淺談公眾廣播及專業音響系統
Basic of Pubic Address & Pro Audio System

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電子基礎問問你
Basic Electronic

- 歐姆定律 (Ohm's Law)

$$V = I \times R$$

- 功率 (Power)

$$P = I \times V$$

$$P = I^2 \times R$$

$$P = V^2 / R$$

電子基礎問問你
Basic Electronic

- 串聯 / 并聯 電路 (Series / Parallel circuit)

$$R_{total} = R_1 + R_2 + R_3 + \cdots + R_n$$

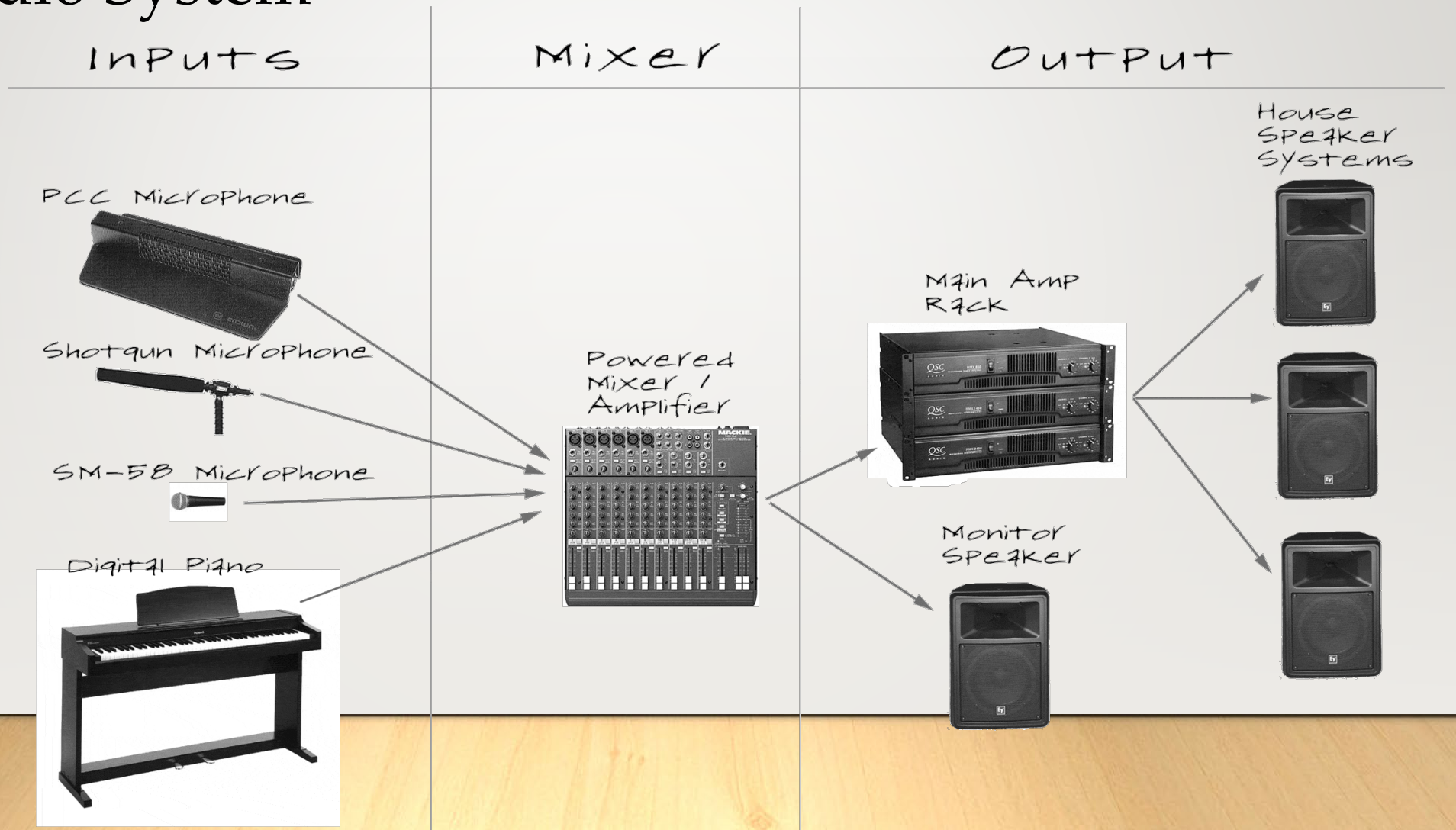
$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots \frac{1}{R_n}$$

- 阻抗 (Impedance)

感抗 $X_l = 2\pi f l$

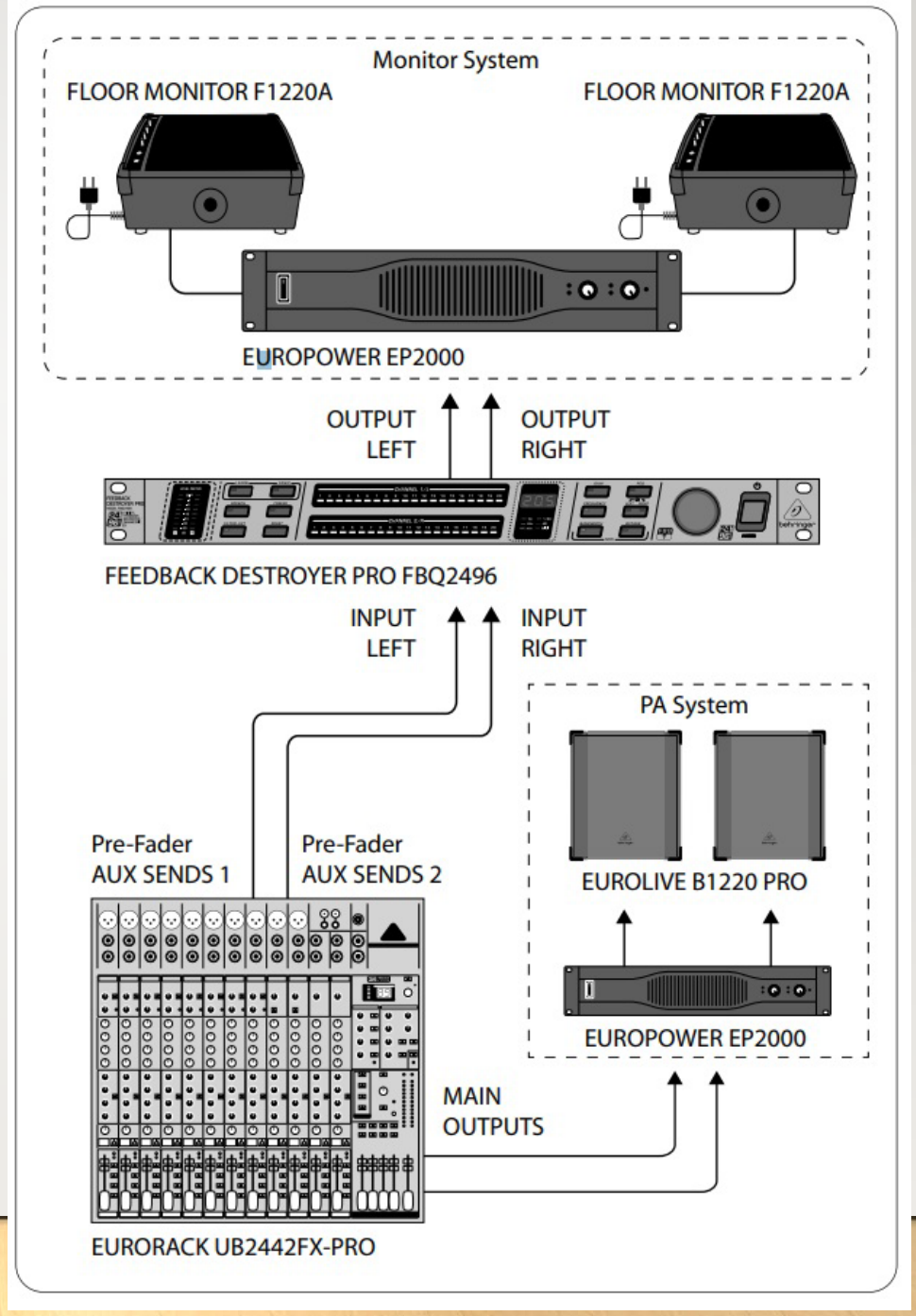
容抗 $X_c = \frac{1}{2\pi f c}$

音響系統
Audio System



傳統音響系統
Traditional Audio System

- Analog Audio Mixer
- Analog Feedback Destroyer
- Analog Equalizer
- Analog Power Amp
- Analog Audio cable



傳統音響系統
Traditional Audio System
Analog Audio Mixer





傳統音響系統
Traditional Audio System
Analog Audio Mixer

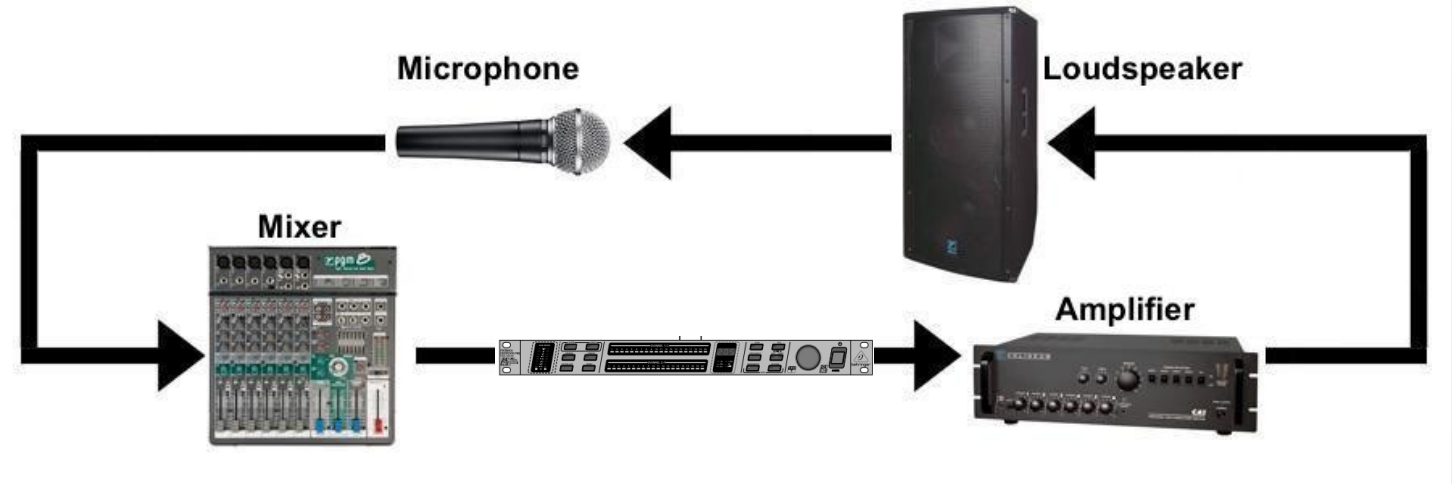




傳統音響系統
Traditional Audio System
Feedback Destroyer / Equalizer



傳統音響系統
Traditional Audio System
Feedback Destroyer / Equalizer



4. FBQ2496 Filters

The FBQ2496 filters can be set up in an extremely narrow-band fashion. This way, the FBQ2496 changes the way your music sounds to such a minor extent that the actual change is absolutely negligible and inaudible.

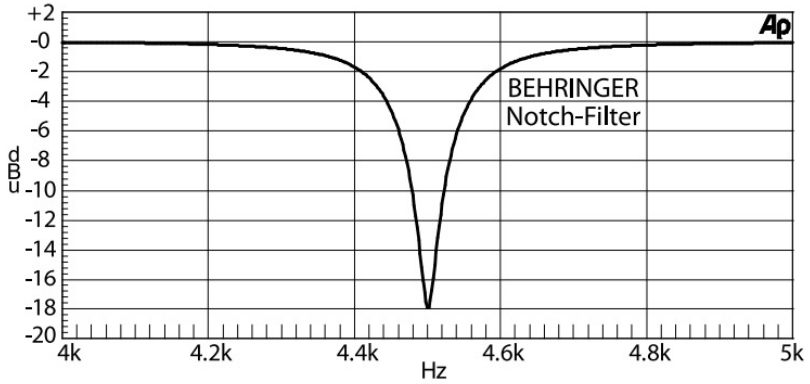
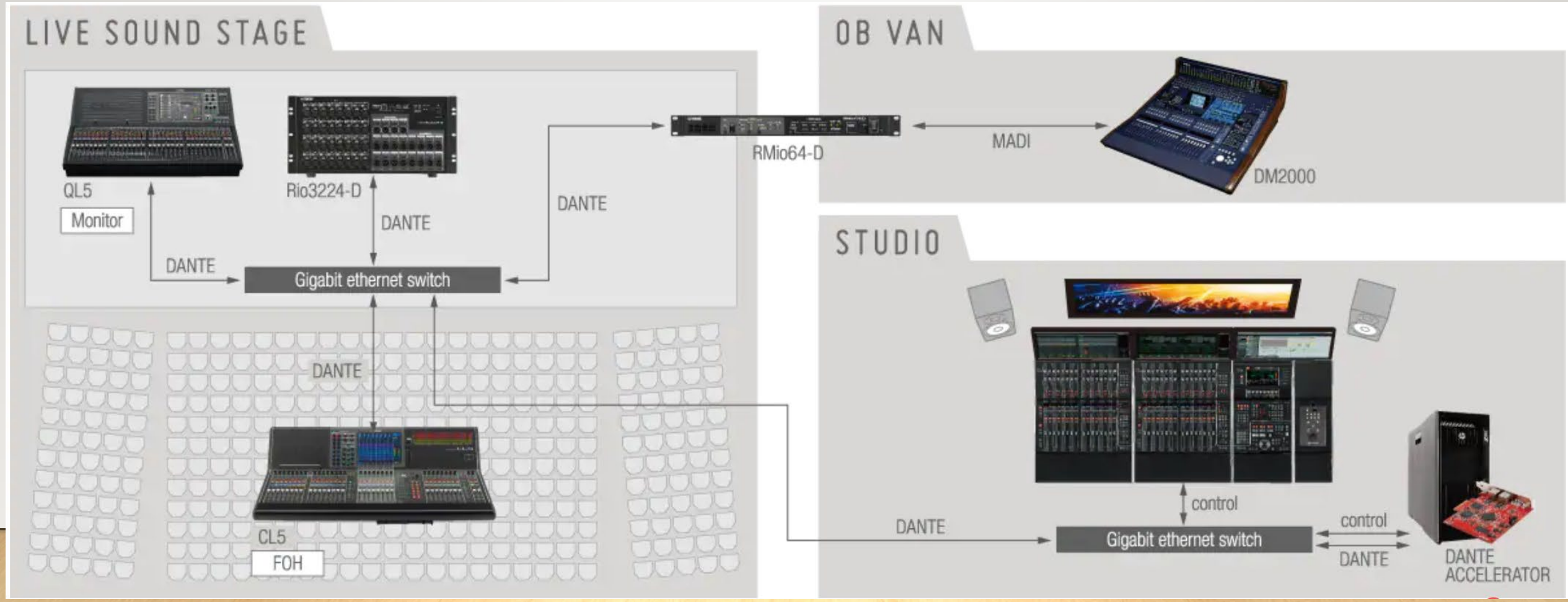
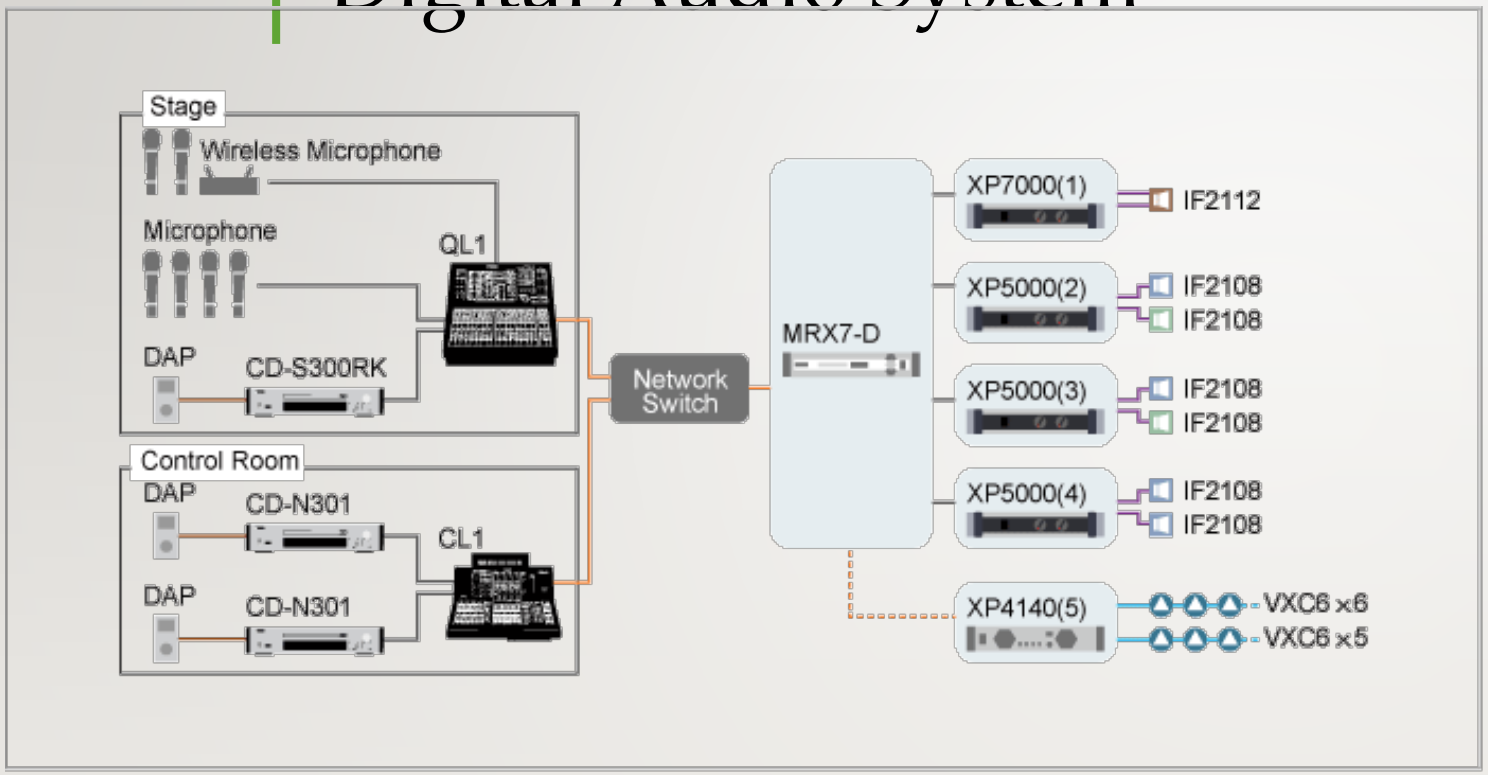


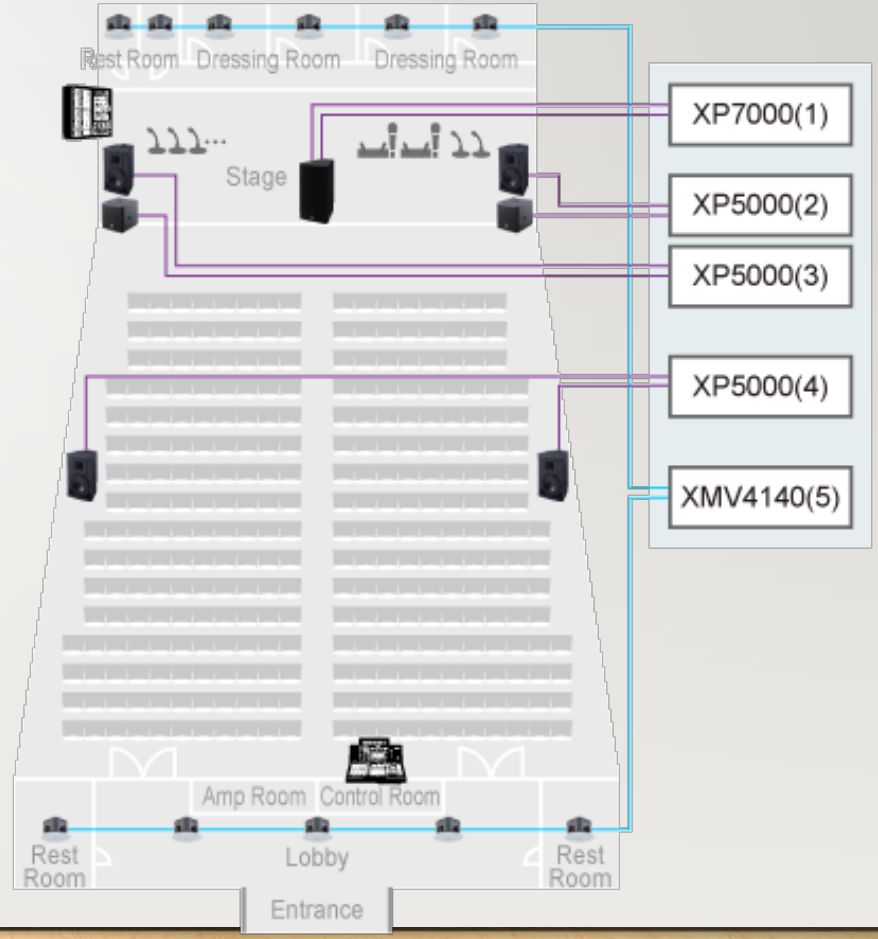
Fig. 4.1: Filter curve of a narrow-band filter

數碼音響系統
Digital Audio System



數碼音響系統
Digital Audio System





數碼音響系統
Digital Audio System

- Digital Audio Mixer





數碼音響系統
Digital Audio System

- Digital Audio Mixer





數碼音響系統
Digital Audio System

- Digital Audio Mixer
- Dante / AES 67

  to extend more

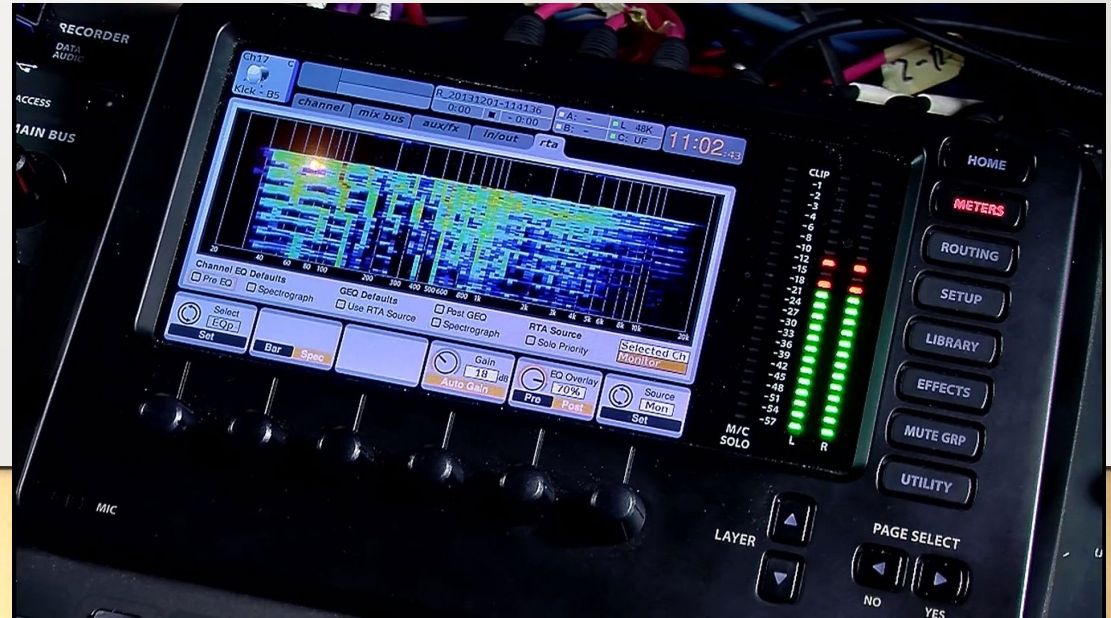
  I/O or share I/O



數碼音響系統
Digital Audio System

- Digital Audio Mixer
- Feedback Destroyer
- Analog Equalizer





數碼音響系統
Digital Audio System

- Digital Signal Processor





音響系統的設計與測量
Design and Measure of Audio System



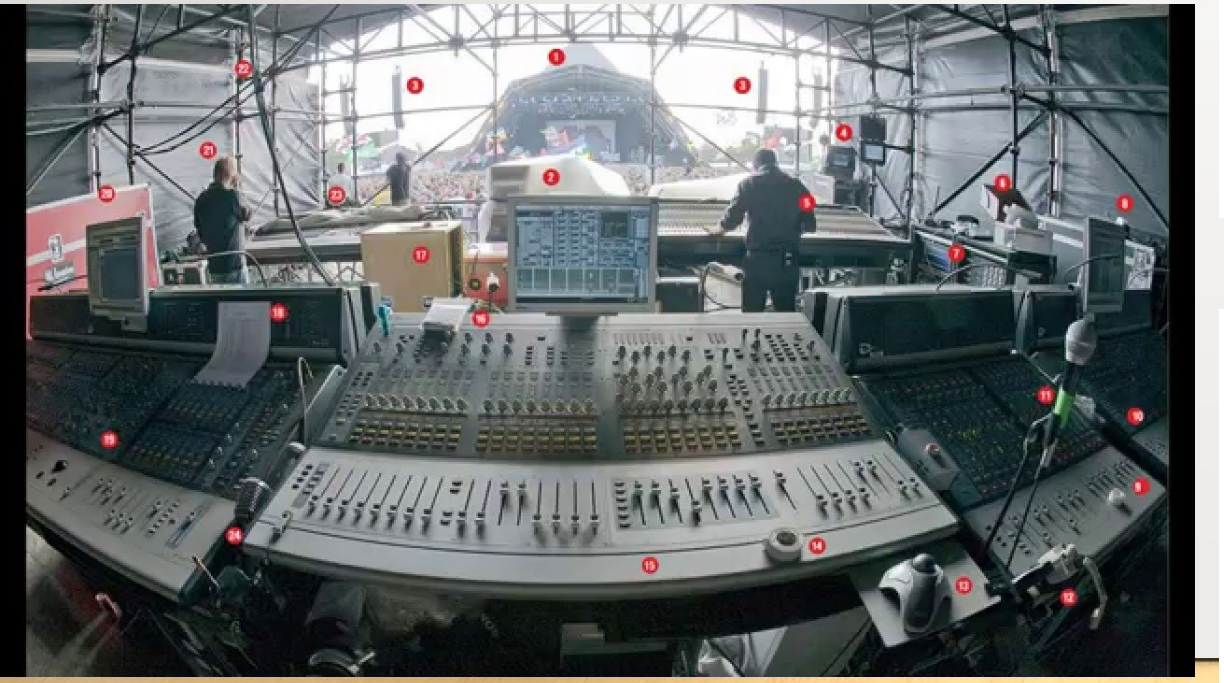
- 咪高峰 (Calibration Microphone)
- 校正器 (Calibrator)
- 測試軟件 (Measurement Software) - SMAART / ATRA / REW

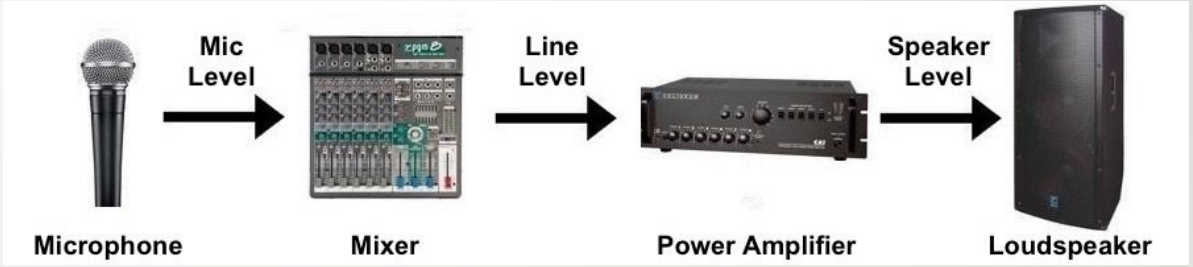


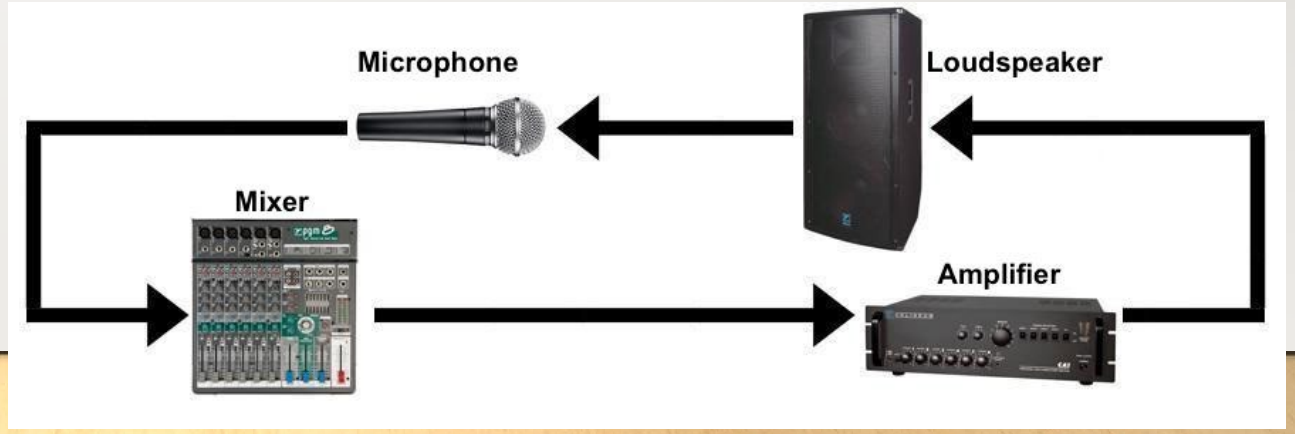




音響系統的設計與測量
Design and Measure of Audio System

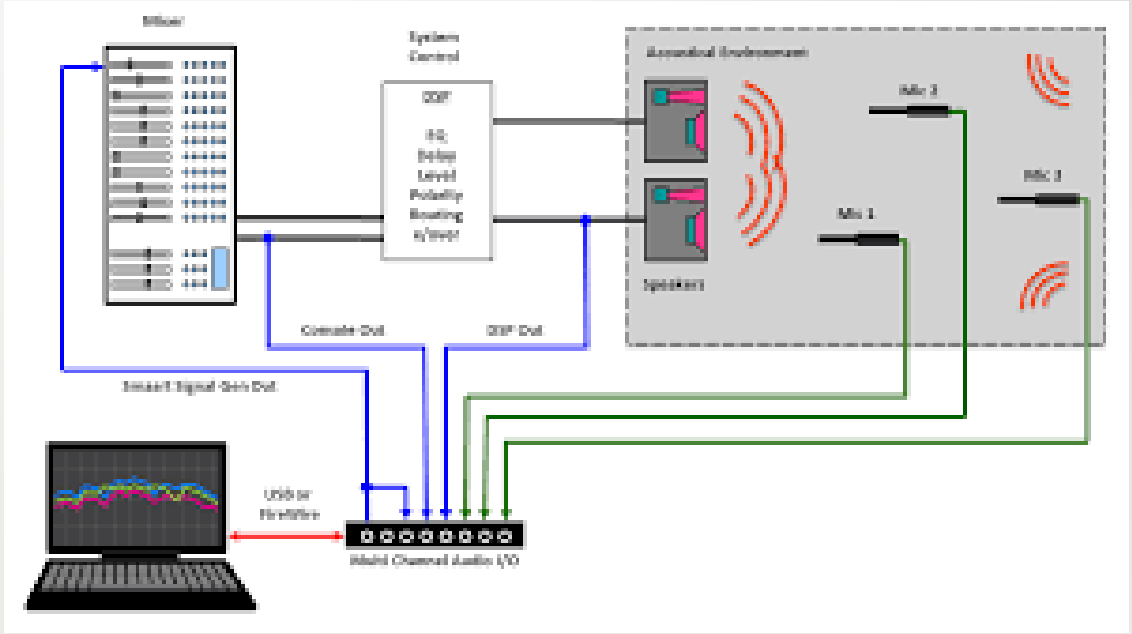






音響系統的設計與測量
Design and Measure of Audio System

- 測試設定 (TEST Setup)



音頻插頭問問你
Audio Plug



- 插頭 (Plug) - 信號篇

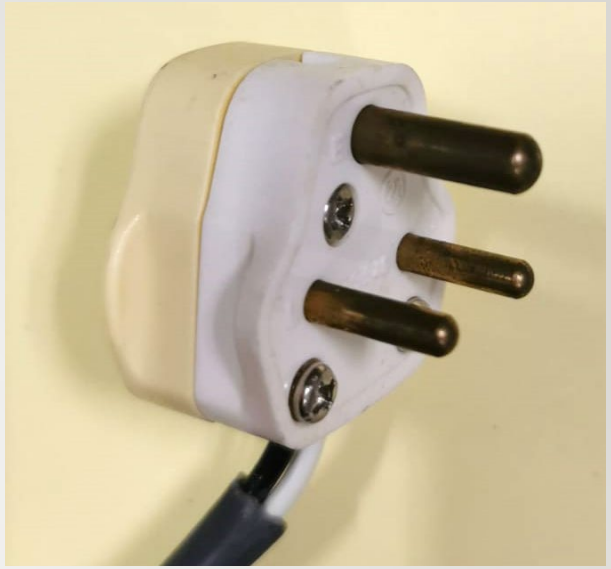






音頻插頭問問你
Audio Plug

- 插頭 (Plug) - 功率篇







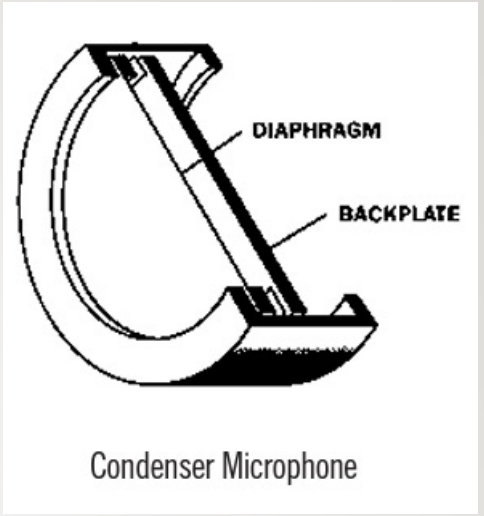


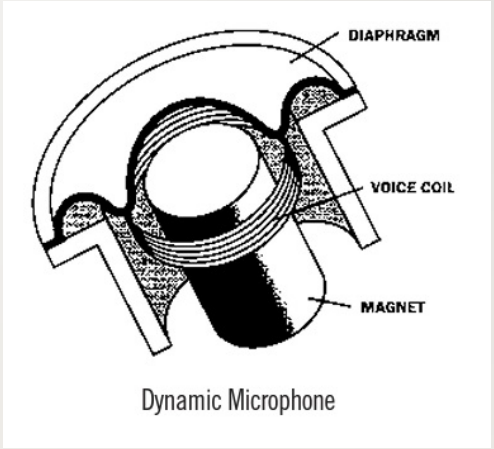
音響系統的部件 (輸入篇)
Equipment of Audio System (Input)

- 咪高峰 (Microphone) - 弱信號 (Mic Level)
- 結他拾音器 (Guitar Pickup) - 弱信號高阻抗 (Instrument Level)
- 影碟機 (CD Player, Etc) - 強信號 (Line Level)
- 電腦 (Computer / Matrix Audio Out) - 強信號 (Line Level)

咪高峰知多少
Microphone

- 電容咪 Condenser Mic
  - 魅影電源 Phantom Power
  - 動態範圍有限制 Dynamic range (Limited)
  - 中高頻比較好 Better in Mid-high frequency range
- 動圈式咪高峰 Dynamic Mic
  - 不需要供電 Work without power supply
  - 動態範圍無限制 Dynamic range (Infinite)
  - 中低頻比較好 Better in Low-mid frequency range





咪高峰知多少
Microphone

- 手揸咪 Handheld Mic

SM58®

Industry standard microphone tailored to deliver warm and clear vocal reproduction.



Lead Vocals
Backup Vocals
Harmonica

50Hz - 15kHz

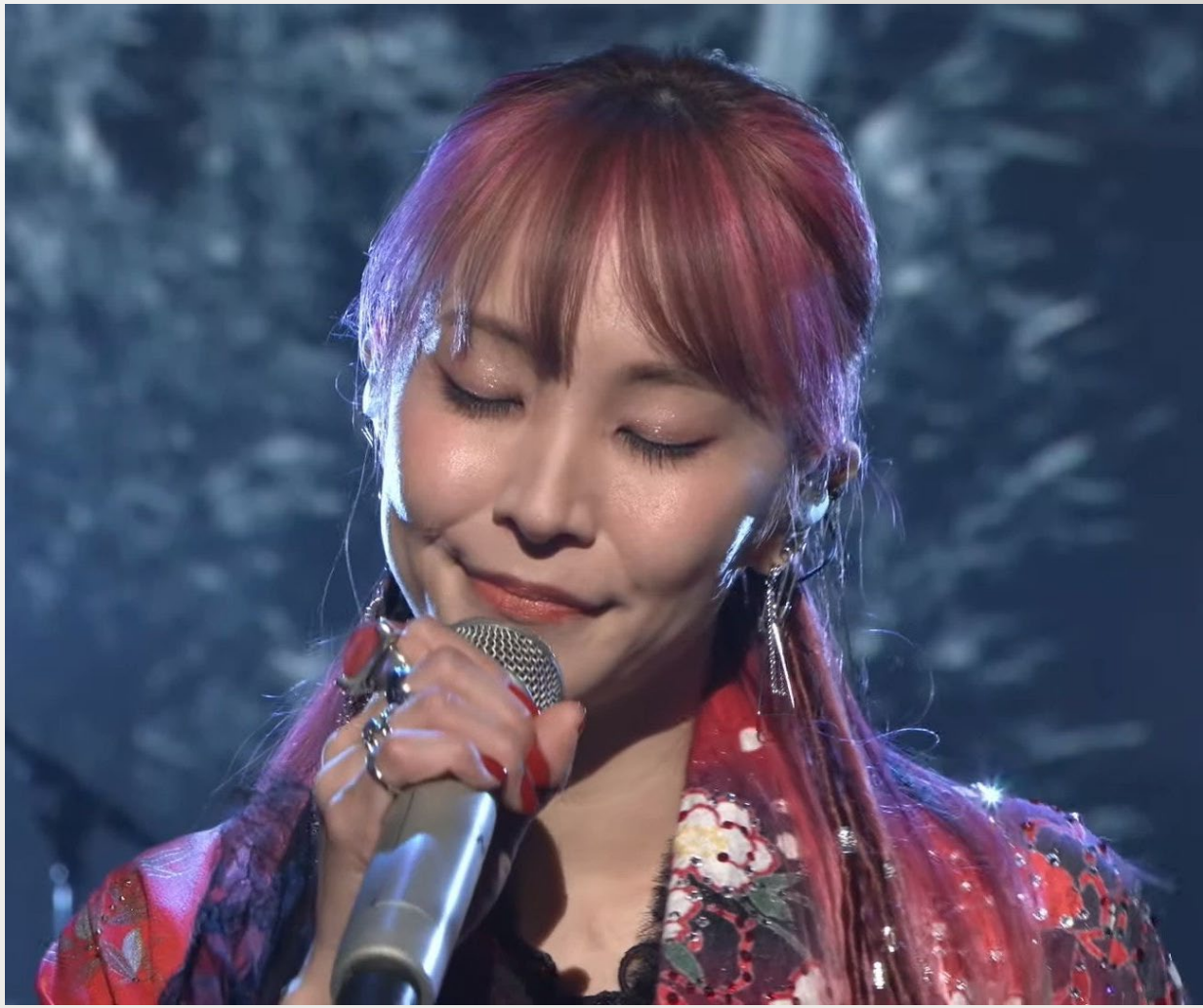
SM86

Rugged microphone with extended high frequency response for smooth reproduction of lead vocals.



Lead Vocals
Backup Vocals

50Hz - 18kHz



咪高峰知多少
Microphone

- 鵝頸咪 Gooseneck Mic





咪高峰知多少
Microphone

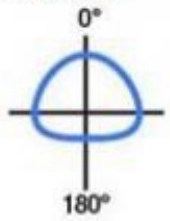
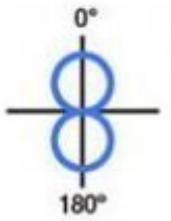
- Paging Mic





咪高峰知多少
Microphone

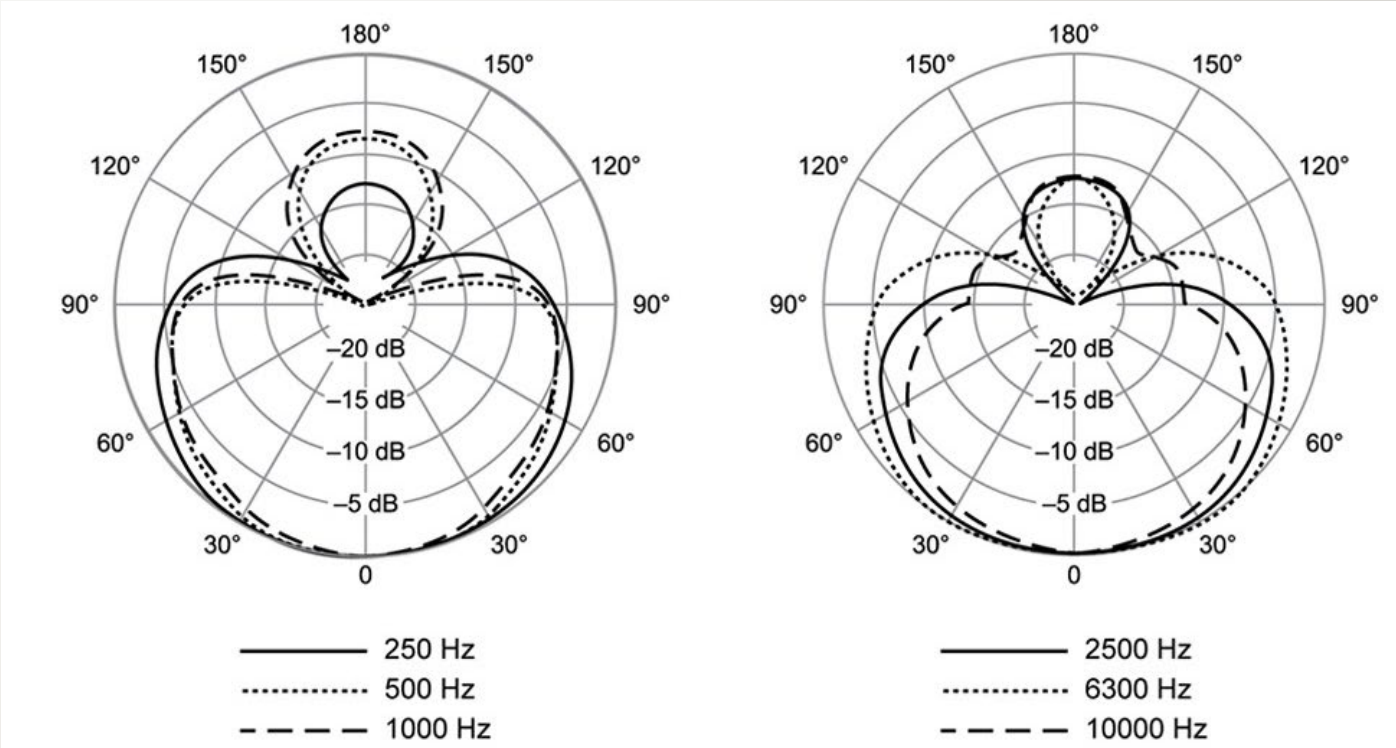
- 指向性 Polar Pattern

Characteristic	Omni-Directional	Sub-Cardioid	Cardioid	Super-Cardioid	Hyper-Cardioid	Bidirectional
Polar Response Pattern						
Coverage Angle	360°	150°	131°	115°	105°	90°
Angle of Maximum Rejection (null angle)	—	180°	180°	126°	110°	90°

MORE REJECTION

咪高峰知多少
Microphone

- 指向性 Polar Pattern

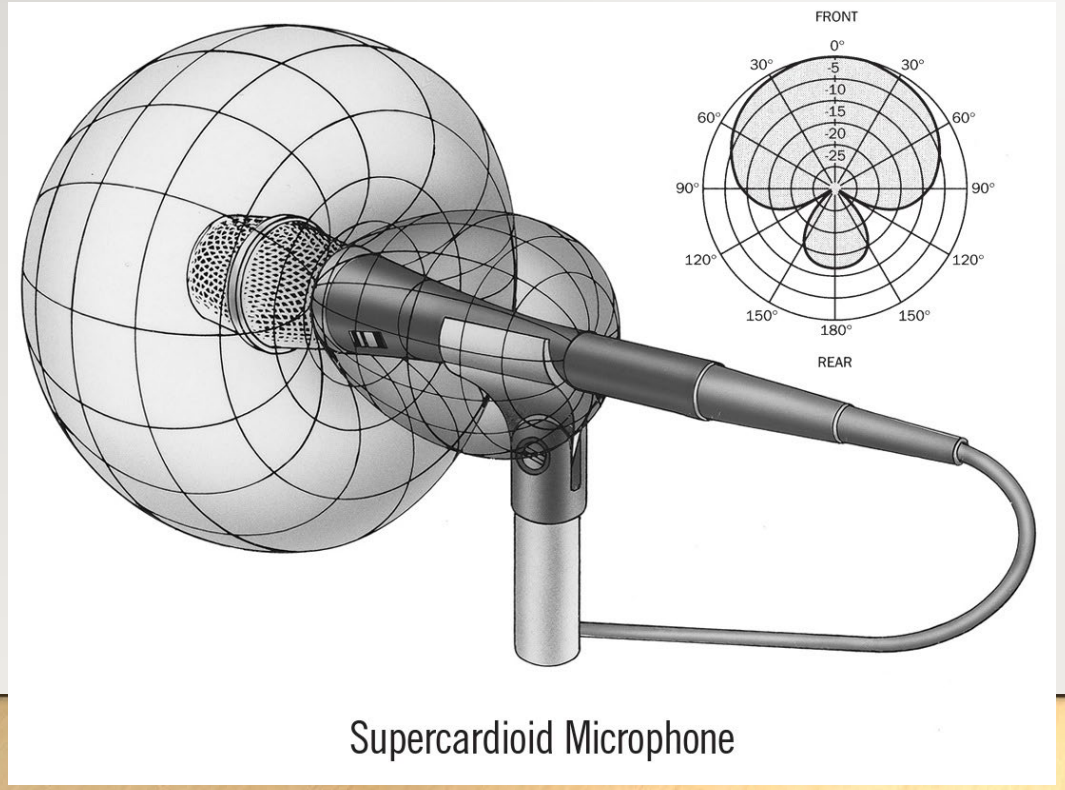


Typical Polar Patterns

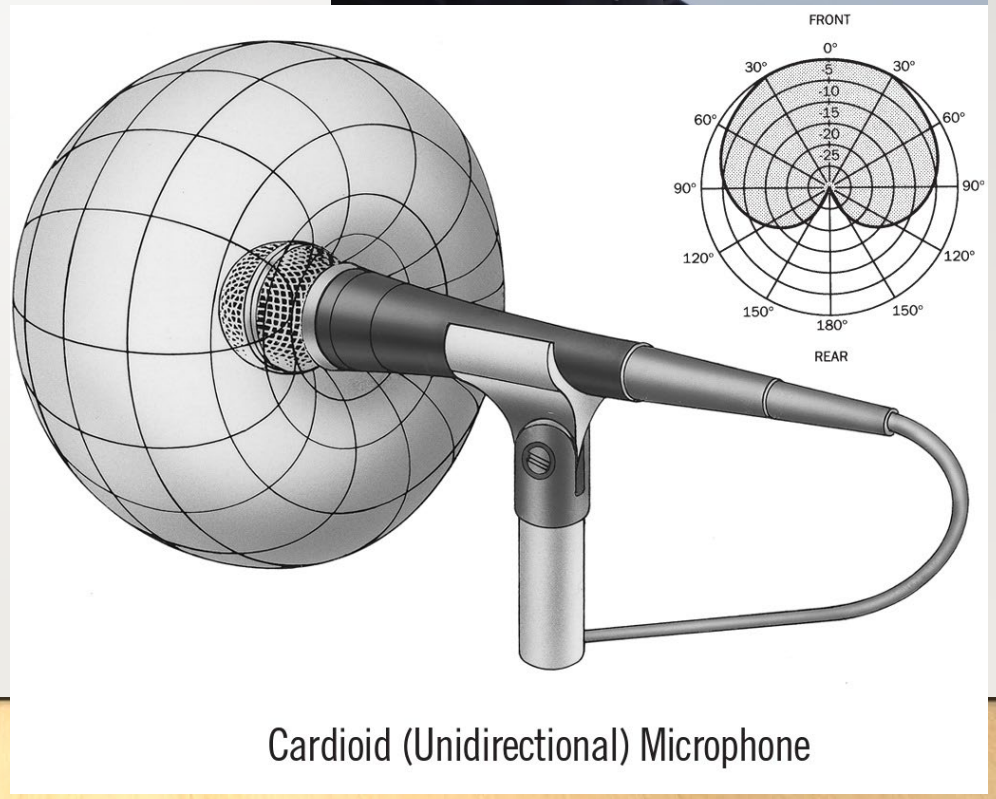
咪高峰知多少
Microphone



- 指向性 Polar Pattern



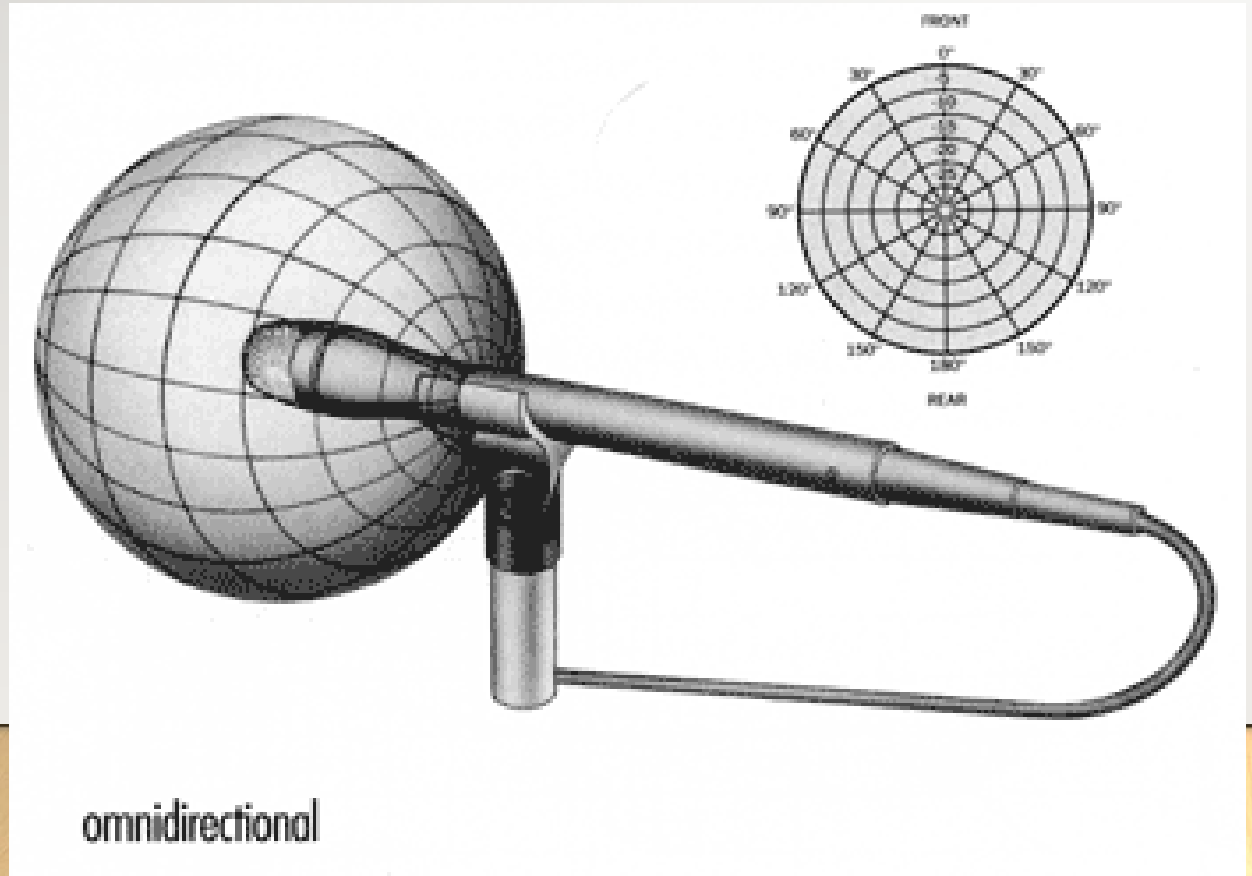
Supercardioid Microphone

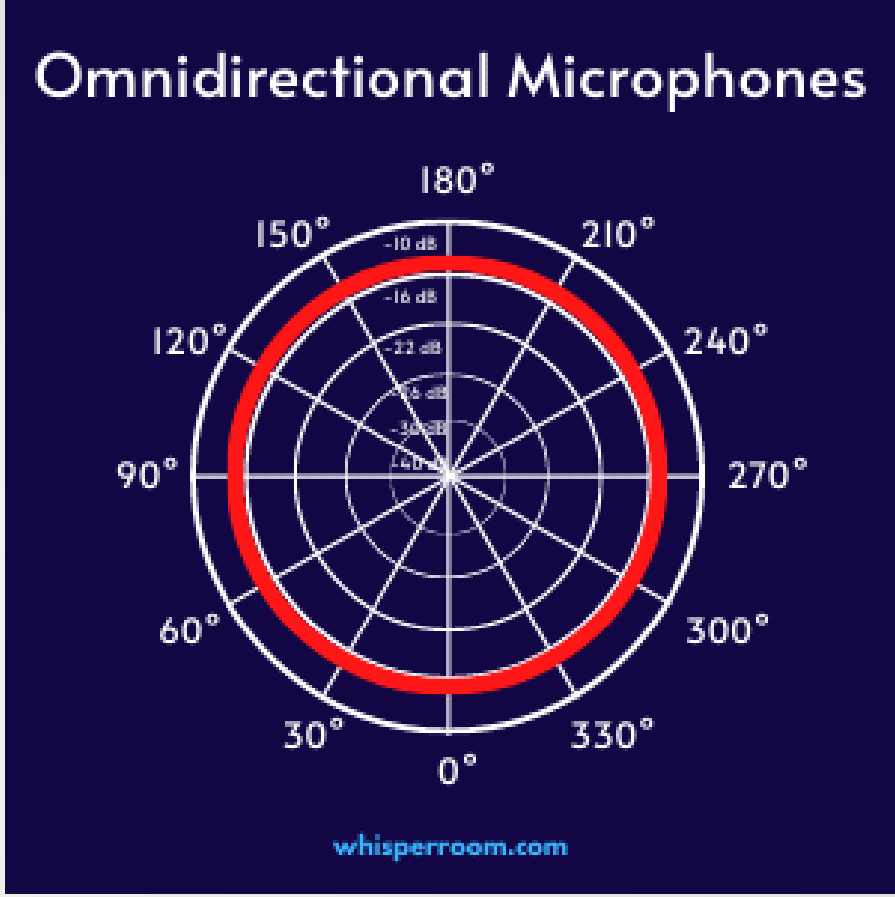


Cardioid (Unidirectional) Microphone

咪高峰知多少
Microphone

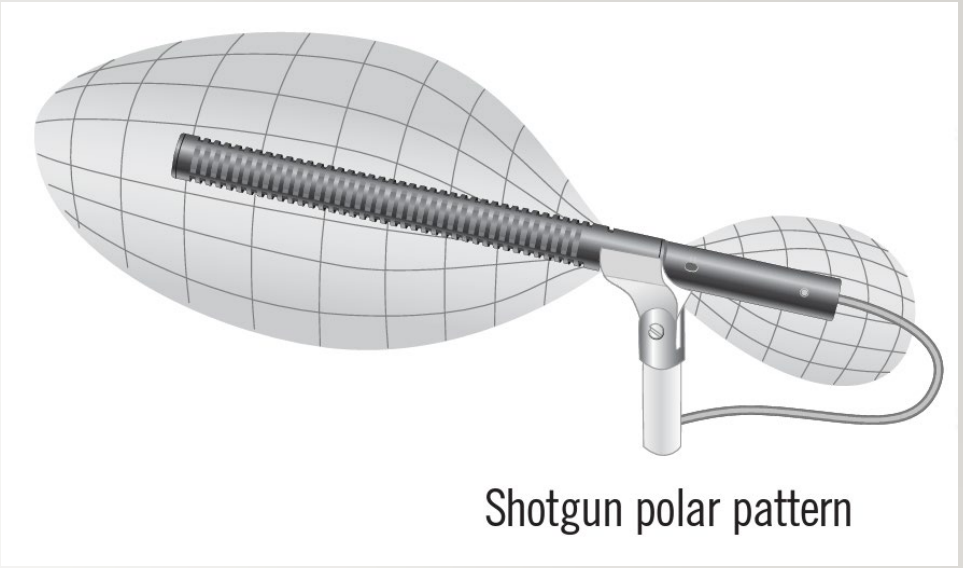
- 指向性 Polar Pattern



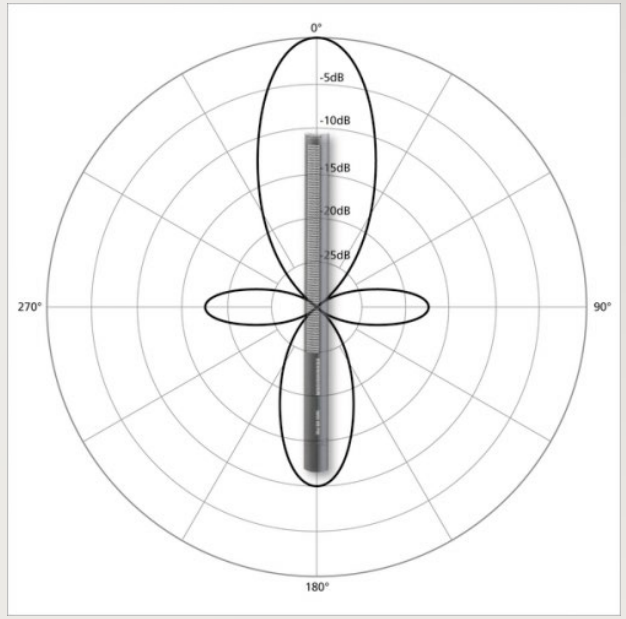


咪高峰知多少
Microphone

- 指向性 Polar Pattern







咪高峰知多少
Microphone

- 指向性 Polar Pattern





咪高峰知多少
Microphone

- 握咪手勢 Hand Placement





咪高峰知多少
Microphone

- 握咪手勢 Hand Placement





咪高峰知多少
Microphone

- 握咪手勢 Hand Placement





廣播系統部件
Inhibitor





What is Pubic address System?
什麼是公眾廣播系統?

- 公共廣播系統是在有限的範圍內為公眾服務的廣播系統
- 主要是播放能令公眾聽到清晰的語音指令 (200 to 8000 Hz)



公眾廣播系統和音響系統的分別
Different between on PA system & HiFi system

- 擴音機 / Amplifier
- 喇叭 / Speaker





公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

- 擴音機 (Amplifier) – PA



公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

- 擴音機 (Amplifier) – HiFi



公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

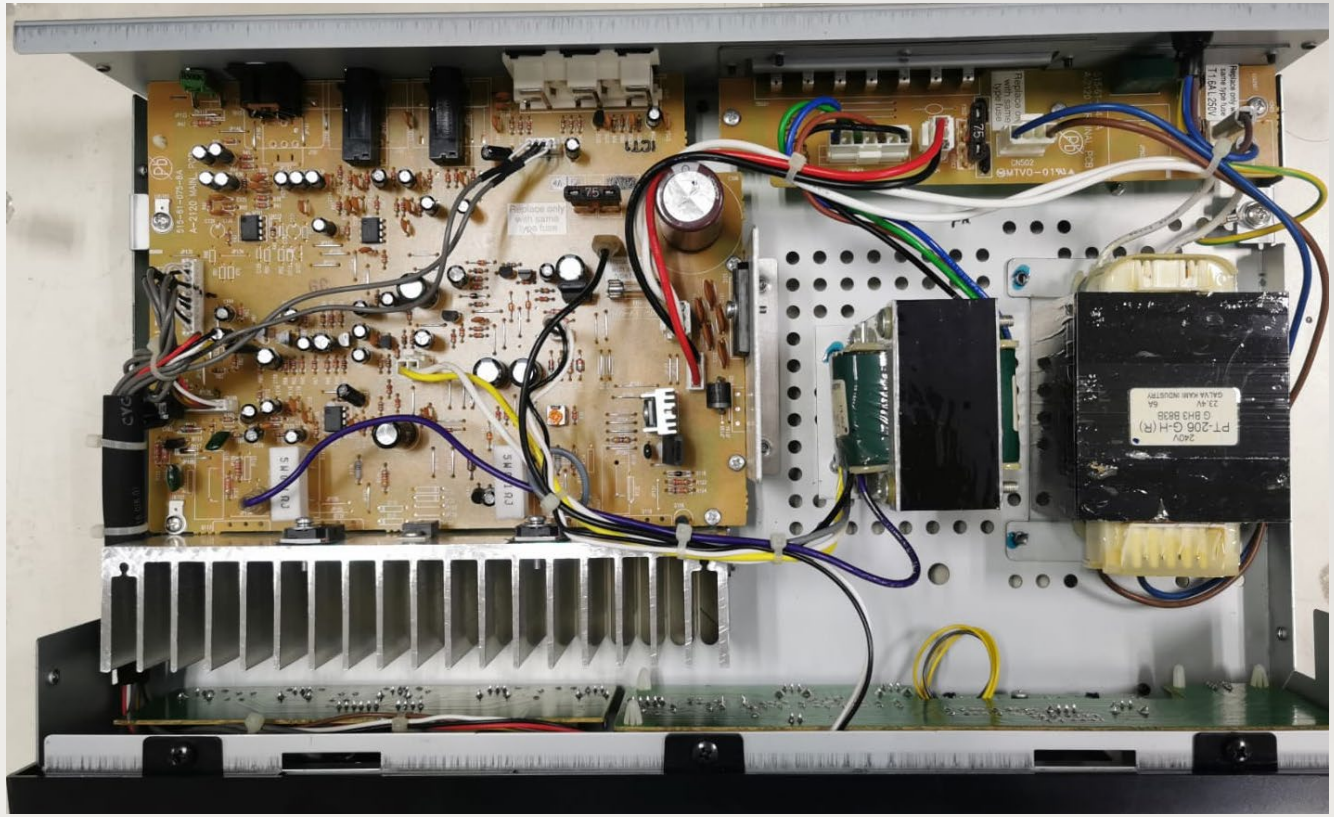
- 擴音機 (Amplifier)

廣播功放不同於HI－FI功放。其最主要的特徵是具有70V和100V恆壓輸出端子。

這是由於廣播線路通常都相當長，須用高壓傳輸才能減小線路損耗。

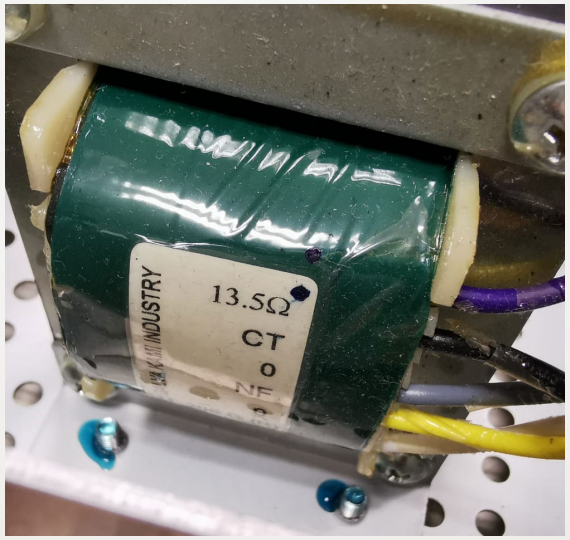
公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

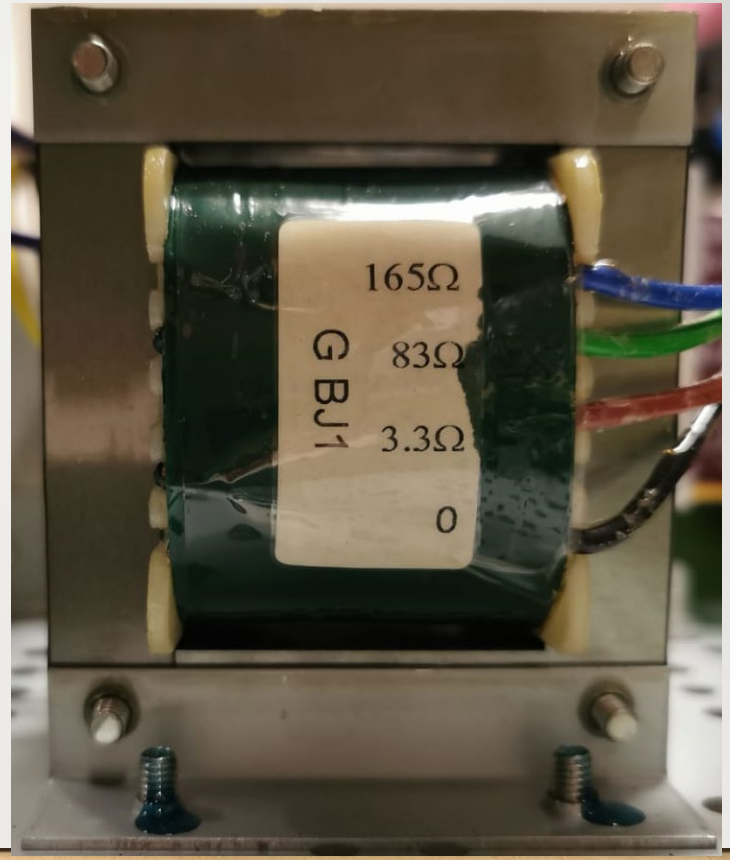
- 擴音機 (Amplifier)



公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

- 擴音機 (Amplifier)





公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

- 喇叭 / 揚聲器 (Speaker)

  連續可承受功率 (Maximum RMS Power) $60w_{rms}$

  瞬間可承受功率 (Musical power) 200w

  聲壓級 (SPL) 88dB/w

  阻抗 (impedance) 8 Ohm / 1kHz

公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

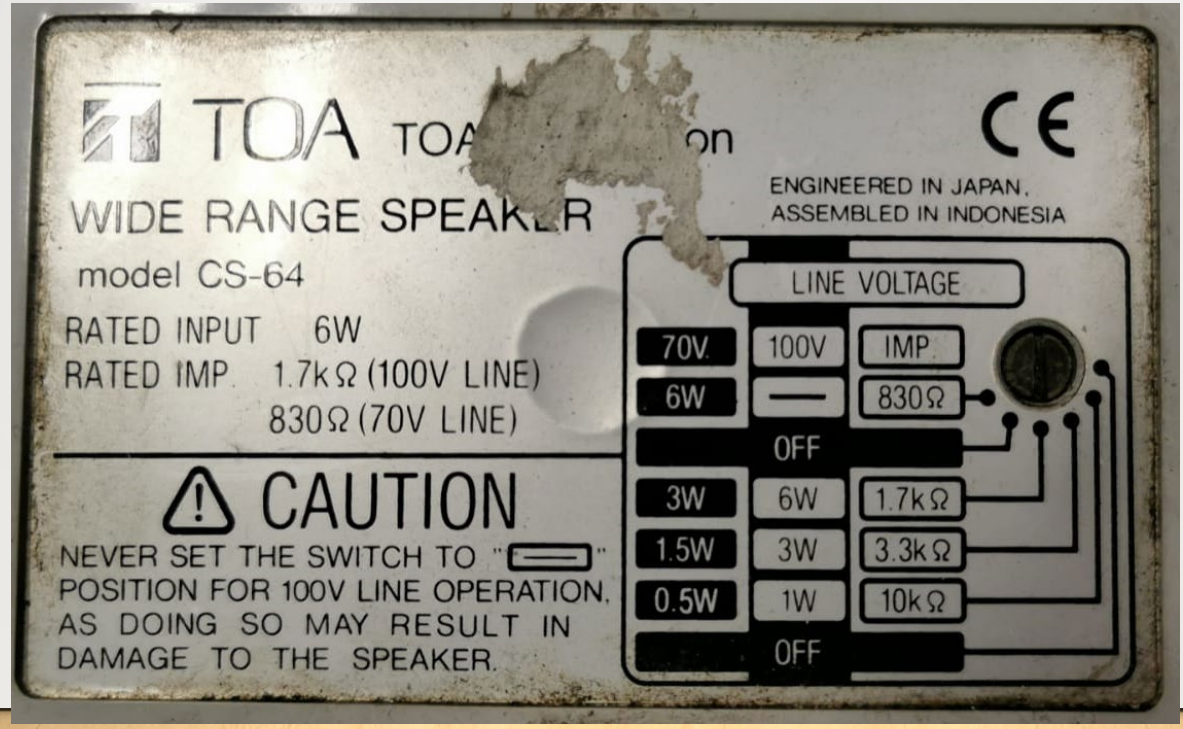
- 喇叭 / 揚聲器 (Speaker)





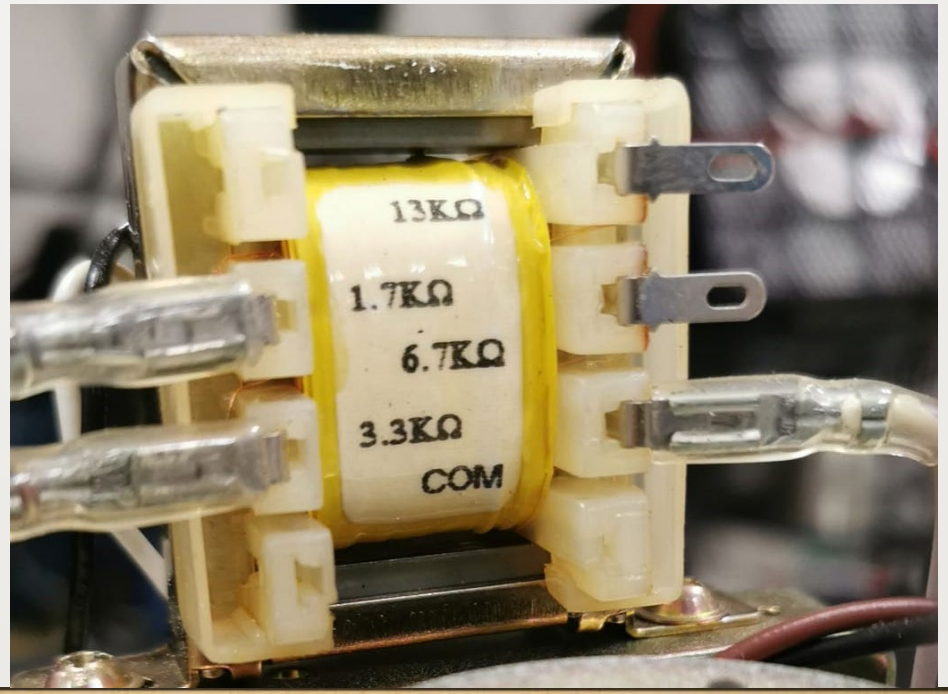
公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

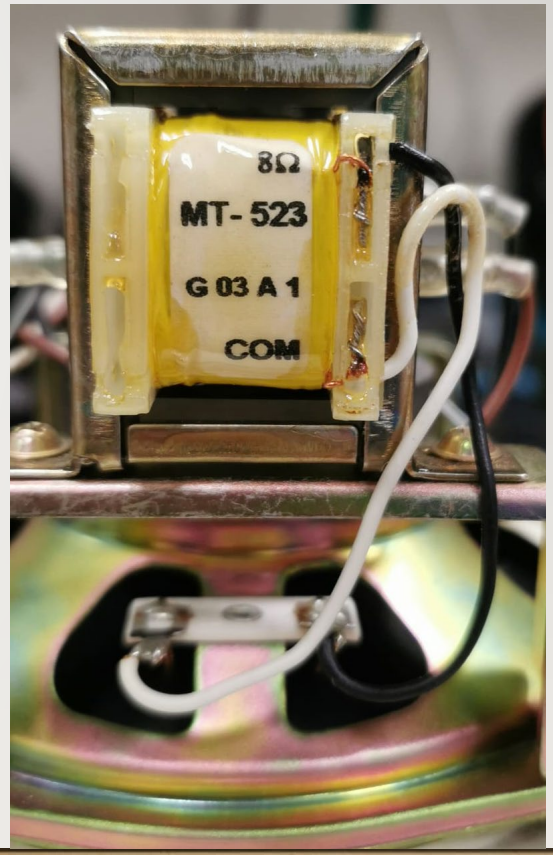
- 喇叭 / 揚聲器 (Speaker)



公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

- 喇叭 / 揚聲器 (Speaker)





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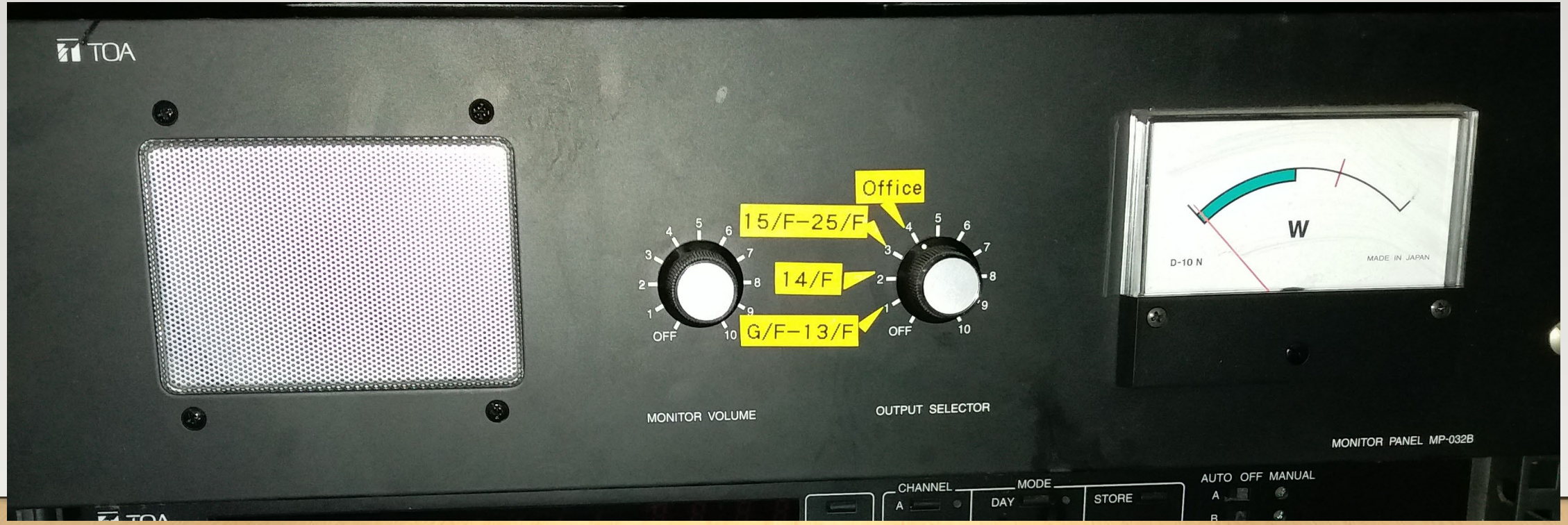
- 喇叭 / 揚聲器 (Speaker)

Power (W)	Load @ 70.7V	Load @ 100V
3	1666Ω	3334Ω
6	833Ω	1667Ω
10	500Ω	1000Ω
50	100Ω	200Ω
100	50Ω	100Ω
150	33.3Ω	66.7Ω
200	25Ω	50Ω
300	16.7Ω	33.4Ω
500	10Ω	20Ω
600	8.3Ω	16.7Ω

Table 1: Load impedances for 70V and 100V line voltage

公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

- 監聽器 (Monitor)



公眾廣播系統
PA system

- 小休片刻 (Break)　　15 Mins

公眾廣播系統
PA system

- 常用工具 (Tool)



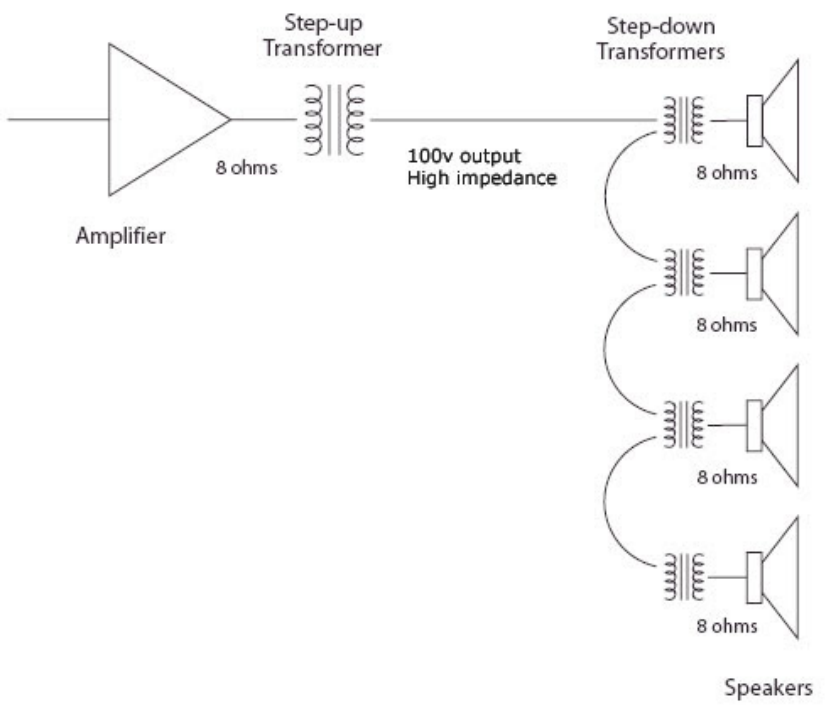


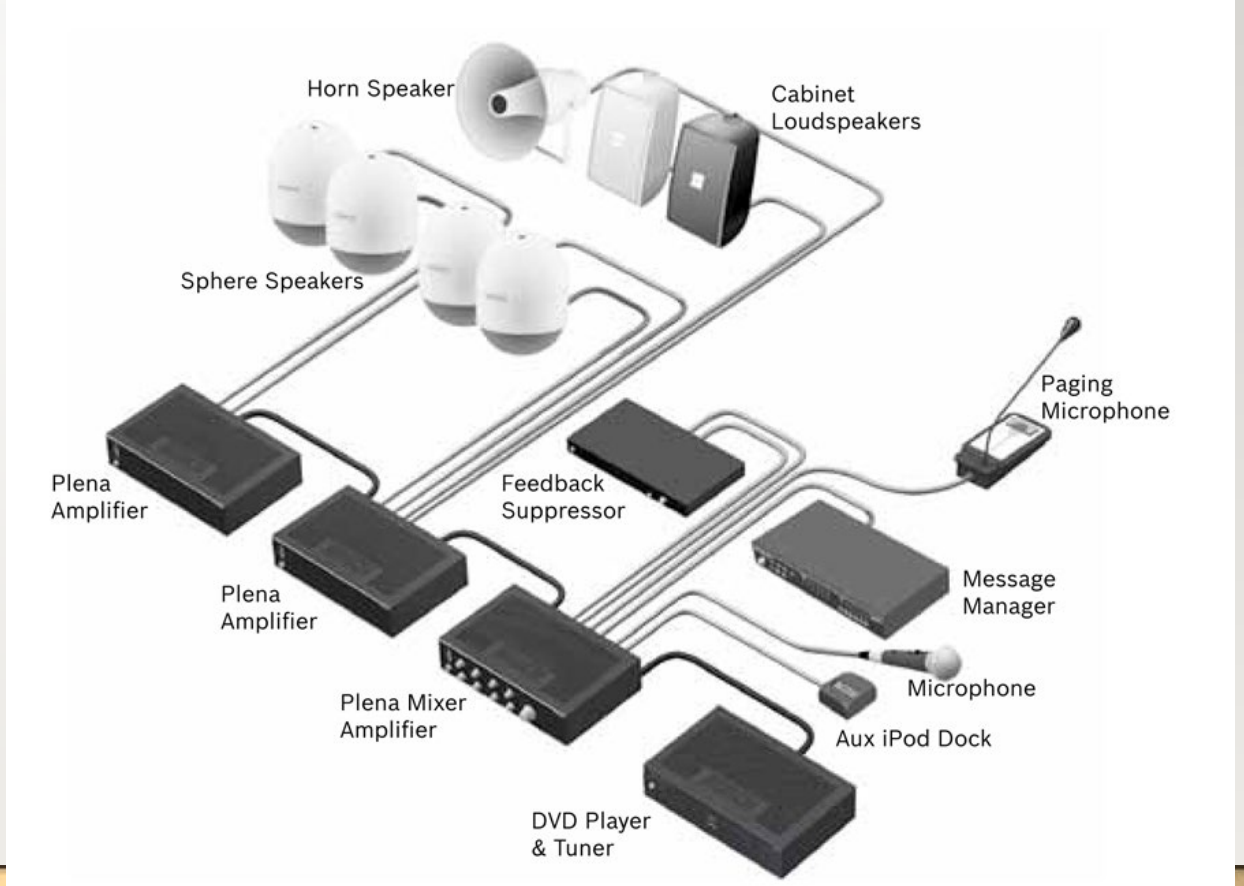
公眾廣播系統驗收標準
T&C of PA system

- EMSD ESG11 (10/2016)
- 設計音量為環境嘈音高 6 - 10dB(A)
  - 環境嘈音量參考數值
    - 一般辦公室　　50dB(A)
    - 厠所　　60dB(A)
    - 食店 / 飯堂　　65dB(A)
    - 會議室/文化中心　　70dB(A)
    - 足球場　　95dB(A)

公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

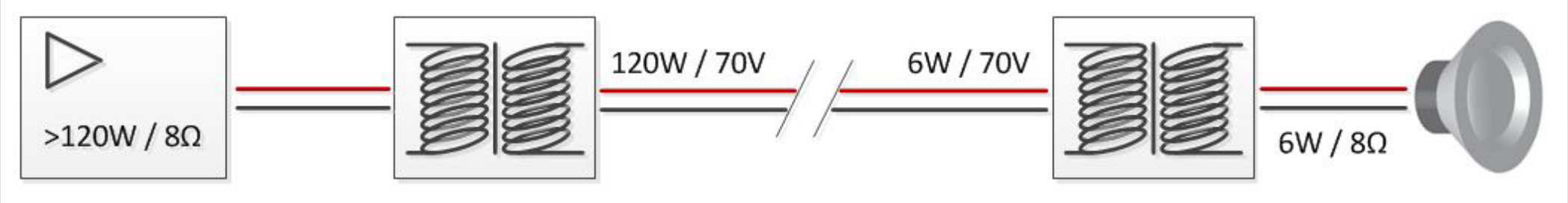
- 系統架構 (System Config)

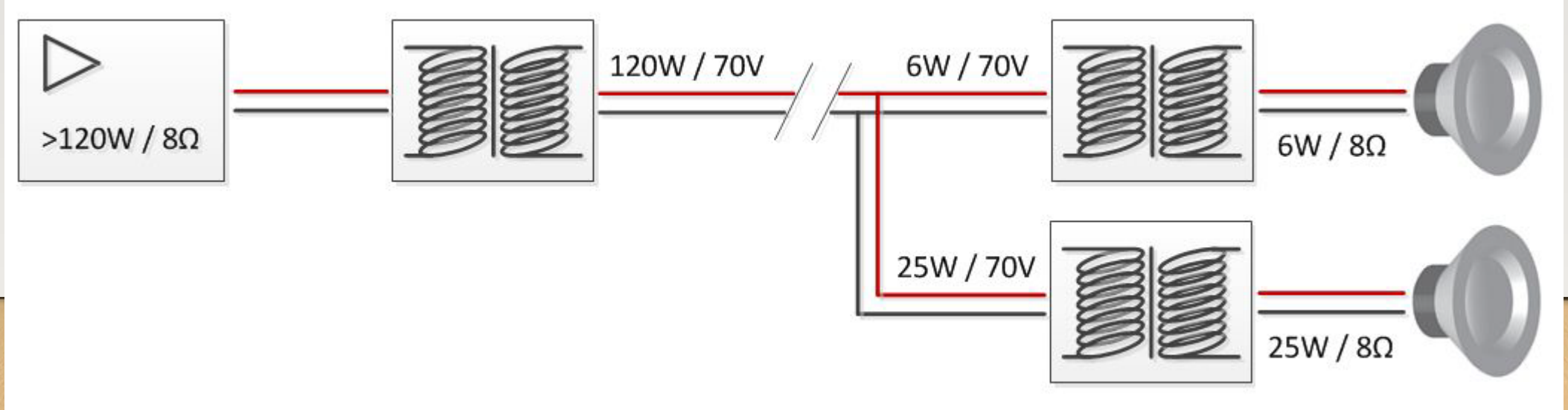


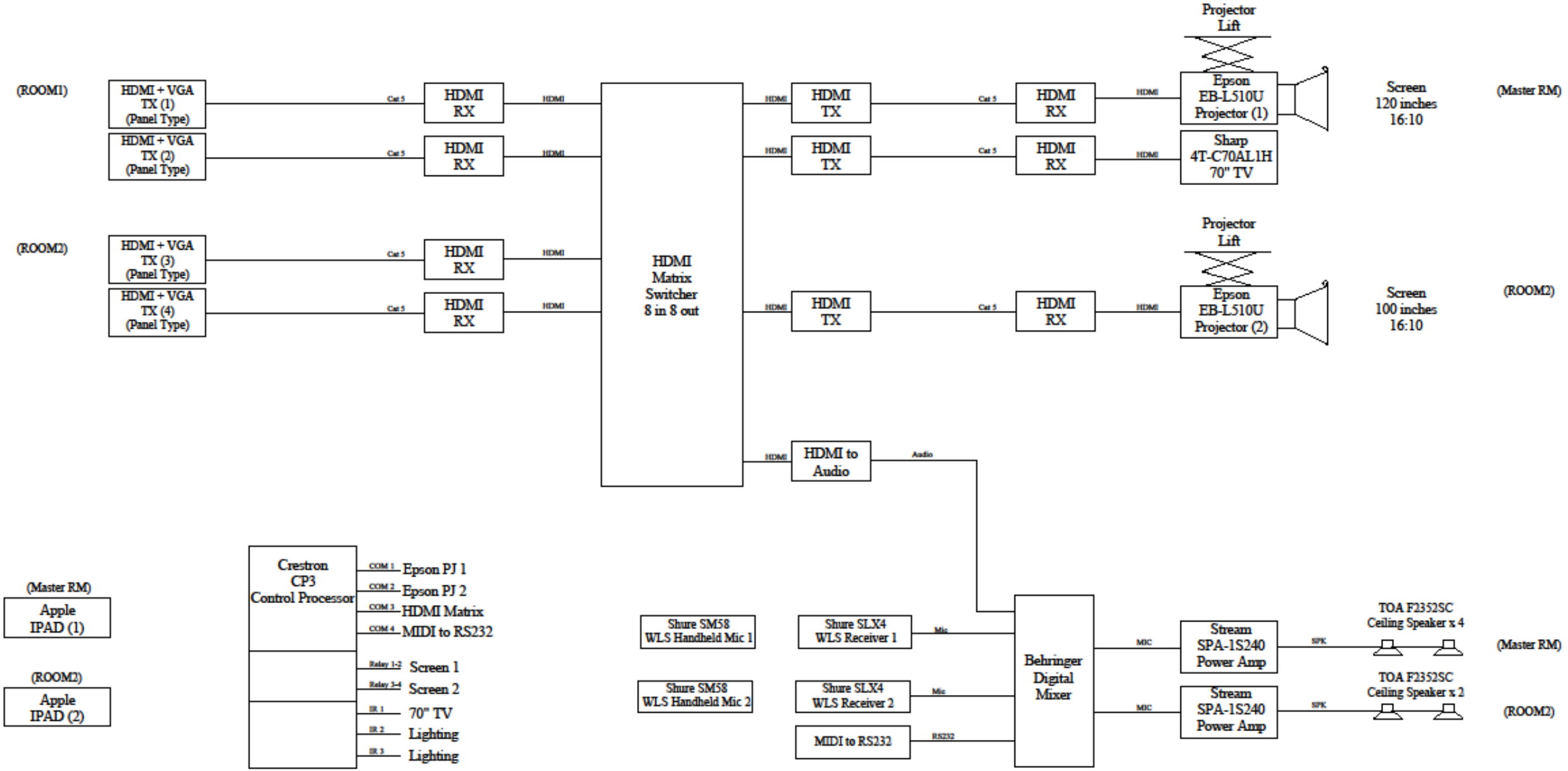


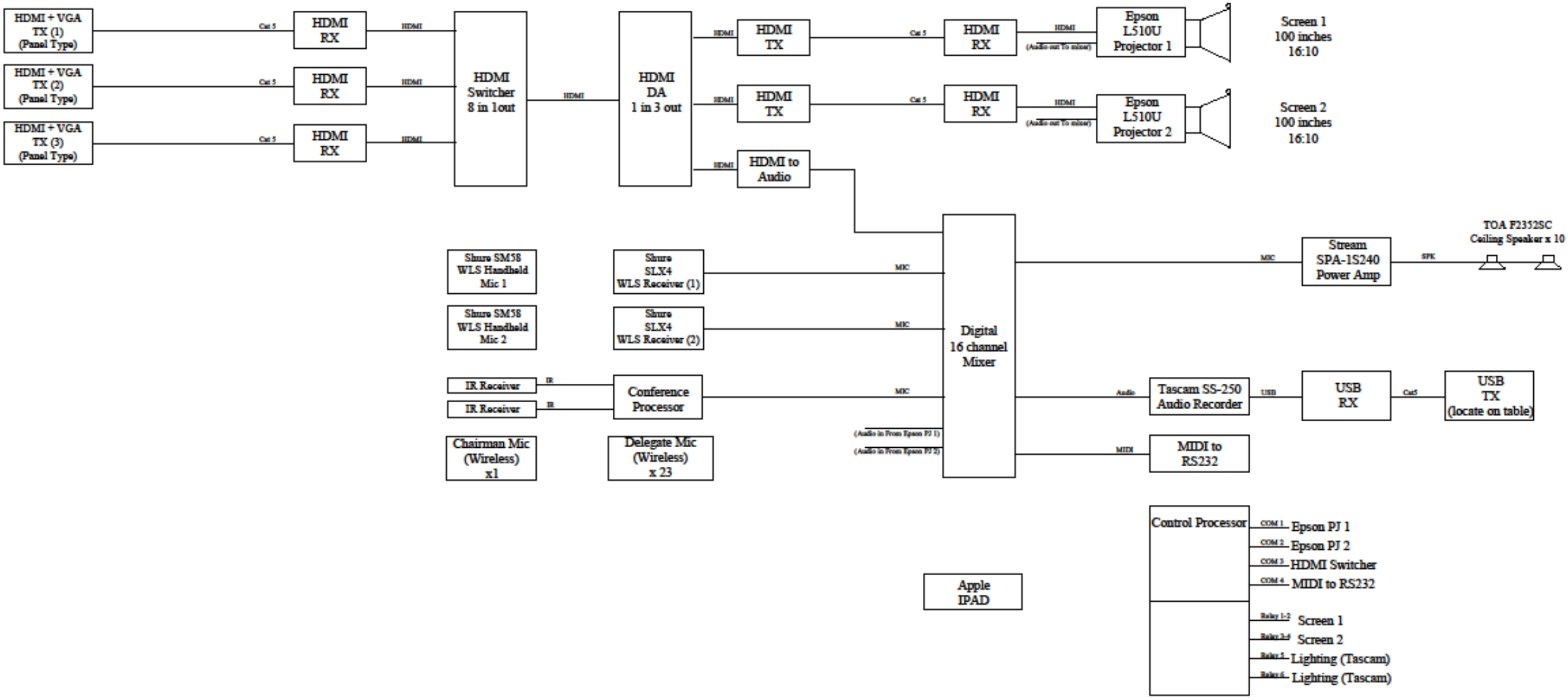
公眾廣播系統和音響系統的分別 (擴音機)
Different between on PA system & HiFi system

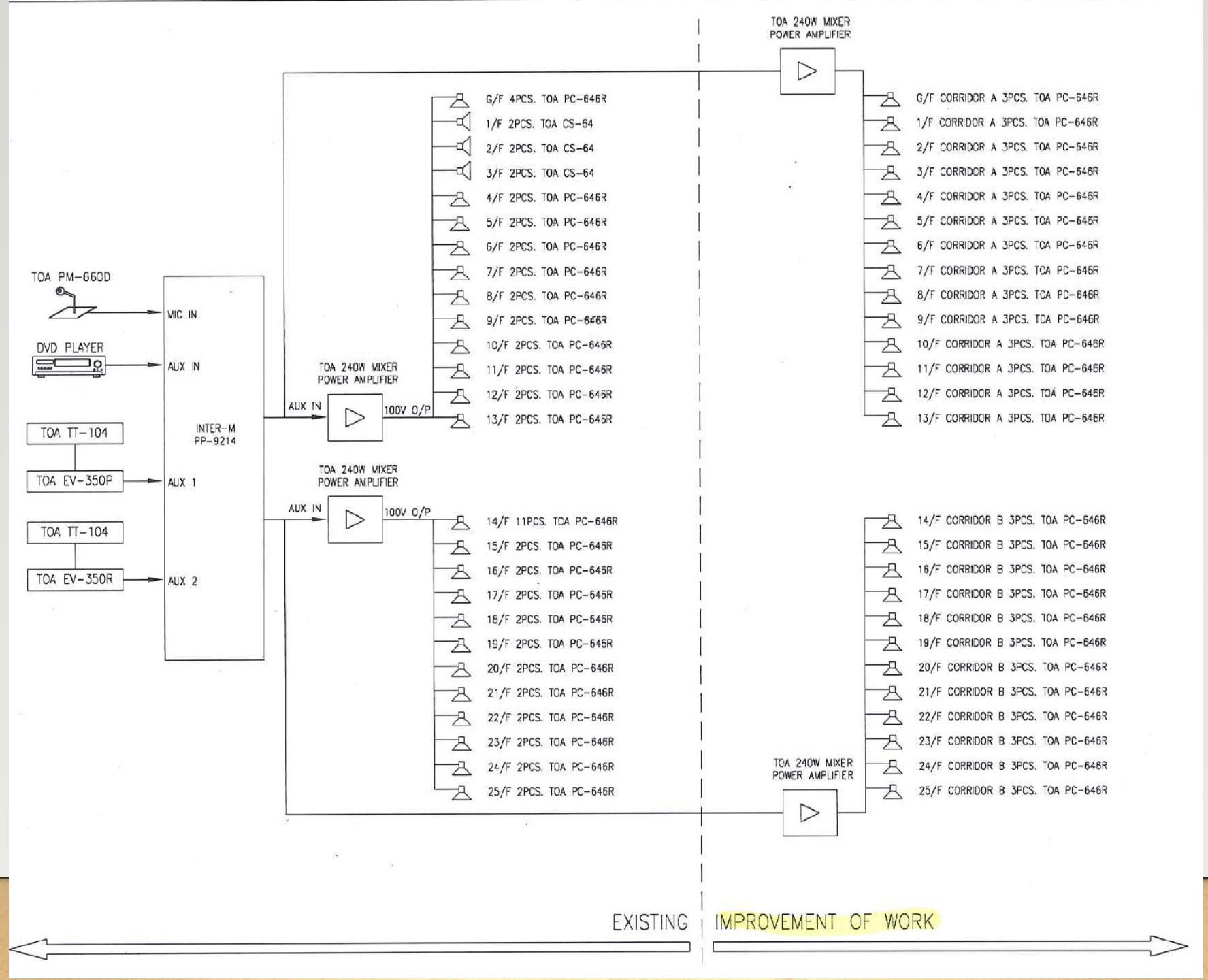
- 系統架構 (System Config)






(ROOM1)
HDMI + VGA TX (1) (Panel Type)
HDMI + VGA TX (2) (Panel Type)
Cat 5
HDMI RX
HDMI
HDMI Matrix Switcher 8 in 8 out
HDMI TX
Cat 5
HDMI RX
Projector Lift
Epson EB-L510U Projector (1)
Sharp 4T-C70AL1H 70" TV
Screen 120 inches 16:10
(Master RM)
(ROOM2)
HDMI + VGA TX (3) (Panel Type)
HDMI + VGA TX (4) (Panel Type)
Epson EB-L510U Projector (2)
Screen 100 inches 16:10
(ROOM2)
HDMI to Audio
Audio
(Master RM)
Apple IPAD (1)
(ROOM2)
Apple IPAD (2)
Crestron CP3 Control Processor
COM 1 Epson PJ 1
COM 2 Epson PJ 2
COM 3 HDMI Matrix
COM 4 MIDI to RS232
Relay 1-2 Screen 1
Relay 3-4 Screen 2
IR 1 70" TV
IR 2 Lighting
IR 3 Lighting
Shure SM58 WLS Handheld Mic 1
Shure SM58 WLS Handheld Mic 2
Shure SLX4 WLS Receiver 1
Shure SLX4 WLS Receiver 2
Mic
MIDI to RS232
RS232
Behringer Digital Mixer
MIC
Stream SPA-1S240 Power Amp
SPK
TOA F2352SC Ceiling Speaker x 4
TOA F2352SC Ceiling Speaker x 2
(Master RM)
(ROOM2)


HDMI + VGA TX (1) (Panel Type)
HDMI + VGA TX (2) (Panel Type)
HDMI + VGA TX (3) (Panel Type)
Cat 5
HDMI RX
HDMI RX
HDMI RX
HDMI
HDMI Switcher 8 in 1out
HDMI DA 1 in 3 out
HDMI TX
HDMI TX
HDMI to Audio
HDMI RX
HDMI RX
(Audio out To mixer)
Epson L510U Projector 1
Epson L510U Projector 2
Screen 1 100 inches 16:10
Screen 2 100 inches 16:10
Shure SM58 WLS Handheld Mic 1
Shure SM58 WLS Handheld Mic 2
Shure SLX4 WLS Receiver (1)
Shure SLX4 WLS Receiver (2)
IR Receiver
IR Receiver
IR
Conference Processor
Chairman Mic (Wireless) x1
Delegate Mic (Wireless) x 23
MIC
(Audio in From Epson PJ 1)
(Audio in From Epson PJ 2)
Digital 16 channel Mixer
Stream SPA-1S240 Power Amp
SPK
TOA F2352SC Ceiling Speaker x 10
Audio
Tascam SS-250 Audio Recorder
USB
USB RX
Cat5
USB TX (locate on table)
MIDI
MIDI to RS232
Apple IPAD
Control Processor
COM 1
COM 2
COM 3
COM 4
Epson PJ 1
Epson PJ 2
HDMI Switcher
MIDI to RS232
Relay 1-2
Relay 3-4
Relay 5
Relay 6
Screen 1
Screen 2
Lighting (Tascam)
Lighting (Tascam)


TOA PM-660D
MIC IN
DVD PLAYER
AUX IN
TOA TT-104
TOA EV-350P
AUX 1
TOA TT-104
TOA EV-350R
AUX 2
INTER-M
PP-9214
TOA 240W MIXER
POWER AMPLIFIER
AUX IN
100V O/P
G/F 4PCS. TOA PC-646R
1/F 2PCS. TOA CS-64
2/F 2PCS. TOA CS-64
3/F 2PCS. TOA CS-64
4/F 2PCS. TOA PC-646R
5/F 2PCS. TOA PC-646R
6/F 2PCS. TOA PC-646R
7/F 2PCS. TOA PC-646R
8/F 2PCS. TOA PC-646R
9/F 2PCS. TOA PC-646R
10/F 2PCS. TOA PC-646R
11/F 2PCS. TOA PC-646R
12/F 2PCS. TOA PC-646R
13/F 2PCS. TOA PC-646R
TOA 240W MIXER
POWER AMPLIFIER
AUX IN
100V O/P
14/F 11PCS. TOA PC-646R
15/F 2PCS. TOA PC-646R
16/F 2PCS. TOA PC-646R
17/F 2PCS. TOA PC-646R
18/F 2PCS. TOA PC-646R
19/F 2PCS. TOA PC-646R
20/F 2PCS. TOA PC-646R
21/F 2PCS. TOA PC-646R
22/F 2PCS. TOA PC-646R
23/F 2PCS. TOA PC-646R
24/F 2PCS. TOA PC-646R
25/F 2PCS. TOA PC-646R
TOA 240W MIXER
POWER AMPLIFIER
G/F CORRIDOR A 3PCS. TOA PC-646R
1/F CORRIDOR A 3PCS. TOA PC-646R
2/F CORRIDOR A 3PCS. TOA PC-646R
3/F CORRIDOR A 3PCS. TOA PC-646R
4/F CORRIDOR A 3PCS. TOA PC-646R
5/F CORRIDOR A 3PCS. TOA PC-646R
6/F CORRIDOR A 3PCS. TOA PC-646R
7/F CORRIDOR A 3PCS. TOA PC-646R
8/F CORRIDOR A 3PCS. TOA PC-646R
9/F CORRIDOR A 3PCS. TOA PC-646R
10/F CORRIDOR A 3PCS. TOA PC-646R
11/F CORRIDOR A 3PCS. TOA PC-646R
12/F CORRIDOR A 3PCS. TOA PC-646R
13/F CORRIDOR A 3PCS. TOA PC-646R
14/F CORRIDOR B 3PCS. TOA PC-646R
15/F CORRIDOR B 3PCS. TOA PC-646R
16/F CORRIDOR B 3PCS. TOA PC-646R
17/F CORRIDOR B 3PCS. TOA PC-646R
18/F CORRIDOR B 3PCS. TOA PC-646R
19/F CORRIDOR B 3PCS. TOA PC-646R
20/F CORRIDOR B 3PCS. TOA PC-646R
21/F CORRIDOR B 3PCS. TOA PC-646R
22/F CORRIDOR B 3PCS. TOA PC-646R
23/F CORRIDOR B 3PCS. TOA PC-646R
24/F CORRIDOR B 3PCS. TOA PC-646R
25/F CORRIDOR B 3PCS. TOA PC-646R
EXISTING
IMPROVEMENT OF WORK

公眾廣播系統 與 音響系統
PA system & HiFi system

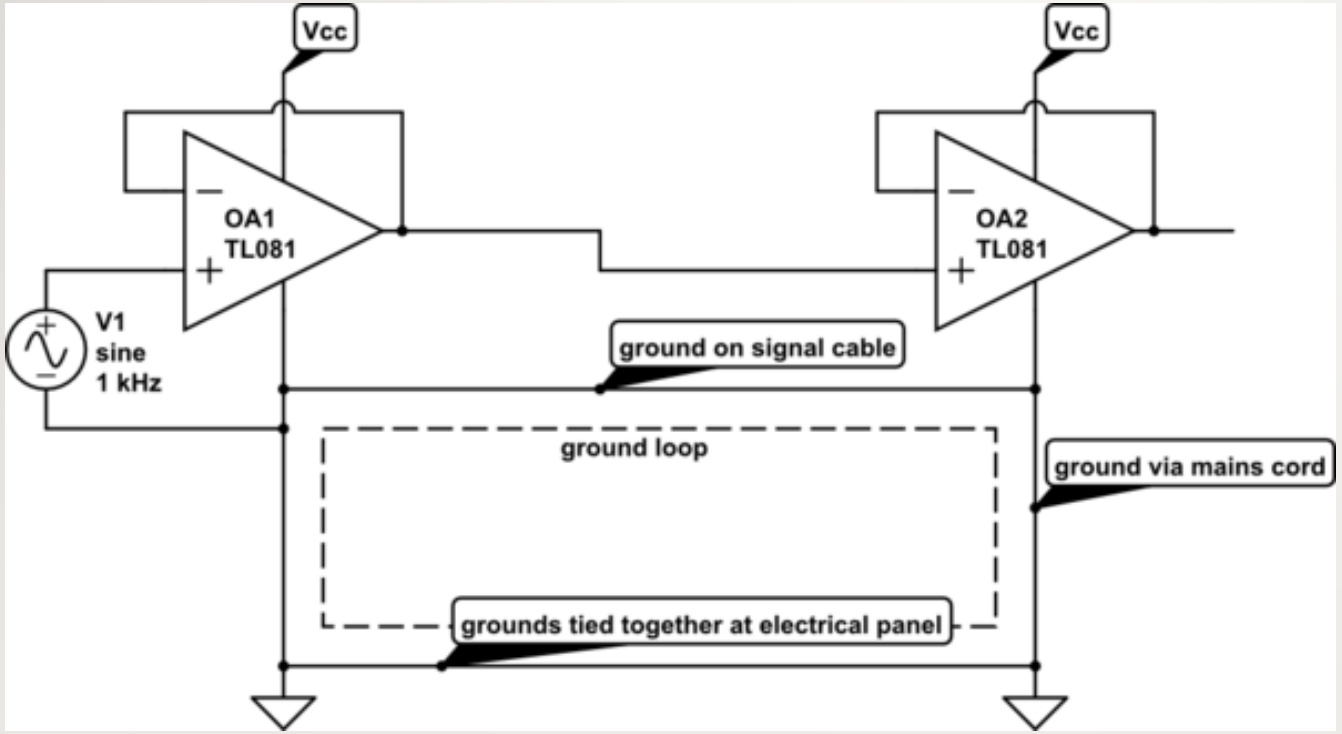
- 參考資料
  - https://www.shure.com/en-US/support/techportal
  - https://www.youtube.com/playlist?list=PL8F3528A5127AE253
  - https://www.toaelectronics.com/
  - https://www.bksv.com/
  - https://www.youtube.com/watch?v=Shtwr8-P0zs
  - https://www.youtube.com/watch?v=dsVEeL1B1ls
  - http://public-address-info.co.uk/Sound%20Pressure%20Levels%20&%20Ambient%20Noise%20.html
  - https://www.ranecommercial.com/kb_article.php?article=2107
  - https://mynewmicrophone.com/do-microphones-output-mic-line-or-instrument-level-signals/

公眾廣播系統 與 音響系統
PA system & HiFi system

- 你問我試答 (Q&A)
  - 現實問題 1 :
    - 學校電腦把音訊輸出用3.5mm轉RCA插入音頻系統後, 產生了電流聲(DEDDDDDD聲)。請問如何可以改善?


Sacred Heart of Mary Catholic Primary School

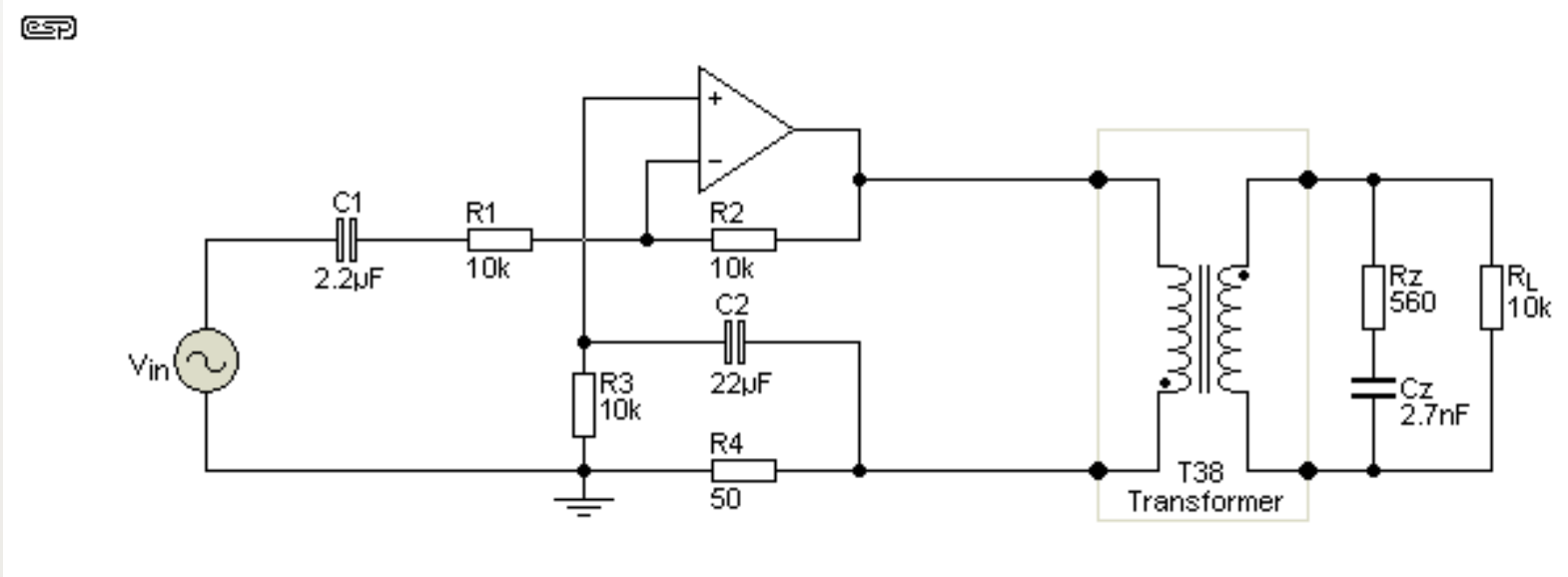
公眾廣播系統 與 音響系統
PA system & HiFi system



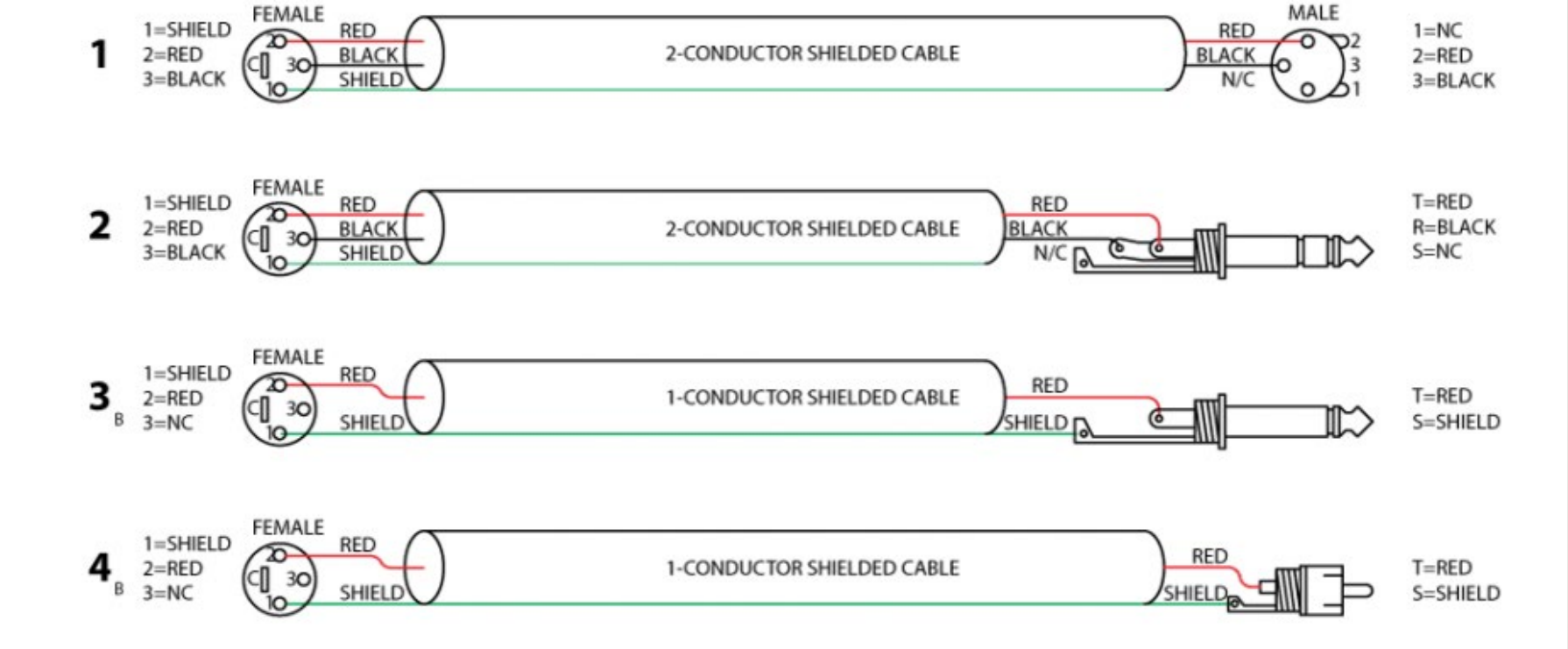
公眾廣播系統 與 音響系統
PA system & HiFi system



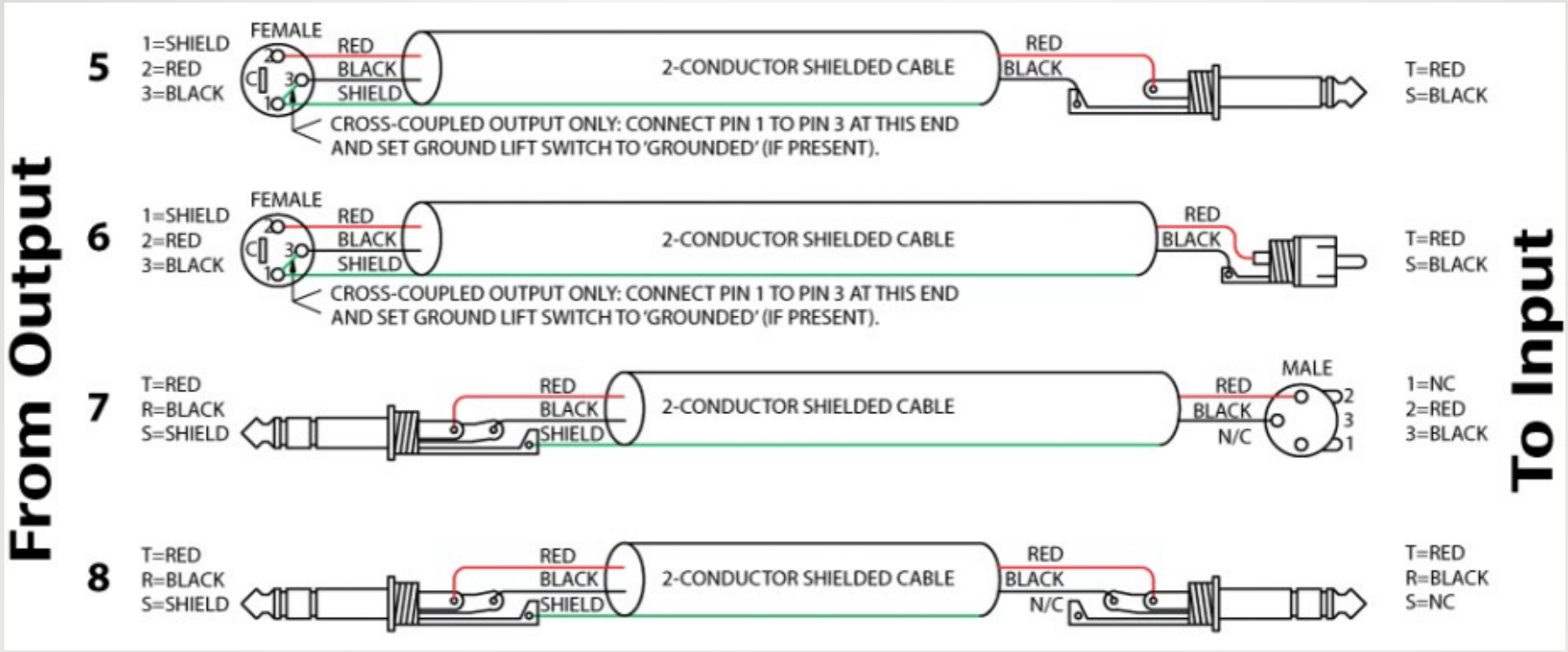




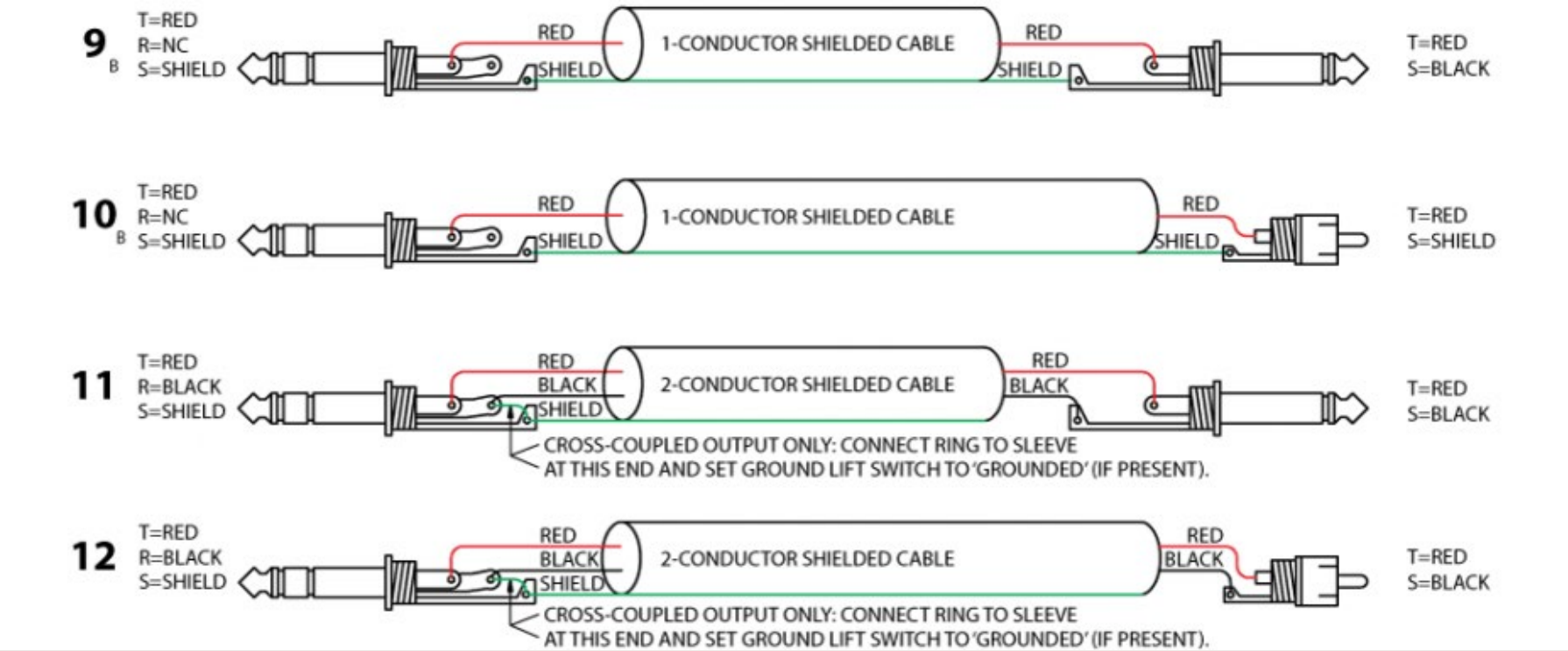
公眾廣播系統 與 音響系統
PA system & HiFi system



公眾廣播系統 與 音響系統
PA system & HiFi system



公眾廣播系統 與 音響系統
PA system & HiFi system

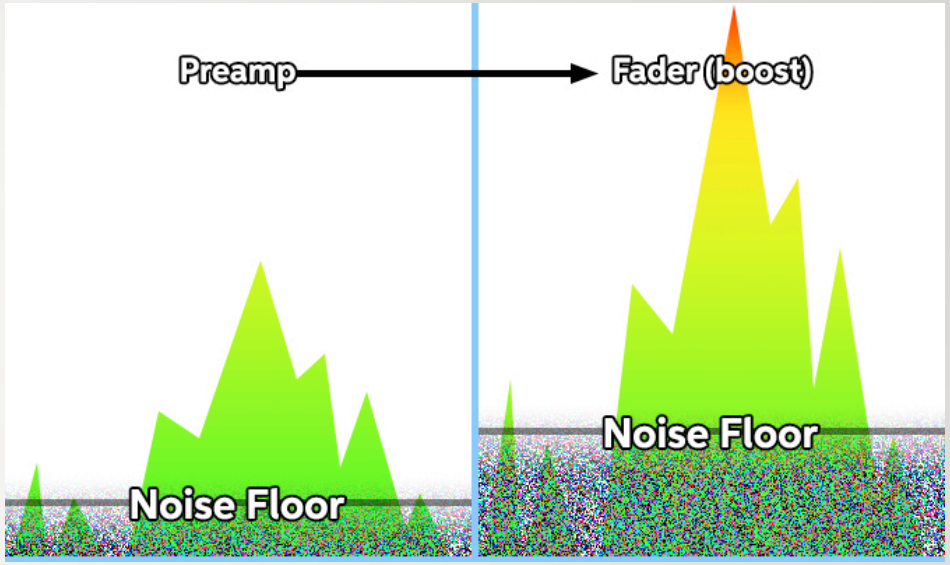


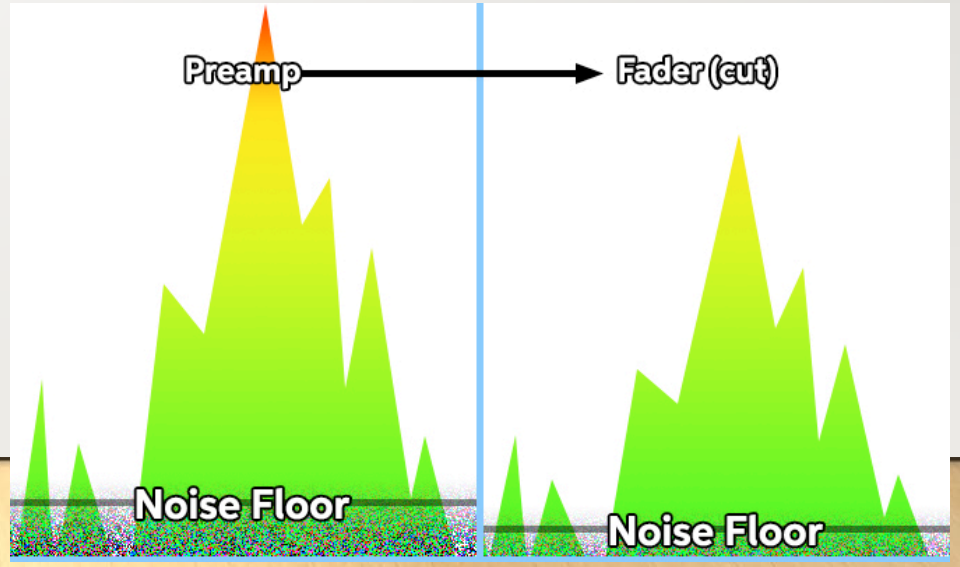
公眾廣播系統 與 音響系統
PA system & HiFi system

- Fader VS Gain









公眾廣播系統 與 音響系統
PA system & HiFi system

- 完(END)