9/12/64

Phase reversing stub for 2085 KC

$\lambda = 144$ meters, $\lambda/4 = 118$ feet desired stub length.

56 feet actual stub length

Coil at bottom = 62 feet effective length.

$\theta = \frac{62}{118} \times 90 = 47.3^\circ$, $Z_L = 612$ ohms line impedance

$X_L = 612 \tan 47.3^\circ = 612 \times 1.085 = 664$ ohms.

$L = 664 / 6.28 \cdot 2.085 = 664/13.1 = 50.8$ microhenries.

Primary in box 54 turns, 0.025" wire, 22.0 tpi, 2.41" long, 1.65" dia.

$L_o = 61.6$ μh, $C_o = 3$ pf, $R_o = 3.8\ \Omega$ at 2.1 mc.

53??

The new end element will have a length of

220 + 2 - 1 = 221 feet. this is $\frac{221}{236} = 94\%$ of $\lambda/2$

which is just right for an antenna supported by the usual insulators. Five feet must be added to the present 216 feet of wire.

Loading Coils

15/12/64

Coil 48T, $5\frac{1}{4}$" long, $2\frac{5}{16}$" dia, 9 tpi, .056" wire

$C_0 = 7$ pf, $L = 50.4$ μh, $R = 2.15\,\Omega$ at 2.1 mc

Coil 54 T, $6\frac{1}{2}$" long, $2\frac{5}{16}$" dia, 9 tpi, .056" wire

$C_0 = 5$ pf, $L_0 = 59.8$ μh, $R = 2.63\,\Omega$ at 2.1 mc.

Primary 54 T, 2.43" long, 1.65' dia, 21.8 tpi, .025" wire

$C_0 = 3$ pf, $L = 53.2$ μh, $R = 3.34\,\Omega$ at 2.1 mc

29/12/64

mc	pf	Q
1.5	320	181
2.1	162	205
3.0	77.5	230

$$C_0 = \frac{320 - 310}{3} = 3 \text{ pf}$$

$$L_0 = 1/(6.28 \cdot 1.5)^2 323 = 1/88.8 \cdot 323 = 1/28700$$

$$= 35 \text{ μh}$$

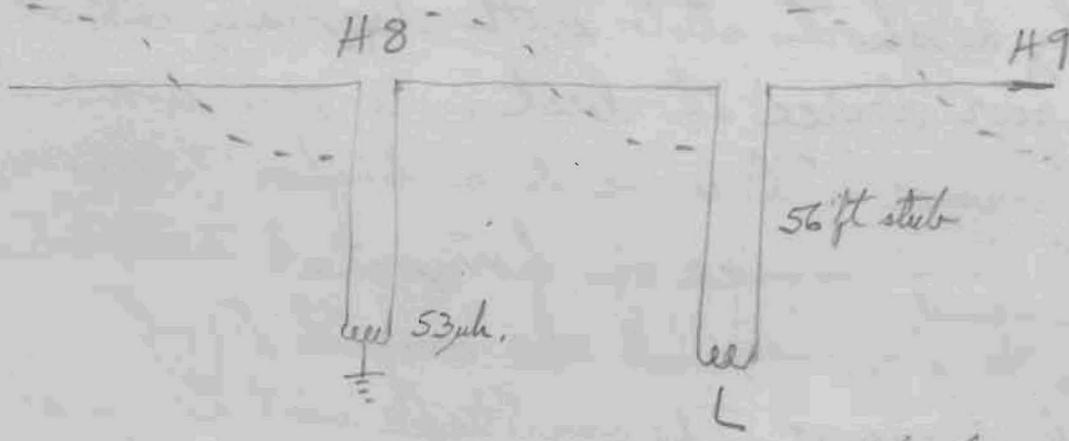
$$R_0 = \frac{6.28 \cdot 2.1 \cdot 35}{205} = 2.2\,\Omega \text{ at } 2.1 \text{ mc}$$

22 tpi .025" wire.

Phase reversing stub + coil between H8 & H9 9/12/64

	Dial	MC	Dial	MC
No Coil (open)	2.4	1.63	3.8	1.87
Inductance L				
50 μh coil	4.8	2.05	3.8	
60 μh coil	4.5	1.99	3.8	
38 μh "	5.1	2.11	3.8	
21 μh "	5.4	2.17	3.8	
6 μh	5.6	2.21	3.8	
84 μh	4.1	1.92	3.8	
178 μh	3.2	1.76	3.8	

Frequencies using large coil C of grid dip meter.



The 1.87 mc resonance is fixed by left (west) wire from H8. The entire wire from H8 to H9 is tuned by L. Apparently about 100 μh will make it resonate identical with west part. It seems this system works. More accurate tests will be measuring frequency response curves as L is changed.

(over)

27/12/64

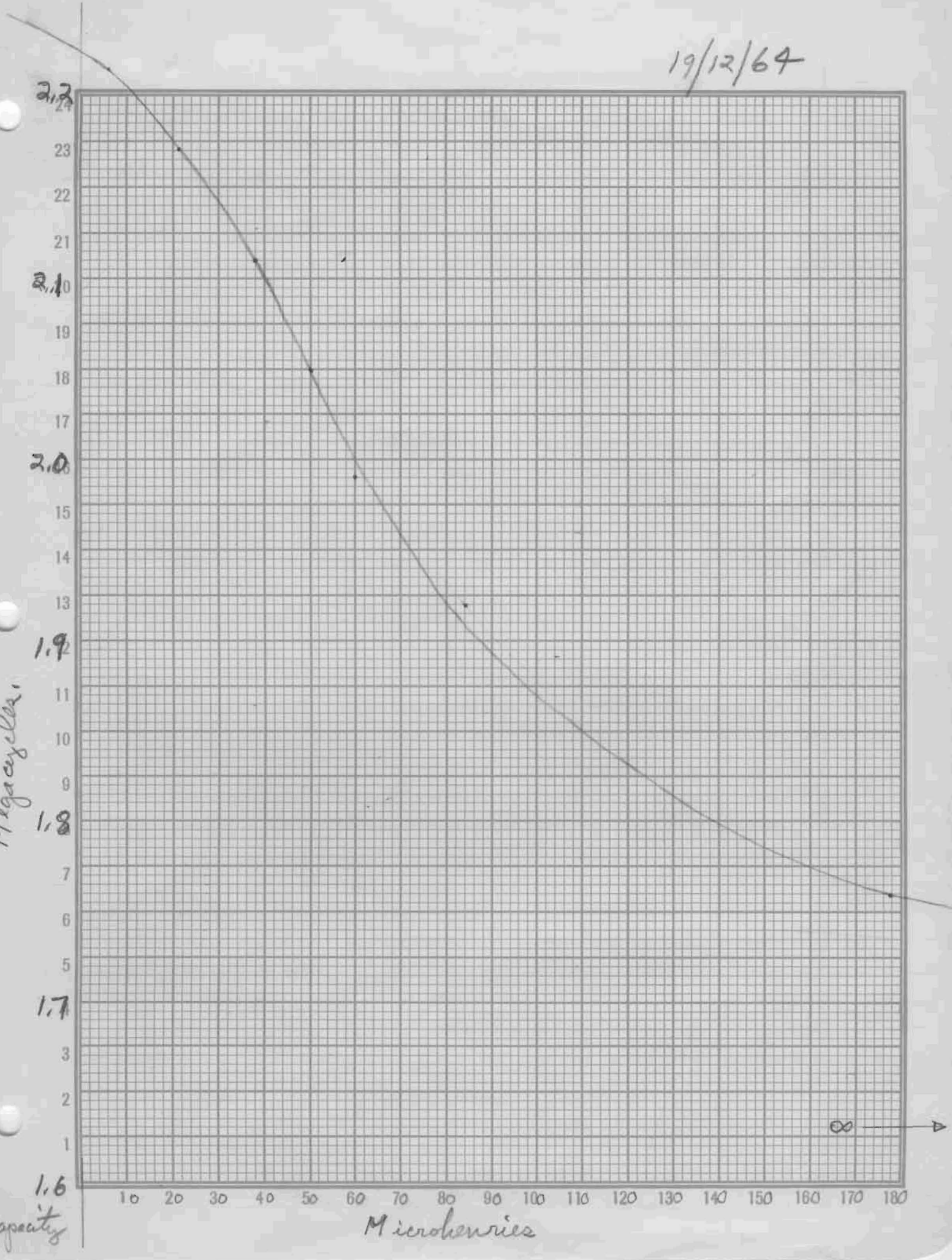
It is now apparent the fixed resonance at 1,87 mc by grid dip meter is same as peak at 1,82 mc of antenna signal generator. It is caused by a reflection at bottom of stub where coil is attached. Thus it is due to east and not west wire.

This reflection is infinite when stub length is zero and coil is hung in center of antenna.

The reflection is zero when stub length is a quarterwave length.

Obviously a short stub with loading coil at bottom is a poor device at best. As stub length is decreased the resonance will move to a higher frequency. The limit will be resonance of horizontal wire alone. as stub length is increased the frequency and the amplitude of resonance will decrease. The amplitude will be zero when length is λ/4.

19/12/64


2.2
2.1
2.0
1.9
1.8
1.7
1.6
Megacycles
Capacity
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
Microhenries
∞

21/12/64

Mc	pf	Q
.7	466	158
1.4	114	210
2.1	49	215

$\frac{66-56}{3} = 3$ pf.

$L = 1/(6.28 \cdot .7)^2 \cdot 469 = 1/19.3 \cdot 469 = 1/9060$

= 110 µh = 88 turns 22 tpi = 4" long.

$R = \frac{6.25 \cdot 110 \cdot 21}{215} = 6.74\,\Omega$ at 2.1 mc

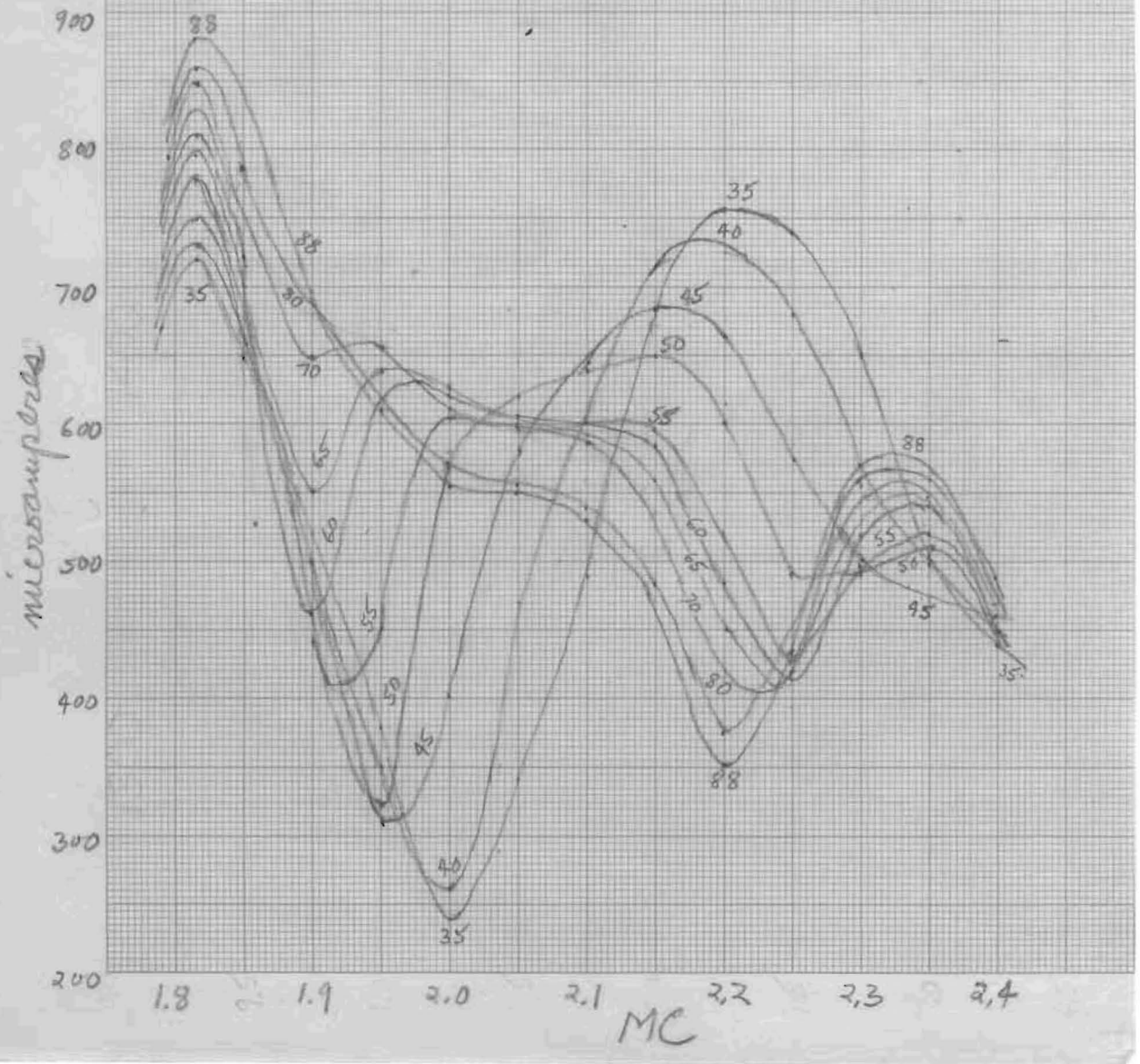
0,025" wire.

10pf at 1 mc, $X_c = 1/6.28 \cdot 10^6 \cdot 10^{-11} = 10^5/6.28 = 16000\,\Omega$

Response at Pole H8 26/12/64

Secondary 184T @ 36 tpc, 11T load taps.

Turns of coil L at base of stub.



Response at Pole H8

26/12/64

Tuner box same as 7/10/64, 184 turns secondary, @ 36 tpi 11 turns load taps, Stub line 56 feet long, 612 ohm impedance. Coil L = 1.65" dia, 22 tpi. Signal Generator current 1.20 amperes.

Turns	88	80	70	65	60	55	50	45	40	35
μh	110					54				35
MC	Detector Output μa. High Scale 9/10/64									
1.78	810	795	780	770	750	730	720	700	680	670
1.82	880	860	840	825	810	795	780	760	740	720
1.85	855	785	755	740	725	710	695	680	665	650
1.90	695	690	650	550	465	440	480	495	510	520
1.95	600	610	655	640	620	450	320	310	350	380
2.00	555	570	610	625	615	605	570	400	260	240
2.05	550	565	600	610	605	595	620	580	470	340
2.10	530	550	585	590	600	605	640	650	600	490
2.15	470	485	535	560	585	595	650	685	715	670
2.20	350	375	415	450	485	520	600	665	725	755
2.25	435	430	420	415	420	425	490	570	680	740
2.30	570	560	550	540	520	495	490	500	570	650
2.35	565	550	540	530	520	510	495	475	495	505
2.40	455	460	490	480	475	470	465	460	450	440

As might be expected the best response curve is obtained when L = 54 μh which is same as primary of tuner box.

Response at Pole H8

26/12/64

Tuner box same as 7/10/64 using 11 turn load tape.

5 stub line 56 feet long. Signal generator ~~1.15~~ 1.20 amps input

Coil Turns	88	80	70	65	60	55	50	45	40	35
Coil mh.										
MC	Detector Output ua.				volt scale					
1.80	880	805	795	770 760	755	730	720	700	680	670
1.82 1.85	855	860 785	735	725 695	810 720	795 700	780 700	750 690	720 660	720 650
1.90	695	690	670	550 515	465	440	488	500	500	520
1.95	610	610	655	640 610	620	450	320	310	350	380
1.97 2.00	555	570	610	625 580	660 620	605	570	400	260	240
2.05	550	555	600	605 560	605	595	620	580	470	340
2.10	530	540	585	570 560	600	600	645	645	600	490
2.15	470	485	535	550 525	585	595	650	685	715	685
2.20	350	375	415	450 425	485	520	600	665	725	755
2.25	435	430	420	400 395	420	425	490	570	680	740
2.30	560	560	560	550 520	520	495	490	500	570	650
2.35	555	595	560	550 525	540	520	520	510	500	505
2.40	455	460	490	470 450 Low	450	445	458	460	450	440

Coil at bottom of stub 72 tpi x 4" original = 88 turns

Stub line between poles H8 and H9. 13/1/65

Down lead feet long to top of post 10 feet above ground. Horizontal section 75 feet long and 10 feet above ground between posts, a coil was placed at end of horizontal section to lengthen. Primary at bottom of H8 is 53μh. Same as 19/12/64

Grid Dip Meter Resonances

Coil L μh	Dial	Mc	Dial	Mc	Dial	Mc	
38	1.75	1.52	3.20	1.76	5.40	2.17	
21	1.80	1.53	3.60	1.83	5.40	2.17	
11	1.90	1.54	4.05	1.91	5.50	2.20	Weak.
6	1.85	1.54	4.30	1.95	5.50	2.20	
0	1.95	1.55	4.55	2.00	5.60	2.21	
-4 ft	2.00	1.56	4.62	2.02	5.80	2.25	
-9 ft	"	"	4.80	2.05	6.00	2.29	Very faint
-14 ft	"	"	4.95	2.09	—		
19 ft	"	"	5.00	2.09	—		
24 ft	"	"	5.05	2.10	—		
29 ft	"	"	5.15	2.12	—		
34 ft	"	"	5.20	2.13	—		
54 ft	2.05	1.57	5.25	2.14	—		
66 ft	2.10	1.58	5.30	2.15	—		

Distances Horizontal Bar from end.

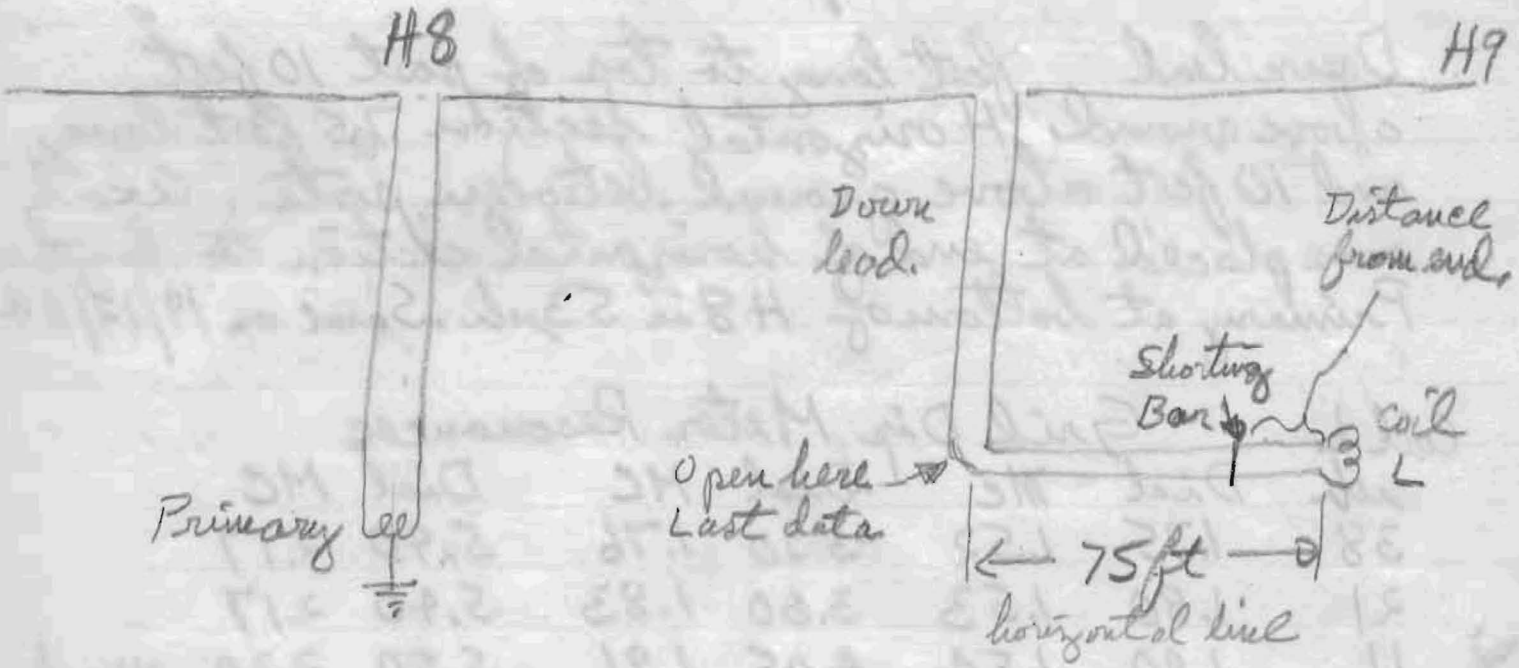
Far end of line open

2.20	1.59	5.40	2.17	0.4	1.32	weak.

Line open at bottom of down lead.

2.60	1.66	4.05	1.91	5.80	2.25	faint

Frequencies using large coil C of grid dip meter coupled to primary at bottom of pole H8 (over)



The center resonance varying from 1.76 to 2.15 mc is the desired one.

The lower resonance varying from 1.52 to 1.58 mc is associated with total length of stub line with two wires acting in parallel. It is out of operating range.

The higher resonance varying from 2.17 to 2.29 mc is associated with asymmetry of system about the energy extraction point at pole H8.

Response at Pole H8.5 Straight Stub

Position of shorting bar from end of stub

Secondary 184T @ 36 tpi, 11T load 16/1/65

16/1/65

Load taps 11 turns. 184T @ 36 tpi

Response Curves of tuner of 7/10/64. Type H8

Stub line one straight length to ground 100 ft north.

Generator current 1.20 amperes

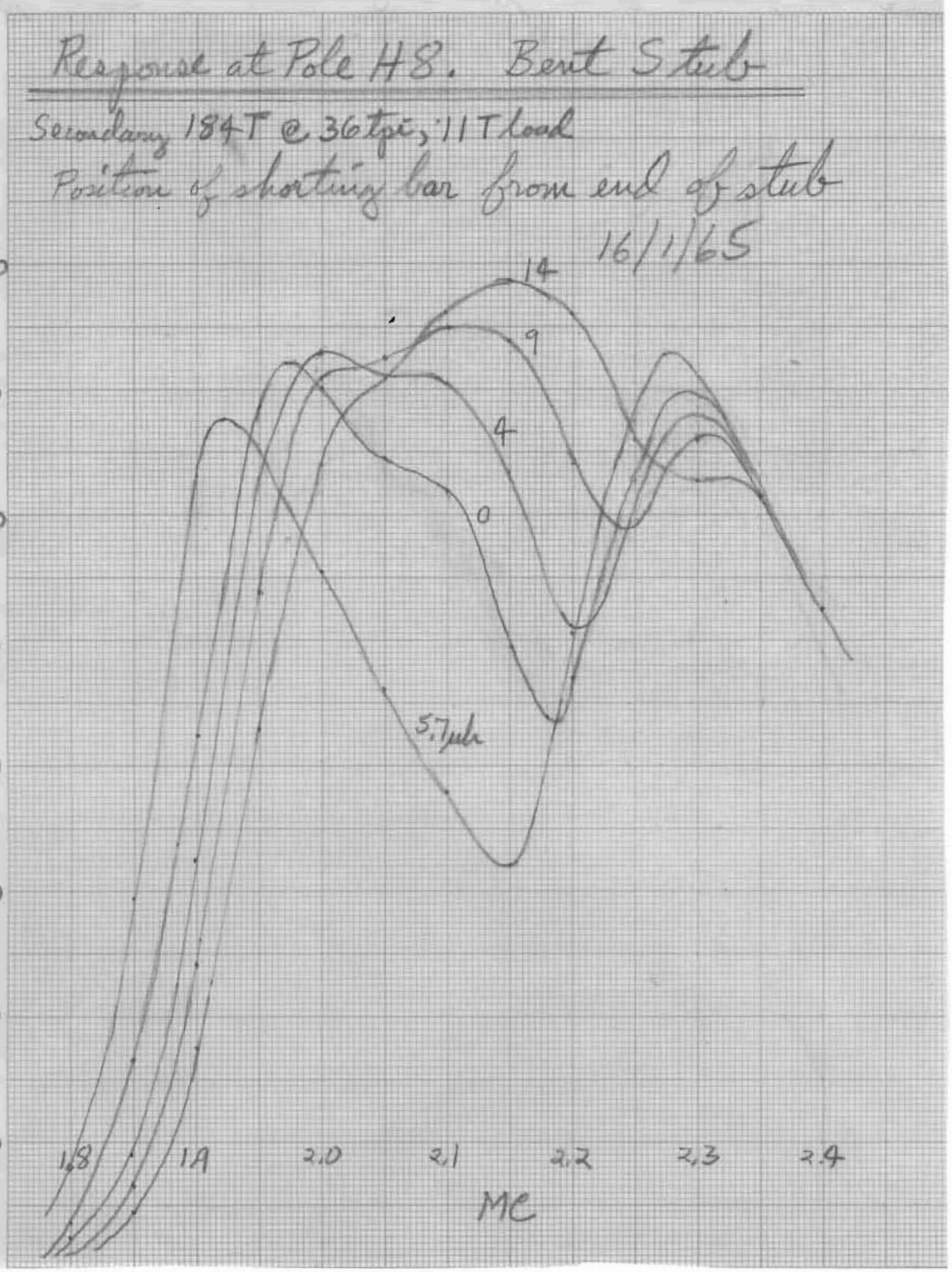
Stub line Termination	5.7 µh at end	Bar at end	Bar 4 ft from end	Bar 9 ft from end	Bar 14 ft from end
MC	Output µa on			volt scale	
1.80	110	40	30	20	15
1.85	350	165	120	85	55
1.90	640	450	355	270	205
1.92	660				
1.95	620	675	615	545	460
1.96		685			
2.00	515	665	690	670	635
2.05	425	610	660	675	670
2.10	345	580	670	695	705
2.13	280				
2.15	300	450	600	690	740
2.18		395			
2.20	340	455	470	590	725
2.23				540	
2.25	690	645	610	555	615
2.27	705	685	660		
2.28					
2.30	680	670	650	635	590
2.35	580	580	580	575	560
2.40	485	475	480	480	480

(over)

Grid Dip Meter Readings.

Primary 53 μh. Same as 13/1/65

Termination	Dial	Mc	Dial	Mc	Dial	Mc
Bar 19 ft.	1,82	1,53	5,00	2,09		
Bar 14 ft	1,80	1,53	4,85	2,06		
" 9"	1,78	1,52	4,75	2,04		
" 4"	1.80	1,53	4,65	2,02	5,80	2,25 (faint)
Bar at End	1.80	1,53	4,55	2,00	5,70	2,23 "
5,7 μh Coil	1.75	1,52	4,30	1,96	5,60	2,21 "
11 μh Coil.	1,70	1,51	4,05	1,91	5,50	2,19
21 μh "	1,65	1,50	3,60	1,84	5,50	2,19


Response at Pole H8. Bent Stub
Secondary 184T @ 36tpi; 11T load
Position of shorting bar from end of stub
16/1/65
14
9
4
0
5.7μh
800
700
600
500
400
300
200
100
Microamperes
1.8
1.9
2.0
2.1
2.2
2.3
2.4
MC
CSIRO GRTICULE A.

16/1/65

Response curves of tuner of 7/10/64 at pole H8
Bent stub line same as 13/1/65
Generator current 1.25 amps.

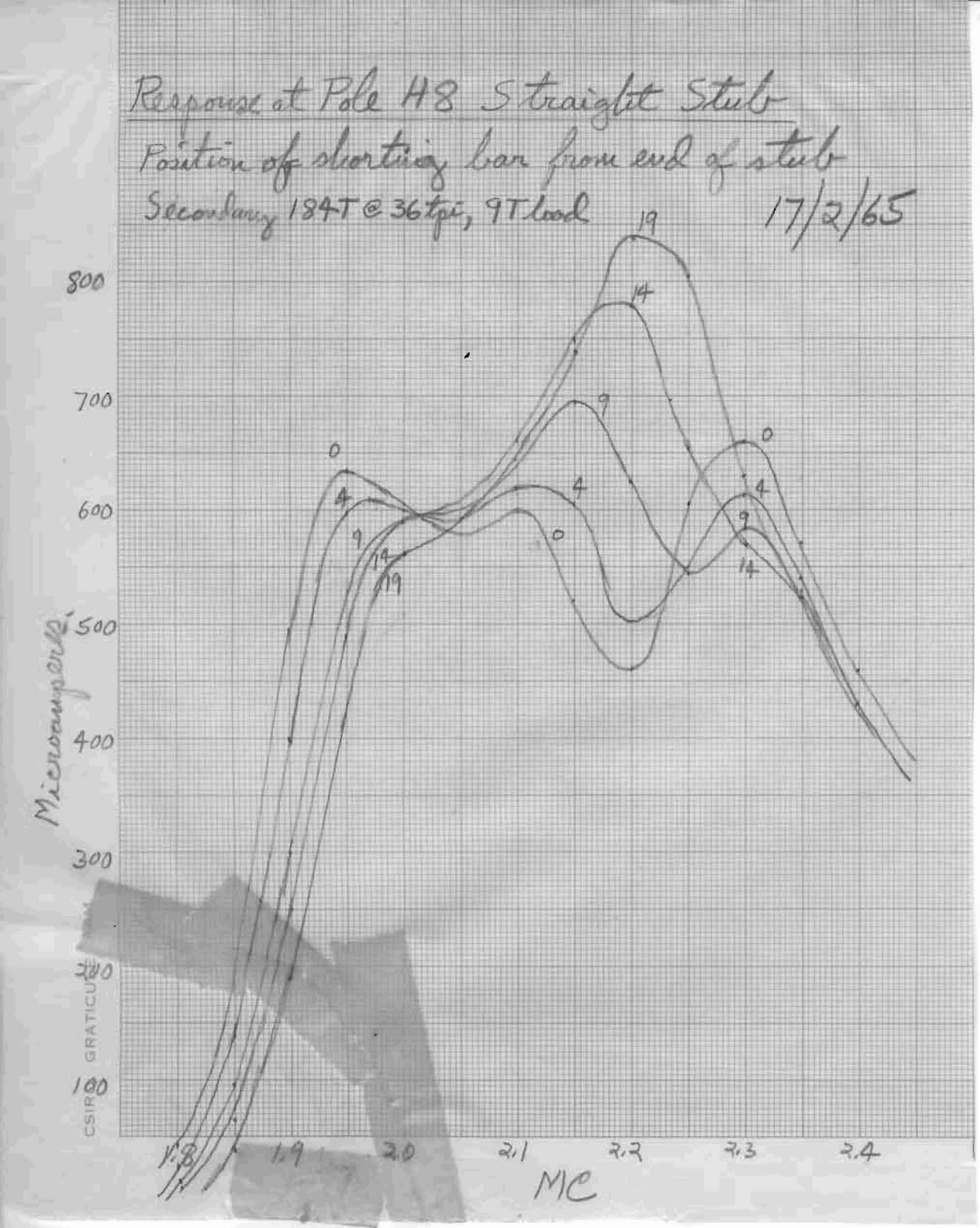
Stub line Termination	5.7 wls at end	Bar at end	Bar 4 ft from end	Bar 9 ft from end.	Bar 14 ft from end,
MC	ua	output on		volt scale.	
1.80	80	35	25	25	35
1.85	295	165	90	65	45
1.90	630	425	325	240	175
192	675				
1.95	650	690	630	540	430
197		720			
2.00	555	700	730	710	640
2.05	460	645	710	725	710
2.10	380	620	705	750	760
2.15	320	495	635	740	785
2.18	505	470			
2.20		470	510	640	760
2.25	685	625	620	590	660
2.28	730	329	700		
2.30	710	695	680	660	625
2.35	620	620	615	620	615
2.40	525	530	540	530	520

A workable combination might result from a longer stub line equal to 5.7 wls at base; plus a tuner like 7/10/64 using 199 secondary turns and 15 turn load taps. Computed curve on reverse of sheet.
A better possibility seems to be a short stub like ~14 feet; plus a more unloaded secondary, say load taps 9 or 7 turns; (over)

MC	5,7 ult coil Bant Stub 16/1/65	199 turn secondary 15 turn load tap 7/10/64	Product.
	Microamperes.		
1.80	80	270	21
1.85	295	410	121
1.90	630	590	371
1.92	675	(640)	(432)
1.95	650	690	448
2.00	555	730	405
2.05	460	740	340
2.10	380	735	280
2.15	320	720	230
2.20	505	680	343
2.25	685	600	411
2.28	730	(560)	(409)
2.30	710	510	362
2.35	620	415	258
2.40	525	360	189

Still very poor response curve.

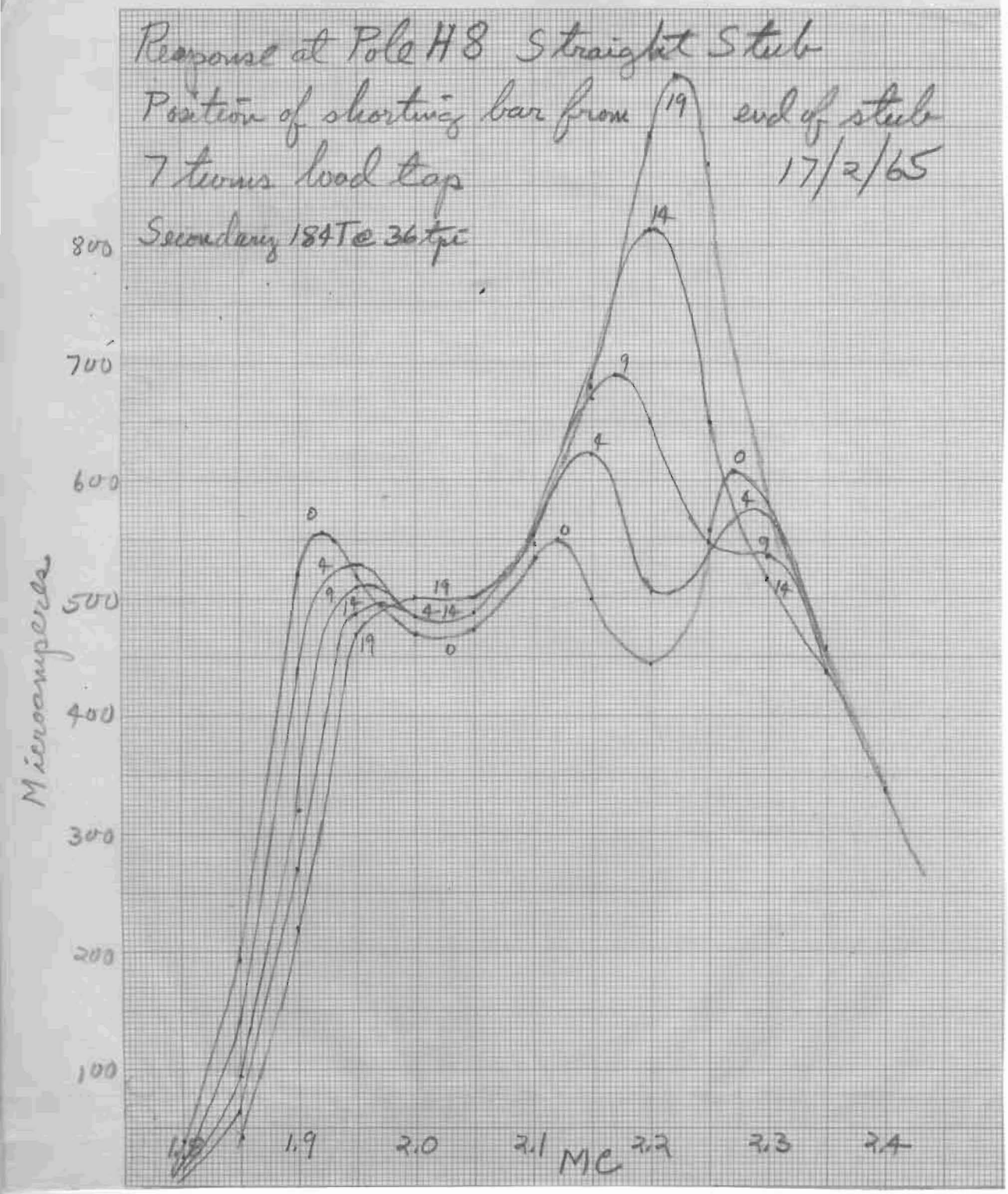
in conjunction with a larger primary inductance. These features should move the unwanted mode near 2.3 mc to a higher frequency outside working range.


Response at Pole 48 Straight Stub
Position of shorting bar from end of stub
Secondary 184T @ 36tpi, 9T load
17/2/65
Microamps/2
800
700
600
500
400
300
200
100
0
4
9
14
19
1.8
1.9
2.0
2.1
2.2
2.3
2.4
MC
CSIRO GRATICULE

Pole H8 17/2/65

Tuner of 7/10/64 load taps 9 turns.
Stub line between H8 & H9 straight line to ground
Generator current 1.20 amps.

Position of Shorting Bar from End	4 ft	9 ft	14 ft	19 ft.	0 feet
MC	Output μa on volt scale				
1.80	30	20	15	10	40
1.85	140	95	65	40	185
1.90	400	300	250	190	495
1.95	600	530	490	420	635
1.97	610				
2.00	600	590	590	560	605
2.05	590	595	605	590	580
2.10	620	640	660	645	600
2.15	605	695	750	790	570
2.20	500	625	780	840	460
2.25	550	545	655	805	605
2.30	615	585	570	630	660
2.35	590	525	530	520	570
2.40	430	420	430	425	460


Response at Pole H8 Straight Stub
Position of shorting bar from end of stub
7 turns load tap
Secondary 184T @ 36 tpi
17/2/65
800
700
600
500
400
300
200
100
Microamperes
1.8
1.9
2.0
2.1
MC
2.2
2.3
2.4
0
4
9
14
19
4-14

Pole H8 17/2/65

Tuner of 7/10/64 bad tape 7 turns,
Stub line between H8 & H9 straight line to ground,
Generator current 1,20 amps.

Distance of shorting Bar from End	0	4	9	14	19
MC	Output μa on H volt scale				
1,80	40	25	20	15	10
1,85	195	140	95	65	45
1,90	520	440	320	270	220
1.92	555	193 550			
1.95	520	530	510	485	470
1,97				495	
2.00	470	485	485	485	500
2,05	475	490	490	485	500
2.10	535	555	550	545	550
2.12	550				
2.15	500	620	670	690	680
2,17			640		
2,20	445	505	650	815	895
2.22					945
2.25	560	550	540	650	870
2.27	610				
2.30	585	580	535	520	585
2.35	460	460	440	435	420
2.40	340	340	330	340	335

Pole H8

20/2/65

Small tuner with secondary 192 turns @ 32 tpi
Load taps 9 turns. Generator current 1.20 amps.
Stub line between H8 & H9 straight line to ground.

Bar from End	4	9	14	4	9	14	4	9	14
Secondary Turns	192	192	192	186	186	186	182	182	182
MC		Output µa on			volt scale				
1.80	40	25	20	25	20	15	25	20	10
1.85	155	120	80	140	100	70	120	90	55
1.90	450	365	275	430	315	245	380	290	205
1.95	615	595	495	670	585	530	680	615	500
2.00	620	630	560	645 (1.98 635)	630	625 (1.96 690)	645	670 (1.98 680)	640
2.05	630	650	595	615	605	620	580	620	610
2.10	700	725	665	635	640	650	580	620	615
2.12	725								
2.15	680	810	810	635	690	725	570	640	650
2.18	850								
2.20	520	690	840	550	660	795	520	630	700
2.25	580	570	640	610	590	710	590	600	680
2.30	600	570	425	645	635	620	695	670	635
2.35	500	475	460	600	590	575	690	670	630
2.40	380	380	360	480	490	480	580	580	570

(over)

Bar from End	4	9	14
Secondary Turns	180	180	180
MC		ua	
1.80	20	15	10
1.85	120	80	50
1.90	370	265	195
1.95	680	585	490
1.96	700	1.98 660	
2.00	635	650	640
2.05	560	590	605
2.10	550	580	600
2.15	525	585	625
2.20	495	580	660
2.25	580	570	650
2.30	690	650	640
2.35	710	680	670
2.4	610	600	600

This configuration of antenna and tuner produces a triple hump response curve.

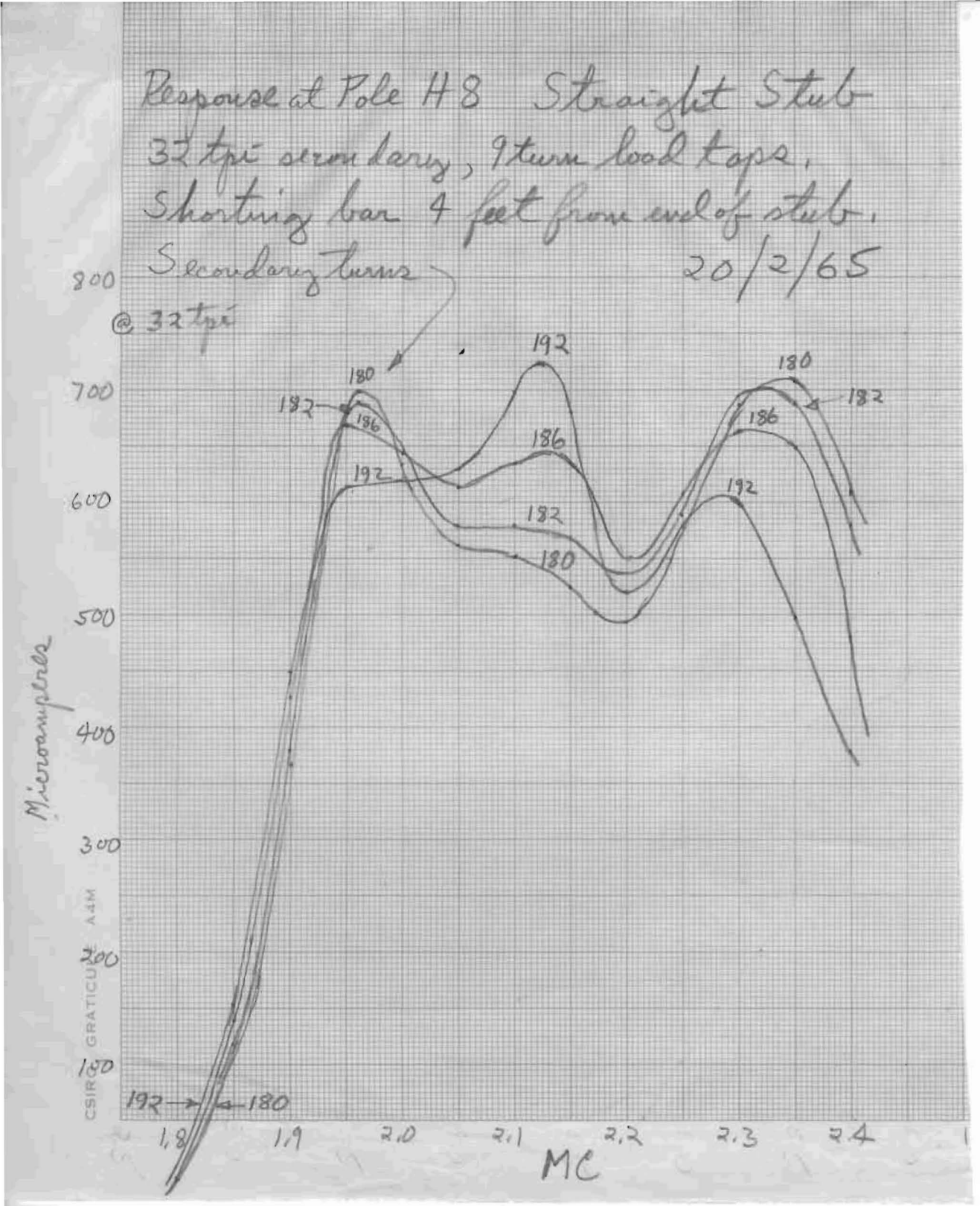
When damping is constant (9 turn load taps), shortening the stub line raises the middle peak in relation to outside peaks.

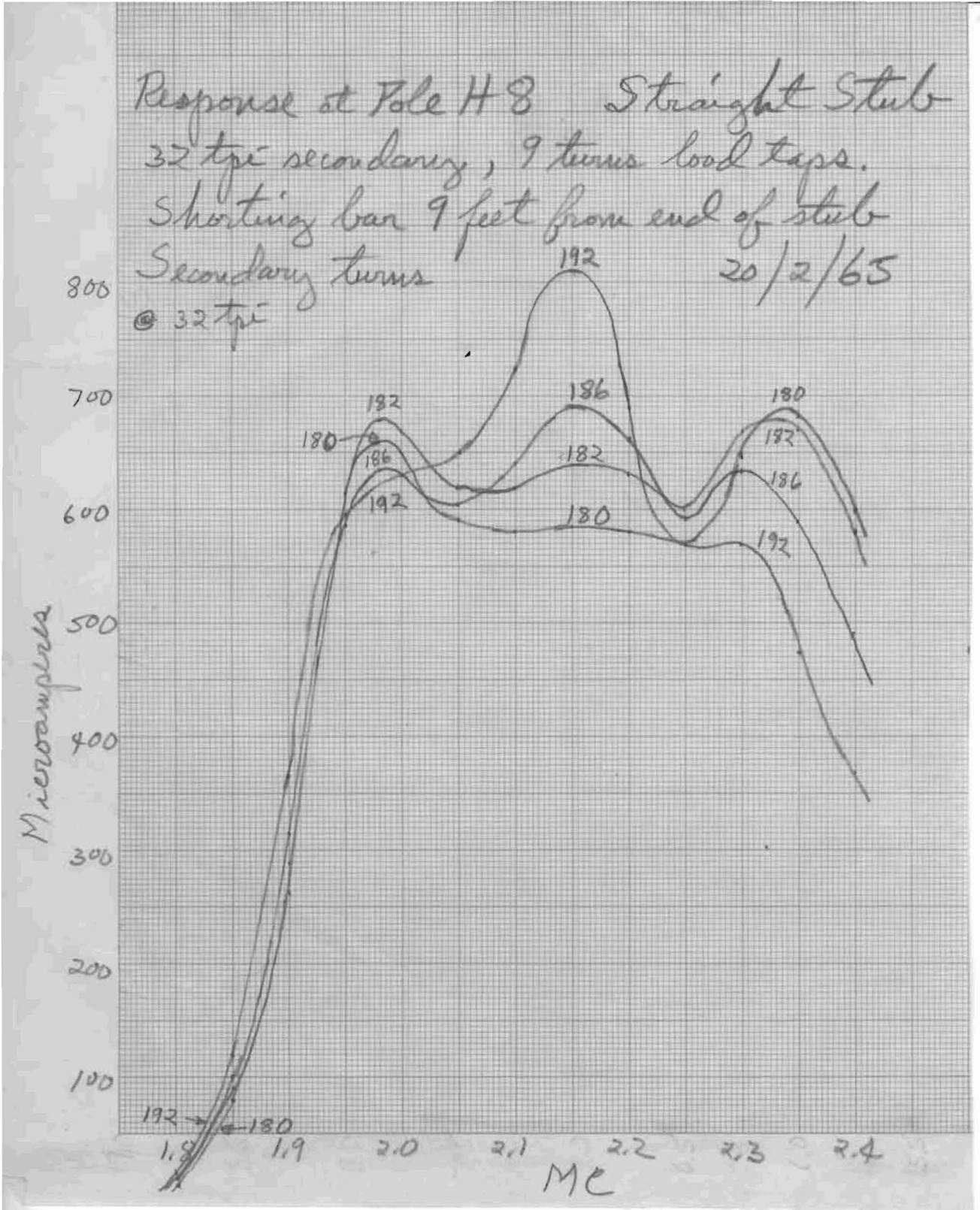
Reducing secondary turns raises outside peaks in relation to middle peak and changes assymetry. The higher dip is decreased and lower dips increased.

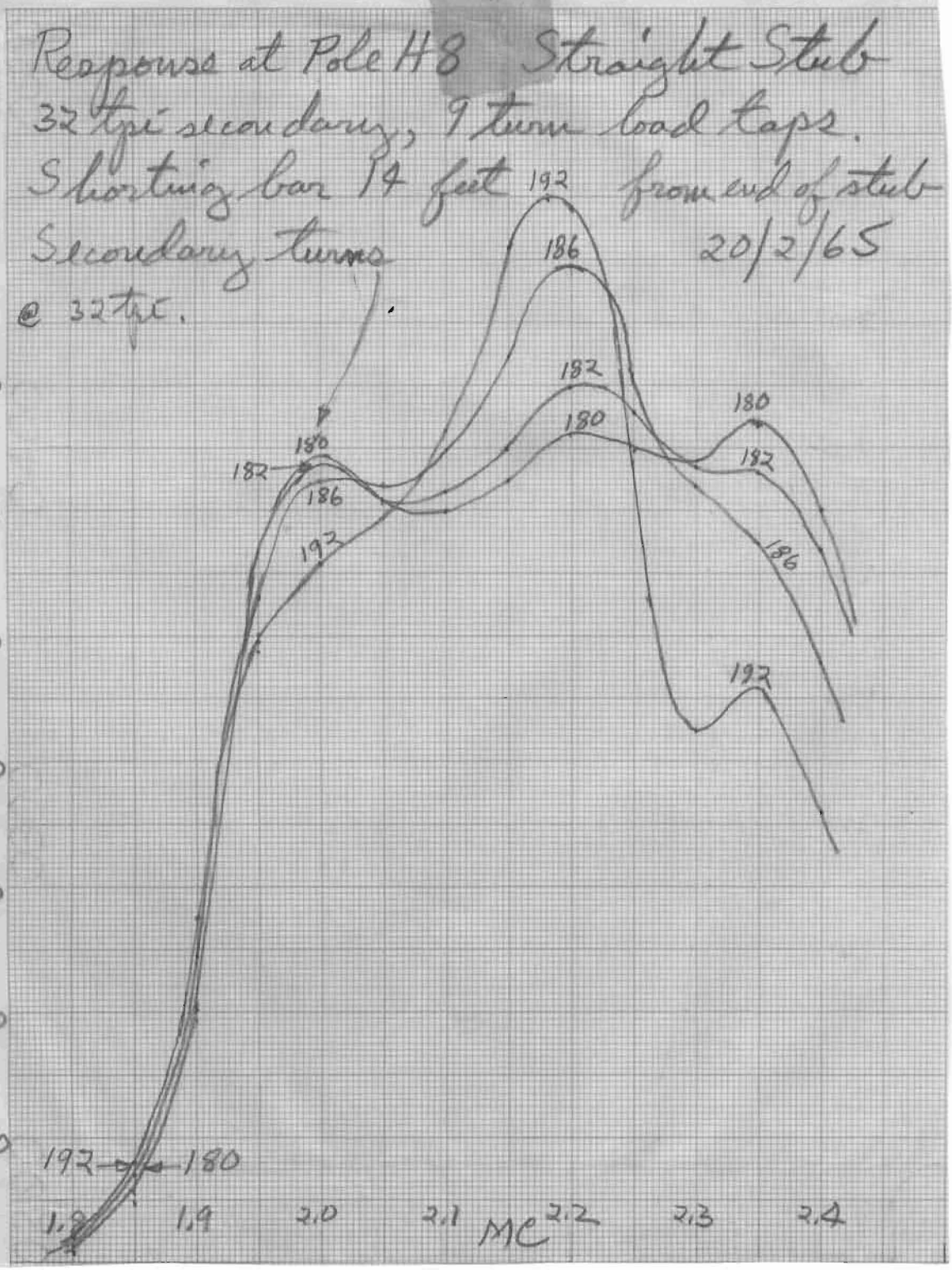
Decreasing the damping (load tapped across fewer turns) makes deeper dips and sharper peaks.

The best combination seems to be 182 secondary turns and shorting bar 9 feet from end of stub.

The response curve can be flattened by increasing the damping to 11 turns load tap and adjusting secondary turns for symmetry. The shorting bar should be 9 feet from end.


Response at Pole H8 Straight Stub
32 tpi secondary, 9 turn load tape.
Shorting bar 4 feet from end of stub.
20/2/65
Secondary turns @ 32 tpi
800
700
600
500
400
300
200
180
Microamperes
192
180
182
186
192
180
186
182
192
186
182
192
180
1.8
1.9
2.0
2.1
2.2
2.3
2.4
MC
CSIRO GRATICULE A4M

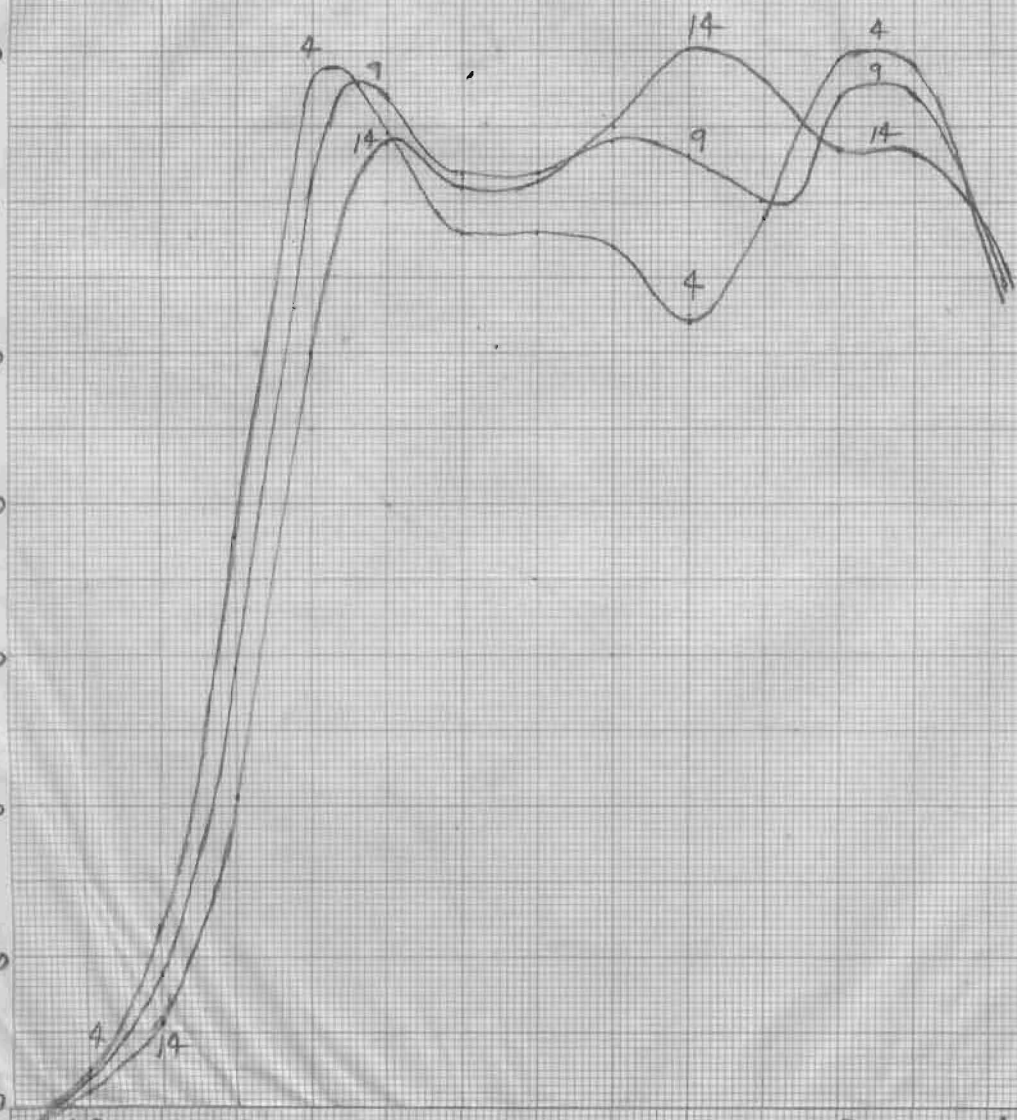

Response at Pole H 8 Straight Stub
32 tpi secondary, 9 turns load taps.
Shorting bar 9 feet from end of stub
Secondary turns
@ 32 tpi
20/2/65
800
700
600
500
400
300
200
100
Microamperes
192
186
182
180
1.8
1.9
2.0
2.1
2.2
2.3
2.4
MC


Response at Pole H8 Straight Stub
32 tpi secondary, 9 turn load taps.
Shorting bar 14 feet from end of stub
Secondary turns
@ 32 tpi.
20/2/65
800
700
600
500
400
300
200
100
Microamperes
192
186
182
180
1.8
1.9
2.0
2.1
MC
2.2
2.3
2.4

Pole H8, Straight Stub 20/2/65

Secondary 18 2T, 32 tpi, 9T load, 3DB attenuator

Shorting bar (-) feet from end



CSIRO GRATICULE A.2

Small tuner, Pole H8, Fanned top stub, 10 ft posts. 10/4/65
Secondary 182 T @ 32 tpi, load 9 turns, 30 DB attenuator.
Antenna coil current 1.2 amps.

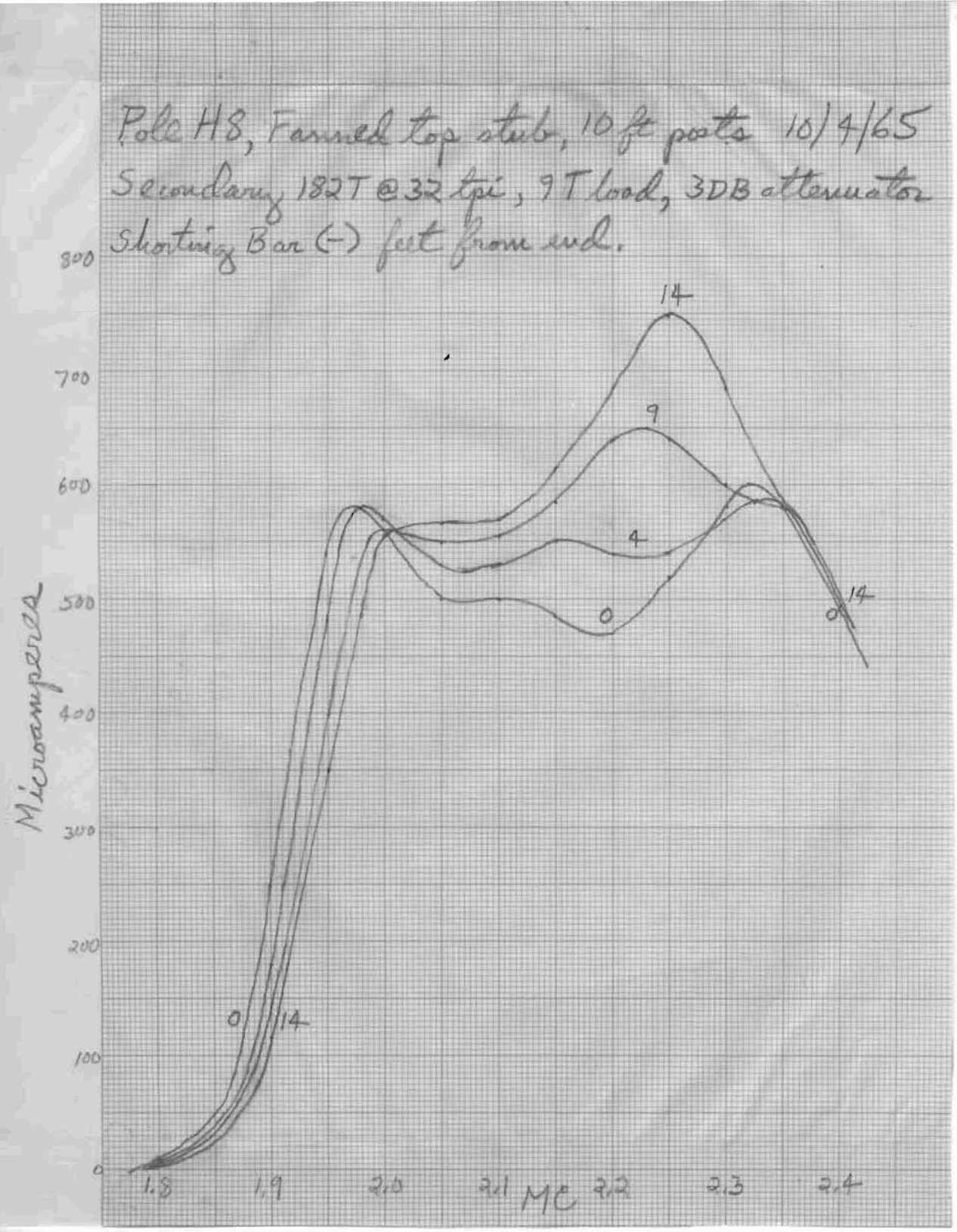
Bar	0	4	9	14	4	9
MC	Output ma on		volt scale			
1.80	5	5	5	5	5	5
1.85	50	30	15	15	30	20
1.90	250	170	140	115	180	145
1.95	540	460	410	350	480	400
2.00	560	560	585?	555	570	560
2.05	500	535	565	565	530	550
2.10	500	535	570	570	530	555
2.15	485	535	605	615	550	585
2.20	470	540	655	685	540	640
2.25	520	550	655	750	540	640
2.30	580?	570	615	685	570	600
2.35	580?	575	585	585	580	580
2.40	490	495	505	505	500	500

↑

Bar 70 ft. from bend in stub at first post.

These results are quite similar to 20/2/65 using a straight stub. Now the line must be about 5 feet longer caused by fanning of top and consequent shortening of last flat top of antenna adjacent to pole H9.

Straight or bent stub quite similar. This agrees with closely same data of 16/1/65


Pole H8, Fanned top stub, 10 ft pots 10/4/65
Secondary, 182T @ 32 tpi, 9T load, 3DB attenuator
Shorting Bar (-) feet from end.
800
700
600
500
400
300
200
100
0
Microamperes
14
9
4
0
14
0
0
14
1.8
1.9
2.0
2.1
MC
2.2
2.3
2.4

Pole H8, Fanned bent stub. 14/4/65

Tuner of 7/10/64. Sec 184T @ 36 tpi,

Load		9T	9T	9T	9T	11T	11T	11T	11T
Stub	9 ft	4 ft	End	5.7 µh	11 µh	11 µh	5.7 µh	End	4 ft
Termination	Bar	Bar	Bar	Coil	Coil	Coil	Coil	Bar	Bar
Mc		ma output on H scale, Generator current 1.25 amps,							
1.80		15	15	40	95	95	45	20	15
1.85		60	85	195	395	360	180	80	60
1.90		260	320	540	620	675	485	380	215
1.95		530	580	1.93, 630 620	525	595	680	575	490
2.00		615	615	565	445	470	620	680	660
2.05		615	600	515	390	380	530	650	2.02, 675 670
2.10		665	645	505	350	340	485	650	695
2.15		730	645	410	350	360	390	600	685
2.20		680	560	475	490	515	475	515	600
2.25		585	560	605	630	635 655	605 625	540	545
2.30		560	590	2.27, 635 620	2.28, 650 640	650	630	585	570
2.35		515	520	555	560	585	585	570	560
2.40		425	435	490	435	500	490	498	488

1 Turn Load

1.80	15	15	40	100	
1.85	60	85	190	395	
1.90	270	335	545	1.89, 600 580	
1.95	510	530	1.92, 570 525	460	
2.00	1.97, 525 510	500	480	410	
2.05	510	500	470	400	
2.10	580	570	505	380	
2.15	705	655	415	340	
2.20	2.18, 740 705	560	445	475	
2.25	475	540	585	640	
2.30	550	560	2.28, 625 610	2.28, 675 650	
2.35	460	465	490	495	
2.40	345	350	360	360	