



ICAO

International Civil Aviation Organization

**THE SIXTH MEETING OF MODE S AND DOWNLINKED
AIRCRAFT PARAMETERS WORKING GROUP
(MODE S RADAR AND DAPs WG/6)**

Bangkok, Thailand 28 – 30 March 2023

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

GUIDANCE ON 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 several 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 States are urged to follow the guidance and SARPs and guidance materials produced to keep the frequency utilization healthy.

3. ACTION BY THE MEETING

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

List of identified Issues

Issue #	Priority Status	Problem description	Possible mitigation(s)	Affected Document(s)	Affected Section(s)	Remarks / Limitations	Proposal for SARPs and Guidance Material	Regulatory aspects
001	TOP	Mode A/C utilization	(1) Reduction of Mode A/C transmissions from transponders	Annex10V4	3.1.1.7.9.2	This means the reduction of the maximum Mode A/C reply rates by decreasing the limit for the reply limiting function in the standard.	Implement a change from 500 to 2000 to only 500 (?)	
			(2) Guidance for the correct calculation of minimum necessary interrogation rates	Doc 9924	Annex?	SSFT-AI-20/004 SSFT-AI-20/007	Introduce a common formula	
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		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 “	Annex10V4	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	closed					see issue 021, CP004 and CP005		
005	closed					see CP005		
006	closed					see CP006		
007	closed					see CP007		
008		ACAS interrogations in high density areas	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 version 7.1 installations
009	closed					see CP009		
010		Unnecessary (re-) extractions of BDS registers	(1) BDS extraction and information distribution in Mode S radar clusters			Data distribution by radar data networks for unclustered radars.		
			(2) closed			see CP010		
			(3) closed			see CP010		

DAPs WG/6
Annex A to IP/02

Issue #	Priority Status	Problem description	Possible mitigation(s)	Affected Document(s)	Affected Section(s)	Remarks / Limitations	Proposal for SARPs and Guidance Material	Regulatory aspects
			(4) closed			see CP010		
011		Active extraction of EHS BDS registers by WAM systems causing high transponder occupation	Candidate: Phase Overlay	Annex10V4	6.3, new 6.3.6 or new note in 6.3.4	Definite statements in the standard necessary (not allowed in high-density areas, only below 2% occupation, use of passive methods, etc.)		
012		High number of All-Call replies (DF11) due to non-clustered 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 based on national or regional regulations
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	closed	Too many interrogation-reply cycles caused by high IRF	(1) closed			see CP005		
			(2) removed			Covered by issue 001 (1)		
016		Implementation of new collision avoidance logic(s) by use of Mode S Extended Squitter messages (e.g., ACAS-X for UAS and sUAS)				Impact of use of additional ADS-B messages for collision avoidance, i.e., high spectrum use due to raised squitter rates.		
017		Implementation of RPAS detect and avoid (DAA) systems operating on 1030/1090 MHz				Information required from RPAS Panel.		
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).		

DAPs WG/6
Annex A to IP/02

Issue #	Priority Status	Problem description	Possible mitigation(s)	Affected Document(s)	Affected Section(s)	Remarks / Limitations	Proposal for SARPs and Guidance Material	Regulatory aspects
019		Interference from non-aviation or non-ICAO L-Band systems adjacent to 1030/1090 MHz	Provision of ITC like S/N or I/N or minimum sensitivity level	Annex 10V4 Doc 9924 ¹⁾		This issue is intended to cover systems NOT used for aviation, e.g., PMSE An ITC proposal could be similar to CP for #22 (2)		
020		Discrepancy in understanding of the use of PARROT's and test equipment due to the split of requirements in SARPS and Guidance Material	Bring together all essential requirements in Annex 10, Volume IV	Annex10V4 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	TOP In Progress (2)	Interference from aviation L-Band systems adjacent to 1030/1090 MHz	(1) Better selectivity of 1030/1090 devices	Annex10V4 Doc 9924 Doc 9871		Currently defined limits seem not sufficient to guarantee good resilience. See also #019		
			(2) Provision of ITC like S/N or I/N or minimum sensitivity level for 90% Pd	Annex10V4 Doc 9924 ¹⁾		This issue is intended to cover systems used for aviation, e.g., LDACS. The development of ITC and SARPS acceptance nearly complete.	See ASWG TSG WP16-10 for PFA.	
023		RPAS C2-Link implementation/operation in the L-band adjacent to 1030/1090 MHz				See ICAO state letter AN 7/67.1.119/52, consider states responses		
024	closed					see FIN024 (1) and CP024 (2)		
025		Lack of guidance material for 1030/1090 MHz environment and surveillance system performance models	Add modeling 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.		
026		More details for guidance and common understanding of RF measurements on 1030/1090 MHz needed	Update guidance material	Doc 9924	Appendix M			

DAPs WG/6
Annex A to IP/02

Issue #	Priority Status	Problem description	Possible mitigation(s)	Affected Document(s)	Affected Section(s)	Remarks / Limitations	Proposal for SARPs and Guidance Material	Regulatory aspects
027	In Progress	High number of All-Call interrogations in the cone of silence of Mode S radars	Develop provisions to avoid unnecessary high transponder reply rates	Annex10V4		Recent analyses in the U.S. did not show this behavior. SP-ASWG14-WP/13		
028		Excessive interrogations, mostly from (military) mobile platforms causing XPDR replies up to the edge of reply capacity.				Mode S, Interrogator Code=0		
029	TOP	ATCRBS Replies to Low-Level Mode S Interrogations				It is suggested that further analysis be conducted, see ASWG TSG WP14-26 for more details.		
030	New	Ground interrogators in maintenance mode cause high transponder reply rates		Doc 9924				
031	New	CW interference on 1030 MHz causes high transponder reply rates		Doc 9924		Recently detected issue, XPDR load was caused by an antenna test facility		
032	In Progress	Doc 9924 Appendix M Interference Considerations is outdated and requires updating for new transponder/ADS-B MOPS and modern surveillance environment	Review applicability of current Appendix M material and propose changes and additions	Doc 9924	Appendix M	First review discussed in ASWG TSG WP16-18		

DAPs WG/6
Annex A to IP/02

Agreed solutions or changes to SARPs and/or guidance material

Issue #	Priority Status	Problem description	Possible mitigation(s)	Affected Document(s)	Affected Section(s)	Remarks / Limitations	Proposal for SARPs and Guidance Material	Regulatory aspects
	FIN	Inconsistency of RF measurement methodologies and results reporting	Add RF measurement guidance material to Doc 9924	Doc 9924	Appendix M		CPASM/19	Doc 9924 3 rd Edition 2020
006	FIN	Use of uncertified transponder or NT/ES devices for small UAS	Add guidance material to Doc 9924	Doc 9924	Appendix S, section 1 to 3		State Letter SP44/2-19/77	Doc 9924 3 rd Edition 2020
024 (1)	FIN	High number of Mode A/C/S All-Call replies (DF11) due to P4 misinterpretation of the XPDR near MTL	Complete removal of long P4 processing from the XPDR	Annex10V4 AMD 90	3.1.2.1.5.1.1.1	The long/wide P4 is not used in civil radars.		Annex10V4 AMD 90 Effective date 01/01/ 2020
	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 3 and keeps the equilibrium of 1030/1090 MHz utilization.	CPA10V4/38 (for approval at SP/5)	
	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).	CPA10V4/38 (for approval at SP/5) (see also CP010-4)	
004	CP	Mode S Transponder unavailability	Removal of Mode A/C/S All-Call interrogations	Annex10V4	3.1.2.5		CPA10V4/39 (for approval at SP/5)	
005	CP	Too many replies issued by Mode S transponders	Introduction of a Mode S reply limit function	Annex10V4	3.1.2.10.3.6	Proposed is a threshold of 180 replies per second	CPA10V4/39 (for approval at SP/5)	
007	CP	Uncoordinated and/or excessive use of 1090 MHz Reduced Performance Devices on small or unpowered aircraft	Guidance Material for the use of Reduced Performance Devices	Doc 9924	Appendix S, section 4	Supplement to the already existing guidance on small drones.	CPASM/26 (for approval at SP/5)	
009	CP	ACAS interrogations in high density areas	Implementation of ACAS-Xa and Xo	Doc 9863 Annex10V4	All sections Section 4 3.1.2	SP/3 (Sep 2018) approved technical provisions for AXAS-Xa and Xo	CP9863/18 (in progress) CPA10V4/37 (AMD 91) CPA10V4/39 (for approval at SP/5)	Not mandatory
010	CP	Unnecessary (re-) extractions of BDS registers	(2) Passive use of ADS-B information instead of active extraction by radars	Annex10V4	3.1.2 5.2.3	Use of ADS-Wx AIREP messages: many of the EHS purposes are served by the ADS-Wx AIREP parameters.	CPA10V4/39 (for approval at SP/5)	Not mandatory

DAPs WG/6
Annex A to IP/02

Issue #	Priority Status	Problem description	Possible mitigation(s)	Affected Document(s)	Affected Section(s)	Remarks / Limitations	Proposal for SARPs and Guidance Material	Regulatory aspects
			(3) Basic Dataflash solution	Annex10V4	2.1.5.2 3.1.2.6.10.3	The Basic Dataflash solution is defined in the in the new version of the MOPS. The implementation will occur over a longer period.		
			(4) Phase Overlay	Annex10V4	3.1.2	Phase modulated BDS content in a regular downlink message.		
022 (2)	CP	Interference from aviation L-Band systems adjacent to 1030/1090 MHz	(2) Provision of ITC like S/N or I/N or minimum sensitivity level for 90% Pd	Annex10V4	2.3 (new)	Proposed is an I/N -10dB	Draft CP in working paper SP-ASWG16-WP07 and ASWG TSG WP16-10	
024 (2)	CP	Misinterpretation of P4 pulses close to MTL causes high rates of DF11	A raised P4 amplitude compared to P3 in Mode A/C interrogations	Annex10V4	3.1.2.4.1 Table 3-11		CPA10V4/39 (for approval at SP/5)	