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EVALUATION OF TEKTRONIX (2 GIGASAMPLE/SECOND)
DIGITAL SIGNAL ANALYZER DSA 602

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Abstract

The results of evaluating the Tektronix (2 gigasample/second) Digital Analyzer DSA 602 is discussed. Evaluations were done using both the 11A52 and 11A72 amplifier modules. Effective bits tests were run from 2 MHz to 1 GHz. Timing tests were done to verify repeatability of triggering. Baseline data were taken to determine noise levels. Pulse testing was done to determine overdrive recoverability. The stability of the internal calibration was verified. TDR tests were done to determine what reflections would be generated if the inputs were overdriven.

Topics:

Effective bits
Baseline noise
Pulse testing
Calibration stability
Timing tests
Crosstalk
TDR

I. INTRODUCTION

The Tektronix (2 gigasample/second) Digital Signal Analyzer DSA 602 was evaluated with both the 11A52 and 11A72 amplifier modules. Tests consisted of effective bits, baseline noise, pulse, calibration stability, timing, crosstalk, and TDR.

II. EFFECTIVE BITS

A. Introduction

Effective bits measurements are stated at Nyquist or analog bandwidth, whichever occurred first. The measurements were taken from the 90-percent full-scale range. The program SINEFIT was used to generate the effective bits measurements. SINEFIT also generated the peak counts used to calculate the analog bandwidth.

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B. Evaluation with the 11A72 Amplifier

Table 1 shows the data collected for the 500 megasample/second acquisition rate. Figure 1 is a plot of the effective bits for the 500 MS/sec sample rate. Figure 2 is a plot of the normalized peak counts versus frequency. A power meter was used to guarantee that the power level remained constant at all input frequencies. When the peak counts reach the -3 dB level, the device has reached its analog bandwidth. Figure 2 shows that even when the digitizer is recording a signal twice the Nyquist frequency, the analog bandwidth has not been reached. The closest data point taken to Nyquist (250 MHz) for the 500 MS/sec rate was 242 MHz. At 242 MHz on the 90-percent full-scale range the effective bits measurement was 6.59 bits. Figures 1 and 2 also show plots of the effective bits and the analog bandwidth for the 45-percent full-scale range for the 500 MS/sec sample rate.

Table 2 shows data taken at 1 gigasample/second. Figure 3 is a plot of the effective bits data in Table 1. Figure 4 is a plot of peak counts versus frequency, a measurement used to determine the analog bandwidth. Nyquist is reached at 500 MHz for the 1 GS/sec sample rate. Figure 4 shows that the -3 dB level is not reached even at nearly twice the Nyquist frequency. The effective bits for the 1 GS/sec sample rate will be determined at 492 MHz, which is the data point taken closest to Nyquist. At 492 MHz on the 90-percent full-scale range for the 1 GS/sec sample rate, the effective bits measurement is 6.10 bits.

Table 3, Figure 5, and Figure 6 show the data taken for the 11A72 at the 2 GS/sec sample rate. 992 MHz is the data point taken closest to Nyquist. Figure 6 shows that the analog bandwidth of the 11A72 was not reached at that frequency. Figure 5 shows that the effective bits at 992 MHz was 4.27 bits.

Table 4 shows the data taken for effective bits at 2 GS/sec as a function of gain setting. Figure 7 is a plot of a sampling of that data. The plot shows that the greatest difference in effective bits is half a bit between the different gain settings.

C. Evaluation with the 11A52 Amplifier

Table 5, Figure 8, and Figure 9 show data taken for the 11A52 at the 500 the MS/sec sample rate. Figure 9 shows that the analog bandwidth was not reached before Nyquist. At the data point taken closest to Nyquist (242 MHz) we measured 6.65 effective bits.

Table 6 and Figures 10 and 11 show data for the 11A52 at the 1 GS/sec sample rate. Figure 11 shows that the Nyquist frequency (500 MHz) was reached before the analog bandwidth. Figure 10 shows that at 492 MHz, 6.14 effective bits were measured.

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Table 7 and Figures 12 and 13 show the data for the 11A52 at the 2 GS/sec sample rate. Nyquist for this sample rate would be 1 GHz. Figure 13 shows that the analog bandwidth was not reached, but neither was the Nyquist frequency. The effective bits of the 11A52 cannot be stated from this data.

Table 8 and Figure 14 show the data taken at 2 GS/sec for effective bits as a function of gain setting. The data show that the 11A52's effective bits are controlled more by the gain settings than were the 11A72's effective bits.

II. BASELINE NOISE

A. Introduction

The inputs were terminated into 50 ohms when data were taken. Baseline noise was taken at all three sample rates on both the 11A72 and the 11A52 plug-in amplifiers. Data was also taken to determine if noise was a function of offset or gain setting.

B. Evaluation with the 11A72 Amplifier

Figures 15, 16, and 17 show a sampling of data taken for the 11A72. Figure 15 shows a plot of the baseline noise taken at 2 the GS/sec sample rate on a gain setting of 50 mV/division. The plot of the data shows that there are plus or minus two counts of noise from the baseline. Figure 16 is a histogram of the data in Figure 15. The histogram shows the number of occurrences of each amplitude out of the 4096 data points. Figure 17 is an fast Fourier transform (FFT) of the data in Figure 15. The FFT shows that there is no one fundamental frequency contributing to the noise level.

C. Evaluation with the 11A52 Amplifier

Figures 18, 19, and 20 show the same information for the 11A52 as Figures 15, 16, and 17 did for the 11A72. The data was taken at a 2 GS/sec sample rate on the 50 mV/division gain setting.

D. Conclusion

There was no significant change in the noise level as a function of sample rate, gain setting, or offset level.

III. PULSE TESTING

A. Introduction

This testing was done for two reasons: to determine how well the digitizer would reproduce a pulse and to determine how long it would take for the digitizer to recover from being overdriven.

B. Evaluation with the 11A72 Amplifier

Figure 21 is a plot of the test signal into the 11A72 as seen by a Hewlett-Packard 54120 digital sampling oscilloscope. Figure 22 is a plot of the 90-percent full-scale signal with a plot of the twice overdriven pulse superimposed on it. The pulse labelled "A" is the 90-percent full-scale pulse, and the pulse labeled "B" is the twice overdriven pulse. Figure 22 shows that the 90-percent full-scale is a very good reproduction of the pulse as seen by the HP 54120. This figure also shows that the digitizer does not stay saturated long after the pulse decreases, but there is a small ring after the digitizer recovers from saturation. Figure 23 is a plot of the 90-percent full-scale pulse with the 16-times overdriven pulse superimposed on it. Pulse A is 90-percent of full scale and pulse B is the 16-times overdriven pulse. This figure shows that at 16 times overdrive, the digitizer does not take long to recover from saturation, but it does have a substantial ringing after it does recover.

C. Evaluation with the 11A52 Amplifier

Figures 24 through 26 are the data for the 11A52, and Figures 21 through 23 are the equivalent data for the 11A72. The major difference in the two data sets is that the 11A52 does not have a large ringing but it does take some time to recover from saturation. The increase in the tail at the end of the pulse can be accounted for by the pulse generator.

IV. CALIBRATION STABILITY

Two tests were done to check for the stability of the internal calibration of the digitizer. The first test consisted of re-collecting the same sine wave a number of times over a period of two days without recalibrating the box. The sine wave was collected five times, as quickly as possible, and the effective bits were calculated. The five collections resulted in a mean of 6.7326 effective bits, with a standard deviation of 0.1092 bits. Five more samples were taken 30 minutes later. This set of data had a mean of 6.7543 effective bits and a standard deviation of 0.1876 bits. One hour later, another set of five files was collected. These had a mean of 6.8916 effective bits and a standard deviation of 0.1465 bits. Twenty-three hours later the next set was taken. This set had a mean of 6.8336 effective bits and a standard deviation of 0.1439 bits. The second test was done as part of the timing test. The trigger stability was being tested from one day to the next for repeatability.

V. TIMING TESTS

Two tests were done to check the stability of the trigger. A Stanford Research pulse generator was used for the trigger and signal sources in the first test. The specification for the jitter between the T0 output and any of the four other outputs was 50 ps. T0 was used for the trigger input and T1 was used for the signal pulse. The same pulse was recorded ten times for each sample rate and then plotted. The cross hairs

of the plotting package allowed us to select an amplitude value and then determine how far from the start of the record each file crossed that amplitude. Twenty-four hours later the same test was rerun. These data are listed below:

		<u>First Day</u>	<u>Second Day</u>
500 MS/sec	mean	3119.285 ns	3119.354 ns
	s. dev.	0.514 ns	0.664 ns
1 GS/sec	mean	2060.141 ns	2060.033 ns
	s. dev.	0.366 ns	0.273 ns
2 GS/sec	mean	1528.969 ns	1528.900 ns
	s. dev.	0.158 ns	0.122 ns

The internal time interval meter and a Stanford Research DG535 pulse generator were used in the second test. The output T0 was put into the left channel 1 (L1) and the output T1 was put into the center channel 1 (C1). The left and center units each have their own trigger systems. In effect, what was being measured was the time from the trigger of L1 to the trigger of C1. Stanford Research specifies that from T0 to T1 on the DG535, the maximum RMS jitter is less than 50 ps. Using an HP 5370 universal time interval counter, we measured the jitter from T0 to T1 as 37 ps. Using the DSA 602 TIM, we collected the same single shot pulse 50 times; the calculated standard deviation was 40.87 ps. According to Dan Knierim of Tektronix, the time of interest is equal to the interpolated time from the main trigger (L1) to the second subsequent clock cycle after the main trigger, plus the integer number of clock cycles from the second clock cycle after the main trigger, to the second clock cycle after the window trigger (C1), minus the interpolated time from the window trigger to the second clock cycle after the window trigger.

VI. CROSSTALK

The purpose of this test was to verify that there was no signal feeding from one channel to the others. A 300-MHz signal was fed into one channel, and another channel was terminated into 50 ohms. An FFT was done on both channels. The channel with the signal showed the fundamental frequency as predominantly 300 MHz. There was no sign of the 300-MHz signal being predominate in the terminated channel. Different combinations of channels were tried. First, the signal in L1 terminating C1 was tried, then reversed, and then the signal was put in L2 and L1 was terminated. There was no visible sign of crosstalk.

VII. TDR

A. Introduction

There is typically multiple coverage on each of the signals looked at in our customer's field application. The purpose of this test is to see what kind of reflections will be seen by other devices used to look at the same signal at the same time. An HP 54120 sampling oscilloscope was used to do the TDR.

B. Evaluation with the 11A52 Amplifier

Figure 27 is the TDR of the 11A52 with a software filter to normalize the data to a 467-MHz input signal. This figure shows that the worst reflection would be 0.794 percent of the input signal. Figure 28 shows the TDR of the 11A52 with a filter to normalize the data to 1 GHz. The worst reflection from this input would be 2.69 percent of the input. Figure 29 shows a TDR normalized to a 2-GHz input with a worst reflection of 4.76 percent of the input.

C. Evaluation with the 11A72 Amplifier

Figure 30 is a plot of the worst-case TDR for the 11A72. A software filter was used to normalize the data to a 2-GHz input signal. Because the analog bandwidth of the digitizer is only 1 GHz, the 11A72 would not be used intentionally to look at a 2-GHz signal, but it could be used as multiple coverage with a faster device that could see a signal that fast. From Figure 30 the worst reflection can be calculated as 3.38 percent. Figure 31 is a plot of the TDR done with a filter to normalize the data to a 1-GHz input signal. The worst reflection this could produce would be 3.01 percent of the input signal. Figure 32 is normalized to a 467-MHz input signal; it shows that the worst reflection from this input would be 2.72 percent. Another interesting feature seen in Figures 30 through 32 is that the 11A72 does not appear to recover to 50 ohms.

TABLE # 1

FREQUENCY (MHZ)		ACTUAL	PEAK	NORMALIZED	EFFECTIVE BITS	FILE
2		116.1639		0	7.29782	501
7		115.1007		-0.07986	7.19583	503
12		113.5973		-0.19406	7.13723	505
18		115.0965		-0.08018	7.09379	507
30		115.1139		-0.07887	7.16571	509
52	90%	114.6546		-0.11359	6.98917	511
72	FULL	114.1479		-0.15206	6.87251	513
92	SCALE	114.8732		-0.09704	6.786	515
142	500MS/S	114.6867		-0.11116	6.83606	517
192		114.3258		-0.13854	6.81676	519
242		113.6669		-0.18874	6.59417	521
292		113.7449		-0.18278	6.51838	523
342		114.2997		-0.14052	6.53824	525
392		112.9626		-0.24273	6.62958	527
442		112.5141		-0.27728	6.48232	529
492		112.9295		-0.24527	6.11644	531
2		60.02059		-5.73542	7.29899	502
7		57.80254		-6.06248	7.19406	504
12		57.42966		-6.11870	7.12215	506
18		58.83531		-5.90866	7.27823	508
30		56.81032		-6.21288	7.15482	510
52	45%	57.33533		-6.13298	7.08261	512
72	FULL	55.79499		-6.36952	7.12642	514
92	SCALE	59.38715		-5.82757	7.10628	516
142	500MS/S	58.89832		-5.89937	7.1253	518
192		59.23978		-5.84915	7.14071	520
242		58.22817		-5.99876	7.18244	522
292		56.17472		-6.31060	6.95823	524
342		56.67171		-6.23410	6.86414	526
392		58.08086		-6.02076	6.97651	528
442		57.95126		-6.04017	6.89006	530
492		56.82533		-6.21058	6.8912	532

TEK 11602 WITH 11A72 PLUG-IN

Figure 1

TEK 11602 WITH 11A72 PLUG-IN

Figure 2

TABLE # 2

FREQUENCY (MHZ)		PEAK ACTUAL	NORMALIZED	EFFECTIVE BITS	FILE
2		114.5238	0	7.31212	101
7		114.2601	-0.02002	7.19355	103
12		113.9013	-0.04734	7.20255	105
18		114.9433	0.031757	7.14807	107
30		115.3444	0.062017	7.02228	109
52	90%	113.9905	-0.04054	6.99773	111
72	FULL	114.0565	-0.03551	6.78241	113
92	SCALE	114.6114	0.006642	6.67084	115
142	1GS/S	114.3293	-0.01476	6.76502	117
192		114.2179	-0.02323	6.64216	119
242		113.1800	-0.10252	6.43422	121
292		113.8012	-0.05497	6.42326	123
342		114.3865	-0.01041	6.4556	125
392		112.4326	-0.16006	6.30626	127
442		112.1845	-0.17926	6.2875	129
492		111.7609	-0.21211	6.10035	131
542		111.7579	-0.21235	5.90651	133
592		108.2725	-0.48755	5.70779	135
642		107.0518	-0.58603	5.41916	137
692		106.2909	-0.64799	5.30905	139
742		104.9841	-0.76371	5.19066	141
792		103.7385	-0.85911	5.17689	143
842		101.9910	-1.00668	5.11389	145
892		90.95175	-2.00169	5.2483	147
942		93.57326	-1.75488	4.80794	149
992		93.33394	-1.77712	4.54679	151
2		59.26481	-5.72198	7.26749	102
7		57.31271	-6.01290	7.27274	104
12		57.34999	-6.00725	7.2471	106
18		58.8395	-5.78454	7.22598	108
30	45%	56.84459	-6.08413	7.14321	110
52	FULL	57.1885	-6.03174	7.17347	112
72	SCALE	55.74006	-6.25457	7.13531	114
92	1GS/S	59.24187	-5.72534	7.11399	116
142		58.86596	-5.78063	7.07234	118
192		59.00754	-5.75976	7.16284	120
242		57.98431	-5.91170	7.0304	122
292		56.05842	-6.20510	6.90622	124
342		56.68502	-6.10855	6.75963	126
392		57.81374	-5.93729	6.81002	128
442		57.65387	-5.96135	6.80502	130
492		56.89001	-6.07719	6.78409	132
542		54.21321	-6.49581	6.77977	134
592		53.4554	-6.61808	6.65149	136
642		52.35117	-6.79939	6.61564	138
692		52.46257	-6.78092	6.66888	140
742		52.1329	-6.83568	6.52081	142
792		53.66155	-6.58465	6.40934	144
842		51.47079	-6.94670	6.47807	146
892		47.35526	-7.67055	6.54158	148
942		48.68292	-7.43038	6.32075	150
992		49.69395	-7.25184	5.87976	152

TEK 11602 WITH 11A72 PLUG-IN

Figure 3

TEK 11602 WITH 11A72 PLUG-IN

Figure 4

TABLE # 3

FREQUENCY (MHZ)		PEAK ACTUAL	NORMALIZED	EFFECTIVE BITS	FILE
2		115.8012	0	7.2008	201
7		115.7832	-0.00134	7.24706	203
12		114.9280	-0.06574	7.19003	205
18		116.0846	0.021231	7.16586	207
30	90%	114.8339	-0.07285	7.04452	209
52	FULL	114.3237	-0.11153	7.00713	211
72	SCALE	113.8568	-0.14708	6.91538	213
92	2GS/S	114.8074	-0.07486	6.70405	215
142		114.1657	-0.12354	6.76461	217
192		114.2413	-0.11779	6.61562	219
242		113.5457	-0.17084	6.52432	221
292		113.7260	-0.15706	6.37806	223
342		114.1208	-0.12696	6.43241	225
392		112.4069	-0.25840	6.26929	227
442		111.8475	-0.30173	6.23006	229
492		111.6576	-0.31649	5.94797	231
542		111.1187	-0.35851	5.7605	233
592		107.6275	-0.63579	5.57681	235
642		106.2534	-0.74740	5.34247	237
692		105.5162	-0.80787	5.23439	239
742		104.2814	-0.91012	5.18326	241
792		102.6871	-1.04394	4.97581	243
842		100.8114	-1.20406	4.70373	245
892		90.69087	-2.12299	4.91957	247
942		93.05103	-1.89984	4.67428	249
992		93.52694	-1.85553	4.27445	251
2		59.70088	-5.75465	7.37215	202
7		58.20433	-5.97515	7.24328	204
12		57.99194	-6.00691	7.21578	206
18		59.44723	-5.79163	7.27383	208
30	45%	56.34873	-6.25658	7.19844	210
52	FULL	57.29509	-6.11191	7.1243	212
72	SCALE	55.53031	-6.38366	7.10488	214
92	2GS/S	59.3698	-5.80295	7.08507	216
142		58.685	-5.90372	7.09609	218
192		59.26226	-5.81870	7.13461	220
242		58.04857	-5.99843	7.01975	222
292		56.12809	-6.29065	6.92383	224
342		56.64995	-6.21027	6.84502	226
392		57.72623	-6.04680	6.78592	228
442		57.43911	-6.09011	6.76706	230
492		56.16455	-6.28501	6.64077	232
542		53.85657	-6.64949	6.60626	234
592		53.28294	-6.74250	6.52042	236
642		51.97778	-6.95791	6.51067	238
692		51.90789	-6.96959	6.47118	240
742		51.6788	-7.00801	6.29513	242
792		52.80565	-6.82065	6.16071	244
842		50.5807	-7.19456	5.98245	246
892		46.83995	-7.86193	6.04585	248
942		47.78804	-7.68788	5.90171	250
992		48.71619	-7.52079	5.57887	252

TEK 11602 WITH 11A72 PLUG-IN

Figure 5

TEK 11602 WITH 11A72 PLUG-IN

Figure 6

TABLE # 4 11A72 EFFECTIVE BITS AT DIFFERENT GAIN SETTINGS

FREQUENCY	GAIN	% FULL SCALE	EFF BITS	FILE
2	10mV/DIV	90%	7.09259	D01
100	10mV/DIV	90%	6.72605	D11
300	10mV/DIV	90%	6.57851	D21
500	10mV/DIV	90%	6.0939	D31
700	10mV/DIV	90%	5.43128	D41
900	10mV/DIV	90%	5.48761	D51
2	10mV/DIV	45%	7.05557	D02
100	10mV/DIV	45%	7.05929	D12
300	10mV/DIV	45%	6.93934	D22
500	10mV/DIV	45%	6.98192	D32
700	10mV/DIV	45%	6.50128	D42
900	10mV/DIV	45%	6.55406	D52
2	20mV/DIV	90%	7.04874	D03
100	20mV/DIV	90%	6.80588	D13
300	20mV/DIV	90%	6.60205	D23
500	20mV/DIV	90%	6.42378	D33
700	20mV/DIV	90%	5.74523	D43
900	20mV/DIV	90%	5.4917	D53
2	20mV/DIV	45%	7.08558	D04
100	20mV/DIV	45%	6.95215	D14
300	20mV/DIV	45%	6.94786	D24
500	20mV/DIV	45%	7.12914	D34
700	20mV/DIV	45%	6.48435	D44
900	20mV/DIV	45%	6.63854	D54
2	50mV/DIV	90%	7.02468	D05
100	50mV/DIV	90%	6.94607	D15
300	50mV/DIV	90%	6.69175	D25
500	50mV/DIV	90%	6.60224	D35
700	50mV/DIV	90%	5.67243	D45
900	50mV/DIV	90%	5.66279	D55
2	50mV/DIV	45%	7.23739	D06
100	50mV/DIV	45%	7.10671	D16
300	50mV/DIV	45%	6.9765	D26
500	50mV/DIV	45%	7.00043	D36
700	50mV/DIV	45%	6.57438	D46
900	50mV/DIV	45%	6.49316	D56

TABLE # 4 (CONTINUED) EFFECTIVE BITS AT DIFFERENT GAIN SETTINGS

FREQUENCY	GAIN	% FULL SCALE	EFF BITS	FILE
2	100mV/DIV	90%	7.24577	D07
100	100mV/DIV	90%		D17
300	100mV/DIV	90%	6.5131	D27
500	100mV/DIV	90%	6.6065	D37
700	100mV/DIV	90%	5.64641	D47
900	100mV/DIV	90%	5.53679	D57
2	100mV/DIV	45%	7.26912	D08
100	100mV/DIV	45%		D18
300	100mV/DIV	45%	7.00533	D28
500	100mV/DIV	45%	6.67629	D38
700	100mV/DIV	45%	6.57442	D48
900	100mV/DIV	45%	6.4582	D58
2	200mV/DIV	90%	7.08203	D09
100	200mV/DIV	90%	6.95213	D19
300	200mV/DIV	90%	6.72309	D29
500	200mV/DIV	90%	6.65416	D39
700	200mV/DIV	90%	5.63515	D49
900	200mV/DIV	90%	5.49386	D59
2	200mV/DIV	45%	7.22075	D10
100	200mV/DIV	45%	7.13804	D20
300	200mV/DIV	45%	6.94996	D30
500	200mV/DIV	45%	7.04494	D40
700	200mV/DIV	45%	6.47284	D50
900	200mV/DIV	45%	6.74464	D60

TEK 11A72 AT DIFFERENT GAIN SETTINGS

Figure 7

TABLE # 5

FREQUENCY (MHZ)		ACTUAL	PEAK	NORMALIZED	EFFECTIVE BITS	FILE
2		115.4438		0	7.1586	501
7		115.0515		-0.02956	7.13808	503
12		114.0002		-0.10929	7.11636	505
18		114.0904		-0.10243	7.06846	507
30		113.9395		-0.11392	7.04875	509
52	90%	115.282		-0.01218	6.92494	511
72	FULL	115.3867		-0.00429	6.85994	513
92	SCALE	114.3962		-0.07917	6.69961	515
142	500MS/S	116.2126		0.057651	6.51031	517
192		115.1775		-0.02005	6.5917	519
242		112.5544		-0.22016	6.6467	521
292		114.5545		-0.06717	6.40452	523
342		114.3251		-0.08458	6.403	525
392		109.0168		-0.49753	6.19935	527
442		108.5100		-0.53801	6.1741	529
492		108.7760		-0.51674	6.20532	531
2		59.9911		-5.68567	7.22099	502
7		57.9347		-5.98863	7.23064	504
12		57.6084		-6.03769	7.13345	506
18		58.87521		-5.84876	7.14979	508
30		57.25011		-6.09188	7.0687	510
52	45%	56.2353		-6.24723	7.04586	512
72	FULL	56.64954		-6.18348	6.96605	514
92	SCALE	58.9636		-5.83573	7.01754	516
142	500MS/S	59.97942		-5.68736	6.99463	518
192		59.71209		-5.72616	7.05446	520
242		57.48277		-6.05666	7.07106	522
292		57.14052		-6.10853	6.8985	524
342		57.18604		-6.10161	6.81008	526
392		57.01404		-6.12777	6.88368	528
442		56.81382		-6.15833	6.71063	530
492		56.93353		-6.14005	6.81669	532

TEK 11602 WITH 11A52 PLUG-IN

Figure 8

TEK 11602 WITH 11A52 PLUG-IN

Figure 9

TABLE # 6

FREQUENCY (MHZ)		ACTUAL	PEAK	NORMALIZED	EFFECTIVE BITS	FILE
2		113.9123		0	7.11395	101
7		114.1426		0.017541	7.10932	103
12		114.0635		0.011519	7.11933	105
18		114.4021		0.037269	7.08095	107
30		114.4576		0.041491	7.06648	109
52	90%	114.6697		0.057559	6.95831	111
72	FULL	115.1201		0.091608	6.80673	113
92	SCALE	114.1528		0.018322	6.69567	115
142	1GS/S	115.8311		0.145094	6.52475	117
192		115.0118		0.083433	6.60954	119
242		112.5301		-0.10604	6.49724	121
292		114.2288		0.024097	6.30903	123
342		114.1682		0.019494	6.20672	125
392		108.4522		-0.42664	6.09576	127
442		108.1088		-0.45418	6.02346	129
492		108.3914		-0.43151	6.14181	131
542		97.16448		-1.38126	6.23008	133
592		101.2868		-1.02035	5.90646	135
642		96.67418		-1.42520	5.74038	137
692		85.50407		-2.49167	5.893	139
2		59.21751		-5.68241	7.2415	102
7		57.46432		-5.94345	7.11202	104
12		57.68306		-5.91044	7.14386	106
18		58.88019		-5.73203	7.12631	108
30	45%	57.36675		-5.95821	7.08924	110
52	FULL	56.13268		-6.14709	7.00167	112
72	SCALE	56.54498		-6.08353	7.00722	114
92	1GS/S	58.77885		-5.74699	7.0452	116
142		59.99924		-5.56850	6.95328	118
192		59.59538		-5.62716	7.01782	120
242		57.55499		-5.92975	6.97903	122
292		57.03721		-6.00824	6.81788	124
342		57.1661		-5.98864	6.79004	126
392		56.8128		-6.04249	6.76935	128
442		56.45794		-6.09691	6.67635	130
492		56.73904		-6.05377	6.85219	132
542		49.24858		-7.28354	6.74581	134
592		52.61939		-6.70849	6.73778	136
642		50.56989		-7.05357	6.69423	138
692		45.09816		-8.04823	6.62211	140

TEK 11602 WITH 11A52 PLUG-IN

Figure 10

TEK 11302 WITH 11A52 PLUG-IN

Figure 11

TABLE # 7

FREQUENCY (MHZ)		ACTUAL	PEAK	NORMALIZED	EFFECTIVE BITS	FILE
2		115.4296		0	7.19355	201
7		115.6960		0.020028	7.12329	203
12		115.2930		-0.01028	7.15647	205
18		114.8579		-0.04312	7.11682	207
30	90%	114.0229		-0.10650	7.0385	209
52	FULL	114.7364		-0.05231	6.93099	211
72	SCALE	114.9043		-0.03961	6.85212	213
92	2GS/S	114.2696		-0.08772	6.74423	215
142		115.1803		-0.01877	6.47238	217
192		114.1455		-0.09716	6.57372	219
242		113.5391		-0.13578	6.55468	221
292		113.9292		-0.11288	6.35891	223
342		113.9975		-0.10843	6.24848	225
392		108.5620		-0.53278	6.1438	227
442		107.6007		-0.61004	6.03893	229
492		107.8708		-0.58826	5.94726	231
542		97.01808		-1.50929	6.02092	233
592		100.7005		-1.18570	5.53465	235
642		96.07426		-1.59420	5.40299	237
692		84.88734		-2.66948	5.52378	239
2		59.92848		-5.69367	7.26717	202
7		58.23035		-5.94335	7.18102	204
12		58.26347		-5.93841	7.18207	206
18		59.15419		-5.80663	7.2162	208
30	45%	57.19053		-6.09986	7.14883	210
52	FULL	56.09713		-6.26753	7.12326	212
72	SCALE	56.42704		-6.21659	7.04769	214
92	2GS/S	58.90148		-5.84382	7.07744	216
142		59.58543		-5.74354	6.97158	218
192		59.61098		-5.73981	7.0941	220
242		57.96344		-5.98326	6.92793	222
292		56.98186		-6.13161	6.85561	224
342		57.08878		-6.11532	6.80353	226
392		56.90487		-6.14335	6.7905	228
442		56.29866		-6.23638	6.69218	230
492		56.57214		-6.19429	6.77547	232
542		49.18012		-7.41055	6.64338	234
592		52.10283		-6.90911	6.37526	236
642		50.16682		-7.23801	6.32491	238
692		44.68724		-8.24267	6.44565	240

TEK 11602 WITH 11A52 PLUG-IN

Figure 12

TEK 11602 WITH 11A52 PLUG-IN

Figure 13

TABLE # 8 11A52 EFFECTIVE BITS AT DIFFERENT GAIN SETTINGS

FREQUENCY	GAIN	% FULL SCALE	EFF BITS	FILE
2	1mV/DIV	90%	5.25216	D01
100	1mV/DIV	90%	5.28489	D15
300	1mV/DIV	90%	5.14489	D29
500	1mV/DIV	90%	5.21552	D57
2	1mV/DIV	45%	5.209	D02
100	1mV/DIV	45%	5.14024	D16
300	1mV/DIV	45%	5.17854	D30
500	1mV/DIV	45%	5.21545	D58
2	2mV/DIV	90%	5.78141	D03
100	2mV/DIV	90%	5.72179	D17
300	2mV/DIV	90%	5.60196	D31
500	2mV/DIV	90%	5.66234	D59
2	2mV/DIV	45%	5.73236	D04
100	2mV/DIV	45%	5.78758	D18
300	2mV/DIV	45%	5.74201	D32
500	2mV/DIV	45%	5.7655	D60
2	5mV/DIV	90%	6.5692	D05
100	5mV/DIV	90%	6.60639	D19
300	5mV/DIV	90%	6.12901	D33
500	5mV/DIV	90%	6.19472	D61
2	5mV/DIV	45%	6.70551	D06
100	5mV/DIV	45%	6.62025	D20
300	5mV/DIV	45%	6.45925	D34
500	5mV/DIV	45%	6.5911	D62
2	10mV/DIV	90%	7.01001	D07
100	10mV/DIV	90%	6.70754	D21
300	10mV/DIV	90%	6.56891	D35
500	10mV/DIV	90%	6.7483	D63
2	10mV/DIV	45%	6.98637	D08
100	10mV/DIV	45%	7.11154	D22
300	10mV/DIV	45%	6.91598	D36
500	10mV/DIV	45%	6.82662	D64
2	20mV/DIV	90%	7.12248	D09
100	20mV/DIV	90%	6.67902	D23
300	20mV/DIV	90%	6.28889	D37
500	20mV/DIV	90%	6.44263	D65
2	20mV/DIV	45%	7.14416	D10
100	20mV/DIV	45%	7.18961	D24
300	20mV/DIV	45%	7.14154	D38
500	20mV/DIV	45%	6.96938	D66

TABLE # 8 (CONTINUED) EFFECTIVE BITS AT DIFFERENT GAIN SETTINGS

FREQUENCY	GAIN	% FULL SCALE	EFF BITS	FILE
2 MHz	50mV/DIV	90%	7.13229	D11
100 MHz	50mV/DIV	90%	6.8791	D25
300 MHz	50mV/DIV	90%	6.19674	D39
500 MHz	50mV/DIV	90%	6.25022	D67
2 MHz	50mV/DIV	45%	7.22968	D12
100 MHz	50mV/DIV	45%	7.27967	D26
300 MHz	50mV/DIV	45%	6.99615	D40
500 MHz	50mV/DIV	45%	6.99903	D68
2 MHz	100mV/DIV	90%	6.9266	D13
100 MHz	100mV/DIV	90%	6.82036	D27
300 MHz	100mV/DIV	90%	6.61577	D41
500 MHz	100mV/DIV	90%	6.53055	D69
2 MHz	100mV/DIV	45%	6.92959	D14
100 MHz	100mV/DIV	45%	6.95342	D28
300 MHz	100mV/DIV	45%	6.77564	D42
500 MHz	100mV/DIV	45%	6.7756	D70

TEK 11A52 AT DIFFERENT GAIN SETTINGS

Figure 14

BASELINE T11A72.B04 2GS/S 50MV/DIV

Figure 15

HISTOGRAM OF T11A72.B04 2GS/S 50MV/DIV

Figure 16

FFT PLOT T11A72.B04 2GS/S 50MV/DIV

Figure 17

BASELINE T11A52.B01 2GS/S 50MV/DIV

Figure 18

HISTOGRAM OF T11A52.B01 2GS/S 50MV/DIV 0 OFFSET

Figure 19

FFT PLOT T11A52.B01 2GS/S 50MV/DIV

Figure 20

Figure 21

SLV>
-- A: P50.LVB 1 T11600
-- B: P51.LVB 1 T11600

Figure 22

SLV>
A: P50.LVB 1 T1160K
B: P53.LVB 1 T1160K

Figure 23

Figure 24

SLV>

A: P01.LVB 1 T11A5E
B: P02.LVB 1 T11A5E

Figure 25

SLV>
.
.

— A: P01.LVB I T11A5C
— B: P05.LVB I T11A5C

Figure 26

Figure 27

Figure 28

17.6800 ns

27.6800 ns

37.6800 ns

Timebase	=	2.00 ns/div	Delay	=	17.6800 ns
Memory 1	=	5.000 mvolts/div	Offset	=	199.0 mvolts
Timebase	=	2.00 ns/div	Delay	=	17.6800 ns
Start	=	2.66032 us	Delta T	=	58.4 ps
Cursor	on	Memory 1	Rho	=	31.81 m%
-1.5360	ns	from ref. plane	Ref Plane	=	25.7760 ns

Stop	=	2.66038 us
Impedance	=	50.0 Ohms
Distance	=	-230.2 mmeters

Figure 29

Figure 30

Figure 31

Figure 32

END

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