

# RTQ2106

## CISPR25 EMI test report

---

Dec 7 . 2017

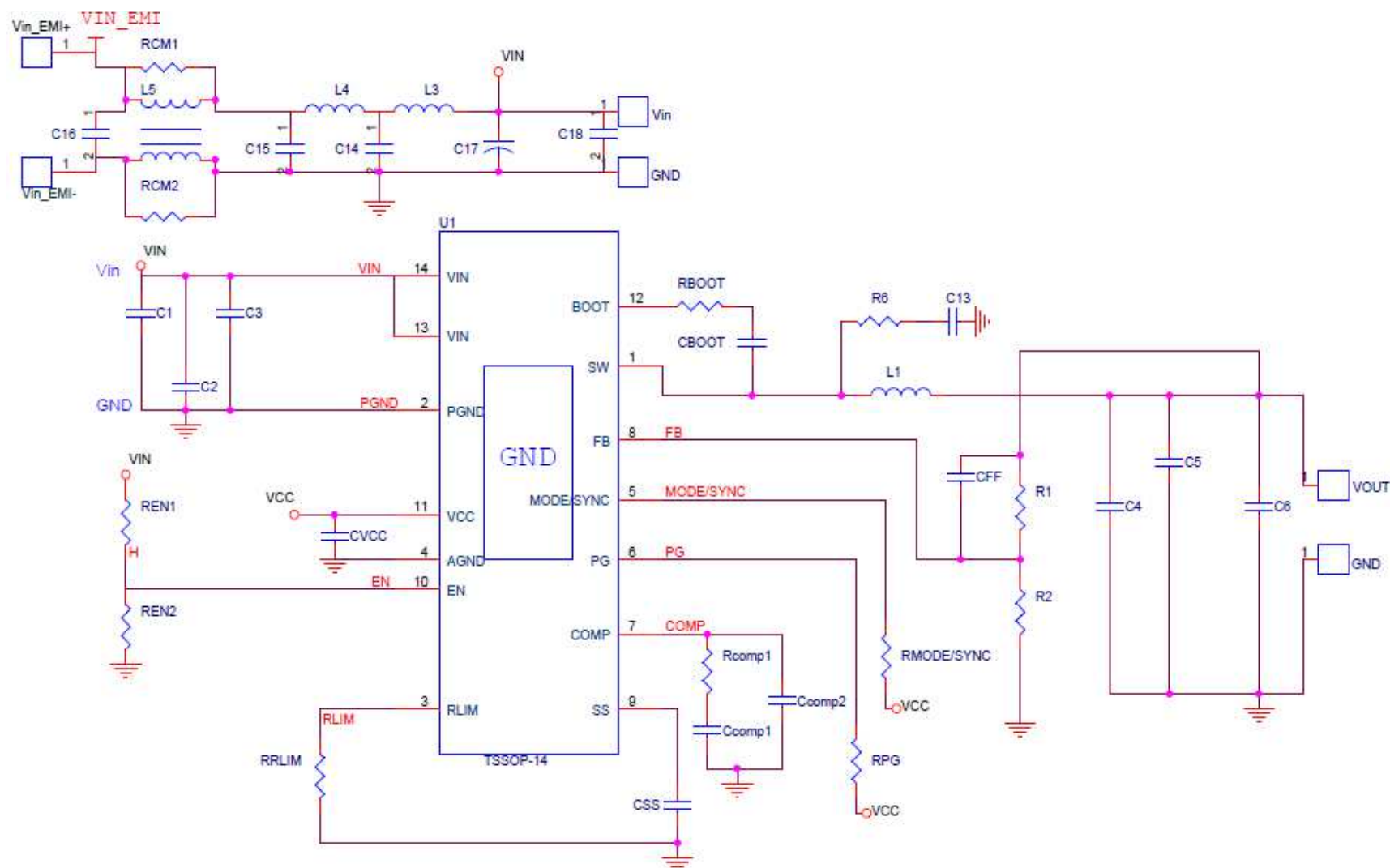
**RICHTEK**  
your power partner.

# System Specifications

---

PARAMETER	VALUE
Input voltage, $V_{in}$	12V
Output Voltage, $V_{out}$	5V
Output Current, $I_{out}$	3A
Switching frequency	2.1MHz

# Schematic

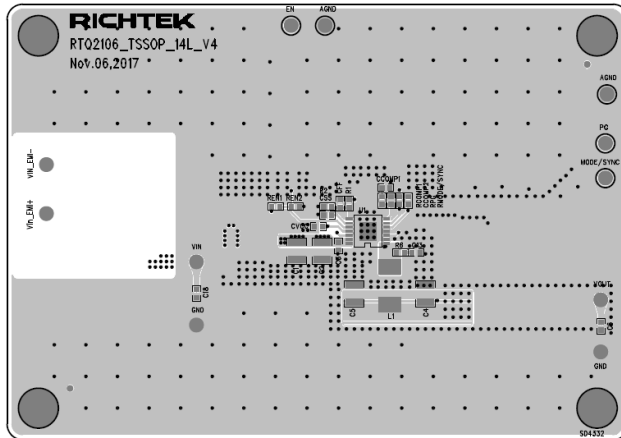


# PCB Layout

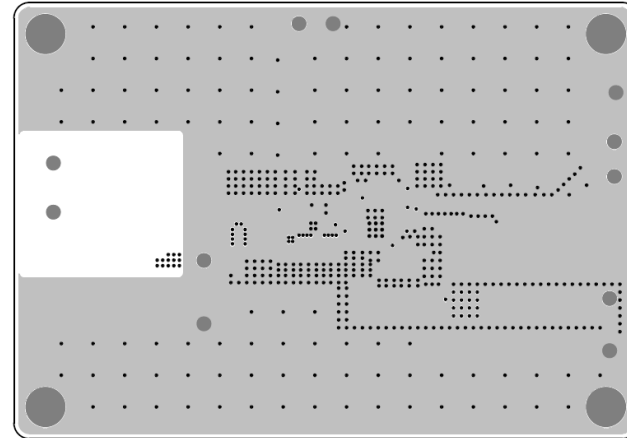
**Layers:** Total of 4 layers with 2 OZ. Cu on the outer layers and 1 OZ. Cu on the inner layers  
**Thickness:** 1.6mm  
**Size:** 70mm\*100mm

CONFIDENTIAL

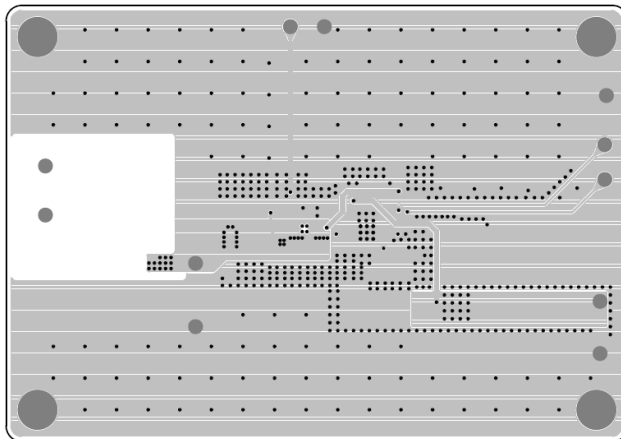
## Top layer



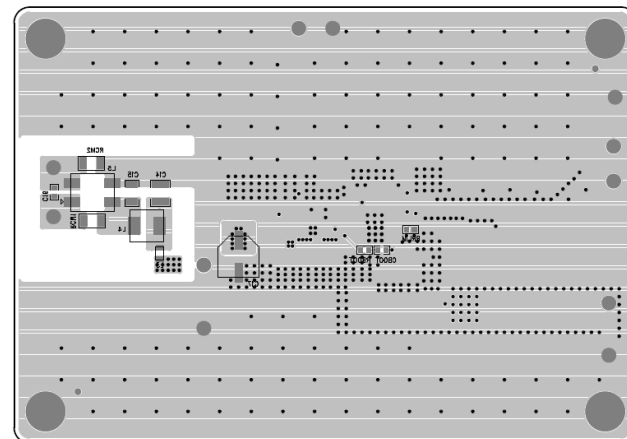
## Inner 1-st layer



## Inner 2-nd layer



## Bottom layer



# BOM

Part Reference	Value/Description	Part Number
C1,C2,C15	10uF/50V/X7R/1210	UMK325AB7106KM-T
C3,C6,C <sub>BOOT</sub> ,C16,C <sub>SS</sub>	0.1uF/50V/X7R/0603	C1608X7R1H104KT000N
C4,C5	22uF/10V/X7R/1210	GRM32ER71E226KE15L
C <sub>FF</sub>	10pF/50V/X7R/0603	
C <sub>VCC</sub>	1uF/25V/C7R/0603	
C17	100uF/50V	EEEFK1H101P
Ccomp1	10nF/50V/X7R/0603	
C13	560pF/50V/X7R/0603	
R6	3.3Ω/0603	
R1	866KΩ/0603	
R2	165KΩ/0603	
R <sub>EN1</sub> , R <sub>PG</sub>	100K/0603	
Rcomp1	7.5k/0603	
R <sub>BOOT</sub> , L3,R <sub>SSP_EN</sub>	0/0603	
R <sub>RT</sub>	22K/0603	
R <sub>RLIM</sub>	33K/0603	
L1	2.2uH	VCMT063T-2R2MN5
L4	4.7uH	IHLP2020BZER4R7MA1
L5	Common mode choke	ACM7060-701-2PL-TL-1
U1	RTQ2106	

5

# Test Standard for Automotive System

---

- **All setting follow the standard CISPR 25 and criteria is Class 5.**
- **CISPR 25** - Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers
- **Standard version : CISPR 25 Edition 3: 2008**

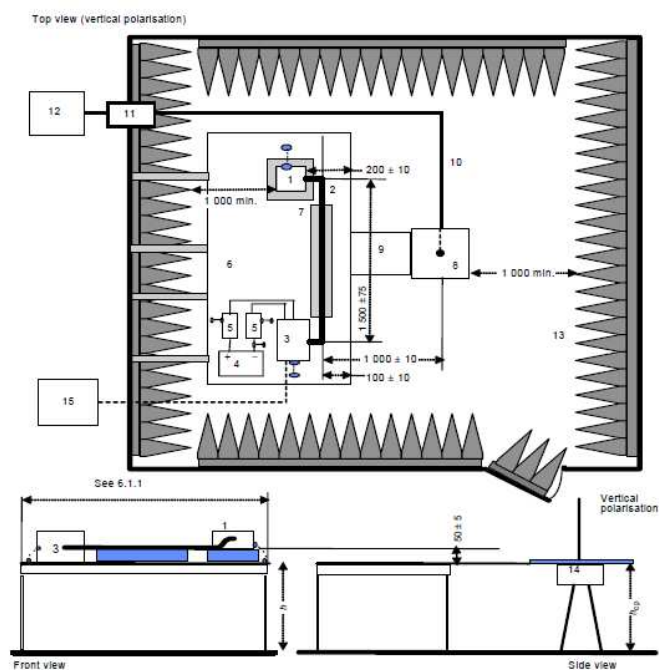
# CISPR 25 Test for Radiated EMI

---

- For full test report, there is four antenna systems need to be tested.
  1. 0.15 MHz to 30 MHz - 1 m vertical monopole
  2. 30 MHz to 200 MHz - a biconical antenna
  3. 200 MHz to 1000 MHz - a log-periodic antenna
  4. 1000 MHz to 2 500 MHz - a horn antenna
  
- From 150 kHz to 30 MHz measurements shall be performed in vertical polarisation only.
- From 30 MHz to 2500MHz measurements shall be performed in vertical and horizontal polarisations.

# Radiated EMI Measurement Setup (1)

Test setup - 0.15 MHz to 30 MHz - 1 m vertical monopole



## Key

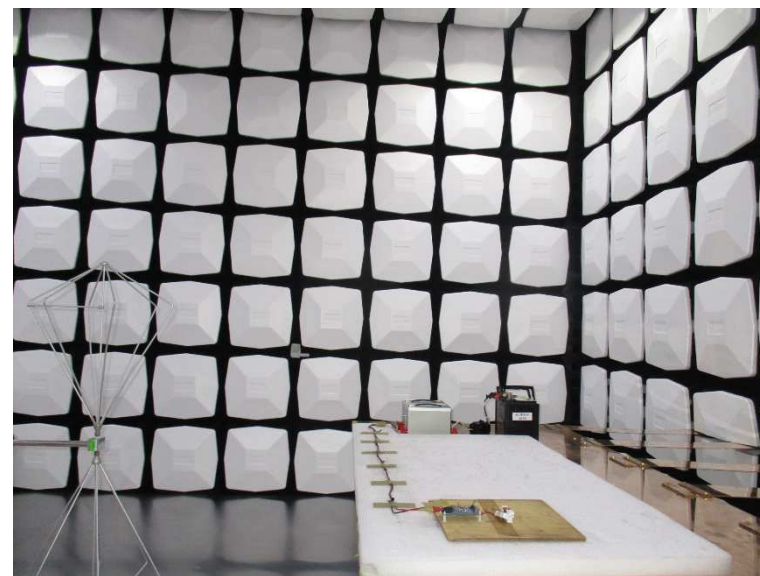
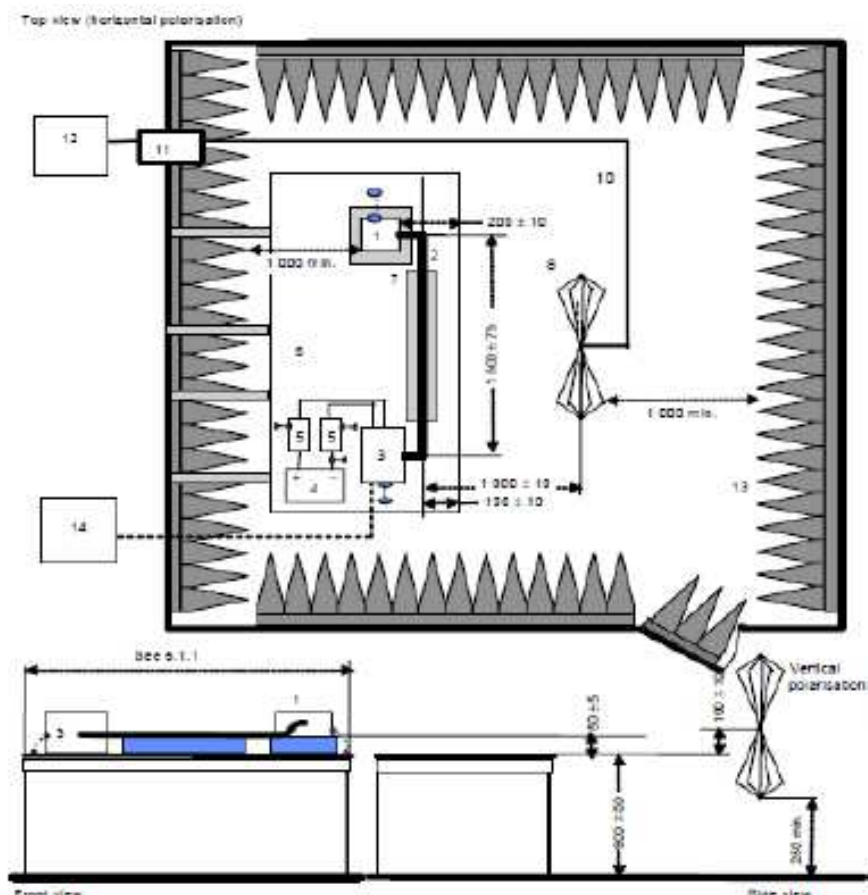
- |   |  |
|---|--|
| 1 EUT (grounded locally if required in test plan)                         | 9 Grounding connection (full width bond between counterpoise and ground plane)   |
| 2 Test harness  | 10 High-quality coaxial cable e.g. double-shielded (50 Ω)  |
| 3 Load simulator (placement and ground connection according to 6.4.2.5)   | 11 Bulkhead connector  |
| 4 Power supply (location optional)  | 12 Measuring instrument  |
| 5 Artificial network (AN)   | 13 RF absorber material  |
| 6 Ground plane (bonded to shielded enclosure)                             | 14 Antenna matching unit (the preferred location is below the counterpoise; if above the counterpoise then the base of the antenna rod shall be at the height of the ground plane) |
| 7 Low relative permittivity support ( $\epsilon_r \leq 1.4$ )             | 15 Stimulation and monitoring system   |
| 8 Rod Antenna with counterpoise<br>(dimensions: 600 mm by 600 mm typical) |  |
| $h = (900 \pm 50) \text{ mm}$   |  |
| $h_{cp} = h + (+10 / -20) \text{ mm}$                                     |  |





# Radiated EMI Measurement Setup (2)

Test setup - 30 MHz to 200 MHz - biconical antenna



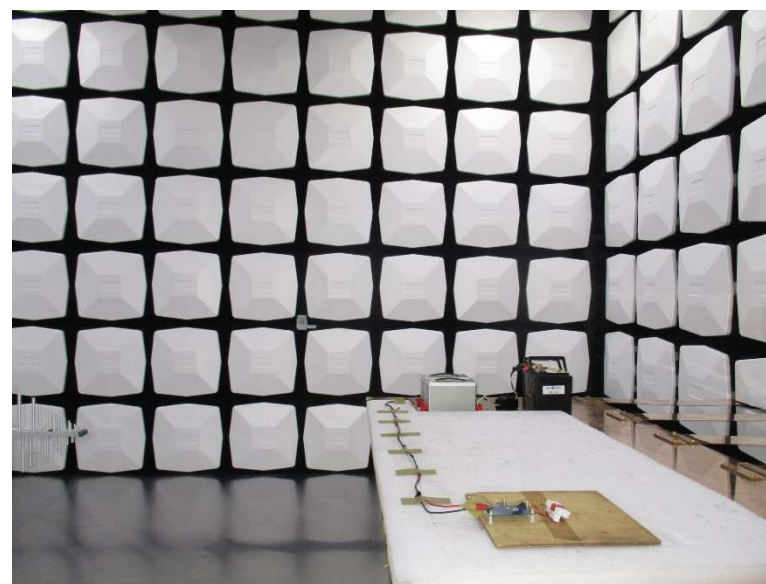
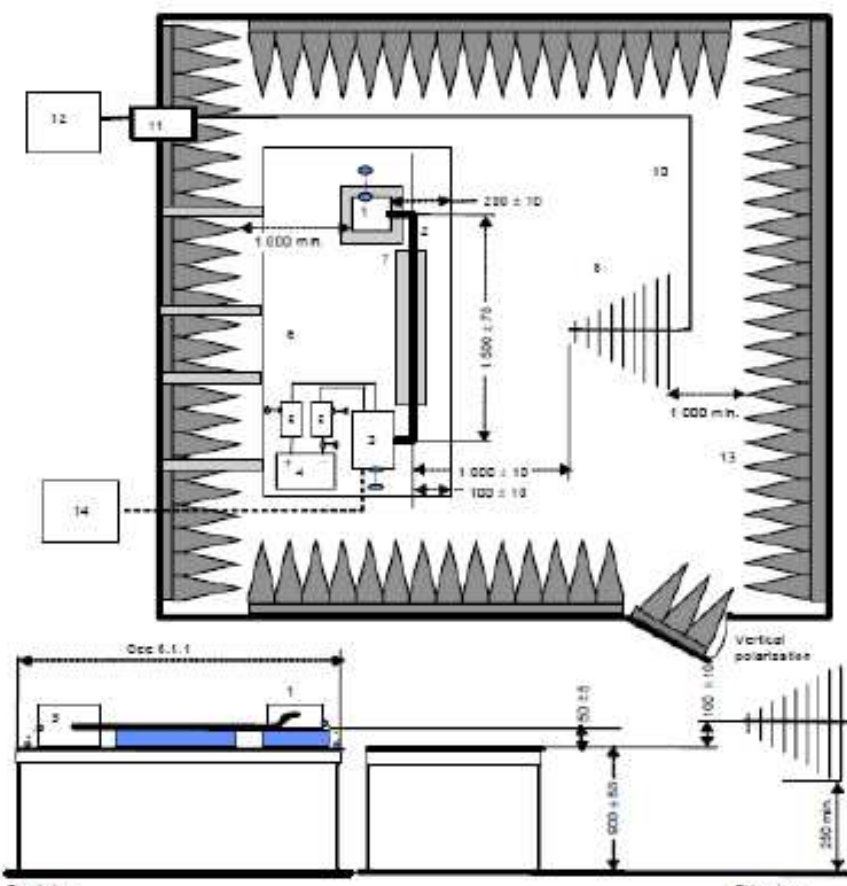
## Key

- |   |   |
|---|---|
| 1 DUT (grounded locally if required in test plan)                       | 8 Biconical antenna                                       |
| 2 Test harness  | 10 High-quality coaxial cable e.g. double-shielded (50 Ω) |
| 3 Load simulator (placement and ground connection according to 5.4.2.5) | 11 Bulkhead connector                                     |
| 4 Power supply (location optional)                                      | 12 Measuring instrument                                   |
| 5 Artificial network (AN)   | 13 RF absorber material                                   |
| 6 Ground plane (bonded to shielded enclosure)                           | 14 Stimulation and monitoring system                      |
| 7 Low relative permittivity support ( $\epsilon_r < 1.4$ )              |   |

# Radiated EMI Measurement Setup (3)

Test setup - 200 MHz to 1000 MHz - log-periodic antenna

Top view (horizontal polarization)

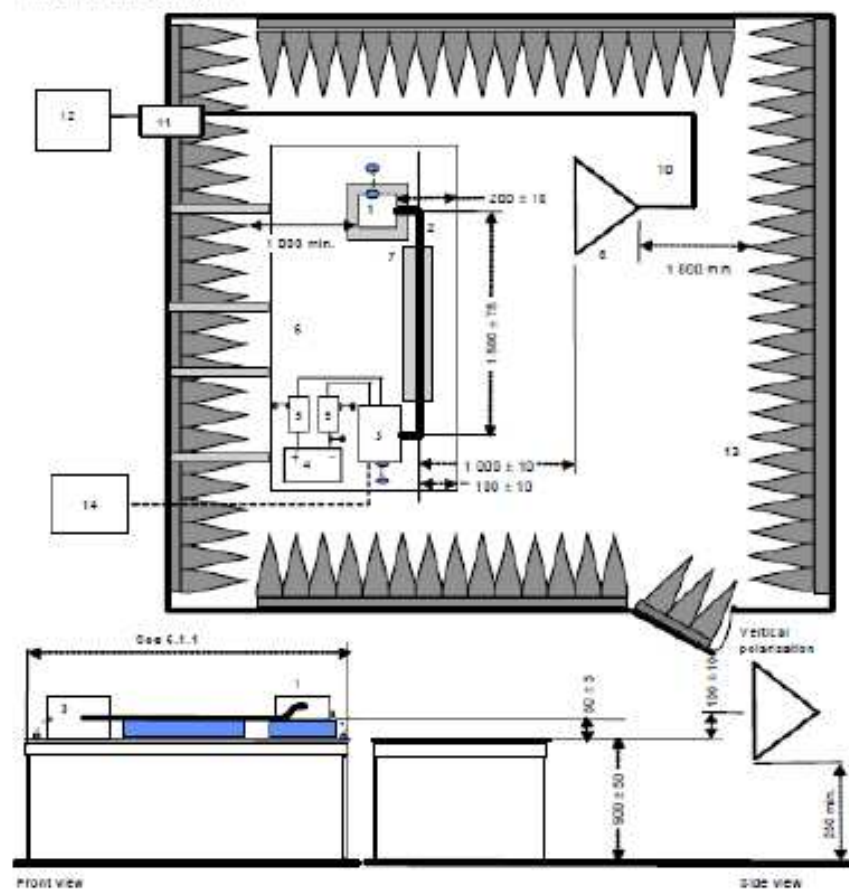


- Key
- |   |   |
|---|---|
| 1 EUT (grounded locally if required in test plan)                       | 8 Log-periodic antenna                                    |
| 2 Test harness  |   |
| 3 Load simulator (placement and ground connection according to 5.4.2.5) | 10 High-quality coaxial cable e.g. double-shielded (50 Ω) |
| 4 Power supply (location optional)                                      | 11 Bulkhead connector                                     |
| 5 Artificial network (AN)   | 12 Measuring instrument                                   |
| 6 Ground plane (bonded to enclosed enclosure)                           | 13 RF absorber material                                   |
| 7 Low relative permittivity support ( $\epsilon_r \leq 1.4$ )           | 14 Stimulation and monitoring system                      |

# Radiated EMI Measurement Setup (4)

Test setup - 1000 MHz to 2500 MHz – horn antenna

Top view (horizontal polarisation)



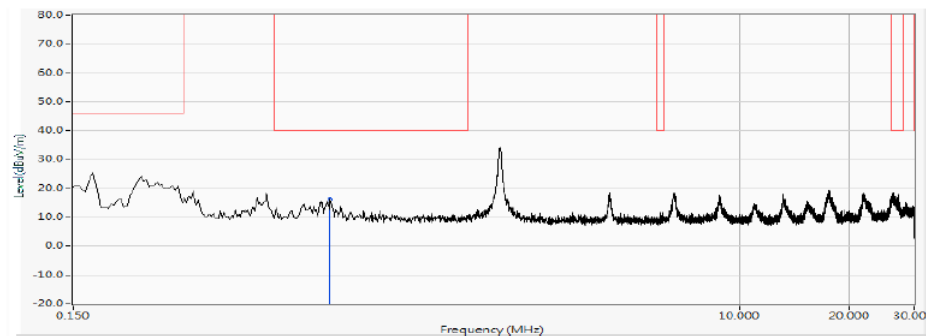
## Key

- |   |   |
|---|---|
| 1 EUT (grounded locally if required in test plan)                       | 8 Horn antenna  |
| 2 Test harness  |   |
| 3 Load simulator (placement and ground connection according to § 4.2.6) | 10 High-quality coaxial cable e.g. double-shielded (50 Ω) |
| 4 Power supply (location optional)                                      | 11 Bulkhead connector                                     |
| 5 Artificial network (AN)   | 12 Measuring instrument                                   |
| 6 Ground plane (bonded to shielded enclosure)                           | 13 RF absorber material                                   |
| 7 Low relative permittivity support ( $\epsilon_r < 1.4$ )              | 14 Simulation and monitoring system                       |

# Radiated EMI test result \_ 1 m vertical monopole

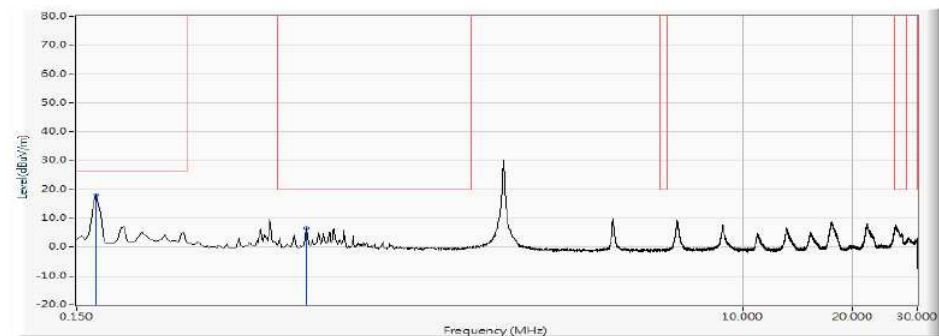
Test band : 0.15 MHz to 30 MHz - 1 m vertical monopole for Horizontal

## Peak Measurement



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	0.758	10.135	6.035	16.170	-23.830	40.000	PEAK

## Average Measurement



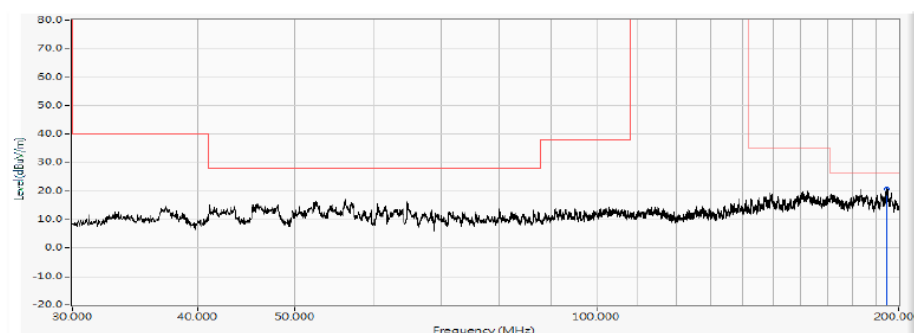
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	0.170	10.127	7.964	18.091	-7.909	26.000	AVERAGE
2		0.638	10.134	-3.544	6.590	-13.410	20.000	AVERAGE

RTQ2106 pass CISPR25 Class 5 criteria

# Radiated EMI test result \_ biconical antenna

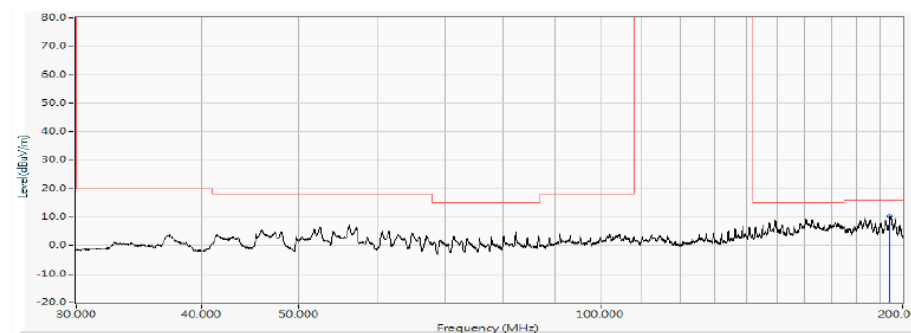
Test band : 30 MHz to 200 MHz - biconical antenna for Horizontal

## Peak Measurement



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	194.920	-32.623	53.379	20.756	-5.244	26.000	PEAK

## Average Measurement



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	194.480	-32.626	42.986	10.361	-5.639	16.000	AVERAGE

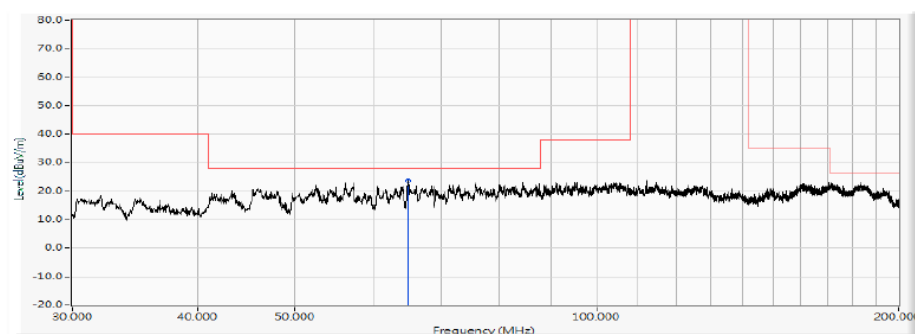
RTQ2106 pass CISPR25 Class 5 criteria



# Radiated EMI test result \_ biconical antenna

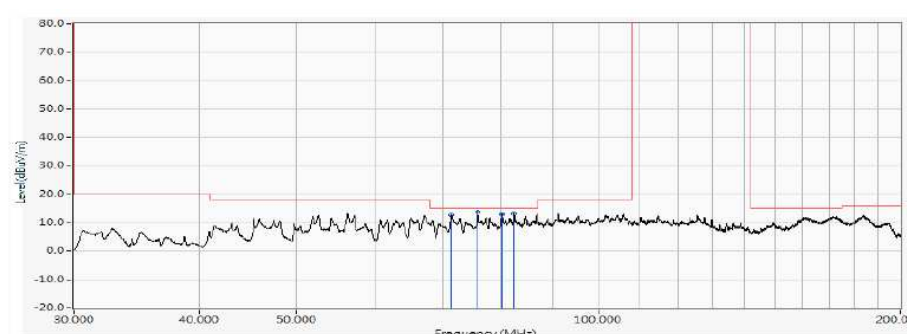
Test band : 30 MHz to 200 MHz - biconical antenna for Vertical

## Peak Measurement



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	64.800	-43.179	66.939	23.760	-4.240	28.000	PEAK

## Average Measurement



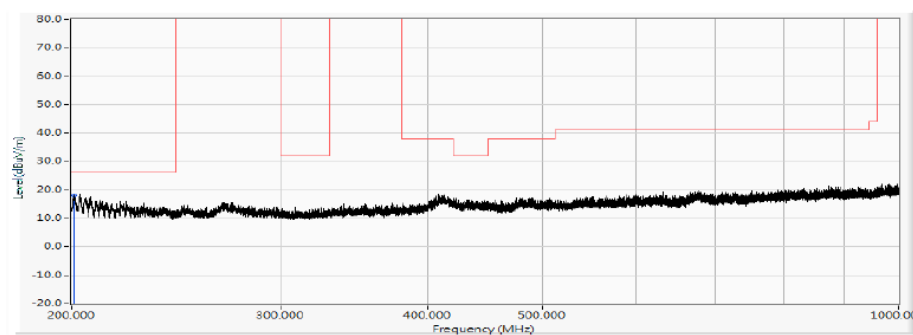
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		71.360	-43.840	56.431	12.591	-2.409	15.000	AVERAGE
2	*	75.800	-43.443	57.103	13.660	-1.340	15.000	AVERAGE
3		80.160	-43.039	55.961	12.923	-2.077	15.000	AVERAGE
4		82.360	-42.645	55.835	13.190	-1.810	15.000	AVERAGE

RTQ2106 pass CISPR25 Class 5 criteria

# Radiated EMI test result \_ log-periodic antenna

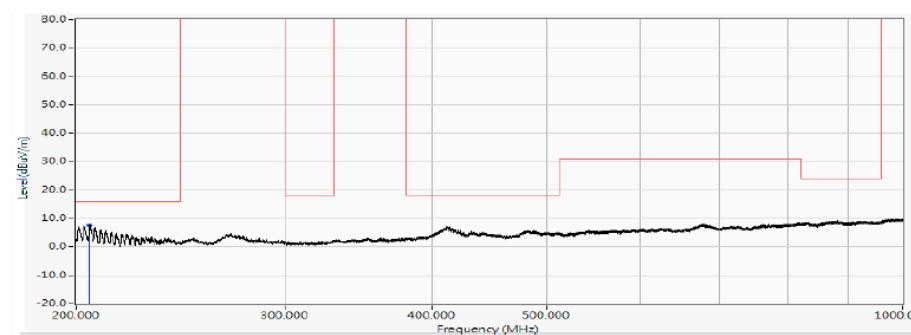
Test band : 200 MHz to 1000 MHz - a log-periodic antenna for Horizontal

## Peak Measurement



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	200.720	-36.303	54.246	17.943	-8.057	26.000	PEAK

## Average Measurement



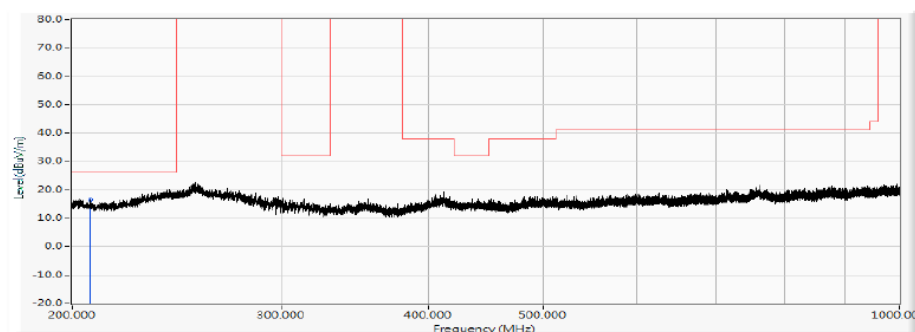
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	205.160	-36.322	44.040	7.718	-8.282	16.000	AVERAGE

RTQ2106 pass CISPR25 Class 5 criteria

# Radiated EMI test result \_ log-periodic antenna

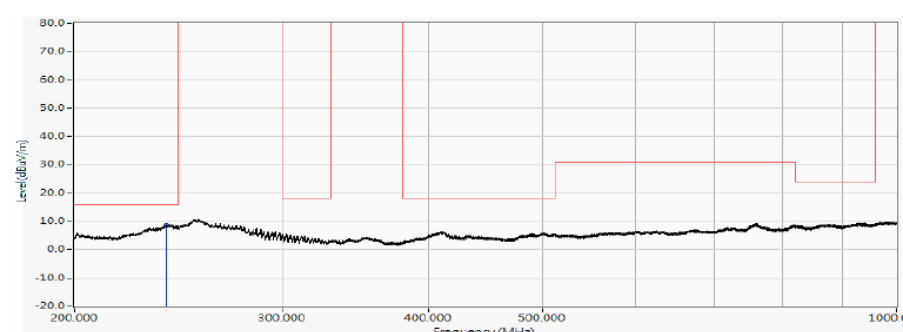
Test band : 200 MHz to 1000 MHz - a log-periodic antenna for Vertical

## Peak Measurement



	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	* 207.320	-36.331	52.855	16.524	-9.476	26.000	PEAK

## Average Measurement



	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	* 239.120	-35.899	44.493	8.594	-7.406	16.000	AVERAGE

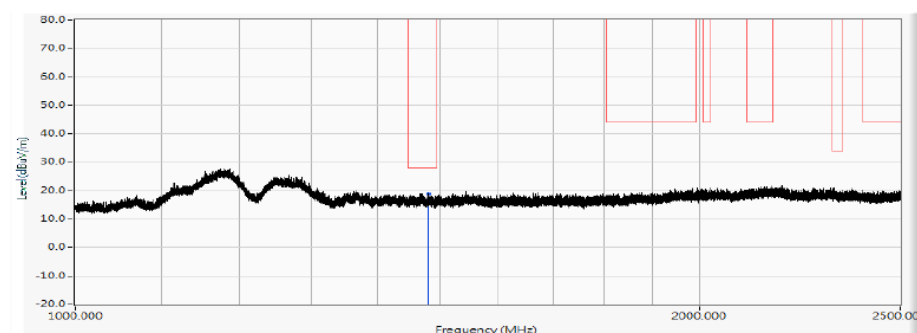
RTQ2106 pass CISPR25 Class 5 criteria



# Radiated EMI test result \_ horn antenna

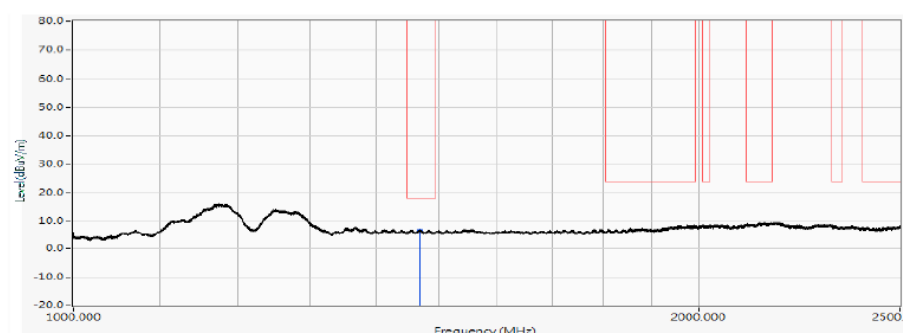
Test band : 1000 MHz to 2500 MHz - a horn antenna for Horizontal

## Peak Measurement



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1481.120	-23.042	41.828	18.786	-9.214	28.000	PEAK

## Average Measurement



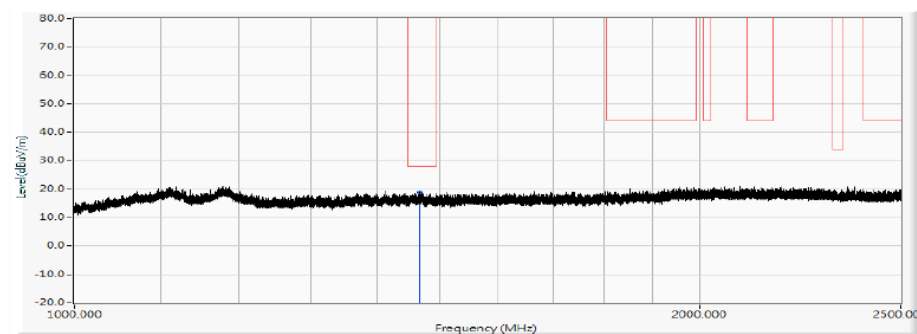
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1468.320	-23.070	29.998	6.928	-11.072	18.000	AVERAGE

RTQ2106 pass CISPR25 Class 5 criteria

# Radiated EMI test result \_ horn antenna

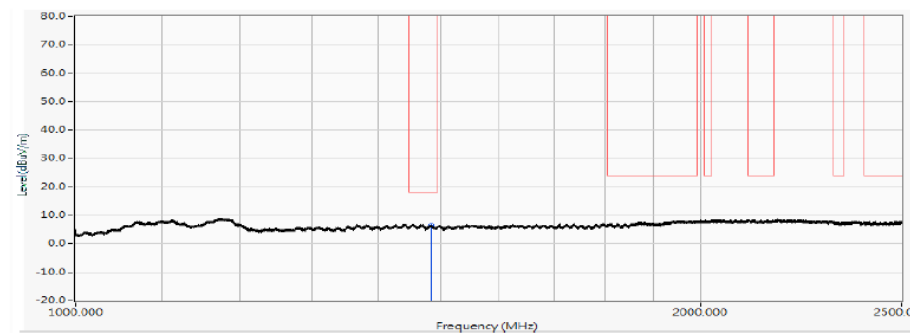
Test band : 1000 MHz to 2500 MHz - a horn antenna for Vertical

## Peak Measurement



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1467.320	-23.072	41.894	18.822	-9.178	28.000	PEAK

## Average Measurement

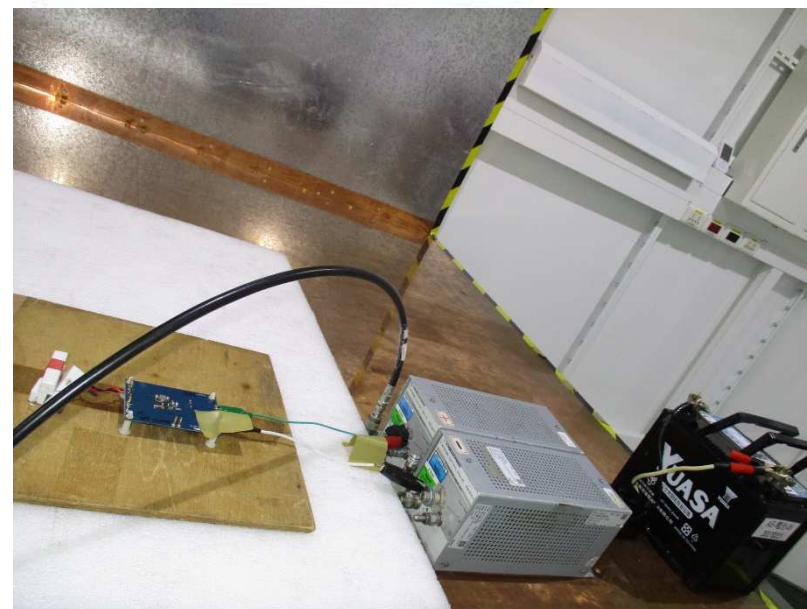
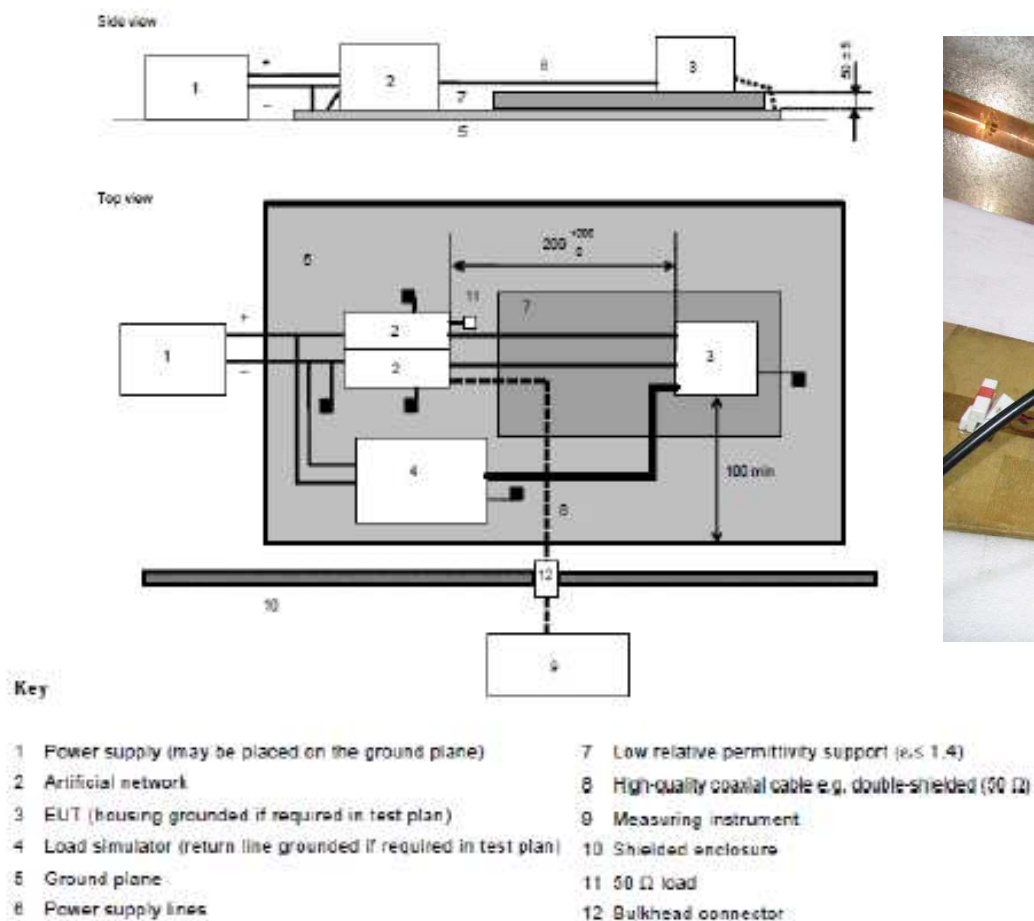


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1483.520	-23.036	29.629	6.593	-11.407	18.000	AVERAGE

RTQ2106 pass CISPR25 Class 5 criteria

# CISPR 25 Test for Conducted EMI

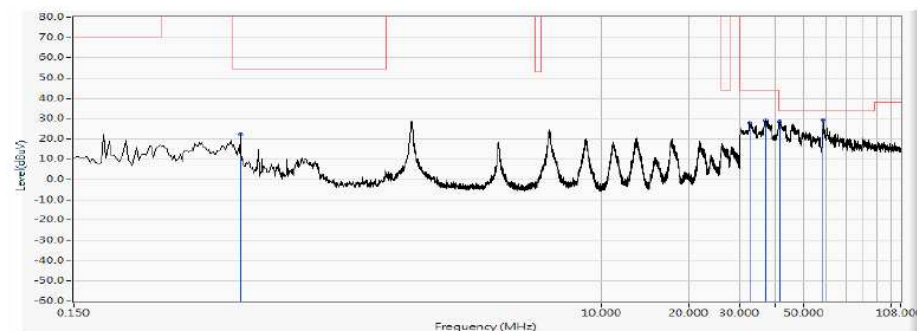
## Conducted emissions from components/modules – Voltage method



# Conducted EMI test result \_ Voltage method(1)

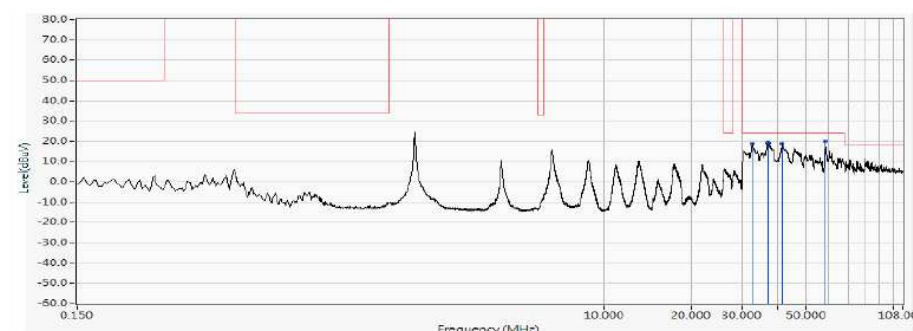
Test band : 150K Hz to 108M Hz

## Line 1\_Peak



	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1	0.562	0.128	21.952	22.080	-31.920	54.000	PEAK
2	32.640	0.472	27.534	28.006	-15.994	44.000	PEAK
3	37.000	0.509	28.567	29.076	-14.924	44.000	PEAK
4	41.360	0.547	27.987	28.534	-5.466	34.000	PEAK
5	*	0.705	28.580	29.285	-4.715	34.000	PEAK

## Line 1\_Average



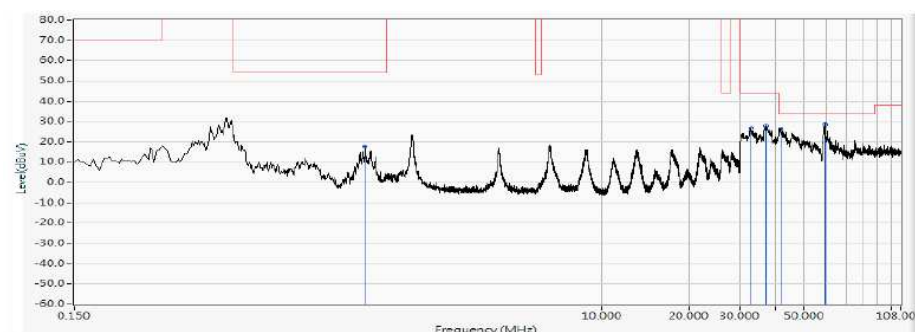
	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1	32.600	0.472	18.218	18.690	-5.310	24.000	AVERAGE
2	36.880	0.508	18.642	19.150	-4.850	24.000	AVERAGE
3	41.240	0.545	18.163	18.709	-5.291	24.000	AVERAGE
4	*	0.704	19.172	19.875	-4.125	24.000	AVERAGE

RTQ2106 pass CISPR25 Class 5 criteria

# Conducted EMI test result \_ Voltage method(2)

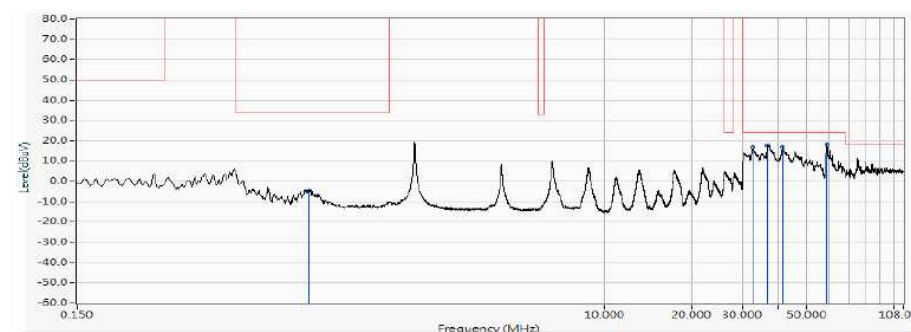
Test band : 150K Hz to 108M Hz

## Line 2\_Peak



	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1	1.518	0.185	17.375	17.560	-36.440	54.000	PEAK
2	32.800	0.414	26.303	26.717	-17.283	44.000	PEAK
3	37.000	0.434	27.225	27.660	-16.340	44.000	PEAK
4	41.480	0.457	25.801	26.258	-7.742	34.000	PEAK
5	*	0.546	28.061	28.607	-5.393	34.000	PEAK

## Line 2\_Average



	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1	0.954	0.180	-4.446	-4.266	-38.266	34.000	AVERAGE
2	32.560	0.413	16.516	16.929	-7.071	24.000	AVERAGE
3	36.800	0.434	17.118	17.552	-6.448	24.000	AVERAGE
4	41.240	0.456	16.375	16.831	-7.169	24.000	AVERAGE
5	*	0.543	17.447	17.990	-6.010	24.000	AVERAGE

RTQ2106 pass CISPR25 Class 5 criteria

**RICHTEK**  
your power partner.

thank you.