S-Series SVA
Signal Vector Analyzer
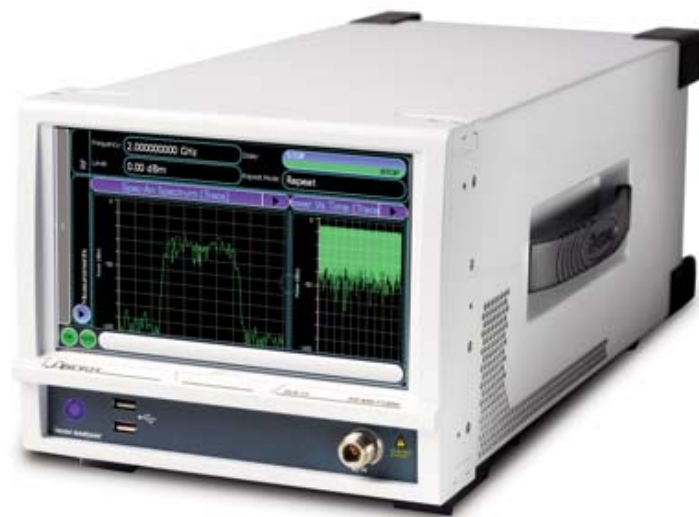
Operating Manual

S-Series SVA Vector Signal Analzyer

Operating Manual

About the SVA Vector Analyzer

The S-Series SVA Vector Signal Analyzer is a compact, easy to use, high performance RF digitizer and vector analyzer for R&D, manufacturing and the field.

The SVA employs a large touch screen user-interface to provide a vector signal analyzer with unparalleled ease-of-use. The small form-factor and light weight ensure minimum footprint on the bench or in a test system, and maximum portability.

The SVA converts RF signals into digital IF or I&Q sampled data, providing vector signal analysis of RF signals with the functionality and performance required in the laboratory or the manufacturing test system. With high linearity, low noise and excellent level accuracy, the SVA is ideally suited for the analysis of WLAN, WMAN, WPAN, 2G, 3G, 4G cellular radio signals as well as general-purpose analog- and digitally-modulated signal analysis. A spectrum analyzer mode provides the features and controls you would expect from a conventional spectrum analyzer.

SVA Vector Analyzer Help

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Table of contents

Contents

Contents

Contents

Contents

Welcome to SVA-6 and SVA-13

Welcome to the operating manual for the SVA-6 and SVA-13 S-Series Vector Signal Analyzers. These compact, easy to use, high performance instruments have a touch-screen interface that simplifies operation and is intuitive to use. This document is intended to support you in operating the instrument, to provide detailed information about each function, and to provide examples of how to use the instrument for making measurements.

Please take time to read the safety information first.

About SVA gives information about the use and user of the instrument, together with patent information.

Installation is primarily for first-time users, with information on positioning and power connections.

Getting started gives information about front- and rear-panel connections, and explains how to use the touch screen.

Analyzing signals details the available analysis modes, which include all common modulation schemes.

Maintenance covers routine maintenance and safety checks.

If at any time you have an unresolved question, or you suspect that the instrument is not functioning correctly, please contact our technical support.

Associated publications

If you want to…	Refer to…
View safety information and basic setup and operation instructions in **pdf** format.	**SVA Vector Signal Analyzer Getting Started Guide** Part no. 47090/125 On the CD-ROM and at www.aeroflex.com/.
View safety information and basic setup and operation instructions in **printed** format.	**SVA Vector Signal Analyzer Getting Started Guide** Part no. 47000/125 Supplied with the instrument.
View operating information for the instrument in **html** Help format.	**SVA Vector Signal Analyzer Help** Part no. 47090/126 On the CD-ROM and at www.aeroflex.com/.
View operating information for the instrument in **pdf** format.	**SVA Vector Signal Analyzer Operating Manual** Part no. 47090/127 On the CD-ROM and at www.aeroflex.com/.
View operating information for the instrument in **printed** format.	**SVA Vector Signal Analyzer Operating Manual** Part no. 47000/127 Available as an optional extra.
View remote programming information for the instrument in **pdf** format.	**SVA Vector Signal Analyzer Remote Command Reference Manual** Part no. 47090/128 On the CD-ROM and at www.aeroflex.com/.
View remote programming information for the instrument in **printed** format.	**SVA Vector Signal Analyzer Remote Command Reference Manual** Part no. 47000/128 Available as an optional extra.

Viewing the SVA operating manual and Help file

Operating manual

This operating manual provides the same information about installing and operating the instrument as the Help file, but in an A4 PDF format. Its part number is 47090/127. It is installed on the CD-ROM. It is available also on request as a printed document, part no. 47000/127.

Help

The SVA Help file (part no. 47090/126) is available on the CD-ROM supplied with the instrument, and provides html help on all aspects of installing and operating the instrument. You should be able to view the Help file on all browsers although you may observe slight changes in presentation depending on the browser used.

Note: if you copy the Help file from the CD-ROM to your computer, be aware that, for security reasons, Windows® xP restricts access to HTML help (x.chm) files across network drives. If you try to view any html help file on a network drive, you will see an error message. You need to move such files to your C drive to view them. Of course, you can run the html Help file directly from the CD-ROM.

Safety

This section contains important information about protecting yourself and the instrument from harm.

Precautions

Precautions

These terms have specific meanings in this document:

WARNING

...information to prevent personal injury.

CAUTION

...information to prevent damage to the instrument.

Hazard symbols

The meaning of hazard symbols appearing on the instrument 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.
	Toxic hazard

WARNING

After unpacking the instrument, inspect the shipping container and its cushioning material for signs of stress or damage.

If there is damage, retain the packing material for examination by the carrier in the event that a claim is made.

Examine the instrument for signs of damage; do not connect the instrument to a supply when damage is present, as internal electrical damage could result in a shock if the instrument is turned on.

General conditions of use

This product is designed and tested to comply with the requirements of IEC/EN 61010-1 'Safety requirements for electrical equipment for measurement, control and laboratory use', for Class 1 portable equipment and is for use in a pollution degree 2 environment. The instrument is designed to operate from an installation category II supply.

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

This product is not approved for use in hazardous atmospheres or medical applications. If the instrument 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 instrument conforms with IEC Safety Class 1, meaning that it is provided with a protective grounding conductor. To maintain this protection the power cord 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 instrument 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.

Fuses

Note that the internal supply fuse is in series with the live conductor of the power cord. If connection is made to a 2-pin unpolarized supply socket, it is possible for the fuse to become transposed to the neutral conductor, in which case, parts of the equipment could remain at supply potential even after the fuse has ruptured.

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 power cord, ensure that the fuse rating is commensurate with the current requirements of this instrument. See the data sheet for power requirements.

WARNING

☠ Toxic hazards

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

WARNING

⚠ Heavy instrument

The weight of this instrument may exceed the 18 kg (40 lb) guideline for manual handling by a single person. To avoid the risk of injury, an assessment should be carried out prior to handling, which takes account of the load, workplace environment and individual capability, in accordance with European Directive 90/269/EEC and associated national regulations.

WARNING

☠ Lithium

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

WARNING

☠ Liquid crystal display (LCD) module

The liquid crystal substance within the display panel used in this instrument is a toxic substance. If the display panel is damaged and any of the liquid crystal substance leaks out, do not allow it to come into contact with your mouth. If the substance comes into contact with your skin, immediately wash the affected areas with soap and water, and seek medical advice.

The display panel is made of glass. Therefore do not subject the instrument to mechanical shocks that might cause fractures.

Do not dispose of these modules, or any part of them, in domestic waste. Use only approved waste disposal methods.

CAUTION

Suitability for use

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

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

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

Précautions

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.

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.

     Danger produits toxiques

WARNING

⚠ Inspection visuelle initiale

Lors du déballage de l'instrument, examinez l'emballage ainsi que les matériaux de protection afin de détecter tout signe de contrainte ou de dommage. Dans ce cas, gardez l'emballage pour le faire examiner par le transporteur et présenter une éventuelle réclamation. Détectez également tout signe de dommage sur l'équipement; ne pas mettre sous tension un équipement présentant des dommages, tout dommage électrique interne pouvant provoquer un choc lors de la mise en route.

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 dans la fiche technique, 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.

Fusibles

Notez que le fusible d'alimentation interne est en série avec la phase du câble d'alimentation. Si la prise d'alimentation comporte deux bornes non polarisées, il est possible de connecter le fusible au neutre. Dans ce cas, certaines parties de l'appareil peuvent rester à un certain potentiel même après coupure du fusible.

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 de la fiche technique.

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

⚠ Equipement lourd

Le poids de cet appareil peut être supérieur à la limite de 18 kg (40 lb), fixée pour le transport par une seule personne. Afin d'éviter tout risque de blessure, il est nécessaire de faire, avant le transport, une évaluation de la charge, des contraintes de l'environnement et des capacités de l'individu, en conformité avec la Directive Européenne 90/269/EEC ainsi que les recommandations Nationales concernées.

WARNING

⚠️ **Lithium**

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.

WARNING

⚠️ **Module d'affichage à cristaux liquides**

Ne pas démonter le module d'affichage à cristaux liquides.

La matière contenue dans l'afficheur à cristaux liquides utilisé dans cet appareil est une substance toxique. Si l'afficheur est endommagé ou si la matière des cristaux liquides s'écoule, il faut éviter de la mettre en contact avec sa bouche. En cas de contact avec la peau, laver immédiatement la surface touchée avec de l'eau et du savon et s'adresser à un service médical.

L'afficheur est en verre. Il faut donc éviter de lui faire subir des chocs mécaniques pouvant causer des dégâts.

Ne pas se débarrasser de ces modules ni d'aucun de leurs composants dans une poubelle à usage domestique. Utilisez uniquement les containers à déchets appropriés.

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

Diese Hinweise haben eine bestimmte Bedeutung in diesem Handbuch:

WARNING

...dienen zur Vermeidung von Verletzungsrisiken.

CAUTION

...dienen dem Schutz der Geräte.

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.

          Warnung vor giftigen Substanzen

WARNING

⚠ Sofortige visuelle Überprüfung

Nach dem Auspacken des Gerät es ist die Verpackung und das Ausfütterungsmaterial auf Druckstellen und Beschädigung hin zu überprüfen. Bei Feststellung von Beschädigung sollte die Verpackung, für den Fall daß Ansprüche an den Spediteur entstehen, sichergestellt werden. Begutachten Sie anschließend das Gerät auf Anzeichen von Beschädigung und verbinden Sie dieses nicht mit dem Netz falls solche vorhanden sind. Interne elektrische Beschädigung kann beim Einschalten zu einem Stromschlag führen.

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 Datenblatt 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.

Sicherungen

Die interne Sicherung in der Spannungszuführung ist in Reihe mit der spannungsführenden Zuleitung geschaltet. Bei Verbindung mit einer zweiadrigen, nicht gepolten Steckdose kann die Sicherung in der Masseleitung liegen, so daß auch bei geschmolzener Sicherung Geräteteile immer noch auf Spannungspotential sind.

WARNING

⚠ Feuergefahr

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

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

⚠ Schweres Gerät

Das Gewicht dieses Geräts kann über der 18 kg (40 lb) Grenze für Transport durch eine einzelne Person liegen. Zur Vermeidung von Verletzungen sollten vor einem Transport die Arbeitsumgebung und die persönlichen Möglichkeiten im Verhältnis zur Last abgewogen werden, wie in der EU-Regelung 90/269/EEC und nationalen Normen beschrieben.

WARNING

☠ Lithium

Eine Lithium Batterie 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.

WARNING

☠ **Das LCD Modul**

Demontieren Sie in keinem Fall das LCD Modul.

Die Flüssigkristallsubstanz, die im Displaymodul dieses Gerätes enthalten ist, enthält giftige Substanzen. Falls das Displaymodul beschädigt wird und die darin enthaltene Flüssigkristall-substanz entweicht, so achten Sie darauf, daß diese Substanz in keinem Fall mit Schleimhäuten in Berührung kommt. Sollte die Substanz mit Ihrer Haut in Berührung kommen, so waschen Sie die betroffenen Hautpartien mit Wasser und Seife ab und geben sich in ärztliche Behandlung.

Das Display besteht aus Glas. Mechanische Einwirkungen können das Glas zerstören.

Entsorgen Sie diese Module oder Teile davon nicht über den normalen Hausmüll, sondern über eine geeignete Sondermüllverwertung.

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

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.

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.

Pericolo sostanze tossiche

WARNING

Ispezione visiva iniziale

Dopo aver sballato lo strumento, ispezionare l'imballo e verificare che non vi siano segni di urti o deformazioni. Nel caso si dovessero riscontrate dei danni, conservare l'imballo per un'eventuale contestazione al cordiere.

Verificare che lo strumento non abbia segni di danni, nel caso si dovessero riscontrate tali segni, non dare alimentazione in quanto vi potrebbero essere dei danni interni causa di possibili shock.

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 nella scheda tecnica, 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 mediche. 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.

Fusibili

Notare che un fusibile è posto sul filo caldo del cavo di alimentazione. Qualora l'alimentazione avvenga tramite due poli non polarizzati, è possibile che il fusibile vada a protezione del neutro per cui anche in caso di una sua rottura, l'apparato potrebbe restare sotto tensione.

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. Tali requisiti sono riportati nella scheda tecnica.

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

⚠ Strumento pesante

Il peso di questo strumento può superare i 18 kg (40 lb) raccomandati come limite per il trasporto manuale da parte di singola persona. Per evitare rischi di danni fisici è bene quindi considerare il carico complessivo, le condizioni del trasporto e le capacità individuali in accordo con la direttiva comunitaria 90/269/EEC e con eventuali regolamenti locali.

WARNING

☠ Litio

Quest 'apparato incorpora 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.

WARNING

☠ Schermo a cristalli liquidi (LCD - Liquid Crystal Display)

Non disassemblare il modulo LCD.

La sostanza contenuta nello schermo LCD è tossica. Se il modulo LCD viene danneggiato e si ha una perdita di liquido, occorre evitarne il contatto con la bocca. In caso di contatto con la pelle, lavare immediatamente le aree interessate con acqua e sapone e contattare un medico.

Lo schermo LCD è di vetro, per cui non devono essere sottoposti a shock meccanici che possono causarne la rottura.

Il modulo LCD, il tubo CCFT o i loro residui vanno eliminati come residui speciali secondo la normativa vigente.

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

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.

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.

Aviso de toxicidad

WARNING

⚠ Inspección visual inicial

Tras desembalar el equipo inspeccione tanto la caja como el material de amortiguamiento para verificar si han sido forzados o dañados. Si encuentra daños, retenga el embalaje para que, en caso de reclamación, pueda ser inspeccionado por el transportista. Examine el equipo para verificar que no ha sufrido daños. No conecte el equipo a al alimentación cuando esté dañado, la avería interna podría originar una descarga al encender el equipo.

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 la hoja técnica, 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 fusible de alimentación interno está enserie con el activo del cable de alimentación a red. Si la clavija de alimentación de red cuenta con sólo dos terminales sin polaridad, el fusible puede pasar a estar en serie con el neutro, en cuyo caso existen partes del equipo que permanecerían a tensión de red incluso después de que el fusible haya fundido.

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 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

⚠ Instrumento pesado

El peso de este equipo podrá ser superior a la recomendación de 18 Kg (40 lb), lo que debe tenerse en cuenta. si va ser transportado manualmente por una sola persona. Para evitar el riesgo de lesiones, antes de mover el equipo deberá evaluar la carga, el entorno de trabajo y la propia capacidad, de acuerdo con la Directiva Europea 90/269/EEC y el Reglamento Nacional Asociado.

WARNING

⚠ **Litio**

En este equipo se utiliza una batería de litio.

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.

WARNING

⚠ **Módulo de visualizador de cristal liquido**

No desmonte el módulo del Visualizador.

La sustancia que forma el Cristal Liquido del panel de visualización es tóxica. En caso de dañarse el visualizador y salir a exterior dicha sustancia, no permita que la misma entre en contacto con su boca. Si la sustancia se pusiera en contacto con su piel, lave inmediatamente las áreas afectadas con agua y jabón y busque asistencia médica.

El visualizador es de vidrio. Por tanto no lo someta a golpes que puedan romperlos.

No tire estos módulos, ni parte de ellos a la basura doméstica. Deshágase de ellos con métodos aprobados para residuos industriales.

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.

Virus protection

This instrument is supplied without anti-virus protection software. We recommend that if you connect to the internet or accept files from portable media (for example, memory sticks), you install a proprietary anti-virus software product. Provided that you install the software in accordance with the manufacturer's recommendations, your Aeroflex warranty is not affected.

Aeroflex accepts no liability whatsoever for any loss or damage caused by viruses, worms, Trojan horses or other malicious programs downloaded through connection of the instrument to the internet or external storage device or portable media.

About the SVA
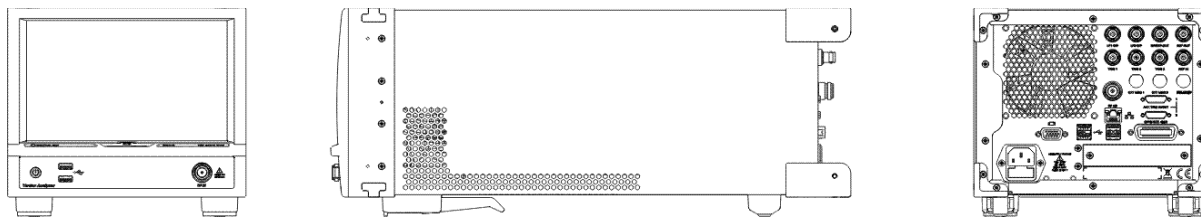
The Aeroflex SVA is a fast, wideband vector signal analyzer, packaged as a compact, bench-top instrument with touch-screen operation. It provides high performance analysis of WLAN, WMAN, WPAN, 2G, 3G, 4G cellular radio signals as well as analysis of general-purpose analog and digitally-modulated signals. Its spectrum-analyzer mode satisfies the need for a general-purpose high quality spectrum analyzer.

The instrument software runs on a Windows® operating system that can be accessed for standard file-handling procedures. Important functions are protected to ensure correct operation of the SVA software.

In its base configuration, the SVA is capable of demodulating FSK, PSK, QAM and analog modulations. All the key analyzer functions are provided, together with list mode sweep. Options provide basic and advanced modulation analysis libraries, removable hard disk, and connection via the rear panel.

Remote operation is provided through Ethernet and GPIB interfaces. SCPI-like commands are used where possible.

Several S-Series products lock together to form a unit that functions physically and electrically as a single integrated test instrument. Test applications (supplied by Aeroflex or created by you) then control the composite instrument, providing precisely the test capabilities that you need for the production line, the laboratory, or in the field.

The SVA is currently available in two frequency ranges:

SVA-6   250 kHz to 6 GHz

SVA-13   250 kHz to 13 GHz

Data sheet

For a product overview, technical specifications, and information about options and accessories, see the latest S-Series SVA data sheet (part number 46891/463) at aeroflex.com.

Intended use

This instrument is intended for bench-top or rack installation, and operation under the conditions defined in *General conditions of use*. It is intended to be used by engineering personnel engaged in vector analysis relating to the design, development and testing of RF devices and sub-systems and modules.

It is assumed that users are familiar with the terms and concepts commonly used in RF measurements.

Power supply

Voltage range: 100 to 240 VAC (limit 90 to 264 VAC). The instrument configures automatically to voltages within this range.

Frequency range: 50 to 60 Hz (limit 45 to 66 Hz).

Power consumption: 110 VA max.

See also: Fuses

Disconnecting device

Heavy instrument

WARNING

This instrument is light enough to be handled by one person. However, if two or more instruments are attached together using the Aerolock mechanism, the combined weight of instruments may become more than 18 kg (40 lb), which exceeds the recommended maximum weight for manual handling by a single person.

In this case, *use two people* to lift the instrument. Lift it by the front surround and rear bumpers to avoid trapping fingers underneath.

Declaration of conformity

A copy of the EC Declaration of Conformity for the SVA Vector Signal Analyzer is included on the supplied CD-ROM, and is also available on request from the Aeroflex help desk at www.aeroflex.com/ats/contact.cfm.. The document number of the Declaration of Conformity is DC287.

China RoHS

A declaration of specified hazardous substances that applies when this product is exported to China is available on request from the Aeroflex help desk at www.aeroflex.com/ats/contact.cfm.

A copy of the RoHS declaration is provided with each shipment of the product to China.

Installation

When combined with other S-Series modules, this may become a heavy instrument; observe the warning about handling it.

Carry out an initial visual inspection before turning the instrument on.

Position the instrument carefully.

Check the installation requirements to ensure that cooling is not impaired.

Connect the instrument to the supply.

Switch the instrument on with the on/off switch.

Perform a goods-in check to establish that the instrument is functional.

Initial visual inspection

WARNING

After unpacking the instrument, inspect the shipping container and its cushioning material for signs of stress or damage.

If there is damage, retain the packing material for examination by the carrier in the event that a claim is made.

Examine the instrument for signs of damage. **Do not** connect the instrument to a supply when damage is present, as internal electrical damage could result in a shock if the instrument is turned on.

Positioning the instrument

CAUTION

Excessive temperatures may affect the performance of the instrument. Completely remove any protective plastic covering, and avoid standing the instrument on or close to another instrument that is hot.

Stability

If you stand the instrument on end on its rear-panel protectors, make sure that you provide support to prevent it from toppling over.

Ventilation

This instrument is air-cooled by a fan mounted on the rear panel. Air enters through ventilation holes on either side of, and underneath, the instrument, and expels through the fan outlet. Before switching on the instrument, ensure that the fan outlet and the ventilation holes are not restricted. Leave a clearance of at least 50 mm (2 in).

If you do not provide adequate clearance, internal temperatures will increase and may affect the instrument's performance adversely.

When two or more instruments are joined together, the design ensures that each instrument receives adequate airflow.

.

Power cord

When the instrument has to be plugged into a Class II (ungrounded) 2-terminal socket outlet, the power cord should either be fitted with a 3-pin Class I plug and used in conjunction with an adapter incorporating a ground wire, or be fitted with a Class II plug with an integral ground wire.

Fasten the ground wire securely to ground. Grounding one terminal on a 2-terminal socket does not provide adequate protection.

If a molded plug has to be cut off a power cord, dispose of it immediately. A plug with bare wires is hazardous if it is inserted into a live socket outlet.

The power cord is the instrument's disconnecting device.

Use only an approved and rated power cord-set, appropriate to the country in which it is to be used. Contact Aeroflex if in doubt.

Connecting to supply

The instrument is a Safety Class 1 product and therefore must be earthed. Use the supplied power cord or an appropriate replacement. Make sure that the instrument is plugged into an outlet socket with a protective earth contact.

Ensure that the AC supply is correctly connected to the instrument's power receptacle. For line power in the range 100 to 240 V~, 50 to 60 Hz, the PSU automatically selects the appropriate range.

No manual voltage-range selection is provided.

Class 1 product

As defined in IEC/EN 61010-1, a Class 1 product contains basic insulation between live parts and exposed conductive parts such as the metal enclosure. Exposed conductive parts are connected to ground by a conductor. If a fault occurs and a live part contacts the enclosure of the product, a current flows in the ground conductor, tripping a protective device.

Category II supply

As defined in IEC/EN 61010-1, a Category II supply is a supply circuit for domestic or digital devices that may include transients with an average value; for example, a power supply suitable for household appliances and portable tools.

Pollution degree 2 environment

As defined in IEC/EN 61010-1, a pollution degree 2 environment is one in which normally non-conductive pollution occurs, but occasionally a temporary conductivity caused by condensation must be expected.

Disconnecting device

The detachable power cord is the instrument's disconnecting device, but if the instrument is integrated into a rack or system, an external power switch or circuit breaker is required.

Whatever the disconnecting device, make sure that you can reach it easily and that it is accessible at all times.

Use only an approved power cord no more than three meters long.

On/off switch

The on/off switch on the front panel does not isolate the instrument from the supply. Remove the power cord from the socket outlet to isolate the instrument.

To turn the instrument on, ensure that the power cord is inserted into the power supply receptacle on the rear panel. Then press the front-panel on/off switch. The instrument starts up Windows®. After that has loaded, the instrument automatically loads the SVA software and displays the signal analyzer screen.

AC fuses

The fuse-holder is integral with the 3-pin supply receptacle on the rear panel. To change the fuse, remove the power cord and then use a screwdriver to lever out the holder.

For the AC voltage range of 100 to 240 V, the fuse rating is T3 15AL250V.

One fuse is fitted, in the live line of the supply (see Precautions). It is a glass cartridge type, measuring $5\,mm \times 20\,mm$.

Replace a fuse only with an approved fuse of the same type and rating.

The plug attached to the power cord is fitted with a 5 A fuse also (in the UK only).

External equipment

Connect only equipment complying with the relevant IEC safety standards to the connectors on the instrument, in order to maintain the protection provided by the instrument.

To minimize electromagnetic interference (EMI), follow the following recommendations:

- Do not use connecting cables longer than 1 m.

- Use double-screened cables where possible.

Goods-in check

The following goods-in check confirms only that the instrument is functioning correctly. It does not verify conformance to the specification given in the data sheet.

1. Ensure that the correct fuse is fitted and that the supply is in the range specified on the data sheet.

2. Connect the instrument to the supply.

3. Press the on/off switch on the front panel. The instrument starts up and displays the vector signal analyzer menu.

4. If the instrument appears to be completely dead, do the following:

    Check that the power cord is providing power to the instrument.

    Check that the instrument's fuse has not blown.

Powering up

1. Plug the power cord into the supply socket and the power supply receptacle on the rear panel.

2. Press the <u>on/off switch</u> on the front panel. The instrument starts up, first loading Windows®, and then the SVA application.

Allow 10 minutes' warm-up time for the instrument's circuits to stabilize.

Power-on settings

Touch the Config button (on the <u>menu tab</u>)...
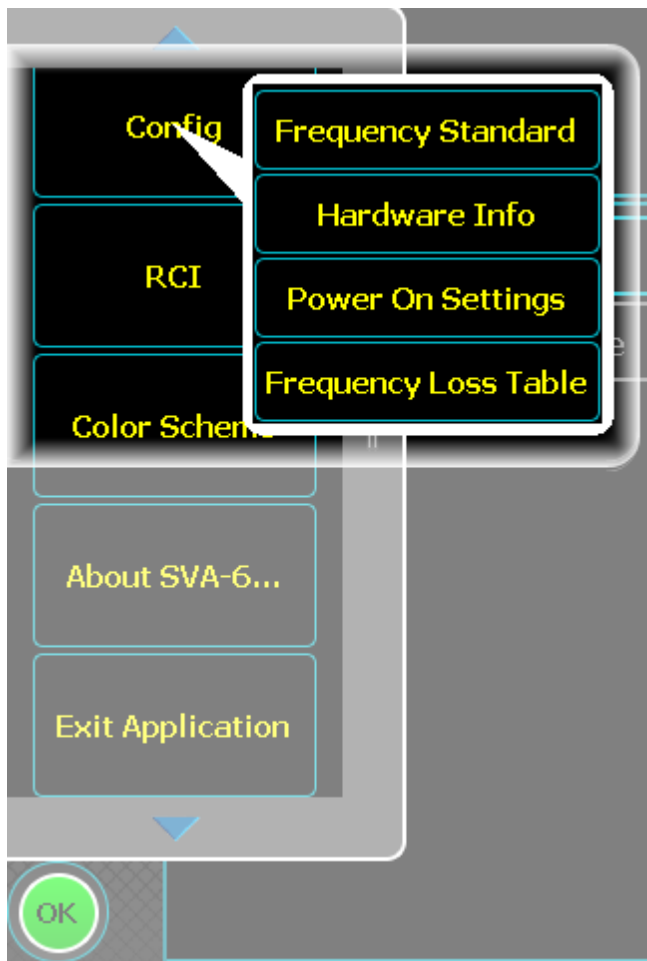
...and select Power On Settings from the drop-down menu.

From this screen, you can:

- Define whether the instrument starts up in the factory default setting, the last used configuration, or in a configuration saved in memory

- Define which memory location is used.
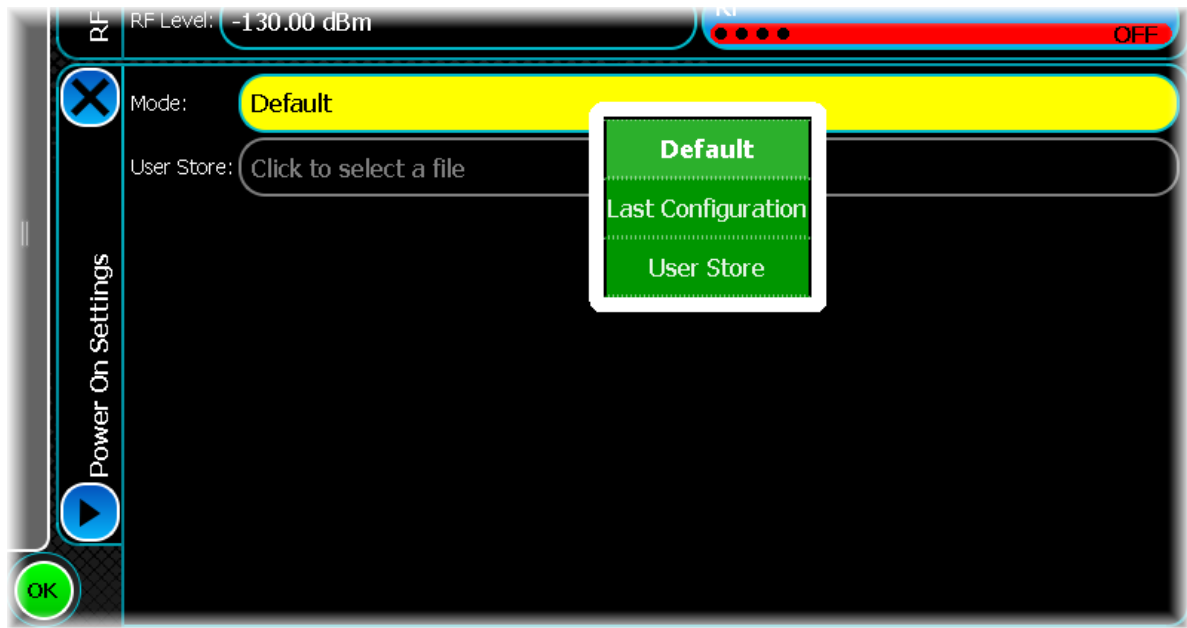
Mode

Touch Default to make the instrument start up with the factory default settings.

Touch Last Configuration to make the instrument start up with the settings used the last time it was powered up.

Touch User Store to make the instrument start up with previously stored power-on settings from the selected user store.

Factory default settings

The instrument reverts to the factory default settings at power-on (unless you have stored a different power-on memory location).

Getting started

This chapter introduces you to the instrument's controls and connectors.

Front panel
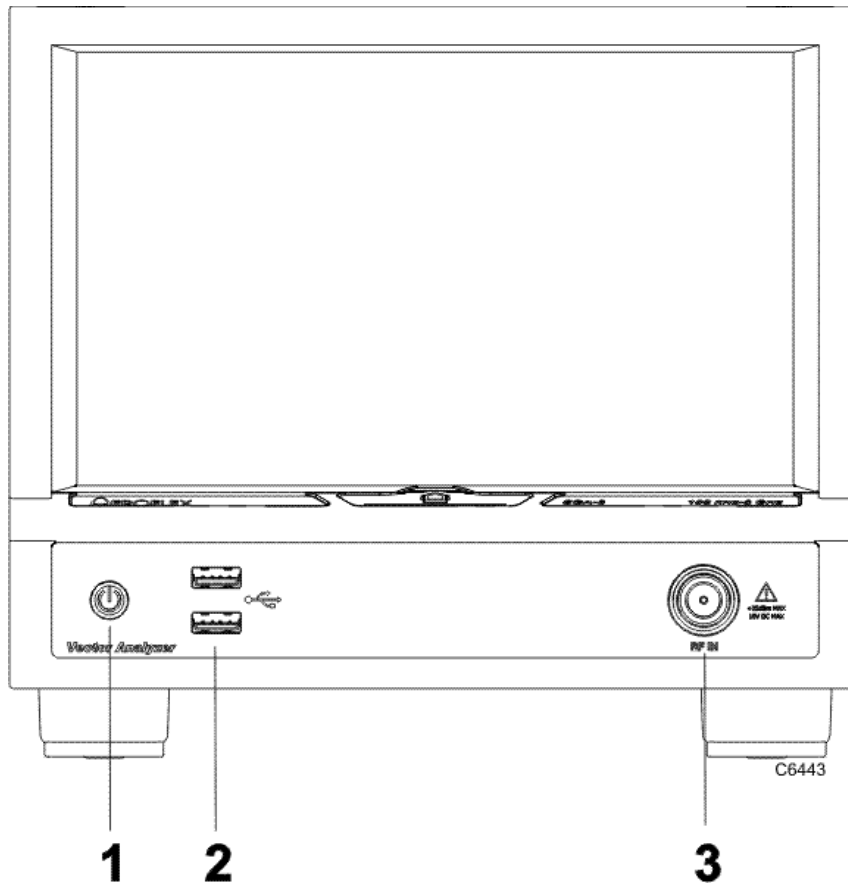
Front panel

See the data sheet for all available options.

1	On/off switch	Activates the instrument using a press on, press off action.
		Note: to completely remove AC line power from the instrument, you must disconnect the power cord.
2	⟲⟲	Dual USB 2.0 socket. Used to transfer memory stores or other files, or to connect a mouse or keyboard.
3	RF IN	50 Ω N-type socket. Signal input.

Rear panel
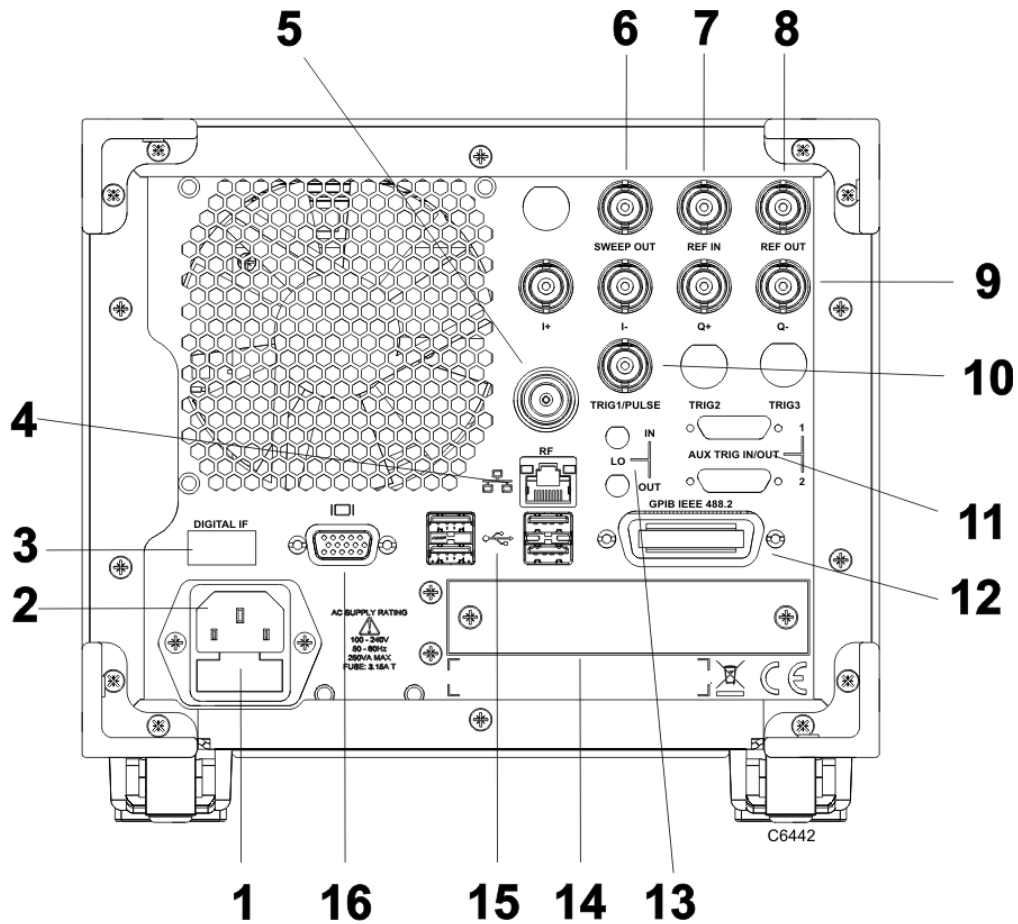
Rear panel

1	Fuse holder	Contains 5 x 20 mm AC line fuse.
2	Power supply receptacle	3-pin IEC C14 filtered panel-mounted male power inlet.
3	Digital I/O	Infiniband connector for IF or IQ 16-bit LVDS data via Aurora interface.
4		Ethernet connector for LAN (local area network), UUT (unit under test), inter-S-Series system connections.
5	RF	**Option 007 only.** 50 Ω N-type socket. The RF input is moved to the rear panel.
6	SWEEP OUT	50 Ω BNC socket: generates 0 to 10 V when the analyzer is sweeping.
7	REF IN	50 Ω/100 kΩ BNC socket: accepts reference frequency of 10 MHz at 200 mV to 2 V RMS.
		Damage level: -0.5 V/+3 V.
8	REF OUT	50 Ω BNC socket: 10 MHz at 2 V p-p into 50 Ω.
		Damage level: -0.5 V/+3 V.

9	I+, I-, Q+, Q-	For future use
10	TRIG/PULSE	50 Ω BNC socket (TTL/CMOS): accepts an external trigger.
11	AUX TRIG IN/OUT	For future use.
12	GPIB IEEE488.2	24-pin socket accepts a standard GPIB connector to allow remote operation of the instrument.
13	LO	For future use.
14	Removable hard drive	**Option 005 only**. Removable serial ATA 80 Gbyte 2.5 inch drive. Can be used to store instrument settings for removal to a secure area.
15	⌥⛛	Four USB 2.0 sockets. Used to transfer memory stores or other files, or to connect a mouse or keyboard. Also provide electrical connections between multiple S-Series modules.
16	▯▭▯	15-way D-type for connecting a VGA monitor.

Using a keyboard and mouse

You can use the instrument with or without keyboard and mouse (see Touch!).

If you are using keyboard and mouse, they need to be USB compatible. Plug them into the USB sockets on the front or rear panel.

If you are using the instrument without keyboard or mouse, you can access all Windows® functions through your fingertips. To access Windows, close down the SVA software by touching the Exit Application button on the menu tab, as explained in Accessing Windows.

Note: connecting a mouse and/or keyboard may compromise the EMC performance of the instrument.

Touch areas on the screen

Touch!

In this document, when we use the term 'touch', it describes the action of touching lightly on an area on the screen with a finger
or
clicking on that area with a mouse.

Similarly, 'double-touch and 'drag' are familiar terms that work equally well for mouse or fingertip.

Touch areas on the screen

How the screen is laid out

This is a typical SVA screen, which is divided into a number of functional areas:
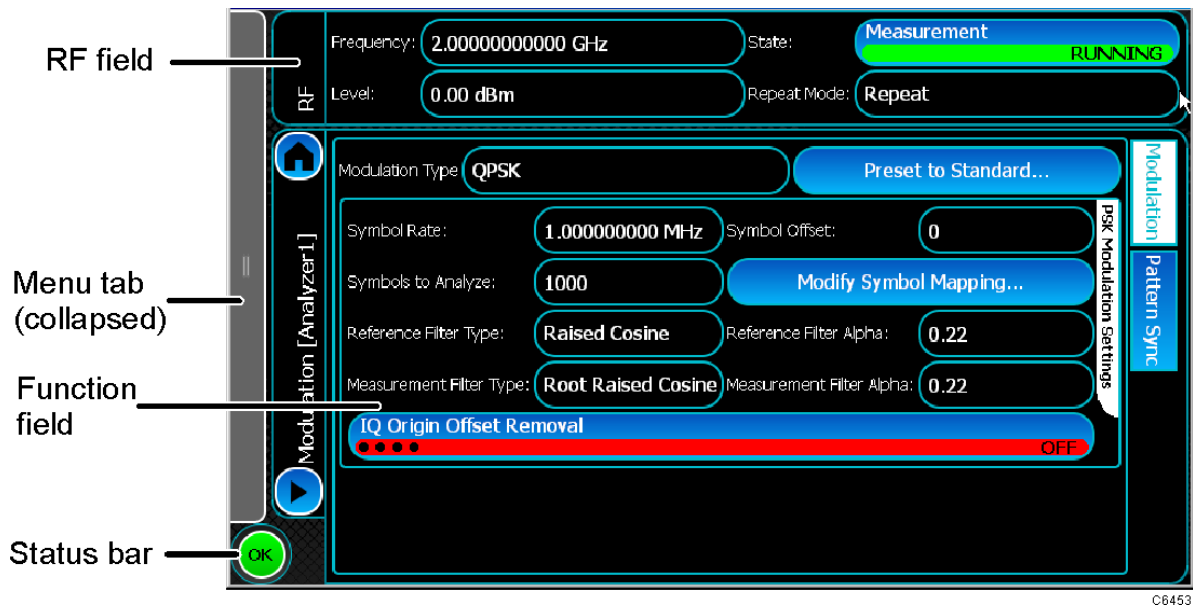
Typical screen layout

RF field

This displays the current RF frequency and RF level settings, and lets you change them using the popup keypad and slider. You can also start and stop the capture, and set its repeat mode.

Function field

In this field, you set up the analyzer to perform spectrum analysis, digitization or vector analysis of cellular or general purpose analog and digitally-modulated signals.

button

Within any analysis screen, the Home button takes you back to the initial (Results) field.

▶ button

Touch the ▶ button to display a list of analysis functions, from which you set up each aspect of the measurement to be performed.

This list is available within each modulation analysis scheme, and displays screens specific to the type of measurement you are currently displaying

Results

RF

Modulation

Spectrum

General

Control

Triggering

Burst Location
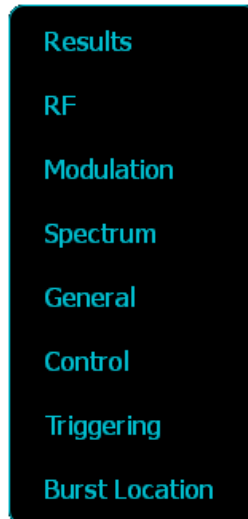
Status bar

Touch the *Status* button ⊗ to see the current state of subsystems such as the frequency standard. Some error messages are displayed here.

Menu tab

The menu tab contains all the system functions. It is normally collapsed in order to maximize the available space on the screen. Touch anywhere on the border of the menu tab to expand it:
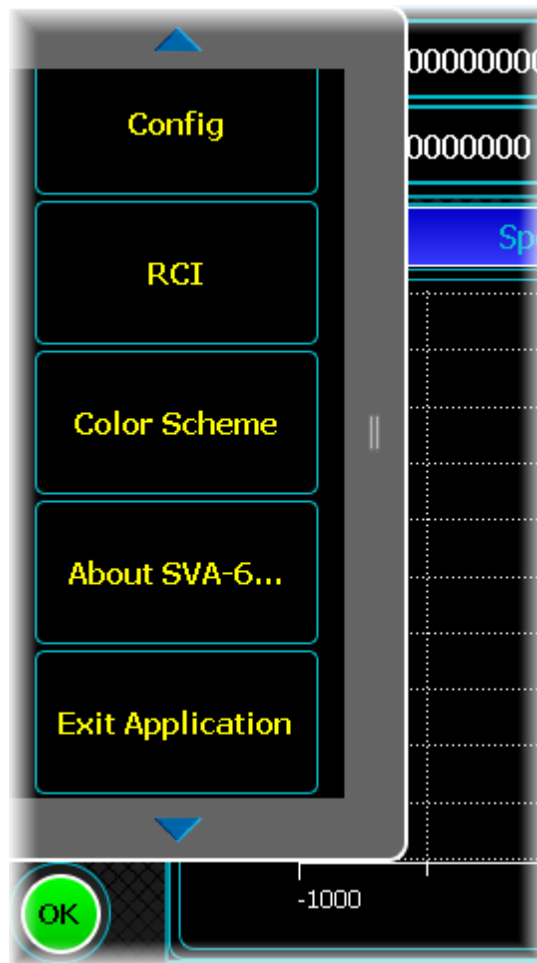
The menu tab does the following:

Store/Recall saves and recalls instrument settings.

Analyzer1... shows the analysis mode.

Config provides access to information about the frequency standard, hardware, power-on settings, available options, and RF level offsets.

RCI provides access to the remote control interface.

Color Scheme selects how the screen is presented, for higher visibility where required.

About... provides details of the instrument and its software.

Exit Application closes the SVA application.

Popups

To ensure that the screen is not cluttered with unnecessary information, the instrument displays a popup keypad, and sometimes a slider adjustment, that overlay the fixed window layout when numeric entries are required.

Popup keypad

In this example, the popup keypad lets you enter a new value of frequency. There are similar popup keypads for power level and voltage entries.

Popup keypad

Popup keypads are overlaid on the main window. They have a standard set of features:

- ![delta button] button. Defines the size of a [frequency or power step](#).

- ![slider button] button. Shows or hides the popup [slider](#).

- Clear button. Clears the current displayed value.

- BKSP button. Deletes the last entry.

- Cancel button. Closes the popup window without making any changes.

- X button. Closes the popup window.

Enter and confirm value

Enter the value required. The entry is confirmed when you touch the units key.

Step button

When you touch the step button on a popup keypad, the 'Edit Step' dropdown menu appears.

Use this to:

- set the size of up/down step increments

- quickly change a displayed value using the step up/down arrows.

1. Touch Edit Step. The title at the bottom of the keypad popup changes from Numeric Entry to Step Entry to show that you are in Edit Step mode.

2. Now enter the step size, and terminate with a units key.

3. The popup keypad reverts to Numeric Entry.

4. Now touch the step button to use the up/down arrows

Slider

For all numeric entries, there is also a slider adjustment.

- The slider provides fast adjustment of a parameter. It consists of a high- and a low-resolution slider (as shown below). Drag the sliders with your fingertip to change the value.

Slider adjustment

Use the /10 and x10 factor buttons to increase or decrease the resolution of the sliders. To see how this works, set the top slider to maximum resolution (touch /10 repeatedly) and the lower slider to minimum resolution (touch x10 repeatedly). Now drag the lower slider. You can see that it acts as a vernier scale for the upper slider, which moves accordingly.

Error messages

System errors

System errors display because of an error notified by the system logic — for example, a failure to locate a training signal. A popup error message displays the information:
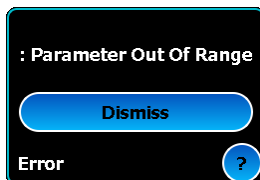
Touch Dismiss to clear the message popup. If another error occurs while the popup is visible, it shows that other system errors have been logged:
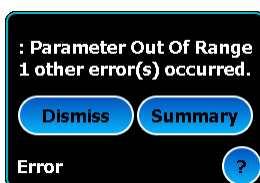
To see logged system errors

Touch Summary on the popup error message

or

Expand the status bar by touching the button. Touch the status bar to display the summary of logged system errors:
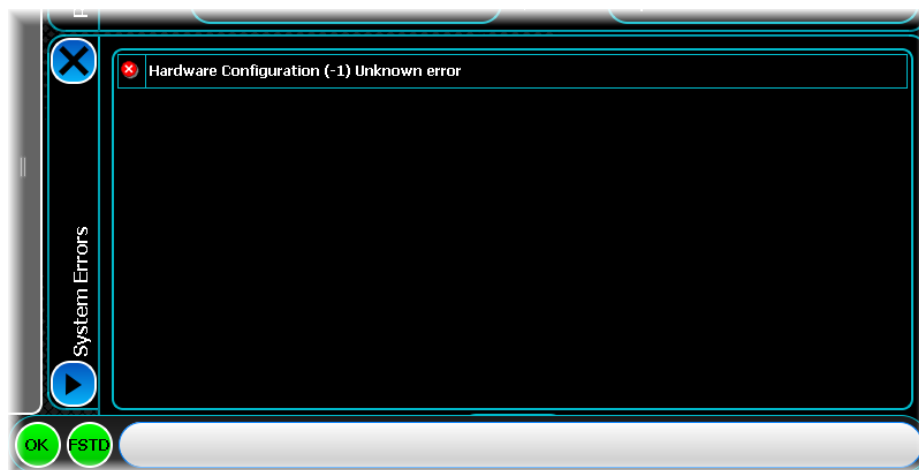
The summary provides a record of all errors that have occurred since the instrument booted. It can be erased only by re-booting the instrument.

Severity

Symbols in the column to the left of the error descriptions show the severity of the error. A red background shows the error is severe; a green background shows that the error is minor.

UI errors

UI (user interface) errors are less severe than system errors — for example, a UI error might occur if a frequency value is entered that exceeds the allowed range:

Error: Value is greater than maximum limit : 10.000000 MHz

Frequency standard errors

If the frequency standard experiences a fault — for example, a failure to locate an external signal — the button becomes red and an explanatory popup message appears. Touch the popup to dismiss the message.

Analyzing signals — common procedures

Many configurations and procedures are common to the analysis of the different modulation schemes of which the SVA is capable. This section covers these common items:

Two measurement windows: displaying two measurements side-by-side.

Results: viewing and printing traces resulting from analysis. Includes information on zooming the trace and adding markers.

RF parameters: set up RF carrier and level.

Capture: starting and stopping measurements.

Control: determine how measurements start and stop, and set up statistical calculations.

Triggering: specifies common triggering parameters.

Spectral mask: defines a mask that can be applied to the spectrum trace.

Frequency standard: defines the source and impedance for the frequency standard.

RF level offsets: compensate for losses and gains introduced into the signal path between the instrument and the unit under test.

Analysis measurements

The SVA makes any of the following parametric measurements:

Spectrum Analysis

1xEVDO Reverse Link

Bluetooth

CDMA 2000 Reverse Link

Generic

GSM

LTE TDD

LTE FDD Uplink

TD-SCDMA (3GPP TDD-LCR)

UMTS Uplink

Wireless LAN

Two measurement windows

The instrument can display either one or two measurement windows. You can open and close the windows and manipulate their size using simple touch operations.

Creating a new measurement window

A single window displays (part of) a blue circle at the right-hand side. Use this blue circle to create a new window and manipulate the relative sizes of the windows.

Create a new measurement window by dragging the blue circle inwards. As you do so, a new area is created, highlighted with a red border:
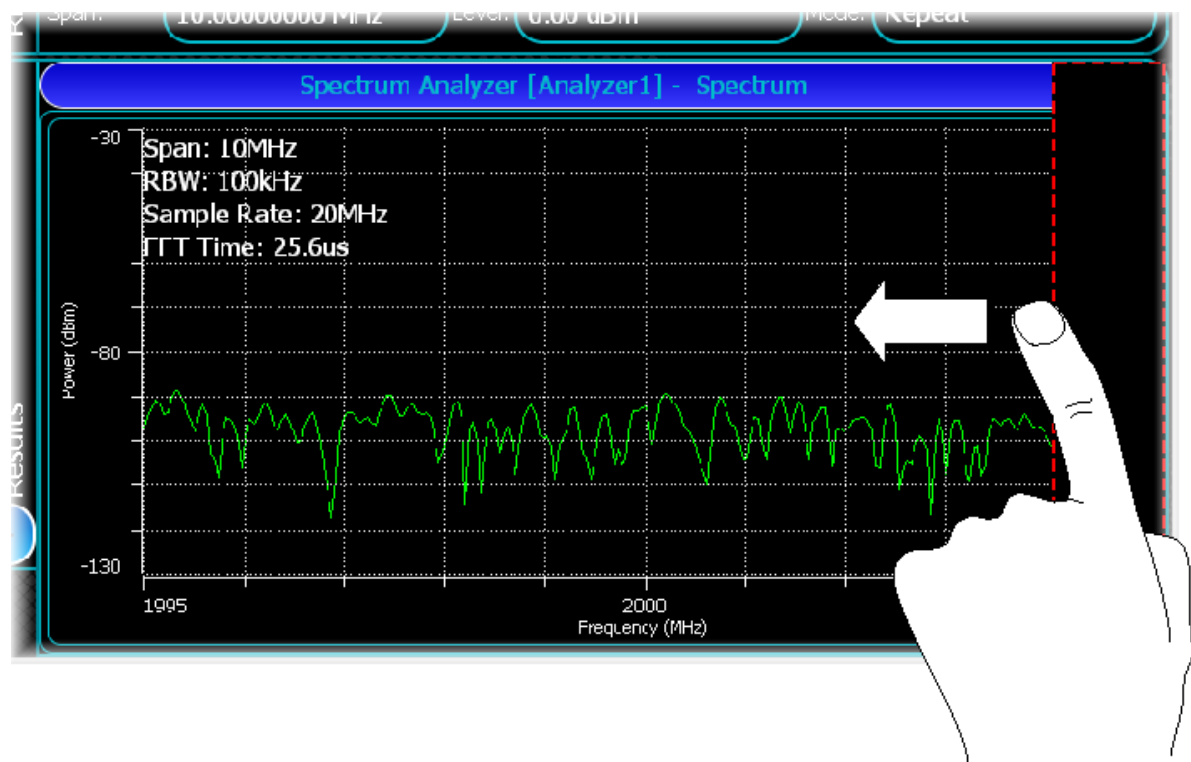
The red border indicates that the area is not yet large enough to create a new window. If you release your finger at this point, no new window is created.

As you drag further, the border changes to green. At this point, releasing your finger creates a new window:
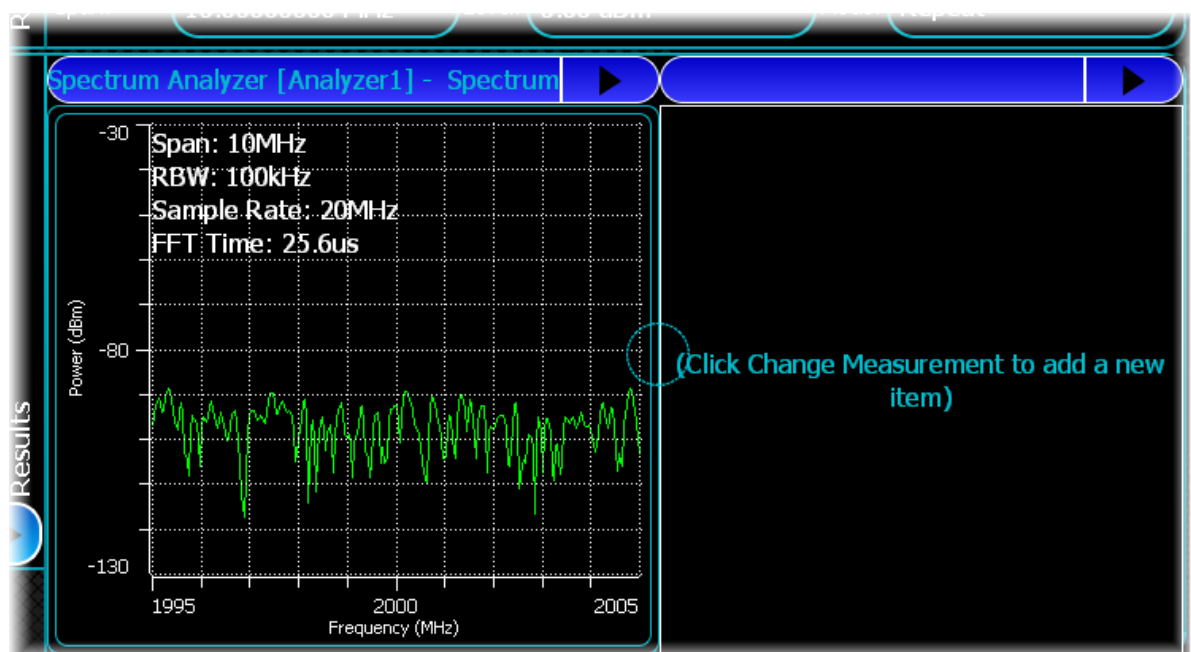
Touch within the new window, or the button on the title bar, to choose which measurement to display.

Resizing measurement windows

Drag the blue circle to adjust the relative size of the two measurement windows:
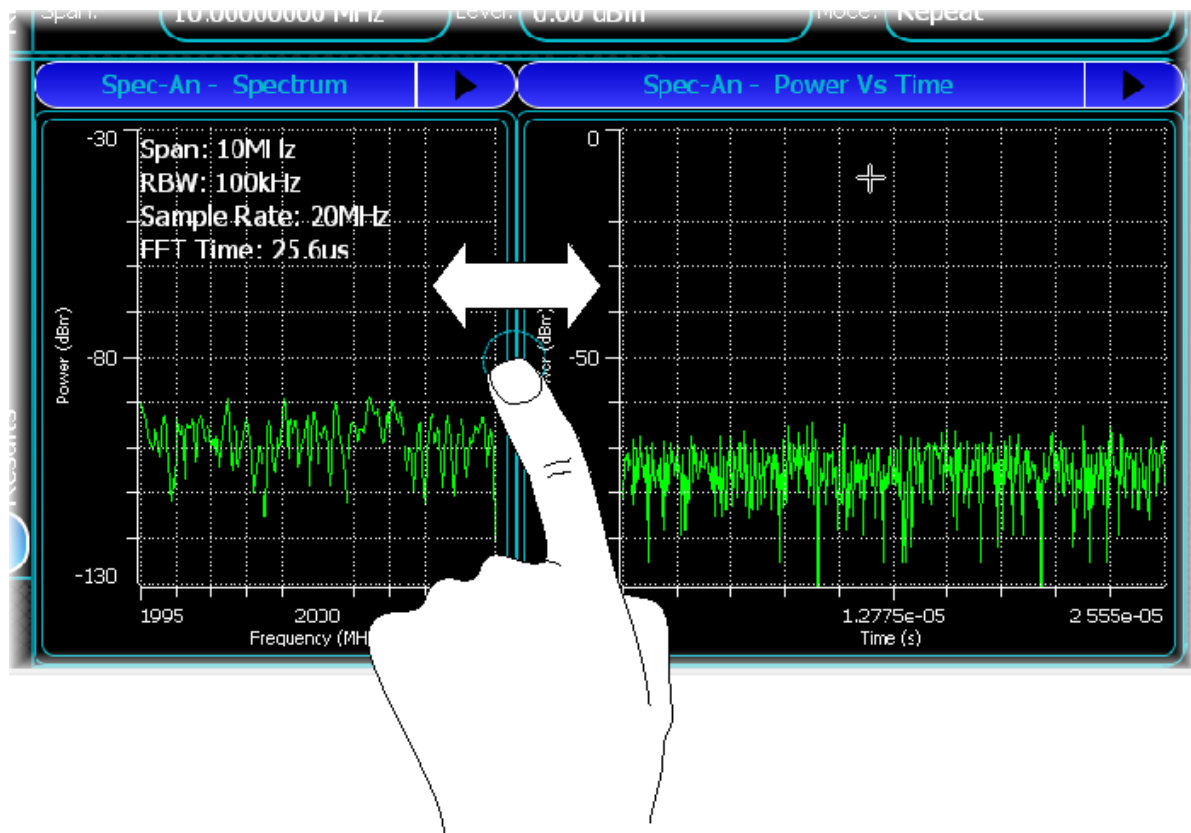
As a window reduces in size, axis, graticule and marker information may disappear to ensure that the trace remains meaningful. This information reappears as the window increases in size.

Auto-sizing

To auto-size two windows, double-touch on the blue circle between them. The windows adjust to the same size.

Removing a window

Reduce the size of the window by dragging the blue circle. When it becomes very small, the reduced window displays 'Remove Column':
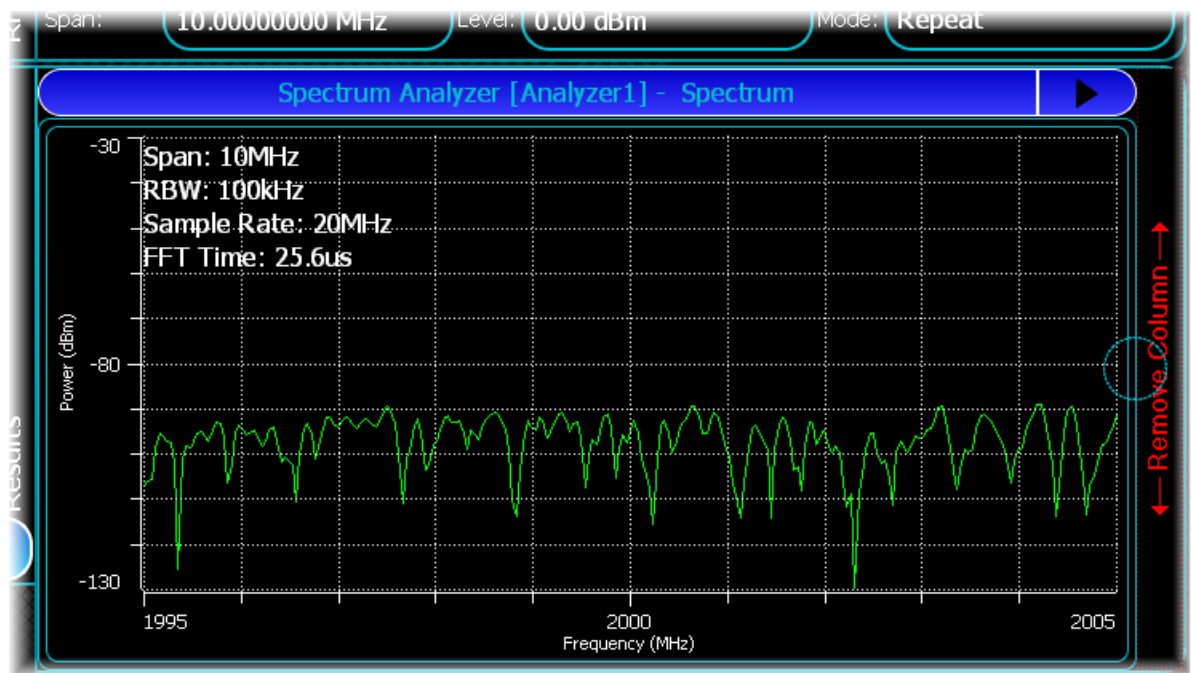
At this point the window has not been permanently removed, and you can use the blue circle to drag the column back to display the window again.

Alternatively, touch the column to remove it completely.

Maximizing a window

You can maximize a window that is currently showing a valid measurement. Double-touch on any part of the window, which expands the window to fill the screen.

Double-touch the maximized window again to return the measurement to its original size.

Note: the blue circle is absent when a window is maximized.

Results

Most modulation types let you display the resulting measurement information in a graphical format. This section describes the common functionality of the graphical output window.

The spectrum analysis modulation scheme is used as an example here, but the method of controlling and manipulating your graphical output is the same for most modulation types.

Results menu

This screen is common to many modulation types. It is displayed when you select Results from the button menu:
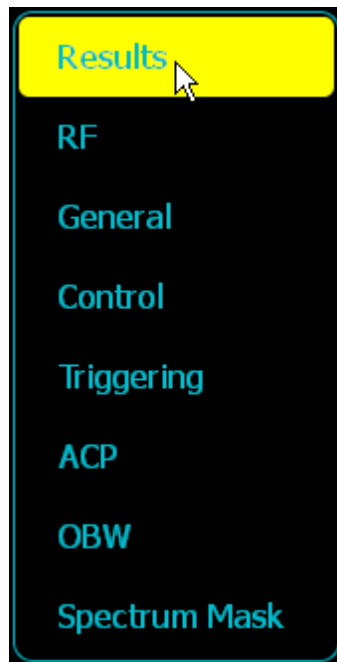
The Results screen displays a measurement title bar, from which you can access trace or text measurements, zoom controls and markers.

Measurement title bar

The measurement title bar shows the measurement currently being analyzed:

The title bar in each measurement screen has a button...
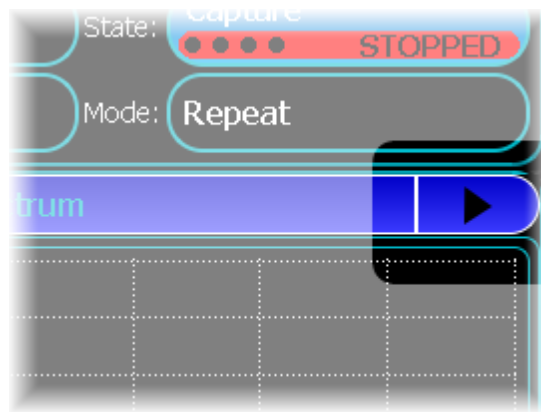
...that displays a drop-down measurement menu...
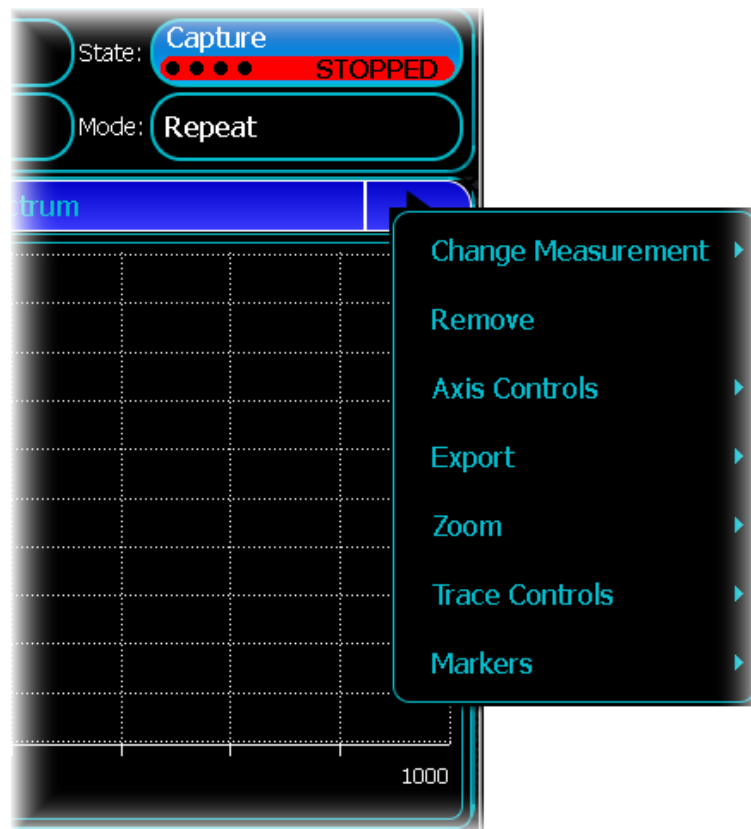
...that lets you change or modify the measurement and how it is displayed.

Most of the items on this menu are specific to the type of measurement you are currently displaying. There are, however, a number of common features for all measurements that are detailed here.

Change Measurement

Most modulation schemes support Trace Measurements (for displaying trace-based measurements) and Text Measurements (items that display a text-formatted output). Select Trace or Text, and then the type of measurement from the drop-down menu. See *Trace measurements* and *Text measurements* for details.
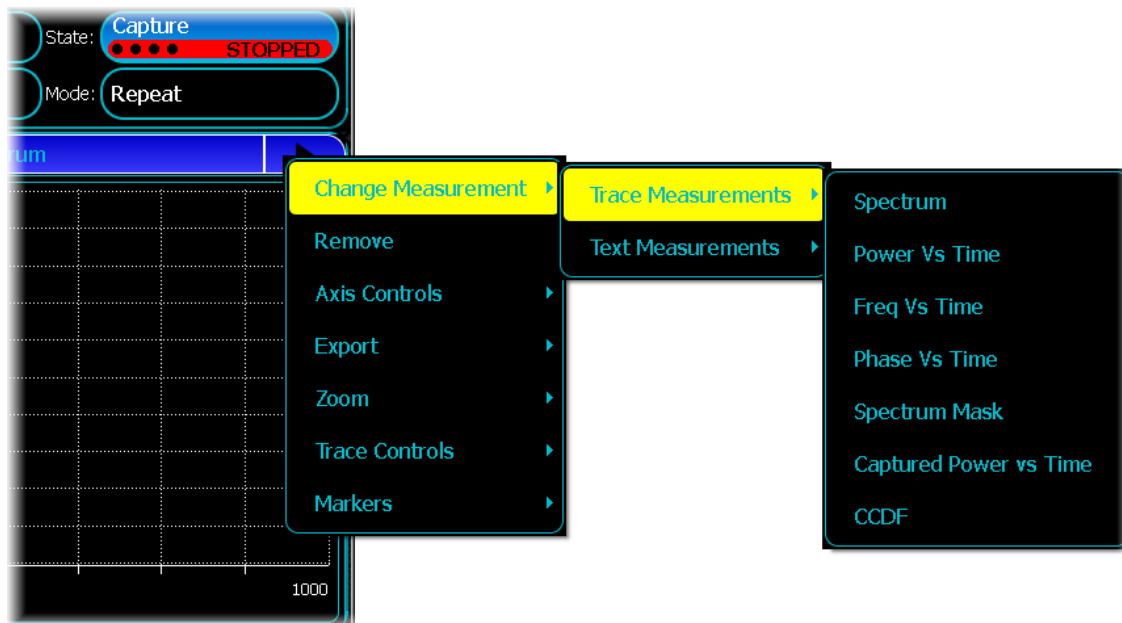
Remove

You may want to completely remove the active measurement. Do this by touching Remove on the measurement menu. This removes all measurements and returns the screen to a default configuration.

Axis Controls

Use this to change the units for the axes of the display.

Export

The instrument supports some standard export functionality for both trace and text displays. Access this by touching the Export option. The following options are provided:

Print

Print the current measurement to a local or network printer.

Copy image to Clipboard

Copy the current measurement to the clipboard as a bitmap.

Export as Bitmap

Save the current measurement as a bitmap.

Export as CSV

Save the graphical data shown in the current graph window to a CSV file.

Note: to maximize the speed of response, the trace may not show all the data that has been captured, and it may also not save all captured data.

Trace measurements

Trace measurement menus

You can enable trace controls by accessing the trace controls menu, either from the drop-down menu from the title bar, or from the context menu displayed by touching on the graph.

This is the context menu, which may have a slightly different structure to the main menu bar, but the options it contains are similar.
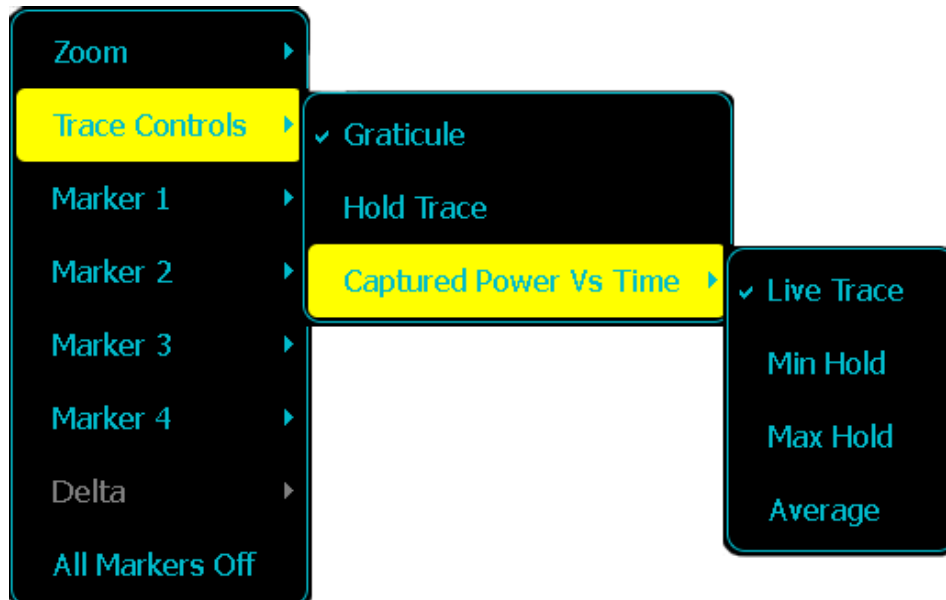
Trace Controls

This menu is where you change how a measurement is shown on the screen. This includes the ability to enable or disable sub-traces within the main area, as well as providing useful features relevant to the trace as a whole.

Graticule

This option lets you turn of the grid lines within the measurement graticule.

Hold Trace

This option lets you prevent any and all updates occurring to the measurements.

Captured Power Vs Time

Some measurements support statistics, so that you can change the trace from showing live data to showing an average of the incoming data, or holding maximum or minimum values.

Zoom

Zoom

Access the zoom control in two ways:

1   from the Results menu

2   touch the graph, and a contextual drop-down zoom menu appears:
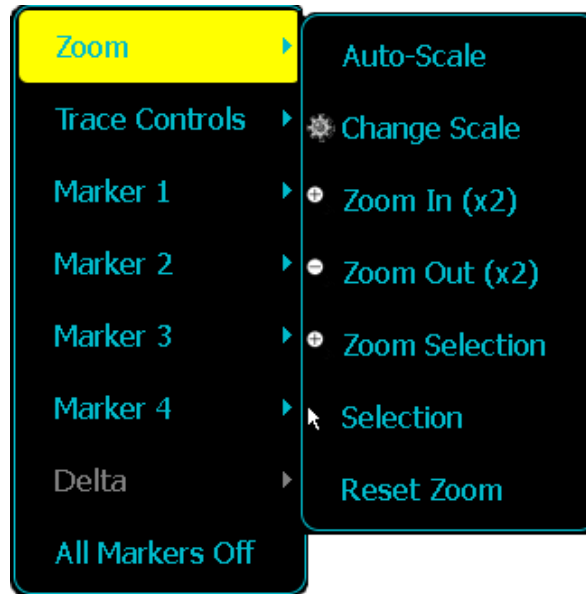
The zoom menu provides the following options:

Auto-Scale

This automatically scales the x and y axes to the nearest multiple of 1, 2, 5 or 10 that encompasses all the trace data. This auto-scaling includes measurement data only, and does not take into account limits or trace references.

Change Scale

Use this to change the x and y axis scales for a given graph.

This displays the scaling screen:

The way you specify the scale of the x and y axis depends on the type of data that the active graph is displaying. There are normally limits on the scales you are permitted to enter on this screen. These are generally dependent on the measurement that is being made. The different methods are as follows:

Centre, Span

Use this to specify a scale in terms of a frequency center point and a span.

Reference, Scale/Division

Use this to specify a scale in terms of a power reference, which is the maximum value of the display, and the value for each division of the graph.

Zoom in (x2)

Use this to zoom in by a factor of 2. For most situations, this applies only to the x axis, but if you are displaying a polar plot, this causes both x and y axes to zoom.

Zoom Out (x2)

Use this to zoom out by a factor of 2. For most situations, this applies only to the x axis, but if you are displaying a polar plot, this causes both x and y axes to zoom.

Zoom Selection

Use this to select and zoom in on a section of the graph. This magnifies the x and y axes together.

Select the option, and drag over the trace to select the region you want to expand:
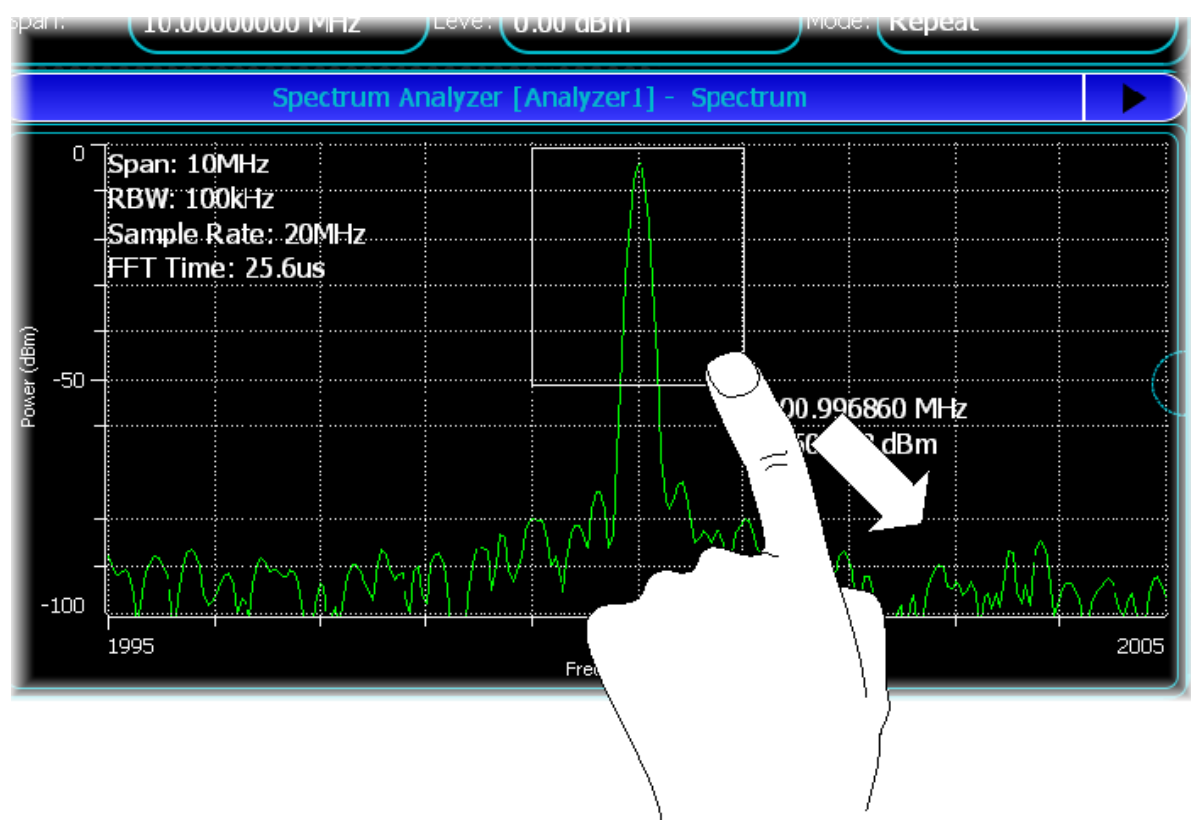
When you release, the graph is rescaled to show only the selected region:
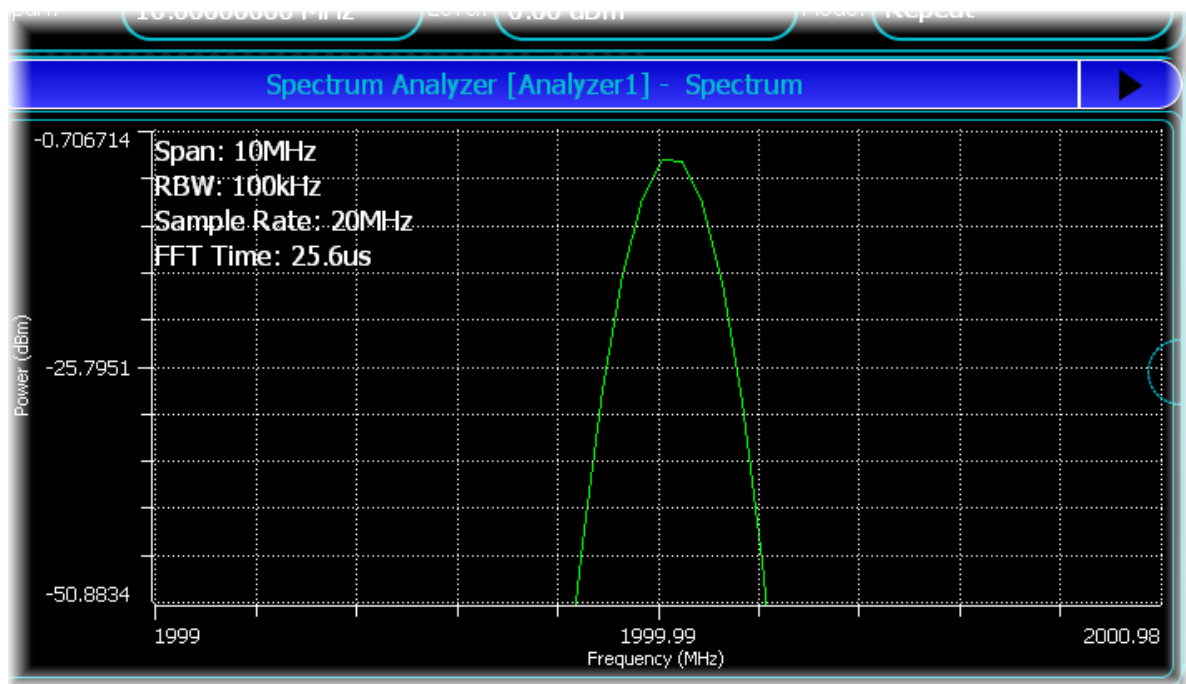
Reset Zoom

Touch this to restore the graph to its normal (not zoomed) size.
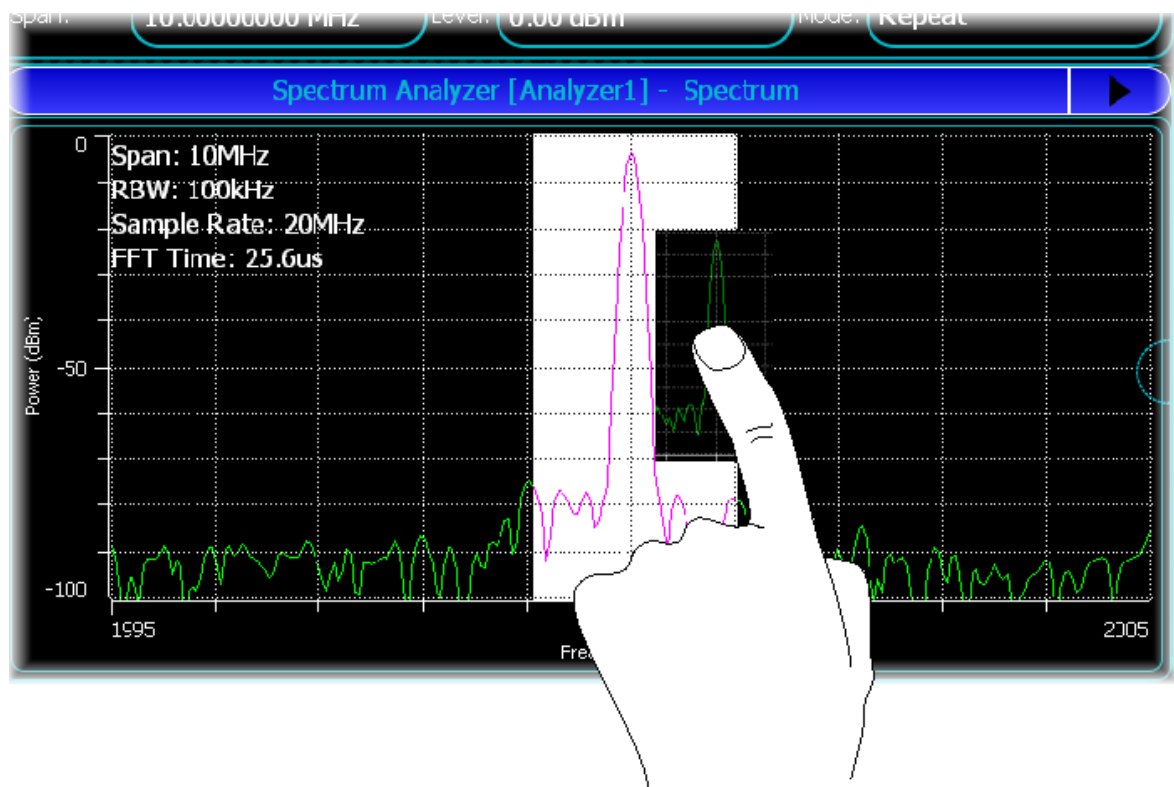
Selection

On most graphs, you can zoom the x axis only.

Touch and hold at the start of the region you want to select, then drag to the end of this region, and release.
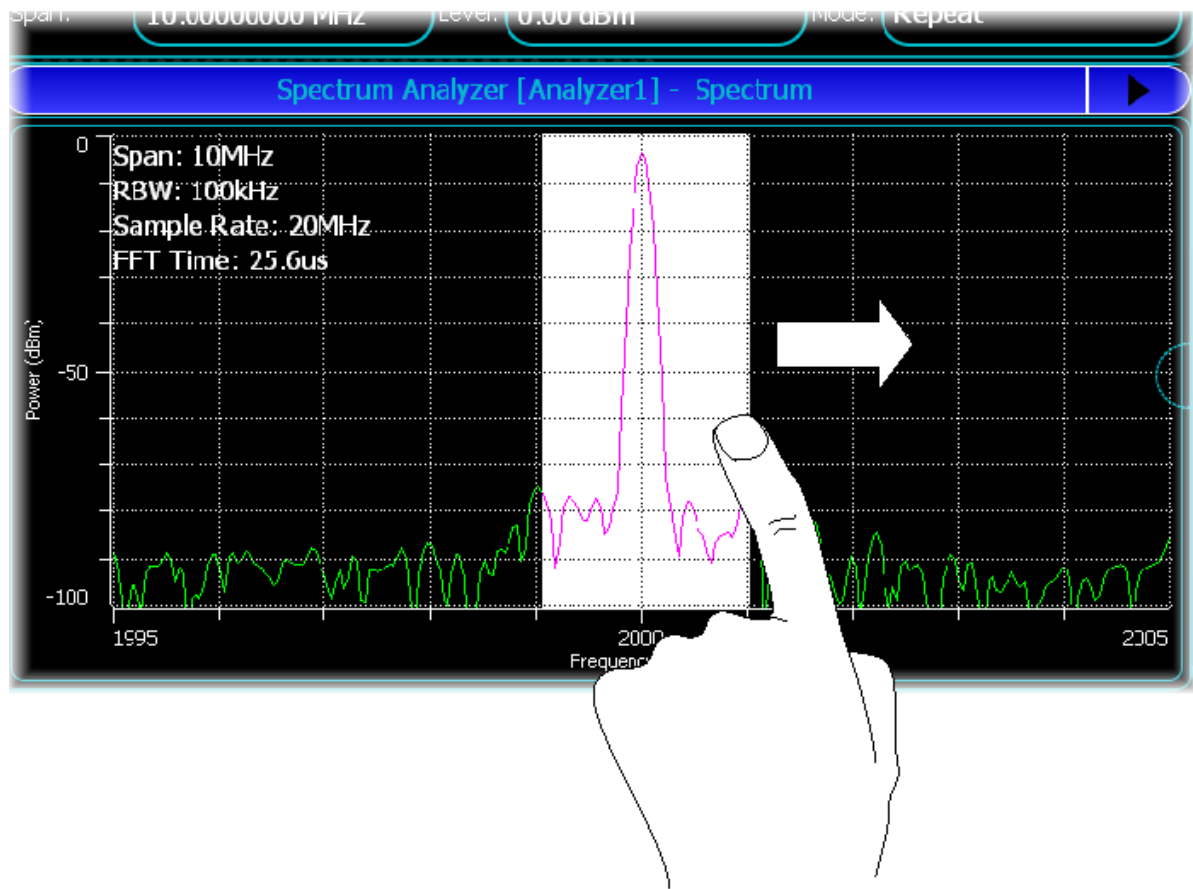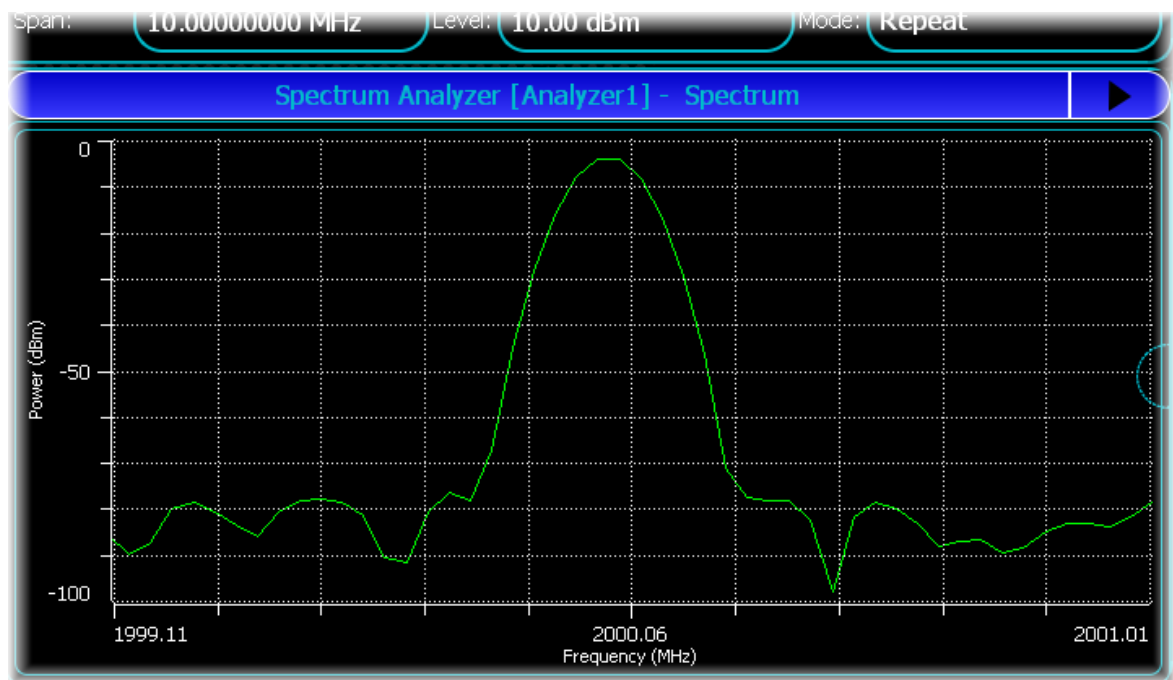
Now touch the selection again and drag it*. As soon as a miniature of the selected area appears under your finger...

...release, and the selected area zooms to fill the screen.

You can either drag within the current window, or to a different one (which can be a different measurement, but must be capable of displaying the units). You can select and drag any selection onto another trace that can work in the data domain of the original selection. So you can drag a selection from any trace that is displayed in terms of samples onto any trace that can process a selection of samples. It is not possible to drag a selection from a trace that is displayed in frequency onto a trace that is displayed in terms of time.

Use Reset Zoom to return the trace to its normal size.

Zooming using the axis

You can rescale the x or y axis by touch. This lets you move the upper or lower extent of the graph, or pan along the axis.

Moving the upper or lower bounds

Move the upper or lower bounds of a graph by touching the very upper or lower portions of the axes. This causes the cursor to change to the bar-resize icon:
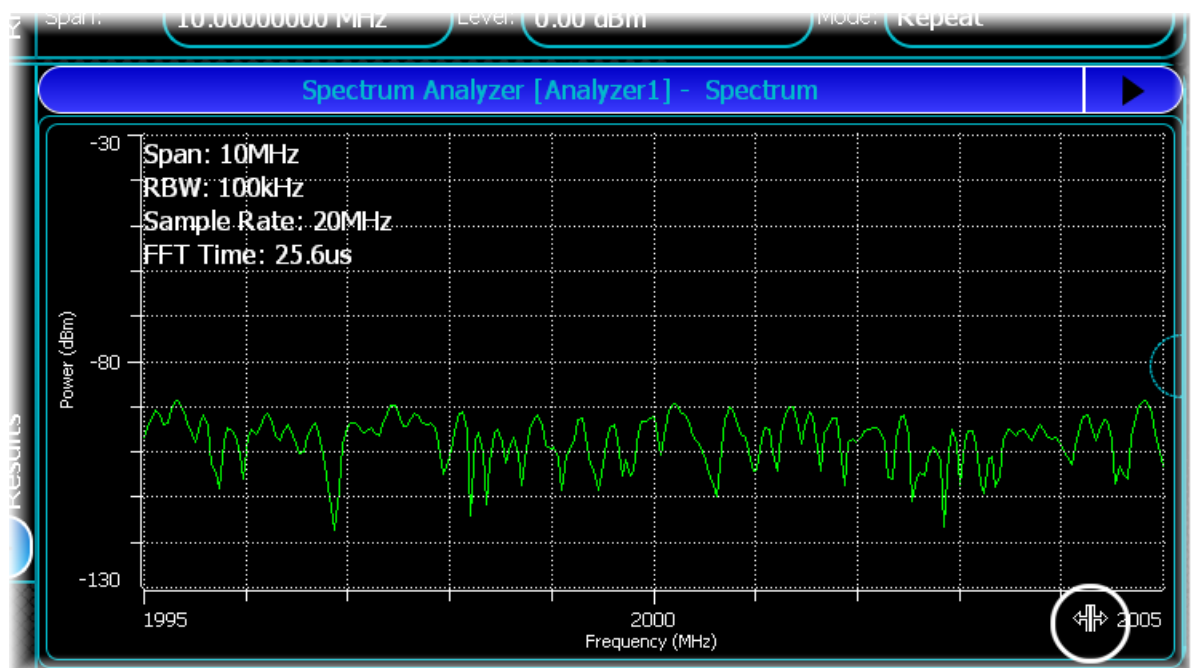
When this icon shows, you can drag to move the upper or lower position of the horizontal or vertical axis. As a visual aid, the graticule and any data contained within the graph immediately show the new scale.

Panning the axis

You can pan the graph. As you move your finger over the central region of the axis, if panning is available, the cursor changes to the movement cursor:
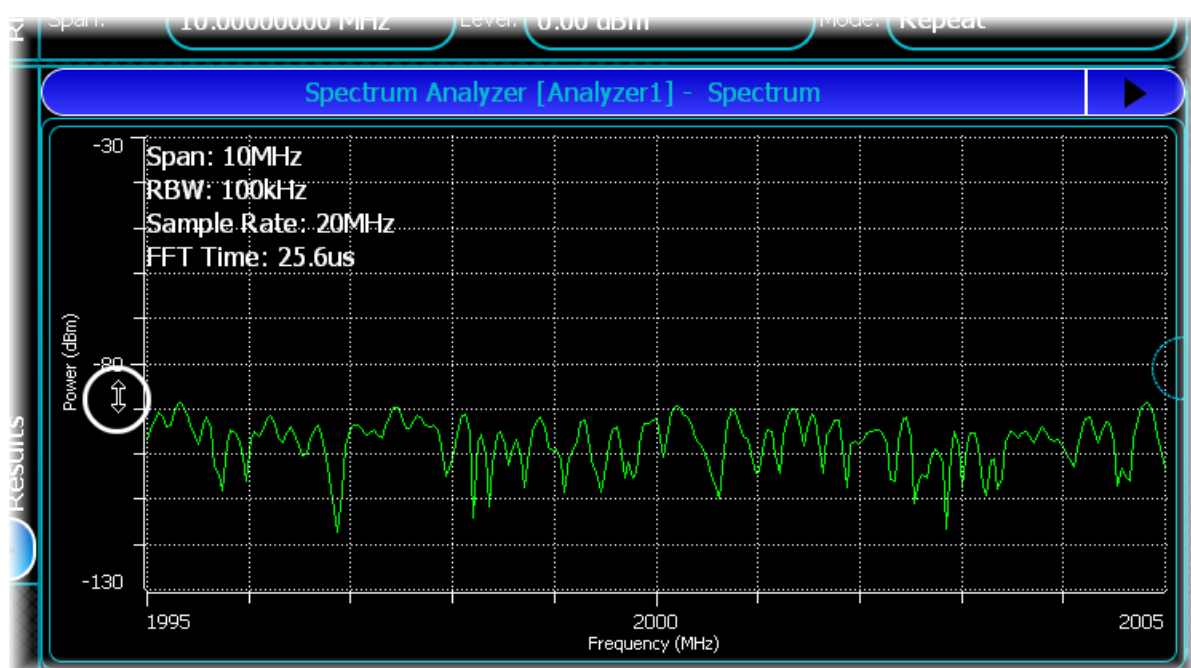
Then slide your finger along to pan the axis scale.

Sometimes it is not possible to move the axis; for instance if you are already displaying the maximum extent possible. In this case, moving the cursor over the centre section of the axis displays a 'not available' cursor:
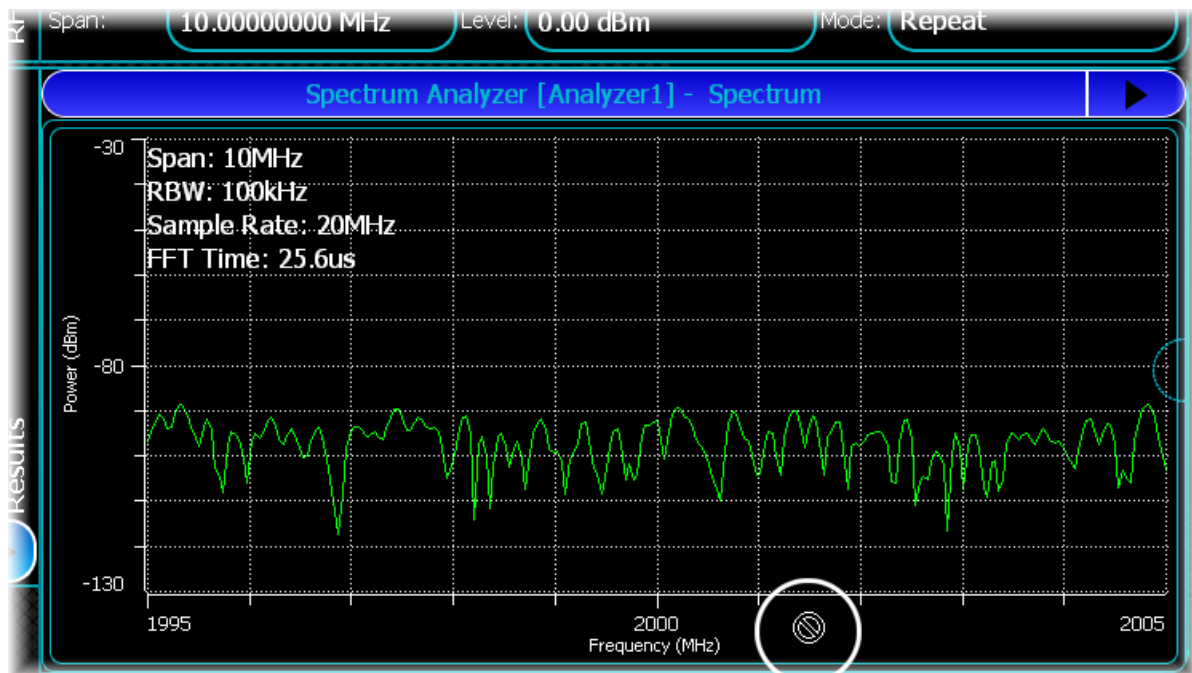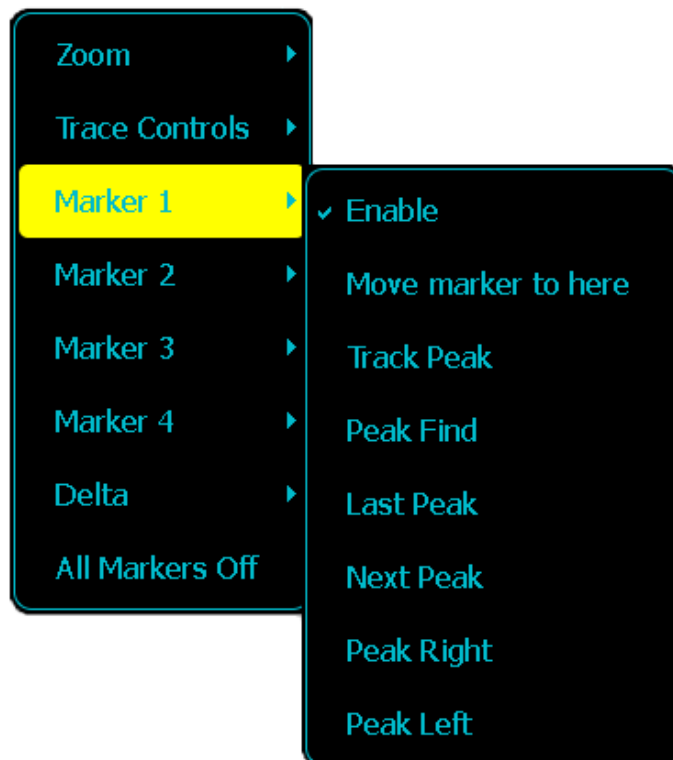

Markers

Most graphs support the ability to show up to four normal markers and one delta marker. These are accessible either from the drop-down menu from the title bar, or from the menu displayed by touching on the graph. The information for each marker, such as x and y values and delta values, is displayed in the marker table, which is located beneath the main graticule when any of the markers are ON.

Enabling a marker

You can enable a marker by accessing the marker menu, either from the drop-down menu from the title bar, or from the context menu displayed by touching on the graph.

From this menu, select the marker you wish to turn on, and then select the enable option from the menu. This enables the marker and places it on the screen. If you used the menu displayed by touching the graph, the marker is placed at the location that you originally touched.

You can enable up to four markers and a delta marker.

Move marker to here

This moves the specified marker to the location at which you initially touched the graph.

Track Peak

This enables the marker and moves it to the point with the highest value in the trace. For each sweep, the marker moves, to track the point with the highest value.

Peak Find

This enables the marker and moves it to the point with the highest value in the trace.

Last Peak

This moves the marker to the next highest peak above the current marker position.

Next Peak

This moves the marker to the next highest peak below the current marker position.

Peak Right

This moves the marker to the next found peak to the right of the current marker position.

Peak Left

This moves the marker to the next found peak to the left of the current marker position.

Delta

Manipulate a delta marker in exactly the same way as normal markers. The delta marker does not report any values itself, but the marker readout at the bottom of the screen changes to show the delta x and y values between any of the enabled markers and the delta marker(s). Because of this, a delta marker can be enabled only if another normal marker is enabled.

A negative frequency value indicates that the delta marker is at a higher frequency than the normal marker.

All Markers OFF

Removes all markers from the trace.

Moving a marker

As well as the standard marker functions described above, you can also drag the marker to the desired position. Touch and drag the marker to move it.

You can also use a keyboard's left/right arrow keys to move the marker:

Left/right

Pressing the left or right arrow keys moves the marker one sample to the left or right. In the case of x/y polar plots, left and right move the marker one data sample forwards or backwards.

Page up/page down

Pressing the page up or page down keys moves the marker 10 samples left or right. In the case of x/y polar plots, left and right moves the marker 10 data samples forwards or backwards.
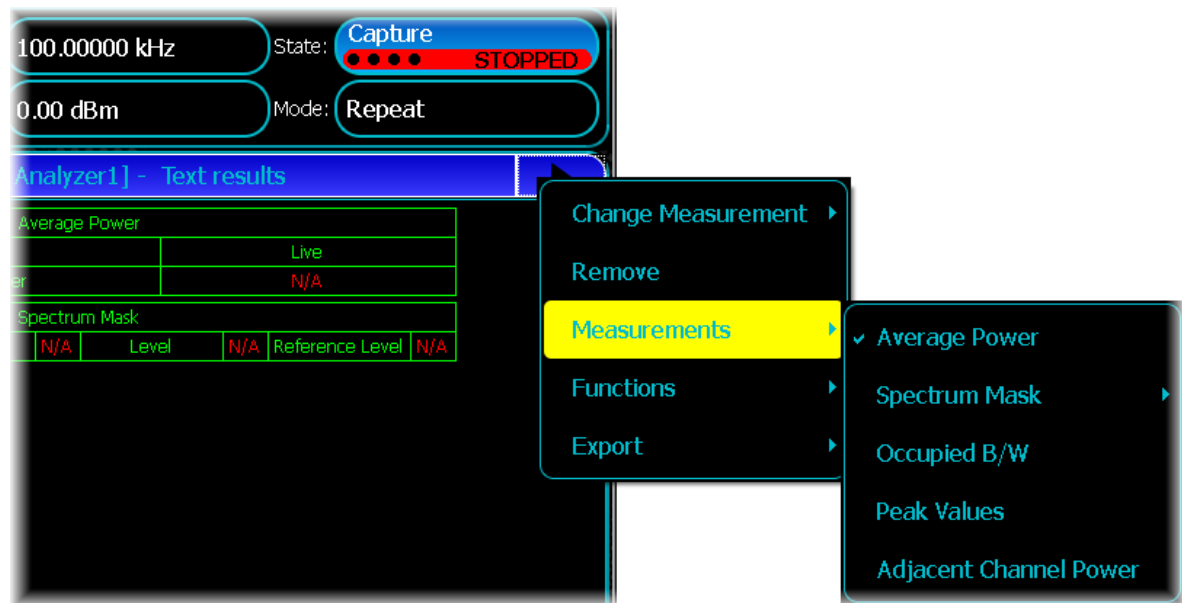
Text measurements

Most modulation types let you display measurement results in a text format using a standard text results panel. For details on what text measurements a modulation type can display, see the relevant modulation system in Analyzing signals.

Adding/removing measurements

As well as providing the standard measurement functionality that is common for all measurement windows, the text measurements panel provides the ability to add extra measurements onto the screen, or to remove existing items.

To do this, choose the item within the drop-down measurement menu:

This menu contains the text measurements that can be added to the screen. Select one of these options to add the item to the screen. Alternatively, if you wish to remove an item, un-check the item from the top menu.

In some cases, a measurement may consist of a set of other measurements. In this case, you are presented with a list of all the individual measurements that are supported.
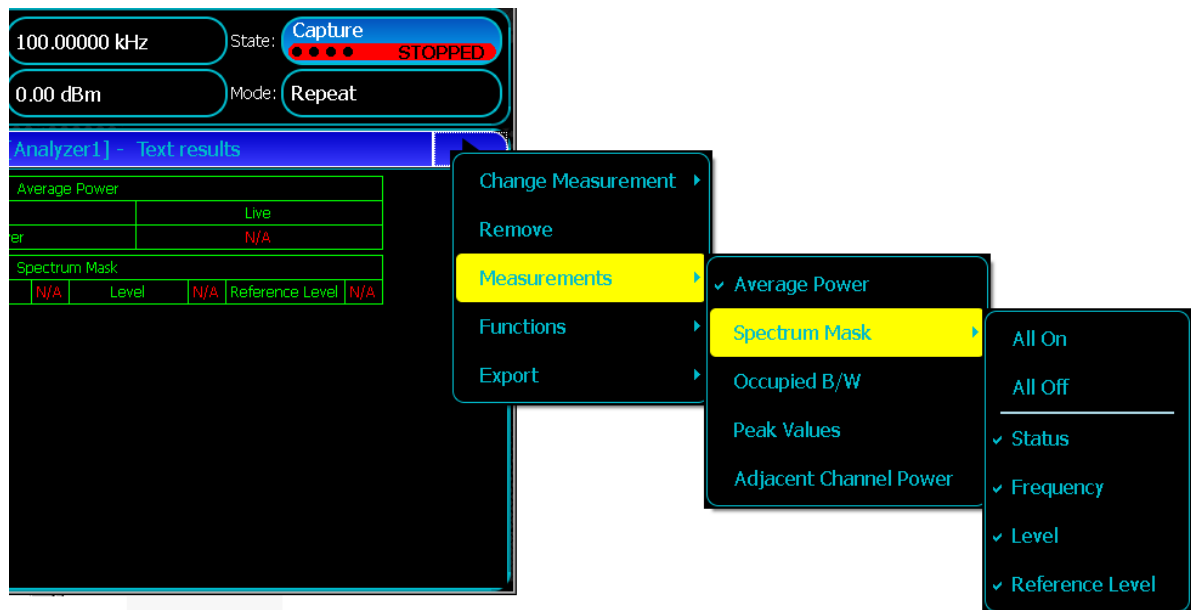

Touch the item you wish to show to enable individual items. Alternatively, you can select All On or All Off to turn all items on or off.

Text functions

Much like the trace display, the text display lets you turn on particular functions, such as Min Hold or Averaging. When a function is enabled, all currently selected text measurements that support this function and that are being displayed in this panel then display the new function, in addition to any functions already enabled.

To enable a function, touch the measurement display. Then touch the item you want to enable:
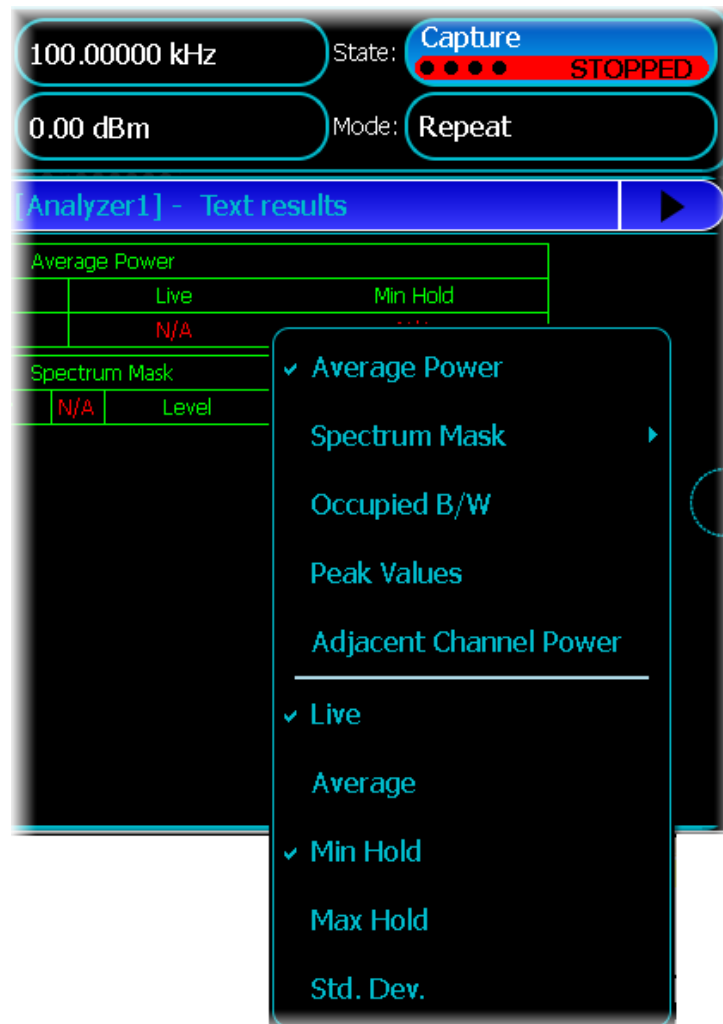
Once a new measurement is available, the text results window updates to reflect your selection

Note: N/A' in red text denotes that the particular measurement value is invalid, either because an error occurred during the measurement processing, or because there is no value available.

Some of the text measurements that can be enabled within the text display panel do not support some of the functions that can be enabled.

Exporting a text measurement

The instrument is able to export text. Touch Export from within the measurement menu.
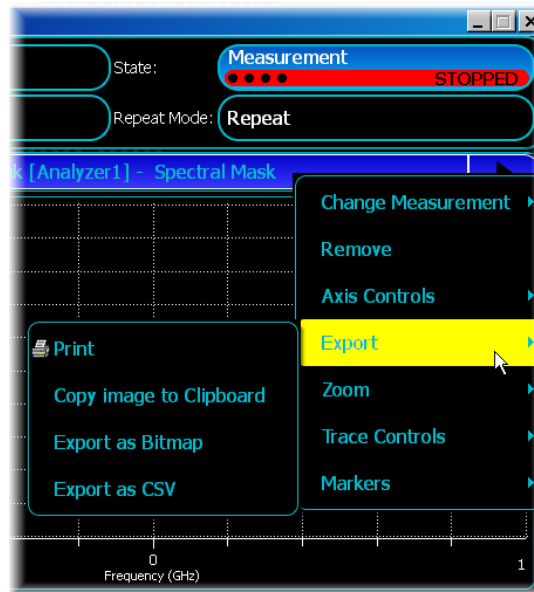
The following options are supported:

Print

Use this to print the current measurement to a local or network printer

Copy image to Clipboard

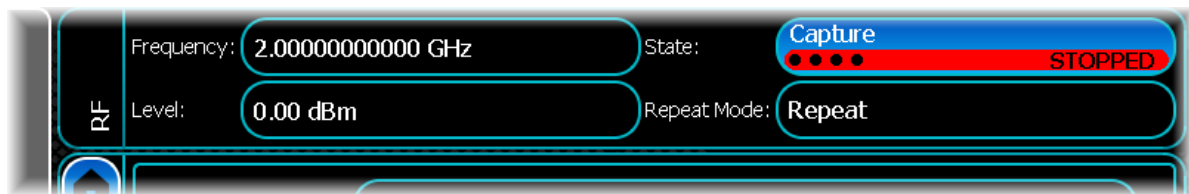Use this to copy the current measurement to the clipboard as a bitmap.

Export as Bitmap

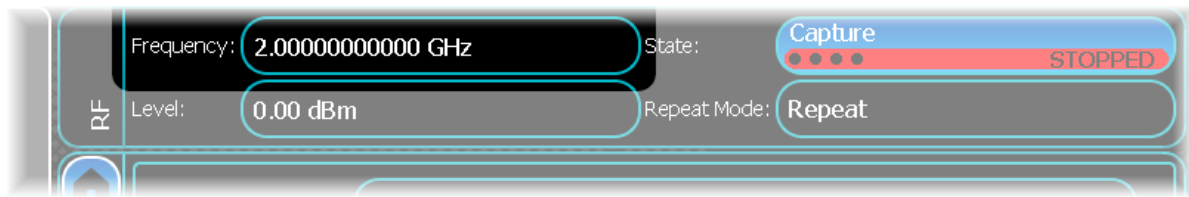Use this to save the current measurement as a bitmap.

Export as CSV

Use this to save the graphical data shown in the current graph window to a .csv (plain text, comma-separated) file.

RF parameters

The RF field appears at the top of all modulation screens. Here, you set up RF frequency and level, and start and stop the capture, and set its repeat mode.
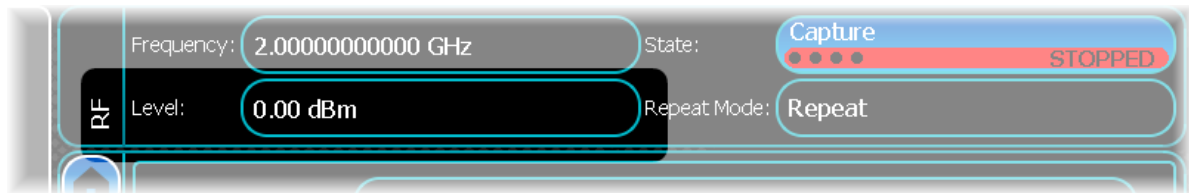
Frequency

This shows the current RF carrier frequency setting. Touch the button to set a different frequency. Enter a carrier frequency in the range

250 kHz to 6 GHz	SVA-6
250 kHz to 13 GHz	SVA-13

and touch the appropriate units button to terminate.

Resolution varies according to the frequency selected: refer to the data sheet for values.

Level

This shows the current input level for the carrier. Touch the button to set a different level from the popup keypad.

Select units:

dBm — power relative to 1 mW into 50 .
dBµV — voltage relative to 1 microvolt into 50 .

Power is limited to +30 dBm maximum, with 10 dB input attenuation.
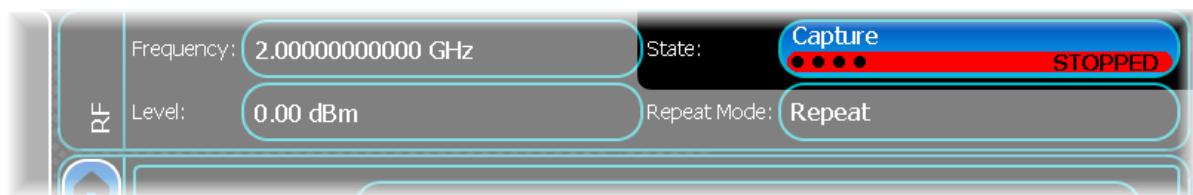
Capture

When you touch Capture STOPPED to start the analysis of a signal, the measurements you have currently selected to display in either a text or graphical representation are made. The default for each analysis scheme is to present the data as a trace.

Measurements that you are not currently displaying are not made, in order to keep update speeds as high as possible.

If you are in continuous run mode, and you change the measurement you want to display by, for instance, selecting a new item in the text display panel, or changing graph types, any measurements in progress are aborted, and a new measurement is started.

If you are in single run mode, and you change the measurement you want to display, you have to restart the analysis by touching Capture STOPPED again. Changing any settings parameter also aborts any measurements that are currently in progress and automatically restarts them.

Capture state

The ![Capture STOPPED button] button toggles the current state of your capture. If you are not capturing, this control is colored red and displays Capture STOPPED; if you are capturing, this control is colored green and labeled Capture RUNNING. To toggle the state, touch this button, and the capture starts and stops accordingly.

Repeat mode
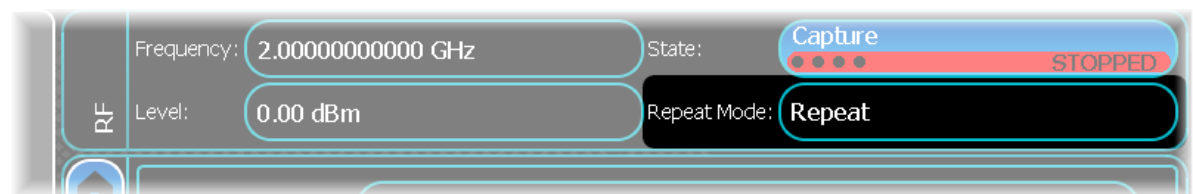
This shows the current repeat mode for the capture. It can either be single or repeated. Single indicates that only one capture is performed; Repeat indicates that the system is immediately re-armed after a capture, providing continuous capture until you decide to stop.

Control

This screen is common to many modulation types. It is displayed when you select Control from the ▶ menu:
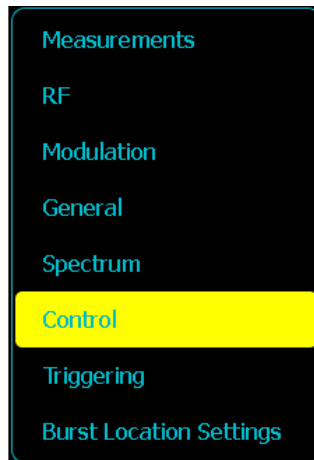
Use this screen to control how measurements start and stop, and how many iterations are used for statistical calculations.

Measurement

This button toggles the current state of your measurements. If you are not performing a measurement, this control is colored red and labeled START; if you are capturing, this control is colored green and labeled STOP. To toggle the state, touch this button, and measurements start and stop accordingly.

Repeat/Single

This toggles the current repeat state of your measurement, which can either be single or repeated. Single mode indicates that only one set of measurements is performed. In repeat mode, measurements are performed continuously until you decide to stop.

Trigger Type

This displays the trigger type. This is for information only: change the trigger type on the Triggering screen.

Statistic Iteration Count

Some statistical functions, such as averaging and standard deviation, are calculated over a number of measurement iterations. Use this control to change the number of iterations over which these functions are calculated. The maximum number of iterations that can be performed is 1000. For more information about measurement functions, see Measurements.
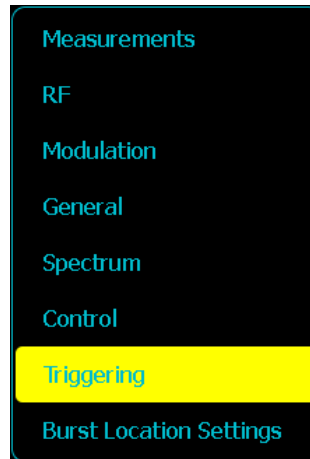
Reset Iterations

Use this to reset any video-averaged or cumulative measurements that are currently in progress.
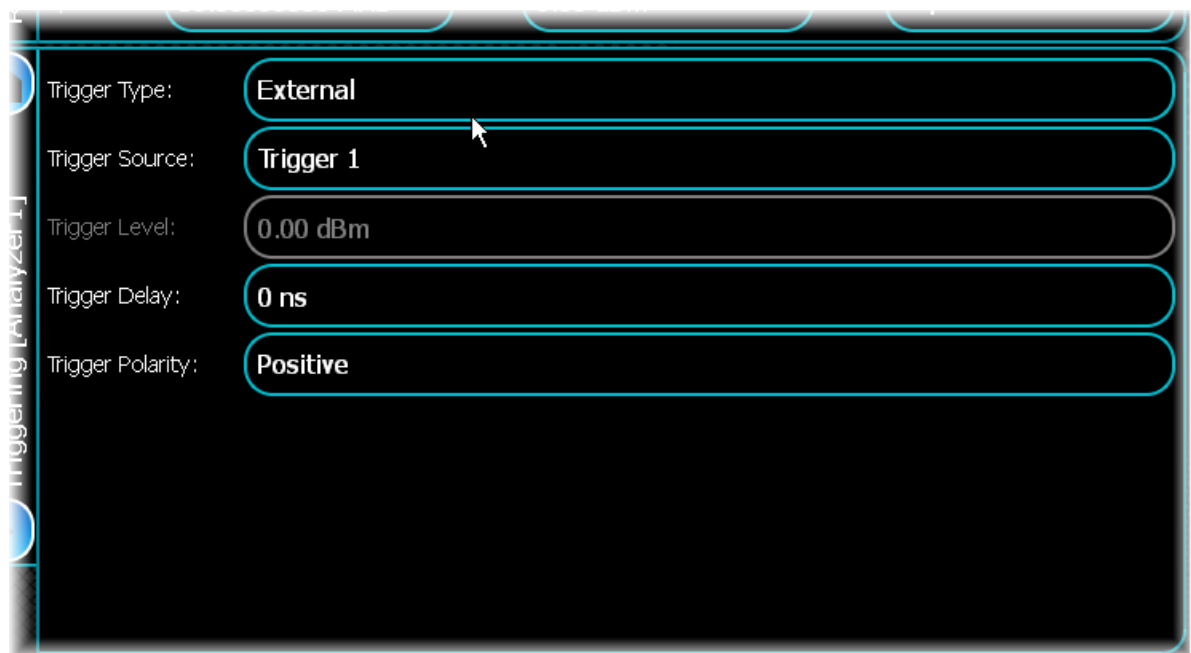
Triggering

Triggering is a function that is common to most analysis measurements . Use it to specify how measurements are triggered.

It is displayed when you select Triggering from the menu:

Here is a typical example:

AAA

Trigger Type

This specifies what triggers the measurement:

Immediate

Select this trigger type to trigger the measurement automatically when you touch on the Capture button

.

External

Select this to specify that the trigger is supplied by an external device.

Burst

Select this trigger type to trigger the measurement whenever the RF level rises above a given level.

Trigger Source

Use this to select which hardware line to trigger from when using an external trigger type. A dropdown menu lists the available trigger lines corresponding to rear-panel inputs (Trigger 1, 2 or 3).

Trigger Level

Use this to select the level at which to trigger when in burst trigger mode.

Trigger Delay

You may want to perform measurements on acquired data that occurs some time before or after the instrument has been triggered. This property lets you specify the amount of time between receiving the trigger and the start of data acquisition. This can be a positive number, indicating that data is acquired some time after a trigger, or a negative number, indicating that the data is acquired for a portion of time before the trigger is received.

Trigger Polarity

Use this to select the polarity of the trigger when in burst trigger mode.

Spectral mask

Use this to define the spectral mask that can be applied to the signal you are analyzing. Either a predefined or a user-defined spectral mask can be applied for comparison with a power spectrum. The screen displays a rough graphical outline of the mask that is applied when making spectral mask measurements. Both user-defined and pre-defined spectral masks are assumed to be symmetrical.

This screen is common to many modulation types. You see it whenever you touch the Configure Spectrum Mask button (enabled only when User-Defined spectral mask type is selected).
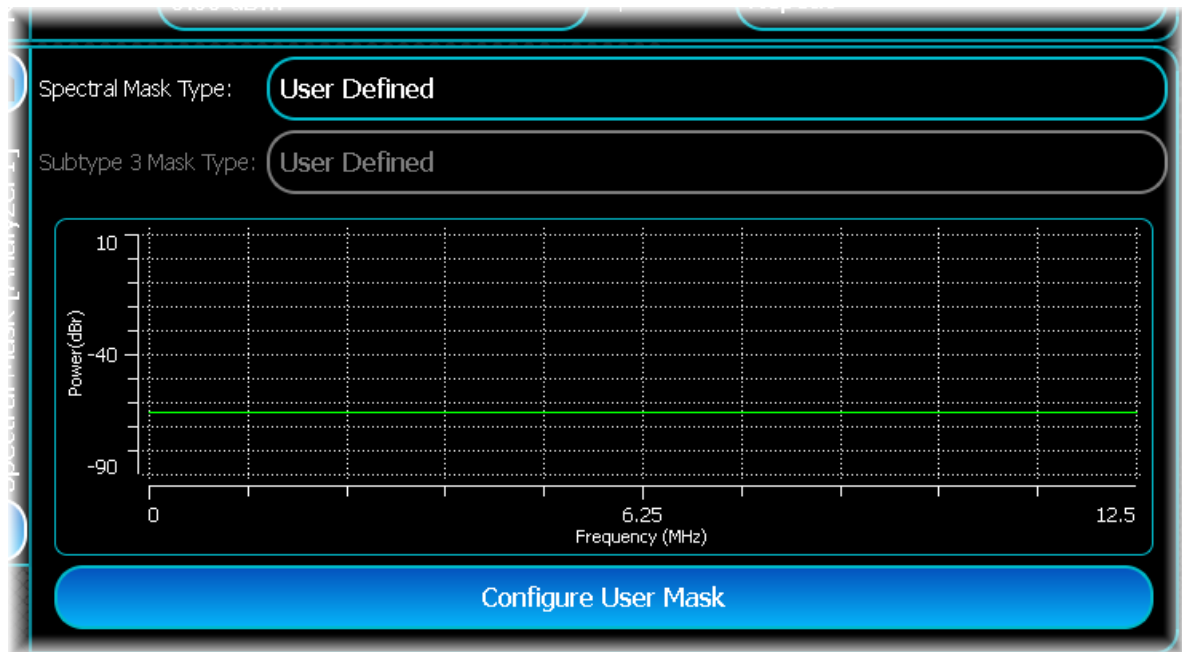
Spectral Mask Type

Use this to select the spectral mask that is to be applied. This can be either a pre-defined or user-defined mask.

Pre-defined

The pre-defined mask is shown within the individual modulation type.

User-defined

The user-defined mask automatically applies the current user-defined settings that you have entered.

Configure Spectrum Mask

Touch this button to display the spectrum mask configuration window, which lets you define your own spectral mask. You can do this manually by using numeric entry, or by using the graphical interface.

The spectrum mask is compared against the computed spectrum. Each frequency has a matching power level and these points therefore define where the mask line changes direction. It is assumed that the mask is symmetrical, so that you only have to define the positive frequency/level pairs and that at 0 Hz the level is 0 dB.

You can add any number of points in the mask as well as independently setting each frequency, level and bandwidth. The screen below shows a user-defined mask with four points.

Manual entry

Touch the Mask Table tab at the right of the table.

Adding a point

To add a spectral mask point, touch the Add button at the bottom of the entry table, and a new point is added into the list. By default, if you add a point, it is automatically assigned the same frequency and level of the last-defined point.

Inserting a point

To insert a spectral mask point, select a point within the entry table before which you wish to insert the new point, and touch Insert. This adds a new point into the list before the point you have selected. By default, if you add a point, it is automatically assigned the same frequency and level as the preceding point.

Removing a point

To remove a spectral mask point, select a point within the Spectral Mask entry table that you wish to remove and touch Remove.
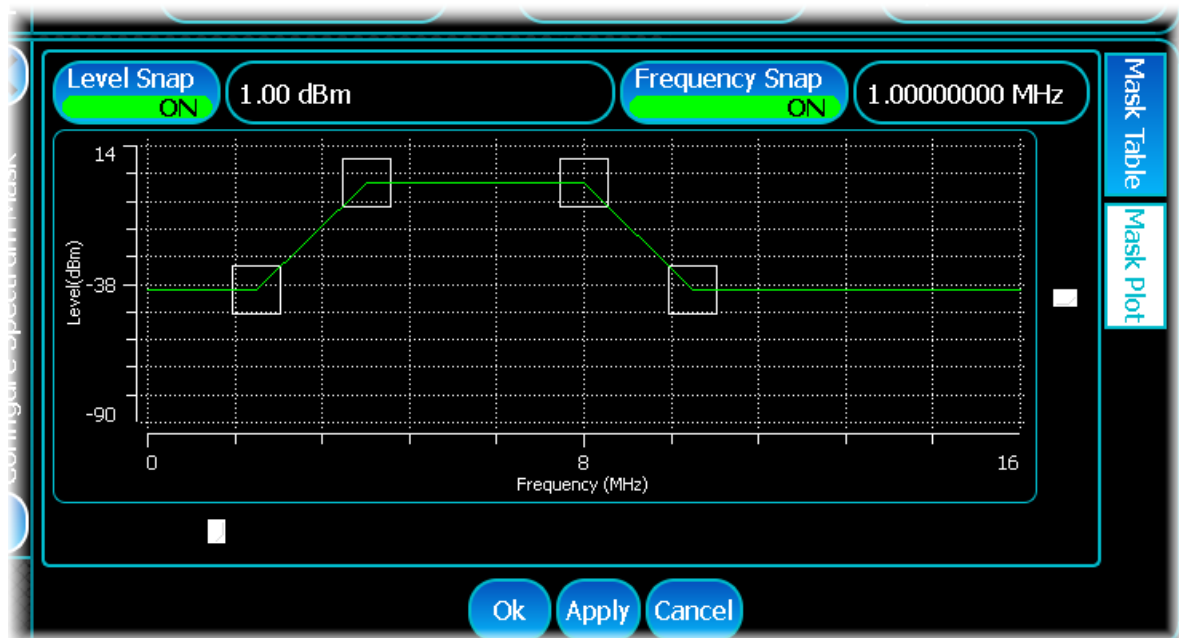
Editing a point

To edit a point, double-touch on the parameter you want to edit. This puts the selected item into edit mode, which lets you modify the value as appropriate. Note that when editing values, you are not permitted to enter a frequency value for a point that is less than that of the point immediately preceding, or greater than that of the point immediately following.

Graphical entry

Touch the Mask Plot tab at the right of the table.

Each spectral mask point is shown as a small white square, with a green line showing the whole spectral mask. This is the plot of the points in the table above.

Adding a point

To add a point, touch the graphic at the desired location. This adds a point at these coordinates.

Moving a point

To move a point that has been defined, move your finger or mouse over the point you wish to modify. The cursor changes to a double-headed arrow to indicate that you may move the point, either vertically or horizontally. Then drag the item to the desired frequency or level. As with the manual entry table, you may not drag an item to a frequency that is less than that of the preceding point, or greater than that of the following point. When you modify points in this way, the manual entry table automatically updates with the new point values.

Level Snap/Frequency Snap

As finding the exact desired point on the spectrum mask can be difficult, you can specify intervals of level and frequency to which a point 'snaps'. When carrier or power snapping is enabled, any point you enter is rounded to the nearest valid interval, and snaps into position.
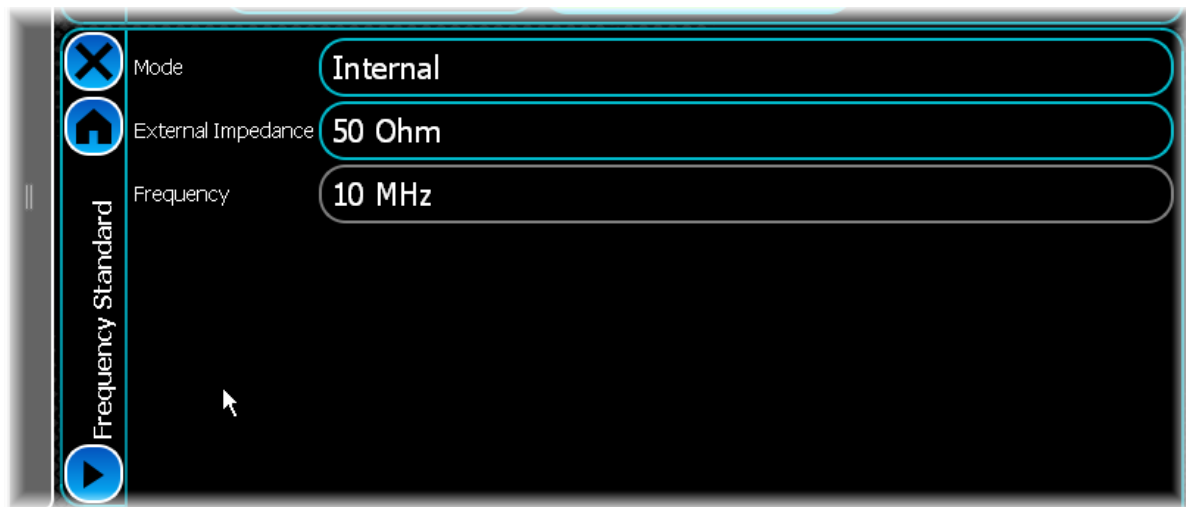
To enable level snapping, touch the Level Snap or Frequency Snap button, and enter the desired interval in the associated field.

Frequency standard

Touch the Config button (on the <u>menu tab</u>)...
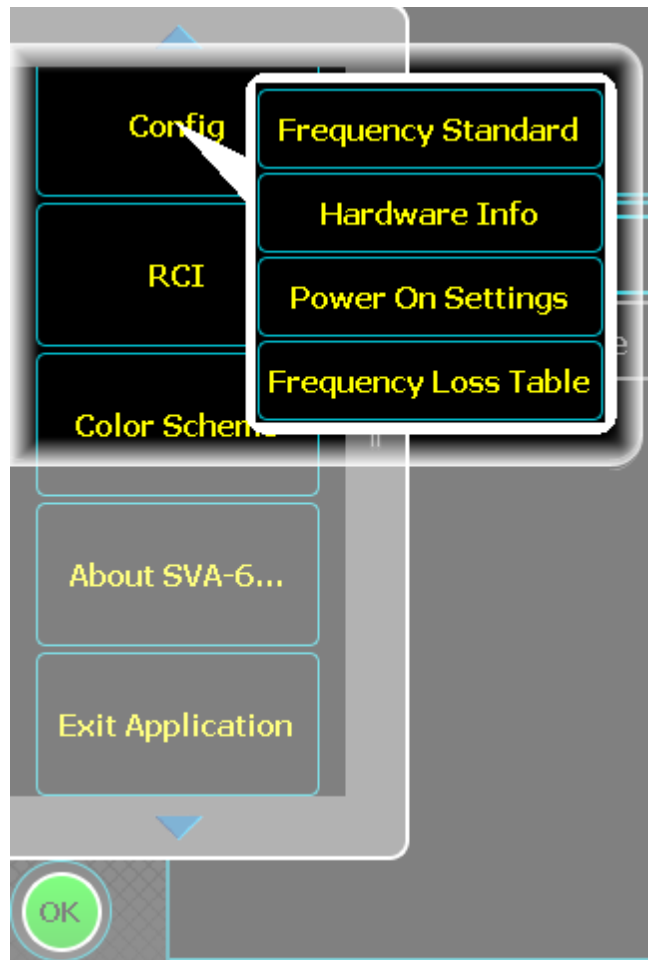
...and select Frequency Standard from the drop-down menu:

Internal or external standard

Select either the internal 10 MHz frequency standard or an external frequency standard. Select Internal or External from the Mode drop-down menu.

Apply an external frequency standard to the REFIN socket on the rear panel.

When the mode is set to External, the instrument locks to the external standard

External impedance

Use the drop-down menu to select low (50 ohm) or high (100 kohm) external impedance.

Frequency reference output

When the Mode is set to Internal O/P, the instrument outputs a 10 MHz square wave (2 V p-p into 50 ohm) as standard at the REFOUT socket on the rear panel.

RF level offsets

The RF level offsets table provides a means of compensating for losses and gains introduced into the signal path between the instrument and the unit under test. Losses and gains for items such as cables and amplifiers can be entered into the table and applied or removed individually.

Many good-quality cables and active elements are supplied with calibration data that can be entered directly into the RF level offsets table. Otherwise, you need to characterize items to establish their loss or gain values.

Touch the Config button (on the menu tab)...
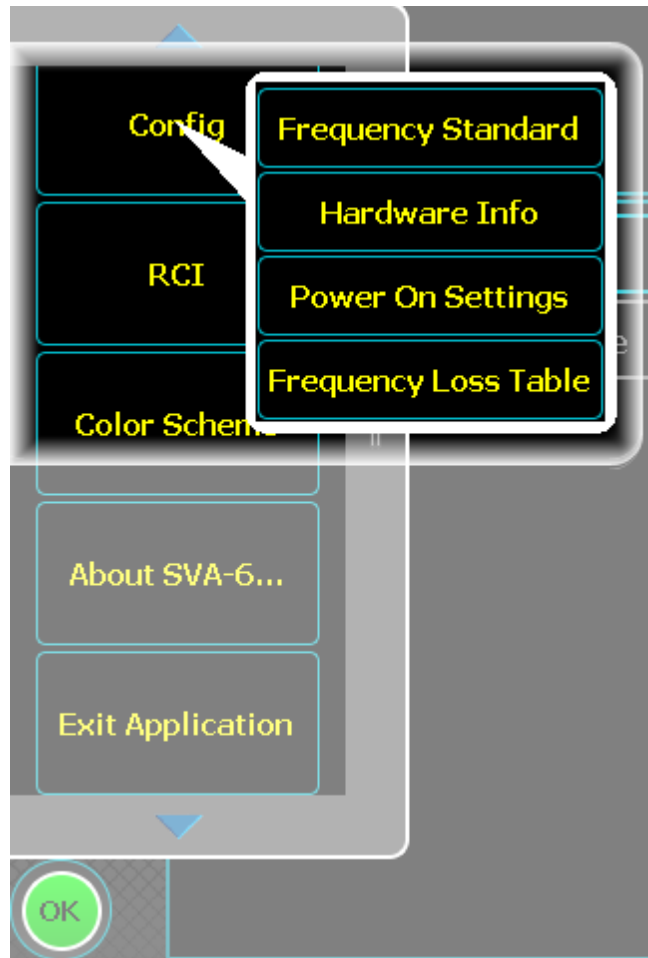
...and select RF Level Offsets from the drop-down menu:

Table

Add

Add another frequency/loss line to the table.

Frequency

Enter all the characterized frequencies for devices in the signal path between the instrument and the UUT.

State

Turn individual device offsets on or off.

Loss

Enter the loss at each frequency point. Note that loss is entered as *positive* value, gain as a *negative* value.

Remove

Touch a line to highlight it, and remove it.

State

Use this button to enable or disable all the entered losses.

Store

Touch Store. The popup shows the current file location.

Enter a file name using the virtual keyboard that pops up when you touch the File Name field.

When you touch Save, the instrument stores the current configuration and settings to the non-volatile memory or to the optional removable hard drive.

Recall

Touch Recall. A popup lets you browse for currently stored files.

Touch the file you want to recall, and the instrument is configured with the stored settings.

Spectrum analyzer mode

This mode provides general spectral analysis of any signal you want to investigate.

Select Spectrum Analyzer from the menu tab. Touch the ▶ button, and configure spectrum analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

General defines capture times, gating and FFT averaging.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Triggering defines how the measurements are triggered. This screen is common to most modulation types.

ACP defines parameters used for measuring the ACPR performance of systems operating on adjacent frequencies.

OBW defines parameters used for measuring the occupied bandwidth.

Spectrum Mask defines a mask that can be compared to a power spectrum. This screen is common to many modulation types.

RF

Use this to set up the basic RF frequency and level parameters of a spectrum analysis.
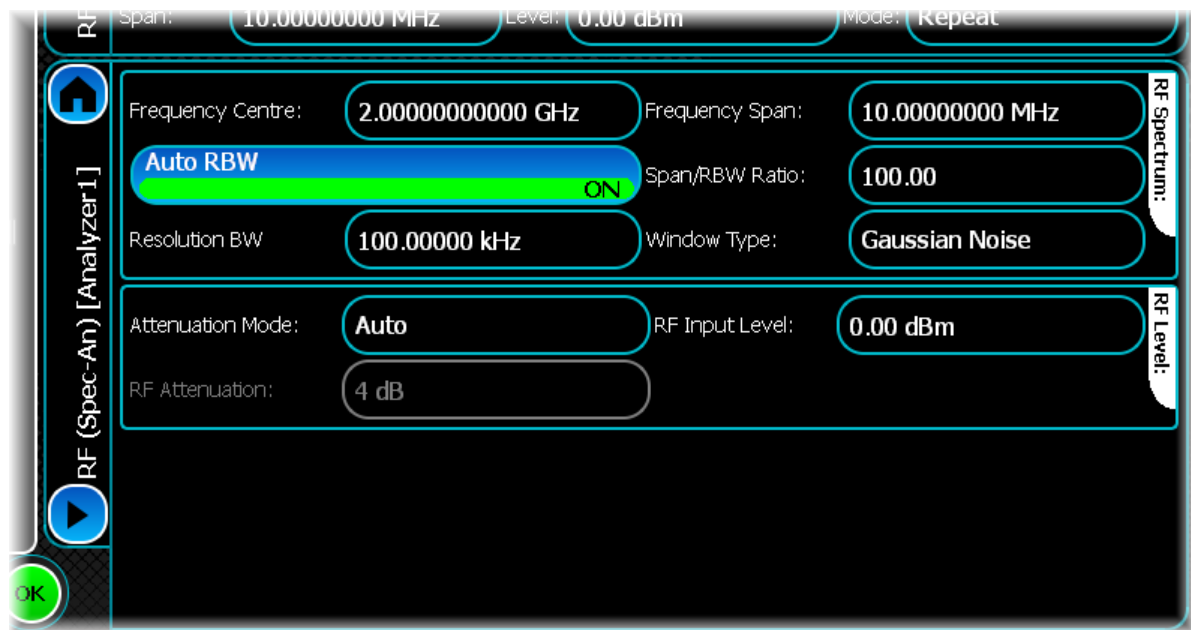
Frequency Centre

Use this to set the center frequency of the measurement.

Auto RBW

This button enables/disables the coupling of the Span properties and RBW properties. When Auto RBW is ON, the RBW is set to the nearest 10/30/100 step below the value of the Span divided by the SpanRBWRatio property.

Resolution BW

Use this to specify the resolution bandwidth of the measurement, provided that Auto RBW is disabled.

If Auto RBW is ON or Span/RBW Ratio is modified, the RBW value is updated automatically.

Frequency Span

Use this to set the span for a spectral measurement.

Span/RBW Ratio

If Auto RBW is ON, this control lets you set the maximum ratio between Span and RBW which ranges from 1 to 10000 in steps of 1. However, when the up/down buttons are used, the value changes to the next value that is in the progression 1/2/5/10/20/50.

Window Type

Use this to specify the window type used when performing a spectral measurement. The options are Gaussian 3dB, Gaussian Noise and Blackman-Harris.

Attenuation Mode

Use this to specify how the RF Attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer.

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

It can be adjusted manually only when Attenuation Mode is set to Manual. When in Auto Attenuation Mode, the RF input level is set automatically, to optimize the RF gain setting.
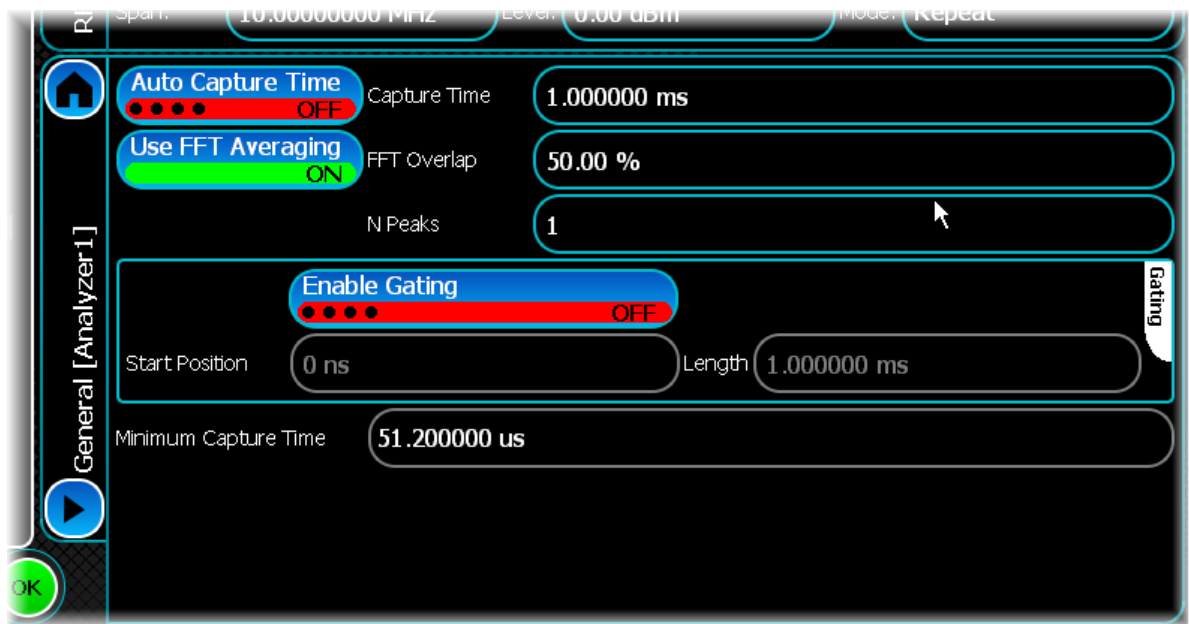
RF Input Level

Use this to specify the RF input level for the measurements you are making.

Set it to the peak level of the input RF signal to ensure the best dynamic range and signal-to-noise ratio.

General

Use this to set up capture times, gating and FFT averaging for the spectrum analyzer.

Auto Capture Time

When this button is ON, the capture time is set automatically to capture a single FFT's worth of data. If the button is OFF, the user-defined capture time is used.

Capture Time

This control is available only if automatic capture time is disabled. Use it to specify the capture time.

Use FFT Averaging

When this button is ON, FFTs are averaged over the capture or gate time using the FFT Overlap parameter.

FFT Overlap

Use this to specify the overlap between each FFT, expressed as a percentage of the FFT size. This is available only if Use FFT Averaging is ON.

N Peaks

The instrument can continuously measure a given number of the highest peaks within a spectral measurement. Use this to specify how many peaks are measured.

Gating

Enable Gating

When this button is ON, the Start Position and Length property values are applied to all measurements.

Start Position

Use this to specify the start of an (optional) gate applied to all measurements.

Length

Use this to specify the length of an (optional) gate applied to all measurements.

Minimum Capture Time

Depending whether Auto Capture Time or Enable Gating is ON, this field displays the minimum capture time or minimum gate length needed to capture a single FFT's worth of data.

ACP

Use this to set up basic parameters for an ACP measurement.

Acp Mode

This lets you specify how the ACP information is set up when making ACP measurements. The possible values are User and Auto.

In Auto ACP mode, there is a fixed number of ACP channels that are measured, as well as a common measurement width and spacing for each of those channels.

In User ACP mode, you can define any number of ACP channels as well as independently setting each channel's spacing and width.
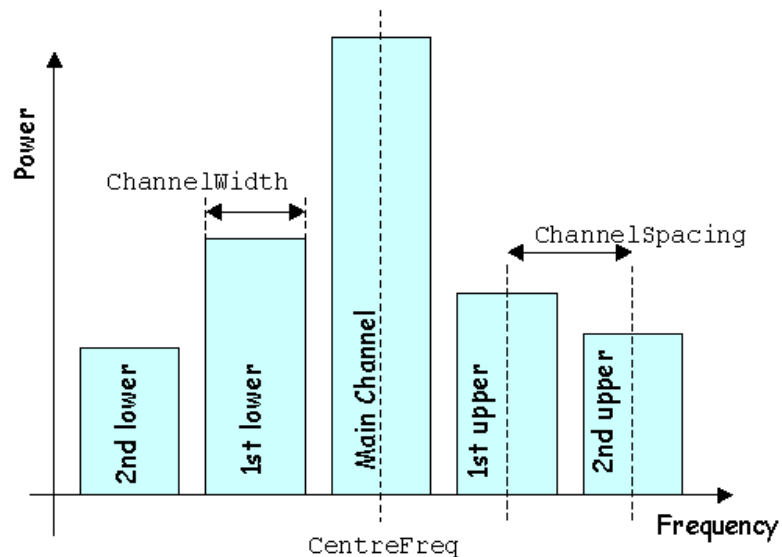
Filter Type

Use this to specify the filter type to use for ACP measurements. Supported options are None, Raised Cosine or Root Raised Cosine.

Filter Alpha

Use this to specify the filter alpha value of the ACP measurement.

Centre Frequency Offset

Use this to specify the position of the carrier channel relative to the RF center frequency. If you want the carrier channel to be located at the RF center frequency, set this parameter to zero.

Channel Count
Use this to define the total number of channels to measure.

Channel Width

Use this to specify the width of all automatic ACP channels. It is enabled only in Auto ACP mode.

Channel Spacing

Use this to specify the channel spacing of all automatic ACP channels. It is enabled only in Auto ACP mode.

OBW

Use this to set the parameters for an Occupied Bandwidth (OBW) measurement. The occupied bandwidth measurement measures the frequency within which some percentage of a signal lies.
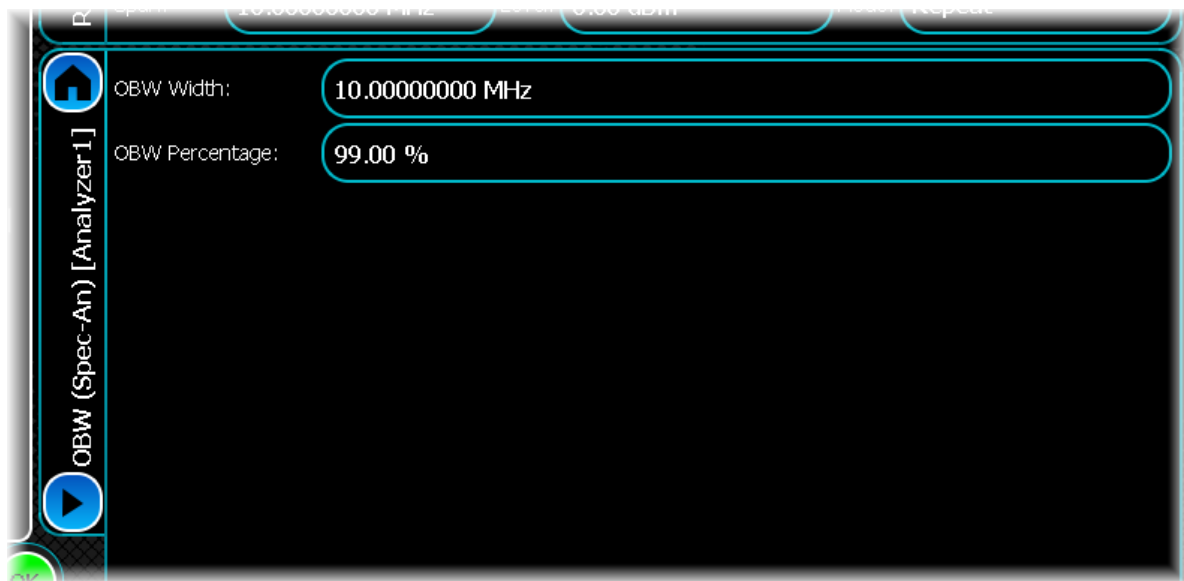
It consists of the following controls:

OBW Width

Use this to specify the width over which the occupied bandwidth is measured.

OBW Percentage

Use this to specify the percentage of signal power that is used to calculate the occupied bandwidth.
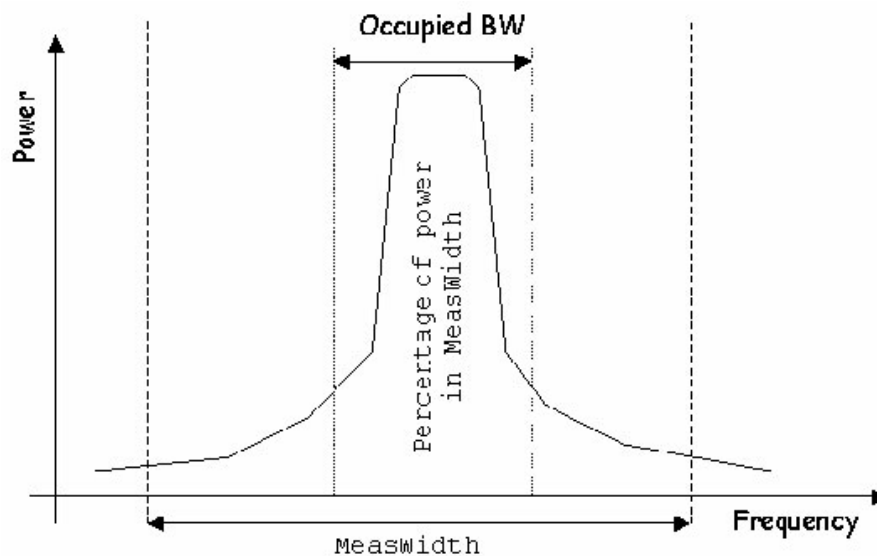
Spectrum Mask

Use this to define the spectrum mask that can be applied to the signal you are analyzing. Either a predefined or a user-defined spectrum mask can be applied for comparison with a power spectrum. The screen displays a rough graphical outline of the mask that is applied when making spectrum mask measurements. Both user-defined and pre-defined spectrum masks are assumed to be symmetrical.
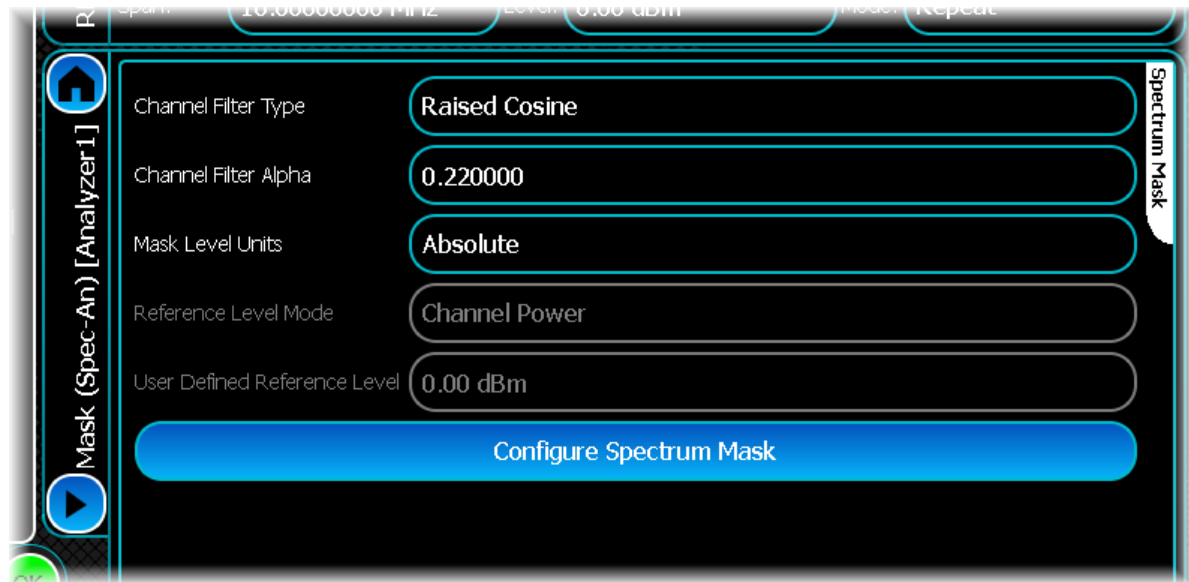
Channel Filter Type

Use this to set the filter to be used to perform the Channel Power measurement.

Channel Filter Alpha

Use this to set the filter roll-off factor used to perform the Channel Power measurement.

Mask Level Units

Use this to set the power level unit for spectrum mask points.

Reference Level Mode

Use this to set the reference level to use for the spectrum mask measurement when relative mask points exist.

User Defined Reference Level

When Mask Level Units is set to User-Defined, use this control to set the reference level to use for the spectrum mask measurement when relative mask points exist.

Configure Spectrum Mask

Touch this button to display the spectrum mask configuration screen, which lets you define your own spectral mask. You can do this manually by using numeric entry, by touching the screen, or by using a mouse to point and click. This function is common to many modulation types.

1xEV-DO Reverse Link analysis

1xEV-DO provides analysis of 1xEV-DO Rev0, Rev A and Rev B (NoFeedbackMultiplexing mode) signals.

Select 1xEV-DO from the menu tab. Touch the ▶ button, and configure 1xEV-DO analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to most modulation types.

Meas. Config defines the parameters needed to make a measurement.

Rev. B Carriers defines parameters for multi-carrier operation.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

ACPR defines the number of offset frequencies that are measured.

Spectral Mask lets defines the shape of the spectral mask. This screen is common to many modulation types.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to 1xEV-DO Reverse Link.

Trace measurements

Raw Spectrum

This graph type displays the spectrum (power vs. frequency) of the signal being measured using a fixed resolution bandwidth of 30 kHz. The spectrum trace supports Min Hold, Max Hold and Averaging functions.

Spectral mask

The currently selected spectral mask (either user-defined or predefined) may also be overlaid on the spectrum trace. This can be disabled by touching anywhere on the graph and disabling it from the Trace Controls\Spectral Mask menu.

Spectral Mask Markers

As well as standard marker functionality, the delta between the spectral mask and the trace is also displayed when displaying a marker.

ACPR (adjacent channel power ratio)

This graph type displays the results of ACPR analysis performed on the 1xEV-DO Reverse Link signal.

The ACPR trace supports Live, Min Hold, Max Hold and Averaging functions. This graph type is not valid when Physical Layer Sub Type 3 is selected.

Composite Constellation

This plot type lets you view the Composite Constellation measurement within the 1xEV-DO Reverse Link signal and optionally the ideal reference points.

Real points are displayed as green dots. Reference points are displayed as small red crosses indicating the exact ideal point.

This trace does not support any statistical functions. When Physical Layer Sub Type 3 is selected, this trace lets you select the carrier of interest.

Composite Constellation zoom in/zoom out

The Composite Constellation plot maintains a fixed 1:1 aspect ratio. This means that when performing a zoom selection, the extent that is displayed may not match the original selection.

Composite Constellation markers

The constellation plot supports an x-y marker system.

The Composite Constellation marker displays the I and Q for the given sample, as well as the reference I and Q value for that particular position.

Moving the marker either horizontally or vertically causes the marker to choose the constellation point closest to the desired position.

When performing continuous captures, the sample retains the marker it is currently displaying. If you use an Immediate trigger, the marker may jump around, as the sample that the marker is measuring is now in a completely different location.

Because of this, it is recommended that you use an external or burst trigger when making continuous measurements.

Captured Power vs. Time

This plot displays the power vs. time trace of the capture that is being used for the underlying analysis of the 1xEV-DO Reverse Link signal.

The power vs. time trace supports Live, Min Hold, Max Hold and Averaging functions.

Code Domain Power

This plot type displays the code domain power of the 1xEV-DO Reverse Link signal being measured.

This trace supports Live, Min Hold, Max Hold and Averaging functions.

Enabling/disabling I/Q branches

To turn off the I or Q branch, select the Trace Controls menu item in the Graph Control menu, and check or uncheck the Show I or Show Q menu items to enable or disable the relevant graph section. This resizes the graph and displays only a single branch. Note that you cannot disable both branches.

Zooming in/out

When performing a zoom in or out on the split code domain trace, the new X/Y limits are applied to both the I and Q branches. This means if you re-scale the Y axis on this trace for the I branch, it applies to the Q branch as well.

Code Domain Error

This plot type displays the code domain error of the 1xEV-DO Reverse Link signal being measured.

This trace supports Live, Min Hold, Max Hold and Averaging functions.

Enabling/disabling I/Q branches

To turn off the I or Q branch, select the Trace Controls menu item (touch the screen to display the menu) and check or uncheck the Show I or Show Q menu items to enable or disable the relevant graph section. This resizes the graph and displays only a single branch. Note that you cannot disable both branches.

Zooming in/out

When performing a zoom in or out on the split code domain trace, the new X/Y limits are applied to both the I and Q branches. This means if you re-scale the Y axis on this trace for the I branch, it applies to the Q branch as well.

CCDF

This plot type shows the CCDF (complementary cumulative distribution function) of the 1xEV-DO Reverse Link signal being analyzed. This trace does not support any statistical functions.

Text measurements

Modulation Accuracy

This measurement displays the numeric results relating to modulation accuracy measurements of the analyzed 1xEV-DO Reverse Link signal.

All modulation accuracy measurements, apart from Payload Index Sub-packet Index and Analyzed Slot Number, support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation. When Physical Layer Sub Type 3 is selected, these results are displayed in tabular form for each carrier.

EVM RMS

This displays the RMS EVM, as a percentage, for the signal being measured.

A perfect ideal signal is synthesized at the chip level and identified as the reference signal. The reference signal is subtracted from the measured signal to produce a time record of error phasors. The square root of the ratio of the mean power of the error signal to the mean power of the reference signal is computed and expressed as a percentage EVM.

EVM Peak

This displays the peak EVM, as a percentage, for the signal being measured.

Rho Factor

This displays the rho modulation accuracy indicator.

Rho is the normalized correlation coefficient between the measured and ideal reference signals. Rho is computed by comparing the normalized correlated power between the measured signal and the reference signal and is designated as the waveform quality factor.

The maximum value of rho is 1.0 (which means the measured signal and reference signal are 100% identical).

A rho value of 1.0 indicates that all of the transmitted power correlates with the ideal signal as determined by the detected sequence.

Rho is the correlated power for all active code channels (as seen in the composite CDP trace data display).

Frequency Error

This displays the frequency error, in Hz, of the signal being measured.

Carrier Leak

This displays the carrier leak, in dB, of the signal being measured.

Phase Error RMS

This displays the measured RMS phase error result, in degrees. This is the RMS value of the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot.

Phase Error Peak

This displays the measured peak phase error result, in degrees. This is the peak RMS among the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot.

Magnitude Error RMS

This displays, as a percentage, the RMS magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) of the composite signal.

Magnitude Error Peak

This displays, as a percentage, the peak magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) for the data segment of the analyzed time slot.

Transmit Time Error

This displays the transmit time error. Note that this measurement requires an external trigger to be used to start the capture on a frame boundary.

Payload Index

This displays the payload index decoded from the RRI channel. In Sub Type 2 physical layers, the RRI channel uses the payload and sub-packet indexes to encode the required data payload, which defines the modulation type required to provide the required data rate.

Sub-packet Index

This displays the sub-packet index decoded from the RRI channel. In Sub Type 2 physical layers, the RRI channel uses the payload and sub-packet indexes to encode the required data payload, which defines the modulation type required to provide the required data rate.

Analyzed Slot Number

This displays which slot was analyzed.

Code Domain Power

All code domain power measurements, apart from Analyzed Slot Number, support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

When Physical Layer Sub Type 3 is selected, these results are displayed in tabular form for each carrier.

CDE Peak I

This measurement displays the peak code domain error (an indication of noise and spurious signals in code channels) for the I channel.

CDE Peak Q

This measurement displays the peak code domain error (an indication of noise and spurious signals in code channels) for the Q channel.

ACK Power

This displays the ACK channel power in dB, relative to the total composite signal power.

ACK Pilot Ratio

This displays the ACK channel power in dB, relative to the Pilot Channel power.

AUX Power

This displays the Auxiliary Pilot channel power in dB, relative to the total composite signal power.

AUX Pilot Ratio

This displays the Auxiliary Pilot channel power in dB, relative to the Pilot Channel power.

Data Power

This displays the Data channel power in dB, relative to the total composite signal power.

Data Pilot Ratio

This displays the Data channel power in dB, relative to the Pilot Channel power.

DRC Power

This displays the DRC channel power in dB, relative to the total composite signal power.

DRC Pilot Ratio

This displays the DRC channel power in dB, relative to the Pilot Channel power.

DSC Power

This displays the DSC channel power in dB, relative to the total composite signal power.

DSC Pilot Ratio

This displays the DSC channel power in dB, relative to the Pilot Channel.

Pilot Power

This property contains a measure of the Pilot channel power in dB, relative to the total composite signal power.

RRI Power

This property contains a measure of the RRI channel power in dB, relative to the total composite signal power.

RRI Pilot Ratio

This displays the RRI channel power in dB, relative to the Pilot Channel power.

Analyzed Slot Number

This displays which slot was analyzed.

Average Power Measurement

The average power measurement supports the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

Average Power

Average power is measured across the whole bandwidth as opposed to channel power, which is measured through a 1.23 MHz filter. The average broadband power of the captured IQ is:

$$\frac{I^2 + Q^2}{NumSamples}$$

Channel Power Measurement

The channel power measurement supports the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation. When Physical Layer Sub Type 3 is selected, these results are displayed in tabular form for each carrier.

Channel Power

Channel power is measured through a 1.23 MHz filter as opposed to average power, which is measured across the whole bandwidth.

Spectral Mask

This measurement displays whether any of the transmitted signal exceeds the limits of the specified spectral mask, as well as giving the frequency and level of the failure. If the transmitted signal does not exceed the spectral mask, the frequency and level supplied represent the closest point to failure.

This measurement does not support any of the statistical functions.

Pass Fail

This gives a simple indication as to whether the signal is within the mask limits.

Fail Frequency

This is the frequency of the largest spectrum peak that exceeds the spectral mask limit.

Fail Level

This is the power of the largest spectrum peak that exceeds the spectral mask limit.

Fail Level Error

If the spectrum fails the mask, the value of this property contains the dB error, or difference, between the largest spectrum peak that exceeds the mask and the power mask limit.

Failure Points

This is the total number of points that fail to meet the spectral mask.

ACPR

This measurement displays the results of the adjacent channel power ratio at the frequency offsets specified in the ACPR settings.

All ACPR measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

This measurement is not valid when Physical Layer Sub Type 3 is selected.

RF

Use this to set up the basic RF frequency and RF level parameters of a 1xEV-DO measurement.

It consists of the following controls:

Frequency Centre

Use this to set the center frequency of the measurement. For Subtype 3, where multiple carriers can be defined, this defines the center frequency of the instrument. The center frequency is normally one of the carrier frequencies present in the signal, but this is not mandatory.

Band Class

Band class refers to a set of frequency channels and a numbering scheme for these channels.

For Band Class 0, the channel is centered on one of the 30 kHz channels. For Band Classes 1, 4, 6, 7, 8 and 9, the channel is centered on one of the 50 kHz channels. For Band Classes 2 and 3, the channel is centered on one of the 25 kHz channels. For Band Class 5, the channel is centered on one of the 20 or 25 kHz channels. Changing the band class also affects the predefined spectral mask. See Spectral Mask for details of the available options.

The band class that is selected determines the range of frequency channels that are valid. The table that follows describes the band classes and associated frequency channels.

Channel Number

Use this to select a specific channel number, which adjusts the center frequency accordingly. The range of valid channel numbers depends upon the band class selected, as described in the following table.

Band classes and associated frequency channels

The band class refers to a set of frequency channels and a numbering scheme for these channels.

This table describes each band and the range of frequency channel appropriate to that band. This implementation corresponds to band class specification 3GPP2 C.S0057-C Version 1.0 July 2008.

Band classes and frequencies

Band	Band description	Channel number	Uplink frequency (MHz)
0	800 MHz cellular band	1 <= N <= 799	0.030 * N + 825.000
		991 <= N <= 1023	0.030 * (N – 1023) + 825.000
		1024 <= N <= 1323	0.030 * (N – 1024) + 815.040
1	1.8 to 2.0 GHz PCS band	0 <= N <= 1199	1850.000 + 0.050 * N
2	872 to 960 MHz TACS band	0 <= N <= 1000	0.025 * N + 889.9875
		1329 <= N <= 2047	0.025 * (N – 1328) + 871.9875
		2048 <= N <= 2108	0.025 * (N – 2048) + 894.000
3	832 to 925 MHz JTACS band	1 <= N <= 799	0.0125 * N + 915.000
		801 <= N <= 1039	0.0125 * (N – 800) + 898.000
		1041 <= N <= 1199	0.0125 * (N – 1040) + 887.000
		1201 <= N <= 1600	0.0125 * (N – 1200) + 893.000
		Note: Only even-valued N values are valid	
4	1.75 to 1.87 GHz Korean PCS band	0 <= N <= 599	(0.050 * N) + 1750.000
5	450 MHz NMT band	1 <= N <= 400	0.025 * (N – 1) + 450.000
		472 <= N <= 871	0.025 * (N – 472) + 410.000
		1039 <= N <= 1473	0.025 * (N – 1024) + 451.010
		1536 <= N <= 1715	0.025 * (N – 1536) + 479.000
		1792 <= N <= 2106	0.025 * (N – 1792) + 479.000
6	2 GHz IMT-2000 band	0 <= N <= 1199	1920.000 + 0.050 * N
7	Upper 700 MHz band	0 <= N <= 240	776.000 + 0.050 * N
8	1800 MHz band	0 <= N <= 1499	1710.000 + 0.050 * N
9	900 MHz band	0 <= N <= 699	880.000 + 0.050 * N
10	Secondary 800 MHz band	0 <= N <= 719	0.025 * N + 806.000
		720 <= N <= 919	0.025 * (N – 720) + 896.000
11	400 MHz European PAMR band	1 <= N <= 400	0.025 * (N – 1) + 450.000
		472 <= N <= 871	0.025 * (N – 472) + 410.000
		1039 <= N <= 1473	Reserved
		1536 <= N <= 1715	0.025 * (N – 1536) + 479.000
		1792 <= N <= 2016	Reserved
12	800 MHz PAMR band	0 <= N <= 239	870.0125 + 0.025 * N

Attenuation Mode

Use this to specify how the RF attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you can specify the amount of RF attenuation that the instrument applies.

DUT Output Level

Use this to specify the DUT output level, which is normally the RMS output level of the DUT.

Use the Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use the DUT Tx Path Loss to allow for any path loss between the DUT and the instrument's input.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer.

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

It can be adjusted manually only when Attenuation Mode is set to Manual. When in Auto attenuation mode, the RF input level is set automatically in order to optimize the RF gain setting.

DUT Tx Path Loss

Use this to specify the loss between the DUT output and the instrument's input, and to adjust the RF input level of the instrument.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

Meas. Config

Use this screen to set up key information about demodulating and analyzing the 1xEV-DO signal.
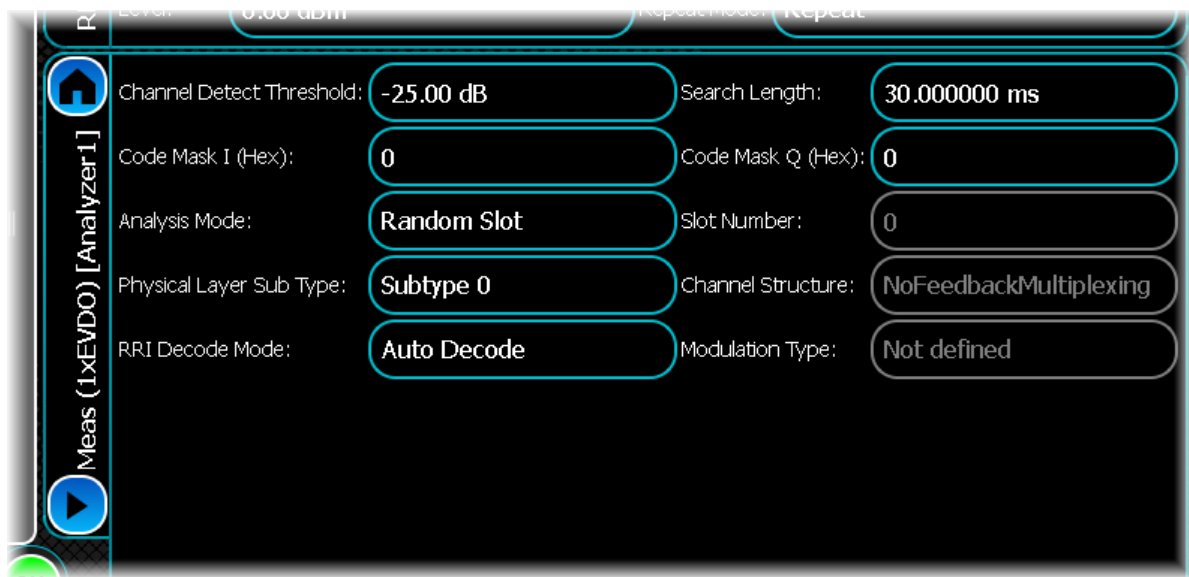
It consists of the following controls:

Channel Detect Threshold

Use this to find the first burst position. To determine the start of a burst, the analysis process looks for a change in power greater than this threshold.

Code Mask I / Q (Hex)

For reverse link channel measurements, you must specify the long code masks to match the I and Q channels of the measured 1xEV-DO reverse link signal.

Long code masks must be in the range: 0 to 4,398,046,511,103 (0h to 3FFFFFFFFFFh).

Analysis Mode

Use this to determine which type of analysis mode is selected, either random slot or specific slot.

Physical Layer Sub Type

Use this to select one of the physical layers sub types 0, 1, 2 or 3.

RRI Decode Mode

Use this to select either Auto or Manual decode mode of the RRI channel.

Search Length

Use this to specify the minimum amount of time for which data is captured when performing demodulation measurements, overriding that determined automatically by the instrument only if the value specified is greater.

A search length of zero allows the instrument to use its automatically-determined capture time. This should always be sufficient when an immediate trigger is employed. Setting the value of search length unnecessarily high adversely affects the analysis time.

Slot Number

Use this to select which specific slot is analyzed when in specific slot analysis mode.

Channel Structure

If the Subtype 3 physical layer is selected, this lets you define the channel structure. The supported value is NoFeedbackMultiplexing mode.

Modulation Type

Use this to set the modulation type used by the Subtype 2 physical layer data channel.

Rev. B Carriers

Rev. B extends 1xEV-DO to multi-carrier operation by connecting users simultaneously over multiple 1.25 MHz carriers. By allowing traffic to flow over more than one carrier, Rev. B improves data rates and transaction latencies, on both forward and reverse links, in proportion to the number of carriers used.

In Subtype 2 physical layer sub-type mode, this screen lets you define the bandwidths and frequency offsets of the different carriers to be analyzed. You can add or remove carriers, and define their frequency offset from the Frequency Centre defined in the RF screen. In addition, measurements on each carrier can be enabled or disabled. If measurements on a carrier are disabled, they are displayed as 'N/A'.
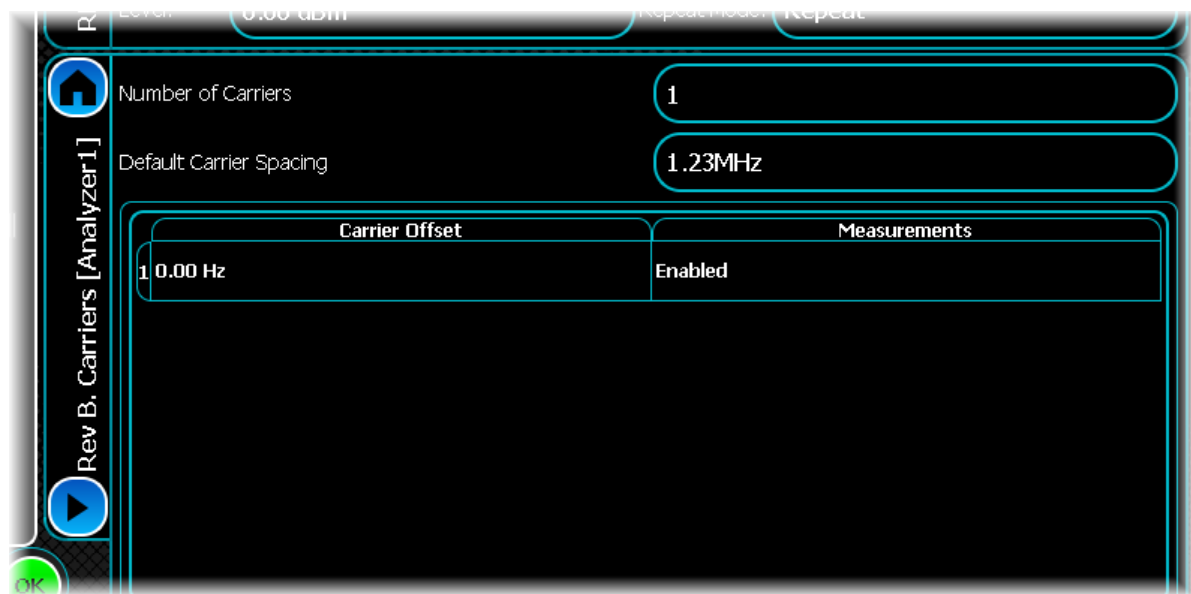
Number of Carriers

Use this to set a maximum data rate of 1.8 x N Mbit/s on the reverse link, where N represents the number of 1.25 MHz carriers provided for the transmission system.

Default Carrier Spacing

The default carrier spacing modifies the step size used when incrementing or decrementing the carrier offset. Leave this at 1.23 MHz unless you want to depart from the standard.

ACPR

Use the ACPR (adjacent channel power ratio) settings screen to specify a number of offset frequencies (relative to the carrier frequency) that are measured when performing ACPR measurements.

ACPR Mode

Select User defined to enter up to five frequency offsets for ACPR.

Modifying a frequency offset

To modify a frequency offset, touch the desired offset value. Enter the desired frequency offset in Hz into the popup keypad.

Note that you cannot modify the first frequency offset, which is fixed to the center frequency.

Spectral Mask

User-defined spectral mask

See the common [Spectral mask](#) section for information on how to create a user-defined spectral mask.

Pre-defined spectral mask

This section provides information about pre-defined masks for 1xEV-DO.

The mask limits defined below (pre-defined spectral masks) are applied depending upon the band class, subtype and Subtype 3 mask type (if Subtype 3 is selected).

Subtype 3 mask type

When physical layer Subtype 3 is selected, use this control to select the pre-defined multi-carrier mask to be used.

Pre-defined spectral masks

The following mask limits are supported, depending upon the band class selected.

Subtypes 0, 1, 2 Band Class 0, 2, 5 & 9:

For center frequency within the range (MHz)	Mask limit
+/- 0.885 to 1.98	-42 dB / 30 kHz
+/- 1.98 to 4.0	-54 dB / 30 kHz

Subtypes 0, 1, 2 Band Class 1, 4 & 8:

For center frequency within the range (MHz)	Mask limit
+/- 1.25 to 1.98	-42 dB / 30 kHz
+/- 1.98 to 4.0	-50 dB / 30 kHz

Subtype 3 Band Class 0, 2, 3, 5, 7, 9, 10, 11 & 12 (two carriers – maximum separation):

For | f| within the range (MHz)	Mask limit
+/- 0.885 to 1.885	6dBm / 1 MHz
> +/- 1.885	-13dBm / 1 MHz

where | f| is measured as the frequency offset from the center frequency of each reverse CDMA channel. Emission limits apply between the reverse CDMA channels when the separation between the carriers = 4×1.23 MHz.

Subtype 3 Band Class 1, 4, 6, & 8 (two carriers – maximum separation):

For | f| within the range (MHz)	Mask limit
+/- 1.25 to 2.25	6dBm / 1MHz
> +/- 2.25	-13dBm / 1 MHz

where | f| is measured as the frequency offset from the center frequency of each reverse CDMA channel. Emission limits apply between the reverse CDMA channels when the separation between the carriers = 4×1.25 MHz.

Subtype 3 (Adjacent Carriers) for three carriers:

For	f| within the range (MHz)	Mask limit
+/- 2.5 to 2.7	14 dBm / 30 kHz
+/- 2.7 to 3.5	[-14 + 15 x	f| - 2.7 MHz)] dBm / 1 MHz
+/- 3.5 to 7.5	[-13 + 1 x	f| - 3.5 MHz)] dBm / 1 MHz
+/- 7.5 to 8.5	[-17 + 10 x	f| - 7.5 MHz)] dBm / 1 MHz
+/- 8.5 to 12.5	-27 dBm / 1 MHz

where:

| f| = center frequency‒ closer measurement edge frequency

= (N - 3) x 625 kHz

N = number of carriers.

Subtype 3 (Adjacent Carriers) for N carriers (N = 2 or N > 3):

For	f| within the range (MHz)	Mask limit
+/- (2.5 +) to (3.5 +)	-13 dBm / (12.5 kHz x N)
+/- (3.5 +) to (3.125 x (N + 1))	-13 dBm / 1 MHz

where:

| f| = center frequency‒ closer measurement edge frequency

= (N - 3) x 625 kHz

N = number of carriers

Bluetooth analysis

Bluetooth provides analysis of Bluetooth 2.1+ EDR signals.

Select Bluetooth from the menu tab. Touch the ▶ button, and configure Bluetooth analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Meas. Config defines the parameters needed to make a measurement.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

Burst Location defines parameters for measuring the burst.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to Bluetooth.

Trace measurements

Captured Power vs Time

This plot displays the power vs. time trace for the capture that is being used for the underlying analysis of the Bluetooth signal.

The Captured Power vs. Time trace supports Min Hold, Max Hold and Averaging functions.

Where BER measurements are enabled, the captured power vs. time trace time axis does not necessarily reflect the search length.

Burst Spectrum

This graph type lets you display the spectrum of the detected burst.

The Burst Spectrum trace supports Min Hold, Max Hold and Averaging functions.

Power vs. Time

This plot displays the power vs. time trace of the detected Bluetooth burst.

The power vs. time trace does not support any statistical functions.

GFSK Frequency vs Time

This plot displays the frequency vs. time trace for the GFSK (Gaussian frequency-shift keying) part of the detected Bluetooth burst. For a basic data rate or LE Test packet type, this represents the complete packet, whereas for an enhanced data rate packet type, this represents the packet header.

The GFSK Frequency vs. Time trace supports Averaging, Min Hold and Max Hold functions.

PSK Constellation

This plot type lets you view the constellation of the PSK modulation within the detected Bluetooth burst, as well as the ideal reference points. This trace is valid only for an enhanced data rate packet type.

Real points are displayed as green dots.

Reference points are displayed as a small red cross indicating the exact ideal point.

No trace functions are supported by this trace.

PSK Constellation zoom in/zoom out

The PSK Constellation plot maintains a fixed 1:1 aspect ratio. This means that when performing a zoom selection, the extent that is displayed may not match the original selection.

PSK Constellation markers

The constellation plot supports an x-y marker system: the PSK Constellation marker displays the I and Q for the given sample, as well as the Reference I and Q value for that particular position.

Moving the marker either horizontally or vertically causes the marker to choose the closest constellation point to the desired position.

PSK DEVM vs Symbol

This plot displays the DEVM (differential error vector magnitude) for each symbol within the PSK-modulated part of the detected Bluetooth burst. This trace is valid only for an enhanced data rate packet type.

The PSK DEVM vs. Symbol trace supports Averaging, Min Hold and Max Hold functions.

Text measurements

This menu displays the results of measurements performed on the Bluetooth signal. It lets you enable or disable individual measurement items, or groups of items; as well as enabling particular statistical functions, such as Averaging, Min Hold and Max Hold.

In single-shot measurement mode, you may need to start another measurement for new results to appear after enabling an item.

Burst Analysis

This measurement displays the status and numeric results relating to the detected Bluetooth burst. It consists of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

Burst Position

The position (time) of the burst relative to the start of the captured data.

Burst Length

The length (time) of the detected burst.

Rising Edge Time

The time taken for the burst power to rise from 10% to 90% of the burst average power.

Falling Edge Time

The time taken for the burst power to fall from 90% to 10% of the burst average power.

GFSK Burst Position

The position of the GFSK section of the burst, relative to the start of burst (the Burst Position).

GFSK Burst Length

The length of the GFSK section of the burst.

PSK Burst Position

The position of the PSK section of the burst, relative to the start of burst (that is, the Burst Position). This is relevant only for enhanced data rate packet types.

PSK Burst Length

The length of the PSK section of the burst. This is relevant only for enhanced data rate packet types.

Power/Spectrum measurements

This displays the numeric results relating to power and spectrum measurements on the analyzed Bluetooth burst. It consists of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

Peak Power

The peak power of the burst, in dBm, as defined in section TRM/CA/01/C or TRM-LE/CA/01/C of the Bluetooth Test Specification.

Average Power

The average power of the burst, in dBm, as defined in section TRM/CA/01/C or TRM-LE/CA/01/C of the Bluetooth Test Specification.

GFSK Peak Power

The peak power of the GFSK section of the burst.

GFSK Average Power

The average power of the GFSK section of the burst.

PSK Average Power

The average power of the PSK section of the burst for an enhanced data rate packet type.

EDR Relative Tx Power

The difference between the average power of the PSK section and the GFSK section of the burst, for an enhanced data rate packet type, as defined in section TRM/CA/10/C of the Bluetooth Test Specification.

-20dB Bandwidth

The –20dB bandwidth, as defined in section TRM/CA/05/C of the Bluetooth Test Specification.

Power Density (dBm/100kHz)

The measured Power Density, as defined in section TRM/CA/02/C of the Bluetooth Test Specification.

Occupied Bandwidth (99%)

This measurement displays the occupied bandwidth of the signal, which is the bandwidth that contains 99% of the total power.

Adjacent Channel Power

This measurement displays the power in adjacent channels for a basic rate packet type, as defined in section TRM/CA/06/C of the Bluetooth Test Specification. Up to 11 channels are displayed, consisting of five channels above, and five channels below the centre channel.

These results support Averaging, Min Hold, Max Hold and Standard Deviation.

EDR Spurious Emissions

This measurement displays the EDR in-band spurious emissions in adjacent channels for an enhanced rate packet, as defined in section TRM/CA/13/C of the Bluetooth Test Specification. Up to 11 channels are displayed, consisting of five channels above, and five channels below the center channel. These results support Averaging, Min Hold, Max Hold and Standard Deviation.

LE Spectral Emissions

This measurement displays the Bluetooth Low Energy in-band spectral emissions in adjacent channels for a Low Energy packet, as defined in section TRM-LE/CA/03/C of the Bluetooth Test Specification. Up to 11 channels are displayed, consisting of five channels above, and five channels below the centre channel. These results support Averaging, Min Hold, Max Hold and Standard Deviation.

Modulation Characteristics

This measurement displays the Modulation Characteristics for a basic rate or LE Test packet type, as defined in section TRM/CA/07/C or TRM-LE/CA/05/C of the Bluetooth Test Specification. It consists of the following results, which support Averaging, Min Hold, Max Hold and Standard Deviation, except for Δf1 Packet Count and Δf2 Packet Count.

Δf1 Packet Count

The number of packets within the captured burst that have a 00001111 payload.

Δf1avg

The average of all the Δf1max values in the detected bursts containing a 00001111 payload.

Δf2 Packet Count

The number of packets within the captured burst that have a 01010101 payload.

Δf2avg

The average of all the Δf2max values in the detected bursts containing a 01010101 payload.

Δf2max Pass Rate

The percentage of Δf2max values that is = 115kHz (for basic rate packets) or = 185kHz (for LE Test packets).

Δf2avg/ Δf1avg Ratio

The ratio of Δf2avg and Δf1avg.

Carrier Frequency Measurements

This measurement displays the numeric results relating to carrier frequency measurements of a basic rate packet type. It consists of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

Init Carrier Freq Tol

The Initial Carrier Frequency Tolerance, as defined in section TRM/CA/08/C or TRM-LE/CA/06/C of the Bluetooth Test Specification.

Max Carrier Freq Drift

The Maximum Carrier Frequency Drift, as defined in section TRM/CA/09/C or TRM-LE/CA/06/C of the Bluetooth Test Specification.

Max Carrier Freq Drift Rate

The Maximum Carrier Frequency Drift Rate, as defined in section TRM/CA/09/C or TRM-LE/CA/06/C of the Bluetooth Test Specification.

EDR Modulation measurements

The Bluetooth Test Specification (section TRM/CA/11/C) requires measurements of DEVM and frequency error to be calculated over a number of 50-symbol blocks, accumulated over a number of packets.

Each packet is split into 50-symbol blocks, and any additional symbols are ignored. Each of these blocks is analyzed, and results are accumulated over the number of blocks defined by EDR Blocks to Analyze. Each analysis always starts at the beginning of a packet.

These values are then used to display results for the packet (see EDR Modulation Burst Measurements) and accumulated packets (see EDR Modulation Cumulative Measurements).

Once the number of blocks defined by EDR Blocks to Analyze has been accumulated, subsequent measurements reflect a rolling value based on the most recent blocks analyzed, subject to the limitation that the first analyzed block must be at the start of a packet. For example, if each packet contains 32 blocks, and the maximum block count is set to 200, results are accumulated for all blocks in the first six packets, together with the first eight blocks in the seventh packet. When another packet is received, the contents of the first packet are removed, and all blocks in packets 2 to 7 are used, together with the first eight blocks in the eighth packet, and so on.

The Reset Cumulative button clears the stored data and restarts accumulating data.

EDR Modulation (Burst) Measurements

This measurement displays the status and numeric results relating to EDR Carrier Frequency Stability and Modulation Accuracy within a single Bluetooth burst. These measurements apply only to the data part of an enhanced data rate Packet Type, and include the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

DEVM Max RMS (Burst)

The maximum RMS DEVM for the PSK section of the burst. Refer to EDR Modulation Measurements for details of how this is calculated.

DEVM Peak (Burst)

The Peak DEVM for the PSK section of the burst. Refer to EDR Modulation Measurements for details of how this is calculated.

DEVM 99% (Burst)

The 99% DEVM value for the PSK section of the burst, which is the maximum value for 99% of the analyzed symbols in the burst. Refer to EDR Modulation Measurements for details of how this is calculated.

Initial Freq Error (Burst)

The Initial Frequency Error (ωi) for the burst.

Max Block Freq Error (Burst)

The maximum Block Frequency Error (ωo) for the blocks analyzed in the burst. Refer to EDR Modulation Measurements for details of how this is calculated.

Max Total Freq Error (Burst)

The maximum Total Frequency Error (ωi + ωo) for the blocks analyzed in the burst. Refer to EDR Modulation Measurements for details of how this is calculated.

Origin Offset Max (%)

The maximum Origin Offset (carrier leak) in % for the burst.

Origin Offset Min (%)

The minimum Origin Offset (carrier leak) in % for the burst.

Origin Offset Average (%)

The average Origin Offset (carrier leak) in % for the burst.

Origin Offset Max (dB)

The maximum Origin Offset (carrier leak) in dB for the burst.

Origin Offset Min (dB)

The minimum Origin Offset (carrier leak) in dB for the burst.

Origin Offset Average (dB)

The average Origin Offset (carrier leak) in dB for the burst.

EDR Modulation (Cumulative) Measurements

These measurements display the numeric results relating to EDR Carrier Frequency Stability and Modulation Accuracy accumulated over a number of Bluetooth bursts. This is defined in section TRM/CA/11/C of the Bluetooth Test Specification. Refer to EDR Modulation Measurements for more details. These measurements apply only to the data part of an enhanced data rate packet type, and consist of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation apart from the Accumulated EDR Block Count.

Accumulated EDR Block Count

This displays the number of 50-symbol blocks that have been analyzed to produce the measurements in this section. This measurement does not support any statistical functions.

DEVM Max RMS

The maximum RMS DEVM over the accumulated blocks.

DEVM Peak

The Peak DEVM over the accumulated blocks.

DEVM 99%

The 99% DEVM value for the accumulated blocks, which is the maximum value for 99% of the analyzed symbol.

Max Initial Freq Error

The maximum Initial Frequency Error (ωi) for the packets containing the accumulated blocks.

Max Block Freq Error

The maximum Block Frequency Error (ωo) for the accumulated blocks.

Max Total Freq Error

The maximum Total Frequency Error ($\omega i + \omega o$) for the accumulated blocks.

RF

Use this to set up the basic RF frequency and RF level parameters of a Bluetooth measurement.

Frequency

Use this to set the center frequency for the signal you want to measure.

Set the frequency in one of three ways:

1. explicitly, by using the Frequency control;

2. by specifying a BR/EDR channel number using the Channel Number control;

3. by specifying a low energy channel number using the LE Channel Number control.

Note that if a valid channel number is specified, the Frequency entry is updated with the corresponding frequency value. If the frequency is entered directly in the Frequency control, the Channel Number and LE Channel Number controls update to report 'No Channel', because the entered frequency may not correspond to a defined channel number.

Channel Number

Use this to set the center frequency by specifying the Bluetooth BR/EDR channel number.

Specifying a channel sets a particular frequency. Refer to the comments for Frequency, which describe how the Frequency and Channel controls interact. When you use this control to set the frequency, the LE Channel Number control is set automatically to the corresponding Bluetooth LE channel number.

LE Channel Number

Use this to set the center frequency by specifying the Low Energy (LE) Channel Number.

Specifying a channel sets a particular frequency. When you use this control to set the frequency, the BR/EDR Channel Number control is set automatically to the corresponding BR/EDR channel number, if there is one at the same frequency, or to 'No Channel' otherwise.

Attenuation Mode

Use this to specify how the RF attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you can specify the amount of RF attenuation that the instrument applies.

DUT Output Level

Use this to specify the output level of the DUT, normally the RMS output level.

Use Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use DUT Tx Path Loss to allow for any path loss between the DUT and the instrument's input.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer.

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust the attenuation manually only when Attenuation Mode is set to Manual. When in Auto attenuation mode, the RF input level is set automatically in order to optimize the RF gain setting.

DUT Tx Path Loss

Use this to specify the loss between the DUT output and the instrument's input, and to adjust the RF input level of the instrument.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

Meas. Config

Use this screen to set up key information for demodulating and analyzing the signal.

Search Length

Use this to set the minimum capture time (in s).

The instrument calculates the time required to capture a complete burst, based on the Packet Type and Payload Length.

Packet Type

Use this to define the type of Bluetooth packet that is to be received and analyzed.

DH1, DH3 and DH5 are basic rate packet types, while 2-DH1, 2-DH3, 2-DH5, 2-EV3, 2-EV5, 3-DH1, 3- DH3 and 3-DH5 are enhanced data rate packet types, and LE Test is a packet type for use in Bluetooth LE testing.

Payload Length

Use this to specify the payload length in the received packet. This excludes the length of the payload header (if any) and CRC.

Payload Bit Pattern

Use this to specify the bit pattern in the received packet.'10101010', '11110000', All Zeros, All Ones and PN9 patterns are available.

EDR Blocks to Analyze

Some Bluetooth measurements (for example, PSK modulation (cumulative) measurements) are accumulated over a number of 50-symbol blocks, which require the analysis of multiple packets. Use this control to specify the number of blocks that are to be analyzed.

Reset Cumulative

Use this button to reset the accumulated data used to calculate the values that are displayed as PSK modulation (cumulative) measurements.

Rx Generator

Not currently available: for future use

Burst Location

Bluetooth signals consist of gated bursts, and the location of the burst needs to be determined prior to analysis. Use burst location to configure the relevant parameters that control how the burst is located within the captured data.

Rising/Falling Edge Threshold

The instrument determines the burst location by looking for significant changes in power. You can specify the magnitude of this change separately for both the rising and falling edges of a burst using the Rising Edge Threshold and Falling Edge Threshold controls.

This figure illustrates these two properties:
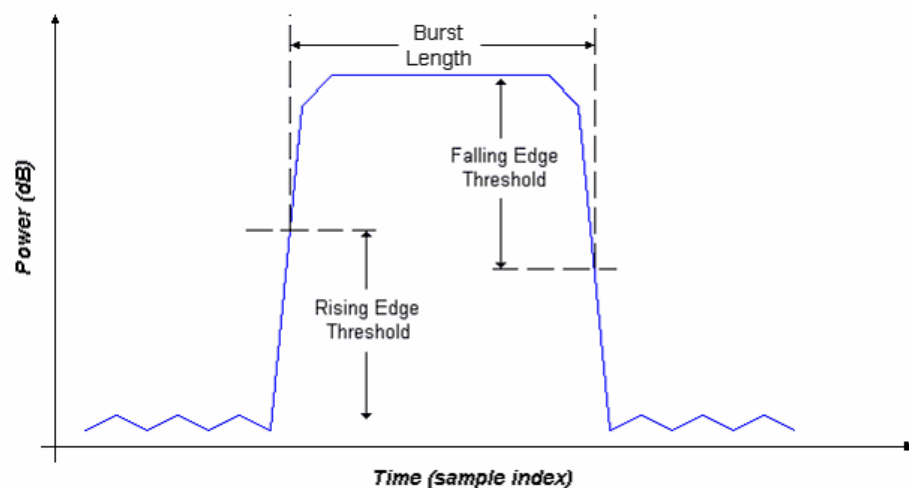
Pre-Trigger Time

Pre-trigger time is the period that the measurement waits for before looking for a burst's rising edge. This means that any supplied IQ data must have at least a 'Pre-trigger Time' number of samples prior to the burst.

If the Integration Skip Time is less than the Integration Time, the integration periods overlap. If the Integration Skip Time is greater than the Integration Time, there is a gap between integration periods. The figure below illustrates the latter scenario:

Minimum Off Time

Having found a burst's rising edge, the instrument searches for the falling edge. The power between two integration periods is compared until it decreases by at least the Falling Edge Threshold and remains below the threshold for the Minimum Off Time.

If the power goes above the threshold during this period, it is not a falling edge. The figure below illustrates the falling edge detection:

Minimum On Time

To detect a burst's rising edge, the power in two integration periods is compared across the IQ data until it increases by at least the Rising Edge Threshold and remains above the threshold for the Minimum On Time. If the power drops below the threshold during this period, it is not a rising edge.

Integration Time

The Bluetooth measurement for burst location uses the concept of a power integration period set by the Integration Time control. This is used to smooth the signal power over a period of time to prevent false burst detection in noisy signals.

Integration Skip Time/Comparator Delay

The two integration periods used for comparison need not be adjacent to each other. The Integration Skip Time and Comparator Delay controls specify where and how far apart the integration periods are.

This figure illustrates these properties for the rising edge:

Here the Integration Time and Integration Skip Time are the same length, which means that the integration periods are adjacent to each other. The Comparator Delay is two integration periods long, so there is a gap of one period between the powers compared, as shown by the shading in the figure above.

Reset to Default
Resets all the fields to their default values: 15 dB for rising and falling edge thresholds, 0 ns for all remaining fields.

cdma2000 Reverse Link analysis

cdma200 Reverse Link provides analysis of cdma2000 signals.

Select cdma2000 from the menu tab. Touch the ▶ button, and configure cdma2000 analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Meas. Config defines the parameters needed to make a measurement.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

ACPR defines the number of offset frequencies that are measured.

Spectral Mask defines the shape of the spectral mask. This screen is common to many modulation types.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to cdma2000 Reverse Link.

Trace measurements

Raw Spectrum

This graph type displays the spectrum (power vs. frequency) of the signal being measured using a fixed resolution bandwidth of 30 kHz. The spectrum trace supports Min Hold, Max Hold and Averaging functions.

Spectral mask

The currently selected spectral mask (either user-defined or predefined) may also be overlaid on the spectrum trace. This can be disabled by touching anywhere on the graph and disabling it from the Trace Controls\Spectral Mask menu.

Spectral Mask Markers

As well as standard marker functionality, the delta between the spectral mask and the trace is also displayed when displaying a marker.

ACPR (adjacent channel power ratio)

This graph type displays the results of ACPR analysis performed on the cdma2000 Reverse Link signal.

The ACPR trace supports Live, Min Hold, Max Hold and Averaging functions.

Composite Constellation

This plot type lets you view the Composite Constellation measurement within the cdma2000 Reverse Link signal and optionally the ideal reference points.

Real points are displayed as green dots. Reference points are displayed as small red crosses indicating the exact ideal point.

This trace does not support any statistical functions.

Composite Constellation zoom in/zoom out

The Composite Constellation plot maintains a fixed 1:1 aspect ratio. This means that when performing a zoom selection, the extent that is displayed may not match the original selection.

Composite Constellation markers

The constellation plot supports an x-y marker system.

The Composite Constellation marker displays the I and Q for the given sample, as well as the reference I and Q value for that particular position.

Moving the marker either horizontally or vertically causes the marker to choose the constellation point closest to the desired position.

When performing continuous captures, the sample retains the marker it is currently displaying. If you use an Immediate trigger, the marker may jump around, as the sample that the marker is measuring is now in a completely different location.

Because of this, it is recommended that you use an external or burst trigger when making continuous measurements.

Captured Power vs. Time

This plot displays the power vs. time trace of the capture that is being used for the underlying analysis of the cdma2000 Reverse Link signal.

The power vs. time trace supports Live, Min Hold, Max Hold and Averaging functions.

Code Domain Power

This plot type displays the code domain power of the cdma2000 Reverse Link signal being measured. Active codes are shown in a brighter shade than inactive codes.

This trace supports Live, Min Hold, Max Hold and Averaging functions.

Enabling/disabling I/Q branches

To turn off the I or Q branch, select the Trace Controls menu item in the Graph Control menu, and check or uncheck the Show I or Show Q menu items to enable or disable the relevant graph section. This resizes the graph and displays only a single branch. Note that you cannot disable both branches.

Zooming in/out

When performing a zoom in or out on the split code domain trace, the new X/Y limits are applied to both the I and Q branches. This means if you re-scale the Y axis on this trace for the I branch, it applies to the Q branch as well.

Code Domain Error

This plot type displays the code domain error of the cdma2000 Reverse Link signal being measured.

This trace supports Live, Min Hold, Max Hold and Averaging functions.

Enabling/disabling I/Q branches

To turn off the I or Q branch, select the Trace Controls menu item (touch the screen to display the menu) and check or uncheck the Show I or Show Q menu items to enable or disable the relevant graph section. This resizes the graph and displays only a single branch. Note that you cannot disable both branches.

Zooming in/out

When performing a zoom in or out on the split code domain trace, the new X/Y limits are applied to both the I and Q branches. This means if you re-scale the Y axis on this trace for the I branch, it applies to the Q branch as well.

CCDF

This plot type shows the CCDF (complementary cumulative distribution function) of the cdma2000 Reverse Link signal being analyzed. This trace does not support any statistical functions.

Text measurements

Modulation Accuracy

This measurement displays the numeric results relating to modulation accuracy measurements of the analyzed cdma2000 Reverse Link signal. All modulation accuracy measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

EVM RMS

This displays the RMS EVM, as a percentage, for the signal being measured.

A perfect ideal signal is synthesized at the chip level and identified as the reference signal. The reference signal is subtracted from the measured signal to produce a time record of error phasors. The square root of the ratio of the mean power of the error signal to the mean power of the reference signal is computed and expressed as a percentage EVM.

EVM Peak

This displays the peak EVM, as a percentage, for the signal being measured.

Rho Factor

This displays the rho modulation accuracy indicator.

Rho is the normalized correlation coefficient between the measured and ideal reference signals. Rho is computed by comparing the normalized correlated power between the measured signal and the reference signal and is designated as the waveform quality factor.

The maximum value of rho is 1.0 (which means the measured signal and reference signal are 100% identical).

A rho value of 1.0 indicates that all of the transmitted power correlates with the ideal signal as determined by the detected   sequence.

Rho is the correlated power for all active code channels (as seen in the composite CDP trace data display).

Frequency Error

This displays the frequency error, in Hz, of the signal being measured.

Carrier Leak

This displays the carrier leak (any output signal appearing when I and Q inputs are set to 0 V) of the signal being measured.

CDE Peak I

This measurement displays the peak code domain error (an indication of noise and spurious signals in code channels) for the I channel.

CDE Peak Q

This measurement displays the peak code domain error (an indication of noise and spurious signals in code channels) for the Q channel.

Phase Error RMS

This displays the measured RMS phase error result, in degrees. This is the RMS value of the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot.

Phase Error Peak

This displays the measured peak phase error result, in degrees. This is the peak RMS among the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot.

Magnitude Error RMS

This displays, as a percentage, the RMS magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) of the composite signal.

Magnitude Error Peak

This displays, as a percentage, the peak magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) for the data segment of the analyzed time slot.

Transmit Time Error

This displays the transmit time error. Note that this measurement requires an external trigger to be used to start the capture on a frame boundary.

Power Measurements

All power measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

Average Power

Average power is measured across the whole bandwidth as opposed to channel power, which is measured through a 1.23 MHz filter. The average broadband power of the captured IQ is:

$$\frac{I^2 + Q^2}{NumSamples}$$

Channel Power

Channel power is measured through a 1.23 MHz filter as opposed to average power, which is measured across the whole bandwidth.

Spectral Mask

This measurement displays whether any of the transmitted signal exceeds the limits of the specified spectral mask, as well as giving the frequency and level of the failure. If the transmitted signal does not exceed the spectral mask, the frequency and level supplied represent the closest point to failure.

This measurement does not support any of the statistical functions.

Pass Fail

This gives a simple indication as to whether the signal is within the mask limits.

Fail Frequency

This is the frequency of the largest spectrum peak that exceeds the spectral mask limit.

Fail Level

This is the power of the largest spectrum peak that exceeds the spectral mask limit.

Fail Level Error

If the spectrum fails the mask, the value of this property contains the dB error, or difference, between the largest spectrum peak that exceeds the mask and the power mask limit.

Failure Points

This is the total number of points that fail to meet the spectral mask.

ACPR

This measurement displays the results of the adjacent channel power ratio at the frequency offsets specified in the ACPR settings.

All ACPR measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

RF

Use this to set up the basic RF frequency and RF level parameters of a cdma2000 measurement.

It consists of the following controls:

Frequency Centre

Use this to set the center frequency of the measurement.

Band Class

Band class refers to a set of frequency channels and a numbering scheme for these channels.

For Band Class 0, the channel is centered on one of the 30 kHz channels. For Band Classes 1, 4, 6, 7, 8 and 9, the channel is centered on one of the 50 kHz channels. For Band Classes 2 and 3, the channel is centered on one of the 25 kHz channels. For Band Class 5, the channel is centered on one of the 20 or 25 kHz channels. Changing the band class also affects the predefined spectral mask. See Spectral Mask for details of the available options.

The band class that is selected determines the range of frequency channels that are valid. The table that follows describes the band classes and associated frequency channels.

Channel Number

Use this to select a specific channel number, which adjusts the center frequency accordingly. The range of valid channel numbers depends upon the band class selected, as described in the following table.

Band classes and associated frequency channels

The band class refers to a set of frequency channels and a numbering scheme for these channels.

This table describes each band and the range of frequency channel appropriate to that band. This implementation corresponds to band class specification 3GPP2 C.S0057-C Version 1.0 July 2008.

Band classes and frequencies

Band	Band description	Channel number	Uplink frequency (MHz)
0	800 MHz cellular band	1 <= N <= 799	0.030 * N + 825.000
		991 <= N <= 1023	0.030 * (N − 1023) + 825.000
		1024 <= N <= 1323	0.030 * (N − 1024) + 815.040
1	1.8 to 2.0 GHz PCS band	0 <= N <= 1199	1850.000 + 0.050 * N
2	872 to 960 MHz TACS band	0 <= N <= 1000	0.025 * N + 889.9875
		1329 <= N <= 2047	0.025 * (N − 1328) + 871.9875
		2048 <= N <= 2108	0.025 * (N − 2048) + 894.000
3	832 to 925 MHz JTACS band	1 <= N <= 799	0.0125 * N + 915.000
		801 <= N <= 1039	0.0125 * (N − 800) + 898.000
		1041 <= N <= 1199	0.0125 * (N − 1040) + 887.000
		1201 <= N <= 1600	0.0125 * (N − 1200) + 893.000
		Note: Only even-valued N values are valid	
4	1.75 to 1.87 GHz Korean PCS band	0 <= N <= 599	(0.050 * N) + 1750.000
5	450 MHz NMT band	1 <= N <= 400	0.025 * (N − 1) + 450.000
		472 <= N <= 871	0.025 * (N − 472) + 410.000
		1039 <= N <= 1473	0.025 * (N − 1024) + 451.010
		1536 <= N <= 1715	0.025 * (N − 1536) + 479.000
		1792 <= N <= 2106	0.025 * (N − 1792) + 479.000
6	2 GHz IMT-2000 band	0 <= N <= 1199	1920.000 + 0.050 * N
7	Upper 700 MHz band	0 <= N <= 240	776.000 + 0.050 * N
8	1800 MHz band	0 <= N <= 1499	1710.000 + 0.050 * N
9	900 MHz band	0 <= N <= 699	880.000 + 0.050 * N
10	Secondary 800 MHz band	0 <= N <= 719	0.025 * N + 806.000
		720 <= N <= 919	0.025 * (N − 720) + 896.000
11	400 MHz European PAMR band	1 <= N <= 400	0.025 * (N − 1) + 450.000
		472 <= N <= 871	0.025 * (N − 472) + 410.000
		1039 <= N <= 1473	Reserved
		1536 <= N <= 1715	0.025 * (N − 1536) + 479.000
		1792 <= N <= 2016	Reserved

Band	Band description	Channel number	Uplink frequency (MHz)
12	800 MHz PAMR band	0 <= N <= 239	870.0125 + 0.025 * N
13	2.5 GHz IMT-2000 Extension band	0 <= N <= 1399	2500.0 + 0.050 * N
14	US PCS 1.9 GHz Band	0 <= N <= 1299	1850.0 + 0.050 * N
15	AWS Band	0 <= N <= 899	1710.0 + 0.050 * N

Attenuation Mode

Use this to specify how the RF attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This allows the input condition to be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust the attenuation manually only when attenuation mode is set to Manual. When in Auto attenuation mode, the RF input level is set automatically in order to optimize the RF gain setting.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

DUT Output Level

Use this to specify the output level of the DUT, which is normally the RMS output level.

Use the Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use the DUT Tx Path Loss to compensate for any path loss between the DUT and the instrument's input.

DUT Tx Path Loss

Use this to specify the loss between the DUT output and the instrument's input, and to adjust the RF input level of the instrument.

Meas. Config

Use this screen to set up key information about demodulating and analyzing the signal.
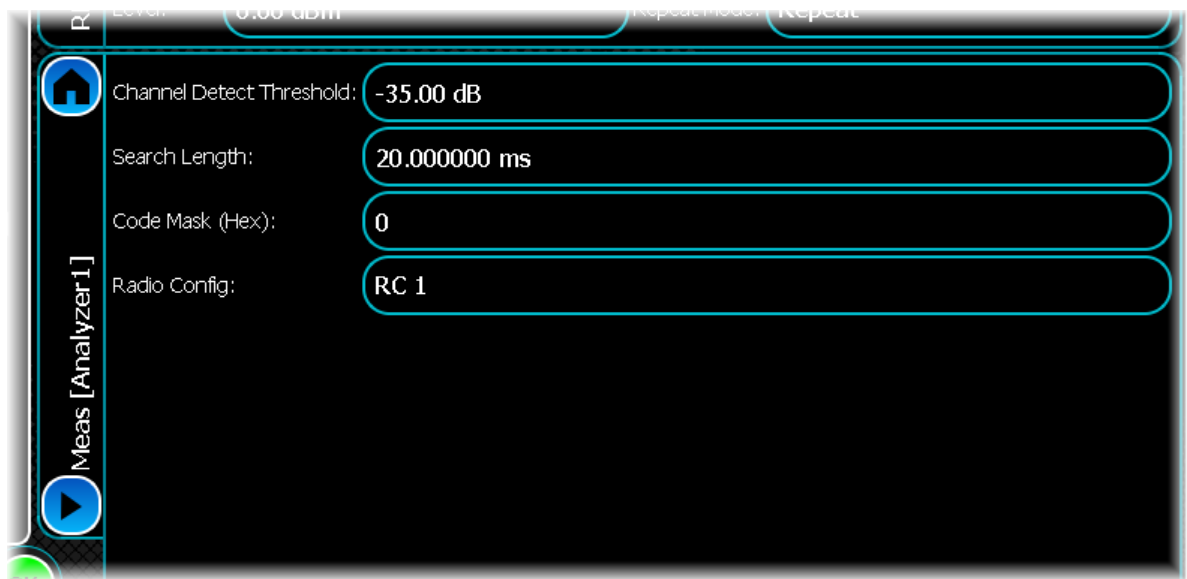
It consists of the following controls:

Channel Detect Threshold

Use this to find the first burst position. To determine the start of a burst, the analysis process looks for a change in power greater than this threshold.

Search Length

This specifies the minimum amount of time for which data is captured when performing demodulation measurements, overriding that determined automatically by the instrument only if the value specified is greater.

A search length of zero allows the instrument to use its automatically-determined capture time. This should always be sufficient when an immediate trigger is employed. Setting the value of search length unnecessarily high adversely affects the analysis time.

Code Mask (Hex)

For reverse link channel measurements, you must specify the long code masks to match the I and Q channels of the measured 1xEV-DO Reverse Link signal.

The long code masks must be in the range: 0 to 4,398,046,511,103 (0h to 3FFFFFFFFFFh).

Radio Config

Use this to define the physical channel configuration, based upon a specific channel data rate.

ACPR

The ACPR (adjacent channel power ratio) settings screen lets you specify a number of offset frequencies (relative to the carrier frequency) that are measured when performing ACPR measurements.

ACPR Mode

Select User defined to enter an odd number of between one and five frequency offsets for ACPR.

Modifying a frequency offset

To modify a frequency offset, select the desired offset and touch it to start editing. Enter the desired frequency offset in Hz into the edit box.

Note that you cannot modify the first frequency offset, which is fixed to the center frequency.

Spectral Mask

User-defined spectral mask

See the common [Spectral mask](#) section for information on how to create a user-defined spectral mask.

Pre-defined spectral mask

This section provides information about pre-defined masks for cdma2000.

The mask limits defined below (Pre-defined spectral masks) are applied depending upon the band class, subtype and Subtype 3 mask type (if Subtype 3 is selected).

Pre-defined spectral masks

The following mask limits are supported depending upon the band class selected.

Band Class 0, 2, 5 & 9:

For center frequency within the range (MHz)	Mask limit
+/- 0.885 to 1.98	-42 dB
+/- 1.98 to 4.0	-54 dB

Band Class 1, 4 & 8:

For center frequency within the range (MHz)	Mask limit
+/- 1.25 to 1.98	-42 dB
+/- 1.98 to 4.0	-50 dB

Generic analysis

Use Generic mode to configure any of the generic FM, audio, QAM and shift keying modes.

Select Generic from the menu tab. Touch the ▶ button, and configure generic analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

Modulation defines the modulation type and its parameters.

General defines timings, analysis mode and filter values for measurements.

Spectrum defines the settings for a spectrum measurement.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Meas defines the parameters needed to make a measurement.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

Burst Location defines parameters for measuring the burst.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to Generic mode.

Trace measurements

Capture Power vs Time

This plot displays the power vs. time trace of the capture that is being used for the underlying analysis of the generic signal.

The power vs. time trace supports Live, Min Hold, Max Hold and Averaging functions.

Burst Power vs Time

This displays the burst power versus time trace of the detected RF signal. This trace is valid only for modulation types BPSK, QPSK and OQPSK when Analysis Mode is set to Burst IQ.

This trace does not support any statistical functions.

Constellation

This plot type lets you view the constellation within the measured signal, as well as the ideal reference points. This trace is valid only for modulation types: BPSK, QPSK and OQPSK. You can select to display or hide the Ideal (reference) constellation

Real points are displayed as green dots. Reference points are displayed as small red crosses indicating the exact ideal point.

This trace does not support any statistical functions.

Constellation zoom in/zoom out

The Composite Constellation plot maintains a fixed 1:1 aspect ratio. This means that when performing a zoom selection, the extent that is displayed may not match the original selection.

Error Vector Magnitude (EVM) vs Symbol

This displays the EVM for each symbol within the modulated part of the detected signal. This trace is valid only for modulation types: BPSK, QPSK and OQPSK.

This trace supports Live, Minimum Hold, Maximum Hold and Averaging functions.

Phase Error vs Symbol

This displays a phase error versus symbol trace of the signal you are measuring. This trace is valid only for modulation types: BPSK, QPSK and OQPSK.

This trace supports Live, Minimum Hold, Maximum Hold and Averaging functions.

Magnitude Error vs Symbol

This displays the magnitude error for each symbol. This trace is valid only for modulation types: BPSK, QPSK and OQPSK.

This trace supports Live, Minimum Hold, Maximum Hold and Averaging functions.

CCDF

This plot type shows the CCDF (complementary cumulative distribution function) of the signal being analyzed. This trace is valid only for modulation types BPSK, QPSK and OQPSK.

This trace does not support any statistical functions.

Spectrum

This displays the spectrum (power versus frequency) of the signal you are measuring, as well as the occupied bandwidth (OBW) and adjacent channel power (ACP).

By default, ACP and occupied bandwidth are disabled. However, you can enable them through the measurement menu (accessed by touching the screen).

To enable or disable ACP, occupied bandwidth or power vs. frequency traces, select the Trace Controls menu item, and enable the graph type from the item list.

This trace supports Live, Minimum Hold, Maximum Hold and Averaging functions.

Spectral mask

The currently selected spectral mask (either user-defined or predefined) may also be overlaid on the spectrum trace. This can be disabled by touching anywhere on the graph and disabling it from the Trace Controls\Spectrum Mask menu.

This trace supports Live, Minimum Hold, Maximum Hold and Averaging functions.

Spectral Mask Markers

As well as standard marker functionality, the delta between the spectral mask and the trace is also displayed when displaying a marker.

Text measurements

Burst Location

This trace is valid only for modulation types: BPSK, QPSK and OQPSK when Analysis Mode is set to Burst IQ.

Burst Position

This displays the IQ burst position relative to the IQ capture, in seconds, of the signal. This measurement supports Live results only.

Burst Length

This displays the IQ burst length, in seconds, of the signal. This measurement supports Live results only.

CW

This displays the CW frequency offset, in Hz, for the signal being measured. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Power

The power measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Average Power

This displays the average power measured through the Channel Filter Type (if enabled).

Peak Power

This displays the peak power measured through the Channel Filter Type (if enabled).

FM

Only valid for modulation type FM.

These measurements support Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

FM Frequency Deviation

This displays the total frequency deviation of the signal, in Hz.

FM Frequency Deviation (M)

This displays the frequency deviation equal to one-half of the sum of the FM audio's left and right channels of the signal, in Hz.

FM Frequency Deviation (S)

This displays the frequency deviation equal to one-half of the difference of the FM audio's left and right channels of the signal, in Hz.

FM Frequency Deviation (P)

This displays the frequency deviation of the FM stereo signal's pilot, in Hz.

Audio

Only valid for modulation type FM.

These measurements support Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Frequency

This displays the frequency of the audio signal, in Hz.

Level RMS

This displays the RMS level of the audio signal in the selected Level Units (dB or Volts).

SNR

This displays the signal-to-noise ratio of the audio signal, in dB.

SINAD

This displays the signal-to-noise and distortion, of the audio signal in dB.

THD

This displays the total harmonic distortion of the audio signal, as a percentage.

THD + Noise

This displays the total harmonic distortion and noise of the audio signal, as a percentage.

Stereo Isolation

This displays the stereo isolation of the audio signal, in dB.

Modulation Accuracy

This measurement displays the numeric results relating to modulation accuracy measurements of the analyzed generic signal. These results are only valid for modulation types, BPSK, QPSK and OQPSK.

EVM RMS

This displays the RMS error vector magnitude for the signal being measured, as a percentage.

A perfect ideal signal is synthesized at the chip level and identified as the reference signal. The reference signal is subtracted from the measured signal to produce a time record of error phasors. The square root of the ratio of the mean power of the error signal to the mean power of the reference signal is computed and expressed as a percentage EVM.

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

EVM Peak

This displays the peak error vector magnitude for the signal being measured, as a percentage. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

EVM Peak Symbol

This displays the symbol position at which the peak EVM was measured. This measurement supports Live results only.

Phase Error RMS

This displays the measured RMS phase error result, in degrees. This is the RMS value of the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Phase Error Peak

This displays the measured peak phase error result, in degrees. This is the peak RMS among the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Phase Error Peak Symbol

This displays the symbol position at which the peak phase error was measured. This measurement supports Live results only.

Magnitude Error RMS

This displays, as a percentage, the RMS magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) of the composite signal. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Magnitude Error Peak

This displays, as a percentage, the peak magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) for the data segment of the analyzed time slot.

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Magnitude Error Peak Symbol

This displays the symbol position at which the peak magnitude error was measured. This measurement supports Live results only.

Frequency Error

This displays the frequency error of the signal being measured, in Hz. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

IQ Origin Offset

This displays the IQ origin offset (carrier leak) of the signal, in dB. This is the magnitude of the carrier feed-through signal, which represents the shift in the IQ origin. When there is no carrier feed-through, the IQ origin offset is zero (-infinity dB).

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

IQ Gain Imbalance

This displays the IQ gain imbalance of the signal, in dB. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

IQ Skew

This displays the IQ skew (orthogonal error or quadrature skew error) between the data I and Q signals of the analyzed time slot, in degrees. Ideally, I and Q signals should be orthogonal (90 degrees apart). A quadrature skew error of 3 degrees means I and Q are 87 degrees (or 93 degrees) apart.

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Sync Pattern Detected

This displays the Boolean result (true/false) indicating if the synchronization pattern was detected.

Adjacent Channel Power

The ACP measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Offset

This displays the offset from the center frequency, in Hz.

Power

This displays the power in the selected channel. The power of the center channel is displayed as the absolute power (in dBm). The power in other channels is displayed relative to this value (in dB).

Occupied Bandwidth

This displays the occupied bandwidth (OBW), in Hz, occupied by the OBW percentage value in the total power in an OBW width. This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Lower Frequency

This displays the lower frequency of the measured Occupied Bandwidth, in Hz, of the signal. This measurement supports Live results only.

Upper Frequency

This displays the upper frequency of the measured Occupied Bandwidth, in Hz, of the signal.This measurement supports Live results only.

Spectrum Mask

This measurement displays whether any of the transmitted signal exceeds the limits of the specified Spectrum Mask, as well as giving the frequency and level of the failure. This measurement supports Live results only.

Status (Pass/Fail)

This gives a simple indication as to whether the signal is within the mask limits.

Frequency

This is the frequency corresponding to the reported Level, which is the point of greatest failure against the mask if the test fails, or the nearest point to failure if the test passes.

Level

If the spectrum fails the mask, the value of this property is the power relative to the mask at which it is furthest from the mask. If the spectrum passes the mask, this property gives the power relative to the mask at which it is closest to the mask. The value is positive if the spectrum fails the mask, and negative if it has passed.

Reference Level

If the mask was defined using relative values, this reports the reference level that was used to compare the spectrum to the mask.

Demodulated Bits

The result is presented in a table with the left column containing indexes for sequences of 16 bits presented in the right column. Bits in the sequence are arranged, from left to right, in the order of their positions in the bit string (so that a bit with lower position appears to the left of a bit with a higher position). Note that the first bit to be displayed is from the symbol determined by the Symbol Offset value.

Demodulated Symbols

The result is presented in a table with Symbol and Value as column headers. The Symbol column contains the symbol number, and the Value column contains the binary representation of the symbol value, which is zero-padded to the correct number of bits. Note that the first symbol to be displayed is determined by the Symbol Offset value.

RF

Use this to set up the basic RF frequency and RF level parameters of a generic measurement.

Frequency Centre

Use this to set the center frequency of the measurement.

Attenuation Mode

Use this to specify how the RF attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This allows the input condition to be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

DUT Output Level

Use this to specify the output level of the DUT, which is normally the RMS output level.

Use the Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use the DUT Tx Path Loss to compensate for any path loss between the DUT and the instrument's input.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust attenuation manually only when Attenuation Mode is set to Manual. When in Auto attenuation mode, the RF input level is set automatically in order to optimize the RF gain setting.

DUT Tx Path Loss

Use this to specify the loss between the DUT output and the instrument's input, and to adjust the RF input level of the instrument.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

Modulation

Use this to set up and control the measurements that are to be performed.
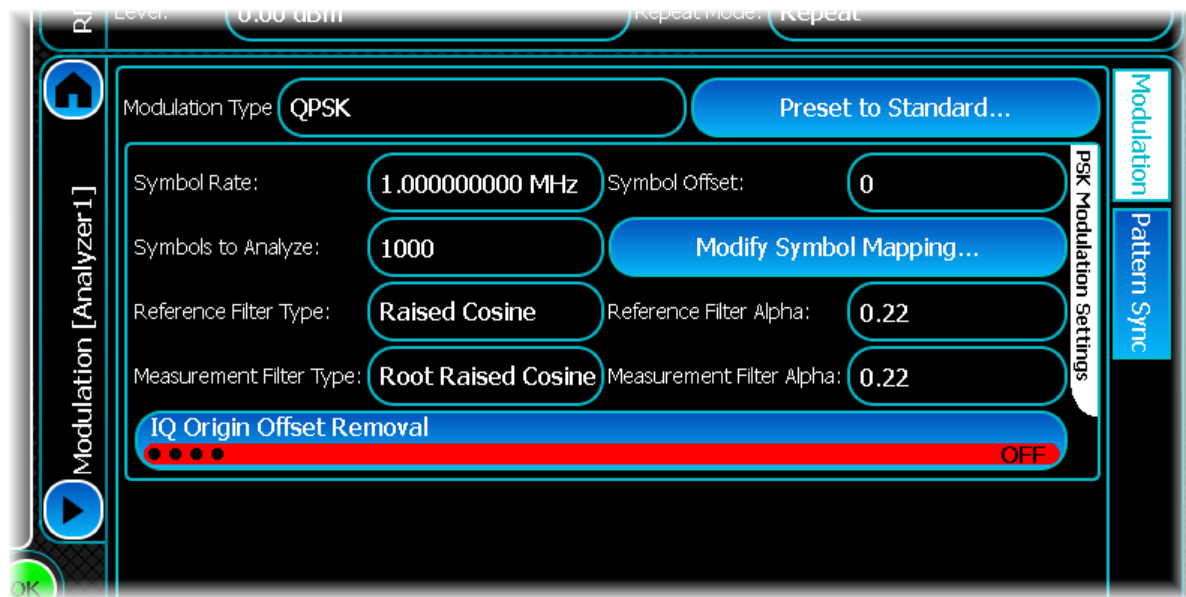
Under the Modulation tab :

Modulation Type

Use this to set the modulation type to use when performing generic measurements.

Options are:

- Frequency Modulation (FM)

- Binary Phase-Shift Keying (BPSK) Modulation

- Offset Quadrature Phase-Shift Keying (OQPSK) Modulation

- Quadrature Phase-Shift Keying (QPSK) Modulation

- Differential Quadrature Phase-Shift Keying (DQPSK) Modulation

- /4 Differential Quadrature Phase-Shift Keying (PiBy4DQPSK) Modulation

- 8 Phase-Shift Keying (8PSK) Modulation

- Differential 8 Phase-Shift Keying (D8PSK) Modulation

- /8 Differential 8 Phase-Shift Keying (PiBy8D8PSK) Modulation

- 8 Phase-Shift Keying Edge (8PSKEDGE) Modulation

- 16 Quadrature Amplitude Modulation (QAM16)

- 64 Quadrature Amplitude Modulation (QAM64)

Modulation settings (when Modulation Type FM is selected)

Mode

This controls the number of audio channels to analyze: one channel (mono) or two channels (stereo).

Weighting

Use this to control what audio weighting to apply to the measured signal.

Audio weighting filters are applied to produce noise measurements that correlate well with what is heard by the human ear. A weighting filter can be applied on both channels of the audio signal. Set the weighting filter to None, A-weighting or C-weighting (IEC 61672:2003). The frequency response of the weighting filters is shown here:
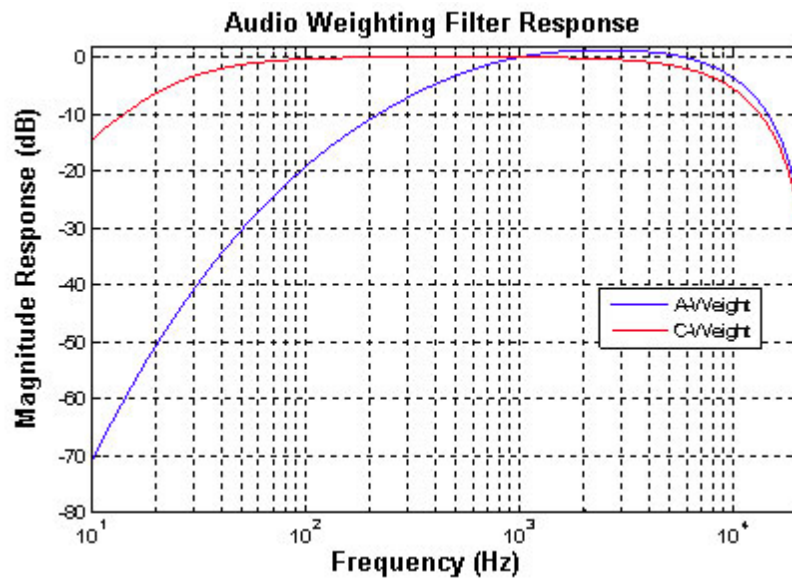
Number of Harmonics

Use this to set the number of harmonics to measure in the Total Harmonic Distortion and Total Harmonic Distortion and Noise results.

De-emphasis Filter

Use this to control what audio de-emphasis filter to apply to the measured signal.

Audio pre-emphasis with a time constant of either 50 μs or 75 μs is used on FM transmitters. It yields a high-pass response with a 6 dB/octave characteristic. The pre-emphasis step is undone in the FM receiver using audio de-emphasis. The frequency response of the de-emphasis filters is shown here:

FM Audio De-emphasis Frequency Response
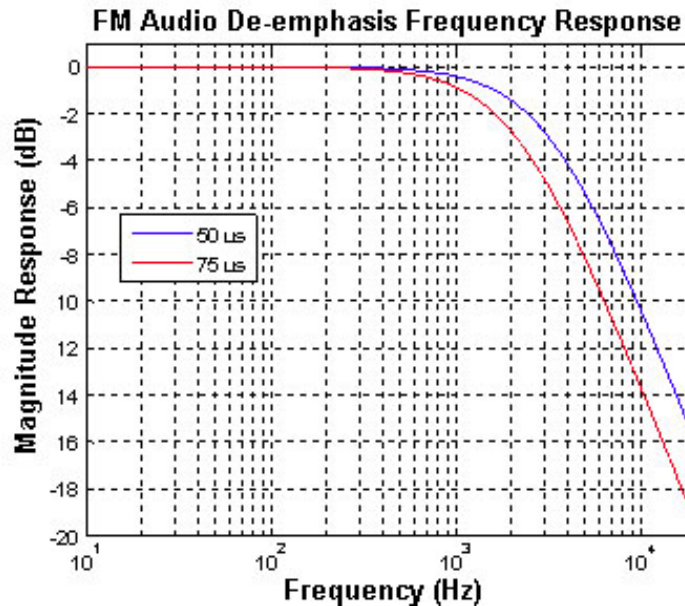
Level Unit

Use this to set the level units in which to return the audio level results (dB or V).

Lower/Upper Frequency Limit

Use this to control the frequency range over which the audio results are calculated.

Modulation Settings (when Modulation Type BPSK, OQPSK, QPSK, QAM is selected)

Preset To Standard

Touch this button to open a dialog for selecting a standard type. This lets you configure the modulation settings to a standard. Once the OK button is pressed, configuration values are set to the selected standard. You can further adjust the configuration after this operation.

Symbol Rate

Use this to specify the symbol rate of the signal.

Symbols to Analyze

Use this to specify the number of symbols of the PSK signal to analyze.

Reference Filter Type

Use this to control the filter type to use on the reference signal.

Options are:

- None (No Filter)

- Raised Cosine (RC) Filter

- Root Raised Cosine (RRC) Filter

- Half Sine Filter

- Rectangular Filter

Measurement Filter Type

Use this to control the filter type to use when capturing the modulated signal.

Options are:

- None (No Filter)

- Raised Cosine (RC) Filter

- Root Raised Cosine (RRC) Filter

- Half Sine Filter

- Rectangular Filter

Symbol Offset

Use this to specify an offset (in symbols) to the first symbol to analyze.

Modify Symbol Mapping

This button opens a symbol mapping editor that lets you modify the symbol mapping for the selected modulation type. Depending on the modulation type, the editor uses either a plotting format or a table format.

Symbol mapping plotting

For all QAM modulations, symbols are plotted in terms of their I-Q values. For all non-differential PSK types, symbols are plotted in terms of their phase values. The Symbol entry lets you change the symbol value. The Set button then sets the selected symbol to a new value (it swaps the symbol value with a symbol having this new value). Any change to the symbol mapping affects the measurement immediately, as the system runs with the current symbol-mapping state displayed in the plot. The Find button locates the symbol in the plot.

The found symbol is marked in red. Touching the *Reset To Default* button resets the symbol mapping to the system's default state. Touching *OK* closes the editor. Touching the *Cancel* button causes a confirmation dialog to pop up: either cancel all changes made in this editing session or carry on with changes made and close the editor.

Symbol mapping table

For all differential PSK modulation types, symbols are listed along with their corresponding phase values. You can change the mapping for a symbol by touching the symbol entry. Moving out of the entry table ends the editing operation, which either ignores the change if the entered symbol value is invalid, or changes the selected symbol to a new value (it swaps the symbol value with a symbol having this new value). Any change in symbol mapping affects the measurement immediately as the system runs with the current symbol mapping state in the table. Touch *Reset To Default* to reset the symbol mapping to the system's default state. Touch *OK* to close the editor. Touching the *Cancel* button causes a confirmation dialog to pop up: either cancel all changes made in this editing session or carry on with changes made and close the editor.

Reference Filter Alpha

Use this to control the filter roll-off (bandwidth coefficient) to use for the reference filter.

Measurement Filter Alpha

Use this to control the filter roll-off (bandwidth coefficient) to use for the measurement filter.

Modulation theory states that the minimum bandwidth needed to transmit a signal is equal to one-half of the symbol rate. However to achieve this system bandwidth, a perfect rectangular shaped filter would be required, where the filter alpha equals zero and the occupied bandwidth equals the symbol rate.

In practice, a communication system typically uses a filter alpha of 0.3. This value provides a good compromise between spectral efficiency and minimum inter-symbol interference (ISI).

IQ Origin Offset Removal

Use this to remove the origin offset from the PSK captured signal.

Under the Pattern Sync tab :

The Pattern Sync screen contains settings for pattern synchronization.

Sync Enabled

Use this button to enable/disable the pattern synchronization. When it is enabled, the instrument searches for the pattern from the captured IQ data.

Sync Pattern Type

The drop-down list Sync Pattern Type lets you select a preset synchronization pattern. Any type except User Defined uses the pre-defined synchronization pattern.

Sync Pattern
You can define your own pattern by choosing User Defined as the synchronization pattern type and editing the pattern in Sync Pattern.

Symbol Offset
Symbol Offset sets the symbol offset for pattern synchronization. This is the offset from the symbol 0 of the burst/capture where the synchronization pattern starts. This value is used to aid detection of the synchronization pattern and also to determine the position of symbol 0 in the signal.

Spectrum

Use this to set up parameters for spectrum measurements.
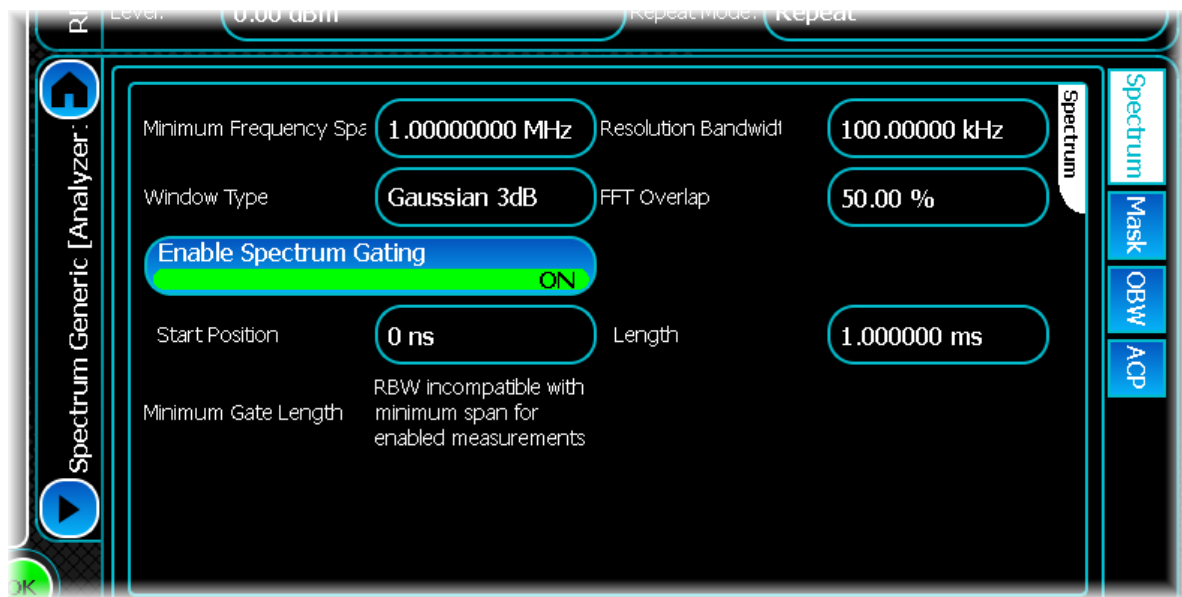
Spectrum tab

Minimum Frequency Span

Use this to set the minimum frequency span (in Hz) used when displaying the spectrum.

Window Type

Use this to set the window type for the spectrum measurements.

Options are:

- Gaussian Noise

- Gaussian 3dB

- Blackman Harris

Enable Spectrum Gating

If spectrum gating is enabled, the Start Position and Length values are applied to the spectrum measurement.

Start Position

Use this to set the start position of the gate applied to the spectrum measurements. This setting is in seconds.

Note that if Analysis Mode is set to Burst IQ, the start of the gate is relative to the start of the burst. If Analysis Mode is set to All IQ, the start of the gate is relative to the start of the capture.

Minimum Gate Length

This displays the minimum time required to perform the current enabled spectrum measurements. The text changes, based on the settings of the Analysis Mode and Enable Spectrum Gating controls.

The following formula defines the minimum time:

Measurement Span = max [Minimum Frequency Span, ACP Span, Spectrum Mask Span, OBW Measurement Bandwidth}

$$\text{Measurement Span} = \max\{\text{Minimum Frequency Span}, \text{ACP Span}, \text{Spectrum Mask Span}, \text{OBW Measurement Bandwidth}\}$$

$$\text{Minimum Time} = \frac{2\lceil\log_2(\text{Measurement Span/Resolution Bandwidth} \times \text{ENB}_{bins})}{\text{Measurement Span}}$$

where ACP Span is defined by the ACP Channel Settings, Spectrum Mask Span is defined by the Spectrum Mask Configuration, and ENB_{bins} is 2.5.

Resolution Bandwidth

Use this to set the resolution bandwidth (in Hz) used when displaying the spectrum.

FFT Overlap

Use this to set the smoothing/Averaging of the spectrum of the given IQ data. Each FFT uses a different portion of the IQ data. This property determines the overlap between each FFT and is expressed as a percentage of the FFT size.

Length

Use this to set the length of the gate applied to the spectrum measurements. This setting is in seconds.

Mask tab
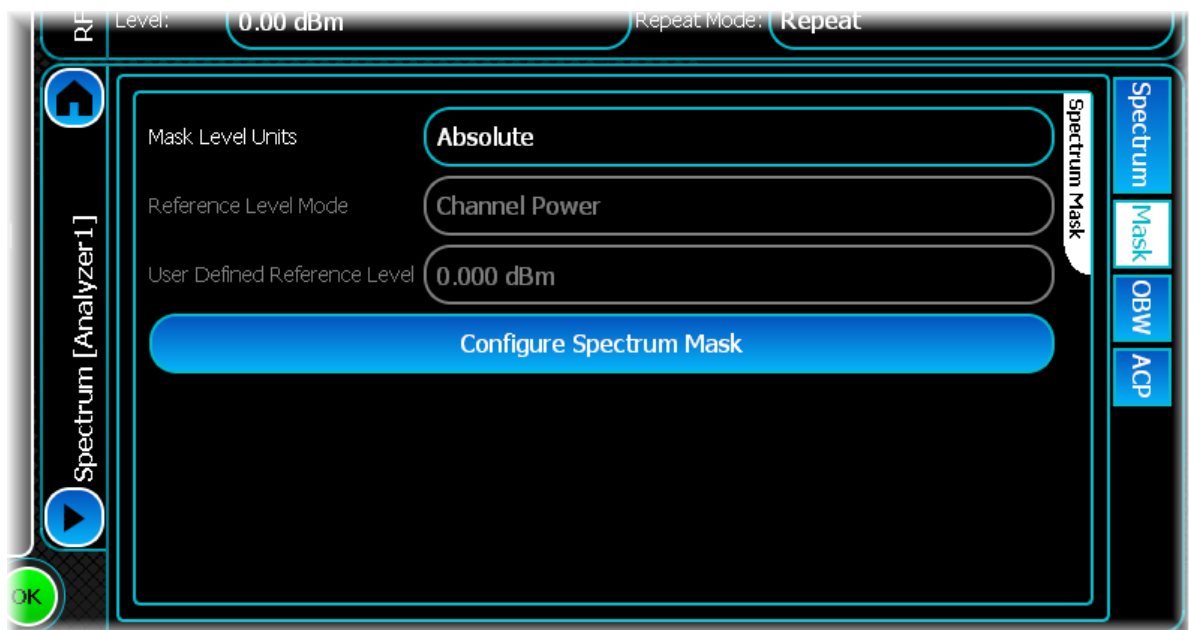
Mask Level Units

This property controls the level units to use when specifying the type of spectrum mask.

- Absolute (power) – the spectrum mask values are specified in dBm.

- Relative (power) – the spectrum mask is specified in dBr, and values are relative to the setting specified in Reference Level Mode.

- User Defined – the spectrum mask can be specified using a mixture of Absolute and Relative values.

Switching between units can create an ambiguity with the currently defined mask. In this situation, you are prompted to select how the values should be modified.

Reference Level Mode

This property controls the measurement to use when specifying the reference level.

- Channel Power – the reference level value is determined using a Channel Power measurement.
- Peak Power – the reference level value is determined using a Peak Power measurement.
- User Defined – the reference level value is determined using the User Defined Reference Level.

User Defined Reference Level

This property controls the reference level to use when specifying Relative Spectrum mask values, where the absolute level of each mask point is determined by adding the relative level, in dBr, to the reference level, in dBm.

OBW tab
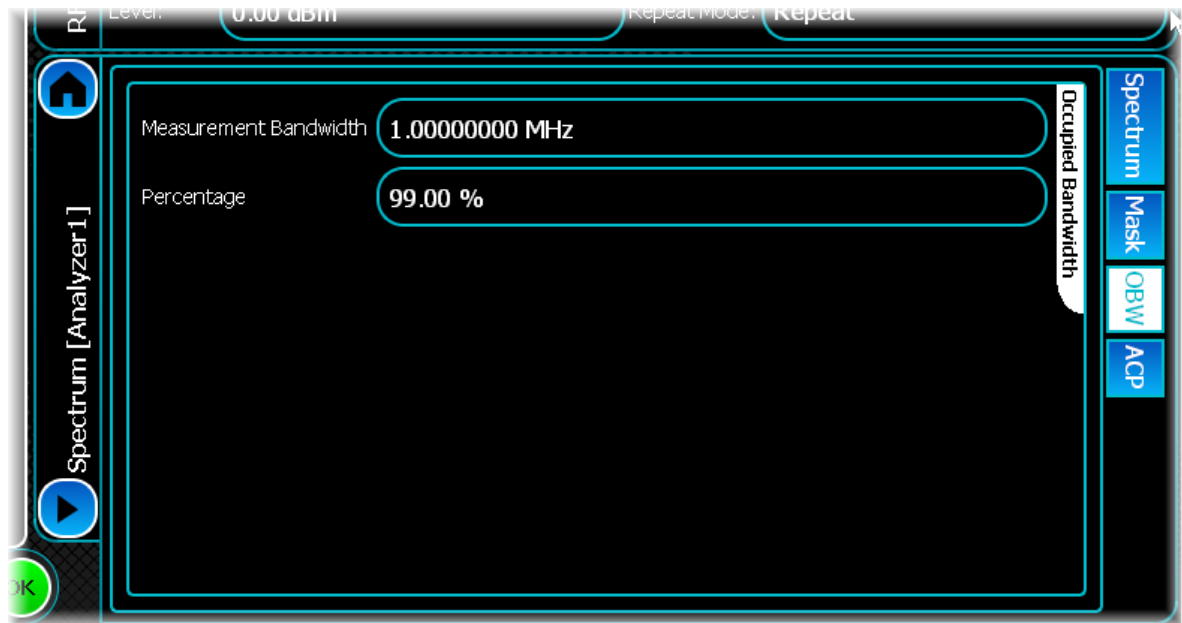
The occupied bandwidth measurement measures the frequency range within which a defined percentage of the signal lies.
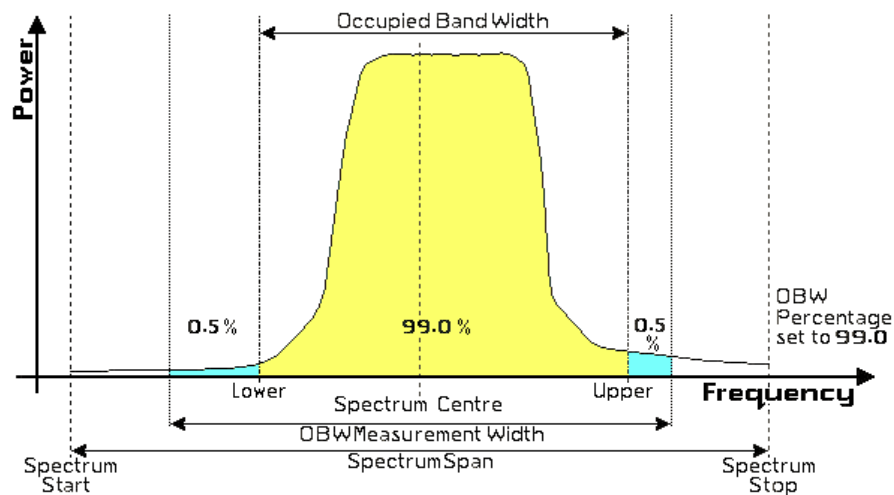
The OBW settings panel consists of the following controls:

Measurement Bandwidth

This control sets the width over which the occupied bandwidth is measured.

Percentage

This control sets the percentage of signal power that is used to calculate the occupied bandwidth.

ACP tab
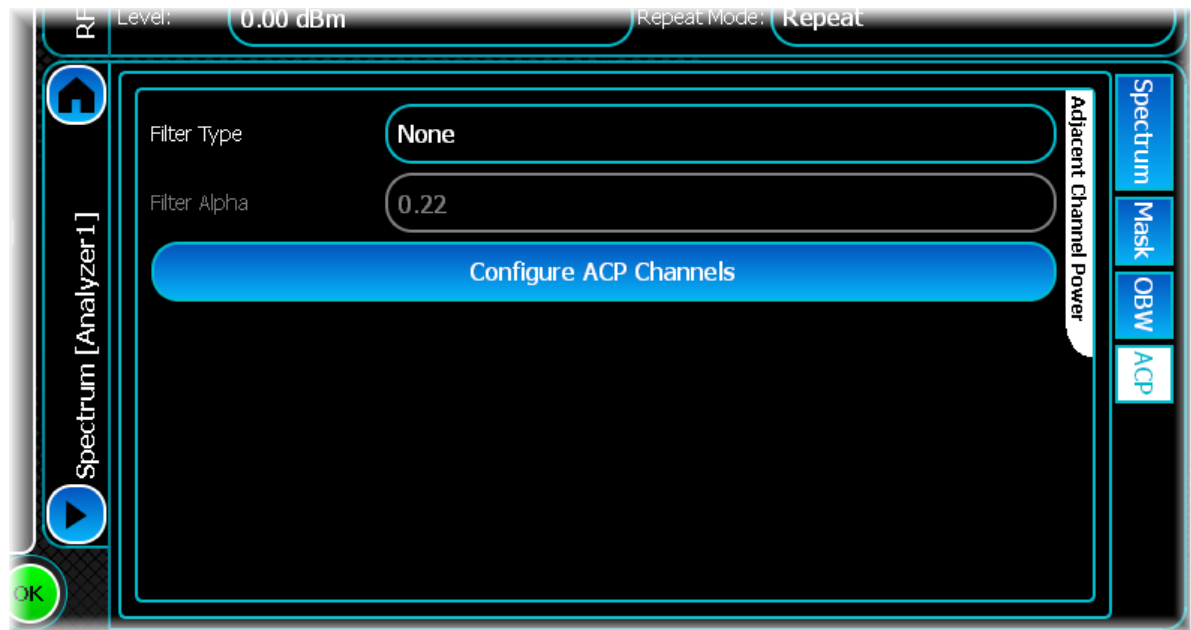
This panel sets the parameters for the Adjacent Channel Power (ACP) measurements.

The adjacent channel power measurement is the relative difference between the signal power in the main channel and the signal power in each adjacent or alternate channel. As digitally modulated signals, as well as the distortion they generate, are very noise-like in nature, the industry standards typically define a channel bandwidth over which the signal power is integrated.
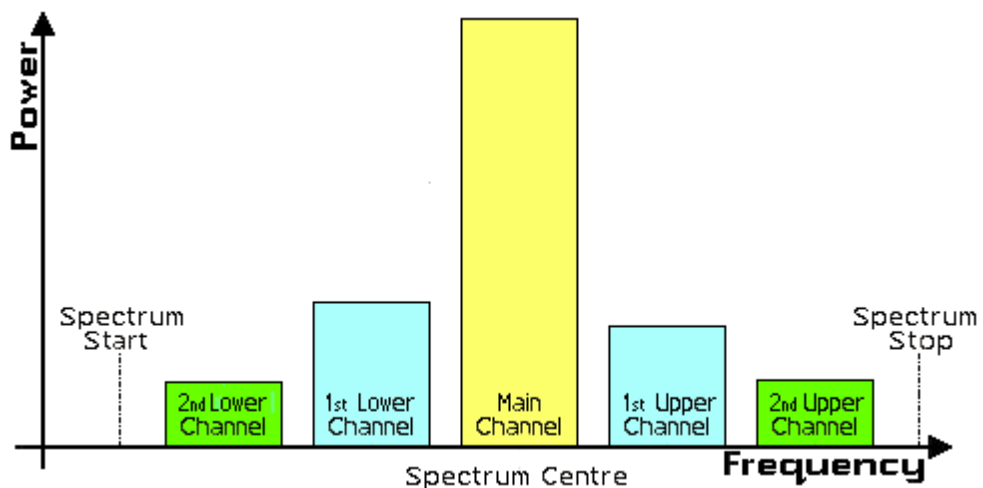
Filter Type

This property controls the ACP filter type to use when capturing the signal. This filter type applies to ALL adjacent channels.

- None (no filter)

- Raised Cosine filter

- Root Raised Cosine filter

Filter Alpha

This property controls the filter roll-off (bandwidth coefficient) to use for the ACP Filter Type. This filter alpha value applies to ALL adjacent channels.

Configure ACP Channels

When you touch the Configure Channels button, the following dialog box is displayed.

Name

The control displays the non-editable name of the adjacent channel.

Frequency Offset

This control lets you specify the frequency offset, in Hz, from the main channel, Channel 0. As Channel 0 is the main (reference) channel, the offset is always 0 Hz.

Bandwidth

This control lets you specify the measurement bandwidth of the adjacent channel.

Filter

The ACP filter as specified in Filter Type.

Alpha

The ACP alpha value as specified in Filter Alpha.

General

Use this to set up and control the search length, analysis mode and channel filter parameters for a generic analysis.
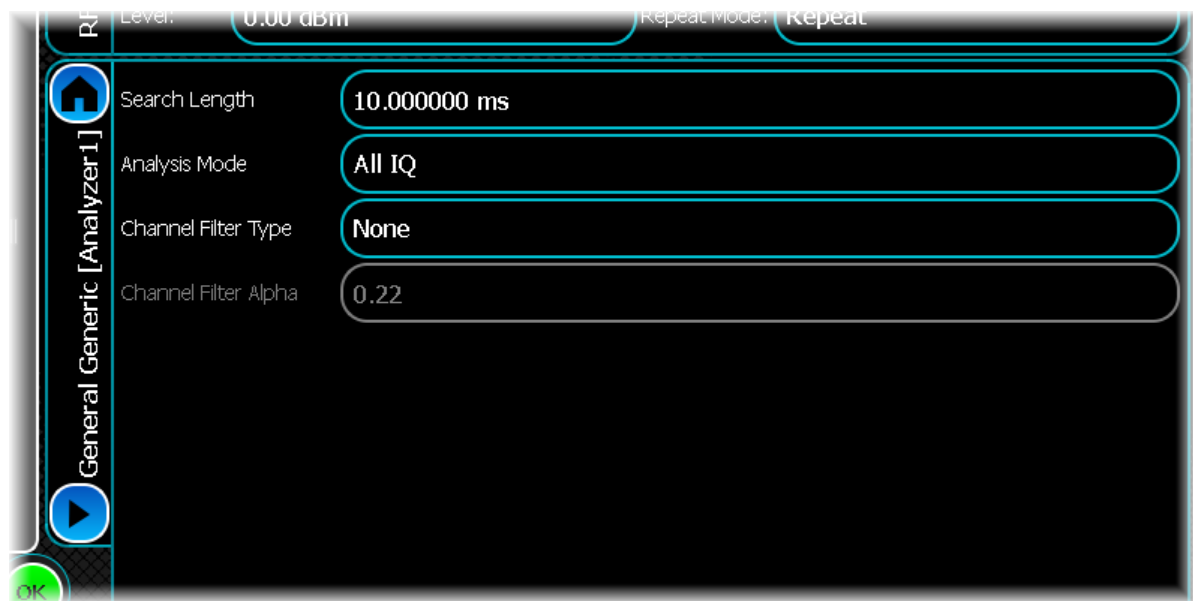
Search Length

Use this to specify the minimum amount of time that data is captured when performing measurements, overriding that determined automatically by the instrument only if the value specified is greater.

A search length of zero allows the instrument to use its automatically determined capture time. This should always be sufficient when an immediate trigger is employed.

Setting the value of search length unnecessarily high adversely affects the analysis time.

Analysis Mode

This control specifies the different analysis modes available:

- All IQ: all of the IQ data is analyzed.

- Burst IQ: only the detected burst region is analyzed.

Channel Filter Type

Use this to control the filter type to use when performing Channel Power measurements.

This feature is typically used in power measurements and for the reference level calculation in Spectrum Mask if Reference Level Mode is set to Channel Power. Options are:

- None (No Filter)

- Raised Cosine (RC) Filter

- Root Raised Cosine (RRC) Filter

Channel Filter Alpha

This property controls the filter roll off (bandwidth coefficient) to use for the Channel Filter.

Burst Location Settings

Use Burst Location Settings to configure the relevant parameters that control how the burst is located within the captured data.

Rising/Falling Edge Threshold

The instrument determines the burst location by looking for significant changes in power. You can specify the magnitude of this change separately for both the rising and falling edges of a burst using the Rising Edge Threshold and Falling Edge Threshold controls.

This figure illustrates these two properties:

Pre-Trigger Time

Pre-trigger time is the period of time that the measurement waits for before looking for a burst's rising edge. This means that any supplied IQ data must have at least a 'Pre-trigger Time' number of samples prior to the burst.

If the Integration Skip Time is less than the Integration Time, the integration periods overlap. If the Integration Skip Time is greater than the Integration Time, there is a gap between integration periods. The figure below illustrates the latter scenario:

Minimum Off Time

Having found a burst's rising edge, the instrument searches for the falling edge. The power between two integration periods is compared until it decreases by at least the Falling Edge Threshold and remains below the threshold for the Minimum Off Time.

If the power goes above the threshold during this period, it is not a falling edge. The figure below illustrates the falling edge detection:

Minimum On Time

To detect a burst's rising edge, the power in two integration periods is compared across the IQ data until it increases by at least the Rising Edge Threshold and remains above the threshold for the Minimum On Time. If the power drops below the threshold during this period, it is not a rising edge.

Integration Time

The measurement for burst location uses the concept of a power integration period set by the Integration Time control. This is used to smooth the signal power over a period of time to prevent false burst detection in noisy signals.

Integration Skip Time/Comparator Delay

The two integration periods used for comparison need not be adjacent to each other. The Integration Skip Time and Comparator Delay controls specify where and how far apart the integration periods are.

This figure illustrates these properties for the rising edge:

Here the Integration Time and Integration Skip Time are the same length, which means that the integration periods are adjacent to each other. The Comparator Delay is two integration periods long, so there is a gap of one period between the powers compared, as shown by the shading in the figure above.

Reset to Default

Resets all the fields to their default values: 15 dB for rising and falling edge thresholds, 0 ns for all remaining fields.

GSM analysis

GSM mode provides analysis of GSM/EDGE signals.

Select GSM from the menu tab. Touch the ▶ button, and configure GSM analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

System defines system parameters for the analysis.

DUT configures the instrument for measuring up to four DUTs.

Meas. Config defines the parameters needed to make a measurement.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

ORFS defines the frequencies used for Output RD Spectrum measurements.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to GSM mode.

Trace measurements

Spectrum

This displays the spectrum (power versus frequency) of the signal you are measuring.

This trace supports Minimum Hold, Maximum Hold and Averaging functions.

Captured Power vs Time

This displays the power vs. time trace of the capture that is being used for the underlying analysis of the GSM/EDGE signal.

Power Profile (Complete)

This displays the complete power vs. time trace of the GSM/EDGE signal.

The Power Profile (Complete) trace supports Averaging, Min Hold and Max Hold functions.

You can apply upper and lower mask limits to the trace. Touch the button on the title bar to view the drop-down measurement menu:
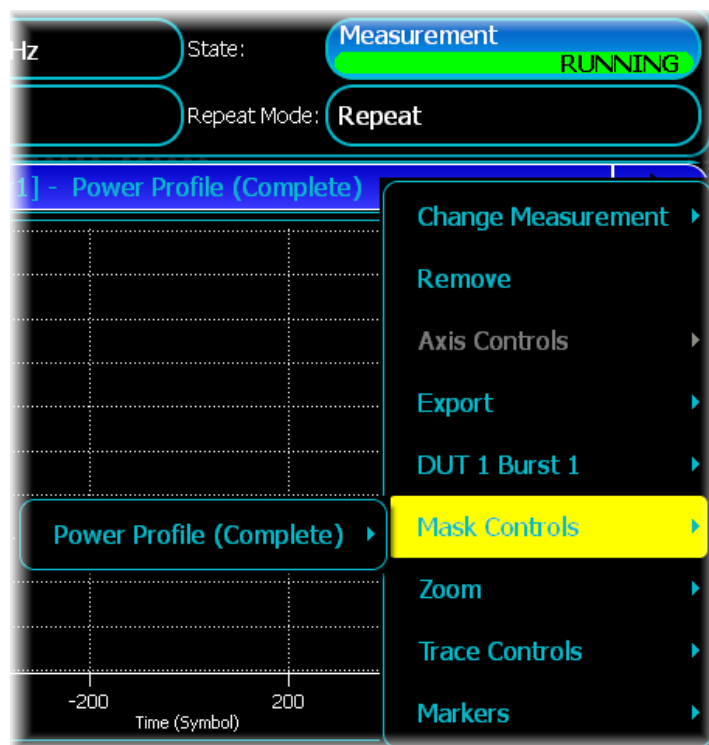
Select Mask Controls\Power Profile (Complete), then select Mask Upper Limit and/or Mask Lower Limit as appropriate.

Power Profile (Useful)

This displays the useful part of the power vs. time trace of the GSM/EDGE signal.

The Power Profile (Useful) trace supports Averaging, Min Hold and Max Hold functions.

Apply upper and lower mask limits to the trace as described above.

Power Profile (Rising)

This displays the rising part of the power vs. time trace of the GSM/EDGE signal.

The Power Profile (Rising) trace supports Averaging, Min Hold and Max Hold functions.

Apply upper and lower mask limits to the trace as described above.

Power Profile (Falling)

This displays the falling part of the power vs. time trace of the GSM/EDGE signal.

The Power Profile (Falling) trace supports Averaging, Min Hold and Max Hold functions.

Apply upper and lower mask limits to the trace as described above.

Power Profile (Guard)

This displays the guard period of the power vs time trace of the GSM/EDGE signal.

The Power Profile (Guard) trace supports Averaging, Min Hold and Max Hold functions.

Apply upper and lower mask limits to the trace as described above.

Phase Error vs Time

This displays the phase error vs. time trace of the GSM signal.

The Phase Error vs. Time trace supports Averaging, Min Hold and Max Hold functions.

EVM vs Time

This displays the EVM vs. Time trace of the EDGE signal.

The EVM vs. Time trace supports Averaging, Min Hold and Max Hold functions.

ORFS Spectrum due to Modulation (Relative)

This displays the ORFS spectrum due to modulation as values relative to the reference frequency. The offsets at which the measurements are performed correspond to the frequency offsets that are configured in the ORFS spectrum frequency settings.

The ORFS Spectrum due to Modulation trace supports Averaging, Min Hold and Max Hold functions.

ORFS Spectrum due to Modulation (Absolute)

This displays the ORFS spectrum due to modulation as absolute values. The offsets at which the measurements are performed correspond to the frequency offsets that are configured in the ORFS spectrum frequency settings.

The ORFS Spectrum due to Modulation trace supports Averaging, Min Hold and Max Hold functions.

ORFS Spectrum due to Switching (Relative)

This displays the ORFS spectrum due to switching as values relative to the reference frequency. The offsets at which the measurements are performed correspond to the frequency offsets that are configured in the ORFS spectrum frequency settings.

The ORFS Spectrum due to Switching trace supports Averaging, Min Hold and Max Hold functions.

ORFS Spectrum due to Switching (Absolute)

This displays the ORFS spectrum due to switching as absolute values. The offsets at which the measurements are performed correspond to the frequency offsets that are configured in the ORFS spectrum frequency settings.

The ORFS Spectrum due to Switching trace supports Averaging, Min Hold and Max Hold functions.

Text measurements

Power Profile measurements

These measurements display the status and numeric results relating to power profile measurements with the analyzed GSM/EDGE signal.

A negative value, representing a pass, shows the margin by which a result fits within the power profile; the smaller the value, the nearer the result is to the profile and to a fail.

The Profile Power measurements consist of the following results, which do not support any statistical functions:

Power Profile (Complete) Pass/Fail

Pass/Fail status of the Power vs Time (Complete) measurement.

Power Profile (Complete) Fail Time

Fail time, in ms, of the Power vs Time (Complete) measurement.

Power Profile (Complete) Fail Level

Fail level, in dBm, of the Power vs Time (Complete) measurement.

Power Profile (Rising) Pass/Fail

Pass/Fail status of the Power vs Time (Rising) measurement.

Power Profile (Rising) Fail Time

Fail time, in ms, of the Power vs Time (Rising) measurement.

Power Profile (Rising) Fail Level

Fail level, in dBm, of the Power vs Time (Rising) measurement.

Power Profile (Falling) Pass/Fail

Pass/Fail status of the Power vs Time (Falling) measurement.

Power Profile (Falling) Fail Time

Fail time, in ms, of the Power vs Time (Falling) measurement.

Power Profile (Falling) Fail Level

Fail level, in dBm, of the Power vs Time (Falling) measurement.

Power Profile (Burst) measurements

These measurements display the status and numeric results relating to the power profile measurements for each burst of the analyzed GSM/EDGE signal.

A negative value, representing a pass, shows the margin by which a result fits within the power profile; the smaller the value, the nearer the result is to the profile and to a fail.

The Profile Power (Burst) measurements consist of the following results, which do not support any statistical functions:

Power Profile (Useful) Pass/Fail

Pass/Fail status of the Power vs Time (Useful) measurement.

Power Profile (Useful) Fail Time

Fail time, in ms, of the Power vs Time (Useful) measurement.

Power Profile (Useful) Fail Level

Fail level, in dBm, of the Power vs Time (Useful) measurement.

Power Profile (Guard) Pass/Fail

Pass/Fail status of the Power vs Time (Guard) measurement.

Power Profile(Guard) Fail Time

Fail time, in ms, of the Power vs Time (Guard) measurement.

Power Profile (Guard) Fail Level

Fail level, in dBm, of the Power vs Time (Guard) measurement.

Burst measurements

These measurements display the status and numeric results relating to burst measurements within the analyzed GSM/EDGE signal. They consist of the following results:

Detected Burst Type

The burst type detected. This measurement does not support any statistical functions.

Detected TSC

The training sequence code detected. This measurement does not support any statistical functions.

Burst Power

The measured burst power, in dBm. This measurement supports Averaging, Min Hold and Max Hold.

Fast Burst Power

The measured fast burst power, in dBm. This measurement supports Averaging, Min Hold and Max Hold.

Burst Timing Error

The measured burst timing error, in symbols. This measurement supports Averaging, Min Hold and Max Hold. You require a signal generator in order to perform a burst timing error measurement.

EDGE measurements

These measurements display the status and numeric results relating to EDGE measurements within the analyzed GSM/EDGE signal. They consist of the following results:

EDGE Origin Offset Suppression

The measured origin offset suppression, in dBc. This measurement supports Averaging, Min Hold and Max Hold.

EDGE Droop

The measured droop, in dB/symbol. This measurement supports Averaging, Min Hold and Max Hold.

EDGE 95th Percentile EVM (Burst)

The measured 95th percentile EVM of a single burst, as a percentage. This measurement supports Averaging, Min Hold and Max Hold.

EDGE 95th Percentile EVM (Cumulative)

The cumulative measured 95th percentile EVM, as a percentage. This measurement does not support any statistical functions. This result accumulates the results over all bursts measured. It is reset whenever measurements are restarted.

EDGE RMS EVM

The RMS EVM, as a percentage. This measurement supports Averaging, Min Hold and Max Hold.

EDGE Peak EVM

The peak EVM, as a percentage. This measurement supports Averaging, Min Hold and Max Hold.

Modulation Accuracy measurements

These measurements display the status and numeric results relating to modulation accuracy measurements with the analyzed GSM/EDGE signal. They consist of the following results:

RMS Phase Error

The RMS phase error, in degrees, of the composite signal. This measurement supports Averaging, Min Hold and Max Hold.

Peak Phase Error

The peak phase error, in degrees, of the composite signal. This measurement supports Averaging, Min Hold and Max Hold.

RF

Use this to set up the basic RF frequency and RF level parameters of a GSM measurement.
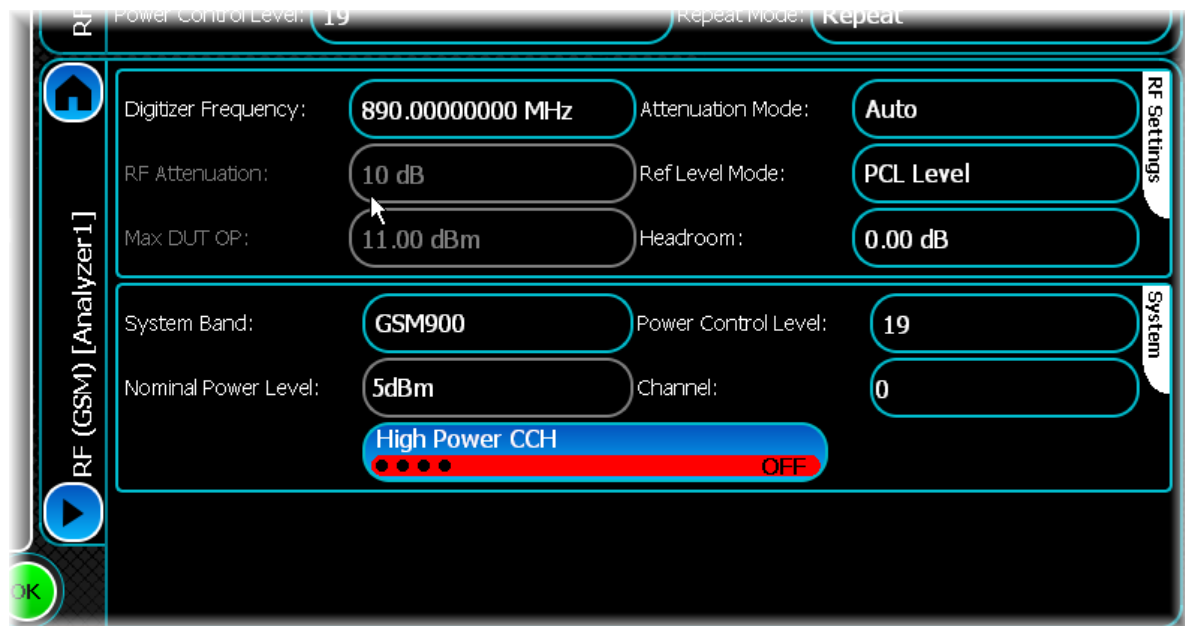
Digitizer Frequency

Use this to set the digitizer's center frequency for the signal you want to measure.

You can set the digitizer frequency explicitly using the Digitizer Frequency control, or by specifying the channel number using the Channel control. Note that if a valid channel number is specified, then the digitizer frequency entry is updated with the corresponding frequency value. If the frequency is entered directly in the Digitizer Frequency control, the Channel control updates to report 'No Channel', because the entered frequency may not correspond to a defined channel number.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust the attenuation manually only when Attenuation Mode is set to Manual. When in Auto Attenuation Mode, the RF input level is set automatically in order to optimize the RF gain setting.

Max DUT OP

When the Ref Level Mode is set to Manual Level, this control is used to specify the anticipated maximum DUT output power in dBm.

When the Ref Level Mode is set to PCL Level, the Max DUT OP control is grayed out, and the value that it displays is determined by the System Band and Power Control Level settings.

The true RF input level to the digitizer may be affected by a loss (or possibly gain) in the connection between the DUT and digitizer. The DUT Tx Path Loss parameter compensates for this.

Attenuation Mode

Use this to specify how the RF attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This allows the input condition to be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

Ref Level Mode

Use this to set the reference level mode to Manual or PCL (Power Control Level).

In Manual mode, you set the Max DUT OP (average burst power). In PCL mode, the maximum DUT output power is determined from the System Band and Power Control Level settings, both of which are set using controls on the System screen.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

System Band

System Band is used as a property in determining absolute frequency from ARFCN (absolute radio frequency channel number) and expected absolute DUT power from the PCL, and is used to select the appropriate power-time template.

This control lets you set the system band to GSM400, GSM700, GSM850, GSM900, DCS1800 or PCS1900. Where the Ref Level Mode is set to PCL, the Max DUT Output Power is determined by the Power Control Level and System Band settings.

Nominal Power Level

An indication only of the output power level of the DUT.

Power Control Level (PCL)

The PCL value is a property that (together with ARFCN and System Band) determines the digitizer RF settings and test limits that define the power profile template mask used for power versus time measurements.

The PCL value should be set to the same value as that commanded in the DUT. The PCL value can be set in the range 0 to 31, according to the following table.

PCL by system band type

System band	PCL	Output power (dBm)	ARFCN	Uplink frequency (MHz)
GSM 400	0–31	39–5	259–293	450.6–457.4
	0-31	39–5	306–340	479–485.8
GSM 700	0–31	39–5	438–511	747.2–761.8
GSM 850	0–31	39–5	128–251	824.2–848.8
GSM 900	0–31	39–5	0–124	890–914.8
	0–31	39–5	975–1023	880.2–889.8
DCS 1800	0–31	36–0	512–885	1710.2–1784.8
PCS 1900 *	0–15	30–0	512–810	1850.2–1909.8
	30-31	33–32		

Note: for the PCS1900 band the PCL range 16-29 is reserved.

Channel

Use this to specify the absolute RF channel for the instrument. Specifying a channel sets a particular digitizer frequency. See Digitizer Frequency, which describes how the Digitizer Frequency and Channel controls interact.

High Power CCH

This control lets you enable or disable the high power control channel mode. This ensures that the first (BCCH) timeslot is transmitted at a level 20 dB higher than the others.

System

Use this screen to define the GSM/EDGE system parameters.
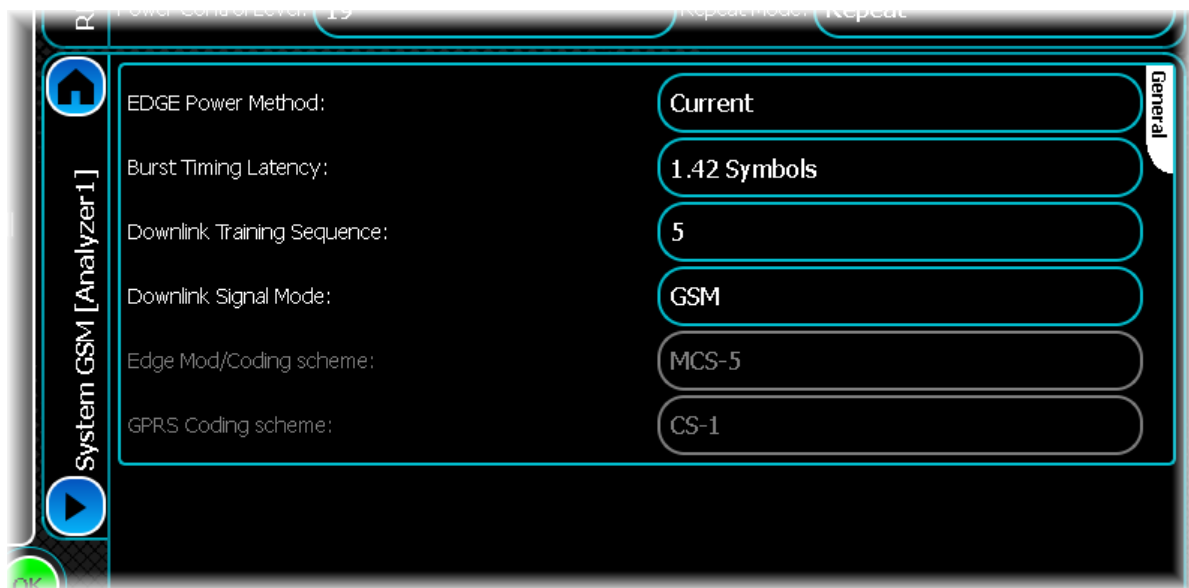
EDGE Power Method

Use this to set the EDGE power method to Current, Long Term, or Estimate.

Current: provides the mean power over the useful part of the last analyzed burst.

Long Term: provides the average of the useful power in a number of bursts.

Estimate: provides an estimate of the long-term average based upon the last analyzed burst.

Burst Timing Latency

Use this to compensate for different path delays in the RF and marker (trigger) signals used in burst timing error measurements. Units are GSM/EDGE symbols.

Downlink Training Sequence

Use this to select the training sequence code (TSC) used (together with Loopback Mode, Downlink Signal Mode and High Power CCH values) to trigger the appropriate ARB file. Values are currently 5 (default) or 0.

Downlink Signal Mode

Use this to select the downlink signal mode used (together with Loopback Mode, Training Sequence and High Power CCH values) to trigger the appropriate ARB file. Values are GSM, EDGE or GPRS.

EDGE Mod/Coding Scheme

Use this to select the modulation and coding scheme (MCS) when the Downlink Signal Mode is set to EDGE.

GPRS Coding Scheme

Use this to select the coding scheme (CS) when the Downlink Signal Mode is set to GPRS.

DUT

Use this to configure the measurement settings for up to four DUTs. By default, the tab for DUT1 is displayed.
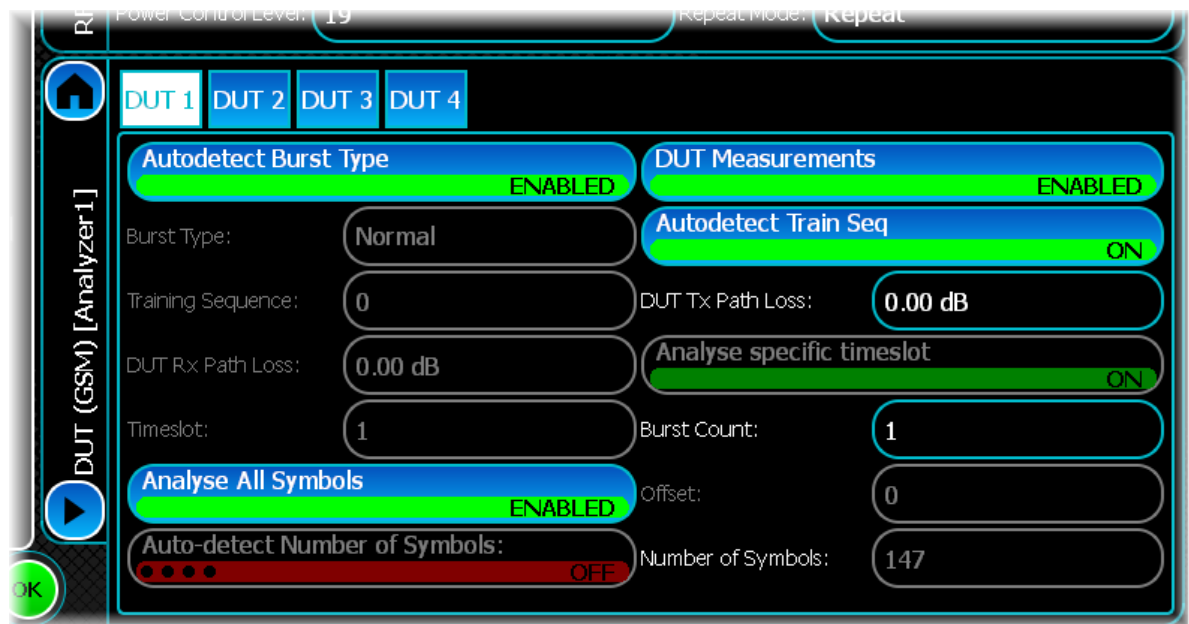
Autodetect Burst Type

When this button is enabled, automatic detection of Normal or Access bursts is performed and the detected burst type is displayed as part of the burst timeslots in the frame, which may assist DUT synchronization.

Where automatic detection is enabled, the detected burst type is displayed as part of the Burst Measurements in the Signal Measurements display.

When disabled, only the selected burst type is measured.

Burst Type

This control is available only if automatic burst type detection is disabled. It lets you specify the burst type to be measured — Normal or Access.

Training Sequence

This control is available only if automatic TSC detection is disabled. Use it to specify the training sequence that is used when making measurements, in the range 0 to 7.

DUT Rx Path Loss

This value (in dB) is used to correct the signal generator output level for the path loss between the signal generator and the DUT input. If a signal generator has been acquired then this control is available, otherwise it is grayed out.

Timeslot

Use this to specify the timeslots used when performing measurements. If a signal generator has been acquired and the Analyse specific timeslot button is enabled, this control is available; otherwise it is grayed out.

Analyse All Symbols

Use this to specify which symbols should be analyzed in each burst when performing modulation accuracy measurements. When this control is enabled, all symbols in each burst are analyzed. When this control is disabled, the Offset and Autodetect Number of Symbols controls are enabled, letting you define which symbols are analyzed in each burst.

Auto-detect Number of Symbols

If Analyse All Symbols is disabled, this control defines the number of symbols to be analysed in each burst. If this control is enabled, then the number of symbols specified here is analyzed. If this control is disabled, then all symbols from the Symbol Offset to the end of the burst are analyzed.

DUT Measurements

When DUT Measurements is enabled, measurements are made for the selected DUT. Text results for each enabled DUT are displayed in tabulated form in the Text Measurements and ORFS Measurements. The trace contains a menu that permits you to select from the currently enabled DUTs.

Autodetect Train Seq

Use this to specify whether automatic detection of the training sequence code is enabled.

When enabled, bursts containing any valid TSC 0 to 7are measured. The detected TSC is displayed as part of the Burst Measurements in the Signal Measurements display, while the Training Sequence control is grayed out.

DUT Tx Path Loss

This value (in dB) is used to correct measurement results for the path loss between the DUT output and the digitizer.

Analyse specific timeslot

Use this to specify whether a specific timeslots should be analyzed. If this is disabled, the first located timeslots is analyzed. If a signal generator has been acquired then this control is available, otherwise it is grayed out.

Burst Count

Use this to specify the number of bursts to analyze when performing a multi-burst analysis.

Offset

If Analyse All Symbols is disabled, this control defines an offset to the first symbol to be analyzed in each burst.

Meas. Config

Use this screen to set up key information about demodulating and analyzing the signal.
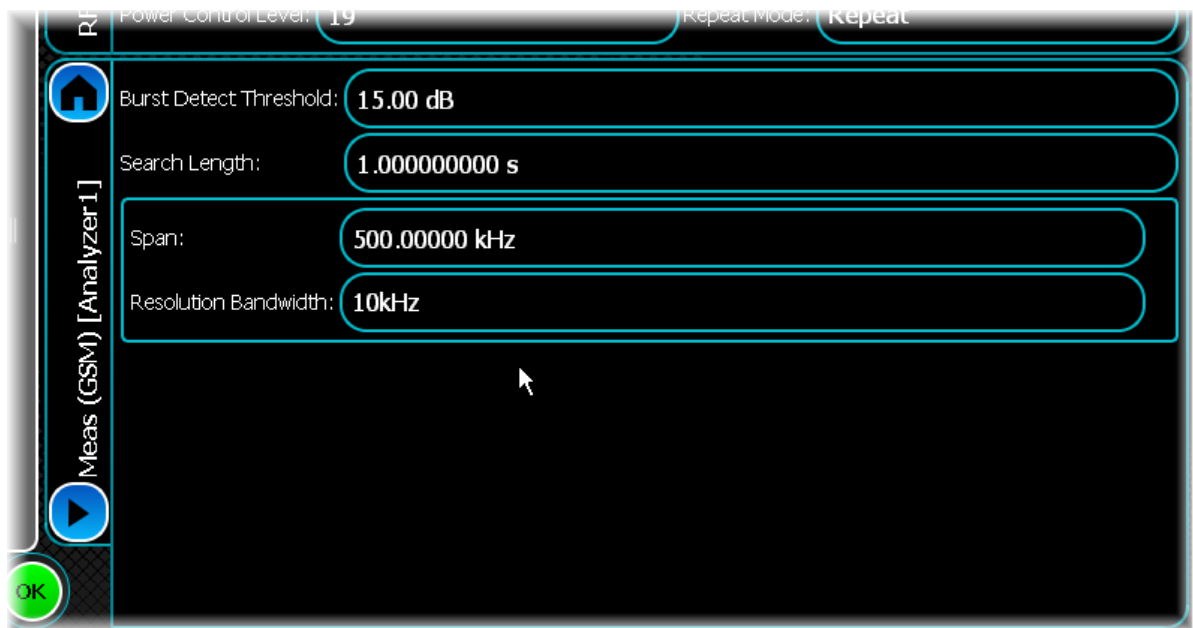
Burst Detect Threshold

Use this to set the capture threshold (in dB), which is used for locating the burst position. To determine the start of a burst, the analysis process looks for a change in power greater than this threshold.

Search Length

Use this to set the minimum capture time (in s).

Where the trigger type is set to Immediate, the search length entered is ignored if it is insufficient, and the capture time used is calculated as the minimum required to guarantee finding a complete RF burst to analyze.

Span

Use this to set the frequency span (in Hz) used when displaying the spectrum.

Resolution Bandwidth

Use this to set the resolution bandwidth used when displaying the spectrum. Values are 10 kHz, 30 kHz and 100 kHz.

ORFS

The ORFS (output RF spectrum) frequency settings specify a number of frequencies, relative to the carrier frequency, that are measured when performing ORFS measurements (ORFS spectrum due to modulation and ORFS spectrum due to switching).
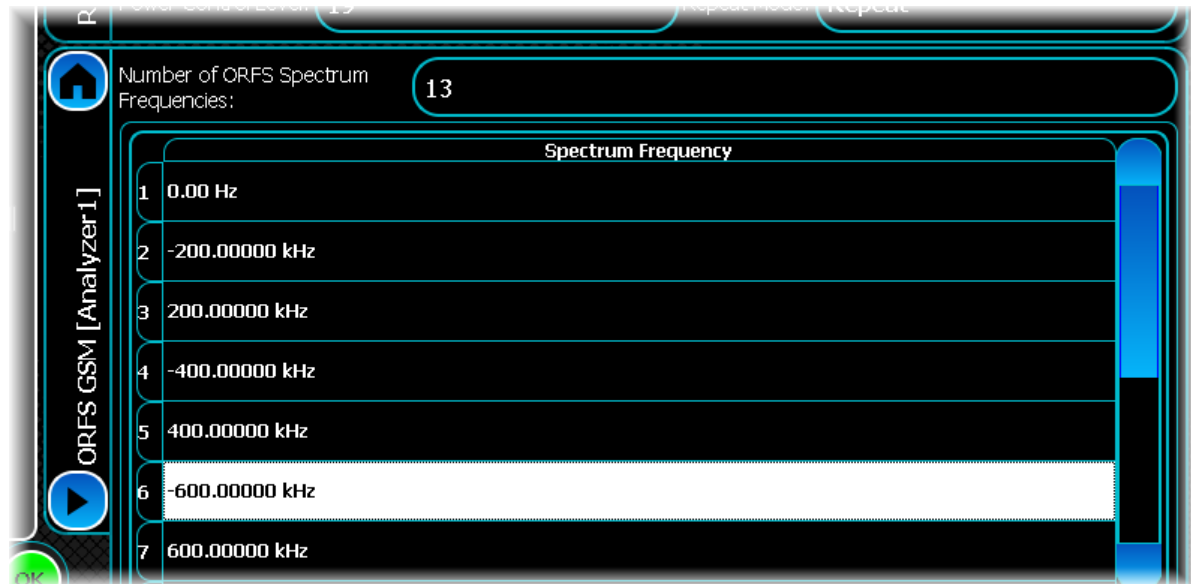
Changing the number of frequencies

You can enter between 1 and 20 frequencies. To modify how many offsets are measured, enter the desired value into the Number of ORFS Spectrum Frequencies control. This adjust the contents of the frequency list to display the desired number of offsets.

Modifying a frequency

To modify an ORFS frequency, select the desired frequency entry and touch it to start editing. Then enter the desired frequency in Hz into the resulting edit box.

Note: you cannot modify the first frequency, which is fixed at 0 Hz.

LTE TDD analysis

LTE TDD provides analysis of KTE TDD Rel. 8 signals.

Select LTE-TDD from the menu tab. Touch the button, and configure LTE TDD analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

System defines system parameters for the analysis.

Channel Settings configures key channel parameters for the signal being measured.

Meas. Config defines the parameters needed to make a measurement.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Slot Config sets up information about slots defined within the signal being analyzed.

ACLR defines offset frequencies that are measured during ACLR measurements.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

Burst Detection defines parameters for detecting rising and falling edges of the burst.

Spectrum Flatness defines the spectral flatness limits to be applied to the signal for analysis.

Spectrum Mask defines the shape of the spectral mask. This screen is common to many modulation types.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to LTE TDD.

Trace measurements

Spectrum

This graph type displays the spectrum (power vs. frequency) of the signal being measured. The spectrum trace supports Min Hold, Max Hold and Averaging functions.

Spectrum Mask

This graph type displays the spectrum mask of the signal being measured. The spectrum mask trace supports Min Hold, Max Hold and Averaging functions.

Captured Power vs Time

This plot displays the power vs. time trace of the capture that is being used for the underlying analysis of the LTE TDD signal.

The power vs. time trace supports Min Hold, Max Hold and Averaging functions.

CCDF

The CCDF (complementary cumulative distribution function) trace displays the peak-to-average power ratio of the signal being analyzed. This trace does not support any statistical functions.

Constellation

This plot displays the constellation trace of the LTE TDD signal being measured.

This trace does not support any statistical functions.

Constellation (Excluding Non Allocated Carriers)

This plot displays the Constellation (Excluding Non Allocated Carriers) trace of the LTE TDD signal being measured.

This trace does not support any statistical functions.

EVM vs Symbol

This plot displays the EVM vs. Symbol trace for the LTE TDD signal.

The EVM vs. Symbol trace supports Averaging, Min Hold and Max Hold functions.

Magnitude Error vs Symbol

This plot displays the Magnitude Error vs. Symbol trace for the LTE TDD signal.

The Magnitude Error vs. Symbol trace supports Averaging, Min Hold and Max Hold functions.

Phase Error vs Symbol

This plot displays the Phase Error vs. Symbol trace for the LTE TDD signal.

The Phase Error vs. Symbol trace supports Averaging, Min Hold and Max Hold functions.

EVM vs Carrier

This plot displays the EVM vs. Carrier trace for the LTE TDD signal.

The EVM vs. Carrier trace supports Averaging, Min Hold and Max Hold functions.

Magnitude Error vs Carrier

This plot displays the Magnitude Error vs. Carrier trace for the LTE TDD signal.

The Magnitude Error vs. Carrier trace supports Averaging, Min Hold and Max Hold functions.

Phase Error vs Carrier

This plot displays the Phase Error vs. Carrier trace for the LTE TDD signal.

The Phase Error vs. Carrier trace supports Averaging, Min Hold and Max Hold functions.

EVM vs Carrier (Excluding Non Allocated Carriers)

This plot displays the EVM vs. Carrier (Excluding Non Allocated Carriers) trace for the LTE TDD signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Magnitude Error vs Carrier (Excluding Non Allocated Carriers)

This plot displays the Magnitude Error vs. Carrier (Excluding Non Allocated Carriers) trace for the LTE TDD signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Phase Error vs Carrier (Excluding Non Allocated Carriers)

This plot displays the Phase Error vs. Carrier (Excluding Non Allocated Carriers) trace for the LTE TDD signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Power Vs. Resource Block

This plot displays the Power vs. Resource Block trace for the LTE TDD signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Power vs Slot

This plot displays the Power vs. Slot trace for the LTE TDD signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Spectrum Flatness

This plot displays the spectrum flatness trace and upper and lower limit lines for the selected slot.

Select the slot to display from the trace control menu (touch the plot and select Trace Controls\Selected Slot Offset). Note that the selected slot offset is an index in to the analyzed slots and does not refer to a specific slot in a frame. Therefore slot offset 0 refers to the first analyzed slot (the sync slot), slot offset 1 refers to the second analyzed slot, etc. This menu is updated dynamically when each set of results is processed, as a different total number of slots may have been analyzed.

PRACH Power vs Time

This plot displays power vs time for the measured PRACH signal.

The PRACH Power vs Time trace supports Min Hold, Max Hold and Averaging functions.

In-band Emissions

This plot displays in-band emissions for each resource block, together with the measurement limit for each unallocated resource block (displayed as a red line above the value).

Select the slot to be displayed from the trace control menu. Note that the selected slot offset is an index in to the analyzed slots and does not refer to a specific slot in a frame. Therefore slot offset 0 refers to the first analyzed slot (the sync slot) and slot offset 1 refers to the second analyzed slot etc. This menu is updated dynamically when each set of results is processed, as a different total number of slots may have been analyzed.

Subcarrier Allocation

This plot displays the allocation of subcarriers for each symbol. These are shown in different colours:

Yellow	PUSCH
Green	PUSCH DMRS
Red	PUCCH
Magenta	PUCCH DMRS
Cyan	SRS

Display more detailed information about the subcarrier allocation by touching the symbol of interest.

Time Mask Power vs Time

This plot displays power vs. time for the selected On/off Time Mask.

The Time Mask Power vs Time trace supports Min Hold, Max Hold and Averaging functions.

Text measurements

Average Power

This measurement displays the average power of the uplink signal. It supports Averaging, Min Hold, Max Hold and Standard Deviation.

Modulation Accuracy

This measurement displays the status and numeric results relating to the LTE TDD signal.

It consists of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

EVM RMS

The RMS error vector magnitude of the measured signal.

EVM Non Allocated Carriers

The error vector magnitude of the non-allocated carriers.

EVM RMS PUSCH

The RMS error vector magnitude of the PUSCH.

EVM RMS PUCCH

The RMS error vector magnitude of the PUCCH.

EVM RMS DMRS

The RMS error vector magnitude of the DMRS.

EVM RMS SRS

The RMS error vector magnitude of the SRS.

Magnitude Error Non Allocated Carriers

The magnitude error of the non-allocated carriers.

Magnitude Error RMS PUSCH

The RMS magnitude error of the PUSCH.

Magnitude Error RMS PUCCH

The RMS magnitude error of the PUCCH.

Magnitude Error RMS DMRS

The RMS magnitude error of the DMRS.

Magnitude Error RMS SRS

The RMS magnitude error of the SRS.

Phase Error RMS

The RMS phase error of the measured signal.

Phase Error Non Allocated Carriers

The phase error of the non-allocated carriers.

Phase Error RMS PUSCH

The RMS phase error of the PUSCH.

Phase Error RMS PUCCH

The RMS phase error of the PUCCH.

Phase Error RMS DMRS

The RMS phase error of the DMRS.

Phase Error RMS SRS

The RMS phase error of the SRS.

Frequency Error

The frequency error of the signal.

Symbol Clock Error

The symbol clock error of the signal.

IQ Origin Offset

The IQ origin offset (carrier leak) of the signal.

IQ Gain Imbalance

The IQ gain imbalance of the signal.

IQ Skew

The IQ skew of the signal.

Spectrum Mask

These measurements display whether any of the transmitted signal exceeds the limits of the specified spectral mask, as well as giving the frequency and level of the failure. If the transmitted signal does not exceed the spectral mask, the frequency and level supplied are the closest point to failure.

This measurement does not support functions.

Pass/Fail

The pass/fail status of the signal.

Fail Frequency

If the spectrum fails the mask, this value is the frequency at which it is furthest from the mask. If the spectrum passes the mask, the value is the frequency at which it is closest to the mask. The Fail Level result corresponds to this frequency.

Fail Level

If the spectrum fails the mask, this value is the power relative to the mask at which it is furthest from the mask. If the spectrum passes the mask, this value gives the power relative to the mask at which it is closest to the mask. The value is positive if the spectrum fails the mask and negative if it has passed. The Fail Frequency result corresponds to this level.

Occupied B/W

These measurements display the numeric results relating to occupied bandwidth measurements on the analyzed LTE TDD signal. It consists of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

Occupied

The measured occupied bandwidth of the signal.

Lower

The measured occupied bandwidth lower frequency of the signal.

Upper

The measured occupied bandwidth upper frequency of the signal.

ACLR

This measurement displays the results of the adjacent carrier leakage ratio at the frequency offsets specified on the ACLR screen.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Spectrum Flatness

This measurement displays spectral flatness pass/fail results for each analyzed timeslot.

Overall

The overall pass/fail result.

Lower

The lower pass/fail result indicates whether or not the measured signal is within the acceptable lower limit for spectrum flatness.

Upper

The upper pass/fail result indicates whether or not the measured signal is within the acceptable upper limit for spectrum flatness.

PRACH

This measurement displays PRACH measurement results.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions for the following results: On Power, Leading Off Power, Trailing Off Power, Trailing Gap Off Power.

Start Position

This defines the start position of the PRACH burst within the captured data. Note that this may not be the first burst visible in the captured data, as the test requires that the Leading Off Power must be measured over 1 ms before the slot containing the PRACH burst.

Preamble ID

The preamble ID of the PRACH signal.

Preamble Format

The preamble format of the PRACH signal.

On Power

The average power of the PRACH burst.

Leading Off Power

The average power of the 1 ms period before the start of the slot containing the PRACH burst.

Trailing Off Power

The average power of the 1 ms period after the end of the slot containing the PRACH burst.

Trailing Gap Off Power

The average power between the end of the PRACH burst and the end of the slot containing the burst.

RB Offset

The offset to the first resource block in the PRACH burst.

In-band Emissions Overall Pass/Fail

This displays whether the measurement passed or failed for all slots being analyzed.

In-band Emissions

These measurements displays the in-band emissions measurement results for each slot that has been analyzed. The results show the following information for each analyzed slot:

Slot Offset

The slot offset from the first slot to be analyzed.

Pass/Fail

Indicates whether this slot has passed or failed.

Fail RB

If the measurement fails, this indicates the resource block that has failed. If more than one resource block fails, this indicates the resource block whose value has failed by the largest margin. If the measurement passes, this indicates the resource block that is nearest to the limit. The Fail Level corresponds to this resource block.

Fail Level

If the measurement fails, this indicates the power relative to the limit of the resource block that has failed, as indicated by the Fail RB. The value is positive if the measurement fails and negative if it passes.

Channel Information

The measurement displays the status of all supported channels within the analyzed signal.

This measurement supports the following information for each channel:

Resource Block Count

This is the calculated resource block for a given channel.

Power

This is the calculated power for a given channel.

Time Mask

All time mask measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

On Power

This displays the power in the On measurement period of the selected time mask type.

On Power (SRS 2)

This displays the power in the second ON measurement period for time mask type SRS.

Leading Off Power

This displays the power in the OFF measurement period preceding the ON measurement period of the selected time mask type.

Trailing Off Power

This displays the power in the OFF measurement period following the ON measurement period of the selected time mask type.

RF

Use this to set up the basic RF frequency and RF level parameters of an LTE TDD measurement.

Frequency

Use this to set the center frequency (uplink frequency) of the signal that you want to measure.

Valid Bands

This displays a list of operating bands that are valid for the current uplink frequency, since bands can overlap in frequency.

Band

Use this to set the current operating band. The operating band is derived automatically from the uplink EARFCN channel number when set as defined in 3GPP TS 36.521 version 8.2.1 §5.

Channel

Use this to set the uplink frequency channel (EARFCN). Supported channels are defined as per 3GPP TS 36.521 version 8.2.1 §5.

Attenuation Mode

Use this to specify how the RF attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This lets the input condition be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust the attenuation manually only when Attenuation Mode is set to Manual. When in Auto Attenuation Mode, the RF input level is set automatically in order to optimize the RF gain setting.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

DUT Output Level

Use this to specify the DUT output level, which is normally the RMS output level of the DUT.

Use the Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use the DUT Tx Path Loss to compensate for any path loss between the DUT and the instrument's input.

DUT Tx Path Loss

Use this to specify the loss between the DUT's output and the instrument's input, and to adjust the RF input level of the instrument.

System

Use this screen, together with the Channel Settings and Slot Config screens, to define the nature of the signal being measured.

Physical Channel

Use this to define the type of physical channel to be measured: Normal or PRACH.

Special SF Config

Use this to specify the special subframe configuration of the signal.

Uplink Cyclic Prefix

Use this to set the cyclic prefix type of the uplink signal. This is used when performing power and modulation accuracy measurements, in determining the length of cyclic prefix used in each SC-FDMA symbol of a slot and the number of symbols in a slot.

Cell ID

Use this to set the cell ID of the signal.

Half Subcarrier Shift

Use this to enable or disable the half subcarrier shift.

Half subcarrier shift is used to indicate whether or not the modulation accuracy measurement should assume that the input signal includes the half subcarrier shift as stated by the specification 3GPP TS 36.211. If the input signal does not conform to this specification (no half subcarrier shift), the subcarrier shift should be disabled.

PUCCH Present

This button indicates the presence or absence of the PUCCH in the signal.

When the button is enabled, the PUCCH is measured if it is present in the signal. If it is known that the measured signal does not contain a PUCCH, measurement speed is improved by disabling this control.

Bandwidth

Use this to set the system bandwidth. The bandwidth defines the LTE Uplink channel width in terms of frequency and the maximum number of resource blocks that can be used for transmission.

ULDL Config

Use this to specify the uplink-downlink configuration of the signal.

Downlink Cyclic Prefix

Use this to set the cyclic prefix type of the downlink signal.

This is used when performing power and modulation accuracy measurements, in determining the length of cyclic prefix used in each SC-FDMA symbol of a slot and the number of symbols in a slot. This control is enabled only when Signal Composition is set to Uplink&Downlink.

Signal Composition

Use this to specify the composition of the measured signal: uplink only or combined uplink and downlink signal.

PUSCH Present

This button indicates the presence or absence of the PUSCH in the measured signal.

When the button is enabled, the PUSCH is measured if it is present in the signal. If it is known that the measured signal does not contain a PUSCH, measurement speed is improved by not enabling this control.

SRS Present

This button indicates the presence or absence of a SRS in the measured signal.

When the button is enabled, the SRS is measured if it is present in the signal. If it is known that the measured signal does not contain a SRS, measurement speed is improved by not enabling this control.

Channel Settings

Use this screen to configure the key channel parameters of the signal being measured.

Physical Channel

This indicates the type of physical channel to be measured: Normal or PRACH. When set to Normal the Channel Settings screen appears as above. When set to PRACH mode the screen appears as shown in the PRACH Settings section.

Physical Channel set to Normal:

PUSCH Present

When ON, this button enables the associated parameters:

DMRS Δ_{SS}: use this to set the PUSCH DMRS delta shift sequence of the signal.

n(1)DMRS: use this to set the PUSCH DMRS1 index of the signal.

PUCCH Present

When ON, this button enables the associated parameters:

Delta Shift Δ_{SS}: use this to set the PUCCH Delta Shift for the signal.

Cyclic Shift: use this to set the PUCCH Cyclic Shift for the signal.

Resource Index 2

Use this to set the PUCCH Resource Index 2 for the signal.

Reserved Resource Blocks

Use this to set the PUCCH Number of Reserved Resource Blocks for the signal.

SRS Present

When ON, this button enables the associated parameters:

Cyclic Shift: use this to set the SRS Cyclic Shift for the signal.

Transmission Comb: use this to set the SRS Transmission Comb for the signal.

Physical Channel set to PRACH:

When the Physical Channel control is changed to PRACH; the main Channel Settings Panel changes to this configuration:

NCS Configuration

Use this to set the PRACH NCS configuration.

High Speed Flag

Use this to set the PRACH high speed flag.

Logical Root Sequence Number

Use this to set the PRACH logical root sequence number. Refer to 3GPP TS 36.211 § 5.7.1 for more details.

Meas. Config

Use this screen to set up key information for demodulating and analyzing the signal.

General

Search Length

Use this to set the minimum capture time (in s).

Analysis Mode

Use this to specify how the slot being analyzed is chosen. When the mode is set to Random Slot; the underlying measurement picks a random slot from within the available data. When the mode is set to Specific Slot, the underlying measurement attempts to locate and analyze the slot specified by Slot Number.

Synchronization Slot

Use this to specify the slot index from which to begin the synchronization.

Number of Slots to Analyse

Use this to specify the number of slots to be analyzed, either as a number of contiguous slots or a number of active slots. If you select contiguous slots, all active slots within that range are analyzed. If you select active slots, the specified number of active slots is analyzed, ignoring any inactive slots found.

Slot Offset

Use this to set the slot offset for the ON period of the selected time mask measurement.

Time Mask Type

This control enables one of the three supported modes of operation:

- General Pusch

- General Pucch

- SRS

183

EVM Exclude

When on, this button indicates that the standards-defined EVM exclusion period is not included in measurement results.

EVM Enable

This button enables a mode that performs the EVM PUSCH and EVM PUCCH measurements over 20 slots and the EVM DMRS measurement over 120 slots, as required by the standard. All other measurements are performed using the specified Number of Slots to Analyse.

EVM Window Position

Use this to position the EVM window within the cyclic prefix. Low positions the window at the left-hand side of the cyclic prefix, Middle at the center, and High at the right-hand-side respectively.

Pilot Tracking

Pilot Amplitude Tracking

Use this button to enable or disable pilot amplitude tracking.

If pilot amplitude tracking is enabled, then after the channel equalizer has been applied (or the gross amplitude offset removed), the received pilot sub-carriers of each symbol are compared to their ideal values and any remaining amplitude offset is estimated and corrected for both the pilot and data sub-carriers.

All the pilot tracking options are additional methods after any equalization performed by the selected channel equalizer mode and help to reduce the effect of time-dependent changes in pilot amplitude, phase or timing on the EVM result.

Pilot Time Tracking

Use this button to enable or disable pilot time tracking.

If pilot timing tracking is enabled, then after the channel equalizer has been applied (or the gross timing offset removed), the received pilot sub-carriers of each symbol are compared to their ideal values and any remaining timing offset is estimated and corrected for both the pilot and data sub-carriers.

All the pilot tracking options are additional methods after any equalization performed by the selected channel equalizer mode and help to reduce the effect of time-dependent changes in pilot amplitude, phase or timing on the EVM result.

Pilot Phase Tracking

Use this button to enable or disable pilot phase tracking.

If pilot phase tracking is enabled, then after the channel equalizer has been applied (or the gross phase offset removed), the received pilot sub-carriers of each symbol are compared to their ideal values and any remaining phase offset is estimated and corrected for both the pilot and data sub-carriers.

All the pilot tracking options are additional methods after any equalization performed by the selected channel equalizer mode and help to reduce the effect of time-dependent changes in pilot amplitude, phase or timing on the EVM result.

Slot Config

Use this screen to set up key information about the slots defined within the signal being analyzed.

This screen is disabled if the Physical Channel is set to PRACH.

Auto Detect

Set Auto Detect to ON to automatically detect the RB Offset, RB Count and Modulation Type.

If Auto Detect is set OFF, enter these values to define the slot. When Auto Detect mode is enabled, most of the columns in the slot configuration table are grayed out.

Synchronization Slot

Choose the number of the slot in the frame (in the range 0 to 19) from which to start the analysis.

You can do this only if Specific Slot is enabled in Analysis Mode. The slot number, together with $n^{(2)}_{DMRS}$, defines the position of the DMRS in the frame.

Number of Slots to Analyse

Enter a value, up to the maximum number of slots in a frame (20).

Maximum Resource Blocks

This displays the maximum number of PUSCH resource blocks available for any particular bandwidth. RB Offset and RB Count cannot exceed this value.

Slot Index

Represents the number of the slot in the frame.

Channel Type

PUSCH by default.

RB Offset

Enter a value by which the RB count is offset within the symbol.

RB Count

Enter a value representing the position of a resource block, in addition to the offset set by RB Offset.

Modulation Type

Define the modulation type: QPSK, 16QAM, 64QAM.

n(2)DMRS

This value, together with the number of the synchronization slot, defines the DMRS for individual slots.

Format

Use this to set the PUCCH Format for the given slot.

Resource Index 1

Use this to set the PUCCH Resource Index 1 for the given slot.

Burst Detection

Use Burst Detection to configure how the burst is detected within the captured data.

Rising/Falling Edge Threshold

The instrument determines the burst location by looking for significant changes in power. You can specify the magnitude of this change separately for both the rising and falling edges of a burst using the Rising Edge Threshold and Falling Edge Threshold controls.

This figure illustrates these two properties:

ACLR

Use the ACLR (adjacent carrier leakage ratio) settings screen to specify a number of offset frequencies (relative to the carrier frequency) that are measured when performing ACLR measurements.

Use this to set up ACLR measurement for up to 15 channels. Define the number of channels, and the table adjusts itself accordingly.

Frequency Offset

You can enter an odd number of between one and fifteen frequency offsets for ACLR

Changing the number of frequency offsets

.To modify how many offsets are measured, enter the desired value into the Number of Channels control: this adjusts the contents of the frequency list to display the desired number of offsets.

Modifying a frequency offset

To modify a frequency offset, select the desired offset and either touch it or press Return to start editing. Then enter the desired frequency offset in Hz into the resulting edit box.

Note that you cannot modify the first frequency offset, which is fixed to the center frequency.

Channel Type

Use this to set the channel type.

Bandwidth

Use this to set the bandwidth when the associated Channel Type is set to LTE Channel. The bandwidth is pre-defined where the Channel Type is UMTS Channel, and is not applicable for User Channel.

Measurement Bandwidth

Use this to set the measurement bandwidth when the associated Channel Type is set to User Channel. The bandwidth is pre-defined where the Channel Type is LTE Channel or UMTS Channel.

Alpha

Use this to set the alpha property when the associated Channel Type is set to User Channel. The alpha is pre-defined where the Channel Type is LTE Channel or UMTS Channel.

Spectrum Flatness

Use this screen to configure the spectral flatness limits that can be applied to the LTE TDD signal you are analyzing. A mask that displays normal, extreme or user-defined spectral flatness limits can be applied for comparison with a spectral flatness measurement. The screen also shows a rough graphical outline of the limits (both upper and lower limit) that are applied when making spectral flatness measurements.

Spectral Flatness Mode

Use this to select whether a normal, extreme or user-defined spectral flatness limit is applied.

Normal: a pre-defined spectral flatness limits mask (for normal conditions) as per 3GPP TS 36.521- 1 § 6.5.2.4.

Extreme: a pre-defined spectral flatness limits mask (for extreme conditions) as per 3GPP TS 36.521-1 § 6.5.2.4.

User-Defined: the user-defined flatness limits mask automatically applies the current user-defined settings you have entered.

Configure User Limits
See the common Spectral mask section for information on how to create a user-defined spectral mask.

Spectrum Mask

Use this screen to define the spectral mask that is to be applied to the LTE TDD signal you are analyzing.
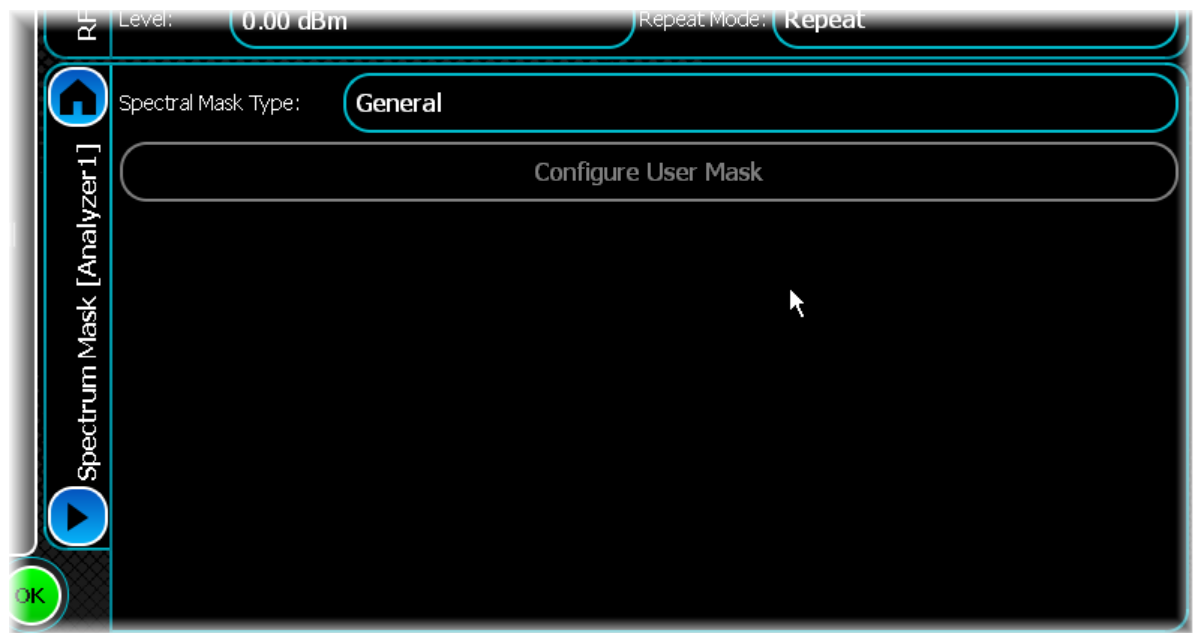
Spectral Mask Type

Use this to select whether a General, NS_03, NS_04, NS_06 or User Defined mask is applied.

Configure User Limits
See the common Spectral mask section for information on how to create a user-defined spectral mask.

LTE FDD Uplink analysis

LTE FDD provides analysis of LTE signals that adhere to the 3GPP 36.211 V8.5.0 (2008-12) technical specifications.

Select LTE FDD Uplink from the menu tab. Touch the ▶ button, and configure LTE FDD analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

System defines system parameters for the analysis.

Channel Settings configures key channel parameters for the signal being measured.

Meas. Config defines the parameters needed to make a measurement.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Slot Config sets up information about slots defined within the signal being analyzed.

ACLR defines offset frequencies that are measured during ACLR measurements.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

Burst Detection defines parameters for detecting rising and falling edges of the burst.

Spectrum Flatness defines the spectral flatness limits to be applied to the signal for analysis.

Spectrum Mask defines the shape of the spectral mask. This screen is common to many modulation types.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to LTE FDD Uplink.

Trace measurements

Spectrum

This graph type displays the spectrum (power vs. frequency) of the signal being measured. The spectrum trace supports Min Hold, Max Hold and Averaging functions.

Spectrum Mask

This graph type displays the spectrum mask of the signal being measured. The spectrum mask trace supports Min Hold, Max Hold and Averaging functions.

Captured Power vs Time

This plot displays the power vs. time trace of the capture that is being used for the underlying analysis of the LTE FDD Uplink signal.

The power vs. time trace supports Min Hold, Max Hold and Averaging functions.

CCDF

The CCDF (complementary cumulative distribution function) trace displays the peak-to-average power ratio of the signal being analyzed. This trace does not support any statistical functions.

Constellation

This plot displays the constellation trace of the LTE FDD Uplink signal being measured.

This trace does not support any statistical functions.

Constellation (Excluding Non Allocated Carriers)

This plot displays the Constellation (Excluding Non Allocated Carriers) trace of the LTE FDD Uplink signal being measured.

This trace does not support any statistical functions.

EVM vs Symbol

This plot displays the EVM vs. Symbol trace for the LTE FDD Uplink signal.

The EVM vs. Symbol trace supports Averaging, Min Hold and Max Hold functions.

Magnitude Error vs Symbol

This plot displays the Magnitude Error vs. Symbol trace for the LTE FDD Uplink signal.

The Magnitude Error vs. Symbol trace supports Averaging, Min Hold and Max Hold functions.

Phase Error vs Symbol

This plot displays the Phase Error vs. Symbol trace for the LTE FDD Uplink signal.

The Phase Error vs. Symbol trace supports Averaging, Min Hold and Max Hold functions.

EVM vs Carrier

This plot displays the EVM vs. Carrier trace for the LTE FDD Uplink signal.

The EVM vs. Carrier trace supports Averaging, Min Hold and Max Hold functions.

Magnitude Error vs Carrier

This plot displays the Magnitude Error vs. Carrier trace for the LTE FDD Uplink signal.

The Magnitude Error vs. Carrier trace supports Averaging, Min Hold and Max Hold functions.

Phase Error vs Carrier

This plot displays the Phase Error vs. Carrier trace for the LTE FDD Uplink signal.

The Phase Error vs. Carrier trace supports Averaging, Min Hold and Max Hold functions.

EVM vs Carrier (Excluding Non Allocated Carriers)

This plot displays the EVM vs. Carrier (Excluding Non Allocated Carriers) trace for the LTE FDD Uplink signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Magnitude Error vs Carrier (Excluding Non Allocated Carriers)

This plot displays the Magnitude Error vs. Carrier (Excluding Non Allocated Carriers) trace for the LTE FDD Uplink signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Phase Error vs Carrier (Excluding Non Allocated Carriers)

This plot displays the Phase Error vs. Carrier (Excluding Non Allocated Carriers) trace for the LTE FDD Uplink signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Power vs Resource Block

This plot displays the Power vs. Resource Block trace for the LTE FDD Uplink signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Power vs Slot

This plot displays the Power vs. Slot trace for the LTE FDD Uplink signal.

This trace supports Averaging, Min Hold and Max Hold functions.

Spectrum Flatness

This plot displays the spectrum flatness trace and upper and lower limit lines for the selected slot.

Select the slot to display from the trace control menu (touch the plot and select Trace Controls\Selected Slot Offset). Note that the selected slot offset is an index in to the analyzed slots and does not refer to a specific slot in a frame. Therefore slot offset 0 refers to the first analyzed slot (the sync slot), slot offset 1 refers to the second analyzed slot, etc. This menu is updated dynamically when each set of results is processed, as a different total number of slots may have been analyzed.

PRACH Power vs Time

This plot displays power vs time for the measured PRACH signal.

The PRACH Power vs Time trace supports Min Hold, Max Hold and Averaging functions.

In-band Emissions

This plot displays in-band emissions for each resource block, together with the measurement limit for each unallocated resource block (displayed as a red line above the value).

Select the slot to be displayed from the trace control menu. Note that the selected slot offset is an index in to the analyzed slots and does not refer to a specific slot in a frame. Therefore slot offset 0 refers to the first analyzed slot (the sync slot) and slot offset 1 refers to the second analyzed slot etc. This menu is updated dynamically when each set of results is processed, as a different total number of slots may have been analyzed.

Subcarrier Allocation

This plot displays the allocation of subcarriers for each symbol. These are shown in different colours:

Yellow	PUSCH
Green	PUSCH DMRS
Red	PUCCH
Magenta	PUCCH DMRS
Cyan	SRS

Display more detailed information about the subcarrier allocation by touching the symbol of interest.

Time Mask Power vs Time

This plot displays power vs. time for the selected On/off Time Mask.

The Time Mask Power vs Time trace supports Min Hold, Max Hold and Averaging functions.

Text measurements

Average Power

This measurement displays the average power of the uplink signal. It supports Averaging, Min Hold, Max Hold and Standard Deviation.

Modulation Accuracy

This measurement displays the status and numeric results relating to the LTE FDD Uplink signal.

It consists of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

EVM RMS

The RMS error vector magnitude of the measured signal.

EVM Non Allocated Carriers

The error vector magnitude of the non-allocated carriers.

EVM RMS PUSCH

The RMS error vector magnitude of the PUSCH.

EVM RMS PUCCH

The RMS error vector magnitude of the PUCCH.

EVM RMS DMRS

The RMS error vector magnitude of the DMRS.

EVM RMS SRS

The RMS error vector magnitude of the SRS.

Magnitude Error Non Allocated Carriers

The magnitude error of the non-allocated carriers.

Magnitude Error RMS PUSCH

The RMS magnitude error of the PUSCH.

Magnitude Error RMS PUCCH

The RMS magnitude error of the PUCCH.

Magnitude Error RMS DMRS

The RMS magnitude error of the DMRS.

Magnitude Error RMS SRS

The RMS magnitude error of the SRS.

Phase Error RMS

The RMS phase error of the measured signal.

Phase Error Non Allocated Carriers

The phase error of the non-allocated carriers.

Phase Error RMS PUSCH

The RMS phase error of the PUSCH.

Phase Error RMS PUCCH

The RMS phase error of the PUCCH.

Phase Error RMS DMRS

The RMS phase error of the DMRS.

Phase Error RMS SRS

The RMS phase error of the SRS.

Frequency Error

The frequency error of the signal.

Symbol Clock Error

The symbol clock error of the signal.

IQ Origin Offset

The IQ origin offset (carrier leak) of the signal.

IQ Gain Imbalance

The IQ gain imbalance of the signal.

IQ Skew

The IQ skew of the signal.

Spectrum Mask

These measurements display whether any of the transmitted signal exceeds the limits of the specified spectral mask, as well as giving the frequency and level of the failure. If the transmitted signal does not exceed the spectral mask, the frequency and level supplied are the closest point to failure.

This measurement does not support functions.

Pass/Fail

The pass/fail status of the signal.

Fail Frequency

If the spectrum fails the mask, this value is the frequency at which it is furthest from the mask. If the spectrum passes the mask, the value is the frequency at which it is closest to the mask. The Fail Level result corresponds to this frequency.

Fail Level

If the spectrum fails the mask, this value is the power relative to the mask at which it is furthest from the mask. If the spectrum passes the mask, this value gives the power relative to the mask at which it is closest to the mask. The value is positive if the spectrum fails the mask and negative if it has passed. The Fail Frequency result corresponds to this level.

Occupied B/W

These measurements display the numeric results relating to occupied bandwidth measurements on the analyzed LTE TDD signal. It consists of the following results, all of which support Averaging, Min Hold, Max Hold and Standard Deviation.

Occupied

The measured occupied bandwidth of the signal.

Lower

The measured occupied bandwidth lower frequency of the signal.

Upper

The measured occupied bandwidth upper frequency of the signal.

ACLR

This measurement displays the results of the adjacent carrier leakage ratio at the frequency offsets specified on the ACLR screen.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Spectrum Flatness

This measurement displays spectral flatness pass/fail results for each analyzed timeslot.

Overall

The overall pass/fail result.

Lower

The lower pass/fail result indicates whether or not the measured signal is within the acceptable lower limit for spectrum flatness.

Upper

The upper pass/fail result indicates whether or not the measured signal is within the acceptable upper limit for spectrum flatness.

PRACH

This measurement displays PRACH measurement results.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions for the following results: On Power, Leading Off Power, Trailing Off Power, Trailing Gap Off Power.

Start Position

This defines the start position of the PRACH burst within the captured data. Note that this may not be the first burst visible in the captured data, as the test requires that the Leading Off Power must be measured over 1 ms before the slot containing the PRACH burst.

Preamble ID

The preamble ID of the PRACH signal.

Preamble Format

The preamble format of the PRACH signal.

On Power

The average power of the PRACH burst.

Leading Off Power

The average power of the 1 ms period before the start of the slot containing the PRACH burst.

Trailing Off Power

The average power of the 1 ms period after the end of the slot containing the PRACH burst.

Trailing Gap Off Power

The average power between the end of the PRACH burst and the end of the slot containing the burst.

RB Offset

The offset to the first resource block in the PRACH burst.

In-band Emissions Overall Pass/Fail

This displays whether the measurement passed or failed for all slots being analyzed.

In-band Emissions

These measurements displays the in-band emissions measurement results for each slot that has been analyzed. The results show the following information for each analyzed slot:

Slot Offset

The slot offset from the first slot to be analyzed.

Pass/Fail

Indicates whether this slot has passed or failed.

Fail RB

If the measurement fails, this indicates the resource block that has failed. If more than one resource block fails, this indicates the resource block whose value has failed by the largest margin. If the measurement passes, this indicates the resource block that is nearest to the limit. The Fail Level corresponds to this resource block.

Fail Level

If the measurement fails, this indicates the power relative to the limit of the resource block that has failed, as indicated by the Fail RB. The value is positive if the measurement fails and negative if it passes.

Channel Information

The measurement displays the status of all supported channels within the analyzed signal.

This measurement supports the following information for each channel:

Resource Block Count

This is the calculated resource block for a given channel.

Power

This is the calculated power for a given channel.

Time Mask

All time mask measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

On Power

This displays the power in the On measurement period of the selected time mask type.

Leading Off Power

This displays the power in the OFF measurement period preceding the ON measurement period of the selected time mask type.

Trailing Off Power

This displays the power in the OFF measurement period following the ON measurement period of the selected time mask type.

RF

Use this to set up the basic RF frequency and RF level parameters of a LTE FDD measurement.

Frequency

Use this to set the center frequency (uplink frequency) of the signal that you want to measure.

Valid Bands

This displays a list of operating bands that are valid for the current uplink frequency, since bands can overlap in frequency.

Band

Use this to set the current operating band. The operating band is derived automatically from the uplink EARFCN channel number when set as defined in 3GPP TS 36.521 version 8.2.1 §5.

Channel

Use this to set the uplink frequency channel (EARFCN). Supported channels are defined as per 3GPP TS 36.521 version 8.2.1 §5.

Attenuation Mode

Use this to specify how the RF Attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This allows the input condition to be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

System

Use this screen, together with the Channel Settings and Slot Config screens, to define the nature of the signal being measured.

Bandwidth

Use this to set the system bandwidth, in six steps in the range 1.4 MHz to 20.0 MHz. The default is 5 MHz. The bandwidth defines the LTE Uplink channel width in terms of frequency and the maximum number of resource blocks that can be used for transmission.

Cell ID

Use this to set the cell ID of the signal.

This sets the physical-layer identity for the current cell, in the range 0 to 503. Each cell identity corresponds to a downlink reference-signal sequence.

Half Subcarrier Shift

Use this button to enable or disable the half subcarrier shift.

Half subcarrier shift is used to indicate whether or not the modulation accuracy measurement should assume the input signal includes the half subcarrier shift as stated by specification 3GPP TS 36.211. If the input signal does not conform to this specification (no half subcarrier shift), the subcarrier shift should be disabled.

PUSCH Present

This button indicates the presence or absence of the PUSCH in the measured signal.

When the button is enabled, the PUSCH is measured if it is present in the signal. If it is known that the measured signal does not contain a PUSCH, measurement speed is improved by not enabling this control.

SRS Present

This button indicates the presence or absence of a SRS in the measured signal.

When the button is enabled, the SRS is measured if it is present in the signal. If it is known that the measured signal does not contain a SRS, measurement speed is improved by not enabling this control.

Physical Channel

Use this to define the type of physical channel to be measured: Normal or PRACH.

Cyclic Prefix

Use this to set the cyclic prefix type of the signal. This is used when performing power and modulation accuracy measurements, in determining the length of cyclic prefix used in each SC-FDMA symbol of a slot and the number of symbols in a slot.

To reduce the sensitivity of an OFDM signal to multi-path signals, each symbol is extended by a cyclic prefix:

Normal corresponds to seven SC-FDMA symbols per slot.

Extended corresponds to six symbols per slot: it increases immunity to time-dispersive interference at the expense of bandwidth and power.

DTX Present

This button indicates whether or not the measured signal contains discontinuous transmissions (DTX).

PUCCH Present

This button indicates the presence or absence of the PUCCH in the measured signal.

When the button is enabled, the PUCCH is measured if it is present in the signal. If it is known that the measured signal does not contain a PUCCH, measurement speed is improved by not enabling this control.

Channel Settings

Use this screen to configure the key channel parameters of the signal being measured.

Physical Channel

This indicates the type of physical channel to be measured: Normal or PRACH. When set to Normal the Channel Settings screen appears as above. When set to PRACH mode the screen appears as shown in the PRACH Settings section.

Physical Channel Normal

PUSCH Present

When ON, this button enables the associated parameters:

DMRS Δ_{SS}: use this to set the PUSCH DMRS delta shift sequence of the signal.

n(1)DMRS: use this to set the PUSCH DMRS1 index of the signal.

PUCCH Present

When ON, this button enables the associated parameters:

Delta Shift Δ_{SS}: use this to set the PUCCH Delta Shift for the signal.

Cyclic Shift: use this to set the PUCCH Cyclic Shift for the signal.

Resource Index 2

Use this to set the PUCCH Resource Index 2 for the signal.

Reserved Resource Blocks

Use this to set the PUCCH Number of Reserved Resource Blocks for the signal.

SRS Present

When ON, this button enables the associated parameters:

Cyclic Shift: use this to set the SRS Cyclic Shift for the signal.

Transmission Comb: use this to set the SRS Transmission Comb for the signal.

Physical Channel PRACH

When the Physical Channel control is changed to PRACH; the main Channel Settings Panel changes to this configuration:

NCS Configuration

Use this to set the PRACH NCS configuration.

High Speed Flag

Use this to set the PRACH high speed flag.

Logical Root Sequence Number

Use this to set the PRACH logical root sequence number. Refer to 3GPP TS 36.211 § 5.7.1 for more details.

Meas. Config

Use this screen to set up key information about demodulating and analyzing the signal.

General

Search Length

Use this to set the minimum capture time (in s).

Spectrum Analysis Mode

Use this to specify what IQ data is used for spectrum measurements. When the mode is set to Measure All IQ Data, spectrum measurements are made using all captured IQ data. When the mode is set to Measure Analysed Slots, only IQ data for the analyzed slots is used for spectrum measurements.

Analysis Mode

Use this to specify how the slot being analyzed is chosen. When the mode is set to Random Slot; the underlying measurement picks a random slot from within the available data. When the mode is set to Specific Slot, the underlying measurement attempts to locate and analyze the slot specified by Slot Number.

Synchronization Slot

Use this to specify the slot index from which to begin the synchronization. You can do this only if Specific Slot is enabled in Analysis Mode. The slot number, together with $n^{(2)}_{DMRS}$, defines the position of the DMRS in the frame.

Number of Slots to Analyse

Use this to specify the number of slots to be analyzed, either as a number of contiguous slots or a number of active slots. If you select contiguous slots, all active slots within that range are analyzed. If you select active slots, the specified number of active slots is analyzed, ignoring any inactive slots found.

Time Mask Type

This control enables one of the three supported modes of operation:

- General Pusch

- General Pucch

- SRS

Slot Offset

Use this to set the slot offset for the ON period of the selected time mask measurement.

EVM Enable

This button enables a mode that performs the EVM PUSCH and EVM PUCCH measurements over 20 slots and the EVM DMRS measurement over 120 slots, as required by the standard. All other measurements are performed using the specified Number of Slots to Analyse.

EVM Exclude

When ON, this button indicates that the standards-defined EVM exclusion period is not included in measurement results.

EVM Window Position

Use this to position the EVM window within the cyclic prefix. Low positions the window at the left-hand side of the cyclic prefix, Middle at the center, and High at the right-hand-side respectively

Pilot Amplitude Tracking

Pilot Amplitude Tracking

Use this button to enable or disable pilot amplitude tracking.

If pilot amplitude tracking is enabled, then after the channel equalizer has been applied (or the gross amplitude offset removed), the received pilot sub-carriers of each symbol are compared to their ideal values and any remaining amplitude offset is estimated and corrected for both the pilot and data sub-carriers.

All the pilot tracking options are additional methods after any equalization performed by the selected channel equalizer mode and help to reduce the effect of time-dependent changes in pilot amplitude, phase or timing on the EVM result.

Pilot Time Tracking

Use this button to enable or disable pilot time tracking.

If pilot timing tracking is enabled, then after the channel equalizer has been applied (or the gross timing offset removed), the received pilot sub-carriers of each symbol are compared to their ideal values and any remaining timing offset is estimated and corrected for both the pilot and data sub-carriers.

All the pilot tracking options are additional methods after any equalization performed by the selected channel equalizer mode and help to reduce the effect of time-dependent changes in pilot amplitude, phase or timing on the EVM result.

Pilot Phase Tracking

Use this button to enable or disable pilot phase tracking.

If pilot phase tracking is enabled, then after the channel equalizer has been applied (or the gross phase offset removed), the received pilot sub-carriers of each symbol are compared to their ideal values and any remaining phase offset is estimated and corrected for both the pilot and data sub-carriers.

All the pilot tracking options are additional methods after any equalization performed by the selected channel equalizer mode and help to reduce the effect of time-dependent changes in pilot amplitude, phase or timing on the EVM result.

Slot Config

Use this screen to set up key information about the slots defined within the signal being analyzed.

This screen is disabled if the Physical Channel is set to PRACH.

Auto Detect

Set Auto Detect to ON to automatically detect the RB Offset, RB Count and Modulation Type.

If Auto Detect is set OFF, enter these values to define the slot. When Auto Detect mode is enabled, most of the columns in the slot configuration table are grayed out.

Synchronization Slot

Choose the number of the slot in the frame (in the range 0 to 19) from which to start the analysis.

You can do this only if Specific Slot is enabled in Analysis Mode. The slot number, together with $n^{(2)}_{DMRS}$, defines the position of the DMRS in the frame.

Number of Slots to Analyse

Enter a value, up to the maximum number of slots in a frame (20).

Maximum Resource Blocks

This displays the maximum number of PUSCH resource blocks available for any particular bandwidth. RB Offset and RB Count cannot exceed this value.

Slot Index

Represents the number of the slot in the frame.

Channel Type

PUSCH by default.

RB Offset

Enter a value by which the RB count is offset within the symbol.

RB Count

Enter a value representing the position of a resource block, in addition to the offset set by RB Offset.

Modulation Type

Define the modulation type: QPSK, 16QAM, 64QAM.

n(2)DMRS

This value, together with the number of the synchronization slot, defines the DMRS for individual slots.

Format

Use this to set the PUCCH Format for the given slot.

Resource Index 1

Use this to set the PUCCH Resource Index 1 for the given slot.

Burst Detection

Use Burst Detection to configure how the burst is detected within the captured data.

Rising/Falling Edge Threshold

The instrument determines the burst location by looking for significant changes in power. You can specify the magnitude of this change separately for both the rising and falling edges of a burst using the Rising Edge Threshold and Falling Edge Threshold controls.

This figure illustrates these two properties:

ACLR

Use the ACLR (adjacent carrier leakage ratio) settings screen to specify a number of offset frequencies (relative to the carrier frequency) that are measured when performing ACLR measurements.

Use this to set up ACLR measurement for up to 15 channels. Define the number of channels, and the table adjusts itself accordingly.

Frequency Offset

You can enter an odd number of between one and fifteen frequency offsets for ACLR.

Changing the number of frequency offsets

To modify how many offsets are measured, enter the desired value into the Number of Channels control: this adjusts the contents of the frequency list to display the desired number of offsets.

Modifying a frequency offset

To modify a frequency offset, select the desired offset and either touch it or press Return to start editing. Then enter the desired frequency offset in Hz into the resulting edit box.

Note that you cannot modify the first frequency offset, which is fixed to the center frequency.

Channel Type

Use this to set the channel type.

Bandwidth

Use this to set the bandwidth when the associated Channel Type is set to LTE Channel. The bandwidth is pre-defined where the Channel Type is UMTS Channel, and is not applicable for User Channel.

Measurement Bandwidth

Use this to set the measurement bandwidth when the associated Channel Type is set to User Channel. The bandwidth is pre-defined where the Channel Type is LTE Channel or UMTS Channel.

Alpha

Use this to set the alpha property when the associated Channel Type is set to User Channel. The alpha is pre-defined where the Channel Type is LTE Channel or UMTS Channel.

Spectrum Flatness

Use this screen to configure the spectral flatness limits that can be applied to the LTE FDD signal you are analyzing. A mask that displays normal, extreme or user-defined spectral flatness limits can be applied for comparison with a spectral flatness measurement. The screen also shows a rough graphical outline of the limits (both upper and lower limit) that are applied when making spectral flatness measurements.

Spectral Flatness Mode

Use this to select whether a normal, extreme or user-defined spectral flatness limit is applied.

Normal: a pre-defined spectral flatness limits mask (for normal conditions) as per 3GPP TS 36.521- 1 § 6.5.2.4.

Extreme: a pre-defined spectral flatness limits mask (for extreme conditions) as per 3GPP TS 36.521-1 § 6.5.2.4.

User-Defined: the user-defined flatness limits mask automatically applies the current user-defined settings you have entered.

Configure User Limits
See the common Spectral mask section for information on how to create a user-defined spectral mask.

TD-SCDMA analysis

TD-SCDMA (3GPP TDD-LCR) is a UMTS standard currently mostly confined to China.

Select TD-SCDMA from the menu tab. Touch the ▶ button, and configure TD-SCDMA analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

System defines system parameters for the analysis.

Meas. Config defines the parameters needed to make a measurement.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Burst Detection defines parameters for detecting rising and falling edges of the burst.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

ACLR defines offset frequencies that are measured during ACLR measurements.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to TD-SCDMA.

Trace measurements

Raw Spectrum

This graph type displays the spectrum (power vs. frequency) of the signal being measured. The spectrum trace supports Min Hold, Max Hold and Averaging functions.

Spectrum Mask

This displays the spectrum (power vs. frequency) of the signal being measured. The spectrum trace supports Min Hold, Max Hold and Averaging functions.

The currently selected spectrum mask (either user-defined or predefined) may also be overlaid on the spectrum trace. This can be disabled by touching anywhere on the graph and disabling it from the Trace Controls\Spectral Mask menu.

Spectrum Mask Markers

As well as standard marker functionality, the delta between the spectral mask and the trace is also displayed when displaying a marker.

ACLR

This graph type displays the results of adjacent channel leakage ratio analysis performed on the TD-SCDMA signal.

The ACPR trace supports Live, Min Hold, Max Hold and Averaging functions.

Composite Constellation

This plot type lets you view the Composite Constellation measurement within the TD-SCDMA signal and optionally, the ideal reference points.

Real points are displayed as green dots. Reference points are displayed as small red crosses indicating the exact ideal point.

This trace does not support any statistical functions.

Composite Constellation zoom in/zoom out

The Composite Constellation plot maintains a fixed 1:1 aspect ratio. This means that when performing a zoom selection, the extent that is displayed may not match the original selection.

Composite Constellation markers

The constellation plot supports an x-y marker system.

The Composite Constellation marker displays the I and Q for the given sample, as well as the reference I and Q value for that particular position.

Moving the marker either horizontally or vertically causes the marker to choose the constellation point closest to the desired position.

When performing continuous captures, the sample retains the marker it is currently displaying. If you use an Immediate trigger, the marker may jump around, as the sample that the marker is measuring is now in a completely different location.

Because of this, it is recommended that you use an external or burst trigger when making continuous measurements.

EVM vs Chip

This plot type displays the EVM vs. Chip measurement results for the TD-SCDMA signal being analyzed.

The trace supports Live, Min Hold, Max Hold and Averaging functions.

Captured Power vs. Time

This plot displays the power vs. time trace of the capture that is being used for the underlying analysis of the TD-SCDMA signal.

The power vs. time trace supports Live, Min Hold, Max Hold and Averaging functions.

Code Domain Power

This plot type displays the code domain power of the TD-SCDMA signal being measured. Active codes are shown in a brighter shade than inactive codes.

This trace supports Live, Min Hold, Max Hold and Averaging functions.

Code Domain Error

This plot type displays the code domain error of the TD-SCDMA signal being measured.

This trace supports Live, Min Hold, Max Hold and Averaging functions.

CCDF

This plot type shows the CCDF (complementary cumulative distribution function) of the TD-SCDMA signal being analyzed. This trace does not support any statistical functions.

Transmit On/Off Time Mask

This plot type displays a power vs. time trace of the TD-SCDMA slot(s) being analyzed, together with a time mask that represents the limits against which the active slots are tested.

The trace supports Live, Min Hold, Max Hold and Averaging functions.

Text measurements

Modulation Accuracy

This measurement displays the numeric results relating to modulation accuracy measurements of the analyzed TD-SCDMA signal. All modulation accuracy measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

Detected Channel Threshold

This displays the detected active channel threshold, in dB, of the signal being measured.

This result is applicable when auto-detected channel threshold is enabled. The detected threshold is used to determine the active code channels.

Detected Basic Midamble Code

This displays the detected basic midamble code of the signal being measured. This result is applicable when auto-detected midamble mode is enabled.

Detected Scramble Code

This displays the frequency error, in Hz, of the signal being measured. This result is applicable when auto-detected midamble mode is enabled.

DwPTS Phase Coding

This displays the downlink pilot test sequence coding of the signal being measured.

Frequency Error

This displays the frequency error, in Hz, of the signal being measured.

Timing Error

This displays the timing error, in millichips, of the signal being measured.

Modulation Accuracy (Data)

This measurement displays the numeric results relating to modulation accuracy measurements of the analyzed TD-SCDMA signal. All modulation accuracy measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

Rho Factor

This displays the rho modulation accuracy indicator.

Rho is the normalized correlation coefficient between the measured and ideal reference signals. Rho is computed by comparing the normalized correlated power between the measured signal and the reference signal and is designated as the waveform quality factor.

The maximum value of rho is 1.0 (which means the measured signal and reference signal are 100% identical).

A rho value of 1.0 indicates that all of the transmitted power correlates with the ideal signal as determined by the detected sequence.

Rho is the correlated power for all active code channels (as seen in the composite CDP trace data display).

EVM RMS

This displays the RMS EVM, as a percentage, for the composite signal.

A perfect ideal signal is synthesized at the chip level and identified as the reference signal. The reference signal is subtracted from the measured signal to produce a time record of error phasors. The square root of the ratio of the mean power of the error signal to the mean power of the reference signal is computed and expressed as a percentage EVM.

EVM Peak

This displays the peak EVM, as a percentage, for the composite signal.

Magnitude Error RMS

This displays, as a percentage, the RMS magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) of the composite signal.

Magnitude Error Peak

This displays, as a percentage, the peak magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) for the data segment of the analyzed time slot.

Phase Error RMS

This displays the measured RMS phase error result, in degrees. This is the RMS value of the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot.

Phase Error Peak

This displays the measured peak phase error result, in degrees. This is the peak RMS among the phase difference between the reference signal and the measured signal for the data segment of the analyzed time slot.

IQ Origin Offset

This displays the IQ origin offset (carrier leak) of the signal, in dB. This is the magnitude of the carrier feed-through signal, which represents the shift in the IQ origin. When there is no carrier feed-through, the IQ origin offset is zero (-infinity dB).

IQ Gain Imbalance

This displays the IQ gain imbalance of the signal, in dB. This is the ratio of I gain over Q gain for the data signal of the analyzed time slot. As IQ gain imbalance detection requires absolute phase information, this result is questionable when the DwPTS phase coding is not known. As uplink traffic time slots are not phase-related to DwPTS, this applies at all times in the uplink case.

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

IQ Skew

This displays the IQ skew (orthogonal error or quadrature skew error) between the data I and Q signals of the analyzed time slot, in degrees. Ideally, I and Q signals should be orthogonal (90 degrees apart). A quadrature skew error of 3 degrees means I and Q are 87 degrees (or 93 degrees) apart.

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Modulation Accuracy (Midamble)

This measurement displays the numeric results relating to modulation accuracy (midamble) measurements of the analyzed TD-SCDMA signal. All modulation accuracy (midamble) measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

Rho Factor

This displays the midamble rho modulation accuracy indicator.

Rho is the normalized correlation coefficient between the measured and ideal reference signals. Midamble rho is computed by comparing the normalized correlated power between the measured midamble signal and the reference signal and is designated as the waveform quality factor.

The maximum value of midamble rho is 1.0 (which means the measured signal and reference signal are 100% identical).

A midamble rho value of 1.0 indicates that all of the transmitted power correlates with the ideal signal as determined by the detected sequence.

Rho is the correlated power for all active code channels (as seen in the composite CDP trace data display).

EVM RMS

This displays the RMS EVM, as a percentage, for the midamble segment of the analyzed time slot.

A perfect ideal midamble signal is synthesized at the chip level and identified as the midamble reference signal. The reference midamble signal is subtracted from the measured midamble signal to produce a time record of error phasors. The square root of the ratio of the mean power of the error signal to the mean power of the reference midamble signal is computed and expressed as a percentage EVM.

EVM Peak

This displays the peak EVM, as a percentage, for the midamble segment of the analyzed time slot.

Magnitude Error RMS

This displays, as a percentage, the RMS magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) for the midamble segment of the analyzed time slot.

Magnitude Error Peak

This displays, as a percentage, the peak magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) for the midamble segment of the analyzed time slot.

Phase Error RMS

This displays the measured RMS phase error result, in degrees. This is the RMS value of the phase difference between the reference signal and the measured signal for the midamble segment of the analyzed time slot.

Phase Error Peak

This displays the measured peak phase error result, in degrees. This is the peak RMS among the phase difference between the reference signal and the measured signal for the midamble segment of the analyzed time slot.

IQ Origin Offset

This displays the IQ origin offset (carrier leak) of the signal, in dB. This is the relative magnitude of the midamble carrier feed-through signal, which represents the shift in the IQ origin. When there is no carrier feed-through, the IQ origin offset is zero (-infinity dB).

IQ Gain Imbalance

This displays the IQ gain imbalance of the signal, in dB. This is the ratio of I gain over Q gain for the data signal of the analyzed time slot. As IQ gain imbalance detection requires absolute phase information, this result is questionable when the DwPTS phase coding is not known. As uplink traffic time slots are not phase-related to DwPTS, this applies at all times in the uplink case.

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

IQ Skew

This displays the IQ skew (orthogonal error or quadrature skew error) between the midamble I and Q signals of the analyzed time slot, in degrees. Ideally, I and Q signals should be orthogonal (90 degrees apart). A quadrature skew error of 3 degrees means I and Q are 87 degrees (or 93 degrees) apart.

This measurement supports Live, Minimum Hold, Maximum Hold, Averaging and Standard Deviation functions.

Midamble Mid Shifts

This measurement does not support any of the statistical functions.

Number of Mid Shifts

This displays the number of midamble mid shifts detected in the midamble of the timeslot being analyzed.

Mid Shifts

This displays the array of midamble mid shift values detected in the midamble of the timeslot being analyzed.

Detected Channels

The detected channel measurements are applicable only when the [auto-detected channel configuration](#) mode is enabled.

This measurement does not support any of the statistical functions.

Channel Code

This displays the auto-detected code channel IDs.

Spreading Factor

This displays the auto-detected spreading factors.

Modulation Type

This displays the auto-detected modulation types.

Power

All power measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

Total Power

This displays the total power in dBm. This is the sum of the average midamble power and the average data power for the analyzed time slot.

Midamble Power

This displays the midamble power in dBm. This is the average power in the midamble for the analyzed time slot.

Data Power

This displays the data power in dBm. This is the average power in the data segments before and after the preamble for the analyzed time slot.

Left Data Power

This displays the left data power in dBm. This is the absolute power measurement for the data segment before the preamble of the analyzed time slot.

Right Data Power

This displays the right data power in dBm. This is the absolute power measurement for the data segment after the preamble of the analyzed time slot.

Transmit On/Off Time Mask

All transmit on/off time mask measurements support the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation, except for Status, Fail Time and Fail Level which do not offer statistical functions.

Status

This displays the status of the measurement as a pass or fail.

Fail Time

This displays the time (in chips) at which the worst case failure (or most marginal pass) occurred.

Fail Level

This displays the power, in dBm, of the worst failing (or most marginal passing) chip.

On Power

This displays the RRC filtered power, in dBm, of the active part of the burst(s) being measured.

Off Power

This displays the RRC filtered power, in dBm, of the inactive part of the trace.

Leading Off Power

This displays the average power, in dBm, of the inactive slot preceding the rising edge of the active slot(s).

Trailing Off Power

This displays the average power in dBm of the inactive slot after the falling edge of the active slot(s).

Spectrum Mask

This measurement displays whether any of the transmitted signal exceeds the limits of the specified spectrum mask, as well as giving the frequency and level of the failure. If the transmitted signal does not exceed the spectrum mask, the frequency and level supplied are the closest point to failure.

This measurement does not support any of the statistical functions.

Status

This gives a simple indication as to whether the signal is within the mask limits.

Frequency

This is the frequency of the largest spectrum peak that exceeds the spectrum mask limit.

Level

This is the power of the largest spectrum peak that exceeds the spectrum mask limit.

Ref Level

If the spectrum fails the mask, the value of this property contains the dB error, or difference, between the largest spectrum peak that exceeds the mask and the power mask limit.

Occupied Bandwidth (99%)

This measurement displays the occupied bandwidth of the TD-SCDMA signal. This measurement supports the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

Occupied Bandwidth (99%)

This displays the occupied bandwidth of the signal, which is the bandwidth that contains 99% of the total power.

ACLR

This measurement displays the results of the adjacent channel leakage ratio at the frequency offsets specified in the ACLR settings panel.

The ACLR measurement supports the following statistical functions: Averaging, Min Hold, Max Hold and Standard Deviation.

CLPC Overall Pass/Fail

This measurement displays the overall pass/fail result and the reason for failure if the test fails.

This measurement does not support functions

CLPC Power Measurements

Max Power

This measurement displays the maximum power observed during measurement.

Min Power

This measurement displays the minimum power observed during measurement.

The measurements above do not support functions.

CLPC Absolute Power vs Slot Table

This measurement displays the results of the CLPC Absolute Power measurement made on a slot-by-slot basis.

This measurement does not support functions.

CLPC Relative Power vs Slot Table

This measurement displays the results of the CLPC Relative Power measurement made on a slot-by-slot basis.

This measurement does not support functions..

RF

Use this to set up the basic RF frequency and RF level parameters of a TD-SCDMA measurement.

Frequency Centre

Use this to set the center frequency of the signal that you want to measure.

Frequency Channel

Use this to set the center frequency of the signal based on the channel number.

Attenuation Mode

Use this to specify how the RF Attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This allows the input condition to be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust the attenuation manually only when Attenuation Mode is set to Manual. When in Auto Attenuation Mode, the RF input level is set automatically in order to optimize the RF gain setting.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

DUT Output Level

Use this to specify the DUT output level, which is normally the RMS output level of the DUT.

Use the Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use the DUT Tx Path Loss to compensate for any path loss between the DUT and the instrument's input.

DUT Tx Path Loss

Use this to specify the loss between the DUT output and the instrument's input, and to adjust the RF input level of the instrument.

System

Use this screen to set up key information about demodulating and analyzing the signal.

Force Code Group

The setting of this control determines which of the codes (Sync DL Code, Sync UL Code, Scramble Code and Basic Midamble Code) is the dominant or master code in relation to the other three codes. Upon setting the master code, the settings of the other three codes change accordingly, to ensure they are within the valid ranges compliant with the specification. Where the Force Code Group is set to Any Code, the code ranges are derestricted and you may set the code to any setting within the full range.

This table provides details of the valid ranges for each code group.

Code Group	Associated Codes			
	Sync Downlink Code	Sync Uplink Code	Scramble Code	Basic Midamble Code
Group 1	0	0…7	0…3	0…3
Group 2	1	8…15	4…7	4…7
Group 3	2	16…23	8…11	8…11
Group 4	3	24…31	12…15	12…15
Group 5	4	32…39	16…20	16…20
Group 6	5	40…47	20…23	20…23
Group 7	6	48…55	24…27	24…27
Group 8	7	56…63	28…31	28…31
Group 9	8	64…71	32…35	32…35
Group 10	9	72…79	36…39	36…39
Group 11	10	80…87	40…43	40…43
Group 12	11	88…95	44…47	44…47
Group 13	12	96…103	48…51	48…51

Code Group	Associated Codes			
	Sync Downlink Code	Sync Uplink Code	Scramble Code	Basic Midamble Code
Group 14	13	104…111	52…55	52…55
Group 15	14	112…119	56…59	56…59
Group 16	15	120…127	60…63	60…63
Group 17	16	128…135	64…67	64…67
Group 18	17	136…143	68…71	68…71
Group 19	18	144…151	72…75	72…75
Group 20	19	152…159	76…79	76…79
Group 21	20	160…167	80…83	80…83
Group 22	21	168…175	84…78	84…87
Group 23	22	176…183	88…91	88…91
Group 24	23	184…191	92…95	92…95
Group 25	24	192…199	96…99	96…99
Group 26	25	200…207	100…103	100…103
Group 27	26	208…215	104…107	104…107
Group 28	27	216…223	108…111	108…111
Group 29	28	224…231	112…115	112…115
Group 30	29	232…239	116…119	116…119
Group 31	30	240…247	120…123	120…123
Group 32	31	248…255	124…127	124…127

Sync Downlink Code

Use this to specify the Synchronisation Downlink Code index. If the Force Code Group is set to Sync DL Code, then by adjusting this control the other code controls change accordingly within the code ranges that correspond to the specified synchronization downlink code index.

Sync Uplink Code

Use this to specify the Synchronisation Uplink Code index. If the Force Code Group is set to Sync UL Code, then by adjusting this control the other code controls change accordingly within the code ranges that correspond to the specified synchronisation uplink code index.

Auto-detect Basic Midamble Code

Use this button to select the auto-detect basic midamble code mode. If this mode is enabled, then the basic midamble code ID is detected automatically using an internal algorithm. If the auto-detect basic midamble code mode is disabled, you should provide the basic midamble code ID using the Basic Midamble Code control.

Scramble Code

Use this to specify the Scramble Code. If the Force Code Group is set to Scramble Code, then by adjusting this control the other code controls change accordingly within the code ranges that correspond to the specified scramble code.

Uplink Switch Point

Use this to set the uplink switch point, which specifies which traffic timeslots are uplink and downlink. The uplink switch point is the last uplink traffic timeslot. Timeslots after the uplink switch point through to the end of the sub-frame are treated as downlink timeslots.

Basic Midamble Code

Use this to specify the Basic Midamble Code. If the Force Code Group is set to Basic Midamble Code, then by adjusting this control the other code controls change accordingly within the code ranges that correspond to the specified basic midamble code.

Reference Data Pattern Type

This is the transmitted test pattern in the downlink signal, which is used for BER testing or making CLPC measurements. Set it to PN9 or PN15, or 'all ones' or 'all zeros'. For CLPC measurements only PN9 is supported.

Configure Channels...

Configure the code channels by touching the Configure Channels... button. The Code Channel Settings screen appears, where you can configure each code channel for use if auto-detect channel configuration is not enabled. When autodetect channel configuration is enabled, the table is grayed-out and the settings are not applied.
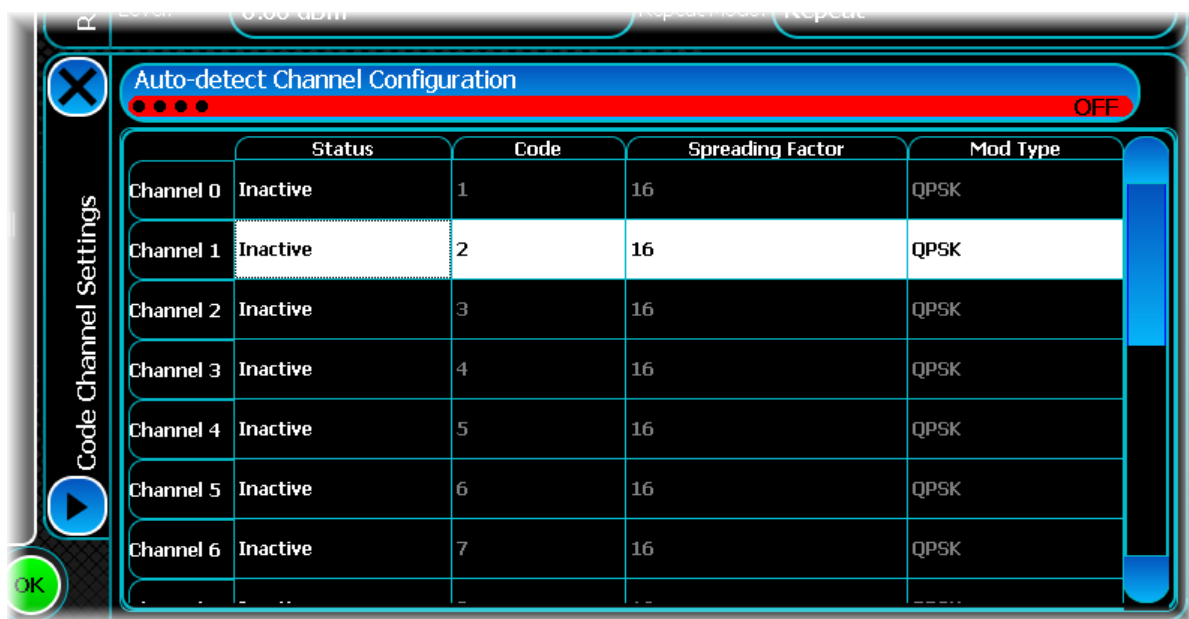
Status

Use this to make each channel active or inactive.

Code

Use the Code column to give each channel a Channel Code Index. The spreading factor and channel code pair should form orthogonal code while allowing the same channel code ID with a different spreading factor.

Spreading Factor

Use the Spreading Factor column to give each channel a spreading factor. This value gives the length of the channel code to be used for de-spreading and spreading. The spreading factor and channel code pair should form orthogonal code while allowing the same channel code ID with a different spreading factor.

Mod Type

Use the Mod Type column to give each channel a modulation type. The modulation type can be QPSK, 8PSK or 16QAM.

Conflicts

If there are any conflicts between channels, the conflicting channels are displayed with a red background.

Configure Time Slots...

Configure the time slots by touching the Configure Time Slot... button. The Time Slot Settings screen appears, where you can configure each time slot with a maximum users (K) setting.

Time slot 0 is always configured with a maximum number of users (K) of 16. You can configure time slots 1 to 6 to 2, 4, 6, 8, 10, 12, 14 or 16 maximum users (K).

Meas.Config

Use this screen to set up key information about demodulating and analyzing the signal.
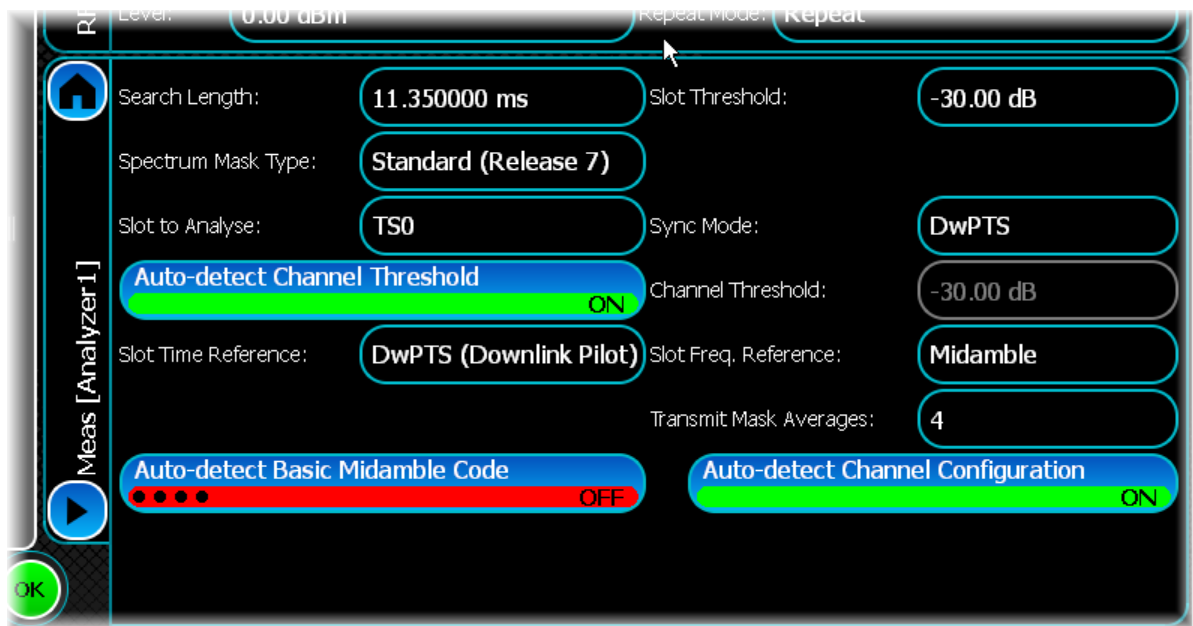
Search Length

Use this to set the minimum amount of time that data is captured when performing demodulation measurements, overriding that determined automatically by the instrument only if the value specified is greater.

A search length of zero permits the instrument to use its automatically-determined capture time. This should always be sufficient when an Immediate trigger is employed.

Setting the value of search length unnecessarily high adversely affects the analysis time.

Spectrum Mask Type

Use this to specify the mask type to be applied in the Spectrum Mask measurement.

The available masks are Standard (Release 4) as per 3GPP TS 34.122 v4.9.0 § 5.5.2.1.2.2, and Standard (Release 7) as per 3GPP TS 34.122 v7.6.0 § 5.5.2.1.2.2.

Slot to Analyse

Use this to specify which sub-frame time slot within the selected sub-frame is to be used for analysis. The available selections include time slots 0 through 6, and the DwPTS and UpPTS time slots.

Auto-detect Channel Threshold

Use this to select the auto-detect channel threshold. If the button is enabled, the channel threshold is determined internally. If the button is disabled, specify the threshold with the Channel Threshold control.

Slot Time Reference

The Slot Time Reference control specifies the time reference that is used to calculate the Overall Error Summary – Timing Error data results.

Auto-detect Basic Midamble Code

Use this to select the auto-detect basic midamble code mode.

If this mode is enabled, the basic midamble code ID is detected automatically using an internal algorithm. If the auto-detect basic midamble code mode is disabled, you should provide the basic midamble code ID using the Basic Midamble Code control.

Slot Threshold

This specifies the active slot detection threshold. Slots with the largest measured power below the active slot threshold are considered to be active slots.

Sync Mode

This specifies the sub-frame synchronization mode, as DwPTS, UpPTS or Midamble.

DwPTS and UpPTS synchronization modes search for the appropriate pilot slot within the capture to establish the position of the subframe boundary. Synchronization fails if the required pilot slot cannot be found or if the SYNC-DL code or SYNC-UL code is incorrect.

Midamble synchronization mode is valid only for uplink time slots. It uses the midamble of the first uplink time slot to establish the position of the subframe boundary, assuming that time slot to be TS1. Synchronization fails if there are no active traffic time slots or if the basic midamble code is incorrect.

Channel Threshold

This specifies the threshold above which a code channel is detected as active and included in the composite reference waveform.

Slot Frequency Reference

The Slot Frequency Reference control setting determines whether the appropriate pilot timeslots or the midamble section of the timeslots is used as the frequency and phase reference for an individual traffic timeslots.

The setting affects the measured composite frequency error, as well as results that depend upon the rotation of the data symbols – the symbols (bits) and the sign of the composite gain imbalance results.

If DwPTS or UpPTS is selected and the appropriate pilot timeslots is not present, an error is reported. The Uplink Switch Point property sets which traffic timeslots are uplink timeslots and which are downlink timeslots.

Transmit Mask Averages

Transmit Mask Averages sets the number of measurements used to average results for the Transmit Mask measurement. The specified number of measurements are made and the results traces are averaged before applying the mask and determining the pass/fail result.

Auto-detect Channel Configuration

Use this to select the auto-detect channel configuration mode.

If this button is enabled, the type of the modulation scheme used in the transmitter is determined before modulating the data. If this button is disabled, specify the modulation scheme in the Code Channel Settings table.

Burst Detection

Use Burst Detection to configure how the burst is detected within the captured data.
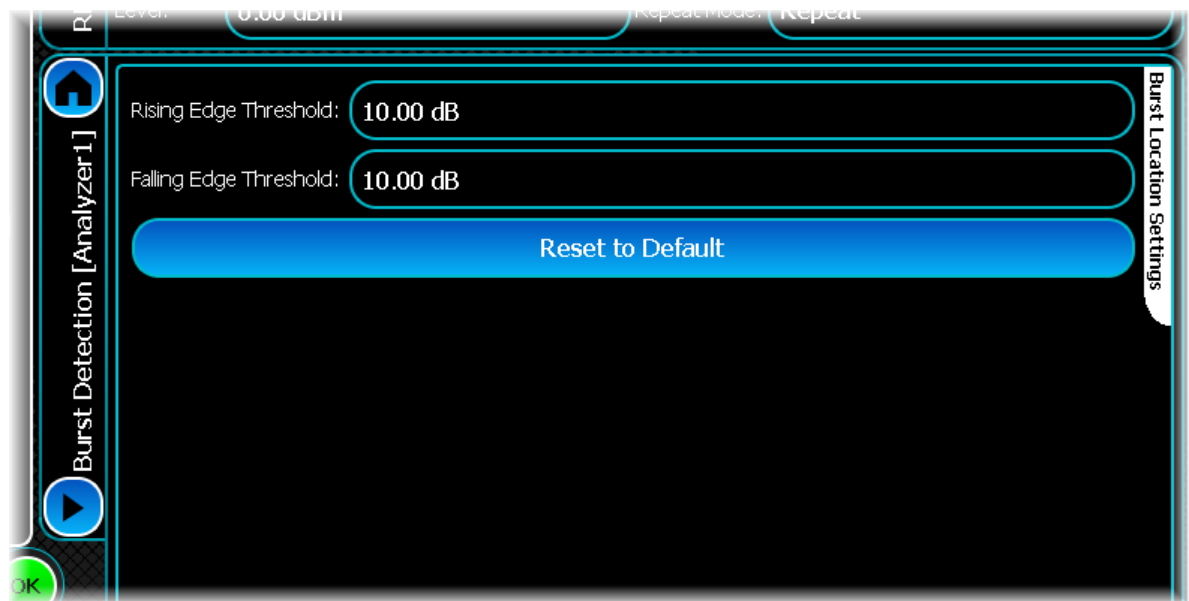
Rising/Falling Edge Threshold

The instrument determines the burst location by looking for significant changes in power. You can specify the magnitude of this change separately for both the rising and falling edges of a burst using the Rising Edge Threshold and Falling Edge Threshold controls.

This figure illustrates these two properties:
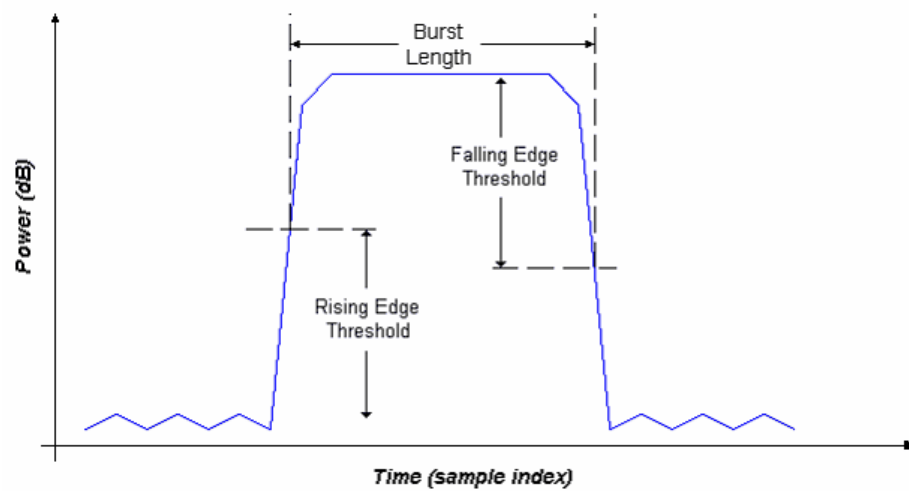
Reset to Default
Resets the fields to their default values: 10 dB for rising and falling edge thresholds.

ACLR

Use the ACLR (adjacent carrier leakage ratio) settings screen to specify a number of offset frequencies (relative to the carrier frequency) that are measured when performing ACLR measurements.

Use this to set up ACLR measurement for up to 15 channels. Define the number of channels, and the table adjusts itself accordingly.

Frequency Offset

To modify a frequency offset, select the desired offset and either touch it or press Return to start editing. Then enter the desired frequency offset in Hz into the resulting edit box.

Note that you cannot modify the first frequency offset, which is fixed to the center frequency

WCDMA Uplink analysis

WCDMA Uplink is an air interface that forms part of the radio transmission standard for UMTS. The terms 'WCDMA' and 'UMTS' are often used interchangeably.

Select WCDMA Uplink from the menu tab. Touch the ▶ button, and configure WCDMA Uplink analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

Measurement Control defines how measurements start and stop, and how many iterations are used for statistical calculations.

Meas. Config defines the parameters needed to make a measurement.

Trigger Settings specifies how the measurements are triggered. This screen is common to most modulation types.

System defines system parameters for the analysis.

ACLR defines offset frequencies that are measured during ACLR measurements.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to WCDMA Uplink.

Trace measurements

Spectral Mask

This graph type displays the spectrum of the signal being measured, together with the spectral mask appropriate to that signal.

The spectrum trace supports Min Hold, Max Hold and Averaging functions. However, Spectral Mask supports only live data.

Spectral Mask Markers

As well as standard marker functionality, the delta between the spectral mask and the trace is also displayed when displaying a marker.

Captured Power vs Time

This plot displays the power vs. time trace of the capture that is being used for the underlying analysis of the WCDMA uplink signal.

The power vs. time trace supports Live, Min Hold, Max Hold and Averaging functions.

ACLR

This graph type displays the results of adjacent carrier leakage ratio analysis performed on the WCDMA signal.

The ACLR trace supports Min Hold, Max Hold and Averaging functions.

Composite Constellation

This plot type lets you view the Composite Constellation measurement within the WCDMA Uplink signal and optionally the ideal reference points.

Real points are displayed as green dots. Reference points are displayed as small red crosses indicating the exact ideal point.

This trace does not support any statistical functions.

Composite Measured/Reference IQ Constellation

Using the Trace Controls menu...
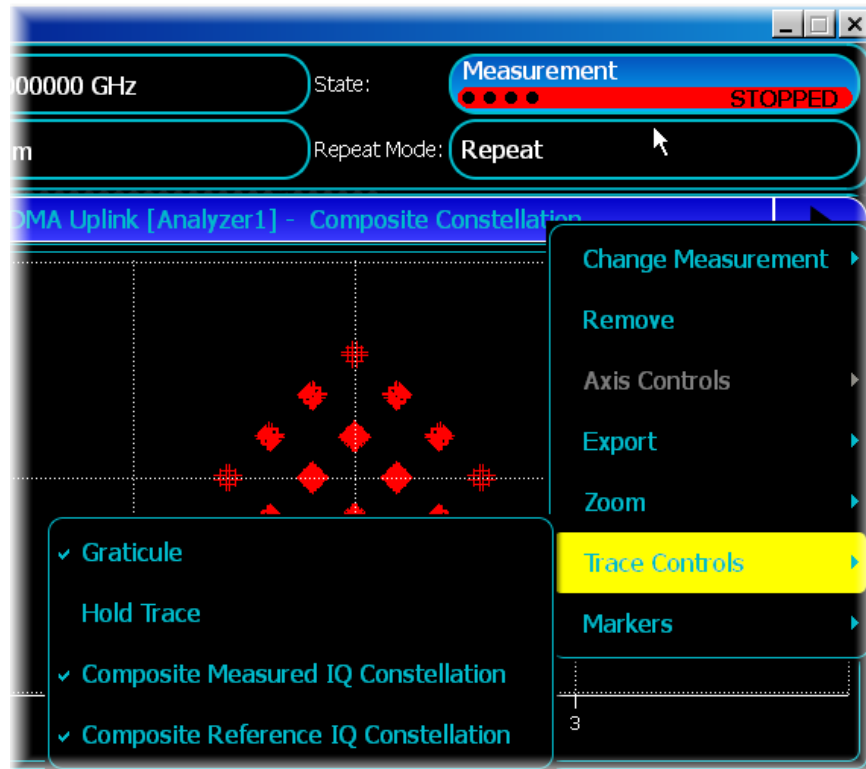
...you can display just the measured constellation points, the reference constellation points or both.

Composite Constellation zoom in/zoom out

The Composite Constellation plot maintains a fixed 1:1 aspect ratio. This means that when performing a zoom selection, the extent that is displayed may not match the original selection.

Composite Constellation markers

The constellation plot supports an x-y marker system.

The Composite Constellation marker displays the I and Q for the given sample, as well as the reference I and Q value for that particular position.

Moving the marker either horizontally or vertically causes the marker to choose the constellation point closest to the desired position.

When performing continuous captures, the sample retains the marker it is currently displaying. If you use an Immediate trigger, the marker may jump around, as the sample that the marker is measuring is now in a completely different location.

Because of this, it is recommended that you use an external or burst trigger when making continuous measurements.

Code Domain Power

This plot type displays the code domain power of the WCDMA uplink signal being measured.

This trace supports Live, Min Hold, Max Hold and Averaging functions.

The results are displayed in the form of a split bar graph. This trace is color-coded, with each color representing a particular channel type for the given code. These colors are as follows:

Channel	Color
No Channel	Light Grey
DPCCH	Green
DPDCH1	Blue
DPDCH2	Cyan
DPDCH3	Dark Cyan
DPDCH4	Yellow
DPDCH5	Dark Green
DPDCH6	Dark Yellow
HSDPCCH	Red
EDPCCH	Dark Magenta
EDPDCH1	Magenta
EDPDCH2	Dark Red
EDPDCH3	Dark Blue
EDPDCH4	White

Show I/Q branches

To turn off the I or Q branch, select the Trace Controls menu item (touch the screen to display the menu) and check or uncheck the Show I or Show Q menu items to enable or disable the relevant graph section. This resizes the graph and displays only a single branch. Note that you cannot disable both branches.

Channel information

The Code Domain power trace lets you obtain specific channel information: spreading factor, channel code, channel type and gain. This can be done in two ways:

- If you touch and hold your finger for a moment on the channel you want to inspect, a popup displays the relevant channel information:

- When using markers, the marker table also displays information for the channel that the marker specifies:

Zooming in/out

When performing a zoom in or out on the split code domain trace, the new X/Y limits are applied to both the I and Q branches. This means if you re-scale the Y axis on this trace for the I branch, it applies to the Q branch as well.

Code Domain Error

This plot type displays the code domain error of the WCDMA uplink signal being measured.

This trace supports Min Hold, Max Hold and Averaging functions.

Enabling/disabling I/Q branches

To turn off the I or Q branch, select the Trace Controls menu item (touch the screen to display the menu) and check or uncheck the Show I or Show Q menu items to enable or disable the relevant graph section. This resizes the graph and displays only a single branch. Note that you cannot disable both branches.

Zooming in/out

When performing a zoom in or out on the split code domain trace, the new x/y limits are applied to both the I and Q branches. This means if you re-scale the y axis on this trace for the I branch, it applies to the Q branch as well.

Channel information

If you touch and hold your finger for a moment on the channel you want to inspect, a popup displays the channel's code and level:

Power vs Slot

This displays a power vs. slot trace resulting from a slot-by-slot analysis performed on the WCDMA signal. No trace functions are supported by this trace.

EVM Peak vs Slot

This displays an EVM peak vs. slot trace resulting from the slot-by-slot analysis performed on the WCDMA signal. No trace functions are supported by this trace.

EVM RMS vs Slot

This displays an EVM RMS vs. slot trace resulting from the slot-by-slot analysis performed on the WCDMA signal. No trace functions are supported by this trace.

Text measurements

Spectral Mask

This measurement displays whether any of the transmitted signal exceeds the limits of the specified spectral mask, as well as giving the frequency and level of the failure. If the transmitted signal does not exceed the spectral mask, the frequency and level supplied represent the closest point to failure.

This measurement does not support any of the statistical functions.

Spectral Mask Offsets

This measurement displays the spectral mask failure points for each of the spectral mask offset regions. The offset regions are defined in specification *3GPP TS 34.121 Section 5.9 Spectrum Emission Mask*, as summarized in the following table:

Region	Offset range
0	-12.5 MHz to –8.5 MHz
1	–8.5 MHz to –7.5 MHz
2	–7.5 MHz to –3.5 MHz
3	–3.5 MHz to –2.5 MHz
4	2.5 MHz to 3.5 MHz
5	3.5 MHz to 7.5 MHz
6	7.5 MHz to 8.5 MHz
7	8.5 MHz to 12.5 MHz

Channel Information

This measurement displays the status and detected settings of all channels within the analyzed WCDMA signal. If a channel is not detected, it is highlighted in red and shown as 'N/A'.

This measurement supports the following information for each channel:

Code

This is the code number of the given channel. If the Channel Detection Mode is set to User; then the code shown here is the same as that configured in the User Channel Configuration screen.

SF

This is the spreading factor of the given channel. This can be 2,4,8,16,32,64,128 or 256. If the Channel Detection Mode is set to User; then the code shown here is the same as that configured in the User Channel Configuration screen.

Branch

This indicates the branch used by the given channel, either I or Q. If the Channel Detection Mode is set to User; then the code shown here is the same as that configured in the User Channel Configuration screen.

Gain

This indicates the gain factor of the channel in dB.

Bits

This indicates the number of bits for the given channel. View the demodulated bits for a given channel separately by selecting the given channel under the Channel Demod Measurements section of the measurement menu

CDE

This indicates the code domain error of the given channel in dB. This is measured over one timeslot, and is reduced by the

RCDE

This indicates the relative code domain error in dB. This is measured over one timeslot, and is reduced by the chosen Slot Power Transient Period.

Modulation Accuracy

The Modulation Accuracy measurement displays composite modulation accuracy for the analyzed slot, as well as information about timing and the slot number.

The Modulation Accuracy measurement consists of the following sub-measurements:

Composite EVM RMS

This displays the RMS error vector magnitude (the ratio of the error vector to the ideal signal vector) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite EVM Peak

This displays the peak error vector magnitude (the ratio of the error vector to the ideal signal vector) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite Phase Error RMS

This displays the RMS phase error (the angle between the measured and the ideal signal vectors) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite Phase Error Peak

This displays the peak phase error (the angle between the measured and the ideal signal vectors) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite Magnitude Error RMS

This displays the RMS magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite Magnitude Error Peak

This displays the peak magnitude error (the difference between the magnitudes of the measured and ideal signal vectors) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite Frequency Error

This displays an estimate of the carrier frequency error of the analyzed slot.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite IQ Gain Imbalance

This displays the IQ gain imbalance (a comparison of the gain of the I signal with that of the Q signal) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite IQ Skew

This displays the IQ skew (a comparison of the difference in length between the I and Q signal paths) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Composite IQ Origin Offset

This displays the IQ origin offset (any output signal appearing when I and Q inputs are set to 0 V) of the composite signal.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Peak Code Domain Error

This measurement displays the maximum peak code domain error for both the I and Q channels.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Peak Code Domain Error (I)

This measurement displays the peak code domain error (an indication of noise and spurious signals in code channels) for the I channel.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Peak Code Domain Error (Q)

This measurement displays the peak code domain error (an indication of noise and spurious signals in code channels) for the Q channel.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Slot Timing

This displays the time of the start of the analyzed slot, compared with the start of the capture. This measurement does not support functions.

HSDPCCH timing offset

This measurement provides the position of the start of HS-DPCCH channel within the analyzed slot in multiples of 256 chips, with a range of 0 to 9. When the HS-DPCCH channel is not present the result is -1. This measurement does not support functions.

Note: when the timing offset is greater than 0, the number of demodulated bits for the HS-DPCCH channel is reduced correspondingly.

Analysed Slot Number

This shows the slot that has been analyzed. This measurement does not support functions.

Power

Average Power

This measurement displays the average power measured across all of the captured data. This is as opposed to the slot power, which is measured over a timeslot (omitting the transient period).

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Slot Power

This measurement displays the power measured over one timeslot. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Analysed Slot Number

This shows the slot that has been analyzed. This measurement does not support functions.

ACLR

This measurement displays the results of the adjacent carrier leakage ratio at the frequency offsets specified in the ACLR settings screen.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Phase Discontinuity

This measurement displays the results of the phase discontinuity measurement and the adjacent slots between which the phase discontinuity was measured.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation functions.

Slot by Slot EVM RMS

This measurement displays the results of the EVM RMS measurement made on a slot-by-slot basis.

This measurement does not support functions.

Slot by Slot EVM Peak

This measurement displays the results of the EVM peak measurement made on a slot-by-slot basis.

This measurement does not support functions.

Slot by Slot Power

This measurement displays the results of the power measurements made on a slot-by-slot basis.

This measurement does not support functions.

Channel Demod

This displays the individual demodulated symbols for specified channels within the analyzed slot:

DPCCH, DPDCH 1 to 6, HS-DPCCH, E-DPCCH, E-DPDCH 1 to 4.

These measurements are controlled in the same way as Text Measurements.

RF

Use this to set up the basic RF frequency and RF level parameters of a UMTS measurement.

Frequency

Use this to set the center frequency of the signal that you want to measure. Entering a value into this control de-selects the currently selected UARFCN channel number and replaces the specified channel number with 'No Channel'.

Current Bands

This displays the current operating frequency band of the signal as defined in 3GPP TS 25.101 version 7.7.0 Release 7. The current operating band is based upon the Frequency or Channel you have specified. This operating band is used to set the spectral mask when in Auto Spectral Mask mode.

Note: some of the operating bands overlap in terms of both frequency and UARFCN. If you have set a channel number or frequency that has two possible bands, the lowest operating band number is used.

DUT Output Level

Use this to specify the DUT output level, which is normally the RMS output level of the DUT.

Use the Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use the DUT Tx Path Loss to compensate for any path loss between the DUT and the instrument's input.

DUT Tx Path Loss

Use this to specify the loss between the DUT output and the instrument's input, and to adjust the RF input level of the instrument. This offset compensates for the loss between the DUT and the input to the test setup.

Channel

Use this to set the center frequency of the signal via a UTRA Absolute Radio Frequency Channel Number (UARFCN). The instrument supports setting frequencies from the full range of Channel numbers defined in 3GPP TS 25.101 version 7.7.0 Release 7.

Attenuation Mode

Use this to specify how the RF Attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This allows the input condition to be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust the attenuation manually only when Attenuation Mode is set to Manual. When in Auto Attenuation Mode, the RF input level is set automatically in order to optimize the RF gain setting.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

System

Use this screen to set up UMTS Uplink system parameters.
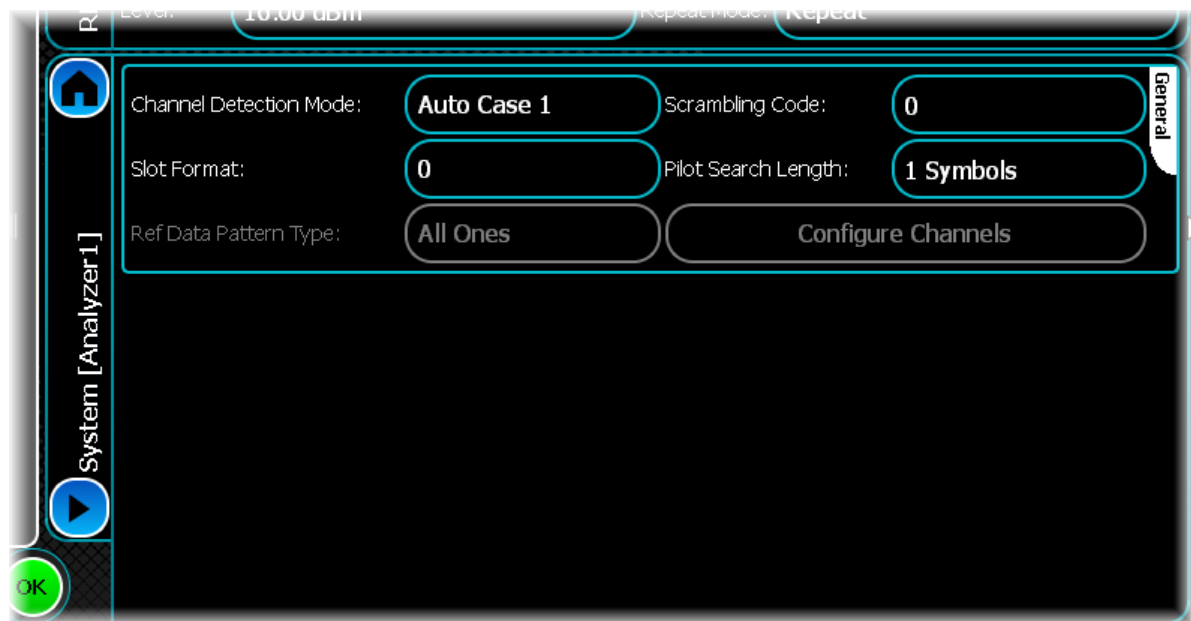
Channel Detection Mode

Use this to specify the channel detection mode to be used for composite modulation analysis measurements. This can be Automatic detection (for Case 1, Case 2 and Case 3 signals) or a user-specified detection mode.

Using user-defined channel detection results in slightly faster analysis. However, results are correct only if the analyzed signal contains the expected channels.

If you have set a user-defined channel detection, you have to set up the appropriate channels using the Channel Settings screen.

From "Spreading and modulation (FDD) (Release 6) 3GPP TS 25.213 V6.5.0 (2006–03) Table 0: Maximum number of simultaneously-configured Uplink dedicated channels" for the definition of Case 1, 2 and 3 is:

	DPDCH	HS-DPCCH	E-DPDCH	E-DPCCH
Case 1	6	1	0	0
Case 2	1	1	2	1
Case 3	0	1	4	1

Each column shows the maximum number of channels of that type that can be active in each case.

Slot Format

Use this to change the slot format of the slot to be analyzed. The slot format defines the pilot bits in the DPCCH.

Slot Format	Number of Pilot Bits
0	6
1	8
2	5
3	7

Ref Data Pattern Type

The reference data pattern type is is the transmitted test pattern in the downlink signal, which is used for BER testing or making ILPC measurements. Set it to PRBS PN9 or PN15, or 'all ones' or 'all zeros'. These last two settings provide a slightly faster BER measurement than when using a PRBS. For iLPC measurements, this must be set to PN9.

Scrambling Code

Use this to change the scrambling code used for the analysis. Enter it as a decimal code.

Pilot Search Length

Use this to change the number of pilot symbols that are used to correlate with the scrambling code. You would typically increase this value if the pilot channel is low in power with respect to other channels. Note that the larger the number, the longer the analysis time.

Configure Channels...

Configure the code channels by touching the Configure Channels button. The UMTS Channels screen appears, where you can configure each code channel. By default, all channels are turned off, with the associated controls for configuring that channel also disabled.

Status

Use this to make each channel active or inactive. Once a channel is enabled, the other configuration options become available.

Code

Use the Code column to give each channel a Channel Code Index. The spreading factor and channel code pair should form orthogonal code while allowing the same channel code ID with a different spreading factor.

Spreading Factor

Use the Spreading Factor column to give each channel a spreading factor. This value gives the length of the channel code to be used for de-spreading and spreading. The spreading factor and channel code pair should form orthogonal code while allowing the same channel code ID with a different spreading factor.

Branch

Use the Branch column to give each channel a branch type, which can be I or Q.

Conflicts

If there are any conflicts between channels, the conflicting channels are displayed with a red background. To find out the cause of the conflict, touch the conflicted channel. Information is displayed, showing the underlying cause of the conflict. This lets you make the necessary changes to resolve the conflict.

Meas. Config

Use this screen to set up key information about demodulating and analyzing the signal.

Channel Threshold

Use this to specify the channel detection threshold (dB relative to the DPCCH) used for identifying active channels.

Any channel with a power below this value is deemed to be inactive and is not included in any EVM measurement.

Search Length

Use this to set the minimum amount of time that data is captured when performing demodulation measurements, overriding that determined automatically by the instrument only if the value specified is greater.

The approximate capture times determined by the instrument can be determined from the table:

	Immediate Trigger	**External/Burst Trigger**
Specific Slot Analysis	16 slots = 10.667 ms	1 slot = 667 μs
Random Slot Analysis	2 slots = 1.334 ms	1 slot = 667 μs

Using the search length to override the automatically determined search time can be useful when, for example, you have a trigger signal at the start of slot 0 but you want to analyze slot 1. Setting an appropriate search length — for example, 2 ms — ensures that all of the data associated with slot 1 (the slot to be analyzed) is present within the capture.

A search length of zero lets the instrument use its automatically-determined capture time. This should always be sufficient when an Immediate trigger is employed.

Setting the value of search length unnecessarily high adversely affects the analysis time. If there is a known constant time relationship between the trigger and the slot to be analyzed, consider using the trigger delay facilities instead, to ensure that the capture is correctly aligned to the slot to be analyzed

Slot Number

When the Analysis Mode is set to Specific Slot, this control specifies which slot is to be analyzed.

Analysis Mode

Use this to specify how the slot being analyzed is chosen. When the mode is set to Random Slot; the underlying measurement picks a random slot from within the available data. When the mode is set to Specific Slot, the underlying measurement attempts to locate and analyze the slot specified by Slot Number.

Analysis Region

Use this to set the analysis region within the specified slot number to be analyzed for composite EVM, phase discontinuity and slot power measurements. If Analysis Mode is set to Random, a random slot is chosen to measure.

The selection choices are Full Slot, First Half Slot and Second Half Slot.

Remove IQ Origin Offset

Use this button to include or exclude the IQ origin offset from the composite EVM measurement.

Channel Threshold

Use this to specify the channel detection threshold (dB relative to the DPCCH) used for identifying active channels. Any channel with a power below this value is considered to be inactive and is not included in any EVM measurement.

Exclude Mod Acc Transient Period

Use the Exclude Modulation Accuracy Transient Period button to exclude the first and last 96 chips of the slot when performing modulation accuracy measurements.

Slot Power Transient Period

Use this to specify the slot power transient period used when performing power measurements. The transient period is the part at the beginning and end of the timeslots that is omitted from the slot power measurement.

CDE Spreading Factor

Use this to specify the spreading factor to be used for code domain error calculations.

Spectrum Analysis Mode

Use this button to define whether to perform spectrum and ACLR measurements using the IQ data of the selected slot (synchronized), or the unsynchronized 'fast' mode where the measurements are made over the whole capture.

Spectral Mask Type

When not in Auto Spectral Mask mode, use this to specify the spectral mask that is used when making spectrum/mask comparison measurements. When in Auto Spectral Mask mode, this control displays the currently active spectral mask type.

Auto Spectral Mask

Use this button to specify whether to derive the spectral mask type automatically from the current operating band

If this button is ON, the spectral mask is set to the Current Band if valid. If there is no defined operating band (for example, if you are entering a frequency that does not fall within any of the defined operating bands) the spectral mask defaults to Band I. Alternatively, as the Spectral Mask only supports up to Band IX, if an operating band greater than IX is defined, the spectral mask defaults to Band I.

If this button is OFF, you can use Spectral Mask Type to specify the band to be used for the measurement. Only the bands shown in the drop-down box are supported.

Notes

In UMTS Release 8. Band V changed its spectral mask limits, as defined in 3GPP TS 34.121-1 version 8.10.0 Release 8. There are now two Band V spectral mask limit settings; the original one and the Release 8 version. For reasons of backwards compatibility, the Auto spectral mask defaults to the original Band V spectral mask limits when a Band V frequency channel is selected, and not to the new Band V Release 8 limits.

Some of the operating bands overlap in terms of both frequency and UARFCN. If you have set a channel number or frequency that has two possible bands, the lowest operating band number is used

ACLR

Use the ACLR (adjacent carrier leakage ratio) settings screen to specify a number of offset frequencies (relative to the carrier frequency) that are measured when performing ACLR measurements.

Use this to set up ACLR measurement for up to five channels. Define the number of channels, and the table adjusts itself accordingly.
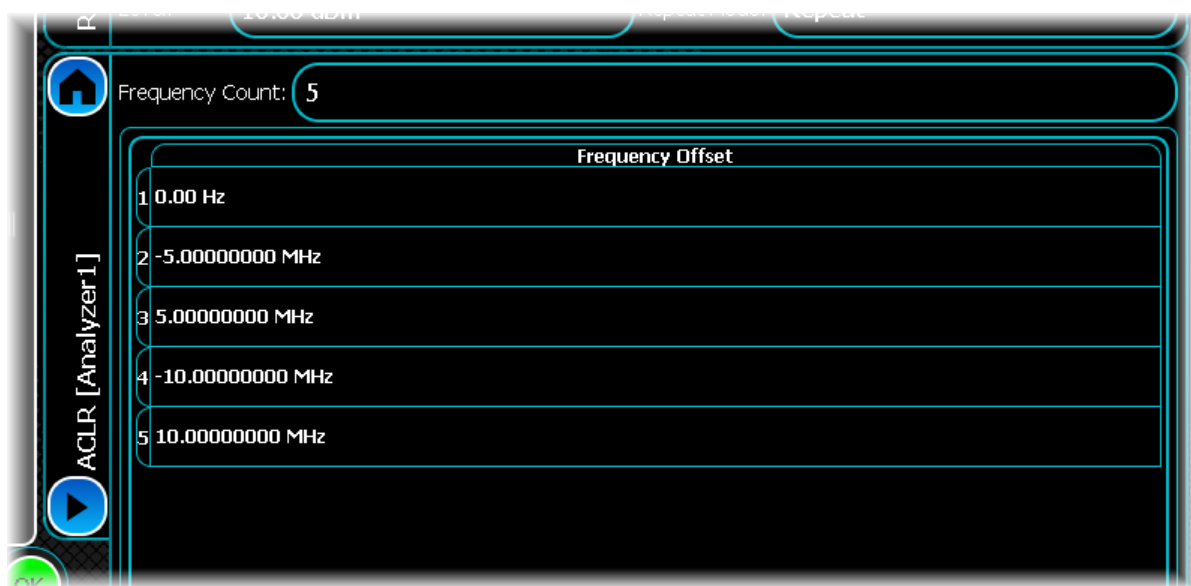
Frequency Count

Enter an odd number of between one and five frequency offsets for ACLR. This adjusts the contents of the frequency list to display the desired number of offsets

Frequency Offset

To modify a frequency offset, select the desired offset and either touch it or press Return to start editing. Then enter the desired frequency offset in Hz into the resulting edit box.

Note that you cannot modify the first frequency offset, which is fixed to the center frequency

Wireless LAN analysis

Wireless LAN provides analysis of WLAN signals that adhere to the 802.11a/b/g/n/ac technical specification.

Select WLAN from the menu tab. Touch the ▶ button, and configure WLAN analysis using the following screens:

Results shows the results of the analysis in graphical and textual format, and is in a format common to all analysis measurements.

RF defines basic RF parameters for the analysis.

Meas. Config defines the parameters needed to make a measurement.

Advanced defines OFDM- and DSSS-related advanced options for the analysis.

Control defines how measurements start and stop, and how many iterations are used for statistical calculations. This screen is common to many modulation types.

Triggering specifies how the measurements are triggered. This screen is common to most modulation types.

Burst Location defines parameters for detecting rising and falling edges of the burst.

Spectral Mask lets defines the shape of the spectral mask. This screen is common to many modulation types.

Spectrum Flatness Limits defines the spectral flatness limits to be applied to the signal for analysis.

Results

This screen shows the results of the analysis in graphical and textual format.

The layout and control of this screen is common to all analysis measurements, and is explained in the common Results section.

This section explains the trace and text measurements that are specific to WLAN.

Trace measurements

Spectral Mask

This displays the FFT spectrum of the signal you are measuring, as well as overlay the currently specified spectral mask. The spectrum is measured using a 100 kHz resolution bandwidth, and the reference value for the spectrum display (i.e. 0 dBr) is the maximum spectral density.

The spectrum trace supports Min Hold, Max Hold and Averaging functions.

Captured Power vs Time

This plot displays the power vs. time of the captured IQ data that is being used for the underlying analysis of the WLAN signal. It lets you view the signal being captured and analyzed and is therefore useful in diagnosing problems if the analysis fails. Note that this trace may also be averaged to limit the number of points that are displayed.

The captured power vs. time trace supports Min Hold, Max Hold and Averaging functions.

Power vs Time

This displays a power vs. time trace of the WLAN burst you are measuring. This plot supports live data only.

CCDF

The complementary cumulative distribution function (CCDF) trace displays the peak-to-average power ratio of the signal.

Clock Error vs Symbol

This displays a clock error vs. symbol trace for the WLAN burst you are measuring.

The Clock error vs. Symbol trace supports Min Hold, Max Hold and Averaging functions.

EVM vs Subcarrier

This displays the overall EVM for a particular subcarrier, as well as overlaying the EVM for each symbol in that subcarrier.

Both the symbol EVM, and RMS EVM traces support Min Hold, Max Hold and Averaging functions.

Inspecting a subcarrier

As the EVM vs. Subcarrier measurement displays the EVM for each symbol, it is possible that you may want to investigate a particular subcarrier in more detail. You can display the EVM vs. symbol for a specific subcarrier.

To do this, first select a marker and move it to the subcarrier you want to investigate. Then touch the marker symbol, or select Markers\Marker x\Inspect Subcarrier from the drop-down menu on the title bar.

This opens a new inspection window that displays the EVM vs.symbol for the given subcarrier. You can display up to four inspection windows for each EVM vs. Subcarrier trace, one for each marker.

Note: this window is linked to the marker on the main EVM vs. Subcarrier trace, so if you move the marker on the main trace, the inspection window automatically updates to reflect the new subcarrier.

EVM vs Symbol

This displasy an EVM vs. Symbol trace for the WLAN burst you are measuring.

The EVM vs. Symbol trace supports Min Hold, Max Hold and Averaging functions.

Composite Constellation

This displays a trace of the signal constellation map. If the signal is a DSSS signal (IEEE 802.11b/g), then the trace reflects the received DBPSK, DQPSK, QPSK, or 8PSK constellation points. If the signal is an OFDM signal (IEEE 802.11a/g/n), then the trace is for the received BPSK, QPSK, 16-QAM or 64-QAM constellation points of the sub-carriers.

Composite Constellation zoom in/zoom out

The Composite Constellation plot maintains a fixed 1:1 aspect ratio. This means that when performing a zoom selection, the extent that is displayed may not match the original selection.

Constellation markers

The constellation plot supports an x-y marker system.

Moving the marker either horizontally or vertically causes the marker to choose the constellation point closest to the desired position.

When performing continuous captures, the sample retains the marker it is currently displaying. If you use an Immediate trigger, the marker may jump around, as the sample that the marker is measuring is now in a completely different location.

Because of this, it is recommended that you use an external or burst trigger when making continuous measurements.

Spectral Flatness

The spectral flatness trace displays the deviation of each sub-carrier from the average power within the central region. The sub-carriers that form the central region depend upon the signal type (see table below).

The limits mask that is applied may be pre-defined or user-defined as selected in the Spectral Flatness Limits screen. The pre-defined spectral flatness limits mask is defined as defined in IEEE 802.11a-1999 §17.3.9.6.2, IEEE 802.11n/D7.0 §20.3.21.2 and IEEE 802.11ac/D1.0 §22.3.18.2, depending on the Analysis Mode. Alternatively the user-defined limits mask may be selected.

Signal Type	Central Region	Limits	Outer Region	Limits
802.11a	-16 to -1 and +1 to +16	±2dB	-26 to -17 and +17 to +26	-4dB to +2dB
802.11n 20 MHz channel	-16 to -1 and +1 to +16	±2dB	-28 to -17 and +17 to +28	-4dB to +2dB
802.11n 40 MHz channel (ex. MCS 32 and non-HT duplicate formats)	-42 to -2 and +2 to +42	±2dB	-58 to -43 and +43 to +58	-4dB to +2dB
802.11n MCS 32 and non-HT duplicate formats	-42 to -33, -31 to -6 and +6 to +31, +33 to +42	±2dB	-58 to -43 and +43 to +58	-4dB to +2dB
802.11ac 20 MHz channel	-16 to -1 and +1 to +16	±4dB	-28 to -17 and +17 to +28	-6dB to +4dB
802.11ac 40 MHz channel	-42 to -2 and +2 to +42	±4dB	-58 to -43 and +43 to +58	-6dB to +4dB
802.11ac 80 MHz channel	-84 to -2 and +2 to +84	±4dB	-122 to -85 and +85 to +122	-6dB to +4dB
802.11ac 40 MHz Non-HT duplicate	-42 to -33, -31 to -6 and +6 to+31, +33 to +42	±4dB	-58 to -43 and +43 to +58	-6dB to +4dB
802.11ac 80 MHz Non-HT duplicate	-84 to -70, -58 to -33, -31 to -6 and +6 to+31, +33 to +58, +70 to +84	±4dB	-122 to -97, -95 to -85 and +85 to +95, +97 to +122	-6dB to +4dB

The Spectral Flatness trace supports Min Hold, Max Hold and Averaging functions

Text measurements

Composite Modulation Accuracy

This measurement displays the composite EVM RMS of the signal being measured, as a percentage.

This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

Power Profile

These measurements display the status and numeric results relating to power profile measurements with the analyzed WLAN signal.

A negative value, representing a pass, shows the margin by which a result fits within the power profile; the smaller the value, the nearer the result is to the profile and to a fail.

The Profile Power measurements support Live, Averaging, Min Hold and Max Hold functions.

Average Power

Displays the average power, in dBm, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation

Peak Power

Displays the peak power, in dBm, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

Burst Postion

Displays the burst position, in μs, of the signal being measured. This measurement does not support any functions.

Burst Length

Displays the burst length, in μs, of the signal being measured. This measurement does not support any functions.

Profile Status

This measurement displays the pass/fail result after both the rising and falling edge times have been compared against the limit given in IEEE802.11b Std.-1999 (§ 18.4.7.6). This limit is 2 μs. The result passes only if both the rising and falling edges are less than this value. This measurement does not support any functions.

Rising Edge Status

Displays the pass/fail result for the rising edge time after it has been compared against the limit given in IEEE 802.11b Std-1999 (§ 18.4.7.6). This limit is 2 μs. This measurement applies to DSSS (IEEE 802.11b/g) signals only. This measurement does not support any functions.

Rising Edge Time

Displays the time, in μs, that it takes for the burst power to rise from 10% to 90% of either the burst peak or average power. This measurement does not support any functions.

Falling Edge Status

Displays the pass/fail result for the falling edge time after it has been compared against the limit given in IEEE 802.11b Std.-1999 (§ 18.4.7.6). This limit is 2 μs. This measurement applies to DSSS (IEEE 802.11b/g) signals only. This measurement does not support any functions.

Falling Edge Time

Displays the time, in μs, that it takes for the burst power to fall from 10% to 90% of either the burst peak or average power. This measurement does not support any functions.

Spectral Flatness

This measurement displays whether any of the transmitted sub-carriers exceed the limits specified in the IEEE 802.11 Std.-1999 § 17.3.9.6.2. specification. Failures are displayed as red text. This measurement does not support functions.

Spectral Mask

This measurement displays whether any of the transmitted signal exceeds the limits of the specified spectral mask, as well as giving the frequency and level of the failure. If the transmitted signal does not exceed the spectral mask, the frequency and level supplied represent the closest point to failure. Failures are displayed as red text.

This measurement does not support any of the statistical functions.

Occupied B/W

This measurement shows the overall occupied bandwidth, in Hz, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

Modulation Accuracy

System Type

Displays the detected system type of the signal being measured. This measurement does not support any functions.

Modulation Type

Displays the detected modulation type of the signal being measured. This measurement does not support any functions.

Data Rate

Displays the detected data rate, in bits per second, of the signal being measured. This measurement does not support any functions.

HT Format

Displays the HT format of the signal being measured.

HT MCS

Displays the HT MCS (modulation and coding scheme) of the signal being measured.

HT Short GI Detected

Displays whether a short guard interval is detected in the signal being measured.

HT Cross Power

Displays the HT cross power, in dB, of the signal being measured. In direct-mapped mode, cross power is a measure of the power leaking from all antennas in the system into the antenna under test. The power is averaged across all subcarriers. The values are normalized by the power of the antenna under test so that the cross power for each antenna is a ratio of the leakage power to the power of the antenna under test. This result is available only for a signal supporting two antennas.

EVM RMS

Displays the RMS EVM, in units of percentage, for the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

EVM Peak

Displays the peak EVM, in units of percentage, for the signal being measured. This measurement is performed according to IEEE802.11b Std.-1999 (§18.4.7.6), and applies to DSSS (IEEE802.11b/g) signals only. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

EVM Data Carriers

Displays the RMS EVM for the data carriers of the signal being measured, as a percentage. This applies to OFDM (IEEE802.11a/g) signals only. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

EVM Pilot Carriers

Displays the RMS EVM for the pilot carriers of the signal being measured, as a percentage. This applies to OFDM (IEEE802.11a/g) signals only. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

RCE RMS

Displays the same measured value as EVM RMS but displays it in dB, rather than as a percentage.

RCE Data Carriers

Displays the same measured value as EVM Data Carriers but in dB, rather than as a percentage.

RCE Pilot Carriers

Displays the same measured value as EVM Data Carriers but in dB, rather than as a percentage.

Frequency Error

Displays the frequency error, in Hz, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

Symbol Clock Error

Displays the symbol clock error, in parts per million, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

Carrier Leak

Displays the carrier leak, in dB, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

IQ Gain Imbalance

Displays the IQ gain imbalance, in dB, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

IQ Skew

Displays the IQ skew, in degrees, of the signal being measured. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

Number of PSDU Bits

Displays the number of bits detected in the physical layer convergence protocol service data unit (PSDU) for the signal being measured. This measurement does not support any functions.

Number of PSDU Symbols

Displays the number of symbols detected in the physical layer convergence protocol service data unit (PSDU) for the signal being measured. This measurement does not support any functions.

Adjacent Channel Power

This measurement displays the adjacent channel powers for the signal being measured. This measurement is based upon the IEEE802.11b Std.-1999 spectral mask definition (§18.4.7.3) with the power measured in five channel bands:

Channel	Frequency Offset	Bandwidth
Lower 2	-27.5 MHz	11 MHz
Lower1	-16.5 MHz	11 MHz
Centre	0	22 MHz
Upper 1	16.5 MHz	11 MHz
Upper 2	27.5 MHz	11 MHz

The power level in each of the lower and upper channels is displayed in dBc relative to the power measured in the centre channel. This measurement supports Averaging, Min Hold, Max Hold and Standard Deviation.

RF

Use this to set up the basic RF frequency and RF level parameters of a wireless LAN measurement.

Frequency

Use this to set the center frequency of the signal that you want to measure. In 802.11ac VHT 80+80 MHz mode, this is the frequency of the primary segment.

Attenuation Mode

Use this to specify how the RF attenuation is applied. This can either be Auto or Manual.

In Auto mode, the RF attenuation is calculated automatically from the reference level.

In Manual mode, you are able to specify directly the amount of RF attenuation that the instrument uses. This allows the input condition to be set optimally to improve measurement dynamic range. Take care not to overdrive the instrument when the attenuation is manually controlled.

RF Attenuation

Use this to specify the amount of RF input attenuation, which establishes the input level to the mixer

Attenuation is needed to prevent high signal levels appearing at the input of the first mixer, which can result in the generation of unwanted intermodulation products.

You can adjust the attenuation manually only when Attenuation Mode is set to Manual. When in Auto Attenuation Mode, the RF input level is set automatically in order to optimize the RF gain setting.

Headroom

Use this to specify the headroom required to ensure that the ADC is not overloaded by the peak level of the signal.

DUT Output Level

Use this to specify the DUT output level, which is normally the RMS output level of the DUT.

Use the Headroom level to ensure that the ADC is not overloaded by the peak level of the signal, and use the DUT Tx Path Loss to compensate for any path loss between the DUT and the instrument's input.

DUT Tx Path Loss

Use this to specify the loss between the DUT output and the instrument's input, and to adjust the RF input level of the instrument.

MIMO Configuration (not currently available)

Meas.Config

Use this screen to set up key information about demodulating and analyzing the signal.

Search Length

Use this to set the minimum capture time (in s).

Spectrum Analysis Mode

Use this to specify what IQ data is used for spectrum measurements. When the mode is set to Analyse All IQ Data, spectrum measurements are made using all captured IQ data. When the mode is set to Analyse Burst, only IQ data for the detected burst is used for spectrum measurements.

Burst Profile Type

Use this to specify the burst profile mode used for calculating burst profile pass/fail results.

According to specification IEEE802.11b Std-1999, the burst rising edge time is measured as the time it takes for the power to transition from 10% to 90% of the burst peak power. The falling edge time is measured as the time it takes for the power to transition from 90% to 10% of the burst peak power. Both of these times must be less than $2\,\mu s$.

The burst profile mode lets you change this method by selecting either the burst peak or average power as the reference for the 10% and 90% points.

Analysis Mode

This is used for modulation accuracy measurements, and together with the Channel Bandwidth is used to configure the spectrum measurements.

Channel Offset

The channel offset configures the modulation accuracy measurements. Use this when the Analysis Mode is set to 802.11n HT or 802.11n Non–HT and the Channel Bandwidth is set to 20 MHz, or if any 802.11ac mode is selected, where the Channel Bandwidth is 20 or 40 MHz. This configures the modulation accuracy measurements.

Frequency Segment Separation

In 802.11ac VHT 80+80MHz mode, this defines the difference between the midpoints of the Primary and Secondary frequency segments.

BSS Bandwidth

Use this to specify the Channel Offset. It is used when the Analysis Mode is set to 802.11n HT or 802.11n Non–HT and the Channel Bandwidth set to 20 MHz, or if any 802.11ac mode is selected. This configures the modulation accuracy measurements.

Number of Symbols

If AutoDetect Number of Symbols to Analyse is OFF, enter the number of symbols to analyze here.

Alpha

This defines the filter alpha value if the DSSS Reference Filter is set to RC (raised cosine).

Channel Bandwidth

Use this to configure the modulation accuracy and spectrum measurements together with the Analysis Mode.

Auto BSS Bandwidth

Use this to select whether the BSS bandwidth is determined automatically. This option is applicable only in 802.11ac and n formats, with a Channel Offset other than 'none'.

Auto-Detect Number of Symbols to Analyse

Use this to control how to determine the number of symbols to analyze. If the button is ON, the software analyzes the number of symbols determined from the header, up to a maximum value of 1000. If the button is OFF, the Number of Symbols is used.

DSSS Reference Filter

Use this to select a DSSS reference filter to apply, which may be set to None, RC (raised cosine), Rectangular or Gaussian.

BT

This defines the filter BT value if the DSSS Reference Filter is set to Gaussian.

Antenna 1, 2, 3

For 802.11n this provides a convenient way of enabling and disabling an antenna and therefore all measurements being performed on it. This is equivalent to enabling and disabling antennas via the MIMO Configuration panel.

Advanced

The Advanced panel is divided into two sections. One section (OFDM) lists all OFDM-related advanced options and the other section (DSSS) lists all DSSS-related advanced options.

OFDM options

Pilot tracking modes

Pilot tracking provides additional methods of reducing EVM (RCE) results for an OFDM (IEEE802.11a/g) signal by reducing any time-dependent changes in pilot amplitude, phase and timing. IEEE 802.11a §17.3.9.7 requires that phase tracking be applied, whilst amplitude and timing tracking are optional.

Pilot Time Tracking

Use this to enable or disable pilot time tracking for the current link direction. If pilot timing tracking is enabled, then after the channel equalizer has been applied (or the gross timing offset removed), the received pilot subcarriers of each symbol are compared to their ideal values and any remaining timing offset is estimated and corrected for in both the pilot and data subcarriers.

Pilot Amplitude Tracking

Use this to enable or disable pilot amplitude tracking for the current link direction. If pilot amplitude tracking is enabled, then for each symbol, the received pilot subcarriers are compared to their ideal values and the average difference in amplitude is applied to both the pilot and data subcarriers.

Pilot Phase Tracking

Use this to enable or disable pilot phase tracking for the current link direction. If pilot phase tracking is enabled, then for each symbol, the received pilot subcarriers are compared to their ideal values and the average difference in phase is applied to both the pilot and data subcarriers.

Equalization Mode

Equalization mode lists the supported equalizer training techniques.

- Preamble: this enables the equalization on sequence only.
- Preamble and Data: this enables both the equalization on sequence and data.

DSSS options

Equalization Filter

This is a DSSS-based WLAN system advanced option. Use this button to apply the equalization filter.

Filter Length

If the Equalization Filter is ON, use this to set the filter length. The length is in chips, and must be an odd number: if an even number is entered, the instrument alerts you. The default is 21.

Burst Location

Wireless LAN signals tend to consist of gated bursts, and the location of the burst needs to be determined by the instrument prior to analysis. Use Burst Location to configure the relevant parameters that control how the burst is located within the captured data.

Rising/Falling Edge Threshold

The instrument determines the burst location by looking for significant changes in power. You can specify the magnitude of this change separately for both the rising and falling edges of a burst using the Rising Edge Threshold and Falling Edge Threshold controls.

This figure illustrates these two properties:

Integration Skip Time/Comparator Delay

The two integration periods used for comparison need not be adjacent to each other. The Integration Skip Time and Comparator Delay controls specify where and how far apart the integration periods are.

This figure illustrates these properties for the rising edge:
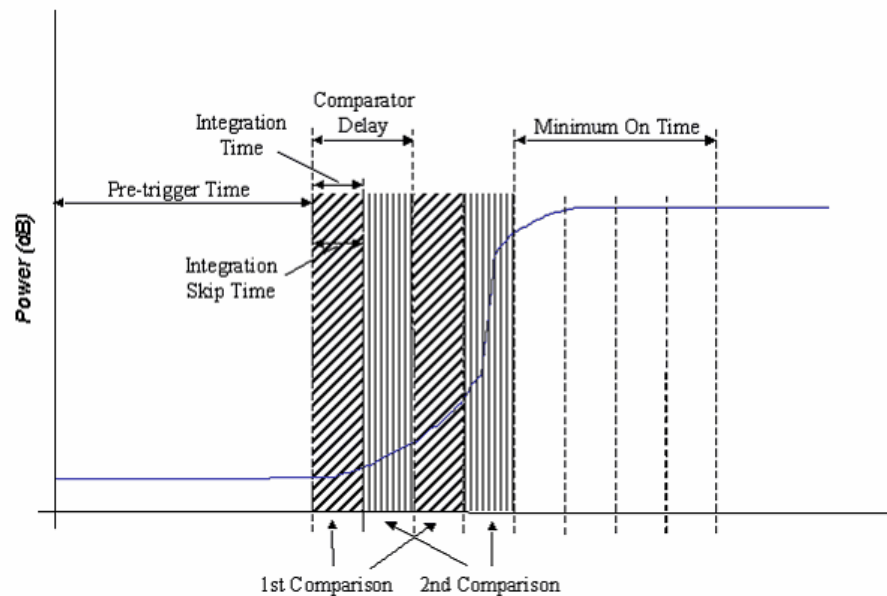
Here the Integration Time and Integration Skip Time are the same length, which means that the integration periods are adjacent to each other. The Comparator Delay is two integration periods long, so there is a gap of one period between the powers compared, as shown by the shading in the figure above.

Pre-Trigger Time

Pre-trigger Time is the period of time that the measurement waits for before looking for a burst's rising edge. This means that any supplied IQ data must have at least a 'Pre-trigger Time' number of samples prior to the burst.

If the Integration Skip Time is less than the Integration Time, the integration periods overlap. If the Integration Skip Time is greater than the Integration Time, there is a gap between integration periods. The figure below illustrates the latter scenario:

Minimum Off Time

Having found a burst's rising edge, the instrument searches for the falling edge. The power between two integration periods is compared until it decreases by at least the Falling Edge Threshold and remains below the threshold for the Minimum Off Time.

If the power goes above the threshold during this period, it is not a falling edge. The figure below illustrates the falling edge detection:

Minimum On Time

To detect a burst's rising edge, the power in two integration periods is compared across the IQ data until it increases by at least the Rising Edge Threshold and remains above the threshold for the Minimum On Time. If the power drops below the threshold during this period, it is not a rising edge.

Integration Time

The Bluetooth measurement for burst location uses the concept of a power integration period set by the Integration Time control. This is used to smooth the signal power over a period of time to prevent false burst detection in noisy signals.

Reset to Default

Resets all the fields to their default values.

Spectrum Flatness

Use this screen to configure the spectral flatness limits that can be applied to the signal you are analyzing. A mask that displays normal, extreme or user-defined spectral flatness limits can be applied for comparison with a spectral flatness measurement. The screen also shows a rough graphical outline of the limits (both upper and lower limit) that are applied when making spectral flatness measurements.

Spectral Flatness Mode

Use this to select whether a normal, extreme or user-defined spectral flatness limit is applied.

Predefined: a pre-defined spectral flatness limits mask as per IEEE Std. 802.11a-1999 § 17.3.9.6.2 or IEEE Std 802.11n/D7.0 § 20.3.21.2 or IEEE 802.11ac/D1.0 §22.3.18.2, depending on the Analysis Mode.

User-Defined: the user-defined flatness limits mask automatically applies the current user-defined settings you have entered.

Configure User Limits
See the common Spectral mask section for information on how to create a user-defined spectral mask.

Controlling another S-Series instrument

You can attach S-Series instruments together physically (using Aerolock™) and electrically (via USB plug & play) to form a combined instrument with multiple functions. After you connect a module to the SVA via USB, its presence is recognized automatically, and the features and applications relevant to that module become available in the on-screen menu of the controlling the SVA, whose menu bar shows (for example) 'SCO/SPA Front Panel'.

Many applications are being supported, including tests for power amplifiers, receiver selectivity, intermodulation, adjacent channel power and mixer testing, with further developments all the time: check the current data sheet at Aeroflex.com.

Storing and recalling instrument settings

You can save the setup of the instrument using a file name, and then recall the setting later. This lets you return easily to a preferred measurement configuration.
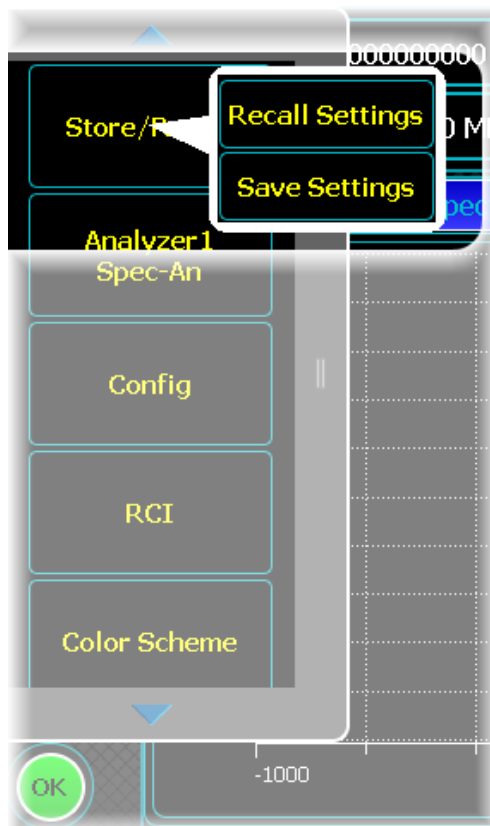
Store

Touch *Store/Recall*, *Save Settings*. The popup shows the current file location.

Enter a file name using the virtual keyboard that pops up when you touch the File Name field.

When you touch *Save*, the instrument stores the current configuration and settings to the non-volatile memory or to the optional removable hard drive.

Recall

Touch *Store/Recall*, *Recall Settings*. A popup lets you browse for currently stored files.

Touch the file you want to recall, and the instrument is configured with the stored settings.

Remote control interface (RCI)

You can operate the instrument remotely over an internet link or via GPIB.

Select RCI from the menu tab.
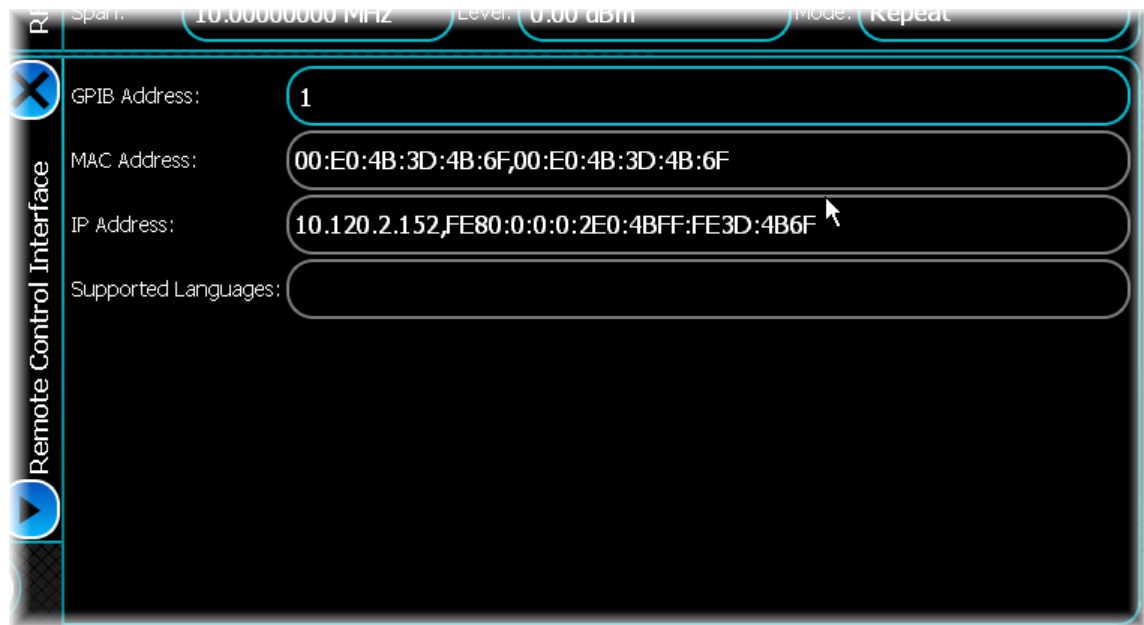
GPIB Address

This shows the instrument's GPIB address.

MAC Address

This shows the instrument's MAC address.

IP Address

This shows the instrument's IP address, which can be used to control it remotely over the internet. An alternative method of finding this is shown below.

Supported Languages

This displays any languages other than English that are supported by the SVA. You can configure the instrument to display Chinese text.

Remote operation via GPIB

You can operate the SVA remotely via the GPIB interface. The GPIB (General Purpose Interface Bus) interface provides instrument control with full talk and listen capability. The command syntax conforms to IEEE 488.2.

Background to GPIB

GPIB is a high-performance bus that allows instruments and computers to be combined into integrated test systems.

The bus and its associated interface operations are defined by the IEEE 488.1 standard. The later IEEE 488.2 standard defines the interface capabilities of instruments and controllers in a measurement system. This standard also defines a set of commands that a device must accept, and programming errors that a device must recognize and report. The cables that link the devices on the bus consist of 16 signal lines that are divided into three groups:

- Data bus: eight signal lines that are used to send data from one device to another.

- Handshake lines: the transfer of each byte of information over the data bus is controlled by a three-wire handshake process between the source of the data (talker) and the destination device (listener). This forces data transfers to occur at the speed of the slowest device, and ensures data integrity in multiple listener transfers. The handshake cycle is usually performed automatically and is transparent to the GPIB programmer.

- Control lines: five control lines (or interface management lines) are used to both send bus commands and to address devices.

Devices that send data over the data lines are called talkers; devices that receive data over the same lines are called listeners. Controllers are devices that use the control lines to specify the talker and listener in a data exchange. A GPIB system can contain more than one device with controller capabilities, but only one is allowed to control data exchanges at any given time.

The device currently controlling data exchanges is called the active controller. One of the controller-capable devices can be designated as the system controller, which can take control of the bus even if it is not the active controller. Up to 15 instruments can be connected to a GPIB system. GPIB addresses are used to identify devices on the bus. The active controller uses these addresses to specify which device talks (via a Talk Address) and which device listens (via a Listen Address) during a data exchange. Each device must therefore have a unique address, and is set on the instrument itself, using either a front-panel key sequence or a rear-panel switch. Any given device address can specify two corresponding address codes, a Talk Address and a Listen Address. The decimal equivalent of the allowable address range is 0 to 30 inclusive.

SCPI compatibility

This instrument may be operated remotely via an interface that conforms to:

- IEEE Std 488.1-1987, which defines the electrical, mechanical and low-level protocol characteristics of the bus structure, the GPIB (General Purpose Interface Bus)

- IEEE Std 488.2-1987, which defines standard codes, formats, protocols and common commands for use with IEEE Std 488.1.

The instrument is not fully compliant with SCPI (Standard Commands for Programmable Instruments) because many product features are not covered by that standard, and modern software trends favor the use of instrument drivers as a means of achieving interchangeability. However, we recognize that SCPI is in common use by system developers and a number of SCPI features that make system integration easier have been implemented. These include the extended status reporting structure, the error-numbering scheme, the command mnemonic derivation rules (long and short form), and many of the most frequently used commands themselves. Refer to SCPI 1999 (standard available from the IVI Foundation) for details.

Command Reference Manual

All available GPIB commands, together with an introduction to the conventions used for GPIB programming, are listed in the SVA Remote Command Reference Manual, part no. 47090/128.

Remote operation over the internet

To do this, you need the instrument's IP address (10.120.2.152 in the example above), and some remote control software (such as VNC®) that lets you view and interact with the SVA from another computer on the internet. The SVA is supplied with VNC® remote control software installed.

On the SVA…

1. Exit the SVA application by touching Exit Application on the menu tab to access the Windows screen.

2. Log in as administrator using the administrator password *sseries*.

3. In Control Panel, select Windows Firewall.

4. Select the <Exceptions> tab.

5. Select [Add Port].

6. Select Name: and enter `VNC_5800`**.**

7. Select Port Number: and enter `5800`**.**

8. Ensure TCP is checked.

9. Go back to the <Exceptions> tab and ensure VNC_5800 is checked.

10. Close Control Panel.

11. Close Control Panel and restart the SVA application from the desktop. Note that it is not necessary to restart the instrument.

On your PC…

12. Go to your web browser on your PC and enter the IP address for the SVA in the form `http:// <ipaddress>:5800`.

13. The VNC window appears: click OK. The SVA desktop now appears on the laptop/PC web browser.

14. Open the SVA application from the desktop and operate the instrument normally.

Note: remote control is useful for monitoring and making measurements, but due to the inherent delays, it is unsuitable for taking instantaneous readings.
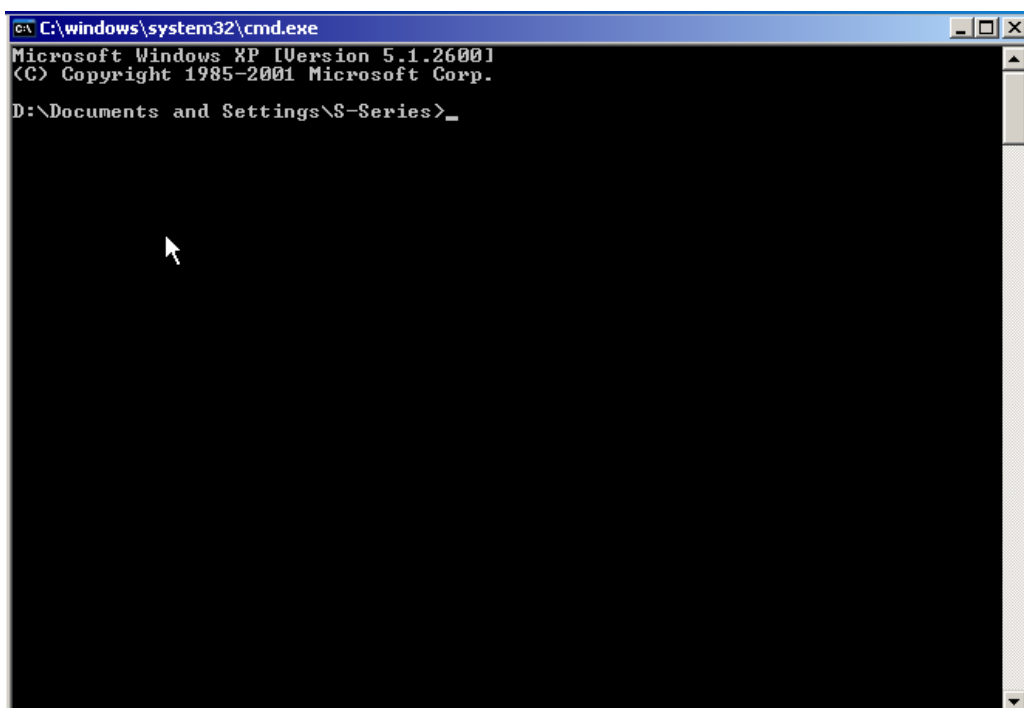
Alternative method of ascertaining IP address

1. Exit the SVA application by touching Exit Application on the menu tab to access the Windows screen.

2. Note the IP address of the SVA by touching Start\Run and entering cmd in the Run screen:
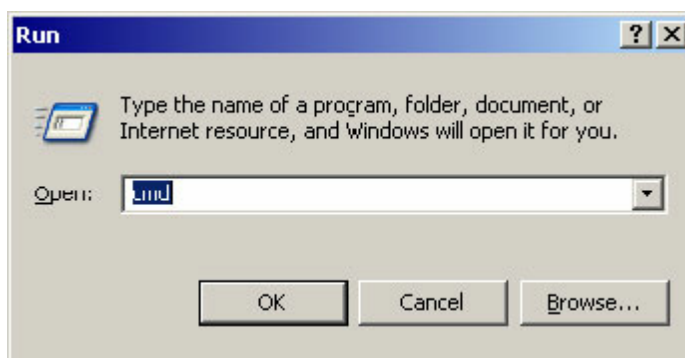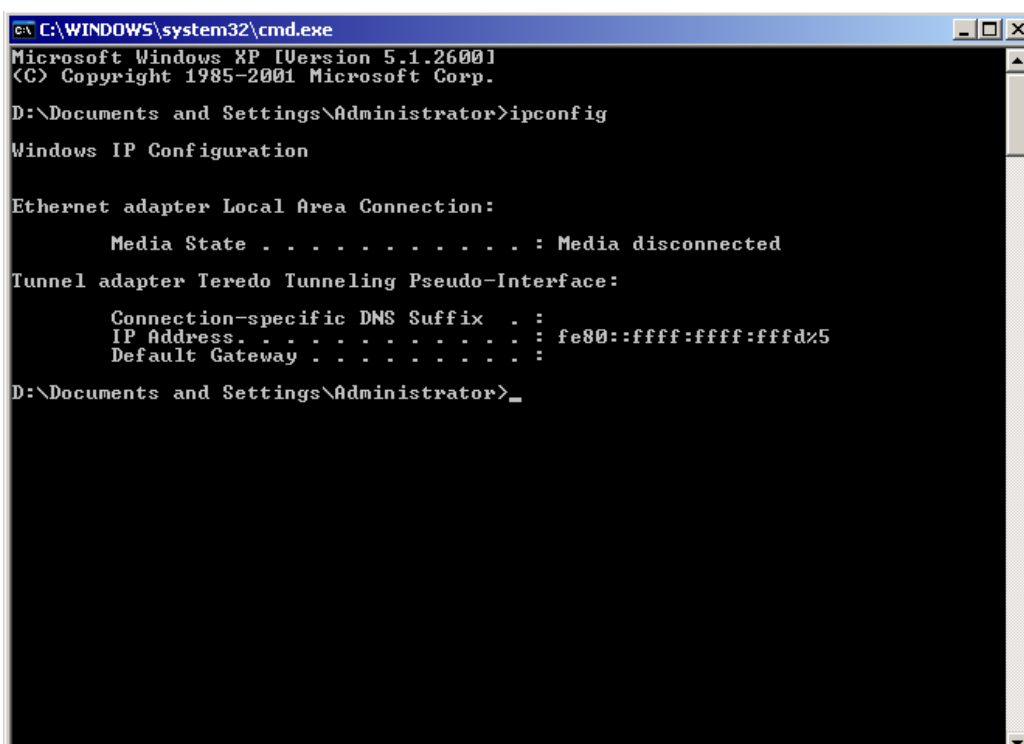
3. Touch OK. The command line appears:

4. Type `ipconfig`, and press Enter. The Windows IP Configuration screen appears, which shows the instrument's IP address. Make a note of this.

Accessing Windows

Touch the Exit Application button (on the menu tab) to close the SVA application:
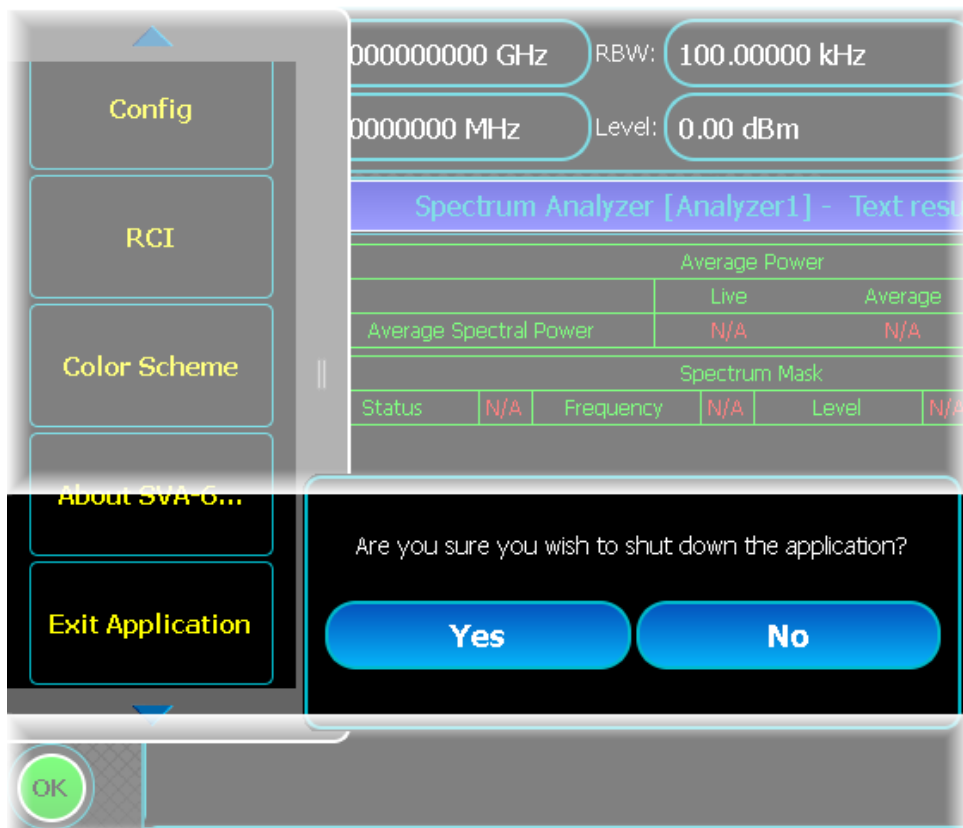
Touch Yes. The SVA application closes and you now see the Windows® desktop.

Powering down

Press the on/off switch on the front panel.

The instrument takes a few seconds to power down, first closing the SVA application, then Windows®. There is no need to exit Windows separately.

Removing power

Note: the on/off switch does <u>not</u> isolate the instrument from the line power. To remove all power from the instrument, disconnect the power cord.

CAUTION

Do not disconnect the power cord until the instrument has finished powering down, as you may corrupt data.

About the instrument

Touch the *About...* button (on the menu tab) to see information about the instrument, such as software version:
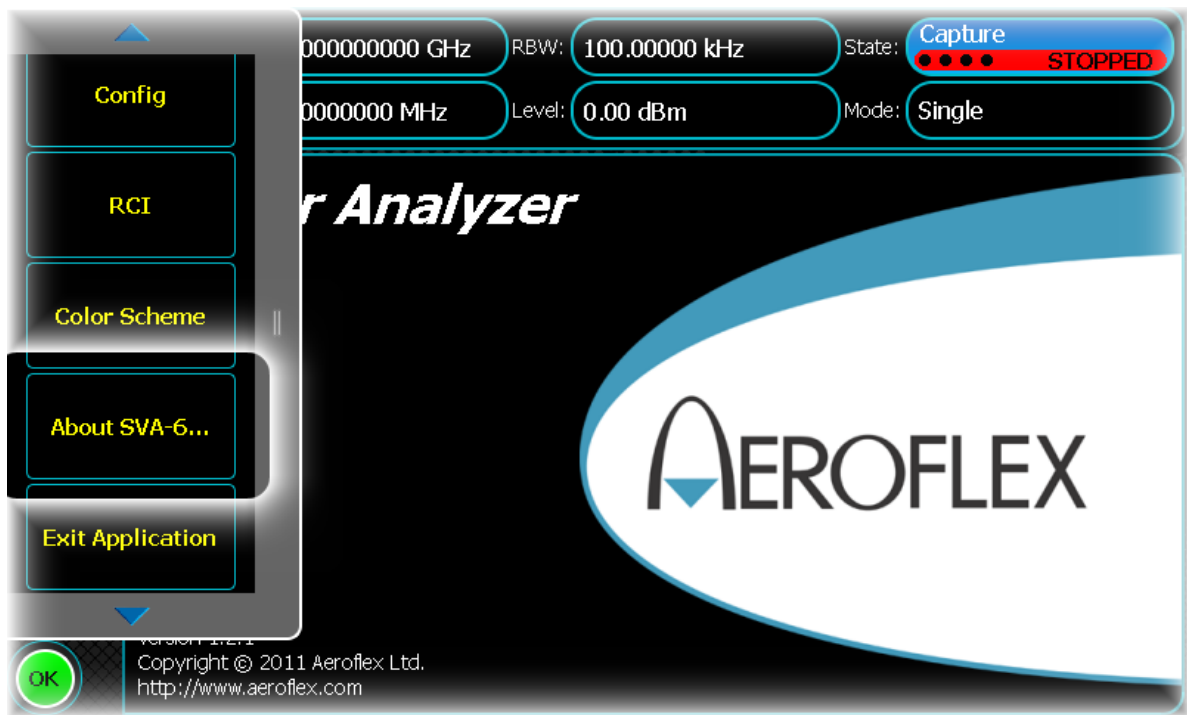
Patent information

This instrument is protected by the following:

UK patent application GB2475514A

Color scheme

Touch the *Color Scheme* button (on the menu tab) to change the appearance of the SVA screen:
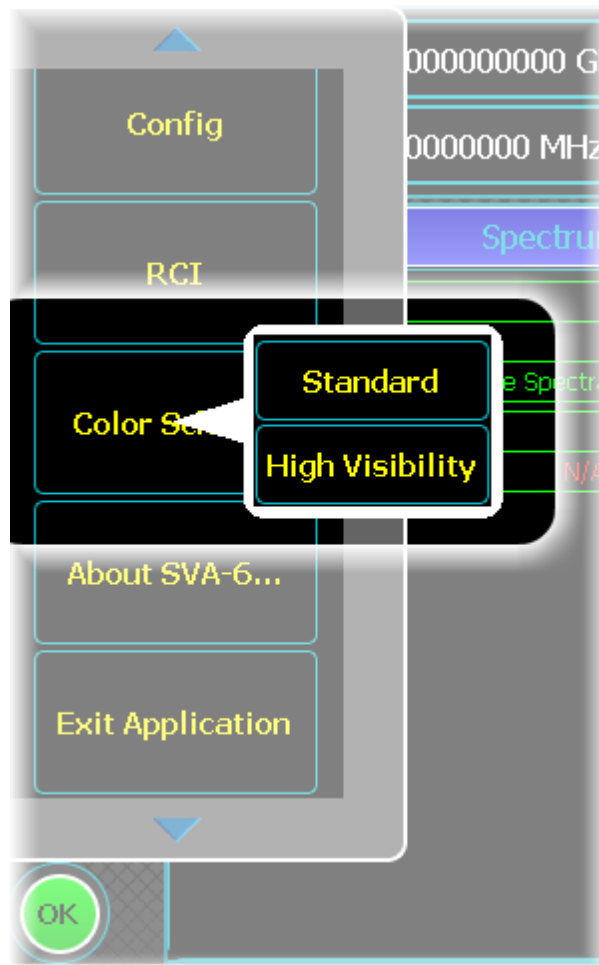
Standard displays white text on a black background, with colored buttons.

High Visibility displays black text on a white background, with minimal color on the screen.

Aerolock

Aerolock™ is a simple, strong interlocking mechanism...

C6430
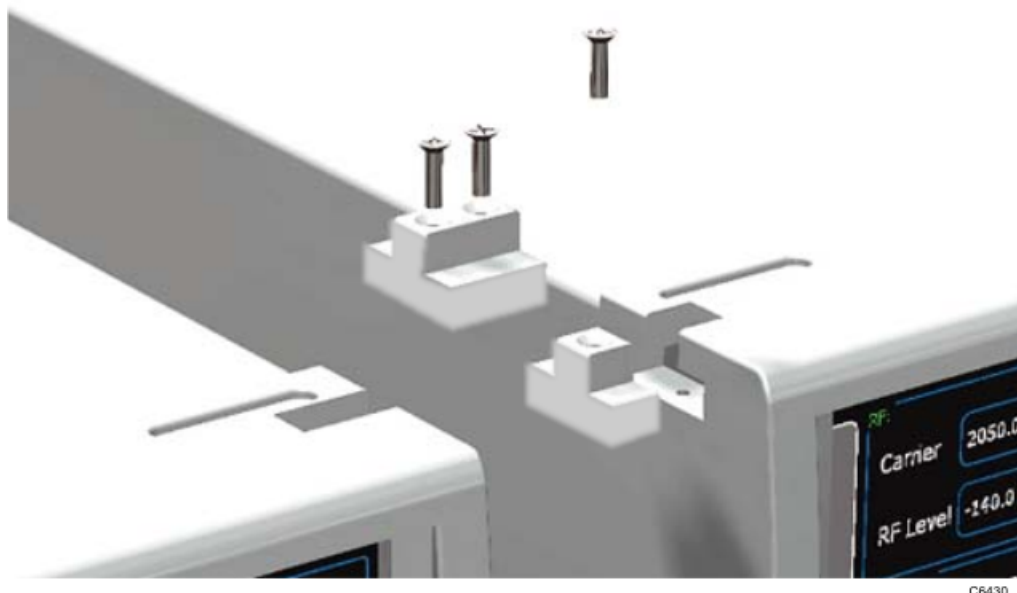
...that allows S-Series instruments to be joined together.

How it works

Each S-Series instrument is supplied with short and long T-bars that are located in the cut-outs at the top and bottom of the screen surround. When joining instruments together, you swap these T-bars over to allow the long T-bar to form a bridging link, and also screw the rear bumpers together.

Procedure: front

For example, to join two instruments side-by-side, remove the long T-bar from the left-hand instrument...
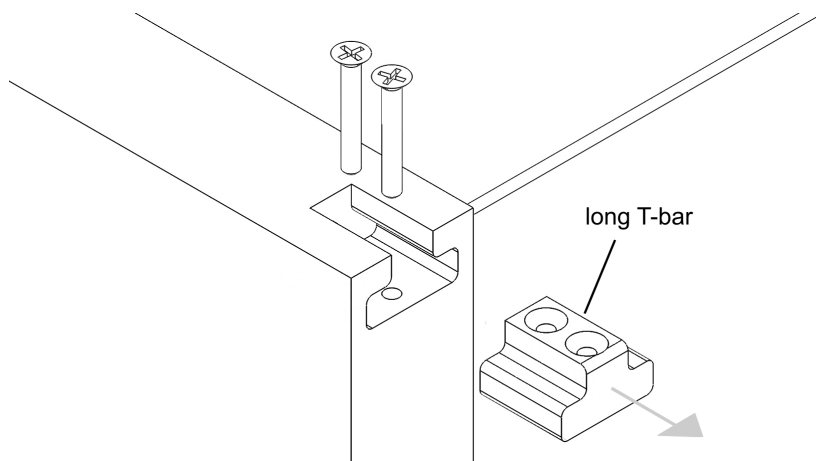
long T-bar

...move the short T-bar from the right-hand instrument into the vacated space on the left-hand instrument...

short T-bar
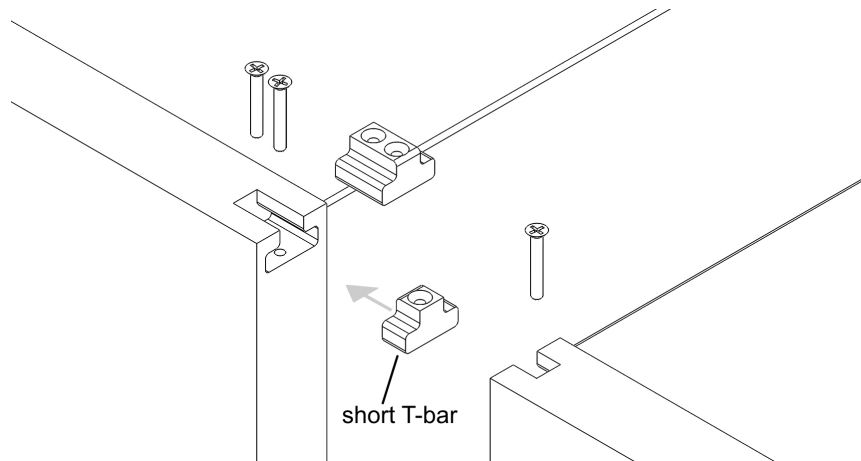
...replace the long T-bar in the left-hand instrument...
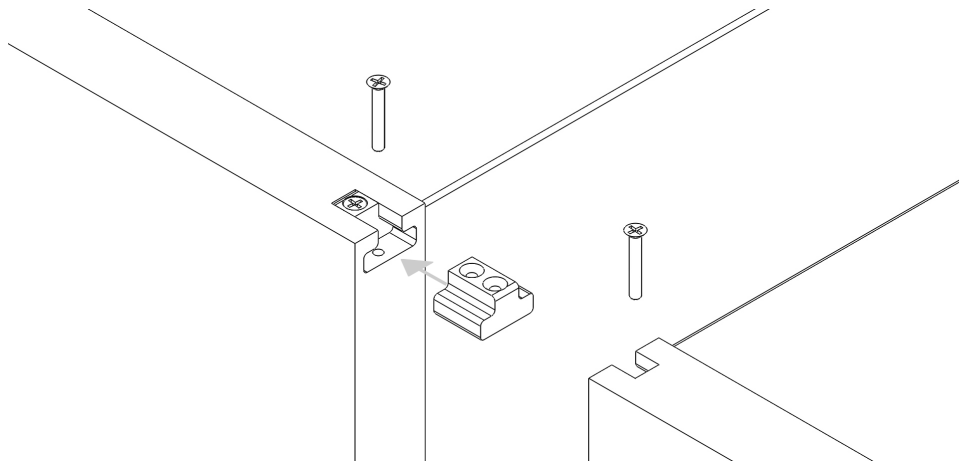
...and join the two instruments using the long T-bar as the bridging piece...
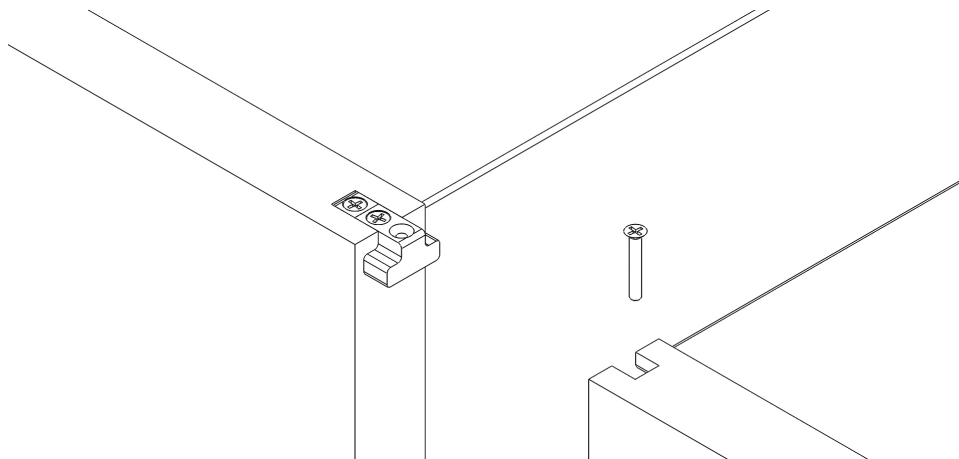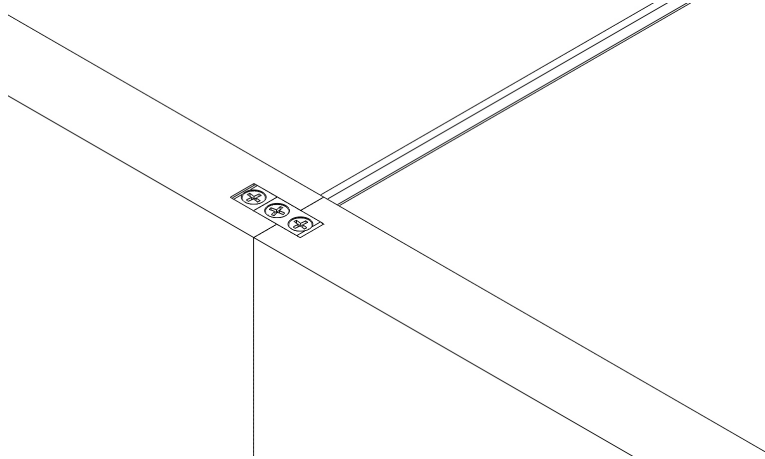
Do this at both the top and bottom of the screen surrounds.

Procedure: rear

At the rear of the instruments, screw the rear bumpers together, using the screws and tapped inserts provided in the adjacent bumpers, top and bottom.
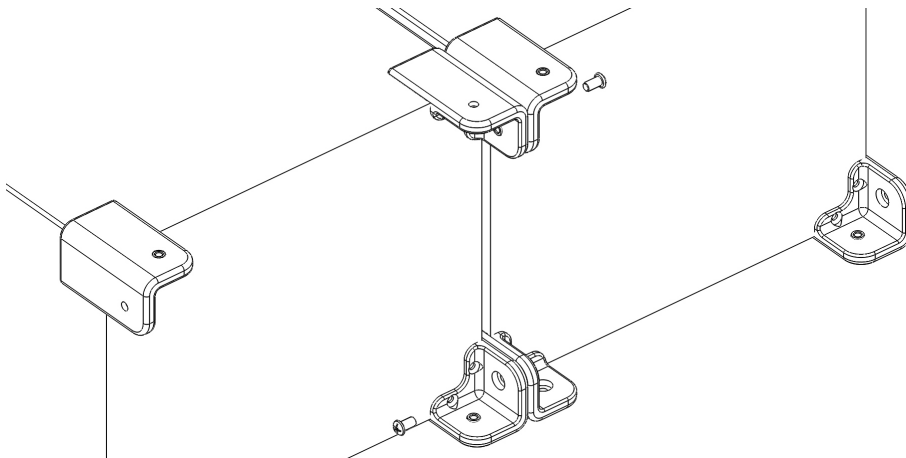
The two instruments are now joined firmly together:
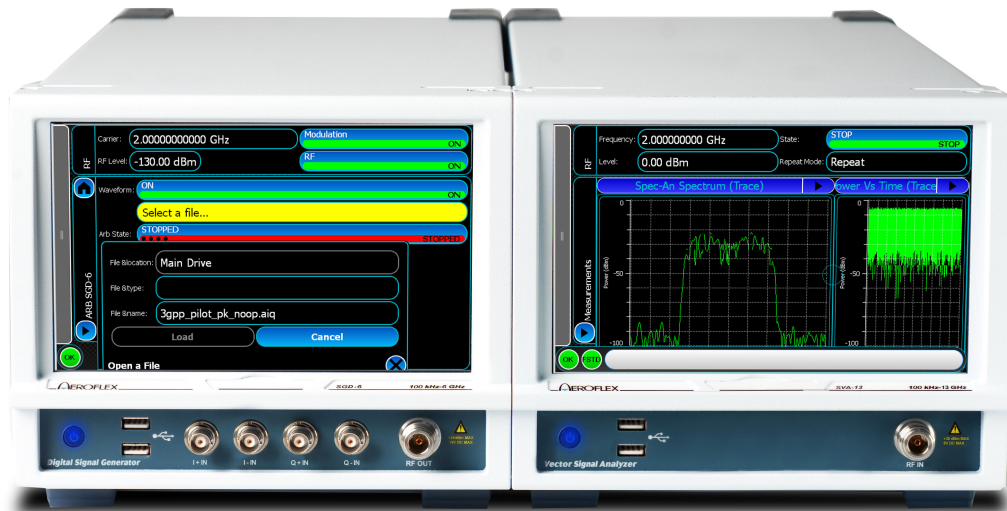
Adding a full-width module

A full-width module, such as an SCO combiner, fits underneath two half-rack-width instruments using I-bars (supplied with the module) in exactly the same way as T-bars. Again, rear bumpers are screwed together also to provide stability.
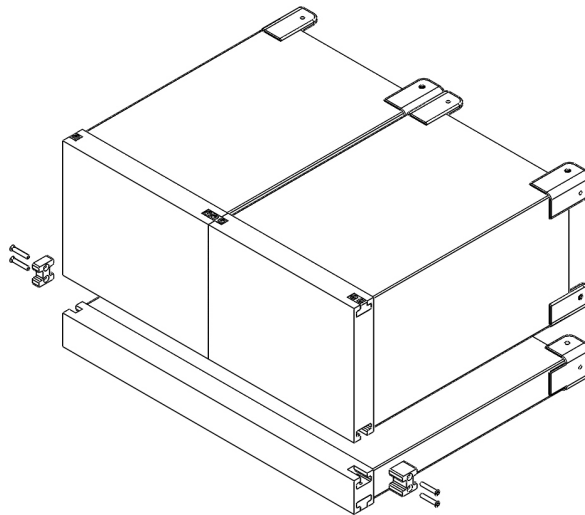
Electrical connections

Signal and control connections are created by USB cables that link the master instrument (for example, the SVA) and further modules such as signal generators, analyzers, and combiner.

Technical support

Aeroflex products are designed and manufactured to provide a high level of trouble-free performance. However, instruments typically require routine maintenance and calibration and installation of new software. If you require help or have a question, you can contact a service facility in your area. In the first instance, contact the Aeroflex help desk at www.aeroflex.com/ats/contact.cfm.

Installing software

From time to time, Aeroflex releases new versions of the SVA application software. You can download the new software from the Aeroflex website.

Contact the Aeroflex help desk if you need assistance.

Installation procedure

To install a new version of the SVA application:

1. Connect a USB keyboard to the instrument

2. Exit the SVA application (touch Exit Application on the menu tab or press Alt+F4 on the keyboard).

3. Log off Windows. The logon screen appears:
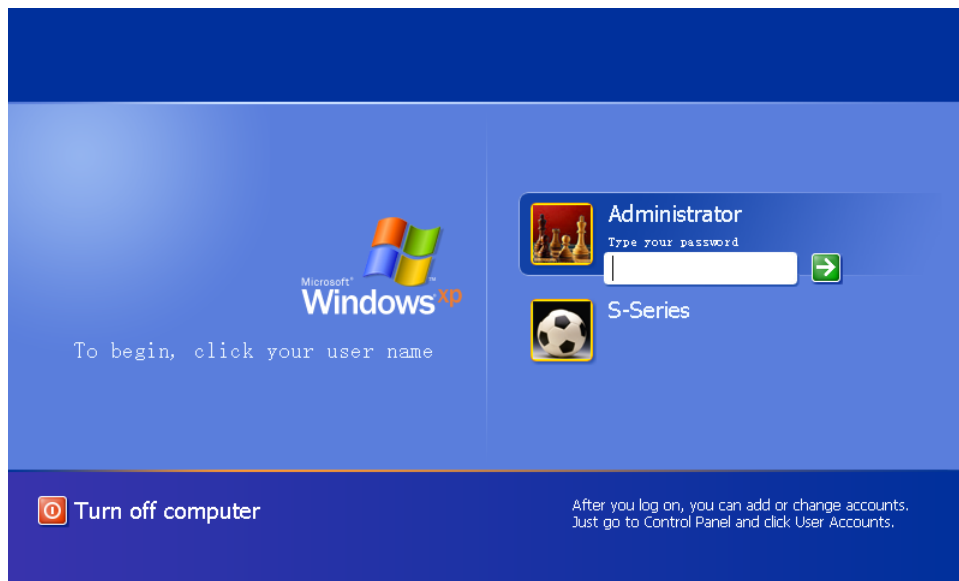
4. Log on again as Administrator.
   The password is **sseries**.

5. Open Windows Explorer (click *Start\All Programs\Accessories\Windows Explorer*).

6. Browse to the location of the installer file (if necessary, download the file from the Aeroflex website).

7. Open the installer, double-click the setup.exe file and follow the on-screen instructions. The file loads, replacing the current SVA application.

8. Restart the instrument (follow *Start\All Programs\Aeroflex\SVA,* or log off Windows and log in again as System).

9. Confirm that the updated application is running by checking the version number on the About... screen.

Installing a license

You may need to add a new software license, for example, to permit analysis of a modulation scheme that is not currently enabled on your instrument. The software license 'unlocks' software options that are installed together with the instrument's application software. A license file may provide one or more options.

The current data sheet shows which options are available for your instrument.

Contact the Aeroflex help desk if you need assistance.

Installation procedure

To install a new license:

1. Connect a USB keyboard to the instrument

2. Exit the SVA application (touch Exit Application on the menu tab or press Alt+F4 on the keyboard).

3. Log off Windows. The logon screen appears:
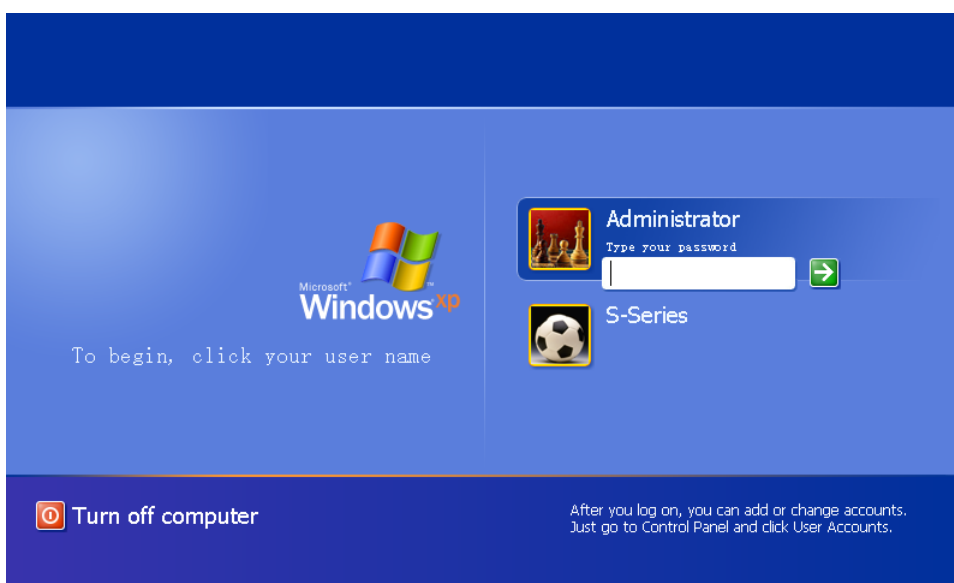
4. Log on again as Administrator.
   The password is **sseries**

5. Open Windows Explorer (click *Start\All Programs\Accessories\Windows Explorer*).

6. Browse to the location of the license file (this may have been sent to you).

7. Copy the file to *My Documents\Aeroflex\Options* and note its name.

8. Restart the instrument (follow *Start\All Programs\Aeroflex\SVA*, or log off Windows and log in again as System).

9. Touch Config\Options on the <u>menu tab</u>.
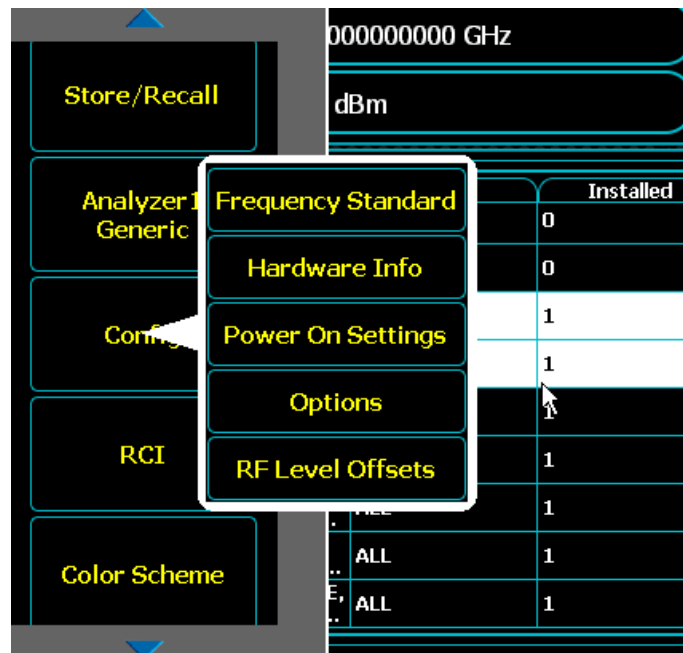
10. The Options screen appears:
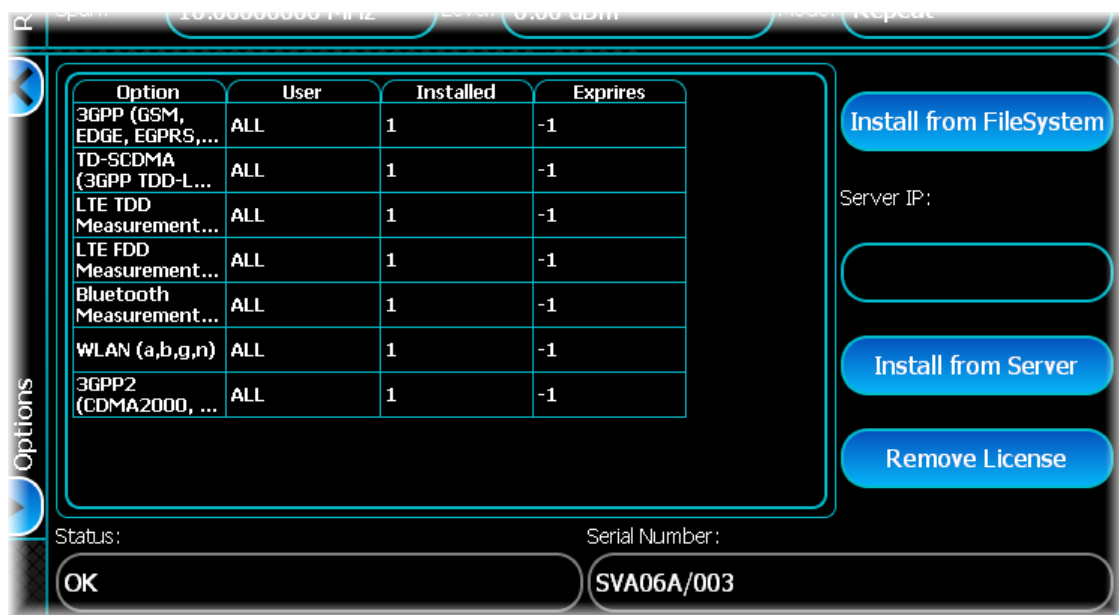
11. Touch Install from FileSystem. You are prompted for File location (this is Main Drive) and File name. Select the correct license file from the drop-down list.

12. Touch Load. The license is updated.

13. <u>Power down</u> the instrument and <u>power it up</u> again.

14. Confirm that the new option(s) appear on the Options screen.

Maintenance

In the UK the 'Electricity at Work Regulations' (1989) section 4(2) places a requirement on the users of equipment to maintain it in a safe condition. The explanatory notes call for regular inspections and tests together with a need to keep records.

The following electrical tests and inspection information is provided for guidance purposes and involves the use of voltages and currents that can cause injury. It is important that these tests are only performed by competent personnel.

Calibration

The recommended calibration interval is 2 years. If the instrument is due for calibration, or you suspect that it is not performing correctly, contact the Aeroflex help desk at www.aeroflex.com/ats/contact.cfm.

Routine

Safety testing and inspection

Prior to carrying out any inspection and tests, you must disconnect the instrument from the power supply, and remove all external signal connections. All tests should include the instrument's own power cord, all covers must be fitted and the power switch must be in the ON position.

The recommended inspection and tests fall into three categories and should be carried out in the following sequence:

1. Visual inspection

Carry out a visual inspection on a periodic basis. This interval is dependent on the operating environment, maintenance and use, and should be assessed in accordance with guidelines issued by the Health and Safety Executive (HSE) or national or local regulations. As a guide, this equipment, when used indoors in a relatively clean environment, would be classified as 'low risk' equipment and hence should be subject to safety inspections on an annual basis. If the use of the equipment is contrary to the conditions specified, you should review the safety retest interval.

As a guide, the visual inspection should include the following where appropriate:

- Check that the equipment has been installed in accordance with the instructions provided (for example, that ventilation is adequate, supply isolators are accessible, supply wiring is adequate and properly routed).

- Check the condition of the power cord and supply connector(s).

- Check that the disconnecting device or isolator is easily accessible.

- Check the correct rating and type of supply fuses.

- Check the security and condition of covers and handles.

- Check the presence and condition of all warning labels and markings, and supplied safety information.

- Check the wiring in rewireable plugs and appliance connectors.

- Check the cleanliness and condition of any ventilation fan filters.

- Check that the power supply switch isolates the equipment from the supply.

- Check the supply indicator functions (if fitted).

If any defects are noted, rectify them before proceeding with the following electrical tests (unless local instructions apply).

2. Ground bonding tests

Ground bonding tests should be carried out using a 25 A (12 V maximum open circuit voltage) DC source. Limit tests to a maximum duration of 5 seconds. The pass limit should be 0.1 Ω after allowing for the resistance of the power cord. Do not exceed the test duration, as this may cause damage to the equipment. Carry out the tests between the supply ground and exposed case metalwork. Make no attempt to perform the tests on functional grounded areas (for example, signal-carrying connector shells or screen connections), as this will result in damage to the equipment.

3. Insulation resistance tests

Apply a 500 V DC test between the protective ground connection and combined live and neutral supply connections, with the equipment supply switch in the ON position. It is advisable to make the live/neutral link on the appliance tester or its connector to avoid the possibility of returning the equipment to the user with the live and neutral poles linked with a temporary strap. Apply the test voltage for 5 seconds before taking the measurement.

Aeroflex employs reinforced insulation in the construction of its products, so a minimum pass limit of 7 MΩ should be achieved during this test.

Where a DC power adapter is provided with the equipment, the adapter must pass the 7 MΩ test limit.

We do not recommend dielectric flash testing during routine safety tests. Most portable appliance testers use AC for the dielectric strength test, which can cause damage to the supply input filter capacitors.

Rectification

We recommend that the results of the above tests are recorded and checked during each repeat test. Investigate significant differences between the previous readings and measured values.

If any failure is detected during the above visual inspection or tests, disable the equipment. The fault should be rectified by an experienced service engineer who is familiar with the hazards involved in carrying out such repairs.

Replace safety-critical components with equivalent parts only, using techniques and procedures recommended by Aeroflex.

The above information is provided for guidance only. Aeroflex designs and constructs its products in accordance with international safety standards such that in normal use the products represent no hazard to the operator. Aeroflex reserves the right to amend the above information in the course of its continuing commitment to product safety.

Cleaning

Before starting any cleaning, switch off the instrument and disconnect it from the supply by removing the power cord.

Case exterior: use a soft cloth moistened with water to clean the case; do not use aerosol or liquid solvent cleaners.

Touch screen: take care not to scratch the touch screen during use or when cleaning. Clean the touch screen by wiping a slightly damp, soft, lint-free cloth gently over the surface. If this does not remove finger marks, dampen the cloth sparingly with isopropyl alcohol.

WARNING *Isopropyl alcohol is flammable.*

Air inlet remove dust and any other impediments to airflow from the air inlet holes on the underside of the instrument

Putting into storage

If you are putting the instrument into storage, ensure that the following conditions are maintained:

Temperature range: -40 to +71°C

Humidity: up to 95% at +40°C

Removing the hard drive

Note: this procedure applies only to instruments fitted with Option 005.

1. Shut down the instrument.

2. Undo the two captive thumbscrews retaining the hard drive unit to the rear panel.

3. Slide out the hard drive unit.

4. Protect the connectors on the hard drive unit. Seal it in an antistatic bag, enclose it in bubble wrap, and protect it from mechanical shocks.

Rack mounting

S-Series products can be mounted in a standard 19-inch rack, using the appropriate Aeroflex rack-mounting kit:

46885/005	Rack-mounting kit, single
46885/006	Rack-mounting kit, double

The figure shows:

on top: a single SGA Signal Generator, fitted into the rack using a single rack-mounting kit (SGA is identical, mechanically, to SVA)

underneath: two SGAs and a combiner, fitted into the rack using a double rack-mounting kit.
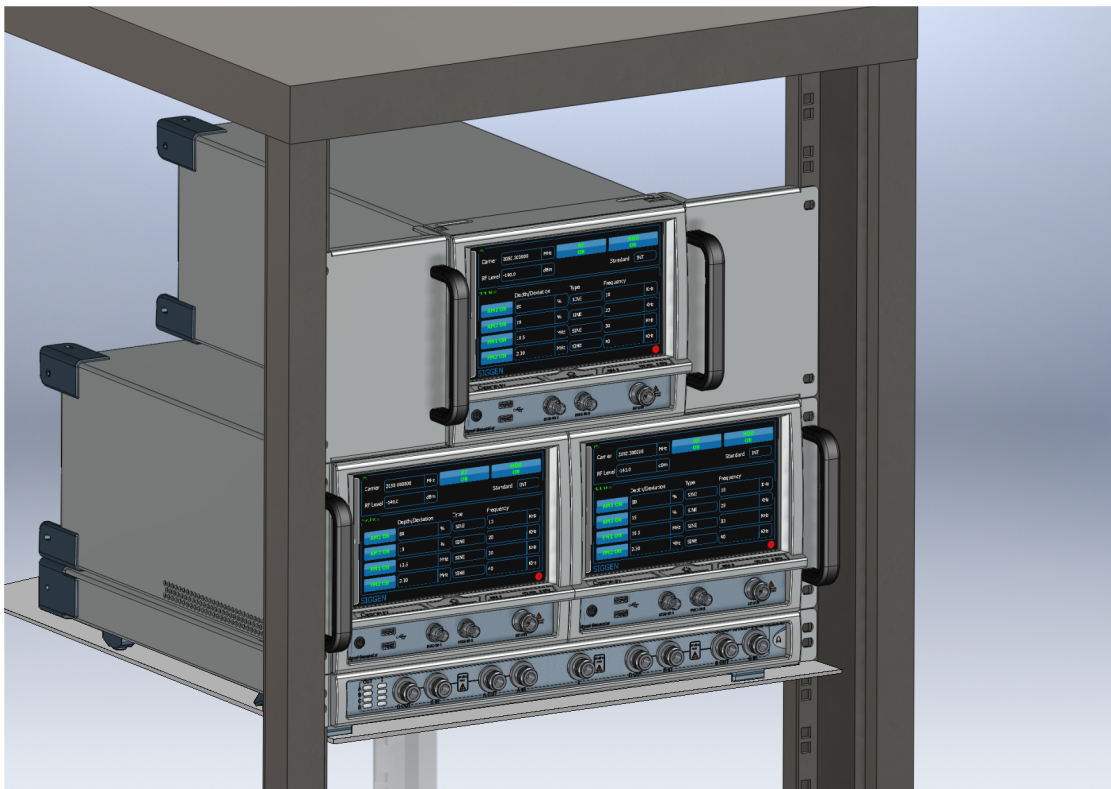
Fitting a rack-mounting kit

WARNING

The brackets supplied with the rack-mounting kits are not strong enough on their own to support the weight of single or multiple SVA or SGA products. You *must* fit a suitable supporting tray to the rack before installing the S-Series product(s). The tray must be capable of supporting the weight of the instrument(s): for example, 8 kg for a single SVA, and a minimum of 45 kg for the two SGAs and combiner shown in the figure.

WARNING

Take care when moving multiple S-Series products as they may exceed the weight that should be lifted by a single person: see Heavy instrument.

CAUTION

Use a perforated tray only. Ensure that no air intakes and outlets are obstructed whilst the instrument is in use. Make sure that the inlet grille underneath the instrument is not obscured by the tray and that there is adequate airflow.

Brackets

1. For both single and double rack-mounting kits, attach each rack mounting bracket to the instrument with three M3 x 10 countersunk Pozidriv screws on each side of the instrument.

2. Locate the instrument(s) in the rack, with the tray supporting the weight of the instrument(s). Attach the rack mounting brackets to the rack using two M5 x 10 countersunk Posidriv screws, washers and cage nuts on each side.

Repackaging and returning

Repackaging

If you need to return an instrument to us, please observe the following:

Tagging

Tag the returned instrument with:

- your name and address

- a full description of the symptoms of the fault

- the type, model number and serial number.

Shipping containers

Repackage the instrument in its original container and packing material. If the original shipping containers and materials are not available, contact Customer Service/Support for shipping instructions.

Freight costs

Contact Customer Service/Support for our freight charge policy on warranty claims. Freight costs on shipments out of warranty are borne by the customer.

Repacking procedure

If the original container or materials are not available, use a strong double-walled carton packed with a 7 to 10 cm (3 to 4 inch) layer of shock-absorbing material around all sides of the instrument to hold it firmly. Protect the front panel with a plywood or cardboard load-spreader. A rear load-spreader is also advisable.

Your labels

It may be necessary for us to cut or remove labels that you have attached to the instrument if they impede access to its interior.

Index

Index

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AEROFLEX LIMITED
SOFTWARE LICENSE AND WARRANTY

This document is an Agreement between the user of this Licensed Software, the Licensee, and Aeroflex Limited ('Aeroflex'), the Licensor. By installing or commencing to use the Licensed Software you accept the terms of this Agreement. If you do not agree to the terms of this Agreement do not use the Licensed Software.

1. DEFINITIONS

The following expressions will have the meanings set out below for the purposes of this Agreement:

Add-In Application Software	Licensed Software that may be loaded separately from time to time into the Designated Equipment to improve or modify its functionality
Computer Application Software	Licensed Software supplied to run on a standard PC or workstation
Designated Equipment	means either:
	the single piece of equipment or system supplied by Aeroflex upon which the Licensed Software is installed; or
	a computer that is connected to a single piece of equipment or system supplied by Aeroflex upon which computer the Licensed Software is installed
Downloaded Software	any software downloaded from an Aeroflex web site
Embedded Software	Licensed Software that forms part of the Designated Equipment supplied by Aeroflex and without which the Equipment cannot function
License Fee	means either the fee paid or other consideration given to Aeroflex for the use of the Licensed Software on the Designated Equipment
Licensed Software	all and any programs, listings, flow charts and instructions in whole or in part including Add-in, Computer Application, Downloaded and Embedded Software supplied to work with Designated Equipment
PXI Software	Licensed Software specific to Aeroflex's 3000 Series PXI product range

2. LICENSE FEE

The Licensee shall pay the License Fee to Aeroflex in accordance with the terms of the contract between the Licensee and Aeroflex.

3. TERM

This Agreement shall be effective from the date of receipt or download (where applicable) of the Licensed Software by the Licensee and shall continue in force until terminated under the provisions of Clause 8.

4. LICENCE

4.1 The following rights and restrictions in this Article 4 apply to all Licensed Software unless otherwise expressly stated in other Articles of this Agreement.

4.2 Unless and until terminated, this License confers upon the Licensee the non-transferable and non-exclusive right to use the Licensed Software on the Designated Equipment.

4.3 The Licensee may not use the Licensed Software on other than the Designated Equipment, unless written permission is first obtained from Aeroflex and until the appropriate additional License Fee has been paid to Aeroflex.

4.4 The Licensee may not amend or alter the Licensed Software and shall have no right or license other than that stipulated herein.

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