The force of microphone anxiety

It's time for changes.!

An insight in the history of a man with a dream, a mission, a leap of technology and the marvellous world of acoustics – It's time for changes.

For musicians, sound technicians and people alike!

The challenge

Occasionally, it can be a daunting task for musicians and sound technicians to amplify acoustic instruments. In the following article, we will attempt to demystify a series of issues and misunderstandings in regards to live sound. These issues and misunderstandings often culminate in musicians and sound technicians having to compromise. Unfortunately, the effort from even extremely talented musicians is often lost, when the sound has to be reproduced.

Furthermore, many people have asked for material comparing data for "Gain before feedback" for REMIC's microphone models, and compared to data from competing products.

Therefore, we have collected a series of data in the form of mean values, which is entered into 2D models, in order to be easily compared.
For legal reasons, REMIC is not allowed to give out the names of competing producers and their respective products used in the aforementioned models of comparison. There has been selected 5 products from leading producers of instrument microphones, whose set of data is illustrated in a compiled column.
In this particular article, we have selected to focus on data in regards to microphones for the violin.

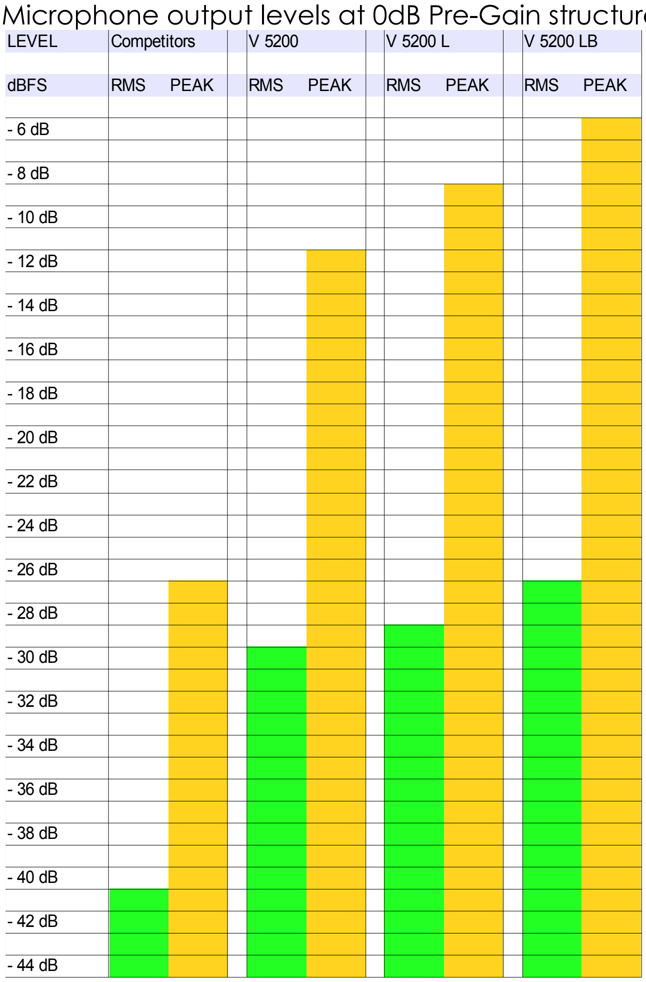
In the subsequent article, we will delve into REMIC MICROPHONES' model "L", which assumes characteristics between the "00" (studio)model and the "LB" (live)model. Model "L" will be launched in the beginning of 2015.

All measurements in the following article have been carried out in the same ambient and reflecting environment (live situation) with the microphone in question mounted upon a violin.

OUTPUT LEVEL

In the model below, "output level" is compared between a series of competing "clip-on" instrument microphones and the three REMIC variants (Gain has, in all cases, been set to "0dB").

Microphone output levels at 0dB Pre-Gain structure.



AMBIENT SUPPRESSION

In the model below, the ability to suppress ambient noise is compared between a series of competing "clip-on" instrument microphones and the three REMIC variants.

Gain has been individually adjusted for all microphones in order for the output to be found identically at "0dB" when the instrument is played.

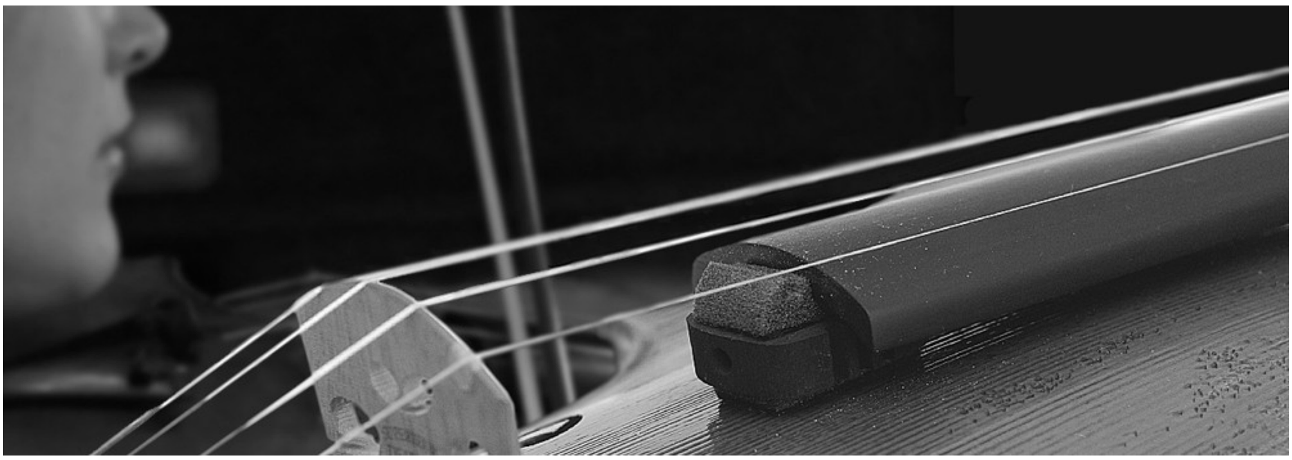
MIC. OUTPUT LEVEL & FEDBACK SUPPRESSION

The model below compares the maximum output of the source signal (the sound of the instrument), before acoustic feedback occurs for the individual microphones.
(Gain set to -6dB under ACOUSTIC POINT OF FEEDBACK. Measured at 102dBA for current setup @ V5200LB).

The maximum output Level of captured instrument sound, before feedback occurs, (With Gain adjust, -6 dB below point of feedback. Point of feedback for the actual setup was measured 102dBA @ V5200LB).

Result

The results shown are mean values based on measurements in different live contexts. For this reason, the differences in practise may vary slightly.
It is, however, very clear that REMIC microphones assume the best "gain before feedback" and thereby the largest dynamic headroom in a live context.
It is in no way encouraged to play louder than necessary on live productions, merely because the REMIC microphones allow this. However, the technician gets a significantly better opportunity to bring forth the solo instrument in the mix (without tunnel-effect and subsequent feedback), and simultaneously have different microphone channels enabled, without the mix in its entirety becoming a muddy clash of sound.



REMIC MICROPHONES model V5200 mounted on a violin.

Directional microphones (true to tradition!)

Through the course of time, many microphone producers have recommended the use of instrument microphones with directional characteristics, such as cardoid, supercardoid or hypercardoid, in connection with the amplification of acoustic instruments in live concerts. These are used in order to avoid or reduce acoustic feedback.

However, the real challenge is that a microphone with one of the above mentioned directional characteristics, does not act the same way in an anechoic …. setting as it does in a live setting. Many sound technicians and musicians are aware of this, and have simply learnt to work under these conditions. It has, quite frankly, become a tradition - by means of many acoustic textbooks and articles describing and recommending - that one should utilize directional microphones in such live conditions. It is important to remember, that the real world is not a laboratory or an anechoic chamber. These theories are well-intentioned, but let's take a look at what happens in reality.

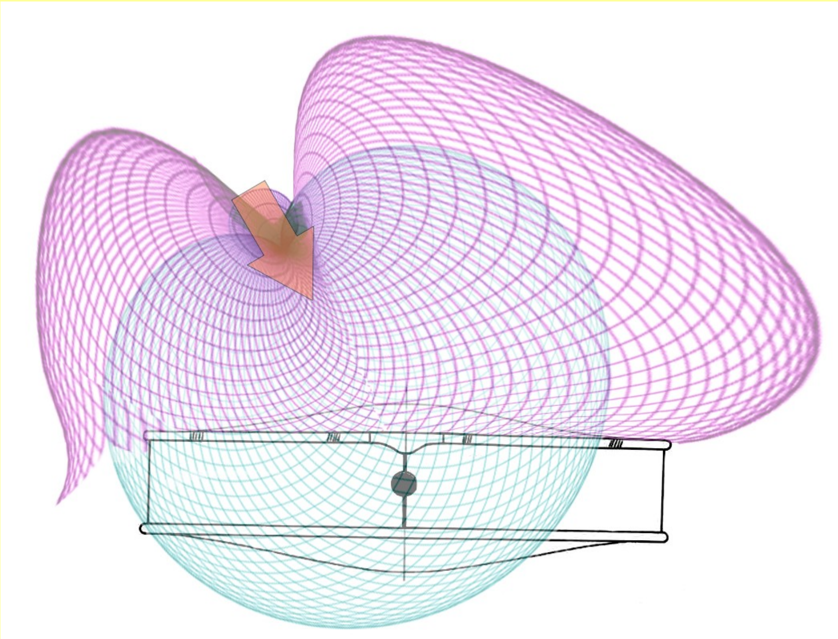
In reality

The mere fact that a directional microphone in practise is mounted pointing towards the soundboard at a distance of just 5 to 10cm, should be a cause for concern. This creates an acoustic parabolic effect between the microphone and the instrument, which in practise causes the polar pattern of the microphone to deviate significantly from the characteristic measured under anechoic conditions. This creates a totally different and and indeterminable polar pattern, which creates many unnecessary challenges for musicians and sound technicians worldwide.

When polar patterns of instrument microphones are measured in anechoic conditions, the microphones are not mounted upon the given instrument, and a hard surface is not placed 5 to 10cm from the front of the microphone. It is already clear from this approach, that the characteristic of the microphone will vary significantly from anechoic measuring to practise.

It has never been the custom to utilize simulated "live" setups for these types of measurements, in spite of it being logical, seeing as it is under these conditions the microphone is to be used.
REMIC MICROPHONES is the only company to conduct simulated live-test measurements as well as real-live-test measurements.

In the model below, the polar pattern of a commonly used instrument microphone with a supercardoid characteristic is compared by:
[Blue] measured in open field* vs [Red] measurement of same microphone, but mounted upon a violin. (violin seen from tailpiece). The arrow indicates the placement and direction of the microphone.



*The blue figure shows the polar pattern of the microphone measured in an anechoic test chamber (without being mounted upon the instrument).

The model above is based on calculated mean values, and exclusively serves the purpose of illustrating the difference between the polar patterns of a microphone with a supercardoid characteristic measured in open field and the same microphone mounted upon a violin.

Naturally, these models can be tricky to decipher and understand, so let's provide you with a practical example. Many violinists have experienced to be on stage in front of a monitor, where a great sound has been engineered and without feedback.

But as the violinist moves just 10-15 centimeters to one side, the venue is suddenly filled with a well-known and intense howling noise, where millions of air molecules suddenly agree that it's to party.
A feedback has been established. The violinist decisively looks up at the sound technician and sends him a look that cannot be misinterpreted. The technician rapidly looks at the mixing console and looks back at the violinist with a wondering look: "Why did that happen? We're using the right type of microphone!".

The characteristic of a directional microphone mounted in a given angle to the hard surface – such as the soundboard of an instrument – assumes a quite indeterminable polar pattern, where some points repress the ambient environment, whilst other points boost the environment. In some cases, a boost or additional self-amplification of ambient sound-sources may arise, as a result of the resonant instrument body.

This might be difficult to understand, so let us reverse the function.
Let us exchange the microphone (mounted on the instrument, facing toward the soundboard) with a small directional speaker, that sends out sound directly toward the soundboard of the instrument.
The air molecules who are affected by the speaker, will now hit the surface of the soundboard and are afterwards thrown in all directions, because of the crooked surface of the board.
The actual "throwing-pattern" is extremely unpredictable, and can be manipulated by changing the distance and angle of the speaker in regards to the soundboard.

It is often helpful to looks for the 'simple' in the 'complex', provided this is still problematic to comprehend. Have you ever turned on the faucet in the kitchen, and failed to notice the spoon lying in the sink, exactly where the water hits? The water from the faucet, the otherwise directional jet, hits the surface of the spoon, which causes numerous jets of water to spurt out in different directions, eventually soaking you.

With this knowledge, it is daring initiative to utilize a directional microphone facing towards a hard, plane or bent object (such as in front of the soundboard on an instrument) in a live context, in order to maintain the necessary and quite unpredictable challenges to skilled technicians on live productions.

But it doesn't have to be like this!

REMIC MICROPHONES has since 1996 developed a series of new microphones and microphone technologies in close collaboration with instrument builders, musicians and sound technicians alike, in order to meet the demands of contemporary professional users.

With these new technologies developed by REMIC MICROPHONES, the well-known and problematic challenges in regards to acoustic feedback, have been largely rectified. The same is applicable in regards to interference between instruments. The string-players in the orchestra pit are situated very close in many theatres and concert houses, which makes instrumental interference a well-known phenomenon. These new technologies are able to help the sound technician an extremely long way.

Aarhus Symphony Orchestra during rehearsals for "Pirates of the Caribbean", in which all strings are equipped with REMIC microphones.

New calculation models

Generally, all REMIC products are developed on the basis of functions for linear and non-linear energy displacement processes.
By utilizing such calculation models, we bypass a series of limitations connected with the older and more common calculation models seen in the common school of acoustics.
Each displacement, be it rotation or acceleration of individual air molecules, are seen as changes in energy. In practise, this makes it easier to think outside the box, and create a set of microphone tools with the ability to fulfill the demands set by today's professional users.

With these new calculation models, and an intricate knowledge of different acoustic instruments' model of operation, we've come a long way.

REMIC MICROPHONES has established a close collaboration with instrument builders, musicians and sound technicians, in order to create the most effective microphone tools and further develop these.

The Larsen effect

However, this is not the be-all and end-all. Acoustic feedback is still something that can occur. But by utilizing REMIC microphones, one can amplify the signal far more, than with other microphone technologies, before this phenomenon occurs. On a sidenote, the feedback phenomenon was first discovered and described by the Danish physicist Søren Absalon Larsen (1871 – 1957) and in earlier literature refered to as the "Larsen effect".

However, many factors are at play here; the instrument, strings, bow, the playing technique of the individual, the amplifier of the musician, scene-monitors, PA and last but not least, the nature of the speaker system.

An integral part of the raison d'être of REMIC, is to bind two worlds together; the world of musicians and the world of acoustics.
In publishing this material, we hope to be able to create a constructive debate concerning the choice and utilization of instrument microphones in a live context, that can help bring us closer to our goal: to tirelessly create and develop microphone tools that do justice to the instrument as well as the musician.

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