuge and inspect the UUT
- 3. Repeat this test procedure for the other test directions
- 4. Upon completing the tests in the six test directions, inspect the UUT

Verify and record parameters in test sheets < *Refer the test sheets* >

7.13 Rapid Decompression:

This test shall be carried out on equipment mounted in pressurised area such as cockpit / cabin to verify the capability of the equipment to meet the Rapid Decompression due to rapid change in pressure.

Test Procedure:

- With the UUT in the storage or transit configuration (Unit OFF), install it in the chamber and adjust the chamber air pressure at a rate not to exceed 3°C/min (to the cabin altitude (2,438m (8,000 ft)
- Reduce the chamber air pressure to 18.8 kPa (2.73 psi) corresponding to 12,192m (40,000 ft) in not more than 15 seconds. Maintain this stabilized reduced pressure for at least 10 minutes. The equipment can be kept OFF during this period.

Checked By	Approved By	Doc No. <	Docun	nent	number
		Issue	Revi	sion	Date
				Page	No: 30 of 36

- 3. Adjust the chamber air to standard ambient conditions using a pressure change rate not greater than 10m/s, and a temperature change rate not to exceed 3°C/min
- 4. Verify and record parameters in test sheets <*Refer test sheets*>

7.14 Explosive Atmosphere Test:

An explosive test shall be carried out to determine the ability of the equipment to either operate in fuel – air atmosphere without causing ignition and / or for verifying containment of an explosive or burning reaction of encased unit. The test may be performed based on Method 511.4 of MIL-STD-810F.

Test setup:

For UUT thermal stabilization measurements, install thermocouples on the most massive functional part of the UUT, and two thermocouples attached to the inside the of test chamber to detect any temperature increase due to burning of the mixture.

Test Procedure:

Procedure I - Operation in an explosive atmosphere.

- 1. With the UUT installed, seal the chamber and stabilize the UUT and chamber inner walls to the $+71^{\circ}C$ ($\pm 2^{\circ}C$).
- 2. Adjust the chamber air pressure to simulate the highest operating altitude of the UUT (not to exceed 40,000 ft) plus 2000 meters (6600 ft) to allow for introducing, vaporizing, and mixing the fuel with the air.
- 3. Slowly introduce the required volume of n-hexane into the test chamber as the simulated altitude begins to drop.
- 4. Circulate the test atmosphere and continue to reduce the simulated chamber altitude for at least three minutes to allow for complete vaporization of fuel and the development of a homogeneous mixture, and for the chamber pressure to reach the test altitude.
- 5. At a pressure equivalent to 1000 m (3300 ft) above the test altitude, verify the potential explosiveness of the fuel-air vapor by attempting to ignite a sample of the mixture taken from the test chamber using a spark-gap device or glow plug ignition source with sufficient energy

Checked By	Approved By	Doc No. <	Docume	ent r	number
		Issue	Revisio	on	Date
			Ра	nge N	No: 31 of 36

to ignite a 3.82 percent hexane mixture. If ignition does not occur, purge the chamber of the fuel vapor and repeat Steps 1-4. An alternative method of determining the explosive characteristics of the vapor is by using a calibrated explosive gas meter that verifies the degree of explosiveness and the concentration of the fuel-air mixture.

- 6. Although above the maximum operational altitude of the UUT, attempt to operate the UUT and continue operation from this step until completion of Step 8. Note the altitude at which the UUT begins proper operation.
- 7. To ensure adequate mixing of the fuel and air, slowly decrease the simulated chamber altitude at a rate no faster than 100 meters per minute by bleeding air into the chamber.
- 8. Stop decreasing the altitude at 1000 m below the test altitude or ground level, whichever is reached first, and perform operational check and switch off power to the UUT.
- 9. Verify the potential explosiveness of the air-vapor mixture as in Step 5 above. If ignition does not occur, purge the chamber of the fuel vapor, and repeat the test from Step 1.
- 10. Adjust the simulated chamber altitude to the equivalent of 2000 m above site pressure.
- 11. Repeat Steps 3-7 at site pressure, perform operational check and switch-off power to the test item.
- 12. Verify the potential explosiveness of the air-vapor mixture as in Step 5 above. If ignition does not occur, purge the chamber of the fuel vapor, and repeat the test from Step 10.
- 13. Verify and record parameters in test sheets <*give test sheet reference*>

7.15 Gunfire Vibration

Gunfire vibration tests are performed to provide a degree of confidence that materiel can physically withstand the transient vibration encountered in operational environments during the firing of a low calibre gun. This test shall be carried out only if the equipment is mounted near to the gun and gun firing is expected during the flight trials for this equipment. The profile may be tailored based on Method 519.5 of MIL-STD-810F. The Gun Fire Vibration Test for SOFT may be carried out on a Mock up unit.

7.16 Final Ambient check:

This test is carried out after completion of all the environmental tests.

Test Procedure:

Switch on the UUT on the bench as per the Test Setup. Perform the complete parameter check at 28.0VDC power supply under ambient temperature as per FTP and record the values.

Checked By	Approved By	Doc No. <	Document	number
		Issue	Revision	Date
			Page	No: 32 of 36

After completion of all the environmental and EMI/EMC tests, compliance chart as given in the annexure III shall be prepared and submitted to RCMA along with SOFT results and application for SOF clearance of UUT.







ANNEXURE-I: Test sheets

<All the test sheets/Test results recording format for the SOF tests are to be included>

Note: Test sheets should have the following data:

- 1. LRU name, platform name and sl.no. of the UUT.
- 2. Environmental Test name and part of the test profile in which parameters are being taken.
- 3. Sl. no. of the UUT
- 4. Software version & Checksum of the UUT
- 5. Date and Venue of the test
- 6. Input data
- 7. Expected Output
- 8. Observed Output
- 9. Remarks (on test pass/ fail, test setup related observations and deviation from the procedure etc)
- 10. Signatures of the test team including AQA Reps

Checked By	Approved By	Doc No. <document number<="" th=""></document>			
		lssue	Revision	Date	
			Page	e No: 35 of 36	

ANNEXURE-II: Compliance Chart

Sl.No.	Type Test	Name of the Test	Test Requirement	Compliance
	Schedule Clause			Status/ Remarks
	No.			

(Designer) (Design QC) (Rep AQA)

Acronyms :

<Complete list of acronyms used in this document>

Checked By	Approved By	Doc No. <document number<="" th=""></document>		
		Issue	Revision	Date
			Page	No: 36 of 36