1	**Name of the Applicant & SGS File no.**	
2	**Model & Category applied for:**	
3	**Application reference:**	
4	**Applicant's Documentation (Applicant to list)**	
5	**Brief information about the Applicant Manufacturer (Applicant to provide)**	
6	**Brief information about the Model Applied (Applicant to provide)**	
7	**Overall Summary of observations**	

8	**Overall Recommendations**

Applicant Representative	
Evaluation Team	

S. No.	Parameter / Characteristics	Compliance Criteria (with Requirements)	Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details)	Document no. /Record no. with para no., where a particular requirement is addressed (Applicant to provide details)	Compliance Yes/No	SGS Team Stage 1 comments after Review & evaluation / Nonconformity Statement
1	**General**					
1.1	i. Classification of UAS	Micro / Small / Medium / Large	**Stage 1:** Verify the statement submitted by the manufacturer stating the classification of theUAS.			

S. No.	Parameter / Characteristics	Compliance Criteria (with Requirements)	Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details)	Document no. /Record no. with para no., where a particular requirement is addressed (Applicant to provide details)	Compliance Yes/No	SGS Team Stage 1 comments after Review & evaluation / Nonconformity Statement
	ii. Category of the UAS	a) Aeroplane b) Rotorcraft c) Hybrid (A combination of Aeroplane and Rotorcraft categories)	**Stage 1:** Verify the statement submitted by the manufacturer.			
	iii. Sub Category	a) RPAS b) Autonomous UAS	**Stage 1:** Verify the statementsubmitted by the manufacturer.			
1.2	Weight	i) Empty weight • Weight without fuel / battery and without payload. • Weight with fuel / battery but no payload.	**Stage 1:** Report of test by calibrated measurement equipment to be verified by SGS with respect to empty weight of the UAS.			
		ii) Maximum all up weight • Weight with maximum fuel/ largest battery and with all compatible payloads (Fixed + Variable)	**Stage 1:** Verification of appropriate analysis done by the manufacturers for calculating CG, for all configurations of the UAS, in the design documents submitted by the manufacturers			
1.2		iii) Relevant CG limits for each configuration	Verification of appropriate analysis done by the manufacturers for calculating CG, for all configurations of the UAS, in the design documents submitted by the manufacturers			
1.3	Type of Launch and/ or Recovery	Launch and Recovery type (as applicable)	**Stage 2:** Physical inspection of the UAS to verify if the UAS type is as per the			

	Mechanism (If installed)		declaration of the manufacturer in the submitted design document.			
			Stage 2: Physical inspection of the launch and recovery system to verify if the launch and recovery system is as per the declaration of the manufacturer in the submitted design document			
1.4	Dimensions	Wing Span / Max Diagonal Length	**Stage 1**: Measure the wing span / max diagonal length using calibrated measuring instruments and verify with submitted design documents.			
1.5	Life of UAS	i) Airframe	**Stage 1:** Verification of design document determining the life of the airframe			
		ii) Engine	**Stage 1:** Verification of design document determining the life of the engine or Manufacturer to submit OEM documents giving details of life of the engine.			
		iii) Battery	**Stage 1:** Cells and batteries used in UAS shall comply to the regulatory requirements of MeitY. Documentary evidence of IS Battery tests for battery used in UAS to be submitted for verification. **Stage 2:** Physical verification of the evidence submitted			

		iv) Propeller / Rotor	**Stage 1:** Verification of design document determining the life of the propeller / rotor.			
		v) Number of Maximum Permissible Landings	**Stage 1:** Verification of design document determining the number of maximum permissible landings.			
1.6	Payloads	Compatible Payload Details	**Stage 1:** Manufacturer to submit a list of all compatible payloads with complete			

			details like weight, specifications, purpose of usage.			

Stage 1 Evaluation for Section 1 'General' Requirements

Summary of observations:

Recommendations:

Stage 2 Evaluation for Section 1 'General' Requirements

Summary of observations:

Recommendations:

2	**Performance**					
2.1	Speeds	i) Minimum operating speed the minimum specified operating speed of UAS at standard sea level conditions shall be at least 10% above the actual stall speed	**Stage 2**: To be witnessed during flight testing: a) Verify that minimum operating speed is at least 10% more than stall speed by design in the submitted design document b) In case the concept of stall speed is not applicable, the minimum operating speed of the rotor should be considered which is needed for supporting the drone while airborne. c) OEM should demonstrate stable flight (without stall) at minimum operating speed (as applicable)			
		ii) Determine maximum operating speed at standard sea level conditions	**Stage 2:** To be witnessed during flight testing: Manufacturer to demonstrate flight with maximum speed as submitted in the design document			
		iii) Determine that maximum kinetic energy on impact does not exceed 95 KJ at any combination of mass and speed	**Stage 1:** Verification of analysis showing maximum kinetic energy on impact does not exceed 95 KJ at any combination of mass and speed. Refer to the Annexure C prepared for the Kinetic Energy calculations with reference to limiting conditions of weight and speed.			
2.2	Range	Determine maximum range in still air	**Stage 1:** Verification of analysis submitted by manufacturer. **Stage 2:** Validation of the same during flight test			

2.3	Endurance	a) Determine fuel and oil consumption and endurance (if applicable)	**Stage 1:** Manufacturer to submit necessary document of endurance test with fuel and oil consumption of a representative flight for verification. **Stage 2:** Verification of witnessing flight testing while ensuring 10% spare fuel remaining in the tank after landing.			
		b) Determine endurance of the UAS with fully charged battery.	**Stage 1:** Manufacturer to submit necessary document of endurance test of a representative flight for verification. **Stage 2:** Verification of results by witnessing flight-testing while ensuring less than 90% battery utilization of a fully charged battery after landing.			
2.4	Operational altitude	Determine maximum attainable altitude above mean sea level condition as per standard atmospheric conditions	**Stage 1:** Manufacturer to declare maximum attainable altitude above mean sea level condition as per standard atmospheric conditions by design and demonstrate restriction of maximum attainable altitude above ground level in GCS or firmware. **Stage 2:** Maximum attainable altitude above ground level to be verified during flight-testing against the design document submitted by the manufacturer.			
2.5	Operational envelope	Determine boundaries of operational envelope within which safe flight, in normal and emergency conditions, can be demonstrated under combinations of weight, center of gravity (if applicable), altitude, temperature and airspeed	**Stage 1:** Verification of design document details. **Stage 2:** Comparison with actual flight performance and parameters. **Note:** In case of medium and above categories of UAS, additionally, operational envelope to be demonstrated during flight test.			

2.6	Ceiling height	Determine ceiling height over a range of weight, center of gravity (if applicable), altitude, temperature and airspeed	**Stage 1:** Verification of design documents details. Stage 2: Comparison with actual flight performance and parameters.			
2.7	Propeller speed and pitch for safe operation	a) Determine propeller speed and pitch (if multiple/variable pitch props are used or intended to be used in the design) limits that ensure safe operation under normal operating conditions.	**Stage 1:** Verification of the certificate/declaration provided by the manufacturer regarding propeller pitch and speed limits for safe operations.			
		b) Determine integrity of propeller and its mounting at maximum rpm	**Stage 1:** Manufacturer to submit design documents determining the integrity of the propeller and its mounting at its maximum rpm or Stage 2: SGS to witness bench test to determine the stated requirement			
2.8	Stability and control	a) Determine that UAS is able to maintain a stable flight without pilot input	**Stage 2:** To be verified during flight testing: i. Manufacturer to demonstrate stable flight and sensor readings, which should be longitudinally, directionally and laterally stable. ii. Similar tests to be carried out in Aeroplane category UAS. **Note on Stability:** The UAS should be tested in all its operating modes, both Flight Control System (FCS) augmented or manual (if available), including the Manufacturer provided demonstratable failsafe features must be longitudinally, directionally and laterally stable in any condition normally encountered in service.			

2.8		b) Determine that pilot is able to control UAS with ease.	**Stage 2:** To be witnessed during flight: Manufacturer to demonstrate stable flight with minimal pilot inputs.			

Stage 1 Evaluation for Section 2 'Performance'
Summary of observations:
Recommendations:
Stage 2 Evaluation for Section 2 'Performance'
Summary of observations:
Recommendations:

3	**Powerplant**

3.1	Powerplant (Engine Operated)	a) Determine that fan blade can withstand ultimate load of 1.5 times the centrifugal force resulting from operation	**Stage 1:** Verification of design analysis and relevant evaluation data of the stated requirement from manufacturer / OEM.			
		b) Determine that engine installation is such that it prevents excessive vibration from any part	**Stage 2:** Vibration measurement test i.e. flight logs to be witnessed for verification of test reports submitted by the manufacturer.			
		c) Ensure that exhaust is firmly mounted to the structure and free from any obstructions	**Stage 2:** Ascertain by physical inspection that exhaust is firmly mounted to the structure and free from any obstruction.			
		d) Determine that there is no fuel leak in the system under pressure during operational tests on ground	**Stage 2:** Physical inspection and witness ground test by manufacturer to demonstrate fuel system integrity under pressure during ground test			
3.2	Powerplant (Battery Operated)	a) Determine that safe cell temperatures and pressures are maintained during charging / discharging cycle	**Stage 1:** Cells and batteries used in UAS shall comply to the regulatory requirements of MeitY. Documentary evidence of IS Tests of battery used in UAS to be submitted for verification. **Stage 2:** i. Physical verification of the evidence submitted. ii. To be verified during flight test.			
		b) Determine that no explosive or toxic gases are emitted in normal operation	**Stage 1:** Cells and batteries used in UAS shall comply to the regulatory requirements of MeitY. Documentary evidence of IS Tests of battery used in UAS to be submitted for verification. **Stage 2:** i. Physical verification of the evidence submitted. ii. To be verified during flight test.			
		c) Determine that no corrosive fluid is discharged which may damage the surrounding structures / equipment	**Stage 1:** Cells and batteries used in UAS shall comply to the regulatory requirements of MeitY. Documentary evidence of IS Tests of battery used in UAS to be submitted for verification.			

			Stage 2: i. Physical verification of the evidence submitted. ii. To be verified during flight test.			
		d) Ensure that motor / motor controller has overcurrent / overheating protection	**Stage 1:** i. Verify details of test bench for testing over current / overheating protection system of motor / motor controller and ascertain its suitability. ii. Verify test report of over current / overheating protection system. **Stage 2:** Witness the test to verify the stated requirement.			
		e) Battery Storage design and installation	**Stage 2:** Physical inspection to be conducted to ascertain and verify the following as per design documents submitted by the manufacturer: 1. Batteries shall be stored in the manner as to prevent deterioration other than standard battery chemistry and Battery Management System (BMS) limitations. 2. Mechanisms for charging and logging of battery voltages should be provided.			
3.2.1	Battery performance (energy, power capability)	Determine rate of discharge of battery as per manufacturers specifications (C-rate, cut off conditions, Ah and Wh, energy and power density)	**Stage 1:** Verification of test reports from an accredited testing laboratory submitted by the manufacturer determining rate of discharge of battery with charge capacity more than 85% at all times. **Stage 2:** Verification of manufactures test results by witnessing flight testing while ensuring less than 90% battery utilization of a fully chargedbattery after landing			
3.2.2	Battery performance (life cycle)	Determine life cycle up to 80% Depth of Discharge (DoD) for various atmospheric conditions (flying conditions of drone).	**Stage 1:** Verification of test reports from an accredited testing laboratory submitted by the manufacturer determining the mentioned specification. **Stage 2:** Verification of manufactures test results by witnessing flight testing			

Stage 1 Evaluation for Section 3 'Powerplant'
Summary of observations:
Recommendations:
Stage 2 Evaluation for Section 3 'Powerplant'
Summary of observations:
Recommendations:

4	**Structure**					
4.1	Strength requirements	a) Demonstrate that airframe structure shall be able to withstand	**Stage 1:** Verification of static load test report/theoretical analysis (if applicable) and design documents as submitted by the manufacturer.			

		flight limit loads without failure, malfunction or permanent deformation.	Demonstration through static load test applicable for Medium and above categories. For all others theoretical analysis to suffice.			
		b) Applicant has to provide analysis of the structure showing that a factor of safety of 1.5 has been used	**Stage 1:** Verification of analysis and design documents as submitted by the manufacturer.			
		c) Determine that each user removable bolt, screw, nut, pin or other fastener whose loss could jeopardize the safe operation of the UAS, shall incorporate a locking device or redundancy.	**Stage 1:** Verification of Design Review Analysis Document to establish that Primary Structure Elements (PSEs) have been identified and their drawings or work instructions have provision of lock nuts or adhesive or other mechanisms as applicable. **Stage 2:** Physical verification to be conducted by the inspection agency on sample UAS.			
		d) Determine that UAS is free from excessive vibrations under any operational speed and power condition.	**Stage 1:** Verify the submitted documents, regarding vibration measurement tests i.e. flight logs at manufacturers end **Stage 2:** Witness the vibration measurement tests i.e flight logs			
		e) Determine that propeller blade clearance is sufficient from structure and/or components, and from ground	**Stage 1:** Verification of design documents details regarding blade tip clearances. **Stage 2:** Validation on sample UAS during physical inspection.			

4.2	Shock absorbing mechanism of UAS, if applicable	a) It must be shown that the limit load factors selected for design will not be exceeded.	**Stage 1:** Verification of design analysis submitted by the manufacturer.			
		b) The landing gear may not fail, but may yield, in a test showing its	**Stage 1:** Verify the design document. **Stage 2:** Witness the drop test.			

		reserved energy absorption capacity				

Stage 1 Evaluation for Section 4 'Structure'
Summary of observations:
Recommendations:
Stage 2 Evaluation for Section 4 'Structure'
Summary of observations:
Recommendations:

5	**Material and Construction**

5.1	Type of material for construction	The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must: a) be established on the basis of experience or tests;	**Stage 1:** Review of material test reports from accredited testing laboratory to ascertain the compliance criteria. However, in the absence of above documentation the manufacturer may submit appropriate analysis or Finite Element Analysis (FEA) whichever applicable.			
		The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must: b) meet approved specifications, which will ensure that strength and other properties assumed in the design data are correct;	**Stage 1:** Review of material test reports from accredited testing laboratory (as per ISO/IEC 17025) to ascertain the compliance criteria. However, in the absence of above documentation the manufacturer may submit appropriate analysis or Finite Element Analysis (FEA) whichever applicable.			
		The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must: c) take into account the effects of environmental conditions, such as temperature and humidity, expected in service.	**Stage 1:** Review of material test reports from accredited testing laboratory (as per ISO/IEC 17025) to ascertain the compliance criteria. However, in the absence of above documentation the OEM may submit appropriate analysis.			

5.2	Fabrication Method	a) Methods of fabrication used must produce consistently sound structures	**Stage 1:** Review of QC process specification and/or procedures submitted by the manufacturer for establishing consistency in quality of fabrication. **Stage 2:** Additionally, physical inspection may be conducted to verify if such processes are in place adequately.			

		b) In a fabrication process, such as gluing, spot welding, heat-treating, etc. requires close control, the process must be performed according to an approved process specification.	**Stage 1:** Review of the approved QC process specification and/or procedures submitted by the manufacturer for establishing consistency in quality of fabrication. **Stage 2:** Additionally, physical inspection may be conducted to verify if such processes are in place adequately.			
		c) Fabrication method must be substantiated by a test program Note: Requirement of a test program is applicable for a new fabrication method - which is not yet established/proved in any industry	**Stage 1:** Review of the test program, QC process specification and / or procedures submitted by the manufacturer.			
5.3	Means of protection Against deterioration or loss of strength in operation due to any cause i.e. weathering, corrosion and abrasion.	a) Effect of in-service wear on the loading of critical components should be determined	**Stage 1:** By design review or analysis **Stage 2:** Physical inspection after ground and flight tests.			

5.3	Means of protection Against deterioration or loss of strength in operation due to any	b) Effect of temperature and moisture should be determined in computing the material design values	**Stage 1:** Verification of test reports from accredited testing laboratory **For Temperature:** Verification of test reports from an accredited testing lab submitted by the manufacturer for temperature			

	cause i.e. weathering, corrosion and abrasion.		range of -10°C and +50°C, as per IS 9000 Part 2 & 3 or equivalent standard **For Humidit**y: Verification of test reports from an accredited testing lab submitted by the manufacturer for 90% Relative Humidity at +40°C, as per IS 9000 Part 4 or **IEC 60068 2 78 or equivalent standard**			
5.4	Fire resistant identification plate on UAS for inscribing UIN.	a) Determination of ID plate material which should be fire resistant	**Stage 1:** Review of the declared material type of the ID plate and supported by test reports from accredited testing laboratories. In case the manufacturer is using certified fire-resistant materials, then a certificate and/or appropriate test report certifying the same from the material manufacturer may be accepted			
		b) Determine location of ID plate along with its secure fixing on UAS	**Stage 1:** The Location of ID Plate Manufacturer has to be mentioned in the Detailed Drawing. **Stage 2:** Ascertain by physical inspection the location of the fire-resistant identification plate and whether it is securely fixed on UAS.			

Stage 1 Evaluation for Section 5 'Material and Construction'
Summary of observations:

Recommendations:
Stage 2 Evaluation for Section 5 'Material and Construction'
Summary of observations:
Recommendations:

6	**Data Link**					
6.1	Type of data link used for communication (C2 data link, frequency band etc.)	a) Determine full functioning of data link communication	**Stage 1:** Verify the following from documents submitted by the manufacturer. i) Verification of ETA from WPC. ii) Verify that specification and full functioning / characteristics of data link are clearly mentioned and described in the documents.			

			iii) Verify associated test reports / results as applicable to ascertain implementation of full functionality of data link. **Stage 2:** Witness the test / demonstration of verification as per below compliance. i) Data submitted by the OEM/ Manufacturer to be verified during a distance communication test from all possible azimuth angles. ii) C2-Data Link capability vs performance comparison through test cases need to be demonstrated by OEM. iii) Functional verification of Manufacturer's Specifications on Stability & Control, Redundancy (Single or dual channel) and Back Up, (if any). iv) Manufacturer to demonstrate the contingencies implemented including return to home functionality when data link is lost or other applicable contingencies.			
6.1	Type of data link used for communication (C2 data link, frequency band etc.)	b) Demonstration of system to alert the remote pilot with aural and visual signal, for any loss of command and control data link	**Stage 1:** Verify from the description / explanation in documents (flight manual) submitted by the manufacturer. (a) That the system alerts the remote pilot with aural or visual signal for any loss of command and control data link. (b) Verify associated test reports to ascertain implementation of the functionality. **Stage 2:** Witness the test of verification as per below compliance.			

			Verify by flight demonstration whether aural and visual signal to alert the UAS Pilot during loss of command and control of data link is implemented satisfactorily.			
		c) Determine that communication range is sufficient to have a permanent connection with the UAS	**Stage 1:** Verify from the description / elucidation given in the documents submitted by the manufacturer. (a) That the communication range is sufficient to have a permanent connection with the UAS in all attitude and operational limits of the UAS specification. (b) Permanent connection with the UAS in all attitude and operational limits are maintained under various battery power conditions. (c) Verify associated test reports to ascertain implementation of the functionality. **Stage 2:** Witness the test / demonstration for verification as per below compliance. i) Manufacturer to demonstrate communication range between the UAS and C2 Data Link for positive, negative and boundary case distances from the GCS for having permanent connection in an environment free from interference. ii) Similar test to be performed under various battery / power conditions and performance demonstrated.			

6.1	Type of data link used for communication (C2 data link, frequency band etc.)	d) Determine that when data link is lost or in other contingencies, the UAS follows a predefined path to ensure safe end of flight within the required area restrictions	**Stage 1:** Verify from the description / elucidation in the documents submitted by the manufacturer. i) That the functionality and how it is implemented is described / explained in detail in the UAS flight manual. ii) Description of function performed in case of link loss or in other contingencies (Contingencies should be listed) clearly explained in UAS Flight Manual iii) SGS to assess the sufficiency of contingency plan. iv) Verify associated test reports to ascertain implementation of the functionality.			

			Stage 2: Witness the test / demonstration for verification as per below compliance. Demonstrate the contingencies implemented including return to home functionality when data link is lost or other applicable contingencies.			
		e) Determine the capability of system to inform remote pilot by means of a warning signal in the event of data link loss	**Stage 1:** Verify from the description / elucidation in documents (flight manual) submitted by the manufacturer: (a) That the system has capability to inform remote pilot by means of a warning signal in the event of data link loss. (b) Verify associated test reports to ascertain implementation of the functionality. **Stage 2:** Witness the test of verification as per below compliance. i) Demonstrate by flight whether aural and visual signals to alert the UAS Pilot during loss of data link is implemented satisfactorily.			

6.1	Type of data link used for communication (C2 data link, frequency band etc.)	f) A command and control data link loss strategy must be established, approved and presented in the UAS Flight Manual	**Stage 1:** Verify from the documents submitted by the manufacturer. (a) That a command and control data link loss strategy has been included in the flight manual. (b) The strategies clearly explain the functions performed in case of link loss. (c) SGS to verify UAS flight manual and assess / ascertain the sufficiency. (d) Verify associated test reports to ascertain implementation of the strategy.			

			2. Witness the test of verification as per below compliance. (a) Demonstrate, implementation of the contingencies as per strategy when command control data link is lost.			

Stage 1 Evaluation for Section 6 'Data Link
Summary of observations:
Recommendations:

Stage 2 Evaluation for Section 6 'Data Link
Summary of observations:

Recommendations:

7	**Secure Flight Module (FM) and Tracking Mechanism**					
7.1	Firmware tamper avoidance	a) Protection of onboard computer firmware from tampering (software) UAS should not function if firmware is changed by any procedure other than authorized update procedure.	**Stage 1:** Verify the documents submitted by the manufacturer. **Stage 2:** Witness the test of verification as per below compliance. A. Verification of Secure Boot: Manufacturer to produce a certificate of compliance indicating compliance with all conditions mentioned below: i) Flight Module Security Implementation a) Flight Module should have as defined in Annexure E. b) Flight modules should follow the communication requirement (if applicable) as defined in Annexure E. c) FM should have a root of trust mechanism implemented (using, for example, TPM or TEE for Level 1 compliance) which is used to sign the data generated inside the FM.			
7.1			d) The verification key of the root of trust may be recorded and retained. (This key will also be used for verifying the origin of logs generated by the FM). ii) Calculation of Checksums a) Manufacturer to submit checksums of the firmware to the SGS and these checksums may be called 'registered checksums'.			

			b) Code part and data part checksums to be calculated separately to enable updating of data/parameters in the future easily. c) All checksums should be calculated using a Secure Hash Algorithm (SHA2 or SHA3). d) Registered checksums should be stored securely in the flight module such that they cannot be updated without the authorisation of the manufacturer. e) These registered checksums may be digitally signed by SGS and retained. iii) Power on Self-Test (POST) a) Manufacturers should implement a Power On Self-Test (POST). b) It should include calculation of checksums of the firmware (code and data part) and the checksum should be matched with the registered checksum stored in the flight module which was supplied at the time of certification. c) The result of the POST should be logged. d) Mismatch of checksum should prevent the UAS from booting and be logged.			

7.1			iv) Testing of Firmware protection (software) a) Attempt modifying the firmware (code and data) in an unauthorised manner. The firmware update should fail. In case the firmware gets updated in an unauthorised manner, then verify that in UAS fails the POST. Test to be conducted in presence of SGS.			

		b) Safety and security of firmware update	**Stage 1:** Verify the certificates submitted by the manufacturer for ensuring safety and security of the firmware. **Stage 2:** Witness the firmware update process as per the process explained below. A. Secure Upgrade Test: i) The update should be permitted only if it is signed by the manufacturer's digital certificate. ii) UAS should be able to verify the authenticity of the update by verifying it with the public key of the manufacturer. iii) Firmware change should be recorded in the logs. iv) After the UAS is upgraded, the registered checksum should be updated in the flight module securely. v) The checksums of the updated firmware (code and data) to be digitally signed by SGS and retained.			

		c) Secure change of flight parameters	**Stage 1:** Verify the documents submitted by the manufacturer citing the process for instituting a change in any given parameter. **Stage 2:** Witness the test for the change process as detailed below. A. Testing of Parameter Update: i) UAS should be able to verify the authenticity of the update by verifying it with the public key of the manufacturer. ii) Change should be recorded in the logs. iii) After the UAS is upgraded, the registered checksum should be updated in the flight module securely. iv) The checksums of the updated firmware (code and data) to be digitally signed by SGS for their records. v) Try to update the parameters that affect compliance conditions using the manufacturer's standard operating procedure. The parameter should remain unaffected. vi) Try to update the parameters in the firmware that affect compliance conditions using an invalid digital signature. The update should fail.			
7.2	Hardware Tamper Avoidance	a) Protection of onboard computer from tampering (physical)	**Stage 1:** Verify the documents submitted by the manufacturer explaining the tamper protection mechanism along with its justification **Stage 2:** Witness the test for the tamper protection as detailed below. A. Hardware Tamper Detection and Response: i) Verify the physical presence of tamper prevention, detection and response mechanisms by inspection of the UAS.			

7.2	Hardware Tamper Avoidance	a) Protection of onboard computer from tampering (physical)	ii) Replace crucial flight-critical components using unauthorised procedure and check if UAS is arming. Physical tampering should be detected by UAS and use of unauthorised flight critical components should be logged. iii) In case of unauthorised replacement of an electronically paired, flight-critical component, the UAS should not arm. iv) In case of non-electronically paired, flight-critical components, verify by visual inspection if the manufacturer has implemented hardware protection mechanisms and designed UAS in a way to minimise tampering.			
		b) Mechanism to replace crucial hardware like radio modules, GPS and flight controller	**Stage 1:** Verify the documents submitted by the manufacturer explaining the process of replacement **Stage 2:** Witness the test for the integrity of the hardware A. Testing of Secure Hardware Change: i) In case of unauthorised replacement of an electronically paired, flight-critical component, the UAS should not arm. ii) In case of non-electronically paired, flight-critical components, verify by visual inspection if the manufacturer has implemented hardware protection mechanisms and designed UAS in a way to detect hardware change. iii) In case of secure hardware change, validate SOP by the manufacturer for completeness.			

Stage 1 Evaluation for Section 7 'Secure Flight Module (FM) and Tracking Mechanism

Summary of observations:
Recommendations:
Stage 2 Evaluation for Section 7 'Secure Flight Module (FM) and Tracking Mechanism
Summary of observations:
Recommendations:

8	**Instruments / Equipment**

8.1	All on-board electrical and electronics equipment's/ components	Following are to be complied in respect of all on-board electrical and electronics equipment:: i) Adequate source of electrical energy, where electrical energy is necessary for operation of UAS ii) Wiring is installed in such a manner that operation of any equipment will not adversely affect the simultaneous operation of any other equipment iii) Wiring lay out is according to the wiring diagram iv) All wiring is suitable for the current and voltage going through v) No kinks in the wiring exist vi) Wiring routing is not along the sharp edges vii) Soldering connections between cables are not there	**Stage 1:** Verification of design documents submitted by the manufacturer: (a) Availability of wireframe diagram, wiring diagram, loom layout diagram. These diagrams should be included in the standard list of diagrams / drawings. (b) Specification of the wires used (in the cables/looms) which carry heavy current and the equipment's where it is used. SGS to verify that the cables are suitable for the specified current. (c) Verification of schemes used for cable terminations and cable joints. Soldering should not be used for connections between cables or termination of safety critical circuits. (d) Verification of types of connectors used for cable termination of on-board equipment's contractors used to connect the equipment's are self-locking or has mechanism to prevent loosening due to vibration. (e) The external terminal for charging is designed to prevent inadvertent shorting, possibility of reverse polarity connection, misalignment etc. **Stage 2:** Physical verification / visual inspection of the following in the UAS: (a) Visual Inspection to be performed to ascertain that the UAS is built as per wire diagram. Internal wiring is as per the wiring and loom layout diagram. (b) Cable routing is supported, clamped or secured in a manner that reduces the likelihood of excessive strain on wire and on terminal connections.			

8.1	All on-board electrical and electronics equipment's/ components	viii) All equipment are connected with adequately secured connections to prevent loosening during vibrations ix) Minimum operating current x) Maximum operating current	(c) No kink in the wiring. (d) Wiring routing is not along the sharp edges. (e) Soldering connection between cables/wires is not there. (f) All equipment is connected with adequately secured connectors to prevent loosening during vibrations. (g) The external terminal for charging is designed to prevent inadvertent shorting, possibility of reverse polarity connection, misalignment etc.			
	a) Global Navigation Satellite System (GNSS) receivers (if applicable)	Determine whether the capability of GPS receiver meets the requirements and functionality of the UAS	**Stage 1:** Verification of the following from design documents submitted by the manufacturer a) Verify from documents specification of the GPS receiver and whether it meets the requirement of the UAS functionality. (b) Verification of the test report of the functionalities of GPS receiver. **Stage 2:** Witness the test of verification as per below compliance. (a) Verification of GPS receiver functionality by flight test.			

8.1	b) Flashing anti-collision strobe lights Mandatory for Night Flight Operations and Optional for Day Flight Operations	Provision for flashing anti-collision light in the UAS	**Stage 1:** Verification of the following from design / technical documents submitted by the manufacturer: (a) To be verified from documents if anti-collision lights are installed. (b) Verification of specification of anti-collision lights. **Stage 2:** Witness the test of verification as per below compliance. (a) Verification of operation of anti-collision lights during flight test.			
	c) Actuators d) Servo controllers e) Other UAS components	Determine whether Actuators, Servo controllers, and Other Components are installed in the UAS.	**Stage 1:** Verification of the following from design / technical documents submitted by the manufacturer: (a) To be verified from documents if Actuators, Servo controllers, and Other Components are installed in the UAS. Manufacturer to clearly mention the same in the documents. (b) If installed, verification of specification and detailed description of operation of these components from the documents. (c) Verify functional test reports of these components in various operating condition and operating envelope of the UAS **Stage 2:** Witness the test o verification as per below compliance. (a) Verification of operation of Actuators, Servo controllers, and Other Components during flight test.			

8.1	f) Geo-fencing capability (Mandatory)	Determine whether Geofencing capability has been implemented.	**Stage 1:** Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer: (a) Detailed explanation of geo fencing capability and how it is implemented in the UAS to be verified from the documents. (b) UAS Pilot should be able to define a Geo-fence from the UAS GCS. (c) Verification from test reports the implementation of geofencing capabilities at different latitude and longitude of geo-fence points. **Stage 2:** Witness the test of verification as per below compliance. (a) Witness demonstration that Remote Pilot is able to define a Geo-fence from the UAS GCS. (b) Demonstrate that the UAS does not breach the Geo-fence during flight.			
	g) SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment applicable for UAS intending to operate above 400 feet AGL	Determine whether UAS has SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment	To be demonstrated or validated as per applicable standards. **Stage 1:** Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer:			

		Justification: SSR transponder (Mode 'C' or 'S') is a secondary radar system. It enables the ATCO to identify and see the aircraft altitude or flight level automatically. ADS-B Out is onboard equipment. It works by broadcasting information about an aircraft's GPS location, altitude, ground speed and other data to ground stations and other aircraft. It enables ATCO precise tracking of aircraft For safety and security, it is essential for ATCO to know details like location, altitude, ground speed etc. of all UAVs flying in the controlled airspace. Without knowing these, controlling of aircraft operation by ATC would be difficult and can lead to midair collision with disastrous consequences.	(a) Manufacturer to declare if UAS has SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment. (b) If present, verify ETA copy and associated test reports as applicable. (c) Verify specification, technical description and principle of operations of the equipment from design document. (d) Verify functional characteristics and specification of the equipment from the test reports. **Stage 2:** Witness the test of verification as per below compliance. (a) Witness and verify functionality of the equipment during flight trial. (b) Verify original copy of the ETA			

		That is why, SSR Transponder (Mode C or S) or ADSB Out equipment is a mandatory requirement for many busy areas of controlled airspace. Therefore, UAVs operating in controlled airspace must have SSR Transponder (Mode C or S) or ADS-B Out equipment	**Note:** 1. Specification, detailed technical description and principle of operations of the equipment should be clearly described / explained / elucidated in the design documents. 2. All tests to verify the equipment specifications and functionalities are to be carried out as per a test plans/test cases.			
	h) Detect and Avoid capability (Optional)	Determine whether Detect and Avoid capability option has been implemented. Justification: There is no pilot physically onboard a UAS. The primary safety concern with drones is the inability of remote operator to see and avoid other aircraft. This can result in near-misses or midair collisions with dangerous consequences. This is more applicable to drones operating in high traffic density area (controlled airspace) and BVLOS category.	**Stage 1:** Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer: (a) Manufacturer to specify if Detect and Avoid capability option has been implemented in the UAS. (b) If present, verify specification, technical description and principle of operations from design documents/ UAS Flight Manual. (c) Verify implementation of Detect and Avoid capability option from test reports.			

		Onboard Detect and Avoid system would enable the drone to detect any approaching aircrafts/drones and avoid. Detect and Avoid capability is therefore, recommended for Drones operating in controlled airspace and for BVLOS category	**Stage 2:** Witness the test of verification as per below compliance. (a) Manufacturer to demonstrate with flight the implementation of Detect and Avoid capability option.			
	i) Flight controller with flight data logging Capability	Determine whether UAS has flight controller with flight data logging capability	**Stage 1:** Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer: (a) Manufacturer to specify if UAS has flight controller with flight data logging capability. (b) If present, verify specifications and data logging capabilities from the design documents. (c) Verify data log of a representative flight. Stage 2: Witness the test of verification as per below compliance. (a) Data log of a representative flight should be verified after conducting flight test.			

	j) Barometric equipment with capability for remote subscale setting Applicable for BVLOS operations	Determine whether UAS has Barometric equipment with capability for remote subscale setting. Justification: Barometric equipment in drone enables altitude tracking during flying and setting of flight level, altitude (QNH) and height (QFE). Remote subscale settings enable setting these parameters remotely from GCS. Barometric equipment is a safety feature and required for safe operation, maintaining correct altitude separation in high-density flying area and in BVLOS operation. Failure to set the appropriate barometric sub-scale pressure may result in a significant deviation from the cleared altitude or Flight Level which is unsafe.	**Stage 1:** Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer: (a) Manufacturer to specify if UAS has flight controller with flight data logging capability. (b) If present, verify specifications and data logging capabilities from the design documents. (c) Verify data log of a representative flight. Stage 2: Witness the test of verification as per below compliance. (a) Data log of a representative flight should be verified after conducting flight test. (b) Verify from test reports the specifications and functionalities of Barometric equipment.			

		Barometric equipment with remote subscale	Stage 2: Witness the test of verification as per below compliance.			

		setting is therefore recommended for drones operating in controlled airspace and for BVLOS categories	(a) Manufacturer to demonstrate with flight the Barometric equipment capability for remote subscale setting			
	k) RFID and GSM Sim Card (Optional)	Determine whether UAS has provision for RFID and GSM SIM Card Justification: GSM or RFID tags are used for remote communication with drones. RFID tags are used to transmit the owner's name, phone number, registration number, GPS location and other information. RFID (reader) is also used for identification, locating and tracking of inventory spread over large areas. The GSM antenna and SIM card is used to send to and receive data from UAV through GSM module.	**Stage 1:** Verify from the description in the documents submitted by the manufacturer: (a) Verify from design documents, whether the manufacturer has implemented RFID and GSM SIM card in the UAS. If implemented, **RFID** (b) Verification of specification of RFID from UAS design documents. **GSM SIM** (c) Verify specification of GSM SIM from the documents **Stage 2:** Witness the test of verification as per below compliance.			
		Presently, transmission number, registration number, GPS location	**RFID**			

		etc. is not compulsory in existing drone rules. Hence, RFID is an optional feature. As regards to GSM, manufacturer to decide how the data would be sent and received from drone. Hence, GSM is also optional	(a) Manufacturer to show and demonstrate working of RFID on the UAS **GSM SIM** (b) Software dashboard to be provided to the regulators/ SGS and real time tracking demonstrated as per a test plan			

Stage 1 Evaluation for Section 8 'Instruments / Equipment'

Summary of observations:

Recommendations:

Stage 2 Evaluation for Section 8 'Instruments / Equipment'

Summary of observations:

Recommendations:

9	**Qualification Testing**					
9.1	Environmental tests	Determine that instruments and	**Stage 1:** If UAS is powered from an external source:			

		equipment withstand the following: a) Effects of voltage spikes from power source;	Verification of test reports from an accredited testing lab submitted by the manufacturer for Surge Immunity as per ANSI/IEEE C62.41 / IEC 61000-4-5 / IS 14700 or equivalent standard. **Stage 2:** If UAS powered from on-board source: Review of design analysis report submitted by the manufacturer: (a) Details of the nominal voltage and current range of the electrical power supply on-board the UAS at various load conditions including the payloads. (b) Details of peak voltage and current range of the electrical power supply on-board the UAS at various load conditions including the payloads in various flight conditions. (c) The design analysis and technical analysis report should justify and clearly bring out that there is no possibility of voltage spikes from the power source.			

		Determine that instruments and equipment withstand the following:	**Stage 1:** Verify from the documents submitted by the manufacturer: (a) Verification of authenticated test reports from an accredited testing lab submitted by the manufacturer for Radiated Immunity as per IEC 61000-4-3			

		b) Susceptibility to HIRF; Applicable if UAS is intended to be operated in environment with HIRF	Equivalent standard. (b) Manufacturer should ensure bonding of the components and grounding them properly to the airframe. The same should be verified from the documents. **Stage 2:** Verification of original test report. (a)Original test report should be verified during flight trial. (b) Bonding of components to be physically verified in the UAS.			
		Determine that instruments and equipment withstand the following: c) Temperature and humidity variations;	**Stage 1:** Verify from the documents submitted by the manufacturer: **For Temperature:** Verification of authenticated test reports as per IS 9000 Part 2 & 3 or equivalent standard from an accredited testing lab submitted by the manufacturer. **For Humidity:** Verification of authenticated test reports as per IS 9000 Part 4 or IEC 60068 2 78 or equivalent standard from an accredited testing lab submitted by the manufacturer. **Stage 2:** Verification of original test report. (a) Verify original copy of temperature and humidity test reports during flight trial			
		Determine that instruments and equipment withstand the following: d) Shock resistant, etc.	**Stage 1:** Verify from the documents submitted by the manufacturer: (a) Verification of authenticated test reports from an accredited testing lab submitted by the manufacturer for shock resistance, as per IEC 60068-2-27 or equivalent standard			

			Stage 2: Verification of original test report. (a) Verify original copy of the shock test reports during flight trial			
		Determine that instruments and equipment withstand the following: e) Ingress Protection (IP) Certification	**Stage 1:** Verify from the documents submitted by the manufacturer: (a) Verify whether the manufacturer has defined IP certification. (b) In case the manufacturer has defined IP Certification, verify from documents the details of specified ingress protections codes like water, dust, chemicals, fumes etc. (c) Verify test plan and test reports of IP parameters as per the codes. (d) The tests should be carried out in accredited lab. **Stage 2:** Verification of original test report. (a) Verify original copy of the IP test reports during flight trial.			
9.2	EMI / EMC test	Determine that each electrical instrument and equipment is protected against EMI coming from the operational environment to ensure normal operation.	**Stage 1:** Verify from the documents submitted by the manufacturer: Verification of test reports from an accredited testing lab submitted by the manufacturer for Radiated Immunity, as per applicable Parts and Clauses of IEC 61000 / IS 14700 or equivalent standard. **Stage 2:** Verification of original test report. (a) Verify original copy of EMI/EMC test reports during flight trial.			
9.3	Software	a) Determine impact of loss of function and malfunction of UAS	**Stage 1:** Verify from the documents submitted by the manufacturer:			

			(a) Verification of Risk analysis statement of software submitted by manufacturer. This should be accepted by SGS			
		b) Determine that sufficient independence exists between software components with respect to both function and design components with respect to both function and design	**Stage 1:** Verify from the documents submitted by the manufacturer: (a) To verify statement of independence software issued by the manufacturer. (b) SGS to approve the statement of independence. (c) Verify software independence test report carried out per the test plan (IV&V). **Stage 2:** If IV&V is done by manufacturer, SGS to validate			
9.4	Hardware	a) Determination of hardware design life cycle through established quality control procedure,	**Stage 1:** Verify from the documents submitted by the manufacturer: (a) Verify documents submitted by the manufacturer on Quality Control Procedure / Internal Quality Assurance procedures adopted during manufacturing of the UAS. **Stage 2:** Verification during flight trial. (a) Verify Quality Control Procedure / Internal Quality Assurance procedures followed by the manufacturer in their facility.			
		b) Component performance and reliability to be monitored on a continuous basis.	**Stage 1:** Verify from the documents submitted by the manufacturer: (a) Verify component performance, monitoring process effectiveness submitted by the manufacturer. (b) Check that component performance, monitoring process effectiveness has been documented in the UAS Maintenance Manual. **Stage 2:** Verification during flight trial.			

			(a) Verify record of various failures observed during product development period, failure analysis, its impact on safety & reliability, rectification carried out and measures taken to ensure no recurrence of such failures etc.			
Stage 1 Evaluation for Section 9 'Qualification Testing'						
Summary of observations:						
Recommendations:						
Stage 2 Evaluation for Section 9 'Qualification Testing'						
Summary of observations:						
Recommendations:						
10	**Documentation**					
10.1	UAS Flight manual	UAS flight manual should contain the following information: 1. Limitations / operating conditions/ operating envelope	**Stage 1:** SGS to review the submitted flight manual and approve the content for its applicability.			

		2. Normal Procedures, pre-flight checklist, etc. 3. Emergency procedures 4. Performance (at various combination of weight, altitude, temperature and wind conditions) Any other relevant information required for safe operation of UAS				
10.2	UAS Maintenance Manual	UAS maintenance manual should consist of the following: 1. Maintenance procedures of the UAS. Continuous Monitoring process for UAS components	**Stage 1:** SGS to review the submitted maintenance manual and approve the content for its applicability.			
10.3	UAS Log book	UAS log book should consist of the following: 1. Provision to maintain UAS Operation Logs 2. Provision to maintain UAS Maintenance Logs	**Stage 1:** SGS to review the submitted log book and approve the content for its applicability.			
10.4	Other design documents	1. Bill of material and country of origin	**Stage 1:** Manufacturer to submit component/sub-system level Bill of Materials (BOM), key specifications (as per manufacturer), and declaration of country of origin. The documentation submitted to be version-controlled. **Stage 2:** SGS to verify BOM submitted by manufacturer against design documents and purchase records.			

		2. Analysis reports	**Stage 1:** Verify for appropriateness the version controlled documents to be submitted along with application that are duly approved by the authorised signatory.			
		3. Test reports	**Stage 1:** Verify for appropriateness the version controlled documents to be submitted along with application that are duly approved by the authorised signatory.			
		4. Detailed drawings	**Stage 1:** Verify for appropriateness the version controlled documents to be submitted along with application that are duly approved by the authorised signatory			
		5. Consolidated hardware and software independently verified and validated reports	**Stage 1:** Verify for appropriateness the version controlled documents to be submitted along with application that are duly approved by the authorised signatory.			
		6. Material procurement record	**Stage 1:** Verify for appropriateness the version controlled documents to be submitted along with application that are duly approved by the authorised signatory.			
		7. Manufacturing process records	**Stage 1:** Verify for appropriateness the version controlled documents to be submitted along with application that are duly approved by the authorised signatory.			

Stage 1 Evaluation for Section 10 'Documentation'
Summary of observations:

Recommendations:

Stage 2 Evaluation for Section 10 'Documentation'

Summary of observations:

Recommendations: