

FE SIMULATOR FOR TESTS ON IF SYSTEM

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A wideband noise generator is used to develop a front end system simulator which provides noise power levels similar to the ones available at the dish base from the front end system at various frequency bands. The unit is useful in testing the response of the IF system and also for the characterisation of the ABR systems. At present the simulator may be used to simulate 150, 235, 325 and 610 MHz FE outputs. 1420 MHz simulator is being done separately.

In the system developed we have used the filter bank and noise source provided by Somsekhar / Gopinathan in the IF test set up, filters are now retuned to provide proper band pass.

Description :

A wideband noise source using NC 501 is used to generate the noise which is further amplified and passed through a filter bank to generate the noise at each FE band. The filters used in the bank are similar to the ones used in actual FE system so that the shape of the noise spectrum generated by simulator is same as that of the FE signal. The simulator also has facilities to vary the power by as much as +/- 30 dB from the normal operating power levels in steps of 1 dB. A two way power splitter provides signals to both channels of IF systems thereby reducing the testing time. A detailed block schematic of the circuit is attached as Annexure 1. Some of the circuits used in the system are shown as Annexure 2(a) and (b).

Calculation:

The power level calculation for the circuit at 325 MHz band considering a bandwidth of 32 MHz :

$$\begin{aligned}\text{Power at NC 501 output} &= (\text{assuming } 31\text{dB ENR}) \\ &= KTB + 31 \text{ dB (assuming } T=300 \text{ K ; Bandwidth} = 32\text{MHz ;} \\ &\quad k = \text{ Boltzman Constant} = 1.38 * 10^{-23} \text{ J/K)} \\ &= - 69 \text{ dBm / } 32\text{MHz}\end{aligned}$$

$$\begin{aligned}\text{Power at the filter bank input} &= (- 69 -10 + 26 + 18 - 6) \text{ dBm} \\ &= - 41 \text{ dBm}\end{aligned}$$

$$\begin{aligned}\text{Power level at filter bank output} &= (- 41 -4) \text{ dBm} \\ &= - 45 \text{ dBm}\end{aligned}$$

$$\begin{aligned} \text{Power at splitter output} &= (-45 -6 -3) \text{ dBm} && \text{(switch settings for 0dB)} \\ &= \underline{-54 \text{ dBm}} \end{aligned}$$

Annexure 3 (a) and (b) gives the response of the band pass filters and the programmable attenuator and Annexure 4 gives the spectrum of the final noise signal output from the simulator.

User Information :

The simulator has been built in two 14 T plug in units. One unit has the noise source, necessary amplifiers and attenuator circuits, the other unit contains the filter bank with selector switches. DC voltage is given to these plus using standard audio connectors and may be connected directly to the ABR power supply. The necessary RF connections are to be done as indicated on the rear panel and the units to be left powered on for at least 15 minutes for warm up. The necessary settings for any frequency band and power level may be done using front panel toggle switches.

The required front panel switch settings are as shown below :

Freq.	Power @ 32 Mhz	Filter setting			Attenuation					Gain
		S1	S2	S3	1dB	2dB	4dB	8dB	16dB	
150MHz	-42	0	0	0	0	0	1	0	1	1
235MHz	-49	1	1	0	0	0	1	1	1	1
325MHz	-53	1	0	1	0	0	0	0	0	0
610MHz	-60	0	1	1	1	0	0	0	0	0

Conclusion :

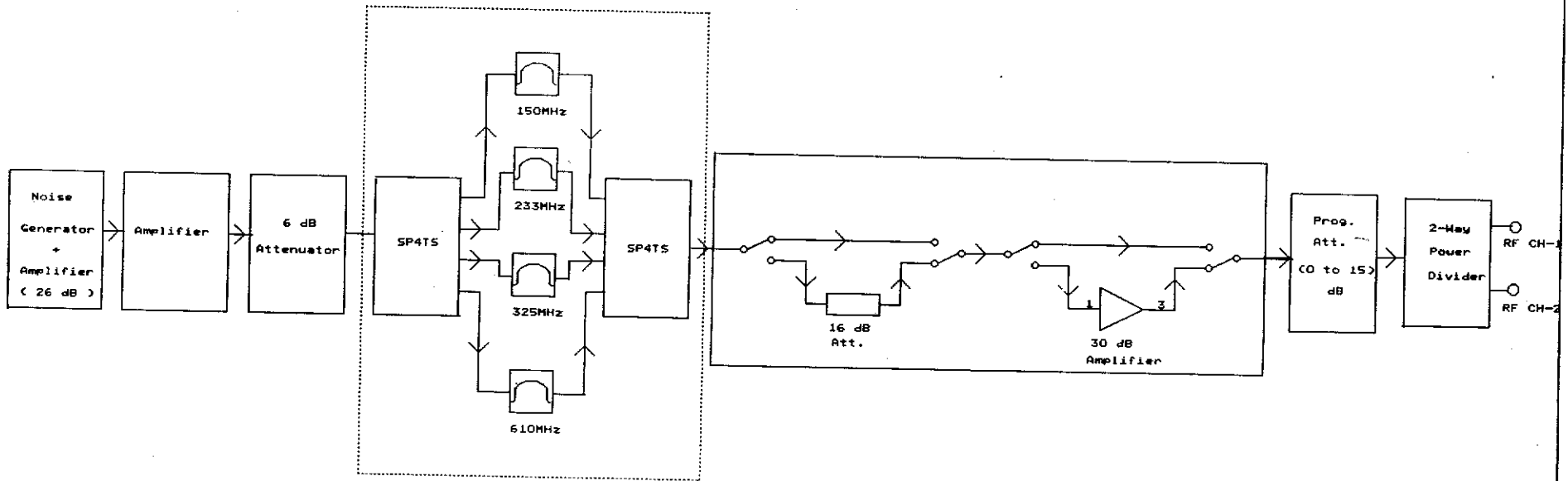
The circuits developed can be used for testing the performance of the IF at various FE bands, parameters like the frequency response, ALC response, linearity and dynamic range of the IF system can be measured. The system can be used to do a full IF characterisation as per the standard procedure.

Further modifications planned include addition of 1420 Mhz system and remote setting of attenuation and filter selection using mem card.

Annexure - 1

Annexure - 1

BLOCK DIAGRAM OF NOISE GENERATOR UNIT FOR IF CHARACTERISATION



Freq.	Power/ (Bandwidth)	Attenuation					Gain
		1dB	2 dB	4 dB	8 dB	16 dB	
150MHz	-42dBm/32MHz	0	0	-6	0	-6	-6
233MHz	-49dBm/32MHz	0	0	-6	-6	-6	-6
327MHz	-53dBm/32MHz	0	0	0	0	0	0
610MHz	-60dBm/32MHz	-6	0	0	0	0	0

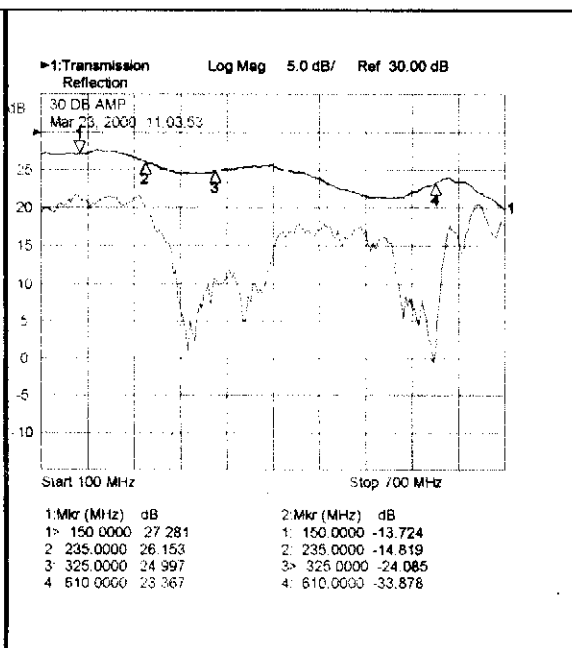
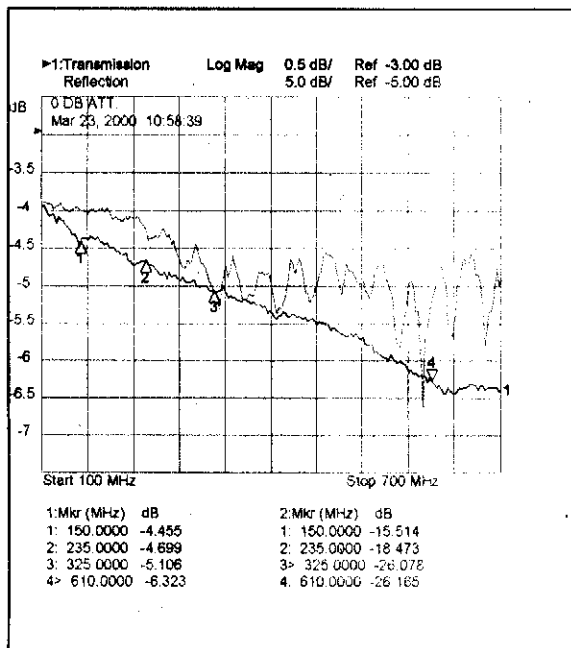
(Annexure 3-a)

FRONT END SIMULATOR

Plot Shows the frequency response of Programmable Attenuator (1dB,2dB,4dB,8dB,16dB) and frequency response of 2-Stage RF amplifier. (Typical Insertion Loss 4 to 6.5 dB & Gain of amplifier 27 to 24 dB)

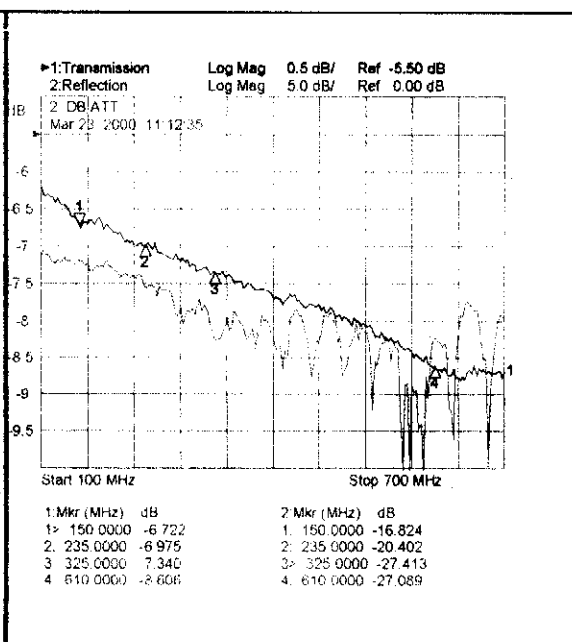
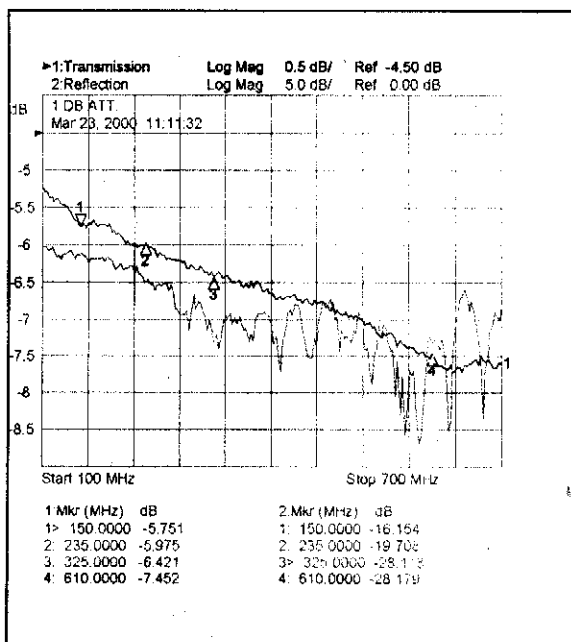
Insertion Loss of RF-Switch

30 dB Amplifier

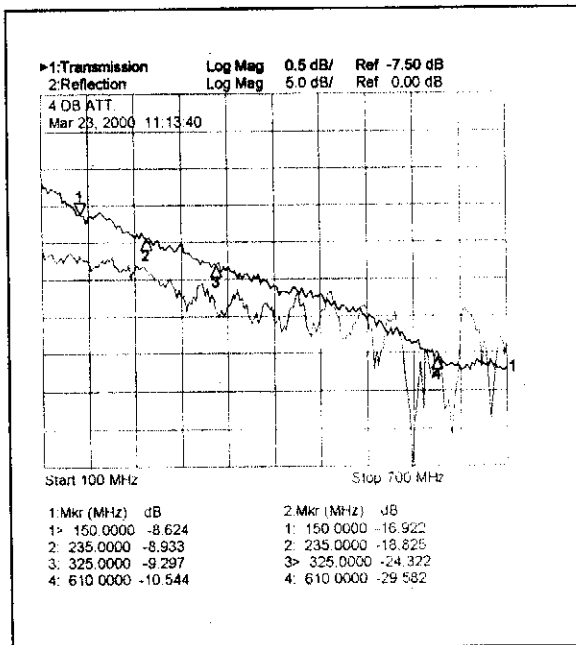


1 dB Attenuation

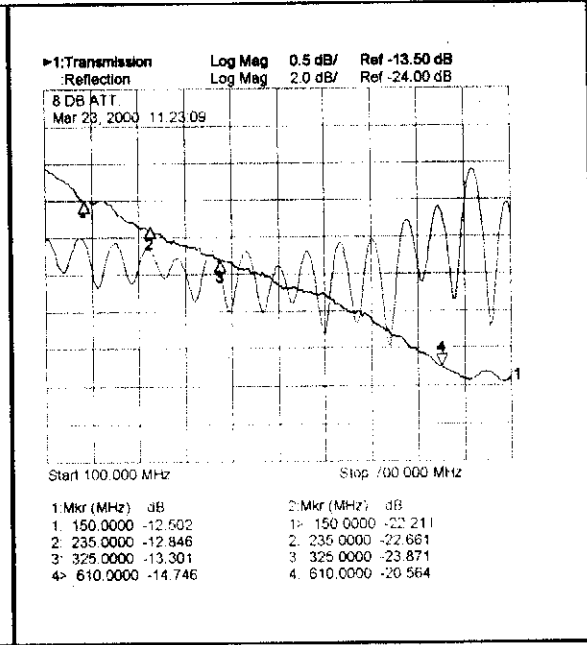
2 dB Attenuation



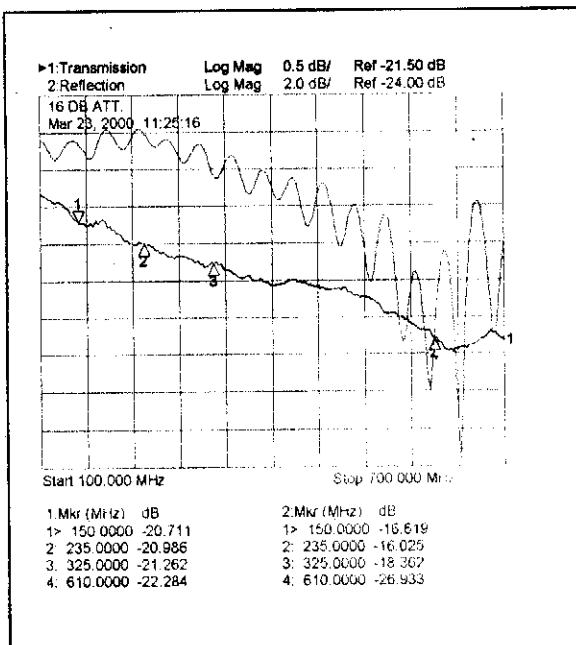
4dB Attenuation



8dB Attenuation



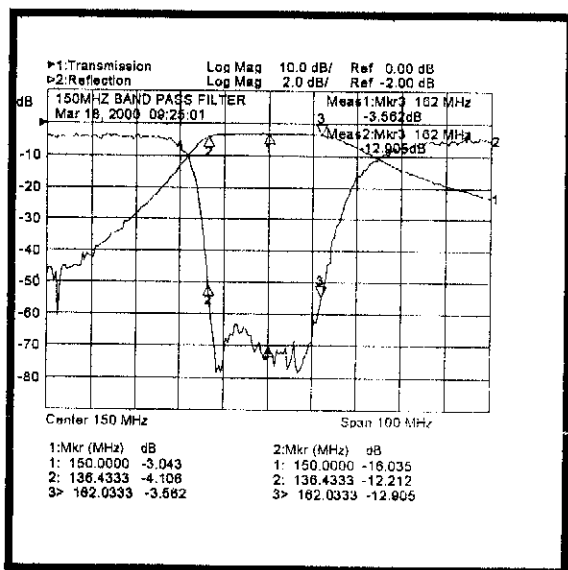
16 dB Attenuation



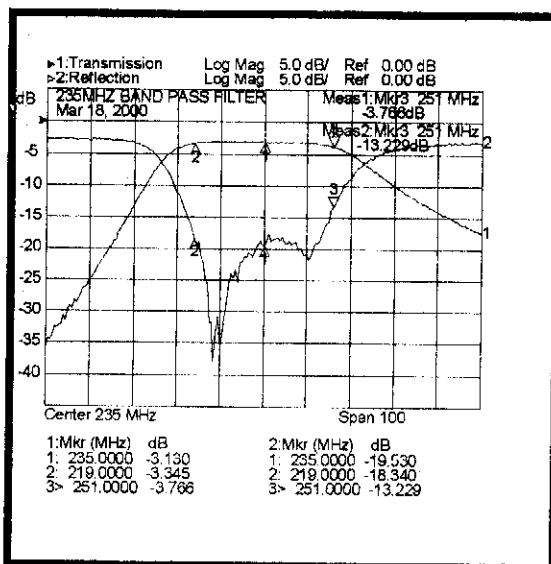
FRONT END SIMULATOR

Plot shows the various frequency bandpass filters response of front end simulator used for IF characterization. (Typical Insertion loss 3 to 4.5 dB & Reflection -15 to -20 dB)

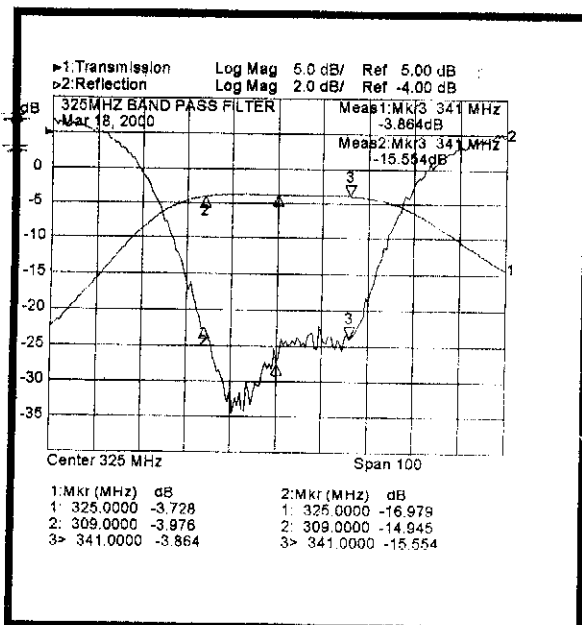
150 Mhz BANDPASS FILTER



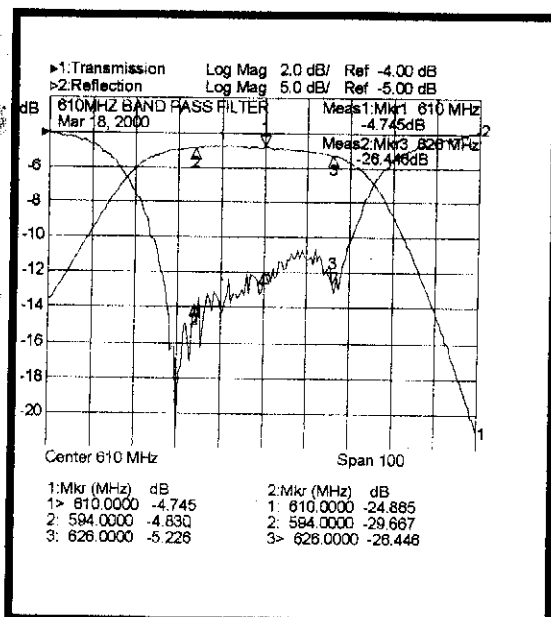
235 Mhz BANDPASS FILTER



325 Mhz BANDPASS FILTER



610 Mhz BANDPASS FILTER



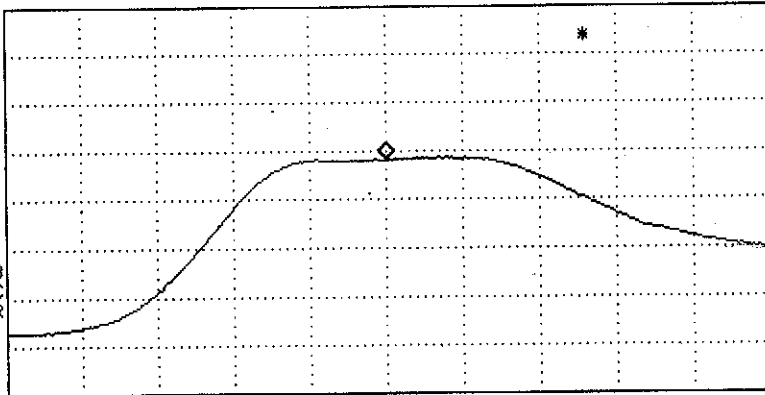
10:39:11 APR 18, 2000
10:28:56 APR 18, 2000
REF -30.0 dBm #AT 0 dB

MKR 150.0 MHz
-61.65 dBm

SMPL
LOG
10
dB/

AVG
14

VA SB
SC FC
CORR



CENTER 150.0 MHz SPAN 100.0 MHz
#RES BW 300 kHz #VBW 3 kHz SWP 333 msec

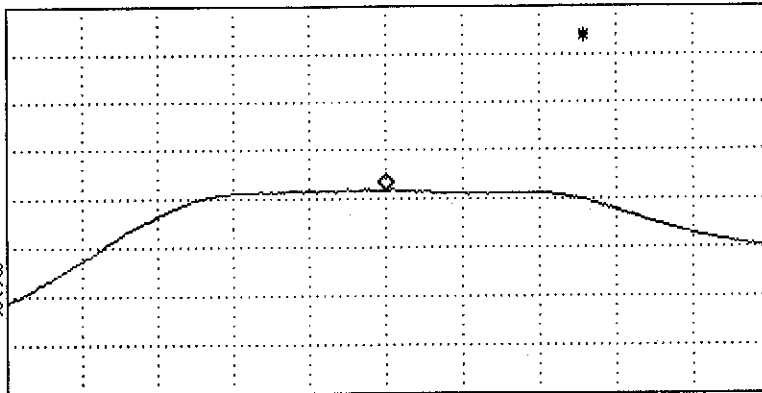
10:39:31 APR 18, 2000
10:32:24 APR 18, 2000
REF -30.0 dBm #AT 0 dB

MKR 233.00 MHz
-68.52 dBm

SMPL
LOG
10
dB/

AVG
14

VA SB
SC FC
CORR



CENTER 233.00 MHz SPAN 80.00 MHz
#RES BW 300 kHz #VBW 3 kHz SWP 267 msec

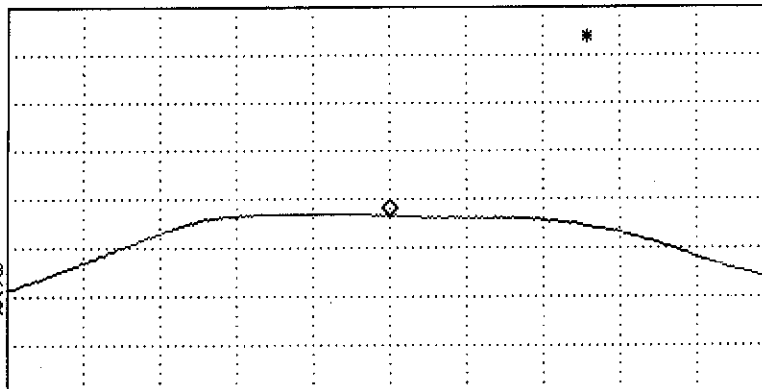
10:39:51 APR 18, 2000
10:34:15 APR 18, 2000
REF -30.0 dBm #AT 0 dB

MKR 327.0 MHz
-73.62 dBm

SMPL
LOG
10
dB/

AVG
14

VA SB
SC FC
CORR



CENTER 327.0 MHz SPAN 100.0 MHz
#RES BW 300 kHz #VBW 3 kHz SWP 333 msec

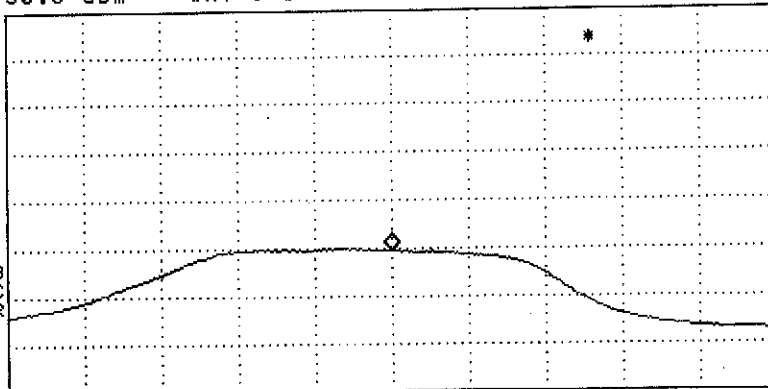
10:41:12 APR 18, 2000
10:36:01 APR 18, 2000
REF -30.0 dBm #AT 0 dB

MKR 610.0 MHz
-80.45 dBm

SMPL
LOG
10
dB/

AVG
14

VA SB
SC FC
CORR



CENTER 610.0 MHz
#RES BW 300 kHz

#VBW 3 kHz

SPAN 150.0 MHz
SWP 500 msec