Microphones in theory and practice

Microphones in theory and practice

Helmut Wittek, 2013
Contents

- The “Sound” of a microphone and where it comes from
  - Frequency response, Impulse response
  - Directional microphones, Polar diagram, Off-axis
  - Diffuse field, Pressure gradient 1st order, Diffuse-field frequency response
  - Shotgun principle

- Around the membrane
  - Boundary layers, Comb filtering
  - Sphere attachments
  - V4 Studio Vocal Microphone

- Microphone signal
  - Self noise, Preamp
  - Digital microphone
  - Microphone specifications

- Disturbances
  - Wind, Popp
  - Handling noise, suspensions

- High Directivity
• Complete support:
  – Accessories, Solutions, Know-how, Custom products, Support, Service, Reliability, Demo loans

• Special accessories for every application
  – Studio, Live, Film, Instrument, Conference, Broadcast, Show, Stereo/Surround, etc.

• Vast variety of stereo and surround microphones
  – Music, Sports, Show, Film, etc.

• Technical and aesthetical know-how and guidance
  – Personal support: Tonmeister, Developer, Workshop, Sales, etc.
• **Colette Modular Series**
  – Modular studio microphone
  – 21 capsules
    • All polar patterns and specific capsules
  – >100 active and passive accessories
    • All types of tubes, goosenecks, table stands, swivels, cables, suspensions, filters, pads, etc.
  – 6 amplifiers
    • Analog, HD analog, battery-powered, for radio transmitters, Digital
• **CCM Compact Series**
  – Compact studio microphone – full studio quality.
  – 18 capsules
    • All polar patterns and specific capsules
  – >100 accessories
    • All types of tubes, goosenecks, table stands, swivels, cables, suspensions, filters, pads, etc.
... further information...

- further information:
  - SCHOEPS website: www.schoeps.de
    - ppt Slides...
    - Infos on the setups
    - Audio Samples
    - Showroom
  - JCE
  - www.hauptmikrofon.de
  - Contact →
    - Wittek “at” schoeps.de
    - Surround “at” schoeps.de
Role of the microphone

- The components of the recording chain:

  - Sound source
  - Room
  - Microphone
  - Processing devices
  - Loudspeaker
How do I choose a certain microphone?

- **Sound**
- Directivity
- Size, Design
- Practicability, Accessories
Frequency response

- Frequency response:

- Flat frequency response:
Frequency response

- 0°- or „Free field“-Frequency response
- 0°- Frequency responses of different microphones: [www.microphone-data.com](http://www.microphone-data.com)
- Fact and fancy: the difference between catalogue and measured data:

- Catalogue *:

- Measurement**:

* Data of a microphone made by an unstated manufacturer
** Measurement of the same microphone at the SCHOEPS company
Frequency response

• What is a good frequency response?

Abb. 13: Freifeld Frequenzgänge Mikrofon 1

Abb. 14: Freifeld Frequenzgänge Mikrofon 2
Abb. 15: Freifeld Frequenzgänge Mikrofon 3

Abb. 16: Freifeld Frequenzgänge Mikrofon 4

H. Wittek, Mikrofone und ihre Anwendung
**Frequency response**

*Abb. 17: Freifeld Frequenzgänge Mikrofon 5*

*Abb. 18: Freifeld Frequenzgänge Mikrofon 6*
Abb. 19: Freifeld Frequenzgänge Mikrofon 7

Abb. 20: Freifeld Frequenzgänge Mikrofon 8

H. Wittek, Mikrofone und ihre Anwendung
Frequency response

Abb. 21: Freifeld Frequenzgänge Mikrofon 9
Impulsantwort

- The temporal properties of a microphone are represented in the frequency response and in the impulse response.
- There are significant differences between the microphone types (Condenser/Dynamic) as well as between single and double membrane types.

How do I choose a certain microphone?

• Sound
• **Directivity**
• Size, Design
• Practicability, Accessories
Polar diagram, Off-axis frequency response

- Cardioid:

Quelle: J. Wuttke
Polar diagram, Off-axis frequency response

- Super cardioid:

Quelle: J. Wuttke
Polardiagramm, Off-axis Frequenzgang

- Figure-8:

Quelle: J. Wuttke
Polar diagram, Off-axis frequency response

- Omni-directional:

Quelle: J. Wuttke
The Polar diagram of an omni at

20 Hz - 2 kHz
4 kHz
8 kHz
16 kHz

Quelle: J. Wuttke
Design of a response curve for 90°(270°) sound incidence

Polardiagramm, Off-axis Frequenzgang

Quelle: J. Wuttke
Pattern:

Kugel / Omni

Niere / Cardioid

breite Niere / Wide cardioid
Polardiagramm, Off-axis Frequenzgang

„Open Cardioid“
Distance factor, Directivity index

SuperCMIT/CMIT

CCM 41 CCM 4 MK 2S
A directional microphone boosts the desired $0^\circ$-signal by two measures:

- attenuation of the off-axis sound sources
- attenuation of the diffuse sound
### Microphone types: Pressure gradient, 1st order

#### Table: Microphone Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Omnidirectional</th>
<th>Bidirectional</th>
<th>Cardioid</th>
<th>Hypercardioid</th>
<th>Supercardioid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A + (1-a) cos Φ</strong></td>
<td>1</td>
<td>cos Θ</td>
<td>1/2(1+cos Θ)</td>
<td>1/4(1+3cos Θ)</td>
<td>0.37+0.63cos Θ</td>
</tr>
<tr>
<td><strong>Pickup Arc 3 dB Down</strong></td>
<td>360°</td>
<td>90°</td>
<td>131°</td>
<td>105°</td>
<td>115°</td>
</tr>
<tr>
<td><strong>Pickup Arc 6 dB Down</strong></td>
<td>360°</td>
<td>120°</td>
<td>180°</td>
<td>141°</td>
<td>156°</td>
</tr>
<tr>
<td><strong>Relative Output At 90° dB</strong></td>
<td>0</td>
<td>-∞</td>
<td>-6</td>
<td>-12</td>
<td>-8.8</td>
</tr>
<tr>
<td><strong>Relative Output At 180° dB</strong></td>
<td>0</td>
<td>0</td>
<td>-∞</td>
<td>-6</td>
<td>-11.7</td>
</tr>
<tr>
<td><strong>Angle At Which Output = 0 (θ₀)</strong></td>
<td>—</td>
<td>90°</td>
<td>180°</td>
<td>110°</td>
<td>126°</td>
</tr>
</tbody>
</table>

**Directivity Index:**
- **0 dB**
- **-4.8 dB**
- **-4.8 dB**
- **-6 dB**
- **-5.7 dB**

**Distance Factor (DSF):**
- **1**
- **1.7**
- **1.7**
- **2**
- **1.9**

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Quelle: W. Schullein, AES paper

Fig. 18. Microphone directivity patterns.
First-order pressure-gradient microphones

- Various different patterns between Omni and Cardioid
- Directivity index (DI) between 0 dB and 6 dB
  → Double M/S demo
Available for free!

Polarflex plug-in
⇒ download at
http://www.schoeps.de/en/products/polarflex

- Mix Omni and Fig-8
- In three frequency bands
- Variation of the diffuse field response
Available for free!


Version 2 (“BF”) offers new functionalities:
- higher directivity
- less correlation
- variable diffuse sound level
• Important for the sound colour of the microphone:

**Diffuse field-frequency response**

= frequency response of the microphone in the diffuse sound field

- **Omni MK 2**
- **Cardioid MK 4**
- **Supercardioid MK 41**
- **Shotgun CMIT 5**
- „SuperShotgun“ SuperCMIT
Shotgun vs. Supercardioid
Existing principles of directive microphones

- Existing principles for directional microphones:
  - First-order pressure-gradient microphones
  - Higher-order gradient microphones
  - Interference tube microphones ("shotgun microphones")
  - Adaptive Systems
  - Parabolic mirrors
• Frequency-dependent directivity:
Richtrohr

- Frequency-dependent directivity:

Sennheiser MKH 416

SCHÖEPS CMIT 5
Directivity index (< 2kHz):
Polardiagramm: Shotgun, „Richtrohr“

![Polardiagramm](image)

*LIT* www.schoeps.de: *Microphone Showroom*  
*EXP* Unterscheidung zwischen CMIT und CCM 41
• **SCHOEPS Microphone Showroom: [www.schoeps.de/showroom](http://www.schoeps.de/showroom)**

  provides an interactive comparison between microphone techniques and models…
Table microphones: Newsroom

- German News show „Tagesschau“:
• What do the two microphones record?
Microphone types: Boundary Layer Microphones

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Boundary Layer Effect

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Sound
Pressure in the center of the front of a reflecting obstacle (cylinder) in the sound field.

a) frequency scale for Ø 34 mm diameter
b) frequency scale for Ø 34 m surface (boundary-layer technique)
c) frequency scale for Ø 1 m surface (on the table)

full line: 0° perpendicular sound incidence, dashed line: 60° sound incidence

$L = \text{diameter of the obstacle}, \ \lambda = \text{wavelength}, \ \text{see LIT: Olson}$
Microphone types: Boundary Layer Microphones

Advantage: similar pressure congestion at all frequencies!
Cardioid or Supercardioid

EXP
1. Vergleich gerichtete Grenzfläche BLC + CCM 41 mit normaler CCM 41: Pegelverlauf
2. Richtwirkung in y-Richtung durch Grenzfläche verhindern
Directivity

- Omni
- Wide Cardioid
- Cardioid
- Supercardioid
- Supercardioid + boundary layer
- Figure-8
- Shotgun (Interference tube)
- Super shotgun
Microphone types: Boundary Layer Microphones

Both boundary layer and comb filtering

Δt

Exp optimalen Abstand/Winkel in der Praxis ermitteln (CCM 41, CCM 4, STR/RG12)
Microphone types: Boundary Layer Microphones

Δs in mm

0
14
28
43
57
71
142
213
Comb filtering, boundary layer:

1: ... U54
2: ... abgesprochen werden
3: ... vorgenommen werden
4: ... sein muß.
5: ... zulässig.
6: ... entnommen werden.

**Microphone types: Boundary Layer Microphones**

**Sound**

**Sound source**

EXP _optimalen Abstand/Winkel in der Praxis ermitteln (CCM 41, CCM 4, STR/RG12)_
Microphone types: Boundary Layer Microphones

- What do the two microphone record?
- Boundary Layer microphone: Pressure Doubling and increased directivity only above ~ 300 Hz, because of the small size of the table.
- Supercardioid: below 1 kHz: Boundary Layer microphone, because the distance to the table is small. The boundary layer avoids the vertical beaming! above 1 kHz: comb filtering
Microphone types: sphere shapes

SCHOEPS CMV 50/2 (1948)  Neumann M 50 (nowadays: TLM 50)
Microphone types: sphere shapes

SCHOEPS MK 2 H with sphere attachment KA 50 (50 mm)
Frequency response of MK2 capsule for different angles of sound incidence
Frequency response of MK2 capsule for different angles of sound incidence + KA 50

Microphone types: sphere shapes

+ KA 50
Microphone types: sphere shapes

Neumann M 50:
Big microphones!
What is the ideal **Studio Vocal Microphone**?

- **Our sonic ideal:**
  - Transparent sound
  - Studio room sound: *pleasant, unobtrusive, damped*

- **The according technical parameters:**
  - Cardioid with uniform *polar patterns*
  - Flat 0°-*frequency response* between 50Hz and 20kHz
  - Flat *diffuse-field response* with high frequency roll-off
• Desired **technical parameters:**
  1. Cardioid with uniform *polar patterns*
  2. Flat *0°-frequency response* between 50Hz and 20kHz
  3. Flat *diffuse-field response* with high frequency roll-off

• 1 and 2 require a decent **small-diaphragm** capsule
• 3 seems to call for a **large-diaphragm** capsule!
What is the principal difference between large and small membrane capsules?

Membrane > 20mm  Membrane < 15mm
• What is the principal difference between large and small membrane capsules?

\[
\frac{\lambda}{4} < d: \text{Pressure built-up due to reflection}
\]

\[
\frac{\lambda}{4} > d: \text{Pressure gradient due to diffraction}
\]
Pressure gradient = pressure difference between front and back of the membrane: (Druckgradient_Applet)

Resonance of the Membrane for pressure gradient transducers

EXP KörperschallEMPfindlichkeit Niere/Kugel (MK 4/ MK 2)

cannot be used

H.Wittek, Mikrofone und ihre Anwendung
What is the principal difference between large and small membrane capsules?

→ Pressure gradient ($\lambda/4 > d$) and Pressure built-up ($\lambda/4 < d$)

- a) Diameter = 34mm
- a) Pressure built-up > 2.5 kHz
- b) Diameter = 17mm
- b) Pressure built-up > 5 kHz

H. Wittek, Microphones
V4 U

- Realisation in the V4 U: 33-mm bevelled collar around a small membrane

- Small-membrane properties: even frequency responses, uniform polar patterns

- Large-membrane properties: early pressure built-up due to large diameter, higher directivity at high frequencies, roll-off of the diffuse-field curve
Studio Vocal Microphone **V4 U**

Available in December 2013
Outstanding technical performance:

- Optimal on-axis frequency response featuring a mild high-frequency lift.
- Very smooth polar response; carefully-controlled narrowing of the pattern at high frequencies.
- Diffuse-field response parallel to the 0 ° response, with a gentle roll-off at high frequencies.
- Newly designed electronics offer a very high maximum sound pressure level.
**The Electronics**

- Newly-developed bridge-type balanced output circuit.
- Maximum sound pressure level of 144 dB SPL, corresponding to an output level of 4.8 V.
- Output stage transformerless and free of coupling capacitors.
- The resulting output impedance is low and constant with frequency, while the symmetry is very high.
- Symmetrical, balanced output, the entire audio circuit is symmetrical from the output of the FET onward.
- High immunity to interference, with gapless shielding and a modern RFI filter at the output; very good electromagnetic compatibility.
Applications:
• Studio recording
• Radio
V4 U

H.Wittek, Microphones

Slide 68
External interference

- Wind
- Popp
- „Handling Noise“
- „EMC“: Electromagnetic interference (e.g. radio frequencies, Wifi, power chords)
External interference

- Wind
- Popp
- „Handling Noise“
- „EMC“: Electromagnetic interference (e.g. radio frequencies, Wifi, power chords)
Wind
Wind

MK 41 - **no** wind screen

MK 41 - wind screen **W 5 D**
(Replay level plus 40 dB)
The functional principles of different types of windshields on a pressure-gradient microphone

Quelle und LIT J. Wuttke: „Mikrofonaufsätze“, www.schoeps.de
Wind

- Wind spectrum: the maximum is < 100 Hz
- Disturbances depend on the type of transducer
- Measure: Wind screen, foam, Low Cut filter
Windshields

B 5 D

B 1 D

Slide 75
Wind

- Schwarz: Ohne Windschutz
- Rot: Hohlraum-Schaumstoff mittel
- Blau: Hohlraum-Schaumstoff groß
- Grün: Korb klein
- Hellgrün: Korb klein mit Gaze
- Orange: Schaumstoff dünn
- Orange mit Stern: Korb mittel
- Rosa: Schaumstoff mittel
- Rosa mit Stern: Korb mittel mit Fell
- Rosa mit Doppelstern: Schaumstoff dick
- Hohlraum-Schaumstoff groß

Diagramme für Windgeschwindigkeiten 3 m/s und 5 m/s.
Windshields

- Windshield SCHOEPS WSC Piano:
External interference

- Wind
- Popp
- „Handling Noise“
- „EMC“: Electromagnetic interference (e.g. radio frequencies, Wifi, power chords)
Poppgeräusche

- Plosive Sounds cause high level air impulses
- Measure: Popp protection
Poppgeräusche

- Cardioid without protection
Poppgeräusche

• The popp protection should not influence the sound (F-response) → no use of thick fabrics (e.g. foam) and solid bodies (e.g. clamps)

Quelle: Poppschutz-Test in tools4music

EXP Kugel/Niere mit/ohne Poppschutz (MK 2/ MK 4)
External interference

- Wind
- Popp
- „Handling Noise“
- „EMC“: Electromagnetic interference (e.g. radio frequencies, Wifi, power chords)
Handling noise

- The diaphragm is exposed to excitations, that have to be attenuated
- Principles: soft suspension (low, attenuated resonance) with springs, rubber bands or bending principles
- classical studio suspensions („Circus tents“) are effective through their mass or even not at all…
CCM 41

- CCM 41 an der OSIX/MINIX
CCM 41

- CCM 41 an der OSIX/“MINIX CCM LL”
  Windschutz B5 D ist optimal an der Angel
Handling noise

- different solutions (Rycote/Cinela):
Handling noise

SCHOEPS AC
Rycote Invision, hart
Cinela OSIX CCM
Rycote Invision, weich

EXP
Angel mit verschiedenen Aufhängungen (MK 41, B 5 D, OSIX, A 20)
H. Wittek, Mikrofone und ihre Anwendung
Low-Cut 3rd order

is necessary to eliminate audible interference from suspensions: (suspension resonance + wind)
Digital microphones
Self noise, distortions, max. SPL

Dynamics = max. SPL – self noise

<table>
<thead>
<tr>
<th>Situation und Schallquelle</th>
<th>Schalldruck $p$ Pascal</th>
<th>Schalldruckpegel $L_p$ dB re 20 μPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretische Grenze für Schallwelle bei 1 Atmosphäre Schalldruck</td>
<td>100.000 Pa</td>
<td>194 dB</td>
</tr>
<tr>
<td>Krakatau Explosion 160 km Entf.</td>
<td>20.000 Pa</td>
<td>[1] dB 180 dB</td>
</tr>
<tr>
<td>M1 Garand Gewehr aus 1 m Entf.</td>
<td>5.000 Pa</td>
<td>168 dB</td>
</tr>
<tr>
<td>Jet in 30 Meter Entfernung</td>
<td>630 Pa</td>
<td>150 dB</td>
</tr>
<tr>
<td>Gewehr aus 1 m Entfernung</td>
<td>200 Pa</td>
<td>140 dB</td>
</tr>
<tr>
<td>Schmerzwelle</td>
<td>100 Pa</td>
<td>134 dB</td>
</tr>
<tr>
<td>Gehörschäden bei kurzfristiger Einwirkung</td>
<td>20 Pa</td>
<td>ab 120 dB</td>
</tr>
<tr>
<td>Düsenflugzeug 100 m entfernt</td>
<td>6.3 - 200 Pa</td>
<td>110 - 140 dB</td>
</tr>
<tr>
<td>Presslufthammer, 1 m entfernt / Diskothek</td>
<td>2 Pa</td>
<td>100 dB</td>
</tr>
<tr>
<td>Gehörschäden bei langfristiger Einwirkung</td>
<td>0,63 Pa</td>
<td>ab 90 dB</td>
</tr>
<tr>
<td>Hauptverkehrsstraße, 10 m entfernt</td>
<td>0,2 - 0,63 Pa</td>
<td>80 - 90 dB</td>
</tr>
<tr>
<td>Pkw, 10 m entfernt</td>
<td>0,02 - 0,2 Pa</td>
<td>60 - 80 dB</td>
</tr>
<tr>
<td>Fernseher in Zimmeraußenstärke 1 m entfernt</td>
<td>0,02 Pa</td>
<td>ca. 60 dB</td>
</tr>
<tr>
<td>Normale Unterhaltung, 1 m entfernt</td>
<td>$2 \cdot 10^{-3} - 6,3 \cdot 10^{-2}$ Pa</td>
<td>40 - 60 dB</td>
</tr>
<tr>
<td>Sehr ruhiges Zimmer</td>
<td>$2 \cdot 10^{-4} - 6,3 \cdot 10^{-4}$ Pa</td>
<td>20 - 30 dB</td>
</tr>
<tr>
<td>Blätterraschen, ruhiges Atmen</td>
<td>$6,3 \cdot 10^{-5}$ Pa</td>
<td>10 dB</td>
</tr>
<tr>
<td>Hörschwelle bei 2 kHz</td>
<td>$2 \cdot 10^{-5}$ Pa</td>
<td>0 dB</td>
</tr>
</tbody>
</table>

Digital microphones can handle nearly the whole dynamics of the microphone capsule. A preamp stage can often be avoided.

- **Self noise, distortions, max. SPL**
- **Digital microphones** can handle nearly the whole dynamics of the microphone capsule. A preamp stage can often be avoided.

![Diagram showing the components of a microphone system: Analog pre-stage, Microphone preamp, AD-Converter in the digital microphone.]

- **Level**
- **dB-SPL (A)**
- **Resulting total dynamics** ~ 135 dB
- **Dynamics AD-Converter**
- **Self noise capsule** ~ 15 dB
- **Clipping capsule** ~ 135 dB
- **Clipping preamp**
- **Self noise preamp**
A digital microphone can:
- increase dynamics
- avoid interference on long analog cables
- realize new features on DSP

but:
- the standard AES-42 is young
- there are not many interfaces
- current consumption is high
- even now there exist incompatible devices
- new investment is often not plausible
What we hear:

- **Pain threshold**: dB
- **Hearing threshold**: dB
- **Music**: dB
- **Speech**: dB

*Quelle: Wikipedia*
• The self noise of the microphone is given as the „Equivalent noise level ENL“. This is the sound pressure level of a sound source in db(A) or dB(CCIR, quasi-peak) that causes the same microphone level as the self noise of the microphone.

• Concluding: The Equivalent noise level does include the sensitivity of the microphone! You don’t have to care for the sensitivity when you know this value.

• ENL:
  – 0 dB-A. No noise
  – > ~ 6 dB-A: Large diaphragm microphone, studio quality
  – > ~ 10 dB-A: Small diaphragm microphone, studio quality
  – > ~ 20 dB-A: Microphones in semi-professional quality
  – > ~ 25 dB-A: Subminiature microphones
Microphone specifications

- Frequency response + tolerance range
- (Diffuse field response)
- Polar diagram
- „Frequency range“: 20Hz – 20kHz
- Sensitivity: e.g. 17 mV/Pa = - 35 dBV/1Pa
- Equivalent Noise Level (for studio microphones < 15db(A) or < 24db(CCIR))
- Microphone Dynamics (eq.ENL) = 94 dB – ENL (94db SPL = 1 Pa)
- Maximum Sound Pressure Level:
  - THD of 0.5 or 1% or „before clip“
  - Different philosophies of different manufacturers
- Output impedance: studio microphones: < 200 Ω for all frequencies
Further properties

- Equality of the same mic types, matching
- Long lifecycle
- Functional reliability
- Long-term compatibility, maintaining of modular series
- Downwards compatibility
- Service, guarantee and long-term repair
- Neutral advice and support
Highly directional microphones
Existing principles of directive microphones

- Existing principles for directional microphones:
  - First-order pressure-gradient microphones
  - Higher-order gradient microphones
  - Interference tube microphones ("shotgun microphones")
  - Adaptive Systems
  - Parabolic mirrors
Existing principles of directive microphones

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• Frequency-dependent directivity:
• Frequency-dependent directivity:

Sennheiser MKH 416

SCHÖEPS CMIT 5
Existing principles for directional microphones:

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  - Adaptive Systems
  - Parabolic mirrors
Parabolic mirror

- Frequency-dependent
- High Signal-Noise ratio at high and medium frequencies
Existing principles of directive microphones

• First-order pressure-gradient microphones
  + compact size, easy to manufacture
  + excellent performance and sound color
  – limited directivity

• Higher-order pressure-gradient microphones
  + higher and potentially variable directivity
  – problems at low and high frequencies → self noise, aliasing

• Interference tube microphones (“shotguns”)
  + compact size, easy to manufacture
  – frequency-dependant directivity, only 1st order at low freq.

• Adaptive Systems
  + separation of discrete and diffuse sound
  – can create artifacts

• Parabolic mirrors
  + high signal, low noise
  – big, not very practical
  – frequency-dependant directivity, < 1st order directivity at low freq.
• “Super”- shotgun SCHOEPS SuperCMIT
  
  – 2 membranes
  – digital signal processor with beamforming
  – digital output (AES42/Mode-1 = AES3 + 10V

  – 2 output channels:
    • ch1: SuperCMIT
      – Preset 1 (normal DSP mode)
      – Preset 2 (strong, take care!)
    • ch2: conventional shotgun signal
Shotgun microphone

- Weakness of the conventional shotgun microphone:
Combining shotgun and beamforming approach:

- A 2nd capsule (cardioid) is placed behind the shotgun capsule
- These two capsules form a “beamforming” array
- Beamforming increases the *directivity* and suppresses diffuse *sound*
- Above 5 kHz only the shotgun signal is used
New approach 1

- Utilize Beamforming
  - using two cardioids in a back-to-back configuration
  - A can be predicted with/from B
  - the predicted signal can be subtracted from A
  - Subtraction is limited to a maximum to decrease effect
New approach 2

- Adjusting the diffuse field level
  - Time-Frequency processing enables to find coherent/incoherent signals
  - The diffuse field level can be tuned according to the resulting beam

Directional response at different “Directness” levels:

- Ideal cardioid
- Aimed microphone
SuperCMIT

- SuperCMIT: Hardware design
- Weight: 112 grams (4 ounces)
- Length: 280 mm
• SuperCMIT: Polar diagrams
• SuperCMIT: Frequency responses

SuperCMIT ch2 (unprocessed)

SuperCMIT, ch1, Preset 1

SuperCMIT, ch1, Preset 2
• SuperCMIT: Frequency responses

SuperCMIT ch2 (unprocessed)

SuperCMIT, ch1, Preset 1

SuperCMIT, ch1, Preset 2
• SuperCMIT: Frequency responses

SuperCMIT ch2 (unprocessed)

SuperCMIT, ch1, Preset 1

SuperCMIT, ch1, Preset 2
• SuperCMIT: Diffuse Field Frequency response

Diffuse-field frequency response:
- front-facing transducer (CMIT) only
- SuperCMIT preset 1
- SuperCMIT preset 2
• Diffuse Field Frequency responses:

Omni MK 2
Cardioid MK 4
Supercardioid MK 41
Shotgun CMIT 5
SuperShotgun SuperCMIT
- SuperCMIT: Directivity index (= level of the diffuse sound at low frequencies)
(some…) Applications

- Location sound
- Sports
- Theatre, Opera
- on a lectern
- in churches
(some…) Applications
ORTF Surround: Soccer World Cup 2010

1. Main ambience:
   ORTF Surround

2. Stereo spots:
   ORTF Stereo

3. „Close-Ball“:
   SuperCMIT

4. Mono spots:
   Single CCM
Application

- 3 Pushbuttons on the microphone:
  - High-frequency boost (+5 dB at 10 kHz)
  - Steep Low-Cut (18dB/Oct)
  - Preset button:
    - Preset 1: normal
    - Preset 2: strong; recommended only for special applications
- Available accessories
  - Basket Windscreen with suspension (Rycote Kit 295)
  - Foam windscreen W 170
  - Rycote Softie 18cm
  - Cinela OSIX CMIT
Interfacing

- Output format of the SuperCMIT: AES42, Mode 1
  = AES3 + 10V digital phantom power.

- You have different options of interfacing the SuperCMIT:
  - **Adapters** (SCHOEPS Mini-DA42 or PSD 2U):
    10V powering /and analog output
    (comes with the microphone)
  - **Portable recorders** (SoundDevices 788T + 664, AETA 4Minx, Zaxcom Nomad)
  - **Consoles and interfaces** (Digigram, RME DMC 842, Lake People DAC 462, etc.)
  - **Wireless** (Zaxcom)
  - **Complete list** of interfacing options for the SuperCMIT:
Simultaneous test recording

KEM

Parabol

SuperCMIT
Thank you for your attention!

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