

# Tyre Cavity Microphone Type TCM<sup>®</sup> - LP

## Product Data and Specification



Figure1.  
TCM installed on test wheel

### Applications:

- Tyre cavity resonances
- Tyre tread noise
- Road noise route tracking
- Tyre coast by noise testing

### Features:

- Installs securely inside the tyre
- Data immune from environmental Noise
- Radio linked
- Radio controlled
- Robust design
- Retains wheel balance
- Tyres inflated as normal
- Wheels run to speeds of 120+ kph

## BAY SYSTEMS Ltd.

Noise and Vibration Systems, Services & Facilities

Crysnal House, Main Road Westhay,  
Glastonbury BA6 9TN Somerset, UK  
Tel +44 (0) 1458860393  
E-mail [sales@baysystems.ltd.uk](mailto:sales@baysystems.ltd.uk)  
Web: [www.baysystems.ltd.uk](http://www.baysystems.ltd.uk)

TCM is a remote controlled radio microphone designed to capture the noise inside the tyre's cavity.

A TCM system comprises two small curved aluminium modules, interconnecting cable, radio receiver with integral antenna, magnetic antenna with 5 metre cable., for in vehicle recording.

The two aluminium modules are tensioned against the wheel hub by a stainless steel harness. The modules are connected by a multi-core umbilical cable that includes the antenna.

The TCM is controlled by a radio key fob. On standby the TCM battery lasts 7 days and when transmitting continuously 8 hours. It can be turned off between recordings to allow recording over several days.

The radio receiver, with BNC socket, provides an output signal suitable for analysis and recording systems.

The radio link range is dependant on wheel and body screening but is typically > 10 metres.

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## Specifications

### Values quoted for 22 degrees C

Nominal sensitivity:

At 800Hz .....	0.44mV/Pa
Frequency Response +/- 2dB .....	50Hz-10kHz
Upper limit of dynamic range .....	150 dB re. 20µPa
dynamic range .....	60dB
Temperature range .....	-10 C to + 50 C
Output Impedance .....	< 50 Ohm
Output .....	BNC
Umbilical/Antenna Cable length .....	500mm
Dimensions .....	length=119mm, width= 44mm, thickness= 15mm
Weight per module .....	190 g

<b>Power supply</b> .....	internal rechargeable battery
Charge cycle .....	
Stand-by time .....	30 days
Transmit time .....	9 hours
Typical combination .....	11 days standby then operate for 6 hours
Predicted battery life .....	500 cycles

### Radio Link

Activation radio range .....	15 metres
Data transmission range .....	15 metres

### Accessories included

	Number
Umbilical cable with integral antenna	2
Vehicle external magnetic mount for antenna	1
5 meter RF cable (magnetic mount to BNC)	1
Battery charger	1

### Three (3) Year Warrantee extendable to five (5) years

Fitting the TCM inside the tyre cavity and the environment inside the tyre are less than benign activities. To make TCM ownership as risk free as possible Bay Systems offers a three (3) year warrantee. This can be extended to five years @ 15% of current list price.

The guarantee covers the repair or replacement of the entire TCM system, provided no seal has been broken, for all failures except the destruction of the TCM due to detachment inside the wheel or damage caused by tyre fitting machines. In the case of tyre fitting and detachment inside the wheel a replacement TCM will be offered at a 40% reduction to current list price.

N.B. As technology and requirements evolve the performance of the TCM will change; please check that you have the most recent specification and pricing information.

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The TCM is designed to be used in the reverberant environment of an automotive tyre. The sensitivity of the TCM system is designed to cope with the normal shocks and inputs suffered by a tyre on a road vehicle. The calibration is therefore carried out at much higher levels than normal e.g. 130dB. The method of calibration is to compare the performance the TCM inside a travelling wave tube with that of a reference microphone. This method of calibration guarantees that each TCM will accurately measure at the very high noise levels found inside a tyre and have a flat frequency response over the frequency range of interest.

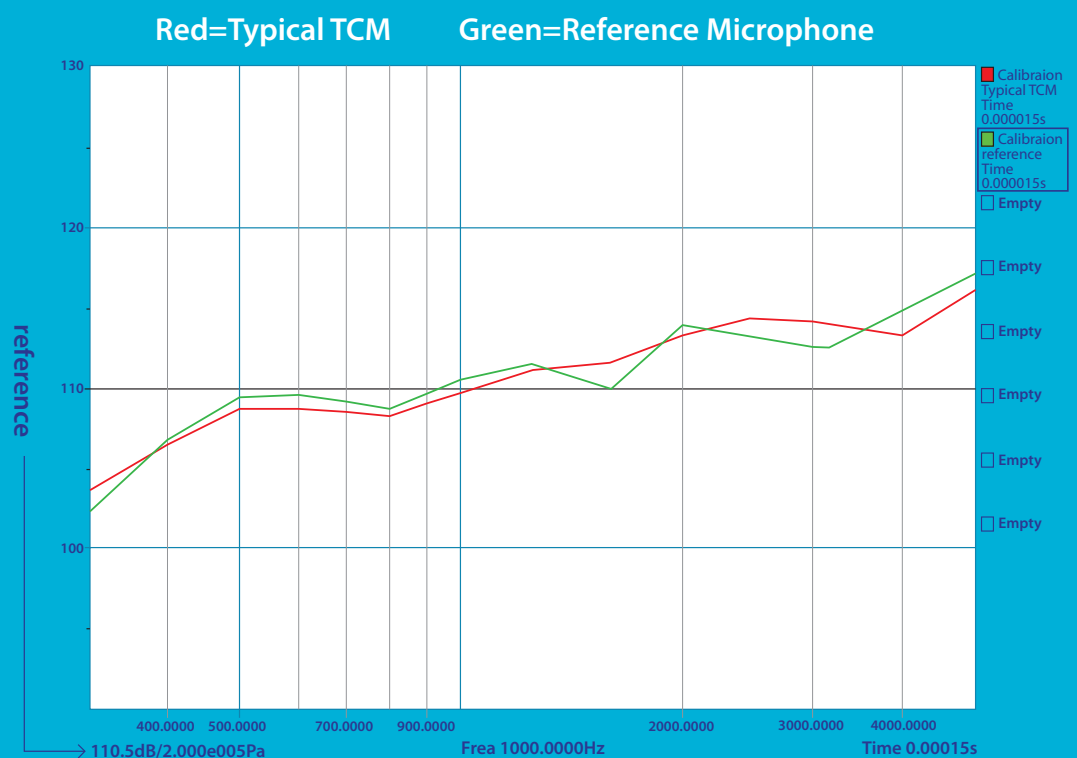


Figure7. Typical travelling wave tube 1/3rd Octave response of TCM compared to reference microphone



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## Fitting the TCM inside the tyre

Each TCM module has a harness of stainless steel wire rope attached to each end. The harness is terminated with an eyelet. The combined length of the TCM modules & harnesses allows fitting to wheel rim sizes from 13" upwards. The TCM modules are tensioned against the wheel hub using two good quality cable ties of appropriate length. The interconnecting antenna cable is located against the wheel hub & wire rope using four small cable ties.

Once the tyre is fitted and inflated the TCM when activated, using the radio key fob, will transmit the internal tyre SPL continuously.

Operation of the system and static resonant frequencies can be checked by tapping the tyre. The response measured by the TCM will contain the first 6-8 cavity and structural modes. The primary cavity mode will normally be the strongest and will be at 200Hz  $\pm$  20Hz.

Coasting down in the laboratory on a steel wheel from 100kph will reveal deep modulations of the tyre cavity resonances. When on the road the same modulation effects are observed with additional inputs from the road surface textures adding to the SPLs.



Figure2. Both TCM modules

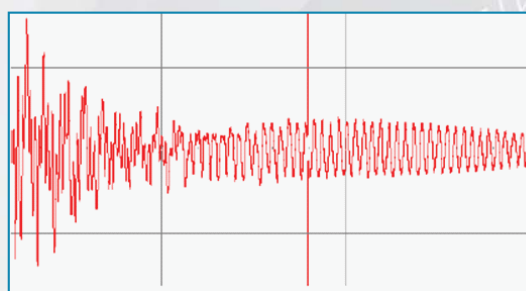


Figure3.  
Response of the Tyre cavity to a tap on the tyre tread

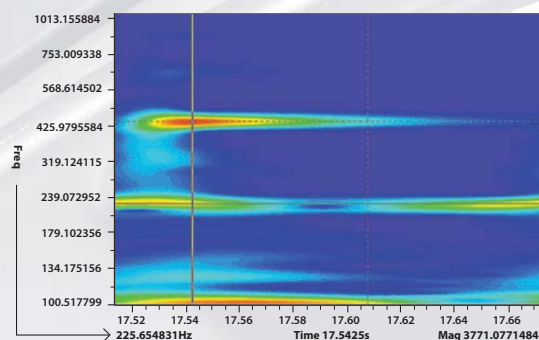


Figure4.  
Time /frequency analysis (wavelet) of a tyre tap  
showing two cavity and one structural mode

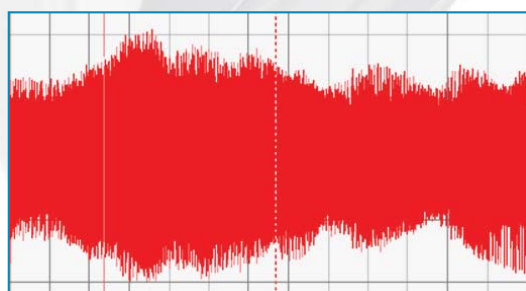


Figure5.  
Cavity resonances during a laboratory coast down

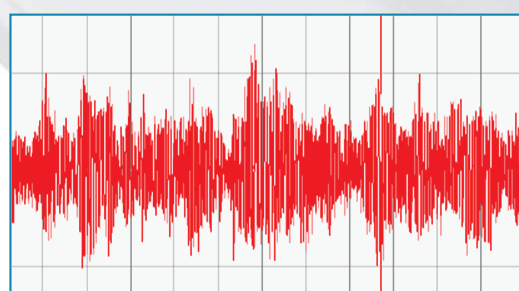


Figure6.  
Cavity resonances whilst driving on road