Atwater Kent model 20 big box, serial number 54384: restoration and test

This Atwater Kent receiver has been purchased from eBay in November 2023 with 137.34 US = 196 CAD, including shipping to Montreal.

Cosmetic repairs:

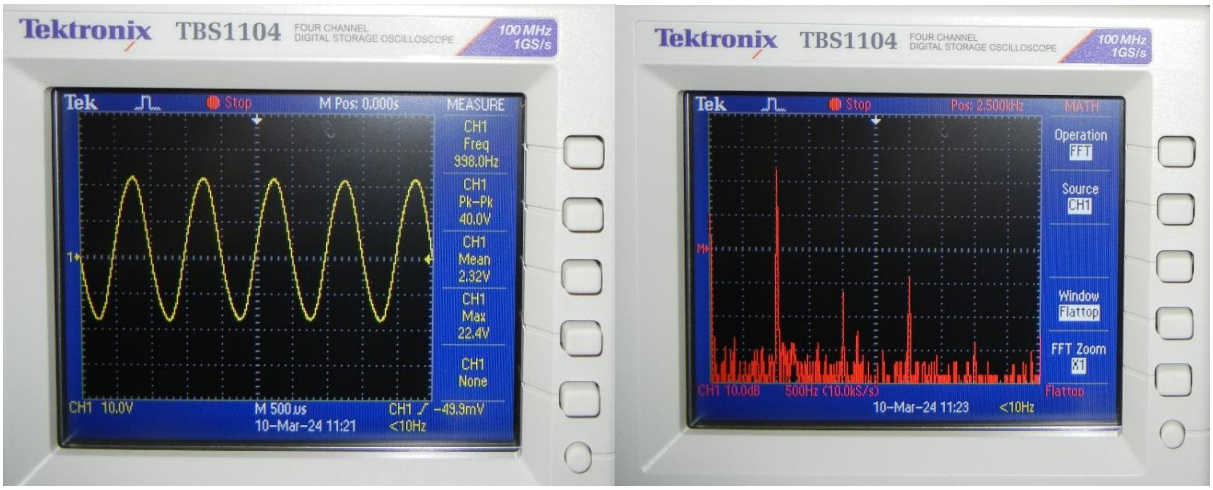
1. The mahogany box has been repaired and varnished. In order to keep the original varnish color when sanding, several layers of lacquer were painted first over the original wood case. All scratches were filled with varnish, and after carefully sanded before applying the last layers of varnish. The back of the radio the varnish has been fully removed due to deep scratches. The wood has been colored with **Mahogany red** and **cabernet** wood finish penetrating stain in several layers, in order to better fit the original color on the sides and top.
2. Only few scratches are visible on metal panel, it was cleaned and repaired partially using a thin permanent marker.

Electronics:

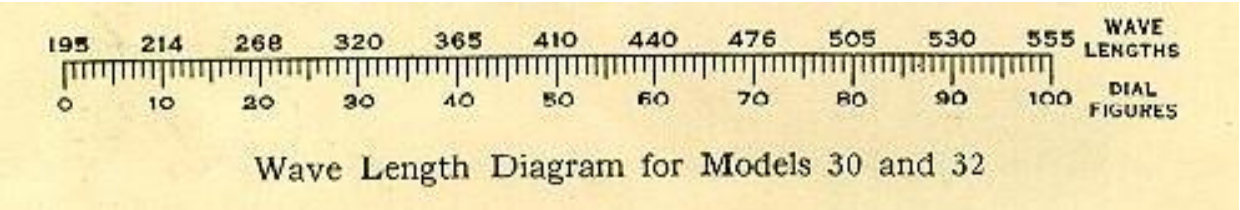
1. Both AF amplifying transformers were not functioning, 1st both primary and secondary open; 2nd transformer the secondary was open. The first transformer has been replaced with a 1000 Ω/7000 Ω transformer for old stock. The second with same with the one of the original ratios, 1700 Ω / 3250 Ω. I put the transformers in this order as in the schematic of later model 20 C with new sockets. Because they cannot fit in original place both were positioned a bit away, 2 holes for each were done in the brown textolit for fixation. For upside looks perfect.
2. The second grid resistor was open, I repaired as usual, short-circuiting and adding in series a 560 Ω carbon one under the black shrink tubing to keep appearance of original.
3. The 300 nF capacitor connected between the + 90 V and ground was disconnected. Usually, it is under the chassis. It was replaced by a modern one 300 nF/100 V.
4. I have replaced all tubes by short pin ones, because the brass sockets can accept both short and long pins. Majority of other 1920 radios work only with long pins; therefore, I could make usage of my several old tubes. When tested with various long pin tubes, no significant difference in gain, no more than few dB.

5. The initial schematic has no wire connected to -C voltage. Both AF grid transformers were connected to the - A (black wire). In some later schematics, the grid of final tube or both grids of AF final tubes are connected to – C. A supplementary green wire was added in order to accommodate this connection (both grids) in case. This is requested especially if the final AF tube is replaced by a higher power 171 or 112 tube. The green wire can be disconnected inside the case. Also, it can be connected to black wire connector, as initial.

6. The measured grid voltage is -7.5 V from the ground of chassis in an optimum audio quality position. Measured voltages are around + 3V (red wire) and – 3 V (black wire) with respect to the ground (metallic case). Therefore, in original schematic the grid of AF tubes is polarised at – 3 V (black wire connection).
7. The demodulated signal is closer to a perfect sinus with a -C battery. The oscilloscope probe is connected directly in parallel with the high impedance speaker. Following screen captures show demodulated 1 kHz signal and its spectrum (using FFT function of the oscilloscope). The second and third harmonics are as low as – 30 dB compared to the fundamental one.



8. Below a dial diagram, as found in literature for later models, with approximative the same LC components in RF sections. Band coverage is 540 kHz to 1540 kHz. My measurements on this receiver are very similar, specially at upper portion of the band, as can be seen in next page.



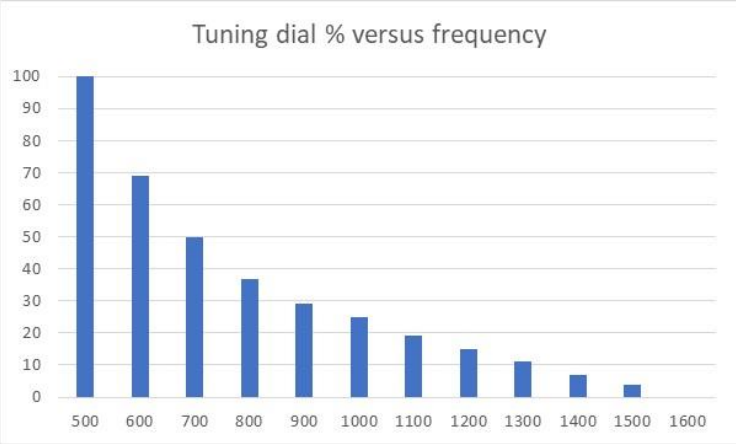
Today we are more comfortable with frequencies instead of wavelengths; therefore, a new line is inserted:

Wavelengths (m)	195	214	268	320	365	410	440	476	505	530	555
Frequence (MHz)	1.54	1.40	1.12	0.937	0.822	0.732	0.682	0.63	0.594	0.566	0.54
Dial Figures	0	10	20	30	40	50	60	70	80	90	100

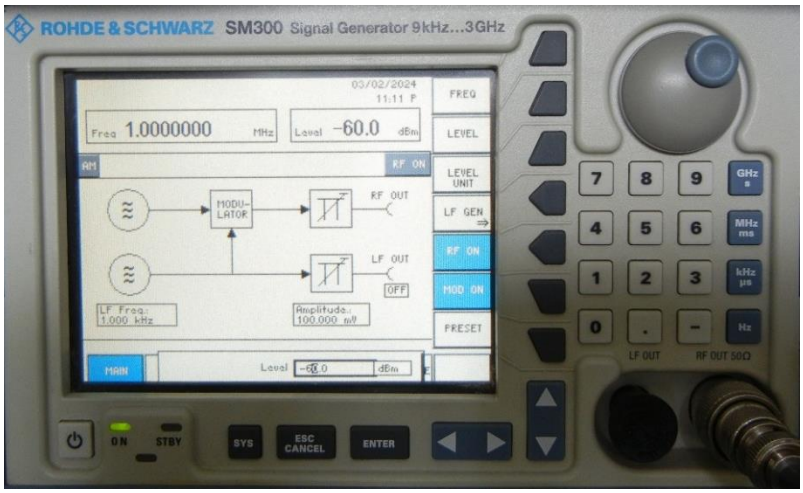
9. Dial frequencies, measured with Rohde & Schwarz SM300 signal generator, output power -40 dBm, 1 kHz tone, AM index 100 %. The three dials' positions were as found, no adjustments were required at all.

No	Frequency (KHz)	C1 (%)	C2(%)	C3(%)
1	**515**	100	100	100
2	**525**	94	94	94
3	**550**	84	84	84
4	**600**	69	69	70
5	**700**	50	50	50
6	**800**	37	37	37
7	**900**	30	29	29
8	**1000**	25	24	23
9	**1100**	19	19	18
10	**1200**	15	15	14
11	**1300**	11	11	10
12	**1400**	7	7	7
13	**1500**	5	4	3

Initial tuning with C2 & C3 the same dial value. Maximised with C1, function of antenna/ signal generator impedance.



10. Receiver sensitivity:



Receiver sensitivity with current short pin tubes is around - 60 dBm at 1 MHz with a good signal to noise ratio, measured with Rohde & Schwarz SM300 signal generator; signals at -70 dBm still detectable. Noise level is -75 dBm. To be observed that with new old stock tubes we can reach around -70 dBm at 1 MHz. At the band edges, 550 kHz and 1400 kHz, respectively, the sensitivity with is around –56 dBm with actual short pin tubes, and -63 dBm with new old stock ones.

11. Tuning dials for the AM stations in Montreal (March 2024) with a 10 ft. indoor wire antenna:

No.	Montreal AM Station	Call	Frequency (KHz)	C1 (%)	C2 (%)	C3 (%)
1	Ma Petite Radio	CFQR	600	69	69	70
2	Montréal Canadiens	TSN	690	51	51	52
3	Radio circulation	CKAC	730	45	45	45
4	Newstalk 800	CJAD	800	37	37	37
5	Super Station CFNV940	CFNV	940	28	27	26
6	Multilingual Canadian Radio	CFMB	1280	12	12	11
7	French Ethnic Radio	CPAM, CJWI	1410	7	7	7

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