

Using mobile duplex gaps and guard bands for audio PMSE

Preliminary remarks

Duplex gaps are frequency ranges between the uplink channels (user equipment (UE) to base station) and downlink channels (base station to user equipment) which are not used by mobile communications. The size of the gap is frequency-dependent (the higher the frequency, the wider the gap) or is based on the standard duplexer filter equipment used by mobile communications. With the introduction of new mobile technology, e.g. 5G, the duplex gap can be completely eliminated in some frequency ranges.

Guard bands are a frequency gap to prevent interference from the mobile service interfering with another service such as Broadcasting.

If PMSE services use the duplex gap or guard band in the vicinity of user equipment or mobile base stations, interference in both directions is created. To protect mobile communications, PMSE devices have to keep outside guard bands to provide protection to both base and UE allocations, but they themselves enjoy no protection at all - a significant disadvantage when comparing the relative RF powers of the mobile equipment to the PMSE low power (<50mW).

1) 800 MHz

800 MHz frequency band

	791-796	796-801	801-806	806-811	811-816	816-821	821-832	832-837	837-842	842-847	847-852	852-857	857-862
Guard band	Downlink						Duplex gap	Uplink					
1 MHz	30 MHz (6 blocks of 5 MHz)						11 MHz	30 MHz (6 blocks of 5 MHz)					



Due to its size of only 1MHz, the guard band does not allow independent PMSE use.

Typical national frequency 800 MHz allocation

	791-796	796-801	801-806	806-811	811-816	816-821	821-823	823-832	832-837	837-842	842-847	847-852	852-857	857-862
Guard band	Downlink						PMSE	Uplink						
1 MHz	30 MHz (6 blocks of 5 MHz)						2	9 MHz	30 MHz (6 blocks of 5 MHz)					

Possible frequency use by PMSE in close proximity to mobile devices

	791-796	796-801	801-806	806-811	811-816	816-821	823-832	832-837	837-842	842-847	847-852	852-857	857-862
Guard band	Downlink						PMSE	Uplink					
1 MHz	30 MHz (6 blocks of 5 MHz)						2	< 5 MHz	> 4 MHz	30 MHz (6 blocks of 5 MHz)			



The out of band energy from the mobile service sometimes causes massive interference for PMSE

Note

Test reports of PMSE problems caused by mobile devices can be accessed via this link

<http://www.apwpt.org/technical-papers/apwpt/index.html>

4) Estimate of the number of audio PMSE applications that can operate within the duplex gap

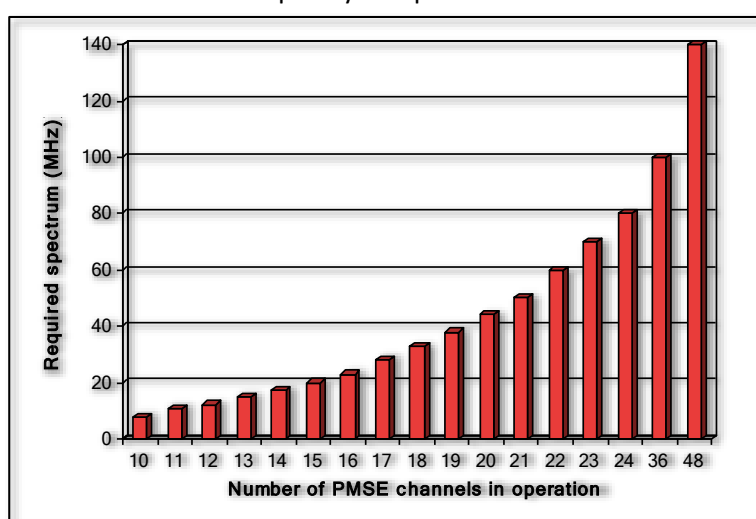
Basically, there are two usage scenarios

- a. radio microphone use only
- b. mixed use with talk-back links (In Ear Monitoring, IEM)

Relatively small duplex gaps normally prevent mixed use as described under point b.

The maximum number of PMSE links which could use parts of a duplex gap which provides sufficient quality with the type of PMSE technology used (analogue or digital technology, different performance criteria) can easily be calculated.

- Analogue PMSE devices which are used in a venue must always be operated in an intermodulation-free frequency setup:



- With a small number of links, digital PMSE devices can be operated in a linear grid over several 100 kHz. With a larger number of links, intermodulation products require larger protection distances.

Note:

PMSE manufacturers provide powerful software management tools for planning on-site use.

5) Useful reference documents

- ETSI, 2006, System Reference Document TR 102 546
- CEPT, 2009, CEPT Report 30 "The identification of common and minimal (least restrictive) technical conditions for 790 - 862 MHz for the digital dividend in the European Union"
- CEPT, 2013, CEPT Report 50 „Technical conditions for the use of the bands 821-832 MHz and 1785-1805 MHz for wireless radio microphones in the EU“
- DKE-AK 731.0.8 (DIN/VDE), 2012, „ LTE Interference potential to Microphones“
- DKE-AK 731.0.8 (DIN/VDE), 2013, „Study on audio PMSE spectrum usage“
- Technische Universität Braunschweig, 2013, „A study of future spectrum requirements for terrestrial TV and mobile services and other radio applications in the 470-790 MHz frequency band, including an evaluation of the options for sharing frequency use from a number of socio-economic and frequency technology perspectives, particularly in the 694-790 MHz frequency sub-band.“
- Institut für Rundfunktechnik GmbH, 2013, „LTE interference on analogue and digital PMSE devices“