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15 – 16 October 2018

**Plenary Meeting Summary Record**

**RTCM Special Committee No. 134**

**Recommended Standards: Integrity for High Accuracy GNSS-Based Applications**

Time/Date: 11:00 AM – 5:00 PM, Monday, 15 October 2018  
9:00 AM – 5:00 PM, Tuesday, 16 October 2018

Location: Steigenberger Hotel Metropolitan  
Poststrasse 6, 60329 Frankfurt, Germany  
Room 2

The main objectives of the meeting were the following:

- WG1 Status Update
- WG2 Status Update
- WG3 Status Update
- Possible change to the WG3 Chair
- WG4 Status Update
- Discussions concerning formation of new WGs

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**Chairman's Executive Summary**  
**Roberto Capua, Co-Chairman of RTCM Special Committee No. 134**

**First Day**

- The meeting was opened by the Co-Chair. All participants introduced him/herself to the meeting.
- The president introduced the 3GPP representative and the fact that RTCM is investigating a relationship.
- Among non RTCM Members, Daniel Lopour and Alberto Fernandez from GSA (European GNSS Agency) participated.
- WG 1 (Automotive) Chairman, Kerry Greer, was not present at the meeting due to other business. A question was sent by email toward the audience asking if, due to the low involvement of the members, the scope of the WG had to be changed. It was emphasized that the work carried out in the rail sector can be harmonized with the automotive one.
- GSA underlined the relevance of certification and regulation processes and initiatives, as the European eCall and the UNIFE WP 29.
- WG 2 (Rail) chairman, Salvo Sabina, presented the concepts developed within ERTMS studies and the virtual Balise concept, as well as the comparison and relevant costs with physical Balises. The replacement of a physical Balise with a virtual Balise whose detection is based on the augmented GNSS position and the Safe odometry or other sensor information and the additional local monitoring techniques currently meets the Safety Integrity requirements for rail.
- Some cost figures have been shown in order to emphasize the cost of physical Balises (260-740 k euros/100 km).
- The importance to establish liaison and contacts with other entities and initiatives, as RTCA and PTC, was shown.
- WG3 (Other Applications) Chair, Roberto Capua, presented the activities carried out. The Work organization and Roadmap has been presented (WP1 Classification of Applications, WP2 Metrics definition, WP3 Standardization, Regulation and Certification Bodies, WP4 Integrity Parameter Definition). WP5 – Standardization actions). The importance of Non-Safety Requirements (e.g. for Cadastral applications) as damage introduced by faults was shown.
- Main Application Groups are defined: maritime, time and frequency, land surveying and mapping, space, drone applications, personal mobility. Time and frequency can be shared among all the applications. Applications Grouping and some relevant requirements have been presented.
- Roberto asked for a change of his chairmanship position on this WG, being him Vice-Chairman and WG4 Chairman.
- He presented the candidature of Dr. Shaojun Feng. 13 members voted to accept this change. There were 0 no votes and 0 abstentions. Dr. Feng has been elected as the new WG3 Chairman.

- WG4 (Harmonization of Requirements and Metrics) Chairman, Roberto Capua, presented relevant WG organization and first activities. Scope of the WG is to define agreed common terminology and metrics to be applied within SC-134.
- An Applications Classification Table, showing Integrity and Safety definitions in Automotive and Rail sectors and the GNSS ones, have been showed and commented. Non-Safety (e.g. Economic damage Risk), must be defined.
- The organization is as follows: WP1 - Review of Reliability, Availability, Maintainability and Safety concepts and relevant metrics. WP2 – Harmonization of requirements and metrics. WP3 – Standardization, regulation and certification bodies and liaison.
- A correct risk definition is central for the work. Furthermore, a difference is envisaged between Service Providers and User Requirements.
- Aleš Filip presented an example of Harmonization between Rail and Automotive sector. Risk Acceptance Principles (RAP) and Risk Acceptance Criteria (RAC, as well as CSM-RA (Common Safety Method-Risk Assessment) and (Common Safety Method-Design Target) approaches can be utilized.
- Next Meeting was decided to be held through teleconference on 6th February 2019.

### **Second Day**

- Roberto Capua presented a SC-134 Working Methodology. The main point is to use the SC-104 protocols and data formats.
- SC134 will request that SC104 reserve a range of messages (i.e. 200 - 299) for their use.
- SC-134 will be free to study algorithms, approaches and to define messages concerning Integrity. Relevant SC-134 WGs will be the source of the messages' proposal. Interoperability tests must be performed by WGs through existing simulators and tools.
- Messages proposals will be discussed by the Plenary meeting and voted through the CDV process.
- The SC-134 has a bottom-up approach (starting from applications). Possible overlapping with SC-104 will be fixed by relevant SC-104 and SC-134 Chairman.
- A breakout session has been held for WG2 and WG4.
- Rail ERTMS Functional Architecture has been showed by Salvatore. On the other hand, basic NTRIP RTCM architecture has been showed by Roberto in parallel.
- For achieving integrity goals, augmentation is required. It must be available in all countries.
- A clear definition of High Accuracy is needed. Furthermore, the errors sources for High Accuracy applications must be detailed. An action was taken on this topic (Salvo, Roberto, Alissa). Main Integrity definitions will be defined within the framework of WG4.
- RTCA standards for aviation are the base for current integrity definitions. They are focused on pseudo range only. RTCA does not cover RTK and PPP solutions.
- An example of embedding RTCA parameters into RTCM SC-104 messages (coming from the previous RTCM WG on Integrity for High precision applications) was shown.
- The RTCM President noted that a meeting with RTCA is scheduled to discuss linkages.
- Washington described the need for a Statement of Work about SC-134 project to be written. An action has been taken with Salvatore and Roberto.
- Attendees were reminded to formalize their membership in the SC and RTCM if they have not already done so.

## RTCM SC-134 Plenary Meeting

Frankfurt, Germany

11:00 AM – 5:00 PM, Monday, 15 October 2018

9:00 AM – 5:00 PM, Tuesday, 16 October 2018

### Meeting Summary Record

#### 1. Welcome – Ed Wendlandt, RTCM President

The meeting began a few minutes late due to attendees that were delayed in transit. At the time the meeting began, there were about 21 people present and three telephone attendees, including Washington from Imperial College, Daniel Lopour and Alberto Fernandez from GSA (European GNSS Agency). Ed began by introducing himself and his wife Pam who has been helping to get organized. He was elected to the president role at the RTCM general meeting in September. Ed mentioned that for those who could not attend this plenary meeting in person, Skype credentials were provided. An RTCM brochure was handed out to attendees providing a general overview of who and what RTCM.org is and does. Logistics were covered. Ed introduced Alexey Khoryaev, representative of 3GPP, and a side meeting to be held with him for discussing possible RTCM and 3GPP collaboration in the future.

#### 2. Introduction of Attendees – Roberto Capua, SC-134 Vice-Chair

Roberto welcomed attendees. Each guest introduced themselves.

#### 3. Goals and Agenda – Roberto Capua, SC-134 Vice-Chair

Roberto outlined the fact that at the Rome meeting, four working groups were established. He then reviewed the agenda. Joe Sass stated that the meeting summary record from Rome had been posted to the SC134 website. He then asked if there were any objections to the record as posted. There were no responses.

#### 4. Patent Disclosure – Roberto Capua, SC-134 Vice-Chair

Chairmen of Special Committees will ask, at an appropriate time in each meeting, whether anyone has knowledge of their own or other organizations' patents, including published pending patents, the use of which may be required to practice or implement the standard being considered. The fact that the question was asked shall be recorded in the meeting summary record, along with any affirmative responses.

Roberto read this statement aloud. There were no affirmative responses.

#### 5. WG1 (Automotive) Status and Progress – Kerry Greer, Automotive WG Chair

Joe Sass read a statement from Kerry from an email dated October 11, 2018

*“...Unfortunately I will not be able to travel to Germany this weekend, and therefore will not be in attendance that the SC134 meetings next week... I had one person call into the WG Automotive conference call in August. As such, there has been little progress since Rome. So during the SC meetings next week, please confirm if the group is really committed to this, or if the scope needs to be changed.”*

There were no responses from the plenary committee.

Roberto brought up the relevance of this WG. Roberto asked “Are there important issues

that need to be addressed within the automotive domain?” Roberto reminded the plenary members that Kerry’s company is in collaboration with Stanford University and they have completed a lot of work in the area of integrity. Aleš suggests that work done already in Rail should be harmonized with the work being done in Automotive.

Roberto asked a general question if anyone knows the certification bodies for automotive. Alberto replied that in Europe there is eCall. UNIFE WP 29 is another reference. GSA noted that it is important to specify the requirements for GNSS and EGNOS missions. GSA is working on the idea of standard safety requirements for autonomous driving. They are also interested in cyber security standards. GSA has interest in WG1 progress and activities.

## **6. WG2 (Rail) Status and Progress – Salvatore Sabina, Rail WG Chair**

Salvatore started by reviewing the work that has been completed and what is left to be done. He displayed a list of the Working Group (WG) members and solicited interested parties to contact him if they would like to participate as well.

ERTMS Location Principles and Train Position – Innovative solution based on the concept of Virtual Balise – Preliminary signaling Performance requirements for the GNSS domain and – state of the Art ERTMS Enhanced Functional Architecture. Current physical Balise method ensures at least 1 meter of accuracy in all conditions. Odometry and the location reference error equal +/- 5 meters plus 5%.

Based on the Ansaldo system functional hazard analysis carried out and the foreseen use of the virtual balises, the replacement of a physical Balise with a Virtual Balise whose detection is based on the augmented GNSS position and the Safe odometry or other sensor information and the additional local monitoring techniques currently meets the THR (safety integrity) requirements for rail.

Physical Balises are expensive: a Balise Group composed of two fixed Balises equals approximately 2,000 to 2,500 euros. For rail segments of 100km, the number of physical Balise Groups required ranges from 130 to 300. CAPEX for Eurobalises: 260K – 750K euros. In order to make the transition from physical to Virtual Balise marketable, the cost of the new solution must be less. Lower cost solutions may also facilitate the entry into new markets.

The on-board interoperable constituent is expected to include a Virtual Balise reader. The Virtual Balise reader would be composed of GNSS antenna, GNSS receiver, Safe PNT and Safe Virtual Balise Detector.

ERTMS functional requirements must not be limited by the introduction of the Virtual Balises. ERTMS RAMS (Reliability, Availability, Maintainability and Safety) requirements must not be degraded by the introduction of GNSS.

Salvatore then reviewed several specifications surrounding latitudinal and longitudinal maximum allowable location errors. The relevance of Local effects (e.g. multipath) has been emphasized.

Washington asked about the cost/benefit analysis. He challenged the statement that the new GNSS augmented solution should not cost more than the current solution. His contention was that if service levels or performances are higher, that often comes with a higher cost. Salvatore countered that operators are asking for these improved performances at no

additional cost.

Current status of aspects not addressed: PTC requirements, support is required.  
Augmentation Service Level – relationship among RTCA/RTCM/Service Providers.

Relationships with other key stakeholders and their on-going initiatives. Preliminary cost analysis of the new high integrity technologies and their delivery plans. Definition of the long-term roadmap up to commercial service.

Local effects

Gang asked about trains and tunnels and GNSS. Salvatore explained that in very long tunnels, odometry may not be adequate. Then real Balises may be the appropriate solution or other sensors (such as IMU).

Gang sought clarification with the point that the goal is to reduce the total number of Balises and the maintenance that their use includes. Costing and cost savings with the suggested changes are highly complicated to compute.

Washington would like to see a “scientific” methodology developed that is transferable across other domains.

Washington asked about timelines. Salvatore summarized by stating that the Shift2Rail project, containing the requirements, system architecture and apportionment definition, will be finished by 2022.

Salvatore pointed out that there are other systems operating in the rest of the world, e.g. PTC (Positive Train Control), and we must liaison with them during our activities. Roberto noted that FRA to be contacted for the U.S.

GSA conveyed continuing interest in WG2 activities.

## **7. WG3 (Other Applications) Chair Position – Roberto Capua, SC-134 Vice-Chair**

Presentation by Roberto titled Drivers and RoadMap Definition. The General methodology, based on Application Requirements Review / Basic Integrity Messages / Advanced Integrity (multiple systems, CRAIM, etc.) has been showed.

The Work organization has been reported.

WP1 (Work Package) – Classification of Applications. WP2 - Metrics definition and requirements derivation methodology. WP3 – Standardization, Regulation and Certification Bodies. WP4 – Integrity Parameter Definition. WP5 – Standardization actions. Definitions of protocols and data formats for integrity parameters in an incremental approach.

Main Application Groups are defined: Maritime, time and frequency, land surveying and mapping, space, drone applications, personal mobility. Single Application definition for each group and sub-group. An “Applications Classification” table was presented.

Washington challenged the placement of “time and frequency” in this table as these are not specific applications. Some applications require T for timing. Some require PN only. And then some applications require both of them (PNT). These should be the high-level group classifications. Washington cited several recently released documents surrounding this topic and promised to locate and provide them to this working group. This has been recorded as Action Item 005.

Key points to be investigated: Non-safety requirements derivation in accordance with WG4 harmonization. Timing integrity risk and requirements definition. Critical infrastructures monitoring specification. Interrelation with security requirements.

Next steps include: Finalization of the classification of application. Definition of metrics and integrity parameters derivation methods for main group of applications. Collection of integrity parameters candidate for being inserted into augmentation messages. Interfacing with WG4 for requirements of harmonization. A timeline/time schedule was presented with staged planning phases with a goal of having a first draft of application classification for consideration by the plenary group.

Roberto would like someone else to take on the WG leadership for WG3 (Other Applications) because he is Vice-Chairman of SC-134 and WG4 Chairman, too. Roberto asked directly if there was any plenary member present that is interested in taking over this position. There were no respondents. Roberto discussed this point into the WG and Dr. Shaojun Feng from Qianxun SI with a lot of experience in the Integrity Monitoring domain, expressed a willingness to take over this position. Dr. Feng is a chief scientist at Qianxun Spatial Intelligence Inc. He was a senior research fellow in navigation and ITS, leader of the positioning and navigation research group at Imperial College London working with Professor Ochieng. Several other impressive credentials were presented to attest to Dr. Feng's expertise and qualifications to take over this position.

13 members voted to accept this change. There were 0 no votes and 0 abstentions. Dr. Feng is now the chairman for WG3.

#### **8. WG4 (Harmonization of Requirements and Metrics) Roberto Capua, WG Chair**

Requirements and Parameters table has been shared and filled in by WG members. Methodology and RoadMap document shared among WG4 members. Progress Meeting held on 19 September 2018. A flowchart was shown displaying the envisioned work methodology.

Standards to be considered in harmonization process: Electronic Equipment IEC 6159508, Automotive ISO 26262, Rail CEI EN50126, CEI EN50128 and CEI EN 50129, GNSS RTCA DO-229D and RTCA DO-245.

WP1 - Review of Reliability, Availability, Maintainability and Safety concepts and relevant metrics. WP2 – Harmonization of requirements and metrics. WP3 – Standardization, regulation and certification bodies and liaison.

Several Integrity definitions have been showed, coming from RTCA and FRP (Federal Radionavigation Plan). Keyword to be better defined for generalization purpose have been underlined.

Harmonization Drivers: Collection of existing standards and scientific literature on integrity concepts harmonization. Classification of existing definition and metrics. Iterative procedures and interaction with application interoperability test. Relevant non-aviation concepts: RAMS (Reliability, Availability, Maintainability, Safety). Non-safety requirements and risk (economic damage). Integrity for carrier phase-based positioning. Analysis to be carried out in a system of system perspective. Generalization has to be performed in the terminology and architectural definitions in order to be applicable to all application domains.

Several of the tables were presented to the plenary group. They contained a significant amount of information. The information was conveyed to the plenary by Roberto. The presentation including the tables will be posted to the SC134 website for reference.

Automotive ASIL definition: Represent a level of risk reduction (A,B,C,D) for a safety function to achieve a tolerable risk.

Interesting Diagrams, created by Aleš, were shown “Reliability vs. Safety”. Sub-headings “Reliability versus Unreliability” and “Reliability versus Safety”.

The relevance of Local effects (e.g. multipath) has been underlined.

First meeting key points: Generic Mission Definition, Service Provider and User Requirements, A translation from GNSS RNP definitions to RAMS, RTK/PPP ambiguity resolution and validation metrics, Protection Level is related to confidence interval. Alert Limit does not have a direct translation in non-aviation applications (e.g. Rail).

The Centrality of Risk Definition has been emphasized: Risk (R) is generally defined as  $R = C$  (consequence of hazardous event due to E/E system failure)  $\times$   $f$  (frequency or probability of occurrence of such event).  $R = S$  (severity of hazardous event)  $\times$   $f$  (ISO 26262). This shows an example of generalization of the concept of risk.

Carrier Phase Integrity is relevant for high accuracy integrity. Two main phases: Ambiguity Resolution/Ambiguity Validation and Calculation of the Protection Level.

Other relevant key points include: Safety metrics classes, Safety and integrity parameters interrelation, Fault cases, Fail State, Exposure time, Continuity metrics, Ambiguity Resolution and Timing integrity definition and metrics.

Next step will be the definition of main generalized terminology, hopefully by the end of the year. 2019 will be devoted to the harmonization efforts with a hope to be standardized by 2020.

Roberto raised the point of the difference between Service Providers and Users requirements. One relevant example is the provision of precise ephemeris and clock corrections for PPP services. Loukis commented that the services provided by the IGS are “As Is” with no guarantees. Thus, it will be unlikely that IGS services will be included in this process. Gang pointed out that service providers responsibilities are dependent upon user hardware and environmental conditions. For instance, the service provider must guarantee precise ephemeris delivery, but cannot guarantee how user equipment will utilize the information.

Is Spoofing a part of this integrity discussion? (Asked by Loukis.) Roberto responded that this was discussed at the initial plenary meeting but that a decision had not been taken.

Harmonization WG will focus on acceptable minimums that can be shared across other WG’s. No specific algorithms or techniques will be specified by the group although various algorithms can be deemed to be acceptable or not. Decisions will not be taken about algorithmic techniques, but rather that a particular parameter used by the algorithms.

Washington observed that a service provider can provide corrections and an estimate of uncertainty.

Aleš provided a presentation demonstrating the harmonization of risk acceptance and safety requirements for GNSS-based applications – Experience from rail sector. Harmonization and mutual recognition of safety requirements is performed via Risk Acceptance Principles



(RAP) and Risk Acceptance Criteria (RAC). Integrity Monitoring models with rail are different from aviation because of different applied risk components. But, the Railway CSM-RA (Common Safety Method-Risk Assessment) could be helpful to the automotive sector for the whole certification and safety approval process as it is in case of ERTMS/ETCS. Aleš also showed the CSM-DT (Common Safety Method-Design Target) definition for risk assessment.

#### **9. New SC 134 Work Areas – Roberto Capua, SC-134 Vice Chair**

Vice Chair opened to the group the opportunity to present new work areas or new methods for proceeding.

No new work areas or methods were offered by the plenary.

#### **10. Next Meeting (date and venue) – Roberto Capua, SC-134 Vice Chair**

The next industry related conference is ITM/ION conference January 29 – February 1 in Reston, VA. Joe Sass commented that there was a request to consider planning two meetings in advance versus just the next meeting. Salvatore suggested that the next meeting be a teleconference around the end of January.

It was decided to hold a teleconference on February 6, 2019 at 7:00 AM to 11:00 AM Pacific Standard time. Call in details will be provided prior to the meeting. At that time and based on the progress made to date, the subsequent meeting will be scheduled at that time.

#### **11. Other Business – Roberto Capua, SC-134 Vice Chair**

RTCM SC-134 Methodology Assumptions

Vice Chair reviewed the plan for today. The concept is to add a block of messages into the RTCM global framework already established in SC-104. SC-134 will request an allocation of approximately 200 messages to SC-104 standard. SC-104 will allocate the message numbers and SC-134 will maintain the details and definitions of the messages. Vice Chair presented a diagram detailing the workflow and methodology for approving messages coming from the single domain WG's along with the interaction between the SC's. A second diagram was presented showing the workflow for the concept and definition of the messages by the WGs and acceptance process by the plenary.

An outline of the Table of Content of the SC-134 standard to be produced was presented.

This spurred a discussion regarding SSR messages. If SC-104 has not yet defined or approved integrity messages how will SC-134 proceed? The Vice-Chair provided an overview distinguishing the approaches of the SC's. SC-104 is using a top-down approach starting from an architectural perspective while SC-134 is using a bottoms-up approach starting with the applications. If there is overlap, the SC's will interact to harmonize the message definition.

Aleš pointed out the need to tackle the certification and regulation aspects for the SC work and to account for it from the beginning. The process for carrying out certification must come from the WG Chair since they are familiar with the domain the bodies to be contacted. This is included as Action Item 009.

A question was raised regarding Sapcorda's activities in this arena. The Vice Chair explained that Kendall Ferguson works for Sapcorda and the RTCM President noted that Kendall has addressed the issue by describing his agreement with Sapcorda regarding

participation in RTCM is that when he is working as an RTCM member the priority is for the common goals of the group and not Sapcorda corporate goals.

Elisabet noted that she can be a point of contact for the GSA.

An open discussion of common definitions was addressed.

The Vice-Chair invited any working group to split into breakout sessions.

## 12. Meeting Action Items Review – Roberto Capua, SC-134 Chair

### 12a. WG-2 & WG-4 Breakout Session

Opened by Salvatore - began with Ansaldo Presentation with the slide titled: State of the Art – ERTMS Functional Architecture.

A general statement was made that in order to achieve integrity, augmentation is required, and that the augmentation must be open to all member states and access should not be limited. The origins of the framework presented by Salvatore is currently from Europe and it was noted that both Australia and the United States also have systems.

The problem was defined as needing a communication path for augmentation. Currently, the augmentation will come from the trackside IC and the on-board IC. The communication with the GNSS Augmentation requires a standard that includes security. The new interface must be a standard to allow multiple trackside interoperable components. The GBAS system is used as a basis for the standard architecture. The source references for LAAS and GBAS was presented and it was noted that currently the GBAS is based on GPS only, even though there are efforts to expand to systems beyond GPS. Roberto showed the RTCM NTRIP standard and the relevant Architecture and emphasized the point that such an architecture and relevant RTCM v3 message format are used in any professional receiver in the world.

WG-2 Chairman is still investigating how RTCM fits into the ongoing work in rail. The current state for rail error modeling is based on EGNOS. This is the current state and WG chair is investigating if RTCM work can provide the necessary corrections.

WG-4 Chairman provided an overview of “what is the right definition for high-accuracy?” Is high-accuracy 2m or something less. For rail 2m at 7 sigma is an acceptable level. The condition that it must include high-accuracy in all conditions not just clear sky conditions. The GBAS pseudo range table (3.5.9) was presented as an outline for the types of data fields to consider. The definition of high-accuracy must be clearly defined including the relative confidence interval. Salvatore discussed that the work must account for backward compatibility with existing applications. It is important to note that RTCA only considers pseudo range and not carrier phase for high-accuracy. Therefore RTCA does not cover RTK or PPP solutions.

A brainstorming session proceeded

- When the standard is defined then the integrity, accuracy and contribution level must be defined and there should be a guarantee.
- Vice Chair offered the RTCM 10400.1 tables from SC-104 WG on integrity monitoring for high-precision applications as a framework as an approach for including RTCA integrity parameters within the RTCM SC-104 message format.

Washington joined by skype conference and was given a summary of the morning meeting.

Washington presented that there's an interesting relationship of 104 and 134 and the scope of the applications that these group's cover. In terms of coverage of applications, it would be interesting to see which applications are covered by 134 and 104 and investigate possible links with RTCA. The RTCM President noted that a meeting with RTCA is scheduled to discuss linkages.

For Salvatore, the issue is that we should consider the work that has already been done. There is an advantage.

The question of the RTCM/RTCA connection was introduced and RTCM President updated the group about a meeting that will take place at the end of the month to see if there are opportunities for RTCA/RTCM to work together, primarily to share logistics to reduce overhead, and also look at joint activities such as those groups that work in both worlds, such as EPIRB or PLB / ELT beacons.

It was observed that the Committee activity implies a relevant effort that should be funded some way. Relevant means will be investigated in the future.

The case was made for a project description (Statement of Work) to look at the integrity issued, to be presented to interested parties. For instance, high-level government groups would be interested in the results. Imperial College volunteered to take an action item to make a 1-page description of the project. Roberto and Salvatore offered to contribute. This is entered as Action Item 010.

Definitions are important for:

- Risk
- Protection level
- And other relevant parameters

A table with a list of error sources that must be accounted for and should be included. This is entered as Action item 011.

The Action items for the group will be included in the proceedings and circulated to the group. Attendees were reminded to formalize their membership in the SC and RTCM if they have not already done so.

**APPENDIX 1: SC-134 Meeting Attendance – 2018 October, 15 & 16**

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✓	Daniel Lopour	European GNSS Agency (Call-in)	
✓	Alberto Fernandez	European GNSS Agency (Call-in)	

**APPENDIX 2: SC-134 Working Groups**

TOP

<b>WORKING GROUP (WG)</b>	<b>WG CHAIR</b>	<b>EMAIL ADDRESS</b>
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Rail	Salvatore Sabina	<a href="mailto:Salvatore.Sabina@ansaldo-sts.com">Salvatore.Sabina@ansaldo-sts.com</a>
Other Applications (not automotive or rail)	Shaojun Feng	<a href="mailto:shaojun.feng@wz-inc.com">shaojun.feng@wz-inc.com</a>
Modernization of Requirements and Metrics	Roberto Capua	<a href="mailto:rcapua@sogei.it">rcapua@sogei.it</a>

**APPENDIX 3: SC-134 Open Action Items as of October 16, 2018**

TOP

<b>Action Item</b>	<b>Description</b>	<b>Responsibility</b>	<b>Review Date</b>
SC-134-012	Defining the Main General Terminology	Roberto and Aleš	December 2018
SC-134-011	Defining Error Sources	Salvatore (lead), Roberto, Alissa Ioannone	May 2019
SC-134-010	SC-134 Statement of Work	Washington, Salvatore and Roberto	January 2019
SC-134-009	WG Chairs must describe the certification process and make contact with the certification body early in the message development process and carrying out their work. Contact with high-level institutional bodies, e.g. UNO, should be done at the plenary level.	WG Chairman	January 2019
SC-134-008	Kendall will contact BoD about the name change to this committee.	Roberto Capua	July 2018
SC-134-007	Kendall will work on getting a conference room and remote access for the next meeting in Frankfurt, October 15-16.	Roberto Capua	July 2018
SC-134-004	ISO has already dependent “Smart City” standards/references that might be used in the formulation of this group’s work	by Dr. Mireille Elhadj (Imperial College London)	October 2018
SC134-005	Washington cited several recently released documents surrounding the topic of applications that have various needs. Some need P. Some require PN. And then others require PNT. Washington promised to locate and provide them to this working group.	Washington Ochieng	February 2019

**APPENDIX 4: SC-134 Closed Action Items as of October 16, 2018**

TOP

Action Item	Description	Responsibility	Review Date
SC-134-006	Joe Sass will send out a group notice about the formation of the four working groups.	Joe Sass	June 2018
SC-134-005	Roberto has agreed to lead an effort with members that are interested in creating an initial work plan for the committee. A general mailing will be sent to all parties that have expressed any interest asking for ideas, inputs and recommendations to create a work plan. Decided to leave this action up to the individual working group chairs. Thus Roberto does not need to do this.	Roberto Capua	September 2018
SC-134-003	Agenda for kick-off plenary meeting	Roberto Capua, Roberto Capua, and Joe Sass	June 2018
SC-134-002	Establish an RTCM SC-134 papers page and post SC-134 TOR to that page.	Bob Markle (RTCM President)	June 2018
SC-134-001	Send RTCM Members SC-134 announcement letter.	Bob Markle (RTCM President)	June 2018