

# Church Video Tips Blog Tips and stuff for people using multimedia

## Radio Microphones – Legal and Usable Frequencies

December 15th, 2010 by Andrew

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[<http://tipsblog.churchvideo.co.uk/wp-content/uploads/2009/10/wave.jpg>]

Here in the UK, we need to be careful about what frequencies we set out radio microphone [<http://www.churchvideo.co.uk/tag/microphone>] receivers/transmitters. Even if your radio mic set has 1,400 available frequencies only a few are usable legally without a license. Hopefully this page covers the basics and give some practical advise in using radio microphones.



Table of Contents
VHF or UHF?
Radio Mics or IEM?
Radio Microphone Frequencies:
Frequency Channels:
Free frequencies:
Purchasing Frequencies
Intermodulation
Intermodulation checkers:
Unlicensed/Free Frequencies in the Future
Example Sets of Usable Frequencies:
Other Links:
Closing Notes
Comments (6)

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### VHF or UHF?

Firstly, this page is about UHF microphones rather than VHF microphones. UHF (Ultra High Frequency) radios operate between 822 MHz and 870 MHz whilst VHF (Very High Frequencies) operate between 173 MHz and 220 MHz. Manufactures are tending to put less effort in to VHF systems, and pretty much your baseline system (eg from Shure, Sennheiser etc) will be using UHF. Cheaper systems may be using VHF, do be careful when buying cheap systems, as you really do get what you pay for – at least purchasing the entry level systems from the top brands is a good place to start – eg Sennheiser G2 series...

If you are using VHF, then all I can say is that these frequencies: 173.80 MHz, 174.10 MHz, 174.50 MHz, 174.80 MHz, 175.00 MHz will be the ones to use, as they are license exempt and can be used free of charge. (be careful with 174.80 as it tends to have intermod problems. If you want to use frequencies other than these then you will need a license (more info about Intermod and licenses below)

### Radio Mics or IEM?

Another thing to note, is that in this page I tend to talk about Radio Microphones, but the concepts apply to In Ear Monitoring systems too – as these use UHF. (IEM is where, rather than a ‘wedge’ speaker for the people up front, they have ear phones that are connected to a radio receiver, and they can monitor themselves that way). So, when your thinking about how many channels you need for your radio equipment, don’t just count your microphones, but count your in ear monitors too!

### Radio Microphone Frequencies:

The Sennheiser G2 series of microphones are fairly common in Churches – they are solid, reliable microphones that are in the professional bracket, all be it at the cheap end. A G2 can operate on 1,400 tunable frequencies, from 518MHz up to 866MHz – so how do you choose with frequency to use?

### Frequency Channels:

When radio frequencies are talked about, they are often referred to as their channel number, eg ‘channel 69’. Here is a simple table describing the channels that are often used for wireless microphones:

Channel	Frequency Range	Information
	450 – 469.999 MHz	Shared with lots of talkback radio systems, (only high end radio mic systems can access this band)
<b>Channel 21-34</b>	470 – 581.99 MHz	Shared with television, limited availability, used for fixed audio links as well as microphones
<b>Channel 35</b>	582 – 589.99 MHz	Shared with television, limited availability, used for temporary audio links as well as microphones
<b>Channel 36</b>	590 – 597.99 MHz	Shared with radar services
<b>Channel 37</b>	598 – 605.99 MHz	Shared with television, limited availability, used for temporary audio links as well as microphones
<b>Channel 38</b>	606 – 613.99 MHz	Radio microphones (Also shared with radio astronomy)
<b>Channels 39-68</b>	614 – 853.99 MHz	Shared with television also used for talkback systems as well as microphones
<b>Channel 69</b>	854 – 862.99 MHz	Radio Microphones and other point to point audio links
<b>Channel 70</b>	863 – 864.99 MHz	<b>License Exempt Radio Microphones</b>
	865 – 959.99MHz	Only high end radio mic systems can access this band

Data correct as of October 2009

As you can see, there are lots of frequencies, but **apart from channel 70 all of them require a license.**

## Free frequencies:

Channel 70, 863 MHz to 864.99 MHz are license exempt. This frequencies can be used without a license – remember though that lots of your neighbours may well be using these same frequencies so watch out for picking up other people’s audio!

## Purchasing Frequencies

You can purchase license to use frequencies. For about £75/year (or £135/2 years) you will be licensed to use up to 14 channels... The organisation that manages frequencies in the UK is JFMG. They will assign you frequencies to use that are specific for your area – this ensures that even if your neighbour purchases a license they will be given a separate set of frequencies and you won’t clash. If you use frequencies out side of Channel 70, then you are committing an offence under the Wireless Telegraphy Act! More info from <http://www.jfmg.co.uk> [<http://www.jfmg.co.uk>]



## Intermodulation

When multiple frequencies when used together, eg if you have more than one radio [microphone](http://www.churchvideo.co.uk/tag/microphone) [<http://www.churchvideo.co.uk/tag/microphone>], the frequencies can sometimes form additional frequencies that are outside the original ones used and cause problems – it’s best to avoid this and therefore pick your frequencies carefully. This is called intermodulation, or intermod for short! It’s worth noting that you can mix UHF and VHF systems without having them interfering with each other as there is a big enough gap between the UHF and VHF frequencies.

## Intermodulation checkers:

There are [software](http://www.churchvideo.co.uk/category/free/software) [<http://www.churchvideo.co.uk/category/free/software>] programs that you can purchase, however Audio Technica have a [free online checker](http://ff.audiotechnica.com/using/wireless/compat/) [<http://ff.audiotechnica.com/using/wireless/compat/>] that is simple to use from their web page. Also, Sennheiser have a [intermodulation software](http://www.churchvideo.co.uk/category/free/software) [<http://www.churchvideo.co.uk/category/free/software>] program that you can download: [Sennheiser](http://sennheiser.co.uk/uk/home_en.nsf/root/professional_wireless-microphone-systems_sifm-software) [[http://sennheiser.co.uk/uk/home\\_en.nsf/root/professional\\_wireless-microphone-systems\\_sifm-software](http://sennheiser.co.uk/uk/home_en.nsf/root/professional_wireless-microphone-systems_sifm-software)].

## Unlicensed/Free Frequencies in the Future

As already said, channel 70 (863 -864.99MHz) is unlicensed and will be remaining so after 2012. The debate Ofcom are having at the moment is regarding Channel 69, and selling those ranges off... the question is, what happens to wireless microphones that are currently licensed to use Channel 69?

## Example Sets of Usable Frequencies:

Here are 2 example sets of 4 usable frequencies in the free/unlicensed bands (channel 70) that have been tested for intermodulation:

<b>Mic 1</b>	863.250 MHz
<b>Mic 2</b>	863.750 MHz
<b>Mic 3</b>	864.625 MHz
<b>Mic 4</b>	864.990 MHz
<b>Mic 1</b>	863.100 MHz
<b>Mic 2</b>	863.900 MHz
<b>Mic 3</b>	864.500 MHz
<b>Mic 4</b>	864.900 MHz

If you are wanting to use more than 4 radio microphones then you have no choice apart from purchasing a license.

You would only use one of these groups – choose either the blue or the green group! – or find your own set of frequencies that don’t have an intermod problem.

## Other Links:

This page is an amalgamation of other resources I have collected and compiled and tried to re-write in an easy to understand way, here are some other links to further your reading:

- **A Discussion:** <http://www.worshipcentral.org/forum/topic/microphones?page=2>
- **Intermodulation:** <http://en.wikipedia.org/wiki/Intermodulation>
- **Channel 69 sell off comment by Sennheiser:** <http://www.theaudiofiles.net/2009/05/uHF-frequencies-what%E2%80%99s-happening/>

## Closing Notes

This information was compiled from various resources and is thought to be correct at the time of writing (October 2009) – this information doesn't come with any guarantees, but do use it for informational purposes.

**Please do leave a reply below with other information, feedback etc!**

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2. [DreamScens – a Source of HD Video Loops](#) It's probably old news to some – I'm still sticking to Windows...

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*David*

*November 17th, 2009 at 12:09 am*

This is one of the clearest accounts of the situation on the net.  
Maybe worth adding that existing equipment on Channels 69 and 70 is ok without a licence until Jan 1st 2012. After that, Channel 70 will still be free but will only have 4 usable frequencies and could be useless if other users (other churches, theatres, clubs etc.) are in range.  
With 7 radio mikes I reckon I shall use four on Channel 70 (free) and three will need licences from 2012, and the calculators on the JFMG website suggest £28 per frequency every year for typical church use.  
Other countries are treating the electromagnetic spectrum as a common good but Ofcom want no such thing as a free frequency.

[Reply](#)



*Andrew*

*November 17th, 2009 at 8:42 am*

Thanks for the comment David – With recent news stories (ie Radio 4 news 16nov 09) I think I'll add some more information about the changes afoot...

[Reply](#)



*David*

*November 16th, 2009 at 10:12 pm*

Thanks for this helpful article which I only discovered after buying two AKG WMS40 Pro Dual Hand-Held microphones (Total cost £179 from Millenium Music). Fortunately, they operate within CH70 and have proved a great success in our church for presentations and audience participation. Large distances from receiver but no dropouts, and up to 30hrs use from a single AA battery! IMHO these perform well in excess of their price point and are just as good as Audio Technica products at more than three times the price.

[Reply](#)



*Bernard*

*November 9th, 2009 at 12:03 pm*

I am a bit confused, you mention that the free frequencies are from 863MHz to 864.900MHz but later on you say 865MHz is included in the free band. Can you clarify if 865MHz is in the free band please. If it isn't, your first example set of 4 frequencies needs amending to not include 865MHz.

[Reply](#)



*Andrew*

*November 9th, 2009 at 2:08 pm*

@Bernard, Ah yes, there could be some rounding up happening here – I'll double check the figures and will update the page, I'll let you know when it's done.

[Reply](#)



*Bernard*

*November 11th, 2009 at 9:58 am*

Thanks for clarifying and correcting your data.

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