ADVANTEST

ADVANTEST CORPORATION

R3261/3361 SERIES

SPECTRUM ANALYZER

MAINTENANCE MANUAL

MANUAL NUMBER MEJ00 9407

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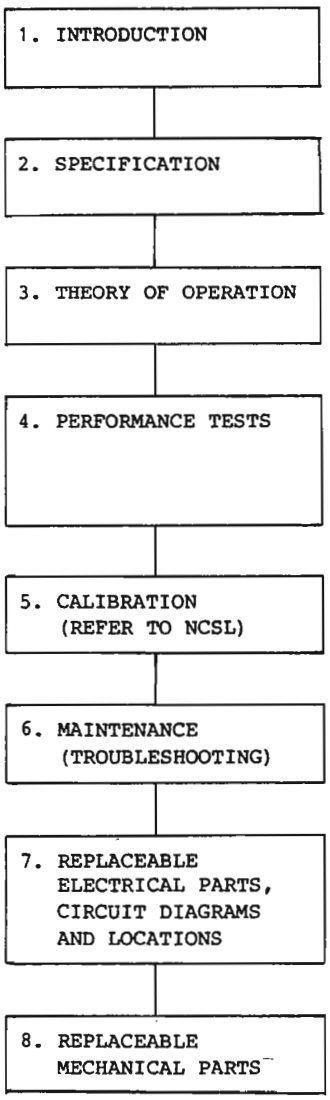
1. INTRODUCTION

This chapter explains how to use this manual, and features of this spectrum analyzer.

1.1 How to Use This Manual



1.2 Overview

The R3261/3361 Series spectrum analyzer, which employs a synthesized local oscillator for assuring highly stable spectrum analyzer, features wide frequency range from 9kHz to 2.6GHz(R3261A,C/AN,CN, R3361A,C/AN,CN),
9kHz to 3.6GHz (R3261B/D, R3361B/D),
wide input range from -130dBm to +25dBm (R3261A,C/B,D, R3361A,C/B,D),
-19dBμ to +132dBμ (R3261AN/CN, R3361AN/CN),
wide measurement display range of 115dB
and high resolution of 30Hz, low residual FM of $20Hz_{p-p}$, less noise sideband of -105dBc/Hz (20kHz output from carrier) as well as full remote-control GPIB, and the memory card function for saving/recalling data and panel settings.

The R3361 contains a tracking generator that facilitates frequency characteristic measurement.

Features

① This analyzer permits sweeping over a wide frequency range from 9kHz to 3.6GHz (R3261B/D,3361B/D).

② A maximum frequency resolution of 30Hz enables analysis of adjacent signals and spurious response.

③ High-precision frequency measurement
A reference crystal oscillator with an aging rate of 2×10^{-8}/day is installed to measure very weak signals (which cannot be measured by any counter) at a resolution of 1Hz in the counter mode.

④ Use of a memory card permits saving/recalling of front panel settings.

⑤ The field strength can be viewed and read directly after compensating the antenna calibration coefficient and that the QR value based on the CISPR standard can be observed directly.

⑥ Various enhanced functions supported by digital indications
Brief information needed for spectrum analysis is displayed on the CRT together with signal traces. The digital memory screen provides flickerless display. Various marker functions assures accurate and easy reading even in the manual mode.

⑦ Two channels of completely independent digital memories enable simultaneous display of two screens.

⑧ A full-remote-control GPIB is used as a powerful system component.

⑨ The built-in tracking generator of the R3361 enables direct viewing of frequency attenuation of 115dB or more.

2. SPECIFICATIONS

This chapter lists the R3261A/C, R3261AN/CN, R3261B/D, R3361A/C, R3361AN/CN, and R3361B/D specifications and accessories.

2.1 R3261A/C Specifications

(1) Frequency Specifications

Measurable bandwidth : 9kHz to 2.6GHz

Center frequency setting increment
: 1Hz

Center frequency indication accuracy
: ±(3% of the span + center frequency x reference oscillator accuracy + 20Hz)
(span ≦ 2MHz)
±(2% of the span + center frequency x reference oscillator accuracy + 50kHz)
(span > 2MHz)

Reference oscillator : Internal or external input (10MHz)

Internal reference oscillator accuracy
Aging : ±(2 x 10^{-8} per day)
±(1 x 10^{-7} per year)
Temperature stability ±5 x 10^{-8} (from 0°C to +50°C, +25°C as a reference)

Frequency span
LIN mode : 1kHz to 2.6GHz, and 0
LOG mode : 1, 2, or 3 decades of span can be selected within the range from 10kHz to 1000MHz.

Frequency span accuracy
LIN mode : ±3% of the span (span > 2MHz)
±5% of the span (span ≦ 2MHz)

Frequency stability
Residual FM : 50kHz p-p or less (span > 10MHz)
2kHz p-p or less (10MHz ≧ span > 2MHz)
20Hz p-p or less (span ≦ 2MHz)
Frequency drift : 300Hz/min. or less (span ≦ 2MHz, at a constant temperature after an hour of warming up)

Side band noise : ≦-105dBc/Hz (20kHz offset)

Resolution
3dB bandwidth : 30Hz to 1MHz, switched at 1 to 3 steps

6dB bandwidth : 200Hz, 9kHz, 120kHz
Selectivity : ≦15: 1 (60dB : 3dB)
Bandwidth accuracy : ±20%

Marker accuracy
Normal mode : Center frequency indication accuracy + span accuracy
Counter mode : Indicated frequency x reference oscillator accuracy ±1 count

(2) Amplitude Specifications

Amplitude measurement range
: -130dBm to +25dBm

Screen display range
LOG mode : 120dB (10dB/div)
: 80dB (10dB/div)
: 50dB (5dB/div)
: 20dB (2dB/div)
: 10dB (1dB/div)
LIN mode : 10div
QP mode : 80dB (10dB/div)
Provided the measurement range is 70dB

Linearity display
LOG mode : ±2.0dB/110dB, ±1.5dB/70dB, ±1.0dB/10dB, ±0.2dB/1dB
LIN mode : ±5% of the fullscale
QP mode : ±2.0dB/70dB, ±1.0dB/40dB

Reference level indication range
: -109.9dBm to +40.0dBm
0.715μV to 22.4V

Reference level accuracy : ±0.3dB 0 to -50dBm
±0.7dB +20 to -70dBm

Dynamic range
Average noise level : -121dBm + 1.55f(GHz)dB
(Resolution bandwidth 300Hz, video bandwidth 1Hz, input attenuator 0dB, frequency 1MHz or more)
Secondary, tertiary distortion
: ≦ -70dB -30dBm input
(Input attenuator 0dB, frequency 10MHz or more)
Frequency response : ±0.5dB 100kHz to 2GHz
±1.0dB 9kHz to 2.6GHz
(LOG mode, input attenuator 10dB, 20 to 30°C)

Residual response : ≦ -100dBm (Input attenuator 0dB, 50Ω terminator, frequency 500kHz or more)

Resolution bandwidth switching accuracy:
: ±0.3dB (after automatic calibration)

Video filter : 1Hz to 1MHz (switched 1 to 10 steps)

(3) Sweep Specifications

Sweep time : 30msec to 1000sec and Manual sweeping

Sweep time accuracy : ≦ 3%

Trigger mode : FREE RUN, LINE, VIDEO, EXT, TV-V, SINGLE

(4) Input Specifications

Input impedance : Approx. 50Ω
VSWR ≦ 1.5 (100kHz ≦ f ≦ 2GHz)
VSWR ≦ 2.0 (9kHz ≦ f ≦ 2.6GHz)
(Input attenuator ≧ 10dB)

Input connector : N connector

Maximum input level : +25dBm (input attenuator ≧ 30dB)
±50VDC max

Input attenuator : 0 to 50dB (10dB steps)

Input attenuator switching accuracy
: ±1.0dB (≦2.0GHz)
±1.5dB (≦2.6GHz)
(Input attenuator 10dB standard)

Detection mode : NORMAL, POSI, NEGA, SAMPLE

(5) Output Specifications

External memory function : IC memory card

Video output : Approx. 1Vp-p, approx 75Ω, composite

Sound monitor output : The AM and FM sound can be monitored with an approximately 8Ω earphone.

Power supply for probes : ±15V, 4-pin connector

Recorder output : X axis approx. -5 to +5V, output impedance approx. 10kΩ
Y axis approx. 0 to +4V, output impedance approx. 220Ω

GPIB data output/ Remote control	: The built-in GPIB interface allows data output and remote control.
Direct plot	: Also, the built-in GPIB interface allows an output of on-screen data to the R9833 plotter to have a hardcopy.
Printer output	: The built-in GPIB interface allows HP2225AJ to output a hard copy of on-screen data.

(6) Indication Specifications

Indicated items	: Waveforms, setting conditions, grid, label
CRT display unit	: 5.5 inch
Trace	: Two screens of A and B
WRITE	: Signal response from the analyzer is indicated at every sweeping.
VIEW	: The WRITE waveform contained in the memory, or other contents in the memory are displayed.
MAX HOLD	: Indication of the maximum signal level of repeat sweeping
AVG	: Indication of the average of repeat sweeping

(7) Other functions (R3261C only)

Occupied bandwidth measurement/Adjacent channel leakage power measurement

Multi-marker function

(8) General Specifications

Using ambient condition	: 0 to 50°C 85%RH or less
Storage temperature range	: -20 to +60°C

Power supply : The power voltage of the analyzer is set at the delivery according to the customer's ordering information.

Option No.	Standard	44
Line voltage (V)	90 to 132	198 to 250

48 to 66Hz

R3261C : Line voltage range 90 to 132VAC or 198 to 250VAC is automatically selected internally.
48 to 66Hz

Power consumption : 220VA or less

Dimensions : Approx. 330(W) x 177(H) x 450(D) mm

Mass : Approx. 15kg

(9) Options and Accessories

Option

OPTION 02 RS-232 interface

OPTION 04 Occupied bandwidth measurement/Adjacent channel leakage power measurement

OPTION 12 Gated sweep function

OPTION 15 Controller function
(Parallel I/O, Serial I/O)

OPTION 70 Multi-marker function

OPTION 72 Printer output

OPTION 80 RS-232 interface/Gated sweep function

OPTION 81 Controller function/Gated sweep function

Separate accessory

R3551	EMI preselector
R16211	Carring case
A02804	Front cover
A09505	Memory card (32k byte, 5 pieces)
A09506	Memory card (128k byte, 5 pieces)
A02034	Panel Mount Kits
A02255	Rack Mount Kits (JIS)
A02455	Rack Mount Kits (EIA)

2.2 R3261AN/CN Specifications

(1) Frequency Specifications

Measurable bandwidth : 9kHz to 2.6GHz

Center frequency setting increment
: 1Hz

Center frequency indication accuracy
: ±(3% of the span + center frequency x reference oscillator accuracy + 20Hz)
(span ≦ 2MHz)
±(2% of the span + center frequency x reference oscillator accuracy + 50kHz)
(span > 2MHz)

Reference oscillator : Internal or external input (10MHz)

Internal reference oscillator accuracy
Aging : ±(2×10^{-8} per day)
±(1×10^{-7} per year)
Temperature stability ±5×10^{-8} (from 0°C to +50°C, +25°C as a reference)

Frequency span
LIN mode : 1kHz to 2.6GHz, and 0
LOG mode : 1, 2, or 3 decades of span can be selected within the range from 10kHz to 1000MHz.

Frequency span accuracy
LIN mode : ±3% of the span (span > 2MHz)
±5% of the span (span ≦ 2MHz)

Frequency stability
Residual FM : 50kHz p-p or less (span > 10MHz)
2kHz p-p or less (10MHz ≧ span > 2MHz)
20Hz p-p or less (span ≦ 2MHz)
Frequency drift : 300Hz/min. or less (span ≦ 2MHz, at a constant temperature after an hour of warming up)

Side band noise : ≦-105dBc/Hz (20kHz offset)

Resolution
3dB bandwidth : 30Hz to 1MHz, switched at 1 to 3 steps

6dB bandwidth : 200Hz, 9kHz, 120kHz
Selectivity : ≦15: 1 (60dB : 3dB)
Bandwidth accuracy : ±20%

Marker accuracy
  Normal mode : Center frequency indication accuracy + span accuracy
  Counter mode : Indicated frequency x reference oscillator accuracy ±1 count

(2) Amplitude Specifications

Amplitude measurement range
: -19dBμ to +132dBμ

Screen display range
  LOG mode : 120dB (10dB/div)
: 80dB (10dB/div)
: 50dB (5dB/div)
: 20dB (2dB/div)
: 10dB (1dB/div)
  LIN mode : 10div
  QP mode : 80dB (10dB/div)
Provided the measurement range is 70dB

Linearity display
  LOG mode : ±2.0dB/110dB, ±1.5dB/70dB, ±1.0dB/10dB, ±0.2dB/1dB
  LIN mode : ±5% of the fullscale
  QP mode : ±2.0dB/70dB, ±1.0dB/40dB

Reference level indication range
: +0.1dBμ to +150dBμ
1.01μV to 31.6V

Reference level accuracy : ±0.3dB +110 to +60dBμ
±0.7dB +130 to +40dBμ

Dynamic range
  Average noise level : -10dBμ + 1.55f(GHz)dB
(Resolution bandwidth 300Hz, video bandwidth 1Hz, input attenuator 0dB, frequency 1MHz or more)
  Secondary, tertiary distortion
: ≦ -70dB -30dBm input
(Input attenuator 0dB, frequency 10MHz or more)
  Frequency response : ±0.5dB 100kHz to 2GHz
±1.5dB 9kHz to 2.6GHz
(LOG mode, input attenuator 10dB, 20 to 30°C)
  Residual response : ≦ +11dBμ (Input attenuator 0dB, 75Ω terminator, frequency 500kHz or more)

Resolution bandwidth switching accuracy
: ±0.3dB (after automatic calibration)

Video filter : 1Hz to 1MHz (switched 1 to 10 steps)

(3) Sweep Specifications

Sweep time : 30msec to 1000sec and Manual sweeping

Sweep time accuracy : ≦ 3%

Trigger mode : FREE RUN, LINE, VIDEO, EXT, TV-V, SINGLE

(4) Input Specifications

Input impedance : Approx. 75Ω
VSWR ≦ 1.5 (100kHz ≦ f ≦ 2GHz)
VSWR ≦ 2.0 (9kHz ≦ f ≦ 2.6GHz)
(Input attenuator ≧ 10dB)

Input connector : N connector

Maximum input level : +132dBμ (input attenuator ≧ 30dB)
±50VDC max

Input attenuator : 0 to 50dB (10dB steps)

Input attenuator switching accuracy
: ±1.0dB (≦2.0GHz)
±1.5dB (≦2.6GHz)
(Input attenuator 10dB standard)

Detection mode : NORMAL, POSI, NEGA, SAMPLE

(5) Output Specifications

External memory function : IC memory card

Video output : Approx. 1Vp-p, approx 75Ω, composite

Sound monitor output : The AM and FM sound can be monitored with an approximately 8Ω earphone.

Power supply for probes : ±15V, 4-pin connector

Recorder output : X axis approx. -5 to +5V, output impedance approx. 10kΩ
Y axis approx. 0 to +4V, output impedance approx. 220Ω

GPIB data output/ Remote control	: The built-in GPIB interface allows data output and remote control.
Direct plot	: Also, the built-in GPIB interface allows an output of on-screen data to the R9833 plotter to have a hardcopy.
Printer output	: The built-in GPIB interface allows HP2225AJ to output a hard copy of on-screen data.

(6) Indication Specifications

Indicated items	: Waveforms, setting conditions, grid, label
CRT display unit	: 5.5 inch
Trace	: Two screens of A and B
WRITE	: Signal response from the analyzer is indicated at every sweeping.
VIEW	: The WRITE waveform contained in the memory, or other contents in the memory are displayed.
MAX HOLD	: Indication of the maximum signal level of repeat sweeping
AVG	: Indication of the average of repeat sweeping

(7) Other functions (R3261CN only)

Occupied bandwidth measurement/Adjacent channel leakage power measurement

Multi-marker function

(8) General Specifications

Using ambient condition	: 0 to 50°C 85%RH or less
Storage temperature range	: -20 to +60°C

Power supply : The power voltage of the analyzer is set at the delivery according to the customer's ordering information.

Option No.	Standard	44
Line voltage (V)	90 to 132	198 to 250

48 to 66Hz

R3261CN : Line voltage range 90 to 132VAC or 198 to 250VAC is automatically selected internally.
48 to 66Hz

Power consumption : 220VA or less

Dimensions : Approx. 330(W) x 177(H) x 450(D) mm

Mass : Approx. 15kg

(9) Options and Accessories

Option

OPTION 02 RS-232 interface

OPTION 04 Occupied bandwidth measurement/Adjacent channel leakage power measurement

OPTION 12 Gated sweep function

OPTION 15 Controller function
(Parallel I/O, Serial I/O)

OPTION 70 Multi-marker function

OPTION 72 Printer output

OPTION 80 RS-232 interface/Gated sweep function

OPTION 81 Controller function/Gated sweep function

Separate accessory

R3551 EMI preselector
R16211 Carring case
A02804 Front cover
A09505 Memory card (32k byte, 5 pieces)
A09506 Memory card (128k byte, 5 pieces)
A02034 Panel Mount Kits
A02255 Rack Mount Kits (JIS)
A02455 Rack Mount Kits (EIA)

2.3 R3261B/D Specifications

(1) Frequency Specifications

Measurable bandwidth : 9kHz to 3.6GHz

Center frequency setting increment
: 1Hz

Center frequency indication accuracy
: ±(3% of the span + center frequency x reference oscillator accuracy + 20Hz)
(span ≦ 2MHz)
±(2% of the span + center frequency x reference oscillator accuracy + 50kHz)
(span > 2MHz)

Reference oscillator : Internal or external input (10Hz)

Internal reference oscillator accuracy
Aging : ±(2 x 10^{-8} per day)
±(1 x 10^{-7} per year)
Temperature stability ±5 x 10^{-8} (from 0°C to +50°C, +25°C as a reference)

Frequency span
LIN mode : 1kHz to 3.6GHz and 0
LOG mode : 1, 2, or 3 decades of span can be selected within the range from 10kHz to 1000MHz.

Frequency span accuracy
LIN mode : ±3% of the span (span > 2MHz)
±5% of the span (span ≦ 2MHz)

Frequency stability
Residual FM : 50kHz p-p or less (span > 10MHz)
2kHz p-p or less (10MHz ≧ span > 2MHz)
20Hz p-p or less (span ≦ 2MHz)
Frequency drift : 300Hz/min. or less (span ≦ 2MHz, at a constant temperature after an hour of warming up)

Side band noise : ≦ -105dBc/Hz f ≦ 3.0GHz
≦ -101dBc/Hz f ≦ 3.6GHz
(20kHz offset)

Resolution
3dB bandwidth : 30Hz to 1MHz, switched 1 to 3 steps
6dB bandwidth : 200Hz, 9kHz, 120kHz
Selectivity : ≦15: (60dB : 3dB)
Bandwidth accuracy : ±20%

Marker accuracy
  Normal mode : Center frequency indication accuracy + span accuracy
  Counter mode : Indicated frequency x reference oscillator accuracy ±1 count

(2) Amplitude Specifications

Amplitude measurement range
: -130dBm to +25dBm

Screen display range
  LOG mode : 120dB (10dB/div)
: 80dB (10dB/div)
: 50dB (5dB/div)
: 20dB (2dB/div)
: 10dB (1dB/div)
  LIN mode : 10div
  QP mode : 80dB (10dB/div)
Provided the measurement range is 70dB

Linearity display
  LOG mode : ±2.0dB/110dB, ±1.5dB/70dB, ±1.0dB/10dB, ±0.2dB/1dB
  LIN mode : ±5% of the fullscale
  QP mode : ±2.0dB/70dB, ±1.0dB/40dB

Reference level indication range
: -109.9dBm to +40.0dBm
0.715µV to 22.4V

Reference level accuracy : ±0.3dB 0 to -50dBm
±0.7dB +20 to -70dBm

Dynamic range
  Average noise level : -121dBm + 1.55f(GHz)dB
(Resolution bandwidth 300Hz, video bandwidth 1Hz, input attenuator 0dB, frequency 1MHz or more)
  Secondary, tertiary distortion
: ≦ -70dB -30dBm input
(Input attenuator 0dB, frequency 10MHz or more)
  Frequency response : ±0.5dB 100kHz to 2GHz
±1.0dB 9kHz to 3.6GHz
(LOG mode, input attenuator 10dB, 20 to 30°C)
  Residual response : ≦ -100dBm (Input attenuator 0dB, 50Ω terminator, frequency 500kHz or more)

Resolution bandwidth switching accuracy
: ±0.3dB (after automatic calibration)

Video filter : 1Hz to 1MHz (switched 1 to 10 steps)

(3) Sweep Specifications

Sweep time : 30msec to 1000sec and Manual sweeping

Sweep time accuracy : ≦ 3%

Trigger mode : FREE RUN, LINE, VIDEO, EXT, TV-V, SINGLE

(4) Input Specifications

Input impedance : Approx. 50Ω
VSWR ≦ 1.5 (100kHz ≦ f ≦ 2GHz)
VSWR ≦ 2.0 (9kHz ≦ f ≦ 3.6GHz)
(Input attenuator ≧ 10dB)

Input connector : N connector

Maximum input level : +25dBm (input attenuator ≧ 30dB)
±50VDC max

Input attenuator : 0 to 50dB (10dB steps)

Input attenuator switching accuracy
: ±1.0dB (≦ 2.0GHz)
±1.5dB (≦ 3.6GHz)
(Input attenuator 10dB standard)

Detection mode : NORMAL, POSI, NEGA, SAMPLE

(5) Output Specifications

External memory function : IC memory card

Video output : Approx. 1Vp-p, approx 75Ω, composite

Sound monitor output : The AM and FM sound can be monitored with an approximately 8Ω earphone.

Power supply for probes : ±15V, 4-pin connector

Recorder output : X axis approx. -5 to +5V, output impedance approx. 10kΩ
Y axis approx. 0 to +4V, output impedance approx. 220Ω

GPIB data output/ Remote control	: The built-in GPIB interface allows data output and remote control.
Direct plot	: Also, the built-in GPIB interface allows an output of on-screen data to the R9833 plotter to have a hardcopy.
Printer output	: The built-in GPIB interface allows HP2225AJ to output a hard copy of on-screen data.

(6) Indication Specifications

Indicated items	: Waveforms, setting conditions, grid, label
CRT display unit	: 5.5 inch
Trace	: Two screens of A and B
WRITE	: Signal response from the analyzer is indicated at every sweeping.
VIEW	: The WRITE waveform contained in the memory, or other contents in the memory are displayed.
MAX HOLD	: Indication of the maximum signal level of repeat sweeping
AVG	: Indication of the average of repeat sweeping

(7) Other functions (R3261D only)

Occupied bandwidth measurement/Adjacent channel leakage power measurement

Multi-marker function

(8) General Specifications

Using ambient condition	: 0 to 50°C 85%RH or less
Storage temperature range	: -20 to +60°C

Power supply : The power voltage of the analyzer is set at the delivery according to the customer's ordering information.

Option No.	Standard	44
Line voltage (V)	90 to 132	198 to 250

48 to 66Hz

R3261D : Line voltage range 90 to 132VAC or 198 to 250VAC is automatically selected internally.
48 to 66Hz

Power consumption : 220VA or less

Dimensions : Approx. 330(W) x 177(H) x 450(D) mm

Mass : Approx. 15kg

(9) Options and Accessories

Option

OPTION 02 RS-232 interface

OPTION 04 Occupied bandwidth measurement/Adjacent channel leakage power measurement

OPTION 12 Gated sweep function

OPTION 15 Controller function
(Parallel I/O, Serial I/O)

OPTION 70 Multi-marker function

OPTION 72 Printer output

OPTION 80 RS-232 interface/Gated sweep function

OPTION 81 Controller function/Gated sweep function

Separate accessory

R3551 EMI preselector
R16211 Carring case
A02804 Front cover
A09505 Memory card (32k byte, 5 pieces)
A09506 Memory card (128k byte, 5 pieces)
A02034 Panel Mount Kits
A02255 Rack Mount Kits (JIS)
A02455 Rack Mount Kits (EIA)

2.4 R3361A/C Specifications

(1) Frequency Specifications

Measurable bandwidth : 9kHz to 2.6GHz

Center frequency setting increment
: 1Hz

Center frequency indication accuracy
: ±(3% of the span + center frequency x reference oscillator accuracy + 20Hz) (span ≦ 2MHz)
±(2% of the span + center frequency x reference oscillator accuracy + 50kHz) (span > 2MHz)

Reference oscillator : Internal or external input (10MHz)

Internal reference oscillator accuracy
Aging : ±(2 x 10^{-8} per day)
±(1 x 10^{-7} per year)
Temperature stability ±5 x 10^{-8} (from 0°C to +50°C, +25°C as a reference)

Frequency span
LIN mode : 1kHz to 2.6GHz and 0
LOG mode : 1, 2, or 3 decades of span can be selected within the range from 10kHz to 1000MHz.

Frequency span accuracy
LIN mode : ±3% of the span (span > 2MHz)
±5% of the span (span ≦ 2MHz)

Frequency stability
Residual FM : 50kHz p-p or less (span > 10MHz)
2kHz p-p or less (10MHz ≧ span > 2MHz)
20Hz p-p or less (span ≦ 2MHz)
Frequency drift : 300Hz/min. or less (span ≦ 2MHz, at a constant temperature after an hour of warming up)

Side band noise : ≦-105dBc/Hz (20kHz offset)

Resolution
3dB bandwidth : 30Hz to 1MHz, switched 1 to 3 steps
6dB bandwidth : 200Hz, 9kHz, 120kHz
Selectivity : ≦15: 1 (60dB : 3dB)
Bandwidth accuracy : ±20%

Marker accuracy
  Normal mode : Center frequency indication accuracy + span accuracy
  Counter mode : Indicated frequency x reference oscillator accuracy ±1 count
  (Excepting TG mode)

(2) Amplitude Specifications

Amplitude measurement range
  : -130dBm to +25dBm

Screen display range
  LOG mode : 120dB (10dB/div)
  : 80dB (10dB/div)
  : 50dB (5dB/div)
  : 20dB (2dB/div)
  : 10dB (1dB/div)
  LIN mode : 10div
  QP mode : 80dB (10dB/div)
  Provided the measurement range is 70dB

Linearity display
  LOG mode : ±2.0dB/110dB, ±1.5dB/70dB, ±1.0dB/10dB, ±0.2dB/1dB
  LIN mode : ±5% of the fullscale
  QP mode : ±2.0dB/70dB, ±1.0dB/40dB

Reference level indication range
  : -109.9dBm to +40.0dBm
  0.715μV to 22.4V

Reference level accuracy : ±0.3dB 0 to -50dBm
  ±0.7dB +20 to -70dBm

Dynamic range
  Average noise level : -121dBm + 1.55f(GHz)dB
  (Resolution bandwidth 300Hz, video bandwidth 1Hz, input attenuator 0dB, frequency 1MHz or more)
  Secondary, tertiary distortion
  : ≦ -70dB -30dBm input
  (Input attenuator 0dB, frequency 10MHz or more)
  Frequency response : ±0.5dB 100kHz to 2GHz
  ±1.0dB 9kHz to 2.6GHz
  (LOG mode, input attenuator 10dB, 20 to 30°C)
  Residual response : ≦ -100dBm (Input attenuator 0dB, 50Ω terminator, frequency 500kHz or more)

Resolution bandwidth switching accuracy
: ±0.3dB (after automatic calibration)

Video filter : 1Hz to 1MHz (switched 1 to 10 steps)

(3) Sweep Specifications

Sweep time : 30msec to 1000sec and Manual sweeping

Sweep time accuracy : ≦ 3%

Trigger mode : FREE RUN, LINE, VIDEO, EXT, TV-V, SINGLE

(4) Input Specifications

Input impedance : Approx. 50Ω
VSWR ≦ 1.5 (100kHz ≦f ≦ 2GHz)
VSWR ≦ 2.0 (9kHz ≦ f ≦ 2.6GHz)
(Input attenuator ≧ 10dB)

Input connector : N connector

Maximum input level : +25dBm (input attenuator ≧ 30dB)
±50VDC max

Input attenuator : 0 to 50dB (10dB steps)

Input attenuator switching accuracy
: ±1.0dB (≦2.0GHz)
±1.5dB (≦2.6GHz)
(Input attenuator 10dB standard)

Detection mode : NORMAL, POSI, NEGA, SAMPLE

(5) Tracking generator specifications

Frequency range : 9kHz to 2.6GHz

Output level range : 0dBm to -50dBm Setting can be done in steps of 1dB.

Output level accuracy : ±0.5dB (30MHz, -10dBm, +20 to +30°C)

Output level flatness : ±0.7dB (100kHz to 1.0GHz)
±1.5dB (9kHz to 2.6GHz)
(-10dBm output)

Output level switching accuracy
: ±1.0dB (100kHz to 1.0GHz)
±2.0dB (9kHz to 2.6GHz)
(-10dBm reference)

Output spuriousness : Harmonics spurious level ≦ -20dB
Non-harmonics spurious level ≦ -30dB
(Output level 0dBm)

TG leakage : ≦ -110dBm

Output impedance : Approx. 50Ω

Output VSWR : ≦ 1.5 (100kHz to 2.0GHz)
≦ 2.0 (9kHz to 2.6GHz)
(At ≦ -10dBm output)

Output connector : N-connector

(6) Output Specifications

External memory function: IC memory card

Video output : Approx. 1Vp-p, approx. 75Ω, composite

Sound monitor output : The AM and FM sound can be monitored with an approximately 8Ω earphone.

Power supply for probes : ±15V, 4-pin connector

Recorder output : X axis approx. -5 to +5V, output impedance approx. 10kΩ
Y axis approx. 0 to +4V, output impedance approx. 220Ω

GPIB data output/
Remote control : The built-in GPIB interface allows data output and remote control.

Direct plot : Also, the built-in GPIB interface allows an output of on-screen data to the R9833 plotter to have a hardcopy.

Printer output : The built-in GPIB interface allows HP2225AJ to output a hard copy of on-screen data.

(7) Indication Specifications

Indicated items	: Waveforms, setting conditions, grid, label
CRT display unit	: 5.5 inch
Trace	: Two screens of A and B
WRITE	: Signal response from the analyzer is indicated at every sweeping.
VIEW	: The WRITE waveform contained in the memory, or other contents in the memory are displayed.
MAX HOLD	: Indication of maximum signal level during repeated sweeping
AVG	: Indication of average signal level during repeated sweeping

(8) Other functions (R3361C only)

Occupied bandwidth measurement/Adjacent channel leakage power measurement

Multi-marker function

(9) General Specifications

Using ambient condition : 0 to 50°C
85%RH or less

Storage temperature range : -20 to +60°C

Power supply : The power voltage of the analyzer is set at the delivery according to the customer's ordering information.

Option No.	Standard	44
Line voltage (V)	90 to 132	198 to 250

48 to 66Hz

R3361C : Line voltage range 90 to 132VAC or 198 to 250VAC is automatically selected internally.
48 to 66Hz

Power consumption : 220VA or less

Dimensions : Approx. 330(W) x 177(H) x 450(D) mm

Mass : Approx. 17kg

(10) Options and Accessories

Option

OPTION 02	RS-232 interface
OPTION 04	Occupied bandwidth measurement/Adjacent channel leakage power measurement
OPTION 12	Gated sweep function
OPTION 15	Controller function (Parallel I/O, Serial I/O)
OPTION 70	Multi-marker function
OPTION 72	Printer output
OPTION 80	RS-232 interface/Gated sweep function
OPTION 81	Controller function/Gated sweep function

Separate accessory

R3551	EMI preselector
R16211	Carring case
A02804	Front cover
A09505	Memory card (32k byte, 5 pieces)
A09506	Memory card (128k byte, 5 pieces)
A02034	Panel Mount Kits
A02255	Rack Mount Kits (JIS)
A02455	Rack Mount Kits (EIA)

2.5 R3361AN/CN Specifications

(1) Frequency Specifications

Measurable bandwidth : 9kHz to 2.6GHz

Center frequency setting increment
: 1Hz

Center frequency indication accuracy
: ±(3% of the span + center frequency x reference oscillator accuracy + 20Hz)
(span ≦ 2MHz)
±(2% of the span + center frequency x reference oscillator accuracy + 50kHz)
(span > 2MHz)

Reference oscillator : Internal or external input (10MHz)

Internal reference oscillator accuracy
Aging : ±(2 x 10^{-8} per day)
±(1 x 10^{-7} per year)
Temperature stability ±5 x 10^{-8} (from 0°C to +50°C, +25°C as a reference)

Frequency span
LIN mode : 1kHz to 2.6GHz and 0
LOG mode : 1, 2, or 3 decades of span can be selected within the range from 10kHz to 1000MHz.

Frequency span accuracy
LIN mode : ±3% of the span (span > 2MHz)
±5% of the span (span ≦ 2MHz)

Frequency stability
Residual FM : 50kHz p-p or less (span > 10MHz)
2kHz p-p or less (10MHz ≧ span > 2MHz)
20Hz p-p or less (span ≦ 2MHz)
Frequency drift : 300Hz/min. or less (span ≦ 2MHz, at a constant temperature after an hour of warming up)

Side band noise : ≦-105dBc/Hz (20kHz offset)

Resolution
3dB bandwidth : 30Hz to 1MHz, switched 1 to 3 steps
6dB bandwidth : 200Hz, 9kHz, 120kHz
Selectivity : ≦15: 1 (60dB : 3dB)
Bandwidth accuracy : ±20%

Marker accuracy
- Normal mode : Center frequency indication accuracy + span accuracy
- Counter mode : Indicated frequency x reference oscillator accuracy ±1 count (Excepting TG mode)

(2) Amplitude Specifications

Amplitude measurement range
: -19dBμ to +132dBμ

Screen display range
- LOG mode : 120dB (10dB/div)
  : 80dB (10dB/div)
  : 50dB (5dB/div)
  : 20dB (2dB/div)
  : 10dB (1dB/div)
- LIN mode : 10div
- QP mode : 80dB (10dB/div) Provided the measurement range is 70dB

Linearity display
- LOG mode : ±2.0dB/110dB, ±1.5dB/70dB, ±1.0dB/10dB, ±0.2dB/1dB
- LIN mode : ±5% of the fullscale
- QP mode : ±2.0dB/70dB, ±1.0dB/40dB

Reference level indication range
: +0.1dBμ to +150dBμ
1.01μV to 31.6V

Reference level accuracy : ±0.3dB +110 to +60dBμ
±0.7dB +130 to +40dBμ

Dynamic range
- Average noise level : -10dBμ + 1.55f(GHz)dB (Resolution bandwidth 300Hz, video bandwidth 1Hz, input attenuator 0dB, frequency 1MHz or more)
- Secondary, tertiary distortion : ≦ -70dB -30dBm input (Input attenuator 0dB, frequency 10MHz or more)
- Frequency response : ±0.5dB 100kHz to 2GHz
  ±1.5dB 9kHz to 2.6GHz
  (LOG mode, input attenuator 10dB, 20 to 30°C)
- Residual response : ≦ +11dBμ (Input attenuator 0dB, 75Ω terminator, frequency 500kHz or more)

Resolution bandwidth switching accuracy
: ±0.3dB (after automatic calibration)

Video filter : 1Hz to 1MHz (switched 1 to 10 steps)

(3) Sweep Specifications

Sweep time : 30msec to 1000sec and Manual sweeping

Sweep time accuracy : ≦ 3%

Trigger mode : FREE RUN, LINE, VIDEO, EXT, TV-V, SINGLE

(4) Input Specifications

Input impedance : Approx. 75Ω
VSWR ≦ 1.5 (100kHz ≦f ≦ 2GHz)
VSWR ≦ 2.0 (9kHz ≦ f ≦ 2.6GHz)
(Input attenuator ≧ 10dB)

Input connector : N connector

Maximum input level : +132dBμ (input attenuator ≧ 30dB)
±50VDC max

Input attenuator : 0 to 50dB (10dB steps)

Input attenuator switching accuracy
: ±1.0dB (≦2.0GHz)
±1.5dB (≦2.6GHz)
(Input attenuator 10dB standard)

Detection mode : NORMAL, POSI, NEGA, SAMPLE

(5) Tracking generator specifications

Frequency range : 9kHz to 2.6GHz

Output level range : 105dBμ to +55dBμ Setting can be done in steps of 1dB.

Output level accuracy : ±0.5dB (30MHz, +95dBμ, +20 to +30°C)

Output level flatness : ±0.7dB (100kHz to 1.0GHz)
±1.5dB (100kHz to 2.0GHz)
±2.0dB (9kHz to 2.6GHz)
(+95dBμ output)

Output level switching accuracy
: ±1.0dB (100kHz to 1.0GHz)
±2.0dB (9kHz to 2.6GHz)
(+95dBμ reference)

Output spuriousness : Harmonics spurious level ≦ -20dB
Non-harmonics spurious level ≦ -30dB
(Output level +105dBμ)

TG leakage : ≦ +1dBμ

Output impedance : Approx. 75Ω

Output VSWR : ≦ 1.5 (100kHz to 2.0GHz)
≦ 2.0 (9kHz to 2.6GHz)
(At ≦ +95dBμ output)

Output connector : N-connector

(6) Output Specifications

External memory function: IC memory card

Video output : Approx. 1Vp-p, approx. 75Ω, composite

Sound monitor output : The AM and FM sound can be monitored with an approximately 8Ω earphone.

Power supply for probes : ±15V, 4-pin connector

Recorder output : X axis approx. -5 to +5V, output impedance approx. 10kΩ
Y axis approx. 0 to +4V, output impedance approx. 220Ω

GPIB data output/
Remote control : The built-in GPIB interface allows data output and remote control.

Direct plot : Also, the built-in GPIB interface allows an output of on-screen data to the R9833 plotter to have a hardcopy.

Printer output : The built-in GPIB interface allows HP2225AJ to output a hard copy of on-screen data.

(7) Indication Specifications

Indicated items : Waveforms, setting conditions, grid, label

CRT display unit : 5.5 inch

Trace : Two screens of A and B

WRITE : Signal response from the analyzer is indicated at every sweeping.

VIEW : The WRITE waveform contained in the memory, or other contents in the memory are displayed.

MAX HOLD : Indication of maximum signal level during repeated sweeping

AVG : Indication of average signal level during repeated sweeping

(8) Other functions (R3361CN only)

Occupied bandwidth measurement/Adjacent channel leakage power measurement

Multi-marker function

(9) General Specifications

Using ambient condition : 0 to 50°C
85%RH or less

Storage temperature range : -20 to +60°C

Power supply : The power voltage of the analyzer is set at the delivery according to the customer's ordering information.

Option No.	Standard	44
Line voltage (V)	90 to 132	198 to 250

48 to 66Hz

R3361CN : Line voltage range 90 to 132VAC or 198 to 250VAC is automatically selected internally.
48 to 66Hz

Power consumption : 220VA or less

Dimensions : Approx. 330(W) x 177(H) x 450(D) mm

Mass : Approx. 17kg

(10) Options and Accessories

Option

OPTION 02	RS-232 interface
OPTION 04	Occupied bandwidth measurement/Adjacent channel leakage power measurement
OPTION 12	Gated sweep function
OPTION 15	Controller function (Parallel I/O, Serial I/O)
OPTION 70	Multi-marker function
OPTION 72	Printer output
OPTION 80	RS-232 interface/Gated sweep function
OPTION 81	Controller function/Gated sweep function

Separate accessory

R3551	EMI preselector
R16211	Carring case
A02804	Front cover
A09505	Memory card (32k byte, 5 pieces)
A09506	Memory card (128k byte, 5 pieces)
A02034	Panel Mount Kits
A02255	Rack Mount Kits (JIS)
A02455	Rack Mount Kits (EIA)

2.6 R3361B/D Specifications

(1) Frequency Specifications

Measurable bandwidth : 9kHz to 3.6GHz

Center frequency setting increment
: 1Hz

Center frequency indication accuracy:
±(3% of the span + center frequency x reference oscillator accuracy + 20Hz)
(span _ 2MHz)
±(2% of the span + center frequency x reference oscillator accuracy + 50kHz)
(span 2MHz)

Reference oscillator : Internal or external input (10Hz)

Internal reference oscillator accuracy
Aging : ±(2 x 10^{-8} per day)
±(1 x 10^{-7} per year)
Temperature stability ±5 x 10^{-8} (from 0°C to +50°C, +25°C as a reference)

Frequency span
LIN mode : 1kHz to 3.6GHz and 0
LOG mode : 1, 2, or 3 decades of span can be selected within the range from 10kHz to 1000MHz.

Frequency span accuracy
LIN mode : ±3% of the span (span > 2MHz)
±5% of the span (span ≦ 2MHz)

Frequency stability
Residual FM : 50kHz p-p or less (span > 10MHz)
2kHz p-p or less (10MHz ≧ span > 2MHz)
20Hz p-p or less (span ≦ 2MHz)
Frequency drift : 300Hz/min. or less (span ≦ 2MHz, at a constant temperature after an hour of warming up)

Side band noise : ≦ -105dBc/Hz f ≦ 3.0GHz
≦ -101dBc/Hz f ≦ 3.6GHz
(20kHz offset)

Resolution
3dB bandwidth : 30Hz to 1MHz, switched 1 to 3 steps
6dB bandwidth : 200Hz, 9kHz, 120kHz
Selectivity : ≦ 15 : 1 (60dB : 3dB)
Bandwidth accuracy : ±20%

Marker accuracy
- Normal mode : Center frequency indication accuracy + span accuracy
- Counter mode : Indicated frequency x reference oscillator accuracy ±1 count (Excepting TG mode)

(2) Amplitude Specifications

Amplitude measurement range
: -130dBm to +25dBm

Screen display range
- LOG mode : 120dB (10dB/div)
  : 80dB (10dB/div)
  : 50dB (5dB/div)
  : 20dB (2dB/div)
  : 10dB (1dB/div)
- LIN mode : 10div
- QP mode : 80dB (10dB/div) Provided the measurement range is 70dB

Linearity display
- LOG mode : ±2.0dB/110dB, ±1.5dB/70dB, ±1.0dB/10dB, ±0.2dB/1dB
- LIN mode : ±5% of the fullscale
- QP mode : ±2.0dB/70dB, ±1.0dB/40dB

Reference level indication range
: -109.9dBm to +40.0dBm
0.715μV to 22.4V

Reference level accuracy : ±0.3dB 0 to -50dBm
±0.7dB +20 to -70dBm

Dynamic range
- Average noise level : -121dBm + 1.55f(GHz)dB (Resolution bandwidth 300Hz, video bandwidth 1Hz, input attenuator 0dB, frequency 1MHz or more)
- Secondary, tertiary distortion : ≦ -70dB -30dBm input (Input attenuator 0dB, frequency 10MHz or more)
- Frequency response : ±0.5dB (100kHz to 2GHz) ±1.0dB (9kHz to 3.6GHz) (LOG mode, input attenuator 10dB, 20 to 30°C)
- Residual response : ≦ -100dBm (Input attenuator 0dB, 50Ω terminator, frequency 500kHz or more)

Resolution bandwidth switching accuracy
: ±0.3dB (after automatic calibration)

Video filter : 1Hz to 1MHz (switched 1 to 10 steps)

(3) Sweep Specifications

Sweep time : 30msec to 1000sec and Manual sweeping

Sweep time accuracy : ≦ 3%

Trigger mode : FREE RUN, LINE, VIDEO, EXT, TV-V, SINGLE

(4) Input Specifications

Input impedance : Approx. 50Ω
: VSWR ≦ 1.5 100kHz ≦ f ≦ 2GHz
: VSWR ≦ 2.0 9kHz ≦ f ≦ 3.6GHz
: Input attenuator ≧ 10dB reference

Input connector : N connector

Maximum input level : +25dBm (input attenuator ≧ 30dB)
±50VDC max

Input attenuator : 0 to 50dB (10dB steps)

Input attenuator switching accuracy
: ±1.0dB (≦2.0GHz)
±1.5dB (≦3.6GHz)
Input attenuator 10dB standard

Detection mode : NORMAL, POSI, NEGA, SAMPLE

(5) Tracking generator specifications

Frequency range : 9kHz to 3.6GHz

Output level range : 0dBm to -50dBm Setting can be done in steps of 1dB.

Output level accuracy : ±0.5dB (30MHz, -10dBm, +20 to +30°C)

Output level flatness : ±0.7dB (100kHz to 1.0GHz)
±1.5dB (9kHz to 2.6GHz)
±2.0dB (9kHz to 3.6GHz)
(-10dBm output)

Output level switching accuracy
: ±1.0dB (100kHz to 1.0GHz)
±2.0dB (9kHz to 2.6GHz)
±3.0dB (9kHz to 3.6GHz)
(-10dBm reference)

Output spuriousness : Harmonics spurious level ≦ -20dB
Non-harmonics spurious level ≦ -30dB
(Output level 0dBm)

TG leakage : ≦ -110dBm (frequency ≦ 3.0GHz)
: ≦ -100dBm (frequency ≦ 3.6GHz)

Output impedance : Approx. 50Ω

Output VSWR : ≦ ±1.5 (100kHz to 2.0GHz)
≦ ±2.0 (9kHz to 3.6GHz)
(At ≦ -10dBm output)

Output connector : N-connector

(6) Output Specifications

External memory function: IC memory card

Video output : Approx. 1Vp-p, approx. 75Ω, composite

Sound monitor output : The AM and FM sound can be monitored with an approximately 8Ω earphone.

Power supply for probes : ±15V, 4-pin connector

Recorder output : X axis approx. -5 to +5V, output impedance approx. 10kΩ
Y axis approx. 0 to +4V, output impedance approx. 220Ω

GPIB data output/
Remote control : The built-in GPIB interface allows data output and remote control.

Direct plot : Also, the built-in GPIB interface allows an output of on-screen data to the R9833 plotter to have a hardcopy.

Printer output : The built-in GPIB interface allows HP2225AJ to output a hard copy of on-screen data.

(7) Indication Specifications

Indicated items : Waveforms, setting conditions, grid, label

CRT display unit : 5.5 inch

Trace : Two screens of A and B

WRITE : Signal response from the analyzer is indicated at every sweeping.

VIEW : The WRITE waveform contained in the memory, or other contents in the memory are displayed.

MAX HOLD : Indication of maximum signal level during repeated sweeping

AVG : Indication of average signal level during repeated sweeping

(8) Other functions (R3361D only)

Occupied bandwidth measurement/Adjacent channel leakage power measurement

Multi-marker function

(9) General Specifications

Using ambient conditions : 0 to 50°C
85%RH or less

Storage temperature range : -20 to +60°C

Power supply : The power voltage of the analyzer is set at the delivery according to the customer's ordering information.

Option No.	Standard	44
Line voltage (V)	90 to 132	198 to 250

48 to 66Hz

R3361D : Line voltage range 90 to 132VAC or 198 to 250VAC is automatically selected internally.
48 to 66Hz

Power consumption : 220VA or less

Dimensions : Approx. 330(W) x 177(H) x 450(D) mm

Mass : Approx. 17kg

(10) Options and Accessories

Option

OPTION 02	RS-232 interface
OPTION 04	Occupied bandwidth measurement/Adjacent channel leakage power measurement
OPTION 12	Gated sweep function
OPTION 15	Controller function (Parallel I/O, Serial I/O)
OPTION 70	Multi-marker function
OPTION 72	Printer output
OPTION 80	RS-232 interface/Gated sweep function
OPTION 81	Controller function/Gated sweep function

Separate accessory

R3551	EMI preselector
R16211	Carring case
A02804	Front cover
A09505	Memory card (32k byte, 5 pieces)
A09506	Memory card (128k byte, 5 pieces)
A02034	Panel Mount Kits
A02255	Rack Mount Kits (JIS)
A02455	Rack Mount Kits (EIA)

3. THEORY OF OPERATION

This section describes the R3261/3361 series of spectrum analyzers and their operation. This section describes the components of the R3261/3361 analyzers and their functions, and briefly explains how spectrum analyzers work.

3.1 How a Spectrum Analyzer Works

A spectrum analyzer is a device that graphically displays the energy distribution of the frequencies that make up a signal. The signal's spectrum is represented by a line whose vertical displacements show the amplitude of the signal at each frequency, as shown in Figure 3–1.

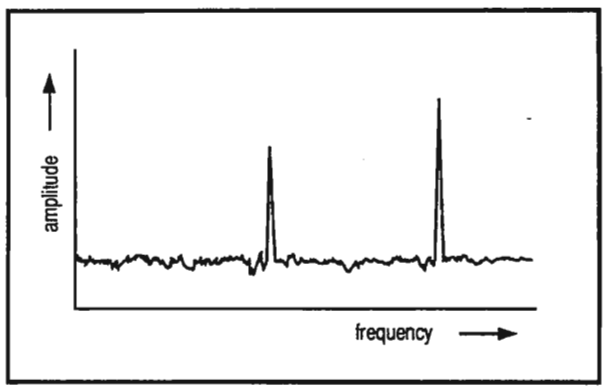


Figure 3–1 Typical Spectrum Analyzer Display

A spectrum analyzer uses circuitry similar to that in a superheterodyne radio receiver. The analyzer mixes the input signal with the signal from a swept local oscillator to produce an IF signal whose amplitude determines the vertical displacement of the line on the display. The local oscillator sweeps through a range of frequencies, thus changing the narrow frequency band being amplified at any time. The horizontal displacement of the displayed spectrum line is synchronized with the local oscillator frequency.

3.2 R3261/3361 Configurations

The R3261/3361 series of spectrum analyzers includes 8 models: R3261A/C, R3261B/D, R3361A/C, and R3361B/D. Table 3-1 summarizes the configurations of the 8 models, and shows the frequency bands that can be analyzed by each. The R3361 models also include a tracking generator (TG).

Table 3-1 R3261/3361 Configurations

Model	Frequency range		TG
	9kHz - 2.6GHz	9kHz - 3.6GHz	
R3261A/C	✓		
R3261B/D		✓	
R3361A/C	✓		✓
R3361B/D		✓	✓

3.3 How the R3261/3361 Works

Figure 3–2 (on the following page) shows a block diagram of the R3261/3361. The primary signal path through the R3261/3361 analyzer is as follows: The signal received by the analyzer (RF IN in the block diagram) passes through an input attenuator, and is mixed with a swept signal from the first local oscillator to produce the first IF signal (4.066 GHz). (The first local oscillator's frequency is controlled by a ramp signal from the CPU.) The first IF signal passes through three additional mixers to produce the fourth IF signal (3.58 MHz). This signal then passes through a logarithmic amplifier and an analog-to-digital converter, and is used by the CPU to control the vertical displacement of the spectrum line on the CRT.

The pages following Figure 3–2 describe in detail this process and the analyzer's components and their functions.

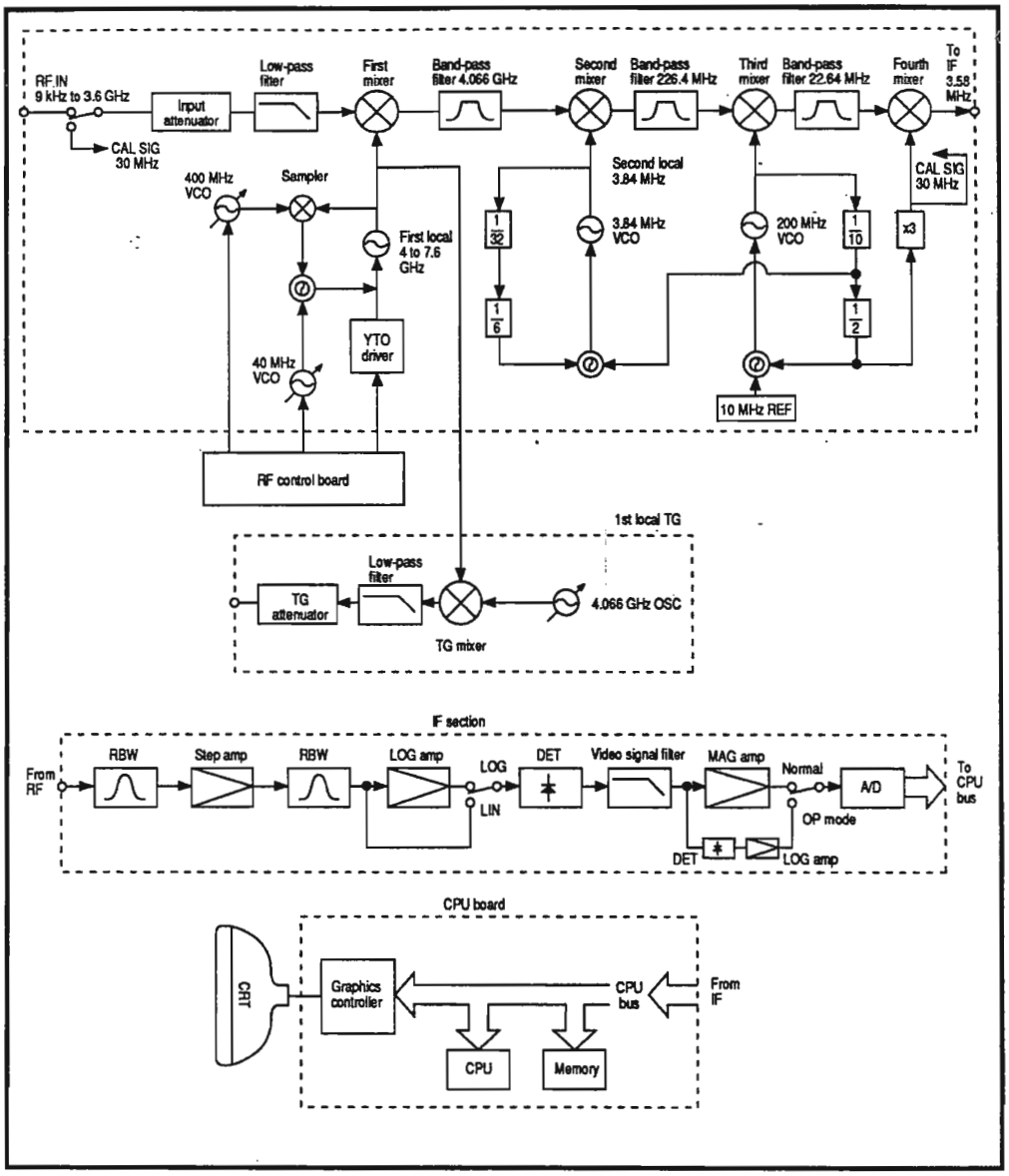


Figure 3–2 R3261/3361 Block Diagram

3.3.1 The Input Attenuator

Figure 3–3 below shows a circuit diagram of the R3261/3361 input attenuator.

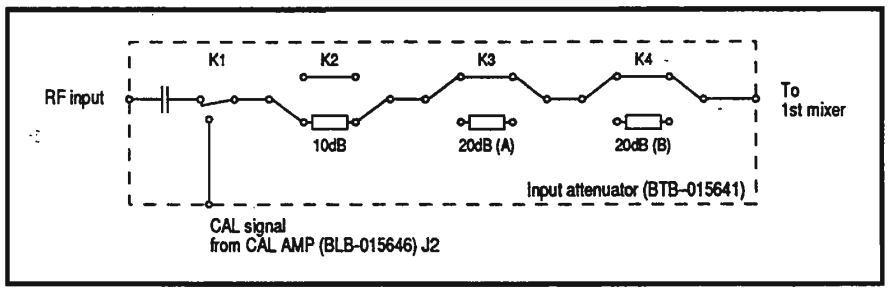


Figure 3–3 Input Attenuator

The input attenuator combines one 10 dB and two 20 dB attenuators to form an attenuator that can be set from 0 to 50 dB in 10 dB increments. The CPU controls the 10 dB and 20 dB attenuators according to the Input Attenuator setting. This setting has two operating modes: an automatic mode that sets the attenuator according to the reference level, and a manual mode that sets the attenuator according to front panel switch settings. Table 3–2 shows these switch settings.

Table 3–2 Attenuator Switch Settings

Attenuator Setting	10 dB K2	20 dB (A) K3	20 dB (B) K4
0 dB			
10 dB	on		
20 dB		on	
30 dB	on	on	
40 dB		on	on
50 dB	on	on	on

on = switch set to the attenuator position.

Unlike conventional spectrum analyzers, the R3261/3361 does not use an external calibration signal. Instead, the R3261/3361 has a self-calibration function that uses an internal calibration signal (see Section 4.1.2). The K1 switch selects this internal signal.

3.3.2 First Mixer/Coupler

Figure 3–4 shows the first mixer/coupler.

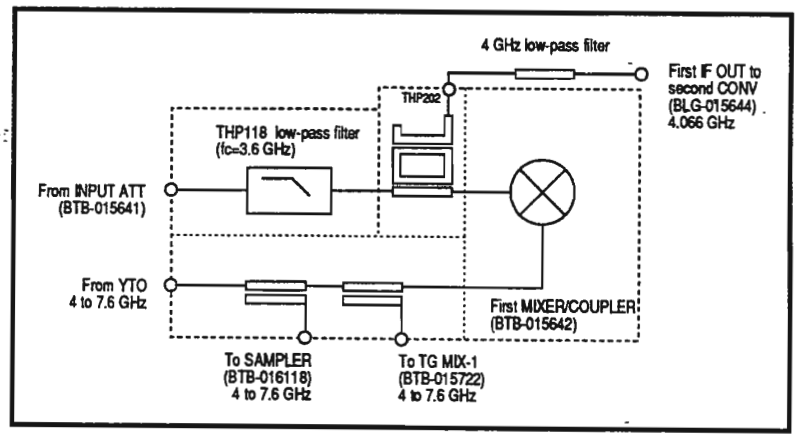


Figure 3–4 First Mixer/Coupler

The first local oscillator signal generated by the YTO (4 to 6.4GHz for the R3261A,C/3361A,C, 4 to 7.6GHz for the R3261B,D/3361B,D) is distributed to the sampler and the TG MIX-1 circuitry before passing to the first mixer/coupler. The input signal from the INPUT ATT terminal passes through the low-pass filter to the mixer/coupler, where it is combined with the first local oscillator signal mix to generate the first IF signal (4.066 GHz). The IF signal then passes through a 4 GHz low-pass filter to the second CONV board (BLG-015644).

Once the SMA connector is active with the YTO output signal, it is possible to check the level and frequency of the first local by removing the SMA connector (frequency range: 4 GHz – 7.6 GHz, level at 4 GHz: 8 dBm).

3.3.3 Second Mixer/Second Local

Figure 3–5 shows the second mixer/second local oscillator.

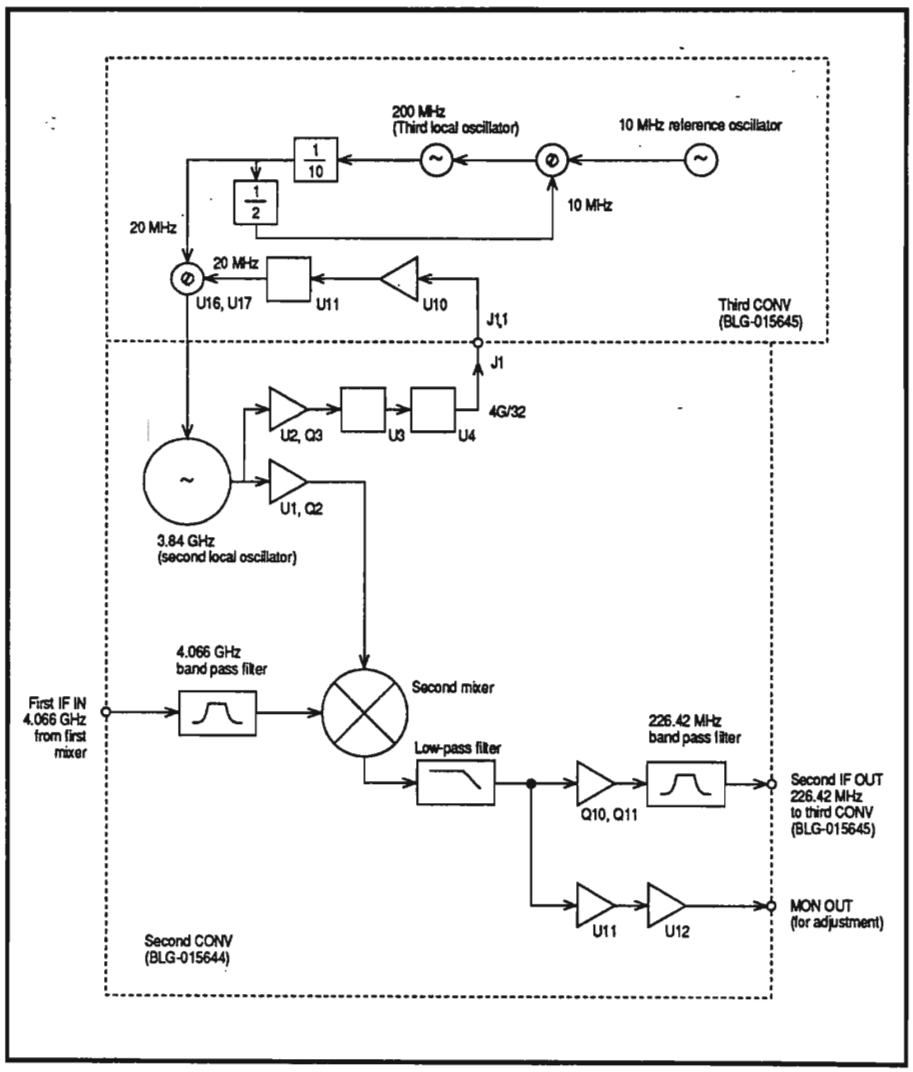


Figure 3–5 Second Mixer/Second Local Oscillator

The first IF signal (4.066 GHz) passes through a 4.066 GHz band-pass filter to the second mixer, where it combines with the second local oscillator signal (3.84 GHz) to create the second IF signal (226.42 MHz). (Note that this intermediate frequency is the difference between 4.066 GHz and 3.84 GHz.) The second IF signal is then amplified by Q10 and Q11 and sent through a 226.42 MHz band-pass filter to the third converter.

The second local oscillator is phase-locked to the internal reference oscillator through the phase-locked loop (P.L.L.) circuit of the third CONV. The monitor out (MON OUT) signal is used to measure the second IF signal and the second local oscillator signal.

Since the second local output is unavailable directly, check for oscillation by monitoring the local leakage signals at the second mixer output (frequency: 3.84 GHz, level: –39 dBm).

Figure 3–6 shows the spectrum distribution of the signal at the MON OUT terminal.

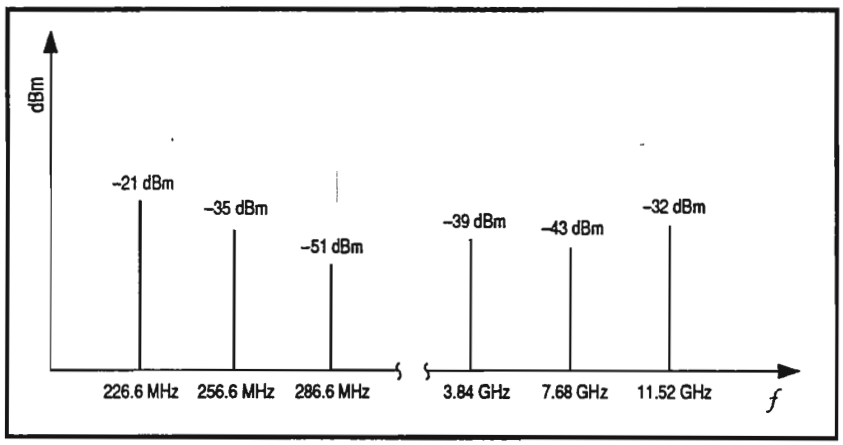


Figure 3–6 Spectrum Distribution at the MON OUT Terminal

3.3.4 Third and Fourth Mixers and Local Oscillators

Figure 3–7 shows the third and fourth mixers and local oscillators.

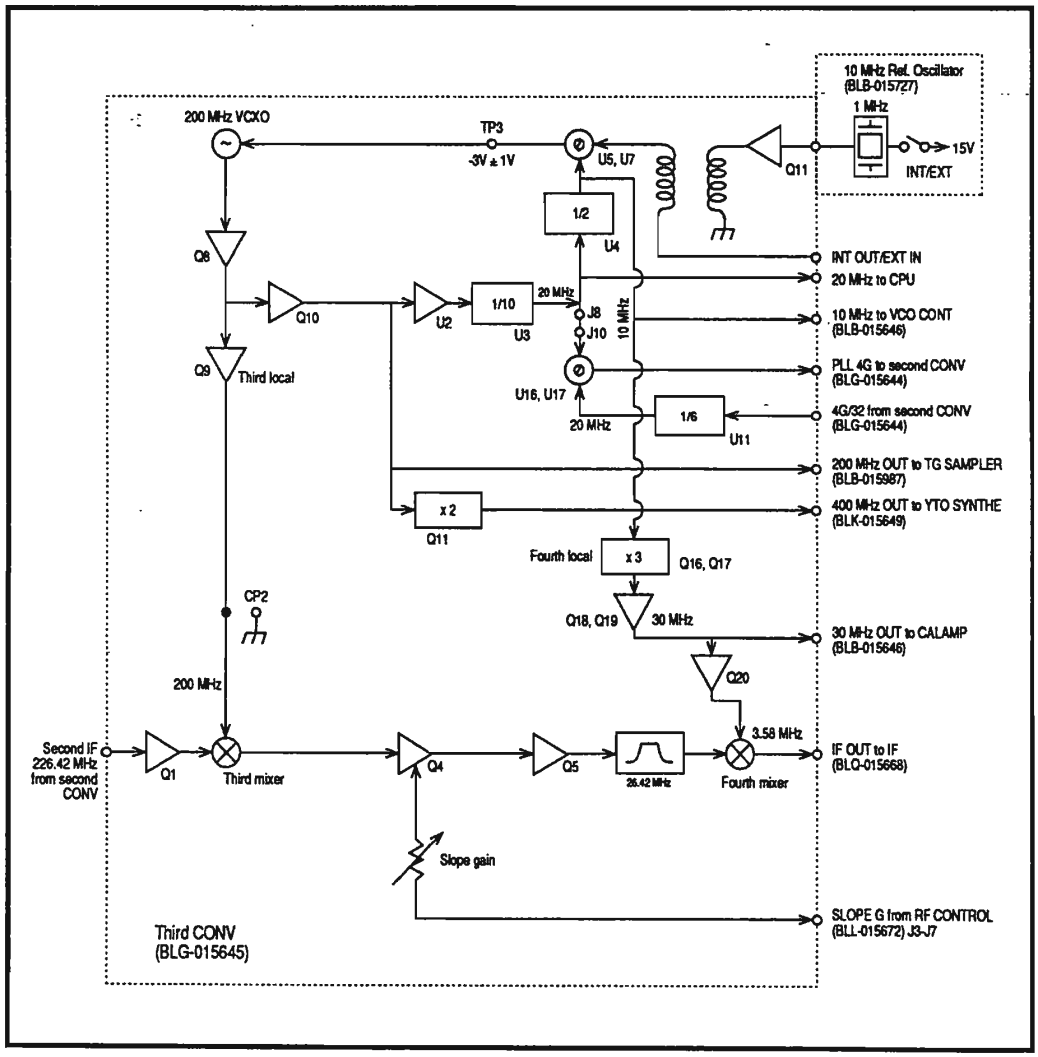


Figure 3–7 Third and Fourth Mixers and Local Oscillators

Third local oscillator

The third local oscillator is a 200 MHz crystal oscillator that is phase-locked to either the built-in reference oscillator or the external reference input. (The phase lock voltage for the 200 MHz signal is –3 VDC ±1 VDC at TP3.) The 200 MHz signal from this oscillator is used as the reference signal for generating the frequencies used by the local oscillators at all other mixer stages.

The frequency multiplier (Q11 and other components not shown in Figure 3–7) multiplies the 200 MHz signal by two and supplies the resulting signal to the YTO SYNTHE board (BLK–015649).

Check the level of the third local oscillator signal by using the TG sampler signal at the third CONV P5 or the UM cable exit on the TG side (frequency: 200 MHz, level: –5 dBm).

Third mixer

The third mixer combines the second IF signal (226.42 MHz) and the third local oscillator signal (200 MHz) to generate the third IF signal (26.42 MHz).

Third IF/filter

The third mixer output signal (third IF signal) passes through the low-pass filter, through a slope gain amplifier (Q4), and through a total gain amplifier (Q5). The amplified signal then passes through the third IF band-pass filter to the fourth mixer.

Fourth local oscillator

The fourth local oscillator signal (30 MHz) is generated by dividing the third local oscillator frequency (200 MHz) by 20 and multiplying the resulting signal by three. The fourth local oscillator signal is also used as the CAL signal.

Check the fourth local oscillator signal by using the CAL AMPLIFIER signal at the third CONV J6 (frequency: 30 MHz, level: 4 dBm).

Fourth mixer

The fourth mixer combines the third IF signal (26.42 MHz) and the fourth local oscillator signal (30 MHz) to produce the fourth IF signal (3.58 MHz) at IF OUT.

Second local oscillator P.L.L.

The second CONV supplies the second local oscillator signal (3.84 GHz) divided by 32. U11 further divides the signal by 6 to produce a 20 MHz signal. The digital phase detector (U16 and U17) compares the 20 MHz signal with the output of the divider, U3. U16 and U17 provide the proper signal by dividing the third local oscillator signal by 10. The second local oscillator is now locked in phase.

Reference oscillator

The 10 MHz reference frequency for the local oscillators is either an internal crystal-controlled oscillator or an external oscillator signal supplied to the INT/EXT connector. The oscillator used is selected by the INT/EXT switch on the rear panel.

3.3.5 IF Step Amplifiers

Figure 3–8 shows the IF step amplifiers.

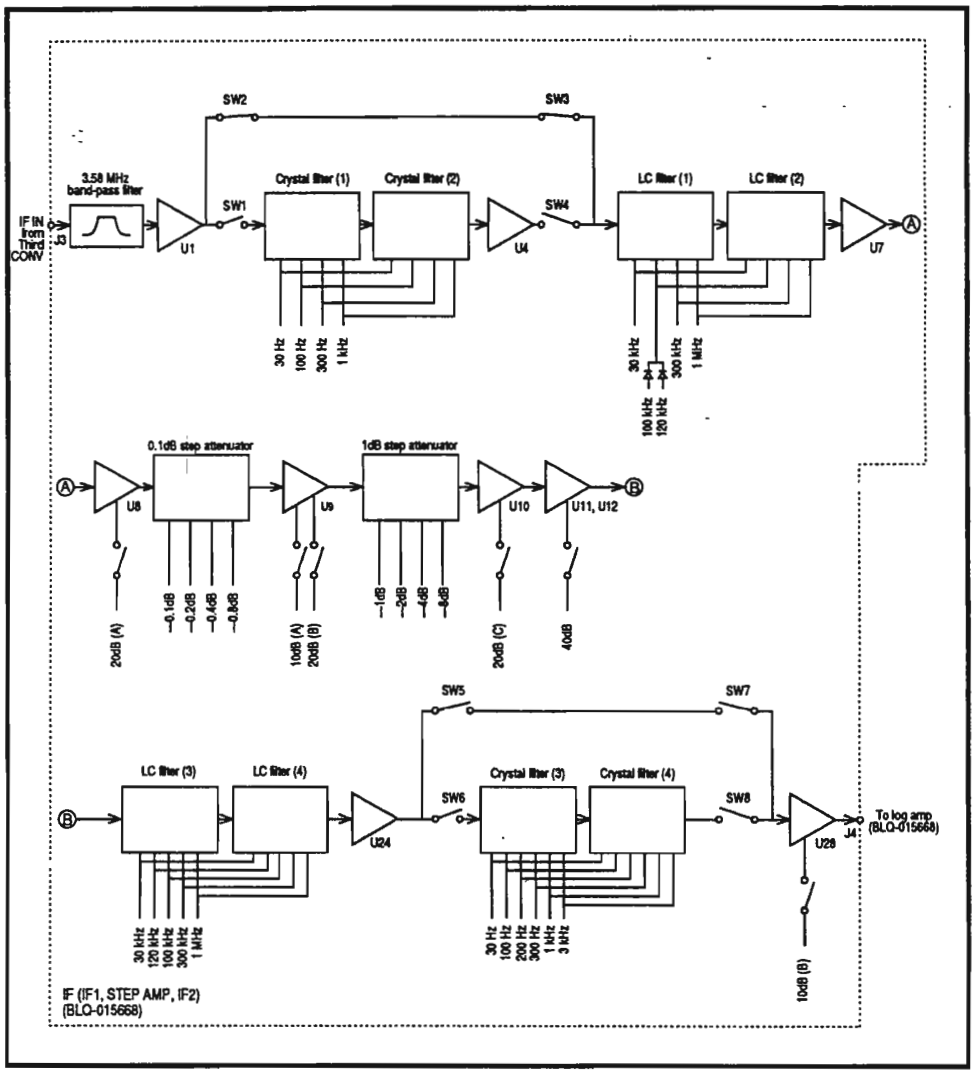


Figure 3–8 IF1 and IF2 Step Amplifiers

The step amplifier consists of two fixed attenuators (0.1 dB step and 1 dB step) and six fixed-gain amplifiers: two 10 dB amplifiers (U28 and U9), three 20 dB amplifiers (U8, U9, and U10), and one 40 dB amplifier (U11). The attenuation is controlled by the INPUT ATT and REF LEVEL settings. Both attenuators are set automatically by the CAL data, which includes data for MAG accuracy, RBW switching accuracy, and frequency characteristics correction.

The latch IC (U42) supplies the RBW select signal to the IF filters. Table 3–3 shows the RBW setup signal for each U42 output pin, and summarizes the RBW setup, the corresponding filters, and the LC/X'tal switch setup (U42 output).

Table 3–3 RBW Setup

RBW Setup		U42 Pin No. 6	5	4	64	61	60	59	55	54	3	56	7	8
L/C	1 MHz	●											●	●
	300 KHz		●										●	●
	100 KHz			●									●	●
	30 KHz				●								●	●
	10 KHz												●	●
X'tal	3 KHz					●								
	1 KHz						●							
	300 Hz							●						
	100 Hz								●					
	30 Hz									●				
QP	120 KHz										●		●	●
	9 KHz													●
	200 Hz											●		

1) ● = 0V, blank = 5V

2) Pin 7: 0V SW2 = SW3 = on, SW1 = SW4 = off

3) Pin 8: 0V SW5 = SW7 = on, SW6 = SW8 = off

Table 3–4 shows the relationship between the REF LEVEL and the step amplifier settings.

Table 3–4 REF LEVELs and Step Amplifier Settings

REF LEVEL	10 dB (A)	10 dB (B)	20 dB (A)	20 dB (B)	20 dB (C)	40 dB
0 dBm						
–10 dBm	✔					
–20 dBm			✔			
–30 dBm	✔		✔			
–40 dBm			✔	✔		
–50 dBm	✔		✔		✔	
–60 dBm			✔	✔	✔	
–70 dBm	✔		✔			✔
–80 dBm			✔	✔		✔
–90 dBm		✔	✔	✔		✔

1) ✔ = on, blank = off

2) This table shows the setup condition with the dynamic range set to 80 dB and the INPUT ATT set to 10 dB.

3.3.6 LOG/QP

Figure 3–9 shows the LOG/QP circuitry.

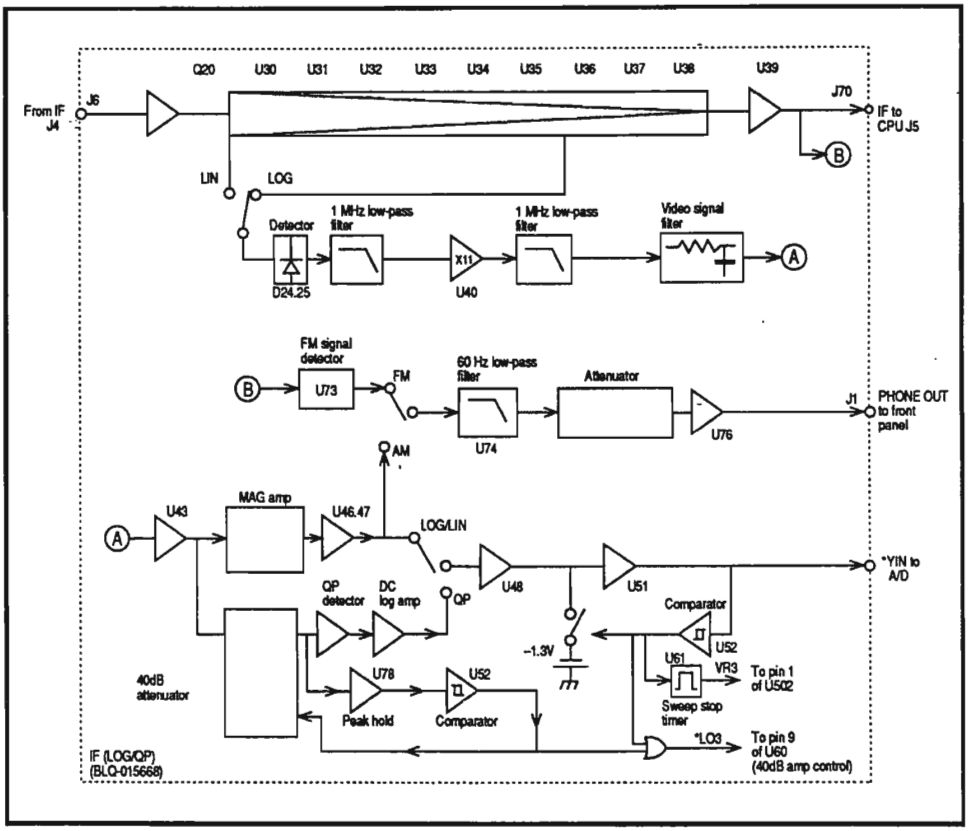


Figure 3–9 LOG/QP

LOG amplifier

The LOG amplifier uses nine stages of serial hybrid ICs to provide 80 dB of dynamic range. The signal is rectified and passed through the low-pass and video filters before being passed to the MAG amplifier (which is a switchable gain amplifier). In the linear (LIN) mode, the signal goes directly to the detector without going through the logarithmic (LOG) amplifier. The video filter can be switched in seven stages between 1 Hz and 1 MHz.

MAG amplifier, PHONE OUT, and 120dB display

The MAG amplifier forms the 1/2, 1/5 and 1/10 attenuators that divide the LOG amplifier output to generate the 5 dB/div, 2 dB/div, and 1 dB/div signals. In the 0.5 dB/div, 0.2 dB/div, and 0.1 dB/div modes, the IF signal bypasses the LOG amplifier and instead passes through the LIN amplifier.

The R3261/3361 provides AM and FM audio output to the front panel PHONE terminal. The FM decoding mode uses the FM detector. AM and FM modes pass signals through the low-pass filter and attenuator to provide voice level control.

The comparator (U52) detects the ON/OFF level of the 40 dB amplifier during a 120 dB dynamic range display (see Section 3.3 and Figure 3–2), and the sweep stop timer (U61) stops sweeping during ON/OFF switching of the 40 dB amplifier.

QP (for 70dB display)

The R3261/3361 has a QP (quasi-peak) measuring section that consists of a QP detector and a DC LOG amplifier. To increase the dynamic range of the QP detector, the signal is attenuated by the 40 dB attenuator before passing through the QP detector, and amplified by the DC LOG amplifier after passing through the QP detector.

3.3.7 Analog-to-digital Conversion and Ramp Generator

Figure 3–10 (on the following page) shows the analog to digital (A/D) conversion and ramp generator circuitry.

Ramp generator

U503 and U504 form the CPU-programmable ramp generator. When the CPU sends data to determine the sweep time, U503 automatically sends the corresponding digital data to U504. Since U504 receives continuous digital data, the result is a ramp waveform output.

A/D conversion

The LOG amplifier output (*Y IN) passes through the POSI/NEGA (positive/negative) peak hold circuit and then the A/D converter U535. The comparators U527 and U528 form the slope detect circuit. (The slope is used to trigger the Peak Hold circuit.)

Trigger signal detection

U538-1, U538-2, U539-2, and U546-1 generate the VIDEO trigger signal. An integrator circuit formed by an electronic switch, a capacitor, and U539-1 detects the vertical sync signal in the TV signal. Once detected, this signal is used as the TV-V trigger; the power unit provides the LINE trigger.

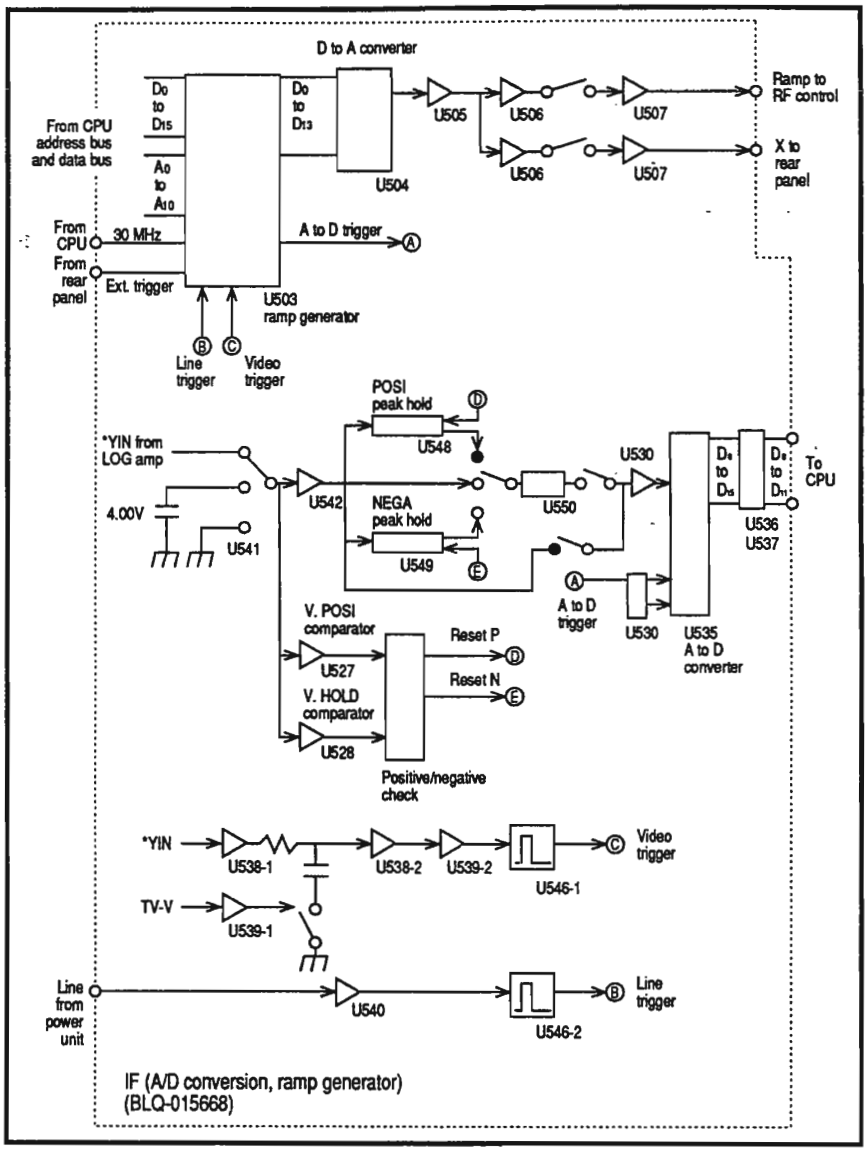


Figure 3–10 A/D Conversion and Ramp Generator

3.3.8 First Local Oscillator

Figure 3–11 shows the first local oscillator. The oscillator has four different operations, controlled by the SPAN front-panel setting.

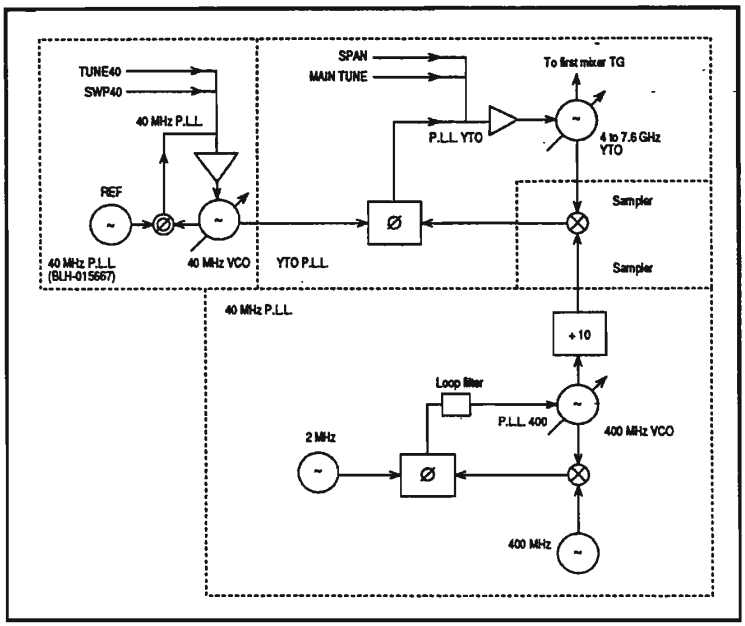


Figure 3–11 First Local Oscillator

Table 3–5 shows the SPAN settings for each of the four oscillator operations.

Table 3–5 SPAN Setting and P.L.L. Functions

SPAN	YTO P.L.L.	400 MHz P.L.L.	40 MHz P.L.L.	Sampler
3.6 GHz – 500 MHz	free run	not used	not used	off
499 MHz – 2.01 MHz	free run/locked	locked	locked	on: sweep end only
2 MHz – 1 KHz	locked	locked	free run/locked	on
0 Hz	locked	locked	locked	on

1) free run: local oscillator sweeps.

2) free run/locked: once locked on the sweep end the voltage is held by the sample hold circuit. The voltage is then applied to the local oscillator on the next sweep to improve the accuracy of the center frequency.

400MHz P.L.L.

Figure 3–12 (on the following page) shows the circuit diagram for the 400 MHz P.L.L., one of the major components of the first local oscillator. The 400 MHz P.L.L. has the following characteristics:

- The 400 MHz VCO is locked in phase with the reference oscillator.
- U10 is a divider for 1/8 and 1/9 (see Figure 3–12).
- U11 contains two programmable dividers.
- U10 and U11 (1/2) combine to form a swallow counter that constitutes the 1/N divider.
- U11 (2/2) is the 1/M divider.
- If the YTO lock is OFF, the loop filter turns Q1 OFF by changing Q1's bias to prevent the sampler from receiving signals.
- The division ratio is set by the M and N data provided by the CPU (at U11).
- The CPU can switch the loop filter to four-way operations, depending on the N value (see Table 3–6). This gives the first local oscillator better phase noise characteristics in different operating modes.

Table 3–6 400MHz VCO Loop Filter Settings

	SPAN setting			
	N ≤ 89			
Switch	M ≤ 27	M ≥ 28	N ≤ 139	N ≤ 261
NAR400N	off	on	off	off
NAR400W	on	off	on	off

1) M: integer degree variable (19–37)

2) N: integer division variable (62–261)

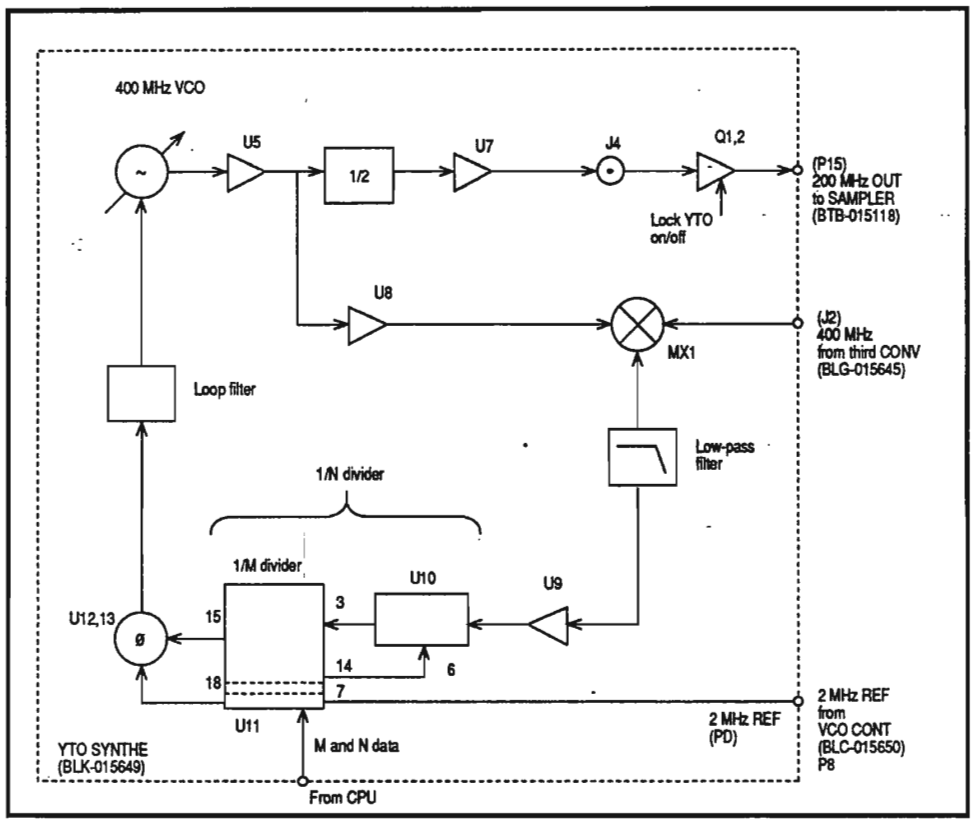


Figure 3–12 400MHz P.L.L.

YTO P.L.L.

Figure 3–13 shows the YTO P.L.L.

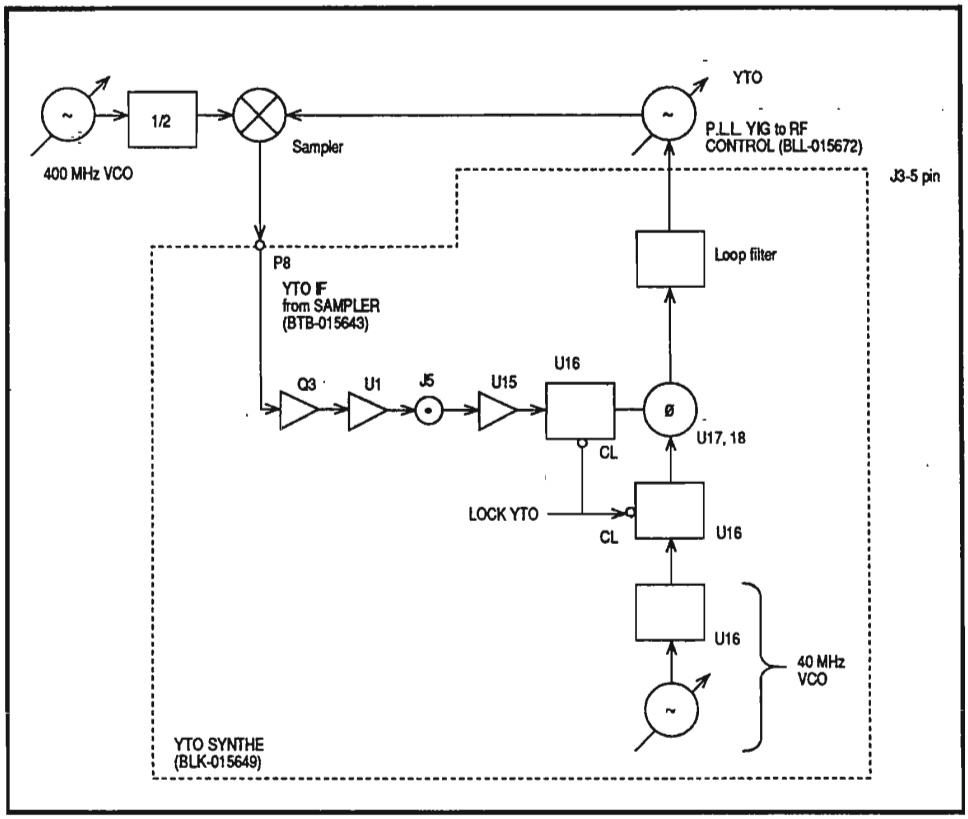


Figure 3–13 YTO P.L.L.

In some sweep modes the first local oscillator is locked only at the end of the sweep. To avoid drift, the YTO IF signal and the 40 MHz VCO signal lock the YTO P.L.L. in phase. If drift cancel is active (lock is OFF), the YTO lock is used as the sample hold circuit.

The YTO P.L.L. loop filter is adjusted by the SPAN setting, which is set at NAR YTO. Table 3–7 shows the filter settings.

Table 3–7 YTO P.L.L. Loop Filter Settings

	SPAN setting	
Switch	≥ 10 KHz	≤ 9.9 KHz
NAR YTO	ON	OFF

When the SPAN setting is 400 MHz VCO and YTO is in free run (see Table 3–5), U16 is made CLEAR to break the lock loop.

40MHz P.L.L.

The 40 MHz VCO generates signals at 380 MHz. The signals are then divided by U25 and the resulting signal is passed to the YTO P.L.L.

The VCO CONT (BLC–015650) U1 is a sample hold circuit used to cancel drift when the 40 MHz P.L.L. is free-running. The P.L.L. voltage (P.L.L. 40), the TUNE voltage (TUNE 40), and the sweep voltage (SWP40) are all summed and linearized in U3. The signals are then passed to the 380 MHz VCO.

3.3.9 RF Control

Figure 3–14 (on the following page) shows the RF control circuitry. This circuitry converts the signals from the ramp generator to sweep signals for the YTO main, the YTO FM, and the 40 MHz VCO (see Figure 3–13). The D/A converter (U8) attenuates the ramp signals to an adjustable reference voltage. Because of its operation U8 is regarded as a programmable attenuator.

D/A converters U12 and U11 generate the 40 MHz VCO TUNE voltage, and D/A converter U10 controls the CAL signal level. The LOG SPAN (a sweep mode that displays output on an analog scale) uses the LIN-LOG circuit Q1. LOG SPAN is set from the front panel.

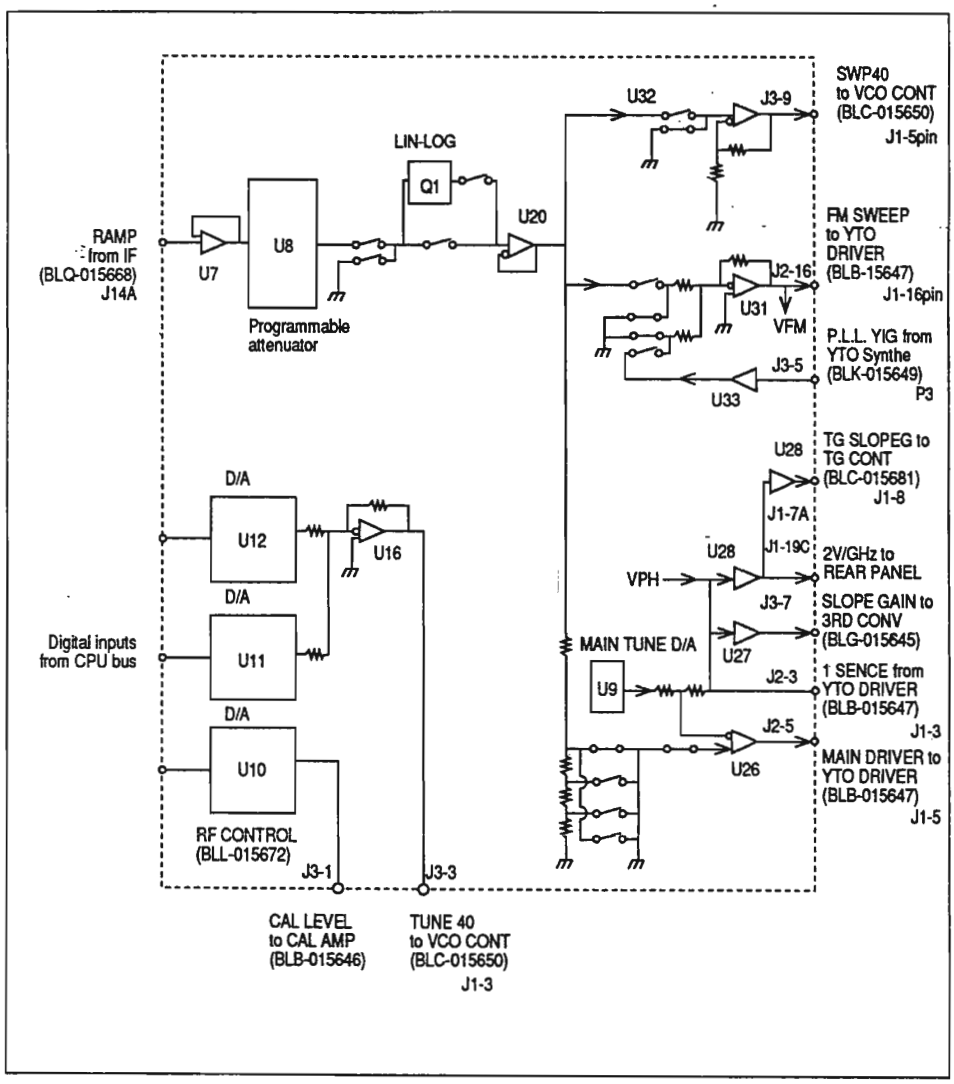


Figure 3–14 RF Control

3.3.10 YTO Driver

Figure 3–15 shows the YTO and YTO driver circuitry. This circuitry converts the YTO driving voltage to current for use by the MAIN and FM circuitry (see YTO P.L.L. in Section 3.3.8). When the SPAN setting is 10 MHz or less, capacitor C7 and the MAIN coil operate as a noise filter. When the filter is OFF the capacitor charges and discharges through U2 to prevent frequency drift.

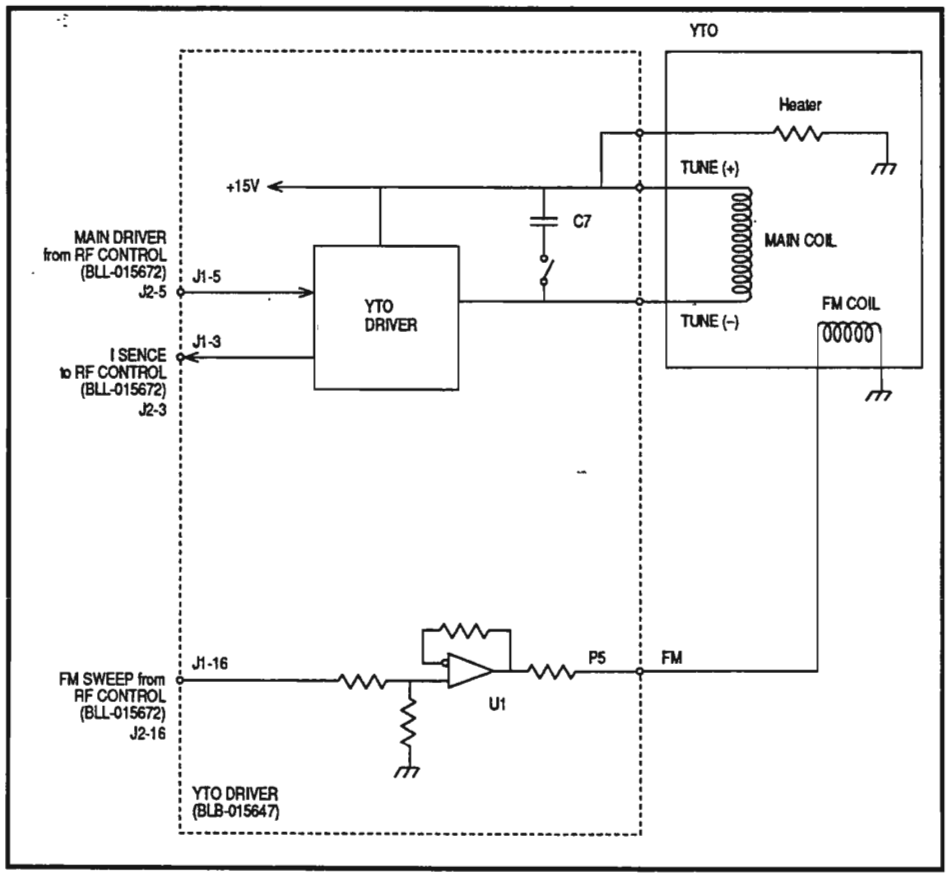


Figure 3–15 YTO Driver

3.3.11 CAL Amplifier

Figure 3–16 shows the CAL amplifier. The 30 MHz signal generated by the fourth local oscillator passes to the INPUT ATT (CAL SIGNAL). The CAL amplifier accurately changes the gain of the saturation amplifier: for example, at a CAL LEVEL of –9.6V to –3.0V the CAL SIGNAL becomes –20.0 dBm to –30.0 dBm.

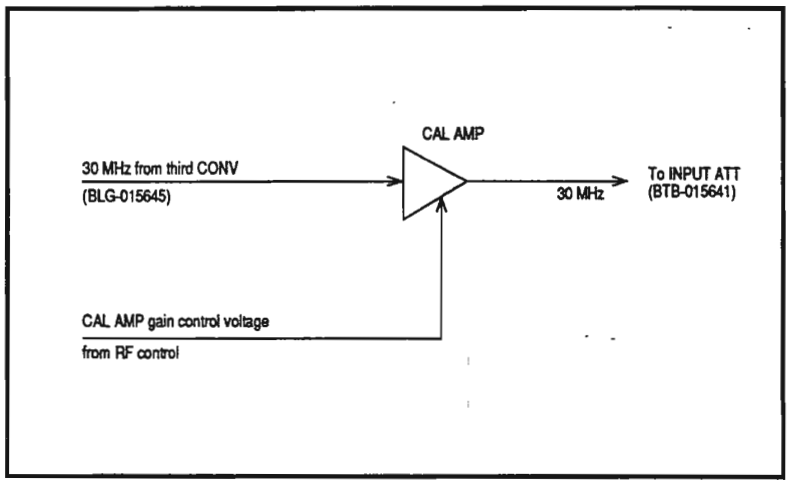


Figure 3–16 CAL Amplifier

Table 3–8 shows the relationship between the CAL LEVEL and the CAL SIGNAL.

Table 3–8 CAL LEVELs and CAL SIGNALs

CAL LEVEL (V)	CAL SIGNAL (dBm)
–9.6	–20.0
–8.9	–20.5
–8.4	–21.0
–8.0	–21.5
:	:
–3.5	–28.5
–3.4	–29.0
–3.2	–29.5
–3.0	–30.0

3.3.12 Tracking Generator (R3361A,C/B,D Only)

Figure 3–17 shows the circuitry for the tracking generator (TG). The TG contains the TG Mixer and an output amplifier to allow direct viewing of frequency attenuations of 115 dB or more.

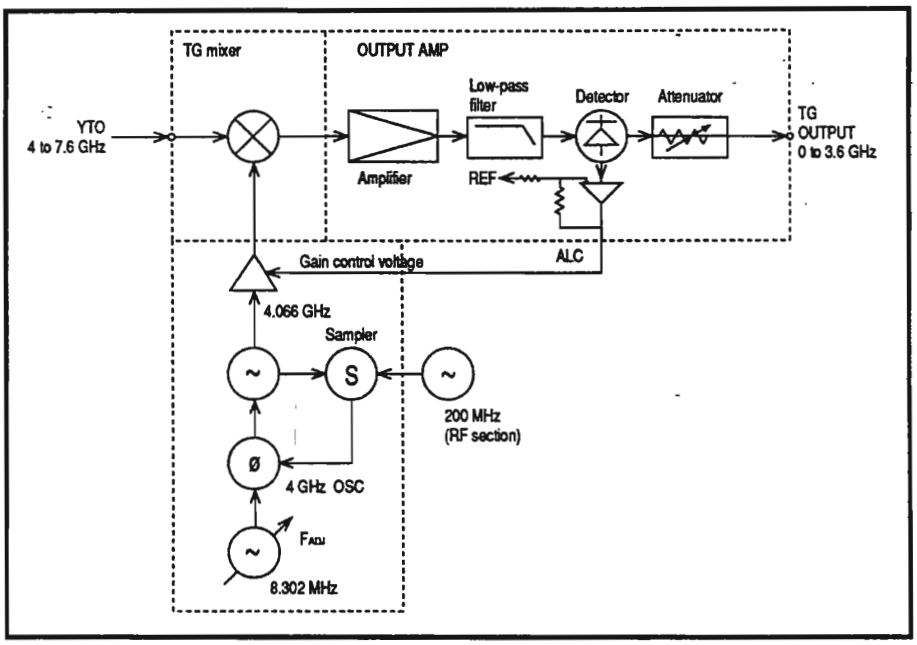


Figure 3–17 Tracking Generator Block Diagram

Unlike conventional tracking generators that generate tracking output signals by inversely mixing each local signal, the R3361A,C/B,D produces the TG output by mixing the second IF (4.066 GHz) and YTO signals.

Output amplifier

The output amplifier shown in Figure 3–18 (on the following page) amplifies the TG mixer signals with a total gain ≥ 30dB and applies the ALC (Automatic Level Control) voltage to the amplifier to provide a consistent output level for all frequencies.

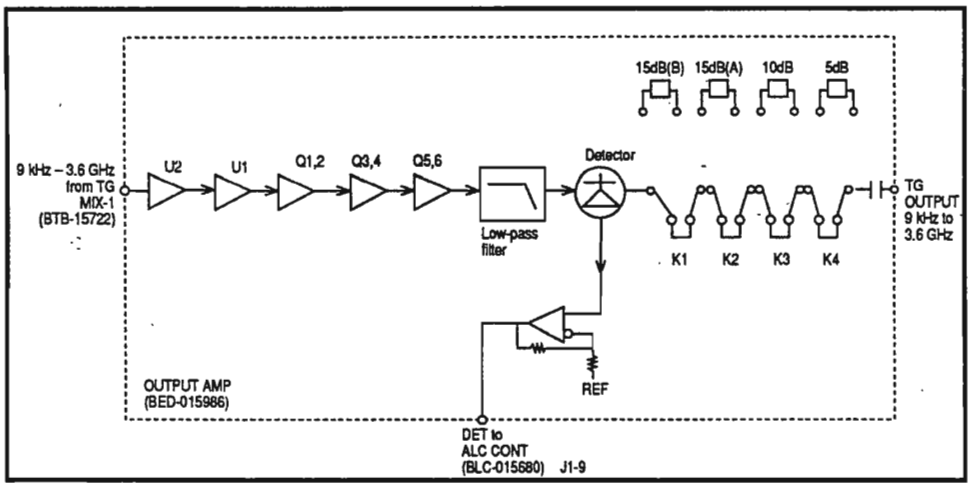


Figure 3–18 Output Amplifier

The TG output level can be adjusted in 5 dB steps by varying the ALC voltage in steps of 1 dB. Table 3–9 shows the relationship between ALC voltage and TG output level.

Table 3–9 Switch Settings for TG Output Levels

Output level (dBm)	5 dB K4	10 dB K3	15 dB (A) K2	15 dB (B) K1
0				
–5	✔			
–10		✔		
–15	✔	✔		
–20	✔			✔
–25		✔		✔
–30	✔	✔		✔
–35	✔		✔	✔
–40		✔	✔	✔
–45	✔	✔	✔	✔
–50	✔	✔	✔	✔
OFF	✔	✔	✔	✔

✔ = Attenuator ON (relay driving voltage = –12V)

Tracking generator mixer

Figure 3–19 shows the TG mixer. This circuitry mixes the output from its 4 GHz oscillator with the signals from the first local oscillator. Note that the mixer follows the sweep frequency while generating its output signals (9 KHz to 3.6 GHz).

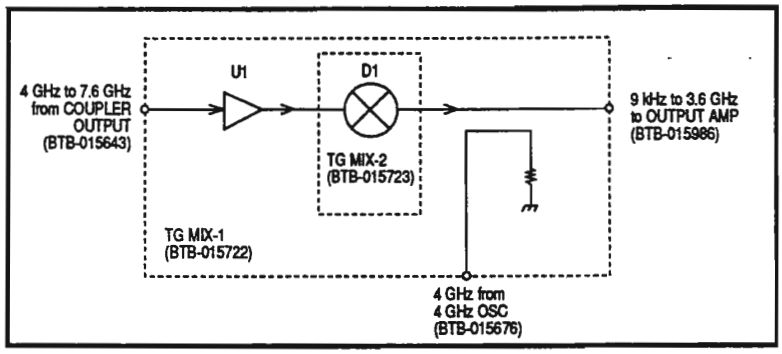


Figure 3–19 TG Mixer

4GHz oscillator

Figure 3–20 (on the following page) shows the 4 GHz oscillator (OSC). Input signals are sampled at 200 MHz (third local oscillator) and phase-locked to the reference oscillator (8.302 MHz VCXO, 7 V).

Tracking errors resulting from errors between the first local oscillator and the TG output can be compensated by adjusting the frequency of the reference oscillator. This adjustment also prevents errors caused by the resomic oscillator, TG P.L.L., or TG SAMPLER U1 power supplies. Adjusting the oscillator's frequency sets the TG attenuator to 45 dB.

Tracking generator control

The tracking generator control (TG CONT) consists of a latching IC (U1) and a D/A converter (U2). The latch IC feeds preset signals for the attenuator, the TG ON/OFF state, and the ALC band to the proper circuitry block. The D/A converter is used to fine tune the oscillation frequency of the reference oscillator. See Figure 3–20.

ALC (Automatic Level Control)

The ALC circuitry combines the SLOPE voltage and the DET voltage, then applies the sum to the ALC modulator. The TG output level and the frequency response can be kept constant by varying the output level of the ALC modulator. See Figure 3–20.

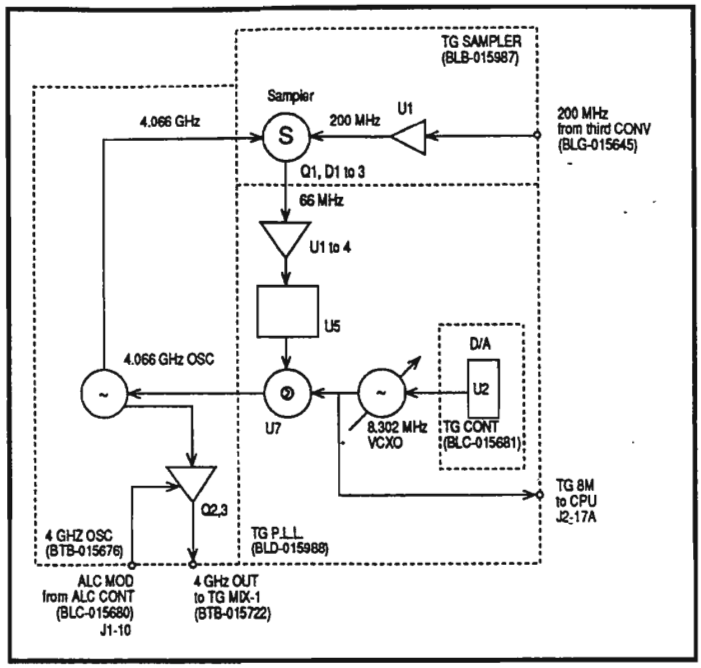


Figure 3–20 4GHz Oscillator

Compensation for tracking error (R3361 only)

The R3361 features three tracking error compensation modes: FREC CAL AUTO mode, FREC CAL MANUAL mode, and TG TRACKING mode. These modes are described below.

FREC CAL AUTO mode

In this mode the R3361 measures the frequencies of the fourth IF (3.58 MHz) and the reference oscillator (8.302 MHz VCXO) for the TG 4 GHz OSC. The tracking error of the RBW setting is calculated from the SYNTHE setting.

The error compensation value is sent to the D/A converter of TG controller U2, then to the reference oscillator. If the RBW is 3 KHz or higher, a compensation value of 1 KHz is used.

FREC CAL MANUAL mode

When in this mode the R3361 uses a compensation value from 000_H to FFF_H. This value can be manually set in the error compensation D/A converter.

TG TRACKING mode

In this mode the tracking error compensation is made in four RBW bands: 1 KHz, 300 Hz, 100 Hz and 30 Hz. If the RBW is 3 KHz or higher, a compensation value of 1 KHz is used.

3.3.13 Central Processing Unit and Peripherals

Figure 3–21 shows the R3261/R3361 mother board.

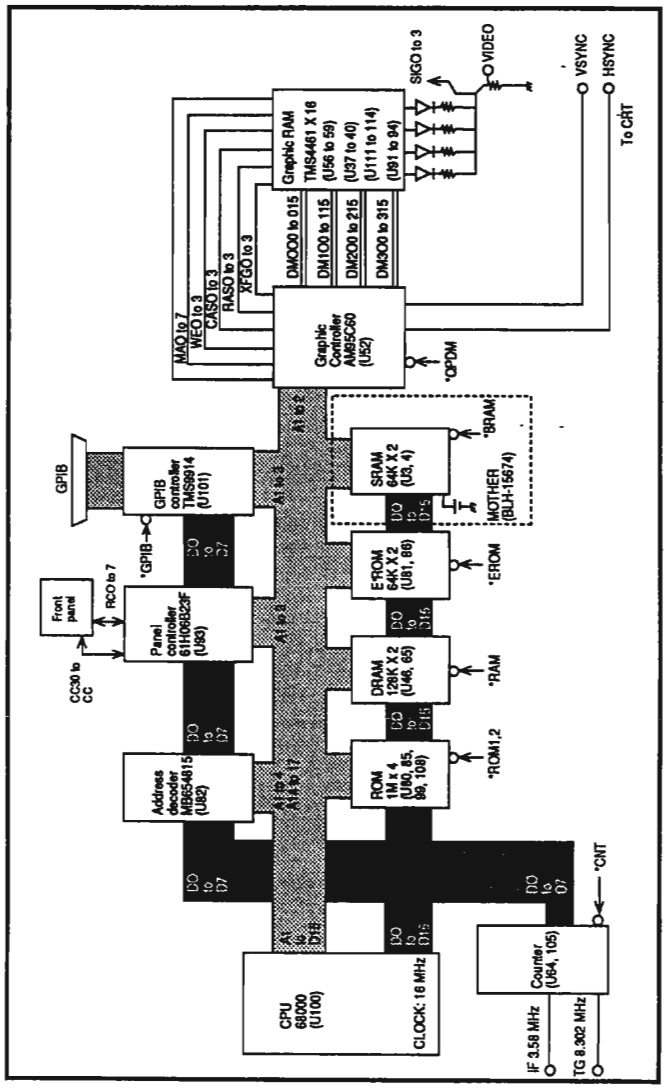


Figure 3–21 R3261/3361 Mother Board

The R3261/3361 mother board contains a Motorola 68000 16-bit CPU and several peripheral chips:

- E^2ROM (U81, 86) contains the frequency characteristic compensation data for the RF circuitry.
- SRAM (MOTHER U3, 4) contains the CAL data and the SAVE/RECALL setting.
- Gate Array (U82) (made by ADVANTEST) is an address decoder.
- Panel Controller (U93) is a controller for the keypad.
- GPIB controller (U101) is the interface controller.
- Graphic Controller (U52) is the CRT display controller.

Memory map

Table 3–10 shows the CPU memory map of the R3261/3361. The table shows how the CPU memory is allocated, and the READ/WRITE abilities of particular memory devices.

Table 3–10 Memory Map

Signal	Address	READ	WRITE	Remarks
ROM	000000 – 0FFFFF	✔		Program ROM
RAM	100000 – 13FFFF	✔	✔	RAM
GRAM	140000 – 17FFFF	✔	✔	RAM in optional controller board
BRAM	180000 – 183FFF	✔	✔	SAVE/RECALL RAM (on mother board)
RAMP	184000	✔	✔	Ramp generator (IF BLQ–015668 U503)
A/D	188000	✔	✔	A/D converter
I/O	18C000	✔	✔	Optional controller board
MCARD	190000	✔	✔	Memory card
HSAD	194000		✔	Optional high speed A/D converter
ARAM	198000 – 19FFFF	✔	✔	Memory in high speed A/D converter
EROM	1A0000 – 1A3FFF	✔	✔	E^2ROM (frequency characteristics compensation data)
KEY	1A4000	✔	✔	Panel controller (61H06B23F)
QPDM	1A8000	✔	✔	Graphic controller (Am95C60)
GPIB	1AC000	✔	✔	GPIB controller (TMS9914)
CNT	1B0000	✔	✔	Counter
PDINT	1B4000	✔		Interrupt (level 3) detail check
SELCI	1B8000		✔	Selection of counter input signal (IF, TG)

(Cont'd)

Signal	Address	READ	WRITE	Remarks
CSTART	1B8100		✔	Counter start
CICLR	1B8200		✔	Counter interrupt clear
GRST	1B8300		✔	Graphic controller reset
CLRSTD	1B8400		✔	STD interrupt clear
MICLR	1B8500		✔	Marker interrupt clear
CLRSTP	1B8600		✔	Sweep stop clear
DISP	1B8700		✔	Display control
CSRF	1C0000		✔	RF block
CSLOG	1D0000		✔	LOG part
CSIF	1E0000		✔	IF part

Debug Mode

The R3261/3361 has a built-in debug mode that allows data to be read from or written to any memory address. Debug mode offers six functions that can be selected by pushing the soft keys. These functions are as follows:

- **READ/WRITE** – reads a specified memory address immediately after writing to it. This function is used as a WRITE/READ test for the RAM.
- **READ ONLY** – continuously reads a specified memory location. READ ONLY is used to monitor the CAL correction and A/D converter data. The R3261/3361 continues to display waveform data while executing READ ONLY.
- **WRITE ONLY** – continuously writes data to a specified address location. WRITE ONLY is used to configure the operation of the analyzer.
- **READ LOOP** – limits memory reads to a specified address (the address can be determined by using the READ ONLY function). Since the R3261/3361 does not display waveforms in a READ LOOP, this function is used mainly for monitoring logic signals.
- **WRITE LOOP** – limits memory writes to a specified address.
- **RETURN** – exits debug mode.

To access debug mode, turn ON the spectrum analyzer, then press [SHIFT] and [BK SP] on the keyboard. Figure 3–22 shows the display that appears.

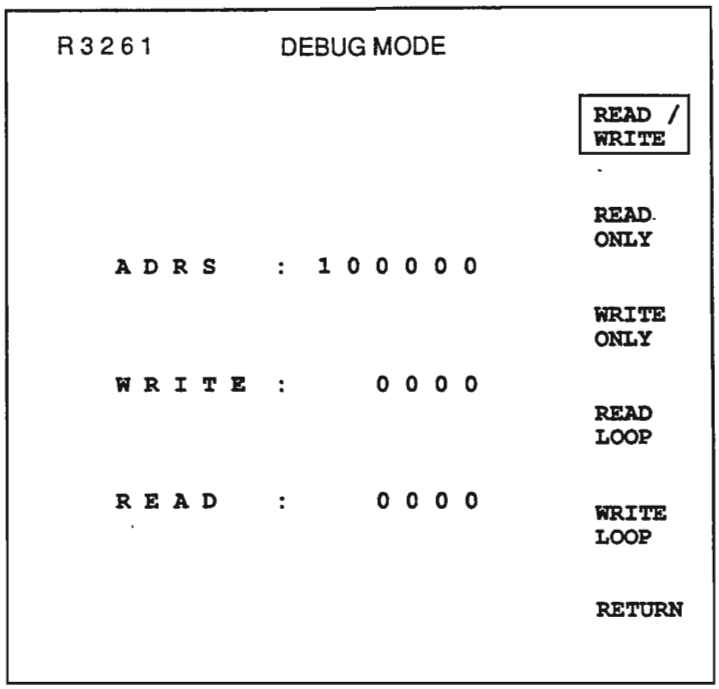


Figure 3–22 Debug Mode Display

Note that memory addresses are displayed and entered in hexadecimal format. To provide all 16 hexadecimal digits the R3261/3361 uses several of its special function keys. Table 3–11 shows the hexadecimal value of each key. To enter a hexadecimal number, type the number using the keys in Table 3–11 and press the [ENTER] key.

Table 3–11 Hexadecimal Values of R3261/3361 Keys

Hex value	Key	Hex value	Key	Hex Value	Key
0	[0]	6	[6]	C	[START]
1	[1]	7	[7]	D	[STOP]
2	[2]	8	[8]	E	[REF LEVEL]
3	[3]	9	[9]	F	[COUPLE]
4	[4]	A	[CENTER FREQ]		
5	[5]	B	[FREQ SPAN]		

3.3.14 Counter Operation

The R3261/3361's built-in frequency counter has a tuned amplifier (TUNED AMP) mode similar to that of conventional spectrum analyzers. The input frequency for the counter is obtained by calculating M, N, and f_{FRAC} after measuring the final IF.

If the SPAN frequency is 2 MHz or higher, the counter sets and locks the ZERO SPAN at the marker position on the CRT, and searches for M, N, and f_{FRAC} at the marker position. The counter then measures the final IF and calculates the input frequency. If the SPAN frequency is less than 2 MHz, the R3261/3361 operates in the same manner except that M and N must be set values (determined by the CPU).

3.3.15 Power Source

Figure 3–23 shows the power source circuitry. The power source supplies ±15V, ±12V, and ±5V to the appropriate block and board on the mother board. A regulator IC and transistors on the mother board provide 8V and 10V levels. The power source also supplies signals for the LINE trigger (frequency = source frequency with a TTL level).

Note that the AC power source voltage can be set to 100V or 220V by a switch on the rear panel of the unit.

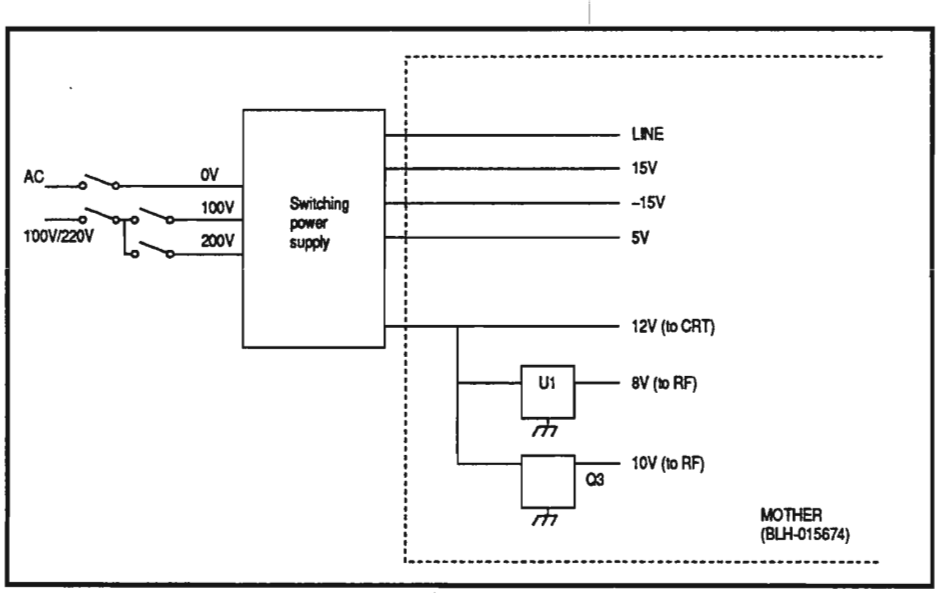
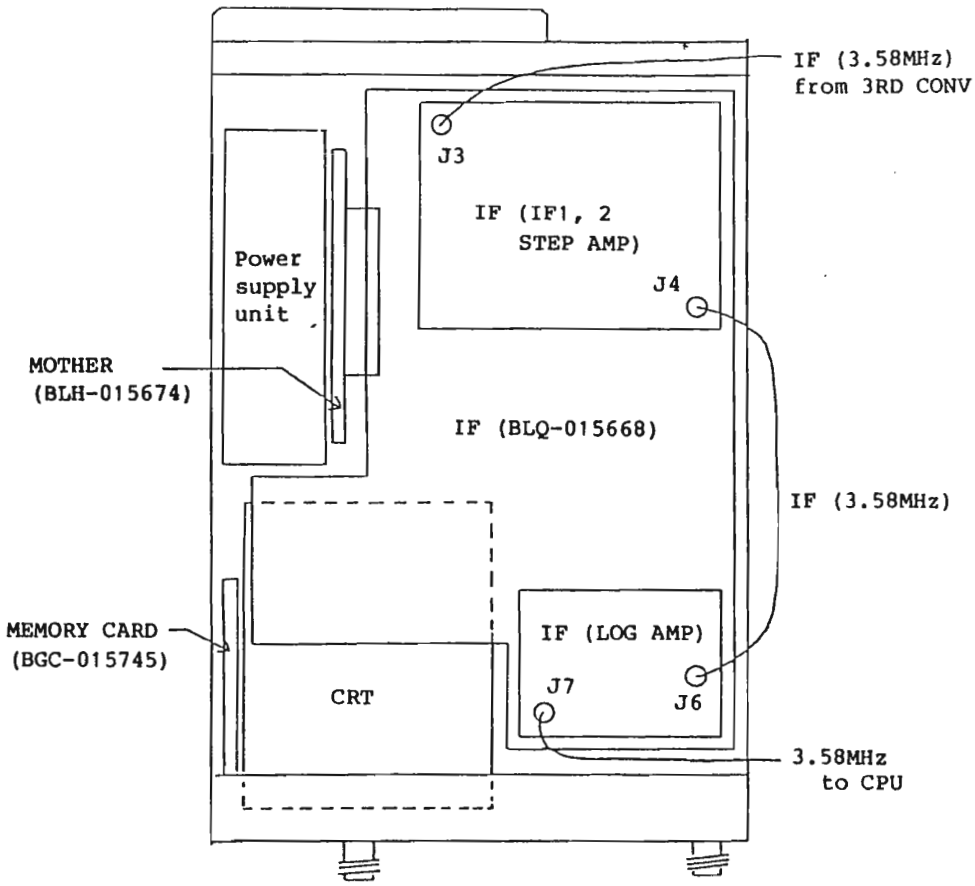


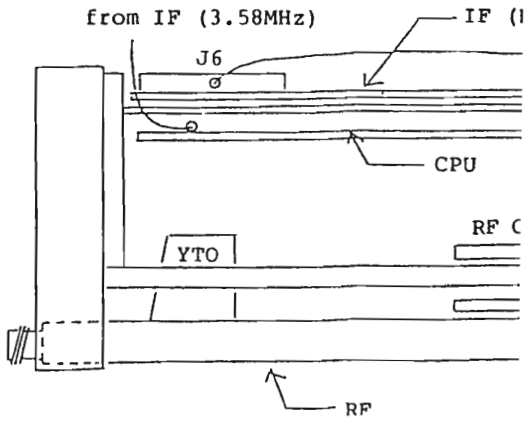
Figure 3–23 Power Source

3.4 Location

3.4.1 Block/Board Layout



Top view



Side view

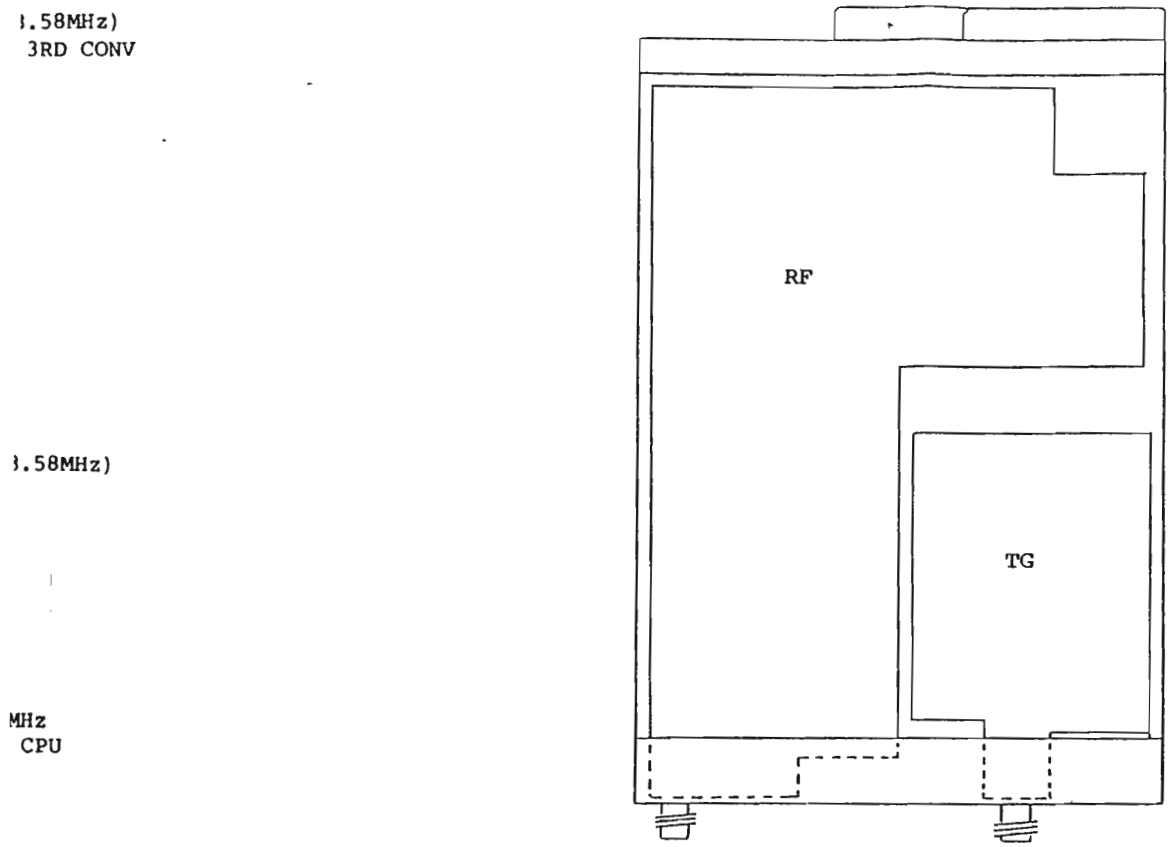
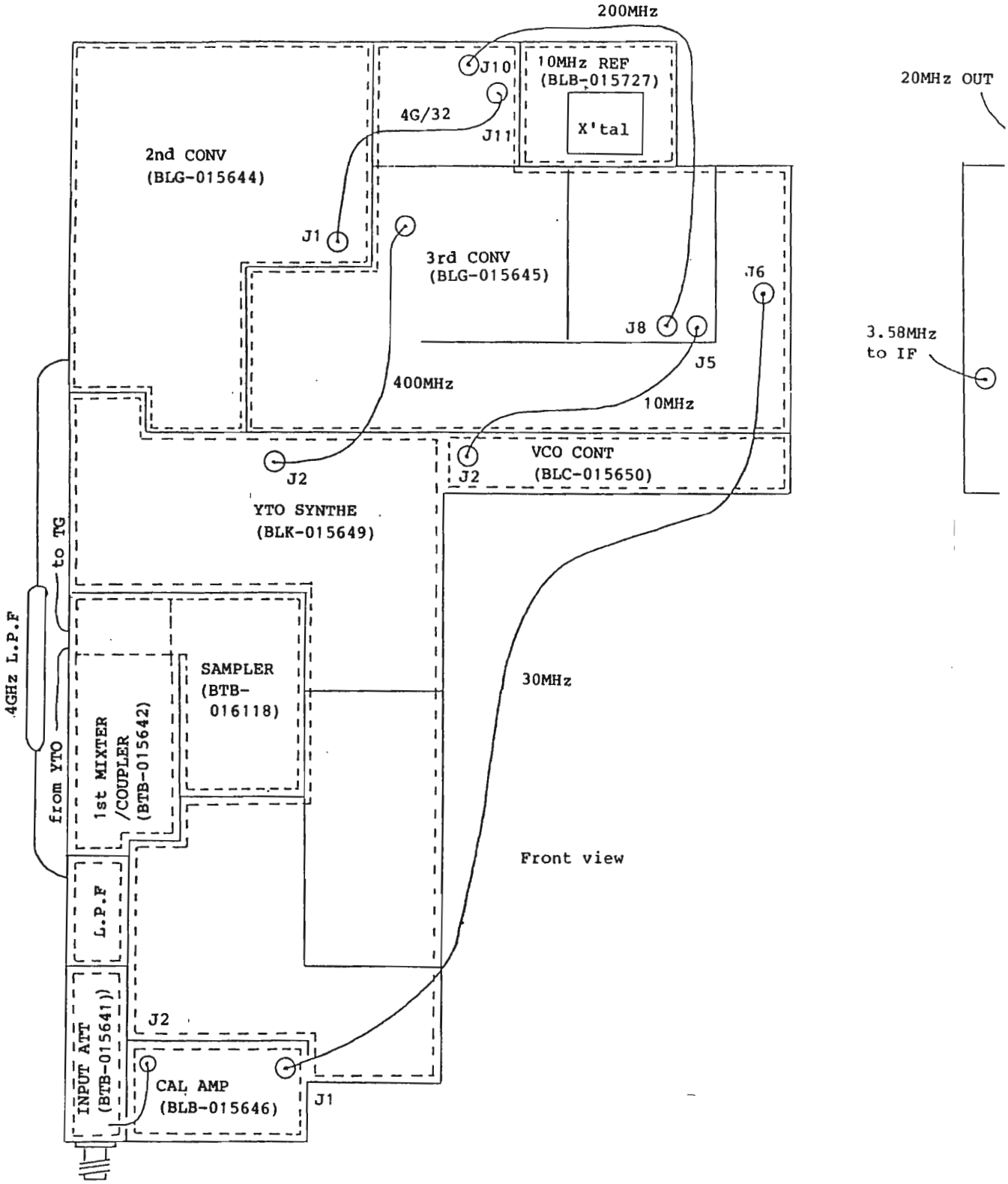


Figure 3-24 Block/Board Layout

3.4.2 RF Block Internal View



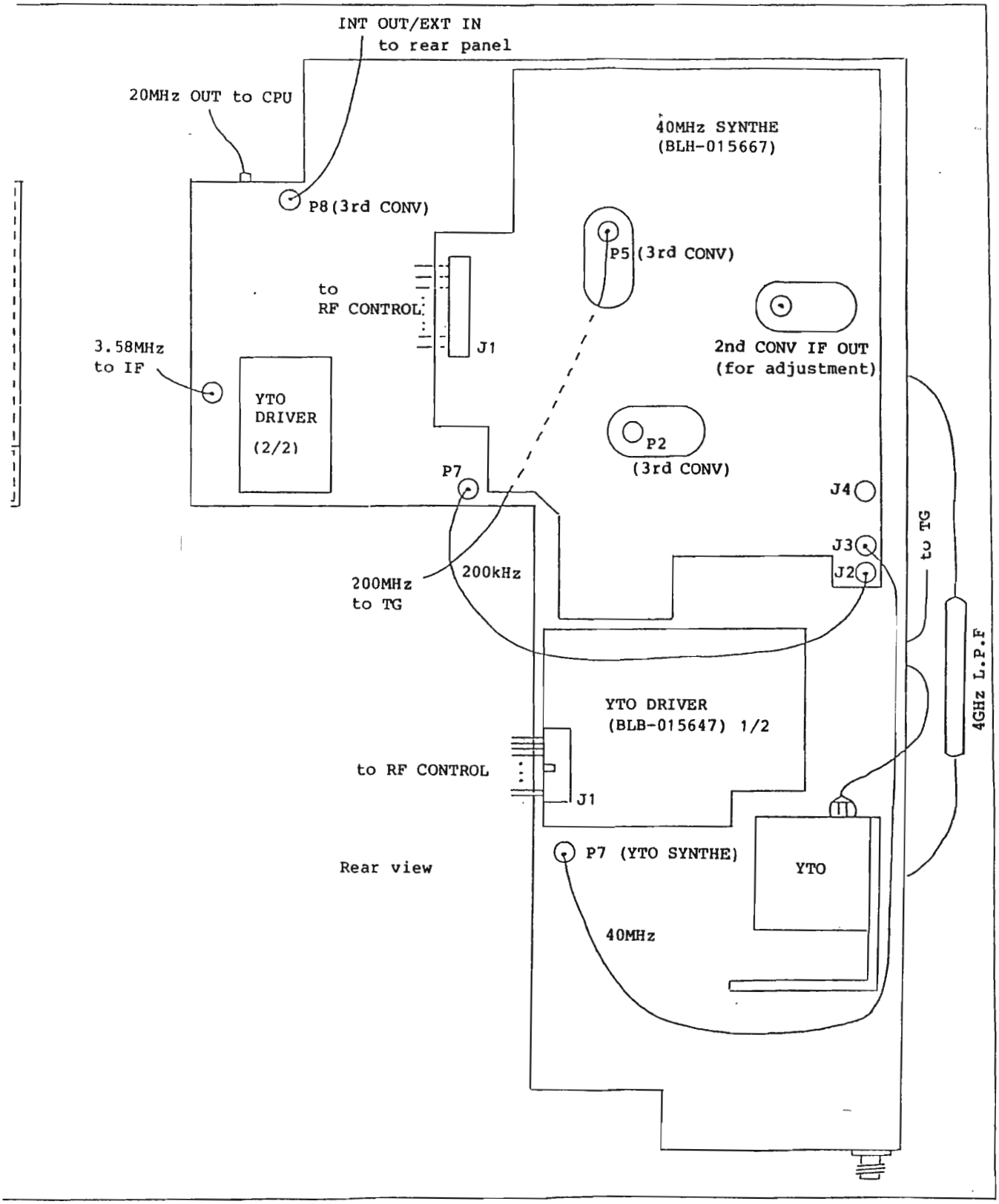
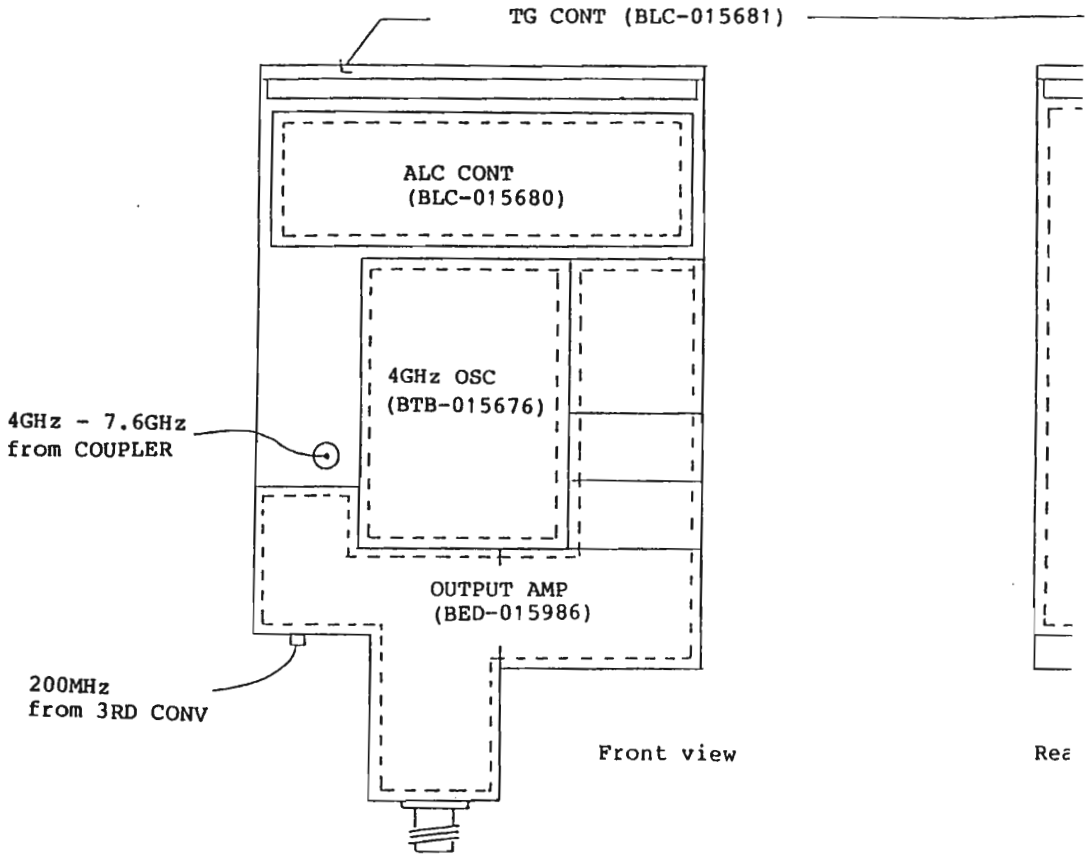


Figure 3-25 RF Block Internal View

3.4.3 TG Block Internal View



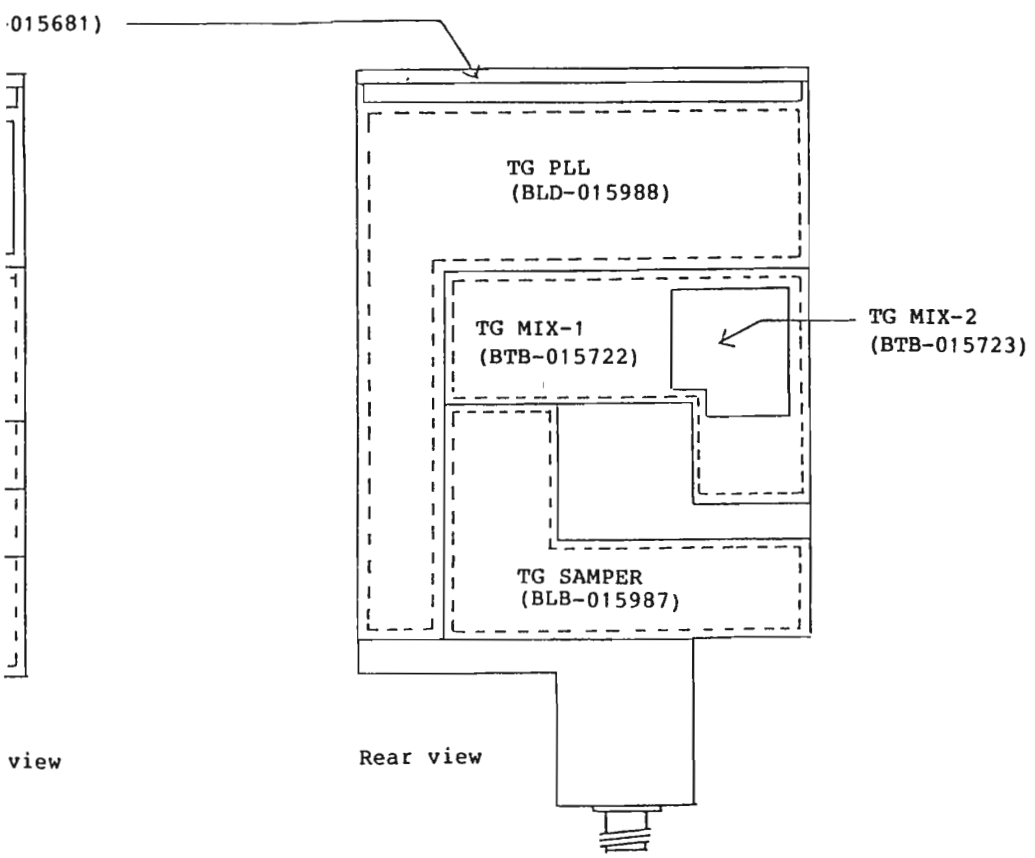


Figure 3-26 **TG Block Internal View**

4. PERFORMANCE TEST

4.1 General

4.1.1 Testing Equipment

Equipment to be used for the performance test is listed in Table 4-1. The cables needed are listed in Table 4-2.

Table 4-1 Test Equipment

Test Equipment	Required Performance		Recommended Equipment
Synthesized Signal Generator	Frequency Output Level Output Impedance AM Modulation	: to 3.6 GHz : +10 dBm to -30 dBm : 50Ω : 100 Hz with 30% Modulation (or external modulation)	Advantest R4262
Low Distortion Signal Generation (or synthesized signal generator with low pass filter)	Frequency Output Level Output Impedance Second Harmonic Frequency	: to 1.8 GHz : -10 dBm : 50Ω : 60dB or less for -10dBm output	Advantest R4262 +L.P.F.
RF Power Meter	Frequency Sensitivity	: to 3.6 GHz : +20 dBm to -50 dBm : ±0.2 dB	Generic
Attenuator	Frequency Attenuation Stability	: to 500 MHz : 10 dB step : 0 to 110 dB : 1 dB step : 0 to 11 dB : 10dB : ±0.2 dB : 1dB : ±0.02 dB	Generic
Low-Frequency Generator	Frequency Output Level	: 100 Hz : 1 Vp-p	Generic
Frequency Comparator			Generic
Frequency Standard	Stability	: 2 X 10^{-9}	Advantest TR3110

Table 4-2 Cables & Adapters Required

Product Name	Model	Stock No.	Remarks
Connecting Cable (BNC-BNC)	MI-02	DCB-FF0386	
Connecting Cable (SMA-SMA)	A01002	-	
N-BNC Conversion Adapter	JUG-201A/U	JCF-AF001Ex03	
N-SMA Conversion Adapter			

4.1.2 Calibration

Self-calibration is an important factor for the high performance spectrum analyzer.
Let the system warm up for 30 minutes and then start the self-calibration performance test.
Self- calibration is started by the following keystrokes.

[SHIFT] [7] [CAL ALL]
(SOFT KEY 1)

The calibration should be made on the following items :

(1) INPUT ATTENUATOR
(2) IF STEP AMP
(3) RBW SWITCHING
(4) LOG LINEARITY
(5) AMPLITUDE MAG
(6) TG TRACKING

4.2 Testing CAL Signals

The CAL signal frequency accuracy is same as that of the reference oscillator because the CAL signal is phase-locked to the reference oscillator.

$\pm 2 \times 10^{-8}$/day
$\pm 1 \times 10^{-7}$/year

Procedure

① Preset and then set spectrum analyzer to the following settings.

CENTER FREQ	:	30MHz
FREQ SPAN	:	2MHz
RBW	:	300kHz
dB/div	:	1dB
REF LEVEL	:	-15dBm

② Enter a 30MHz, -20.0dBm signal from an external signal generator to the system.

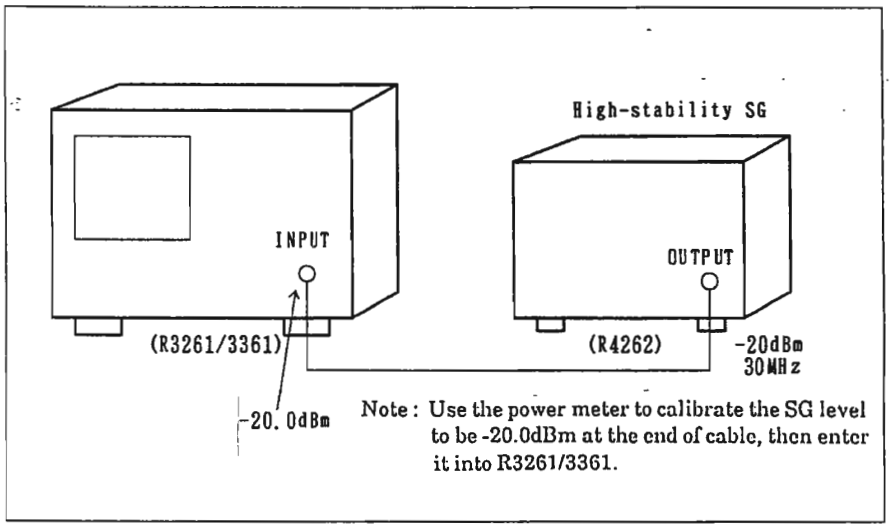
③ Adjust the REF LEVEL so that the spectrum of the signal appears at the center of the screen.

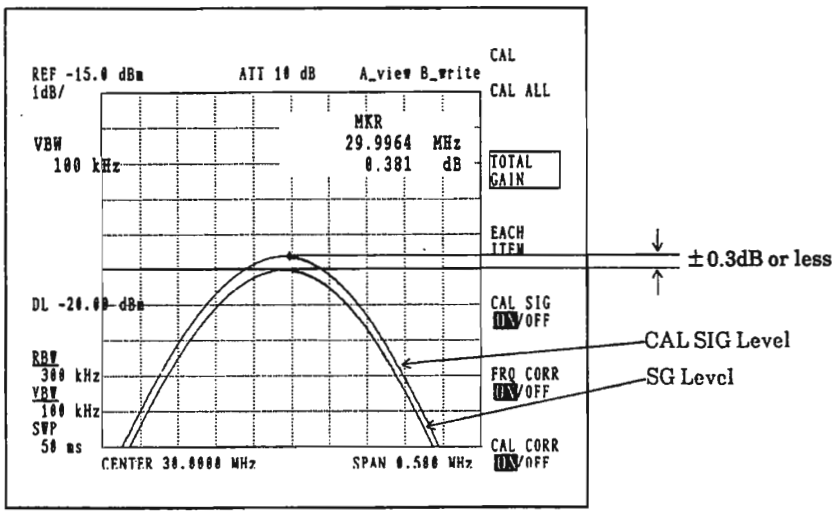
④ Remove the cable that is connected to the external signal generator. Make the CAL SIG (at -20.0dBm) appear on the screen.

SHIFT | 7 | CAL SIG ON/OFF

(SOFT KEY 4)

⑤ Check that the difference is within ±0.3dB between the levels of the signal at the input from SG and the CAL SIG. If not, make adjustments according to the chapter 5. "ADJUSTMENTS" in maintenance manual.





4.3 Test Using Internal Signal

4.3.1 Testing Noise Sideband

Procedure

① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	0MHz
FREQ SPAN	:	40kHz
ATT	:	0dB
VBW	:	10Hz
RBW	:	300Hz

② Read the peak level of the zero spectrum using the marker.

③ Set the spectrum analyzer as follows:

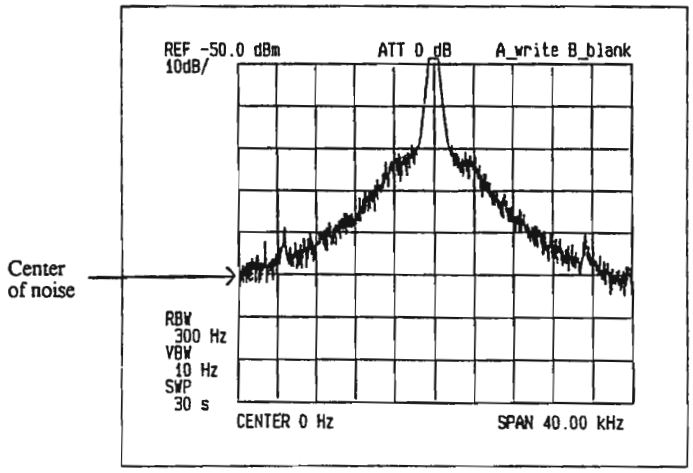
REF LEVEL : -50dBm

④ Read the average left end level of the noise waveform as it appears on the screen.

⑤ Obtain the noise sideband (with 20kHz offset) from the levels determined in steps ② and ④ above.

The formula used is:

result of ② put into XdB
result of ④ put into YdB
$|Y| - |X| - 23dBc/Hz \leqq -105dBc/Hz$



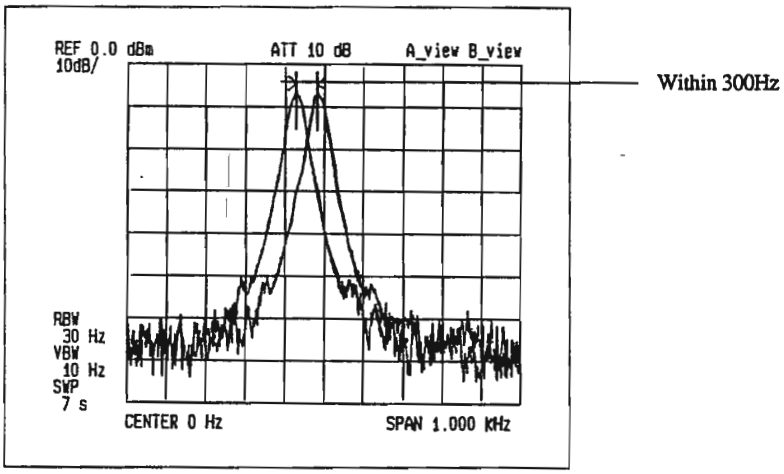
4.3.2 Testing Frequency Drift

Procedure

① Preset and then set the spectrum analyzer to the following settings :

CENTER FREQ : 0MHz
FREQ SPAN : 1kHz

② Confirm that the drift of the zero spectrum as measured for one minute is within 300Hz.



4.3.3 Testing Resolution Bandwidth (3dB bandwidth)

Procedure

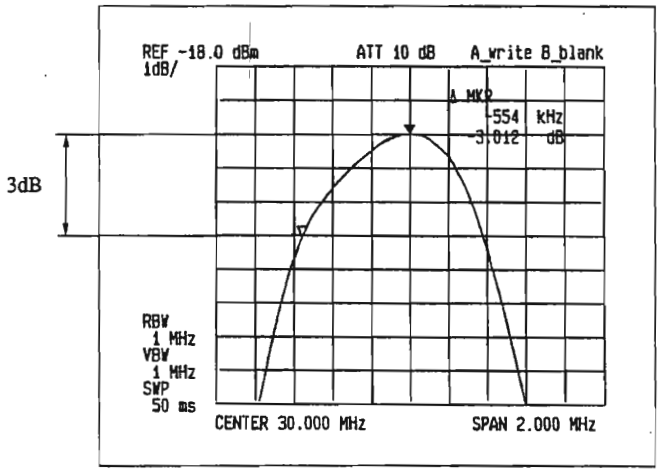
① Preset and then set the spectrum analyzer to the following settings:

CENTER FREQ	:	30MHz
FREQ SPAN	:	2MHz
RBW	:	1MHz
REF LEVEL	:	-18dBm
dB/div	:	1dB
CAL SIG	:	ON

② Set the spectrum analyzer as follows:

PEAK
ΔMKR

③ By turning the data knob counterclockwise, move the marker to such a position as to give a 3dB difference between the two points indicated by the marker.

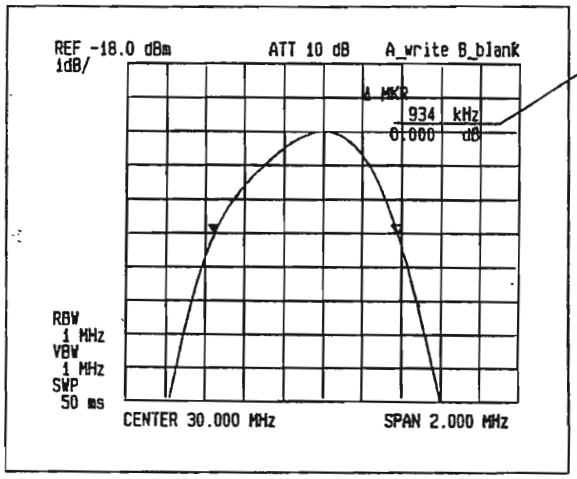


④ Set the spectrum analyzer as follows:

ΔMKR

⑤ By turning the data knob counterclockwise, move the marker to such a position as to give a 0.0dB difference between the two points indicated by the marker.

Cont'd



⑥ Confirm that the frequency difference, Δf, is within ±20% of the set value.

⑦ Check for 300kHz and 3kHz resolution bandwidths by performing steps ② through ⑥ above. Table 4-3 lists the span values most suitable to each resolution bandwidth. If the test result falls out of the specification, make adjustments in accordance with "5.4.3 Resolution Band Width Switching Between".

Table 4-3 Relationship Between Resolution Bandwidth and Span

RBW [Hz]	1M	300k	3k
FREQ SPAN [Hz]	2M	500k	5k

4.3.4 Testing Selectivity of Resolution Bandwidth

Procedure

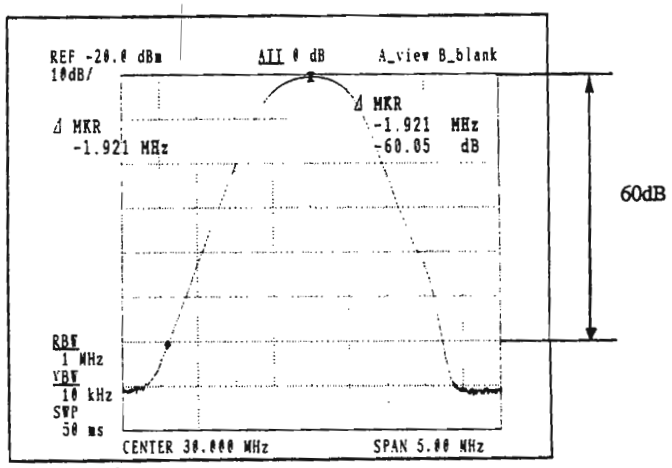
① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	30MHz
FREQ SPAN	:	5MHz
RBW	:	1MHz
VBW	:	10kHz
ATT	:	0dB
REF LEVEL	:	-20dBm
CAL SIG	:	ON

② Set the spectrum analyzer as follows:

PEAK
ΔMKR

③ By turning the data knob counterclockwise, move the marker to such a position as to give a 60dB difference between the two points indicated by the marker.

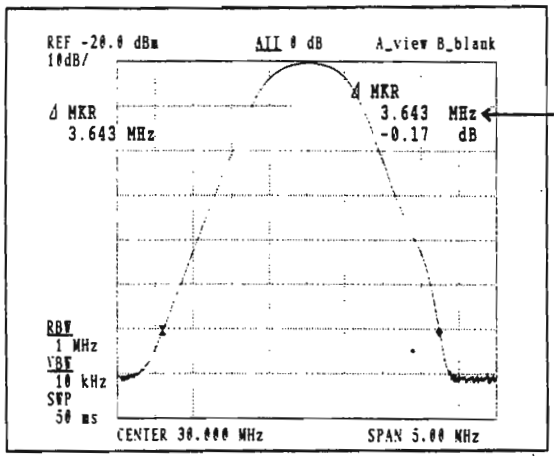


④ Set the spectrum analyzer as follows:

ΔMKR

Cont'd

⑤ By turning the data knob counterclockwise, move the marker to such a position as to give a 0.0dB difference between the two points indicated by the marker.



⑥ The 60dB bandwidth of the IF filter is given as the frequency difference, Δf, between the two points. Confirm that the ratio of this value to the value obtained in the resolution bandwidth test is 15:1 or less.

⑦ Check for 300kHz and 3kHz resolution bandwidths by performing steps ② through ⑥ above. Table 4-4 shows the relationship between resolution bandwidth and FREQ SPAN. If the test result falls out of the specification, make adjustments according to "5.4.3 Resolution Band Width Switching Between".

Table 4-4 Settings for Resolution Bandwidth Selectivity Test

RBW [Hz]	1M	300k	3k
FREQ SPAN [Hz]	5M	5M	50k
VBW [Hz]	10k	10k	1k

4.3.5 Testing Stability of QP Bandwidth

The QP value measurement is for measuring the pulse characteristic noise. Various constants in this measurement are defined values in the CISPR Standards as shown in Table 4-5.

Table 4 - 5 CISPR Standards for QP Value Measurement Basic Characteristic

Measuring band	6dB bandwidth	Charging time constant	Discharging time constant	Mechanical time constant
10kHz to 150kHz	200Hz	45ms	500ms	160ms
150kHz to 30MHz	9kHz	1ms	160ms	160ms
30MHz to 1GHz	120kHz	1ms	550ms	100ms

Procedure

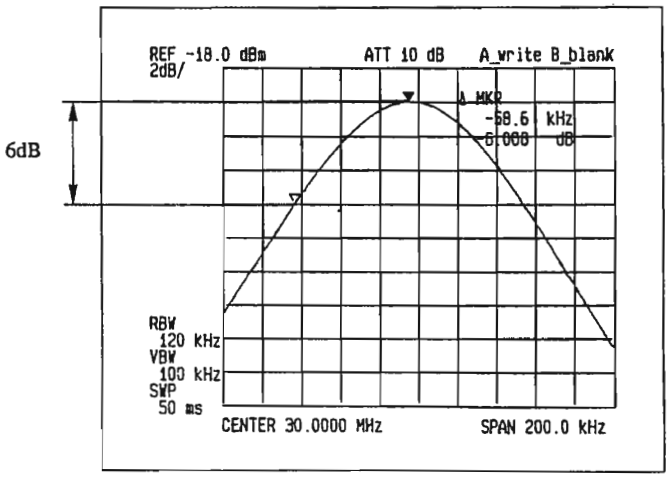
① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ : 30MHz
FREQ SPAN : 200kHz
REF LEVEL : -18dBm
dB/div : 2dB/
QP BW : 120kHz (6dB)
CAL SIG : ON

② Set the spectrum analyzer as follows:

PEAK
ΔMKR

③ By turning the data knob counterclockwise, move the marker to such a position as to give a 6dB difference between the two points indicated by the marker.

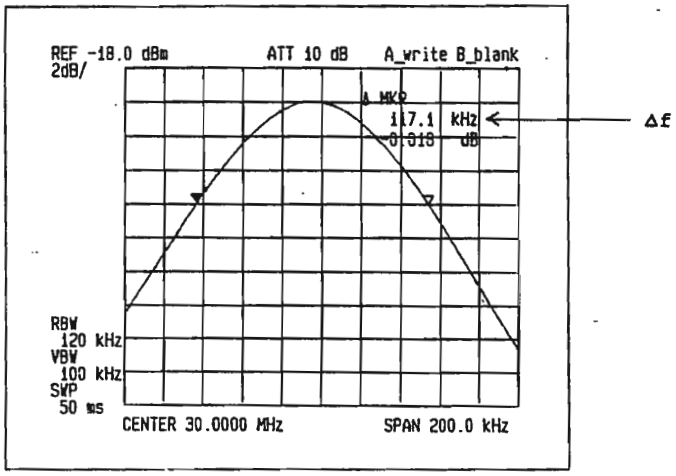


Cont'd

④ Set the spectrum analyzer as follows:

ΔMKR

⑤ By turning the data knob counterclockwise, move the marker to such a position as to give a 0.0dB difference between the two points indicated by the marker.



⑥ **Confirm that the frequency difference, Δf, between the points is within 110kHz to 130kHz.**

⑦ Check for 9kHz and 200Hz QP bandwidths by performing steps ② to ⑥ above. Table 4-6 shows the relationships between QP bandwidth, FREQ SPAN and sweep time.

Table 4-6 Setting for the QP Bandwidth Stability Test

QP bandwidth	120kHz	9kHz	200Hz
FREQ SPAN	200kHz	20kHz	2kHz
Sweep time	50ms	100ms	2sec

4.3.6 Testing Stability of Marker Indication (In normal mode)

Procedure

① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	30MHz
FREQ SPAN	:	20MHz
CAL SIG	:	ON
MARKER	:	PEAK

② Confirm that the marker indication is within 30MHz ±1.05MHz.

③ Set the spectrum analyzer as follows:

FREQ SPAN	:	10MHz
MARKER	:	PEAK

④ Confirm that the marker indication is within 30MHz ±0.55MHz

⑤ Set the spectrum analyzer as follows:

FREQ SPAN	:	2MHz
MARKER	:	PEAK

⑥ Confirm that the marker indicator is within 30MHz ±0. 16MHz.

4.3.7 Testing Stability of Marker Indication (In counter mode)

Procedure

① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	30MHz
FREQ SPAN	:	1kHz
CAL SIG	:	ON
MARKER	:	PEAK COUNTER
RESOLUTION	:	1Hz

② Confirm that the marker indication is within 30MHz ± 1Hz.

4.3.8 Testing Average Noise Level

Procedure

① From the preset condition, set the spectrum analyzer as follows:

ATT	:	0dB
REFLEVEL	:	-70dBm
RBW	:	1MHz
VBW	:	1kHz
START FREQ	:	50MHz
STOP FREQ	:	3600MHz **(2600MHz for R3261A,C/R3361A,C)**

② At completion of the sweep, set the spectrum analyzer as follows:

Press the [PEAK], [MKR→] and [MKR→ CF] keys.

SPAN	:	1kHz
RBW	:	300Hz
VBW	:	1kHz

③ Confirm that the noise level at the frequency, in GHz, determined in step ② above is -121dBm+1.55f[GHz] or less.

4.3.9 Testing Residual Response

Procedure

① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	250MHz
SPAN	:	500MHz
RBW	:	30kHz
VBW	:	1kHz
ATT	:	0dB
REF LEVEL	:	-60dBm

② Confirm that there is no residual spurious when no connection is made to the input terminal of the spectrum analyzer.

③ Confirm that there is no residual spurious when the frequency is changed up to 3.6GHz (2.6GHz for R3261A,C/R3361A,C) with the CENTER FREQ set to 500MHz.

4.3.10 Testing Switchover Stability of Resolution Bandwidth

Procedure

① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	30MHz
FREQ SPAN	:	500kHz
RBW	:	300kHz
REF LEVEL	:	-15dBm
dB/div	:	1dB/
CAL SIG	:	ON

② While changing the resolution bandwidth from 1MHz to 30Hz, confirm that the peak level of each spectrum is within ±0.3dB of the level at 300kHz resolution bandwidth. Table 4-7 shows that relationship between bandwidth and FREQ SPAN. If the test result falls out of the specification, make adjustments according to "5.4.3 Resolution Band Width Switching Between".

Table 4-7 Relationship Between Resolution Bandwidth and FREQ SPAN

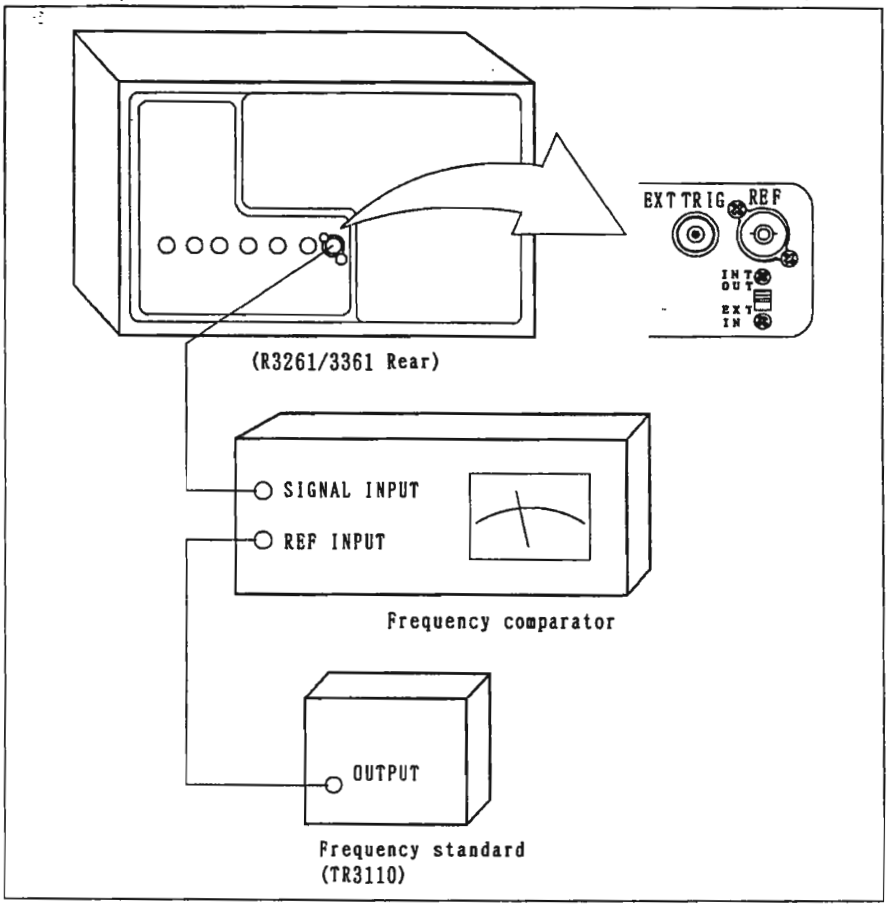
RBW [Hz]	1M	300k	100k	30k	10k	3k	1k	300	100	30
FREQ SPAN [Hz]	2M	500k	200k	50k	20k	5k	2k	1k	1k	1k

4.4 Testing Using Measuring Equipment

4.4.1 Testing Stability of Reference Oscillator

Procedure

① Set the REF INT OUT/EXT IN switch on the rear panel of the spectrum analyzer to INT OUT. Connect frequency standard to REF socket on spectrum analyzer through a frequency comparator.



② Confirm that the reading on the frequency comparator is 2×10^{-8} or less.

Cont'd

4.4.2 Testing Stability of Center Frequency

Procedure

① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ : 30MHz
FREQ SPAN : 20MHz

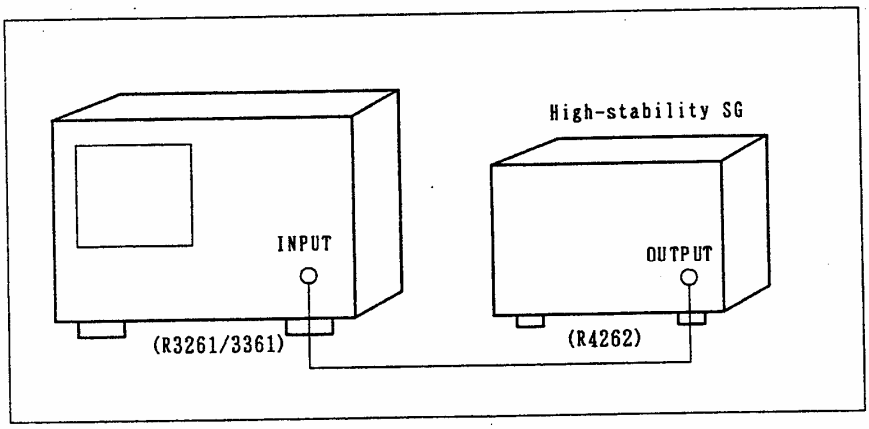
② Input a 30MHz, -10dBm signal-generated signal to the spectrum analyzer. The signal generator must have stability of 2×10^{-8} or better.

③ Confirm that the peak of the spectrum is within ±450kHz (±0.2 div). of the screen center.

④ Set the spectrum analyzer to the following settings, and confirm that the position of the spectrum peak is still within the specification.

Table 4-8 FREQ SPAN and Center Frequency Stability

FREQ SPAN	20MHz	10MHz	2MHz	1 kHz
Specification	±450kHz (±0.2div)	±250kHz (±0.2div)	±60kHz (±0.3div)	±50Hz (±0.5div)



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