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| IALA Guideline |

1111-9

FRAMEWORK FOR ACCEPTANCE OF VTS SYSTEM

Edition 1.0

Date (of approval by Council)

urn:mrn:iala:pub:gnnnn

Revisions to this document are to be noted in the table prior to the issue of a revised document.

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# Introduction

## G1111 guideline series

This Guideline is one of the G1111 series of guideline documents. The purpose of the G1111 series is to assist the VTS authority in preparing the definition, specification, establishment, operation, and upgrades of a VTS system. The documents address the relationship between the operational requirements and VTS system performance and functional requirements and how these reflect VTS System design and VTS Equipment requirements.

WITHOUT INFERRING PRIORITY, the G1111 series of guideline documents present system design, sensors, communications, processing, and acceptance. The guideline documents are numbered and titled as follows:

* G1111 Establishing Functional & Performance Requirements for VTS Systems
* G1111-1 Producing Requirements for the Core VTS System
* G1111-2 Producing Requirements for Voice Communications
* G1111-3 Producing Requirements for RADAR
* G1111-4 Producing Requirements for AIS and VDES
* G1111-5 Producing Requirements for Environment Monitoring Systems
* G1111-6 Producing Requirements for Electro Optical Systems
* G1111-7 Producing Requirements for Radio Direction Finders
* G1111-8 Producing Requirements for Long Range Sensors
* **G1111-9 Framework for Acceptance of VTS Systems (this guideline)**

## Document Purpose

The purpose of this document is to advise authorities providing Vessel Traffic Services on the acceptance process of a VTS System and VTS Equipment (as specified in IALA Recommendation V128 – Preparation of Operational and Technical Performance of VTS Systems).

IALA Guideline G.1111 – Preparation of Operational and Technical Performance Requirements for VTS Systems provides a framework to assist these authorities in preparing requirements for a VTS System(s) and VTS Equipment.

This document provides a framework for the acceptance process such that the specified system:

* is working according to the agreed requirements (e.g. verification); and
* is suitable for the intended services (e.g. validation).

As a result, there will be a common understanding between the authority and the system supplier about the set requirements and the procedures that demonstrate compliance.

This document’s suggested steps can be tailored depending on the system’s size and/or complexity.

This Guideline provides high-level guidance and doesn’t replace existing internationally recognised standards such as ISO 21500:2012 nor does it seek to replace individual suppliers own project management and acceptance methods.

## Defenitions

For the purposes of this document, the following definitions apply:

|  |  |  |
| --- | --- | --- |
| **Customer** | – | Authority providing Vessel Traffic Services |
| **Supplier** | – | The organisation provides a VTS System or VTS Equipment. |
| **System** | – | A system is an arrangement of parts or elements that together exhibit behaviour or meaning that the individual constituents do not [8]. This can be a group of items or devices working together. |
| **Test Procedure** | – | A (detailed) sequence of steps to be executed to demonstrate compliance to a requirement. |
| **VTS System** | – | within this document, the VTS System is considered the VTS software, hardware, communications and sensors. This excludes personnel and procedures [3]. |
| **VTS Equipment** | – | within the G.1111 guidelines, VTS Equipment refers to the individual items of software, hardware, communications and sensors, which make up the VTS System. |

# Acceptance Process Planning and Management

The acceptance process shall demonstrate the compliance of the VTS system, before an operation, to the agreed requirements.

This section provides a general framework to manage an acceptance process and suggests possible acceptance steps, focusing on the possible steps and documentation in the Acceptance Process. In the following chapters, these steps are subsequently worked out in more detail.

## *Acceptance Process Framework*

A VTS System is a complex system that includes many different technologies at single or multiple sites to support the VTS operation. These technologies include in, e.g. communications systems, monitoring systems, sensors and environmental monitoring systems and are described as “System” of the VTS System in Figure 1.

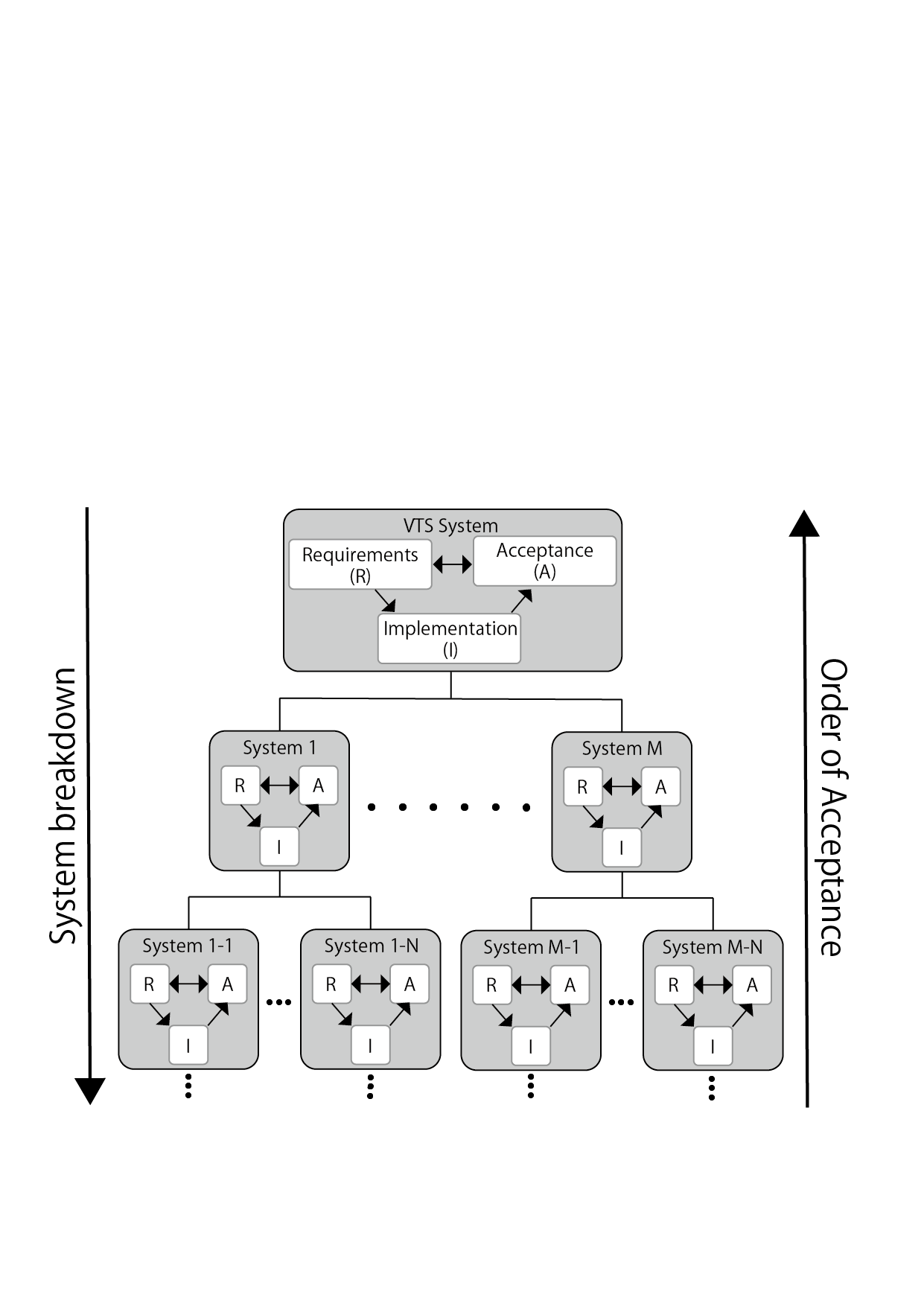
A typical acceptance process demonstrates compliance, starting from the lowest-level building blocks “System” to functional sub-“System” and, finally, the complete VTS System. This process may include multiple systems at multiple sites (e.g. the VTS centre and multiple sites for sensors and communications).

The acceptance process of VTS System and VTS Equipment consists of the following components:

* a set of agreed requirements;
* a (physical) implementation of the requirements; and
* a group of acceptance tests to evaluate the fulfilment of the requirements.

Once the lower-level systems are satisfactorily tested, the acceptance testing at the next higher level can commence, as Figure 1 illustrates.

Setting up a proper Acceptance Plan allows detecting mismatches/requirements not being met at an early stage. It prevents expensive rework in a later stage that could have been detected earlier.



1. VTS System breakdown structure and order of acceptance

### Acceptance Steps

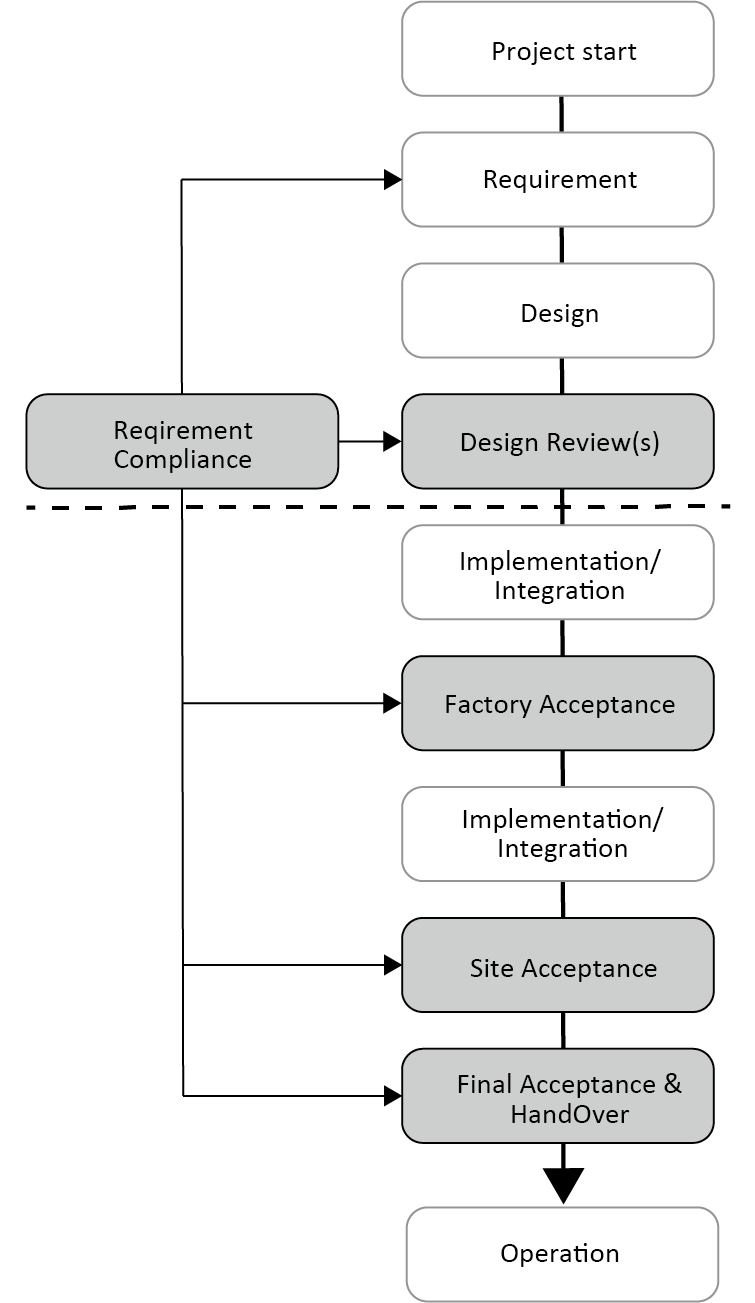
Typically, accepting a VTS system starts during the system’s design phase and continues while implementing it.

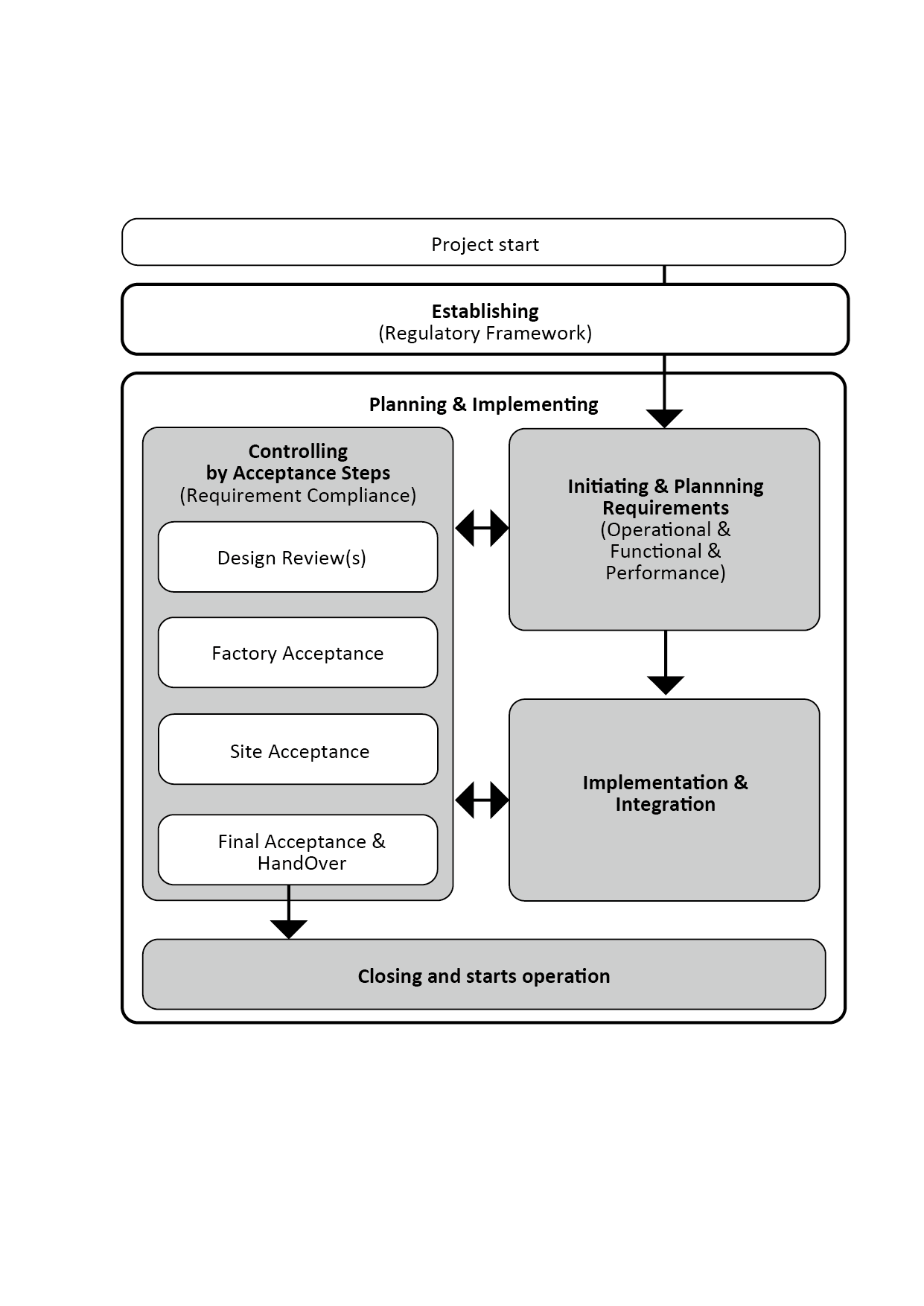
Figure 2 shows the typical steps to establish a VTS System and illustrates acceptance steps in grey boxes:

* Acceptance at Design Review(s);
* Factory Acceptance;
* Site Acceptance;
* System Acceptance; and
* Final Acceptance.

The steps illustrated by the white boxes are important steps in establishing, planning, and implementing a VTS system. Still, as these steps are not directly a part of the system acceptance, this document does not discuss them.

This acceptance process can apply equally well to the different VTS Equipment.





1. Acceptance steps within the establishment of a VTS System

## Acceptance Documentation Management

The purpose of a proper acceptance process is that the system to be delivered is, when set operational, meets all the requirements. In a complex VTS system, the Acceptance Process may be problematic. Therefore, it should be considered to organise the acceptance process and the documentation belonging to that process. During the acceptance process, both Supplier and Customer develop a mutual understanding of the requirements to be fulfilled. All the performed acceptance processes, e.g. planning, set-up and result, should be documented.

### Requirement Traceability Matrix

The Customer and Supplier should develop a clear mutual understanding of:

* The requirements: which need to be as smart as possible to avoid any ambiguity and be able to test;
* The overall test processes: which should be documented and maintained during the entire project, which includes:
* Test Plan;
* Test Criteria;
* Test Procedure; and
* Test Report;
* The timing to conduct each test: at the early stage of the project; and
* Responsibility.

It is essential to record, map and trace the link between the requirement and implementing a VTS system and/or VTS Equipment. The Customer can manage the status of each and all requirements by using the Requirement Traceability Matrix (RTM); for example:

* which requirements are tested: e.g. passed or filed, test plan, test procedure and test result;
* who is dealing with what developing issues (e.g. discrepancy, defects and project delay) relating which requirement;
* if a certain functionality has not been appropriately demonstrated, the RTM can be used to analyse the effect and control which test(s) must be repeated after correction (regression testing).

Therefore, the RTM should at least contain the followings, as illustrated in Table 1:

* uniquely identified requirement;
* unique test plan ID; and
* pass/fail indication.

1. An example of the simple Requirement Traceability Matrix

| Req No | | Requirement | Test item | Test ID | Status |
| --- | --- | --- | --- | --- | --- |
| 1 | 1 | VTS System provides situational awareness | VTS System | TP101 | Pass/Fail |
| 2 | Radar A | TP201 | Pass/Fail |
| 3 | Radar B | TP202 | Pass/Fail |
| 4 | AIS | TP301 | Pass/Fail |

1. An Example of detailed Requirement Traceability Matrix

| Requirement | | Tested VTS Equipment | Test | | | Test Documentation ID | Status | Responsible |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Description | Type | ID | Description |
| R-0213 | User protected login | VTS Console | FAT | FT-001 | Login with a valid username/password | PL-0004  SC-0004  RE-0004 | Pass | Doyle  (ABC VTS) |
| VTS Console | FT-002 | Login with invalid Username | PL-0004  SC-0004  RE-0004 | Pass | Doyle  (ABC VTS) |
| VTS Console | FT-003 | Login with invalid Password | PL-0004  SC-0004  RE-0004 | Pass | Doyle  (ABC VTS) |
| R-0726 | The system should be log errors | Data Processing | SAT | ST-023 | Produce Error xyx | TR-0052 | Fail /  Repairing | James  (ABC VTS) |
| Data Processing | SAT | ST-024 | Produce Error vwx | TR-0052 | Pass | James  (ABC VTS) |

### Acceptance Test Plan

The test plan describes an overview of acceptance steps, how the Supplier intends to fulfil the requirements. The Customer should approve the Test Plan before executing tests.

There are the following discussions and practices in the process of producing the Acceptance Test Plan:

* It makes it easier to control discrepancies and when the acceptance test broke down into smaller (sub) systems (e.g. Radar System can break down into antenna, rotation unit, antenna control unit, transceiver);
* It makes it easier to handle discrepancies by testing in the earlier acceptance step;
* If a new system is planned to connect to an existing system, it might need to consider in which step to demonstrate interaction with the current system to makes it easier to handle discrepancies and identifies a critical item.
* Prioritise and simplify the acceptance steps and reduce cost and time: every system may need not test in detail, and checking a test report can be good enough.

The acceptance test plan can be split into one high-level test plan and associated multiple test plans for VTS Equipment depending on:

* The level of effort and detail;
* the system complexity and criticality;
* Timing of the testing; and
* Cost of testing.

The Acceptance Test Plan of a VTS System should describe how the overall acceptance steps are organised, and this may include:

* Scope;
* List of items to be tested: which can be a plan to design, implement, integrate and/or interface a VTS System or VTS Equipment;
* Test approach;
* Test readiness criteria;
* Resources and Schedule;
* Acceptance Criteria(may be included in the RTM);
* Risk assessment (including action plan how to deal with discrepancies)
* Risks if the test do not fulfil the requirement and its contingency (e.g. back-up plan);
* Regression testing, e.g. a new software version has been released;
* Role and responsibility of the stakeholders (e.g. the personnel involved or conducting the acceptance test);
* Dependencies between process and steps;
* Logistics arrangements;
* Key milestones;
* Test procedure and sequence.

Also, on the forehand, thought should be given a classification of discrepancies encountered during testing. E.g. they may be classified as:

* Major/blocking; the test procedure cannot continue before solving this issue, and the responsible person should decide (preferably on the forehand ) the level of regression testing;
* Corrective: the Supplier can solve the issue during the test process, and after that, testing can continue; and
* Cosmetic; testing can continue, and the issue may be solved in a later stage.

The personnel who accept VTS System and/or VTS Equipment should be:

* familiar with the set-up and operation of the system;
* appropriately qualified to review test report and accept the system and/or VTS System; and
* appropriately qualified to make decisions in case of discrepancies.

The personnel who conduct the VTS System and/or VTS Equipment should be:

* familiar with the set-up of the system to be tested;
* appropriately qualified to perform the test; and
* appropriately qualified to decide the direction in case of discrepancies.

### Acceptance Criteria

The acceptance criteria specify conditions for how the system fulfils requirements. It should consider how to handle any discrepancies.

Acceptance criteria should:

* Be uniquely identifiable
* Have an acceptance criterion
* Be SMART (Specific, Measurable, Achievable, Relevant, Time-bound).

All requirements may not be SMART, or can easily be turned into SMART requirements. This might be the case with so-called non-functional requirements. e.g. the system should be ergonomic, easy to use/intuitive, robust, etc. These requirements usually require special attention in the Acceptance Process.

1. An Example of Acceptance Criteria

| Requirement | | Tested VTS Equipment | Test | | Result | Responsible | Remarks |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Description | ID | Description |
| R-0501 | The IALA target type 4 should be displayed on the User Interface of the VTS System | User Interface | SC-UI-0051 | Traffic Image presentation | Pass | Wim |  |
| Data Processing | SC-DP-0105 | Radar and AIS inputs are properly presented | Pass | Wim |  |
| Radar | SC-RA-0015 | Radar plot is presented with agreed quality and accuracy | Pass | Wim |  |
| AIS | SC-AI-010 | AIS information of the target is appropriately presented | Pass | Wim |  |

### Test Procedure

Test procedures should describe how to execute acceptance test for VTS System or VTS Equipment. It includes the test:

* Scope;
* Type of test;
* Functionality;
* Capacity;
* Compliance;
* Stress;
* Security;
* Test conditions, equipment, and environments;
* Test methods;
* Acceptance Criteria (if not maintained separately);
* Expected outcomes (e.g. test measurement result and log file); and
* Test scenario’s; describing the different scenario’s used in demonstrating a Requirement.

The basic test methodologies applicable to system acceptance may include the following:

|  |  |  |
| --- | --- | --- |
| Inspection | – | Inspection determines acceptance by whether the system is in proper condition and right quantity involving examination and observation (e.g. paint colour, weight, physical dimensions, etc.); |
| Similarity | – | Similarity determines acceptance by whether the system is modified or similar to an existing accepted system. It needs to be a similar system and/or system architecture. |
| Analysis: | – | Analysis determines acceptance by showing theoretical compliance under defined conditions between the proposed system and the agreed requirement. Analysis (including simulation) is used where testing to realistic conditions cannot be achieved or is not cost-effective. |
| Demonstration | – | Demonstration determines acceptance by a practical or qualitative exhibition and explains how the system works or performs functionally. Demonstration may be conducted by using a set of system stimuli or test jig. Demonstration can be used to show that the system responses to the stimuli are suitable. Demonstration may be appropriate when requirements or specifications are given in statistical or practical terms (e.g. mean time to repair, average power consumption, etc.) or test item is a partial system of a larger system (e.g. replace or repair of system module). |
| Verification: | – | Verification is an action to confirm an item’s operability, supportability, or performance capability. Verification often occurs under controlled conditions, which is real or simulated, and uses special test equipment or instrumentation to obtain very accurate quantitative data for analysis. |
| Operational Trial | – | Operational Trial is a period to demonstrate system performance and reliability. |
| Certification | – | Certification is a written assurance that the product can perform its assigned functions by legal or industrial standards. (e.g. CE certification, UL certification, etc.) |

### Test script

The test script is the most detailed documentation in acceptance testing and is a line-by-line description of all plans, actions and data to execute the acceptance tests. The test script typically has steps that try to describe the planned test in as detail as possible. These steps should have expected results.

A test script describes one or more tests to be executed in the Acceptance process and may refer to or include:

* A requirement to be demonstrated (requirement ID as well as a short description);
* A (detailed) description of the test set-up (if not described elsewhere yet);
* Required input parameters (if applicable);
* An expected outcome of the test;
* The actual result of the test; and
* A pass/fail indication



### Test report

After each test is performed according to the Acceptance Test Plan, the Supplier should produce a test report. The purpose of the test report is to record and have a reference on:

* Tested requirement(s);
* List of items to be tested;
* Configuration details (e.g. Customer, software revisions, hardware revisions, parts and serial numbers);
* Test date and time;
* Test environment (e.g. weather, temperature, humidity, and air pressure);
* Person(s) who performed/witnessed the test and Signatories;
* Test outcome (e.g. Pass/fail);
* Functional and performance test results (e.g. measurement result, log file) and comments (e.g. measurements, findings, etc.);
* Updated Compliance matrix to the requirement and design;
* Documentation (e.g. manuals, quality assurance document, copy of certifications, design document, system configuration drawing);
* References to project name;
* List of instruments and their calibration status; and
* Report of discrepancies (if applicable).
* Acceptance criterium; and
* remarks (if needed).

# Test Execution / Acceptance steps

## *Design Review*

### Introduction

The acceptance process can include design review(s) depending on the VTS system complexity. The design review evaluates whether or not the developing system design meets requirements. Early involvement of relevant stakeholders in the process of the system architecture and design development:

* Reduces risk of misunderstandings of requirements;
* Helps to identify possible risks (e.g. first-time development risk, delay of delivery) and prepare the approach to them;
* Develops mutual understandings of the system design and architecture;
* Works as input for the way, steps and timing to accept the system;
* Demonstrates if the system design fulfils the requirements before implementation; and
* Helps them to be aware of issues related to the design, performance and legality.

Typically, in a design review, a ‘walk through’ might be done to check if all the required elements/subsystems are designed correctly to form a coherent and integrated system. In this stage, issues such as flexibility, expandability, security, etc., might be clarified. This is also a base for a more detailed lower-level Design, upon which further subsequent orders might be placed.

### Test readiness

The Customer should make sure documentation by the Supplier is ready before design review, which can include:

* A high-level design document (e.g. system architecture diagram, overall system configuration, technical datasheet) ;
* A low-level/detailed design which is available at this stage (e.g. network diagram, circuit diagram, manual);
* Interface designs and arrangements;
* A risk assessment by Supplier, for example:
* interference or unwanted reflection of radio transmitting system;
* Site survey report (if applicable): (e.g. a new radar implementation may require a site survey to test that the planned location doesn’t lead to unexpected/unwanted side effects, like reflections from large objects in the neighbourhood);
* Analytic or demonstrated documentation of proposed system under defined conditions (e.g. coverage simulation, strength calculation and wind load calculation).
* (if applicable or available), Technical documents (e.g. Technical data sheet and Manuals).

### test execution

The Customer can execute design review by inspection of the documentation against the requirements. The design review execution should take into account:

* To check all requirement has a design to be implemented;
* To check the design meets expectations; e.g. centralised vs de-centralised;
* To check all (external) interfaces projected in the design;
* To check the total number of inputs and outputs are available; and
* Besides all these aspects, to walk-through’ regarding outage and calamity.

### test result

The design review’s execution may result in developing:

* Mutual misunderstandings of the requirement;
* The awareness and an approach developed for possible risks;
* The system design and architecture with mutual understandings;
* Input for the way, step and timing of the acceptance;
* The awareness of the design, performance and legal issues.

In that design, various subsystems may have been identified performing a particular task each other. The requirement and RTM should be updated if necessary in the process of the design review.

## *Factory Acceptance*

### Introduction

The Customer can set an acceptance step at the factory level (Factory Acceptance) for VTS Equipment or overall VTS System, depending on the VTS system complexity to demonstrate the functional and technical performance and their interaction to the requirement before installation on-site.

The Factory Acceptance may be the only opportunity to demonstrate that the developed system aligns with the requirement and design before integration or installation on-site.

The Factory Acceptance is unique in the Acceptance Steps because the specific and specialised test equipment (e.g. measuring equipment and test jig) and the controlled environment are available, which makes Factory Acceptance:

* Methodical;
* Efficient;
* Precise; and
* Repeatable.

Depending on the importance and criticality of the system, the Customer can select to conduct Factory Acceptance by:

* Documentations, which the Supplier publishes (e.g. a quality assurance document and factory test report); or
* Customer or Customer’s representative witnessed the Factory Acceptance Test (FAT).

The above way of the Factory Acceptance could be decided at an earlier stage (e.g. Design phase and Design Review).

### Test readiness

The Customer should make sure the Supplier who has prepared the followings before Factory Acceptance, which can include:

* The Factory Acceptance Test Plan(obligation and responsibility of that Supplier and Customer);
* The Factory Acceptance Test Procedure;
* The Factory Acceptance Test Scripts
* Detailed system design documentation;
* The Implemented system is placed at the factory and ready for the test.

The Customer should take into account the following when checking test readiness of the Factory Acceptance:

* The test set-up fits for the test purpose;
* Condition of the test set-ups;
* The test is capable of demonstrating one or more requirements; and
* Condition of the production and integration of VTS Equipment or overall VTS System.

### Test Execution

Factory Acceptance should be executed based on the agreed Test Plan, Test Procedure and Test Scripts. The Supplier should issue the FAT report, including the items listed in Section 2.2.6, after Factory Acceptance.

Factory Acceptance could include the following activities:

* Inspection of Documentation (including Production Test Reports);
* Review of Quality, Health, Safety and Environmental processes;
* Demonstration and Test by FAT.

In case the FAT is performed by test, the FAT could include the following activities:

* Inspection of physical configuration(including items to be tested and test equipment) ;
* Visual inspection;
* Inspection of set-up, parameter adaptations, and tuning;
* Execute the Test Plan step by step;
* fill in the result into the Test Report.

If Failing a test, a ‘Fail’ should be noted, and a re-test may occur. Any adjustments made for re-test should be reported and agreed upon. As far as possible, clarification for the difference between test and re-test should be given.

### Test Result

Factory Acceptance execution results in:

* Factory Acceptance testing has been performed, and results are available;
* The Customer confirms the tested system’s performance to meet requirements (The RTM need to be updated);
* The Customer obtains Factory Acceptance Test Report by the Supplier;
* The Customer confirms that there are no blocking issues noted to the tested system
* The Tested system is ready for the next step (e.g. prepared to ship, install and integrate on-site).

On request, Both the Customer and Supplier have to agree upon discrepancies found during testing and the belonging Classification (e.g. Major/blocking, Corrective, Cosmetic).

## *Site Acceptance*

### Introduction

The Customer can set an acceptance step on-site (Site Acceptance) to demonstrate VTS Equipment or overall VTS System, depending on the VTS system complexity, against the agreed design and requirements after installation. The Customer can select to set Site Acceptance as a single test or multiple tests depending on the VTS system complexity.

Site Acceptance may be the only opportunity to test fulfilling the requirements in the operational environment before the operation launches. The Customer should consider conducting a Site Acceptance test because:

* The Customer can observe dynamic performance measurement;
* The Customer can obtain live data;
* The Customer can confirm the interaction and integration between:
* the developed system and the developed system; and
* the developed system and the present system and infrastructure;
* The test is performed in the representative environment (e.g. geography);
* The test demonstrates the compliance and suitability of the system to the mutually agreed requirement.

The Customer needs to consider the Factory Acceptance result, not repeat the tests done at FAT.

### Test readiness

To avoid the situation that the installed system does not meet the requirement or expected result, the Customer and the Supplier should ensure the following aspects before conducting Site Acceptance:

* The developed system fits the installation environment or facility;
* Possible radio transmission-related interference does not occur between the installed system and the existing system, which are placed at the same or nearby facility; and
* the installation location doesn’t lead to any unexpected and unwanted side effects by conducting a radar system site survey (e.g. reflections from objects nearby, unwanted ghost echo).

The Customer should make sure the Supplier prepare the following before Site Acceptance, which can include:

* The Site Acceptance Test Plan;
* The Site Acceptance Test Procedure;
* The Site Acceptance Test Scripts
* The on-site condition report (e.g. installation, set up, integration and construction work)
* The status of possible corrective actions from previous acceptance steps (e.g. Design Review and Factory Acceptance);
* The site access and physical security;
* Facilities and environmental condition (e.g. power supplies (grid / non-grid / back-up));
* Safety measures (e.g. proper grounding, fire and lightning protection);
* Ergonomics;
* Communication and network connections on-site and, if required, off-site;
* Presence of authorised and qualified personnel (both Customer and Supplier)

### Test Execution

Site Acceptance could include the following activities:

* Physical Configuration Audits;
* Inspection of installation and workmanship, including regulatory compliance;
* Inspection of operational mode testing of:
* the system;
* the system interface; and
* integration (e.g. communications);
* Inspection of set-up, parameter adaptations, and tuning.

It should be recorded to assess and discuss the impact between the Customer and the Supplier if there is:

* any modification made for performing the Site Acceptance test;
* any failure to the test; and
* the determined error classification.

### Test Result

Site Acceptance execution results in:

* a developed system meets the requirement (RTM should be updated accordingly);
* a developed system is in line with the system (detailed) design;
* the system is working according to the requirements with operational data and;
* the system is working according to the requirements with the external interface; and
* all SAT results and documentation are available.

The test results should be discussed/spoken through with the Customer. If no blocking issues have been noted, the (sub-) system under test is ready for the next phase in the Acceptance Plan, which may be, e.g. a further integration or releasing it for operational use.

## *SYSTEM ACCEPTANCE*

### Introduction

The Customer can conduct System Acceptance depending on the complexity of the system. System Acceptance is:

* A complete acceptance test for VTS Equipment, which is set up to be ready for the operation;
* End-to-end testing where the Customer tests entire system flows (from login to logout) based on the requirement (both functional and non-functional); and
* Conducted before Final Acceptance.

The System Acceptance can be performed to test operational readiness. The Customer evaluates a developed VTS Equipment by working and maintaining under their operational process and procedure. The activities of the System Acceptance can be found in Chapter 4.1.

### Test Readiness

To avoid the situation that the developed and installed system does not meet the requirement or expected result, the Customer and the Supplier should ensure the following aspects before conducting the System Acceptance:

* The tester(s) has/have full access to the VTS Equipment;
* the VTS Equipment have passed previous tests; and
* the VTS Equipment has been installed and set operational according to the requirements.

### Test Execution

The System Acceptance could be performed over a period of time and could monitor the performance and functionality of the VTS Equipment including:

* Communications (e.g. Networking);
* Interfaces and Integration;
* Reliability and Availability; and
* Coverage.

### Test Result

System Acceptance execution results in:

* a developed system is functioning and performing according to the requirements and ready for operation as a VTS Equipment;
* all operational input data to the VTS System is accepted;
* the external interface of the VTS Equipment is working and accepted; and
* all System Acceptance test results and documentation are available.

# Final Acceptance

## Introduction

Final Acceptance is a Customer’s acceptance of the VTS System from the Supplier after the overall work is completed and tested in accordance with the contract requirements. When the Final Acceptance is completed, the VTS System is handed over to the Customer and ready for operational use.

The Final Acceptance Test provides certainty and confidence to your PV project by verifying the fulfilment of technical and safety standards. Without a FAT, there may be a loss of long-term sustainable protection of revenue. Warranty compliance for future warranty claims against manufacturers may also be affected.k

The Final Acceptance test should be performed regardless of the complexity of the VTS System in order to:

* Test the complete VTS system;
* Ensure the interfaces are functioning and performing correctly;
* Ensure the VTS system is functioning and performing as intended;
* Ensure the VTS system is reliable; and
* Observe the VTS system across different Meteorological and Hydrographical conditions.

The Final Acceptance for the overall VTS System is a unique process to the other acceptance tests. It may follow the confirmation of all acceptance documentation(s) for the VTS Equipment. The activities of the Final Acceptance test can include:

* back-up facilities;
* Performance test;
* Evaluation of the VTS System to work with operational procedures (e.g. disaster recovery procedures, maintenance procedures, security procedures); and
* Component and network fail-over (Within the same data centre);
* Functional test; to evaluate:
* Accessibility;
* Stability;
* Usability;
* (IT) Service Management (Supportability);
* Monitoring and Alerts (to ensure proper alerts are configured in the system if something goes wrong);
* Recovery (across data centres) (e.g. application/system recovery and Data recovery);
* Reliability;
* Back-up and Restoration (Recovery);
* Disaster Recovery;
* Maintainability;
* Performance, Stress and Volume;
* Procedures (Operability) and Supporting Documentation (Supportability);
* and
* Security and Penetration.

## Test Readiness

The VTS System may have been through its own Design Review acceptance, Factory Acceptance, Site Acceptance and System Acceptance, and the results of the acceptance tests’ reports are available for the Customer.

The VTS System should be set up for operational mode, and the following documentation should be ready before conducting Final Acceptance including:

* The Final Acceptance Test Plan (obligation and responsibility of that Supplier and Customer);
* The Final Acceptance Criteria
* The Final Acceptance Test Procedure; and
* The Final Acceptance Test Scripts.

## Test Execution

The Final Acceptance could be performed over a period of time and could monitor the performance and functionality of the VTS System including:

* Communications (e.g. Networking);
* Interfaces and Integration;
* Reliability and Availability;
* Coverage;
* Monitoring and alerts; and
* Recovery (e.g. application/system recovery and Data recovery).

## Test Result

The completion of Final System Acceptance means:

* A VTS system is functioning and performing according to the requirements and ready for operation;
* A VTS system presents all available operational data;
* Interface and interaction of all VTS Equipment is working;
* , including a VTS System is handover to the Customer

# references

1. IALA Recommendation V-119 The Implementation of Vessel Traffic Services
2. IALA Recommendation V-128 Preparation of Operational and Technical Performance Requirements for VTS Systems
3. IALA Guideline 1111 Preparation of Operational and Technical Performance Requirements for VTS Systems
4. IALA Guideline 1150 Establishing, Planning and Implementing VTS
5. IEEE 1012-2016 IEEE Standard for System, Software, and Hardware Verification and Validation
6. ISO 9000-2005 Quality Management Systems
7. ISO 15288-2008 Systems and Software Engineering – System life cycle processes
8. INCOSE-TP-2003-002-03.2.2 INCOSE Systems Engineering Handbook. A Guide for System Life Cycle Processes and Activities, Ver. 3.2.2 October 2011