

## 1. Summary

AWA 7 Watt Amplifier Type PA746, S.N. A36317.

### 1.1 Original design

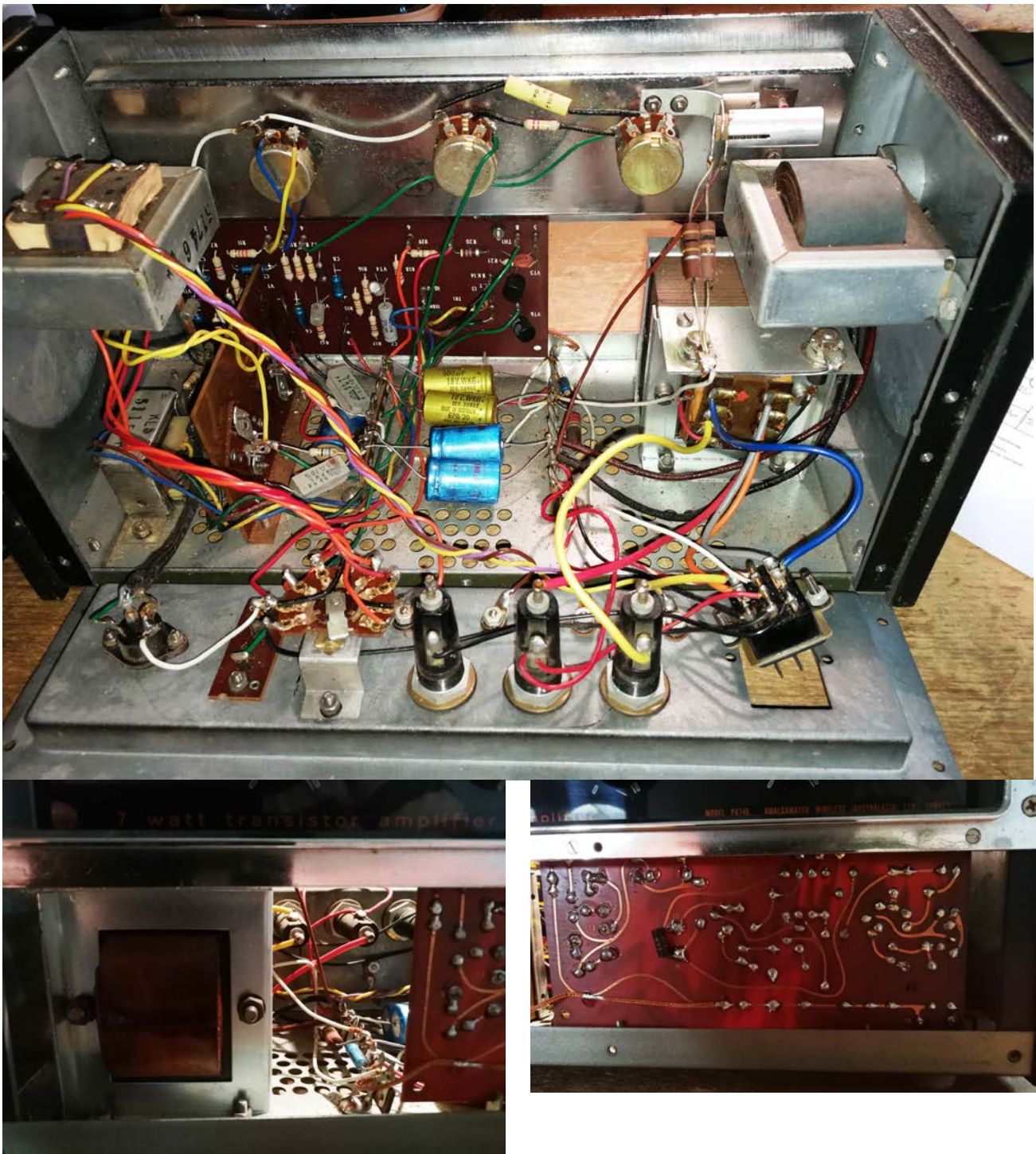
One microphone and one P.U. input channel PA amplifier. Preamp uses 4x 2N217. Output stage is transformer coupled from preamp stage, into 2x 2N270 driving 2x 2N301 pushpull (on copper heatsink) to OPT. OPT with 100, 200 and 600Ω outputs. Painton 12-pin connector with separate mains AC and battery plug assemblies. Speaker output is floating. Internal ground is floating with just a capacitor link to chassis.

6V or 12V external or mains fed transformer and LC filtered supply. Battery pos feed is via each PT secondary arm and diode, with no local decoupling of output stage, and the choke and filter caps aren't used.

Output transformer	5174 6 MC6; primary – switched 6V setting 6Ω PP, or 12V setting 20Ω PP; secondary - com, 100, 200, 600Ω.
Driver transformer	KL5 51151B
Power transformer	Unmarked; likely 0-5-240-250V (Prim 72ohm DCR); 15-0-15V.
Choke	51748 A
Transistors	2N301 x2 AWA; marked BH (T03 PNP germanium) 2N270 x2 (PNP germanium) 2N217 x4 (PNP germanium)
Diodes	1N1199A x2
Capacitors	UCC coded 095 AEE coded 3467 Ducon coded 255 Philips Miniwatt coded 085H 055H (Hendon 1965)
Resistors	IRC WW codes 65 44
Bulb	Mazda 12V 2.2W

5W IRC resistors with 65 44 date code (circa 1966 production). RTV&H advert dated Feb 1964. UCC cap likely dated Sept 1975. So likely made late 1965.





Issues: AC mains earth through 2 pins on 12 pin connector. AC mains through 12 pin connector. Vintage AC mains cable and insulation.

In comparison, the PA1004Z has:

- 20W output
- Different plug, transformers/chokes/transistors
- 50, 100, 150, 300, 600 OT output taps
- Speaker output connector
- PT secondary 100nF noise cap.
- Floating ground to chassis cap now a 0.5uF paper.
- 10nF loading on OT output, and 10nF to ground cap

- Output stage decoupling caps.
- Common emitter connection for output stage.
- Separate driver stage RC supply decoupling, and loading of driver transformer output.
- Zener stabilised reference for bias.
- Battery feed just through one diode (and other diode but with PT secondary)
- Bass cut switch for VT5
- Multiple inputs.

## 2. Modifications

- Replaced all electrolytics.
- Replaced 12-pin Painton with IEC/fuse/switch/indicator combo.
  - Need to solder mains wiring to rear of socket, as no space for spade lugs. Minor trimming to fit new socket.
  - Configured filter caps across output stage
  - Removed FS2 from CT connection to choke/indicator.
- Disconnected 6V/12V switch, and just connected 12V to OT CT, and removed all tap wires.
- Replace 4-pin MIC socket with insulated 6.5mm input socket.
- Fixed chassis protective earthing links to rear panel.
- Reduced 220k MIC input to 10k to lower noise.
- Removed PU input. Reconfigured PU Tone and Volume pots and treble cut and lift pots, and replaced 68k mixer with 1k2 to lower noise.
- Add 15V 5W Zener in series with UF4007 across each output transformer half-primary to limit 2N301 collector voltage to about  $15+16 = 31V$  for 15VDC supply (2N301 Vcb max = 40V). UF4007 to provide fast turn-on and off, and low off-state capacitance.
- Added 3A Schottky steering diodes to allow mains powering or 12-14VDC powering.
- Added 15Ω ground links for positive rail to chassis, and speaker output 100Ω tap to chassis.

To do:

- Check turns ratio of driver Tx.
- Replace FS2 with DC supply plug and FS3 with DC power switch
  - Use FS1 for in-line fuse
  - use series Schottky diode for polarity and reverse current protection
  - place LP1 on load side of Schottky (13mA load).
  - DC supply loaded by 220R (check what can be done)

Options:

- Move input socket to front panel, or side panel, or screen the existing socket.
- Match bias in output stage (not sure how) – and add trimpot.
  - Add 5V6 zener supply with a split 470 ohm R20 to regulate raw bias supply.
  - Perhaps attach a germanium diode to copper heatsink and include in bias supply.
  - Check performance with TH1 bonded to VT5/VT6.
  - Trim bias current variation with ambient temp and copper h/s temp.

### 3. Measurements

PT prim: 70Ω DCR. 1.3Ω total sec. Pri to chassis megger ok.  
Sec: 15-0-15VAC

240VAC. 250VAC tap. Schottky diode in series

Rail	Idle		
VS1	12.1		
VS2	6.00		
VS3	5.29		
VS4	5.06		
2N301 emitters	83mV, 83mV (166mA,166mA)		
2N301 bases	278mV, 281mV		
Bias	419mV		

VS2 feed:  $6.1/390 = 15.6\text{mA}$

VS3 feed:  $0.71/220 = 3.2\text{mA}$

VS4 feed:  $0.23/220 = 1.05\text{mA}$

2VAC 50Hz nominal applied to output transformer half-primary YEL-RED winding

Winding	Voltage rms	Turns ratio; Pri Impedance; Spec level; Notes
Pri P-P:	3.996	1 ; ; N/A; appears to be 20 P-P
Half-Pri: YEL- RD	1.993	1 ; ; N/A; appears to be 20 P-P
Half-Pri: YEL- OR	1.408	1 ; ; N/A; appears to be 6 P-P
Sec: 100 to Com	8.93	100Ω; based on 60Ω P-P
Sec: 200 to Com	12.6	200Ω; based on 60Ω P-P
Sec: 600 to Com	21.83	600Ω; based on 60Ω P-P
Sec: 200 to 100		16.8Ω; based on 60Ω P-P

Primary: 20Ω P-P (Red CT)                      6Ω P-P (OR CT)  
100Ω to 200Ω taps present 17Ω loading with 17% of secondary turns.

Front 0.5 ohm measures 502mΩ. 69 ohm.

Rear 0.5 ohm measures 510mΩ. 67 ohm

Clipping starts at 10Vrms in to 16Ω

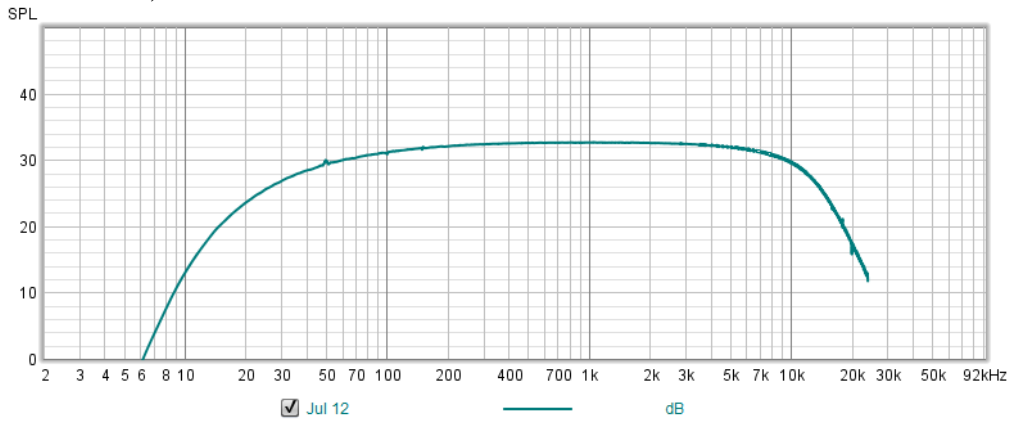
1Vrms has 0.7% THD with -70dB noise floor in to MIC input.

6Vrms has 5.5% THD with -70dB noise floor in to MIC input. Mainly 3<sup>rd</sup>, then 5<sup>th</sup>.

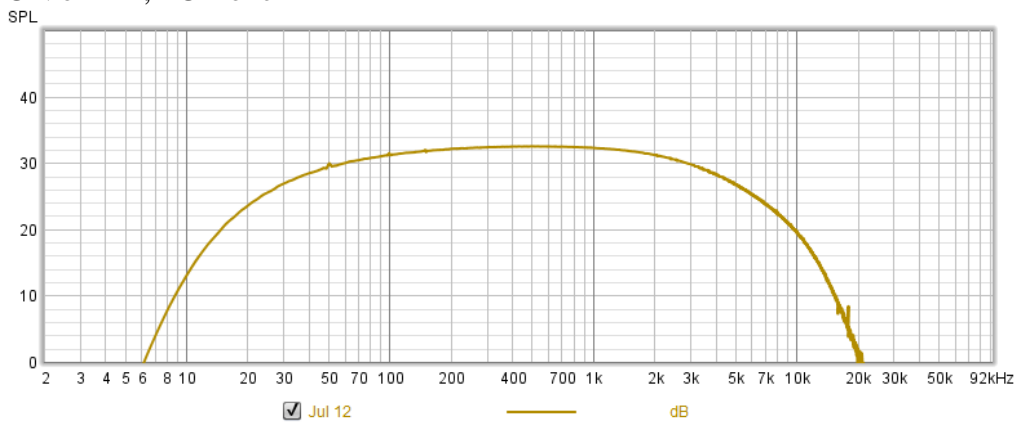
AC mains current increase to 100mA at output clipping (6.2W). So using 200mA IEC T fuse.



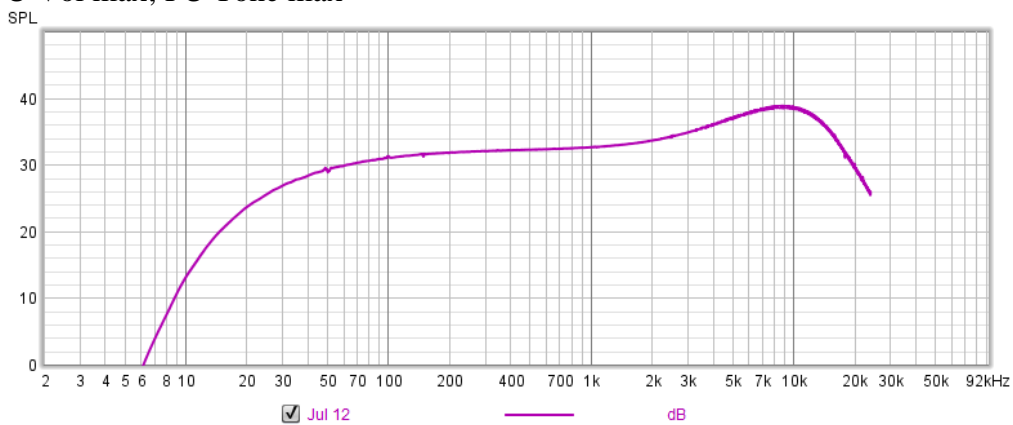
Sweep response at 65mW:  
PU Vol max; PU Tone min



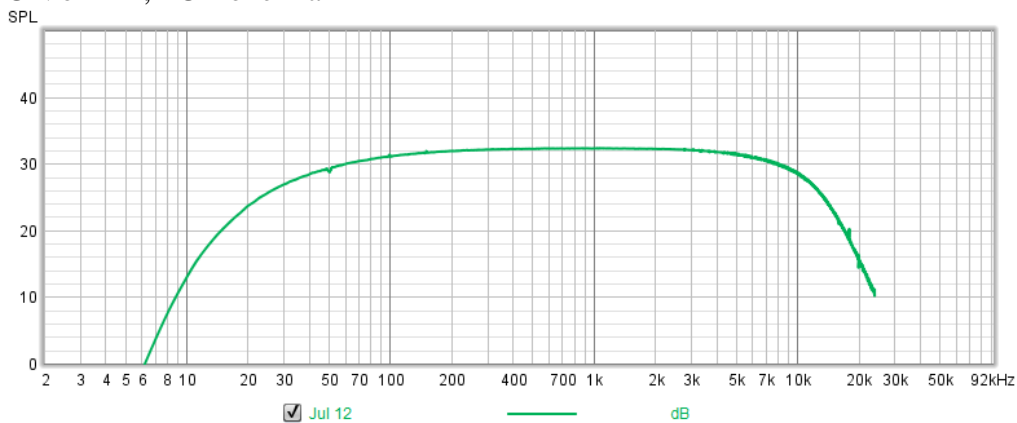
PU Vol min; PU Tone min



PU Vol max; PU Tone max

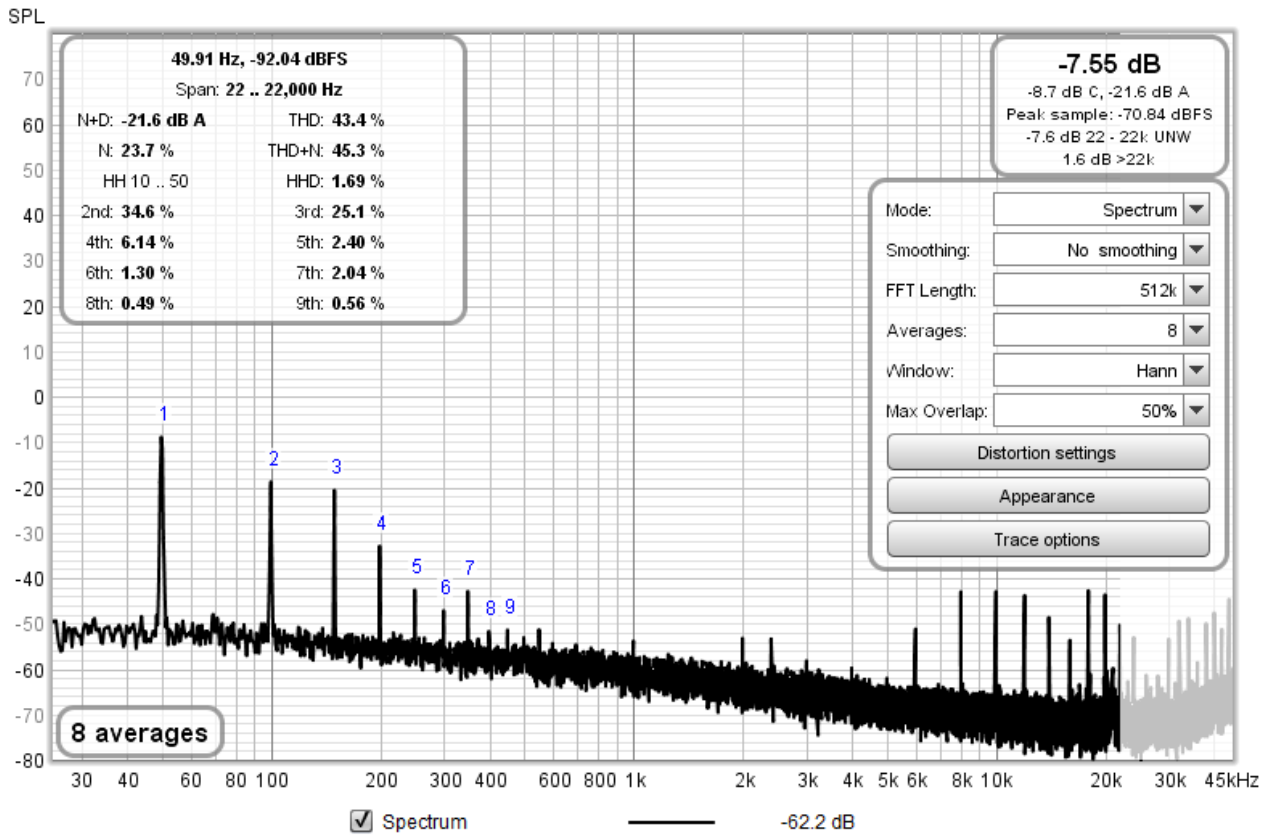


PU Vol min; PU Tone max

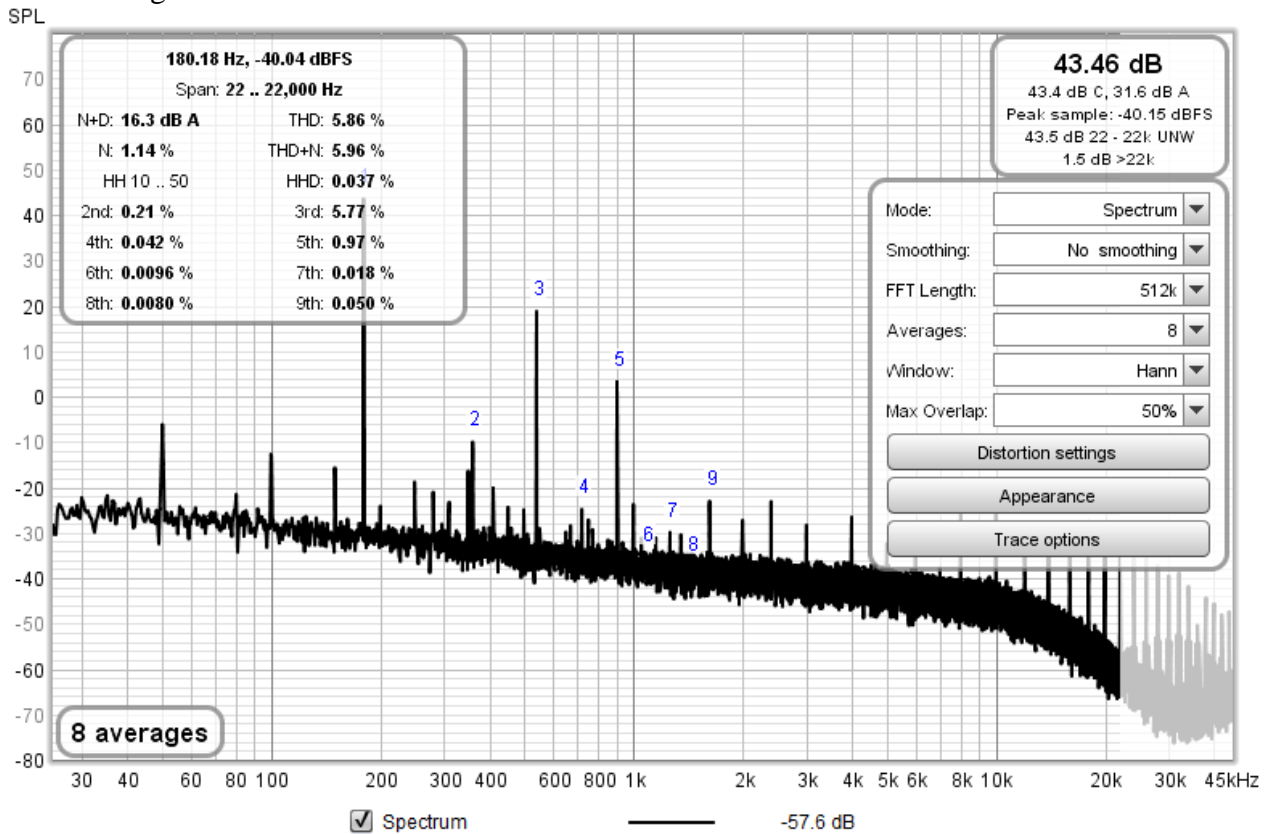


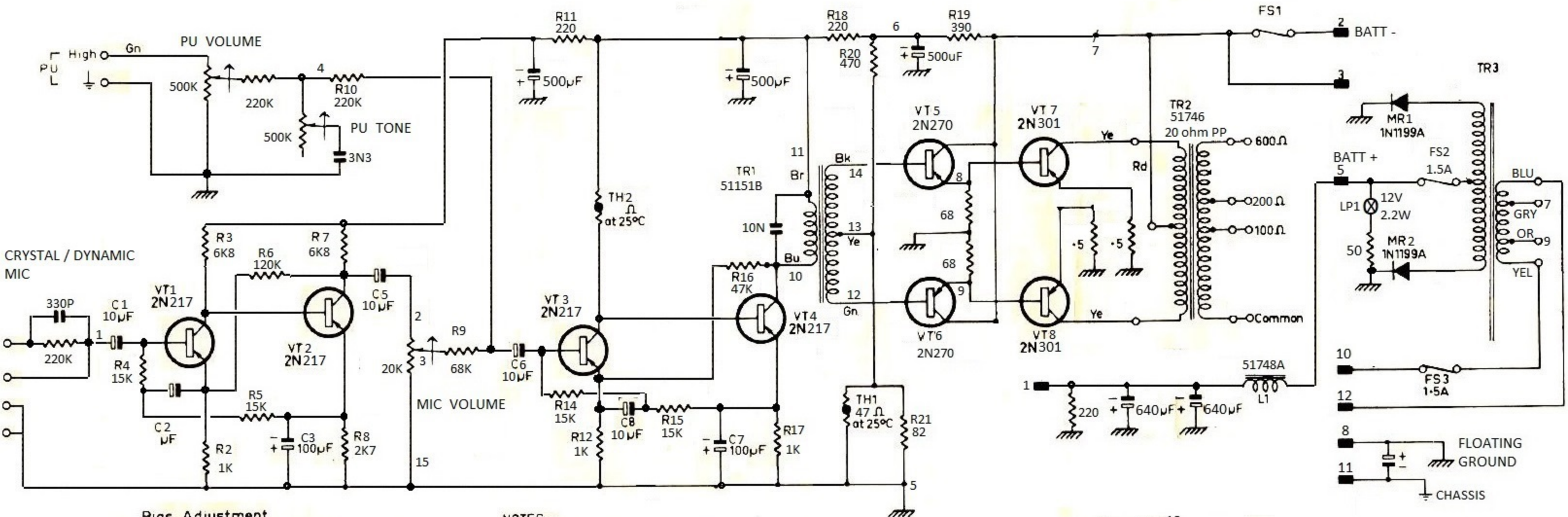
Spectrum response

No signal input and MIC Vol at minimum (ie. noise floor with AC power)



180Hz test signal with 1W in to 16Ω resistive load





**Bias Adjustment**

- 1 Volume controls set fully anti clockwise no signal input
- 2 Supply voltage to 2PL2 set to 12volts
- 3 Adjust Bias control to give standing current through FS1 of 100mA

**NOTES-**

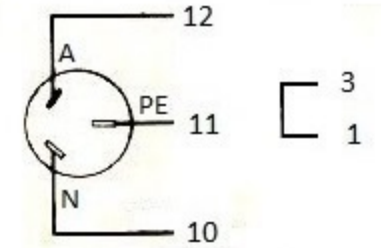
Arrows on potentiometers indicate direction of clockwise rotation

Voltages shown measured with 20,000 ohm/volt meter, an Radio position with no signal input; all voltages are negative with respect to printed board earth

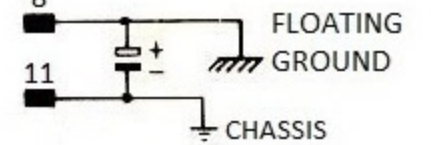
Voltages shown are for mains operation

Voltages on battery operation are approximately 25% less.

Indicates printed board positive rail

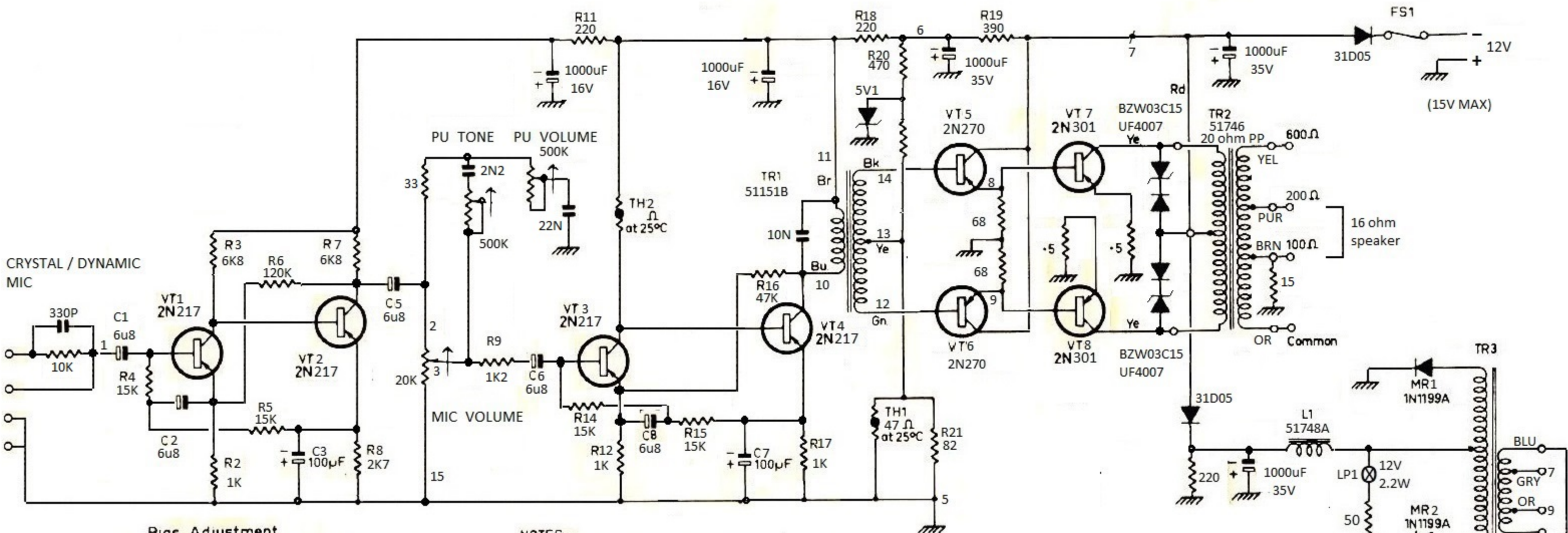


Mains Cable



BATTERY CABLE





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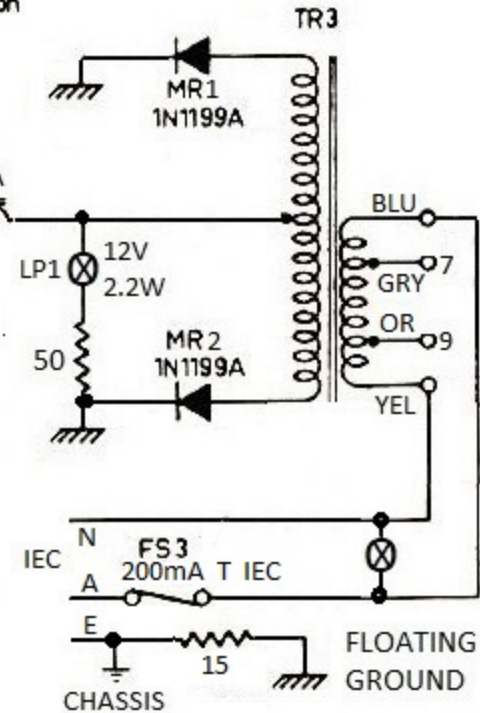
Voltages shown measured with 20,000 ohm/volt meter, on Radio position with no signal input; all voltages are negative with respect to printed board earth

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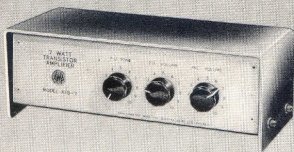
**AWA PA746 12V CONFIGURATION MODIFIED**





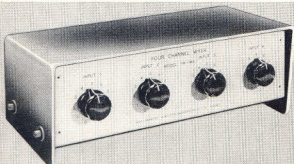


# FOREMOST IN SOUND



## 7 WATT TRANSISTOR AMPLIFIER—PA745

A small portable unit for speech and music amplification. Operates from a 12-volt D.C. source and is highly suitable for Mobile Address work. Can also be operated on a 6-volt D.C. supply with corresponding reduction in audio output.



## FOUR CHANNEL MIXER—PA399

Fully transistorised. Allows the mixing of four low impedance microphone channels, each with individual level control. The unit is mounted in a cabinet of robust and pleasing design.

## technical data 7 watt transistor amplifier

### specifications for PA amplifier type PA745—7 watt.

#### application

The amplifier is a small portable unit for speech and music amplification for operation from a 12-volt D.C. source and is highly suitable for Mobile Address work. The unit can also be operated on a 6-volt D.C. supply with a corresponding reduction in audio output.

#### facilities

Input and output facilities are as follows: 1. Crystal Microphone input, 4 megohms. 2. Dynamic Microphone input, low impedance. 3. Pick-up input, 5 megohms. 4. Output taps are provided at impedances of 6 and 12 ohms on 12-volt operation and 3 and 6 ohms on 6-volt operation.

#### amplifier performance

- 1. Sensitivity:** On pick-up approximately .5V for full output. On microphone approximately 2mV for full output.
- 2. Frequency Response:** With tone control at normal, response is substantially level from 50 cycles to 10 KC.
- 3. Harmonic Content:** Less than 5% at full output.
- 4. Noise Level:** Pick-up input better than -60db below full output. Microphone input better than -30db below full output.
- 5. Tone Control:** Operative on pick-up channel only. Gives a smooth cut to top frequencies with a full cut of -22db at 10 KC. in maximum clockwise position.
- 6. Power Consumption:** 12-volt operation—approximately 1.35 amps. at full load condition, quiescent current 150 MA. 6-volt operation—1.2 amps. at full load condition, quiescent current 200 MA.

### specifications of four channel mixer, type PA399

#### application

This unit, which is fully transistorised, allows the mixing of four low impedance microphone channels, each with individual level control. The complete unit is mounted in a sturdy cabinet of most attractive design.

#### response

is substantially linear over the range 50 cycles to 10 KC.

#### sensitivity

When correctly loaded, an input of approximately .8mV will provide a .5V R.M.S. at the output terminals.

#### harmonic content

less than 1% at .5 R.M.S. output.

#### noise level

better than 50db below .5 R.M.S. output.

#### termination

Low impedance input and output.



## 7 watt all-transistor amplifier

(AC or Battery operated)

### Smartly Styled Model PA746

This amplifier is a 240 volt AC unit or a portable battery powered unit for speech and music amplification. 12 volt DC operation makes the amplifier highly suitable for all types of mobile address work. The unit also operates from a 6 volt DC supply with a corresponding reduction in audio output. The attractive case is in sturdy black armorette with polished chrome trim.

#### Input and output facilities

Input and output facilities are as follows: 1. Crystal Microphone input, 4 megohms. 2. Dynamic Microphone input, low impedance. 3. Pick-up input, .5 megohms. 4. Output taps are provided at impedances of 600 ohms, 200 ohms and 100 ohms.

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#### Specifications

##### CONNECTIONS

Mains connection by plug-in power cable. Battery connection by plug-in battery cable. 6V or 12V battery selection by screwdriver switch at rear.

##### TRANSISTORS

Microphone Preamps.	2N217	(2)
Main Amplifiers	2N217	(2)
Push-pull Drivers	2N270	(2)
Push-pull Output	2N301	(2)
B-supply Diode Rectifiers	1N1199A	(2)

##### DIMENSIONS

Width	5 1/2"
Height	7 1/2"
Length	13 1/2"
Wt.	19 lbs.

Manufactured and guaranteed by

**AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED**

Australia's National Wireless Organisation





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Main Amplifiers	2N217	(2)			Width 5 3/4"
Push-pull Drivers	2N270	(2)			Height 7 1/2"
Push-pull Output	2N301	(2)			Length 13 1/2"
B- supply Diode Rectifiers	1N1199A	(2)			Wt. 19 lbs.

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