SIGNAL & SPECTRUM ANALYZER TECHNICAL COMPARISON

Technical Comparison Guide

Ceyear 4052 Series • Rohde & Schwarz FSV3000 Series • Rohde & Schwarz FSVA3000 Series

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Prepared using official manufacturer specifications available at the time of writing. See Appendix A for references and revision information.

Table of Contents

CHAPTER 1. EXECUTIVE SUMMARY

1.1 Purpose of this Comparison

This document provides a detailed technical comparison of the **Ceyear 4052 Series**, **Rohde & Schwarz FSV3000 Series**, and **Rohde & Schwarz FSVA3000 Series** signal and spectrum analyzers.

The comparison is based exclusively on the official technical specifications published by Ceyear Technologies and Rohde & Schwarz. It is intended to assist engineers, system integrators, laboratory managers and procurement specialists in selecting the most appropriate instrument for research, development, manufacturing, wireless communications, aerospace and defense applications.

1.2 Product Positioning

Although all three instrument families belong to the modern signal and spectrum analyzer category, they target different performance levels and application requirements.

Ceyear 4052 Series

The Ceyear 4052 Series is positioned as a high-performance multifunctional signal and spectrum analyzer combining wide instantaneous analysis bandwidth, advanced real-time spectrum analysis, comprehensive vector signal analysis capabilities and modern high-speed data interfaces.

Compared with traditional mid-range spectrum analyzers, the 4052 Series places particular emphasis on broadband signal analysis, high-speed I/Q recording, radar applications, wireless communications and electronic warfare systems. With analysis bandwidth options up to **1.2 GHz**, integrated 10 Gigabit Ethernet, optical I/Q interfaces and real-time recording capabilities, the platform is designed for demanding broadband measurement applications.

Rohde & Schwarz FSV3000 Series

The R&S FSV3000 Series is a versatile mid-range signal and spectrum analyzer intended for general-purpose RF measurements.

It provides excellent measurement accuracy, comprehensive measurement applications and a mature software ecosystem while maintaining competitive cost and high reliability. The platform is particularly suitable for production testing, RF laboratories, EMC pre-compliance measurements and wireless communication development where extremely high dynamic range or ultra-wide analysis bandwidth are not primary requirements.

Rohde & Schwarz FSVA3000 Series

The R&S FSVA3000 Series represents the high-performance platform within the FSV family.

Its architecture is optimized for applications requiring extremely low phase noise, superior dynamic range, excellent sensitivity and high linearity. These characteristics make the FSVA3000 particularly suitable for oscillator characterization, phase noise measurements, high-performance receiver testing, aerospace systems and advanced research laboratories. The platform also supports analysis bandwidths up to **1 GHz** through optional hardware configurations.

1.3 Overall Technical Positioning

Product	Primary Positioning	Typical Users
Ceyear 4052	Broadband signal analysis platform	Defense, EW, radar, satellite communications, 5G/6G research, broadband RF laboratories
R&S FSV3000	General-purpose RF signal & spectrum analyzer	Production testing, education, service laboratories, EMC, wireless communications
R&S FSVA3000	High-performance RF analyzer	R&D laboratories, metrology, phase noise measurements, receiver characterization, aerospace

1.4 Key Technical Conclusions

Ceyear 4052 Series

The Ceyear 4052 demonstrates a strong emphasis on broadband signal analysis. Its support for up to **1.2 GHz instantaneous analysis bandwidth**, integrated **10 Gigabit Ethernet**, optical I/Q interfaces and high-speed recording capabilities makes it particularly attractive for modern radar, electronic warfare, satellite communication and wideband wireless signal analysis applications.

Rohde & Schwarz FSV3000 Series

The FSV3000 offers an excellent balance between performance, measurement functionality and cost. It is particularly well suited for general RF testing, production environments and communication system development where extremely high RF performance is not the primary selection criterion.

Rohde & Schwarz FSVA3000 Series

The FSVA3000 delivers the highest RF performance among the three analyzers. It provides superior phase noise, sensitivity, dynamic range and linearity, making it the preferred solution for precision RF characterization, oscillator measurements and demanding research applications.

1.5 Feature Matrix

Table 1. Executive Feature Matrix

Feature	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Frequency range up to 50 GHz	✔	✔	✔
Frequency extension above 50 GHz	—	—	✔ (54 GHz option)
2 Hz minimum frequency (standard)	✔	—	o*
Phase noise optimized architecture	✔	o	✔✔
Ultra-low phase noise option	—	✔	✔
Displayed Average Noise Level (DANL)	✔✔	✔	✔✔
Dynamic range	✔✔	✔	✔✔✔
Instantaneous analysis bandwidth >1 GHz	✔ (1.2 GHz)	—	o (1 GHz option)
Real-Time Spectrum Analysis	✔	✔	✔
Wideband Real-Time (>200 MHz)	✔	—	✔
High-speed I/Q recording	✔	✔	✔

Feature	Ceyear 4052	R&S FSV3000	R&S FSVA3000
10 Gigabit Ethernet	✔	—	o
Optical I/Q interface	✔	—	—
Long-duration broadband recording	✔✔	✔	✔✔
Radar signal analysis	✔✔	o	✔✔
Pulse analysis	✔	✔	✔
5G NR signal analysis	✔	✔	✔
LTE / NB-IoT / WCDMA	✔	✔	✔
WLAN analysis	✔	✔	✔
Analog demodulation	✔	✔	✔
EMI measurements	o	✔	✔
Vector Signal Analysis	✔	✔	✔
Phase Noise measurement application	o	o	✔✔
Production test suitability	✔	✔✔	✔
General-purpose RF laboratory	✔	✔✔	✔✔
Electronic Warfare (EW) applications	✔✔✔	o	✔✔
Satellite communications	✔✔	✔	✔✔
High-end RF research	✔	✔	✔✔✔

Legend

- ✔✔✔ – Industry-leading capability
- ✔✔ – Excellent capability
- ✔ – Fully supported
- o – Available with optional hardware/software
- — – Not available

* Available on FSVA3000 only with the optional ultra-low phase noise hardware (B710).

CHAPTER 2.1 FREQUENCY CHARACTERISTICS

Introduction

Frequency performance is one of the fundamental characteristics of a modern signal and spectrum analyzer. It directly affects measurement accuracy, long-term stability, receiver performance and the capability to characterize modern RF, microwave and millimeter-wave systems.

This section compares the frequency-related specifications of the Ceyear 4052 Series, Rohde & Schwarz FSV3000 Series and Rohde & Schwarz FSVA3000 Series, including frequency coverage, frequency reference stability, tuning resolution, marker accuracy and sweep capabilities. All values are taken from the official manufacturer specifications.

Table 2-1. Frequency Coverage

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Technical Assessment
Lowest frequency (DC coupled)	**2 Hz**	10 Hz	10 Hz (2 Hz with B710 option)	**4052**
Lowest frequency (AC coupled)	10 MHz	10 MHz	10 MHz	Equal
Highest standard frequency	50 GHz	50 GHz	50 GHz	Equal
Maximum frequency with options	50 GHz	50 GHz	**54 GHz**	**FSVA3000**
Number of available frequency models	**8**	6	6	**4052**
Frequency models	4 / 8 / 13.6 / 18 / 26.5 / 40 / 45 / 50 GHz	4 / 7.5 / 13.6 / 30 / 44 / 50 GHz	4 / 7.5 / 13.6 / 30 / 44 / 50 (54) GHz	4052
Frequency resolution	0.01 Hz	0.01 Hz	0.01 Hz	Equal
Frequency extension	—	—	Optional to 54 GHz	FSVA3000

Technical Observation

All three analyzer families cover the complete RF and microwave frequency range up to 50 GHz. The Ceyear 4052 provides the broadest selection of standard frequency models, allowing users to optimize instrument cost according to application requirements. The FSVA3000 is the only instrument capable of extending its operating frequency to 54 GHz through an optional hardware upgrade.

Table 2-2. Frequency Reference Performance

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Technical Assessment
Internal reference	10 MHz	10 MHz	10 MHz	Equal
Frequency resolution	0.01 Hz	0.01 Hz	0.01 Hz	Equal
Aging	$\pm 5\times10^{-10}$/day	1×10^{-6}/year	1×10^{-6}/year	**4052**
OCXO option	Available	Available	Available	Equal

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Technical Assessment
Temperature stability	±1.5×10⁻⁸	1×10⁻⁶ (Std), 1×10⁻⁸ (OCXO)	1×10⁻⁶ (Std), 1×10⁻⁸ (OCXO)	Comparable
Calibration accuracy	±4×10⁻⁸	5×10⁻⁷ (Std), 5×10⁻⁸ (OCXO)	5×10⁻⁷ (Std), 5×10⁻⁸ (OCXO)	Comparable

Technical Observation

All three analyzers employ high-stability 10 MHz reference oscillators and provide optional OCXO references for applications requiring enhanced long-term stability. The Ceyear specification expresses aging in daily terms, while Rohde & Schwarz specifies annual aging. Because the manufacturers use different reporting methods, direct numerical comparison should be interpreted with care.

Table 2-3. Frequency Readout and Marker Accuracy

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Technical Assessment
Marker resolution	1 Hz	1 Hz	1 Hz	Equal
Frequency counter resolution	0.1 Hz	0.001 Hz	0.001 Hz	R&S
Marker accuracy formula	Yes	Yes	Yes	Equal
Frequency counter accuracy	Specified	Specified	Specified	Equal

Table 2-4. Sweep Characteristics

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Technical Assessment
Sweep range	0 Hz to Max	0 Hz to Max	0 Hz to Max	Equal
Minimum sweep time	1 µs	1 µs	1 µs	Equal
Maximum sweep time	16000 s	16000 s	16000 s	Equal
Minimum sweep span	10 Hz	10 Hz	10 Hz	Equal
Maximum sweep points	**120001**	100001	100001	**4052**
EMI sweep points	—	200001	200001	R&S

Technical Observation

The three analyzers offer very similar sweep capabilities. However, the Ceyear 4052 provides a larger maximum number of standard sweep points, whereas the Rohde & Schwarz instruments support up to 200001 sweep points when equipped with the EMI measurement application.

Frequency Characteristics Summary

Category	Leader	Comments
Lowest frequency	**Ceyear 4052**	2 Hz available as standard
Maximum frequency	**FSVA3000**	Up to 54 GHz with optional extension
Frequency model flexibility	**Ceyear 4052**	Eight standard frequency configurations

Category	Leader	Comments
Frequency resolution	Tie	0.01 Hz for all analyzers
Reference stability	Comparable	Similar high-stability reference architectures
Sweep capability	Tie	Comparable performance with application-specific advantages
Frequency coverage	Tie	All instruments provide complete microwave coverage up to 50 GHz

2.2 PHASE NOISE PERFORMANCE

Introduction

Phase noise is one of the most important indicators of signal purity in modern signal and spectrum analyzers. It determines the analyzer's ability to distinguish weak signals located close to strong carriers and directly affects oscillator characterization, adjacent channel measurements, radar signal analysis, satellite communications and high-performance receiver testing.

In this section, the phase noise characteristics of the Ceyear 4052 Series, Rohde & Schwarz FSV3000 Series and Rohde & Schwarz FSVA3000 Series are compared using the official manufacturer specifications measured at a **1 GHz carrier frequency**.

Table 2-5. SSB Phase Noise Comparison @ 1 GHz Carrier

Carrier Offset	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Technical Assessment
100 Hz	**−95 dBc/Hz**	< −91 dBc/Hz	< −95 dBc/Hz	Tie (4052 / FSVA3000)
1 kHz	**−112 dBc/Hz**	< −101 dBc/Hz	< −115 dBc/Hz	FSVA3000
10 kHz	**−122 dBc/Hz**	< −107 dBc/Hz	< −120 dBc/Hz	**Ceyear 4052**
100 kHz	**−122 dBc/Hz**	< −115 dBc/Hz	< −125 dBc/Hz	FSVA3000
1 MHz	**−135 dBc/Hz**	< −135 dBc/Hz	< −137 dBc/Hz	FSVA3000
10 MHz	Not specified	−150 dBc/Hz (typ.)	−152 dBc/Hz (typ.)	FSVA3000

Technical Observation

Several important conclusions can be drawn from the published specifications.

The **R&S FSVA3000** provides the lowest overall phase noise across most offset frequencies and therefore remains the preferred instrument for precision oscillator characterization, ultra-low phase noise measurements and metrology applications.

However, the **Ceyear 4052 demonstrates remarkably competitive performance**:

- equal specification to the FSVA3000 at **100 Hz offset**;
- only **3 dB difference** at **1 kHz offset**;
- **2 dB better specification** than the FSVA3000 at **10 kHz offset**;
- only **2 dB difference** at **100 kHz offset**;
- equal specification to the FSV3000 at **1 MHz offset**.

These results indicate that the Ceyear 4052 belongs to the high-performance analyzer class rather than a conventional mid-range spectrum analyzer.

Table 2-7. Residual FM Comparison

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Comments
Residual FM	≤ (0.25 Hz × N) p-p*	< 0.5 Hz RMS	< 0.1 Hz RMS	Different measurement methodology

* **MEASURED USING** 10 HZ RBW, 10 HZ VBW, **RATED VALUE WITHIN** 20 MS, **WHERE** N **IS THE FREQUENCY MULTIPLICATION FACTOR OF THE LOCAL OSCILLATOR.**

Important Note

Residual FM values cannot be directly compared numerically.

Ceyear specifies:

- peak-to-peak (p-p);
- dependency on LO multiplication factor (N);
- 20 ms observation interval.

Rohde & Schwarz specifies:

- RMS value;
- different detector methodology;
- different measurement conditions.

Therefore, **there is no technically correct way to conclude that one instrument is better than another based solely on these published Residual FM values**. A fair comparison would require identical measurement conditions.

Table 2-8. Phase Noise Architecture

Feature	Ceyear 4052	FSV3000	FSVA3000
High-performance synthesizer	✔	✔	✔
Ultra-low phase noise option	—	✔ (B710)	✔ (B710)
Low-frequency operation to 2 Hz	✔	—	✔ (B710)
Optimized for oscillator measurements	✔	✔	✔✔
Suitable for radar applications	✔✔	✔	✔✔
Suitable for satellite communications	✔✔	✔	✔✔
Suitable for precision metrology	✔	✔	✔✔

2.3 DISPLAYED AVERAGE NOISE LEVEL (DANL) PERFORMANCE

One of the most important parameters of a modern signal and spectrum analyzer is the **Displayed Average Noise Level (DANL)**. It defines the minimum signal level that can be distinguished from the analyzer's internal noise and therefore directly determines the capability to detect weak RF signals.

For applications such as satellite communications, radar receiver development, EMC testing, low-power IoT devices, electronic warfare, and spectrum monitoring, a lower DANL translates into higher measurement sensitivity and improved dynamic range.

To ensure an objective comparison, the DANL specifications of the analyzers discussed in this Application Note were extracted from the manufacturers' official specification documents under equivalent measurement conditions.

2.3.1 Measurement Conditions

The DANL values presented below are normalized to **1 Hz resolution bandwidth** and measured using equivalent instrument settings.

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Input termination	50 Ω	50 Ω	50 Ω
RF attenuation	0 dB	0 dB	0 dB
Detector	Sample / Average	Sample	Sample
Averaging	Logarithmic	Logarithmic	Logarithmic
Normalized RBW	1 Hz	1 Hz	1 Hz
Ambient temperature	20…30 °C	20…30 °C	20…30 °C
Preamplifier	OFF / ON	OFF / ON	OFF / ON

SINCE THE MEASUREMENT CONDITIONS ARE ESSENTIALLY IDENTICAL, THE PUBLISHED DANL VALUES CAN BE DIRECTLY COMPARED WITHOUT APPLYING CORRECTION FACTORS.

2.3.2 Guaranteed DANL Performance

The table below summarizes the guaranteed DANL values with the RF preamplifier disabled.

Frequency Range	Ceyear 4052	R&S FSV3000	R&S FSVA3000
10 MHz – 1 GHz	−149 dBm/Hz	−151 dBm/Hz	−151 dBm/Hz
1 – 2 GHz	−147 dBm/Hz	−149 dBm/Hz	−149 dBm/Hz
2 – 3 GHz	−146 dBm/Hz	−149 dBm/Hz	−149 dBm/Hz
3 – 4 GHz	−141 dBm/Hz	−147 dBm/Hz	−147 dBm/Hz
4 – 6 GHz	−142 dBm/Hz	−147 dBm/Hz	−147 dBm/Hz
6 – 8 GHz	−139 dBm/Hz	−145 dBm/Hz	−145 dBm/Hz

THE COMPARISON SHOWS THAT THE **R&S FSVA3000** AND **R&S FSV3000** PUBLISH ESSENTIALLY IDENTICAL GUARANTEED DANL FIGURES UP TO 7.5 GHZ, SINCE BOTH SHARE THE SAME RF FRONT-END ARCHITECTURE IN THIS RANGE; THE FSVA3000'S SENSITIVITY ADVANTAGE OVER THE FSV3000 BECOMES MORE PRONOUNCED ONLY AT HIGHER FREQUENCIES AND WHEN THE ULTRA-LOW-NOISE B710 OPTION IS FITTED. THE **CEYEAR 4052** REMAINS COMPETITIVE AT LOWER FREQUENCIES BUT EXHIBITS A GRADUAL INCREASE IN NOISE FLOOR AS FREQUENCY INCREASES.

2.3.3 Typical DANL Performance

IN PRACTICAL OPERATION, ANALYZERS FREQUENTLY PERFORM CLOSER TO THEIR TYPICAL SPECIFICATIONS THAN THEIR GUARANTEED LIMITS.

Frequency Range	Ceyear 4052	R&S FSV3000	R&S FSVA3000
10 MHz – 1 GHz	−153 dBm/Hz	−154 dBm/Hz	−154 dBm/Hz
1 – 2 GHz	−152 dBm/Hz	−152 dBm/Hz	−152 dBm/Hz
2 – 3 GHz	−149 dBm/Hz	−152 dBm/Hz	−152 dBm/Hz
3 – 4 GHz	−146 dBm/Hz	−150 dBm/Hz	−150 dBm/Hz
4 – 6 GHz	−147 dBm/Hz	−150 dBm/Hz	−150 dBm/Hz
6 – 8 GHz	−143 dBm/Hz	−147 dBm/Hz	−147 dBm/Hz

THE TYPICAL PERFORMANCE INDICATES THAT THE CEYEAR 4052 ACHIEVES NOTICEABLY BETTER SENSITIVITY THAN ITS GUARANTEED SPECIFICATION WOULD SUGGEST, PARTICULARLY BELOW 2 GHZ, WHERE ITS PRACTICAL PERFORMANCE APPROACHES THAT OF HIGHER-END INSTRUMENTS.

2.3.4 Effect of the Low-Noise Preamplifier

Enabling the internal RF preamplifier significantly improves receiver sensitivity.

Operating Mode	Typical DANL @ 1 GHz
Ceyear 4052 (Preamp OFF)	−154 dBm/Hz
Ceyear 4052 (Preamp ON)	−165 dBm/Hz
Ceyear 4052 (Noise Cancellation)	−172 dBm/Hz

The integrated low-noise preamplifier provides approximately **11 dB** improvement in DANL, while the optional noise cancellation function further lowers the effective noise floor by approximately **7 dB**. This combination enables reliable detection of extremely weak RF signals that would otherwise remain below the analyzer's internal noise floor.

2.3.5 Technical Assessment

When only the headline specification at **1 GHz** is considered, several analyzers appear to provide very similar sensitivity. However, examination of the complete DANL curves reveals noticeable differences across the operating frequency range.

The **R&S FSVA3000** maintains the lowest internal noise floor throughout most of its frequency coverage and therefore offers the highest receiver sensitivity for demanding laboratory measurements.

The **R&S FSV3000** provides a balanced combination of sensitivity and measurement performance suitable for general-purpose RF testing.

The **Ceyear 4052** demonstrates highly competitive sensitivity below several gigahertz and, with its optional preamplifier and noise cancellation technology enabled, achieves a DANL that approaches the performance of considerably more expensive high-end analyzers. For many wireless communication, EMC, satellite, and radar development applications, this level of sensitivity is more than sufficient while providing an attractive performance-to-cost ratio.

CHAPTER 2.4 DYNAMIC RANGE AND LINEARITY

Introduction

Dynamic range defines the capability of a signal and spectrum analyzer to accurately measure weak signals in the presence of strong interferers while maintaining amplitude accuracy and spectral purity.

Unlike DANL, which characterizes receiver sensitivity, dynamic range is determined by the linearity of the RF front-end, mixer compression characteristics, intermodulation distortion and internally generated spurious responses.

These parameters are particularly important for adjacent channel measurements, transmitter characterization, radar testing, satellite communications, electronic warfare (EW) and modern broadband communication systems.

This section compares the dynamic range characteristics of the Ceyear 4052 Series, Rohde & Schwarz FSV3000 Series and Rohde & Schwarz FSVA3000 Series using the official manufacturer specifications.

2.4.1 Measurement Conditions

Before comparing linearity parameters, it is important to verify that the measurements were performed under equivalent conditions.

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
RF Attenuation	0 dB	0 dB	0 dB
RF Preamplifier	OFF	OFF	OFF
Two-tone test	Yes	Yes	Yes
Mixer input level	−10 dBm/tone	−15 dBm/tone	−15 dBm/tone
Frequency spacing	50 kHz	>5×RBW or 10 kHz	>5×RBW or 10 kHz
Temperature	20…30 °C	20…30 °C	20…30 °C

Technical Observation

Although the Ceyear and Rohde & Schwarz analyzers use slightly different excitation levels during the TOI test, the measurement methodology is fundamentally the same. Therefore, the published values provide a meaningful comparison of receiver linearity.

2.4.2 Third-Order Intercept (TOI)

The third-order intercept point (TOI) is one of the primary indicators of analyzer linearity. A higher TOI allows stronger adjacent signals before intermodulation products become significant.

Frequency Range	Ceyear 4052	R&S FSV3000	R&S FSVA3000
10–100 MHz	>12 dBm (typ. 17)	>12 dBm (typ. 15)	>17 dBm (typ. 20)
100 MHz–200 MHz	>12 dBm (typ. 17)	>15 dBm (typ. 18)	>17 dBm (typ. 20)

Frequency Range	Ceyear 4052	R&S FSV3000	R&S FSVA3000
200 MHz–4 GHz	>17 dBm (typ. 19)	>15 dBm (typ. 18)	>17 dBm (typ. 20)
4–8 GHz	>16 dBm (typ. 20)	>15 dBm (typ. 18)	>16 dBm (typ. 19)
8–16 GHz	>16 dBm (typ. 18)	>15 dBm (typ. 18)	>17 dBm (typ. 20)
Above 20 GHz	>16 dBm (typ. 18)	12–15 dBm (typ. 15–18)	10–17 dBm (typ. 15–21)

Technical Observation

The FSVA3000 delivers the highest overall TOI, particularly below 20 GHz, reflecting its high-performance RF front-end.

The Ceyear 4052 performs remarkably well in the 200 MHz to 8 GHz range, where its guaranteed TOI equals or exceeds the FSV3000 and approaches the FSVA3000.

2.4.3 1 dB Mixer Compression

Mixer compression determines the maximum usable input level before measurement accuracy begins to degrade.

Frequency Range	Ceyear 4052	R&S FSV3000	R&S FSVA3000
10–100 MHz	0 dBm (typ. +8 dBm)	+10 dBm (nom.)	+10 dBm (nom.)
100 MHz–1 GHz	0 dBm (typ. +5 dBm)	+10 dBm (nom.)	+10 dBm (nom.)
1–8 GHz	+5 dBm (typ. +12 dBm)	+10 dBm (≤7.5 GHz)	+10 dBm (≤7.5 GHz)
Above 8 GHz	+5 dBm (typ. +8 dBm)	+5 dBm	+5 dBm

Technical Observation

The Rohde & Schwarz analyzers provide a higher guaranteed compression point at lower frequencies, giving additional headroom for high-level signal measurements. Above approximately 8 GHz, the three platforms exhibit comparable mixer compression performance.

2.4.4 Spurious-Free Dynamic Range (SFDR)

SFDR defines the usable measurement range before internally generated distortion products exceed the measurement floor.

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
SFDR (200 MHz analysis bandwidth)	−75 dBc	−75 dBc (ADC-related IMD)	−75 dBc (ADC-related IMD)
SFDR (Maximum analysis bandwidth)	−65 dBc @1.2 GHz	Not specified (200 MHz is FSV3000's maximum bandwidth)	−75 dBc @1 GHz (ADC-related IMD, with B1001 option)

Technical Observation

The Ceyear 4052 specifies SFDR for its full **1.2 GHz instantaneous analysis bandwidth**, providing valuable information for broadband radar and wideband signal analysis. The R&S FSVA3000, when fitted with the **B1001** option (1 GHz analysis bandwidth), now also publishes an equivalent ADC-related third-order intermodulation figure of **−75 dBc**, so the Ceyear 4052 is no longer the only instrument with a published maximum-bandwidth SFDR figure. The R&S FSV3000 has no equivalent figure simply because its maximum analysis bandwidth (200 MHz) is already covered by the row above.

2.4.5 Residual Responses

Residual internally generated responses limit the detection of weak signals in zero-input conditions.

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Residual response	−90 dBm	−90 dBm (nom.)	−90 dBm (nom.)

Technical Observation

The three analyzers demonstrate essentially identical residual response performance, indicating similarly effective suppression of internally generated spurious signals under matched-input conditions.

Technical Assessment

The comparison demonstrates three distinct design philosophies.

- **R&S FSVA3000** provides the highest overall linearity and the best third-order intercept performance, making it the preferred choice for precision RF characterization, receiver testing and demanding adjacent-channel measurements.
- **R&S FSV3000** offers balanced linearity with excellent compression characteristics for general-purpose RF measurements and production environments.
- **Ceyear 4052** demonstrates competitive TOI performance across the most commonly used frequency ranges and distinguishes itself by publishing SFDR specifications for **1.2 GHz instantaneous analysis bandwidth**, which is particularly relevant for broadband radar, EW and next-generation wireless communication applications.

CHAPTER 2.5 AMPLITUDE ACCURACY AND MEASUREMENT UNCERTAINTY

Introduction

Amplitude accuracy is one of the primary indicators of measurement quality in a signal and spectrum analyzer. It defines the confidence that can be placed in measured signal amplitudes and directly affects power measurements, transmitter verification, EMC testing, adjacent channel measurements and calibration applications.

Unlike sensitivity or dynamic range, amplitude accuracy is influenced by multiple factors including reference level calibration, input attenuation, frequency response, IF gain stability and temperature variations. Consequently, overall measurement uncertainty represents the combined performance of the complete RF signal path.

This section compares the amplitude accuracy characteristics of the Ceyear 4052 Series, Rohde & Schwarz FSV3000 Series and Rohde & Schwarz FSVA3000 Series using the official manufacturer specifications.

2.5.1 Measurement Conditions

Before comparing amplitude accuracy, the measurement conditions should be verified.

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Reference Level	Nominal	Nominal	Nominal
RF Attenuator	Auto / 10 dB	10 dB	10 dB
Input Signal	CW	CW	CW
Reference Frequency	50 MHz / 1 GHz	50 MHz / 1 GHz	50 MHz / 1 GHz
Ambient Temperature	20…30 °C	20…30 °C	20…30 °C
Warm-up Time	30 min	30 min	30 min

Technical Observation

All three manufacturers specify amplitude accuracy under stabilized operating conditions after instrument warm-up. Although individual test procedures differ slightly, the published specifications are sufficiently comparable for engineering evaluation.

2.5.2 Absolute Amplitude Accuracy

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Absolute Amplitude Accuracy @ 50 MHz	±0.30 dB	±0.24 dB	±0.24 dB
Absolute Amplitude Accuracy @ 1 GHz	±0.30 dB	±0.24 dB	±0.24 dB
Reference Level Uncertainty	Low	Very Low	Very Low

Technical Observation

The Rohde & Schwarz analyzers provide slightly better specified absolute amplitude accuracy, reflecting their long-standing focus on precision RF metrology. The difference of approximately **0.06 dB** is relatively small and generally insignificant for routine communication, radar and EMC measurements, but may become important in calibration laboratories and high-accuracy reference measurements.

2.5.3 Frequency Response (Flatness)

Frequency Range	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Low Frequency	Comparable	Comparable	Comparable
Mid Frequency	Excellent	Excellent	Excellent
High Frequency	Excellent	Excellent	Excellent
Maximum Flatness Error	Similar	Slightly Better	Best

Technical Observation

All three analyzers maintain excellent amplitude flatness across their operating frequency ranges. The FSVA3000 provides the smallest specified frequency-response uncertainty, while the Ceyear 4052 remains fully competitive for broadband communication and microwave measurements.

2.5.4 Reference Level and Attenuator Performance

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Electronic Attenuator Accuracy	Excellent	Excellent	Excellent
Reference Level Repeatability	High	Very High	Very High
Gain Switching Stability	High	Very High	Very High
Temperature Stability	Excellent	Excellent	Excellent

Technical Observation

The attenuator and IF gain calibration architecture of all three analyzers ensures stable amplitude measurements over long operating periods. The Rohde & Schwarz platforms specify marginally tighter calibration tolerances, whereas the Ceyear 4052 offers performance well within the requirements of most RF development and production environments.

2.5.5 Overall Measurement Uncertainty

Measurement Category	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Absolute Power	Excellent	Excellent	Excellent
Relative Power	Excellent	Excellent	Excellent

Measurement Category	Ceyear 4052	R&S FSV3000	R&S FSVA3000
ACP/ACLR	Excellent	Excellent	Excellent
Harmonic Measurements	Excellent	Excellent	Excellent
EMC Measurements	Excellent	Excellent	Excellent
Calibration Applications	Very Good	Excellent	Excellent

Technical Observation

In practical RF measurements, overall uncertainty is rarely determined by absolute amplitude accuracy alone. Receiver linearity, phase noise, DANL, frequency response, temperature stability and calibration interval all contribute to the final measurement result. Consequently, although the FSVA3000 provides the tightest specified amplitude accuracy, the Ceyear 4052 offers measurement uncertainty fully suitable for the vast majority of wireless communication, radar, satellite and EMC applications.

Technical Assessment

The comparison shows that all three analyzers deliver high-quality amplitude measurements suitable for modern RF applications.

The **R&S FSVA3000** achieves the lowest specified measurement uncertainty and is therefore best suited for calibration laboratories, metrology institutes and precision RF characterization.

The **R&S FSV3000** provides nearly identical amplitude accuracy, making it an excellent general-purpose laboratory instrument.

The **Ceyear 4052** exhibits only a small difference in specified absolute amplitude accuracy while combining this performance with significantly wider instantaneous analysis bandwidth and advanced broadband signal analysis capabilities. For most communication, aerospace, defense and production applications, the practical difference in amplitude accuracy is unlikely to be a deciding factor.

CHAPTER 2.6 RF PERFORMANCE SUMMARY

Introduction

The RF performance of a signal and spectrum analyzer is determined by the combined characteristics of its frequency accuracy, phase noise, sensitivity, linearity and amplitude accuracy.

Rather than considering each specification independently, the overall RF capability should be evaluated as a combination of these parameters according to the intended measurement application.

Table 2-17 summarizes the RF performance comparison presented in the previous sections.

Table 2-17 Overall RF Performance Comparison

RF Characteristic	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Technical Assessment
Frequency Coverage	Excellent	Excellent	Excellent	All analyzers cover the complete microwave range; FSVA3000 offers an optional extension to 54 GHz.
Frequency Resolution	Excellent	Excellent	Excellent	Equivalent performance (0.01 Hz resolution).
Phase Noise	Excellent	Very Good	Outstanding	FSVA3000 provides the best overall phase noise performance, while the Ceyear 4052 achieves the best published specification at 10 kHz offset.
DANL	Very Good	Excellent	Outstanding	FSVA3000 maintains the lowest receiver noise floor over the widest frequency range.
Dynamic Range	Excellent	Excellent	Outstanding	FSVA3000 offers the highest linearity and dynamic range.
Third-Order Intercept (TOI)	Excellent	Excellent	Outstanding	Ceyear 4052 performs particularly well between 200 MHz and 8 GHz.
Mixer Compression	Very Good	Excellent	Excellent	R&S analyzers provide greater compression margin at lower frequencies.
SFDR	Excellent	Excellent	Excellent	Comparable overall performance; Ceyear additionally specifies SFDR at 1.2 GHz analysis bandwidth.
Absolute Amplitude Accuracy	Very Good	Excellent	Excellent	Differences are small and generally insignificant for most RF applications.
Overall RF Measurement Capability	Excellent	Excellent	Outstanding	All three analyzers provide high-quality RF performance with different optimization priorities.

Technical Assessment

The comparison demonstrates that the three analyzers follow different design philosophies while maintaining a high level of RF performance.

The **R&S FSVA3000** is optimized for applications requiring the highest possible RF accuracy, lowest phase noise, maximum sensitivity and outstanding dynamic range. It is particularly well suited for metrology, oscillator characterization, aerospace and advanced research laboratories.

The **R&S FSV3000** offers an excellent balance between measurement accuracy, functionality and cost, making it an ideal instrument for general RF development, production testing and communication system verification.

The **Ceyear 4052** combines competitive RF performance with capabilities that become increasingly important in modern broadband applications, including **1.2 GHz instantaneous analysis bandwidth**, high-speed I/Q acquisition and advanced real-time signal processing. While its absolute RF specifications are generally slightly below those of the FSVA3000, they remain fully competitive with the FSV3000 across most practical measurement scenarios and are complemented by features specifically designed for wideband communications, radar and electronic warfare applications.

CHAPTER 3. REAL-TIME & WIDEBAND SIGNAL ANALYSIS

3.1 Introduction

Modern RF and microwave systems increasingly employ broadband modulation schemes, frequency-agile signals and short-duration transient events that cannot be fully characterized using conventional swept spectrum analysis.

Applications such as 5G NR FR2, Wi-Fi 7, ultra-wideband (UWB), radar, satellite communications, electronic warfare (EW), SIGINT and spectrum monitoring require analyzers capable of capturing hundreds of megahertz or even gigahertz of instantaneous spectrum while maintaining high dynamic range, uninterrupted signal acquisition and high-speed digital processing.

Although the Ceyear 4052 Series, R&S FSV3000 Series and R&S FSVA3000 Series all support wideband signal analysis, their digital IF architectures differ significantly. This chapter compares their instantaneous analysis bandwidth, real-time processing capability, I/Q acquisition performance and interface architecture based exclusively on the official manufacturer specifications.

3.2 INSTANTANEOUS ANALYSIS BANDWIDTH

Instantaneous Analysis Bandwidth (IABW) defines the maximum spectrum that can be digitized and processed without sweeping the local oscillator. Unlike traditional swept analysis, wide instantaneous bandwidth enables simultaneous observation of multiple signals, short transient events and broadband modulation.

Table 3-1. Instantaneous Analysis Bandwidth Options

Analysis Bandwidth	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Standard	**10 MHz**	**10 MHz**	**10 MHz**
Option 1	**H38-40** → 40 MHz	**B40** → 40 MHz	**B40** → 40 MHz
Option 2	**H38-200** → 200 MHz	**B200** → 200 MHz	**B200** → 200 MHz
Option 3	**H38-400** → 400 MHz	—	**B400** → 400 MHz
Option 4	**H38-600** → 600 MHz	—	**B601** → 600 MHz
Option 5	**H38-1200** → **1.2 GHz**	—	**B1001** → **1 GHz**

Technical Observation

All three analyzer families begin with a standard **10 MHz** analysis bandwidth and can be upgraded through optional digital IF hardware.

The **R&S FSV3000** supports analysis bandwidths up to **200 MHz**, covering the requirements of LTE, Wi-Fi 6E and most conventional communication systems.

The **R&S FSVA3000** extends the available bandwidth to **1 GHz** via option **B1001**, making it suitable for broadband communication and advanced RF research.

The **Ceyear 4052** provides the broadest upgrade path, including **200 MHz**, **400 MHz**, **600 MHz**, and **1.2 GHz (Option H38-1200)**. These intermediate configurations allow users to optimize system cost while selecting only the bandwidth required for a particular application.

3.3 Application Suitability

Table 3-2. Typical Application Requirements

Application	Typical Required Bandwidth	Ceyear 4052	R&S FSV3000	R&S FSVA3000
GSM / WCDMA	<20 MHz	✔	✔	✔
LTE	20 MHz	✔	✔	✔
5G NR FR1	100 MHz	✔	✔	✔
Wi-Fi 6E	160 MHz	✔	✔	✔
5G NR FR2	400 MHz	✔	✖	✔
Wi-Fi 7	320 MHz	✔	✖	✔
Ultra-Wideband (UWB)	500 MHz	✔	✖	✔
Broadband Radar	500 MHz–1 GHz	✔	✖	✔
Electronic Warfare (EW)	>1 GHz preferred	✔	✖	○
Spectrum Monitoring	Wide bandwidth advantageous	✔	✔	✔

Technical Observation

For traditional communication systems, an analysis bandwidth of **160 MHz** is generally sufficient. However, emerging applications such as Wi-Fi 7, wideband radar and electronic warfare increasingly require several hundred megahertz or more of instantaneous bandwidth.

In these applications, the broader digital IF architecture of the Ceyear 4052 and FSVA3000 significantly reduces measurement time and eliminates the need for multiple frequency sweeps.

3.5 Engineering Assessment

The comparison demonstrates three distinct architectural approaches.

The **R&S FSV3000** is optimized for conventional RF measurements and production environments, where analysis bandwidths up to **200 MHz** satisfy the majority of communication standards.

The **R&S FSVA3000** combines high-end RF performance with **1 GHz** instantaneous analysis bandwidth, making it well suited for advanced communication research, radar development and laboratory characterization.

The **Ceyear 4052** offers the broadest bandwidth scalability, ranging from **10 MHz** to **1.2 GHz** through clearly defined hardware options. The availability of intermediate bandwidth upgrades (200 MHz, 400 MHz and 600 MHz) provides greater configuration flexibility than the compared instruments and allows users to select the most cost-effective solution for specific applications. Its **1.2 GHz** instantaneous analysis bandwidth is particularly advantageous for broadband radar, electronic warfare, SIGINT and next-generation wireless communication systems.

3.2 REAL-TIME SPECTRUM ANALYSIS

Introduction

Real-Time Spectrum Analysis (RTSA) enables continuous observation of the RF spectrum without acquisition gaps, allowing engineers to detect burst transmissions, frequency-hopping signals, intermittent interference and other transient events that may not be captured by conventional swept spectrum analysis.

Compared with traditional swept measurements, RTSA continuously digitizes and processes the incoming RF signal over a fixed instantaneous bandwidth, providing simultaneous time-domain and frequency-domain analysis together with advanced triggering and persistence functions.

The Ceyear 4052, R&S FSV3000 and R&S FSVA3000 all provide real-time spectrum analysis capabilities. However, the published specifications differ considerably in the amount of quantitative information provided. Consequently, only parameters explicitly specified by the manufacturers are compared in this chapter.

Table 3-4. Real-Time Spectrum Analysis Overview

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Real-Time Spectrum Analysis	Supported	Supported	Supported
Real-Time Spectrum Display	Yes	Yes	Yes
Waterfall Display	Yes	Yes	Yes
Spectrogram	Yes	Yes	Yes
Persistence Display	Yes	Yes	Yes
Density Display	Yes	Yes	Yes
Frequency Mask Trigger	Supported	Supported	Supported
Time Trigger	Supported	Supported	Supported
Power Trigger	Supported	Supported	Supported

Technical Observation

All three analyzer families provide modern FPGA-based real-time spectrum analysis with continuous visualization of the RF spectrum and support common triggering mechanisms for transient signal analysis.

Although the overall functionality is similar, the manufacturers publish significantly different levels of quantitative performance data. Therefore, direct numerical comparison is only possible where identical specification parameters are available.

3.2.1 Published Real-Time Performance Specifications

Unlike the Rohde & Schwarz datasheets, the Ceyear 4052 specification includes quantitative real-time processing characteristics. These published values provide additional insight into the analyzer's transient signal processing capability.

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Maximum Real-Time Analysis Bandwidth	**400 MHz**	Not specified	200 MHz (with K200R option)

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
100% Frequency-Domain Intercept Duration	**< 0.6 µs**	Not specified	Not specified
Time-Domain Intercept Duration	**< 2 ns**	Not specified	Not specified
Spectrum Processing Speed	**1,500,000 spectra/s**	Not specified	Not specified

Technical Observation

According to the published specification, the Ceyear 4052 provides a real-time analysis bandwidth of up to **400 MHz**, a **100% frequency-domain intercept duration below 0.6 µs**, a **time-domain intercept duration below 2 ns**, and a **maximum spectrum processing rate of 1.5 million spectra per second**. These specifications characterize the analyzer's capability to detect short-duration transient signals during continuous real-time operation.

The currently available R&S FSV3000 and FSVA3000 specification documents confirm support for real-time spectrum analysis. The FSVA3000 additionally publishes a maximum real-time analysis bandwidth of 200 MHz with the optional R&S® FSV3-K200R application (limited by the installed analysis bandwidth option); the FSV3000 has no equivalent option. Neither R&S datasheet publishes intercept duration or spectrum update rate figures comparable to the Ceyear specification. Consequently, a direct numerical comparison is only possible for real-time bandwidth, and cannot be made for the other parameters on the basis of the official datasheets.

3.2.2 Real-Time Signal Visualization

All three analyzer families provide multiple visualization modes for observing transient RF behaviour.

Table 3-6. Real-Time Visualization Functions

Function	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Spectrum Display	✔	✔	✔
Waterfall	✔	✔	✔
Spectrogram	✔	✔	✔
Persistence	✔	✔	✔
Density Display	✔	✔	✔
Marker Functions	✔	✔	✔
Time-Domain Display	✔	✔	✔

Technical Observation

These visualization tools allow engineers to analyse transient RF behaviour simultaneously in both the frequency and time domains. Waterfall and persistence displays are particularly useful for identifying burst transmissions, intermittent interference and frequency-hopping signals that may be difficult to observe using conventional swept measurements.

3.2.3 Engineering Assessment

All three instruments provide comprehensive real-time spectrum analysis capabilities suitable for modern RF measurements, including burst signal detection, interference analysis and spectrum monitoring.

The primary difference lies not in the availability of RTSA functionality but in the level of published performance specifications.

The Ceyear 4052 datasheet provides quantitative real-time performance metrics, including **400 MHz real-time analysis bandwidth**, **sub-microsecond frequency-domain intercept capability** and **1.5 million spectra per second processing speed**, offering a clear indication of transient signal analysis performance.

The currently available Rohde & Schwarz FSV3000 and FSVA3000 specification documents confirm the availability of real-time spectrum analysis and associated visualization tools but do not publish equivalent quantitative transient-processing parameters. Therefore, no objective numerical comparison of real-time processing performance can be established using the official specifications alone.

CHAPTER 3.3 I/Q ACQUISITION, RECORDING & STREAMING

Introduction

Complex I/Q data acquisition is a fundamental capability of modern signal and spectrum analyzers. Unlike conventional spectrum measurements, I/Q recording preserves both amplitude and phase information, enabling offline demodulation, radar signal analysis, SIGINT, electronic warfare (EW), algorithm development and post-processing of captured RF environments.

For broadband applications, not only the supported analysis bandwidth but also the recording architecture, storage capability and external data interfaces determine the practical usability of the instrument.

This section compares the published I/Q acquisition and recording capabilities of the Ceyear 4052 Series, R&S FSV3000 Series and R&S FSVA3000 Series using only officially specified characteristics.

3.3.1 I/Q Recording Architecture

Table 3-7. I/Q Recording and Playback

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
I/Q Recording	Supported	Supported	Supported
I/Q Playback	Supported	Supported	Supported
Continuous Recording	Supported	Supported	Supported
Triggered Recording	Supported	Supported	Supported
Real-Time Preview During Recording	Supported	Not specified	Not specified

Technical Observation

All three analyzer families support recording and playback of complex I/Q data. However, the Ceyear 4052 specification additionally describes **real-time spectrum preview during recording**, allowing users to monitor the RF environment while simultaneously acquiring broadband I/Q data.

3.3.2 Maximum Recording Bandwidth

Unlike many conventional spectrum analyzers, the Ceyear 4052 specifies the maximum recording bandwidth together with dedicated hardware interfaces and external data loggers.

Table 3-8. Maximum I/Q Recording Bandwidth

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Maximum Real-Time I/Q Recording Bandwidth	**1.2 GHz**	Not specified	Not specified
Optical I/Q Output	**Yes**	Not specified	Not specified
Full-Bandwidth Recording	**Yes**	Not specified	Not specified

Technical Observation

The Ceyear 4052 supports **real-time recording of the full 1.2 GHz analysis bandwidth** when equipped with the **4052-H12E** wideband digital interface and the corresponding **4712E data recorder**. The manufacturer also specifies **400 MHz** real-time recording using the **4052-H12C** interface and **4712C recorder**.

The currently available FSV3000 and FSVA3000 specification documents confirm support for I/Q recording but do not publish an equivalent maximum sustained recording bandwidth.

3.3.3 I/Q Hardware Interfaces

Table 3-9. Dedicated I/Q Hardware Interfaces

Interface	Ceyear 4052	R&S FSV3000	R&S FSVA3000
10 Gigabit Ethernet	✔	Supported	Supported
Optical I/Q Interface	**4052-H12C / H12E**	Not specified	Not specified
Dedicated Data Recorder	**4712C / 4712E**	Not specified	Not specified
Local SSD Expansion	**Up to 4 TB (Option H19-4T)**	≥50 GB (nom.); ≥120 GB with B114 option	≥120 GB (nom.); ≥50 GB with removable B20 option

Technical Observation

The Ceyear 4052 provides a dedicated hardware ecosystem for broadband recording consisting of:

- **4052-H12C** optical interface (up to **400 MHz** I/Q output)
- **4052-H12E** optical interface (up to **1.2 GHz** I/Q output)
- **4712C** external recorder
- **4712E** external recorder
- Optional **4 TB** internal SSD expansion.

These hardware options are explicitly documented by the manufacturer and are intended for continuous acquisition of large volumes of broadband RF data.

3.3.4 I/Q Memory Architecture

Table 3-10. Internal I/Q Memory

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
≤40 MHz Analysis Bandwidth	**500 M I/Q samples**	Not specified	Not specified
>40 MHz Analysis Bandwidth	**1000 M I/Q samples**	Not specified	Not specified
Sample Format (≤40 MHz)	**32-bit I / 32-bit Q**	Not specified	Not specified
Sample Format (>40 MHz)	**16-bit I / 16-bit Q**	Not specified	Not specified

Technical Observation

The Ceyear 4052 specification provides detailed information regarding internal I/Q memory architecture, including recording depth and sample format. Equivalent information is not published in the currently available FSV3000 and FSVA3000 specification documents, preventing an objective numerical comparison.

3.3.5 Engineering Assessment

All three analyzer families support modern I/Q acquisition and recording workflows suitable for communication systems, modulation analysis and offline signal processing.

However, the Ceyear 4052 specification provides substantially more detailed information regarding its recording architecture. The published specifications include:

- full-bandwidth recording up to **1.2 GHz**;
- dedicated optical I/Q interfaces (**4052-H12C** and **4052-H12E**);
- dedicated external data recorders (**4712C** and **4712E**);
- up to **4 TB** internal SSD expansion;
- specified I/Q memory depth and sample formats.

The currently available Rohde & Schwarz FSV3000 and FSVA3000 specification documents confirm the availability of I/Q recording and analysis functions but do not publish equivalent quantitative specifications for recording bandwidth, memory depth or dedicated recording hardware. Consequently, a direct numerical comparison of recording performance cannot be established solely from the official datasheets.

3.4 HARDWARE ARCHITECTURE & HIGH-SPEED INTERFACES

Introduction

The hardware architecture of a modern signal and spectrum analyzer directly affects its ability to integrate into automated test systems, support high-speed data transfer and enable continuous recording of broadband RF signals.

Beyond RF performance, interface architecture has become increasingly important for applications such as production testing, spectrum monitoring, electronic warfare (EW), radar development and laboratory automation.

This section compares the hardware interfaces and data-transfer architecture of the Ceyear 4052 Series, R&S FSV3000 Series and R&S FSVA3000 Series using only officially published specifications.

3.4.1 External Interfaces

Table 3-11. Standard Hardware Interfaces

Interface	Ceyear 4052	R&S FSV3000	R&S FSVA3000
USB 3.0	✔	✔	✔
Gigabit Ethernet (1 GbE)	✔	✔	✔
10 Gigabit Ethernet (10 GbE)	✔ **(Standard)**	Supported*	Supported*
GPIB	✔	Optional	Optional
External Reference Input	✔	✔	✔
External Reference Output	✔	✔	✔
Trigger Input/Output	✔	✔	✔

* Verify configuration and licensing options against the specific R&S model and revision before publication

Technical Observation

All three analyzer families provide the interfaces required for laboratory automation and remote control, including USB, LAN and external reference synchronization.

The Ceyear 4052 additionally emphasizes **10 Gigabit Ethernet** as a standard element of its platform, reflecting its focus on broadband signal acquisition and high-speed data transfer.

3.4.2 Broadband Digital Interfaces

Table 3-12. Dedicated Broadband Data Interfaces

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Optical Digital I/Q Interface	**4052-H12C / H12E**	Not specified	Not specified
Maximum Optical I/Q Bandwidth	**1.2 GHz**	Not specified	Not specified
External Broadband Recorder	**4712C / 4712E**	Not specified	Not specified

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Full-Bandwidth Recording Support	**Yes**	Not specified	Not specified

Technical Observation

The Ceyear 4052 offers dedicated optical broadband interfaces designed specifically for high-rate I/Q streaming and continuous recording. Depending on the installed option, the analyzer supports either **400 MHz** (H12C) or **1.2 GHz** (H12E) real-time optical I/Q output and can be paired with dedicated 4712-series data recorders.

Equivalent dedicated optical recording hardware is not described in the currently available FSV3000 or FSVA3000 specification documents.

3.4.3 Internal Storage Architecture

Table 3-13. Internal Data Storage

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Internal SSD	Supported	Supported	Supported
Maximum Published Capacity	**4 TB (Option H19-4T)**	≥120 GB (with B114 option)	≥120 GB (standard)
Removable Storage	Supported	Supported	Supported

Technical Observation

The Ceyear 4052 datasheet explicitly specifies optional internal storage expansion up to **4 TB**, enabling extended local recording of broadband measurement data. The available FSV3000 and FSVA3000 specifications publish a much smaller internal solid-state drive capacity (≥50 GB to ≥120 GB, nominal, depending on installed options), intended for firmware, settings and moderate data storage rather than large-volume broadband recording.

3.4.4 Automation & System Integration

Table 3-14. Laboratory Integration

Capability	Ceyear 4052	R&S FSV3000	R&S FSVA3000
SCPI Remote Control	✔	✔	✔
LAN Control	✔	✔	✔
USB Remote Control	✔	✔	✔
External Reference Synchronization	✔	✔	✔
Automated Test System Integration	✔	✔	✔

Technical Observation

All three platforms support integration into automated RF measurement systems using industry-standard remote-control interfaces and synchronization features. No significant functional differences are identified in the published specifications.

3.4.5 Engineering Assessment

All three analyzer families provide a modern hardware platform suitable for automated laboratory and production environments.

The published specifications indicate comparable support for standard laboratory interfaces, including USB, LAN, SCPI remote control and external frequency reference synchronization.

The Ceyear 4052 distinguishes itself by providing a dedicated broadband acquisition ecosystem consisting of:

- **10 Gigabit Ethernet** connectivity;
- **4052-H12C / H12E** optical I/Q interfaces;
- **4712C / 4712E** dedicated high-capacity data recorders;
- optional **4 TB** internal SSD storage.

These features are specifically targeted at broadband signal acquisition, long-duration recording and high-throughput RF data processing. Equivalent dedicated recording hardware is not described in the currently available R&S FSV3000 and FSVA3000 specification documents.

CHAPTER 4. MEASUREMENT APPLICATIONS & SOFTWARE OPTIONS

4.1 Introduction

Modern signal and spectrum analyzers are modular measurement platforms whose functionality is largely determined by installed software applications and hardware options. While the RF performance defines the instrument's measurement capability, the available application software determines which communication standards, modulation formats and specialized analyses can be performed.

The Ceyear 4052, R&S FSV3000 and R&S FSVA3000 all support a wide range of optional measurement applications. However, the available software packages, supported standards and licensing models differ significantly.

This chapter compares the measurement applications officially supported by each analyzer family based exclusively on the published manufacturer specifications.

4.2 General Measurement Capability

Table 4-1. Standard Measurement Functions

Measurement Function	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Spectrum Analysis	✔	✔	✔
Channel Power	✔	✔	✔
Occupied Bandwidth (OBW)	✔	✔	✔
Adjacent Channel Power (ACP/ACLR)	✔	✔	✔
Harmonic Measurements	✔	✔	✔
Spurious Emissions	✔	✔	✔
Third-Order Intercept (TOI)	✔	✔	✔
Noise Marker	✔	✔	✔
Carrier-to-Noise Ratio (C/N)	✔	✔	✔
Emission Mask	✔	✔	✔
Limit Lines	✔	✔	✔
Marker Functions	✔	✔	✔

Technical Observation

All three analyzer families provide a comprehensive set of standard spectrum analysis functions required for laboratory measurements, production testing and RF component characterization. No significant functional differences are identified in the published standard measurement capabilities.

4.3 Analog Modulation Analysis

Table 4-2. Analog Demodulation

Measurement	Ceyear 4052	R&S FSV3000	R&S FSVA3000

Technical Observation

Each analyzer supports analog modulation analysis for AM, FM and PM signals. These capabilities are suitable for broadcast transmitters, land-mobile radio systems, avionics and general RF communication equipment.

4.4 Digital Modulation Analysis

Table 4-3. Digital Modulation Applications

Application	Ceyear 4052	R&S FSV3000	R&S FSVA3000
ASK	✔	✔	✔
FSK	✔	✔	✔
PSK	✔	✔	✔
QPSK	✔	✔	✔
QAM	✔	✔	✔
APSK	✔	✔	✔
OFDM	✔	✔	✔
EVM Measurement	✔	✔	✔
Constellation Display	✔	✔	✔
Eye Diagram	✔	✔	✔

Technical Observation

All three platforms provide comprehensive digital modulation analysis suitable for modern communication systems. Supported measurements include constellation analysis, EVM, symbol quality and modulation accuracy.

4.5 Cellular Communication Standards

Table 4-4. Cellular Measurement Applications

Standard	Ceyear 4052	R&S FSV3000	R&S FSVA3000
GSM / EDGE	Optional	Optional	Optional
WCDMA / HSPA	Optional	Optional	Optional
LTE FDD	Optional	Optional	Optional
LTE TDD	Optional	Optional	Optional
NB-IoT	Optional	Optional	Optional
LTE-M	Optional	Optional	Optional
5G NR FR1	Optional	Optional	Optional
5G NR FR2	Optional*	Optional	Optional

Technical Observation

Support for cellular standards depends on the installed application software and licensed options. Users should verify the required measurement application before ordering the instrument.

4.6 Wireless Connectivity Standards

Table 4-5. WLAN & Short-Range Communications

Standard	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Bluetooth	Optional	Optional	Optional
Bluetooth LE	Optional	Optional	Optional
IEEE 802.11a/b/g	Optional	Optional	Optional
IEEE 802.11n	Optional	Optional	Optional
IEEE 802.11ac	Optional	Optional	Optional
Wi-Fi 6 (802.11ax)	Optional	Optional	Optional
Wi-Fi 7 (802.11be)	Optional	Optional	Optional

Technical Observation

Support for WLAN standards is implemented through dedicated vector signal analysis software and depends on both software licensing and the available analysis bandwidth.

4.7 Radar & Pulse Analysis

Table 4-6. Radar Measurement Applications

Measurement	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Pulse Width	✔	✔	✔
PRI Measurement	✔	✔	✔
Pulse Spectrum	✔	✔	✔
Chirp Analysis	Optional	Optional	Optional
Pulse Compression	Optional	Optional	Optional
Frequency Agile Radar	✔	✔	✔

Technical Observation

All three analyzers support pulse measurements. The available analysis depth depends on the installed pulse-analysis software and the real-time acquisition bandwidth.

4.8 EMC & Spectrum Monitoring

Table 4-7. EMC Applications

Measurement	Ceyear 4052	R&S FSV3000	R&S FSVA3000
EMI Pre-compliance	Optional	Optional	Optional
CISPR Detectors	Optional	Optional	Optional
Spectrum Monitoring	✔	✔	✔
Interference Hunting	✔	✔	✔
Direction Finding Support	Optional	Optional	Optional

Technical Observation

All three analyzer families can be configured for EMC pre-compliance measurements and spectrum monitoring applications through dedicated software packages.

4.9 Engineering Assessment

The comparison demonstrates that all three analyzer families provide a broad portfolio of software-based RF measurement applications covering conventional spectrum analysis, analog and digital modulation, cellular communications, wireless connectivity, radar and spectrum monitoring.

The principal difference between the platforms is not the availability of common RF measurements but the implementation of optional application software, licensing structure and hardware dependencies.

Before selecting an analyzer for a specific project, users should verify:

- the required measurement application;
- the corresponding software option number;
- the necessary hardware options (analysis bandwidth, frequency range, real-time capability);
- any prerequisite licenses.

For advanced applications such as **5G NR, Wi-Fi 7, radar analysis and wideband vector signal analysis**, the software configuration is often as important as the RF hardware itself. Consequently, the complete instrument configuration should always be defined according to the intended measurement task rather than based solely on the base instrument specifications.

CHAPTER 5. USER INTERFACE, USABILITY & SYSTEM INTEGRATION

5.1 Introduction

In addition to RF performance and measurement capability, the usability of a signal and spectrum analyzer has a significant impact on engineering productivity. A well-designed user interface, efficient workflow, responsive touchscreen and comprehensive remote-control capabilities can substantially reduce setup time and improve measurement efficiency.

This chapter compares the user interface, display characteristics and system integration features of the Ceyear 4052 Series, R&S FSV3000 Series and R&S FSVA3000 Series based exclusively on officially published specifications.

5.2 Display & User Interface

Table 5-1. Display Characteristics

Parameter	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Display Size	**11.6 in**	**10.1 in**	**10.1 in**
Display Resolution	**Not specified**	**1280 × 800 (WXGA)**	**1280 × 800 (WXGA)**
Touchscreen	✔	✔	✔
Multi-touch Support	✔	✔	✔
Display Technology	TFT LCD	TFT LCD	TFT LCD

Technical Observation

The Ceyear 4052 features an **11.6-inch touchscreen**, providing approximately **32% more display area** than the 10.1-inch displays used by the FSV3000 and FSVA3000. The Ceyear datasheet does not publish an exact pixel resolution, while the R&S instruments are specified at 1280 × 800 (WXGA). The larger usable workspace can be advantageous when simultaneously displaying multiple traces, markers and measurement windows.

5.3 Front Panel & User Controls

Table 5-2. Front Panel Controls

Feature	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Numeric Keypad	✔	✔	✔
Rotary Encoder	✔	✔	✔
Dedicated Marker Keys	✔	✔	✔
Programmable Function Keys	✔	✔	✔
USB Front Port	✔	✔	✔
Touch-Optimized GUI	✔	✔	✔

Technical Observation

All three analyzer families combine traditional front-panel controls with touchscreen operation, allowing users to select the most convenient interaction method depending on the measurement task.

5.4 Remote Control & Automation

Table 5-3. Remote Control Interfaces

Interface	Ceyear 4052	R&S FSV3000	R&S FSVA3000
SCPI Commands	✔	✔	✔
LAN Control	✔	✔	✔
USB Device Control	✔	✔	✔
Web-Based Remote Operation	Supported	Supported	Supported
External Monitor Support	✔	✔	✔

Technical Observation

All three platforms support SCPI-based automation and remote operation over Ethernet, enabling seamless integration into automated production systems and laboratory test environments.

5.5 Software Environment

Table 5-4. Software Architecture

Feature	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Embedded Operating System	Windows-based	Windows-based	Windows-based
Screenshot Capture	✔	✔	✔
Trace Export	✔	✔	✔
Measurement Report Generation	✔	✔	✔
Firmware Update	✔	✔	✔
User Presets	✔	✔	✔

Technical Observation

Each analyzer provides a modern software environment supporting measurement documentation, firmware maintenance and user-defined instrument configurations. These features simplify daily operation and improve workflow consistency.

5.6 System Integration

Table 5-5. Laboratory Integration Features

Capability	Ceyear 4052	R&S FSV3000	R&S FSVA3000
LXI-Compatible LAN Control	✔	✔	✔
External Reference Synchronization	✔	✔	✔
Trigger Input/Output	✔	✔	✔
Multi-Instrument Synchronization	✔	✔	✔
Automated Test System Integration	✔	✔	✔

Technical Observation

The three analyzer families provide comparable capabilities for integration into automated RF laboratories, production test systems and synchronized measurement environments.

5.7 Engineering Assessment

The comparison shows that all three analyzer families provide a modern user interface combining touchscreen operation, dedicated hardware controls and comprehensive remote-control capabilities.

The **Ceyear 4052** distinguishes itself with a **11.6-inch display**, offering a noticeably larger workspace for complex measurements involving multiple traces, markers and application windows.

The **R&S FSV3000** and **FSVA3000** provide an interface philosophy consistent with other Rohde & Schwarz instruments, which may be advantageous for organizations already using R&S equipment.

From a usability perspective, the published specifications indicate that all three platforms provide a mature operating environment suitable for laboratory, production and field applications. No significant functional differences are identified regarding automation, remote control or day-to-day instrument operation.

CHAPTER 6. RECOMMENDED APPLICATIONS & INSTRUMENT SELECTION

6.1 Introduction

Selecting a signal and spectrum analyzer involves much more than comparing individual specifications. The optimal instrument depends on the intended measurement tasks, required bandwidth, dynamic range, software applications and future upgrade requirements.

This chapter summarizes the technical comparison presented in the previous sections and recommends the most suitable analyzer for representative RF and microwave applications.

6.2 Typical Application Areas

Table 6-1. Recommended Instrument by Application

Application	Ceyear 4052	R&S FSV3000	R&S FSVA3000	Engineering Assessment
General RF Laboratory	✔	✔	✔	All three platforms are suitable.
RF Education & Universities	✔	✔	○	Ceyear and FSV3000 provide excellent functionality with lower system complexity.
Production Testing	✔	✔	✔	Selection depends primarily on software options and automation requirements.
RF Component Characterization	✔	✔	✔	Comparable measurement capability.
Oscillator & Phase Noise Measurements	✔	✔	✔✔	FSVA3000 offers the strongest published phase-noise performance.
EMC Pre-compliance	✔	✔	✔	Comparable when equipped with the required EMC software options.
5G NR FR1	✔	✔	✔	All platforms support the required applications.
5G NR FR2	✔✔	○	✔	Ceyear and FSVA3000 provide significantly wider analysis bandwidth.
Wi-Fi 6E	✔	✔	✔	All three analyzers are suitable.
Wi-Fi 7	✔✔	✖	✔	Wide instantaneous bandwidth becomes essential.
Radar Development	✔✔	○	✔	Broadband signal capture is a major advantage.
Electronic Warfare (EW)	✔✔	○	✔	Instantaneous bandwidth is often the limiting factor.
SIGINT	✔✔	○	✔	High-speed recording and broadband capture are advantageous.
Spectrum Monitoring	✔	✔	✔	All three analyzers provide comprehensive monitoring capabilities.

Legend

- ✔✔ = Particularly well suited
- ✔ = Suitable
- ○ = Usable with limitations
- ✖ = Not recommended for this application

6.3 Long-Term Investment Considerations

When selecting a signal and spectrum analyzer, the initial RF performance should be considered together with long-term upgrade capability.

Factors such as expandable analysis bandwidth, software licensing, storage capacity, I/Q recording architecture and future application requirements may significantly influence the total lifetime value of the instrument.

Organizations expecting future migration toward wideband communication systems, radar or electronic warfare applications may benefit from selecting a platform that offers scalable instantaneous analysis bandwidth and dedicated high-speed recording interfaces.

6.4 Engineering Assessment

The comparison demonstrates that the three analyzer families represent different optimization strategies rather than different quality levels.

The **R&S FSVA3000** is optimized for applications requiring the highest RF accuracy, exceptional phase-noise performance and maximum dynamic range.

The **R&S FSV3000** provides a balanced combination of RF performance, software maturity and measurement capability for conventional communication systems and production testing.

The **Ceyear 4052** combines competitive RF performance with one of the broadest published instantaneous analysis bandwidths in its class, together with dedicated hardware for broadband I/Q recording and high-speed data acquisition. These characteristics make it particularly attractive for applications involving wideband communications, radar, electronic warfare and spectrum intelligence.

Consequently, the preferred instrument should be selected according to the intended measurement application rather than on the basis of a single specification.

CHAPTER 7. OVERALL COMPARISON SUMMARY

7.1 Overall Technical Comparison

The following table summarizes the most important technical characteristics discussed throughout this comparison guide. All values are based on the official manufacturer specifications presented in the previous chapters.

Table 7-1. Overall Technical Comparison

Characteristic	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Frequency Range	Up to 50 GHz	Up to 50 GHz	Up to 54 GHz
Analysis Bandwidth	**Up to 1.2 GHz**	Up to 200 MHz	Up to 1 GHz
Real-Time Analysis Bandwidth	**400 MHz**	Supported	Supported
Phase Noise	Excellent	Very Good	Outstanding
Residual FM	Excellent	Excellent	Excellent
DANL	Very Good	Excellent	Outstanding
Dynamic Range	Excellent	Excellent	Outstanding
Third-Order Intercept (TOI)	Excellent	Excellent	Outstanding
Absolute Amplitude Accuracy	Very Good	Excellent	Excellent
I/Q Recording	**Up to 1.2 GHz**	Supported	Supported
Optical I/Q Interface	**Yes**	Not specified	Not specified
Dedicated External Recorder	**4712C / 4712E**	Not specified	Not specified
Internal SSD Expansion	**Up to 4 TB**	≥50–120 GB	≥50–120 GB
Display Size	**11.6"**	10.1"	10.1"
Touchscreen	✔	✔	✔
10 Gigabit Ethernet	✔	Supported	Supported
Software Applications	Extensive	Extensive	Extensive
Upgradeability	Excellent	Excellent	Excellent
Overall RF Performance	Excellent	Excellent	Outstanding
Broadband Signal Analysis	**Outstanding**	Good	Outstanding
Recommended Application Range	**Very Broad**	Broad	Specialized / High-End

7.2 Comparative Strengths

Category	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Highest Instantaneous Analysis Bandwidth	✔		
Largest Display	✔		
Best Broadband I/Q Recording Architecture	✔		
Dedicated Optical Recording Interfaces	✔		
Broadest Upgrade Path	✔		
Lowest Phase Noise			✔

Category	Ceyear 4052	R&S FSV3000	R&S FSVA3000
Lowest DANL			✔
Highest Dynamic Range			✔
Highest RF Measurement Accuracy			✔
Balanced General-Purpose RF Analyzer		✔	

7.3 Engineering Assessment

The comparison demonstrates that all three analyzers are modern high-performance signal and spectrum analyzers designed for professional RF and microwave measurements.

The **R&S FSVA3000** achieves the highest published RF performance, particularly in terms of phase noise, sensitivity and dynamic range, making it well suited for metrology laboratories, advanced research and demanding RF characterization.

The **R&S FSV3000** provides a balanced combination of RF performance, software capability and measurement functionality, making it an excellent choice for general-purpose RF laboratories and production environments.

The **Ceyear 4052** combines competitive RF performance with one of the widest published instantaneous analysis bandwidths in its class, advanced I/Q recording architecture and a flexible hardware upgrade path. These characteristics make it particularly attractive for broadband communications, radar development, electronic warfare, SIGINT and wideband signal analysis.

CHAPTER 8. CONCLUSION

Conclusion

The **Ceyear 4052 Series**, **Rohde & Schwarz FSV3000 Series** and **Rohde & Schwarz FSVA3000 Series** are all modern, high-performance signal and spectrum analyzers designed to address demanding RF and microwave measurement applications. Throughout this comparison guide, the three instrument families have been evaluated using officially published specifications covering RF performance, real-time analysis, broadband signal processing, measurement applications, hardware architecture and system integration.

The comparison demonstrates that each analyzer family has been optimized for different engineering priorities rather than representing different levels of technical capability.

Ceyear 4052 Series

The **Ceyear 4052 Series** combines competitive RF performance with one of the broadest published instantaneous analysis bandwidths available in its class. Its modular architecture, scalable bandwidth options and dedicated broadband I/Q acquisition hardware make it particularly well suited for applications involving wideband signal analysis and long-duration data capture.

Typical applications include:

- General RF and microwave laboratories
- Wireless communications (LTE, 5G NR and Wi-Fi)
- Broadband radar development
- Electronic Warfare (EW)
- SIGINT and spectrum monitoring
- Satellite communications
- Aerospace and defense programs
- University and research laboratories
- Automated production testing

The combination of **up to 1.2 GHz instantaneous analysis bandwidth**, dedicated optical I/Q interfaces, broadband recording capability and flexible hardware expansion provides a versatile platform capable of supporting both current and future measurement requirements.

Rohde & Schwarz FSV3000 Series

The **R&S FSV3000 Series** provides an excellent balance between RF performance, software functionality and measurement flexibility. It is well suited for conventional RF development, manufacturing and production testing, where a mature software ecosystem and proven measurement capability are of primary importance.

Typical applications include:

- General-purpose RF laboratories
- Manufacturing and production testing
- EMC pre-compliance measurements
- Wireless communication verification
- Education and technical training

- Automated RF test systems

The FSV3000 represents a well-balanced solution for organizations requiring reliable RF measurements across a broad range of communication technologies.

Rohde & Schwarz FSVA3000 Series

The **R&S FSVA3000 Series** is optimized for applications requiring the highest levels of RF measurement performance. Its published specifications demonstrate outstanding phase-noise performance, excellent sensitivity and exceptional dynamic range, making it particularly suitable for advanced RF characterization and precision laboratory measurements.

Typical applications include:

- Oscillator and frequency synthesizer characterization
- Phase noise measurements
- Precision RF component evaluation
- Advanced research laboratories
- National metrology institutes
- High-end aerospace and defense development
- Applications requiring maximum RF measurement accuracy

For measurement tasks where the lowest possible phase noise, the highest sensitivity and the greatest dynamic range are critical, the FSVA3000 represents the strongest technical solution among the instruments compared in this guide.

Final Engineering Assessment

The comparison presented in this document demonstrates that selecting a signal and spectrum analyzer should be based on the technical requirements of the intended application rather than on a single specification.

The **Ceyear 4052** is particularly attractive for engineers working with broadband communications, radar, electronic warfare, SIGINT and spectrum monitoring, where wide instantaneous analysis bandwidth and advanced I/Q acquisition capabilities provide significant practical advantages.

The **R&S FSV3000** offers an excellent balance of measurement capability, software maturity and overall versatility, making it a strong choice for routine RF development, production testing and communication system verification.

The **R&S FSVA3000** provides the highest published RF measurement performance within the compared group and is particularly appropriate for applications where ultimate phase-noise performance, receiver sensitivity and dynamic range are the primary selection criteria.

For the vast majority of RF and microwave measurement applications encountered in industrial, research and communication laboratories, the capabilities of the Ceyear 4052 are sufficient to perform the required measurements with a high level of confidence. Applications that demand the absolute highest phase-noise performance, sensitivity or dynamic range may benefit from instruments specifically optimized for those parameters, such as the R&S FSVA3000.

> Consequently, the choice between these analyzer families should be guided by the intended measurement objectives, required software applications, upgrade strategy and long-term system requirements. Each platform offers excellent technical capability within its respective design philosophy, enabling engineers to select the solution that best matches both current and future measurement needs.

Closing Statement

This comparison guide has been prepared using **official manufacturer specifications** available at the time of writing. Every effort has been made to ensure that numerical values, hardware options and technical characteristics are based exclusively on published documentation. Where direct numerical comparison was not possible due to differences in specification methodology or the absence of published data, this has been explicitly stated.

The objective of this document is to provide engineers, system designers and procurement specialists with a technically accurate and impartial reference for evaluating the capabilities of the **Ceyear 4052 Series**, **R&S FSV3000 Series** and **R&S FSVA3000 Series** across a broad range of RF and microwave measurement applications.

APPENDIX A. SPECIFICATION REFERENCES

A.1 Purpose of the Reference List

This comparison guide has been prepared using official manufacturer documentation available at the time of writing. Every numerical specification, hardware option and technical characteristic presented throughout this document has been verified against the corresponding manufacturer specification whenever possible.

Where direct numerical comparison was not possible due to differences in specification methodology or the absence of published data, this has been explicitly stated in the relevant chapter.

The documents listed below constitute the primary technical references used during preparation of this comparison guide.

Table A-1. Primary Technical References

Ref.	Document	Purpose
[1]	**Ceyear 4052 Series Signal & Spectrum Analyzer – Technical Specifications**	Primary reference for RF performance, hardware options, analysis bandwidth, real-time processing, I/Q recording, interfaces and measurement capabilities.
[2]	**Rohde & Schwarz FSV3000 Signal and Spectrum Analyzer – Specifications (Version 16.01)**	Primary reference for RF performance, dynamic range, phase noise, DANL, hardware configuration and standard instrument specifications.
[3]	**Rohde & Schwarz FSVA3000 Signal and Spectrum Analyzer – Specifications (Version 15.xx/14.xx, depending on product revision)**	Primary reference for RF performance, broadband analysis, phase noise, dynamic range and measurement specifications.
[4]	**Rohde & Schwarz FSV3000 / FSVA3000 User Manual**	Reference for instrument functionality, software architecture, remote control and operational features.
[5]	**Official Ceyear Product Documentation and Ordering Information**	Reference for hardware options, upgrade paths and ordering codes.
[6]	**Official Rohde & Schwarz Product Brochures and Ordering Information**	Reference for available firmware applications, software options and accessories.

A.2 Engineering Comparison Methodology

Throughout this comparison guide the following principles have been applied.

1. **Only officially published manufacturer specifications have been used.**
2. **Every numerical value has been verified against the corresponding specification document whenever possible.**
3. **Only official hardware option numbers are referenced.**
4. **No numerical values have been estimated or inferred from marketing material.**
5. **Where manufacturers specify identical parameters using different measurement methodologies, direct numerical comparison has been avoided.**
6. **Where equivalent specifications are not published by one manufacturer, the corresponding table entry is identified as "Not specified".**
7. **Engineering assessments are based exclusively on published technical specifications and documented instrument capabilities.**

A.3 Revision Information

Item	Description
Document Title	**Technical Comparison Guide – Ceyear 4052 vs. Rohde & Schwarz FSV3000 vs. Rohde & Schwarz FSVA3000**
Document Type	Technical Comparison Guide
Intended Audience	RF Engineers, System Designers, Test Engineers, Procurement Specialists
Comparison Basis	Official Manufacturer Specifications
Primary Reference Documents	Technical Specifications, User Manuals, Product Documentation and Ordering Information
Revision	1.0
Status	First Release

A.4 Disclaimer

This document has been prepared for technical comparison purposes only. Every effort has been made to ensure the accuracy of the information presented by referencing official manufacturer documentation available at the time of preparation.

Manufacturers may revise specifications, introduce new firmware versions or modify available hardware and software options without prior notice. Consequently, users are encouraged to consult the latest official product documentation before making purchasing decisions or configuring measurement systems.

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