

DEVELOPMENT OF SPECTRUM ANALYZER SYSTEM

Project report submitted by

JOANNA TSERKEZOU

In part satisfaction of the award of
DIPLOMA OF TECHNICIAN ENGINEER
in Electrical Engineering of the
Higher Technical Institute, Cyprus.

Project Supervisor: Mr. D. Lampranides
Lecturer in Electrical
Engineering, H.T.I.

Type of project: Individual ✓
Group

Project number: E/855

June 1993



SUMMARY

A simplified diagram is shown for a typical spectrum analyzer, superheterodyne receiver, the spectrum analyzer is electronically tunable by applying an adjustable saw-tooth voltage ramp to a voltage tuned local oscillator (VTO), The same saw-tooth voltage ramp is applied simultaneously to the horizontal deflection plates of the CRT, to form the frequency axis of the display. The input signal is mixed with a signal from VTO, the output of the mixer is amplified, detected and then applied to the vertical plates of the Cathod Ray Tybe. Thus the vertical deflection is proportional to the amplitude of the input signal.

For an input signal F_s , the VTO frequency is tuned so that $F_{vto} - F_s = F_{if}$

When this equation is satisfied the input signal is deflected and displayed on the CRT.

Furthermore by slowly sweeping the full saw-tooth voltage the VTO sweeps through its frequency range and the output of the mixer will be a wide range of frequencies, but the IF amplifier will pass only those frequencies within its passband.

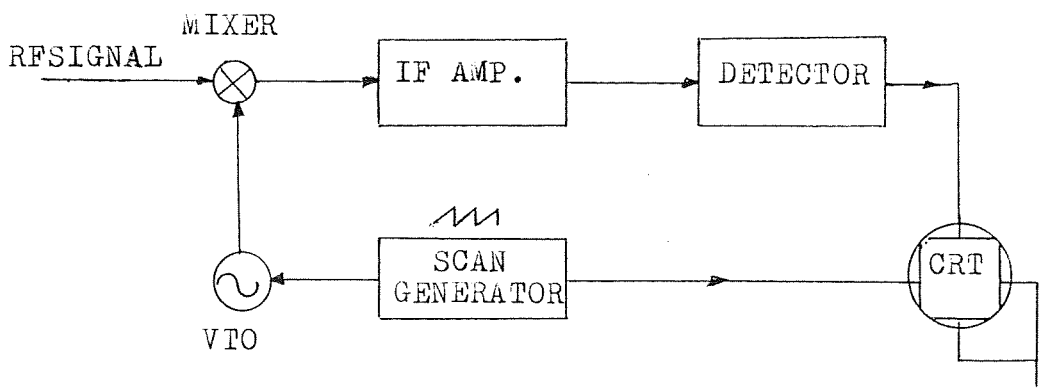


Figure 1. Simplified Spectrum Analyzer Block Diagram

CONTENTS

| | <u>PAGE</u> |
|---|-------------|
| ACKNOWLEDGEMENTS | I |
| SUMMARY | III |
| INTRODUCTION | IV |
| | |
| CHAPTER 1 | |
| INVESTIGATION OF VARIOUS TYPES OF SPECTRUM ANALYZERS. | 1 |
| 1.1 REAL TIME SPECTRUM ANALYZER | 2 |
| 1.2 SWEEP-TUNED SPECTRUM ANALYZER | 4 |
| 1.3 SUPERHETERODYNE SPECTRUM ANALYZER | 5 |
| 1.4 PROFESSIONAL STANDARDS REFERENCE | 8 |
| | |
| CHAPTER 2 | |
| THE SPECTRUM ANALYZER BLOCK DIAGRAM | |
| 2.1 FUNCTION | 14 |
| 2.2 BLOCK DIAGRAM | 17 |
| | |
| CHAPTER 3 | |
| THE POWER SUPPLY | |
| 3.1 FUNCTION | 19 |
| 3.2 CIRCUIT DIAGRAM | 24 |
| 3.3 TESTING - RESULTS | 21 |
| 3.4 INSTRUMENTS REQUIRED | 21 |
| | |
| CHAPTER 4 | |
| THE MARKER GENERATOR | |
| 4.1 FUNCTION | 22 |
| 4.2 CIRCUIT DIAGRAM | 24 |
| 4.3 TESTING | 25 |
| 4.4 INSTRUMENTS REQUIRED | 25 |
| 4.5 TROUBLESHOOTING | 26 |
| 4.6 RESULTS & WAVEFORMS | 27 |

| | |
|------------------------------------|----|
| CHAPTER 5 | |
| THE SWEEP GENERATOR | |
| 5.1 FUNCTION | 28 |
| 5.2 CIRCUIT DIAGRAM | 31 |
| 5.3 TESTING - CALIBRATION | 32 |
| 5.4 INSTRUMENTS REQUIRED | 35 |
| 5.5 CALCULATIONS | 36 |
| 5.6 RESULTS & WAVEFORMS | 38 |
| CHAPTER 6 | |
| THE VIDEO AMPLIFIER | |
| 6.1 FUNCTION | 39 |
| 6.2 CIRCUIT DIAGRAM | 41 |
| 6.3 TESTING - CALIBRATION | 42 |
| 6.4 INSTRUMENTS REQUIRED | 43 |
| 6.5 TROUBLESHOOTING | 43 |
| 6.6 RESULTS & WAVEFORMS | 44 |
| CHAPTER 7 | |
| THE RF BOARD | |
| 7.1 FUNCTION | 45 |
| 7.2 CIRCUIT DIAGRAM | 51 |
| 7.3 TESTING - CALIBRATION | 52 |
| 7.4 INSTRUMENTS REQUIRED | 55 |
| 7.5 TROUBLESHOOTING | 55 |
| CHAPTER 8 | |
| COSTING | 56 |
| CHAPTER 9 | |
| IMPROVEMENTS - GENERAL CONCLUSIONS | 64 |
| REFERENCES | |
| APPENDIX 1 PRINTED CCT BOARDS | |
| 2 DRAWINGS-CIRCUITS | |
| 3 DATA SHEETS | |