F: Acceptance Test Procedure

Transponder Landing System
Tactical Transponder Landing System

Advanced Navigation
& Positioning Corporation

GTU TEST PROCEDURE

DOCUMENT# 920-00101-070

Approved:	____________________	**Date:**	____________________
Name:	____________________	**Title:**	____________________

ENGINEERING CHANGE ORDER RECORD

GTU TEST PROCEDURE

Document# 920-00101-070

REVISION LEVEL	ISSUE DATE	REVISION DESCRIPTION	ECO #
		INITIAL RELEASE	

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ACRONYMS AND ABBREVIATIONS

ANPC	Advanced Navigation & Positioning Corporation
FAA	Federal Aviation Administration
TLS	Transponder Landing System and variants
TTLS	Transportable Transponder Landing System

Scope

This procedure provides for the setup and performance validation of the TLS Guidance Transmitter Unit (GTU) (ANPC P/N 920-00101).

3. TEST PROCEDURE

3.1 Visual Inspection

Prior to the application of power, visually inspect the GTU for complete and proper connections and good workmanship. Indicate completed inspection on the test data sheet.

3.2 Calibration of Test Cables

3.2.1 Connect localizer test cables per *Figure 1.*

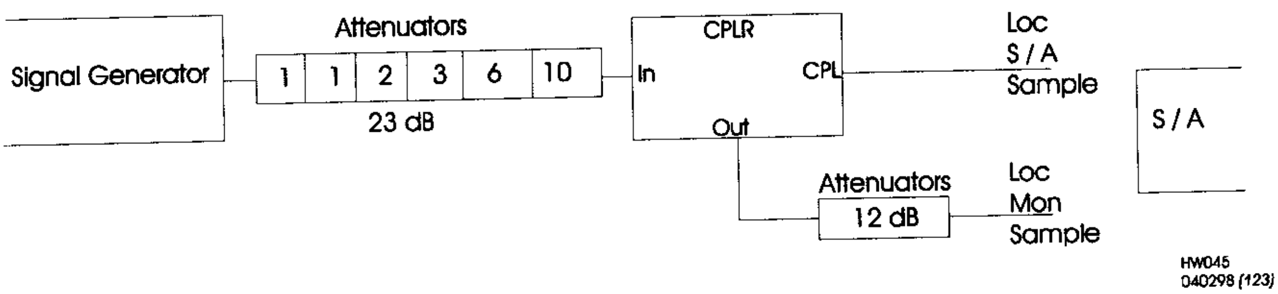


Figure 1

3.2.2 Verify carrier off on Signal Generator until S/A settings are verified. Set Signal Generator at 110 MHz 0 dBm. Measure and record the Loc S/A Sample and Localizer Monitor Sample power levels with the Spectrum Analyzer.

3.2.3 Calculate

3.2.4 Connect GS test cables per *Figure 2.*

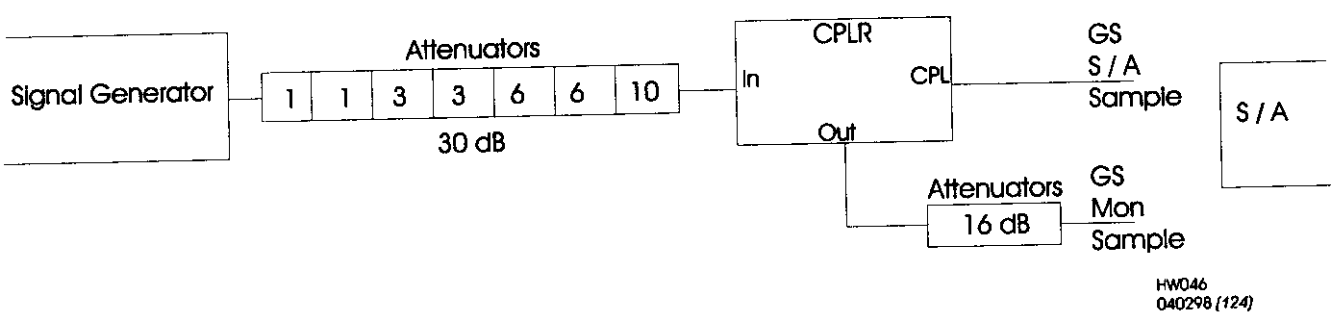


Figure 2

3.2.5 Set Signal Generator at 332 MHz 0 dBm. Measure and record the GS S/A Sample and GS Monitor Sample power levels with the Spectrum Analyzer.

3.2.6 Calculate

3.3 DC POWER FORMS

Apply AC power to the GTU. Turn the front panel power switch to the ON position.

3.3.1 Verify and indicate on the data sheet that the power ON indicator lights, and that both fans run.

3.3.2 Use test harness to enable 24V supply. Using a DMM, measure and record the voltages at the Power Supply DC connector. Verify that each power is within 2% of its expected value. Measure the +12V at the power pin of the Frequency Synthesizer .

3.4 LOCALIZER POWER / SDM SETTINGS

3.4.1 Connect test setup per *Figure 3.*

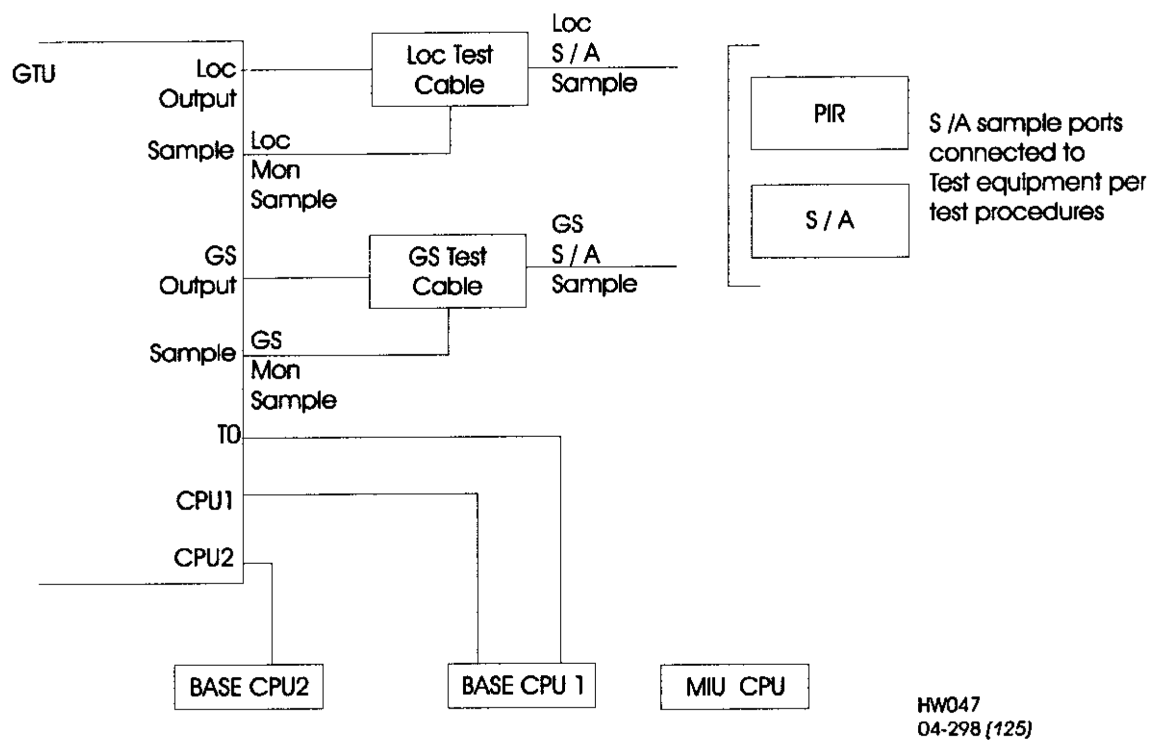


Figure 3

3.4.2 Connect the LOC S/A Sample to the PIR. Set the PIR to the Channel of test, Normal, SDM.

3.4.3 On the Localizer Transmitter Assembly, (ANPC P/N 920-00103), adjust the GAIN potentiometer fully clockwise (20 turn potentiometer).

3.4.4 Initiate test software by following the:

a. Stop all base station Software
b. On CPU1, run "ulCal_base".
c. On CPU2, run "ulCal_base" by double clicking on the desktop shortcut of the same name.
d. On MIU, run MIU
e. On MIU interface "Tools" pulldown, select GTU Test.
f. In the Control Field, enable the Localizer enable "button".
g. In the Control Field, enable Localizer reset "button". Note that this reset is a "rising edge" reset and will have to be cycled if it is required to reset the transmitter. At this point, the Transmitter Status indicators should indicate both ON and SWR OK, and there should be non-zero numbers in the Monitor Carrier 90 Hz and 150 Hz fields.

With the transmitter enabled, let the transmitter warm up for 15 minutes.

3.4.5 Adjust the Loc Gain potentiometer CCW until the SDM reads 39.5% as read on the PIR.

3.4.6 Move the Loc S/A Sample to the Spectrum Analyzer.

Center = Channel of Choice   Ref Value +10 dBm
SPAN = 2.4 KHz
RBW = AUTO
VBW = 3 Hz

3.4.7 Calculate desired carrier power = 24 – Localizer S/A Sample setup loss of paragraph 3.2.3. Record desired carrier power.

3.4.8 Adjust the Localizer Gain potentiometer so that the carrier power matches the desired value. Record value.

3.4.9 By moving the Localizer S/A sample to the PIR and the S/A, adjust the GAIN potentiometer such that the SDM is 40 ± 0.5%, and the carrier power is the desired value ± 1 dB. Record final % mod and power levels.

3.4.10 Turn the transmitter power off and put the test enable cable in power supply J1 (enables 24V). Turn Transmitter ON. Do NOT enable the transmitter with the SW interface.

3.4.11 Move the Localizer S/A Sample to the S/A.

Center = Channel of Choice
SPAN = 1 MHz
Ref level = -50 dBm
RBW = 300 Hz

3.4.12 Adjust the XMTR NULL potentiometer to minimize the signal. This nulled signal shall be a minimum of 40 dB below the "enabled" carrier level. Record the peak value. Make sure that any oscillations are tuned out.

3.4.13 Turn power off. Replace regular cable at power supply.

3.4.14 SA / Settings to :

Center = Channel of Choice
SPAN = 2.4 kHz
RBW = Auto
VBW = 3 Hz
Ref level = +10 dBm

3.4.15 Turn power on and enable the transmitter. Measure peak power. Verify that it is still equal to desired power ±1 dB. Record carrier power.

3.4.16 Move the LOC S/A Sample to the PIR and verify that the SDM equals 40 ± .5. Record % MOD.

3.4.17 Carrier Frequency
Using the S/A. verify that the carrier frequency is equal to desired frequency ± 2 kHz. Record the carrier frequency.

3.4.18 Spurs

3.4.18.1 Move the LOC S/A Sample to the S/A. Change the S/A span and measure the largest signal in each Frequency window from the 150 Hz side tone. For each window, record frequency and power (Delta from 150).

	S/A Span	Frequency From 150 Hz Tone	Spec Limit
1	2.4 kHz	25 Hz – 145 Hz	-20 dB
2		145 Hz – 300 Hz	-25 dB
3		300 Hz – 800 Hz	-35 dB
4	20 kHz	800 Hz – 10 kHz	-40 dB
5	200 kHz	10 kHz – 100 kHz	-40 dB

3.4.19 Tones

3.4.19.1 Change the S/A span to 6 kHz.

3.4.19.2 In the GTU test interface, Tone Control window, enable the Morse tone.

3.4.19.3 On the S/A, verify that the tone is at 1020 ± 10 Hz and the power indicates 10 ± 2% modulation. Record Delta Frequency and power.

3.4.19.4 In the GTU test interface, Tone Control window, enable Tones A, B, and C.

3.4.19.5 On the S/A, verify that the tones are at 2000 ±10 Hz, 700 ± 10 Hz, and 2500 ± 10 Hz for atones A, B, and C respectively and the power is indicates 30 to 35% modulation. Record Delta Frequency and power for each tone.

3.4.20 Carrier Harmonics

3.4.20.1 Disable the GTU

3.4.20.2 S/A settings to:

SPAN =	20 kHz
Ref level =	-70 dBm
RBW =	10 Hz

Change the S/A Center frequency per the table. Enable the GTU and verify that the carrier harmonics are below - 70 dBm. Record the level of each carrier harmonics.

Carrier from 2x
3x
4x
5x

3.4.21 Harmonic Distortion

3.4.21.1 Connect the test equipment per *Figure 4*.

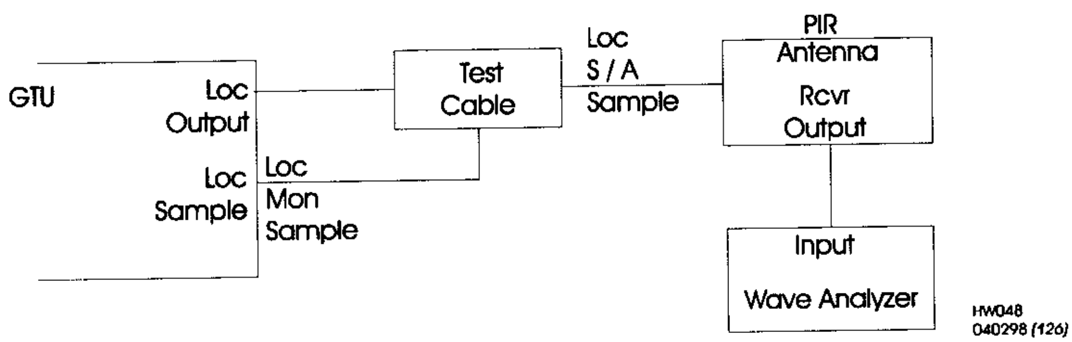


Figure 4

3.4.21.2 Turn Wave Analyzer function to FAST. Use AC input power only. Adjust the CAL knob full counter clockwise. Set the METER RANGE knob for 1V full scale.

3.4.21.3 Ensure that the Transmitter is enabled by checking that SDM is 40± 1% and DDM is 0± .004 on the PIR.

3.4.21.4 Tune the FREQUENCY knob to 90 Hz. Fine tune the FREQUENCY knob while increasing the CAL knob until a peak is clearly found. Adjust the CAL knob so that the 90 Hz peak is approximately 0.5 V.

3.4.21.5 Tune the FREQUENCY knob to the 150 Hz peak. If the 150 is less than full scale, do NOT change the CAL knob. Record the max value. If the 150 Hz peak is at full scale, adjust the CAL knob so that the 150 Hz peak is approximately 0.8 volt, and repeat measurement of the 90 Hz peak per step **3.4.21.4** . (Both 90 and 150 recorded measurements are with same CAL knob setting).

3.4.21.6 Peak the FREQUENCY knob for the lower amplitude of the two frequencies. Adjust the CAL knob so that the peak is full scale (10 volt mark). *Do not adjust the CAL knob after this step.*

3.4.21.7 Tune the FREQUENCY knob to peak reading at each of the following frequencies: 30, 60, 120, 180, 240, 270, 300, 360, 390, 450 Hz. At each frequency, change the meter range as required to get an on scale reading. Record the peak voltage (in MV) for each frequency.

3.4.21.8 Calculate and record harmonic distortion for each frequency.

> HD% = (Amplitude at harmonic frequency (MV) / 1000 MV) * 100. Each harmonic shall be less than 5%.

3.4.21.9 Calculate total harmonic distortion. TH = RSS (square root of the sum of the squares of all of the harmonic elements measured in **3.4.21.7**. The total harmonic distortion % is then = (RSS amplitude of all harmonic (MV) / 1000 MV) *100 and shall be less than 10%.

3.5 Glide slope Power / SDM settings

3.5.1 Connect test setup per *Figure 3*, (paragraph 3.4.1).

3.5.2 Connect the Glide Slope S/A Sample to the PIR. Set the PIR to the Channel of test, Normal, SDM.

3.5.3 On the Glide Slope Transmitter Assembly, (ANPC P/N 920-00103), adjust the GAIN potentiometer fully clockwise (20 turn potentiometer).

3.5.4 Initiate test software by following the:

a. Stop all base station Software
b. On CPU1, run "ulCal_base".
c. On CPU2, run "ulCal_base" by double clicking on the desktop shortcut of the same name.
d. On MIU, run MIU

e. On MIU interface "Tools" pulldown, select GTU Test.
f. In the Control Field, enable the Localizer enable "button".
g. In the Control Field, enable Localizer reset "button". Note that this reset is a "rising edge" reset and will have to be cycled if it is required to reset the transmitter. At this point, the Transmitter Status indicators should indicate both ON and SWR OK, and there should be non-zero numbers in the Monitor Carrier 90 Hz and 150 Hz fields.
h. In the Control Field, enable the Glide Slope enable "button".
i. In the Control Field, enable Glide Slope reset "button". Note that this reset is a "rising edge" reset and will have to be cycled if it is required to reset the transmitter. At this point, the Transmitter Status indicators should indicate both ON and SWR OK, and there should be non-zero numbers in the Monitor Carrier 90 Hz and 150 Hz fields.

With the transmitter enabled, let the transmitter warm up for 15 minutes.

3.5.5 Adjust the Glide Slope Gain potentiometer CCW until the SDM reads 79.5%.

3.5.6 Move the Glide Slope S/A Sample to the Spectrum Analyzer.

Center = Channel of Choice   Ref Value +10 dBm
SPAN = 2.4 KHz
RBW = AUTO
VBW = 3 Hz

3.5.7 Calculate desired carrier power = 34 – Glide Slope S/A Sample setup loss of paragraph ________. Record desired carrier power.

3.5.8 Adjust the Glide Slope Gain potentiometer so that the carrier power matches the desired value. Record value.

3.5.9 By moving the Glide Slope S/A sample to the PIR and the S/A, adjust the GAIN potentiometer such that the SDM is 80 ± 1.0%, and the carrier power is the desired value ± 1 dB. Record final % mod and power levels.

3.5.10 Turn the transmitter power off and put the test enable cable in power supply J1 (enables 24V). Turn Transmitter ON. Do NOT enable the transmitter with the SW interface.

3.5.11 Move the Glide Slope S/A Sample to the S/A.

Center = Channel of Choice
SPAN = 1 MHz
Ref level = -50 dBm
RBW = 300 Hz

3.5.12 Adjust the XMTR NULL potentiometer to minimize the signal. Record the peak value. Make sure that any oscillations are tuned out.

3.5.13 Turn power off. Replace regular cable at power supply.

3.5.14 SA / Settings to :

Center = Channel of Choice
SPAN = 2.4 kHz
RBW = Auto
VBW = 3 Hz
Ref level = +10 dBm

3.5.15 Turn power on and enable the transmitter. Measure peak power. Verify that it is still equal to desired power ±1 dB. Record carrier power.

3.5.16 Move the Glide Slope S/A Sample to the PIR and verify that the SDM equals 80 ± .1. Record % MOD.

3.5.17 Carrier Frequency

Using the S/A. verify that the carrier frequency is equal to desired frequency ± 6 kHz. Record the carrier frequency.

3.5.18 Spurs

3.5.18.1 Move the Glide Slope S/A Sample to the S/A. Change the S/A span and measure the largest signal in each Frequency window from the 150 Hz side tone. For each window, record frequency and power (Delta from 150).

	S/A Span	Frequency From 150 Hz Tone	Spec Limit
1	2.4 kHz	25 Hz – 145 Hz	-20 dB
2		145 Hz – 300 Hz	-25 dB
3		300 Hz – 800 Hz	-35 dB
4	20 kHz	800 Hz – 10 kHz	-40 dB
5	200 kHz	10 kHz – 100 kHz	-40 dB

* Note: Use data hold max – in Measurement Display menu

3.5.19 Carrier Harmonics

3.5.19.1 Disable the GTU

3.5.19.2 S/A settings to:

SPAN =	20 kHz
Ref level =	-70 dBm
RBW =	10 Hz

Change the carrier frequency per the table. Enable the GTU and verify that the carrier harmonics are below - 70 dBm. Record the level of each carrier harmonics

Carrier from 2x
3x
4x
5x

If unmeasurable at these settings, i.e. , less than –120 dBm, just mark as such.

3.5.20 Harmonic Distortion

3.5.20.1 Connect the test equipment per *Figure 5.*

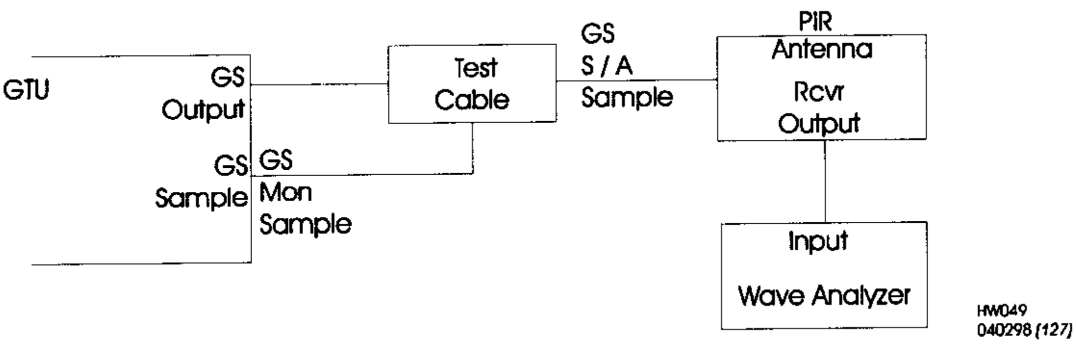


Figure 5

3.5.20.2 Turn on the Wave Analyzer. Use AC input power only. Adjust the CAL knob full counter clockwise. Set the METER RANGE knob for 1V full scale.

3.5.20.3 Ensure that the Transmitter is enabled by checking that SDM is 80± 1% and DDM is 0± .004 on the PIR.

3.5.20.4 Tune the FREQUENCY knob to 90 Hz. Fine tune the FREQUENCY knob while increasing the CAL knob until a peak is clearly found. Adjust the CAL knob so that the 90 Hz peak is approximately 0.5 V. Record the max value.

3.5.20.5 Tune the FREQUENCY knob to the 150 Hz peak. If the 150 is less than full scale, do NOT change the CAL knob. Record the max value. If the 150 Hz peak is at full scale, adjust the CAL knob so that the 150 Hz peak is approximately 0.8 volt, and repeat measurement of the 90 Hz peak per step **3.5.21.4**. (Both 90 and 150 recorded measurements are with same CAL knob setting).

3.5.20.6 Peak the FREQUENCY knob for the frequency with the <u>lower</u> amplitude of the two frequencies. Adjust the CAL knob so that the peak is full scale (10 volt mark). *Do not adjust the CAL knob after this step.*

3.5.20.7 Tune the FREQUENCY knob to peak reading at each of the following frequencies: 30, 60, 120, 180, 240, 270, 300, 360, 390, 450 Hz. At each frequency, change the meter range as required to get an on scale reading. Record the peak voltage (in MV) for each frequency.

3.5.20.8 Calculate and record harmonic distortion for each frequency.
HD% = (Amplitude at harmonic frequency (MV) / 1000 MV) * 100. Each harmonic shall be less than 5%.

3.5.20.9 Calculate total harmonic distortion. TH = RSS (square root of the sum of the squares of all of the harmonic elements measured in **3.5.21.7**. The total harmonic distortion % is then = (RSS amplitude of all harmonic (MV) / 1000 MV) *100 and shall be less than 10%.

3.6 MONITOR ADJUSTMENT

3.6.1 Turn the GTU Transmitter OFF

3.6.2 Remove the transmitter cover and insert a header jumper across the two pin connector labeled FRQ KEY at the back/ top of the GTU control board.

3.6.3 Set up the transmitter per Figure 3. Connect the S/A sample to the PIR.

3.6.4 Turn the GTU ON. Enable the transmitter via the Maintenance Interface.

3.6.5 Adjust both the LOC Mon Gain and GS Mon potentiometers full clockwise. Adjust these potentiometers counter clockwise until GTU test window Monitor readings for carrier power are 3000 ± 100.

3.6.6 Place cover on transmitter and allow 15 minutes transmitter ON time prier to continuing evaluation / test.

3.6.7 Change Localizer DDM control settings and record carrier 90 and 150 Hz monitor levels and PIR SDM and DDM values at +0.18 and –0.18 DDM.

Note: Localizer PIR DDM polarity is opposite of MIU display.

3.6.8 For the Glide Slope, change DDM control settings and record carrier 90 and 150 Hz monitor levels and PIR SDM and DDM values at +0.20 and –0.20 DDM.

Note: Glideslope PIR DDM polarity is opposites of MIU display.

3.6.9 Using Excel worksheet "Monitor Correction Calculator .xls", size ___KB, created ______. Enter the carrier, 90 and 150 Hz values in the entry fields per instructions on the worksheet. Print out the worksheet and attach to the data sheet.

3.6.10 In the GTU Test Interface, depress the Monitor Scale Factors button. In the Monitor Scaling window, enter the calculated ratio and offset numbers.

3.6.11 In the Monitor Scaling window, depress the Send to Bases button. Verify that the Base 1 and Base 2 readbacks are the same as the control fields.

3.6.12 Remove the jumper from the FRQ KEY convector on the GTU control board. Replace the transmitter cover.

3.6.13 In the Monitor Scaling window, depress the Read from Bases button. Verify that the Base 1 and Base 2 readbacks are the same as the control fields.

3.6.14 In the Monitor Scaling window, depress the Done button. Re-enter the Glideslope and Localizer outputs.

3.6.15 For the Localizer signal, change DDM control settings per list below and record monitor SDM, monitor DDM, PIR SDM, and PIR DDM values. SDM values for Localizer shall be 40±1% and DDM values shall be setting ±.002.

+.18, +015, .012, .09, .06, .03, .00, -.03, -.06, -.09, -.12, -.15, -.18

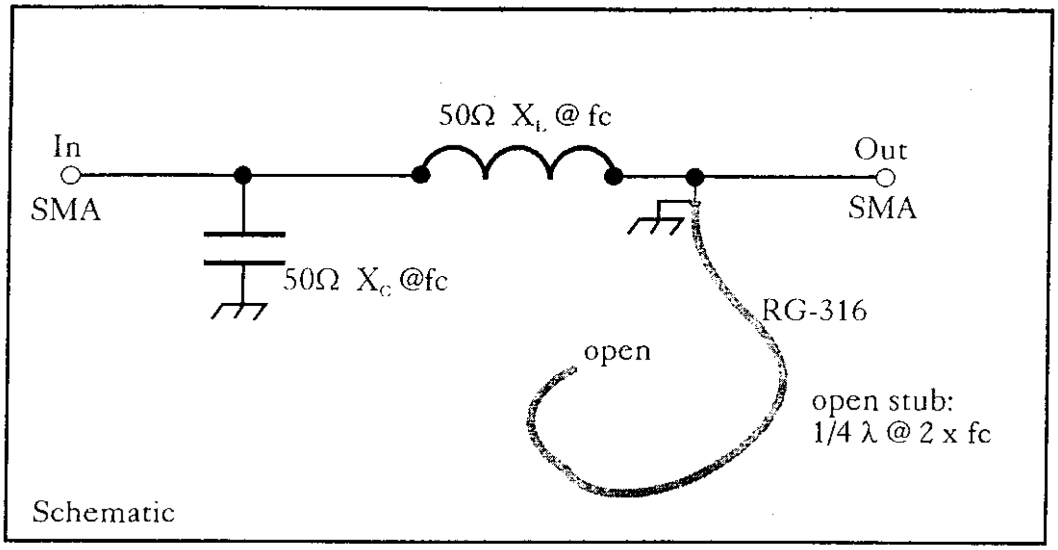
Note: PIR readings on DDM are reversed polarity.

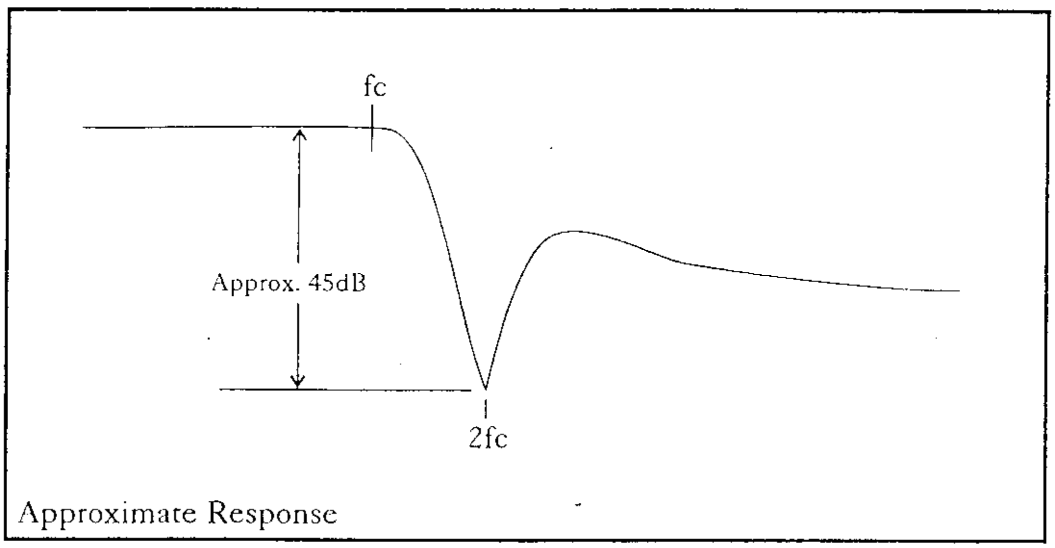
3.6.16 For the Glideslope signal, change DDM control settings per the list below and record monitor SDM, Monitor DDM, PIR SDM, and PIR DDM values. SDM values for Glideslope shall be 80.0 ± 2% and DDM values shall be setting ± .004.

.2, .18, .14, .10, .06, .02, 0.00, -.02, -.06, -.10, -.14, -.18, -.2

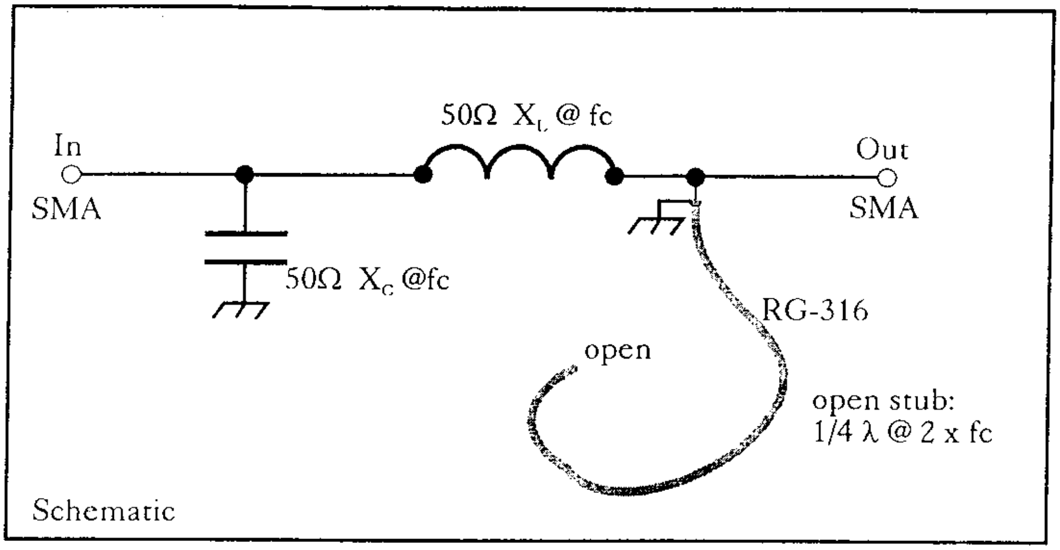
G: Filter Data

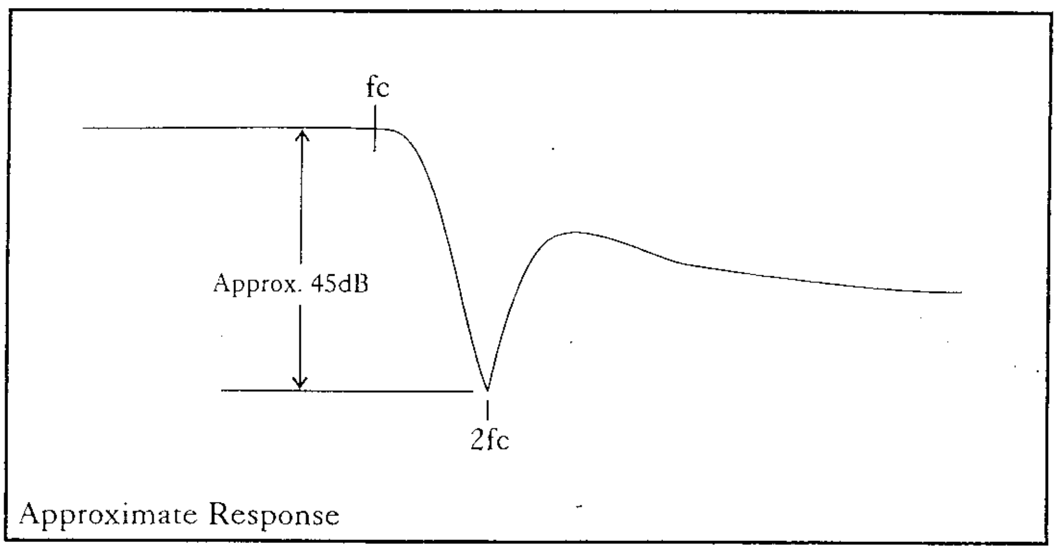
Final Harmonic Filter for Model 920-0101Transmitter

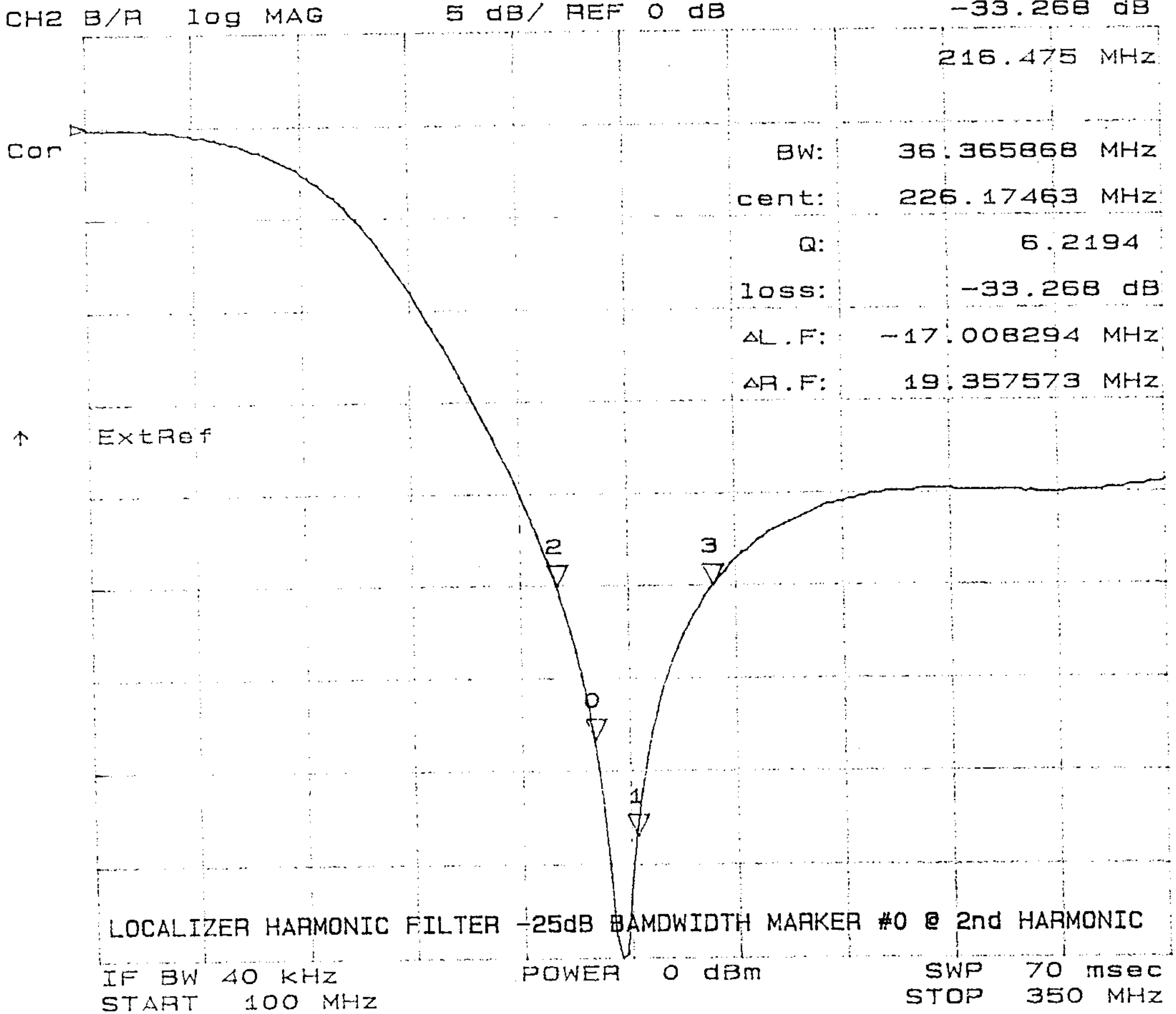


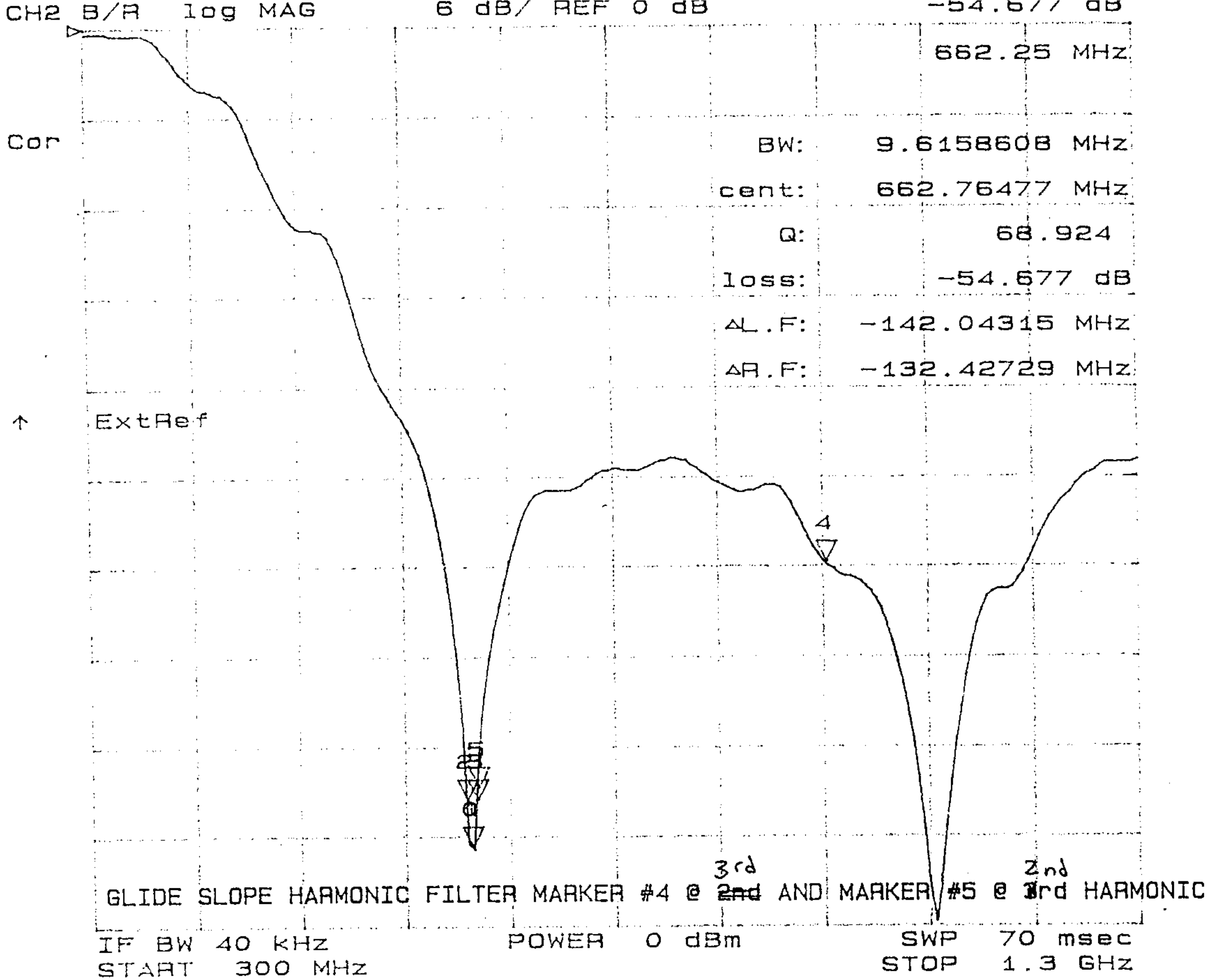


Final Harmonic Filter for Model 920-0101Transmitter






CH2 B/R log MAG
5 dB/ REF 0 dB
-33.268 dB
216.475 MHz
Cor
BW: 36.365868 MHz
cent: 226.17463 MHz
Q: 6.2194
loss: -33.268 dB
ΔL.F: -17.008294 MHz
ΔR.F: 19.357573 MHz
ExtRef
2
3
0
1
LOCALIZER HARMONIC FILTER -25dB BAMDWIDTH MARKER #0 @ 2nd HARMONIC
IF BW 40 kHz
START 100 MHz
POWER 0 dBm
SWP 70 msec
STOP 350 MHz


CH2 B/R log MAG
6 dB/ REF 0 dB
-54.677 dB
662.25 MHz
Cor
BW: 9.6158608 MHz
cent: 662.76477 MHz
Q: 68.924
loss: -54.677 dB
ΔL.F: -142.04315 MHz
ΔR.F: -132.42729 MHz
ExtRef
4
5
2
3
6
3rd
2nd
GLIDE SLOPE HARMONIC FILTER MARKER #4 @ ~~2nd~~ 3rd AND MARKER #5 @ ~~3rd~~ 2nd HARMONIC
IF BW 40 kHz
START 300 MHz
POWER 0 dBm
SWP 70 msec
STOP 1.3 GHz

H: RF Output Measurements

GTU Transmitter Glide Slope Spectrum Analyzer Plots

For all plots, carrier is at 333.95 MHz.

- Figure G1

  Plot shows that the 2^{nd} harmonic is the only measurable signal out to the 5^{th} harmonic.

- Figure G2

  Using a 2 MHz span, plot shows that no close-in spurious products above 70 dB down from desired frequency exist.

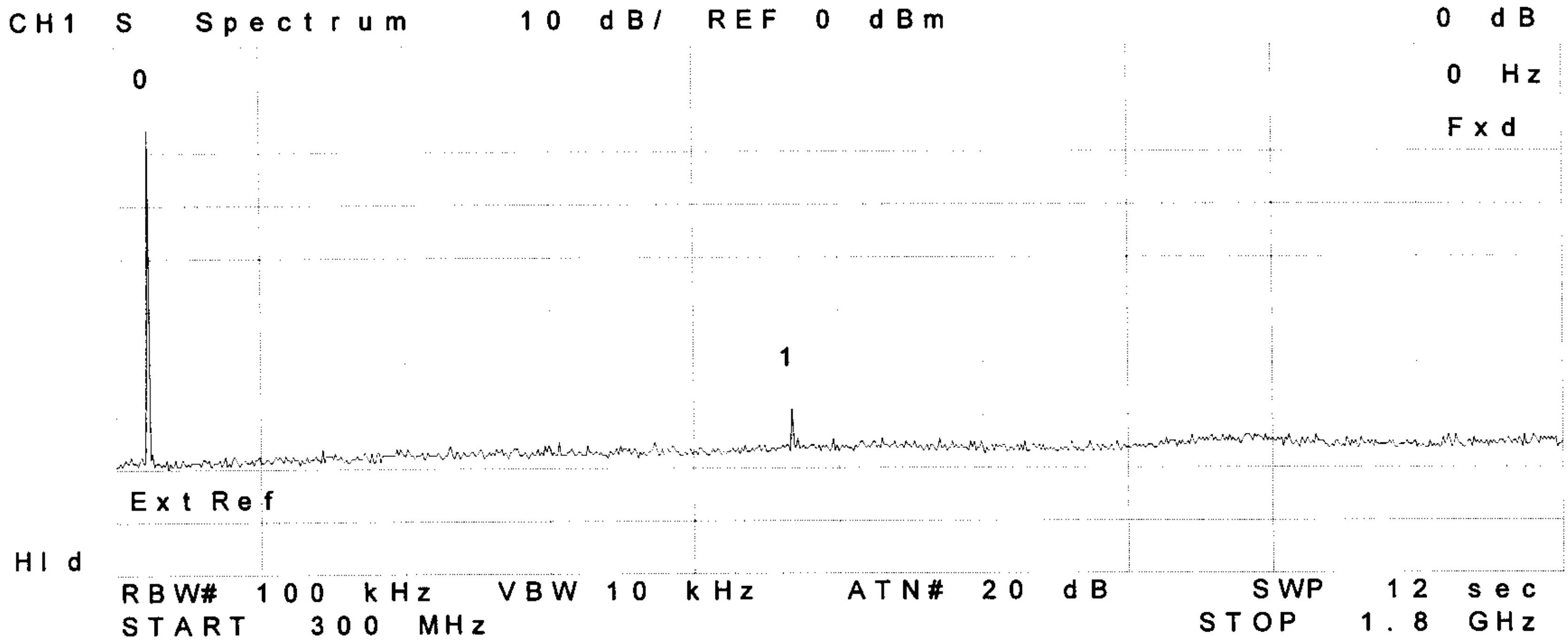
- Figure G3

  Using a 10 kHz span demonstrates that no harmonics out to the 5^{th} harmonic of the 90 and 150 sidebands exist above 20 dB down. Note the measurable spurs at 3.6 kHz are remnants of the modulation synthesizer sample frequency.

- Figure G4

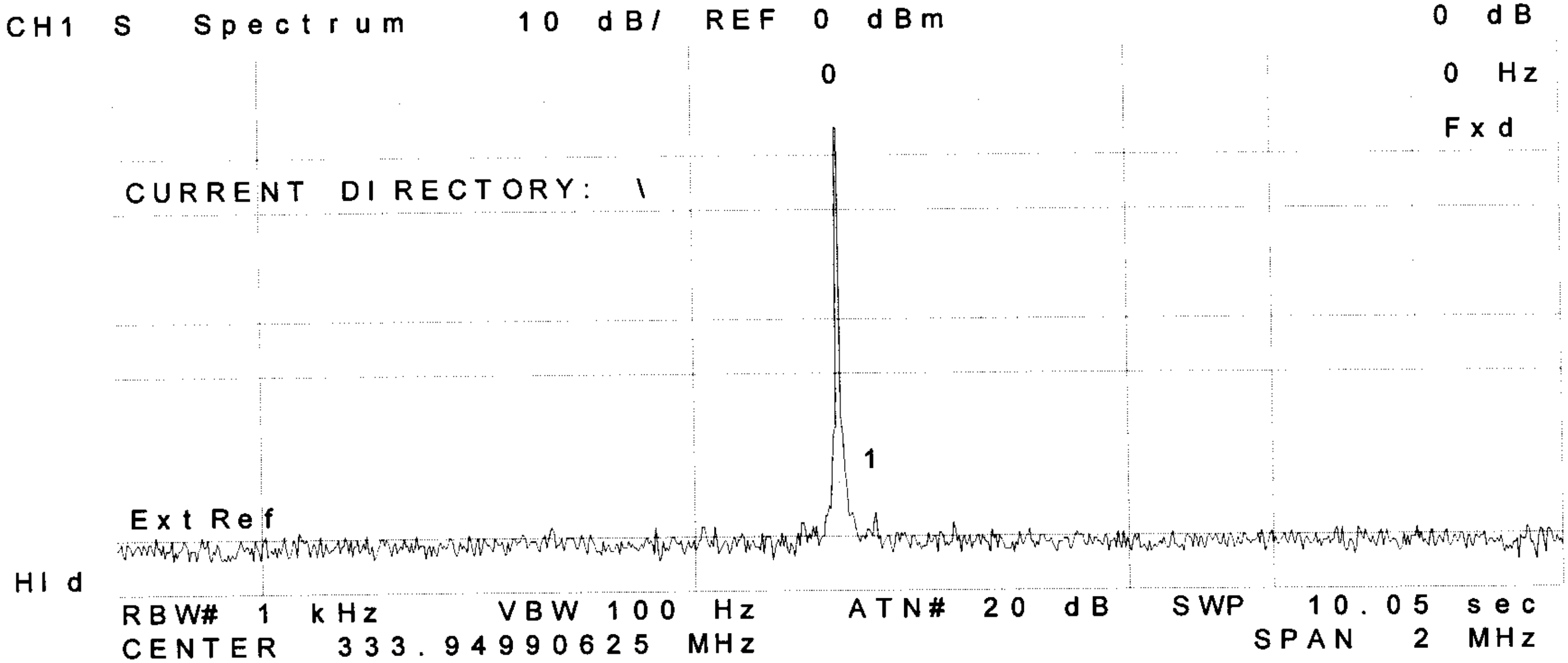
  Using a 1 kHz span shows the 90 and 150 sidetones and their harmonics. Measured harmonics were all more than 20 dB down from the 90 and 150 Hz sidebands.

Figure G1



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	667.5 MHz	-52.941 dB
	333.75 MHz	-15.924 dBm

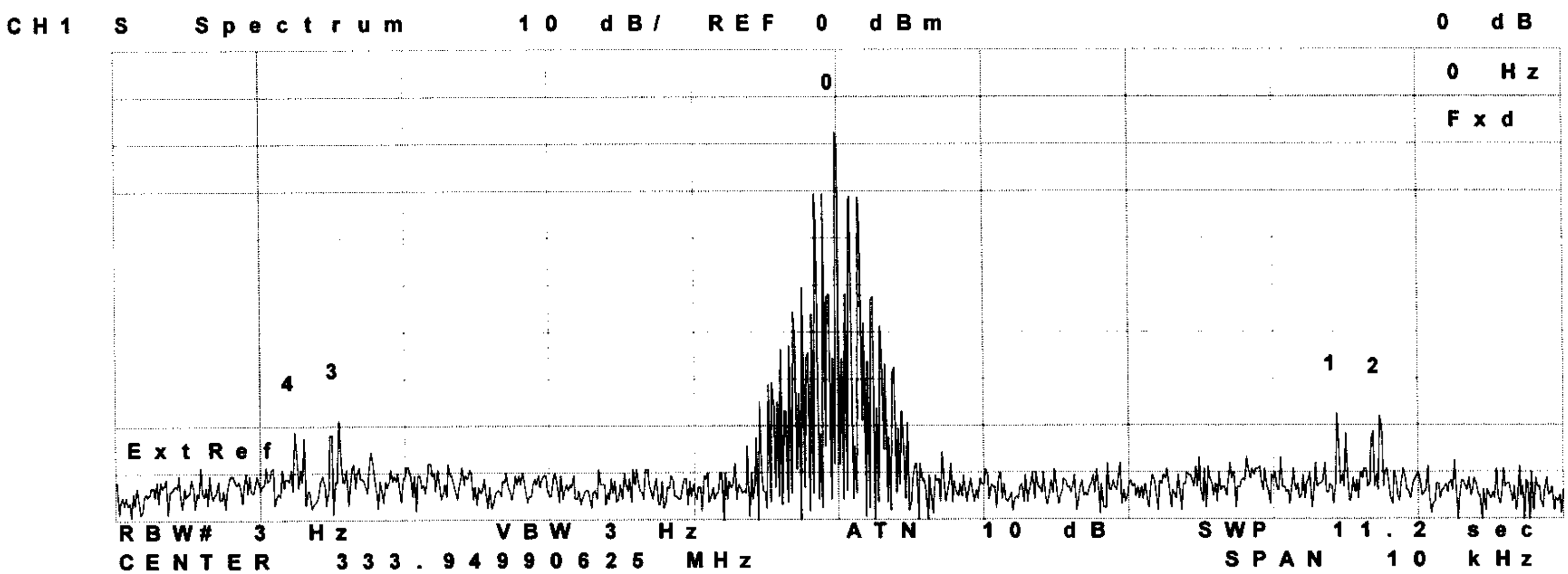
Figure G2



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	50 kHz	-70.975 dB

333.94990625 MHz -14.962 dBm

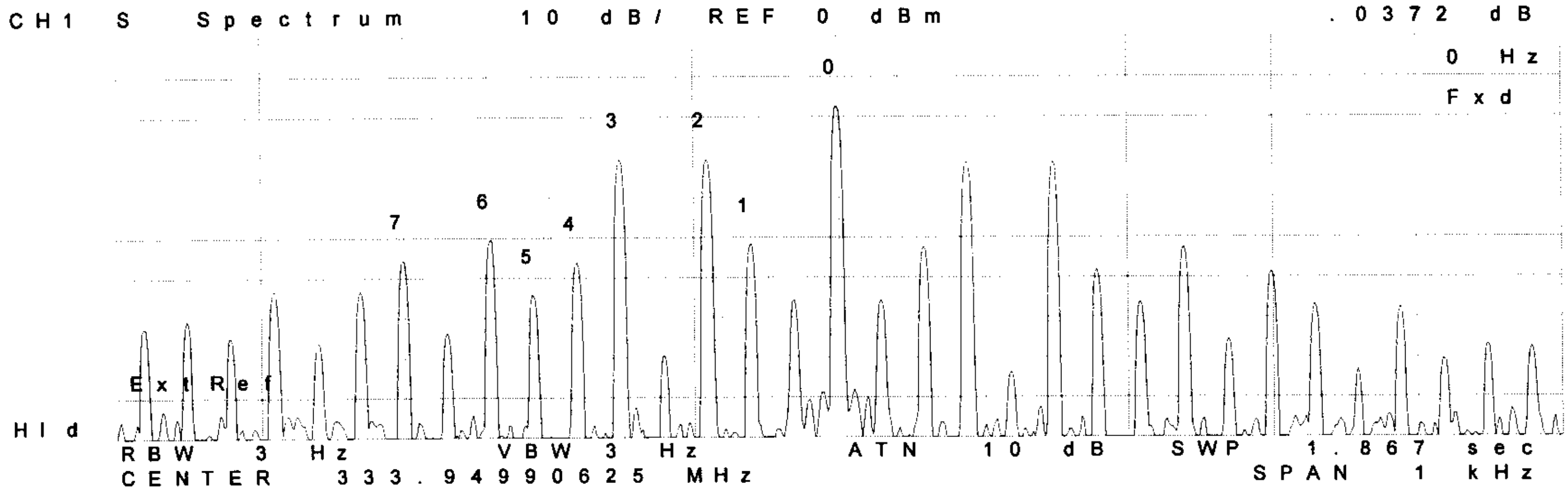
Figure G3



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	3.45 kHz	-60.037 dB
2	3.75 kHz	-60.869 dB
3	-3.45 kHz	-61.737 dB
4	-3.75 kHz	-64.242 dB

333.94989375 MHz -17.194 dBm

Figure G4



N	SWP PARAM	VAL
0	0 Hz	.0372 dB
1	-60 Hz	-34.386 dB
2	-90 Hz	-13.392 dB
3	-150 Hz	-13.28 dB
4	-180 Hz	-39.036 dB
5	-210 Hz	-46.945 dB
6	-240 Hz	-33.203 dB
7	-300 Hz	-38.258 dB

333.949905 MHz -17.25 dBm

GTU Transmitter Localizer Spectrum Analyzer Plots

For all plots, carrier is at 108.35 MHz.

- Figure L1

  Plot shows that the 1st harmonic is the only measurable signal out to the 5th harmonic.

- Figure L2

  Using a 2 MHz span, plot shows that no close-in spurious products above 67 dB down from desired frequency exist.

- Figure L3

  Using a 10 kHz span demonstrates that no harmonics out to the 5th harmonic of the 90 and 150 sidebands exist above 20 dB down.

- Figure L4

  Using a 1 kHz span shows the 90 and 150 sidetones and their harmonics. Measured harmonics were all more than 20 dB down. Note the measurable spurs at 3.6 kHz are remnants of the modulation synthesizer sample frequency.

- Figure L5

  Using a 10 kHz span with the 700 Hz tone on, harmonics were greater than 30 dB down.

- Figure L6

  Using a 10 kHz span with the 1020 Hz tone on, harmonics were greater than 35 dB down.

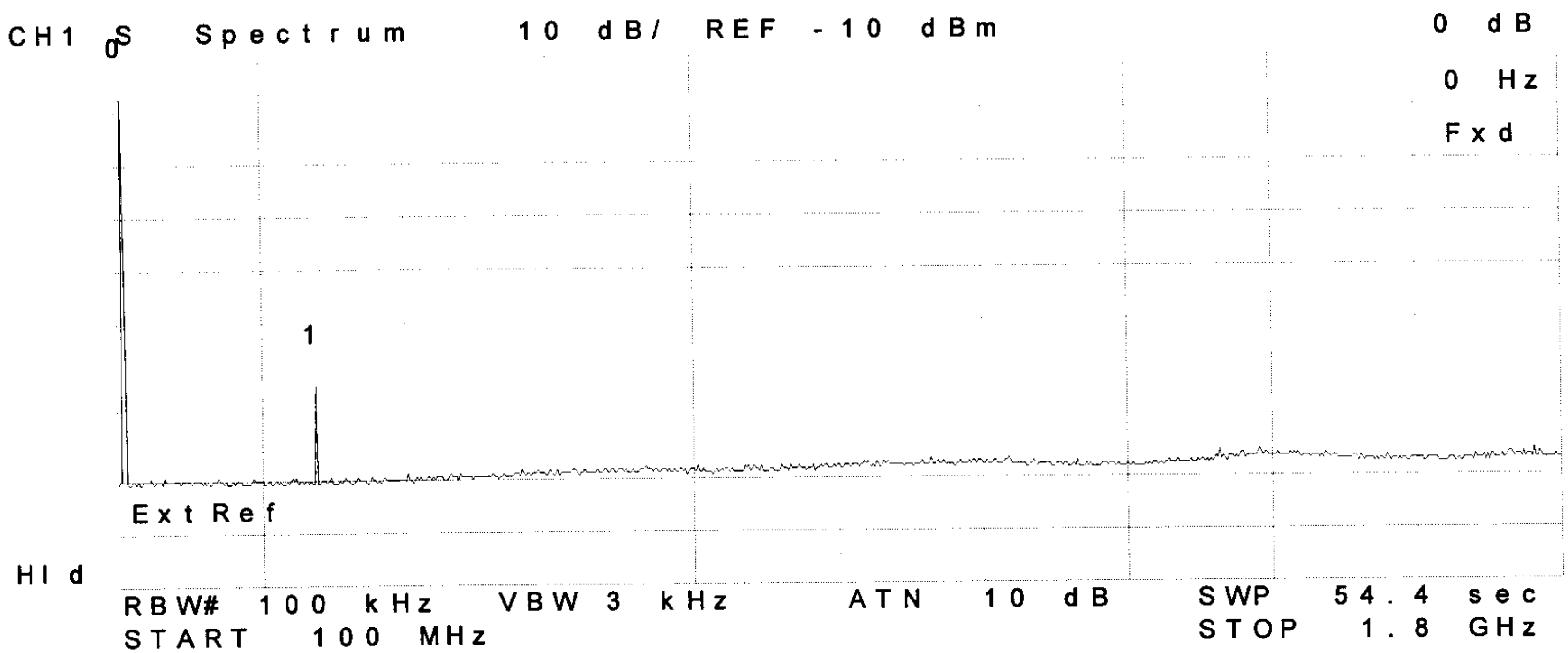
- Figure L7

  Using a 10 kHz span with the 2000 Hz tone on, harmonics were greater than 30 dB down.

- Figure L8

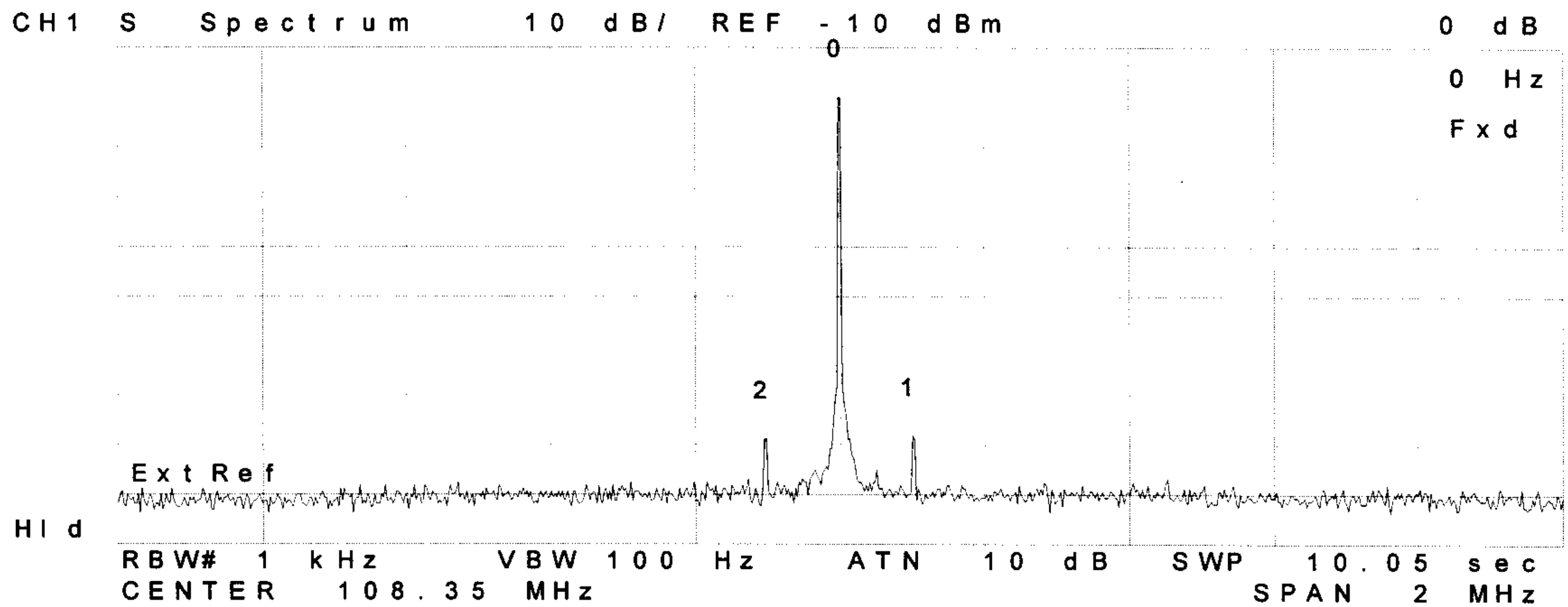
  Using a 10 kHz span with the 2500 Hz tone on, harmonics were greater than 30 dB down.

Figure L1



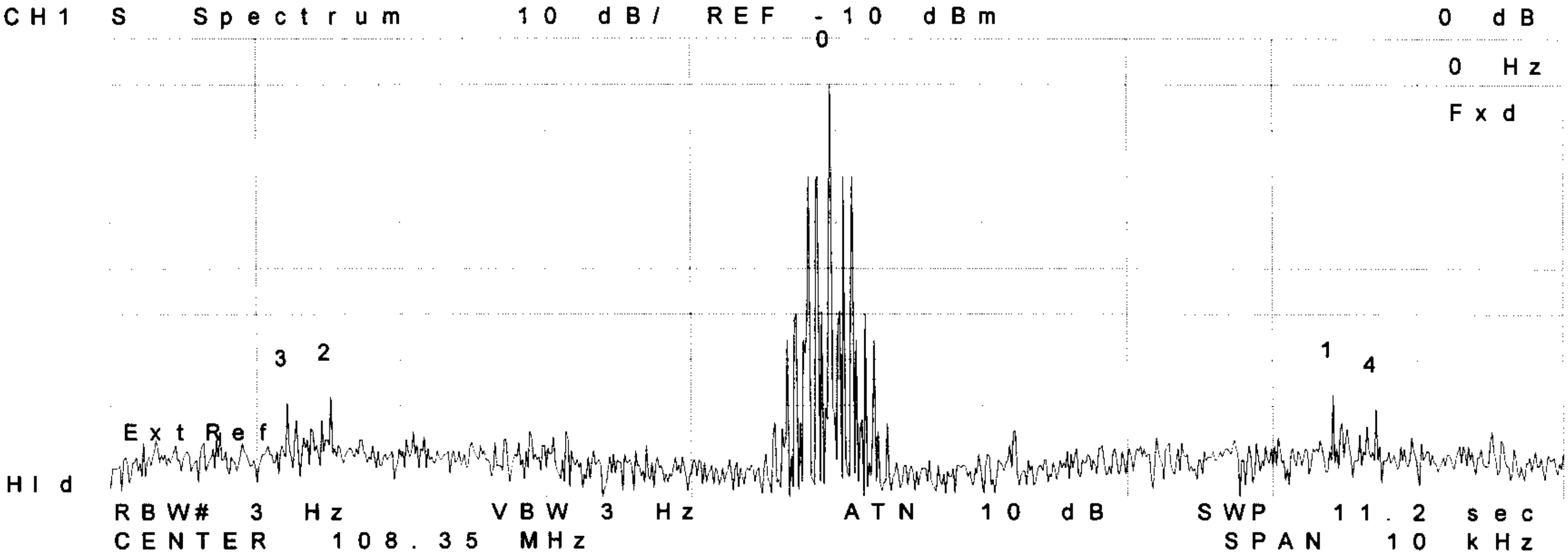
N	SWP PARAM	VAL
0	0 Hz	0 dB
1	227.375 MHz	-54.418 dB
	106.375 MHz	-17.238 dBm

Figure L2



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	100 kHz	-67.915 dB
2	-102.5 kHz	-68.39 dB
	108.35 MHz	-20.203 dBm

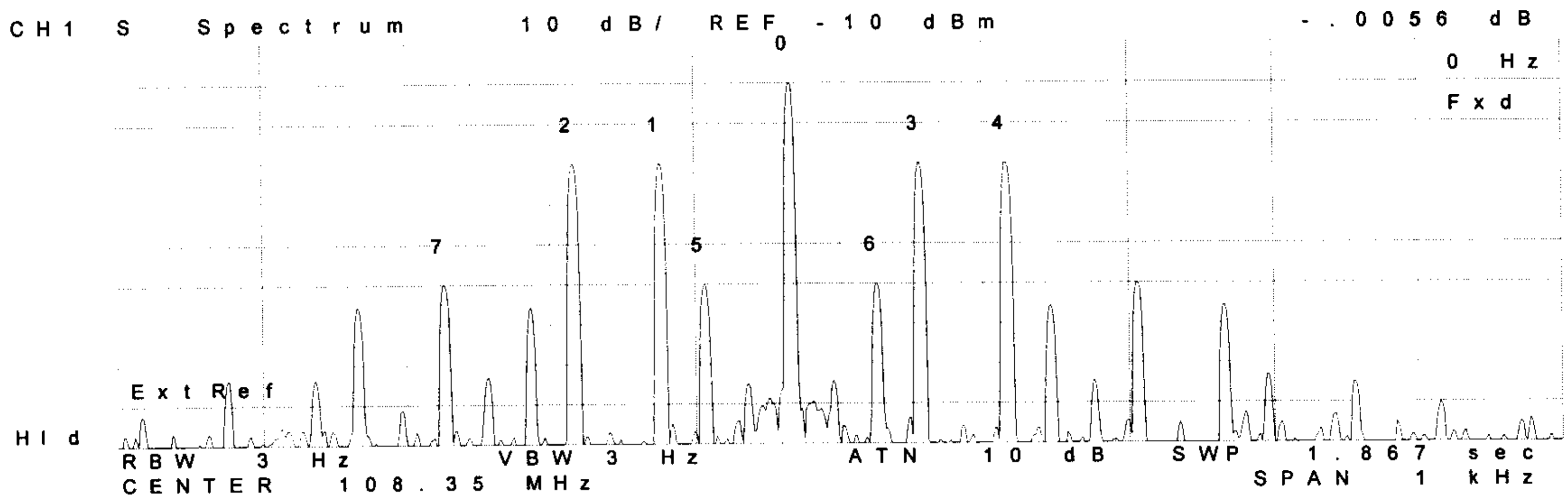
Figure L3



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	3.45 kHz	-67.541 dB
2	-3.45 kHz	-67.988 dB
3	-3.75 kHz	-69.432 dB
4	3.75 kHz	-70.614 dB

108.3499625 MHz -19.858 dBm

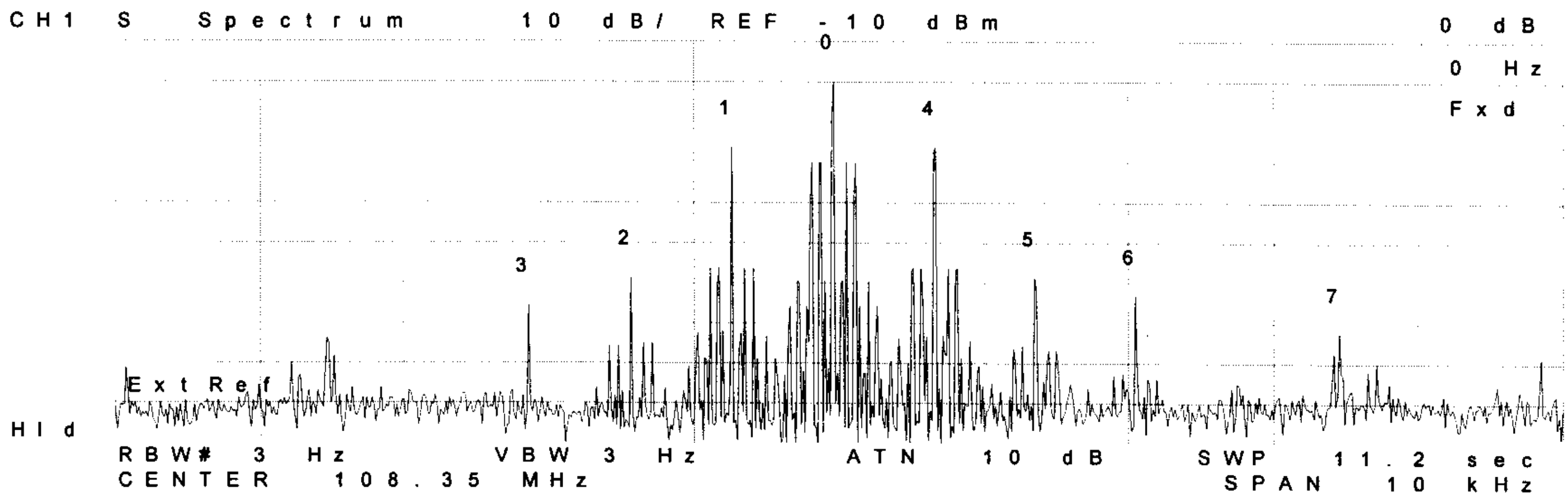
Figure L4



N	SWP PARAM	VAL
0	0 Hz	-.0056 dB
1	-90 Hz	-19.889 dB
2	-150 Hz	-19.957 dB
3	90 Hz	-19.825 dB
4	150 Hz	-19.839 dB
5	-60 Hz	-50.105 dB
6	60 Hz	-50.104 dB
7	-240 Hz	-49.791 dB

108.34996625 MHz -19.926 dBm

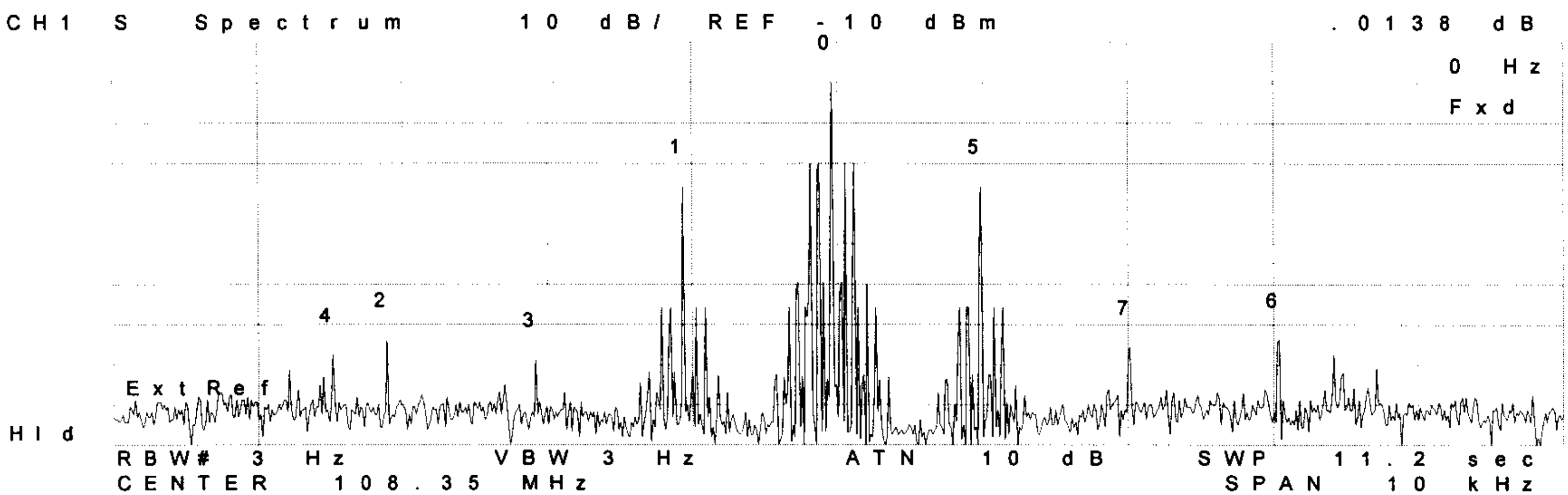
Figure L5



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	-700 Hz	-16.37 dB
2	-1.4 kHz	-48.953 dB
3	-2.1 kHz	-55.795 dB
4	700 Hz	-16.314 dB
5	1.3875 kHz	-48.791 dB
6	2.0875 kHz	-53.483 dB
7	3.4875 kHz	-62.691 dB

108.3499625 MHz -19.917 dBm

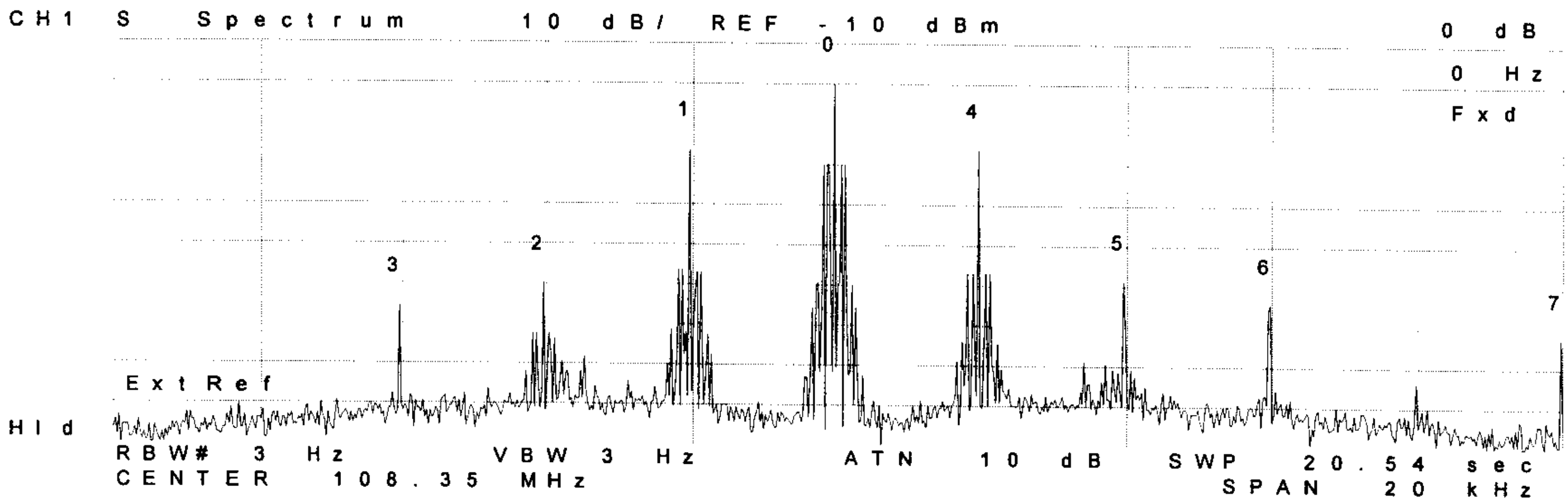
Figure L6



N	SWP PARAM	VAL
0	0 Hz	.0138 dB
1	-1.025 kHz	-25.84 dB
2	-3.075 kHz	-63.759 dB
3	-2.05 kHz	-69.056 dB
4	-3.45 kHz	-67.546 dB
5	1.025 kHz	-25.698 dB
6	3.075 kHz	-64.038 dB
7	2.05 kHz	-65.736 dB

108.3499625 MHz -19.885 dBm

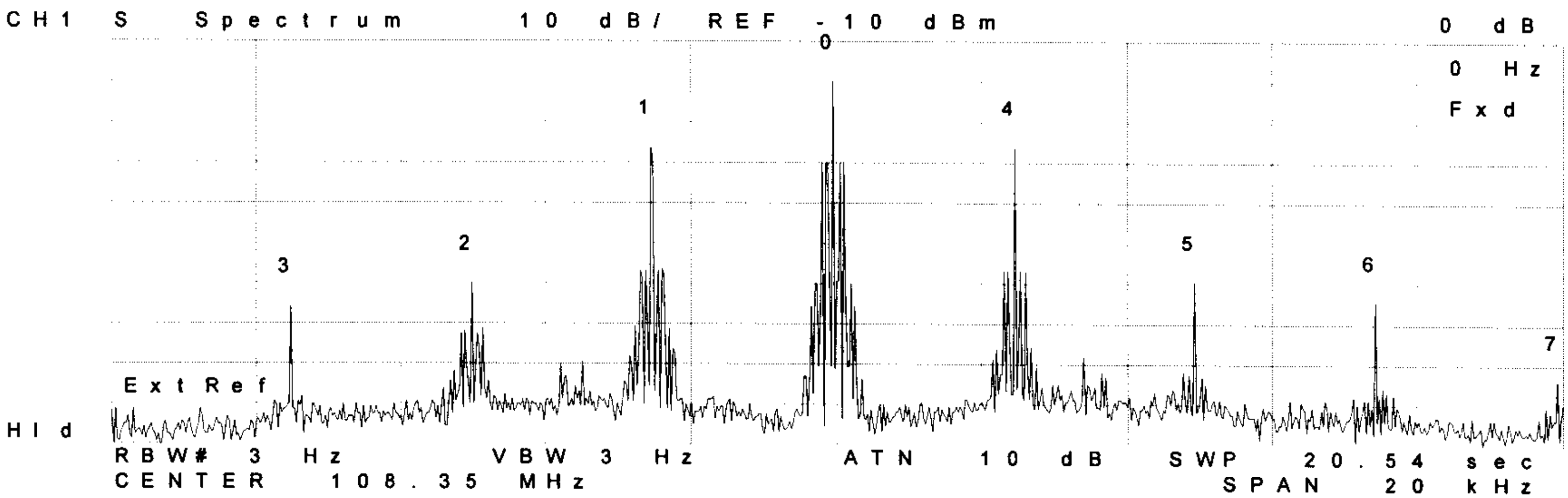
Figure L7



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	-2 kHz	-16.404 dB
2	-4 kHz	-49.842 dB
3	-6 kHz	-55.627 dB
4	2 kHz	-16.244 dB
5	4 kHz	-49.152 dB
6	6.025 kHz	-54.331 dB
7	10.025 kHz	-62.83 dB

108.34995 MHz -19.869 dBm

Figure L8



N	SWP PARAM	VAL
0	0 Hz	0 dB
1	-2.5 kHz	-16.333 dB
2	-4.975 kHz	-50.023 dB
3	-7.475 kHz	-55.966 dB
4	2.5 kHz	-16.212 dB
5	4.975 kHz	-49.654 dB
6	7.475 kHz	-54.24 dB
7	9.975 kHz	-74.038 dB

108.34995 MHz -19.924 dBm

I: Radiated Spurious Emissions

Radiated Spurious Emissions; ANPC Model 920-00101

Radiated Spurious measurements were done at Acme Testing in Acme, Washington. This testing facility is listed with the FCC and should have a facility description on file.

Carrier data:
See enclosed data report.

Field Strength:
See enclosed data report.

Most of the harmonics were not measurable or even locatable. This is in part due to good engineering practices in the design and construction. The photographs of the hardware construction delineate this point. Also, because this is all class-A amplification, fewer harmonics are generated.

ACME TESTING, 2002 VALLEY HWY, P.O. BOX 3, ACME, WASHINGTON 98220-0003 888 226-3837.

FCC PART 87
REPORT OF MEASUREMENTS

DEVICE: GLIDESLOPE/LOCALIZER TRANSMITTER

MODEL: 920-00101

MANUFACTURER: ADVANCED NAVIGATION & POSITIONING CORPORATION

ADDRESS: 11 THIRD STREET
PO BOX 838
HOOD RIVER OR 97031

THE DATA CONTAINED IN THIS REPORT WAS COLLECTED ON 20 & 21 APRIL 1998 AND COMPILED BY:

PAUL G. SLAVENS
CHIEF EMC ENGINEER

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1. General

1.1 Manufacturer

Company Name:	Advanced Navigation & Positioning Corporation
Contact:	Mark J. Zanmiller
Street Address:	11 Third Street
Mailing Address:	PO Box 838
City/State/Zip:	Hood River OR 97031
Telephone:	541 386-1747
Fax:	541 386-2124
E-mail:	ANPC1@aol.com

1.2 Test location

Company:	Acme Testing
Street Address:	2002 Valley Highway
Mailing Address:	PO Box 3
City/State/Zip:	Acme WA 98220-0003
Laboratory:	Test Site 2
Telephone:	888 226-3837
Fax:	360 595-2722
E-mail:	acmetest@acmetesting.com
Web:	www.acmetesting.com
Receipt of EUT:	20 April 1998

1.3 Test Personnel

Paul G. Slavens

2. Test Results Summary

Summary of Test Results

920-00101 Glideslope/Localizer Transmitter

Paragraph No.	Test	Status
2.993	**Field Strength of Spurious Radiation**	**Pass**

The signed original of this report, supplied to the client, represents the only "official" copy. Retention of any additional copies (electronic or non-electronic media) is at Acme Testing's discretion to meet internal requirements only. The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

The measurements contained in this report were made in accordance with the referenced standards and all applicable Public Notices received prior to the date of testing. Acme Testing assumes responsibility only for the accuracy and completeness of this data as it pertains to the sample tested.

Paul G. Slavens
Chief EMC Engineer

24 APRIL 1998
Date of Issuance

3. Description of Equipment

3.1 Equipment Under Test (EUT)

Device:	Glideslope/Localizer Transmitter
Model Number:	920-00101
Serial Number:	None
FCC ID:	MPO920-0101
Power:	120 V/60 Hz
Grounding:	AC
Antenna Distance:	3 m

3.2 Mode of Operation

The EUT was exercised by constantly transmitting @ 24 dBm with 110.1 MHz for the localizer and transmitting 34 dBm @ 332.0 MHz for the Glidescope.

4. Field Strength of Spurious Radiation

Paragraph No: 2.993

4.1 Test Procedures

The method of measurement is TIA/EIA-603 2.2.12.

4.2 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2747A-05662, Calibrated: 4 September 1997, Calibration due Date: 4 September 1998

⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2510A-00106, Calibrated: 4 September 1997, Calibration due Date: 4 September 1998

⇒ Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2521A-00931, Calibrated: 4 September 1997, Calibration due Date: 4 September 1998

⇒ Broadband Biconical Antenna (20 MHz to 200 MHz): EMCO 3110, Serial Number 1115, Calibrated: 27 June 1997, Calibration due Date: 27 June 1998

⇒ Broadband Log Periodic Antenna (200 MHz to 1000 MHz): EMCO 3146, Serial Number 2853, Calibrated: 27 June 1997, Calibration due Date: 27 June 1998

⇒ Broadband Log Periodic Antenna (2 GHz - 18 GHz) , A & H Systems SAS-200/518, Serial Number 252, Calibrated: 16 June 1997, Calibration due Date: 16 June 1998

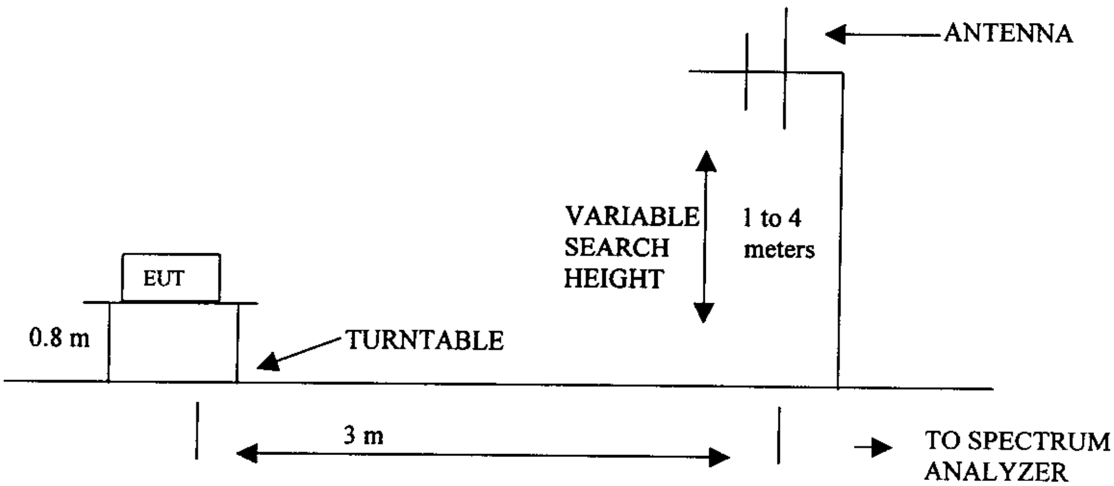
⇒ EUT Turntable Position Controller: EMCO 1061-3M 9003-1441, No Calibration Required

⇒ Antenna Mast: EMCO 1051 9002-1457, No Calibration Required

⇒ 2 GHz to 10 GHz Low Noise Preamplifier: Milliwave 593-2898, Serial Number 2494, Calibrated: 19 June 1997, Calibration due Date: 19 June 1998

⇒ Signal Generator: Wavetek 2500, Serial Number 001-4004, Calibrated: 21 July 1997, Calibration due Date: 21 July 1998

4.3 Test Set-up Block Diagram



4.4 Minimum Standard

When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aeronautical station transmitters must be at least 43 + 10 $\log_{10}$ pY dB.

Calculation of necessary attenuation

Localizer Transmitter Attenuation = 43 + 10 $\log_{10}$ 0.25 Watt = 37.0 dB
Glideslope Transmitter Attenuation = 43 + 10 $\log_{10}$ 2.50 Watt = 47.0 dB

4.5 Test Results

Localizer Transmitter

Frequency (MHz)	Field Strength (dBuV/m)	Effective Radiated Power (dBm)	Attenuation (dBc)
220.067	35.2	-62.2	-96.2
330.074	39.5	-57.9	-91.9
440.09	43.7	-53.7	-87.7

Glideslope Transmitter

Frequency (MHz)	Field Strength (dBuV/m)	Effective Radiated Power (dBm)	Attenuation (dBc)
995.984	51.7	-45.7	-69.7

5. Miscellaneous Comments and Notes

1. None.

6. List of Attachments

1. Photographs of EUT. (1)

J: Frequency Stability Measurements

Frequency Stability over Temperature

From 87.131, the frequency stability requirement is 20ppm. Part 2.995 gives temp range as -30 to +50C and 87.147 give -20 to +50C. This is part of a base station unit that will be installed in a temperature-controlled environment. The controller computer contains a temperature sensor that will shut down the entire system if temperatures go outside of the specified range of -10 to +50C, and maintenance warnings are given when any significant deviation in environment is noted.

While these safety mechanisms further ensure good performance, the unit passes the 20ppm requirement. Measured test data is presented below.

Temperature (Deg C)	Glide Slope Frequency Freq = 333.95 MHz	Localizer Frequency Freq = 108.35 MHz
-10	333.9501313	108.3500438
0	333.9503688	108.3501188
+10	333.9503063	108.3500938
+20	333.950075	108.350025
+30	333.9498438	108.3499438
+40	333.9497813	108.3499313
+50	333.9497213	108.3499225
Stability =	**1.9 ppm**	**1.8 ppm**

Stability = (Max - Min)/freq