Contents

SPECTRUM ANALYZERS

3250 Series

Operating Manual

Document part no. 46892/974

SPECTRUM ANALYZERS
3250 SERIES
Operating Manual

3251	**1 kHz–3.0 GHz**
3252	**1 kHz–8.0 GHz**
3253	**1 kHz–13.2 GHz**
3254	**1 kHz–26.5 GHz**

Some of the features detailed in this manual may not be available in every model.

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About this manual

This manual explains how to use the 3250 Series Spectrum Analyzers.

Intended audience

People carrying out work relating to the design and manufacture of RF and microwave sub-systems and modules, or the installation and maintenance of those systems.

Familiarity with the terms used in RF and microwave measurements is assumed.

Structure

Chapter 1

Provides an introduction to the 3250 Series instruments. Also includes complete performance data and lists the versions, options and accessories available.

Chapter 2

Installation details, including location and safety observations.

Chapter 3

Describes connections to the front and rear panels of the instrument.

Chapter 4

Description of all the menus available on the instrument.

Chapter 5

Describes operation of the instrument.

Chapter 6

Performance test procedures to verify that the instrument is functioning correctly.

Chapter 7

Describes cleaning, storage and transportation of the instrument.

Chapter 8

Restoring the operating system.

Appendix A

Measurement guide, with details of how to perform measurements such as noise, low-level signals, and distortion products.

Document conventions

The following conventions apply throughout this manual:

CAPS Capitals are used to identify names of controls and panel markings.

[CAPS] Capitals in square brackets indicate hard key titles.

[Italics] Italics in square brackets indicate soft key titles.

Associated publications

- **3250 Series Programming Manual**
  (Printed version 46882/975, PDF version 46892/975)

Contents

Precautions

WARNING **CAUTION** **Note**

These terms have specific meanings in this manual:

WARNING **information to prevent personal injury.**

CAUTION **information to prevent damage to the equipment.**

Note **important general information.**

Symbols

The meaning of hazard symbols appearing on the equipment and in the documentation is as follows:

Symbol	Description
	Refer to the operating manual when this symbol is marked on the instrument. Familiarize yourself with the nature of the hazard and the actions that may have to be taken.
	Dangerous voltage
	Toxic hazard
	Static sensitive components

General conditions of use

This product is designed and tested to comply with the requirements of IEC/EN61010-1 'Safety requirements for electrical equipment for measurement, control and laboratory use', for Class I portable equipment and is for use in a pollution degree 2 environment. The equipment is designed to operate from an installation category II supply.

Equipment should be protected from the ingress of liquids and precipitation such as rain, snow, etc. When moving the equipment from a cold to a hot environment, it is important to allow the temperature of the equipment to stabilize before it is connected to the supply to avoid condensation forming. The equipment must only be operated within the environmental conditions specified in Chapter 1 in the Operating Manual, otherwise the protection provided by the equipment may be impaired.

This product is not approved for use in hazardous atmospheres or medical applications. If the equipment is to be used in a safety-related application, e.g. avionics or military applications, the suitability of the product must be assessed and approved for use by a competent person.

WARNING

Electrical hazards (AC supply voltage)

This equipment conforms with IEC Safety Class I, meaning that it is provided with a protective grounding lead. To maintain this protection the supply lead must always be connected to the source of supply via a socket with a grounded contact.

Be aware that the supply filter contains capacitors that may remain charged after the equipment is disconnected from the supply. Although the stored energy is within the approved safety requirements, a slight shock may be felt if the plug pins are touched immediately after removal.

Do not remove instrument covers as this may result in personal injury. There are no user-serviceable parts inside.

Refer all servicing to qualified personnel. See list of Service Centers at rear of manual.

WARNING

Fire hazard

Make sure that only fuses of the correct rating and type are used for replacement.

If an integrally fused plug is used on the supply lead, ensure that the fuse rating is commensurate with the current requirements of this equipment.

WARNING

Toxic hazards

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.

WARNING

Beryllium copper

Some mechanical components within this instrument are manufactured from beryllium copper. This is an alloy with a beryllium content of approximately 5%. It represents no risk in normal use.

The material should not be machined, welded or subjected to any process where heat is involved.

It must be disposed of as “special waste”.

It must NOT be disposed of by incineration.

WARNING

Lithium

A Lithium battery (or a Lithium battery contained within an IC) is used in this equipment.

As Lithium is a toxic substance, the battery should in no circumstances be crushed, incinerated or disposed of in normal waste.

Do not attempt to recharge this type of battery. Do not short circuit or force discharge since this might cause the battery to vent, overheat or explode.

WARNING

Tilt facility

When the equipment is in the tilt position, it is advisable, for stability reasons, not to stack other equipment on top of it.

CAUTION

Static sensitive components

This equipment contains static sensitive components which may be damaged by handling — refer to the Service Manual for handling precautions.

CAUTION

Precision connector

The precision microwave connectors fitted to this equipment may be damaged by mating with a non-precision type. Damage to the connector may also occur if the connector interface parameters are not within specification. The connector should be checked with the appropriate gauging tool.

CAUTION

Suitability for use

This equipment has been designed and manufactured by Aeroflex to perform measurements on RF and microwave components and systems.

If the equipment is not used in a manner specified by Aeroflex, the protection provided by the equipment may be impaired.

Aeroflex has no control over the use of this equipment and cannot be held responsible for events arising from its use other than for its intended purpose.

Précautions

WARNING **CAUTION** **Note**

Les termes suivants ont, dans ce manuel, des significations particulières:

WARNING contient des informations pour éviter toute blessure au personnel.

CAUTION contient des informations pour éviter les dommages aux équipements.

Note contient d'importantes informations d'ordre général.

Symboles signalant un risque

La signification des symboles de danger apparaissant sur l'équipement et dans la documentation est la suivante:

Symbole	Nature du risque
	Reportez-vous au manuel d'utilisation quand ce symbole apparaît sur l'instrument. Familiarisez-vous avec la nature du danger et la conduite à tenir.
	Tension dangereuse
	Danger produits toxiques

Conditions générales d'utilisation

Ce produit a été conçu et testé pour être conforme aux exigences des normes CEI/EN61010-1 "Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire", pour des équipements Classe I portables et pour une utilisation dans un environnement de pollution de niveau 2. Cet équipement est conçu pour fonctionner à partir d'une alimentation de catégorie II.

Cet équipement doit être protégé de l'introduction de liquides ainsi que des précipitations d'eau, de neige, etc... Lorsqu'on transporte cet équipement d'un environnement chaud vers un environnement froid, il est important de laisser l'équipement se stabiliser en température avant de le connecter à une alimentation afin d'éviter toute formation de condensation. L'appareil doit être utilisé uniquement dans le cadre des conditions d'environnement spécifiées au chapitre 1 'Performance data' du manuel d'utilisation, toute autre utilisation peut endommager les systèmes de protection.

Ce produit n'est pas garanti pour fonctionner dans des atmosphères dangereuses ou pour un usage médical. Si l'équipement doit être utilisé pour des applications en relation avec la sécurité, par exemple des applications militaires ou aéronautiques, la compatibilité du produit doit être établie et approuvée par une personne compétente.

WARNING

Sécurité électrique (tension d'alimentation alternative)

Cet appareil est protégé conformément à la norme CEI de sécurité Classe 1, c'est-à-dire que sa prise secteur comporte un fil de protection à la terre. Pour maintenir cette protection, le câble d'alimentation doit toujours être branché à la source d'alimentation par l'intermédiaire d'une prise comportant une borne de terre.

Notez que les filtres d'alimentation contiennent des condensateurs qui peuvent encore être chargés lorsque l'appareil est débranché. Bien que l'énergie contenue soit conforme aux exigences de sécurité, il est possible de ressentir un léger choc si l'on touche les bornes sitôt après débranchement.

Ne démontez pas le capot de l'instrument, car ceci peut provoquer des blessures. Il n'y a pas de pièces remplaçables par l'utilisateur à l'intérieur.

Faites effectuer toute réparation par du personnel qualifié. Contacter un des Centres de Maintenance Internationaux dans la liste jointe à la fin du manuel.

WARNING

Risque lié au feu

Lors du remplacement des fusibles vérifiez l'exactitude de leur type et de leur valeur.
Si le câble d'alimentation comporte une prise avec fusible intégré, assurez vous que sa valeur est compatible avec les besoins en courant de l'appareil.

WARNING

Danger produits toxiques

Certains composants utilisés dans cet appareil peuvent contenir des résines et d'autres matières qui dégagent des fumées toxiques lors de leur incinération. Les précautions d'usages doivent donc être prises lorsqu'on se débarrasse de ce type de composant.

WARNING

Bronze au béryllium

Dans cet équipement,certaines pièces mécaniques sont à base de bronze au béryllium. Il s'agit d'un alliage dans lequel le pourcentage de béryllium ne dépasse pas 5%. Il ne présente aucun danger en utilisation normale.
Toutefois, cet alliage ne doit pas être travaillé, soudé ou soumis à un processus qui implique l'utilisation d'une source de chaleur.
En cas de destruction, il sera entreposé dans un container spécial. IL ne devra pas être détruit par incinération

WARNING

Lithium

Une pile au Lithium ou un CI contenant une pile au Lithium est utilisé dans cet équipement.
Le Lithium étant une substance toxique, il ne faut en aucun cas l'écraser, l'incinérer ou le jeter avec des déchets normaux.
N'essayez pas de recharger ce type de pile. Ne court-circuitez pas ou ne forcez pas la décharge de la pile car cela pourrait causer une fuite, une surchauffe ou une explosion.

WARNING

Position inclinée

Lorsque l'appareil est dans une position inclinée, il est recommandé, pour des raisons de stabilité, de ne pas y empiler d'autres appareils.

CAUTION

Utilisation

Cet équipement a été conçu et fabriqué par Aeroflex pour effectuer des mesures sur des composants et des systèmes RF et hyperfréquences

La protection de l'équipement peut être altérée s'il n'est pas utilisé dans les conditions spécifiées par Aeroflex.
Aeroflex n'a aucun contrôle sur l'usage de l'instrument, et ne pourra être tenu pour responsable en cas d'événement survenant suite à une utilisation différente de celle prévue.

Vorsichtsmaßnahmen

WARNING **CAUTION** **Note**

Diese Hinweise haben eine bestimmte Bedeutung in diesem Handbuch:

WARNING **dienen zur Vermeidung von Verletzungsrisiken.**

CAUTION **dienen dem Schutz der Geräte.**

Note **enthalten wichtige Informationen.**

Gefahrensymbole

Die Bedeutung der Gefahrensymbole auf den Geräten und in der Dokumentation ist wie folgt:

Symbol	Gefahrenart
	Beziehen Sie sich auf die Bedienungsanleitung wenn das Messgerät mit diesem Symbol markiert ist. Machen Sie sich mit der Art der Gefahr und den Aktionen die getroffen werden müssen bekannt.
	Gefährliche Spannung
	Warnung vor giftigen Substanzen

Allgemeine Hinweise zur Verwendung

Dieses Produkt wurde entsprechend den Anforderungen von IEC/EN61010-1 “Sicherheitsanforderungen für elektrische Ausrüstung für Meßaufgaben, Steuerung und Laborbedarf”, Klasse I transportabel zur Verwendung in einer Grad 2 verunreinigten Umgebung, entwickelt und getestet. Dieses Gerät ist für Netzversorgung Klasse II zugelassen.

Das Gerät sollte vor dem Eindringen von Flüssigkeiten sowie vor Regen, Schnee etc. geschützt werden. Bei Standortänderung von kalter in wärmere Umgebung sollte das Gerät wegen der Kondensation erst nach Anpassung an die wärmere Umgebung mit dem Netz verbunden werden. Das Gerät darf nur in Umgebungsbedingungen wie im Kapitel 1 ‘Lesitungstdaten (Performance data)’ der Bedienungsanleitung beschrieben, betrieben werden; ansonsten wird der vom Gerät vorgesehene Schutz des Anwenders beeinträchtigt.

Dieses Produkt ist nicht für den Einsatz in gefährlicher Umgebung (z.B. Ex-Bereich) und für medizinische Anwendungen geprüft. Sollte das Gerät für den Einsatz in sicherheitsrelevanten Anwendungen wie z.B. im Flugverkehr oder bei militaerischen Anwendungen vorgesehen sein, so ist dieser von einer für diesen Bereich zuständigen Person zu beurteilen und genehmigen.

WARNING

Elektrische Schläge (Wechselspannungsversorgung)

Das Gerät entspricht IEC Sicherheitsklasse 1 mit einem Schutzleiter nach Erde. Das Netzkabel muß stets an eine Steckdose mit Erdkontakt angeschlossen werden.

Filterkondensatoren in der internen Spannungsversorgung können auch nach Unterbrechung der Spannungszuführung noch geladen sein. Obwohl die darin gespeicherte Energie innerhalb der Sicherheitsmargen liegt, kann ein leichter Spannungsschlag bei Berührung kurz nach der Unterbrechung erfolgen.

Öffnen Sie niemals das Gehäuse der Geräte das dies zu ernsthaften Verletzungen führen kann. Es gibt keine vom Anwender austauschbare Teile in diesem Gerät.

Lassen Sie alle Reparaturen durch qualifiziertes Personal durchführen. Eine Liste der Servicestellen finden Sie auf der Rückseite des Handbuches.

WARNING

Feuergefahr

Es dürfen nur Ersatzsicherungen vom gleichen Typ mit den korrekten Spezifikationen entsprechend der Stromaufnahme des Gerätes verwendet werden.

WARNING

Warnung vor giftigen Substanzen

In einigen Bauelementen dieses Geräts können Epoxyharze oder andere Materialien enthalten sein, die im Brandfall giftige Gase erzeugen. Bei der Entsorgung müssen deshalb entsprechende Vorsichtsmaßnahmen getroffen werden.

WARNING

Beryllium Kupfer

In diesem Gerät sind einige mechanische Komponenten aus Berylium Kupfer gefertigt. Dies ist eine Verbindung welche aus einem Berylliumanteil von ca. 5 % besteht. Bei normaler Verwendung besteht kein Gesundheitsrisiko.

Das Metall darf nicht bearbeitet, geschweißt oder sonstiger Wärmebehandlung ausgesetzt werden.

Es muß als Sondermüll entsorgt werden.

Es darf nicht durch Verbrennung entsorgt werden.

WARNING

Lithium

Eine Lithium Batterie oder eine Lithium Batterie innerhalb eines IC ist in diesem Gerät eingebaut.

Da Lithium ein giftiges Material ist, sollte es als Sondermüll entsorgt werden.

Diese Batterie darf auf keinen Fall geladen werden. Nicht kurzschließen, da sie dabei überhitzt werden und explodieren kann.

WARNING

Schrägstellung

Bei Schrägstellung des Geräts sollten aus Stabilitätsgründen keine anderen Geräte darauf gestellt werden.

CAUTION

Eignung für Gebrauch

Dieses Gerät wurde von Aeroflex entwickelt und hergestellt um Messungen an HF- und Mikrowellenkomponenten und -Systemen durchzuführen

Sollte das Gerät nicht auf die von Aeroflex vorgesehene Art und Weise verwendet werden, kann die Schutzfunktion des Gerätes beeinträchtigt werden.

Aeroflex hat keinen Einfluß auf die Art der Verwendung und übernimmt keinerlei Verantwortung bei unsachgemässer Handhabung.

Precauzioni

WARNING **CAUTION** **Note**

Questi termini vengono utilizzati in questo manuale con significati specifici:

WARNING **riportano informazioni atte ad evitare possibili pericoli alla persona.**

CAUTION **riportano informazioni per evitare possibili pericoli all'apparecchiatura.**

Note **riportano importanti informazioni di carattere generale.**

Simboli di pericolo

Il significato del simbolo di pericolo riportato sugli strumenti e nella documentazione è il seguente:

Simbolo	Tipo di pericolo
	Fare riferimento al manuale operativo quando questo simbolo è riportato sullo strumento. Rendervi conto della natura del pericolo e delle precauzioni che dovrete prendere.
	Tensione pericolosa
	Pericolo sostanze tossiche

Condizioni generali d'uso

Questo prodotto è stato progettato e collaudato per rispondere ai requisiti della direttiva IEC/EN61010-1 'Safety requirements for electrical equipment for measurement, control and laboratory use' per apparati di classe I portatili e per l'uso in un ambiente inquinato di grado 2. L'apparato è stato progettato per essere alimentato da un alimentatore di categoria II.

Lo strumento deve essere protetto dal possibile ingresso di liquidi quali, ad es., acqua, pioggia, neve, ecc. Qualora lo strumento venga portato da un ambiente freddo ad uno caldo, è importante lasciare che la temperatura all'interno dello strumento si stabilizzi prima di alimentarlo per evitare formazione di condense. Lo strumento deve essere utilizzato esclusivamente nelle condizioni ambientali descritte nel capitolo 1 'Performance data' del manuale operativo, in caso contrario le protezioni previste nello strumento potrebbero risultare non sufficienti.

Questo prodotto non è stato approvato per essere usato in ambienti pericolosi o applicazioni medicali. Se lo strumento deve essere usato per applicazioni particolari collegate alla sicurezza (per esempio applicazioni militari o avioniche), occorre che una persona o un istituto competente ne certifichi l'uso.

WARNING

Pericoli da elettricità (alimentazione c.a.)

Quest ’apparato è provvisto del collegamento di protezione di terra e rispetta le norme di sicurezza IEC, classe 1. Per mantenere questa protezione è necessario che il cavo, la spina e la presa d’alimentazione siano tutti provvisti di terra.

Il circuito d’alimentazione contiene dei filtri i cui condensatori possono restare carichi anche dopo aver rimosso l’alimentazione. Sebbene l’energia immagazzinata è entro i limiti di sicurezza, purtuttavia una leggera scossa può essere avvertita toccando i capi della spina subito dopo averla rimossa.

Non rimuovete mai le coperture perché così potreste provocare danni a voi stessi. Non vi sono all’interno parti di interesse all’utilizzatore.

Tutte gli interventi sono di competenza del personale qualificato. Vedi elenco internazionale dei Centri di Assistenza in fondo al manuale.

WARNING

Pericolo d’incendio

Assicurarsi che, in caso di sostituzione, vengano utilizzati solo fusibili della portata e del tipo prescritti.
Se viene usata una spina con fusibili, assicurarsi che questi siano di portata adeguata ai requisiti di alimentazione richiesti dallo strumento.

WARNING

Pericolo sostanze tossiche

Alcuni dei componenti usati in questo strumento possono contenere resine o altri materiali che, se bruciati, possono emettere fumi tossici. Prendere quindi le opportune precauzioni nell’uso di tali parti.

WARNING

Rame berillio

Alcuni componenti meccanici in questo strumento sono realizzati in rame berillio. Si tratta di una lega con contenuto di berillio di circa il 5%, che non presenta alcun rischio in usi normali.

Questo materiale non deve essere lavorato, saldato o subire qualsiasi processo che coinvolge alte temperature.

Deve essere eliminato come "rifiuto speciale". Non deve essere eliminato tramite "inceneritore".

WARNING

Litio

Quest ’apparato incorpora una batteria al litio o un circuito integrato contenente una batteria al litio.

Poiché il litio è una sostanza tossica, la batteria non deve essere mai né rotta, né incenerita, né gettata tra i normali rifiuti.

Questo tipo di batteria non può essere sottoposto né a ricarica né a corto-circuito o scarica forzata. Queste azioni possono provocare surriscaldamento, fuoriuscita di gas o esplosione della batteria.

WARNING

Posizionamento inclinato

Quando lo strumento è in posizione inclinata è raccomandato, per motivi di stabilità, non sovrapporre altri strumenti.

CAUTION

Caratteristiche d’uso

Questo strumento è stato progettato e prodotto da Aeroflex eseguire misure su componenti o sistemi RF e microonde

Se lo strumento non è utilizzato nel modo specificato da Aeroflex, le protezioni previste sullo strumento potrebbero risultare inefficaci.

Aeroflex non può avere il controllo sull’uso di questo strumento e non può essere ritenuta responsabile per eventi risultanti da un uso diverso dallo scopo prefisso.

Precauciones

WARNING **CAUTION** **Note**

Estos términos tienen significados específicos en este manual:

WARNING **contienen información referente a prevención de daños personales.**

CAUTION **contienen información referente a prevención de daños en equipos.**

Note **contienen información general importante.**

Símbolos de peligro

El significado de los símbolos de peligro en el equipo y en la documentación es el siguiente:

Símbolo	Naturaleza del peligro
	Vea el manual de funcionamiento cuando este símbolo aparezca en el instrumento. Familiarícese con la naturaleza del riesgo y con las acciones que deban de tomarse.
	Voltaje peligroso
	Aviso de toxicidad

Condiciones generales de uso

Este producto ha sido diseñado y probado para cumplir los requerimientos de la normativa IEC/EN61010-1 “Requerimientos de la normativa para equipos eléctricos de medida, control y uso en laboratorio”, para equipos clase I portátiles y para uso en un ambiente con un grado de contaminación 2. El equipo ha sido diseñado para funcionar sobre una instalación de alimentación de categorías II.

Debe protegerse el equipo de la entrada de líquidos y precipitaciones como nieve, lluvia, etc. Cuando se traslada el equipo de entorno frío a un entorno caliente, es importante aguardar la estabilización el equipo para evitar la condensación. Solamente debe utilizarse el equipo bajo las condiciones ambientales especificadas en el capítulo 1 “Especificaciones” o “Performance data” del Manual de Instrucciones, en caso contrario la propia protección del equipo puede resultar dañada.

Este producto no ha sido aprobado para su utilización en entornos peligrosos o en aplicaciones médicas. Si se va a utilizar el equipo en una aplicación con implicaciones en cuanto a seguridad, como por ejemplo aplicaciones de aviónica o militares, es preciso que un experto competente en materia de seguridad apruebe su uso.

WARNING

Nivel peligroso de electricidad (tensión de red)

Este equipo cumple las normas IEC Seguridad Clase 1, lo que significa que va provisto de un cable de protección de masa. Para mantener esta protección, el cable de alimentación de red debe de conectarse siempre a una clavija con terminal de masa.

Tenga en cuenta que el filtro de red contiene condensadores que pueden almacenar carga una vez desconectado el equipo. Aunque la energía almacenada está dentro de los requisitos de seguridad, pudiera sentirse una ligera descarga al tocar la clavija de alimentación inmediatamente después de su desconexión de red.

No retire las cubiertas del chasis del instrumento, ya que pudiera resultar dañado personalmente. No existen partes que puedan ser reparadas en su interior.

Deje todas las tareas relativas a reparación a un servicio técnico cualificado. Vea la lista de Centros de Servicios Internacionales en la parte trasera del manual.

Fusibles

Se hace notar que el Equipo está dotado de fusibles tanto en el activo como el neutro de alimentación. Si sólo uno de estos fusibles fundiera, existen partes del equipo que pudieran permanecer a tensión de red.

WARNING

Peligro de incendio

Asegúrese de utilizar sólo fusibles del tipo y valores especificados como repuesto.

Si se utiliza una clavija con fusible incorporado, asegúrese de que los valores del fusible corresponden a los requeridos por el equipo. Consulte la Hoja Técnica (tras el Capítulo 1) para comprobar los requisitos de alimentación.

WARNING

Aviso de toxicidad

Alguno de los componentes utilizados en este equipo pudieran incluir resinas u otro tipo de materiales que al arder produjeran sustancias tóxicas, Por tanto, tome las debidas precauciones en la manipulación de esas piezas.

WARNING

Berilio-cobre

Algunos componentes mecánicos contenidos en este instrumento incorporan berilio-cobre en su proceso de fabricación. Se trata de una aleación con un contenido aproximado de berilio del 5%, lo que no representa ningún riesgo durante su uso normal.

El material no debe ser manipulado, soldado, ni sometido a ningún proceso que implique la aplicación de calor.

Para su eliminación debe tratarse como un "residuo especial". El material NO DEBE eliminarse mediante incineración.

WARNING

Litio

En este equipo se utiliza una batería de litio (o contenida dentro de un CI).

Dada que el litio es una substancia tóxica las baterías de este material no deben ser aplastadas, quemadas o arrojadas junto a basuras ordinarias.

No trate de recargar este tipo de baterías. No las cortocircuite o fuerce su descarga ya que puede dar lugar a que la esta emita gases, se recaliente o explote.

WARNING

Tener en cuenta con el equipo inclinado

Si utiliza el equipo en posición inclinada, se recomienda, por razones de estabilidad, no apilar otros equipos encima de él.

CAUTION

Idoneidad de uso

Este equipo ha sido diseñado y fabricado por Aeroflex para realizar medidas en RF y microondas en componentes y sistemas

Si el equipo fuese utilizado de forma diferente a la especificada por Aeroflex, la protección ofrecida por el equipo pudiera quedar reducida.

Aeroflex no tiene control sobre el uso de este equipo y no puede, por tanto, exigirsele responsabilidades derivadas de una utilización distinta de aquellas para las que ha sido diseñado.

Chapter 1
GENERAL INFORMATION

Contents

General

This section outlines the 3250 Series spectrum analyzer (the 'instrument') and details the optional accessories and the instrument's specifications.

Product outline

The instrument is a portable spectrum analyzer suited for signal analysis of high-frequency digital radio equipment. It uses a synthesized local oscillator to cover the following frequencies:

1 kHz to 3 GHz	3251
1 kHz to 8 GHz	3252
1 kHz to 13.2 GHz	3253
1 kHz to 26.5 GHz	3254

The spectrum analyzer provides excellent distortion and frequency/level accuracy performance, and easy operation, using the soft-key menu screen.

It provides excellent cost performance with a choice of options for various applications.

It is equipped with highly accurate calibration signals and attenuator, so that it can accurately calibrate switching errors of LOG/LIN scales, various resolution bandwidths, variable reference levels, etc. As frequency response data is corrected by built-in calibration data, the instrument provides accurate level measurement over a wide range.

The MEASURE function performs measurements of various applications without requiring the use of an external controller. In this way, the performance of radio equipment can be easily evaluated in terms of frequency, noise, occupied frequency bandwidth and other important paramters.

Applications

This instrument is designed for use in the production and maintenance of the following:

- AM/FM radio equipment
- Digital cellular telephones/cordless telephones
- Satellite broadcasting and TV equipment
- Small capacity microwave equipment
- Wireless LAN equipment.

Instrument configuration

Various options are available to increase the range of functions. These options (page 1-11) are sold separately.

Please specify the model number, name, and quantity when ordering.

Specifications

***Note** : Allow a thirty-minute warm-up time.*

Frequency

Frequency range	1 kHz–3 GHz / 8 GHz / 13.2 GHz / 26.5 GHz
Resolution	1 Hz
Frequency reference	
Temperature drift	± 1 ppm (± 0.01 ppm, option)
Aging per year*	± 1 ppm (± 0.01 ppm, option)
	*Horizontal resolution is span/(sweep points − 1)
Frequency readout	
Marker resolution	depending on span (1 Hz minimum)
Accuracy	± (marker frequency X reference error + 3% span + 5% RBW)
Frequency counter	
Resolution	1 Hz / 10 Hz / 100 Hz / 1 kHz
Accuracy	± ((reference frequency accuracy X marker frequency) ± (counter resolution ± 1 LSB))
Sensitivity	<−45 dBm @13.2 GHz for frequencies >2 MHz, span <3 GHz
	<−40 dBm @26.5 GHz for frequencies >13.2 GHz, span <3 GHz
Frequency span	
Range	0 Hz, 10 Hz–3 GHz, 6.2 GHz, 13.2 GHz, 26.5 GHz
Resolution	1 Hz
Accuracy	±1%
Sweep	
Zero span	1 μs to 2000 s, ± 0.5 %
Span ≥10 Hz	10 ms to 2000 s, ± 0.5 % nominal
Sweep points	3 to 8192 (Span = 0 Hz) 101 to 8192 (Span ≥10 Hz)
Trigger	
Span ≥10 Hz	Source: external, video, free run, burst
	Offset: 1 μs to 500 ms
Span = 0 Hz	Source: external, video, free run, burst
	Offset: −150 ms to +500 ms
Spectral purity (dBc/Hz)	
1 kHz offset	−92 (−95 typical) @ f = 1 GHz
10 kHz offset	−112 (−115 typical)
100 kHz offset	−112 (−115 typical)
1 MHz offset	−136
10 MHz offset	−144

Residual FM

<100 X N* Hz p-p in 1 s

*N = LO harmonic order

Frequency	Band	N
0 Hz–3 GHz	0	1
2.9 GHz–6.4 GHz	1	1
6.3 GHz–13.2 GHz	2	2
13.1 GHz–26.5 GHz	3	4

Resolution bandwidth (RBW)

3 dB bandwidths: 30 Hz to 5 MHz in a 1-2-3-5 sequence

Bandwidth accuracy:

	20–30°C	0–55°C
500 Hz to 500 kHz filters	± 3 %	± 5 %
1 MHz to 5 MHz filters	± 10 %	± 12 %

Shape factor –60 dB/ –3 dB: < 5 (@ 500 Hz to 5 MHz)

Bandwidth switching uncertainty: ± 0.05 dB nominal at 5 kHz RBW reference, CF = 100 MHz

VBW

3 dB bandwidths: 1 Hz to 3 MHz, none (1-2-3-5 sequence)

FFT filters

3 dB bandwidths: 1 Hz to 300 Hz (1-2-3-5 sequence)

Bandwidth accuracy: < 1 %, nominal

Shape factor (–60 dB: –3 dB): < 4.5, nominal

Amplitude

Display range: DANL to +30 dBm

Maximum input level

DC (AC coupled): ±50 V DC

CW RF power: +30 dBm

Peak power: +50 dBm, 5 µs pulse width, 0.5% duty cycle

Preamp on: +20 dBm

RF input attenuator

Range: 0 dB to 55 dB

Steps: 5 dB

Switching accuracy: ± 0.5 dB at 100 MHz

± 0.5 dB at <13.2 GHz

± 0.8 dB from 13.2 GHz to 26.5 GHz

1 dB compression point

0 dB RF attenuation: –10 dBm at 10 MHz to 3 GHz
0 dBm at 3 GHz to 26.5 GHz

Preamp on: –32 dBm at 1 GHz

Third–order intermodulation distortion (TOI): For two tones of –30 dBm at the input mixer with a tone separation of >100 kHz:

+8 dBm at 10 MHz to 200 MHz
+12 dBm (15 dBm typical) at 200 MHz to 26.5 GHz

Second harmonic intercept (SHI): with –30 dBm at the input

+40 dBm typical up to 1.5 GHz

+80 dBm, 1.5 GHz to 26.5 GHz

Displayed average noise level (DANL)

0 dB RF attenuation, 50 ohm termination
RBW 1 Hz, VBW 1 Hz, preamp OFF

	20–30°C (dBm/Hz)	0–55°C (dBm/Hz)
100 kHz to 10 MHz	−135	−132
10 MHz to 2 GHz	−143 (−145 typ)	−140 (−142 typ)
2 GHz to 13.2 GHz	−141 (−145 typ)	−138 (−142 typ)
13.2 GHz to 18 GHz	−138 (−142 typ)	−135 (−139 typ)
18 GHz to 26.5 GHz	−133 (−138 typ)	−130 (−135 typ)

Immunity to interference

Residual responses (input terminated, 0 dB attenuation): −90 dBm

Other input-related spurii: −55 dBc with −30 dBm input

Display range

Log scale: 0.1 to 1 dB /div in 0.1 dB steps
1 to 20 dB / div in 1 dB steps

Linear scale: 10 divisions

Units of level axis: dBm, dBmV, dBµV, V, W (log level display)
mV, µV, dBmV (linear level display)

Reference level

Logarithmic range: −170 dBm to +30 dBm, 0.1 dB steps

Linear range: 7.07 nV to 7.07 V in 1 % steps

Accuracy: 0 dB

Traces

Number of traces: 3

Trace detectors: Normal, peak, sample, negative peak, log power average, RMS average, voltage average

Trace functions: Clear / write, max hold, min hold, view, blank, average

Frequency response

with 10 dB input attenuation, preselector centering applied

	20–30°C (dBm/Hz)	0–55°C (dBm/Hz)
1 MHz to 3.0 GHz	±0.5 dB	±1.0 dB
3.0 GHz to 8 GHz	±1.0 dB	±3.0 dB
8 GHz to 13.2 GHz	±1.5 dB	±4.0 dB
13.2 GHz to 22 GHz	±2.0 dB	±5.0 dB
22 GHz to 26.5 GHz	±2.5 dB	±5.0 dB
1 MHz to 3.0 GHz	Preamp on	±1.0 dB

Display linearity

Linear and log switching error: 0 dB

Log scale switching error: 0 dB

Linearity: ± 0.1 dB total at input mixer level of ≤−20 dBm
± 0.13 dB total at −20 dBm < mixer level ≤−10 dBm

Digitizer

Maximum analysis bandwidth	30 MHz
ADC resolution	14 bit
Dynamic range	85 dB
Residual FM	<1% (nominal)
Capture memory	128 Mbyte (32 Msample)

AM/FM demodulation

Input power range	−60 dBm to +30 dBm, preamp OFF
	−80 dBm to +30 dBm, preamp ON
Modulation rate range	1 kHz to 10 kHz at RBW 10 kHz to 100 kHz
	1 kHz to 30 kHz at RBW 200 kHz to 500 kHz
Peak FM deviation	200 Hz to 500 kHz
FM deviation accuracy	±5%
AM depth range	5% to 99%
AM depth accuracy	±5%
Audio output port	Loudspeaker, phone jack

Inputs and outputs

RF input	
Type	Front: N female, 50 Ω; APC 2.92 mm, 50 Ω (26.5 GHz)
VSWR	with ≥10 dB input attenuation
	<1.5 nominal, 10 MHz to 3 GHz
	<1.8 nominal, 3 GHz to 13.2 GHz
	<2.0 nominal, 13.2 GHz to 26.5 GHz
3rd IF output	
Type	Rear: BNC female, 50 Ω
Frequency	21.4 MHz
Bandwidth	16 MHz max, different as prefilter
Level	+2 dBm nominal, top of screen
Audio output	
Type	Front panel phone jack
External trigger input	
Type	Rear: BNC female, 10 kΩ nominal
Trigger level	TTL nominal
Sweep gate output	BNC female
Type	Rear: BNC female
Trigger level	TTL nominal

Reference frequency output

Type	Rear: BNC female, same as reference input port
Frequency	10 MHz
Level	+5 dBm nominal

Reference frequency input — BNC female

Type	Rear: BNC female, same as reference output port
Frequency	10 MHz
Level	–5 to +15 dBm nominal

GPIB

Type	Rear: IEEE 488.2, 24-pin female
Command set	SCPI 1997.0
Interface functions	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, E2, LE0, TE0

Serial interface — Rear: RS-232-C (COM) 9-pin D–sub connector, female

LAN interface — Rear: 10/100/1000 Base T, connector RJ45

USB — Front: two USB 2.0 connectors
Rear: two USB 2.0 connectors

Printer interface — Rear: —

Monitor output (VGA) — Rear: 15-pin min D-SUB

Mouse connector — Front

Keyboard connector — Front

Cal output

Frequency	Front: 40 MHz
Level	–20 dBm ±1.0 dB

General specifications

Display

Size	17.7 cm (7 inch) color TFT LCD (touch screen)
Resolution	800 x 480 pixel

Mass memory — Hard disk, removable, 80 Gbyte

Environmental conditions — MIL-PRF-28800F, Class 3

Temperature	
Operating	0ºC to +50ºC
Permissible	0ºC to +55ºC
Storage	–40ºC to +71ºC
	Permissible temperature has a slightly wider range as compared to the normal operating temperature. We guarantee the specification of the equipment when operating within the Operating Temperature range. We guarantee that the equipment is functional when operating within the Permissible Temperature range.
Humidity	5 to 95% (5 to 75% above 30ºC, 5 to 45% above 40ºC)
Altitude	Up to 4600 m (15 000 feet)

Mechanical resistance — MIL-PRF-28800F, Class 3

Vibration, random	5 Hz to 500 Hz
Vibration, sinusoidal	5 Hz to 55 Hz
Shock	30 G half-sine shock pulse

Electromagnetic compatibility	EN 61326-1 : 2006 EN 55022 : 2006 EN 55024 : 1998 + A1 + A2 EN 61000 - 3 - 2 : 2000 + A2 EN 61000 - 3 - 3 : 2000 + A1 + A2
Safety	EN 61010 - 1 : 2001 (2nd edition)
Power supply	
Steady state voltage	100 VAC to 240 VAC
Frequency	50/60 Hz
Power consumption	120 W maximum
Dimensions and weight	
Dimensions (W x H x D)	373 mm x 194 mm x 401 mm (without handles, feet not extended) 384 mm x 203 mm x 437 mm (with handles, feet extended) 14.7 in x 7.6 in x 15.8 in (without handles, feet not extended) 15.1 in x 8 in x 17.2 in (with handles, feet extended)
Weight	11.0 kg (3251) 12.8 kg (3252) 13.0 kg (3253) 13.4 kg (3254)
Recommended calibration interval	1 year
Standard warranty	2 years

3 GHz tracking generator

Frequency range	9 kHz to 3.0 GHz
Output level	–30 dBm to 0 dBm
Output level resolution	0.1 dB
Absolute level accuracy	±2.0 dB
Frequency flatness at –10 dBm	±4.0 dB (9 kHz to 100 kHz) before normalization ±2.5 dB (100 kHz to 3 GHz) before normalization ±1.0 dB (9 kHz to 3 GHz) after normalization
Spurious	Harmonics: <–15 dBc Non-harmonics: < –30 dBc
Leakage	–90 dBm
VSWR	<1.5 at 0 dBm output level
Connector	Type N female, 50 Ω

8 GHz tracking generator

Frequency range	100 kHz to 8.0 GHz
Output level	0 dBm to −20 dBm (in 0.5 dB steps)
Attenuator steps	0.5 dB
Absolute level accuracy	±3.0 dB, 100 kHz to 3 GHz ±4.5 dB, 3 GHz to 8 GHz
Frequency flatness at –10 dBm	±3.0 dB (100 kHz to 3 GHz) before normalization ±4.5 dB (3 GHz to 8 GHz) before normalization ±1.0 dB (100 kHz to 8 GHz) after normalization
Spurious	Harmonics: <−15 dBc Non-harmonics: < −20 dBc
Leakage at TG output level 0 dBm	−90 dBm, 100 kHz to 3 GHz −80 dBm, 3 GHz to 8 GHz
VSWR	<1.5:1 at −10 dBm output level, 100 kHz to 3 GHz <2:1 all output levels, 3 GHz to 8 GHz
Connector	Type N female, 50 Ω

Preselector— Option 5

When selected, all specifications remain the same except for the following:

Frequency Range— AC Coupled	9 kHz to 30 MHz
Preselection	
7 preselection filters	9 kHz to 150 kHz, fixed LPF
	150 kHz to 600 kHz, fixed BPF
	600 kHz to 1.2 MHz, fixed BPF
	1.2 MHz to 2.5 MHz, fixed BPF
	2.5 MHz to 5 MHz, fixed BPF
	5 MHz to 10 MHz, fixed BPF
	10 MHz to 30 MHz, fixed BPF
Third order intercept point (IP3) (dBm)	
Two −30 dBm tones at input mixer with tone separation >100 kHz	
Preselector OFF, preamp OFF	+8 @ 10 MHz to 200 MHz
	+12, +15 typical @ 200 MHz to 8 GHz
Preselector ON, preamp OFF	+8 @ 10 MHz to 30 MHz
Preselector ON, preamp ON	−10 typical @ <100 MHz
	−10, −8 typical @ 100 MHz to 1 GHz
	−8, −5 typical @ 1 GHz to 3 GHz
Second order intercept point (IP2) (dBm) –30 dBm input	
Preselector OFF, preamp OFF	+40 typical @ 10 MHz to 4 GHz
Preselector ON, preamp OFF	+40 typical @ 10 MHz to 4 GHz
Preselector ON, preamp ON	+25 typical @ 10 MHz to 1.5 GHz

Displayed Average Noise Level (DANL)	0 dB RF attenuation, 50 Ω termination, zero span, sweep time 100 ms, RBW 1 kHz, VBW 10 Hz, Average detector, trace average 10, normalize to RBW 1 Hz
Preselector OFF, preamp OFF	−130 @ 9 kHz to 1 MHz
	−140, −150 typical @ 1 MHz to 10 MHz
	−145, −149 typical @ 10 MHz to 1 GHz
	−143, −147 typical @ 1 GHz to 1.5 GHz
	−141, −145 typical @ 1.5 GHz to 2.5 GHz
	−139, −142 typical @ 2.5 GHz to 3 GHz
	−142, −147 typical @ 3 GHz to 6.4 GHz
	−140, −145 typical @ 6.4 GHz to 8 GHz
Preselector ON. preamp OFF	−130 @ 9 kHz to 1 MHz
	−142, −147 typical @ 1 MHz to 30 MHz
Preselector ON, preamp ON	−140 @ 9 kHz to 1 MHz
	−158, −165 typical @ 1 MHz to 30 MHz
	−162, −165 typical @ 30 MHz to 1 GHz
	−160, −163 typical @ 1 GHz to 1.5 GHz
	−157, −160 typical @ 1.5 GHz to 2.3 GHz
	−155, −158 typical @ 2.3 GHz to 3 GHz
Frequency Response	10 dB input attenuation, preselector centering applied, reference to100 MHz
Preselector OFF, preamp OFF	±0.5 dB @ 9 kHz to 3.0 GHz
	±1.0 dB @ 3.0 GHz to 8 GHz
Preselector OFF, preamp ON	±0.7 dB @ 9 kHz to 3.0 GHz
Preselector ON, preamp ON	±1.0 dB @ 9 kHz to 1.0 GHz
	±1.5 dB @ 1 GHz to 3.0 GHz

Versions and accessories

When ordering, please quote the full ordering number information.

Ordering numbers	Version
3251/0	1 kHz to 3 GHz spectrum analyzer
3251/1	1 kHz to 3 GHz spectrum analyzer with 3 GHz tracking generator
3252/0	1 kHz to 8 GHz spectrum analyzer
3252/1	1 kHz to 8 GHz spectrum analyzer with 3 GHz tracking generator
3252/2	1 kHz to 8 GHz spectrum analyzer with 8 GHz tracking generator
3253/0	1 kHz to 13.2 GHz spectrum analyzer
3253/1	1 kHz to 13.2 GHz spectrum analyzer with 3 GHz tracking generator
3253/2	1 kHz to 13.2 GHz spectrum analyzer with 8 GHz tracking generator
3254/0	1 kHz to 26.5 GHz spectrum analyzer
3254/1	1 kHz to 26.5 GHz spectrum analyzer with 3 GHz tracking generator
3254/2	1 kHz to 26.5 GHz spectrum analyzer with 8 GHz tracking generator
	Options
Option 03	High stability oscillator (80029)
Option 05	External pre-selector (A, B band) (80030)
Option 06	AC/DC power supply (80025)
Option 08	GSM/EDGE measurement suite (80031)
Option 09	UMTS UL measurement suite (80032)
Option 10	CDMA measurement suite (80033)
Option 11	WLAN measurement suite (80034)
Option 12	WiMAX measurement suite (80035)
Option 13	EMI measurement suite (80036)
	Supplied with
–	AC supply lead
46886/070	CD-ROM containing operating and programming manuals
	Optional accessories
80027	Soft carrying case
80026	DC battery pack
80039	Connector and cable assembly
80040	Hard carrying case
80041	Rack mounting kit
46882/974	3250 Series Operating Manual (paper version)
46882/975	3250 Series Programming Manual (paper version)

Chapter 2
PREPARING FOR USE

Contents

Introduction

This section explains the preparations and safety procedures that you should perform before using the instrument. The safety procedures are to prevent injury to you and others, and damage to the instrument.

Read these together with the **safety precautions** in the Preface.

Ensure that you understand the contents of the pre-operation preparations before using the instrument.

For connecting a GPIB cable and setting the GPIB address, refer to the Programming Manual (document no. 46892/975).

Installation site and environmental conditions

Locations to be avoided

The instrument operates correctly at temperatures from 0 to 50ºC. However, for best performance, avoid the following situations:

- where there is severe vibration
- where the humidity is high
- where the instrument is exposed to direct sunlight
- where the instrument is exposed to active gases.

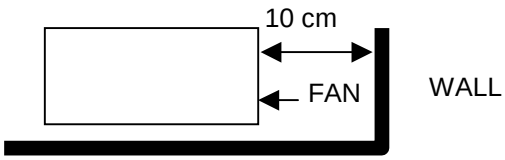
In addition to the above, to ensure long-term trouble-free operation, use the instrument at room temperature and in a location where the power supply voltage does not fluctuate greatly.

CAUTION

There is a risk of a short-circuit caused by condensation if the instrument is brought into a warm environment after it has been used or stored for a long time at a low temperature. To prevent this, do not turn the instrument on until it has been allowed to dry out completely.

CAUTION

The instrument has a fan on the rear panel to maintain a steady internal temperature. Leave a gap of at least 10 cm between the rear panel and wall, nearby equipment or any obstructions so that fan ventilation is not blocked, as shown in the diagram below.



Safety measures

This paragraph explains safety procedures that you must follow in all circumstances, to prevent the risk of an accidental electric shock, damage to the instrument or a major interruption to operation.

Preparations before power-on

The instrument operates normally when it is connected to a 100 VAC to 250 VAC 50/60 Hz power supply (voltage selected automatically). To prevent:

- Accidental electric shock
- Damage caused by abnormal voltage
- Ground current problems.

follow the procedures described on the next pages before applying power.

To protect you, the following WARNING and CAUTION notices appear on the rear panel of the instrument.

WARNING 

TO AVOID ELECTRIC SHOCK,
THE PROTECTIVE GROUNDING CONDUCTOR
MUST BE CONNECTED TO GROUND.
DO NOT REMOVE COVERS.
REFER SERVICING TO QUALIFIED PERSONNEL.

CAUTION 

FOR CONTINUED FIRE PROTECTION
REPLACE ONLY WITH SPECIFIED
TYPE AND RATED FUSE.

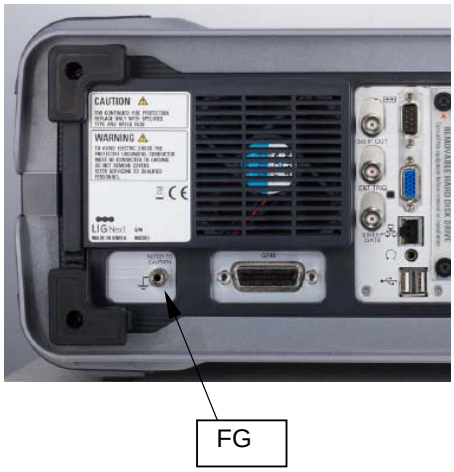
WARNING 

Disassembly, adjustment, maintenance, or other access inside this equipment is to be performed by qualified personnel only. Only trained service personnel who are familiar with the risk involved of fire and electric shock should perform maintenance of this equipment. Potentially lethal voltages existing inside this equipment, if contacted accidentally, may result in personal injury or death, or in the possibility of damage to precision components.

WARNING

Protective grounding with frame ground terminal

When there is no grounded AC power-supply outlet, connect the protective frame ground (FG) terminal on the rear panel directly to ground potential.



WARNING

If power is applied without protective grounding, there is a risk of accidental electric shock. The protective frame ground (FG) terminal on the rear frame, or the ground pin of the supplied power cord, must be connected to ground potential before power is supplied to the equipment.

WARNING

Before power-on

- Connect the instrument to protective ground. If power is switched on without taking this precaution, there is a risk of receiving an accidental electric shock.
- Check the power source voltage. If an abnormal voltage that exceeds the specified value is input, there is risk of damage to the instrument, and fire.

WARNING

Use a proper power source

Do not operate this instrument from a power source that supplies more than the specified voltage. Use a stable supply.

WARNING

Do not operate with suspected damage

If you suspect there is damage to the instrument, protection may be impaired, so do not attempt to operate the instrument under these conditions. Have it inspected by qualified service personnel.

WARNING

Object and liquid entry

Do not push any kind of object through openings into the instrument, as it may touch dangerous voltage points or short out parts that could result in electric shock or a fire. Avoid spilling liquid of any kind on the instrument. If liquid enters the instrument, return it to an agent for checking.

Do not use the instrument near water. Keep the instrument in a dry, dust-free environment.

WARNING

Flammable and explosive substances

Avoid using the instrument where there are flammable or explosive substances, including gases, in the immediate vicinity.

WARNING

Unstable location

Do not place the instrument on an unstable cart, stand or table. If the instrument were to fall, it could cause serious personal injury, and serious damage to the instrument. Do not subject the instrument to vibration.

WARNING

Cleaning

Keep the power supply and cooling fan free of dust.

Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.

Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

CAUTION

Replacing memory backup battery

A primary lithium battery supplies power for CMOS backup. Replace this battery with one of the same type (Maxell CR2032H). Only an approved technician can replace the battery, so please contact your local service representative when replacement is necessary.

Battery life is about seven years. Replace the battery early to avoid loss of stored information.

Dispose of the battery according to local environmental requirements.

CAUTION

Data storage

The instrument stores data using a hard disk. The hard disk may be damaged by strong vibration or electrical shock.

If you need to exchange a damaged hard disk, connect your local service representative.

CAUTION

Altering or deleting important files

The instrument uses the Windows operating system on the hard disk (C:\Program Files). Altering or deleting contents of the Windows folder may cause improper system operation.

CAUTION

Input level to RF input

Frequency range: 1 kHz to 3 GHz (3251)
1 kHz to 8 GHz (3252)
1 kHz to 13.2 GHz (3253)
1 kHz to 26.5 GHz (3254)

Measurement level: the maximum signal level that can be applied to the RF input connector is **+30 dBm**.

The RF input circuit is not protected against excessive power:

If you apply a signal exceeding **+30 dBm**, the input attenuator and internal circuit will be damaged.
Do not input over **0 VDC** to the RF input connector.

Front panel power switch

Power-on

When the instrument is in the standby state, a momentary press of the front power switch turns on the power.

The instrument uses the Windows operating system. Windows starts up first, before the instrument boots up.

***Note**: if the instrument does not automatically start correctly, click the Aeroflex icon on the display twice.*

Supply interruption

If, while the instrument is in the power-on state, the power plug is removed from the outlet and then reinserted, the power is not turned on again. Also, if power is disconnected due to a momentary supply interruption or failure, the instrument is not turned on again when power is restored. This prevents incorrect data being acquired when line power is disconnected and reconnected.

For example, if the sweep is 1.000 s and data acquisition requires a long time, a momentary power supply interruption (power failure) might occur during measurement and the instrument would then recover automatically to the power-on state. In such a case, the instrument might mistake incorrect data for correct data without recognizing the momentary power supply interruption.

If the instrument enters the standby state due to a momentary power supply interruption or power failure, check the state of the measuring system and press the front power switch to restore power to the instrument.

CAUTION

An incorrect power-down may damage the hard disk. We recommend that you use a stable power supply.

Detection mode

This instrument is a spectrum analyzer that uses a digital storage system. The instrument makes level measurements in frequency steps obtained by dividing the frequency span by the number of measurement data points (551–8192). Optimal results are obtained by using the following detector modes for the associated measurements.

Measurement	Detector mode
Normal spectrum	POS PEAK
Random noise	SAMPLE OR AVERAGE
Pulsed noise	NORMAL
Occupied frequency bandwidth (for analog communication systems)	SAMPLE
Occupied frequency bandwidth (for digital communication systems)	POS PEAK or SAMPLE

Chapter 3
PANEL DESCRIPTION

Contents

Introduction

This chapter describes the front (Fig. 3-1) and rear (Fig. 3-2) panels.

The following conventions apply throughout this manual:

CAPS	Capitals are used to identify names of controls and panel markings.
[CAPS]	Capitals in square brackets indicate hard-key titles.
[Italics]	Italics in square brackets indicate soft-key titles (F1–F8).
Example:	[FREQ]
	[Center]

Front and rear panel features

Table 3-1 Front and rear panel features

1	LCD	The liquid crystal display. Displays waveforms, the parameter settings, the value of marker, the soft menu keys, etc.
2	F1–F8, NEXT	These are the soft keys for selecting the soft key menus linked to the panel key operation.
3	[FREQ]	The frequency parameter data input section.
	[SPAN]	The span parameter data input section.
	[AMPL]	The amplitude parameter data input section.
	[MEAS]	Sets the selected measurement functions.
4	[MARKER]	Sets the marker.
	[MKR →]	Sets the marker value to a specified parameter.
	[PEAK]	Related to the peak search function.
	[FUNC]	Sets the function related to a marker.
	[COUPLE]	Sets the detection mode.
	[BW]	Sets the RBW and VBW.
	[CONTROL]	Sets the measurement functions.
	[SWEEP]	Sets the sweep time and the number of data.
5	[SYSTEM]	Sets the configuration of the system.
	[SOURCE]	Selects the signal source.
	[MODE]	Selects the measurement mode.
	[SETUP]	Sets the measurement mode.
	[LIMIT]	Sets the limit line functions.
	[DISPLAY]	Sets the display functions.
	[AUX]	Sets the auxiliary functions, such as FM/AM demodulation.
	[TRACE]	Selects the trace waveform and video average mode.
6	NUMERIC	Used for setting the numeric data and moving the cursor. [↵] (backspace-key) corrects wrongly input data. [0…9, '.', '+/-'] are numeric data setting keys.
7	(SCROLL KNOB)	Used for scrolling through parameters.
8	(STEP KEY)	Used for stepping parameters up or down.
9	RF INPUT	RF input connector.
10	CAL. OUT	Output connector for the calibration signal.
11	PHONE	Output of audio signal.
12	TG Out	Output of tracking generator (Option).
13	Front USB	USB connector for external equipment/mouse.
14	STBY/ON	Power switch. Functional when the rear-panel power switch is on. The instrument goes to power-on from the STBY condition when the key is pressed momentarily. The instrument returns to the STBY condition from the power-on condition when the key is pressed again.

15		Enters the Windows menu.
	[File]	Manages the file.
	[Save]	Used for saving the waveforms' status and limit lines.
	[Print]	Used for printing.
	[Preset]	Sets the measurement parameters to the default values. Calibration menus are also included under this key.
	[Tune]	Used for the auto tuning function.
	[Trig]	Sets the trigger functions.
	[Single]	One sweep is executed by pressing this key.
16	SWEEP GATE	Output connector for a sweep gate signal.
17	EXT TRIG	Input connector for an external trigger.
18	3rd IF OUT	Output connector for the 3rd IF signal.
19	RS-232C	The RS-232C connector: connects to an external system controller.
20	Removable HDD	Removable storage. Remove only when instrument is powered down.
21	EXT VGA	VGA output for an external monitor.
22	ETHERNET	Ethernet connector for network connection.
23	REF OUT 10MHz	Output connector for a reference frequency. When other equipment is used with this instrument, the output of this connector can be used as a reference.
24	(AC inlet)	The fused AC power inlet to which the supplied power cord is connected.
25	REF IN 10MHz	Input connector for a reference frequency. When an external reference signal is applied to this connector, the present condition is displayed on the upper right side of the display.
26	Rear USB	Connector for USB equipment.
27	GPIB	For use with the GPIB interface: connects to an external system controller.
28	(FG)	Frame ground terminal.
29	(FAN)	Cooling fan, ventilating internally-generated heat. Leave a clearance of 10 cm between the fan and any nearby surface.

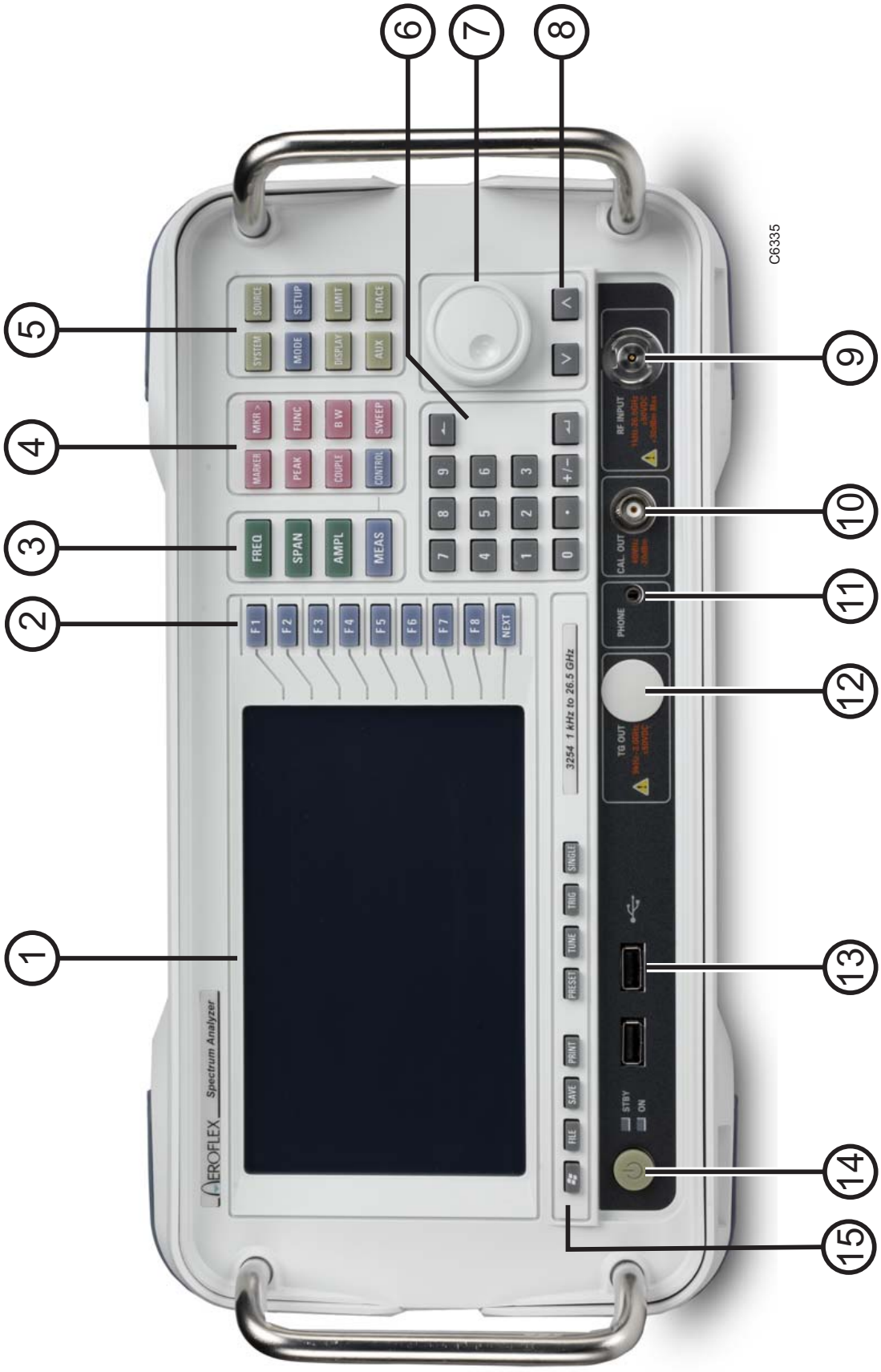


Fig. 3-1 Front panel

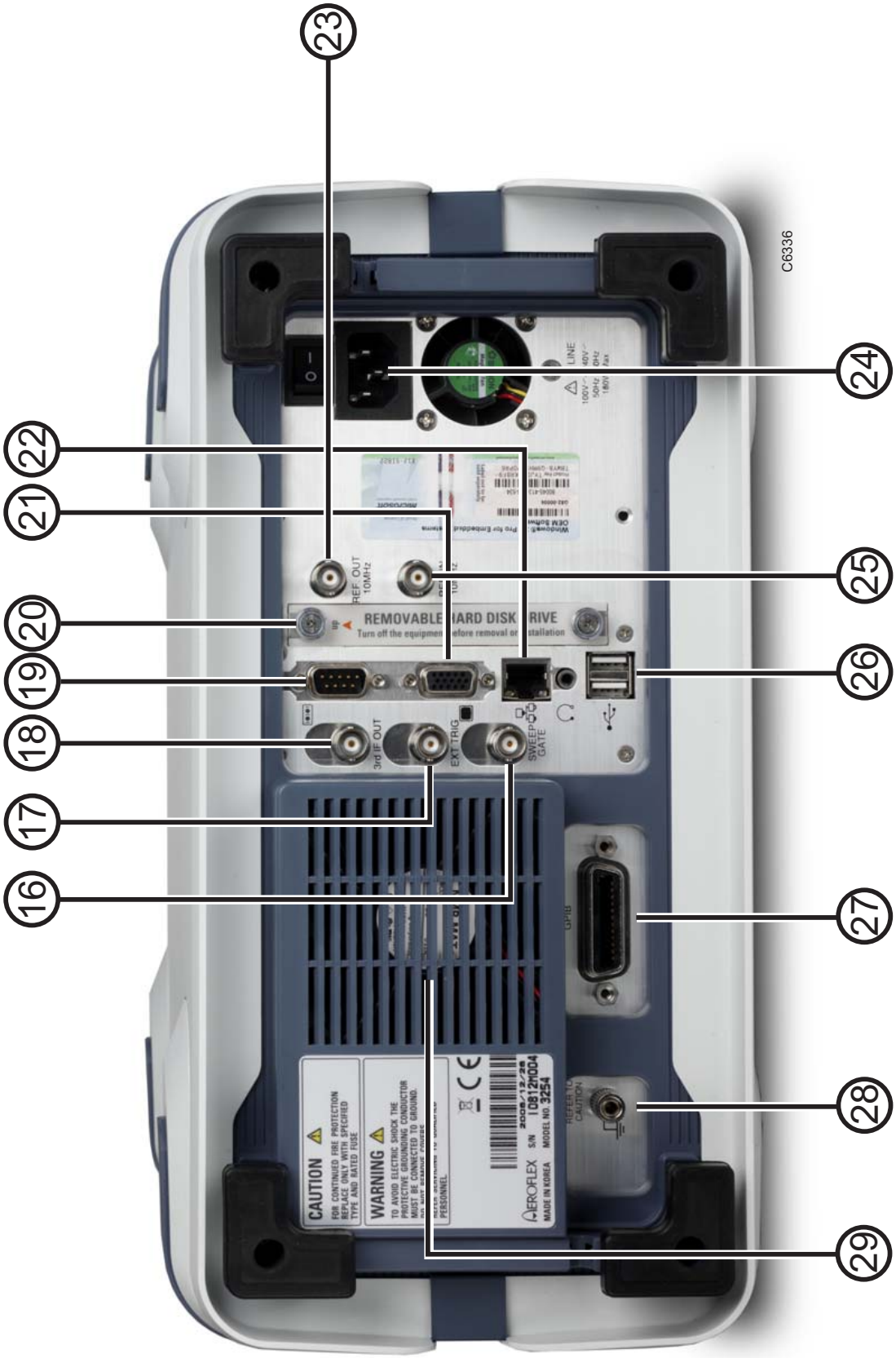


Fig. 3-2 Rear panel

I/O connectors

Table 3-2 I/O connectors

Connector	Type	In/out	Signal	Location
AC INPUT	IEC 320 socket	Input	AC power	Rear 25
RF INPUT	Type N (2.92 mm female)	Input	1 kHz–3.0/8/13.2/26.5 GHz	Front 9
CAL. OUT	BNC female	Output	40 MHz, –20 dBm	Front 10
EXT TRIG	BNC female	Input	TTL level	Rear 17
SWP GATE	BNC female	Output	TTL level	Rear 16
3rd IF OUT	BNC female	Output	21.4 MHz, 2 dBm	Rear 18
REF IN	BNC female	Input	10 MHz	Rear 25
REF OUT	BNC female	Output	10 MHz	Rear 23
GPIB	24-pin champ	In/Out	Refer to pin specification (Table 3-3)	Rear 27
RS-232C	9-pin, D-sub male	In/Out	Refer to pin specification (Table 3-4)	Rear 19
ETHERNET	10/100/1000 Base-T	In/Out	Refer to pin specification (Table 3-7)	Rear 22
USB	USB 2.0 support	In/Out	Refer to pin specification (Table 3-6)	Front 13 Rear 26
EXT VGA	15-Pin, D-sub female	Output	Refer to pin specification (Table 3-5)	Rear 21

GPIB connector

The IEEE-488 GPIB connector complies with ANSI/IEEE Standard 488.2-1987.

Table 3-3 Pin-out for IEEE-488 GPIB connector

Pin number	Signal	Pin number	Signal
1	DIO 1	13	DIO 5
2	DIO 2		DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EQI	17	REN
6	DAV	18	Ground
7	NRFD	19	Ground
8	NDAC	20	Ground
9	IFC	21	Ground
10	SRQ	22	Ground
11	ATN	23	Ground
12	Ground	24	Ground

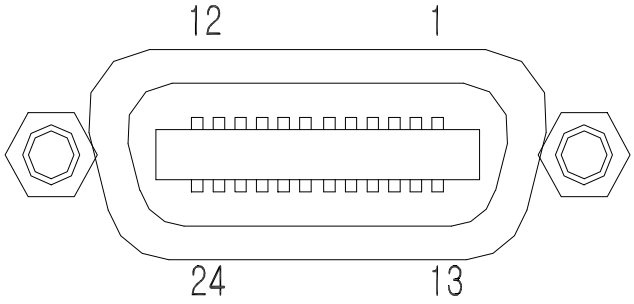


Fig. 3-3 IEEE-488 GPIB connector

RS-232C connector

Table 3-4 Pin-out for RS-232C connector

Pin number	Signal
1	DCD
2	RXD
3	TXD
4	DTR
5	Ground
6	DSR
7	RTS
8	CTS
9	RI (NC)

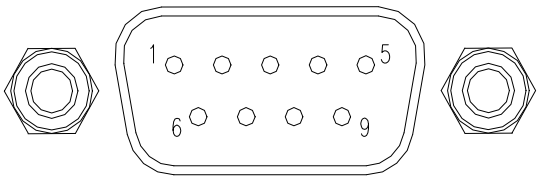


Fig. 3-4 RS-232C connector

Ext VGA connector

Table 3-5 Pin-out for EXT VGA connector

Pin number	Signal
1	RED
2	GREEN
3	BLUE
4	NC
5	Digital GND
6	RGND
7	GGND
8	BGND

9	Vcc
10	Digital GND
11	NC
12	DDC data
13	HSYNC
14	VSYNC
15	DDC clock

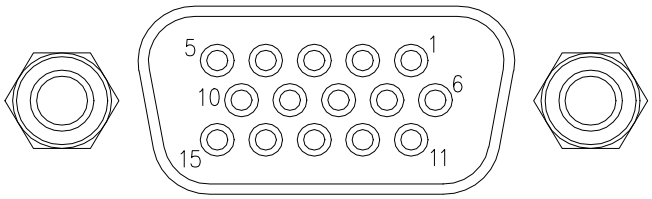


Fig. 3-5 EXT VGA connector

USB connector

Table 3-6 Pin-out for USB

Pin number	Signal
1	USB Vcc
2	DATA–
3	DATA+
4	USB GND

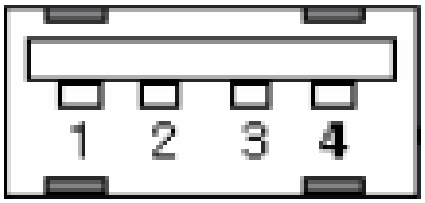


Fig. 3-6 USB connector

Ethernet connector

Table 3-7 Pin-out for ETHERNET

Pin number	Signal
1	TX+
2	TX–
3	RX+
4	NC
5	NC
6	RX–
7	NC
8	NC

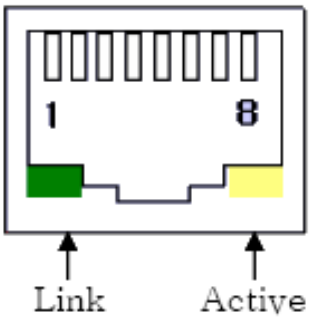


Fig. 3-7 ETHERNET connector

Chapter 4

MENU TREE

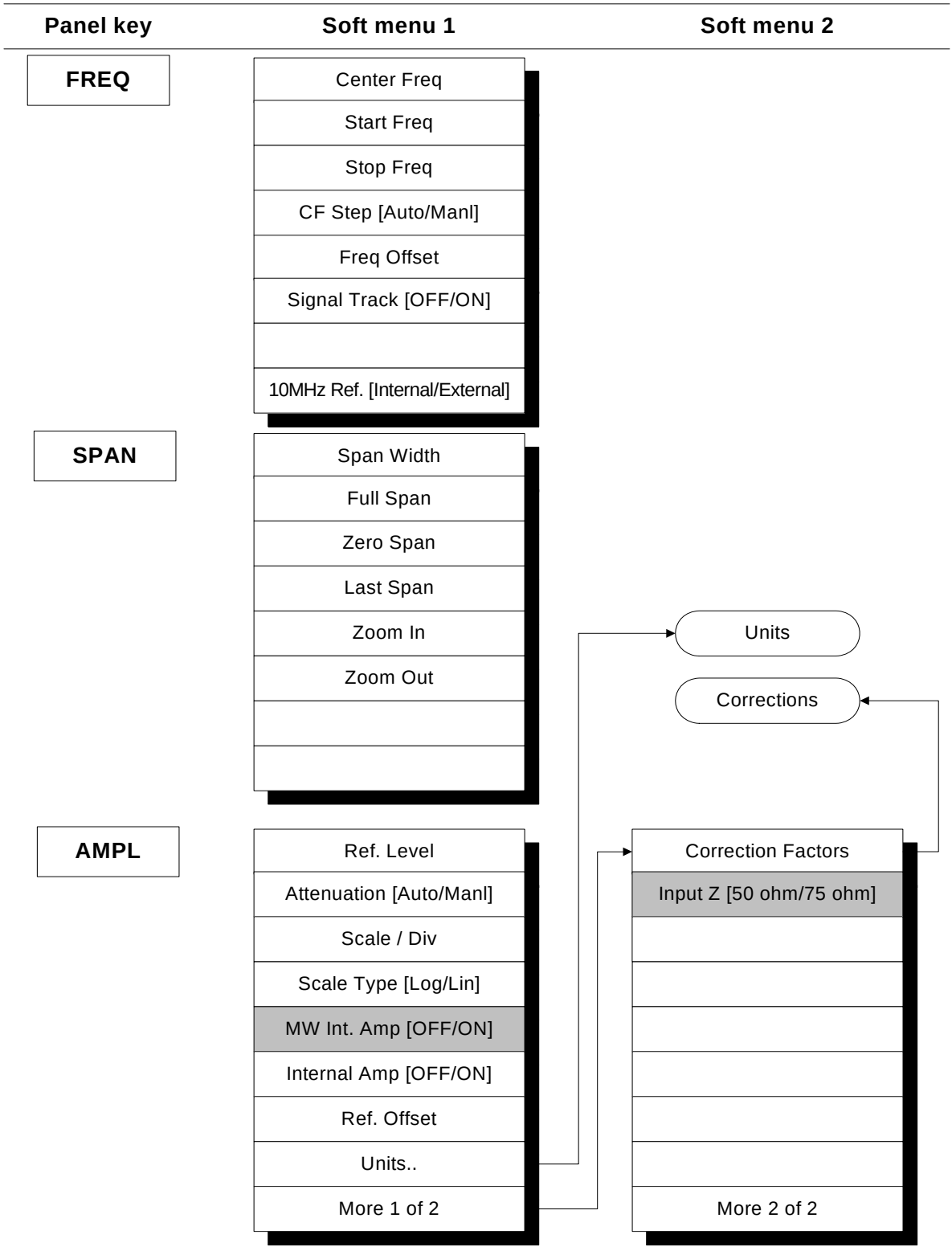
Introduction

In this section, soft menu functions and their hierarchy in the system are described using a menu tree.

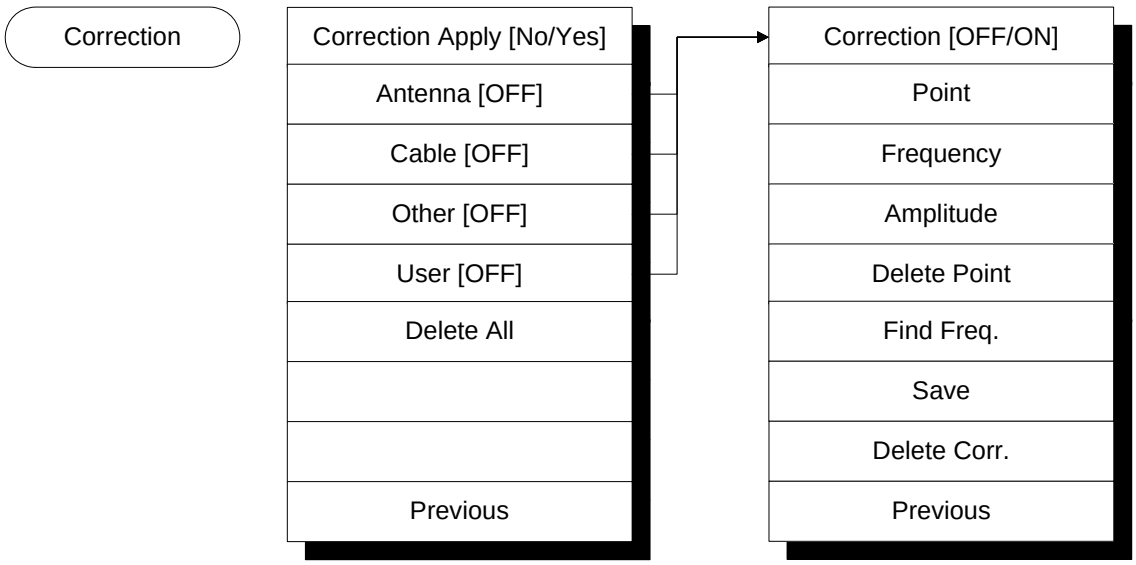
Note the following general operational points about the menu tree:

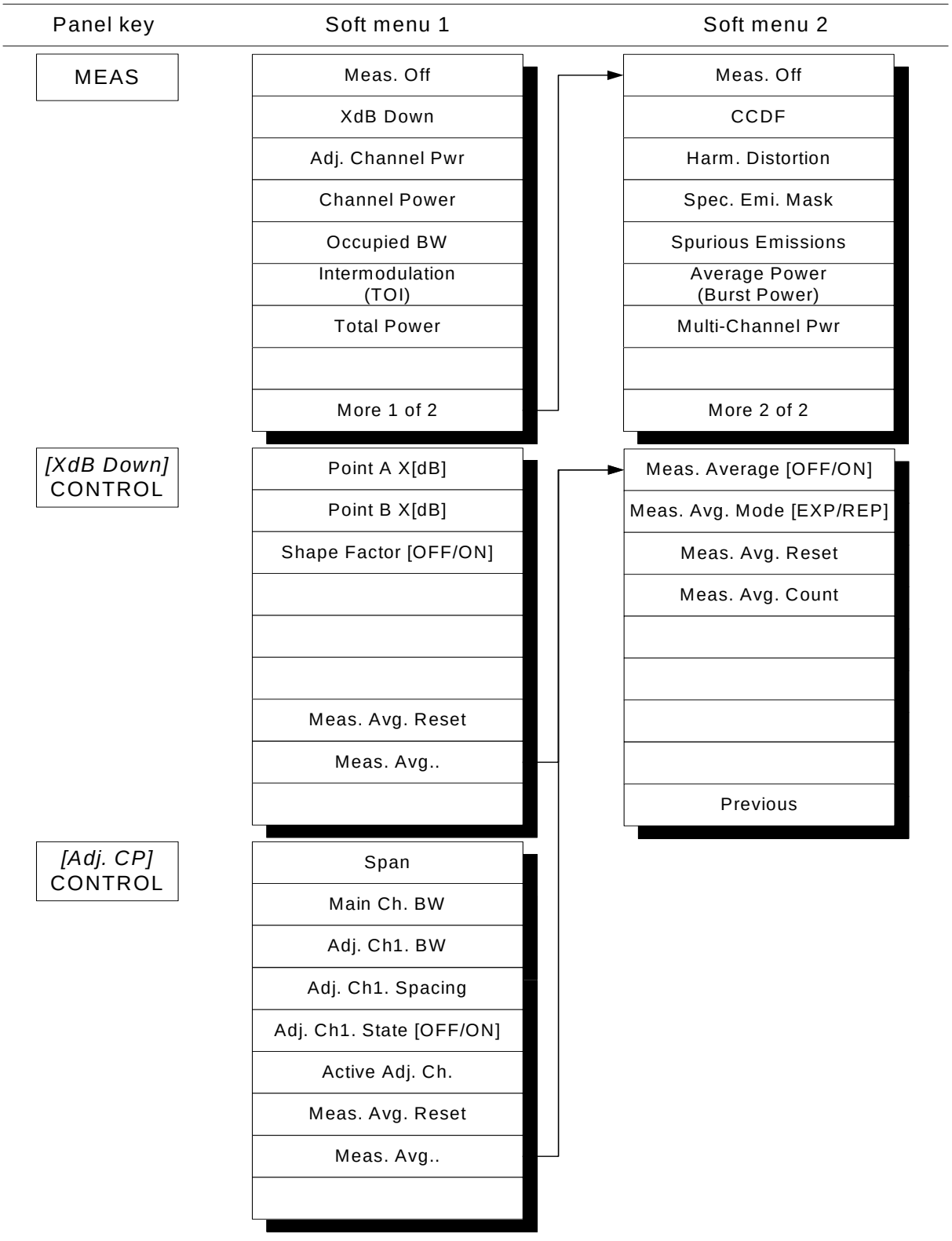
- **Panel Key** represents a hard key on the front panel.
- **Soft Menu 1** is displayed on the screen when the panel key is pressed. **Soft Menu 2** indicates that there is another menu below **Soft Menu 1**.
- Pressing *[Prev..]* on **Soft Menu 2** takes you back to **Soft Menu 1**.

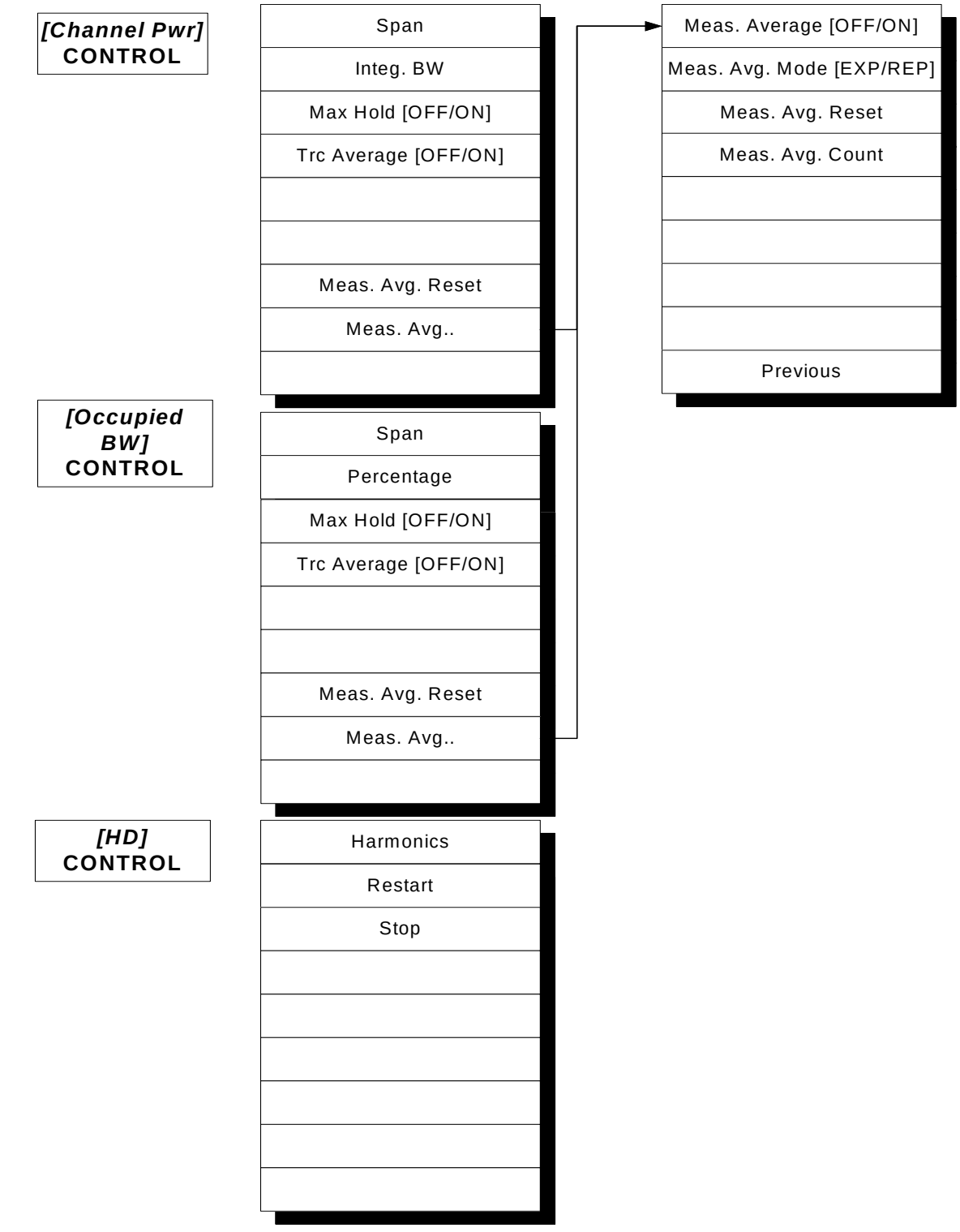
Menu tree

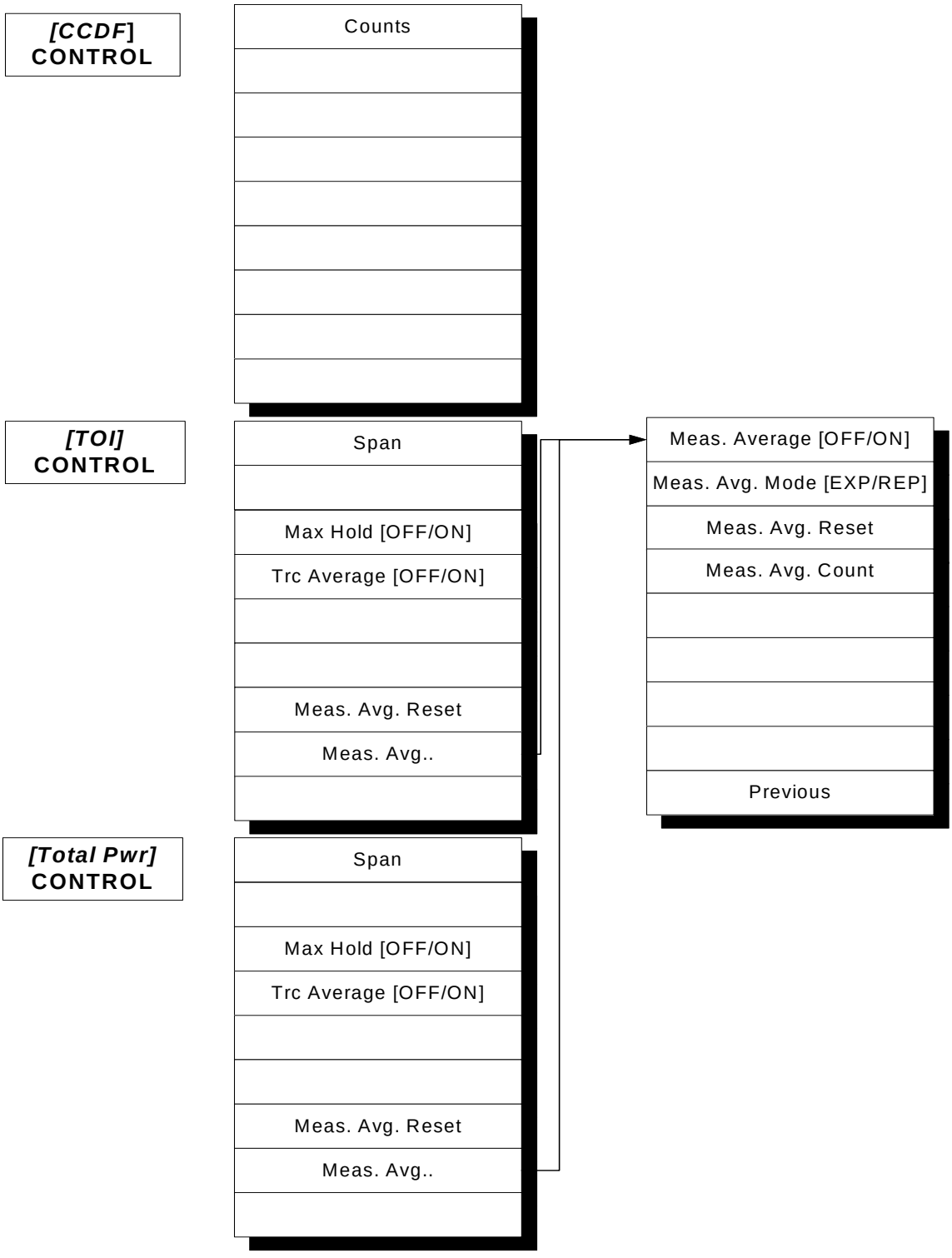

Panel key
Soft menu 1
Soft menu 2
FREQ
Center Freq
Start Freq
Stop Freq
CF Step [Auto/Manl]
Freq Offset
Signal Track [OFF/ON]
10MHz Ref. [Internal/External]
SPAN
Span Width
Full Span
Zero Span
Last Span
Zoom In
Zoom Out
Units
Corrections
AMPL
Ref. Level
Attenuation [Auto/Manl]
Scale / Div
Scale Type [Log/Lin]
MW Int. Amp [OFF/ON]
Internal Amp [OFF/ON]
Ref. Offset
Units..
More 1 of 2
Correction Factors
Input Z [50 ohm/75 ohm]
More 2 of 2

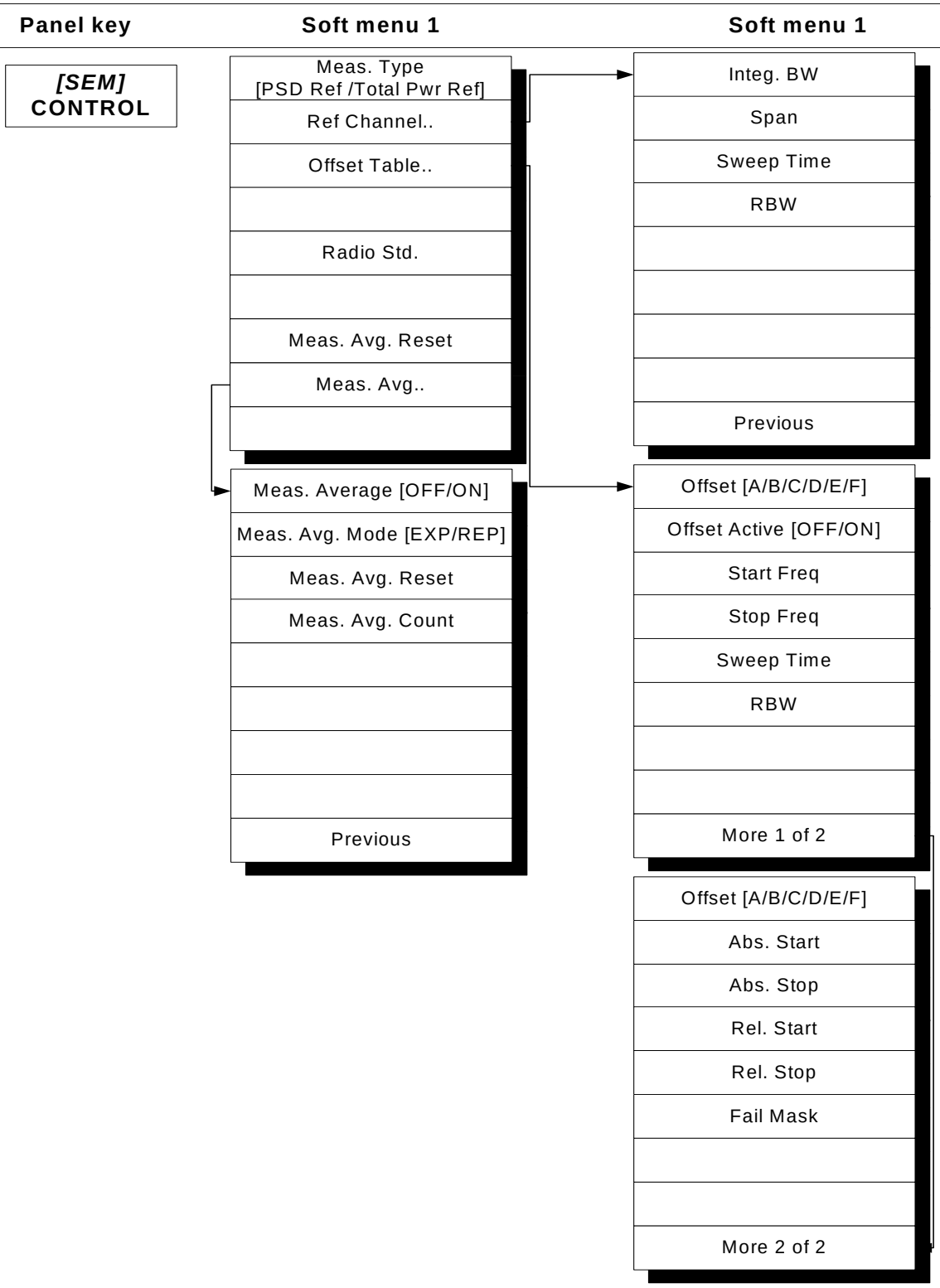
	Soft menu 1	Soft menu 2
Units	dBm	
	dBmV	
	dBuV	
	dBmA	
	dBuA	
	Volts	
	Watts	
	Amps	
	Previous	

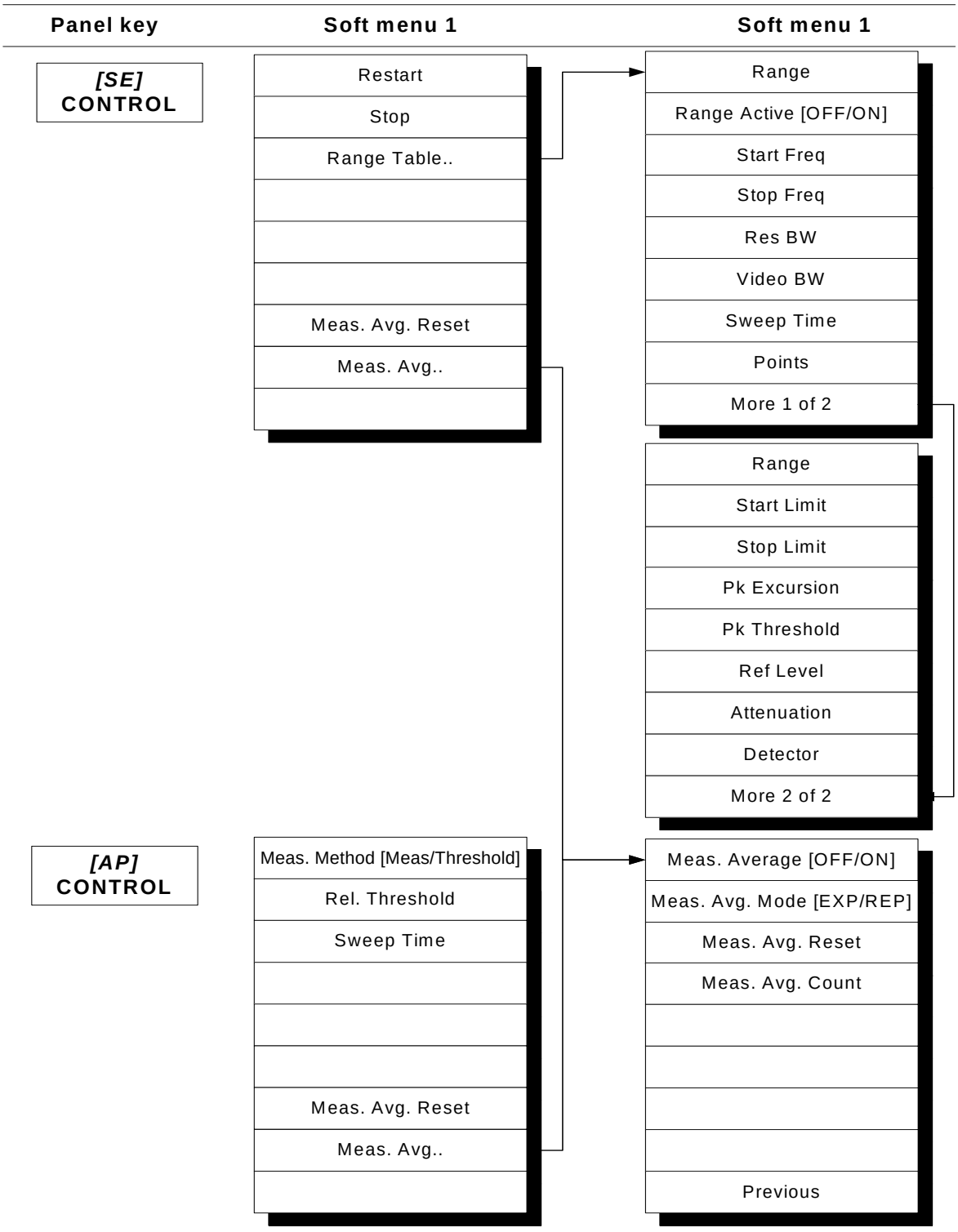


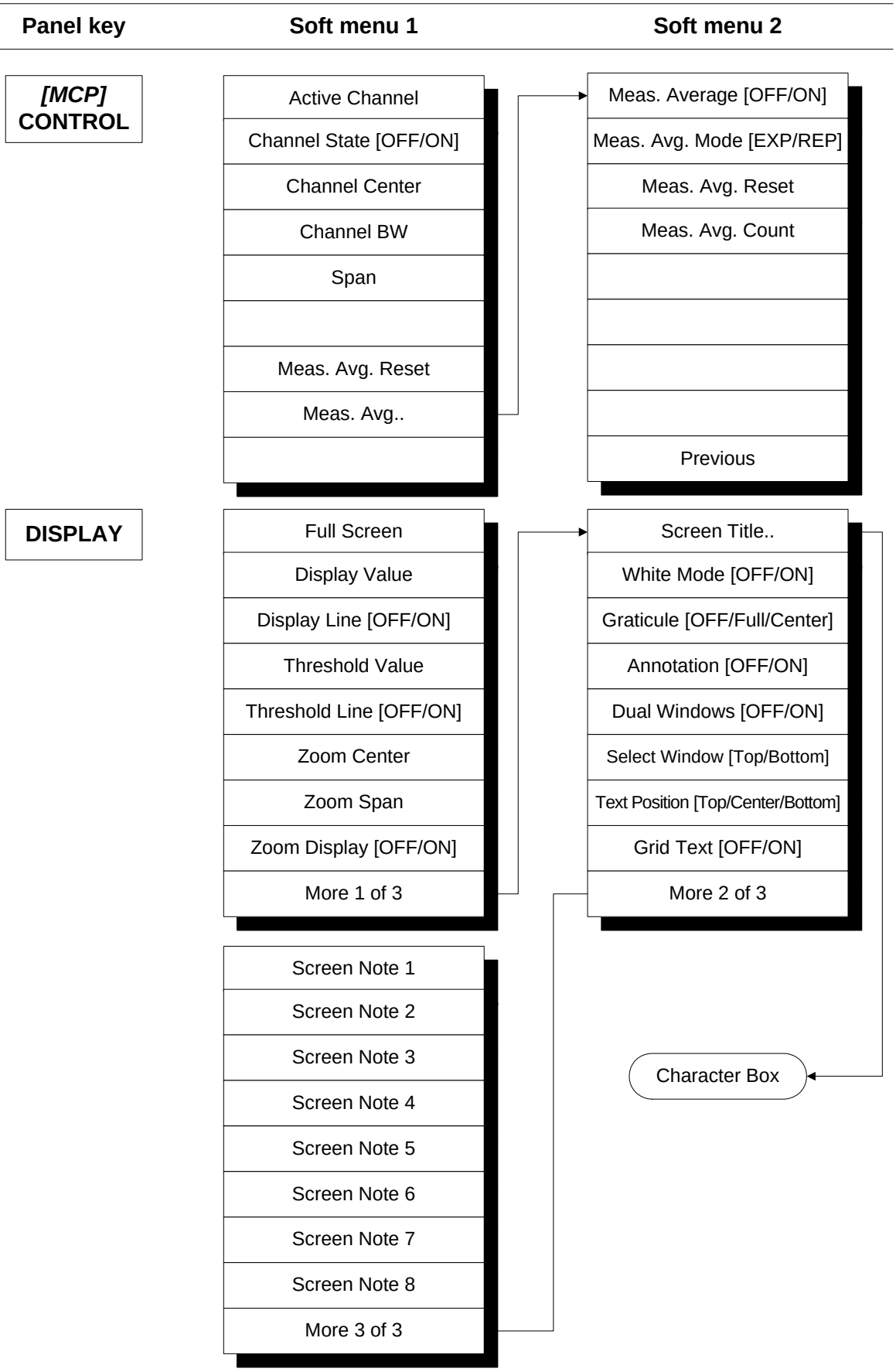

Panel key
Soft menu 1
Soft menu 2
MEAS
Meas. Off
XdB Down
Adj. Channel Pwr
Channel Power
Occupied BW
Intermodulation (TOI)
Total Power
More 1 of 2
Meas. Off
CCDF
Harm. Distortion
Spec. Emi. Mask
Spurious Emissions
Average Power (Burst Power)
Multi-Channel Pwr
More 2 of 2
[XdB Down] CONTROL
Point A X[dB]
Point B X[dB]
Shape Factor [OFF/ON]
Meas. Avg. Reset
Meas. Avg..
Meas. Average [OFF/ON]
Meas. Avg. Mode [EXP/REP]
Meas. Avg. Reset
Meas. Avg. Count
Previous
[Adj. CP] CONTROL
Span
Main Ch. BW
Adj. Ch1. BW
Adj. Ch1. Spacing
Adj. Ch1. State [OFF/ON]
Active Adj. Ch.
Meas. Avg. Reset
Meas. Avg..

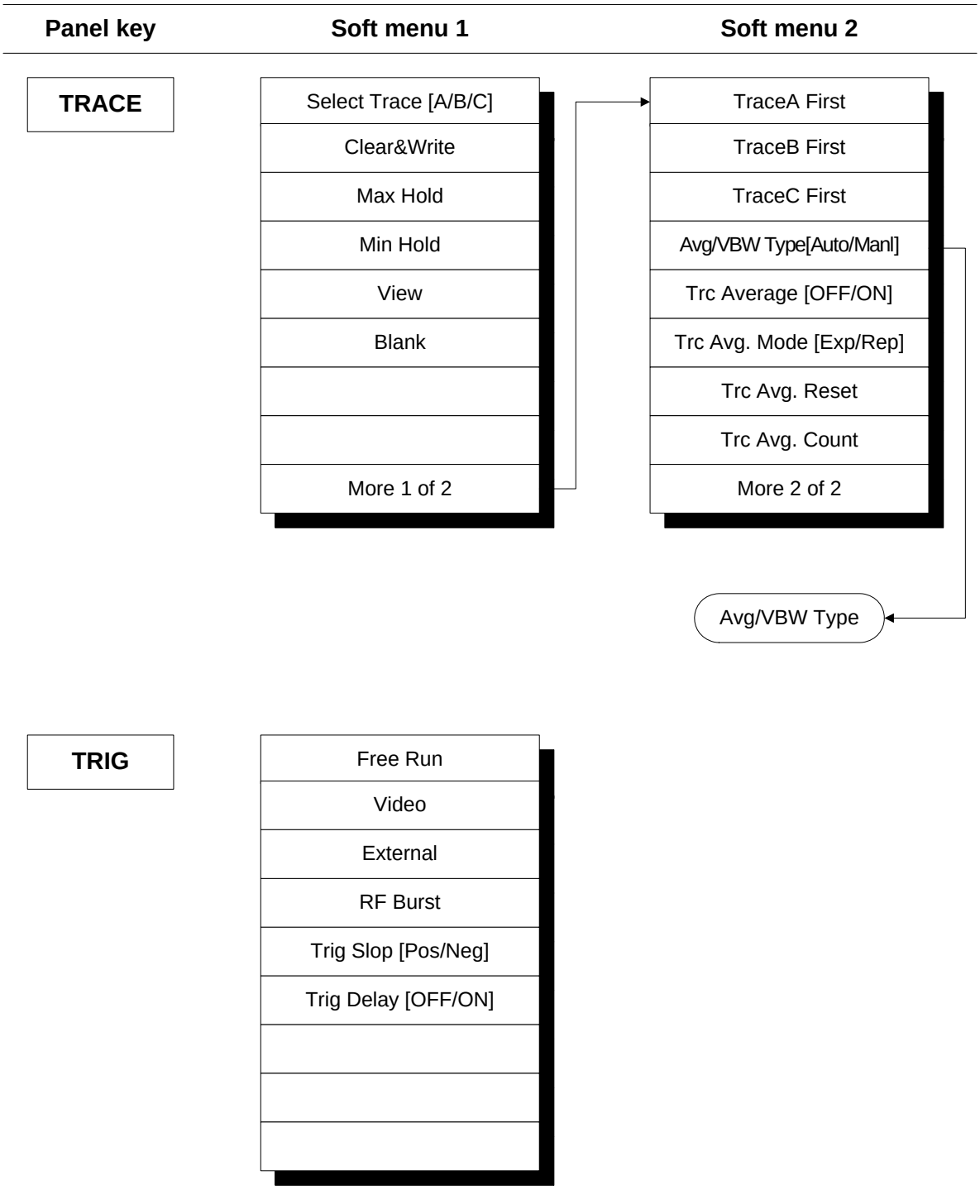

Panel key
Soft menu 1
Soft menu 1
[Channel Pwr] CONTROL
Span
Integ. BW
Max Hold [OFF/ON]
Trc Average [OFF/ON]
Meas. Avg. Reset
Meas. Avg..
Meas. Average [OFF/ON]
Meas. Avg. Mode [EXP/REP]
Meas. Avg. Reset
Meas. Avg. Count
Previous
[Occupied BW] CONTROL
Span
Percentage
Max Hold [OFF/ON]
Trc Average [OFF/ON]
Meas. Avg. Reset
Meas. Avg..
[HD] CONTROL
Harmonics
Restart
Stop

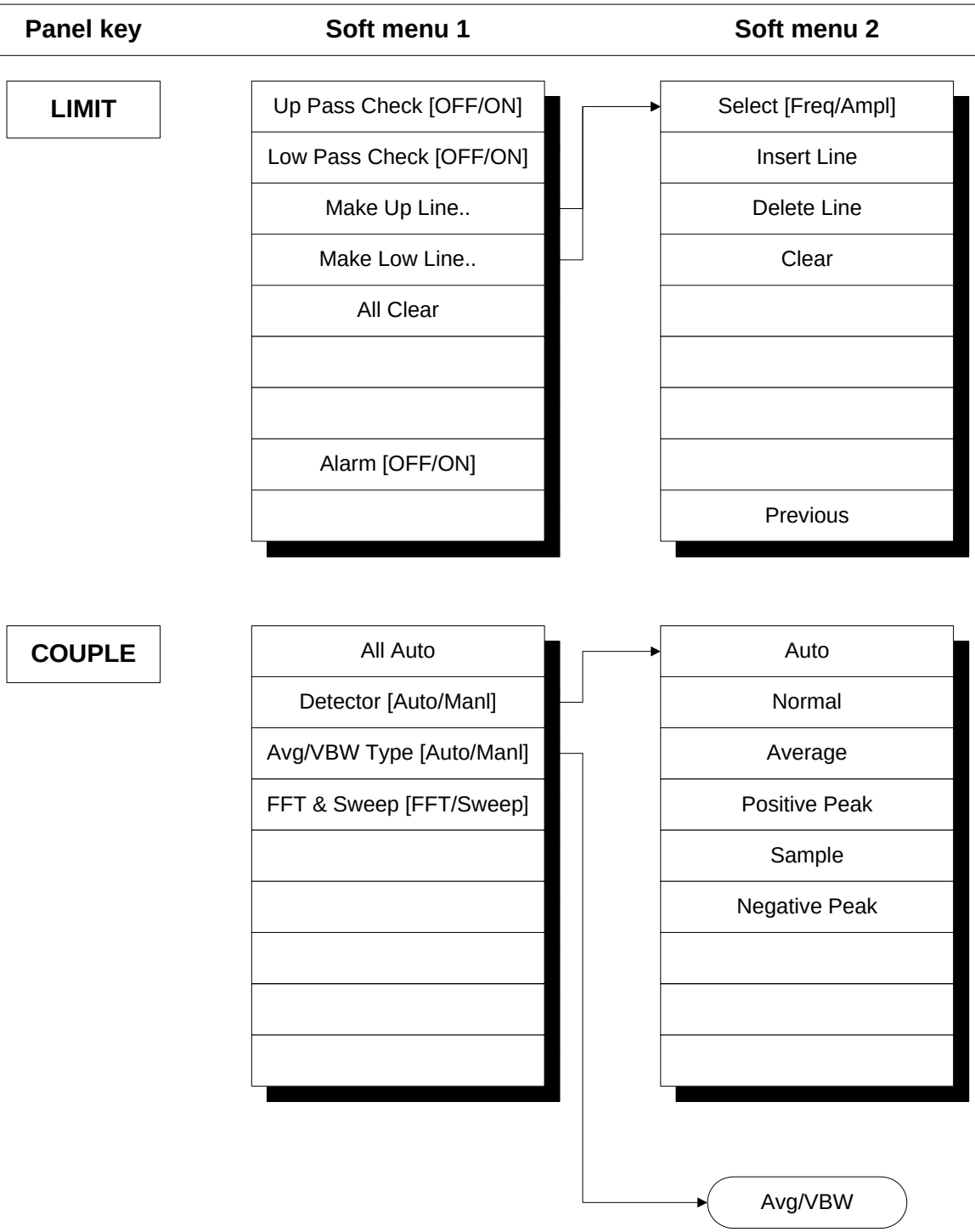

Panel key
Soft menu 1
Soft menu 1
[CCDF] CONTROL
Counts
[TOI] CONTROL
Span
Max Hold [OFF/ON]
Trc Average [OFF/ON]
Meas. Avg. Reset
Meas. Avg..
Meas. Average [OFF/ON]
Meas. Avg. Mode [EXP/REP]
Meas. Avg. Reset
Meas. Avg. Count
Previous
[Total Pwr] CONTROL
Span
Max Hold [OFF/ON]
Trc Average [OFF/ON]
Meas. Avg. Reset
Meas. Avg..


Panel key
Soft menu 1
Soft menu 1
[SEM] CONTROL
Meas. Type [PSD Ref /Total Pwr Ref]
Ref Channel..
Offset Table..
Radio Std.
Meas. Avg. Reset
Meas. Avg..
Meas. Average [OFF/ON]
Meas. Avg. Mode [EXP/REP]
Meas. Avg. Reset
Meas. Avg. Count
Previous
Integ. BW
Span
Sweep Time
RBW
Previous
Offset [A/B/C/D/E/F]
Offset Active [OFF/ON]
Start Freq
Stop Freq
Sweep Time
RBW
More 1 of 2
Offset [A/B/C/D/E/F]
Abs. Start
Abs. Stop
Rel. Start
Rel. Stop
Fail Mask
More 2 of 2


Panel key
Soft menu 1
Soft menu 1
[SE] CONTROL
Restart
Stop
Range Table..
Meas. Avg. Reset
Meas. Avg..
Range
Range Active [OFF/ON]
Start Freq
Stop Freq
Res BW
Video BW
Sweep Time
Points
More 1 of 2
Range
Start Limit
Stop Limit
Pk Excursion
Pk Threshold
Ref Level
Attenuation
Detector
More 2 of 2
[AP] CONTROL
Meas. Method [Meas/Threshold]
Rel. Threshold
Sweep Time
Meas. Avg. Reset
Meas. Avg..
Meas. Average [OFF/ON]
Meas. Avg. Mode [EXP/REP]
Meas. Avg. Reset
Meas. Avg. Count
Previous

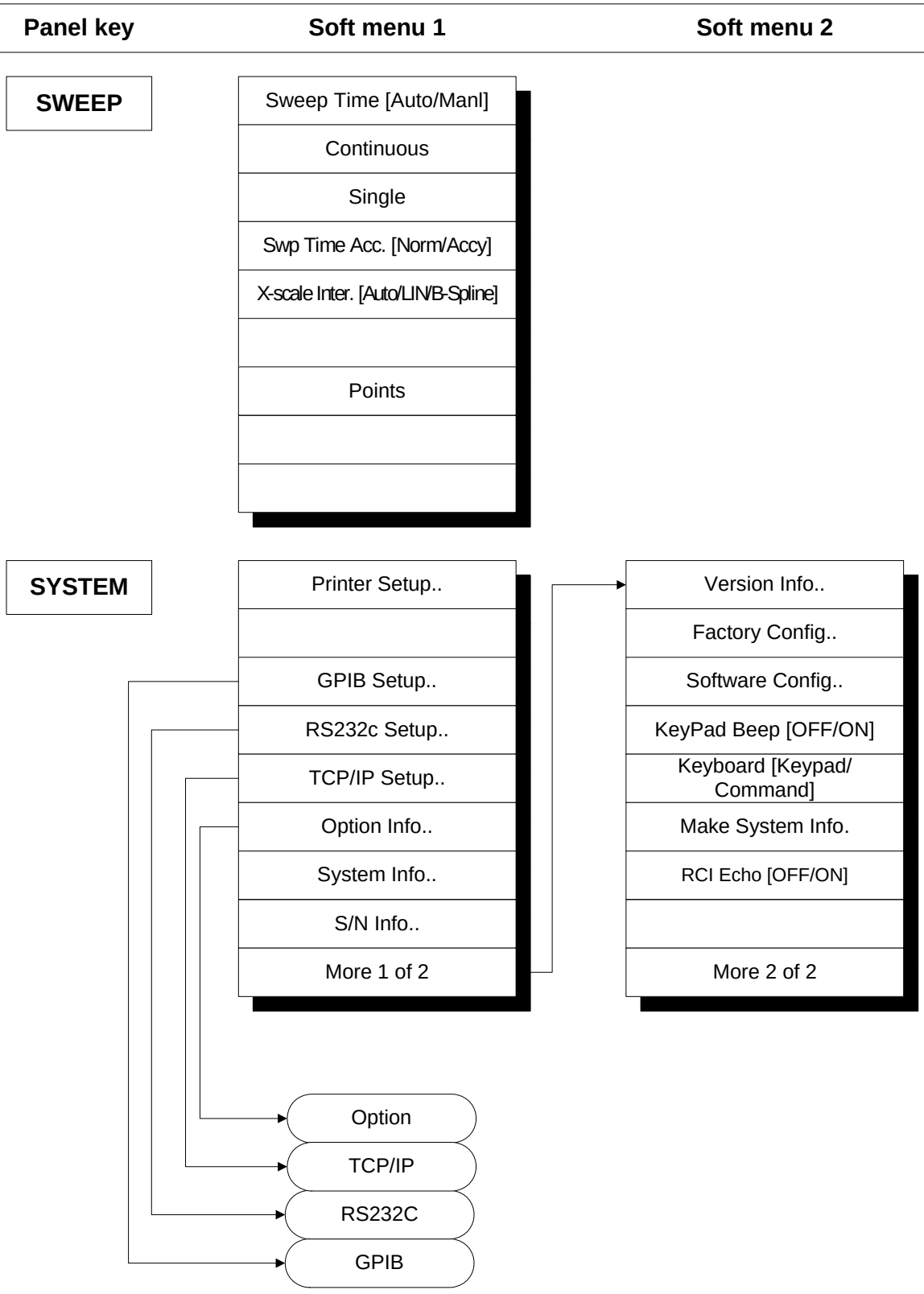

Panel key
Soft menu 1
Soft menu 2
[MCP] CONTROL
Active Channel
Channel State [OFF/ON]
Channel Center
Channel BW
Span
Meas. Avg. Reset
Meas. Avg..
Meas. Average [OFF/ON]
Meas. Avg. Mode [EXP/REP]
Meas. Avg. Reset
Meas. Avg. Count
Previous
DISPLAY
Full Screen
Display Value
Display Line [OFF/ON]
Threshold Value
Threshold Line [OFF/ON]
Zoom Center
Zoom Span
Zoom Display [OFF/ON]
More 1 of 3
Screen Title..
White Mode [OFF/ON]
Graticule [OFF/Full/Center]
Annotation [OFF/ON]
Dual Windows [OFF/ON]
Select Window [Top/Bottom]
Text Position [Top/Center/Bottom]
Grid Text [OFF/ON]
More 2 of 3
Screen Note 1
Screen Note 2
Screen Note 3
Screen Note 4
Screen Note 5
Screen Note 6
Screen Note 7
Screen Note 8
More 3 of 3
Character Box


Panel key
Soft menu 1
Soft menu 2
TRACE
Select Trace [A/B/C]
Clear&Write
Max Hold
Min Hold
View
Blank
More 1 of 2
TraceA First
TraceB First
TraceC First
Avg/VBW Type[Auto/Manl]
Trc Average [OFF/ON]
Trc Avg. Mode [Exp/Rep]
Trc Avg. Reset
Trc Avg. Count
More 2 of 2
Avg/VBW Type
TRIG
Free Run
Video
External
RF Burst
Trig Slop [Pos/Neg]
Trig Delay [OFF/ON]

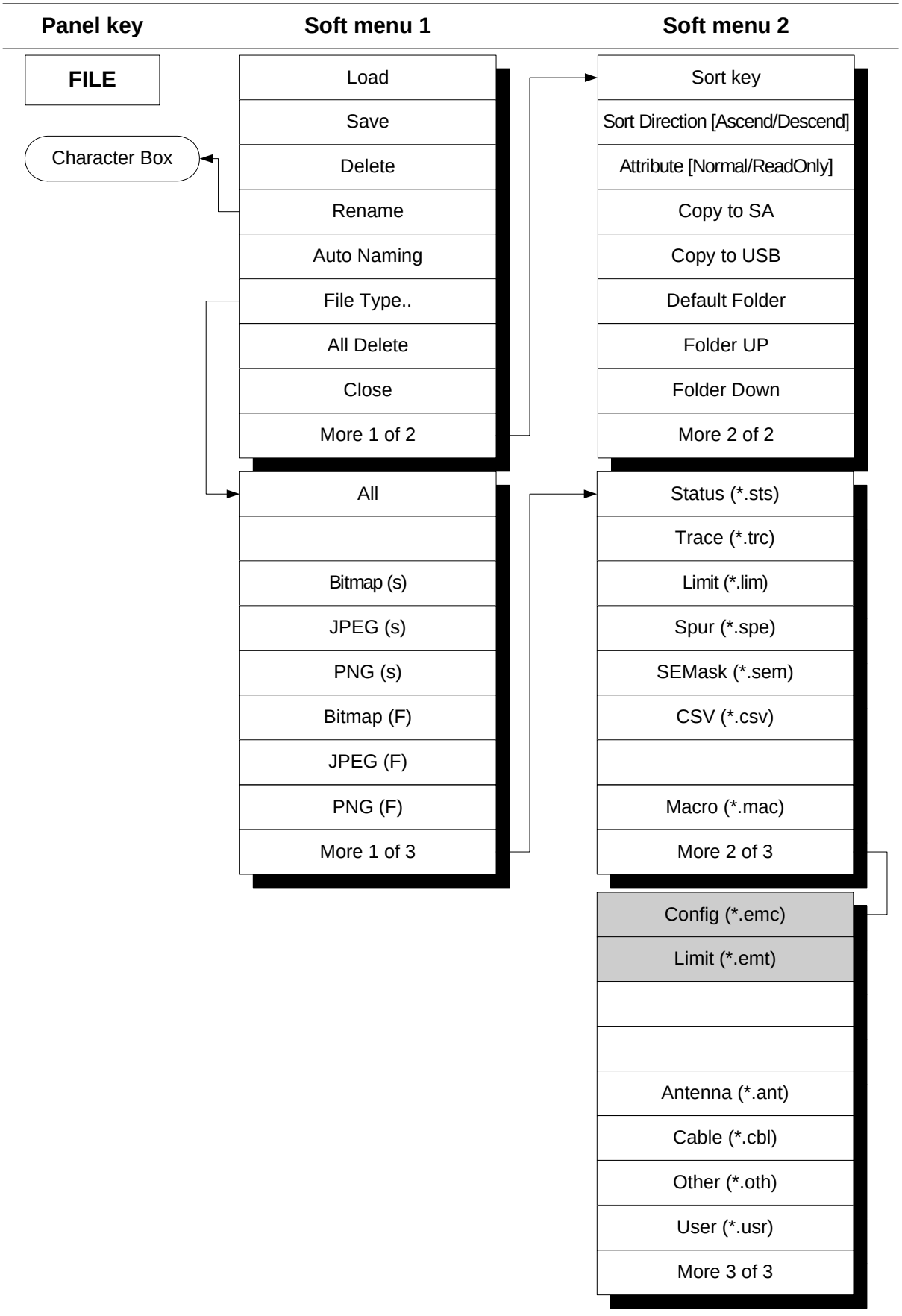

Panel key
Soft menu 1
Soft menu 2
LIMIT
Up Pass Check [OFF/ON]
Low Pass Check [OFF/ON]
Make Up Line..
Make Low Line..
All Clear
Alarm [OFF/ON]
Select [Freq/Ampl]
Insert Line
Delete Line
Clear
Previous
COUPLE
All Auto
Detector [Auto/Manl]
Avg/VBW Type [Auto/Manl]
FFT & Sweep [FFT/Sweep]
Auto
Normal
Average
Positive Peak
Sample
Negative Peak
Avg/VBW

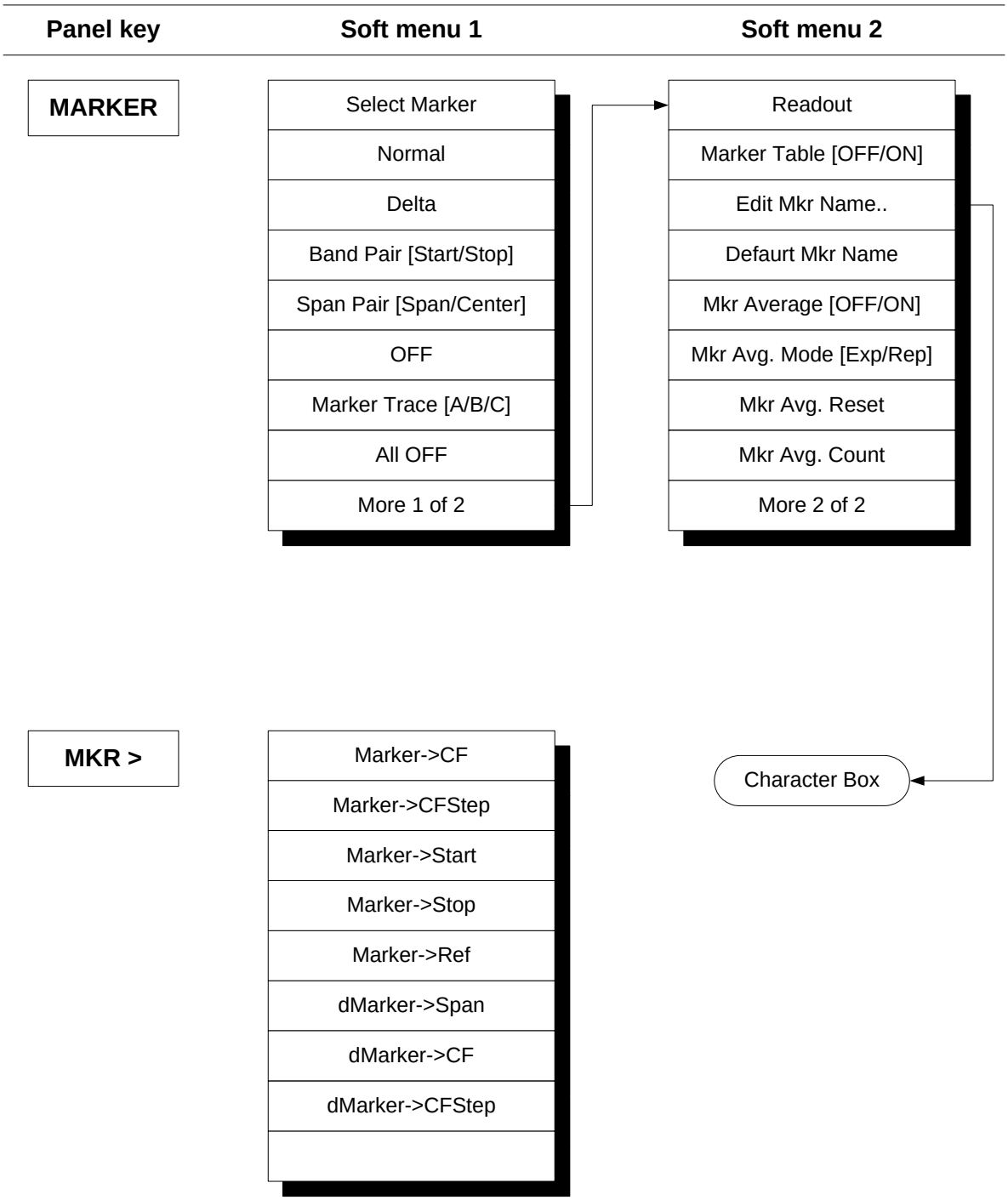
Panel key	Soft menu 1	Soft menu 2
Avg/VBW	Auto	
	Log-Pwr Avg	
	Pwr Avg	
	Voltage Avg	
BW	All Auto	
	RBW [Auto/Manl]	
	VBW [Auto/Manl]	
	VBW/RBW	
	Span/RBW [Auto/Manl]	

Panel key	Soft menu 1	Soft menu 2
AUX	Am Demod. [OFF/ON]	
	FM Demod. [OFF/ON]	
	Audio Sound [OFF/ON]	
	Audio Level	
	Spectrum View [OFF/ON]	
	Window Type	
	AM Scale	
	FM Scale	
SOURCE	TG	Tracker [OFF/ON]
	SG	Output Lvl
		Normal [OFF/ON]
		Power Swp [OFF/ON]


Panel key
Soft menu 1
Soft menu 2
SWEEP
Sweep Time [Auto/Manl]
Continuous
Single
Swp Time Acc. [Norm/Accy]
X-scale Inter. [Auto/LIN/B-Spline]
Points
SYSTEM
Printer Setup..
GPIB Setup..
RS232c Setup..
TCP/IP Setup..
Option Info..
System Info..
S/N Info..
More 1 of 2
Version Info..
Factory Config..
Software Config..
KeyPad Beep [OFF/ON]
Keyboard [Keypad/ Command]
Make System Info.
RCI Echo [OFF/ON]
More 2 of 2
Option
TCP/IP
RS232C
GPIB

Panel key	Soft menu 1	Soft menu 2
RS232C	Baud Rate	
	Data Length	
	Stop Bit	
	Parity Bit	
	Previous	
GPIB	Set Address	
	Previous	
OPTION	Option Activate	
	Display Option	
	Previous	


Panel key
Soft menu 1
Soft menu 2
FILE
Character Box
Load
Save
Delete
Rename
Auto Naming
File Type..
All Delete
Close
More 1 of 2
Sort key
Sort Direction [Ascend/Descend]
Attribute [Normal/ReadOnly]
Copy to SA
Copy to USB
Default Folder
Folder UP
Folder Down
More 2 of 2
All
Bitmap (s)
JPEG (s)
PNG (s)
Bitmap (F)
JPEG (F)
PNG (F)
More 1 of 3
Status (*.sts)
Trace (*.trc)
Limit (*.lim)
Spur (*.spe)
SEMask (*.sem)
CSV (*.csv)
Macro (*.mac)
More 2 of 3
Config (*.emc)
Limit (*.emt)
Antenna (*.ant)
Cable (*.cbl)
Other (*.oth)
User (*.usr)
More 3 of 3


Panel key
Soft menu 1
Soft menu 2
MARKER
Select Marker
Normal
Delta
Band Pair [Start/Stop]
Span Pair [Span/Center]
OFF
Marker Trace [A/B/C]
All OFF
More 1 of 2
Readout
Marker Table [OFF/ON]
Edit Mkr Name..
Defaurt Mkr Name
Mkr Average [OFF/ON]
Mkr Avg. Mode [Exp/Rep]
Mkr Avg. Reset
Mkr Avg. Count
More 2 of 2
MKR >
Marker->CF
Marker->CFStep
Marker->Start
Marker->Stop
Marker->Ref
dMarker->Span
dMarker->CF
dMarker->CFStep
Character Box

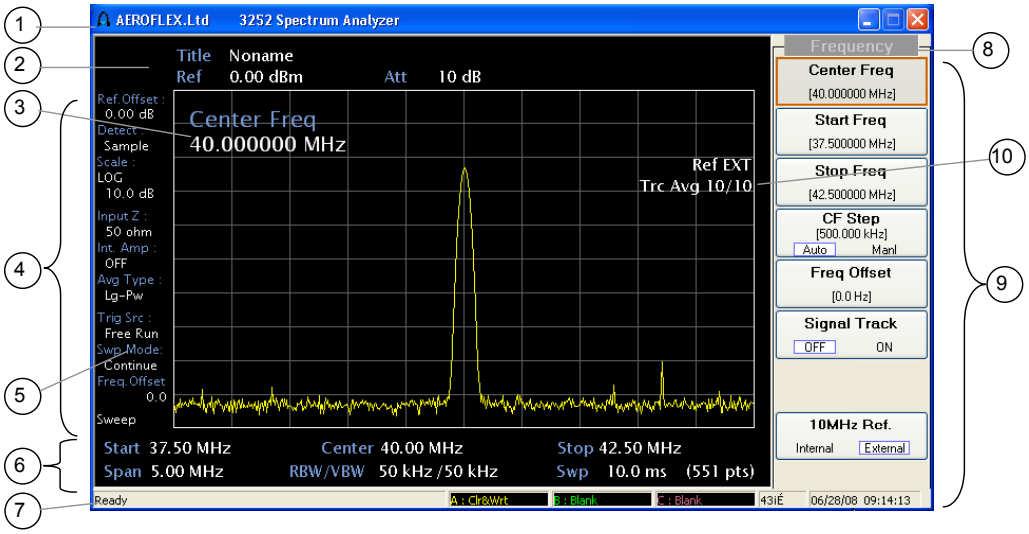
Panel key	Soft menu 1	Soft menu 2
PEAK	Next Peak	Run Multi Peak
	Next Pk Left	Multi Peak Number
	Next Pk Right	Multi Pk Trace [A/B/C]
	Min Search	
	Pk-Pk Search	
	Signal Track [OFF/ON]	Pk Excursion
	Continuous [OFF/ON]	Pk Threshold
	Marker->CF	Pk Method [Param/Max]
	More 1 of 2	More 2 of 2
FUNC	Marker Noise	
	Freq. Counter	
	Meas. OFF	

Chapter 5
OPERATING PROCEDURES

Contents

Screen layout

This is the initial screen that you see at start-up.



1	Title window	Manufacturer, display model
2	Upper display window	Displays screen subject, reference level, scale, attenuation and marker parameter
3	Parameter window	Displays current active menu parameter
4	Wave display window	Displays current active waveform
5	Left display window	Displays information about trigger and operating mode
6	Lower display window	Displays Freq. Info, RBW, VBW, Sweep time, number of points
7	Status display window	Displays current job processing status and waveform status
8	Menu name	Displays the current soft menu name
9	Soft key menu	Displays the available auxiliary function associated with the selected hard key
10	Effective data / average number display	Displays the number of signal waveform averages. Displays confirmation of frequency input.

Selecting parameters with touch screen

Because this instrument has a touch-sensitive screen, you can select parameters by pressing either a soft key (F1–F8, NEXT) or touching the associated screen area.

Toggling values

To toggle between values (for example, *[Max Hold]* OFF/ON), either press the soft key repeatedly to toggle, or touch the [OFF] or [ON] box on the associated screen area.

Control using keyboard and mouse

Keyboard

You can control the equipment with an externally connected keyboard by setting the instrument to Keypad mode in the System menu (page 5-54).

Keys on the keyboard then corresponds to the instrument as below:

Keyboard	Instrument
F1–F9	Soft keys (F1–F8) and NEXT (F9) key
0–9 / - / **.** (period) / ← (backspace)	Number keys on the keypad and hard keys
Left/right cursor keys (← →)	Scroll knob
Up/down cursor keys (↑↓)	Step key
A–Z	Hard keys (refer to the table below)

Table 5-1 Hard key equivalents on external keyboard

Hard key	Keyboard	Hard key	Keyboard	Hard key	Keyboard
FREQ	FR	DISPLAY	DI	BW	BW
SPAN	SP	TRACE	TRA	AUX	AU
AMPL	AM	TRIG	TRI	SOURCE	SO
MEAS	ME	LIMIT	LI	SWEEP	SW
CONTROL	CON	COUPLE	COU	SYSTEM	SY
PRESET	PRE	FUNC	FU	START	ST
FILE	FI	SAVE	SA	PRINT	PRI
MARKER	MA	SINGLE	SI	PEAK	PE
MKR >	MK				

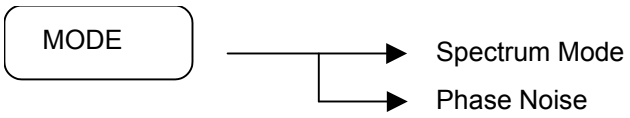
Mouse

Soft-key operation can be simulated using a mouse. If the mouse has a wheel, wheel operation corresponds to the instrument's scroll knob.

Selecting spectrum analysis or phase noise measurement mode

By default, the instrument starts up in spectrum analysis mode.

To toggle between spectrum analysis and phase noise measurement modes, do the following:



Select the [MODE] hard key on the front panel of the signal analyzer, and then press the *[Spectrum Mode]* or *[Phase Noise]* soft key to select the appropriate operating mode.

Then go to:

page 5-8 for spectrum analysis operation

page 5-69 for phase noise operation.

Instrument in spectrum analysis measurement mode

Freq/span functions

Frequency is set in either of two modes:

- Center-span mode
- Start-stop mode

The lower and upper span limits are 1 kHz to 3 GHz (3251) / 8 GHz (3252) / 13.2 GHz (3253) / 26.5 GHz (3254).

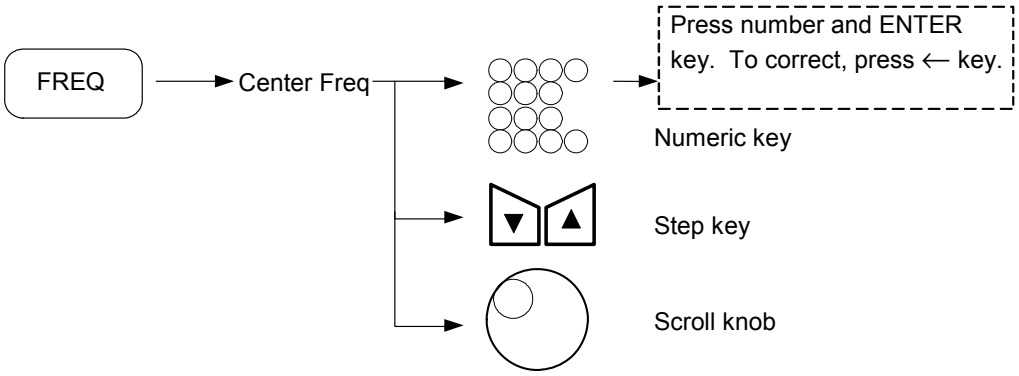
Use [FREQ] for setting frequency.

Use [SPAN] for setting frequency span.

Center-span mode frequency data entry

Setting the center frequency

To set the center frequency, do the following:



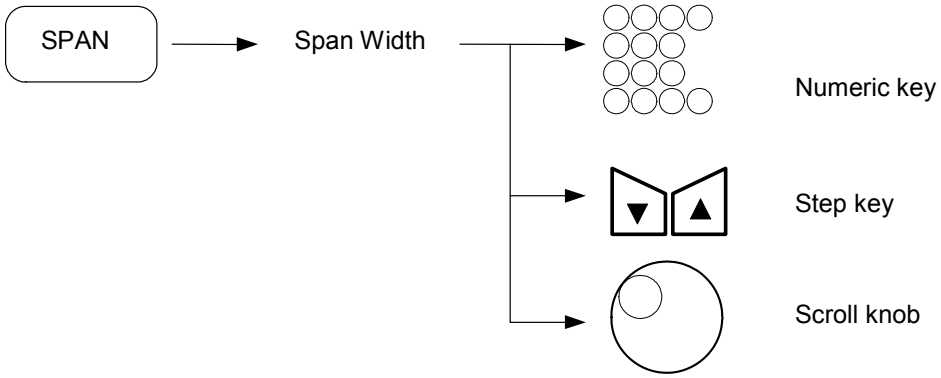
The step size of the step up/down key is 1/10 of the current frequency span (CF Step mode set to MANL, page 5-11).

The step size of the scroll knob is 1/500 of the current frequency span.

The span can be changed if the center moves too near the boundary.

Setting the frequency span

To set the frequency span, do the following:



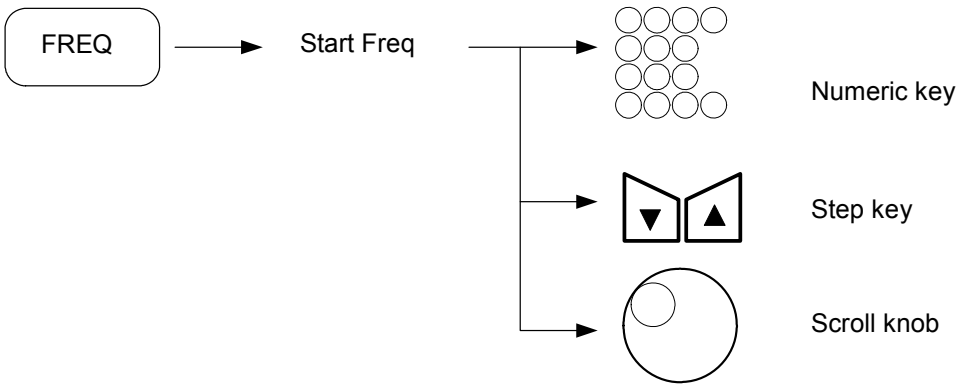
Span range is 10 Hz–3 GHz/6.2 GHz/13.2 GHz/26.5 GHz. It changes in a 1, 2, 5-step sequence: 1 k, 2 k, 5 k, ……, 100 k, 200 k, 500 k, …

The step size of the scroll knob is 1/100 of the current frequency span.

Start-stop mode frequency data entry

Setting the start frequency

To set the start frequency, do the following:

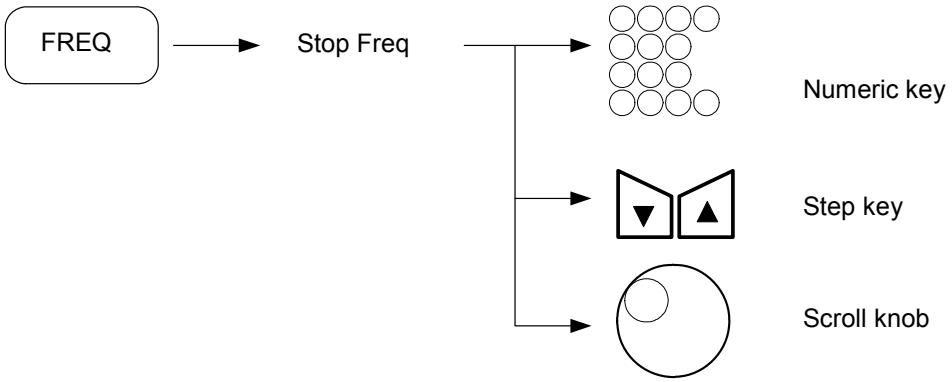


The step size of the step up/down key is 1/10 of the current frequency span.

The step size of the scroll knob is 1/500 of the current frequency span.

Setting the stop frequency

To set the stop frequency, do the following:



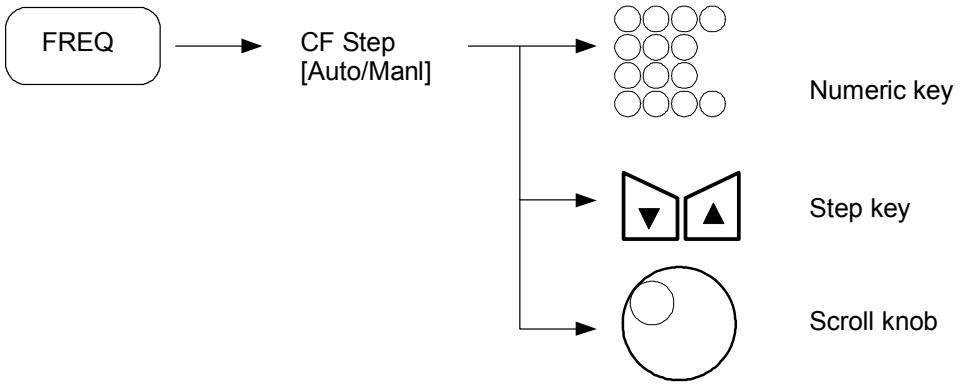
The step size of the step up/down key is 1/10 of the current frequency span.

The step size of the scroll knob is 1/500 of the current frequency span.

***Note**: the start and stop frequencies are also determined by setting the center and the span frequency. For example, if the center frequency is 40 MHz and the span frequency is 20 MHz, the start and the stop frequency are determined as 30 MHz and 50 MHz respectively.*

Setting center frequency step

To set the start frequency, do the following:



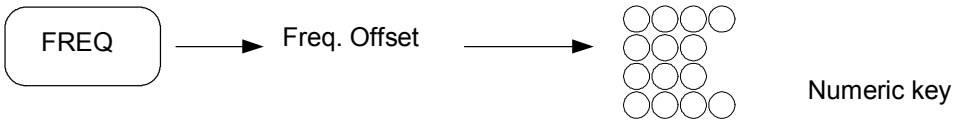
Change the CF Step mode from AUTO to MANL mode by pressing *[CF Step]*.

In CF Step MANL (Manual) mode, the step size can be set by the data entry section (numeric keys, step keys or scroll knob).

If CF Step [AUTO/MANL] 'AUTO' is selected, the CF Step size is 1/10 of the current span.

Setting frequency offset

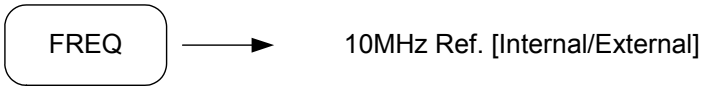
To set frequency offset, do the following:



Change the Freq. Offset mode from OFF to ON mode by pressing *[Freq. Offset]*. In Freq. Offset [ON] mode, the frequency-offset size can be set by the numeric key.

Setting 10 MHz reference frequency

You can choose to synchronize to an external 10 MHz reference frequency:



If you use an external reference frequency, set the 10 MHz Ref to External.

Setting signal tracking

The maximum level point always moves to the center position of the horizontal axis when signal tracking is on.

Signal tracking is ON or OFF.

***Note**: the span changes to minimum span in the following cases:*

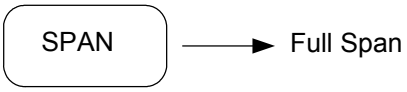
1) if the center frequency is less than the minimum frequency (0 Hz) or is greater than the maximum frequency (3/8/13.2/26.5 GHz)

2) if the start frequency is greater than the stop frequency

3) if the stop frequency is less than the start frequency.

Setting full span

To set full span without affecting other parameters, do the following.



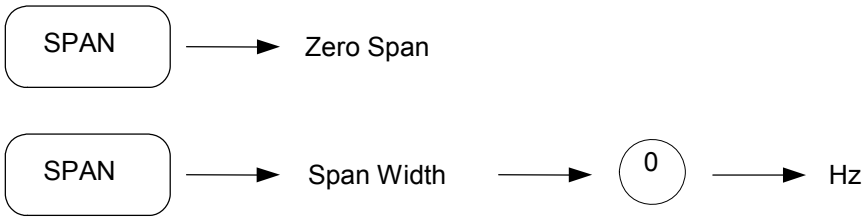
Set the start frequency to 0 Hz and the stop frequency to 3 GHz/8 GHz/13.2 GHz/26.5 GHz.

Setting zero span

This instrument can operate as a selective level meter in which the horizontal axis is changed to a time axis by setting the frequency span to 0 Hz.

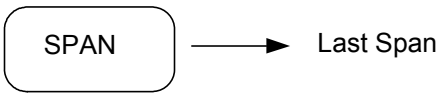
The rising and falling edges of the signal burst wave can also be observed and measured.

Do either of the following operations to allow the instrument to operate in the zero span (span = 0 Hz) mode.



Return to the previous span

The previous span is returned by the following key operation:

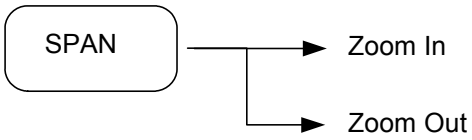


Zoom in/zoom out

The Zoom In function changes the span from the current span to 1/2 of the current span.

The Zoom Out function changes the span from the current span to 2 times the current span.

The center frequency does not change.

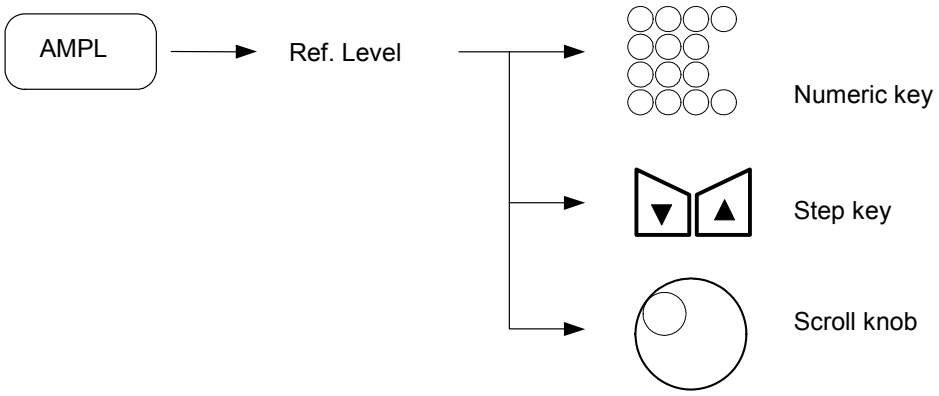


Amplitude function

The [AMPL] hard key displays soft keys for setting the amplitude.

Setting reference level

Set the reference level (top graticule) by doing the following:

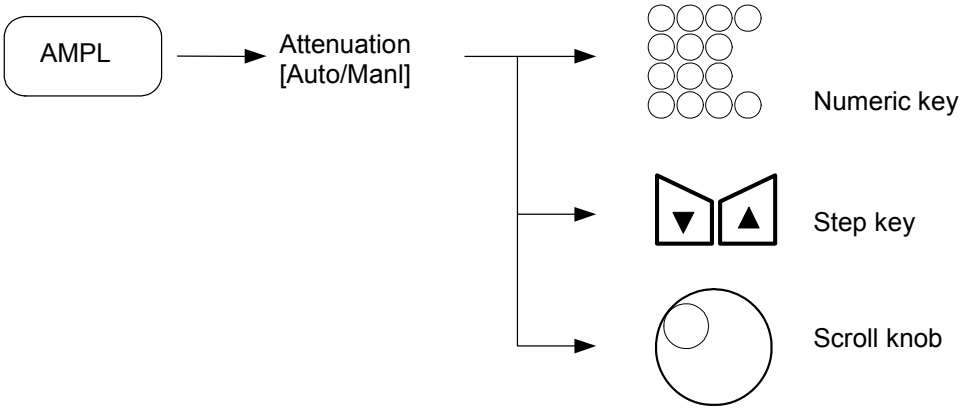


The step size is one division of the current scale (see *Setting Amplitude Scale* on page 5-15).

The step size of the scroll knob is 1 dB.

Setting input attenuation

Do the following to set the input attenuator level:



Change the Atten. mode [AUTO or MANL] by pressing *[Attenuation [Auto/Manl]]*. In Atten MANL (manual) mode, the step size of the input attenuator can be set by the numeric keys, step keys, and scroll knob (range 0 to 55 dB) (see *Input Attenuator* on page 5-19).

If Atten 'AUTO' is selected, the input attenuator is automatically coupled to the current reference level.

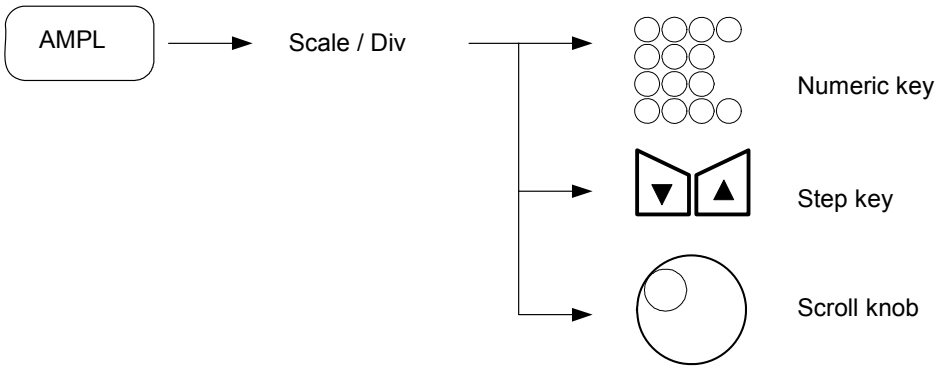
Setting amplitude scale

In log scale, this instrument provides 0.1 to 20 dB/div scales.

In linear scale, the instrument uses the full scale.

To set the amplitude scale, do the following:

- Log Scale Mode



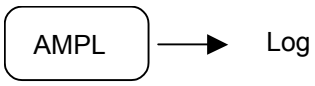
The amplitude scale is changed into a 1, 2, 5 step sequence by pressing the step key.

The step size of the scroll knob is 0.1 (at 0.1–1.0 dB/div) and 1 (at 1.0–20.0 dB/div).

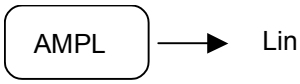
Selecting log/linear detector mode

To set the amplitude scale to log scale or linear scale, do the following:

Setting log detector



Setting linear detector

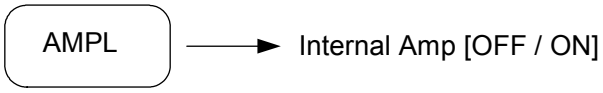


If the mode is changed between log and linear detector modes, the reference level remains constant.

Log detector mode uses the dBm reference unit, Linear detector mode uses the Volt reference unit.

Setting internal amp

Set the internal amp to operate by doing the following:



This function is usable from 1 MHz to 3 GHz.

CAUTION

An input signal level greater than –20 dBm will damage the instrument.

Setting MW amp

Set the MW amp to operate by doing the following:

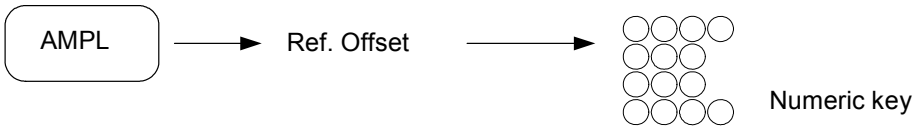
This function is usable from 30 MHz to 26.5 GHz.

CAUTION

An input signal level greater than –20 dBm will damage the instrument.

Setting the reference level offset

Set the reference level offset by doing the following:



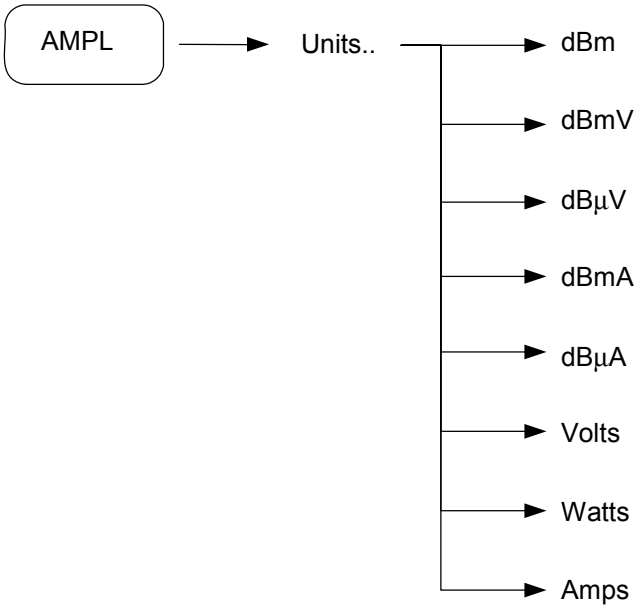
The reference level offset size is from –300 dB to 300 dB.

Setting amplitude units

In log scale, this instrument provides eight reference level units: dBm (dBmW), dBmV, dBµV, dBmA, dBµA, Volts, Watts, Amps.

In linear scale, the only reference level unit is V.

To select one of the reference level units, do the following:



Setting amplitude correction

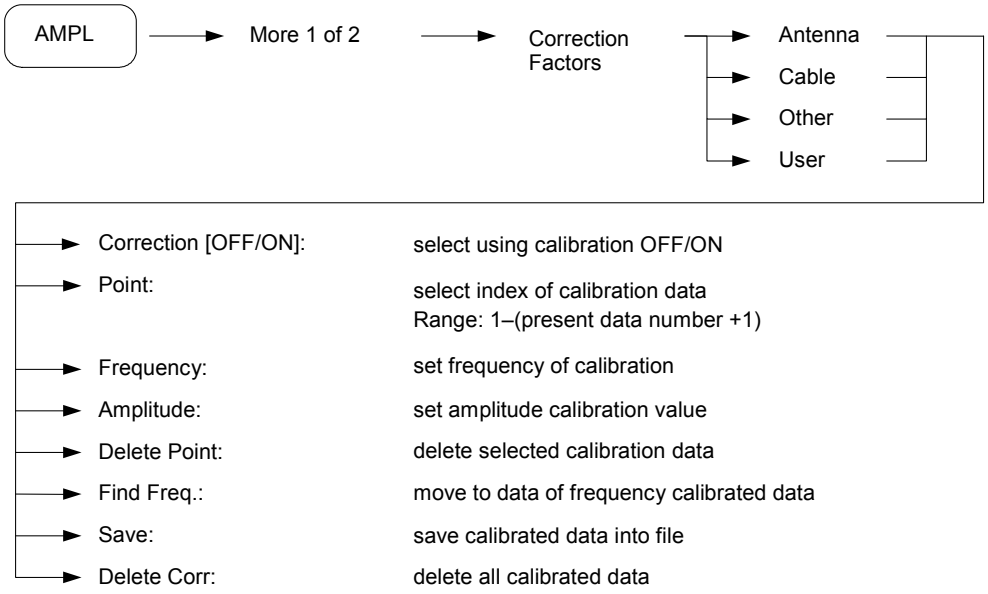
Setting an amplitude correction allows you to specify a correction to the measurement environment.

The instrument provides four types of amplitude correction.

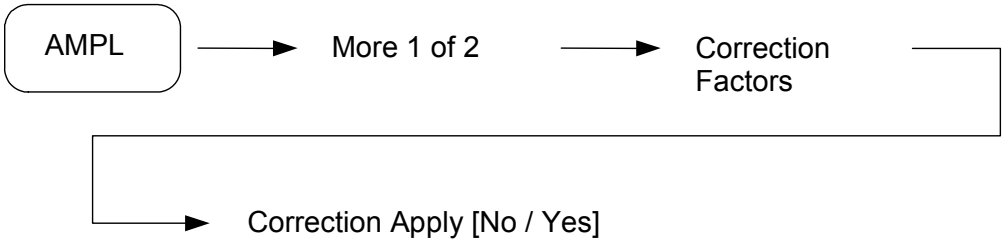
- Antenna correction
- Cable correction
- Other correction
- User correction

Amplitude correction can perform the four types of correction at the same time or individually.

To set amplitude correction, do the following:

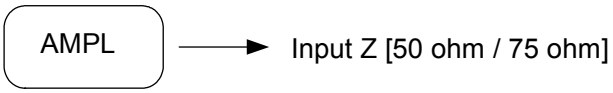


To apply corrections individually, do the following:



Selecting input impedance

To select the input impedance, do the following:



The *[Input Z [50/75]]* soft key sets input impedance to 50 or 75 ohm.

Input attenuator

To set the input attenuator, do the following:

Auto mode

When a signal is input with the same level as the reference level, the input attenuator value in the AUTO mode is controlled so that high accuracy measurements can be made without being influenced by gain compression, and the noise level can be reduced.

While Auto is selected, the input attenuator is automatically set to the optimum value according to the reference level:

Reference level range	Attenuation Auto
25.1 dBm to 30.0 dBm	40
20.1 dBm to 25.0 dBm	35
15.1 dBm to 20.0 dBm	30
10.1 dBm to 15.0 dBm	25
5.1 dBm to 10.0 dBm	20
0.1 dBm to 5.0 dBm	15
Less than 0 dBm	10

Manual setting

When you want to measure a low-level signal by raising the sensitivity, set the input attenuator manually as shown in the table below:

Reference level range	Attenuation Manual
+30 dBm to –170 dBm	55
+30 dBm to –170 dBm	50
+30 dBm to –170 dBm	45
+30 dBm to –170 dBm	40
+25 dBm to –170 dBm	35
+20 dBm to –170 dBm	30
+15 dBm to –170 dBm	25
+10 dBm to –170 dBm	20
+5 dBm to –170 dBm	15
0 dBm to –170 dBm	10
–5 dBm to –170 dBm	5
–10 dBm to –170 dBm	0

***Note**: you can change values in steps of 5 dB and 10 dB only.*

Measurement function

The instrument provides the following measurements:

- X dB Down
- Adjacent Channel Power
- Channel Power
- Occupied Bandwidth
- Harmonic Distortion
- CCDF
- Intermodulation (TOI)
- Total Power
- Spectrum Emission Mask
- Spurious Emissions
- Average Power (Burst Power)
- Multi-channel Power

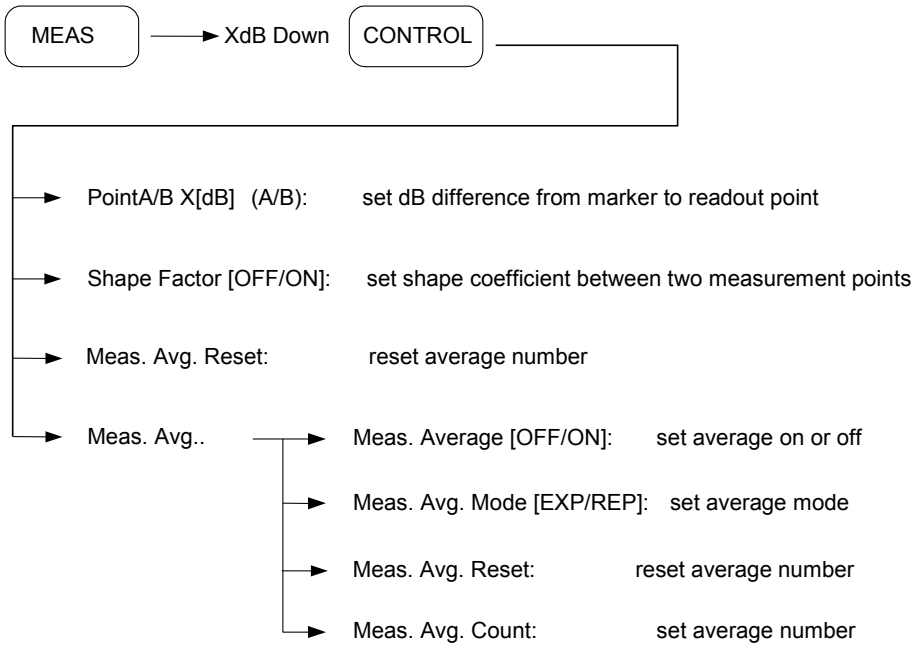
Make the measurement in single or continuous sweep mode by pressing [SWEEP], *[Continuous]* or [SWEEP], *[Single]*. Close each measurement by pressing the *[Meas. Off]* soft key.

X db Down measurement

The X dB Down function displays the frequency difference between a reference marker (◊) and another marker (⟶ ⟵) that is X dB down from the reference marker.

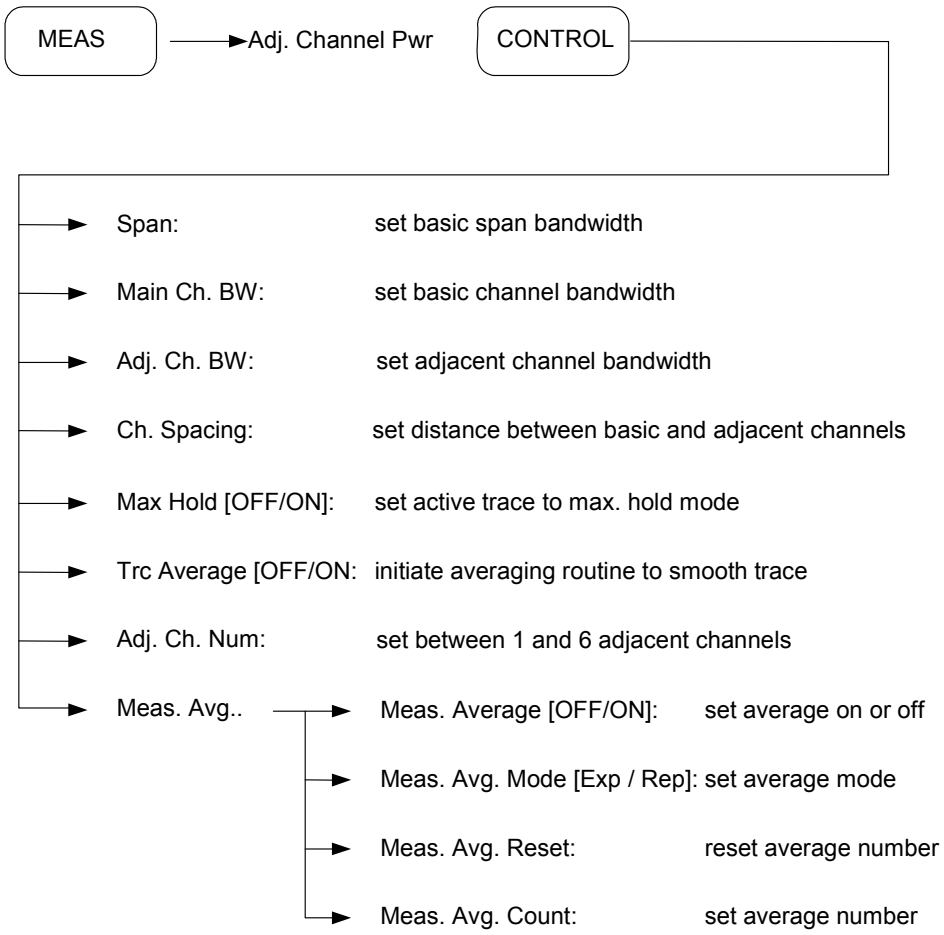
The relative dB range that can be specified for X from the screen dynamic range is selected using the step key or scroll knob. The default values are 3 dB and 60 dB. If the measurement of point A and point B is done at the same time, the shape factor of the signal can be measured.

To use the X dB Down measurement function, do the following:



Adjacent channel power measurement

The ACP measurement function measures the center of the signal (designated by three marker lines) and the power of adjacent channels.

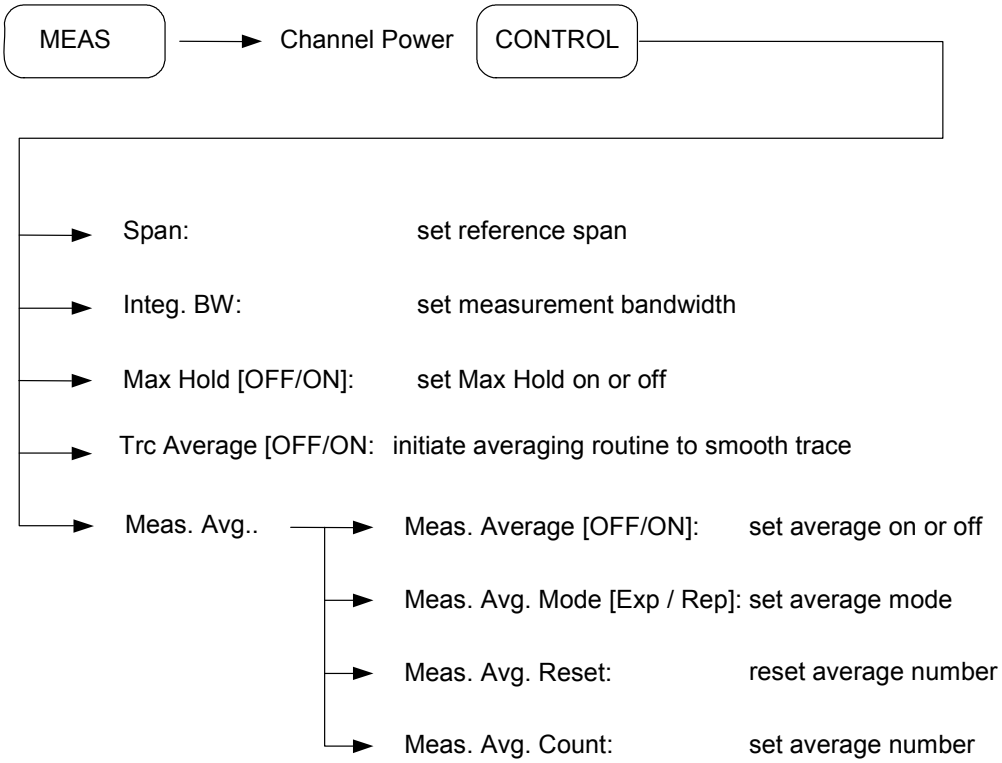


Measurement configuration is done by using the data entry section (numeric keys, step keys or scroll knob) after each soft key *[Main Ch. BW]*, *[Adj. Ch. BW]*, *[Ch. Spacing]* is pressed. Adjust the BW and spacing by observing the messages at the bottom of the result window.

For a more stable measurement value, find the average measurement value (page 5-31) by setting *[Meas. Average]* ON.

Channel power measurement

Measures the power and power spectral density in the channel bandwidth specified.



Configure the measurement by using the data entry section (numeric keys, step keys or scroll knob) after each soft key is pressed. The BW and spacing can be adjusted by observing the message at the bottom of the result window.

For a more stable measurement value, find the average measurement value (page 5-31) by setting *[Meas. Average]* ON.

You must set the center frequency, reference level, and channel bandwidth.

Occupied bandwidth measurement

Measures the occupied bandwidth of the signal being displayed on the screen.

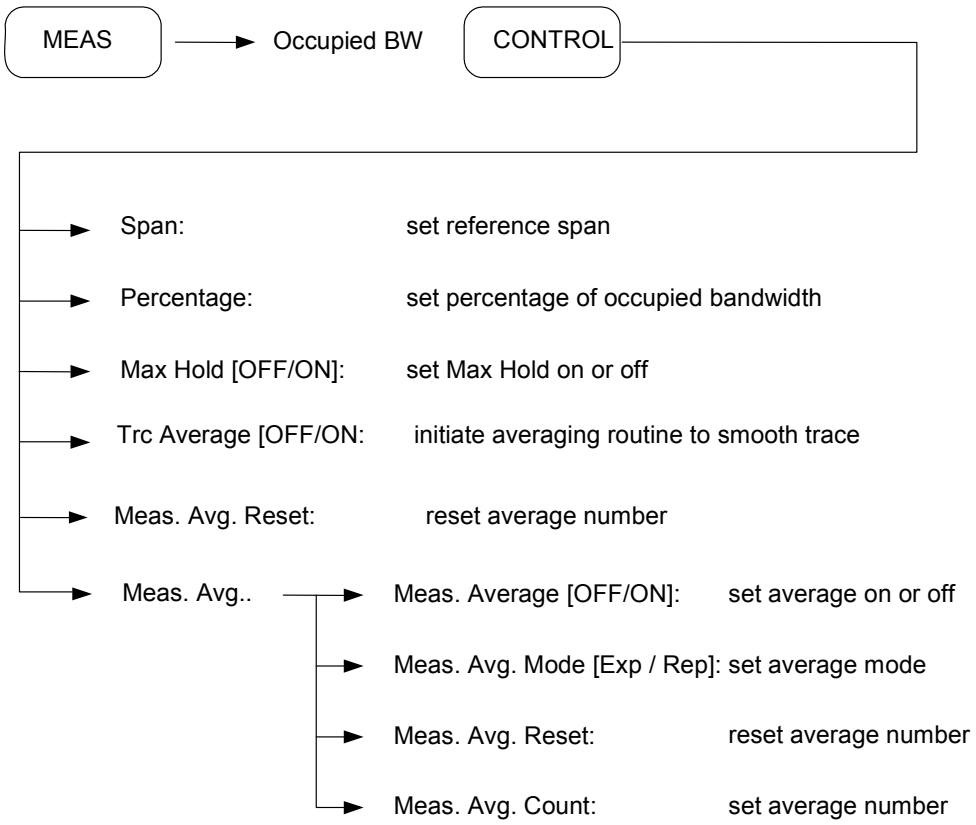
The instrument has an OBW (occupied bandwidth) measurement function that uses the measurement data displayed on the screen. It calculates the frequency band that contains a specified percentage of the total power. The default value is 99%, and a measurement range between 0.01% and 100% can be specified.

The results of the OBW and the occupied bandwidth channel power (OBW CHP) are shown in the result display area.

OBW measurement procedure

1 Set the center frequency and normal marker to the known carrier frequency and set the frequency, span, resolution bandwidth (RBW), and sweep time to AUTO mode.

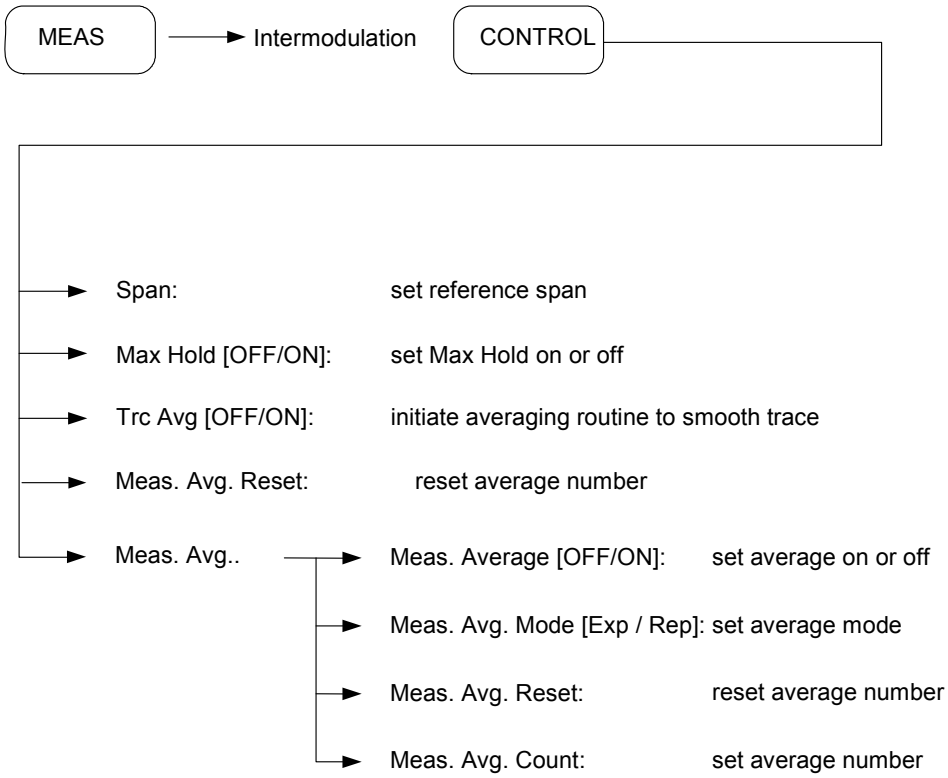
2 Calculate the occupied bandwidth by doing the following:



3 To change the percentage of occupied bandwidth, use the numeric keys to set a new percentage. The measurement lines adjust automatically.

Intermodulation (TOI) measurement

Measures the IP3 in the span specified.

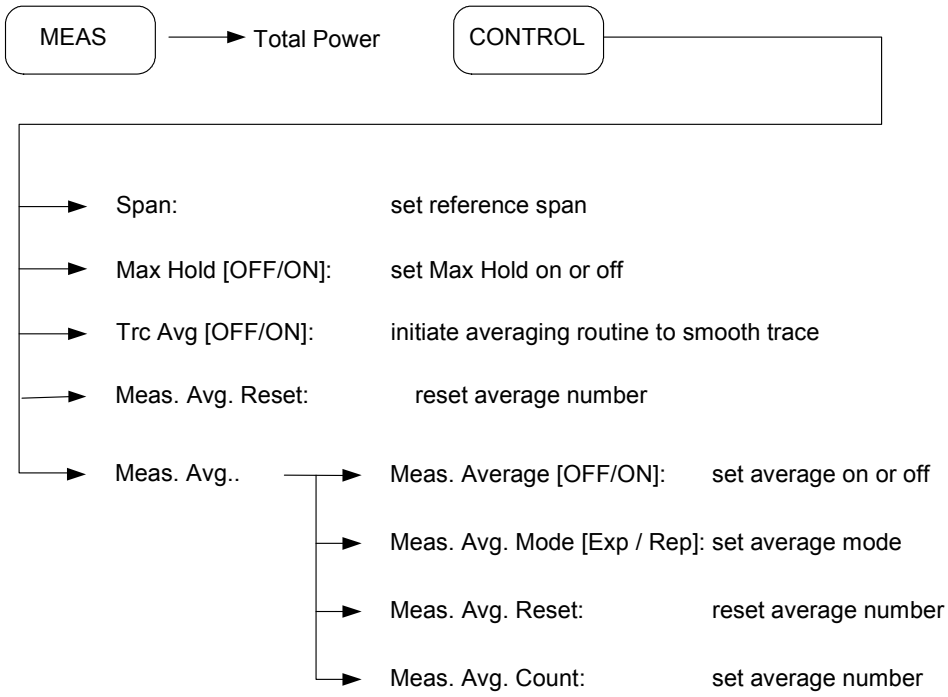


Choose the measurement configuration by using the data entry section (numeric keys, step keys or scroll knob) after each soft key *[Span]* is pressed. Adjust the BW and spacing by noting the warning or error message at the bottom of the results window.

For a more stable measurement value, find the average measurement value (page 5-31) by setting *[Meas. Average]* ON.

Total power measurement

Measures the power and power spectral density in the span specified..



Choose the measurement configuration by using the data entry section (numeric keys, step keys or scroll knob) after each soft key *[Span]* is pressed. Adjust the BW and spacing by noting the warning or error message at the bottom of the results window.

For a more stable measurement value, find the average measurement value (page 5-31) by setting *[Meas. Average]* ON.

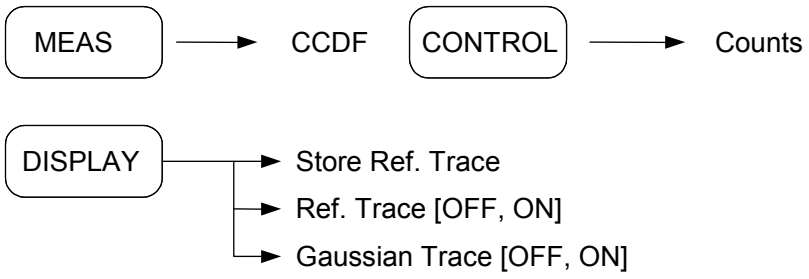
CCDF measurement

This function measures the CCDF (complementary cumulative distribution function) of the present center frequency at a span of 5 MHz.

The horizontal axis shows the dB value above average power and the vertical axis shows the time percentage value above the assigned value.

- The green line shows the Gaussian wave in the CCDF measurement display.
- The yellow line shows the current measured wave.
- Press [DISPLAY], *[Ref. Trace [ON]]* to show the reference wave as a purple line. Press [DISPLAY], *[Store Ref. Trace]* to save the present wave as the reference wave.
- Press [CONTROL], *[Counts]*, then set the point number of the accumulated data. Input range is from 1 kpt to 4000 kpt.
- Use [BW], *[RBW]* in CCDF measurement mode to set the 3 dB bandwidth between 10 kHz and 5 MHz.
- Change the measured bandwidth using [SPAN], *[Scale/Div]*.

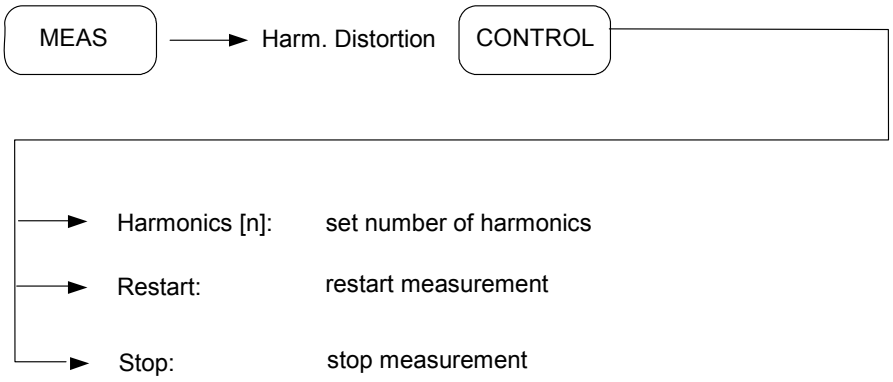
For CCDF measurement and setting the display, use the following keys:



Harmonic distortion measurement

This function measures the harmonics of a single carrier signal and computes the total harmonic distortion. The carrier signal becomes the maximum peak on the display and the total harmonic distortion is calculated from the measured harmonics.

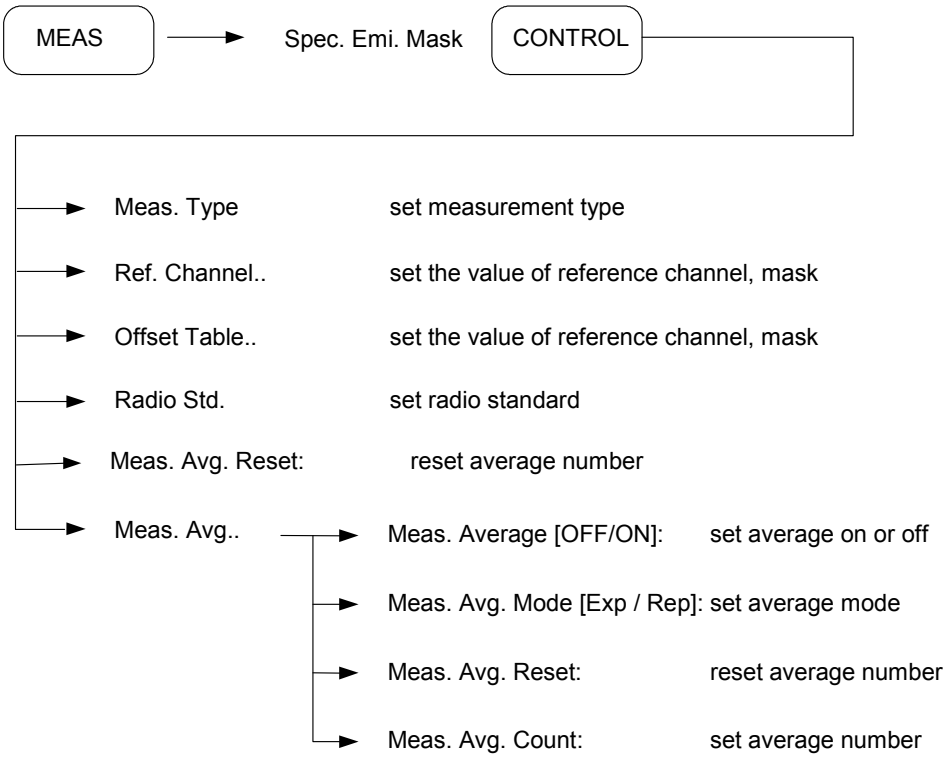
When measuring the nth harmonic, the analyzer chooses the optimum resolution bandwidth (RBW) to capture the best harmonic signal.



'Harmonics number' means the number of nth harmonics. The harmonics number can be set between 2 and 5; the default is 5. The recommended SPAN value is less than 4 MHz for an accurate measurement.

Spectrum emission mask measurement

Measures the pass/fail state according to the reference channel mask.



The measurement type is either Total Pwr Ref method using Total Power or PSD Ref method using Power Spectral Density.

This equipment supports the following four standards for SEM.

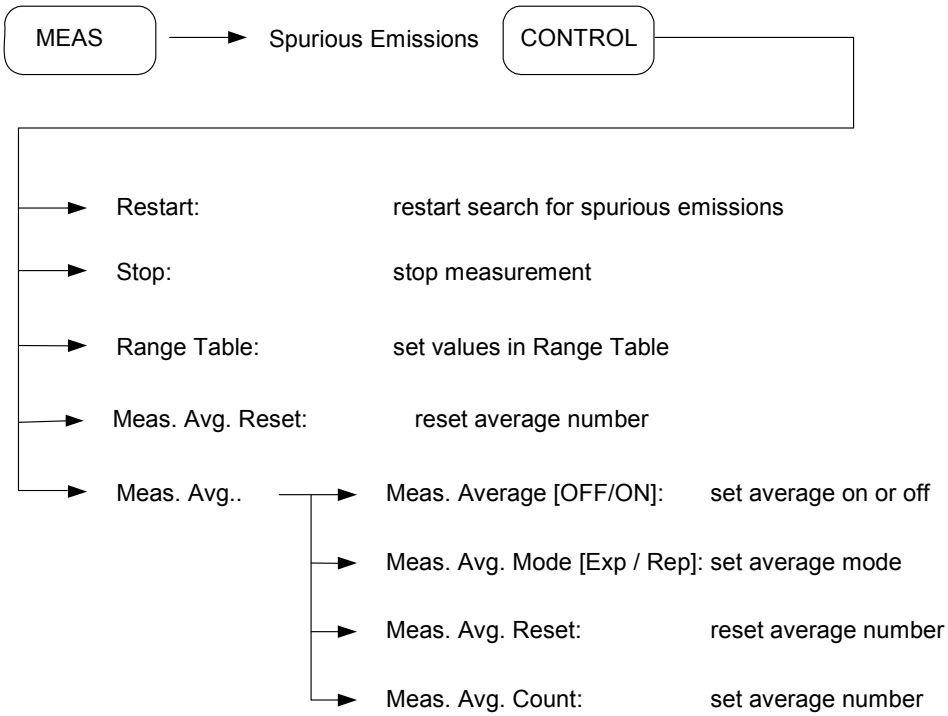
- WLAN 802.11a/g
- WLAN 802.11b/T
- W-CDMA (3GPP) Base
- W-CDMA (3GPP) Mobile

Using the offset table, you can set six regions (A to F), sweep range, RBW, Absolute / Relative Mask Region, and Fail application.

For a more stable measurement value, find the average measurement value (page 5-31) by setting *[Meas. Average]* ON.

Spurious emissions measurement

Measures the pass/fail state of spurii according to the Range Table.



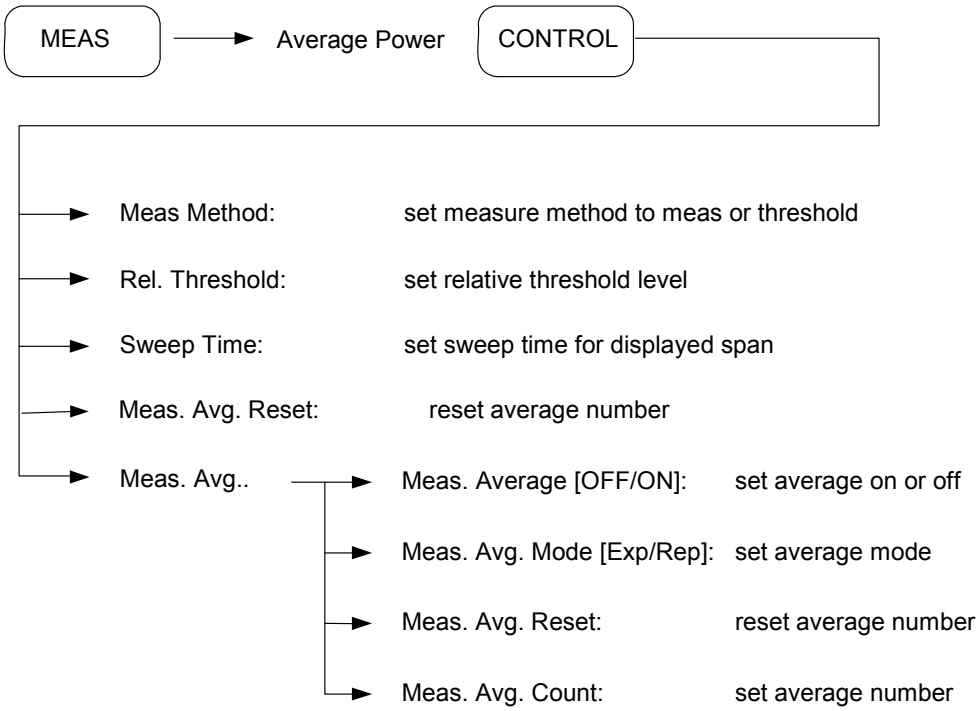
Using the range table, you can distinguish a total of 200 ranges (range setting duplicates allowed) and set ranges such as RBW, VBW, sweep time, input attenuation and peak parameters.

The measured spurii are displayed by amplitude, with 10 numbers for each range in the bottom table. Spurii that exceed the limits are displayed in red.

For a more stable measurement value, find the average measurement value (page 5-31) by setting *[Meas. Average]* ON.

Average power measurement

Measures the average power of the burst signals at the frequency specified.



To measure Average Power, set the span to zero span at the current center frequency. You need to have set the center frequency and reference previously.

This mode measurement operates only when the input is a burst signal.

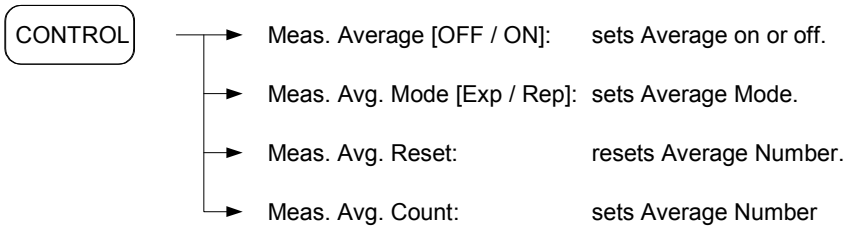
For a more stable measurement value, find the average measurement value (page 5-31) by setting *[Meas. Average]* ON.

Closing the window

The present measuring window is closed and measurement mode is ended.

Averaging measurement

A measurement is averaged the designated number of times and then a stable measurement result is displayed. To set the averaging measurement, do the following:



Meas. Avg. Repeat Mode: if the specified averaging number is exceeded, all existing data is reset and then averaging restarts.

Meas. Avg. Exponential Mode: if the specified averaging number is exceeded, only the first data obtained is deleted, and then averaging restarts, including the newly entered data.

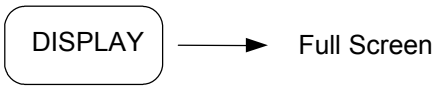
Display function

The instrument provides the following functions related to the screen display:

Full Screen	Displays the maximum enlarged graticule
Display Line	Displays the horizontal line at the top of the graticule
Threshold Line	Displays the horizontal line at the bottom of the graticule
Zoom Display	Displays the enlarged part of the signal waveform under the screen
Screen Title	Edits the title of the screen
White Mode	Economy mode for screen save and printing
Graticule	Displays a graticule behind the signal waveform.
Annotation	Displays information about the waveform in the annotation window at bottom left of the screen
Dual Windows	Divides the display into two screens. Freezes the signal waveform on one screen and displays its progress on the other.
Text Position	Sets the position of the parameter window on the screen
Level Display	Displays the value of the level corresponding to the graticule at the left of the display.

Full Screen

Full Screen enlarges the graticule to fill the screen. The left and bottom display windows and the soft keys are not displayed.

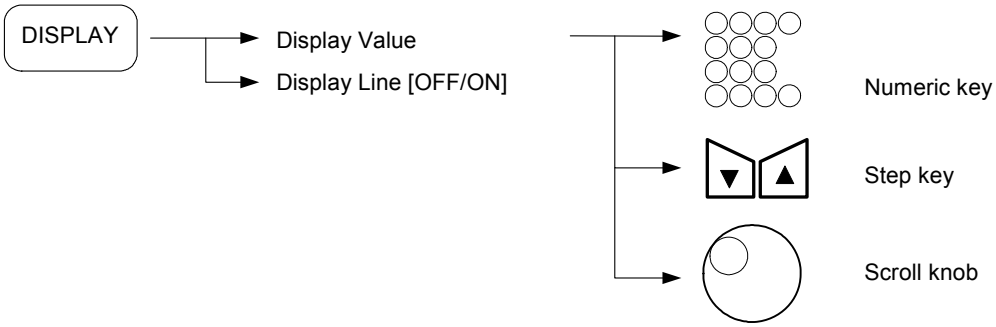


To return to normal screen status, press any key.

Display Line

The display line is a horizontal cursor line that runs across the screen for making level comparisons. *[Display Value]* allows you to set it between the reference level and the lowest level, using the numeric keys, step keys or scroll knob.

[Display Line [OFF]] removes the display line from the screen.

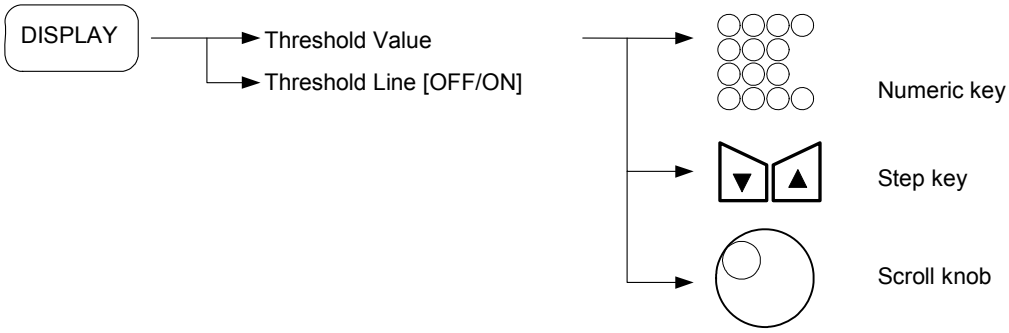


The step size of the step up/down key is one division of the vertical range.

The step size of the scroll knob is 0.1 dB.

Threshold Line

The threshold line is a horizontal line above which the waveform is displayed. *[Threshold Value]* allows you to set it between the reference level and the lowest level, using the numeric keys, step keys or scroll knob. *[Threshold Line [OFF]]* removes the threshold line from the screen.

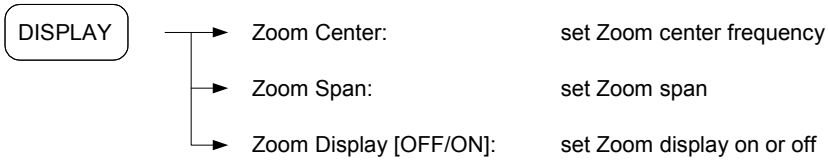


The step size of the step/up down keys is one division of the vertical range.

The step size of the scroll knob is 0.1 dB.

Zoom Display

You can expand part of the display in order to view it more clearly. The expanded part displays in a separate window.



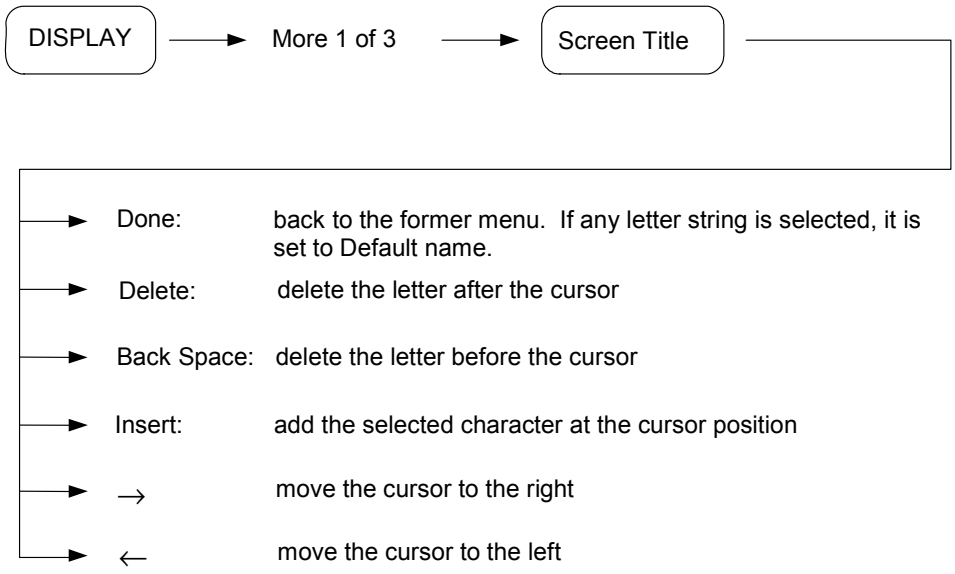
Screen Title

You can label the current screen displaying the spectrum, or the waveform, with this function. You can use the screen title as a filename for a printer and file function (see Filename on page 5-58).

When you press *[Screen Title]*, the screen title part changes to the edit window, and an edit menu appears in the soft menu area. Use this menu to edit the screen title.

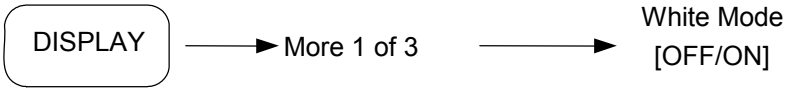
If you only want to correct a screen title, use the step key to move the cursor to the correction position. Any key operation except for the step key initializes the character bar.

Use the scroll knob to select the character for input. The character bar appears in the status window at the bottom of the graticule, and the character can be selected using the scroll knob.



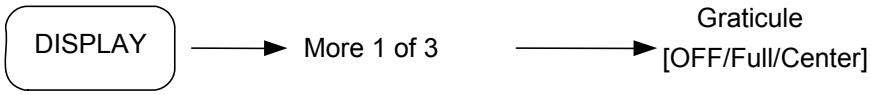
White mode

In this mode, the screen background color changes to white to save ink or toner.



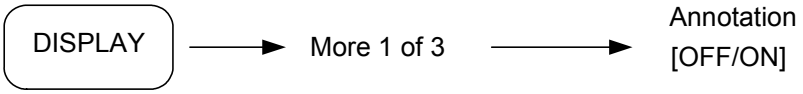
Graticule

This menu selects a full graticule, a pair of orthogonal lines that define the center of the display, or OFF.



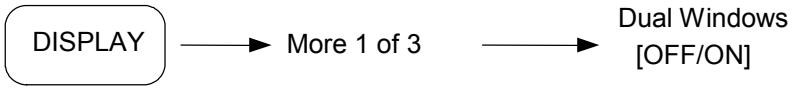
Annotation

This key selects removes or displays all on-screen annotation. When annotation is OFF, the display is enlarged.

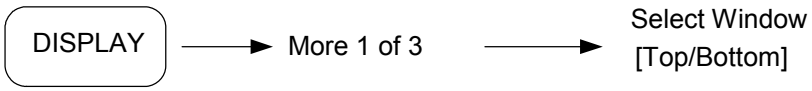


Dual Window

This key divides the display into two. It fixes the signal waveform on the lower screen and displays the progress of the signal waveform on the other screen.

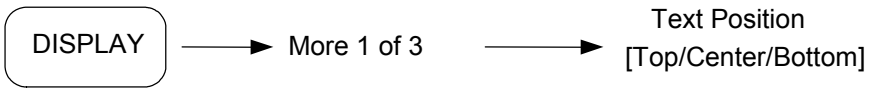


To select which window shows the changing waveform, do the following:



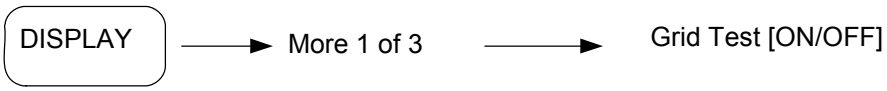
Text Position

This changes the position of the signal parameter text that appears on the graticule.



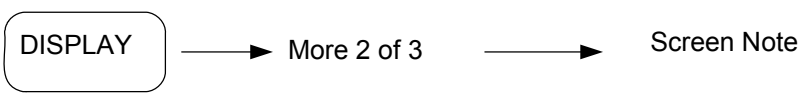
Auxiliary Level Display

This displays the auxiliary value of level on the left of the display.



Screen Note Display

This displays text that you can insert as required.



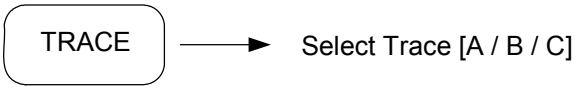
Use the same text insertion procedure as for Screen Title (page 5-34).

Trace function

The [TRACE] hard key displays the menu for the trace function.

Select trace

The instrument provides three trace memories, A, B and C.



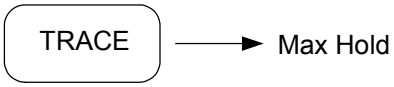
Clear & Write

To change the waveform to Clear & Write status in the selected trace memory, select the following menu:

Press *[Clear & Write]* to overwrite the existing trace memory data with new data.

Max Hold

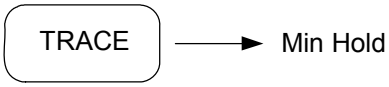
New data for each trace point is compared with the previous data, and the level with the higher value is stored and displayed. The signal waveform accumulates the maximum values for each point.



Max Hold is displayed in the status display window.

Min Hold

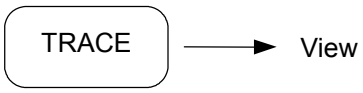
The new data for each trace point is compared with previous data, and the level with the lower value is stored and displayed. The signal waveform accumulates the minimum values for each point.



Min Hold is displayed in the status display window.

View

When *[View]* is pressed, it saves the current trace signal waveform and displays the stored trace on the screen. The signal waveform is fixed.



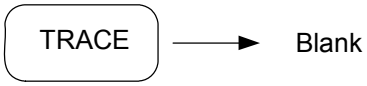
View is displayed in the status display window.

To return to the normal write mode, press *[Clear & Write]*.

Blank

When this key is pressed, trace data is erased from the screen, but the contents of the memory still remain.

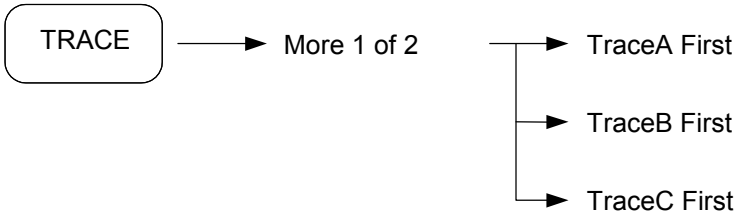
If you press *[View]*, Blank is redisplayed.



Blank is displayed in the status display window.

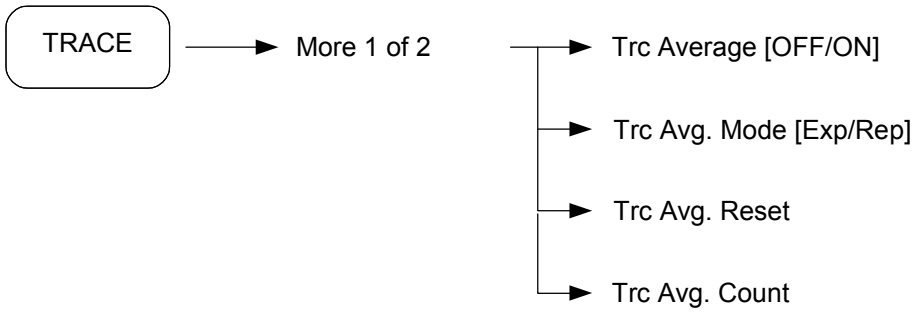
Trace Array

Trace Array selects which trace to display in front when several traces are superimposed.



Averaging function

The averaging function calculates the average data at each vertical axis point for each sweep, and displays the results. It improves the S/N ratio, depending on the averaging rate and the number of sweep repetitions.



See *Setting averaging method* on page 5-44 to learn more about averaging methods.

[Trc Average [OFF/ON]] activates an averaging function that smoothes the trace display by averaging the digital data after analog to digital conversion at each sweep, without narrowing the video bandwidth (VBW).

Averaging by video filter has the disadvantage that the sweep time becomes longer when the video bandwidth is narrowed to improve the averaging effect.

Limit line function

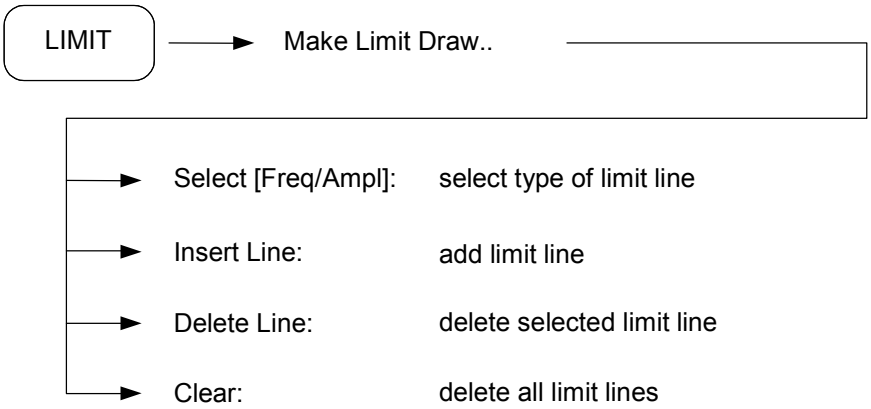
The [LIMIT] hard key displays the menu for the limit line function, which displays two lines that can be set to show permissible upper and lower bounds on the spectral waveform. Comparison of measured data with the limit lines is then easy.

Drawing a limit line

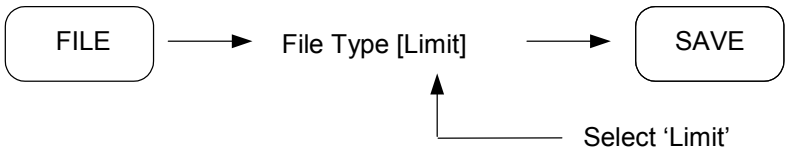
1	*[Make Limit Draw]*	Displays the limit line edit menu
2	*[Select [Freq/Ampl]]*	Selects type of limit to edit
3	Input data using keypad	
4	*[Insert line]*	Add limit line to edit
5	Repeat 2) to 4) to create further limit lines	

Whilst editing, delete unessential data using *[Delete Line]*.

Delete limit line data using *[Clear]*.

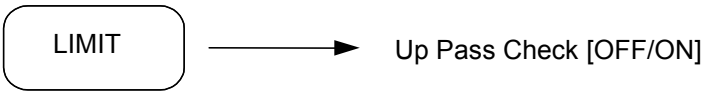


To save the limit line, do the following:

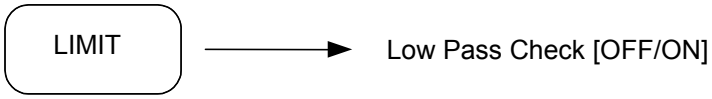


Setting the PASS/FAIL mode

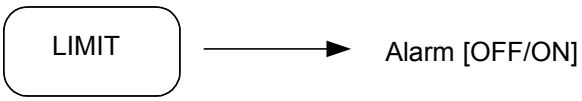
The Pass/Fail result window is displayed at the top right of the screen. When the spectral waveform falls between the upper and lower limit lines, PASS is displayed on the screen; if not, FAIL is displayed. The number of occurrences of failure is displayed to the right of the FAIL sign.



When ON is selected, the signal is checked against the upper limit line, and a fail is displayed if it is exceeded.

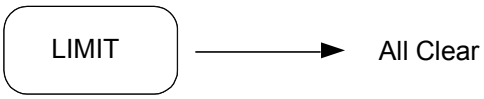


When ON is selected, the signal is checked against the lower limit line, and a fail is displayed if it is exceeded.



When ON is selected, an audible alarm sounds if a fail occurs.

Turn off the Limit Line function



When this key is selected, it turns off the limit line function.

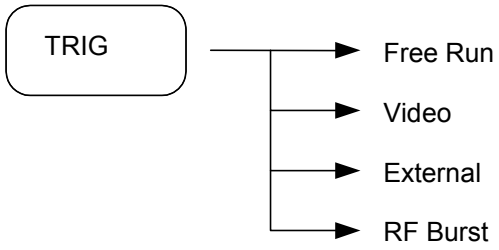
Trigger function

The [TRIG] hard key displays the menu for using the trigger function.

Trigger source

The trigger mode of the instrument is generally set to Free Run.

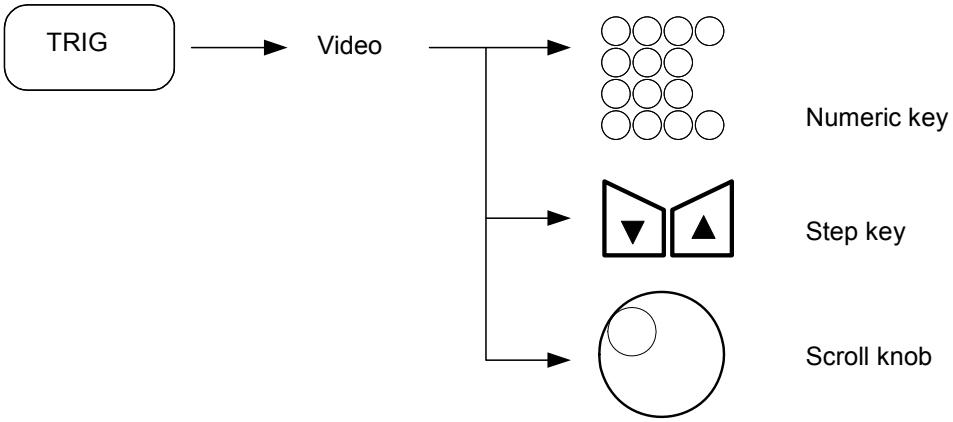
In the Triggered mode, Video, External or RF Burst can be selected as the trigger source.



Video trigger

When the Video Trigger source is selected, the sweep is started in synchronization with a positive leading edge of the detected waveform that is greater than the trigger level.

To select video trigger level, do the following:



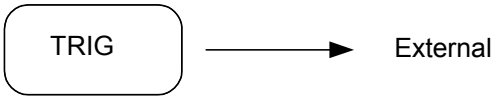
The trigger level is controlled by the step up/down keys or the scroll knob.

The trigger level is shown by a line on the screen.

External trigger

This function starts a sweep in synchronization with an external trigger source.

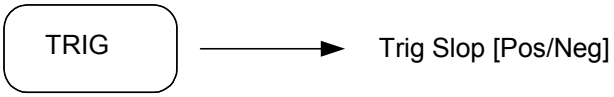
The sweep starts in synchronization with the positive leading edge of a TTL signal waveform that is input to the EXT TRIG connector on the rear panel.



Selecting trigger edge

Select the type of trigger edge.

There are two trigger edge types: Positive and Negative.



Trigger delay

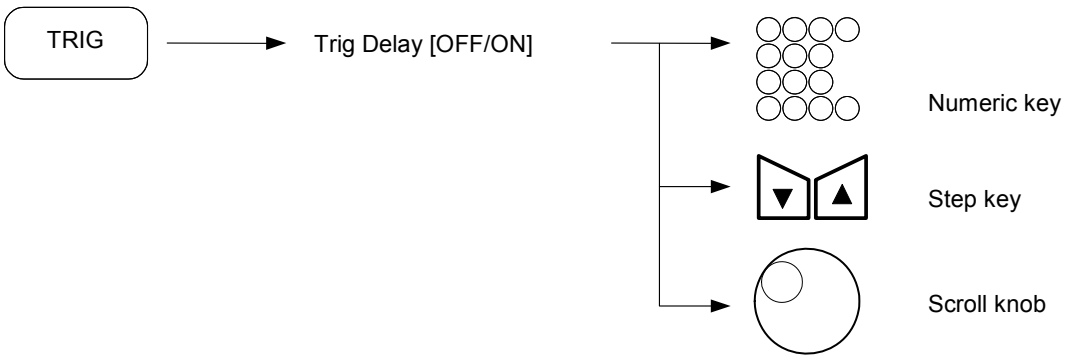
When the trigger mode is set to Triggered mode (trigger source is selected as Video or External only), the trigger point is usually positioned at the left side of the screen.

However, this means that it is not possible to see the waveform before the trigger point and the waveform beyond the right end of the screen.

A waveform before the trigger point or after the end of the display can be displayed by changing the delay time.

Note: *trigger delay works in Zero Span mode only.*

To set the delay time, do the following:



Set the delay time using numeric keys, the scroll knob and the step up/down keys in Zero Span mode. The range of delay time is (−150 ms to +500 ms).

A negative value of delay time means the Pre-Trigger mode is used. It shows the waveform before the trigger point.

A positive value of delay time means the Post-Trigger mode is used. It shows the waveform after the trigger point.

Coupled function

The [COUPLE] function sets the signal detection mode and the Avg/VBW type of the instrument. Modes are: All Auto function, Detector Mode and the Set Averaging method.

All Auto

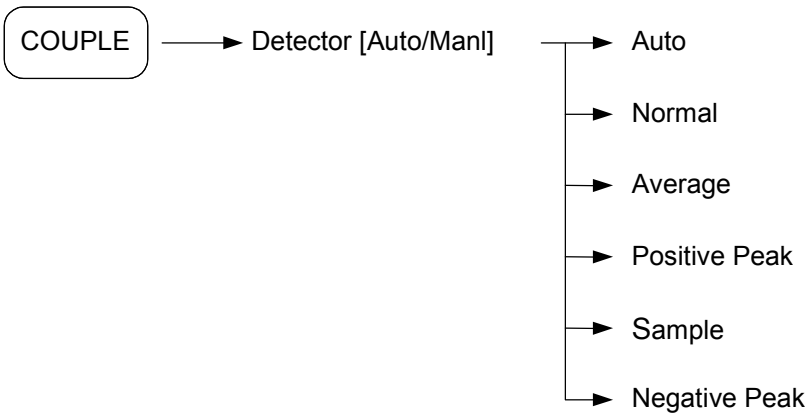
[All Auto] optimizes the coupling of the instrument for the measurement environment by setting the detector mode to Normal. If you select manual for a particular detector mode, that mode is uncoupled but other modes remain under automatic control.

Detector mode

The instrument has five signal detector modes:

- Normal
- Average
- Positive Peak
- Sample
- Negative Peak

Select the signal detect mode using the following key operations:



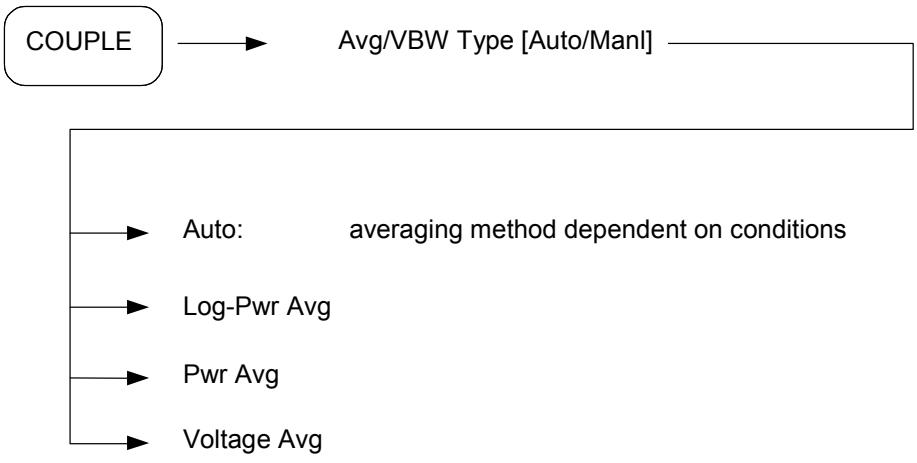
Mode	Contents
Normal	The Normal detection mode is used to detect the maxima and minima of noise-type signals and the peaks of CW-type signals. Odd-number points on the horizontal axis display the minimum value of oversampling data for each display point, and even-number points on the horizontal axis display the maximum value.
Average	The Average detection mode stores the average data between the positive peak and negative peak. It reduces the random noise level without reducing the video filter bandwidth or using the trace averaging function. This allows averaged displays with faster sweep rates. Uses one of three types of averaging method: Log-Pwr, Pwr, Voltage (see below).
Positive Peak	Compares the maximum level point present between the current display point and next display point, then stores the maximum value in the trace memory corresponding to the current display point.
Sample	Stores the instantaneous signal level at each sample point in the trace memory. The Sample detection mode is primarily used for noise level and time domain measurements.
Negative Peak	Compares the minimum level point present between the current display point and next display point, then stores the minimum value in the trace memory corresponding to the current display. Negative Peak detection mode is often used to measure the lower envelope side of a modulated waveform.

Setting averaging method

The instrument supports the following three averaging methods:

- Log-Power Averaging: averages the signal waveform to a dB scale.
- Power Averaging: averages the signal waveform to a power scale (RMS). Best for measuring the true time-power relationship of complex signals.
- Volt Averaging: averages the signal waveform to a voltage scale, using the signal envelope.

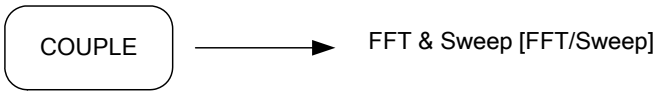
Set the averaging method as follows:



Setting FFT & Sweep

The instrument uses the FFT sweep method below the 30 MHz RBW.

You can also use this key below 30 MHz RBW in the general sweep method.



***Note**: RBW is limited to a minimum of 30 MHz in the general sweep method.*

BW (bandwidth) function

So that the instrument can automatically select the optimum setting, RBW, VBW, Sweep Time and Input Attenuation are initially set to Auto mode.

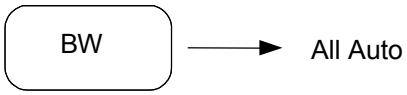
The bandwidth function has three hard keys:

- [BW] Bandwidth function
- [AMPL] Amplitude function
- [SWEEP] Sweep function

Auto bandwidth function

In the Bandwidth Function, there are two modes: Auto and Manual.

To set RBW, VBW, Sweep Time, and Input Attenuation to Auto mode, do the following:



Auto mode, input attenuator

The input attenuator's value is set according to the amplitude of the signal waveform by the values below (see also *Setting input attenuation* on page 5-14):

Reference level range	Attenuation Auto
25.1 dBm to 30.0 dBm	40
20.1 dBm to 25.0 dBm	35
15.1 dBm to 20.0 dBm	30
10.1 dBm to 15.0 dBm	25
5.1 dBm to 10.0 dBm	20
0.1 dBm to 5.0 dBm	15
≤ 0 dBm	10

Auto mode, Span and RBW

The ratio of Span/BW changes to the initial value (96). RBW bandwidth is approximately equal to (Span divided by 96).

Auto mode, Video Mode and Resolution Bandwidth

Resolution bandwidth is adjusted to match the Video bandwidth.

Auto mode, Sweep time

Sweep time is optimally set by span, resolution bandwidth and video bandwidth.

Setting the Resolution Bandwidth

Auto Mode

If the frequency span varies, the RBW is automatically set by setting the value of the *[Span/RBW]* soft key (the standard setting value of *[Span/RBW]* = 96).

The VBW, Sweep Time, and Input Attenuator values are automatically set. The respective parameters are set to the optimum values by the following:

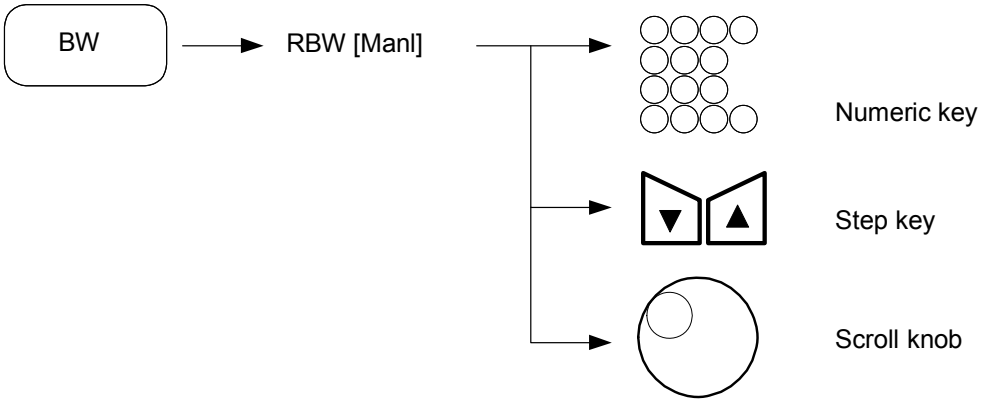
For Span/RBW = a, VBW/RBW = b:

If Span > 500 MHz, RBW = 5 MHz, VBW = 3 MHz: Sweep Time = set to the optimum values.

If Span <= 500 MHz, RBW = Span/a Hz, VBW = RBW * b Hz: Sweep Time = set to the optimum values.

Manual Mode

To set RBW in the manual mode, do the following:



If VBW is in Auto Mode, the VBW value varies, depending on the value of RBW. However, the RBW value does not vary even if the value of VBW changes.

***Note**: if the RBW is below 30 MHz and not in zero span mode, the instrument uses FFT analysis. In this mode, you cannot change the sweep time manually.*

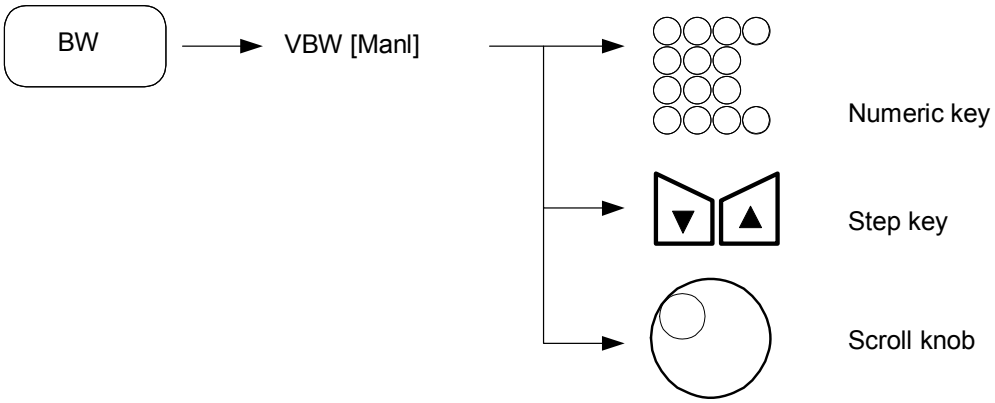
Setting the Video Bandwidth

Auto Mode

When the VBW is set to Auto Mode, the VBW is set according to the RBW value.

Manual Mode

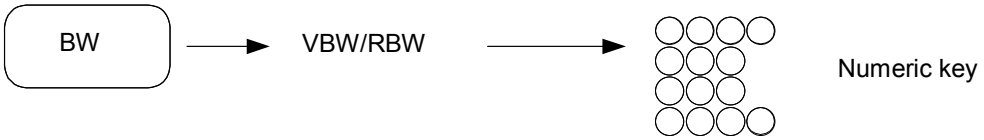
To set the VBW, do the following:



Use the MANUAL setting to average noise by making the VBW narrow without regard to the RBW value, or when wanting to make the VBW wide to observe the waveform of signals modulated at a high frequency. The VBW value can be manually set from 1 Hz to 3 MHz in 1, 2, 3, 5 steps.

Setting the ratio of VBW and RBW

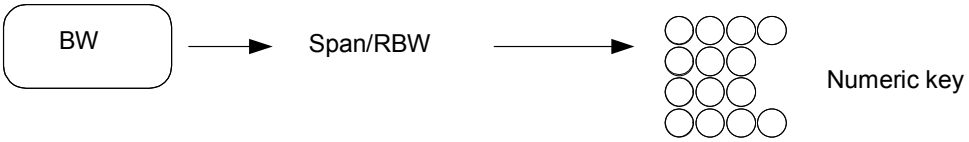
To change the RBW and VBW to a ratio in Auto Mode, do the following:



The possible input range is from 0.000001 to 3,000,000.

Setting the ratio of Span and RBW

To change the ratio of RBW in compliance with Span in the Auto Mode, do the following:



The possible input range is from 2 to 10,000.

Aux function

The instrument provides analog demodulation and audio monitor functions:

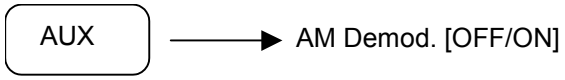
- AM demodulation
- FM demodulation
- Audio ON/OFF, audio level control
- Frequency spectrum view

AM demodulation

The AM demodulation function displays the amplitude-demodulated waveform.

By pressing this key, the horizontal axis changes to a time axis. The carrier frequency is the center frequency.

To use the AM demodulation function, do the following:



[AM Demod.] toggles AM demodulation ON and OFF.

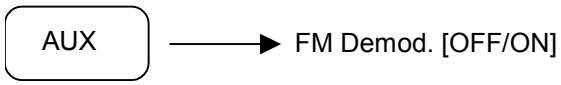
***Note**: if the AM demodulation function is active, RBW and VBW are fixed to 100 kHz and the bandwidth-setting key is inactive. The marker displays the modulation depth at the current point.*

FM demodulation

The FM demodulation function displays the frequency-demodulated waveform.

By pressing this key, the horizontal axis changes to the time axis. The carrier frequency is the center frequency.

To use the FM demodulation function, do the following:



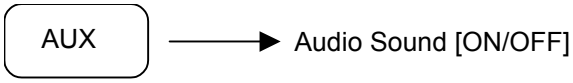
[FM Demod.] toggles FM demodulation ON and OFF.

***Note**: if the FM demodulation function is active, RBW and VBW are fixed to 100 kHz and the bandwidth-setting key is inactive. The marker displays the modulation depth at the current point.*

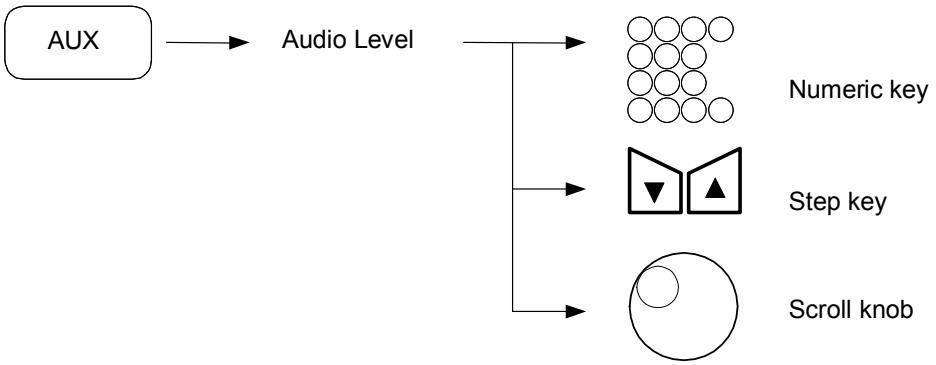
Audio monitor

The instrument has an internal speaker and phone jack on the front panel.

[Audio Sound] is used to turn on the internal speaker.



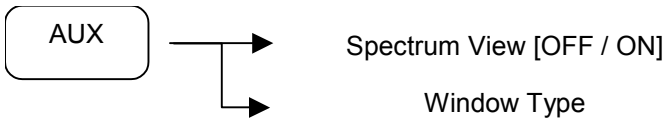
[Audio Level] controls the audio level, which can be adjusted by the data entry keys and knob. The possible audio level is 1–100. The default value is 1.



Spectrum display

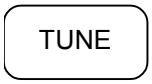
This function displays a spectrum graph for each frequency at the bottom of the signal waveform display.

Nine windows can be used for the spectrum display: Rectangle, Flat_Top, Hanning, Hamming, Blackman, Bartlett, Triangle, Kaiser, Bman_Harris.



Auto Tune

Detects the maximum peak point in full span, displays its spectrum in the center of the screen and then changes to a small span width.



***Note**: in Auto Tune operation, input by keypad is not permitted. Auto Tune does not search signals below –70 dBm.*

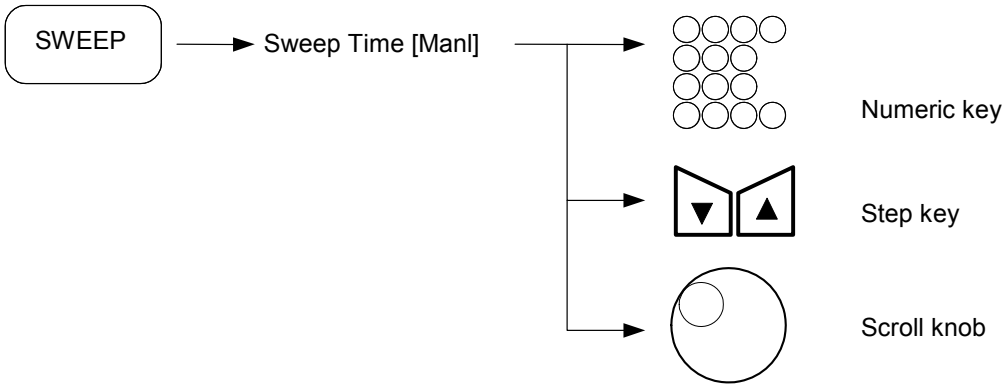
Sweep function

The Sweep function is associated with Sweep Time, Sweep Mode, and values for the instrument's display data.

- Sweep time
- Continuous sweep mode
- Single sweep mode
- The number of display points

Setting the sweep time

To set the sweep time in Manual mode, do the following:



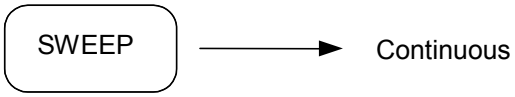
The Auto sweep time ranges are:

Normal spans	20 ms–2000 s
Zero span	1 µs–2000 s

Continuous sweep mode

When the trigger source is not Free Run, the sweep executes each time trigger conditions are met. When the trigger source is set to Free Run, the sweep executes continuously.

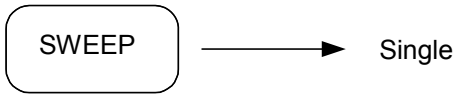
To set the Continuous Sweep Mode, do the following:



Single sweep mode

When the trigger source is set to Free Run, the sweep executes once, immediately after *[Single]* is pressed. When the trigger source is not set to Free Run, the sweep executes only once when the trigger conditions are met.

To set the Single Sweep Mode, do the following:



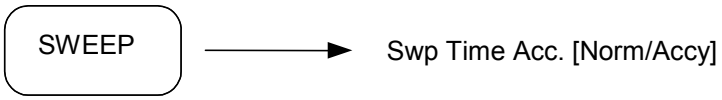
or

Setting sweep time accuracy

Increasing the sweep time contributes to a more accurate measurement.

If *[Swp Time Acc]* is set to *Accy*, the current sweep time of the instrument increases automatically.

To set the Sweep Time Accuracy, do the following:

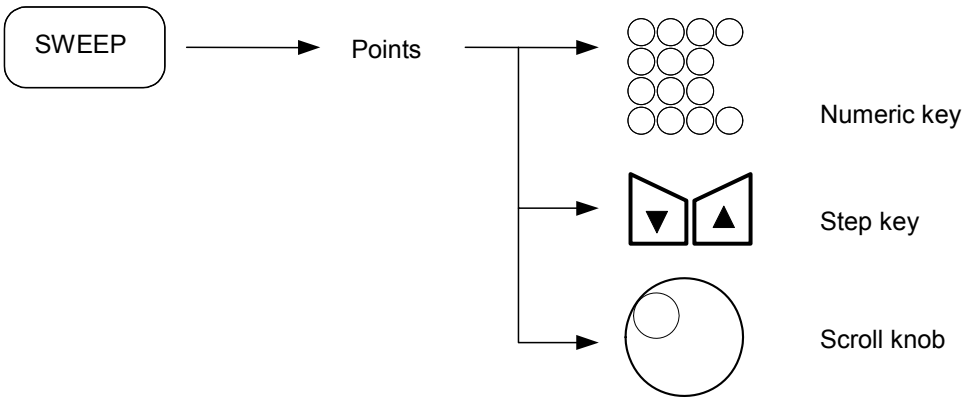


The default value is *Normal*.

Setting the data points

To display data more accurately, the instrument can change the number of data points displaying on the screen. If the number of data points is increased, marker movement is more detailed and more accurate values can be displayed. However, this does entail more data processing time.

To set the data points, do the following:



The data point ranges are:

Normal spans	101–8192 points
Zero span	3–8192 points

System configuration

Set the system parameters of the instrument according to your requirements.

The [SYSTEM] hard key displays soft keys that set the system configuration.

The instrument supports the spectrum analyzer mode, Phase Noise, CDMA, EMI and CATV modes. Spectrum mode is the default, and the others are provided by options; consult your local agent for information.

Setting GPIB address

Use the keypad and scroll knob to set the GPIB address:

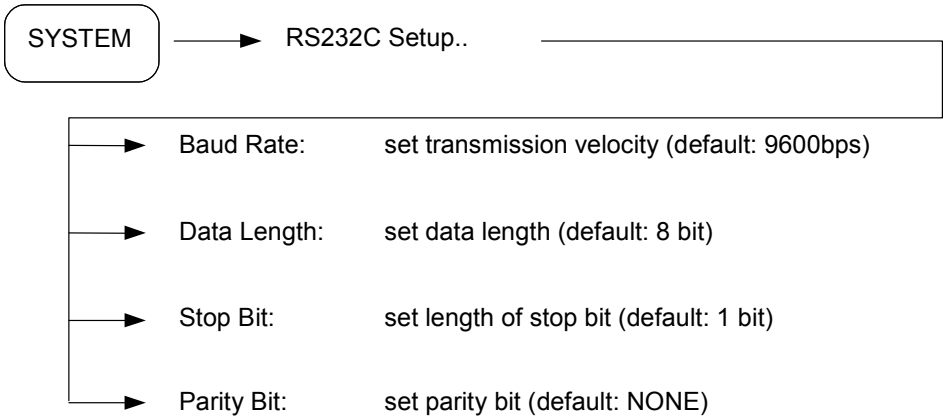
GPIB Address range: 1–30

GPIB Address default: 7

RS-232C configuration

The system can be remotely controlled using an RS-232C interface.

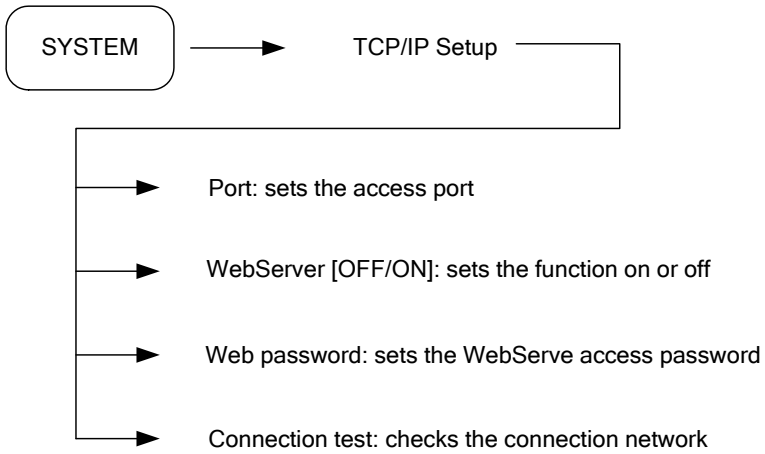
To set up the RS-232C protocol, do the following:



***Note**: interface settings do not change when power is removed*

TCP/IP configuration

The system can be controlled using an Ethernet.



System information

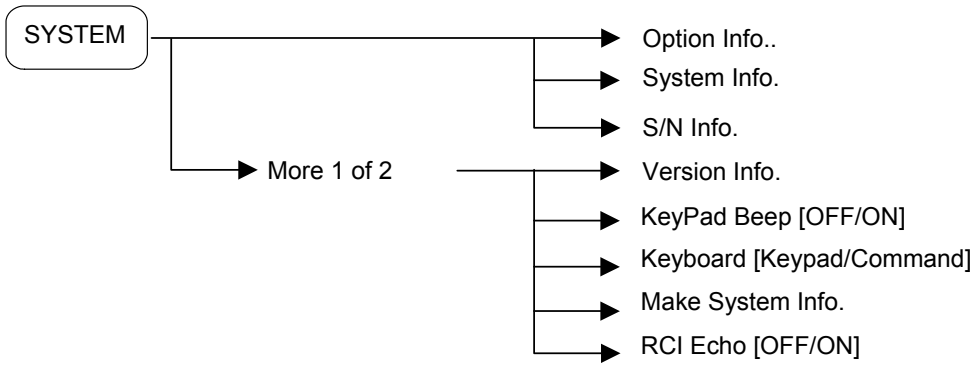
[Option Info..] displays the current option specifications.

[System Info.] shows information about modules installed in the instrument.

[S/N Info.] shows serial number information about modules installed in the instrument.

[Version Info.] shows the current software version.

[KeyPad Beep] enables a beep when you press the keypad.



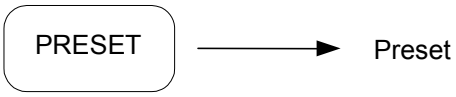
Preset function

The [PRESET] hard key displays soft keys for preset and calibration functions.

- Preset
- Last State
- Save User State
- Load User State
- Boot On [Last/System/Macro]
- Auto Alignment [OFF/ON]

Preset

Pressing *[PRESET]* returns all of the analyzer parameters to the factory initial setup values.



Factory initial setup

Center frequency:	1.5 GHz/4.0 GHz/6.6 GHz/13.25 GHz
Frequency span:	3 GHz/8 GHz/13.2 GHz/26.5 GHz
Reference level:	0 dBm
Detector:	LOG
Scale:	10 dB/DIV
Sweep time:	20 ms, AUTO mode
RBW:	5 MHz, AUTO mode
VBW:	3 MHz, AUTO mode
ATTEN:	10 dB, AUTO mode
Trigger:	Free Run
Marker:	OFF
Display line:	OFF
Threshold line:	OFF
Trace detector mode:	Normal

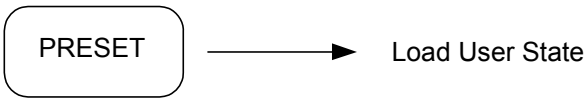
Last State

Pressing *[Last State]* returns all of the analyzer parameters to the values that existed before the last system power-off.

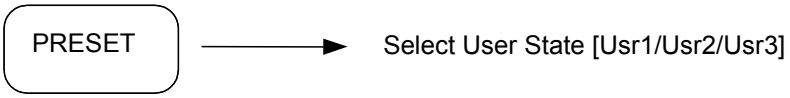
Save/Load User State

Pressing *[Save User State]* saves the current settings of User State into the current parameters.

Press *[Load User State]* to read the User State saved in the current settings. If there is no saved record, an error message is displayed.



Press *[Select User State]* to select the state to Save or Load. User State has three values.

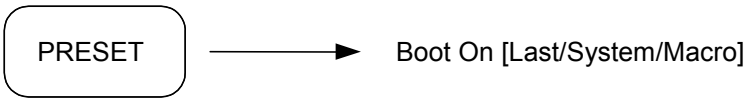


Boot On

This function sets the system condition for the power-on state.

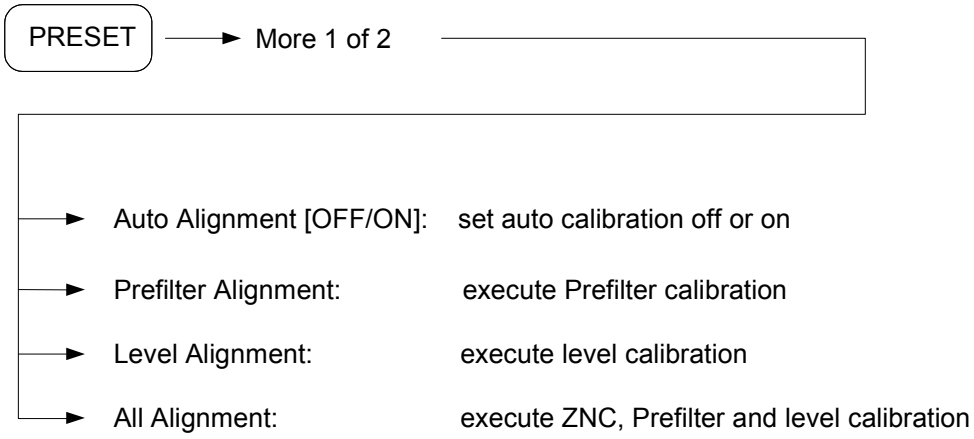
When *System* is selected, every power-on condition is the same as the preset state.

When *Last* is selected, the power-on condition is set to the state before system power-off.



Calibration mode

This function sets the system to minimize hardware variations (temperature, operation time, etc.) for more precise measurements.



***Note**: if a calibration is executing, the keypad is disabled.*

File and save function

The instrument can save system parameters, limit line data, and waveform data (Trace) to the internal hard disc or a removable storage device. This data can be recalled and used.

Internal memory

The internal memory uses a hard disk in the instrument

The internal memory can save the data and waveforms given in *File Type* on page 5-58.

Save parameters and waveform

The [SAVE] hard key is for saving parameters and waveforms.

To save the current system parameters, waveform data and limit line data to the internal hard disc or storage removable device, press [SAVE].

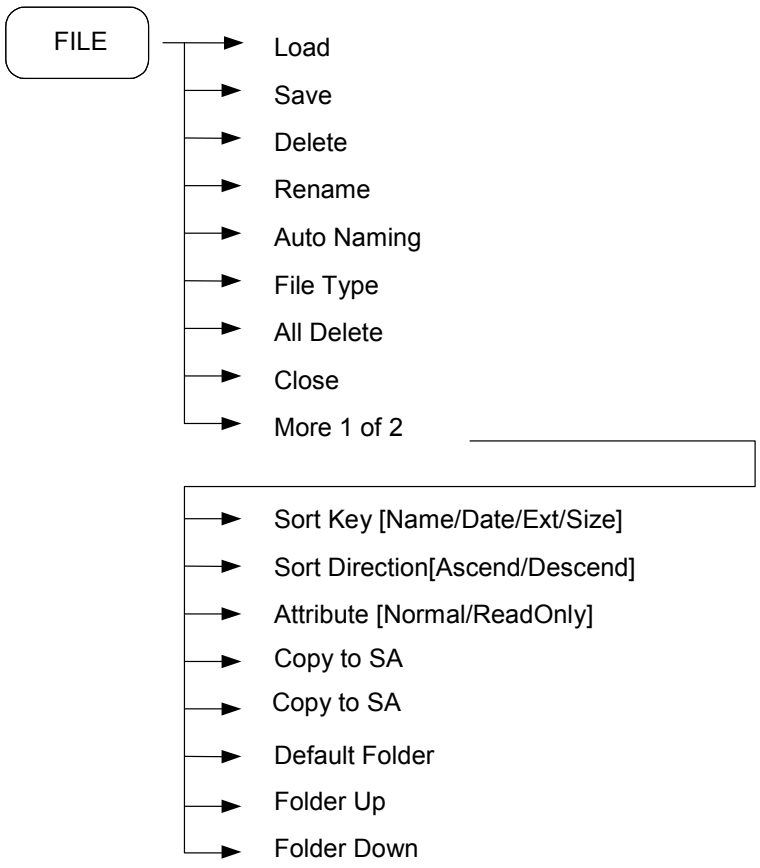
The file type and destination is then configured in compliance with the FILE menu setting (*File Type* on page 5-58). The file name is decided by *Auto* or *Title* set by *[Filename]* (page 5-58). The Auto generation method automatically generates from ext_0000.ext to ext_9999.ext; the screen Title method generates the same filename as the current screen title.

File management

The [FILE] hard key displays the file management menu for the internal hard disc or removable storage device.

When you press [FILE], the file directory window is displayed. To select the file, use the scroll knob or step key. Pressing any hard key closes the file directory window.

Do the following to access the file management menu:



Load	Loads the selected file with the system
Save	Saves the file into the selected file type
Delete	Accesses menu keys that allow you to delete selected files
File Type	Selects the file type for display in the file directory window. Also decides the file type for saving when the [SAVE] hard key is pressed.

File type	Extension	Comments
All	*	All files (only for View)
Status	STS	System status file
Trace	TRC	Trace data file
Limit	LMT	Limit data file
Bitmap	BMP	Screen image file
JPEG	JPG	Screen image file
PNG	PNG	Screen image file
CSV	CSV	Trace data file
Antenna	ANT	Antenna calibration file
Cable	CBL	Cable calibration file
Other	OTH	Other calibration file
User	USR	User calibration file

All Delete	Deletes all the files in the current file directory
Close	Closes the file directory
Sort Key	Selects the sorting field in the directory. The kinds of fields are filename, extension, size, date. Select fields in turn by pressing *[Sort Key]*.
Sort Direction	Chooses the direction of sorting. By pressing *[Sort Direction]*, you can select Ascend or Descend.
Attribute	Changes the current file characteristics. Normal characteristic can delete or change, Read Only characteristic cannot.
Auto Naming	Selects the filename-creating mode. In Auto mode, the filename is generated sequentially from FILE0000 to FILE9999 without regard for the current disk. In Title mode, the filename is the screen title.
Default Folder	Changes the save location into the standard folder of the standard drive (D:\SaveData)
Folder Up	Moves to a higher level folder than the current folder
Folder Down	Moves to the contents of the selected folder

Start key

Press the Windows start hard key () to display the Windows task bar and start menus. You can select items via the touch screen.

Marker function

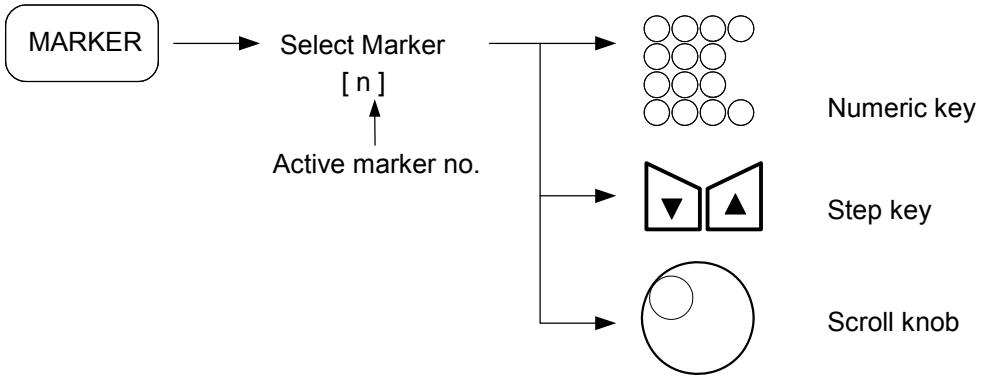
Keys related to the [MARKER] hard key are the [MKR >] and [FUNC] keys.

Up to nine markers can be set.

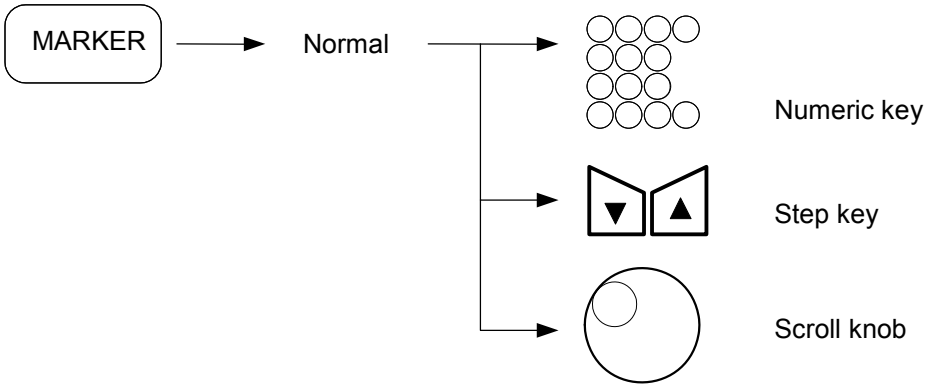
Selecting and changing marker position

Press [MARKER], which activates Marker 1 as the default. A single marker is indicated by ◊ on the waveform. Use the step up/down key to move the active marker position in 1-division steps. When the up step up key is pressed, the marker moves to the right. The down step key moves it left. The scroll knob step size is 1/(data points of the horizontal line) (span). You can also use the numeric keys to position the marker.

1 Selecting marker



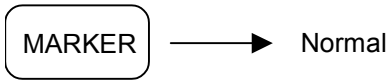
2 Moving marker



Normal marker

A normal marker is indicated by ◊ on the waveform. The frequency and level of the marker position are shown in the upper display window.

The normal marker is initially set ON. When the current state is another marker mode, or when the normal marker is set OFF, do the following to set the normal marker ON.



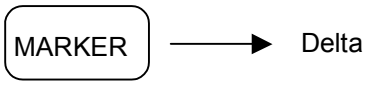
The normal marker displays the absolute amplitude level.

***Note**: in zero span mode, the x-axis of the marker displays time.*

Delta marker

In the delta marker mode, the reference marker is indicated by ∇.

To set the delta marker ON, do the following:



When the delta marker is ON, the reference marker is displayed and fixed at the normal marker position. Then the normal marker is moved, and the relative frequency (time) and level differences between the reference marker and the current marker are displayed as delta marker values.

Press *[Delta]* while in delta marker mode to reset the reference marker to the current normal marker position.

Band Pair

Use *[Band Pair]* to adjust the width between the normal and delta markers.

Select *[Band Pair [Start]]* to change the delta marker position.

Select *[Band Pair [Stop]]* to change the normal marker position.

Span Pair

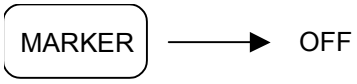
Use *[Span Pair]* to move the normal marker and delta marker together, maintaining a constant spacing between them; or to move them apart or together equally about a common frequency.

Select *[Span Pair [Span]]* to move the normal and delta markers apart or together about their common frequency.

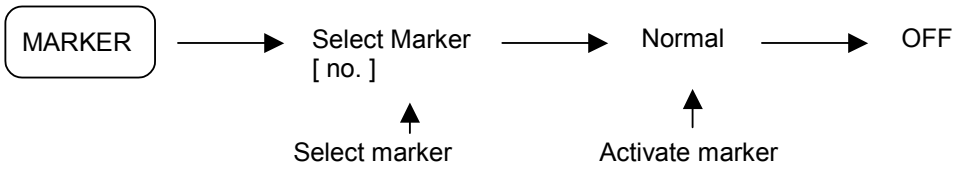
Select *[Span Pair [Span]]* to move the two markers together, maintaining a constant spacing between them.

Marker off in reverse order

The markers are turned off by the following key operations:



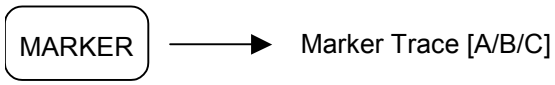
The markers are removed in reverse order by continuously pressing *[OFF]*. If you want to turn off a specific marker, do the following:



Setting the marker trace

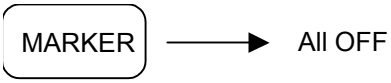
The marker can be set to trace A, B or C (see *Trace Array* on page 5-37).

First, activate the marker. Set the trace for marker position by doing the following:



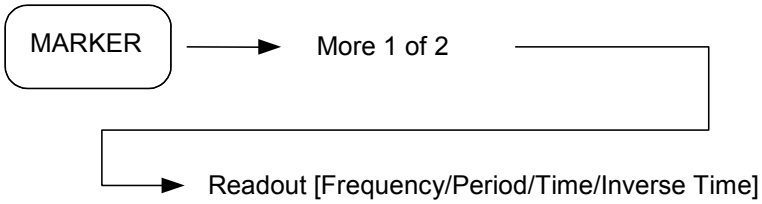
Delete all markers

To delete all markers, do the following:



Setting the marker readout mode

The following menu keys allow you to change the active marker readout:



Frequency:	sets the marker readout to frequency.
Period:	sets the marker readout to period (inverse of frequency)
Time:	sets the marker readout to time (range: within sweep time)
Inverse Time:	sets the marker readout to inverse time.

Setting the marker table

[Marker Table] toggles the marker table ON and OFF.

When the marker table is ON, it compresses the graticule and displays marker information in a table under the screen. The information includes the marker number, marker type, frequency, amplitude and marker readout status.

Setting the marker name

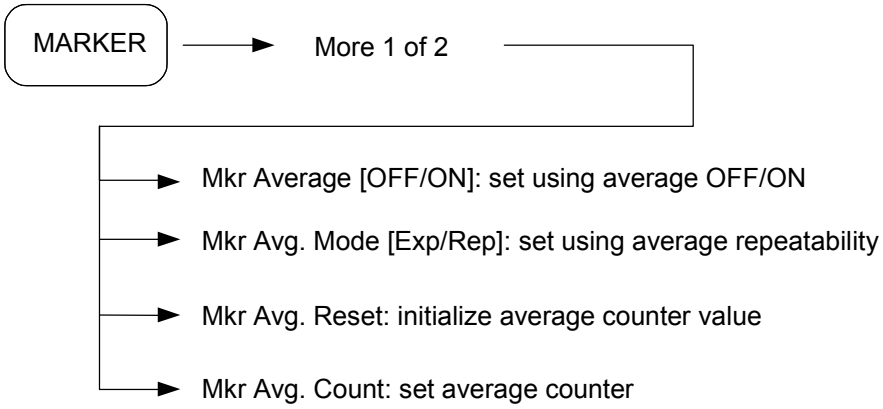
Use *[Edit Mkr Name]* to give each marker a characteristic name (see *Screen Title* on page 5-34)

Default marker name

Use *[Default Mkr Name]* to restore the default marker name (default markers are numbered 1–9).

Marker averaging function

The Marker Value Averaging function interprets the marker value by averaging the variation in marker values.



Setting parameters using marker values

The marker value can be set as the parameter value of the observed frequency/span function, reference level, and so on. This facilitates observation of the desired waveform.

To set parameters using the marker value, the following settings are possible:

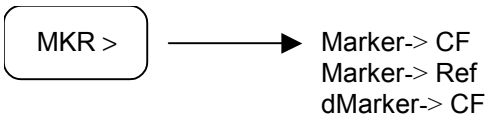
- Marker-> CF: sets the marker value to the center frequency.
- Marker-> CFstep: sets the marker value to the center frequency step size.
- Marker-> Start, Stop: sets the marker value to the start/stop frequency value.
- Marker-> Ref: sets the marker value to the reference level.
- dMarker-> Span: sets the delta marker value to the span.
- dMarker-> CF: sets the delta marker value to the center frequency.
- dMarker-> CFstep: sets the delta marker value to the center frequency step size.

In Zero Span Mode (= Time Domain), only Marker-> Ref is valid.

Marker-> CF/Marker-> Ref

Sets the current marker frequency or level to the center frequency or the reference level.

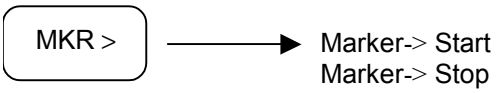
To execute the Marker Shift, do the following:



Marker-> Start/Marker-> Stop

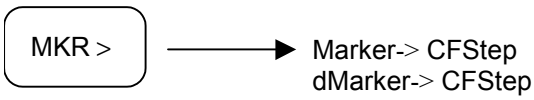
Sets the current marker frequency to the start or stop frequency.

To execute the Marker Start/Stop, do the following:



Marker-> CFStep/dMarker-> CFStep

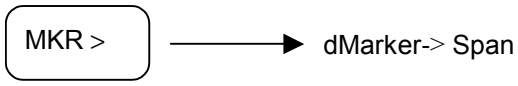
Sets the marker frequency to the center frequency step size (resolution determined by up/down keys.)



Although this action does not cause any change to appear on the screen, when the center frequency is changed with the step key, in the case of *[Marker > CFStep]* the center frequency changes with a multiple of the current frequency. This facilitates observation of harmonics.

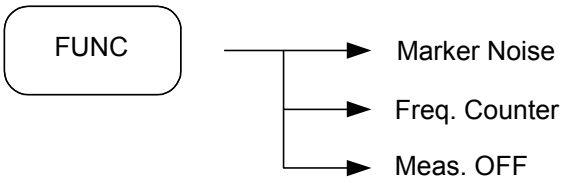
Dmarker-> Span

In the delta marker mode, this operation sets the difference frequency between the reference and current marker frequencies to span frequency.



Setting marker function

You can set the marker function to provide information about noise and frequency/amplitude at the current marker's location:



[Marker Noise]	Interprets the reference average noise level with 1 Hz noise power bandwidth.
[Freq. Counter]	Measures the accurate frequency value and amplitude of the current marker position. Marker counter resolution can be set to 1 kHz, 100 Hz, 10 Hz, 1 Hz.
[Meas. OFF]	Disables the marker function.

Peak search function

The instrument has the following marker search functions:

- Peak Search
- Next Peak Search
- Next Left Peak Search
- Next Right Peak Search
- Minimum Search
- Peak to Peak Search

Peak search

Peak search detects the maximum level point in the entire trace and moves a marker to that point.

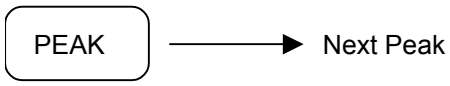
Execute peak search by doing the following:

If no marker exists, Marker 1 is activated.

Next Peak search

Next Peak search detects the next largest peak relative to the current marker level, and moves the marker to that point. When there are two or more peaks with the same level on the screen, the left-most peak is detected.

Execute Next Peak search by doing the following:

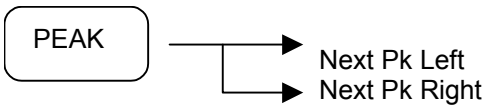


The next largest peak is detected. The marker can be moved to each peak in turn by executing the *[Next Peak]* search consecutively.

Peak Left search/Peak Right search

Peak Left search and Peak Right search detect the adjacent peak level to the right or left of the current marker and move the marker to that point.

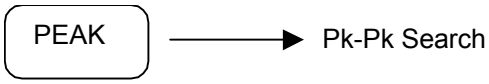
To execute Peak Left search and Peak Right search, do the following:



The adjacent peak to the right or left is detected and the marker moves to that peak by executing the *[Next Pk Left]* or *[Next Pk Right]* menu consecutively.

Peak to Peak search

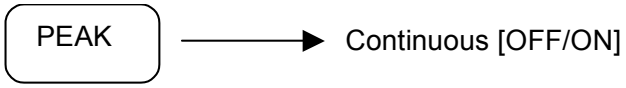
Finds and displays the frequency (or time, if in zero span) and amplitude differences between the highest and lowest trace points.



If you search Peak to Peak again, you should set the current activated marker off.

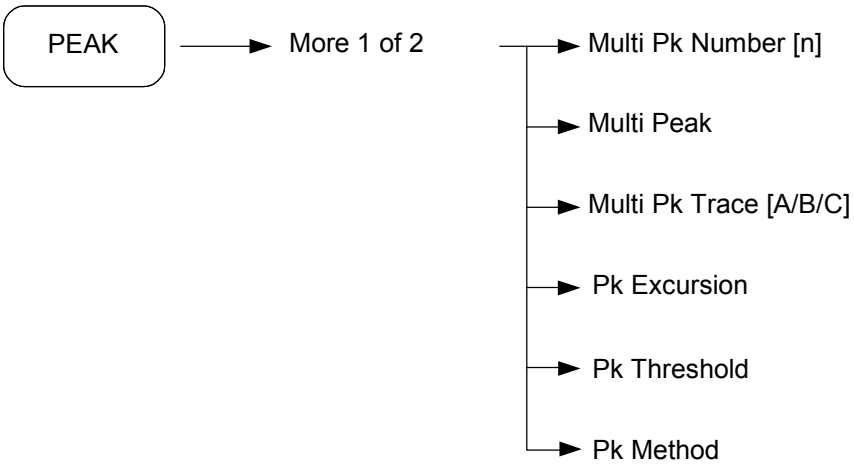
Continuous Peak search

When the *[Continuous]* soft key status is ON, the instrument continuously searches for the peak on the screen trace.



Setting the Peak Search parameters

Accesses the following menu keys:

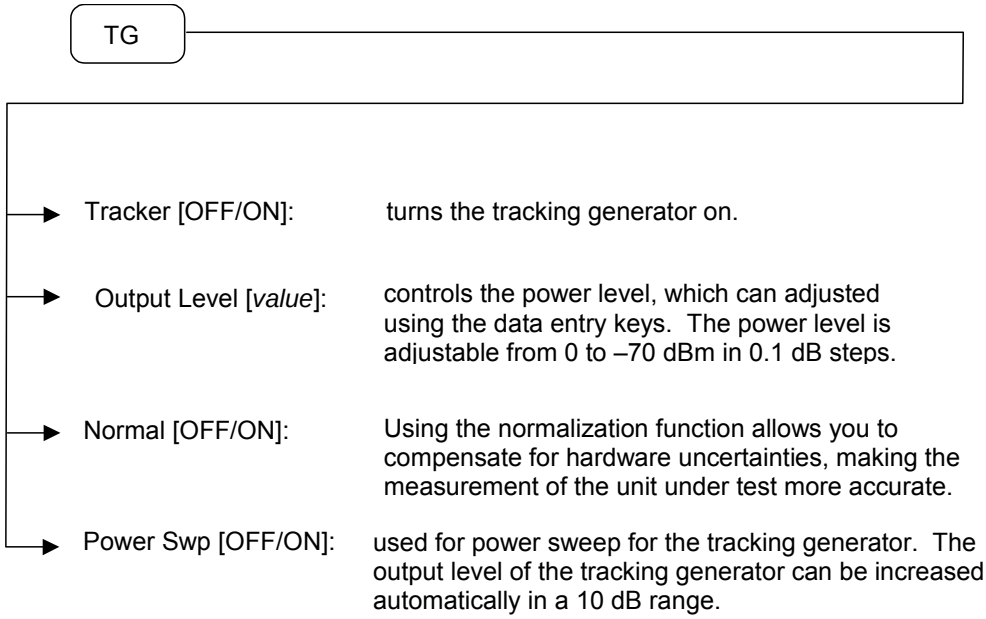


Multi Pk Number [n]	Sets the number of search markers in the multi peak search. n = 1–9.
Multi Peak	This function is used for multiple peak searching. The set number of markers position in order of level of peak on one sweep waveform. If only one peak exists that meets the condition, all the markers (= n markers) gather on that one peak.
Multi Pk Trace [A/B/C]	Selects the trace to execute the multi peak search.
Pk Excursion	Sets the minimum amplitude variation of signals that the marker can identify as a peak. If a value of 10 dB is selected, the marker moves only to peaks that rise and fall more than 10 dB above the peak threshold value.To set the excursion value, use the numeric keys or scroll knob.
Pk Threshold	Sets a lower boundary for the active trace. The value of the peak threshold level can be changed using the numeric keys or the scroll knob. The threshold level does not influence the trace memory or marker position.
Peak Search [Param/Max]	If *Param* mode is set, it finds the peak dependent on the setting value of Excursion and Threshold. If *Max* mode is set, it finds the maximum peak value of the displayed trace.

Tracking generator (option)

The instrument has an optional tracking generator.

To set up the tracking generator, do the following:



The *Normal* menu provides for a more convenient measurement by normalizing the unloaded output signal.

Power Swp is used for measuring the characteristics of amplitude gain in fixed frequency. It sets the target frequency to center frequency and Power Swp ON, then enters zero span mode and increases the amplitude within 10 dBm in the specified range. For example, if the amplitude of the center frequency is -33 dBm, the start frequency amplitude is –40 dBm and the stop frequency amplitude is –30 dBm.

Instrument in phase noise measurement mode

Freq/span function

Frequency is set in either of two modes:

- Carrier frequency
- Carrier search

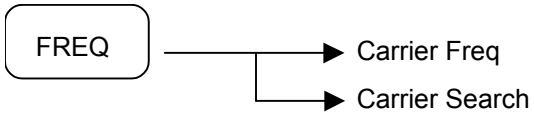
The lower and upper span limits are 1 KHz to 3 GHz (3251) / 6.2 GHz (3252) / 13.2 GHz (3253) / 26.5 GHz (3254).

Use [FREQ] for setting frequency.

Use [SPAN] for setting offset frequencies for measurements.

FREQ function

The [FREQ] hard key allows you to set frequency functions for the instrument.



Carrier Freq

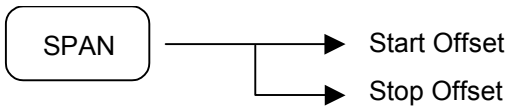
Allows you to specify the frequency of the carrier wave whose phase noise is to be measured. As long as the frequency you enter is within ±5% of the carrier signal's true frequency, the analyzer tunes to it automatically.

Carrier Search

Automatically tunes the analyzer to the strongest signal it can find. If Search Span is set to Automatic, the search is performed from a lower limit of 100 Hz to an upper limit of the analyzer's maximum capabilities. When Search Span is set to Manual, the search is performed within the frequency range specified in Search Span, centered on the current carrier frequency.

SPAN menu

The [SPAN] hard key allows you to set the span of the Log Plot measurement of phase noise.



Start Offset

Allows you to specify the offset frequency at which your Log Plot measurement starts.

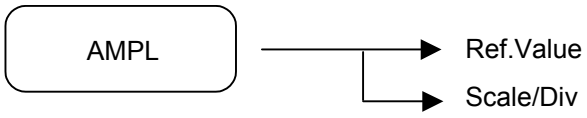
Stop Offset

Allows you to specify the offset frequency at which your Log Plot measurement stops.

AMPL function

The [AMPL] hard key displays soft keys for setting the amplitude.

These keys are used for setting functions that affect the way data on the vertical axis is displayed or corrected.



Ref.Value

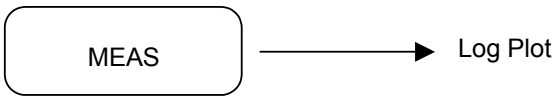
This allows you to set the value (in dBc/Hz) of a specified position on the graticule display.

Scale/Div

This allows you to set the value of the scale (in dB) for each division of the Y axis.

Measurement function

MEASURE menu

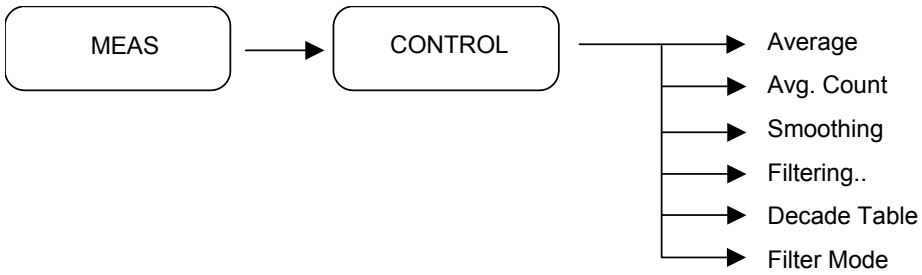


Log Plot

Displays a logarithmic plot of the measured phase noise over a range of frequency offsets.

MEASURE Control menu

Press [MEAS] followed by [CONTROL] to display the measurement control menu, which allows you to enter custom setup parameters for measurement. Some keys perform the same function as in Spectrum Analyzer mode (page 5-21).



Average

Determines whether you use the averaging function or not.

- ON: enables measurement averaging
- OFF: disables measurement averaging.

Avg. Count

Allows you to specify the number of measurements that are averaged.

Smoothing

Allows you to specify the amount of smoothing done to the trace after the measurement has been performed. The amount of smoothing can be varied between 0.00% and 16%. By default, both the trace of the raw data and the smoothed trace are displayed.

Filtering

Allows you to set the ratio of VBW/RBW. Ratios are: 1.0, 0.3, 0.1 and 0.03.

Decade Table

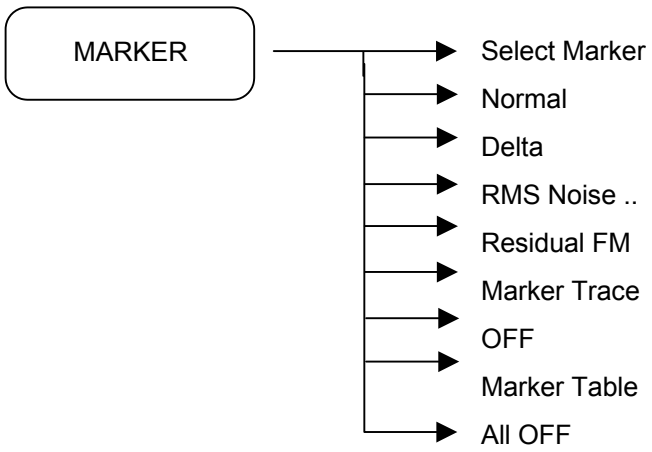
Allows you to toggle the Decade Table on and off. The Decade Table is a table of measurements that shows, for each of the analyzer's two traces (raw and smoothed), the value in dBc/Hz at the point where the traces cross each decade line on the display.

Filter Mode

Allows you to select the filter to be used in phase measurement analysis.

- Narrow: selects narrow filter
- Wide: selects wide filter.

Marker function



Select Marker

Allows you to select one of the four possible markers. Having selected one of the markers, use the other soft keys on this menu to specify the type of marker or measurement.

Normal

Sets the specified marker to be a normal marker. That is, it marks the point of the frequency offset that you specify, and then the analyzer measures and displays the phase noise at this point.

Delta

A delta marker is actually a pair of markers. By pressing *[Delta]*, you set a pair of markers at your current frequency offset. One of this pair of marker is fixed while the second of the pair can be moved using the scroll knob or the numeric keys. The frequency difference and the phase noise difference between these two points is displayed.

RMS Noise

Displays a second menu allowing access to three RMS noise functions. An RMS noise marker is actually a pair of markers. By pressing *[RMS Noise Degrees]*, you set a pair of markers at your current frequency offset. One of this pair of markers is fixed while the second of the pair can be moved using the scroll knob or the numeric keys.

[RMS Noise [Degrees]]: RMS phase noise between these two points is calculated, and is displayed in degrees.

[RMS Noise [Radians]]: RMS phase noise between these two points is calculated, and is displayed in radians.

[RMS Noise [Jitter]]: RMS jitter between these two points is calculated, and is displayed in units of time, typically in picoseconds (ps).

Residual FM

A residual FM marker is actually a pair of markers. By pressing *[Residual FM]*, you set a pair of markers at your current frequency offset. One of this pair of markers is fixed while the second of the pair can be moved using the scroll knob or the numeric keys. The RMS value of the residual FM between these two points is calculated and displayed.

Marker Trace

Allows you to select which of the two traces your currently selected marker is applied to.

OFF

Switches the specified marker off.

Marker Table

Allows you to display all of the data from all of your markers in a tabular form. For every marker you have set, the table shows the number of the trace to which it has been applied, the marker's position on the X axis, and its measured Y axis value.

- On: sets the marker table on. The table is displayed beneath the graticule
- Off: sets the marker table display off.

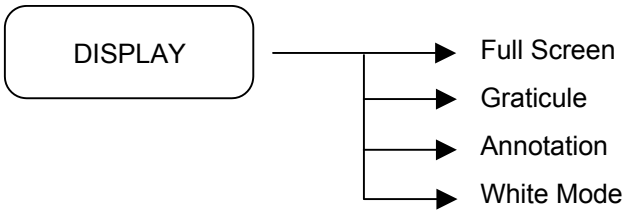
All OFF

Switches all markers off. All markers are removed from the graticule display, and if the marker table is also being displayed, all entries are removed from it.

Display function

The instrument provides functions related to the screen display.

Full Screen	Displays the maximum enlarged graticule
Graticule	Sets the graticule on or off
Annotation	Displays information about the waveform in the annotation window at bottom left of the screen
White Mode	Economy mode for screen save and printing



Full Screen

Extends the measurement window over the entire analyzer display, removing the soft key menu as it does so. To restore the soft key menu, press any key except [Print], [Save], or any of the data entry keys.

Graticule

Allows you to display or hide the graticule lines on the display.

Annotation

Allows you to display or hide some of the annotation pertaining to the current display.

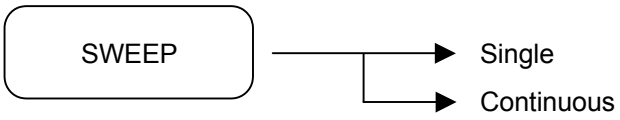
White Mode

Changes the screen background to white.

Sweep function

The Sweep function lets you choose the Sweep Mode.

- Single sweep mode
- Continuous sweep mode



Single

The analyzer performs one single measurement and then stops. Press *[Restart]* every time you want to make another measurement.

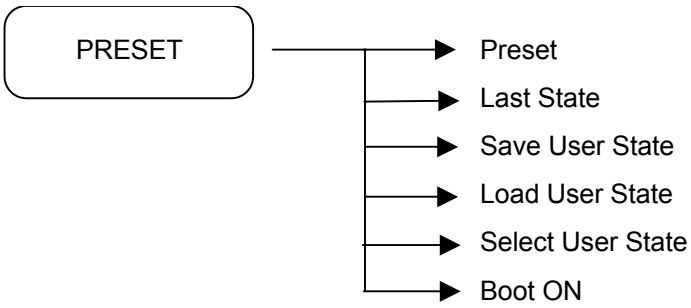
Continuous

The analyzer continuously measures the signal it is receiving and repeatedly updates the plots and the measurements.

Preset function

The [Preset] hard key is the header key for preset and calibration functions.

- Preset
- Last State
- Save User State
- Load User State
- Select User State [Usr1/Usr2/Usr3]
- Boot On [Last/System]



Apart from the *[Preset]* sub-menu (see below), sub-menus of the [Preset] hard key have the same function as in spectrum analysis mode (page 5-55); please refer to this part of the manual for information.

Preset

Pressing *[Preset]* returns the analyzer parameters to the factory initial setup values for phase noise operation.

Chapter 6
PERFORMANCE TESTS

Contents

Introduction

This chapter describes setup and operation procedures necessary for conducting performance tests.

Requirement for performance tests

Performance tests are used as preventive maintenance to prevent degradation of equipment performance before it occurs. Use the performance tests whenever necessary such as at acceptance and periodic inspection to verify performance after repair.

- Frequency span readout accuracy
- Reference oscillator frequency accuracy
- Frequency counter accuracy
- Resolution bandwidth (RBW) and selectivity and switching error
- Phase noise
- Residual FM noise
- Average noise level
- Input attenuator switching error
- Frequency response
- Spurious response
- Second harmonic distortion
- 3rd order intermodulation
- Spurious related to input
- Input VSWR
- Trigger (ext, video)
- Preamplifier

Execute the performance tests at regular intervals as preventive maintenance for important evaluation items. We recommend that the performance be checked regularly once or twice a year. If the performance test does not meet the specifications, please contact your nearest agent.

Instruments required for performance test

Recommended instrument (Model number)	Required performance Item	Specification	Test item
Signal generator (Agilent E8257D)	Frequency range	250 kHz–26.5 GHz	Frequency-span readout accuracy
	Resolution	1 kHz	Frequency counter accuracy
	Output level range	–130 to +18 dBm	Resolution bandwidth, selectivity
	Output level resolution	0.01 dB	Phase noise
	SSB phase noise	≤–100 dBc/Hz (at 10 kHz offset)	Residual FM noise, displayed average noise level
	External reference output	10 MHz	Input attenuator switching error frequency response
(Agilent E4432B)	Frequency range	250 kHz–3 GHz	Second harmonic distortion
	Resolution	1 kHz	3rd order intermodulation
	Output level range	–136 to +10 dBm	Spurious relating with input
	Output level resolution	0.01 dB	Input VSWR
	SSB phase noise	≤–120 dBc/Hz (at 20 kHz offset)	Preamplifier
Power meter (Agilent EPM441BB)	Frequency range	9 kHz–110 GHz	Frequency response
	Measure range	–70 dBm to +44 dBm	
	Power resolution	0.001 dB	
Power sensor (Agilent E9304A)	Frequency range	9 kHz–6 GHz	Frequency response
	VSWR (max)	1.13 (9 kHz–2 GHz) 1.19 (2 GHz–6 GHz)	
	Power range	–60 dBm to +20 dBm	
Power sensor (Agilent E4413A)	Frequency range	50 MHz–26.5 GHz	Frequency response
	VSWR (max)	1.21 (50 MHz–100 MHz) 1.19 (100 MHz–8 GHz) 1.21 (8 GHz–18 GHz) 1.26 (18 GHz–26.5 GHz)	
	Power range	–70 dBm–-+20 dBm	
50 ohm termination (Agilent 909F)	Frequency range	DC–6 GHz (– 18 GHz)	Average noise level Spurious response
	VSWR	1.005 (DC–5 GHz) 1.01 (5–6 GHz) 1.15 (6–18 GHz)	
Power splitter (Agilent 11636B)	Frequency range	DC–26.5 GHz	3rd order intermodulation
	Input / output Impedance	50 Ω	

Frequency counter (HP 5328B)	Resolution	0.1 Hz–1 MHz	Reference oscillator frequency accuracy
Network analyzer (Agilent E8363B)	Frequency range	10 MHz–40 GHz	Input VSWR
Arbitrary wave generator (Tektronix AFG310)	Frequency range	0.01 Hz–16 MHz	Trigger response

Test precautions

For tests other than for oscillator frequency stability, warm up the equipment for at least fifteen minutes and test the performance after the equipment stabilizes completely.

Also, begin measurements after taking the warm-up time of the calibration instrument into full consideration. In addition, the test should be conducted at room temperature with little AC power supply voltage fluctuation, and should be free of noise, vibration, dust humidity, etc.

Frequency span readout accuracy

Using the setup shown in Fig. 6-1, set the frequencies corresponding to the first and ninth vertical divisions from the left side of the screen scale with the signal generator. The frequency difference between the peak levels at the first and ninth vertical division is equal to the frequency span x 0.8.

Specification

Frequency span accuracy: ≤±1%

Test instrument

Signal generator: E8257D

RF cable: SMA (male)–SMA (male)

BNC cable: BNC (male)–BNC (male)

Adapter: N (male)–SMA (female)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

10 dB attenuator: SMA (female)–SMA (female)

Setup

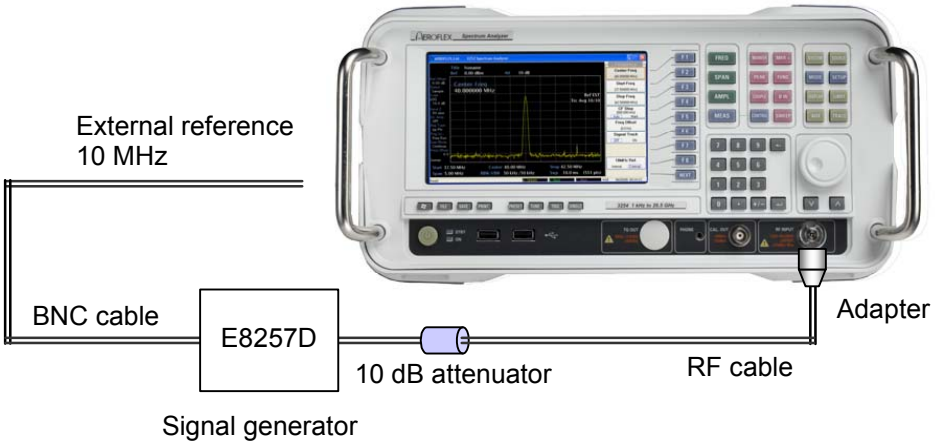


Fig. 6-1 Frequency span readout accuracy test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set the equipment as follows:

Center frequency: 1500 MHz
Span: 10 MHz
RBW: Auto
VBW: Auto
Reference level: −10 dBm
Sweep time: 50 ms (Span<5 GHz), 200 ms (Span>5 GHz)

4 Set the signal generator output frequency equal to the center frequency as follows:

Frequency: 1500 MHz
Power: −15 dBm

5 Adjust the E8257D output frequency to set the signal peak at the first division from the left of the screen scale. Record the frequency of F1:
F1 = center frequency − (span/10 x 4)

6 After setting the E8257D output frequency to the F2 frequency, adjust it to set the signal peak at the ninth division. Record the frequency of F2:
F2 = center frequency + (span/10 x 4)

7 Calculate (F2 − F1) / (Span x 0.8) and check that the value is within the specified range shown in Table 6-1.

8 Calculate the frequency span accuracy by using the following equation:

$$\text{Frequency span accuracy} = \frac{(\text{Span} \times 0.8) - [\text{Frequency (F2)} - \text{Frequency (F1)}]}{(\text{Span} \times 0.8)} \times 100$$

9 Repeat steps 5 to 8 for each frequency span with a center frequency range between the maximum and minimum values shown in Table 6-1.

Table 6-1 Frequency span accuracy

Equipment		Signal generator (MHz)		Specification (±1 %)
Center frequency	**Span**	**F2**	**F1**	**Accuracy**
1500 MHz	10 MHz 50 MHz 2000 MHz 3000 MHz			
4700 MHz	10 MHz 50 MHz 2000 MHz 3000 MHz			
9700 MHz	10 MHz 40 MHz 80 MHz 2000 MHz 3000 MHz			
19700 MHz	10 MHz 50 MHz 160 MHz 2000 MHz 5000 MHz 10000 MHz 13600 MHz			

Reference oscillator frequency stability

Frequency stability is tested by measuring the 10 MHz reference oscillator. Stability is determined by measuring frequency variation at ambient temperatures of 0°C and 50°C.

Specification

Frequency:	10 MHz
Aging rate:	≤±1 ppm (±0.1 ppm with HSO Option)
After 24 hour warm-up at 25°C ± 5°C:	
Temperature stability:	≤±1 ppm (±0.1 ppm with HSO Option) / one year at 0°C and 50°C referred to the frequency measured at 25°C.

Test instruments

Frequency counter:	HP 5328B
BNC cable:	BNC (male)–BNC (male)

Setup

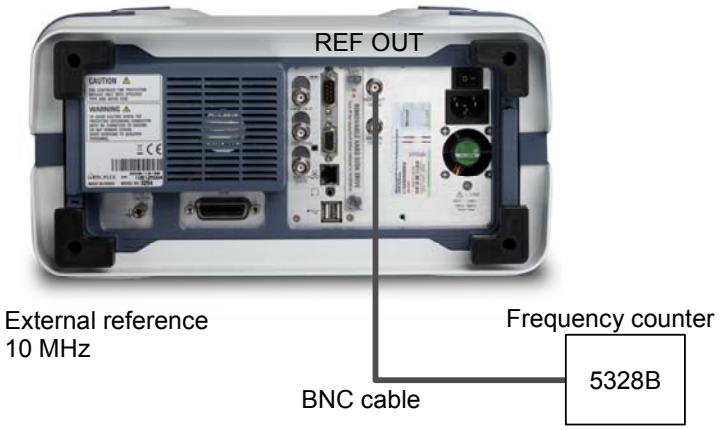


Fig. 6-2 Reference oscillator frequency stability test

Procedure

Temperature stability

Test condition: test this performance in a vibration-free variable-temperature chamber.

1 Set up the equipment in a constant-temperature chamber at 25°C.

2 Set the line and power switches on the equipment to ON and wait until the equipment's internal temperature stabilizes (approx. 1.5 hours after the chamber temperature stabilizes).

3 When the internal temperature stabilizes, measure the frequency by using the counter with 0.1 Hz resolution.

4 Change the chamber temperature to 50°C.

5 When the chamber temperature and the equipment's internal temperature stabilize, measure the frequency by using the counter.

6 Calculate the stability by using the following equation.

7 Repeat steps 5 and 6 at 0°C chamber temperature.

$$\text{Frequency Stability}\,(50^{o}\text{C}) = \frac{(\text{counter reading at } 50^{o}\text{C}) - (\text{counter reading at } 25^{o}\text{C})}{(\text{counter reading at } 25^{o}\text{C})}$$

$$\text{Frequency Stability}(0^{o}\text{C}) = \frac{(\text{counter reading at } 0^{o}\text{C}) - (\text{counter reading at } 25^{o}\text{C})}{(\text{counter reading at } 25^{o}\text{C})}$$

Frequency counter accuracy

Examine the frequency counter accuracy.

Specification

Accuracy:	± [(Reference frequency accuracy x Marker frequency accuracy) ± (counter resolution x 1 LSB)]
Resolution:	1 Hz, 10 Hz, 100 Hz, 1000 Hz
Sensitivity:	–45 dBm @ 2 MHz < frequency < 13.2 GHz (span<3 MHz)
	–40 dBm @ 13.2 GHz < frequency < 26.5 GHz (span<3 MHz)

Test instruments

Signal generator:	E8257D
RF cable:	SMA (male)–SMA (male)
BNC cable:	BNC (male)–BNC (male)
Adapter:	N (male)–SMA (female)
(Reference):	use additional adapter: 3.5 mm (male)–N (female) (3254 model)
10 dB attenuator:	SMA (female)–SMA (female)

Setup

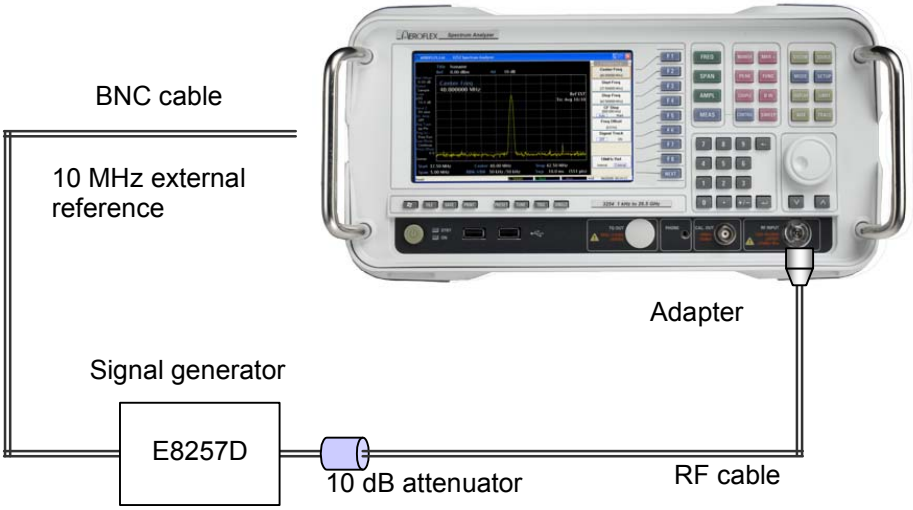


Fig. 6-3 Frequency counter accuracy test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 2.9 GHz
Span: 200 kHz
Reference level: −20 dBm
ATT: 0 dB
RBW: Auto
VBW: Auto

4 Set the signal generator as shown below:

Frequency: 2.9 GHz
Power: −50 dBm

5 Press [PEAK], [FUNC], *[Freq Counter]*.

6 Read out the frequency counter value.

7 Measure the frequency counter value with changing frequency generator value (1 Hz→10 Hz→100 Hz→1000 Hz) (Table 6-2).

Table 6-2 Frequency counter accuracy

Spectrum analyzer	Signal generator		Result
Center	Center	Power level	
2.9 GHz	2.9 GHz	–50 dBm	
6.3 GHz	6.3 GHz	–45 dBm	
13.1 GHz	13.1 GHz	–45 dBm	
26.4 GHz	26.4 GHz	–40 dBm	

Resolution bandwidth (RBW) and selectivity and switching error

Resolution bandwidth (RBW)

When there are two input signals with a frequency difference corresponding to the 3 dB bandwidth of the IF final stage, the signals can be resolved as two waveforms. This is called resolution bandwidth.

RBW accuracy and selectivity

The accuracy is defined by the coincidence between setting of RBW and 3 dB bandwidth of signal.

The selectivity is defined by the ratio of the filter width, in Hz, at the –60 dB point, to the filter width, in Hz, at the –3 dB point, as shown in the following formula:

To test the resolution bandwidth and selectivity, first measure the resolution bandwidth (3 dB bandwidth), then the 60 dB bandwidth and calculate the 60 dB/3 dB bandwidth ratio.

RBW switching error

The switching error is defined as the shift in amplitude when the RBW filter is switched.

Specification

Accuracy:	≤±3% at 3 dB (500 Hz–500 kHz, 1-2-3-5 step)
	≤±10% at 3 dB (1 MHz~5 MHz, 1-2-3-5 step)
Selectivity:	≤5:1 (1 Hz–5 MHz, 1-2-3-5 step)
Switching error:	±0.05 dB (RBW 5 kHz reference)

Test instruments

Signal generator:	E8257D
RF cable:	SMA (male)–SMA (male)
BNC cable:	BNC (male)–BNC (male)
Adapter:	N (male)–SMA (female)

(Reference) Use additional adapter 3.5 mm (male)–N (female) (3254 model)

Setup

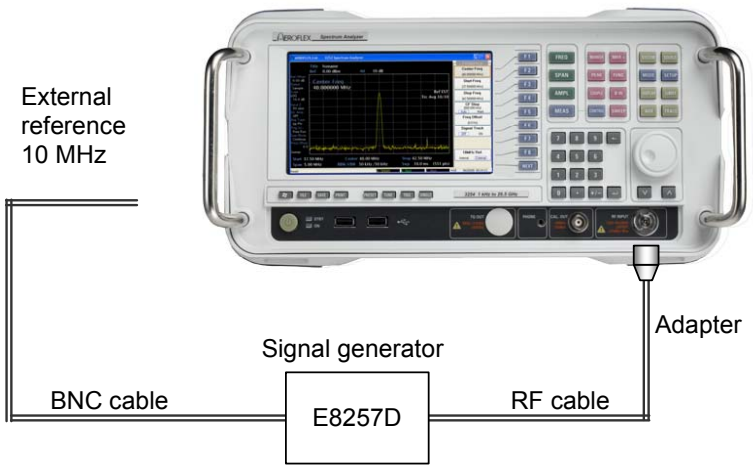


Fig. 6-4 Resolution bandwidth and selectivity and error test

Procedure

RBW accuracy

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 1101 MHz
Span: 15 MHz
Reference level: −10 dBm
RBW: 5 MHz
VBW: Auto
Scale: 2 dB/div
Sweep time: 50 ms

4 Set the signal generator as shown below:

Frequency: 1101 MHz
Power: −10 dBm

5 Press [PEAK], [MARKER>], *[Marker>Ref]* and match the peak of the signal trace to the top line Ref Level on the screen.

6 Press [SINGLE], *[Single]* to execute a single sweep, then check that the single sweep has been completed.

7 Press [MEAS], *[X dB Down..]*, *[X[dB] Point [3.0]]* and then measured value.

8 Press [SWEEP], *[Continuous]*.

9 Repeat steps 5 to 8 for the other resolution bandwidth according to the combinations of resolution bandwidth and frequency span shown in Table 6-3.

10 Calculate RBW filter accuracy:

$$\text{Accuracy} = \frac{(\text{RBW} - \text{Measured Value})}{\text{RBW}} \times 100\%$$

Table 6-3 RBW accuracy

Equipment			Marker Δ 3 dB bandwidth			Accuracy	Remark
Center	RBW	Span	Minimum	Measure	Maximum		
	1 kHz	3 kHz					
	2 kHz	6 kHz					
	3 kHz	9 kHz					
	5 kHz	15 kHz					
	10 kHz	30 kHz					
	20 kHz	60 kHz					
	30 kHz	90 kHz					
1101 MHz	50 kHz	150 kHz					
	100 kHz	300 kHz					
	200 kHz	600 kHz					
	300 kHz	900 kHz					
	500 kHz	1.5 MHz					
	1 MHz	3 MHz					
	2 MHz	6 MHz					
	3 MHz	9 MHz					
	5 MHz	15 MHz					
	1 kHz	3 kHz					
	2 kHz	6 kHz					
	3 kHz	9 kHz					
	5 kHz	15 kHz					
	10 kHz	30 kHz					
	20 kHz	60 kHz					
	30 kHz	90 kHz					
9501 MHz	50 kHz	150 kHz					
	100 kHz	300 kHz					
	200 kHz	600 kHz					
	300 kHz	900 kHz					
	500 kHz	1.5 MHz					
	1 MHz	3 MHz					
	2 MHz	6 MHz					
	3 MHz	9 MHz					
	5 MHz	15 MHz					

Equipment			Marker Δ 3 dB bandwidth			Accuracy	Remark
Center	RBW	Span	Minimum	Measure	Maximum		
	1 kHz	3 kHz					
	2 kHz	6 kHz					
	3 kHz	9 kHz					
	5 kHz	15 kHz					
	10 kHz	30 kHz					
	20 kHz	60 kHz					
20001 MHz	30 kHz	90 kHz					
	50 kHz	150 kHz					
	100 kHz	300 kHz					
	200 kHz	600 kHz					
	300 kHz	900 kHz					
	500 kHz	1.5 MHz					
	1 MHz	3 MHz					
	2 MHz	6 MHz					
	3 MHz	9 MHz					
	5 MHz	15 MHz					

RBW selectivity

1 Set the power switch on the equipment's front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set the equipment as shown below:

Center frequency: 108 MHz
Span: 5 MHz
Reference level: −10 dBm
ATT: Auto
RBW: 1 MHz
VBW: Auto
Sweep time: 50 ms

4 Set the signal generator as shown below:

Frequency: 108 MHz

Power: 0 dBm

5 Press [PEAK], [MARKER>], *[Marker>Ref]* and match the peak of the signal trace to the stop line Ref Level on the screen.

6 Press [SINGLE], *[Single]* to execute a signal sweep, then check that the single sweep has completed.

7 Press [MEAS], *[X dB Down..]*, [CONTROL], *PointA [X [dB] point[−60]]* and then measure the X dB Relate.

8 Press [SWEEP], *[Continuous]*. Change the RBW and frequency spans according to the combinations of RBW and frequency span shown in Table 6-4.

9 For 3 dB bandwidth, used the value table (Item RBW Accuracy].

10 Calculate RBW selectivity:

$$\text{Selectivity} = \frac{60\text{ dB Bandwidth}}{3\text{ dB Bandwidth (or 6 dB Bandwidth)}}$$

Table 6-4 RBW selectivity

Equipment			3 dB BW	60 dB BW	Selectivity	Remark
Center	RBW	Span				
	300 Hz	1.8 kHz				
108 MHz	30 kHz	180 kHz				
	300 kHz	1.8 MHz				
	1 MHz	6 MHz				

RBW switching error

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 100 MHz
Span: 9 MHz
Reference level: −10 dBm
ATT: Auto
RBW: 3 kHz
VBW: Auto
Scale: 10 dB/div
Sweep time: 100 ms

4 Set the signal generator as shown below:

Frequency: 100 MHz
Power: −5 dBm

5 Press [PEAK], [MARKER>], *[Marker > CF]* to move the signal peak to the center and the top of the screen.

6 Press [MARKER], *[Delta]* to set the marker to delta marker.

7 Set RBW and SPAN sequentially as shown in Table 6-5 (300 Hz/1.5 kHz–3 MHz/15 MHz).

8 Press [PEAK] to conduct a peak search and move the current marker to the peak point of the signal spectrum.

9 Read the Δ marker level value.

10 Repeat steps 7 to 9.

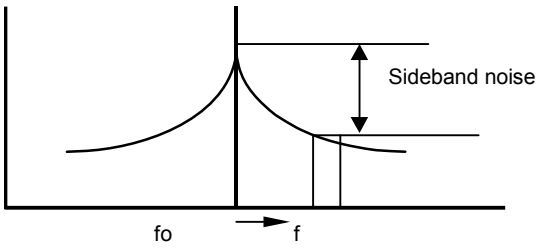
Table 6-5 RBW switching error

Equipment			3 dB BW	60 dB BW
Center	RBW	Span		
	1 kHz	3 kHz		
	2 kHz	6 kHz		
	3 kHz	9 kHz		
	5 kHz	15 kHz		
	10 kHz	30 kHz		
	20 kHz	60 kHz		
	30 kHz	90 kHz		
100 MHz	50 kHz	150 kHz		
	100 kHz	300 kHz		
	200 kHz	600 kHz		
	300 kHz	900 kHz		
	500 kHz	1.5 MHz		
	1 MHz	3 MHz		
	2 MHz	6 MHz		
	3 MHz	9 MHz		
	5 MHz	15 MHz		

Equipment			3 dB BW	60 dB BW
Center	RBW	Span		
	1 kHz	3 kHz		
	2 kHz	6 kHz		
	3 kHz	9 kHz		
	5 kHz	15 kHz		
	10 kHz	30 kHz		
	20 kHz	60 kHz		
	30 kHz	90 kHz		
9000 MHz	50 kHz	150 kHz		
	100 kHz	300 kHz		
	200 kHz	600 kHz		
	300 kHz	900 kHz		
	500 kHz	1.5 MHz		
	1 MHz	3 MHz		
	2 MHz	6 MHz		
	3 MHz	9 MHz		
	5 MHz	15 MHz		
	1 kHz	3 kHz		
	2 kHz	6 kHz		
	3 kHz	9 kHz		
	5 kHz	15 kHz		
	10 kHz	30 kHz		
	20 kHz	60 kHz		
	30 kHz	90 kHz		
19000 MHz	50 kHz	150 kHz		
	100 kHz	300 kHz		
	200 kHz	600 kHz		
	300 kHz	900 kHz		
	500 kHz	1.5 MHz		
	1 MHz	3 MHz		
	2 MHz	6 MHz		
	3 MHz	9 MHz		
	5 MHz	15 MHz		

Phase noise

Sideband noise measures the noise of a local oscillator signal at an offset from the carrier frequency. It is important to use a signal source with sideband noise performance 10 dB or better than the equipment.



Specification

Phase noise: –92 dBc/Hz @ frequency = 1 GHz, 1 kHz offset

–112 dBc/Hz @ frequency = 1 GHz, 10 kHz offset

–112 dBc/Hz @ frequency = 1 GHz, 100 kHz offset

–136 dBc/Hz @ frequency = 1 GHz, 1 MHz offset

–144 dBc/Hz @ frequency = 1 GHz, 10 MHz offset

at 20°C room temperature

Test instruments

Signal generator: E8257D

RF cable: SMA (male)–SMA (male)

BNC cable: BNC (male)–BNC (male)

10 dB attenuator: SMA (female)–SMA (female)

Adapter: N (male)–SMA (female)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

Setup

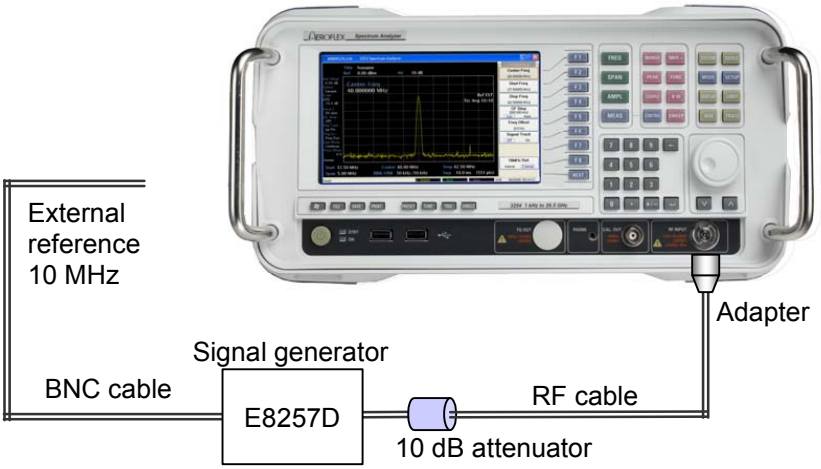


Fig. 6-5 Phase noise test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 1 GHz
Span: 100 kHz
Reference level: −10 dBm
ATT: 0 dB
RBW: 1 kHz
VBW: Auto
Scale: 10 dB/div
Sweep time: Auto

4 Set up the signal generator as shown below:

Frequency: 1 GHz
Power: 0 dBm

5 Press [PEAK], [MARKER>], *[Marker>CF]* and *[Marker>Ref]* to move the signal spectrum peak to the center and the top of the screen.

6 Press [MARKER], *[Delta]* in order to set to the marker to the Δ marker.

7 Set the Δ marker to a frequency of 10 kHz and read the marker value (amplitude).

8 Calculate sideband noise:

Sideband noise = Measured value (Δ marker value) − 10 log (RBW/1 Hz)

Example:

Offset frequency	RBW	Measured value	Sideband noise
10 kHz	1 kHz	−65 dBc	−95 dBc/Hz

Residual FM noise

Measures the purity of frequency.

Specification

≤ 100 x N Hz p-p, 1 s, RBW 1 kHz, VBW 1 kHz (N: LO harmonic mixing mode)

Test instruments

Signal generator:	E8257D
RF cable:	SMA (male)–SMA (male)
Adapter:	N (male)–SMA (female) (Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

Setup

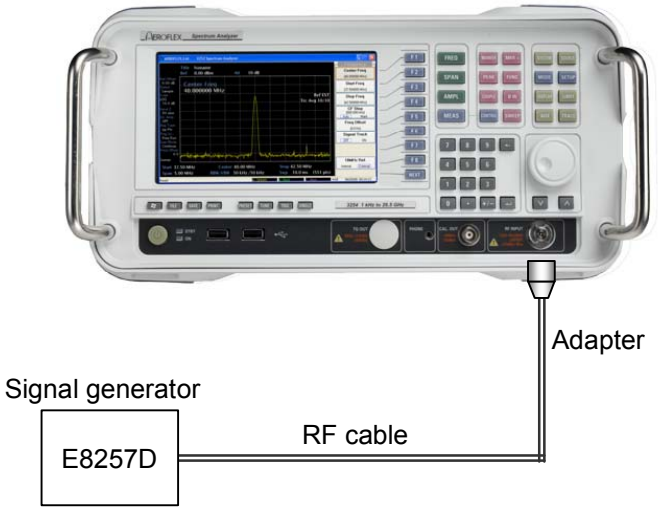


Fig. 6-6 Residual FM test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 3 GHz
Reference level: –20 dBm
Span: 10 kHz
RBW: 1 kHz
VBW: 1 kHz
Sweep time: 500 ms
Log Scale: 1 dB/div

4 Set the signal generator 83650B as shown below:

Frequency: 3 GHz
Power: –20 dBm

5 Press [MARKER], *[Normal]* and press [SPAN], *[Zero Span]*.

6 Change the frequency of the signal generator and press [MARKER], *[Delta]* when the equipment's marker level is –25 dBm.

7 Record the frequency of the signal generator (A).

8 Change the frequency until the equipment delta marker level reads –27 dBm.

9 Record the frequency of the signal generator (B).

10 Press [SINGLE], *[Single]* and check the peak-to-peak value (C).

11 Residual FM = (B–A) / 2 x C

Average noise level

This test measures the internal noise of the instrument.

Specification

Average noise level: (RBW: 1 Hz, VBW: 1 Hz)

≤ –143 dBm	10 MHz–2 GHz
≤ –135 dBm	100 kHz–10 GHz
≤ –143 dBm	10 MHz–2 GHz
≤ –141 dBm	2 GHz–13.2 GHz
≤ –138 dBm	13.2 GHz–18 GHz
≤ –133 dBm	18 GHz–26.5 GHz

Test instruments

50 ohm terminator: 909F

Setup

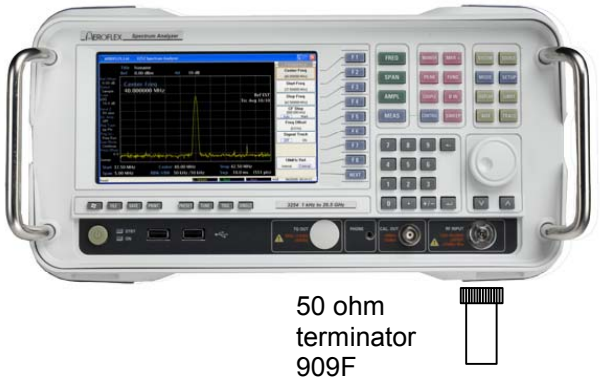


Fig. 6-7 Average noise level test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 2.91 GHz
Span: zero
Reference level: –40 dBm
ATT: 0 dB
RBW:
VBW: 3 Hz
Detector mode: Average
Sweep time: Average

4 Terminate the RF input with a 50 Ω terminator.

6 Press [TRACE], *[More..]*, *[Trc Average.. [ON]]*, *[Trc Avg Count [9]]*.

7 Wait until the 9 sweeps have completed.

8 Press [PEAK] to execute a peak search. At this point, read the level value at the marker. If a spurious signal exists within the span, move the marker to a flat noise region and then read the level value at the marker*.

9 Repeat steps 6 to 8, changing the center frequency. Enter the results in Table 6-6.

Note: *DANL (displayed average noise level) is different to residual spurious response.*

DANL is also called noise floor, that is, a flat noise level caused by the instrument's internally generated noise with no input signal.

Residual spurious response is a discrete response, that is, a CW-like noise seen on a spectrum analyzer display without input signal.

Table 6-6 Average noise level

Center frequency	Span	Average noise level	Remark
501 Hz	1 kHz		<10 MHz
11 MHz			
50 MHz			
101 MHz			
201 MHz			
301 MHz	1 kHz		>10 MHz (3251)
…			
2.9 GHz			
3.0 GHz			
6.6 GHz			
6.4 GHz			
…	1 kHz		>10 MHz (3252)
7.9 GHz			
8.0 GHz			
8.1 GHz			
8.2 GHz			
…	1 kHz		>10 MHz (3253)
13.1 GHz			
13.2 GHz			
13.3 GHz			
13.4 GHz			
…	1 kHz		>10 MHz (3254)
26.4 GHz			
26.5 GHz			

Input attenuator switching error

This test measures the switching error when the amount of attenuation in the RF input section is switched.

Specification

Input attenuator switching error: ±0.5 dB by steps at 100 Hz (3281 only)
±0.5 dB by steps at frequencies less than 13.2 GHz
±0.8 dB by steps at 13.2 GHz–26.5 GHz

Test instruments

Signal generator: E8257D
RF cable: SMA (male)–SMA (male)
BNC cable: BNC (male)–BNC (male)
Adapter: N (male)–SMA (female)
(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254)
10 dB attenuator: SMA (female)–SMA (female)

Setup

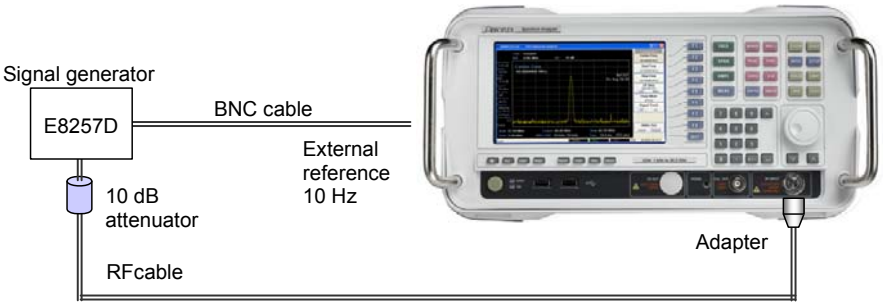


Fig. 6-8 Input attenuator switching error test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 100 MHz
Span: 50 kHz
Reference level: −10 dBm
ATT: 0 dB
RBW: 3 kHz
VBW: 3 kHz
Sweep time: 50 ms
Average: ON

4 Set the 83650B signal generator as shown below:

Frequency: 100 MHz
Power: −10 dBm

5 Press [PEAK], [MKR >], *[Mkr > CF]* and *[Mkr > Ref]* to set the spectrum waveform peak to the center and top of the screen.

6 Press [MARKER], *[Delta]*, check the marker level is 0.

7 Press [AMPL], *[Attenuation [Mnl]]*, increasing attenuation in 5 dB steps, read the delta marker level and enter it in Table 6-7.

8 Press [MARKER], *[OFF]*.

9 Repeat steps 5 to 8 for other values in the table.

10 When you finish the measurements, compare the results with the values in the table.

Table 6-7 Average noise level

Center frequency (MHz)	Input attenuator		Delta marker level	Spec
	Before changing ATT	After changing ATT		
	0 dB	5 dB		
	5 dB	10 dB		
	10 dB	15 dB		
	15 dB	20 dB		
	20 dB	25 dB		
100	25 dB	30 dB		±0.5dB
	30 dB	35 dB		
	35 dB	40 dB		
	40 dB	45 dB		
	45 dB	50 dB		
	50 dB	55 dB		

Center frequency (MHz)	Input attenuator		Delta marker level	Spec
	Before changing ATT	After changing ATT		
	0 dB	5 dB		
	5 dB	10 dB		
	10 dB	15 dB		
	15 dB	20 dB		
	20 dB	25 dB		
2900	25 dB	30 dB		±0.5 dB
	30 dB	35 dB		
	35 dB	40 dB		
	40 dB	45 dB		
	45 dB	50 dB		
	50 dB	55 dB		
	0 dB	5 dB		
	5 dB	10 dB		
	10 dB	15 dB		
	15 dB	20 dB		
	20 dB	25 dB		
8000	25 dB	30 dB		±0.5dB
	30 dB	35 dB		
	35 dB	40 dB		
	40 dB	45 dB		
	45 dB	50 dB		
	50 dB	55 dB		
	0 dB	5 dB		
	5 dB	10 dB		
	10 dB	15 dB		
	15 dB	20 dB		
	20 dB	25 dB		
13200	25 dB	30 dB		±0.5dB
	30 dB	35 dB		
	35 dB	40 dB		
	40 dB	45 dB		
	45 dB	50 dB		
	50 dB	55 dB		

Center frequency (MHz)	Input attenuator		Delta marker level	Spec
	Before changing ATT	After changing ATT		
	0 dB	5 dB		
	5 dB	10 dB		
	10 dB	15 dB		
	15 dB	20 dB		
	20 dB	25 dB		
26500	25 dB	30 dB		±0.8dB
	30 dB	35 dB		
	35 dB	40 dB		
	40 dB	45 dB		
	45 dB	50 dB		
	50 dB	55 dB		

Frequency response

When one or more signals with a different frequency but the same amplitude are applied to the unit, the instrument should display the same amplitude for each signal on the screen.

Specification

Frequency response: ±0.5 dB from 1 MHz to 3.0 GHz
±1.0 dB from 3.0 GHz to 8 GHz
±1.5 dB from 8 GHz to 13.2 GHz
±2.0 dB from 13.2 GHz to 22.0 GHz
±2.5 dB from 22.0 GHz to 26.5 GHz
(10 dB attenuation)

Test instruments

Signal generator: E8257D
Power meter: E4418B
Power sensor: E9304A, E4413A
RF cable: SMA (male)–SMA (male)
BNC cable: BNC (male)–BNC (male)
Adapter: N (male)–SMA (female), N (female)–SMA (female)
(Reference) use additional adapter: 3.5 mm (female)–N (female) (3254 model)

Setup

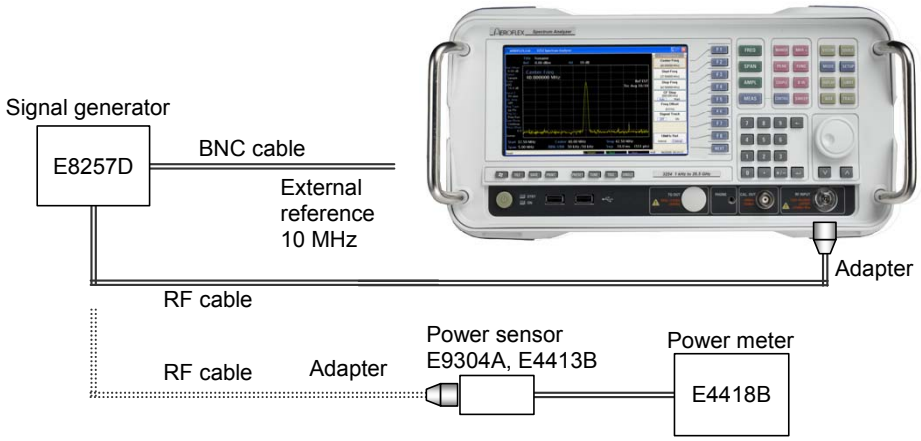


Fig. 6-9 Frequency response test

Procedure

1 Calibrate the power meter to the power sensor.

2 Connect the power sensor to the signal generator with the RF cable and adapter as shown in Fig. 6-9.

3 Set the signal generator as shown below:

Frequency: 300 kHz
Power: 0 dBm

4 Set the power meter to measure frequency 10 MHz.

5 Read the power meter display and enter the result in Table 6-8.

6 Change the signal generator output frequency and measure the power meter frequency as shown in Table 6-8 and enter the values in the table.

7 Disconnect the signal generator from the power sensor.

8 Connect the power sensor to the test equipment with the RF cable and adapter as shown in Fig. 6-9.

9 Set up the equipment as shown below:

Center frequency: 300 kHz
Reference level: 0 dBm
SPAN: 50 kHz
RBW: 3 kHz
VBW: 3 kHz
Sweep time: 50 ms

10 Press [PEAK] and the marker level and enter the value in the table.

11 Change the signal generator output frequency and the test equipment frequency as shown in Table 6-8 and enter the values in the table.

12 Calculate the frequency response.

13 Error = display maker peak value (B) – power meter value (A)

Table 6-8 Frequency response

Signal generator	Frequency	Power Meter value (dBm)	Marker peak value (dBm)	Error	Remark
	300 kHz				
	1 MHz				
	10 MHz				
	50 MHz				
E8257D	100 MHz				3251
	200 MHz				
	…				
	2.9 GHz				
	3.0 GHz				
	3.1 GHz				
	6.4 GHz				
E8257D	…				3252
	7.9 GHz				
	8.0 GHz				
	8.1 GHz				
	8.2 GHz				
E8257D	…				3253
	13.1 GHz				
	13.2 GHz				
	13.3 GHz				
	13.4 GHz				
E8257D	…				3254
	26.4 GHz				
	26.5 GHz				

Spurious response

This test measures spurious frequency levels in the equipment.

The RF input is terminated and 0 dB input attenuation is selected.

Specification

≤–90 dBm (input terminated, 0 dB attenuation)

Test instruments

50 ohm termination: 909F

Setup

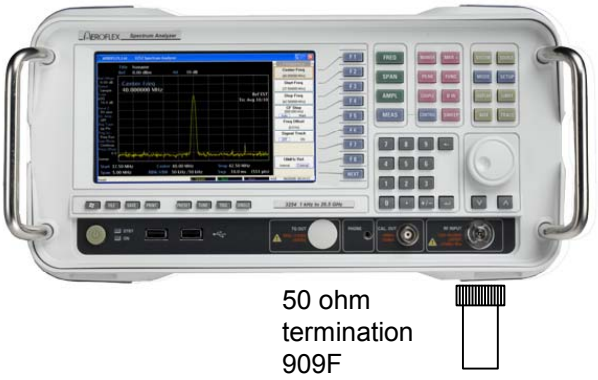


Fig. 6-10 Residual response test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 10 MHz
Span: 10 MHz
Reference level: –30 dBm
ATT: 0 dB
RBW: 10 kHz
VBW: 1 kHz
Sweep Time: Auto

4 Terminate the RF input with a 50 Ω terminator.

5 Press [DISPLAY], *[Disp Line [ON]]*, *[Disp Value]* and rotate knob to display –95 dBm.

6 Press [SINGLE], *[Single]*. Wait for completion of the sweep.

Any residual responses must be below the display line.

7 Press [PEAK] and record the marker amplitude in Table 6-9.

8 Set the center frequency step to 9 MHz using [FREQ], *[CF Step [MNL]]*, *[CF Step]* and change the center frequency.

9 Repeat steps 7 and 8.

Table 6-9 Spurious response

Frequency	Marker amplitude (dBm)	Equipment spec. (dBm)
10 MHz		< –90
to		
13.2 GHz		
to		
26.45 GHz		

Second harmonic distortion

The main point of the test is to apply a signal with harmonic distortion that is at least 20 dB lower than the equipment's internal harmonic distortion to the equipment, and to measure the level difference between the fundamental signal and the second harmonic.

A low-distortion signal source can be obtained by applying a signal to the equipment after passing the signal through a low-pass filter (LPF).

Specification

IP2 (Second Order Intercept Point: –30 dBm input, 0 dB attenuation):

≥+40 dBm, 100 MHz–1.5 GHz (typical)

≥+80 dBm, 1.5 GHz–26.5 GHz

Test instruments

Signal generator:	E8257D
RF cable 1:	N (male)–N (male)
RF cable 2:	SMA (male)–SMA (male)
BNC cable:	BNC (male)–BNC (male)
LPF:	with attenuation of 70 dB or more at twice the fundamental frequencies
Adapter:	N (male)–SMA (female)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254)

Setup

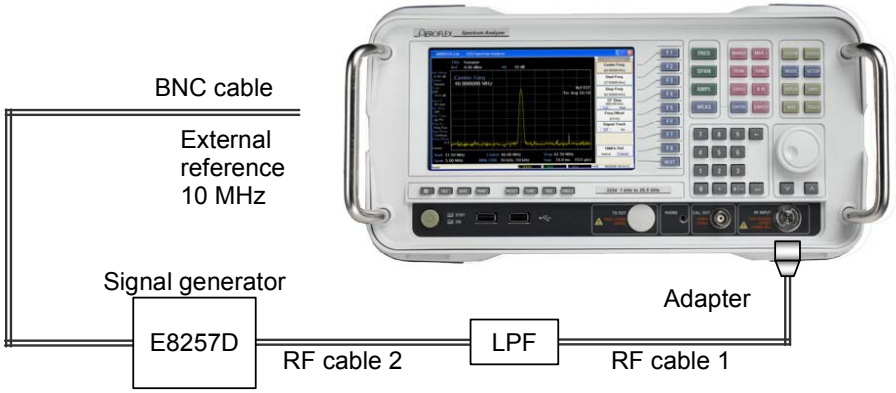


Fig. 6-11 Second harmonic distortion test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 95 MHz
Span: 10 kHz
Reference level: −10 dBm
ATT: 0 dB
RBW: 1 kHz
VBW: 30 Hz
Sweep time: Auto

4 Set the signal generator as shown below:

Frequency: 95 MHz
Power: −30 dBm

5 Adjust the signal generator level so that the signal measured is −30 dBm on the equipment.

6 Set the center frequency to twice the fundamental frequency to display the second harmonic on the screen.

7 Press [PEAK], [MKR >], *[Marker > CF]* and calculate the difference from −30 dBm. Enter this in Table 6-10.

8 Adjust the frequency and LPF as indicated in the table and repeat steps 3 to 7.

Table 6-10 Second harmonic distortion

Signal generator		Second harmonic		
Output power	**Frequency**	**Marker level**	**dBc**	**Frequency**
−30 dBm	95 MHz			190 MHz
	245 MHz			490 MHz
	495 MHz			990 MHz
	995 MHz			1990 MHz

Third-order intermodulation

Two signal generators provide the signals required for measuring third-order intermodulation.

It becomes difficult when the input level is –30 dBm, as the intermodulation signal is very close in level to the noise.

Specification

(IP3: Third Order Intercept Point, –15 dBm input)

≥+8 dBm, 10 MHz–200 MHz

≥+12 dBm, 200 MHz–26.5 GHz

Test instruments

Signal generator 1,2:	E8257D
Power splitter:	11636B
RF cable 1,2,3:	SMA (male)–SMA (male)
BNC cable 1,2:	BNC (male)–BNC (male)
Adapter:	T-BNC (female), N (male)–SMA (female)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

3 dB, 6 dB attenuator: SMA (female)–SMA (female)

Setup

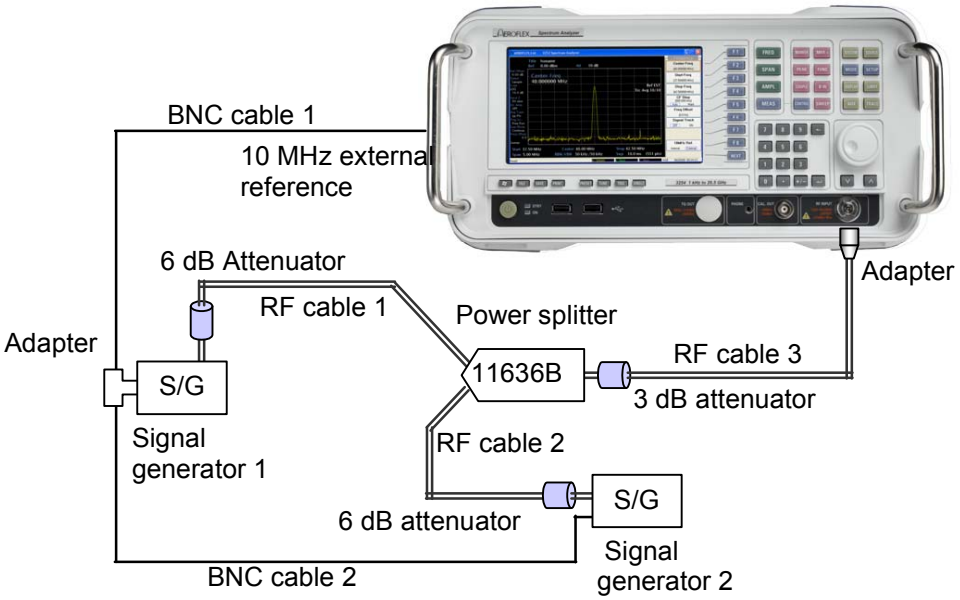


Fig. 6-12 Third-order intermodulation test

Procedure

Power meter calibration

1 Set up synthesized signal generators as shown in Fig. 6-12.

Signal generator 1:

Frequency: 10 MHz
Power: −5 dBm

Signal generator 2:

Frequency: 10.1 MHz
Power: −5 dBm

2 Set up the equipment as shown below:

Center frequency: 100 MHz
Reference level: −10 dBm
Span: 500 kHz
ATT: 0 dB
RBW: 3 kHz
VBW: 50 Hz

3 Adjust signal generator 1, 2 level so that power meter reads –15 dBm.

4 Press [PEAK] to set the normal marker to one of the two signals at –15 dBm.

5 Press [MARKER], *[Delta]*.

6 Move the normal marker to the peak of the intermodulation product signal (left side of signal generator 1). Read the level difference and enter it in Table 6-11.

7 Repeat steps 3 to 6 for other frequencies in Table 6-11.

Table 6-11 Third-order intermodulation

Signal generator (–15 dBm)		Third-order Intermodulation distortion	
Number 1 (MHz)	Number 2 (MHz)	Δ marker (dBc)	Specification (dBc)
10	10.1		
20	20.1		–70
…	…		
80	80.1		(1 MHz–100 MHz)
90	90.1		
100	100.1		
200	200.1		–84
…	…		
25300	25300.1		(100 MHz–26.5 GHz)
25400	25400.1		

Spurious relating to input

This test measures the spurious frequency level relating to the input of the equipment.

Specification

≤–55 dBc Δf>100 kHz (input level –30dBm, 0 dB attenuation)

Test instruments

Signal generator: E8257D

RF cable: SMA (male)–N (female)

BNC cable: BNC (male)–BNC (male)

LPF: N (male)–N (female)

Adapter: N (male)–N (male)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

10 dB attenuator: SMA (female)–SMA (female)

Setup

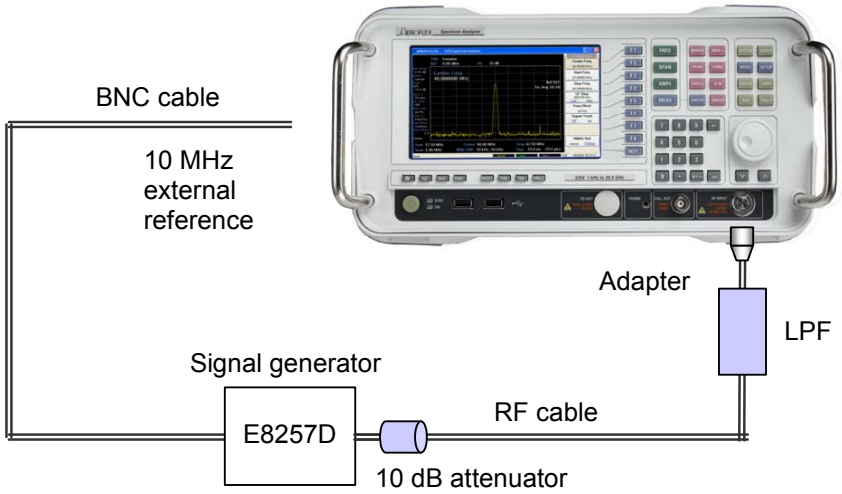


Fig. 6-13 Spurious relating to input test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 100 MHz
Span: 50 MHz
Reference level: −20 dBm
ATT: 0 dB
RBW: 10 kHz
VBW: 1 kHz

4 Set the signal generator as shown below:

Frequency: 100 MHz
Power: −20 dBm

5 Press [PEAK], [MKR >], *[Marker > Ref]*, then set the peak value of the spectrum analyzer to the reference level.

6 Measure spurious level in the ±10.7 MHz delta frequency, then record frequencies greater than −60 dBc and the spurious level.

7 Repeat steps 5 and 6, increasing by 100 MHz frequency steps to 26.5 GHz on the spectrum analyzer and signal generator.

Input VSWR

This test verifies the input VSWR of the equipment.

Specification

10 MHz–3.0 GHz ≤1.5: 1 @ 10 dB attenuation

3.0 GHz–13.2 GHz ≤1.8: 1 @ 10 dB attenuation

13.2 GHz–26.5 GHz ≤2.0: 1 @ 10 dB attenuation

Test instruments

Network analyzer:	E8363B
Frequency range:	10 MHz–40 GHz
Calibration cable:	85133-60016 (2.4 mm –2.92 mm, female)
	85131-60017 (2.4 mm –2.92 mm, male)
Calibration kit:	N4692-6003
Adapter:	SMA (female)–N (male)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

Setup

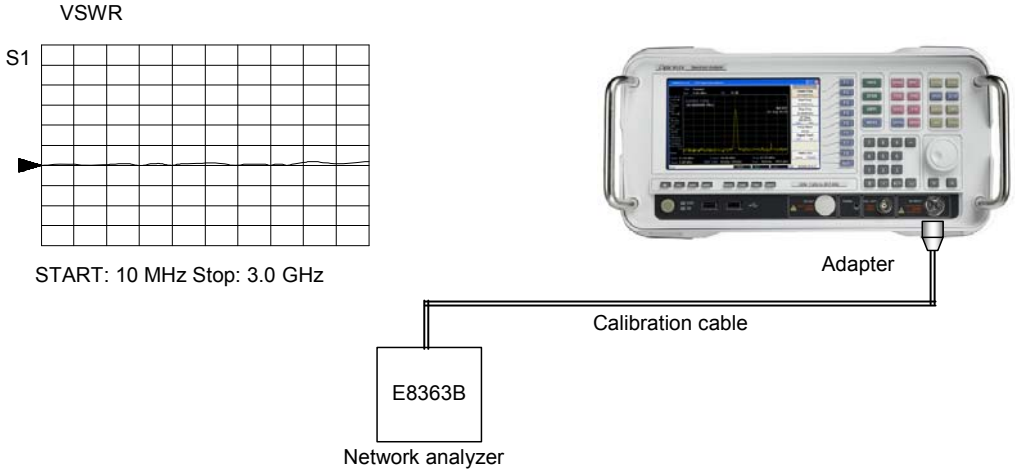


Fig. 6-14 Input VSWR test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 100 MHz
ATT: 10 dB
Reference level: −10 dBm
Span: Zero span

4 Set up the network analyzer (E8363B) as shown below:

Start frequency: 10 MHz
Stop frequency: 3.0 GHz
Output level: −20 dBm

5 Connect the cable to the network analyzer and calibrate, following each equipment calibration procedure.

6 Connect the cable from the network analyzer to the instrument and measure the VSWR. Compare with the specification (Table 6-12).

7 Set up the network analyzer (E8363B) as shown below:

Start frequency: 3.0 GHz
Stop frequency: 6.4 GHz
Output Level: −20 dBm

8 Repeat steps 5 and 6.

9 Repeat steps 7 and 8 in Band 2, 3.

Table 6-12 Input VSWR

Frequency range		Measurement (max)	Specification
Band 0	10 MHz–3.0 GHz		≤1.5:1
Band 1	3.0 GHz–6.4 GHz		≤1.8:1
Band 2	6.4 GHz–13.2 GHz		≤1.8:1
Band 3	13.2 GHz–26.5 GHz		≤2.0:1

Trigger (EXT, Video, Line)

This test tests standard operation of the equipment's trigger.

Specification

EXT, Video

Test instruments

Arbitrary function generator: AFG310

RF cable: SMA (male)–BNC (male)

BNC cable: BNC (male)–BNC (male)

Adapter: N (male)–SMA (female)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

Setup

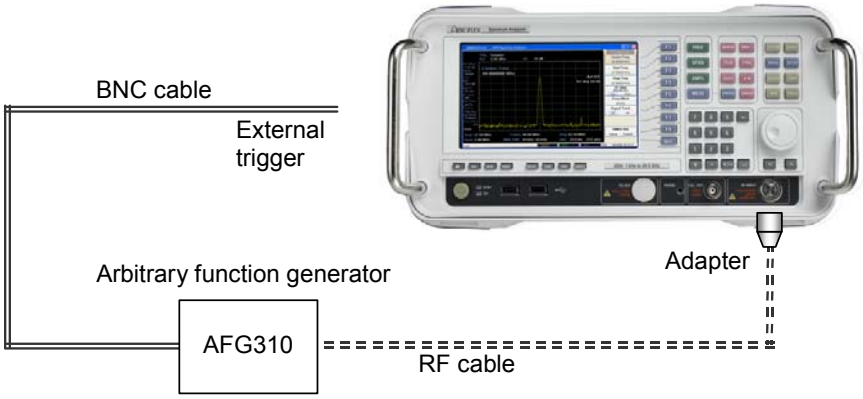


Fig. 6-15 Trigger test

Procedure 1 (EXT Trigger)

The following is a procedure for examining the EXT Trigger.

1 Set up the equipment as shown below:

Center frequency: 10 MHz
Span: 10 MHz
Reference level: 0 dBm
ATT: Auto
RBW: 30 kHz
VBW: 30 kHz
Trigger: Free Run

2 Set the arbitrary function generator as shown below:

Function: SQUA
Frequency: 0.5 Hz
Amplitude: 3.3 V

3 Set the Trigger to External on the equipment.

4 Check that the noise level on the screen is refreshed.

Procedure 2 (Video Trigger)

The following is a procedure for examining the Video Trigger.

1 Set up the equipment as shown below:

Center frequency: 10 MHz
Span: Zero span
Reference level: 0 dBm
ATT: Auto
RBW: 30 kHz
VBW: 30 kHz
Sweep time: 2 ms
Trigger: Free Run
Trig Slop: Pos
Trig Delay: 0 µs

2 Set the arbitrary function generator as shown below:

Function: SQUA
Frequency: 10 MHz
Amplitude: 0.1 V
Modulation: FM
FM Modulation: Sine
FM Frequency: 1 kHz
FM Deviation: 50 kHz

3 Set the Trigger to Video on the equipment.

4 Adjusting the trigger level, check that the starting pint of the sine wave on the screen is on the upper line of the video trigger.

5 Press *[Trig Slop [Neg]]*.

6 Adjusting the trigger level, check that the starting pint of the sine wave on the screen is on the lower line of the video trigger.

7 Check the trigger delay.
[Trig Delay [ON]] → −500 ms–500 ms

Preamplifier

Checks the preamplifier for normal operation.

Specification

Peak: < ±1 dBm (1 MHz–3.0 GHz)

Test instruments

Signal generator: E8257D

RF cable: SMA (male)–N (male)

BNC cable: BNC (male)–BNC (male)

Adapter: N (male)–N (male)

(Reference) use additional adapter: 3.5 mm (male)–N (female) (3254 model)

10 dB attenuator: SMA (female)–SMA (female)

LPF: N (female)–N (male)

Setup

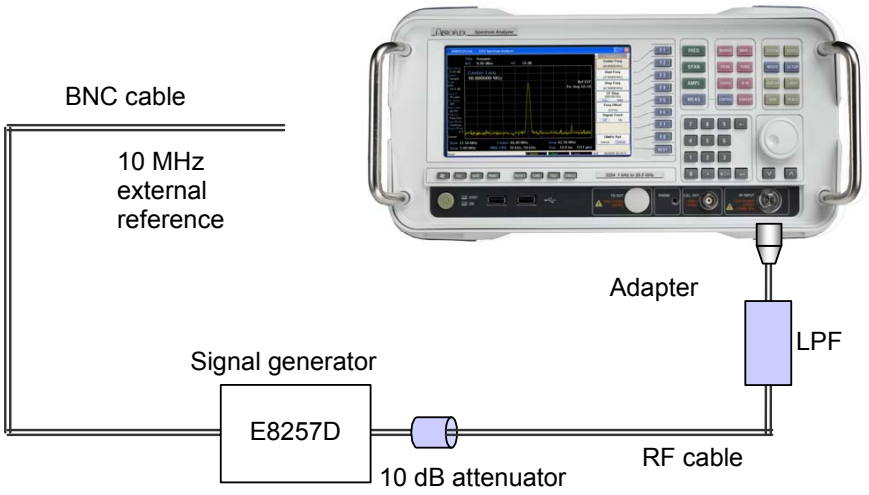


Fig. 6-16 Preamplifier test

Procedure

1 Set the power switch on the equipment front panel to ON.

2 Press [PRESET], *[Preset]*.

3 Set up the equipment as shown below:

Center frequency: 100 MHz
Reference level: −40 dBm
ATT: Auto
Span: 10 MHz
RBW: Auto
VBW: Auto
Sweep Time: Auto
Average: On

4 Set the signal generator as shown below:

Frequency: 100 MHz
Power: −50 dBm

5 Turn PreAmp OFF, then measure peak level after 10 averages.

6 Shift 2.5 MHz at the peak frequency, then measure noise level.

7 Turn PreAmp ON after setting Average OFF

8 Measure peak level after 10 averages.

9 Shift 2.5 MHz at the peak frequency, then measure noise level.

10 Repeat steps 5 to 9 according to the frequency (1500 MHz, 2900 MHz).

Chapter 7
STORAGE AND TRANSPORTATION

Contents

Introduction

This section describes the long-term storage, repacking and transportation of the instrument as well as regular care procedures and their timing.

Cleaning

Always turn the instrument's POWER switch OFF and disconnect the power plug from the AC power inlet before cleaning the cabinet.

To clean the case exterior:

- Wipe using a soft, dry cloth
- Use a cloth moistened with diluted neutral cleaning liquid if the instrument is very dirty or before long-term storage. After insuring that the cabinet has been thoroughly dried, use a soft, dry cloth for wiping off.
- Tighten any loose screws.

CAUTION

Never use benzene, thinner, or alcohol to clean the cabinet: it may damage the coating, or cause deformation or discoloration.

Storage precautions

This paragraph describes the precautions to take for long-term storage of the instrument.

Precautions before storage

Before storage, wipe dust, finger marks, and other dirt off the instrument.

Avoid storing the instrument where:

- it may be exposed to direct sunlight or high dust levels
- it may be exposed to active gases
- it may be exposed to extreme temperatures (>50°C) or high humidity (>90%).

Recommended storage precautions

The recommended storage conditions are:

Temperature: 0 to 50°C

Humidity: 10% to 60%

Repacking and transportation

Take the following precautions if the instrument must be returned for servicing.

Repacking

Use the original packing materials. If the instrument is packed in other materials, observe the following packing procedure:

- wrap the instrument in plastic sheet or similar material
- remove handles from the instrument, if fitted
- use a corrugated paper or wooden box, or aluminum case, which allows shock-absorbent material to be inserted on all sides of the instrument
- secure the container with packing straps, adhesive tape or bands.

Transportation

Do not subject the instrument to severe vibration during transport. It should be transported under the recommended storage conditions.

Service

If the instrument is damaged or does not operate as specified, contact your nearest agent. If you request a repair, provide the following information:

- model number and serial number on rear panel
- fault description: symptoms, operation carried out before the fault occurred (include peripheral equipment and a drawing of the circuit), circumstances (temperature, humidity, time, date, place), any suggestions, etc.
- a name and contact details for when a fault is confirmed or at completion of repair.

Chapter 8
SYSTEM RESTORATION

Contents

Introduction

This section contains information about restoring the system if errors occur in the software.

Operating system

The spectrum analyzer uses Microsoft's Windows XP™ as the basic operating system.

The Windows™ OS is easy to use but errors have been known to occur. The instrument can recover the initial state using an internal restoration solution in hard memory.

CAUTION

Take this course of action only if actions such as reinstalling Windows and inspecting the disk do not restore correct operation.

Recovering the booting system

Phoenix Recover Pro 6

The internal restoration solution for this instrument is *Recover Pro 6 MFG*, manufactured by Phoenix.

Recover Pro 6 consists of *Phoenix Always* (which always reboots regardless of the state of the operating system) and *Phoenix Recover Pro* (which backs up and restores the system).

You can find more detailed information at Phoenix's website: www.phoenix.com

System restoration using *Recover Pro*

You can return the instrument to its default state by carrying out the following steps.

***Note**: If you proceed, the system driver is initialized into the C:Drive. Any stored data will disappear.*

Steps for system restoration

1 Connect a mouse and keyboard.

2 Press the power button located on the front panel of the signal generator.

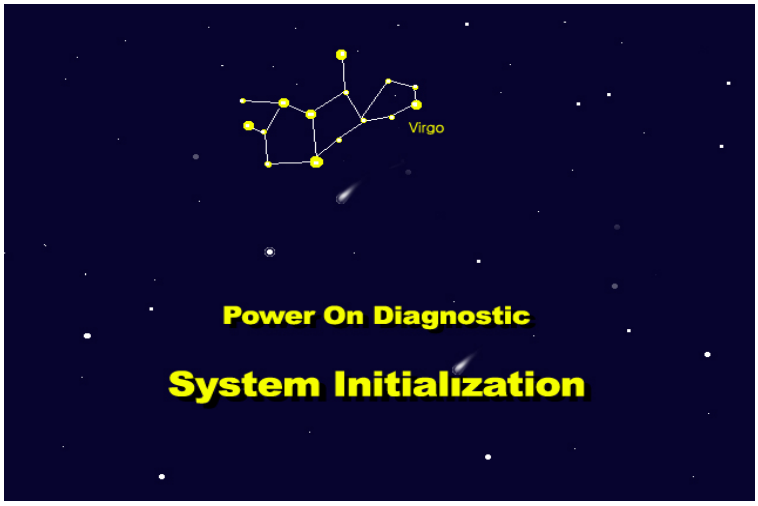


Fig. 8-1 Recover Pro *initial screen*

3 If Fig. 8-1 appears in the display window, press [ESC] and press F4 several times.

4 When the booting sequence display appears, select *Hard Disk*.

5 A display about *Phoenix Always* should appear.

If the Windows booting display appears instead, press the power button to put the instrument into the stand-by state and repeat steps 3 and 4.

6 From the Always menu (Fig. 8-2), select *Protect / Recover*.

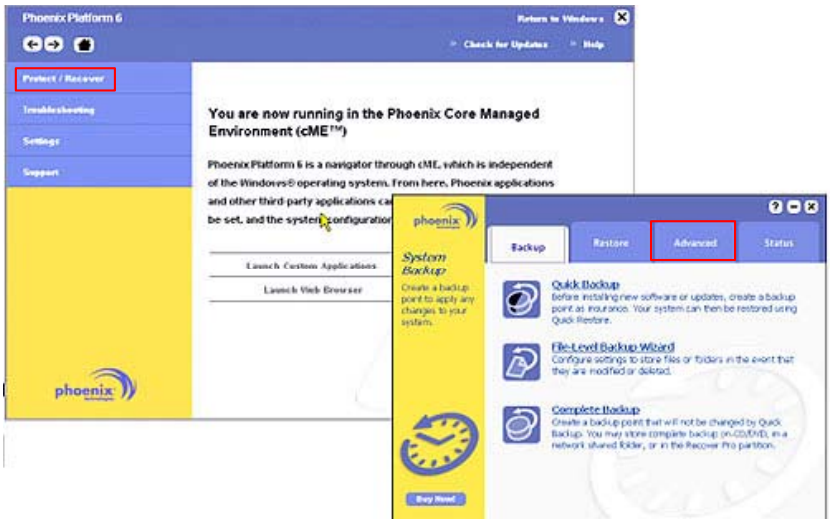


Fig. 8-2 Phoenix Always *screen*

7 Select the *Phoenix Recover Pro 6* menu.

8 Select the *Advanced* tab.

9 Select *Factory Restore*.

10 If a caution appears about system restarting, press *OK*.

11 When the system reboots, operate the *Phoenix Recover Pro* program.

12 Select *Recover Boot Partition*.

13 If there is a request for confirmation, select *Yes*.

14 After completing the system restoration, start Windows.

Virus elimination

We provide our customers with a vaccine program for virus detection and elimination.

- Vaccine program: *Kaspersky® Antivirus 6.0* (included on CD)
- Vaccine activation code: included in packing.

Note: a license is supplied with the instrument, if bought through Aeroflex or one of its agents. This license is valid for 1 year. If you want to extend the period, visit the web site (www.kasperskylab.co.kr).

Appendix A
MEASUREMENT GUIDE

Contents

Introduction

This chapter demonstrates basic analyzer measurements with examples of typical measurements; each measurement focuses on different functions. This chapter does not focus on testing the instrument's performance; examples use the least amount of extra equipment and show the instrument's basic functions. For more specific information refer to the operating manual.

Comparing signals

Using the analyzer, you can easily compare frequency and amplitude differences between signals, such as radio or television signal spectra. The analyzer delta marker function lets you compare two signals when both appear on the screen at one time or when only one appears on the screen.

Example: delta marker function

Measure the difference between two signals on the same display screen.

1 Connect 10 MHz REF OUT from the rear panel of the signal generator to the spectrum analyzer's front-panel RF INPUT.

2 Set the center frequency to 30 MHz and the span to 50 MHz by pressing [FREQ] 30 MHz, [SPAN] 50 MHz.

3 Set the reference level to 10 dBm by pressing [AMPL] 10dBm.
The 10 MHz reference signal and its harmonics appear on the display.

4 Press [PEAK] to place a marker at the highest peak on the display (the *[Next Pk Right]* and *[Next Pk Left]* soft keys move the marker from peak to peak). The marker should be on the 10 MHz reference signal, as shown in Fig. A-1.

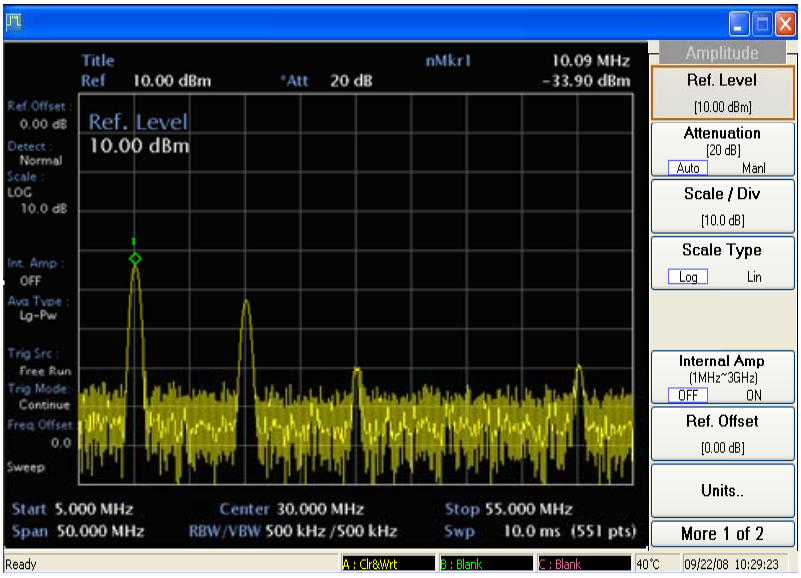


Fig. A-1 Placing a marker on the 10 MHz signal

5 Press [MARKER], *[Delta]*, to activate a second marker at the position of the first marker. Move the second marker to another signal peak using the knob, or by pressing [PEAK], *[Next Peak]*.

6 The amplitude and frequency difference between the markers is displayed in the active function block and in the upper right corner of the screen.

7 Press *[OFF]* to turn the markers off.

Resolving signals of equal amplitude

Two equal-amplitude input signals that are close in frequency can appear as one on the analyzer's display. Responding to a single-frequency signal, a swept-tuned analyzer traces out the shape of the selected internal IF (intermediate frequency) filter. As you change the filter bandwidth, you change the width of the displayed response. If a wide filter is used and two equal-amplitude input signals are close enough in frequency, then the two signals appear as one. Thus, signal resolution is determined by the IF filters inside the analyzer.

The bandwidth of the IF filter tells us how close together equal-amplitude signals can be and still be distinguished from each other. The resolution bandwidth function selects an IF filter setting for a measurement. Resolution bandwidth is defined as the 3 dB bandwidth of the filter.

Generally, to resolve two signals of equal amplitude, the resolution bandwidth must be less than or equal to the frequency separation of the two signals. If the bandwidth is equal to the separation and the video bandwidth is less than the resolution bandwidth, a dip of approximately 3 dB is seen between the peaks of the two equal signals, and it is clear that more than one signal is present. See Fig. A-3.

In order to keep the analyzer measurement calibrated, sweep time is automatically set to a value that is inversely proportional to the square of the resolution bandwidth (for resolution bandwidths ≥ 1 kHz). So, if the resolution bandwidth is reduced by a factor of 10, the sweep time is increased by a factor of 100 when sweep time and bandwidth settings are coupled (sweep time is proportional to $1/BW^2$). For shortest measurement times, use the widest resolution bandwidth that still permits discrimination of all desired signals. The analyzer allows you to select from 1 kHz to 3 MHz resolution bandwidths in a 1, 3, 10 sequence for maximum measurement flexibility.

Option Digital RBW adds narrower resolution bandwidths, from 30 Hz to 5 MHz, in a 1-2-3-5 sequence. These bandwidths are digitally implemented and have a much narrower shape factor than the wider, analog resolution bandwidths. Also, the auto coupled sweep times when using the digital resolution bandwidths are much faster than analog bandwidths.

Example: selection RBW

Resolve two signals of equal amplitude with a frequency separation of 100 kHz.

1 Connect two sources to the analyzer's RF INPUT as shown in Fig. A-2.

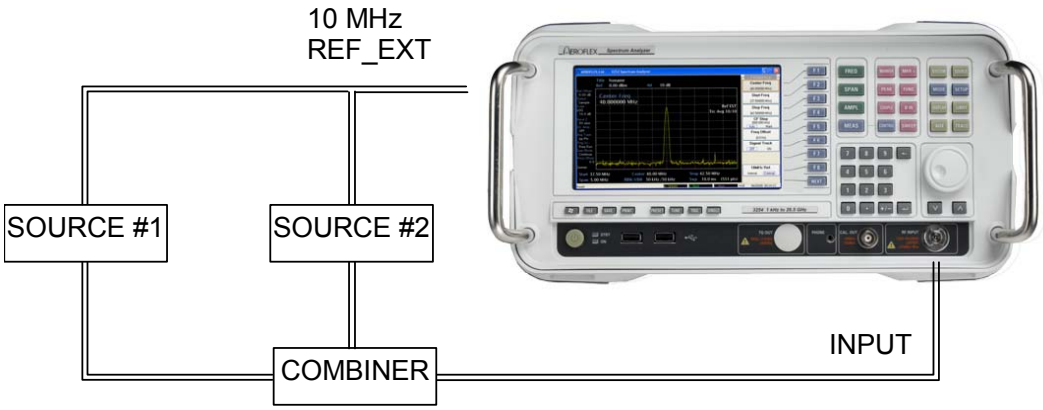


Fig. A-2 Setup for obtaining two signals

2 Set one source to 300 MHz. Set the frequency of the other source to 300.1 MHz. The amplitude of both signals should be approximately −10 dBm.

3 On the analyzer, press [PRESET], *[Preset]*. Set the center frequency to 300 MHz, the span to 1 MHz, and the resolution bandwidth to 300 kHz by setting [FREQ] 300 MHz, [SPAN] 1 MHz, then [BW], *[RBW Manl]*, *[RBW]* 50 kHz. A single signal peak is visible.

***Note**: if the signal peak cannot be found, increase the span to 10 MHz by pressing [SPAN] 10 MHz. The signal should be visible. Press [PEAK], [MKR >],* [Mkr→CF]*, then [SPAN] 1 MHz to bring the signal to center screen.*

4 Since the resolution bandwidth must be less than or equal to the frequency separation of the two signals, a resolution bandwidth of 50 kHz must be used. Change the resolution bandwidth to 50 kHz by setting [RBW] 50 kHz. Two signals are now visible as shown in Fig. A-3. Use the knob or step keys to further reduce the resolution bandwidth and better resolve the signals.

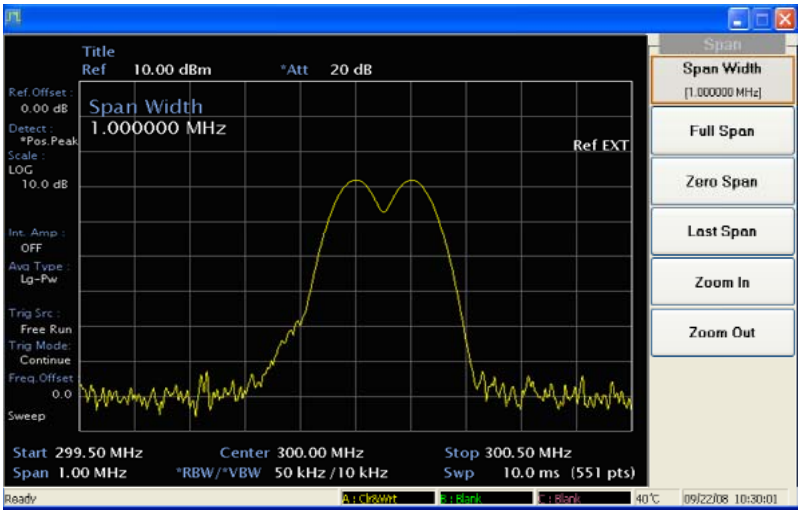


Fig. A-3 Resolving signals of equal amplitude

5 Decrease the video bandwidth to 10 kHz by pressing [BW], *[VBW Manl]*, *[VBW]* 10 kHz. As the resolution bandwidth is decreased, resolution of the individual signals is improved and the sweep time is increased. For fastest measurement times, use the widest possible resolution bandwidth. Under couple conditions, the resolution bandwidth is 'coupled' (or linked) to the span.

6 Since the resolution bandwidth has been changed from the coupled value, a * mark appears next to RBW in the lower-left corner of the screen, indicating that the resolution bandwidth is uncoupled.

***Note**: to resolve two signals of equal amplitude with a frequency separation of 200 kHz, the resolution bandwidth must be less than the signal separation, and resolution of 100 kHz must be used. The next larger filter, 300 kHz, would exceed the 200 kHz separation and would not resolve the signals.*

Resolving small signals hidden by large signals

When dealing with the resolution of signals that are close together and not equal in amplitude, you must consider the shape of the IF filter of the analyzer, as well as its 3 dB bandwidth (see *Resolving signals of equal amplitude* on pageA-3 for more information). The shape of a filter is defined by the selectivity, which is the ratio of the 60 dB bandwidth to the 3 dB bandwidth. If a small signal is too close to a larger signal, the smaller signal can be hidden by the skirt of the larger signal. To view the smaller signal, you must select a resolution bandwidth such that k is less than a: see Fig. A-4.

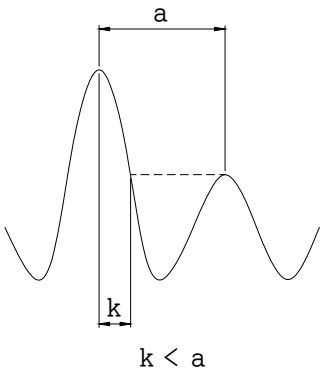


Fig. A-4 Resolution bandwidth requirements for resolving small signals

The separation between the two signals (a) must be greater than half the filter width of the larger signal (k) measured at the amplitude level of the smaller signal.

Example: selection RBW

Resolve two input signals with a frequency separation of 200 kHz and different amplitude.

1 To obtain two signals with a 200 kHz separation, connect the equipment as shown in Fig. A-2. Set one source to 300 MHz at 0 dBm.

2 Set the analyzer center frequency to 300 MHz and the span to 1 MHz: press [FREQ] 300 MHz, then [SPAN] 1 MHz.

***Note**: if the signal peak cannot be found, increase the span to 10 MHz by pressing [SPAN] 10 MHz. The signal should be visible. Press [PEAK], [MKR >],* [Mkr→CF] *to bring the signal to center screen, then [SPAN], 1 MHz.*

3 Set the second source to 300.200 MHz, so that the signal is 200 kHz higher than the first signal. Set the amplitude of the signal to –60 dBm (60 dB below the first signal).

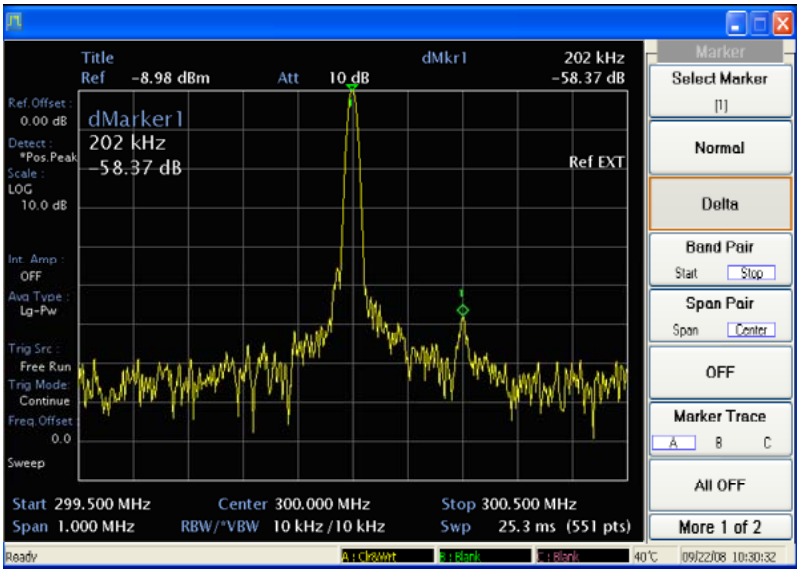


Fig. A-5 Signal resolution with a 10 kHz resolution bandwidth

4 Set the 300 MHz signal to the reference level by pressing [PEAK], then [MKR >], *[Marker→Ref]*. If a 10 kHz filter with a typical shape factor 15:1 is used, the filter will have a bandwidth of 150 kHz at the 60 dB point, the half-bandwidth (75 kHz) is narrower than the frequency separation, so the input signals will be resolved: see Fig. A-5.

5 Place a marker on the smaller signal by pressing [MARKER], *[Delta]*, [PEAK], *[Next Pk Right]*. If a 30 kHz filter is used, the 60 dB bandwidth could be as wide as 450 kHz. Since the half-bandwidth (225 kHz) is wider than the frequency separation (200 kHz), the signals will most likely not be resolved (Fig. A-6). (In this example, we used the 60 dB bandwidth value. To determine resolution capability for intermediate values of amplitude level differences, assume the filter skirts between the 3 dB and 60 dB points are approximately straight.)

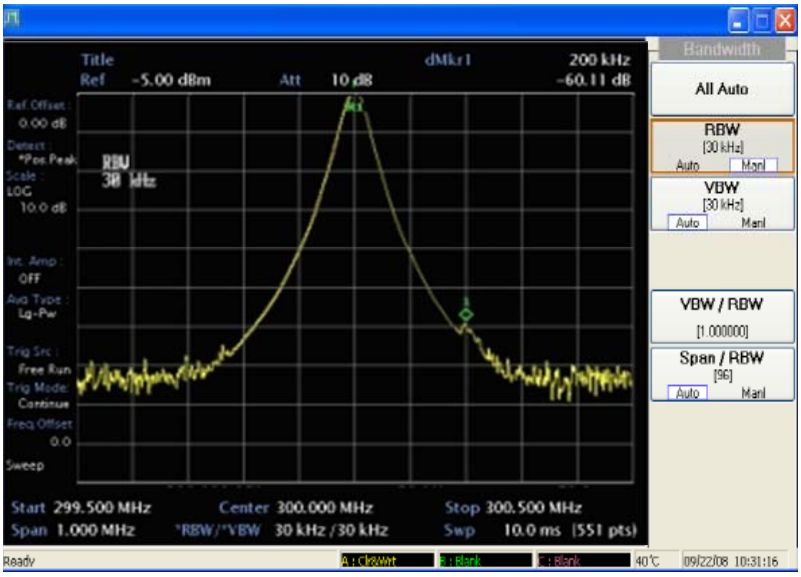


Fig. A-6 Signal resolution with a 30 kHz resolution bandwidth

Making better frequency measurements

A built-in frequency counter increases the resolution and accuracy of the frequency readout.

Example: marker counter function

Increase the resolution and accuracy of the frequency readout on the signal of interest.

1 Connect CAL. OUT to RF INPUT with BNC-BNC cable and N-BNC adapter in front panel.

2 Set the center frequency to 100 MHz by pressing [FREQ] 100 MHz.

3 Set the span to 10 MHz by pressing [SPAN] 10 MHz.

4 Press [FUNC], *[Freq. Counter]*. The count result appears at the bottom of the screen.

5 Move the marker to the peak of the signal by pressing [PEAK].

***Note**: marker count functions properly only on CW signals with discrete spectral components and whose level is more than –70 dBm.*

6 Increase the counter resolution by pressing [FUNC], *[Freq. Counter]* and then setting the desired resolution using the step keys or the knob. The marker counter readout is in the upper-right corner of the screen. The resolution can be set from 1 Hz to 1 kHz in decade steps.

7 The marker counter remains on until turned off. Turn off the marker counter by pressing *[Meas. OFF]*.

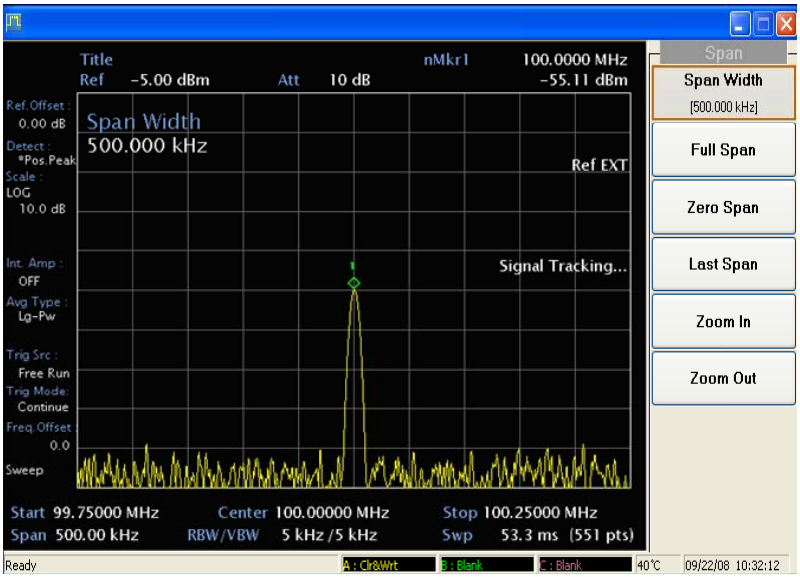


Fig. A-7 Using marker counter

Decreasing the frequency span around the signal

Using the analyzer signal tracking function, you can quickly decrease the span while keeping the signal at center frequency. This is a fast way to take a closer look at the area around the signal to identify signals that would otherwise not be resolved.

Example: signal track function

Examine a signal in a 200 kHz span.

1 Connect CAL. OUT to RF INPUT with BNC-BNC cable and N-BNC adapter in front panel.

2 Set the center frequency to 100 MHz by pressing [FREQ], *[Center Freq]* 100 MHz.

3 Press [PEAK] to place a marker at the peak.

4 Press [PEAK], *[Signal Track On]* and the signal moves to the center of the screen, if it is not already positioned there. (Note that the marker must be on the signal before turning signal tracking on.) Because the signal tracking function automatically maintains the signal at the center of the screen, you can reduce the span quickly for a closer look. If the signal drifts off of the screen as you decrease the span, use a wider frequency span.

5 Press [SPAN] 500 kHz. The span decreases in steps as automatic zoom is completed (Fig. A-8). You can also use the scroll knob or step keys to decrease the span or use the *[Zoom]* function under [SPAN]. Press [PEAK], *[Signal Track OFF]* (so that OFF is highlighted) to turn off the signal tracking function.

***Note**: when you are finished with the example, turn off the signal tracking function.*

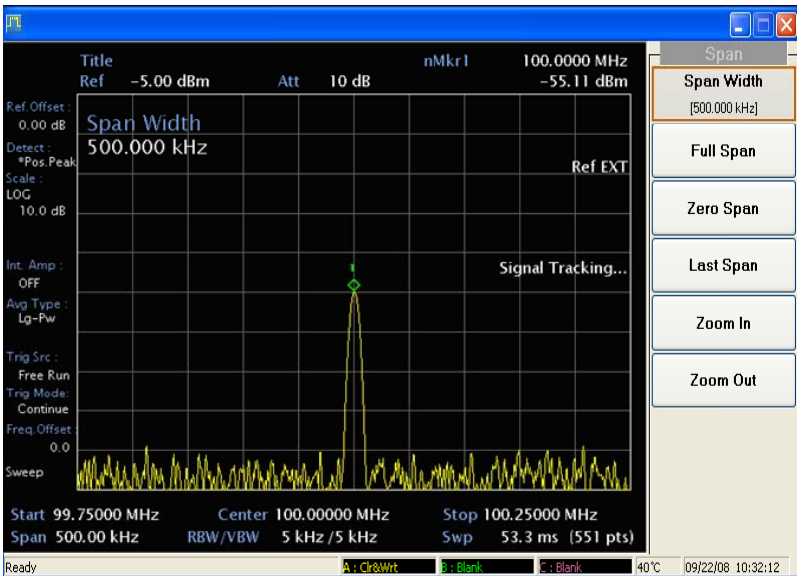


Fig. A-8 After zooming in on the signal

Tracking drifting signals

The signal tracking function is useful for tracking drifting signals that drift relatively slowly.

[PEAK], *[Signal Track]* may be used to track these drifting signals. Use [PEAK] to place a marker on the signal you wish to track. Pressing [PEAK], *[Signal Track ON]* brings that signal to the center frequency of the graticule and adjusts the center frequency every sweep to bring the selected signal back to the center.

Note that the primary function of the signal tracking function is to track unstable signals, not to track a signal as the center frequency of the analyzer is changed. If you choose to use the signal tracking function when changing center frequency, check to ensure that the signal found by the tracking function is the correct signal.

Example 1: signal track function

Use the signal tracking function to keep a drifting signal at the center of the display and monitor its change.

This example requires a signal generator. The frequency of the signal generator will be changed while you view the signal on the display of the analyzer.

1 Connect a signal generator to the analyzer's RF INPUT. Press [PRESET], *[Preset]*.

2 Set the signal generator frequency to 300 MHz with an amplitude of –20 dBm.

3 Set the center frequency of the analyzer to 300 MHz by pressing [FREQ] 300 MHz.

4 Press [PEAK] to move the marker to the peak of your signal.

5 Press [SPAN] 500 kHz. Notice that the signal has been held in the center of the display.

6 You can read the signal frequency drift from the screen if both the signal tracking and marker delta functions are active. Press [PEAK], *[Signal Track ON]*. The marker readout indicates the change in frequency and amplitude as the signal drifts.

7 Tune the frequency of the signal generator. Notice that the center frequency of the analyzer changes in < 10 kHz increments, centering the signal with each increment; see Fig. A-9.

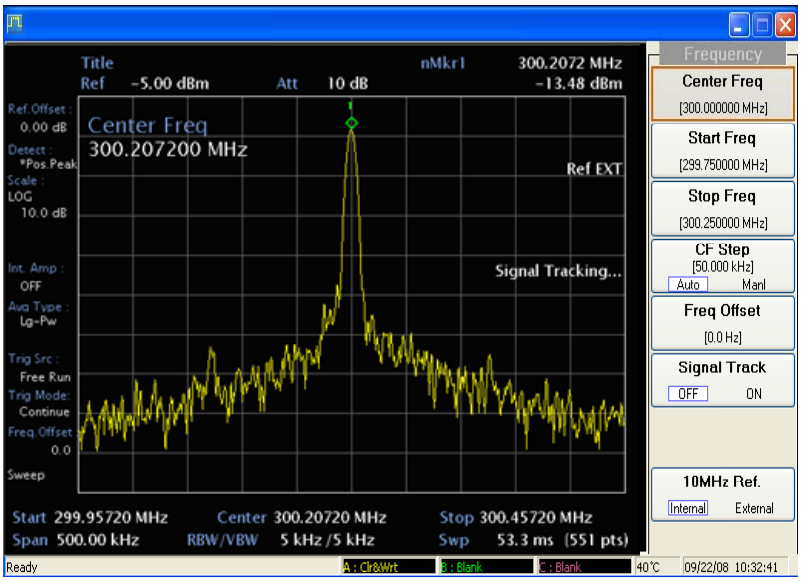


Fig. A-9 Using signal tracking to track a drifting signal

Example 2: max hold function

The analyzer can measure the short-and long-term stability of a source. The maximum amplitude level and the frequency drift of an input signal trace can be displayed and held by using the maximum-hold function. You can also use the maximum hold function if you want to determine how much of the frequency span a signal occupies.

1 Connect a signal generator to the analyzer RF INPUT. Press [PRESET], *[Preset]*.

2 Set the signal generator frequency to 300 MHz with an amplitude of –10 dBm.

3 Set the center frequency of the analyzer to 300 MHz by pressing [FREQ] 300 MHz.

4 Press [PEAK] to move the marker to the peak of your signal.

5 Press [SPAN] 500 kHz.

6 To measure the excursion of the signal, press [TRACE] then *[Max Hold]*. As the signal varies, maximum hold maintains the maximum responses of the input signal. Annotation on the left side of the screen indicates the trace mode (MAX HOLD).

7 Press *[Select Trace B]* to select trace B (trace B is selected when A changes to B in the menu). Press *[Clear&Write]* to place trace B in clear-write mode, which displays the current measurement results as it sweeps. Trace A remains in maximum hold mode, showing the frequency shift of the signal.

8 Slowly change the frequency of the signal generator ±50 kHz. Your analyzer display should look similar to Fig. A-10.

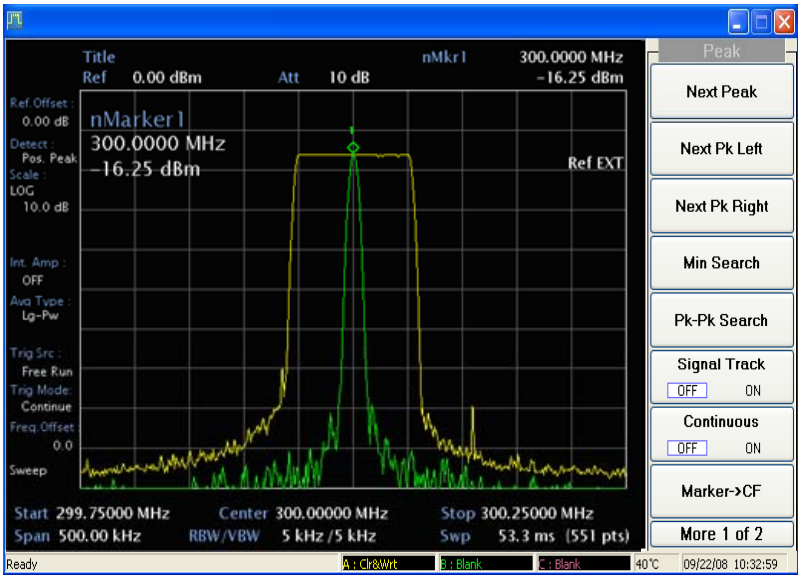


Fig. A-10 Viewing a drifting signal with Max Hold and Clear & Write

Measuring low-level signals

The ability of the analyzer to measure low-level signals is limited by the noise generated inside the analyzer. A signal may be masked by the noise floor so that it is not visible. This sensitivity to low-level signals is affected by the measurement setup.

The analyzer's input attenuator and bandwidth settings affect the sensitivity by changing the signal-to-noise ratio. The attenuator affects the level of a signal passing through the instrument, whereas the bandwidth affects the level of internal noise without affecting the signal. In the first two examples in this section, the attenuator and bandwidth settings are adjusted to view low-level signals.

If, after adjusting the attenuation and resolution bandwidth, a signal is still near the noise, visibility can be improved by using the video bandwidth and video averaging functions, as demonstrated in the third and fourth examples.

Example 1: set input attenuation

If a signal is very close to the noise floor, reducing input attenuation brings the signal out of the noise. Reducing the attenuation to 0 dB maximizes signal power in the analyzer.

CAUTION

The total power of all input signals at the analyzer's input must not exceed the maximum power level for the analyzer.

1 Connect a signal generator to the analyzer RF INPUT. Press [PRESET], *[Preset]* on the analyzer.

2 Set the signal generator frequency to 300 MHz with an amplitude of –50 dBm.

3 Set the center frequency of the analyzer to 300 MHz by pressing [FREQ] 300 MHz.

4 Set the span to 5 MHz by pressing [SPAN] 5 MHz.

5 Set the reference level to –20 dBm by pressing [AMPL], *[Ref Level]* –20 dBm.

6 Set the attenuation level to 0 dB by pressing [AMPL], *[Attenuation Manl]* and then using the step-down key (▼).

7 Place the signal at center frequency by pressing [PEAK], [MKR >], *[Mkr→CF]*.

8 Reduce the span to 1 MHz. Press [SPAN], and then use the step-down key (▼). See Fig. A-11.

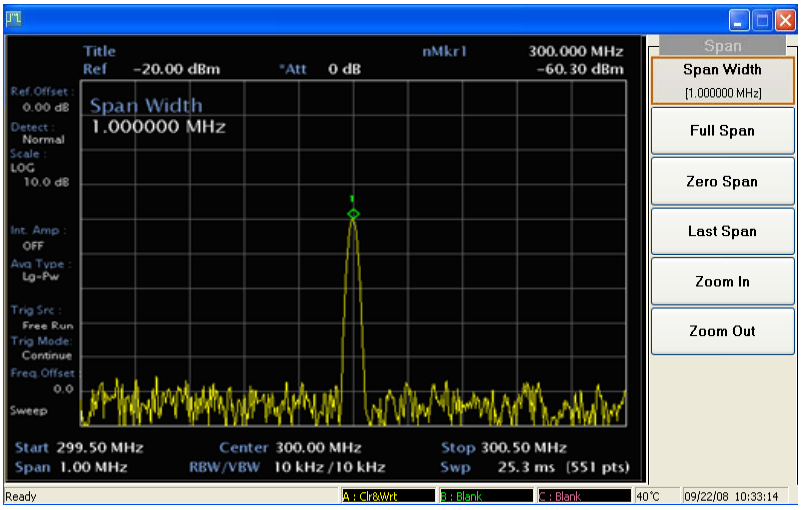


Fig. A-11 Using 0 dB attenuation

9 Press [AMPL], *[Attenuation Manl]*. Press the step-up key (▲) to select 10 dB attenuation. Increasing the attenuation moves the noise floor closer to the signal. See Fig. A-12. A '*' appears next to the ATT annotation at the top of the display, indicating that the attenuation is no longer coupled to other analyzer settings.

10 To see the signal more clearly, enter 0 dB or *[Attenuation Manl]*. Zero attenuation makes the signal more visible.

CAUTION

Before connecting other signals to the analyzer input, increase the RF attenuation to protect the analyzer input.

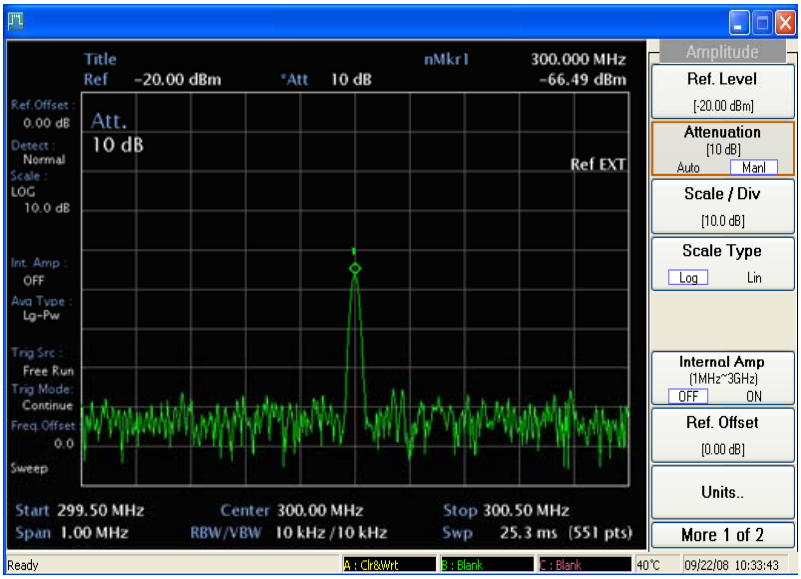


Fig. A-12 Low-level signal with 10 dB attenuation

Example 2: selection RBW

The resolution bandwidth can be decreased to view low-level signals.

1 As in the previous example, set the analyzer to view a low-level signal. Connect a signal generator to the analyzer RF INPUT. Press [PRESET], *[Preset]* on the analyzer.

2 Set the signal generator frequency to 300 MHz with an amplitude of –60 dBm.

3 Set the center frequency of the analyzer to 300 MHz by pressing [FREQ], 300 MHz.

4 Set the span to 1 MHz by pressing [SPAN] 1 MHz.

5 Set the reference level to –20 dBm by pressing [AMPL], *[Ref Level]* –20 dBm.

6 Set the attenuation level to 0 dB by pressing [AMPL], *[Attenuation Manl]* and then using the step-down key (▼).

7 Press [BW], *[RBW Manl]*, *[RBW]* and the step-down key (▼) to decrease RBW. The low-level signal appears more clearly because the noise level is reduced. See Fig. A-13.

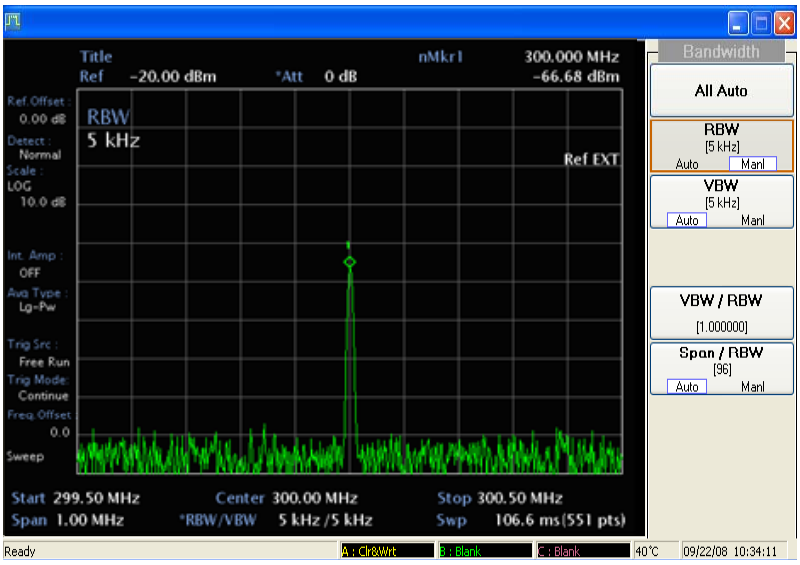


Fig. A-13 Decreasing resolution bandwidth

8 A '*' appears next to the RBW annotation at the lower center of the screen, indicating that the resolution bandwidth is uncoupled.

9 As the resolution bandwidth is reduced, the sweep time is increased to maintain calibrated data.

Example 3: selection VBW

Narrowing the video filter can be useful for noise measurements and observation of low-level signals close to the noise floor. The video filter is a post-detection low-pass filter that smoothes the displayed trace. When signal responses near the noise level of the analyzer are visually masked by the noise, the video filter can be narrowed to smooth this noise and improve the visibility of the signal. Reducing video bandwidths requires slower sweep times to keep the analyzer calibrated.

Using the video bandwidth function, measure the amplitude of a low level signal.

1 As in the previous example, set the analyzer to view a low-level signal. Connect a signal generator to the analyzer RF INPUT. Press [PRESET], *[Preset]* on the analyzer.

2 Set the signal generator frequency to 300 MHz with an amplitude of –60 dBm.

3 Set the center frequency of the analyzer to 300 MHz by pressing [FREQ] 300 MHz.

4 Set the span to 1 MHz by pressing [SPAN] 1 MHz.

5 Set the reference level to –20 dBm by pressing [AMPL], *[Ref Level]* –20 dBm.

6 Set the attenuation level to 0 dB by pressing [AMPL], *[Attenuation Manl]* and then using the step-down key (▼).

7 Set the video bandwidth to 100 Hz by pressing [BW], *[VBW Manl]*, *[VBW]* and the step-down key (▼). This clarifies the signal by smoothing the noise, which allows better measurement of the signal amplitude.

8 A '*' appears next to the VBW annotation at the bottom of the screen, indicating that the video bandwidth is not coupled to the resolution bandwidth. See Fig. A-14.

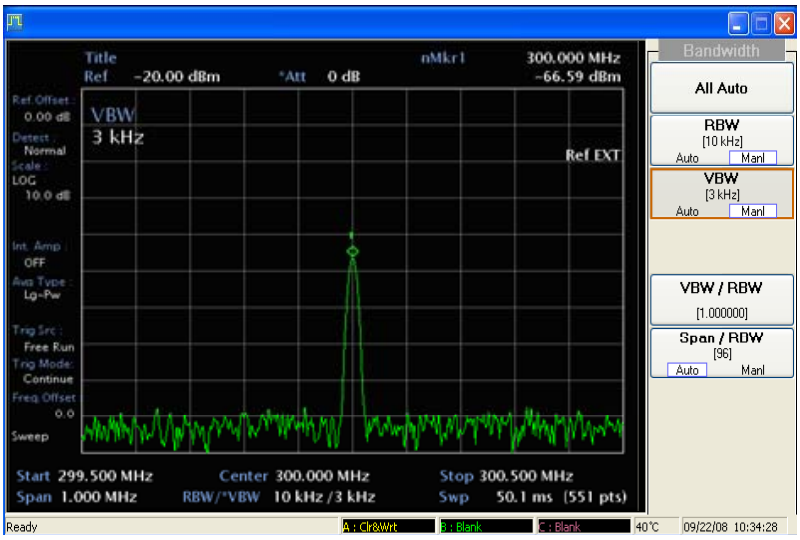


Fig. A-14 Decreasing video bandwidth

9 Instrument preset conditions couple the video bandwidth to the resolution bandwidth so that the video bandwidth is equal to the resolution bandwidth. If the bandwidths are uncoupled when video bandwidth is the active function, pressing *[VBW AUTO]* (so that AUTO is highlighted) recouples the bandwidths.

***Note**: the video bandwidth must be set wider than the resolution bandwidth when measuring impulse noise levels.*

Example 4: video average function

If a signal level is very close to the noise floor, video averaging is another way to make the signal more visible.

***Note**: the time required to construct a full trace that is averaged to the desired degree is approximately the same when using either the video bandwidth or the video averaging technique. The video bandwidth technique completes the averaging as a slow sweep is taken, whereas the video averaging technique takes many sweeps to complete the average. Characteristics of the signal being measured, such as drift and duty cycle, determine which technique is appropriate.*

Video averaging is a digital process in which each trace point is averaged with the previous trace-point average. Video averaging clarifies low-level signals in wide bandwidths by averaging the signal and the noise.

1 As in the previous example, set the analyzer to view a low-level signal. Connect a signal generator to the analyzer RF INPUT. Press [PRESET], *[Preset]* on the analyzer.

2 Set the signal generator frequency to 300 MHz with an amplitude of –60 dBm.

3 Set the center frequency of the analyzer to 300 MHz by pressing [FREQ] 300 MHz.

4 Set the span to 1 MHz by pressing [SPAN] 1 MHz.

5 Set the reference level to –20 dBm by pressing [AMPL], *[Ref Level]* –20 dBm.

6 Set the attenuation level to 0 dB by pressing [AMPL], *[Attenuation Manl]* and then using the step-down key (▼).

7 Press [Trace], *[More..]*, *[Trc Average]* then [ON]. When ON is highlighted, the video averaging routine is initiated. As the averaging routine smoothes the trace, low-level signals become more visible. *Trc Avg. Count [8]* appears on the upper left screen. The number represents the number of samples (or sweeps) taken to complete the averaging routine.

8 To set the number of samples, press *[Trc Avg. Count]* and use the numbers keypad. For example, press *[Average ON]*, *[Trc Avg. Count]* (so that ON is highlighted), 2, 5, ENTER. *[Trc Avg. Reset]* initializes the current average and starts averaging.

9 During averaging, the current sample number appears in the right-upper screen. The sampling also restarts if video averaging is turned off and then on again. Once the set number of sweeps has been completed, the analyzer continues to provide a running average based on this set number.

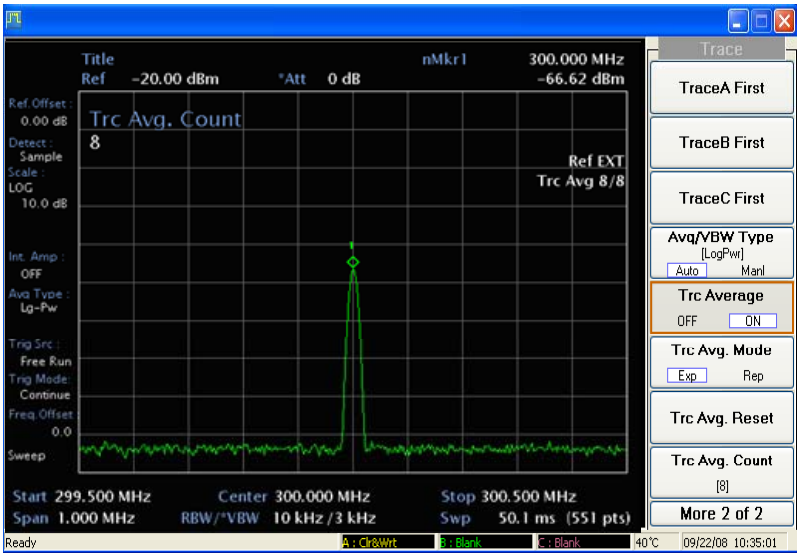


Fig. A-15 Using the video averaging function

Identifying distortion products

Distortion from the analyzer

High-level input signals may cause analyzer distortion products that could mask the real distortion measured on the input signal.

Example: delta marker function

Using a signal from a signal generator, determine how many harmonic distortion products are generated by the analyzer. Fine distortion measurement is possible when suppressing the input signal's distortion.

1 Connect a signal generator to the analyzer RF INPUT. Set the signal generator frequency to 250 MHz and the amplitude to 0 dBm.

2 Set the center frequency of the analyzer to 500 MHz and the span to 600 MHz by pressing [FREQ] 500 MHz, [SPAN] 600 MHz.

3 To measure the second harmonic distortion, press [PEAK]: the marker then locates on the highest-level signal, the 200 MHz fundamental. Press [MARKER], *[Delta]* 250 MHz, then the marker locates in the second harmonic signal. The signal shown in Fig. A-16 produces harmonic distortion products in the analyzer input mixer.

Note that you must consider the harmonic distortion product when measuring the high-level signal.

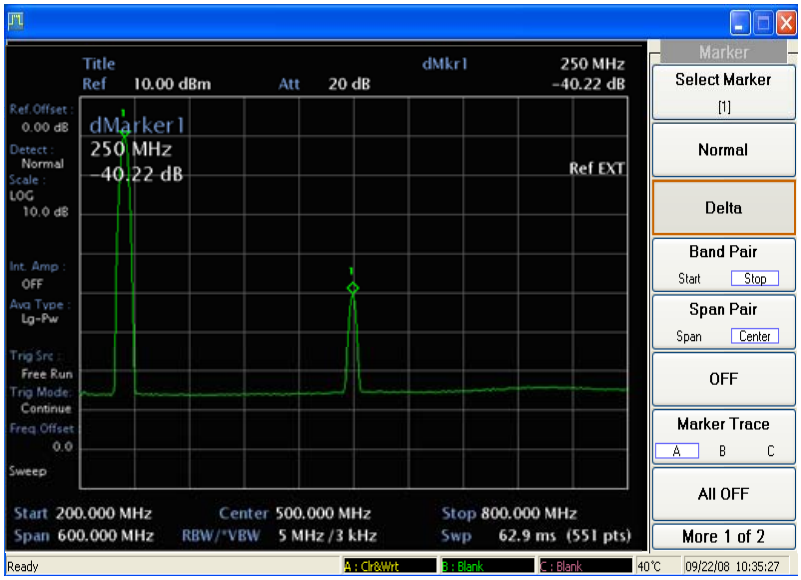


Fig. A-16 Harmonic distortion

Third-order intermodulation distortion

Two-tone, third-order intermodulation distortion is a common test in communication systems. When two signals are present in a non-linear system, they can interact and create third-order intermodulation distortion products that are located close to the original signals. These distortion products are generated by system components such as amplifiers and mixers.

Example: delta marker function

Test a device for third-order intermodulation.

This example uses two sources, one set to 300 MHz and the other to approximately 301 MHz. Other source frequencies may be substituted, but try to maintain a frequency separation of approximately 1 MHz.

1 Connect the equipment as shown in Fig. A-17. Press [PRESET], *[Preset]*.

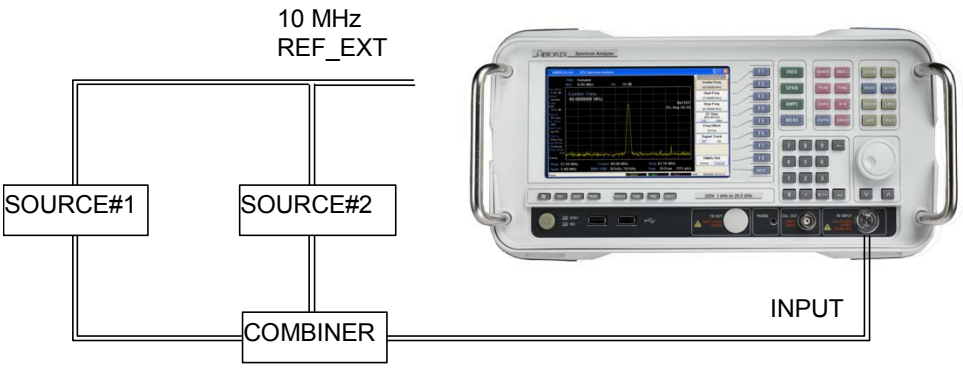


Fig. A-17 Third-order intermodulation equipment setup

***Note**: the combiner should have a high degree of isolation between the two input ports so that the sources do not intermodulate.*

1 Set one source to 300 MHz and the other source to 301 MHz, for a frequency separation of 1 MHz. Set the sources equal in amplitude (in this example, they are set to –5 dBm).

2 Tune both signals onto the screen by setting the center frequency to 300.5 MHz. Then, using the knob, center the two signals on the display. Reduce the frequency span to 5 MHz. This is wide enough to include the distortion products on the screen. To be sure the distortion products are resolved, reduce the resolution bandwidth until the distortion products are visible.

3 Press [BW], *[RBW Manl]*, *[RBW]*, and the used the step-down key (▼) to reduce the resolution bandwidth until the distortion products are visible.

4 To measure a distortion product, press [MARKER] to place a marker on a source signal. To activate the second marker, press [MARKER], *[Delta]*. Using the knob, adjust the second marker to the peak of the distortion product that is beside the test signal. The difference between the markers is displayed in the upper-right screen.

5 To measure the other distortion product, press [PEAK], *[Next Pk Left]* or *[Next Pk Right]*. This places a marker on the next highest peak, which, in this case, is the other source signal. To measure the difference between this test signal and the second distortion product, press [MARKER], *[Delta]* and use the knob to adjust the second marker to the peak of the second distortion product: see Fig. A-18.

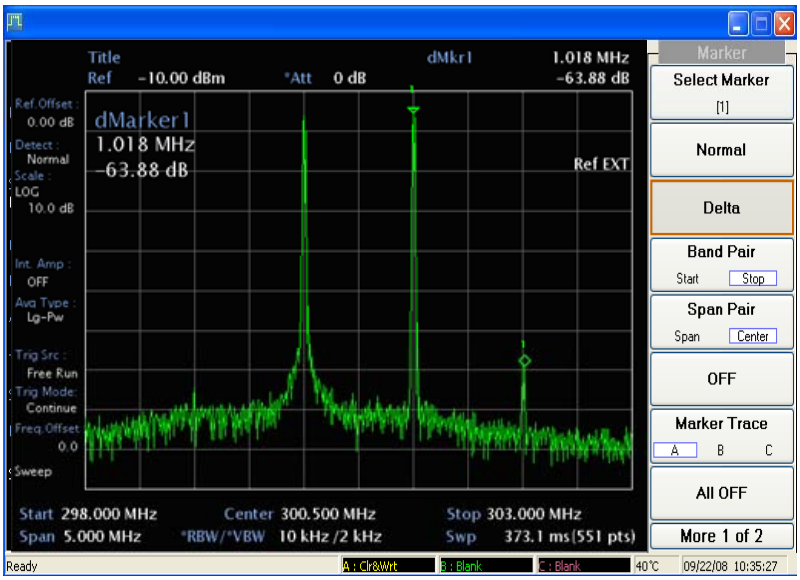


Fig. A-18 Measuring the distortion product

Making noise measurements

There are a variety of ways to measurement noise power. The first decision you must make is whether you want to measure noise power at a specific frequency or the total power over a specified frequency range, for example over a channel bandwidth.

Example 1: MKR noise function

Using the marker function, MKR Noise, is a simple method to make a measurement at a single frequency. In this example, attention must be paid to the potential errors due to discrete signals (spectral components). This measurement is made near the 100 MHz amplitude reference signal to illustrate the use of MKR Noise.

1 Connect CAL. OUT to RF INPUT with BNC-BNC cable and N-BNC adapter in front panel.

2 Tune the analyzer to the frequency of interest. In this example we are using the reference signal. Press [FREQ] 99.98 MHz.

3 Set the span the 50 kHz by pressing [SPAN] 100 kHz.

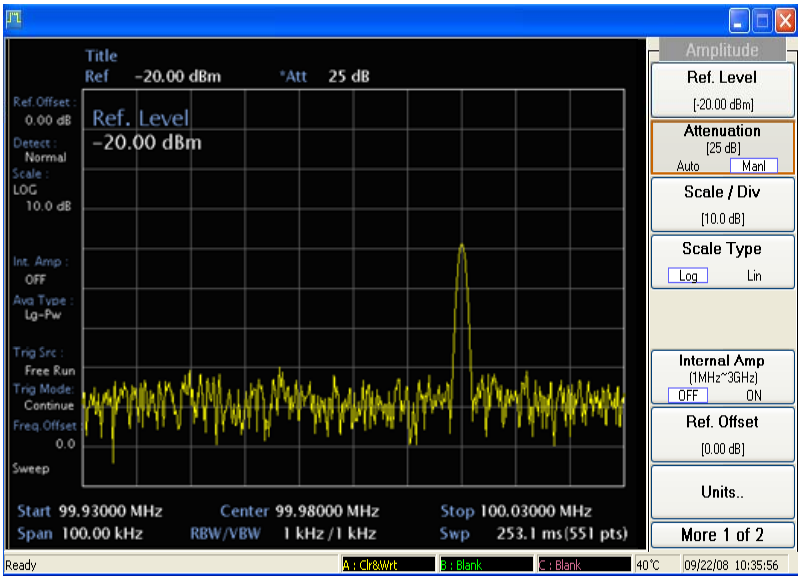


Fig. A-19 Setting the input attenuator

4 Set the reference level to –10 dBm by pressing [AMPL], *[Ref Level]* –10 dBm. See Fig. A-19. Note that if the signal is much higher than shown, adjust the input attenuator. In this example the input attenuation was set to 30 dB by pressing *[Attenuation. Manl]* 30 dB.

5 Activate the noise marker by pressing [MARKER], *[Marker Noise]*.

Note that the display detection changes to sample, and the marker floats between the maximum and the minimum of the noise. The marker readout is in dBm or dBm per bandwidth. See Fig. A-20. For noise power in a different bandwidth, add 10×log (BW). For example, for noise power in a 1 kHz bandwidth, add 10×log (1000) or 30 dB to the noise marker value.

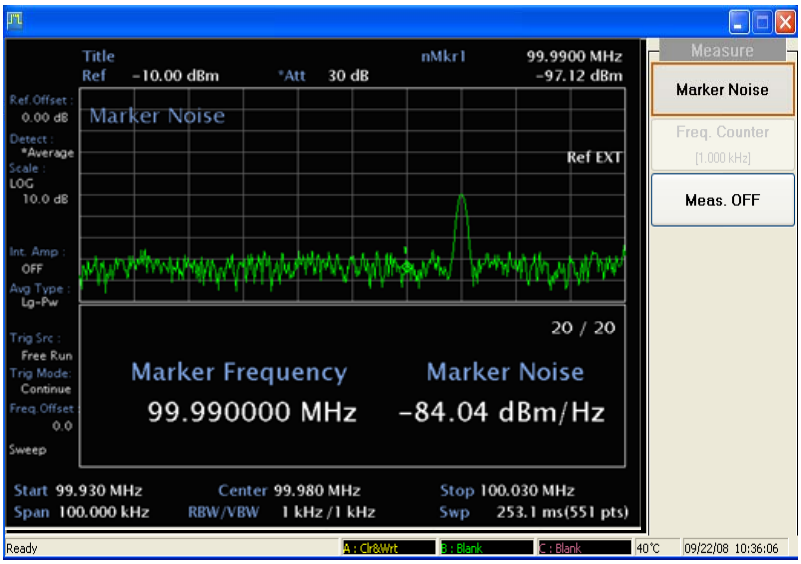


Fig. A-20 Activating the noise marker function

6 Video filtering can be introduced to reduce the variations of the sweep-to-sweep marker value. Set the video filter by pressing [BW], *[VBW Manl]*, *[VBW]*, 100 Hz.

Note that these variations are expected, due to the nature of the signal. We can reduce the variations by introducing video filtering. Since reducing the video bandwidth filter affects sweep time, it is recommended to limit the degree of filtering.

Example 2: video filtering/average

The normal marker can also be used to make a signal frequency measurement as described in the previous example, again using video filtering or averaging to obtain a reasonably stable measurement.

While video averaging automatically selects the sample display detection mode, video filtering does not. With sufficient filtering that results in a smooth trace, there is no difference between the sample and peak modes because the filtering takes place before the signal is digitized.

Be sure to account for the fact that the averaged noise is displayed approximately 2 dB too low for a noise bandwidth equal to the resolution bandwidth. Therefore, you must add 2 dB to the marker reading. For example, if the marker indicates –100 dBm, the actual noise level is –98 dBm.

Example 3: channel power measurement

You may want to measure the total power of a noise-like signal that occupies some bandwidth. For example, you may want to determine the power in a communications channel. If the signal is noise and is flat across the band of interest, you can use the noise marker as described in example 1 and add 10×log (channel BW). However, if you are not certain of the characteristics of the signal, or if there are discrete spectral components in the band of interest, we can use the Channel Power routine. In this example, you will use the noise of the analyzer, then add a discrete tone to see what happens and assume a channel bandwidth of 50 kHz. If desired, a specific signal may be substituted.

1 Reset the analyzer by pressing [PRESET], *[Preset]*.

2 Connect CAL. OUT to RF INPUT with BNC-BNC cable and N-BNC adapter in front panel.

3 Tune the analyzer to the frequency of 100 MHz. In this example we are using the amplitude reference signal. Press [FREQ] 100 MHz.

4 Set the span to 100 kHz by pressing [SPAN] 1 MHz.

5 Set the reference level to –20 dBm by pressing [AMPL], *[Ref Level]* –20 dBm.

6 Set the input attenuation to 30 dB by pressing [AMPL], *[Attenuation Manl]* 30 dB.

7 Set the analyzer to setup the channel-power measurement by pressing [MEAS], *[Channel Power]*.

8 Set the integration bandwidth to 500 kHz by pressing [CONTROL], *[Integ. BW]* 500 kHz.

9 Set the span to 1 MHz by pressing [SPAN] 1 MHz.

***Note**: the display detection mode has been set to sample mode and the video bandwidth has been set to be ten times wider than the resolution bandwidth. This setting is important to prevent any averaging. You can reduce the sweep-to-sweep variation in the power reading by averaging over a number of sweeps.*

10 Set the Average to ON.

11 The channel power reading is essentially equal to the 100 MHz calibration signal. The total noise power is far enough below that of the tone that the noise power contributes very little to the total.

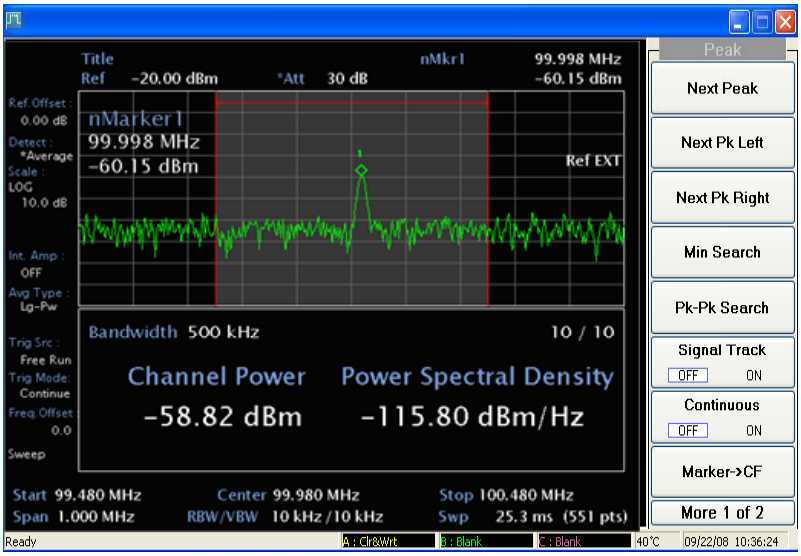


Fig. A-21 Measuring channel power

The algorithm that computes the total power compensates for the fact that some of the trace points on the response to the continuous wave tone may be at or very close to the peak value of the tone and so yields the correct value whether the signal comprises just noise, a tone, or both.

Demodulating AM signals

The zero span mode can be used to recover amplitude modulation on a carrier signal. The analyzer operates as a fixed-tuned receiver in zero span to provide time domain measurements.

The center frequency in the swept-tuned mode becomes the tuned frequency in zero span. The horizontal axis of the screen becomes calibrated in time only, rather than both frequency and time. Markers display amplitude and time values.

The following functions establish a clear display of the waveform:

- Trigger stabilizes the waveform trace on the display by triggering on the modulation envelope. If the modulation of the signal is stable, video trigger synchronizes the sweep with the demodulated waveform.
- Linear mode should be used in amplitude modulation (AM) measurements to avoid distortion caused by the logarithmic amplifier when demodulating signals.
- Sweep time adjusts the full sweep time from 20 ms to 1000 s (from 25 µs to 15 s in zero span). The sweep time readout refers to the full 10-division graticule. Divide this value by 10 to determine sweep time per division.
- Resolution and video bandwidth are selected according to the signal bandwidth.

Each of the coupled function values remains at its current value when zero span is activated. Video bandwidth is coupled to resolution bandwidth. Sweep time is not coupled to any other function.

Example: AM demod. function

View the modulation waveform of an AM signal in the time domain.

To obtain an AM signal, you can either connect a source to the analyzer input and set the source for amplitude modulation, or connect an antenna to the analyzer input and tune to a commercial AM broadcast station. This example uses a source. If you are using a commercial broadcast station as your signal, press [AUX], *[AM Demod. [ON]]* to turn on AM demodulation. Then press *[Audio Sound [ON]]*, and the analyzer operates as a radio.

1 Connect a signal generator output to the analyzer RF INPUT.

2 Set the source output frequency to 300 MHz, AM rate to 400 Hz and AM depth to 50%.

3 Set the center frequency of the analyzer to 300 MHz by pressing [FREQ] 300 MHz.

4 To demodulate the AM, press [AUX], *[AM Demod. ON]*. See Fig. A-22.

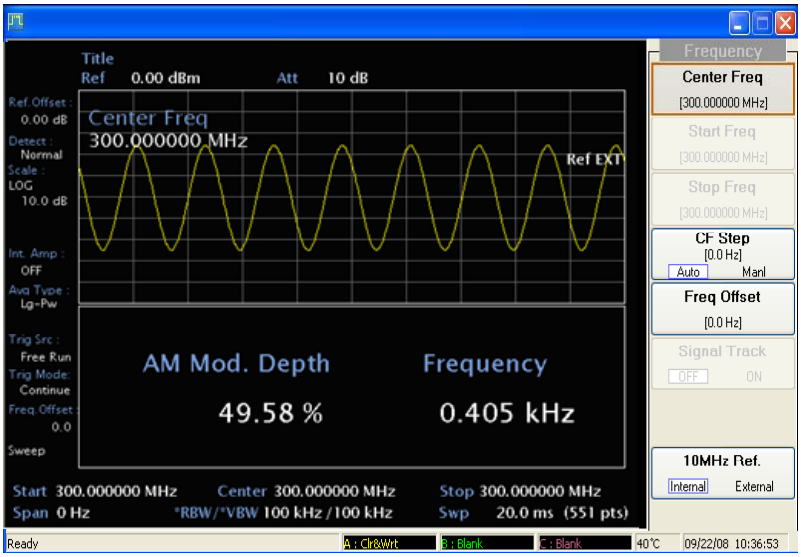


Fig. A-22 Measuring modulation using AM demodulation function

Another method to demodulate the AM signal is to use zero span by repeating steps 1 to 4 and performing the following:

5 Set the span to 20 MHz by pressing [SPAN] 20 MHz.

6 Set the resolution bandwidth to 1 MHz by pressing [BW], *[RBW Manl]*, *[RBW]* 1 MHz. See Fig. A-23.

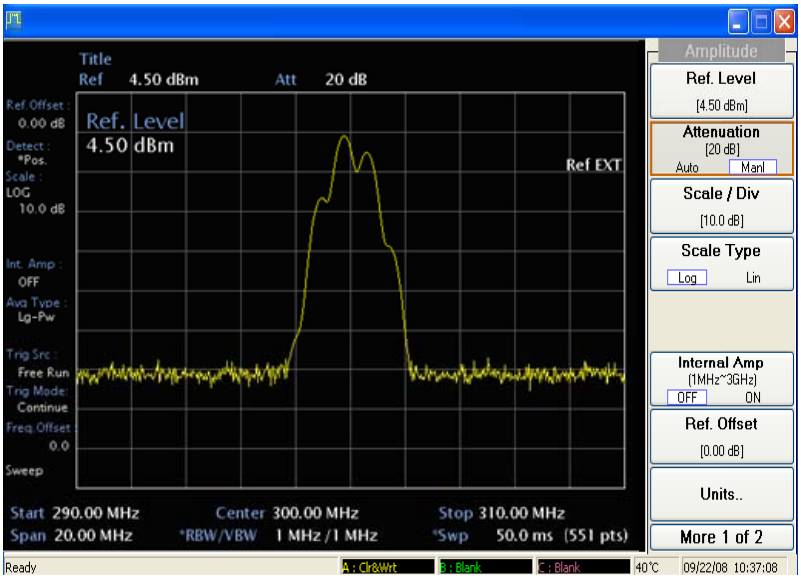


Fig. A-23 Viewing an AM signal

7 To select zero span, either press [SPAN] 0 Hz, or press [SPAN], Zero Span.

8 Next, position the signal peak near the reference level and select a linear voltage display. Press [AMPL], *[Scale Type Lin]*, *[Ref Level]* to adjust the reference level.

9 Adjust the sweep time to change the horizontal scale by pressing [BW], *[Sweep Time]* 10 ms. See Fig. A-24.

10 If the modulation is a steady tone, for example from a signal generator, use the video trigger to trigger on the waveform and stabilize the display. (If you are viewing an off-the-air signal you will not be able to stabilize the waveform.)

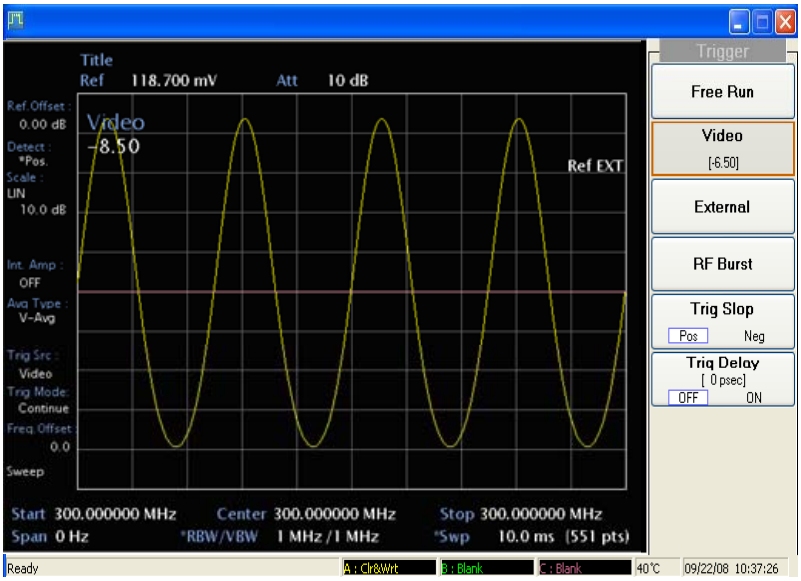


Fig. A-24 Measuring modulation in zero span

11 Use markers and delta markers to measure the time parameters of the waveform.

Demodulating FM signals

As with amplitude modulation you can utilize zero span to demodulate a FM signal. However, unlike the AM case, you cannot simply tune to the carrier frequency and widen the resolution bandwidth. The reason is that the envelope detector in the analyzer responds only to amplitude variations, and there is no change in amplitude if the frequency changes of the FM signal are limited to the flat part of the resolution bandwidth.

You can demodulate FM signals by using the FM demodulation function. Or, if you tune the analyzer slightly away from the carrier, you can utilize slope detection to demodulate the signal by performing the following steps:

1 Determine the correct resolution bandwidth.

2 Find the center of the linear portion of the filter skirt (either side).

3 Tune the analyzer to put the center point at mid screen of the display.

4 Select zero span.

The demodulated signal is now displayed; the frequency changes have been translated into amplitude changes. To listen to the signal, turn on AM demodulation and the speaker.

In this example you will demodulate a broadcast FM signal that has a specified 75 kHz peak deviation.

Example 1: delta marker function

Determine the correct resolution bandwidth. With a peak deviation of 75 kHz, your signal has a peak-to-peak excursion of 150 kHz. So we must find a resolution bandwidth filter with a skirt that is reasonably linear over that frequency range.

Connect CAL. OUT to RF INPUT with BNC-BNC cable and N-BNC adapter on the front panel.

1 Tune the analyzer to 100 MHz. In this example we are using the amplitude reference signal. Press [FREQ] 100 MHz.

2 Set the span to 1 MHz by pressing [SPAN] 1 MHz.

3 Set the reference level to –30 dBm by pressing [AMPL], *[Ref Level]* –30 dBm.

4 Set the resolution bandwidth to 100 kHz by pressing [BW], *[RBW Manl]*, *[RBW]* 100 kHz. The skirt is reasonably linear starting about half a division down from the peak.

5 Select a marker by pressing [MARKER], then move the marker approximately half a division down the right of the peak (high frequency) using the front-panel knob.

6 Place a delta marker 150 kHz from the first marker by pressing *[Delta]* 150 kHz. The skirt looks reasonably linear between markers.

7 Determine the offset from the signal peak to the desired point on the filter skirt by moving the delta marker to the midpoint. Press 75 kHz to move the delta marker to the midpoint. See Fig. A-25.

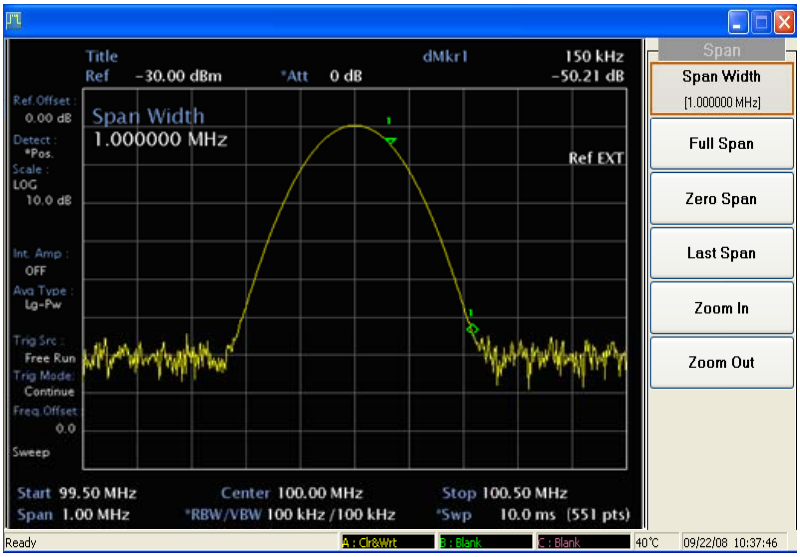


Fig. A-25 Determining the offset

8 Press *[Delta]* to make the active marker the reference marker.

9 Press [PEAK] to move the delta marker to the peak. The delta value is the desired offset, for example 130 kHz.

Example 2: FM demod. function

1 Connect a signal generator output to the analyzer RF INPUT.

2 Set a source frequency to 300 MHz, amplitude to 0 dBm, FM deviation to 75 kHz, and FM rate to 1 kHz.

3 Reset the analyzer by pressing [PRESET], *[Preset]*.

4 Tune the analyzer to 300 MHz by pressing [FREQ] 300 MHz.

First, demodulate the FM signal by using the FM demodulation function.

5 Demodulate the FM signal by pressing [AUX], *[FM Demod. ON]*.

6 To listen to the signal (1 kHz), press *[Audio Sound ON]*.

7 Adjust the sweep time by pressing [SWEEP], *[Sweep Time]* 10 ms. See Fig. A-26.

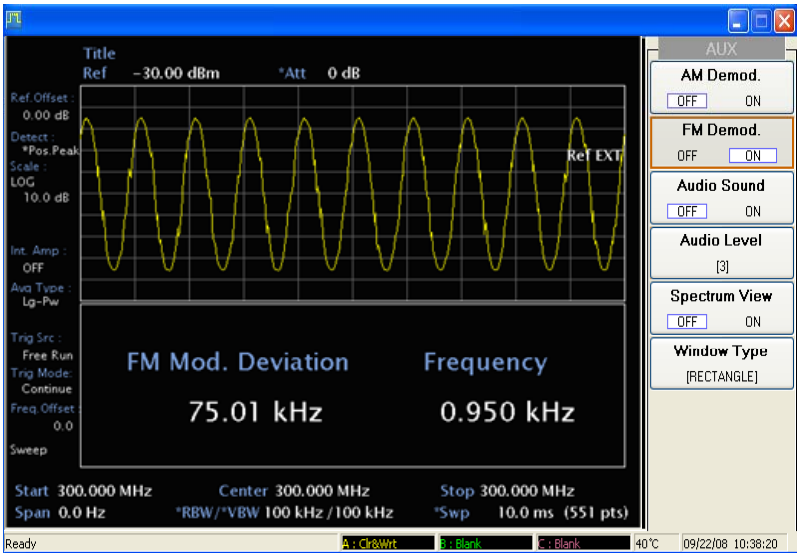


Fig. A-26 Measuring modulation using FM demodulation function

Another method is to use zero span by repeating steps 1 to 4 and then performing the following:

8 Tune above or below the FM signal by the offset noted above, in this example 130 kHz. Press [FREQ], *[CF Step Manl]*, *[CF Step]* 130 kHz, *[Center]* then use the step-up key (▲) or step-down key (▼).

9 Set the resolution bandwidth to 100 kHz, then go to zero span by pressing [BW], *[RBW Manl]*, *[RBW]* 100 kHz, [SPAN], and *[Zero Span]*.

10 Activate signal sweep by pressing [SINGLE], *[Single]*.

11 Listen to the demodulated signal through the speaker by pressing [AUX], *[Audio Level]*, then adjusting the volume using the front-panel knob or the step-key.

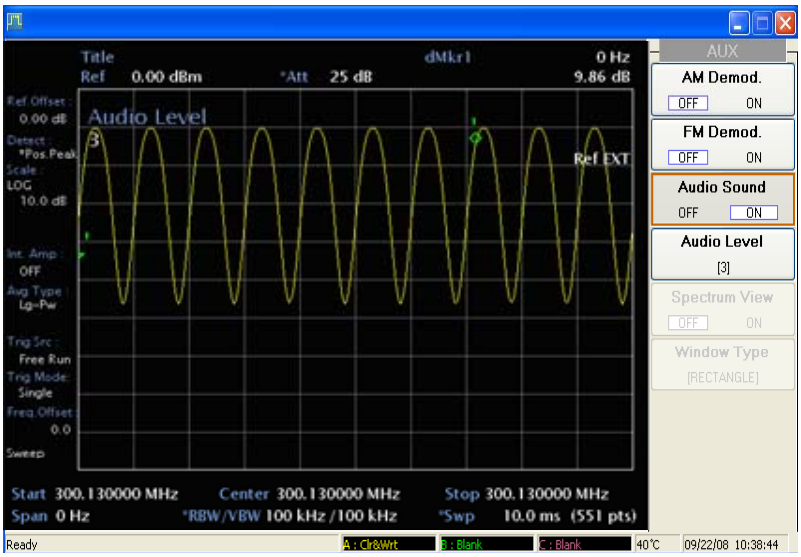


Fig. A-27 Measure the demodulation in zero span

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