



**TEST REPORT**  
**ON**  
**0.7 TO 1.3 GHz**  
**HIGH SPEED**  
**LOW VIDEO TRANSIENT**  
**NON-RECIPROCAL**  
**0dB GAIN SP4T SWITCH MODULE**

**PMI MODEL No:**  
**MSN-4DT-561R875**  
**OPTION: NG**  
Series Number: Prototype

DESIGNED  
BY  
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TESTED  
BY  
RENE AFABLE, YU RONG, HOLLY HAHN

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BY  
YU RONG

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**ISO9001 : 2000 CERTIFIED**



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## 0.7 To 1.3 GHz HIGH SPEED LOW VIDEO TRANSIENT NON-RECIPROCAL SP4T SWITCH MODULE

### KEY FEATURES:

- **Frequency Range: 0.7 to 1.3GHz**
- **Insertion Loss: 0 dB  $\pm$ 0.6dB**
- **Isolation between Inputs: 70 dB min.**
- **Output to Input Isolation: 35dB min.**
- **Video Transient: -70dBm max  
from 0.5 to 1.3GHz**
- **P1dB: +6dBm min**
- **Noise Figure: 11dB max.**
- **Switch Speed: 25ns max. Switch ON/OFF  
3ns max. Rise/Fall time**
- **Harmonics and Spurious:  
-20dBc and -60dBc min when Pin=3dBm  
-65dBc and -65dBc min when Pin=-20dBm**
- **Input: +3dBm nominal, +25dBm max**
- **Size: 1.75" L x 2.80"W x 0.60"H**



### SPECIFICATIONS:

- **Frequency Range: 0.7 to 1.3 GHz**
- **Path Gain: 0  $\pm$  0.6dB**
- **Port to Port Gain Deviation:  $\pm$  0.4dB max at room temperature 0.5dB to -1dB max.  
from room temperature to operating temperature range**
- **Power Input: 3dBm (nominal), CW +25dBm Max. +25dBm ( 1 $\mu$ s, 0.1% Duty Cycle)**
- **P<sub>1dB</sub>: +6dBm min.**
- **Harmonics: -20 dBc min when Pin is +3dBm  
-65 dBc min when Pin is -20dBm**
- **Spurious: -60 dBc min when Pin is +3dBm  
-65 dBc min when Pin is -20dBm**
- **RF Isolation: 65 dB min from unselected input to output  
35 dB min from output to selected input  
70 dB min from isolation input to selected input  
-60 dBm max spectral energy leakage due to port select communication from  
700MHz to 1.3GHz**



- Insertion Phase variation:  $\pm 1.5^\circ$  max for any 50MHz segment
- Insertion Gain variation:  $\pm 0.3\text{dB}$  max for any 50MHz segment
- VSWR: input 1.6:1 max; Output: 1.6:1 max from 700 MHz to 1.3GHz
- Switching Time: 25ns max from 50% TTL to 90% RF output
- Video Feed through: from 500MHz to 1.3GHz, -70 dBm and -60 dBm max after a duration of 45 and 25 ns, respectively.
- Switch Control: “0” ON, “1” OFF
- DC Power Requirement: 5Vdc at 320mA max, -12Vdc at 50mA max

### Environmental Ratings:

- Temperature:  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$  (operating)  
 $-55^\circ\text{C}$  to  $+95^\circ\text{C}$  (storage)
- Humidity: MIL-STD-202, METHOD 103 COND. B
- Shock: MIL-STD-810, METHOD 516 COND. B
- Vibration: MIL-STD-810, METHOD 514 PROC. I
- Altitude : MIL-STD-202, METHOD 105 COND. C
- Salt Fog: ASTM G85.A4
- Explosive Atmosphere: MIL-STD-810, METHOD 511.1
- Acoustic Noise: FELLOW FIG.4 IN SCD





**PRODUCT FEATURE**

REVISIONS		DESCRIPTION	DATE	APPROVED
ZONE	REV.	ORIGINAL RELEASE	JOB# 412302N	2/1/05

**DESCRIPTION**  
 AMC MODEL MSN-4DT-561R875 OPTION: NG, IS A TERMINATED SINGLE POLE FOUR THRU SWITCH MODULE, WHICH INCLUDES HIGH SPEED SP4T, PIN DIODE LIMITER, VIDEO FILTER, GAIN EQUALIZER, ATTENUATOR AND AMPLIFIER. THE MODULE IS DESIGNED TO OPERATE FROM 0.7 TO 1.3GHz WITH 0dB GAIN, HIGH SWITCHING SPEED, EXTREME LOW VIDEO TRANSIENT, MINIMUM 6dBm P1dB AND MINIMUM 35dB REVERSE ISOLATION.

**SPECIFICATIONS**

- FREQUENCY RANGE: 0.7 TO 1.3 GHz
- PATH GAIN: 0.0 dB ± 0.6 dB
- GAIN DEVIATION: ± 0.4dB MAX AT ROOM TEMPERATURE  
0.5 dB or -1 dB MAX FROM ROOM TEMPERATURE TO OPERATING TEMPERATURE RANGE
- POWER INPUT: 3dBm(NOMINAL), CW +25 dBm (MAX)  
+25 dBm (1 uS, 0.1% DUTY CYCLE)  
+6 dBm MIN
- P1dB: -20 dBc MIN WHEN Pin = 3 dBm
- HARMONICS: -65 dBc MIN WHEN Pin = -20 dBm
- SPURIOUS: -60 dBc MIN WHEN Pin = 3 dBm
- RF ISOLATION: -65 dBc MIN WHEN Pin = -20 dBm  
-65 dBc MIN FROM UNSELECTED INPUT TO OUTPUT  
35 dB MIN FROM OUTPUT TO SELECTED INPUT  
70 dB MIN FROM ISOLATION INPUT TO INPUT  
-60 dBm MAX SPECTRAL ENERGY LEAKAGE FROM 700 TO 1300 MHz
- INSERTION PHASE VARIATION: ± 1.5° MAX FOR ANY 50 MHz SEGMENT
- INSERTION GAIN VARIATION: ± 0.3 dB MAX FOR ANY 50 MHz SEGMENT
- VSWR: INPUT: 1.4:1 MAX; OUTPUT: 1.6:1 MAX  
FROM 700 TO 1300 MHz
- SWITCHING TIME: 25 ns MAX FROM 50% TTL TO 90% RF OUTPUT
- VIDEO FEEDTHROUGH: FROM 500 TO 1300 MHz, -70 AND -60 dBm MAX AFTER A DURATION OF 45 ns AND 25ns, RESPECTIVELY.
- SWITCH CONTROL: "0" ON, "1" OFF
- DC POWER REQUIREMENT: 5Vdc AT 320 mA MAX, -12Vdc AT 50mA MAX

**ENVIRONMENTAL RATINGS:**

- TEMPERATURE: -40°C TO +85°C (OPERATING)  
-55°C TO +95°C (STORAGE)
- HUMIDITY: MIL-STD-202, METHOD 103 COND. B
- SHOCK: MIL-STD-810, METHOD 516 COND. B
- VIBRATION: MIL-STD-810, METHOD 514 PROC. I
- ALTITUDE: MIL-STD-202, METHOD 105 COND. C
- SALT FOG: ASTM G85.44
- EXPLOSIVE ATMOSPHERE: MIL-STD-810, METHOD 511.1
- ACOUSTIC NOISE: FOLLOW FIG.4 IN SCD

NOTE: SPECIFICATIONS WILL VARY OVER OPERATING TEMPERATURE  
 NOTE: THE ABOVE SPECIFICATIONS ARE SUBJECT TO CHANGE OR REVISION

CONTROL / WORLD LINES	SWITCH PATH
E1 E2 E3 E4	SELECTED
0 1 1 1	J1 TO J5
1 0 1 1	J2 TO J5
1 1 0 1	J3 TO J5
1 1 1 0	J4 TO J5

AMERICAN MICROWAVE CORPORATION  
 MODEL: MSN-4DT-561R875  
 OPTION: NG  
 DATE CODE: 2502-561R875-01  
 DATE CODE: 2502-561R875-01  
 DATE CODE: 2502-561R875-01

AMERICAN MICROWAVE CORPORATION  
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 ISO 9001:2000 CERTIFIED

**PRODUCT FEATURE**  
 MSN-4DT-561R875  
 OPTION: NG  
 0.7 TO 1.3GHz SP4T AND AMPLIFIER MODULE

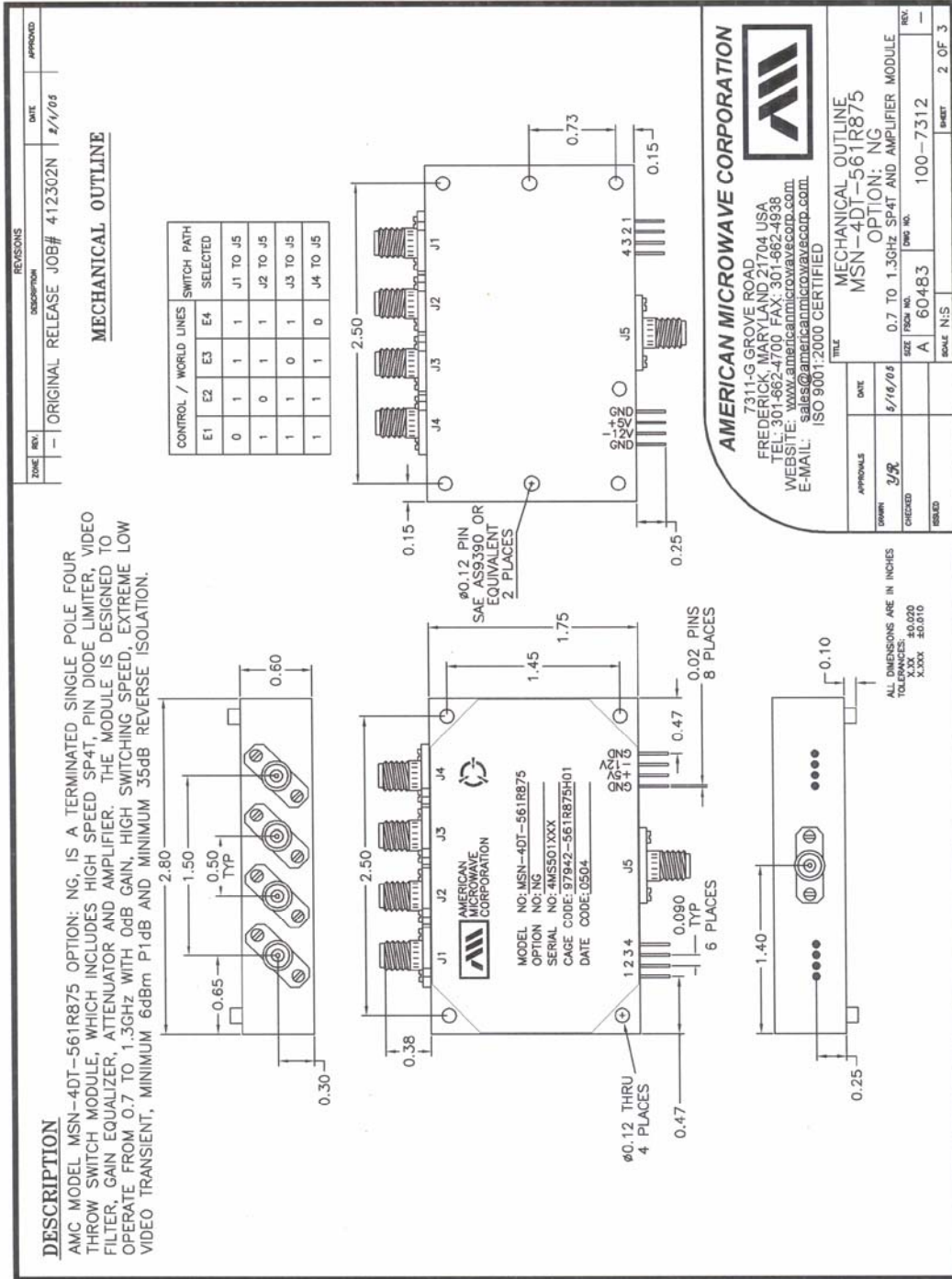
APPROVALS	DATE
3/9/05	5/16/05

SIZE FROM A: 60483  
 SHEET 1 OF 3

ALL DIMENSIONS ARE IN INCHES  
 TOLERANCES:  
 3.000 ±0.010  
 2.000 ±0.010



**OUTLINE DRAWING**



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**FUNCTIONAL SCHEMATIC**

REVISES	DATE	APPROVED	
NO. DESCRIPTION	DATE	APPROVED	
1 ORIGINAL RELEASE JOB# 412302N DETECTION MONITORING TECHNOLOGIES, VA	8/17/05		

**DESCRIPTION**  
 AMC MODEL MSN-4DT-561R875 OPTION: NG, IS A TERMINATED SINGLE POLE FOUR THROW SWITCH MODULE, WHICH INCLUDES HIGH SPEED SP4T, PIN DIODE LIMITER, VIDEO FILTER, GAIN EQUALIZER, ATTENUATOR AND AMPLIFIER. THE MODULE IS DESIGNED TO OPERATE FROM 0.7 TO 1.3GHz WITH 0dB GAIN, HIGH SWITCHING SPEED, EXTREME LOW VIDEO TRANSIENT, MINIMUM 6dBm P1dB AND MINIMUM 35dB REVERSE ISOLATION.

**FUNCTIONAL BLOCK DIAGRAM**

**CONFIDENTIAL AND PROPRIETARY**

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 ISO 9001:2000 CERTIFIED

APPROVALS	DATE	TITLE	
3/98	8/16/05	FUNCTIONAL BLOCK DIAGRAM MSN-4DT-561R875 OPTION: NG	
CHECKED	SIZE	FORM NO.	REV.
A	60483	0.7 TO 1.3GHz SP4T AND AMPLIFIER MODULE	-
DRAWN	DWG NO.	SCALE	SHEET
-	100-7312	NS	3 OF 3



## Reflections, Transmissions & Reverse Isolations



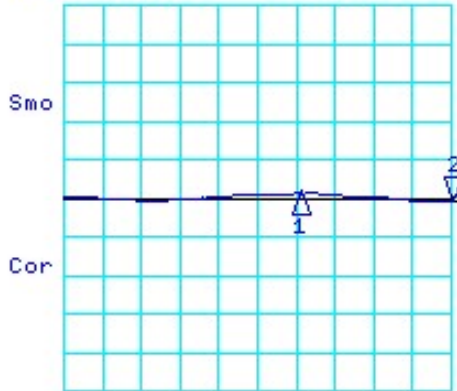
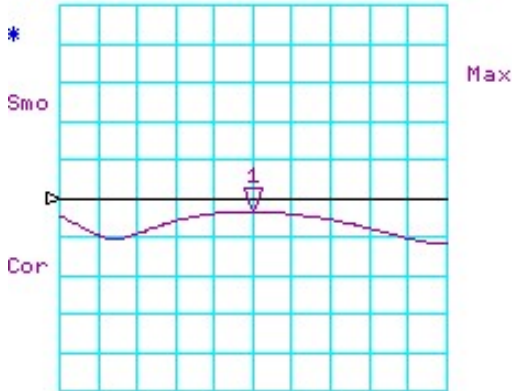


## J1 to J5 at 25°C

10 May 2005 16:19:09

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-13.006 dB .997 000 000 GHz

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.08800 dB 1.300 000 000 GHz



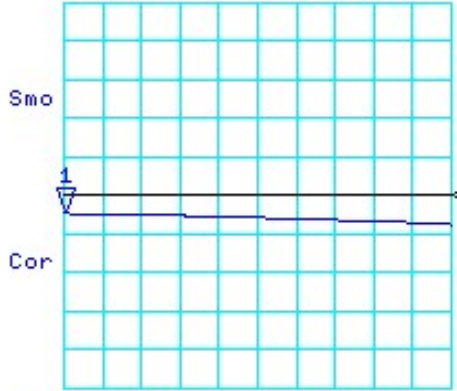
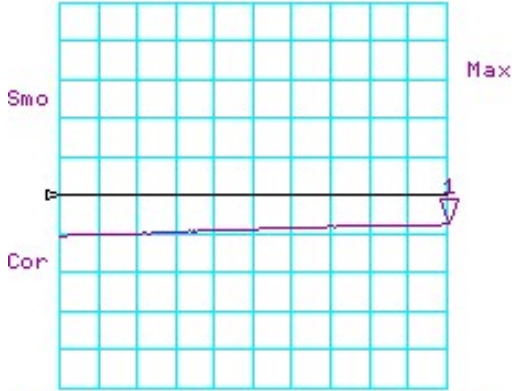
CH2 Markers  
 Min  
 1: .12300 dB  
 1.05300 GHz

START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.476 dB 1.300 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.317 dB .700 000 000 GHz



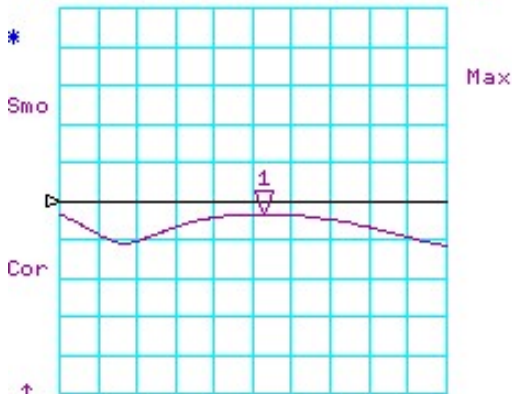
START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

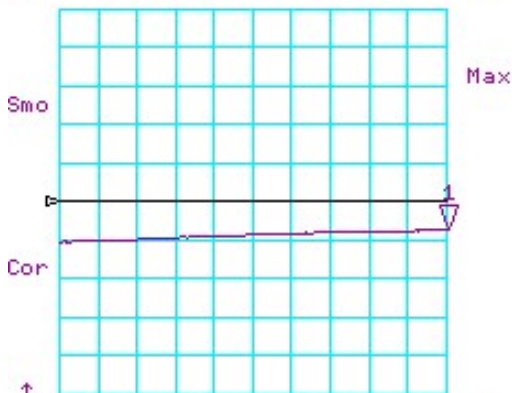


## J1 to J5 at -40°C

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-12.857 dB 1.015 000 000 GHz

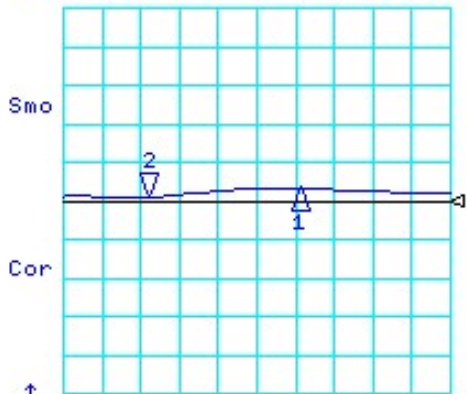


START 700.000 MHz STOP 1300.000 MHz  
 CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.337 dB 1.300 000 000 GHz

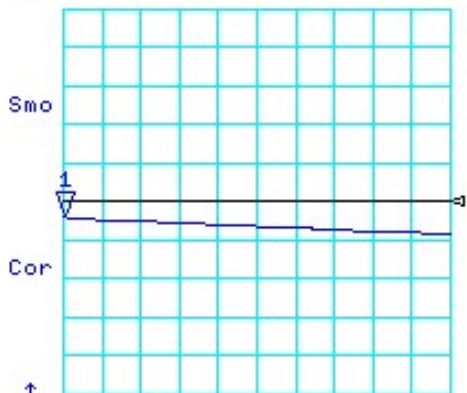


START 700.000 MHz STOP 1300.000 MHz

10 May 2005 16:58:38  
 CH2 LOG 1 dB/ REF 0 dB  
 S21 2:.09400 dB .829 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz  
 CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-16.854 dB .700 000 000 GHz



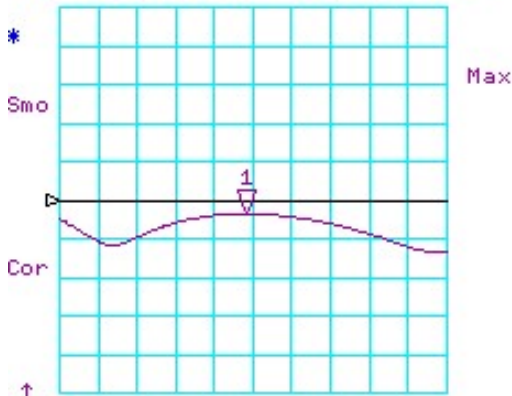
START 700.000 MHz STOP 1300.000 MHz

CH2 Markers  
 Min  
 1: .34000 dB  
 1.06300 GHz



## J1 to J5 at 85°C

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-13.019 dB .988 000 000 GHz



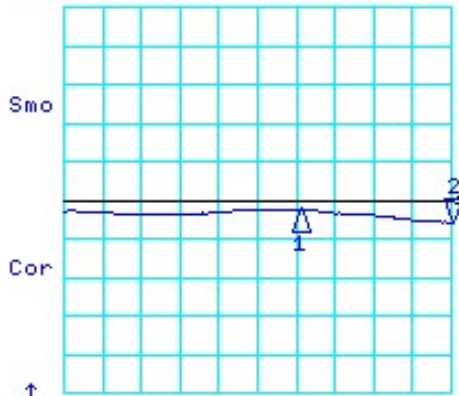
START 700.000 MHz STOP 1300.000 MHz  
 CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.719 dB 1.294 000 000 GHz



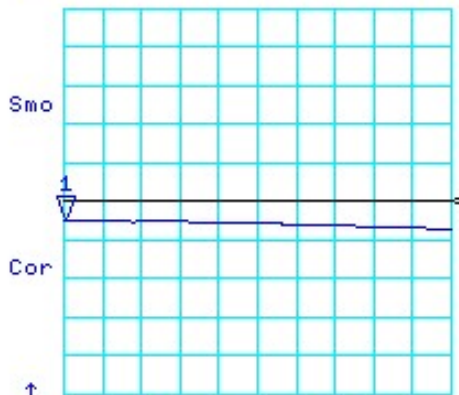
START 700.000 MHz STOP 1300.000 MHz

10 May 2005 17:29:05

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.58500 dB 1.300 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz  
 CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.615 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

CH2 Markers  
 Min  
 1:-.25700 dB  
 1.06300 GHz

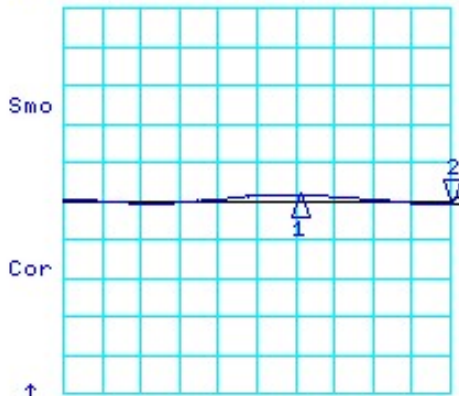
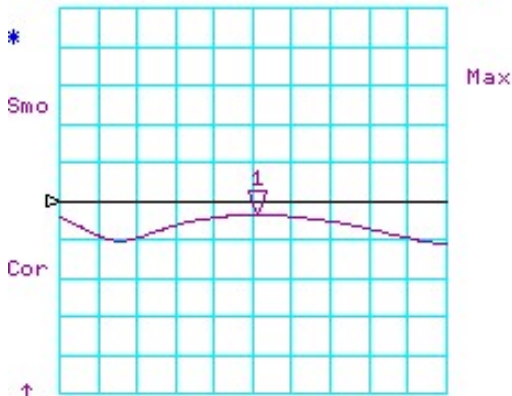


## J2 to J5 at 25°C

10 May 2005 16:30:51

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-13.138 dB 1.003 000 000 GHz

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.09800 dB 1.300 000 000 GHz



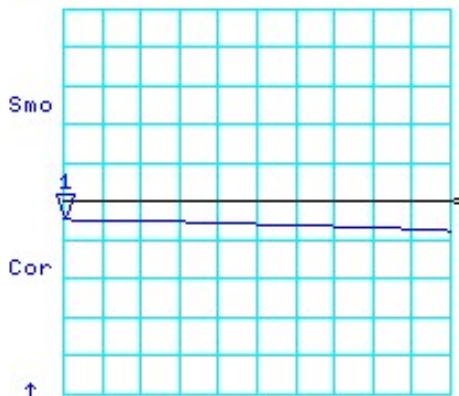
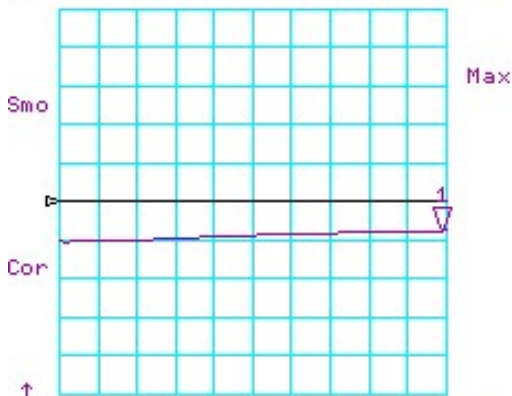
CH2 Markers  
 Min  
 1: .16100 dB  
 1.06300 GHz

START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.556 dB 1.291 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.282 dB .700 000 000 GHz



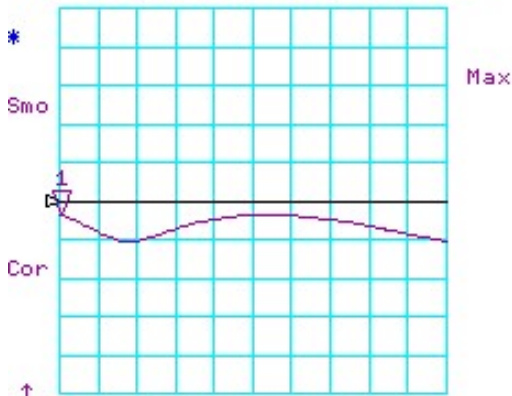
START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz



## J2 to J5 at -40°C

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-12.954 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

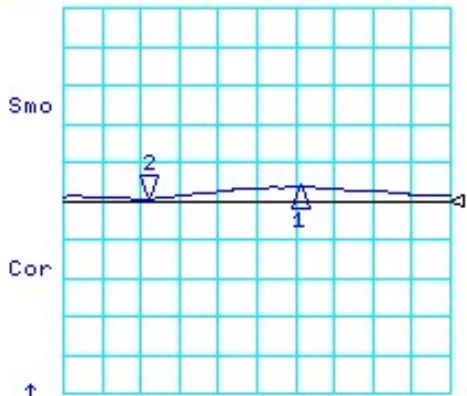
CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.365 dB 1.294 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

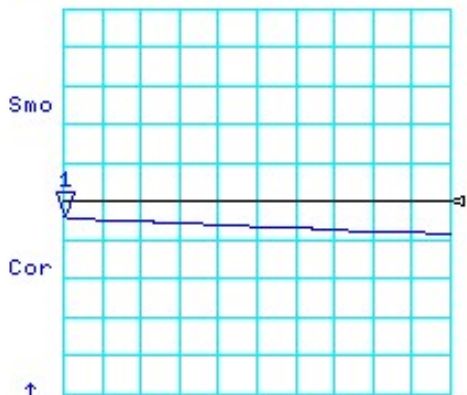
10 May 2005 17:04:24

CH2 LOG 1 dB/ REF 0 dB  
 S21 2: .055500 dB .829 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-16.854 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

CH2 Markers  
 Min  
 1: .36200 dB  
 1.06300 GHz

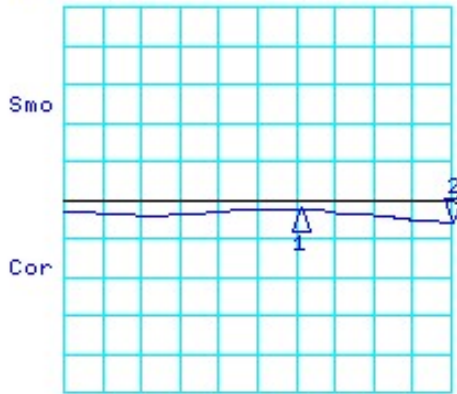
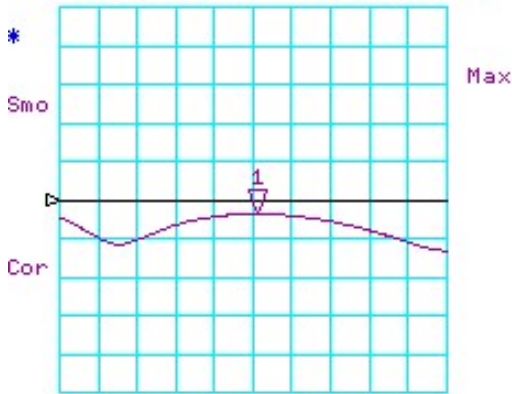


## J2 to J5 at 85°C

10 May 2005 17:33:54

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-13.125 dB 1.003 000 000 GHz

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.59900 dB 1.300 000 000 GHz



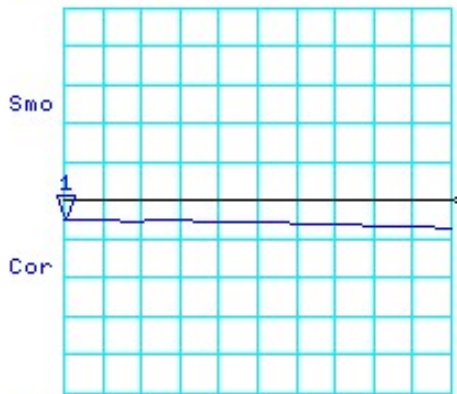
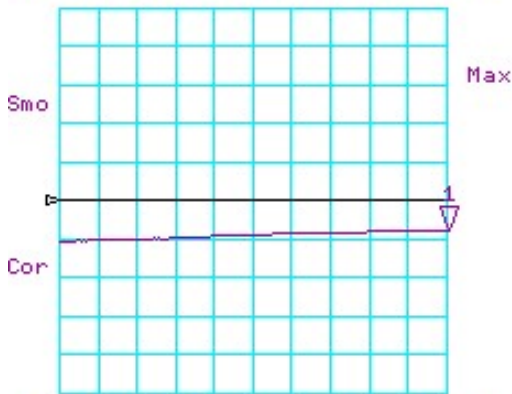
CH2 Markers  
 Min  
 1:-.24100 dB  
 1.06300 GHz

START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.753 dB 1.300 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.609 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

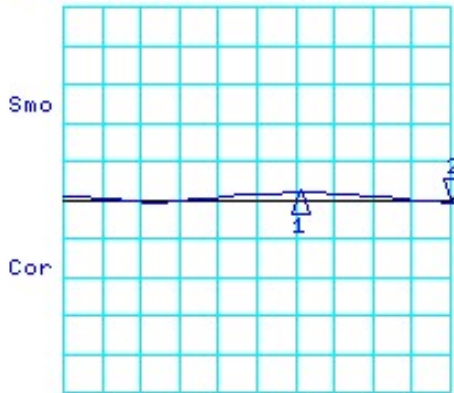
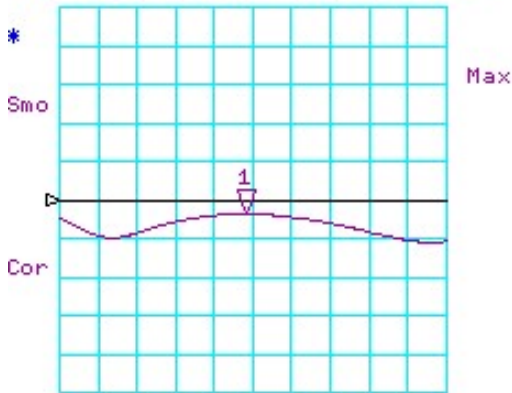


### J3 to J5 at 25°C

10 May 2005 16:35:04

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-13.147 dB .985 000 000 GHz

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.05500 dB 1.300 000 000 GHz



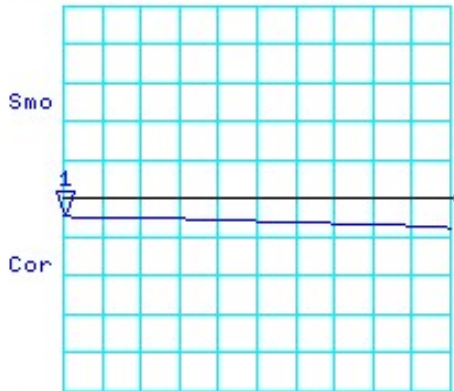
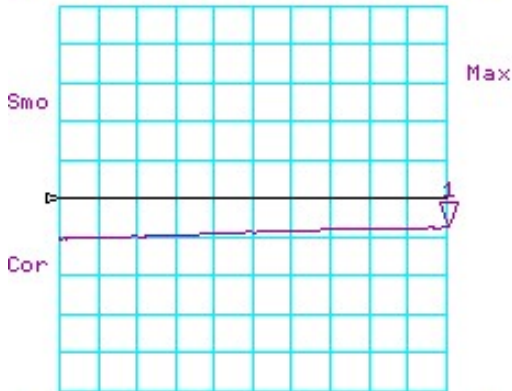
CH2 Markers  
 Min  
 1: .20300 dB  
 1.06300 GHz

START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.432 dB 1.300 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.291 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

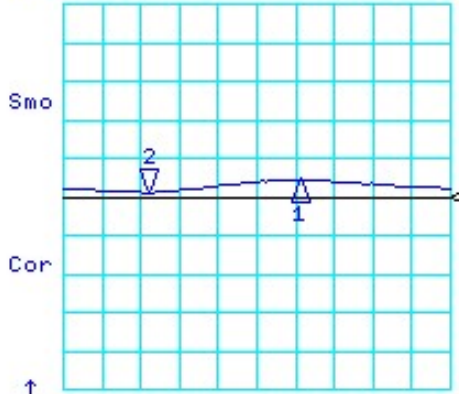
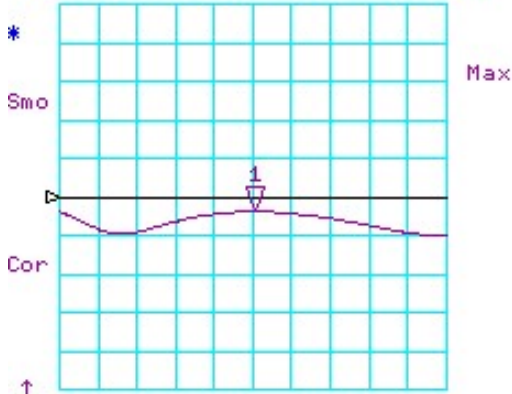


## J3 to J5 at -40°C

10 May 2005 17:09:19

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-13.291 dB 1.000 000 000 GHz

CH2 LOG 1 dB/ REF 0 dB  
 S21 2: .11300 dB .829 000 000 GHz



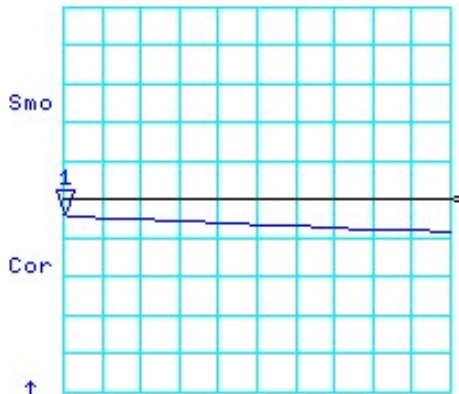
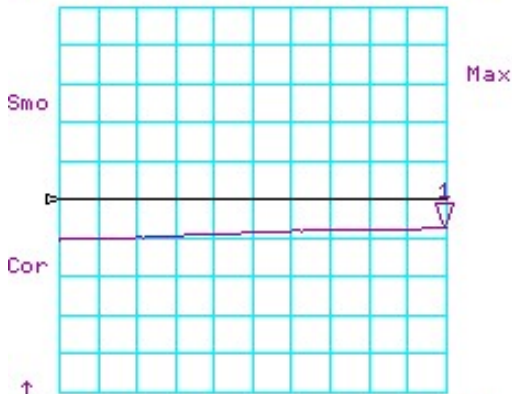
CH2 Markers  
 Min  
 1: .43900 dB  
 1.06300 GHz

START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.325 dB 1.294 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-16.858 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz



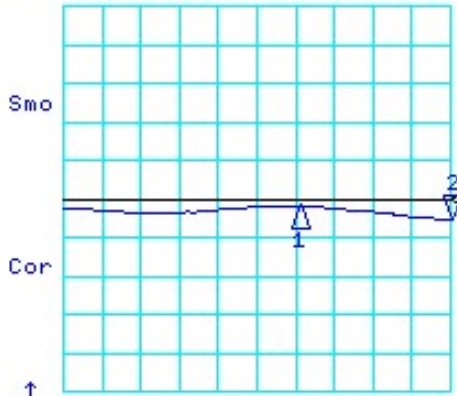
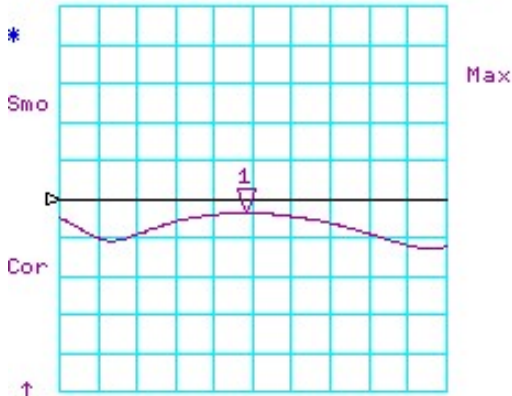


### J3 to J5 at 85°C

10 May 2005 17:38:10

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-13.151 dB .985 000 000 GHz

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.55100 dB 1.300 000 000 GHz



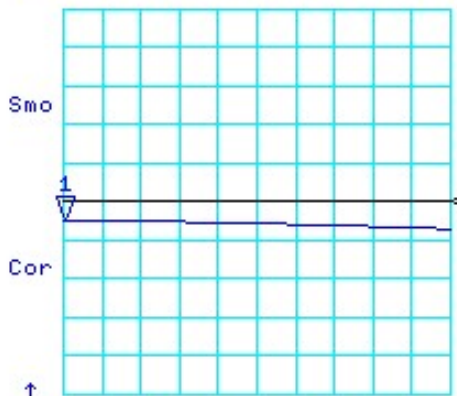
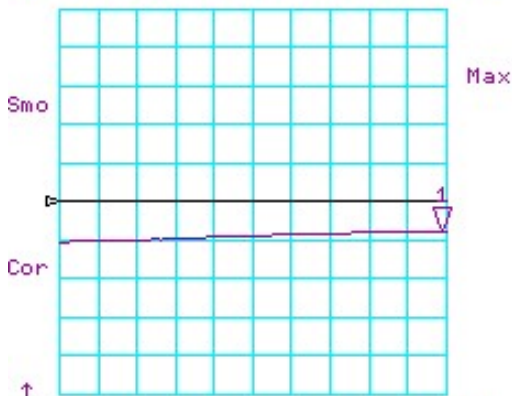
CH2 Markers  
 Min  
 1:-.18800 dB  
 1.06300 GHz

START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.747 dB 1.291 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.636 dB .700 000 000 GHz



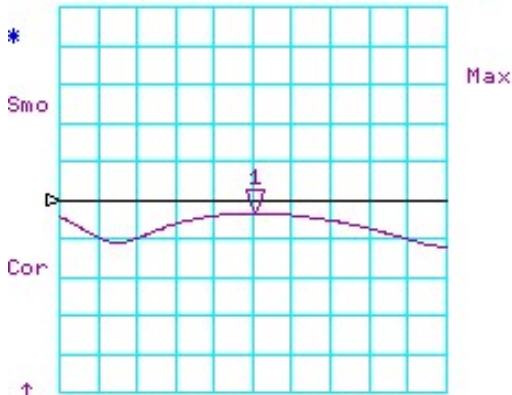
START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz



## J4 to J5 at 25°C

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-12.942 dB 1.000 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

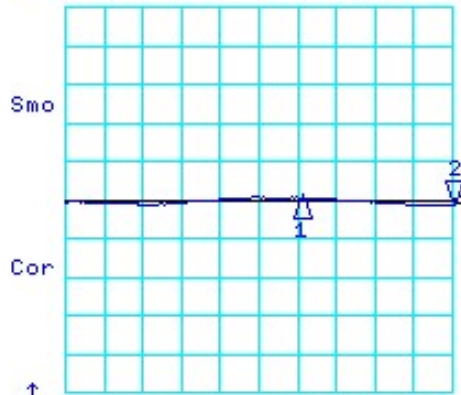
CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.575 dB 1.294 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

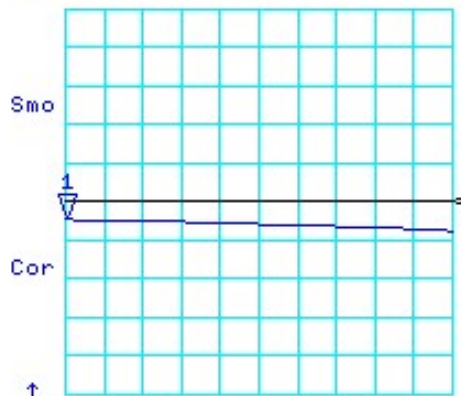
10 May 2005 16:40:14

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.15200 dB 1.300 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.282 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

CH2 Markers  
 Min  
 1: .07200 dB  
 1.06300 GHz

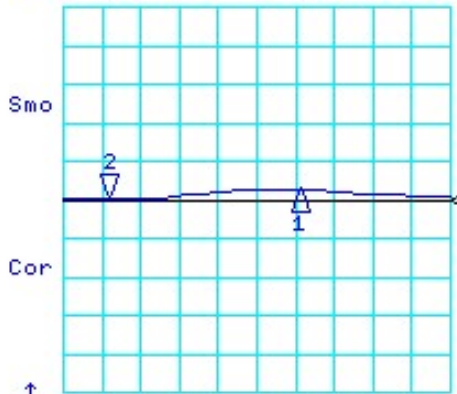
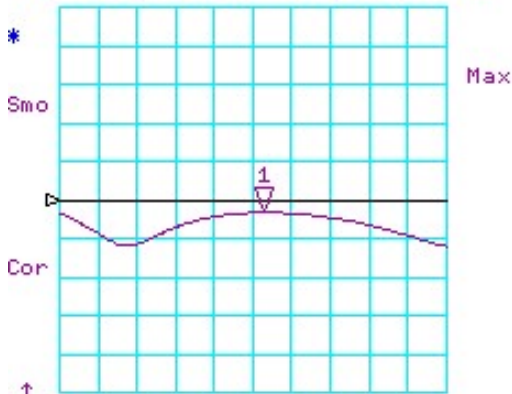


## J4 to J5 at -40°C

10 May 2005 17:14:01

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-12.709 dB 1.015 000 000 GHz

CH2 LOG 1 dB/ REF 0 dB  
 S21 2:.02800 dB .769 000 000 GHz



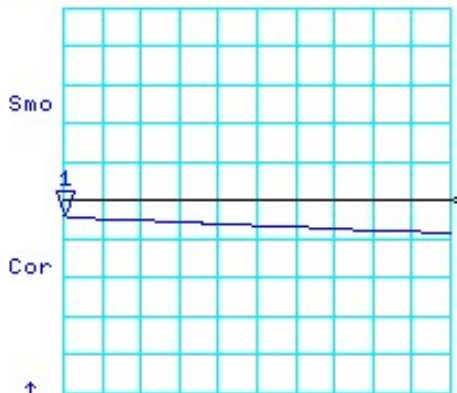
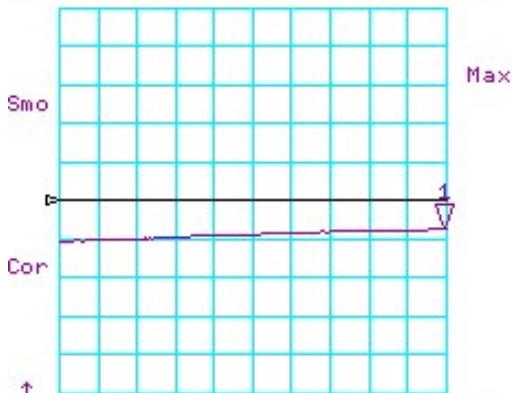
CH2 Markers  
 Min  
 1: .27200 dB  
 1.06300 GHz

START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.337 dB 1.294 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-16.861 dB .700 000 000 GHz



START 700.000 MHz STOP 1300.000 MHz

START 700.000 MHz STOP 1300.000 MHz

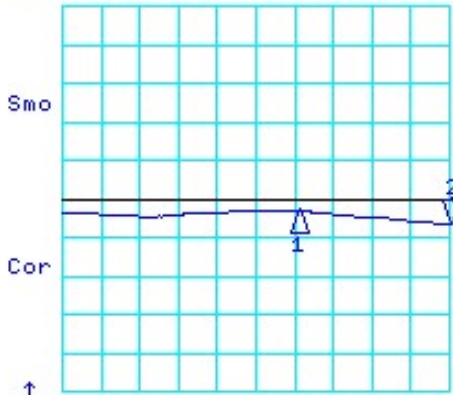
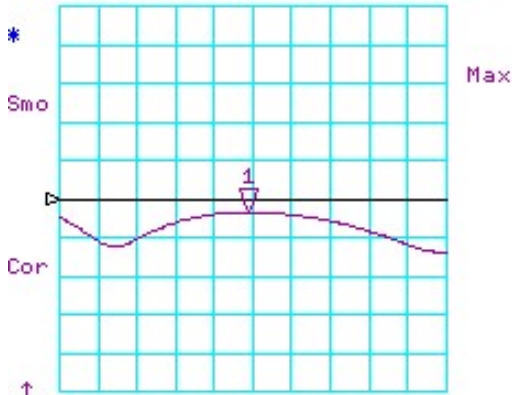


## J4 to J5 at 85°C

10 May 2005 17:42:25

CH1 LOG 10 dB/ REF -9.54 dB  
 S11 1:-12.939 dB .991 000 000 GHz

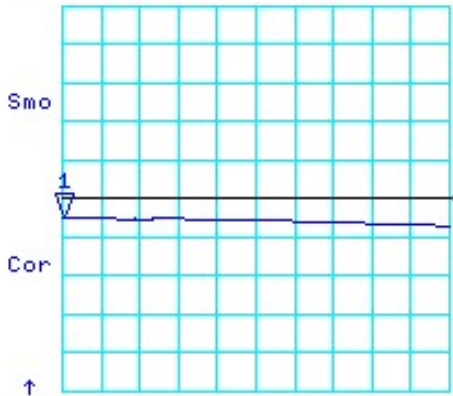
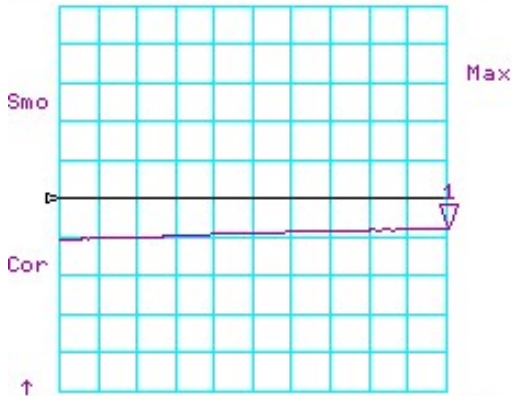
CH2 LOG 1 dB/ REF 0 dB  
 S21 2:-.64700 dB 1.300 000 000 GHz



CH2 Markers  
 Min  
 1:-.31300 dB  
 1.06300 GHz

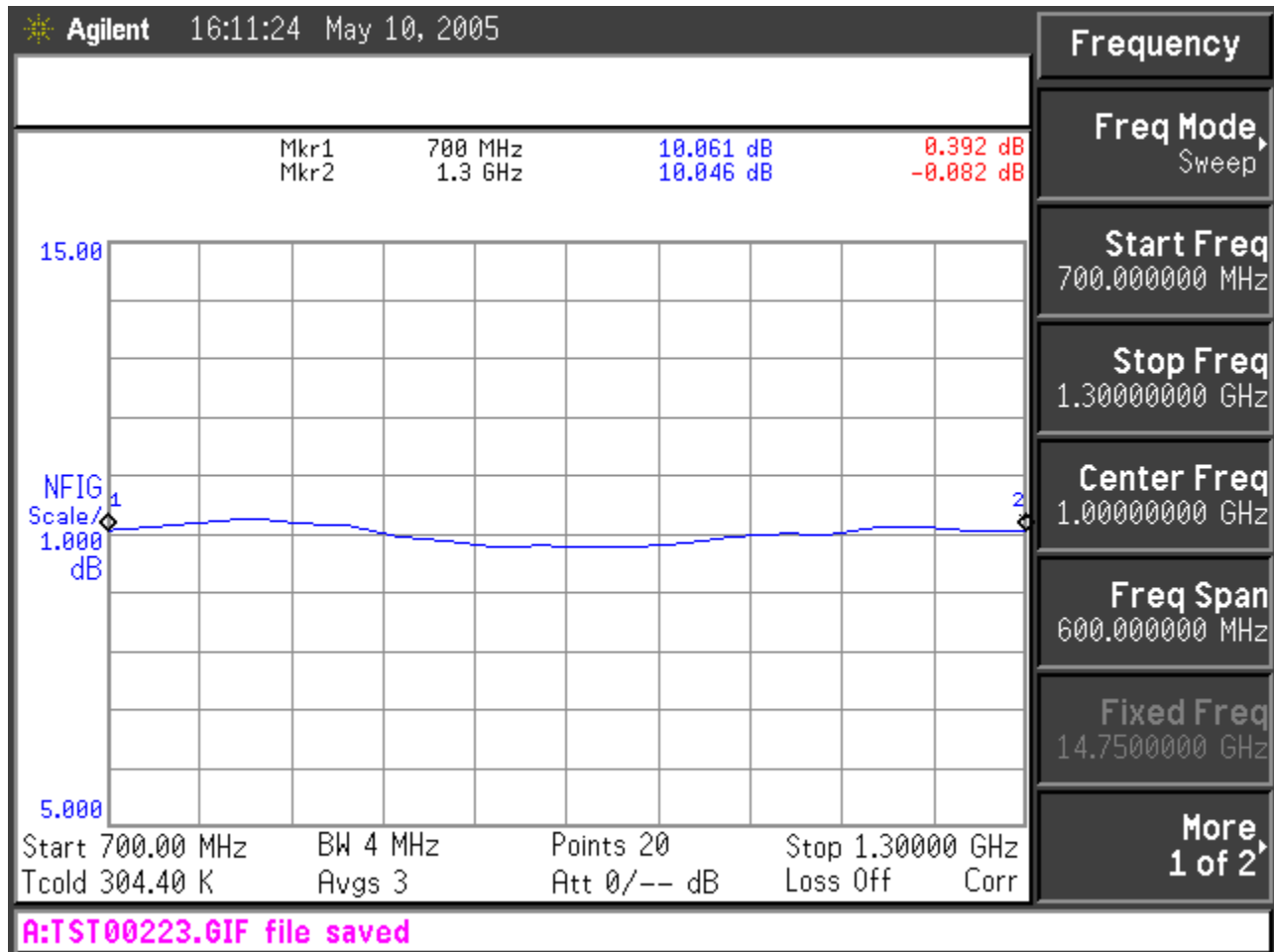
CH3 LOG 10 dB/ REF -35 dB  
 S12 1:-42.781 dB 1.300 000 000 GHz

CH4 LOG 10 dB/ REF -12.74 dB  
 S22 1:-17.623 dB .700 000 000 GHz



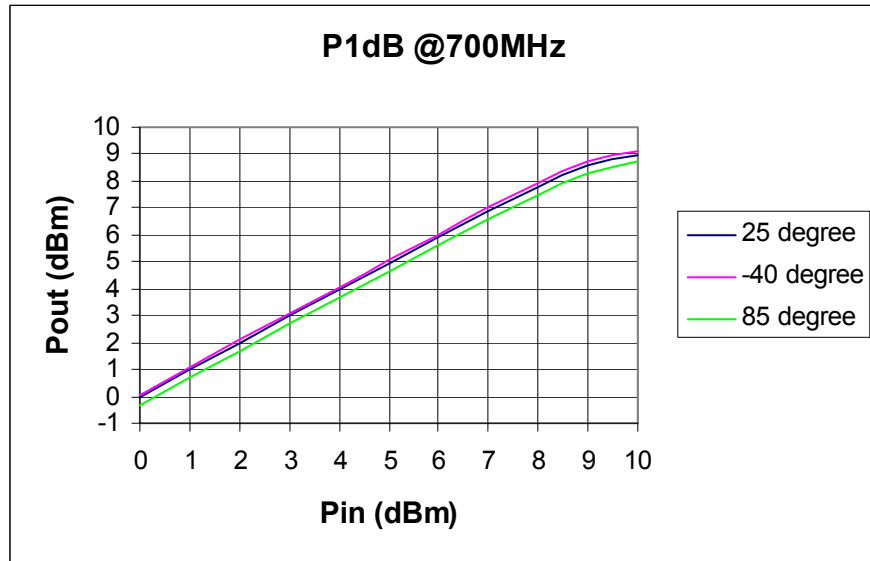


## Noise Figure Performance

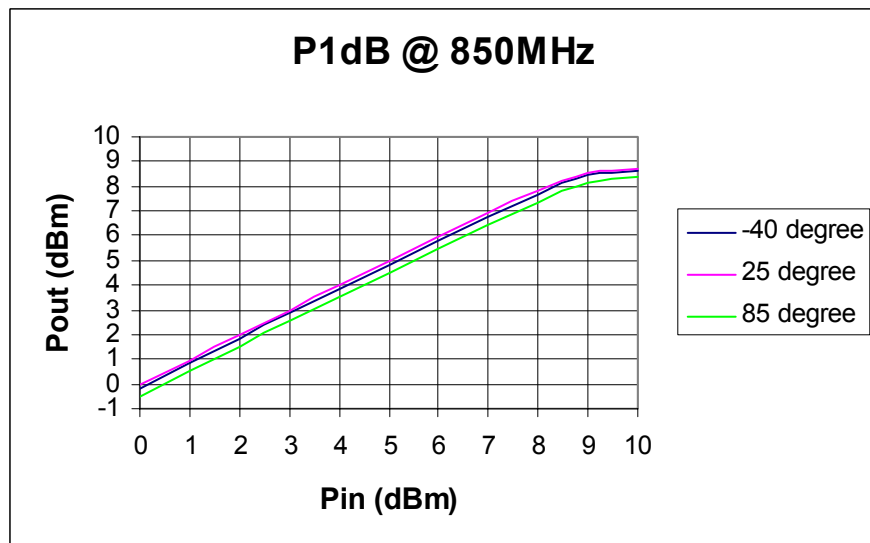




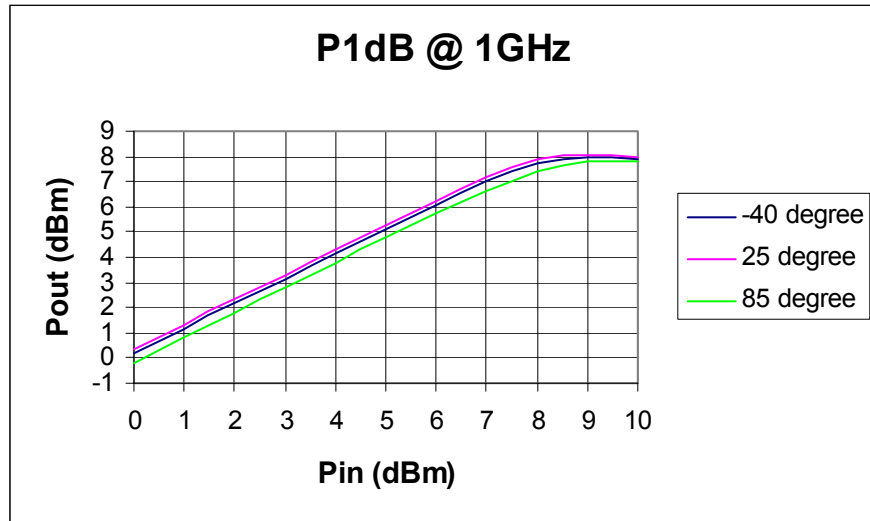
## The $P_{1dB}$ Performance



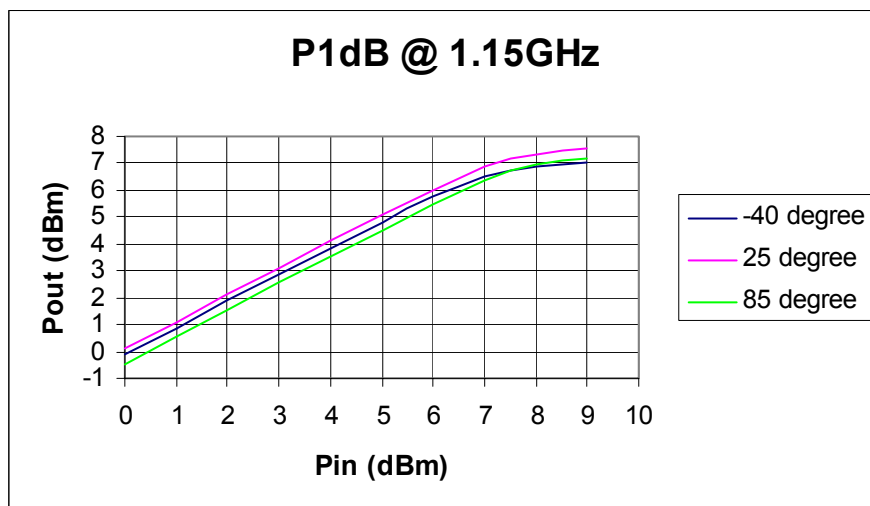
(a)



(b)

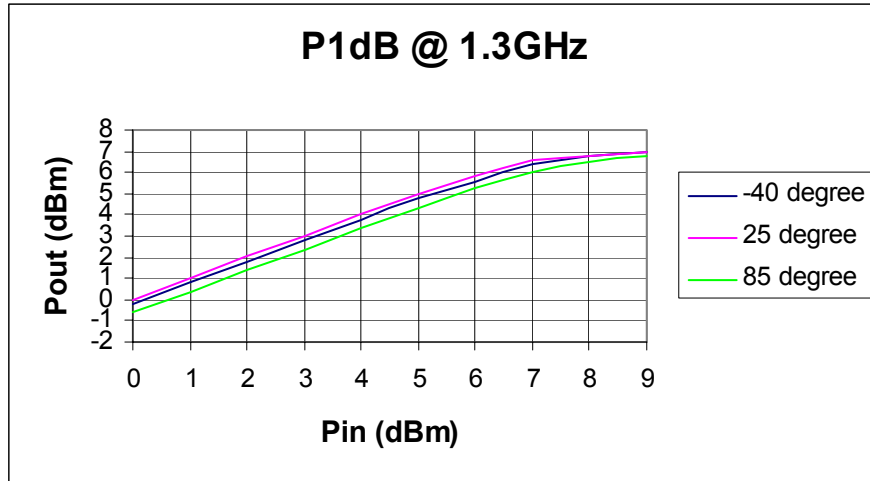


(C)



(d)





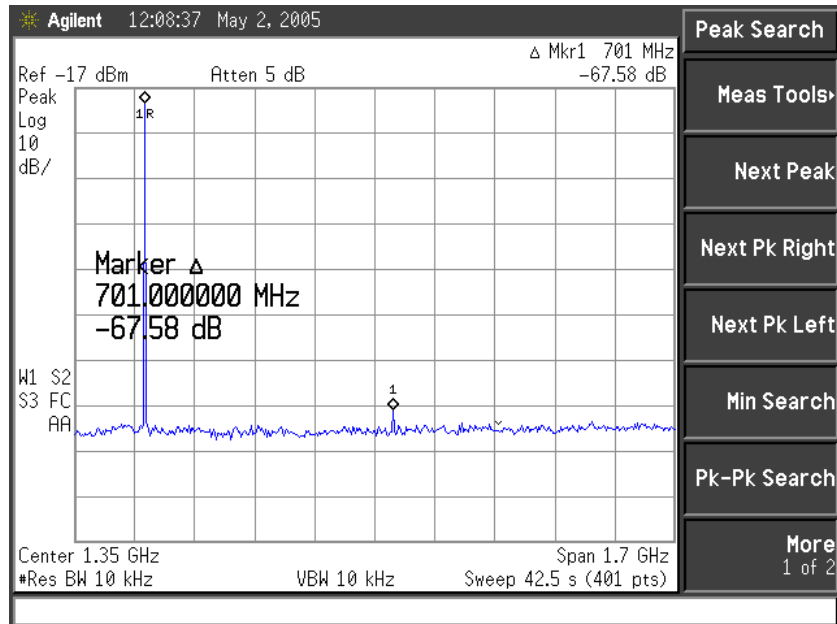
(e)



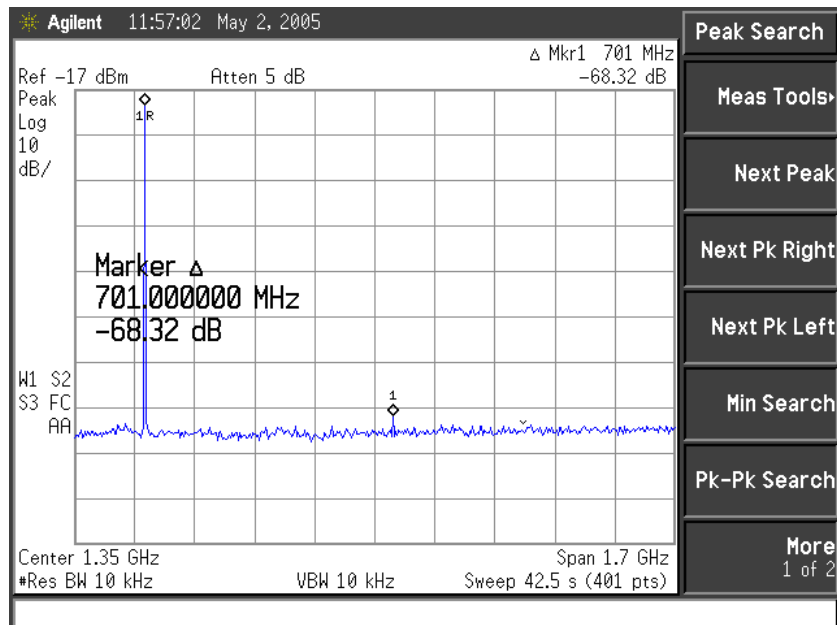
## The Harmonic Performance



### -20dBm input @ J1

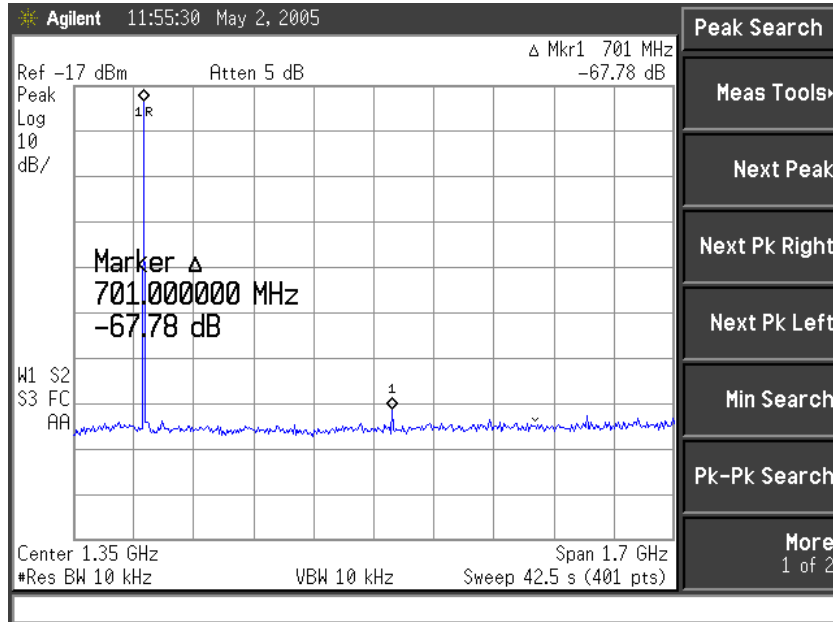


### -20dBm input @ J2

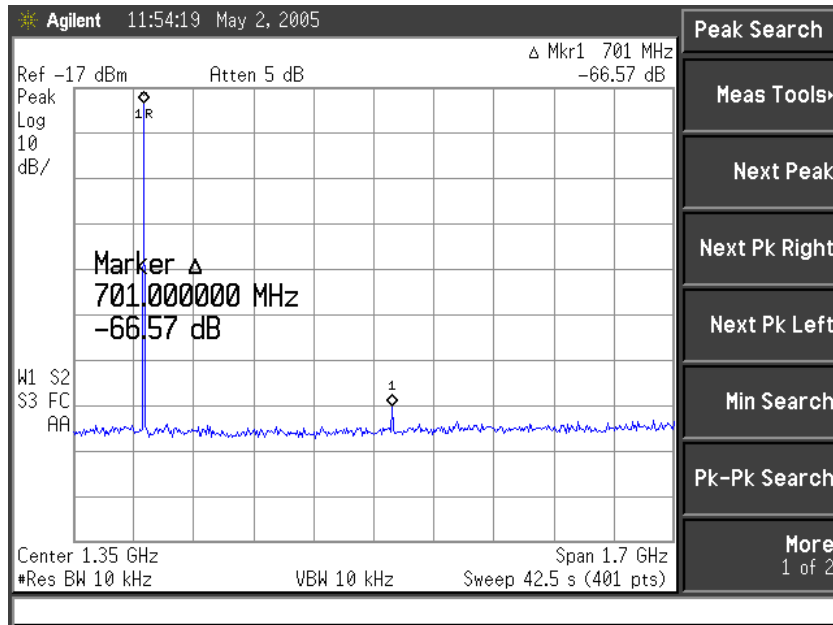




### -20dBm input @ J3

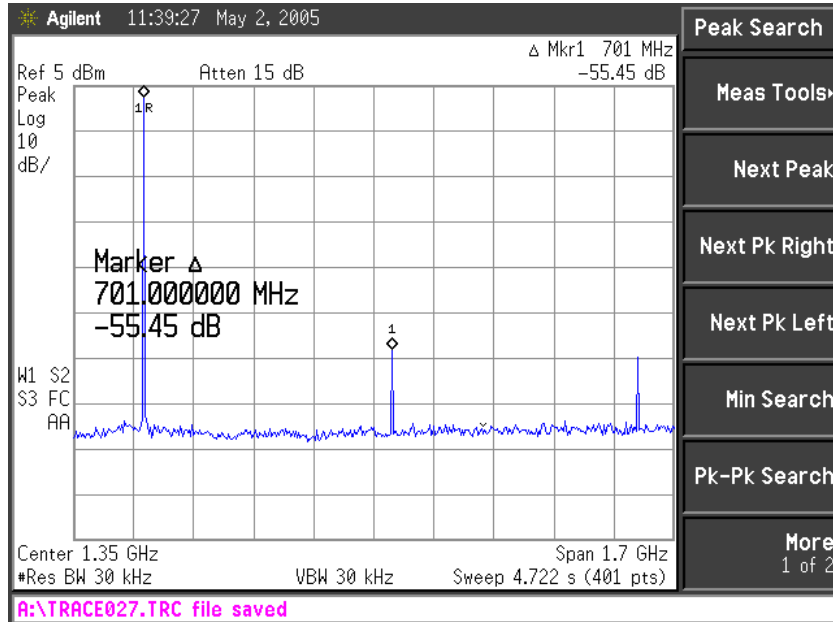


### -20dBm input @ J4

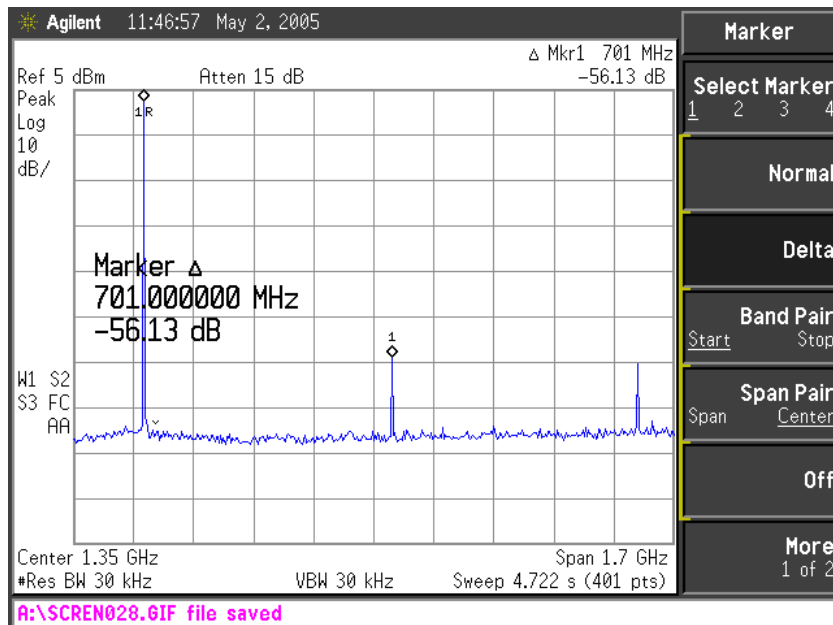




### +3dBm input @ J1

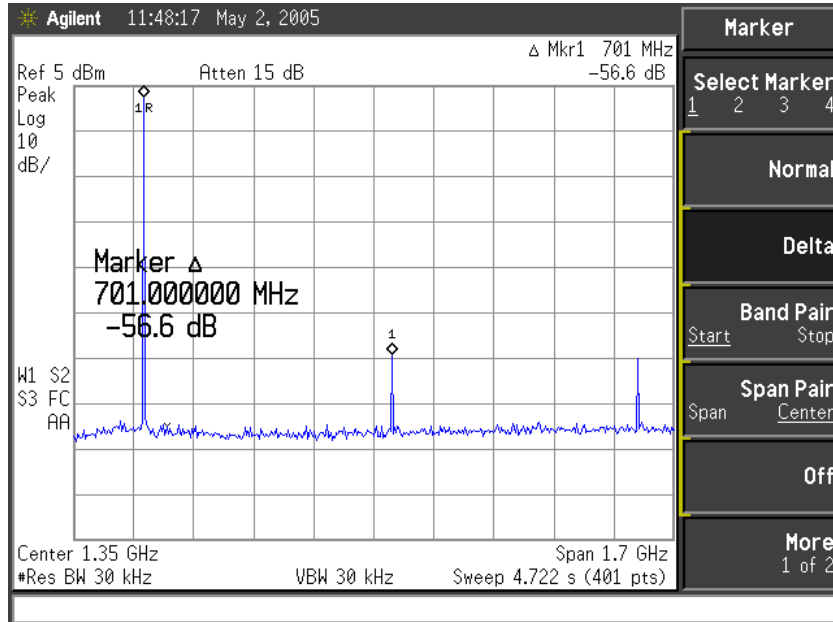


### +3dBm input @ J2

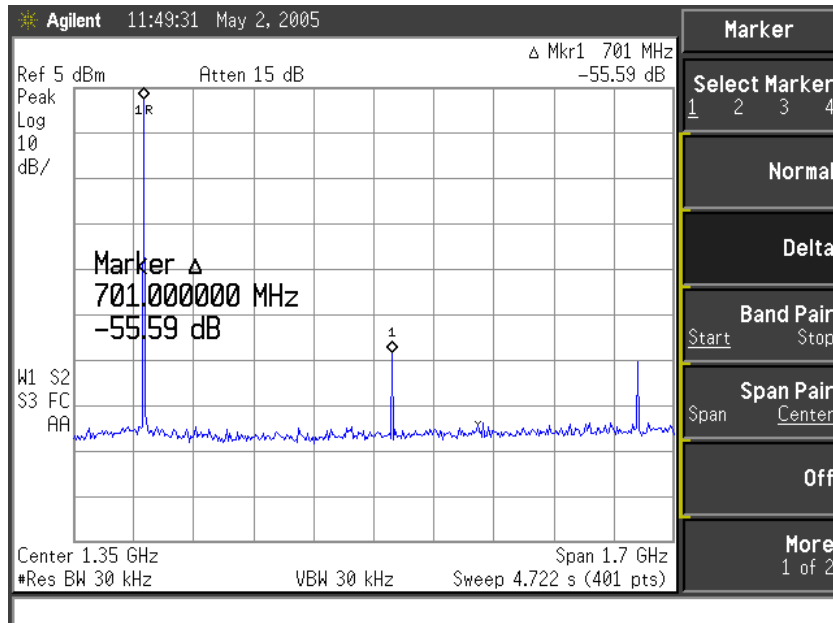




**+3dBm input @ J3**



**+3dBm input @ J4**

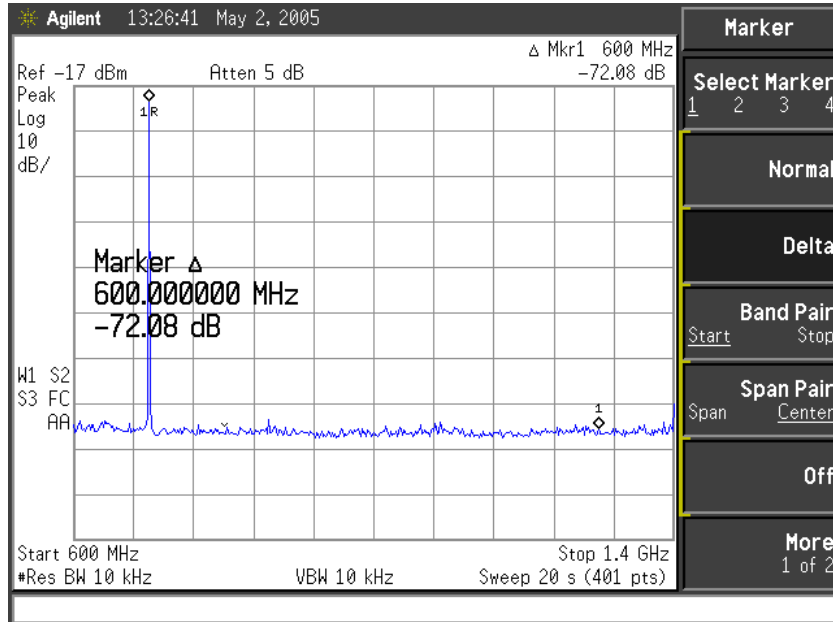




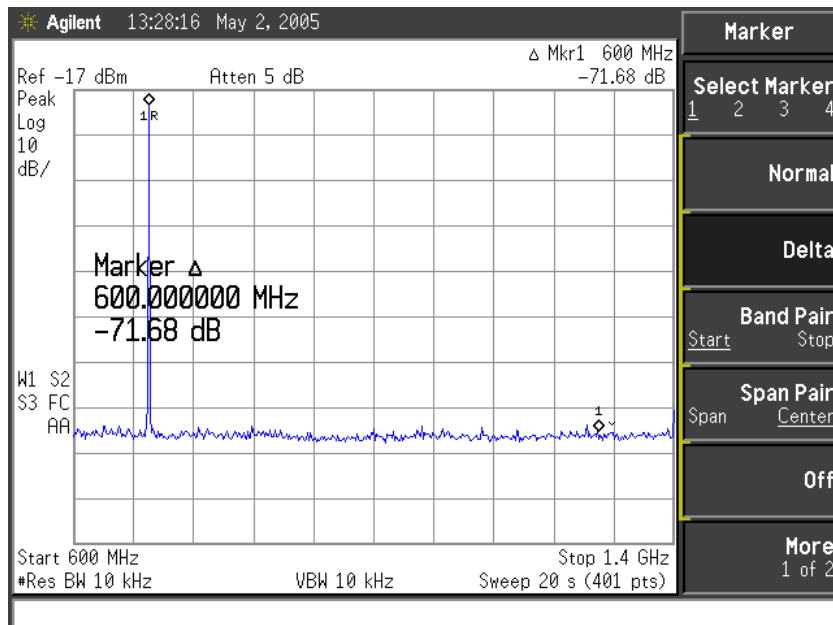
## The Spurious Performance



### -20dBm input @ J1



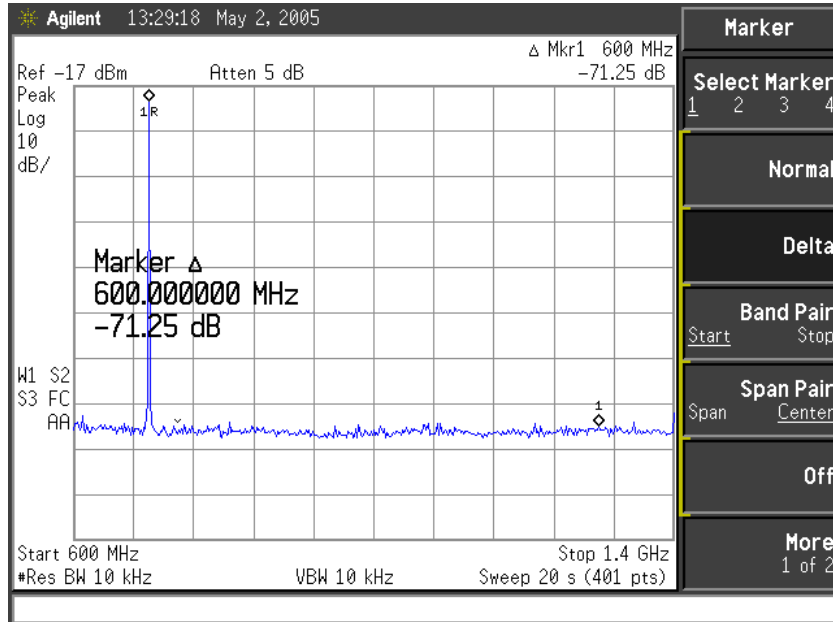
### -20dBm input @ J2



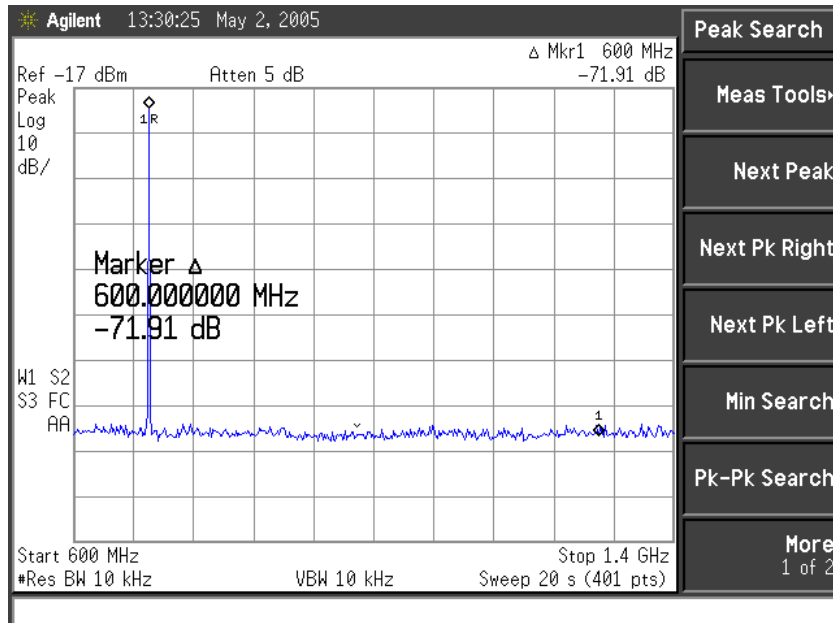




### -20dBm input @ J3

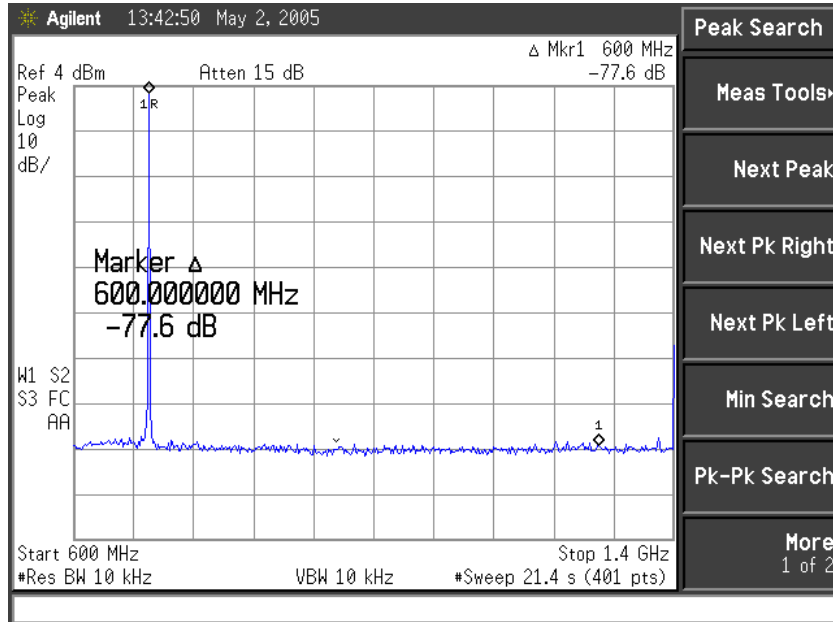


### -20dBm input @ J4

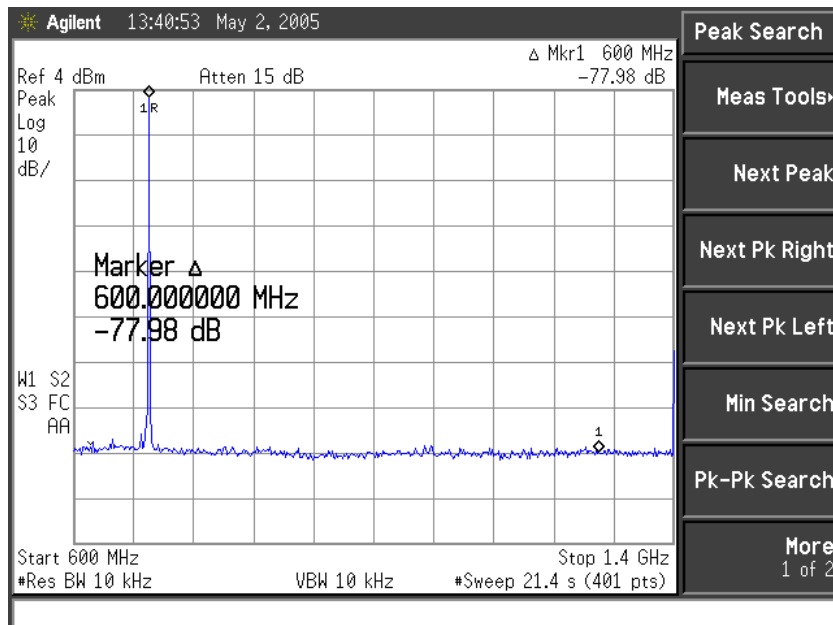




### +3dBm input @ J1

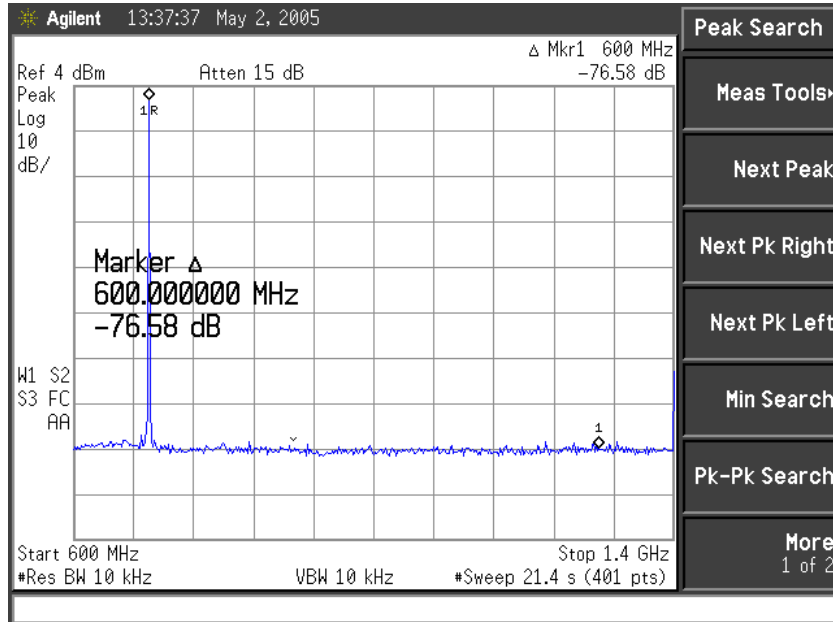


### +3dBm input @ J2

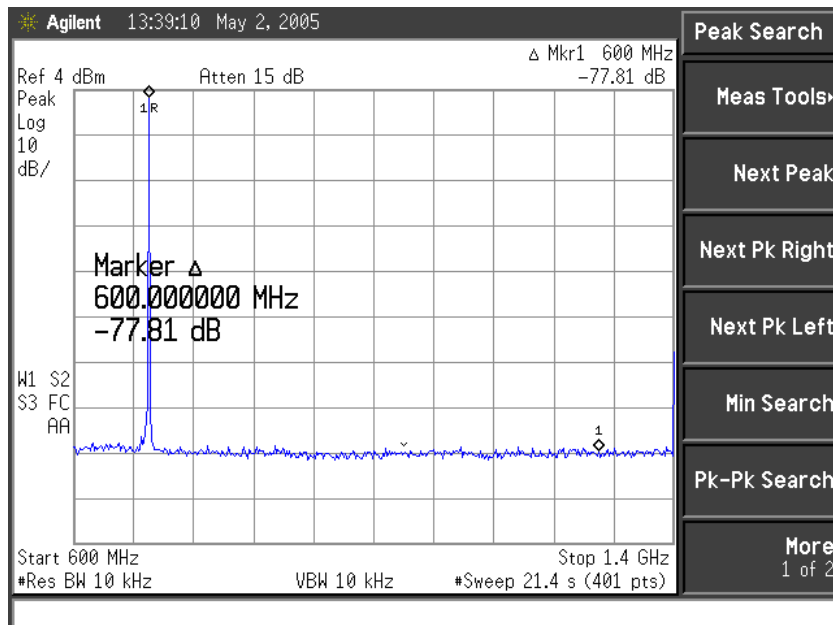




### +3dBm input @ J3



### +3dBm input @ J4

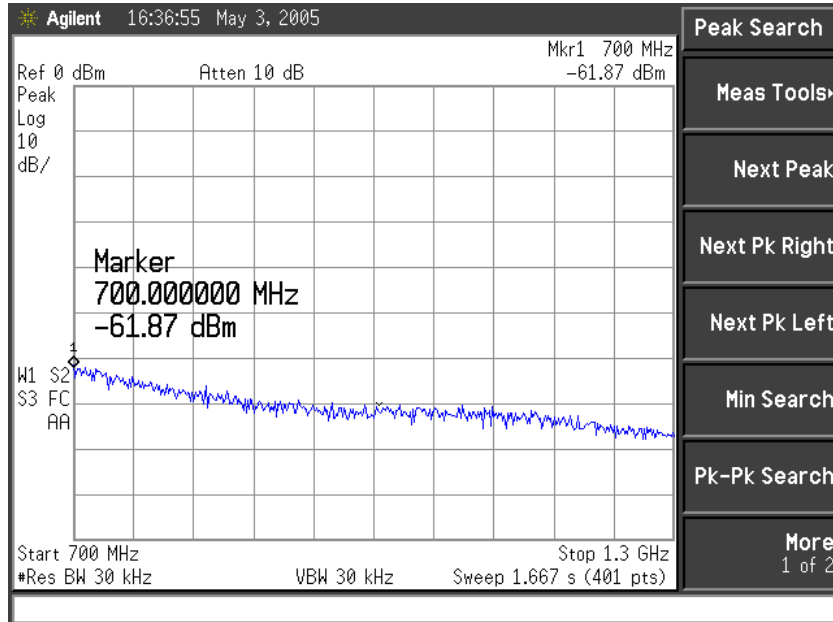




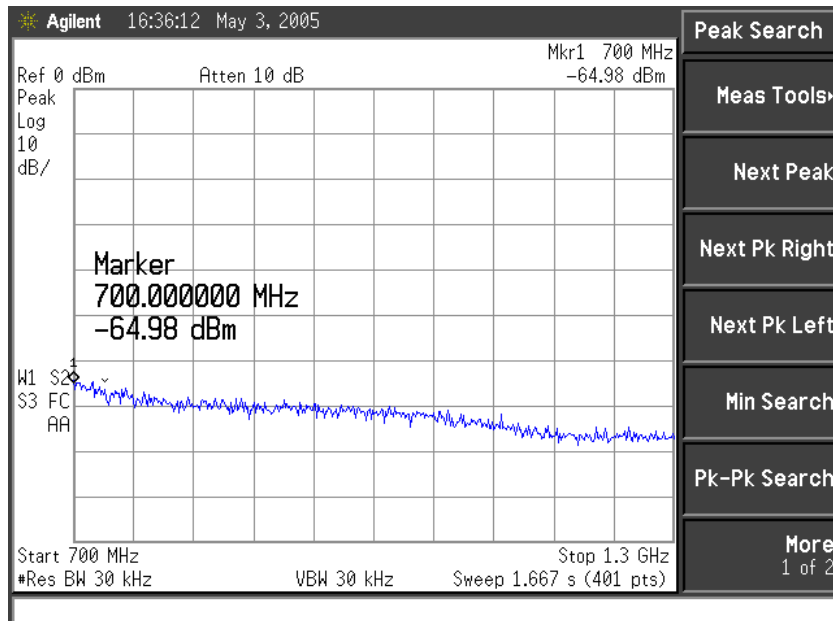
## Spectral Energy Leakage Performance



J1

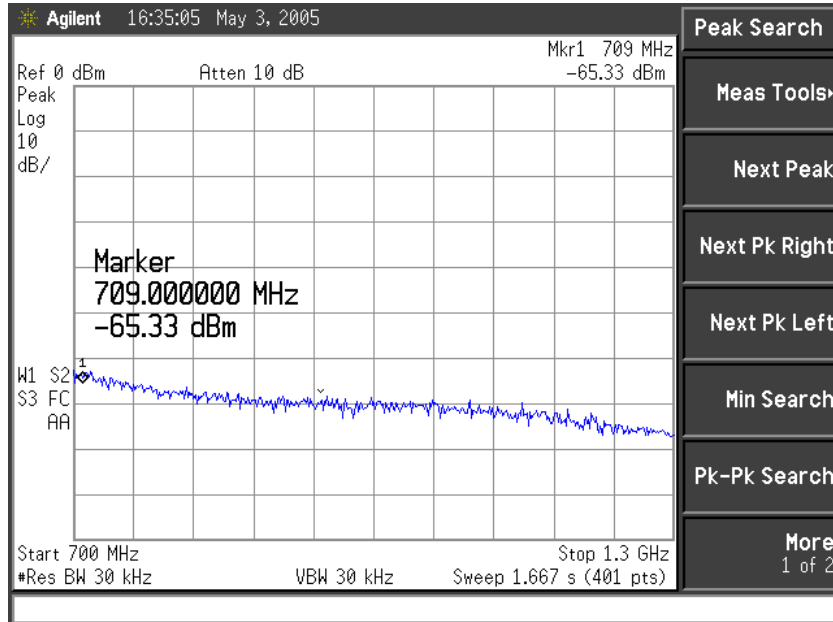


J2

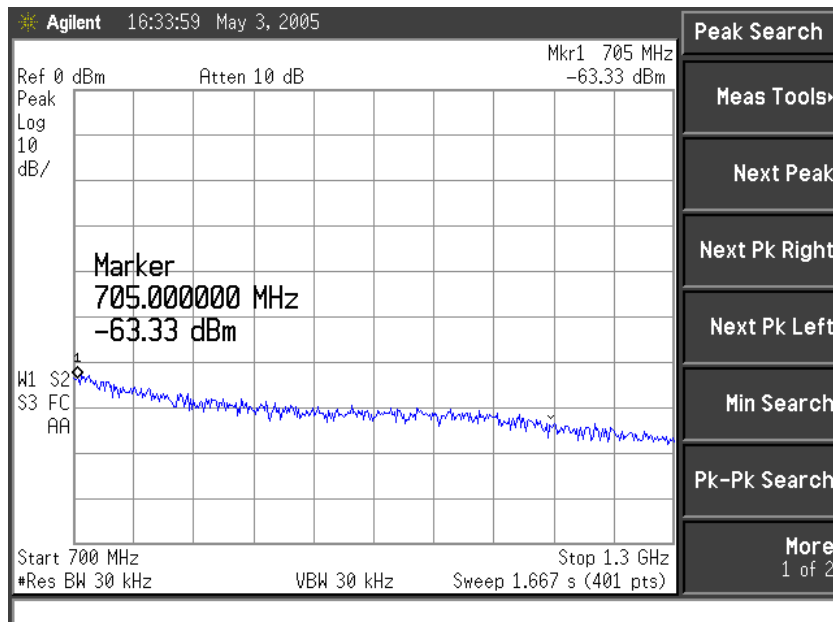




J3



J4



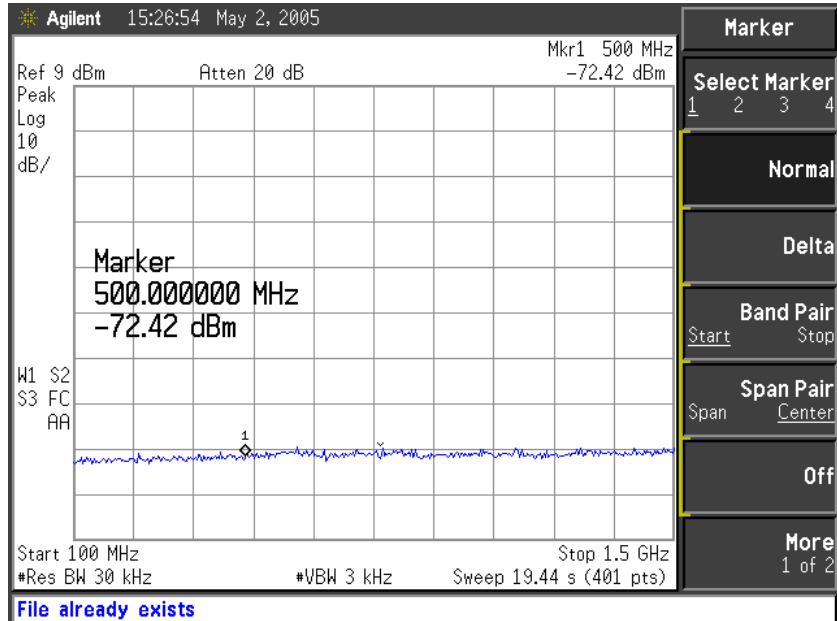


## Video Feed Through Performance

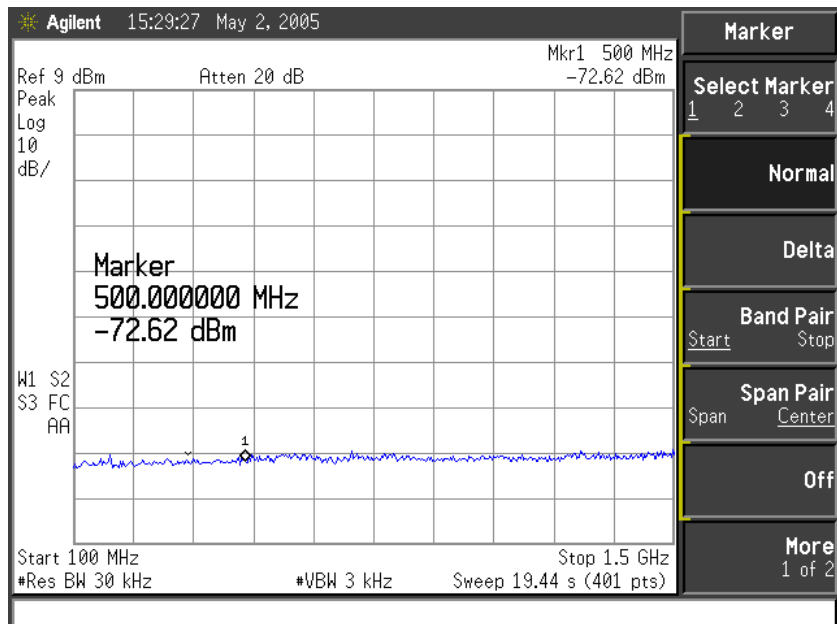
(Frequency Domain)



## J1 to J5



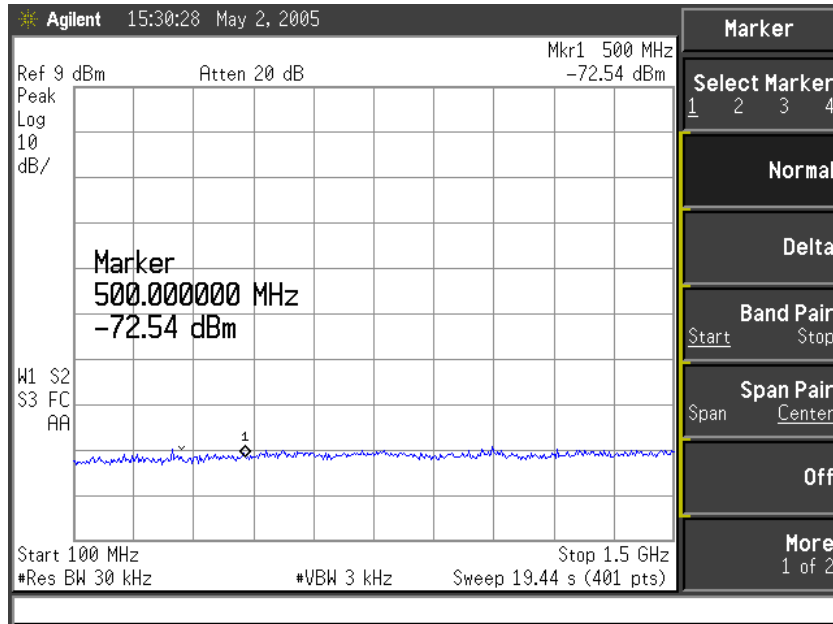
## J2 to J5



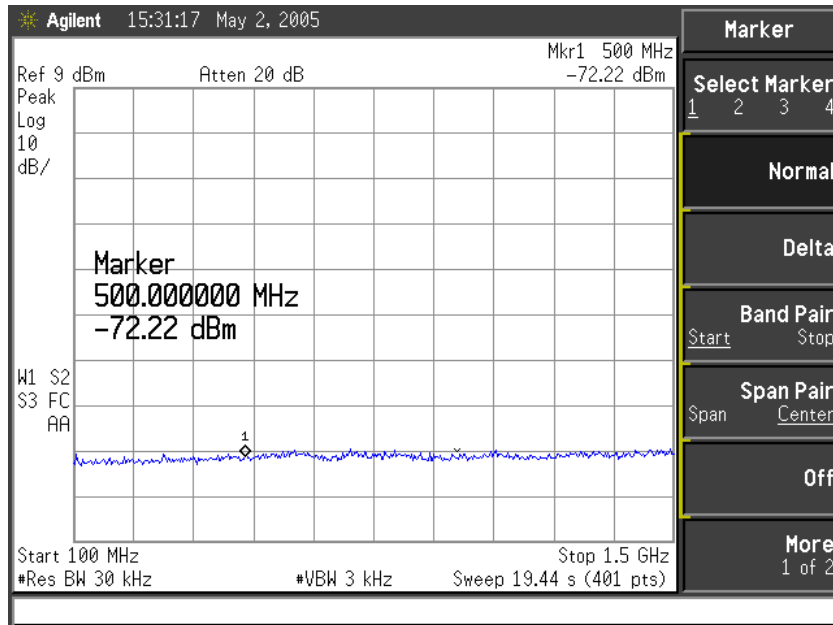




### J3 to J5



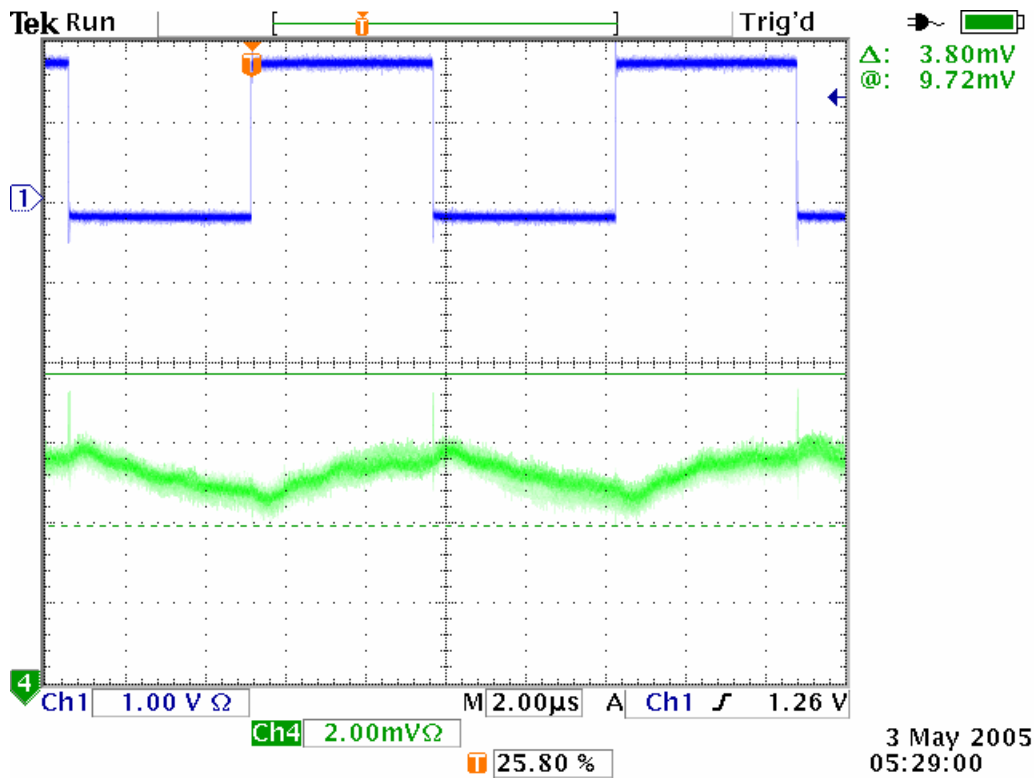
### J4 to J5





## Video Feed Through Performance

(Time Domain)



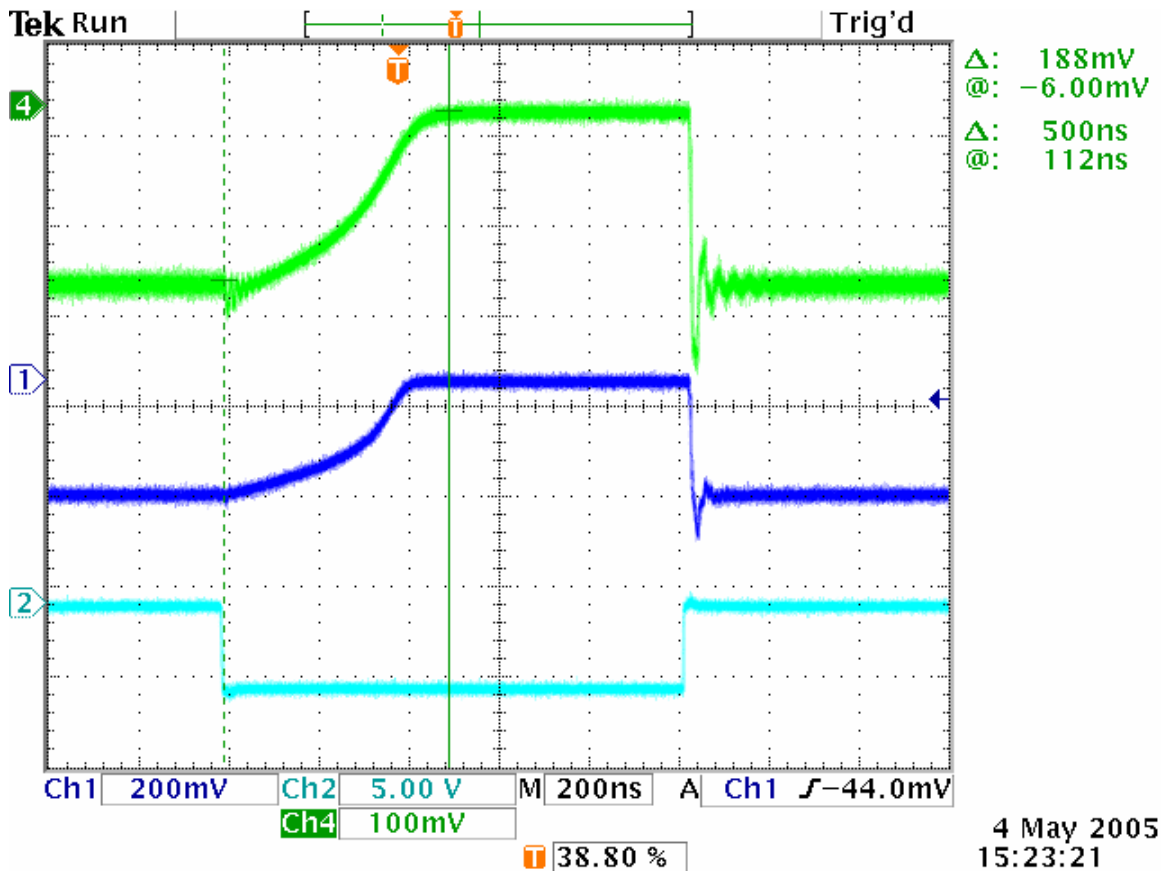
Note:

Purple Trace: TTL Signal

Green Trace: Video Transient



## Recovery Time Performance



Note:

Blue Trace: TTL Signal

Purple Trace: Input Detector Signal (Reference)

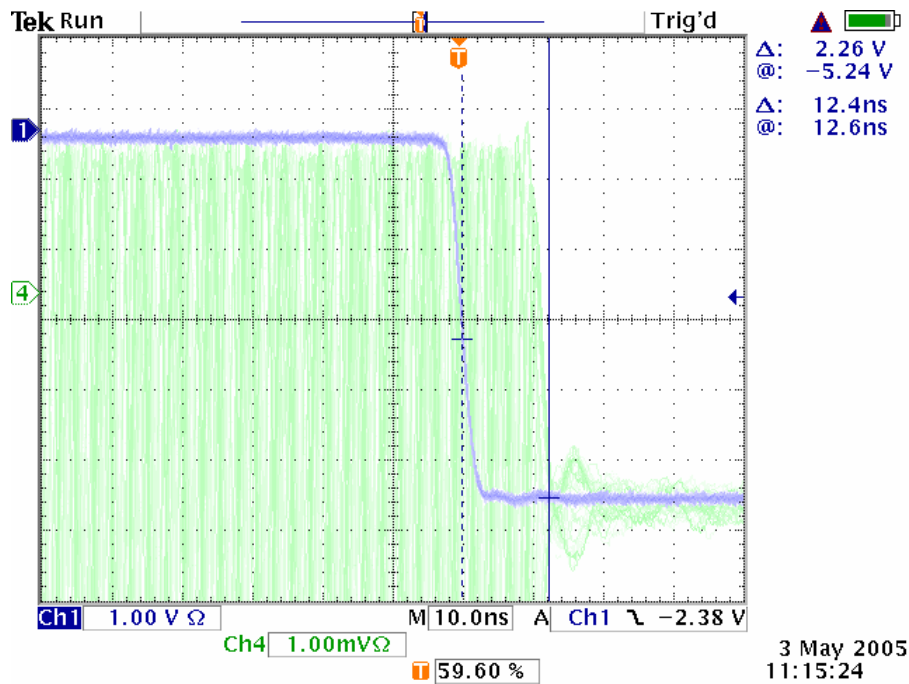
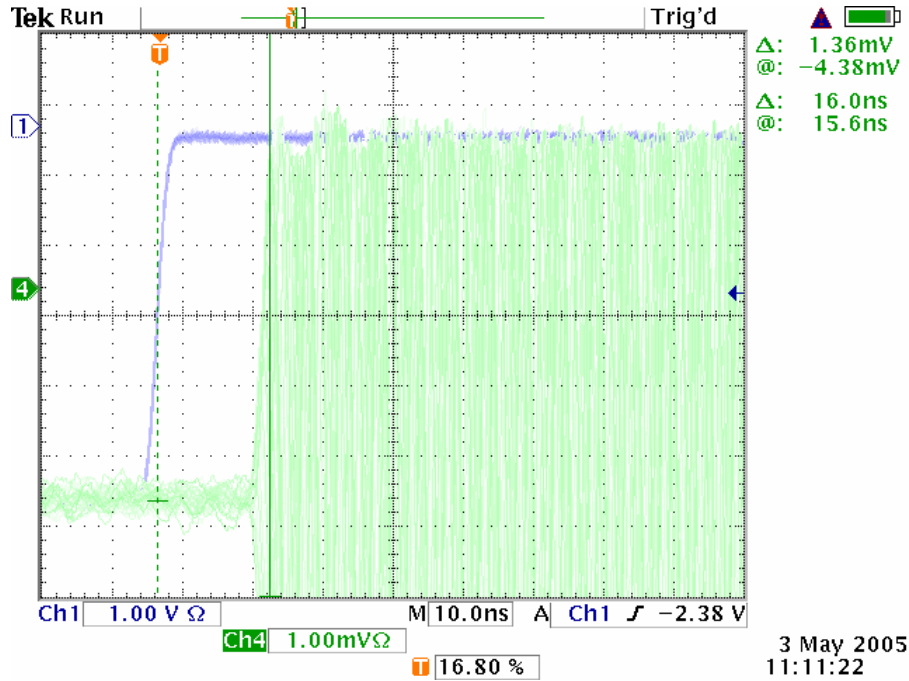
Green Trace: Output Detector Signal



## Switching Speed Performance

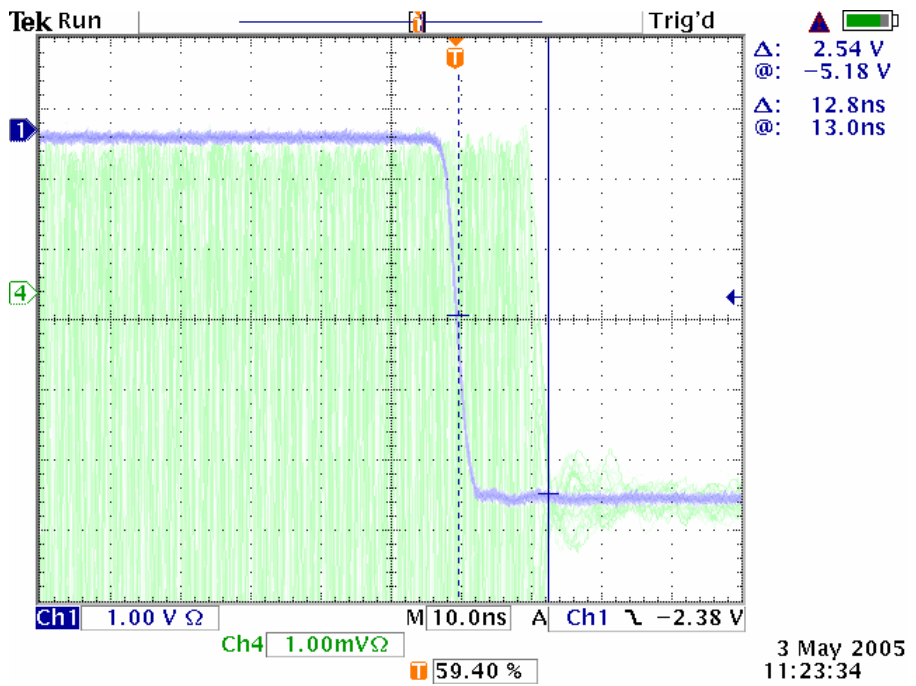
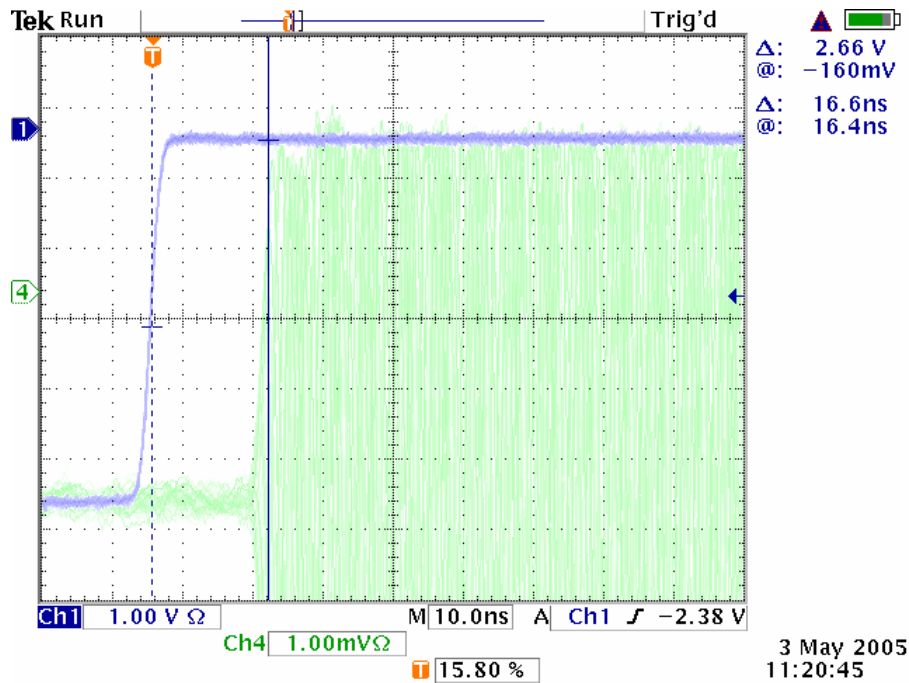


### J1 - J5



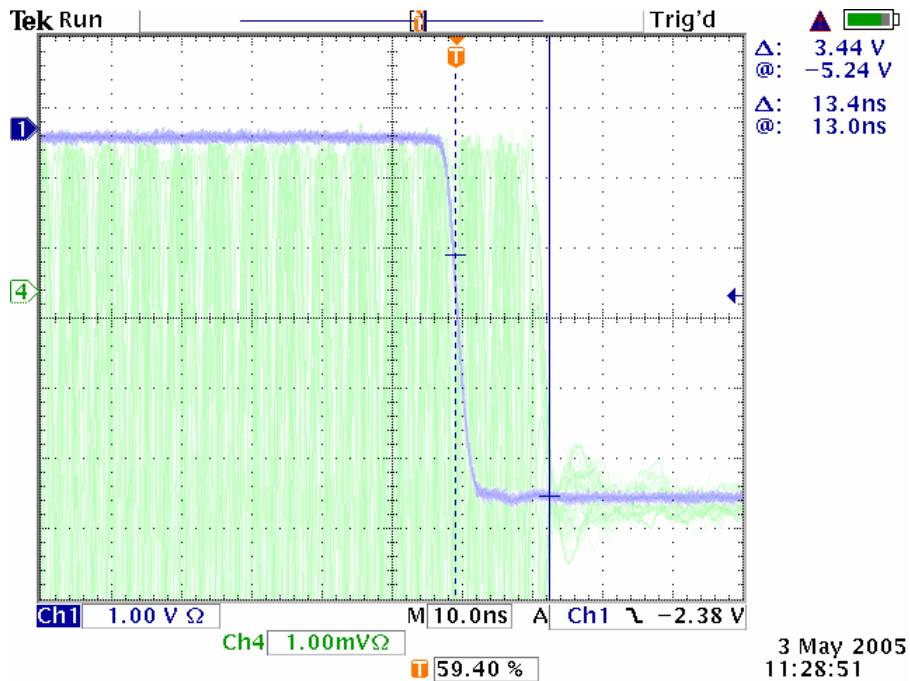
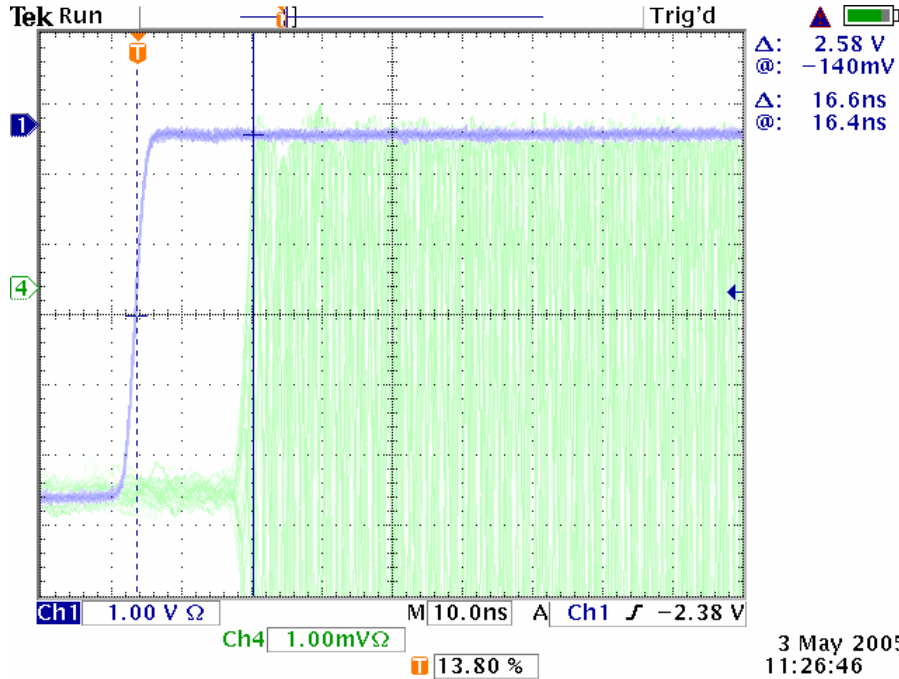


### J2 - J5





### J3 - J5





### J4 - J5

