22/5/62

Oscillator Tracking and Coil

Obsolete

See Terman pages 650 651

f_0 = I.F. in MC = 0.25

F_1 F_2 F_3 = tracking frequencies in MC = 1.7, 2.2, 2.7

F_0 = lowest frequency of R.F. stage in MC = 1.6

C_0 = maximum tuning capacity of R.F. stage in pf = 148.5

L = R.F. stage inductance in $\mu h = \frac{25330}{C_0 F_0^2} = 66.6$

$a = F_1 + F_2 + F_3 = 1.7 + 2.2 + 2.7 = 6.60$

$b^2 = F_1F_2 + F_1F_3 + F_2F_3 = 3.74 + 4.59 + 5.94 = 14.27$

$c^3 = F_1F_2F_3 = 10.10$

$d = a + 2f_0 = 7.10$

$l^2 = (b^2 d - c^3)/2f_0 = (14.27 \cdot 7.10 - 10.10)/2.25 = (101.4 - 10.1)/.5 = 182.6$

$m^2 = l^2 + f_0^2 + ad - b^2 = 182.6 + .06 + 6.60 \cdot 7.10 - 14.27 = 215.2$

$n^2 = (c^3 d + f_0^2 l^2)/m^2 = (10.10 \cdot 7.10 + .0625 \cdot 182.6)/215.2 = 0.386$

C_2 = oscillator series condenser in $pf = C_0 F_0^2 \left(\frac{1}{n^2} - \frac{1}{l^2}\right)$

$= 148.5 \cdot 1.6^2 \left(\frac{1}{.386} - \frac{1}{182.6}\right) = 984$ pf.

C_3 = oscillator shunt condenser in $pf = C_0 F_0^2 / l^2$

$= 148.5 \cdot 1.6^2 / 182.6 = 2.1$ pf extra compared to R.F. stage.

(over)

25/7/62

Receiver Range 1.85 to 2.35 MC

$\left(\frac{2.35}{1.85}\right)^2 = 1.615$ capacity range

Variation of capacity = 100 pf.

Fixed shunt capacity = $100/.615 = 163$ pf.

Maximum capacity = 263 pf.

Inductance = $1/\omega^2 C = 1/(6.28 \cdot 1.85 \cdot 10^6)^2 \cdot 263 \cdot 10^{-12} = 28.2$ μh.

Air Inductance = $28.2/.93 = 30.3$ μh (93% in can)

26/7/67

Antenna Input Coil

7 ~~8~~ turns, 2½" dia, ~~0.15~~ 0.15" long, close wound.

MC	pf	Q
1.50	430	120
1.85	286	126
2.10	214	130
2.65	170	131
3.00	103	131

Antenna Primary Coil

16 ~~20~~ turns, 2.3" dia, ~~2.1~~ 2.2" long, space wound. 0.064"

MC	pf	Q
2.10	414	350
2.35	329	370
4.20	99	435

Condenser has 359 pf variation
359/.615 = 584 pf fixed shunt
Total 943 pf max

Required inductance 7.86 μh in position.

27/7/62

Oscillator Coil

45 turns $1\frac{3}{16}$" dia, $2\frac{1}{4}$" long.

MC	pf	Q
1.50	446	138
1.85		
2.10	224	157
2.35	179	164
2.60	145	169
3.00	109	178

$C_0 = \frac{446 - 436}{3} = 3\,pf$

$L_0 = 1/(6.28 \cdot 1.5\,10^6)^2 \cdot 449 \cdot 10^{-12} = 10^6/0887 \cdot 449 = 25.1\,\mu h.$

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Now
Grid coil 40 turns, 2" long.
Plate winding $10\frac{1}{2}$ turns, 3/16" long.

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R.F. Stage Performance 1 volt output

Dial	KC	KC	Peak Input	Output Dip.
0	2460	2420	.0940	.88
50	2200	2160	.0990	.84
100	1900	1867	.108	.78

Obsolete R.F. Stage

Output 0.2V 27KΩ load.

Dial 0 KC	mv.
2260	340
2280	215
2300	114
2320	50
2340	21
2360	20
2380	21
2400	53
2420	122
2440	220
2460	340

Faint peaks at 2350 + 2370
2360 centre

Dial 50 KC	mv
2040	330
2060	190
2080	83
2100	28
2120	22
2140	22
2160	65
2180	162
2200	305

Faint peaks at 2110 + 2130
2120 centre

Dial 100 KC	mv.
1780	300
1800	134
1820	36
30	24
40	26
50	25
60	27
1880	104
1900	260

Faint peaks at 1835 + 1855
1845 centre

Bandwidth a bit too narrow at low end.
Need more inductive coupling + less capacitive coupling.
Shield 5½ inches from left edge of chassis.
Can get more gain + bandwidth by raising load resistance

R.F. stage Performance

Obsolete

Dial 100			Dial 50			Dial 0		
Freq KC	Input mv	Gain DB	Freq KC	Input mv	Gain DB	Freq KC	Input mv	Gain DB
2260	360		2040	335		1780	250	
2280	260		2060	200		1800	104	
2300	148		2080	80		1820	20	
2320	68		2100	20		1822	18	
2340	15		2103	17		1830	26	Dip
2341	15		2110	19		1840	30	4.4DB
2350	17		2120	25	Dip	1850	25	
2360	21		2130	26	3.9 DB	1860	18	
2370	22	Dip 3.3 DB	2140	20		1870	43	
2380	19		2145	16		1880	96	
2390	15		2150	21		1900	260	
2400	26		2160	44				
2420	82		2180	130				
2440	185		2200	280				
2460	300							

Output 0.2 volts, 100,000 ohm load.
Shield $5\frac{1}{2}$" from outside wall.
Capacity coupling backs inductive. No extra
Cathode resistor 15K Ω $E_K = 16$V $I_K = 1.1$ ma, $E_G = -3.0$V
$E_B = +160$V $E_C = +12$V
Dip too great & load too low. Decrease coupling.

100 2080
SD 2020
0 1780

1840 KC .31V 1775 KC .05 V 1780 KC .32V
1580 KC .24V 1660 KC .26V 1670 KC .21V

Trial .49V 1838 KC .33V 1822 KC .48V 1832 KC
.47V 1802 KC .41 1802 KC .48V 1798 KC
Back of coil 2" out of shield Ant dial 32.5
Re " 10.0

.72V 1830 KC
.70V 1780 KC

.76V 1820 KC Ant dial 39, Re dial 10
.78V 1810 KC Back of coil 2½" out of shield.

Ant = 11 turns Center 3/8" from bottom Pri.
Bottom Pri 1 9/16" from shield.
Pri. Coil. 23½, Sec. Coil 10
Output 0.2 volts

KC	mv	DB.
1680	335	
1710	230	
1720	135	
1740	70	
1760	43	
1780	42	
1800	43	
1820	58	
1840	110	
1860	197	
1880	290	

Pri Coil 100
Sec Coil 68.3

KC	mv	DB
1960	280	
2000	120	
2020	72	
2040	47	
2060	39	
2080	38	
2100	43	
2120	64	
2140	104	
2160	171	
2200	320	

KC	Dial Pri	Dial Sec	
2350	70	100	11 turns Ant
2120	34	51.5	
1860	8.5	8.5	
2360	90	100	9 turns Ant
2100	40	52.5	one less turn Pri.
1840	8.0	6.0	Sec as was.
2358	87	100	7 turns Ant
2095	34	48.5	
1840	5.5	6.0	
2362	91	100	7 turns Ant
2112	37	50	two less Pri turns
1872	4	0	Bottom of Pri. 1 1/16" from case.
2365	91.5	100	7 turns Ant
2125	36.8	50	3 turns less Pri turns.
1840	3.0	0	

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2365	100	100	4 less Pri turns
2125	37.5	50	7 ant turns
1840	1.5	0	Bottom of Pri 1 9/16" from case.

Antenna Stage.

2/8/62

Input Stage Performance

Receiver Dial	100		50		0	
Antenna Dial	100		35.5		0.5	
KC	mv	DB	KC	mv	KC	mv
2280	290		2060	245	1780	360
2300	168		2080	114	1800	149
2320	80		2100	48	1820	54
2330	58		2110	35	1830	38
2340	37		2120	31	1840	36
2350	30		2130	35	1850	42
2360	30		2140	48	1860	74
2370	36		2160	114	1880	192
2380	51		2180	240	1900	370
2400	110					
2420	197					
2440	320					

Output 0.2 volts.
Dummy Antenna 600 ohms.
Bottom of Primary 1 9/16" from case

2/8/62

Input plus R.F. Stages Performance

Obsolete

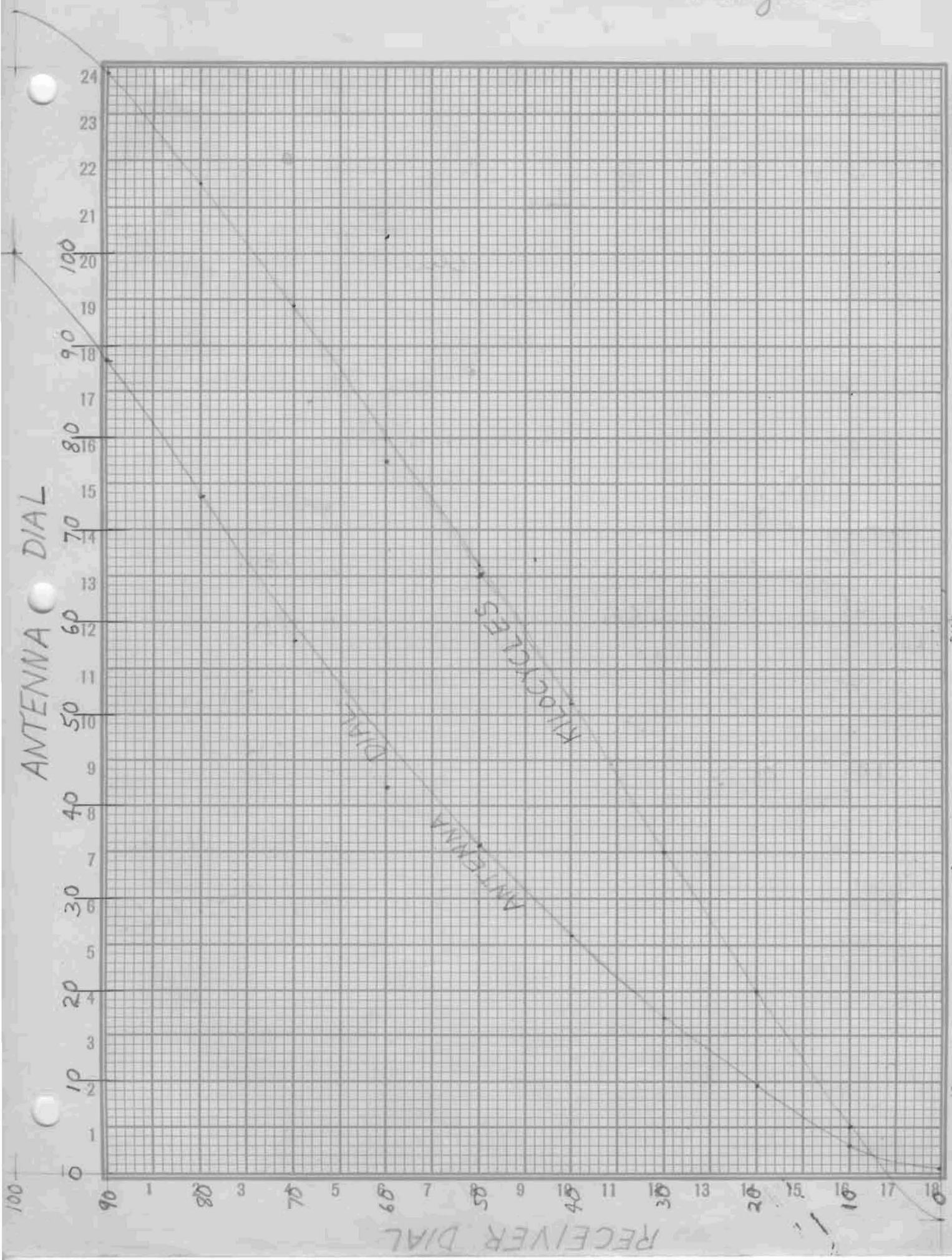
Dials								
Receiver	100			50			0	
Antenna	100			35.5			0.5	
KC	mv	DB	KC	mv	DB	KC	mv	DB
2280	330		2060	710		1780	360	
2300	98		2080	34		1800	55	
2320	16.2		2090	11.6		1810	16	
2330	7.2		2100	7.6		1820	8.8	
2340	6.8		2110	7.8		1830	9.4	
2350	7.0		2120	7.7		1840	9.0	
2360	6.6		2130	7.5		1850	8.8	
2370	6.3		2140	7.8		1860	9.6	
2380	6.6		2150	8.5		1870	21	
2390	7.3		2160	19.5		1880	88	
2400	11.4		2180	131		1890	185	
2420	66		2200	>360				
2440	260							

Output 0.2 volt

Dummy Antenna 600 ohms.

100K Ω load on R.F. stage

2nd August 62



18/12/62

Oscillator Coil & Performance.

Original coil 45 turns. Removed 5 turns to 40 turns. Series condenser 6000pf. Also bent the oscillator rotor outside plates on gang condenser a bit.

KC	Dial
2366	100.0
2362	97.0
*2338	90.0
2290	80.2
2238	70.0
2182	60.2
2125	50.0
2065	40.0
2000	29.8
1940	20.4
*1880	10.0
1840	2.2
1836	0.0

The 6KC band filter on I.F. amplifier was used. Exact frequency taken as bottom of center valley in response. Tracking points marked *.

Dial	10	50	90
R.F. grid Volts	14.3	15.6	16.8
Plate ma	1.80	1.86	1.88
E_p volts	138	137	136

250pf grid condenser
220K-Ω grid leak
15K-Ω plate resistor

Larger R.F. grid volts may be secured by more plate turns and tighter coupling not by more plate volts as B+ supply only 165 volts.

11/1/63

Overal Performance

600-Ω input, 2 volt output, 50KC bandswitch.

Receiver	0	Dial		50			100		
antenna	.5	Dial.		35.5			100		
KC	Input	db		KC	μv	db	KC	μv	db
1750	270μv	17.4		2030	330μv	15.6	2260	360μv	14.9
1780	6.6mv	49.6		2060	9.0mv	46.9	2280	49mv	32.2
1800	400μv	74.0		2080	430μv	73.3	2300	3.6mv	54.9
1820	23μv	98.8		2100	24	98.4	2320	250μv	78.1
1825	13.8μv	103.2		2110	10.5	105.6	2340	15.6	102.2
1840	18.2μv	100.8		2120	12.0	104.4	2352	9.5	106.5
1855	13.4μv	103.5		2138	10.5	105.6	2360	9.8	106.2
1860	22μv	99.2		2150	21μv	99.6	2373	9.5	106.5
1880	520μv	71.7		2160	72	88.9	2390	14.1	103.0
1900	43mv	33.3		2180	2.2mv	59.2	2400	43μv	93.3
1910	215mv	19.4		2200	104mv	25.7	2420	1.62mv	61.8
							2440	62mv	30.2
							2450	260mv	17.7
	2.5db	Dip.			1.2db			0.3db	
	35KC	Bandwidth			28KC	between		21KC	peaks.
	40KC	Bandwidth			46KC	3DB below		51KC	Dip.

all R_K now 15K-Ω

E_R = 18.1V

E_B = 150V

Total I_B = 6.8ma

	E_G	Battery Leads.
RF.	−1.82V	Clear
Mixer	−0.35V	Brown
1st I.F.	−1.64V	Blue
2nd I.F.	−1.35V	White.

Load on R.F. = 47K-Ω

Shield extends $5\frac{1}{2}$" across between coils.

(over)

Receiver Dial	0	50	100
Antenna Dial.	0.5	35.5	100
Image	>3.2 volts.	2.7 volts	1.5 volts
Image DB	>104.9	107.0	103.6
250KC	>3.2 volts.	>3.2 volts.	>3.2 volts.
I.F. DB	>104.9	>108.5	>110.3

During test the E_B was low causing low E_G. However no appreciable change in gain is to be expected with full E_B. Values of E_G will merely ride accordingly to hold total I_B constant.

The bandwidth of entire receiver is limited by the R.F. stage. Stage bandwidth may be increased by tighter coupling (shorter shield, say $5\frac{1}{4}$") and lower load resistance, say 38KΩ. The gain will decrease somewhat.

4 Feb 63

Frequency Calibration using GR-1213A Standard.
Beat oscillator dial at 45,
Calibration at even 100 KC, others interpolated.

KC	Dial	Δ	KC	Dial	Δ
1850			2110		
60			20	49.7	
70			30		.168 div/KC
80			40	53.0	
90			2150		
1900	13.3		60	56.4	
10			70		
20	16.6		80	59.7	
30			90		
40	19.9		2200	63.1	
1950		.165 div/KC	10		
60	23.2		20	66.6	
70			30		
80	26.5		40	70.2	.184 div/KC
90			2250		
2000	29.8		60	73.9	
10			70		
20	33.1		80	77.7	
30			90		
40	36.4		2300	81.5	
50		.165 div/KC	10		
60	39.7		20		
70			30		
80	43.0		40		
90			2350		
2100	46.3				

The 10KC position on calibrator not working

5 stations at 50.1 46.5 43.2 6/2/63

3.6 3.3

48.3 47.8

9 Feb 63
5 stations at dial div.

30.2 31.5 33.2 36.4 37.8 39.8 40.5 43.1 46.4 47.7 48.8 50.0
50.6 51.3 53.1
51.5 54.1
55.2
56.3
60.0

2.6 3.3 3.7

3.2

61.5
62.5
63.2
65.6
67.0
71.1 69.6 69.7

2.4

division gaps

$\frac{\text{all}}{\text{one}} = \frac{RS}{1} - \frac{\Sigma\Sigma}{1} = \frac{K}{1}$

$\frac{K}{1} + \frac{RS}{1} = \frac{\Sigma\Sigma}{1}$

There are 20KC gaps centered on 2030, 2090, 2170KC
Probably can use 12KC bandwidth.