



ICAO NAM/CAR/SAM REGIONAL PREPARATORY GROUP (RPG)

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**Programme Making and Special Events (PMSE), aiming to
share the 960 – 1164 MHz band**

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Spectrum Fundamental resource for aviation

- ATM will evolve much faster than ever
- Spectrum resource will remain the backbone of future technological progress
- The aviation industry is and will remain dependent on spectrum



As ANSPs we provide CNS services

CNS is based on radio communications (Telecom)

De facto, ANSPs are Telecom service providers

Competition in the Telecom market

Safety **versus** Best available effort

Spectrum Limited natural resource

- The increasing demand of spectrum puts pressures on all sectors
- Market mechanisms to regulate spectrum
- Make communications markets work for everyone
- Promote competition and ensure that markets work effectively
- Efficient use of the limited spectrum resource
- Spectrum sharing becomes an accepted practice



- Promoting the shared use of Europe's radio spectrum
- The EU's Radio Spectrum Policy Programme (RSPP) sets out the framework, based on the principle that spectrum should be used efficiently
- **However**
- With all the respect of the above; one should not underestimate safety requirements of aviation industry

What is Programme Making and Special Event PMSE

- Wireless Microphones and in Ear Monitors

- Freedom of movement
- Equipment worn on the body
- Flexibility: hold events in almost any location
- Significantly reduce installation costs
- Monitor
- Infrastructure:



- it is not uncommon to find 50 wireless microphones and monitors on a stage
 - Eurovision more than 600 channels

- Quality requirements

- high quality spectrum
 - duty cycle 100%
 - Real time audio transmission



PMSE wireless Microphones & in Ear Monitors Sharing the Frequency Band 960-1164 MHz UK Ofcom's perspective

- Make the 700 MHz frequency band available for mobile data, release the 700 MHz band in Q2 2020
- Government grant scheme to support PMSE users who will have to vacate the 700 MHz band
- Planning criteria that will ensure the protection of DME/TACAN from PMSE
- Insufficient testing to ensure the protection of SSR/TCAS/ADS-B from PMSE; a ± 15 MHz guard band would be used around 1030 & 1090 MHz
- PMSE licenses are time, location and frequency specific
- Spectrum Management Rules to minimise the risk of harmful interference to aeronautical systems in the 960-1164 MHz band



Why Sharing the 960-1164 MHz band

- Global Harmonisation – engagement with other administrations for widespread adoption
- To avoid fragmentation in the use of spectrum for wireless microphones
- No change compared to current PMSE equipment / practices
- Cost of PMSE equipment kept low
- Propagation characteristics

PERFORMANCE™

ULX-D® DIGITAL WIRELESS



Is there other candidate bands for audio PMSE ?

- Draft Amended ERC Recommendation 25-10

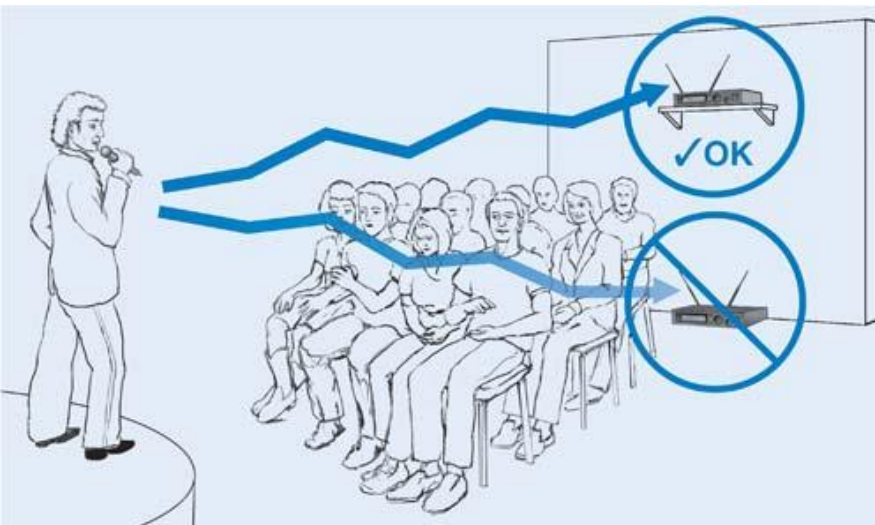
Table 2: frequency ranges for use by audio PMSE applications

Type of link	Frequencies/Tuning ranges	Technical information	Background information
Radio microphones and In-ear monitors	A1: 29.7-47.0 MHz	See ERC/REC 70-03 [5], Annex 10	Non-professional PMSE use. Legacy systems still in use. No broadcast quality equipment available. Shared use. ETSI EN 300 422 [8].
	A2: 174-216 MHz	See ERC/REC 70-03, Annex 10	Shared use. EN 300 422.
	A3: 470-694 MHz	See ERC/REC 70-03, Annex 10	Core band for professional use. Shared use. EN 300 422.
	A4: 694-790 MHz	CEPT Report 60 [6]	Currently a core band for professional PMSE use. Changes to the band will limit its utility for PMSE. The extent of the impact is dependent on national decisions (see ECC/DEC (15)01 [7]). Shared use. EN 300 422.
	A5: 823-832 MHz	See ERC/REC 70-03, Annex 10 and EC Decision 2014/641/EU [9]	Risk of out of band emissions from adjacent mobile services means there is limited utility for broadcast quality audio. Harmonised (within EU member states). EN 300 422.
	A6: 863-865 MHz	See ERC/REC 70-03, Annex 10 and EC Decision 2013/752/EU [10].	Risk of out of band emissions from adjacent mobile services and other short range devices means there is very limited utility for broadcast quality audio. Shared use. Note 1. EN 300 422 and EN 301 357 [11].
	A7: 1350-1400 MHz	See ECC Report 245 ERC/REC 70-03, Annex 10	Newly recommended tuning range in 2016. Shared use. EN 300 422
	A8: [1518-1525 MHz]	[Draft] ECC Report 253	[Newly recommended tuning range in 2016. Shared use. EN 300 422]
	A9: 1785-1805 MHz	See ERC/REC 70-03, Annex 10 and EC Decision 2014/641/EU [9]	Harmonised (within EU member states). EN 300 422.

- 1525-1559 MHz also addressed in UK Ofcom's public consultation

Is there other candidate bands for audio PMSE ?

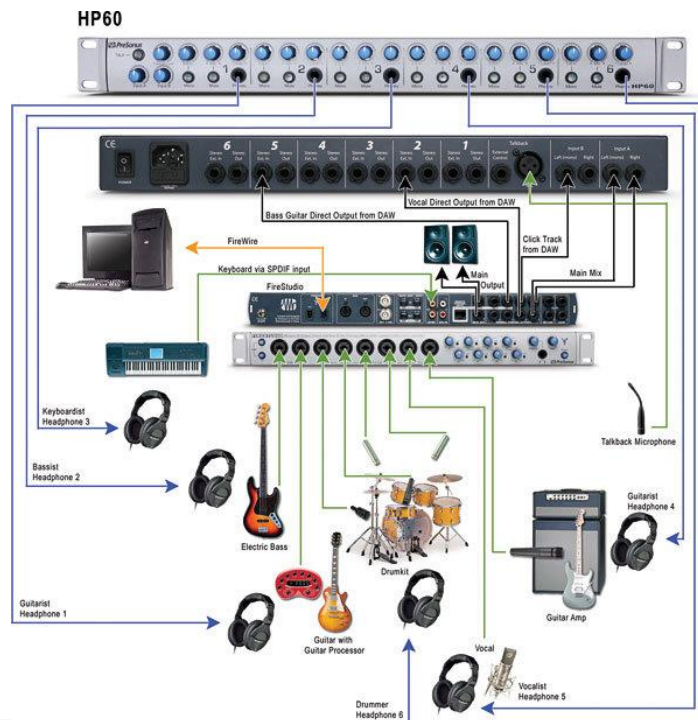
- Above 6GHz
- Primary allocation to PMSE
- Long term solution
- Preserve investments



Significant change compared to current PMSE equipment / practices;
But insignificant compared to the aviation sector's efforts if PMSE share the 960-1164 MHz band

PMSE Spectrum requirements

- Spectrum requirements varies significantly between States
- Average daily requirements for social / cultural events: 40 to 94 MHz
- 2012 Olympics: 400 MHz



When and for how long

- Equipment already available on the market
- Possible to get one on the web for less than 200€
- PMSE users, manufacturers requesting long-term implementation (15 - 20 years)

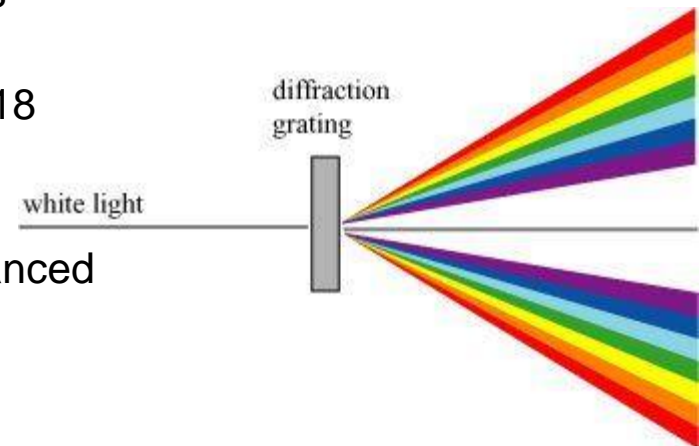


- <http://www.goodluckbuy.com/lawmate-1-2ghz-8ch-1000mw-wireless-av-transmitter-vtx-and-receiver-vrx-for-fpv-cctv-camera.html>

Approach adopted by PMSE

Bottom up approach; State+s, Region+s, ITU WRC

- CEPT WG-FM (change of strategy);
 - Original decision to start technical studies only if regulatory studies are in favour
 - The FM51 “ECC Report on legal and regulatory aspects of audio PMSE sharing the 960-1164 MHz band” was degraded by WG-FM to “Draft Report to WG-FM”
 - FM51 shall bring the completed report to the May 2018 meeting of WG FM and that no extensions were envisaged;
 - WG FM requires presentation of the issues, with balanced positions when there is no agreement;
 - WG FM does not expect conclusions, but a short summary of the issues is appropriate;
 - the work in FM51 on this work item will be paused at the May 2018 WG FM meeting and resumed again when the outcome of the WG SE studies is available;
 - the final deliverable will be an ECC Report with a deadline May 2020.



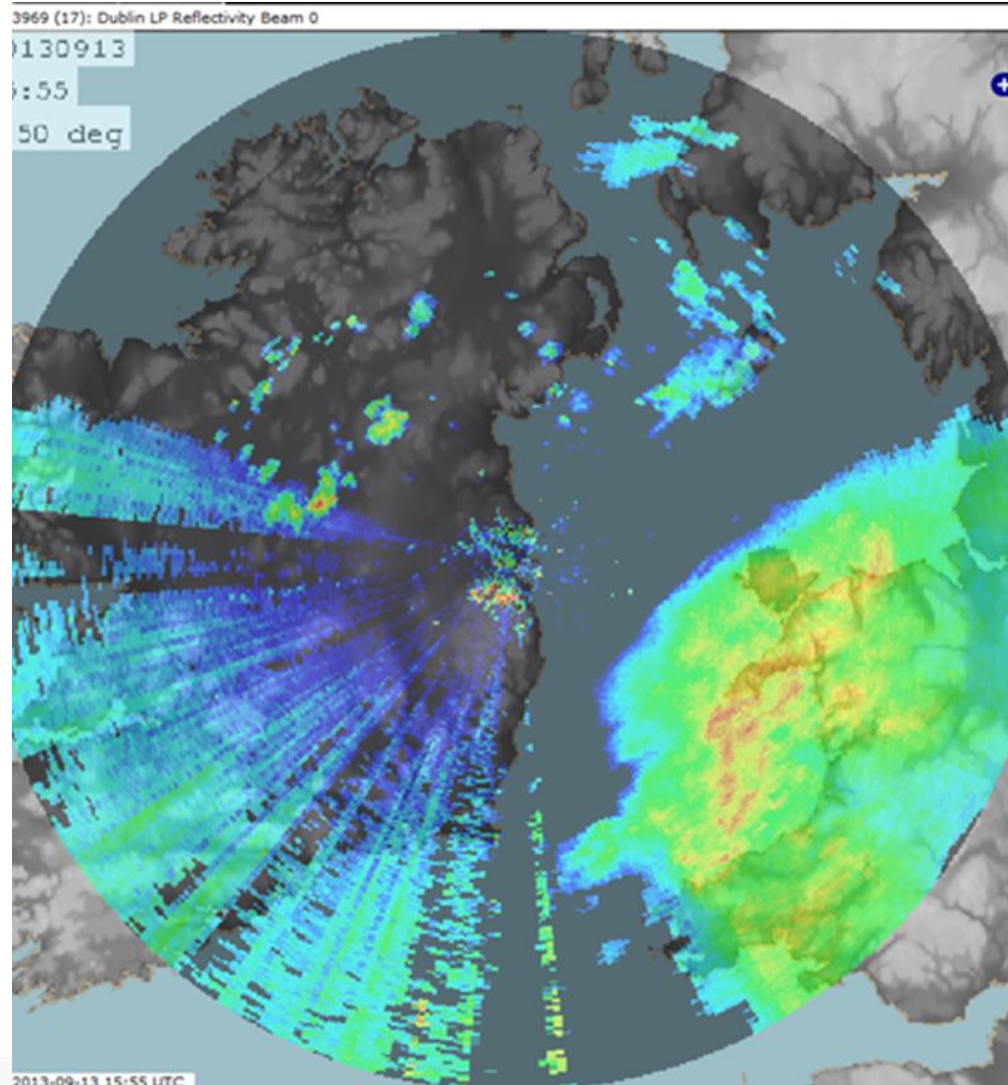
Increasing threat to meteorological radars in the 5600-5650 MHz band due to interference from 5 GHz RLAN

the perfect example of the non respect of agreements, incapacity to monitor and enforce the agreed sharing rules

PMSE users are famous for not respecting terms of their licenses

The safety of travelling people can by no means be put at risk

Technical / Reality
Side effects

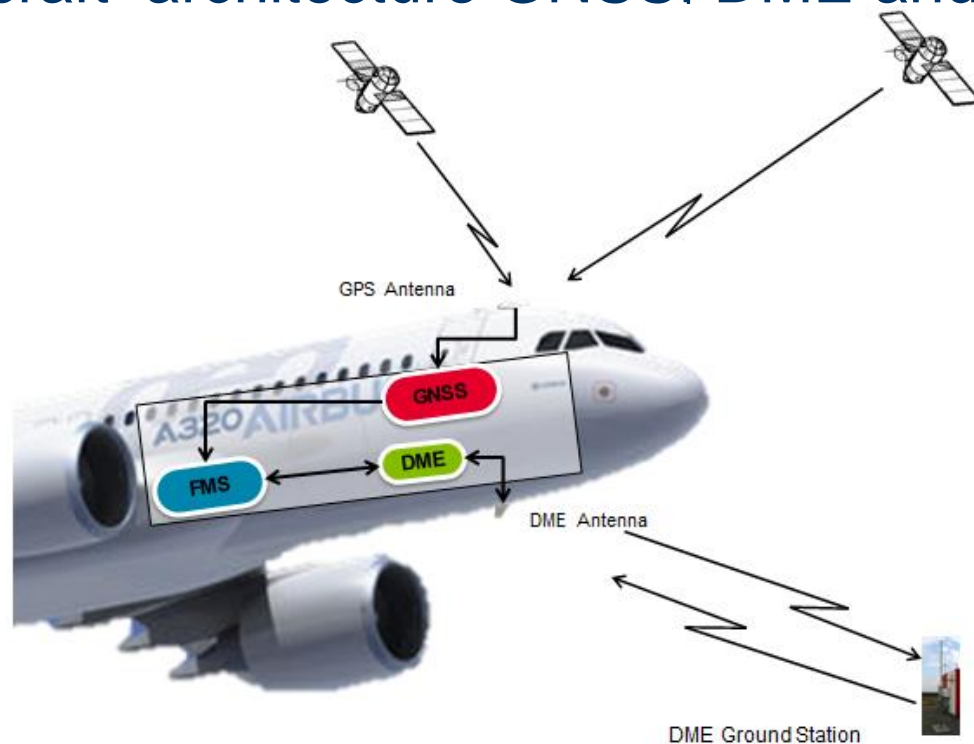


Potential impact on DME in case of PMSE interference

- 1st Hypothesis: PMSE transmitter is jamming only one DME ground station.
 - The DME on board receiver will transmit Non Computed Data (NCD) to the aircraft systems for this Ground Station
 - DME distance and Ident, will disappear from the Navigation Displays and will be replaced by dashes
 - That DME ground station cannot be used by the FMS for Radio position computation
 - If no other adequate ground station(s) available, it will lead to the loss of aircraft radio position

- 2nd Hypothesis: PMSE transmitter is jamming on-board DME receiver
 - The DME on board receiver will transmit NCD to the aircraft systems, including FMS, for all DME Ground Stations and the radio aircraft position will be lost
 - DME distance(s) and Ident will disappear from the Navigation Displays and will be replaced by dashes

Typical Aircraft architecture GNSS, DME and FMS



- The PMSE interference in the 960-1164 MHz band could create noise on aircraft DME receivers, leading to the loss of the Aircraft radio position and to the degradation of aircraft operational performances (loss of DME distances display). This can become critical in case of difficult conditions such as bad weather, low flight altitude.

Current Civil/Military systems operating in the band

- Is globally allocated to ARNS, AM(R)S, and AMS(R)S Earth-to-space.
- Prime radionavigation band, used intensively, and extensively
 - Distance measuring equipment (DME)
 - Secondary Surveillance Radar (SSR); SSR Modes (A, A/C, S)
 - Automatic Dependent Surveillance-Broadcast (ADS-B)
 - Universal Access Transceiver (UAT)
 - Multilateration systems (MLAT); Wide area multilateration (WAM)
 - ACAS/TCAS : Airborne Collision Avoidance System
 - RSBN (similar to ILS, VOR, DME and TACAN)
 - Identification Friend or Foe (IFF)
 - Tactical Air Navigation (TACAN)
 - Joint Tactical Information Distribution System (JTIDS) / Multifunctional Information Distribution System (MIDS)
 - Future systems in the band:
 - ACAS-Xu, ACAS-Xp,
 - L-band Digital Aeronautical Communication System (LDACS)
 - Remotely Piloted Aircraft System (RPAS) C2 link
- Systems operating in this band comply with aviation safety requirements
- High level predictability of systems in place
- Current aeronautical use of the band will increase

Impact on Civil/Military Aviation

- Opening the band to commercial, non-safety terrestrial applications represents a fundamental change that will have significant economic impact, as civil aviation equipment / procedures would need to be changed to accommodate new failure mechanisms.
- Negative impact on Capacity; reduction of Military channels
- PMSE industry can claim protection from Civil/Military Aviation
- Significant cost for coordinating and monitoring the band
- Loss of flexibility for aviation current and future systems
- Slow down / freeze future aviation modernisation programmes
- Severe financial and ecological consequences on aviation
- Safety risks; Legal and Liability issues
- The proliferation of commercial equipment targeting the band may lead to an uncontrolled illegal usage, not compatible with the safety requirements of aeronautical systems
- The severity of occurrences resulted by interference in this band should invite decision makers and regulatory authorities to more precaution

ITU Constitution (CS)

- CS Article 40 : Priority of Telecommunications Concerning Safety of Life : 191 International telecommunication services must give absolute priority to all telecommunications concerning safety of life at sea, on land, in the air or in outer space, as well as to epidemiological telecommunications of exceptional urgency of the World Health Organization.
- CS No. 1003 (also RR No. 1.169) : 1003 Harmful Interference: Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with the Radio Regulations.



ITU Radio Regulations (RR)

- ITU RR No. 4.10 : Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies.
- ITU RR, Art 43 "Special rules relating to the use of frequencies"
43.1 § 1 Frequencies in any band allocated to the aeronautical mobile (R) service and the aeronautical mobile-satellite (R) service are reserved for communications relating to safety and regularity of flight between any aircraft and those aeronautical stations and aeronautical earth stations primarily concerned with flight along national or international civil air routes.

Compatibility of aeronautical safety services with co-band or adjacent band aeronautical non-safety services or non-aeronautical services must be considered with extreme care in order to preserve the integrity of the aeronautical safety services

Sharing Logic !!!!!



There is room for me, I can share this place
I do not practice surgery; therefore I do not need to comply with surgery rules and regulations

Misinterpretation or Regulatory gaps ??????

- By design aviation services do not expect in-band interference from non-aviation systems; it goes the same for processes and operational procedures developed around these environments. Safety cases and mitigation techniques are also developed based on the same assumption.
- Sharing ARNS, AM(R)S or AMS(R)S bands by a non-safety service is not common but there are growing sharing attempts.
- Based on the postulate that non-safety systems cannot operate in ARNS, AM(R)S or AMS(R)S bands the legal and regulatory aspects addresses so far only the safety of life part. The misinterpretation of the ITU CS and RR mentioned above highlights the need to complement existing regulations and the legal framework to avoid any unfortunate abuse.
- Legal and regulatory gaps derived from the misinterpretation of existing CS and RR, need to be fulfilled

Pandora's Box



**Non safety of life systems,
willing to share a safety of
life band; have to comply
with the aviation safety
requirements applicable in
that band**

Sharing only if it includes responsibility and liability

Administrations taking the decision to open ARNS, AM(R)S or AMS(R)S bands to non-safety systems shall also bear the overall responsibility and liability of their decision

Non-safety of life users can seek a license only when they can provide evidence that their equipment, processes, operational procedures, SMS, safety cases and mitigations techniques are approved by the National Supervisory Authority NSA.

The performance of users regarding the scrupulous respect of rules shall be recorded by the radio regulator and made available to the NSA.

A non-aviation user of the safety band cannot be under the responsibility and authority of the CAA; they have to operate under the full responsibility of the Radio Administration delivering licenses. As a CAA is liable for licenses delivered to Air Navigation Service Providers (ANSPs), Airports, ...; the same logic shall apply to Radio Regulators.

As ANSPs and Airports are liable for their operations; the same logic shall apply to non safety of life users sharing the band.

Sharing ARNS, AM(R)S or AMS(R)S bands

Administrations, radio regulators, equipment manufacturers and users shall act under the supervision of a designated National Supervisory Authority (NSA) and provide evidence that:

- All aspects including side effects of sharing are taken into consideration to preserve the safety of the aviation operational environment;
- Effective actions are taken to prevent any proliferation of equipment having the capability to transmit in the safety of life band in question;
- Efficient market surveillance is performed and ensure that manufacturing, importing and the prevention of using illegal equipment are fully under control;
- Licenced systems are manufactured according to and are in conformance with the internationally agreed standards;
- Traceability of manufactured equipment;
- Users of the non-safety system are qualified to operate in an ARNS, AM(R)S and AMS(R)S bands and hold a valid certificate;
- An effective and continuous monitoring of the RF environment is put in place, and measures / resources are made available for a diligent intervention;
- The non-safety of life users' :
 - operational handbooks are valid;
 - safety management system (SMS) is accepted and validated by the NSA;
 - Insured for their liability;

(to be further developed)

Urgent Actions on Aviation

- Adds to ICAO Annexes (13 and 19)
- **Aviation Spectrum Vision and Strategy**
 - Decision on 960-1164 MHz and 2700-2900 MHz bands
 - LDACS
 - Cost of spectrum
 - Sharing partners
- Aviation has to be pro-active

Strong Political Decision

- The most important for aviation is
 - **SAFETY**
- Sharing ARNS, AM(R)S or AMS(R)S bands without respecting aviation standards compromises safety

Q & A

