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.

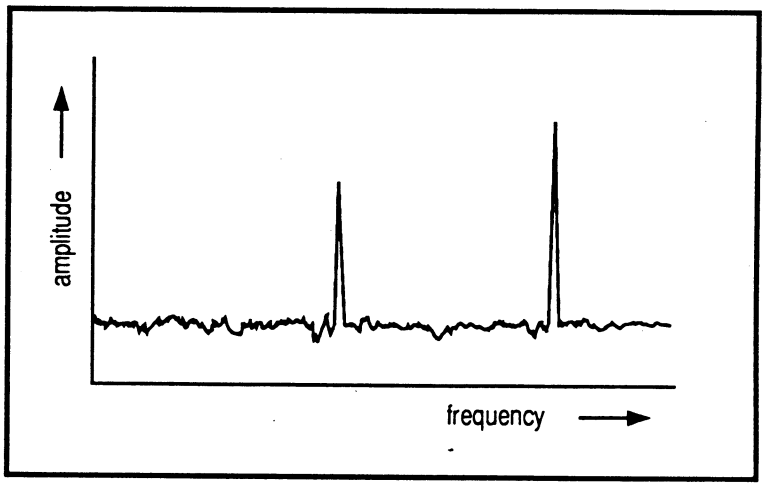


Figure 3–1 Typical Spectrum Analyzer Display

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 four models: R3261A, R3261B, R3361A, and R3361B. Table 3–1 summarizes the configurations of the four 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
	9 KHz – 2.6 GHz	9 KHz – 3.6 GHz	
R3261A	✔		
R3261B		✔	
R3361A	✔		✔
R3361B		✔	✔

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.

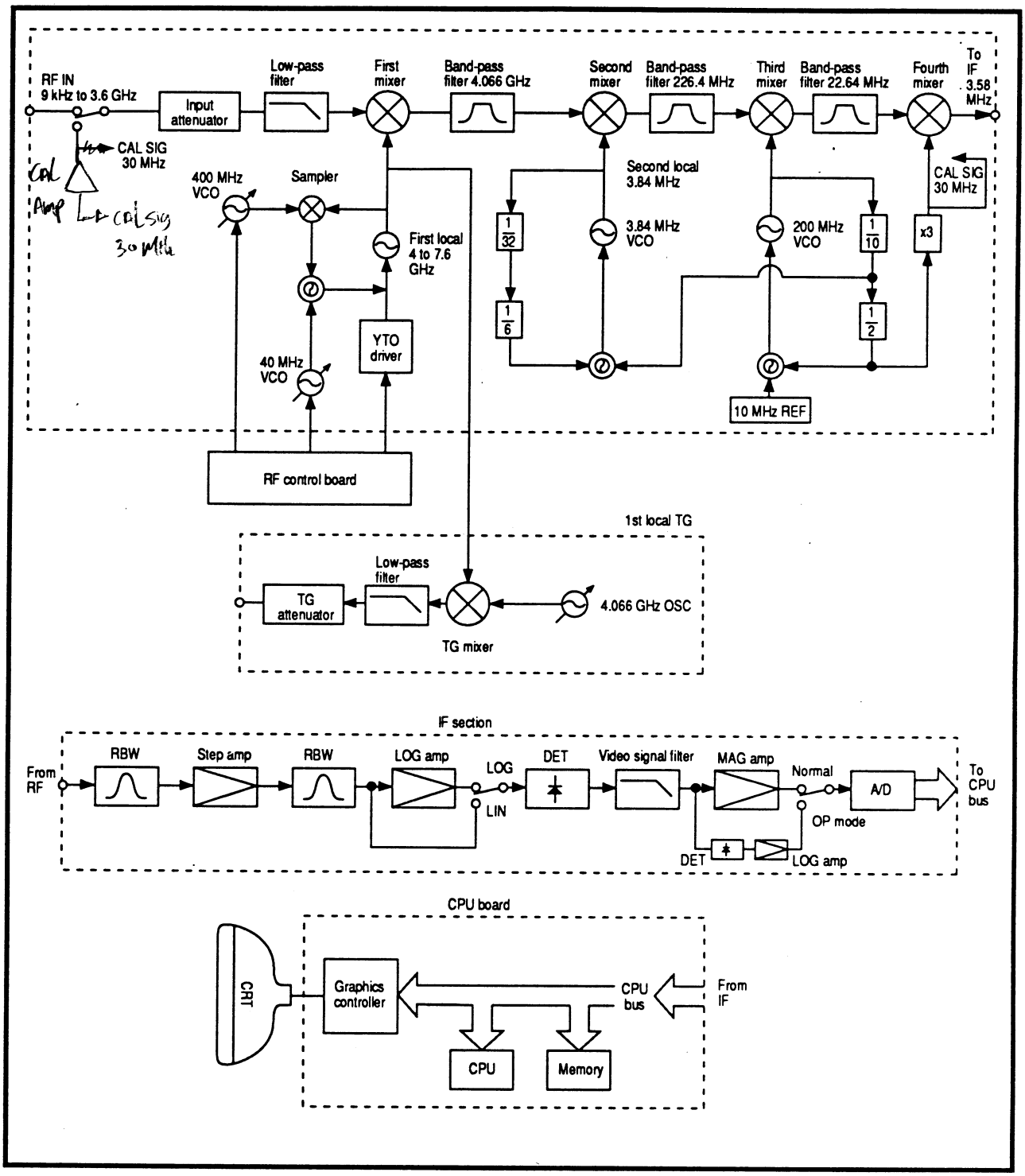


Figure 3–2 R3261/3361 Block Diagram

3.3.1 The Input Attenuator

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

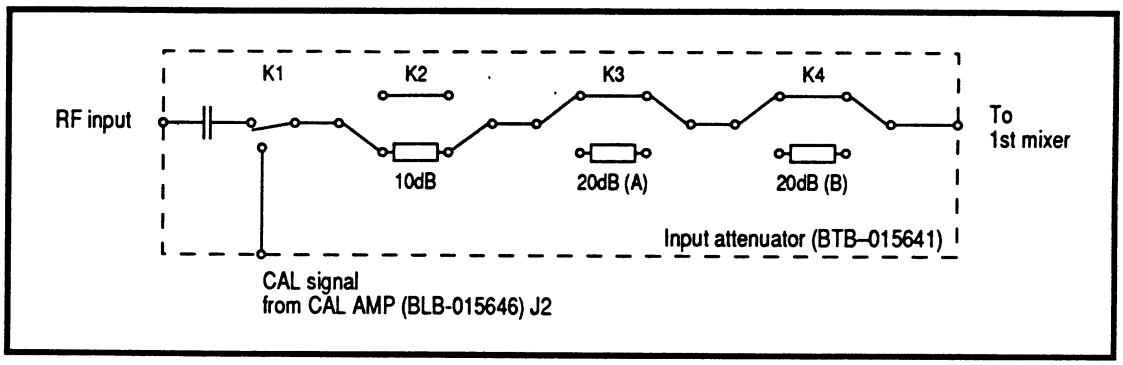


Figure 3–3 Input Attenuator

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.

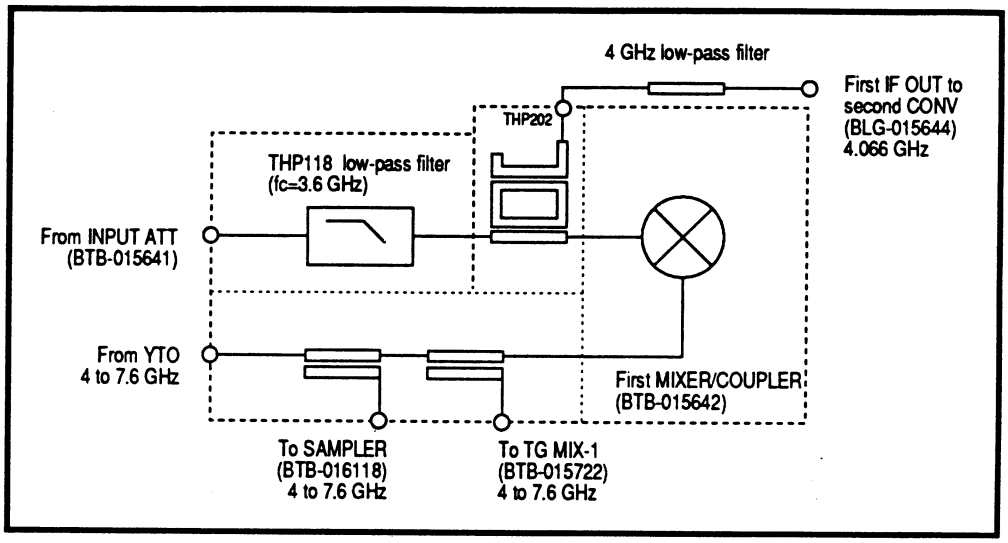


Figure 3–4 First Mixer/Coupler

The first local oscillator signal generated by the YTO (4 to 6.4 GHz for the R3261A/3361A, 4 to 7.6 GHz for the R3261B/3361B) 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.

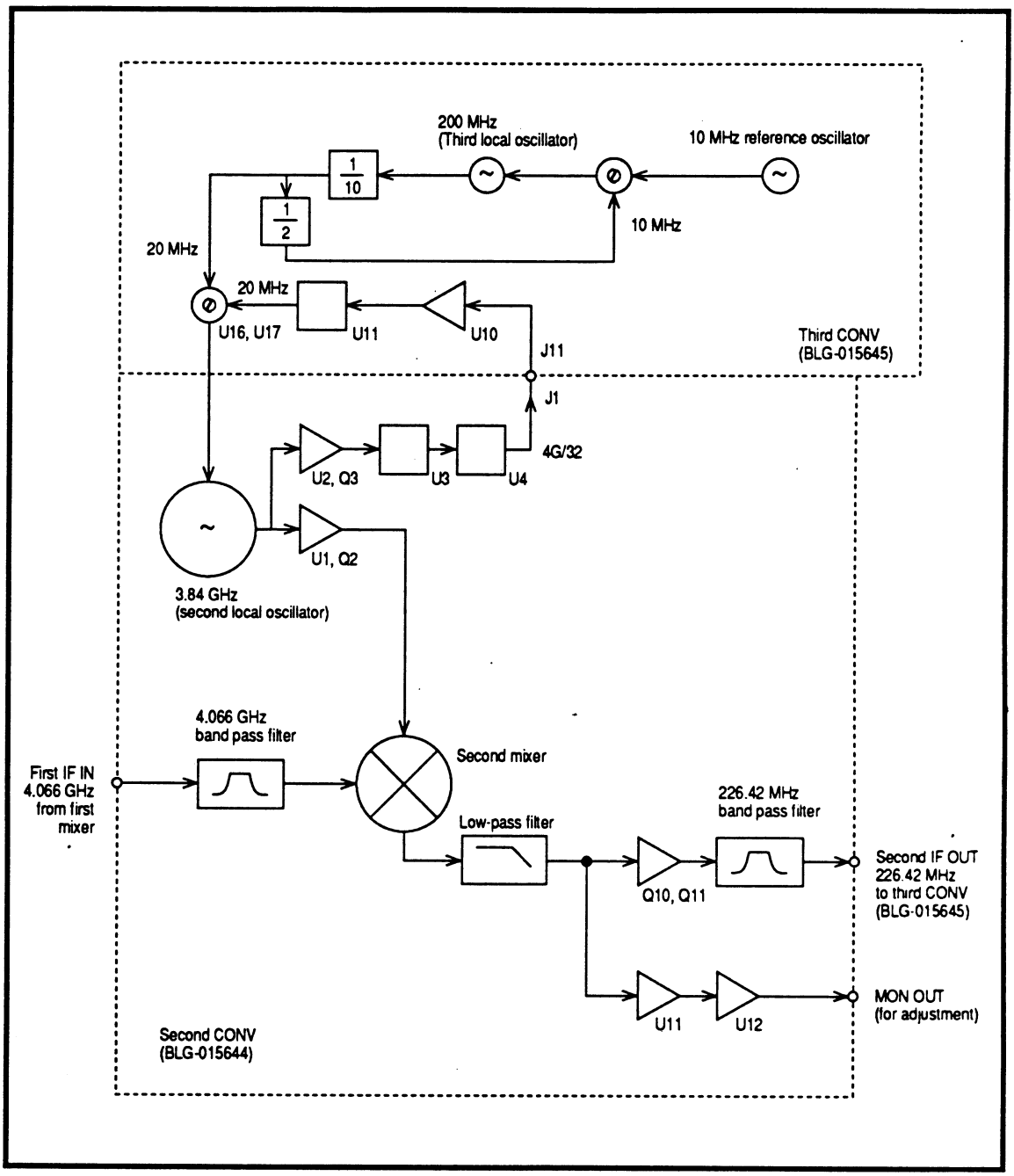


Figure 3–5 Second Mixer/Second Local Oscillator

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.

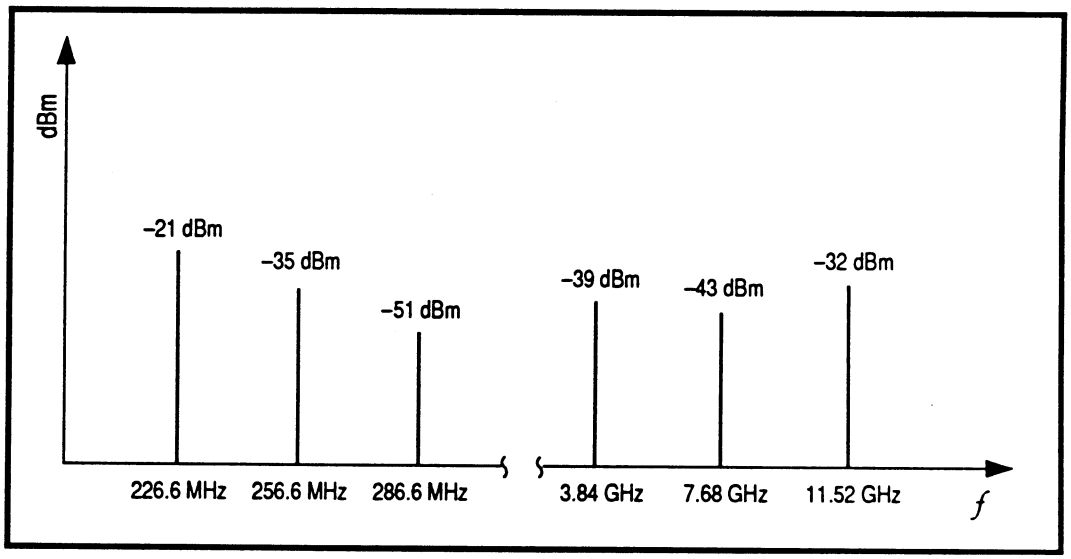


Figure 3–6 Spectrum Distribution at the MON OUT Terminal

3.3.4 Third and Fourth Mixers and Local Oscillators

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

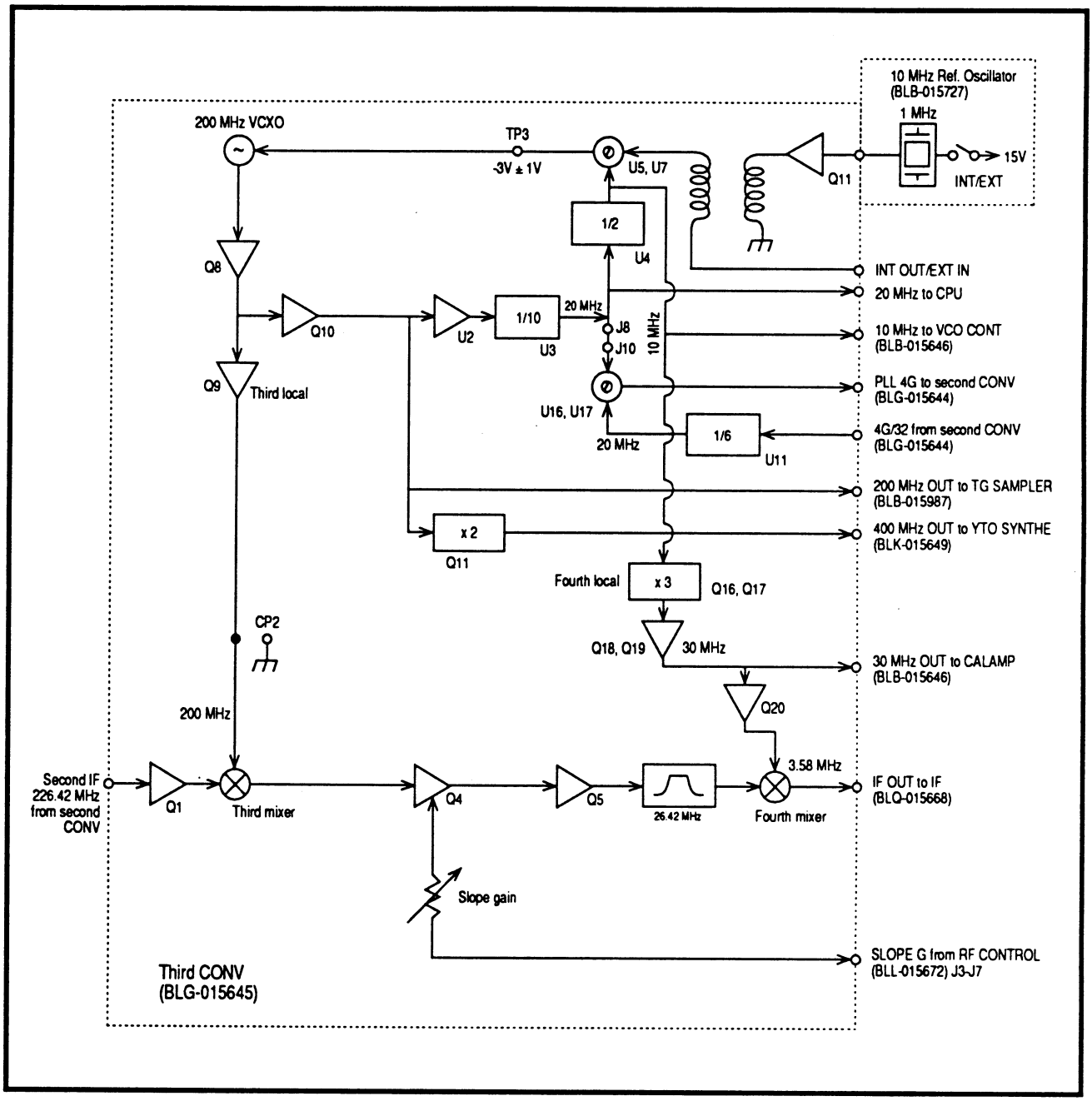


Figure 3–7 Third and Fourth Mixers and Local Oscillators

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.

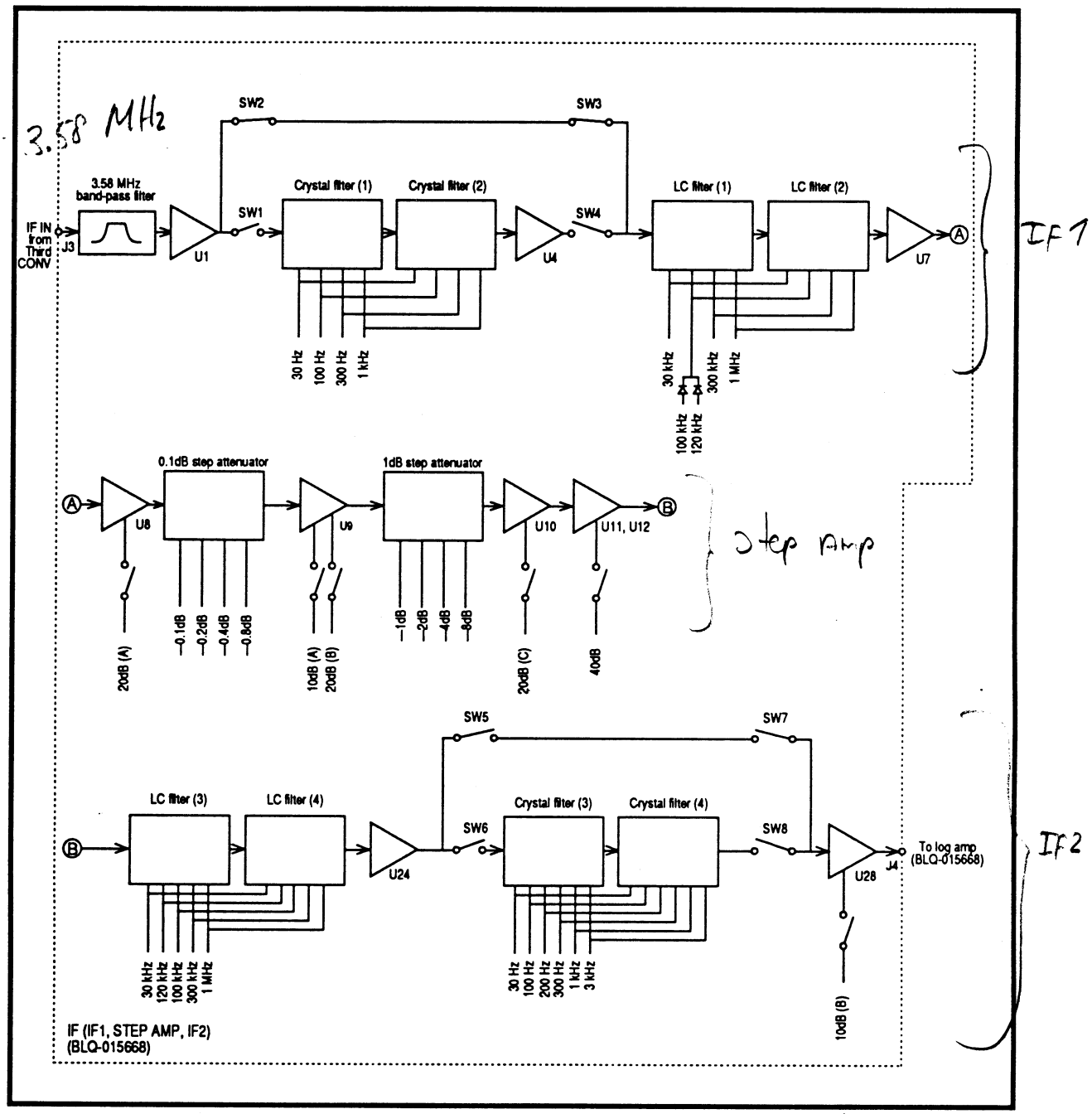


Figure 3–8 IF1 and IF2 Step Amplifiers

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

		U42 Pin No.											
RBW Setup		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.

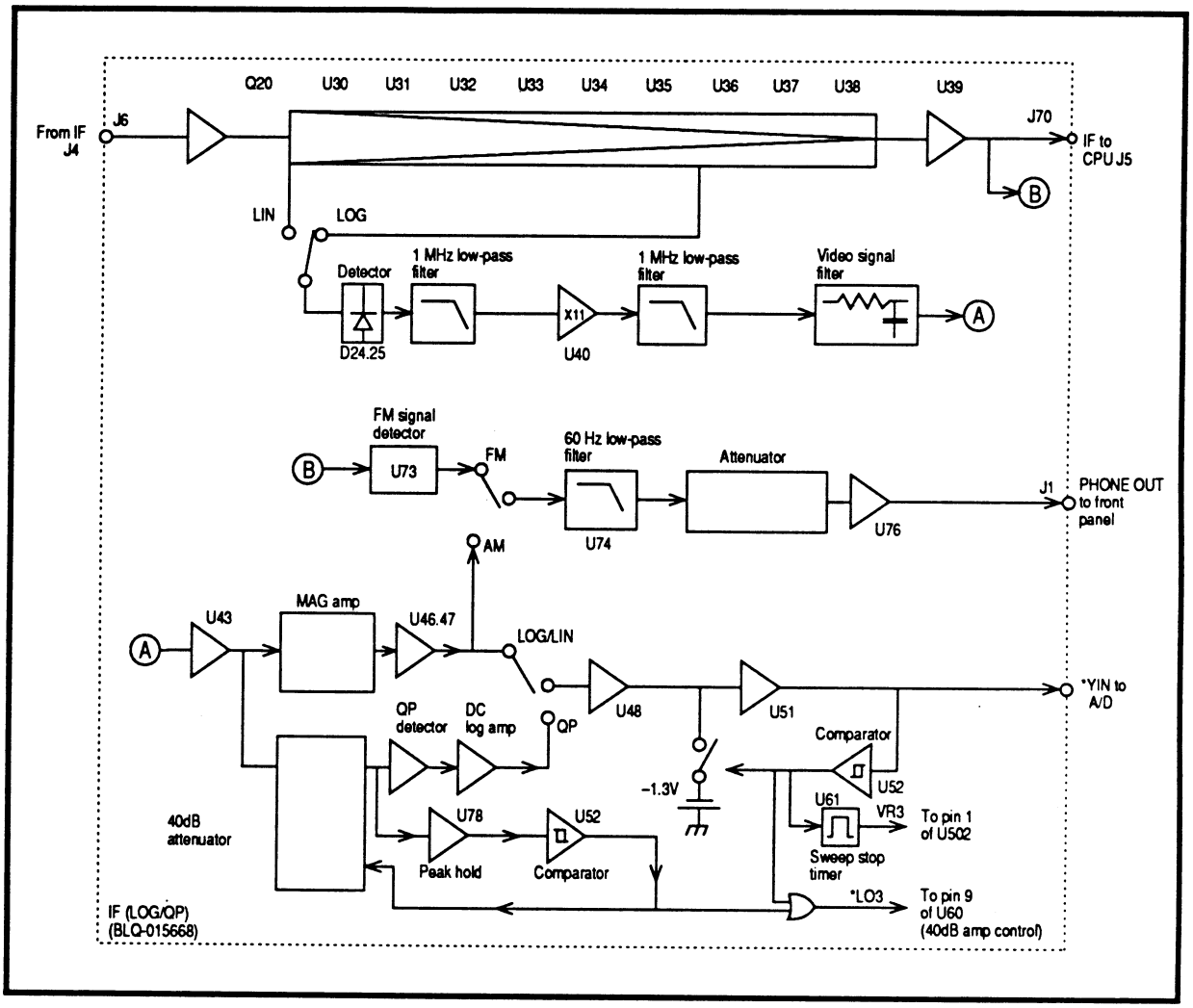


Figure 3–9 LOG/QP

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.

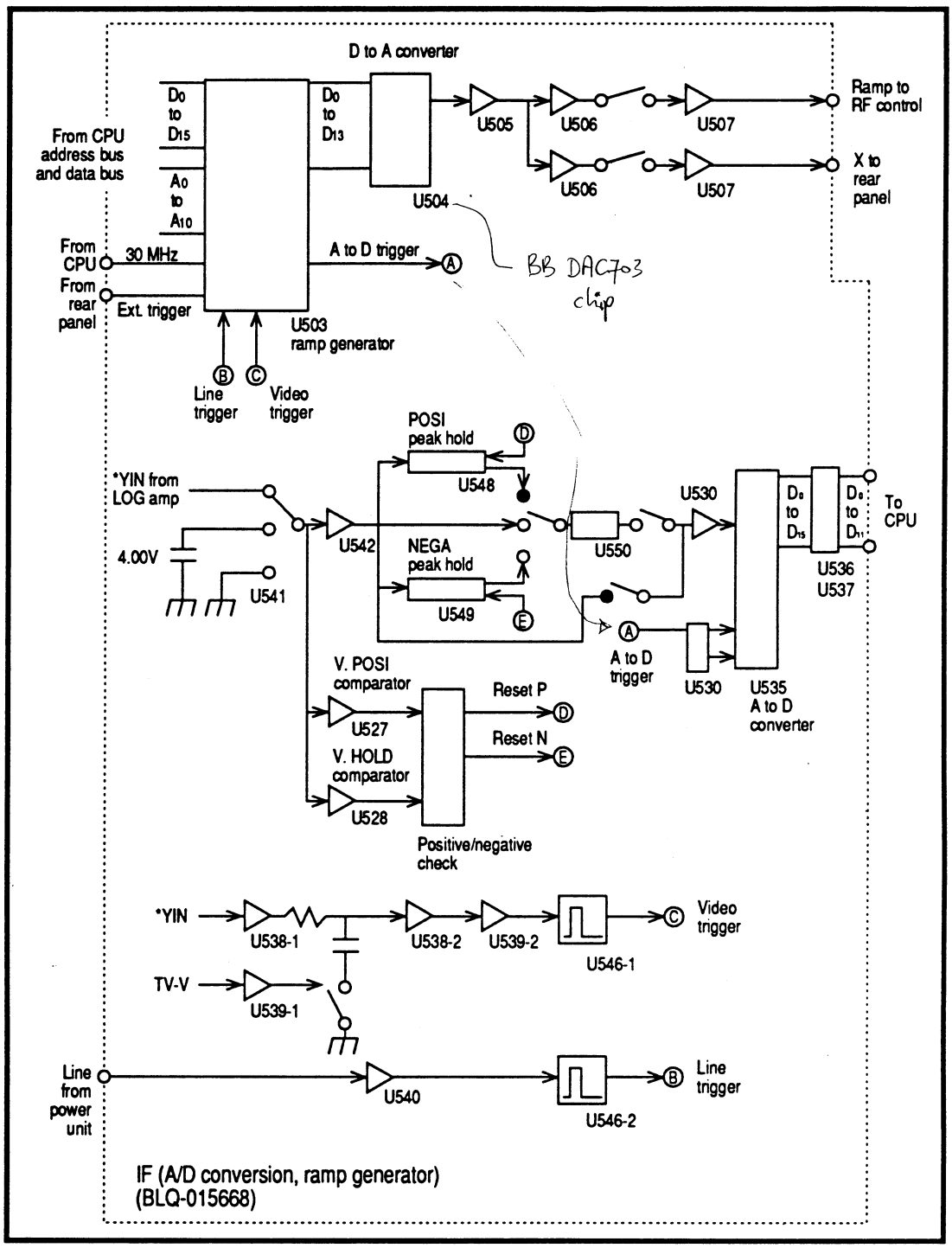


Figure 3–10 A/D Conversion and Ramp Generator

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.

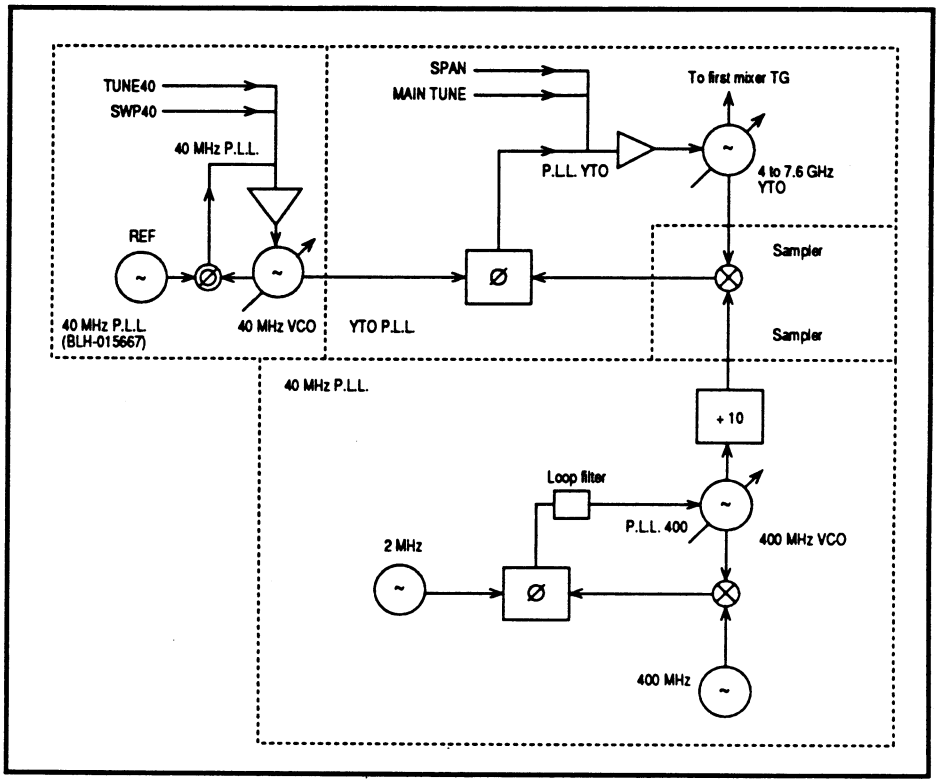


Figure 3–11 First Local Oscillator

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)

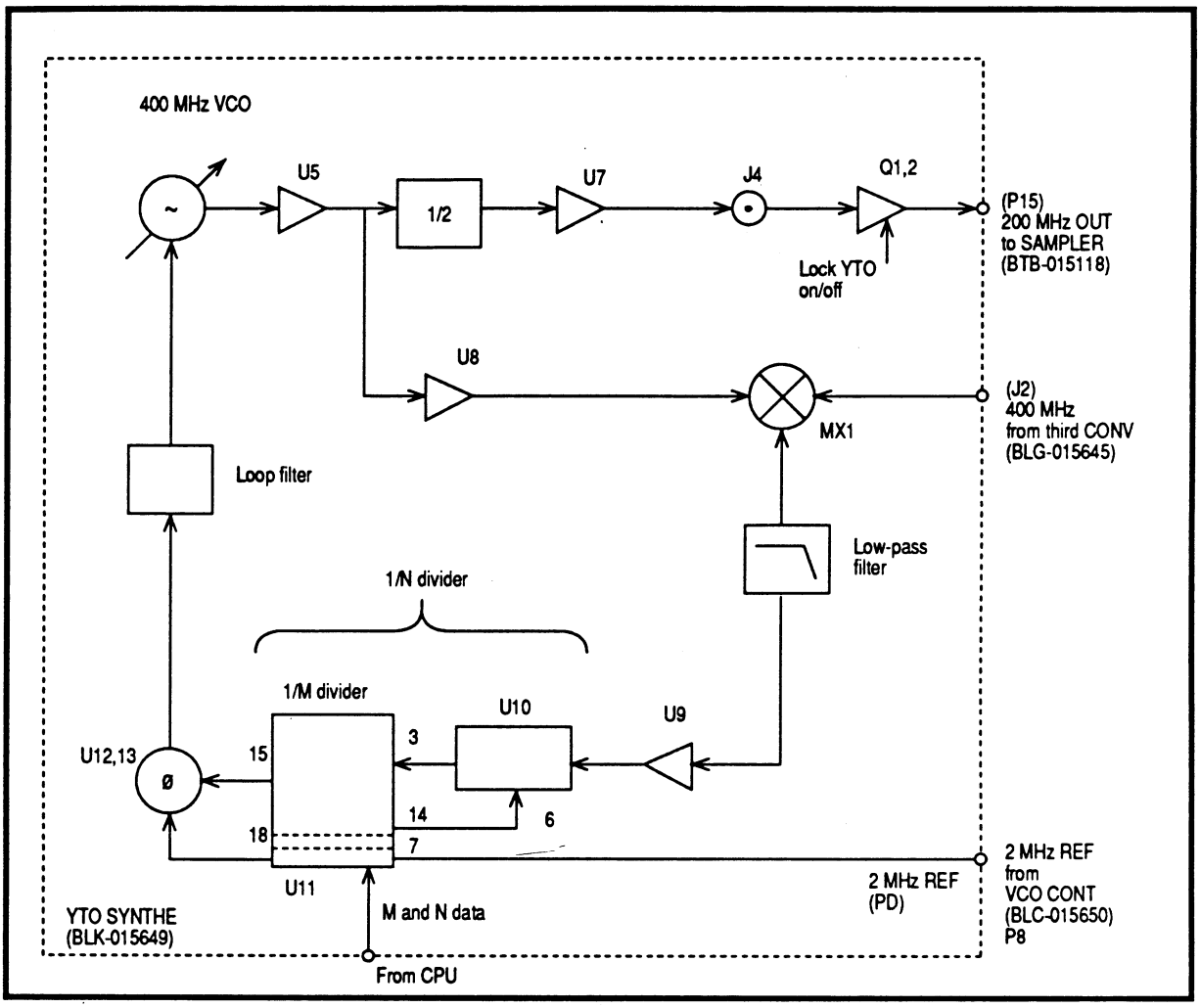


Figure 3–12 400MHz P.L.L.

YTO P.L.L.

Figure 3–13 shows the YTO P.L.L.

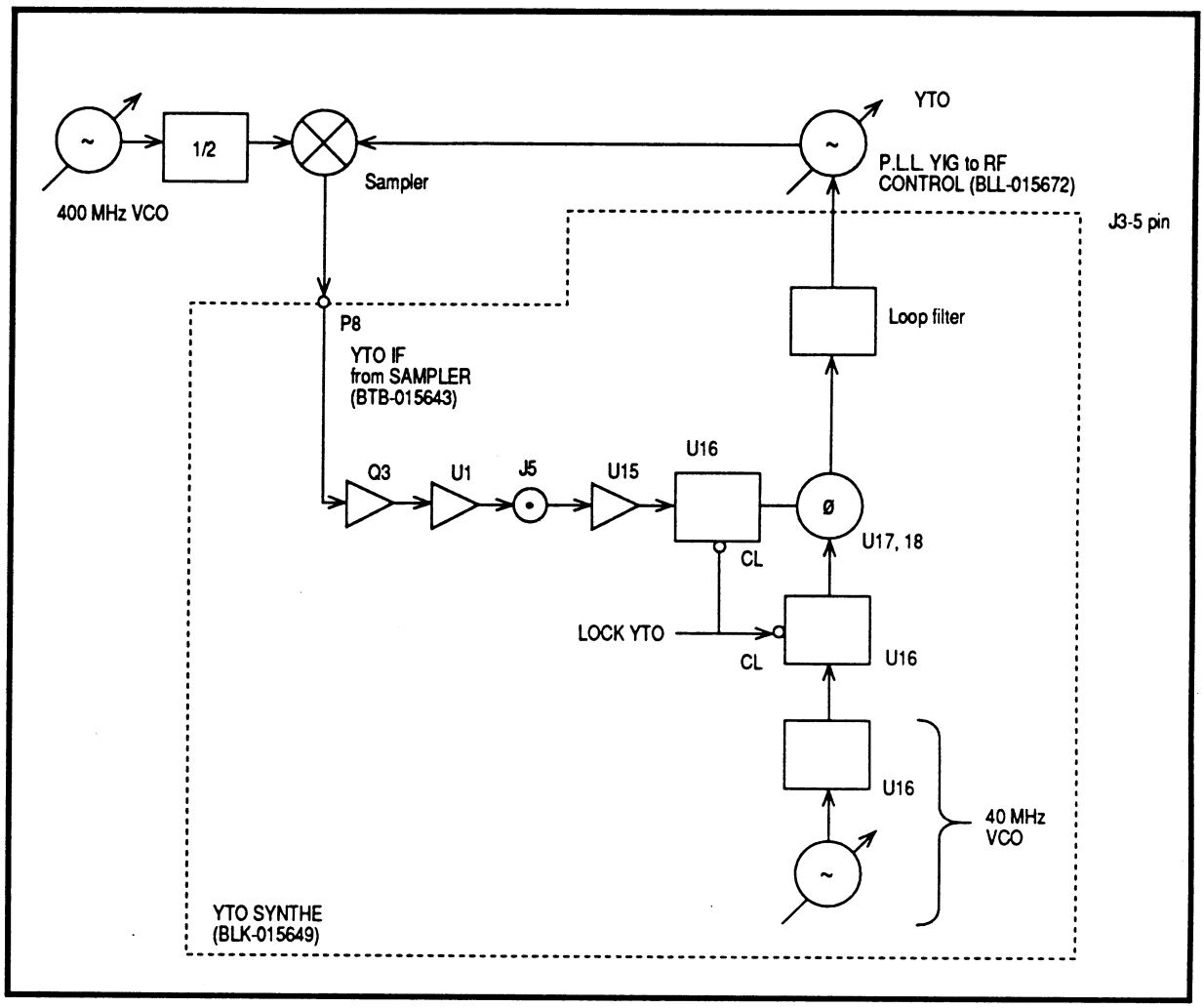


Figure 3–13 YTO P.L.L.

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.

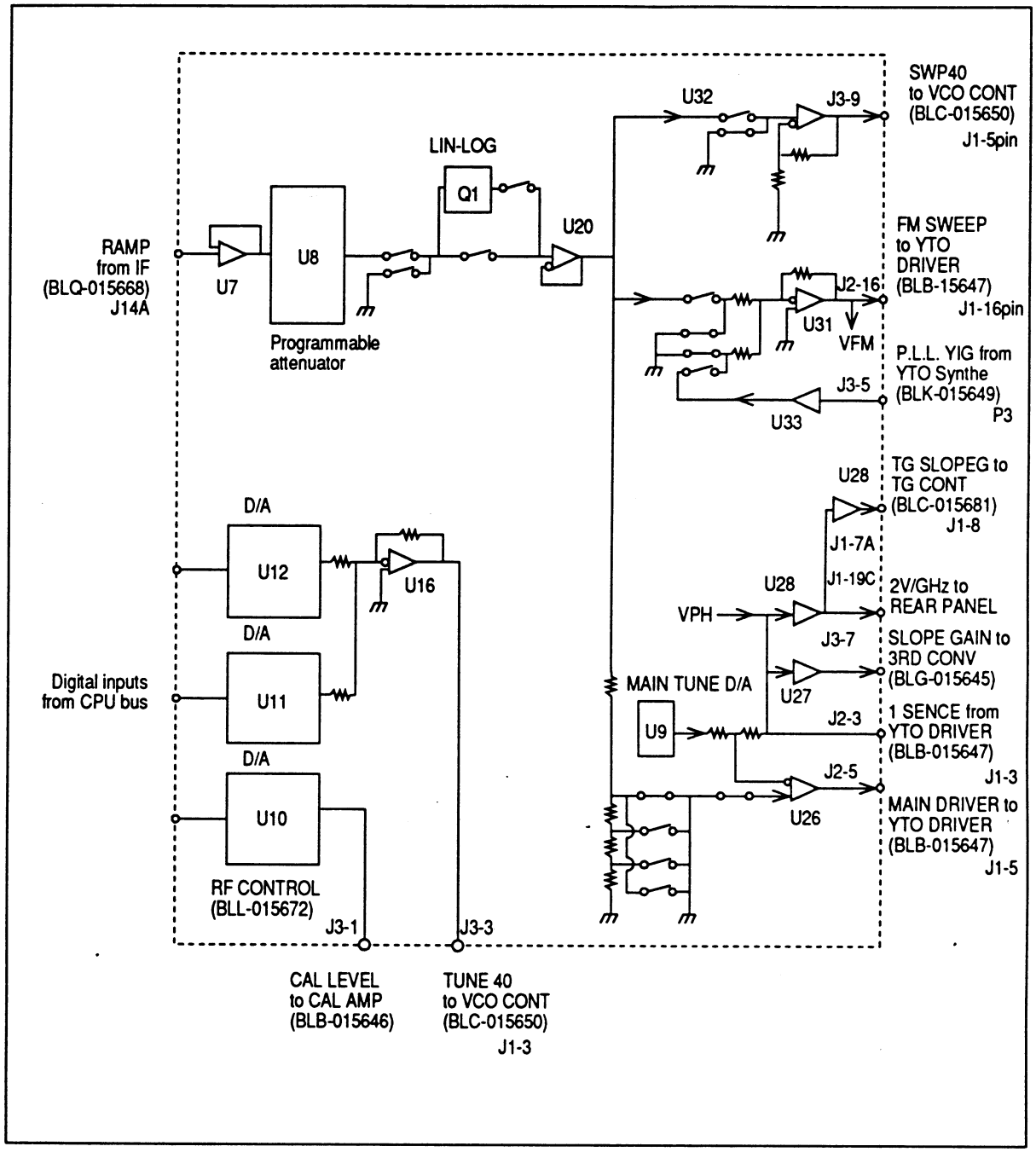


Figure 3–14 RF Control

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.

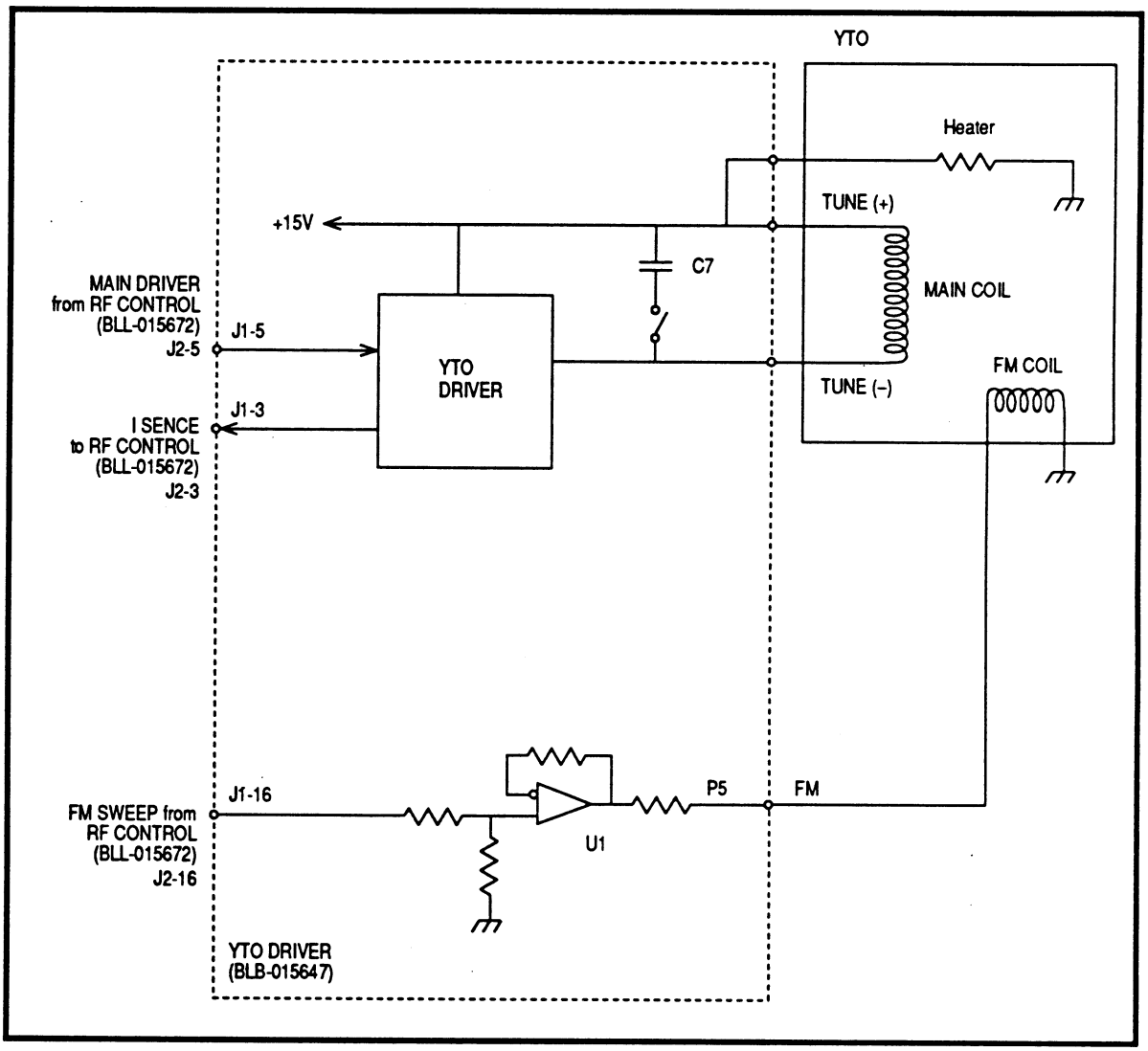


Figure 3–15 YTO Driver

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.

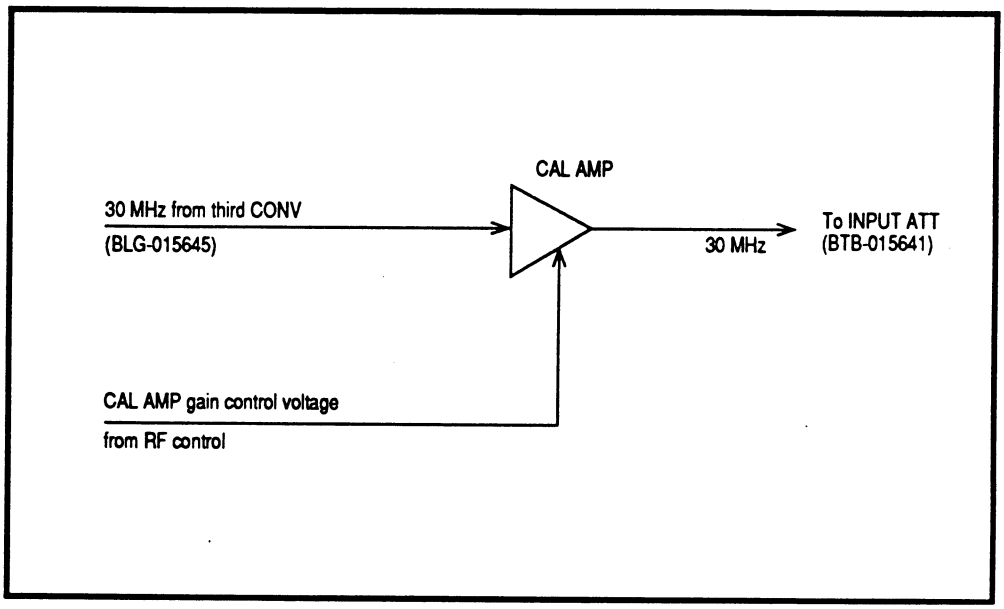


Figure 3–16 CAL Amplifier

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/B 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.

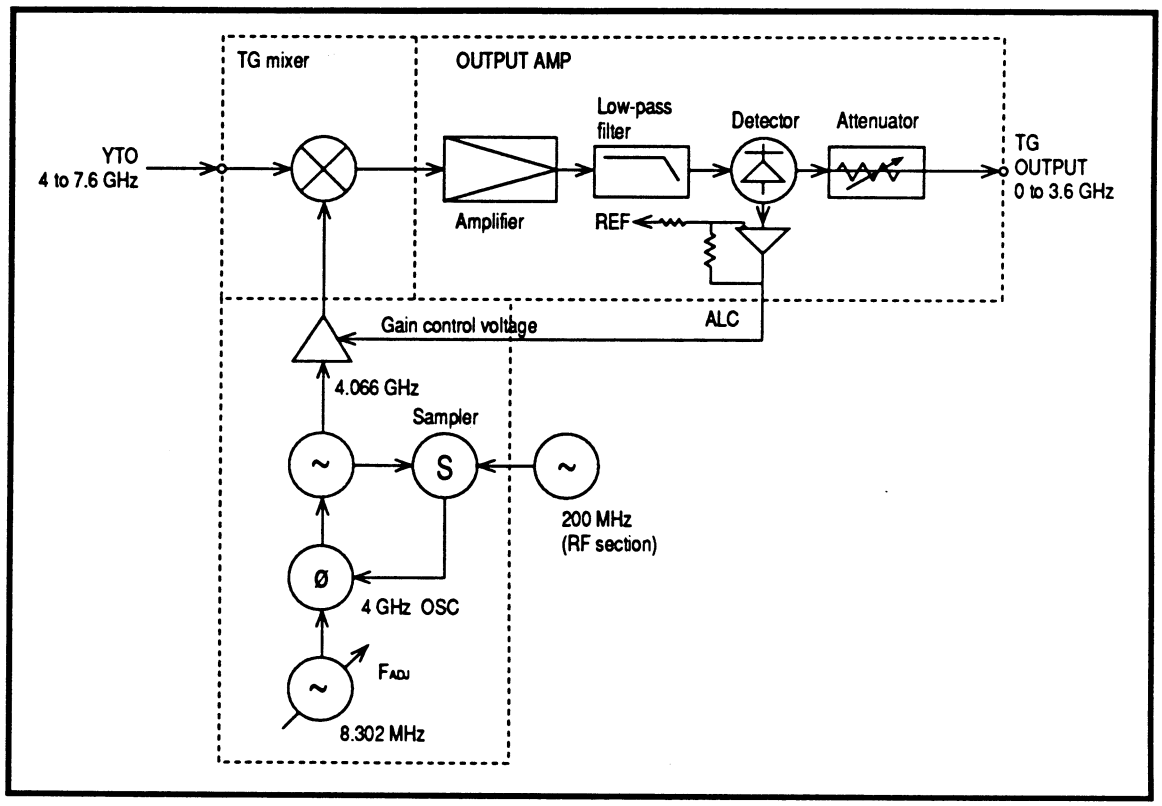


Figure 3–17 Tracking Generator Block Diagram

Unlike conventional tracking generators that generate tracking output signals by inversely mixing each local signal, the R3361A/B 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.

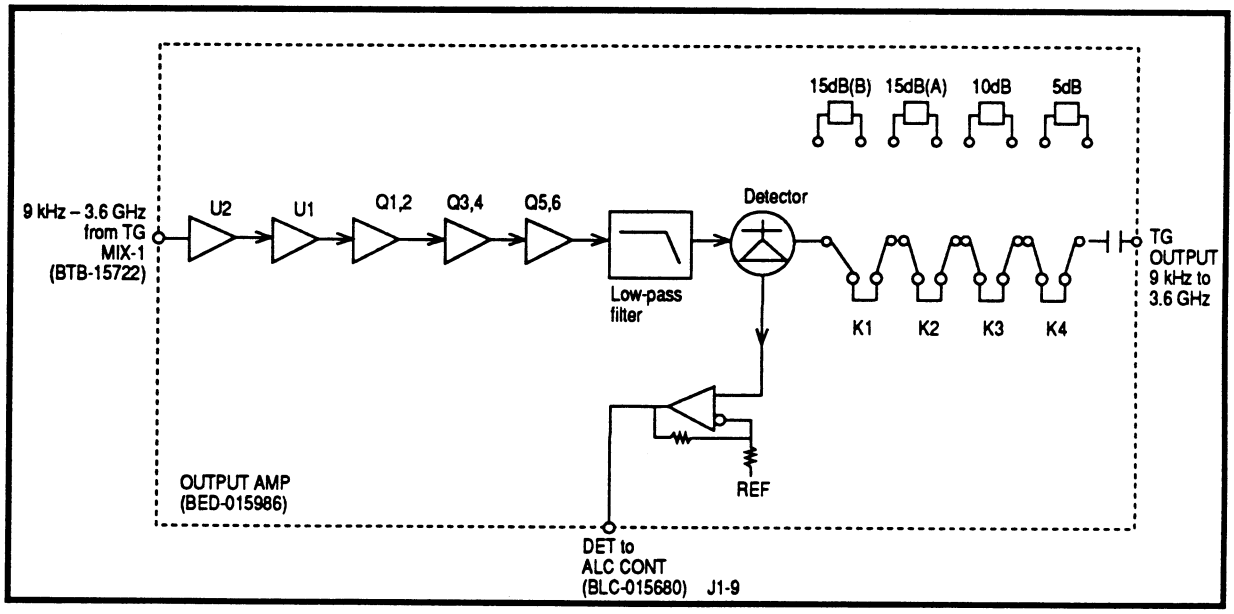


Figure 3–18 Output Amplifier

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).

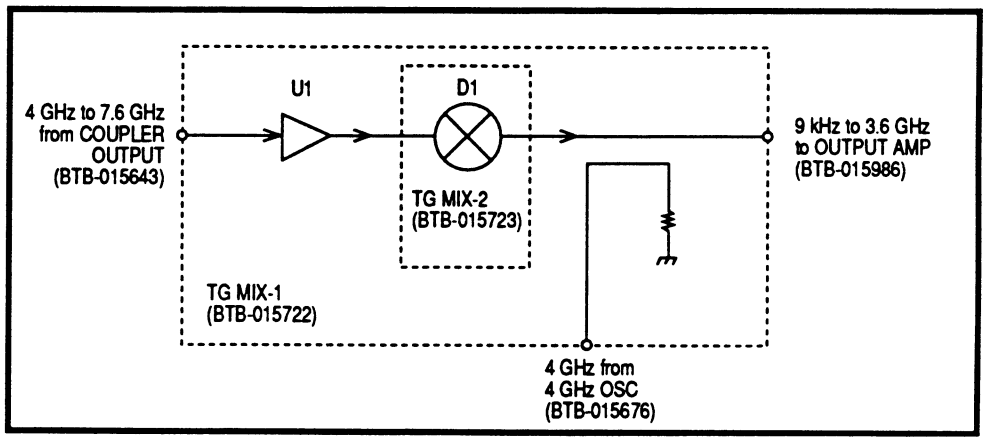


Figure 3–19 TG Mixer

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.

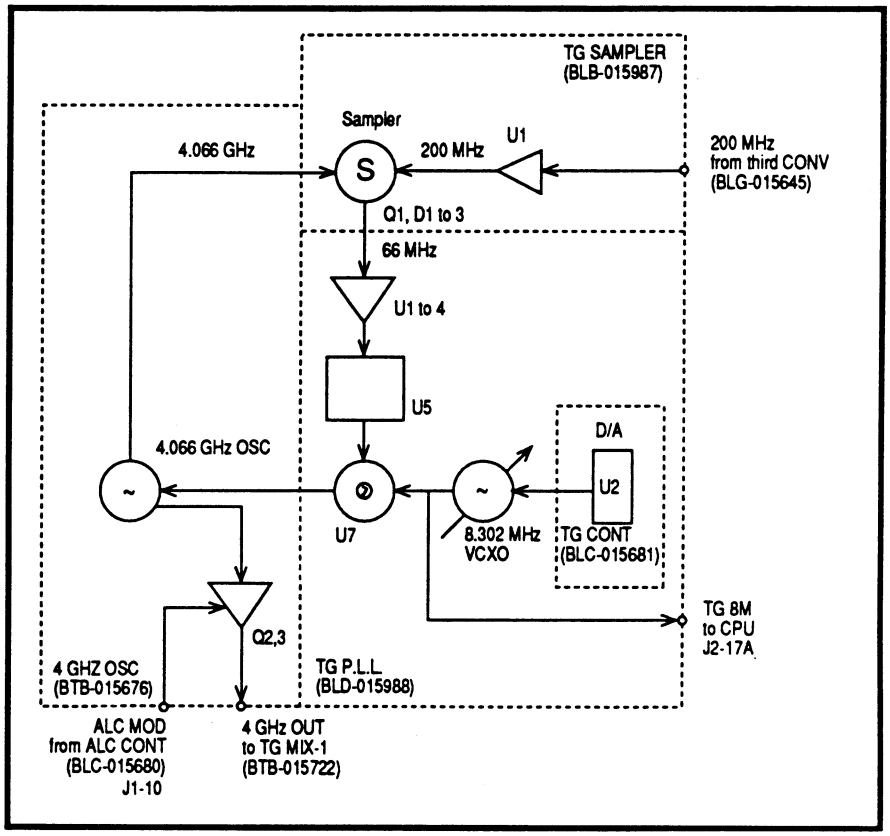


Figure 3–20 4GHz Oscillator

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.

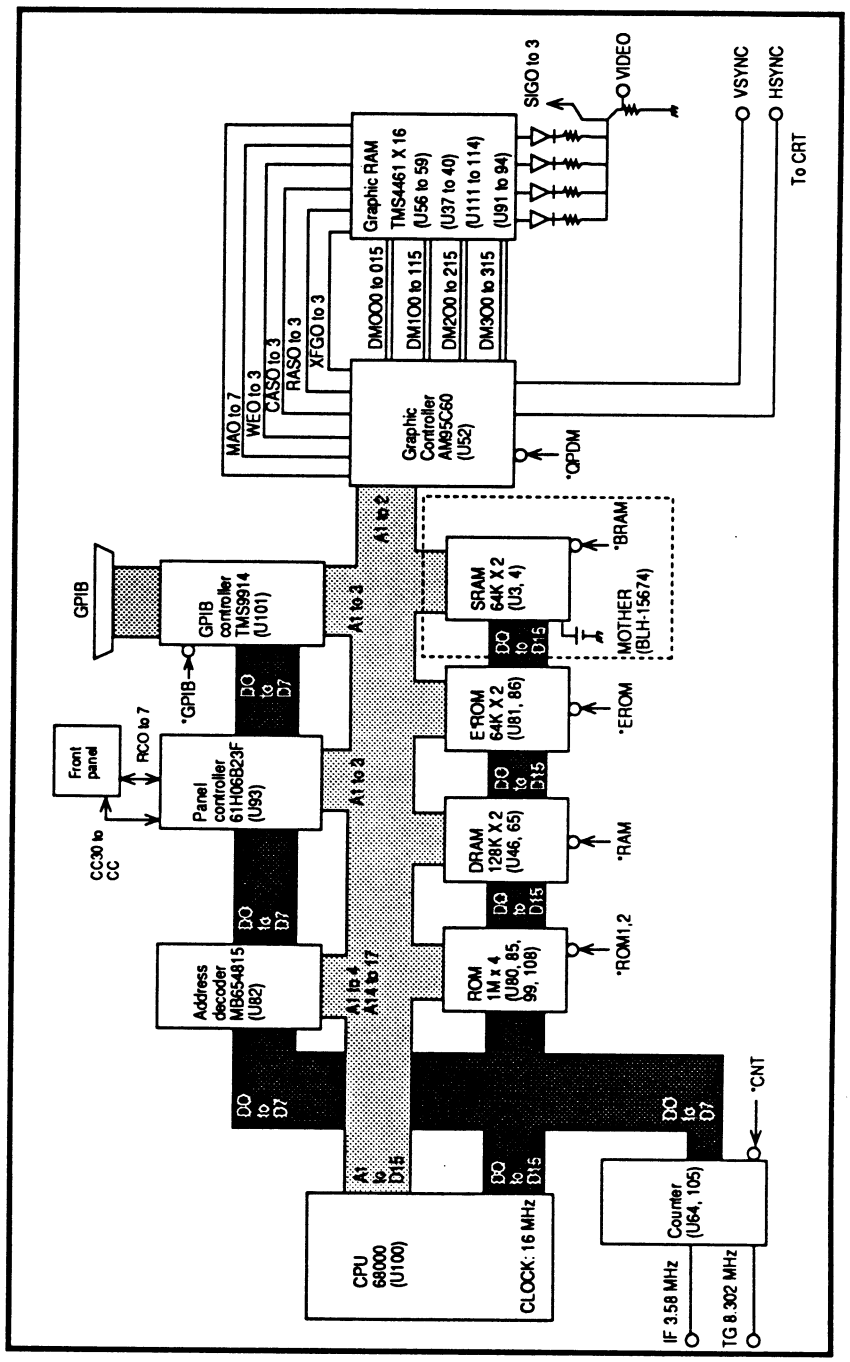


Figure 3–21 R3261/3361 Mother Board

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.

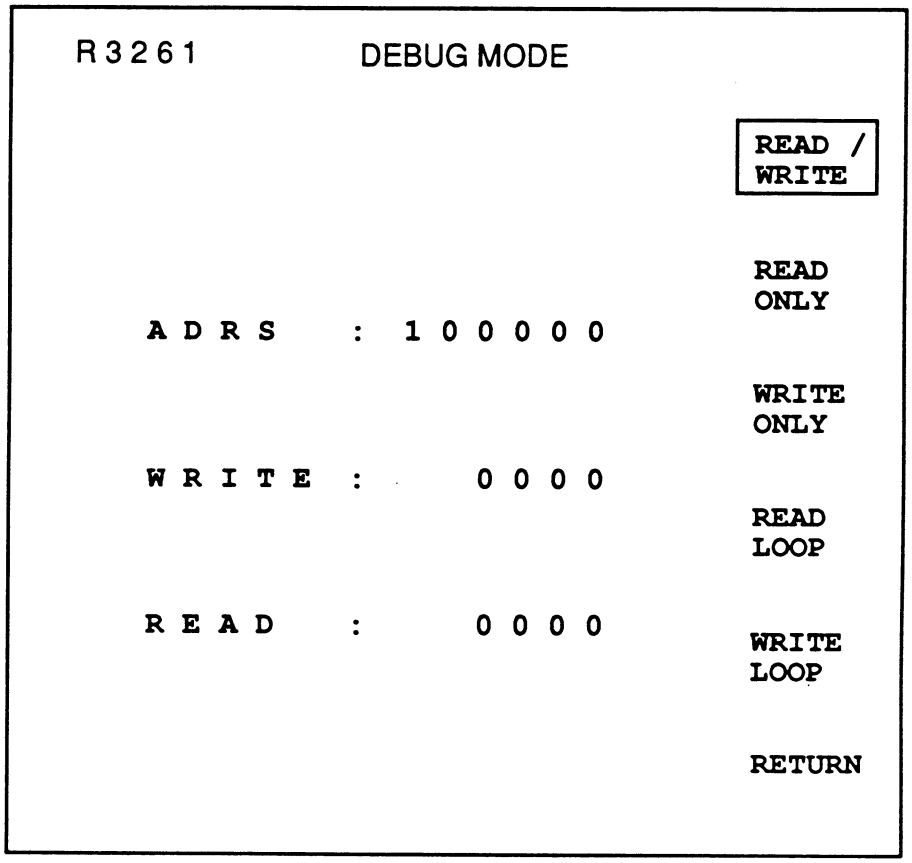


Figure 3–22 Debug Mode Display

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.

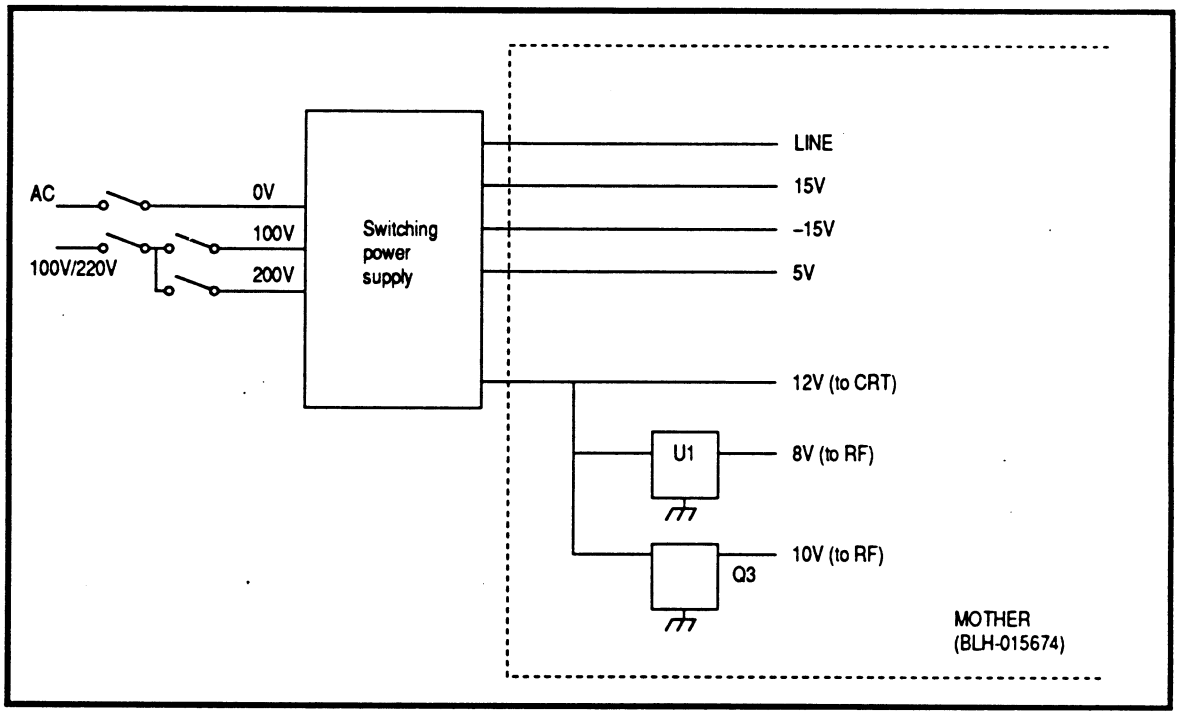
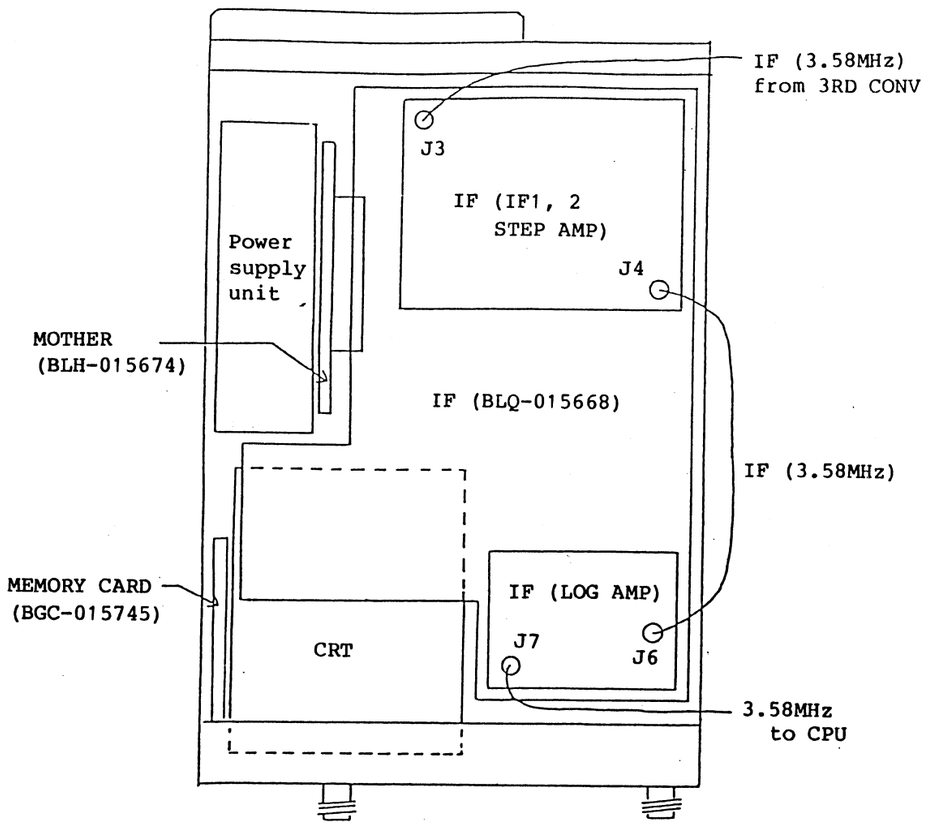


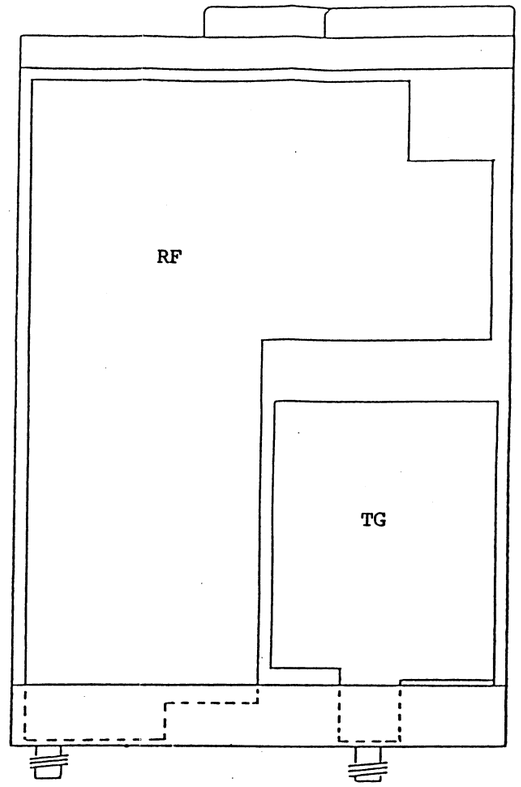
Figure 3–23 Power Source

3.4 Location

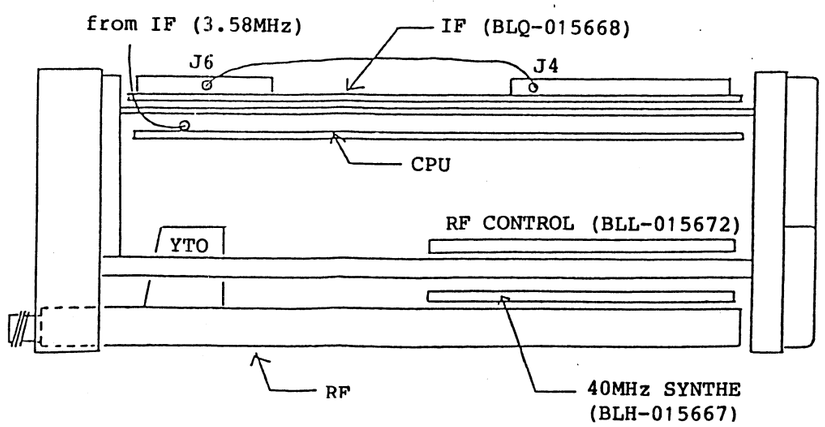
3.4.1 Block/Board Layout



Top view



Rear view



Side view

Figure 3-24 Block/Board Layout

3.4.2 RF Block Internal View

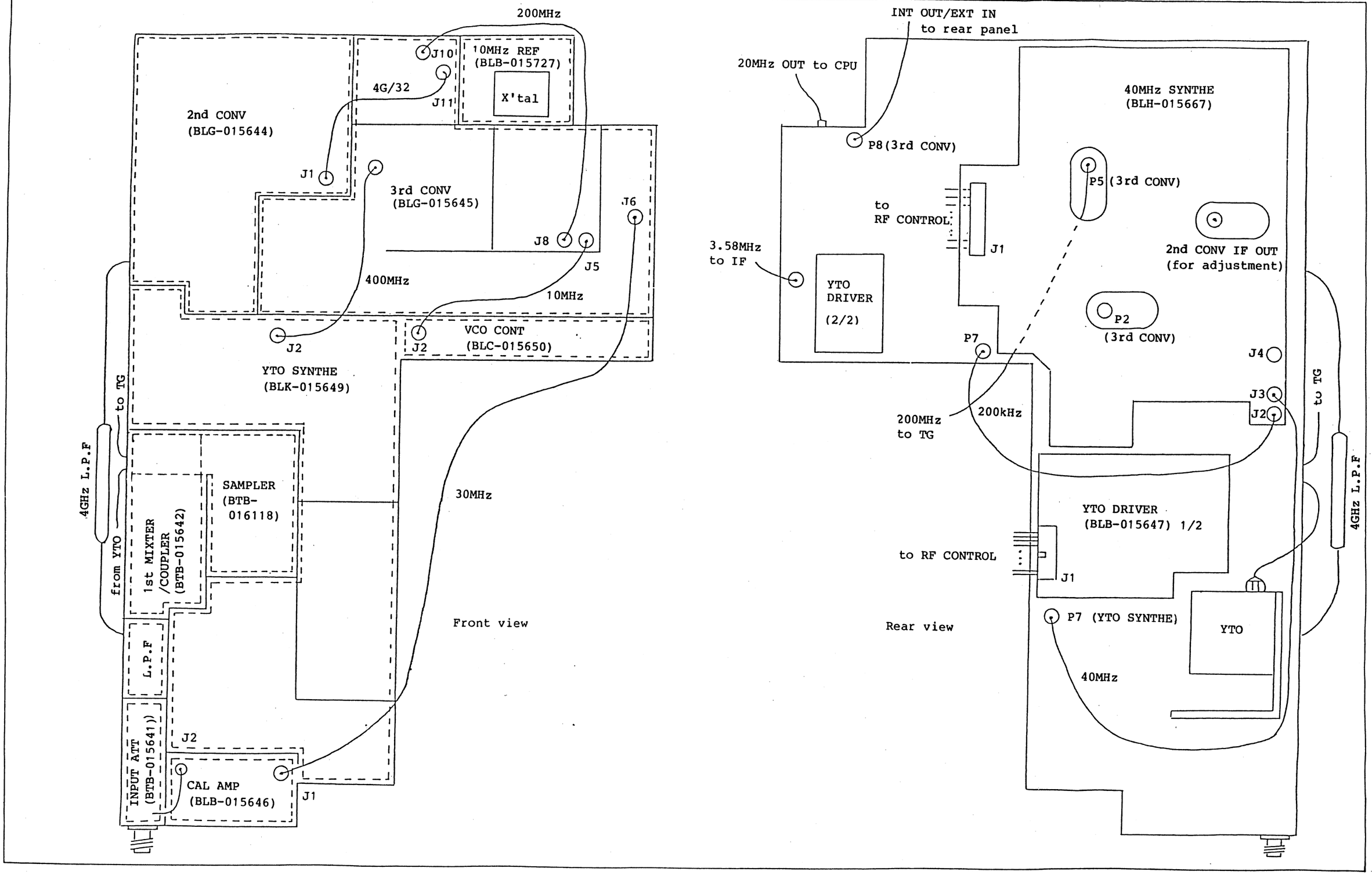


Figure 3-25 RF Block Internal View

3.4.3 TG Block Internal View

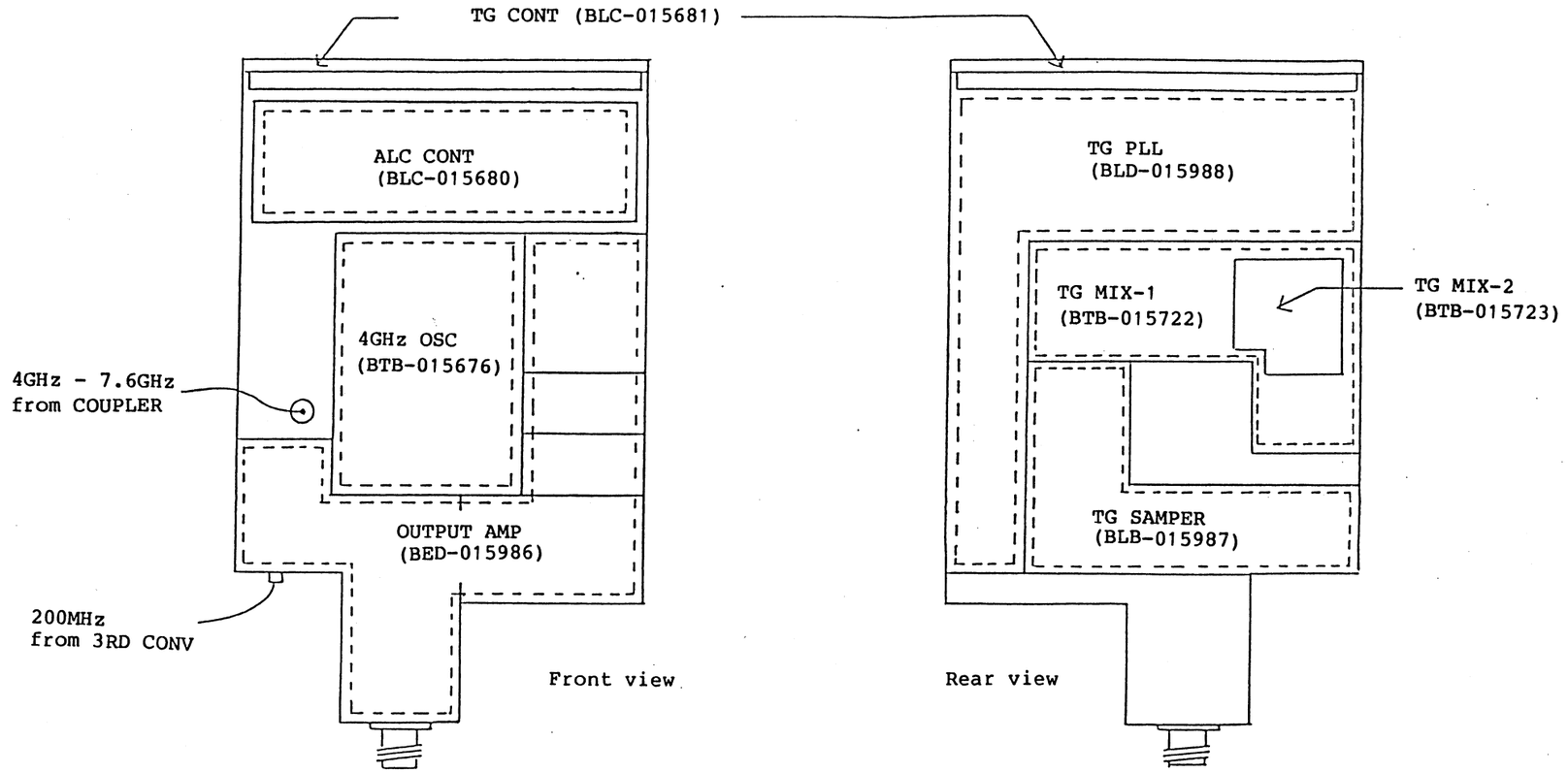


Figure 3-26 TG Block Internal View

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 : -20 dBm : 50Ω :70dB or less for -20dB 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	: 2×10^{-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.

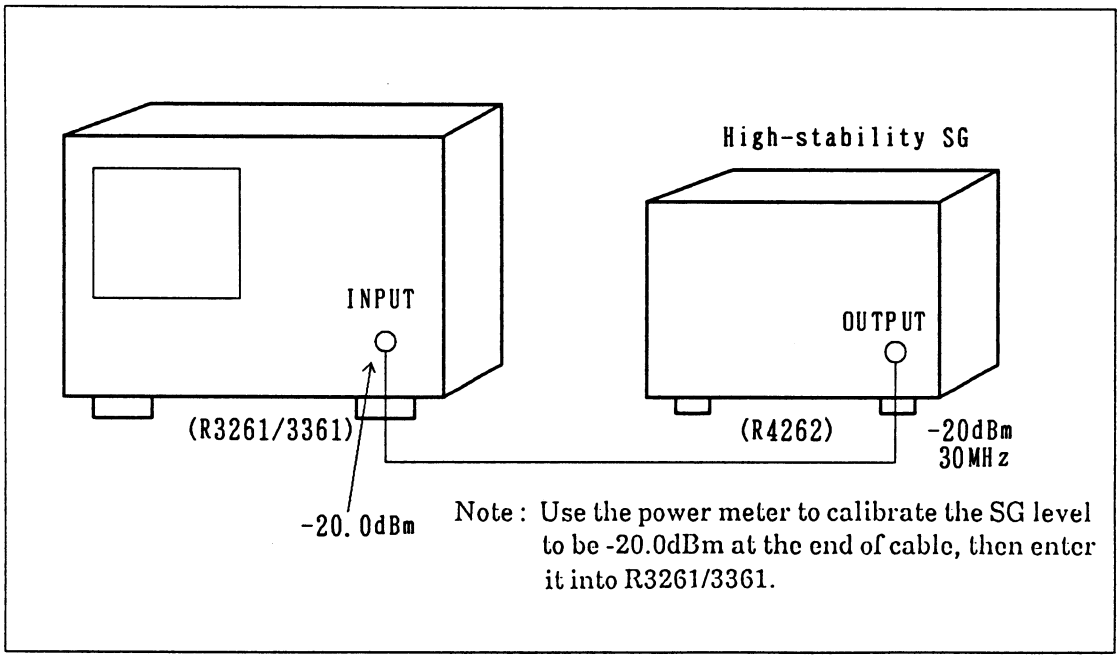
③ Adjust the REF LEVEL so that the spectrum of the signal appears at the center of the screen.

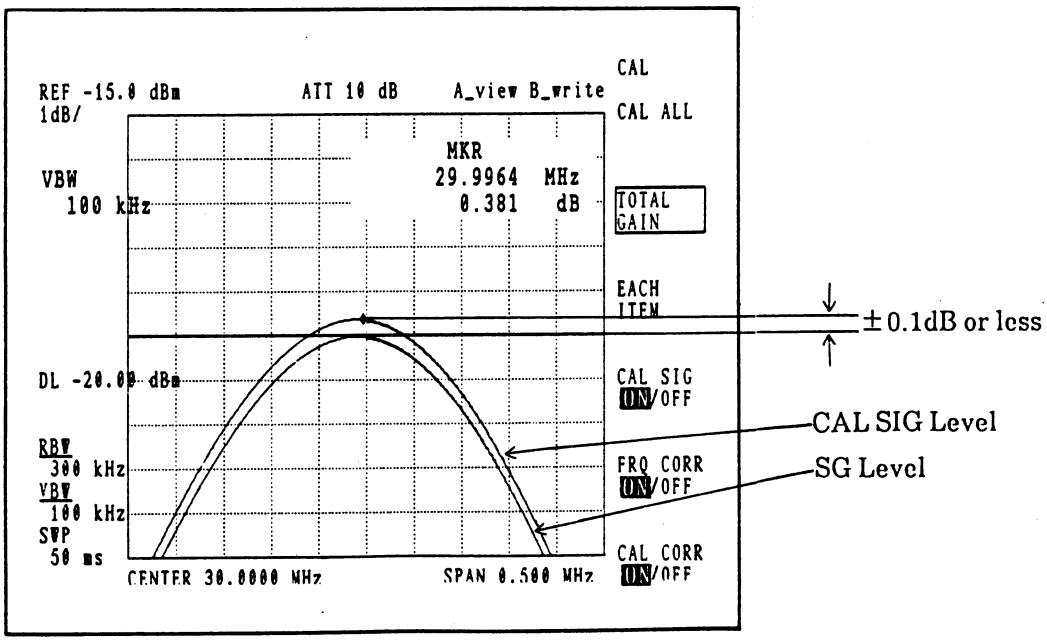
④ Remove the cable that is connected to the external signal generator. Make the CAL SIG (at -20.0dBm) appear on the screen.

SHIFT | 7 | CAL SIG ON/OFF

(SOFT KEY 4)

⑤ Check that the difference is within ±0.1dB between the levels of the signal at the input from SG and the CAL SIG. If not, make adjustments according to "5.4.2 Calibration Signal Level".





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:

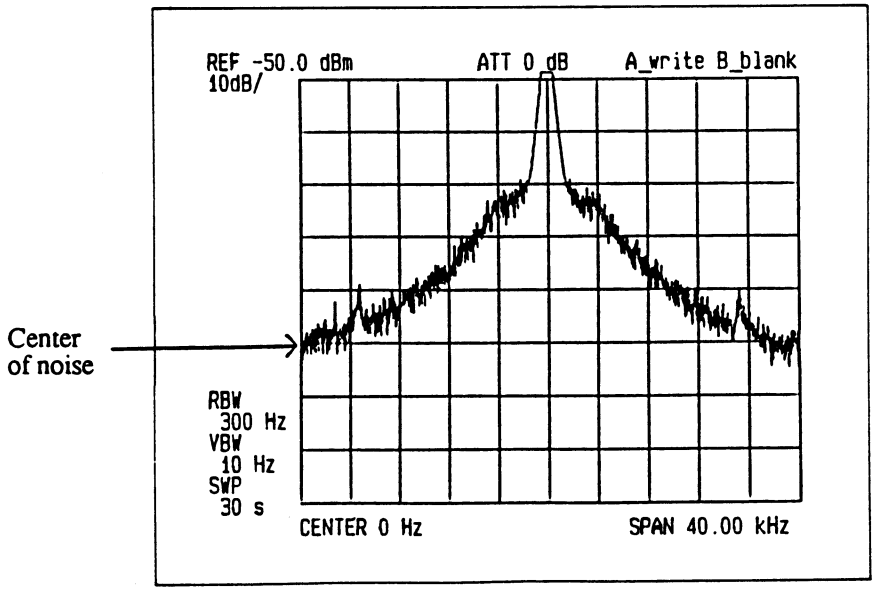
REF LEVEL : -50dBm

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
$|Y| - |X| + 23\text{dBc/Hz} \leq -105\text{dBc/Hz}$



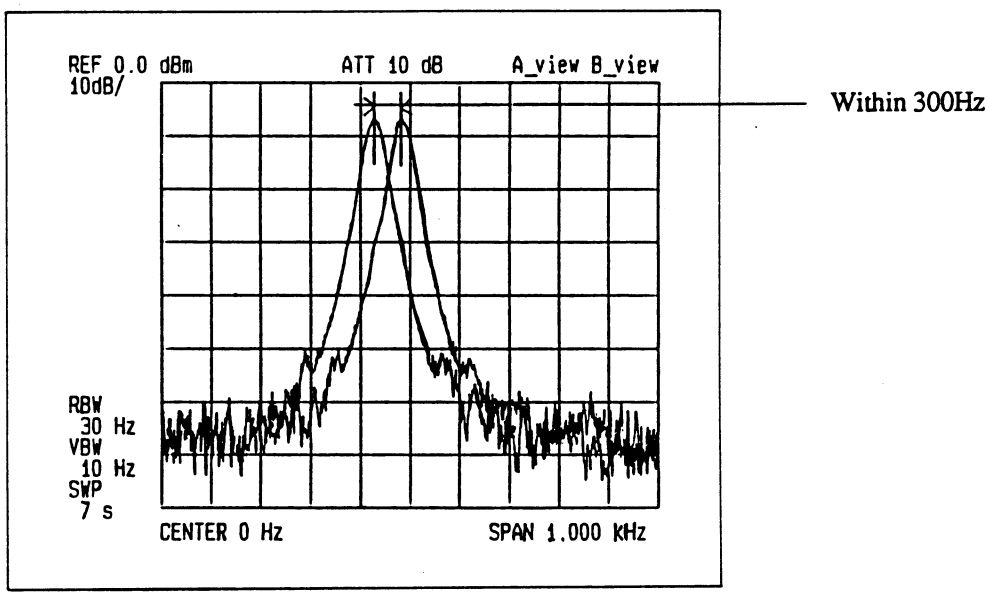
4.3.2 Testing Frequency Drift

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

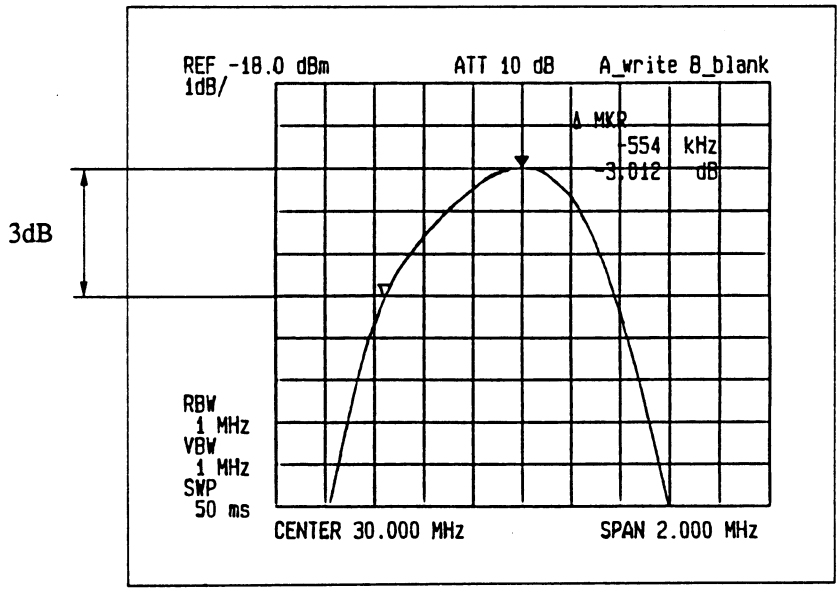
① Preset and then set the spectrum analyzer to the following settings:

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.

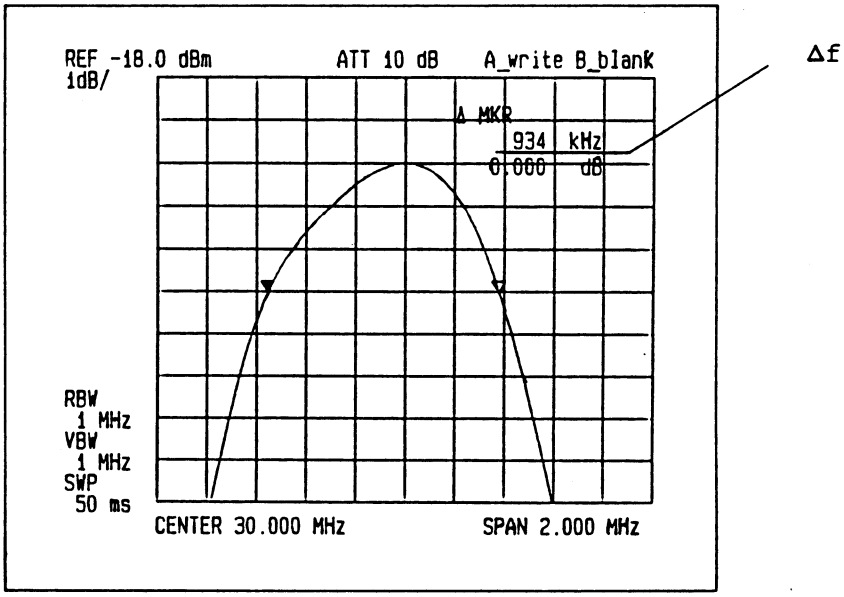


④ Set the spectrum analyzer as follows:

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

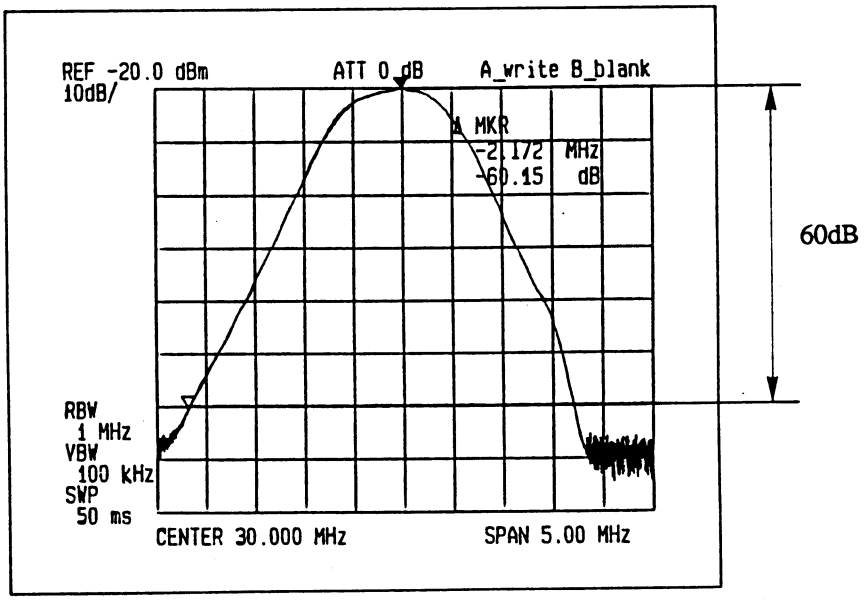
① From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	30MHz
FREQ SPAN	:	5MHz
RBW	:	1MHz
VBW	:	100kHz
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.

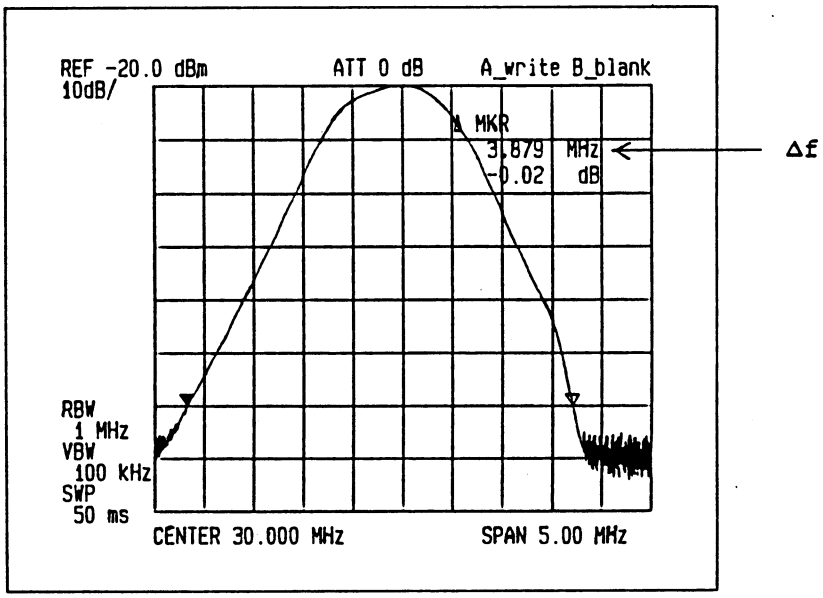


④ Set the spectrum analyzer as follows:

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
RBW [Hz]	100k	100k	100k

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 band width	Charging time constant	Discharging time constant	Mechanical time constant
10kHz to 150kHz	20Hz	45ms	500ms	160ms
150kHz to 30MHz	9kHz	1ms	160ms	160ms
30MHz to 300MHz	120kHz	1ms	550ms	100ms
300MHz to 1GHz	110kHz	1ms	550ms	100ms

Procedure

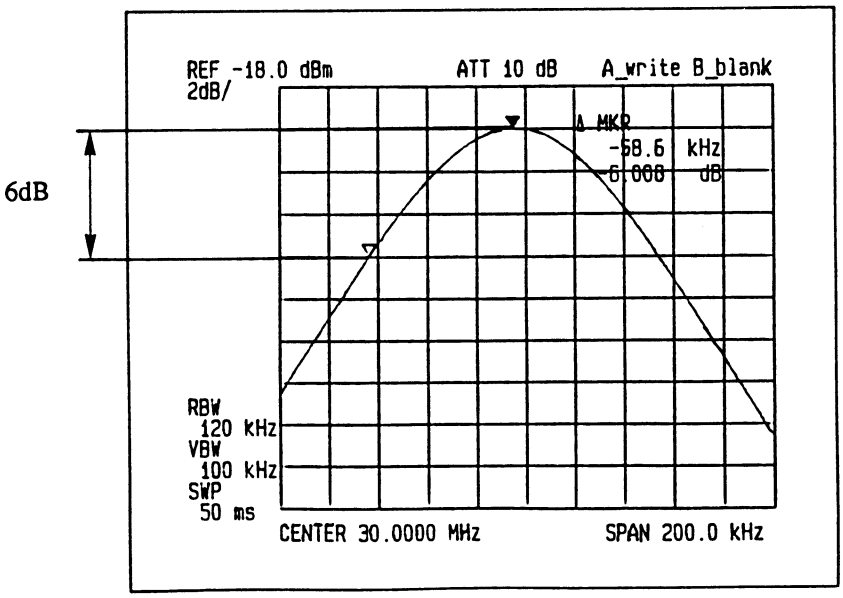
① From the preset condition, set the spectrum analyzer as follows:

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.

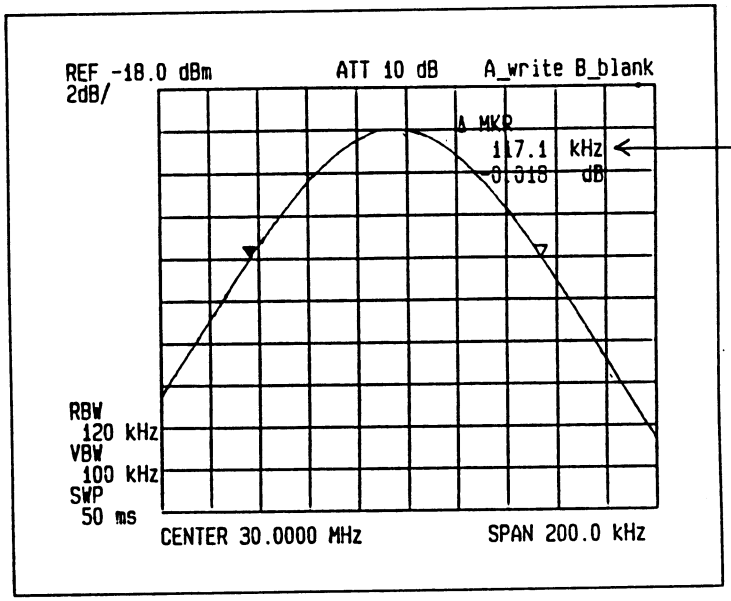


Cont'd

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 120kHz ±20%.

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 ±20Hz.

4.3.8 Testing Average Noise Level

Procedure

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

ATT	:	0dB
REF LEVEL	:	-70dBm
SWEEP TIME	:	50sec
RBW	:	300Hz
VBW	:	1Hz
START FREQ	:	50MHz
STOP FREQ	:	3600MHz
TRIGGER	:	SINGLE

② Make a sweep by pressing the SINGLE switch.

③ At completion of the sweep, set the spectrum analyzer as follows:

MARKER	:	PEAK

④ Confirm that the noise level at the frequency, in GHz, determined in step③above 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 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

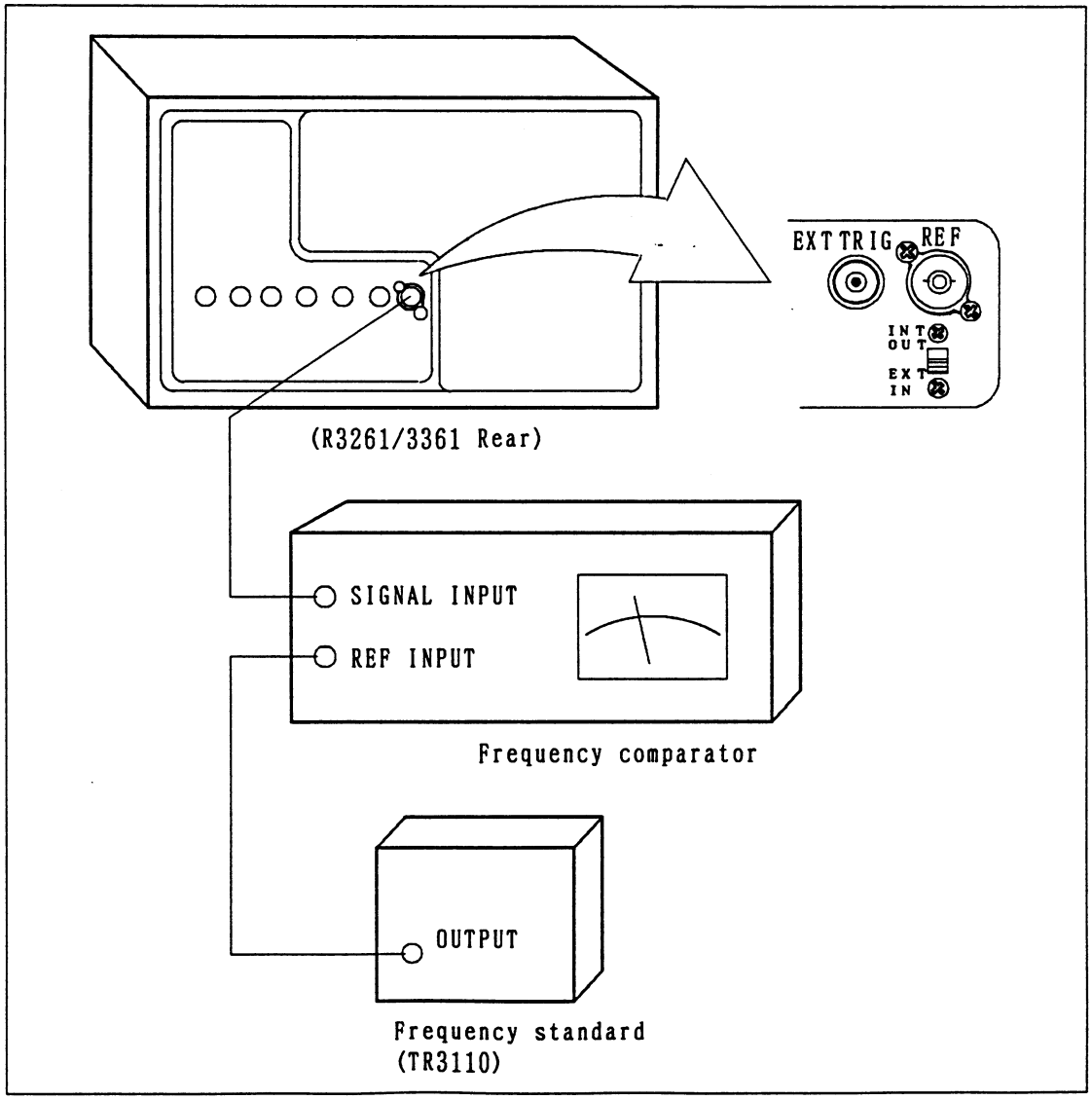
RBW [Hz]	1M	300k	100k	30k	10k	3k	1k	300k	100k	30k
FREQ SPAN [Hz]	2M	500k	200k	50k	20k	5k	2k	1k	1k	1k

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

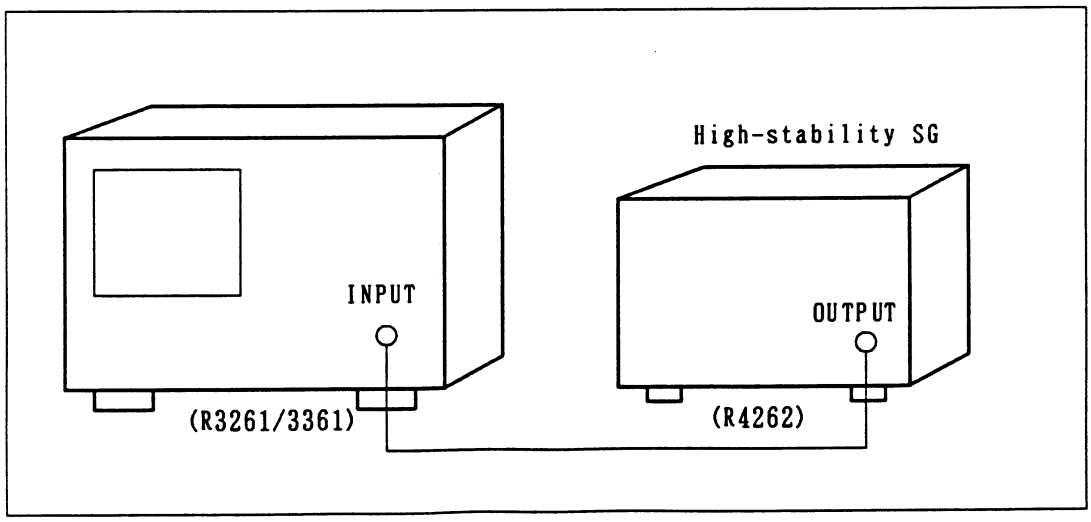
② Input a 30MHz, -10dBm signal-generated signal to the spectrum analyzer. The signal generator must have stability of 2×10^{-8} or better.

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

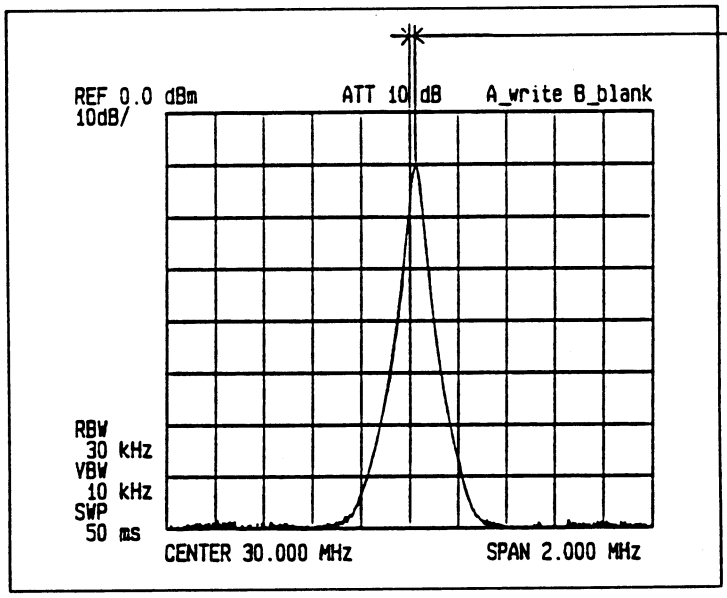
④ Set the spectrum analyzer to the following settings, and confirm that the position of the spectrum peak is still within the specification.

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)



Cont'd



Confirm that the position of the spectrum peak is within the specification

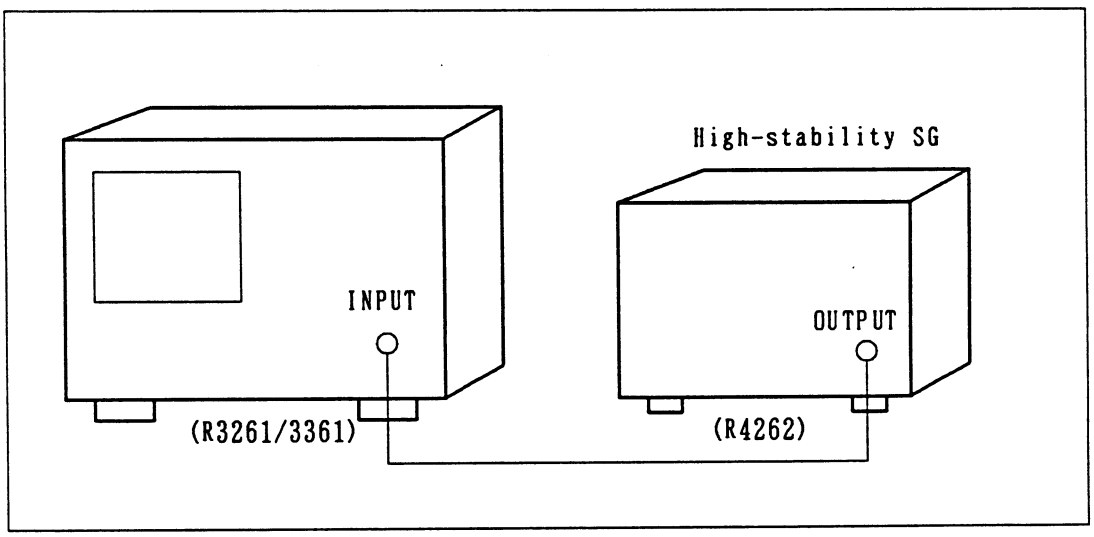
4.4.3 Testing Stability of Frequency Span

Procedure

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

CENTER FREQ : 1GHz
FREQ SPAN : 2GHz

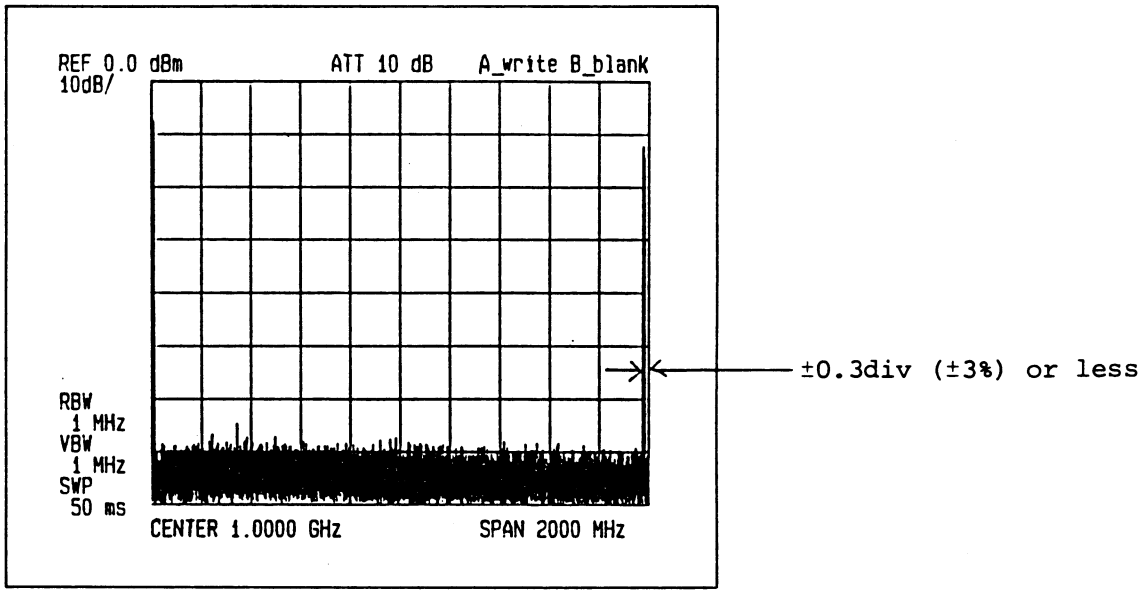
② Input to the spectrum analyzer a 2GHz, -10dBm signal from an external signal generator.



③ Adjust the CENTER FREQ so that the zero spectrum is at the left end of the scale.

④ Confirm that the difference between the 2GHz spectrum and the right scale end is within ±0.3 div. (within ±3%). If not, make adjustments according to "5.4. 1 (1) Main Span (2GHz)".

Cont'd



⑤ Set the spectrum analyzer as follows:

CENTER FREQ : 5MHz
FREQ SPAN : 10MHz

⑥ Adjust the CENTER FREQ so that the peak of the zero spectrum is at the left end of the scale.

⑦ Input a 10MHz, -10dBm signal from an external signal generator to the spectrum analyzer. Confirm that the difference between the 10MHz spectrum and the right end of the scale is within ±0.3 div. (±3%). If not, make adjustments according to "5.4.1 (2) 10MHz SPN".

⑧ Set the spectrum analyzer to the following settings:

CENTER FREQ : 1MHz
FREQ SPAN : 2MHz

Then input a 2MHz, -10dBm signal from an external signal generator to the spectrum analyzer. Confirm that the difference between the 2MHz spectrum and the right end of the scale is within ±0.5 div. (±5%). If not, make adjustments according to "5.4.1 (3) 2MHz SPAN".

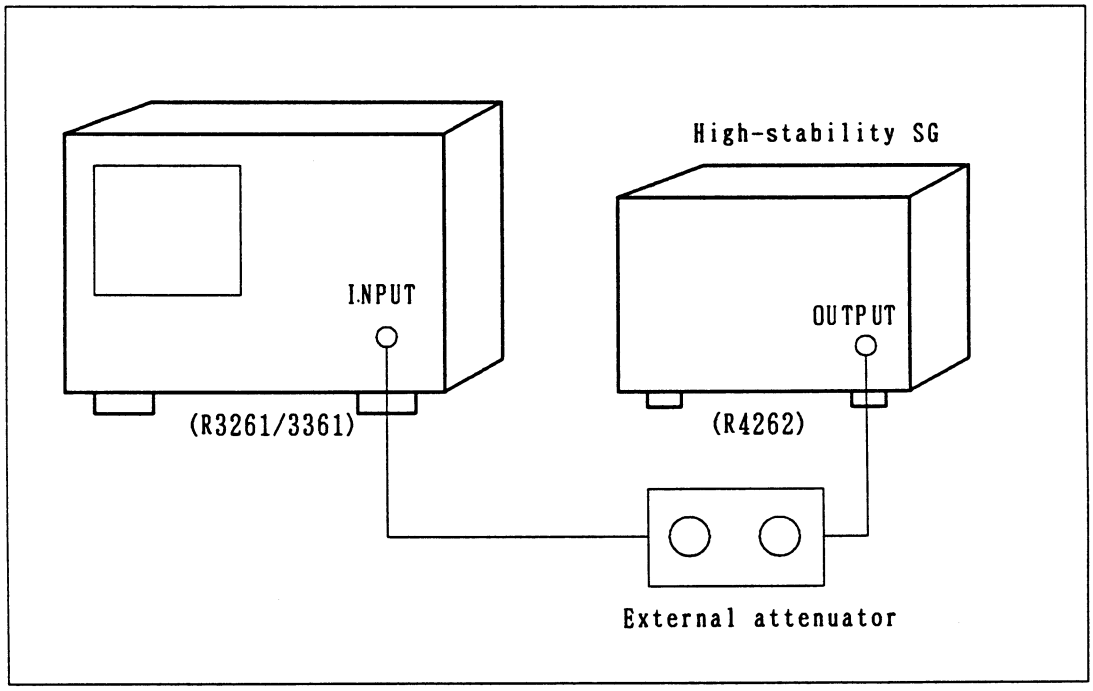
4.4.4 Testing LOG Linearity

Procedure

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

CENTER FREQ	:	30MHz
SPAN	:	2MHz
RBW	:	300kHz
REF LEVEL	:	-10dBm
dB/div	:	1dB/div

② Connect a signal generator to the spectrum analyzer through an external attenuator.

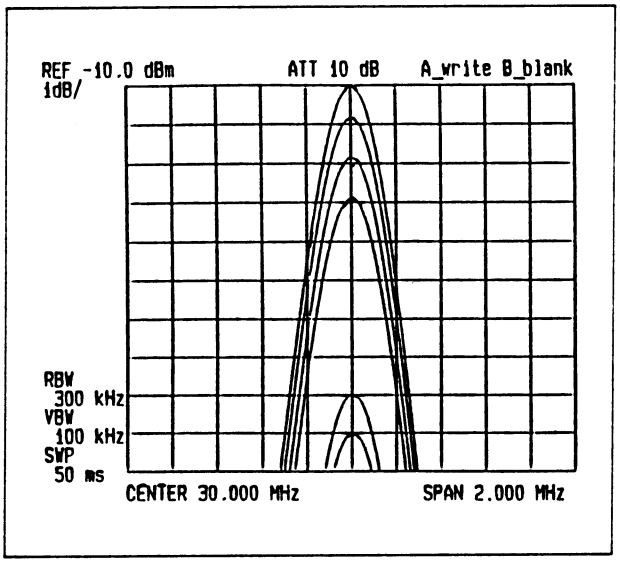


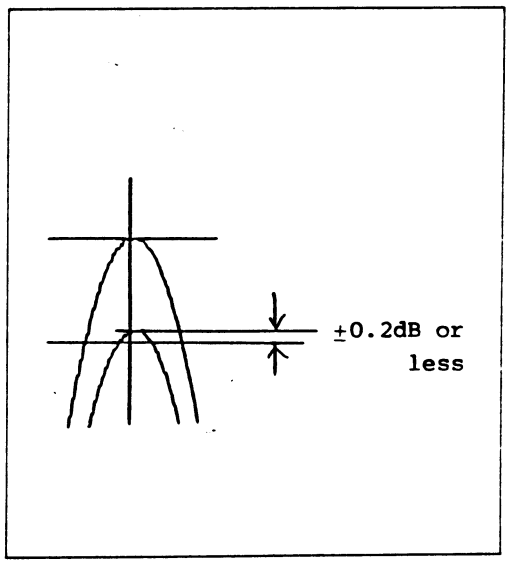
③ Input a 30MHz, - 10dBm signal from the signal generator to the spectrum analyzer.

④ Adjust the output level of the signal generator so that the spectrum peaks at -10dBm when the attenuator is set to 0dB.

⑤ Confirm that the deviation in peak level as read on the screen is within ±0.2dB (±0.2div) while the attenuator setting is incremented by 1dB.

Cont'd





⑥ Set the spectrum analyzer to the following settings:

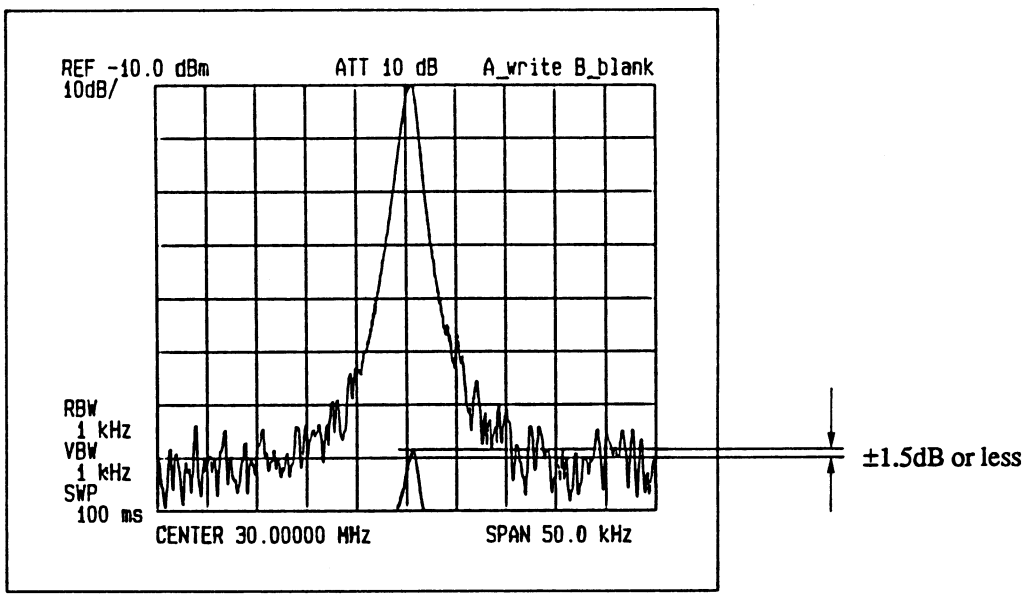
dB/div	:	10dB/
SPAN	:	50kHz
RBW	:	1kHz

⑦ Adjust the output level of the signal generator so that the spectrum peaks at -10dBm when the attenuator is set to 0dB.

⑧ Confirm that the deviation in peak level as read on the screen is within ±1dB (±0. 1 div) while the attenuator setting is incremented by 10dB.

⑨ Confirm that the spectrum peaks at -80dBm ±1. 5dB when the attenuator is set to 70dB. If not, make adjustments according to "5.4.5 (1) Adjusting LCG AMP".

Cont'd



⑩ Set the spectrum analyzer to the following settings:

CENTER FREQ	:	50MHz
FREQ SPAN	:	1kHz
RBW	:	30Hz
ATT	:	-10dBm

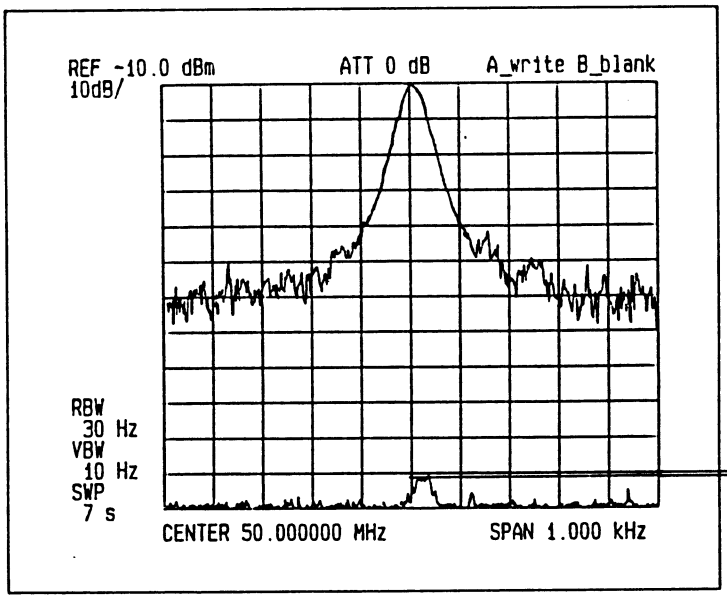
12div display

⑪ Input a 50MHz, -10dBm signal from the signal generator to the spectrum analyzer.

⑫ Adjust the output level of the signal generator so that the spectrum peaks at -10dBm when the attenuator is set to 0dB.

⑬ Confirm that the spectrum peaks at -120dBm ±2dB when the attenuator is set to 110dB.

Cont'd


REF -10.0 dBm
10dB/
ATT 0 dB
A_write B_blank
RBW
30 Hz
VBW
10 Hz
SWP
7 s
CENTER 50.000000 MHz
SPAN 1.000 kHz
±2dB or less.

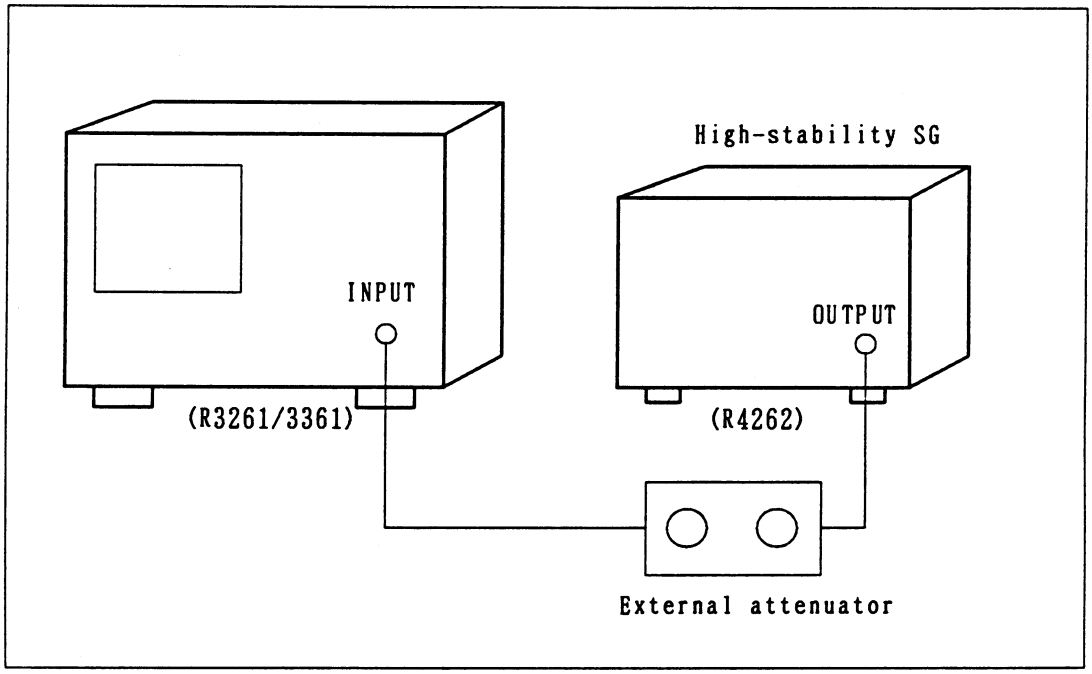
4.4.5 Testing LIN Linearity

Procedure

① Set the spectrum analyzer as follows from the preset condition.

CENTER FREQ : 30MHz
SPAN : 2MHz
RBW : 100kHz
REF LEVEL : -10dBm
LINEAR DISPLAY MODE

② Connect a signal generator to the spectrum analyzer through an external attenuator.



③ Set the signal generator so that it puts out a 30MHz, -10dBm signal.

④ Adjust the output level of the signal generator so that the spectrum peaks at the uppermost scale on the screen.

⑤ Using the marker, read the peak level of the spectrum.

⑥ Set the attenuator to 6dB, and read the peak level of the spectrum using the marker.

⑦ Obtain the LIN linearity from the values determined in steps ⑤ and ⑥ above. Confirm that the LIN linearity thus obtained is 100±5%.

LIN linearity (%) = 2 x value in step ⑥/value in step ⑤ x 100

If the linearity is out of specification, make adjustments according to "5.4.1 (1) Adjusting LOG AMP".

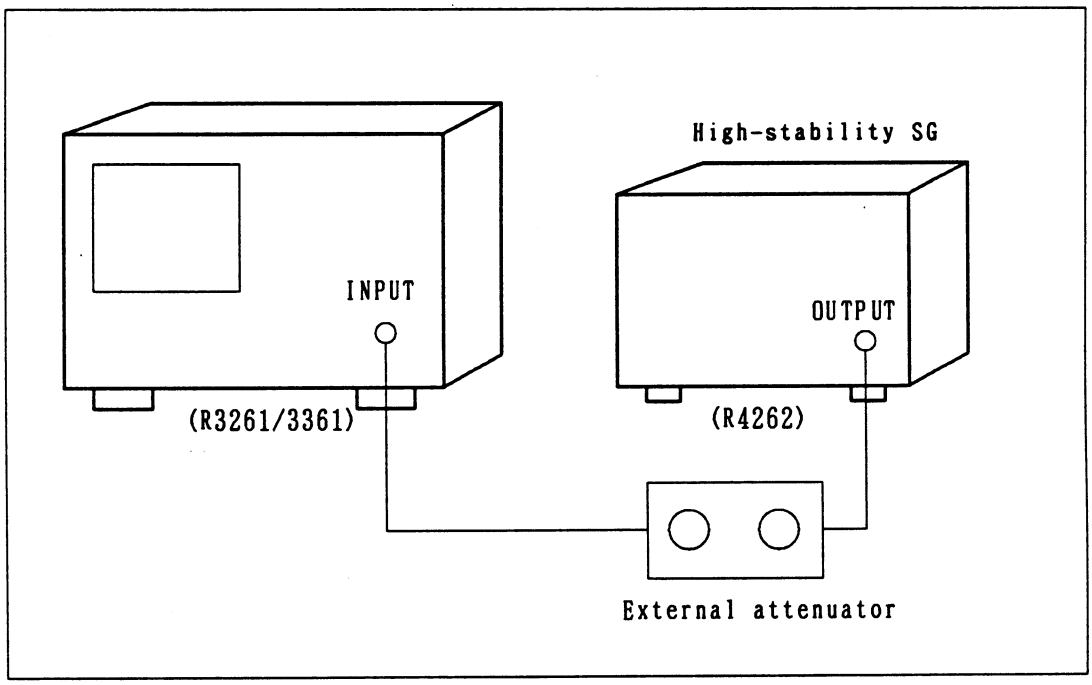
4.4.6 Testing Stability of Reference Level

Procedure

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

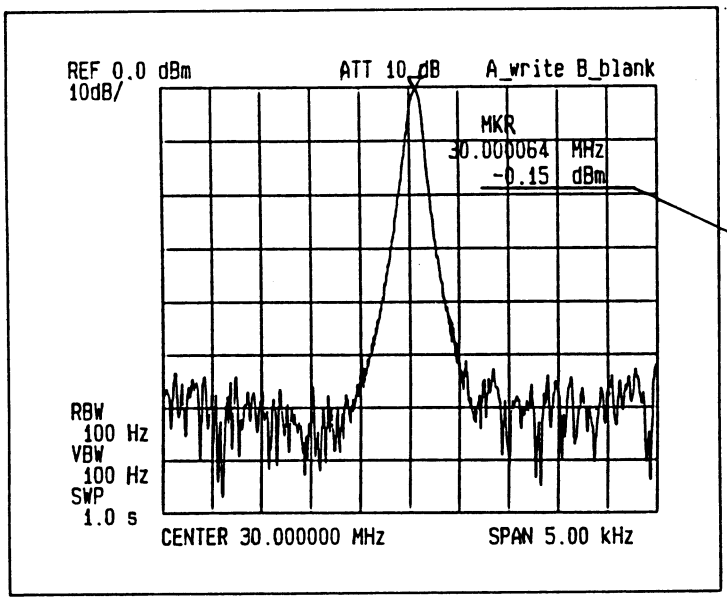
CENTER FREQ	:	30MHz
FREQ SPAN	:	5kHz
ATT	:	10dB
REF LEVEL	:	0dBm

② Input a 30MHz, 0dB signal from a signal generator through an external attenuator to the spectrum analyzer .



③ Set the attenuator to 0dB, and read the peak level of the input waveform using the marker. Confirm that this level is within ±0.3dB of the REF LEVEL setting.

Cont'd



④ Change the REF LEVEL and attenuator settings as shown in Table 4-9 and confirm that the deviation from each setting is within ±0.3dB. If not, make adjustments according to "5.4.3 Resolution Band Switching Between".

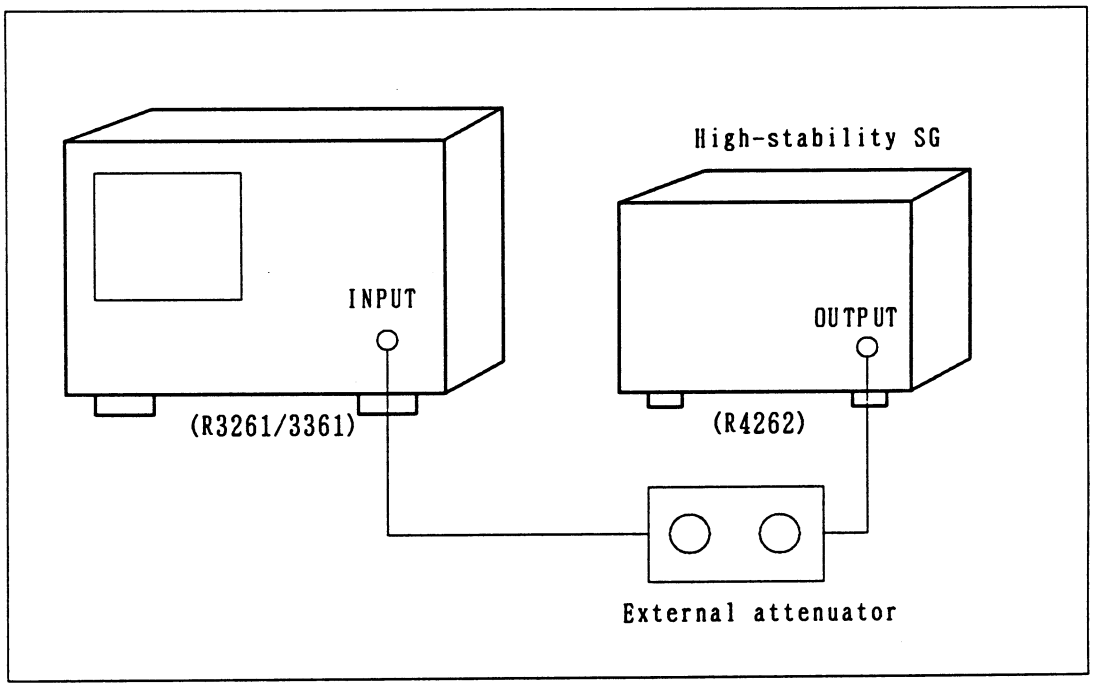
Table 4-9 REF LEVEL and External Attenuator Settings

REF LEVEL [dBm]	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
External attenuator [dB]	0	10	20	30	40	50	60	70	80	-90

4.4.7 Testing Stability of Input Attenuator Changeover

Procedure

① Input a 50MHz, -10dBm signal from a signal generator to the spectrum analyzer through an external attenuator set to 40dB.



② From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	50MHz
FREQ SPAN	:	10kHz
RBW	:	3kHz
ATT	:	10dB
dB/div	:	1dB/
REF LEVEL	:	-45dBm

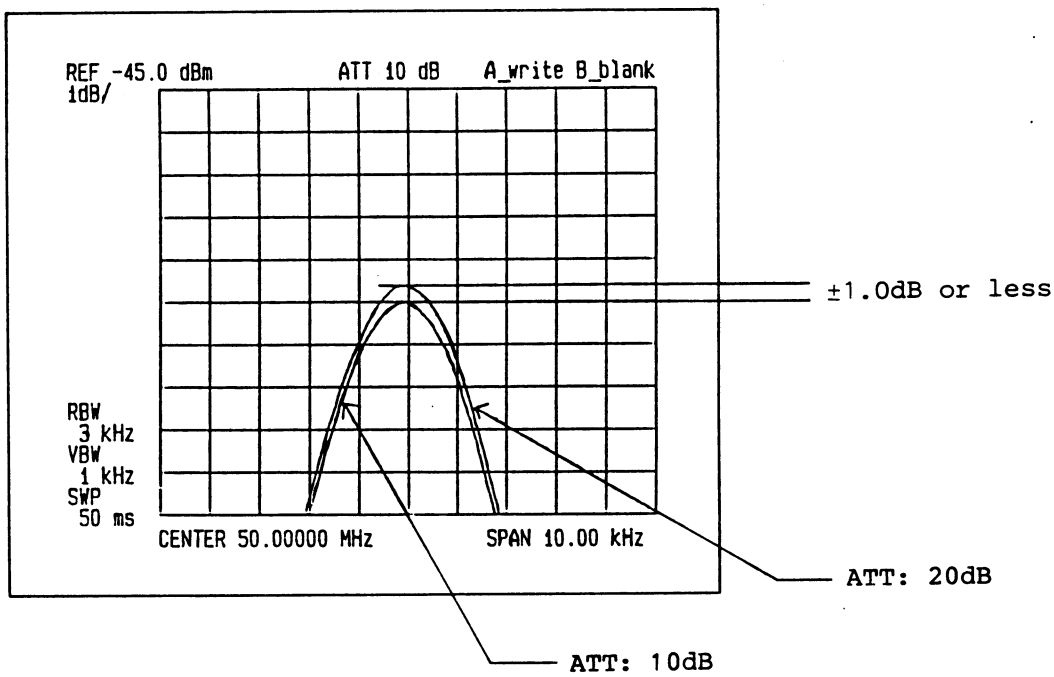
③ Adjust the output level of the signal generator so that the spectrum peaks at the center of the screen.

④ Set the attenuator to 30dB, and set the spectrum analyzer to the following settings:

ATT	:	20dB
REF LEVEL	:	-35dBm

Then confirm that the difference between the current indication and the indication for the 10dB attenuation is with ±1.0dB.

Cont'd



⑤ Change the ATT, external attenuator and REF LEVEL settings as shown in Table 4-10. Confirm that the stability of the input attenuator changeover is within ±1.0dB of the 10dB ATT setting.

Table 4 - 10 Testing Stability of Input Attenuator Changeover

ATT [dB]	10	20	30	40	50
External attenuator [dB]	40	30	20	10	0
REF LEVEL [dBm]	45	-35	-25	-15	-5

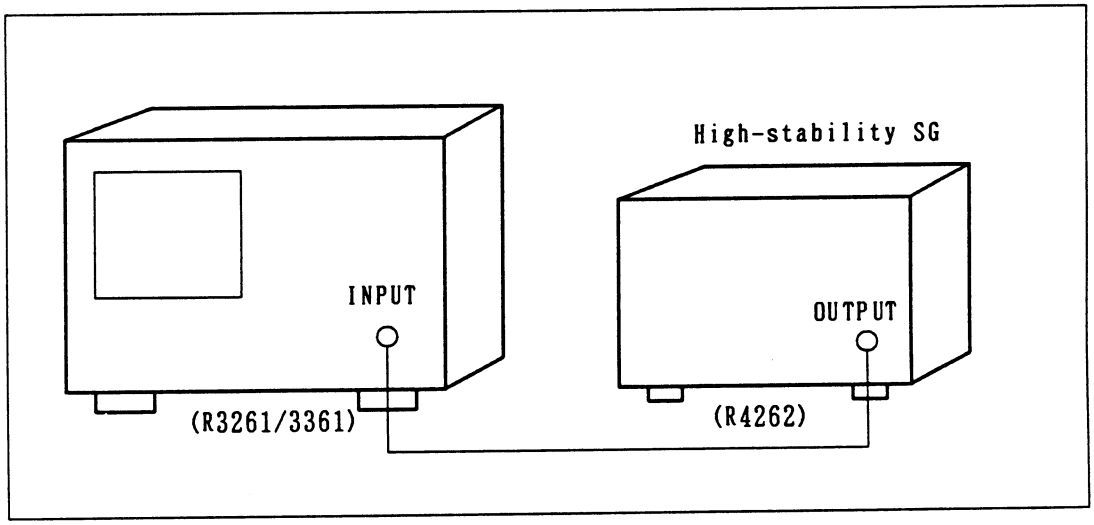
4.4.8 Testing Frequency Response

Procedure

① Set the spectrum analyzer as follows from the preset condition:

ATT	:	10dB
dB/div	:	1dB/
CENTER FREQ	:	1GHz
SPAN	:	2GHz
REF LEVEL	:	-15dBm

② Input a signal of -20dBm at a frequency of between 100kHz and 2GHz to the spectrum analyzer and confirm that the deviation as read on the screen for each frequency is within ±1dB.

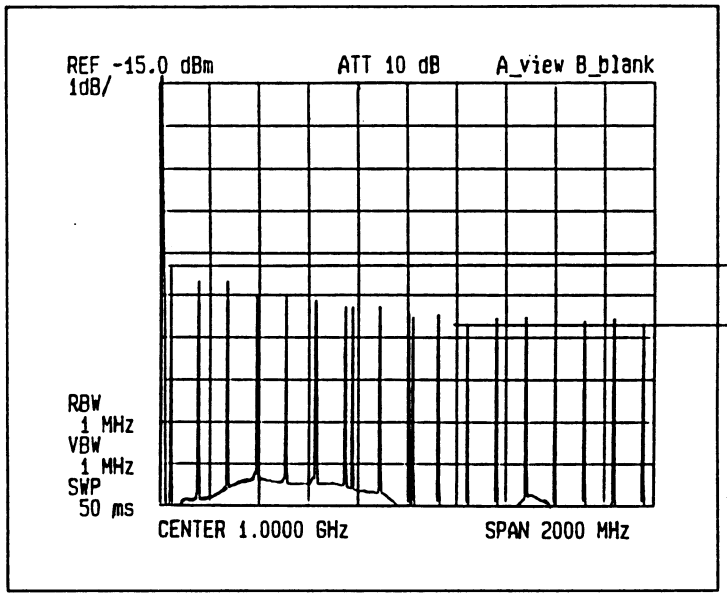


③ Set the spectrum analyzer to the following settings:

START FREQ	:	0MHz
STOP FREQ	:	3.6GHz

④ Input to the spectrum analyzer a signal of -20dBm at a frequency between 9kHz and 3.6GHz, and confirm that the deviation as read on the screen for each frequency is within ±2dB.

Cont'd



Confirm that the deviation for each frequency is within ±2dB

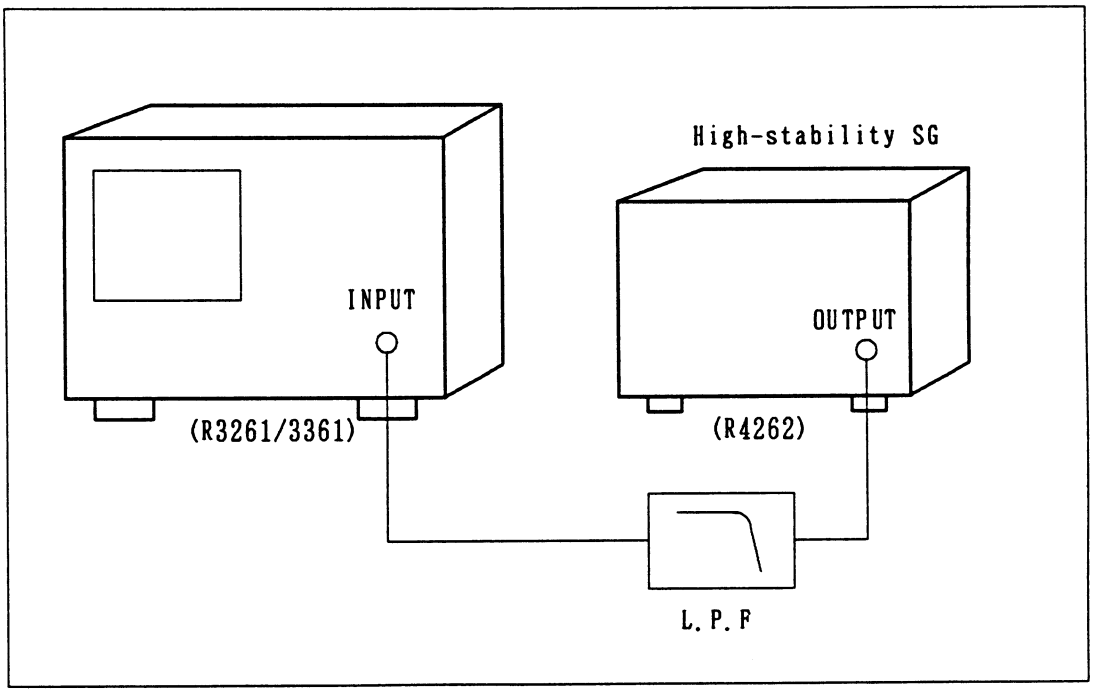
4.4.9 Testing Spurious Response

Procedure

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

CENTER FREQ	:	500MHz
FREQ SPAN	:	1000MHz
FREQ LEVEL	:	-20dBm
RBW	:	100kHz
VBW	:	10kHz
ATT	:	0dB

② Input a signal of -20dB from a low-distortion signal generator to the spectrum analyzer. A signal from a signal generator with a low-pass filter capable of reducing the level of the second harmonics by a least 70dB will also work.



③ Change the output frequency of the low-distortion signal generator from 10MHz to 500MHz and confirm that the signal level of the second harmonics is lower than that of the reference waveform by at least 60dB (equivalent to 70dB for -30dBm input).

Cont'd

④ For low-distortion signal generator frequencies of 500MHz or over, change the setting of the spectrum analyzer as shown in Table 4-11.

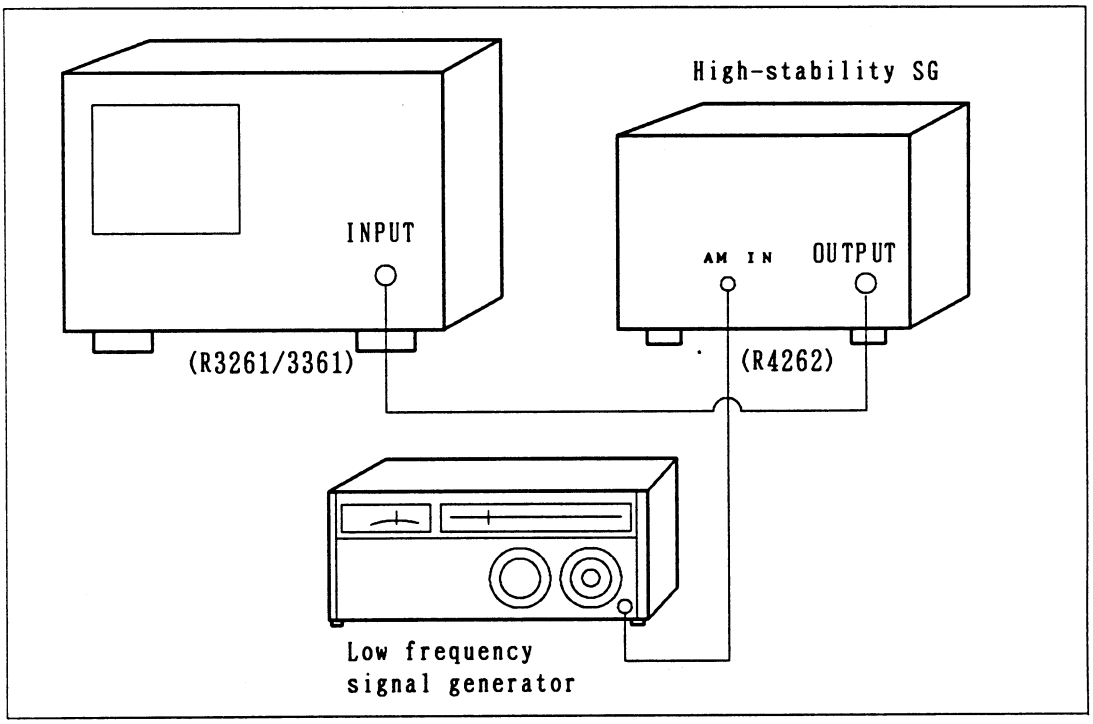
Table 4-11 CENTER FREQ AND SPAN for Dynamic Range Test

Frequency [MHz]	R3261A/B R3361a/B Set	
	CENTER FREQ [GHz]	SPAN [GHz]
10 to 500	0.5	1
500 to 1000	1.5	1
1000 to 1500	2.5	1
1500 to 1800	3.5	0.6

4.4.10 Testing Stability of Sweep Time

Procedure

① Input a 30MHz, -5dBm, amplitude-modulated signal (100Hz, 30% modulation) from the signal generator to the spectrum analyzer.

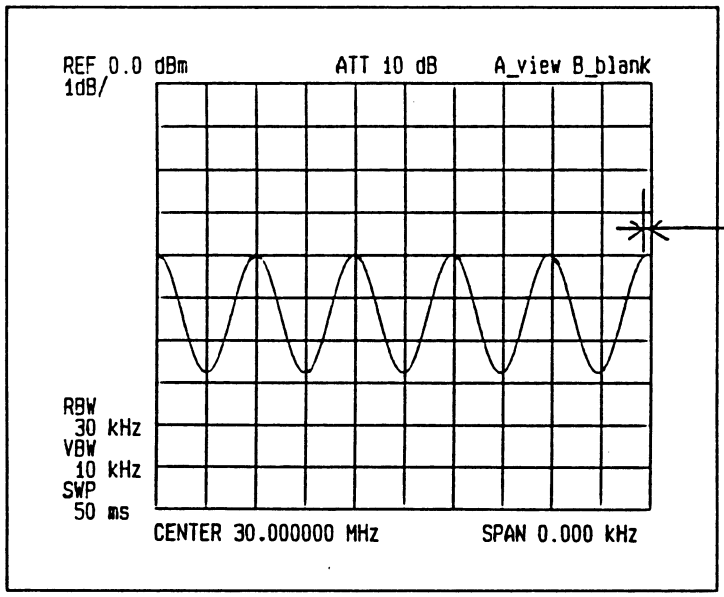


② From the preset condition, set the spectrum analyzer as follows:

CENTER FREQ	:	30MHz
SPAN	:	0kHz
RBW	:	30kHz
dB/div	:	1dB
TRIGGER	:	VIDEO
SWEEP TIME	:	50ms

③ Confirm that there are 5 cycles ±3/20 cycles (±1. 5ms, ±0.3div.) of the amplitude-modulated waveform on the screen.

Cont'd


REF 0.0 dBm
1dB/
ATT 10 dB
A_view B_blank
RBW
30 kHz
VBW
10 kHz
SWP
50 ms
CENTER 30.000000 MHz
SPAN 0.000 kHz
±1.5ms (±3%) or less

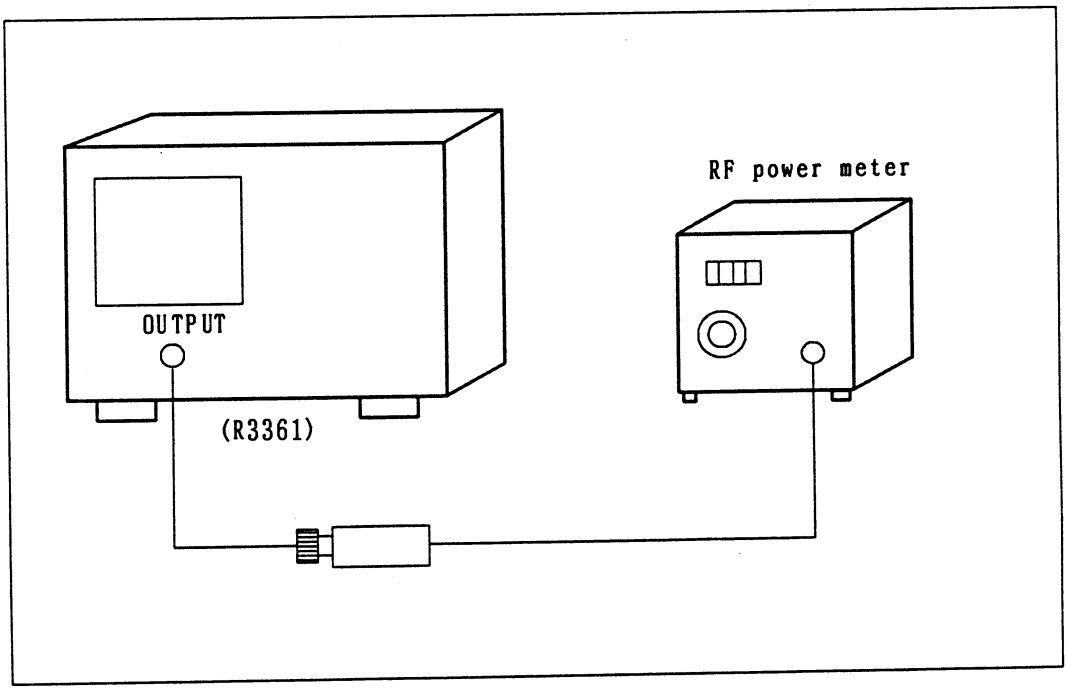
4.4.11 Testing Stability of TG Output Level (For R3361A/B only)

Procedure

① Reset and then set the spectrum analyzer (R3361A/B only) to the following settings:

CENTER FREQ	:	30MHz
FREQ SPAN	:	0Hz
TG	:	ON
TG LEVEL	:	-10dBm

② Connect an RF power meter to the spectrum analyzer at the TG OUTPUT to measure the TG output level. Confirm that the TG output level is -10dBm ±0.5dB. If not, make adjustments according to "5.4.6 (1) Adjusting 1dB Attenuator Output Level Stability".



4.4.12 Testing TG Frequency Response (for R3361A/B only)

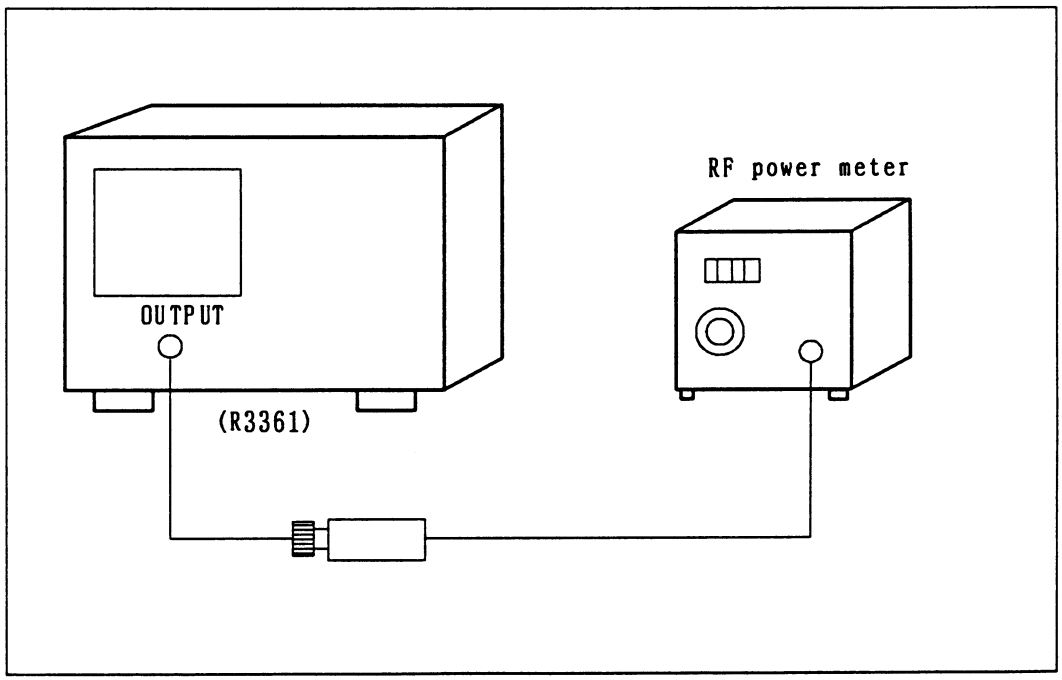
Procedure

① Reset and then set the spectrum analyzer (R3361A/B only) to the following settings.

CENTER FREQ	:	30MHz
FREQ SPAN	:	0Hz
TG	:	ON
TG LEVEL	:	-10dBm

② Connect an RF power meter with the spectrum analyzer at the TG output.

③ Confirm that the TG output level is - 10dBm ±0.7dB when the CENTER FREQ of the R3361A/B is changed in a range of 100kHz to 1.0GHz.



④ Confirm that the TG output level is -10dBm ±2.0dB when the CENTER FREQ of the spectrum analyzer is changed in a range of 9kHz to 2.6GHz.

⑤ Confirm that the TG output level is -10dBm ±2.0dB when the CENTER FREQ of the spectrum analyzer is changed in a range of 9kHz to 3.6GHz.

4.4.13 Testing Stability of TG Output Level Changeover (For R3361A/B only)

Procedure

① Reset and then set the spectrum analyzer (R3361A/B only) to the following settings.

CENTER FREQ	:	30MHz
FREQ SPAN	:	0Hz
TG	:	ON
TG LEVEL	:	-10dBm

② Connect an RF power meter to the spectrum analyzer to measure the TG output level.

③ Set the TG LEVEL to -15dBm, and take reading on power meter.

④ Confirm that the difference between the readings of steps③ and④ above is 5dB±1dB.

⑤ For a range from 0dBm to -50dBm of the TG output level, test according to Table 4-12.

Table 4-12 Stability of TG output Level Changeover

TG LEVEL [dBm]	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
Output level difference. at -10dBm setting	+10 ±1	+5 ±1	0	-5 ±1	-10 ±1	-5 ±1	-20 ±1	-25 ±1	-30 ±1	-35 ±1	-40 ±1

⑥ Perform steps ② to ④ for 1. 5GHz and 3.0GHz center frequencies. The deviations for 1.5GHz and 3.0GHz must be within ±2dB and ±3dB respectively.

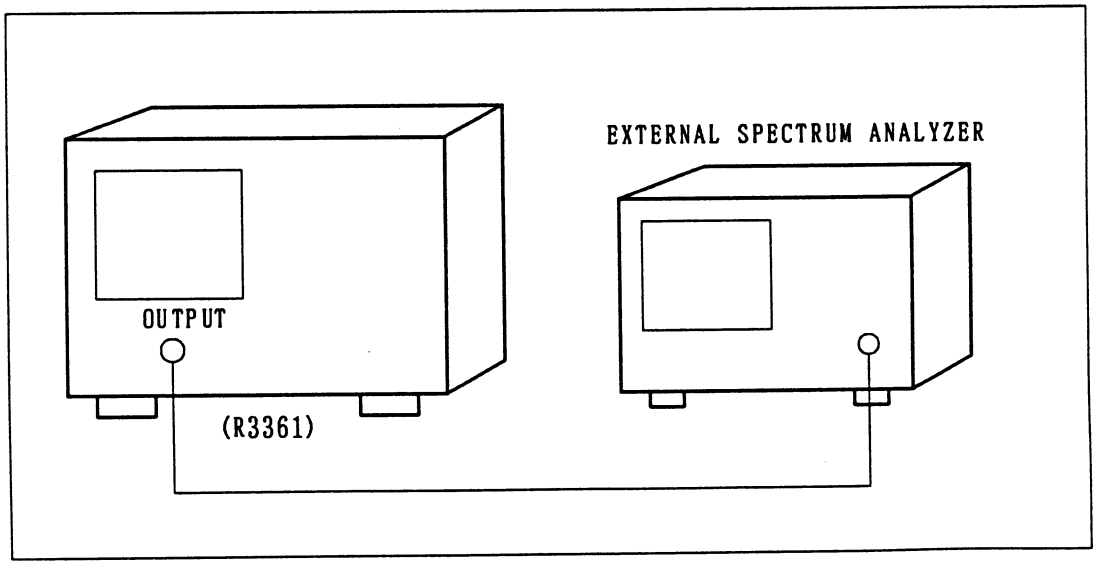
4.4.14 Testing Output Spurious (For R3361A/B only)

Procedure

① Reset and then set the spectrum analyzer (R3361A/B only) to the following settings.

CENTER FREQ	:	30MHz
FREQ SPAN	:	0Hz
TG	:	ON
TG LEVEL	:	0dBm

② Connect an external spectrum analyzer to the R3361A/B at the TG OUTPUT.



③ Change the center frequency to up to 3.6GHz for the R3361B, or 2.6GHz for the R3361A, and confirm that the harmonics spurious is lower than the basic waveform by at least -20dBc and that the non-harmonics spurious is lower by at least -30dBc.

4.4.15 Testing TG Leak (For R3361 A/B only)

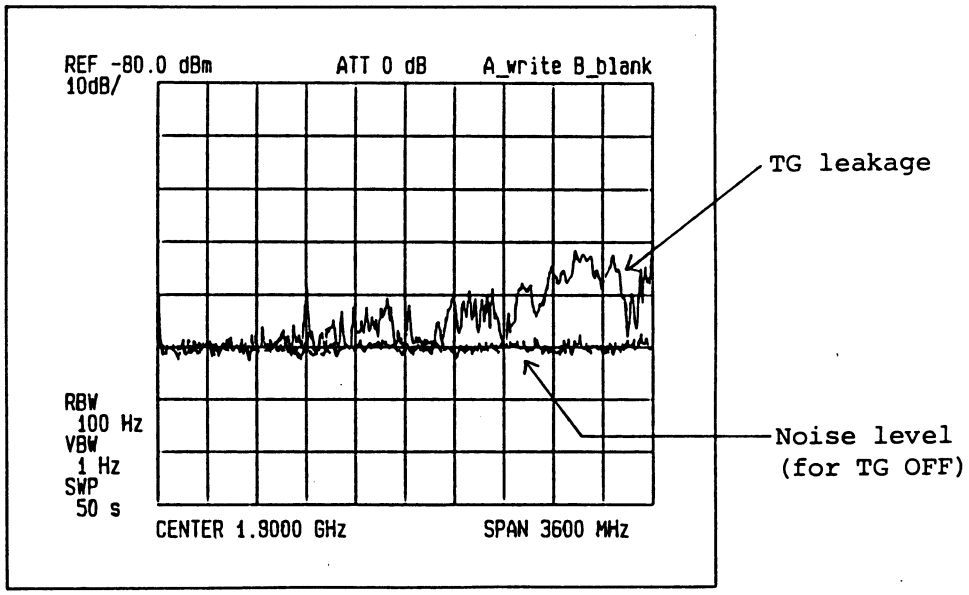
Procedure

① Reset and then set the spectrum analyzer (R3361A/B only) to the following settings.

REF LEVEL	:	-80dBm
SWP TIME	:	50sec
RBW	:	100Hz
VBW	:	1Hz
ATT	:	0dB
TG	:	ON
TG LEVEL	:	0dBm

② Execute the TG FREQ CAL (AUTO) to compensate for any tracking error. Make no connection to the INPUT or TG OUTPUT connector.

③ Confirm that TG leak is not more than -110dBm for up to 3GHz, and not more than -100dBm for up to 3.6GHz.



4.5 Test Report

The test report form for the spectrum analyzer is given below.

R3261A/B R3361A/B Test Report

Item		Specification	Measurement
1. CAL signal test			
1. CAL signal level		-20dBm ±0.1dB	dBm
2. Test using CAL signals			
1. Noise side band	20kHz offset	-105dBc/Hz	dBc/Hz
2. Frequency drift		300Hz/min.	
3. Stability of resolution bandwidth (3dB band width)	RBW 1 MHz	±20%	%
	RBW 300kHz		%
	RBW 3kHz		%
4. Resolution bandwidth selectivity (6dB : 3dB)	RBW 1 MHz	15 : 1	:
	RBW 300kHz		:
	RBW 3kHz		:
5. QP bandwidth stability (6dB bandwidth)	QP 200kHz	±20kHz	kHz
	QP 9kHz	±1kHz	kHz
	QP 200kHz	±20Hz	Hz
6. Marker indication stability (normal mode)	SPAN 20MHz	±1.05MHz	MHz
	SPAN 10MHz	±550kHz	kHz
	SPAN 2 MHz	±160kHz	kHz
7. Marker indication stability (counter mode)	SPAN 20Hz	±20Hz	Hz
8. Average noise level		-121dBm+1.55f	dBm
9. Residual response		-100dBm	dBm

R3261A/B R3361A/B Test Report

Item		Specification	Measurement
3. Test Using measuring equipment			
1. Reference oscillator stability		$\pm 2 \times 10^{-8}$	x10
2. Central frequency stability	SPAN 20MHz	±450kHz	kHz
	SPAN 10MHz	±250kHz	kHz
	SPAN 2MHz	±60kHz	kHz
3. Frequency span stability	SPAN 2GHz	±3%	%
	SPAN 10MHz	±3%	%
	SPAN 2MHz	±5%	%
4. LOG linearity		±0.2dB/1dB	dB
		±1.0dB/10dB	dB
		±1.5dB/70dB	dB
		±2.0dB/110dB	dB
5. LIN linearity		±5% of Full Scale	%
6. Reference level stability		±0.3dB	dB
7. Input attenuator changeover stability		±1.0dB	dB
8. Frequency response	100kHz to 2GHz	±1dB	dB
	9kHz to 3.5GHz	±2dB	dB
9. Spurious response		-70dBc	dBc
10. Sweep time stability		±3%	%
11. TG output level stability		±0.5dB	dB
12. TG output frequency respone	100kHz to 1GHz	±0.7dB	dB
	9kHz to 2.6GHz	±1.5dB	dB
	9kHz to 3.6GHz	±2.0dB	dB

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Item		Specification	Measurement
13. Stability of TG Output Level Changeover	9kHz to 1GHz	±1.0dB	dB
	9kHZ to 2.6 GHz	±2.0dB	dB
	9kHz to 3.6GHz	±3.0dB	dB
14. Output Spurious	High frequency	-20dB	dB
	Low frequency	-30dB	dB
15. TG leakage	to 3.0GHz	-110dBm	dBm
	to 3.6GHz	-100dBm	dBm