ROHDE AND SCHWARZ:

PRECOMPLIANCE LIKE A PRO

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Rohde and Schwarz Australia
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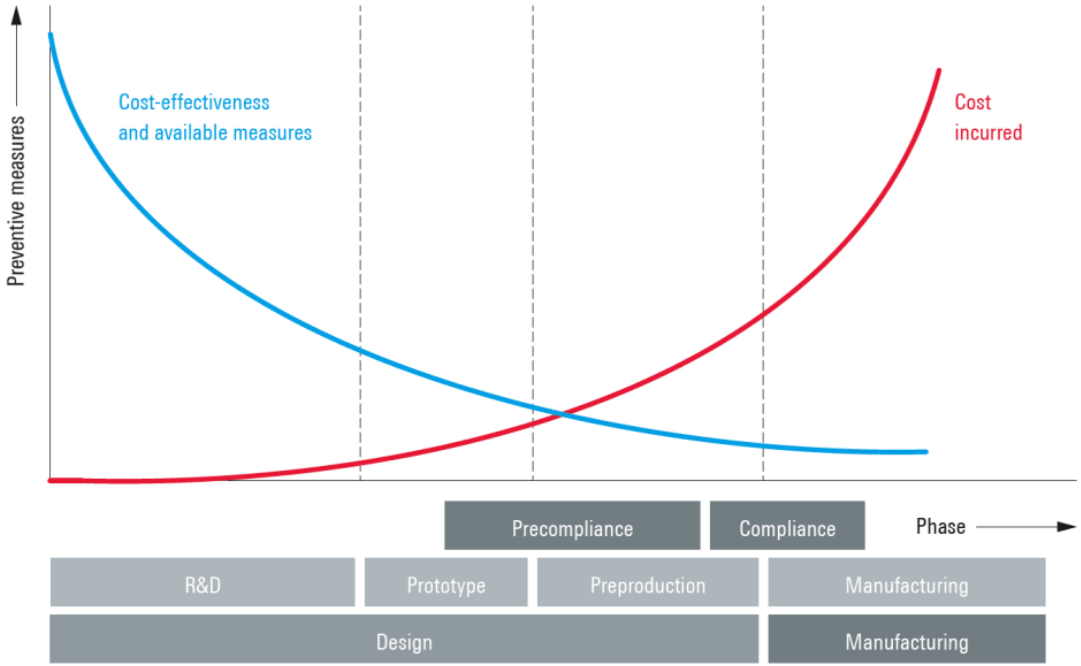
ROHDE&SCHWARZ
Make ideas real

EMC PRECOMPLIANCE

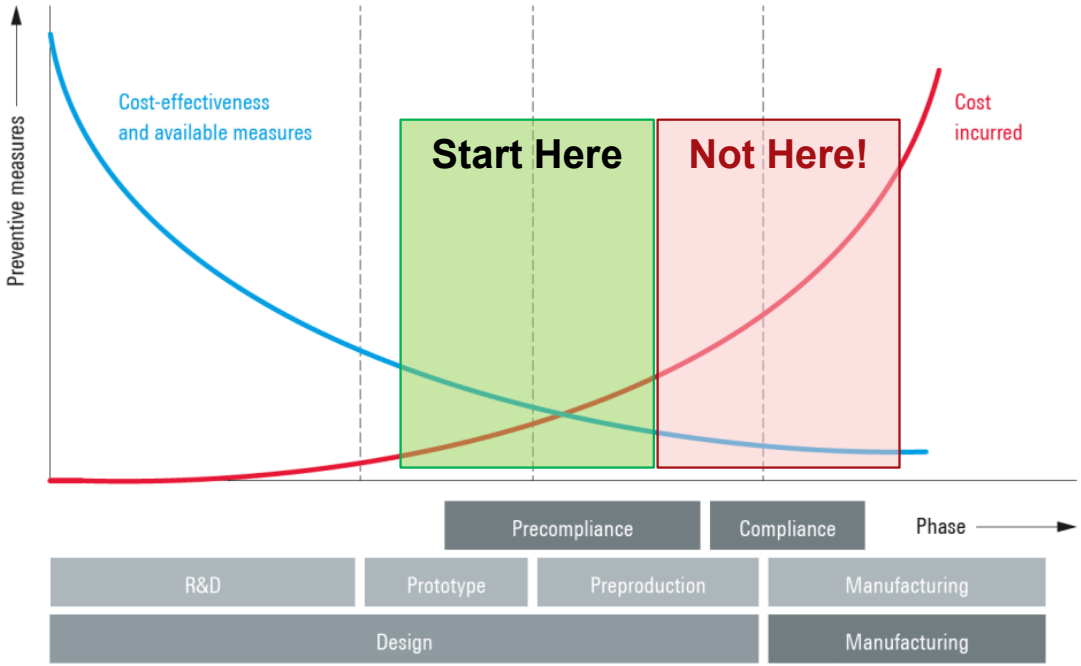
- EMC Precompliance:
  - What is it?
  - Why do we do it?

- Basically:
  - Early/Earlier ‘compliance’ type testing, to;
  - Find/Fix problems earlier in design lifecycle, to;
  - Avoid re-work/-design/-tests later, to;
  - **Save time and money, meet deadlines!**



EMC PRECOMPLIANCE

- EMC Precompliance:
  - To what degree do we do it?
  - No general rule - but typically it is not considered early enough!
- Dependencies on degree include:
  - Product + complexity
  - Markets + Applicable Standards
  - Scale of development / production
  - Timelines

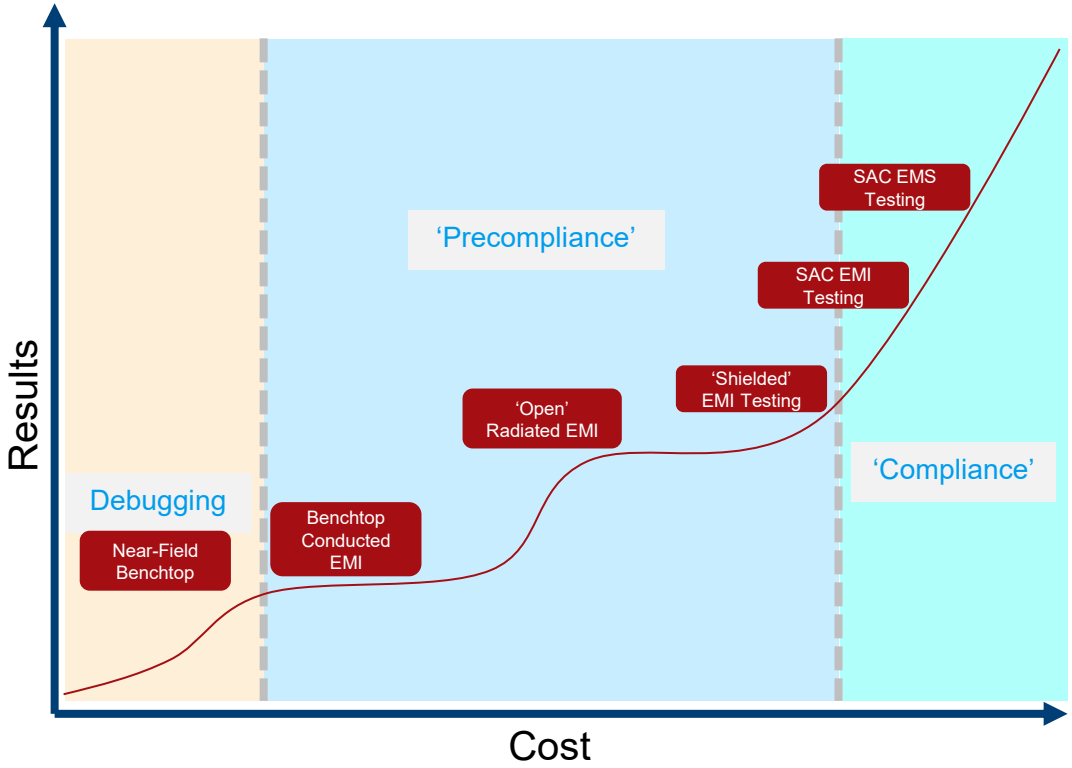


PRECOMPLIANCE

- **Remember: Precompliance is broadly a cut-down or 'imitation' version of the final compliance environment**

- It's where we go after 'debugging'
  - Many valid solutions fall under the umbrella of 'Precompliance'

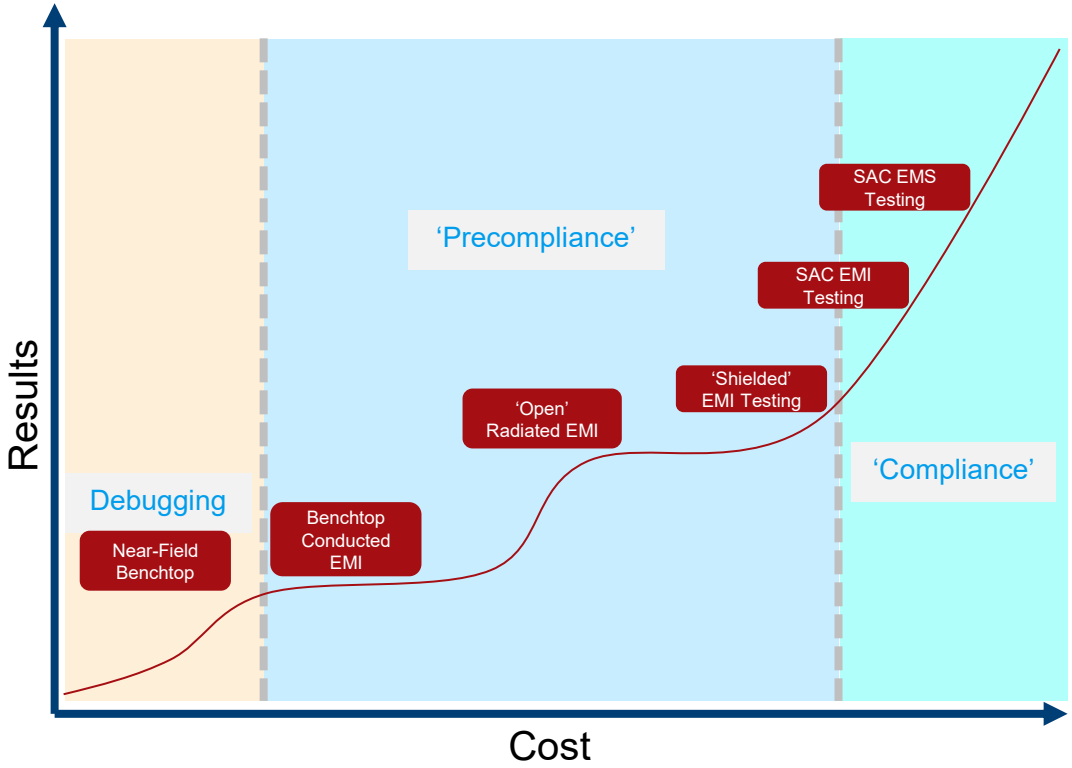
  - *Speed vs Accuracy*
  - *Scope vs Cost*
  - *Cost vs Benefit*



EMC PRECOMPLIANCE

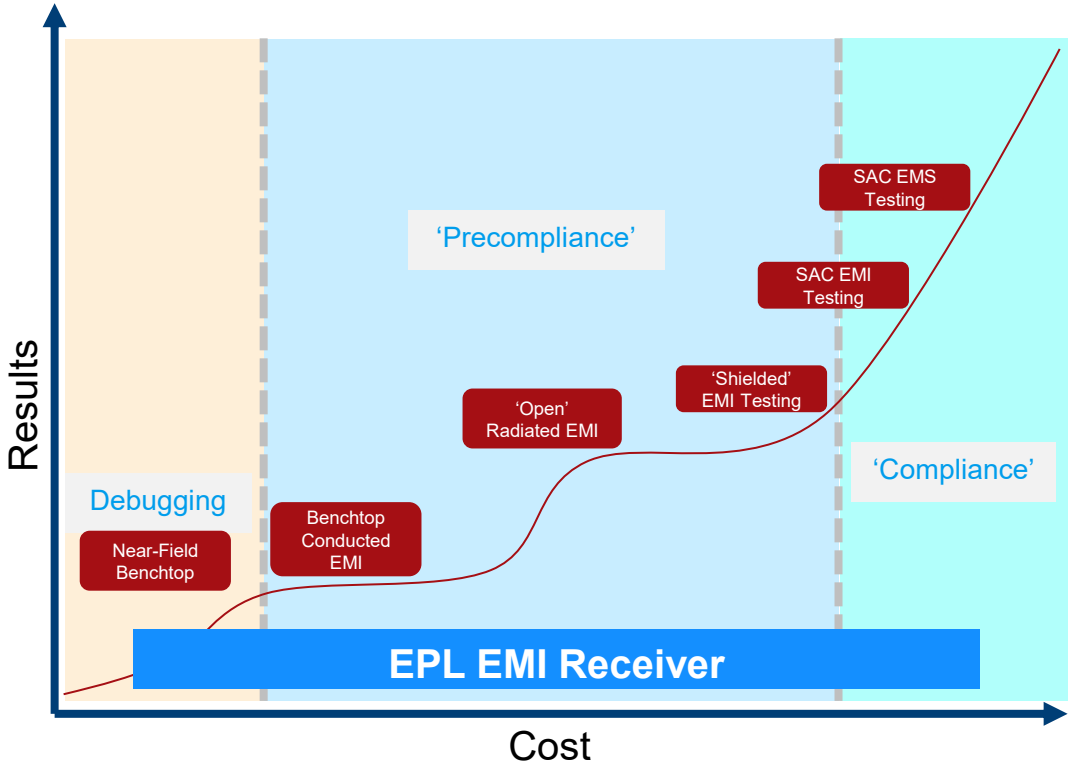
- What to consider in terms of scope?
  - Current needs elsewhere
  - Product Revisions
  - Future development
  - Speed/Iteration of design
  - Earliest point you can start testing
  - Man-hours / cost of rework
  - Opportunity Cost

- Needs will evolve with time too



EMC PRECOMPLIANCE

- Today – we'll focus on scalable core of an EMI precompliance approach, the EPL EMI Receiver
- This allows you to scale from debugging to precompliance and 'heavier' pre-compliance and even compliance testing
- **Helping you to do… 'Precompliance Like a Pro'**



EMI RECEIVERS

EMI TEST RECEIVERS OVERVIEW

R&S®EPL
5 kHz up to 7.125 GHz
Optionally CISPR compliant

R&S®ESW
1 Hz up to 44 GHz
CISPR compliant

R&S®ESRP
10 Hz / 9 kHz
up to 7 GHz
Not CISPR compliant

R&S®ESR
10 Hz / 9 kHz
up to 26.5 GHz
CISPR compliant

EMI TEST RECEIVERS FREQUENCY RANGE

EPL1000 | EPL1001 | EPL1-B7125 EPL1007

ESRP-B29 | ESRP3 | ESRP7

7.125G

ESR-B29 | ESR3 | ESR7 | ESR26

ESW8 | ESW26 | ESW44

1 10 5k 9k 30M 1G 3.6G 7G 8G 26.5G 44G

Frequency [Hz]

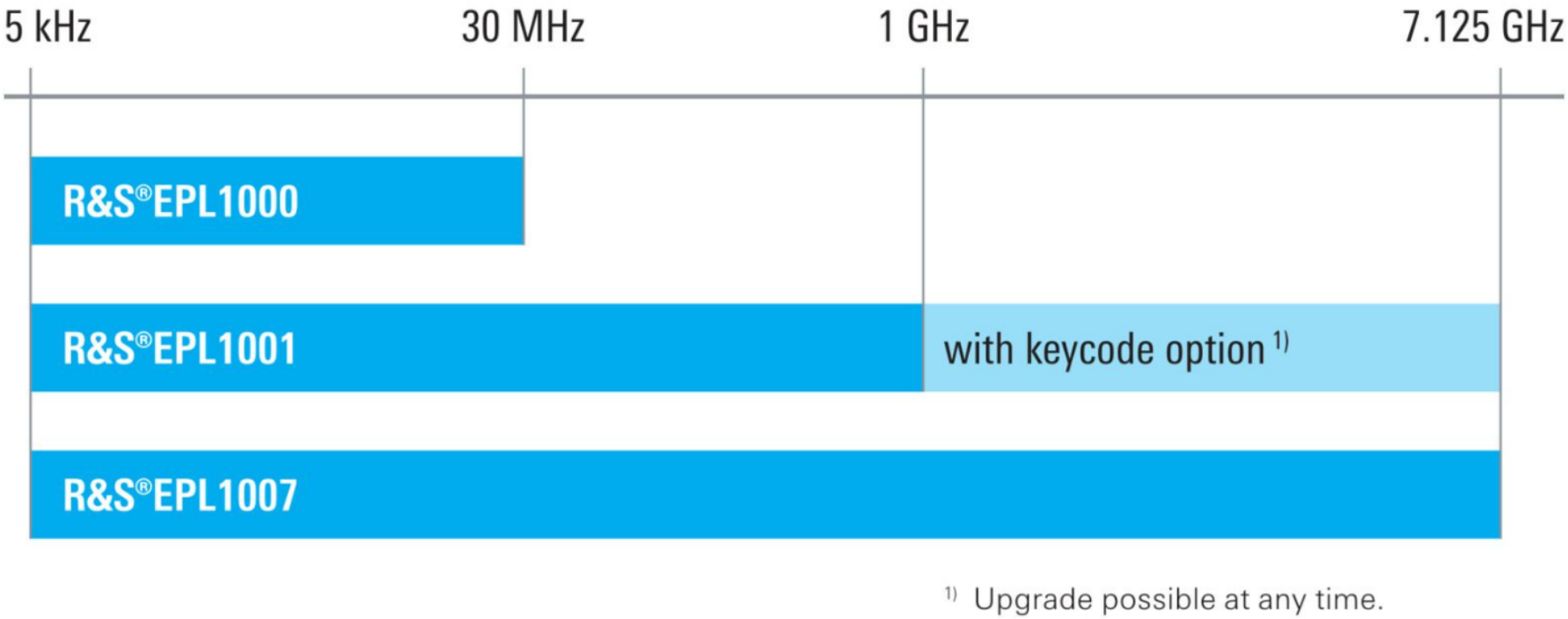
Remarks:
- Higher frequency models also cover the frequency range of lower frequency models.
- White boxes represent optional extensions.

EPL - ADDRESSED APPLICATIONS

Perfect for

- Precompliance and compliance applications
- Measurements during development
- Preparing for certification
- Final testing to confirm compliance

EPL - MODEL OVERVIEW

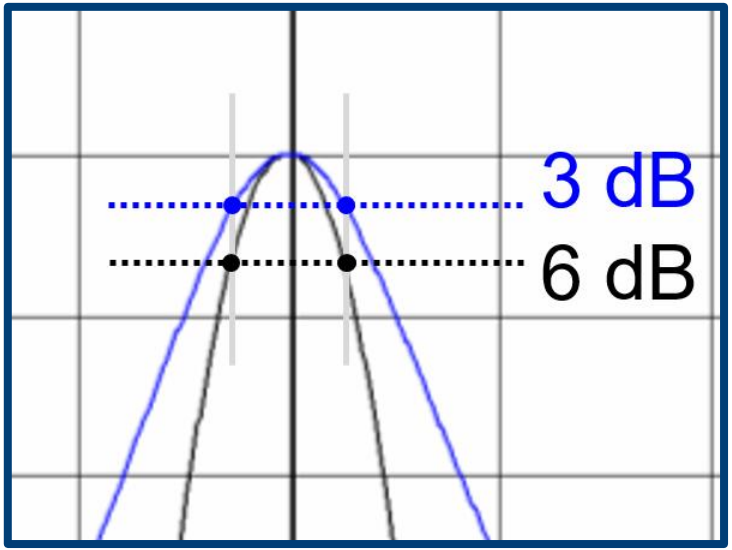


1) Upgrade possible at any time.

RF AND CISPR 16-1-1 FEATURES

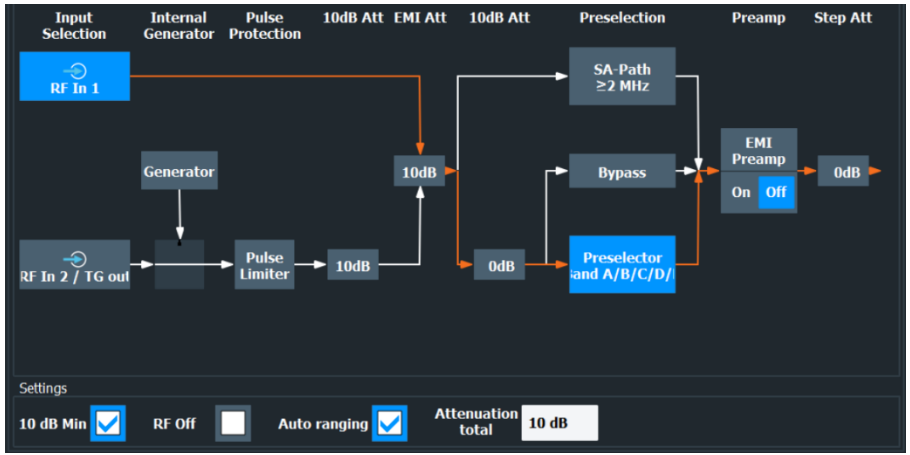
BASE UNIT

- EMI detectors (CISPR 16-1-1)
  - Peak
  - quasi-peak,
  - CISPR-average,
  - RMS-average
- EMI bandwidths (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, 1 MHz (MIL-STD-461 and DO-160)



BASE UNIT

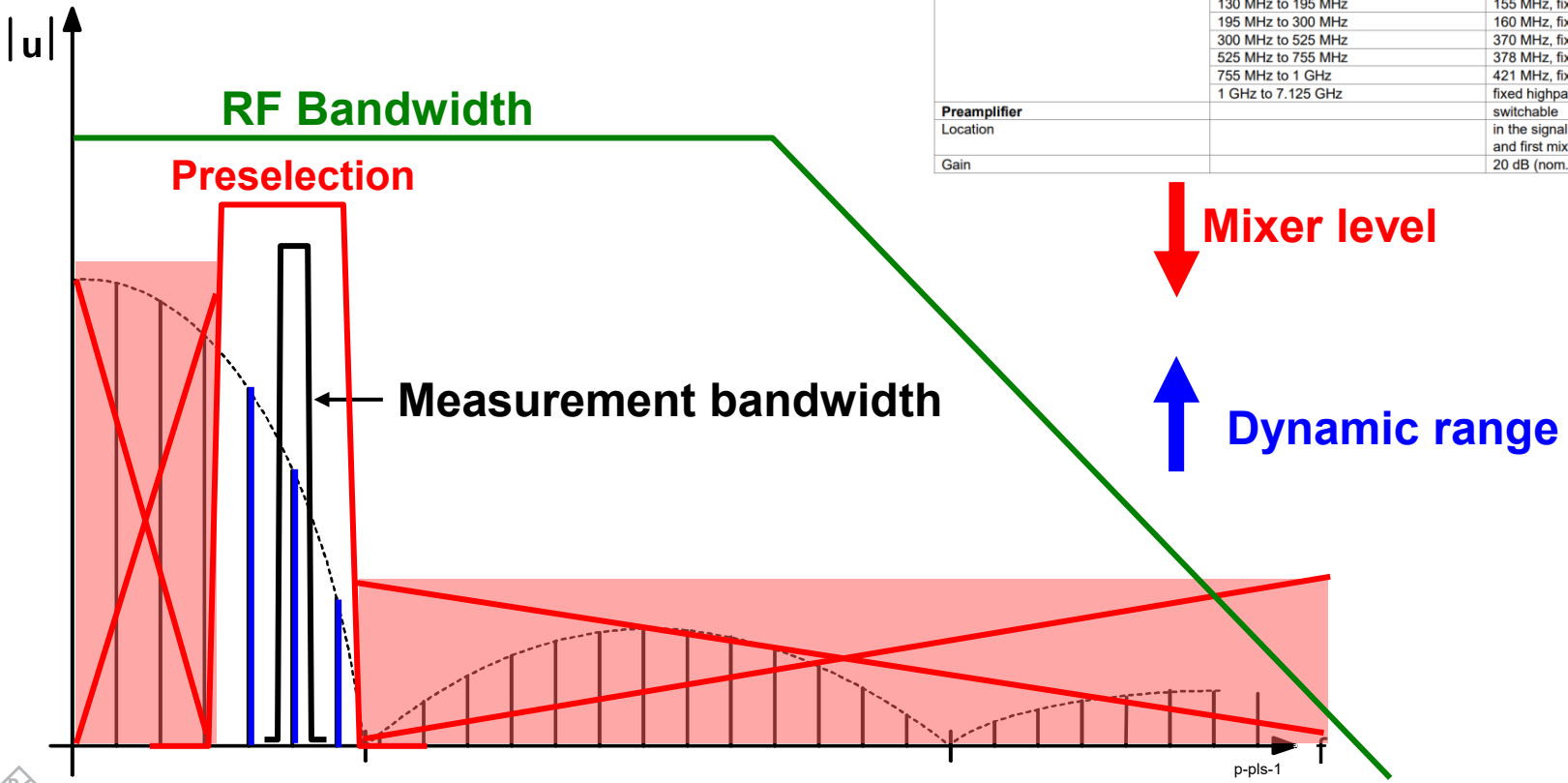
- Hardware protection
  - Pulse limiter
  - Pulse-resistant 10 dB attenuator
- Attenuation of strong signals
  - Up to 55 dB attenuation in 1 dB steps
- Maximum use of dynamic range and overload handling to prevent distorted measurement results
  - Automatic attenuator ranging



PRESELECTION PRINCIPLES

Preselection and preamplifier

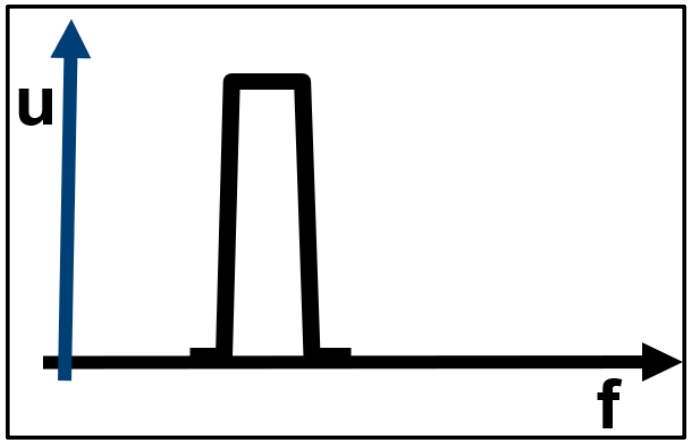
Preselection		
State	receiver mode	always on
	analyzer mode	on/off (selectable)
Number of preselection filters	R&S®EPL1000	2
	R&S®EPL1001, R&S®EPL1007, with R&S®EPL1-B2 option	9
Bandwidths (–6 dB), nominal	10 Hz to 150 kHz	fixed lowpass filter
	150 kHz to 30 MHz	38 MHz, fixed bandpass filter
	30 MHz to 130 MHz	146 MHz, fixed bandpass filter
	130 MHz to 195 MHz	155 MHz, fixed bandpass filter
	195 MHz to 300 MHz	160 MHz, fixed bandpass filter
	300 MHz to 525 MHz	370 MHz, fixed bandpass filter
	525 MHz to 755 MHz	378 MHz, fixed bandpass filter
	755 MHz to 1 GHz	421 MHz, fixed bandpass filter
	1 GHz to 7.125 GHz	fixed highpass filter
Preamplifier		switchable
Location		in the signal path between preselection and first mixer
Gain		20 dB (nom.)



R&S®EPL1-B2; PRESELECTION WITH PREAMPLIFIER*

- Protects the input circuits of the receiver from overload and damage
- Prevents the generation of harmonic and intermodulation signals
- Increases the dynamic range, important for measuring short pulses with low repetition frequency using quasi-peak detector

- Protected preamplifier with 20 dB gain directly after the preselection filters for measuring small signals in the presence of a strong fundamental signal from EUT or radio transmitters



* included in R&S®EPL1000

FOR ALL USE CASES UP TO CISPR 16-1-1 COMPLIANCE

Precompliance applications:

- Debugging
- Measurements during development phase
- Preparation of certification

Compliance

CISPR 16-1-1 compliance
R&S®EPL1-B1611*

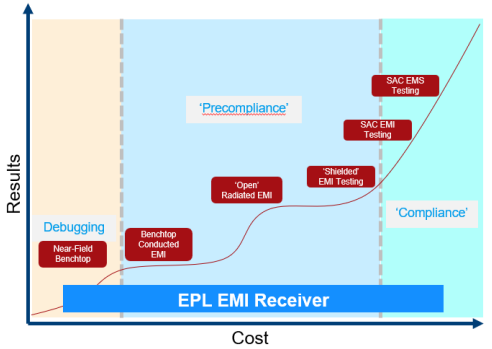
Pre-Compliance

Preselection with preamplifier
R&S®EPL1-B2*

Debugging and Pre-Compliance

Compliance applications:

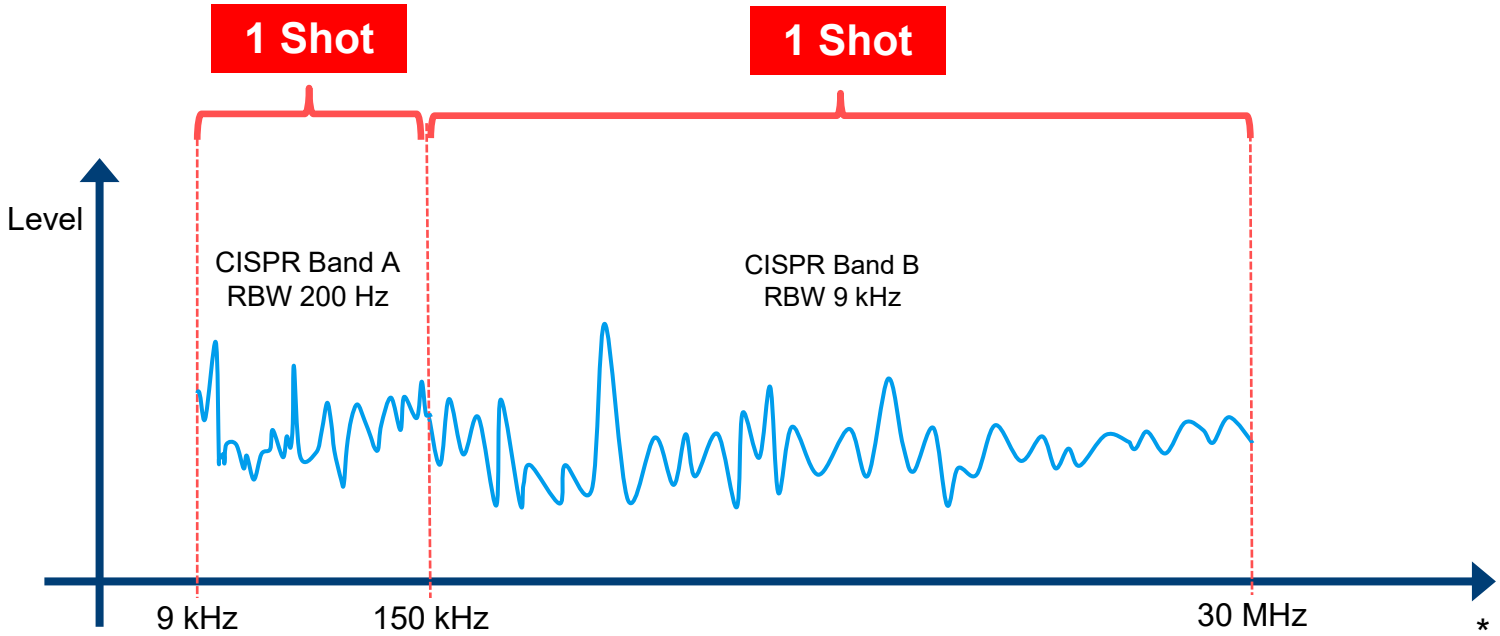
- Certification of products



* included in R&S®EPL1000

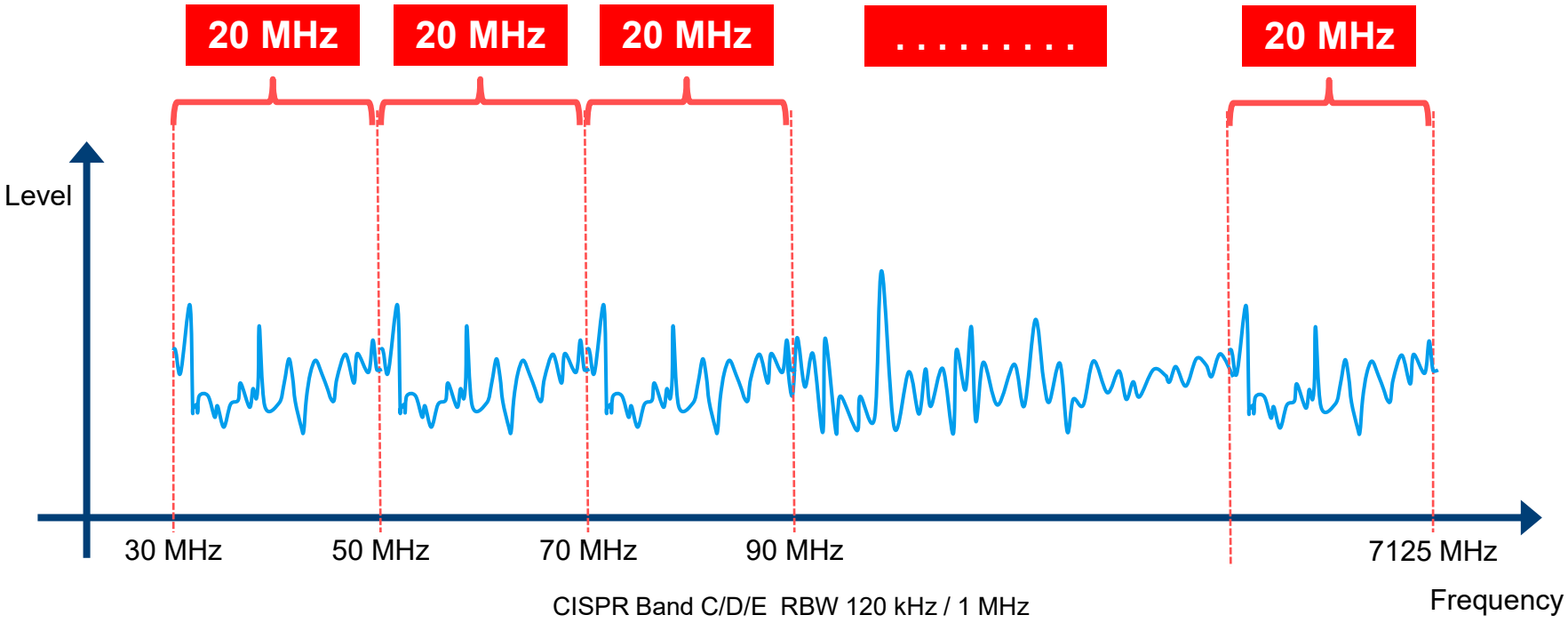
TIME DOMAIN SCAN

R&S®EPL1-K53 TIME DOMAIN SCAN*
CISPR BAND A AND B



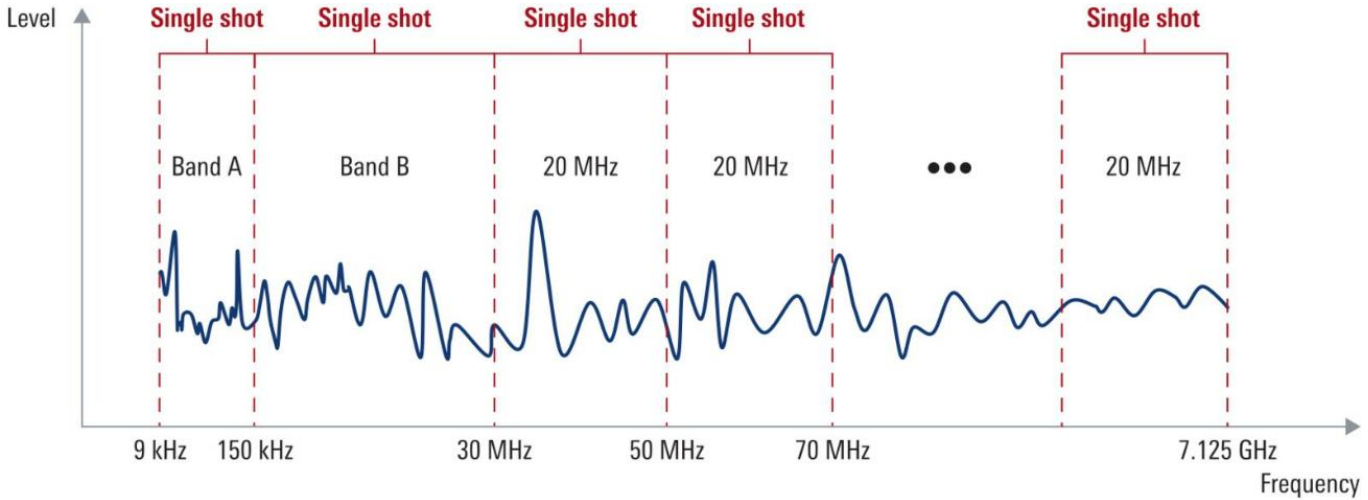
* included in R&S®EPL1000

R&S®EPL1-K53 TIME DOMAIN SCAN ABOVE 30 MHZ



R&S®EPL1-K53 TIME DOMAIN SCAN SUMMARY

- With CISPR band related RBWs:
  - CISPR band A and B: one shot for each band
  - Above 30 MHz: 20 MHz step size
- Up to 3 different detectors at the same time



TIME DOMAIN SCAN TIMES

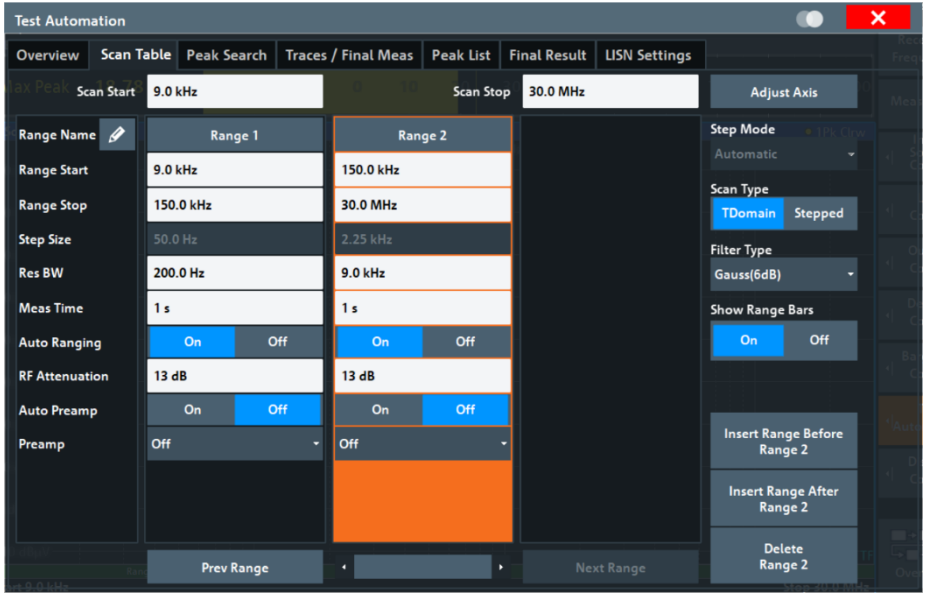
- What this means is very fast scan times to help speed up debugging and fault-finding – see specified scan times from spec sheet:

Band/Freq	BW	Detector	Meas Time	Scan Time
A (9k-150k)	200Hz	Pk	100ms	500ms
B (150k-30M)	9kHz	Pk	1s	1.4s
A	200Hz	QP/CAv	1s	3s
B	9kHz	QP/CAv	1s	3s
C/D (30M-1G)	120kHz	Pk	100ms	5.8s
C/D	120kHz	QP/CAv/Pk	1s	100s
E (1G-6G)	1M	Pk	10ms	4.8s
E (1G-6G)	1M	Pk	100ms	28s
E (1G-6G)	1M	Pk/CAv	1s	510s

EMISSION MEASUREMENTS

AUTOMATION

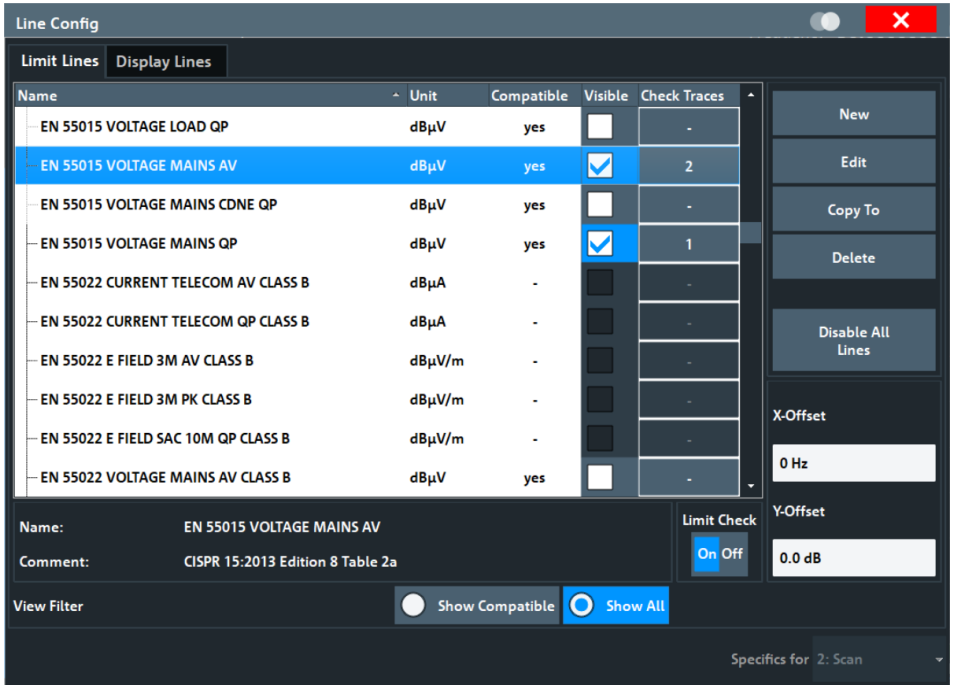
- Scan table
  Automatic measurement of multiple frequency segments with individual settings
- Automatic measurement of multiple lines connected to a Rohde & Schwarz LISN
- Automatic preview and final measurement sequence as an alternative to using the final detector with time domain scan
- **And then there's R&S ELEKTRA (EMC Software) for heavier applications**



LIMIT LINE DISPLAY AND CHECKING

Easily evaluate measurement results:

- Easy definition of limit lines
- Library with about 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 measurements
- Automatic checking of limit line violations



ANALYSIS

BAR GRAPH, IF ANALYSIS AND AUDIO DEMODULATION

Bar graph display

- Up to 4 configurable bar graphs (detectors)

IF analysis (option)

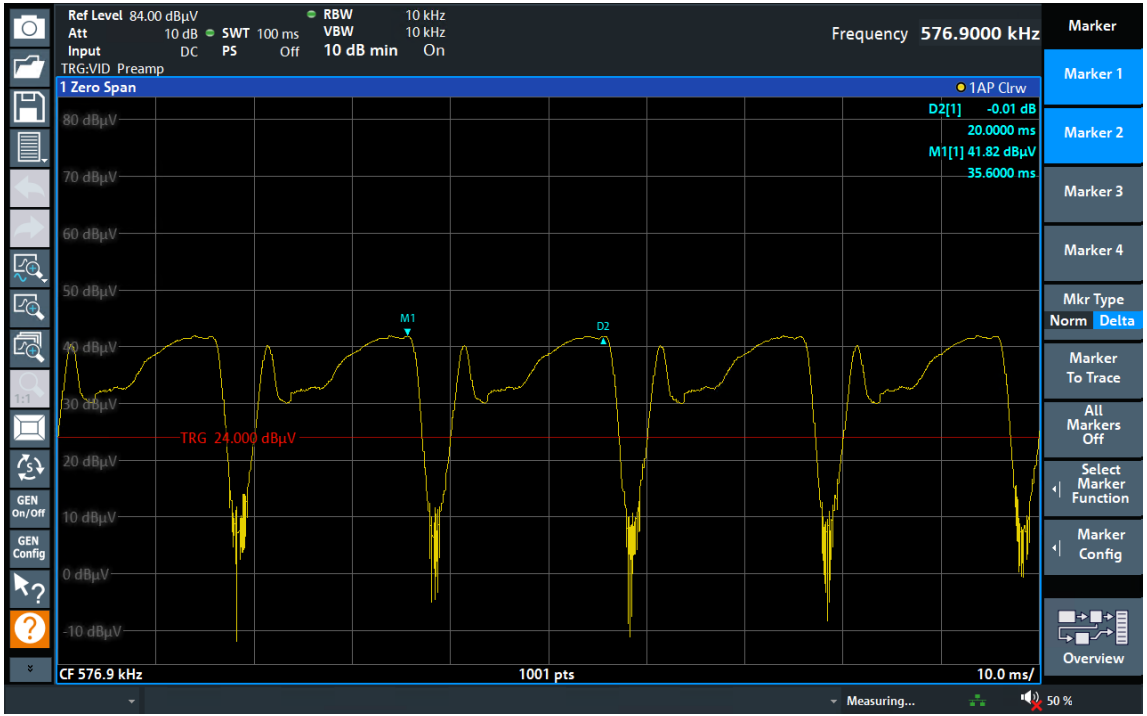
- Span up to 10 MHz
- RBW 10 Hz up to 100 kHz
- Spectrogram display

Audio output

- AM / FM audio output (internal speaker / headset)

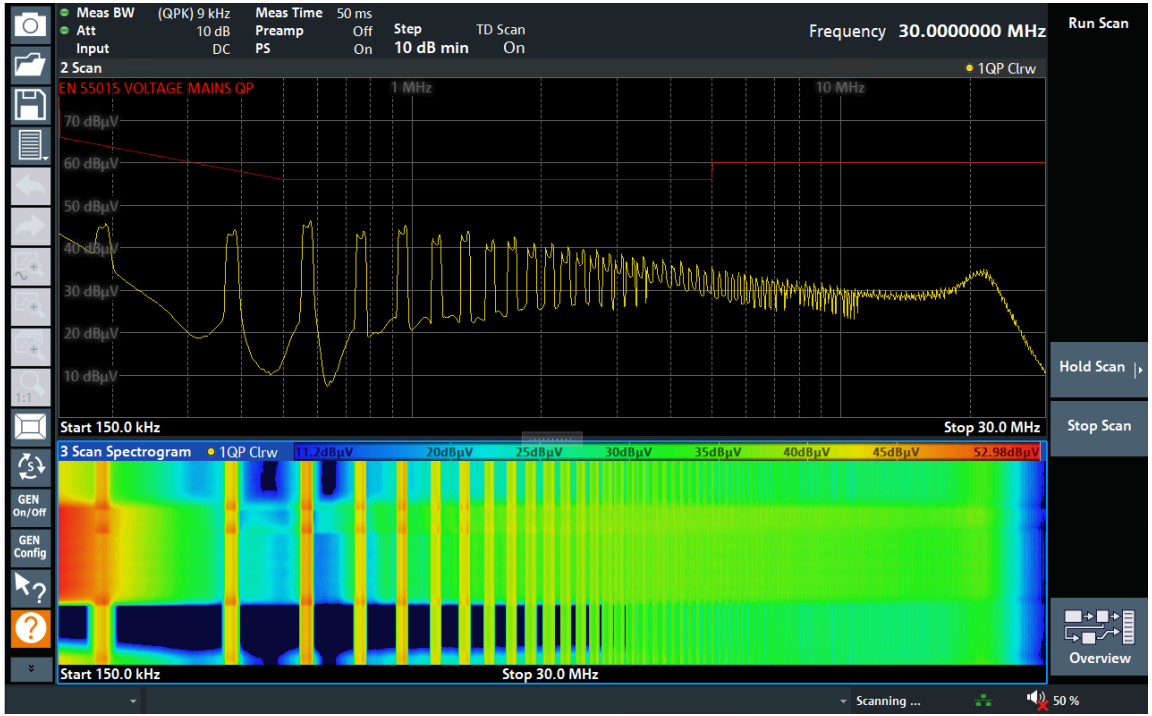
ZERO SPAN

- Spectrum analysis function
- Helpful to determine period of periodic interferers



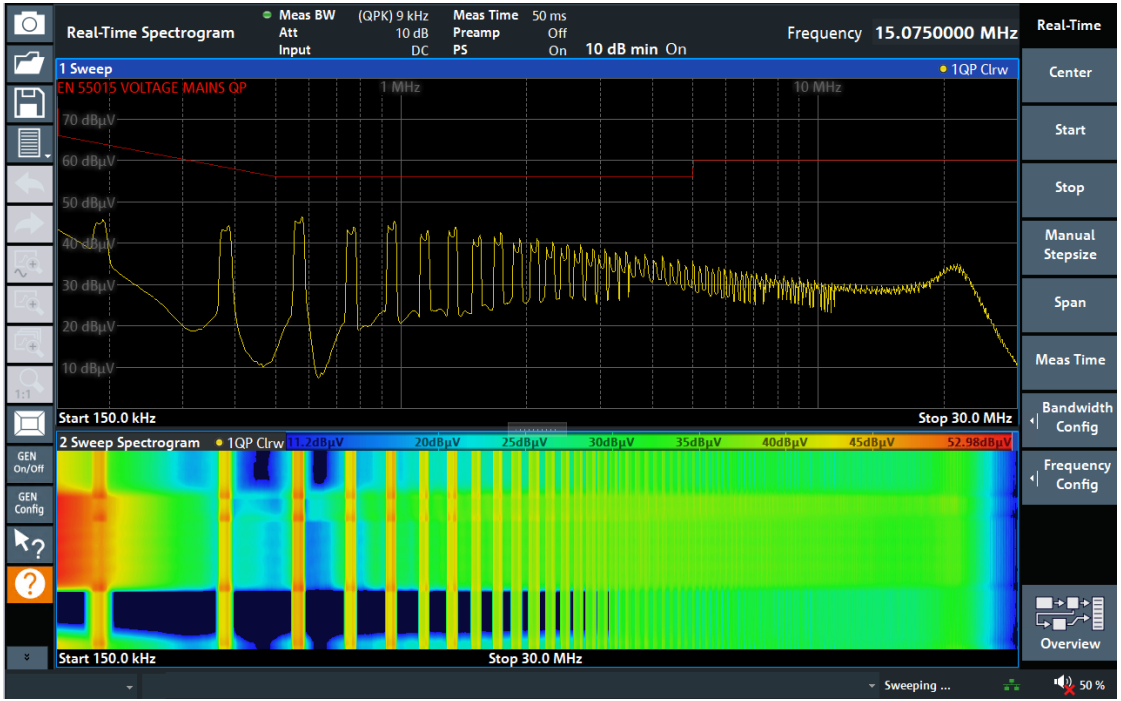
SPECTRUM ANALYSIS AND SPECTROGRAM

- Standard or CISPR detectors
- Standard or EMI bandwidths
- 2D or 3D display
- Marker functions



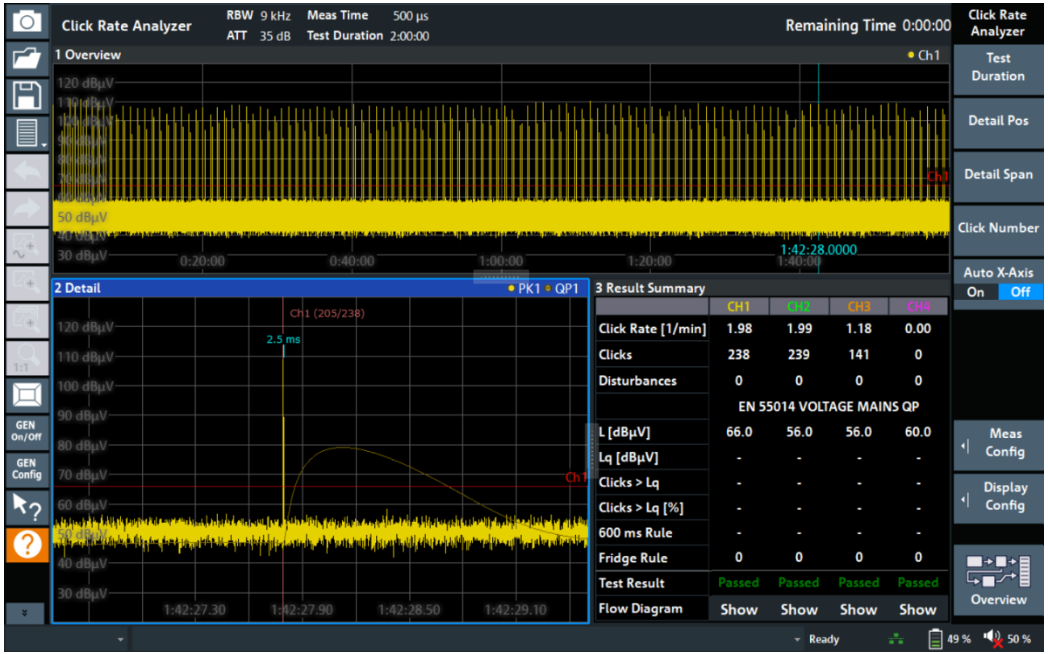
REAL-TIME SPECTROGRAM OPTION

- Measure gapless over time and frequency
- Measure for example band B using quasi-peak detector and 9 kHz RBW (6 dB)
- Ring buffer for recent 100.000 measurements, resulting in 3.300 s of gapless measurement results when using the minimum measurement time of 33 ms
- Use markers to analyze the results



CLICK RATE ANALYZER OPTION

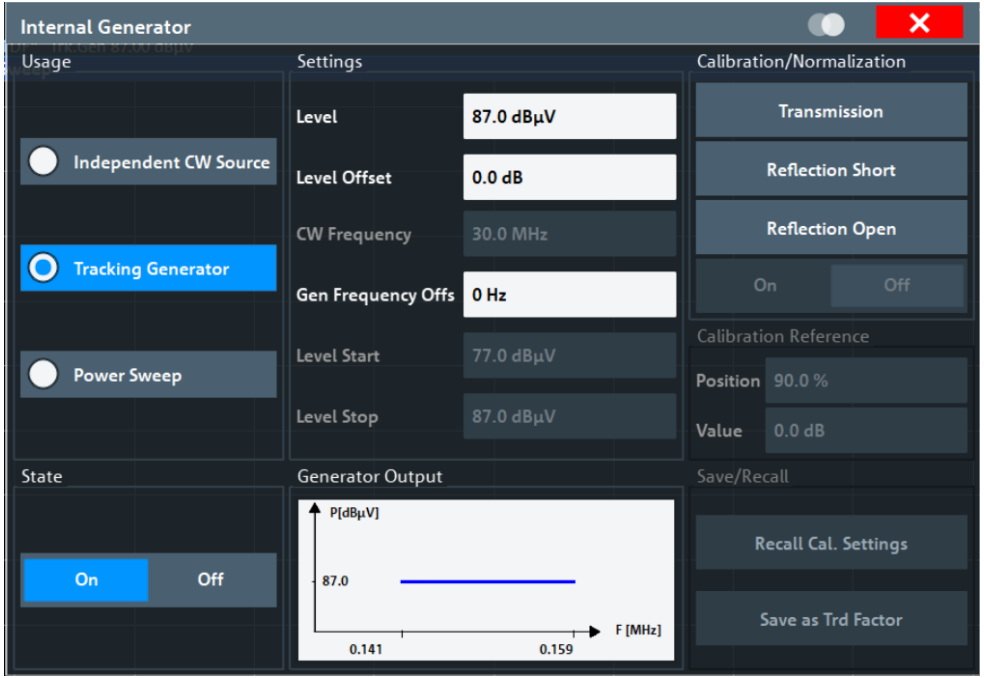
- Compliant with CISPR 14-1 editions 6 and 7
- Simultaneous and gapless measurement of all four frequencies defined by CISPR 14-1
- Up to 4 hours of measurement time
- Optional frequency setting in line with DENAN law (Japan)
- Special operating mode to measure repetitive igniters
- Verification of each R&S®EPL using CISPR 16-1-1 defined pulses before delivery and on request by R&S service



SIGNAL GENERATOR OPTION

- Tracking generator
- Continuous wave
- Power sweep

- Use Case:
  - Calibrate Cable Losses etc



UPGRADE ANY TIME

Upgrade any hardware or software option any time, Including

- CISPR 16-1-1 compliance and
- Frequency upgrade to 7.125 GHz for R&S®EPL1001

- ► Only exception: Tracking generator in case of R&S®EPL1000
  (only available with a new R&S®EPL1000)
- ► Installation of most options can be done by the user
  (details are given by the R&S®EPL ordering information
  part of the R&S®EPL specifications)

Options

Designation	Type	Order No.	Available for R&S®EPL...			Remarks	Retrofit by
			1000	1001	1007		
Hardware options							
Preselection with preamplifier	R&S®EPL1-B2	1350.4015.02	○ [23]	•	•		Rohde & Schwarz service center
OCXO reference frequency	R&S®EPL1-B4	1323.1902.02	•	•	•		Rohde & Schwarz service center
GPIB interface	R&S®EPL1-B10	1323.1890.02	•	•	•		user
DC power supply, 12 V/24 V input	R&S®EPL1-B30	1323.1877.02	•	•	•		user
Internal lithium-ion battery	R&S®EPL1-B31	1323.1725.02	•	–	–	contains 2 battery packs and internal charging unit	Rohde & Schwarz service center
Internal lithium-ion battery	R&S®EPL1-B31	1323.1725.03	–	•	•	contains 2 battery packs and internal charging unit	Rohde & Schwarz service center
Internal generator, 5 kHz to 30 MHz	R&S®EPL1-B91	1350.4073.02	•	–	–		not possible
Keycode options							
Internal generator, 5 kHz to 1 GHz	R&S®EPL1-B9	1350.4467.02	–	•	–	requires R&S®EPL1-B2	user
Internal generator, 5 kHz to 7.125 GHz	R&S®EPL1-B9	1350.4044.02	–	–	•	requires R&S®EPL1-B2	user
Low noise amplifier, 2 MHz to 1/7.125 GHz	R&S®EPL1-B22	1350.4480.02	–	•	•		user
CISPR 16-1-1 compliance	R&S®EPL1-B1611	1350.4515.02	○ [23]	•	•	requires R&S®EPL1-B2	Rohde & Schwarz service center
AM/FM/PM measurement demodulator	R&S®FPL1-K7	1323.1731.02	•	•	•		user
Time domain scan	R&S®EPL1-K53	1350.4050.02	○ [23]	•	•		user
EMI real-time spectrogram	R&S®EPL1-K55E	1350.4473.02	•	•	•	requires R&S®EPL1-K53	user
IF analysis	R&S®EPL1-K56	1350.4067.02	•	•	•		user
Click rate analyzer	R&S®EPL1-K59	1350.4509.02	•	•	•	optional verification of response to pulses by Rohde & Schwarz service center (part of extended instrument calibration)	user
Upgrade							
Frequency upgrade for R&S®EPL1001, 1 GHz to 7.125 GHz	R&S®EPL1-B7125	1350.4021.02	–	•	–	only retrofit; optional calibration by Rohde & Schwarz service center	user

MODEL COMPARISON

MAIN DIFFERENCES R&S®EPL MODELS

	R&S®EPL1000	R&S®EPL1001 / R&S®EPL1007
Upper Frequency	30 MHz	1 GHz (R&S®EPL1001), 7.125 GHz (R&S®EPL1007)
Frequency upgrade option	–	R&S®EPL1001 upgradeable to 7.125 GHz (R&S®EPL1-B7125)
Time domain scan, preselection with preamplifier and CISPR 16-1-1 compliance	included	option (R&S®EPL1-K53, R&S®EPL1-B2, R&S®EPL1-B1611)
RF input(s), generator output	1 input, 1 optional output	2 inputs (1 of the 2 inputs optionally configurable as output)
Instrument depth	23.5 cm (9.25 in)	30.5 cm (12.0 in)

THANK YOU!

- Happy to take questions in person or by email!

- Please reach out via:
- Sales.Australia@rohde-schwarz.com

- **Website:**
- https://www.rohde-schwarz.com/