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RTCA Paper No. 112-24/SC230-082  
5/17/2024

## Summary of the 37<sup>th</sup> SC-230 Plenary

Virtually held on 14-16 May 2024.

<b>Attendees list</b>	<b>Organization</b>	<b>Date(s) Attended</b>
Andrew Roy	ASRI	<del>14 May</del>   <del>15 May</del>   16 May
Bob Avjian	The MITRE Corporation	<del>14 May</del>   15 May   16 May
Dawn Gidner (Co-Chair)	SeaTec Consulting, Inc	14 May   15 May   16 May
Divesh Lakhi	Collins Aerospace	14 May   <del>15 May</del>   <del>16 May</del>
Jared Adams	ALPA	<del>14 May</del>   <del>15 May</del>   16 May
Jean-Baptiste Berthier	Airbus	14 May   15 May   16 May
Jeff Finley (Co-Chair)	Collins Aerospace	14 May   15 May   16 May
Karan Hofmann	RTCA, Inc	14 May   <del>15 May</del>   16 May
Marc Pos	Reliable Robotics	14 May   <del>15 May</del>   <del>16 May</del>
Marius Irimia	Collins Aerospace	14 May   15 May   16 May
Mariusz Starzec	Garmin	14 May   15 May   16 May
Mark Billsberry	Collins Aerospace	14 May   15 May   <del>16 May</del>
Matt Wiebold	Honeywell	14 May   <del>15 May</del>   <del>16 May</del>
Moin Abulhosn (GAR)	Federal Aviation Administration	14 May   15 May   16 May
Rebecca Morrison	RTCA, Inc	<del>14 May</del>   15 May   <del>16 May</del>
Rockee Zhang	University of Oklahoma	14 May   15 May   <del>16 May</del>
Sai Kalyanaraman	Collins Aerospace	<del>14 May</del>   <del>15 May</del>   16 May
Stephan Enzone	Honeywell	14 May   15 May   <del>16 May</del>
Venkata Sishtla	Collins Aerospace	14 May   15 May   16 May
Yahya Golestani	Honeywell	14 May   15 May   16 May



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## **Summary of Day 1 (May 14<sup>th</sup>, 2024)**

### **Welcome and Administrative Remarks**

- Jeff led with opening remarks.
- RTCA Opening remarks on Anti-Trust Laws, IP Policy, RTCA Membership Policy, and notice that recording of audio or video is not allowed provided by Karan Hofmann.
- Minutes from previous plenary have not yet been uploaded. Will reach out to Mohammed for status, otherwise Jeff and Mariusz will work on combining notes.
- The current secretary, Mohammed Ahmed, was not available. Mariusz Starzec agreed to be the acting secretary.
- Jeff Finley is retiring in July. Karan discussed the process for selecting a new co-chair of the committee. Will send out a letter of interest to the committee with a deadline and requirements to fill the co-chair position.

### **Overview of Agenda, schedule, and deliverables**

- Activities since last plenary - Five WG meetings since last plenary with discussion on the analysis plan, scenarios, assumptions, and schedule
- Review WG-12 obligations – radar rfi susceptibility (summary):
  - Determine susceptibility to airborne weather radar to spectrum interference from anticipated future adjacent-band telephony and other x-band sources.
  - Generate white paper to develop standards/guidance for policy for in- and out-of-band X-band transmission sources.
  - Coordinating with SC239 (low alt altimeter) and SC242 (spectrum compatibility)

### **Going over detailed agenda**



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## SC-230 Detailed Technical Agenda

1. Schedule and milestones.
2. Discussion on how realistic vs speculative the RFI threats under this study are to airborne X-band weather radars.
3. Finalize In-Band interferers list/characteristics.
4. For RF test, discuss the assumptions and scenarios and how to test for those assumptions.
5. How to set up the analysis parameters.
6. Are we going to start testing for the interferers' full characteristics
7. Discuss starting small like AWGN and then incrementally increase the power level until the system breaks in terms of performance or even HW damage.
8. How to correlate degradation under item 7 with overall weather detection performances like windshear.
9. For RF test, shall we ignore range, angle, etc. to the interferers and start with PSD at the antenna and establish tolerance level? Then using propagation model, establish the minimum distance that a particular interferer can be tolerated.
10. Discuss conducting analysis through simulations, HW lab test, or both.
11. How to superimpose and test for different weather phenomena like convective, windshear, etc.
12. Other topics

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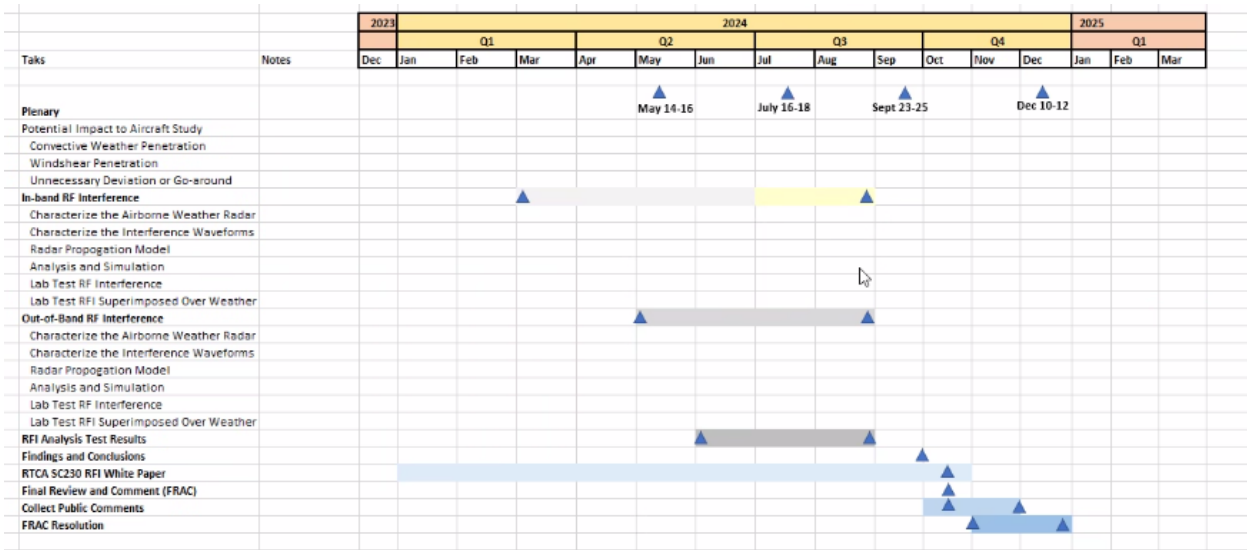
### Regarding #1 from detailed agenda

- Yahya is going through a proposed schedule. No issues with schedule noted, other than it is an “aggressive schedule.”



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Jeff: Regarding schedule

- What sort of impacts/issues are involved with getting high-powered PSGs and filters, which are needed for some types of testing? What are the lead times? Will this impact the schedule?
- What interferers are we testing for? Are we starting at low power and testing up (referencing WG meeting where we were advised by SC239 members to start with AGWN and slowly bump up levels). Perhaps the “bottom-up” approach can help minimize impacts of waiting for high-powered PSGs.

Regarding #2 from detailed agenda

- Jean-Baptiste: Not seeing major RFI impacts or at least not hearing about it. This document is more for anticipation of future problems/interferers instead of dealing with current problems/interferers. This is discussed in the draft of the white paper already.

Regarding #3 from the detailed agenda:

- Ven discussing path taken to get to where we are now.
  - Summarizing that we picked a couple of interferers from ITU-R M.1796-3 list of radars and the (Rainscanner RS90) Tahiti radar, but some of those are too high powered and would “fry the radars immediately”.
  - Decided to look at ‘bottom-up’ approach advised by altimeter people, who suggesting slowly bumping up the power of the interferer to see what happens.



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- Briefly going over scenarios in the white paper and summarizing setups.
  - Trying to address question: “At what range will the selected interfering radars cause a problem?” And will that range be a problem given the scenarios and realistic airport environment.
- Discussing that we will need to figure out when will functions such as PWS get impacted.
- Brief discussion on chosen radars for in-band interferers.
  - Initial selected as “worst case scenarios” and realistic ground-based radar scenario (referencing the Tahiti radar)
- Brief discussion on out-of-band interferers
  - Selected based on recent white house strategy document. Nearest band for potential 6g allocation is 7.125-8.4 GHz.
    - No objection from the group to this methodology.
    - Hard to quantify 6g characteristics without any actual numbers being known. Basing it off known 5g characteristics is probably the best way to move forward at this time.
  - 65 dBm/MHz and 62 dBm/MHz EIRP for non-rural environments is limited by FCC. Peak EIRP considering 100 MHz bandwidth would be 85 dBm for rural and 82 dBm for non-rural.

Started discussion about testing strategy:

- Mariusz: For very initial testing, Garmin planning on starting with AGWN adjustments and determining when something shows up on the display or what the impact is on the MDS. No problem with scenarios but don’t know how to model interfering radars at the moment because of the wide variety of adjustable parameters. Trying to see how much an impact AGWN makes and how it affects the system – might make future testing methodology easier to pin down.
  - Stephan: Concerned that AGWN might be too simple (especially for in-band?).  
One idea could be starting simple with CW tone in the bandwidth of the receiver.
- Jeff: Perhaps we should discuss output and not just inputs or interfering radar characteristics. Need to know what the goal is/what we need to test. What is considered success or fail criteria? For example:
  - False alarm impacts
  - Loss of sensitivity impacts/missed detection.
  - Others (e.g., momentary or consistent?)
  - Do we need to consider faults?
- Jeff brought up breaking everything out into 3 boxes in a block diagram:



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- Input: Data and interference coming into the system
- Radar (black box): entirety of the radar system
- Output: result and/or testing success/fail criteria
- For output box: Need to define thresholds at which we no longer meet MOPS. Might make it easier to define the testing required.
- Quick off-topic question: Stephan asked if he thinks something like this is doable within the proposed schedule. He thinks the work is doable in a few months with dedicated time to do it.
  - When looking at high-powered inputs, heard that long lead times are present or need to outsource testing? Stephan thinks it reasonable to believe that.
- **Action Item: Come up with a list of things that cause the radar to “break”; by “break”: when do we no longer meet the MOPS. Essentially: define success/fail criteria.**
  - Ven: Would this be the same for in-band and out-of-band interference if we consider success/failure from a “failing to meet the MOPS” perspective? Agreement that that seems to be the case.
- Jeff: Do we need to make a list of inputs required for testing?
- Started putting together a list of input for testing. Assuming AGWN with a “bottom-up” approached.
  - Out-of-band:
    - For out of band testing, is enough to test additive gaussian white noise across frequency, bandwidth, and various power levels?
      - Stephan thinks yes.
    - Mark: May eventually need to test 5g waveforms for a more accurate representation. Stephan agrees.
    - Mark: -13 dBm per MHz is noise floor for 5g
    - List of testing parameters:
      - Frequency
        - Look at closest band to potential 6G band: according to white house spectrum strategy: 7.125 to 8.4 GHz.
        - going with 8.35 GHz to account for bandwidth
      - Bandwidth
        - 100 MHz. That is what 5G used. It is channelized.
      - Power level
        - Start at 0 and increase until things “break”
  - In-band:
    - Starting out with the same procedure should be adequate for now.



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- List of testing parameters:
  - Frequency
    - Use the center frequency of the radar
  - Bandwidth
    - Radar manufacturers bandwidth (minimum 100 MHz)
    - If central frequency channelized, then bandwidth needs to cover entire range of central frequency channels.
  - Power levels
    - Start at 0 and increase until things “break”
- Stephan: Should multi-path fading be included? Or other effects?
- **Not a formal action item – but Stephan mentioned that we may want to track this: Think about other scenarios that produce/induce additional amplitude and doppler effects (e.g., multi-path fading)**
- In reality, we will not have uniform power coming into the antenna all the time. Do we need to assume an exposure duration (to interference) that is a function of scanning, beam width, etc.?
  - Eventually yes. Collected interference signal data can always be modulated by assuming some antenna direction or scanning rate, etc.
  - Question asked: For out-of-band, does this also matter or do we assume a constant value? Mark and/or Stephan: It will matter where the antenna is facing.
- The point came up that we never talked about distance to interferer, antenna gain, etc.
  - Discussion that when you do this testing, you can calculate power density. With power density you can translate that information into ranges and with certain antenna gain.
    - Will need to put this testing into context of the scenarios eventually.
    - Although antenna is important, decided that testing is to be done without antenna (and this is how Collins is starting out as well). But need to somehow include effects of antenna in testing. Bandpass filtering of antenna should be included at some point and converted to range/power.
      - Mark: That is typically how it is done (referring to testing without the antenna). Back-out/include antenna response later.
- Everyone agreed this is a good start. Moving on to other points of discussion.



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- Jeff: We need to discuss output block of our 3-box block diagram: success/fail criteria.
- Yahya: Presenting document/idea going over RFI superimposed over weather. How do we combine signal and interference? Can we just add them together?
  - Discussing ways to simplify the process so don't have to simulate too many scenarios.
    - How intricate do the simulations need to be?
  - Mariusz: Perhaps we should start working on the “output” block and see what we define for success/fail criteria, and perhaps in answering how we meet that criteria can tie back to what we need to simulate.
  - Discuss weather simulation:
    - Assume an idealized weather cell (probability of missed detection)
      - Not meeting PI = fail criteria? (MDS has a false alarm rate baked in)
      - How much of this is subjective? Hard to quantify.
      - Ven: Probably need to simulate an idealized weather target of a certain reflectivity and figure out at what point weather is no longer detected.
        - Mariusz: where does “we still see weather but all the attributes (e.g., reflectivity, turbulence) are all wrong if overlaid with interference?”
          - Perhaps the individual functions defined in the MOPs will have their own success/fail and detectability criteria.
    - Noise false alarm, nuisance (probability of false alarm)
      - How do we establish language to set a false alarm criterion?
      - Jeff/Ven: Pixel counting may be hard to test out. Leaning more towards a subjective determination of when the interference is no longer “acceptable”. Perhaps providing images showing what is acceptable and what is not – at a guidance level.
    - PWS? Needs to be addressed in the future.
    - **Action Item: Venkata to think about potential weather simulations needed for pass/fail criteria, such as missed detection.**
- Going over agenda again before we finish the session. Selecting which topics to discuss and revisit on Day 2.
- Questions for Day2:
  - Do we still need to keep the list of interferers? Where do they fall into our strategy moving forward?





- Can we define any sort of test criteria to start?

## Summary of Day 2 (May 15<sup>th</sup>, 2024)

### SC-230 Detailed Technical Agenda

1. Schedule and milestones.
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3. Finalize In-Band interferers list/characteristics.
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10. Discuss conducting analysis through simulations, HW lab test, or both.
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Overview of what was accomplished on the technical agenda yesterday.

- Bullets points 1, 2, 7, 9, 10 considered satisfactorily done. Point 3, 4, 5, 6, 8, 11 have been touched on but require more discussion today.

Yahya: Do we need to revisit discussion of range?

- If we calculate everything relative to power spectral density (PSD), do not need to directly consider range. Can use the PSD to answer questions given a certain radar and scenario (i.e., can use that to put context on the scenarios we came up with)

Hoping to finalize methodology and plan today. Tomorrow (Day 3) will be review day.



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Ven: Make sure we confirm the “bottom-up” methodology and the testing procedure we came up with RF teams.

- Bullet point 3 checked off.

Regarding bullet point 6:

- “Are we going to start testing for interferes full characteristics”:
  - Right now, no.
- Need to create a paragraph as to how we’ll use this data.

Regarding bullet point 8 and 10:

- Missed purposes: yellow cube of 30 dBZ cell at 80 NMI? When noise is increased, when does it become a missed detection?
- Are we doing this for every function for the MOPS? General consensus is yes.
- Moin: Are we doing all this this in the white paper or are we going to put requirements for receiver/transmitted behavior in the MOPS?
  - Ven: Is SC242 using the white paper to set requirements?
    - Jeff: We might be called upon to put technical requirements of the receiver, transmitter, RF characteristics in MOPS.
  - Dawn: Anything to do with MOPS is phase two. In the white paper, this is just looking at susceptibility. Group agrees.
    - Ven: Where do we draw the line between white paper and MOPS changes? Do we look at all functions or just PWS and general weather detectability – what is the cut-off?
      - Jeff: Look at the spectrum and see if there are any issues here. Contextualize analysis that would support regulation around 5g and 6g spectrum allocation and impacts on weather radar.
        - Right now, we just need to see where/how we are susceptible. Might have a follow-on MOPS in the future.
      - Dawn: We should/need to do all the functions now – otherwise it may be more challenging in the future to re-test everything if any MOPS changes are required/requested by SC242
        - Jeff: Phase A – evaluate effect of assumed interference in order to make recommendations to ICAO and others. This will most likely result in some sort of additional specifications in the MOPS later that we don’t know much about at this time (which would be phase B).



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- Ven: When would phase B happen?
  - Jeff: Would need to do a TOR revision and has to have support.
  - Dawn: Phase B may not even be needed; shouldn't jump the gun. Manufacturers may take information and adjust their radars to account for the findings. Also, may find on spectrum becomes protected based on findings. Summary of comments: Future problem; don't speculate now since we have no idea what tests will show.
- This will be addressed in the future. But it is a possibility the MOPS may have to be adjusted later. Will likely will depend on test results and what external organizations want.
  - Do we need to test MOPS functions with interferers?
- Jeff, suggestion:
  - For weather detection:
    - Sensitivity test. Just use Performance Index test, using the MDS. MOPS level test. Need to address minimum PI vs maximum system range table in MOPS?
- We need to write down test approaches and agree on them. Need to go through each function. #8 noted as work in progress.

Regarding bullet point #11:

- Can we take interference IQ values and add them into the simulations and test cases?
  - Are we assuming anything when we do that? Can we just simply add the values together? That would require assuming linearity otherwise we might have non-linear effects like compression.
    - How does AWGN affect this? We don't know this yet – TDB from testing.
- Agree to take approach (to start off with) that we can linearly sum IQ values.
- Yahya showing: RFI only and RFI superimposed over weather guidelines for simulation.
  - For RFI only:
    - Agreement that this needs to change to match discussion yesterday. Need to include the values we discussed yesterday (8.35 GHz, 100 MHz bandwidth, etc.)
      - What is the purpose of this test?



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- Mark concerned that receivers would be deep in compression (context: 5/6g EIRP levels; out-of-band). For example, 5g would cause time varying gain in receiver.
  - What is the best way to study this? Ven: Can we model this somehow?
    - Mark: compression gain changes will likely not show up as an artifact, and it won't be constant either.
- Mark wants to consider measuring receiver gain and phase response for out-of-band to generate interference model.
  - **Action Item: Mark and Stephan to discuss RFI-only testing and setting reasonable bounds for testing. Potentially have a draft by the next WG meeting on 5/28. Revisit RFI and weather superimposed testing after.**
  - RFI superimposed over weather:
    - Need to write pass/fail criteria for each function/mode of the weather radar to figure out this section better.
      - Dawn: Is it really a pass/fail criteria? Or do we just report findings when we incrementally step power up. "Characterization" for than a "pass/fail" criterion.
        - Jeff: Need to know the threshold where the function no longer works properly.
  - In-band stuff should be much easier than out-of-band. Assume linearity for in-band.

Bullet points 6, 8, and 11 need to be re-visited in the future.

Looking at the working draft of white paper and seeing where we left off.

- Specifically look at going through section 6 and the interference analysis methodology and if anything, now drastically change with the "bottom up" approach.
  - 6.1.2
    - Mariusz: Section definitions are still appropriate as they are real world examples, but because testing procedure changes, we may need to do some minor adjustments. All this section does is put testing into context. Dawn & Ven agree.
  - 6.1.3



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- Section may need to be changed to adapt to the new testing procedure.
- ~~Action Item: Venkata will have modifications to section 6 by the next working group meeting~~ *(superseded by future action item)*
  - Extend 5/28 WG meeting to two hours to anticipate going through new sections (in action items) added to paper.
- Relabeling and reworking the layout of section 6. Temporary new outline:
  - 6.1.3.1 intro
  - 6.1.3.2 input parameters
  - 6.1.3.3 methodology
    - 6.1.3.3.1 Lab test
      - Talk about bottom up approach
      - Testing info
      - Test steps/rfi superposition
    - 6.1.3.3.2 Simulation
  - 6.1.3.4 characterization
    - Intended function
    - WX
      - PI (missed detection)
    - Turbulence
      - Run simulation test cases?
    - HAIC
      - 20 dBZ threshold
      - Run simulation test cases?
    - PWS
      - Run simulation test cases? (pick challenging one?)
    - ATA?
      - False alarms may be a concern – not well defined in MOPS
  - **Action Items:**
    - **Ven to write subsections 6.1.3.1 – 6.1.3.3**
    - **Yahya (following Mark and Stephan discussion) 6.1.3.3.1**
    - **Jeff 6.1.3.4 -outline will suffice.**
- Address future sections once we get results.
- Discussion on how to deal with defining criteria for false alerts and missed detections, and general success criteria.
  - False alerts are challenging to define.
    - Can we use RF susceptibility testing (DO-160) as a reference?



- What is a “false alarm”? If an entire wedge is filled with RFI, that is obviously an error and is that really a “false alarm”?
  - Jeff: Caveat - “Cannot be mistaken for weather and cannot hide weather for X amount of time”
    - Does that mean a “false alarm” is open to interpretation?  
Objective vs subjective definitions.
- Dawn: May need to revisit after we see effects of RFI because right now we are speculating.
  - Jeff: At some point we have to say what is and what isn’t ok. Is one small wedge of RFI acceptable/unacceptable?
- Discussion summary, Dawn: Reporting artifacts and impacts on MOPS may be in one section, interpreting them and discussing whether or not they are acceptable can be another.
- Need to revisit false alarms and success criteria once we get test results to address how to determine acceptable/unacceptable artifacts.
- Ven: “If the failure criteria are defined as what we see now [referring to current state of RFI ‘wedges’ on display], then I wouldn’t consider that a failure necessarily.” But then what is the failure criteria? Double [the coverage]? Triple?
  - Jean-Baptiste: Potential to bring in pilots and show images and see their interpretation.
    - Jeff: Might be outside the scope of the work, especially given the timeline of everything being done by August.
    - Moin prefers we set the recommendations and success/fail criteria.
    - “Pilots are the end user who interpret the display, so why shouldn’t they set the criteria?”
    - Jean-Baptiste: Strong preference to have images displaying scenarios. Wouldn’t take too long to send out images and get pilot feedback.
- Agreement to wait and see what the results look like and not dig too far into this at the moment. Jeff will work on further outlining the section.

Switching topics for the last 30 minutes. Looking at Errata for DO-220B.

- Is there an errata sheet that is published or is it a “Change” to the document? Is there an official procedure to approve these changes or is that something for RTCA to do?
  - ~~Action: Need to ask Karan for procedure.~~ (completed end of day 3)
- No objection to changes. Changes accepted.



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**Action item – Anyone can take the next two weeks to go through the DO-220B document if they wish, to make any additional changes.**

### **Summary of Day 3 (May 16<sup>th</sup>, 2024)**

Recap of the last few days. Ven presenting some summary slides he put together.

- Jeff asked Sai: Is AWGN a valid approach or do we need to use some CW tone?
  - Sai: AWGN is valid and useful.
  - Is testing one frequency (e.g., 8.35 GHz) valid for out-of-band testing?
    - Sai: Initial evaluation at 8.3 to 8.4 GHz for out-of-band is good for an initial cut. But it is expected you'd test more frequencies to generate a more accurate interference tolerance mask.
      - Expected that, in the end “based on the current WX radars out there, here are the power levels at each frequency that you should not exceed otherwise you will impact the performance requirements for WX radars.”
        - This is from the perspective of victim radar/victim assessment. Then, eventually, may need to contextualize this for source path assessment (e.g., communications, 6g, etc.)

Going over the summary slides again for Andrew and Sai to get feedback.

- Jeff adding context that we are taking a “bottoms up” approach.
- Andrew: Central frequency: Just one frequency?
  - Jeff: Central frequency of each radar, if channelized, need to account for entire radar bandwidth that radar can hop around with
    - Andrew: Need to encompass the entire 200 MHz of space [9.3-9.5]
    - Andrew: Altimeters had nonsymmetrical stability/effect depending on if interference above or below the band.
      - Comment regarding symmetry: if you only test below the band, the assumption is that the interference tolerance mask can be mirrored to be the same as above the band of interest, but that assumption is not true.
      - Sai: There are two parts:
        - Test radars on the lower side and upper side of the band (at input of radar receiver). Start from 7 GHz up to 9.3 GHz, then go from 9.5 GHz to 12 GHz. As you do that, you will



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see asymmetry in your test results (*filters are not symmetric around central frequency*).

- Test what resilience you get.
  - How does the antenna pattern manifest on the lower side and upper side of the band? Antennas are tuned from say 9.3 to 9.5, but what is the response at 7 or 8 or 11 GHz? Antenna response decorrelates and will get some asymmetry.
  - Recommends expanding the testing. Not just 8.35 GHz, but from 7 to 11 or 12 GHz (excluding 9.3-9.5) for out-of-band. Need to declare the frequency limits and state why – will be iterative based on findings of initial testing.
- Two-minute context from Andrew: WRC – proposals initially came in for 6g for entire 7-24 GHz range. Had until 2027 to investigate this – didn't foster complete support at the conference last year. Likely will come back for consideration in 2027.
  - Upper C-band, X-band, and lower-Ku are bands of interest.
    - No direct impacts for X-band now, but likely will come up in the next few years.
  - Sai: The reason they stopped at 8.4 GHz is because spectrum was allocated (protected?) to (radio location?). Lots of work is being done to investigate interactions around 8.4 GHz and 8.4 GHz+.
    - **Key comment: Recommends starting at 7.1 to 8.4 GHz, because that is currently being looked at based on national spectrum strategy. But eventually needs to expand to cover the full spectrum on both sides of x-band radar band.**
- In-band: Biggest treat is spurious transmission somewhere in the 9.3 to 9.5 GHz band, so AWGN is good approximation but need to include it within the entire spectrum.
- **Action item:**
  - **In-band: Consider expanding 100 MHz in-band to 200 MHz.**
  - **Out-of-band: Consider everything up to and adjacent to 9.3-9.5 GHz; both sides of the spectrum.**
- Andrew: AWGN is a good approach for investigating 5g/6g type signals to avoid testing for every type of signal.





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- (slide 6 of summary slides) Sai: Had discussion on how close you can get to station or sources for RFI for altimeter.
  - If there is a concern that the aircraft can show up in any of the volumes of space with interference – need to assess performance issues vs survivability.
  - Integrity and continuity – “If I lose my function or get erroneous reading, within a given radius of the source, as the aircraft enters the bubble and leaves the bubble of interference influence, what is the impact on the aircraft level of operation?”
    - Altimeter issue: had no initial requirements that said altimeter had to “come back” after being affected (NCD), in addition to dealing with erroneous values.
  - Jeff: Testing of proximities is more of a survivability issue than a performance issue.
  - **Key comment by Sai: half-wingspan is used for horizontal distance assessment.**
- Jeff: Based on timing and lead times, some testing will be done but also some extrapolation will be needed (especially for higher powered PSGs).
  - Sai: Were also not able to hit high power levels starting out [regarding altimeter testing]. But for radar, if the concern is survivability, may not need to test higher power PSG if lower power causes issues. Maybe can derived survivability threshold from response of lower powered testing.
    - Jeff: We [Collins] will have to purchase equipment for high power testing. Mariusz: Same with Garmin.
    - Anticipating hitting performance issues before needing higher power.
    - Sai: The need for higher power PSGs in altimeter testing was ultimately due to new filters; how much more survivability did we get. Sai is not expecting us to need higher powered PSGs to start out with for characterization purposes.
- (slide 7 from summary slides) Sai: Is there any level of automation of information being supplied to the aircraft by the radar?
  - Jeff: PWS is autonomous mode that provides information only once an event is detected. Nothing with radar is coupled to flight control.
- Andrew: RTCA update to ICAO about spectrum work in July (at least for altimeter). Can radar work be presented as starting/on-going as well?
  - That is fine. Will help drive schedule or put some expectations on what is needed.
- Sai: If I have a “clean” signal generator with “clean” phase noise, how will this impact reality where the phase noise in RFI is “noisy?”



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- Jeff: Additive signal will have all the phase information used in Doppler filters that has been collected in a separate channel and is just being superimposed on the amplitude retrieved from the AWGN.

Last item of business for plenary, is date of the next meeting:

- July 16-18 at Boeing in Seattle
  - **Action Item:**
    - **[Jeff] Confirm with Mohammed can still host us at Boeing.**
    - **[Karan]: Confirm audio, Webex, etc. capabilities setup.**
  - Karan: RTCA may potentially be used as a backup.

**[Action item] Jeff: get meeting minutes from Mohammed if possible.**

Karan: Confirming errata to be presented to the PMC at June. It will be an “errata” not a “change”. Change requires FRAC (and usually means there was a content change).

~~**Action Karan: Setup 2 pm pacific Monday—RF discussion.**~~



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### Summary of Action Items:

- Day one:
  - [All] Come up with a list of things that cause the radar to “break”; when we no longer meet the MOPS (displaying false alarms, MDS/PI impacts, PWS). Essentially to define success/fail criteria.
    - *Note: We started working on this at the end of Day 1 and continued into Day 2. But not yet defined.*
  - [Venkata] Think about potential weather simulations needed for pass/fail criteria, such as missed detection.
- Day two:
  - [Mark and Stephan] Discuss RFI-only testing and setting reasonable bounds for testing. Potentially have a draft by the next WG meeting on 5/28. Revisit RFI and weather superimposed testing after.
  - ~~[Venkata] Rework section 6 by the next working group meeting.~~
    - [Venkata] Write a draft of subsections 6.1.3.1 – 6.1.3.3.
    - [Yahya] Write a draft of 6.1.3.3.1 (related to outcome of from action item assigned to Mark and Stephan above)
    - [Jeff] Try to write 6.1.3.4. May be in outline form.
  - [All] Anyone can take the next two weeks to go through DO-220B document if they wish, to make any additional changes for the errata.
  - ~~Ask Karan procedure for changes to DO-220B document.~~
    - *Completed at the end of day three.*
  - ~~[Venkata] Ask Karan to extend the timeframe for working group meeting from one hour to two hours.~~
    - *Completed at the end of day three.*
- Day three:
  - [Group] In-band testing: Consider expanding 100 MHz in-band to 200 MHz.
  - [Group] Out-of-band testing: Consider everything up to and adjacent to 9.3-9.5 GHz (e.g., 7-11 GHz); consider assessing both sides of the spectrum due to potential asymmetry.
  - For next plenary:
    - [Jeff] Confirm with Mohammed can still host us at Boeing.
    - [Karan]: Confirm audio, Webex, etc. capabilities setup.
  - [Jeff] Contact Mohammed to see if he has the meeting minutes for the last plenary available.
  - ~~[Karan] Setup 2 pm pacific Monday meeting RF discussion.~~



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CERTIFIED as a true and accurate summary of the meeting.

Mariusz Starzec, SC-230 Acting Secretary

Jeff Finley, SC-230 Co-Chair

Dawn Gidner, SC-230 Co-Chair