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# Objectives / Purpose

This document describes all the Software quality related aspects during the development of the STRX RFE FW project. It presents the quality organization interaction with project team, its role and responsibilities within the projects, specific quality assurance activities, the quality goals and metrics, peer review activities. This document describes project specific quality assurance process not documented into AMP SW Quality Assurance Procedure [3].

# Scope

This Software Quality Assurance document is applicable for RFE FW project.

RFE FW is classified as Class A , whereas RFE GUI is classified as Class C.

All the process, activities and goals are as applicable based on the class type.

# Quality Assurance Organization

## Roles, Responsibilities and Assignment

The following roles are involved in STRX RFE FW software quality assurance activities:

| Role | Responsibilities | Role Assignment |
| --- | --- | --- |
| Project Manager | Documented in BL AMP SW Roles Description [2] aligned to BU Auto Roles Description | Maulik Prabhudesai |
| Development Team Manager | Documented in BL AMP SW Roles Description [2] aligned to BU Auto Roles Description | Sridhar Ramaswami |
| Resource Manager | Documented in BL AMP SW Roles Description [2] aligned to BU Auto Roles Description | Nur Engin |
| Test Team Manager | Documented in BL AMP SW Roles Description [2] aligned to BU Auto Roles Description | Anoop Kant Dixit |
| Software Architect | Documented in BL AMP SW Roles Description [2] aligned to BU Auto Roles Description | Artur Burchard |
| Quality Assurance Engineer | Documented in BL AMP SW Roles Description [2] aligned to BU Auto Roles Description | Siddareddy S |
| Software Quality Assurance | Documented in BL AMP SW Roles Description [2] aligned to BU Auto Roles Description | Eleonora Gianfermi |

Table 1 Roles, Responsibilities and Assignment

## Reporting structure

The relationship between the RFE FW, RFE GUI team and the SW Quality organization is presented in the following figure:

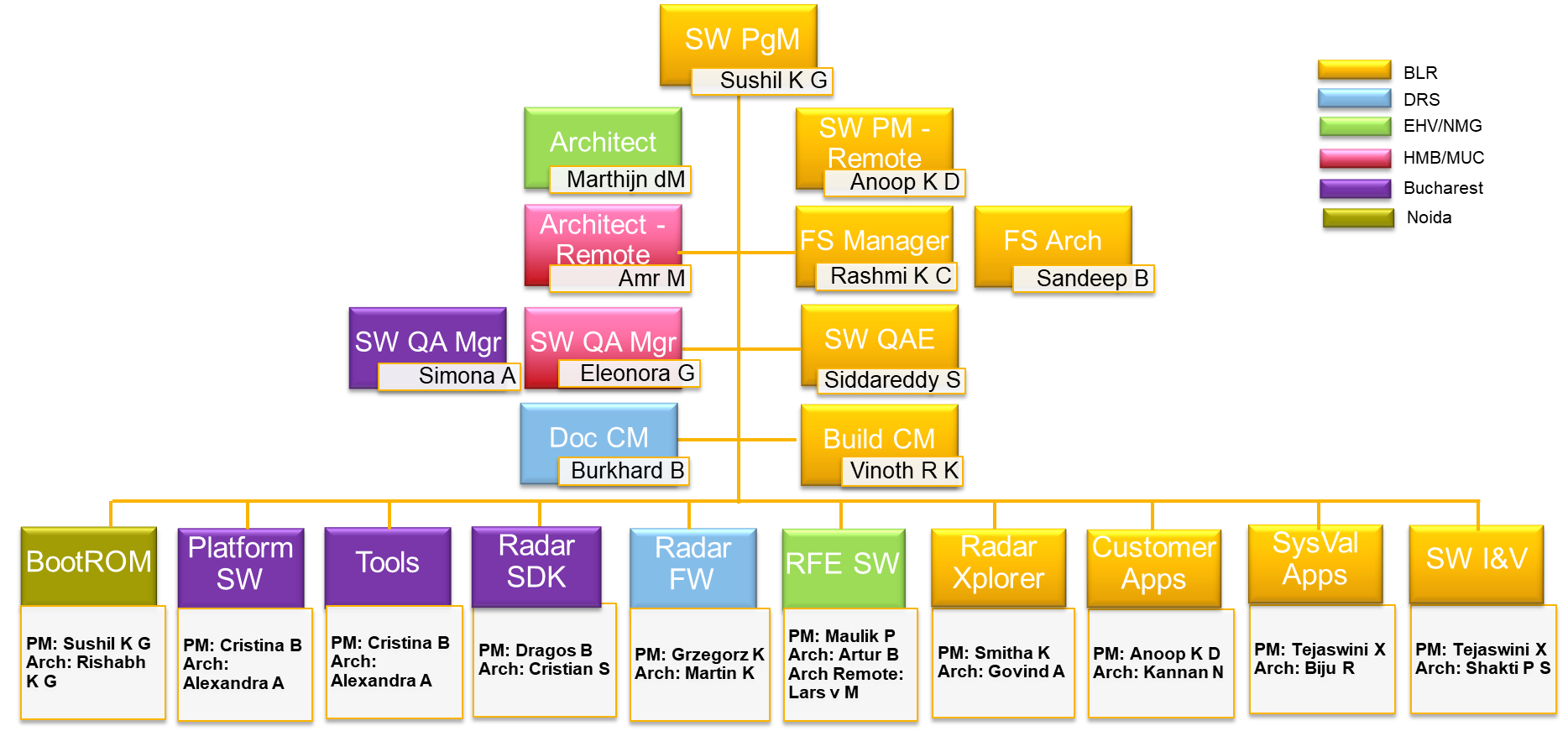


Figure 1 STRX RFE FW, GUI SW and QA organization

## Escalation Path

Issues found during QA activities are discussed first with Project Manager and escalated to the Quality Manager and Team Manager if not resolved.

## Quality Resources and Infrastructure

Quality Assurance resources, infrastructure and facilities required for performing the STRX RFE FW quality assurance activities and the information related to quality management and process tools can be found in the AMP SW Quality Assurance Generic Plan [3].

.

# Quality Assurance Activities – Project Planning

Quality assurance activities are performed per AMP SW Quality Assurance Generic Plan [3].

##### Variations or tailoring to the global process are explicitly identified in STRX RFE FW[6] Project Management Plan[7].

## Project Quality Activities Schedule

The quality assurance activities with their frequency, development phase and outputs are described in the table below:

| Activity | Frequency | BCaM Phase | Output |
| --- | --- | --- | --- |
| Elaborate the Quality Assurance Plan.  Set project quality goals, metrics, QA activities schedule | Created in Planning phase, updated as needed | Planning | Software Quality Assurance Plan |
| Facilitate the Lessons Learned sessions | After each major milestone or as appropriate | Execution | Lessons Learned summary |
| Evaluate and present the quality status at the Release Readiness Reviews | Prior to each release, during RRR sessions | Execution | Release Readiness Review Report |
| Analyze, review and report metrics | Per Metrics Plan | Execution | Metrics reported in AMP SW Metrics database |
| Train teams on Process & Tools | As needed (if necessary) | Planning | Training Records |
| Facilitate defect root cause analysis, follow up corrective actions | Quarterly | Execution | Defect analysis report |

Table 2 Quality Activities and Frequency

The following table contains the schedule of the STRX RFE FW quality assurance activities:

| Phase | Activity | Due date |
| --- | --- | --- |
| Planning | Create STRX RFE FW and GUI SW Quality Assurance Plan | Initial Version at PDA and Approved Version at PPA |
| Execution | Gates Reviews | Before each gate and major milestone per STRX RFE FW schedule |
| Release Readiness Review | Before each major milestone |
| Metrics Implementation & Analysis | As per Metric Plan – see chapter 8.0 |
| Change Management Audits | Before each release as part of RRR |
| Lessons Learned | As planned by Project Manager |
| Process & Tools Trainings | Process & Tools Training set for the all team members, per STRX RFEFW Training Plan |
| Defect root cause analysis | Quarterly after first EAR release |

Table 3 Schedule of Quality Assurance Activities

Each activity is described in detail in AMP SW Quality Assurance Generic Plan. Templates and checklists are used for audits and reviews.

## Estimations and Costs

BL Manager of Infrastructure and Support team is responsible for allocation of SQE/QAE to projects. Quality assurance activities are estimated and scheduled as part of the project planning and are available in project schedule.

Costs are managed at BL RFP level. There are no additional costs related to quality assurance of this project.

## Risks

Quality risks and issues are reported to the Quality Manager and Project Manager and tracked into the project Risk Register [9], as described in the STRX RFE FW SW Project Management Plan[9].

## Assumptions and Constraints

Assumptions and constraints impacting the successful execution of this plan are documented in AMP SW Quality Assurance Generic Plan.

# Peer Reviews

## Process

For detailed description of the peer review process, see AMP SW Review Guideline [4]. The tailoring of the review process is described in Radar SDK Project Management Plan (Safety Plan).

## Review Activities

Every artifact (documents and code, including internal engineering documentation, JIRA tickets of type New Feature, Bug and Task) is reviewed and evidences of the review are available in Atlassian Bitbucket/Pull request or in Crucible, project CR-STRX.

The reviewers, review specification, review type and the records for each work product are documented in STRX RFE FW SW Project Management Plan .

Usage of checklists is required for verifying compliance with design guidelines and coding guidelines[10] (also for verifying the reason for accepting MISRA non-compliances):

* for the arch spec review – at least once before its approval (PDA), and upon major changes (STRX RFE FW SW Arch to decide and to document this in JIRA Ticket, Analysis Report field)
* for the detailed design review – at least once before its approval (first EAR) and upon major changes (Component Tech Lead to decide and to document this in JIRA Ticket, Analysis Report field)
* for the code review – at least once before starting test campaign for the BETA or RTM, and upon major code changes (Component Tech Lead to decide and to document this in JIRA ticket, Analysis Report field)

The review checklists are stored in git as specified by STRX RFE FW SW Configuration Management Plan [8].

### Records

Each review has a formal record consisting of – review date, participants and roles (the moderator can approve/reject the artefact), the artefact under review.

In case the checklists are used for design/code, then the pull request or Crucible record must contain reference to the final version of the review checklist.

## Safety Confirmation Measures

| Confirmation Measures Type | Work-Product Under Review | Performed By | Date |
| --- | --- | --- | --- |
| Confirmation Reviews | Safety Plan | corporate assessor | before first safety-related EAR, no later RTM |
| Safety Analysis (SW FMEA) | corporate assessor | before safety-related BETA, no later RTM |
| Tools Qualification | other member of SQE team | before safety-related BETA, no later RTM |
| Safety Case | corporate assessor | RTM |
| Safety Audit | all | corporate assessor | RTM |
| Safety Assessment | all | corporate assessor | RTM |

Table 4 Safety Confirmation Measures

# Release Readiness Review

## Process

The Release Readiness Review process is described in detail in AMP SW Quality Assurance Generic Plan.

## Project Specific Release Readiness Review

Actions and owners:

* Review the content of Quality Package, per the Release Criteria [8] – SQA/QAE
* Review of Release Notes – SQA/QAE
* Review in JIRA the status of the tickets planned to be implemented in the release (including bitbucket and Crucible) – SQA/QAE
* Communicate gaps, if any, to PM and team - SQA/QAE
* Define actions to close the gaps reported by SQA – PM
* Track actions to closure (by the end of the release day or for future release) – PM
* Communicate decision to PM and product owner (Go, Go (with actions), No Go) – SQA/QAE
* Request waiver (level 1 or level 2), per AMP Governance Generic Plan – PM
* Finalize the RRR report, BCaM7 Compliance Report and BCaM7 milestones presentation, and communicate them to Project Board - SQA/QAE

A specific STRX RFE FW SW Release Readiness Review checklist is used, aligned with AMP SW template, enriched with specific STRX SW checks.

STRX RFE FW SW Release Readiness Review reports are stored in the STRX RFE FW SW git repos.

# Project Quality Goals

RFE FW is classified as Class A , where as RFE GUI is classified as Class C, respective goals are applicable based on Classes.

As RFE GUI is based on python/Java code, the metrics applicable for C Code will not be measured , however additional metrics in the Table 6 will be measured in addition to the applicable ones from Table 5.

The following table contains the quality goals, metrics and targets aligned to the AMP SW organizational requirements:

| Metrics Category | Metric Name | Frequency | **Mandatory for classes:** | Analysis |
| --- | --- | --- | --- | --- |
| Requirements Management/ Design | Feature Complete =  100% requirements fulfilled out of total reqts approved at PDA, as per agreement with Marketing (approved roadmap and SOW) | BETA, RTM | A, A’, B, C, O | RRR |
| Requirements Management/  Design | 100% traceable requirements fulfilled in design or in design and code out of the total requirements | BETA, RTM | A, A’, B, C, O | RRR |
| Requirements Management/  Design | 100% verified requirements (tested or reviewed) out of the total requirements | BETA, RTM | A, A’, B, C, O | RRR |
| Requirements Management/  Design | 100% RRU, RRS - detailed design elements traced in sw units and, if possible, in function name  100% RRM, RRU2 - detailed design elements traced in sw units and function name | BETA, RTM | A, A’, B, C, O | RRR |
| Code | 0 Unjustified MISRA Violations  (Mandatory, Required, Advisory; project deviations documented in Coding Guidelines) | BETA, RTM | A, A’, B, C (partially) | RRR |
| Code | 0 static analysis issues reported by quality checkers (Coverity) | BETA, RTM | A, A’, B, C | RRR |
| Code | HIS Code Metrics[11]:  RRU, RRS – Cyclomatic Complexity only  RRU2, RRM – Cyclomatic Complexity and Nesting Level  Max Cyclomatic Complexity = 30  Recommended target for Nesting Level = 4; number of existing unjustified violations to be gradually reduced to 0 for BETA and RTM  The reason for accepting functions having cyclomatic complexity and nesting level greater than the target to be documented in the HIS Metrics report, on the respective lines | BETA, RTM | A, A’, B | RRR |
| Testing Process Metrics | 100% Requirements-Test Coverage for testable requirements (tests that cover requirements are executed) | BETA, RTM | A, A’, B, C | RRR |
| Testing Process Metrics | Code Coverage: Statement Coverage, Branch or Decision Coverage; MC/DC for safety only  *Goals for BETA to be defined*  *Goal for RTM: 100% Statement and Branch or Decision Coverage* ***as technically feasible; i****n case there are technical constraints and some statements or decisions cannot be tested, the reason is documented in the code coverage report (****see section below****)* | BETA, RTM | A, A’, B, C | RRR |
| Testing Process Metrics | 100% Test Pass Rate | RTM | A, A’, B, C, O | RRR |
| Testing Process Metrics | 0 S1 for EAR  0 S1, 0 S2, 0 S3 for BETA and RTM | EAR, BETA, RTM | A, A’, B, C, O | RRR |
| Peer Review Process Metrics | 100% Peer Review Coverage (pull requests + Crucible Reviews) for both code and documents | EAR,,BETA, RTM | A, A’, B, C, O | RRR |
| Quality Assurance Metrics | BCaM 7.0 "Clean Gate" metric for both Gates and Major Milestones  100% expected deliverables are available complete and approved | every gate/ milestone | A, A’, B, C, O | every gate/ milestone |
| Functional Safety | 0 Safety Issues reported during ISO26262 assessments | twice per year | A | twice per year |
| Functional Safety | 100% safety measures resulted from Safety Analysis (SW-FMEA) traced in Requirements Specification or in the Safety Manual | BETA, RTM | A | RRR |
| Functional Safety | 100% safety measures resulted from Safety Analysis (SW-FMEA) which are tested (excluding those documented as assumptions in the Safety Manual) | RTM | A | RRR |
| Problem Resolution | Each Customer Defect (Severity 1) to be resolved in less than 14 days | Monthly | A, A’, B, C, O | AMP SW metrics |

Table 5 Quality Goals and Targets

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Metrics Category** | **Metric Name** | **Frequency** | **Mandatory for classes:** | **Analysis** |
| Code | 0 Unjustified SonarQube blockers | BETA, RTM | NA | RRR |

Table 6 :Quality Goals and Targets

If the customer or product management or marketing requires a release with known defects of S1 and S2, the release must carry the following notice in the Release Notes: “This release contains defects or other issues which could compromise its *usefulness, stability, or compatibility with previous and future releases.”* And the defects shall be listed as known issues in Release Notes.

## Code Coverage Limitations

As reason for not testing a statement/branch it is highly recommended to select one of the options as possible:

1. **Not technically feasible, accepted limitation:** This statement/branch cannot reach due to avoiding MISRA violation (coding rule)
2. **Not technically feasible, accepted limitation**: This statement/branch cannot reach limitation of software testing (some test scenarios cannot produce by software).
3. **Technically feasible, accepted limitation**: This statement/branch has been reached, by modified source files and tested by fault injection, but tool would not count this test*.*
4. **Technically feasible, accepted limitation**: This statement/branch has been tested by functional test, but not in tool test suites
5. **Technically feasible, no limitation:** This statement/branch has not been reached. Code coverage can be improved and Jira tickets are raised to plan and track the testing activities performed to increase the code coverage numbers

# Project Metrics Plan (Project KPIs)

## Metrics Strategy

Metrics are identified, defined, implemented and analysed per AMP SW Metrics Plan [5].

## Metrics List

Metrics list is documented in section 7.0 above.

# Acceptance Reviews and Approvals

| Name | Role | Location | Date |
| --- | --- | --- | --- |
| Sridhar Ramaswami | SW Development Manager | Bangalore,India |  |
| Bernhard Bollig | BL RFP Quality Head | Hamburg,Germany |  |

# Document Information

## References

| ***Item*** | ***Description*** |
| --- | --- |
| 1. AMP SW Quality Process | <https://nxp1.sharepoint.com/:f:/s/ampsoftware/Ego1HUjbNBpMvjbJMVwc7UcBODLKgJczqgQbrXREAMqDiA?e=yxyqaU> |
| 1. BL AMP SW Roles Description | <https://nxp1.sharepoint.com/:f:/s/ampsoftware/Ego1HUjbNBpMvjbJMVwc7UcBODLKgJczqgQbrXREAMqDiA?e=uFYgEA> |
| 1. AMP SW Quality Assurance Generic Plan | <https://nxp1.sharepoint.com/:f:/s/ampsoftware/EqfZQnBF8g9ClxRB8oYAt68BcCVFtVX4uuNpPnlf-CmMKg?e=XasvGm> |
| 1. AMP SW Review Guideline | <https://nxp1.sharepoint.com/:f:/s/ampsoftware/EmSAxm3NpStOvmiD7Xn8tpcBMkJwrIPP-oxaLTmBk12IAg?e=Uh3YVS> |
| 1. AMP SW Metrics Plan | <https://nxp1.sharepoint.com/:f:/s/ampsoftware/EkpcWuyOBA9PsQ__FyTnDaYBpw0HDaLGgr4L6fE3bYrhHA?e=3GcOwF> |
| 1. STRX RFE FW Project Management Plan | <https://bitbucket.sw.nxp.com/projects/STRX/repos/rfe/browse/docs/Project_Management/RFE_SW_Project_Management_Plan_(Safety_Plan).docx> |
| 1. STRX RFE GUI Project Management Plan | <https://bitbucket.sw.nxp.com/projects/STRX/repos/rfe/browse/docs/Project_Management> |
| 1. STRX RFE SW Configuration Management Plan | <https://bitbucket.sw.nxp.com/projects/STRX/repos/rfe_sw_process/browse/Change_and_Configuration_Management/RFE_Configuration_Management_Plan.docx>  <https://crucible1.sw.nxp.com/cru/R-STRX-153> |
| 1. STRX RFE SW Risk Register | <https://www.collabnet.nxp.com/sf/go/doc349045> |
| 1. Zebra Coding guidelines | https://nxp1.sharepoint.com/:w:/r/sites/ampsoftware/Shared%20Documents/AMP%20SW%20Process%20-%20BU%20BCaM7%20Process%20Adoption%20in%20AMP%20BL/AP%20Software%20%20-%20Development/Best%20Practices/Best%20Practice\_Coding\_Guideline\_Zebra.docx?d=w1a47db01b9dd45119e4d6f2e0368c7f4&csf=1&web=1&e=Kr26MW |
| 1. HIS Metrics Template | <https://nxp1.sharepoint.com/:x:/r/sites/ampsoftware/_layouts/15/Doc.aspx?sourcedoc=%7B5FBF18BE-BCD1-4F39-9D65-465597E3F36F%7D&file=BL%20AMP%20Software%20Project%20HIS%20Metrics%20Report%20Content%20(Template).xlsx&action=default&mobileredirect=true> |

Table 8 Reference Table

## Terms/Acronyms and Definitions

| ***Acronym / Terms*** | ***Definition*** |
| --- | --- |
| CM | Configuration Management |
| CR | Change Request |
| ISO | International Standards Organization |
| PM | Project Manager |
| QA | Quality Assurance |
| QAE | Quality Assurance Engineer |
| RRR | Release Readiness Review |
| RTM | Release to Market |
| RFE | Radio Front End |
| SPMP | Software Project Management Plan |
| SQAP | Software Quality Assurance Plan |
| SQA | Software Quality Assurance Engineer |
| SW | Software |

Table 9 Terms and acronyms

## Revision History

| ***Document Author*** | ***Version*** | ***Date*** | ***Description of Change*** |
| --- | --- | --- | --- |
| Rashmi K C | 1.0-D01 | 21 May 2020 | Initial version |
| Eleonora Gianfermi | 1.0-D02 | 06 June 2020 | Updated version ready for review |
| Rashmi K C | 1.0-D03 | 30 June 2020 | Review comments reworked from Artur B |
| Rashmi K C | 1.0-D04 | 02 July 2020 | Review comments reworked from Artur B |
| Rashmi K C | 1.0-D05 | 23 Sep 2020 | STRX-554: Change in the coding guideline for RFE FW (SQAP and RS) |
| Rashmi K C | * 1. D06 | 01 Dec 2020 | Updated the QA plan for GUI scope. |
| Rashmi K C | * 1. D07 | 03 Dec 2020 | Approved Version for the PPA |
| Rashmi K C | * 1. D08 | 05 Feb 2021 | Section 7.0 updated based on the ticket [STRX-1194](https://jira.sw.nxp.com/browse/STRX-1194) |
| Rashmi K C | * 1. D08 | 19 June 2022 | Removed the GUI scope and updated the QAE and Eng Manager Names |