International Civil Aviation Organization

THE FOURTH MEETING OF MODE S DOWNLINKED AIRCRAFT PARAMETERS WORKING GROUP (MODE S DAPs WG/4)

Web-conference, 29 – 31 March 2021

Agenda Item 5: Review on the 1030/1090MHz occupancy in Asia Pacific

MANAGEMENT OF 1030/1090 MHz UTILIZATION

(Presented by Singapore)

SUMMARY

This information paper presents the works that is being undertaken by the Surveillance Panel to manage the 1030/1090 MHz utilization.

1. INTRODUCTION

1.1 The utilization of the 1030/1090 MHz frequencies has greatly increased in certain areas of the world. If no action is taken, the situation will reach an unacceptable level that will result in harmful corruption or loss of information to the aeronautical surveillance and collision avoidance systems.

1.2 The total or partial loss of this data will affect the ATM systems and aircraft to-aircraft systems resulting in an increase in the probability of mid-air collisions, disruption to Air Traffic Services, and a reduction in airspace efficiency.

1.3 There are a number of applications currently competing for channel time on the 1030/1090 MHz frequencies. It must be ensured that the spectrum capacity is being utilized in the most efficient way to preserve the performance of current systems and to consider future applications that require an increase in capacity.

2. DISCUSSION

2.1 The Surveillance Panel therefore established the Surveillance Spectrum Focus Team (SSFT) in September 2019 to look into the overall issue of 1030/1090 MHz utilization, including the impact of evolving systems that will potentially share the 1030/1090 MHz link (e.g. RPAS, new ACAS versions, military IFF, Electronic Conspicuity devices for General Aviation) contributing to the spectrum load. It also covers examining techniques and capabilities that could be considered to reduce 1030/1090 MHz congestion.

2.2 The SSFT will develop specific solutions, which can be transferred into Proposals for Amendment for Annex 10 Volume IV or change proposals for ICAO Manuals.

2.3 Annex A identified issues related to 1030/1090 MHz spectrum load and possible mitigations. It also contains information to affected ICAO documents and specific aspects like regulation and already available standards. All this material is considered as a basis to formulate appropriate text for ICAO SARPs and guidance material. Annex A is a "living document" and will be continuously updated to provide a comprehensive database.

2.4 It is unclear whether there are frequency congestions occurs in various parts of Asia Pacific (pre-COVID). States are urged to follow the guidance and SARPs and guidence materials produced to keep the frequency utilization healthy.

2.5 The meeting is urged to refer to the following materials produced to address frequency congestions:

a) Amendment of Section 3.1.2.1.5.1.1.1 of Annex 10 Vol 4 to address removal of long P4 processing;
b) Amendment of Appendix S of Doc 9924 to address use of uncertified transponder for small UAS.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information presented in this paper.

Annex A

Issue #	Status Priority	Problem description	Possible mitigation(s)	Affected Document(s)	Affected Section(s)	Remarks / Limitations	Proposal for SARPs and Guidance Material	Regulatory aspects	EMS Version
001	TOP	Mode A/C utilization	(1) Reduction of Mode A/C transmissions from transponders (2) Guidance for the correct calculation of minimum necessary interrogation rates	A10V4 Doc 9924	3.1.1.7.9.2 Annex …	This means the reduction of the maximum Mode A/C reply rates by decreasing the limit for the reply limiting function in the standard. **SSFT-AI-20/004** **SSFT-AI-20/007**	Implement a change from 500 to 2000 to only 500 (?) Introduce a common formula	none	
002		Too many Mode A/C replies	Removal of Mode A/C only transponders from the fleet			Since this is a very long process, it might be necessary to implement technical solutions before.		This is only achievable with official regulations	
003	TOP	Too high or also insufficient number of all-call replies due to unclear interpretation of allcall IRF for “paired interrogation “	Clarify the meaning/number of IRF for “paired interrogation “	A10V4	3.1.2.11.1.1	Limit of 250 for A/C/S and “paired” interrogations seems insufficient for “paired” (125+125). **SSFT-AI-20/006**			
004	TOP	Mode S Transponder unavailability				Excessive interrogations, consider issue #021 **SSFT-AI-20/008**			
005		Too many replies issued by Mode S transponders	Introduction of a Mode S reply limit	A10V4		Discussion is on a limit of 180 and 65±5 replies per second (where the limiting function starts)	Already captured by CSC and TSG. Issue kept open by SSFT for future discussion / solutions		
006		Closed							

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007		Uncoordinated and/or excessive use of low-power and Electronic Conspicuity (EC) devices in ultralight aircraft, gliders, hang gliders and all other types of small or unpowered aircraft				A high number of low-power and EC devices used simultaneously in the same place can have an unwanted impact to legacy systems. Studies and simulations show an unacceptable high load on 1090 MHz with huge impact to legacy systems See also working paper SP-ASWG11-WP/26.	Draft GM is available from ASWG TSG WP 11-24. The technical part shall be developed as a new CP for Doc 9924 according to AI ASWG/12-19. **ASWG TSG WP12-16**		
008		ACAS interrogations in high density areas	(1) Implementation of ACAS-II V7.1 Extended Hybrid Surveillance			This might be limited to high-density areas. (criteria need to be defined)		Perhaps only as an upgrade to existing ACAS-II Version7.1 installation	
009			(2) Implementation of ACAS-Xa and Xo					Not mandated, after certification only voluntary utilization in the US.	
010		Unnecessary (re-) extractions of BDS registers	(1) BDS extraction and information distribution in Mode S radar clusters (2) Passive use of ADS-B information instead of active extraction by radars (3) Basic Dataflash solution (4) Phase Overlay			Data distribution by radar data networks for unclustered radars. Use of ADS-Wx AIREP messages: many of the EHS purposes are served by the ADS-Wx AIREP parameters (SD) Phase modulated BDS content in a regular downlink message.	Draft CP available See ASWG TSG WP09-40 Phase Modulation in long Mode S replies		

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011		Active extraction of EHS BDS registers by WAM systems causing high transponder occupation	Maybe Phase Overlay	A10V4	6.3, new 6.3.6 or new note in 6.3.4	Definite statements in the standard necessary (not allowed in highdensity areas, only below 2% occupation, use of passive methods, …)			
012		High number of All-Call replies (DF11) due to unclustered operation of radars	Networking radars into clusters (national/international)	Doc 9924	Appendix J, sections 4 and 8	Central and distributed cluster modes are available and already in operational use	Cluster description already available in Doc 9924.	Could be mandated on a national basis	
013		Misaligned Surveillance and Lockout Coverage in Mode S radars	Both coverage maps should be aligned to minimize the area of all-calls without lockout. A corresponding output power should be chosen.	Doc 9924					
014		Generation of unused XPDR replies due to unnecessary high interrogator output power	The interrogator output power shall be adjusted to the surveillance coverage			See also issue 013			
015		Too many interrogation-reply cycles caused by high IRF	(1) Graceful decrease of Mode S replies after reaching a dedicated threshold. (2) Reduction of the maximum Mode A/C reply rates by decreasing the limit for the reply limiting function in the standard.			See also issue 001			
016		Implementation of new collision avoidance logic(s) by use of Mode S Extended Squitter messages (e.g. ACASX for UAS and sUAS)							
017		Implementation of RPAS detect and avoid (DAA) systems operating on 1030/1090 MHz				Information required from RPAS Panel.			

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018		Utilization of military Mode 5 on a regular base				Current studies/simulations and tests show a neglectable impact to the civil 1030/1090 MHz environment, but spectrum monitoring is needed. Impact of the transition from Mode 1&2 to Mode 5 (parallel operation).			
019		Use of non-aeronautical devices (e.g. PMSE) in the aeronautical frequency band				Still under review.			
020		Discrepancy in understanding of the use of PARROTs and test equipment due to the split of requirements in SARPS and Guidance Material	Bring together all essential requirements in Annex 10, Volume IV	A10V4 Doc 9924 …		This can lead to only a partly application of requirements to such equipment and consequently cause interference.			
021		SSR/Mode S transponder unavailability due to high mutual suppression bus activity caused by other onboard equipment		Doc 9924		General: what is the MSB load today? Input to Doc9924 table M-1 and M-2? New systems like LDACS may cause unexpected load.			
022		Interference from out-of-band (adjacent channels) systems, e.g. LDACS	Better selectivity of 1030/1090 devices Provision of IPC like S/N or I/N ratio or minimum sensitivity level for 90% Pd or …	A10V4 Doc 9924 Doc 9871		Currently defined limits seem not sufficient to guarantee good resilience. See also #019 The development of IPC (in the LDACS context) has been started.			
023		RPAS C2-Link implementation/operation in the L-band adjacent to 1030/1090 MHz				See ICAO state letter AN 7/67.1.1-19/52, consider states responses			
024		Misinterpretation of P4 pulses close to MTL causes high rates of DF11	A raised Mode A/C amplitude for P4 compared to P1/P2/P3			NEW issue from **SSFT-AI-20/005**			

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025		Lack of guidance material for 1030/1090 MHz environment and surveillance system performance models	Add modelling GM to Doc 9924	Doc 9924	Appendix M	Start with compilation of TSG papers presenting modelling results. Proprietary methods that cannot be shared may limit the depth of material that can be added to any GM. (MB)			

	Agreed solutions or change proposals for SARPs and/or Guidance Material								
024(I)	FIN	High number of Mode A/C/S All-Call replies (DF11) due to P4 misinterpretation of the transponder near minimum triggering level	Complete removal of long P4 processing from the transponder	Annex10V4	3.1.2.1.5.1.1.1	The long/wide P4 is not used in civil radars.	See Annex10V4, 5th edition July 2014 Amendment 90 **Effective date 01 January 2020**	none	n/a
006	FIN	Use of uncertified transponder or NT/ES devices for small UAS	Add guidance material to Doc 9924	Doc 9924	Appendix S		Based on State Letter SP44/2-19/77 **Doc 9924 3rd Edition 2020**	none	n/a
	CP	Increase in ADS-B squitter rates to introduce MOPS Version 3	Removal of the reply to long/wide P4 in ADS-B version 3 transponders	Annex 10V4	3.1.2.8.9.1.2	This supports the ADS-B MOPS Version 3and keeps the equilibrium of 1030/1090 MHz utilization.	See working paper SPASWG10-WP/11 R1 **CPA10V4/38**	none	n/a
	CP	Demand on increasing ADS-B squitter rates to introduce new services or provision of additional information	The implementation of Phase Modulation and its use for all new defined ADS-B messages.	Annex10V4	3.1.2.8.9.1.2 Note 1	The implementation will occur over a longer period. In the current text proposal, it is only a note (recommendation).	See working paper SP-ASWG10-WP/11 R1 **CPA10V4/38**	none	n/a
	CP	Inconsistency of RF measurement methodologies and results reporting	Add RF measurement guidance material to Doc 9924	Doc 9924	Appendix M	Material is in response to SP CP ASM/19	See working paper SP3-WP/06 **CP ASM/19**	none	n/a
	CP	Unnecessary (re-) extractions of BDS registers	(3) Basic Dataflash solution	Annex10V4	Sections 2 and 3	This Dataflash solution is defined in the in the new version of the MOPS. The implementation will occur over a longer period.	See draft CP in working paper **SP-ASWG11-WP/20**	none	n/a

010 (3)	CP	Use of uncertified transponder or NT/ES devices for small UAS	Add guidance material to Doc 9924	Doc 9924			See Guidance Material in the attachment of **State Letter SP44/2-19/77**	none	n/a

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