EXTEND YOUR REACH

50-75 GHz | 60-90GHz | 75 - 110 GHz

COBALTFx

COPPER MOUNTAIN TECHNOLOGIES

Farran Technology

CobaltFx

50 - 75 GHz

60 - 90 GHz

75 - 110 GHz

COBALT Fx

Extend Your Reach

Farran Technology and Copper Mountain Technologies, globally recognized innovators, with a combined 50 years' experience in RF test and measurement systems have partnered to create CobaltFx; your new millimeter-wave frequency extension solution.

CobaltFX is the first mmWave frequency extension solution that utilizes a 9 GHz VNA. CobaltFx's high dynamic range and directivity allow for highly accurate and stable millimeter-wave S-parameter measurements in three dedicated waveguide bands 50-75 GHz, 60-90 GHz, and 75-110 GHz. CobaltFx offers an unparalleled combination of price, performance, flexibility and size.

C4209, the VNA used in this system, is from Copper Mountain Technologies' industry leading Cobalt Series. It features fast sweep speeds down to 10 microseconds per point and a dynamic range of up to 160 dB, all comprised in a compact, USB form factor. C4209 works seamlessly with Farran Technology's millimeter-wave FEV frequency extenders.

The extenders are packaged in small and versatile enclosures, that allow for flexible port arrangements with respect to the waveguide. Waveguide ports are manufactured in accordance to the new IEEE 1785a standard and ensure industry best alignment and repeatability of connection, allowing for long interval times between calibration. The system comes with a precision calibration kit containing flush short, offset piece and broadband load and allows for full 12-term port calibration.

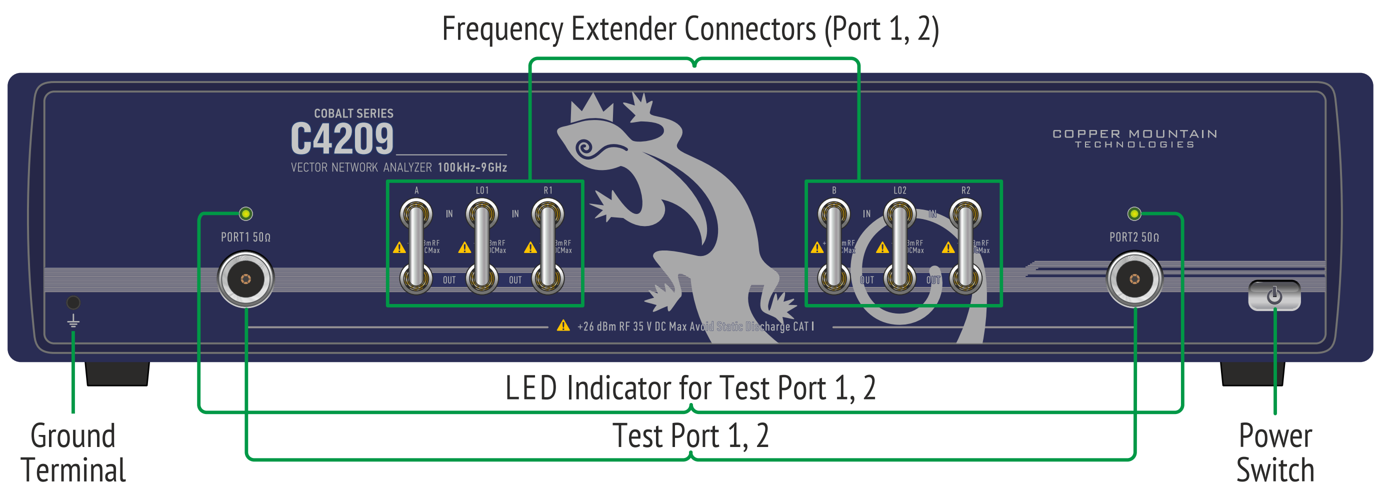
visit **www.coppermountaintech.com or www.farran.com** for more information.

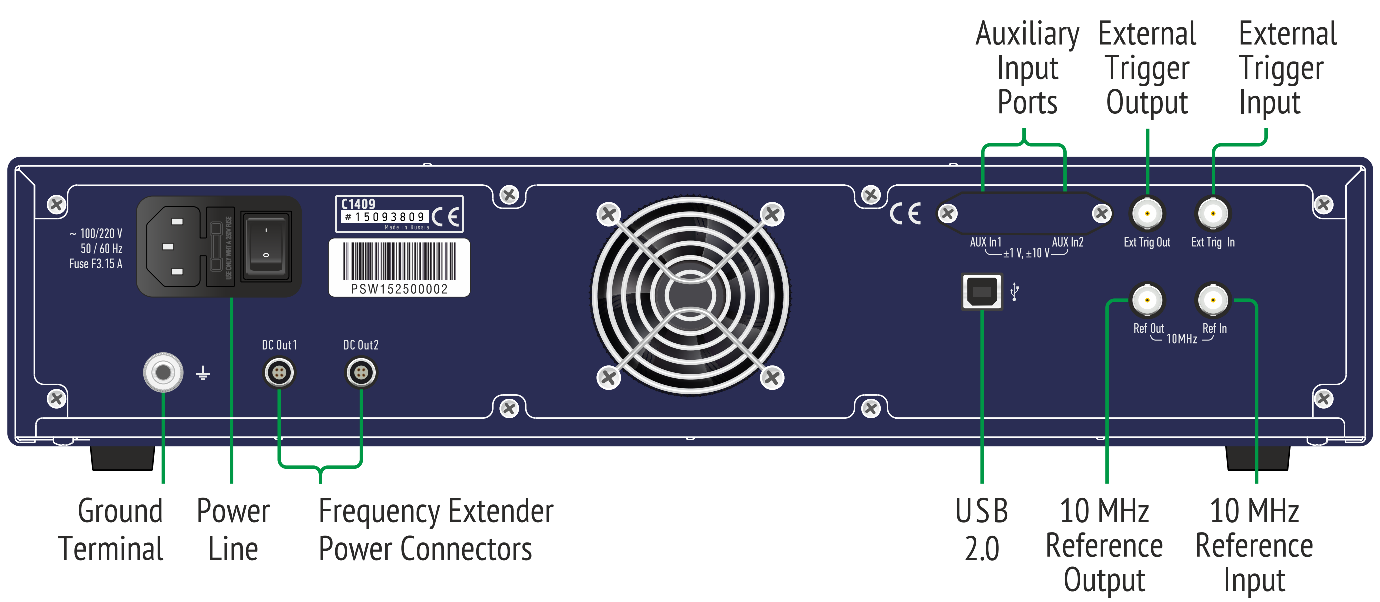
from:

COPPER MOUNTAIN TECHNOLOGIES

Farran Technology

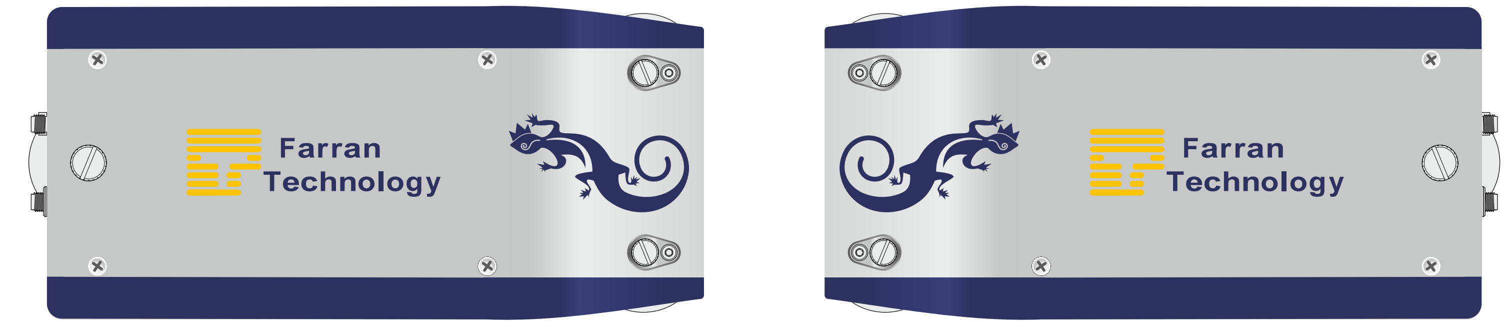
C4209 Front



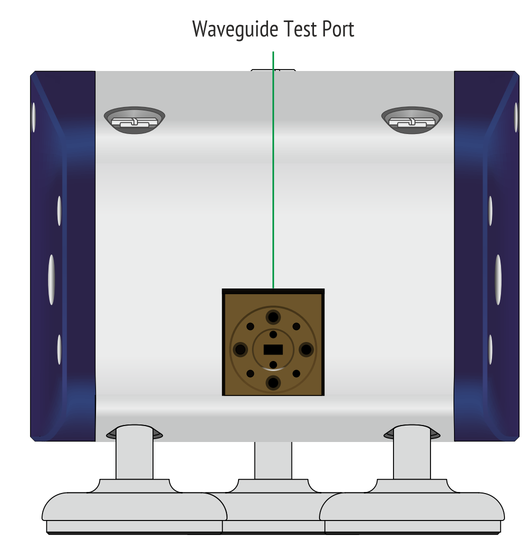


C4209 Back

Extender Top



Extender Front



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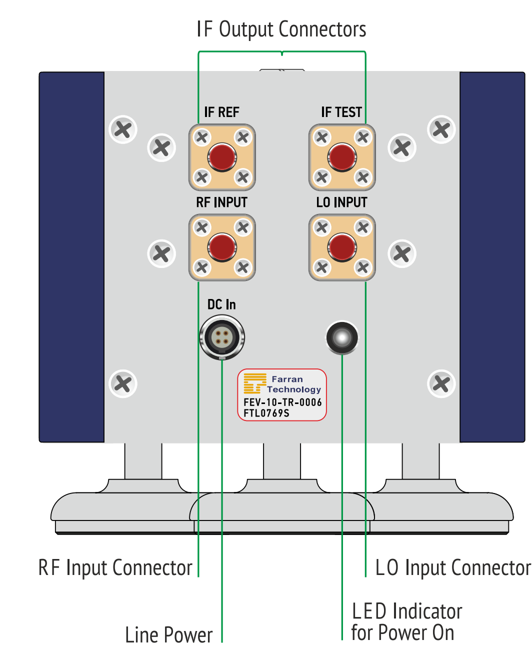
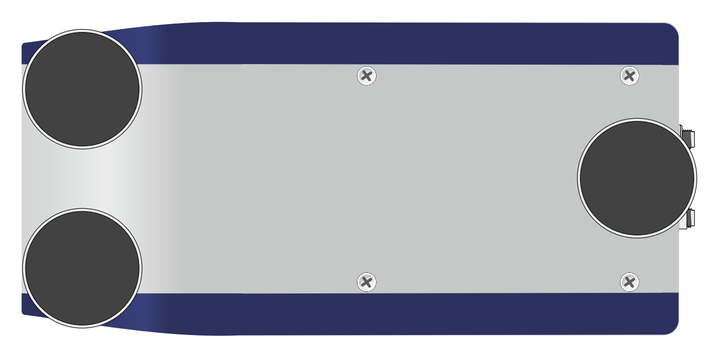
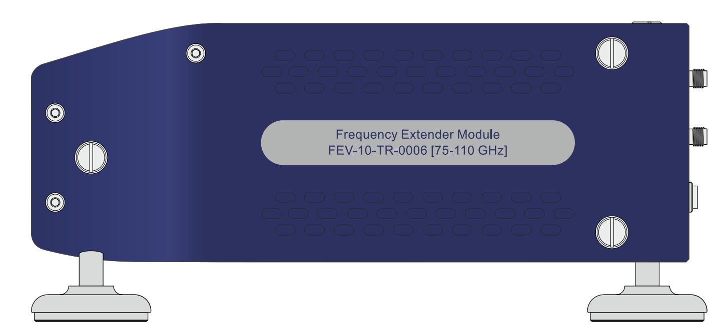


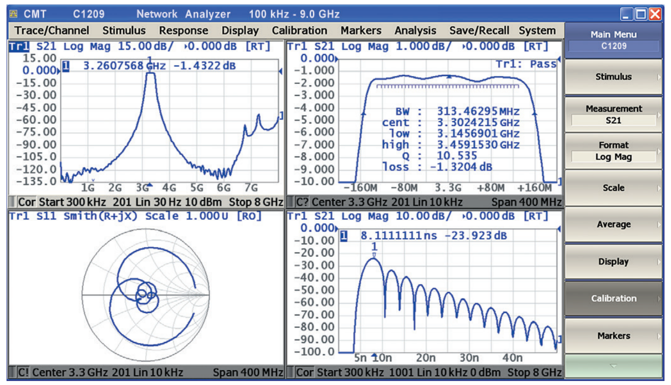
Extender Bottom

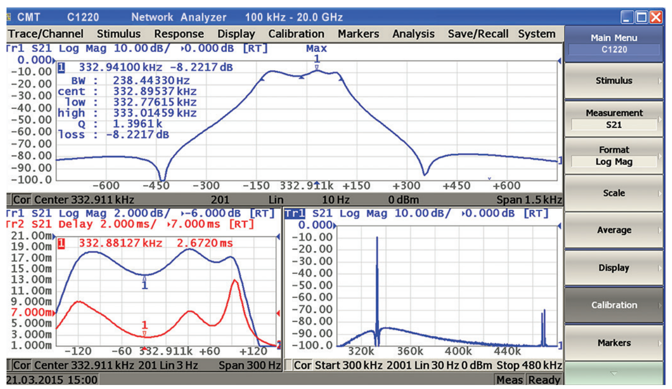


Extender Side



Measurement Capabilities





Measured parameters

S_{11}, S_{21}, S_{12}, S_{22} and absolute power of the reference and received signals at the port.

Number of measurement channels

Up to 16 independent logical channels: each logical channel is represented on the screen as an individual channel window. A logical channel is defined by such stimulus signal settings as frequency range, number of test points, or power level.

Data traces

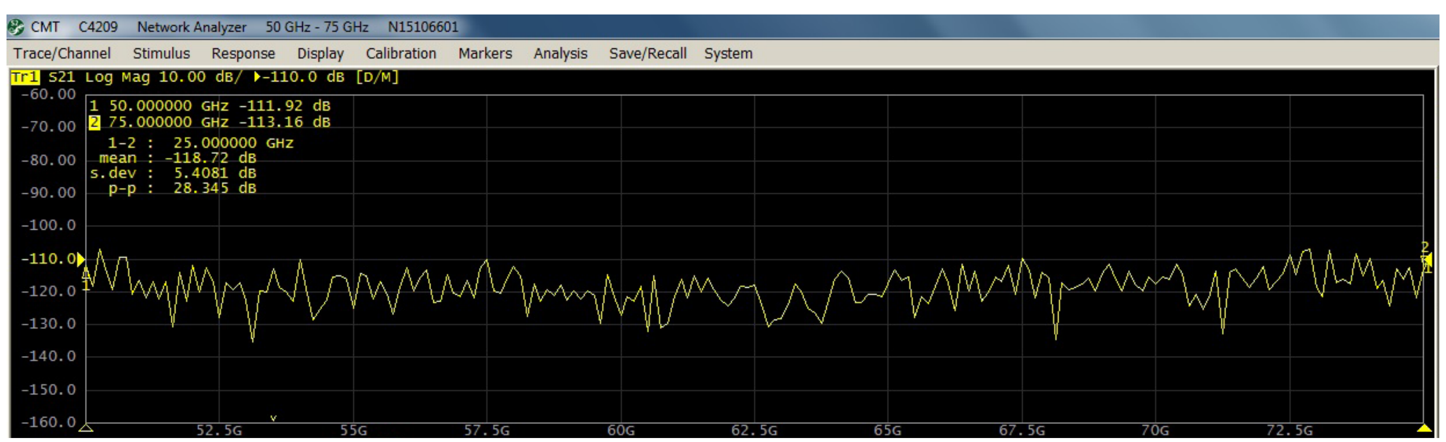
Up to 16 data traces can be displayed in each channel window. A data trace represents one of such parameters of the DUT as S-parameters, response in time domain, input power response.

Memory traces

Each of the 16 data traces can be saved into memory for further comparison with the current values.

Data display formats

Logarithmic magnitude, linear magnitude, phase, expanded phase, group delay, SWR, real part, imaginary part, Smith chart diagram and polar diagram display formats are available.



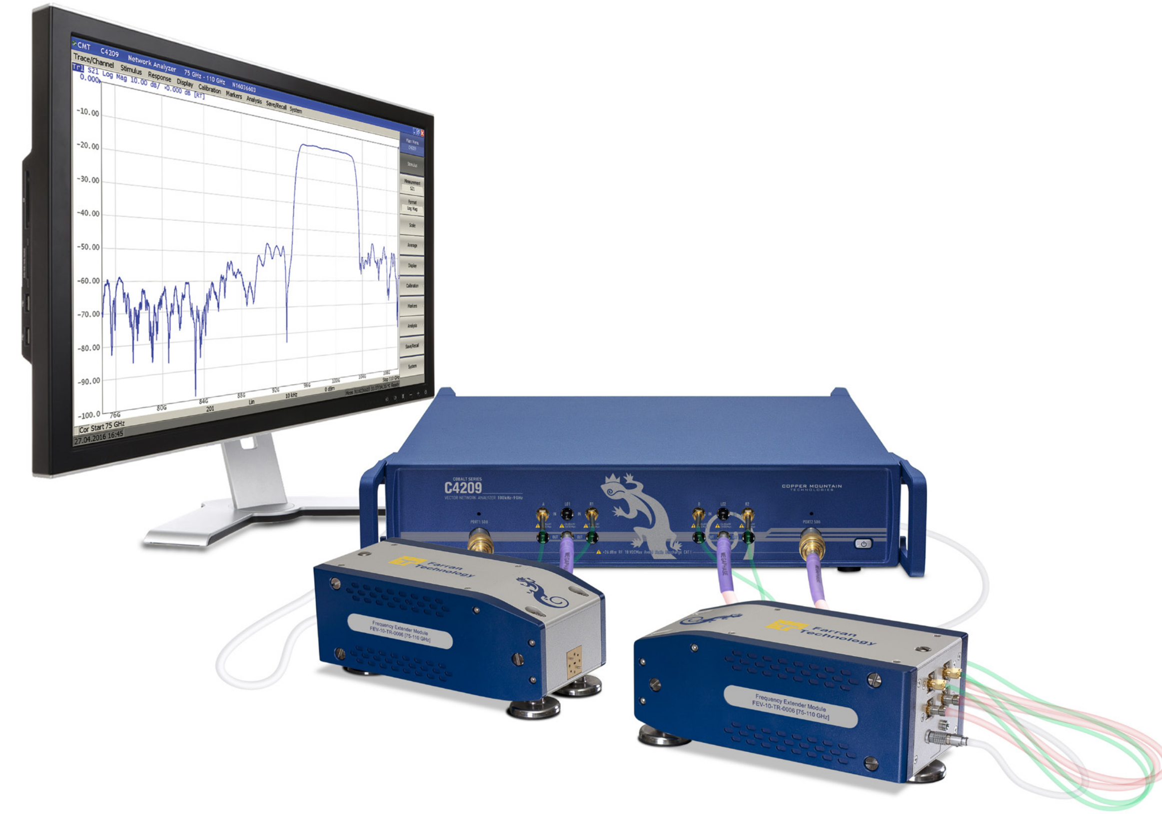
Dynamic Range vs IF Bandwidth

Extension module 1: 50-75GHz this is information about this extension module

Extension module 2: 60-90GHz this is information about this extension module

Extension module 3: 75-110GHz this is information about this extension module

Applications & Examples



Material Characterization

Material characterisation: test fixture based (transmission line, resonance) and free space based for permittivity, dielectric loss tangent and resistivity measurements. This application is touching on the problem that companies like Rogers, Taconic and the likes have in characterising their products up to 110 GHz.

5G Applications

5G applications: Multiple-element antenna testing and beamforming characterisation at 73 GHz.

WiGig at 60 GHz

WiGig at 60 GHz: Multiple-element antenna testing and beamforming characterisation at 60 GHz – essentially the same as the 5G, only at different frequency with different medium constraints (propagation channel loss) to play with. Companies involved in this activity: Intel, Samsung, Cisco, Qualcom, Microsoft.

Backhaul at 70 & 80 GHz

Backhaul at 70 and 80 GHz. Companies involved: Verizon, Erikson, Nokia etc.

Automotive Radar & Sensor Testing

Automotive (and non-automotive) radar and sensor testing at 77-79 GHz.

On Wafer S-parameter Measurements:

On wafer S-parameters measurements: transistor characterisation for model extraction and mmic evaluation. WIN Semi, Ommic, UMS and other semiconductor manufacturers but also system integrators.

Bench-top DUT Characterization

Bench-top DUT characterization: evaluation of packaged active and passive mm-wave components.

Antenna Range Measurements

Antenna range measurements. Somewhat contains ii and iii described above. Normally here a customer would an antenna system integrator: Orbit FR, NSI etc.

Sweep Features

Sweep type

Linear frequency sweep, logarithmic frequency sweep, and segment frequency sweep occur when the stimulus power is a fixed value. Linear power sweep occurs when frequency is a fixed value.

Measurement points per sweep

Set by the user from 2 to 500,001

Segment sweep features

A frequency sweep within several independent user-defined segments. Frequency range, number of sweep points, source power, and IF bandwidth should be set for each segment.

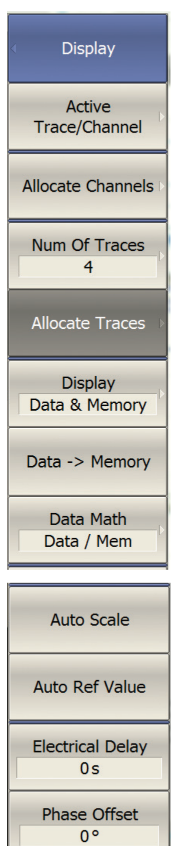
Power

Source power from -60 dBm to +15 dBm with resolution of 0.05 dB. In frequency sweep mode, the power slope can be set up to 2 dB/GHz for compensation of high frequency attenuation in connection wires.

Sweep trigger

Trigger modes: continuous, single, or hold. Trigger sources: internal, manual, external, bus.

Trace Functions



Trace display

Data trace, memory trace, or simultaneous indication of data and memory traces.

Trace math

Data trace modification by math operations: addition, subtraction, multiplication or division of measured complex values and memory data.

Autoscaling

Automatic selection of scale division and reference level value allow the most effective display of the trace.

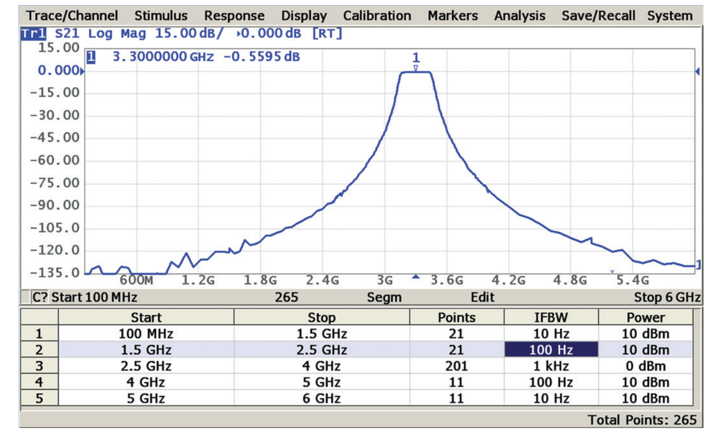
Electrical delay

Calibration plane moving to compensate for the delay in the test setup. Compensation for electrical delay in a device under test (DUT) during measurements of deviation from linear phase.

Phase offset

Phase offset is defined in degrees.

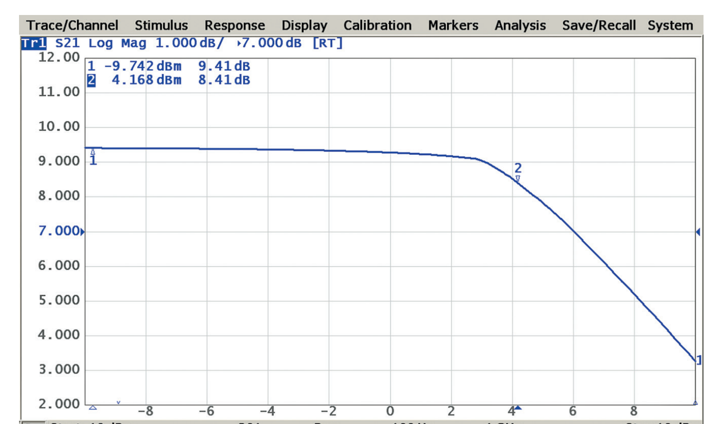
Frequency Scan Segmentation



Frequency scan segmentation

The VNA has a large frequency range with the option of frequency scan segmentation. This allows optimal use of the device, for example, to realize the maximum dynamic range while maintaining high measurement speed.

Power Scaling & Compression Point Recognition



Power scaling & compression point recognition

The power sweep feature turns compression point recognition, one of the most fundamental and complex amplified measurements, into a simple and accurate operation.

Mixer/Converter Measurements

Scalar mixer/converter measurements

The scalar method allows the user to measure only the magnitude of the transmission coefficient of the mixer and other frequency translating devices. No external mixers or other devices are required. The scalar method employs port frequency offset when there is a difference between the source port frequency and the receiver port frequency.

Scalar mixer/converter calibration

This is the most accurate method of calibration applied for measurements of mixers in frequency offset mode. The OPEN, SHORT, and LOAD calibration standards are used. An external power meter should be connected to the USB port directly or via USB/GPIB adapter.

Vector mixer/converter measurements

The vector method allows the measurement of both the magnitude and phase of the mixer transmission coefficient. This method requires an external mixer and an LO common for both the external mixer and the mixer under test.

Vector mixer/converter calibration

This method of calibration is applied for vector mixer measurements. OPEN, SHORT, and LOAD calibration standards are used.

Automatic frequency offset adjustment

This function performs automatic frequency offset adjustment when the scalar mixer/converter measurements are performed to compensate for internal LO setting inaccuracy in the DUT.

Measurement Automation

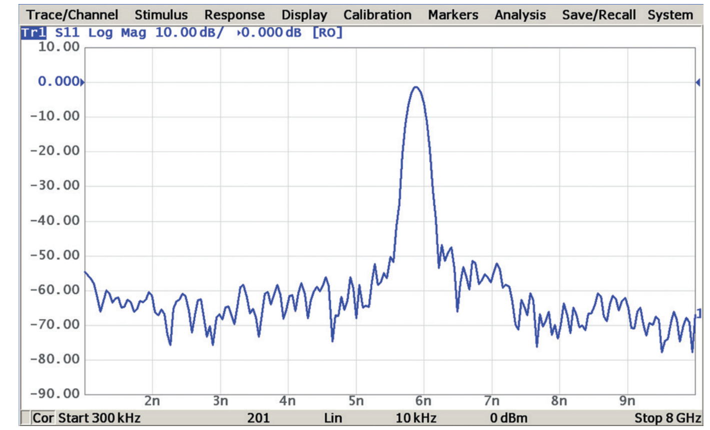
COM/DCOM compatible

Cobalt's software is COM/DCOM compatible, which allows the unit to be used as a part of an ATE station and other special applications. COM/DCOM automation is used for remote control and data exchange with the user software. The Analyzer program runs as COM/DCOM client. The COM client runs on Analyzer PC. The DCOM client run on a separate PC connected via LAN.

LabView compatible

The device and its software are fully compatible with LabView applications, for ultimate flexibility in user-generated programming and automation.

Time Domain Measurements

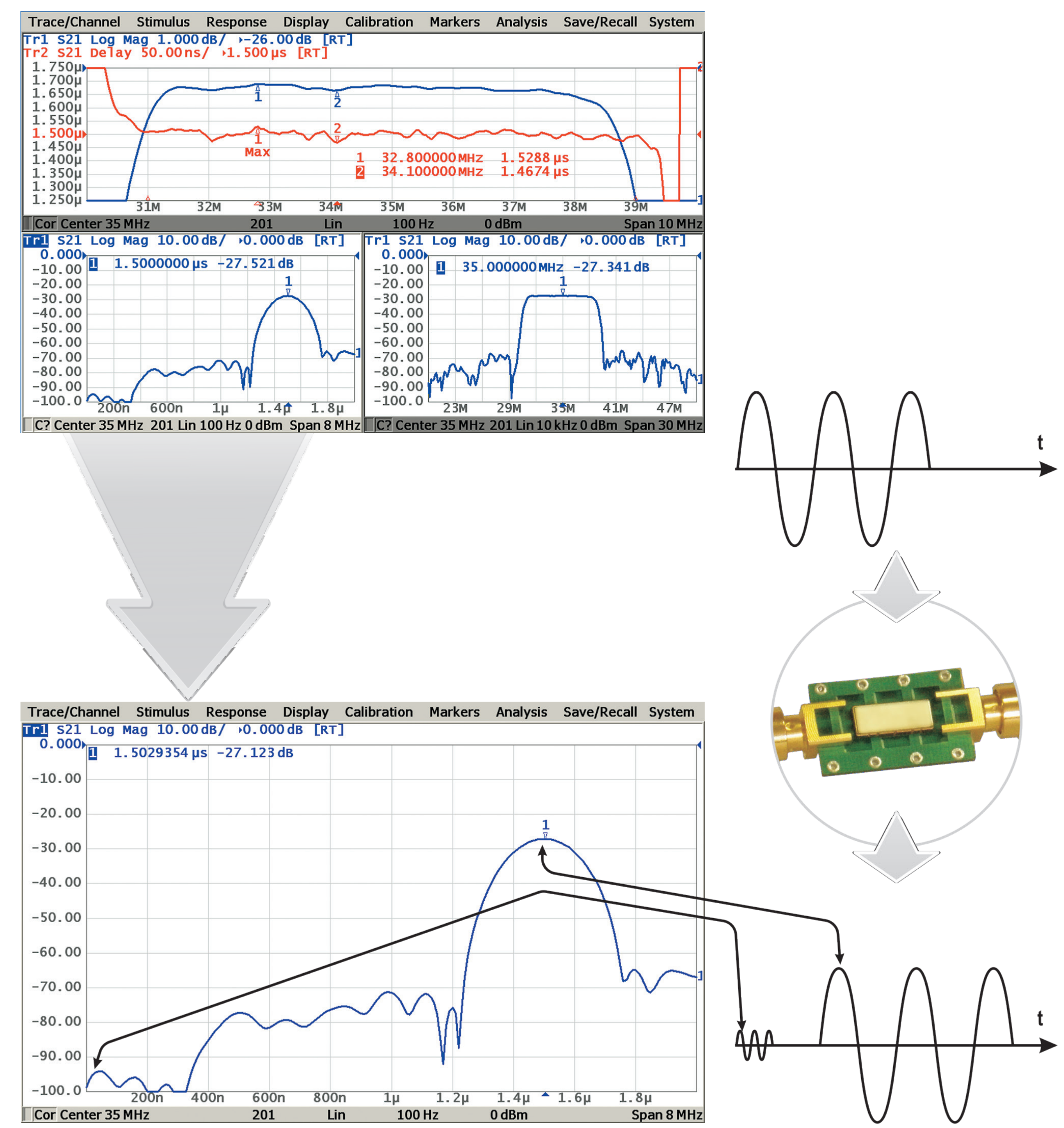


Time domain measurements

This function performs data transmission from frequency domain into response of the DUT to various stimulus types in time domain. Modeled stimulus types: bandpass, lowpass impulse, and lowpass step. Time domain span is set by the user arbitrarily from zero to maximum, which is determined by the frequency step. Windows of various forms are used for better tradeoff between resolution and level of spurious sidelobes.

Here, built in time domain analysis allows the user to detect a physical impairment in a cable.

Time domain analysis allows measurements of parameters of SAW filters such as the signal time delay, feedthrough signal suppression.



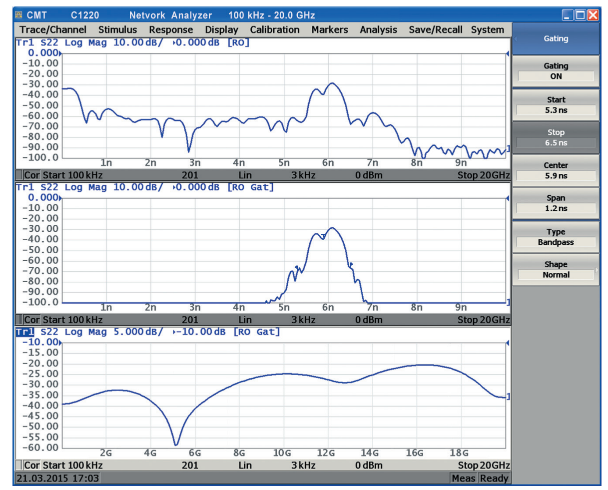
Time Domain Gating

Time domain gating

This function mathematically removes unwanted responses in the time domain, which allows the user to obtain frequency response without influence from fixture elements.

This function applies reverse transformation back to the frequency domain after cutting out the user-defined span in time domain. Gating filter types: bandpass or notch. For a better tradeoff between gate resolution and level of spurious sidelobes the following filter shapes are available: maximum, wide, normal and minimum.

Applications of these features include, but are not limited to: measurements of SAW filter parameters, such as filter time delay or forward transmission attenuation.

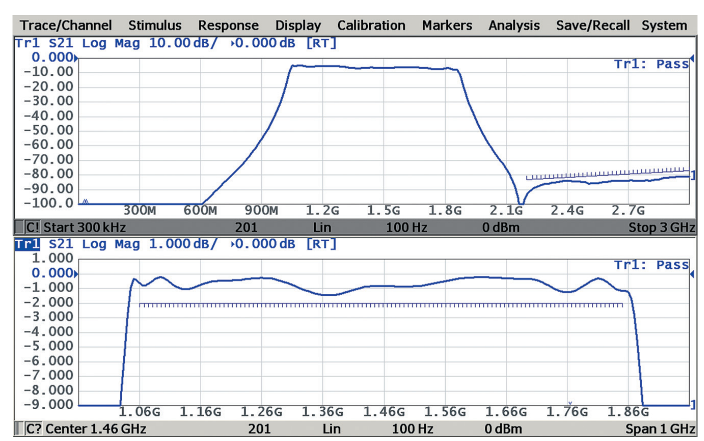


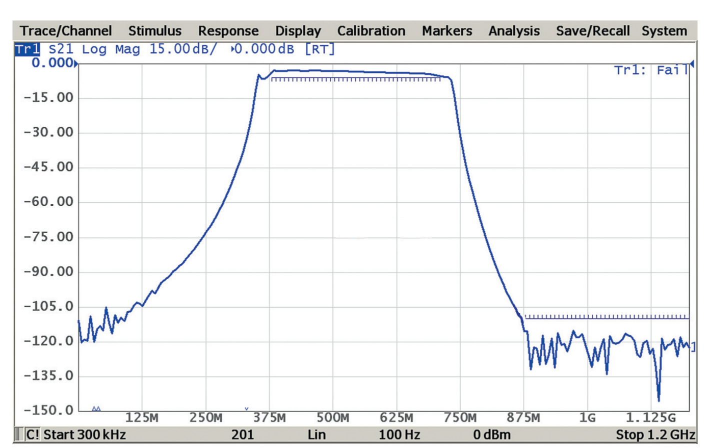
Limit Testing

Limit testing

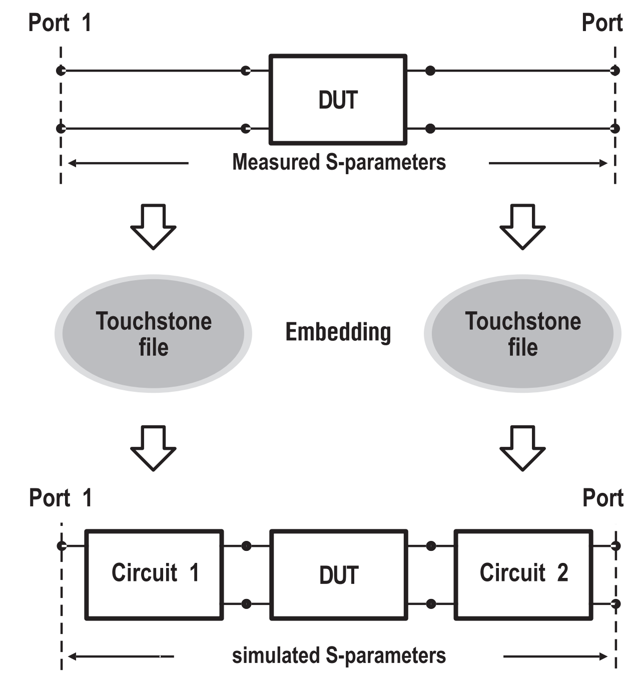
Limit testing is a function of automatic pass/fail judgement for the trace of the measurement results. The judgement is based on the comparison of the trace to the limit line set by the user and can consist of one or several segments.

Each segment checks the measurement value for failing either the upper or lower limit, or both. The limit line segment is defined by specifying the coordinates of the beginning (X0, Y0) and the end (X1, Y1) of the segment, and type of the limit. The MAX or MIN limit types check if the trace falls outside of the upper or lower limit, respectively.





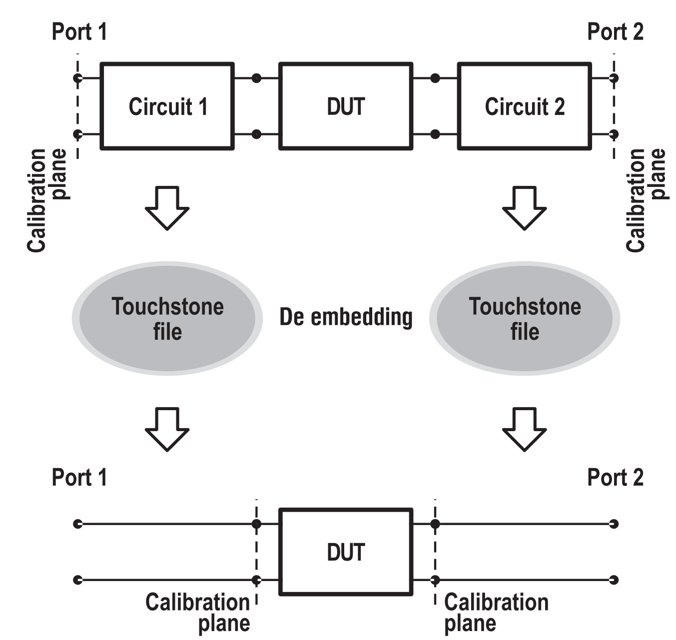
Embedding



Embedding

This function allows the user to mathematically simulate DUT parameters by virtually integrating a fixture circuit between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file.

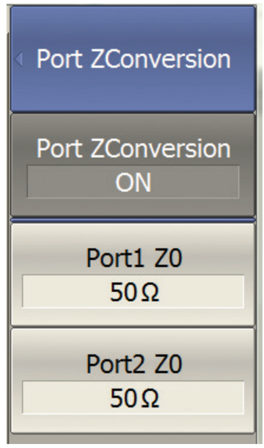
De-Embedding



De-Embedding

This function allows the user to mathematically exclude the effects of the fixture circuit connected between the calibration plane and the DUT from the measurement results. This circuit should be described by an S-parameter matrix in a Touchstone file.

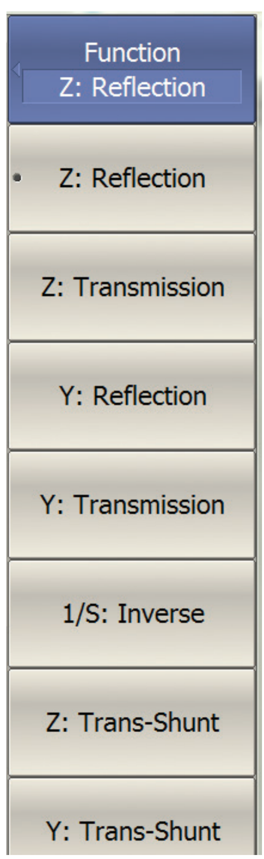
Port Impedance Conversion



Port impedance conversion

This function of conversion of the S-parameters measured at 50 Ω port into the values, which could be determined if measured at a test port with arbitrary impedance.

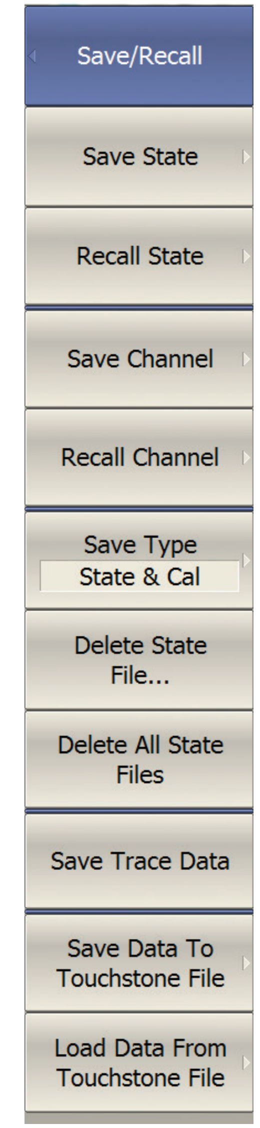
S-Parameter Conversion

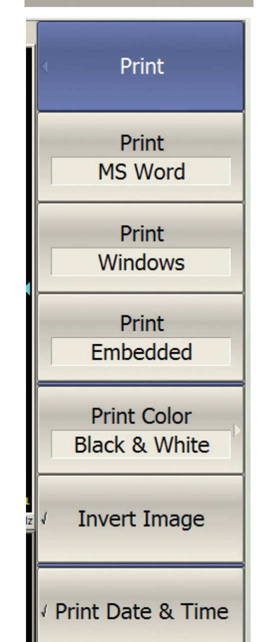


S-parameter conversion

The function allows conversion of the measured S-parameters to the following parameters: reflection impedance and admittance, transmission impedance and admittance, and inverse S-parameters

Data Output





Analyzer State

All state, calibration and measurement data can be saved to an Analyzer state file on the hard disk and later uploaded back into the software program. The following four types of saving are available: State, State & Cal, Stat & Trace, or All.

Channel State

A channel state can be saved into tha Analyzer memory. The channel state saving procedure is similar to saving of the Analyzer state saving, and the same saving types are applied to the channel state saving. Unlike the Analyzer state, the channel state is saved into the Analyzer inner volatile memory (not to the hard disk) and is cleared when the power to the Analyzer is turned off. For channel state storage, there are four memory registers A, B, C, D. The channel state saving allows the user to easily copy the settings of one channel to another one.

Trace Data CSV File

The Analyzer allows the use to save an individual trace data as a CSV file (comma separated values). The active trace stimulus and response values in current format are saved to *.CSV file. Only one trace data are saved to the file.

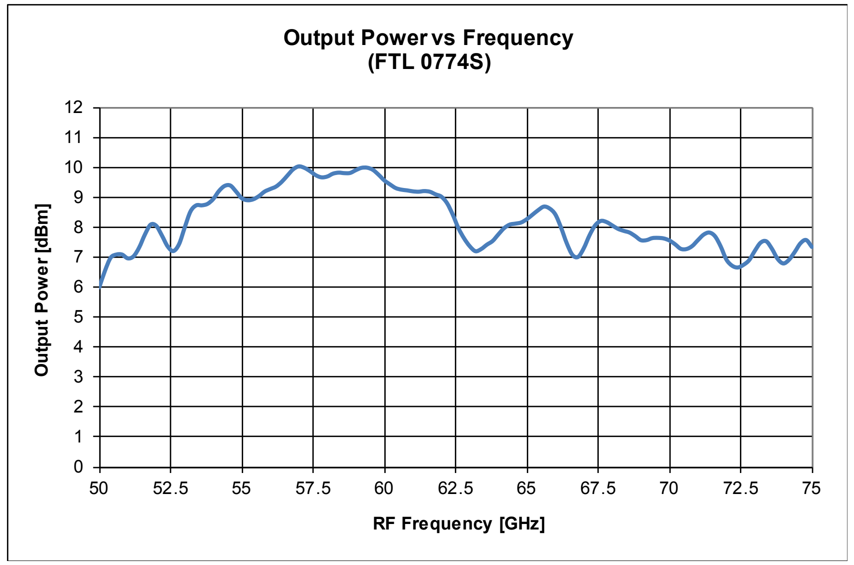
Trace Data Touchstone File

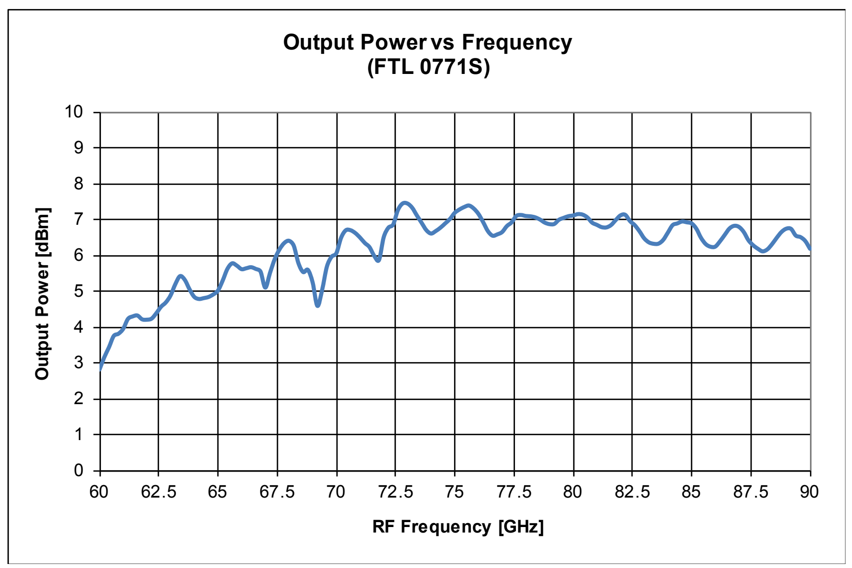
The Analyzer allows the user to save S-parameters to a Touchstone file. The Touchstone file contains the frequency values and S-parameters. The files of this format are typical for most of circuit simluator programs. The *.s2p files are used for saving all the four S-parameters of a 2-port device. The *.s1p files are used for saving S_{11} and S_{22} parameters of a 1-port device. Only one (active) trace data are saved to the file. The Touchstone file saving function is applied to individual active channels.

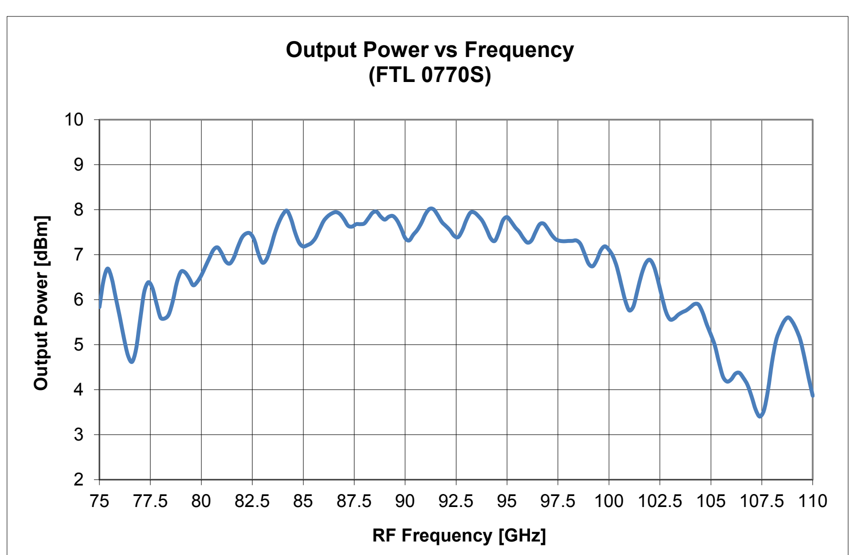
Screenshot capture

The print function is provided with the preview feature, which allows the user to view the image to be printed on the screen, and/or save it to a file. Screenshots can be printed using three different applications: MS Word, Image Viewer for Windows, or the Print Wizard of the Analyzer. Each screenshot can be printed in color, grayscale, black and white, or inverted for visibility or ink use. The current date and time can be added to each capture before it is transferred to the printing application, resulting in wuick and easy test reporting.

Waveguide Calibration Kits







Description

The FEK-15-0006, FEK-12-0006 and FEK-10-0006 calibration kits provide accurate calibration of the CobaltFx millimeter wave measuremet system in WR-15, WR-12 and WR-10 bands respectively. They are compatible with TRL and SOLT calibration techniques

Features

- Ensures accurate and repeatable measurements
- Contains characterisation data for the kit components in a suitable format for the VNA

Applications

- Millimeter wave S-parameter measurements that require system error correction

General Data: Waveguide Calibration Kits

Specification	FEK-15-0006				FEK-12-0006				FEK-10-0006			
	Unit	Min	Typ	Max	Unit	Min	Typ	Max	Unit	Min	Typ	Max
Operating Frequency Range	GHz	50		75	GHz	60		90	GHz	75		110
Waveguide Designation			WR-15, WG-25				WR-12, WG-26				WR-10, WG-27	
Flange Type			IEEE 1785-2a (Precision style)				IEEE 1785-2a (Precision style)				IEEE 1785-2a (Precision style)	
Cut Off Frequency	GHz		39.8765		GHz		48.3692		GHz		59.0143	
Fixed Load VSWR			<1.035:1				<1.04:1				<1.04:1	
Flush Short Flatness	mm		<0.016		mm		<0.012		mm		<0.012	
Operating Temperature Range	°C	+20		+30	°C	+20		+30	°C	+20		+30

Content	FEK-15-0006 Quantity	FEK-12-0006 Quantity	FEK-10-0006 Quantity
Broadband Termination	1 off	1 off	1 off
Flush Short	1 off	1 off	1 off
1/4 Lambda Offset	1 off	1 off	1 off
Accessories			
Hex Driver 5/64" A/F	1 off	1 off	1 off
Flange Screws - Short	4 off	4 off	4 off
Flange Screws - Long	4 off	4 off	4 off
Alignment Pins	4 off	4 off	4 off
USB Flash Memory	1 off	1 off	1 off

Note: Farran Technology reserves the right to change, without notice, the characteristic data and other specifications applied to this product. The product may be subject to Irish export restrictions.

Technical Specifications

Specification	FEV-15-0006			
	Unit	Min	Typ	Max
System Operating Frequency	GHz	50		75
Test Port Output Power	dBm	+5	+8	
System Dynamic Range (2)	dB	110	120	
Raw Coupler Directivity	dB	40	45	
Trace Stability Magnitude (3)	dB		±0.2	
Trace Stability Phase (3)	degree		2	
Test Port Input 0.1dB Compression Point	dBm		+15	
RF Input Frequency	GHz	6.25		9.375
RF Input Power	dBm		0	
LO Input Frequency	GHz	4.17		6.25
LO Input Power	dBm		0	
IF Output Frequency	MHz		7.5	
Test Port Damange Level	dBm	+20		
RF/LO Port Damange Level	dBm	+10		
Test Port Interface	-		WR-10 IEEE 1785-2a compatible with UG-387/UM	
RF/LO/IF Conenctor	-		SMA (F)	
DC Power Requirements	-		+6V at 2200 mA	
Weight	kg		3.5	
Dimensions (L x W x H)	-		220 x 105 x 80	
Operating Temperatures	°C	0		30

Specification	FEV-12-TR-0006				FEV-10-TR-0006			
	Unit	Min	Typ	Max	Unit	Min	Typ	Max
System Operating Frequency	GHz	60		90	GHz	75		110
Test Port Output Power	dBm	+2	+5		dBm	0	+5	
System Dynamic Range (2)	dB	100	110		dB	100	110	
Raw Coupler Directivity	dB	40	45		dB	40	45	
Trace Stability Magnitude (3)	dB		±0.2		dB		±0.2	
Trace Stability Phase (3)	degree		2		degree		2	
Test Port Input 0.1dB Compression Point	dBm		+15		dBm		+10	
RF Input Frequency	GHz	5		7.5	GHz	6.25		9.17
RF Input Power	dBm		0		dBm		0	
LO Input Frequency	GHz	5		7.5	GHz	4.688		6.875
LO Input Power	dBm		0		dBm		0	
IF Output Frequency	MHz		7.5		MHz		7.5	
Test Port Damange Level	dBm	+20			dBm	+20		
RF/LO Port Damange Level	dBm	+10			dBm	+10		
Test Port Interface	-		WR-10 IEEE 1785-2a compatible with UG-387/UM		-		WR-10 IEEE 1785-2a compatible with UG-387/UM	
RF/LO/IF Conenctor	-		SMA (F)		-		SMA (F)	
DC Power Requirements	-		+6V at 2200 mA		-		+6V at 2200 mA	
Weight	kg		3.5		kg		3.5	
Dimensions (L x W x H)	-		220 x 105 x 80		-		220 x 105 x 80	
Operating Temperatures	°C	0		30	°C	0		30

(1) Specifications are typical and subject to change without a notice.

(2) Measured at 10 Hz of IF bandwidth.

(3) Measured at 1h after 1h warm up and calibration. Assuming ideal RF and LO cables.

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COBALTFX