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**EUROCAE WG-119 Plenary Meeting #4 “Radar Altimeter” /  
RTCA SC-239 Plenary Meeting #4 “Low Range Radar Altimeter”**

**DATE:** May 5-6, 2021

**TIME:** 9 AM – 1 PM EDT

**PLACE:** Virtual

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**AGENDA**

1. Welcome, Introduction and Agenda - Jean-Luc
3. EUROCAE/RTCA présentations and policy - Rebecca, Karan, Anna
4. Round table and detailed agenda for SG – Jean-Luc
5. Review of Minutes from the previous plenary – Sai
6. Main Accomplishments and SG deliverables / dependencies – Jean Luc
7. SG1 Status and Update: Ore and Charisse
8. SG2 Status and Update: Kim
9. SG5 Status and Update: Dave Redman
10. SG3 Status and Update: Miles Bellman
11. SG4 Status and Update: Samh Menshawy
12. SG6 Status and Update: Timo Warns
13. Previous action status, Identification of the next plenary session date, Other Business and review of Action Items, Adjourn

**PARTICIPANTS**

Name	Organization
Andrew Roy	ASRI
Angela Roth	Airbus
Anna Guegan	EUROCAE
Anne Lena Vaske	TU Braunschweig – Institute for EMC
Ashu Pande	NextNav
Barbara Clark	FAA
Charisse Green	FAA
Charles Glass	NITA
David Redman	AVSI
Donny Morrow	ALPA
Ed Hahn	ALPA
Eddie Straub	Garmin
Gerhard Berz	EUROCONTROL
Gerlof Osinga	The Boeing Company
Hamza Abduselam	FAA
Hussain Al-Sadi	The Boeing Company
Jean Luc Robin	Airbus
Jim McClay	AOPA
Karan Hofmann	RTCA, Inc.
Kim Kolb	The Boeing Company
Laurie Foster	U.S. Navy
Matt Harris	The Boeing Company
Michael Tran	The MITRE Corporation
Michael Verran	Maxcraft
Miles Bellman	FAA
Natalie Wong	Transport Canada
Oreoluwa Ajayi	NeuralVol Inc.
Rebecca Morrison	RTCA, Inc.
Richard Amy	ANAC-Brazil
Robert Kebel	Airbus
Rodrigo Machado	ANAC-Brazil
Sai Kalyanaraman	Collins Aerospace
Samh Menshawy	Thales Group
Sergio Roberto	ANAC-Brzil
Seth Frick	Honeywell
Shunichi Futatsumori	ENRI
Simon Atkinson	Roke
Ted Peterson	Collins Aerospace
Tim Murphy	The Boeing Company

Timo Warns	Airbus
Tomas Beda	Honeywell
Uwe Schwark	Airbus
Wes Googe	American Airlines
Zhimin Li	Collins Aerospace

### 1. Welcome, Introductions and Administrative Remarks

After a round-table of introductions, the co-chairs Jean-Luc and Seth Frick along with Karan Hofmann and Rebecca Morrison from RTCA and Anna Guégan from EUROCAE welcomed the participants.

### 2. Agenda Review

The group reviewed and approved the meeting agenda.

### 3. Plenary Discussions

Jean Luc provided the master agenda for the meeting and the group reviewed the RTCA and EUROCAE policies. Jean Luc provided an overview of the MOPS planning and new MOPS schedule. This included 4 revisions of the MOPS draft document (with rev 4 being the FRAC/OC version). He presented an updated schedule for the weekly cadence of the SG meetings. He also provided a list of SC-239/WG-119 OOB updates (including identifying the emissions from 5G in the OOB (for rad alt) that translates into an aggregated mask (input from SG2 – SG5). SG5 has had in depth technical discussions on standard antenna, the ITM methodology, what drives the OOB ITM vs in band interference levels and tests to determine breaking criteria, accuracy under threat, VCO and cable loss assumptions. SG3 had made good progress in determining the regulatory receiver mask which is comparable in to the ITM. Further discussions are proposed on this item SG1 has compiled details on integrity and continuity class (at the airborne level). An integrity/continuity tree has been compiled to eke out the RFI impacts on the integrity and continuity objectives. This can be leveraged by SG5 to compute the relevant probabilistic thresholds at which any OOB RFI may compare to the stress case level ITM.

A review of deliverables and dependencies for the OOB chain, the performance chain and the in-band chain were performed. Detailed information can be found in the slides compiled by Jean Luc for the May 5<sup>th</sup> plenary.

Gary Berz had questions on how the ITM will be determined (Will it be agnostic of the base station layout?) Sai and Jean luc explained the sc-239 approach to determining the ITM. Gary also wants to know if the environmental conditions we will have in the performance spec will address rad alt performance at typical airborne conditions. Jean Luc stated yes, and clarified that the perf requirements will need to be met under the identified DO-160 conditions.

Jean luc also reviewed some of the slides from the last plenary to help refresh people's memories and to level set the table for the ensuing SG1-6 hour long outbriefs.

Sai presented minutes from previous plenary meeting. This was shared with the group for further review and comment.

SG1 Discussions:

Ore presented the SG1 update to the group. The Discussions centered on the integrity and continuity tree and sub allocations. There was further discussion that ensued on interference monitoring and flagging the same at a given level. It was identified that this was not a minimum requirement and would perhaps be helpful for the purposes of maintenance. Further discussion in support of this to take place within SG6.

SG2 Discussions:

SG2 discussions focused on identifying the 5G RF threats and other services and applications that one needs to consider in the adjacent band when building the ITM. Kim provided an overview of the allocation in the C band per the ITU and also provided an updated view of the global plans for 5g/LTE around the rad alt band. Kim also shared the 5G emissions limits (per regulation) that have been published by other states for their 5G plans. Pursuant to this, he posed the question on what we need to do to project 5G in the future (around the rad alt band). We will need to do this for the purposes of coming up with a robust ITM that will help the rad alt operate in an evolving spectral neighborhood. The alternate question on how much the rad alt can tolerate was also posed and this will be a key consideration when it comes to nailing down the final ITM. Further recommended actions from Kim's brief included 1) Interference propagation modeling, 2) modeling 5G deployment and interference aggregation and 3) continue to interface with SG5 to determine an effective ITM.

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**5/6/21**

Jean Luc opened the meeting and shared a slightly updated agenda for the day.

SG5 Discussions:

Dave R presented the SG5 updates. Discussions ensued on the need to perform path loss analyses and to iron out the path loss models. This needs more discussions within the SG5 forum. Kim Kolb stated that this needs to include some of the sg2 stakeholders too. Dave spoke to the number of potential ITM curves that we may end up with as a function of altitude, aircraft type. This was identified as an item that needed further discussion. The group recognized the need to minimize the number of ITM curves. This was part of the activity within SG5 to determine the interference levels at the aircraft based on the airborne operational scenarios. There was further discussion on the (ITM's) threshold criteria for tracking vs acquisition and whether we will need different integrity requirements for different altitudes. There was further discussion on how to determine the test procedures (under conditions of RFI per the ITM) for the MOPS. This included consideration of cabling loss, concurrent AWGN for in band spurious and sizing of samples to make the pass/fail determination.

Pursuant to Dave's presentation, Jean Luc presented info on the MOPS schedule (seen in his presentation slides). The goal is to get the MOPS FRAC'd/OC'ed and done by the end of 2022. Charisse followed this presentation and shared a slide that addressed the FAA's take on what needs to be done within this time line for the purposes of MOPS validation (in addition to the development). This led to the need to identify what is needed for a MOPS validation effort in the same timeline as the MOPS development. More discussions within SG1 will need to take place on this item.

This spurred additional discussions on aircraft level vs bench level testing along with the need to validate the RFI environment as well.

SG3 discussions:

Miles bellman spoke about the Transmitter requirements and wanted to keep it simple. There is a proposed MOPS Tx characteristics section that includes an emission mask. Discussions ensued on potential state regulations that may apply over and above the ITU regs and as Gary Berz pointed out, this was a slippery slope and needed further discussions within the SG. Miles shared more details on the emissions mask (along with a plot that had details on potential emissions mask curves per ITU-R superposed on the FCC part 87 Mask curve). It was determined that further discussion was needed within sg3 to help finalize this item.

SG4 Discussions:

Samh presented updates to Scn 2.2 to reflect the operating frequency and the baselining of the DO-155, 123, A707, c87a requirements for the sensor. Similar compilation has been done for the respective antenna as well. Samh has a spreadsheet that we are using to define the classes for integrity and continuity. We will soon begin compiling the performance reqs into a draft.

Samh also mentioned that he is working on merging the legacy standards. Pursuant to this, the team will work on section outlines and then we can start working on the actual req text which can then be integrated back into the MOPS document. This doc that SG4 develops will need to be socialized with other SG's as they touch on the requirements that this document captures.

SG6 Discussions:

Timo Warns Presented the threat space, the response to the same, and the ways to classify the different dimensions of the threat space (such as waveform, modulation, signal source, power level, in/out of band etc.). Translation of what this means into requirements needs further discussions within SG4. Further refinement of these threat space definitions and responses will be done within SG6. He presented further details on an outline proposal re: Security inputs to the MOPS.

#### 4. Future Meetings

- a. Next joint plenary with Eurocae WG-119 on Sep 8<sup>th</sup> and 9<sup>th</sup> 2021: 9 AM – 1 PM US ET.

#### 5. Other Actions (reflected from Jean Luc's Slides)

1. Planning with an important milestone the 28th of May (MOPS outlines) and in September (all reqs laid out with placeholders and env and test procedures described): Action **SG leaders** to try hard to detail pertaining contents and to infer a more detailed planning.
2. To identify in **SG-1** the contribution of RFI in the integrity objective as a next step. Discussion on the opportunity to have an information sent out from the RA to Maintenance which would reflect interference presence (More about an IB datasecurity item: to be discussed within **SG-6** to come to a consensus)
3. **SG-5/SG-2** Next Step: Modelling (propagation and aggregation); leverage the existing work. Work sharing and work assignment to be discussed during the next SG-2 meeting and the next SG-5 meeting. Modelling to be addressed during the following recurrent meetings.
4. Discussion regarding the « Open buffer » (Edge of the RA band) in **SG-2**: FMCW waveform, resolution and accuracy requires the full RA band. ITM need to be determined: Need RA manufacturers position regarding the last "state of the art" RA already available in service in order to propose an ITM level in that band (tests or engineering judgment): the level needs to be stringent enough to be considered as reasonable for Telecommunication and acceptable enough to be feasible and compatible with the last "state of the art" RA already in service.
5. Charisse presented the need to have bench tests / in-flight. Planning issue. Not necessarily needed to have in-flight (to be discussed). Need to assess the possibility to rely on last "state of the art" RA that should be able to be compliant with the future MOPS. To discuss the way forward within **SG-1** but a collaborative effort with **SG-4** and **SG-5**
6. **SG-3** discussion about the note regarding the Tx frequency allocation. To precise the dB/decade reference (central freq or BW). To make decision whether relying on ITU or FCC rule framework.
7. **SG-4**: To review the <Performance Class Excel sheet> and to continue the « working document » to write requirements compliant with the <Performance Class Excel sheet>. To be merged in the MOPS template once completed. To integrate other SG-x contribution. (MOPS template: used for reference doc)
8. **SG-6**: next step: security requirements

#### 6. Adjourn

The meeting adjourned around 1 PM ET on the 6<sup>th</sup> of May 2021.