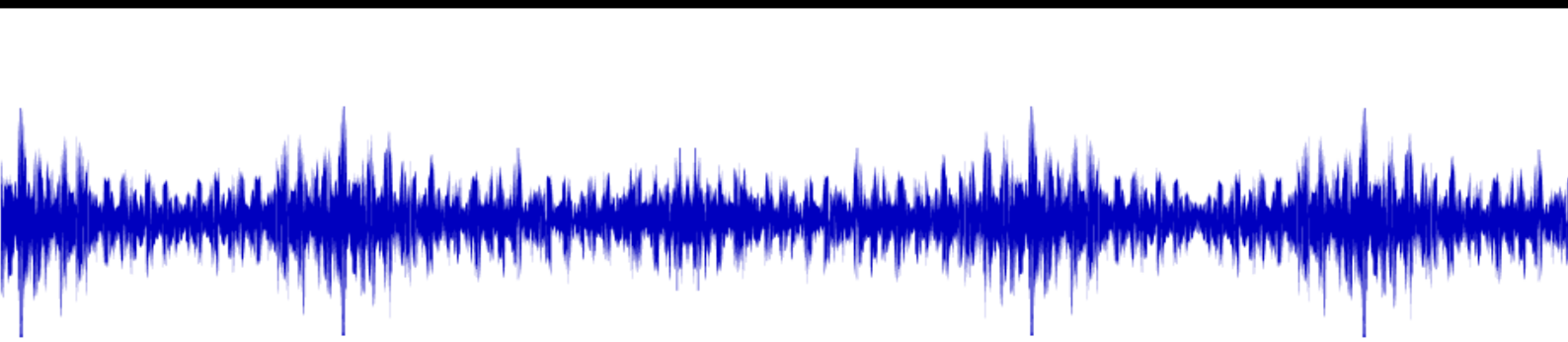

SOUND CONTROL MANUAL

For use by Sound Control Officials

in conjunction with the current G.C.R's

1st Edition – January 2013

Motorcycling Australia

MOTORCYCLING AUSTRALIA

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Overview

Motorcycling Australia (MA) and its State controlling Bodies (SCBs) are committed to our sport through development and promotion of programs which incorporate the principles of sustainability in motorcycle sport within Australia.

Whilst focused on reducing our environmental footprint, and taking responsibility for the way motorcycle sport is conducted we also want to secure the future of our sport for following generations by ensuring sustainable noise management controls are implemented and other environmental management controls remain effective.

MA and the SCBs are taking noise issues very seriously and we aim to proactively deal with these issues, which can at times be complex.

This Sound Control Manual aims to provide a practical framework to assist Motorcycling Australia (MA), its State Controlling Bodies (SCB's), affiliated clubs and members in the management of noise emitted during motorcycle activities and events.

Concerns regarding noise at motorcycle events are not limited to the machines themselves. In addition to the expected engine noise, organisers and environmental officials must be aware of the magnitude of sound from public address systems, crowds and other sources associated with an event.

Minimising excessive noise associated with motorcycle activity and taking public reaction to sound levels in consideration is the responsibility of all concerned: riders, clubs, organisers and all officials.

The manual focusses on how to assess and manage the noise issues including the testing of motorcycles and provides details on the new noise testing procedures.

The 2013 Manual of Motorcycling (MoMs) noise emission specifications are based on a new noise measurement method called "2 metre max" which aims to significantly reduce noise omissions from facilities.

This document is to be used in conjunction with the current GCR's.

Acknowledgements

This document was developed by Derek and Katherine Rumble for use by Motorcycling Australia to train Officials in noise control. This document cannot be altered or used beyond the purpose of training officials without the express permission of MA, Derek and Katherine Rumble.

Derek and Katherine also wish to acknowledge the input from Farad Ashari (Bruel & Kjaer), Ben Groothoff, and the use of FIM and MA manuscripts.

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1. Introduction to Sound

Concerns regarding sound at motorcycle events are not limited to the machines themselves. In addition to the expected engine sound, organisers and environmental officials must be aware of the magnitude of sound from public address systems, crowds and other sources associated with an event. Minimising excessive sound associated with motorcycle activity and taking public reaction to sound in consideration is the responsibility of all concerned: riders, clubs, organisers and all officials.

1.1 Sounds of motorcycles

Sound is a measurable phenomenon created when a source, such as a motorcycle engine, causes the air to vibrate. In contrast, noise is an individual interpretation of the impact of that sound. A sound enjoyed by one may be annoying to another. Motorcycles with high sound levels are almost always considered noisy. The Sound Control Officers (SCO) must understand the difference between the two and how sound is quantified.

The decibel (dB) is the unit used to express sound pressure levels and they are measured on several scales.

Motorcycle sound is tested on the "A" weighted scale and is expressed as dB(A). Sound pressure levels increase at a logarithmic rate (very quickly) while the human ear interprets that increase more slowly. As a consequence, each time the number of identical sound sources is doubles (as with many motorcycles at the starting line), the sound pressure level measurement is increased by only 3 dB(A).

Sound levels decrease as the distance from the source increases. A doubling of the distance from the source to the ear causes a loss of 6 dB(A). Temperature, elevation, humidity and the frequency of the sound waves also contribute to the rate of energy loss. Such things as foliage, uneven ground and large obstacles, such as walls, structures or embankments will reflect sound and affect sound levels in the immediate area.

The FIM (Federation Internationale Motorcycliste) recommends:

- To avoid all unnecessary running of engines and;
- To reduce as much as possible the noise levels for all activities and events and ensure that all applicable regulations are respected.

1.2 Sound or Noise?

Motorcycle racing and their venues are under ever increasing pressure, especially in locations and areas with increasing population density.

A major cause is the sound produced by motorcycles, which may be music to the ears of the rider and enthusiast but is regarded as noise by many others and is therefore experienced as disturbing.

For us to be able to enjoy and participate in motorcycle racing in the longer term, the people engaged in these activities must have a thorough understanding of the sound aspect. In this chapter the phenomenon of sound is therefore dealt with in depth.

1.3 What is Sound?

Sound is a physical phenomenon which can be characterised as successive fluctuations of the pressure around the atmospheric pressure. These variations can differ in intensity, or they can follow each other more of less rapidly. The

magnitude of the fluctuations (with respect) to the atmospheric pressure) is referred to as the intensity of the sound or the sound pressure; it is usually measured in decibels.

The time between two fluctuations determines the pitch or frequency of the sound, this is measured in Hertz.

The “sound” from a certain source is usually composed of a multitude of sounds, each with its own pitch. This constitutes what is referred to as a sound spectrum.

1.4 How is Sound produced?

Sound is produced if a source (e.g. a guitar string or a running engine) sets the surrounding material, the sound box or the air, into vibration. The vibrating object knocks against particles, each of which knocks against the adjacent particles so the vibrations are passed on and spread out.

The ease with which this occurs depends on the type of material. Vibrations propagate easily in metals, but in air it is more difficult; this phenomenon is expressed as the propagation speed. Sound travels through air at about 340 m/s (765 miles/hr, the speed of sound or ‘sound barrier’).

1.5 How is Sound measured?

We could compare sound with waves in the water; a boat passing by sets the water in motion in the form of waves. If the bow wave hits a boat moored to the bank, the latter is rocked, which requires energy: apparently the wave carries energy. The wave exerts pressure on the moored boat; the pressure decreases as the wave passes and increases again as the next one approaches.

Vibration causes pressure fluctuations; if waves follow each other rapidly the frequency is high, and a high wave causes a large pressure fluctuation and thus produces much energy.

Throw a stone into the water and you will see that the wave height (pressure fluctuation) decreases as the wave travels further outward. The same occurs with sound.

The pressure transferred by a sound wave can be measured. A number of practical conversion methods have been developed, which give a reasonable impression of the relationship between sound pressure and pitch on the one hand and the ‘impression’ of that sound on the other. Usually a special conversion method, called the A-characteristic, is used to correct the sound of traffic etc. for variations in sensitivity. The influence of the low frequencies (about 1000 hertz) and the relatively high ones (about 10,000 hertz) is reduced by this method.

A sound pressure level measured in this way is no longer expressed in decibels but is described as ‘decibels-A’, abbreviated as dB(A).

An important aspect of measuring in dB(A) is that this unit is in fact a specific conversion (logarithmic transformation) of the effective pressure of the sound in question, related to a certain reference level.

The significance of this can be demonstrated with the following example. Suppose that someone stands near a racing track and hears a motorcycle passing by; the sound pressure of the sound at the spot where he is standing is, say 80 dB(A). Now suppose that two such motorcycles, travelling side by side at the same speed, subsequently pass our observer. Each of them separately would produce a sound pressure of 80 dB(A), BUT together they produce not 160dB(A), as one might think, but about 83 dB(A) because of the conversion mentioned above. Two equally load sources, located next to each other (doubling of the pressure) lead to an increase of 3 dB(A) in the sound pressure.

So far we have talked about sound as if this were a homogeneous category, in the sense that all sound of a similar dB(A) level would be of equal importance to a person.

However, sounds differ in the significance they may have for a receiver. Some sounds serve as a signal that people are keen to receive (the crying of one's own baby), whereas others are not particularly welcome (the crying of the neighbours' baby). Apparently a distinction should be made between desired and undesired sound. Undesired sound is described by the receiver as sound; one speaks of sound nuisance when a person exposed to sound experiences this sound as undesired. In principle the relationship between a certain sound and a certain person is therefore subjective.

1.6 Reducing sound levels

Since sound is caused by vibrations, sound reduction is vibration reduction. With motorcycles, vibrations are caused in the first place by combustion gases which leave the exhaust and continue in the open air. But the vibrations produced and propagated by the cylinder wall and cooling fins and by other (revolving) parts of the engine contribute as well.

The exhaust sound of motorcycles depends largely on the power of the combustion and the shape of the exhaust (and the air intake), so the engine tuning is a major determining factor in the sound produced. Further more, the mixture composition and atmospheric humidity, for instance, are important as well. Thus it is possible that two identical engines show different sound pressure values, or that one engine gives a somewhat different value on another (practice) day. It is therefore very important that silencers are developed as part of the engine tuning.

A silencer will 'wear', due to the vibration forces and the gases flowing through it, so that regular maintenance or timely replacement is necessary to keep it working properly.

This is especially important at training facilities and club races, where the motorcycles used are often relatively old and no longer subjected to the regular sound checks at national or international races. Owing to a lack of information, club riders often do not know how much sound their machines produces and they do not worry about it. Adequate information and regular sound measurements can prevent the authorities from taking measures which may even cause a facility to be closed.

It is usually much easier and cheaper to take measures to reduce the sound at source than to take other measures such as constructing sound barriers and/or excavating the track site. Another source not to be forgotten is the public address system of a facility, which may also provide a major contribution to the sound nuisance to the people living in the neighbourhood.

1.7 Sound systems

The sound system often causes more annoyance outside the track area than the actual event. Make arrangements with the people in charge of the sound system to reduce the sound volume between races/practice sessions. To reduce the impact of sound systems the following should be considered:

- Separate public-address systems for riders' paddock and the public area are preferable;
- Position of loud-speakers: slanted towards the ground and directed towards the center of the track or the course;
- Maintain sound level as low as possible and;
- The whole system must be ready and tested 30 minutes before the start of the practice.

2. Sound Testing Equipment

2.1 Minimum requirements

- TYPE 1 or TYPE 2 Instruments
- International Standard IEC 651
- AS 1259.1
- Range 70 – 130 dBA
- Suggested standard equipment for use in Australia
- Tecpel DSL330 Sound Level Meter
- Tecpel DSL336 Sound Level Calibrator
- Tape Measure
- Adjustable Tripod
- Thermometer / Anemometer
- Hearing Defenders
- Sound Report Cards / Forms

2.2 The Sound Level Meter (SLM)

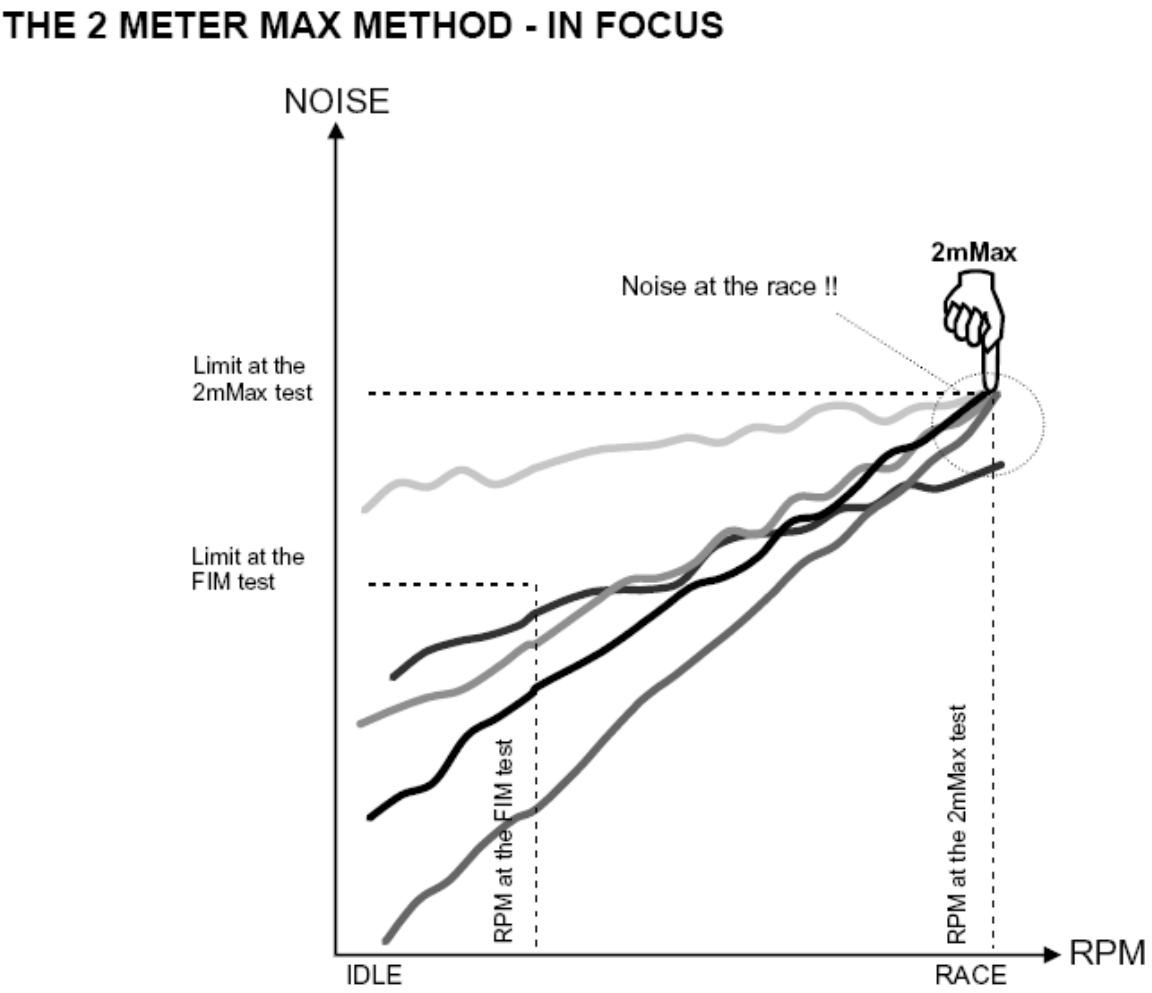
Sound Level Meters fall into several international standards.

Type 1 SLM is accurate to within +/- 1dBA, so an allowance of 1dBA is deducted.

Type 2 SLM is accurate to within +/- 2dBA, so an allowance of 2dBA is deducted.

These deductions ensure no one is disadvantaged by a SLM reading high or low.

3. The Operating Procedure



The “2 metre max” method will consist in quantifying not only the sound level produced by the silencer of the exhaust, but the maximum global sound level achieves by the motorcycle when the engine rpm’s are raised to the maximum engine speed, limited by

- ⇨ natural regulation for 2T, or
- ⇨ rev limiter for 4T

3.1 The preparation of the sound meter

For all FIM Championship-and Prize events, a sound meter Class 1 (type 1)

is required to measure the sound levels. For all other events, a sound meter of Class 1 or 2 (type 1 or 2) are required.

- Activate the ‘A’ weighing
- FAST time weighting must be activated
- Select range High 80~130 dB

- Calibrate the sound meter at 93,5 dB or 113.5 dB to take into account the incidence of the wind foam ball.
- Place the wind foam ball on the microphone
- Activate the function MAX MIN – set on MAX

3.2 The set up of the sound metre and the motorcycle

The sound levels will be measured with the sound meter/microphone fixed on a tripod, in the horizontal position, at the rear of the motorcycle.

- For the place and position of the motorcycle, ensure that there are no solid obstacles within 10 meters around the microphone.
- The sound meter will be positioned at a distance of 2 metres behind the motorcycle, with an angle of 45° away from the centerline, on the exhaust side and at a height of 1.35 metres above the ground, with the sound meter level.
- The 2 metres distance is measured from the point where the centre of rear tyre touches the ground.
- It is preferred to make the tests on soft ground, not reverberating, i.e. grass or fine gravel.
- In other than moderate wind, machines should face forward in the wind direction.
- The ambient sound level must remain lower than 100 dB/A.

3.3 The Positioning of the Motorcycle (see illustrations following)

The reference points:

- For a motorcycle: the contact point of the rear wheel on the ground.
- For motorcycles fitted with 2 exhaust outputs, the measurement will be made on the side of the air intake. If a central positioned air intake is used, both sides will be tested.
- For Side-cars: the contact point of the side wheel on the ground.
- For Quad vehicles: the vertical line to the ground from the centre point of the rear axle.
- For Quad vehicles with exhaust outlet moved from the median axis, the measurement will be made on the offset side.

To make repetitive measurements, all motorcycles can be positioned into a small frame fixed on the ground.

3.4 The new 2 metre max method

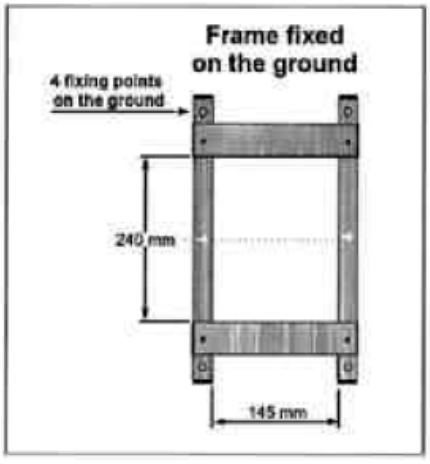
IMPORTANT: PROTECT YOUR HEARING – USE EAR PROTECTION!!

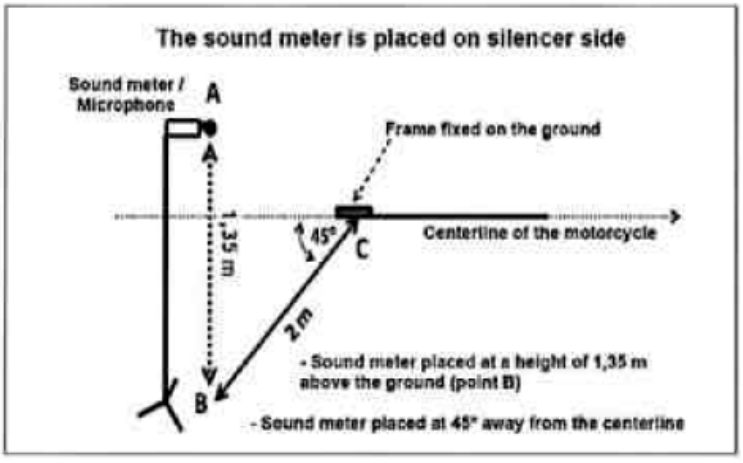
The measurement is made with the motorcycle on its wheels, with a hot engine.

- The Sound Control Officer stands beside the motorcycle, opposite to the microphone, not to screen or stand between the bike and the microphone. A mechanic, is to stand on the left side of the motorcycle, shall disengage the clutch.
- For anybody attending the sound level checks, it is strongly advised for him to use earplugs, a headset or ear protectors.
- The Sound Control Officer shall open throttle as fast as possible until full open throttle (instantly, within 0.3 seconds). He will keep at max engine 'rpm' for at least 1 second. To end, the inspector will release the throttle quickly.
- If the result exceeds the limit, including 'after fire', the Sound Control Officer shall test the motorcycle, maximum 2 times more.
- For motorcycles equipped with an engine rpm limiter, opening the throttle will be made - instantly, within 0.3 seconds - and kept open until at least 1 second has evolved and/or when there is an audible sign of over revving the engine.
- For motorcycles without an engine 'rpm' limiter, the opening of the throttle will have to be lower than 2 seconds and/or when there is an audible sign of over-revving the engine.
- If the engine tends to suffocate, close the throttle slightly and re-open the throttle.
- If detonations appear, the measurement must be started again.

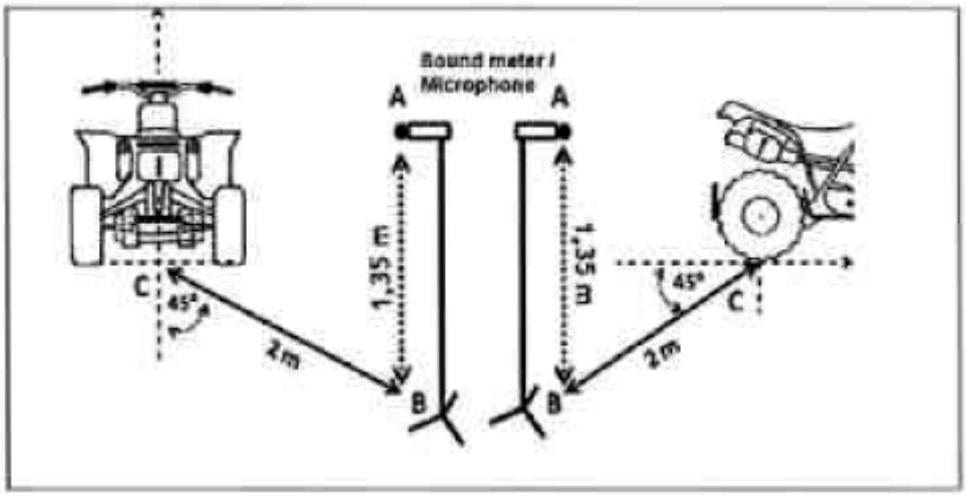
The sound readings obtained from the test shall not be rounded down.

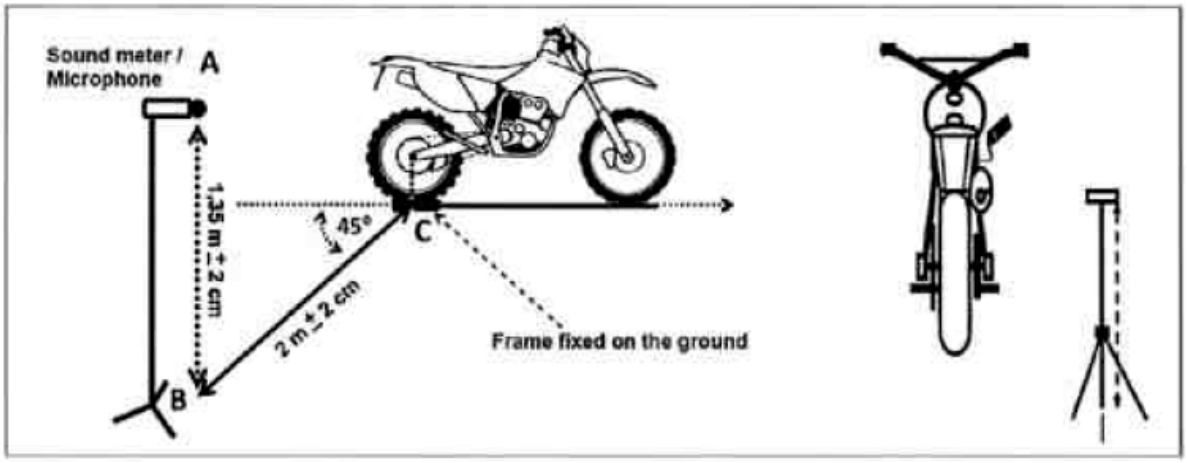
For the sound level measurement, the handling of the throttle is limited only to the Sound Control Officer, who shall open the throttle himself in order to minimize the influence by another operator (for that, it is helpful to have the microphone equipped with an extension cable to the sound meter).

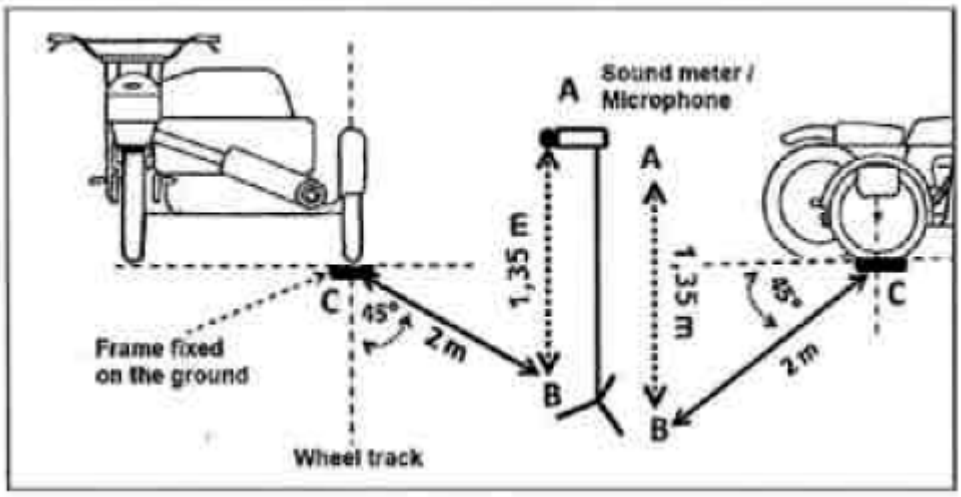




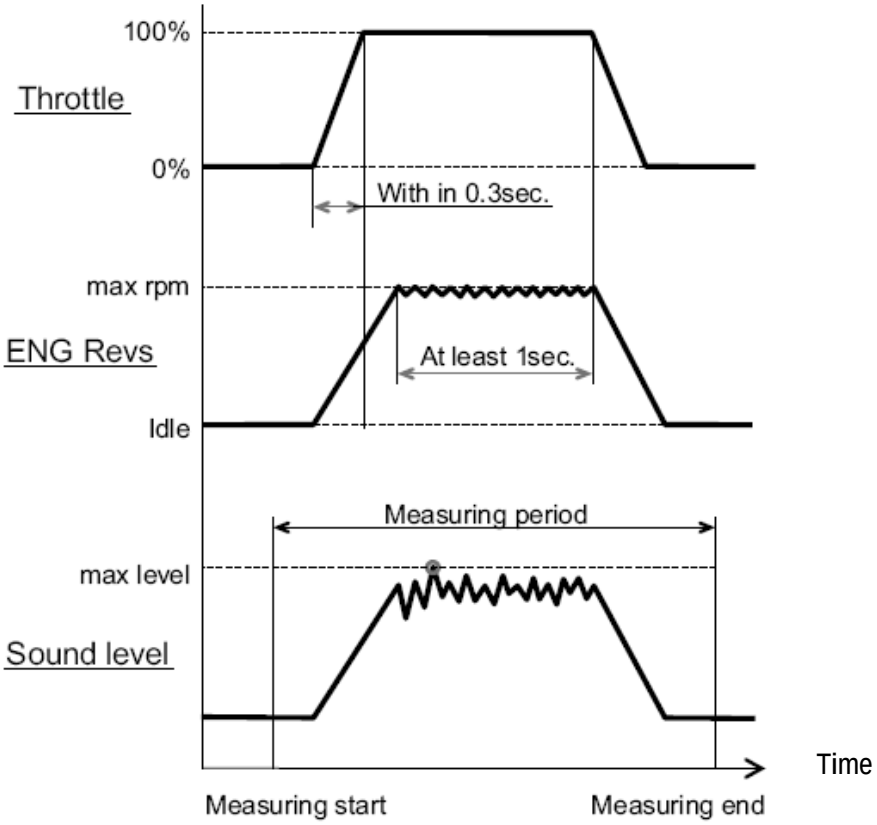
POSITION OF THE SOUND METER IN RELATION TO THE MOTORCYCLE







THE IMAGE OF THE SOUND MEASUREMENT PROCEDURE



1. The Sound Control Officer shall open the throttle until full open throttle within 0.3 seconds.

2. And keep at the max rpm (at rpm limiter) at least 1 second. Then, release the throttle quickly.

3. The sound level is measured in the all period and the maximum level shall be recorded in any case. (automatically by the sound meter).

3.5 The Measurement – Recording of Sound Level

- When the measurement is considered acceptable, write down the result, then reset (push on the sideline) the MAX MIN setting until the disappearance of the previously displayed value.
- Push again on the sideline MAX MIN to arm the sound level meter.
- The sound level meter is then ready for the following measurement.

An attempt by a participant to prevent his/her engine to reach the maximum published rpm figure will be considered a breach of the rules.

Even after passing the sound control, if there is doubt, the motorcycle may be checked again.

A noticeably lower engine speed is detected easily by hearing. If doubt, control the true reading of the rpm limiter with a tachometer.

Sound levels will be controlled to limits as stated in each section relevant to the discipline in the G.C.R's.

Other spare silencers may be presented after all participants have presented their motorcycles.

3.6 Guidelines for use of Sound Level Meters

Sound level measuring equipment must include a compatible calibrator, which must be used immediately before testing begins and always just prior to a re-test if a disciplinary action may be imposed.

Corrections

Corrections are presented as the 'precision of the method'. All corrections are cumulative.

3.7 Sound testing at events

Arriving at an event, Sound Control Officers should give themselves plenty of time for introductions to the Steward, Clerk of Course, Chief Scrutineer and Pit Marshals in order that a suitable test area can be agreed upon and set up. Also, remember to sign in on the Officials Indemnity Form.

3.8 Static sound testing

Here the machine is in neutral, stationary in the middle of a clear 10.0 meter test zone (see aerial view diagram), away from the track and loudspeaker sound, with background sound no greater than 100 dB(A).

Ensure the sound level meter is at ambient temperature, and calibrated prior to the start of testing. Note the temperature and time on report form, together with the meter type. Check and if necessary, recalibrate the meter every hour whilst in use. Adjust the meter to the "A" weighted scale with the "fast" response setting.

Explain the test to the rider and what is required of him. The machine must be in neutral. Bring the machine to the centre of the test area, and position it so any breeze or wind is blowing from behind you. Thus any mechanical sound will be blown forward away from the microphone. Request that the engine be started. The Sound Control Officer will control the throttle, whilst the rider will engage the clutch.

3.9 Protocol

As Sound Control Officer you are going to experience the occasional resistance and confrontation from some Riders/Representatives with regards to Sound testing and it's procedures.

It is EXTREMELY important that you DO NOT engage in any dispute/argument with a Rider/Representative and furthermore NEVER offer advice on how to lessen the sound of a machine that contravenes the G.C.R.'s.

The Sound Control Officer has no powers of penalty/exclusion, it is the Clerk of Course (C.o.C.) that after receiving the information from the Sound Control Officer, will take any necessary action required.

DO:-

1. Introduce yourself to the rider/Representative and maintain a courteous and informative attitude at all times.
2. Explain to the Rider/Representative what you require of them during the test.
3. Always inform the Rider/Representative of their sound level result.
4. At all times be aware of what is happening within your 10 metre sound test area.

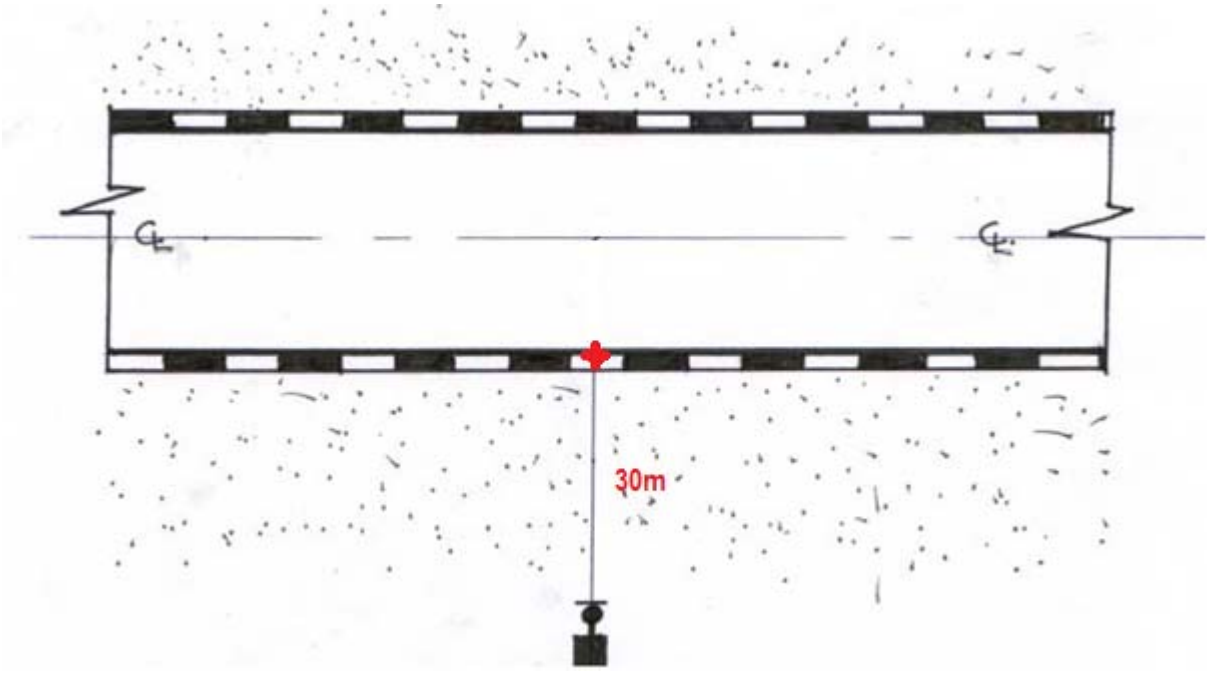
Ensure that your sound test procedures and protocols are maintained at a consistent level at all times. (This is extremely important)

DON'T:-

1. Engage Junior Riders in sound test procedures, seek assistance from their guardian.
2. Enter into any dispute or confrontation.
3. Offer any advice on sound reduction or offer your personal opinions.
4. Keep Riders/Representatives or your assistants exposed to unacceptable weather conditions for prolonged periods.
5. Leave expensive or personal equipment unattended at any time.

4. 30 Metre “Ride by” method

The following information has been provided by Derek Rumble:



Sound Level Meter

4.1 The Operating Procedure

The “30 Metre Ride By” method will consist in quantifying not only the sound level produced from the silencer of the exhaust, but the maximum global sound level achieved by the motorcycle at high speed and high R.P.M.

4.2 Preparation of Sound Metre

- Activate the ‘A’ weighing scale
- Activate the ‘Fast’ Time weighing
- Select high range 80 – 130 dB
- Calibrate the sound meter at 93.5dB to take into account the incidence of the foam wind ball.
- Position the wind foam ball onto the calibrated sound level meter microphone
- Activate the MAX.MIN function – to MAX

4.3 Positioning of Sound Level Metre

- The sound levels will be measured with the sound meter/microphone fixed on a tripod in the horizontal position
- The height of the sound level meter should be as close as possible to 1.35mtrs above track surface.
- The sound levels will be measured with the sound meter/microphone fixed on a tripod, in the horizontal position (90 degrees to direction of travel), 30 metres from the edge of the track at a high speed point.
- The ambient sound level must remain lower than 85dbA
- The sound control officer and equipment should have adequate protection/ safety barriers in place to avoid any possible contact with out of control race vehicles or debris.
- The sound level meter should be positioned at a track location where high R.P.M. and high speed are achieved, thus producing realistic sound levels.

4.4 Protocol

- Never enter a 'Live' Track
- Obey any directions given to you by sector/track marshals
- Radio Communication with chief marshal and race control is strongly recommended.
- Appropriate clothing and provisions for all conditions is also strongly recommended.

5. Conclusion

Always dress smart and if possible wear the shirt of your S.C.B. or series promoter. Avoid wearing clothing that may be considered a “Conflict of Interest” such as a Team shirt, accessory or Motorcycle manufacturer.

Always remember that you, as a licensed S.C.O. are producing a ‘STATEMENT OF FACT” and are subject to the usual Protest and Appeals process.

RECORDED SOUND TEST LOG

Venue : ________________________ Meeting Title :__________________________Class : ____________

Date : ______/_________/_________ Time :________:_________am / pm Temp : ____________°C

Name of Rider	Bike No.	Silencer ID Number	Silencer Brand	dbA	Make of Bike	Capacity

SOUND TEST FAILURE REPORT

I hereby certify that I have tested the Motorcycle of

Name : _____Class : _____ Bike No :_____

Venue : _____

Meeting Title _____

Date : _____/_____/_____ Time : _____:_____ AM / PM Temp : _____°C

Returning a Sound Reading of : _____dbA, which exceeds the allowable levels within the current

General Competition Rules (G.C.R) .

Other Comments : - (If any)

_____

_____

_____

_____

_____

_____

_____.

SOUND CONTROL OFFICER DETAILS:

Name : _____ Licence No.:_____

Signature : _____ Date : _____/_____/_____

Name of : RIDER / GUARDIAN / TEAM MANAGER : _____

Signature : - _____ Date : _____/_____/_____