Cm: Fast-TEV-004

FAST PRELIMINARY MAGNETIC TESTING

David Everett

July 24, 1992 (finished Aug 12)

On July 21 and 22, 1992, Rick Schnurr and I performed some AC and DC magnetic field testing at Goddard's Spacecraft Magnetic Test Facility (SMTF) on Goodluck Road. We wanted to test some SAMPEX components to compare the magnetic field emissions to the FAST EMI specification. We hoped to find out if our normal design practices are adequate to meet the FAST specifications.

AC TESTING

We started with AC magnetic field testing. The SMTF provided zero DC field throughout testing . We used the search-coil magnetometer from UCLA as our sensor. To it, we connected a power supply and an HP 35660A Dynamic Signal Analyzer. The power supply was set to ±14 V, and the current draw was small, almost undetectable on the power supply.

The background plot between 1 kHz and 100 kHz showed a noise floor around -90 dBV, with several large (30 dB above background) signals and some broad emissions below 25 kHz. We rotated the search coil to an east-west orientation to minimize the background noise.

We aligned the magnetometer with the x-axis of the ACE box and placed it 1 m away. After powering it on, we observed four new signals: one at 15.6 kHz, one at 46.9 kHz, and two around 62 kHz. Each was between 30 and 40 dB above ambient. Plots of a narrow region around each signal show that the two lower frequencies are narrow-band emissions. The signals around 62 kHz were a bit wider than a discrete sine wave (see plots). The signals around 62 kHz are DC-DC converters within the ACE box. By moving the magnetometer around near the box, we discovered that the emissions were passing through the walls of the box, not coming out the power leads.

In the 10 to 12.8 kHz range, we saw no emissions from the ACE box.

In the 0 to 1.6 kHz range, the ambient was fairly noisy. The ACE box showed two signals in this range, each about 10 dB above the noise floor. One was around 350 Hz, and the other was around 840 Hz. See plots.

We then connected the 50 Ω HP 8562A Spectrum Analyzer to the magnetometer to test the 100 kHz to 2 MHz frequency range. Starting at 100 kHz, the noise floor was around -65 dBm to 300 kHz, -75 dBm to 900 kHz, -70 dBm to 1430 kHz, then a linear roll off to -80 dBm at 2 MHz. We saw no emissions from the ACE box anywhere in the 100 kHz to 2 MHz frequency range.

When we reconnected the HP 35660A Signal Analyzer, all readings were 20 to 30 dB higher than those taken earlier in the day! The change in amplitude happened several times during testing. At the end of the day, we found a loose wire on the shield line at the connector near the magnetometer. All readings, both signals and the noise floor, simply shifted in amplitude.

The HP 35660A readings seemed consistent with those of the HP 8562A. The magnetometer preamp has a 100 Ω resistor in both the + and - output lines. The 35660 has a 1 MΩ load resistance. And the 8562 has a 50 Ω load resistance. The 35660 voltage reading should be five times larger than that of the 8562. I measured the 65 kHz DC-DC converter emission from the ACE box with a span of 6.4 kHz on each machine. The reading from the 35660 was 25.1 mV, and the 8562's reading was 4.6 mV.

We repeated the ACE box readings for the y and z-axis and obtained similar results. See plots.

We repeated the y-axis test at 2 m. The signal levels from the ACE box were less than 10 dB above the noise floor. See plots.

The final plots show ambient with the magnetometer inside and outside of a shielded can. This test showed that the ambient below 50 kHz was above the noise floor of the magnetometer. This final AC test was performed on July 22, 1992.

DC TESTING

Using the Magnetic Test Facility equipment, we ran the ACE box through unpowered and powered DC magnetic field testing. The unpowered initial perm test showed a maximum field of about 1.8 nT at 1 m. After deperm, the field dropped to about .6 nT. The powered test indicated a change of less than 1.5 nT at .5 m due to applied power. See printouts.

We then tested various objects for their DC field emissions. Loops in the power leads tended to be the biggest contributor to the DC fields. An axial lead current measuring resistor showed almost no field except that created by the input power loop. A toroid also had low DC emissions. A small shunt resistor patch (5"x5") with 1 A created almost no field in the plane of the shunt, but out of plane we measured 36 nT at 12 inches and 2 nT at 1 m. A large shunt (similar to those used on SAMPEX) produced up to 13 nT at 1 m due to a 1 A current. Again, in plane fields were near zero.

We tested the relays which Bob Snare tested at UCLA. We were able to duplicate his measurements of the relay's DC field emissions. We ran 1 A of current through various contacts of the relays and saw very little field produced.

CONCLUSIONS

The SAMPEX ACE box ETU is compatible with the DC magnetic field specification for FAST. The FAST spacecraft should be able to meet the specification with the following considerations:

--Latching relays will require special care in mounting or shielding.

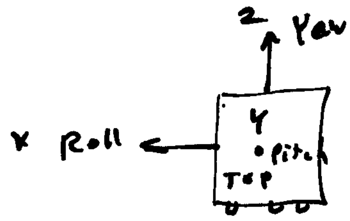
--All wiring which carries substantial current (solar array, shunt, main bus, and battery wiring) must be carefully routed to minimize loop area.

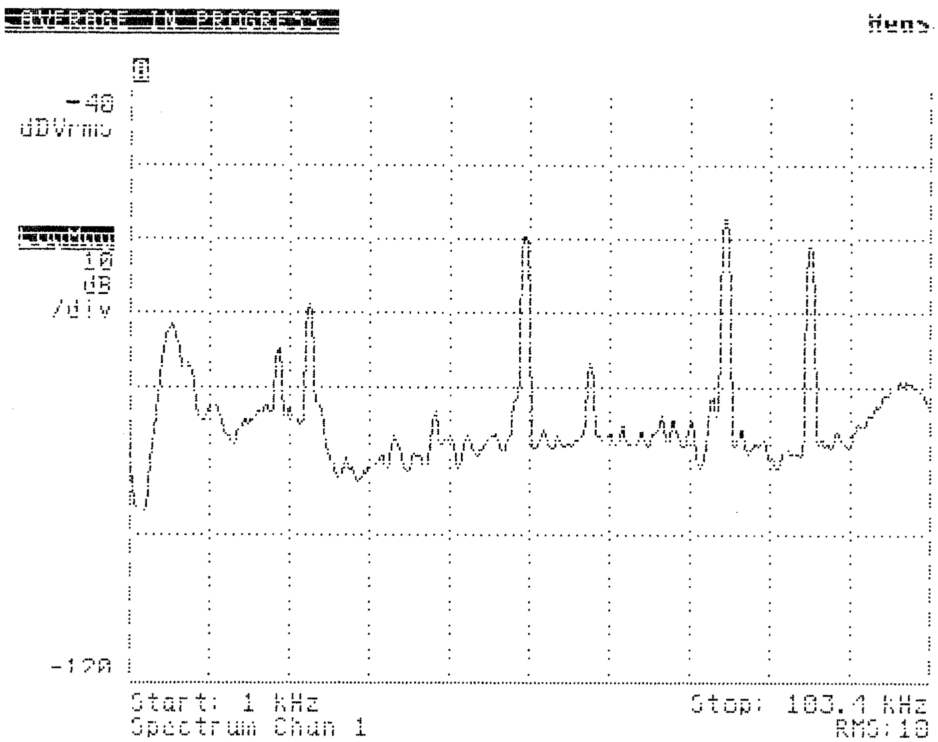
--Shunt resistors must be selected carefully, with the DC field specifications in mind. The selected shunts must be tested at the Magnetic Test Facility prior to installation.

The Magnetic Test Facility is unsuitable for AC magnetic field testing below 50 kHz (at least during the day). The magnetic test room in building 7 has good attenuation above 200 Hz and, therefore, may be a good location to perform AC magnetic field testing. We will retry our AC tests of the ACE box in the near future.

The tests above 50 kHz indicate that the DC-DC converter frequencies will definitely be a problem, but low-current, digital switching probably will not be a problem. The PI has indicated that he can live with some noise from the converters, but the converter design must minimize those emissions.

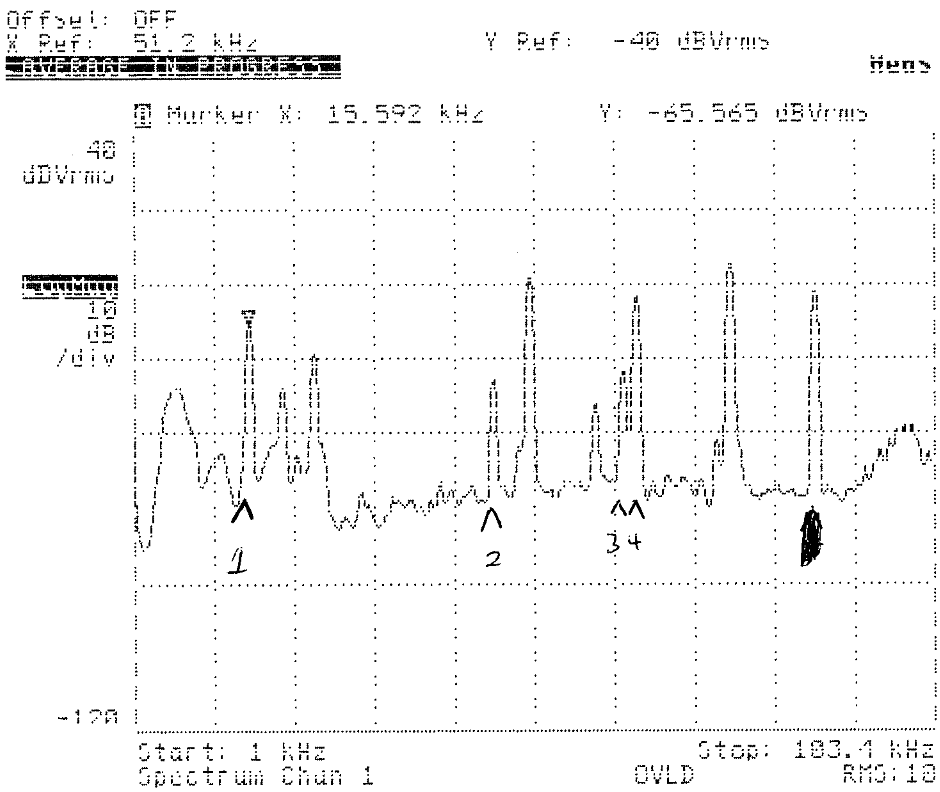
The design practices used for the SAMPEX ACE box will get us close to the FAST radiated magnetic field specification. A little extra care during layout will be required. Additionally all boxes must be tested at the ETU level and at the flight level prior to integration so that problems can be identified and corrected as early as possible.





background plot

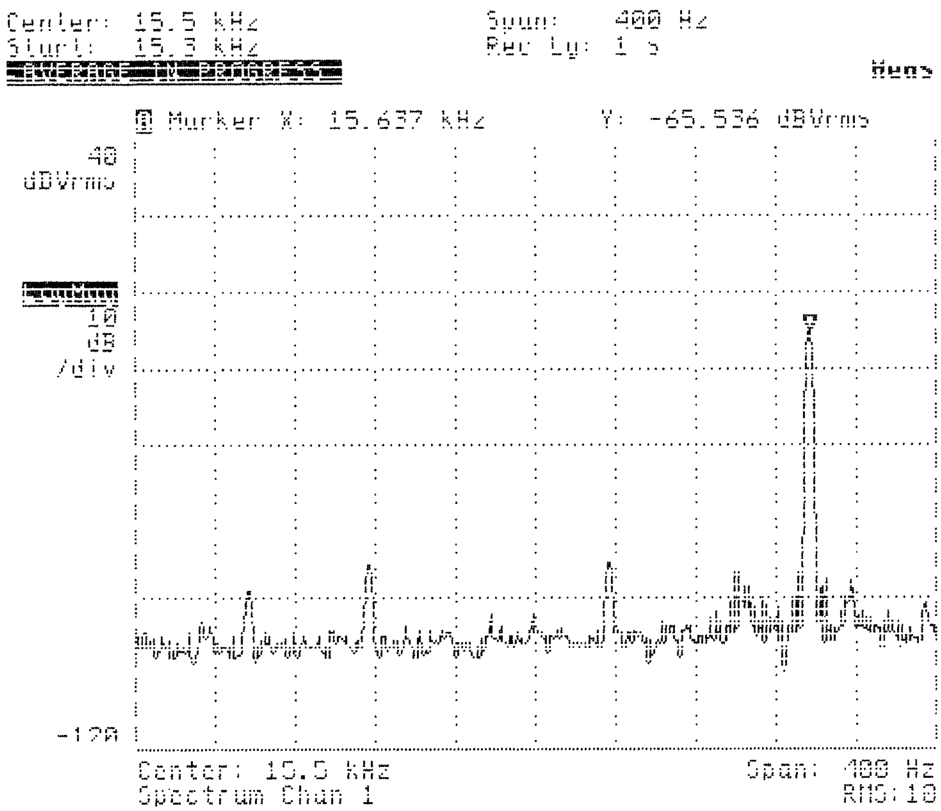
1 Meter



ACE Box ON X axis

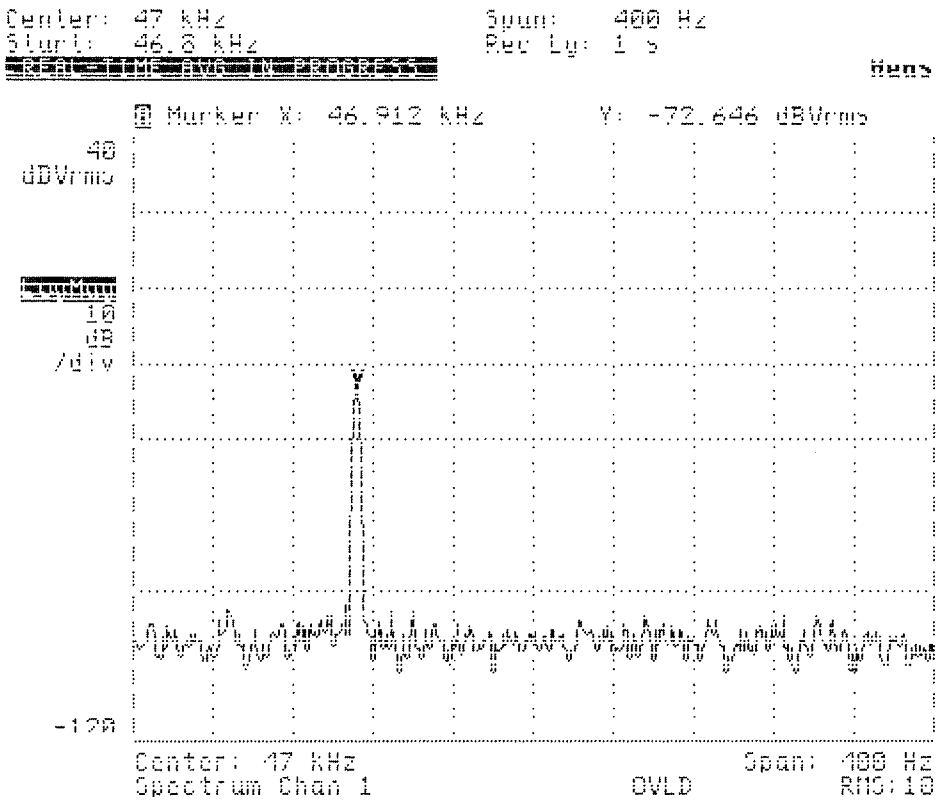
1 15.5 KHz
2 46.9 KHz
3 62 KHz
4 62 KHz
~~5 86 KHz~~

1 Meter



ACE Box ON X axis
Freq 1

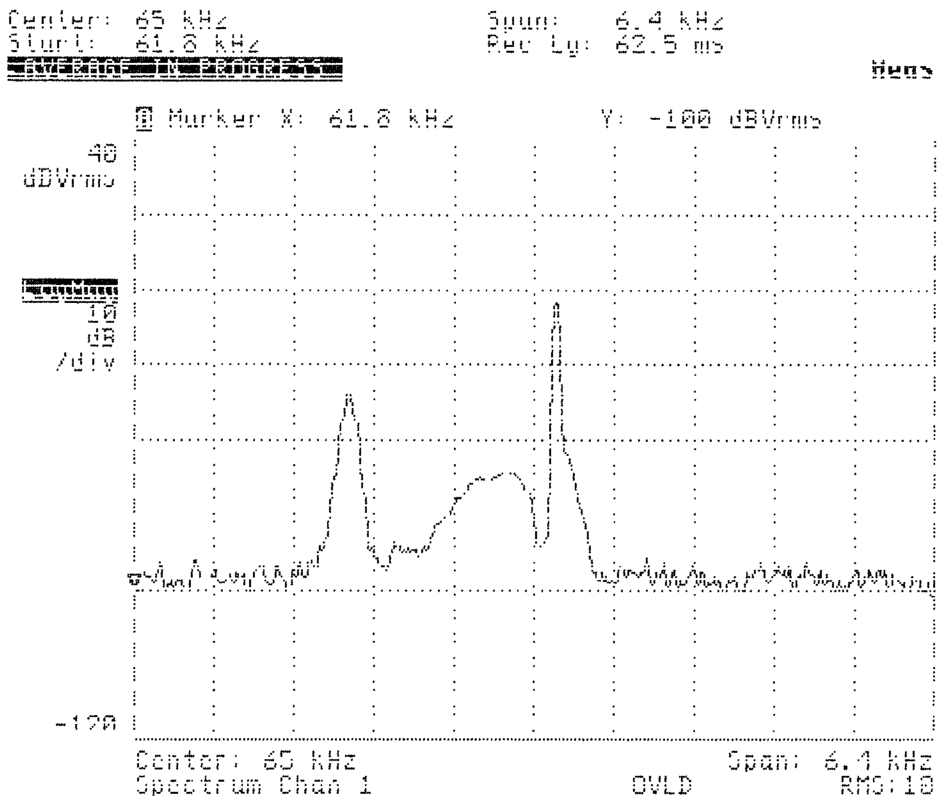
| Meter



ACE Box X axis

Freq 2

1 Meter



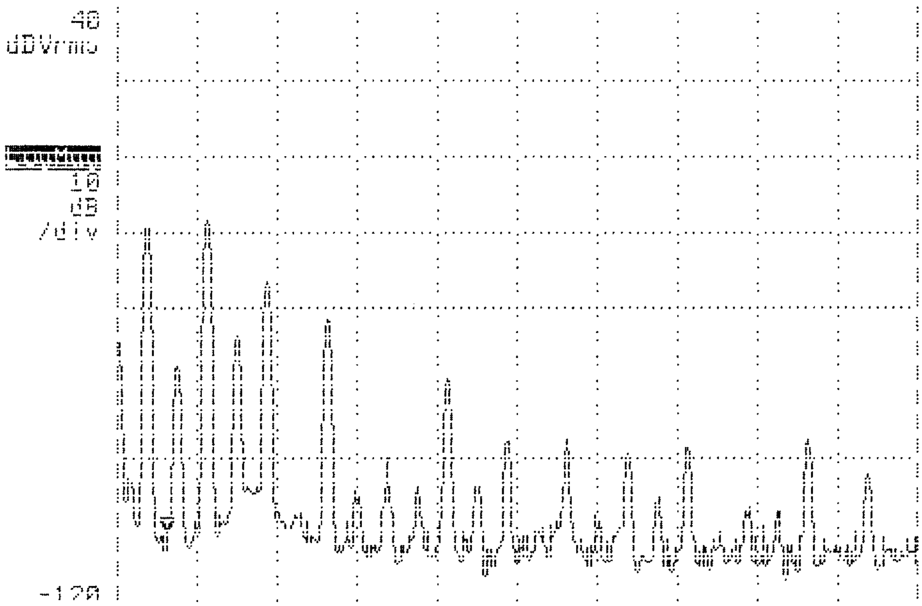
ACE Box X axis
Freq 3, 4

1 Meter

Number: 10 Update Rate: 5
Overlap: 0%
AVERAGE IN PROGRESS

Meas

Marker X: 100 Hz Y: -110.1 dBVrms

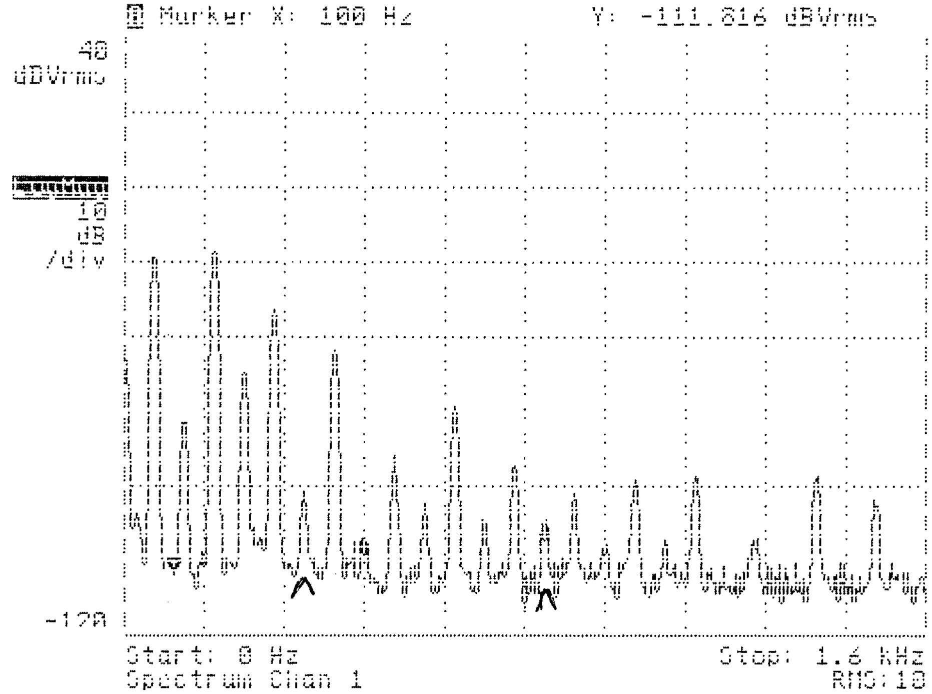


Start: 0 Hz Stop: 1.6 kHz
Spectrum Chan 1 OVLD RMS:10

ACE OFF Background

1 Meter

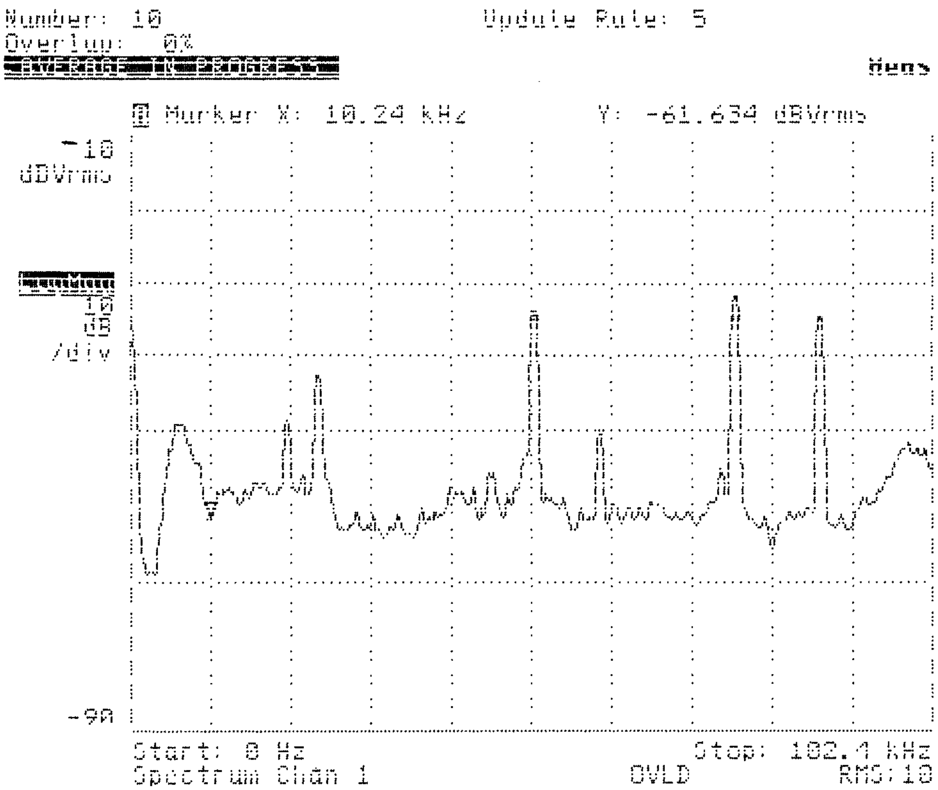
Number: 10 Update Rate: 5
Overlap: 0%
AVERAGE IN PROGRESS
Meas



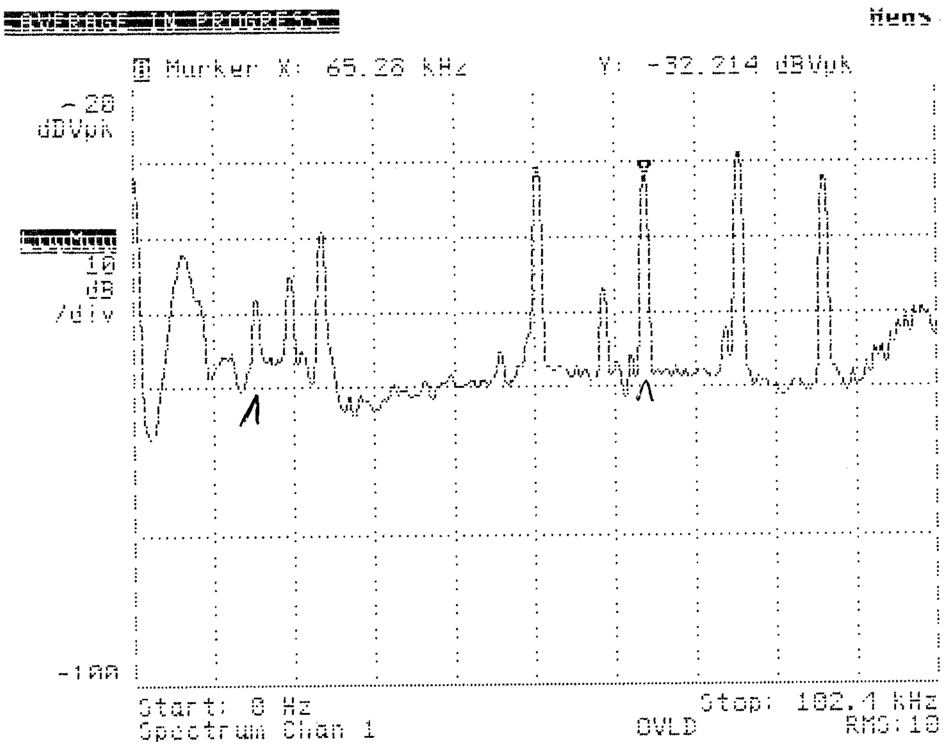
ACE ON

1 Meter

Background after reconnecting from 50Ω load
20 to 30 dB increase!

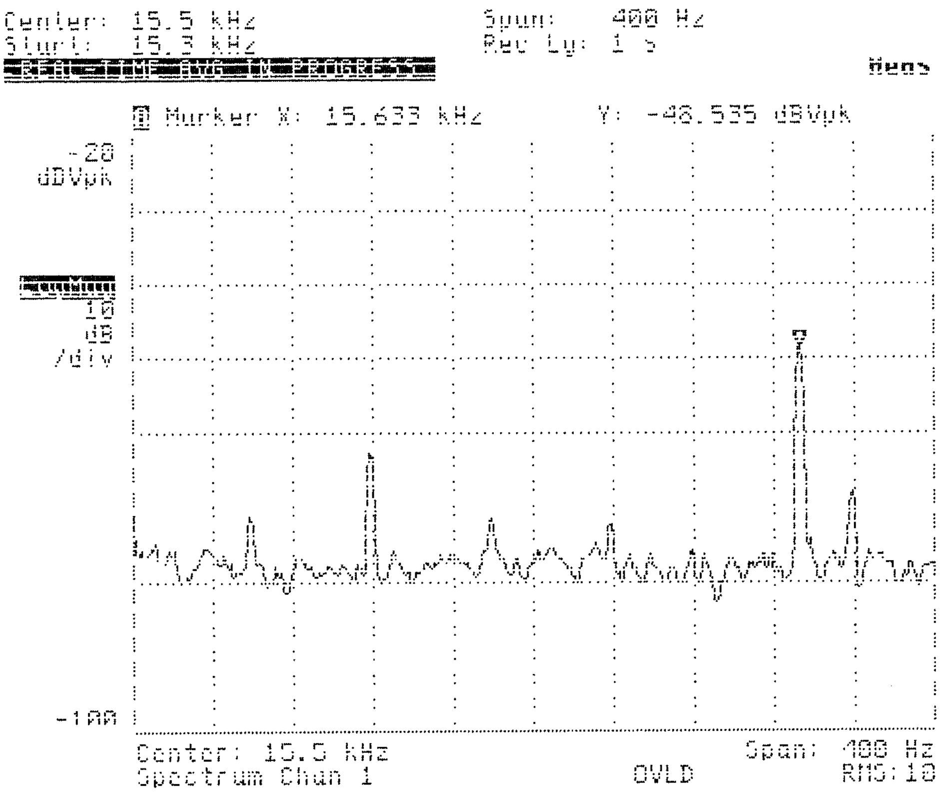


1 Meter



z-direction
power connector facing magnetometer

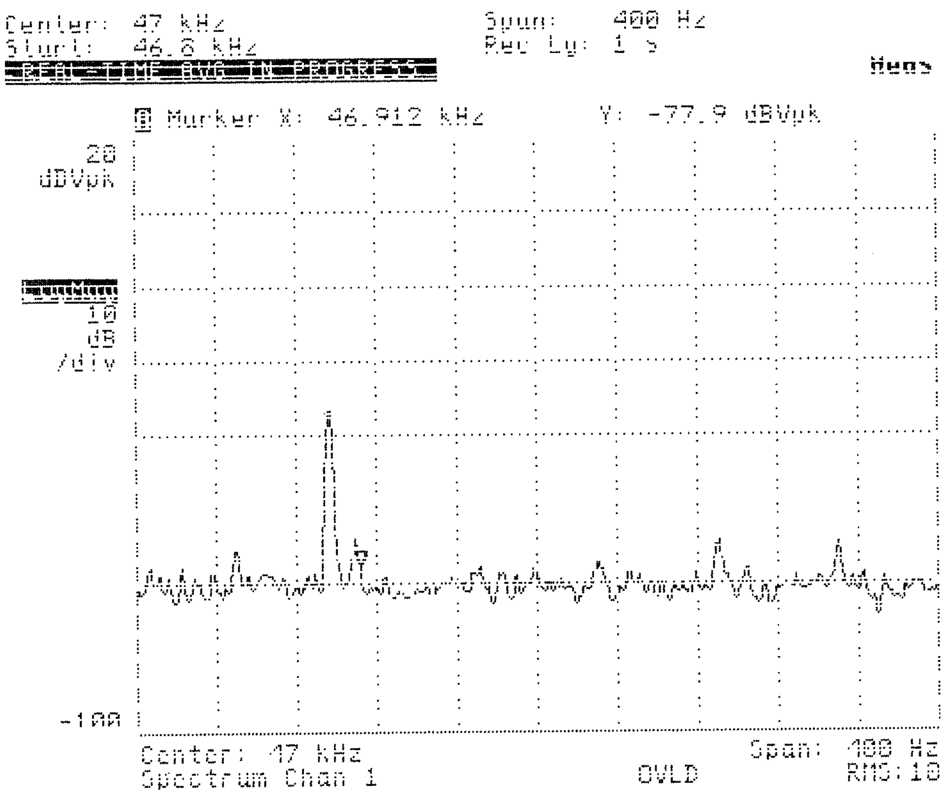
1 Meter



freq 1

Z-axis

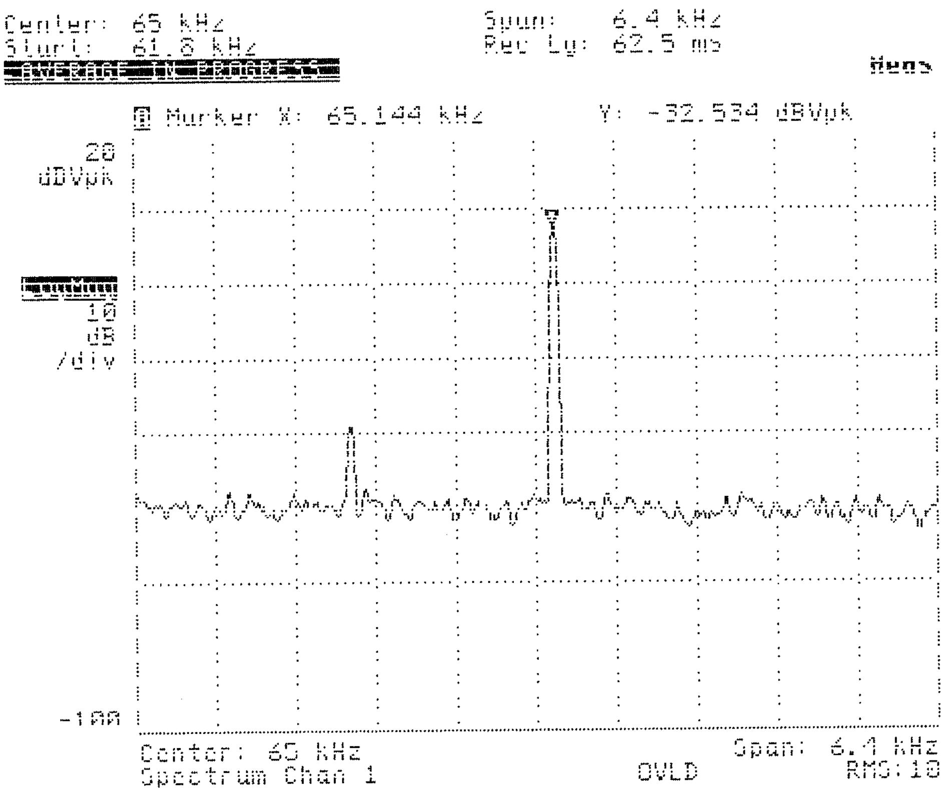
1 Meter



freq 2

z-axis

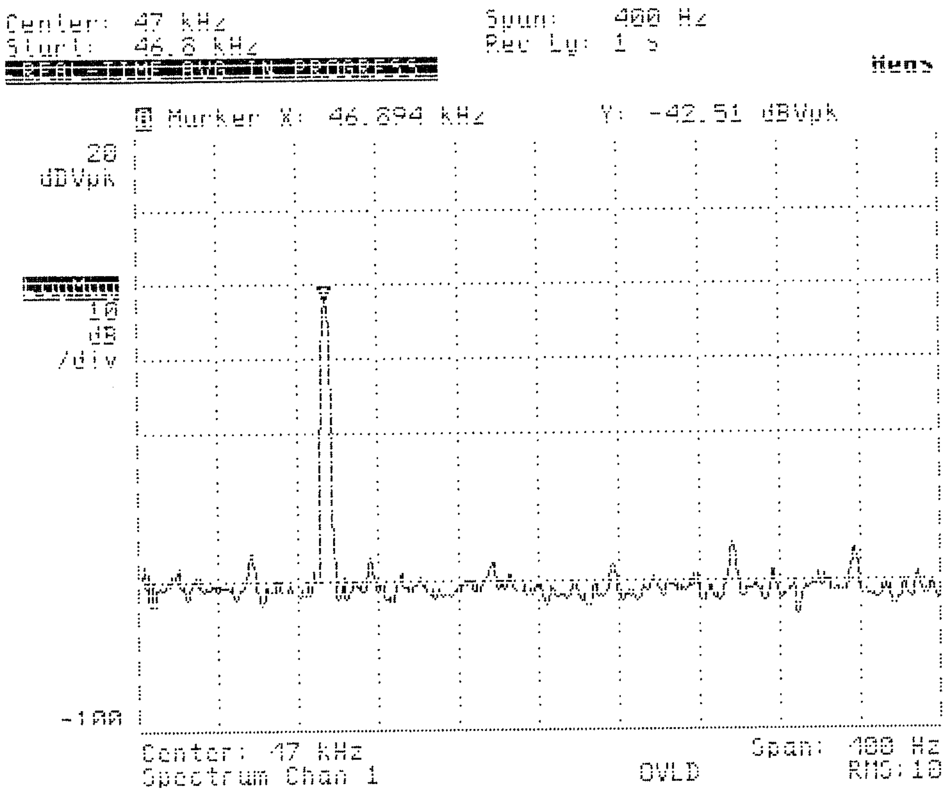
1 Meter



Z-axis

frequencies 3, 4

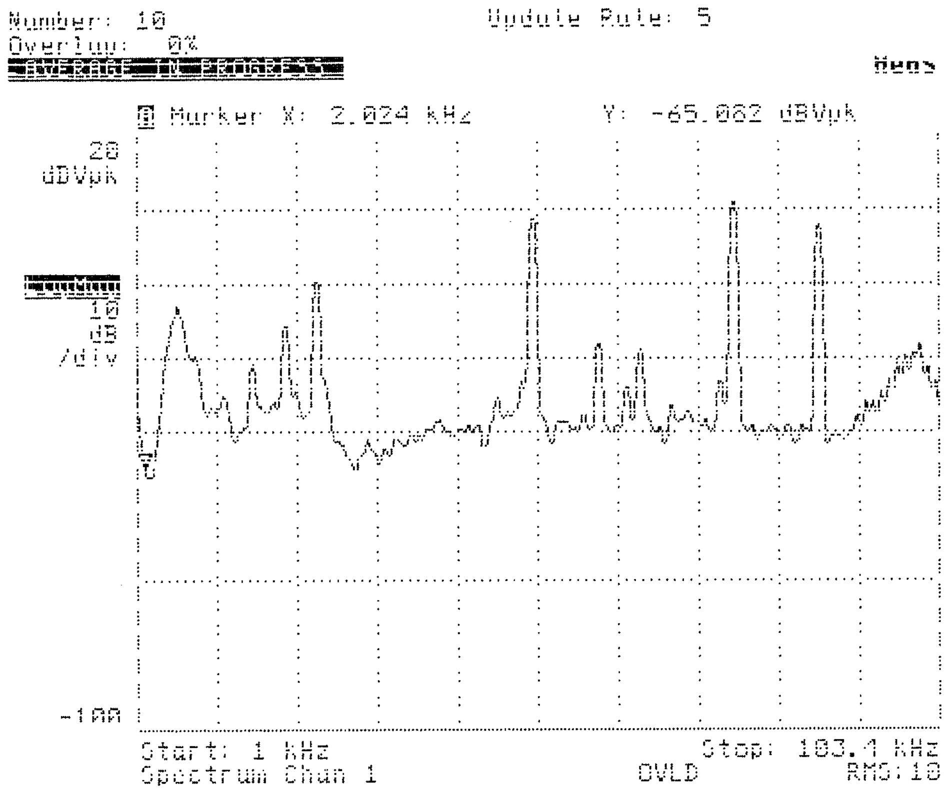
1 Meter



freq 2
x-axis retest

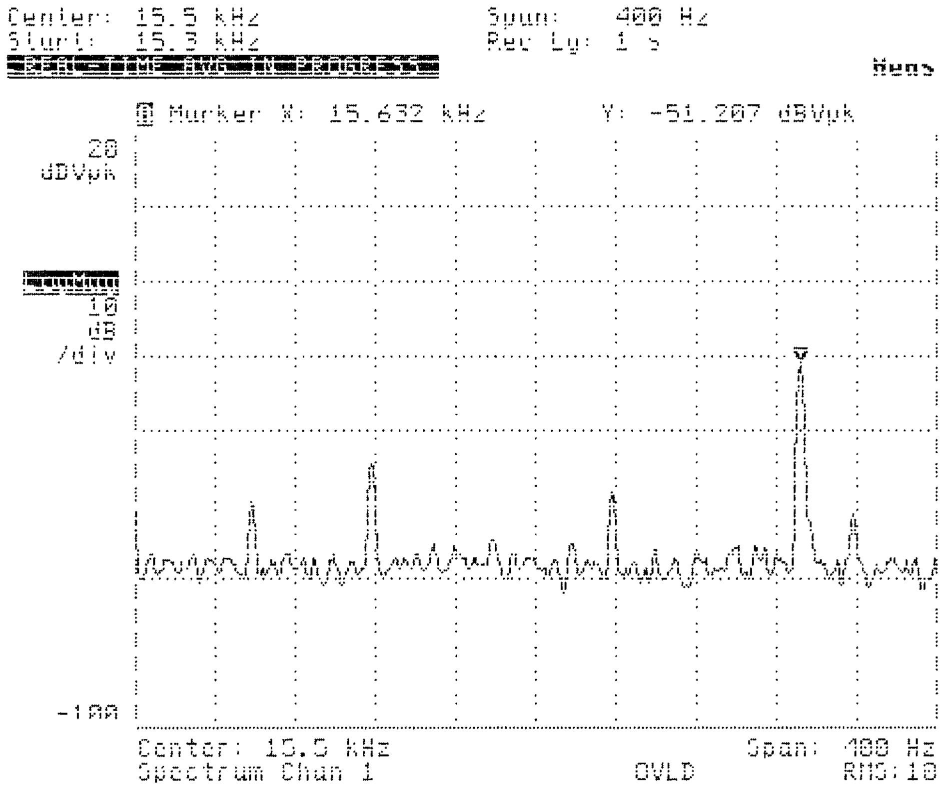
note frequency shift

1 Meter



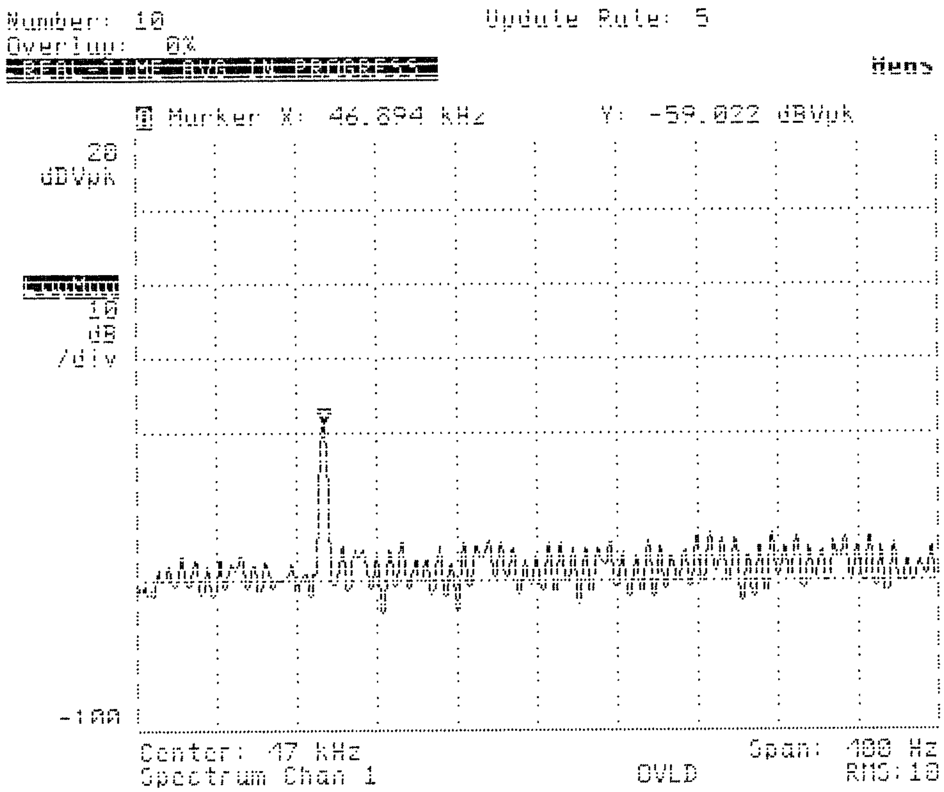
y-axis

1 Meter



Freq 1 Y axis
ACE ON

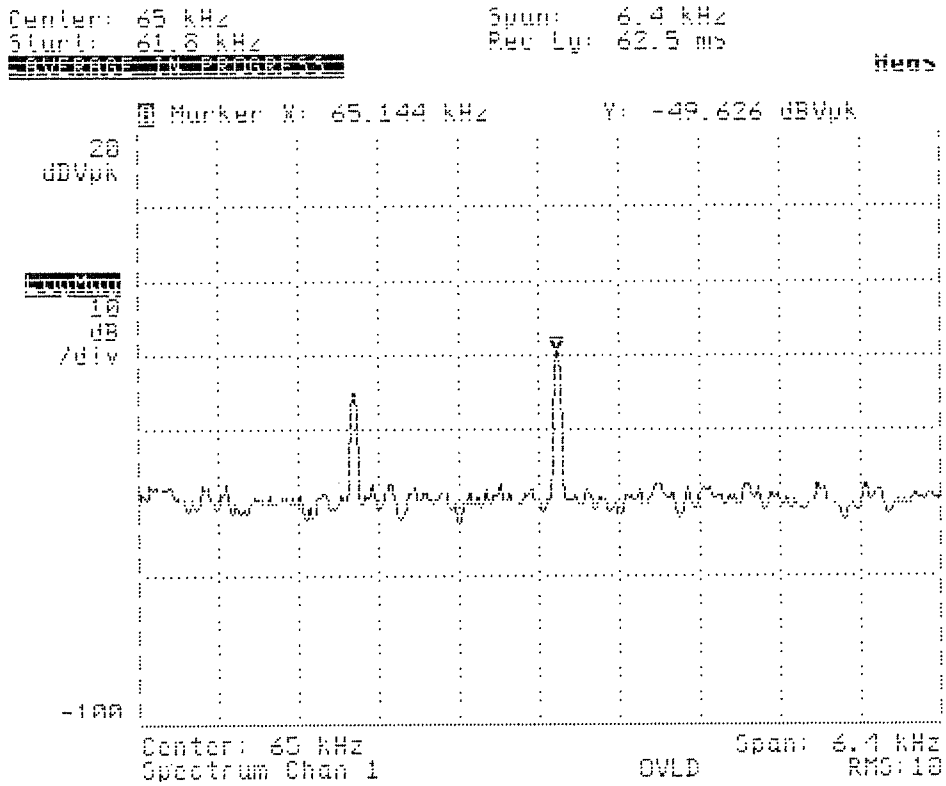
1 Meter



Freq 2

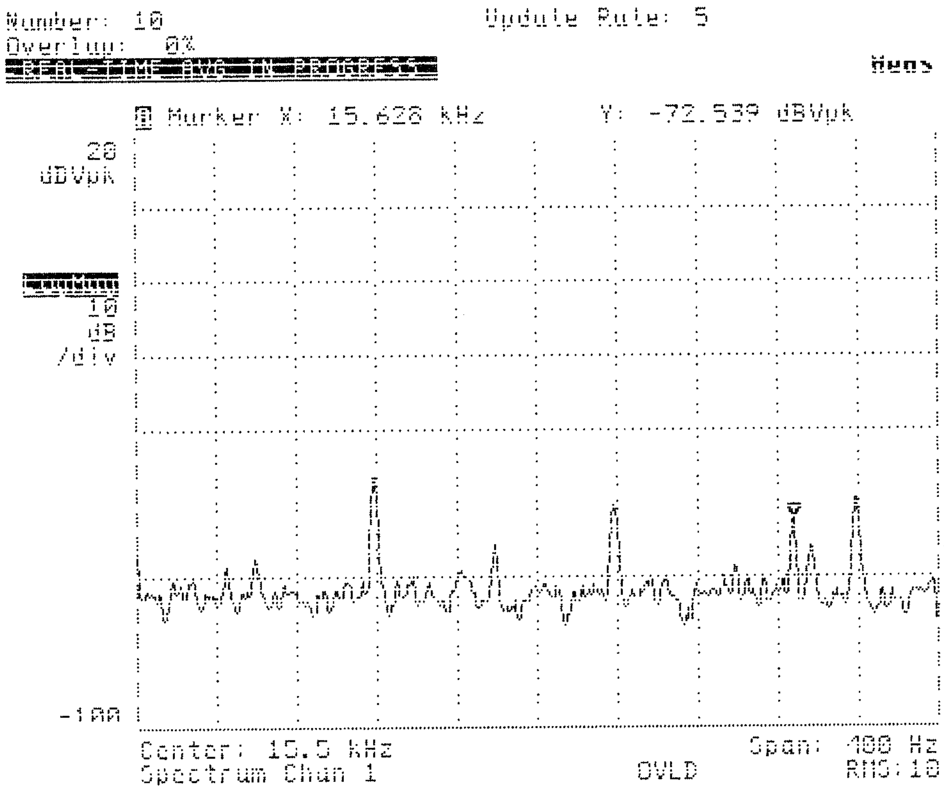
Y axis
ACE ON

1 Meter



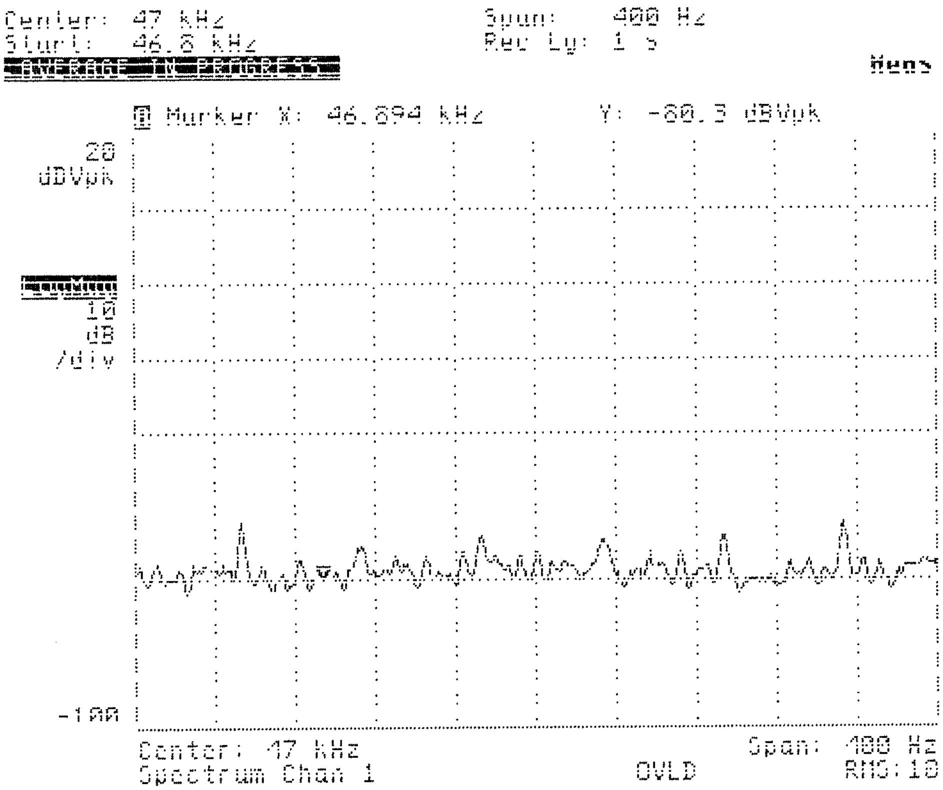
Freq 3 & 4 Y axis ACE ON

1 Meter



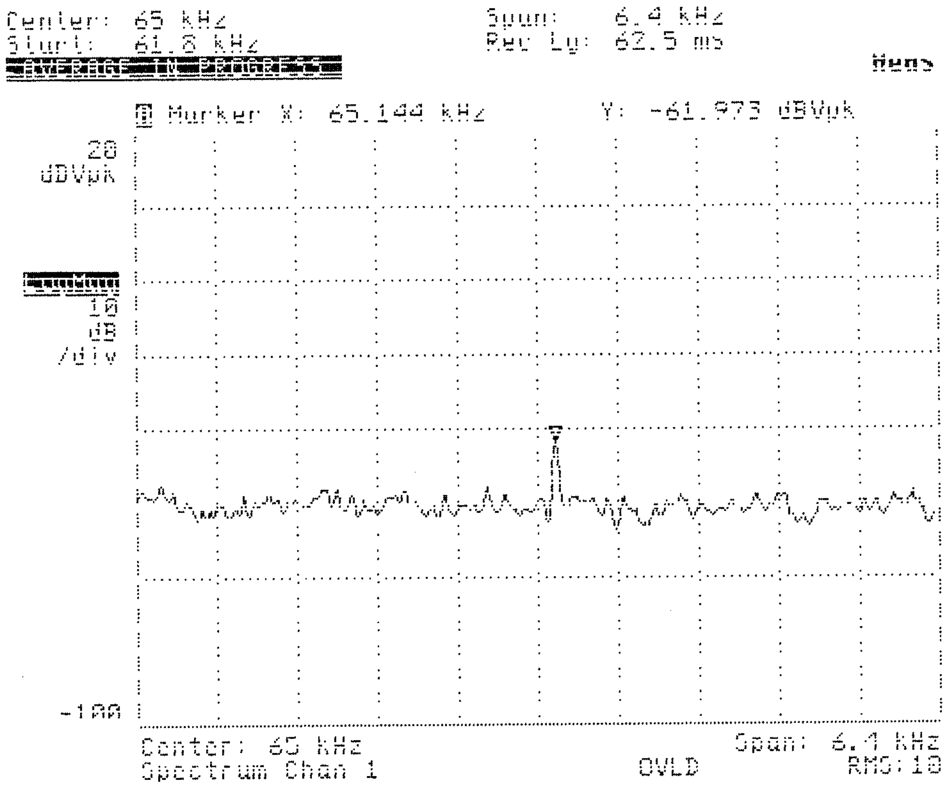
y-axis at 2m

freq 1



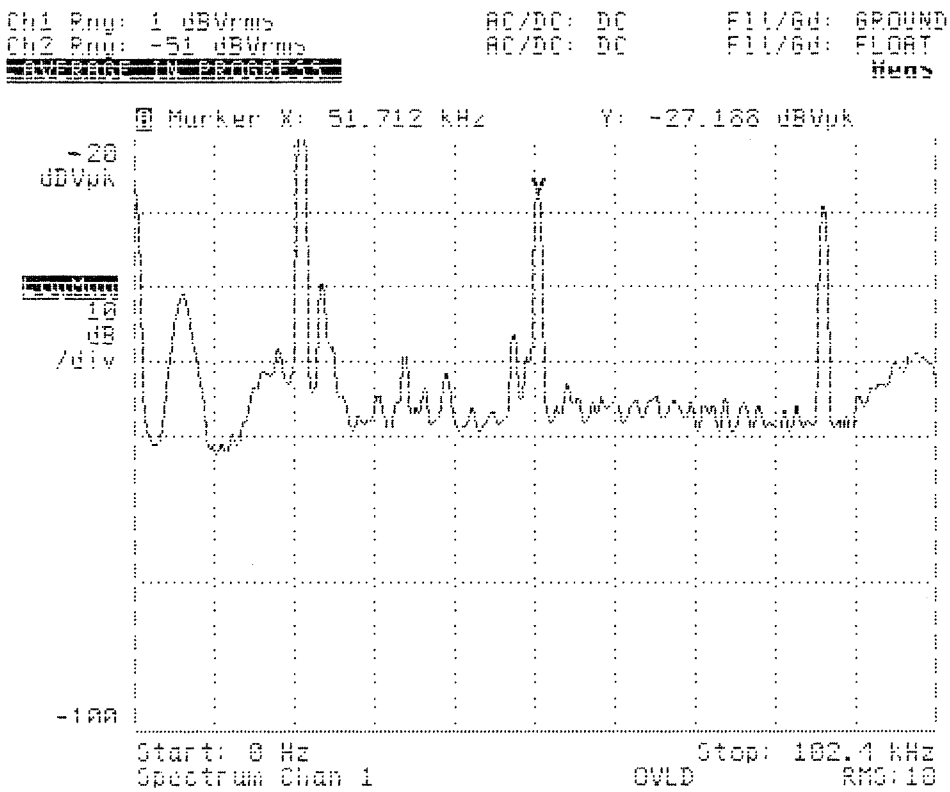
y-axis at 2m

freq 2

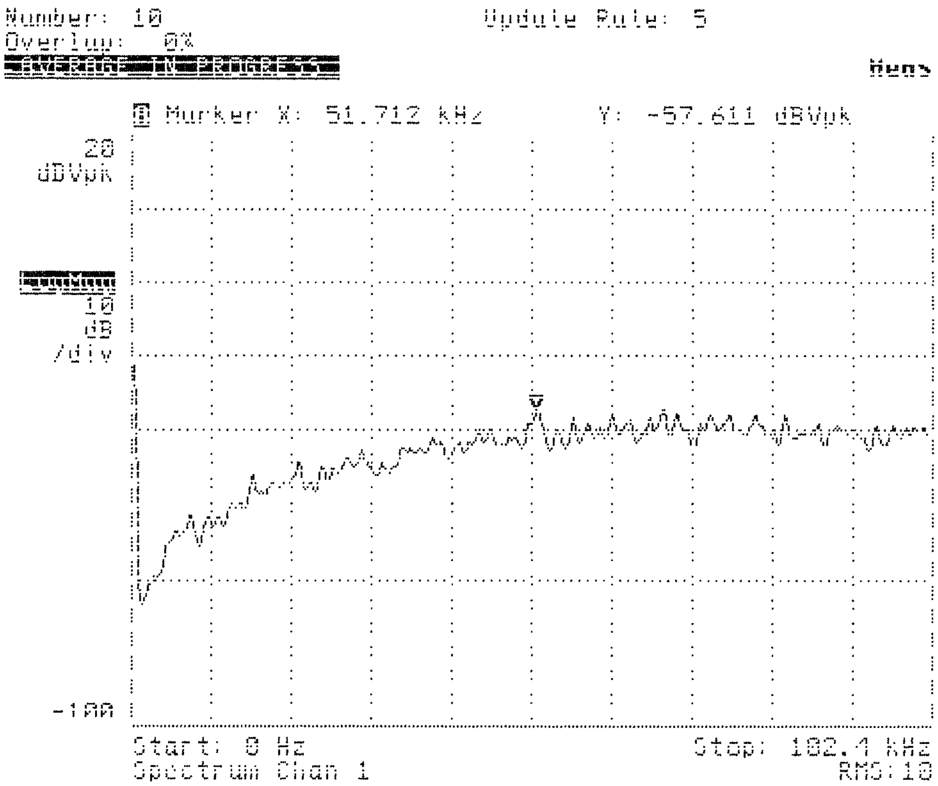


y-axis at 2 m

freq 3, 4



7/22/92
ambient



7/22/92

Magnetometer in a Can

SAMPEX ACE ETU ET/1 DATE: 07/21/92

MAGNETIZATION PROBE DISTANCE IN METERS

MAGNETIZATION
INITIAL PERM

DISTANCE (M)
PROBE 1= 1 : PROBE 2= 1.5 : PROBE 3= 2

MAGNETIC FIELD IN NANOTESLA

−Z −X Y

ANGLE	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
DATA SCANS									
0	-1.0	.8	-.9	-.2	.7	-.1	-.2	.4	-.2
10	-1.2	.7	-.9	-.4	.6	-.2	-.1	.3	-.5
20	-1.2	.7	-.8	-.1	.6	-.2	-.4	.3	-.5
30	-1.4	.7	-.8	-.4	.6	-.3	-.4	.3	-.3
40	-1.7	.6	-.8	-.3	.6	-.2	-.5	.3	-.1
50	-1.7	.5	-.8	-.6	.5	-.2	-.7	.3	-.3
60	-1.8	.3	-.8	-.4	.4	-.1	-.7	.2	-.4
70	-1.8	.2	-.8	-.9	.2	-.2	-.5	.2	-.4
80	-1.8	.1	-.9	-.6	.2	-.2	-.5	.2	-.2
90	-1.7	-.1	-.8	-.7	.1	-.1	-.3	.2	-.0
100	-1.5	-.4	-.8	-.7	.1	-.1	-.3	.1	-.2
110	-1.5	-.5	-.8	-.6	-.2	-.0	-.3	.1	-.3
120	-1.2	-.7	-.8	-.7	-.3	-.1	-.4	.1	-.2
130	-.8	-.9	-.8	-.0	-.4	-.3	-.2	.0	-.2
140	-.5	-1.0	-.9	-.1	-.3	-.0	-.3	.0	-.0
150	.1	-1.0	-.9	.0	-.5	-.1	-.0	-.0	-.2
160	.3	-1.0	-.9	0.0	-.4	-.1	-.3	.0	-.2
170	.8	-1.0	-1.0	-.1	-.5	-.2	-.0	-.0	-.3
180	1.2	-.7	-1.1	-.1	-.4	-.2	.1	-.1	-.1
190	1.3	-.6	-1.0	-.5	-.4	-.2	-.2	-.1	-.1
200	1.7	-.4	-1.0	-.3	-.4	-.1	.1	-.2	-.2
210	1.9	-.2	-1.1	.0	-.5	-.1	.1	-.2	-.3
220	1.8	-.0	-1.1	.4	-.3	-.3	.2	-.2	-.4
230	1.5	.1	-1.1	.4	-.2	-.3	.0	-.1	-.1
240	1.3	.2	-1.1	.3	-.2	-.1	-.1	-.2	-.0
250	1.1	.2	-1.2	-.1	-.2	-.1	-.1	-.2	-.1
260	.8	.3	-1.1	.2	-.3	-.2	-.0	-.1	-.3
270	.5	.2	-1.1	.1	-.2	-.1	.1	-.2	-.1
280	.3	.2	-1.1	-.2	-.3	-.2	-.1	-.2	-.0
290	.2	.2	-1.1	-.0	-.3	-.2	-.3	-.2	.1
300	-.1	.1	-1.0	-.3	-.2	-.0	-.3	-.2	-.2
310	-.3	.0	-1.1	-.9	-.3	-.2	-.2	-.2	-.1
320	-.4	0.0	-.9	-.3	-.4	-.2	-.3	-.2	0.0
330	-.4	-.1	-.9	-.3	-.5	-.2	-.1	-.2	.1
340	-.7	-.2	-.8	-.8	-.4	-.0	-.4	-.2	.1
350	-.8	-.2	-.8	-.6	-.5	-.1	-.3	-.3	-.1

TOTAL FIELD MAGNITUDE IN NANOTESLA AT:

50 CM	75 CM	100 CM
2.9328	1.1112	2.1668

DIPOLE MOMENTS IN GAUSS-CM^3

X Y Z T

SAMPEX ACE ETU ET/3 DATE: 07/21/92

~GNETIZATION

PROBE DISTANCE IN METERS

MAGNETIZATION
POST DEPERM

DISTANCE (M)
PROBE 1= 1 : PROBE 2= 1.5 : PROBE 3= 2

MAGNETIC FIELD IN NANOTESLA

ANGLE	X1 (- Z)	Y1 (- x)	Z1 (y)	X2	Y2	Z2	X3	Y3	Z3
DATA SCANS									
0	.2	-.0	-.1	.0	-.1	-.1	.5	-.2	-.2
10	.1	-.1	-.2	-.0	-.1	-.1	.4	-.3	-.1
20	.0	-.1	-.2	-.0	-.1	-.0	.4	-.3	.2
30	.0	-.1	-.1	-.0	-.1	.0	.2	-.3	.1
40	-.1	-.1	-.1	-.0	-.1	.1	.4	-.3	-.3
50	-.3	-.1	-.1	-.0	-.1	-.0	.2	-.3	-.5
60	-.6	-.1	-.2	-.0	-.1	-.1	.2	-.3	-.1
70	-.6	-.1	-.1	-.0	-.1	.1	0.0	-.3	.2
80	-.7	-.1	-.1	-.1	-.1	.2	.0	-.4	.1
90	-.7	-.1	-.1	-.0	-.1	.1	.2	-.3	-.4
100	-.7	-.1	-.1	.0	-.1	.0	.1	-.3	-.4
110	-.7	-.1	-.2	.0	-.1	-.1	.1	-.3	.2
120	-.7	-.1	-.2	-.0	-.1	.0	-.1	-.4	.5
130	-.5	-.1	-.2	-.1	-.1	.1	.1	-.5	.3
140	-.4	-.1	-.1	.0	-.1	.1	.1	-.4	-.2
150	-.2	-.1	-.2	.0	-.1	-.1	.0	-.4	-.1
160	-.0	-.1	-.2	.0	-.1	-.1	-.1	-.4	.1
170	.4	-.1	-.2	.0	-.1	-.0	.1	-.5	.2
180	.4	-.1	-.3	-.0	-.1	.1	.0	-.4	-.0
190	.5	-.1	-.3	.0	-.1	-.0	-.1	-.4	-.3
200	.6	-.1	-.2	.0	-.1	-.1	-.1	-.4	-.2
210	.7	-.1	-.3	.0	-.1	-.1	-.0	-.3	.1
220	.5	-.1	-.3	.1	-.1	-.1	.1	-.4	.1
230	.4	-.1	-.2	.0	-.1	.1	.1	-.5	.2
240	.4	-.1	-.3	.0	-.1	.0	.1	-.5	-.2
250	.4	-.1	-.3	.0	-.1	-.0	.1	-.5	-.2
260	.4	-.1	-.3	.1	-.1	-.0	.3	-.5	.2
270	.5	-.1	-.2	.0	-.1	-.1	.2	-.5	.5
280	.4	-.1	-.2	.0	-.1	.0	.1	-.5	.1
290	.4	-.1	-.3	.1	-.1	.0	.1	-.5	.0
300	.3	-.1	-.2	.1	-.1	-.0	-.1	-.5	-.1
310	.4	-.1	-.2	.1	-.1	-.1	.1	-.5	.3
320	.3	-.1	-.3	.0	-.1	-.1	.0	-.5	.4
330	.3	-.1	-.2	.1	-.1	.1	.1	-.6	.1
340	.3	-.1	-.1	.0	-.1	-.0	-.1	-.5	-.5
350	.2	-.1	-.1	.1	-.1	-.2	.1	-.4	-.4

DIPOLE MOMENTS IN GAUSS-CM^3

X	Y	Z	T
-.3	-2.9	2.1	3.6

Probe 1 = 0,5 m

STRAY MAGNETIC FIELD IN NANOTESLA 7/22/92

G.	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
ANGLE (DEGREES) 270									
PWR ON OFF	4.5	-15.5	-.9	-4.7	16.2	.1	-5.8	-.3	-5.2
PWR OFF ON	1.2	.4	.9	.3	-.1	-.2	-.4	0.0	-.6
PWR OFF ON	1.3	.3	.7	.8	-.2	-.2	.7	0.0	1.9

STRAY MAGNETIC FIELD IN NANOTESLA 7/22/92

B.G.	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
ANGLE (DEGREES) 180									
PWR ON	14.2	-15.6	-3.2	-3.3	15.3	.5	9.8	.4	34.9
PWR OFF	-.1	.2	-1.1	-.6	.2	-.1	.9	0.0	2.0
PWR OFF	0.0	.1	-1.3	0.0	0.0	-.1	.9	0.0	2.0

STRAY MAGNETIC FIELD IN NANOTESLA 7/22/92

B.G.	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
	ANGLE (DEGREES)		90						
PWR ON									
	8.3	-16.1	-.4	.9	15.3	0.0	7.0	.1	22.9
PWR OFF	-1.2	-.2	-.8	.7	-.1	-.1	.5	0.0	1.1
PWR OFF	-1.2	-.2	-.9	2.1	-.2	-.1	-.2	-.1	-.8

STRAY MAGNETIC FIELD IN NANOTESLA 7/22/92

B.G.	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
	ANGLE (DEGREES)		0						
PWR ON									
	2.8	-17.8	2.3	.9	14.9	.7	5.7	-.2	18.8
PWR OFF	1.7	2.6	-2.6	.9	.1	-.1	.6	.1	1.0
IR OFF	1.8	2.5	-2.9	1.3	.1	-.3	.8	.1	1.5

SAMPEX ACE ETU ET/1 DATE: 07/21/92

GNETIZATION

PROBE DISTANCE IN METERS

MAGNETIZATION
INITIAL PERM

DISTANCE (M)
PROBE 1= 1 : PROBE 2= 1.5 : PROBE 3= 2

MAGNETIC FIELD IN NANOTESLA

-Z -X Y

ANGLE	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
DATA SCANS									
0	-1.0	.8	-.9	-.2	.7	-.1	-.2	.4	-.2
10	-1.2	.7	-.9	-.4	.6	-.2	-.1	.3	-.5
20	-1.2	.7	-.8	-.1	.6	-.2	-.4	.3	-.5
30	-1.4	.7	-.8	-.4	.6	-.3	-.4	.3	-.3
40	-1.7	.6	-.8	-.3	.6	-.2	-.5	.3	-.1
50	-1.7	.5	-.8	-.6	.5	-.2	-.7	.3	-.3
60	-1.8	.3	-.8	-.4	.4	-.1	-.7	.2	-.4
70	-1.8	.2	-.8	-.9	.2	-.2	-.5	.2	-.4
80	-1.8	.1	-.9	-.6	.2	-.2	-.5	.2	-.2
90	-1.7	-.1	-.8	-.7	.1	-.1	-.3	.2	-.0
100	-1.5	-.4	-.8	-.7	.1	-.1	-.3	.1	-.2
110	-1.5	-.5	-.8	-.6	-.2	-.0	-.3	.1	-.3
120	-1.2	-.7	-.8	-.7	-.3	-.1	-.4	.1	-.2
130	-.8	[illegible]	-.8	-.0	-.4	-.3	-.2	.0	-.2
140	-.5	-1.0	-.9	-.1	-.3	-.0	-.3	.0	-.0
50	.1	-1.0	-.9	.0	-.5	-.1	-.0	-.0	-.2
160	.3	-1.0	-.9	0.0	-.4	-.1	-.3	.0	-.2
170	.8	-1.0	-1.0	-.1	-.5	-.2	-.0	-.0	-.3
180	1.2	-.7	-1.1	-.1	-.4	-.2	.1	-.1	-.1
190	1.3	-.6	-1.0	-.5	-.4	-.2	-.2	-.1	-.1
200	1.7	-.4	-1.0	-.3	-.4	-.1	.1	-.2	-.2
210	1.9	-.2	-1.1	.0	-.5	-.1	.1	-.2	-.3
220	1.8	-.0	-1.1	.4	-.3	-.3	.2	-.2	-.4
230	1.5	.1	-1.1	.4	-.2	-.3	.0	-.1	-.1
240	1.3	.2	-1.1	.3	-.2	-.1	-.1	-.2	-.0
250	1.1	.2	-1.2	-.1	-.2	-.1	-.1	-.2	-.1
260	.8	.3	-1.1	.2	-.3	-.2	-.0	-.1	-.3
270	.5	.2	-1.1	.1	-.2	-.1	.1	-.2	-.1
280	.3	.2	-1.1	-.2	-.3	-.2	-.1	-.2	-.0
290	.2	.2	-1.1	-.0	-.3	-.2	-.3	-.2	.1
300	-.1	.1	-1.0	-.3	-.2	-.0	-.3	-.2	-.2
310	-.3	.0	-1.1	-.9	-.3	-.2	-.2	-.2	-.1
320	-.4	0.0	-.9	-.3	-.4	-.2	-.3	-.2	0.0
330	-.4	-.1	-.9	-.3	-.5	-.2	-.1	-.2	.1
340	-.7	-.2	-.8	-.8	-.4	-.0	-.4	-.2	.1
350	-.8	-.2	-.8	-.6	-.5	-.1	-.3	-.3	-.1

TOTAL FIELD MAGNITUDE IN NANOTESLA AT:

50 CM	75 CM	100 CM
2.9328	1.1112	2.1668

DIPOLE MOMENTS IN GAUSS-CM^3

X Y Z T

SAMPEX ACE ETU ET/3 DATE: 07/21/92

GNETIZATION

PROBE DISTANCE IN METERS

MAGNETIZATION
POST DEPERM

DISTANCE (M)
PROBE 1= 1 : PROBE 2= 1.5 : PROBE 3= 2

MAGNETIC FIELD IN NANOTESLA

ANGLE	X1 (-Z)	Y1 (-x)	Z1 (y)	X2	Y2	Z2	X3	Y3	Z3
DATA SCANS									
0	.2	-.0	-.1	.0	-.1	-.1	.5	-.2	-.2
10	.1	-.1	-.2	-.0	-.1	-.1	.4	-.3	-.1
20	.0	-.1	-.2	-.0	-.1	-.0	.4	-.3	.2
30	.0	-.1	-.1	-.0	-.1	.0	.2	-.3	.1
40	-.1	-.1	-.1	-.0	-.1	.1	.4	-.3	-.3
50	-.3	-.1	-.1	-.0	-.1	-.0	.2	-.3	-.5
60	-.6	-.1	-.2	-.0	-.1	-.1	.2	-.3	-.1
70	-.6	-.1	-.1	-.0	-.1	.1	0.0	-.3	.2
80	-.7	-.1	-.1	-.1	-.1	.2	.0	-.4	.1
90	-.7	-.1	-.1	-.0	-.1	.1	.2	-.3	-.4
100	-.7	-.1	-.1	.0	-.1	.0	.1	-.3	-.4
110	-.7	-.1	-.2	.0	-.1	-.1	.1	-.3	.2
120	-.7	-.1	-.2	-.0	-.1	.0	-.1	-.4	.5
130	-.5	-.1	-.2	-.1	-.1	.1	.1	-.5	.3
140	-.4	-.1	-.1	.0	-.1	.1	.1	-.4	-.2
150	-.2	-.1	-.2	.0	-.1	-.1	.0	-.4	-.1
160	-.0	-.1	-.2	.0	-.1	-.1	-.1	-.4	.1
170	.4	-.1	-.2	.0	-.1	-.0	.1	-.5	.2
180	.4	-.1	-.3	-.0	-.1	.1	.0	-.4	-.0
190	.5	-.1	-.3	.0	-.1	-.0	-.1	-.4	-.3
200	.6	-.1	-.2	.0	-.1	-.1	-.1	-.4	-.2
210	.7	-.1	-.3	.0	-.1	-.1	-.0	-.3	.1
220	.5	-.1	-.3	.1	-.1	-.1	.1	-.4	.1
230	.4	-.1	-.2	.0	-.1	.1	.1	-.5	.2
240	.4	-.1	-.3	.0	-.1	.0	.1	-.5	-.2
250	.4	-.1	-.3	.0	-.1	-.0	.1	-.5	-.2
260	.4	-.1	-.3	.1	-.1	-.0	.3	-.5	.2
270	.5	-.1	-.2	.0	-.1	-.1	.2	-.5	.5
280	.4	-.1	-.2	.0	-.1	.0	.1	-.5	.1
290	.4	-.1	-.3	.1	-.1	.0	.1	-.5	.0
300	.3	-.1	-.2	.1	-.1	-.0	-.1	-.5	-.1
310	.4	-.1	-.2	.1	-.1	-.1	.1	-.5	.3
320	.3	-.1	-.3	.0	-.1	-.1	.0	-.5	.4
330	.3	-.1	-.2	.1	-.1	.1	.1	-.6	.1
340	.3	-.1	-.1	.0	-.1	-.0	-.1	-.5	-.5
350	.2	-.1	-.1	.1	-.1	-.2	.1	-.4	-.4

DIPOLE MOMENTS IN GAUSS-CM^3

X	Y	Z	T
-.3	-2.9	2.1	3.6

STRAY MAGNETIC FIELD IN NANOTESLA 7/22/92

ANGLE (DEGREES) 270

B.G.	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
PWR ON	4.5	-15.5	-.9	-4.7	16.2	.1	-5.8	-.3	-5.2
PWR OFF	1.2	.4	.9	.3	-.1	-.2	-.4	0.0	-.6
PWR OFF	1.3	.3	.7	.8	-.2	-.2	.7	0.0	1.9

STRAY MAGNETIC FIELD IN NANOTESLA 7/22/92

ANGLE (DEGREES) 180

B.G.	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
PWR ON	14.2	-15.6	-3.2	-3.3	15.3	.5	9.8	.4	34.9
PWR OFF	-.1	.2	-1.1	-.6	.2	-.1	.9	0.0	2.0
PWR OFF	0.0	.1	-1.3	0.0	0.0	-.1	.9	0.0	2.0

STRAY MAGNETIC FIELD IN NANOTESLA 7/22/92

ANGLE (DEGREES) 90

B.G.	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
PWR ON	8.3	-16.1	-.4	.9	15.3	0.0	7.0	.1	22.9
PWR OFF	-1.2	-.2	-.8	.7	-.1	-.1	.5	0.0	1.1
PWR OFF	-1.2	-.2	-.9	2.1	-.2	-.1	-.2	-.1	-.8

FAST MAGNETIC CALIBRATION TEST SUMMARY:

- ACE BOX ETU PERMANENT FIELD FOUND TO BE COMPATIBLE WITH FAST SPECIFICATIONS.

- THE MUE SHOULD BE COMPATIBLE WITH FAST DC MAGNETIC SPECIFICATIONS WITH THE FOLLOWING EXCEPTIONS:
  - PERMANENT MAGNETISM OF LATCHING RELAYS.
  - WIRE LOOPS IN MUE SOLAR ARRAY AND SHUNT WIRING.

- SPECIAL CARE MUST BE EXCERSIZED FOR ALL SOLAR ARRAY AND SHUNT WIRING IN THE MUE TO MEET FAST DC MAGNETIC SPECIFICATIONS.

- SPECIAL CARE IN MOUNTING OR SHIELDING OF THE LATCHING RELAYS MUST BE USED TO REDUCE DC FIELD TO THE FAST SPECIFICATION.

- THE SHUNT RESISTORS USED ON SAMPEX WERE FOUND TO PRODUCE EXCESSIVE MAGNETIC FIELDS. FAST SHUNT RESISTORS AND HEATER ELEMENTS MUST BE SPECIFIED TO MEET FAST REQUIREMENTS AND TESTED AT MAGNETIC CALIBRATION FACILITY.

- THE NOISE FLOOR AT THE MAGNETIC CALIBRATION SITE IS NOT LOW ENOUGH IN THE 0 TO 50 KHZ RANGE TO ALLOW FOR INTERFERENCE TESTING OF THE AC MAGNETOMETER.

- MEASUREMENTS TAKEN FROM 50 TO 100 KHZ WITH THE SAMPEX ACE BOX ETU WERE ENCOURAGING. ONLY THREE FREQUENCIES VIOLATED THE FAST SPECIFICATION.

- ANOTHER TEST SITE MUST BE FOUND WHICH WILL ALLOW FOR INTERFERENCE TESTING OF THE ETU UNITS AND THE FLIGHT SPACECRAFT WITH THE FAST AC MAGNETOMETER.