ACAS Ground Monitoring System Specification

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Abstract

This system specification addresses the high level technical requirements for an ACAS ground monitoring system. The system specification will take into account the operational requirements received by partner Project 4.8.3 and consider the results of the Initial Data Collection task realized by means of an already installed and used Background system in the Germany Airspace.

The system specification includes the following key information:

- Scope and context of the ACAS ground monitoring system.
- Technical requirements applying to this system.
- A description of both architecture and interfaces for this system.

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00.01.01	04/07/2012	Final		Assessment updates

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Executive summary

This Technical Specification enfolds the definition of the architecture and the high level technical requirements of an ACAS ground monitoring system as well its connection to an ATC surveillance system. The Project have analysed in the first work step the operational requirements defined by its operational counter part Project 4.8.3. Based on these requirements, previous inquests and several two-way Project discussions, the Project tries to set down base technical requirements to build a prospective ACAS ground monitoring system.

The Technical Specification constitutes a fundamental input for the ACAS monitoring system prototype development, and will be used as well as reference for the subsequent prototype verification.

Main objective of the specification is to describe a technical system on the ground, which permits reception, analysis and distribution of ACAS Resolution Advisory (RA) information.

The specification contains the characterization of the base system components, the system architecture design, and the allocation of common system interfaces.

Please refer also to the brief system scheme below: Figure 1.

Key parts of an ACAS ground monitoring system are the collection and storage of RA information in a database, and the fusion, classification and dispatch of validated RA information to external connected ATM systems.

The specification encloses a concept of an operational Resolution Advisory event report interface to external ATC surveillance systems, by upgrading the current Ground Safety Nets protocol [9].

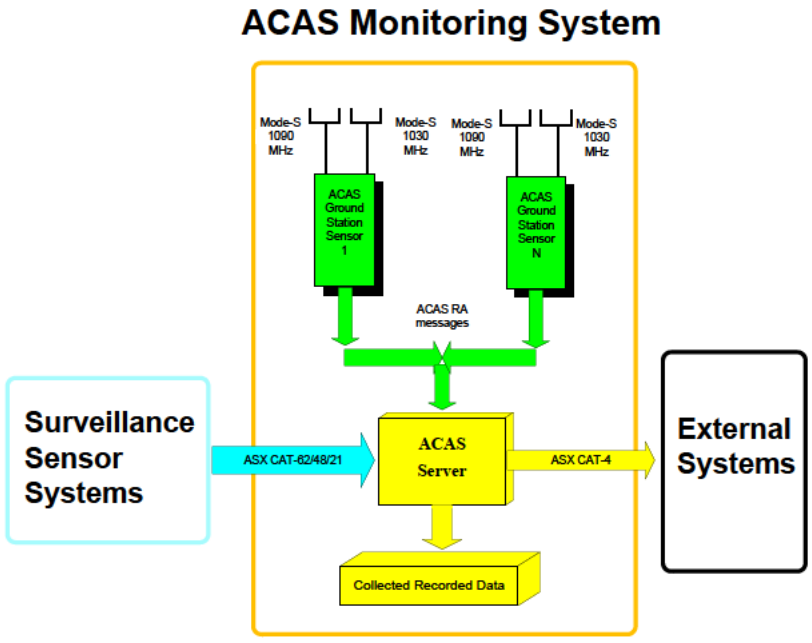

Figure 1 Scheme of ACAS ground monitoring system

1 Introduction

1.1 Purpose of the document

This Technical Specification enfolds the definition of the architecture and the high level technical requirements of an ACAS ground monitoring system as well its connection to an ATC surveillance system.

The Technical Specification constitutes a fundamental input for the ACAS monitoring system prototype development, and will be used as well as reference for the subsequent prototype verification.

1.2 Intended readership

The Technical Specification is a key reference document inside the project for all partners.

Furthermore, the Technical Specification is a key reference document for the coordination with the Operational Counterpart Project 04.08.03. In particular, the requirements defined in this Technical Specification are traced to operational requirements defined by project 04.08.03 in [13].

Project 15.04.03 is only involved in the V2 validation activities of project 04.08.03 and therefore the Technical Specification is not of interrest for other projects involved in validation activities.

The integration of the ACAS ground monitoring system in the target ATM system is subject of a dedicated task within the project (T15.4.3-011). However, the integration relies entirely on existing standards and therefore the Technical Specification is not of interrest for other projects involved in integration and architectural activities.

1.3 Inputs from other projects

Inputs for the ACAS ground monitoring system specification are based mainly on the requirements provided by:

- SESAR SJU projects:
  - SWP4.8 and more specifically Project 04.08.03 (Ground-Airborne Safety Net Compatibility).
  - Project 15.4.5b (Surveillance Ground System enhancements for ADS-B (prototype development)).
- PASS Project.
- FARADS Project.

1.4 Structure of the document

This document is organised as follows:

- Chapter 1: Purpose and scope; Inputs from other Projects and definitions.
- Chapter 2: General Functional block description
- Chapter 3: 1090 GS Functional and Non-Functional requirements
- Chapter 4: Assumptions
- Chapter 5: References
- Appendices with traceability and justification material.

1.5 Requirements Definitions – General Guidance

The ACAS ground monitoring system requirements have been developed according to the SESAR Requirements and V&V Guidelines [11].

The requirements have been broken down by the Project according to its identified source, and are in line with the guidelines in Ref.[11].

The high level system requirements are following the next scheme:

REQ-15.04.03-TS-xxyy.zzzz, whereby xx and yy means:
(zzzz - consecutive requirements numbering)

xx	Meaning
GE	General System Requirement
PR	Processing Requirement
RR	Recording & Replay Requirement
SU	Supervision Requirement

Table 1 Requirement Identifier Allocation 1

yy	Meaning
10	Requirements First revision

Table 2 Requirement Identifier Allocation 2

1.6 ACAS Ground Monitoring System Purpose

The Airborne Collision Avoidance System (ACAS) II concept (realised as Traffic alert and Collision Avoidance System (TCAS) II equipment) is an airborne avionics system which acts independently of ATC as a last resort safety net to mitigate the risk of midair collision.

ACAS tracks aircraft in the surrounding airspace through replies from their ATC transponders. If the system diagnoses a risk of impending collision it issues a Resolution Advisory (RA) to the flight crew which directs the pilot how best to regulate or adjust his vertical speed so as to avoid a collision. When the intruder aircraft is also fitted with an ACAS II system, both systems coordinate their RAs through the Mode S data link, in order to select complementary resolution senses.

ACAS operations can be monitored on the ground in several ways:

- By using Mode S data link to read out dedicated transponder registers where current RA information is stored until 18 second after Clear of Conflict is declared.
- By intercepting RA broadcast messages that are transmitted when an RA occurs and then at 8 second intervals until Clear of Conflict is declared.
- By intercepting RA coordination messages that are exchanged by ACAS II systems at 1 second intervals until Clear of Conflict is declared.
- In the future also by intercepting dedicated hybrid surveillance messages that will be transmitted at 0.8 seconds intervals until Clear of Conflict is declared.

ICAO PANS-ATM states in 15.7.3.5 that ACAS can have a significant effect on ATC. Therefore, the performance of ACAS in the ATC environment should be monitored. Within the Mode S coverage area such monitoring is already taking place for offline analyses and/or for display at Controller Working Positions (CWP). However, such monitoring is subject to the inherent limitations of using rotating antennas.

The ACAS Ground Monitoring System overcomes these limitations and also extends the possibility to monitor ACAS operations beyond the Mode S coverage area. It does this by using passive receiver stations to intercept RA broadcast messages and RA coordination messages and by merging these with RA information obtained via Mode S and hybrid surveillance. The merged RA information is made available in real time to external systems. Furthermore recording and replay tools are provided for offline analyses.

1.7 ACAS Ground Monitoring System Overview

An ACAS ground monitoring system basically consists of a set of distributed ACAS ground station receivers and a central ACAS processing unit (ACAS server). The number of ACAS servers in operation is subject to the specific user requirements and user environment. The receivers are connected via usual network lines with the ACAS server. The ACAS server output will be transmitted for further processing via a Ground Safety network to external linked ATM system(s).

The system components mentioned above will be managed by a separate Control and Monitoring system (CMS). The ACAS server input could be optional extended by the data of available Surveillance sensor systems. Additionally, the ACAS ground monitoring system involves tools for ACAS data recording and replay. The entire system architecture is depicted schematically in the graph below (Figure 2)

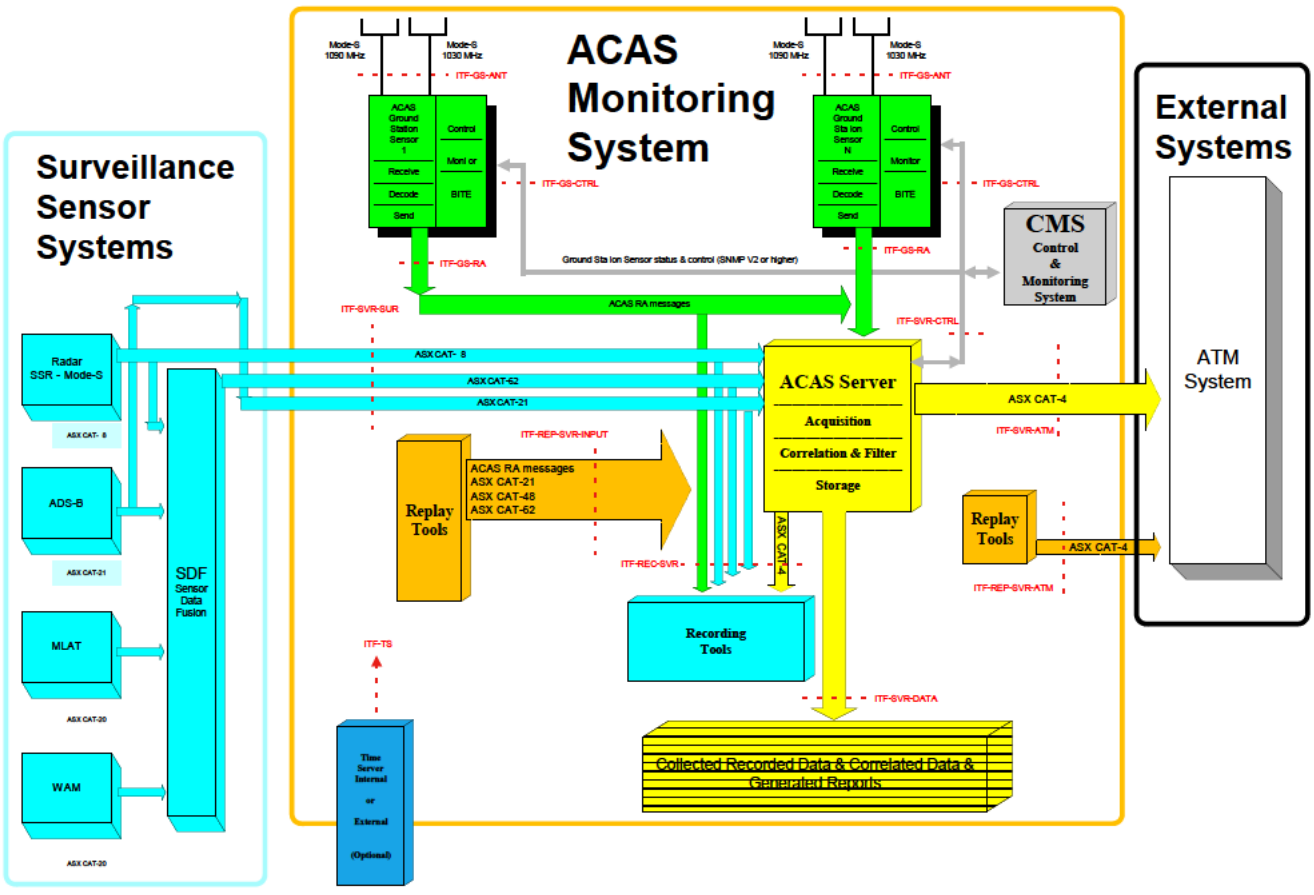

Figure 2 ACAS ground monitoring system architecture

1.8 Acronyms and Terminology

Term	Definition
ACAS	Airborne Collision Avoidance System
ADS-B	Automatic Dependent Surveillance – Broadcast
AMOR	ACAS Monitoring Project
ANSP	Air Navigation Service Provider
ASCII	American Standard Code for Information Interchange
ATC	Air Traffic Control
ASTERIX	All Purpose Structured Eurocontrol Surveillance Information Exchange
ATM	Air Traffic Management
BITE	Built In Test Equipment
CMS	Control and Monitoring System
CWP	Controller Working Position
DL	Downlink
E-ATMS	European Air Traffic Management System
EUROCAE	European Organisation for Civil Aviation Equipment
FAB	Functional Airspace Block
FL	Flight Level
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IP	Internet Protocol
MLAT	Multilateration
MOPS	Minimum Operational Performance Standards
PANS	Procedure for Air Navigation Services
PD	Probability of Detection
RA	Resolution Advisory
RF	Radio Frequency

Term	Definition
RTCA	Radio Technical Commission for Aeronautics
SDF	Sensor Data Fusion
SSR	Secondary Surveillance Radar
STCA	Short Term Conflict Alert
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme, which addresses all activities of the SESAR Joint Undertaking Agency.
SESAR Programme	The programme, which defines the Research and Development activities and Projects for the SJU.
TCAS	Traffic Alert and Collision Avoidance System
TMA	Terminal Manoeuvre Area
UDP	User Datagram Protocol
UL	Uplink
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
WAM	Wide Area Multilateration
WP	Work Package

1.9 Definitions

The following definitions have been highlighted as very significant to fully understand the requirements in next sections.

1.9.1 ACAS Resolution Advisory Downlink Message

Each received ground Mode-S radar interrogation, will be responded by TCAS II by the transmission of a corresponding downlink reports (DF20/DF21). Theses reports could be included in current active RA information, and provided by the aircraft Mode S transponder on the 1090 MHz channel. The RA downlink report includes also an RA terminated indicator for the next 18 seconds after the termination of an RA.

1.9.2 ACAS Broadcast Message

TCAS II presence messages (UF16-32) are transmitted every 8 to 10 seconds by the aircraft. It will be used by other TCAS II units to acquire aircrafts in their own coverage.

1.9.3 Resolution Advisory Broadcast Message

RA triggered Broadcast messages (UF16-31) will be send out every 8 seconds with RA initiation up to the RA termination.

1.9.4 Coordination Interrogation and Reply Message

If the threat aircraft is ACAS equipped, ACAS II tries to coordinate the RA by interrogating continuously every second the threat aircraft by coordination messages (UF16-30).

The threat aircraft will respond by a corresponding coordination reply message (DF-16-30).

1.9.5 ACAS Resolution Advisory Message

ACAS RA message(s) forms a generic term/superset for the RA message types: ACAS RA downlink, RA broadcast and Coordination interrogation and reply messages.

1.9.6 Resolution Advisory Event

A Resolution Advisory event comprises all relevant ACAS RA messages of an RA encounter.

The time line of RA event starts with the first received ACAS RA message and ends with the last received RA message.

2 General Functional block Description

2.1 Context

The primary function of an ACAS ground monitoring system is the radio reception, the (signal) processing and the storage of ACAS Resolution Advisories. The system receives Resolution Advisories (Mode-S Downlink and Uplink signals) on the 1090 MHz & 1030 MHz channel.

The system consists of a network of distributed ACAS ground station sensors, which are connected via dedicated network lines to a central ACAS processing unit (server). At first, the server validates and fuses all incoming RA data from ground station sensors and optional linked Surveillance Sensor systems, and stores it afterwards for offline analysis onto disk.

The second main ACAS ground monitoring system function comprises the generation of ACAS event reports. The ACAS server send these reports via its operational interface to external systems (ATM) for further processing (online).

For an system overview please refer to Figure 2.

2.2 Functional block Modes and States

An ACAS processing unit (server) is able to operate in two main modes related to the kind of data that is being processed by the system, Online and Offline.

When working in Online processing mode, the central ACAS processing unit (server) is receiving live incoming RA data from ground station sensors and optional linked Surveillance Sensor systems. At the same time, the ACAS server, verifies and combines incoming relevant RA data to ACAS event reports and distributes these reports, after internal validation, to external connected systems (ATM) for further online processing through the use of ASTERIX CAT 4 messages.

At the same time, the ACAS server is able to store all the information received from ground station sensors and also from other surveillance sensors. The server is able to store offline the trajectory data of an RA involved aircraft before and after the RA event, by fusing available Surveillance sensor system data with ground station sensor data.

When working in Offline processing mode, the ACAS server is able to replay stored data coming from ground station & surveillance sensors with the aim to repeat further situations and analysis once the events have taken place.

2.3 Major Functional block Capabilities

2.3.1 ACAS Monitoring System Components

An ACAS ground monitoring system consists at least of a set ground station sensors, one or more ACAS server, a Control and Monitoring system, and Tools for Recording and Replay of RA events. The ACAS ground monitoring system could be extended, if available, by the input of ACAS related data provided by connected Surveillance Sensors systems - like WAM, ADS-B, MLAT and Radar SSR Mode-S. The existence of Surveillance Sensors systems are not required. The following section will brief describe in more detail the main system components. Please see also: Figure 2.

2.3.1.1 ACAS Ground Station Sensor(s)

The ground station sensors are forming the main cornerstone of an ACAS ground monitoring system. The sensors are creating a network of ACAS capable receivers within the desired ACAS RA acquisition area. Main functions of the sensor are the reception and the processing of Mode-S Downlink signals in the 1090 MHz channel and Mode-S Uplink signals in the 1030 MHz channel. Each valid received Mode-S Downlink and Uplink signal will be time stamped by the sensor and cached in an internal telegram buffer (Raw data). Based on the operating mode (buffered or direct), the sensor transmit the telegrams over a dedicated system network to a central RA data collection and processing system (ACAS server). Before further processing, the sensors are validate and filter uplink and downlink Raw data telegrams. In addition to the Raw data output generation, the sensor could create ADS-B target reports. These ADS-B target reports could be feed in as input to a linked ADS-B Surveillance system (ASTERIX CAT021). All ground station sensors are controlled and monitored by local or remote installed system supervision (CMS).

2.3.1.2 ACAS Server

The counter part to the ground station sensors is the ACAS server. The server will take the RA relevant data from connected ground station sensors and Surveillance systems (if available) and stores first the data onto a data memory for further offline analysis. In the second work step, the server verifies and combines incoming relevant RA data to ACAS event reports, and distributes these reports, after internal validation, to external connected systems (ATM) for further online processing. Bad ACAS event reports will be discarded by the server itself automatically. ACAS event reports could be either send out by the server periodically or direct (event driven). The server is able to store offline the trajectory data of an RA involved aircraft before and after the RA event, by fusing available Surveillance sensor system data with ground station sensor data. The entire server will be observed and controlled, as the ground station sensors, by a supervision system (CMS).

2.3.1.3 Control and Monitoring System (CMS)

The Control and Monitoring system allows the system user to monitor all base system components (ground station sensor(s) and ACAS server). With the aid of an user-friendly graphical interface the system user is able to modify ground station sensor and the ACAS server configuration parameters from local or remote. The CMS will record system status and parameter changes. The communication between CMS and linked system components is based on SNMP.

2.3.1.4 Recording and Replay Tools

Due to that ACAS Resolution Advisories are very rare events, a minimum set of ACAS data Recording and Replay Tools are affiliated to the ACAS ground monitoring system. These tools are seen essential for ACAS data test and analysis purposes.

The ACAS ground monitoring system includes tools for recording of:

- All incoming ACAS server interface data
  - ACAS RA messages (Raw data) from ground station sensors
  - Surveillance data from the Sensor Data Fusion system (SDF) – ASTERIX CAT062
  - Surveillance data from Radar SSR Mode-S – ASTERIX CAT048
  - Surveillance data from ADS-B system – ASTERIX CAT021
- Ground station sensor output data
  - ACAS RA messages (Raw data)
- ACAS server output data
  - ACAS event reports – ASTERIX CAT04

The ACAS ground monitoring system includes tools for replay of:

- Complete ACAS server input data scenarios
- Separate incoming ACAS server data interfaces
  - ACAS RA messages (Raw data) from ground station sensors
  - Surveillance data from the Sensor Data Fusion system (SDF) – ASTERIX CAT062
  - Surveillance data from Radar SSR Mode-S – ASTERIX CAT048
  - Surveillance data from ADS-B system – ASTERIX CAT021
- ACAS server output data
  - ACAS event reports – ASTERIX CAT04

2.3.1.5 External Systems

2.3.1.5.1 Surveillance Sensor Systems

The core ACAS ground monitoring system could be extended by regional available Surveillance sensor systems. These sensors could be used as additive data source to amplify and state RA events.

For instance: The SDF Surveillance sensor data could supply the RA aircraft trajectory before or after an RA event, or the Radar SSR Mode-S could deliver received ACAS RA downlink data for the later fusion in the ACAS server. Remark: With the introduction of DO260B the Ground Station sensor will not only supply RA data via the Raw data output interface (new updated DF17 telegram format), the sensor will provide also decoded RA telegram data included into ADS-B reports.

2.3.1.5.2 ATM System

ATM systems or upstream ATM processing components are the main receivers for operational RA event reports. RA event reports are transferred via Ground Safety Nets (ASTERIX CAT04) from the

ACAS server to the ATM system. The further basis of valuation and representation of RA event reports, for instance on the Controller display, are key parts of the ATM system, whereby the system is capable to consult various information sources (full air picture).

2.4 User Characteristics

N/A

2.5 Operational Scenarios

N/A

2.6 Functional

2.6.1 Functional decomposition

The ACAS ground monitoring system decomposes into the following functional key parts:

- Resolution Advisory information reception and decoding
- Resolution Advisory information acquisition, correlation and filter
- Resolution Advisory information storage
- Resolution Advisory information distribution
- Resolution Advisory information replay
- Resolution Advisory ground monitoring system management and status
- System time synchronisation

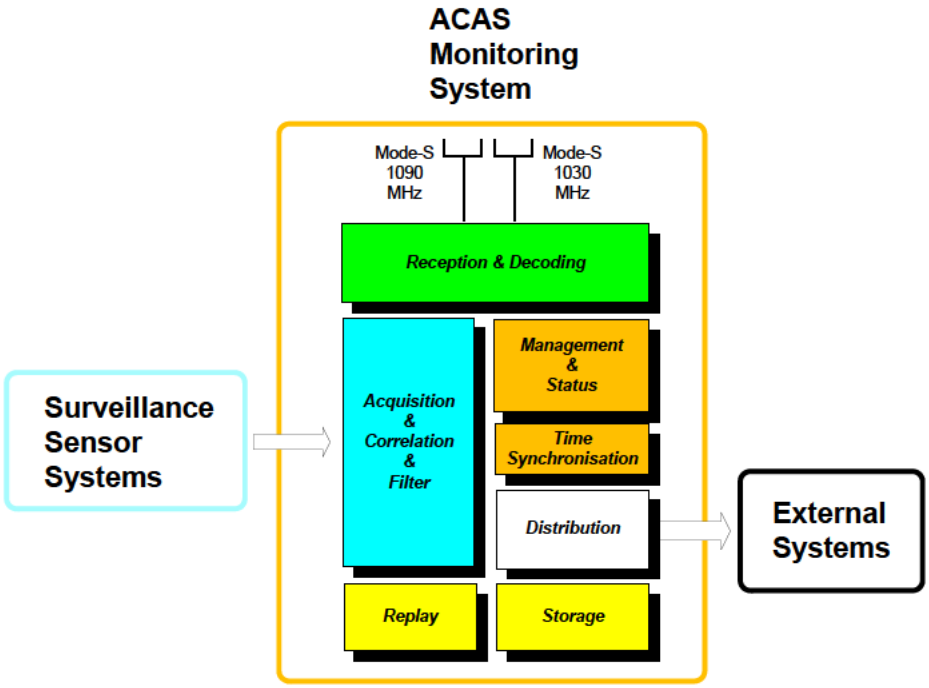

Figure 3 Main ACAS Ground Monitoring System Functions

2.6.2 Functional analysis

In accordance with Section. 2.6.1 the ACAS ground monitoring system provides at a minimum the following functions:

- **Reception and decoding:** Reception of Mode-S 1090 MHz RF and extraction of Extended Squitter messages broadcast by ADS-B Out transponders, Reception of Mode-S 1030 MHz RF and extraction of information contained on Mode S interrogations (ACAS RA downlink messages), coordination interrogation and reply messages, RA broadcast messages and ACAS broadcast messages.
- **RA information acquisition, correlation and filter: :** Reception and fusion of decoded RA messages together with available Surveillance sensor data. Validation and filter of data.
- **RA information storage:** The ACAS ground monitoring system includes a storage capability for all the data received either by surveillance sensors or by RF interfaces.
- **RA information distribution:** Compilation of ASTERIX Category 4 reports to be forwarded to external ATM system(s).
- **RA information replay:** ACAS ground monitoring system could include a replay capability for all the data received or send out by the system.
- **System Management and Status Reporting**: ACAS ground monitoring system component management, monitoring and control functions, and service status, including Built In Test Equipment (BITE).
- **System Time Synchronisation**: The function provides main system components a common source for time synchronisation.

2.7 Service View

- N/A

3 Functional block Functional and non-Functional Requirements

In the following requirements the word "**shall**" is used to indicate a statement of requirement which is essential (= mandatory).

The word "**Should**" is used to indicate a statement of requirement which is desirable (= optional).

3.1 General System

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0010
Requirement	The ACAS ground monitoring system **shall** be able to detect messages from aircraft equipped with TCAS II versions 6.04a, 7.0 and 7.1.
Title	Monitored TCAS versions
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Interoperability>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-05	<Full>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0020
Requirement	The ACAS ground monitoring system **shall** provide Resolution Advisory (RA) information reception coverage within the defined airspace (i.e. ANSP, FAB). Note: The system reception coverage is subject to the specific user requirements and user environment.
Title	System Coverage
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Design>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-10	<Full>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0030
Requirement	The ACAS ground station sensor **shall** detect ACAS RA messages with a minimum probability (PD) of 95% at MTL +3dB. .
Title	Probability of Detection
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Performance>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-4.8.3-SPR-RADL-08	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0040
Requirement	An ACAS ground monitoring system **shall** enfold at minimum the following base functions: •Function for RA reception and decoding •Function for RA information acquisition, correlation and filter •Function for RA information storage •Function for RA information distribution •Function for RA information replay •Fuction for system monitoring and control •Function for system time synchronisation
Title	ACAS ground monitoring system components
Status	<In Progress>
Rationale	Design
Category	<Design>
Validation Method	
Verification Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0050
Requirement	The ACAS ground monitoring system **shall** consist of a set of one or more receive-only ACAS ground station sensor(s) being able to detect, decode and process Mode-S signals received on the 1090 MHz channel.
Title	ACAS ground station sensor Mode-S 1090 MHz reception channel
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-02	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0060
Requirement	The ACAS ground monitoring system **shall** consist of a set of one or more receive-only ACAS ground station sensor(s) being able to detect, decode and process Mode-S signals received on the 1030 MHz channel.
Title	ACAS ground station sensor Mode-S 1030 MHz reception channel
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-02	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0070
Requirement	The ACAS ground monitoring system **shall** be able to decode and process aircraft transponder messages complying as specified in EUROCAE/RTCA MOPS ED102A/DO-260B §2.2.3.2.7.8.2 (FTC=28 – Subtype=2).
Title	Support EUROCAE/RTCA MOPS version ED102A/DO-260B
Status	<In Progress>
Rationale	Design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0080
Requirement	The ACAS ground monitoring system **shall** be able to process simultaneously at minimum 10 RA events. Note: The ACAS ground monitoring system will be suitable for use for the anticipated traffic numbers in core Europe until at least 2030.[1] [2]
Title	RA Processing Capability
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Performance>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-04	<Full>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0090
Requirement	The ACAS ground monitoring system time **shall** be synchronized by an internal or external time source.
Title	ACAS Ground Monitoring System Time Reference
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-12	<Partial>

[1] **1030/1090 Scenario Description Deliverable**, Draft 00.00.01, SESAR WP15.01.06

[2] **Long - Term Forecast: IFR Flight Movements 2008 – 2030**, Edition Number: v1.0, Edition Date: 19/11/08, EUROCONTROL

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0100
Requirement	The ACAS ground monitoring system **shall** use Coordinated Universal Time (UTC) time as time base.
Title	ACAS Ground Monitoring System Time Base UTC
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-12	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0110
Requirement	The ACAS ground monitoring system **shall** use a system time with a maximum resolution of 1/128 second.
Title	ACAS Ground Monitoring System Time Resolution
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirement
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-12	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-1	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-14	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0120
Requirement	The ACAS ground monitoring system **shall** use a system time with an accuracy better than ± 2ms.
Title	ACAS Ground Monitoring System Time Accuracy
Status	<In Progress>
Rationale	Design
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0130
Requirement	The ACAS ground monitoring system **shall** provide RA event data to external systems via Standard ASTERIX CAT 4 protocol for Online Processing. Remark: Please see also requirement REQ-15.04.03-TS-PR10.0360.
Title	Supply Data for Online Processing and Analysis
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirements
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-01	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-02	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-03	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0140
Requirement	The ACAS ground monitoring system **shall** provide RA event and related Surveillance Sensor data for Offline Processing and Analysis.
Title	Supply Data for Offline Processing and Analysis
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirements
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-02	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-07	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-16	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0150
Requirement	The ACAS ground monitoring system **shall** provide information on the external ACAS ground monitoring system output interface within 2 seconds from the time the RA is generated in 95% or more of the cases. Remark: Transfer time is: Time of emitting RA by aircraft to transmission time of RA via output interface to external systems.
Title	ACAS Ground Monitoring System Latency
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirements
Category	<Performance>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.08.03-SPR-RADL-08	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0160
Requirement	The ACAS monitoring ground station sensor(s) and the ACAS server **shall** store system configuration parameters persistent in a non-volatile memory.
Title	ACAS Ground Monitoring System Configuration
Status	<In Progress>
Rationale	Design
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0170
Requirement	The ACAS ground monitoring system **shall** prevent unauthorized user access to system components and system data.
Title	ACAS Ground Monitoring System Security
Status	<In Progress>
Rationale	design
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0180
Requirement	The ACAS ground monitoring system **shall** be controlled and monitored by an autonomous Control and Monitoring System (CMS).
Title	Control and Monitoring System
Status	<In Progress>
Rationale	Design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0190
Requirement	The ACAS ground monitoring system **shall** be controllable by a system user from remote.
Title	Remote ACAS Ground Monitoring System Control
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0200
Requirement	The ACAS ground monitoring system **shall** be local controllable by a system user.
Title	Local ACAS Ground Monitoring System Control
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0210
Requirement	The ACAS ground monitoring ground station sensor(s) and the ACAS server **shall** start automatically after system blackout.
Title	ACAS Ground Monitoring System Resume after System Blackout
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-GE10.0220
Requirement	During start-up, the system (Ground station sensor(s) and the ACAS server) **shall** read-out and use system configuration parameters from the non-volatile memory.
Title	System Start-up
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

3.2 Processing

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0010
Requirement	The ACAS ground monitoring system **shall** be able to receive, decode and process ACAS RA messages. Please see also chapter 1.9 definitions.
Title	Supported ACAS RA message types
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirements
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_02	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0020
Requirement	The ACAS ground monitoring system **shall** provide ACAS RA messages on the external ACAS ground monitoring system output interface.
Title	Provision of ACAS Resolution Advisory messages
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirements
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_01	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_02	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0030
Requirement	The ACAS ground monitoring system **should** be able to receive, decode and process Surveillance information provided by the Surveillance Sensor Systems: SSR-Mode-S, ADS-B and Sensor Data Fusion system (SDF).[3]
Title	Supported Surveillance information Sources
Status	<In Progress>
Rationale	Desirable
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0040
Requirement	The ACAS ground monitoring system **shall** provide connection to external systems via UDP/IP.
Title	Support Network Protocol Type
Status	<In Progress>
Rationale	To satisfy 4.8.3 D05 requirements
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ 4.8.3 SPR RADL 03	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0050
Requirement	ACAS ground monitoring system network addresses **shall** be configurable by the system user.
Title	System Network Addresses Configuration
Status	<In Progress>
Rationale	Design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[3] The SDF could be fed by data from the surveillance systems: SSR-Mode-S, ADS-B, MLAT and WAM.

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0060
Requirement	The ACAS ground monitoring system **shall** support unicast, multicast and broadcast network addresses.
Title	System Network Addresses
Status	<In Progress>
Rationale	Design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0070
Requirement	ACAS ground monitoring system network ports **shall** be configurable by the system user.
Title	System Network Ports
Status	<In Progress>
Rationale	Design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0080
Requirement	The ACAS ground monitoring system **shall** be able to receive, decode and process the Mode-S uplink (UF-0 to UF-24) telegram formats as defined in ICAO Annex 10 Volume 4.
Title	Supported Mode-S Uplink telegram formats
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional><Interface>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ 4.8.3 SPR RADL 02	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0090
Requirement	The ACAS ground monitoring system **shall** be able to receive, decode and process the Mode-S downlink (DF-0 to DF-24) telegram formats as defined in ICAO Annex 10 Volume 4.
Title	Supported Mode-S Downlink telegram formats
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ 4.8.3 SPR RADL 02	

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0100
Requirement	The ACAS ground monitoring system **shall** be able to filter Mode-S uplink (UF-0 to UF-24) telegram formats as defined in ICAO Annex 10 Volume 4.
Title	Mode-S Uplink telegram format filter
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ 4.8.3 SPR RADL 11	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0110
Requirement	The Mode-S Uplink telegram format filter **shall** be configurable by the system user.
Title	Configuration of Mode-S Uplink telegram format filter
Status	<In Progress>
Rationale	Design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0120
Requirement	The ACAS ground monitoring system **shall** be able to filter Mode-S downlink (DF-0 to DF-24) telegram formats as defined in ICAO Annex 10 Volume 4.
Title	Mode-S Downlink telegram format filter
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_11	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0130
Requirement	The Mode-S Downlink telegram format filter **shall** be configurable by the system user.
Title	Configuration of Mode-S Downlink telegram format filter
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0140
Requirement	The ACAS ground monitoring ground station sensors **shall** be able to send decoded Mode-S telegrams over a network to local and remote installed processing units.
Title	Ground Station Sensor Data output
Status	<In Progress>
Rationale	design
Category	<Interface>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0150
Requirement	The ACAS monitoring ground station sensor **shall** mark each incoming received Mode-S telegram by a unique system time stamp.
Title	Ground Station sensor Mode-S telegram time stamping
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_12	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0160
Requirement	The resolution of this time stamp **shall** be at maximum 1/128 seconds.
Title	Ground Station time stamp resolution
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_01	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_12	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_14	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0170
Requirement	The ACAS ground monitoring system **should** be able to receive and process Surveillance data provided by a Sensor Data Fusion (SDF) system in ASTERIX Category 62 edition 0.27.
Title	Sensor Data Fusion data and data format
Status	<In Progress>
Rationale	Design
Category	<Interface>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0180
Requirement	The ACAS ground monitoring system **should** be able to receive and process Surveillance data in ASTERIX Category 48 edition 1.15.
Title	SSR-Mode-S radar sensor data and data format
Status	<In Progress>
Rationale	design
Category	<Interface>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0190
Requirement	The ACAS ground monitoring system **should** be able to receive and process Surveillance data in ASTERIX Category 21 edition 0.23.
Title	ADS-B Surveillance Sensor data and data format
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0200
Requirement	The ACAS ground monitoring system **shall** be able to filter incoming ACAS ground station sensor data based on the ACAS ground station sensor.
Title	ACAS Ground Station Sensor filter
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0210
Requirement	The ACAS ground station sensor filter **shall** be configurable by the system user.
Title	Configuration of ACAS ground station sensor filter
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0220
Requirement	The ACAS ground monitoring system **shall** be able to filter incoming Surveillance Sensor data based on the surveillance data source.
Title	Surveillance data source filter
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0230
Requirement	The Surveillance data source filter **shall** be configurable by the system user.
Title	Configuration of Surveillance data source filter
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0240
Requirement	The ACAS ground monitoring system **shall** provide functions to read, process and merge received incoming ACAS ground station sensor data messages and Surveillance data messages.
Title	ACAS Ground Monitoring data merging
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_07	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0250
Requirement	The ACAS ground monitoring system **shall** provide functions to store received incoming ACAS ground station sensor data messages and Surveillance data messages.
Title	ACAS Ground Monitoring data storage
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_02	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_16	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0260
Requirement	Incoming ACAS ground station sensor data messages **shall** continuously stored into a user readable file. (ASCII format). Note: The storage could also be a database.
Title	ACAS Ground Monitoring data storage format
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Interface>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_16	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0270
Requirement	Surveillance data **shall** be stored within a user defined period. (i.e. number of minutes before an aircraft RA acquisition by the system and number of minutes after an aircraft RA termination.
Title	ACAS Ground Monitoring data storage time span
Status	<In Progress>
Rationale	design
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0280
Requirement	The system user **shall** be able to configure the Surveillance data storage time span.
Title	Configuration of ACAS Ground Monitoring data storage time span
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0290
Requirement	This time span **shall** be between 1 and 15 minutes before and after an RA event.
Title	Data storage time span parameter
Status	<In Progress>
Rationale	design
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0300
Requirement	The system **shall** mark each recorded ACAS ground station sensor data message and Surveillance data message in the file by a unique identifier (source) and its reception time.
Title	ACAS Ground Monitoring data storage identification
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0310
Requirement	The ACAS server **shall** mark incoming received ACAS RA messages and Surveillance data messages by a unique system time stamp.
Title	ACAS server Surveillance Data and ACAS RA Message time stamping
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0320
Requirement	The resolution of the time stamp **shall** be at maximum 1/128 seconds.
Title	ACAS server Surveillance Data and ACAS RA Message time stamping resolution
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_01	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_12	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_14	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0330
Requirement	The ACAS server **should** mark incoming received ACAS RA messages, ACAS broadcast messages and Surveillance data messages by an unique system origin identifier.
Title	ACAS server Surveillance Data and Information Message system origin identifier
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0340
Requirement	The ACAS ground monitoring system **shall** provide the following information when an RA event occurs and when there is a change. •Aircraft identification (call sign or registration) •Aircraft address (24 bit Mode S address) •Type of the RA, if available (ARA field as specified in [4]) •Source of information (RA DL, Broadcast or Coordination message) •Time stamp (resolution 1/128 s)
Title	Real-time output of RA event data
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ 4.8.3 SPR RADL 12	<Partial>

[1] [4] **Standards and Recommended Practices and Guidance Material for Airborne Collision Avoidance Systems** Convention on International Civil Aviation, Annex 10, Volume IV, 4th Edition, ICAO, July 2007.

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0350
Requirement	The ACAS ground monitoring system (ACAS server) **should** additionally provide the following information when an RA event occurs. In case of a threat indicated as Mode S equipped (TTI=1) in received messages. •Threat aircraft address (24 bit Mode S address) In case of a threat indicated as not Mode S equipped (TTI=2) in received messages. •Threat aircraft altitude, range and bearing Threat aircraft Mode A code (when possible)5
Title	Additional Real-time output of RA event data
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_13	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0360
Requirement	The ACAS ground monitoring system **shall** provide information to external systems by using ASTERIX Category 4 edition 1.5 (SESAR WP15.4.3 proposal).
Title	ACAS Ground Monitoring system output format
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Interface>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_01	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_15	<Partial>

[5] Note: Aircraft 2 is the threat

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0370
Requirement	The ACAS ground monitoring system **shall** provide a data fusion function to suppress duplicated ACAS RA messages and duplicated Surveillance data messages.
Title	ACAS data fusion and suppression function
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_07	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0390
Requirement	The ACAS ground monitoring system **shall** validate all incoming ACAS RA messages to filter out technical error cases (e.g. empty data fields, missing intruder data, undefined data in data fields received).
Title	Validation of ACAS RA messages
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_11	<Partial>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0410
Requirement	The ACAS ground monitoring system **shall** mark each invalid ACAS RA messages.
Title	Marking of invalid ACAS RA messages
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_11	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_16	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0420
Requirement	In case the ACAS ground monitoring system is not receiving RA termination, the RA termination **shall** be declared 16 seconds after reception of the last ACAS RA message.
Title	Termination of RA
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_09	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-PR10.0430
Requirement	The ACAS ground monitoring system **shall** provide the following summary RA information per RA event. •Date •Time (UTC) with a resolution of at maximum 1/128 seconds •Aircraft 1 identification (call sign or registration) •Aircraft 1 address (24 bit Mode S address) •type of the RA (ARA field as specified in [6]) •Geographical location of event (LAT/LON in WGS84) In case of a threat indicated as Mode S equipped (TTI=1) in received messages. •Aircraft 2 address (24 bit Mode S address) In case of a threat indicated as not Mode S equipped (TTI=2) in received messages. •Aircraft 2 altitude, range and bearing •Aircraft 2 Mode A code (when possible)[7]
Title	Offline information
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ 4.8.3 SPR RADL 16	<Partial>

[6] **Standards and Recommended Practices and Guidance Material for Airborne Collision Avoidance Systems** Convention on International Civil Aviation, Annex 10, Volume IV, 3rd Edition, ICAO, July 2002.

[7] Note: Aircraft 1 is the transmitter of the RA information, Aircraft 2 is the threat

3.3 Recording & Replay

[REQ]

Identifier	REQ-15.04.03-TS-RR10.0010
Requirement	Recording functions shall be able to receive decoded Mode-S telegrams from ACAS monitoring ground station sensors over network.
Title	Recording function of ground station sensors data
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_16	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-RR10.0030
Requirement	The ACAS ground monitoring system **shall** provide a function to record data sent out by the system.
Title	ACAS Ground Monitoring system data recording
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ 4.8.3 SPR RADL 16	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-RR10.0040
Requirement	The ACAS ground monitoring system **shall** provide a function to replay recorded data.
Title	ACAS Ground Monitoring system data replay
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

3.4 Supervision

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0010
Requirement	The ACAS monitoring ground station sensor **shall** automatically and periodically perform a self-testing function (BITE) in parallel to the normal operation.
Title	Ground Station Sensor BITE function
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0020
Requirement	The ACAS server **shall** automatically and periodically perform a self-testing function (BITE) in parallel to the normal operation.
Title	ACAS Server BITE function
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0030
Requirement	The ACAS server **shall** be able to send out its current system status in ASTERIX Category 4 edition 1.5 (SESAR WP15.4.3 proposal).
Title	ACAS Server System Status Report
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional><Interface>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_15	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0040
Requirement	ACAS server **shall** be able to send out system status reports event-driven and periodically.
Title	ACAS Server System Status Reporting Mode
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_15	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0050
Requirement	In case of a periodically system status reporting mode, the ACAS server status update rate **shall** be adjustable between 1 and 60 seconds.
Title	Configuration of ACAS Server Status Update Rate
Status	<In Progress>
Rationale	To satisfy D05 requirement
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ_4.8.3_SPR_RADL_15	<Partial>

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0060
Requirement	The ACAS ground monitoring system **shall** be able to monitor the status of the Surveillance Data interface.
Title	Monitoring of Surveillance Data Interface
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0070
Requirement	The activation or de-activation of the Surveillance Data Interface Monitoring **shall** be configurable by the system user.
Title	Activation/Deactivation Monitoring of Surveillance Data Interface
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0080
Requirement	The Control and Monitoring system **shall** control and monitor the following ACAS system components: •N x ACAS ground station sensor(s) •N x ACAS server(s)
Title	Control and Monitoring System
Status	<In Progress>
Rationale	design
Category	<Design>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-15.04.03-TS-SU10.0090
Requirement	The ACAS ground monitoring system and the associated Control and Monitoring System (CMS) **shall** use the standard management network protocol SNMP V2 or higher for communication.
Title	Control and Monitoring System Communication Protocol
Status	<In Progress>
Rationale	design
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

3.5 Reliability

N/A

3.6 Functional block Internal Data Requirements

N/A

3.7 Design and Construction Constraints

No design or construction constraints have been identified.

3.8 Functional block Interface Requirements

In the following pages, internal and external ACAS ground monitoring system interfaces are described, whereas they are not referred as requirements but to descriptions.

These Interfaces can be identified in the Diagram shown in Figure 2

3.8.1 ACAS Ground Station Sensor

3.8.1.1 Receiver Antenna 1030 & 1090 MHz Interface

ACAS ground monitoring system interface: ITF-GS-ANT (please refer to: Figure 2)

The interface exists between the ground station sensor antenna(s) and sensor receiver(s). The interface shall process all Mode-S Downlink signals in the 1090 MHz channel and all Mode-S Uplink signals in the 1030 MHz channel that comply with Signal-in-Space characteristics defined in ICAO Annex 10 [2] and [3].

The interface is unidirectional - from the Sensor antenna to the Sensor receiver.

3.8.1.2 Ground Station Sensor Raw Data Output Interface

ACAS ground monitoring system interface: ITF-GS-RA (please refer to: Figure 2)

The interface exists between ground station sensor and the ACAS server. The ground station sensor(s) send so-called Raw data packets via the UDP/IP network protocol to the central ACAS server data processing system. The ACAS ground station sensor Raw data output interface will be described in detail in the Thales Interface Definition document [1].

The interface is unidirectional - from the ground station sensor to the ACAS server.

3.8.1.3 Ground Station Sensor Control and Monitoring Interface

ACAS ground monitoring system interface: ITF-GS-CTRL (please refer to: Figure 2)

The interface exists between Control and Monitoring System (CMS) and the ground station sensor(s). The interface will used to observe and configure the ground station sensor(s) from remote or locally. The CMS will use the standard communication protocol SNMP version 2 or higher for system information exchange. For further information to SNMP, please referring to: [4].

The interface is bidirectional.

3.8.2 ACAS Server

3.8.2.1 Surveillance Sensor Data Interface

ACAS ground monitoring system interface: ITF-SVR-SUR (please refer to: Figure 2)

The interface exists between the Surveillance Sensor systems (Radar SSR-Mode-S, ADS-B, MLAT and WAM) and the ACAS ground monitoring system. The input of the various Surveillance sensors is optional and depends strong on the on ACAS ground monitoring system environment. Usually, the Surveillance sensor data will send via a Sensor Data Fusion system (SDF) to the ACAS server, but in some cases the data could also bypass the SDF.

The system interface will used by the following system parts:

- SDF to ACAS server by using the ASTERIX Category 62 protocol [5]
- RADAR SSR-Mode-S to ACAS server by using the ASTERIX Category 48 protocol [6]
- ADS-B to ACAS server by using the ASTERIX Category 21 protocol [8]

All system interface parts described above are unidirectional - from the Surveillance sensor or SDF to the ACAS server.

3.8.2.2 Record Data Interface

ACAS ground monitoring system interface: ITF-SVR-DATA (please refer to: Figure 2)

The ACAS monitoring server store all incoming and processed Resolution Advisory (RA) related data into an user readable ASCII files. These data files could be later offline analysed.

Each received target RA event data will be stored in into three event and contents specific separate target files:

- Target RA event raw data file
- Target RA event devolution data file
- Target RA event track data file
- Daily RA message log file

The interface is unidirectional - from the ACAS server into file(s).

3.8.2.2.1 Format of Target RA Raw Data File

The file contains target RA event related raw data (DF16/UF16 and DF17) and target RA event relevant Surveillance data. An target RA event will be unique identified by the aircraft ICAO address and the RA event timestamp.

Each target RA event file record is subdivided into several fields, these fields are separated by a blank character.

- Field-1: Link Indicator – 000 for 1090 and 001 for 1030
- Field-2: System Area Code (SAC) – XXX (decimal)
- Field-3: System Identification Code (SIC) – XXX (decimal)
- Field-4: Time Stamp ACAS server: YYYY-MM-DDTHH:MM:SS.SSS
- Field-5: Time Stamp ACAS sensor: YYYY-MM-DDTHH:MM:SS.SSS
- Field-6: Telegram: UF16 / DF16 /DF17 (hex) – 28 characters
- Field-7: Mode-S Sender ICAO Address: 6 characters (hex)
- Field-8: Time Stamp Track: HH:MM:SS.SSS
- Field-9: Aircraft Callsign: 8 characters
- Field-10: Aircraft Squawk (Mode3A): 4 characters (octal)
- Field-11: Aircraft Position-X: Cartesian coordinates
- Field-12: Aircraft Position-Y: Cartesian coordinates
- Field-13: Aircraft Flight Level (feet)
- Field-14: Aircraft Position Longitude: WGS-84 coordinates
- Field-15: Aircraft Position Latitude: WGS-84 coordinates„

File type: Standard ASCII format

File name: YYYY-MM-DDTHHMMSS.ModeSAddr.raw – Example: 2012-02-10T123552.4B1A58.raw

3.8.2.2.2 Format of Target RA Devolution Data File

The file contains the decoded devolution data of one recorded target RA event. The RA event will be identified by the aircraft ICAO address and the RA event timestamp.

Each target file record is subdivided into several fields separated by a semicolon character.

- Field-1: Time Stamp
- Field-2: Mode-S Sender ICAO Address: 6 characters (hex)
- Field-3: Alarm Short designation
- Field-4: Alarm Description (long)
- Field-5: Aircraft Callsign

File type: Standard ASCII format

File name: YYYY-MM-DDHHMMSS.ModeSAddr.vlf – Example: 2012-02-10T123552.4B1A58.vlf

3.8.2.2.3 Format of Target RA Track Data File

The file contains the aircraft trajectory data before and after an recorded target RA event. The RA event will be identified by the aircraft ICAO address and the RA event timestamp.

Each target file record is subdivided into several fields separated by a blank character.

- Field-1: Time Stamp
- Field-2: Aircraft Squawk (Mode3A): 4 characters (octal)
- Field-3: Mode-S Sender ICAO Address: 6 characters (hex)
- Field-4: Aircraft Callsign: 8 characters
- Field-5: Aircraft Flight Level (feet)
- Field-6: Aircraft Position-X: Cartesian coordinates
- Field-7: Aircraft Position-Y: Cartesian coordinates
- Field-8: Aircraft Position Longitude: WGS-84 coordinates
- Field-9: Aircraft Position Latitude: WGS-84 coordinates„

File type: Standard ASCII format

File name: YYYY-MM-DDHHMMSS.ModeSAddr.trk – Example: 2012-02-10T123552.4B1A58.trk

3.8.2.2.4 Daily RA message log file

The log file contains RA information received and recorded by the ACAS server over one day.

The log file handling (creation/closure) will be managed in the background by the ACAS server automatically.

Each file record is subdivided into several fields separated by a blank character.

- Field-1: Data Source: 000 – DF16 telegram; 001 – UF16 telegram, 002 – RA Downlink (RADL)
- Field-2: System Area Code (SAC) – XXX (decimal)
- Field-3: System Identification Code (SIC) – XXX (decimal)
- Field-4: Time Stamp ACAS server: YYYY-MM-DDTHH:MM:SS.SSS
- Field-5: Time Stamp ACAS sensor: YYYY-MM-DDTHH:MM:SS.SSS
- Field-6: Telegram Data
- Field-7: BDS10 register (RADL) or Quality (DF16/UF16)
- Field-8: ICAO Adress 24-bit - 6 characters (hex) (RADL) or Signal Amplitude (DF16/UF16)

3.8.2.3 Operational ATM System Data and System Status Interface

ACAS ground monitoring system interface: ITF-SVR-ATM (please refer to: Figure 2)

The interface exists between the ACAS server and external systems. Operational ACAS server data (RA event and system status) will send by using the Standard ASTERIX Category 04 protocol [9].

The data could send out by the ACAS server in event driven or periodical mode.

The interface is unidirectional - from the ACAS server to the external system(s)/tool(s) (ATM).

3.8.2.4 Server Control and Monitoring Interface

ACAS ground monitoring system interface: ITF-SVR-CTRL (please refer to: Figure 2)

The interface exists between Control and Monitoring System (CMS) and the ACAS server. The interface will used to observe and configure the ACAS server from remote or locally. The CMS will use the standard communication protocol SNMP version 2 or higher. For further information to SNMP, please referring to: [4].

The interface is bidirectional.

3.8.3 Recording Tools

3.8.3.1 Server Input and Output Data

ACAS ground monitoring system interface: ITF-REC-SVR (please refer to: Figure 2)

The ACAS ground monitoring system contains a set of tools to record and analyse all relevant ACAS ground monitoring system RA input and output data. This circumstance allows the user not only to analyse the data offline, it gave the user also the possibility to rerun recorded target RA events in a realistic environment by feeding the data into an offline-operated ACAS server.

The following data formats supported by this interface:

- Ground station Raw data [1]
- SDF output data in the Standard ASTERIX Category 62 protocol [5]
- RADAR SSR-Mode-S output data in the Standard ASTERIX Category 48 protocol [6]
- ADS-B system output data in the Standard ASTERIX Category 21 protocol [8]
- ACAS server operational output data in the Standard the ASTERIX Category 04 protocol [9]

The interface is unidirectional - from the ground station sensor, Surveillance sensor and ACAS server to the specific recording tool(s).

3.8.4 Replay Tools

3.8.4.1 Server Input Data

ACAS ground monitoring system input interface: ITG-REP-SVR-INPUT (please refer to: Figure 2)

The ACAS ground monitoring system contains tools to replay recorded ACAS ground monitoring system RA input data. The user is able to rerun (time-independent) complete RA event scenario(s) by feeding the data via this interface into an offline-operated ACAS server.

The following data formats could be separate or mixed replayed from a file via this interface:

- Ground station Raw data [1]
- SDF output data in the Standard ASTERIX Category 62 protocol [5]
- RADAR SSR-Mode-S output data in the Standard ASTERIX Category 48 protocol [6]
- ADS-B system output data in the Standard ASTERIX Category 21 protocol [8]

The interface is unidirectional - from the replay tool to the ACAS server.

3.8.4.2 Replay Tools – Server Output Data

ACAS ground monitoring system output interface: ITF-REP-SVR-ATM (please refer to: Figure 2)

ACAS Monitoring tool to replay recorded ACAS server operational output data. The user is able to rerun scenario(s) by feeding the data via this interface into an external system/tool.

The following data format could be replayed from a file via this interface:

- ACAS server operational output data in the Standard the ASTERIX Category 04 protocol [9]

The interface is unidirectional - from the replay tool to the external system/tool.

3.8.5 System Time Synchronisation

ACAS ground monitoring system time synchronisation interface: ITF-TS (please refer to: Figure 2)

All main ACAS ground monitoring system components (server, ground station sensor(s) and CMS) are time synchronized by using the Standard Network Time Protocol [10].

The interface is bidirectional between NTP server and system components.

4 Assumptions

Project 04.08.03 has been identified as Operational Counterpart Project, receiving Operational Requirements (see [13]).

5 References

[1] SESAR-15.4.3-Thales-RD-IDD (Version 3.0)

[2] Annex 10 to the International Convention on Civil Aviation, Volume III, Communication Systems

[3] Annex 10 to the International Convention on Civil Aviation, Volume IV, Standards and Recommended Practices for Mode-S

[4] RFC 1157 – Simple Network Management Protocol (SNMP)

[5] Eurocontrol Standard Document for Surveillance Data Exchange Part9: Category 062 Edition 0.27 SDPS Track Messages

[6] Eurocontrol Standard Document for Surveillance Data Exchange Part4: Category 048 Edition 1.15 Transmission of Monoradar Target Reports

[7] Eurocontrol Standard Document for Surveillance Data Exchange Part12: Category 021 Edition 2.77 ADS-B Messages

[8] Eurocontrol Standard Document for Surveillance Data Exchange Part12: Category 021 Edition 0.23 ADS-B Messages

[9] Eurocontrol Standard Document for Surveillance Data Exchange Part17: Category 04 Edition 1.5a Safety Net Messages

[10]RFC 958 – Network Time Protocol (NTP)

[11]SESAR - Requirements and V&V Guidelines 02.00.00 June 2011

[12] Del 03: ACAS Ground Monitoring System Specification, Ed 00.01.00

[13] DEL04.08.03.D05 PR-RADL.doc Performance Specifications of ACAS Monitoring System for the collection of ACAS RA downlink information.

5.1 Use of copyright/patent material/classified material

The Raw Data Interface description [1] supplied by Thales will be considered as copyright material.

Appendix A Traceability

Requirement Identifier	Requirement title	Enabler code
		Satisfied Enabler
REQ-15.04.03-TS-GE10.0010	Monitored TCAS versions	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0020	System Coverage	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0030	Probability of Detection	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0040	ACAS ground monitoring system components	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0050	ACAS ground station sensor Mode-S 1090 MHz reception channel	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0060	ACAS ground station sensor Mode-S 1030 MHz reception channel	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0070	Support EUROCAE/RTCA MOPS version ED102A/DO-260B	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0080	RA Processing Capability	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0090	ACAS Ground Monitoring System Time Reference	*CTE-S11b* *New collision Avoidance Systems*

Requirement Identifier	Requirement title	Enabler code
REQ-15.04.03-TS-GE10.0100	ACAS Ground Monitoring System Time Base UTC	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0110	ACAS Ground Monitoring System Time Resolution	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0120	ACAS Ground Monitoring System Time Accuracy	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0130	Supply Data for Online Processing and Analysis	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0140	Supply Data for Offline Processing and Analysis	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0150	ACAS Ground Monitoring System Latency	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0160	ACAS Ground Monitoring System Configuration	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0170	ACAS Ground Monitoring System Security	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0180	Control and Monitoring System	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0190	Remote ACAS Ground Monitoring System Control	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0200	Local ACAS Ground Monitoring	*CTE-S11b*

Requirement Identifier	Requirement title	Enabler code
	System Control	*New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0210	ACAS Ground Monitoring System Resume after System Blackout	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-GE10.0220	System Start-up	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0010	Supported ACAS RA message types	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0020	Provision of ACAS Resolution Advisory messages	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0030	Supported Surveillance information Sources	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0040	Support Network Protocol Type	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0050	System Network Addresses Configuration	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0060	System Network Addresses	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0070	System Network Ports	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0080	Supported Mode-S Uplink telegram formats	*CTE-S11b* *New collision Avoidance*

Requirement Identifier	Requirement title	Enabler code
		Systems
REQ-15.04.03-TS-PR10.0090	Supported Mode-S Downlink telegram formats	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0100	Mode-S Uplink telegram format filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0110	Configuration of Mode-S Uplink telegram format filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0120	Mode-S Downlink telegram format filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0130	Configuration of Mode-S Downlink telegram format filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0140	Ground Station Sensor Data output	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0150	Ground Station sensor Mode-S telegram time stamping	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0160	Ground Station time stamp resolution	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0170	Sensor Data Fusion data and data format	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0180	SSR-Mode-S radar sensor data and data format	*CTE-S11b* *New collision Avoidance Systems*

Requirement Identifier	Requirement title	Enabler code
REQ-15.04.03-TS-PR10.0190	ADS-B Surveillance Sensor data and data format	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0200	ACAS Ground Station Sensor filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0210	Configuration of ACAS ground station sensor filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0220	Surveillance data source filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0230	Configuration of Surveillance data source filter	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0240	ACAS Ground Monitoring data merging	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0250	ACAS Ground Monitoring data storage	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0260	ACAS Ground Monitoring data storage format	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0270	ACAS Ground Monitoring data storage time span	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0280	Configuration of ACAS Ground Monitoring data storage time span	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0290	Data storage time span parameter	*CTE-S11b*

Requirement Identifier	Requirement title	Enabler code
		New collision Avoidance Systems
REQ-15.04.03-TS-PR10.0300	ACAS Ground Monitoring data storage identification	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0310	ACAS server Surveillance Data and ACAS RA Message time stamping	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0320	ACAS server Surveillance Data and ACAS RA Message time stamping resolution	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0330	ACAS server Surveillance Data and Information Message system origin identifier	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0340	Real-time output of RA event data	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0350	Additional Real-time output of RA event data	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0360	ACAS Ground Monitoring system output format	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0370	ACAS data fusion and suppression function	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0390	Validation of ACAS RA messages	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0410	Marking of invalid ACAS RA messages	*CTE-S11b* *New collision Avoidance*

Requirement Identifier	Requirement title	Enabler code
		Systems
REQ-15.04.03-TS-PR10.0420	Termination of RA	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-PR10.0430	Offline information	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-RR10.0010	Recording function of ground station sensors data	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-RR10.0030	ACAS Ground Monitoring system data recording	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-RR10.0040	ACAS Ground Monitoring system data replay	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0010	Ground Station Sensor BITE function	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0020	ACAS Server BITE function	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0030	ACAS Server System Status Report	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0040	ACAS Server System Status Reporting Mode	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0050	Configuration of ACAS Server Status Update Rate	*CTE-S11b* *New collision Avoidance Systems*

Requirement Identifier	Requirement title	Enabler code
REQ-15.04.03-TS-SU10.0060	Monitoring of Surveillance Data Interface	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0070	Activation/Deactivation Monitoring of Surveillance Data Interface	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0080	Control and Monitoring System	*CTE-S11b* *New collision Avoidance Systems*
REQ-15.04.03-TS-SU10.0090	Control and Monitoring System Communication Protocol	*CTE-S11b* *New collision Avoidance Systems*

Table 3: TS requirements / Enabler traceability

Requirement Identifier	Requirement title	Functional block identifier
REQ-15.04.03-TS-GE10.0010	Monitored TCAS versions	Reception & Decoding
REQ-15.04.03-TS-GE10.0020	System Coverage	General
REQ-15.04.03-TS-GE10.0030	Probability of Detection	General
REQ-15.04.03-TS-GE10.0040	ACAS ground monitoring system components	General
REQ-15.04.03-TS-GE10.0050	ACAS ground station sensor Mode-S 1090 MHz reception channel	Reception & Decoding
REQ-15.04.03-TS-GE10.0060	ACAS ground station sensor Mode-S 1030 MHz reception channel	Reception & Decoding
REQ-15.04.03-TS-GE10.0070	Support EUROCAE/RTCA MOPS version ED102A/DO-260B	Reception & Decoding
REQ-15.04.03-TS-GE10.0080	RA Processing Capability	General
REQ-15.04.03-TS-GE10.0090	ACAS Ground Monitoring System Time Reference	Time Synchronisation

Requirement Identifier	Requirement title	Functional block identifier
REQ-15.04.03-TS-GE10.0100	ACAS Ground Monitoring System Time Base UTC	Time Synchronisation
REQ-15.04.03-TS-GE10.0110	ACAS Ground Monitoring System Time Resolution	Time Synchronisation
REQ-15.04.03-TS-GE10.0120	ACAS Ground Monitoring System Time Accuracy	Time Synchronisation
REQ-15.04.03-TS-GE10.0130	Supply Data for Online Processing and Analysis	Distribution
REQ-15.04.03-TS-GE10.0140	Supply Data for Offline Processing and Analysis	Storage
REQ-15.04.03-TS-GE10.0150	ACAS Ground Monitoring System Latency	General
REQ-15.04.03-TS-GE10.0160	ACAS Ground Monitoring System Configuration	Management & Status
REQ-15.04.03-TS-GE10.0170	ACAS Ground Monitoring System Security	Management & Status
REQ-15.04.03-TS-GE10.0180	Control and Monitoring System	Management & Status
REQ-15.04.03-TS-GE10.0190	Remote ACAS Ground Monitoring System Control	Management & Status
REQ-15.04.03-TS-GE10.0200	Local ACAS Ground Monitoring System Control	Management & Status
REQ-15.04.03-TS-GE10.0210	ACAS Ground Monitoring System Resume after System Blackout	General
REQ-15.04.03-TS-GE10.0220	System Start-up	Management & Status
REQ-15.04.03-TS-PR10.0010	Supported ACAS RA message types	Reception & Decoding
REQ-15.04.03-TS-PR10.0020	Provision of ACAS Resolution Advisory messages	Distribution
REQ-15.04.03-TS-PR10.0030	Supported Surveillance information Sources	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0040	Support Network Protocol Type	Distribution
REQ-15.04.03-TS-PR10.0050	System Network Addresses	Distribution

Requirement Identifier	Requirement title	Functional block identifier
	Configuration	
REQ-15.04.03-TS-PR10.0060	System Network Addresses	Distribution
REQ-15.04.03-TS-PR10.0070	System Network Ports	Distribution
REQ-15.04.03-TS-PR10.0080	Supported Mode-S Uplink telegram formats	Reception & Decoding
REQ-15.04.03-TS-PR10.0090	Supported Mode-S Downlink telegram formats	Reception & Decoding
REQ-15.04.03-TS-PR10.0100	Mode-S Uplink telegram format filter	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0110	Configuration of Mode-S Uplink telegram format filter	Management & Status
REQ-15.04.03-TS-PR10.0120	Mode-S Downlink telegram format filter	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0130	Configuration of Mode-S Downlink telegram format filter	Management & Status
REQ-15.04.03-TS-PR10.0140	Ground Station Sensor Data output	Distribution
REQ-15.04.03-TS-PR10.0150	Ground Station sensor Mode-S telegram time stamping	Reception & Decoding
REQ-15.04.03-TS-PR10.0160	Ground Station time stamp resolution	Time Synchronisation
REQ-15.04.03-TS-PR10.0170	Sensor Data Fusion data and data format	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0180	SSR-Mode-S radar sensor data and data format	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0190	ADS-B Surveillance Sensor data and data format	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0200	ACAS Ground Station Sensor filter	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0210	Configuration of ACAS ground station sensor filter	Management & Status
REQ-15.04.03-TS-PR10.0220	Surveillance data source filter	Acquisition & Correlation & Filter

Requirement Identifier	Requirement title	Functional block identifier
REQ-15.04.03-TS-PR10.0230	Configuration of Surveillance data source filter	Management & Status
REQ-15.04.03-TS-PR10.0240	ACAS Ground Monitoring data merging	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0250	ACAS Ground Monitoring data storage	Storage
REQ-15.04.03-TS-PR10.0260	ACAS Ground Monitoring data storage format	Storage
REQ-15.04.03-TS-PR10.0270	ACAS Ground Monitoring data storage time span	Storage
REQ-15.04.03-TS-PR10.0280	Configuration of ACAS Ground Monitoring data storage time span	Management & Status
REQ-15.04.03-TS-PR10.0290	Data storage time span parameter	Storage
REQ-15.04.03-TS-PR10.0300	ACAS Ground Monitoring data storage identification	Storage
REQ-15.04.03-TS-PR10.0310	ACAS server Surveillance Data and ACAS RA Message time stamping	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0320	ACAS server Surveillance Data and ACAS RA Message time stamping resolution	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0330	ACAS server Surveillance Data and Information Message system origin identifier	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0340	Real-time output of RA event data	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0350	Additional Real-time output of RA event data	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0360	ACAS Ground Monitoring system output format	Distribution
REQ-15.04.03-TS-PR10.0370	ACAS data fusion and suppression function	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0390	Validation of ACAS RA messages	Acquisition & Correlation & Filter
REQ-15.04.03-TS-PR10.0410	Marking of invalid ACAS RA	Acquisition &

Requirement Identifier	Requirement title	Functional block identifier
	messages	Correlation & Filter
REQ-15.04.03-TS-PR10.0420	Termination of RA	General
REQ-15.04.03-TS-PR10.0430	Offline information	Distribution
REQ-15.04.03-TS-RR10.0010	Recording function of ground station sensors data	Storage
REQ-15.04.03-TS-RR10.0030	ACAS Ground Monitoring system data recording	Storage
REQ-15.04.03-TS-RR10.0040	ACAS Ground Monitoring system data replay	Replay
REQ-15.04.03-TS-SU10.0010	Ground Station Sensor BITE function	Management & Status
REQ-15.04.03-TS-SU10.0020	ACAS Server BITE function	Management & Status
REQ-15.04.03-TS-SU10.0030	ACAS Server System Status Report	Distribution
REQ-15.04.03-TS-SU10.0040	ACAS Server System Status Reporting Mode	Distribution
REQ-15.04.03-TS-SU10.0050	Configuration of ACAS Server Status Update Rate	Management & Status
REQ-15.04.03-TS-SU10.0060	Monitoring of Surveillance Data Interface	Management & Status
REQ-15.04.03-TS-SU10.0070	Activation/Deactivation Monitoring of Surveillance Data Interface	Management & Status
REQ-15.04.03-TS-SU10.0080	Control and Monitoring System	Management & Status
REQ-15.04.03-TS-SU10.0090	Control and Monitoring System Communication Protocol	Management & Status

Table 4: TS requirements / Functional block traceability

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
REQ-15.04.03-TS-GE10.0010	Monitored TCAS versions	REQ-04.08.03-SPR-RADL-05	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0020	System Coverage	REQ-04.08.03-SPR-RADL-10	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0030	Probability of Detection	REQ_04.08.03_SPR_RADL_08	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0040	ACAS ground monitoring system components	N/A	N/A
REQ-15.04.03-TS-GE10.0050	ACAS ground station sensor Mode-S 1090 MHz reception channel	REQ_04.08.03_SPR_RADL_02	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0060	ACAS ground station sensor Mode-S 1030 MHz reception channel	REQ_04.08.03_SPR_RADL_02	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0070	Support EUROCAE/RTCA MOPS version ED102A/DO-260B	N/A	N/A
REQ-15.04.03-TS-GE10.0080	RA Processing Capability	REQ-04.08.03-SPR-RADL-04	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0090	ACAS Ground Monitoring System Time Reference	REQ-04.08.03-SPR-RADL-12	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0100	ACAS Ground Monitoring System Time Base UTC	REQ-04.08.03-SPR-RADL-12	Please refer to requirements text in document.
REQ-15.04.03-TS-	ACAS Ground	REQ-04.08.03-SPR-RADL-1	Please refer to

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
GE10.0110	Monitoring System Time Resolution	REQ-04.08.03-SPR-RADL-12 REQ-04.08.03-SPR-RADL-14	requirements text in document.
REQ-15.04.03-TS-GE10.0120	ACAS Ground Monitoring System Time Accuracy	N/A	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0130	Supply Data for Online Processing and Analysis	REQ-04.08.03-SPR-RADL-01 REQ-04.08.03-SPR-RADL-02 REQ-04.08.03-SPR-RADL-03	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0140	Supply Data for Offline Processing and Analysis	REQ-04.08.03-SPR-RADL-02 REQ-04.08.03-SPR-RADL-07 REQ-04.08.03-SPR-RADL-16	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0150	ACAS Ground Monitoring System Latency	REQ-04.08.03-SPR-RADL-08	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0160	ACAS Ground Monitoring System Configuration	N/A	N/A
REQ-15.04.03-TS-GE10.0170	ACAS Ground Monitoring System Security	REQ-04.08.03-SPR-RADL-06	Please refer to requirements text in document.
REQ-15.04.03-TS-GE10.0180	Control and Monitoring System	N/A	N/A
REQ-15.04.03-TS-GE10.0190	Remote ACAS Ground Monitoring System Control	N/A	N/A
REQ-15.04.03-TS-GE10.0200	Local ACAS Ground Monitoring System Control	N/A	N/A
REQ-15.04.03-TS-GE10.0210	ACAS Ground Monitoring System Resume after System Blackout	N/A	N/A
REQ-15.04.03-TS-	System Start-up	N/A	N/A

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
GE10.0220			
REQ-15.04.03-TS-PR10.0010	Supported ACAS RA message types	REQ-04.08.03-SPR-RADL-02	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0020	Provision of ACAS Resolution Advisory messages	REQ-04.08.03-SPR-RADL-01 REQ-04.08.03-SPR-RADL-02	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0030	Supported Surveillance information Sources	N/A	N/A
REQ-15.04.03-TS-PR10.0040	Support Network Protocol Type	REQ-04.08.03-SPR-RADL-03	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0050	System Network Addresses Configuration	N/A	N/A
REQ-15.04.03-TS-PR10.0060	System Network Addresses	N/A	N/A
REQ-15.04.03-TS-PR10.0070	System Network Ports	N/A	N/A
REQ-15.04.03-TS-PR10.0080	Supported Mode-S Uplink telegram formats	REQ_04.08.03_SPR_RADL_02	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0090	Supported Mode-S Downlink telegram formats	REQ_04.08.03_SPR_RADL_02	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0100	Mode-S Uplink telegram format filter	REQ-04.08.03-SPR-RADL-11	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0110	Configuration of Mode-S Uplink telegram format filter	N/A	N/A
REQ-15.04.03-TS-PR10.0120	Mode-S Downlink telegram format filter	REQ-04.08.03-SPR-RADL-11	Please refer to requirements text in

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
			document.
REQ-15.04.03-TS-PR10.0130	Configuration of Mode-S Downlink telegram format filter	N/A	N/A
REQ-15.04.03-TS-PR10.0140	Ground Station Sensor Data output	N/A	N/A
REQ-15.04.03-TS-PR10.0150	Ground Station sensor Mode-S telegram time stamping	REQ-04.08.03-SPR-RADL-12	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0160	Ground Station time stamp resolution	REQ-04.08.03-SPR-RADL-01 REQ-04.08.03-SPR-RADL-12 REQ-04.08.03-SPR-RADL-14	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0170	Sensor Data Fusion data and data format	N/A	N/A
REQ-15.04.03-TS-PR10.0180	SSR-Mode-S radar sensor data and data format	N/A	N/A
REQ-15.04.03-TS-PR10.0190	ADS-B Surveillance Sensor data and data format	N/A	N/A
REQ-15.04.03-TS-PR10.0200	ACAS Ground Station Sensor filter	N/A	N/A
REQ-15.04.03-TS-PR10.0210	Configuration of ACAS ground station sensor filter	N/A	N/A
REQ-15.04.03-TS-PR10.0220	Surveillance data source filter	N/A	N/A
REQ-15.04.03-TS-PR10.0230	Configuration of Surveillance data source filter	N/A	N/A
REQ-15.04.03-TS-PR10.0240	ACAS Ground Monitoring data merging	REQ-04.08.03-SPR-RADL-07	Please refer to requirements text in document.
REQ-15.04.03-TS-	ACAS Ground	REQ-04.08.03-SPR-RADL-02	Please refer to requirements

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
PR10.0250	Monitoring data storage	REQ-04.08.03-SPR-RADL-16	text in document.
REQ-15.04.03-TS-PR10.0260	ACAS Ground Monitoring data storage format	REQ-04.08.03-SPR-RADL-16	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0270	ACAS Ground Monitoring data storage time span	N/A	N/A
REQ-15.04.03-TS-PR10.0280	Configuration of ACAS Ground Monitoring data storage time span	N/A	N/A
REQ-15.04.03-TS-PR10.0290	Data storage time span parameter	N/A	N/A
REQ-15.04.03-TS-PR10.0300	ACAS Ground Monitoring data storage identification	N/A	N/A
REQ-15.04.03-TS-PR10.0310	ACAS server Surveillance Data and ACAS RA Message time stamping	N/A	N/A
REQ-15.04.03-TS-PR10.0320	ACAS server Surveillance Data and ACAS RA Message time stamping resolution	REQ-04.08.03-SPR-RADL-01 REQ-04.08.03-SPR-RADL-12 REQ-04.08.03-SPR-RADL-14	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0330	ACAS server Surveillance Data and Information Message system origin identifier	N/A	N/A
REQ-15.04.03-TS-PR10.0340	Real-time output of RA event data	REQ-04.08.03-SPR-RADL-12	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0350	Additional Real-time output of RA event data	REQ-04.08.03-SPR-RADL-13	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0360	ACAS Ground Monitoring system output	REQ-04.08.03-SPR-RADL-01 REQ-04.08.03-SPR-RADL-15	Please refer to requirements text in

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
	format		document.
REQ-15.04.03-TS-PR10.0370	ACAS data fusion and suppression function	REQ-04.08.03-SPR-RADL-07	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0390	Validation of ACAS RA messages	REQ-04.08.03-SPR-RADL-11	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0410	Marking of invalid ACAS RA messages	REQ-04.08.03-SPR-RADL-11 REQ-04.08.03-SPR-RADL-16	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0420	Termination of RA	REQ-04.08.03-SPR-RADL-09	Please refer to requirements text in document.
REQ-15.04.03-TS-PR10.0430	Offline information	REQ-04.08.03-SPR-RADL-16	Please refer to requirements text in document.
REQ-15.04.03-TS-RR10.0010	Recording function of ground station sensors data	REQ-04.08.03-SPR-RADL-16	Please refer to requirements text in document.
REQ-15.04.03-TS-RR10.0030	ACAS Ground Monitoring system data recording	REQ-04.08.03-SPR-RADL-16	Please refer to requirements text in document.
REQ-15.04.03-TS-RR10.0040	ACAS Ground Monitoring system data replay	N/A	N/A
REQ-15.04.03-TS-SU10.0010	Ground Station Sensor BITE function	N/A	N/A
REQ-15.04.03-TS-SU10.0020	ACAS Server BITE function	N/A	N/A
REQ-15.04.03-TS-SU10.0030	ACAS Server System Status Report	REQ-04.08.03-SPR-RADL-15	Please refer to requirements text in document.

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
REQ-15.04.03-TS-SU10.0040	ACAS Server System Status Reporting Mode	REQ-04.08.03-SPR-RADL-15	Please refer to requirements text in document.
REQ-15.04.03-TS-SU10.0050	Configuration of ACAS Server Status Update Rate	REQ-04.08.03-SPR-RADL-15	Please refer to requirements text in document.
REQ-15.04.03-TS-SU10.0060	Monitoring of Surveillance Data Interface	N/A	N/A
REQ-15.04.03-TS-SU10.0070	Activation/Deactivation Monitoring of Surveillance Data Interface	N/A	N/A
REQ-15.04.03-TS-SU10.0080	Control and Monitoring System	N/A	N/A
REQ-15.04.03-TS-SU10.0090	Control and Monitoring System Communication Protocol	N/A	N/A

Table 5: TS requirements traceability

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
REQ-15.04.03-TS-GE10.0010	Monitored TCAS versions	The ACAS ground monitoring system **shall** be able to detect messages from aircraft equipped with TCAS II versions 6.04a, 7.0 and 7.1.	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-GE10.0020	System Coverage	The ACAS ground monitoring system **shall** provide Resolution Advisory (RA) information reception coverage within the defined airspace (i.e. ANSP, FAB). Note: The system reception coverage is subject to the specific user requirements and user environment.	*Validation – <Shadow Mode>*
REQ-15.04.03-TS-GE10.0030	Probability of Detection	The ACAS ground station sensor **shall** detect ACAS RA messages with a minimum probability (PD) of 95% at MTL +3dB.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0040	ACAS ground monitoring system components	An ACAS ground monitoring system **shall** enfold at minimum the following base functions: •Function for RA reception and decoding •Function for RA information acquisition, correlation and filter •Function for RA information storage •Function for RA information distribution •Function for RA information replay •Fuction for system monitoring and control Function for system time	*Verification - <Inspection>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
		synchronisation	
REQ-15.04.03-TS-GE10.0050	ACAS ground station sensor Mode-S 1090 MHz reception channel	The ACAS ground monitoring system **shall** consist of a set of one or more receive-only ACAS ground station sensor(s) being able to detect, decode and process Mode-S signals received on the 1090 MHz channel.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0060	ACAS ground station sensor Mode-S 1030 MHz reception channel	The ACAS ground monitoring system **shall** consist of a set of one or more receive-only ACAS ground station sensor(s) being able to detect, decode and process Mode-S signals received on the 1030 MHz channel.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0070	Support EUROCAE/RTCA MOPS version ED102A/DO-260B	The ACAS ground monitoring system **shall** be able to decode and process aircraft transponder messages complying as specified in EUROCAE/RTCA MOPS ED102A/DO-260B §2.2.3.2.7.8.2 (FTC=28 – Subtype=2).	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0080	RA Processing Capability	The ACAS ground monitoring system **shall** be able to process simultaneously at minimum 10 RA events. Note: The ACAS ground monitoring system will be suitable for use for the anticipated traffic numbers in core Europe until at least 2030.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0090	ACAS Ground Monitoring System Time Reference	The ACAS ground monitoring system time **shall** be synchronized by an internal or external time source.	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
REQ-15.04.03-TS-GE10.0100	ACAS Ground Monitoring System Time Base UTC	The ACAS ground monitoring system **shall** use Coordinated Universal Time (UTC) time as time base.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0110	ACAS Ground Monitoring System Time Resolution	The ACAS ground monitoring system **shall** use a system time with a maximum resolution of 1/128 second.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0120	ACAS Ground Monitoring System Time Accuracy	The ACAS ground monitoring system **shall** use a system time with an accuracy better than ± 2ms.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0130	Supply Data for Online Processing and Analysis	The ACAS ground monitoring system **shall** provide RA event data to external systems via Standard ASTERIX CAT 4 protocol for Online Processing.	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-GE10.0140	Supply Data for Offline Processing and Analysis	The ACAS ground monitoring system **shall** provide RA event and related Surveillance Sensor data for Offline Processing and Analysis.	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-GE10.0150	ACAS Ground Monitoring System Latency	The ACAS ground monitoring system **shall** provide information on the external ACAS ground monitoring system output interface within 2 seconds from the time the RA is generated in 95% or more of the cases.	*Validation - <Shadow Mode>* *(long term field test)* *&* *Verification - <Test>* *(deterministic laboratory test)*
REQ-15.04.03-TS-GE10.0160	ACAS Ground Monitoring System Configuration	The ACAS monitoring ground station sensor(s) and the ACAS server **shall** store system configuration parameters persistent in a non-volatile memory.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0170	ACAS Ground Monitoring	The ACAS ground monitoring system **shall**	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
	System Security	prevent unauthorized user access to system components and system data.	
REQ-15.04.03-TS-GE10.0180	Control and Monitoring System	The ACAS ground monitoring system **shall** be controlled and monitored by an autonomous Control and Monitoring System (CMS).	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0190	Remote ACAS Ground Monitoring System Control	The ACAS ground monitoring system **shall** be controllable by a system user from remote.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0200	Local ACAS Ground Monitoring System Control	The ACAS ground monitoring system **shall** be local controllable by a system user.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0210	ACAS Ground Monitoring System Resume after System Blackout	The ACAS ground monitoring ground station sensor(s) and the ACAS server **shall** start automatically after system blackout.	*Verification - <Test>*
REQ-15.04.03-TS-GE10.0220	System Start-up	During start-up, the system (Ground station sensor(s) and the ACAS server) **shall** read-out and use system configuration parameters from the non-volatile memory.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0010	Supported ACAS RA message types	The ACAS ground monitoring system **shall** be able to receive, decode and process ACAS RA messages.	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-PR10.0020	Provision of ACAS Resolution Advisory messages	The ACAS ground monitoring system **shall** provide ACAS RA messages on the external ACAS ground monitoring system output interface.	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-PR10.0030	Supported Surveillance information	The ACAS ground monitoring system **should** be able to receive, decode	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
	Sources	and process Surveillance information provided by the Surveillance Sensor Systems: SSR-Mode-S, ADS-B and Sensor Data Fusion system (SDF).	
REQ-15.04.03-TS-PR10.0040	Support Network Protocol Type	The ACAS ground monitoring system **shall** provide connection to external systems via UDP/IP.	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-PR10.0050	System Network Addresses Configuration	ACAS ground monitoring system network addresses **shall** be configurable by the system user.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0060	System Network Addresses	The ACAS ground monitoring system **shall** support unicast, multicast and broadcast network addresses.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0070	System Network Ports	ACAS ground monitoring system network ports **shall** be configurable by the system user.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0080	Supported Mode-S Uplink telegram formats	The ACAS ground monitoring system **shall** be able to receive, decode and process the Mode-S uplink (UF-0 to UF-24) telegram formats as defined in ICAO Annex 10 Volume 4.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0090	Supported Mode-S Downlink telegram formats	The ACAS ground monitoring system **shall** be able to receive, decode and process the Mode-S downlink (DF-0 to DF-24) telegram formats as defined in ICAO Annex 10 Volume 4.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0100	Mode-S Uplink telegram format filter	The ACAS ground monitoring system **shall** be able to filter Mode-S uplink (UF-0 to UF-24) telegram formats as defined in ICAO Annex 10 Volume 4.	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
REQ-15.04.03-TS-PR10.0110	Configuration of Mode-S Uplink telegram format filter	The Mode-S Uplink telegram format filter **shall** be configurable by the system user.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0120	Mode-S Downlink telegram format filter	The ACAS ground monitoring system **shall** be able to filter Mode-S downlink (DF-0 to DF-24) telegram formats as defined in ICAO Annex 10 Volume 4.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0130	Configuration of Mode-S Downlink telegram format filter	The Mode-S Downlink telegram format filter **shall** be configurable by the system user.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0140	Ground Station Sensor Data output	The ACAS ground monitoring ground station sensors **shall** be able to send decoded Mode-S telegrams over a network to local and remote installed processing units.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0150	Ground Station sensor Mode-S telegram time stamping	The ACAS monitoring ground station sensor **shall** mark each incoming received Mode-S telegram by a unique system time stamp.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0160	Ground Station time stamp resolution	The resolution of this time stamp **shall** be at maximum 1/128 seconds.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0170	Sensor Data Fusion data and data format	The ACAS ground monitoring system **should** be able to receive and process Surveillance data provided by a Sensor Data Fusion (SDF) system in ASTERIX Category 62 edition 0.27.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0180	SSR-Mode-S radar sensor data and data format	The ACAS ground monitoring system **should** be able to receive and process Surveillance data in ASTERIX Category 48 edition 1.15.	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
REQ-15.04.03-TS-PR10.0190	ADS-B Surveillance Sensor data and data format	The ACAS ground monitoring system **should** be able to receive and process Surveillance data in ASTERIX Category 21 edition 0.23.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0200	ACAS Ground Station Sensor filter	The ACAS ground monitoring system **shall** be able to filter incoming ACAS ground station sensor data based on the ACAS ground station sensor.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0210	Configuration of ACAS ground station sensor filter	The ACAS ground station sensor filter **shall** be configurable by the system user.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0220	Surveillance data source filter	The ACAS ground monitoring system **shall** be able to filter incoming Surveillance Sensor data based on the surveillance data source.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0230	Configuration of Surveillance data source filter	The Surveillance data source filter **shall** be configurable by the system user.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0240	ACAS Ground Monitoring data merging	The ACAS ground monitoring system **shall** provide functions to read, process and merge received incoming ACAS ground station sensor data messages and Surveillance data messages.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0250	ACAS Ground Monitoring data storage	The ACAS ground monitoring system **shall** provide functions to store received incoming ACAS ground station sensor data messages and Surveillance data messages.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0260	ACAS Ground Monitoring data storage format	Incoming ACAS ground station sensor data messages **shall**	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
		continuously stored into a user readable file. (ASCII format). Note: The storage could also be a database.	
REQ-15.04.03-TS-PR10.0270	ACAS Ground Monitoring data storage time span	Surveillance data **shall** be stored within a user defined period. (i.e. number of minutes before an aircraft RA acquisition by the system and number of minutes after an aircraft RA termination.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0280	Configuration of ACAS Ground Monitoring data storage time span	The system user **shall** be able to configure the Surveillance data storage time span.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0290	Data storage time span parameter	This time span **shall** be between 1 and 15 minutes before and after an RA event.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0300	ACAS Ground Monitoring data storage identification	The system **shall** mark each recorded ACAS ground station sensor data message and Surveillance data message in the file by a unique identifier (source) and its reception time.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0310	ACAS server Surveillance Data and ACAS RA Message time stamping	The ACAS server **shall** mark incoming received ACAS RA messages and Surveillance data messages by a unique system time stamp.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0320	ACAS server Surveillance Data and ACAS RA Message time stamping resolution	The resolution of the time stamp **shall** be at maximum 1/128 seconds.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0330	ACAS server Surveillance Data and Information	The ACAS server **should** mark incoming received ACAS RA messages, ACAS	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
	Message system origin identifier	broadcast messages and Surveillance data messages by an unique system origin identifier.	
REQ-15.04.03-TS-PR10.0340	Real-time output of RA event data	The ACAS ground monitoring system **shall** provide the following information when an RA event occurs and when there is a change. •Aircraft identification (call sign or registration) •Aircraft address (24 bit Mode S address) •Type of the RA, if available (ARA field as specified in) •Source of information (RA DL, Broadcast or Coordination message) Time stamp (resolution 1/128 s)	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-PR10.0350	Additional Real-time output of RA event data	The ACAS ground monitoring system (ACAS server) **should** additionally provide the following information when an RA event occurs. In case of a threat indicated as Mode S equipped (TTI=1) in received messages. •Threat aircraft address (24 bit Mode S address) In case of a threat indicated as not Mode S equipped (TTI=2) in received messages. •Threat aircraft altitude, range and bearing Threat aircraft Mode A code (when possible)	*Validation - <Shadow Mode>* *Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
REQ-15.04.03-TS-PR10.0360	ACAS Ground Monitoring system output format	The ACAS ground monitoring system **shall** provide information to external systems by using ASTERIX Category 4 edition 1.5 (SESAR WP15.4.3 proposal).	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-PR10.0370	ACAS data fusion and suppression function	The ACAS ground monitoring system **shall** provide a data fusion function to suppress duplicated ACAS RA messages and duplicated Surveillance data messages.	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-PR10.0390	Validation of ACAS RA messages	The ACAS ground monitoring system **shall** validate all incoming ACAS RA messages to filter out technical error cases (e.g. empty data fields, missing intruder data, undefined data in data fields received).	*Validation - <Shadow Mode>* *Verification - <Test>*
REQ-15.04.03-TS-PR10.0410	Marking of invalid ACAS RA messages	The ACAS ground monitoring system **shall** mark each invalid ACAS RA messages.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0420	Termination of RA	In case the ACAS ground monitoring system is not receiving RA termination, the RA termination **shall** be declared 16 seconds after reception of the last ACAS RA message.	*Verification - <Test>*
REQ-15.04.03-TS-PR10.0430	Offline information	The ACAS ground monitoring system **shall** provide the following summary RA information per RA event. •Date •Time (UTC) with a resolution of at maximum 1/128 seconds	*Validation - <Shadow Mode>* *Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
		•Aircraft 1 identification (call sign or registration) •Aircraft 1 address (24 bit Mode S address) •type of the RA (ARA field as specified in) •Geographical location of event (LAT/LON in WGS84) In case of a threat indicated as Mode S equipped (TTI=1) in received messages. •Aircraft 2 address (24 bit Mode S address) In case of a threat indicated as not Mode S equipped (TTI=2) in received messages. •Aircraft 2 altitude, range and bearing •Aircraft 2 Mode A code (when possible)The ACAS ground monitoring system **shall** provide the following summary RA information per RA event. •Date •Time (UTC) with a resolution of at maximum 1/128 seconds •Aircraft 1 identification (call sign or registration) •Aircraft 1 address (24 bit Mode S address) •type of the RA (ARA field as specified in) •Geographical location of event (LAT/LON	

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
		in WGS84) In case of a threat indicated as Mode S equipped (TTI=1) in received messages. •Aircraft 2 address (24 bit Mode S address) In case of a threat indicated as not Mode S equipped (TTI=2) in received messages. •Aircraft 2 altitude, range and bearing •Aircraft 2 Mode A code (when possible)	
REQ-15.04.03-TS-RR10.0010	Recording function of ground station sensors data	Recording functions shall be able to receive decoded Mode-S telegrams from ACAS monitoring ground station sensors over network	*Verification - <Test>*
REQ-15.04.03-TS-RR10.0030	ACAS Ground Monitoring system data recording	The ACAS ground monitoring system **shall** provide a function to record data sent out by the system.	*Verification - <Test>*
REQ-15.04.03-TS-RR10.0040	ACAS Ground Monitoring system data replay	The ACAS ground monitoring system **shall** provide a function to replay recorded data.	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0010	Ground Station Sensor BITE function	The ACAS monitoring ground station sensor **shall** automatically and periodically perform a self-testing function (BITE) in parallel to the normal operation.	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0020	ACAS Server BITE function	The ACAS server **shall** automatically and periodically perform a self-testing function (BITE) in parallel to the normal operation.	*Verification - <Test>*

Requirement Identifier	Requirement title	Requirement description	Validation / Verification Method
REQ-15.04.03-TS-SU10.0030	ACAS Server System Status Report	The ACAS ground monitoring system **shall** provide a function to record data sent out by the system.	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0040	ACAS Server System Status Reporting Mode	The ACAS ground monitoring system **shall** provide a function to replay recorded data.	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0050	Configuration of ACAS Server Status Update Rate	In case of a periodically system status reporting mode, the ACAS server status update rate **shall** be adjustable between 1 and 60 seconds.	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0060	Monitoring of Surveillance Data Interface	The ACAS ground monitoring system **shall** be able to monitor the status of the Surveillance Data interface.	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0070	Activation/Deactivation Monitoring of Surveillance Data Interface	The activation or de-activation of the Surveillance Data Interface Monitoring **shall** be configurable by the system user.	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0080	Control and Monitoring System	The Control and Monitoring system **shall** control and monitor the following ACAS system components: •N x ACAS ground station sensor(s) •N x ACAS server(s)	*Verification - <Test>*
REQ-15.04.03-TS-SU10.0090	Control and Monitoring System Communication Protocol	The ACAS ground monitoring system and the associated Control and Monitoring System (CMS) **shall** use the standard management network protocol SNMP V2 or higher for communication.	*Verification - <Test>*

Table 6: TS requirements Validation / Verification Methods

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