008. A WARNING ABOUT 8.33KHZ RADIOS.

Tijl Schmelzer – aboutgliding.com

The telephone rang at the Klippeneck competition office.

On the line was the air traffic control of Zurich-Kloten. Two glider pilots were blocking the tower frequency of the international airport with continuous chatter. These pilots did not react to the calls from the ATC to leave the frequency. As a consequence, airliners approaching Kloten got in communication difficulties, and they were forced to activate an emergency-backup frequency.

From their information, they knew that the gliders were flying over the Swabian Alb. As it was a busy Sunday with fantastic weather, there were hundreds of gliders flying in that area. So, the ATC looked on the internet for gliding activities on the Alb and contacted all competitions and the main airports in that area, in the hope to establish contact with the offending glider pilots that way.

The ATC were clear, that they were close to sending an aircraft to the area, capable of tracking the radio source, and thus identify the gliders. If that were to happen, the consequences would be severe for them. In the end, luckily for both pilots, they decided not to do this.

The chatter did not end that day, so the main tower frequency remained blocked. But the next days there were no incidents anymore. Either because the glider pilots were not flying, or because the story had reached them as well.

According to my information the pilots were never identified.

But how could this have happened? Why did these pilots not react to the calls from the ATC?

Our new radios work very differently

Since the beginning of 2018, 8.33kHz radios became mandatory. These radios work very differently from the 25kHz we were used to for many decades. Although this has been communicated via various channels, this still is not clear to a very large number of pilots.

The problem is the following:

- The frequency on the screen is not the actual frequency the radio uses.
- There is overlap between frequencies.

25kHz radios are simple

In our old radios, you selected one of the 760 frequencies from 118.000 till 136.975Mhz. That frequency on you screen corresponded to the frequency the radio used as the carrier frequency. There was also no overlap, and thus no interference with neighboring frequencies.

If you selected for instance 122.050, you would hear everyone on that frequency, and nobody from the neighboring frequencies 122.025 or 122.075.

Simple, and error-proof.

8.33kHz radios are not strict 8.33kHz radios

To increase the number of channels, the 25kHz spacing was reduced by a factor of 3 to 8.33kHz. Thus tripled the amount of channels from 760 to 2280.

To assure backward compatibility to the 25kHz frequencies, our 8.33kHz make it possible to use both (thus why you have 3040 frequencies instead of 2280 in your radio). To enable this, they had to detach the number your radio displays (and thus the frequency your radio selects), from the actual carrier frequency the radio uses.

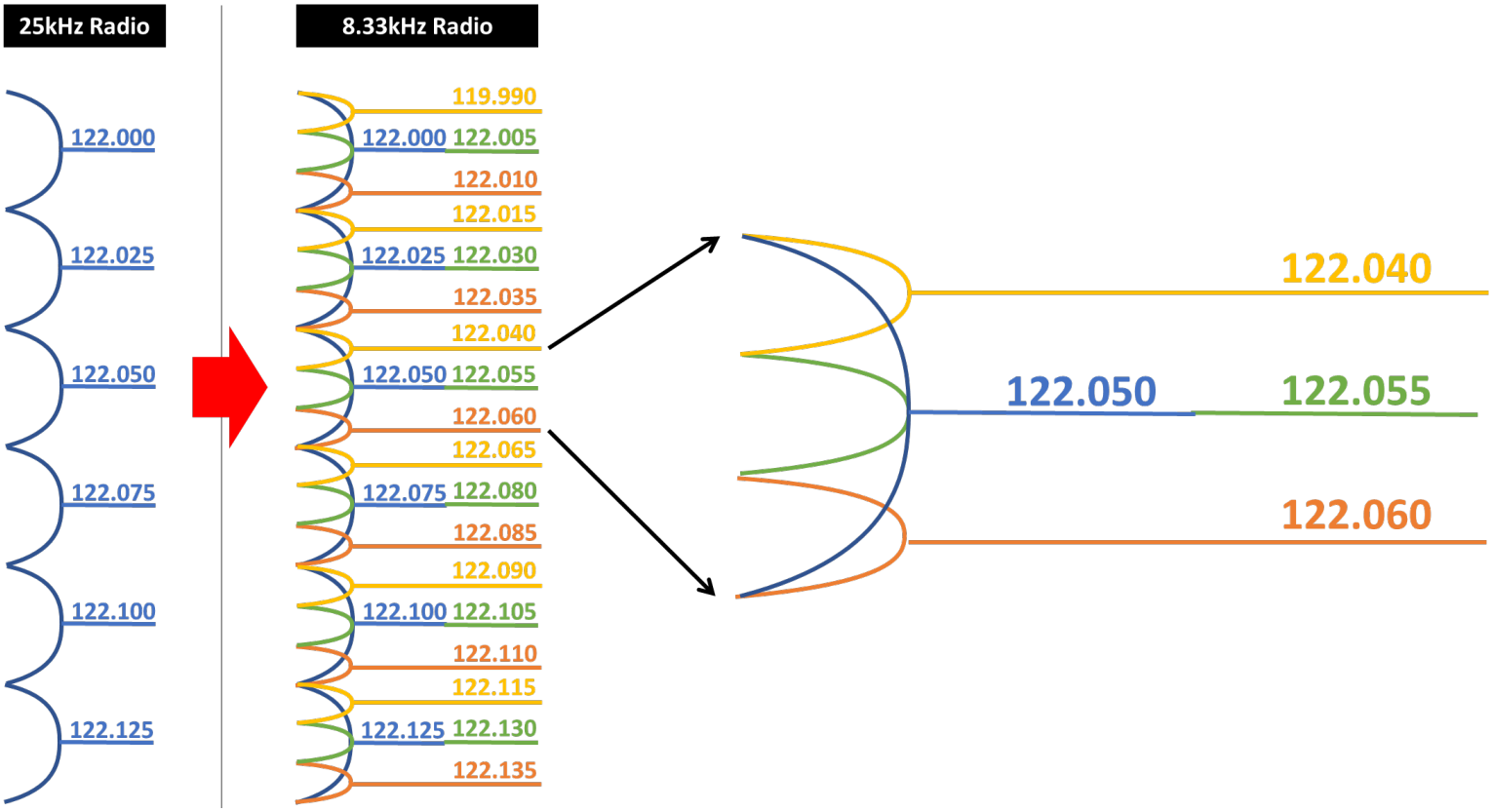
As an example, if you select in your new 8.33kHz radio the frequency 122.050, you have selected an old 25kHz frequency. The actual carrier frequency thus equals the displayed number: 122.050kHz.

However, if you select 122.055, this is a new 8.33kHz frequency. The actual carrier frequency is NOT 122.055, but 122.050, which is the same as the carrier frequency of the previous frequency. The only difference is the bandwidth: 8.33kHz vs 25kHz.

And that is where the problem lies: these old 25kHz frequencies thus overlap with the new 8.33kHz frequencies. To be precise, a single 25kHz frequency overlaps with 3 8.33kHz frequencies: one lower and 2 higher.

122.050 (25kHz) overlaps with

- 122.040 (8.33kHz)
- 122.055 (8.33kHz)
- 122.060 (8.33kHz)



FROM ANOTHER PRESENTATION:

How it used to be

How it is in your new radio

Each 25kHz frequency conflicts with 3! 8.33 kHz frequencies

Old 25kHz radio	New 8.33kHz radio				
	Dial selection			Real TX/RX frequency	
Frequency	Dial	25kHz Frequency	8.33kHz Channel	Frequency (Mhz)	Spacing (kHz)
118.000	118.000	118.000		118.0000	25
	118.005		118.005	118.0000	8.33
	118.010		118.010	118.0083	8.33
	118.015		118.015	118.0167	8.33
118.025	118.025	118.025		118.0250	25
	118.030		118.030	118.0250	8.33
	118.035		118.035	118.0333	8.33
	118.040		118.040	118.0417	8.33

What your display shows

What you actually get

Why that overlap brings trouble

If you select any frequency on your 8.33kHz radio, this interferes at least with 1 other frequency.

A single 8.33kHz frequency interferes with one 25kHz frequency.

A single 25kHz frequency interferes with three 8.33kHz frequency.

You can easily test this: take a radio, set it at a 25kHz frequency. Then take another radio and set it at one of the overlapping neighboring 8.33kHz frequencies. When you push the PTT on one of those radios, you will *likely* hear it on the other radio. This would not happen on two old 25kHz radios.

I used the term “likely”, since this interference is not 100% predictable in practice. It really depends on a number of factors: the technology in the sending radio, the technology in the receiving radio, the distance between the radios, shielding between the radios, the orientation of the radios, and even the weather.

It’s perfectly possible that one radio set at 122.050 will receive the broadcasts of another radio set at 122.060, but not the other way around. The opposite is also possible as well. And it is possible that both hear each other, or that none of the two receive each other.

And that is the problem with the 8.33kHz radios:

With 8.33kHz radios, if radio user Alice is communicating on a certain frequency with another radio user Bob, they have no possibility to know with 100% certainty that another radio user Carol, who is using an overlapping frequency, is not hearing everything they say, but cannot communicate back to them.

Normally, the authority who has granted a frequency to an airport, has checked if there are no other users of that frequency close by. In this way, there should be no interferences between operations of different airports. However, that frequency might very well be used by another airport further away, outside of each other’s normal radio reach.

Some pilots who fly from smaller airfields use that frequency to communicate with each other during cross country flying. If they would get within reach of another airport that uses that frequency, they would be able to communicate, and immediately stop using the frequency for their chatting.

With the new 8.33kHz frequencies, when you are using your home airfield frequency to chat to other pilots, it can happen (and it will happen), that you get into radio reach of another airport with an overlapping frequency, and that they can hear everything you say, but they can not reach you.

So, ***you can not use your home airfield radio frequency for communicating with other pilots while cross country flying.***

Also, in the past, some pilots were used to using an “empty” frequency for communicating to each other. This was never legal. But now, you have no way of knowing if it is disturbing any of the neighboring overlapping frequencies. So, ***you absolutely can not do that anymore.***

Back to the incident from the opening paragraph

I know of a few cases where this issue has led to a variety of incidents in the past year.

It is highly likely also the cause of the situation with Zurich-Kloten tower. The two glider pilots were likely chatting on an 8.33kHz frequency adjacent to the 25kHz frequency of the airport. Perhaps they were using a frequency they thought was empty? Or perhaps they were using their home airfield frequency, but far away from their homes while flying cross country?

Anyways, it needs to be said to be extremely careful with this.

First of all, it can endanger other people. Blocking the main frequency of a major airport can lead to major communication issues and thus potentially even accidents.

Secondly, it is illegal to use radio equipment in an unlawful way and can lead to a lot of troubles if caught: loss of license (radio license and pilots license), legal proceedings, the bill of the disturbance that was caused, fines, and in some countries even prison sentences.

Being caught is not impossible. The frequencies of major airports and flight information services are permanently recorded. If you communicate, you use a lot of identifying information, such as names, call-signs, locations, etc. That can be used to track you down.

Major airports also have homing devices installed, which are used to guide airplanes who are lost. Using homing data combined with another datasource, such as transponder-data, flarm/glidernet, onlinecontest or skylines, and soaringspot or strepla, could in principle point to the offending planes.

And finally, planes with radio direction finders aboard could be sent up, to track down the emitters of the broadcast directly.

What should be done?

- Just taking an “empty frequency” is not possible anymore.
- Using your home-airfield frequency in another location to talk to each other in the air is not possible anymore.
- The creation of multiple dedicated glider cross-country frequencies should be supported.
- Each 25kHz frequency blocks three 8.33kHz frequencies, thus urge your own airfield/club to change their frequency to an 8.33 frequency.