

## Version 26.1.1

- Added support for SC0402, SC0602, SC0902
- Added support for RFM0402, RFM0602, RFM0902

## Version 25.4.1

- Added support for ACM2202

## Version 25.3.3

- Added bug fixes for spikes at some frequencies on A2202

## Version 25.3.1

- Updated sc7540 firmware to fix spike on the last point of frequency sweep
- Fixed WinUSB driver's Microsoft signature

## Version 25.2.1

- Added support for V series VNAs
- Fixed bugs related to trigger on S5180 and V0902
- Added support for A2202

## Version 25.1.2

- Fixed a bug with the FIFO buffer not working with S5243
- Linux version now detects new VID VNAs

## Version 25.1.1

- Fixed a bug with FET1854 devices showing "Factory Failure: xALC" error message

## Version 24.3.4

- Fixed a bug with WinUSB driver. The driver was missing the configuration file

## Version 24.3.3

- Added support for Mini Circuits USB power sensors. Note that these power sensors does not have zeroing functionality

## Version 24.3.1

- Fixed a bug where the \*IDN? Query response shows wrong model
- Fixed a bug related to S5180B measurement spike around 5.5GHz when measuring high gain DUTs
- Added support for new CMT USB VID

## Version 24.2.2

- Data is now saved without frequency information in high security mode

## Version 24.1.5

- Added SCPI command for naming traces “DISP:WIND:TRAC:PAR:ALI”
- Removed “Analyzer model/Serial number” and “Enable Demo mode” pages from the installer

## Version 24.1.3

- Added “frequency” in trace calculator

## Version 23.4.7

- Added F7511, N1.2, N3.5 calibration kit definitions

## Version 23.4.5

- Enabled the SC series VNAs to have a maximum number of points of 500001

## Version 23.4.4

- Fixed a software bug that resulted in spikes in all s-parameters measurements under 5MHz

## Version 23.3.4

- Removed executables in the programming examples for IT security reasons

## Version 23.3.2

- Added demo mode support for SC7540 VNA

## Version 23.3.1

- Adjusted frequency synchronization timings for S5243 VNAs

## Version 23.2.4

- Fixed a bug in the Custom Frequency Extender menu

## Version 23.2.3

- Added support for CobaltFx FET-WR series frequency extenders (System > Misc Setup > Frequency Extender)

## Version 23.2.2

- Fixed a bug with external trigger output which previously flipped the voltage level whenever the trigger switched to the 'off' state

## Version 23.1.4

- Fixed an issue with the SC7540 VNA where the unit wouldn't sweep under certain conditions

## Version 23.1.3

- Added Keysight U2049, L205x, L206x LAN power sensors

## Version 23.1.2

- Fixed a bug where the S5243 VNA output power remained on even after closing the software

## Version 23.1.1

- Fixed spikes seen when output power was to -60 dBm in Cobalt series VNA

## Version 22.4.3

- Fixed an issue where a spike could be seen at low frequencies in the compact S series VNAs

## Version 22.3.3

- Fixed a bug that affected certain S5243 VNAs

## Version 22.3.2

- Fixed a bug connecting the LadyBug power sensor

## Version 22.3.1

- The 304/1 VNA uses WinUSB driver from this version

## Version 22.2.2

- Fixed a bug with **SENS:CORR:INF?** command when a query was performed after recalling a state file with cal data in it

## Version 22.2.1

- Extended the lower frequency limit for the RF and the LO output from the C4xxx VNAs when using custom frequency extenders

## Version 22.1.5

- Added USB driver selection for the 304/1 VNAs since they require the legacy Ezusb driver

## Version 22.1.3

- Fixed a bug when using pulse mode with the S5180B VNA

## Version 22.1.2

- Added support for the SC7540 VNA

## Version 22.1.1

- Fixed an issue recognizing license files to enable pulse mode

## Version 22.1.0

- New USB driver was implemented starting 22.1.0 based on WinUSB. This new driver resolves issues for users having problems with the memory integrity feature enabled on newer Windows 10 PCs.

## Version 21.4.3

- Fixed a bug with ACM calibration for SC5090 VNAs

## Version 21.3.4

- Fixed a bug where the system impedance changed to the offset impedance value when using unknown thru

## Version 21.3.3

- Fixed a bug where the RF output was set to max whenever toggled between on/off state

## Version 21.3.2

- Fixed an issue related to trigger delay setting where the actual delay was half the entered value
- Added N1802 cal kit to the table
- Improved S5243 functionality when using shorter pulse width (<165 us)
- Added SCPI commands for offset adjust menu

## Version 21.3.1

- Added SCPI command to support ACMs for Scalar and Vector Mixer Calibrations
- Added S5243 model to the initial analyzer selection when installing the application
- Fixed a bug related to time domain gating with one way reflection type
- Fixed an issue with trigger delay setting for 804/1 and S5048 VNAs

## Version 21.2.5

- Added SCPI command to support cycle time functions

## Version 21.2.1

- Fixed bug with selecting 'Ref Source' from the drop-down menu
- Fixed bug related to writing user characterization into the ACM with proper indexing

## Version 21.1.7

- Added support to assign VNA serial numbers through SCPI command or command line interface */serialnumber:<num>* (or see command help S2VNA /?)  
The SCPI command is *SYST:CONN:SER:NUMB* (or see the programming manual)
- Added a field to input DC value correction in time domain
- Fixed bug with *CALC1:DATA:FDAT?* SCPI command for Smith and Polar formats when selecting various output Log/Phase, Lin/Phase, Re/Im, R/X, G/B

## Version 21.1.6

- Fixed issue with spikes seen in the S5243 VNA
- Added SCPI command for 'Theory' selection under Port Z conversion menu

## Version 21.1.5

- Added ACM support for Scalar Mixer Calibration method

## Version 21.1.1

- Fixed bug with Vector Mixer Calibration when the operating frequency exceeded instrument's frequency range

## Version 20.4.1

- Added ACM support for Vector Mixer Calibration, adapter removal
- Removed '+' sign in saved touchstone files

## Version 20.3.1

- Added support for S5045 and M5045 VNAs
- Added support for Lady Bug (LB4xx, LB5xx and LB6xx) power sensors

## Version 20.2.4

- Socket binary transfer is now terminated by NL

## Version 20.2.3

- Added support for S5435 VNA

## Version 20.2.2

- Added option for saving touchstone file to include trace specific operations such as time domain gating:  
*Save/Recall > save Data To Touchstone File > Include Active Trace Transform*

## Version 20.2.1

- Realized partial characterization of 4-port ACMs with a 2-port VNA

## Version 20.1.3

- Added the Save/Recall calibration only feature. The SCPI commands:  
MMEM:LOAD:CHAN:CAL  
MMEM:STOR:CHAN:CAL

## Version 20.1.2

- Fixed the Loss Compensation bug in power calibration
- Added support for the university series VNAs: CMT304U, CMT804U
- Added SCPI and COM commands for the reverse sweep feature
- Added support for LadyBug LB59xx power sensors.
- Added the Step Size feature for the most used numeric input fields (the feature activates on the right mouse click on the field)

## Version 20.1.1

- Fixed S5180 issue with the extended dynamic range.
- Fixed initialization issues with Cobalt VNAs
- Improved CW time accuracy

## Version 19.4.3

- Extended the upper frequency of the custom frequency extenders selection to 110 GHz when using C4209 VNA

## Version 19.4.2

- USB: Fixed the S5180 firmware bugs:
  - Eliminate false Power Trip actuation
  - Enhanced the dynamic range expansion function

## Version 19.4.1

- Added support for ACM2506, ACM2504
- Added support for SC5065 and SC5090

## Version 19.3.3

- Added support for SC5090

## Version 19.3.2

- Added SCPI support for the vector mixer calibration
- The SCPI manual has been transformed to \*.chm format

## Version 19.3.1

- Added the waveguide correction in the electrical delay function

## Version 19.3.0

- Added ACMB2506 support
- Turns off the RF power when the software terminates
- Added SCPI/COM command for one path 2-port calibration using AutoCal Module (SENS:CORR:COLL:ECAL:ERES)
- Added SCPI/COM command for confidence check using AutoCal Module (SENS:CORR:COLL:ECAL:CCH)

## Version 19.2.6

- Added COM command for setting separator symbol in the Touchstone file (SCPI.MMEMory.STORe.SNP.Separator)

## Version 19.2.5

- Changed the SCPI command SYST:READy? behavior in the S5180 model. Now the READY state arises after the frequency alignment step

## Version 19.2.4

- Fixed the SCPI compound statement bug
- Added SCPI command for setting separator symbol in the Touchstone file (MMEM:STOR:SNP:SEP).

## Version 19.2.3

- Fixed a bug related to the CW time feature

## Version 19.2.2

- Fixed a bug in the 'About' window where the model, hardware revision and serial number showed incorrect data

## Version 19.2.1

- Added CW Sweep Time function.
- Added command line keys for enabling and configuring the Socket Server and the HiSLIP Server. For full command line help launch the S2VNA application with key /? For example: S2VNA /?
- Updated FET-1854 firmware allowing work with long digital cables up to 20 meters.

## Version 19.1.3

- Fixed an issue with the Cobalt DSP firmware that was introduced in S2VNA v19.1.2 and possibly v19.1.1 which prevented the S2VNA software from working consistently with Cobalt VNAs

## Version 19.1.2

- Added support for M Series VNAs

## Version 19.1.1

- Added support for Keysight U2000 Series USB power sensors
- Added support for Keysight U8480 Series USB power sensors

## Version 18.3.3

- Added support for ACM4520.1
- Added print to file function with uncial file names

## Version 18.3.2

- Added an option for saving the touchstone file format with either Space or Tab as the separator character
- Fixed a bug in the Time Domain function when the number of points set was more than 50,000

## Version 18.3.1

- Fixed a bug with the Vector Mixer Calibration menu. Now the \*.s2p file of the mixer automatically de-embeds upon completing the calibration process

## Version 18.2.4

- Added T4311 and Z5411 to the predefined list in the calibration table

## Version 18.2.3

- Added support for the S5180 VNA
- Updated the operating manual

## Version 18.2.2

- Fixed a bug related to the Frequency Offset Mode with S5065/S5085 models

- Added the ability to customize the language shown on the VNA GUI using the language template file (DIY localization) and the language select menu

#### Version 18.2.1

- Added support for the FET1854 extenders
- Improved the Auto-orientation algorithm for poorly matched test setups

#### Version 18.2.0

- Improved the Automatic Calibration Module (ACM) functionality with the software
- Fixed a bug with the “Unknown thru addition” algorithm
- Fixed a bug with the \*.CSV file output format when the saving Polar and Smith displays
- Changed the recall state logic. Now recalling the “State Only” file retains the current calibration
- Fixed a bug in the HiSLIP protocol and the SCPI command \*OPC?
- Fixed the "CMT S2 and S4 VNA" LabView driver from the "Programming Examples and Guides"
  - The data fetch vi's had unnecessary delay that slow down the execution
  - Fixed a bug in the “Send Trigger.vi”
  - Fixed a bug in the “Wait for Operation Complete.vi”

#### Version 18.1.5

- Added the definitions of the new calibration kits: S911T, N1801 and S2611
- Fixed a few minor bugs

#### Version 18.1.2

- Updated the operating manual

#### Version 18.1.0

- Implemented S-parameters renormalization transformation to the complex reference impedance

- Added the Frequency Auto Adjust Function while measuring a mixer with an internal LO without the ability of having common reference source

## Version 17.3.7

- Added support for the C1220 hardware version 2.0

## Version 17.3.6

- Added support for the new ACM2509 hardware version 2.0, R&S NRP110T power sensor and third-party frequency extenders

## Version 17.3.2

- Introduced new LabView driver using SCPI commands and VISA library (The previous driver used COM commands and is not recommended for new developments)
- Added memory FIFO function, up to 8 memory traces
- Fixed limit test issue with log sweep mode
- Fixed a bug with the S5048, S7530 models where the sweep freezes sometimes after powering on
- Improved termination of the VNA application when closing the COM reference

## Version 17.2.5

- Driver and installer are digitally signed using an enhanced certificate. Enables driver installation on all Windows versions including fresh (non-upgraded) installations of Windows 10, version 1607 with Secure Boot ON
- Added Invisible Mode feature. Wherein a user can hide the GUI, while programmatically access all the functions

## Version 17.2.3

- Both driver and installer are now digitally signed using a CMT certificate. Improves installation and is tested for all Windows versions except fresh (non-upgraded) installations of Windows 10, version 1607 with Secure Boot ON

## Version 17.2.2

- Added support for the model C4220
- Added the ability to assign a marker's color

## Version 17.2.1

- Implemented the Max/Min Trace Hold Function

## Version 17.2.0

- Added HiSLIP protocol functionality: an update to TCP/IP functionality of the instrument
- Updated SxVNA programming manual to reflect additional SCPI commands
- Fixed a bug related to the external reference setting on S5065 and S5085 models

## Version 17.1.3

- Fixed a bug affecting measurement results of models S5065 and S5085

## Version 17.1.2

- Improved the CSV save function with one-click, multi-trace saving and advanced formatting options

## Version 17.1.1

- Added new trigger functions: averaging trigger and calibration trigger source (including point trigger for calibration)

## Version 16.4.5

- Added support for Cobalt auxiliary voltmeter input module

## Version 16.4.2

- Fixed a bug related to limit test that would prevent a measurement point from being tested

## Version 16.4.1

- Added a new Security Level feature to hide frequency values during measurement

## Version 16.3.2

- Fixed a bug SCPI command interface bug related to the SElected]:MARKer:FUNcTion:DOMain group of commands

## Version 16.3.1

- Fixed a bug related to establishing a TCP Socket Server connection after calibration

## Version 16.3.0

- Added a new automation interface: SCPI commands can be sent over TCP/IP socket

## Version 16.2.5

- Added support for new instruments: C2220, C1209 v2 (extended dynamic range), S5065 and S5085

## Version 16.2.4

- Fixed a bug in the MCM plugin when used jointly with the Port Extension function

## Version 16.2.3

- Special version temporarily enabling (unspecified) S5048 operation from 9 kHz

## Version 16.2.2

- Fixed a bug in the Unknown Thru Addition function related to loading calibration coefficients from a state file

## Version 16.2.1

- Fixed various minor bugs
- Changed the step increment of the power input field to 0.1 dB

## Version 16.1.0

- Fixed a bug related to IFBW settings below 10 Hz in the S5048 and S7530 models
- Changed the application icon

## Version 15.4.0

- **IMPORTANT:** All instruments in the S2 Family (reversing 2-Port VNAs) now share a common installer and software; instrument type can be dynamically detected or manually set on the System->Misc Setup menu. Version 16.1.0 supports the Planar 304/804/814, S5048/7530, and Cobalt 1209/1220 instruments
- **IMPORTANT:** This software release includes significant changes to the name of the COM interface. Legacy programs written in C# and VB.NET may experience issues related to the COM server name change, necessitating a code modification and recompile
- **IMPORTANT:** This software release includes significant changes to demo/simulator mode: during installation, select whether the software should run in a demo/simulator mode or not. This setting can be changed later on the System->Misc Setup menu
- **IMPORTANT:** The version number now reflects the year of release, major, and minor revisions; it is unified across software families
- The program can be limited to connect with any particular VNA instrument type and/or serial number
- Added two kits (N611/12/911/12 S/N Axx, Bxx and N611/12 S/N 4xx, 5xx, 6xx) to the predefined calibration kit table
- Added simulation mode for forthcoming instruments
- Added Reverse Sweep (sweeping from higher frequencies to lower frequencies)
- Improved the Gating algorithms with respect to window roll-off effects
- Changed the COM interface to the more universal name: IS2VNAPtr

- Added a new more universal name for the COM server: S2VNA.Application

## Version 3.52

- Fixed a problem with figures in the Operating Manual

## Version 3.51

- Added new plug-in for matched circuit modelling
- Updated automation examples and guides
- Modified the auto port extension function; now the full frequency range is used to determine extension delay
- Fixed a bug related to port extension not working when de-embedding is active
- Fixed a bug related to the beep sound at the end of a calibration sweep

## Version 3.50

- Fixed a bug related to incorrect marker position when recalling a saved state file

## Version 3.49

- Added Adapter Removal calibration
- Added the Autoscale All function
- Added Unknown Thru Addition calibration
- Added support for plugin programs
- Added a user prompt when loading touchstone file with stimulus settings different from the active settings
- Reworked programming examples and guides
- Removed the frequency adjustment function
- Fixed a bug related to disappearance of the Cal Kits table below the plot window
- Fixed a bug related to power level setting when an a state file created in a version the program predating the port power coupling feature is recalled

- Fixed a bug related to time position of the sampling window relative to a trigger event when an external trigger is used

## Version 3.48

- Added Trigger scope function
- Added ability for user to erase the User Characterization from an attached Auto Calibration Module (ACM)
- Changed behavior of Port Switching Delay function; disabled by default due to incompatibility with certain earlier hardware revisions
- Added a COM command SCPI.SENSE(Ch).SElected.CORRection.Status to allow for checking the active trace's correction status (Planar 804/1 only)

## Version 3.47

- Added support for AutoCal Module (ACM) characterization using segment sweep mode, enabling ACM to be used down to 20 kHz

Added support for the 4-port AutoCal Module ACM8400T

Added support for 2-Port, One-path Calibration using ACM

Added auto port extension feature

Added support for waveguide calibrations and waveguide calibration kit definitions

Made enhancements to port switchover delay behavior:

Reduced minimum port switching delay from 10 msec to 0 msec

Added Stimulus Port Switching Delay setting to maximize port power level accuracy when stimulus direction is changing; the delay value applied depends on the analyzer model: 40 ms for Planar-804/1, 10 ms for other models

## Version 3.46

Changed Fdata property to read/write from read only

## Version 3.45

Added support for Planar 804M. Build "a" adds calibration comparison functionality

## Version 3.44

Changed processing order of the Time Domain/Gating function and the S-parameter conversion function: now Time Domain/Gating precedes S-parameter conversion (Analysis > Conversion)

Added new COM commands to switch ON/OFF the display of various GUI elements

## Version 3.43

Added general s-parameter conversion

Added overload indication and power trip function (S5048, S7530)

Added support of the SC4000 75-Ohm Autocal Module

Fixed a bug related to incorrect impedance marker value with Smith (R+jX) chart display format when the Port Impedance Conversion function is active

## Version 3.42

Added function "Restore Previous Session"

Fixed a few bugs

## Version 3.41

Extended Time Domain functionality

Unit selection of seconds, meters, or feet

Reflection Type selection of either Round Trip or One Way

Cable correction function allowing for velocity factor and cable loss correction

Cable data can be entered manually or selected from a cable table

Cable table includes commonly used cables and can be extended by the user

Cable table data is saved when the program is closed

Added related remote commands (see PM)

Fixed bugs introduced in version Version 3.40 related to the GUI display

Added an indication of a failed S2P file load

## Version 3.40

Added description of the CMT N611, N612 Cal Kits

Changed the recall state logic: recalling the "State Only" file retains the current calibration

The IFBW button is now duplicated in the "Stimulus" menu

## Version 3.39

Added independent port power control feature

Added Source/Receivers frequency offset feature

Added Point feature for external trigger

Added new COM command to support features above

## Version 3.38

Added access to all 4 receivers when absolute measurements are performed. Receiver data is now complex valued. Both GUI and COM allow setting of all receiver/stimulus combinations and retrieving of complex data

## Version 3.36

Fixed miscellaneous bugs

Changed COM server registration method. Now the COM server is registered during the software installation procedure or by using the keyword /REGSERVER

Added the automatic USB driver installation in the software installation procedure

## Version 3.35

Fixed a bug with the AutoCal confidence check function in a one port scenario

## Version 3.34

Added SCPI.CALCulate(Ch).SElected.MARKer.MATH.FLATness.DATA

Added SCPI.CALCulate(Ch).SElected.MARKer.MATH.FLATness.STATe

Added SCPI.CALCulate(Ch).SELected.MARKer.MATH.FLATness.DOMain.START

Added SCPI.CALCulate(Ch).SELected.MARKer.MATH.FLATness.DOMain.STOP

## Version 3.33

Added new function "Band Limit". The Function checks whether the frequency of a minimum (case of Notch) or maximum (case of Peak) of the trace falls within a specified frequency band

## Version 3.32

Fixed bug related to segment table loading; previously if any segment except the first contained only 1 point, the next segment indicated an invalid start frequency value

## Version 3.31

Fixed a bug in SCPI.CALCulate(Ch).SELected.SMOothing.APERTure

Added a new COM command to remote load Touchstone file to the memory trace:

SCPI.MMEMory.LOAD.SNP.TRACe(Tr).MEMory = File

Added new COM command to remote load Touchstone file to the S-parameters: SCPI.MMEMory.LOAD.SNP.DATA = File

Added new COM/DCOM application object names "S5048.Application" and "S7530.Application". COM/DCOM application object may be created using these names as well as "Obzor304.Application" and "Obzor804.Application"

## Version 3.30

Fixed an access violation error in the AutoCal procedure. The error was introduced in the previous version of software.

## Version 3.29

Planar 304 and 804 only: Start frequency was changed to 100 kHz. Factory calibration of the instruments produced after March 2013 starts from 100 kHz. Factory calibration of the instruments produced before March 2013 starts from 300 kHz. The power level accuracy of the instruments produced before march 2013 is out of specification

from 100 kHz to 300 kHz (typical error is not greater than 3 dB). If needed the instrument may be recalibrated across the full frequency range at an authorized service center

Planar 804 only: modified spur reduction algorithm

## Version 3.28

Fixed bug in the COM command SCPI.SENSE(Ch).SEGMENT.DATA. Error description: Number of Points of first segment always was assigned 1, irrespective of actual parameter

Fixed bug in the COM command SCPI.SENSE(Ch).FREQUENCY.DATA when the sweep type is SEGMENT. Error description: Abnormal program termination

Enhanced COM remote control compatibility with MATLAB. Problem description: arguments passed from MATLAB to COM server as a one-dimensional array are converted to two-dimensional arrays when passed. Problem solved

Updated Operating and Programming Manuals

## Version 3.27

COM command SCPI.CALCULATE(Ch).SELECTED.LIMIT.DATA now supports Single Point Limit function

## Version 3.26

Corrected definition of Maury 8050A/Y, 8050B, 8850P/Q, 8860A calibration kits

Fixed bug with printing via menu system > print > print embedded (blank image sometimes)

Installation and driver pack test on Windows 8 64-bit and 32 bit is Ok

## Version 3.25

Added Maury calibration kits definition: 8050A/Y, 8050B, 8850P/Q, 8860A

## Version 3.24

Corrected limit test issue when frequency span is zero or too small

## Version 3.22

Number of points increased to 500001 for 8 GHz version, and to 200001 for Version 3.2 GHz

## Version 3.21

Added new *Multiline* TRL option in 2-Port TRL Calibration menu

## Version 3.20

AutoCal remote control command set. All undocumented yet commands has been added to Programming manuals

## Version 3.19

Fixed bug with external reference source switching. Bug was only present in Version 3.17 and Version 3.18

## Version 3.18

Load Touchstone File Data feature added

## Version 3.17

Several small bugs fixed

## Version 3.16

Extended the application of Port Extension feature to Frequency Offset Mode

## Version 3.15

Fixed an Access Violation Error

## Version 3.14

Added Single Point Limit function

Added Folder History; last opened folder appears by default

Fixed a bug related to On Screen Keyboard in Edit Title Label menu

Fixed a bug related to scroll in Display > Properties > Font Size > Soft Button menu

Added Bold Property setting in the Font Menus

Fixed a bug related to loading Cal Kits from file

Discontinued the continuous limit test beep warning feature

## Version 3.13

Added continuous beep warning in the limit test mode as per customer request

## Version 3.11

Calibration kit Agilent 85032F is selected by default

Executable renamed to Planar.exe. This change applies to Planar 304/1 and 804/1 models. It can be renamed by the user if necessary.

## Version 3.10

User interface of "unknown thru" calibration is improved. Definitions of all calibration kits are augmented to include an "unknown thru" standard in order to simplify the user choosing between "conventional thru" and "unknown thru" calibration

## Version 3.9

Bug fixed related to frequency setting error during performance tests (7.6.7, 7.6.8)

## Version 3.8

Fixed a bug which was causing receiver noise floor rise of 20 dB when the user switches the 10 MHz reference source to external and then back to internal. The problem appeared when IFBW was > 10 kHz. The issue has been resolved by a software workaround

## Version 3.6



# Software Release Notes

S2 Family

Full 2-port VNAs from Planar, S and Cobalt Series

304/804/814  
M5045/5065/5090  
SC5065/5090  
S5048/7530/5045/5065/5085/S5180  
Cobalt x209/x220  
CobaltFX

Offset Delay in “unknown thru” definition appears as AUTO when Offset Delay equals to zero

Instrument doesn't return to LOCAL state if changed to REMOTE state by SCPI command via the LAN interface. Bug fixed