

8.1.4 Engineering Change: Addition of Anti-Spurious Filter

SMA Inc.

ENGINEERING NOTICE #:280-9A-001 DATE:99.1.2 RUSH


INDICATE TYPE OF NOTICE Check One: RELEASE CHANGE DEVIATION

SCOPE: Products Listed Parts Where Used

Title: Addition of Input Harmonic Filter

Originator: S. Makk Form Ref #: N/A NCR CAR

Control Class: Class (A) Class (B) Class C (Draft)

Engineer: S. Makk Signature: 

Reason for Change: Unit failed FCC Part 15 Antenna Conducted Spurious Test
Bring design into compliance.


Part Number	Complete Description Of Change	<input checked="" type="checkbox"/> Drawing Chg. <input checked="" type="checkbox"/> BOM Chg. <input type="checkbox"/> Initial Release
<u>00M1030.DWG</u>	<u>To add filter to schematic</u>	
<u>BOM FE9M</u>	<u>Add 8n2 0603 Inductor, 2pcs 2p7 0603 ceramic cap</u>	
<u>Process Instruction</u>	<u>Add components on underside of PCB near input to preselector.</u>	
	<u>Cut trace and expose groundplane for connection</u>	
	<u>Advise to keep center conductor exposure to a minimum.</u>	

CRITICAL ISSUE

Product Safety Cost Change General Improvement

Legal Issues Involved Manufacturing Change Software Change

Product Regulatory Marketing Features/Product Specs/Manuals MFG Process or Test Equipment

Technical Evaluation Required: T.E. #: Done - Verbal Report, SIGNED:  3

Change Type:

Rework all Products (Customer Recall) Immediate Running Change

Rework Products in Plant, (Finished Goods) Documents Only

Work in Progress Special: _____

Deviations: Effective Dates: 99.1.3

Part use up

Disposition of Inventory: Use until (Date) _____ Scrap

No effect - use as is Re-work Other

Use until new parts available Use on other product


Parts in Inventory _____

Parts on Order _____

Engineering Cost Estimate: \$0.20 cost increase + labor

Implementation Notes: Hand modify existing stock See report and drawings attached.

Update layout when reordered.

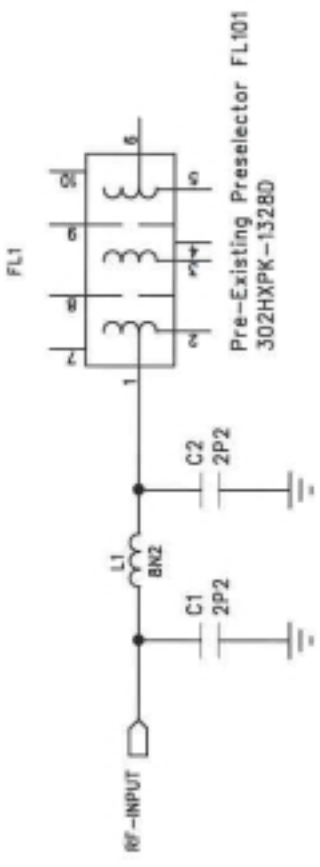
Authorization	Signature	Date	Authorization	Signature	Date
Eng. Mgmt. (A/B/C)		<u>99.1.4</u>	O.A. (A)		
Purchasing (A/B/C)			Manufacturing (A)		
Test Eng (A/B)			Material Cntrl (A)		
Marketing CI (A/B/C)			Sales CI (A)		

Documents Verified By: _____ DATE: _____ Total Pages (including cover): _____

EN Cancelled: SIGN: _____ DATE: _____ Explanation Attached Page: _____

REVISION RECORD

LTR	ECO NO	BY	APPRVD	DATE
??	?????	???	???	??-??-??



NOTES: COMPONENTS TO BE HAND SOLDERED
ON UNDERSIDE OF PCB
RF INPUT TRACE TO BE CUT AND GROUNDS EXPOSED AS NEEDED
THIS AMENDS 00MIC030.DWG

RESTRICTION NOTICE

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KAVAL TELECOM

TITLE: OFR-P300F FRONT END

DESIGN MODIFICATION
ECN 280-9A-001

DRAWN: STM
DATED: 99.1.3

CHECKED:
DATED:

RELEASED:
DATED:

CODE: SC

REV: 00

SIZE: A
DRAWING NO: E280-9A-001

SHEET: ? OF ?

Memo

To: David Quinn

From: Stephen T. Makk
President
Stephen Makk and Associates, Inc.
1015 Conyers Executive Park, Suite 200,
Conyers, GA, 30012, USA
Tel: (770) 388-0107, Fax: (770) 388-0702, Email: stephen@makk.com

CC: Scott Proffitt, US Tech, Mazen Jaafar, Kaval

Date: 09/12/98

Re: Skytel OFR RX Antenna Conducted Emissions

Dear David,

US Tech informed me that the Skytel OFR failed FCC Part 15.111 antenna conducted emissions tests. Any product must radiate less than 2 nW (-57 dBm) at any frequency up to 5 GHz. Some spurs between 2 GHz and 3 GHz violate this requirement or are uncomfortably close.

I have engineered a solution to this problem. The attached graphs show before and after plots of the emissions. My lab results were very similar to what US Tech reported, so I am confident this fix will work.

Two changes must be made. The first is a workmanship issue. Any excess exposed center conductor in the input RF connector pigtail acts as a pickup antenna at microwave frequencies. L.O. harmonics are easily picked up. You should use flexible semirigid cable for this application and trim the exposed center conductor at the PCB end of the cable to the absolute minimum length. You cannot allow production to get sloppy with this. The unit I got had over 1/2 inch of exposed wire.

Cable trimming made about 8 dB of difference at 2.3 GHz.

This still left too close a margin. I added a simple PI lowpass filter on the underside of the PCB. This involves a trace cut and removal of some solder mask. 0603 caps and inductors were used. You must implement an Engineering Change Order that adds this filter to all Skytel OFRs. We did not design the L.O. so our bills of materials will not reflect this change, as they call up the module as a single part. SMA can write up the ECO if you wish.

Final performance resulted in spurs so low they were hard to measure. We obtained at least a 20 dB improvement in my estimation. Also, the filter improved the input return loss and front end sensitivity. I postulate that the PI filter acts as a matching network between the connector and helical preselector.

I am sending David Vernon to US Tech to swap out the front end in the failed unit today. Testing should proceed with minimal delay.

Best Regards,

Stephen T. Makk

4 pages attached.

Best Regards,

Stephen T. Makk

Ø8: 11: 45 DEC 09, 1998
hp

Skytel OFR Rx Antenna Conducted Emisision
(Unmod: f:nd)

REF -30.0 dBm AT 10 dB

MKR 2.300 GHZ
-53.59 dBm

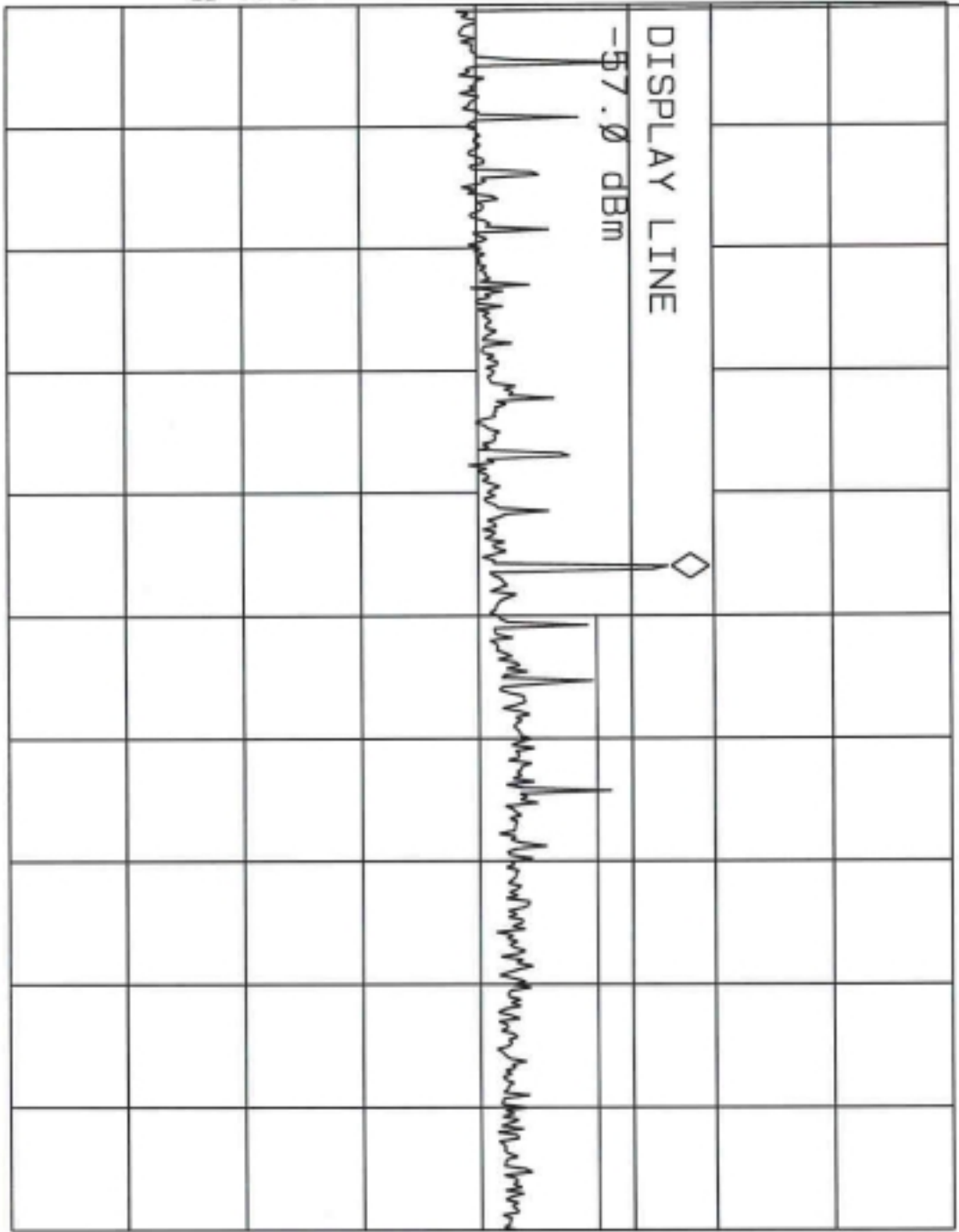
HOLD

PEAK
LOG
10
dB/

DSP LINE
ON OFF

DL
-57.0
dBm

← 2nd 15.111



WA SB
SC FC
CORR

Limit
Lines
ANALOG+
ON OFF

More
1 of 2

START 0 HZ

FS BW 3.0 MHz

VBW 1 MHz

STOP 5.000 GHz
SWP 100 msec

08: 54: 38 DEC 09, 1998
HP

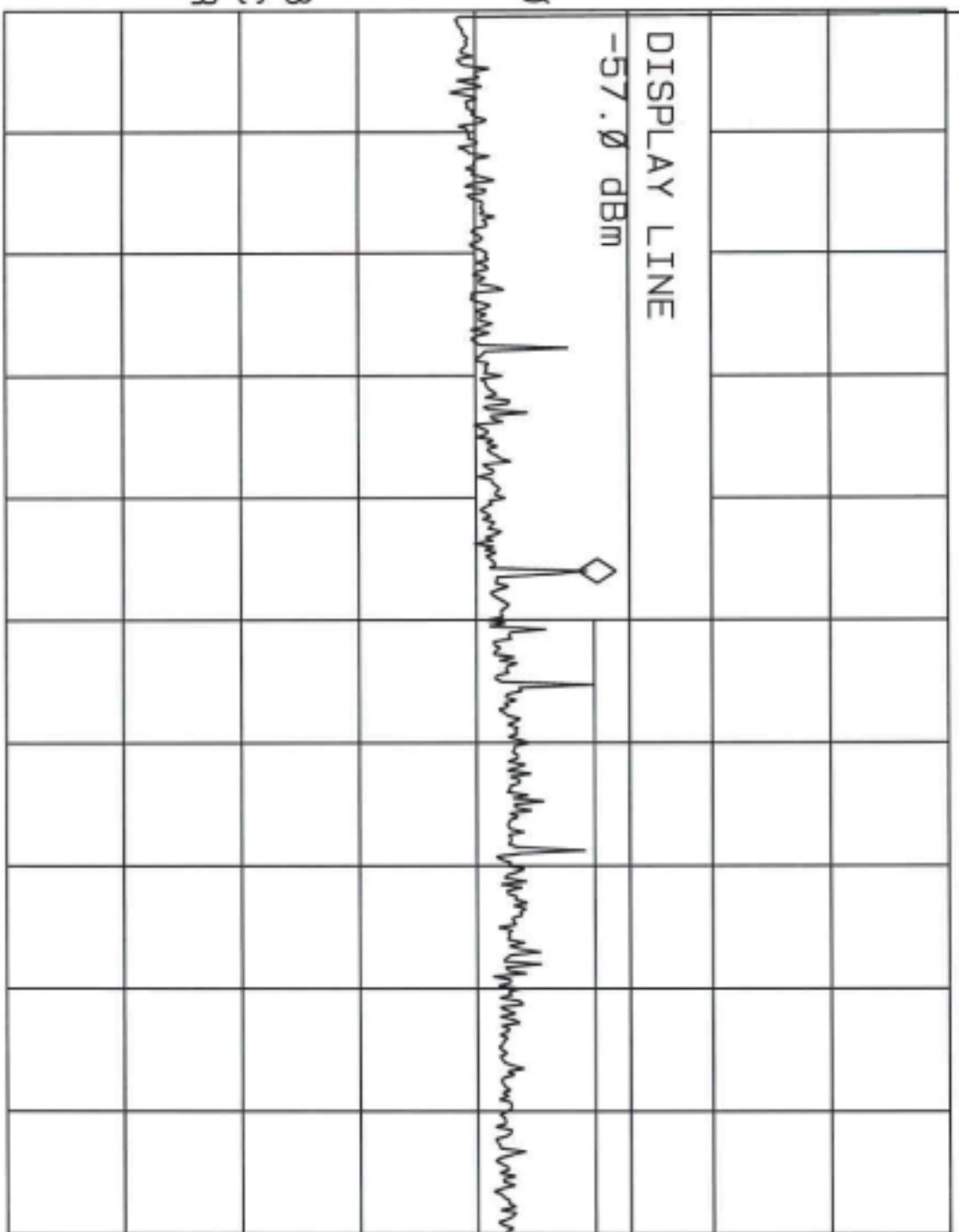
Skynet 1 OFR Rx Antenna
Conducted Emissions
- Pigtail trimmed back.

REF -30.0 dBm AT 10 dB

MKR 2.300 GHz
-61.34 dBm

HOLD

PEAK
LOG
10
dB/



DSP LINE
ON OFF

2mW 15.111

Change Title

Limit Lines

ANALOG+
ON OFF

More
1 of 2

WA SB
SC FC
CORR

START 0 HZ

FS BW 3.0 MHz

VBW 1 MHz

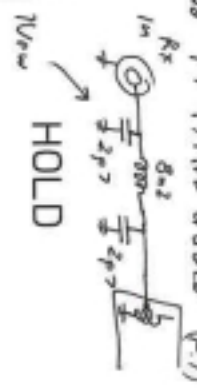
STOP 5.000 GHz

SWP 100 msec

10: 17: 37 DEC 09, 1998
 HP

REF -30.0 dBm AT 10 dB

MKR 2.500 GHz
 -68.87 dBm



Skynet OFR Rx conducted emissions

Digital Trimmed and P1 filter added (P-1)

PEAK
 LOG
 10
 dB/

DSP LINE
 ON OFF

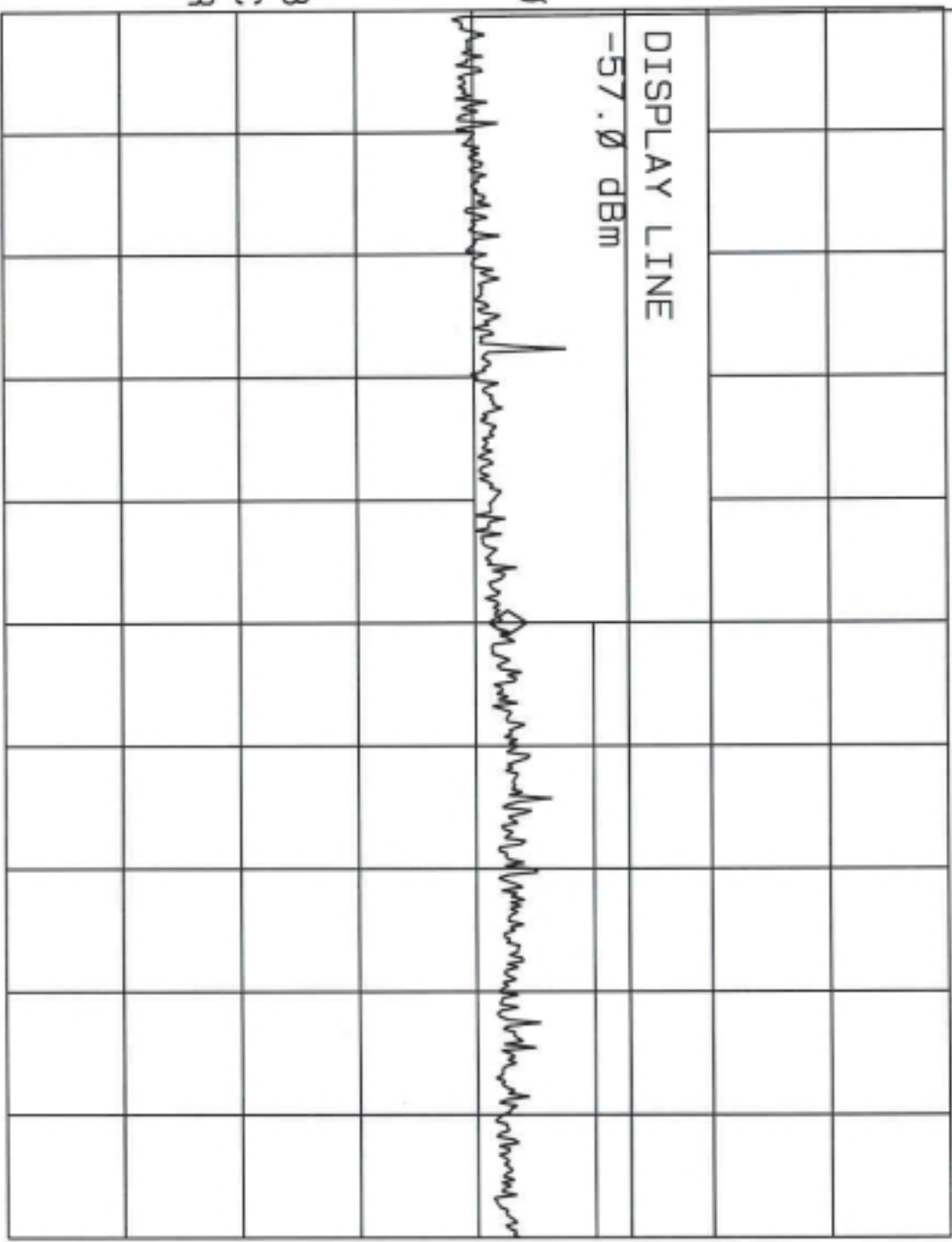
DL
 -57.0
 dBm

Change
 Title

Limit
 Lines

WA SB
 SC FC
 CORR

ANALOG+
 ON OFF



More
 1 of 2

START 0 Hz

STOP 5.000 GHz

RES BW 3.0 MHz

VBW 1 MHz

SWP 100 msec

10: 19: 05 DEC 09, 1998
Hy

Same as Previous
(Noise Filtered)

>20dB Improvement

REF -30.0 dBm AT 10 dB

MKR 2.500 GHz

-76.63 dBm

SMP L

VID AVG
ON OFF

LOG

10

DETECTOR

SMP PK

VIDEO AVG

100

DL

-57.0

dBm

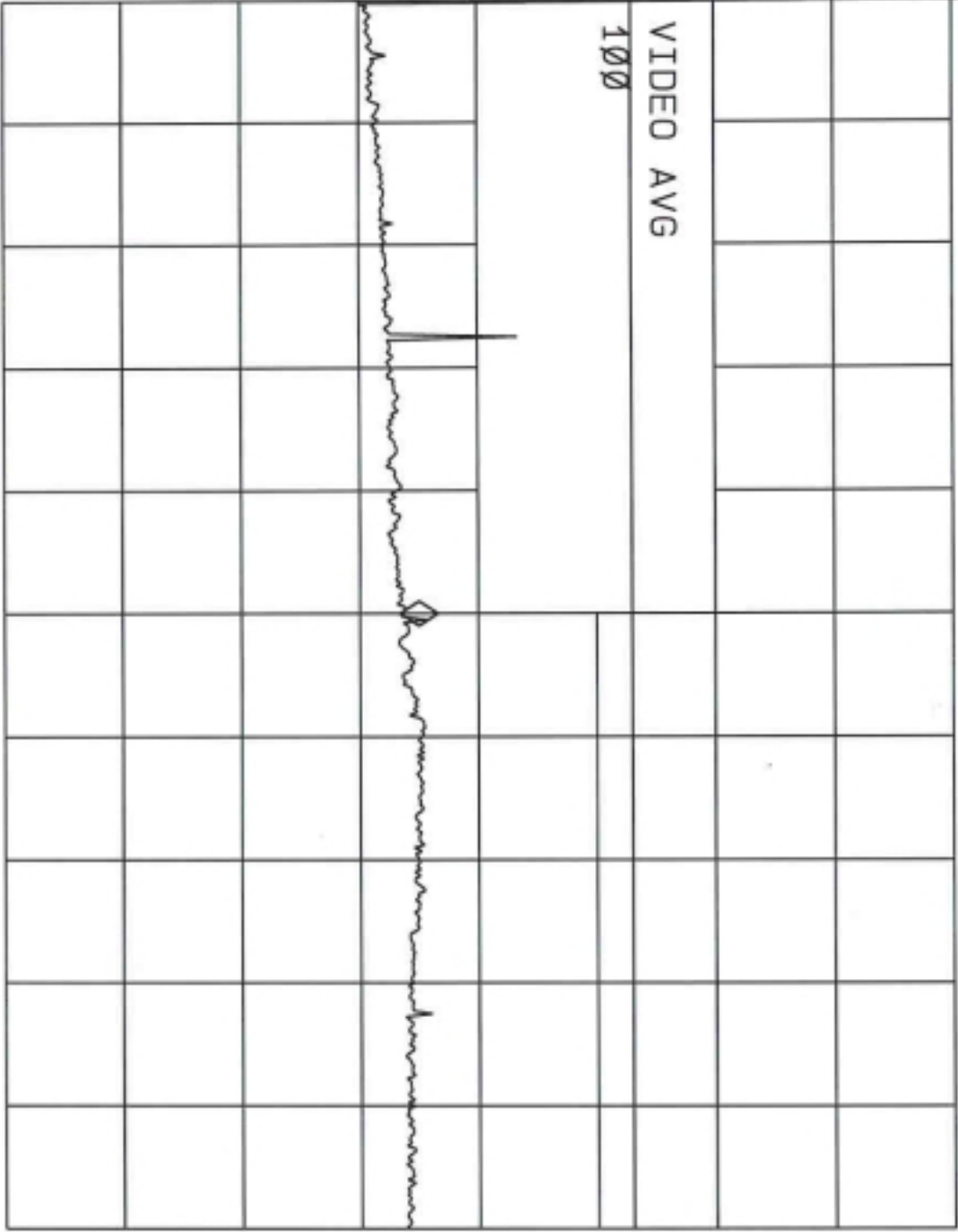
AVG

100

WA SB

SC FC

CORR



NORMLIZE
POSITION

A <--> B

More
2 of 3

START 0 Hz

RES BW 3.0 MHz

VBW 1 MHz

STOP 5.000 GHz

SWP 100 msec