CHAPTER - V

RESULTS

AND

DISCUSSIONS

5.1 Empirical Analysis :

If transmitting station is "PEKING in China" and is transmitting signals at 15 MHz, then ray may suffer multiple hops. The transmission distance for single hop is 5280 Km. For two hops it will be 2640 Km. in that case appropriate values can be chosen from Table. 5.1(a) and (b)

5.2 Time Dispersion Analysis of Audio Signal

C language is used to develope specific purpose software to study timing circuits. Empirical analysis is carried out by simulating some formulae using C-programming,with the proper choice of different parameters ionospheric model for F-layer is constructed from output results of programs. Ray paths are traced for oblique propagations for transmitter on the earth to ionosphere and back on earth at receiving station by the process of mirror reflection Freqnencies (f's) used for calculation are

(1) 10 MHZ for transmitting station Delhi (India)

(2) 15 MHZ for transmitting station Pekeing (China)

Transmission distance (D) from Delhi to Kolhapur is taken 1500 km. for single hop, as receiving station is Kolhapur.

Number of factors chosen at particular frequencies are,

(1) Transmission distance (D)

(2) Maximum height of reflection (Zm)

(3) ratio of transmission frequency (f) to ciritical frequency (f_c)

(4) Angle of incidence (θ_I - theta).

Values of above factors for frequency 10 MHZ and 15 MHZ are tabulated in Table 5.12(a). It is assumed that ionosphere starts from height of 50 km. c-programmes are writter in Fig 5.4, Fig 5.5

Computerization of time signals received at different frequencices, different dates and time is done and output data is graphed and tabulated in a specified way to determine

(1) electorn concentration (N / cc),

(2) modulation index (m),

(3) nature of signal,

(4) fourier transform of signal wave

To determine electron concentration N/cc time signals recorded on 24th July 1995 at 2.30 p.m and at frequency 10 MHz are used

To study amplitude variation of signal frequencies are used and date and time are given in Table 5.12(a)

Maxima seperations of B.B.C `6' signals recorded on date 3.8.1995 and 3-11-95 at 8hrs GMT and 10.30 p.m. succesively are shown in Table 5.6

Modulation index is determined by using output data from 12th

June 1995 at 10 p.m. at frequency 10 MHz. onwards and are tabulated in Table 5.6(a) to 5.6(j)

It is supposed that time dispersion of standered time signals can be written in terms of equivalent path as,

from eqs 4.73 and 4.47

(with height and dipole appeoximation).

$$P' = P + f\,(\delta P / \delta f)$$

$$P = P' - f\,(\delta P / \delta f) \qquad 5.1$$

$$P/C = P'/C - f/C\,(\delta P/\delta f) \qquad 5.2$$

But $P' = D / c \sin \theta_I$

Therefore ,

$$P/C = D / c \sin \theta_I - f/C\,(\delta P/\delta f) \qquad 5.3$$

or

$$\blacktriangle P/C = \blacktriangle (D / c \sin \theta_I) - \blacktriangle (f/C\,(\delta P/\delta f)) \qquad 5.4$$

Now with proper choice of,

$D = 1500$ Km, $f = 10$ MHz, $C = 3 \times 10^8$ m/sec.

$\theta_I = 25°$, f ration = 1.1, ho = 100 Km

Zm = 50 Km, hm = 150 Km.

If there are no effects of ionospheric distrubances on signal, output should be periodic. But in actual practice there is back or forward shift in maxima of amplitude along the time axis due to presence of ionospheric disturnaces and change of degree of ionization and they corresponds to two factors on R.H.S. of equation.

Here $D / c \sin \theta_I$ can be taken as standared delay time factor.

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and ▲ (D/c sin θ_I) as incremental change in time factor which is in the form of delay slower or faster and second factor can be refered as half-width.

To determine electron concentration ,succesively recorded 10 signals in 10 sec with 640 data values, on a radio receiver on date 24th July 1995 at 2.30 p.m. of model DR 180, are computarized on computer machine PC/XT with interface card 23086.

Values of 2 shift factors are given in Table 5.1 and 5.2

Here 5.1 table referred values from graph on t-axis in cm and 5.2 table transferred to specification in ms.

Table :- 5.1

Sec.	Amplitude	delay fast/slow	half width
1st	0.603516	--Nil--	1.0 cms.
2nd	0.662109	--Nil--	0.5 cms.
3rd	0.714844	slower by 6 cms	0.6 cms.
4th	0.685547	faster by 3 cms	0.5 cms.
5th	0.685547	faster by 3 cms	0.35 cms.
6th	0.703125	faster by 2 cms	0.45 cms
7th	0.720703	faster by 5 cms	0.3 cms.
8th	0.7272	slower by 2 cms	2.1 cms.
9th	0.726562	slower by 6 cms	0.25 cms.
10th	0.732422	--nil--	0.35 cms.

Table 5.2

Sec	Delay fast/slow.by	Half width
1st	--nil--	15.625 ms
2nd	--nil--	7.8125 ms
3rd	slower 93.75 ms	9.375 ms
4th	faster 46.875 ms	7.8125 ms
5th	faster by 15.625 ms	5.4687 ms
6th	faster by 31.25 ms	7.0312 ms
7th	faster by 78.125 ms	4.6875 ms
8th	faster by 31.25 ms	32.8125 ms
9th	faster by 93.75 ms	3.9062 ms
10th	--nil--	5.4687 ms

From eq 5.4 and Table 5.2

$$D / C \sin\theta_I = \blacktriangle (D / C \sin\theta_I) - \blacktriangle (f/c\ (dp/df))$$

For 1st signal, referring 2nd column of Table 5.2 for L.H.S. and 3rd column of same table for 1st factor on R.H.S.

$$\blacktriangle (f/c\ (dp/df)) = 0.06624516 \text{ sec.}$$

For 2nd signal

$$\blacktriangle (f/c\ (dp/df)) = 0.059066952 \text{ sec.}$$

For 3rd signal

$$- \blacktriangle (f/c\ (dp/df)) = \blacktriangle (P/c) - \blacktriangle (D / C \sin\theta_I)$$

$$- \blacktriangle (f/c\ (dp/df)) = 93.75 - (11.876484 + 9.375)$$

$f/c\ (dp/df) = - 0.06624516$ sec. For radio frequency signal. Similarly the factor (dp/df) can be calculated likewise for remaining 7 signals. Which are tabulated in table 5.3

Table 5.3.1s1

Sec	▲(dp/df) factor
1st	+ 0.82504452
2nd	+ 0.59066952
3rd	- 1.9874554
4th	- 0.81288048
5th	+ 0.05160552
6th	- 0.37026948
7th	- 1.8468304
8th	+ 0.40316952
9th	- 2.2921444
10th	+ 0.052035552

3

5.2 Electron concentration determined with the help of(Fig. 3.4 (a) and 3.4 (b)) Atmospheric Nomenclature

Zm	$N \times 10^{12}$ /m^3
50	0.099996667
100	0.100013333
150	0.100060167
200	1.000000000
250	0.100086
300	0.100067
350	0.099993

TABLE 5.1

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Values of N can be estimated as given in Table 5.5

Sec.	N
1st	$0.003395243 \times 10^{12}/m^3$
2nd	$0.002430733 \times 10^{12}/m^3$
3rd	$0.08100008 \times 10^{12}/m^3$
4th	$0.033451874 \times 10^{12}/m^3$
5th	$0.002123683 \times 10^{12}/m^3$
6th	$0.015240938 \times 10^{12}/m^3$
7th	$0.076001251 \times 10^{12}/m^3$
8th	$0.016591338 \times 10^{12}/m^3$
9th	$0.09432693 \times 10^{12}/m^3$
10th	$0.000214138 \times 10^{12}/m^3$

Also time signals received on radio receiver are computerized, the output waveform of voltages represents fading phenomenon due to ionospheric effects. Scintillations are apparent in amplitude of the received signal.

With the help of values of minimum, amplitude (V min) and maximum amplitude (V max), ionosphere amplitude modulation index of reflected wave can be determined as,

$m = (V_{max} - V_{min}) / (V_{max} + V_{min})$.

This index is a significant parameter reported for the first time, by us, utilizing amplitudes of the encoded audio time signals. Further work on Fourier transforms is also cited in the diagrams given elsewhere in this chapter.

Detected output is proprotional to the orginal modulated wave with an appropriated phase shift now from formula

$$\blacktriangle (dP/dF) = - 40.5 / f^3 \; 2 \; {}_{o}f^{s} \; Nds$$

Therefore ${}_{o}f^{s}$ Nds = $-f^3$ / 81 (dp/df)

$${}_{o}f^{s} \; Nds = -f^3 / 81 \; (dp/df)$$

$${}_{o}f^{s} \; Nds = 10^{21} / 81 \; (1.9874554)$$

$$= 2.453648642 \times 10^{19}$$

Accordingly, estimation of the variations electron density ${}_{o}f^{s}$ Nds, in the ionospheric layer is shown in Table 5.4

sec	n= ${}_{o}f^{s}$ Nds(variation)/m^2
1st	0.01018573 x 10^{20}
2nd	0.0072922 x $10^{20}/m^3$
3rd	0.245364 x $10^{20}/m^3$
4th	0.1003556148 x $10^{20}/m^3$
5th	0.0063710518 x $10^{20}/m^3$
6th	0.045722814 x $10^{20}/m^3$
7th	0.228003753 x $10^{20}/m^3$
8th	0.0497740148 x $10^{20}/m^3$
9th	0.2829807901 x $10^{20}/m^3$
10th	0.006422414 x $10^{20}/m^3$

Table 5.6

Data of recording 2/11/1995
Time of recording : 7 a.m.
Transmitting Station: Delhi (MW)
1st signal

i-values	amplitude
490	-6.000000
491	0.328125
492	-6.000000
493	0.322266
494	-6.000000
495	0.328125
496	-6.000000
497	0.333984
498	-6.000000
499	0.339844
500	-6.000000
501	0.333984
502	-6.000000
503	0.339844
504	-6.000000
505	0.339844
506	-6.000000
507	0.328125
508	-6.000000
509	0.333984
510	-6.000000
511	0.339844
512	-6.000000
513	0.333984
514	-6.000000
515	0.328125
516	-6.000000
517	0.339844
518	-6.000000
519	-6.000000
520	0.292969
521	-6.000000
522	0.292969
523	-6.000000
524	0.257812
525	-5.443359

able 5.7

Data of Recording 2/11/1995
Time of recording:7 a.m.
Transmitting Station: Delhi (MW).
2nd Signal

i Values	Amplitude	i-Values	Amplitude
538	-6.000000	579	-6.000000
539	0.000000	580	-3.474609
540	-6.000000	581	-6.000000
541	0.251953	582	-3.193359
542	-6.000000	583	-5.625000
543	0.275391	584	-4.880859
544	-6.000000	585	-4.125000
545	0.328125	586	-4.505859
546	-6.000000	587	-3.937500
547	-2.625000	588	0.251953
548	-4.880859	589	-6.000000
549	-2.630859	590	0.275391
550	-6.000000	591	-6.000000
551	-3.427734	592	0.275391
552	-6.000000	593	-6.000000
553	-3.105469	594	0.216797
554	-3.380859	595	-6.000000
555	-5.460938	596	-0.380859
556	-3.380859	597	-6.000000
557	-5.250000	598	-0.380859
558	-3.568359	599	-6.000000
559	-4.875000	600	0.134766
560	-3.755859	601	-6.000000
561	-4.265625	602	-0.005859
562	-3.849609	603	-6.000000
563	-5.250000	604	0.093750
564	-4.505859	605	-6.000000
565	-4.265625	606	0.093750
566	-3.849609	607	-6.000000
567	-4.593750	608	0.093750
568	-4.880859	609	-6.000000
569	-4.312500	610	0.187500
570	-4.505859	611	-6.000000
571	-4.078125	612	0.210938
572	-4.904297	613	-6.000000
573	-4.218750	614	0.269531
574	-4.974609	615	-6.000000
575	-3.750000	616	0.281250
576	-2.255859	617	-6.000000
577	-6.000000	618	0.263672
578	-2.630859	619	-4.628906

Table 5.8 :Data of Recording 2.11.95 Time of Recording : 7 a.m.
Transmitting station : Delhi (Mw) 3rd signal.

v=-6.000000 i=98	v=-6.000000 i=146
v=-6.000000 i=99	v=-6.000000 i=147
v=-6.000000 i=100	v=-6.000000 i=148
v=-6.000000 i=101	v=-6.000000 i=149
v=-6.000000 i=102	v=-6.005859 i=150
v=-6.000000 i=103	v=-6.000000 i=151
v=-6.000000 i=104	v=-2.630859 i=152
v=-6.000000 i=105	v=-6.000000 i=153
v=-6.000000 i=106	v=-2.255859 i=154
v=-6.000000 i=108	v=-6.000000 i=155
v=-6.000000 i=109	v=-2.255859 i=155
v=-6.000000 i=110	v=-6.000000 i=156
v=-6.000000 i=111	v=-2.255859 i=157
v=-6.000000 i=112	v=-0.755859 i=158
v=-6.000000 i=113	v=-6.000000 i=158
v=-6.000000 i=114	v=-6.000000 i=159
v=-6.000000 i=115	v=0. 275391 i=160
v=-6.000000 i=116	v=-6.000000 i=161
v=-6.000000 i=117	v=0. 298828 i=162
v=-6.000000 i=118	v=-6.000000 i=163
v=-6.000000 i=119	v=0. 333984 i=164
v=-6.000000 i=120	v=-6.000000 i=165
v=-6.000000 i=121	v=0. 333984 i=166
v=-6.000000 i=122	v=-6.333984 i=166
v=-6.000000 i=123	v=-6.000000 i=167
v=-6.000000 i=124	v=0. 339844 i=168
v=-6.000000 i=125	v=-6.000000 i=169
v=-6.000000 i=126	v=0. 322266 i=170
v=-6.000000 i=127	v=-6.000000 i=171
v=-6.000000 i=128	v=0. 275391 i=172
v=-6.000000 i=129	v=0. 275391 i=172
v=-6.000000 i=130	v=-6.000000 i=173
v=-6.000000 i=131	v=0. 298828 i=174
v=-6.000000 i=132	v=-6.000000 i=175
v=-6.000000 i=133	v=-0.000000 i=176
v=-6.000000 i=134	v=-6.005859 i=177
v=-6.000000 i=135	v=-3.375000 i=178
v=-6.000000 i=136	v=-4.787109 i=179
v=-6.000000 i=137	v=-4.406250 i=180
v=-6.000000 i=138	v=-4.687500 i=181
v=-6.000000 i=139	v=-4.787109 i=183
v=-6.000000 i=140	v=-4.177734 i=184
v=-6.000000 i=141	v=-4.037109 i=185
v=-6.000000 i=142	v=-4.974609 i=186
v=-6.000000 i=142	v=-4.599609 i=187
v=-5.812500 i=143	v=-4.599609 i=188
v=-6.000000 i=144	v=-4.265625 i=189
v=-4.500000 i=145	v=-4.640625 i=190

Table 5.9

Data of Recording 2/11/95.
Time of Recording:7 a.m.
Transmission Station: Delhi (mw)
4th signal

i values	Amplitude	i values	Amplitude
546	-3.298828	575	-3.750000
547	0.328125	576	-3.755859
548	-6.000000	577	-5.625000
549	0.351562	578	-3.943359
550	-6.000000	579	-4.875000
551	0.339844	580	-5.250000
552	-6.000000	581	-4.8750000
553	0.339844	582	-3.755859
554	-6.000000	583	-3.937500
555	0.328125	584	-4.505859
556	-6.000000	585	-4.312500
557	0.322266	586	-4.130859
558	-6.000000	587	-3.750000
559	0.333984	588	-6.000000
560	-5.994141	589	-3.832031
561	-4.125000	590	-5.250000
562	-5.255859	591	-4.318359
563	-4.031250	592	-4.500000
564	-4.505859	593	-4.500000
565	-4.734375	594	-3.849609
566	-5.162109	595	-6.000000
567	-4.500000	596	-3.351562
568	-4.505859	597	-5.906250
569	-3.375000	598	-3.193359
570	-5.255859	599	-4.875000
571	-4.312500	600	-4.693359
572	-5.255859	601	-4.312500
573	-3.750000	602	-4.130859
574	-4.505859	603	-4.500000
		604	0.281250
		605	-5.156250

able 5.10

Data of Recording 2/11/95.
Time of Recording:7 a.m.
Transmission Station: Delhi (mw)
5th signal

i values	Amplitude
288	-6.000000
289	0-503906
290	-6.000000
291	-3.000000
292	-6.000000
293	-3.000000
294	-6.000000
295	-3.750000
296	-6.000000
297	-2.625000
298	-5.912109
299	-3.375000
300	-5.443359
301	-3.937500
302	-3.937500
303	-4.007812
304	-4.500000
305	-4.224609
306	-4.880859
307	-3.380859
308	-4.500000
309	-3.380859
310	-5.302734
311	-3.750000
312	-3.943359
313	-3.140625
314	-5.255859
315	-3.843750
316	-4.957031
317	-3.380859
318	-4.798828
319	-3.533203
320	-3.093750
321	-6.000000
322	0.498047
323	-6.000000
324	0.515625
325	-6.000000
326	0.421875
327	-6.000000

Table 5.11

v=-6.000000 i=292	v=-3.193359 i=341
v=-6.000000 i=293	v=-6.000000 i=342
v=-6.000000 i=294	v=-3.005859 i=343
v=-6.000000 i=295	v=-6.000000 i=344
v=-6.000000 i=296	v=-3.380859 i=345
v=-6.000000 i=297	v=-6.000000 i=136
v=-6.000000 i=298	v=-3.755859 i=347
v=-6.000000 i=299	v=-4.880859 i=348
v=-6.000000 i=300	v=-2.062500 i=349
v=-6.000000 i=301	v=-6.000000 i=350
v=-6.000000 i=302	v=-1.500000 i=351
v=-6.000000 i=303	v=-6.000000 i=352
v=-6.000000 i=304	v=-1.500000 i=353
v=-6.000000 i=305	v=-6.000000 i=354
v=-6.000000 i=306	v=-3.937500 i=355
v=-6.000000 i=307	v=-4.505859 i=356
v=-6.000000 i=308	v=-3.052734 i=357
v=-6.000000 i=309	v=-5.343750 i=358
v=-6.000000 i=310	v=-4.224609 i=359
v=-6.000000 i=311	v=-5.062500 i=360
v=-6.000000 i=312	v=-5.208984 i=361
v=-6.000000 i=313	v=-3.849609 i=362
v=-6.000000 i=314	v=-1.875000 i=363
v=-6.000000 i=315	v=-3.755859 i=364
v=-6.000000 i=316	v=0.140625 i=365
v=-6.000000 i=317	v=-6.000000 i=366
v=-6.000000 i=318	v=-6.263672 i=367
v=-6.000000 i=319	v=-6.000000 i=368
v=-6.000000 i=320	v=0. 281250 i=369
v=-0.099609 i=321	v=-6.000000 i=370
v=-6.000000 i=322	v=0. 240234 i=371
v=-0.755859 i=323	v=-6.000000 i=372
v=-6.000000 i=324	v=-1.880858 i=373
v=-0.943359 i=325	v=-6.000000 i=374
v=-6.000000 i=326	v=-3.427734 i=375
v=0. 169922 i=327	v=-6.000000 i=376
v=-6.000000 i=328	v=-0.755859 i=377
v=-1.130859 i=329	v=-2.818359 i=379
v=-6.000000 i=330	v=-5.250000 i=380
v=-0.755859 i=331	v=-3.662109 i=381
v=-6.000000 i=332	v=-4.125000 i=382
v=-1.505859 i=333	v=-4.318359 i=383
v=-6.000000 i=334	v=-3.615234 i=384
v=-1.130859 i=335	v=-4.500000 i=385
v=-6.000000 i=336	v=-3.750000 i=386
v=-1.130859 i=337	v=-3.943359 i=387
v=-6.000000 i=338	v=-0.750000 i=388
v=-0.755859 i=339	v=-3.943359 i=389
v=-6.000000 i=340	v=-3.468750 i=390

v=-5.068359 i=391	v=0. 251953 i=440
v=-3.099609 i=392	v=-6.000000 i=441
v=-4.500000 i=393	v=-0.000000 i=442
v=-4.031250 i=394	v=-6.005859 i=443
v=-2.990234 i=395	v=-2.349609 i=444
v=-2.250000 i=396	v=-5.906250 i=445
v=-6.000000 i=397	v=-4.318359 i=446
v=0. 093750 i=398	v=-4.429688 i=447
v=-6.000000 i=399	v=-3.404297 i=448
v=0 .234375 i=400	v=-4.757812 i=449
v=-6.000000 i=401	v=-4.687500 i=450
v=0 .246094 i=402	v=-3.849609 i=451
v=-6.000000 i=403	v=-3.375000 i=452
v=0. 263672 i=404	v=-4.101562 i=453
v=-4.505859 i=405	v=-4.318359 i=454
v=-2.250000 i=406	v=-4.500000 i=455
v=-6.000000 i=407	v=-4.593750 i=456
v=0. 199219 i=408	v=-4.458984 i=457
v=-6.000000 i=409	v=-4.037109 i=458
v=0. 257812 i=410	v=-4.037109 i=459
v=-6.000000 i=411	v=-3.234375 i=460
v=0. 287109 i=412	v=-4.822266 i=461
v=-6.000000 i=413	v=-4.599609 i=462
v=0. 275319 i=414	v=-4.599609 i=463
v=0. 275391 i=415	v=-3.937500 i=464
v=-6.000000 i=416	v=-4.318359 i=465
v=-6.000000 i=417	v=-4.388672 i=466
v=-1.505859 i=418	v=-4.406250 i=467
v=-6.000000 i=419	v=-5.068359 i=468
v=-1.505859 i=420	v=-4.101562 i=469
v=-6.000000 i=421	v=-4.031250 i=470
v=-1.599609 i=422	v=-4.031250 i=471
v=-6.000000 i=423	v=-4.031250 i=472
v=0. 246094 i=424	v=-4.078125 i=473
v=-6.000000 i=425	v=-4.125000 i=474
v=0. 263672 i=426	v=-5.039062 i=475
v=-6.000000 i=427	v=-4.880859 i=476
v=0. 269531 i=428	v=-4.042969 i=477
v=-6.000000 i=429	v=-4.130859 i=478
v=0. 269531 i=430	v=-4.224609 i=479
v=-6.000000 i=431	v=-3.914062 i=480
v=0 .287109 i=432	v=-4.130859 i=481
v=-6.000000 i=433	v=-4.687500 i=482
v=0. 000000 i=434	v=-3.890625 i=483
v=-6.000000 i=435	v=-4.693359 i=484
v=0. 269531 i=436	v=-3.427734 i=485
v=-6.000000 i=437	v=-4.130859 i=486
v=0. 269531 i=428	v=-4.875000 i=487
v=-6.000000 i=439	v=-4.623047 i=488

Table 5.11 : Datta of recording 2/11/95
Time of recording : 7 a.m.Transmitting station : Delhi(MW)

Table 5.12(a) Recording of time Signals taken from different stations.

sr.no.	Date	time of recording	frequency / transmitting station
1.	12-6-95	10 a.m.	10 MHz2.13-6-959 a.m.15 M
2.	13-6-95	9 a.m.	15 MHZ
3.	19-6-95	9 a.m.	10 MHZ
4.	19-6-95	11.15 p.m.	10 MHZ
5.	20-6-95	8.30 a.m.	10 MHZ
6.	21-6-95	11.45 a.m.	10 MHZ
7.	22-6-95	8.45 a.m.	10 MHZ
8.	22-6-95	8.45 a.m.	10 MHZ
9.	22-6-95	9 p.m.	10 MHZ
10.	25-6-95	9 a.m.	10 MHZ
11.	22-7-95	10 a.m.	10 MHz
12	23-7-95	9.30 a.m.	15 MHz
13	23-7-95	10 a.m.	15 MHz
14	25-7-95	5 p.m.	10 MHz
15	25-7-95	6 p.m.	10 MHz
16	25-7-95	8.30 p.m.	10 MHz
17	26-7-95	8.30 a.m.	15 MHz
18	27-7-95	10.40 a.m.	10 MHz
19	27-7-95	11.30 a.m.	10 MHz
20	27-7-95	12.30 a.m.	10 MHz
21	27-7-95	1.30 a.m.	10 MHz

Sr.no.	Date	Time of recording	Frequency / transmitting station
22	27-7-95	2.30 a.m.	10 MHz
23	2-8-95	12.45 a.m.	Shrilanka Broadcast
24	2-8-95	1.30 a.m.	10 MHz
25	2-8-95	2.30 a.m.	10 MHz
26	2-8-95	3.45 p.m.	10 MHz.
27	2-8-95	3.30 p.m.	B.B.C.
28	2-8-95	4.30 p.m.	B.B.C.
29	3-8-95	5.30 p.m.	B.B.C.
30	3-8-95	6.30 p.m.	B.B.C.
31	3-8-95	7.30 p.m.	B.B.C.
32	4-8-95	11.30 a.m.	B.B.C.
33	4-8-95	5.30 p.m.	10 MHz
34	4-8-95	10.30 p.m.	B.B.C.
35	1-11-95	2.30 p.m.	B.B.C.
36	1-11-95	3.30 p.m.	B.B.C.
37	1-11-95	5.30 p.m.	B.B.C.
38	1-11-95	10.30 p.m.	B.B.C.
39	2-11-95	7 a.m.	Delhi - 1431 KHz
40	2-11-95	4.30 p.m.	B.B.C.
41	2-11-95	10.30 p.m.	B.B.C.
42	3-11-95	7 a.m.	Delhi
43	3-11-95	10.30 p.m.	B.B.C.
44	3-11-95	11.30 p.m.	B.B.C.
45	4-11-95	7 a.m.	Delhi
46	4-11-95	7.30 a.m.	Shrilanka Broadcast
47	4-11-95	8 a.m.	Vividh Bharati.

Table 5.12(b) Showing frequency chart for different sta tions

VIVIDH BHARATI

SHORT WAVE SERVICE.	Frequency KHz	Wavelength meters
6.30 a.m.to 10 a.m.	10330	29.04
12.30 p.m to 5.30 p.m.	10330	29.04
7.00 p.m. to 11.00 p.m.	10330	29.04

MEDIUH	WAVE SERVICE	KHz	Meters
Ahmedabad	B	1440	208.3
Allhabad	B	1485	202.0
Bangolor		675	444.4
Bhopal	B	1233	243.3
Bombay	C	1188	252.5
Culcutta	C	1323	226.7
Caliout	B	1323	226.6
Delhi	C	1431	209.6
Dharwad	B	1368	219.3
Hydrabad	C	1170	256.4
Indor	B	1584	189.3
Jalandhor		1360	222.2
Jaipur	B	1269	256.4
Jodhpur	B	1197	250.6
Kolhapur	C	1449	207.0
Lucknow	C	1276	234.7
Madrs	C	783	383.1
Nagpur	B	1602	187.2
Panji	B	1539	194.9
Patna	B	1602	187.2
Puna	B	1002	187.2
Rajkot	B	1422	210.4
Renchi		1152	260.4
Shrinagar		1224	146.7
Techirapalli	B	891	366.7
Travandrum	B	1499	200.8
Vijayvoada	B	2503	149.6
Varansi		2502	149.6
Vadodara		1602	187.2

Table 5.13(a) Showing modulation index values of date 24.7.95(time -2.30 p.m) Transmitting station-Delhi (SW)

Recording date : 24/7/95 Frequency/

Time 2.30 p.m. transmission station. Delhi (SW) 10 MHz

Signal no.	i	Amplitude Vmax	Amplitude Vmin	Modulation Index M
1ST	38	0.603516	-	0.2189349
	13	-	0.386719	
2ND	102	0.662109	-	0.1356783
	81	-	0.503906	
3RD	172	0.714844	-	0.9062506
	132	-	0.035156	
4TH	227	0.685547	-	0.0733944
	243	-	0.591797	
5TH	293	0.685547	-	0.0934583
	264	-	0.568359	

Table 5.13 (b) :Showing modulation index values of date 24.7.95(time 8 hrs.GMT Transmitting stattion B.B.C.)

Recording date : 24/7/95

Time: 8hrs Gmt. Transmission station. B.B.C.

Signal no.	i	Vmax	Vmin	Modulation Index M
1st	262	0.410156	-	-- Nil--
2nd	265	0.451172	-	0.0620684
	269	-	0.398438	
3rd	305	0.404297	-	0.1311475
	281	-	0.310547	
4th	385	0.304688	-	--Nil
5th	566	0.445312	-	0.1603042
	555	-	0.322266	
6th	611	0.380859	-	0.2999998
	607	-	0.2050278	

table 5.13(c)Showing modulation Index values datte 3.8.95(time : 7 a.m. transmitting station Delhi) (Mw).

Recording date : 3/8/95

Time: 7 A.M. Transmission station. Delhi. (mw)

Signal no.	i	Vmax	Vmin	Modulation Index M
1st	306	0.380859	-	--Nil
2nd	326	0.404297	-	0.22124
	325	-	0.257812	
3rd	332	0.351562	-	0.0526311
	333	-	0.316406	
4th	354	0.398438	-	0.0303036
	359	-	0.375000	
5th	372	0.304688	-	0.1685398
	376	-	0.216797	
6th	533	0.304688	-	0.2530118
	447	-	0.181641	

Table 5.13(d) Showing modulation index values of date 1.11.95 (time : 2.30 pm. Transmitting station B.b.C.)

Recording date : 1/11/95

Time: 2.30 p.m. Transmission station. B.B.C.

Signal no.	i	Vmax	Vmin	Modulattion Index M
1st	85	0.246094	-	--Nil
2nd	1350.	304688	-	0.0196082
	131	-	0.292969	
3rd	199	0.310547	-	0.4520532
	200	-	0.117188	
4th	261	0.304688	-	0.0097097674
	262	-	0.298828	
5th	326	0.316406	-	0.1368424
	329	-	0.240234	
6th	492	0.310547	-	0.737705
	577	-	0.046875	

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Table 5.13(e) Showing modulation index value date 2.11.95 (time 7 a.m., Transmitting station : Delhi (Mw).

Recording date : 2/11/95 Freqncy/

Time: 7 a.m. Transmission station. Delhi (m.w.)

Signal no.	i	Amplitude Vmax	Vmin	Modulation Index M
1st	85	0.339844	--Nil--	--
2nd	158	0.375000	-	0.1428571
	154	-	0.281250	
3rd	232	0.416016	-	.0006052
	237	-	0.410156	
4th	308	0.398438	-	0.0967748
	-	-	0.328125	
5th	387	0.410156	-	0.0370372
	-	-	0.380859	
6th	461	0.380859	-	0.3402057
	457	-	0.187500	

Table 5.13(f) Showing modulation index values of date 3.11.95 (time : 7 a.m., Transmitting station : Delhi (MW).

Recording date : 3/11/95

	Time: 7 a.m.		Transmission station. Delhi (mw)	
Signal no.	i	Amplitude Vmax	Vmin	Modulattion Index M
1st	370	0.392578	-	0.1964281
	390	-	0.263672	
2nd	386	0.263672	-	0.3432846
	396	-	0.128906	
3rd	398	0.755859	-	0.5542165
	436	-	0.216797	
4th	401	0.328125	-	0.4177203
	437	-	0.134766	
5th	185	0.357422	-	0.3260861
	151	-	0.181641	
6th	382	0.404297	-	0.3799992
	404	-	0.181641	

206 Table 5.13(g) :Showing modulation index values of date 12.6.95 (time 10 p.m. ,Transmitting station Delhi (sW).

Recording date : 12/6/95 Freqency 10MHz
Time: 10 p.m. Delhi (sw)

Signal no.	i	Amplitude Vmax	Amplitude Vmin	Modulation Index M
1st	2	0.73	-	0.8024691
	0	-	0.08	
2nd	9	0.61	-	0.0701754
	8	-	0.53	
3rd	11	0.72	-	0.7349397
	13	-	0.11	
4th	14	0.73	-	0.92729729
	15	-	0.01	
5th	20	0.66	-	0.8857142
	22	-	0.04	
6th	26	0.72	-	0.9459459
	27	-	0.02	
7th	32	0.7	-	0.9444444
	31	-	0.2	
8th	34	0.68	-	0.916666
	35	-	0.04	-
9th	39	0.74	-	0.804878
	40	-	0.08	
10th	45	0.73	-	0.871948
	47	-	0.05	

Table 5.13(b) : Showing modulation index values of date 13.6.95(Time 10 p.m. Transmitting station : 15 MHz).

Recording date : 13/6/95 Freqency
Time: 10 p.m. Transmitting station 15MHz.

Signal no.	i	Amplitude Vmax	Amplitude Vmin	Modulation Index M
1st	3	0.533203	-	0.61062
	1	-	0.128906	
2nd	9	0.509766	-	0.7595774
	7	-	0.070312	
3RD	13	0.732422	-	0.7605642
	14	-	0.099609	
4TH	19	0.720703	-	0.822233
	20	-	0.070312	
5TH	24	0.70312	-	0.610738
	22	-	0.169922	
6TH	25	0.304688	-	0.5522378
	30	-	0.087891	
7TH	33	0.580078	-	0.736841
	30	-	0.087891	
8TH	37	0.351562	-	0.7142843
	36	-	0.058594	
9TH	43	0.556641	-	0.5200007
	44	-	0.175781	
10	50	0.246094	-	0.4736829
	47	-	0.087891	

Table 5.13(i) Showing modulation index values of date 19.6.95(Time : 9 a.m. Transmitting station : 15 MHz).

Recording date : 19/6/95 Freqency

Time: 9 a.m. Transmitting station 15MHz.

Signal no.	i	Amplitude Vmax	Vmin	Modulation Index M
1st	8	0.650391	-	0.8813868
	4	-	0.041016	
5th	13	0.0703125	-	0.9510549
	15	-	0.017578	
3rd	25	0.732422	-	0.7985617
	27	-	0.082031	
4th	36	0.562500	-	0.8989894
	34	-	0.041016	
5th	45	0.720703	-	0.9523812
	38	-	0.017578	
6th	54	0.726562	-	0.7971018
	48	-	0.082031	
7th	55	0.0703125	-	0.9512198
	63	-	0.017578	

Table 5.,13(j) : Showing modulation index values of date 22.7.95 (time : 9 ar
Transmitting station : 10 MHz).

Recording date : 22/7/95 Freqency : 10 MHz.
Time: 9 a.m.

Signal no.	i	Amplitude Vmax	Amplitude Vmin	Modulation Index M
1st	6	0.720703	-	0.9548193
	2	-	0.017578	
2nd	10	0.703125	-	0.0958905
	13	-	0.580078	
3rd	20	0.726562	-	0.016393
	19	-	0.703125	
4th	35	0.738281	-	0.1004362
	33	-	0.603516	
5th	43	0.726562	-	0.0553194
	37	-	0.650391	
6th	46	0.714844	-	0.0844443
	52	-	0.603516	
7th	60	0.708984	-	0.0386263
	63	-	0.656250	
8th	69	0.703125	-	0.0958905
	72	-	0.580078	
9th	80	0.708984	-	0.9674789
	76	-	0.011719	
10th	89	0.726562	-	0.1121073
	86	-	0.580078	

Table 5.14 : Fourier Transform

Values of 1st Signal.

Dated 2-11-95, time 7 a.m. transmitting station Delhi.

W	Theta	Amplitude
1	0	0.2279402
2	0.9651271	2.575164×10^{-2}
3	-1.174546	2.058793×10^{-2}
4	8.6652375×10^{-3}	0.0183352
5	1.105649	1.651749×10^{-2}
6	-0.8015298	1.505611×10^{-2}
7	0.2987871	1.560307×10^{-2}
8	1.475556	1.637798×10^{-2}
9	-0.7944701	1.491454×10^{-2}
10	0.3175709	1.374996×10^{-2}
11	1.371118	0.0103635
12	-0.4880163	8.317638×10^{-3}
13	0.6564419	7.547631×10^{-3}
14	-1.230966	6.848854×10^{-3}
15	0.2486009	5.696045×10^{-3}
16	0.6796399	3.600309×10^{-3}
17	0	7.943182×10^{-3}
18	-0.3227625	2.395523×10^{-3}
19	0	3.552148×10^{-4}
20	1.452678	6.106911×10^{-3}
21	-1.2222987	0.0159234
22	0.7004931	7.548166×10^{-3}
23	-0.5220031	6.67374×10^{-3}
24	-6.895975×10^{-2}	1.277351×10^{-2}
25	0.2212728	1.769188×10^{-2}
26	0.8453519	0.0142226
27	0.4024276	4.737444×10^{-3}
28	1.021898	1.494078×10^{-2}
29	-0.1545084	1.538973×10^{-2}
30	-0.9656768	1.639512×10^{-2}
31	-1.233806	9.467819×10^{-3}
32	-0.7176585	2.559886×10^{-2}
33	1.321482	2.016443×10^{-2}

FFT output is multiplied by 200

Table 5.15

640 data in 10 sec. Date of recording 24th July 95'
Time of recording 2.30 p.m.
Freq. 10 MHz

maxsdB = 30.000000
minsdB = -40.000000
maxtime = 1.000000
mintime = -1.000000

v=0.521484 i=0	v=0.568359 i=42
v=0.509766 i=1	v=0.521484 i=43
v=0.533203 i=2	v=0.527344 i=44
v=0.492188 i=3	v=0.480469 i=45
v=0.574219 i=4	v=0.533203 i=46
v=0.451172 i=5	v=0.562500 i=47
v=0.509766 i=6	v=0.568359 i=49
v=0.503906 i=7	v=0.603516 i=50
v=0.421875 i=8	v=0.527344 i=51
v=0.550781 i=9	v=0.562500 i=52
v=0.498047 i=10	v=0.603516 i=53
v=0.451172 i=11	v=0.544922 i=54
v=0.562500 i=12	v=0.580078 i=55
v=0.386719 i=13	v=0.550781 i=55
v=0.527344 i=14	v=0.550781 i=56
v=0.492188 i=15	v=0.515625 i=57
v=0.492188 i=16	v=0.580078 i=58
v=0.468750 i=17	v=0.644531 i=59
v=0.498047 i=18	v=0.533203 i=60
v=0.492188 i=19	v=0.574219 i=61
v=0.468750 i=20	v=0.550781 i=62
v=0.468750 i=21	v=0.544922 i=63
v=0.480469 i=22	v=0.562500 i=64
v=0.480469 i=23	v=0.533203 i=65
v=0.468750 i=25	v=0.580078 i=66
v=0.474609 i=26	v=0.509766 i=67
v=0.474609 i=27	v=0.597656 i=68
v=0.515626 i=28	v=0.562500 i=69
v=0.503906 i=29	v=0.574219 i=70
v=0.492188 i=30	v=0.632812 i=71
v=0.457031 i=31	v=0.521484 i=72
v=0.533203 i=32	v=0.556641 i=73
v=0.509766 i=33	v=0.544922 i=74
v=0.515625 i=34	v=0.585938 i=75
v=0.550781 i=35	v=0.539062 i=76
v=0.498047 i=36	v=0.609375 i=77
v=0.521484 i=37	v=0.533203 i=78
v=0.603516 i=38	v=0.544922 i=79
v=0.603516 i=39	v=0.585938 i=80
v=0.544922 i=40	v=0.503906 i=81
v=0.591797 i=41	v=0.626953 i=82
	v=0.574219 i=83
	v=0.568359 i=84
	v=0.521484 i=85

Table 5.15

v=0.591797 i=86
v=0.580078 i=87
v=0.574219 i=88
v=0.498047 i=89
v=0.562500 i=90
v=0.550781 i=91
v=0.626953 i=92
v=0.544922 i=93
v=0.603516 i=94
v=0.580078 i=95
v=0.597656 i=96
v=0.650391 i=97
v=0.644591 i=98
v=0.603516 i=99
v=0.603516 i=100
v=0.615234 i=101
v=0.662109 i=102
v=0.615234 i=103
v=0.615234 i=104
v=0.656250 i=105
v=0.615235 i=106
v=0.621094 i=107
v=0.533203 i=108
v=0.603516 i=109
v=0.603516 i=110
v=0.644531 i=111
v=0.591797 i=112
v=0.574219 i=113
v=0.615234 i=114
v=0.585938 i=115
v=0.621094 i=116
v=0.591797 i=117
v=0.609375 i=118
v=0.574219 i=119
v=0.574219 i=120
v=0.556641 i=121
v=0.574219 i=122
v=0.585938 i=123
v=0.603516 i=124
v=0.603516 i=126
v=0.615234 i=128
v=0.615234 i=129
v=0.662109 i=130
v=0.580078 i=131
v=0.035156 i=132
v=0.574219 i=133
v=0.650391 i=134
v=0.650391 i=135
v=0.580078 i=136
v=0.585938 i=137
v=0.626953 i=138
v=0.574219 i=139
v=0.638672 i=140
v=0.574219 i=141
v=0.580075 i=142
v=0.615234 i=143
v=0.580078 i=144
v=0.615234 i=145
v=0.603516 i=146
v=0.638672 i=147
v=0.568359 i=148
v=0.603516 i=149
v=0.597656 i=150
v=0.632812 i=151
v=0.585938 i=152
v=0.597656 i=154
v=0.597656 i=155
v=0.632812 i=156
v=0.638672 i=157
v=0.626953 i=158
v=0.632812 i=159
v=0.615234 i=160
v=0.650391 i=161
v=0.638672 i=162
v=0.638672 i=163
v=0.632812 i=164
v=0.644531 i=165
v=0.609375 i=166
v=0.644531 i=167
v=0.656250 i=168
v=0.632812 i=169
v=0.638672 i=170
v=0.644531 i=171
v=0.714844 i=172
v=0.667969 i=173
v=0.638672 i=174
v=0.621094 i=175
v=0.637672 i=176
v=0.656250 i=177
v=0.644531 i=178
v=0.656250 i=179
v=0.632812 i=180
v=0.621094 i=181
v=0.673828 i=182
v=0.650391 i=183
v=0.650391 i=184
v=0.662109 i=185
v=0.650391 i=186
v=0.632816 i=187
v=0.638672 i=188

v=0.644531 i=189
v=0.621094 i=190
v=0.662109 i=191
v=0.644531 i=192
v=0.667939 i=193
v=0.626953 i=194
v=0.685547 i=195
v=0.597656 i=196
v=0.644531 i=197
v=0.603516 i=198
v=0.632812 i=199
v=0.656250 i=200
v=0.656250 i=201
v=0.632818 i=202
v=0.631064 i=203
v=0.597656 i=204
v=0.597656 i=205
v=0.644531 i=206
v=0.644531 i=207
v=0.609375 i=208
v=0.615234 i=209
v=0.656250 i=210
v=0.632812 i=211
v=0.615234 i=212
v=0.580078 i=213
v=0.615234 i=214
v=0.650391 i=215
v=0.632812 i=216
v=0.632815 i=217
v=0.609375 i=218
v=0.638672 i=219
v=0.638675 i=220
v=0.644531 i=221
v=0.626953 i=222
v=0.585938 i=223
v=0.615234 i=224
v=0.662109 i=225
v=0.629653 i=226
v=0.685547 i=227
v=0.621094 i=228
v=0.632812 i=229
v=0.609375 i=230
v=0.650391 i=231
v=0.662109 i=232
v=0.650391 i=233
v=0.638672 i=234
v=0.626953 i=234
v=0.626953 i=235
v=0.615234 i=236
v=0.632812 i=237
v=0.626953 i=238
v=0.662109 i=239
v=0.656250 i=240
v=0.650391 i=241
v=0.650391 i=242
v=0.591797 i=243
v=0.650391 i=244
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v=0.714844 i=639

RESULTS AND DISCUSSION cont.

Table 5.16 Frequency 15 MHz
Empirical Analysis done using C - programming.
To obtain the requisite D and θ values.

Zm = 50 Km fratio = 5.283613		Zm = 250 Km fratio = 5.281254	
D	Theta	D	Theta
5280.012695	87.784988	5280.0113	87.59954
2640.056396	85.218903	2640.002930	73.177994
1760.005127	78.089699	1760.030884	67.031998
1320.024902	75.839500	1320.06140	61.114996
1056.003540	73.163399	1056.025024	55.705994
880.039124	70.406097	880.95855	50.874983

Zm = 100 Km fratio = 5.283173		Zm = 300 Km fratio = 5.281755	
D	Theta	D	Theta
5280.000488	87.734917	5280.009277	87.471199
2640.05835	84.402702	2640.033203	71.366997
1760.005493	75.37300	1760.076294	64.393990
1320.070190	71.871384	1320.032593	57.915993
1056.04660	68.274002	1056.013184	52.162998
880.039124	70.406097	880.95855	50.874983

Zm = 150 Km fratio = 5.281936		Zm = 350 Km fratio = 5.283710	
D	Theta	D	Theta
5280.070801	87.679893	5280.020020	87.379295
2640.039062	76.688988	2640.07140	69.560497
1760.010254	72.547096	1760.016724	61.851997
1320.073120	68.100021	1320.040771	54.918995
1056.055908	63.755901	1056.023193	48.925995
880.014648	59.646099	880.059998	43.830002

Zm = 200 Km fratio = 1.670797	
D	Theta
5280.047852	87.813194
2640.048096	85.52000
1760.004272	82.972794
1320.000000	79.80000
1056.025879	75.334000
880.079285	46.967513

Zm	D	Theta
50	1056.003540	73.163399
100	1056.04660	68.274002
150	1056.055908	63.755901
200	1056.025879	75.334000
250	1056.025024	55.705994
300	1056.013184	52.162998
350	1056.023193	48.925995

Zm	D	Theta
50	880.039124	70.406097
100	880.040222	64.755997
150	880.014648	59.646099
200	880.079285	46.967513
250	880.095855	50.874983
300	880.005005	47.151997
350	880.059998	43.830002

Table 5.17 Data of recording 13th June 1995
Time of recording 9 a.m.
frequency : 15 MHz

0 0.210938	49 0.240234	98 0.685547
1 0.638672	50 0.152344	99 0.603516
2 0.708984	51 0.234375	100 0.134766
3 0.662109	52 0.210938	101 0.316406
4 0.210938	53 0.011719	102 0.269531
5 0.738281	54 0.140625	103 0.304688
6 0.052734	55 0.744141	104 0.181641
7 0.082031	56 0.304688	105 0.281250
8 0.117188	57 0.234375	106 0.398438
9 0.673828	58 0.011719	108 0.187500
10 0.035156	59 0.76172	109 0.158203
11 0.087891	60 0.123047	110 0.099609
12 0.533203	61 0.041016	111 0.181641
13 0.123047	62 0.134766	112 0.222656
14 0.035156	63 0.251953	113 0.228516
15 0.585938	64 0.257812	114 0.105469
16 0.632812	65 0.023428	115 0.152344
17 0.205078	66 0.093750	116 0.117188
18 0.046875	67 0.398438	117 0.263672
19 0.281250	68 0.345703	118 0.656250
20 0.000000	69 0.773438	119 0.164062
21 0.251953	70 0.234375	120 0.123047
22 0.562500	71 0.146484	121 0.210938
23 0.011719	72 0.111328	122 0.357422
24 0.076175	73 0.134766	123 0.275391
25 0.322266	74 0.205078	123 0.275391
26 0.099609	75 0.140625	124 0.234375
27 0.000000	76 0.093750	125 0.199219
28 0.152344	77 0.117188	126 0.146484
29 0.328125	78 0.292969	127 0.181641
30 0.000000	79 0.234375	128 0.275391
31 0.070312	80 0.087891	129 0.187500
32 0.082031	81 0.708984	130 0.181641
33 0.105469	82 0.585938	131 0.199219
34 0.105469	83 0.310547	132 0.181641
35 0.708984	84 0.732422	133 0.152344
36 0.175781	85 0.093750	134 0.257812
37 0.023438	86 0.240234	135 0.304688
38 0.222656	87 0.152344	136 0.234375
39 0.046875	88 0.228516	137 0.228516
40 0.187500	89 0.164062	138 0.175781
41 0.128906	90 0.041016	139 0.222656
42 0.070312	91 0.041016	140 0.175781
43 0.257812	92 0.216797	141 0.298828
44 0.257812	93 0.158203	142 0.199219
45 0.005859	94 0.210938	143 0.093750
46 0.720703	95 0.292969	144 0.228516
47 0.281250	96 0.070312	145 0.392578
48 0.181641	97 0.058594	146 0.328125

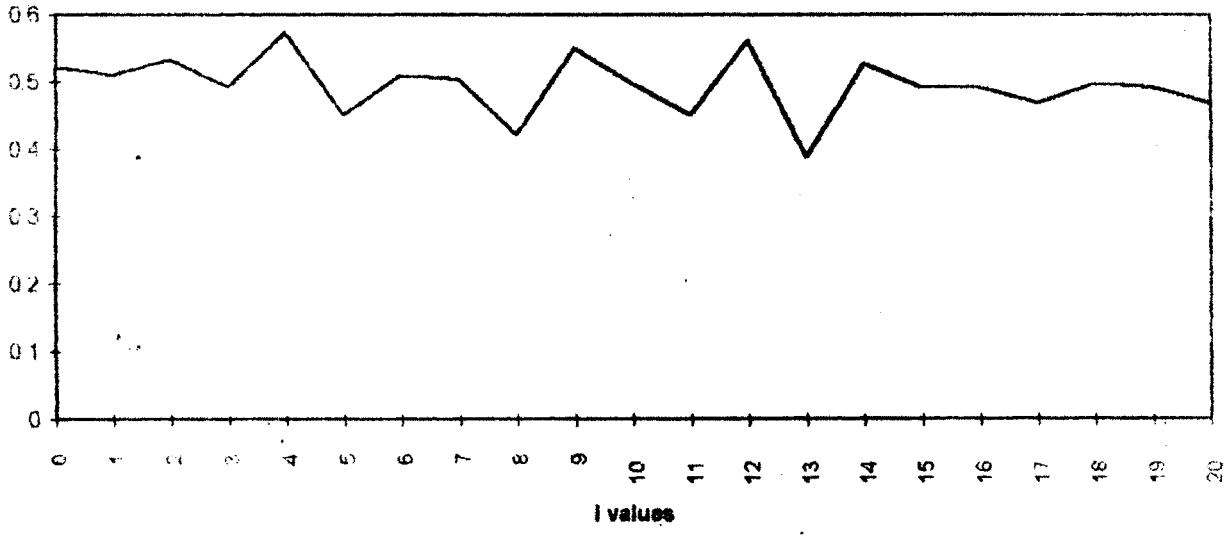
147 0.187500	196 0.281250	246 0.304688
148 0.240234	197 0.222656	247 0.287109
149 0.257812	198 0.603516	248 0.333984
150 0.199219	199 0.251953	249 0.222656
151 0.164062	200 0.152344	250 0.251953
152 0.234375	201 0.263672	251 0.392578
153 0.246094	202 0.205078	252 0.158203
154 0.275391	203 0.099609	253 0.281250
155 0.375000	204 0.164062	254 0.111328
156 0.205078	205 0.298828	255 0.251953
157 0.257812	206 0.310547	256 0.216797
158 0.281250	207 0.187500	257 0.093750
159 0.298828	208 0.246094	258 0.363281
160 0.011719	209 0.275391	259 0.251953
161 0.351562	210 0.263672	260 0.251953
162 0.246094	211 0.187500	261 0.357422
163 0.187500	212 0.275391	262 0.228516
164 0.187500	213 0.187500	263 0.462891
165 0.181641	214 0.257812	264 0.304688
166 0.134766	215 0.152344	265 0.298828
167 0.304688	216 0.281250	266 0.322266
168 0.205078	217 0.345703	267 0.134766
169 0.292969	218 0.292969	268 0.169922
170 0.304688	219 0.123047	269 0.111328
171 0.392578	220 0.292969	270 0.316406
172 0.017578	221 0.357422	271 0.304688
173 0.269531	222 0.152344	272 0.093750
174 0.269531	223 0.146484	273 0.240234
175 0.070312	224 0.292969	274 0.345703
176 0.216797	225 0.439453	275 0.322266
177 0.246094	226 0.292969	276 0.210938
178 0.281250	227 0.257812	277 0.193359
179 0.193359	228 0.398438	278 0.369141
180 0.199219	229 0.328125	279 0.246094
181 0.134766	231 0.234375	280 0.445312
182 0.210938	232 0.210938	281 0.445312
183 0.369141	233 0.164062	283 0.058594
184 0.251953	234 0.246094	284 0.304688
185 0.263672	235 0.222656	285 0.228516
186 0.339844	236 0.351562	286 0.093750
187 0.322266	237 0.281250	287 0.263672
188 0.199219	238 0.345703	288 0.263672
189 0.263672	239 0.328125	289 0.257812
190 0.228516	240 0.169922	290 0.164062
191 0.181641	241 0.345703	291 0.298828
192 0.240234	242 0.240234	292 0.257812
193 0.199219	243 0.257812	293 0.304688
194 0.275391	244 0.187500	294 0.333984
195 0.187500	245 0.216797	295 0.281250

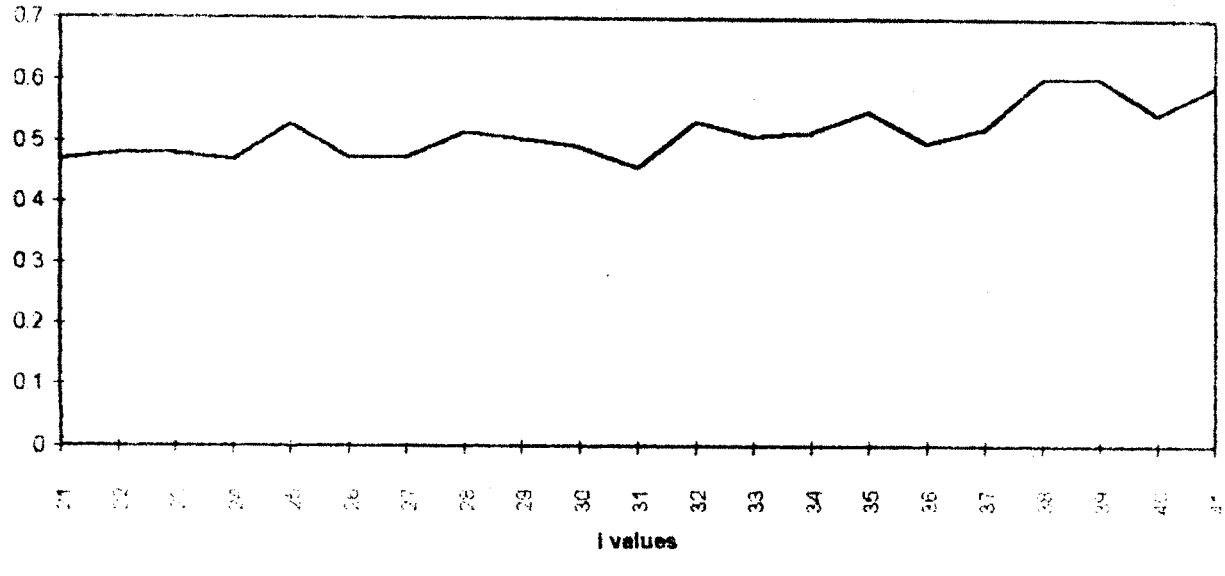
296 0.339844	345 0.169922	395 0.199219
297 0.275391	346 0.263672	396 0.269531
298 0.251953	347 0.193359	397 0.427734
299 0.000000	348 0.375000	398 0.304688
300 0.416016	349 0.375000	399 0.363281
301 0.375000	350 0.251953	400 0.234375
302 0.251953	351 0.216797	401 0.380859
303 0.351562	352 0.322266	402 0.287109
304 0.234375	353 0.205078	403 0.134766
305 0.304688	354 0.316406	404 0.363281
306 0.175781	355 0.357422	405 0.152344
307 0.175781	356 0.357422	406 0.369141
308 0.263672	357 0.339844	407 0.351562
309 0.281250	358 0.386719	408 0.287109
310 0.181641	359 0.322266	409 0.175781
311 0.304688	361 0.298828	410 0.310547
312 0.257812	362 0.234375	411 0.292969
313 0.240234	363 0.269531	412 0.404297
314 0.281250	364 0.146484	413 0.37[illegible]
315 0.339844	365 0.398438	414 0.427734
316 0.298828	366 0.123047	415 0.210938
317 0.351562	367 0.333984	416 0.357466
318 0.339844	368 0.228516	417 0.398438
319 0.146484	369 0.421875	418 0.328125
320 0.193359	370 0.169922	419 0.363281
321 0.474609	371 0.392578	420 0.363281
322 0.029297	372 0.328125	421 0.380859
323 0.240234	373 0.193359	422 0.369141
324 0.140625	374 0.187500	423 0.287109
325 0.275391	375 0.234375	424 0.328125
326 0.199819	376 0.392578	425 0.328125
327 0.345703	377 0.275391	426 0.427734
328 0.187500	378 0.339844	427 0.263672
329 0.339844	379 0.369141	428 0.433594
330 0.164062	380 0.287109	429 0.216797
331 0.351562	381 0.585938	430 0.392578
332 0.251953	382 0.181641	431 0.322266
333 0.310547	383 0.404297	432 0.369141
334 0.128906	384 0.246094	433 0.398438
335 0.216797	385 0.292969	434 0.187500
336 0.287109	386 0.750000	435 0.275391
337 0.205078	387 0.205078	436 0.263672
338 0.339844	388 0.246094	437 0.275391
339 0.281250	389 0.386719	438 0.322266
340 0.210938	390 0.410156	439 0.222656
341 0.263672	391 0.281250	440 0.398438
342 0.404297	392 0.345703	441 0.439453
343 0.404297	393 0.262669	442 0.257812
344 0.310547	394 0.199219	443 0.292969

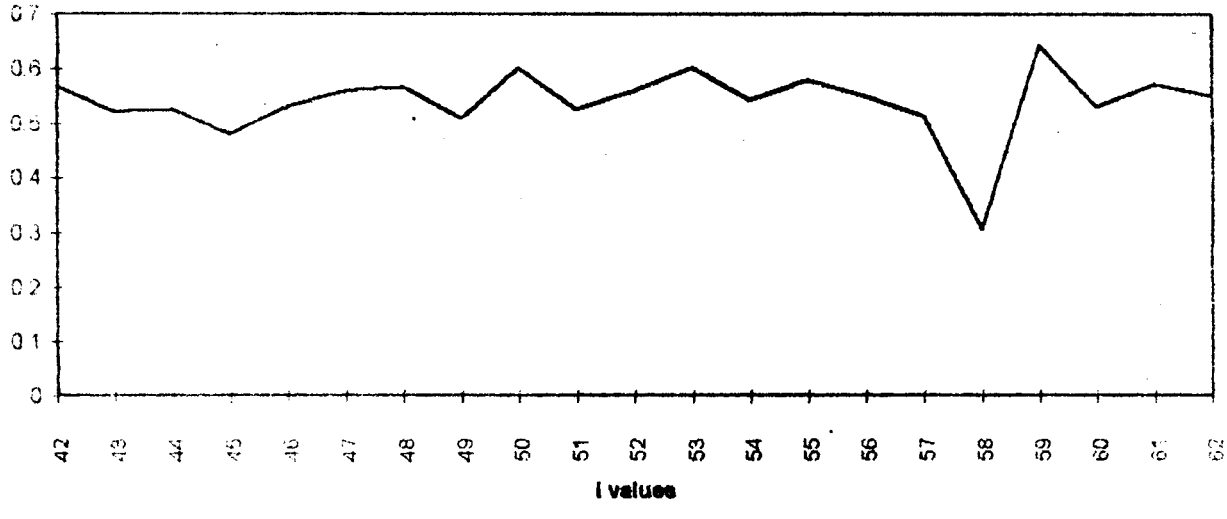
444 0.269531 493 0.308859541 0.363281
445 0.304688 494 0.325125 542 0.351562
446 0.445312 495 0.339844 543 0.380859
447 0.339844 496 0.339844 544 0.246094
448 0.410156 497 0.316406 545 0.416016
449 0.398828 498 0.398438 546 0.304688
450 0.439453 499 0.281250 547 0.257812
451 0.322266 500 0.328125 548 0.298828
452 0.468750 501 0.451172 549 0.433594
453 0.304688 502 0.310547 550 0.187500
454 0.281250 503 0.375000 551 0.445312
455 0.345705 504 0.416016 552 0.246094
456 0.228516 505 0.227816 553 0.433594
457 0.269531 506 0.304688 554 0.416016
458 0.322266 507 0.328125 555 0.322266
459 0.322266 508 0.451172 556 0.380859
460 0.322266 509 0.363281 557 0.714844
461 0.287109 510 0.457031 558 0.128906
462 0.238125 511 0.404297 559 0.333984
463 0.333984 512 0.357422 560 0.369141
464 0.345703 513 0.164062 561 0.222656
465 0.310547 514 0.316406 562 0.416016
466 0.275391 515 0.269531 563 0.416016
467 0.269531 516 0.363281 564 0.298828
468 0.357422 517 0.234375 565 0.199219
469 0.33398 518 0.369141 566 0.445312
470 0.404297 519 0.257812 567 0.339844
471 0.287109 520 0.064453 568 0.398438
472 0.325125 521 0.457031 569 0.304688
473 0.128906 522 0.673828 570 0.451172
474 0.281250 523 0.404297 571 0.304688
475 0.480469 524 0.386719 572 0.375000
476 0.392578 524 0.386719 573 0.275391
477 0.328125 525 0.421875 574 0.328125
478 0.345705 526 0.527344 575 0.386195
479 0.556641 527 0.339844 576 0.281250
480 0.369141 528 0.462891 577 0.462891
481 0.369140 529 0.363281 578 0.369141
482 0.457031 530 0.468750 579 0.568359
483 0.410156 531 0.521484 580 0.451172
484 0.275391 532 0.310547 581 0.357422
485 0.310547 533 0.351562 882 0.199219
486 0.257812 534 0.222656 583 0.257812
487 0.269531 535 0.292969 584 0.380859
488 0.304688 536 0.433594 585 0.325125
489 0.369140 537 0.310547 586 0.562500
490 0.357422 538 0.287109 587 0.656250
491 0.287109 539 0.287109 588 0.410516
492 0.878906 540 0.339844 589 0.316406

590 0.375000
591 0.310547
592 0.375000
593 0.310547
594 0.351562
595 0.298828
596 0.445312
597 0.380859
598 0.398438
599 0.392578
600 0.251953
601 0.251953
602 0.369141
603 0.363281
604 0.421875
605 0.457031
606 0.339844
607 0.533203
608 0.433594
609 0.421875
610 0.468750
611 0.486328
612 0.380859
613 0.427734
614 0.351562
615 0.474609
616 0.269531
617 0.416016
618 0.304688
619 0.304688
620 0.451172
621 0.328125
622 0.281250
623 0.585938
624 0.287109
625 0.287109
626 0.515625
627 0.339844
628 0.257812
629 0.351562
630 0.146484
631 0.210938
632 0.123047
633 0.386719
634 0.275391
635 0.550781
636 0.445312
637 0.398438
638 0.287109

: Computer output graph showing response of Ten successively taken
nals on Datte 24.7.95 Transmitting station : 10 MHz Time of Recording :2.30 p.m.



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0.5
0.4
0.3
0.2
0.1
0
42
43
44
45
46
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48
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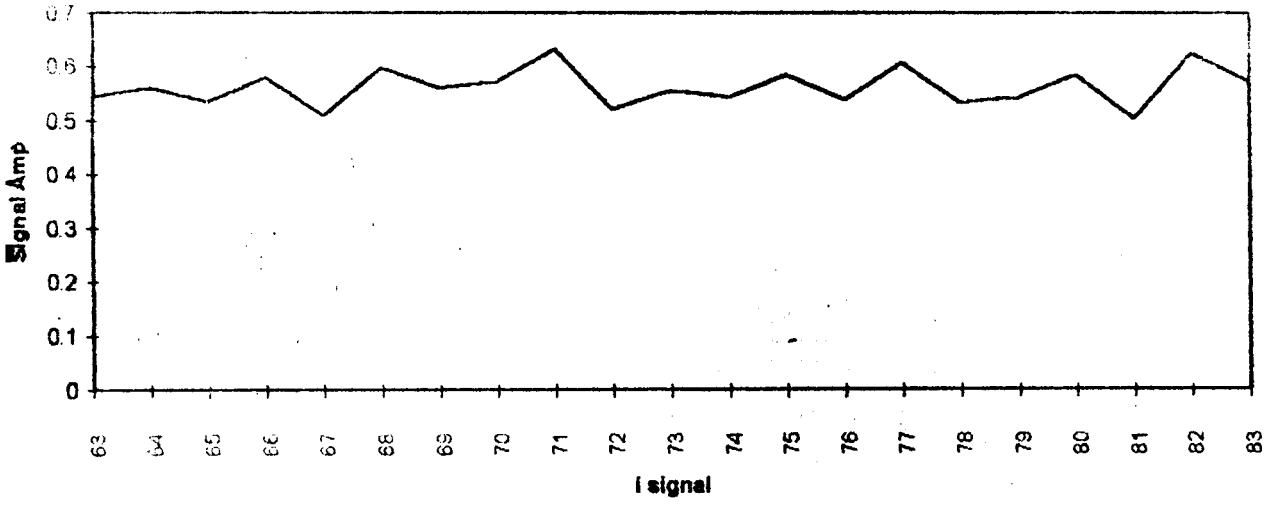
50
51
52
53
54
55
56
57
58
59
60
61
62
I values


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Signal Amp
63
64
65
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67
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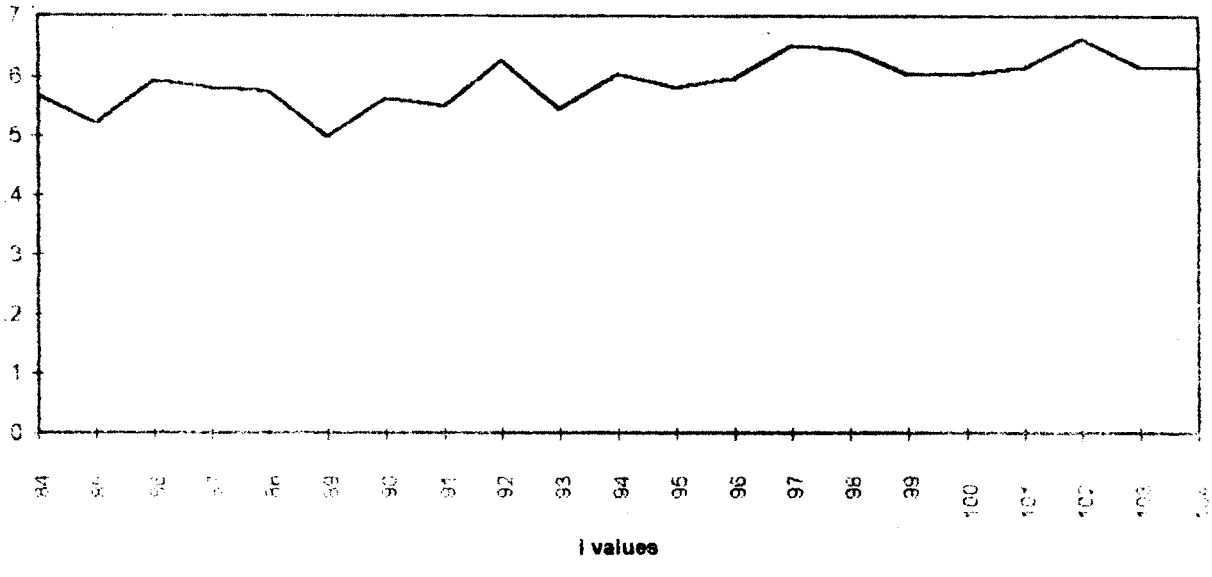
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
I signal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1
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94
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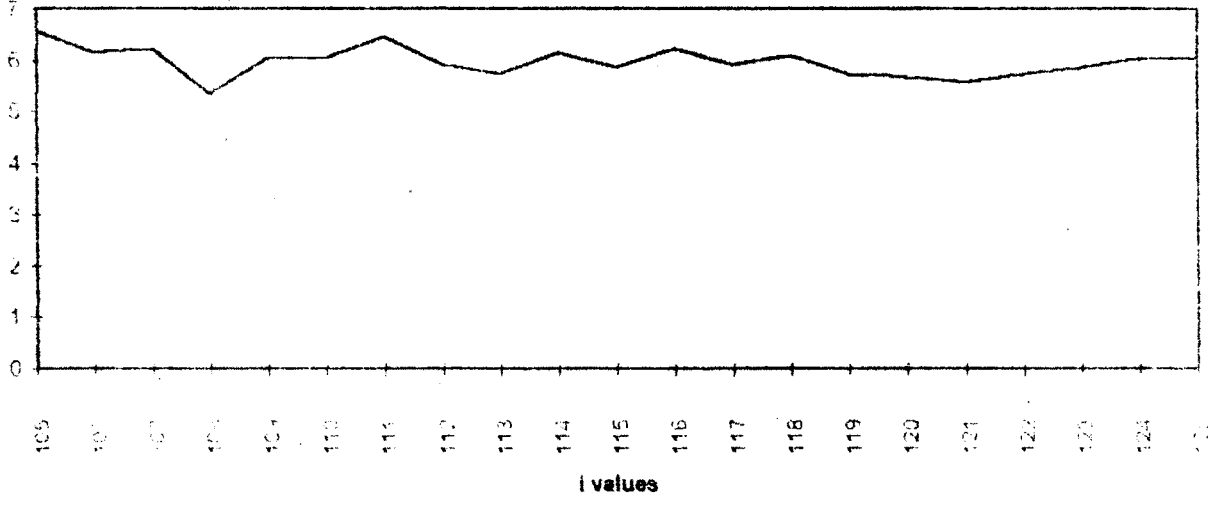
96
97
98
99
100
i values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6
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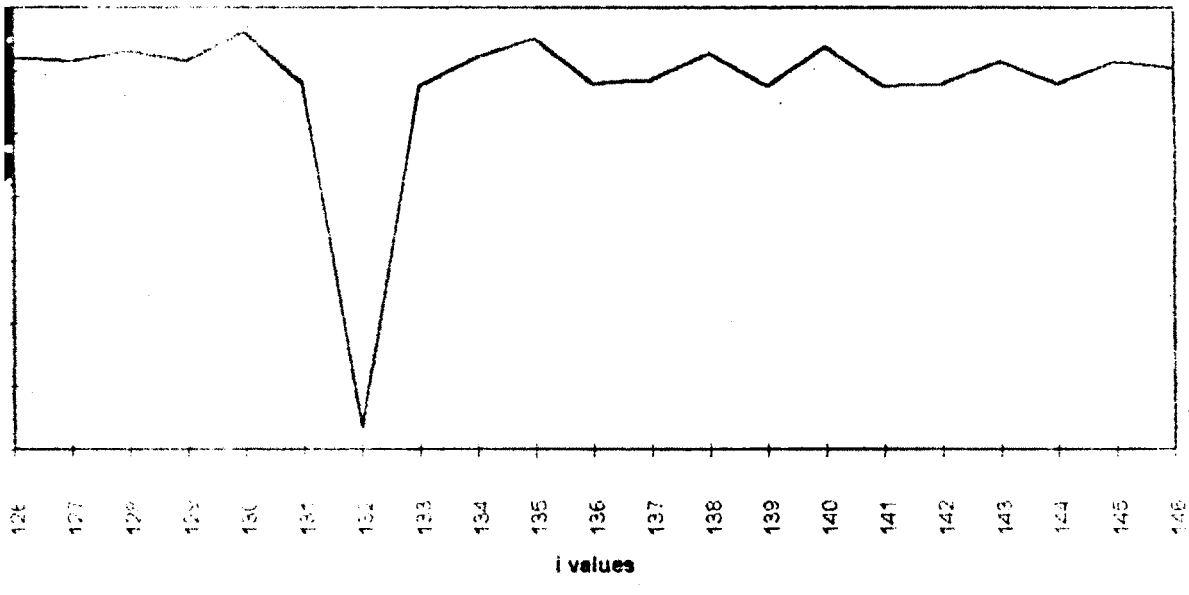
3
2
1
0
115
116
117
118
119
120
121
i values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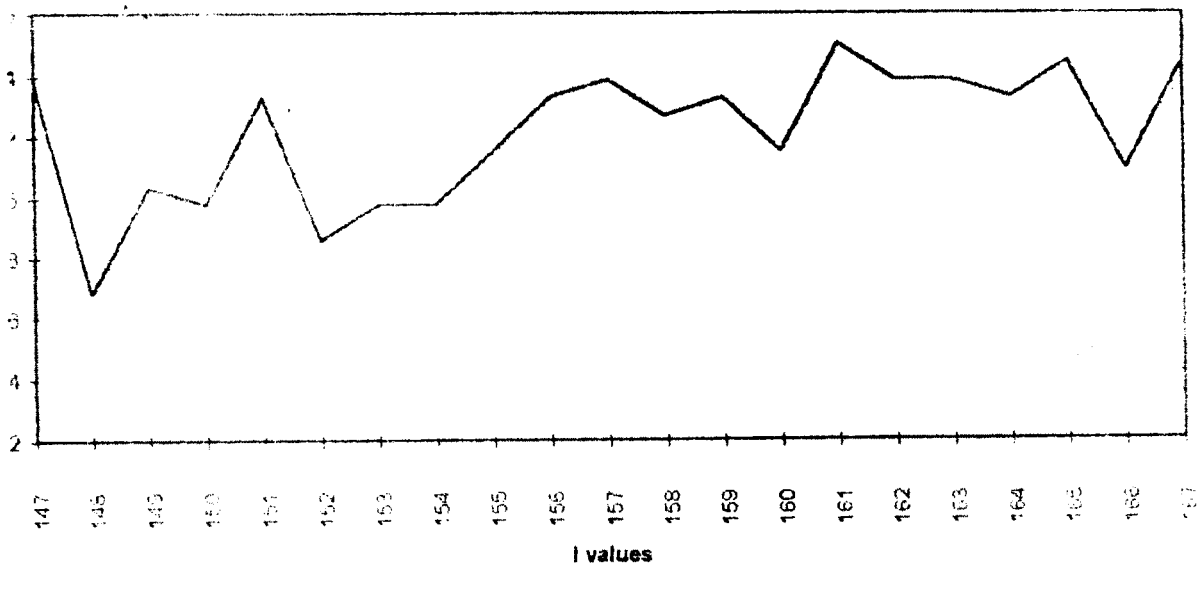
144
145
i values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159
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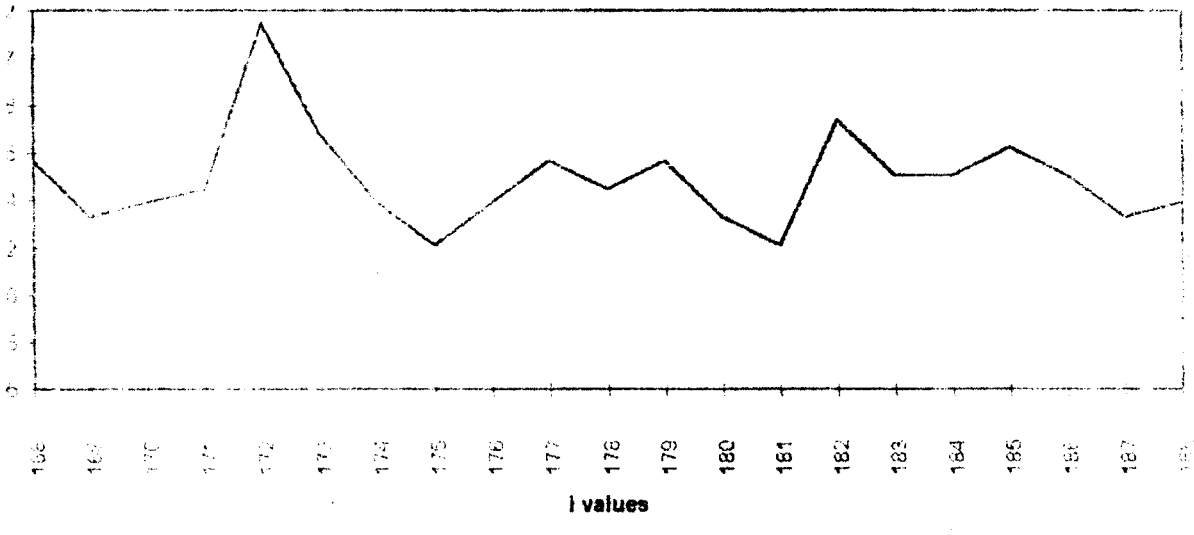
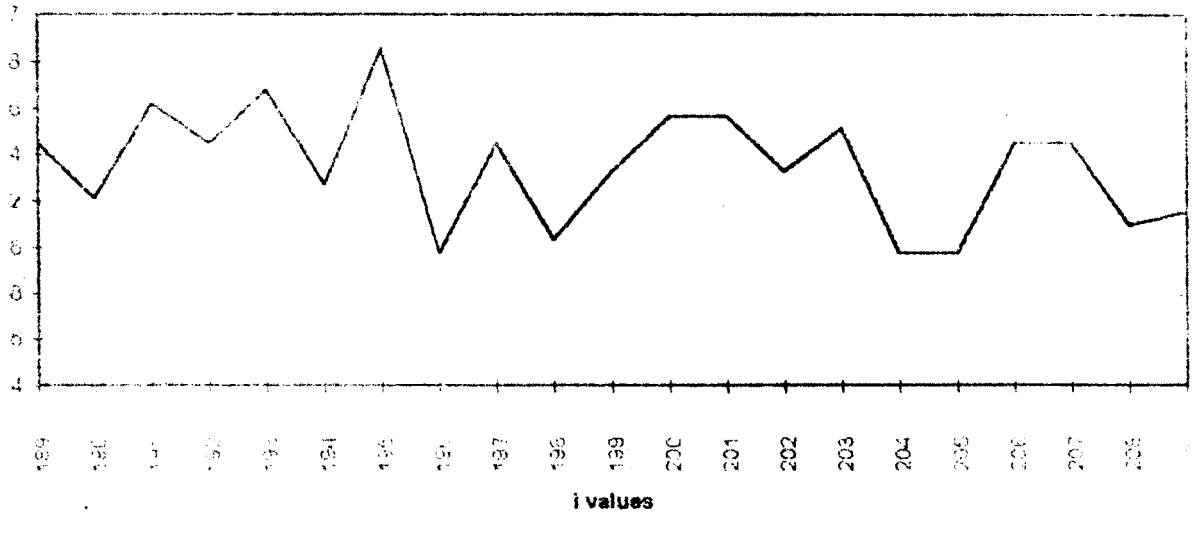
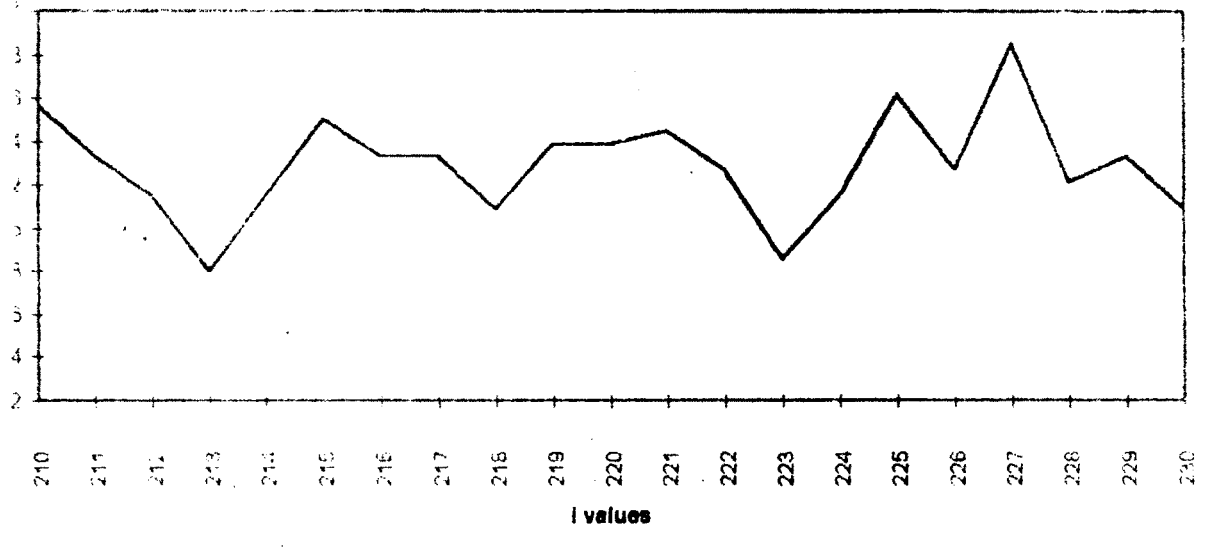
161
162
163
164
i values


i values


i values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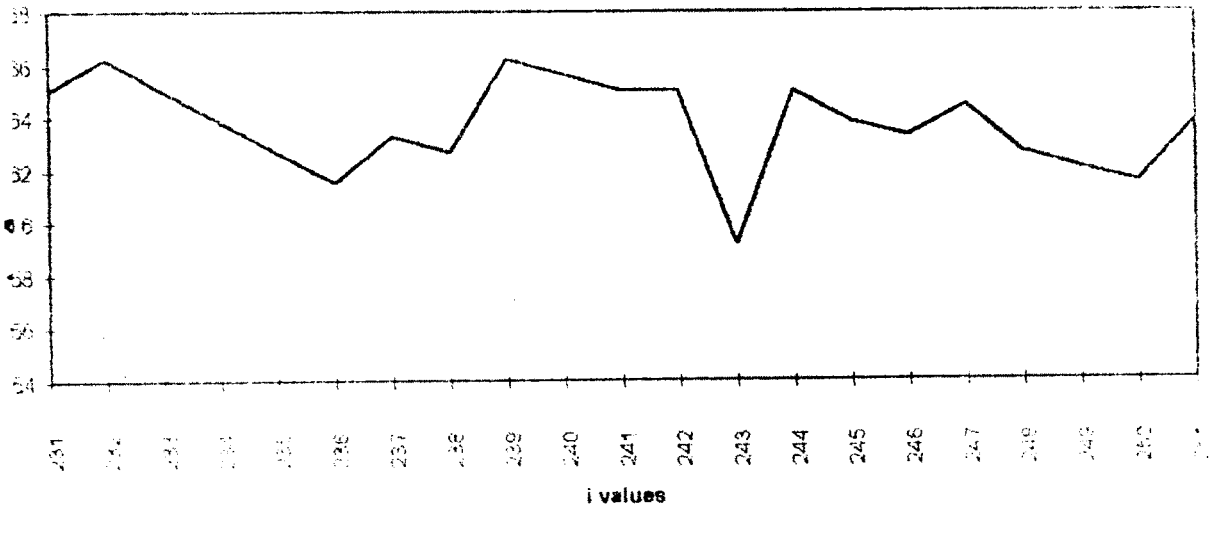
229
i values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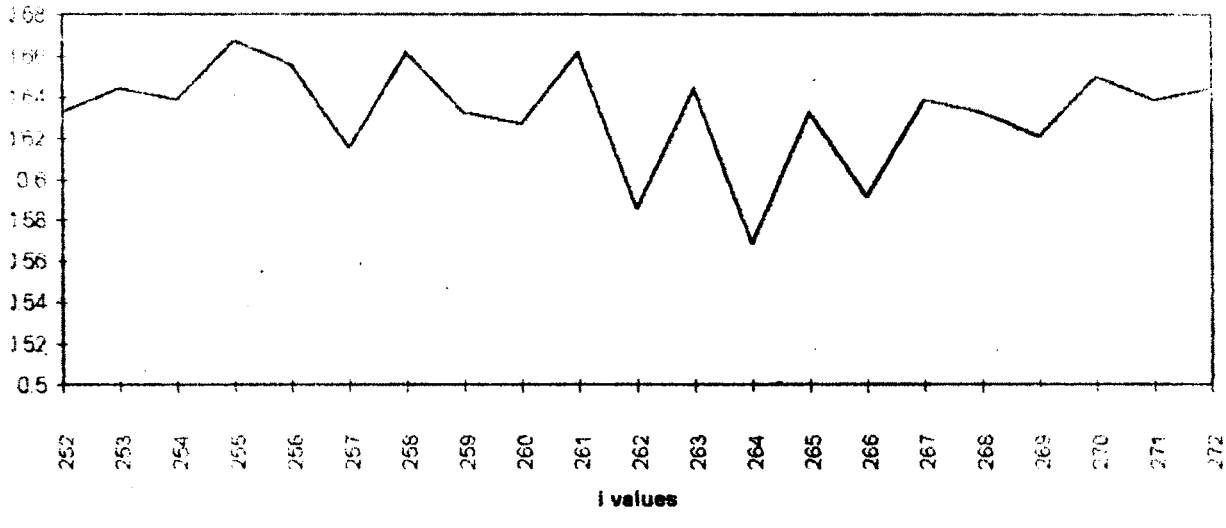
i values


0.5
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260
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264
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266
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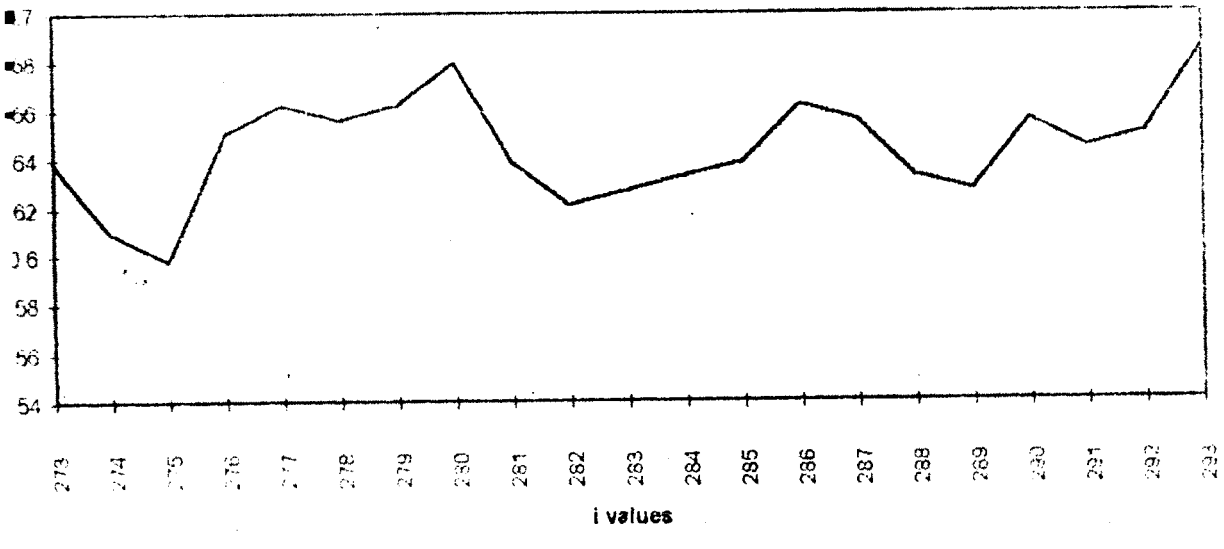
270
271
272
i values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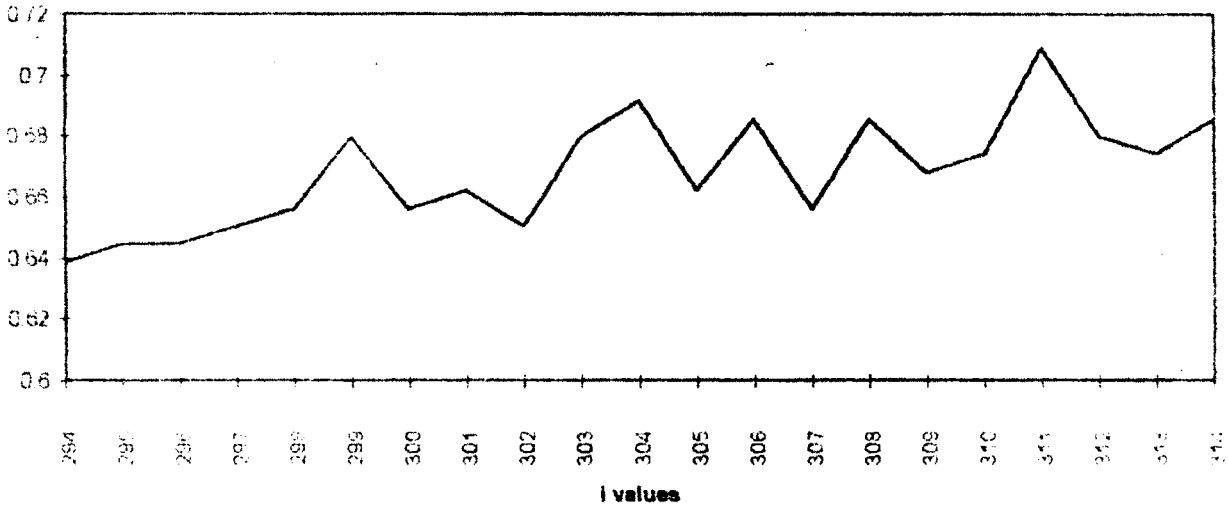
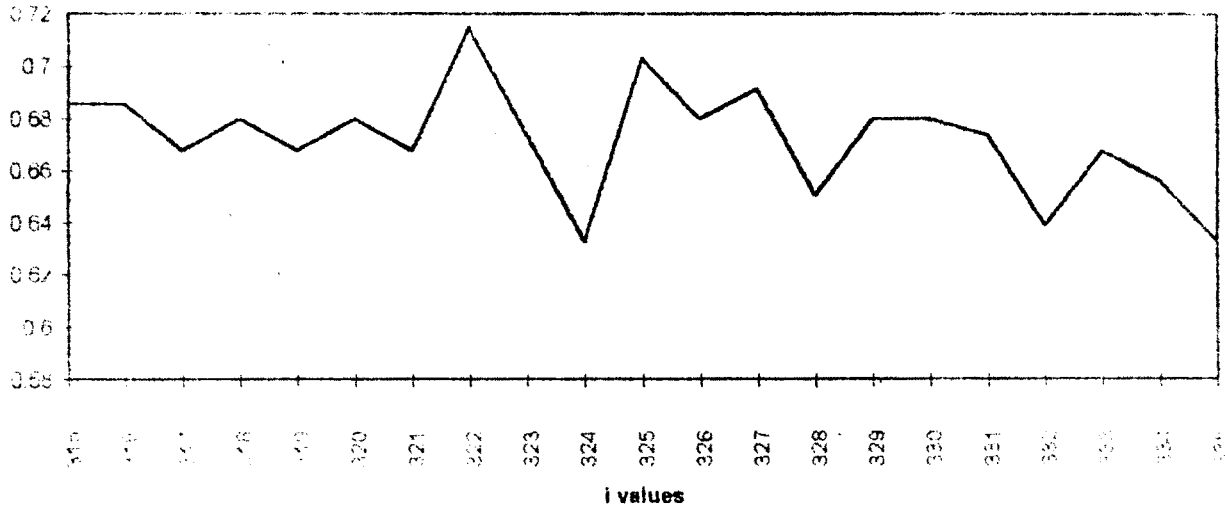
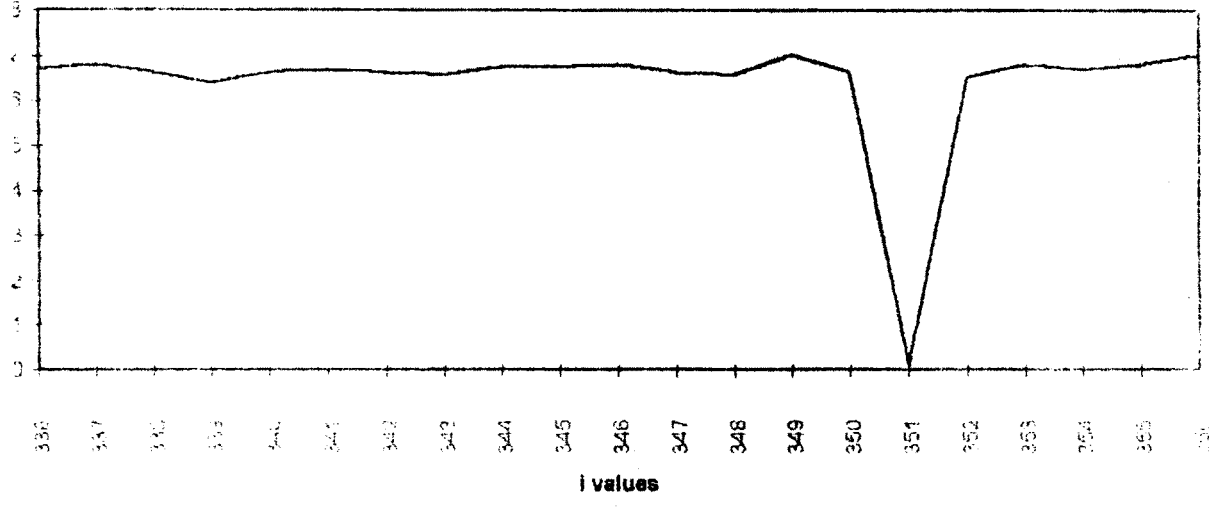
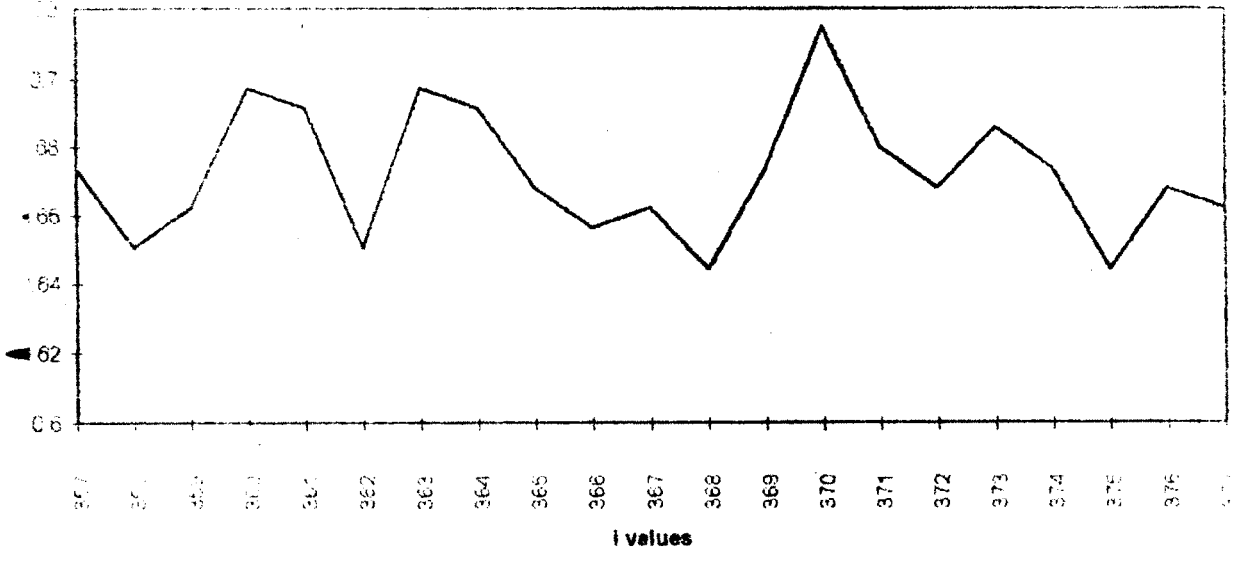
293
i values


0.72
0.7
0.68
0.66
0.64
0.62
0.6
i values


0.72
0.7
0.68
0.66
0.64
0.62
0.6
i values


348
349
350
351
i values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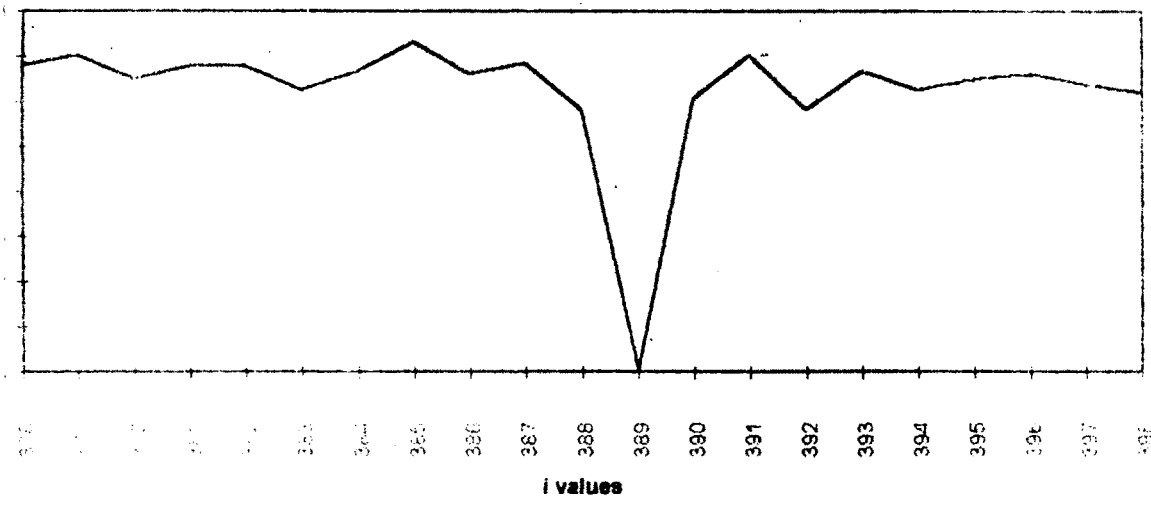
368
369
370
371
372
373
374
i values


387
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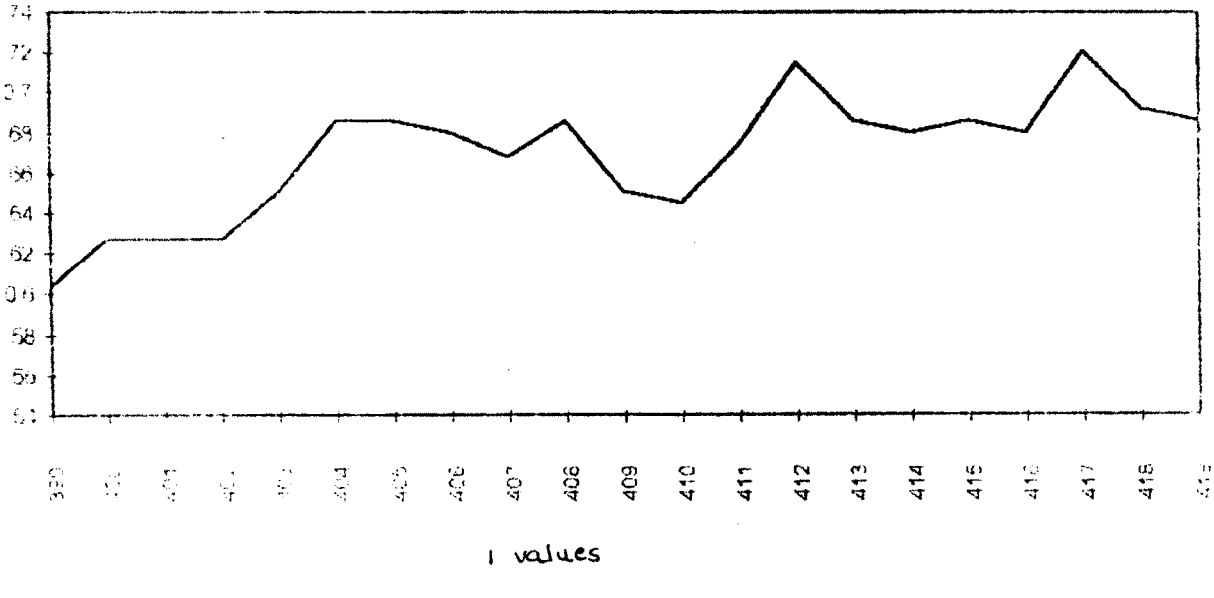
391
392
393
394
395
i values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62
58
406
409
410
411
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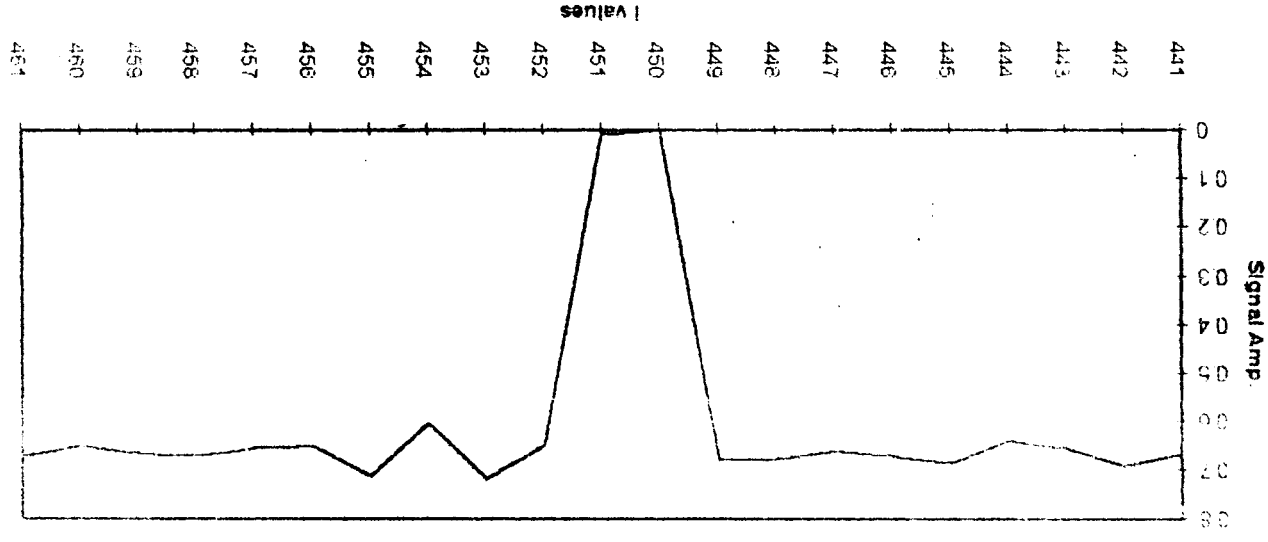
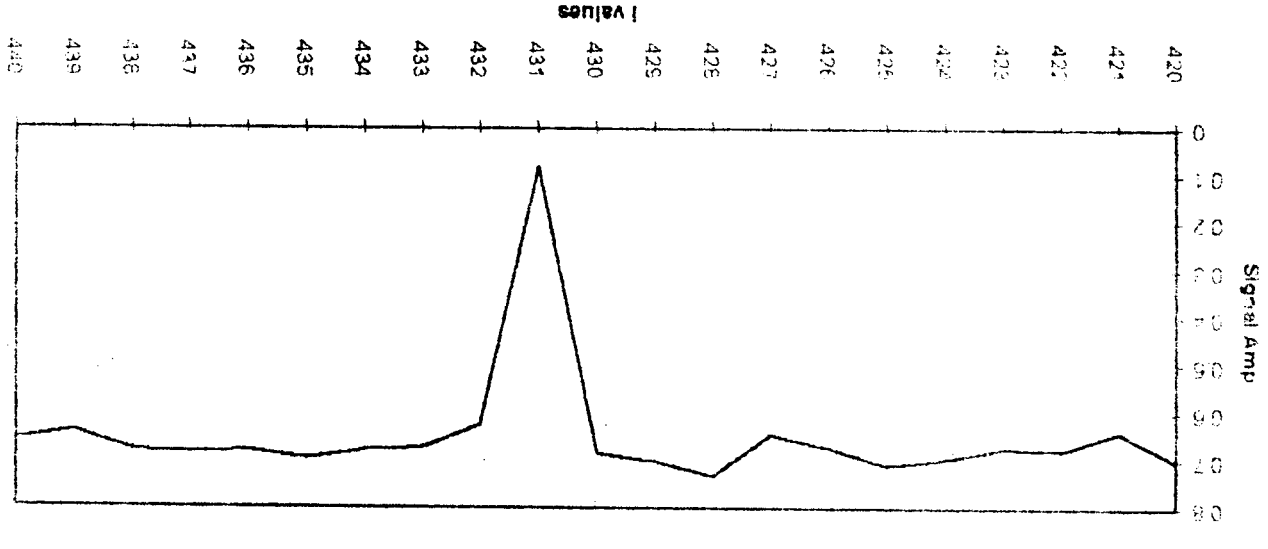
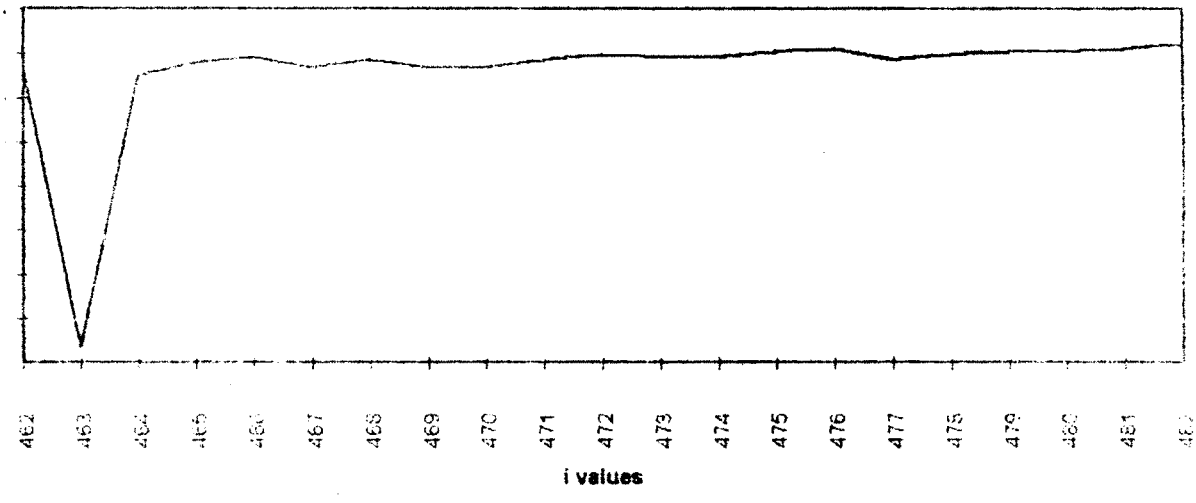
413
414
415
417
i values


Signal Amp
I values


Signal Amp
I values


462
463
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466
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468
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475
476
477
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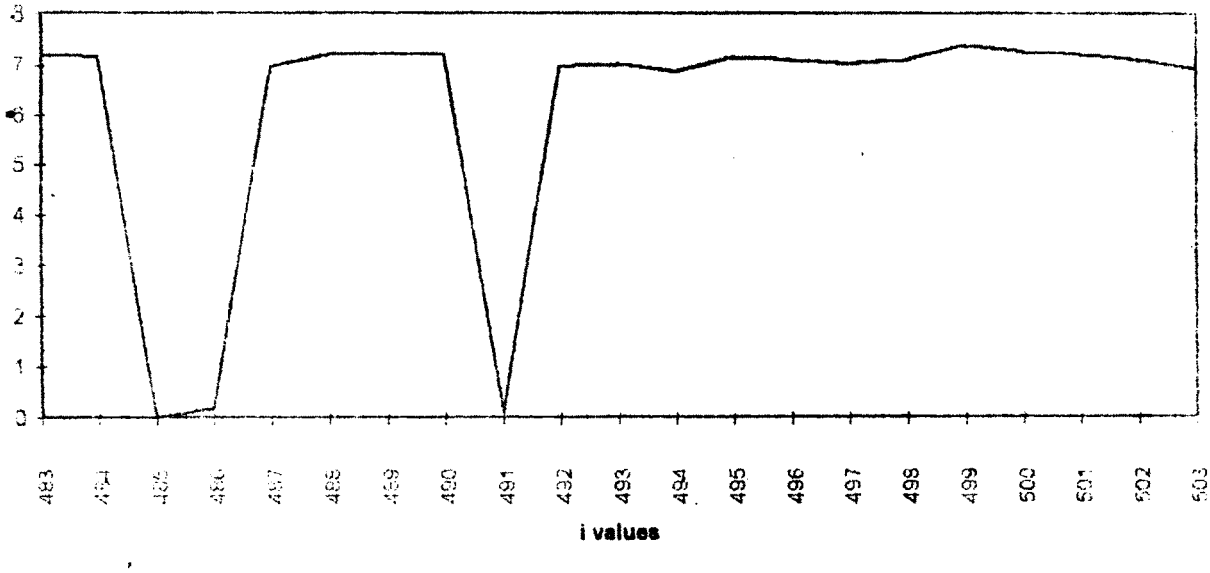
479
480
481
482
i values


0
1
2
3
4
5
6
7
8
483
484
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493
494
495
496
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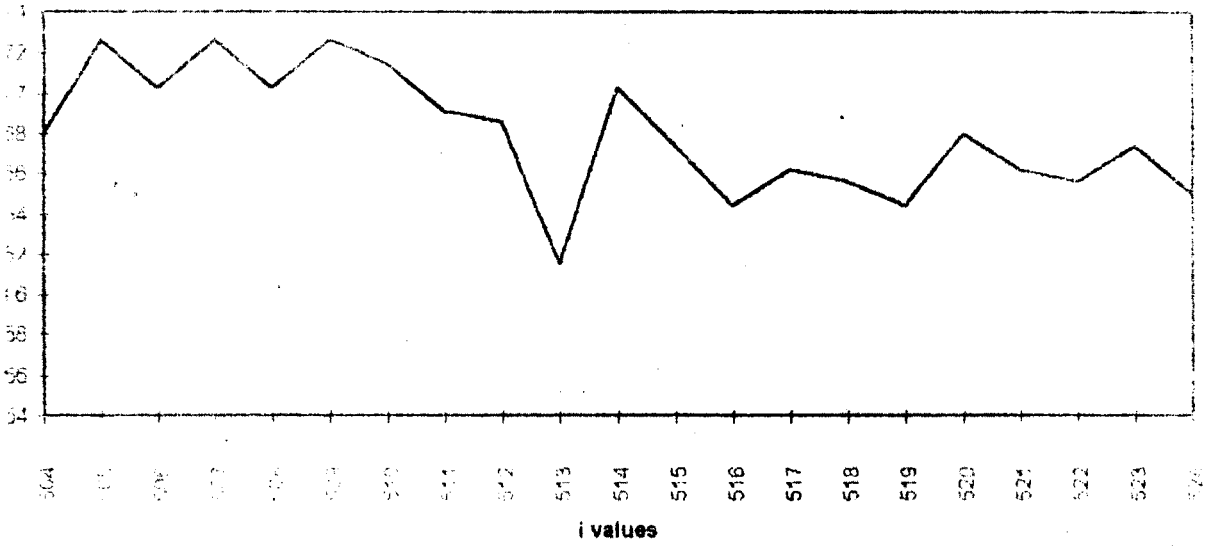
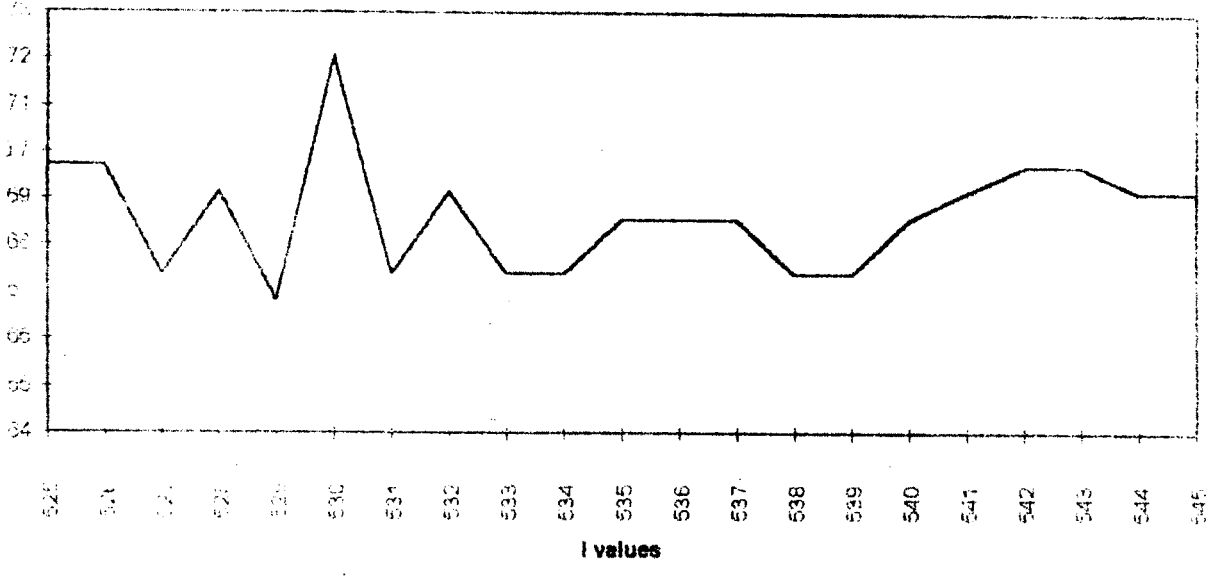
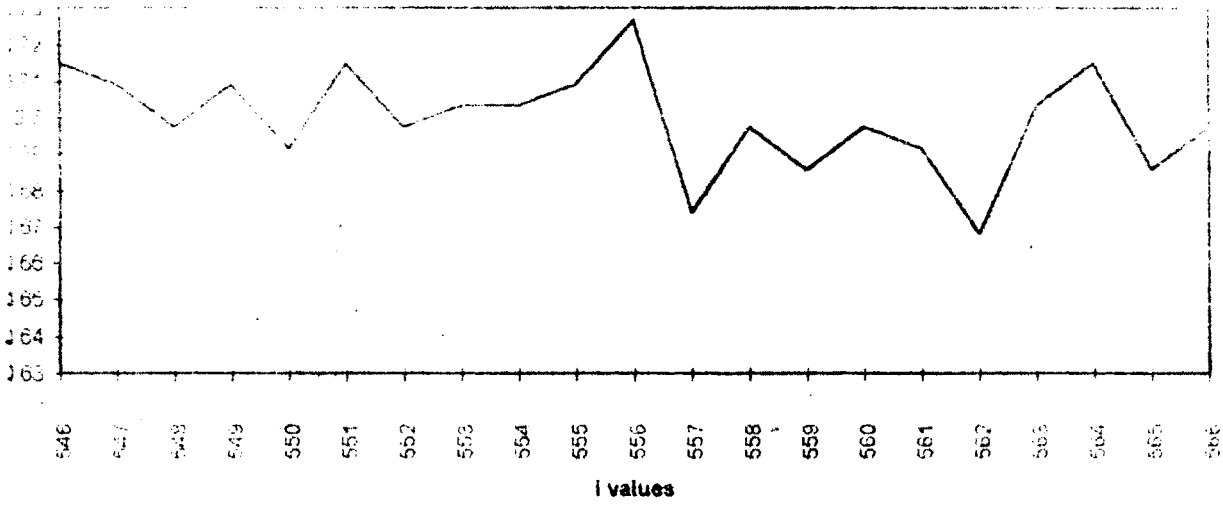
498
499
500
501
502
503
i values


i values


I values


546
550
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552
553
554
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556
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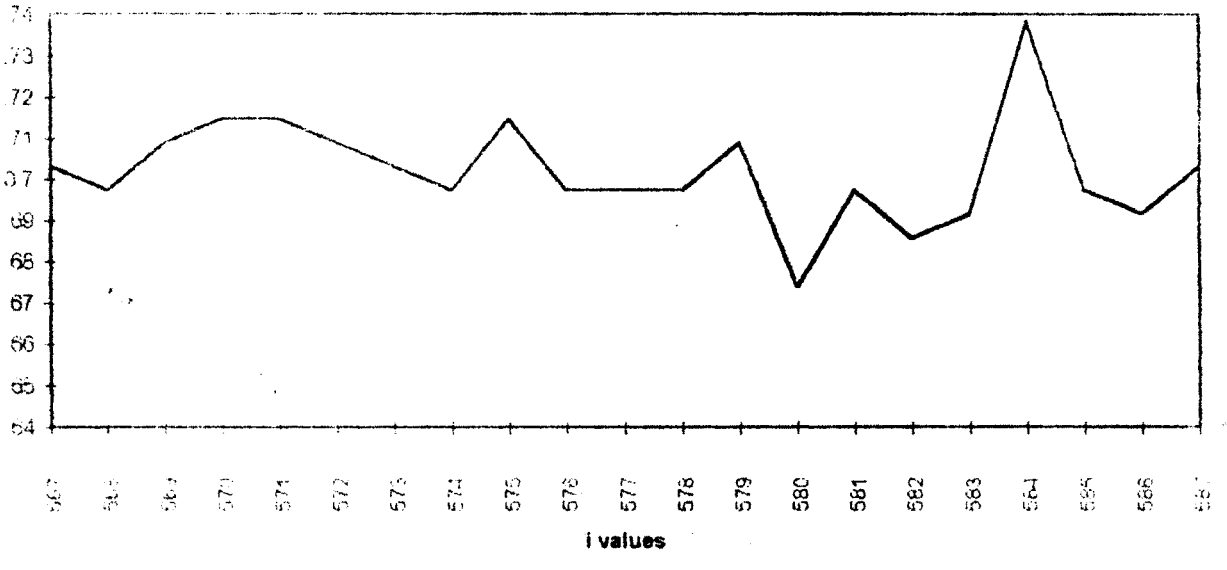
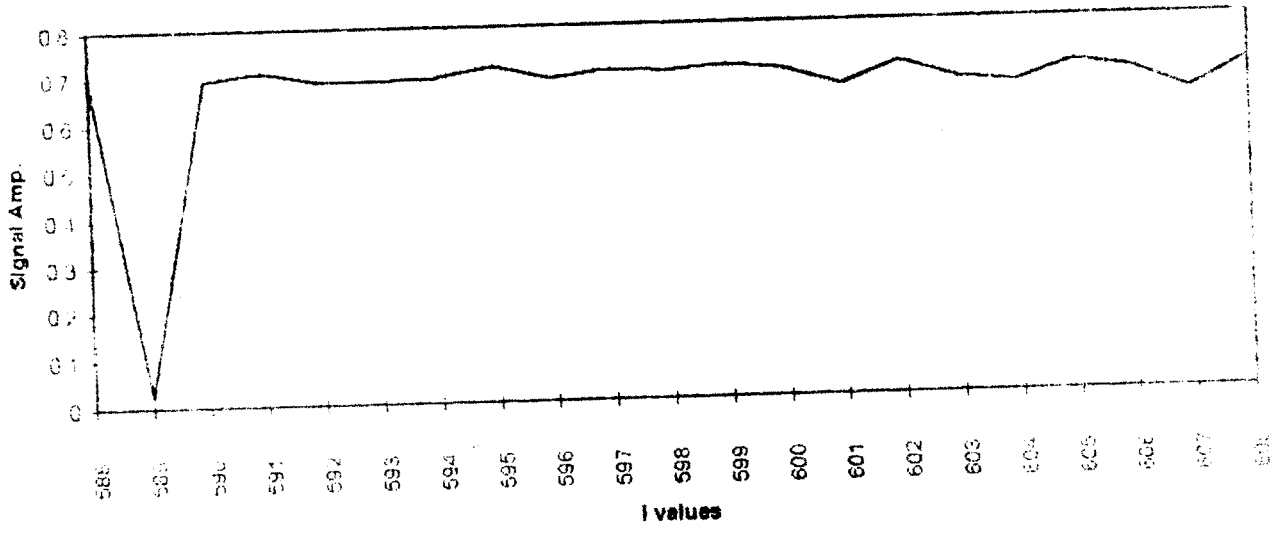
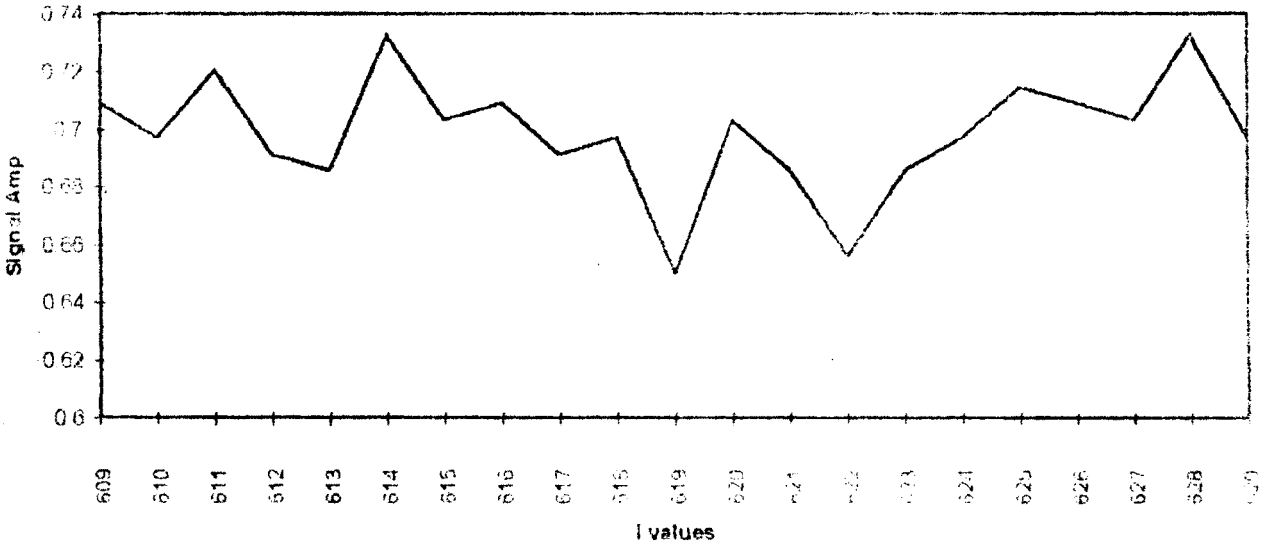
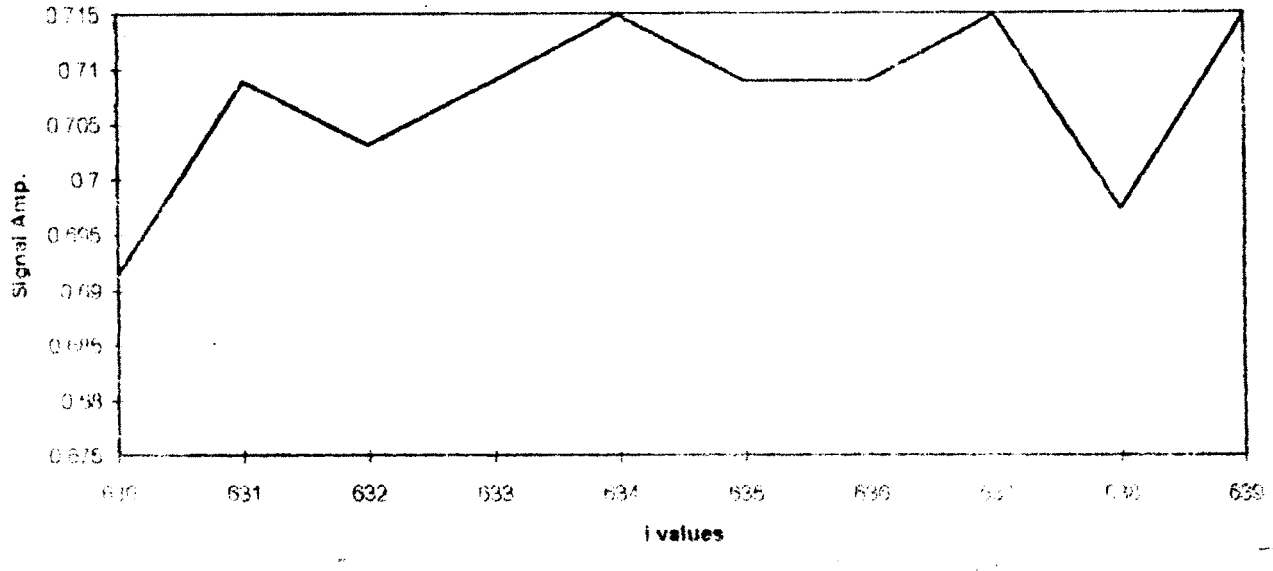
559
560
561
562
i values


i values


Signal Amp.
i values


Signal Amp
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
609
610
611
612
613
614
615
616
617
618
619
620
621
622
626
627
628
i values


Signal Amp.
0.715
0.71
0.705
0.7
631
632
633
634
635
636
639
i values

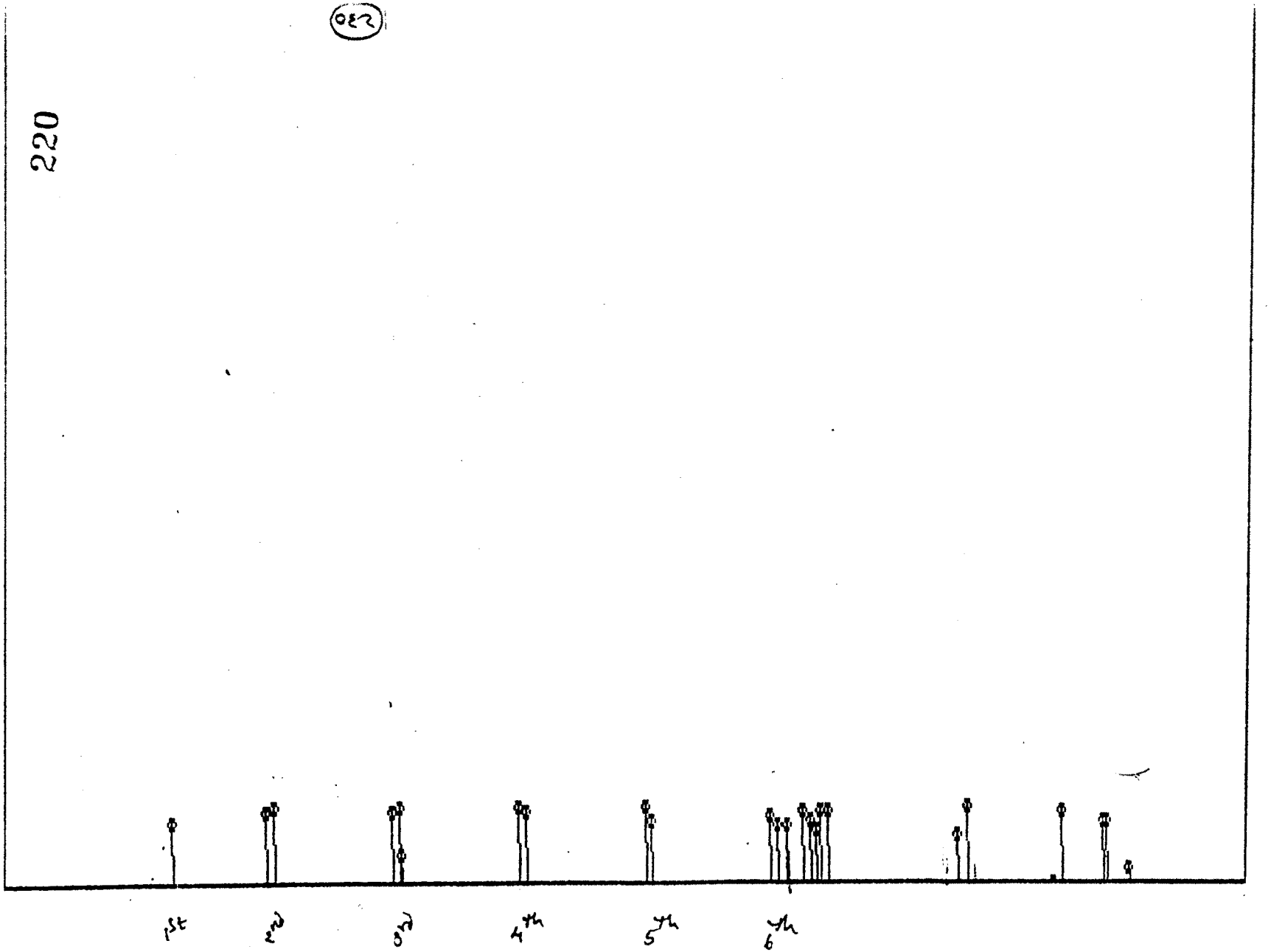


Fig.5.2 : showing computer graph of all 6 signals recorded on 21.11.1995 time of recording : 2.30 pm. Transmitting Station : B.B.C.

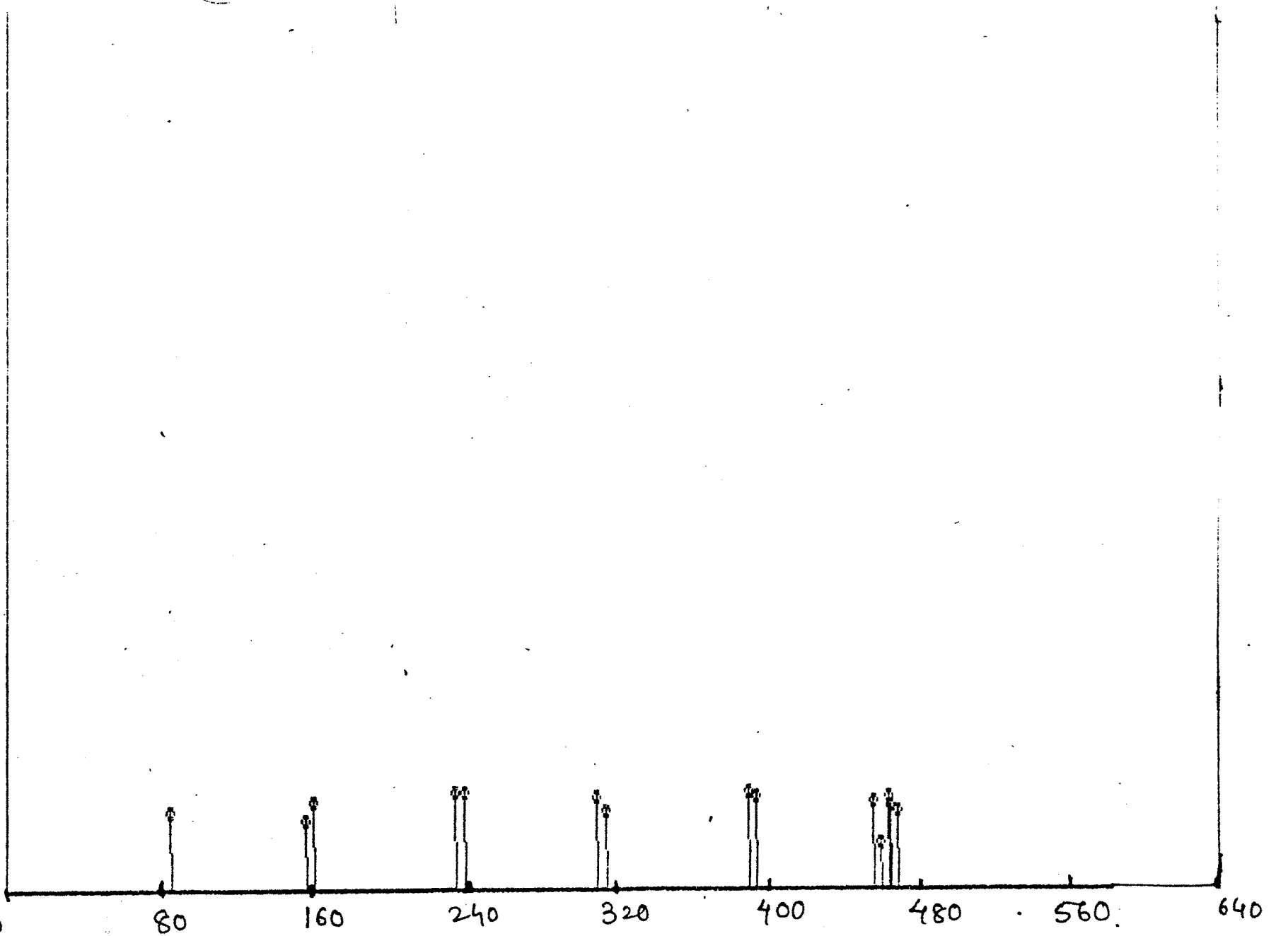


Fig.5.3 : showing computer graph of all 6-signals recorded on date 2.11.95 time of recording : 7 a.m. Transmitting

Fig 5.4

C - program to calculate transmission distance

```
#include<stdio.h>
#include<math.h>
#include<conio.h>
#include<stdlib.h>
void plot(float,int);
main()
{
int gdriver = DETECT,gmode;
double nm,fact,num,den,y,y1,theta1,sine,cosine,tangent;
int zm,ho,N;
float  fratio,x,D,theta,theta1;
float  f,fc,hm;
initgraph(&gdriver,&gmode,"c:\\turbo\\bgi");
for(theta=79.8868;theta<=79.8879;theta=theta+0.0001)
{
theta1=theta*3.14159/180.00;
zm=200;
ho=100.0;
hm=ho+zm;
nm=1.0;
fc=sqrt(80.6*nm); /*nm=9.999e10 */
f=15;
fratio=f/fc; /*f=15MHz is a constant */
/*for(fratio=1.14575;fratio<=3.5238322;fratio=fratio+1.14575)*/
theta1=acos(1.0/fratio);
theta1=theta1*180.0/3.14159;
/*printf("theta1=%f fratio=%f",theta1,fratio)  */
/*plot(5.0*(float)theta1,199-195);*/
x=zm*fratio*sin(theta1);
fact=fratio*cos(theta1);
num=1.0+fact;
den=fabs(1.0-fact);
/*printf(fratio=%f          zm=%d          fact=%f          num=%e
den=%e\n",fratio,zm,fact,num,den);*/
y1=2.0*ho*tan(theta1);
y=(log(num/den));
D=x*y+y1;   /* 5282km from peking to Kolhapur */
/* plot (5.0* (float) theta, 199-(int)D/100); */
/*printf("D=%f   x=%f   y=%f   y1=%f   theta1=%f   theta=%f   \n",
D,x,y,y1,theta1,theta); */
printf ("zm=%d hm=%f D=%f nm=%e fratio=%f teta=%f teta=%f\n",
zm,hm,D,nm,fratio,theta);
}
getch();
}
void plot (float a, int b)
{
circle (a,b,2);
putpixel (a,b,1);
}
```

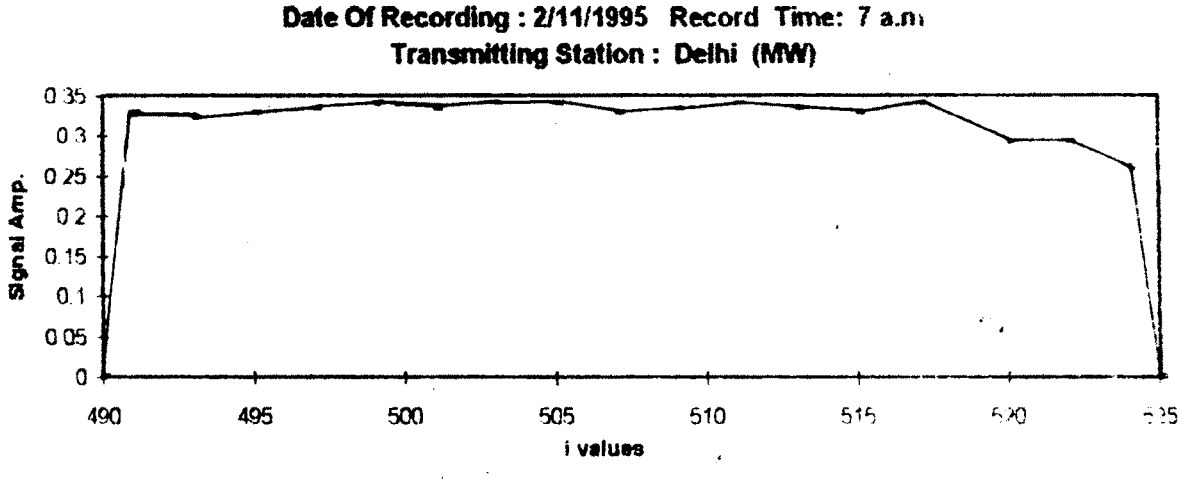
Fig 5.5

C - programs for calculation of Ionospheric Range

```
#include<stdio.h>
#include<math.h>
#include<graphics.h>
#define   ZM  50
#define   FRATIO   1.1
# define  THETA  48
void plot(int,float);
main()
{
int graphdriver = DETECT,graphmode;
float   x,p,o,n,d,y,s,w;
double   di,t,g,zr,ang,i,so;
float  ansm,hs,num,den,ans,a,b,r;
float  ho=100.0,k,u;
double sine, cosine,tangent;
initgraph (&graphdriver,&graphmode,"c:\\turbo\\bgi");
ang=(48.0+1.3/3.0)*3.1416/180.0;
x=ZM*FRATIO*sin(ang);
p=FRATIO*cos(ang);
o=p*p;
n=sqrt(1.0-o);
zr=ZM*(1.0-n_;
  den=1.0-p;
for(hs=0.0;hs<ho;hs=hs+10.0)
{
ans=hs*tan(ang);
plot((int)and,hs);
}
/*printf("hs=%f ans=%f\n",hs, ans);  */
for(g=0.0;g<=zr'g=g+2.0) /*
{
r=(g/ZM)*(g/ZM)'
t=2.0*g/ZM'
i=g/ZM;
s=t-r'
so=(o-s);
di=sqrt(so);
num=1.0-i-di;
den=1.0-p;
y=log(num/den);
d=x*y;
ans=d+ho*tan(ang);
plot(int)ans,ho+g;
ansm=ans;
```

```
printf ("ansm=%f\n", ansm);
}
/*pirntf("g=%f d=%6.4f\n",g,d);*/
a=1.0+p;
b=1.0-p;
w=x*log(a/b)+2.0*ho*tan(ang);
k=w-ans;
u=w-d;
/*printf("w=%f k=%f u=%f\n",w,k,u);*/
                    /*can d and ans be summed to get distance?*/
/*plot((int) k,(float) hs);
plot ((int) u,(float) g); */
getxh();
}
void plot(int a,float b)
{
circle(a,b,2);
putpixel(a,b,1);
}
```

Fig.5.6



First encloded audio time signal

Fig.5.7

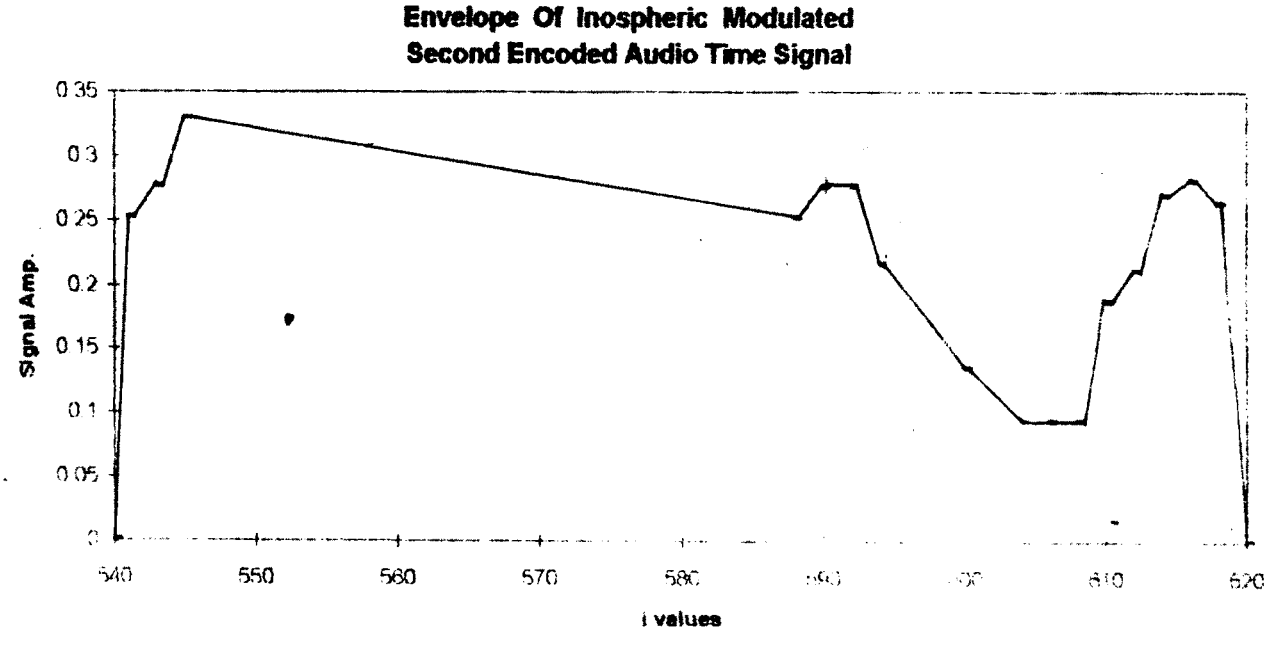


Fig.5.8

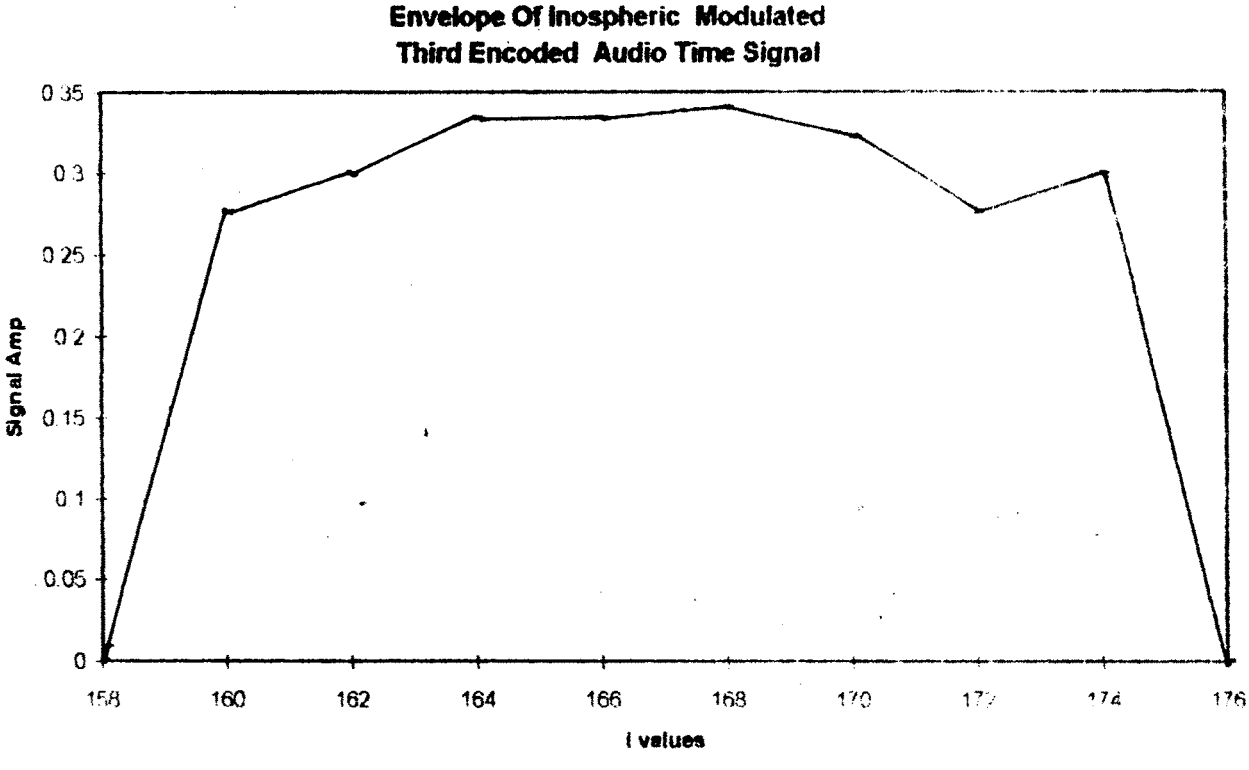

Envelope Of Inospheric Modulated
Third Encoded Audio Time Signal
Signal Amp
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
158
160
162
164
166
168
170
172
174
176
I values

Fig.5.9

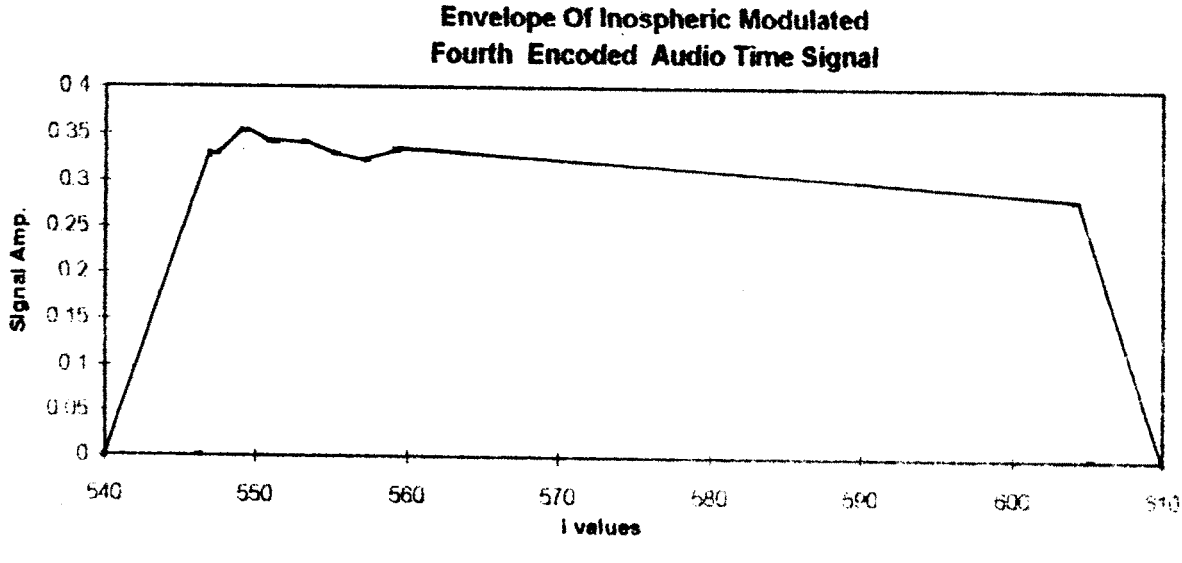

Envelope Of Inospheric Modulated
Fourth Encoded Audio Time Signal
Signal Amp.
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
540
550
560
570
580
590
600
610
I values

Fig.5.10

Envelope Of Inospheric Modulated
Fifth Encoded Audio Time Signal

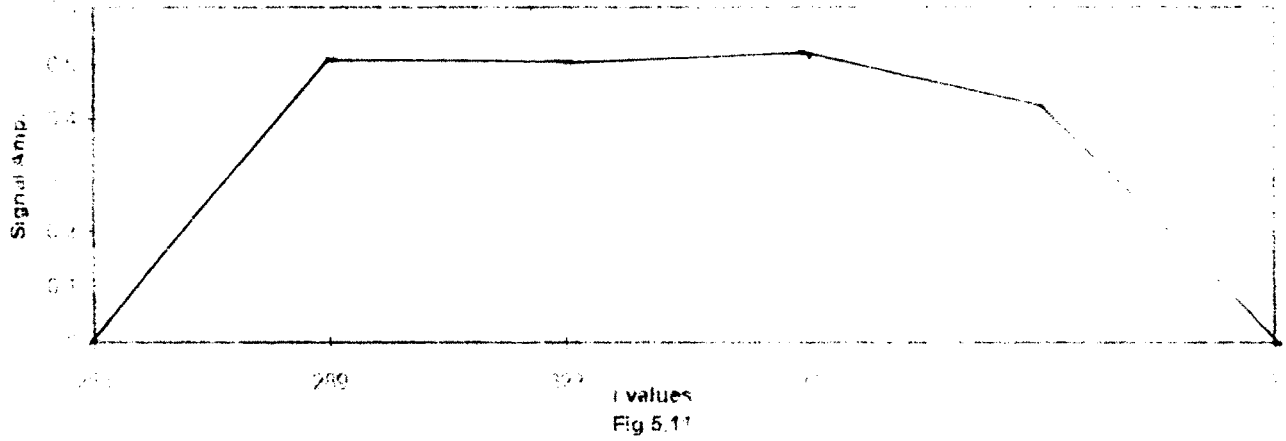


Fig 5.11

Fig.5.11

Envelope Of Inospheric Modulated Sixth Encoded Audio Time Signal

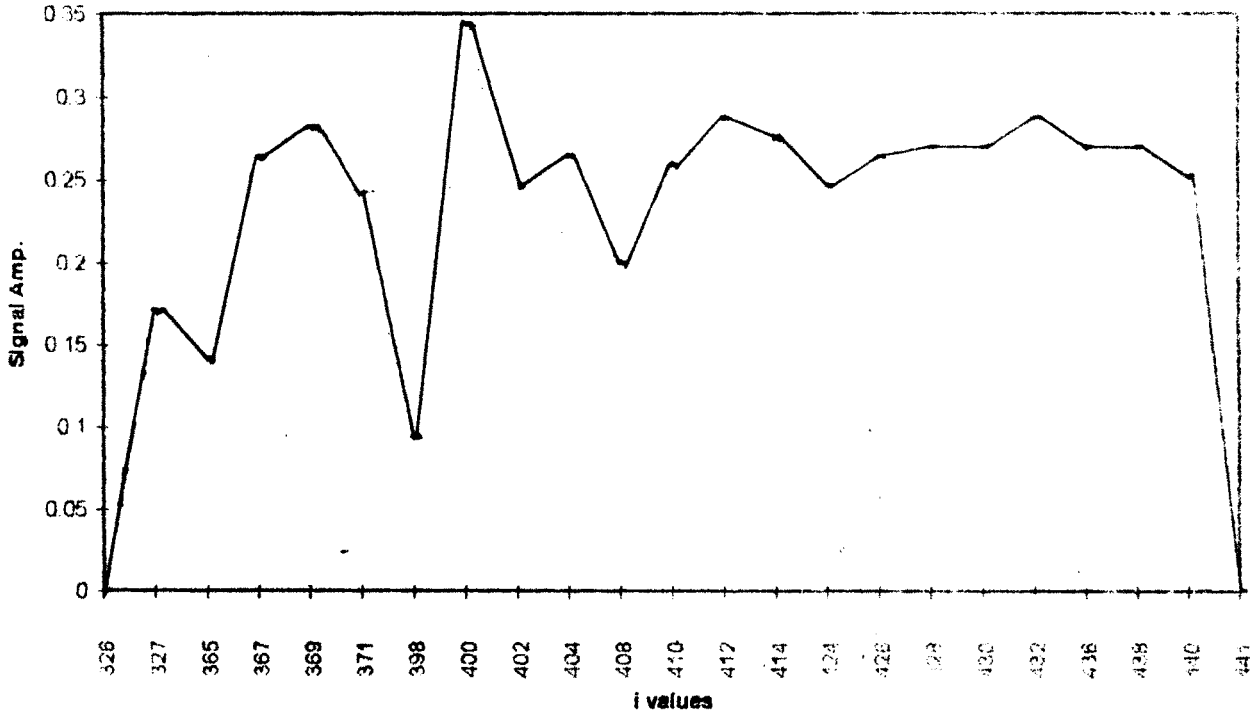


Fig 5.12

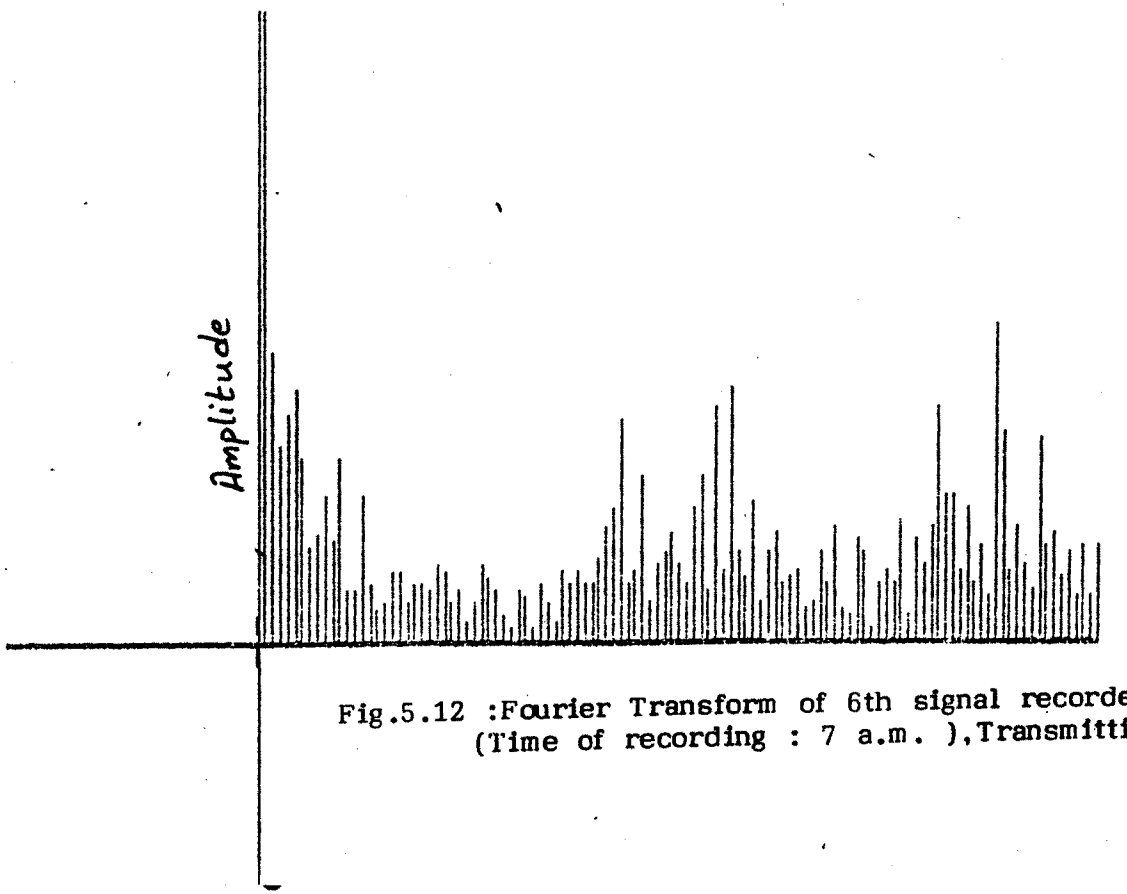


Fig.5.12 :Fourier Transform of 6th signal recorded on date 2.11.95
(Time of recording : 7 a.m.),Transmitting station : Delhi) (MW).

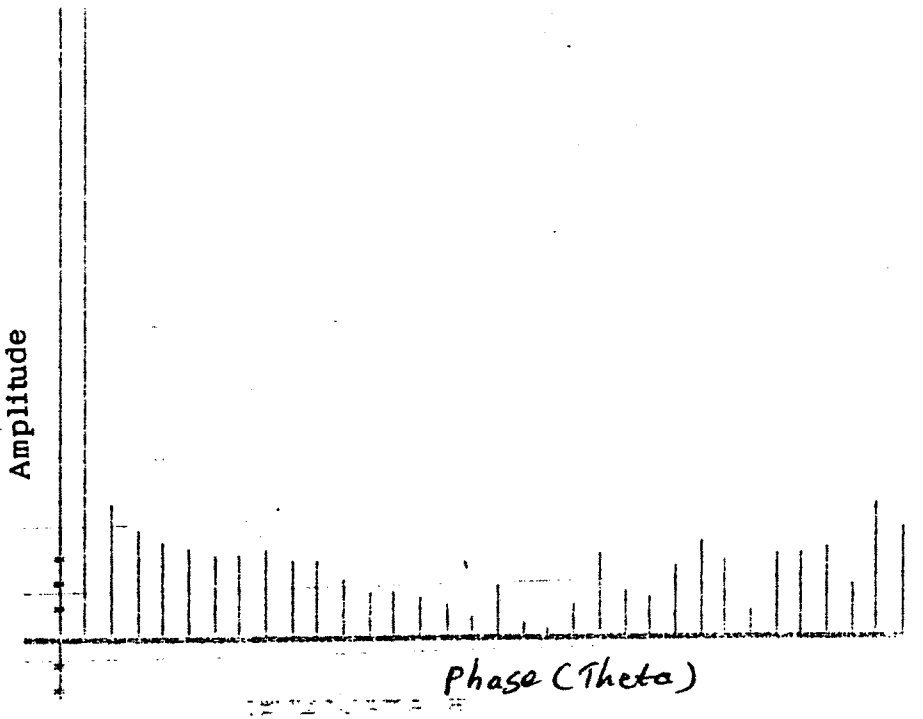


Fig.5.14 : Showing fourier transform of 1st time signal recorded on date 2.11.95 time :L 7 a.m., Transmitting station : Delhi(MW).

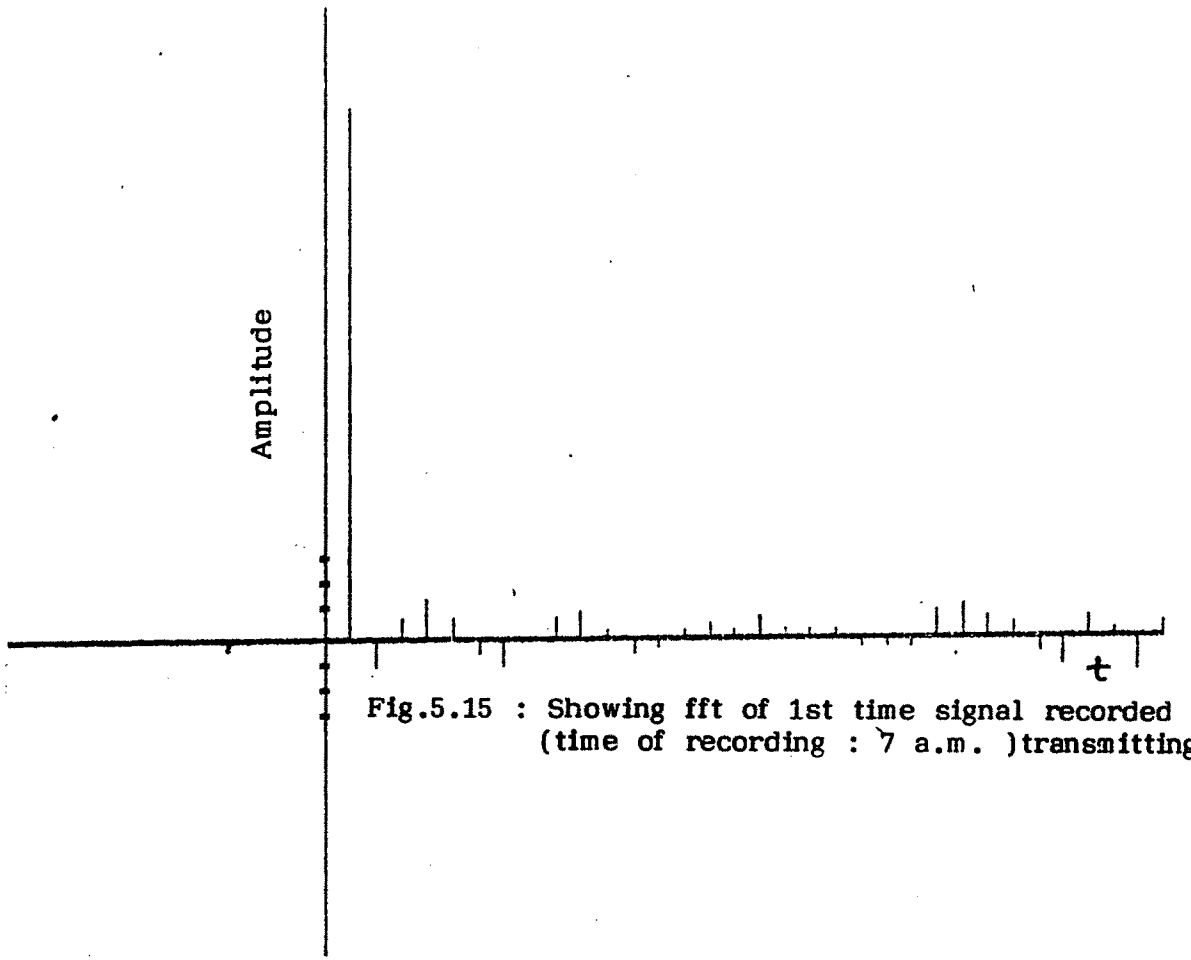


Fig.5.15 : Showing fft of 1st time signal recorded on 2.11.95
(time of recording : 7 a.m.)transmitting station : Delhi(MW).

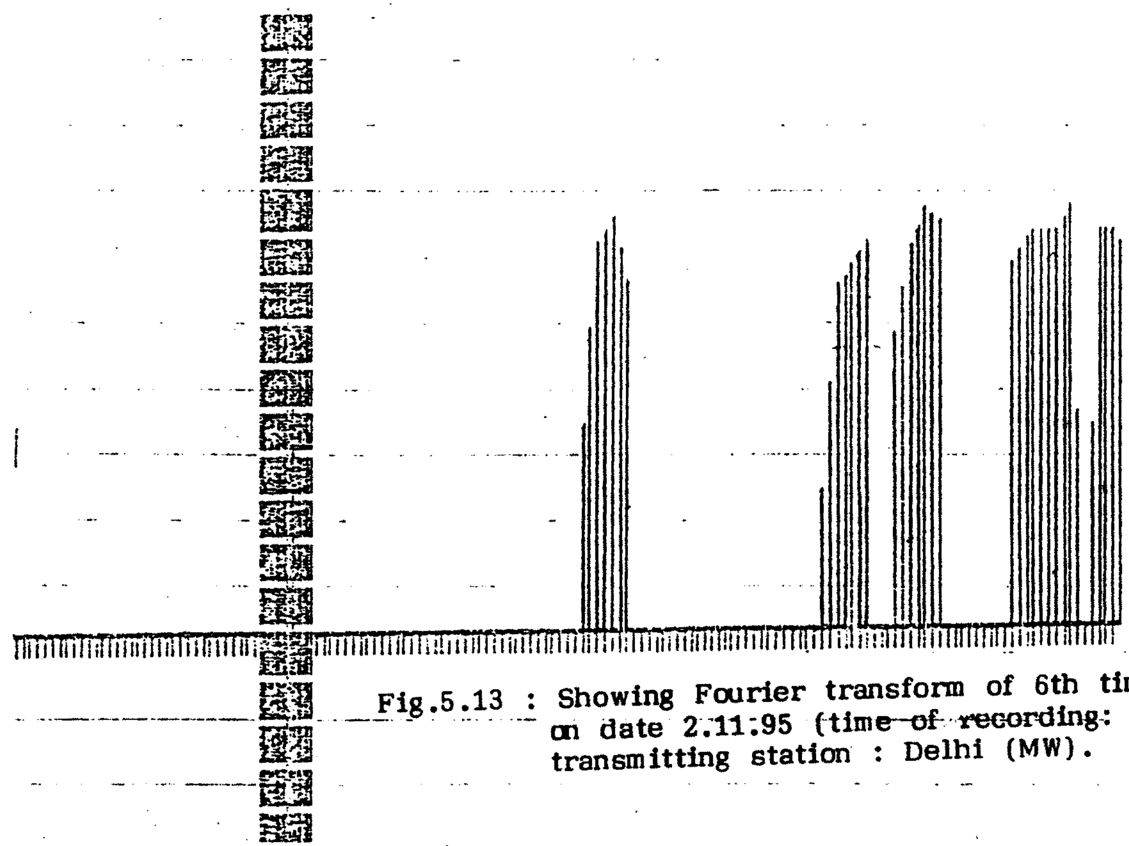


Fig.5.13 : Showing Fourier transform of 6th time signal recorded on date 2.11.95 (time of recording: 7 a.m.), transmitting station : Delhi (MW).

Table 5.18

6th Signal Fourier transform data
Time :- 7 a.m.
Date :- 2-11-95 Transmitting Station :- Delhi

W	r	Im	amp
1	4.615541×10^{-2}	0	4.615541×10^{-2}
2	7.513376×10^{-3}	1.799907×10^{-2}	1.950429×10^{-2}
3	-2.344023×10^{-3}	0.0127131	1.292749×10^{-2}
4	1.498428×10^{-2}	2.25093×10^{-3}	0.0151524
5	-5.875788×10^{-3}	1.572046×10^{-2}	1.678266×10^{-2}
6	-4.075782×10^{-3}	1.142903×10^{-2}	1.213403×10^{-2}
7	2.616626×10^{-4}	-6.32998×10^{-3}	6.335386×10^{-3}
8	-6.941092×10^{-3}	6.120223×10^{-4}	6.968022×10^{-3}
9	9.66953×10^{-3}	3.865518×10^{-5}	9.669608×10^{-3}
10	6.144581×10^{-3}	2.388781×10^{-3}	6.592583×10^{-3}
11	-4.525805×10^{-3}	1.121864×10^{-2}	1.209714×10^{-2}
12	3.153756×10^{-3}	-5.077201×10^{-4}	3.194363×10^{-3}
13	3.260042×10^{-3}	9.756731×10^{-5}	3.261502×10^{-3}
14	2.309067×10^{-3}	9.495112×10^{-3}	9.771844×10^{-3}
15	-3.646376×10^{-3}	-5.127043×10^{-4}	3.682244×10^{-3}
16	-1.703252×10^{-3}	7.501658×10^{-4}	1.81133×10^{-3}
17	1.978667×10^{-3}	1.39637×10^{-3}	2.42177×10^{-3}
18	-3.847394×10^{-3}	2.607033×10^{-3}	4.647477×10^{-3}
19	-3.940619×10^{-3}	1.769133×10^{-3}	4.319527×10^{-3}
20	-1.090921×10^{-3}	-1.95335×10^{-3}	2.237339×10^{-3}
21	1.909126×10^{-3}	3.22066×10^{-3}	3.743983×10^{-3}
22	-3.973182×10^{-4}	-3.66852×10^{-3}	3.689974×10^{-3}
23	3.103583×10^{-3}	-1.246913×10^{-3}	0.0033447
24	2.884216×10^{-3}	4.150794×10^{-3}	5.054483×10^{-3}
25	7.279482×10^{-4}	4.473441×10^{-3}	4.532282×10^{-3}
26	8.800017×10^{-4}	2.099153×10^{-3}	2.276147×10^{-3}
27	3.064742×10^{-3}	-3.432548×10^{-5}	3.064934×10^{-3}
28	-8.807566×10^{-4}	6.945823×10^{-5}	8.834912×10^{-4}
29	2.390004×10^{-3}	0	2.390004×10^{-3}
30	4.309066×10^{-3}	2.221784×10^{-3}	4.848131×10^{-3}
31	2.871638×10^{-3}	2.955049×10^{-3}	4.120512×10^{-3}
32	2.069169×10^{-3}	2.675118×10^{-3}	3.381969×10^{-3}
33	-1.489612×10^{-3}	3.870412×10^{-4}	1.539073×10^{-3}
34	-5.223976×10^{-3}	-6.395584×10^{-4}	8.25793×10^{-4}
35	-3.034801×10^{-3}	1.196351×10^{-3}	3.26096×10^{-3}
36	1.832833×10^{-3}	2.037785×10^{-3}	3.262096×10^{-3}
37	2.018795×10^{-4}	-7.972042×10^{-4}	8.2223685×10^{-4}