# EMI MEASUREMENT APPLICATION FOR SIGNAL AND SPECTRUM ANALYZERS

## Detecting and eliminating electromagnetic interference

R&S®FSW-K54
R&S®FSV3-K54
R&S®FPL1-K54
R&S®FSV-K54


Product Brochure
Version 01.01

ROHDE&SCHWARZ
Make ideas real

# AT A GLANCE

The EMI measurement application (K54 option) adds EMI precompliance measurement functions to the following spectrum analyzers: R&S®FSW, R&S®FSVA3000, R&S®FSV3000, R&S®FPL1000 and R&S®FSVR. It is the ideal EMI analysis extension for product development and a smooth certification process. Typical application fields include commercial, automotive, avionics and military product development (CISPR, EN, FCC, DO-160 and MIL-STD-461 standards).

The EMI-specific measurement bandwidths and CISPR detectors provided by the K54 option allow the use of standard EMI measurement methods to measure emission levels. Limit lines allow simple identification of critical levels and related frequencies. The K54 option provides a library of limit lines for common product standards – so they do not have to be created individually – as well as functions for in-depth signal analysis.

The K54 option supports automated analysis of large frequency ranges. This is particularly helpful when using detectors with long measuring times, such as a quasi-peak detector (measuring time ≥ 1 s).

The K54 option sweeps the user-defined frequency range with a fast detector, usually a peak detector, and only measures automatically detected critical frequencies with a slow detector. The results are compiled in a table for a quick and easy overview. The results can also be exported in a customizable layout with the trace and other details in a PDF or Microsoft Word document. [1)]

The K54 option can also be combined with R&S®ELEKTRA EMC test software for even more convenient measurements. [2)]

[1)] Supported by the R&S®FSW, R&S®FSVA3000, R&S®FSV3000 and R&S®FPL1000.
[2)] Supported by the R&S®FSW, R&S®FSVA3000, R&S®FSV3000, R&S®FPL1000 and R&S®FSV.


R&S®FPL1007 spectrum analyzer with R&S®FPL1-K54 EMI measurement application.

# KEY FACTS

- EMI detectors
- EMI measurement bandwidths
- Limit line library
- Measurement automation
- Report generation [1)]

# BENEFITS

Conclusive results
▶ page 4

Repeatable and fast measurement thanks to automated test sequences
▶ page 5

In-depth signal analysis
▶ page 6

Fast and efficient
▶ page 7

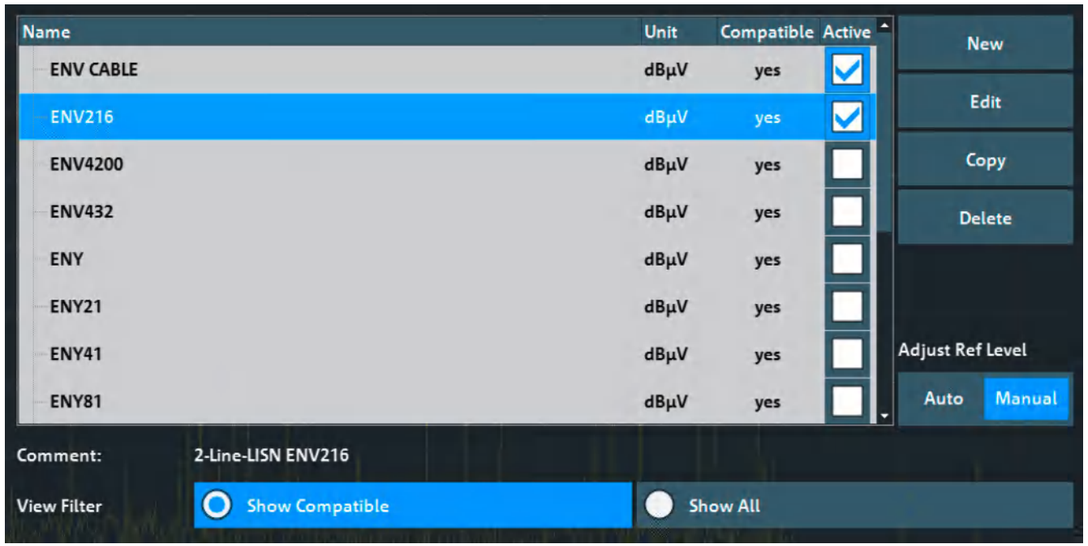
# CONCLUSIVE RESULTS

## Key features

- EMI detectors: quasi-peak, CISPR-average, RMS-average (CISPR 16-1-1).
- EMI bandwidth (6 dB)
  - 200 Hz, 9 kHz, 120 kHz and 1 MHz (CISPR 16-1-1)
  - 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz and 1 MHz (MIL-STD-461 and DO-160)
- Selection of one or more transducer factors to compensate for antenna factors or cable attenuation.

**Transducer definition – example from R&S®FPL1000**

Selection of two transducer factors (artificial mains network/LISN and related cabling).





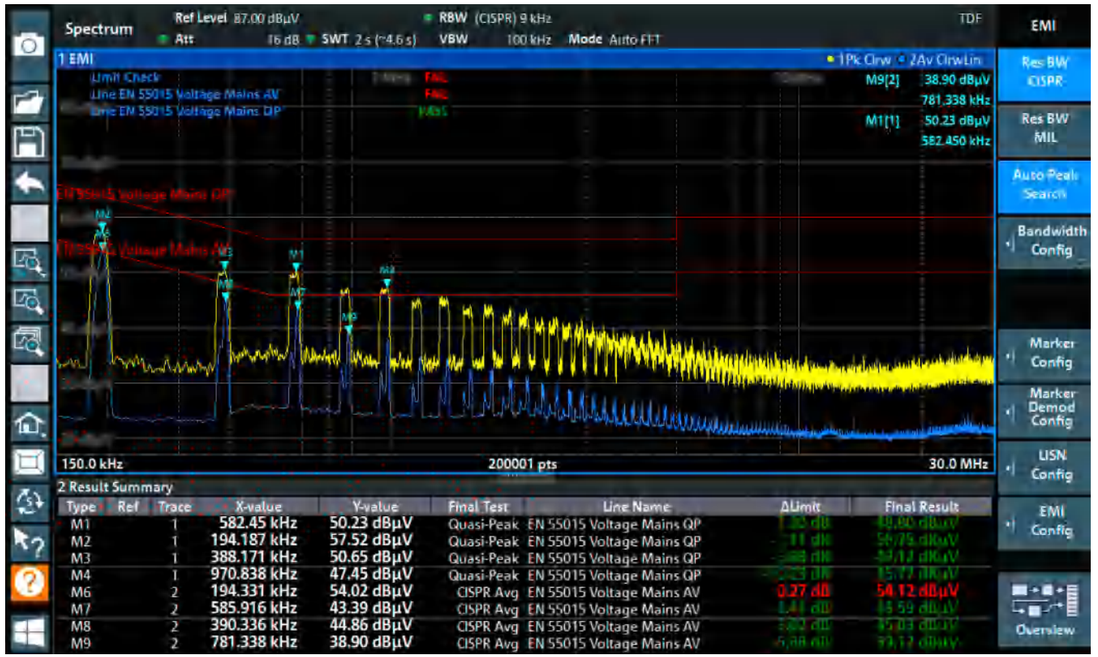

# REPEATABLE AND FAST MEASUREMENT THANKS TO AUTOMATED TEST SEQUENCES

## Key features

- Pretesting: sweeping of set frequency range with one or more fast detectors, e.g. peak or average
- Identification of critical frequencies: automatic detection of peaks and limit deviations as well as tabular overview of frequencies found
- Final measurement of identified frequencies: automatic final measurement using detectors that require a longer measuring time, e.g. quasi-peak, and final evaluation based on the set limit line

**Measurement automation – example from R&S®FPL1000**

Two detectors are used for the sweep: positive peak (yellow curve) and average (blue curve). PASS/FAIL information is given based on the defined limits (red lines). The identified maximum values (auto peak search) are automatically measured using the relevant CISPR detectors (quasi-peak and CISPR-average) and listed in the result table. The final PASS/FAIL status is clearly indicated. R&S®FPL1000 applies the correction values (transducer factor) of the used LISN to the measurement results.



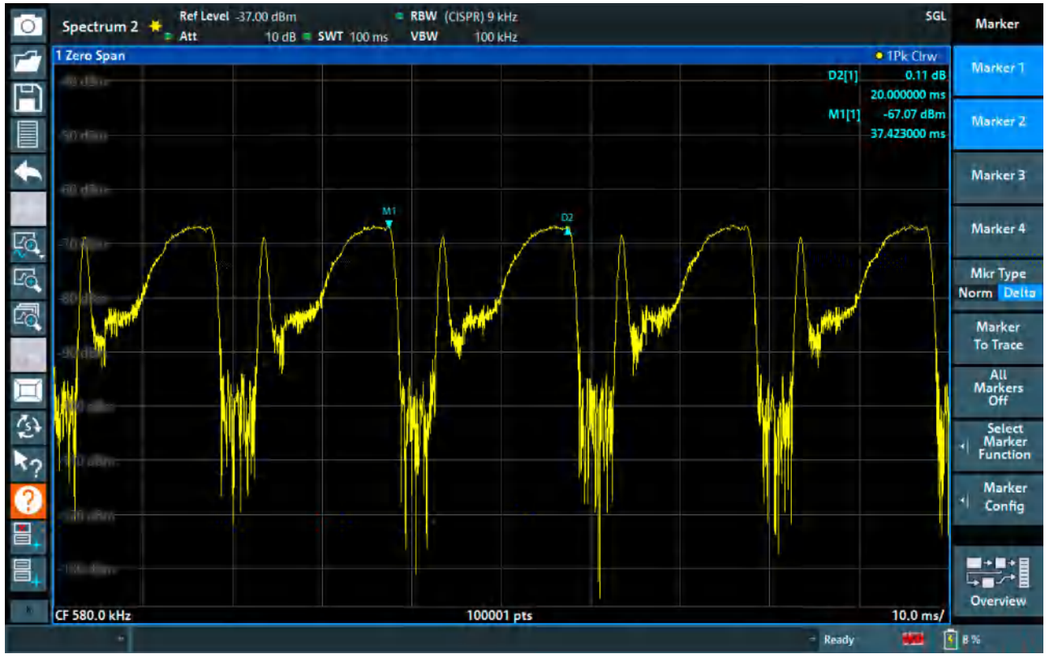
# IN-DEPTH SIGNAL ANALYSIS

## Key features

- Up to 200 001 sweep points for high frequency resolution even with large span/small measurement bandwidths
- Zero span measurement for analyzing the signal behavior over time of selected frequencies with standard and EMI detectors and bandwidths
- AM and FM demodulation with audio output to identify ambient interferers, for example during open area testing (except for R&S®FSW; additional option required)

**Zero span measurement – example from R&S®FPL1000**

The signal is analyzed over time at 580 kHz. The repetition rate of the interference is 50 Hz (20 ms).






# FAST AND EFFICIENT

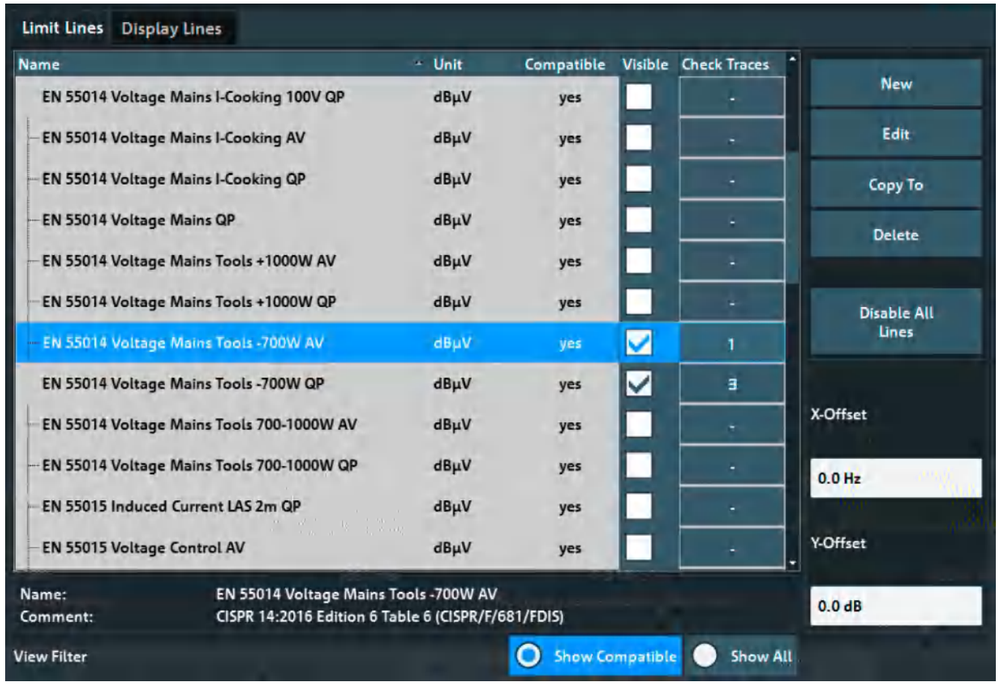
## Key features

- Limit lines: more than 170 EMI limit lines based on the latest versions of common EMI standards (CISPR/EN, FCC, MIL-STD-461 and DO-160) for fast and accurate configuration of measurement setups
- Logarithmic frequency scale: simple comparison of traces and limit lines with definitions used in standards and results displayed by EMI-specific measuring instruments
- Line impedance stabilization network (LISN) remote control [1]: simplified test execution by controlling connected Rohde&Schwarz LISNs via the spectrum analyzer's user interface (especially helpful when the spectrum analyzer and LISN are physically separated)
- Report generation [2]: output of measurement results with user-defined details and layouts at the push of a button (PDF or Microsoft Word)

[1] Except for R&S®FSW; additional option required.
[2] Supported by the R&S®FSW, R&S®FSVA3000, R&S®FSV3000 and R&S®FPL1000.

**Limit line selection – example from R&S®FPL1000**

Limit line selection for electric tools up to 700 W and definition of visibility and trace assignment.



# INTEGRATION IN R&S®ELEKTRA EMC TEST SOFTWARE

R&S®ELEKTRA EMC test software is a complete solution that controls EMC test systems. The base option for EMI measurements is the R&S®ELEMI-E essential EMI test software. R&S®ELEMI-E helps users define, perform, evaluate and archive EMI measurements in line with current EMI standards. Users can quickly generate correct and reproducible results.

R&S®ELEMI-E can be used with the R&S®FSW, R&S®FSVA3000, R&S®FSV3000, R&S®FPL1000 and R&S®FSV spectrum analyzers with the K54 option.

For more information, see the R&S®ELEKTRA EMC test software product brochure (PD 5216.3695.12).

**Test sequence control with R&S®ELEKTRA**


Automated EMI measurement with R&S®ELEMI-E.



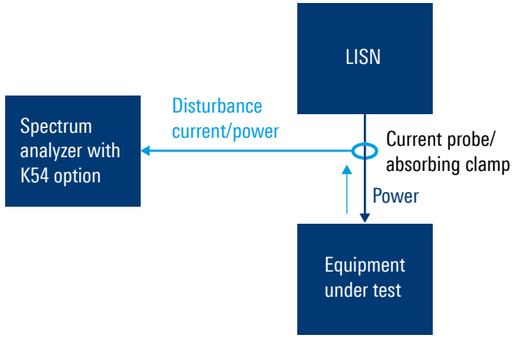

# TYPICAL USE CASES

## CONDUCTED VOLTAGE MEASUREMENTS

An LISN supplies the EUT (defined network impedance and isolation from the network) and decouples the disturbance voltage for measurement. The disturbance voltage is measured using a spectrum analyzer with the K54 option and a configured transducer factor matching the LISN. Support is also available for other measurement setups, such as those using a voltage sensor or measuring data transmission lines.

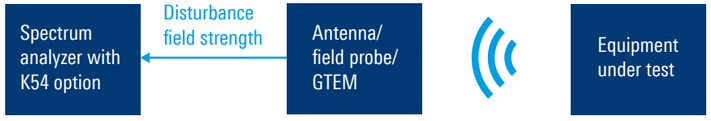

## CONDUCTED CURRENT/POWER MEASUREMENTS

An LISN supplies the EUT (defined network impedance and isolation from the network). The unused measuring output of the LISN is terminated with 50 Ω. The disturbance current/disturbance power measurement uses a current probe/absorbing clamp. A spectrum analyzer – with the K54 option and a configured transducer factor matching the transducer – measures the disturbance current/disturbance power. Support is also available for other measurement setups, such as those measuring data transmission cables.




## RADIATED MEASUREMENTS

Radiated measurements for a quantitative assessment of the measurement results are typically performed with an antenna in a defined measurement environment and at a defined distance between the EUT and the antenna. The disturbance field strength is determined using a spectrum analyzer with the K54 option and a transducer factor matching the antenna. When measuring with GTEM waveguides, R&S®ELEKTRA EMC test software enables a comparison of the measurement results with standardized limit lines. Field probes are normally used for locating disturbance sources.



# SIGNAL AND SPECTRUM ANALYZERS

The EMI measurement application is available for the following signal and spectrum analyzers.

| | R&S®FSW | R&S®FSVA3000 | R&S®FSV3000 | R&S®FPL1000 | R&S®FSVR |
|---|---|---|---|---|---|
| **EMI option name** | **R&S®FSW-K54** | **R&S®FSV3-K54** | **R&S®FSV3-K54** | **R&S®FPL1-K54** | **R&S®FSV-K54** |
| CISPR calibration option | R&S®FSW-K54CAL | not available yet | not available yet | – | – |
| Lowest frequency | 2 Hz | 2 Hz | 10 Hz | 5 kHz | 10 Hz |
| Highest frequency (depending on model) | 85 GHz | 44 GHz | 44 GHz | 7.5 GHz | 40 GHz |
| Real-time spectrum | up to 800 MHz | – | – | – | up to 40 MHz |
| Tracking generator | external generator control | external generator control | external generator control | ● | – |
| DC operation | – | – | – | ● | – |
| Battery operation | – | – | – | ● | – |
| Report generation | ● | ● | ● | ● | – |
| R&S®ELEKTRA support | ● | ● | ● | ● | – |

Note: the specified data may require special models or options.

# ORDERING INFORMATION

| Designation | Type | Order No. |
|---|---|---|
| **Signal and spectrum analyzers** | | |
| **R&S®FSW signal and spectrum analyzer** | | |
| EMI measurement application | R&S®FSW-K54 | 1313.1400.02 |
| **Recommended extras** | | |
| CISPR calibration | R&S®FSW-K54CAL | 1331.5932.02 |
| RF preamplifier | R&S®FSW-B24 | 1313.0832.13/.26/.43/.49/.51/.66/.67 |
| External generator control | R&S®FSW-B10 | 1313.1622.02 |
| **R&S®FSVA3000 and R&S®FSV3000 signal and spectrum analyzers** | | |
| EMI measurement application | R&S®FSV3-K54 | 1330.5068.02 |
| **Recommended extras** | | |
| Additional interfaces for LISN control | R&S®FSV3-B5 | 1330.3820.02 |
| AM/FM demodulation audio output including speaker, jack for headphones and volume control | R&S®FSV3-B3 | 1330.3765.02 |
| RF preamplifier | R&S®FSV3-B24 | 1330.4049.07/.13/.30/.44 |
| Control of external signal generators via LAN for use as tracking generators | R&S®FSV3-B10 | 1330.3859.02 |
| **R&S®FPL1000 signal and spectrum analyzer** | | |
| EMI measurement application | R&S®FPL1-K54 | 1323.1783.02 |
| **Recommended extras** | | |
| Additional interfaces (for LISN control and AF output) | R&S®FPL1-B5 | 1323.1883.02 |
| RF preamplifier | R&S®FPL1-B22 | 1323.1719.02 |
| Internal generator | R&S®FPL1-B9 | 1323.1925.03/.07 |
| DC power supply | R&S®FPL1-B30 | 1323.1877.02 |
| Lithium-ion battery pack | R&S®FPL1-B31 | 1323.1725.02 |
| **R&S®FSVR signal and spectrum analyzer** | | |
| EMI measurement application | R&S®FSV-K54 | 1310.0425.02 |
| **Recommended extras** | | |
| Additional interfaces (for LISN control) | R&S®FSV-B5 | 1310.9539.02 |
| AM/FM demodulation audio output including speaker, jack for headphones and volume control | R&S®FSV-B3 | 1310.9516.02 |
| RF preamplifier (up to 7.5 GHz) | R&S®FSV-B22 | 1310.9600.02 |
| RF preamplifier (above 7.5 GHz) | R&S®FSV-B24 | 1310.9616.13/.30/.40 |
| **Extensions** | | |
| **System software** [1] | | |
| Essential EMI test software | R&S®ELEMI-E | 5601.0030.02 |
| License dongle | R&S®EMCPC | 5601.0018.02 |
| **Cables for control of Rohde & Schwarz LISNs** | | |
| Control cable, R&S®FPL1000 to R&S®ENV216/ENV432/ENV420 | | |
| Length: 3 m | R&S®EZ-21 | 1107.2087.03 |
| Length: 10 m | R&S®EZ-21 | 1107.2087.10 |
| Control cable, R&S®FSW/FSVA3000/FSV3000/FSVR/FSVA/FSV to R&S®ENV216/ENV432/ENV4200 | | |
| Length: 3 m | R&S®EZ-29 | 1326.6470.03 |
| Length: 10 m | R&S®EZ-29 | 1326.6470.10 |

[1] Supports R&S®FSW, R&S®FSVA3000, R&S®FSV3000, R&S®FSV and R&S®FPL1000.

Listed here: ordering information of the K54 option and recommended extensions for EMI applications.
For ordering information of the signal and spectrum analyzer base units, see the base unit data sheet.

Your local Rohde&Schwarz expert will help you find the best solution for your requirements.
To find your nearest Rohde&Schwarz representative, visit www.sales.rohde-schwarz.com

For detailed specifications, see PD 3608.3949.22 and www.rohde-schwarz.com.

R&S®FSW

R&S®FSVA3000

R&S®FSV3000

R&S®FPL100

R&S®FSVR

## Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

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- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

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ISO 9001

Certified Environmental Management
ISO 14001

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PD 3608.3949.12 | Version 01.01 | August 2021 (ch)
EMI Measurement Application for Signal and Spectrum Analyzers
Data without tolerance limits is not binding | Subject to change


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3608.3949.12 01.01 PDP/PDW 1 en