

# SPECTRUM AND NETWORK ANALYZERS UPDATE

Laura Sanchez  
Director of product management  
handheld & economy analyzers,  
EMI test receivers

**ROHDE & SCHWARZ**

Make ideas real



# AGENDA

## SPECTRUM ANALYZERS & VECTOR NETWORK ANALYZERS

- ▶ General overview and update (Laura Sanchez)
  - Product positioning, application fields & target customers
  - Solutions for education, EMI pre-compliance
  - Available Materials & special promotion
- ▶ New handheld Vector Network Analyzer R&S®ZNH (Nellie Pang)
  - Product positioning
  - Highlights & USPs
  - Application Fields
  - Competitor comparison
  - Ordering information

# OVERVIEW HANDHELD & GENERAL PURPOSE SPECTRUM AND NETWORK ANALYZERS



**R&S®FPH**  
Spectrum analyzer  
up to 31 GHz



**R&S®FSH**  
Spectrum analyzer  
20 GHz, Combi analyzer  
(SA&VNA\*)

\*VNA up to 8 GHz



**R&S®ZPH**  
Cable & Antenna analyzer up  
to 4 GHz,  
spectrum analyzer



**R&S®ZVH**  
Combi analyzer up to 8 GHz  
(SA&VNA)



**R&S®FPC**  
3 in 1 (SA, VNA, SG),  
3GHz



**R&S®FPL1000**  
Signal & spectrum analyzer,  
CW source  
7.5 GHz



**R&S®ZNLE**  
2 port VNA, 6 GHz



**R&S®ZNL**  
2 port VNA, spectrum  
analyzer 6 GHz

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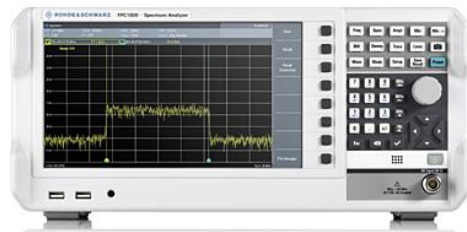


**R&S®ZNLE**  
2 port VNA, 6 GHz



**R&S®ZNL**  
2 port VNA, spectrum  
analyzer 6 GHz

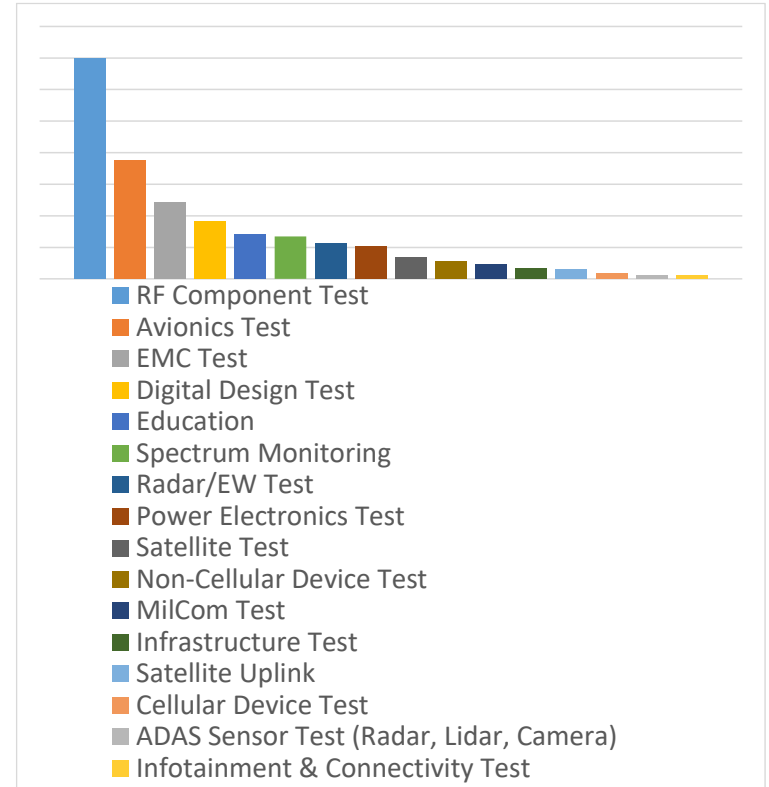
# GENERAL PURPOSE SPECTRUM ANALYZERS (BENCHTOP)



	R&S@ FPL1000 Signal & spectrum analyzer	R&S@FPC1000 /FPC1500 Spectrum analyzer
Advantages	Best RF performance in class, wide range of applications, advanced signal analysis, portable	Cost efficient combination analyzer (SA & VNA) with source, multiple uses
Frequency models	5 kHz to 3, 7.5 GHz	5 kHz to 3 GHz (1, 2, 3 GHz frequency upgrades via SW keycode)
Analysis Bandwidth	up to 40 MHz	-
Phase Noise	< -105 dBc / Hz (f = 1 GHz, 10 kHz offset)	-92 dbc / 1 Hz (f = 500 MHz, 30 kHz offset)
DANL @ 1 GHz, PA ON	< -163 dBm	-165 dBm
TOI	> 17 dBm	+10 dBm
Main features	Multitouch, Optional Battery, Tracking generator /scalar transmission measurements Noise figure, phase noise, Analog demodulation, Vector Signal Analysis, NB-IoT (with VSE), EMI pre- compliance	Spectrum Analyzer. FPC1500 model with Vector Network Analysis and tracking generator, EMI Debugging, Analog demodulation

# SPECTRUM ANALYZERS CUSTOMERS & APPLICATIONS

- ▶ Component testing in RF labs (R&D, service, repair)
- ▶ EMC
- ▶ Education
- ▶ A&D, Government
- ▶ Wireless communications, Broadcast & Media
- ▶ Automotive



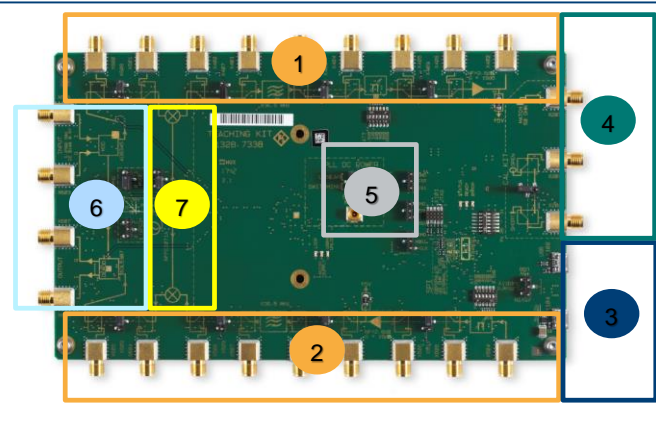
# RF TEACHING SOLUTION WITH FPC1500 AND FPC-Z10

COVERS RF COMPONENT AND TRANSCEIVER MEASUREMENTS AS WELL AS EMI DEBUGGING APPLICATIONS

- ▶ FPC1500 (Spectrum analyzer with VNA)
- ▶ FPC-Z10 – an universal board that designed with transceiver circuitry, DC-DC converter circuitry for EMI troubleshooting use cases, and user define cal-kit for network analysis.
- ▶ FPC-Z10 User guide available online



Teaching Kit  
R&S®FPC-Z10  
User Guide



1. Upconverter
2. Downconverter
3. Supply
4. Calibration Kit
5. DC/DC converter
6. IQ Modulator / Demodulator
7. Local Oscillator

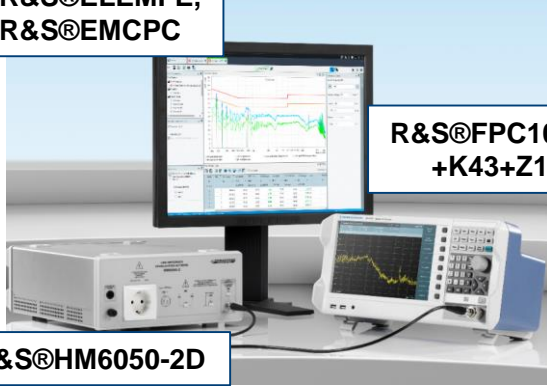


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# SOLUTIONS FOR EMI PRE-COMPLIANCE WITH R&S®FPC1000 AND R&S®FPL1000

R&S®ELEMI-E,  
R&S®EMCPC



R&S®FPC1000  
+K43+Z1

R&S®HM6050-2D



R&S®HZ-17



R&S®HZ-17



R&S®FPL1003+K54+B22  
+B5



R&S®ENV216

## Entry level (with R&S®FPC1000 )

- ▶ Spectrum Analyzer with options: R&S®FPC1000 + K43
- ▶ EMC H-Field Probe Set: R&S®HZ-17
- ▶ ELEKTRA EMI Software, R&S®ELEMI-E, R&S®EMCPC
- ▶ LISN, 9 kHz to 30 MHz (CISPR16) HM6050-2D + Z1(USB-RS-232 adapter)

## Essential (with R&S®FPL1000 )

- ▶ Spectrum Analyzer with options: R&S®FPL1003 + K54 + B22 + B5
- ▶ EMC H-Field Probe Set: R&S®HZ-17
- ▶ LISN, 9 kHz to 30 MHz: R&S®ENV216 + EZ-29 cable for remote control of LISN
- ▶ Optionally: ELEKTRA EMI Software, R&S®ELEMI-E, R&S®EMCPC



# SOLUTIONS FOR EMI DEBUGGING & PRE-COMPLIANCE

## WITH R&S®FPC1000 AND R&S®FPL1000 (COMPARISON)

Feature	Essential (with R&S®FPL1000 )	Entry level (with R&S®FPC1000 )
EMI detectors / bandwidths	<b>X</b> K54 Option (EMI measurements with CISPR & MIL BWs)	<b>X</b> K43 Option (receiver mode with CISPR bandwidths)
Log-scale	<b>X</b> K54 Option	<b>X</b> K43 Option
Limit lines	<b>X</b> K54 Option	<b>(X)</b> with Elektra EMC software
Time/frequency correlation	<b>X</b> Spectrogram	-
Advantages	<ul style="list-style-type: none"> <li>- Faster measurements</li> <li>- Better accuracy for EMI debugging and validation compared to entry level</li> <li>- Measurement sequencer allows automation</li> <li>- Report generation capability &amp; full EMI Scan methodology</li> <li>- More comfort, full automation and reporting with Elektra EMC software</li> </ul>	<ul style="list-style-type: none"> <li>- More affordable</li> <li>- Using compliance measurement methodology &amp; Report generation capability with Elektra EMC software</li> <li>- Related application card &amp; fact sheet available online</li> </ul>

# OVERVIEW HANDHELD & GENERAL PURPOSE SPECTRUM AND NETWORK ANALYZERS



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up to 31 GHz



R&S®FSH  
Spectrum analyzer  
20 GHz, Combi analyzer  
(SA&VNA\*)



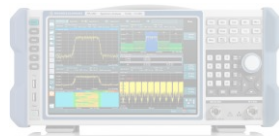
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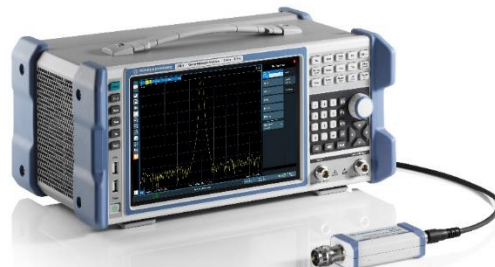


R&S®ZNLE  
2 port VNA, 6 GHz



R&S®ZNL  
2 port VNA, spectrum  
analyzer 6 GHz

# GENERAL PURPOSE VNAS (BENCHTOP)



Key Specification	R&S®ZNL Vector Network Analyzer	R&S®ZMLE Vector Network Analyzer
	High End Specs, General Purpose Box VNA, Spectrum Analyzer and Power meter in one box	Best price/performance in its class, easy to configure
Frequency Range	5 kHz to 3 / 6 GHz, <b>new</b> 4.5 GHz model	<b>100 kHz</b> to 3 / 6 GHz <b>new</b> 4.5 GHz model
Dynamic Range	120 dB	120 dB
Measurement Speed (100 kHz IFBW)	401 pts @ 16.7 ms	401 pts @ 16.7 ms
Trace Noise	0.0025 dB	0.005 dB
Special features	Spectrum analysis HW Option, up to 40 MHz analysis bandwidth, Analog & Digital Demod, power sensor support, optional battery pack, noise figure measurements with noise sources	-

# R&S®ZNL/ZNLE CUSTOMERS & APPLICATIONS

Main application is RF component testing for different markets and industries

- IoT Device characterization
- Antenna, Filter, passive components
- Mobile communication, R&D and production
- In field maintenance
- Education



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2 port VNA, 6 GHz



**R&S®ZNL**  
2 port VNA, spectrum  
analyzer 6 GHz

# HANDHELD ANALYZERS CAPABILITIES (TODAY)



Functionality selection guide – RF handheld analyzer

	Cable & Antenna Measurement	Transmission/Reflection VNA	Spectrum Measurement	Digital (Mobile) Modulation	Interference Hunting	Power Measurement (built-in / with power sensor)	Pulse Measurement
R&S®ZPH (.02)	✓	✓ (S11 only)				✓	✓
R&S®ZPH (.12)	✓	✓ (both S11, S21)	✓		✓	✓	✓
R&S®ZVH	✓	✓	✓			✓	✓
R&S®FPH			✓		✓	✓	✓
R&S®FSH	✓	✓	✓	✓	✓	✓	✓

# HANDHELD ANALYZERS FREQUENCY OVERVIEW (TODAY)



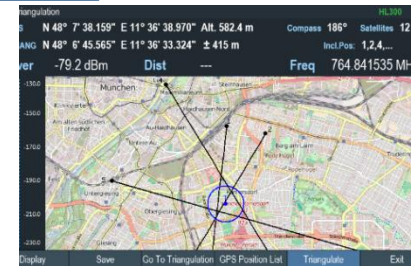
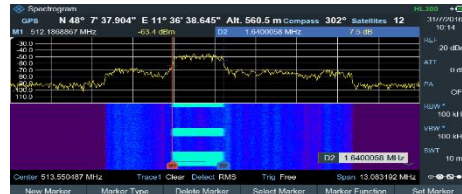
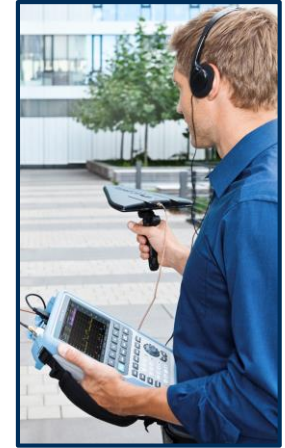
**Frequency Selection guide – RF handheld analyzer**

Minimum Frequency	R&S®ZPH	R&S®ZVH		R&S®FPH				R&S®FSH			
CAT / VNA mode	2 MHz	100 kHz		N.A.				300 kHz (FSH4/8 model .24/.28) 100 kHz ((FSH13/20 model .23/.30)			
SA mode	5 kHz (ZPH model .12)	100 kHz		5 kHz				9 kHz		100 kHz	
Maximum Frequency	.02/.12	.24	.28	.02	.06	.13	.26	.04/.14/.24	.08/.18/.28	.13/.23	.20/.30
2 GHz				√							
3 GHz	√			○							
3.6 GHz		√						√			
4 GHz	○			○							
6 GHz					√						
8 GHz			√		○				√	√ CAT/VNA	√ CAT/VNA
13.6 GHz						√				√ SA	
20 GHz						○					√ SA
26.5GH							√				
31 GHz							○				



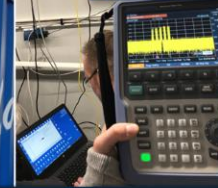
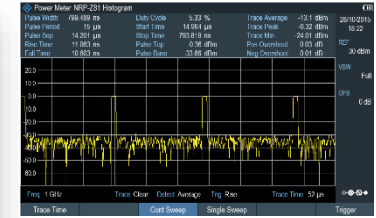
# APPLICATIONS HANDHELD ANALYZERS UP TO 31 GHZ

- ▶ Wireless Networks installation & maintenance
- ▶ Interference hunting
  - Mobile / fixed network operators
  - Subcontractors and rental companies
- ▶ Spectrum monitoring, EMF
  - Government agencies, Frequency regulators,
  - Public telecommunications authorities



# APPLICATIONS HANDHELD ANALYZERS UP TO 31 GHZ

- ▶ Installation and Maintenance of Radar and Satellite facilities
  - A&D Primes, OEMs & manufacturers, operators
  - Security forces
  - A&D Subcontractors and rental companies
- ▶ Education in RF and Telecommunications
  - Universities, schools
- ▶ Basic RF component testing
  - R&D laboratories, RF components manufacturers with lower budget for
  - Automotive, medical industry etc
- ▶ 5G / IOT- Smart factory: Industry 4.0 / Factory in a box
  - FPH ensuring smooth setup!



# APPLICATION MATERIAL AVAILABLE ONLINE: APPLICATION CARDS, FACT SHEETS, VIDEOS, TUTORIALS, ETC

## ANTENNA MATCHING IN IoT AND LOW POWER DEVICES

Antennas have become an integral part of consumer electronics, even on an energy source with limited capacity. Consequently, antennas need to be efficient.



Measuring network connected to R&S FPC150B and antenna cable

**Your task**  
Antenna matching is an important aspect of any transmitting RF system in order to achieve the best coverage and lowest power consumption. A contradicting aspect is the physical antenna footprint. The small antennas typically required in IoT applications battle with performance trade-offs due to size constraints. The efficiency of small antennas is usually included in the link budget calculation and is overcome by increased transmit power, which is detrimental to system performance, e.g. battery life. This makes proper antenna matching extremely important, as a well-matched antenna maximizes the radiation efficiency of the power it receives as an input.

**Rohde & Schwarz solution**  
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- Calibration
- Measurement
- Adjustment

Application Card  
Version 01.00

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## RF PORT IMPEDANCE VERIFICATION

Well-matched RF ports are a crucial aspect to any RF system. Matched ports, for example, protect amplifier output ports from reflected power overload. This undesired reflected power could destroy the whole amplifier. Matched ports also maximize power transmission, effectively extending the battery life of wireless products such as those made for the internet of things.

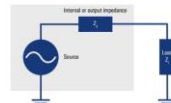
### Your task

In the RF world, there are two standard values for the characteristic impedance of single-ended components: 50 Ω and 75 Ω. Most cables, connectors and RF components are matched to one of these two values. 75 Ω value frequently found in (cable) TV applications and is close to 77 Ω, which is the point of minimum RF reflection. 50 Ω is a compromise between high power transmission capability (50 Ω) and low attenuation. It is, however, important to have all components matched to the impedance value.

### Achieving maximum power transmission

According to the power transfer theorem, the key component to achieving maximum power transfer is to match the source impedance  $Z_s$  and load impedance  $Z_L$ . In a matching case,  $Z_s$  equals  $Z_L^*$ .

Impedance matching ( $Z_L = Z_s^*$ )



Application Card | Version 01.00

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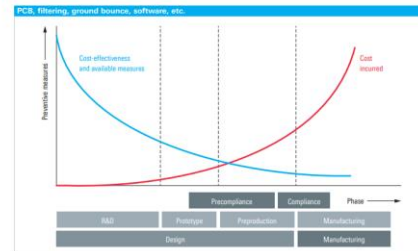
## EMI debugging a switched-mode power supply with R&S®FPC1000/ R&S®FPC1500

### Your task

Today, R&D engineers face challenging time-to-market goals. Extending the product development schedule and delaying the product launch can prove to be extremely costly in terms of lost opportunity and lost market share. A significant number of products fail EMC compliance the first time. Every day spent debugging, isolating and correcting the EMI problem increases the time to market.

### Rohde & Schwarz solution

To address these challenges, it makes sense to perform EMI tests during the product design cycle. This will increase the probability of passing the EMC compliance test, which is typically performed at the end of the product development cycle. As illustrated, the cost of fixing EMI problems late in the development cycle can prove to be more expensive than doing so earlier. Preventive measures integrated into design cycle checkpoints can help avoid costly project delays.



**ROHDE & SCHWARZ**

Application Card | Version 01.00



### Easy to use and portable spectrum and signal analyzer

The R&S FPL1000 spectrum analyzer from Rohde & Schwarz supports many applications such as power measurements and the analysis of digital and analog modulated signals. The easy to use and portable R&S FPL1000 is ideal for your everyday working tasks.



### Analog demodulation using the R&S FPL1000 spectrum analyzer

The R&S FPL1000 spectrum analyzer equipped with the R&S FPL1-K7 option demodulates AM, FM and PM modulated analog signals. The R&S FPL1-K7 is ideal for troubleshooting AM and FM transmitters, for transient and settling measurements of oscillators and for simple chirp analysis of pulsed or continuous wave signals.

# R&S ESSENTIALS PROMOTION ON SELECTED PACKAGES

## Vector network analyzers

R&S Model	Frequency range	Product bundle description	List price Europe	Discount
R&S*ZNL6-COM	5 kHz to 6 GHz	R&S*ZNL6 base unit; -B1: spectrum analysis; -B22: extended power range R&S*ZN-Z135 calibration kit; total of 4 years warranty	EUR 31,244 EUR 26,415	15 %
R&S*ZNL3-COM	5 kHz to 3 GHz	R&S*ZNL3 base unit; -B1: spectrum analysis; -B22: extended power range R&S*ZN-Z135 calibration kit; total of 4 years warranty	EUR 25,409 EUR 22,215	12 %
R&S*ZNL6-COM	5 kHz to 6 GHz	R&S*ZNL6 base unit; -B100: extended frequency range; R&S*ZN-Z135 calibration kit	EUR 16,754	10 %

## Cable & antenna analyzers

R&S Model	Frequency range	Product bundle description	List price Europe	Discount
R&S*ZPH-COM1	2 MHz to 4 GHz	R&S*ZPH base unit; frequency upgrade; -B10: GPS support; -K9: power sensor support; -K19: channel power meter; -K29: pulse measurements with power sensor	EUR 6,515 EUR 3,390	48 %
R&S*ZPH-COM2	2 MHz to 4 GHz	R&S*ZPH combi analyzer; frequency upgrade; -B22: spectrum analyzer preamplifier; -K1:	EUR 13,460	48 %

## Spectrum analyzers

R&S Model	Frequency range	Product bundle description	List price Europe	Discount
R&S*FPC-COM1	5 kHz to 3 GHz	R&S*FPC1000: frequency upgrade; -B22: preamplifier; -K7: modulation analysis; -K43: receiver mode; -K55: advance measurements	EUR 5,290 EUR 3,050	42 %
R&S*FPC-COM2	5 kHz to 3 GHz	R&S*FPC1500: frequency upgrade; -B22: preamplifier; -K7: modulation analysis; -K42: vector network analysis; -K43: receiver mode; -K55: advanced measurements	EUR 6,800 EUR 4,400	36 %
R&S*FPH-COM1	5 kHz to 4 GHz	R&S*FPH base unit; frequency upgrade; -B22: spectrum analyzer preamplifier; -K15: Interference analysis; -K16: signal strength mapping measurement application; -K7: modulation analysis; -K9: power sensor support; -K19: channel power meter; -K29: pulse measurements with power sensor; -K43: receiver mode & channel scanner measurement application	EUR 11,400 EUR 5,990	48 %
R&S*FPL1003-P6	5 kHz to 3 GHz	R&S*FPL1003 base unit; -B4: OCXO freq. reference; -B5: additional interfaces; -B9: Internal generator; -B10: GPIB interface; -B22: RF preamplifier; -B25: 1 dB step attenuator; -K7: anal. modulation analysis; -K54: EMI meas. application	EUR 19,855 EUR 16,825	15 %
R&S*FPL1007-P6	5 kHz to 7.5 GHz	R&S*FPL1007 base unit; -B4: OCXO freq. reference; -B5: additional interfaces; -B9: internal generator; -B10: GPIB interface; -B22: RF preamplifier; -B25: 1 dB step attenuator; -K7: anal. modulation analysis; -K54: EMI meas. application	EUR 23,930 EUR 20,340	15 %

R&S Essentials Promotion

**FULL BENCH.  
HIGH VALUE.**

Up to 50% off our signature instrument bundles. Preconfigured for you.

Widest variety of fully equipped products up to  
**50 % off**

Order now through  
March 31, 2021



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**THANK YOU!**