



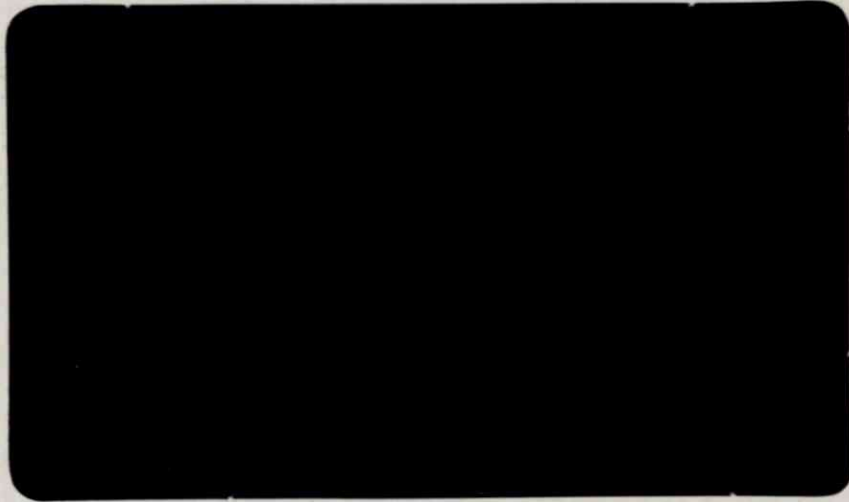
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Rapport 4034.04 Stabekk, 4. april 1978

SEISMISKE UNDERSØKELSER

I LØKKEN GRUBE 1977

for ORKLA INDUSTRIER A/S

A/S GEOTEAM

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Rapport 4034.04

Stabekk, 4. april 1978.

SEISMISKE UNDERSØKELSER
I LØKKEN GRUBE 1977

for ORKLA INDUSTRIER A/S

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Innledning	Side 1
Feltarbeid og datainnsamling	Side 2
Dataanalyse og resultater	Side 3
Konklusjoner	Side 9

BILAG OG TEGNINGER

Bilag S1	: Seismiske metoder, generelt grunnlag
Bilag S30	: DHR-1632 Seismisk registreringsutrustning
Bilag 1	: Pulstester DHR-1632
Bilag 2	: Pulstester DFS-V
Tegning 4034-9	: Situasjonsplan, måleoppstillinger
Tegning 4034-10	: Reprosesseringer, profil 1/76

INNLEDNING

På oppdrag fra Orkla Industrier A/S, har A/S Geoteam utført seismiske pulsmålinger i Løkken Grube, 1977. Hensikten med målingene har vært å fastlegge :

1. Gjennomsnittlige seismiske hastigheter for P-bølger vertikalt fra forskjellige nivåer i Løkken Grube mot dagen.
2. Energiinnhold i P-bølgene som funksjon av frekvens, sprengstofftype og ladningsstørrelse.
3. Gunstigste kobling og montering av geofoner i fjell og i løsmasser.

Målingene er utført ved to tidspunkter, begge ganger i forbindelse med helgestans i gruva.

Målingene ved første tidspunkt uke 23, 1977, ble utført med utrustning DHR-1632.

Målingene ved andre tidspunkt, uke 45, 1977, ble utført med utrustning DFS-V. De sistnevnte målingene er utført fordi DHR-1632 p.g.a. en feil ga "cross-feed" fra en kanal til en annen ved de første målingene.

På grunn av denne feilen kan data fra første måletidspunkt bare benyttes til å trekke konklusjoner vedrørende punktene 1. og 2., mens data fra andre måling gir opplysninger også om punkt 3.

Målingene som er utført og beskrevet i denne rapporten, er en videreføring av forsøk med refleksjonsseismikk som prospekteringsmetode i Løkkenfeltet, 1976, vår rapport 4034.03.

Rapporten inneholder også resultater av tilleggs-prosesseringer utført på refleksjonsseismisk profil målt 1976 (profil 1/76).

Fouriertransformasjoner av pulser, samt nevnte tilleggs-prosessering, er utført ved GECO's regnesenter.

FELTARBEID OG DATAINNSAMLING

Målingene av seismiske pulser er utført ved detonasjon av sprengladninger på forskjellige nivåer i gruva, og registrering på overflaten.

Det er skutt på 3 nivåer, 380, 720 og 930. Skuddene er avfyrt i ca. 4m lange borhull som faller 45° inn i tunnelveggene i gruva, i retning mot registreringsområdet på overflaten. Det er også skutt i et borhull på overflaten. Forberedelser og boring av hull er utført av oppdragsgiver.

Skuddhullenes beliggenhet er angitt i situasjonsplan tegning 4034-9, som viser horisontalprojeksjoner av de 3 nevnte nivåer.

Tegning 4034-9 viser også registreringsområdet på overflaten nord for Astrup Sjakt.

Detonasjonstidspunktet for skuddene er definert ved ledningsbrudd i en leder som er viklet omkring sprengladningene. Bruddkretsen fra DHR-1632 til ladningene ble koblet opp over gruvas interne telefonnett. Hensikten med dette er å få definert starttidspunktet for bølgeutsendelsen, slik at registreringene på overflaten kan gi grunnlag for beregning av den tid bølgen bruker på å

tilbakelegge en strekning L fra skuddpunktet til geofonen. Tegning 4034-9 viser vertikalsnitt for beregning av L for noen skudd/geofon-kombinasjoner.

Kobling av geofoner i registreringsområdet ved måling med DHR-1632 er beskrevet i Bilag 1, Tabell 1. Tabellen gir også alle avstander (L) fra skudd til geofon. Bilag 1, Tabell 2 gir en oversikt over skuddposisjon, type og størrelse av de ladninger som er avfyrt, og motsvarende registrerings beliggenhet på tape.

Bilag 2, Tabell 1 og Tabell 2 gir tilsvarende data for målingene i andre periode utført med DFS V.

DATAANALYSE OG RESULTATER

Et utvalg av pulsformer registrert med DHR-1632, samt tilsvarende frekvens-amplitudespektra er vist i Bilag 1.

Registreringer med DFS-V ved andre måletidspunkt er vist i Bilag 2.

De registrerte pulser og deres fouriertransformasjoner danner grunnlag for vurderinger omkring spørsmålene 1, 2 og 3, stillt innledningsvis.

a. Seismiske hastigheter

Følgende gjennomsnittlige hastigheter for P-bølger er beregnet på grunnlag av DHR-1632 registreringene.

Nivå 380-overflate (registrering Bilag 1, 1.60) 5905 m/s

Nivå 720-overflate (registrering Bilag 1, 1.76) 5870 m/s.

Nivå 930 (1-2)-overflate (registrering Bilag 1, 1.83)
5990 m/s.

Nivå 930 (3)-overflate (registrering Bilag 1, 1.89)
5900 m/s.

Med en antatt usikkerhet i tidsmålingene for puls-
ankomster på ± 1 ms blir usikkerheten i beregning
av hastigheter ca. ± 100 m/s for nivå 380, noe
mindre for de dypere nivåer.

b. Energiinnhold i P-bølger som funksjon av frekvens,
-----sprengstofftype og ladningsstørrelse.-----

For registreringer med DHR-1632 er samplingshastig-
heten 4000 Hz. Registreringen er begrenset mot høye
frekvenser av samplingsfilteret (anti-alias) som
starter på 500 Hz og faller ca. 60 db/oct. Mot
lave frekvenser er registreringene begrenset av
geofonenes frekvensresponser, og i praksis vil nedre
begrensning falle sammen med geofonenes naturlige
frekvenser (50 Hz).

For registrering med DFS-V er samplingshastigheten
1000 Hz og samplingsfilteret 256 Hz.

Registrering av bakgrunnsstøy (Bilag 1, 1.1-1.10)
viser maksima i støyspektret ved ca. 50Hz, ca. 145Hz
og ca. 220Hz. Disse maksima ligger 5-10 db over
den øvrige bakgrunnsstøyen. Maksimaene representerer
sannsynligvis kulturell støy, eller instrumentell
støy. Støyen ved 50Hz er trolig forårsaket av støy
fra kraftlinjer i nærheten. Støyen ved 145 Hz kan

muligvis være forårsaket av en vifte i drift i Astrup Sjakt, mens vi tror støyen ved 220 Hz er instrumentell støy knyttet til geofoner, kabler, og DHR-1632.

For skudd i overflaten (Bilag 1, 1.11-1.24), viser registreringene og analysen at energien i pulsene ligger i frekvensområdet 75-200 Hz. Svært lite energi ligger så høyt som 300 Hz. For skudd avfyrt i gruva (Bilag 1, 1.25-1.90 og Bilag 2, 2.1-2.42) er konklusjonen sammenfallende med den som gjelder for skudd i overflaten.

Energi fra 1-3 tennere er for liten til å trenge gjennom støynivået selv på grunneste nivå (nivå 380).

Avfyring av 65 g dynamitt på dypeste nivå (nivå 930) gir akseptabelt signal/støy forhold. Ladningsstørrelser på fra 50-100 g sprengstoff er derfor trolig optimalt for undersøkelser ned til dyp på 500-1500 m i krystalline bergarter av denne type.

Ladningsstørrelser ser ikke ut til å ha noen avgjørende innflytelse på energiens frekvensfordeling. Dobling av ladningen fra 65 g (Bilag 1, 1.78) til 130 g (Bilag 1, 1.83) gir ingen signifikant endring i frekvensfordelingen.

En sammenligning av forskjellige sprengstoffkvaliteter (dynamitt, comp. C4, og ekstra dynamitt), viser at Comp. C4 sprengstoff gir det høyeste innhold av høye frekvenser, og den kraftigste pulsen. Dette er bekreftet av tidligere teoretiske antakelser om at sprengstoff med høy detonasjons hastighet og styrke gir best signal/støy forhold og relativt

større innhold av høye frekvenser.

Ser en på absorpsjonsegenskapene for seismiske bølger i bergarter (hovedsakelig gabbro), vil en ved å betrakte amplitudespektene for ekvivalente ladningsmengder avfyrt på forskjellige nivåer, tydelig se en utfiltrering av frekvenser over 200 Hz, økende med dypet dvs. med økende avstand fra skudd til geofon.

Den totale dempningen av pulsene er summen av sfærisk spredning og frekvensavhengig absorpsjoner.

For frekvensområdet 100-200 Hz, synes den totale dempningen av pulsene å ligge omkring 1.5 db pr. bølgelengde.

Observasjonsmaterialet for vurdering av denne parameteren er imidlertid sparsomt, og vi kan bare akseptere dette tallet som en retningsgivende verdi.

c. Montering av geofoner i fjell og løsmasser.

Konklusjoner vedrørende kobling av geofoner bygger på målinger utført med DFS-V, analyseresultater vist i Bilag 2.

Målingene gir grunnlag for å sammenligne geofoner med egenfrekvens 10 Hz, 30 Hz, 50 Hz og 100 Hz.

En sammenligning av pulser og spektra, viser at 50Hz geofoner gir den gunstigste frekvensrespons. Forskjellen mellom 50Hz, 30 Hz og 10 Hz geofoner er marginal både når det gjelder pulsform og frekvensinnhold (30Hz og 10Hz geofonene er koblet med motsatt

polaritet). Geofonen med 100 Hz egenfrekvens viser imidlertid en mer komplisert pulsform enn de øvrige, og dette tror vi er et konstruksjonsproblem m.h.t. dempning av geofoner med så høy egenfrekvens.

Når det gjelder kobling mot fjell, er tre alternativer undersøkt, kobling med "Geoteam patent" kobling med konvensjonell plate, og kobling med treplugg som slås ned i borhull. Målingene viser at koblingen med treplugg er den dårligste løsningen. Ved denne koblingen forekommer også et dempningsproblem. Pulsformen blir komplisert, og utfiltrering av frekvensbåndene 125-150 Hz samt 190-210Hz er karakteristisk for beregnede spektra for denne koblingen.

Kobling med plate mot fjell er akseptabelt, og spesielt ved tildekning med sandsekk. En skal imidlertid være oppmerksom på at bruk av plate representerer et praktisk problem, fordi den bare eigner seg i områder hvor fjellet er plant og horisontalt, dvs. slik at geofonen svinger nær vertikalen. Kobling med "Geoteam patent" vil dermed praktisk og geofysisk sett fortsatt være den beste løsningen.

Kobling i løsmasser gir generelt en mer komplisert pulsform enn kobling direkte mot fjell (Bilag 2, 2.12-2.18). Kobling med spett på løsmasser er den dårligste løsningen m.h.t. registrering av høye frekvenser. Fra ca. 60Hz og mot høyere frekvenser, faller spektrene med ca. 10 db/octav for denne koblingsløsningen.

Geofoner nedgravd i løsmasser og koblet til plater viser et bedre pulsspektrum enn geofoner på spett.

4034.04

Små plater synes å være å foretrekke framfor store plater.

d. Reprossessering av seismisk profil 1/76.

Reprosessering av profil 1/76 er utført for å bedømme effekten av datareduksjon.

Det er prossessert to versjoner som tilsvare originalversjonen presentert i rapport 4034.03, tegning 4034-7.

Den ene versjonen inneholder alle skudd med like nummere 2,4,6,..... osv., mens den andre versjonen inneholder alle skudd med odde nummere 1,3,5,.... osv. Ellers er prossesseringsrekkefølgen og innholdet i prossesseringen identisk med originalversjonen.

De to versjonene er vist på tegning 4034-10, sammen med originalen.

Seksjonene viser at 50% datareduksjon medfører et betydelig tap av signal/støyforhold. En ville forvente at de to reduserte versjoner ville gi nær identiske resultater. Når så ikke skjer, tror vi dette skyldes det til dels svært inhomogene skuddpunktmonster i profil 1/76, jfr. tegning 4034-6, rapport 4034.03.

I hovedsak inneholder de to versjonene den samme informasjon, men begge gir vesentlig dårligere tolkningsmuligheter enn originalen.

KONKLUSJONER

Den seismiske P-hastighet fra malmnivå til overflaten i Løkken Grube er effektivt ca. $5900 \text{ m/s} \pm 100 \text{ m/s}$.

Dette er noe høyere enn tidligere antatt i vår rapport 4034.03.

Med en avstand fra nivå 200 m.o.h. i profil 1/76 til malmen på 750 m, gir denne hastigheten en to-veis refleksjonstid på 0,254 s.

I den migrerte seksjon, rapport 4034.03, tegning 4034-8 vil en kunne se at denne refleksjonstiden tilsvarende en markert refleksjon. Denne refleksjonen er derfor sannsynligvis en refleksjon fra overgangen mellom grønnstein og malm.

Den migrerte seksjon viser også en refleksjon ved ca. 0,200 s, tilsvarende et dyp til reflektoren på ca. 590 m under nivå 200 m.o.h. i profil 1/76.

På grunnlag av denne undersøkelsen antyder vi følgende parametre for prospektering med refleksjonsseismikk i Løkkenfeltet.

- | | |
|-------------------------|-------------------------|
| 1. Frekvensområde: | 75 - 200 Hz |
| 2. Energikilde: | C4 |
| 3. Ladningsstørrelse: | 50 - 100 g |
| 4. Geofoner: | 50 Hz naturlig frekvens |
| 5. Kobling på fjell: | "Patent" (Geoteam) |
| 6. Kobling i løsmasser: | Nedgravd på liten plate |

Koblinger i løsmasser bør unngås i størst mulig utstrekning. I prosesseringsfasen bør registreringer som må gjøres i løsmasser korrigeres for den pulsforandring som oppstår, i forhold til registreringer gjort på fjell.

Datainnsamling etter CDP-metoden bør være 12-fold eller tilsvarende for å oppnå et godt signal/støy-forhold.

Stabekk, 4. april 1978

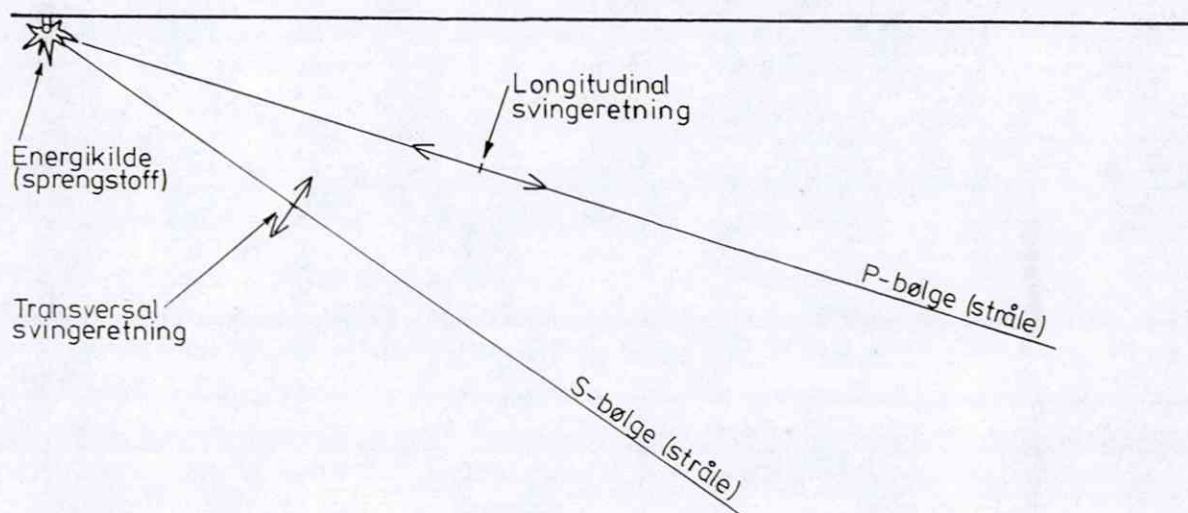
for A/S G E O T E A M


Anders Dahle

SEISMISKE METODER, GENERELT GRUNNLAG

De seismiske metodene bygger på elastiske (seismiske) bølgers evne til å forplante seg i jord og fjell.

Dersom bakken settes i bevegelse, f.eks. ved slag eller detonasjon av sprengstoff, dannes to hovedtyper bølger som er av spesiell interesse ved seismiske undersøkelser. Disse to bølgetypene kalles P-bølger og S-bølger. Se fig.1.



Figur 1.

P-bølgene er karakterisert ved at forplantningsmediet svinger parallelt med bølgenes forplantningsretning (longitudinal svingbevegelse), på samme måte som akustiske bølger i luft og vann.

S-bølgene setter forplantningsmediet i svingninger på tvers av bølgenes utbredelsesretning (transversal svingbevegelse). Forplantningshastigheten for de to bølgetyper er bestemt av mediets elastiske egenskaper karakterisert ved parametrene:

- K : kompressibilitetsmodul
- G : skjærmodul
- E : dynamisk elastisitetsmodul
- μ : Poissons tall
- ρ : massetetthet

Hastigheten V_p for P-bølger i et isotrop medium kan teoretisk uttrykkes ved formlene:

$$V_p = \sqrt{\frac{K + 4/3 G}{\rho}} = \sqrt{\frac{E(1-\mu)}{\rho(1-2\mu)(1+\mu)}} \quad (1)$$

mens hastigheten V_s for S-bølger tilsvarende uttrykkes som:

$$V_s = \sqrt{\frac{G}{\rho}} = \sqrt{\frac{E}{2\rho(1+\mu)}} \quad (2)$$

Fra (1) og (2) er:

$$\frac{V_p}{V_s} = \sqrt{\frac{1-\mu}{1/2-\mu}} \quad (3)$$

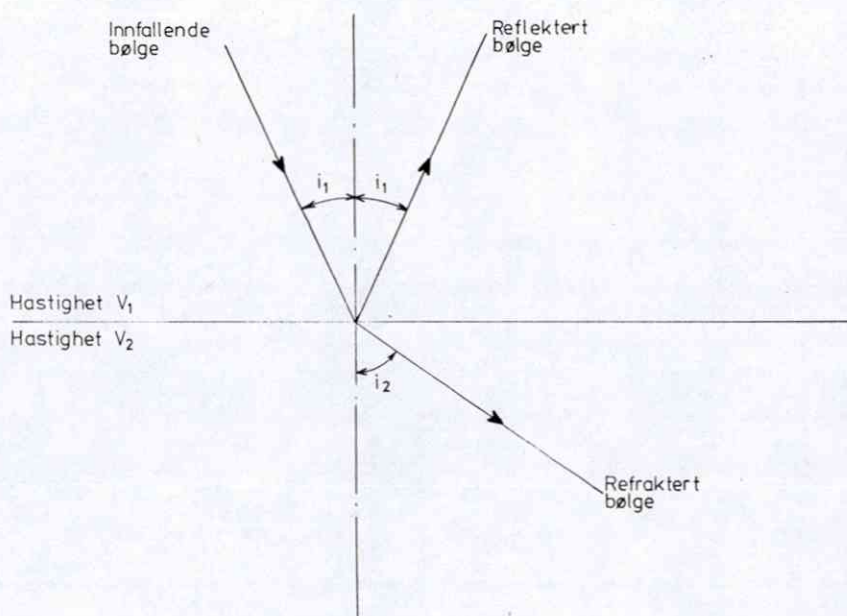
Poisson's tall er altså gitt ved forholdet mellom de seismiske hastighetene til P- og S-bølger. Dersom tettheten for et medium er kjent, kan de øvrige elastiske konstanter beregnes ved å måle P- og S-bølgenes hastigheter.

De seismiske bølgene brer seg i alle retninger ut fra energikilden. Den strekningen (s) bølgene tilbakelegger i tiden (t) er knyttet til hastigheten (v) etter formelen.

$$s = v \cdot t \quad (4)$$

Kjenner en hastigheten v , kan avstander beregnes ved å måle den tid (gangtid) bølger bruker på å tilbakelegge en viss strekning.

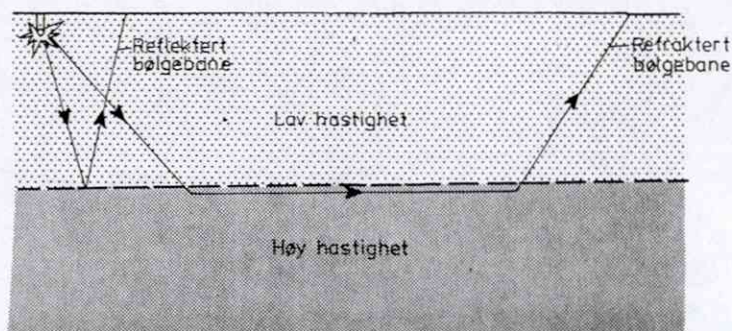
Ved overgang fra et medium med hastighet v_1 til et medium med hastighet v_2 vil samme bølgetype brytes (refrakteres) og reflekteres etter Snell's lov. Se fig. 2.



Figur 2.

SNELL'S LOV:
$$\frac{\sin i_1}{\sin i_2} = \frac{v_1}{v_2} \quad (5)$$

Refleksjonsseismikk er basert på å registrere bølger som er reflektert fra laggrenser, mens refraksjonsseismikk er basert på å registrere refrakterte bølger. Se fig. 3.



Figur 3.

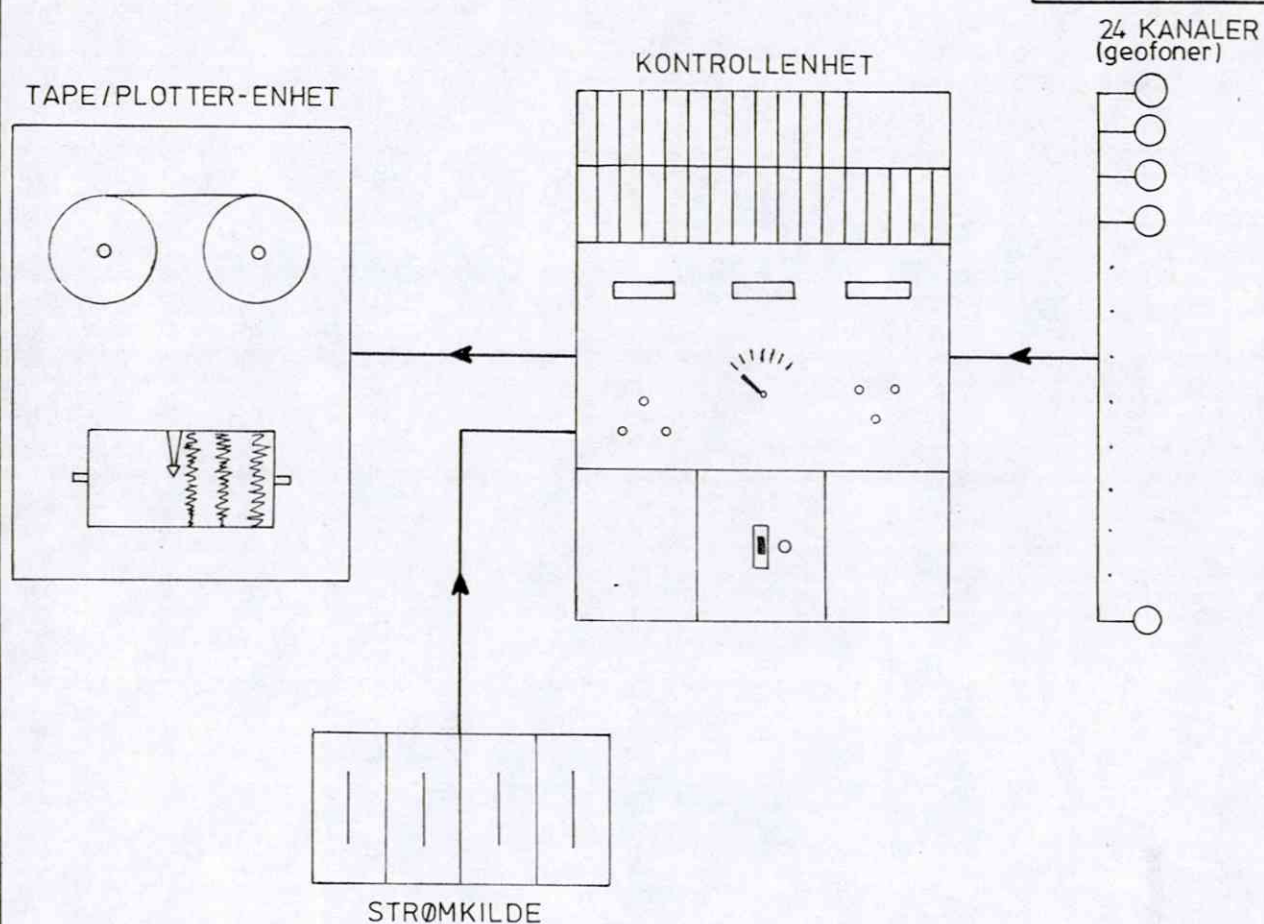
Refraksjonsmetoden gir normalt den fyldigste informasjon om de geologiske forhold, idet både hastigheter og lagtykkelser kan bestemmes.

Refleksjonsmetoden gir ingen hastighetsinformasjon, men har sin styrke i at forløpet av laggrenser kan bestemmes med stor detaljrikhet.

Ved de seismiske metodene forsøker en å tilpasse gangtidsobservasjoner til regnemodeller basert på formlene (4) og (5).

Som ved alle andre geofysiske metoder er det selve modelltilpasningen som er det kritiske trinn i anvendelsen. Selv om en kan forbedre målenøyaktigheten av størrelsenes gangtid (t) og avstand (s) nær sagt ubegrenset, ligger den vesentlige usikkerhet i spørsmålet om hvor godt forutsetningene for modellen tilsvarende de virkelige fysiske forhold på målestedet.

Seismiske målinger influeres ikke, som f.eks. boringer av blokker og steiner i løsmasselag. Målingene kan utføres i vann, og dette gjør disse metodene godt egnet ved problemstillinger hvor andre metoder faller kostbare og tidkrevende.



Antall kanaler:	24
Samplingshastighet:	1 ms
Datalengde:	2 sek (1 sek)
Datalagring:	Magnetbånd (tape) og/eller papirplott
Strømkilde:	12 v likstrøm
Vekt:	{ Kontrollenhet 32 kg { Tape/plotter-enhet: 35 kg

DHR-1632 digital seismisk registreringsutrustning

Spesifikasjoner og skjematisk opplegg for feltmålinger.

Bilag 1
til rapport 4034.04
SEISMISKE UNDERSØKELSER
I LØKKEN GRUBE 1977
FOR ORKLA INDUSTRIER A/S
PULSTESTER DHR-1632

INNHold:

Tabell 1 : Geofonkoblinger og avstander skudd-geofon.

Tabell 2 : Liste over registreringer.

Blad 1.1 - 1.90: Pulser og frekvens-amplitudespektra
registrert med DHR-1632.

GEOFON	BESKRIVELSE AV GEOFONKOBLING	KORTESTE AVSTAND (L) SKUDD-GEOFON, i m			
		nivå 930 (1-2)	nivå 930 3	nivå 720	nivå 380
1 og 3	L25E montert på plugg av gran i fjell	917	930	709	375
2 og 4	" " " " " hicory " "	"	"	"	"
5	" montert på 30 cm spett mot fjell i 10 cm løsmasse	"	"	"	"
6, 8, 10	" montert på tripod plate på fjell	"	"	"	"
7, 9, 11	" montert i fjell etter GEOTEAM "patent"	"	"	"	"
12	" montert som 4 x 10 m array, GEOTEAM "patent"	"	"	"	"
15 og 17	" montert på 30 cm spett i løsmasse	916	930	707	374
16	" montert på 5 cm spett i løsmasse	"	"	"	"
18 og 19	" montert på jernplate 35 cm x 25 cm og nedgravd i løsmasse	"	"	"	"
22	" montert på jernplate 20 cm x 15 cm i åpent hull i løsmasse 0,5 x 0,5 x 0,5	913	929	704	367
23	" montert på spett i løsmasse	"	"	"	"
24	" som geofon 22, nedgravd i løsmasse	"	"	"	"

Bilag 1, Tabell 1, Geofonkoblinger og avstander skudd-geofon.

TAPE REF.	SPRENGSTOFF	LADNING	FORSTERKNING	SKUDDETS BELIGGENHET
file	type	g	db	
1	-	-	60	bakgrunnsstøy
3-4	dynamitt	32.5	24	borehull på overfl.
6	3 tennere	0	84	nivå 380
7	1 tenner	0	84	"
8	dynamitt	65	60	"
9	"	130	60	"
10	"	32.5	60	"
11	C 4	25-30	60	"
12	C 4	10-15	84	"
13	3 tennere	0	84	"
14	dynamitt	65	84	"
15	C 4	65	84	"
16	extra dyn.	65	84	"
18	dynamitt	65	84	nivå 720
19	"	130	84	"
20	"	65	84	nivå 930 (1-2)
21	"	130	84	"
22	"	130	84	" (3)

BILAG 1, TABELL 2

Liste over registreringer.

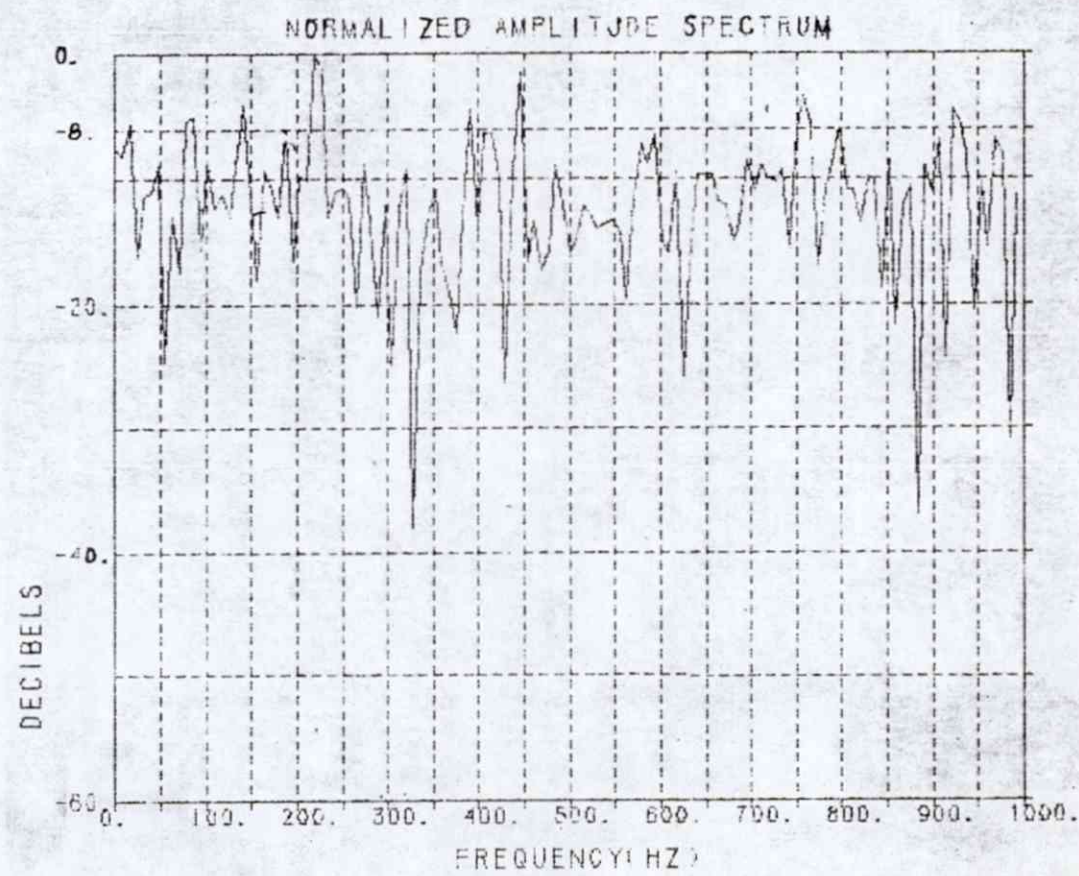
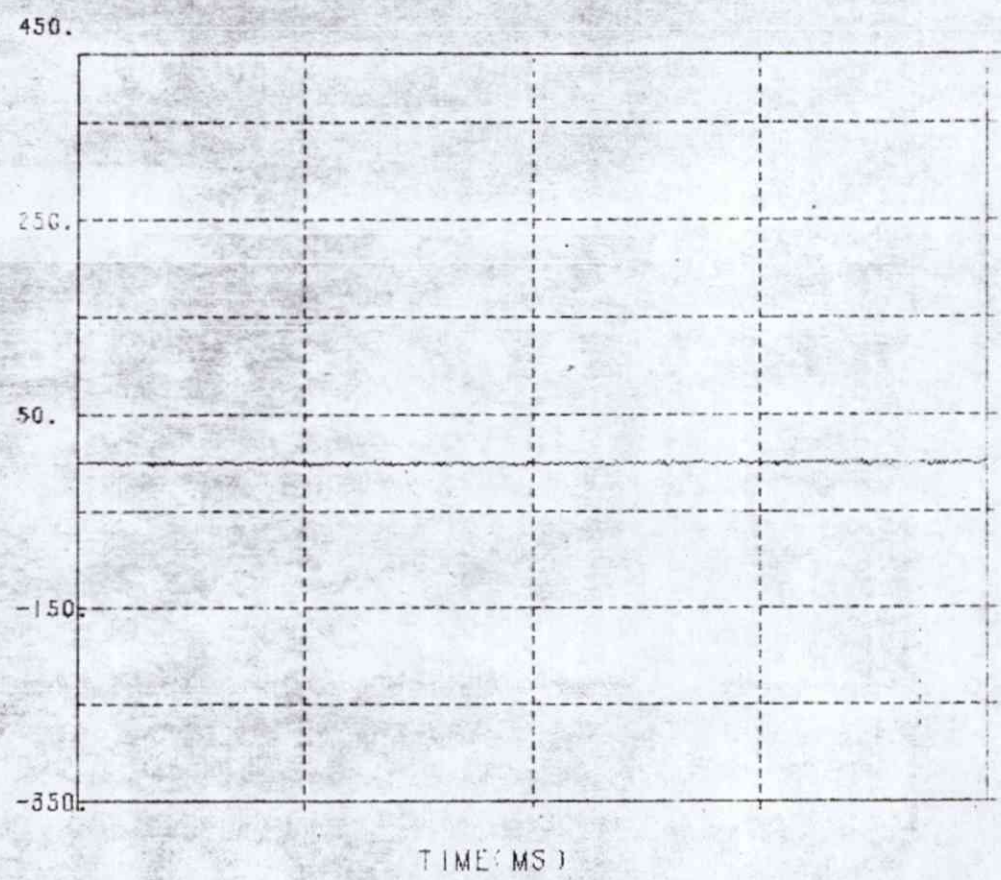
stop
the plugg

GEO PULSE TEST

1.1

IDENT 10000 CHANNEL 1

GEOTEAM TEST FILE 1 TRACE 1 WINDOW 100-200 MS.



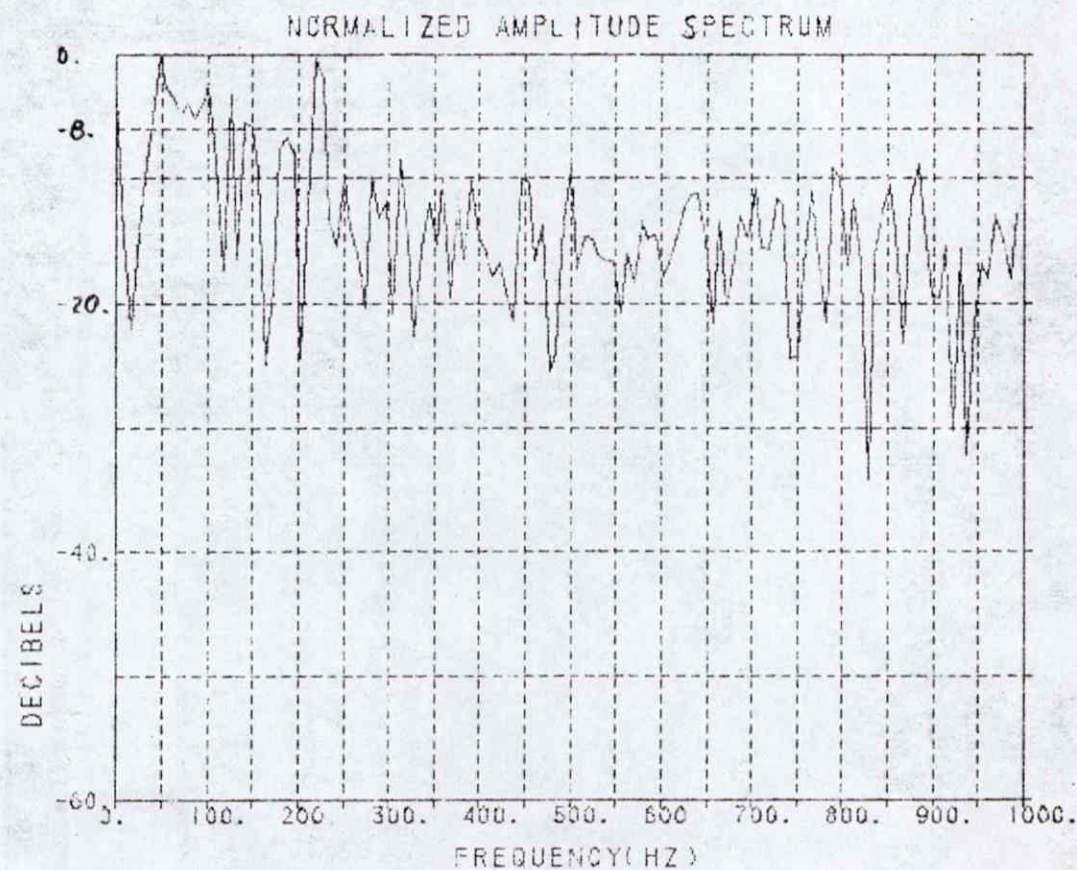
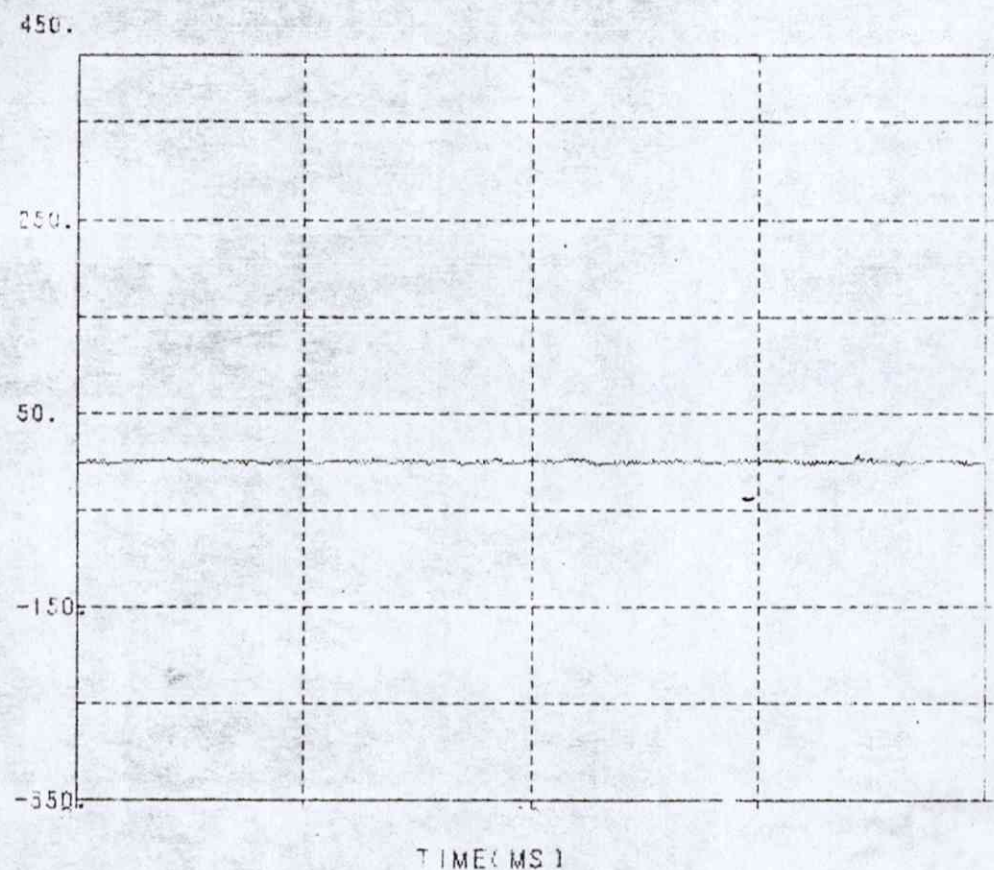
spelt

GECO PULSE TEST

IDENT 10000 CHANNEL 5

GEOTEAM TEST FILE 1 TRACE 5 WINDOW 100-200 MS.

1.2



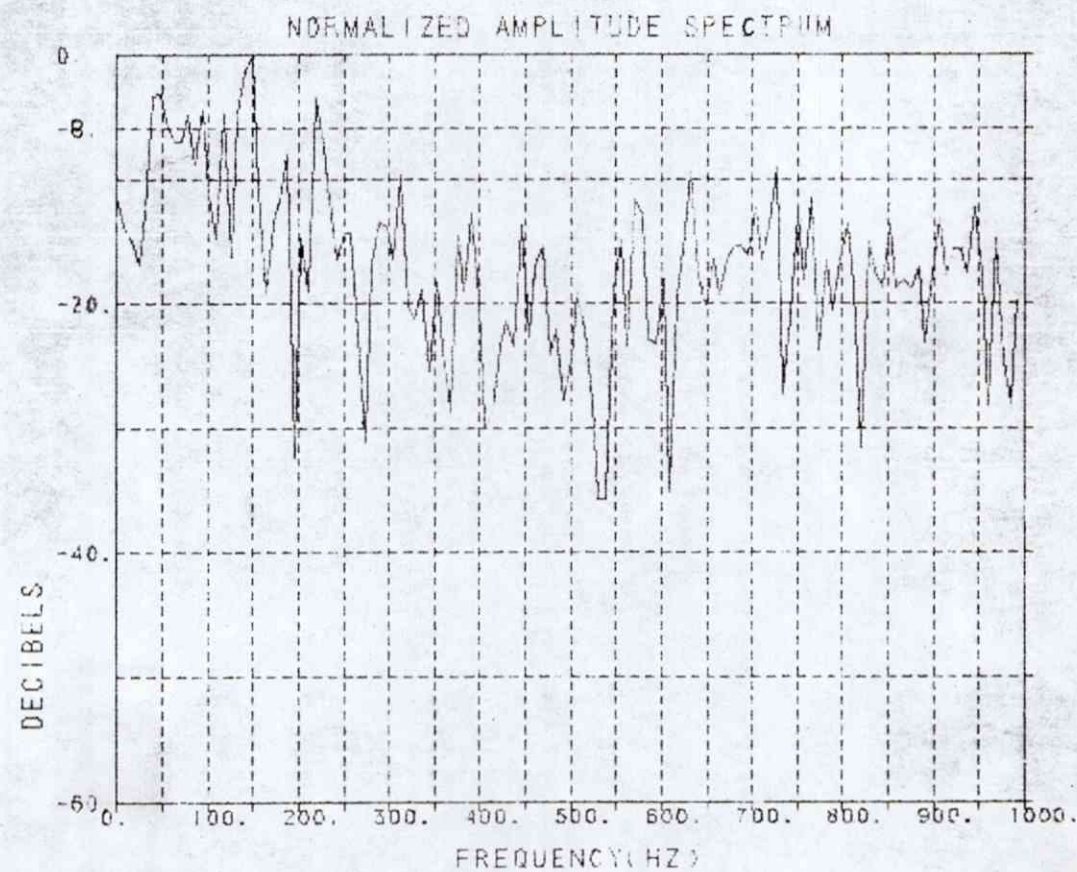
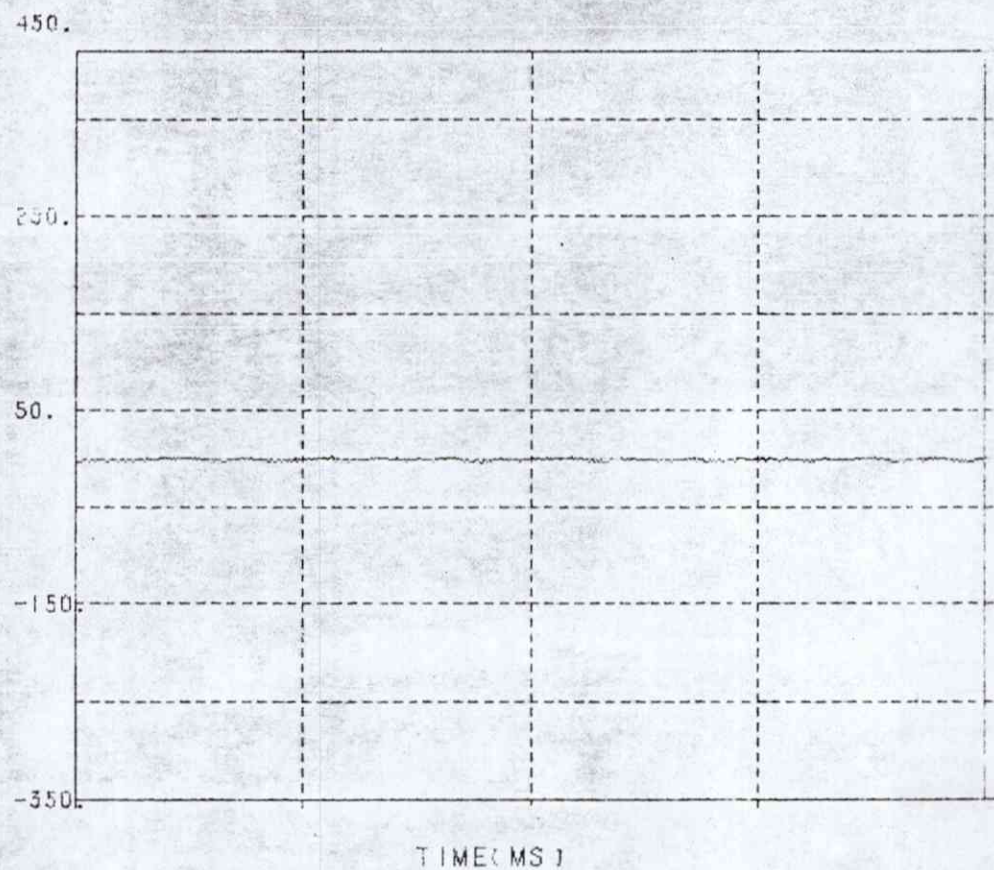
tripod.

GECØ PULSE TEST

1.3

IDENT 10000 CHANNEL 6

GEOTEAM TEST FILE 1 TRACE 6 WINDOW 100-200 MS



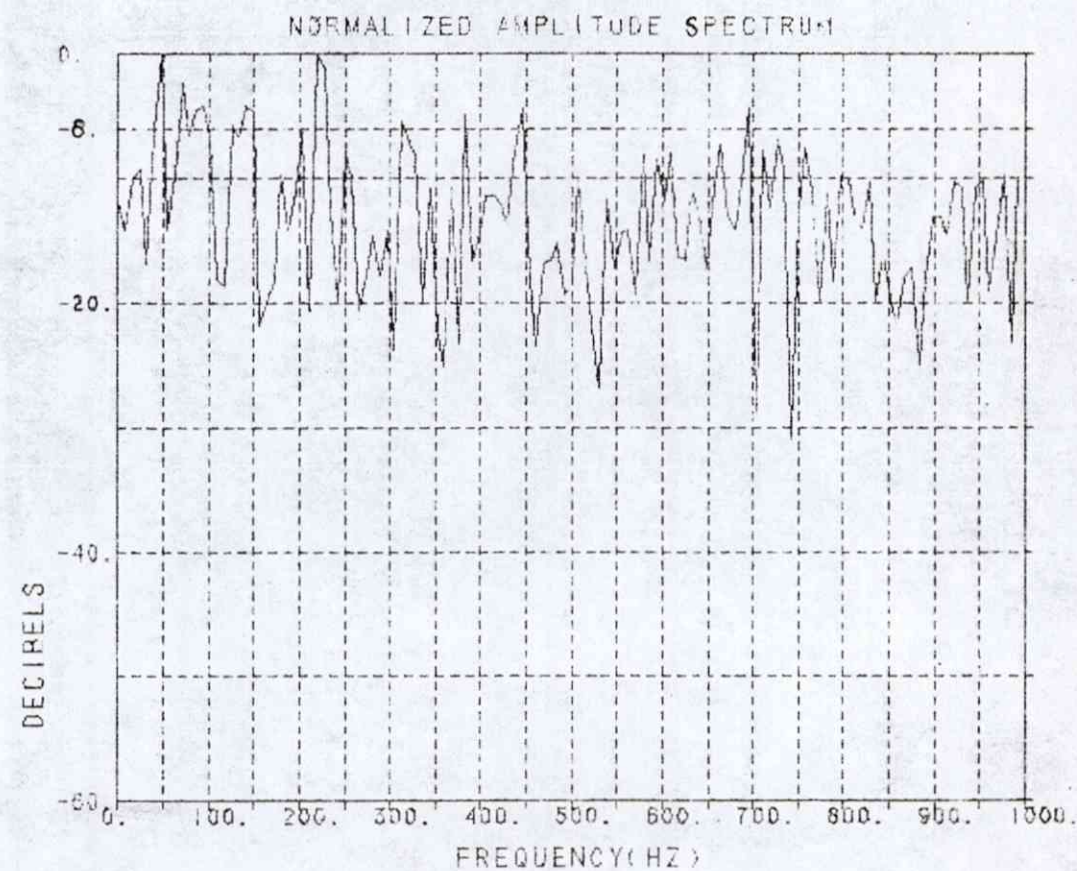
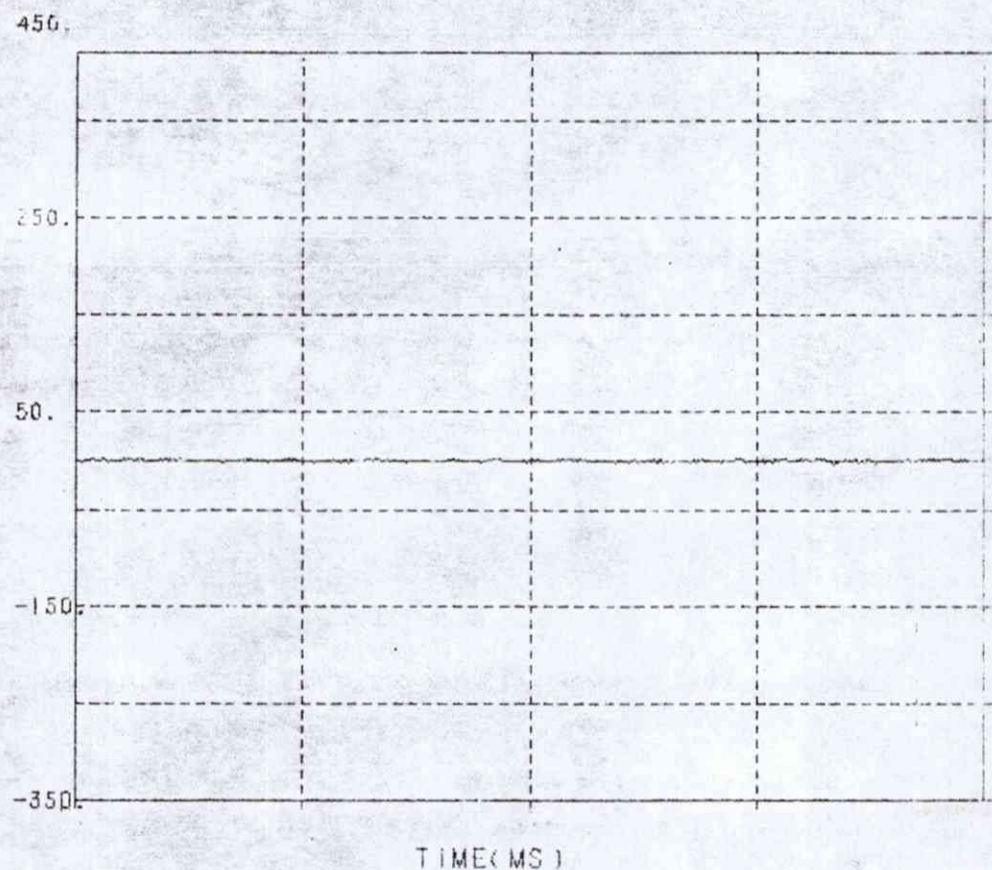
Start bolt all

GECO PULSE TEST

IDENT 10000 CHANNEL 7

1.4

GEMTEAM TEST FILE 1 TRACE 7 WINDOW 100-200 MS



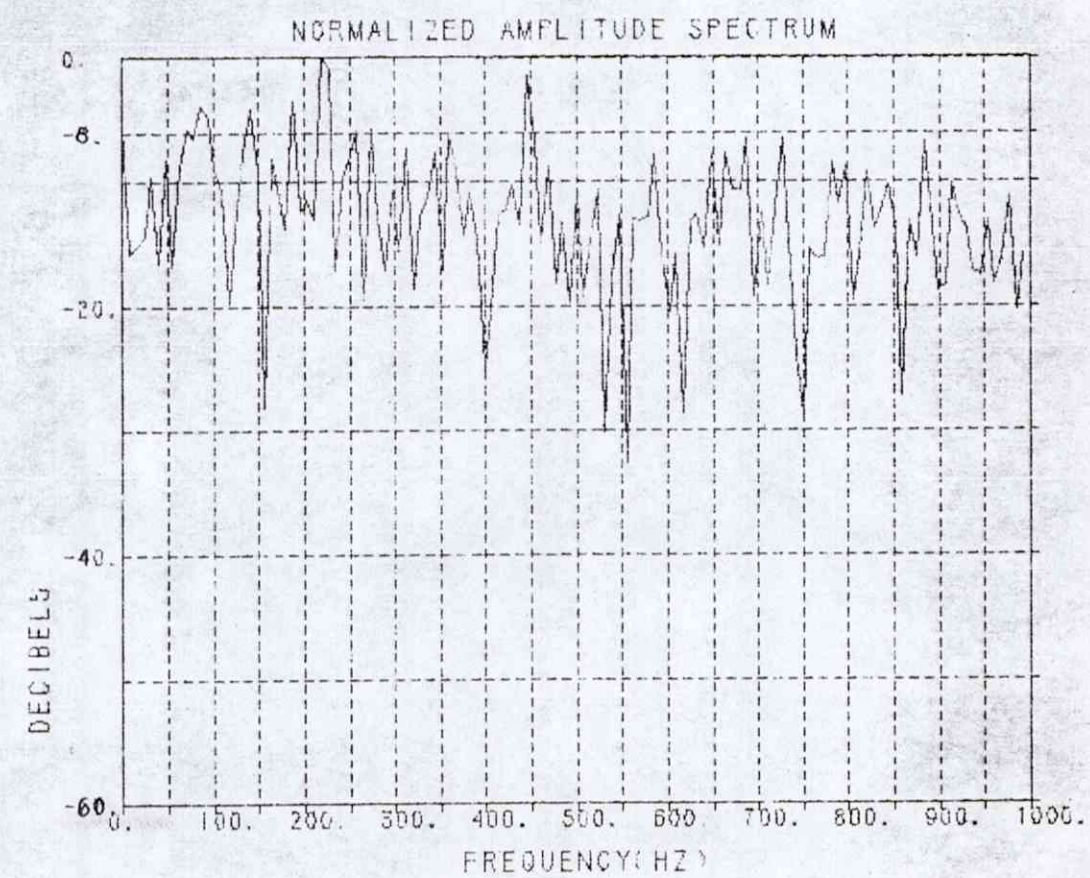
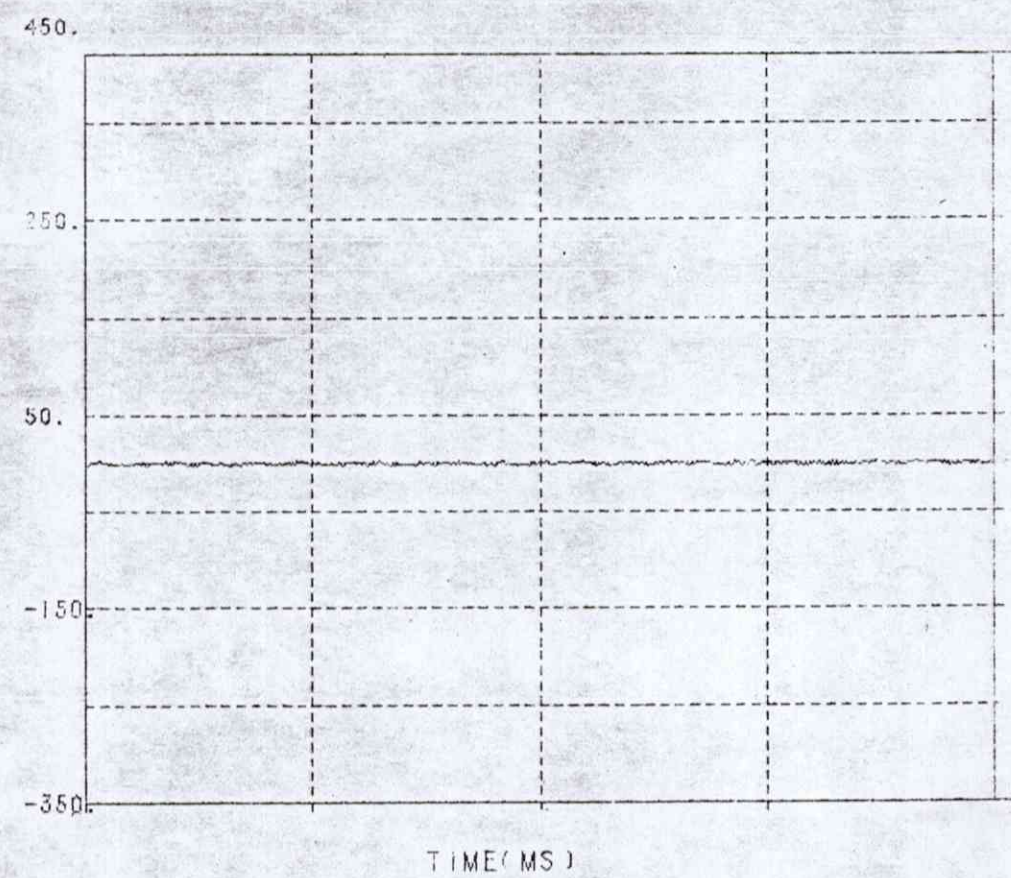
patent

GEC0 PULSE TEST

1.5

IDENT 10000 CHANNEL 11

GEC0TEAM TEST FILE 1 TRACE 11 WINDOW 100-200 MS.



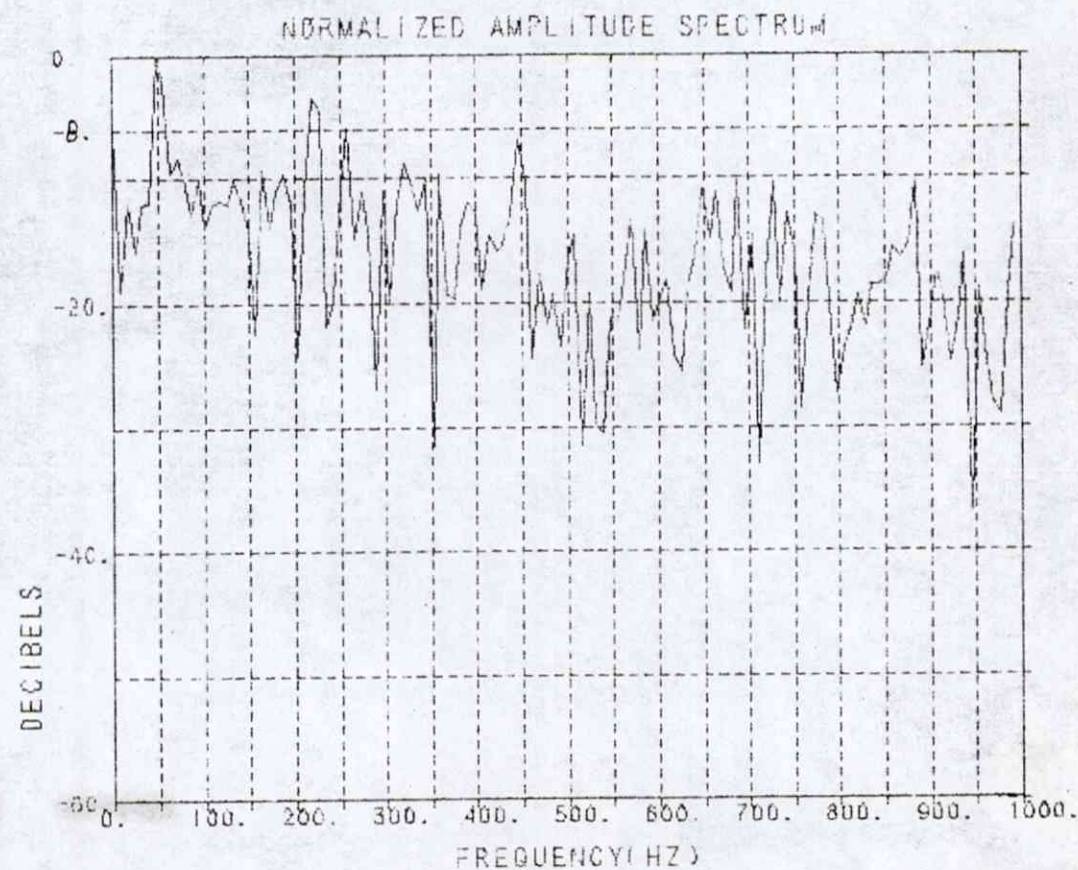
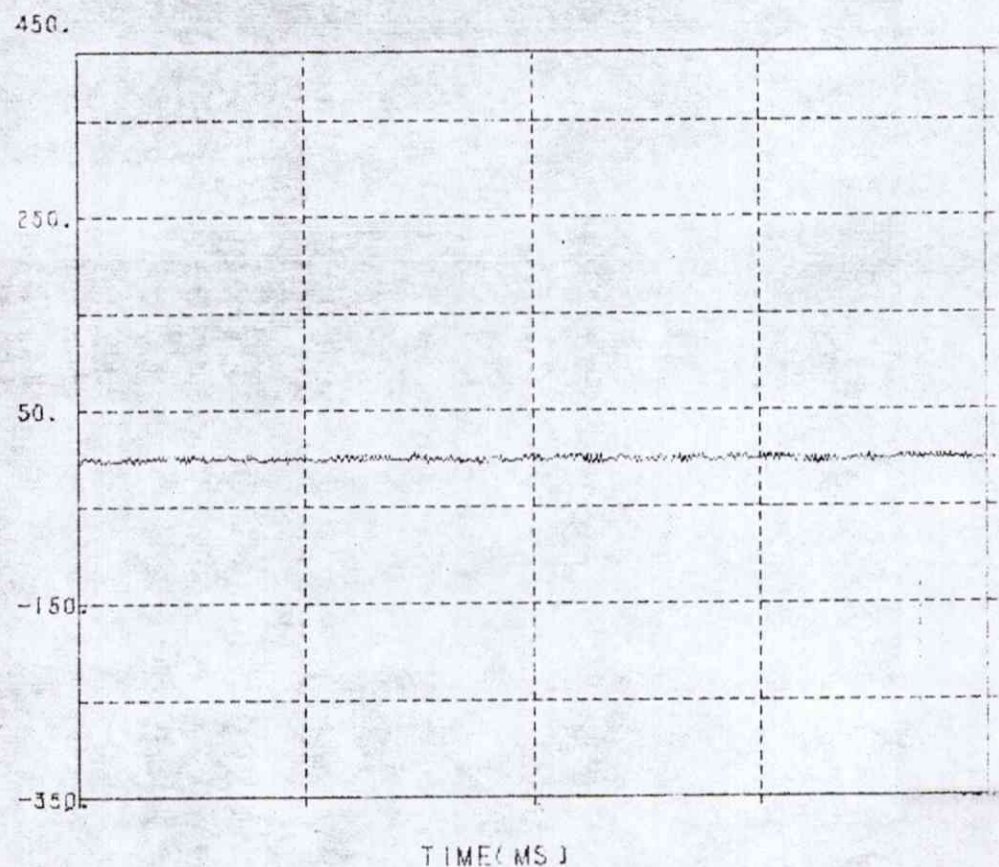
array

GEC0 PULSE TEST

1.6

IDENT 10000 CHANNEL 12

GEC0TEAM TEST FILE 1 TRACE 12 WINDOW 100-200 MS.



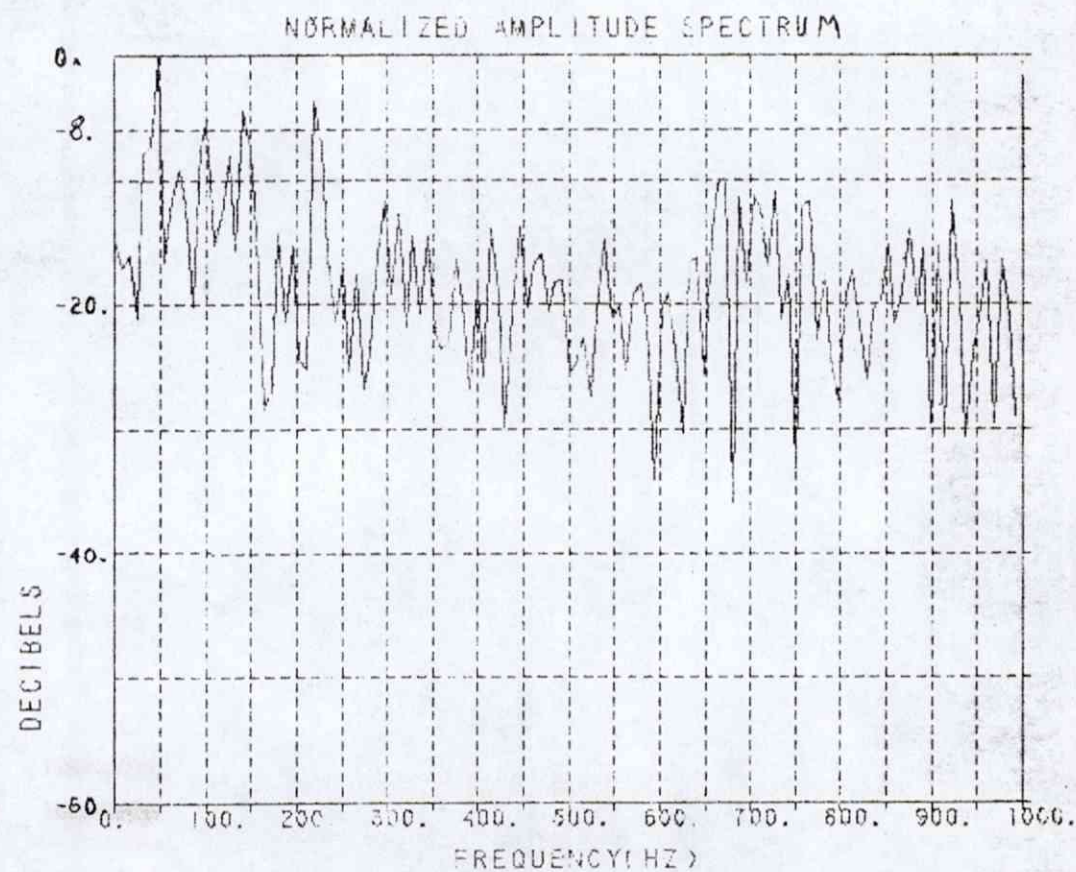
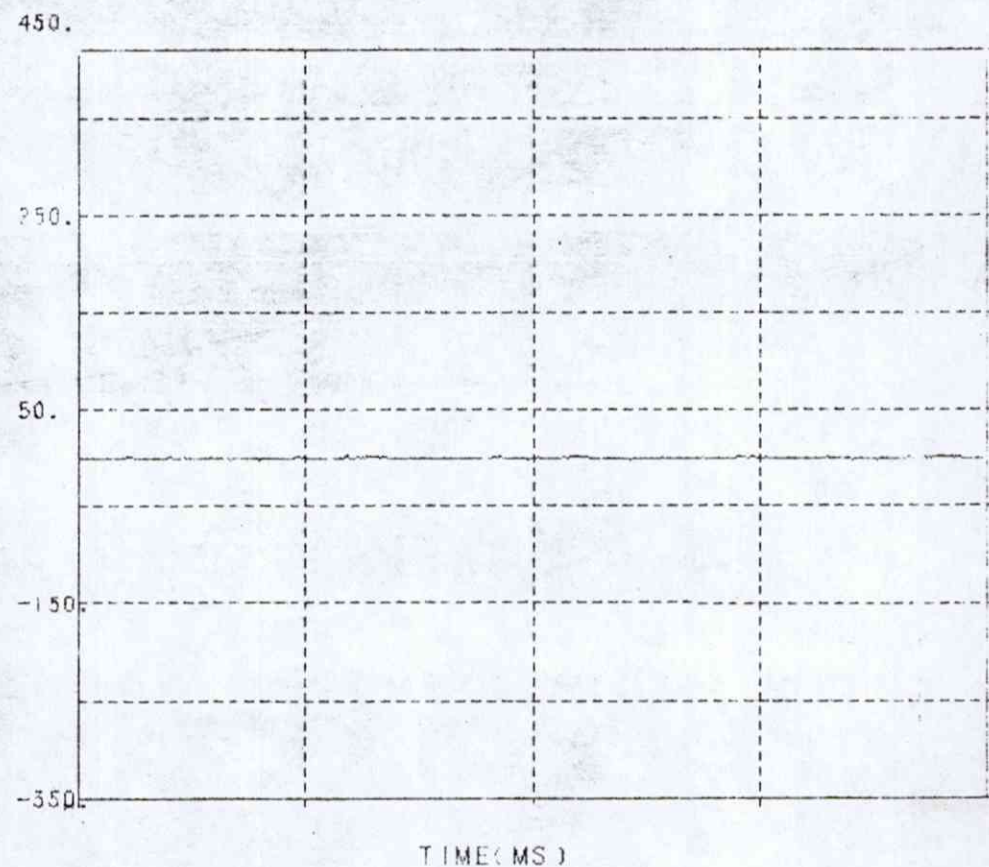
30am spectr loss

GEC0 PULSE TEST

IDENT 10000 CHANNEL 15

1.7

GEOTEAM TEST FILE 1 TRACE 15 WINDOW 100-200 MS.



5 cm. split beam

GECO PULSE TEST

1.8

IDENT 10000 CHANNEL 16

GEOTEAM TEST FILE 1 TRACE 16 WINDOW 100-200 MS.

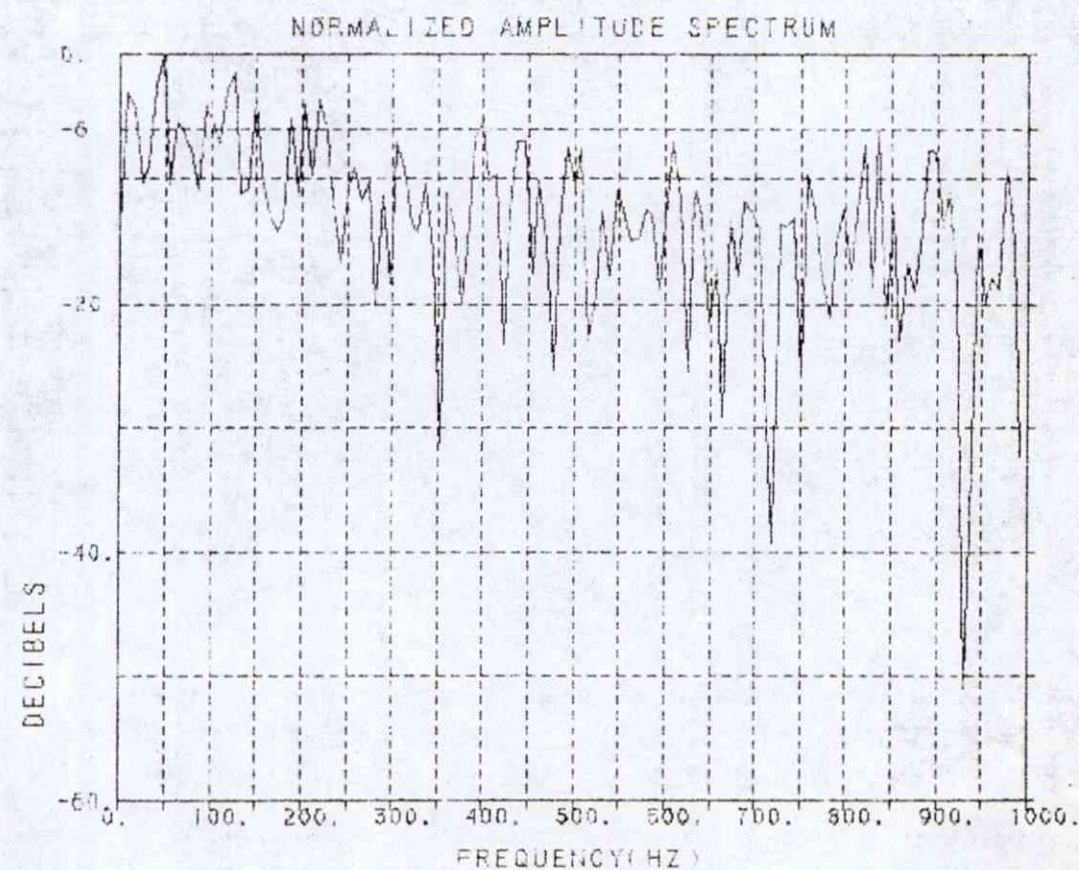
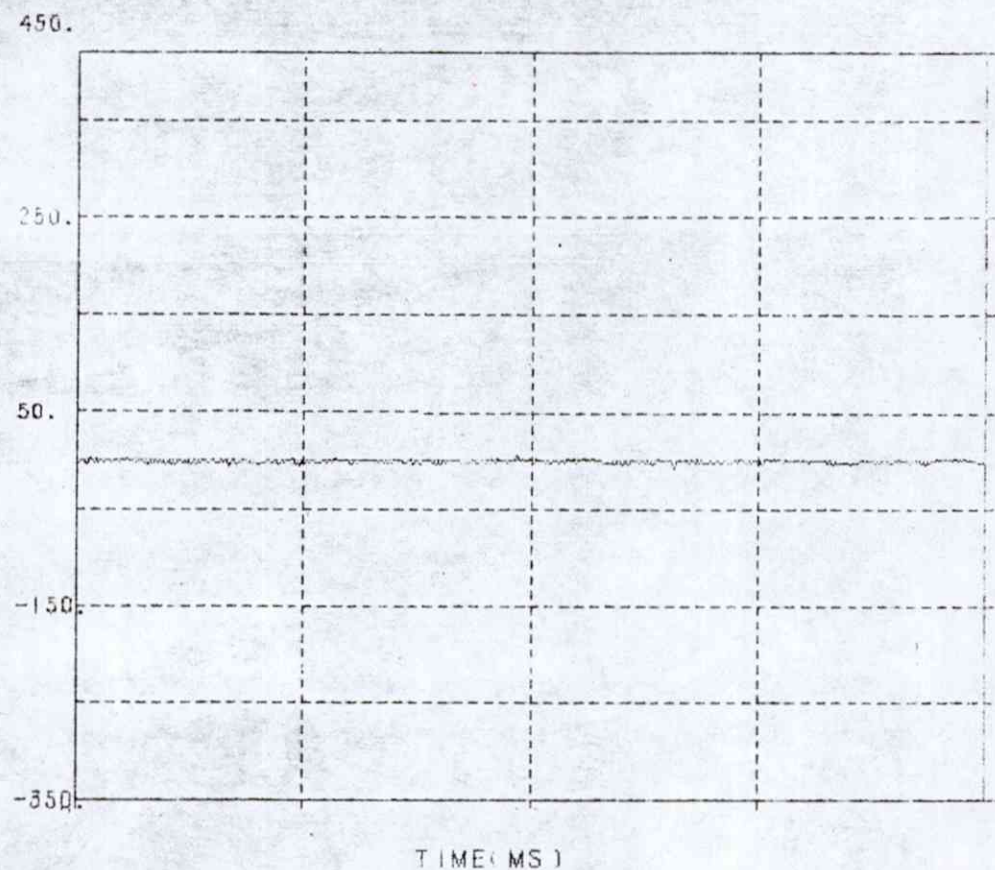


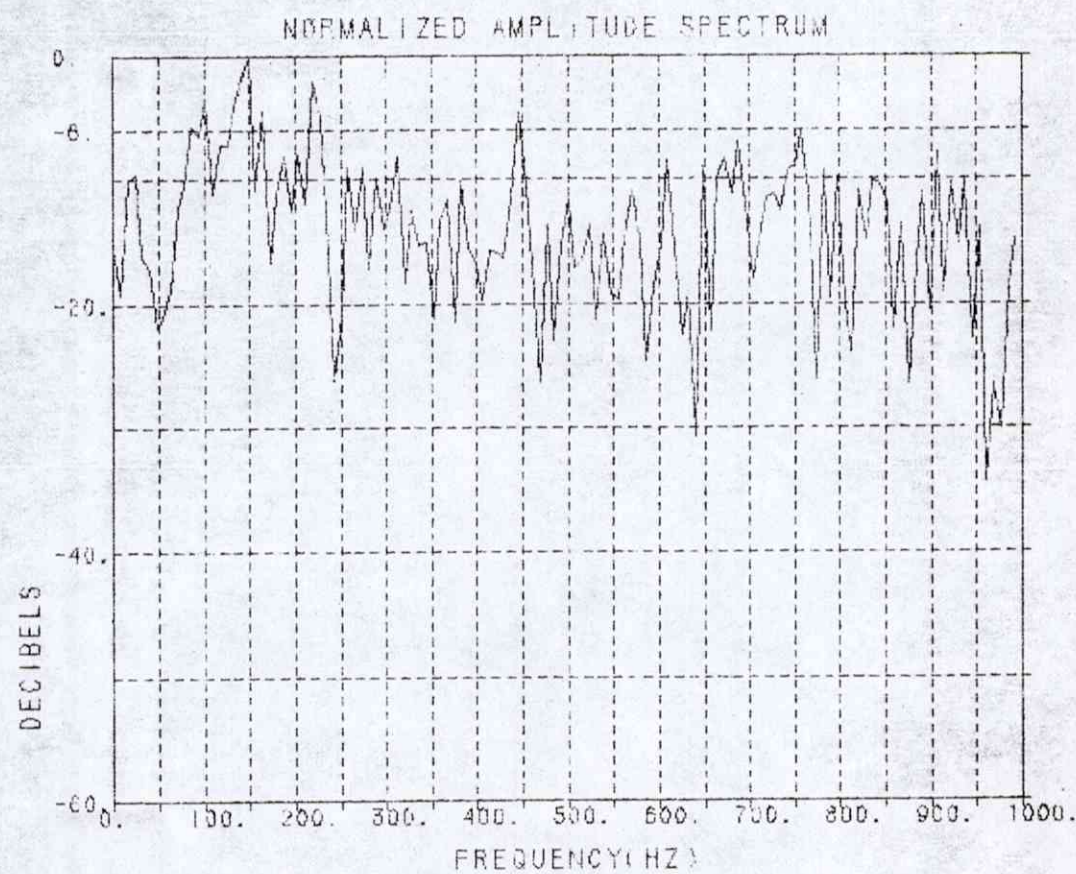
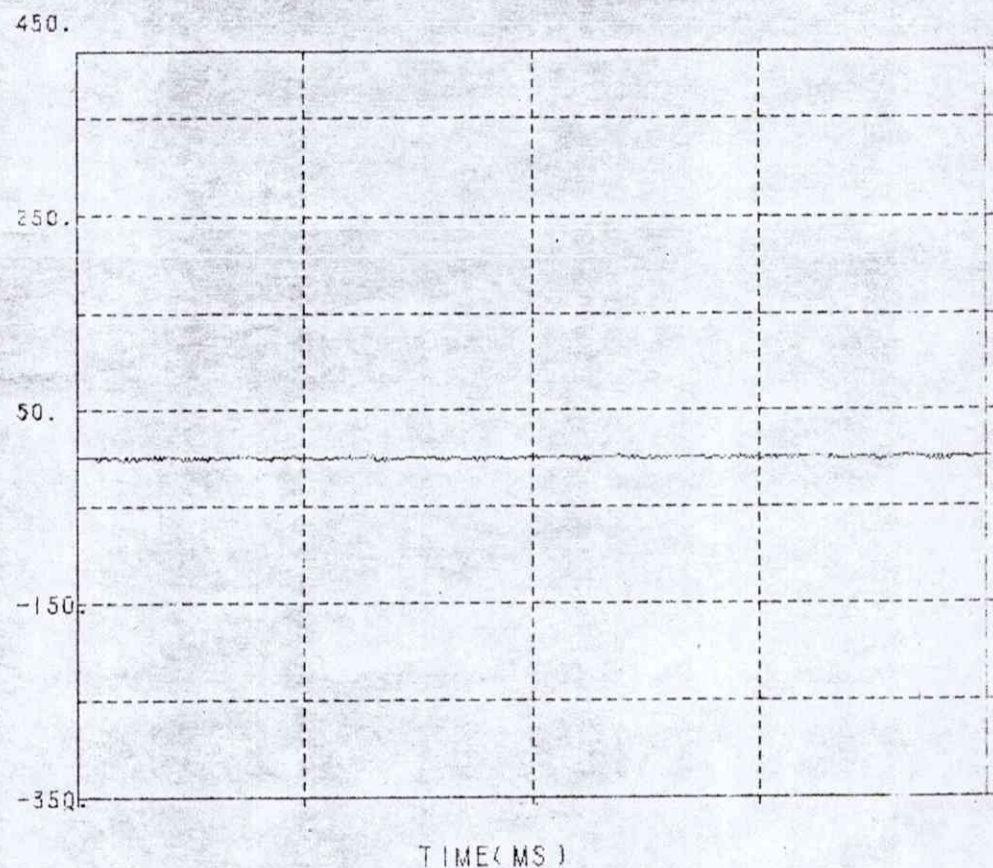
Plate 64m.

GECO PULSE TEST

1.9

IDENT 10000 CHANNEL 18

GECOTEAM TEST FILE 1 TRACE 18 WINDOW 100-200 MS.



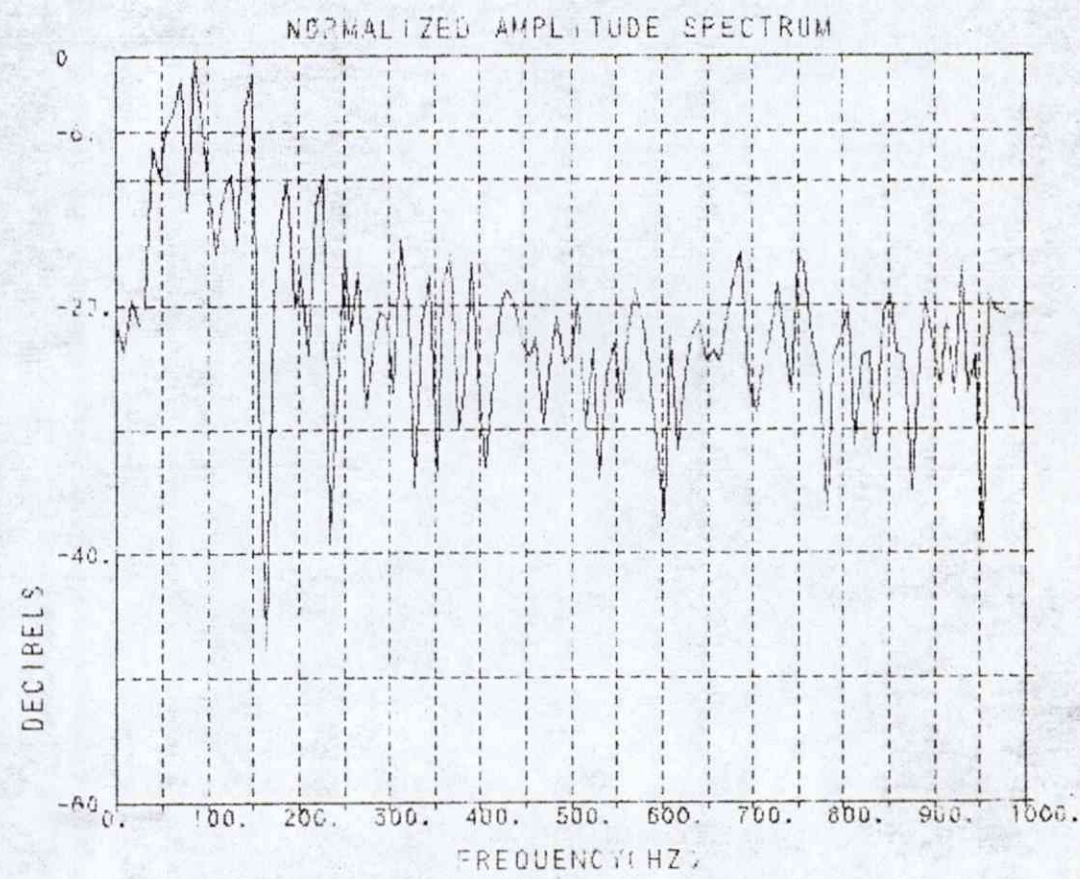
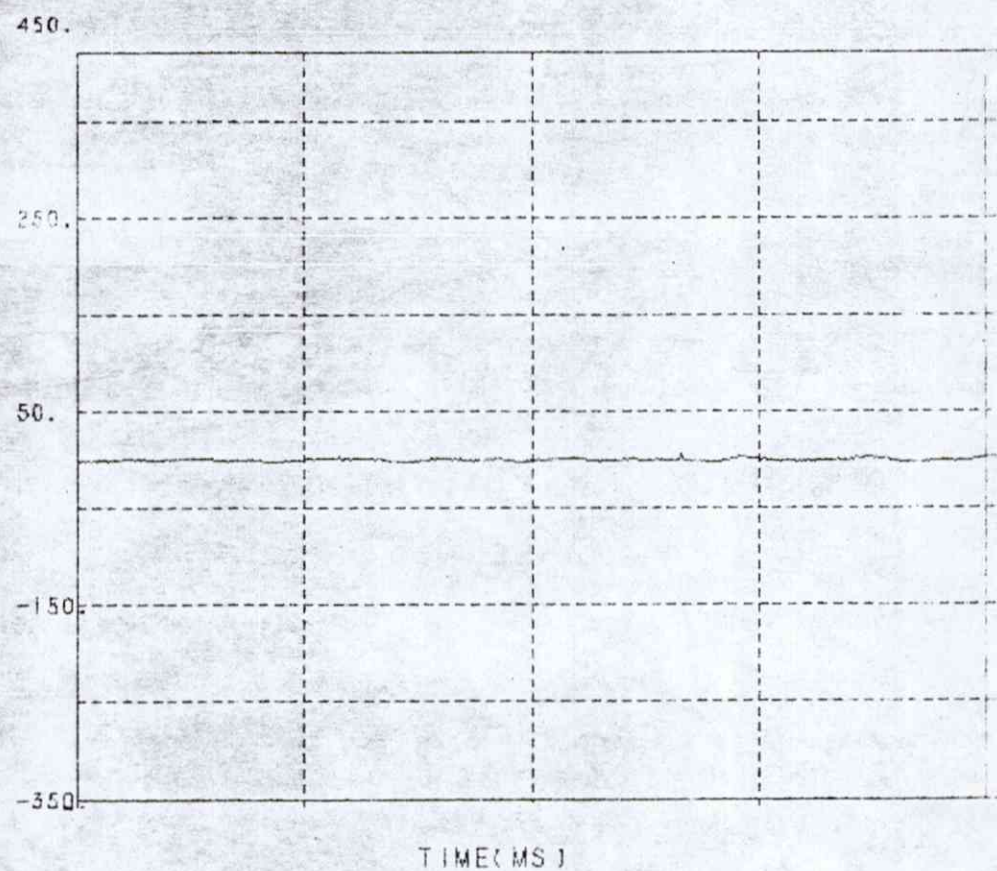
20x15 plate beam.

GECO PULSE TEST

1.10

IDENT 10000 CHANNEL 22

GEOTEAM TEST FILE 1 TRACE 22 WINDOW 100-200 MS.



D 32,5 grain

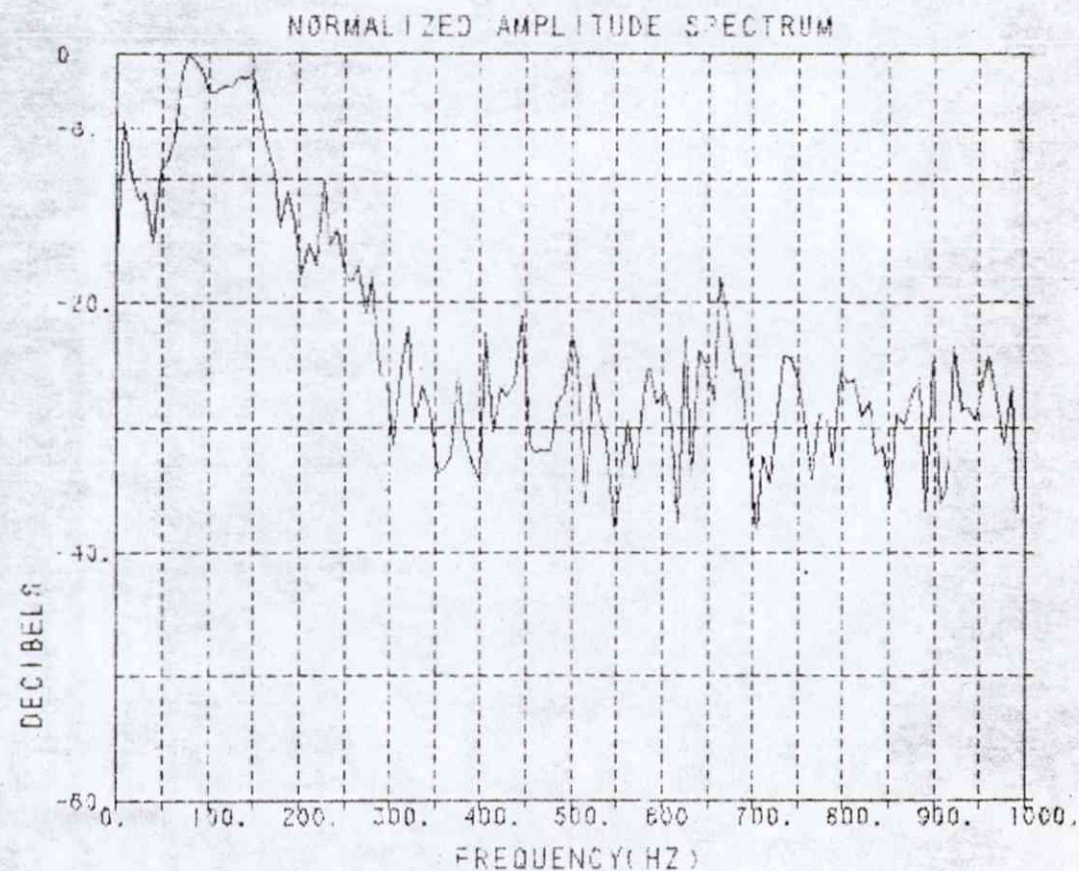
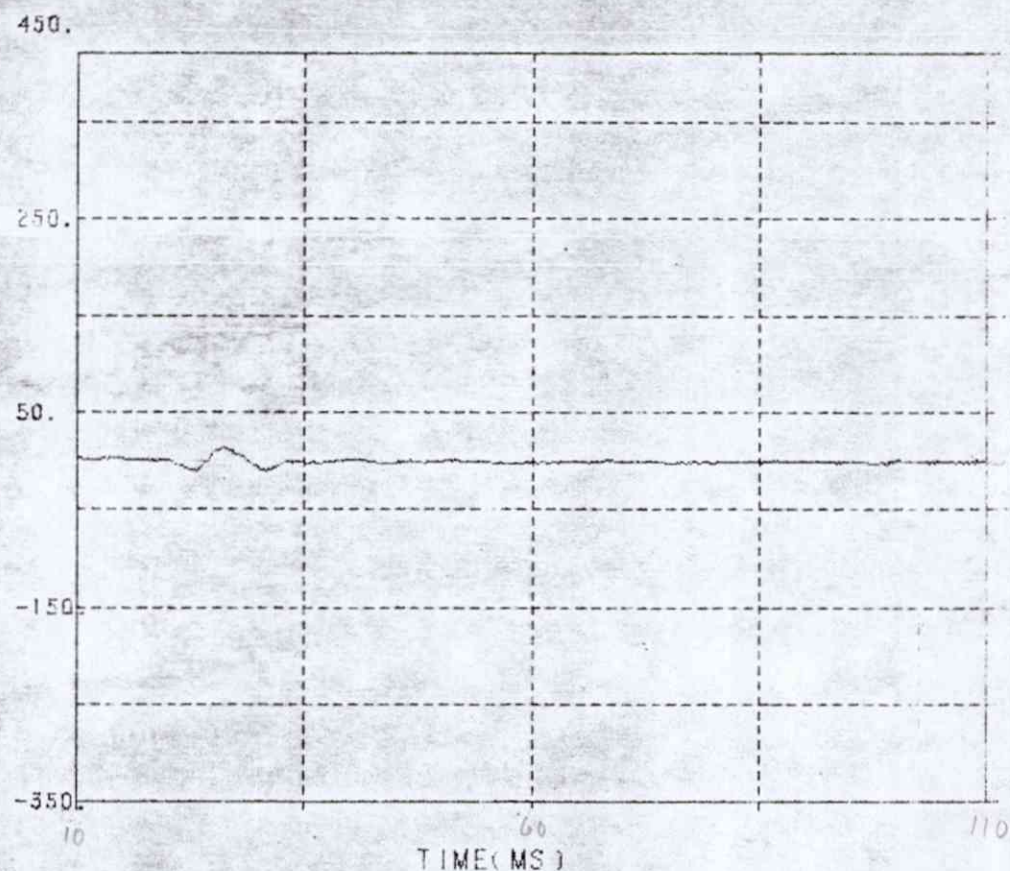
plugs

GECO PULSE TEST

IDENT 30000 CHANNEL 1

1.11

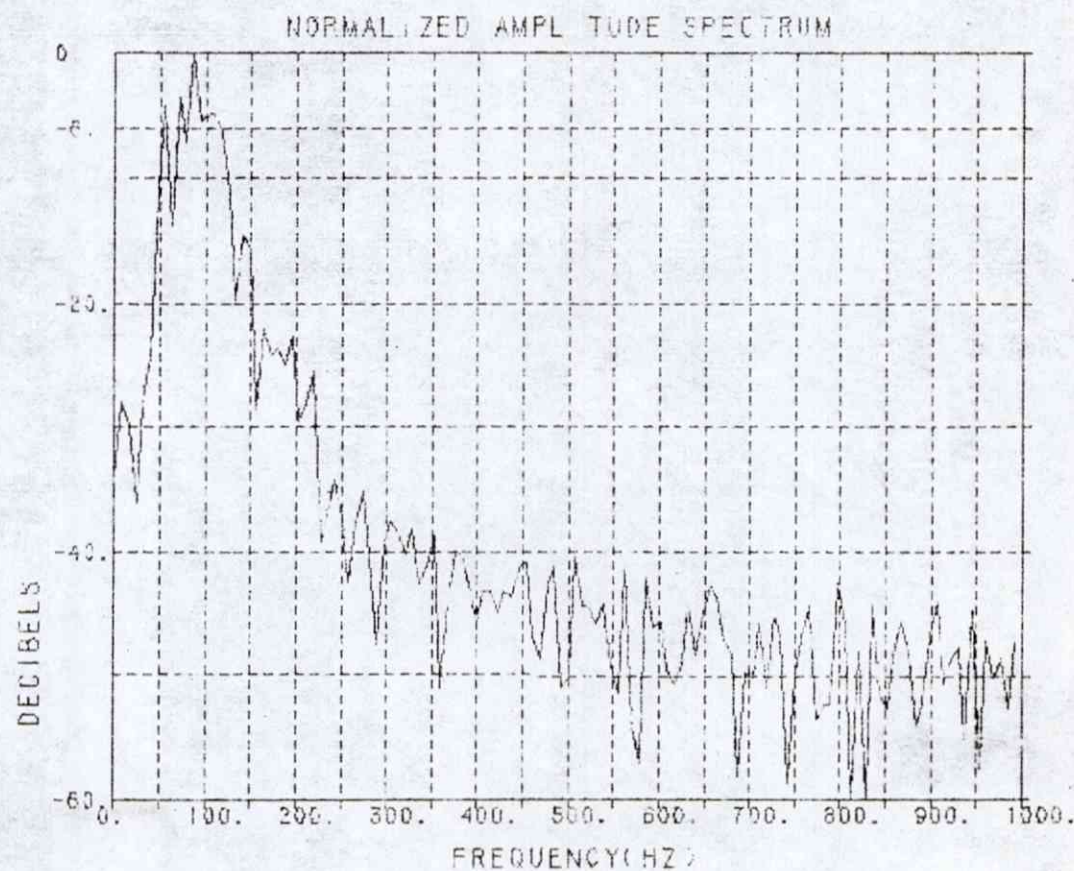
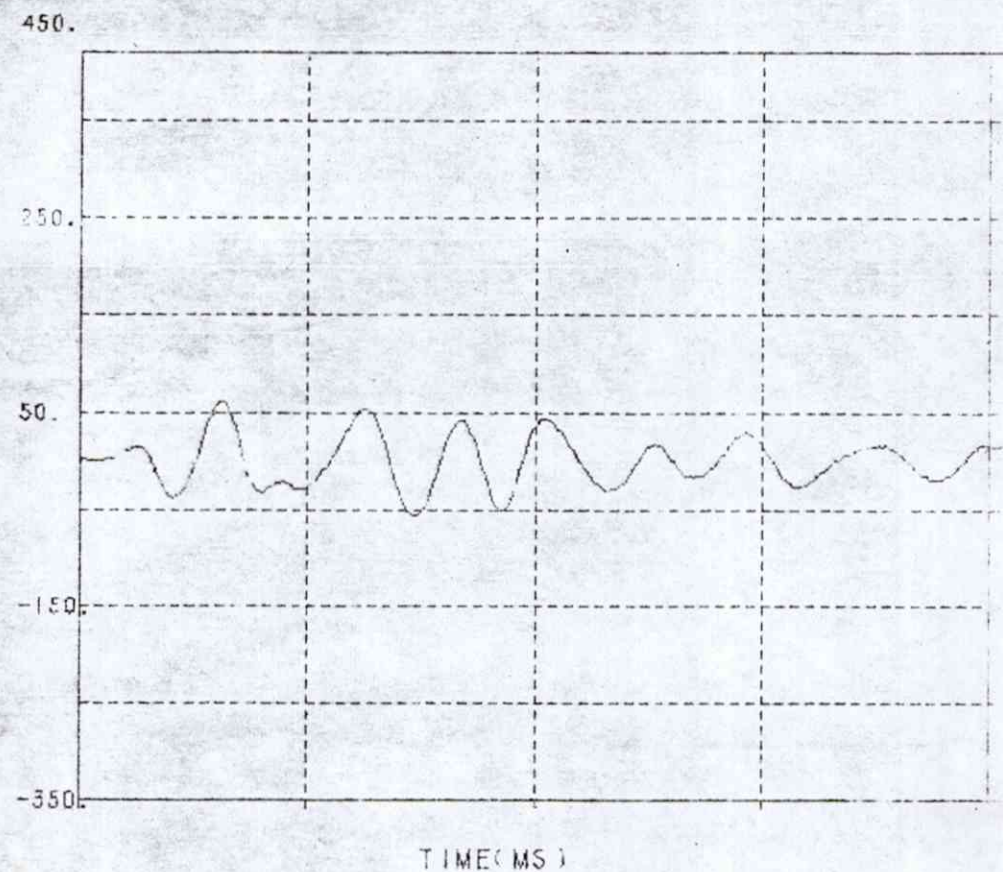
GEOTEAM TEST FILE 3 TRACE 1 WINDOW 10-110 MS.



GECO PULSE TEST

IDENT 20000 CHANNEL 6

GEOTEAM TEST FILE 3 TRACE 6 WINDOW 0-110 MS



tripod fell

32.5g

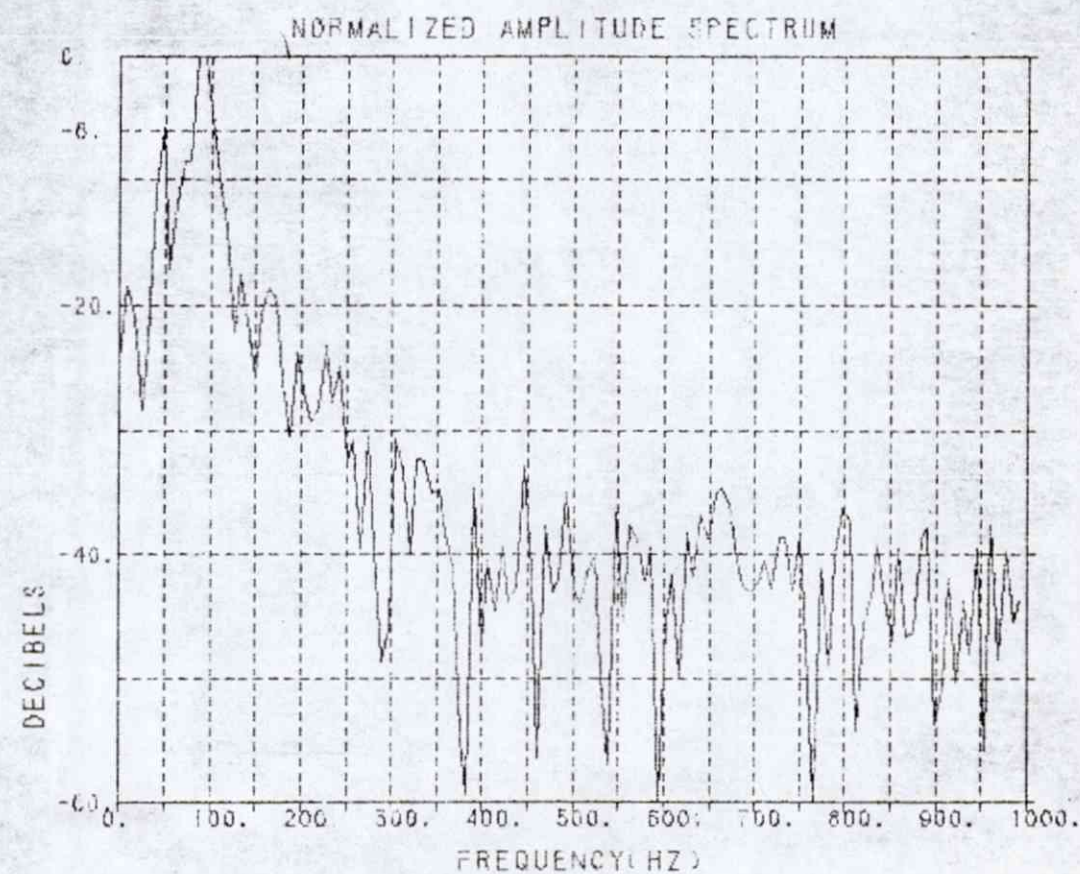
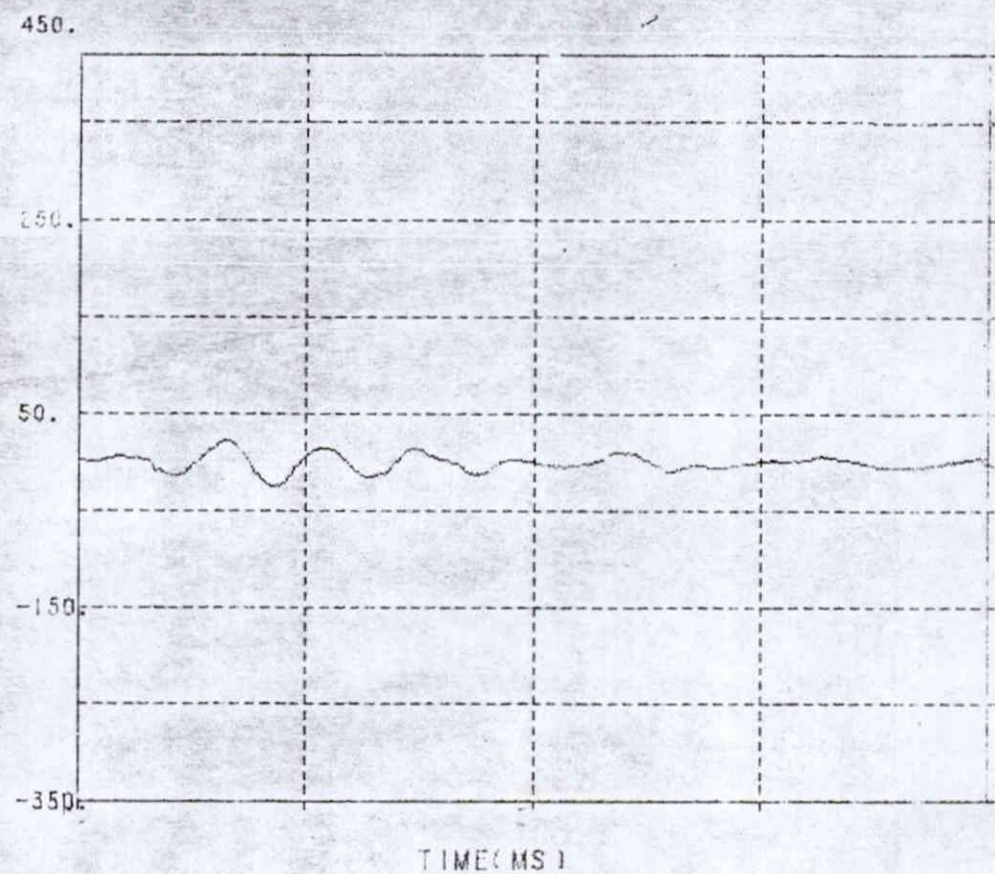
1.12

GECO PULSE TEST

IDENT 30000 CHANNEL 7

1.13

GECOTEST TEST FILE 3 TRACE 7 WINDOW 10-110 MS.

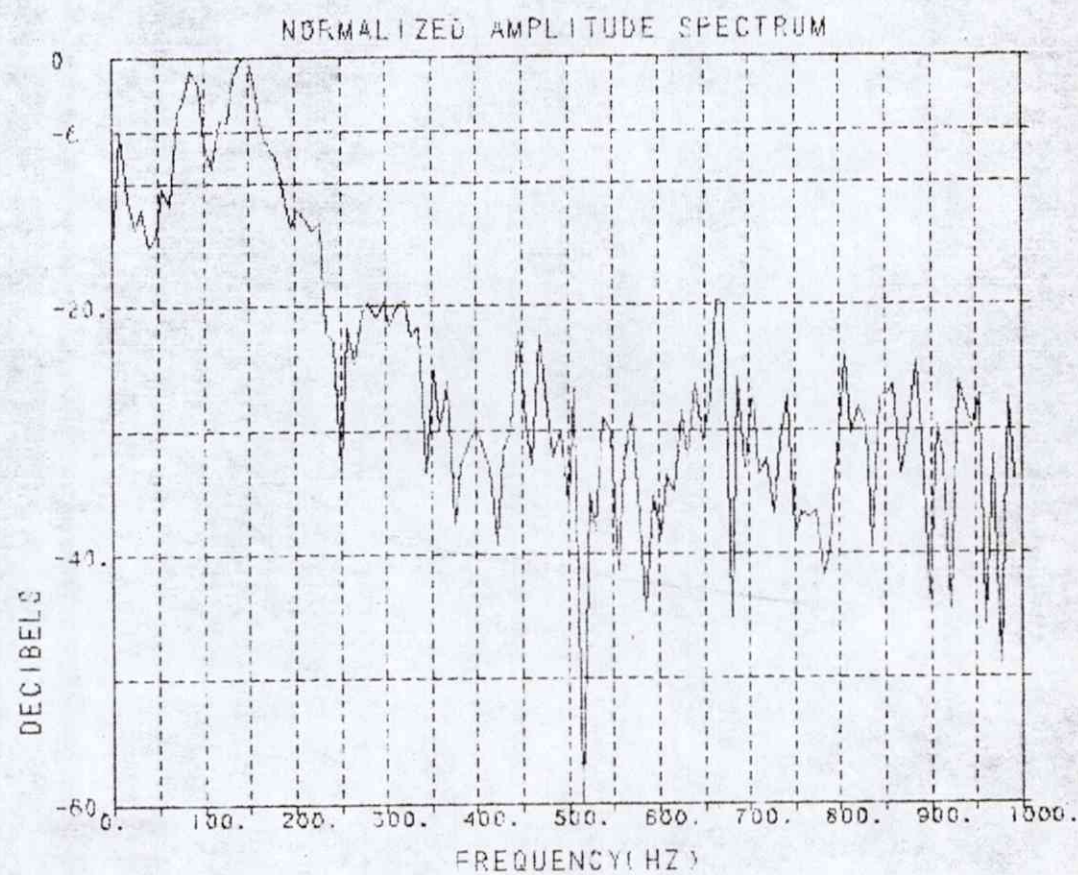
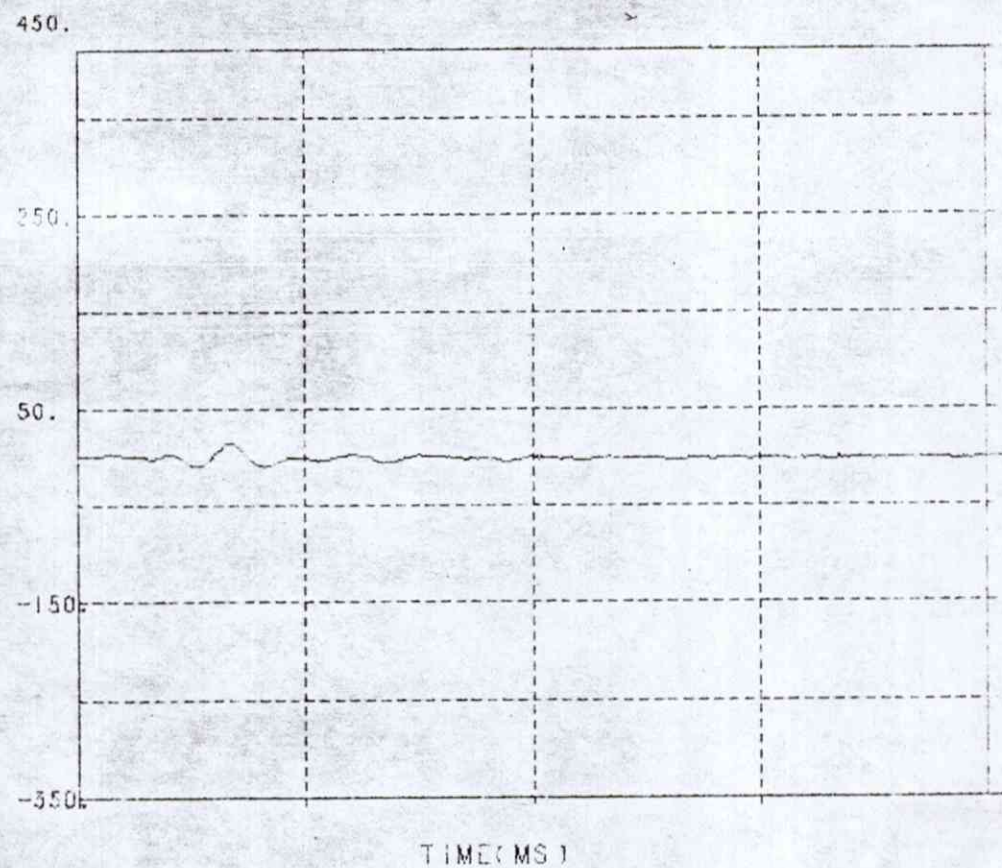


GEC0 PULSE TEST

IDENT 30000 CHANNEL 11

GECTEAM TEST FILE 3 TRACE 11 WINDOW 10-110 MS.

1.14

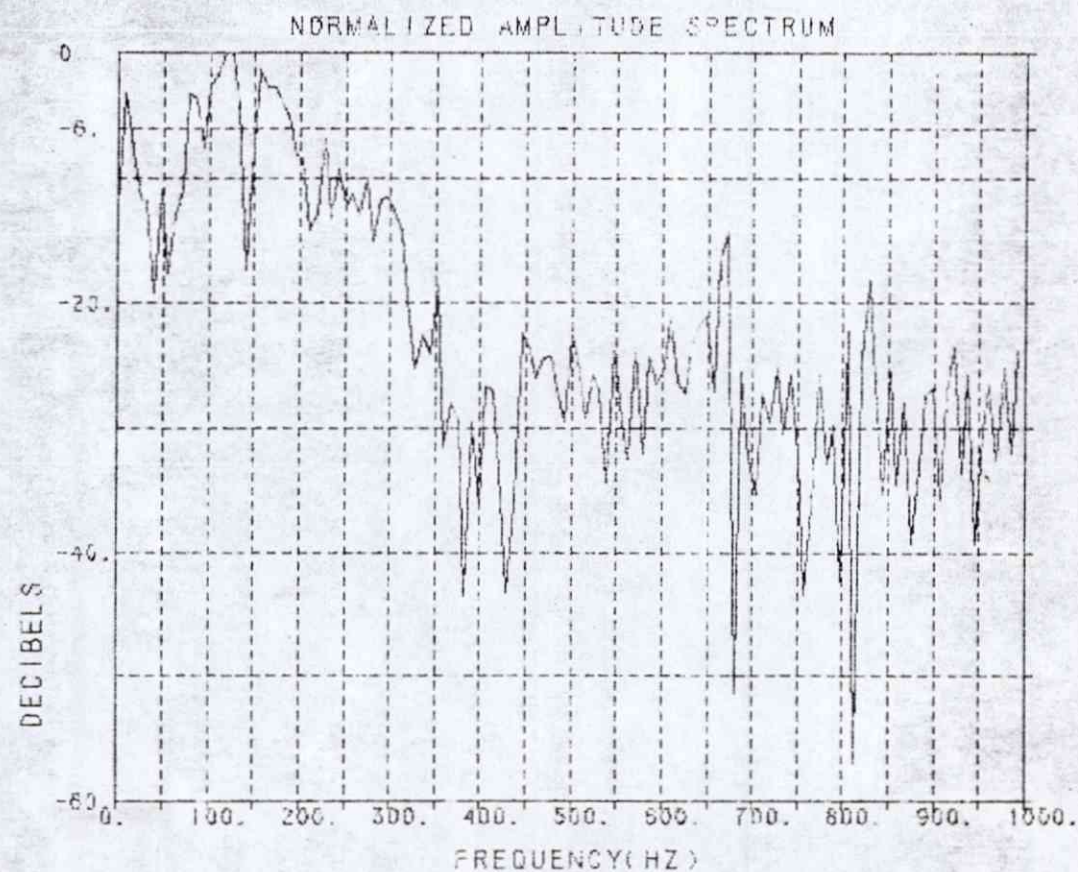
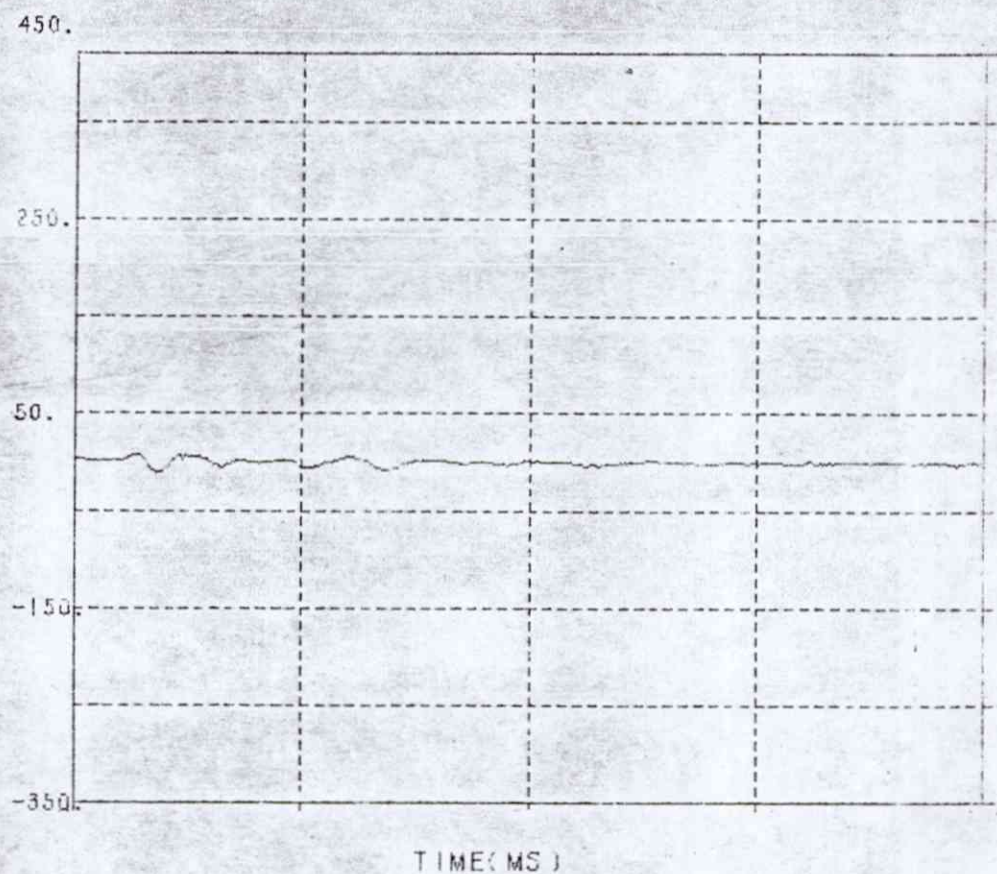


GEC3 PULSE TEST

IDENT 30000 CHANNEL 12

1.15

GEOTEAM TEST FILE 3 TRACE 12 WINDOW 10-110 MS.

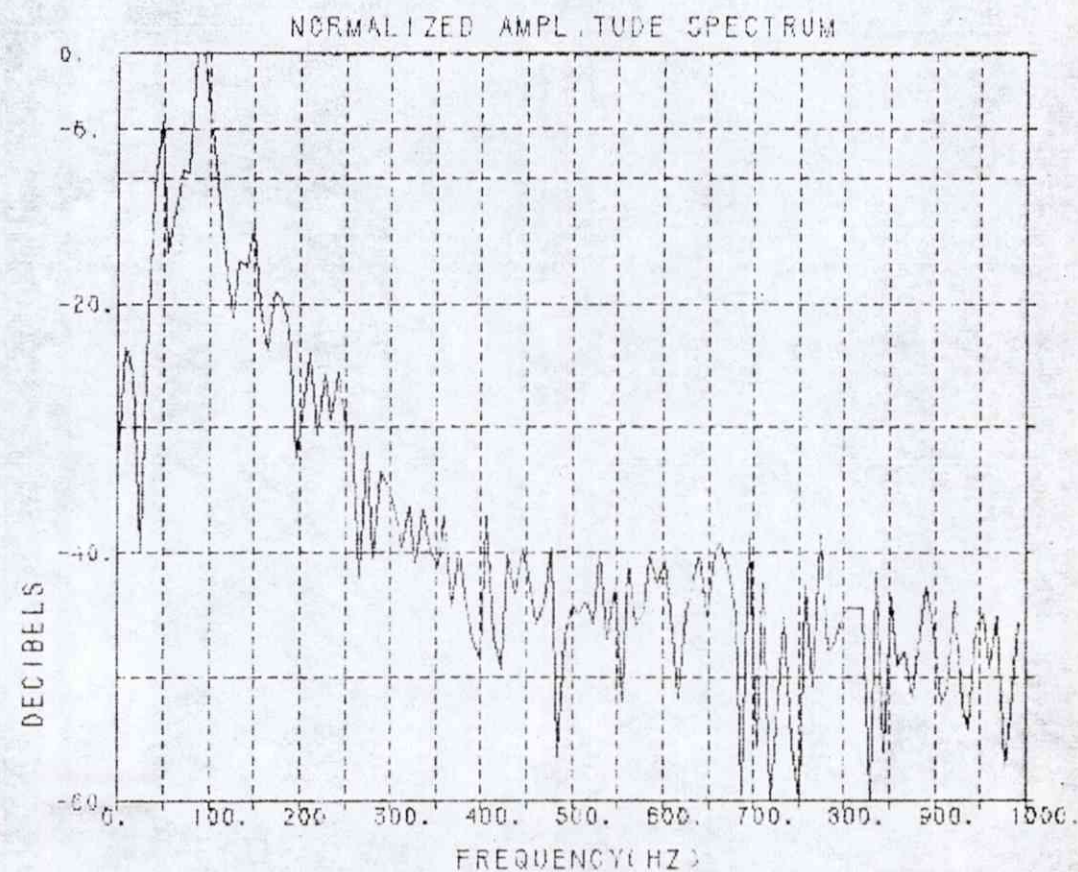
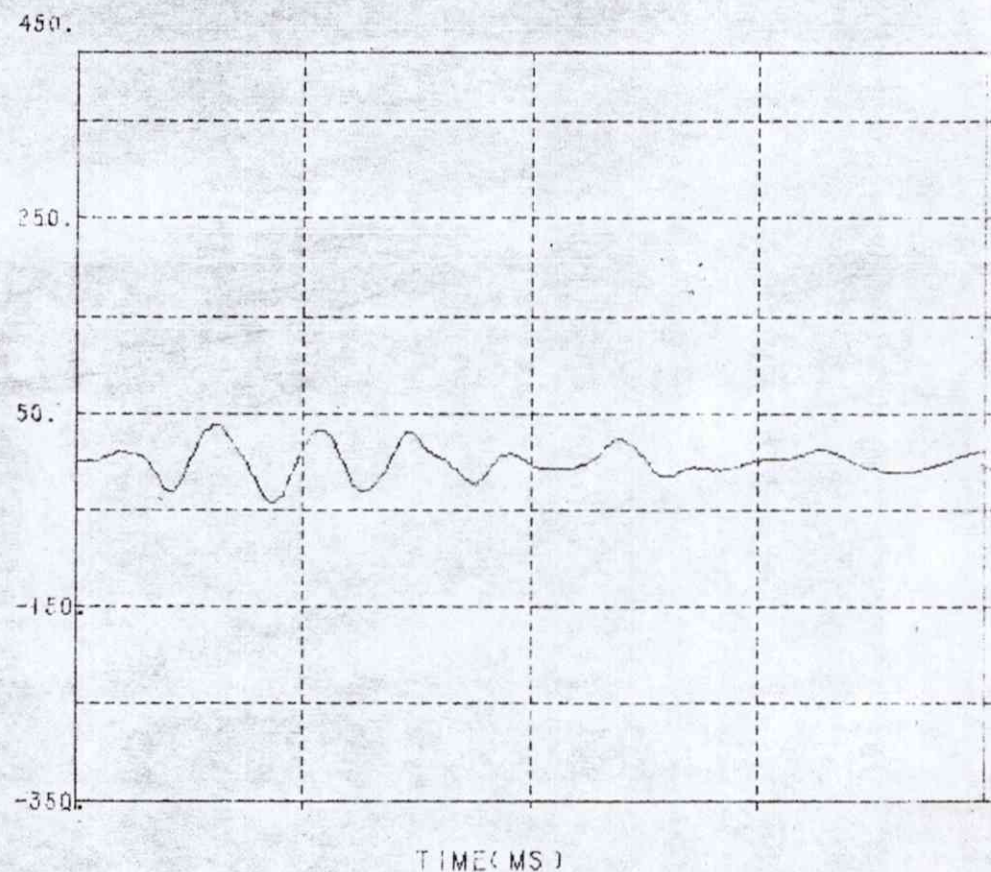


GECO PULSE TEST

IDENT 30000 CHANNEL 15

GEOTEAM TEST FILE 3 TRACE 15 WINDOW 10-110 MS.

1.16

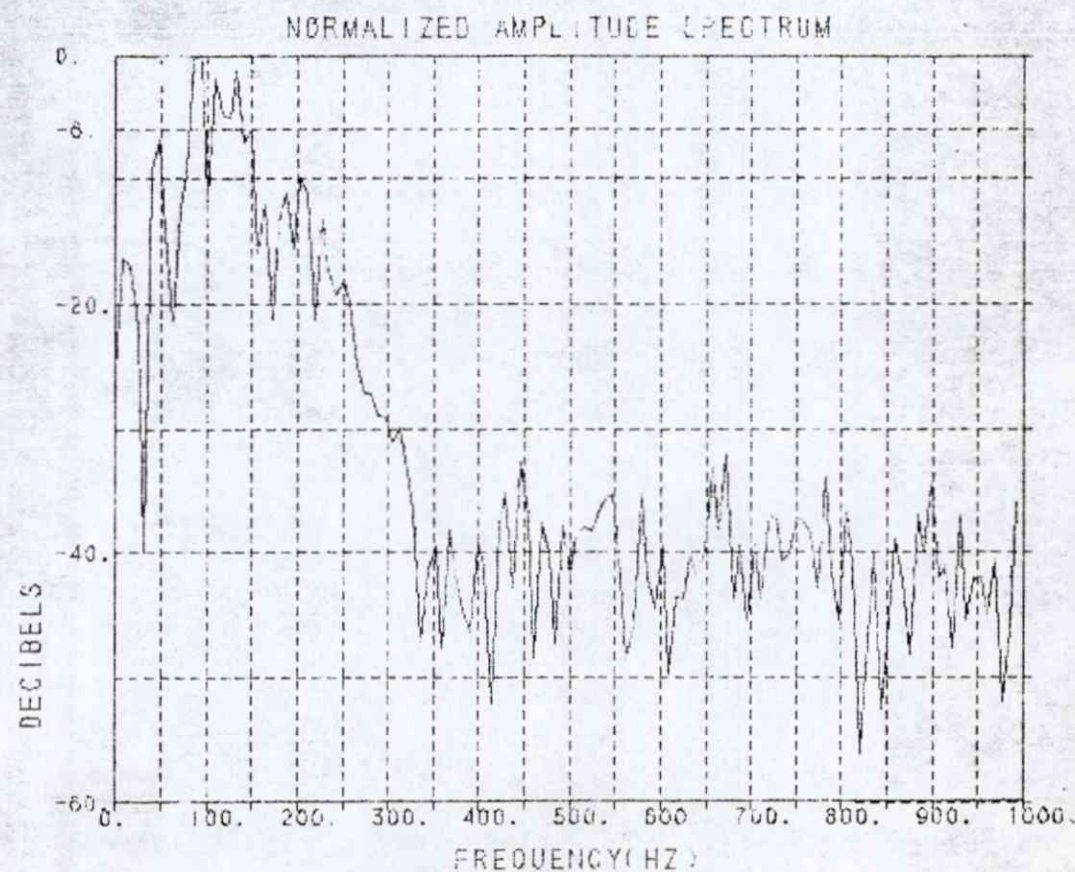
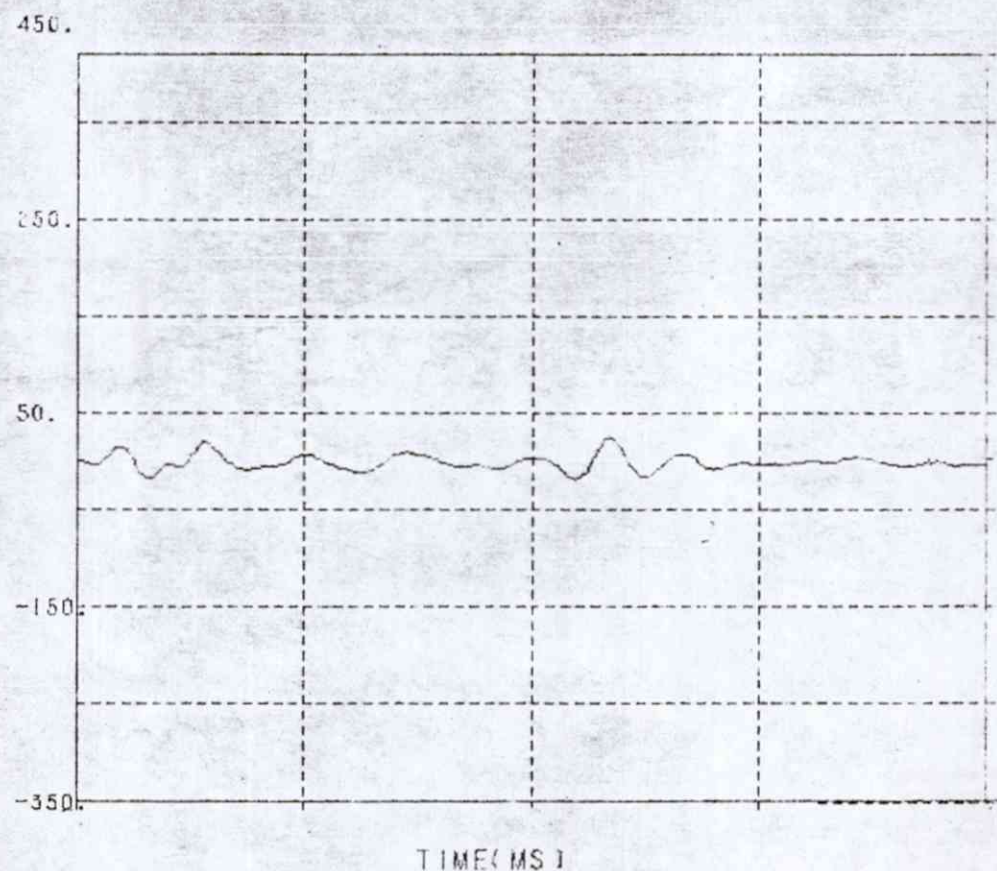


GECO PULSE TEST

IDENT 30000 CHANNEL 19

GEOTEAM TEST FILE 3 TRACE 19 WINDOW 10-110 MS.

1.17

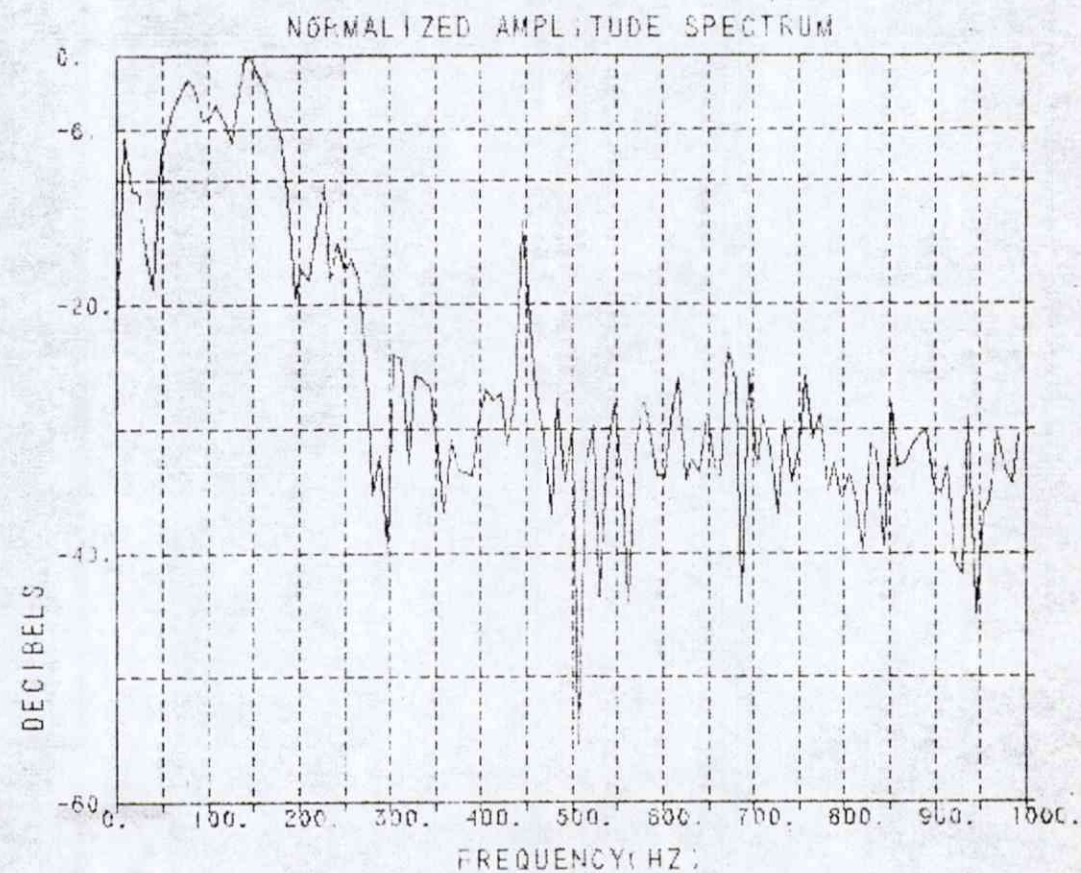
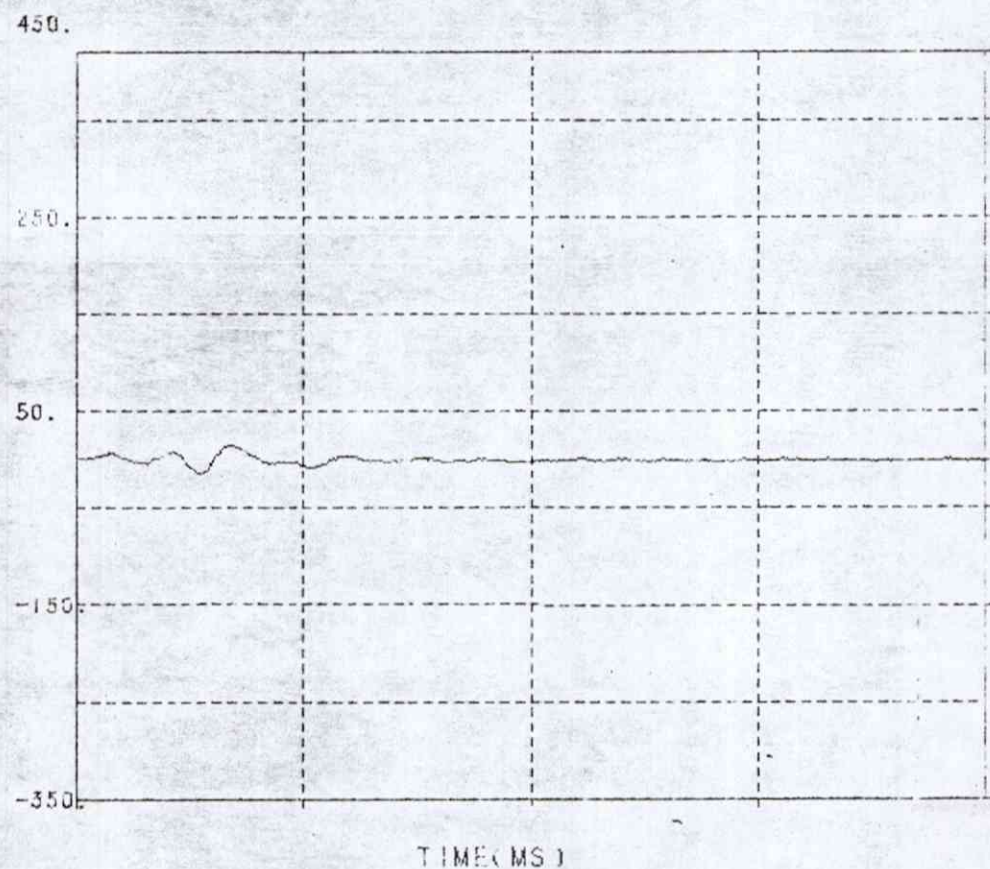


GECO PULSE TEST

IDENT 40000 CHANNEL 1

GEOTEAM TEST FILE 4 TRACE 1 WINDOW 10-110 MS.

1.18

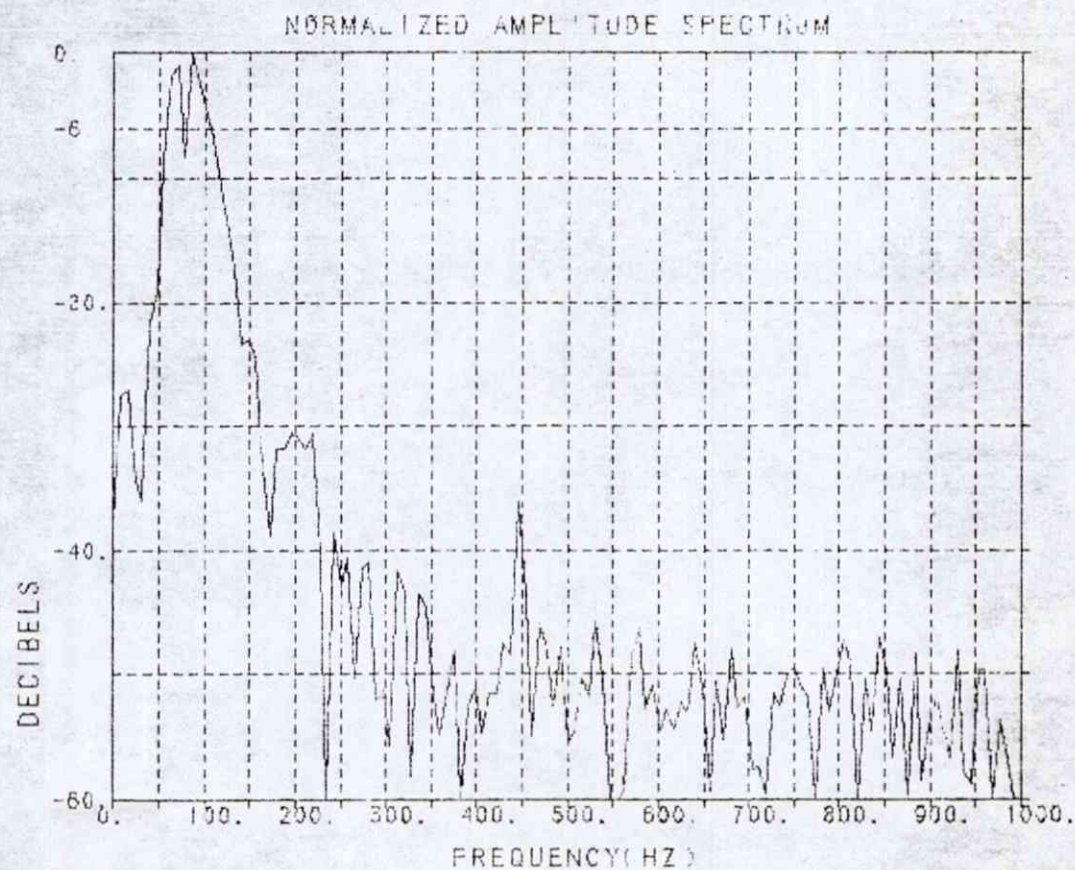
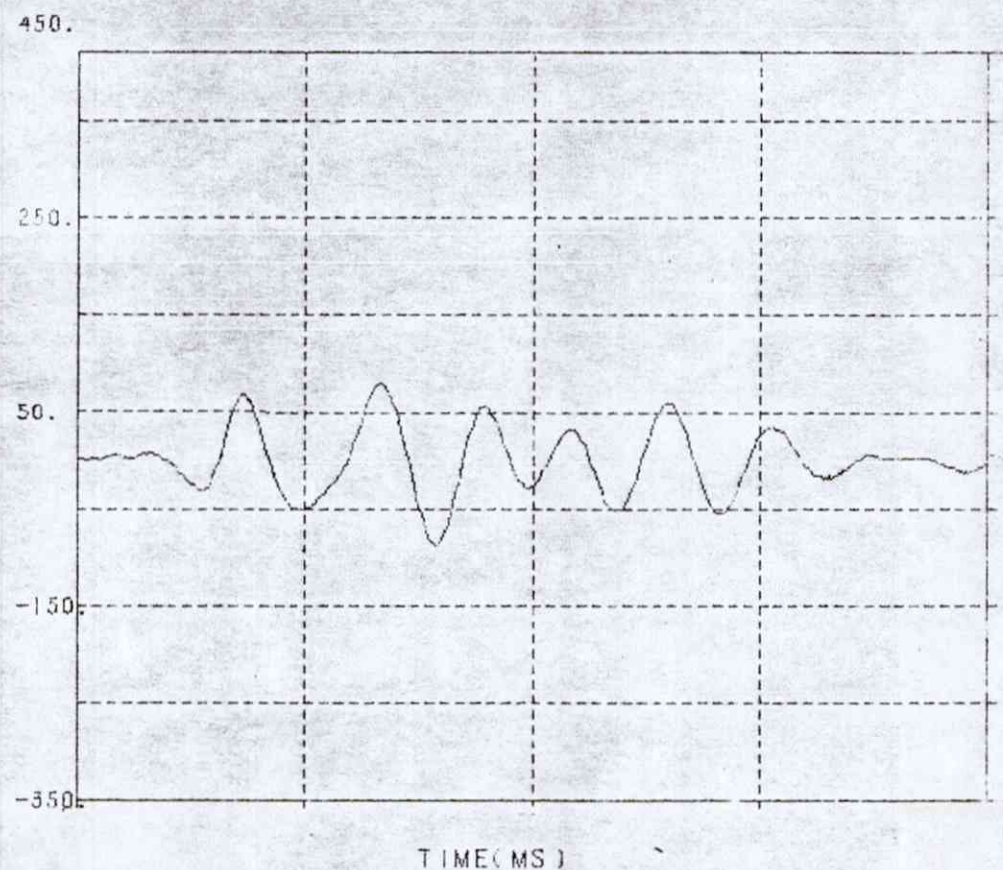


GECO PULSE TEST

IDENT 40000 CHANNEL 6

GECOTEAM TEST FILE 4 TRACE 6 WINDOW 10-110 MS.

1.19

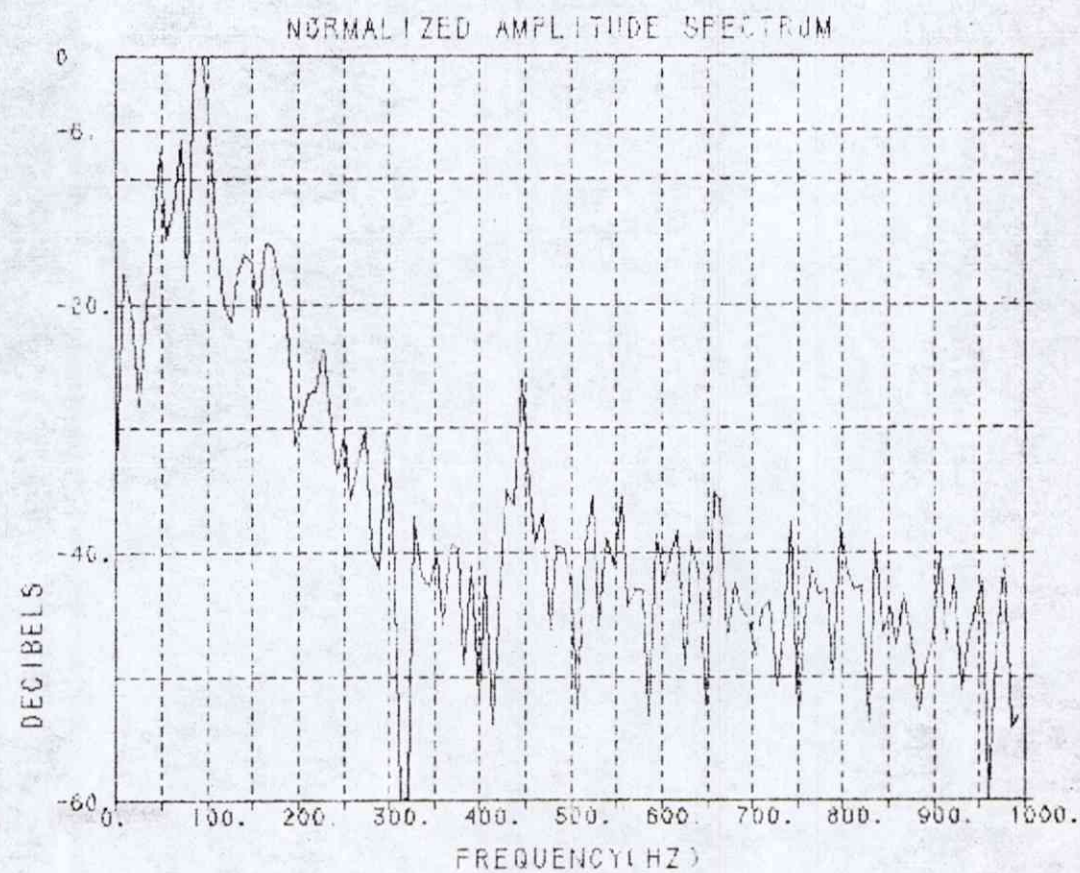
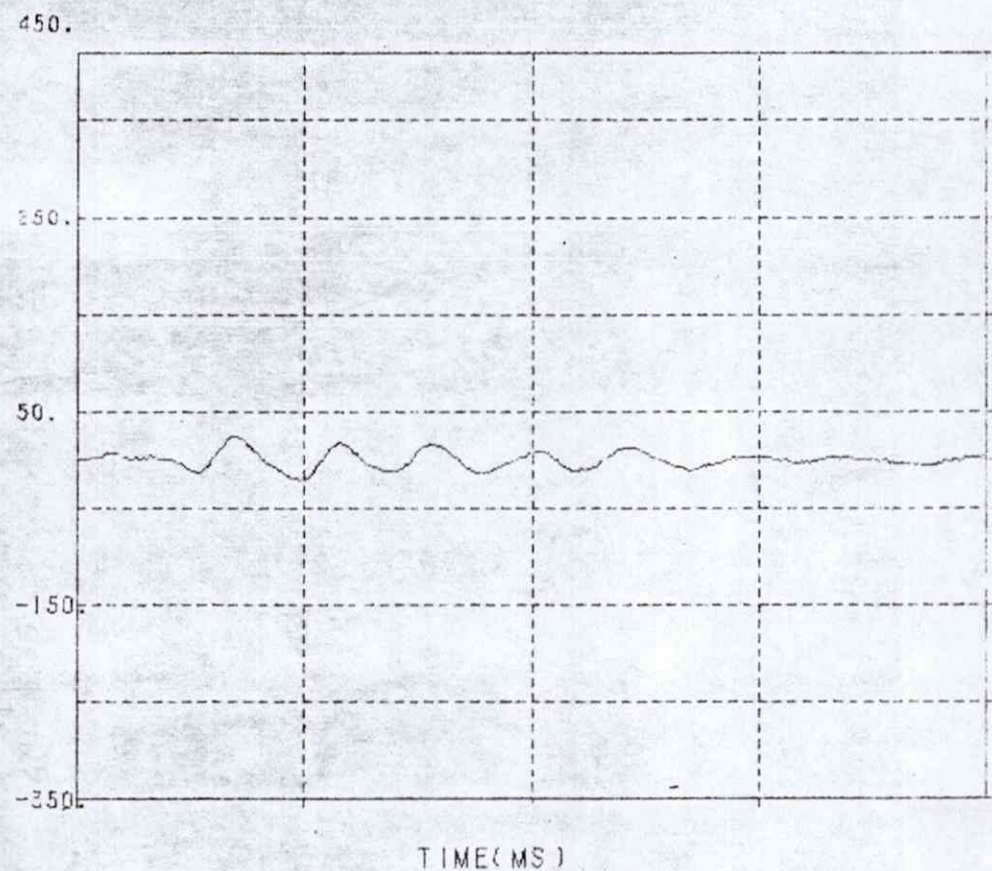


GECØ PULSE TEST

IDENT 40000 CHANNEL 7

GECTEAM TEST FILE 4 TRACE 7 WINDOW 10-110 MS.

1.20



GEC0 PULSE TEST

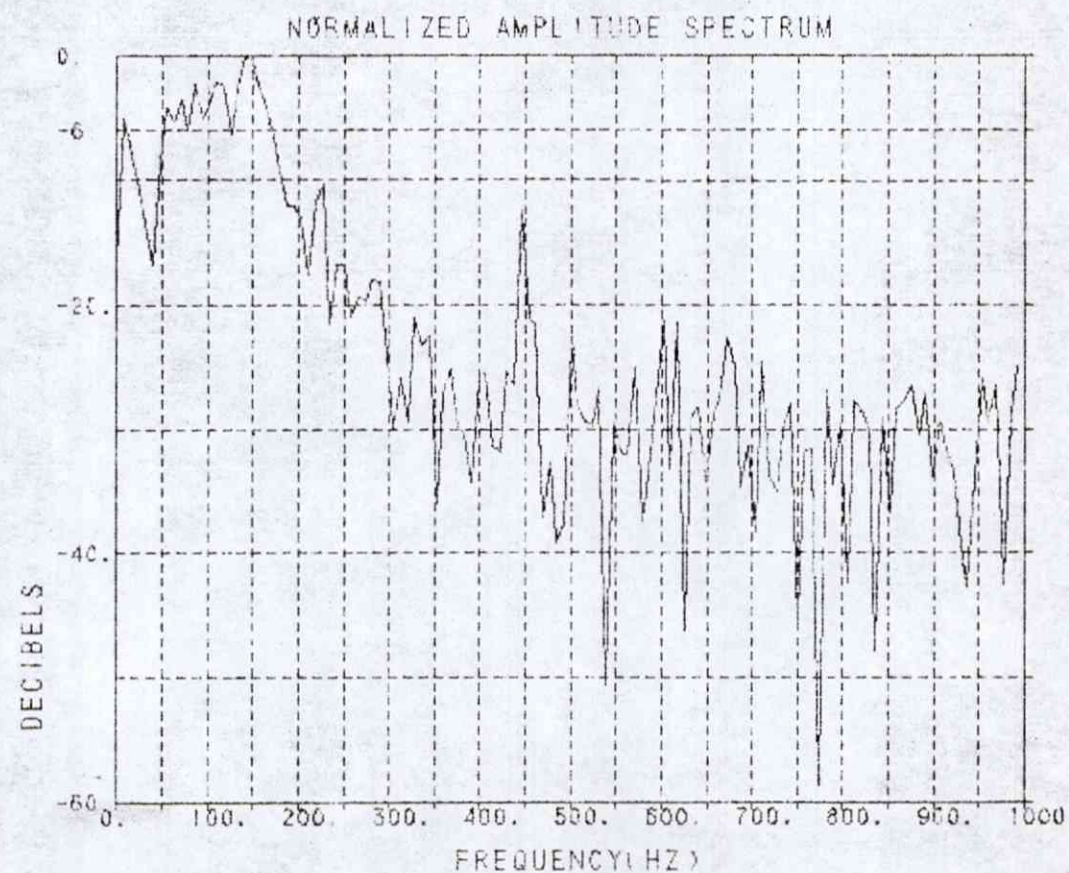
IDENT 40000 CHANNEL 11

1.21

GEOTEAM TEST FILE 4 TRACE 11 WINDOW 10-110 MS.



TIME (MS)

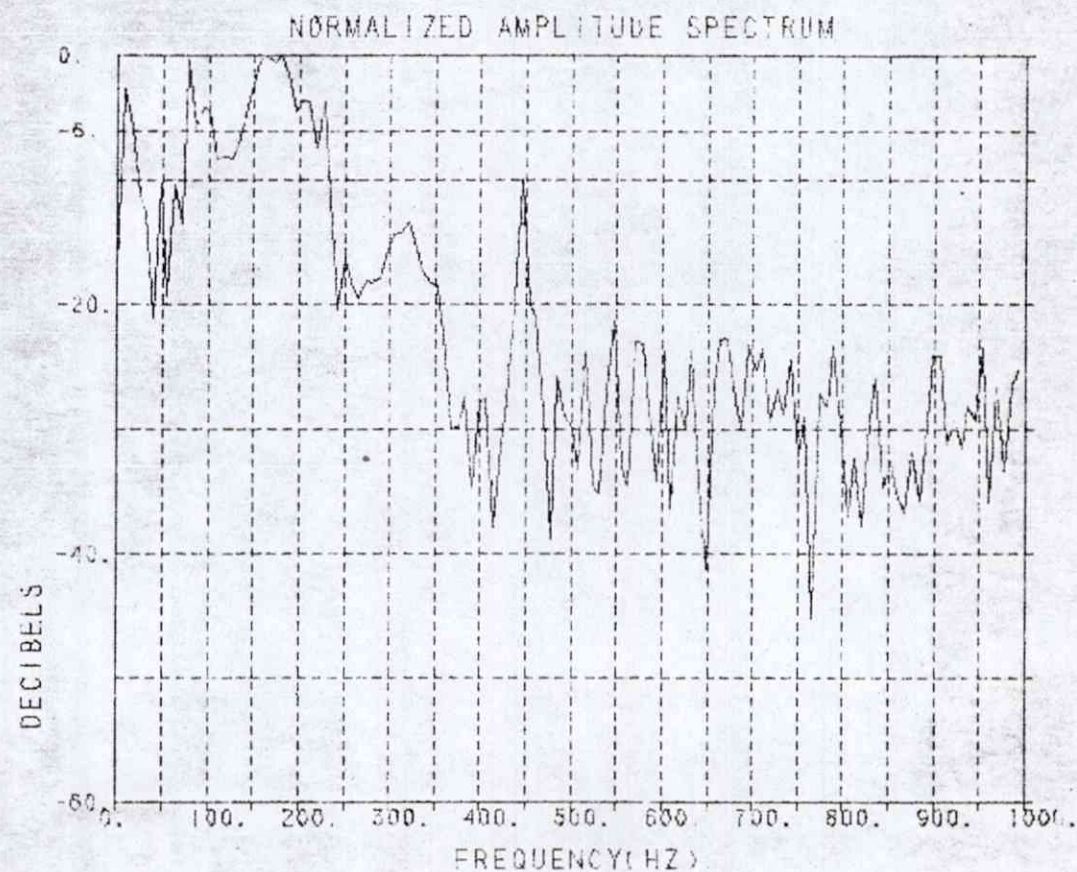
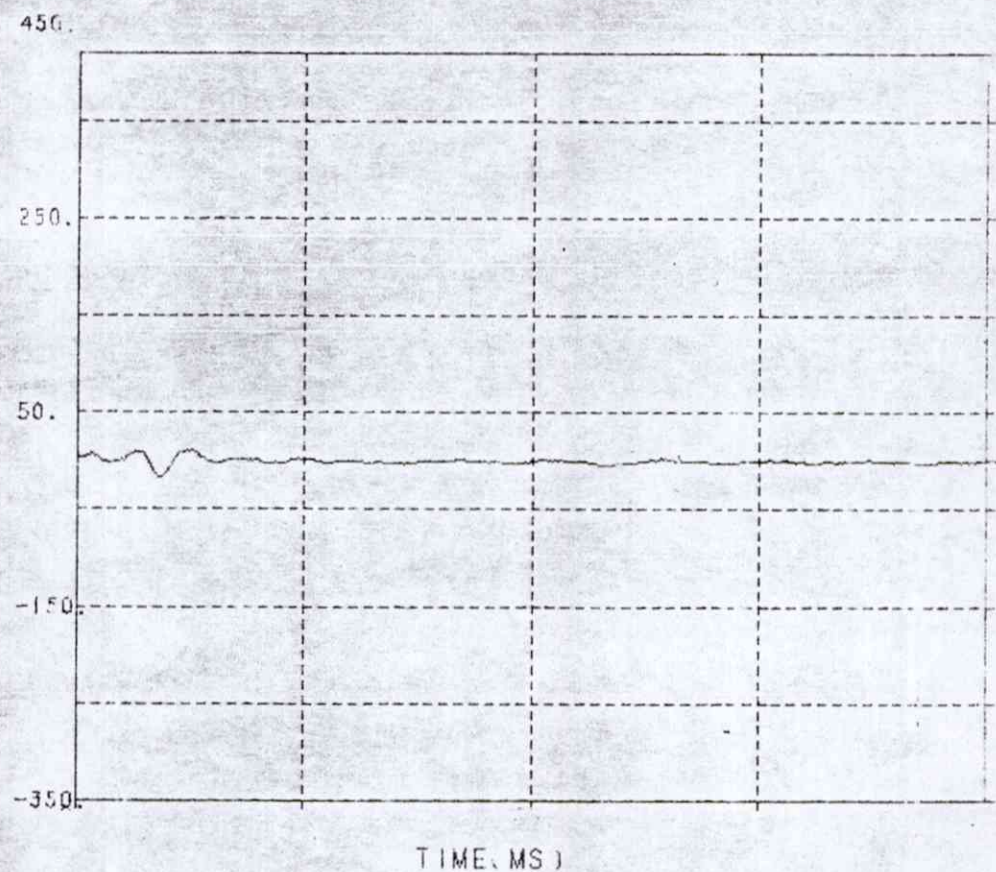


GECO PULSE TEST

IDENT 40000 CHANNEL 12

1.22

GEC TEAM TEST FILE 4 TRACE 12 WINDOW 10-110 MS

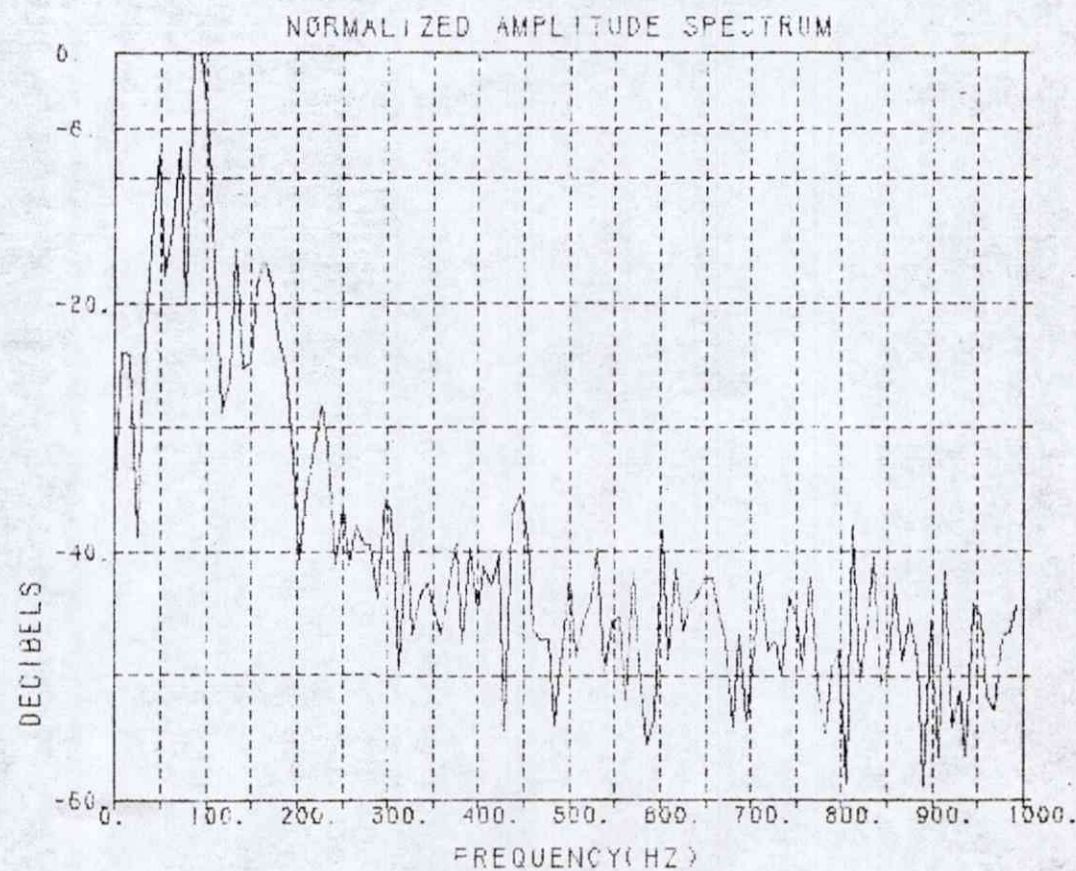
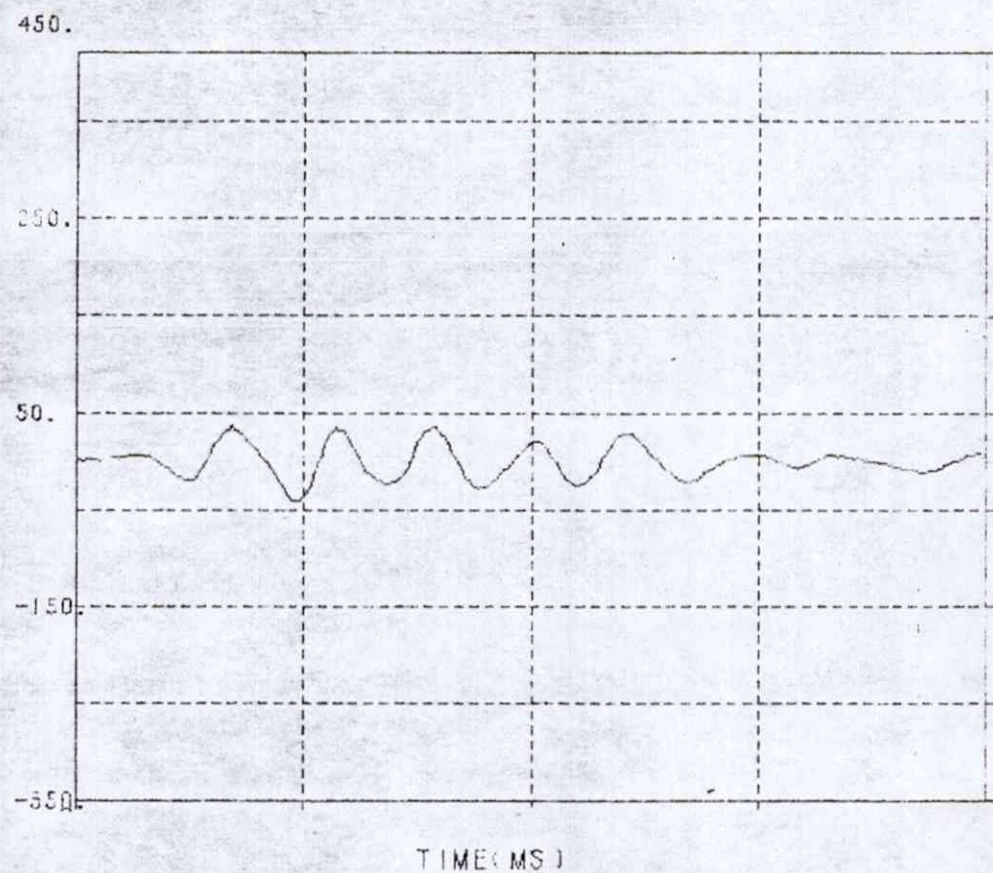


GEGO PULSE TEST

IDENT 40000 CHANNEL 15

GEGTEAM TEST FILE 4 TRACE 15 WINDOW 10-110 MS.

1.23

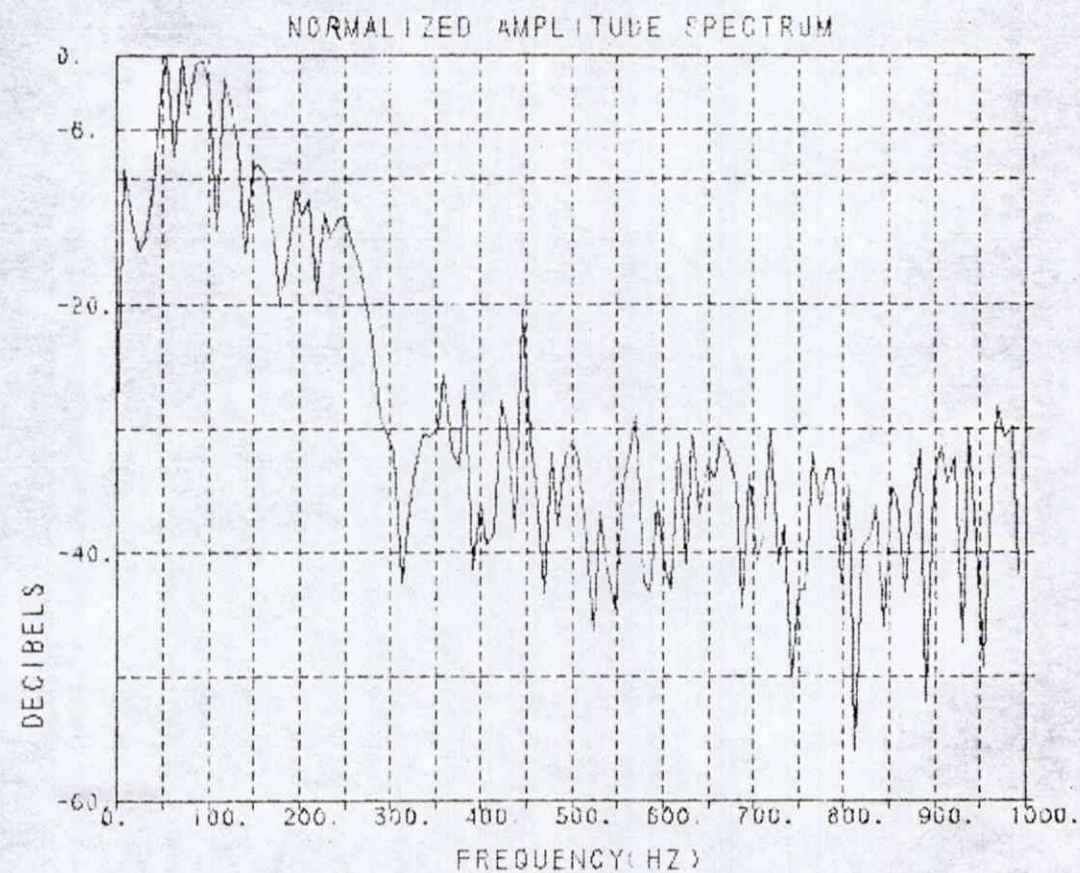
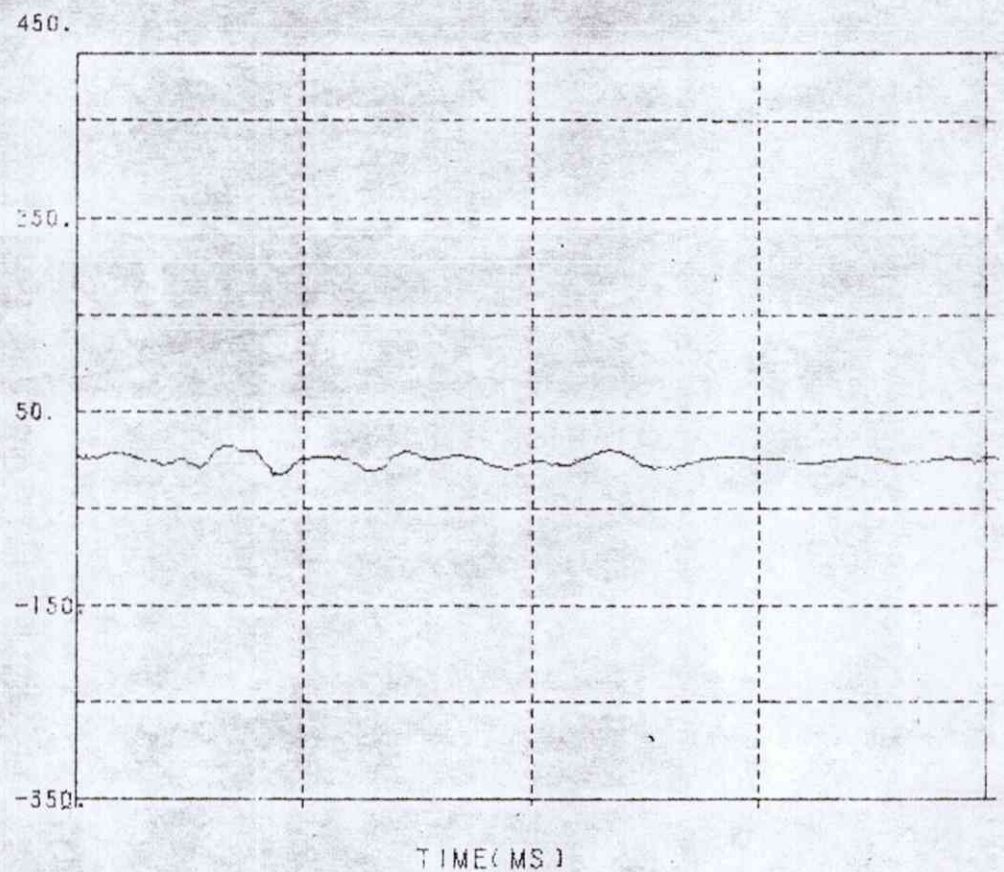


GECØ PULSE TEST

IDENT 40000 CHANNEL 19

1.24

GEOTEAM TEST FILE 4 TRACE 19 WINDOW 10-110 MS



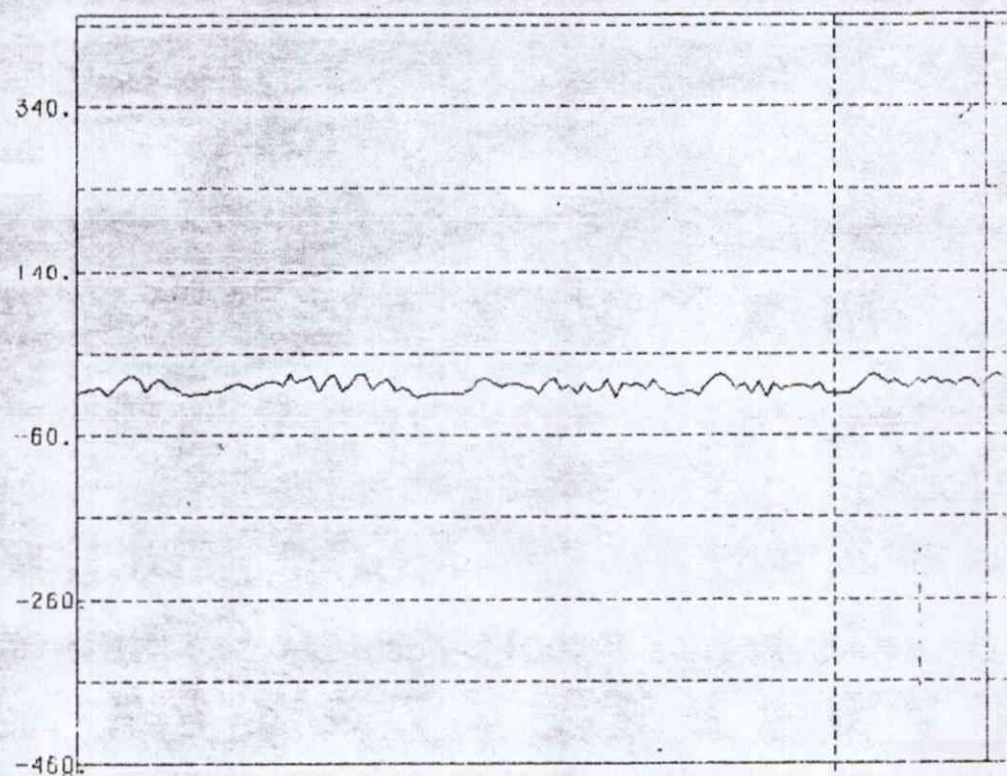
GECØ PULSE TEST

IDENT 80000 CHANNEL 1

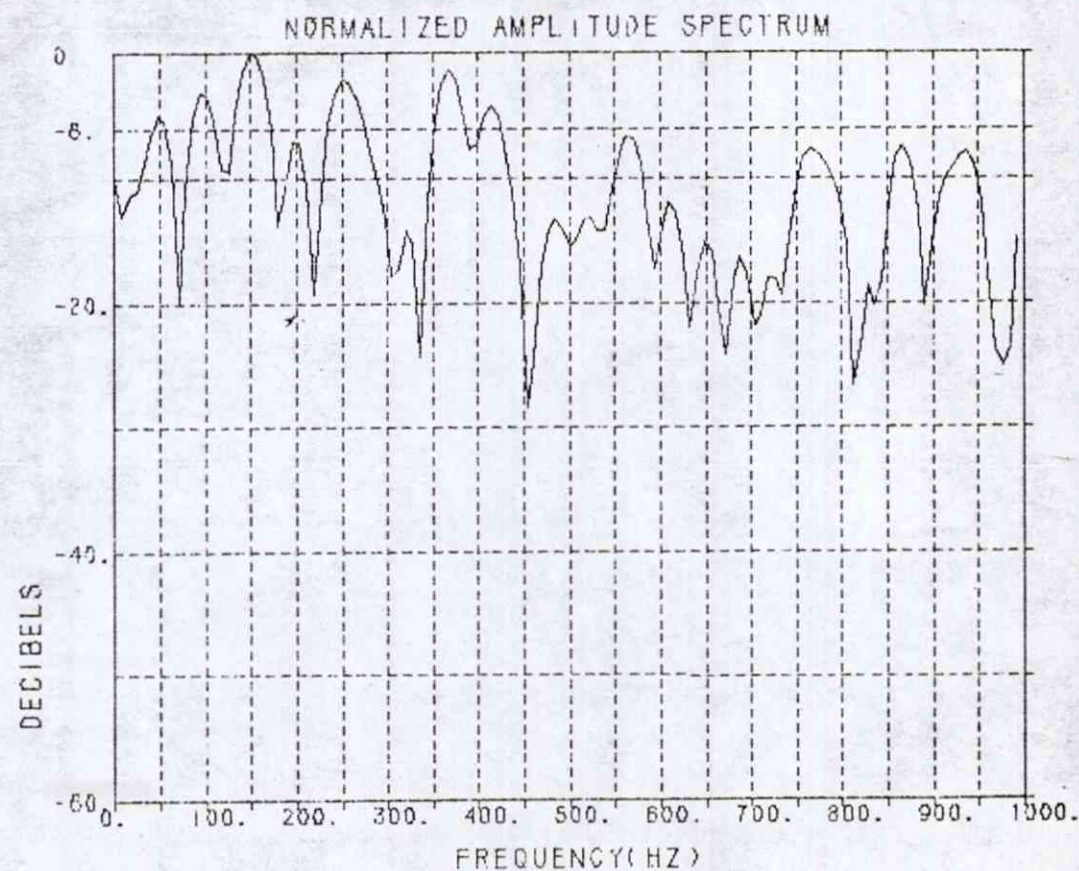
GEOTEAM TEST FILE 6 TRACE 1 WINDOW 67-90 MS.

1.25

540.



TIME(MS)

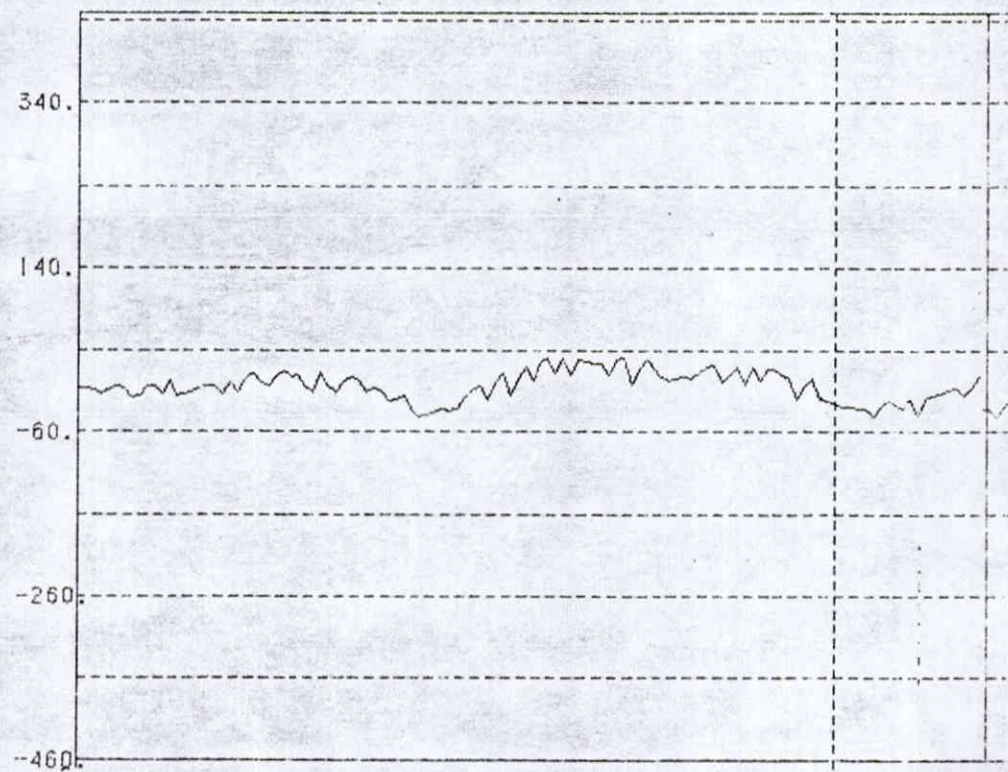


GEC0 PULSE TEST

IDENT 60000 CHANNEL 8

GEOTEAM TEST FILE 6 TRACE 8 WINDOW 60-90 MS.

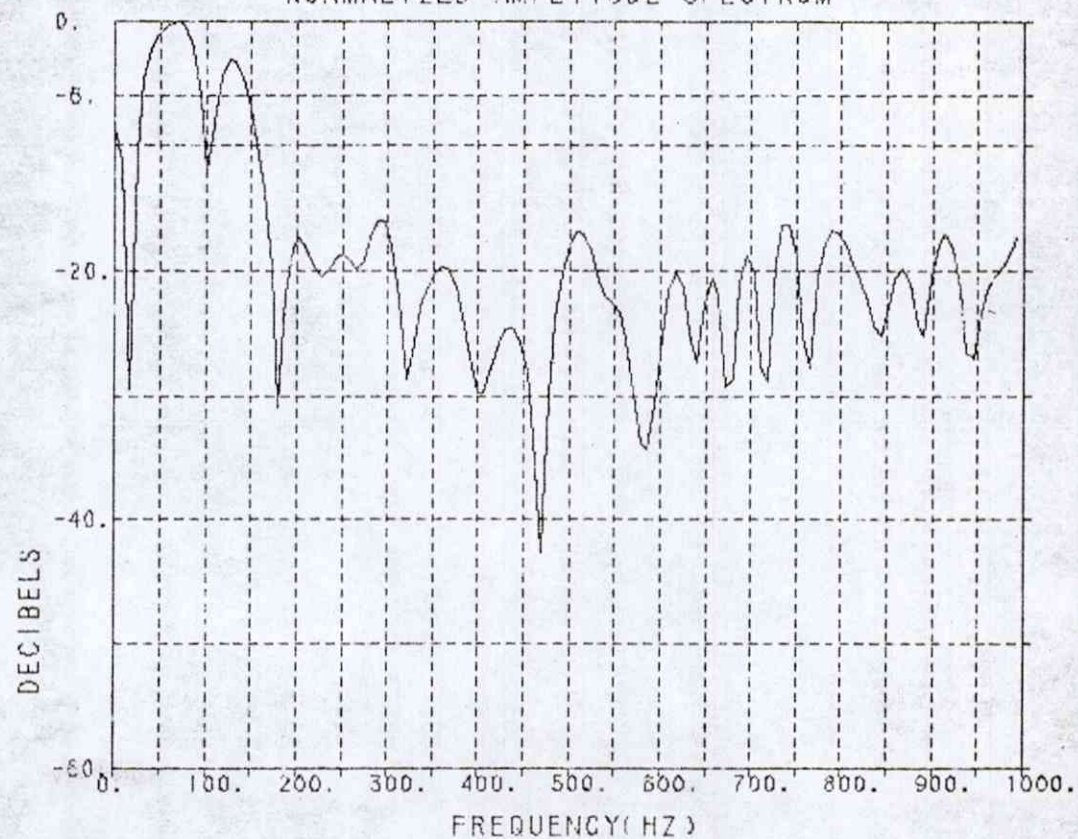
540.



TIME (MS)

1.26

NORMALIZED AMPLITUDE SPECTRUM

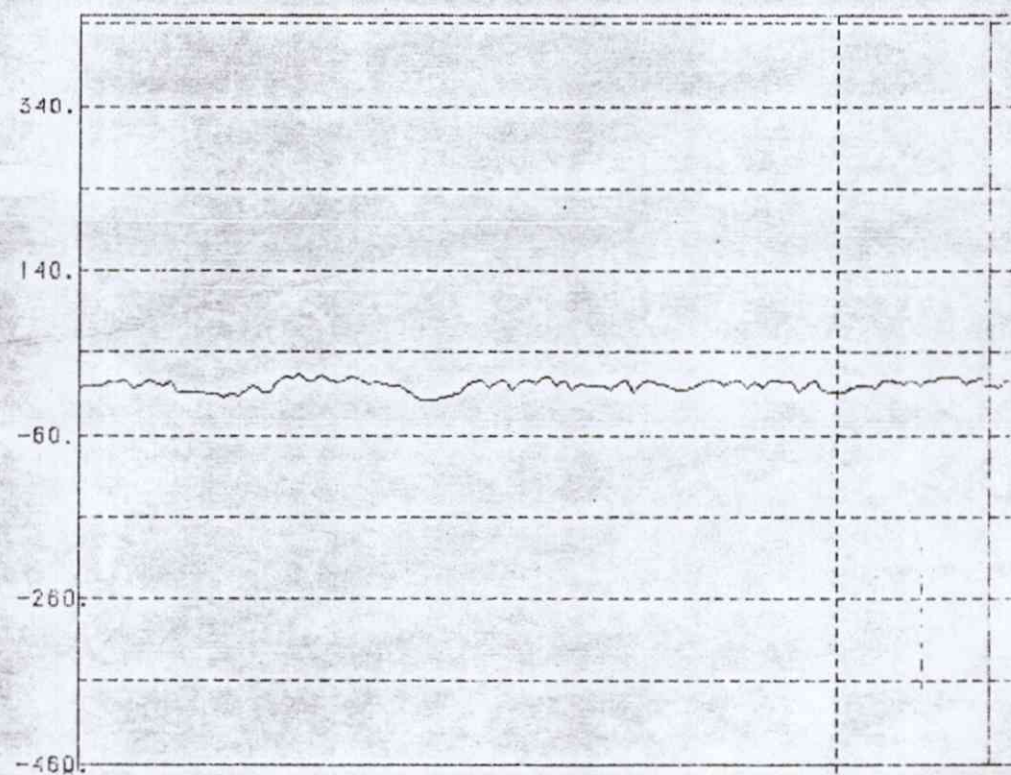


GECØ PULSE TEST

IDENT 60000 CHANNEL 9

GEOTEAM TEST FILE 6 TRACE 9 WINDOW 60-90 MS.

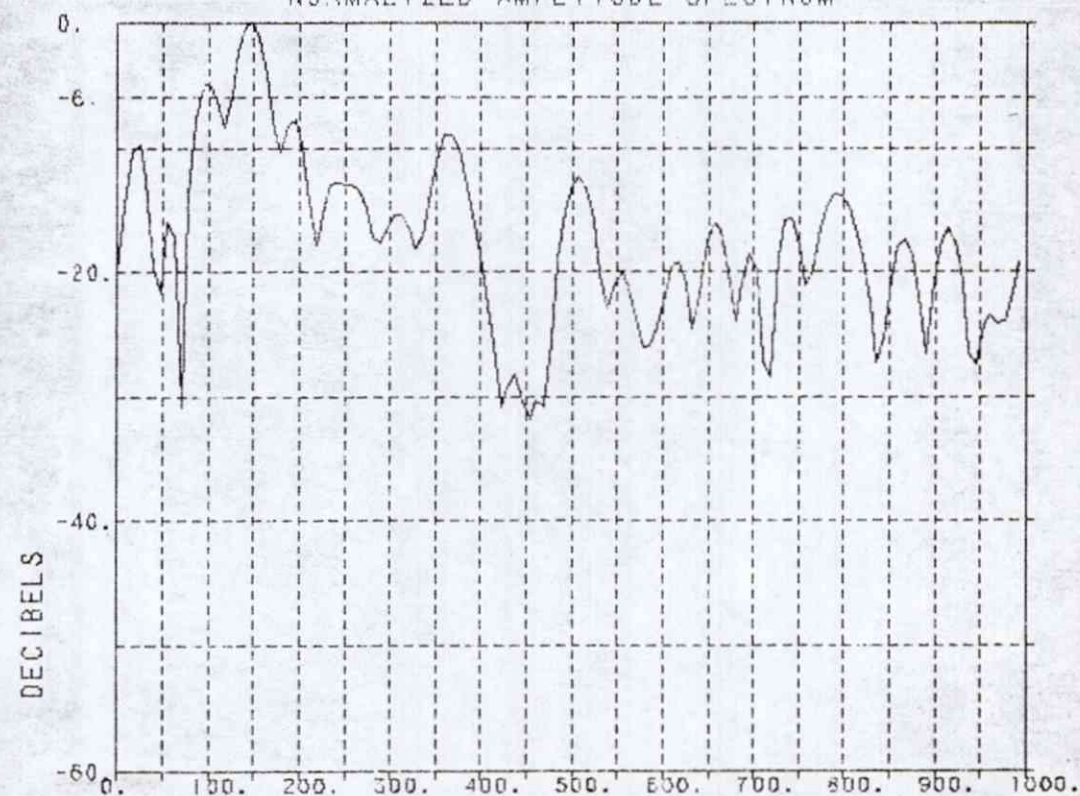
540.



TIME(MS)

1.27

NORMALIZED AMPLITUDE SPECTRUM

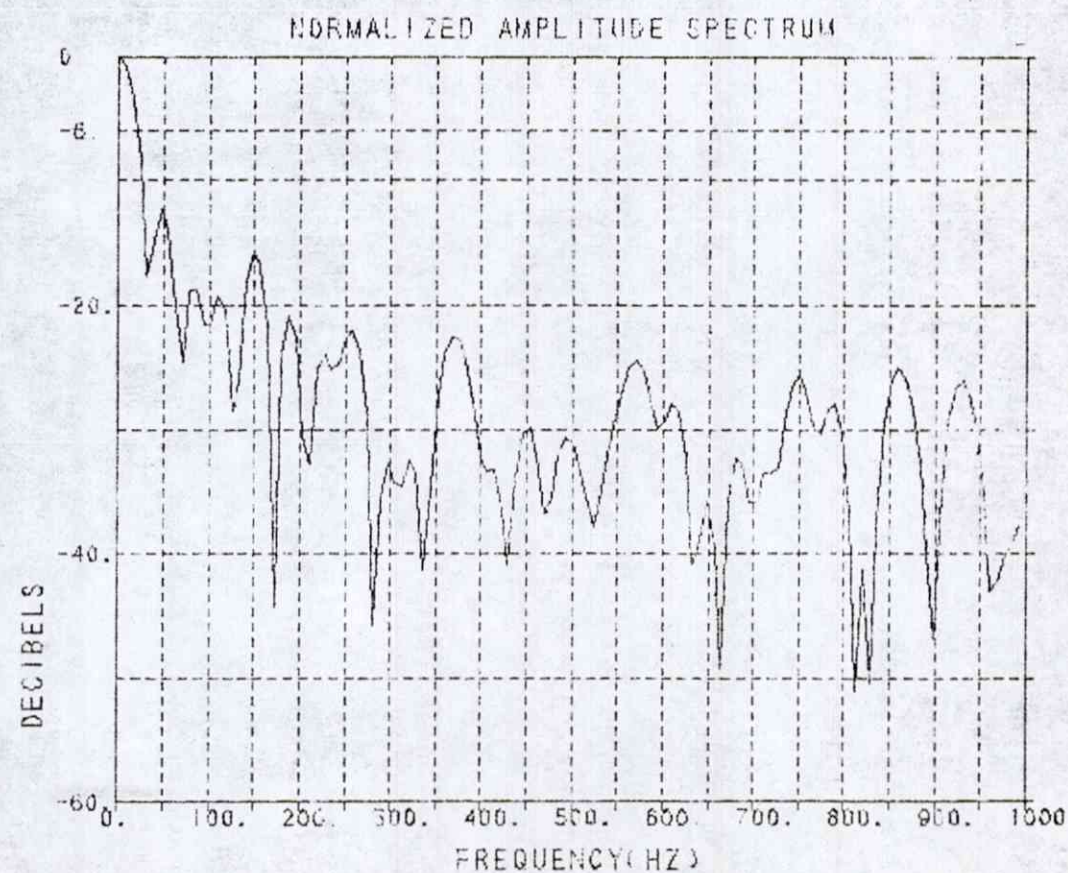
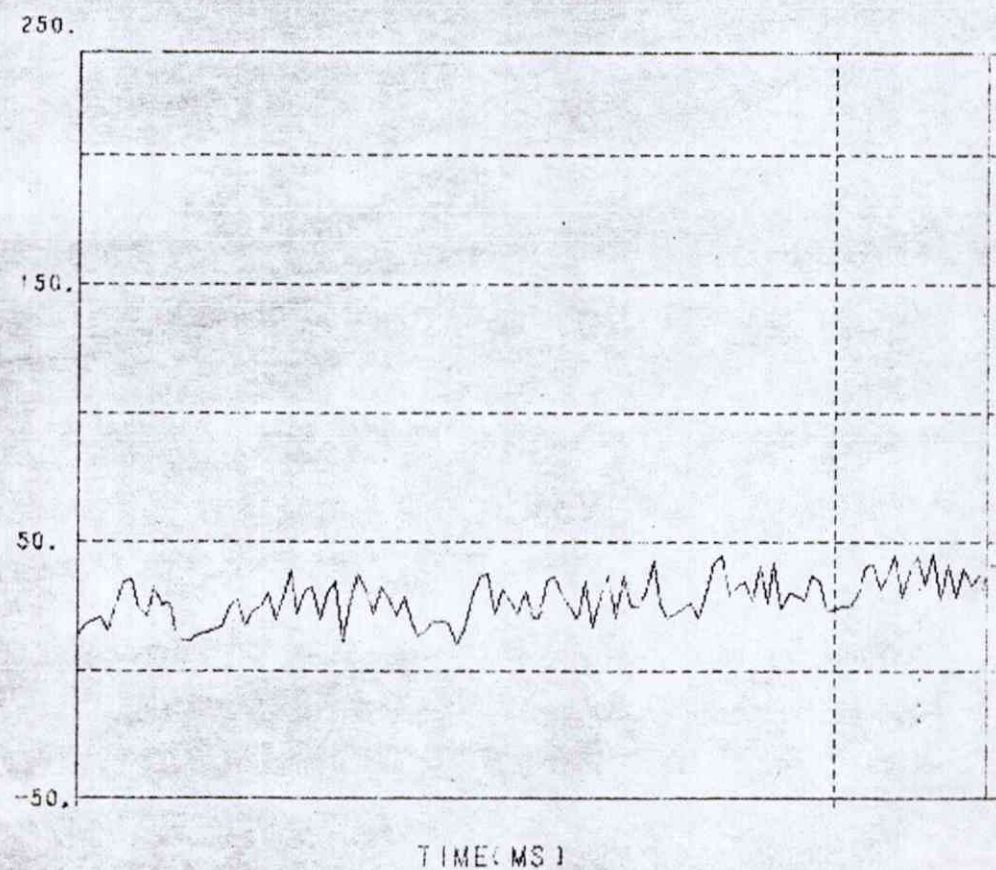


FREQUENCY(HZ)

GECO PULSE TEST

1.28

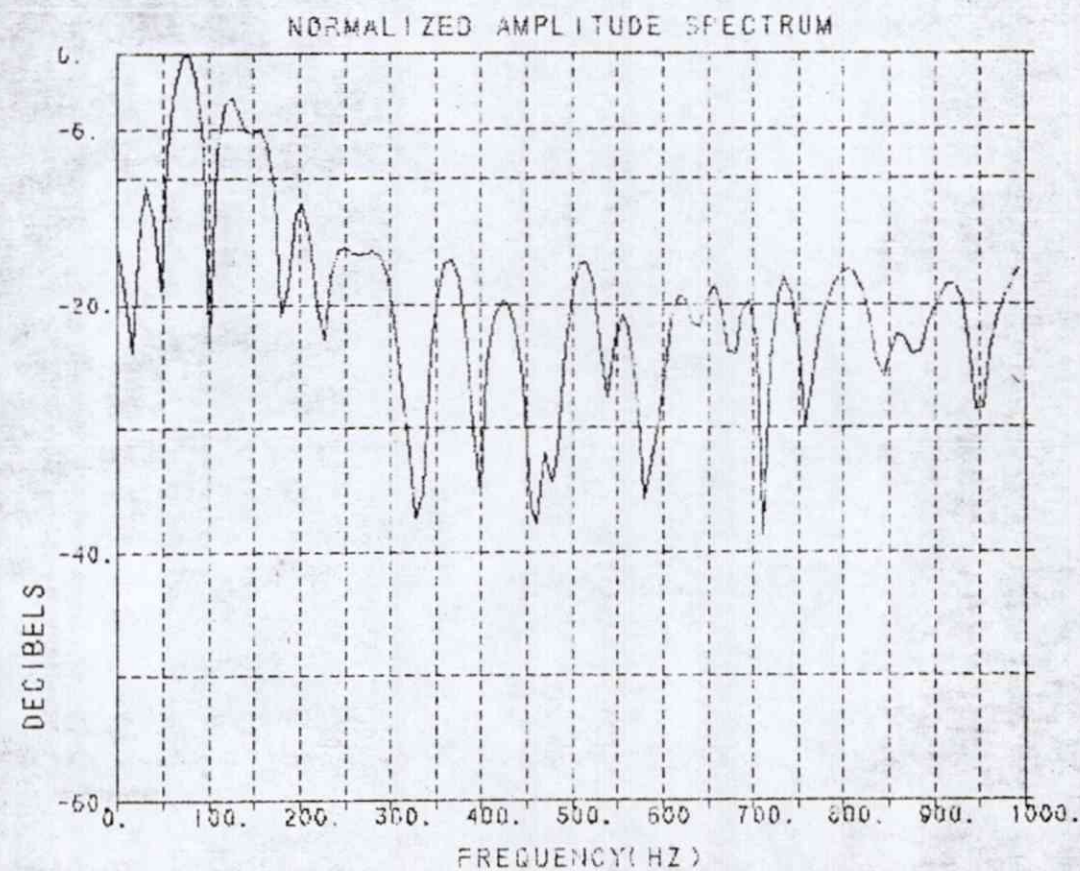
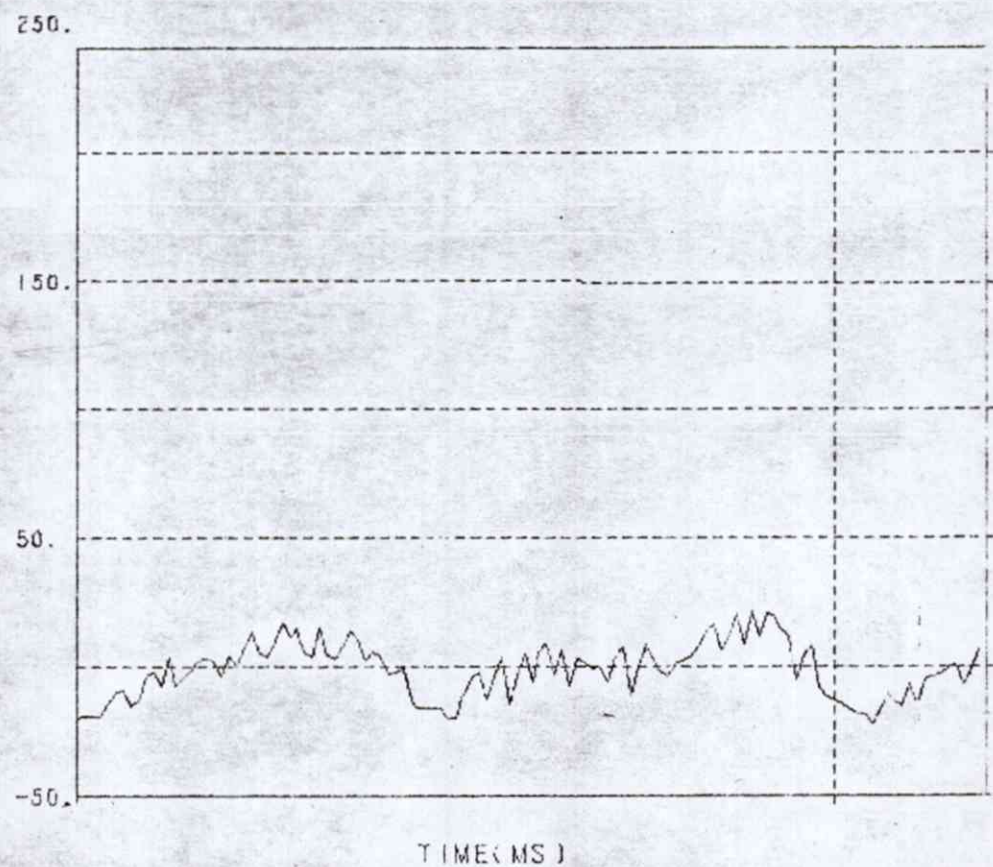
STACK PULSE FILE 6 TRACE $\Sigma 1, 2, 3, 4$ WINDOW: 60 - 90 MS



GEC0 PULSE TEST

1.29

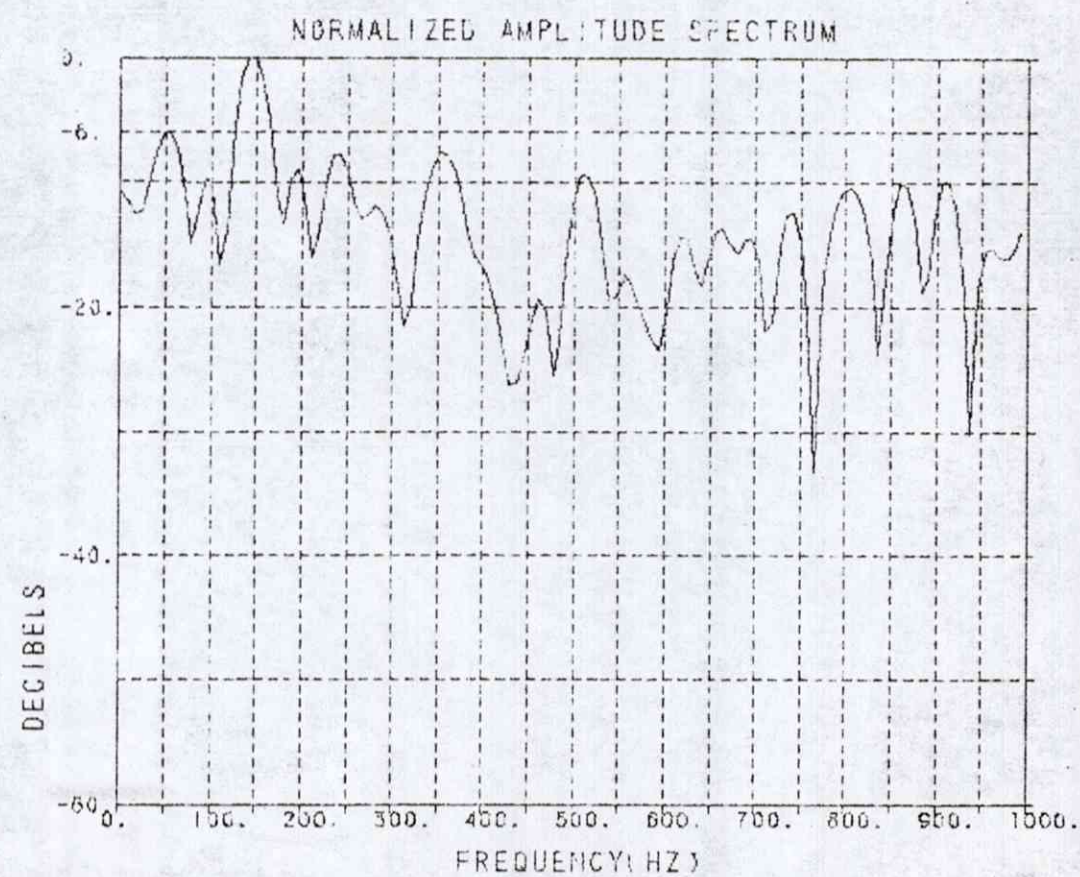
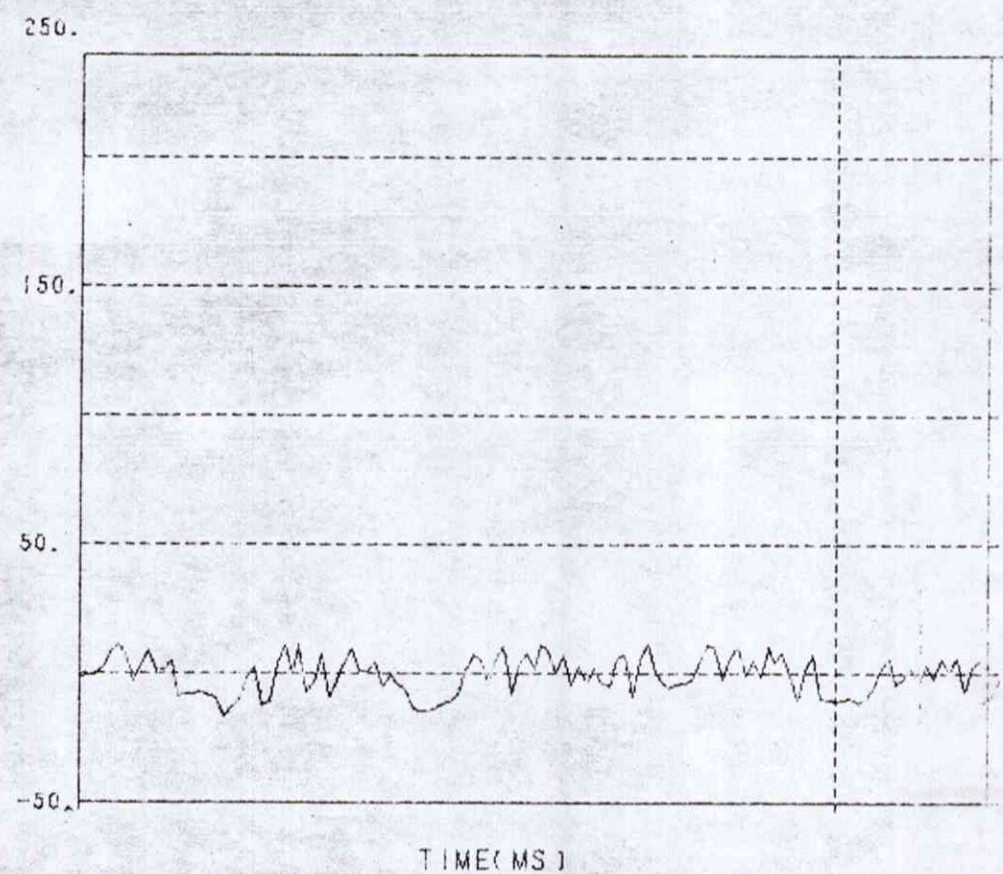
STACK FULSE FILE 6 TRACE $\Sigma 6,8,10$ WINDOW: 60 - 90 MS



GECO PULSE TEST

1.30

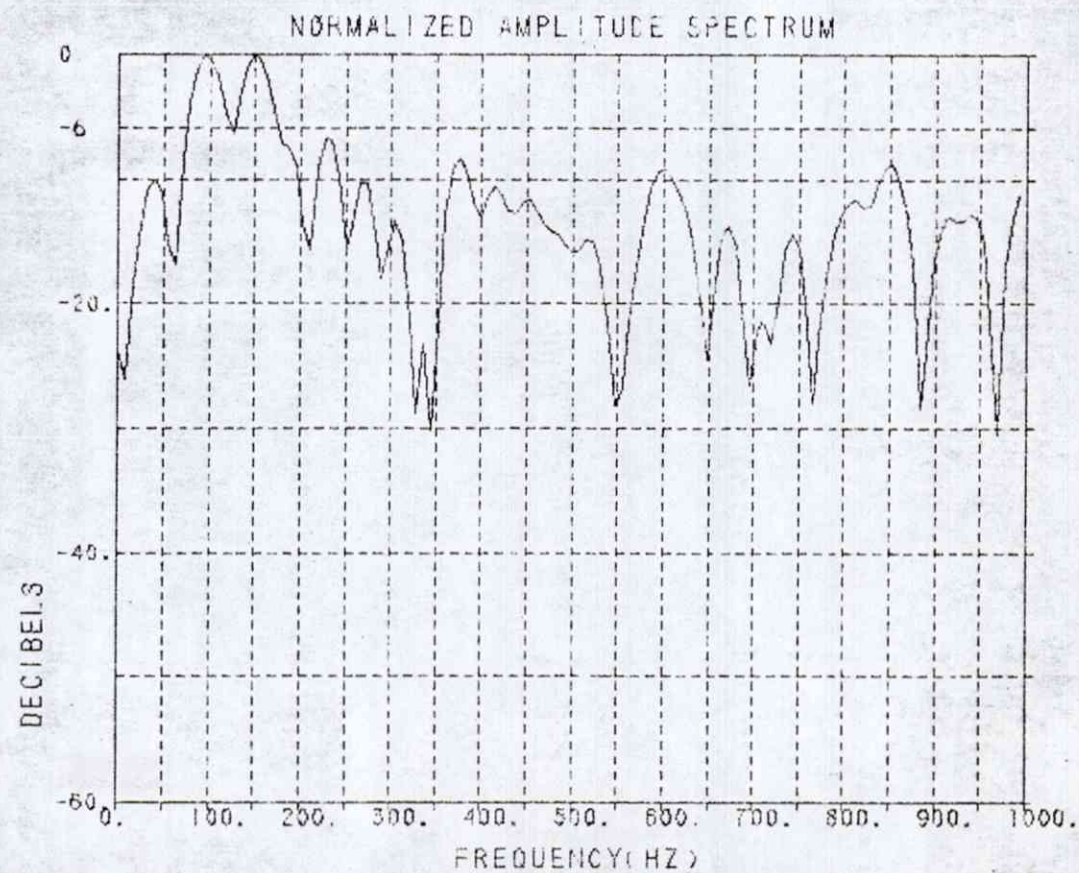
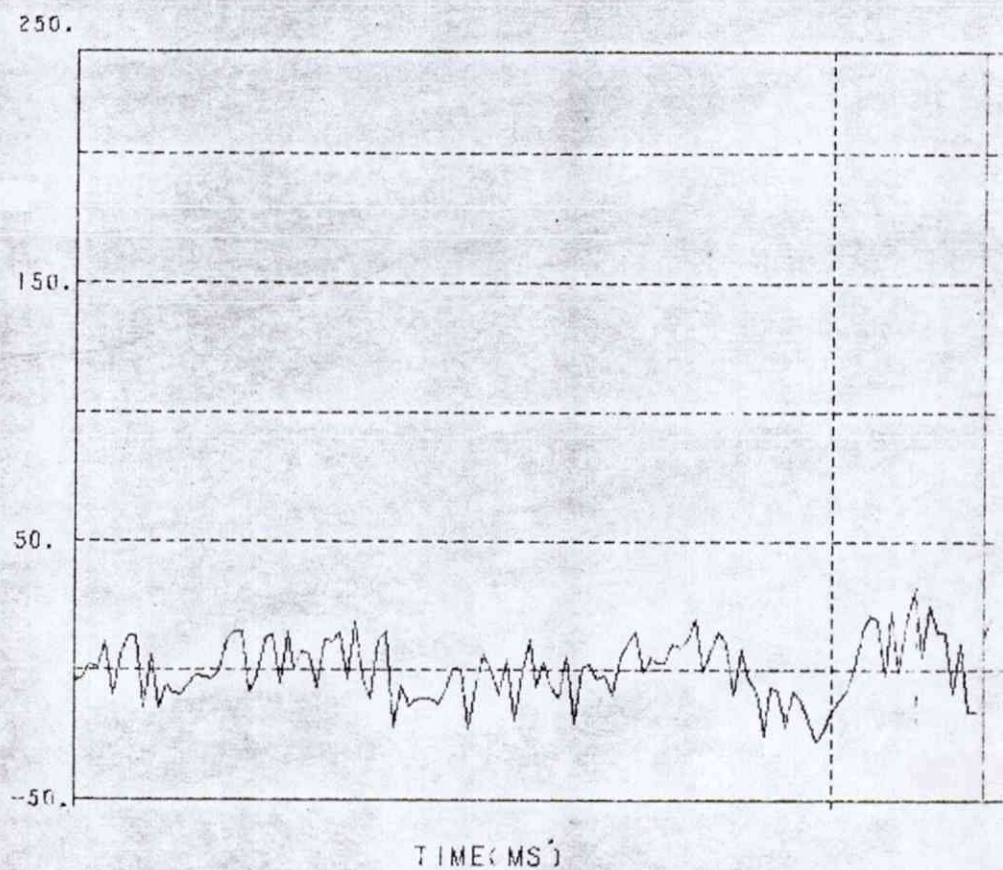
STACK PULSE FILE 6 TRACE Σ 7, 9, 11 WINDOW: 60 - 90 MS



GECØ PULSE TEST

1.31

STACK PULSE FILE 6 TRACE 18 WINDOW: 60 - 90 MS

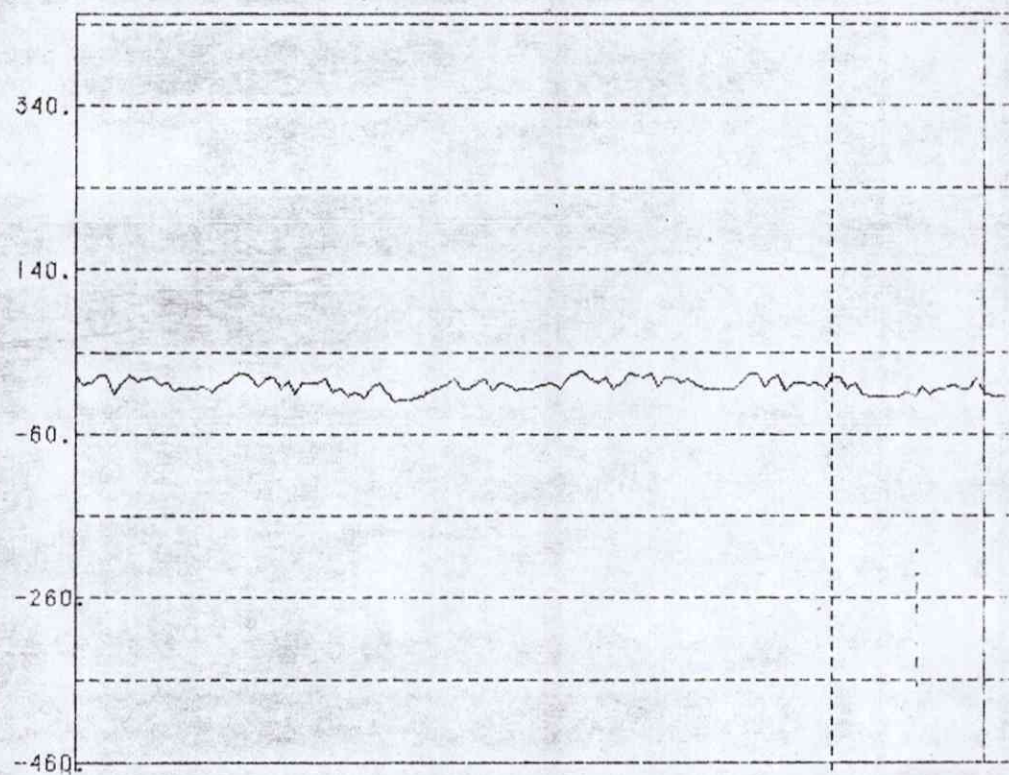


GECØ PULSE TEST

IDENT 70000 CHANNEL 1

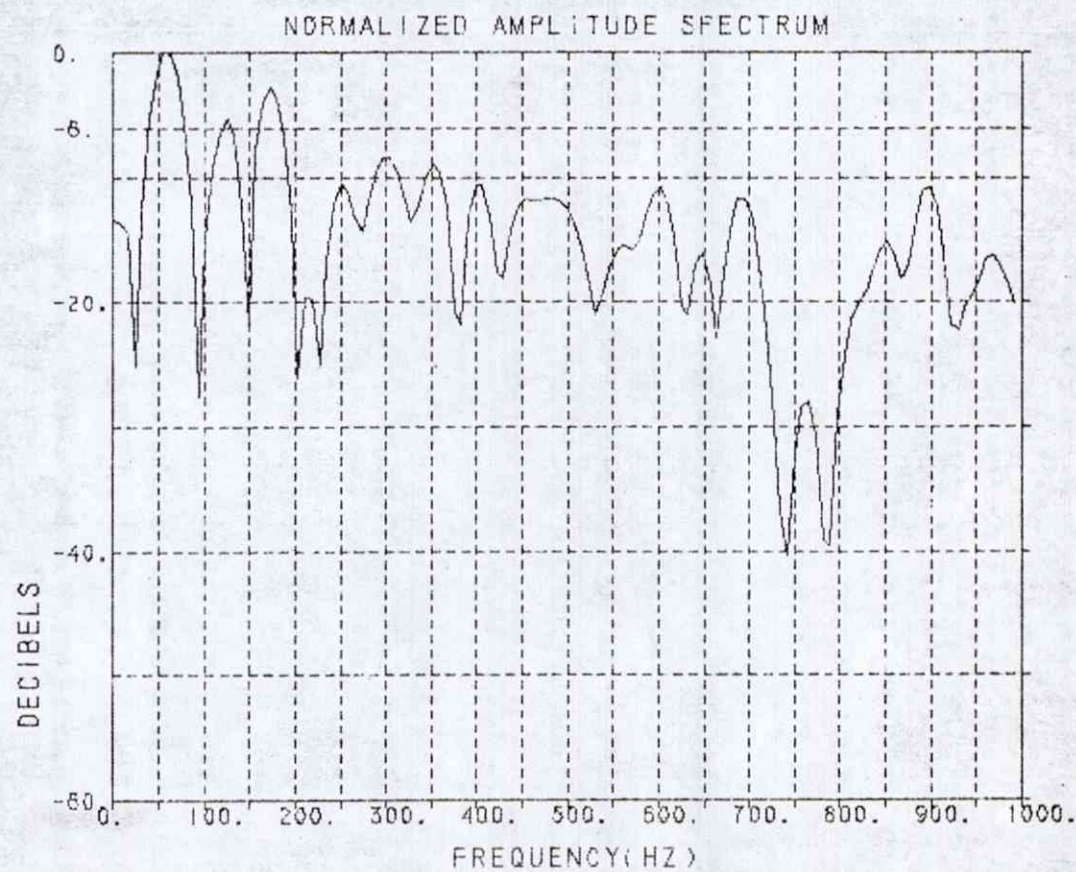
GECØTEAM TEST FILE 7 TRACE 1 WINDOW 60-90 MS.

540.



TIME (MS)

1.32

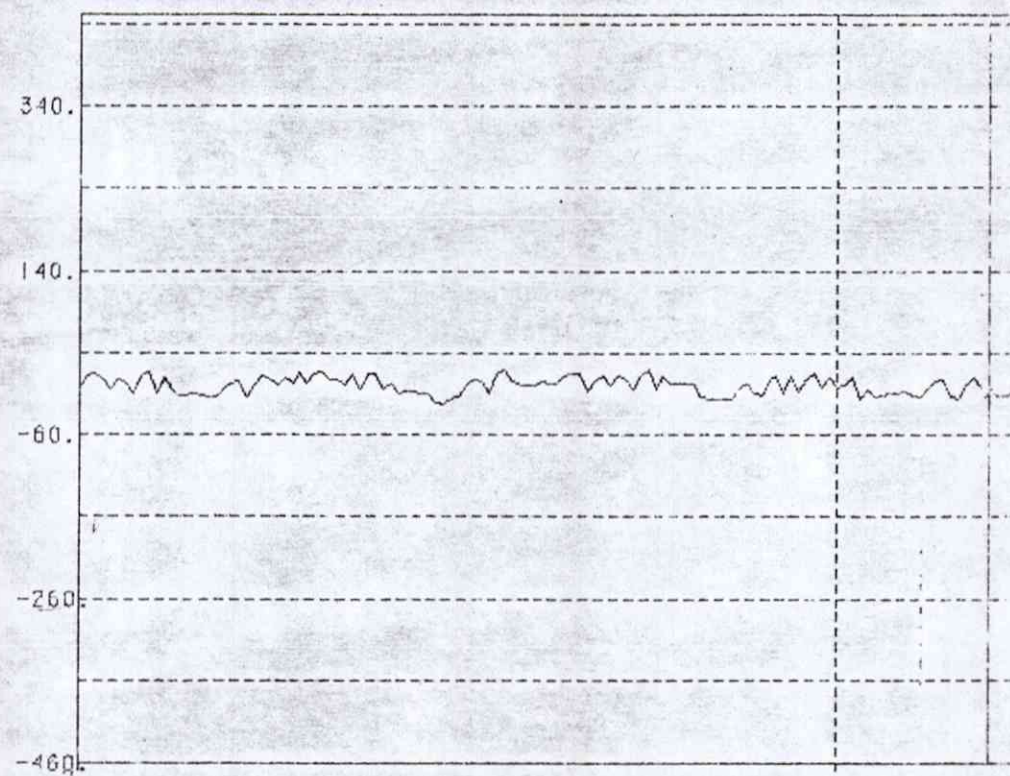


GEC0 PULSE TEST

IDENT 70000 CHANNEL 8

GEOTEAM TEST FILE 7 TRACE 8 WINDOW 60-90 MS.

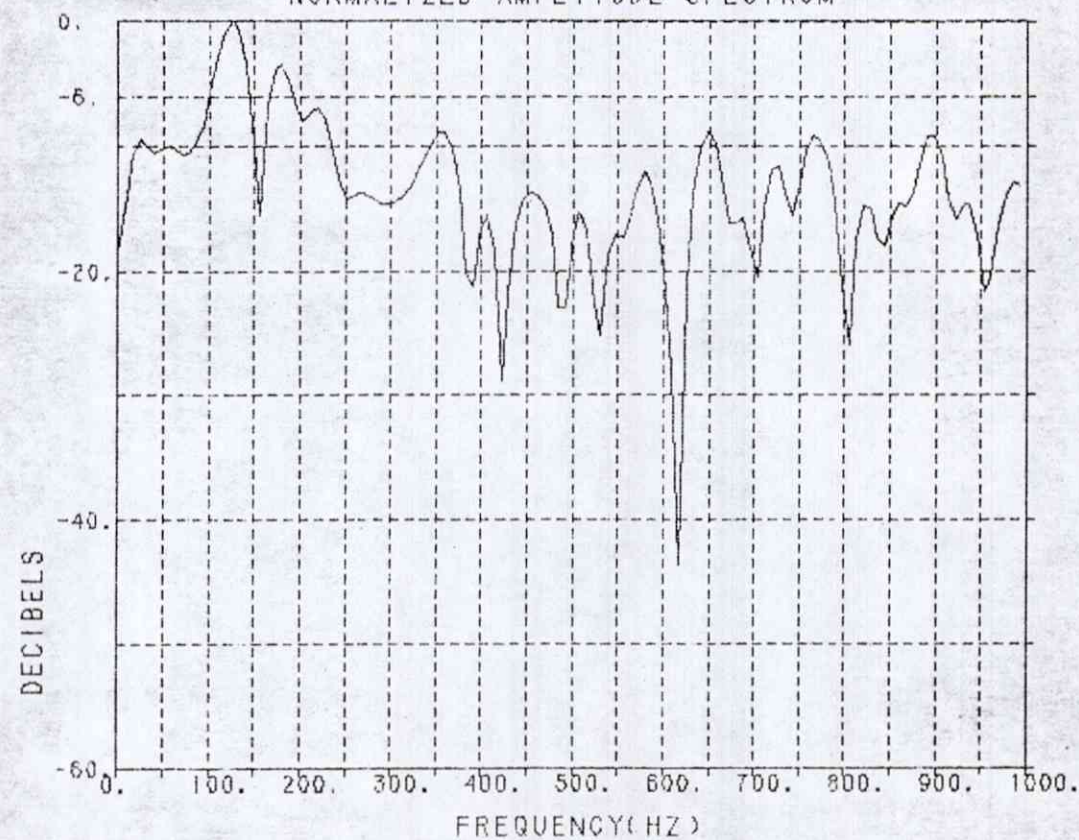
540.



TIME(MS)

1.33

NORMALIZED AMPLITUDE SPECTRUM

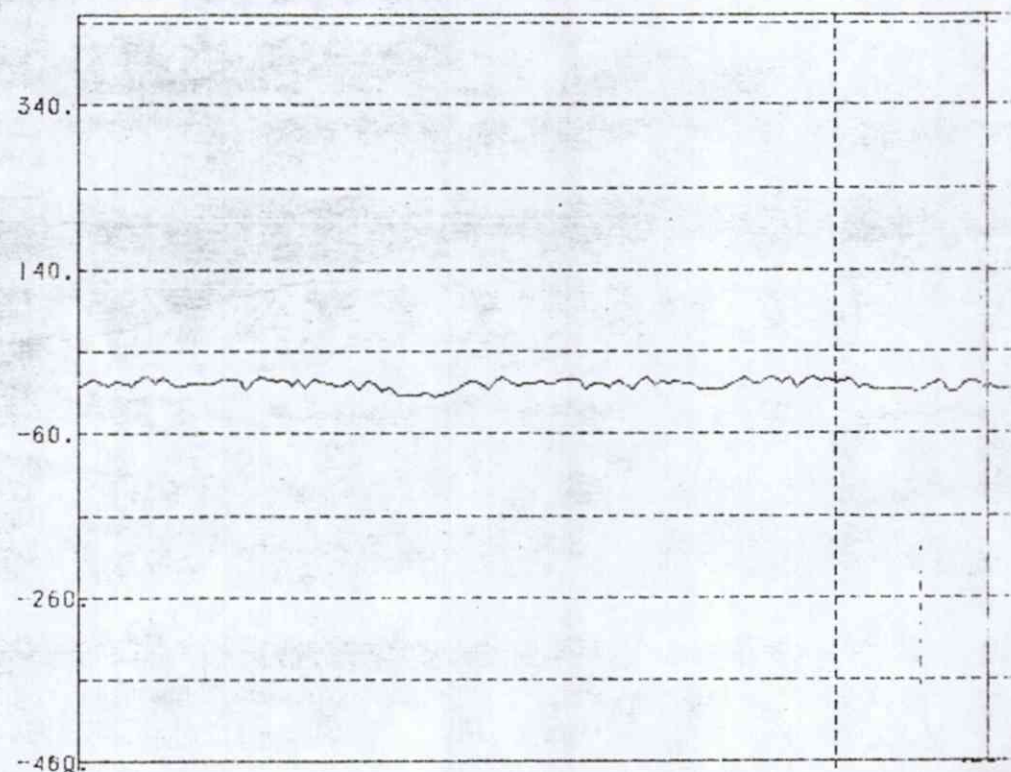


GECØ PULSE TEST

IDENT 70000 CHANNEL 9

GEOTEAM TEST FILE 7 TRACE 9 WINDOW 60-90 MS.

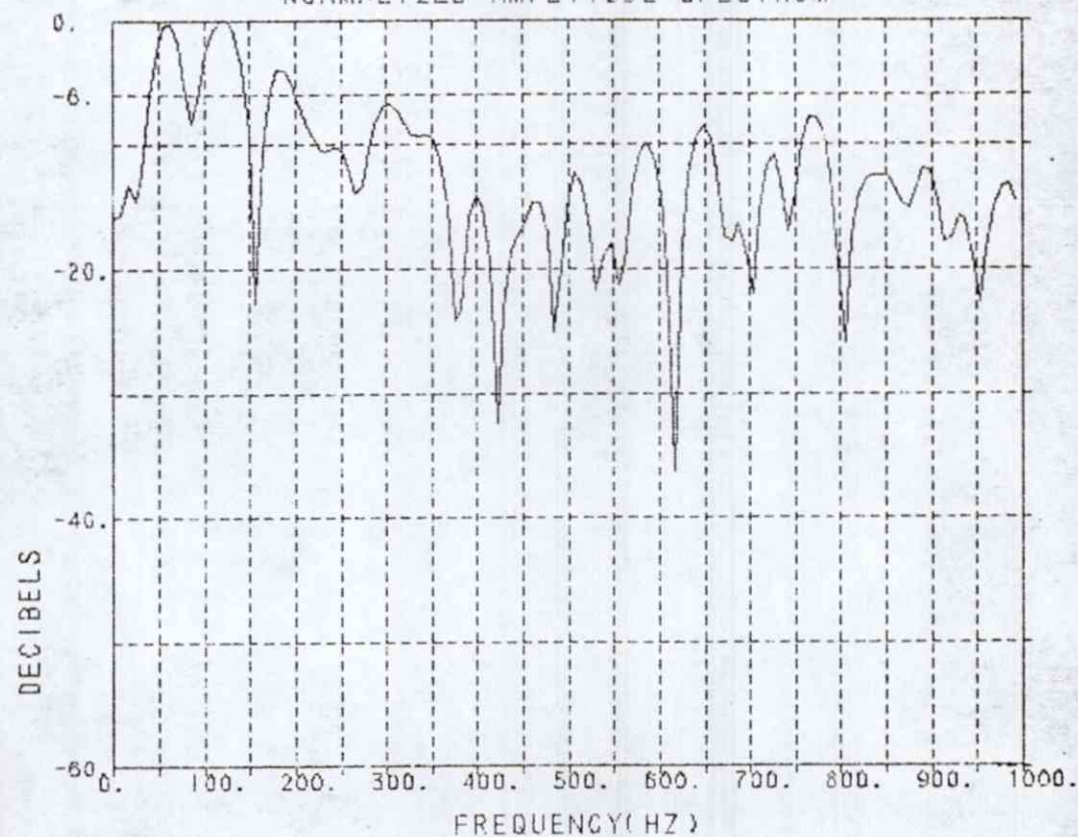
540.



TIME (MS)

1.34

NORMALIZED AMPLITUDE SPECTRUM



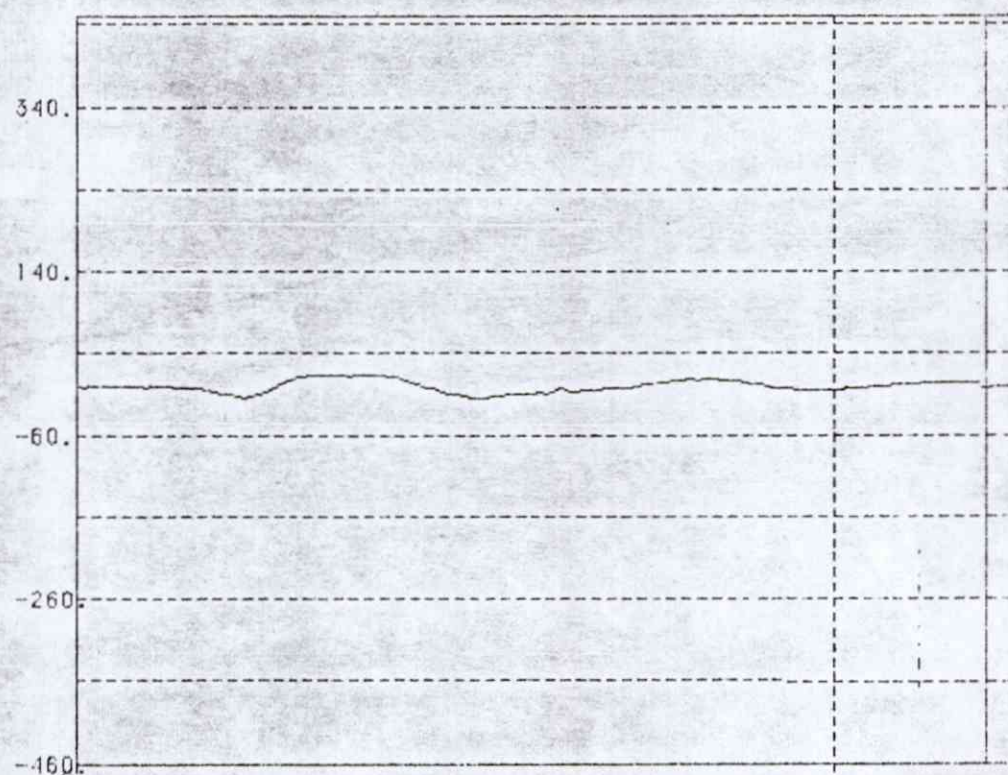
GECO PULSE TEST

IDENT 80000 CHANNEL 1

1.35

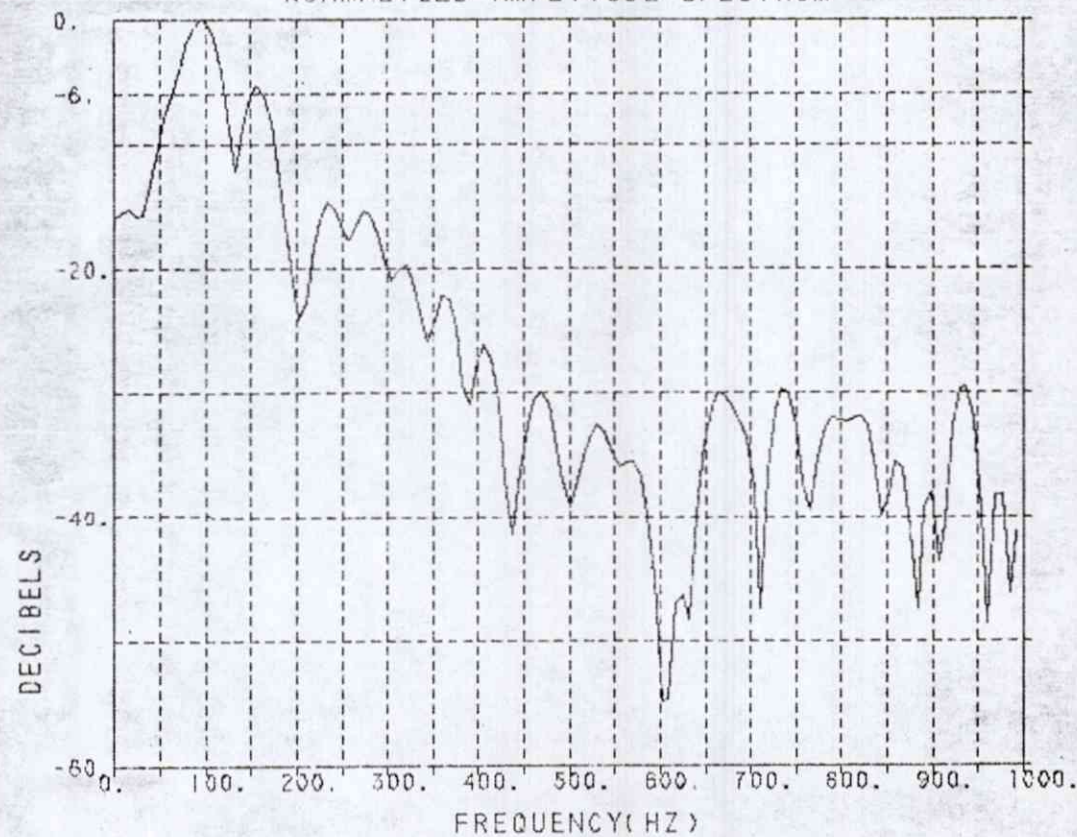
GEC TEAM TEST FILE 8 TRACE 1 WINDOW 60-90 MS.

540.



TIME(MS)

NORMALIZED AMPLITUDE SPECTRUM



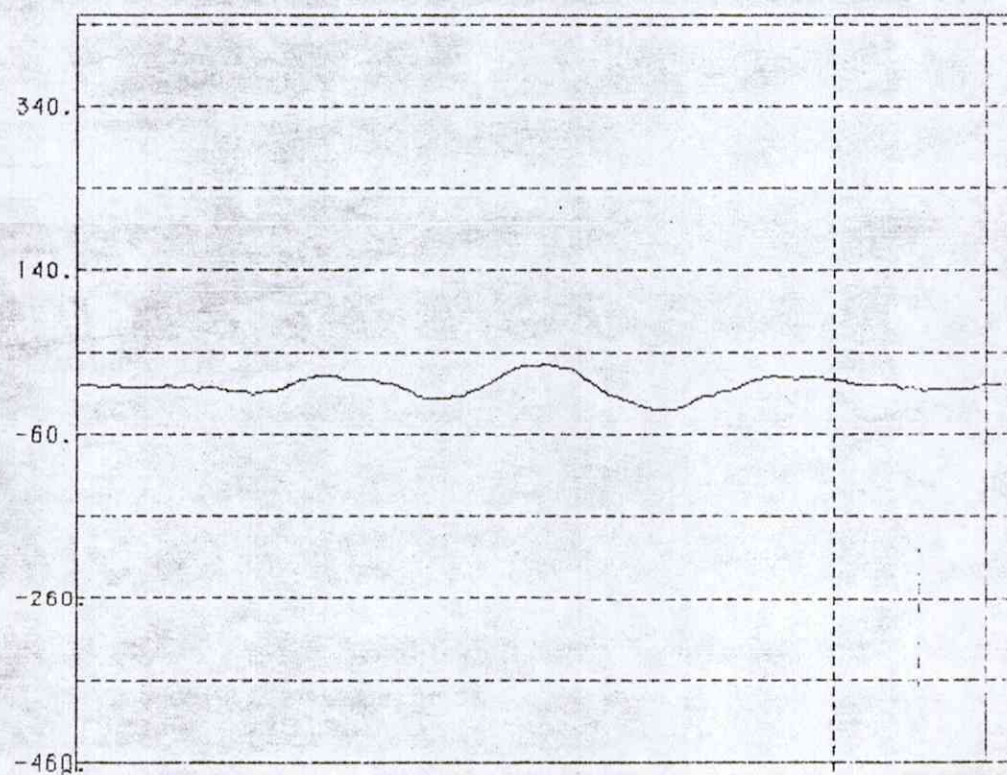
GEC0 PULSE TEST

IDENT 80000 CHANNEL 8

GEOTEAM TEST FILE 8 TRACE 8 WINDOW 60-90 MS.

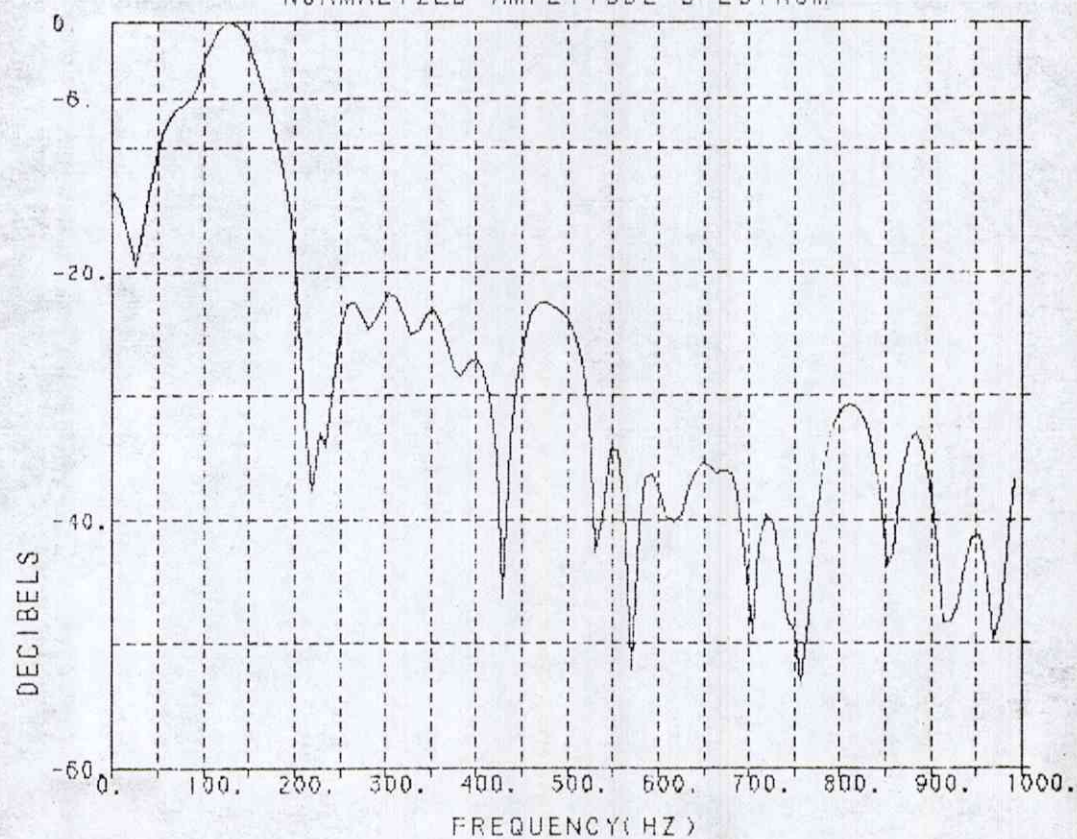
1.36

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



Stålplugg
65 g D, N380.

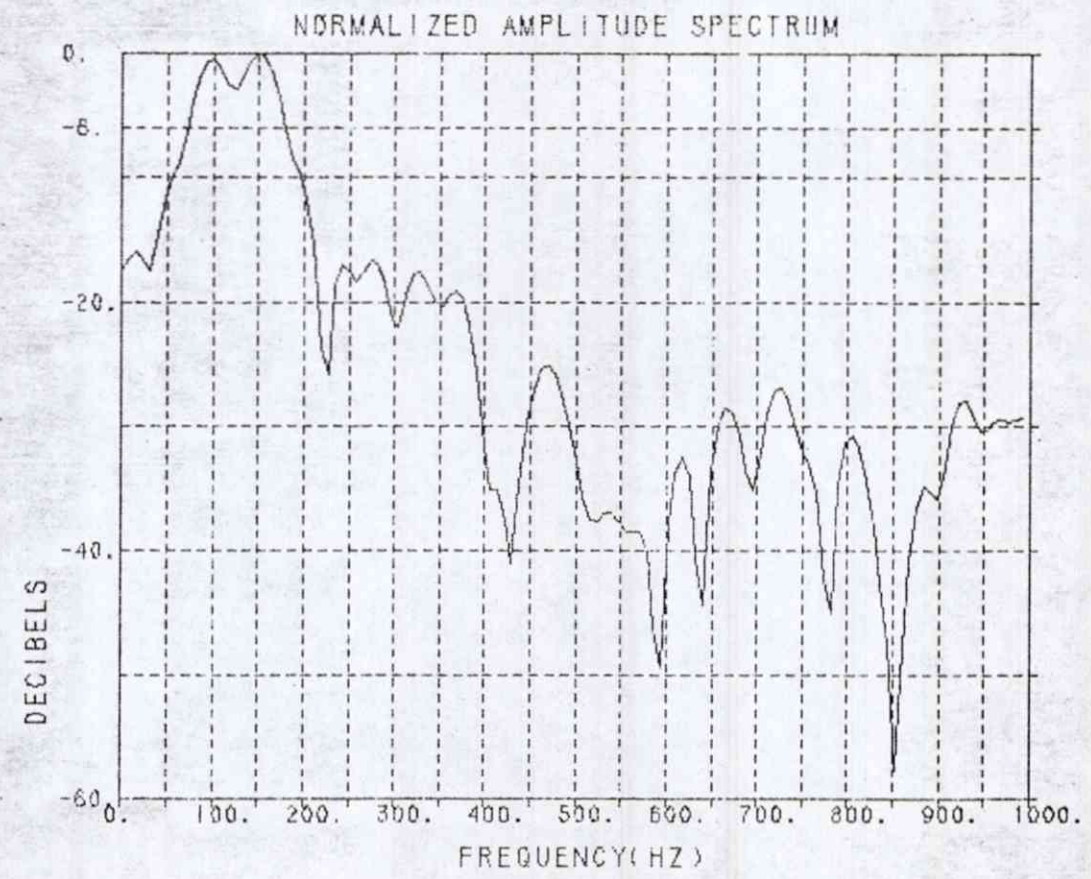
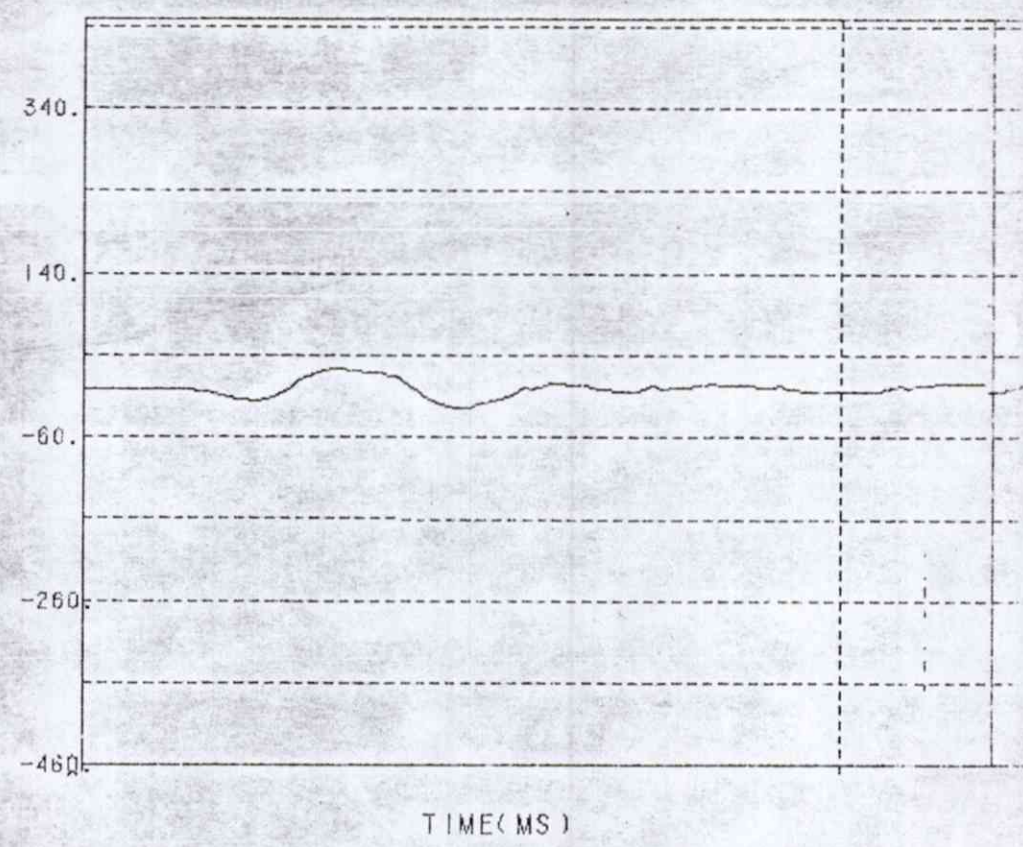
GECO PULSE TEST

1.37

IDENT 80000 CHANNEL 9

GEOTEAM TEST FILE 8 TRACE 9 WINDOW 60-90 MS.

540.



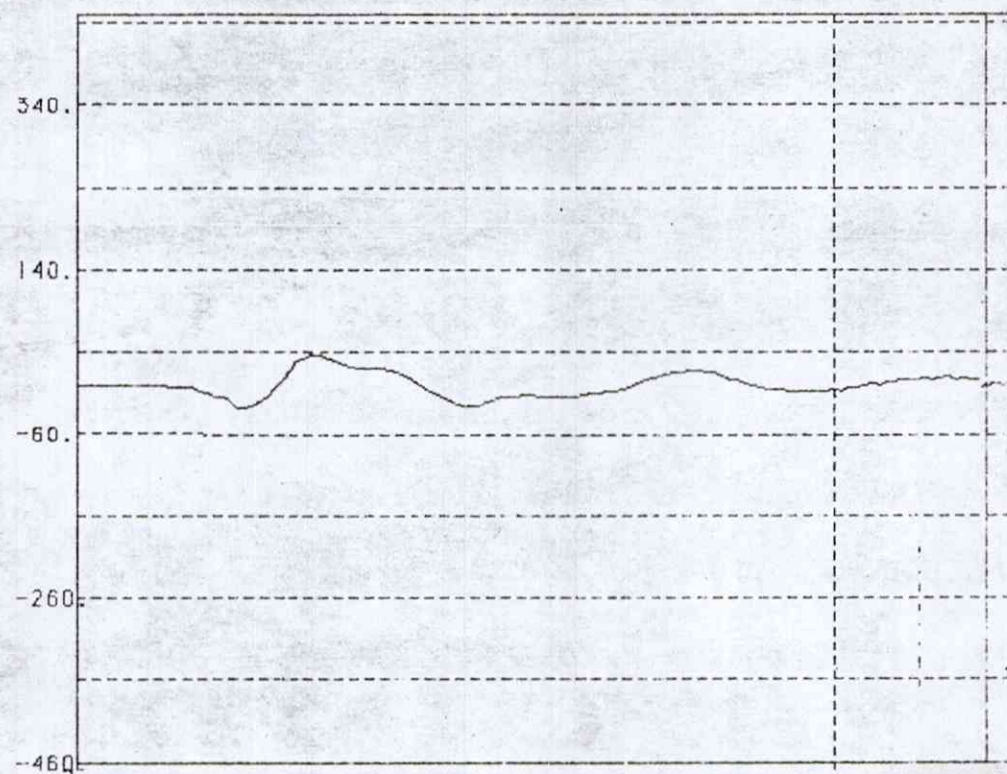
GECØ PULSE TEST

IDENT 90000 CHANNEL 1

1.38

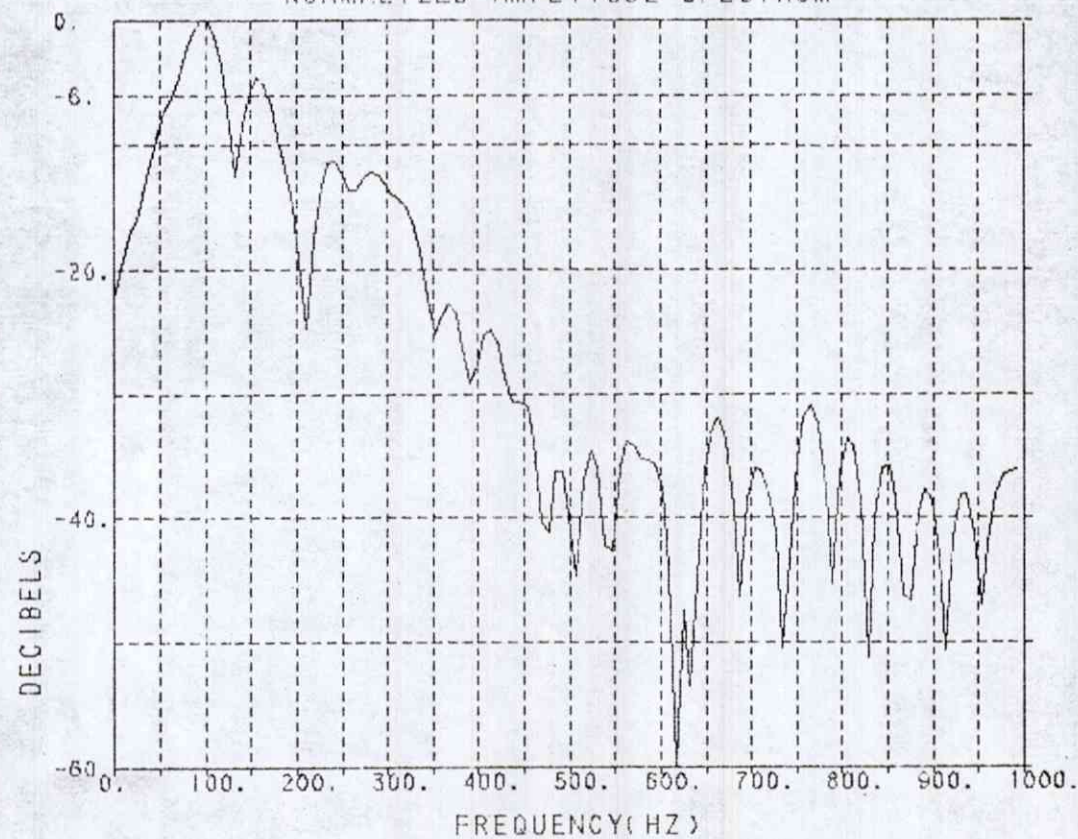
GECTEAM TEST FILE 9 TRACE 1 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



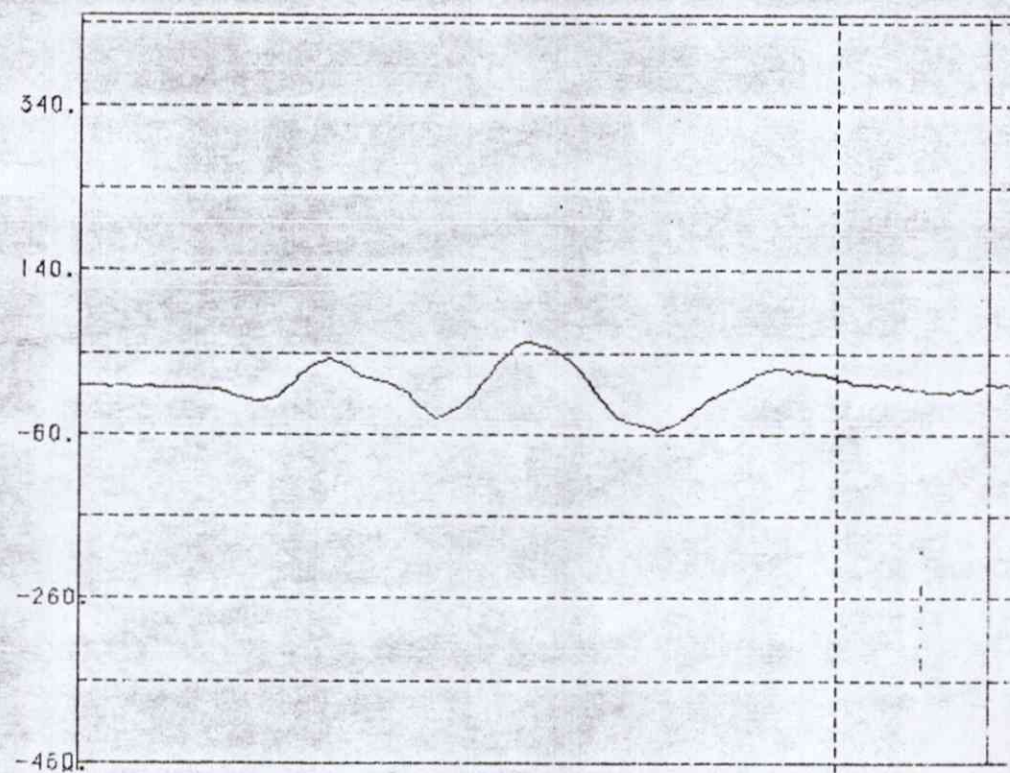
GECØ PULSE TEST

IDENT 90000- CHANNEL 8

1.39

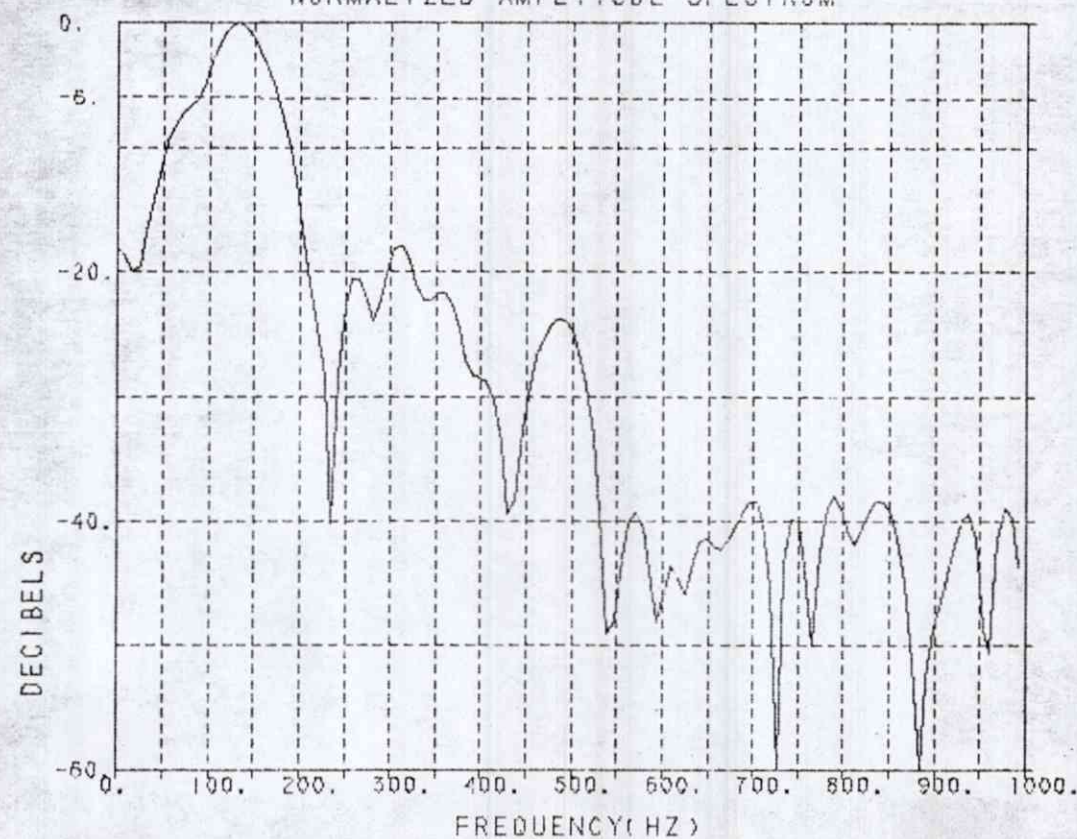
GECTEAM TEST FILE 9 TRACE 8 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



FREQUENCY (HZ)

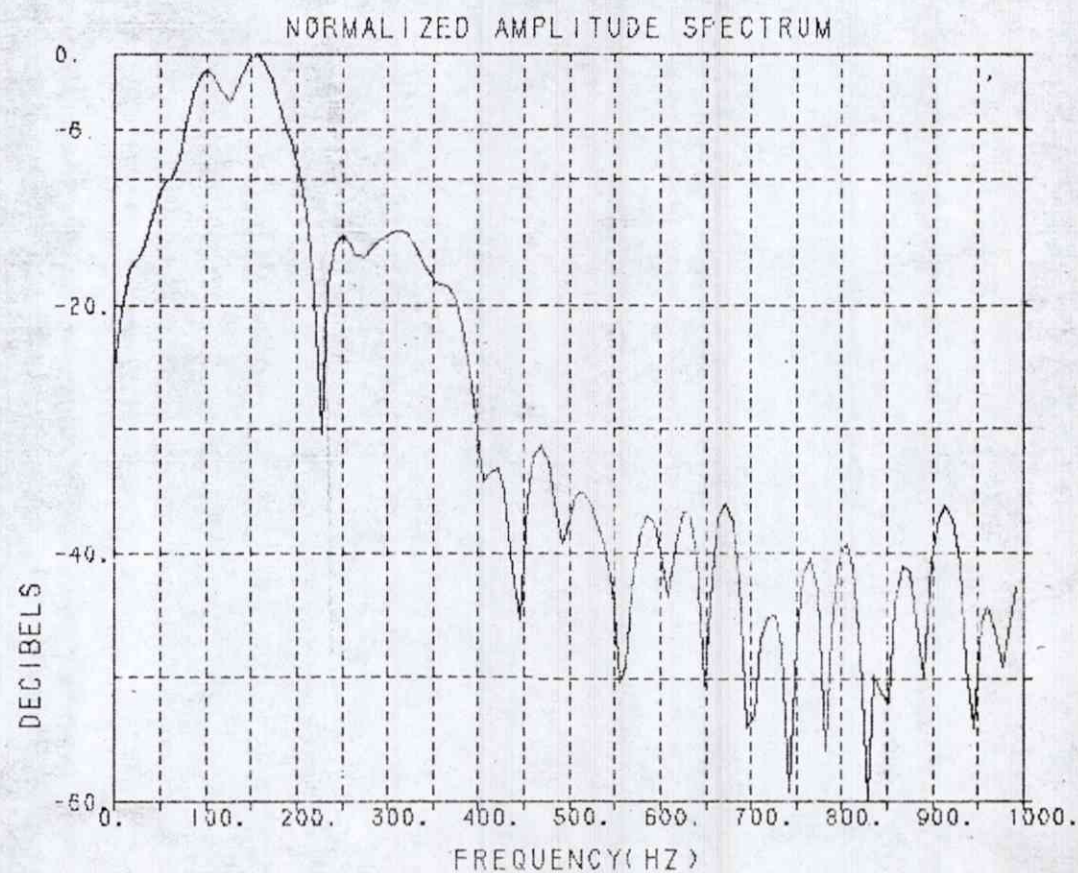
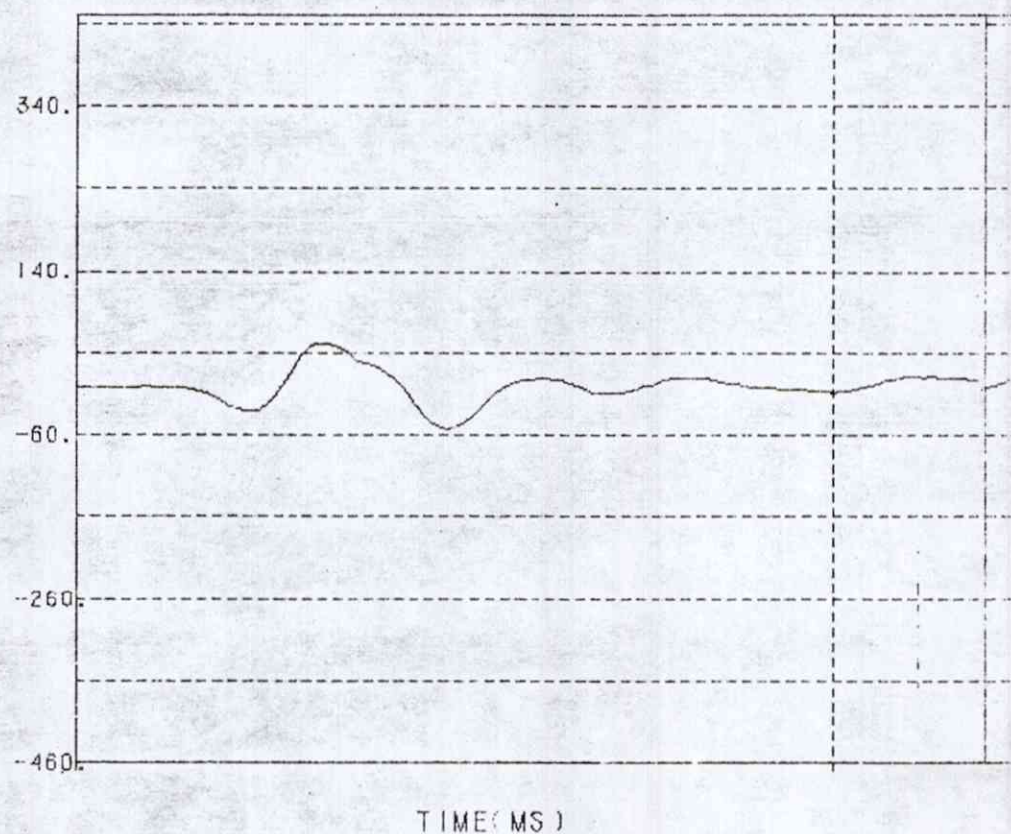
GECO PULSE TEST

IDENT 90000 CHANNEL 9

GECOTEAM TEST FILE 9 TRACE 9 WINDOW 60-90 MS.

1.40

540.

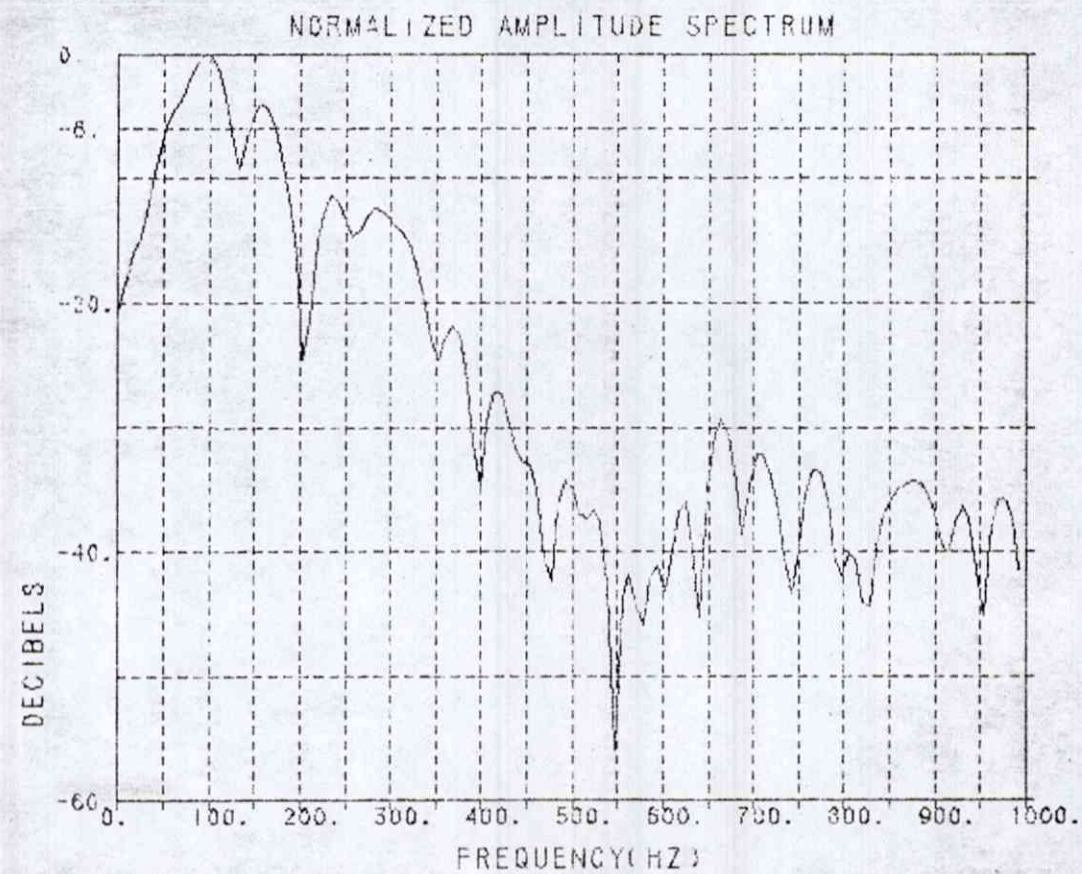
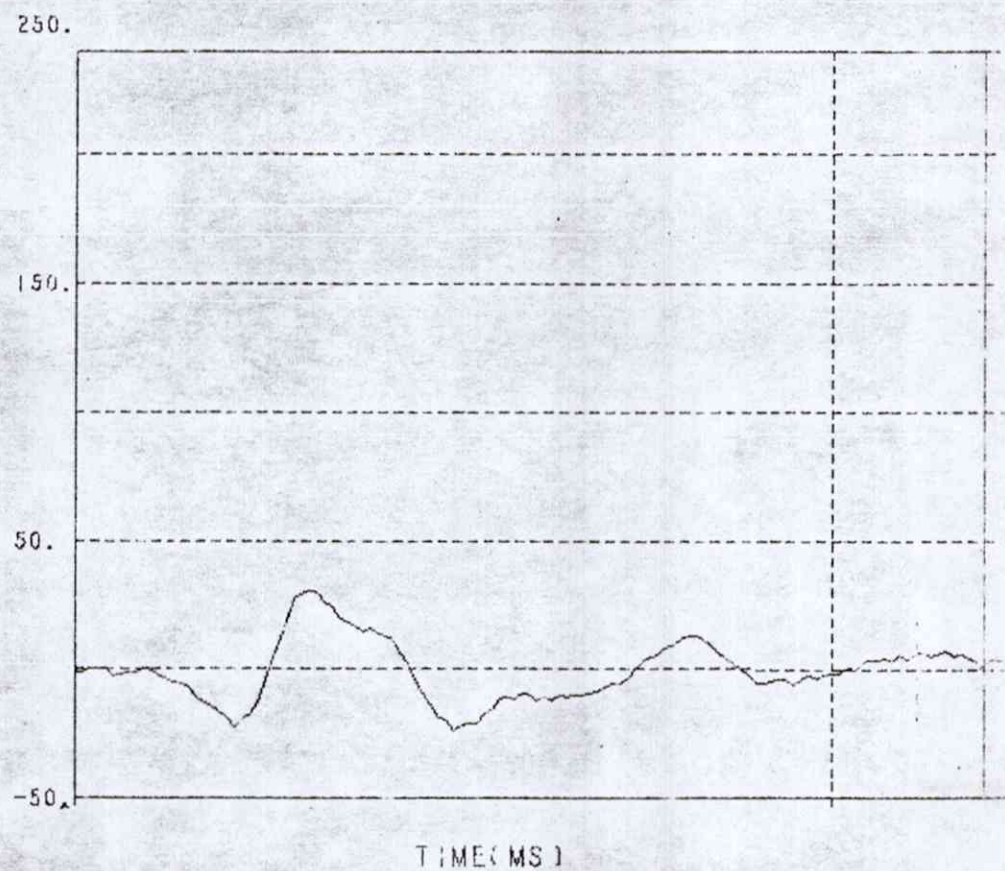


Stålplugg. 130gD. N380.

GECØ PULSE TEST

1.41

STACK PULSE FILE 9 TRACE Σ 1, 2, 3, 4 WINDOW: 60 - 90 MS



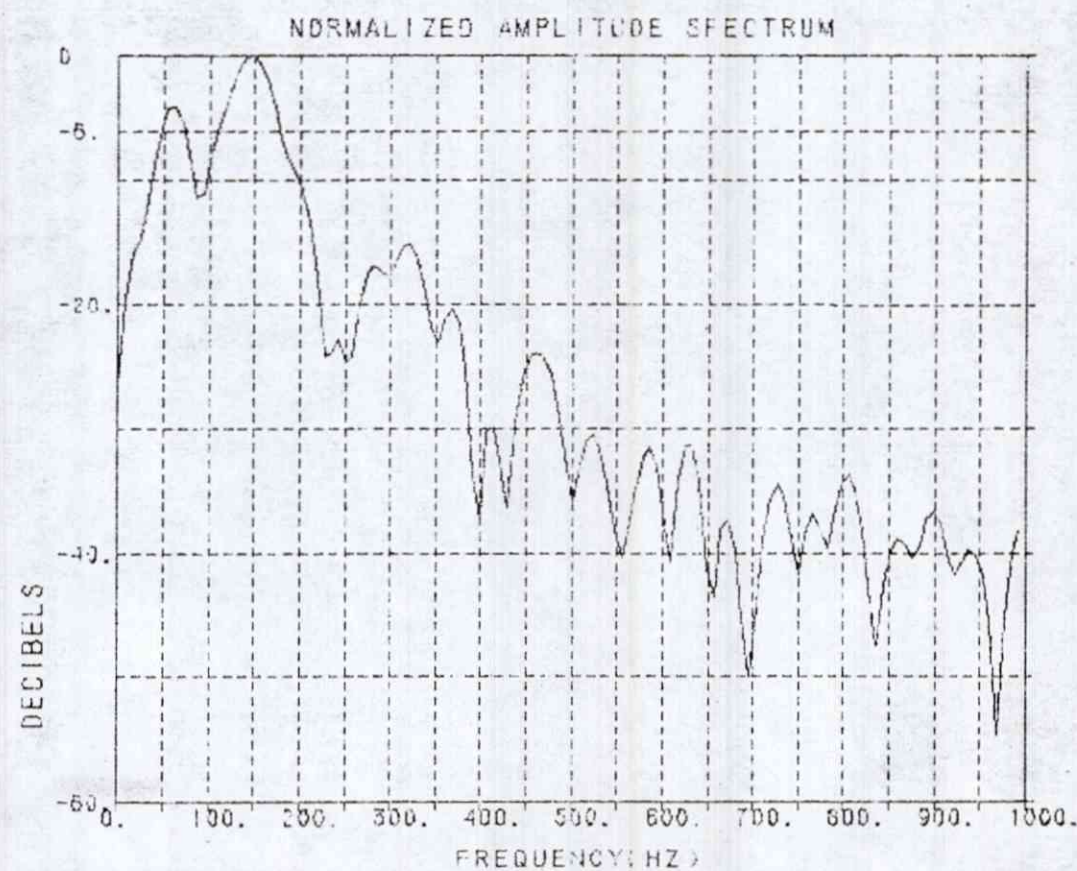
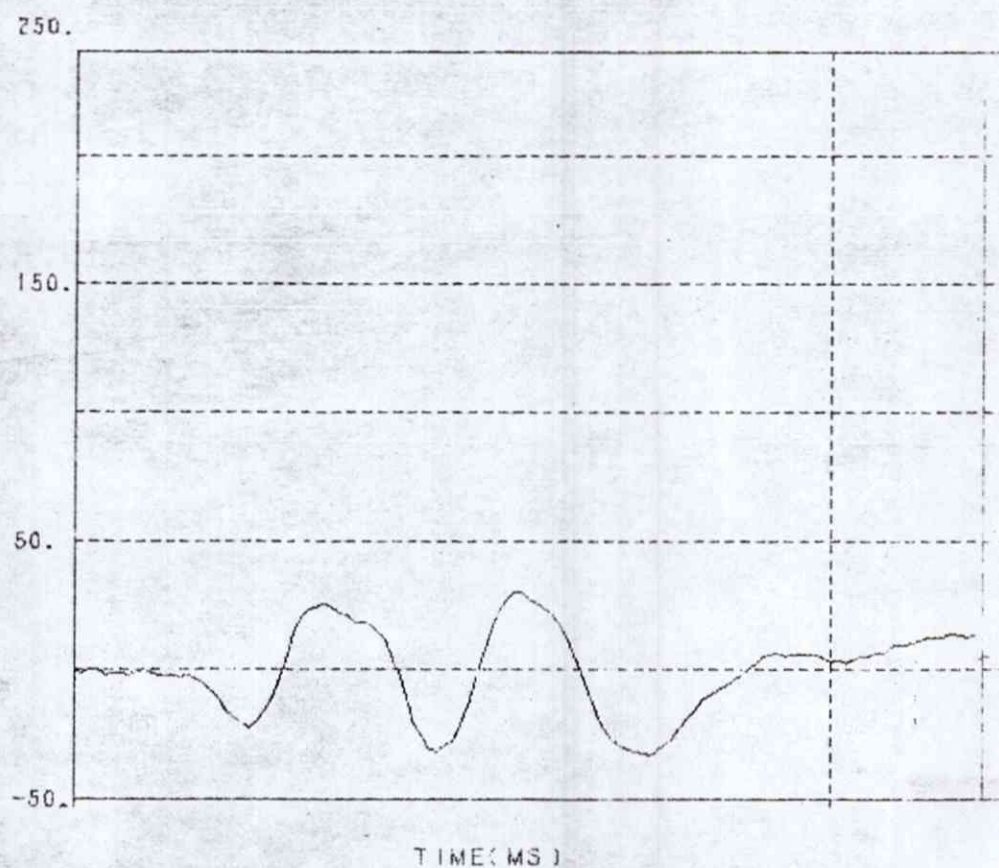
D 130

Plate

GECO PULSE TEST

1.42

STACK PULSE FILE 9 TRACE Σ 6, 8, 10 WINDOW: 60 - 90 MS



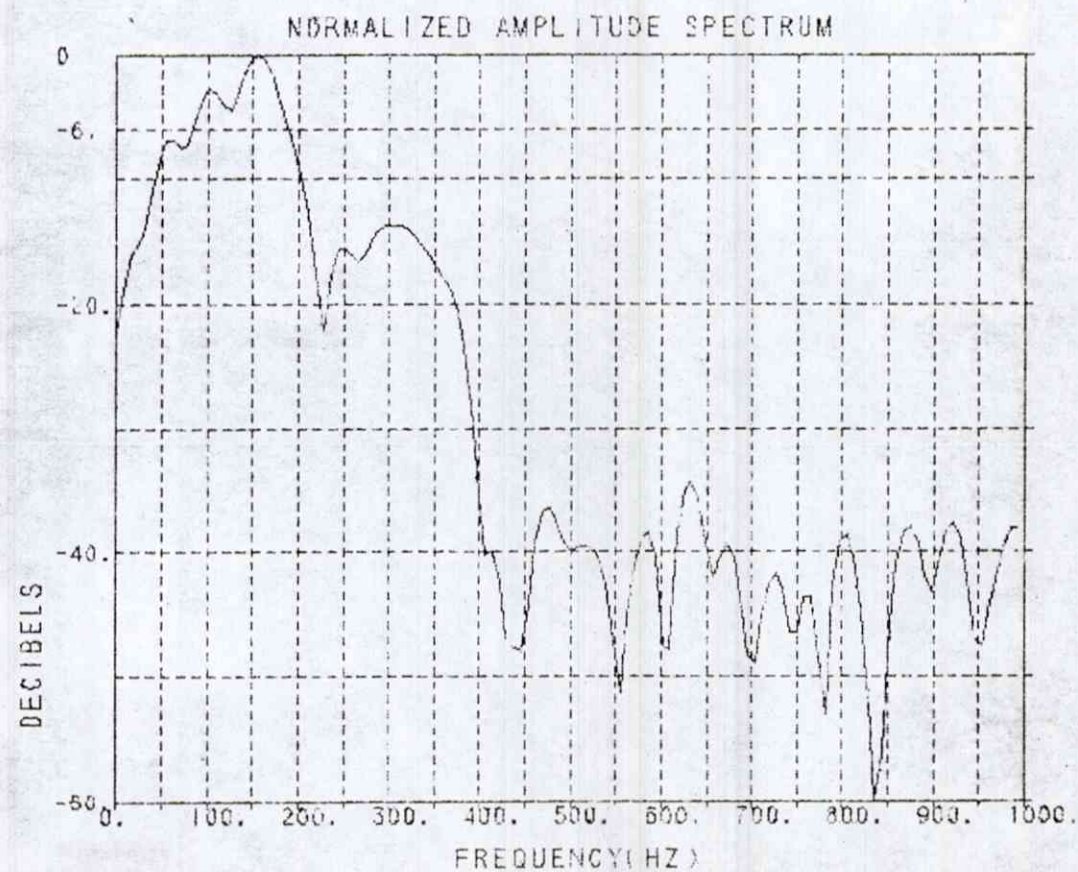
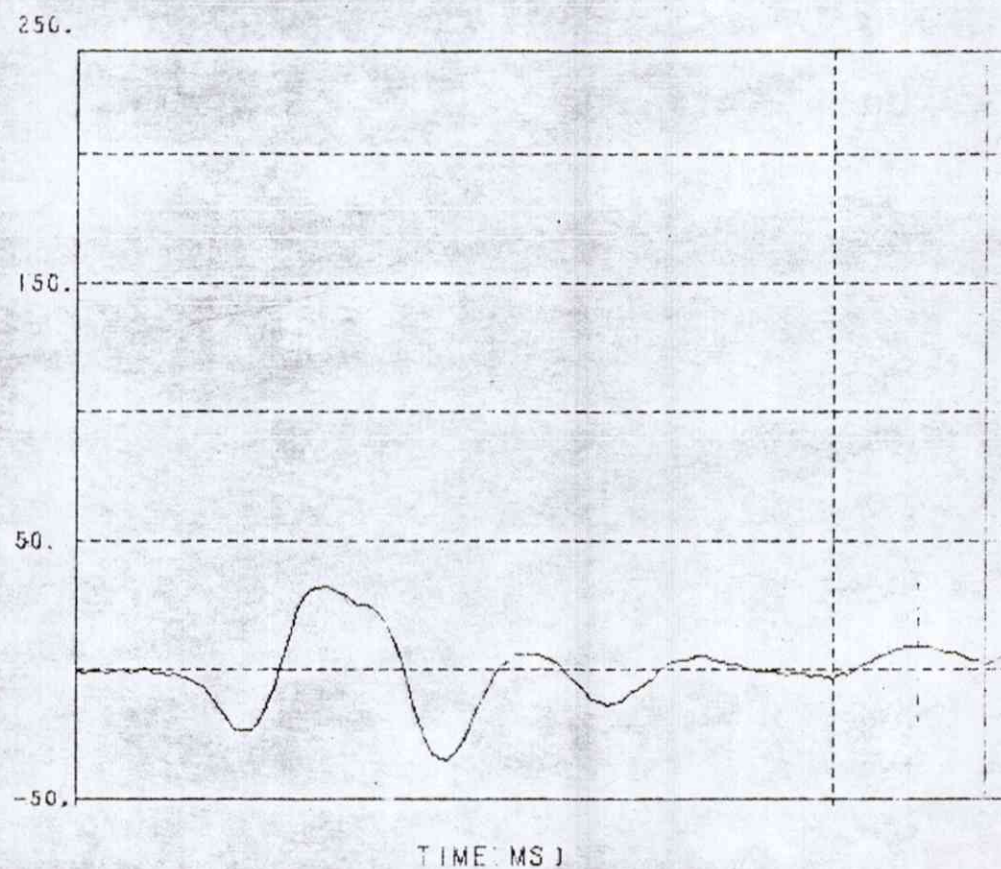
Stålpuigg
130g D. N 38

D 130g
patent

GECO PULSE TEST

1.43

STACK PULSE FILE 9 TRACE Σ 7, 9, 11 WINDOW: 60 - 90 MS

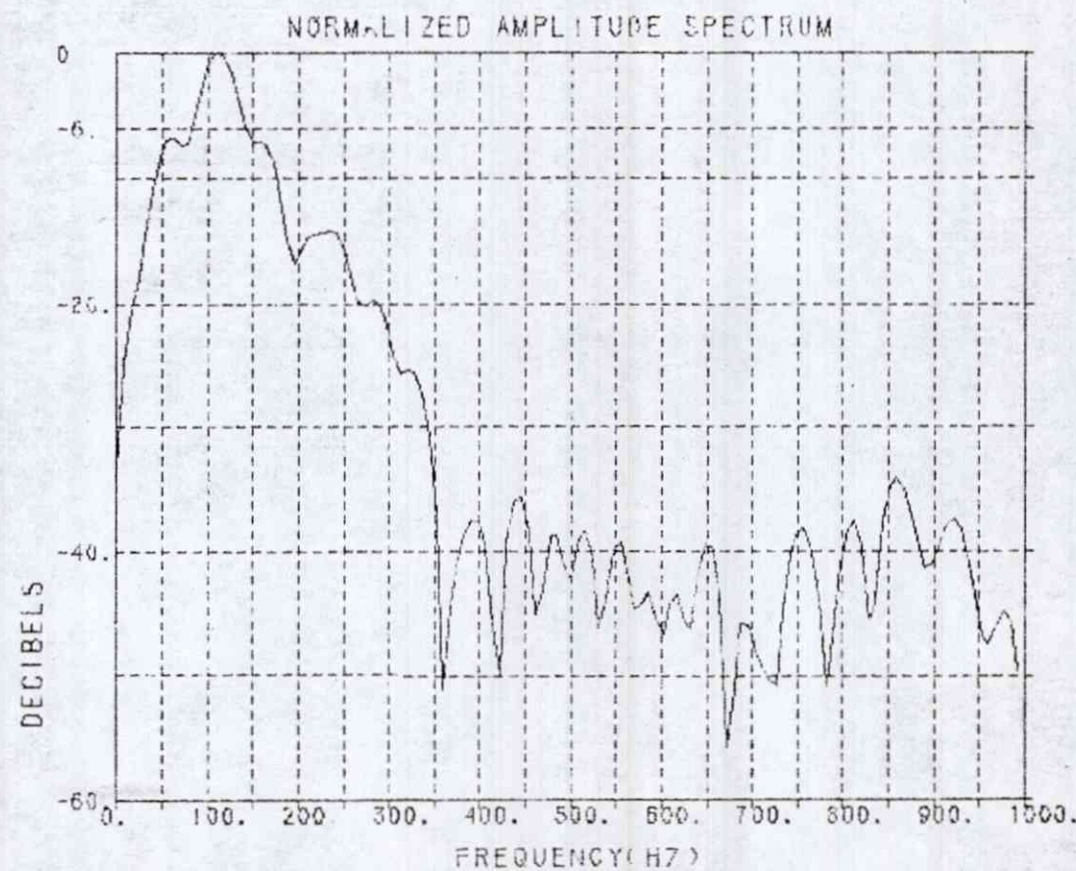
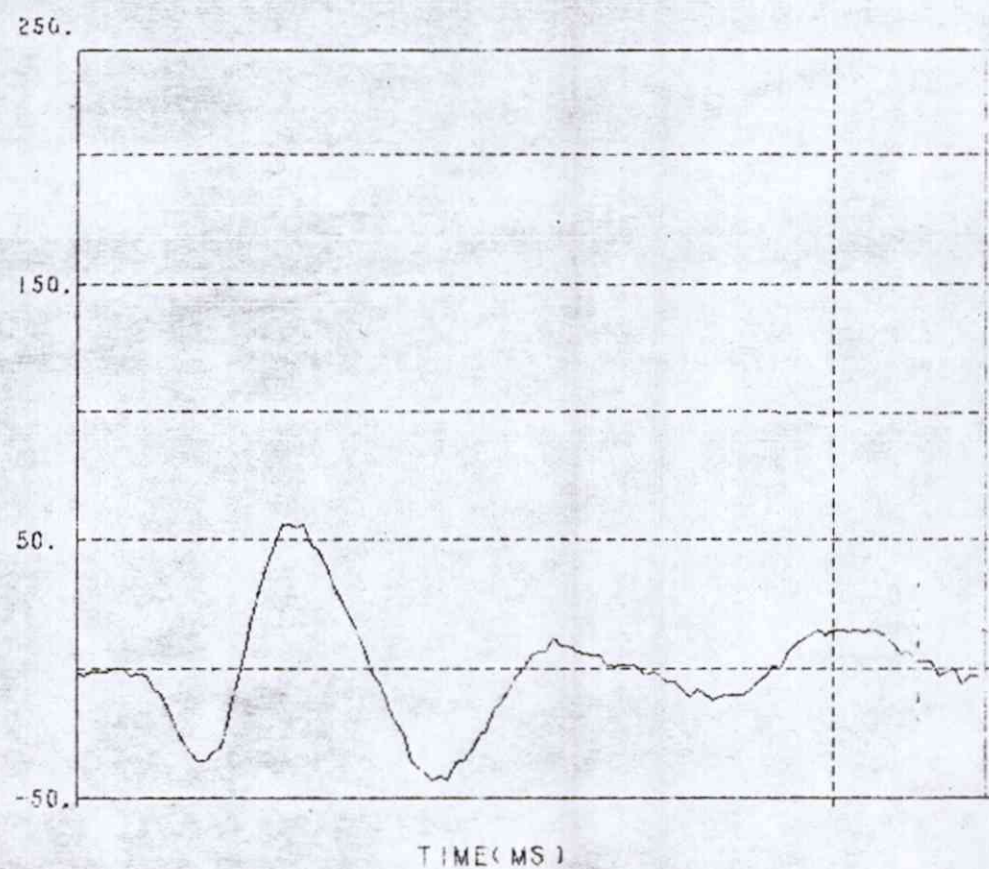


D130g
4x10m Array Pulse

GECO PULSE TEST

1.44

STACK PULSE FILE 9 TRACE 12 WINDOW: 60 - 90 MS

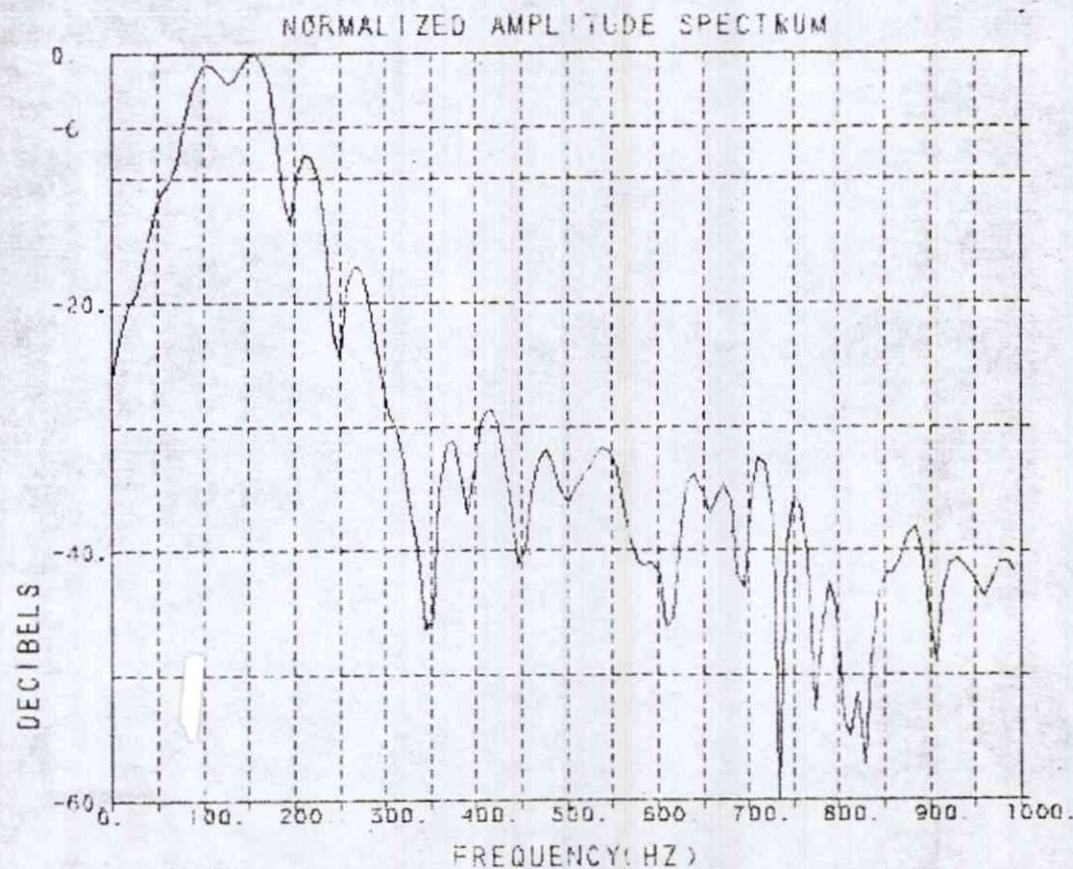
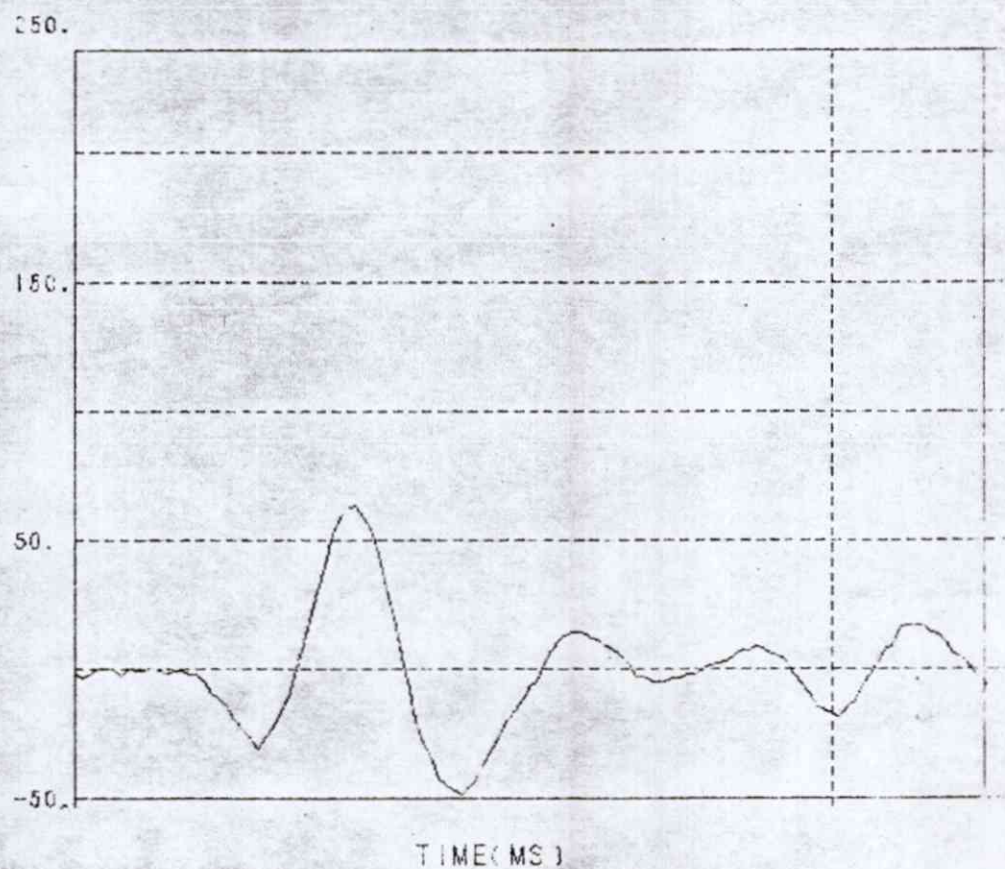


D/30g
Plate 10mm.

GECØ PULSE TEST

1.45

STACK PULSE FILE 9 TRACE 18 WINDOW 60 - 90 MS



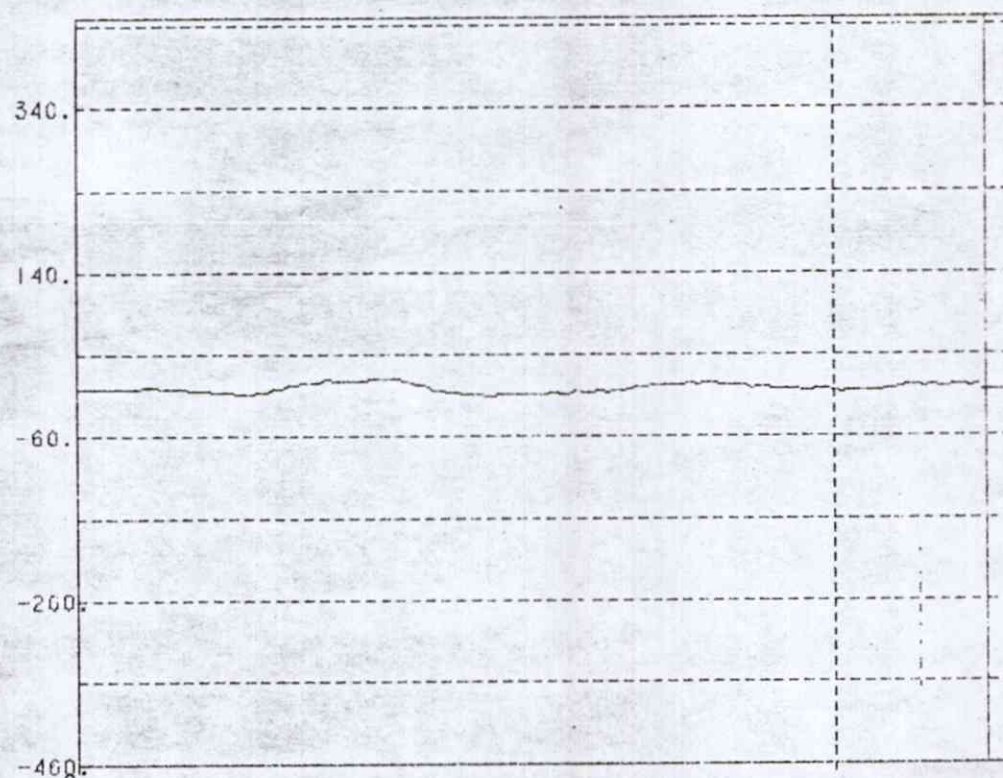
D 32.5g
Treplugg

GECO PULSE TEST

IDENT 100000 CHANNEL 1

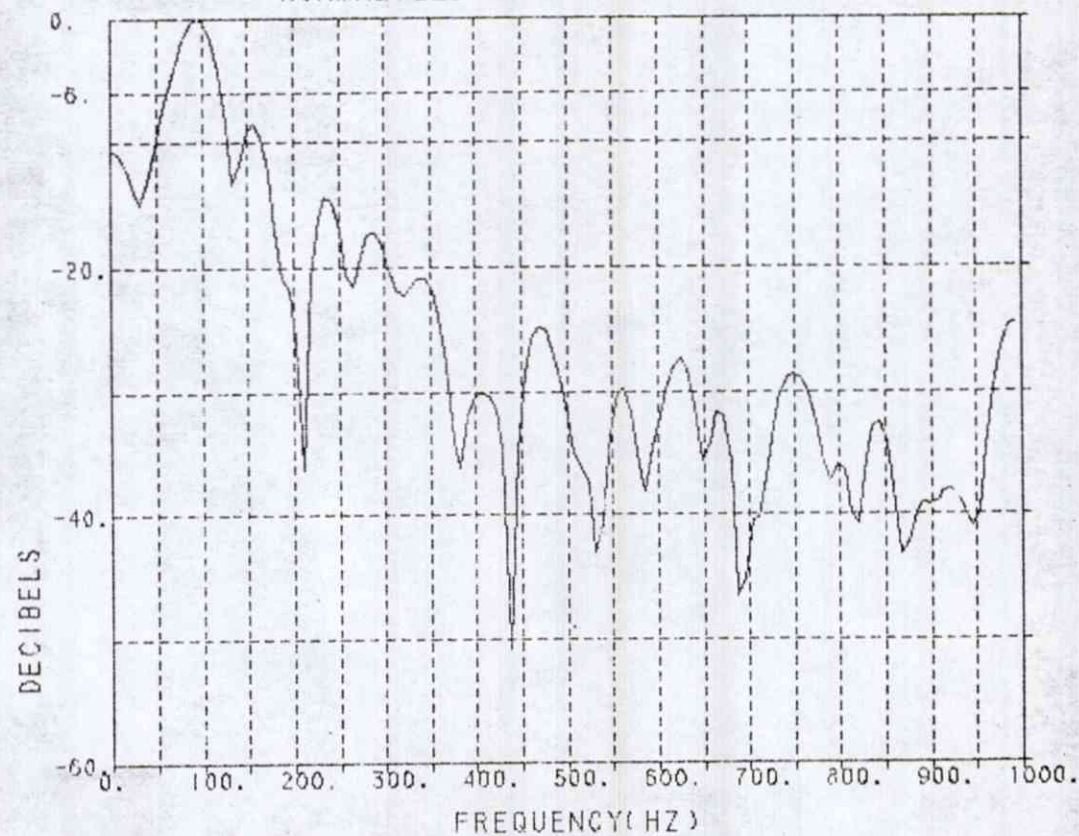
GEOTEAM TEST FILE 10 TRACE 1 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



32.5g
Tripod

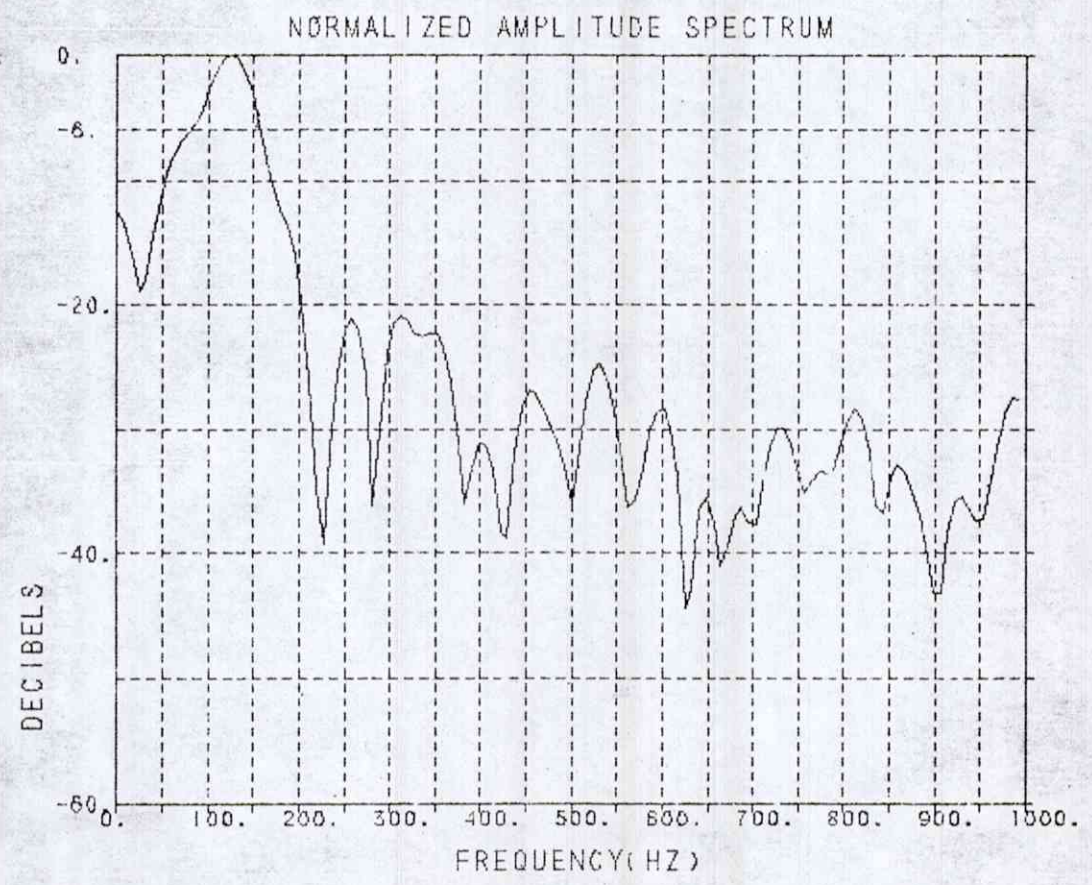
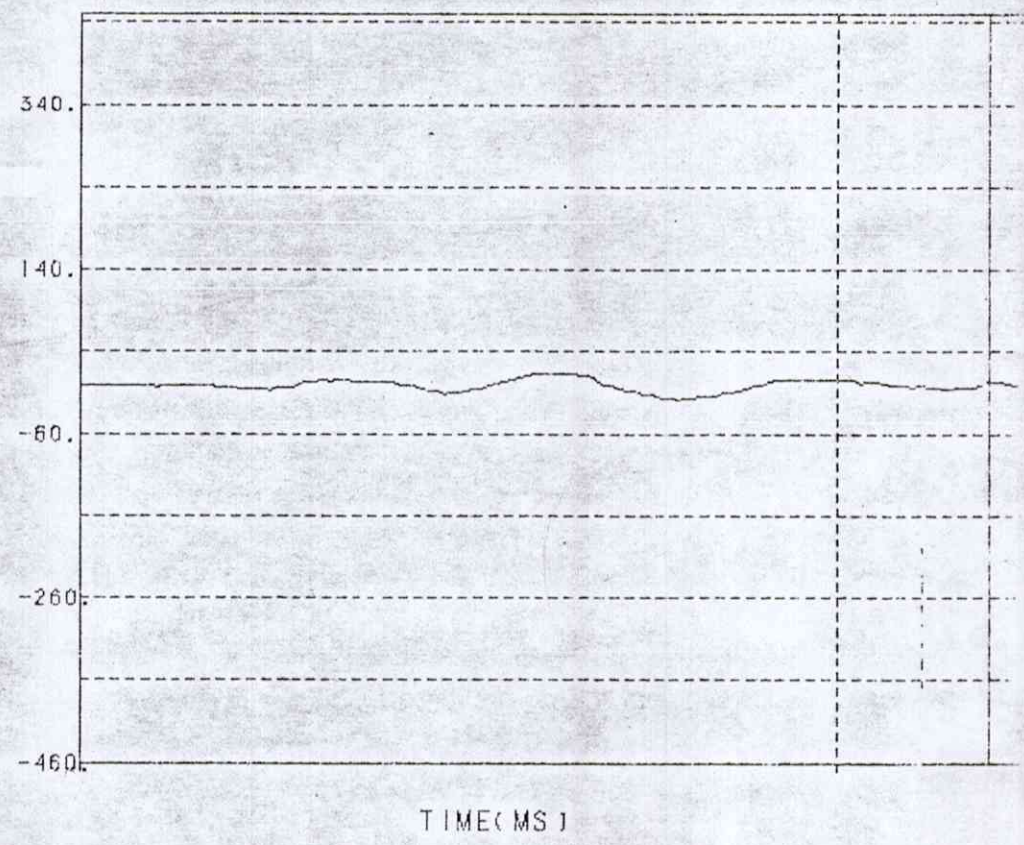
GECØ PULSE TEST

IDENT 100000 CHANNEL 8

GECTEAM TEST FILE 10 TRACE 8 WINDOW 60-90 MS.

1.47

540.



Stålplugg

32,5g D N 380

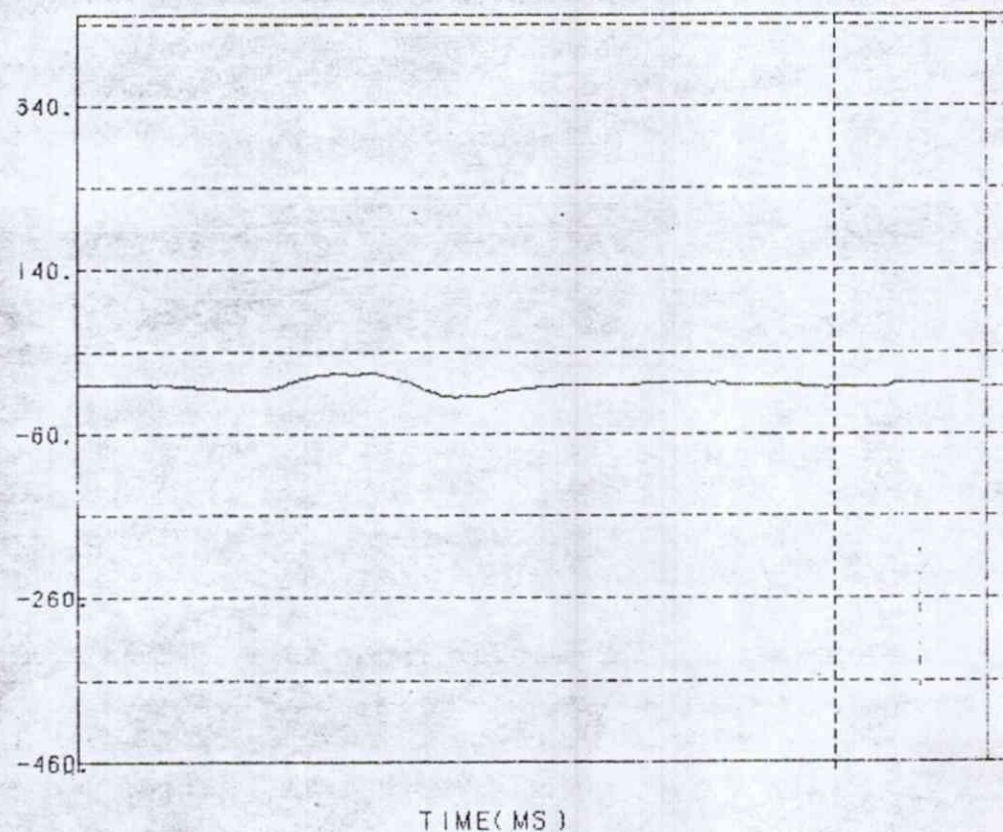
32,5g
Pulver

GECØ PULSE TEST

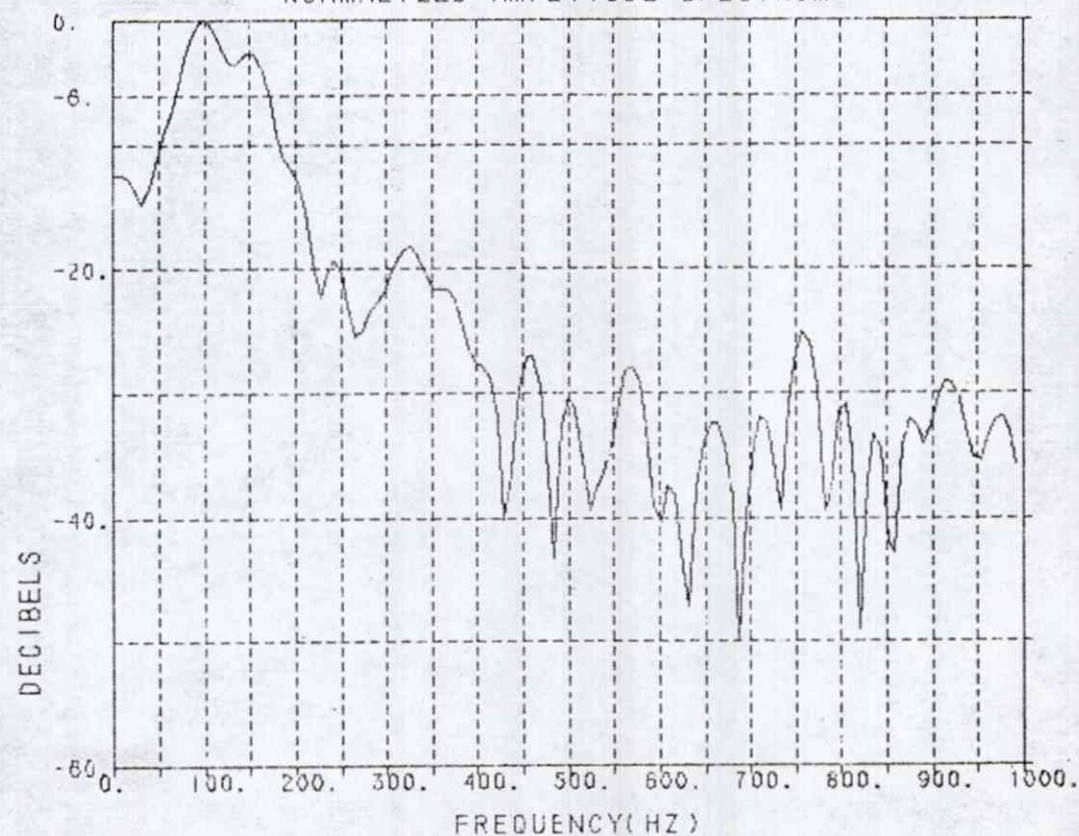
IDENT 100000 CHANNEL 9

GEOTEAM TEST FILE 10 TRACE 9 WINDOW 60-90 MS.

540.



NORMALIZED AMPLITUDE SPECTRUM



Stålplugg . 32,5D . N380

1.48

CY-30g
Treplugg.

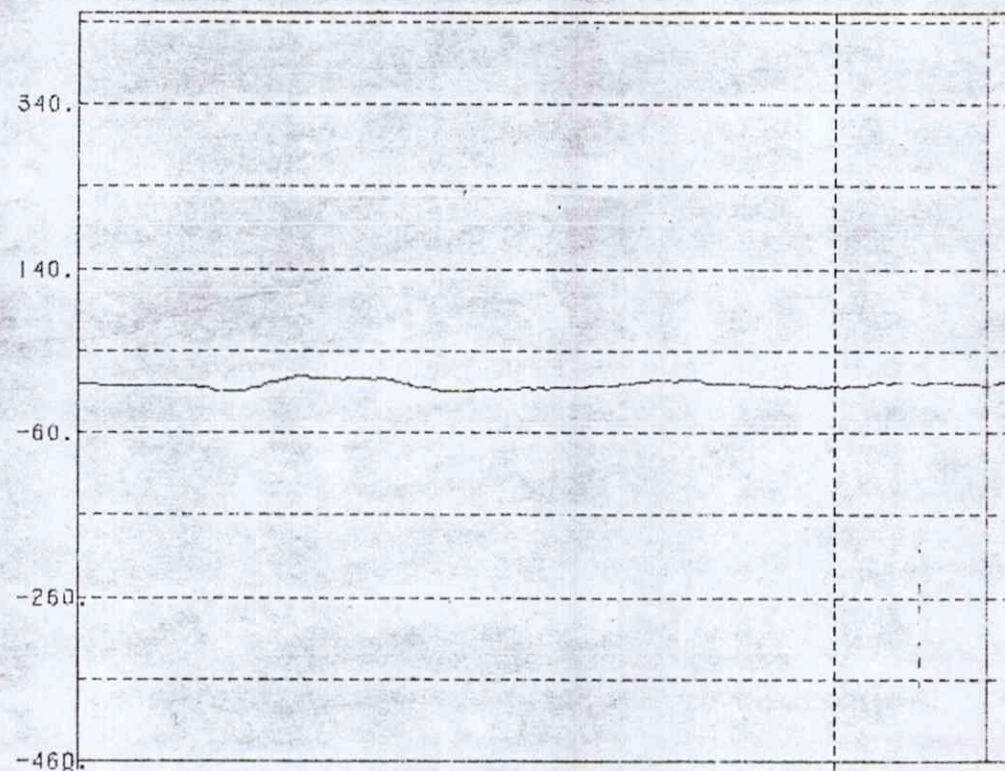
GEC0 PULSE TEST

IDENT 110000 CHANNEL 1

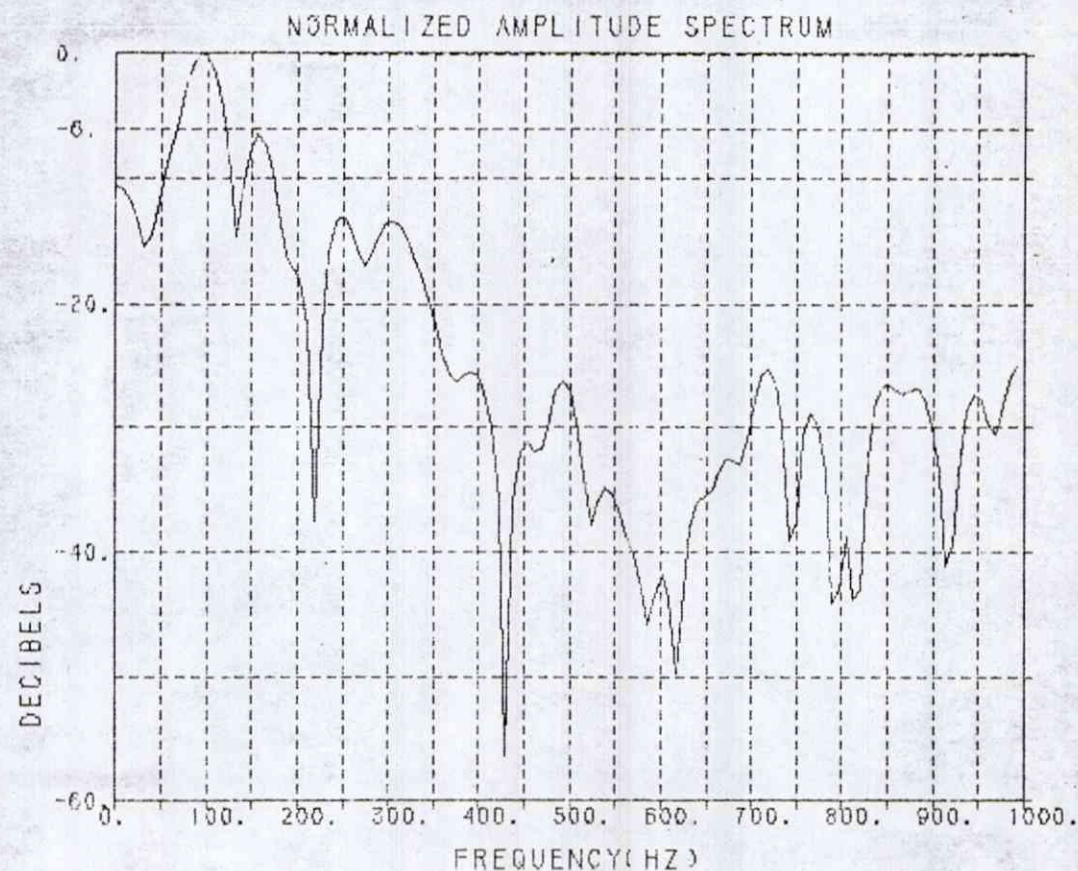
1.49

GEOTEAM TEST FILE 11 TRACE 1 WINDOW 80-90 MS.

540.



TIME (MS)



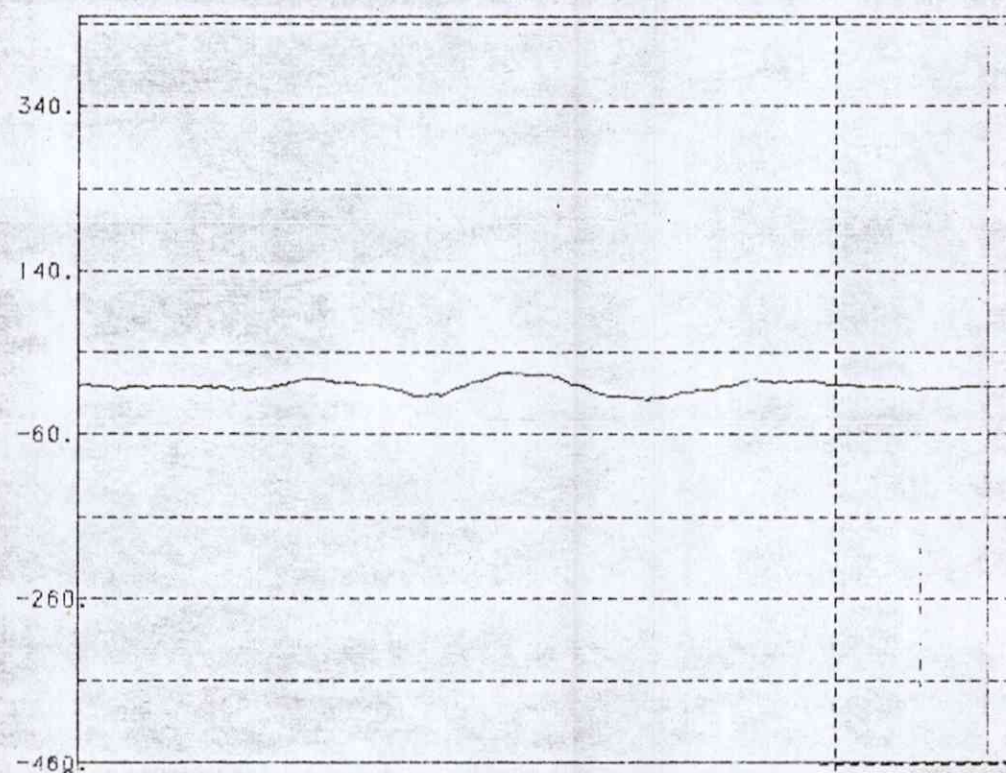
C4-30g
Triped

GECØ PULSE TEST

IDENT 110000 CHANNEL 8

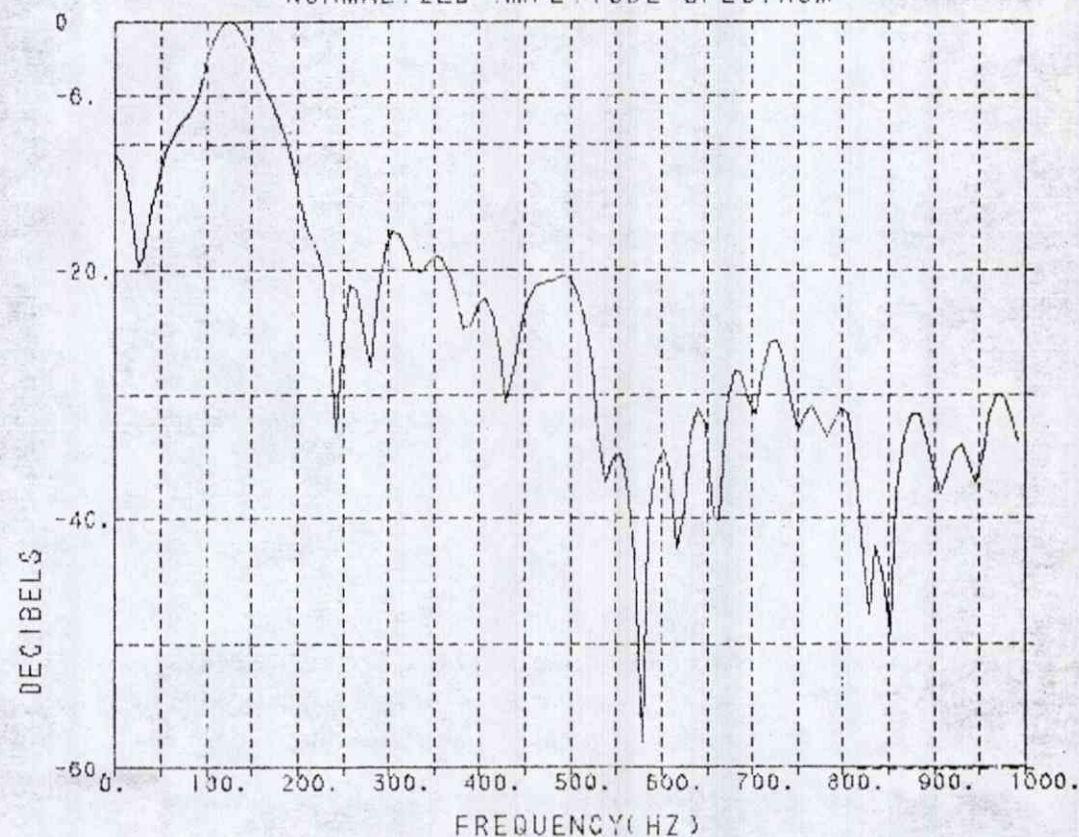
GEOTEAM TEST FILE 11 TRACE 8 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



C4,30g
Patent

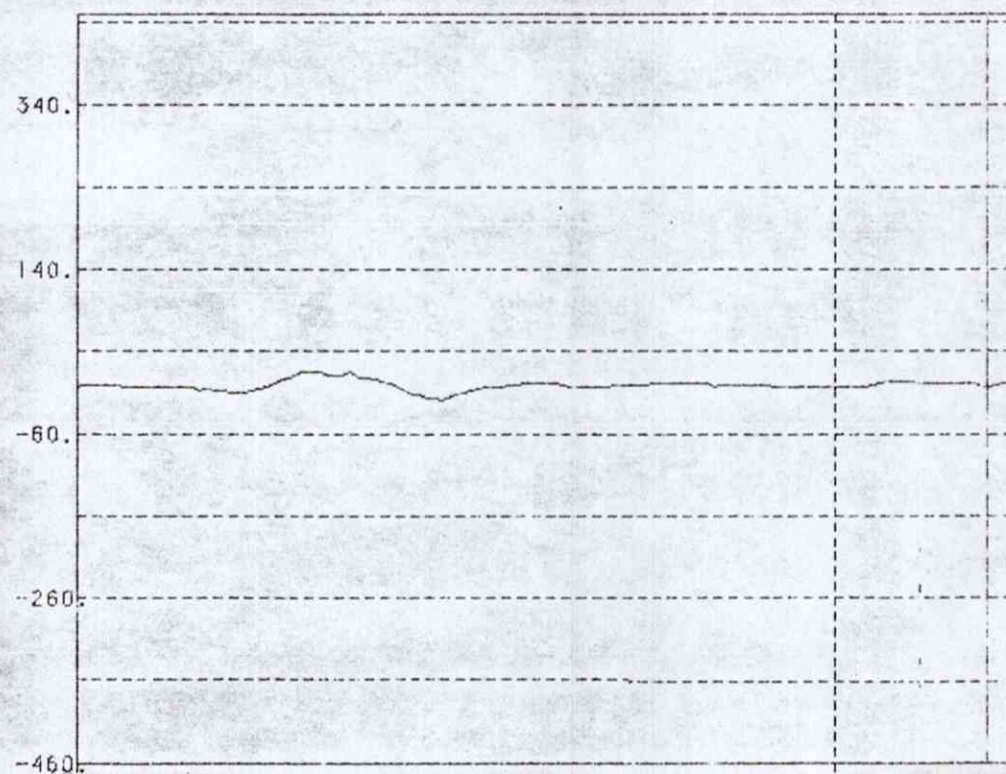
GECØ PULSE TEST

IDENT 110000 CHANNEL 9

1.51

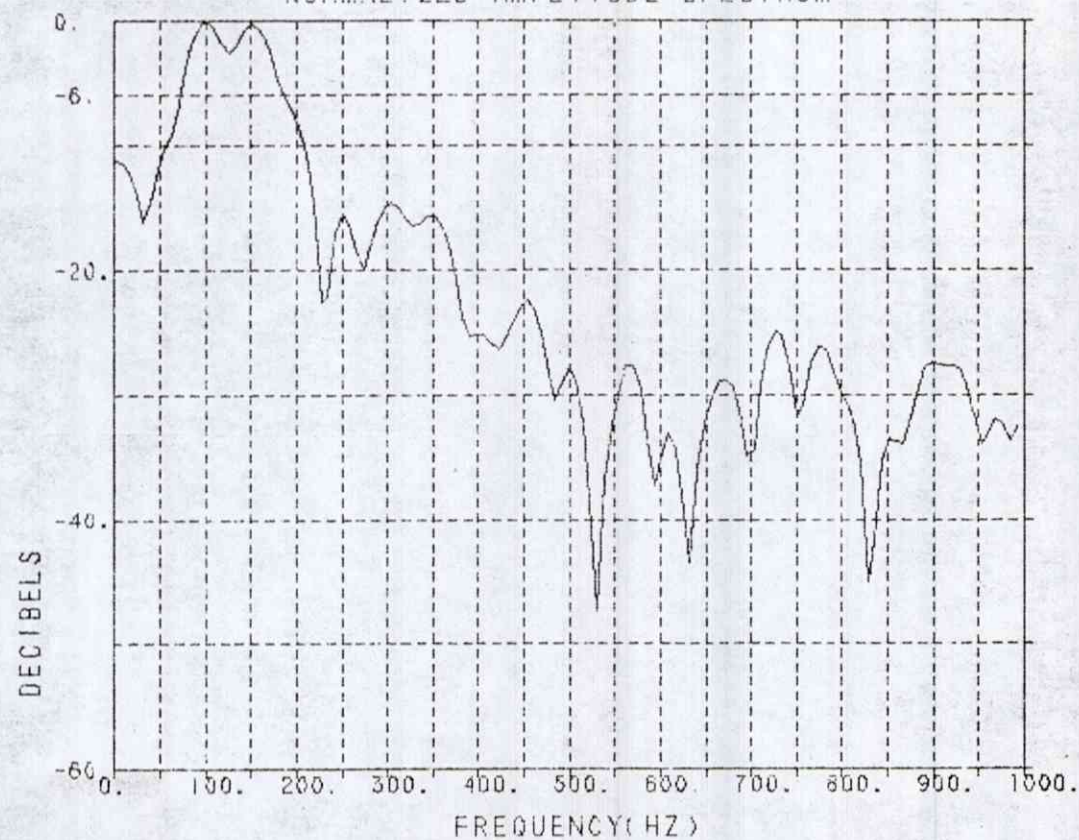
GEOTEAM TEST FILE 11 TRACE 9 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



Stålplugg. 25-30g C4. N380

04, 15g
Trephing

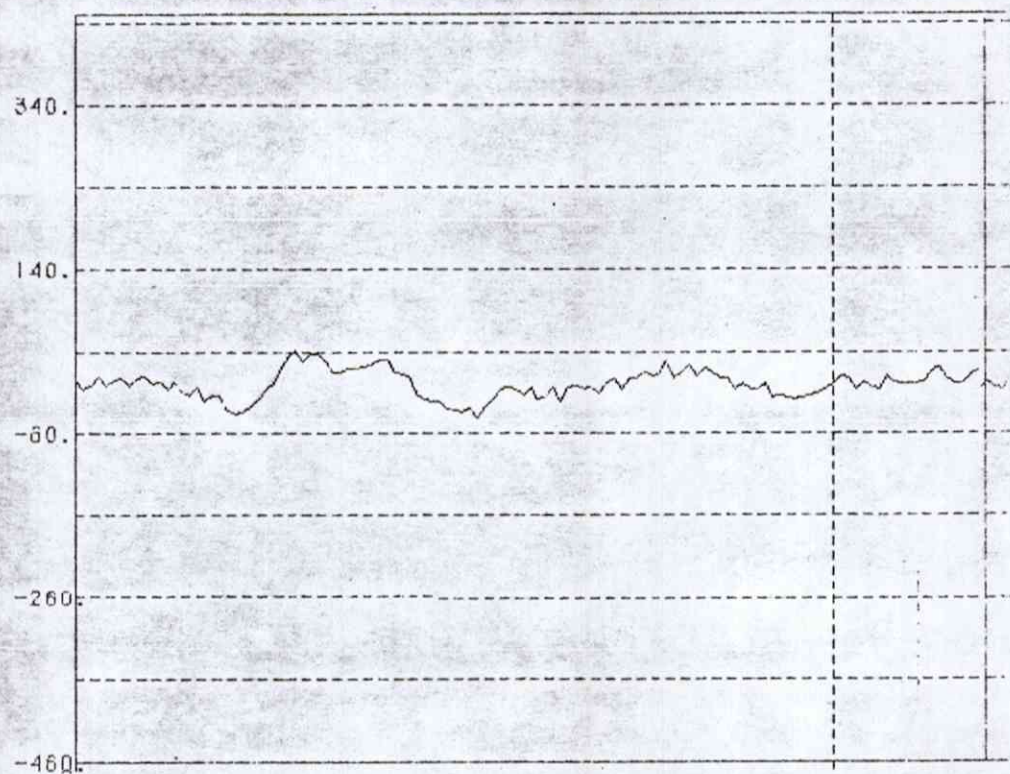
GECO PULSE TEST

1.52

IDENT 120000 CHANNEL 1

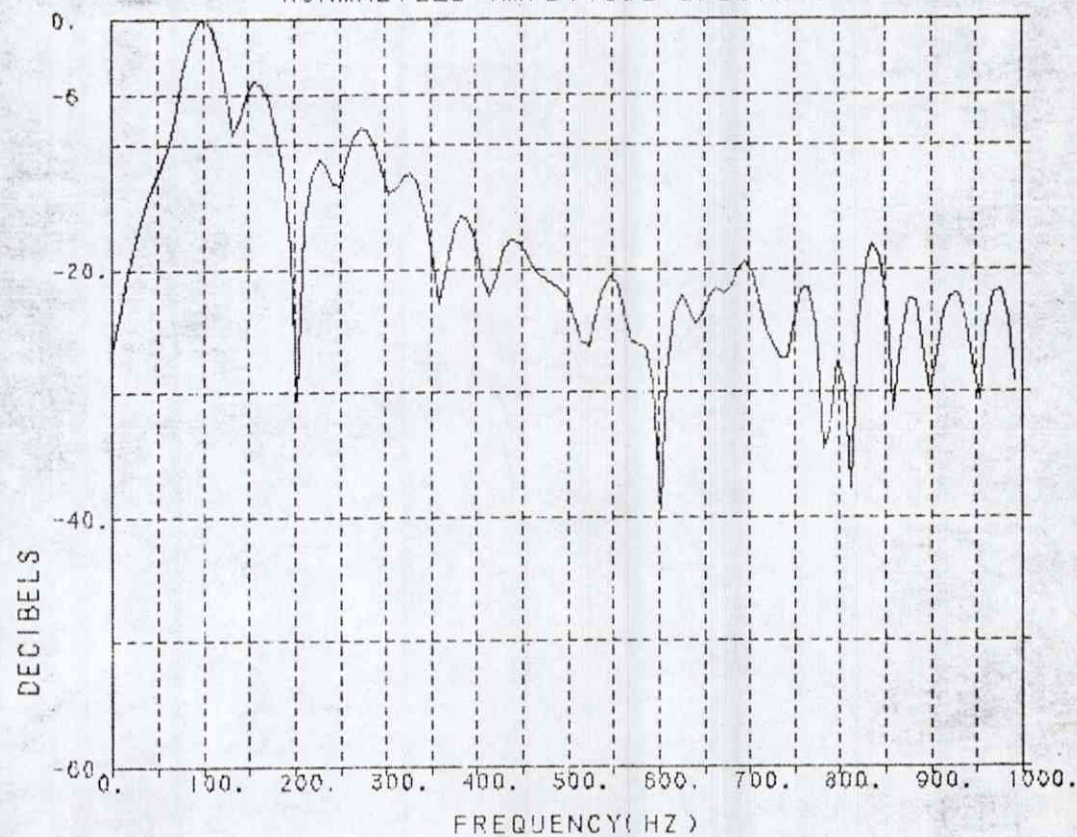
GEOTEAM TEST FILE 12 TRACE 1 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



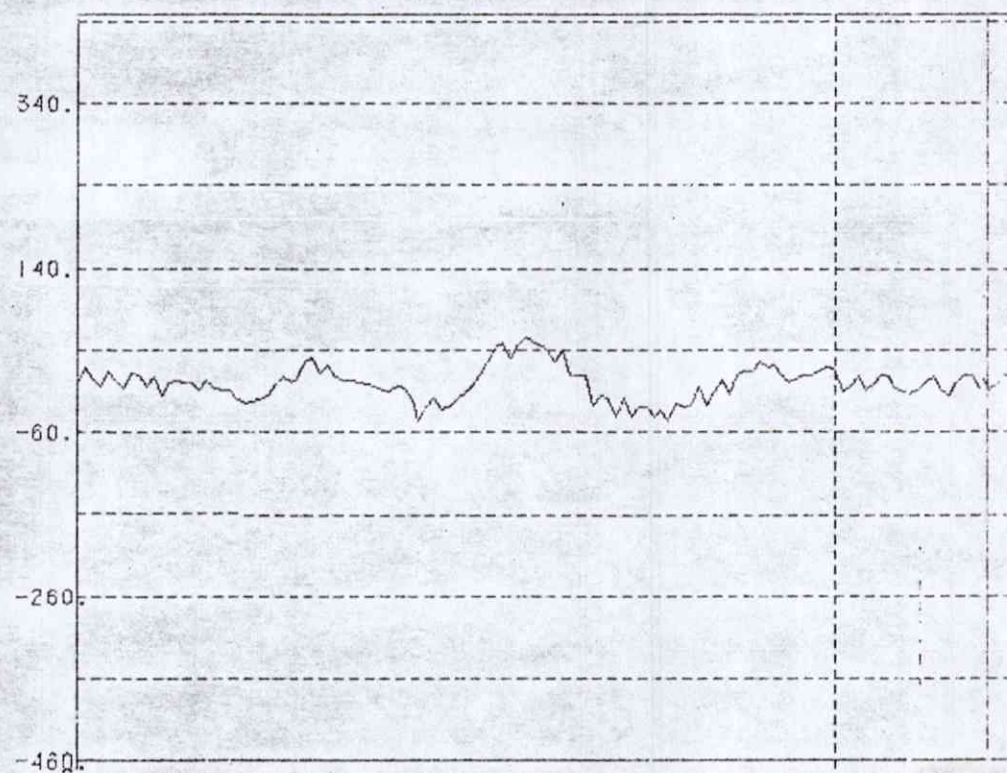
04, 15g
Tripod

GEC3 PULSE TEST

IDENT 120000 CHANNEL 8

GEOTEAM TEST FILE 12 TRACE 8 WINDOW 60-90 MS.

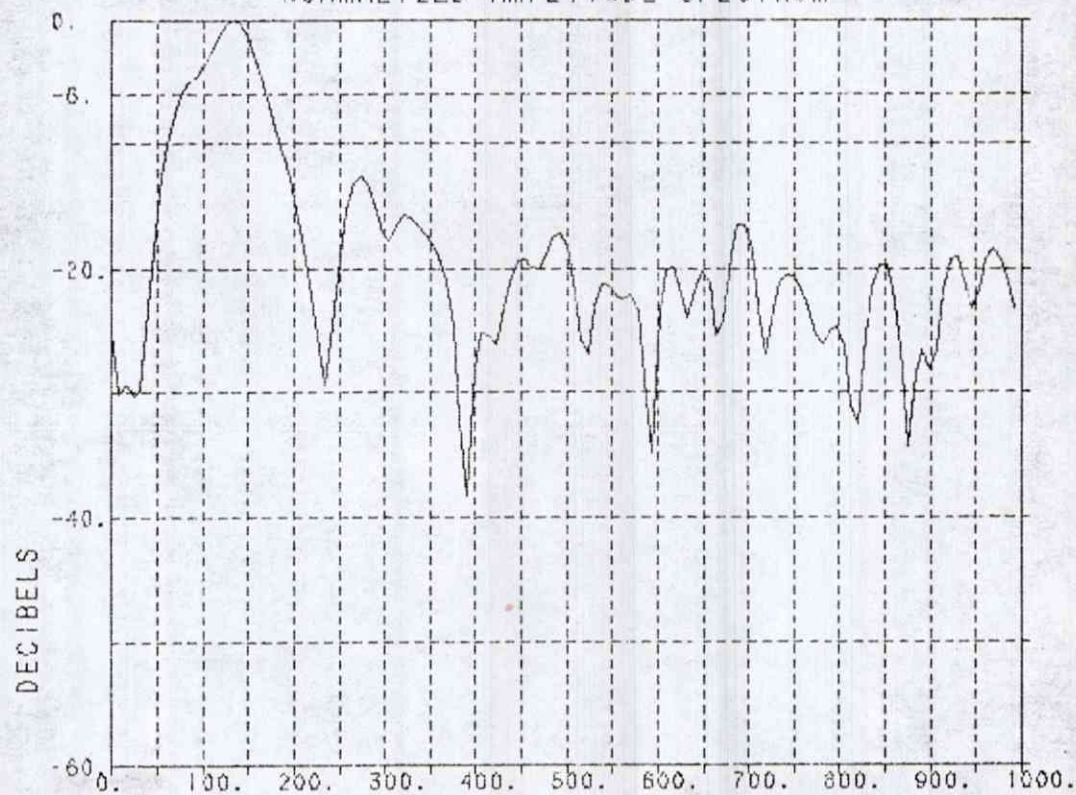
540.



TIME(MS)

1.53

NORMALIZED AMPLITUDE SPECTRUM



FREQUENCY(HZ)

C4, 15g
1 Patent

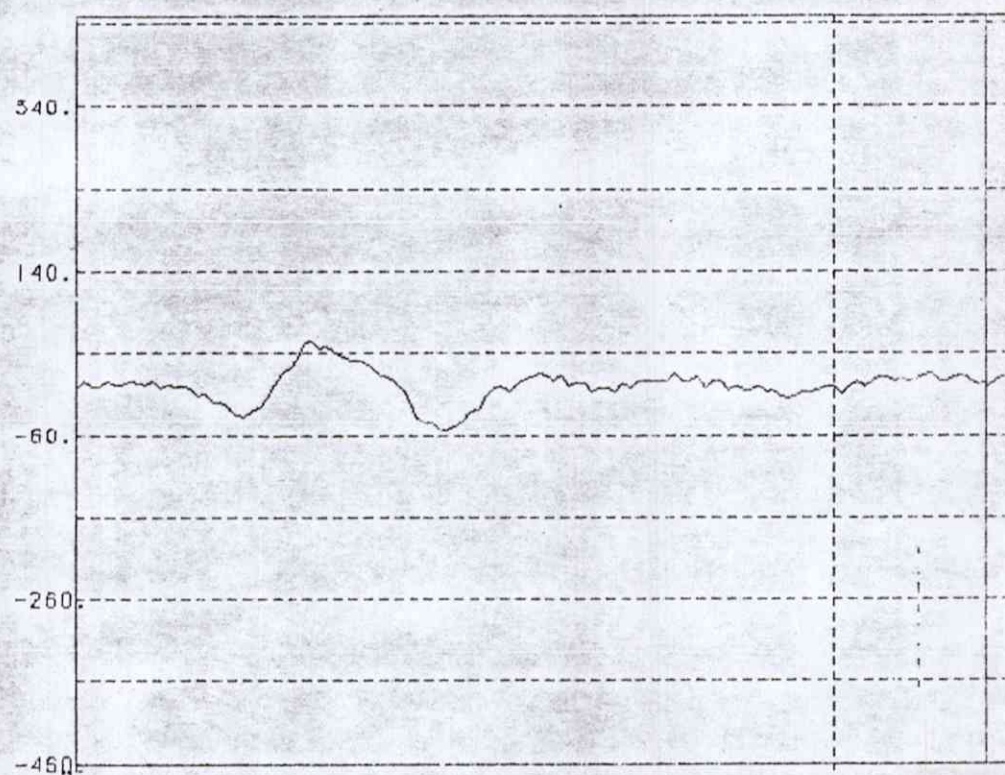
GECØ PULSE TEST

1.54

IDENT 120000 CHANNEL 9

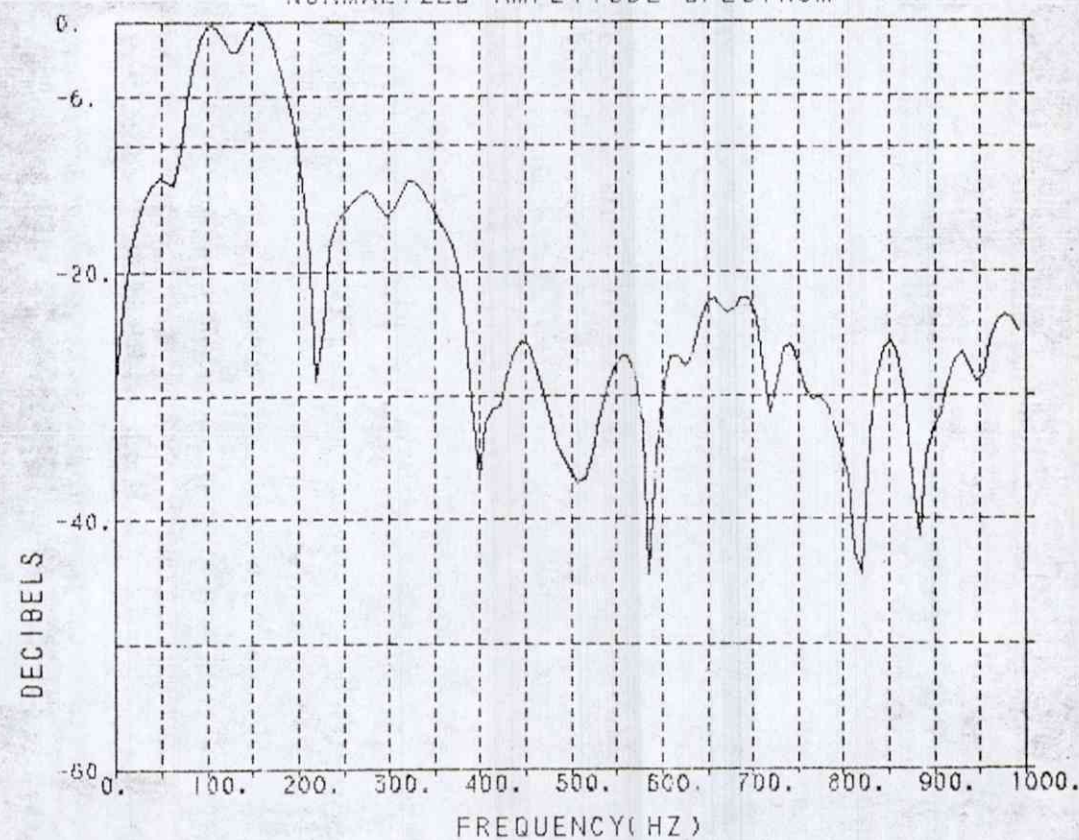
GEOTEAM TEST FILE 12 TRACE 9 WINDOW 60-90 MS.

540.



TIME(MS)

NORMALIZED AMPLITUDE SPECTRUM



Stålplugg. 10-15g C4. N-380

3 kumre
Treplugg

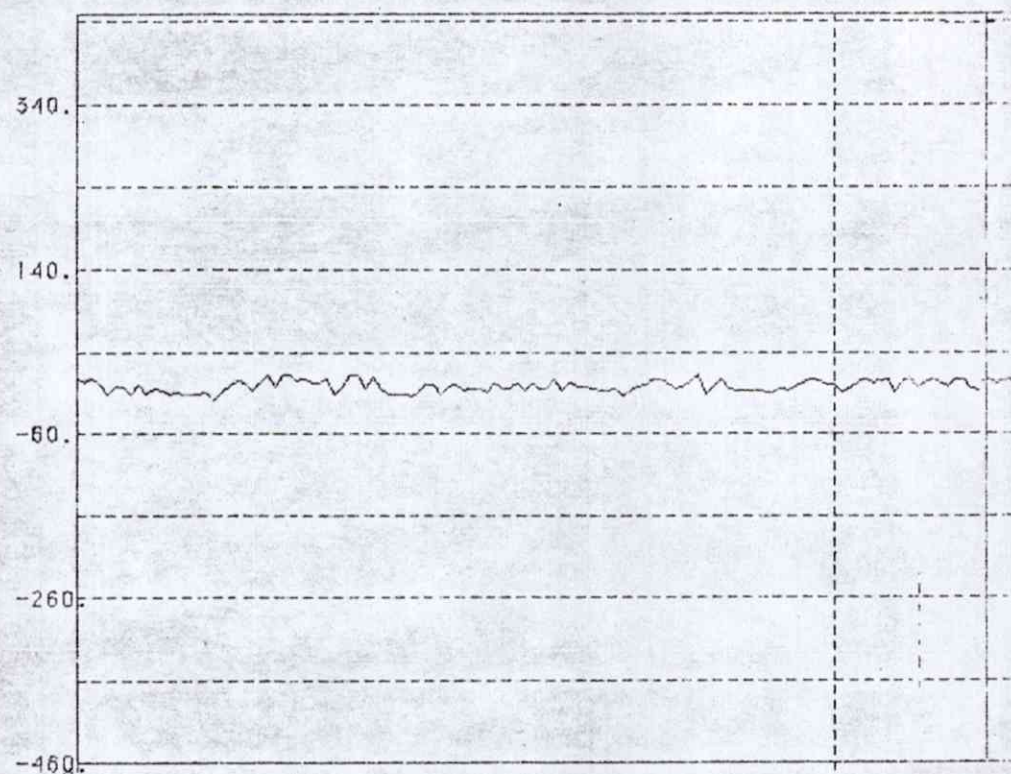
GEC0 PULSE TEST

IDENT 130000 CHANNEL 1

1.55

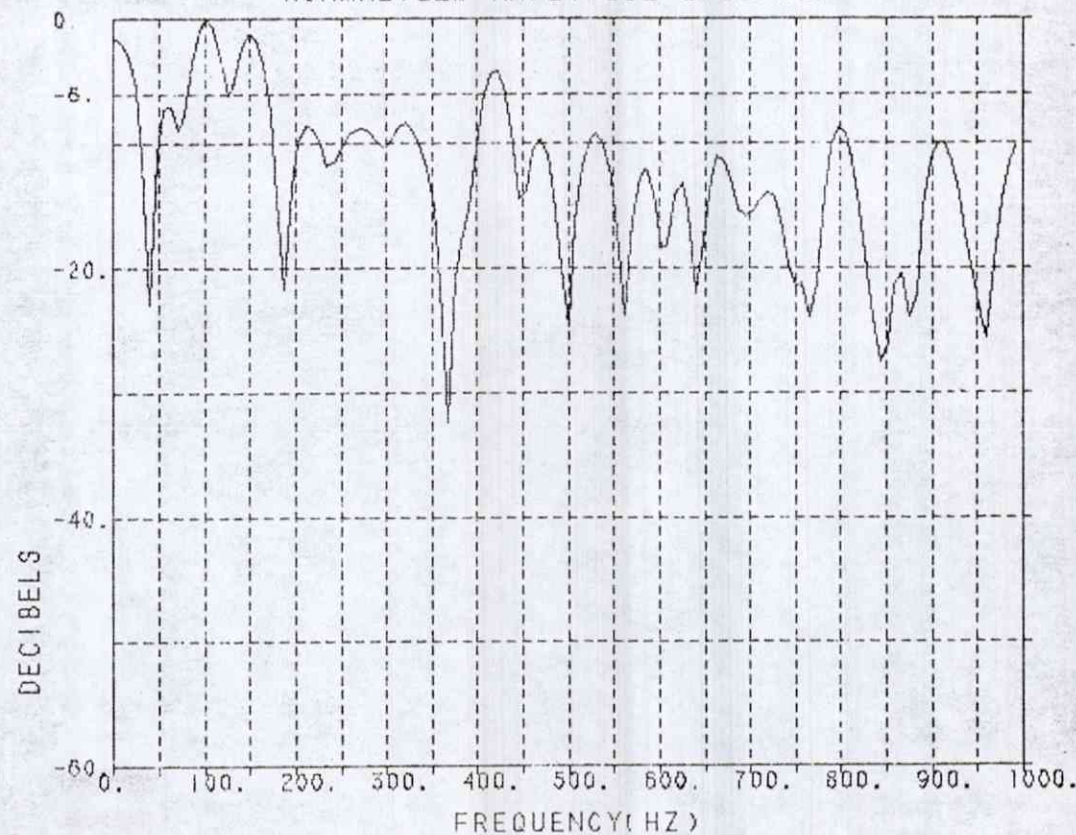
GECTEAM TEST FILE 13 TRACE 1 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



3 turn
Tripod

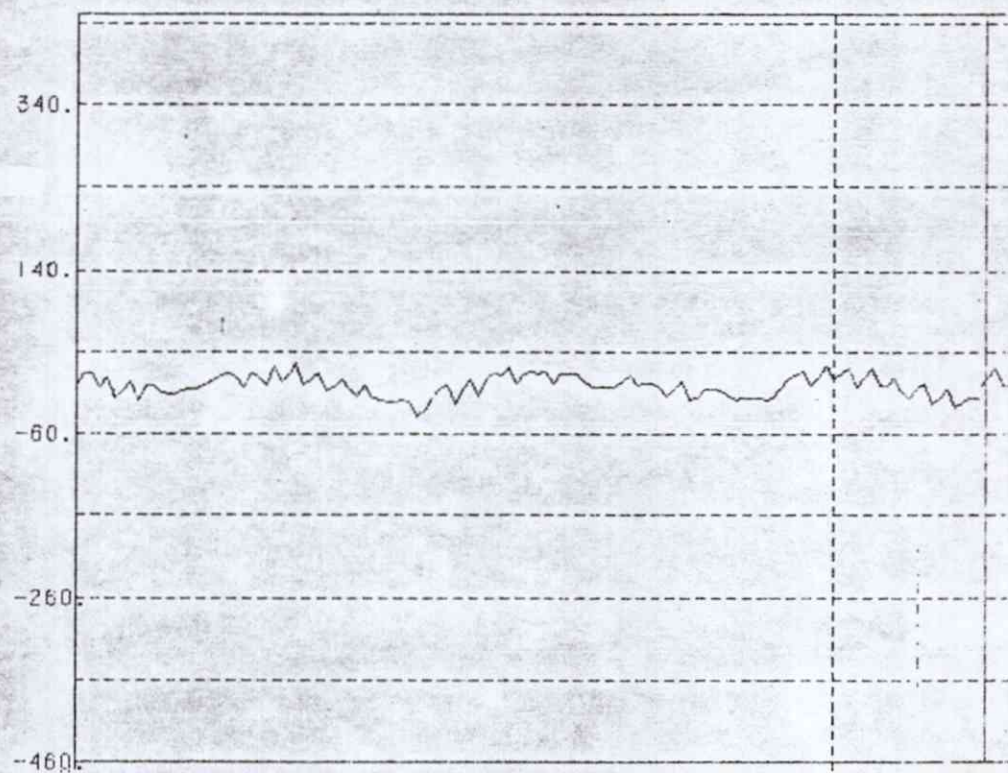
GECØ PULSE TEST

IDENT 130000 CHANNEL 8

1.56

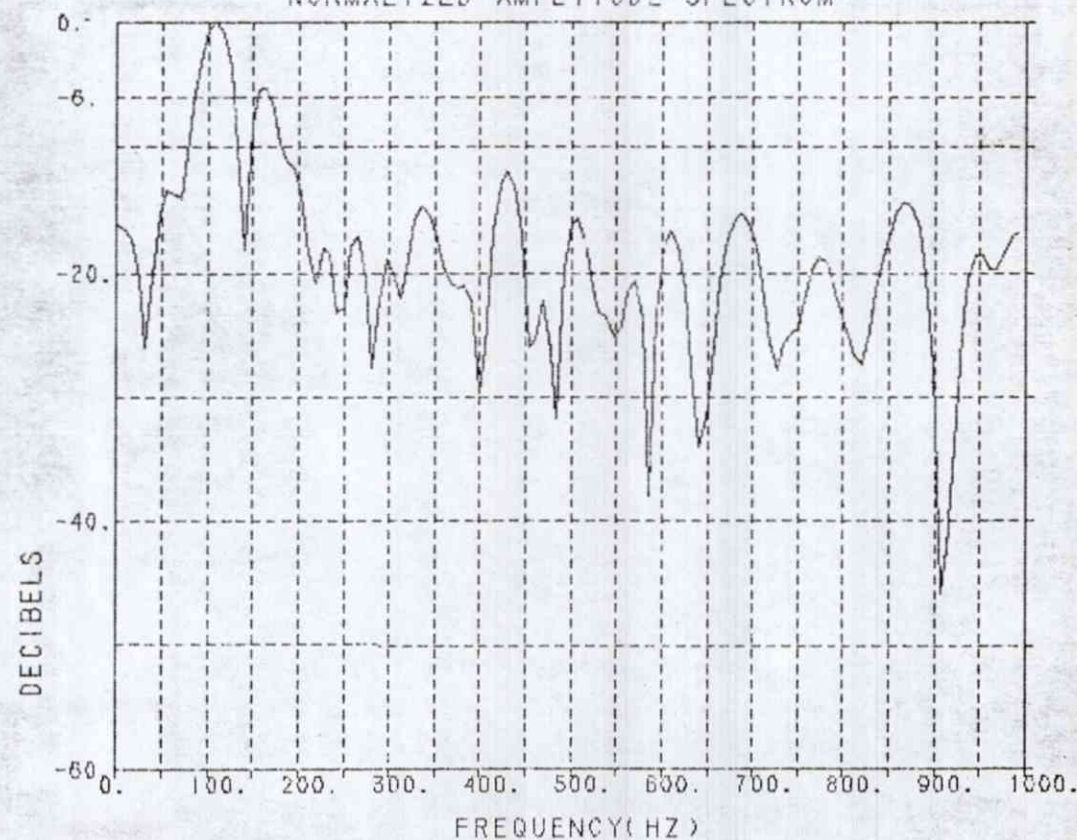
GEOTEAM TEST FILE 13 TRACE 8 WINDOW 60-90 MS.

540.



TIME(MS)

NORMALIZED AMPLITUDE SPECTRUM



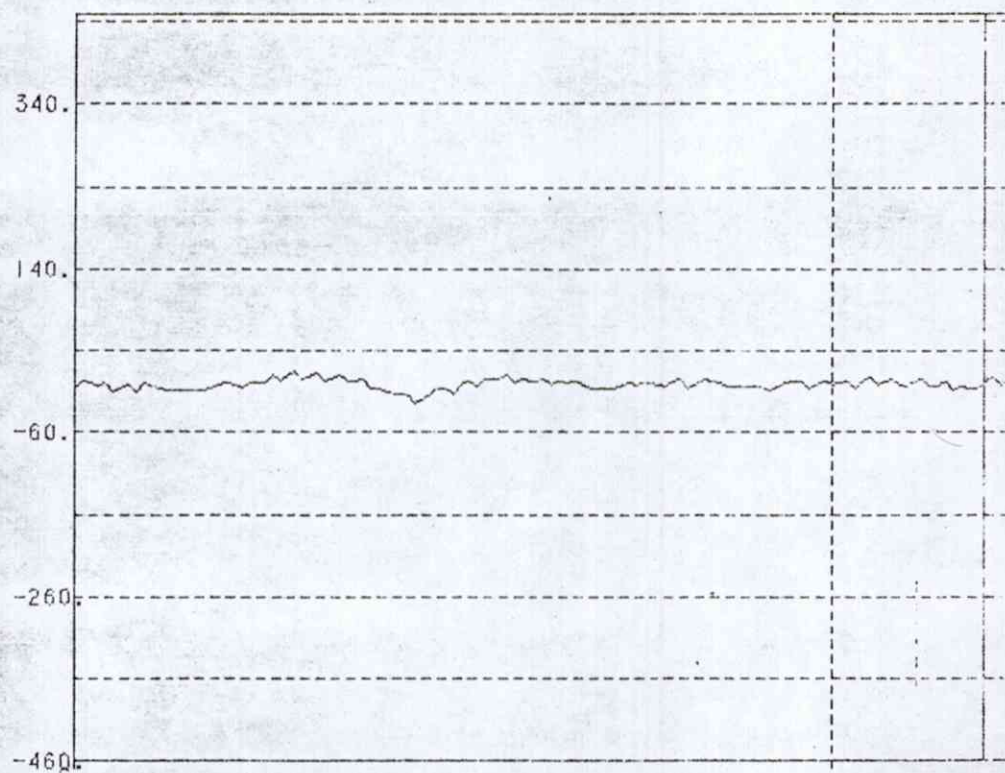
3 km
Patent

GECØ PULSE TEST

IDENT 130000 CHANNEL 9

GECØTEAM TEST FILE 13 TRACE 9 WINDOW 60-90 MS.

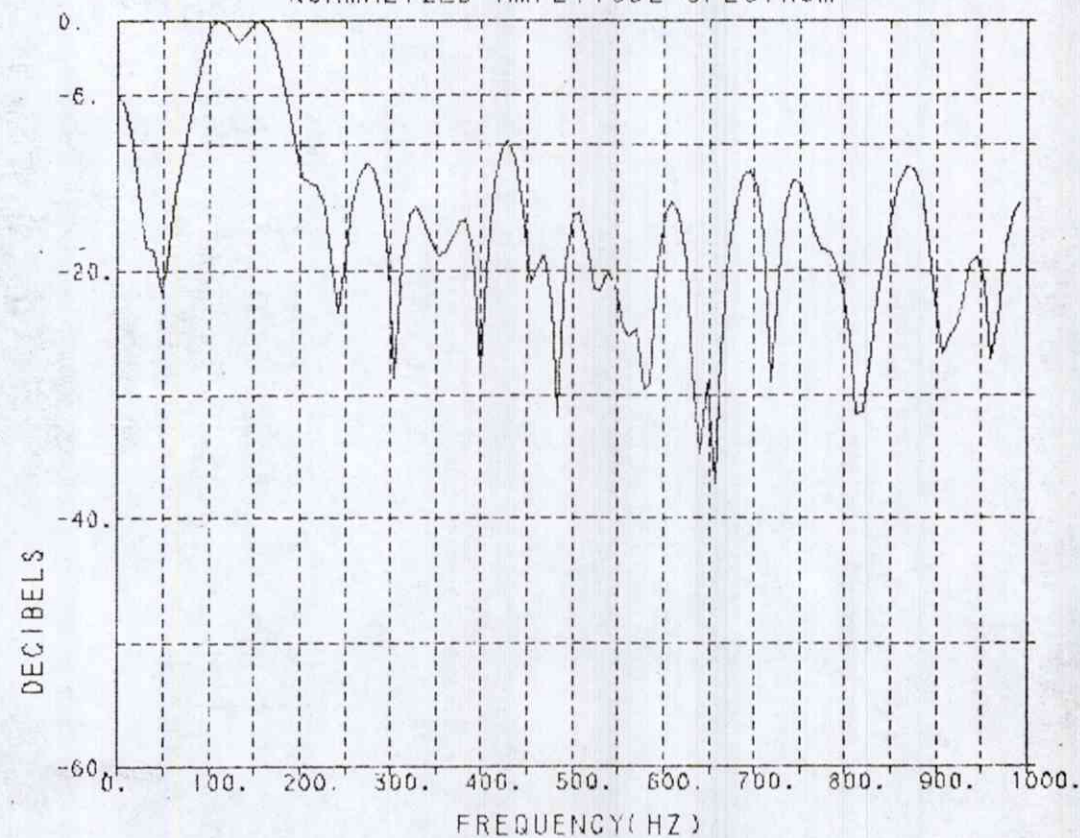
540.



TIME (MS)

1.57

NORMALIZED AMPLITUDE SPECTRUM



D 65g
Trephing

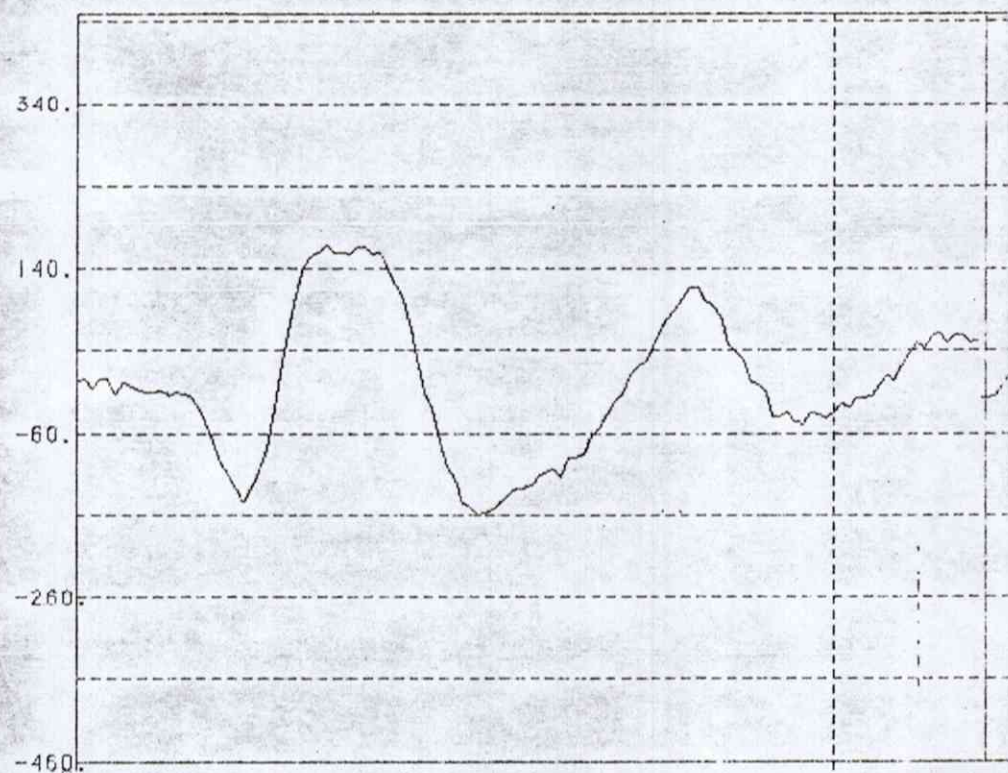
GECØ PULSE TEST

IDENT 140000 CHANNEL 1

1.58

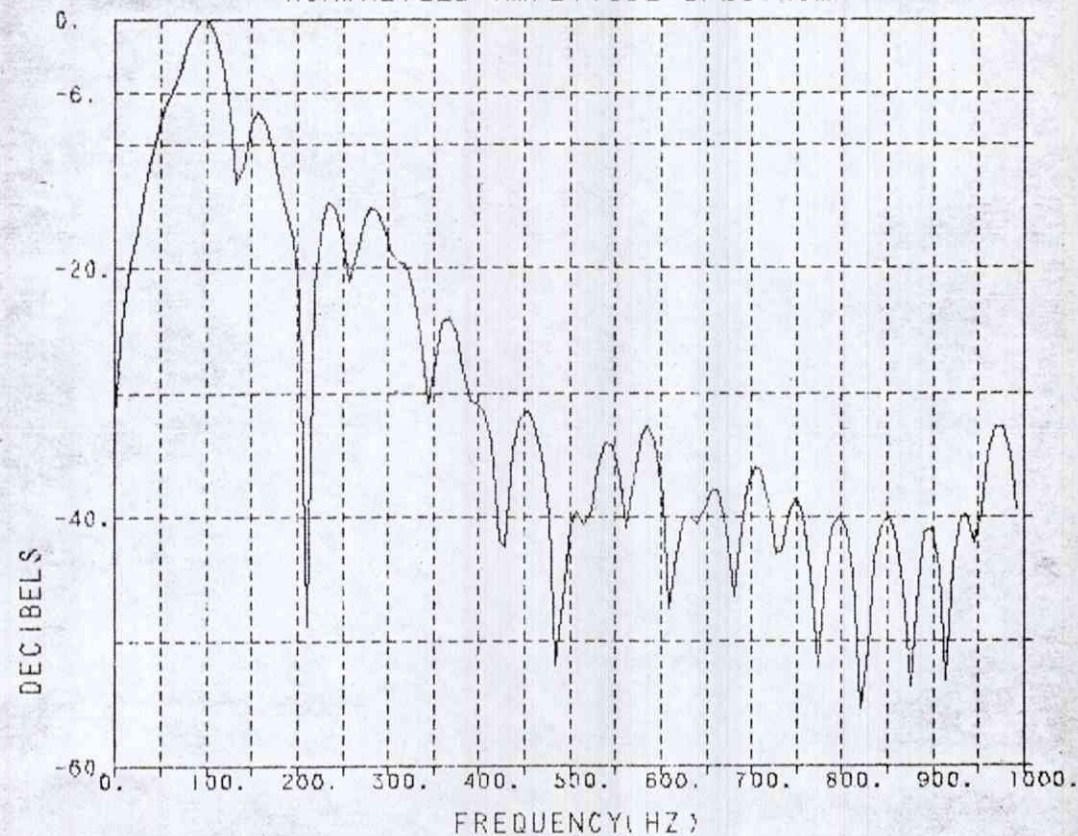
GECTEAM TEST FILE 14 TRACE 1 WINDOW 60-90 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



D 65g
Tripod

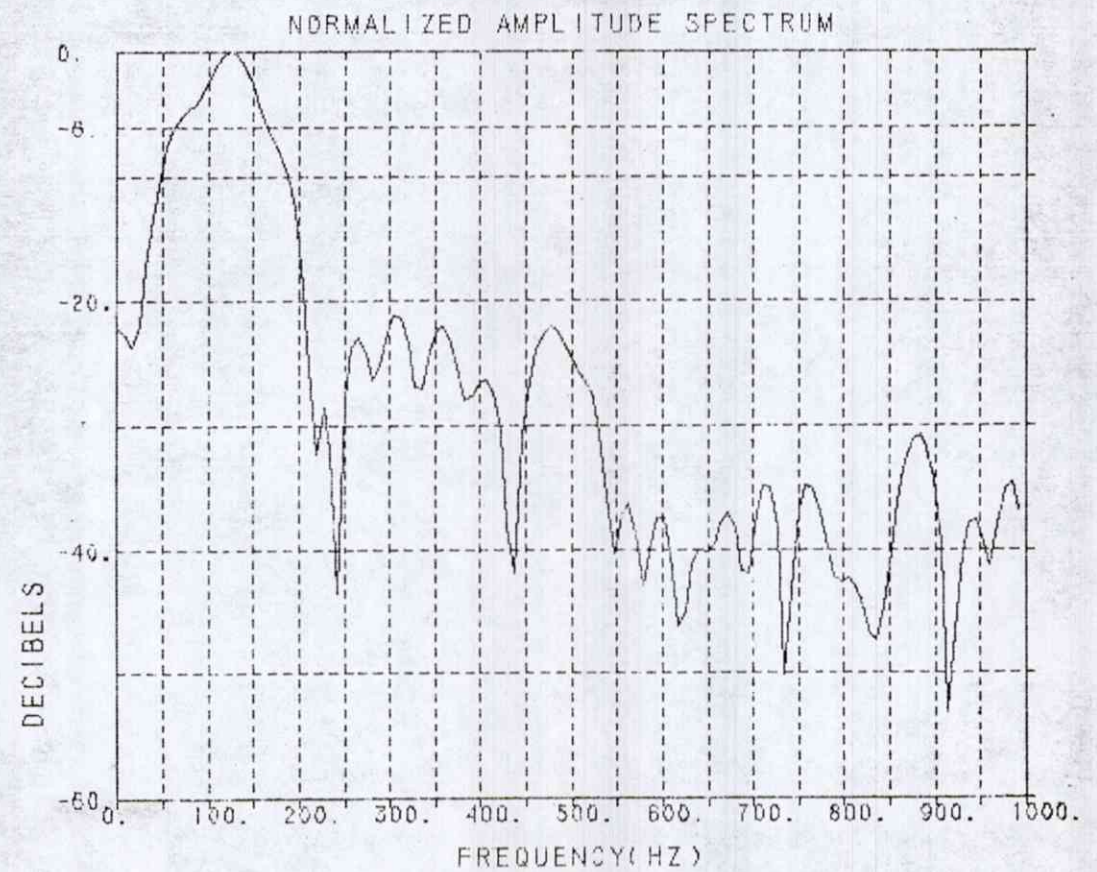
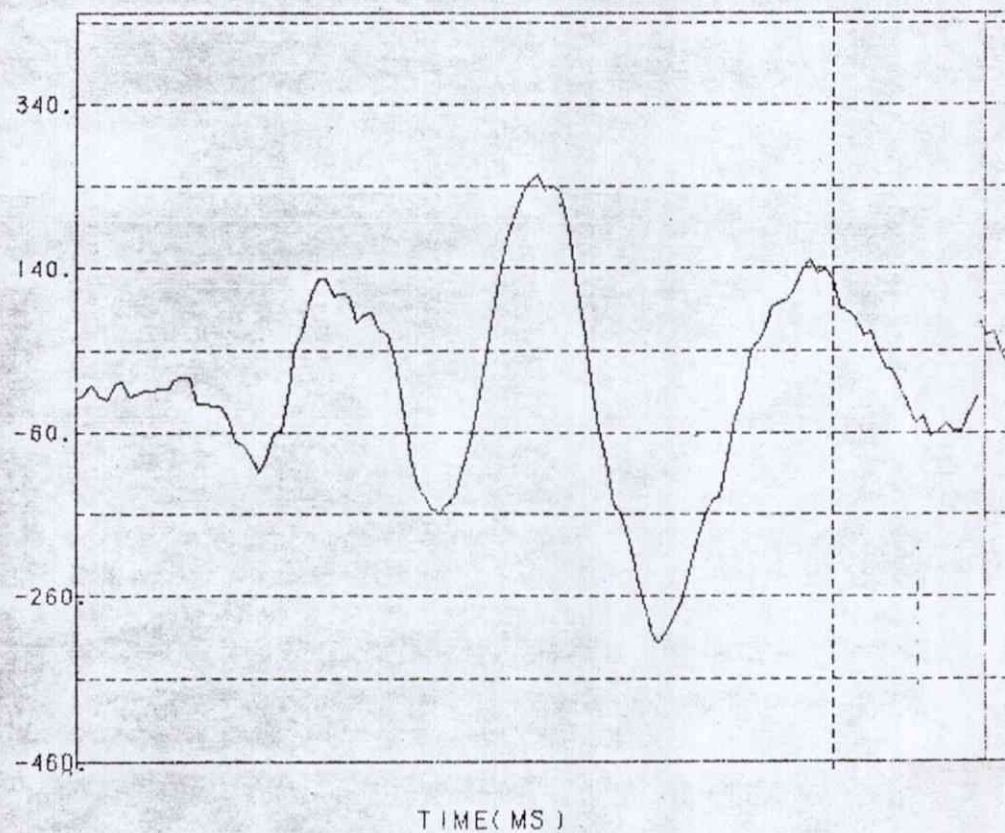
GECØ PULSE TEST

IDENT 140000 CHANNEL 8

1.59

GEOTEAM TEST FILE 14 TRACE 8 WINDOW 60-90 MS.

540.



D. 65g
Patent

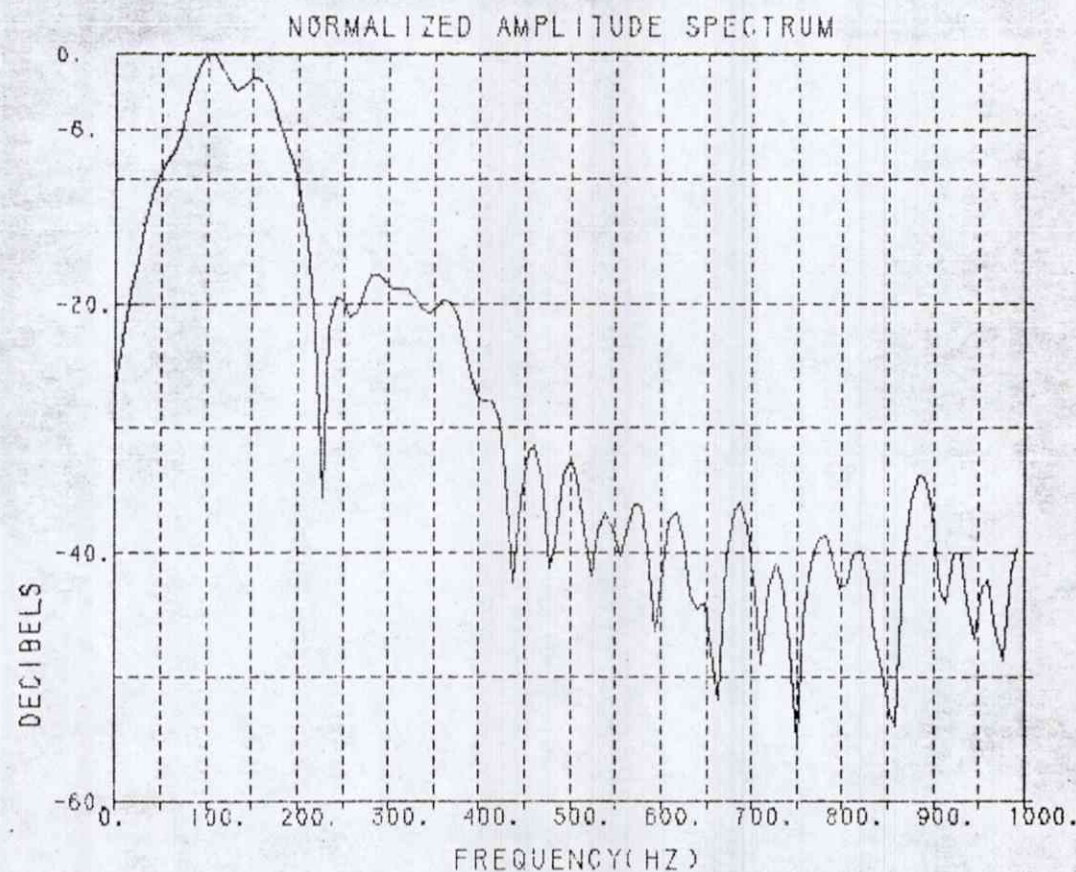
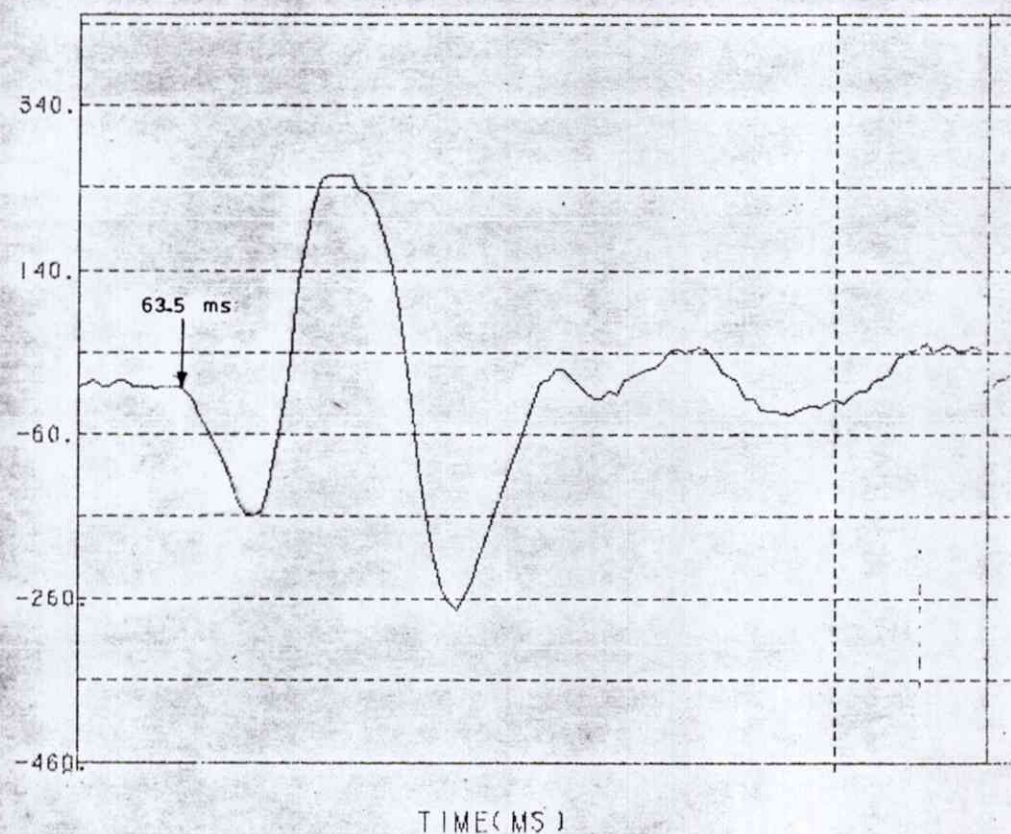
GECØ PULSE TEST

IDENT 140000 CHANNEL 9

GECØTEAM TEST FILE 14 TRACE 9 WINDOW 60-90 MS.

1.60

540.



Stålplugg . 65g D. N-380

CY 65g
Treplugg

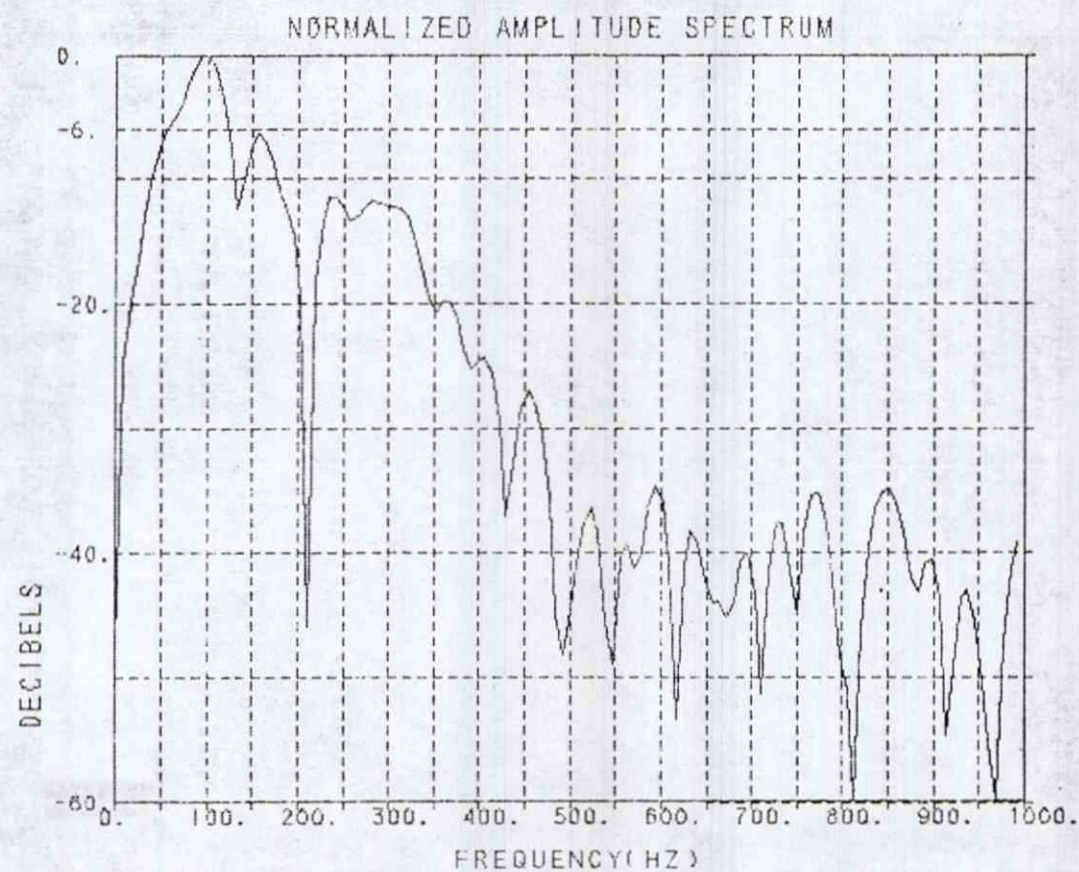
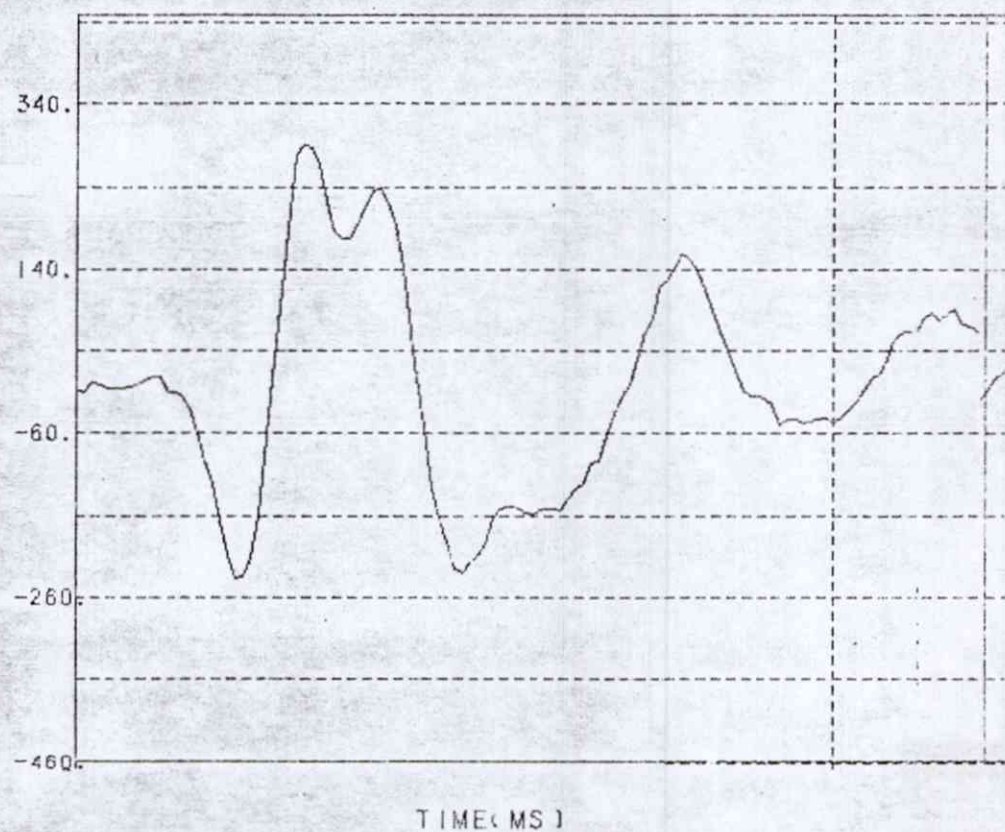
GECØ PULSE TEST

1.61

IDENT 150000 CHANNEL 1

GEOTEAM TEST FILE 15 TRACE 1 WINDOW 60-90 MS.

540.



C4, 65g
Tripod

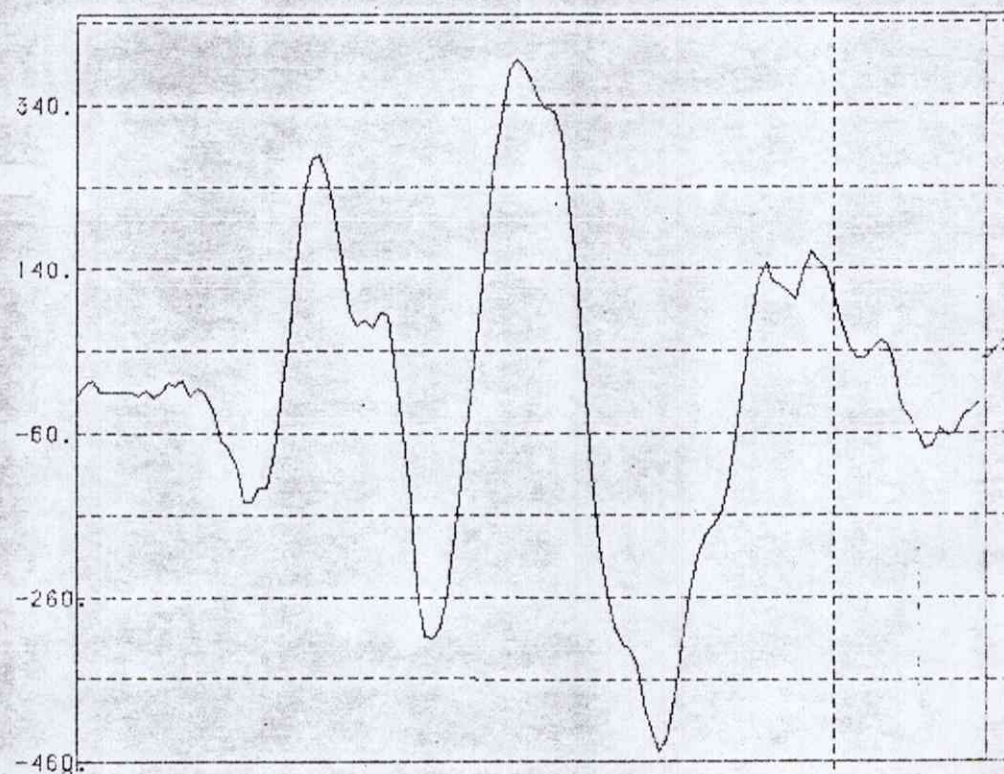
GEC0 PULSE TEST

1.62

IDENT 150000 CHANNEL 8

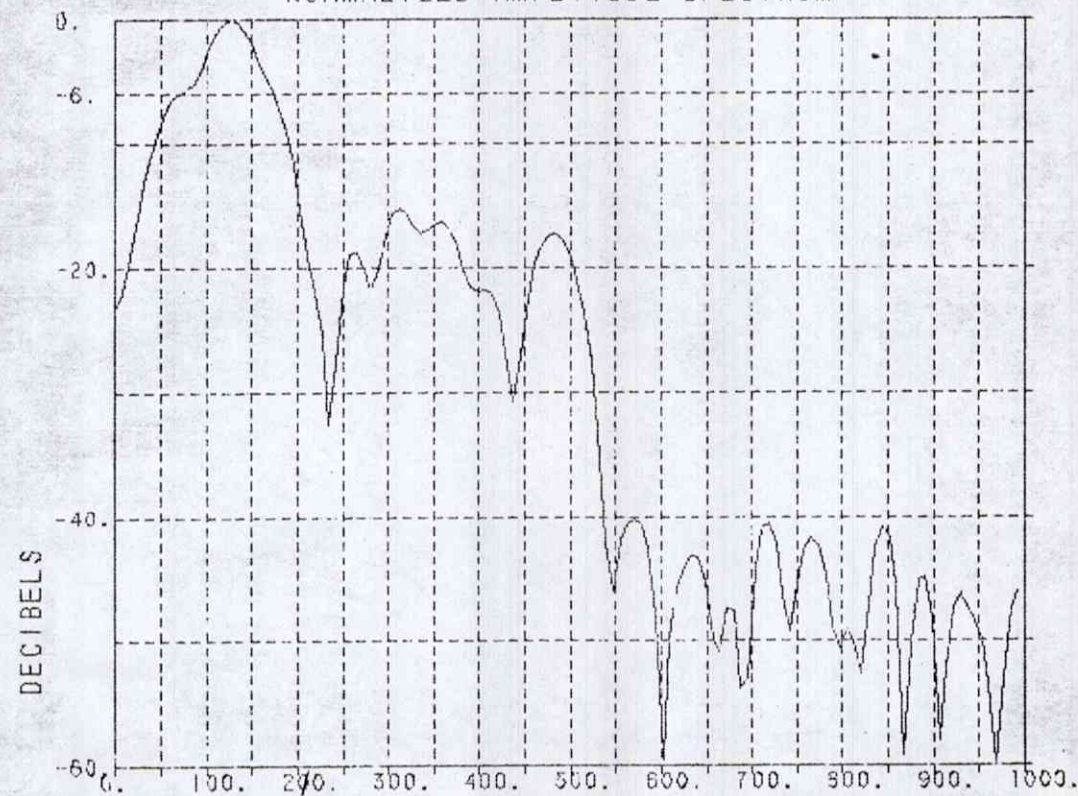
GEOTEAM TEST FILE 15 TRACE 8 WINDOW 60-90 MS.

540.



TIME(MS)

NORMALIZED AMPLITUDE SPECTRUM



FREQUENCY(HZ)

C4, 65g
Patent

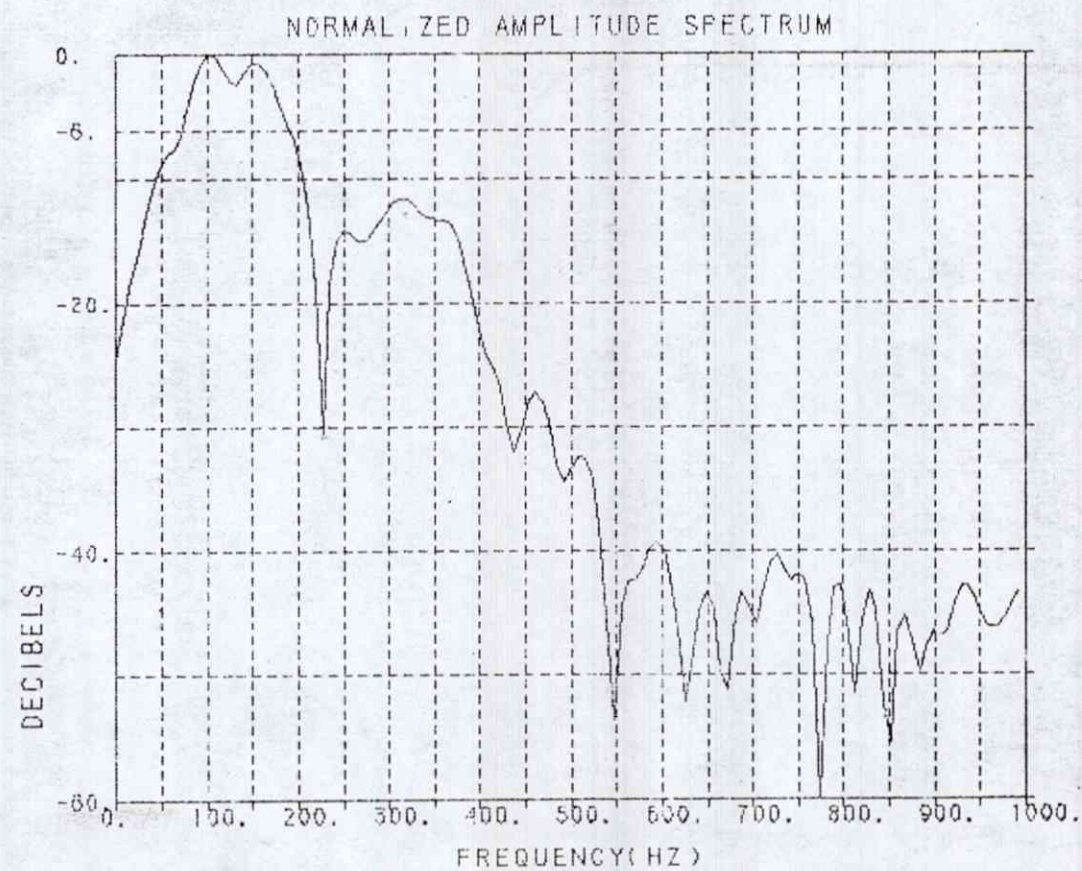
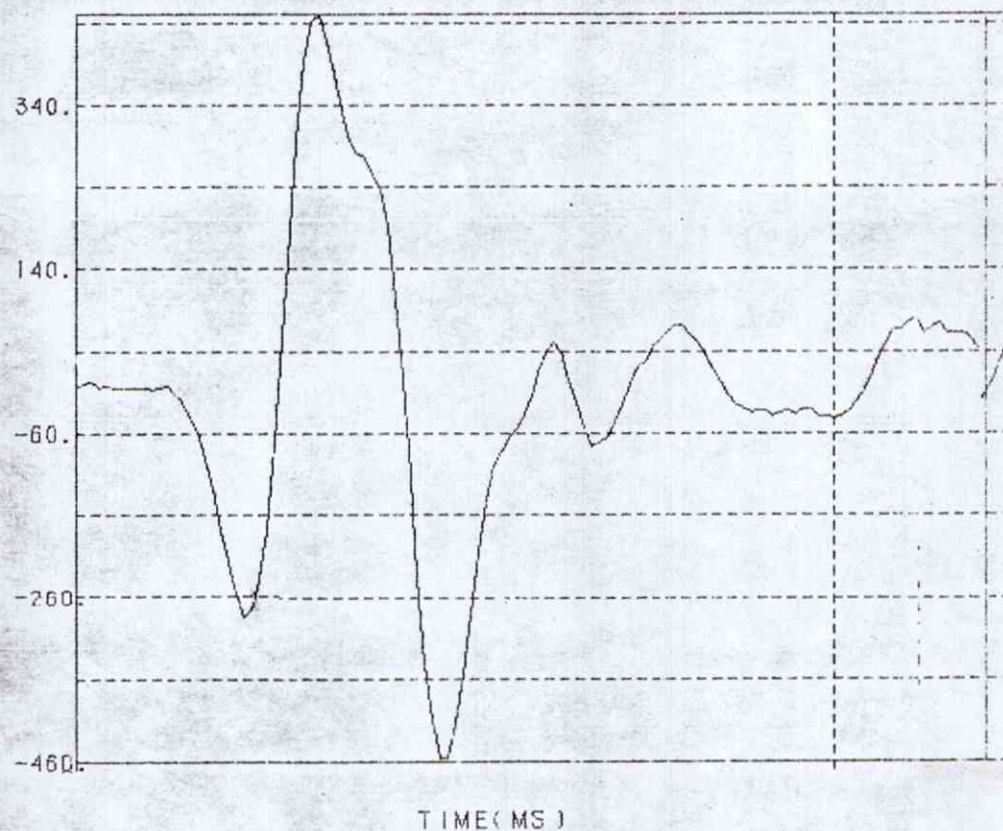
GECO PULSE TEST

1.63

IDENT 150000 CHANNEL 9

GEOTEAM TEST FILE 15 TRACE 9 WINDOW 60-90 MS.

540.



Stålplugg . 65g C4 . N-380

ExD 6sg
Treplugs

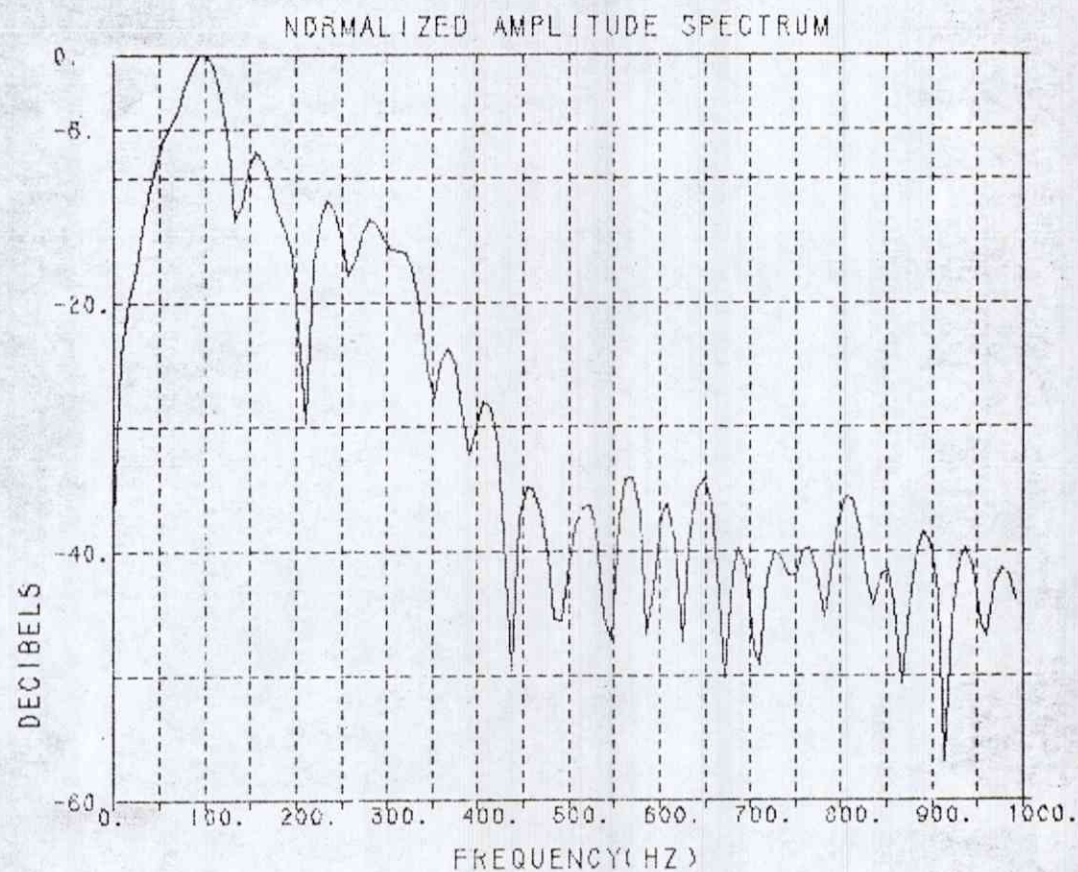
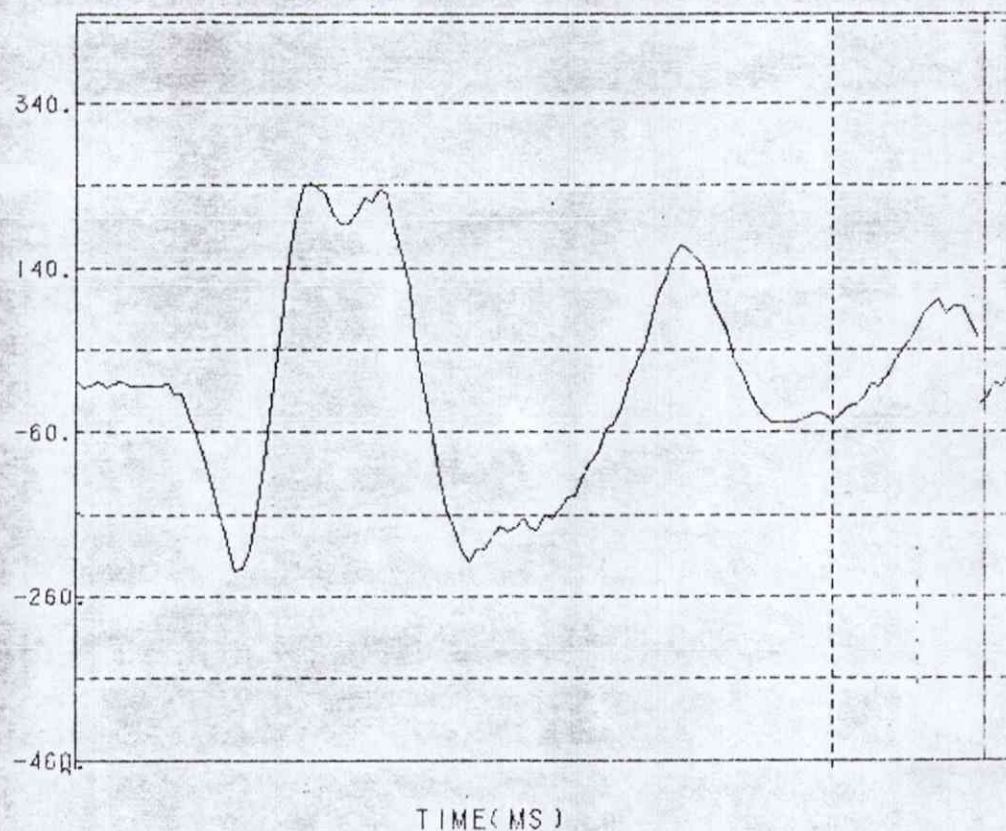
GECØ PULSE TEST

IDENT 160000 CHANNEL 1

1.64

GECØTEAM TEST FILE 18 TRACE 1 WINDOW 80-90 MS.

540.



Ex D, 65g
Tripod

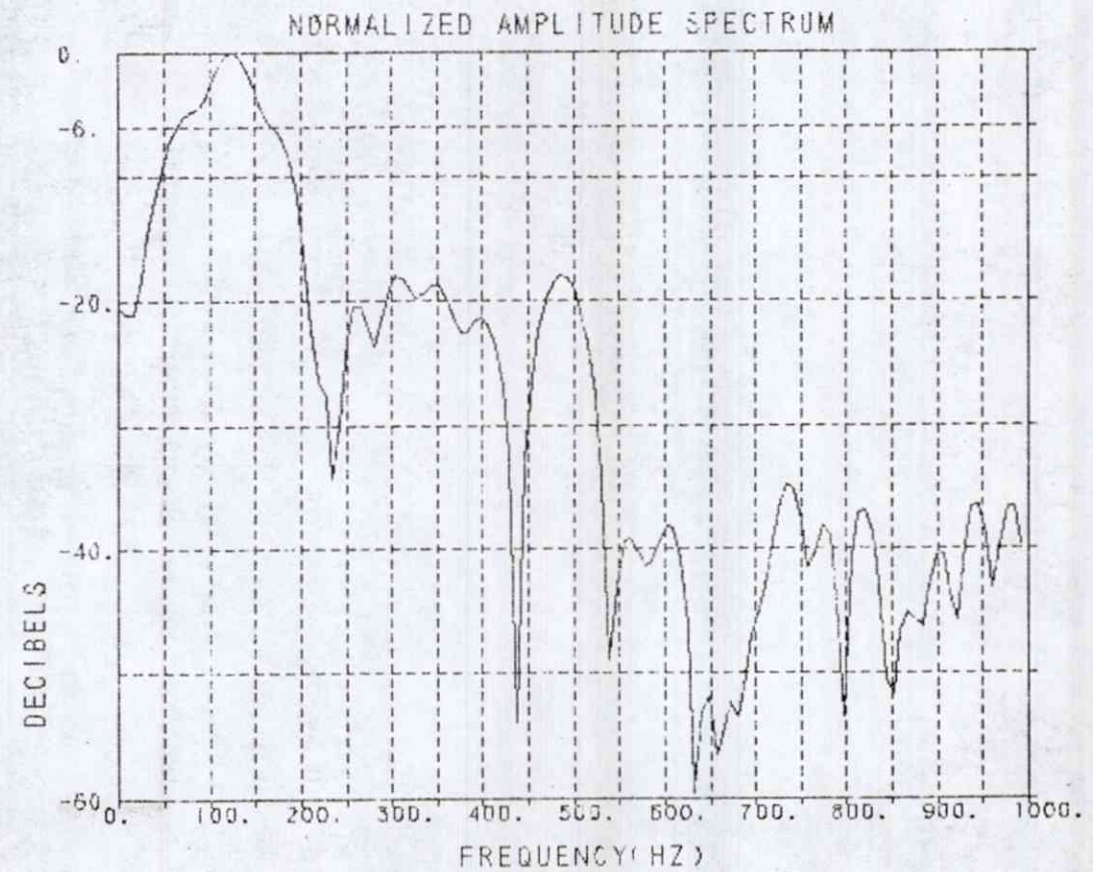
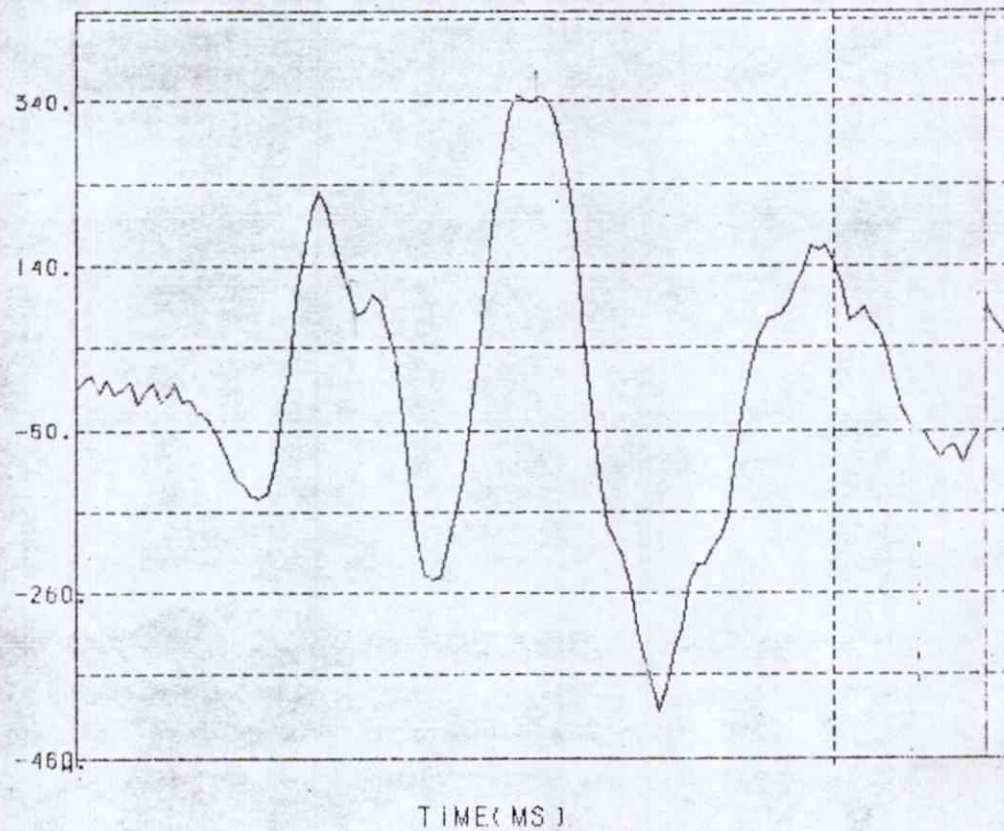
GECØ PULSE TEST

IDENT 160000 CHANNEL 8

GECTEAM TEST FILE 16 TRACE 8 WINDOW 60-90 MS.

1.65

540.



Ex D 65g
Patent

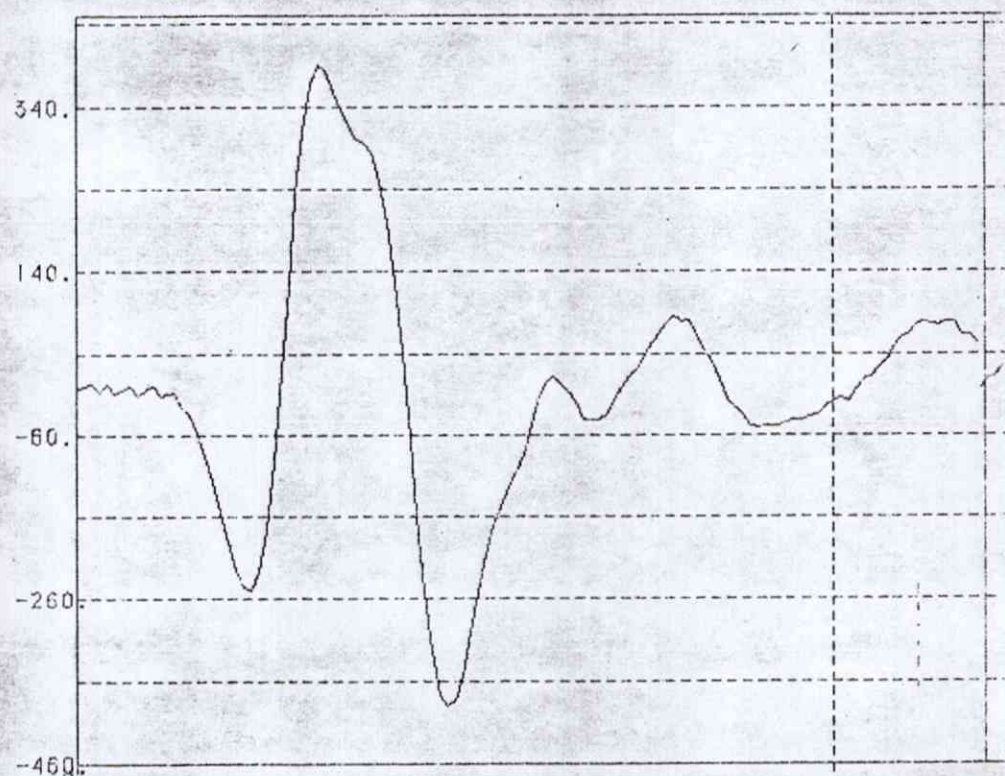
GECØ PULSE TEST

IDENT 160000 CHANNEL 9

GEOTEAM TEST FILE 16 TRACE 9 WINDOW 60-90 MS.

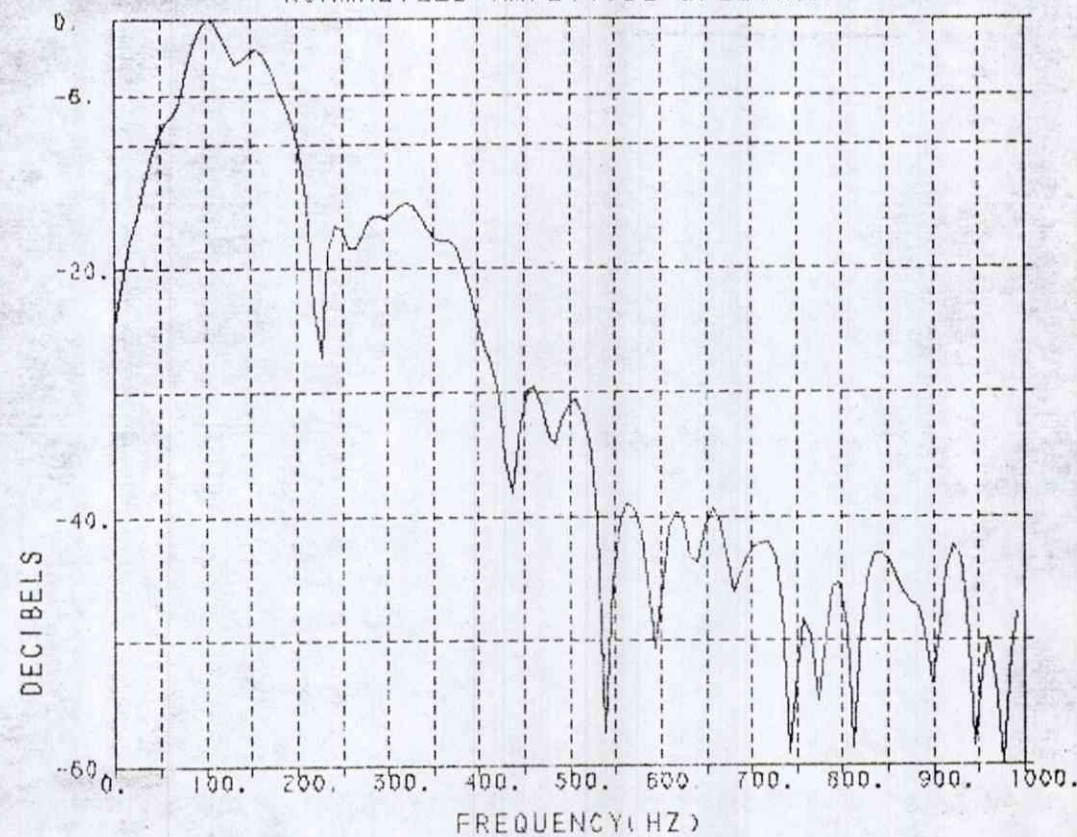
1.66

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



Stålplugg. 65g Ex D. N 380.

D 65g 720m
Patent

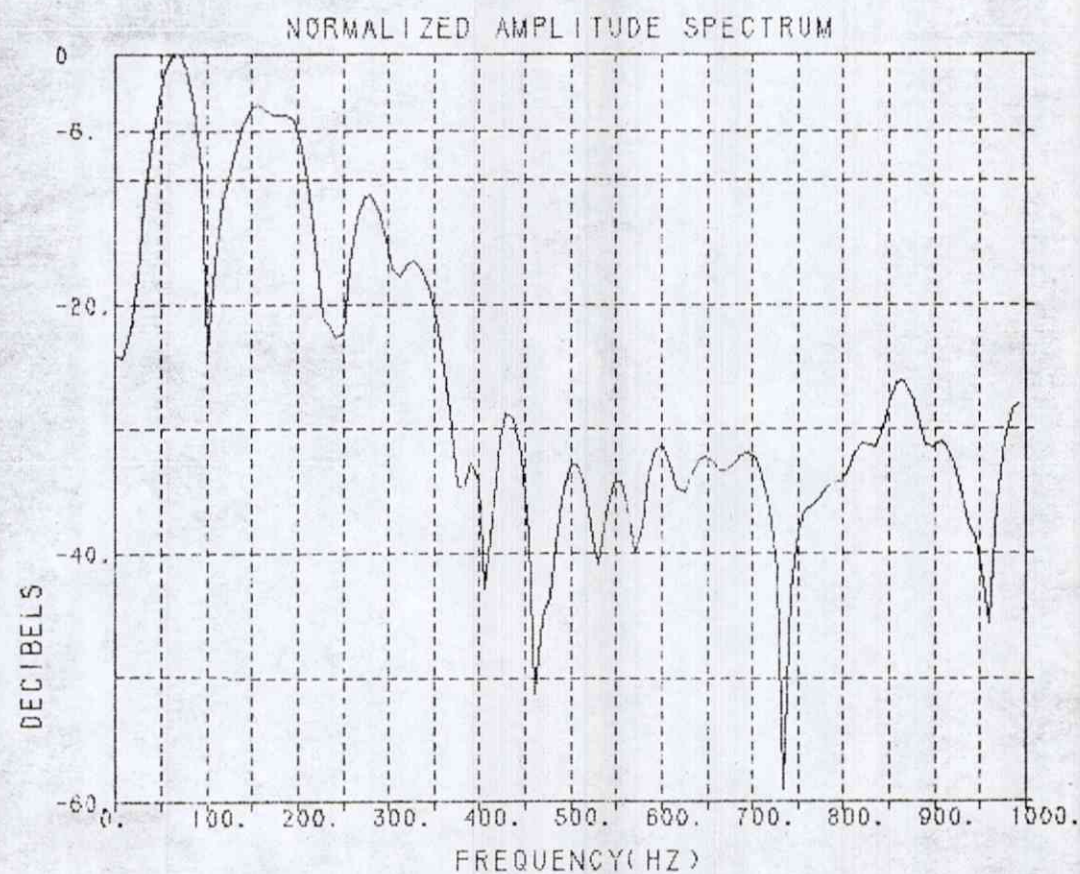
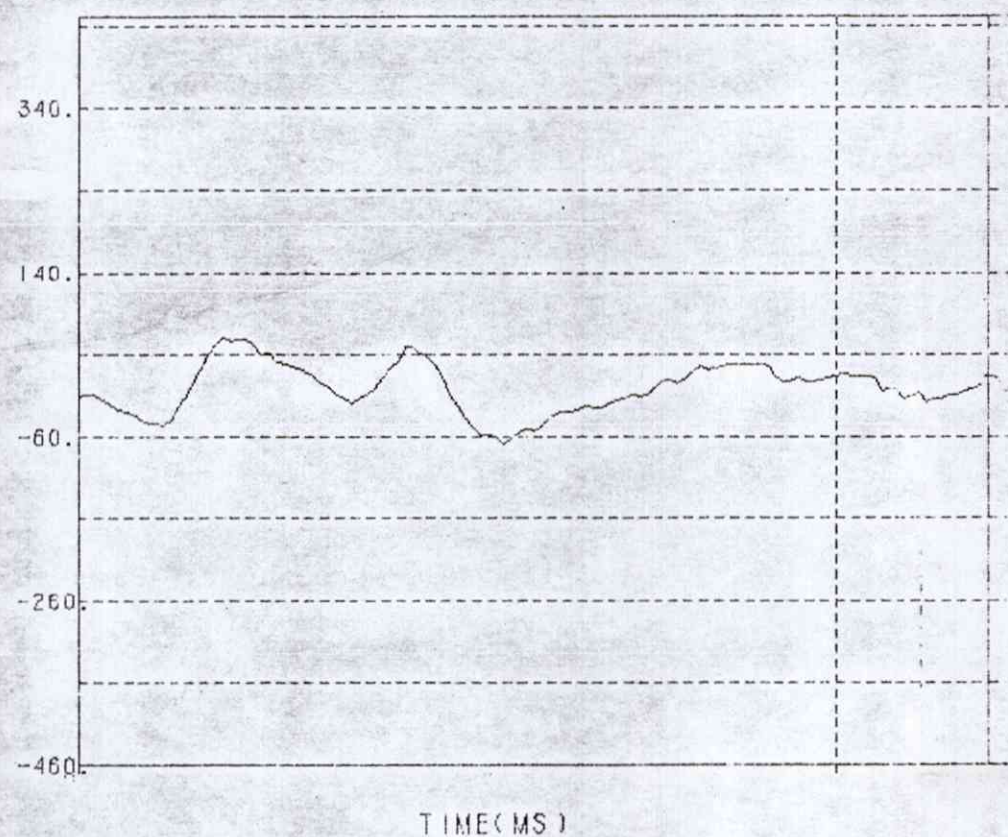
GECØ PULSE TEST

IDENT 180000 CHANNEL 7

1.67

GEOTEAM TEST FILE 18 TRACE 7 WINDOW 120-150 MS.

540.



0.65g 720m
Patent

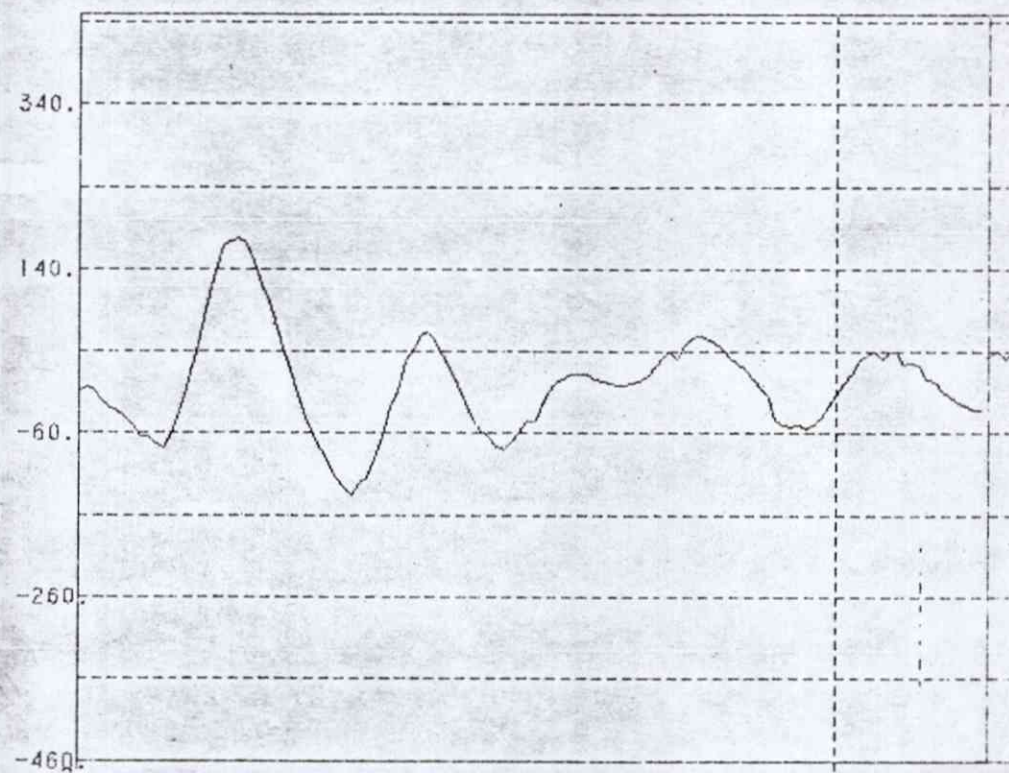
GECØ PULSE TEST

IDENT 180000 CHANNEL 9

1.68

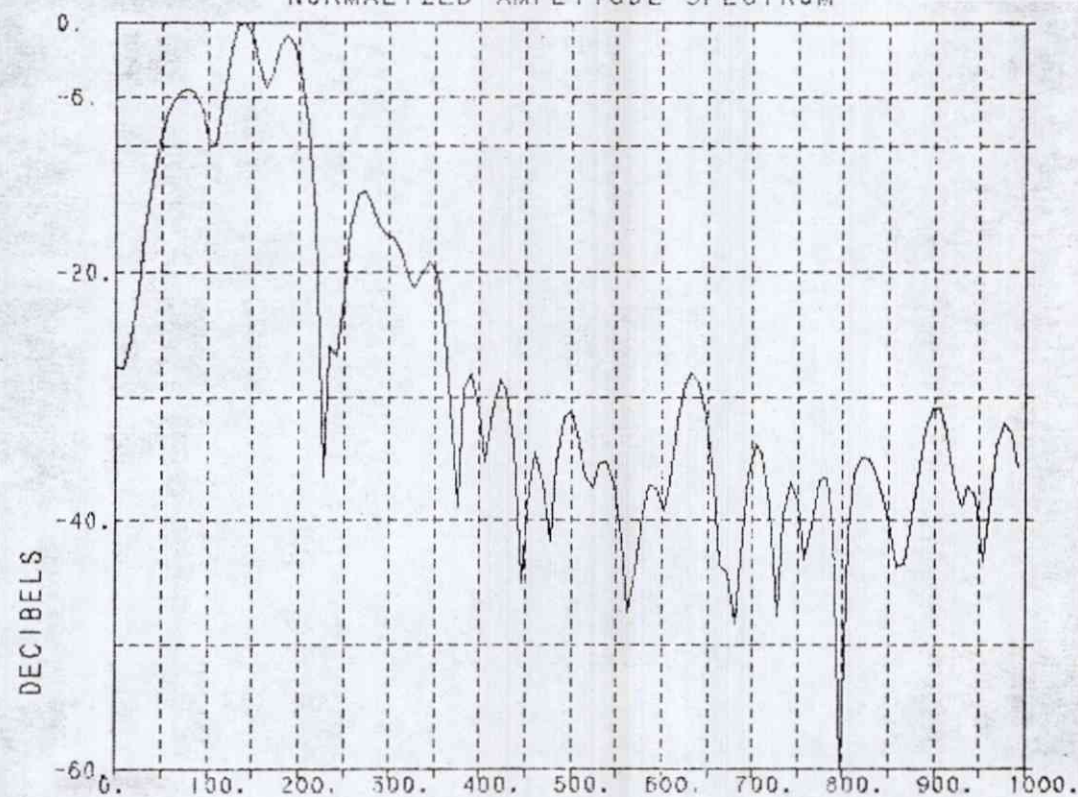
GEØTEAM TEST FILE 18 TRACE 9 WINDOW 120-150 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



FREQUENCY (HZ)

D 65, 720m
Patent

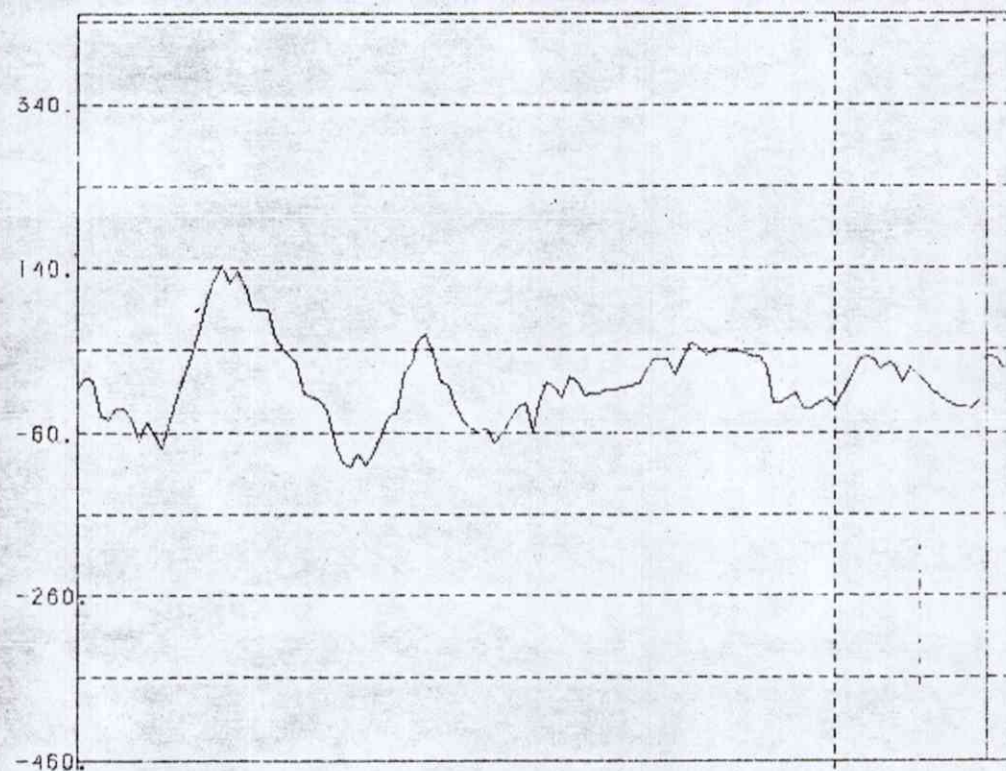
GECØ PULSE TEST

1.69

IDENT 180000 CHANNEL 11

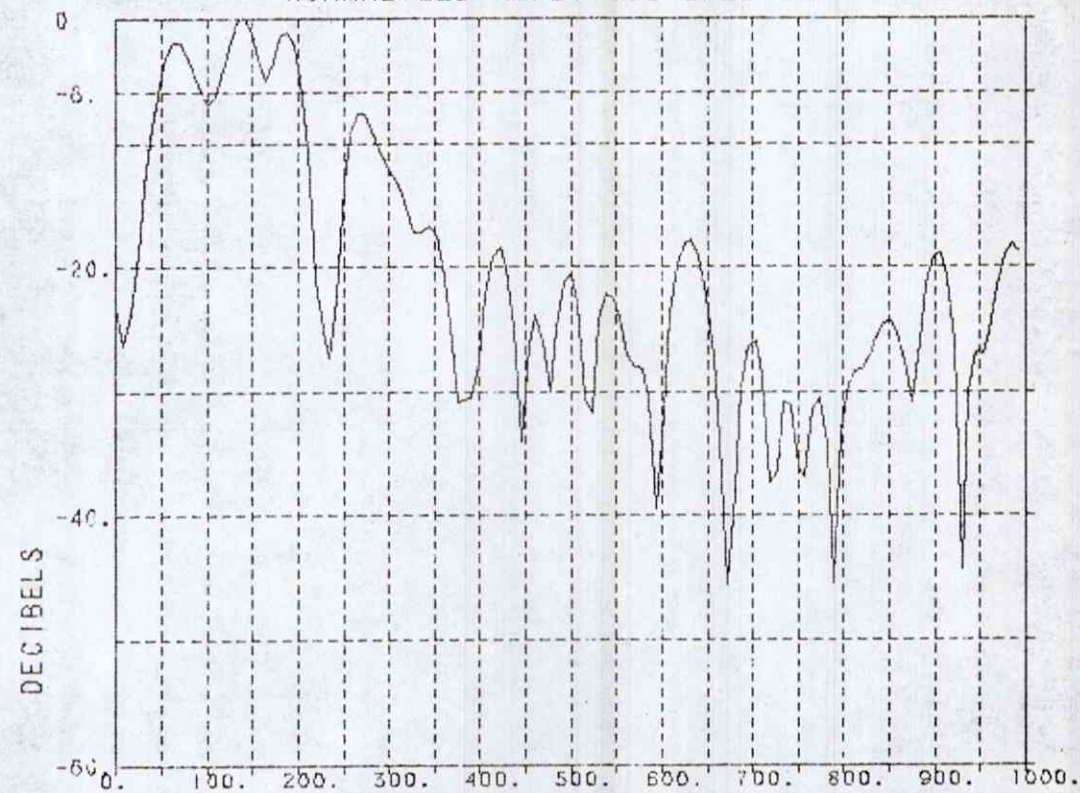
GECØTEAM TEST FILE 18 TRACE 11 WINDOW 120-150 MS.

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



FREQUENCY (HZ)

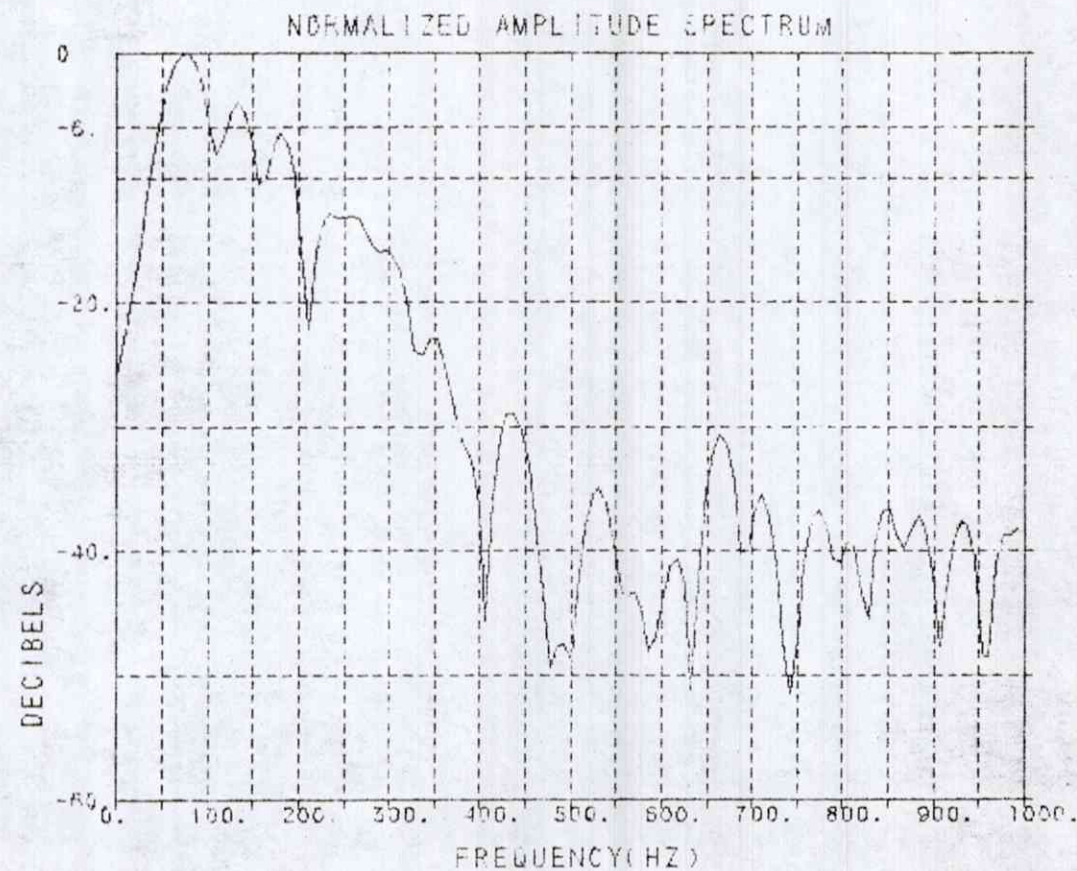
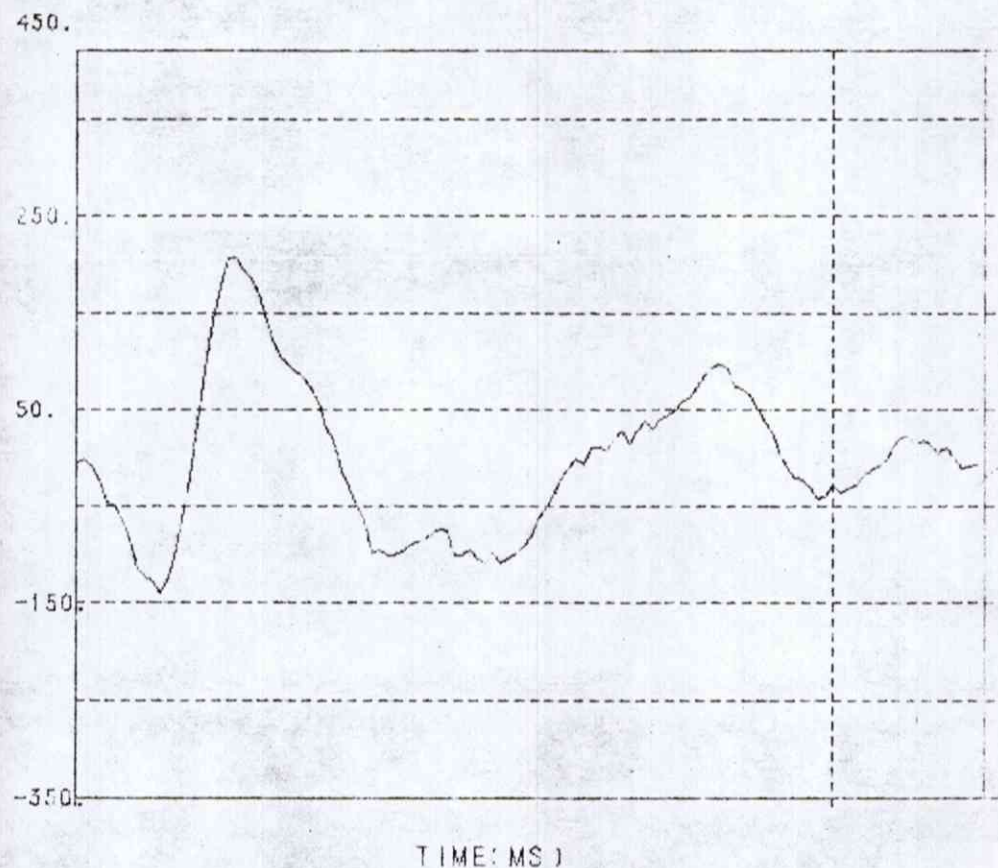
Dynamit 130g 720
Treplugg

GEC3 PULSE TEST

IDENT 190000 CHANNEL 1

GEC TEAM TEST FILE 19 TRACE 1 WINDOW 120-150 MS.

1.70



D130 720m

Patent

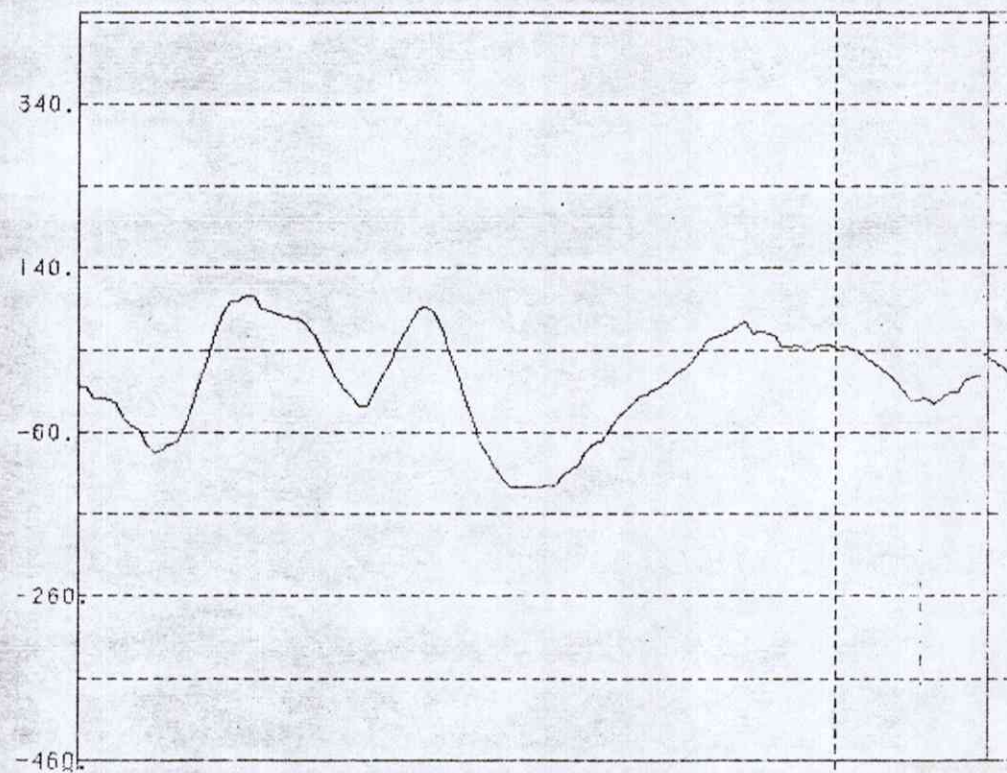
GECO PULSE TEST

IDENT 190000 CHANNEL 7

1.71

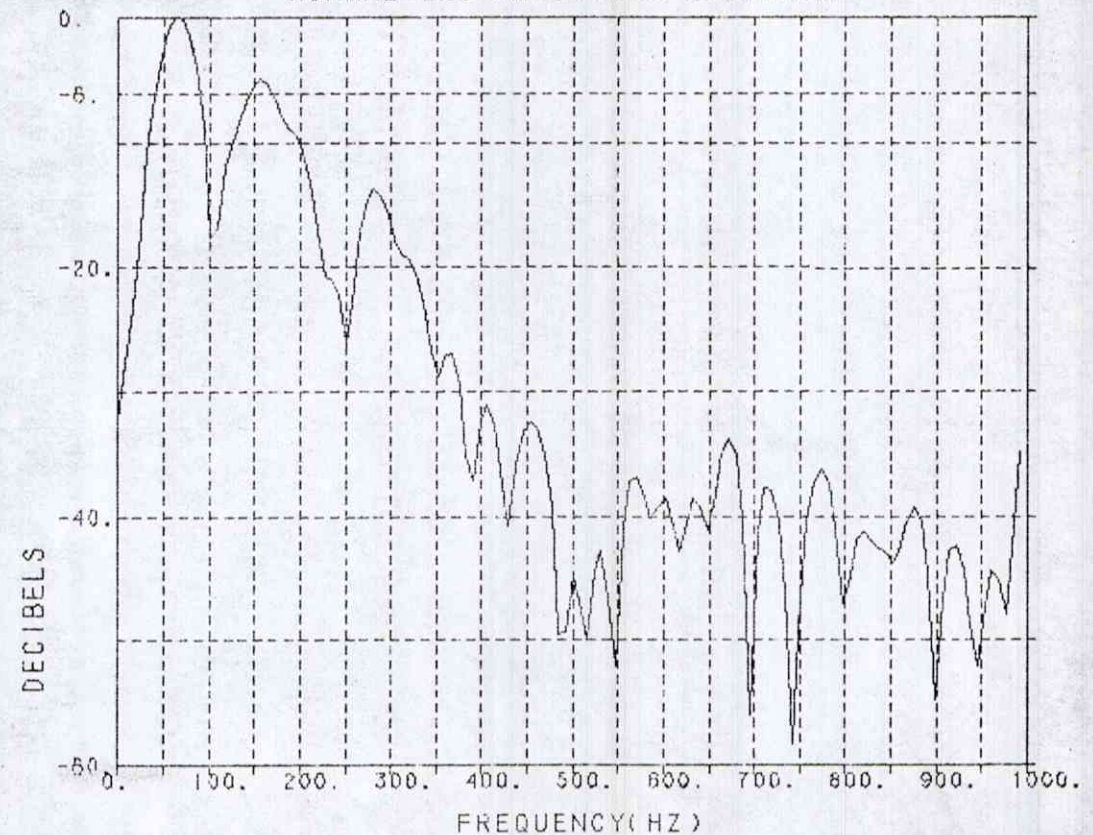
GEOTEAM TEST FILE 19 TRACE 7 WINDOW 120-150 MS.

540.



TIME(MS)

NORMALIZED AMPLITUDE SPECTRUM



D130 720m

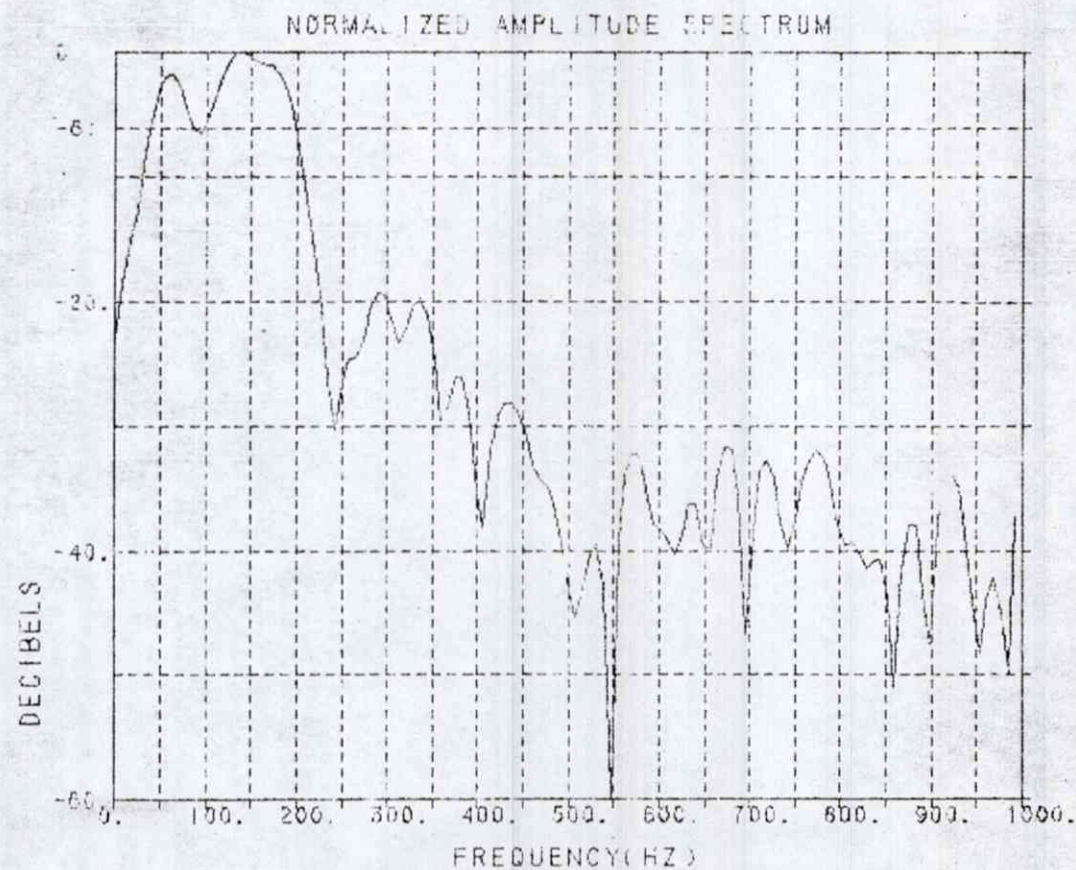
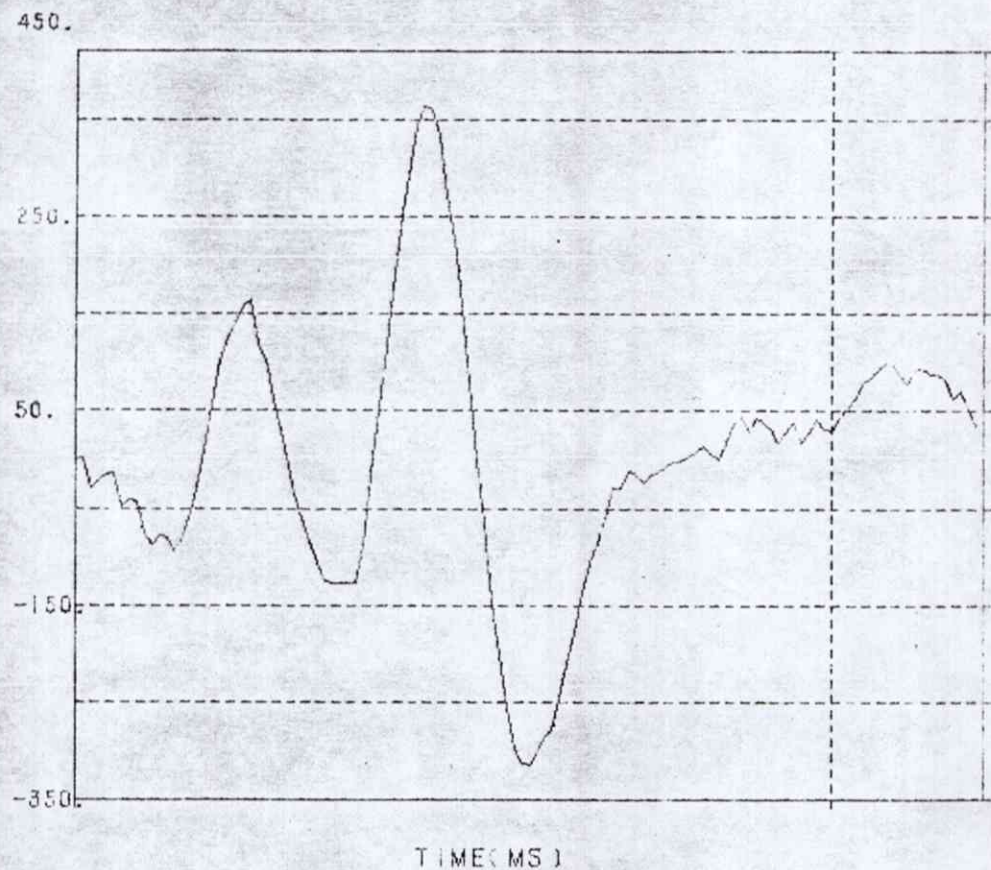
Tripod

GECØ PULSE TEST

IDENT 190000 CHANNEL 8

GEOTEAM TEST FILE 19 TRACE 8 WINDOW 120-150 MS.

1.72



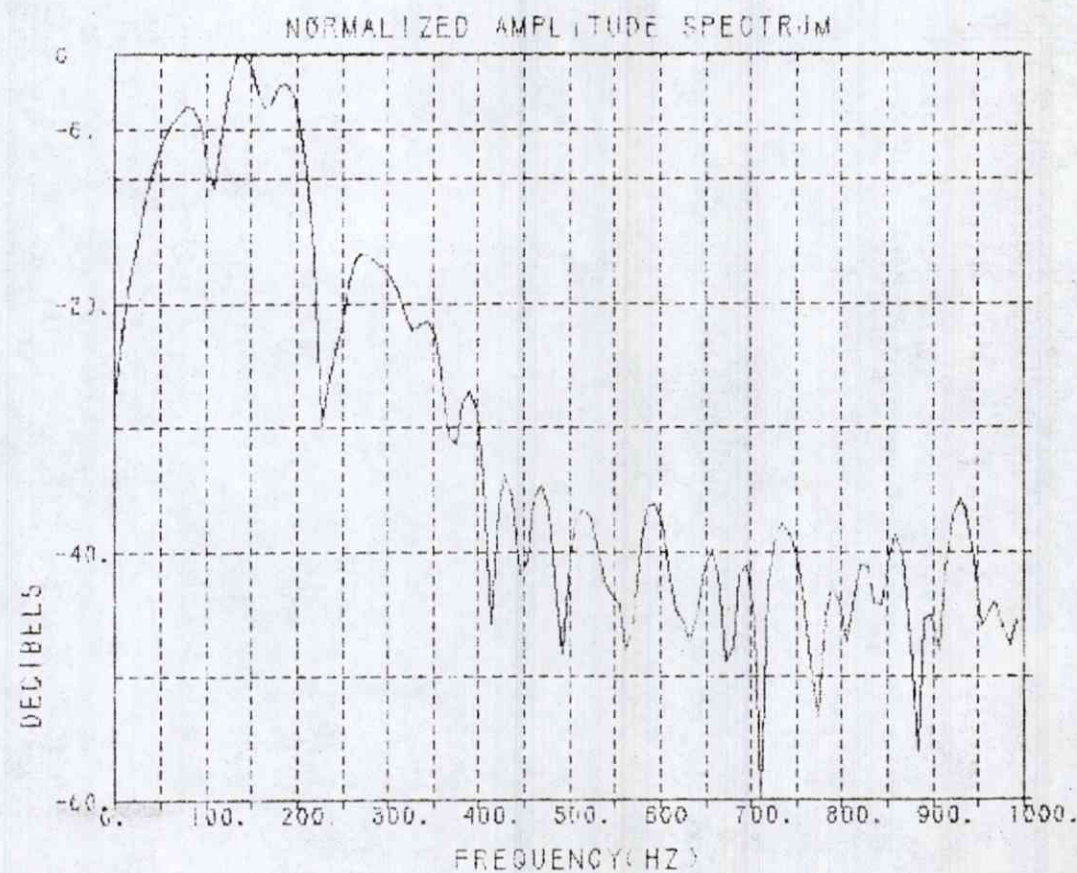
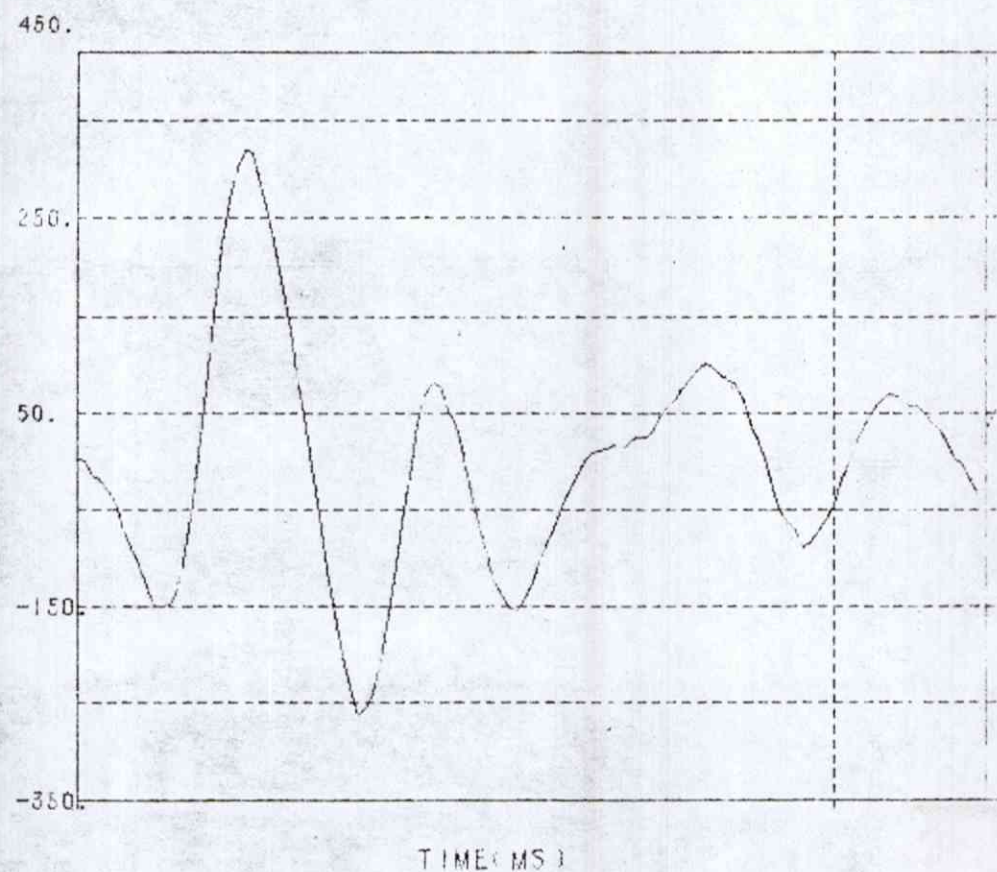
D130 720m
Patent

GECO PULSE TEST

IDENT 190000 CHANNEL 9

GECOTEAM TEST FILE 19 TRACE 9 WINDOW 120-150 MS.

1.73



Stålplugg - 130g D. N-720

D130, 720m
Patient

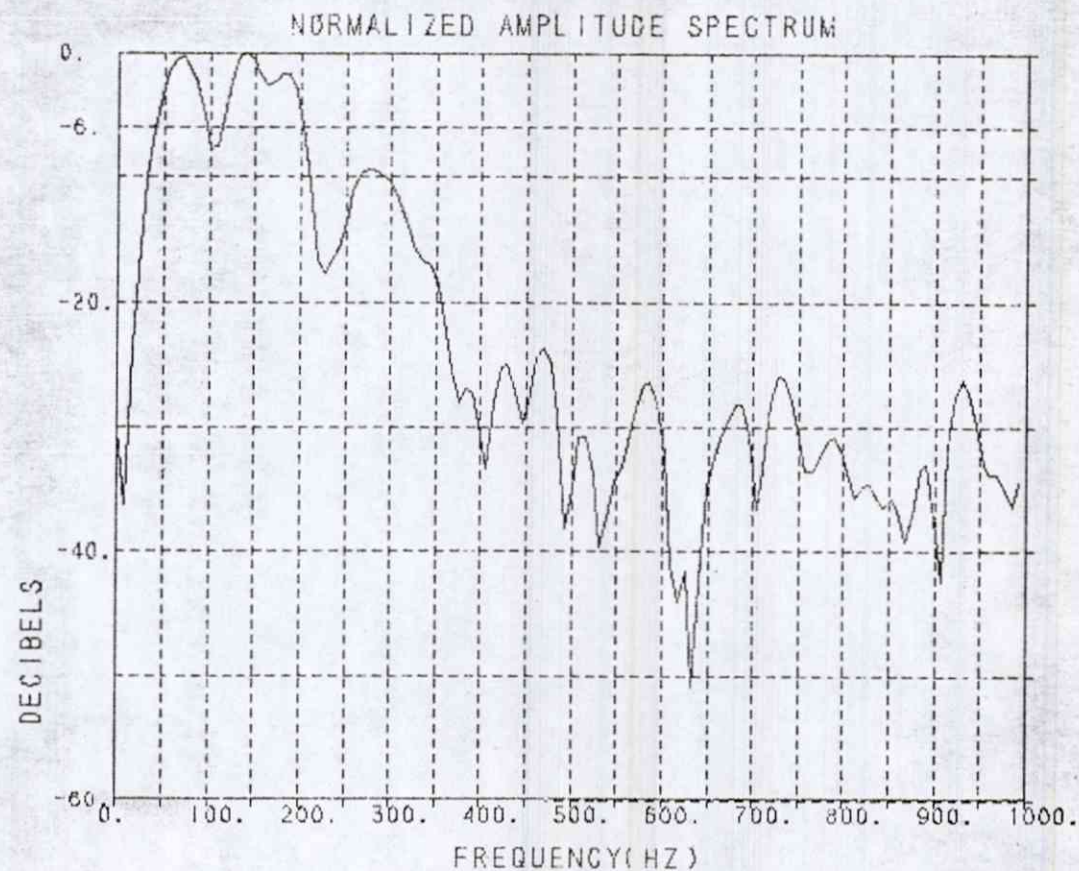
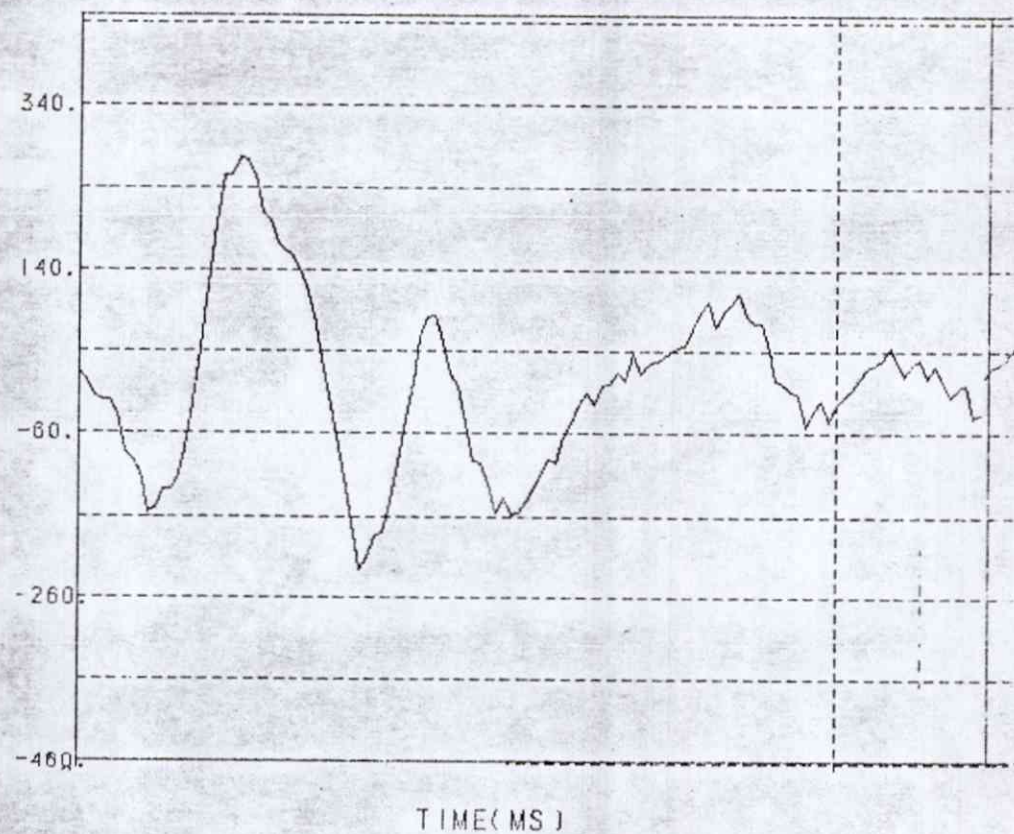
GECØ PULSE TEST

IDENT 190000 CHANNEL 11

GEØTEAM TEST FILE 19 TRACE 11 WINDOW 120-150 MS.

1.74

540.



D130, 720 m

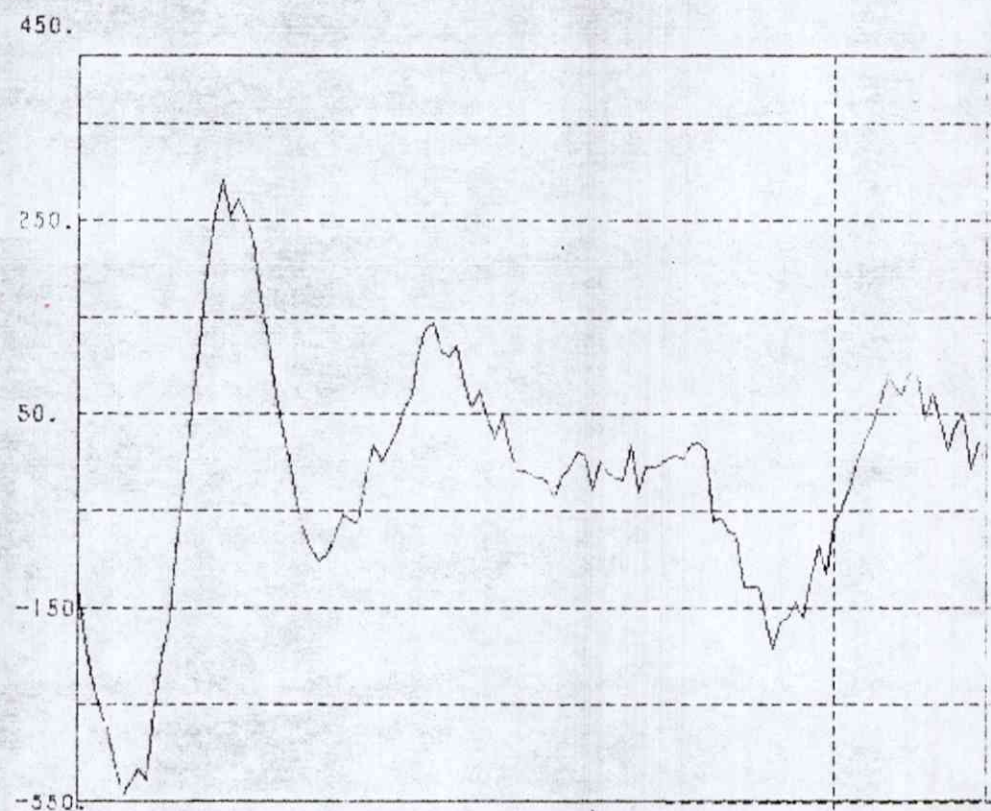
Array Point

GECU PULSE TEST

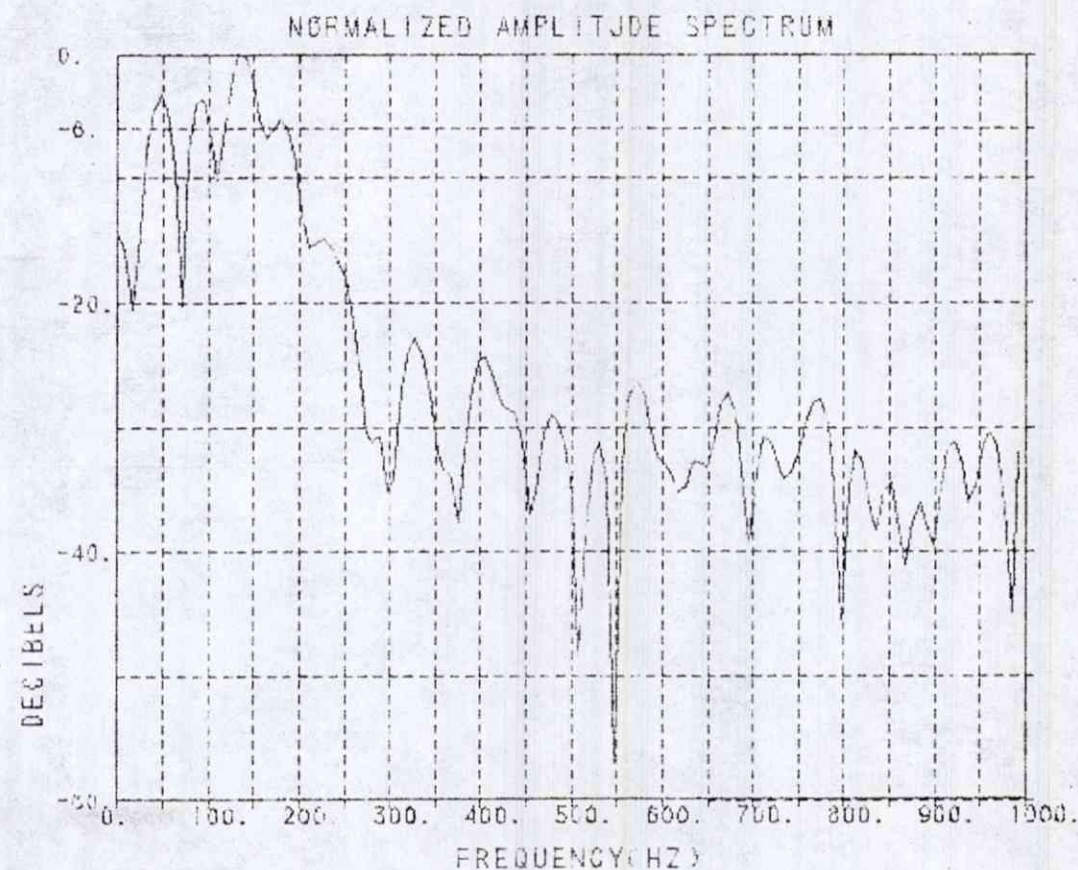
1.75

IDENT 190000 CHANNEL 12

GECU TEST FILE 19 TRACE 12 WINDOW 120-150 MS.



TIME (MS)



D 130 720 m

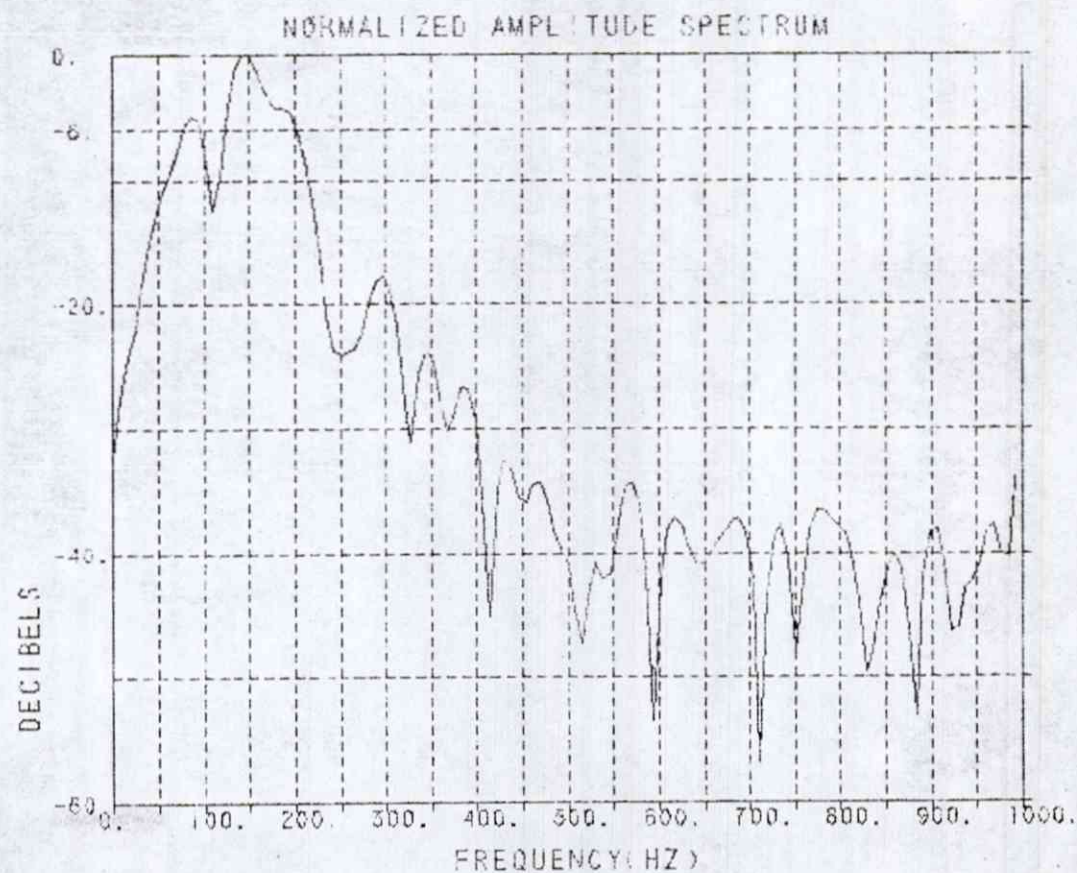
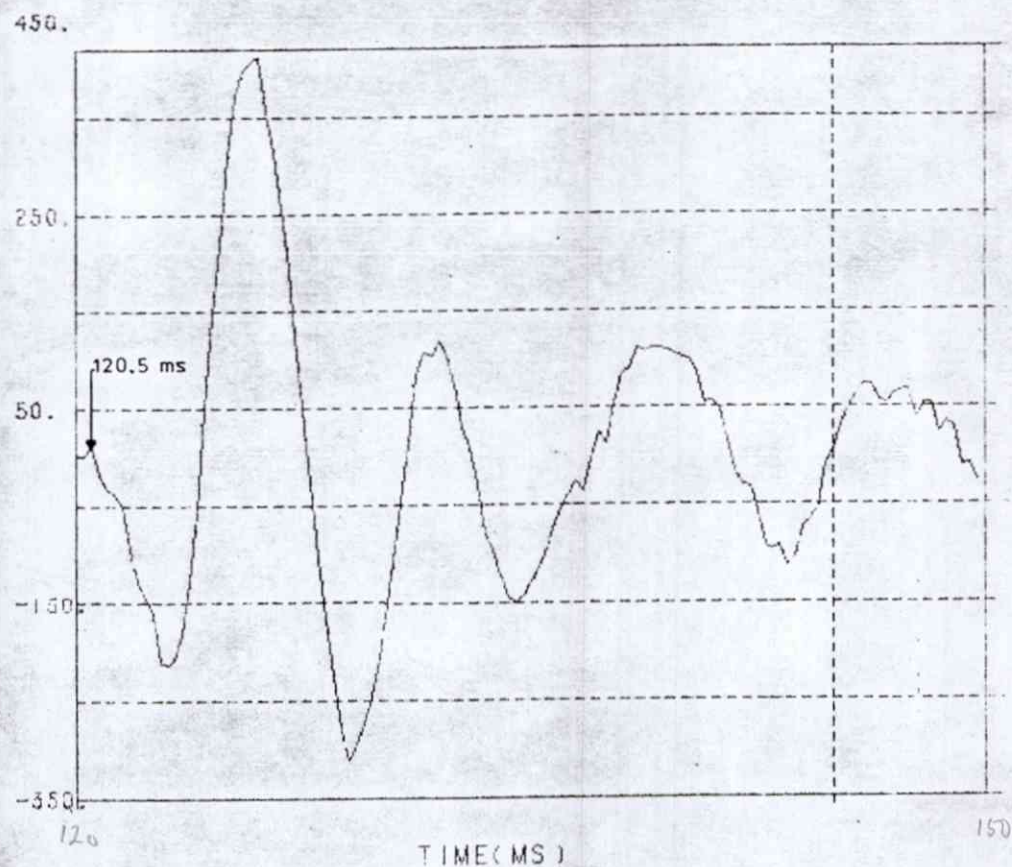
Zernpl. stor i losmasse

GECO PULSE TEST

1.76

IDENT 190000 CHANNEL 18

GEOTEAM TEST FILE 19 TRACE 18 WINDOW 120-150 MS



D 65 930m

Patent

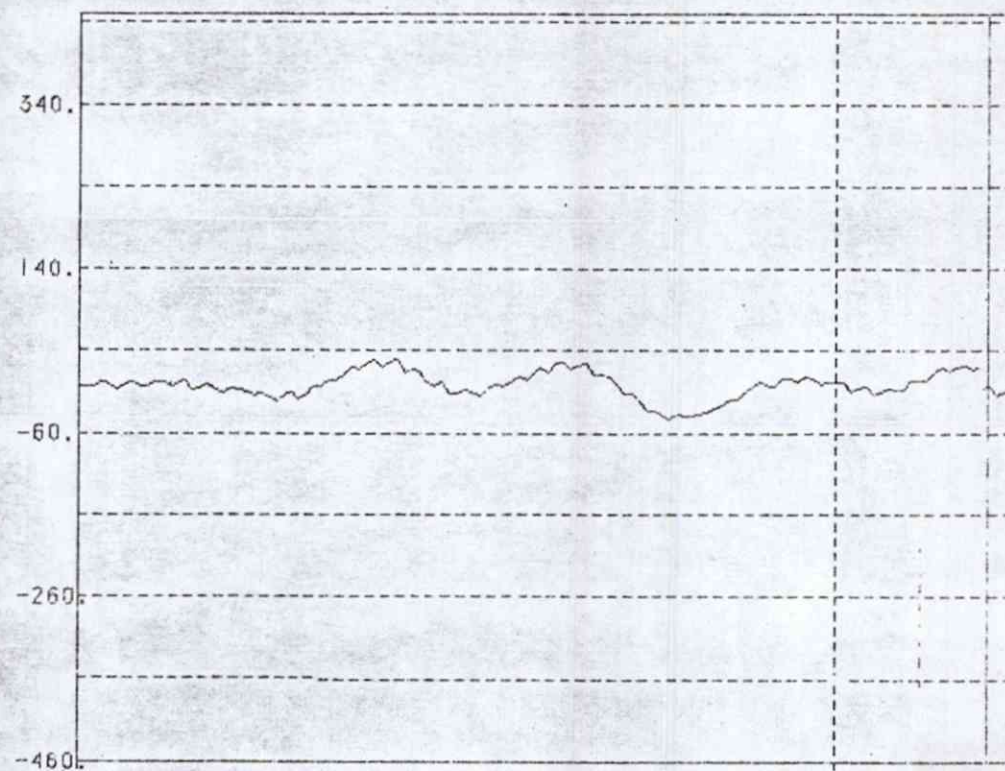
GECØ PULSE TEST

1.77

IDENT 200000 CHANNEL 7

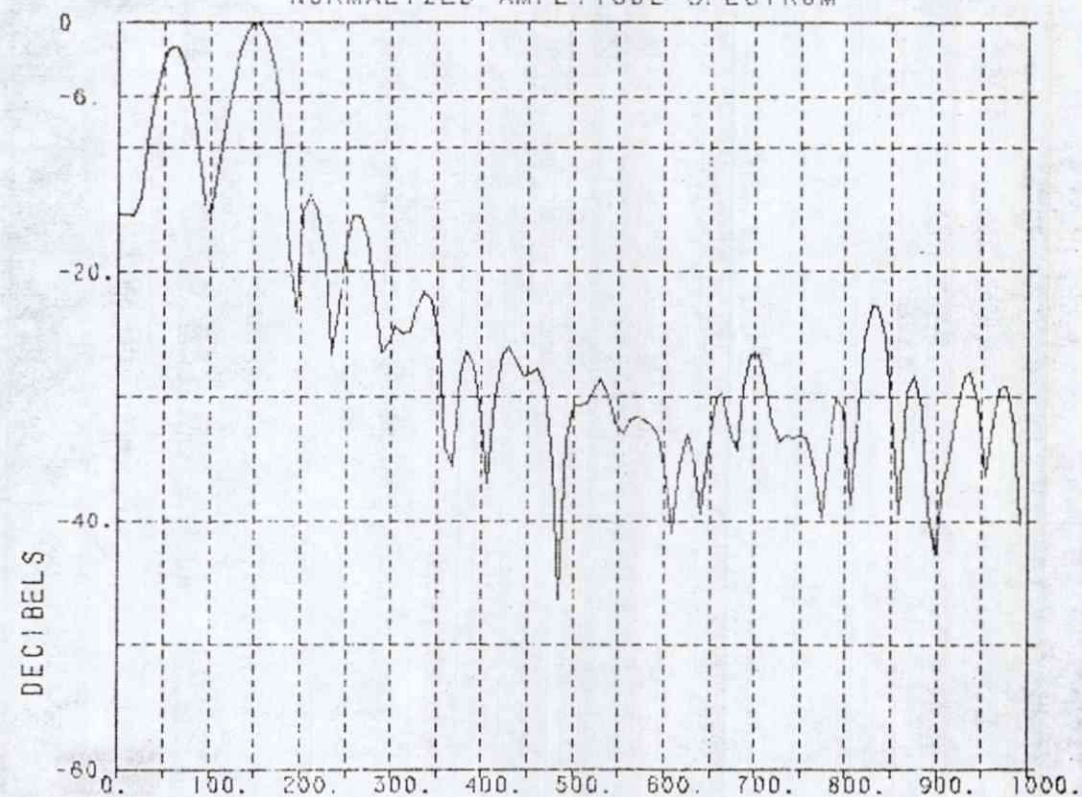
GEOTEAM TEST FILE 20 TRACE 7 WINDOW 130-160 MS

540.



TIME (MS)

NORMALIZED AMPLITUDE SPECTRUM



FREQUENCY (HZ)

065, 930 m

Patent

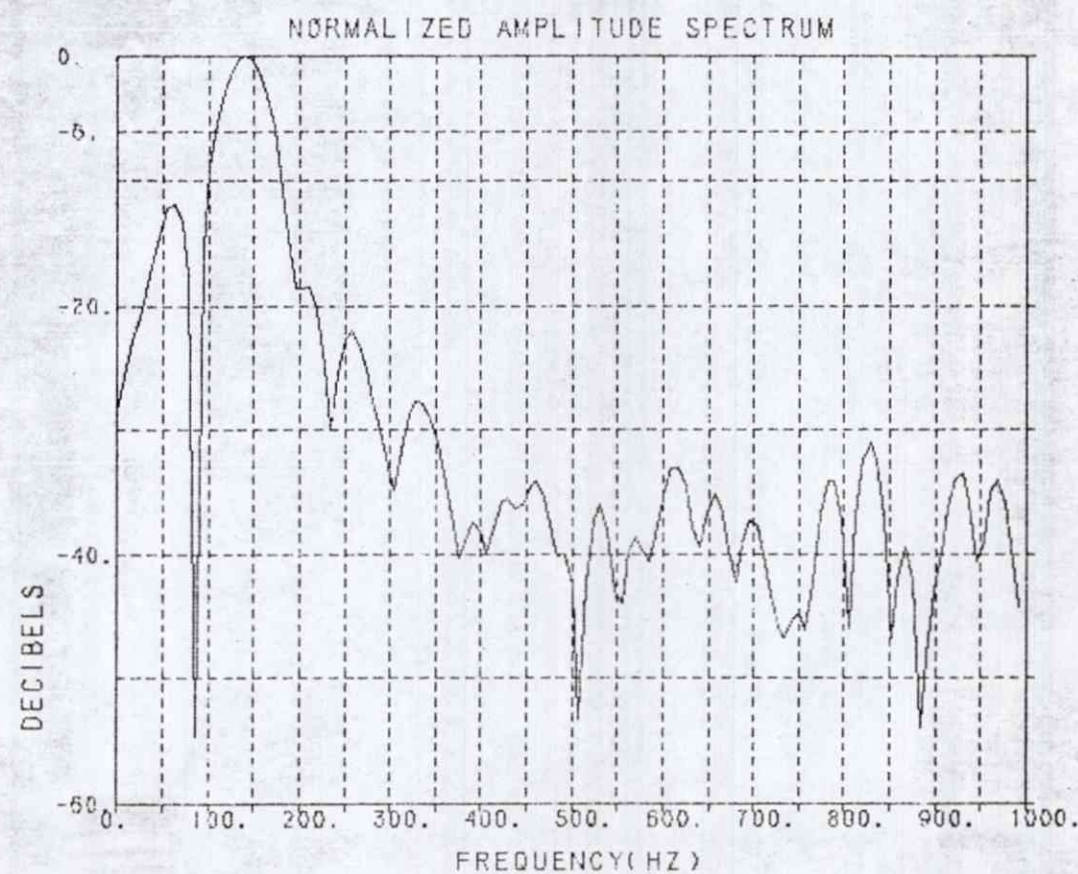
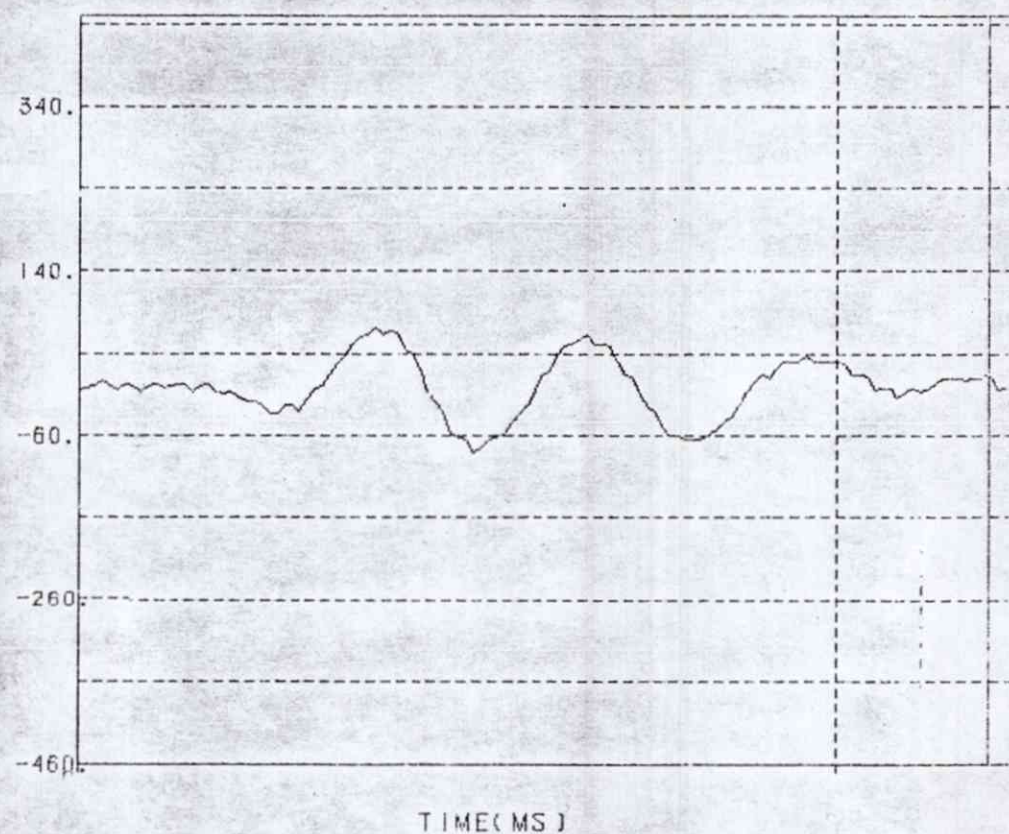
GEC0 PULSE TEST

1.78

IDENT 200000 CHANNEL 9

GEOTEAM TEST FILE 20 TRACE 9 WINDOW 130-160 MS.

540.



065, 930m

Patent

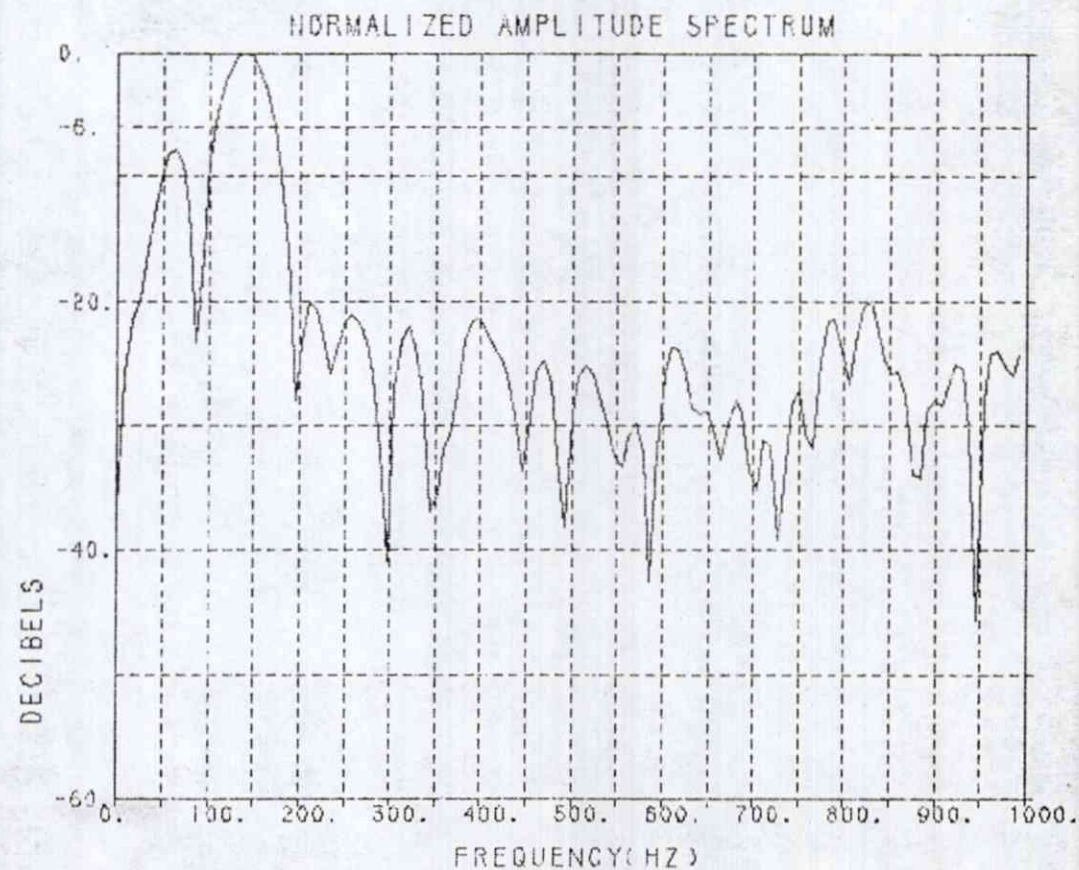
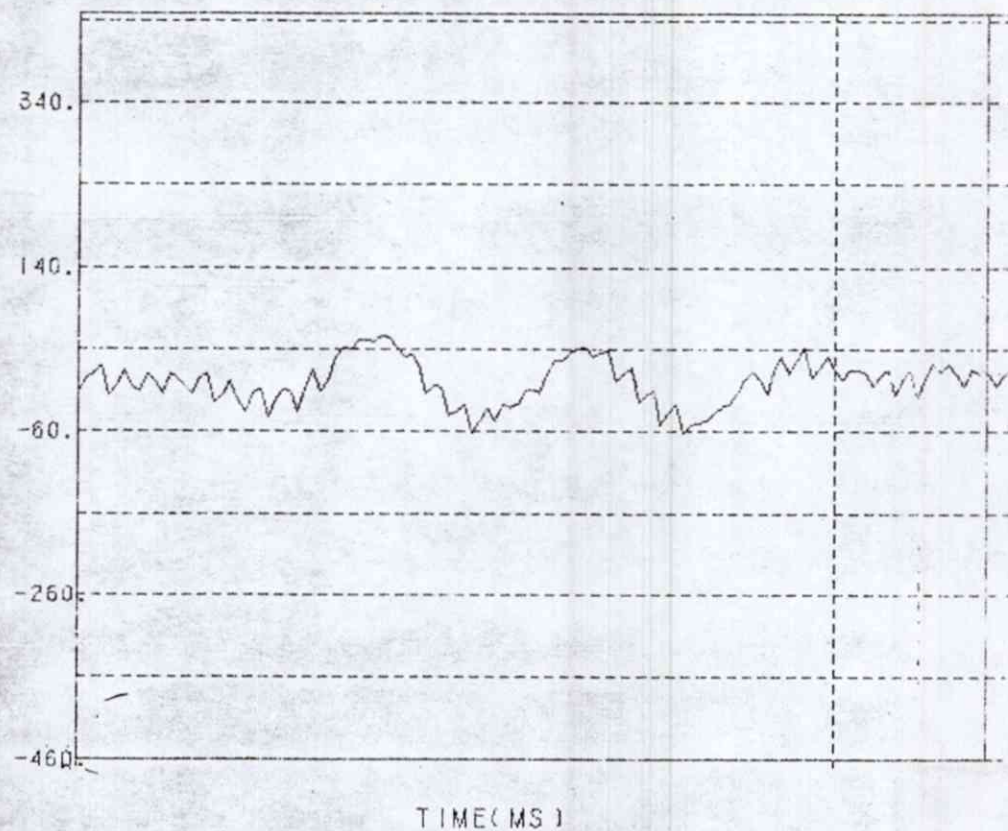
GECØ PULSE TEST

IDENT 200000 CHANNEL 11

1.79

GECØTEAM TEST FILE 20 TRACE 11 WINDOW 130-160 MS.

540.



0130 930

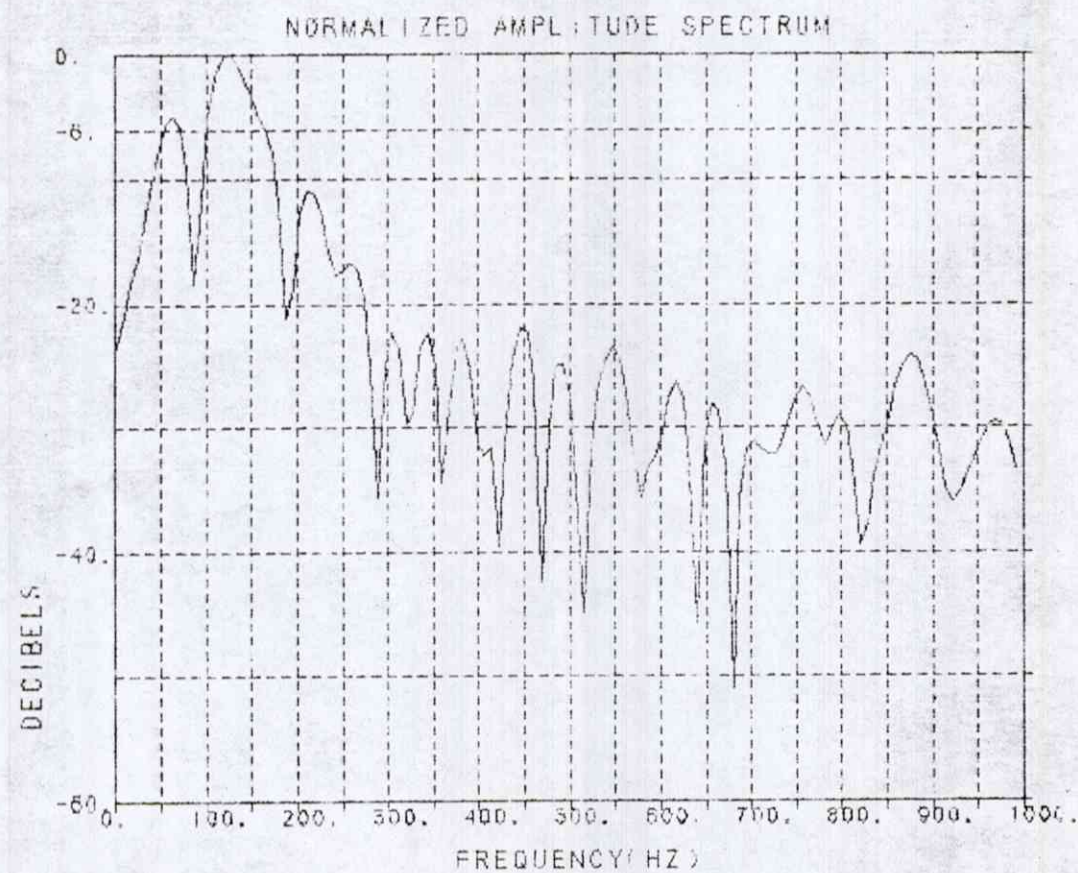
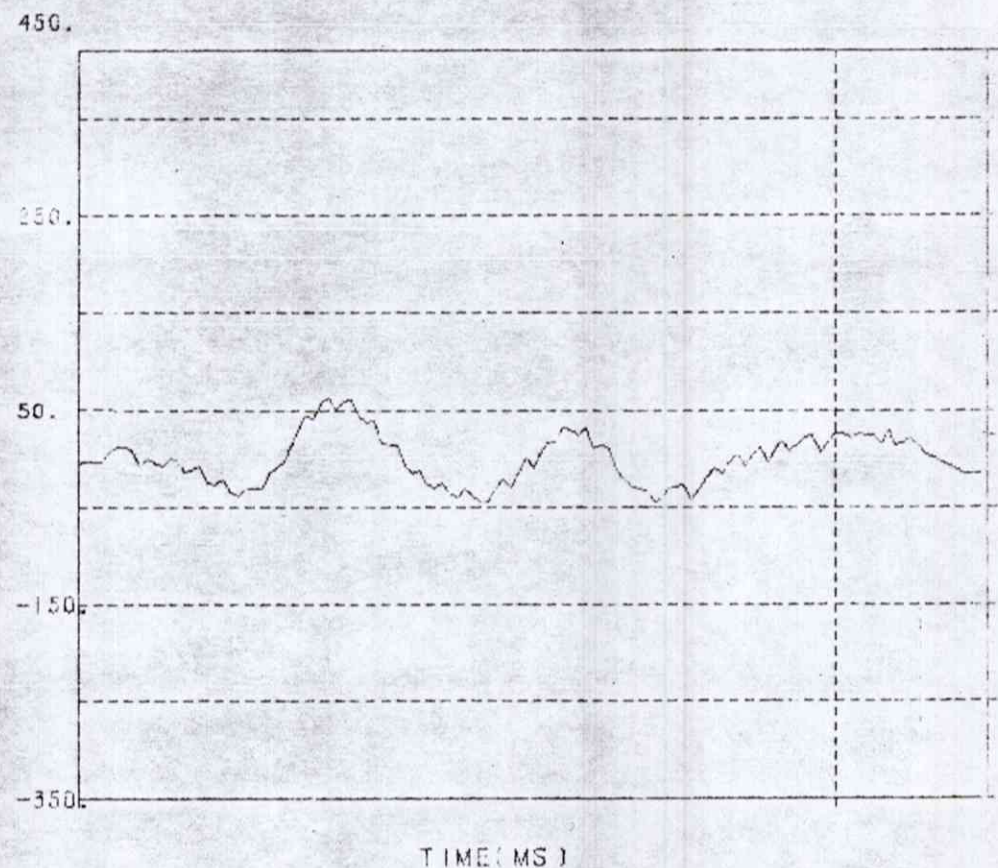
Trephing

GECO PULSE TEST

1.80

IDENT 210000 CHANNEL 1

GECOTEAM TEST FILE 21 TRACE 1 WINDOW 150-180 MS.



D130, 930 m
Patent

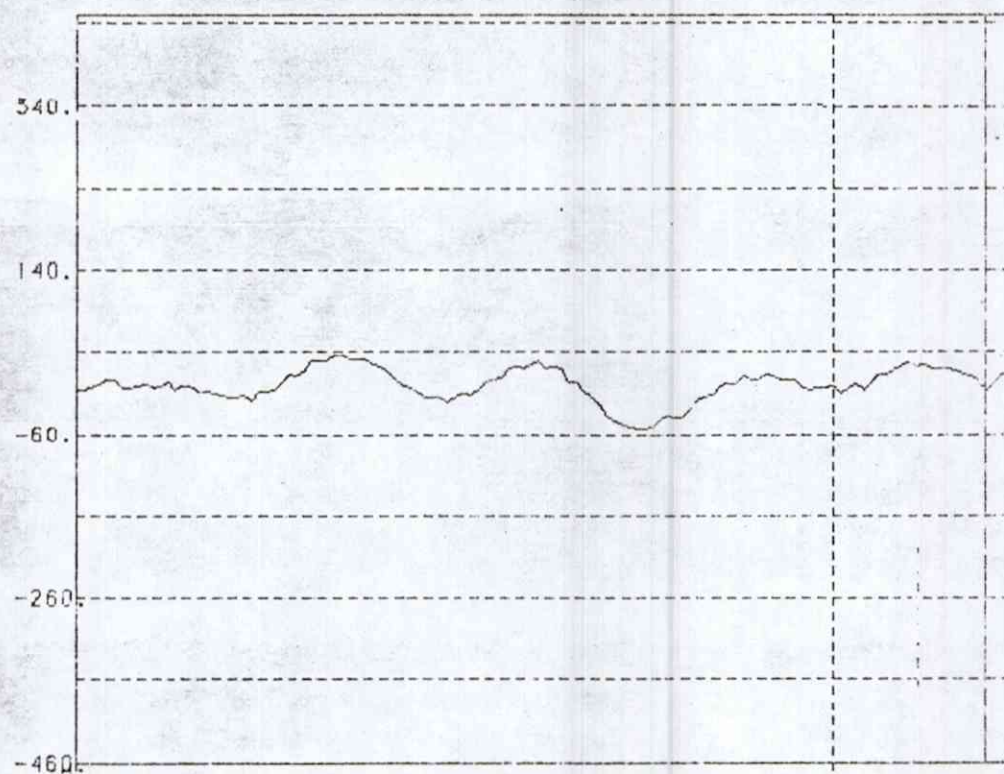
GECØ PULSE TEST

IDENT 210000 CHANNEL 7

GEOTEAM TEST FILE 21 TRACE 7 WINDOW 150-180 MS.

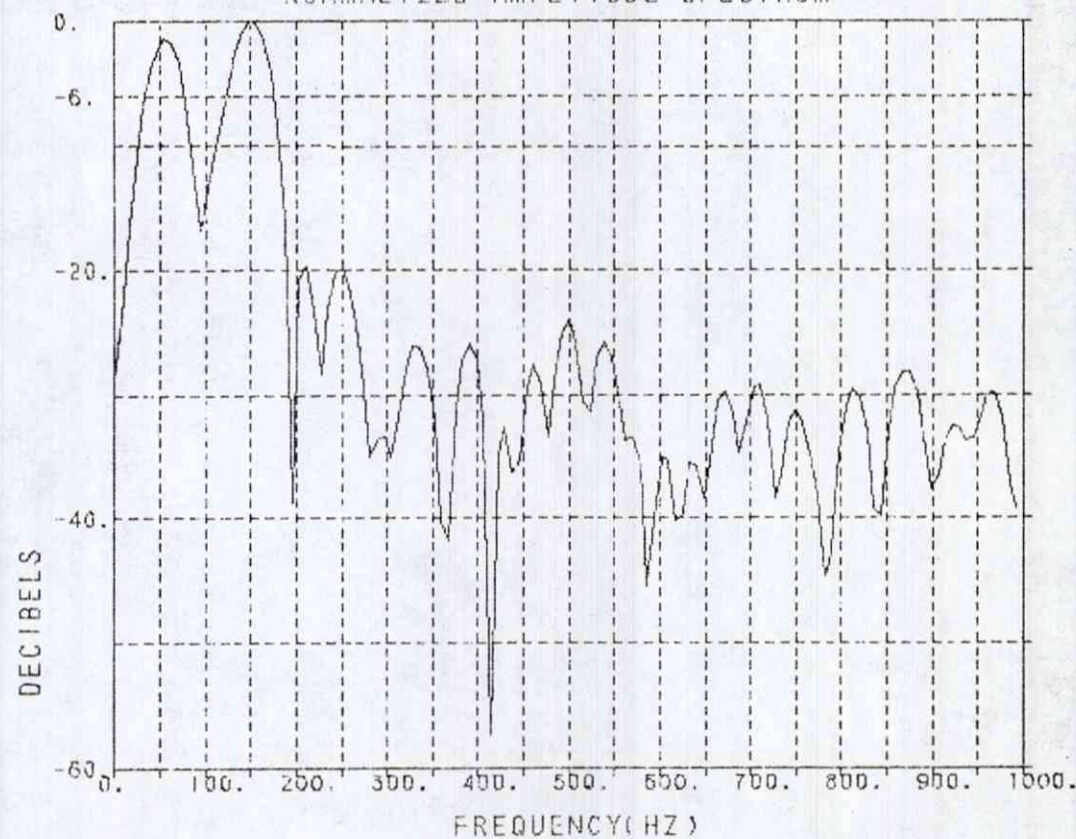
1.81

540.



TIME(MS)

NORMALIZED AMPLITUDE SPECTRUM



FREQUENCY(HZ)

D130 930

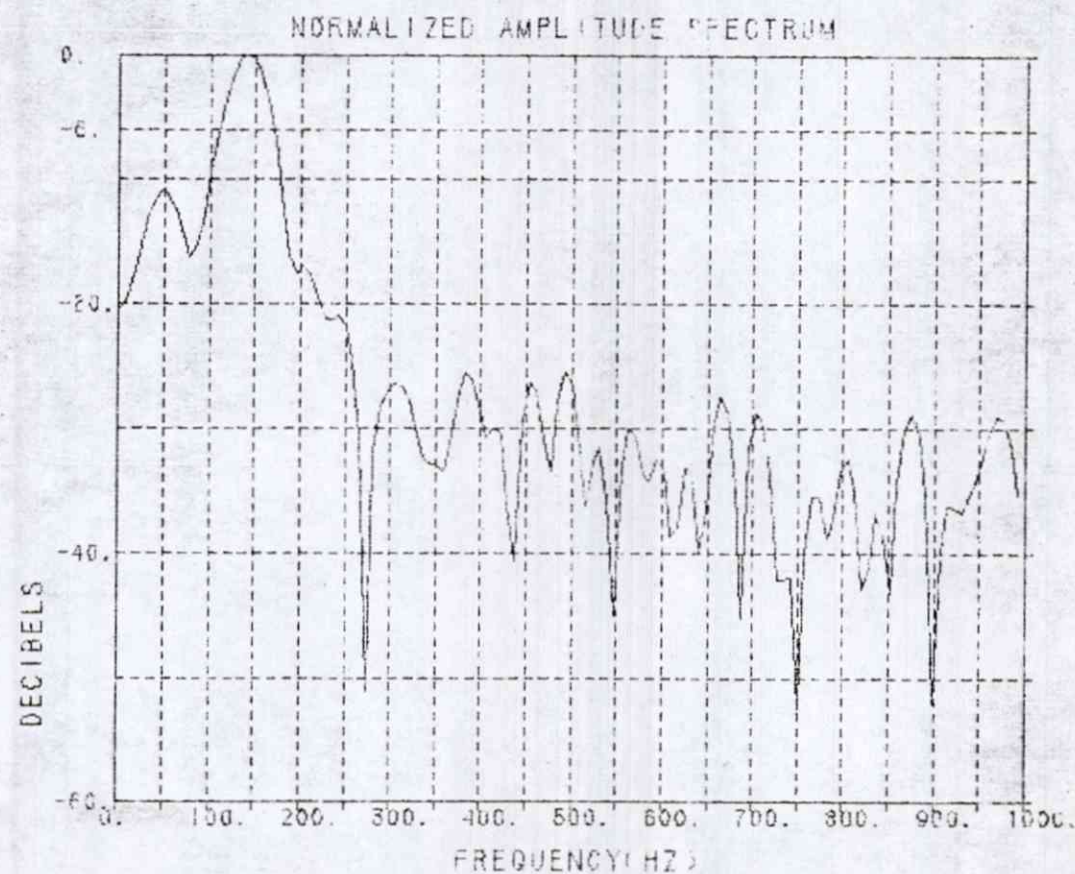
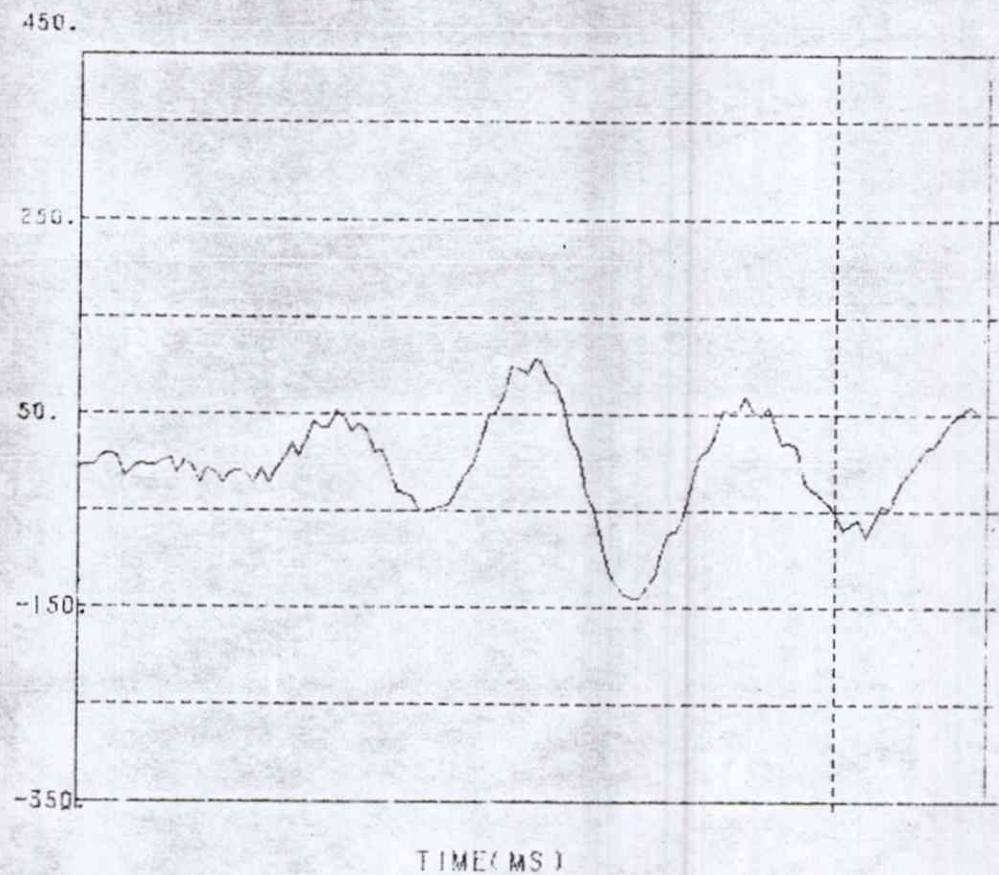
Tripod

GECO PULSE TEST

IDENT 210000 CHANNEL 8

1.82

GECOTEAM TEST FILE 21 TRACE 8 WINDOW 150-100 MS



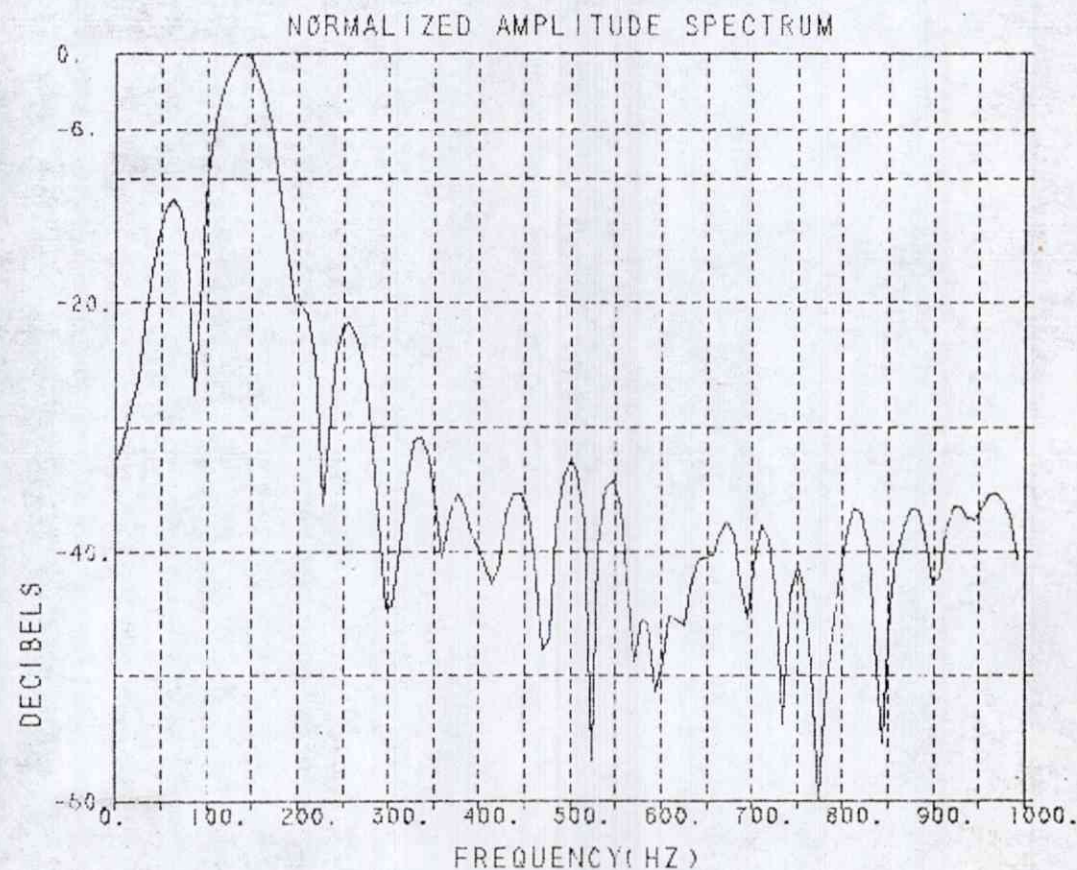
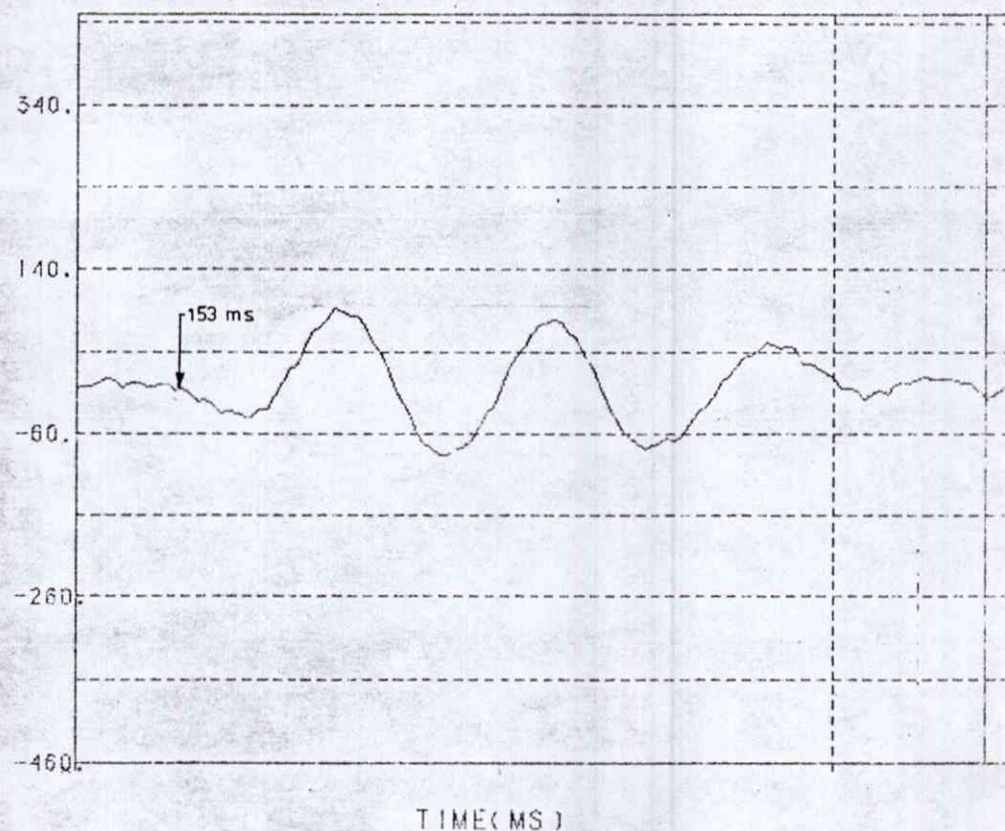
0130 930m
Patent

GECO PULSE TEST

IDENT 210000 CHANNEL 9

GEOTEAM TEST FILE 21 TRACE 9 WINDOW 150-180 MS.

540.



Stålplugg. 130g D. N930

D130 930m
Patient

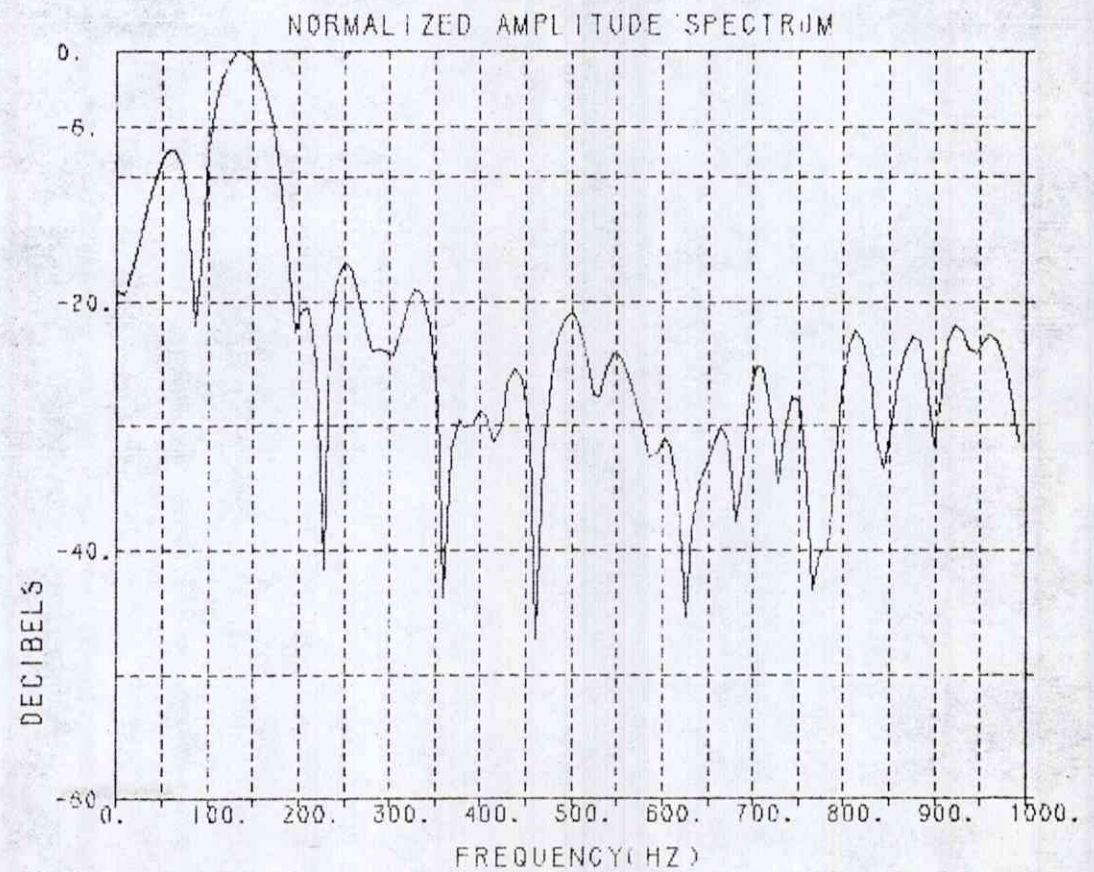
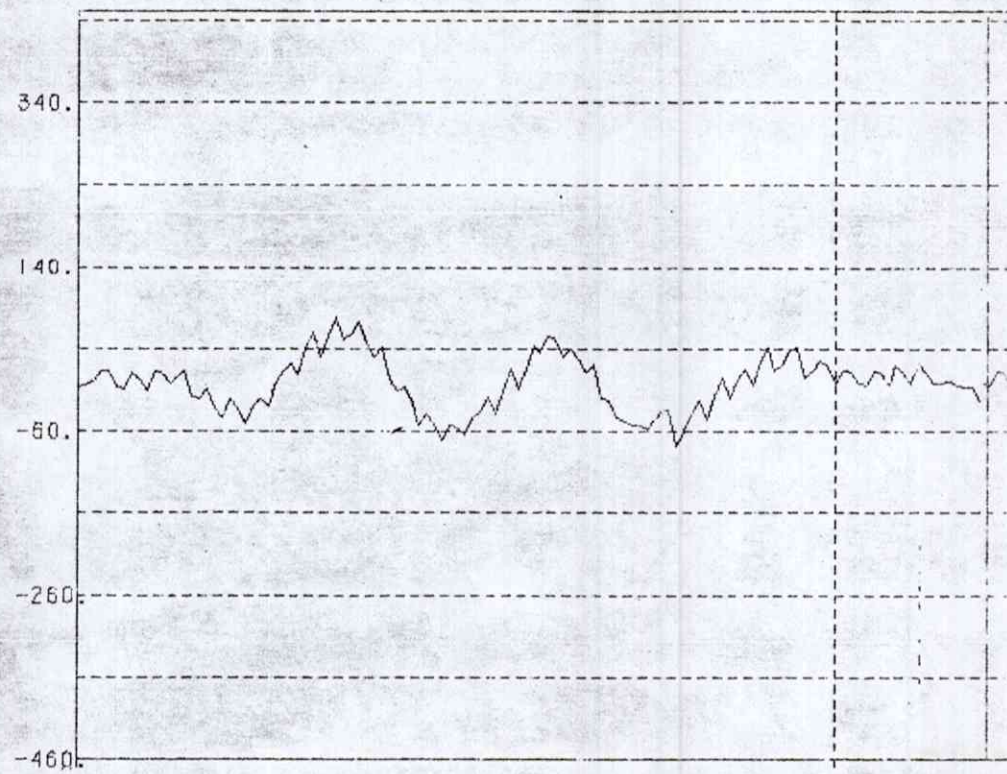
GECO PULSE TEST

IDENT 210000 CHANNEL 11

GEOTEAM TEST FILE 21 TRACE 11 WINDOW 150-180 MS.

1.84

540.



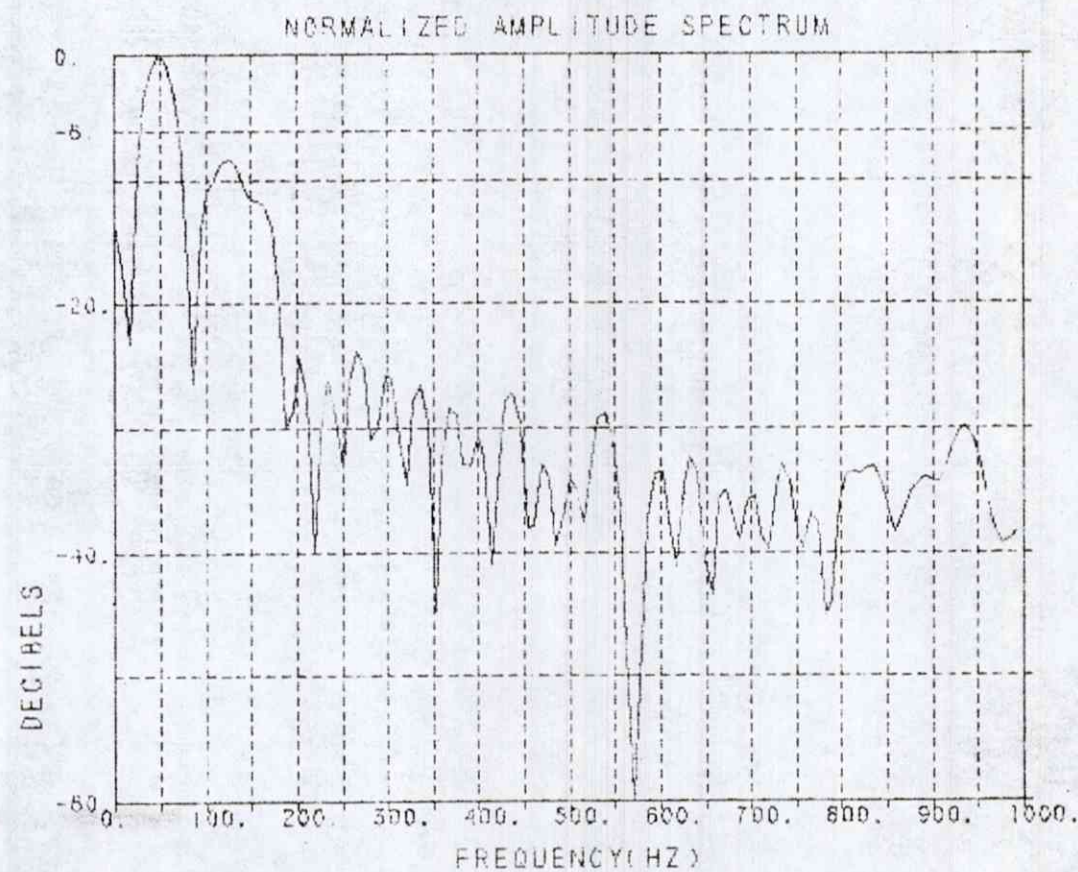
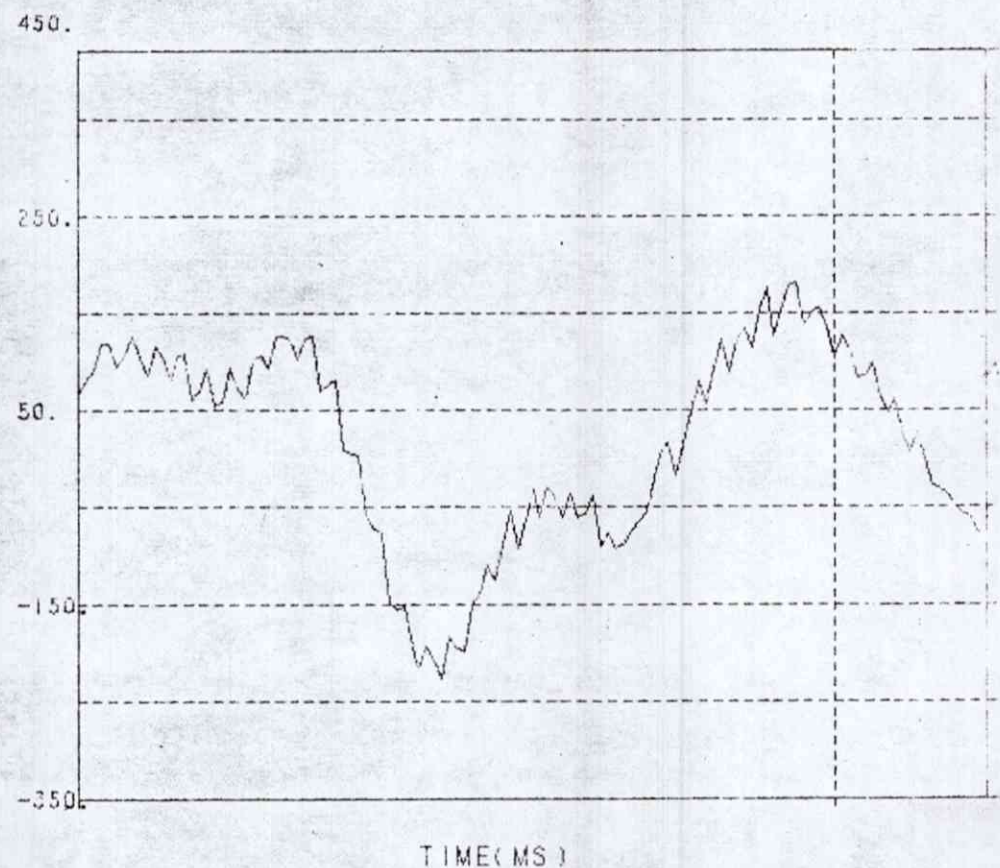
D130 930m
Array Patent

GECO PULSE TEST

1.85

IDENT 210000 CHANNEL 12

GECOTEAM TEST FILE 21 TRACE 12 WINDOW 150-180 MS.



D/30 930m

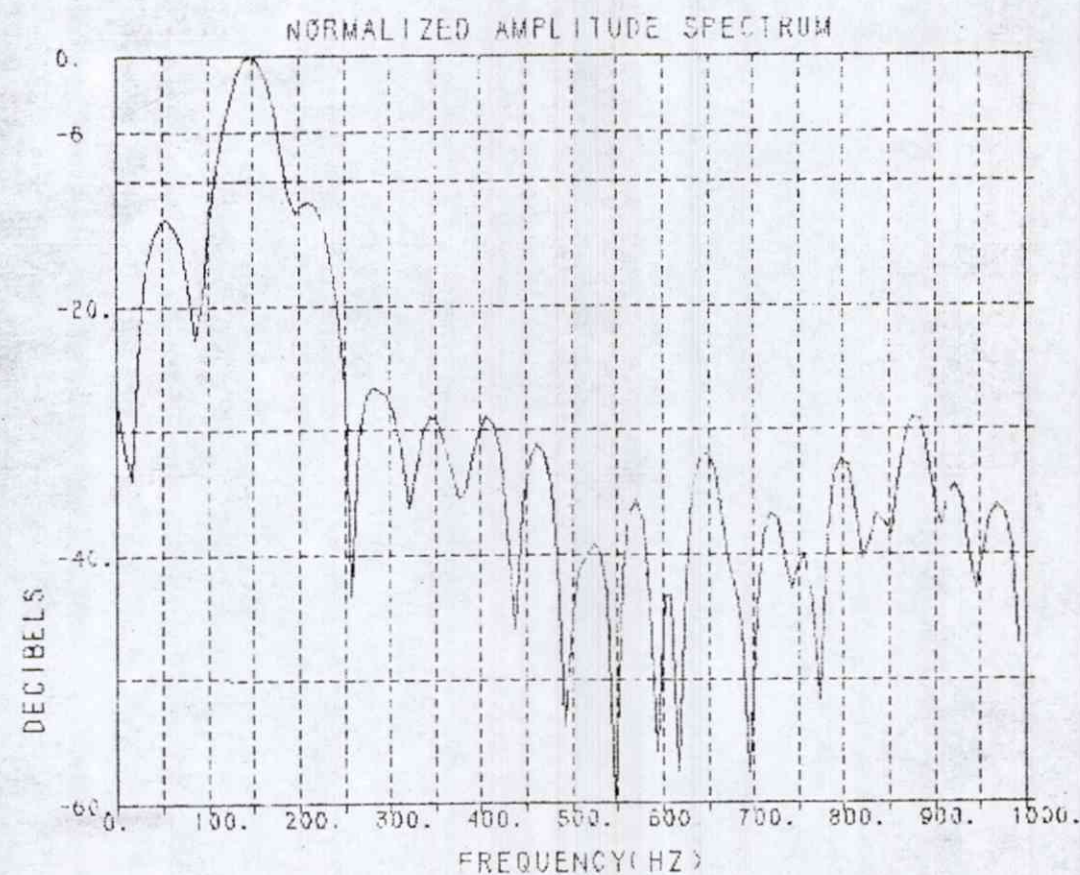
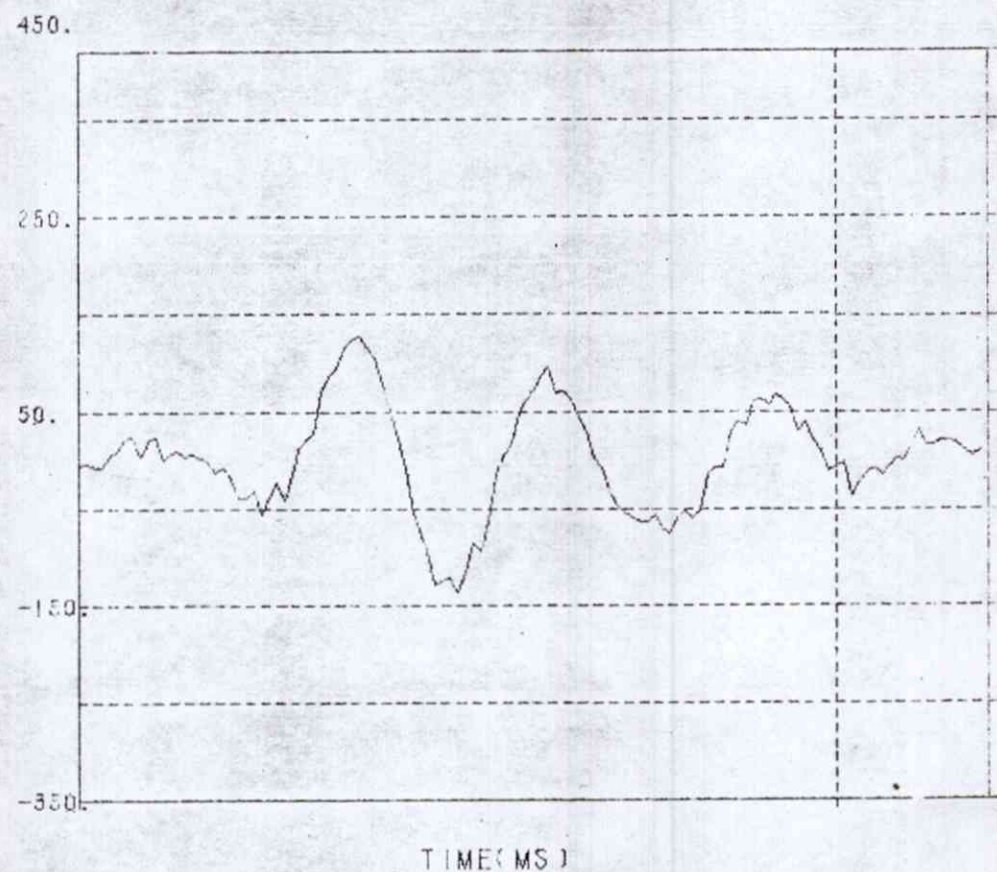
fermpl. stor lbrm.

GECO PULSE TEST

IDENT 210000 CHANNEL 18

1.86

GEOTEAM TEST FILE 21 TRACE 18 WINDOW 150-180 MS.



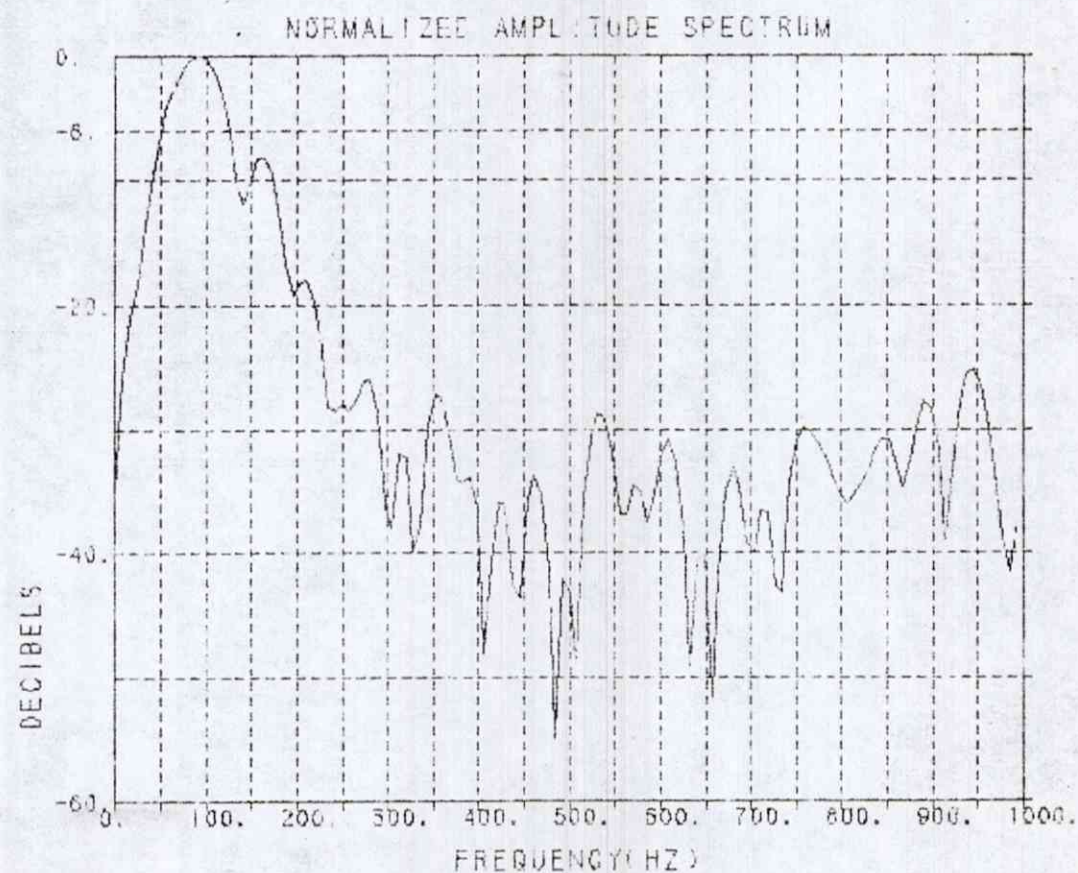
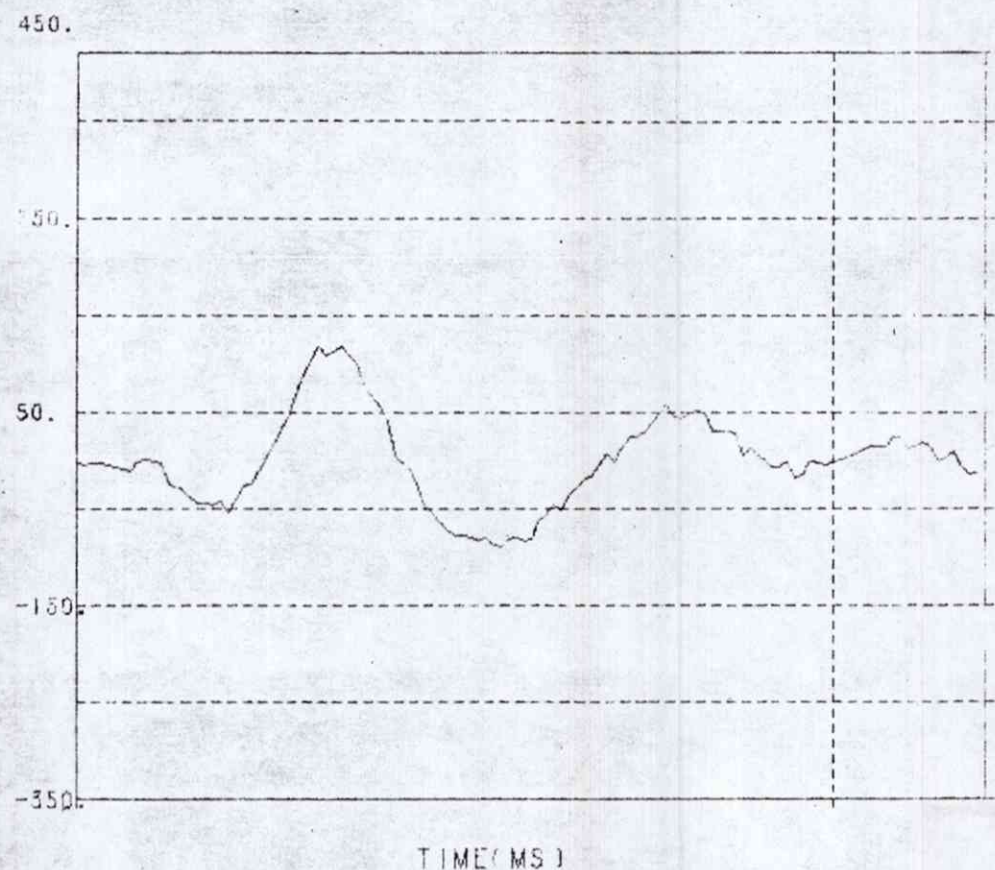
0130 930 in
Tre plugg

GEC0 PULSE TEST

IDENT 220000 CHANNEL 1

GEOTEAM TEST FILE 22 TRACE 1 WINDOW 155-165 MS.

1.87



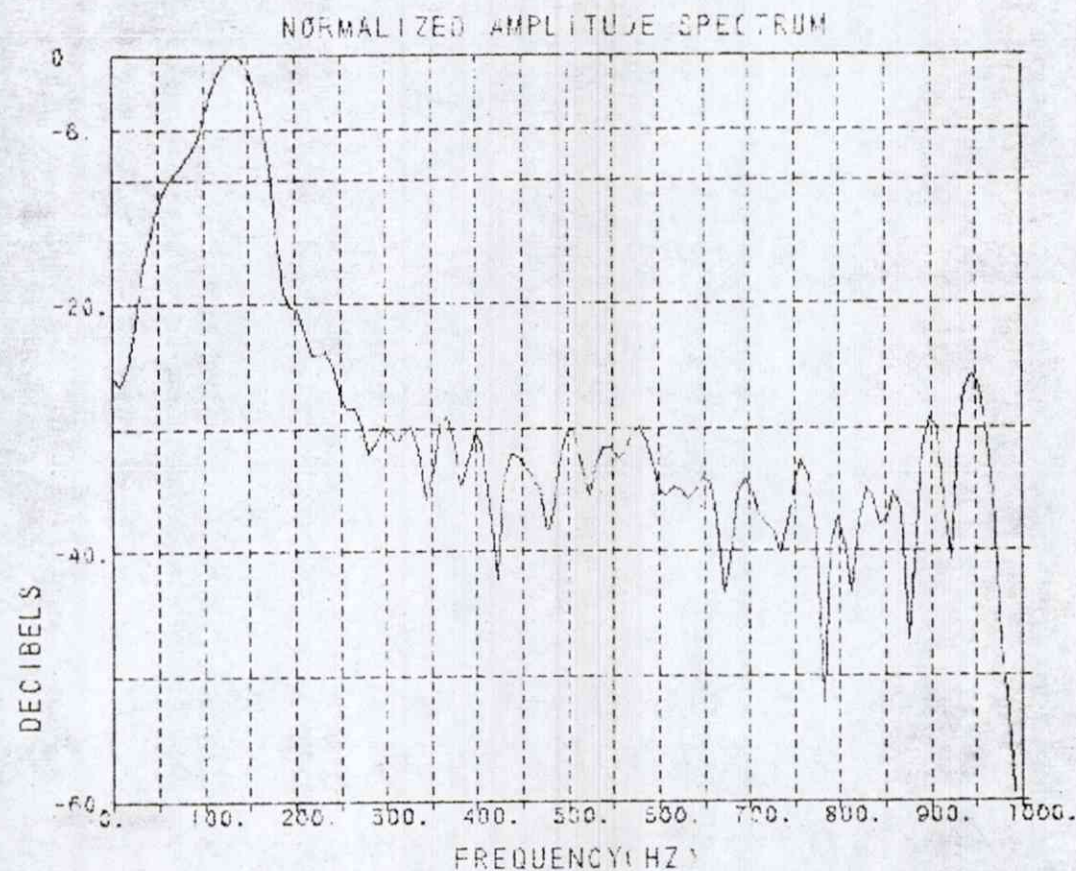
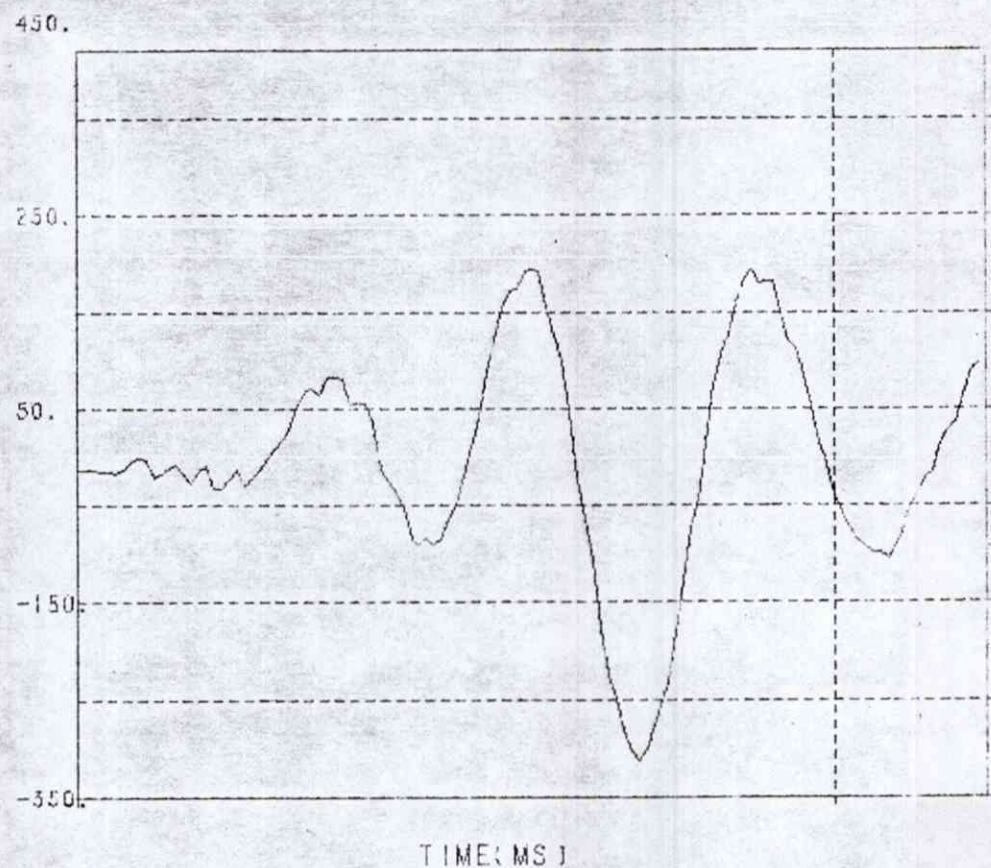
8130 930'm
Tripod

GECO PULSE TEST

IDENT 220000 CHANNEL 8

GEOTEAM TEST FILE 22 TRACE 8 WINDOW 155-185 MS.

1.88



D 130 930 m

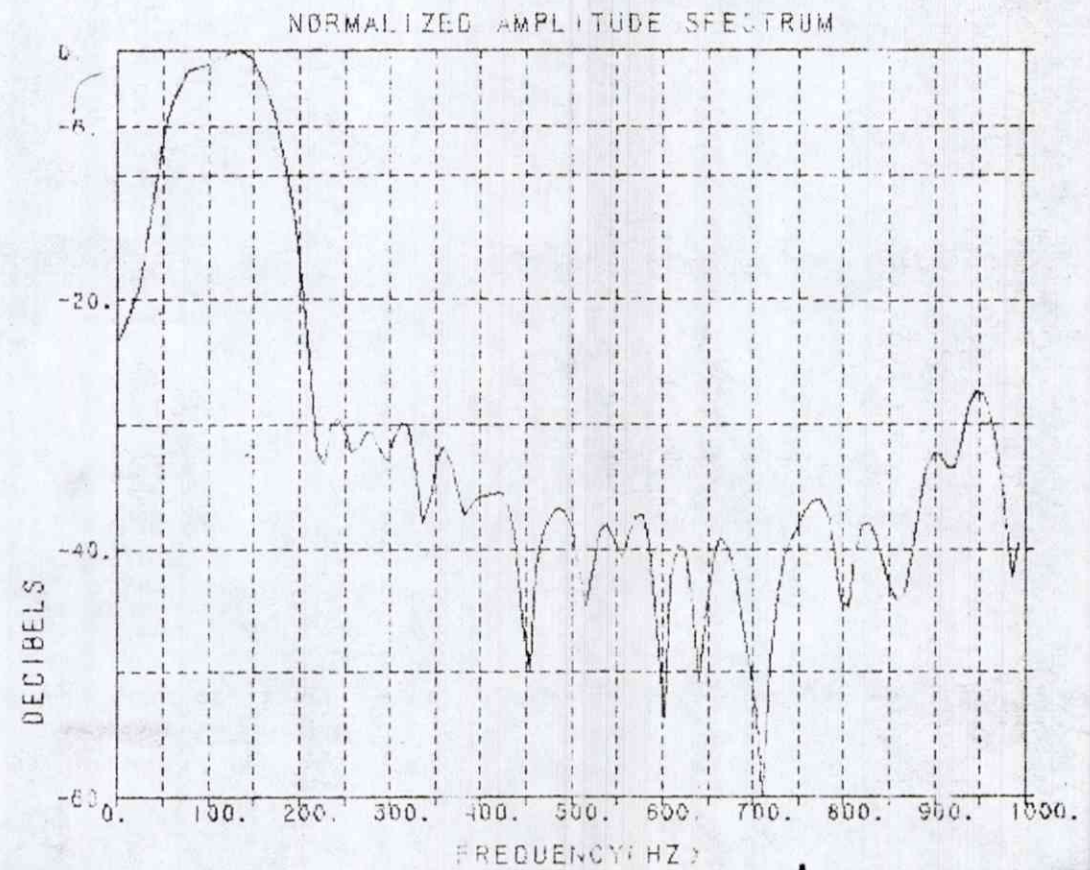
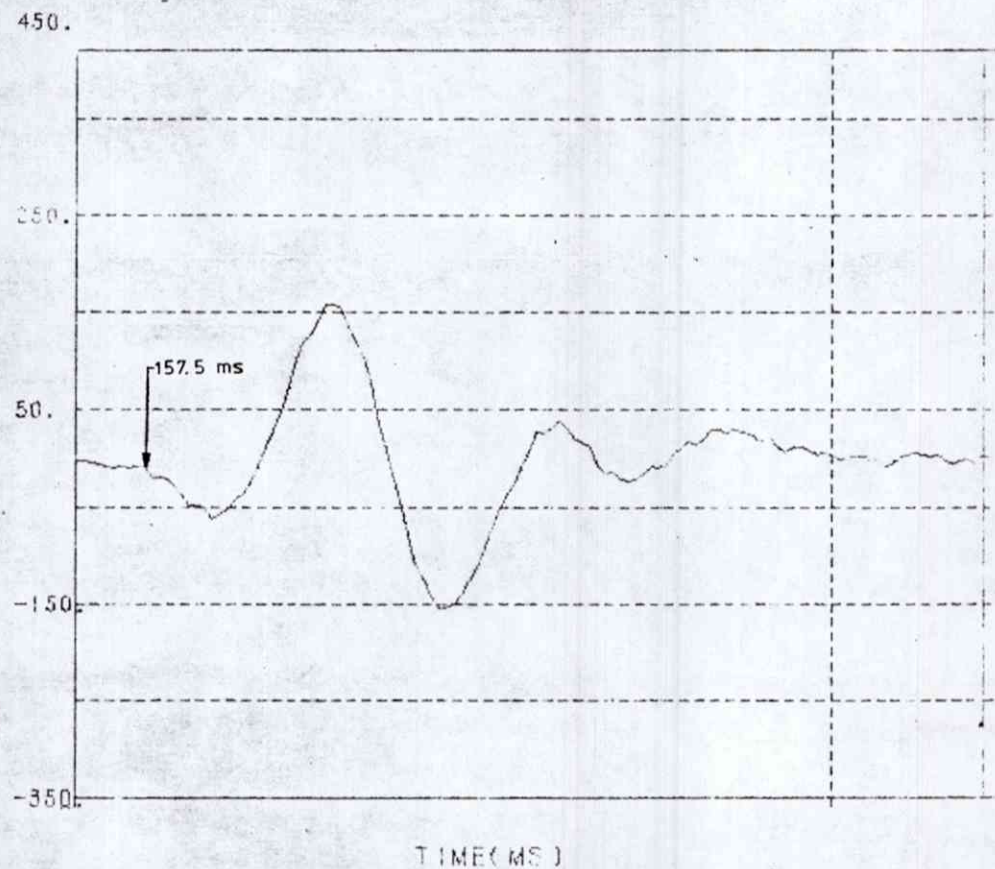
Patent

GECO PULSE TEST

IDENT 220000 CHANNEL 9

1.89

GEOTEAM TEST FILE 22 TRACE 9 WINDOW 155-185 MS.



Stålplugg 130g D N 930

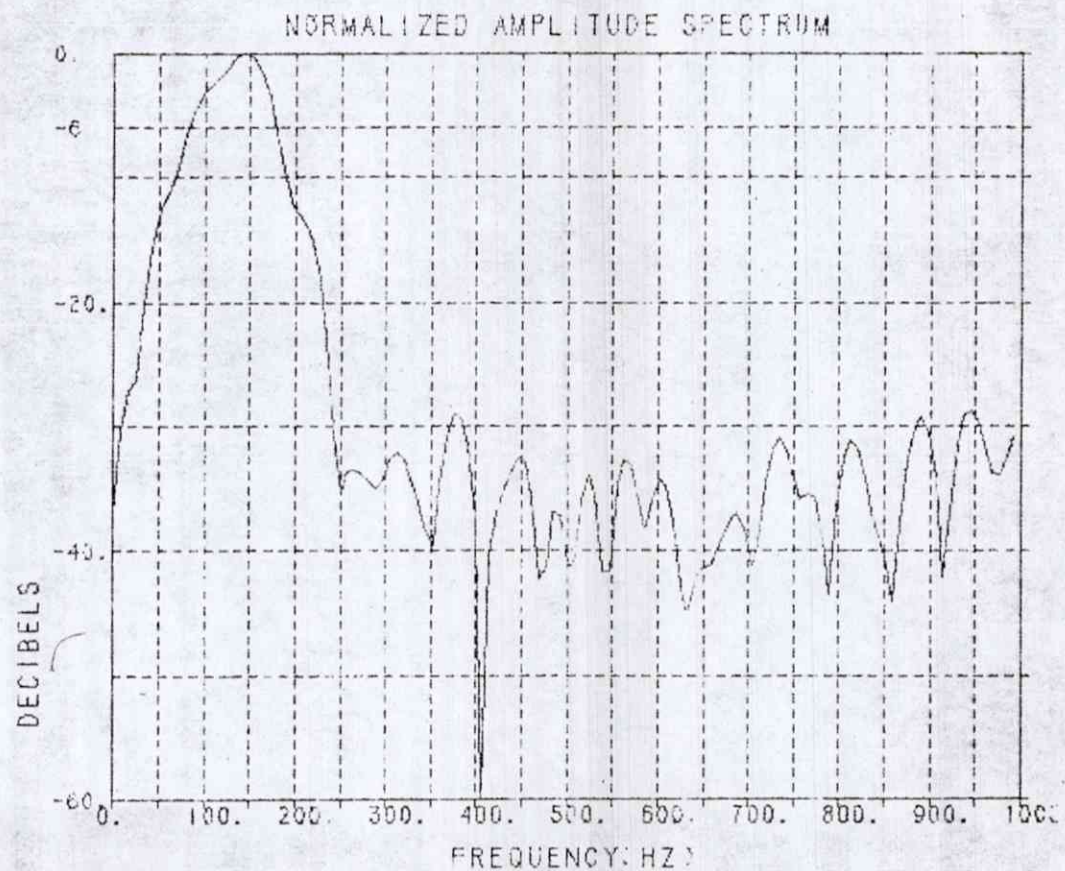
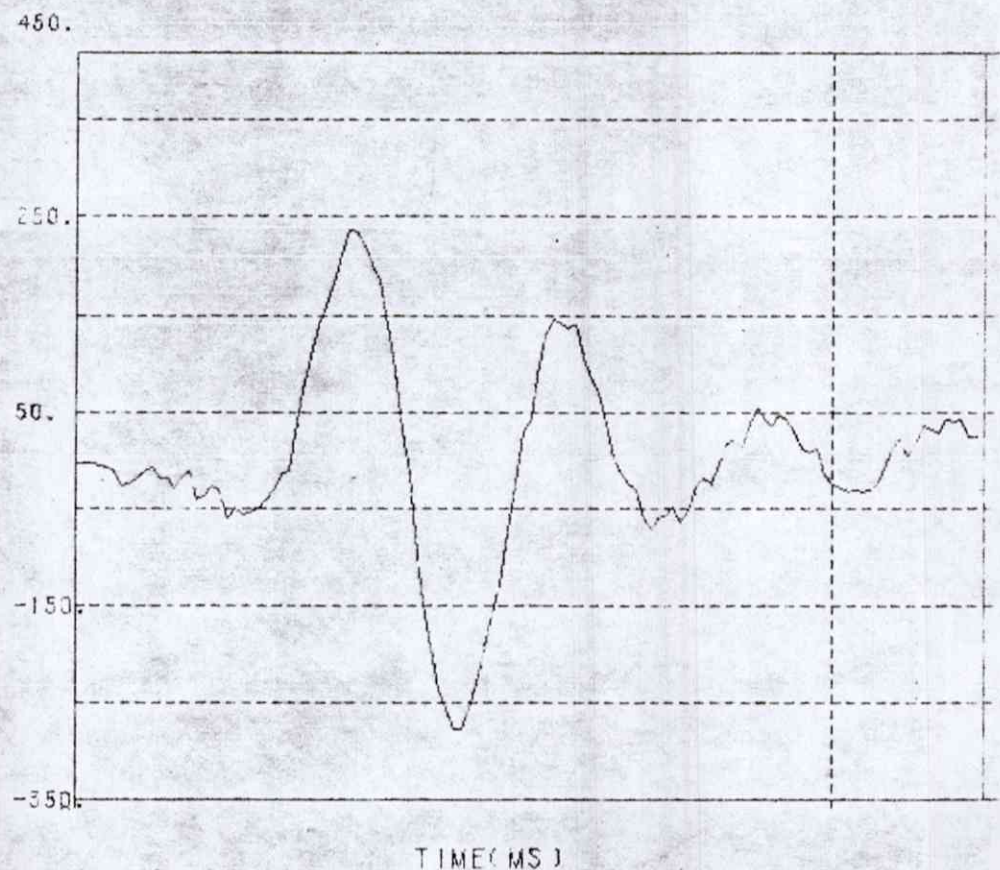
DT30 930¹_m
fempl. stor lbrm.

GECO PULSE TEST

IDENT 220000 CHANNEL 18

GEOTEAM TEST FILE 22 TRACE 18 WINDOW 135-185 MS.

1.90



Bilag 2
til rapport 4034.04
SEISMISKE UNDERSØKELSER
I LØKKEN GRUBE 1977
FOR ORKLA INDUSTRIER A/S
PULSTESTER DFS-V

INNHold:

Tabell 1 : Geofonkoblinger.

Tabell 2 : Liste over registreringer.

Blad 2.1 - 2.42: Pulser og frekvens-amplitudespektra
registrert med DFS-V.

TAPE REF.	SPRENGSTOFF	LADNING	FORSTERKNING	SKUDDETS BELIGGENHET
file	type	g		
53	dynamitt	100	ifp	nivå 380
56	dynamitt	5	ifp	nivå 380
59	dynamitt	50	ifp	nivå 720
60	dynamitt	100	ifp	nivå 720
61	dynamitt	5	ifp	nivå 930
62	dynamitt	50	ifp	nivå 930
63	dynamitt	100	ifp	nivå 930

Bilag 2, Tabell 2,
Liste over registreringer.

GEOFON	BESKRIVELSE AV GEOFONKOBLING									
1	GS	100 Hz	montert med "patent" i fjell, dekket med sandsekk.							
2, 4, 8	L 25 E	50 Hz	"	"	"	"	"	"	"	"
3	Sensor	30 Hz	"	"	"	"	"	"	"	"
5	GS	10 Hz	"	"	"	"	"	"	"	"
6, 7	L 25 E	50 Hz	montert på treplugg i fjell, uten sandsekk.							
9, 10, 11	L 25 E	50 Hz	montert på plate på fjell, dekket med sandsekk.							
12	L 25 E	50 Hz	montert på plate på fjell, uten sandsekk.							
18	L 25 E	50 Hz	montert på stor plate, nedgravd i løsmasse.							
19, 20, 21	L 25 E	50 Hz	montert på langt spett nedsatt i løsmasse.							
22	GS 11 D	10 Hz	"	"	"	"	"	"	"	"
23	L 25 E	50 Hz	montert på stor plate, nedgravd i løsmasse.							
24	L 25 E	50 Hz	montert på liten plate, nedgravd i løsmasse.							

Bilag 2, Tabell 1, Geofonkoblinger.

D 130g 380m
GS 100Hz Portant

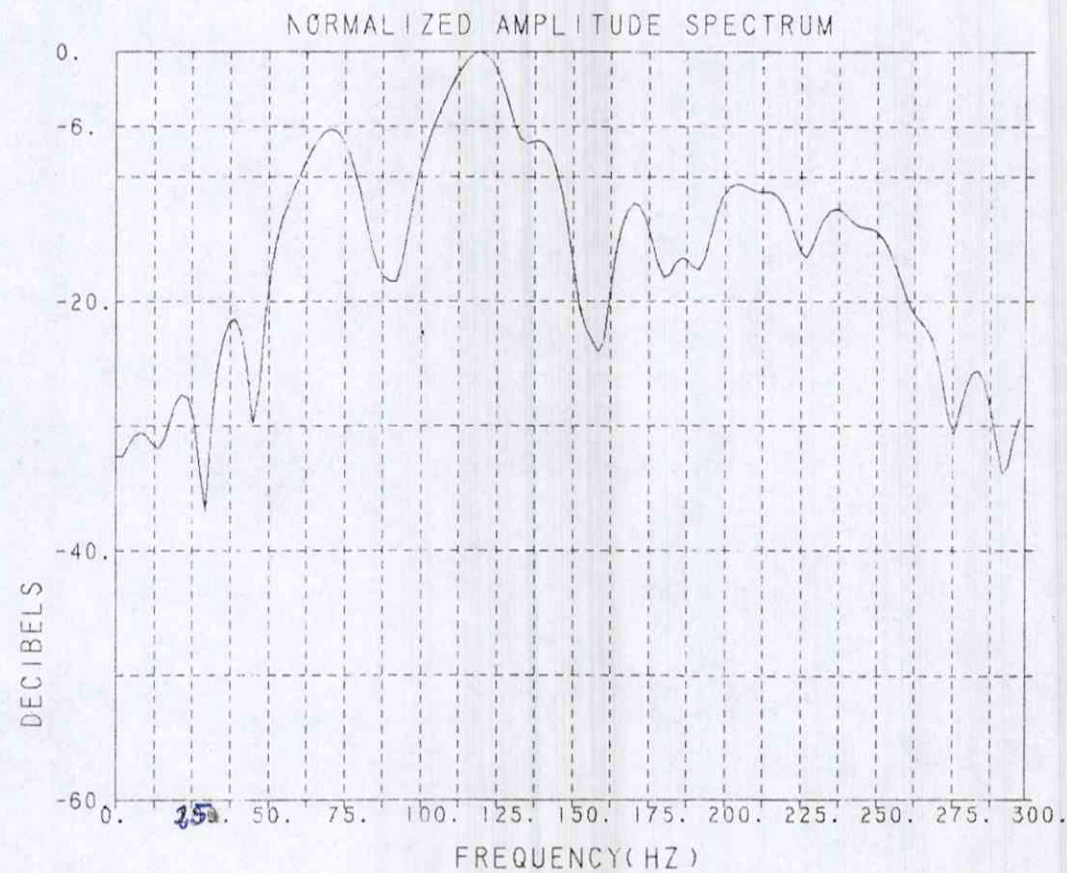
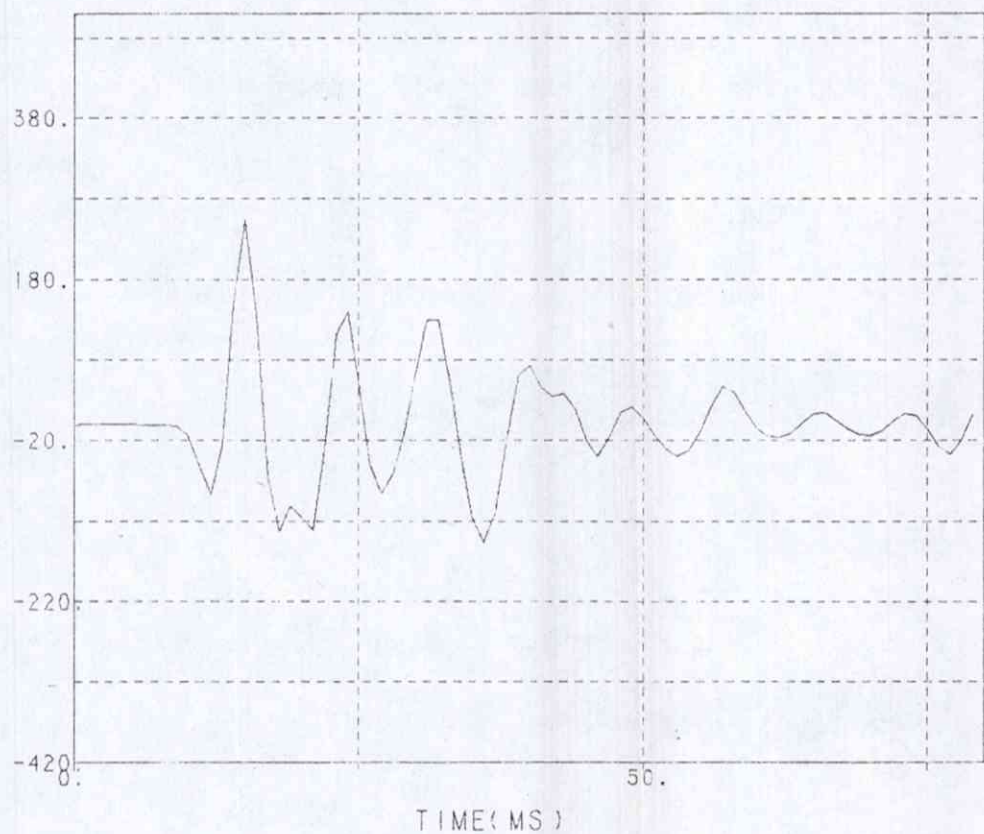
GECØ PULSE TEST

IDENT 530000 CHANNEL 1

GEOTEAM TEST FILE 53 TRACE 1 WINDOW 20-100 MS.

2.1

580.



D 130 g 380 m

6.25E 50Hz Patent

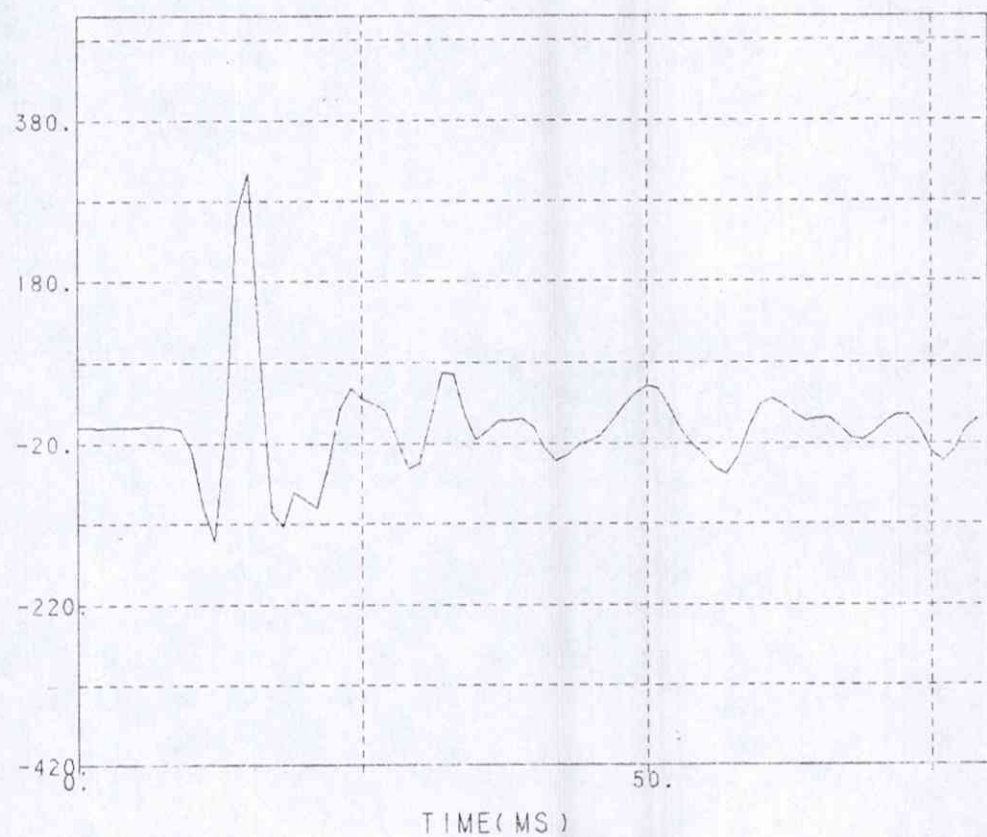
GECO PULSE TEST

2.2

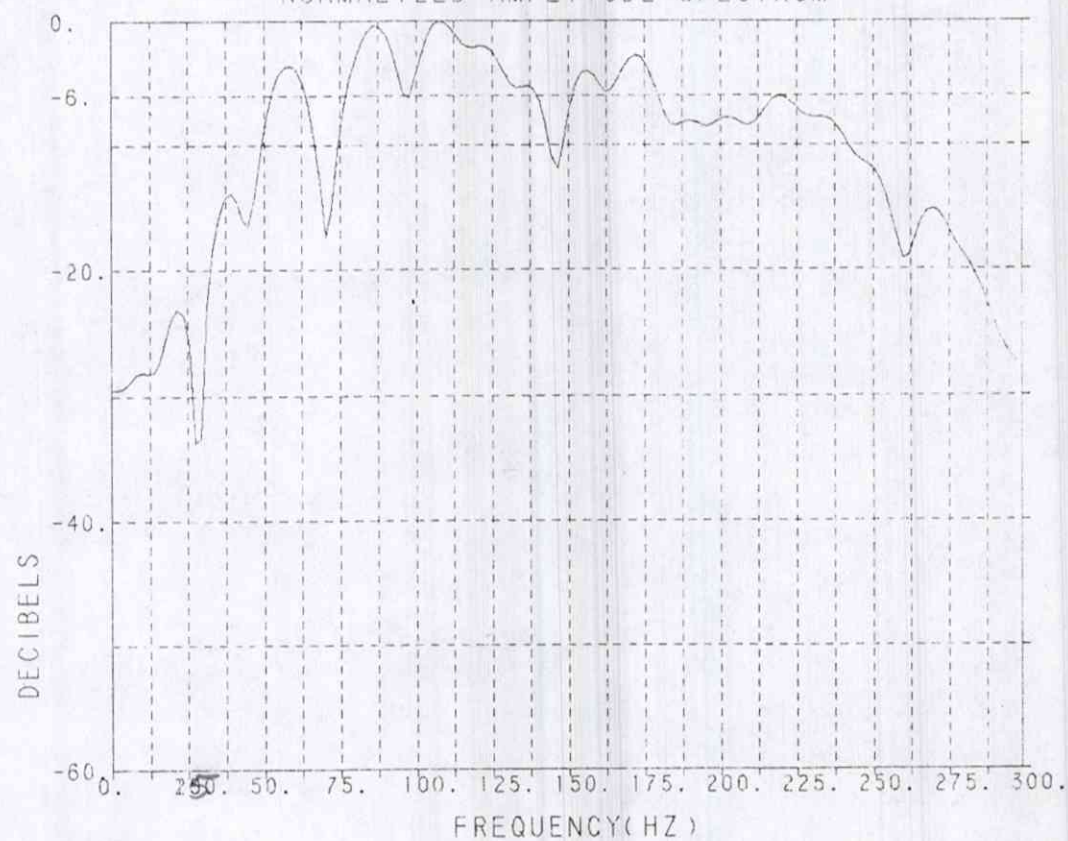
IDENT 530000 CHANNEL 2

GEOTEAM TEST FILE 53 TRACE 2 WINDOW 20-100 MS.

580.



NORMALIZED AMPLITUDE SPECTRUM



Sensor 30Hz Patent

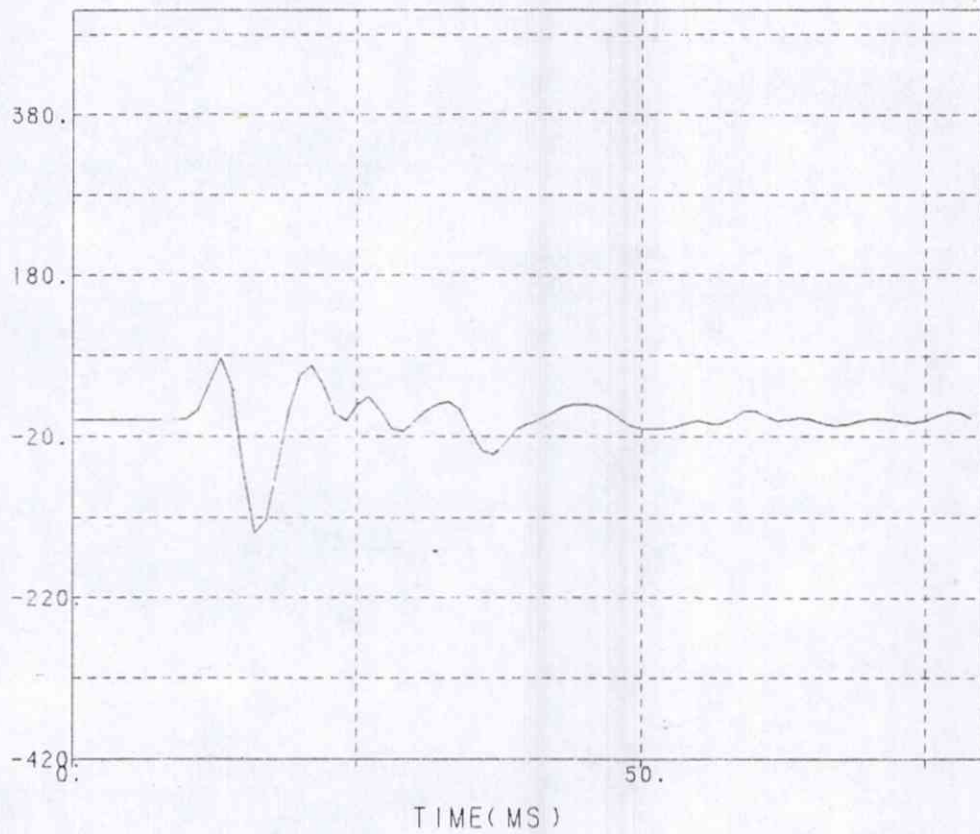
GECO PULSE TEST

IDENT 530000 CHANNEL 3

GEOTEAM TEST FILE 53 TRACE 3 WINDOW 20-100 MS.

2.3

580.



6.25E per test

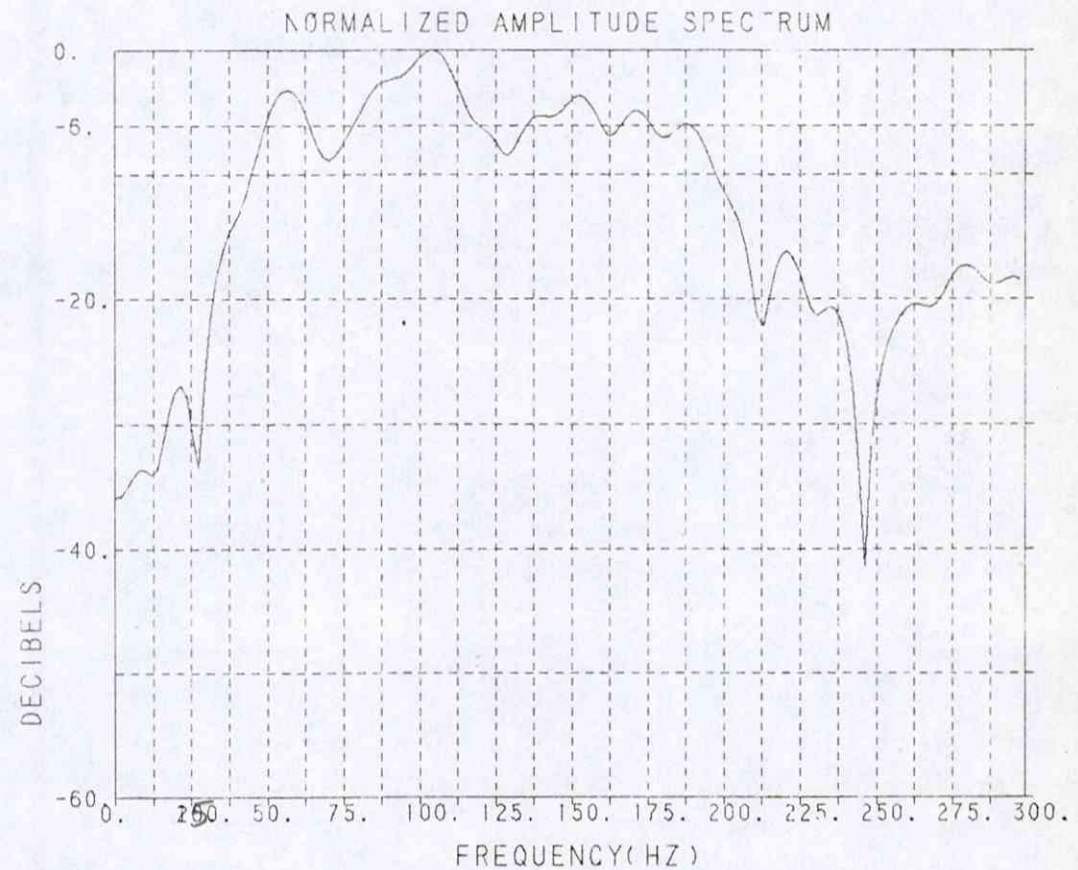
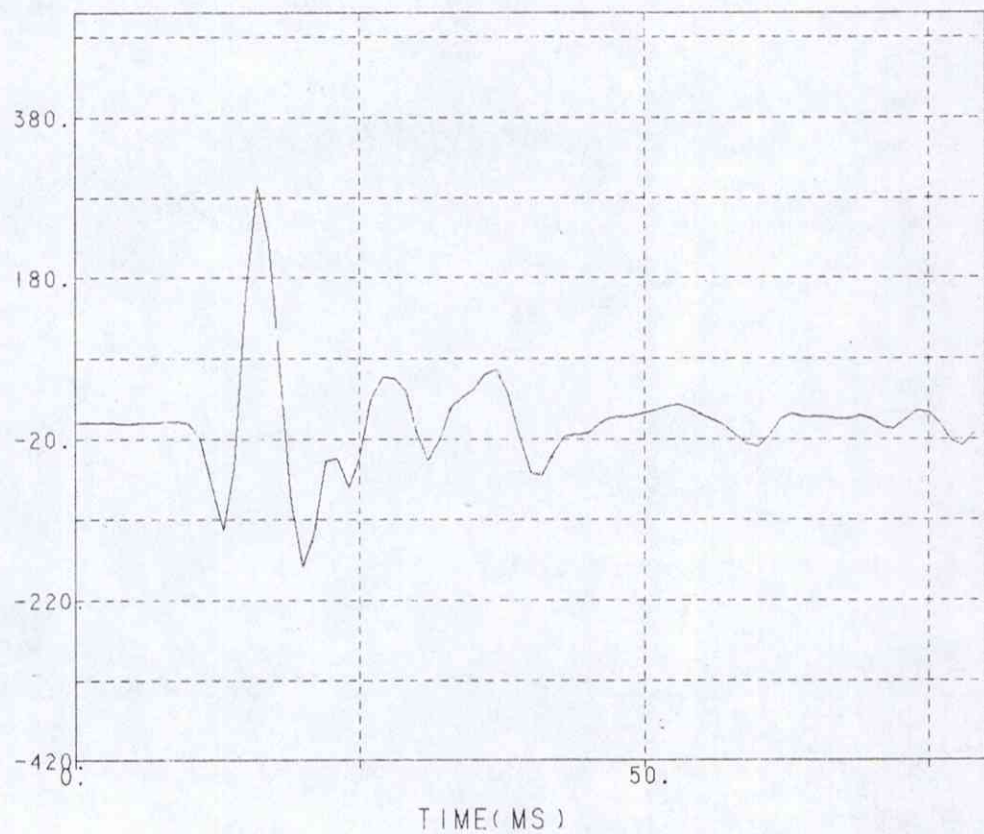
GECO PULSE TEST

2.4

IDENT 530000 CHANNEL 4

GEOTEAM TEST FILE 53 TRACE 4 WINDOW 20-100 MS.

580.



Stålplugg . 130 g D . N-380 .

¹⁰
65 Hz packet

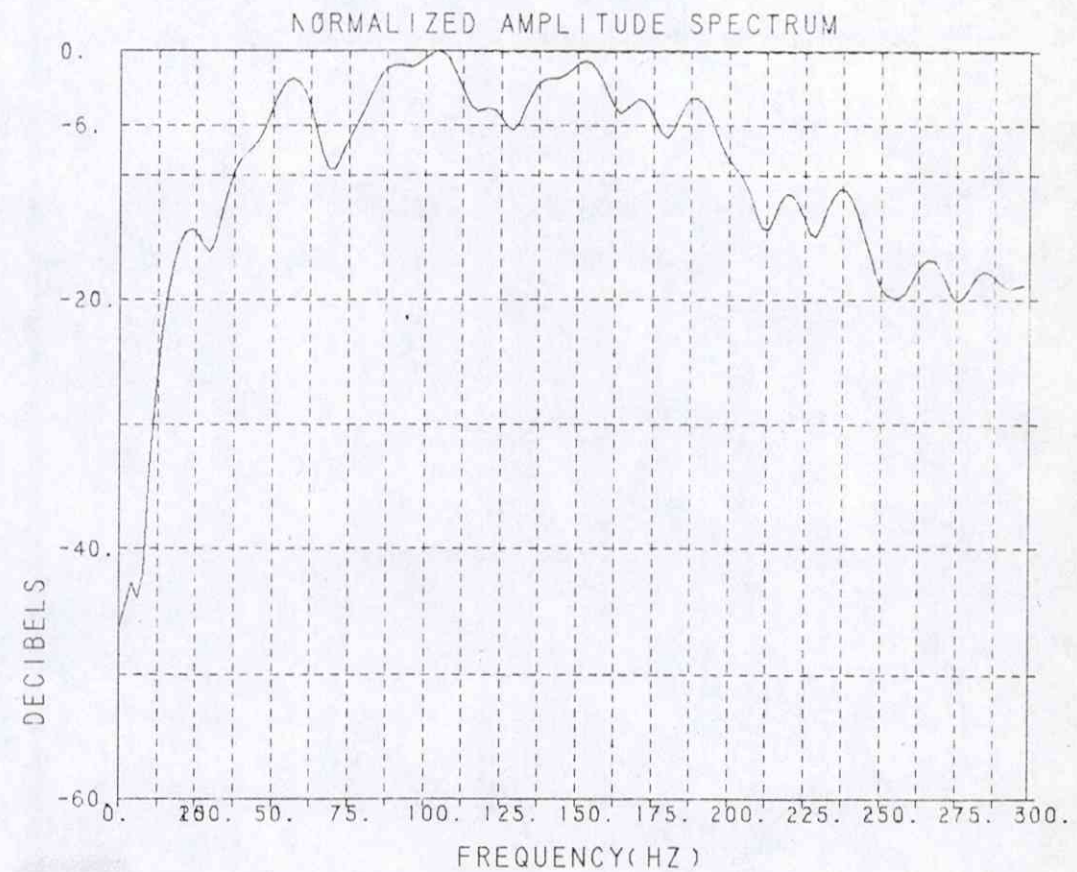
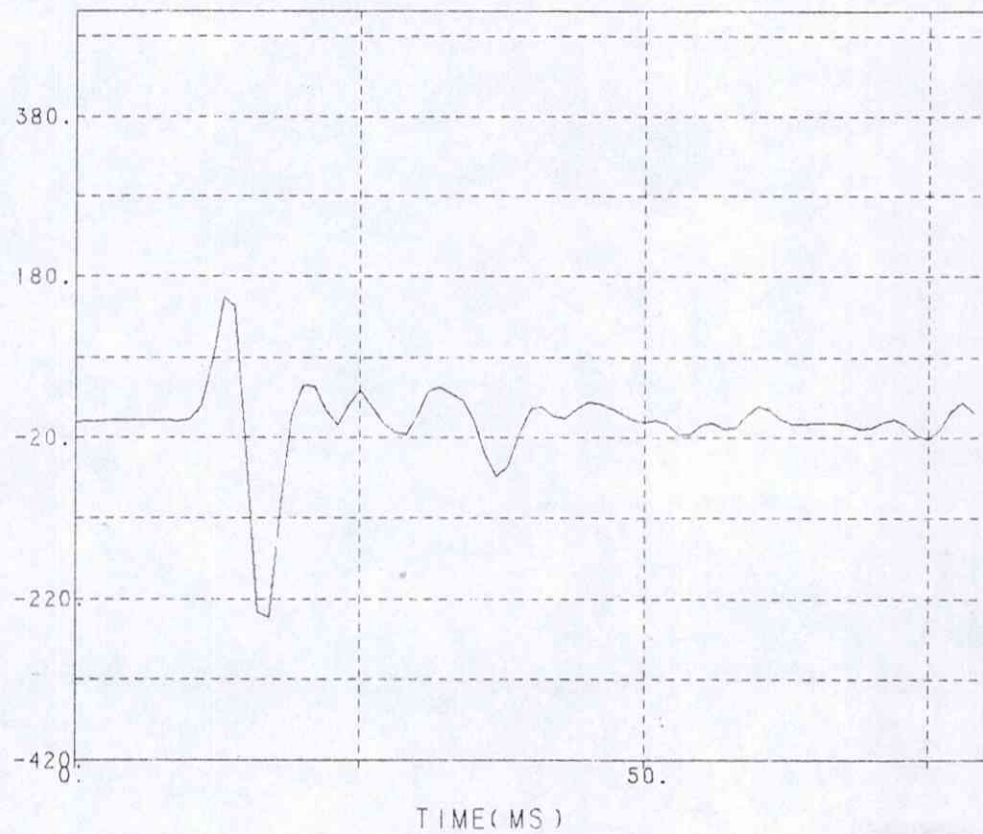
GECØ PULSE TEST

IDENT 530000 CHANNEL 5

GEOTEAM TEST FILE 53 TRACE 5 WINDOW 20-100 MS.

2.5

580.

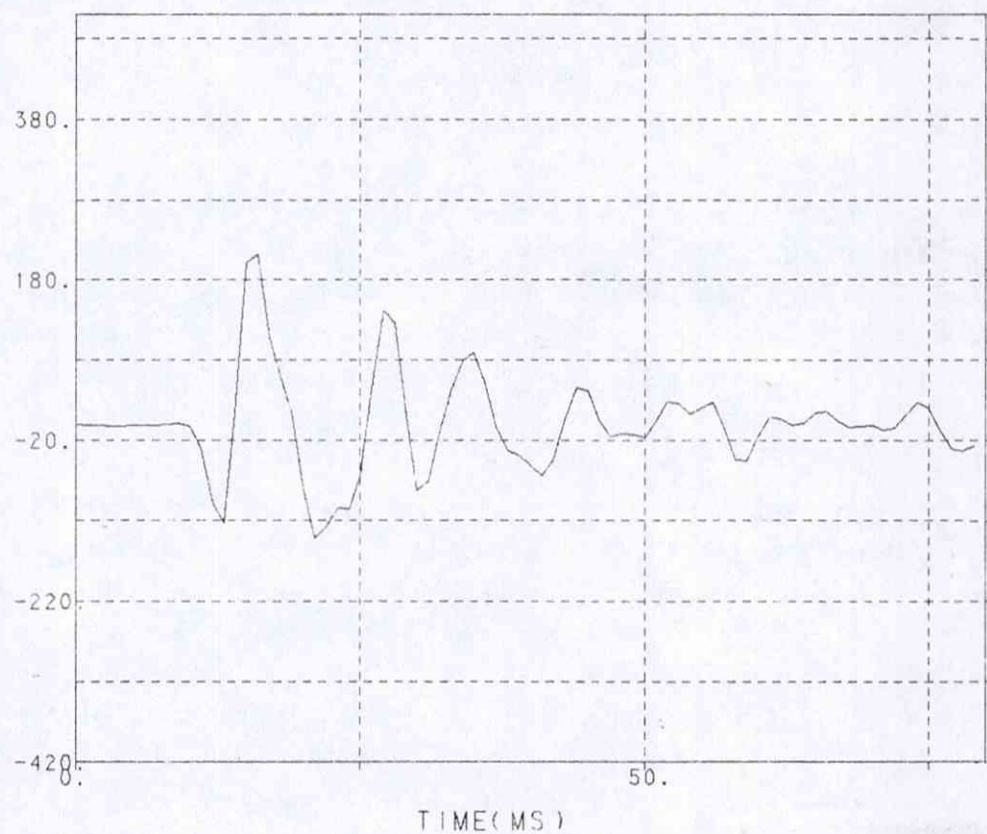


GECØ PULSE TEST

IDENT 530000 CHANNEL 6

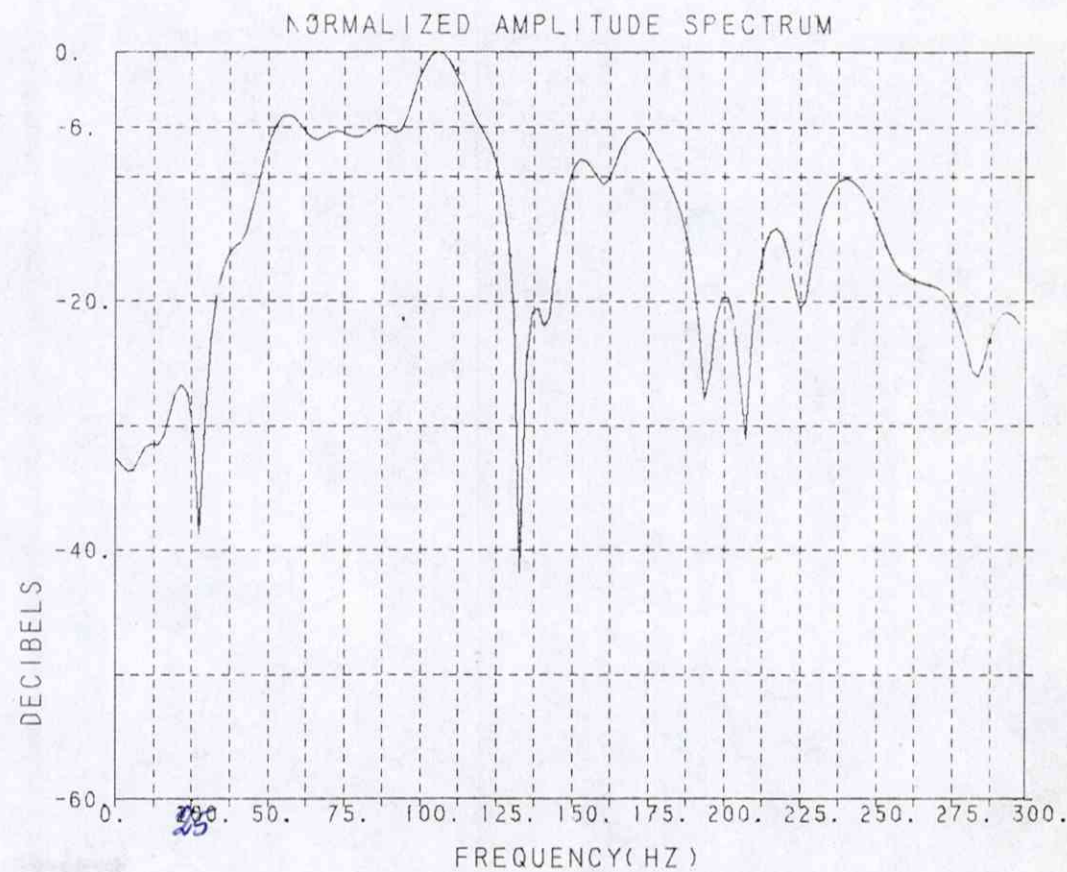
GEOTEAM TEST FILE 53 TRACE 6 WINDOW 20-100 MS.

580.



L25E Treplugg.

2.6



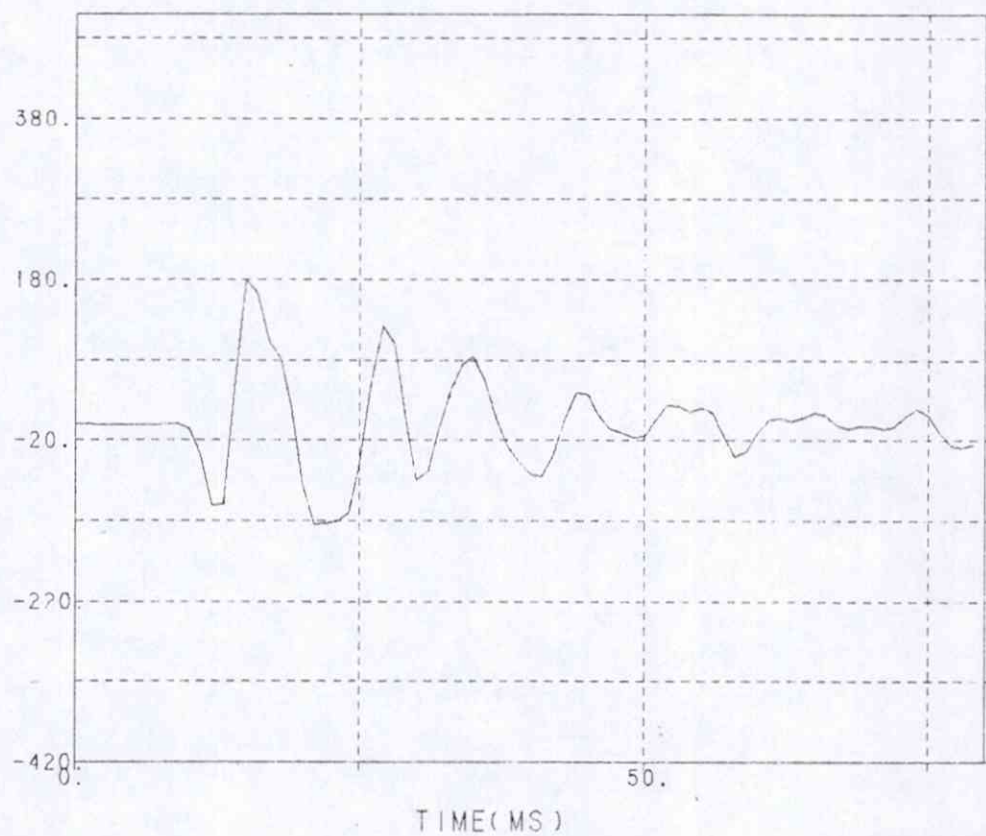
Treplugg . 130 g D . N-380

GEC0 PULSE TEST

IDENT 530000 CHANNEL 7

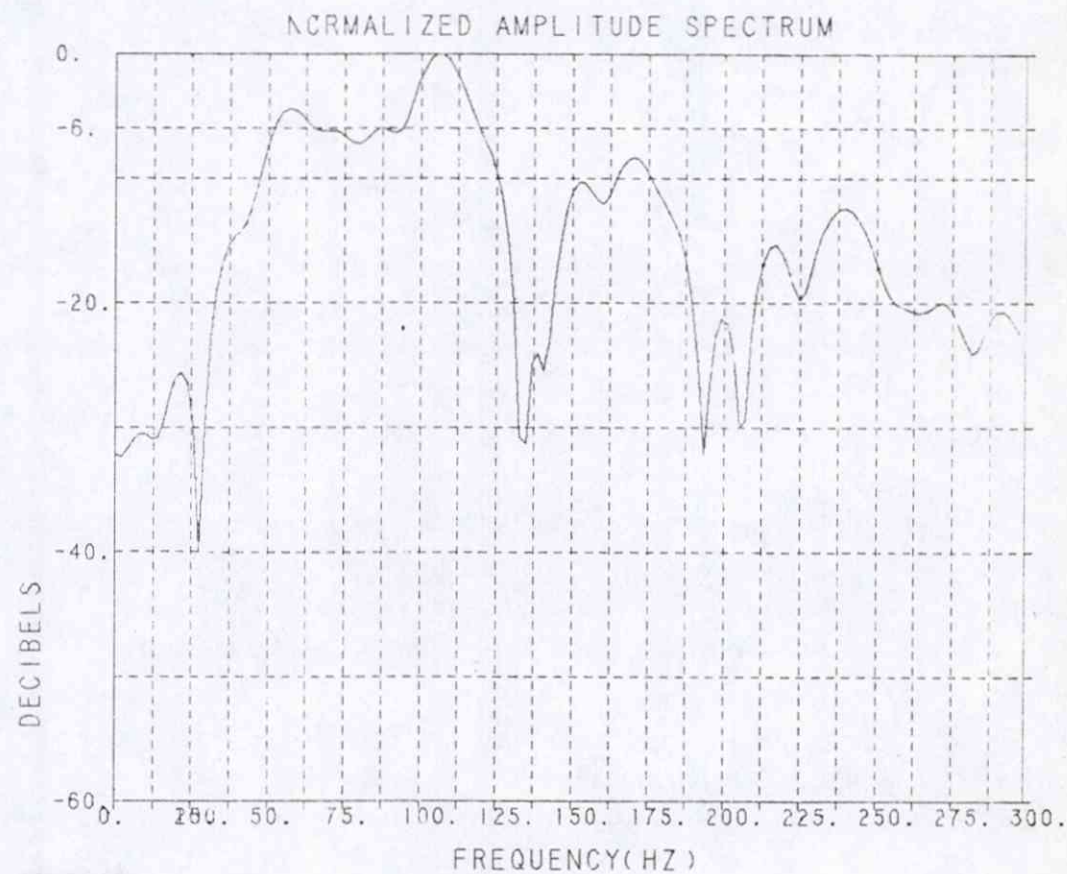
GEOTEAM TEST FILE 53 TRACE 7 WINDOW 20-100 MS.

580.



625E Treplugg

2.7



625E patient

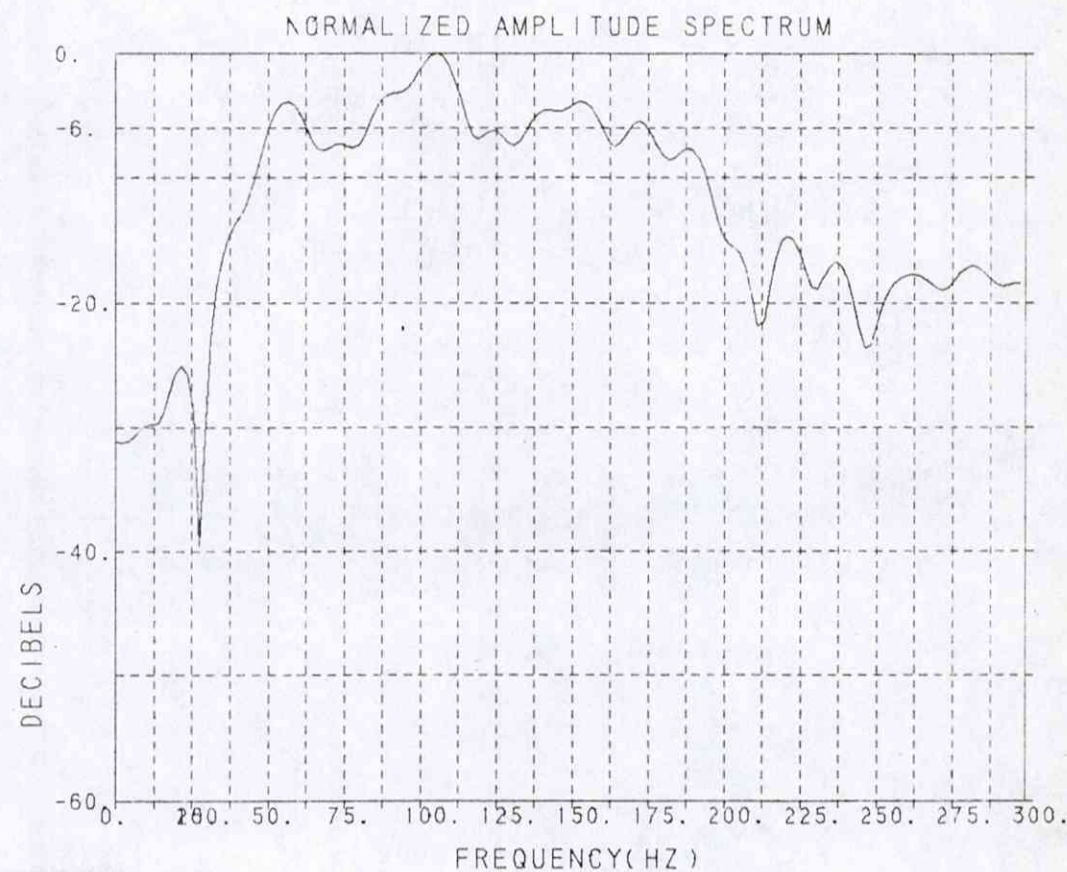
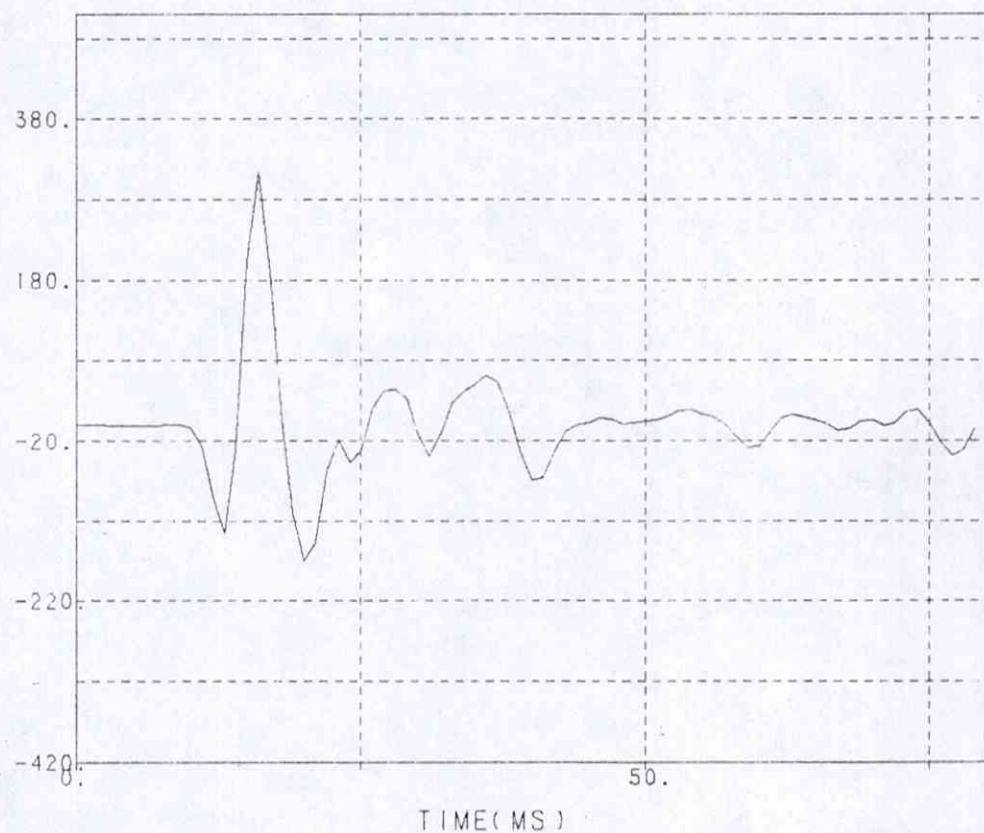
GECØ PULSE TEST

2.8

IDENT 530000 CHANNEL 8

GEOTEAM TEST FILE 53 TRACE 8 WINDOW 20-100 MS.

580.



Stålplugg . 130g D . N-380

GEO PULSE TEST

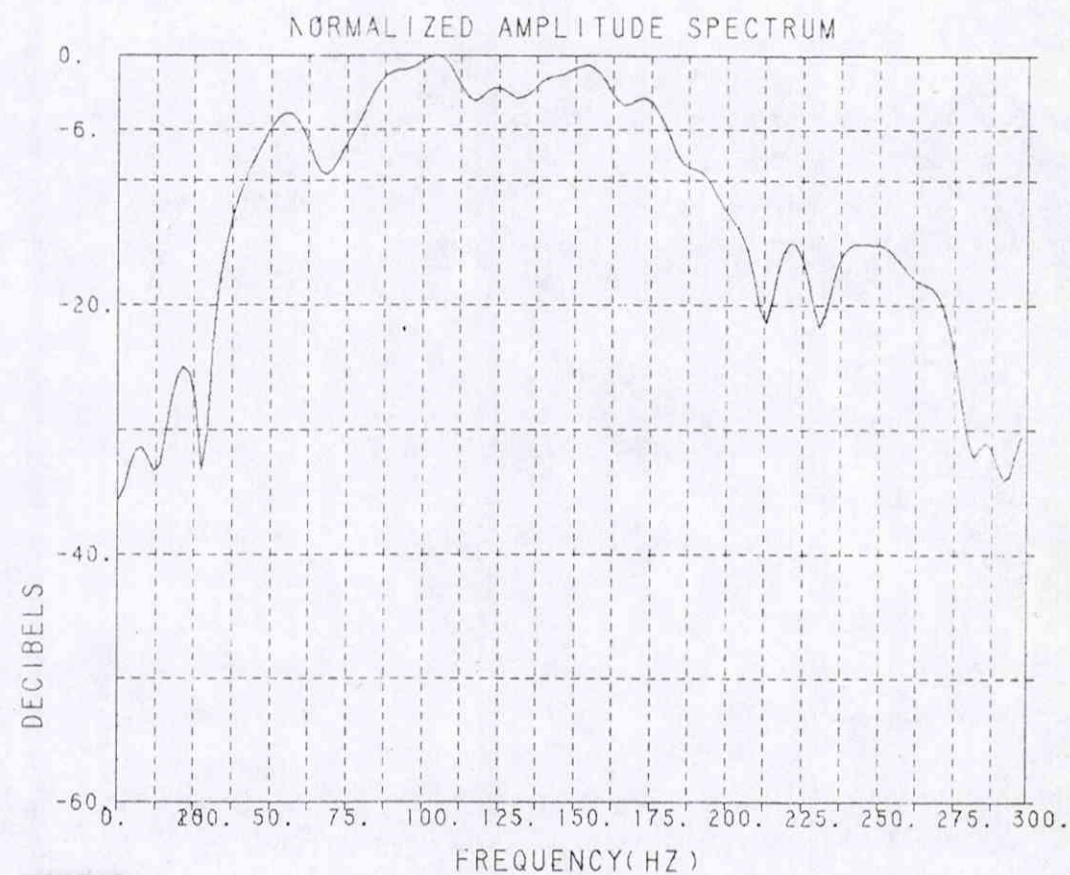
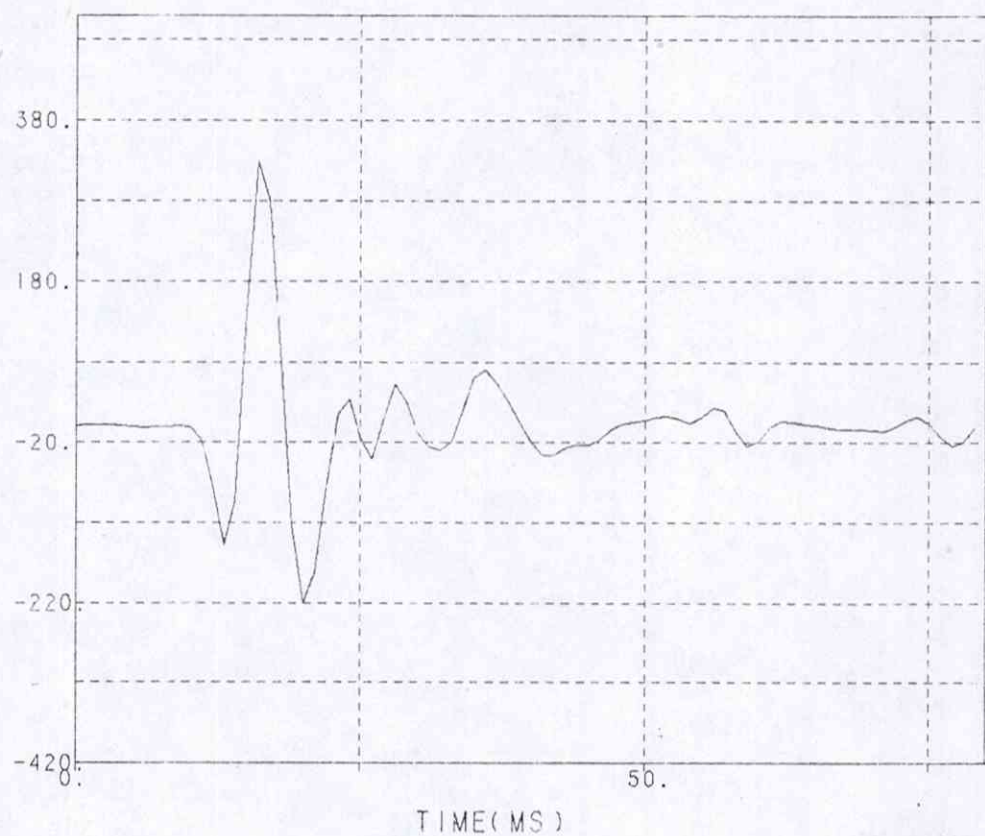
IDENT 530000 CHANNEL 9

GEOTEAM TEST FILE 53 TRACE 9 WINDOW 20-100 MS.

L25 E Tripod

2.9

580.



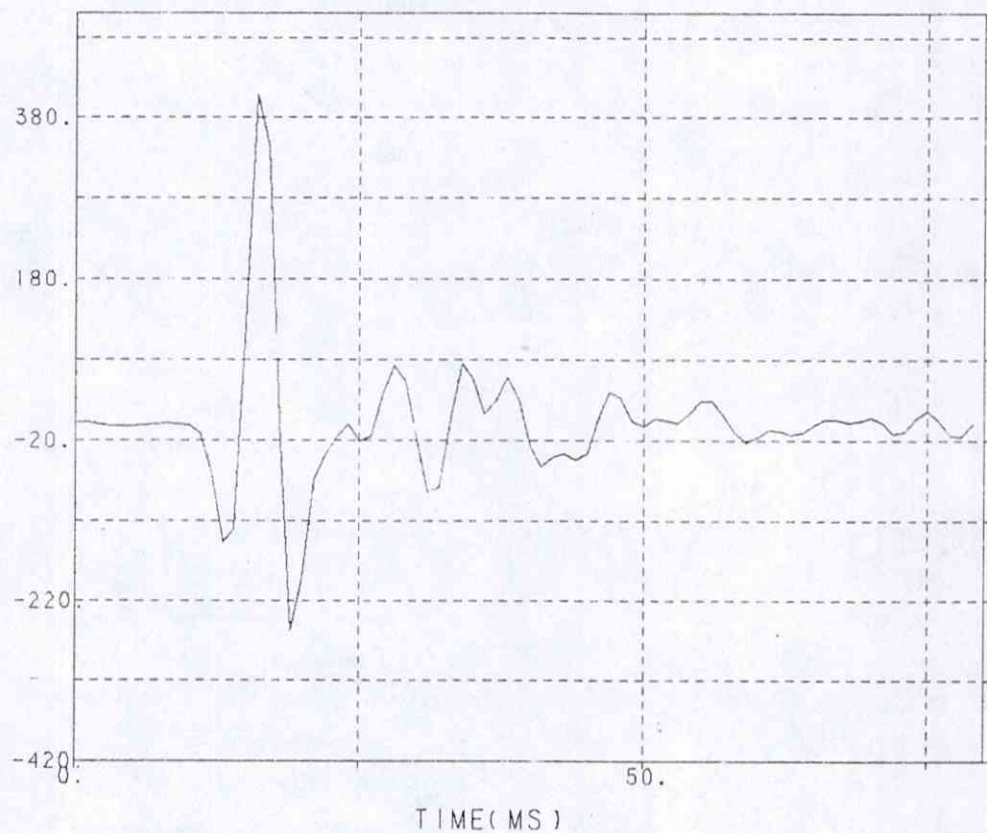
Tripod . 130g D. N-380

GECØ PULSE TEST

IDENT 530000 CHANNEL 11

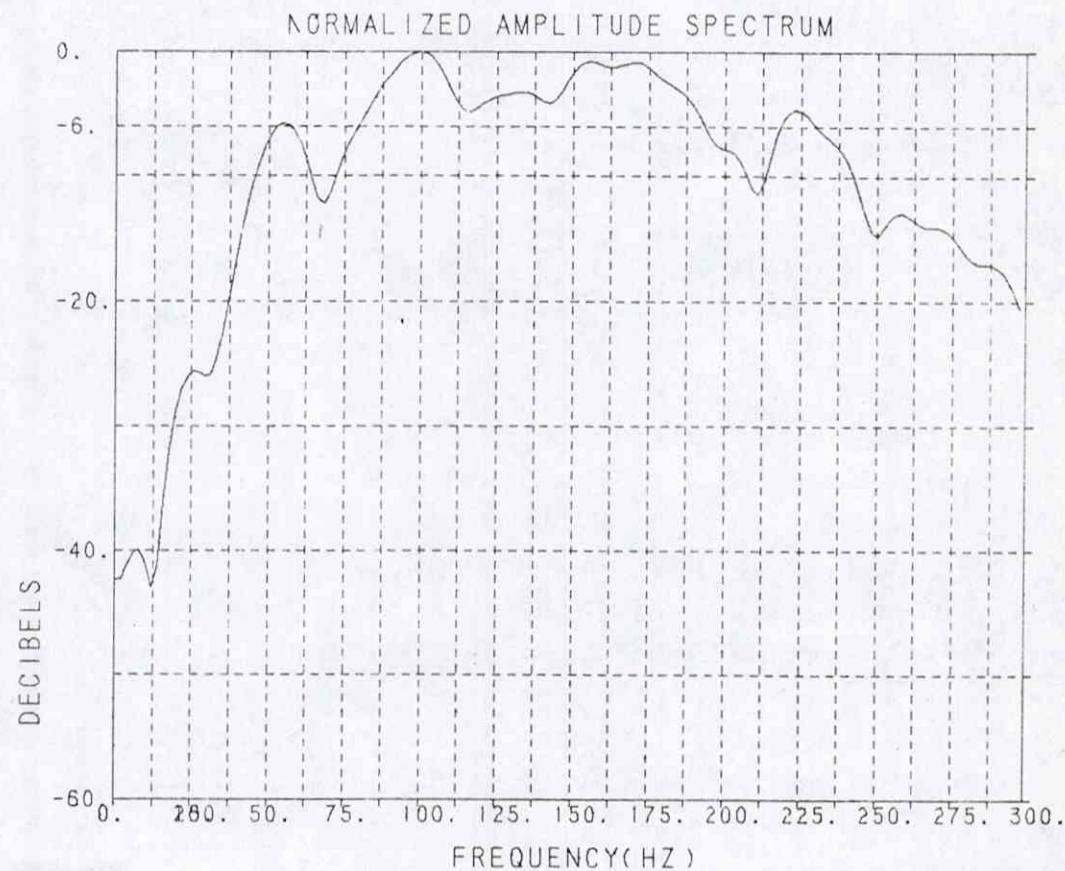
GEOTEAM TEST FILE 53 TRACE 11 WINDOW 20-100 MS.

580.



L25E Tripod

2.10



Tri

L25E Tripod utun sandsekk

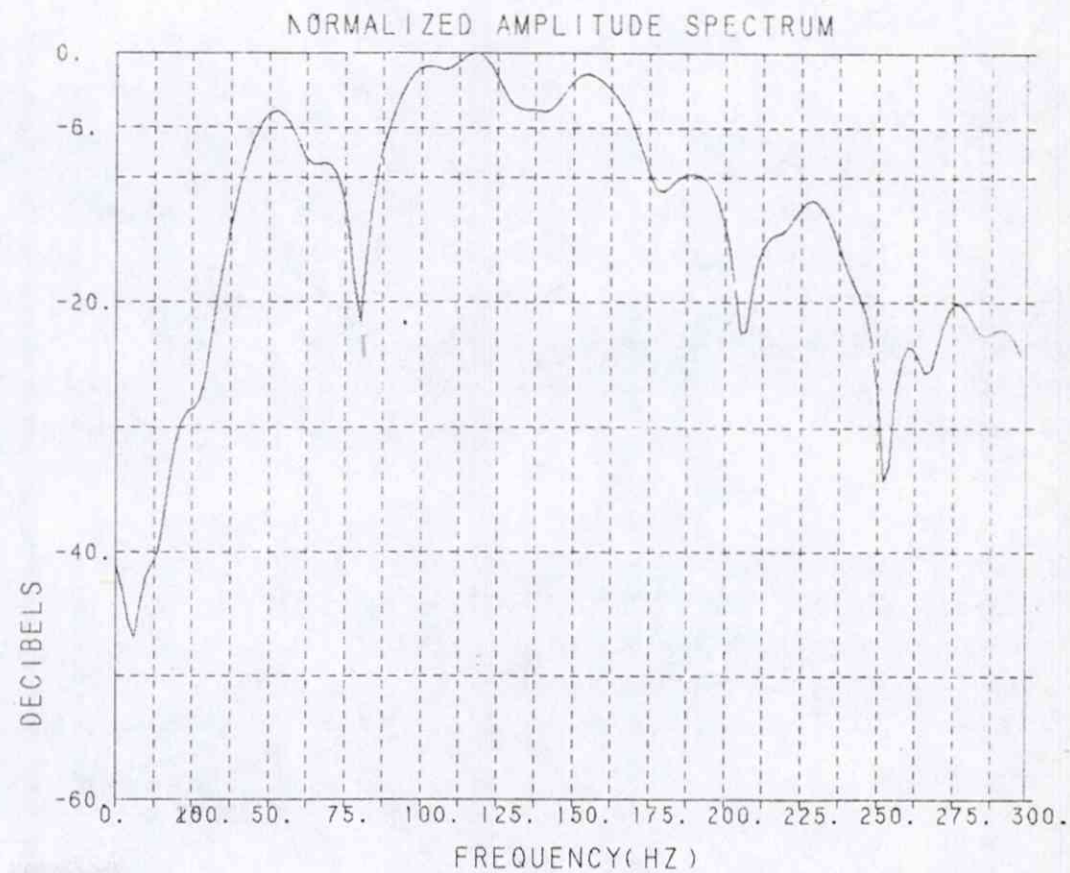
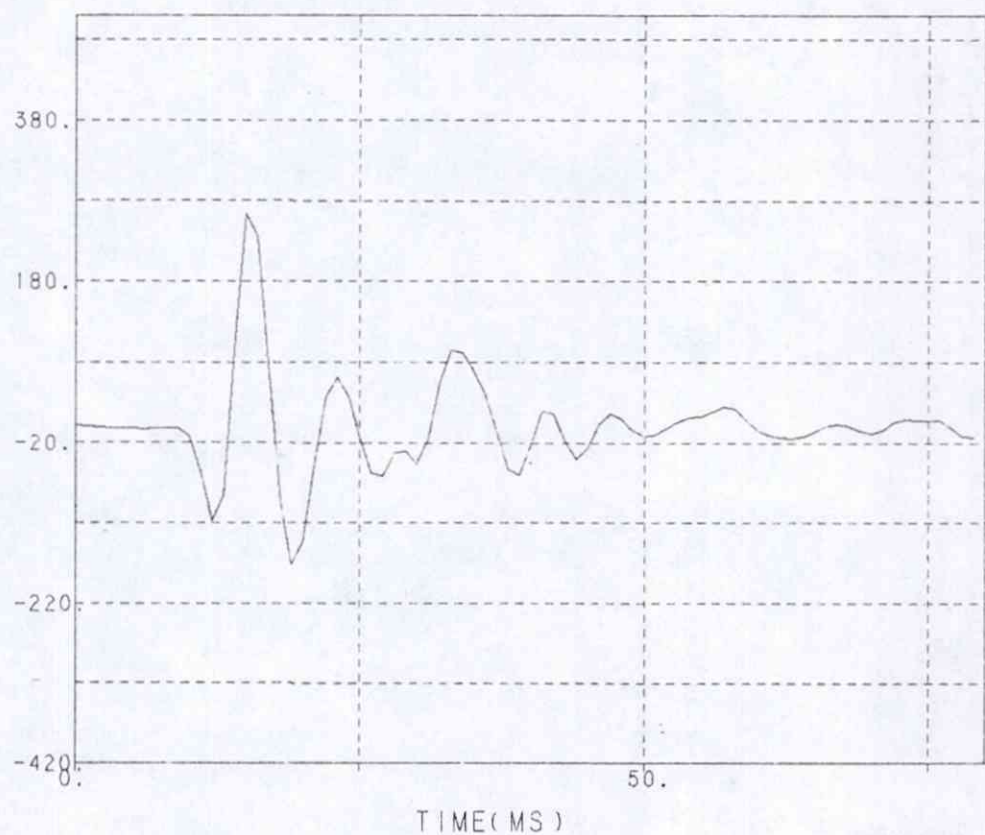
GECO PULSE TEST

IDENT 530000 CHANNEL 12

2.11

GEOTEAM TEST FILE 53 TRACE 12 WINDOW 20-100 MS.

580.

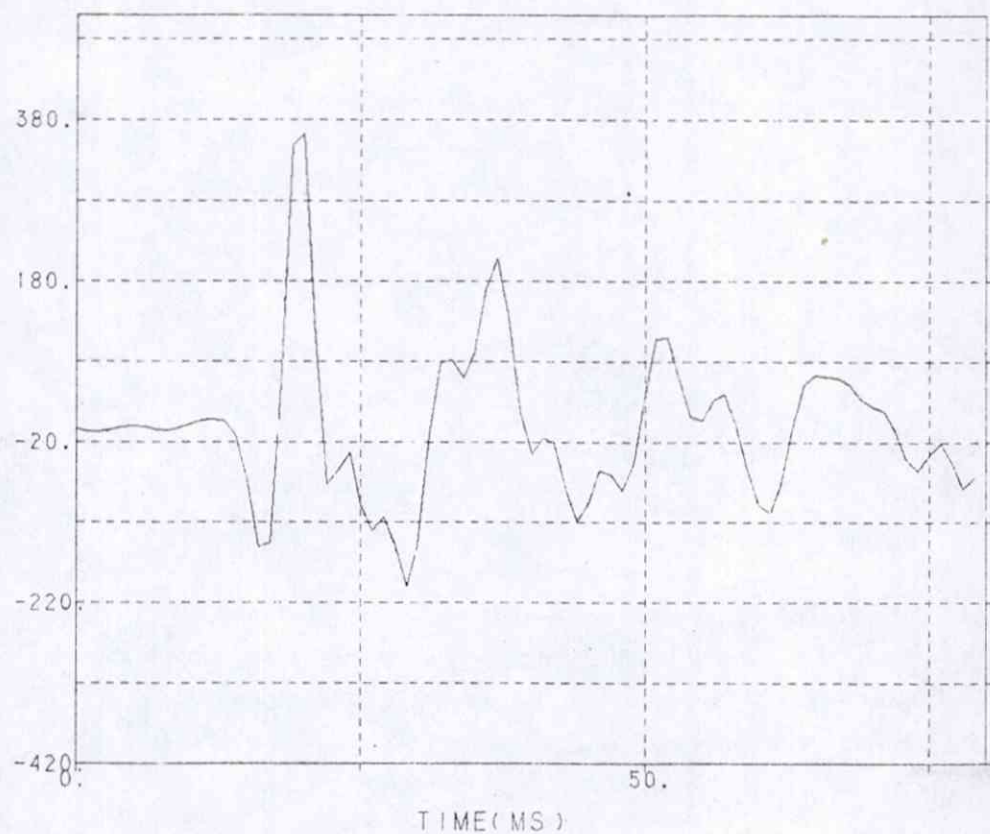


GECO PULSE TEST

IDENT 530000 CHANNEL 18

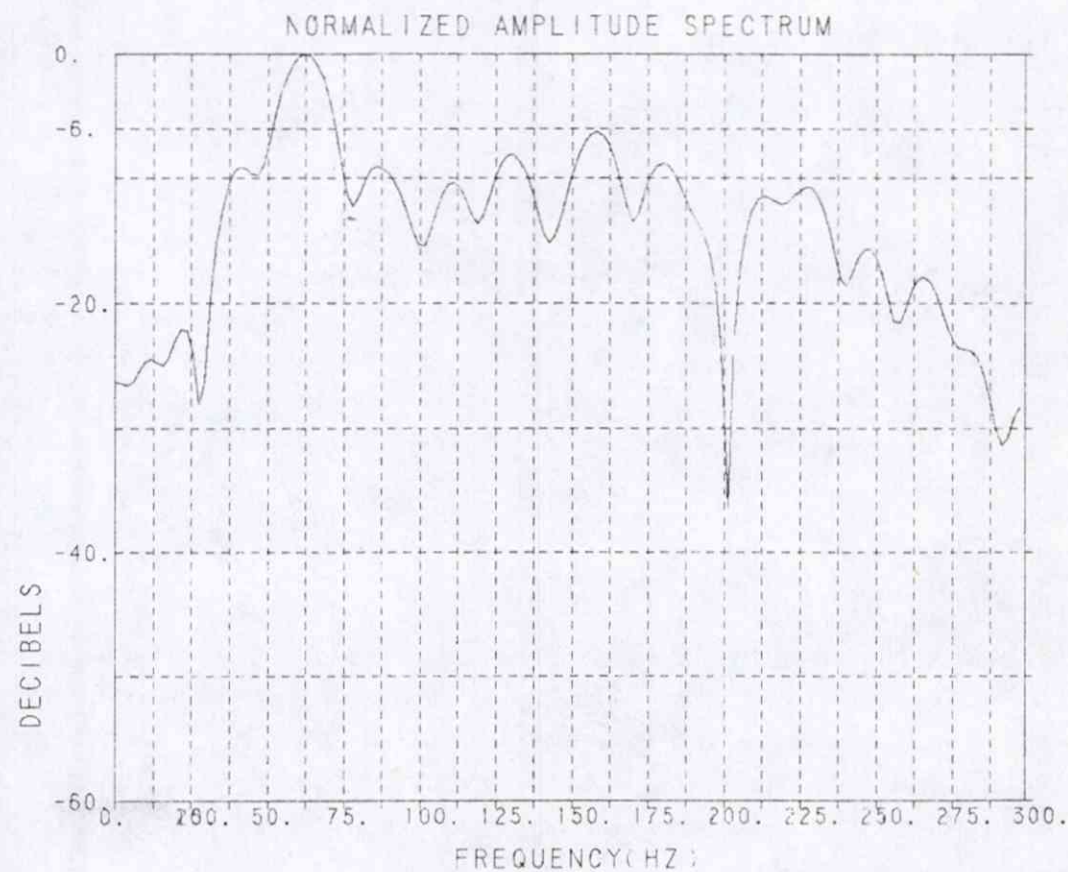
GEOTEAM TEST FILE 53 TRACE 18 WINDOW 20-100 MS.

580.



425E stor plate lösm.

2.12



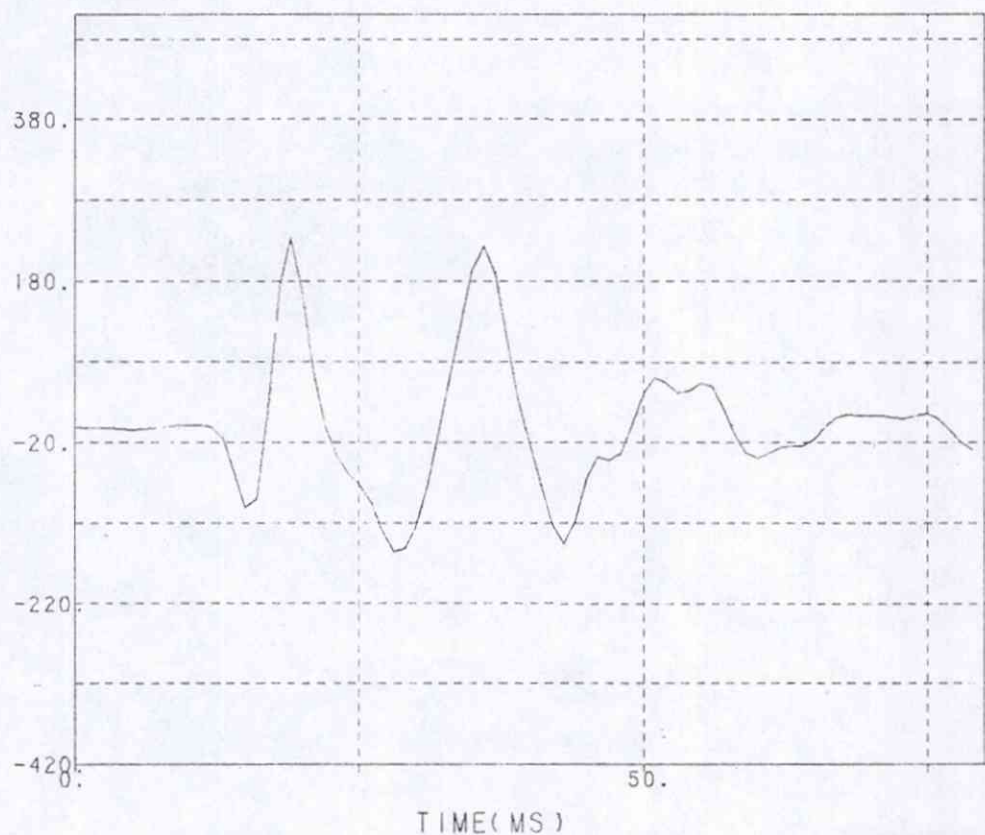
Stor plate i lösmasse, 130g D. N-380

GEC0 PULSE TEST

IDENT 530000 CHANNEL 19

GEOTEAM TEST FILE 53 TRACE 19 WINDOW 20-100 MS.

580.



L25E - Spett

2.13

NORMALIZED AMPLITUDE SPECTRUM

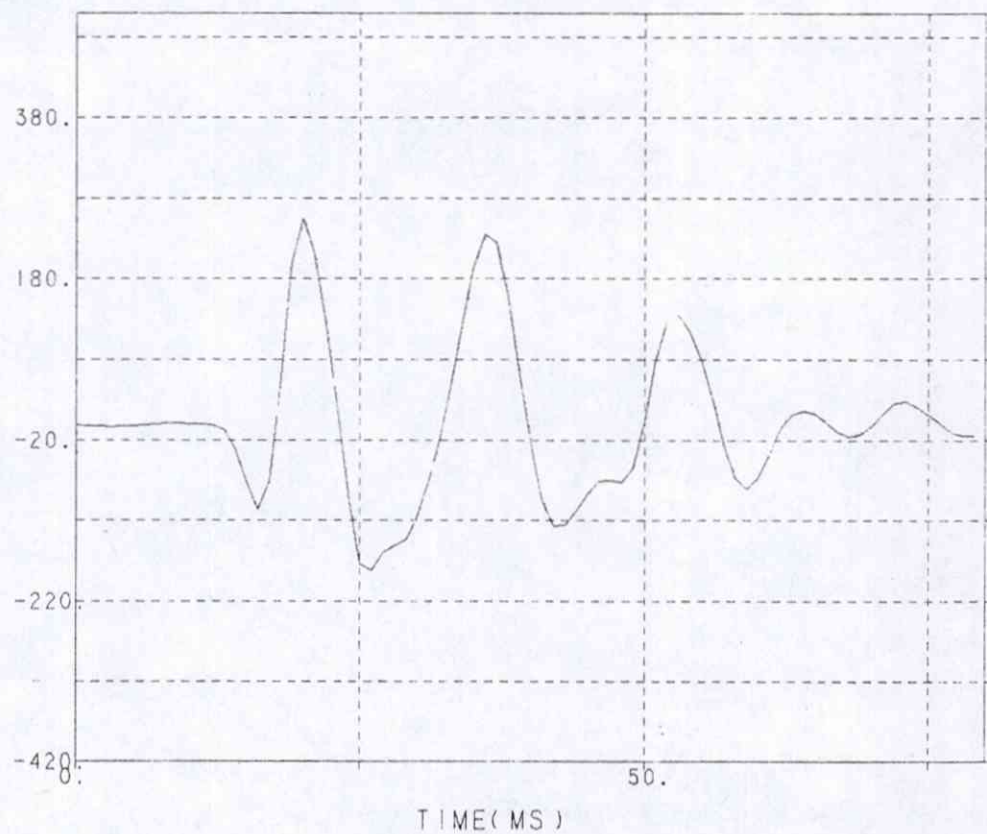


GEC0 PULSE TEST

IDENT 530000 CHANNEL 20

GEOTEAM TEST FILE 53 TRACE 20 WINDOW 20-100 MS.

580.



625E Spect

2.14

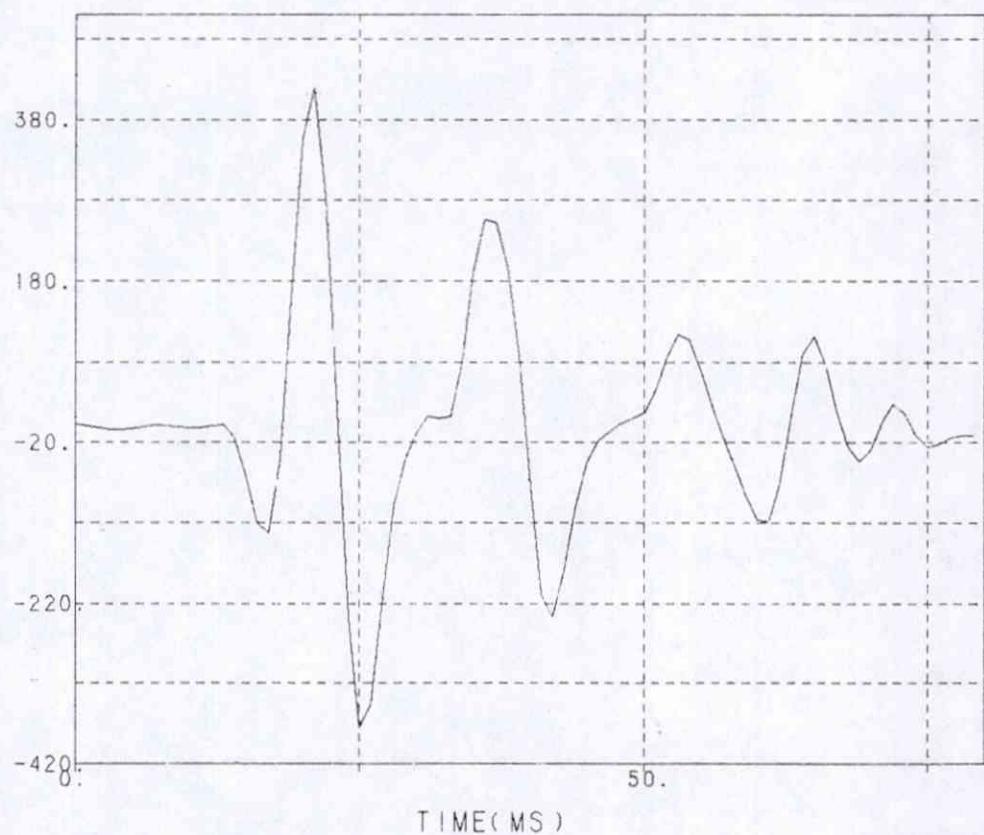


GECO PULSE TEST

IDENT 530000 CHANNEL 21

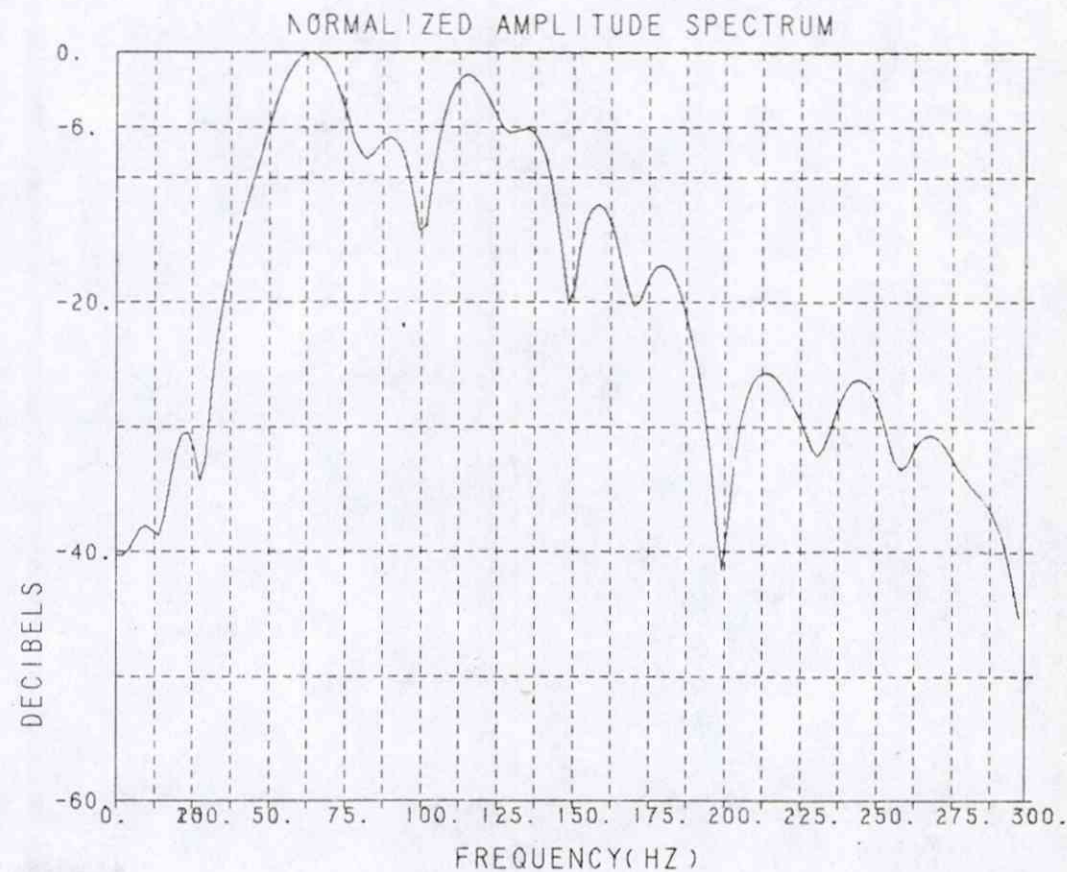
GEOTEAM TEST FILE 53 TRACE 21 WINDOW 20-100 MS.

580.



L25E Spett

2.15



GECØ PULSE TEST

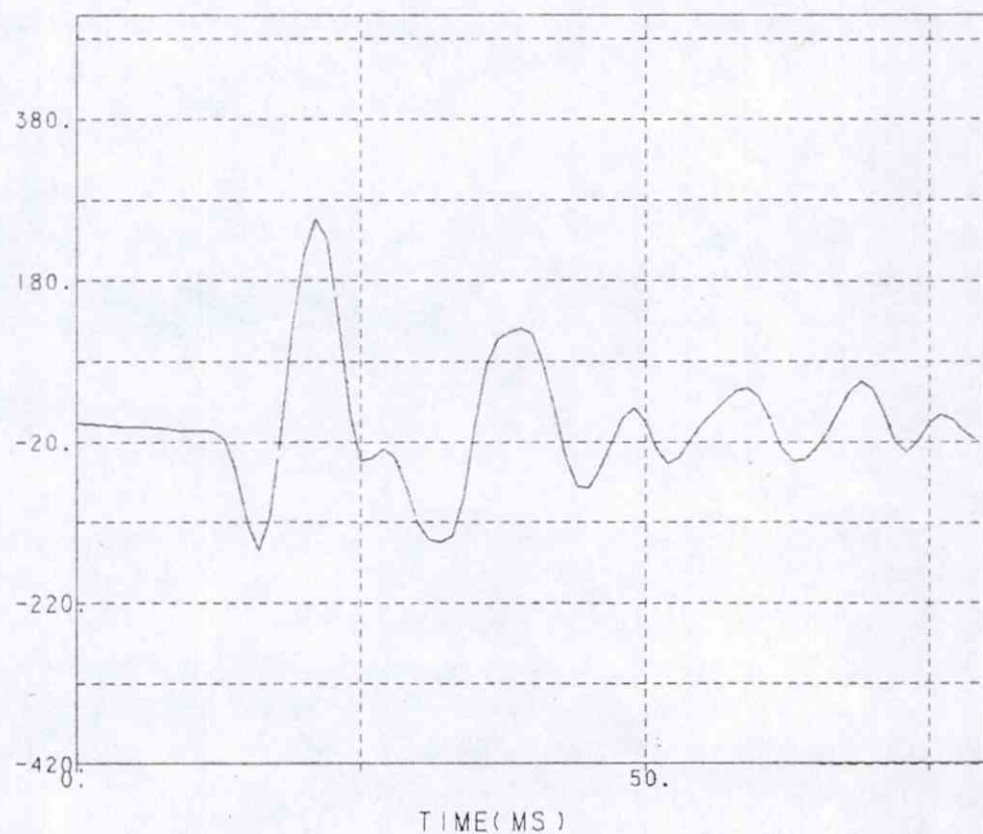
IDENT 530000 CHANNEL 22

GEOTEAM TEST FILE 53 TRACE 22 WINDOW 20-100 MS.

6511D 10 Hz Spitt

2.16

580.



GECØ PULSE TEST

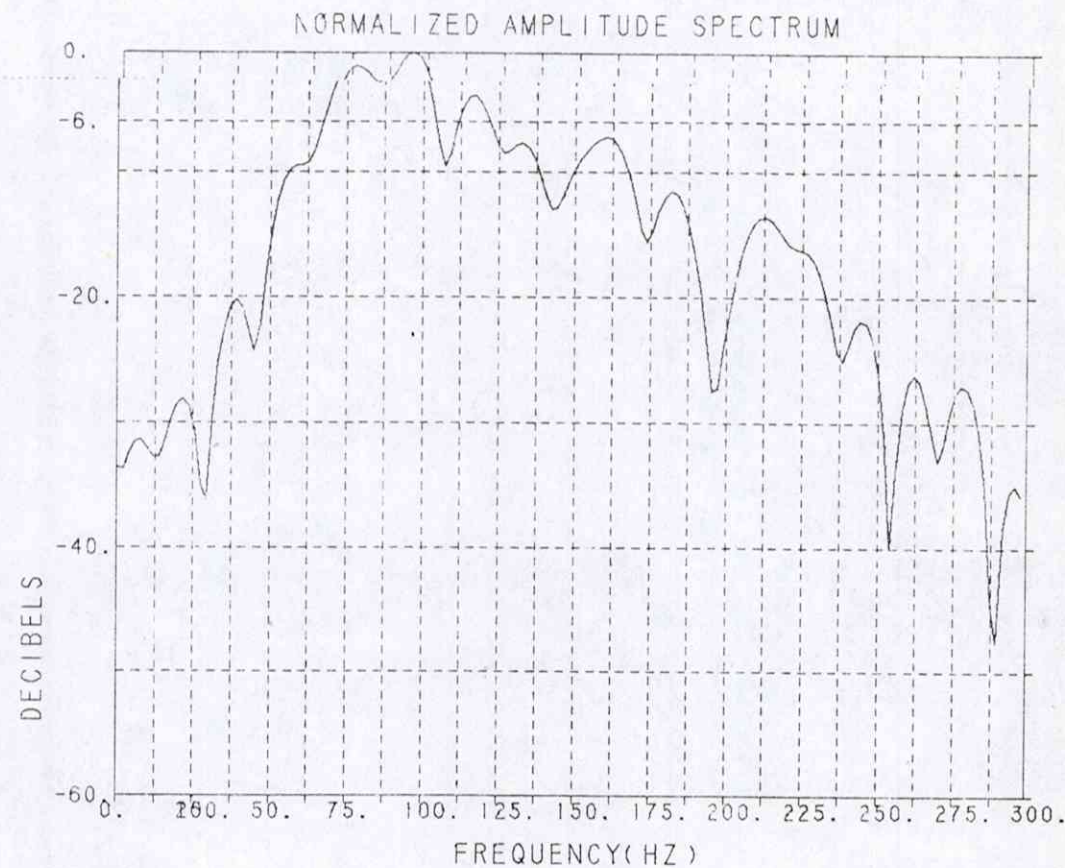
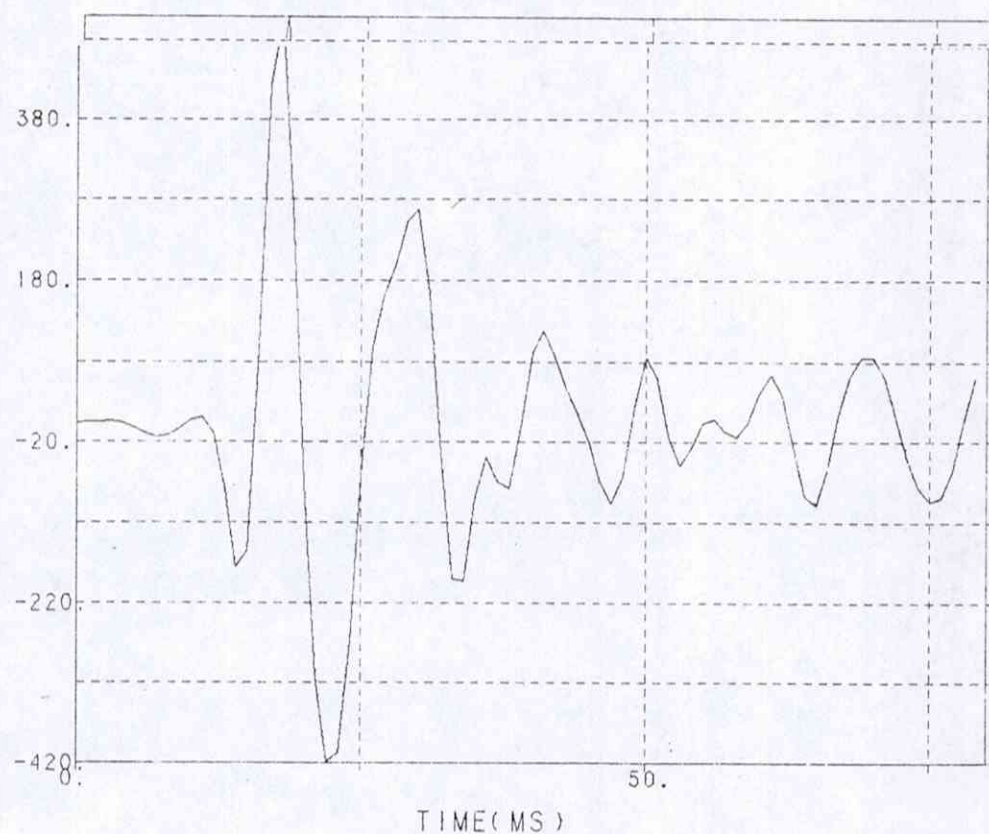
IDENT 530000 CHANNEL 23

GEOTEAM TEST FILE 53 TRACE 23 WINDOW 20-100 MS.

625E Stor pl. losmarre

2.17

580.



stor plate i losmarre. 130gD. N-380.

625E liten plate lösn.

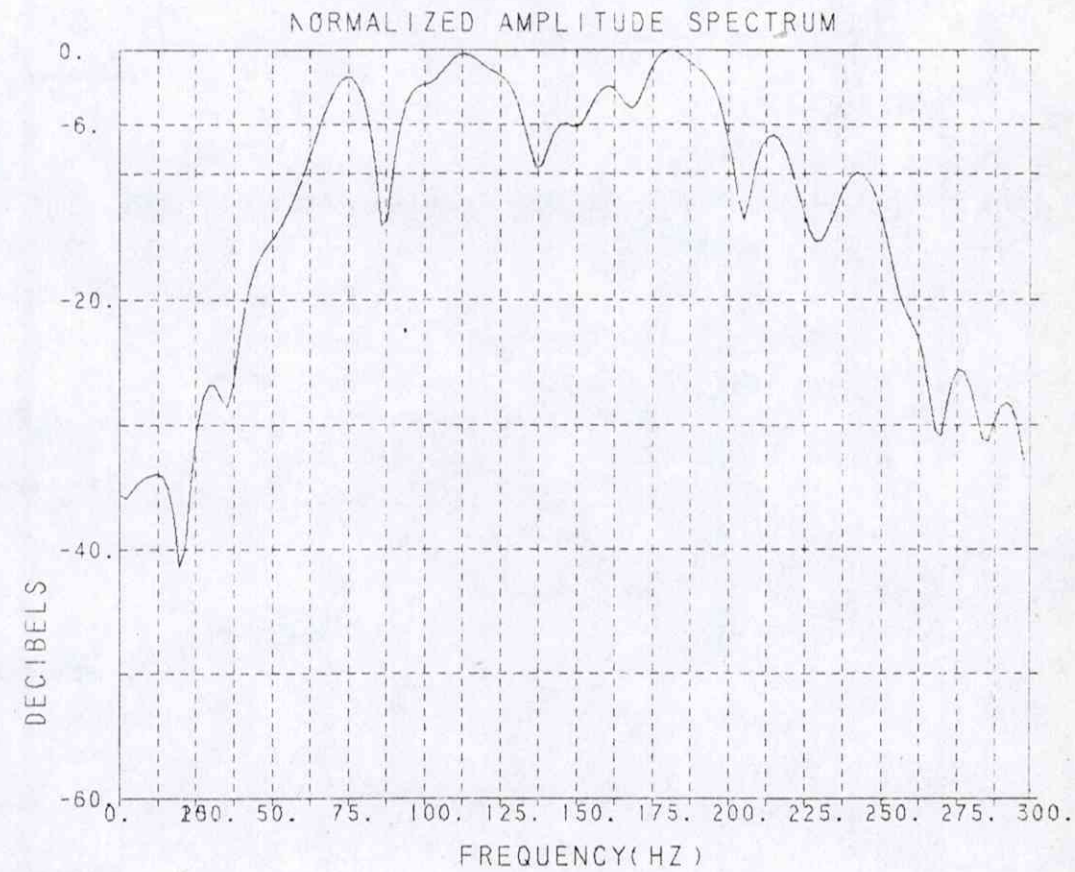
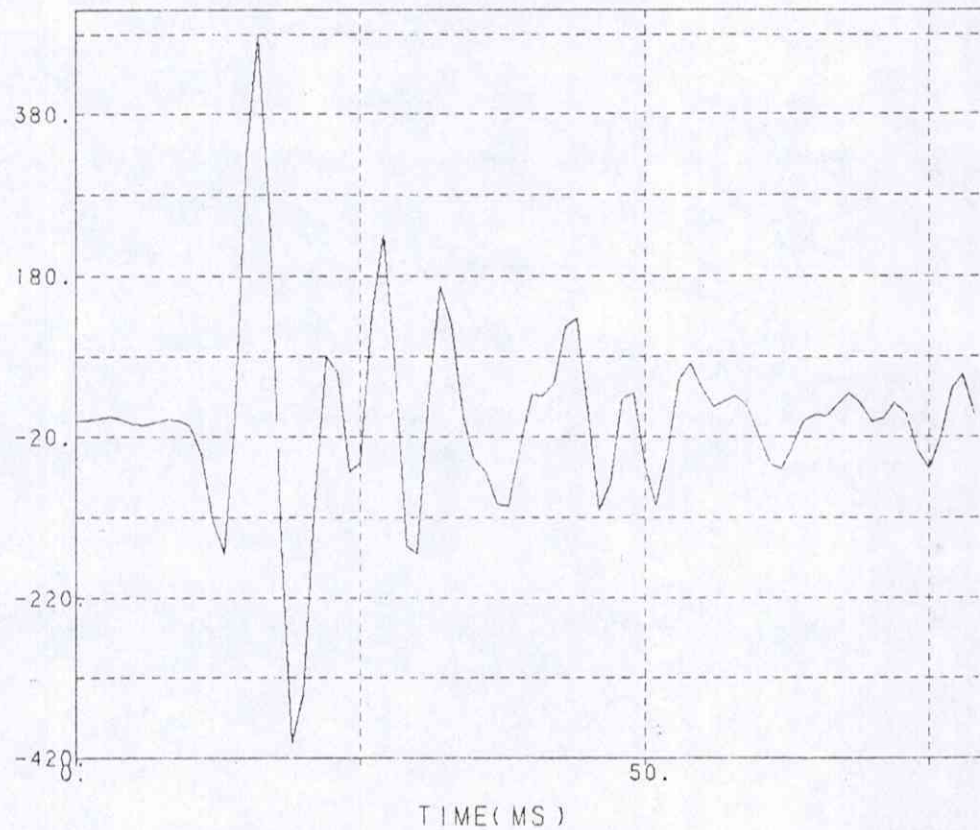
GECO PULSE TEST

IDENT 530000 CHANNEL 24

GEOTEAM TEST FILE 53 TRACE 24 WINDOW 20-100 MS.

2.18

580.



liten plate i lösnare. 130g D. N-380

D 5g 380
GS 100 Hz protant

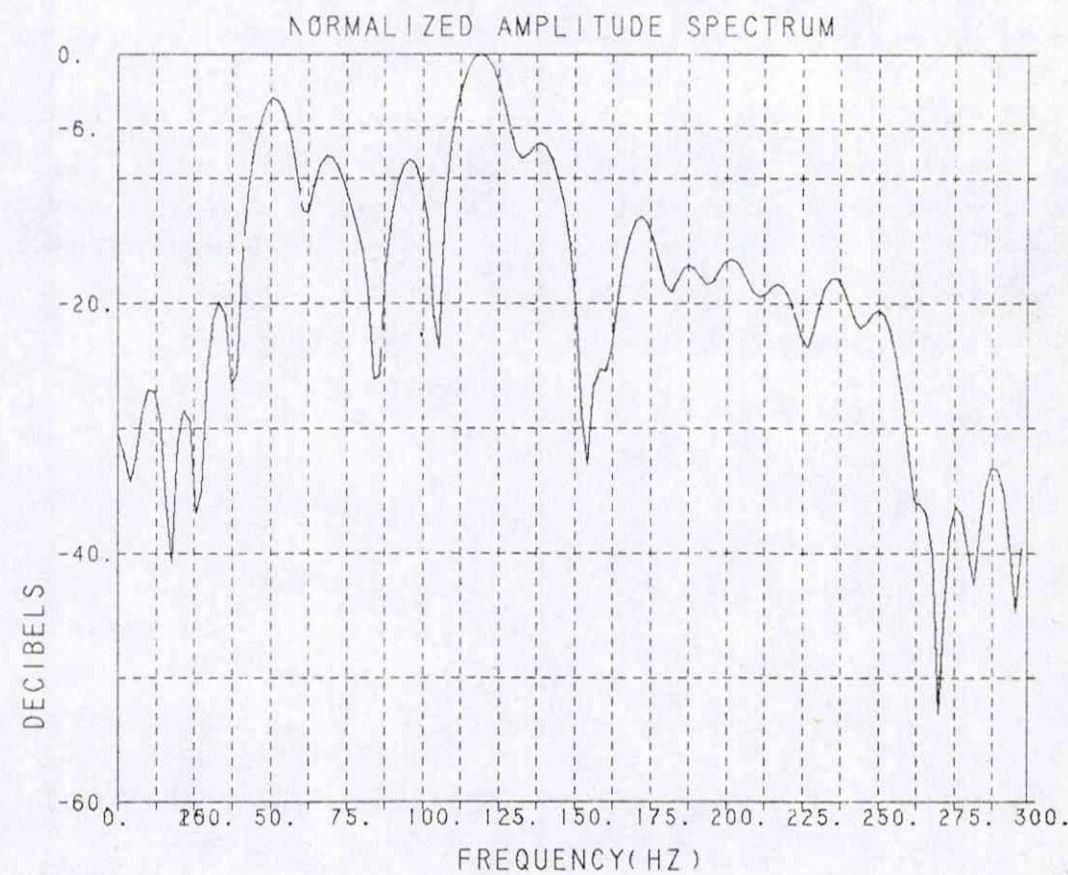
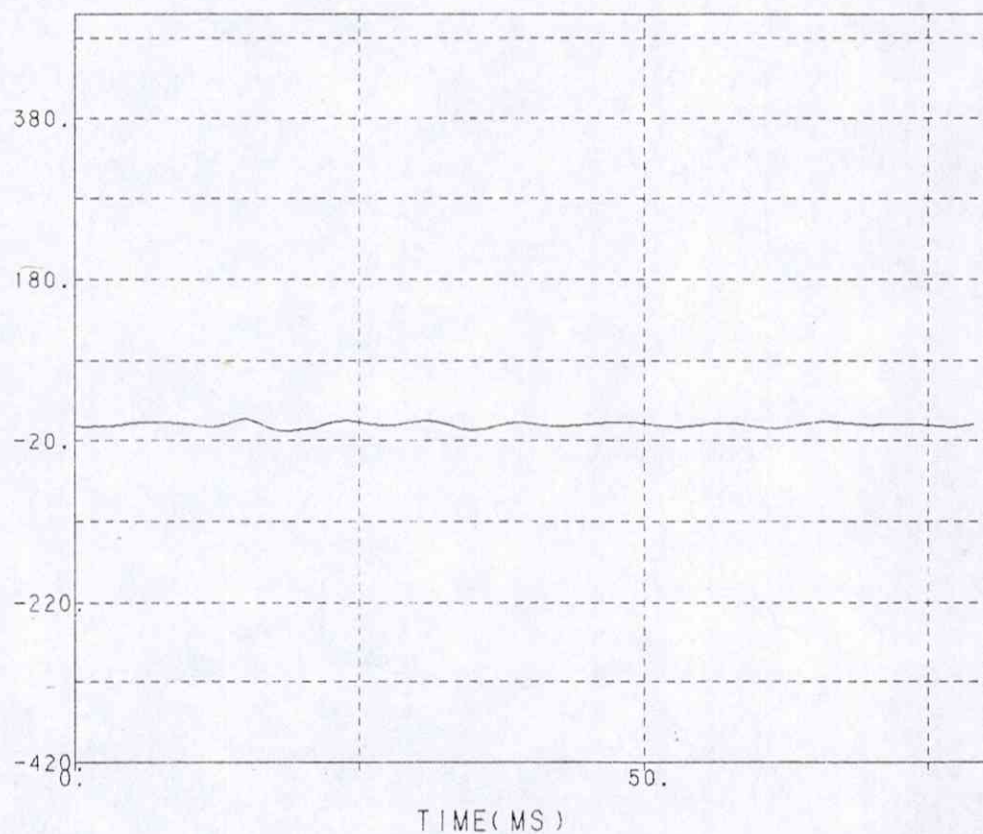
GECO PULSE TEST

IDENT 560000 CHANNEL 1

2.19

GEOTEAM TEST FILE 56 TRACE 1 WINDOW 380-460 MS.

580.



425E patent

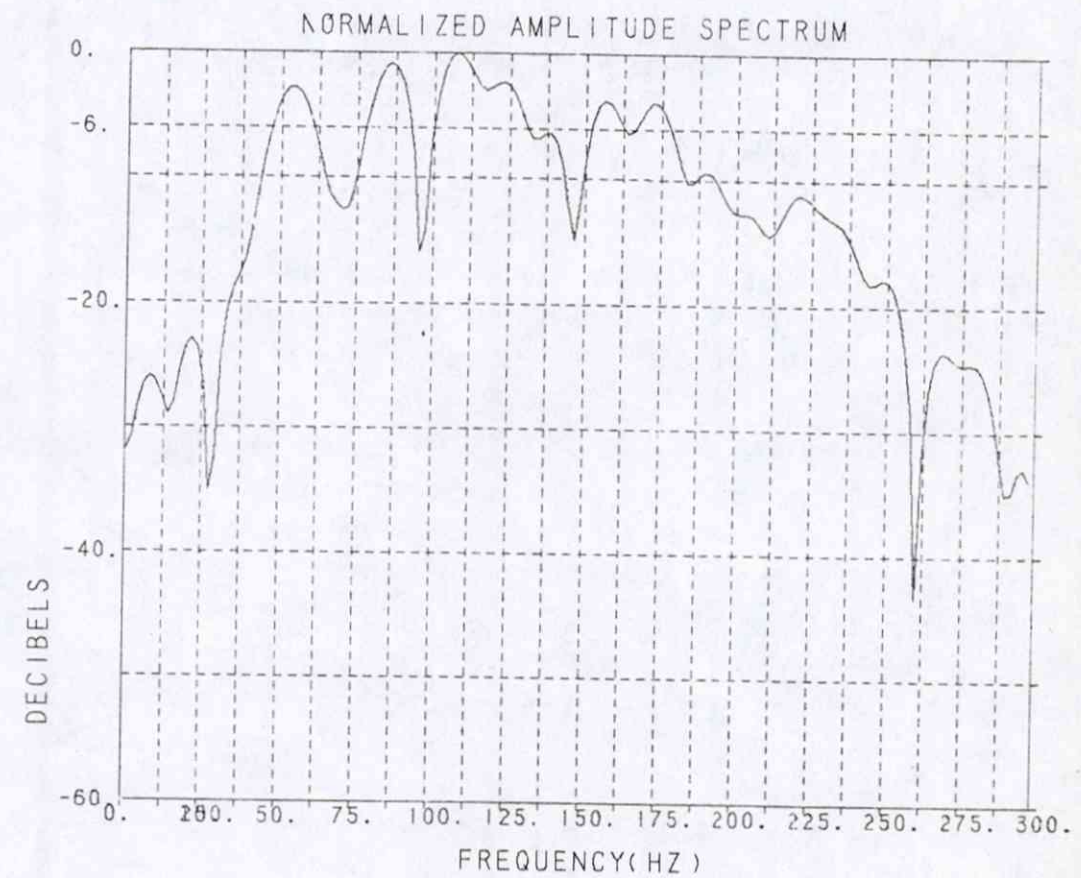
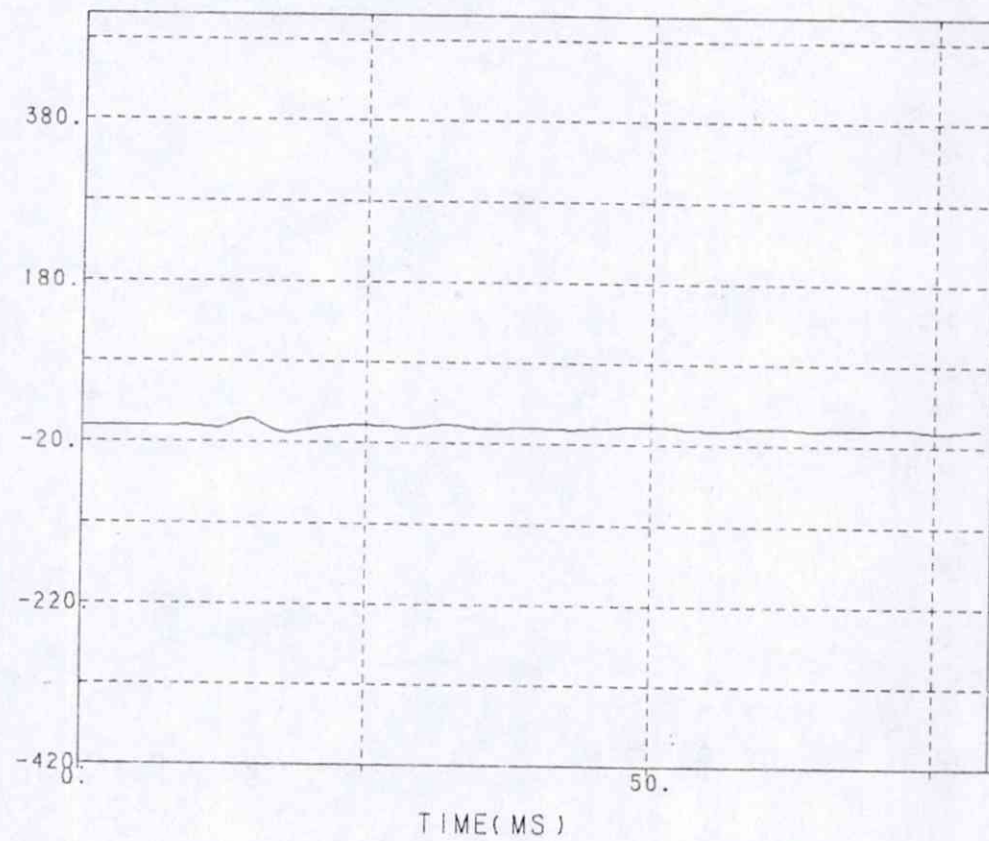
GECØ PULSE TEST

IDENT 560000 CHANNEL 2

2.20

GEOTEAM TEST FILE 56 TRACE 2 WINDOW 380-460 MS.

580.



GEC0 PULSE TEST

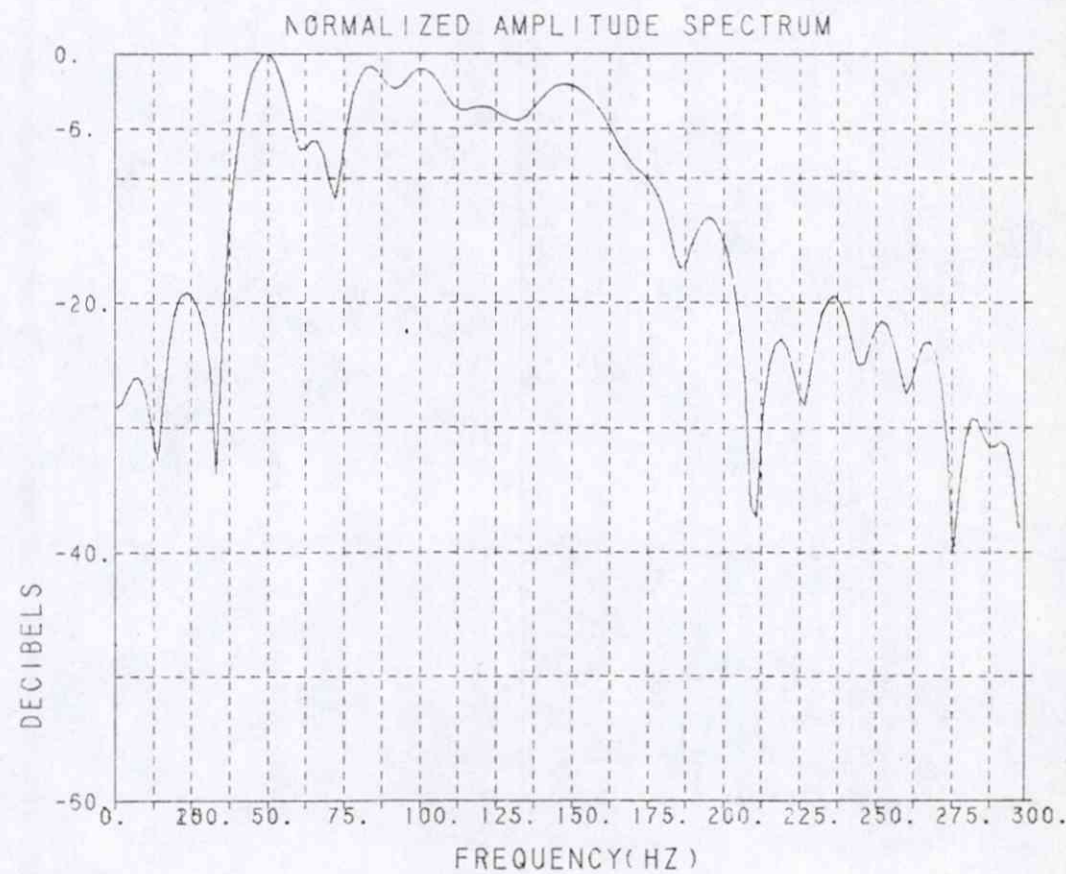
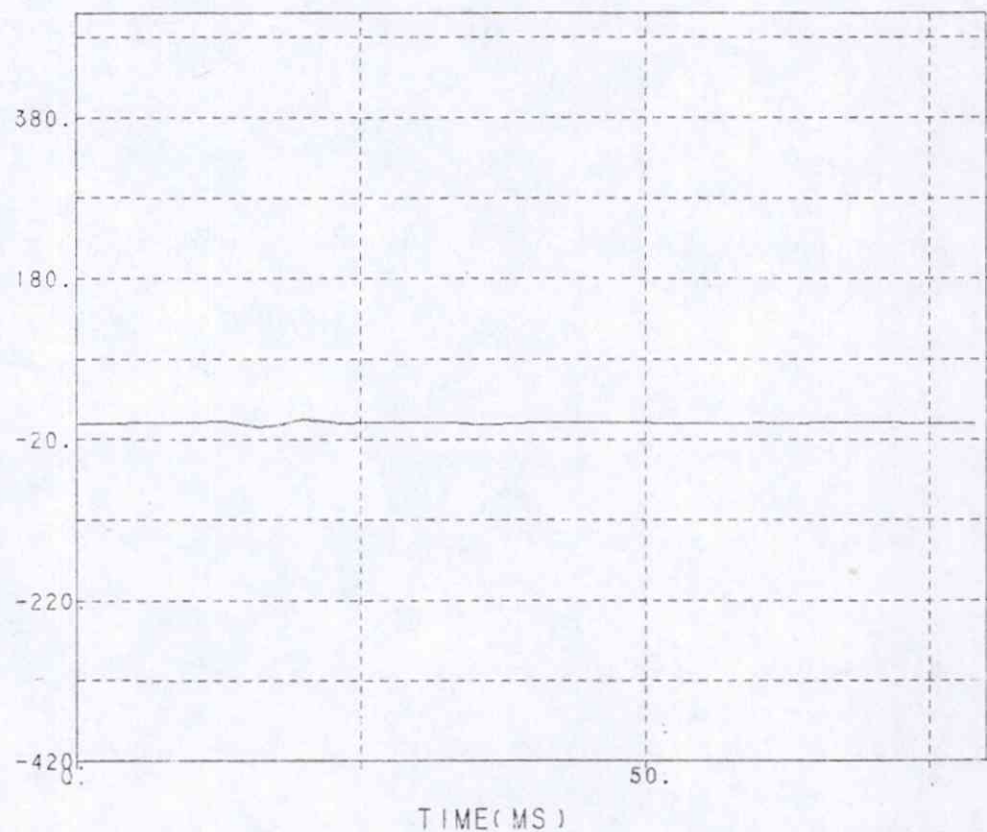
IDENT 560000 CHANNEL 3

GEOTEAM TEST FILE 56 TRACE 3 WINDOW 380-460 MS.

Source 30 Hz packet

2.21

580.



GECO PULSE TEST

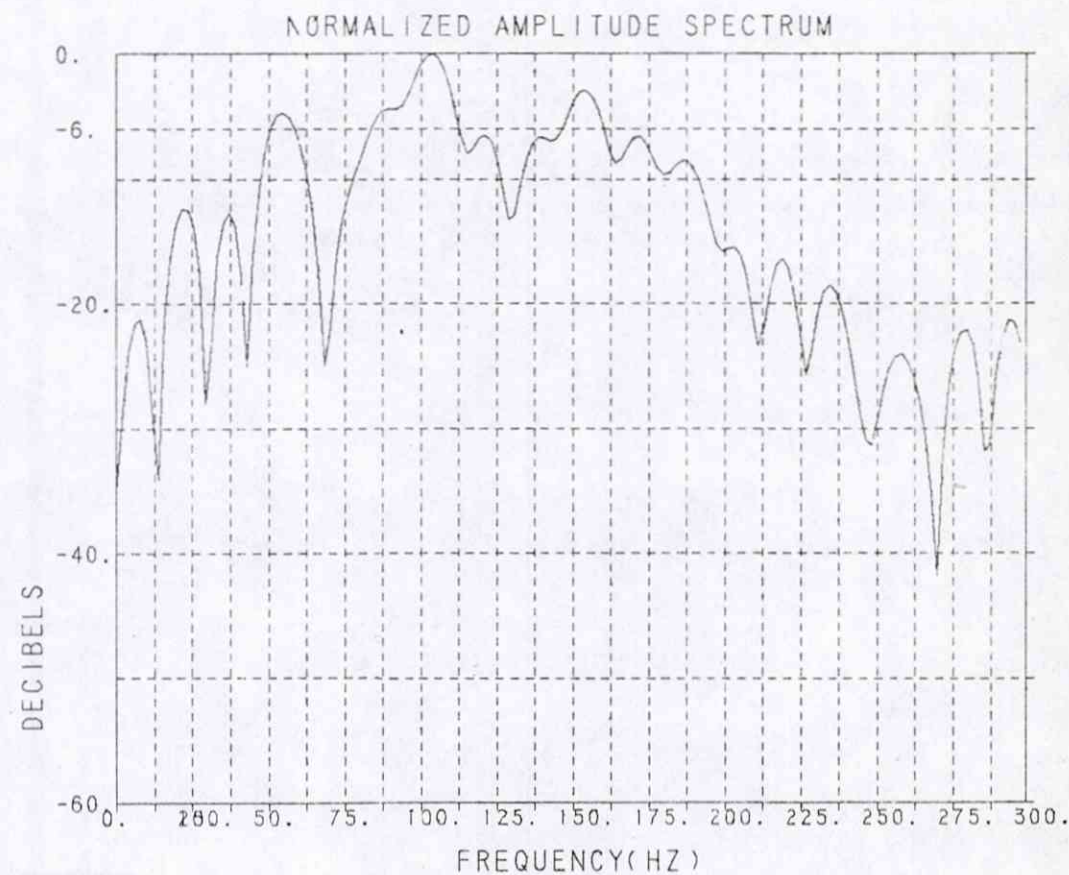
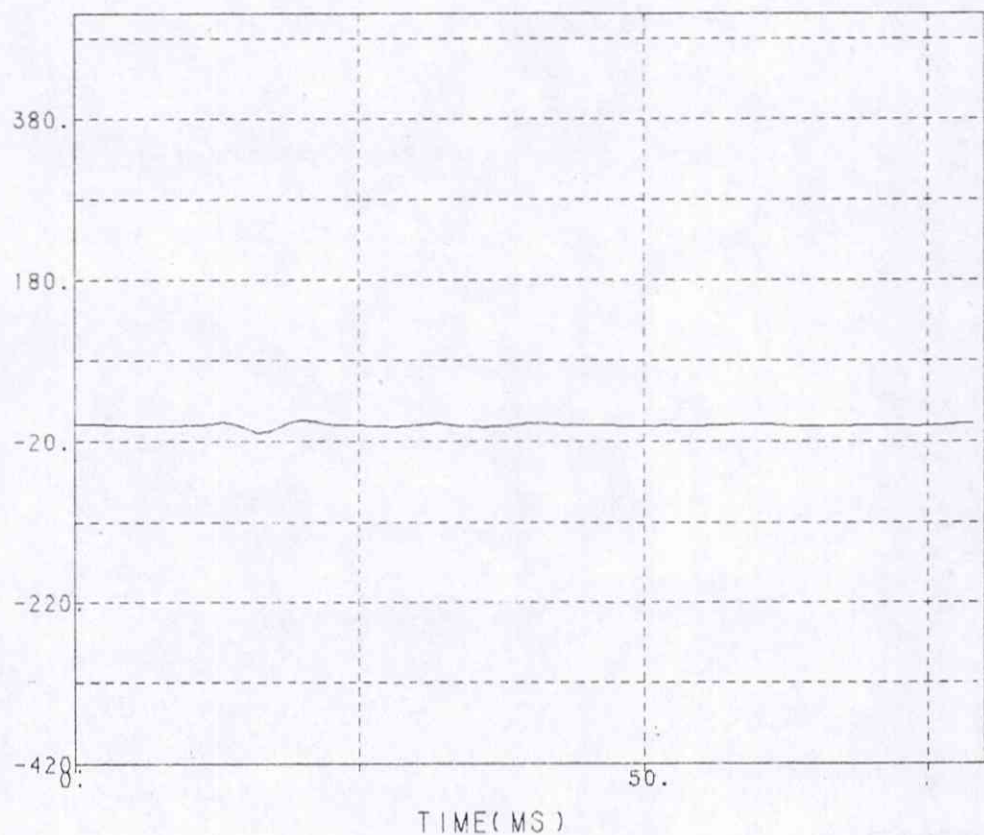
IDENT 560000 CHANNEL 5

GEOTEAM TEST FILE 56 TRACE 5 WINDOW 380-460 MS.

GS 10 Hz patient

2.22

580.



D 50 720 mv.

GS 100 Hz patent

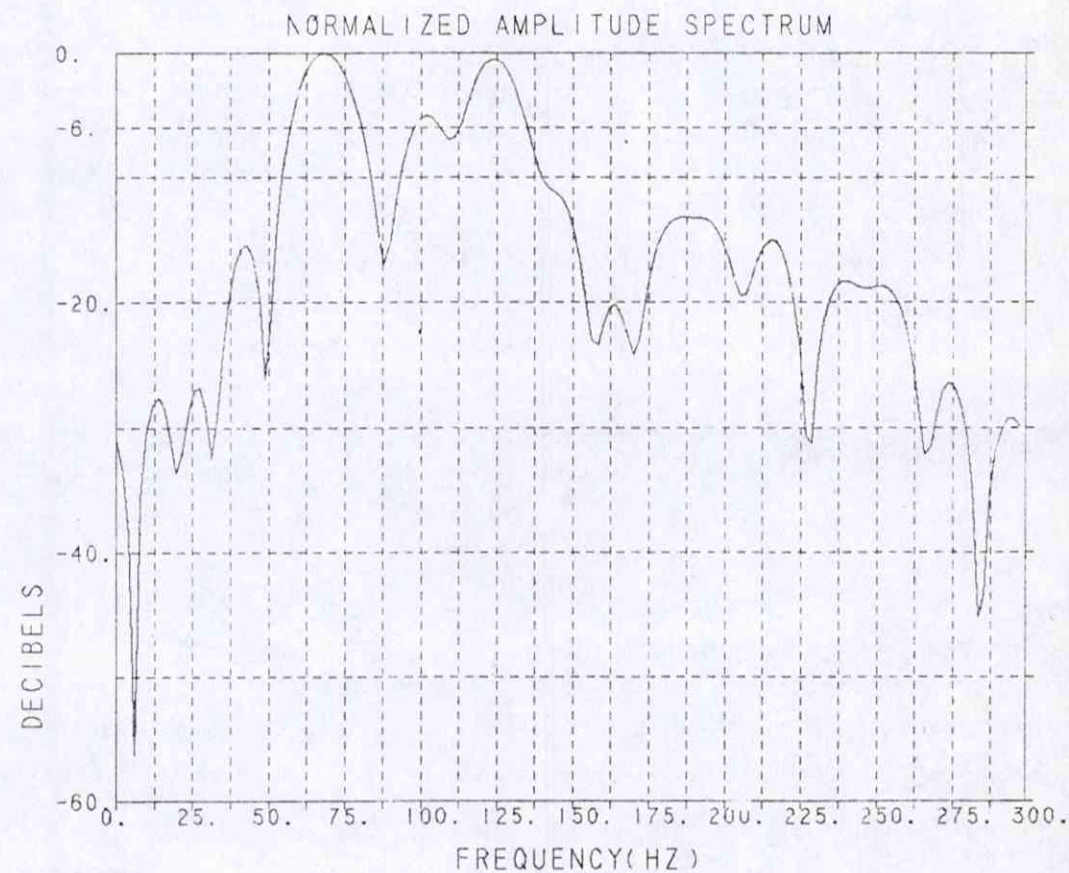
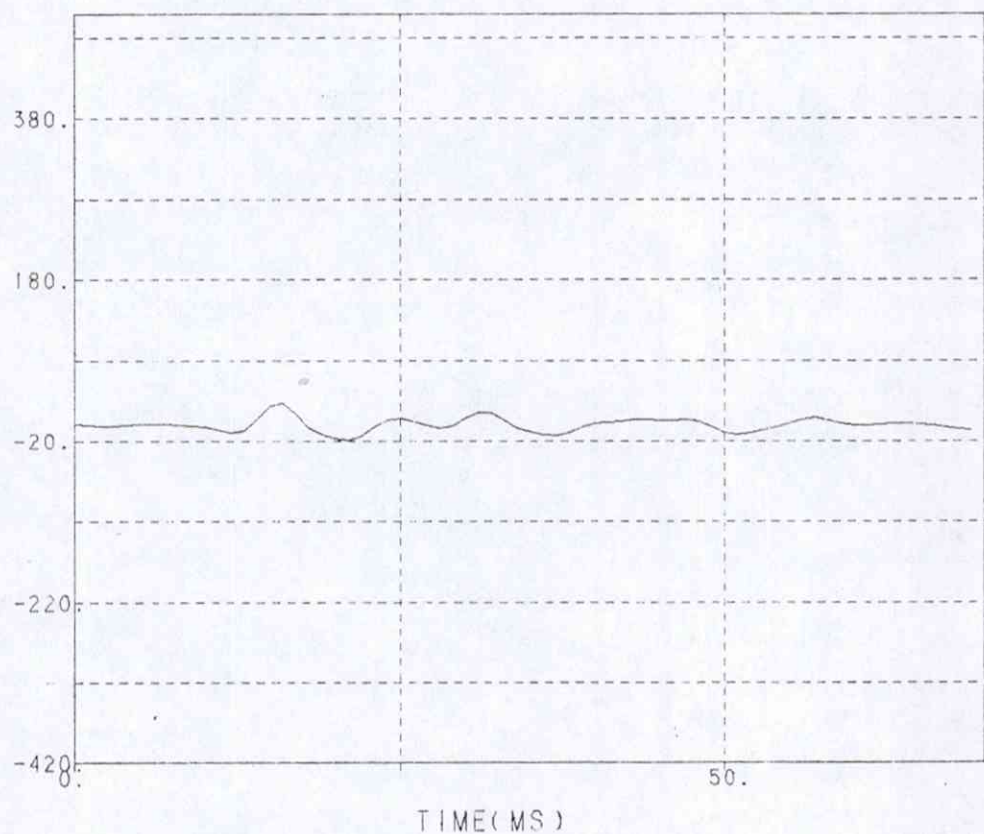
GECO PULSE TEST

IDENT 590000 CHANNEL 1

2.23

GEOTEAM TEST FILE 59 TRACE 1 WINDOW 390-460 MS.

580.

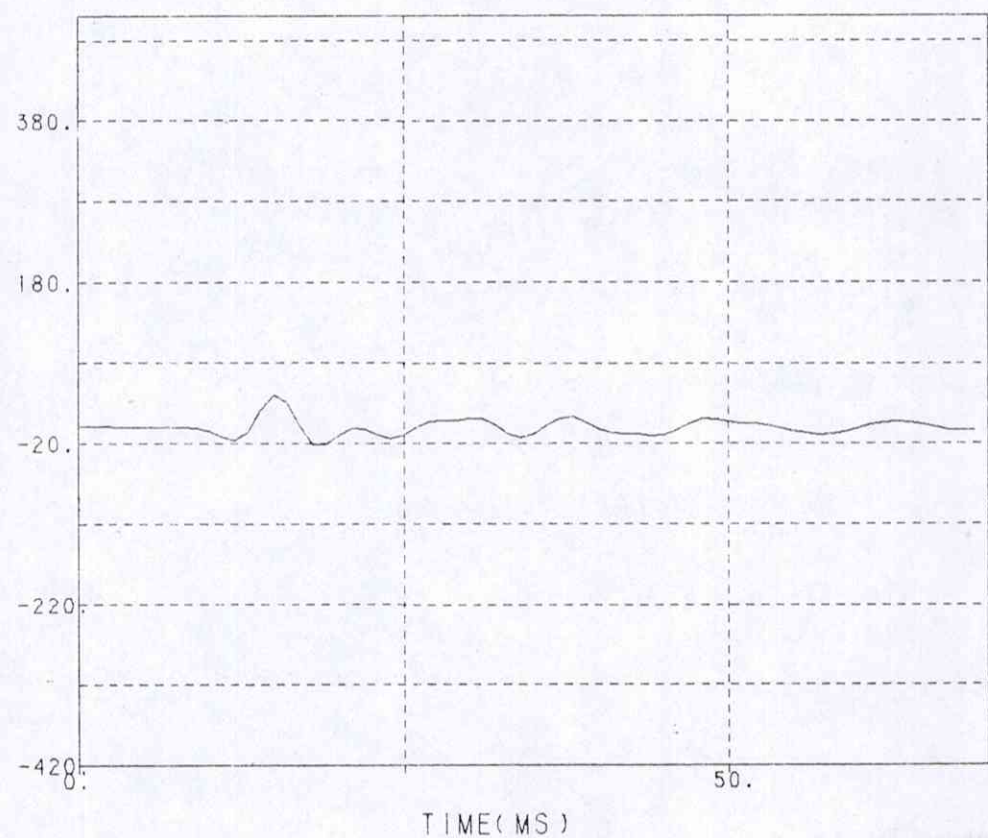


GECO PULSE TEST

IDENT 590000 CHANNEL 2

GEOTEAM TEST FILE 59 TRACE 2 WINDOW 390-460 MS.

580.



L 25E patient

2.24

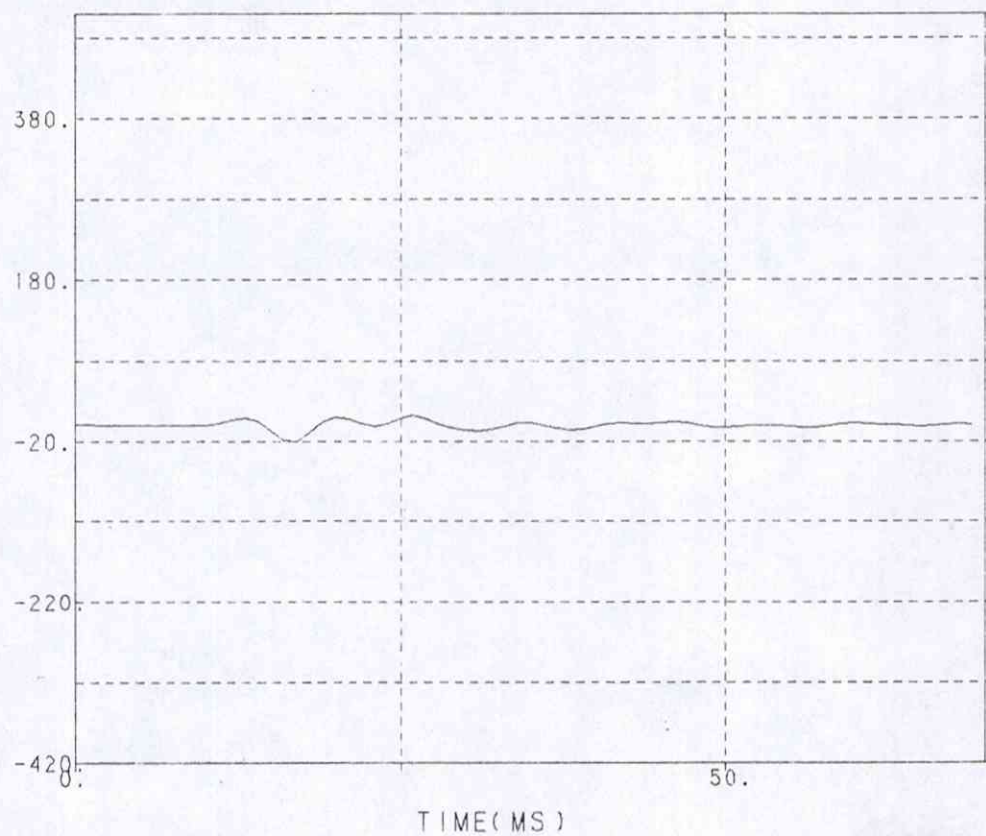


GEC0 PULSE TEST

IDENT 590000 CHANNEL 3

GEOTEAM TEST FILE 59 TRACE 3 WINDOW 390-460 MS.

580.



Source 30 Hz packet

2.25



GEC0 PULSE TEST

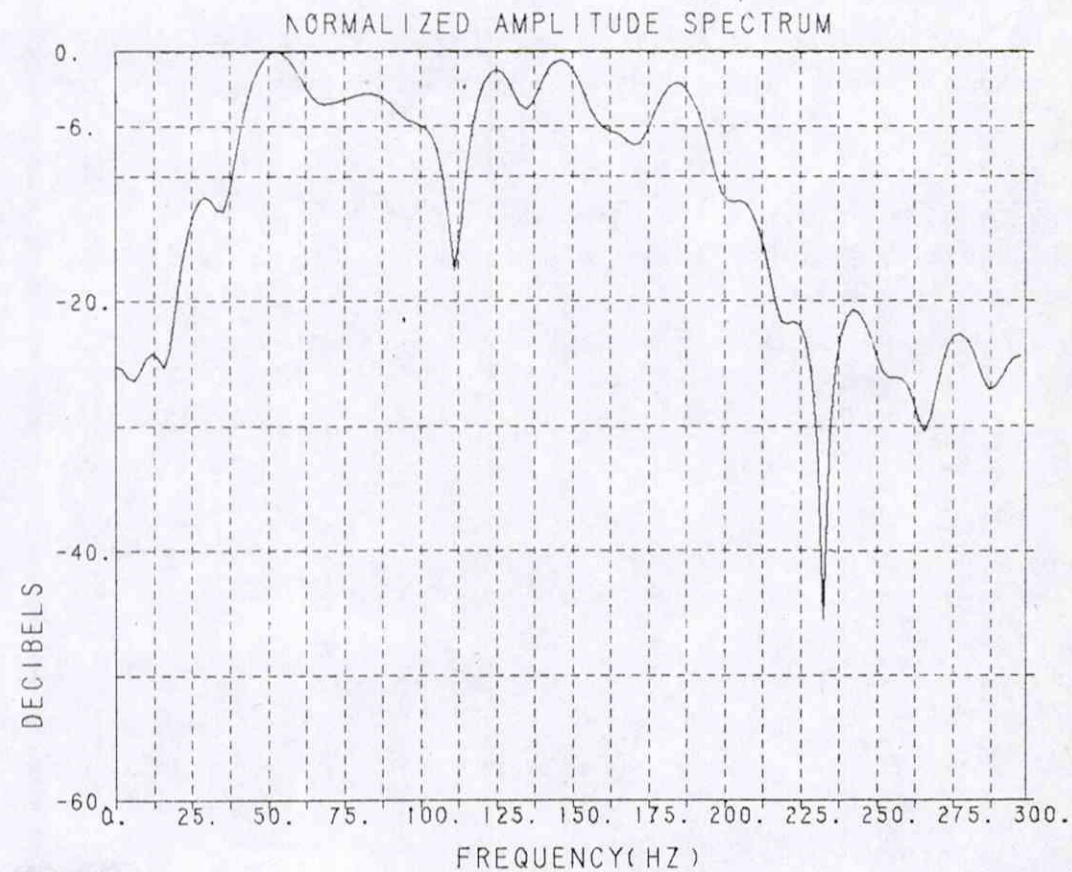
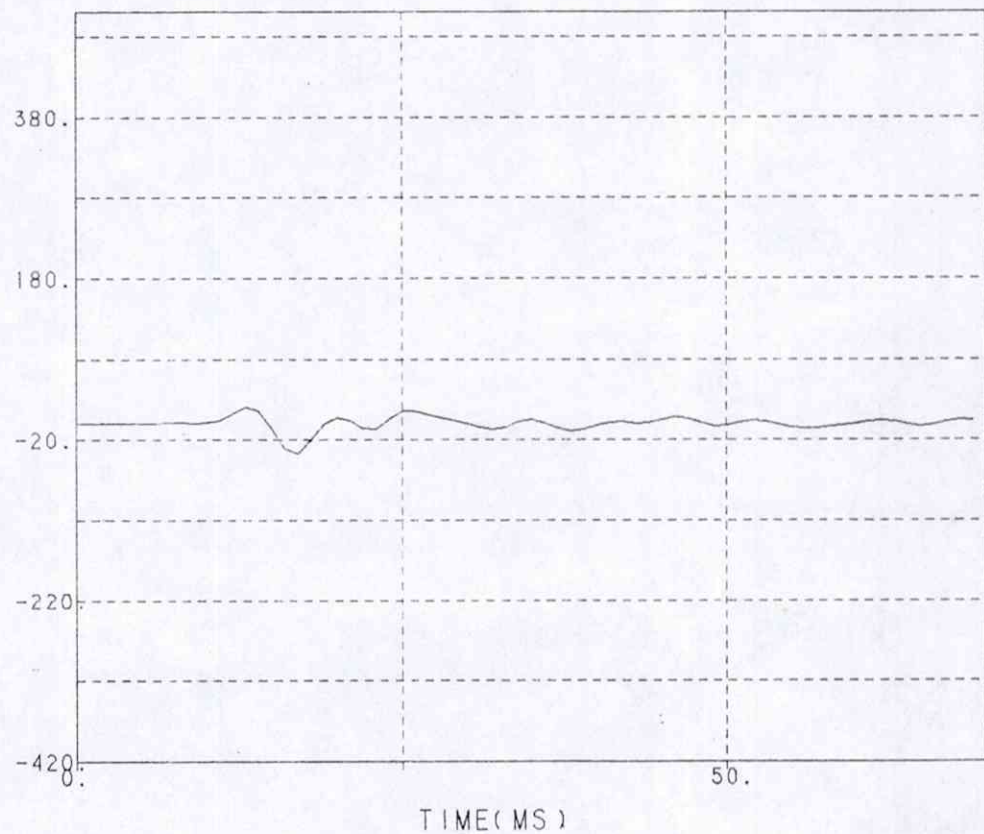
IDENT 590000 CHANNEL 5

GEOTEAM TEST FILE 59 TRACE 5 WINDOW 390-460 MS.

65 10 Hz *put in*

2.26

580.



D 100 720 m

100 Hz

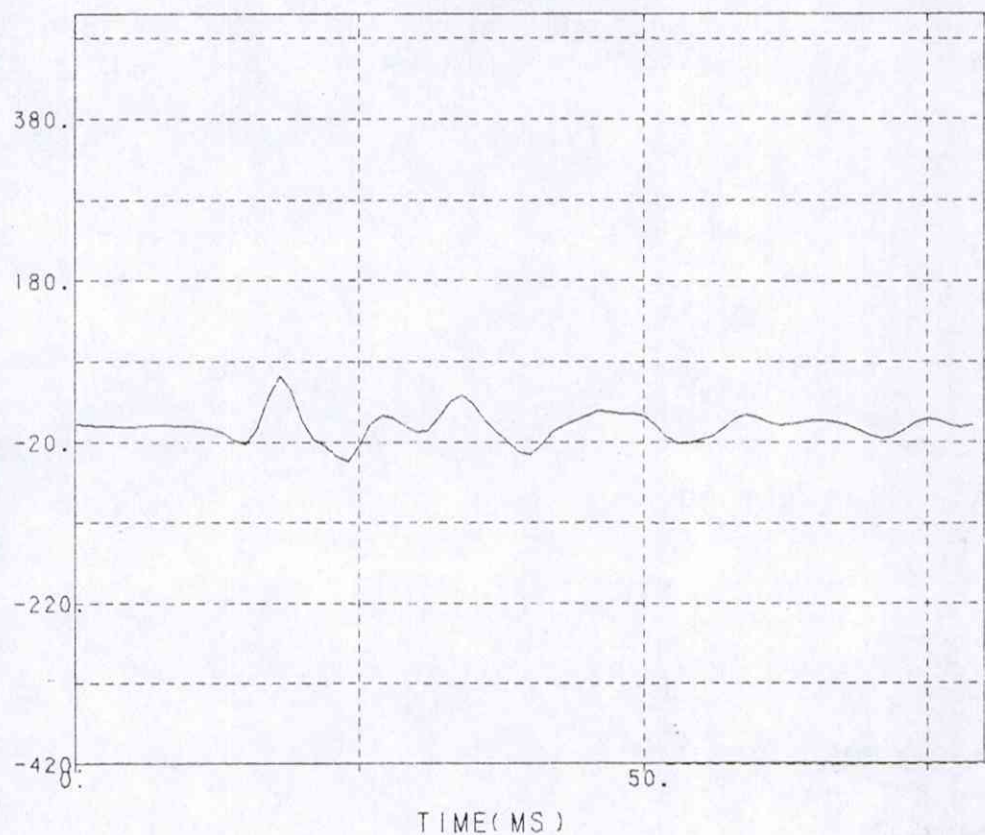
GEC0 PULSE TEST

IDENT 600000 CHANNEL 1

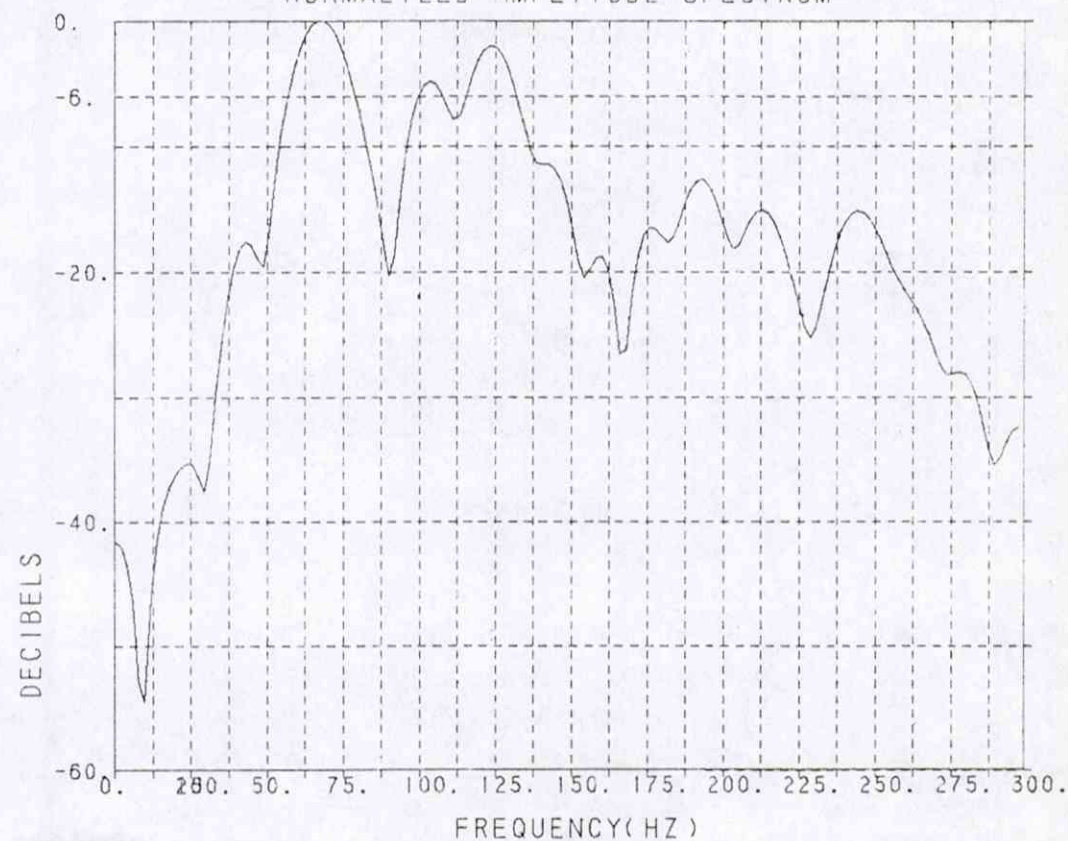
2.27

GEOTEAM TEST FILE 60 TRACE 1 WINDOW 140-220 MS.

580.



NORMALIZED AMPLITUDE SPECTRUM



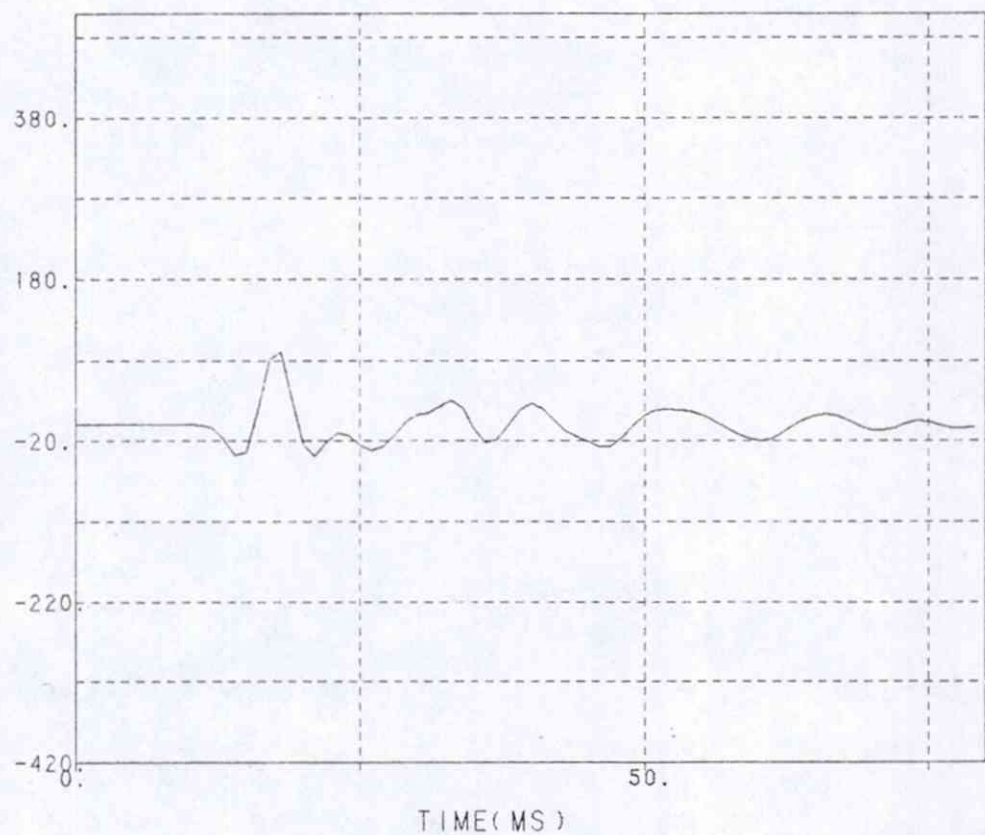
GECØ PULSE TEST

IDENT 600000 CHANNEL 2

GEOTEAM TEST FILE 60 TRACE 2 WINDOW 140-220 MS.

2.28

580.



50Hz

NORMALIZED AMPLITUDE SPECTRUM

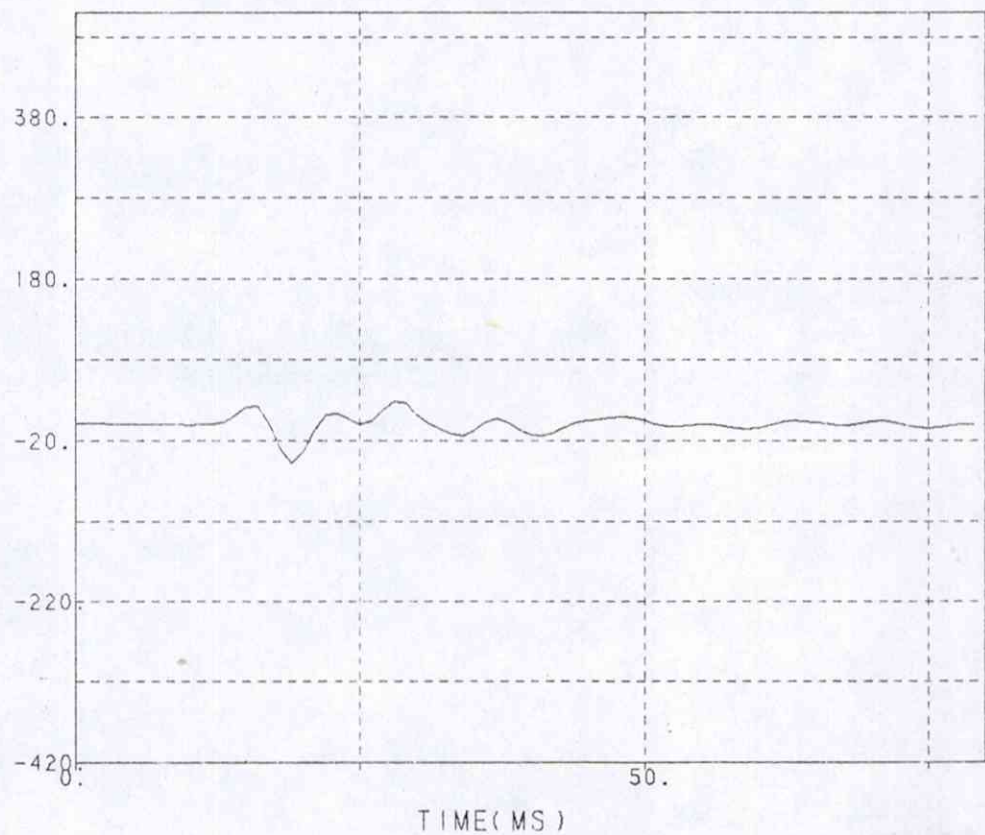


GECØ PULSE TEST

IDENT 600000 CHANNEL 3

GEOTEAM TEST FILE 60 TRACE 3 WINDOW 140-220 MS.

580.



30 Hz

2.29

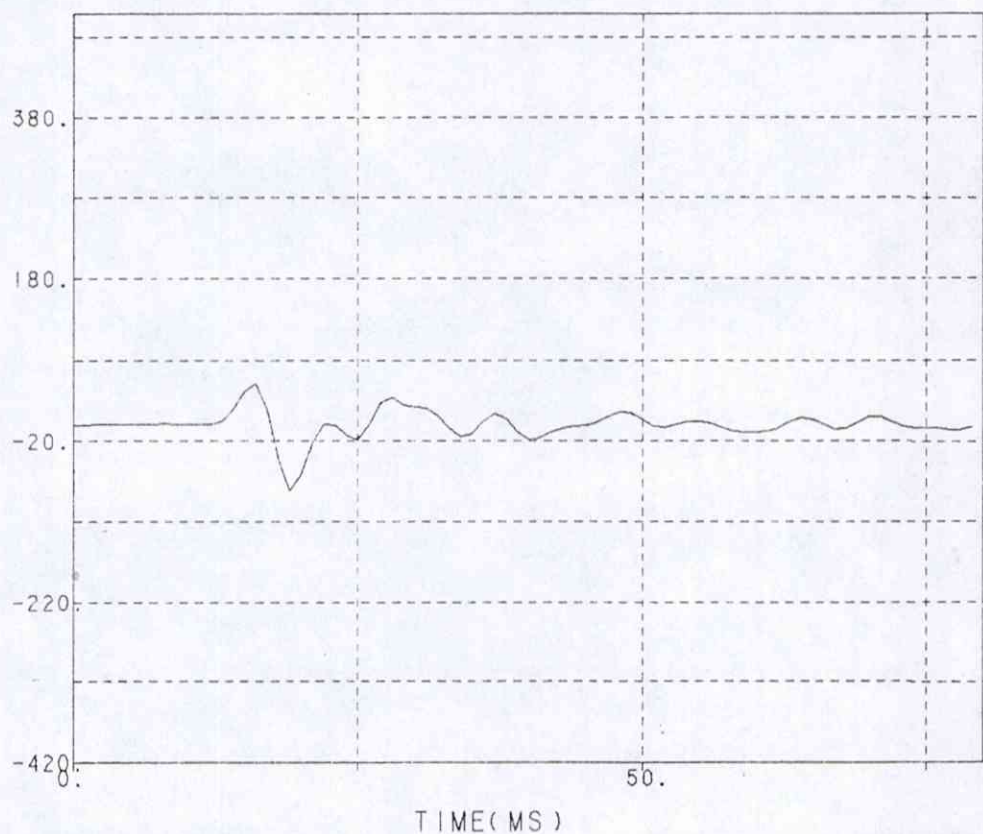


GECØ PULSE TEST

IDENT 600000 CHANNEL 5

GEOTEAM TEST FILE 60 TRACE 5 WINDOW 140-220 MS.

580.



10 Hz

2.30

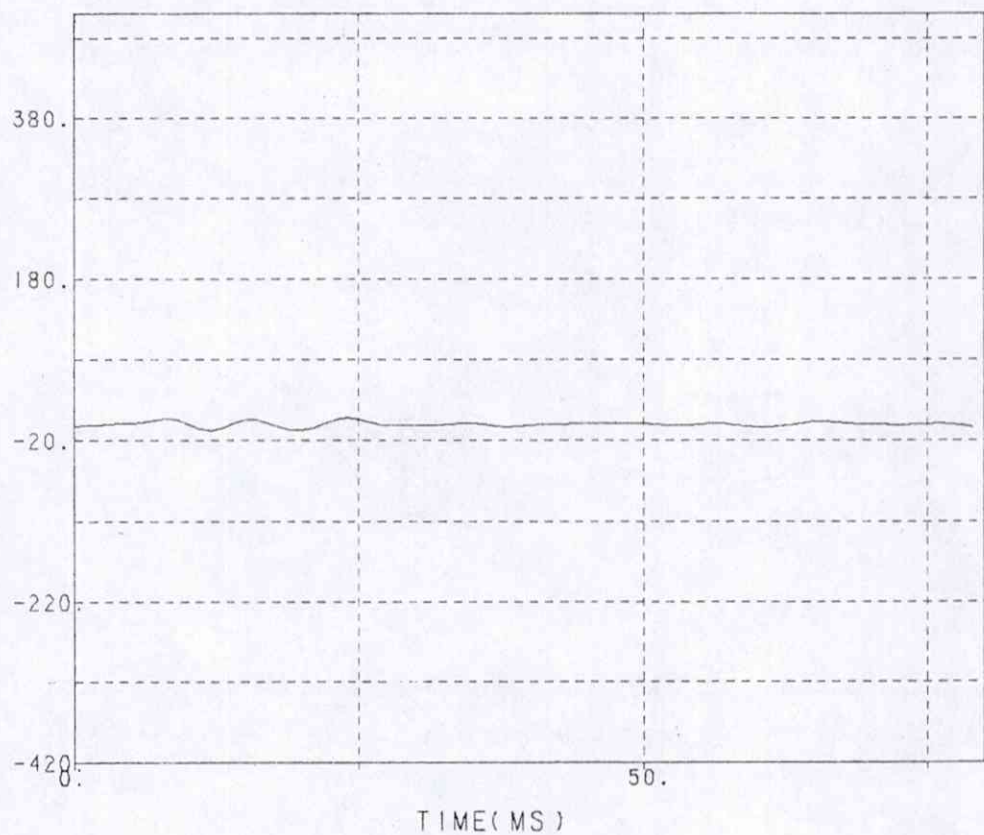


GECO PULSE TEST

IDENT 610000 CHANNEL 1

GEOTEAM TEST FILE 61 TRACE 1 WINDOW 500-580 MS.

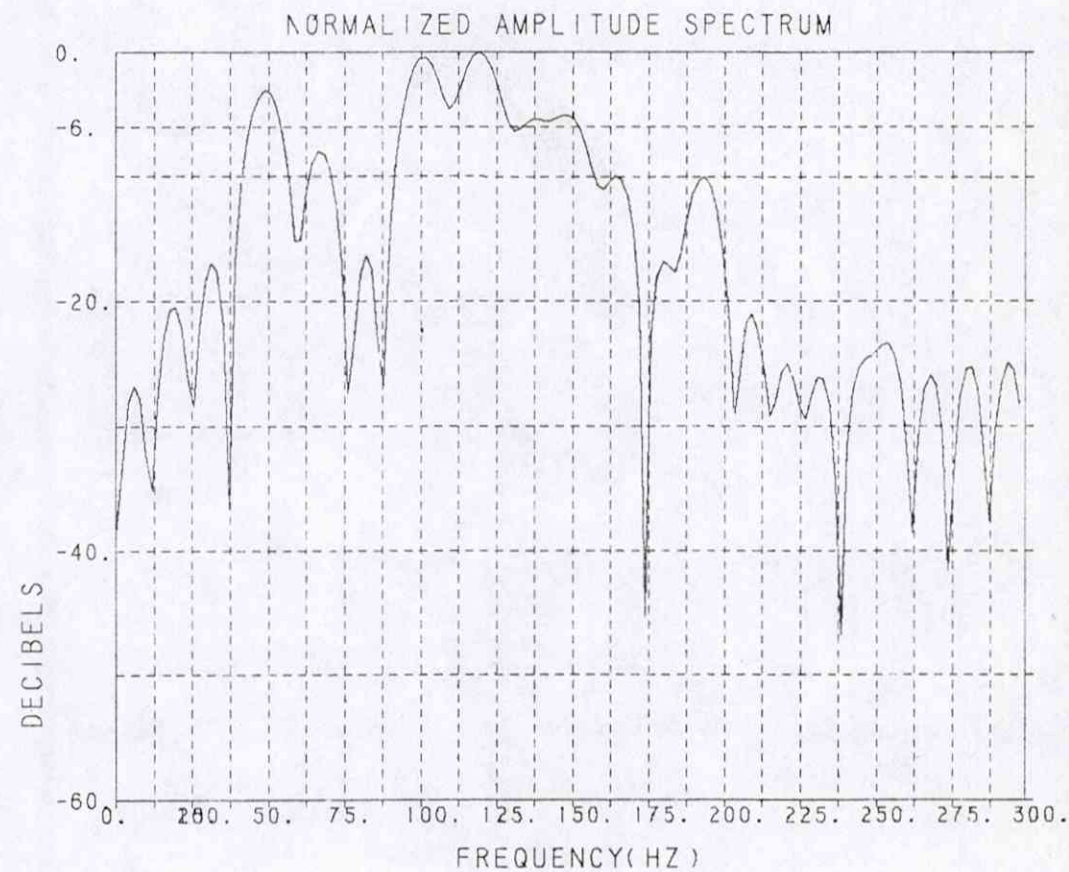
580.



59m 930 m..

100 Hz

2.31

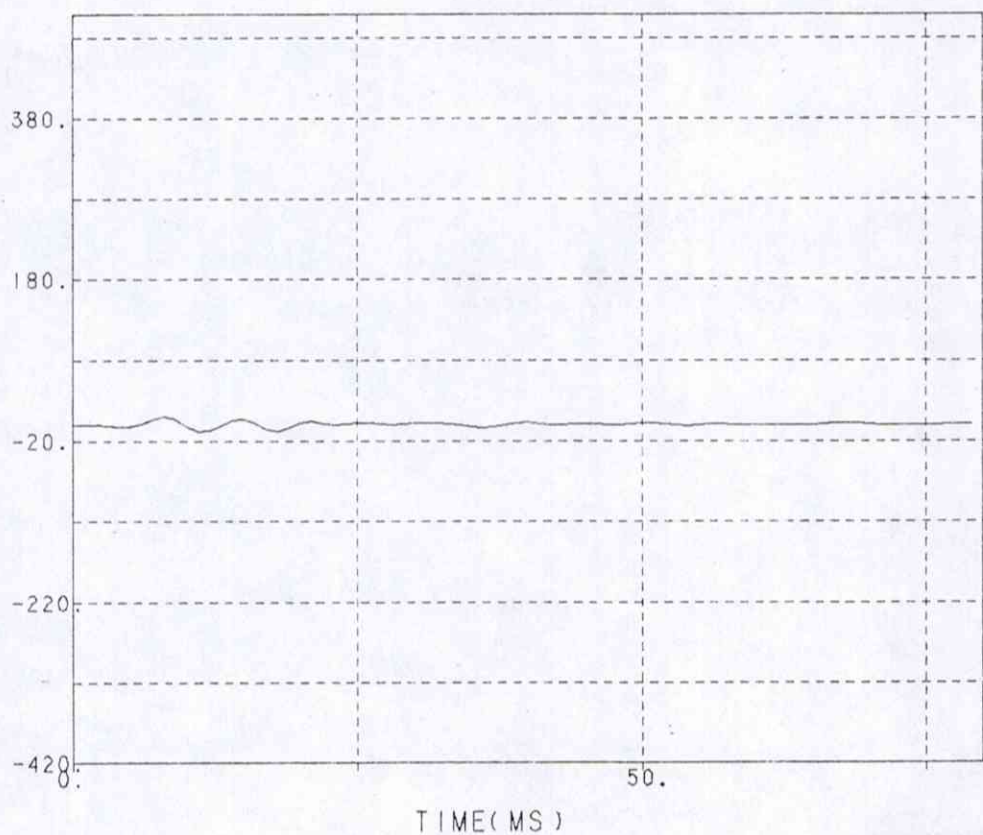


GECO PULSE TEST

IDENT 610000 CHANNEL 2

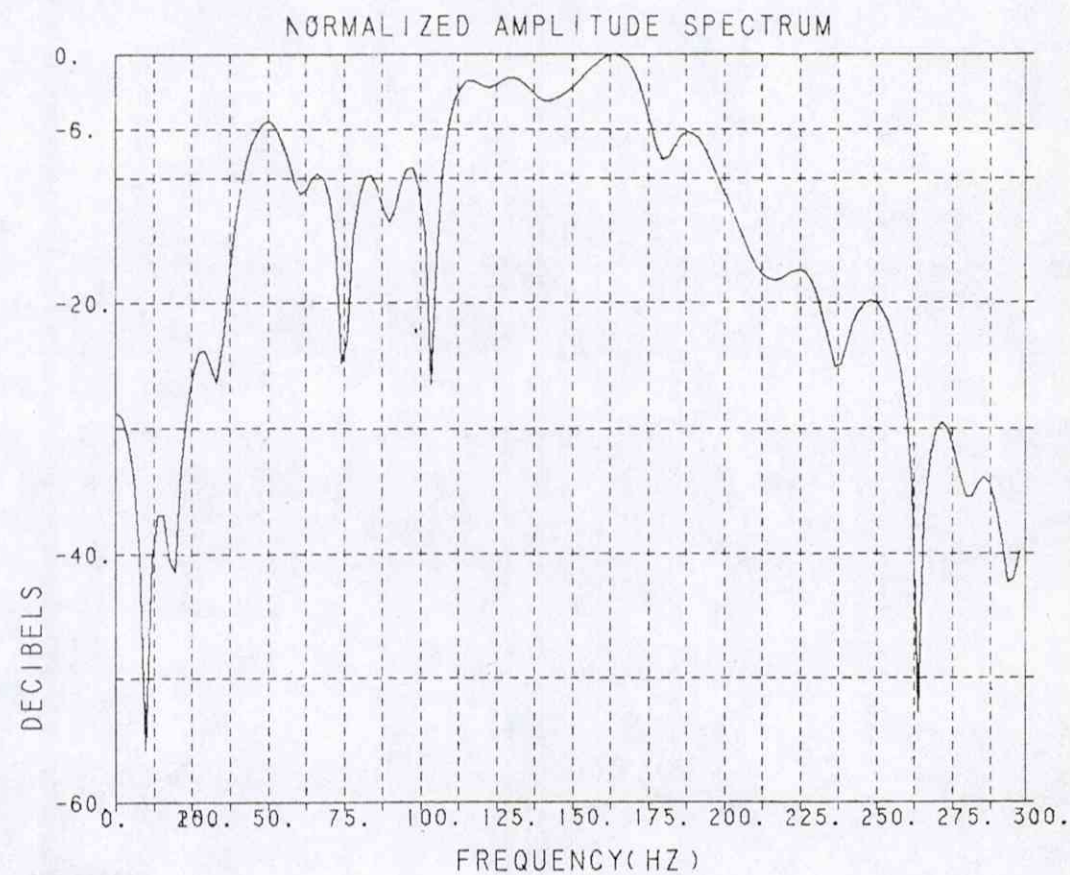
GEOTEAM TEST FILE 61 TRACE 2 WINDOW 500-580 MS.

580.



50 Hz

2.32



30 Hz

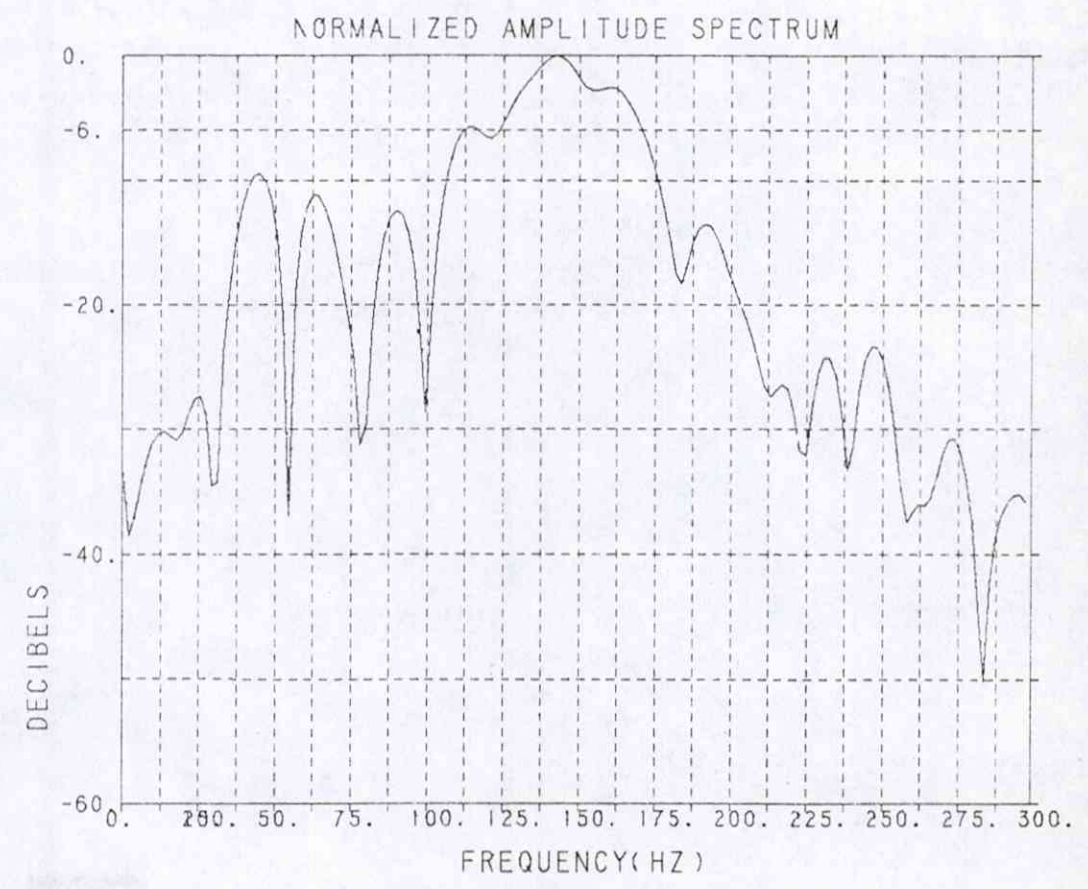
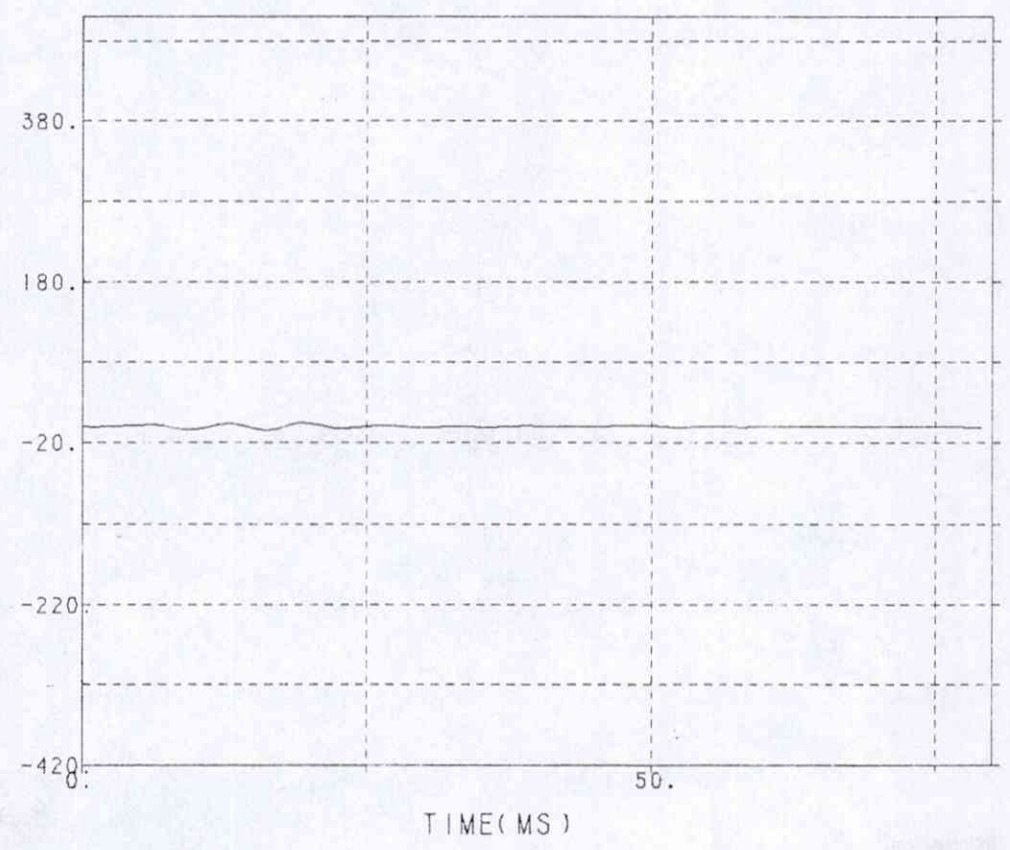
GECO PULSE TEST

2.33

IDENT 610000 CHANNEL 3

GEOTEAM TEST FILE 61 TRACE 3 WINDOW 500-580 MS.

580.

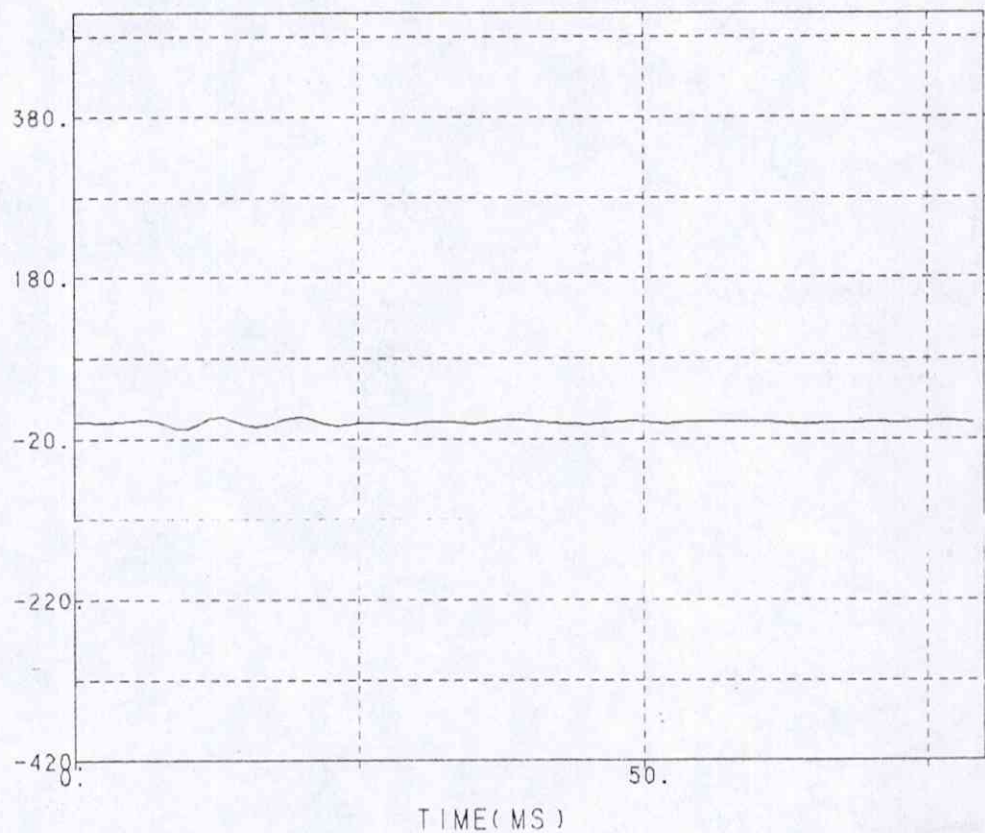


GECØ PULSE TEST

IDENT 610000 CHANNEL 5

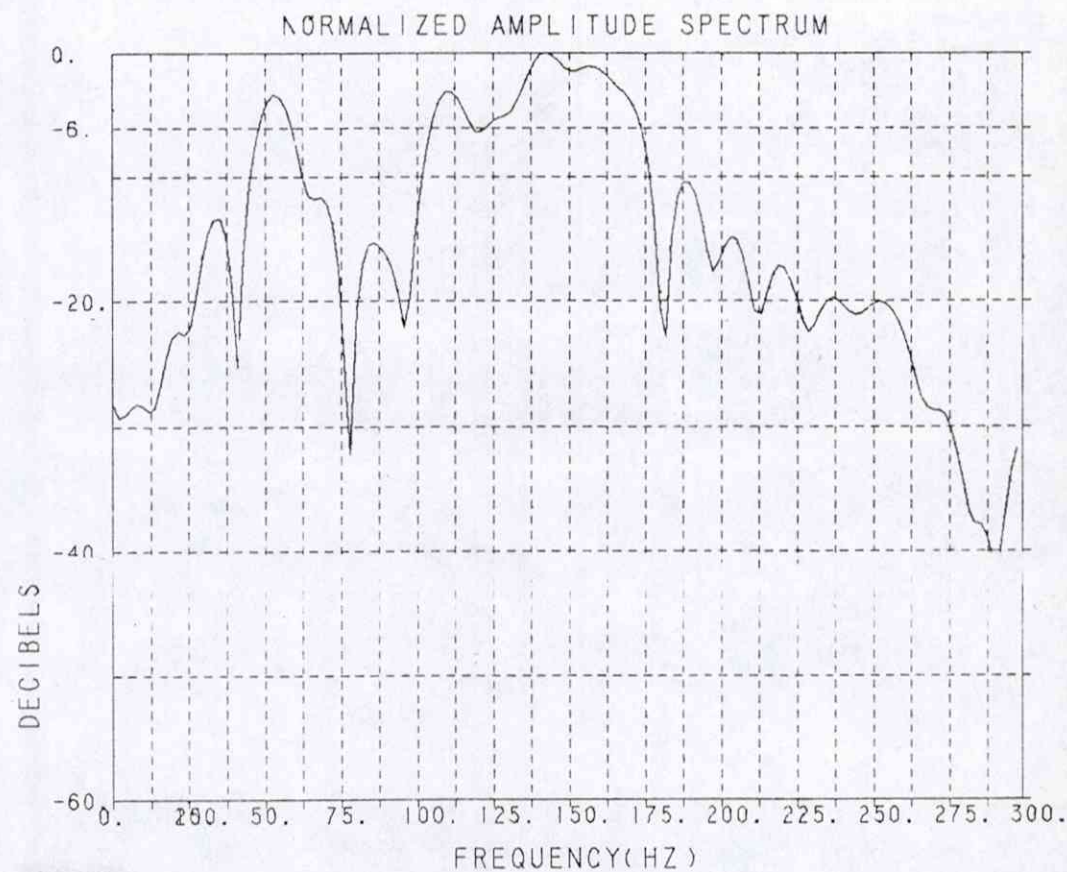
GEOTEAM TEST FILE 61 TRACE 5 WINDOW 500-580 MS.

580.



10 Hz

2.34

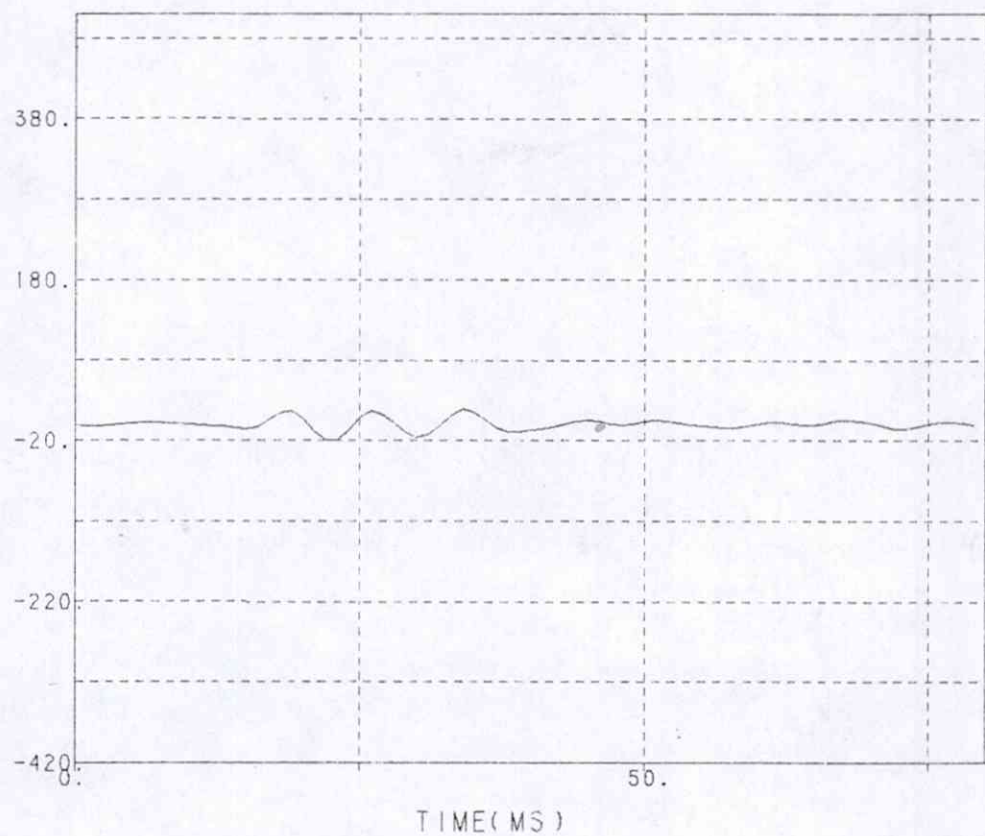


GECØ PULSE TEST

IDENT 620000 CHANNEL 1

GEOTEAM TEST FILE 62 TRACE 1 WINDOW 640-720 MS.

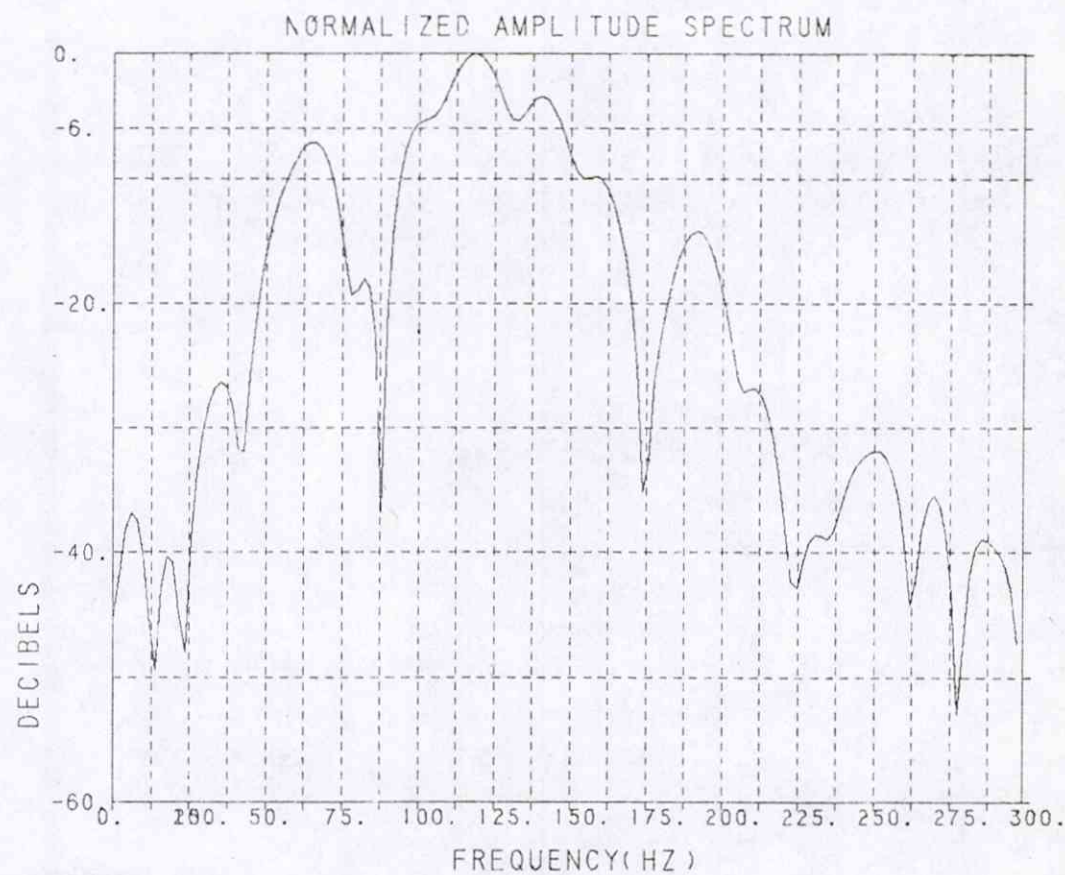
580.



50 gr. 930 m

100 Hz

2.35

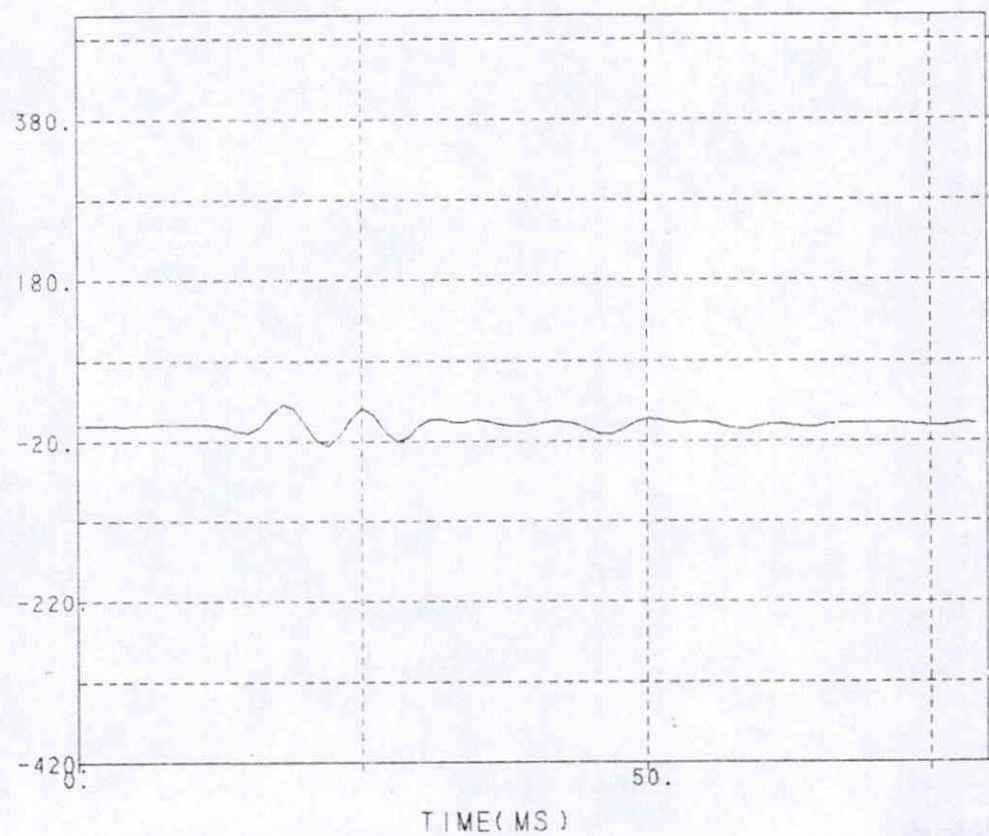


GECO PULSE TEST

IDENT 620000 CHANNEL 2

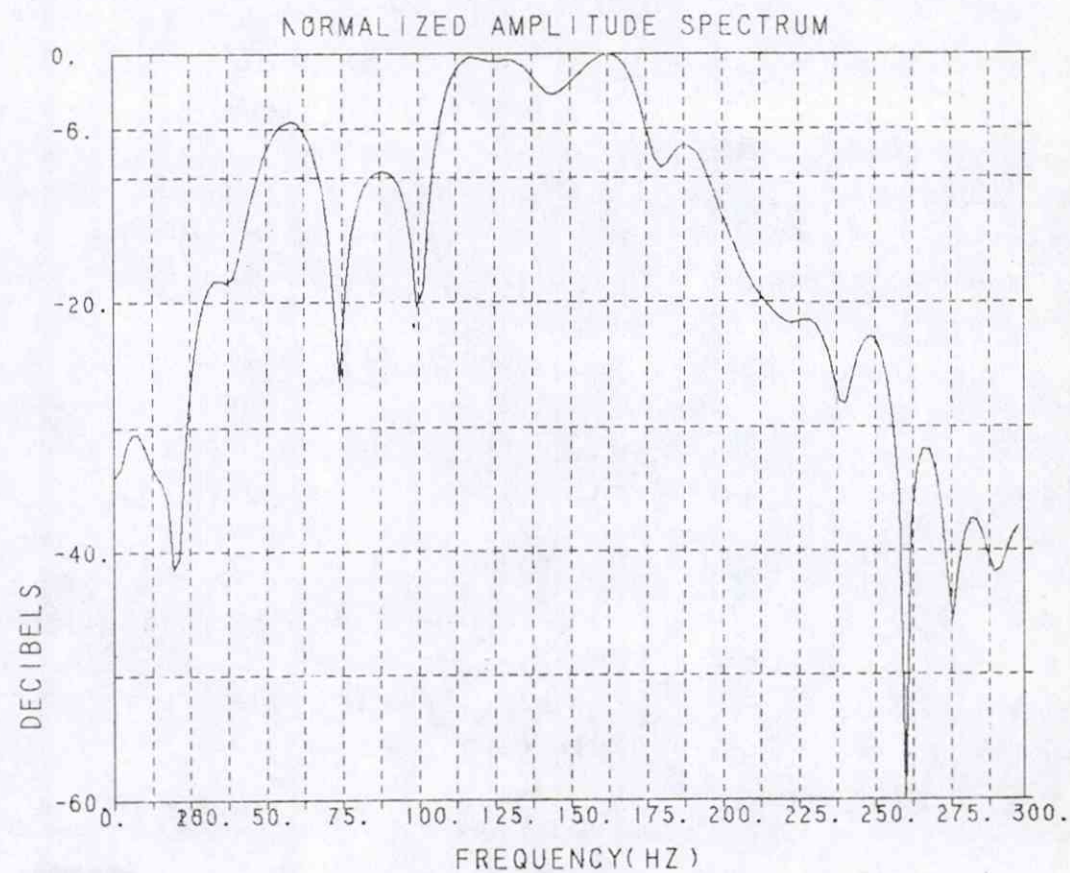
GEOTEAM TEST FILE 62 TRACE 2 WINDOW 640-720 MS.

580.



50Hz

2.36

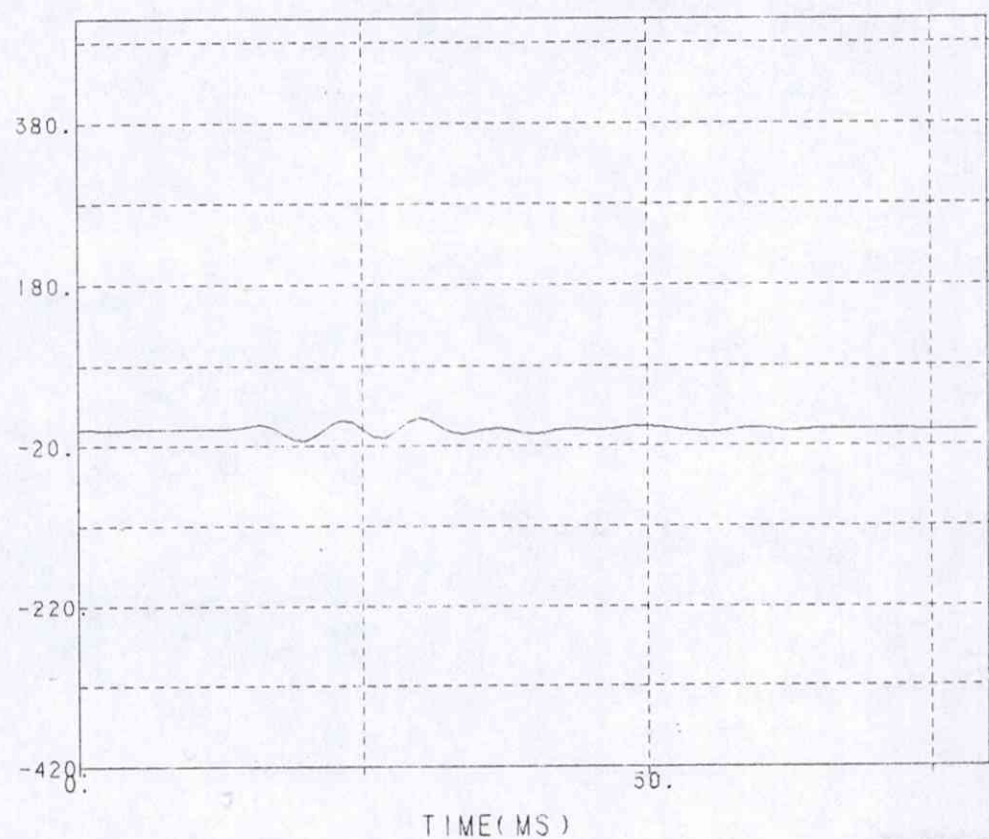


GECØ PULSE TEST

IDENT 620000 CHANNEL 3

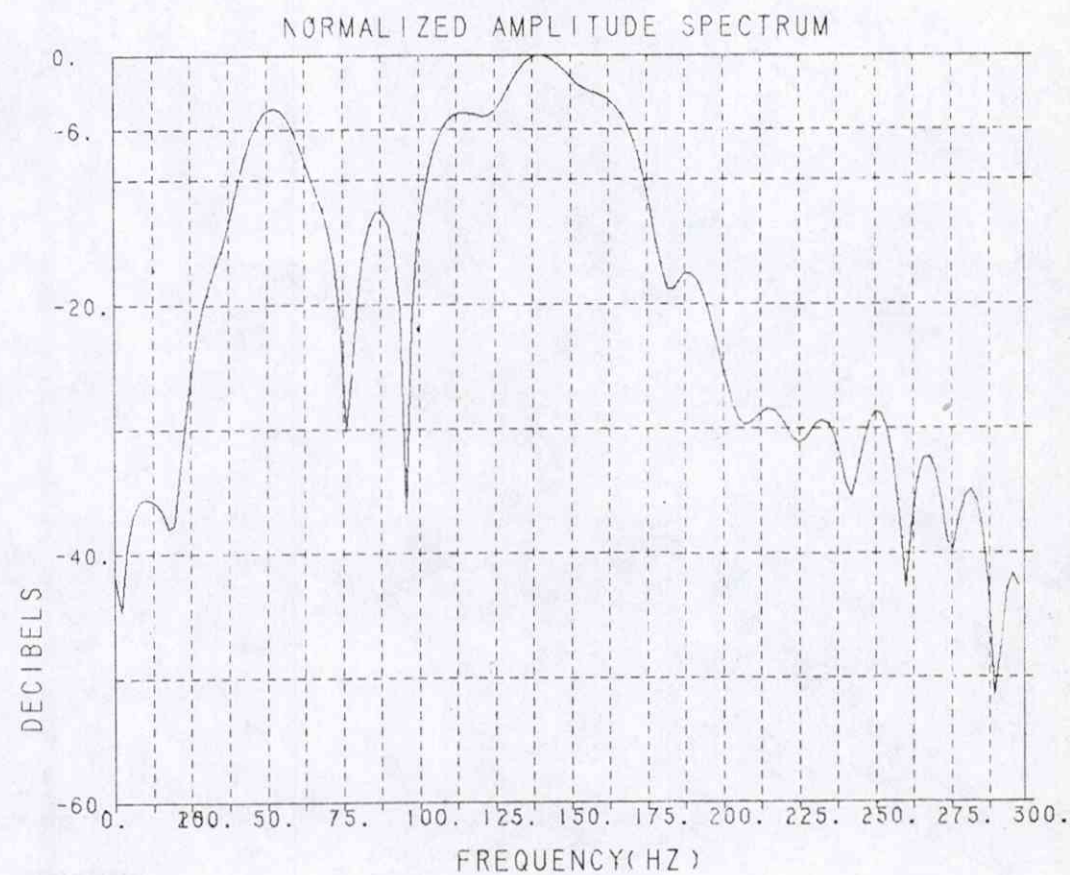
GEOTEAM TEST FILE 62 TRACE 3 WINDOW 640-720 MS.

580.



30 Hz

2.37

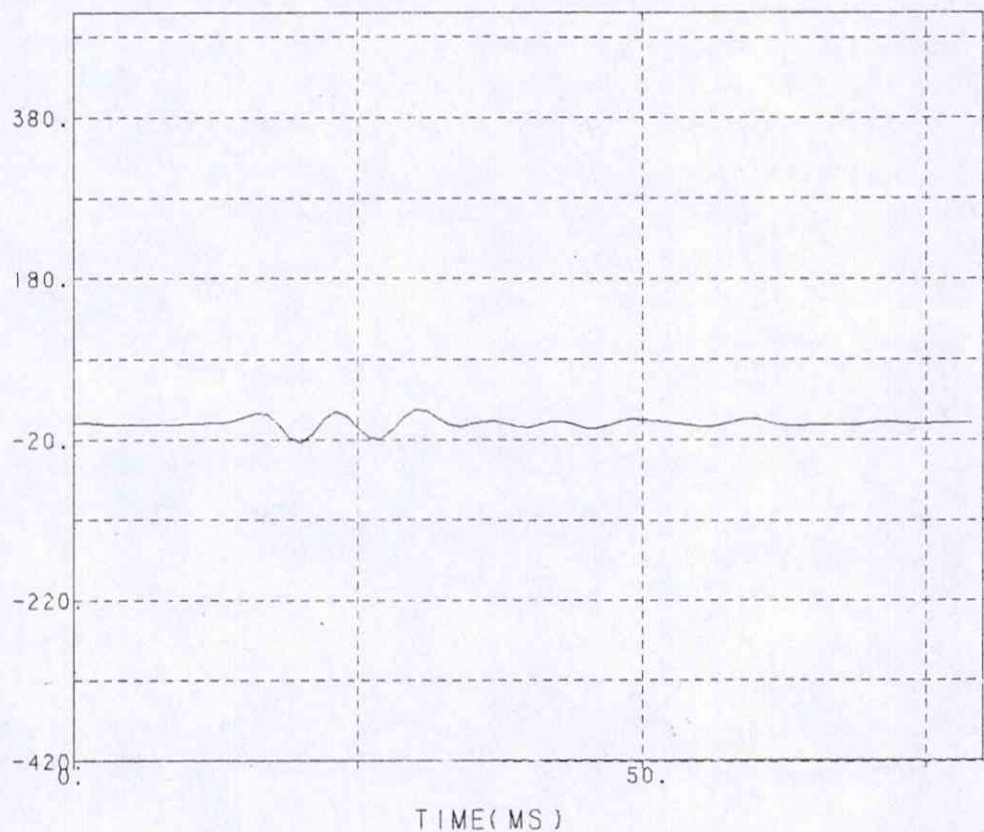


GECO PULSE TEST

IDENT 620000 CHANNEL 5

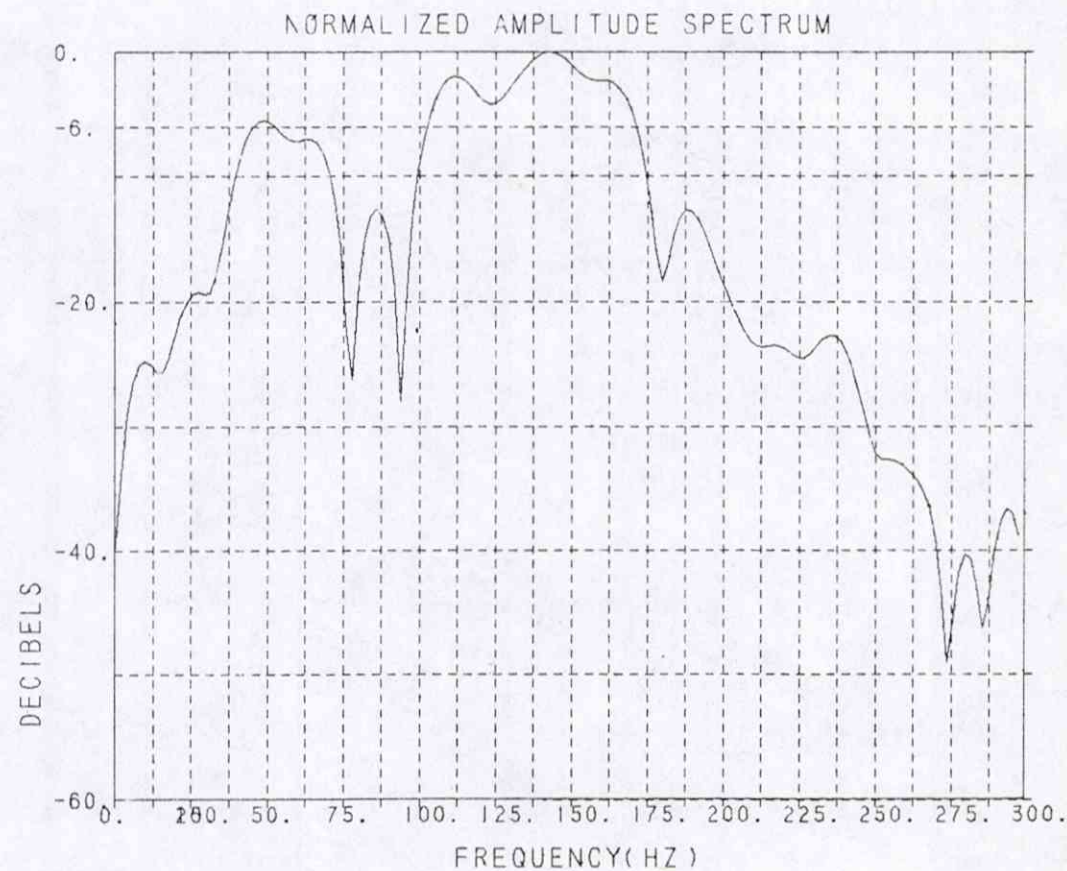
GEOTEAM TEST FILE 62 TRACE 5 WINDOW 640-720 MS.

580.



10 Hz

2.38

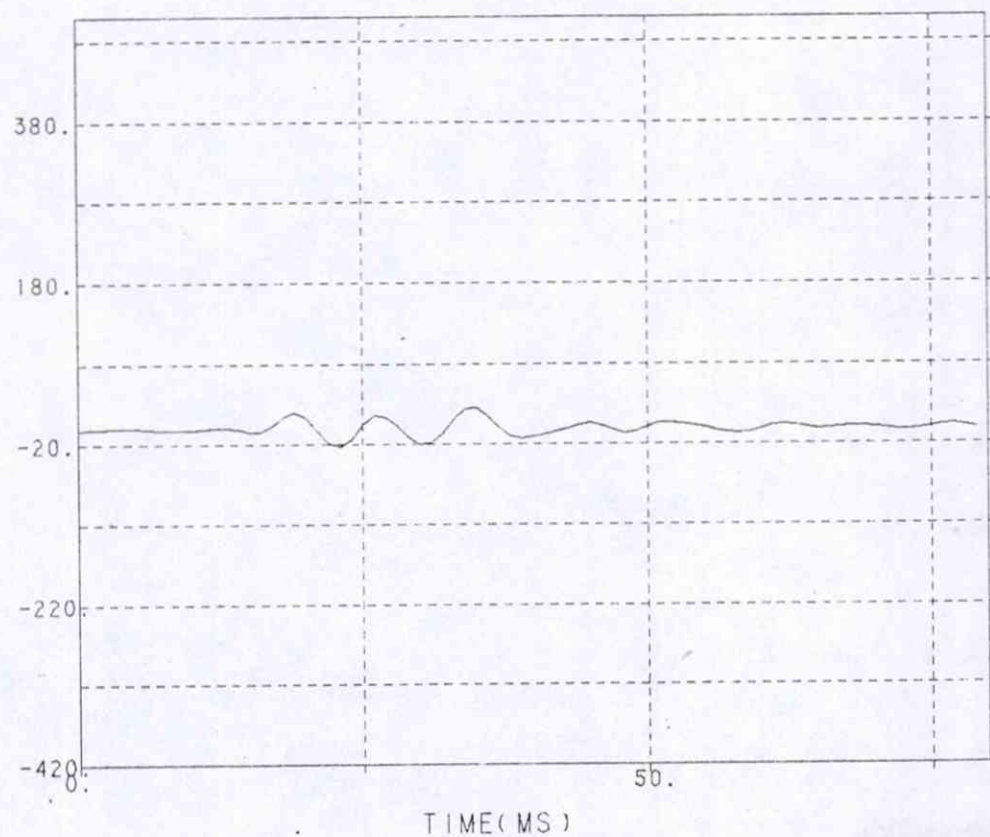


GECO PULSE TEST

IDENT 630000 CHANNEL 1

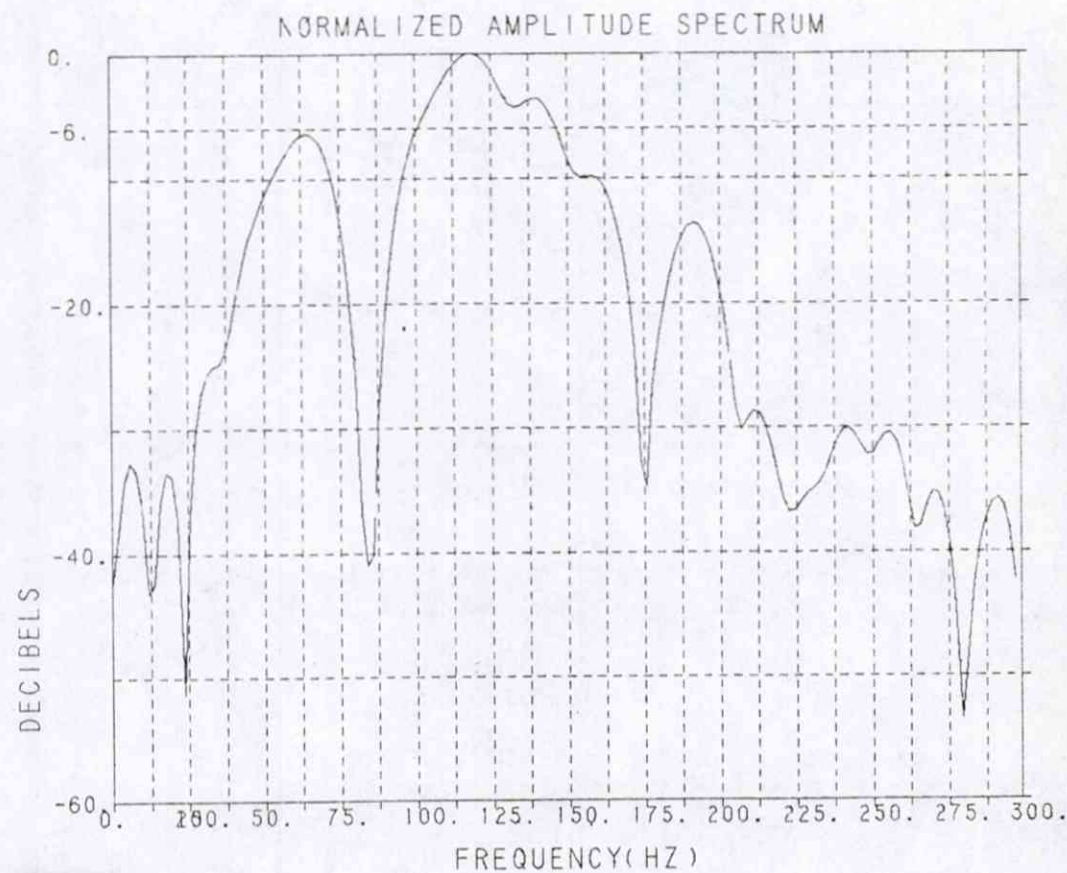
GEOTEAM TEST FILE 63 TRACE 1 WINDOW 150-230 MS.

580.



100 gr. 930m
100 Hz

2.39

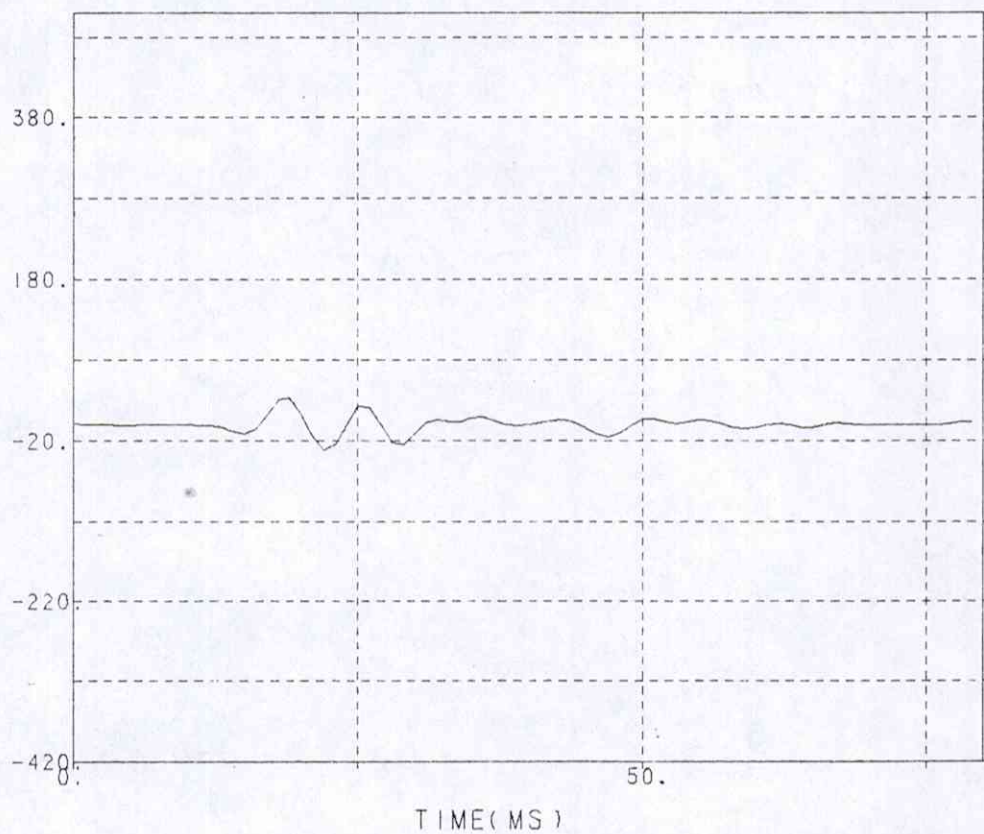


GECØ PULSE TEST

IDENT 630000 CHANNEL 2

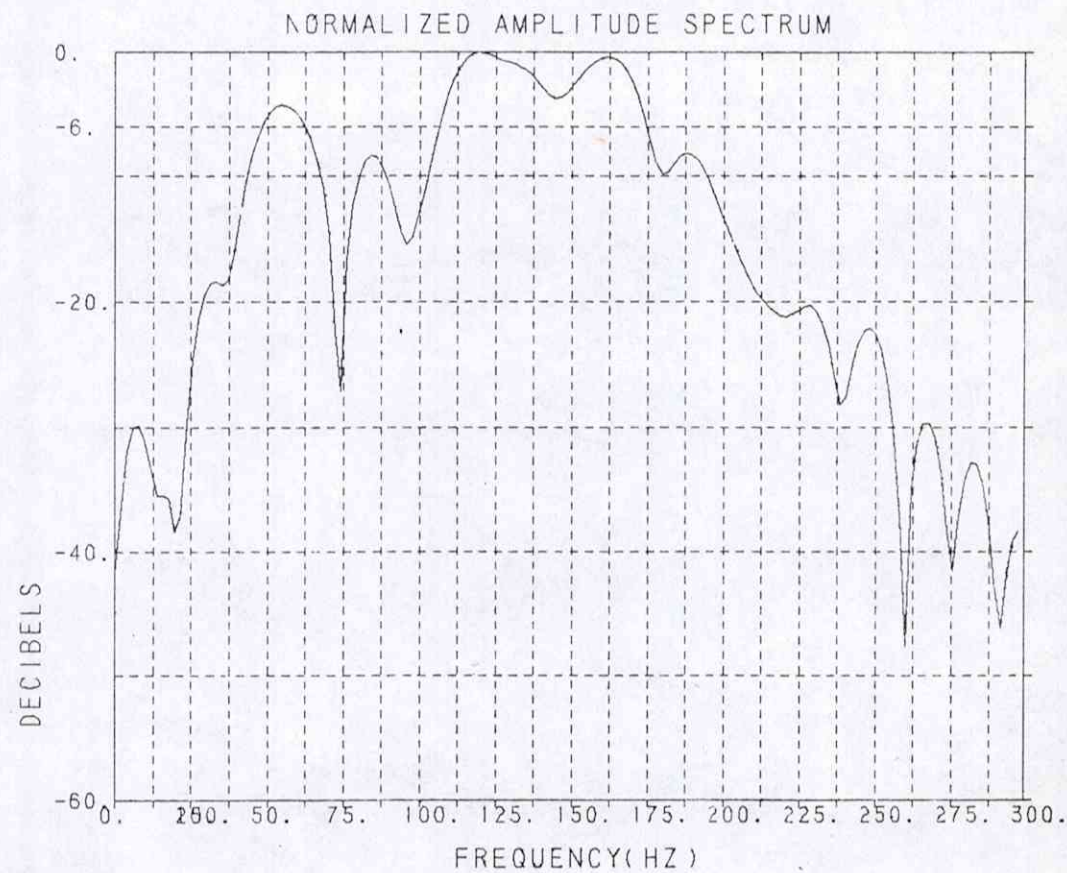
GEOTEAM TEST FILE 63 TRACE 2 WINDOW 150-230 MS.

580.



50 Hz

2.40

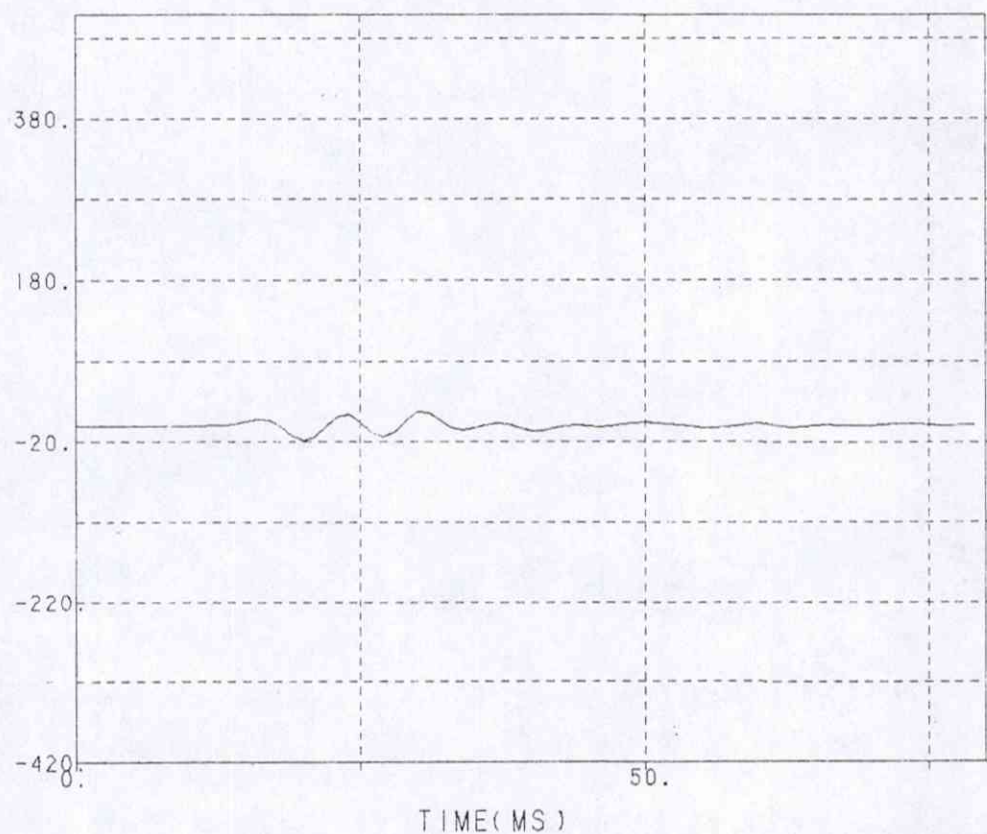


GECO PULSE TEST

IDENT 630000 CHANNEL 3

GEOTEAM TEST FILE 63 TRACE 3 WINDOW 150-230 MS.

580.



30 Hz

2.41

NORMALIZED AMPLITUDE SPECTRUM

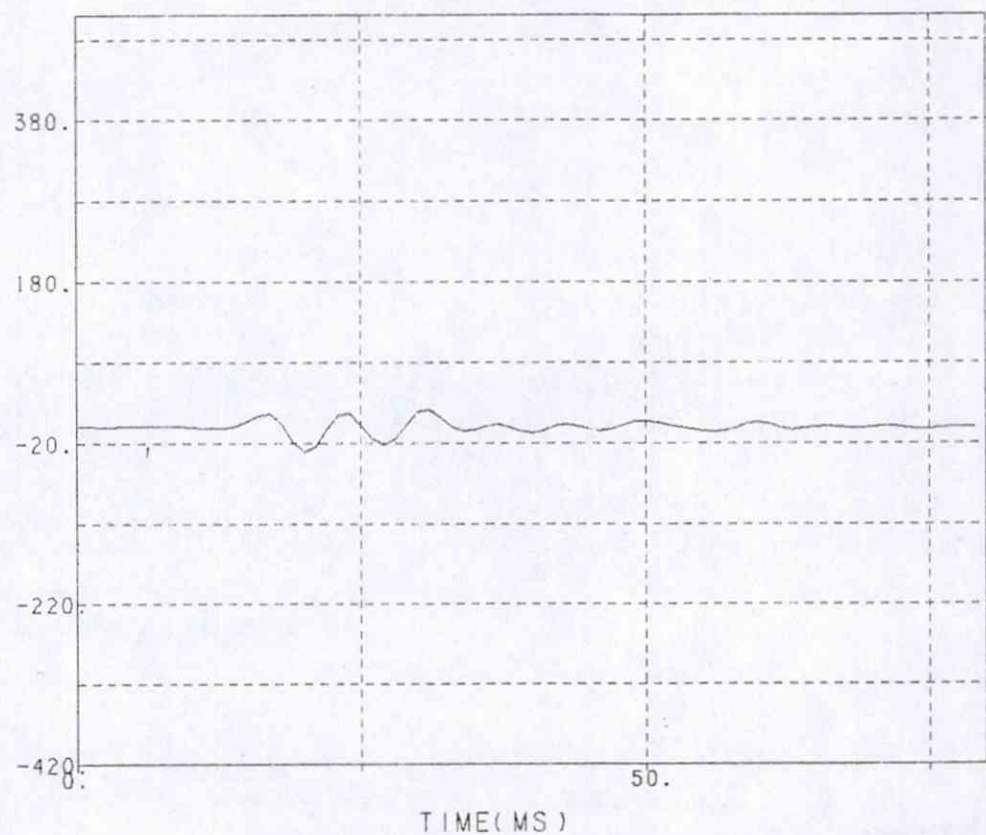


GECØ PULSE TEST

IDENT 630000 CHANNEL 5

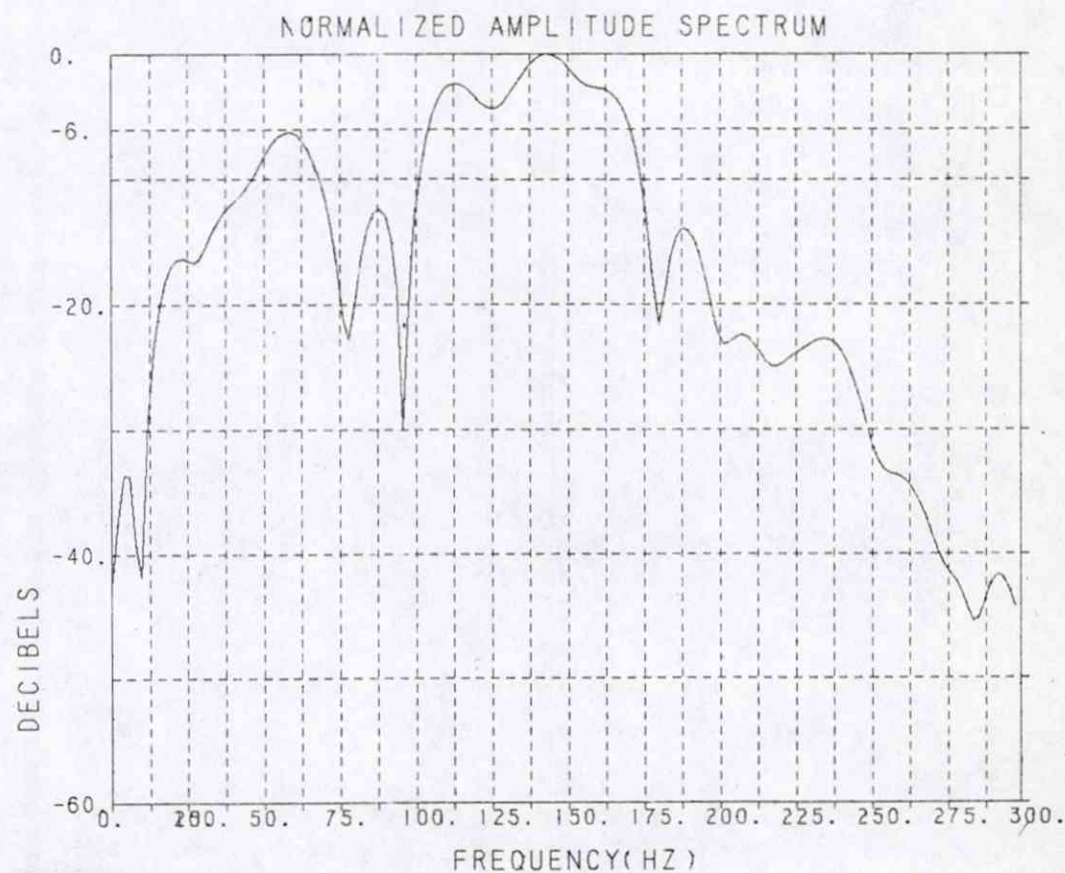
GEOTEAM TEST FILE 63 TRACE 5 WINDOW 150-230 MS.

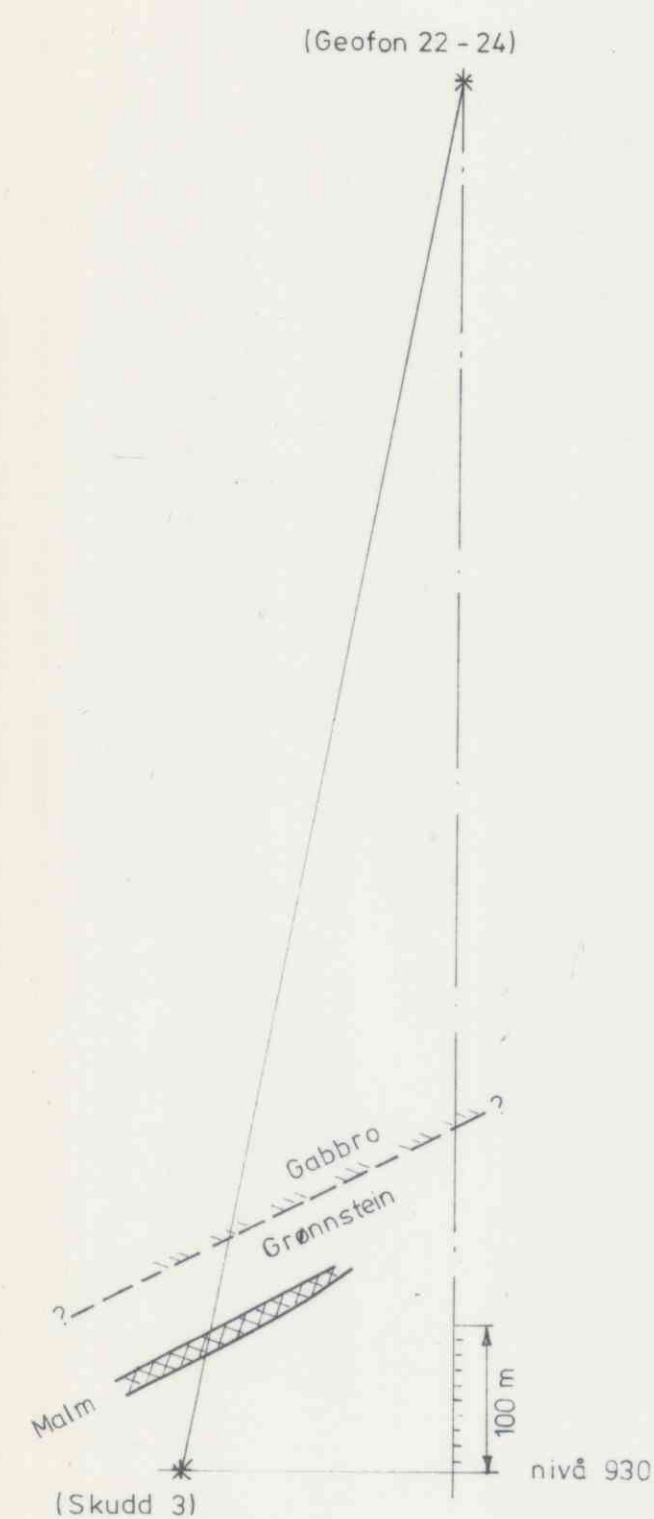
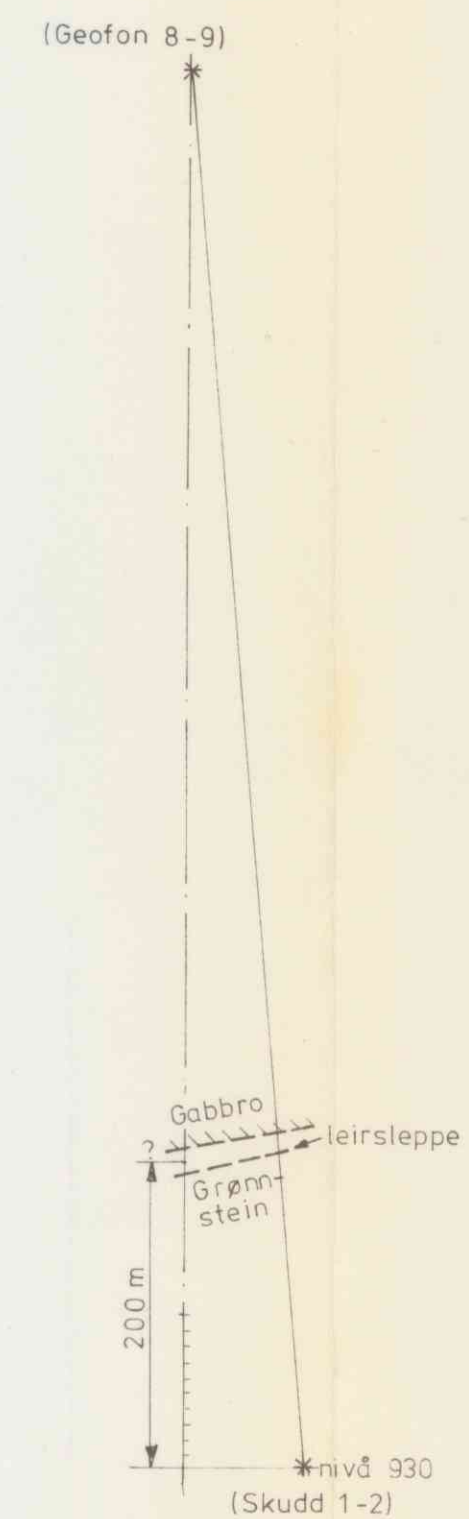
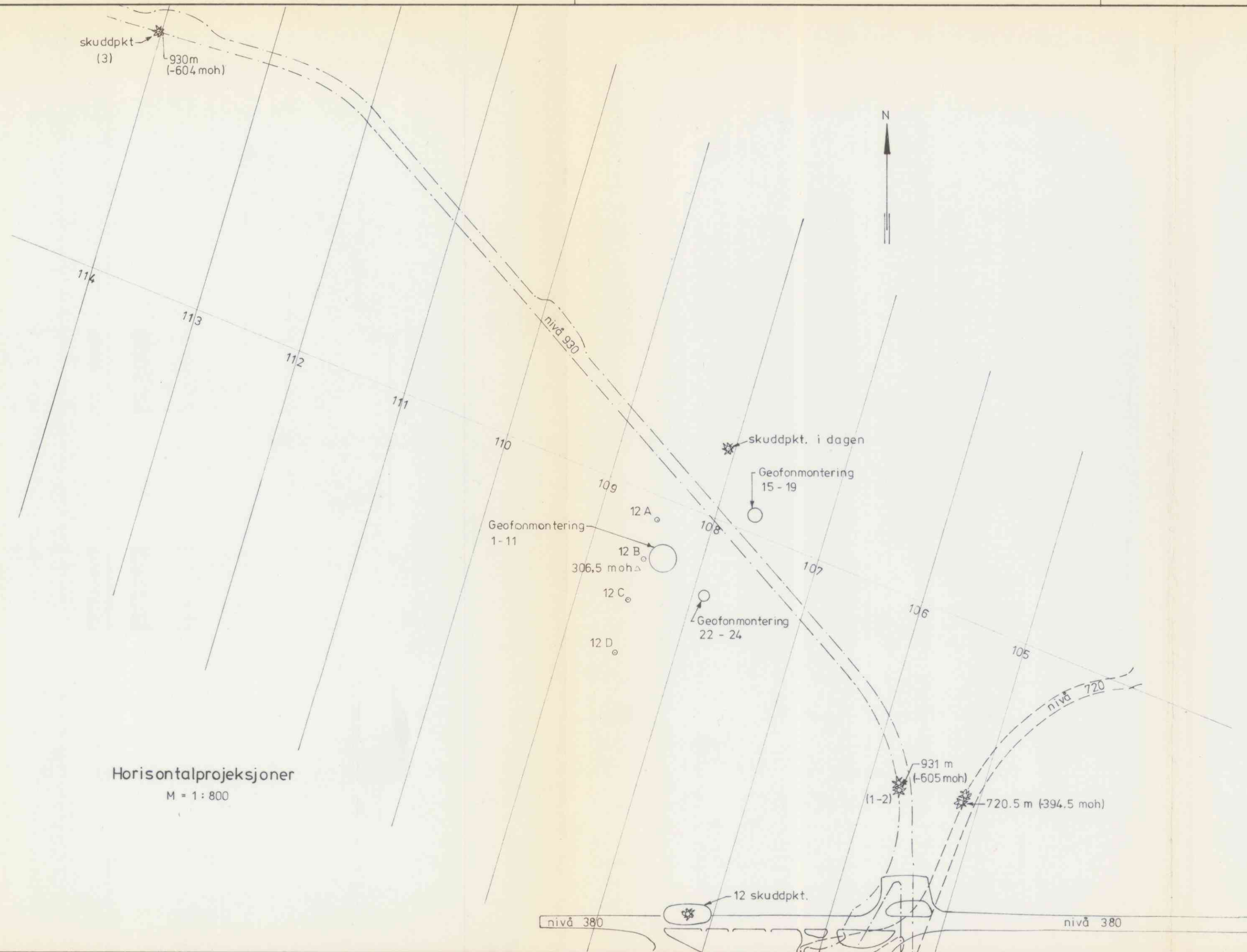
580.



10 Hz

2.42



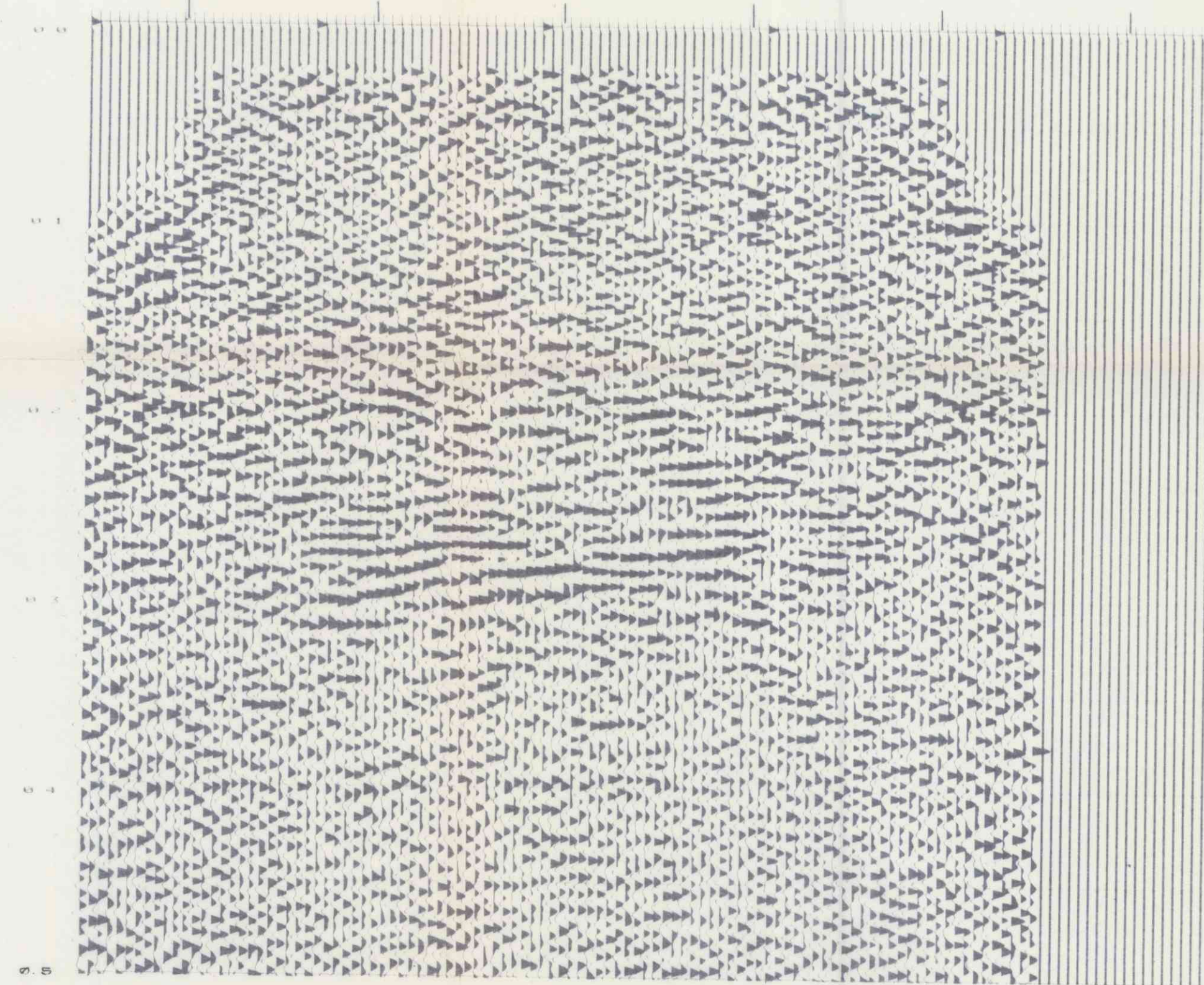


Vertikalsnitt
M = 1:5000

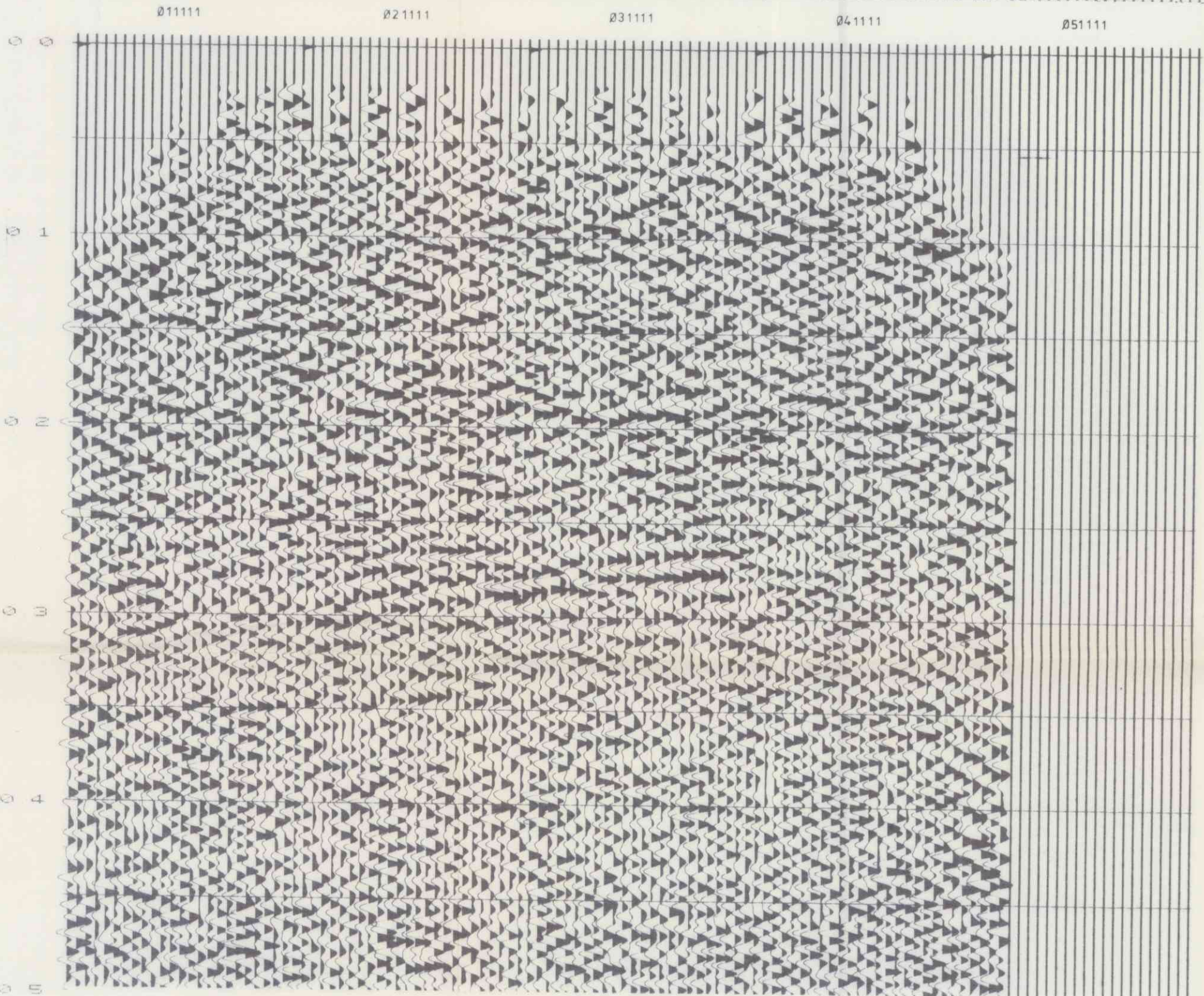
c			
b			
a			
Rev.	Dato	Sign.	
Oppdragsgiver: ORKLA INDUSTRIER A.S			
Anlegg: LØKKEN GRUBE			
Sted: LØKKEN			
SITUASJONSPLAN MÅLEOPPSTILLINGER		Målestokk	Målt
		1:800	Bereg.
		1:5000	Tegn. AB Feb. 1978
			Kfr.
A/s GEOTEAM GEOLOGI GEOFYSIKK GEOTEKNIKK INGENIØRGEOLOGI		Tegn. nr. 4034 - 9	

SP 0 10 20 30 40 50 SP

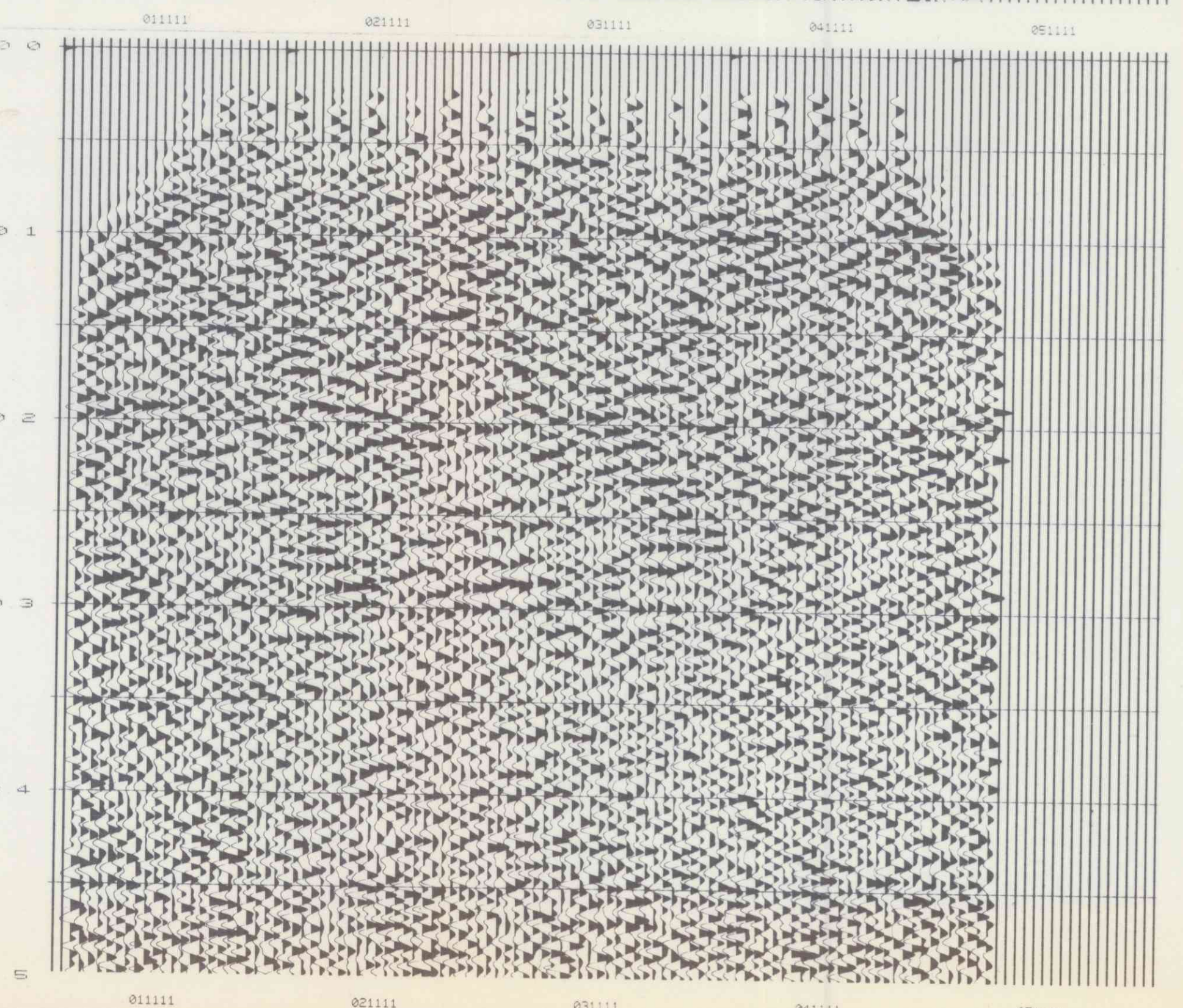
ORIGINAL VERSION



(REDUSERT 50 %)
Skudd 1, 3, 5,



(REDUSERT 50 %)
Skudd 2, 4, 6,



LINE 1/76

SP 0 to SP 40

4x1200% FILTERED STACK
SW —————> NE



A/S GEOTEAM



LØKKEN GRUBE

SHOT BY A/S GEOTEAM
PROCESSED BY GECO A S
CONTRACT NO 847

DATE OCT 1976
DATE NOV 1976
FIELD REEL NO 142106739

RECORDING DATA

SOURCE DYNAMITE
SPLITSREAD
SP INTERVAL 10 m
GEOPHONES PER GROUP 1
GROUPS 24
GROUP INTERVAL 10 m
INSTRUMENTS AMPLIFIER DHR 1632
FILTER 10 CUT 60 Hz dB Oct
RECORD LENGTH 1 sec
SAMPLE RATE 1 ms
TYPE AMPLITUDE CONTROL FIX POINT
RECORDING TAPE 800 BPI
RECORDING FORMAT SEG Y

POLARITY CONVENTION: RECORDED POSITIVE NUMBER DISPLAYED AS A PEAK (BLACK)

PROCESSING SEQUENCE AND PARAMETERS

EDIT DEMULTIPLEX
SUMMER 4 SHOT VERTICAL SUM
GAIN APP FIRST GAIN ZONE 40 ms
MAX GAIN ZONE 160 ms
DBS MINIMUM PREDICTION DISTANCE 4 ms
MAXIMUM PREDICTION DISTANCE 100 ms
NO OF AUTOCORR WINDOWS 2
STOP OF AUTOCORR 1000 ms
STOP OF DECONVOLUTION 1000 ms
NMO 1 VEL FUNCT, MUTE, STATICS
COHERENCY STACK 3 GATES Sec Max Shift
0.001 - 0.200 4 ms
0.200 - 0.400 4 ms
0.400 - 1.000 4 ms
TV FILTER Sec 1c Hc Slopes dB/oct
0.001 - 0.200 75 200 24/48
0.200 - 0.500 65 150 24/48
0.500 - 1.000 60 120 24/48
DATUM PLANE 200m
PLAYBACK SCALES HORIZONTAL 5 tr/cm
VERTICAL 40 cm/sec
GAIN 9 dB BIAS -4

HORIZONTAL SCALE 1:2 500

0 5 10 SP's
0 50 100m

c			
b			
a			
Rev.	Dato	Sign.	
Oppdragsgiver: ORKLA INDUSTRIER A/S			
Anlegg: LØKKEN GRUBE			
Sted: LØKKEN			
REPROSESSERINGER AV PROFIL 1/76			Målestokk
MED 50 %, DATAREDUKSJON			Målt
			Beregnet
			Tegn.
			Kir.
A/s GEOTEAM			Tegn. nr. 4034-10