## Power Line Conducted Emissions

### Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard and measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio, maritime radio, CB radio, and so on, from unwanted interference.

### Limits & Method

The limits and method are as defined in CISPR 11.

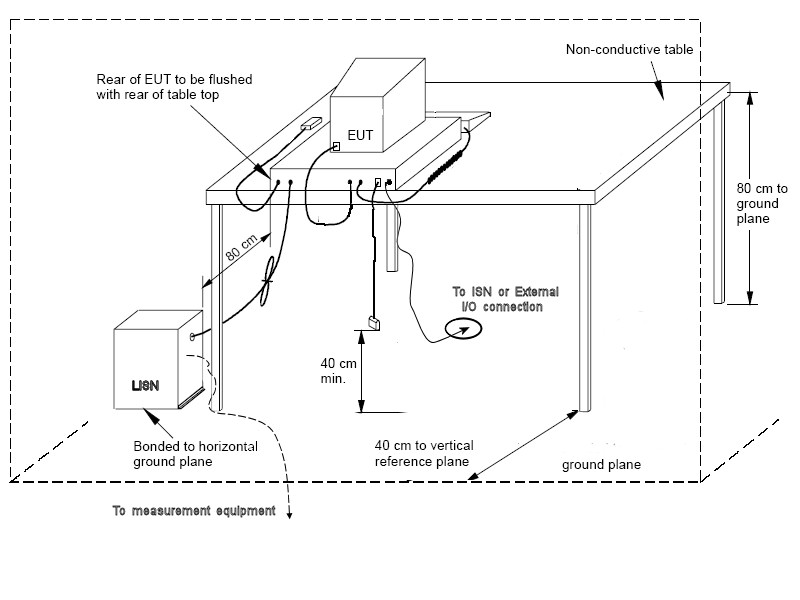
CLASS A

|  |  |  |  |
| --- | --- | --- | --- |
| **Average Limits** | | **Quasi-Peak Limits** | |
| 150 kHz – 500 kHz | 66 dBµV | 150 kHz – 500 kHz | 79 dBµV |
| 500 kHz – 30 MHz | 60 dBµV | 500 kHz – 30 MHz | 73 dBµV |

Both Quasi-Peak and Average limits are applicable and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

Based on CISPR 11 Section 7.3.1, if the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Typical Setup Diagram

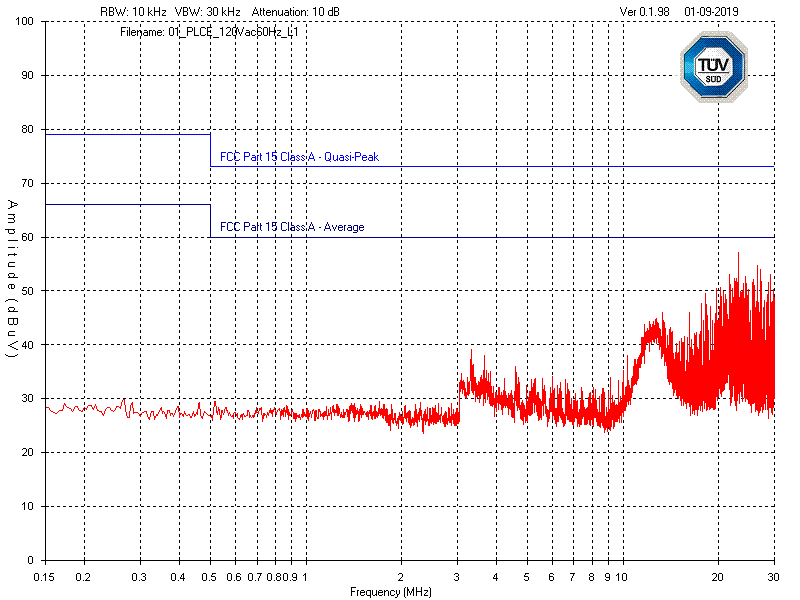


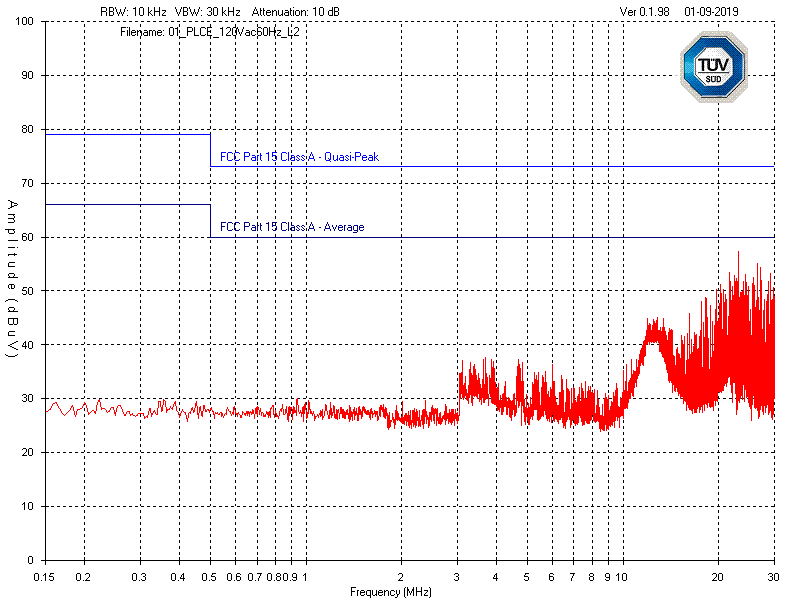
### Measurement Uncertainty

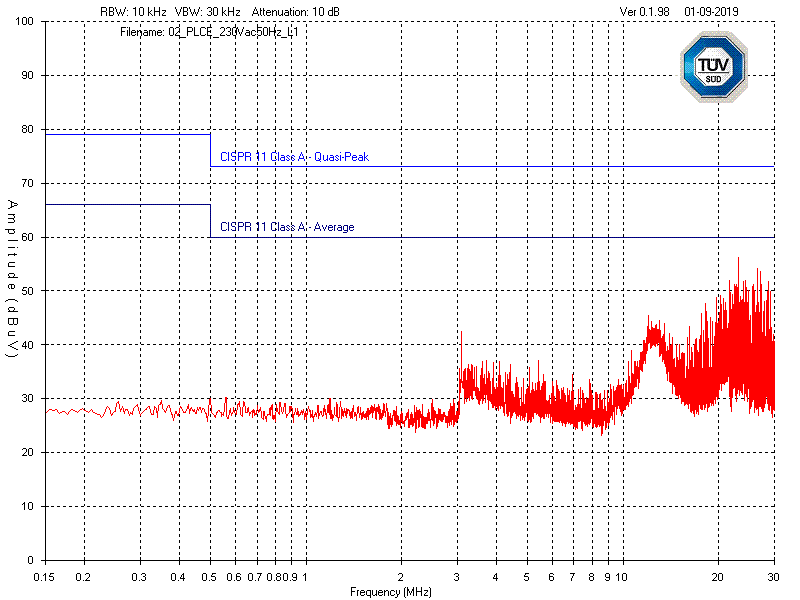
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±2.73dB with a 'k=2' coverage factor and a 95% confidence level.

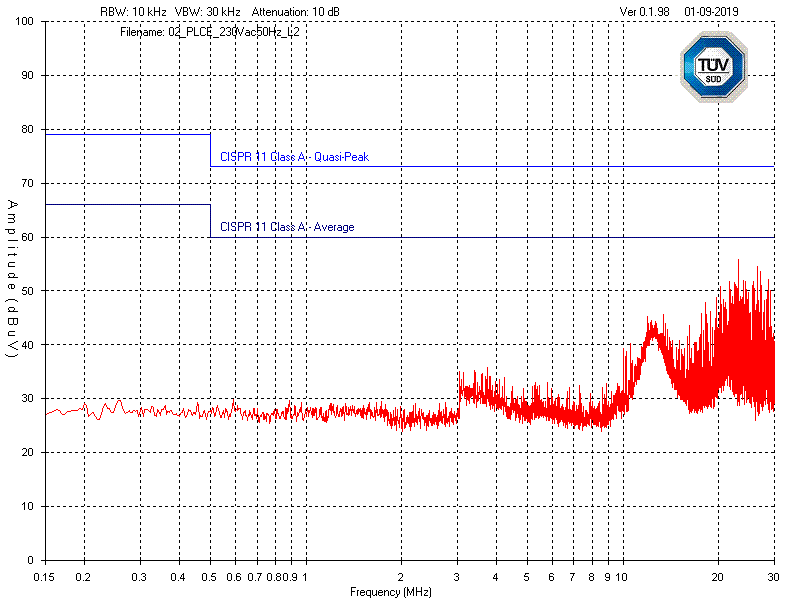
### Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

Line (L1) - 120Vac60Hz  
  


Neutral (L2) - 120Vac60Hz  
  


Line (L1) - 230Vac50Hz  
  


Neutral (L2) - 230Vac50Hz  
  


### Final Measurements

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Product Category | | | Class A | | | | | | | | |
| EUT | | | LPS-7 | | | | | | | | |
| Supply | | | **120Vac60Hz** | | | | | | | | |
| **Frequency (MHz)** | **Detector** | **Received Signal (dBµV)** | **Atten Factor (dB)** | **Cable Factor (dB)** | **LISN Factor (dB)** | **Level (dBµV)** | **QP Limit (dBµV)** | **AVG Limit (dBµV)** | **QP Margin (dB)** | **AVG Margin (dB)** | **Pass/ Fail** |
| Line | | | | | | | | | | | |
| 23.131 | AVG | 42.4 | 10.0 | 0.1 | 0.1 | 52.6 | -- | 60.0 | -- | 7.4 | Pass |
| 26.613 | AVG | 34.1 | 10.0 | 0.1 | 0.2 | 44.4 | -- | 60.0 | -- | 15.6 | Pass |
| 26.491 | AVG | 35.6 | 10.0 | 0.1 | 0.2 | 45.9 | -- | 60.0 | -- | 14.1 | Pass |
| 27.159 | AVG | 39.8 | 10.0 | 0.1 | 0.2 | 50.1 | -- | 60.0 | -- | 9.9 | Pass |
| 26.550 | PEAK | 43.1 | 10.0 | 0.1 | 0.2 | 53.4 | 73.0 | 60.0 | 19.6 | 6.6 | Pass |
| 23.071 | PEAK | 43.0 | 10.0 | 0.1 | 0.1 | 53.2 | 73.0 | 60.0 | 19.8 | 6.8 | Pass |
| Neutral | | | | | | | | | | | |
| 23.131 | AVG | 42.6 | 10.0 | 0.1 | 0.2 | 52.9 | -- | 60.0 | -- | 7.1 | Pass |
| 26.613 | AVG | 34.2 | 10.0 | 0.1 | 0.2 | 44.5 | -- | 60.0 | -- | 15.5 | Pass |
| 26.491 | PEAK | 44.3 | 10.0 | 0.1 | 0.2 | 54.6 | 73.0 | 60.0 | 18.4 | 5.4 | Pass |
| 27.159 | PEAK | 44.0 | 10.0 | 0.1 | 0.2 | 54.3 | 73.0 | 60.0 | 18.7 | 5.7 | Pass |
| 26.554 | PEAK | 43.2 | 10.0 | 0.1 | 0.2 | 53.5 | 73.0 | 60.0 | 19.5 | 6.5 | Pass |
| 23.071 | PEAK | 43.2 | 10.0 | 0.1 | 0.2 | 53.5 | 73.0 | 60.0 | 19.5 | 6.5 | Pass |

Average and Quasi-Peak Emissions Table

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Product Category | | | Class A | | | | | | | | |
| EUT | | | LPS-7 | | | | | | | | |
| Supply | | | **230Vac50Hz** | | | | | | | | |
| **Frequency (MHz)** | **Detector** | **Received Signal (dBµV)** | **Atten Factor (dB)** | **Cable Factor (dB)** | **LISN Factor (dB)** | **Level (dBµV)** | **QP Limit (dBµV)** | **AVG Limit (dBµV)** | **QP Margin (dB)** | **AVG Margin (dB)** | **Pass/ Fail** |
| Line | | | | | | | | | | | |
| 23.134 | AVG | 37.0 | 10.0 | 0.1 | 0.1 | 47.2 | -- | 60.0 | -- | 12.8 | Pass |
| 26.613 | PEAK | 43.8 | 10.0 | 0.1 | 0.2 | 54.1 | 73.0 | 60.0 | 18.9 | 5.9 | Pass |
| 26.491 | PEAK | 43.5 | 10.0 | 0.1 | 0.2 | 53.8 | 73.0 | 60.0 | 19.2 | 6.2 | Pass |
| 27.159 | PEAK | 43.4 | 10.0 | 0.1 | 0.2 | 53.7 | 73.0 | 60.0 | 19.3 | 6.3 | Pass |
| 26.554 | PEAK | 42.5 | 10.0 | 0.1 | 0.2 | 52.8 | 73.0 | 60.0 | 20.2 | 7.2 | Pass |
| 23.071 | PEAK | 42.0 | 10.0 | 0.1 | 0.1 | 52.2 | 73.0 | 60.0 | 20.8 | 7.8 | Pass |
| Neutral | | | | | | | | | | | |
| 23.134 | AVG | 36.9 | 10.0 | 0.1 | 0.2 | 47.2 | -- | 60.0 | -- | 12.8 | Pass |
| 26.613 | AVG | 37.3 | 10.0 | 0.1 | 0.2 | 47.6 | -- | 60.0 | -- | 12.4 | Pass |
| 26.491 | PEAK | 43.7 | 10.0 | 0.1 | 0.2 | 54.0 | 73.0 | 60.0 | 19.0 | 6.0 | Pass |
| 27.159 | PEAK | 43.2 | 10.0 | 0.1 | 0.2 | 53.5 | 73.0 | 60.0 | 19.5 | 6.5 | Pass |
| 26.554 | PEAK | 42.8 | 10.0 | 0.1 | 0.2 | 53.1 | 73.0 | 60.0 | 19.9 | 6.9 | Pass |
| 23.071 | PEAK | 41.9 | 10.0 | 0.1 | 0.2 | 52.2 | 73.0 | 60.0 | 20.8 | 7.8 | Pass |

Average and Quasi-Peak Emissions Table

Note:

Peak = Peak measurement

AVG = Average measurement

QP = Quasi-Peak measurement

See 'Appendix B – EUT, Peripherals, and Test Setup Photos' for photos showing the test set-up for the highest line conducted emission.

### Test Equipment List

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Equipment** | **Model No.** | **Manufacturer** | **Last Calibration Date** | **Next Calibration Date** | **Asset #** |
| Spectrum Analyzer | ESL 6 | Rohde & Schwarz | Dec. 27, 2017 | Dec. 27, 2019 | GEMC 160 |
| LISN | FCC-LISN-50/250-  16-2-01 | FCC | Jan. 10, 2018 | Jan. 10, 2020 | GEMC 302 |
| RF Cable 3m | LMR-400-3M-50Ω-MN-MN | LexTec | NCR | NCR | GEMC 276 |
| Attenuator 10 dB | 612-10-1 | Meca Electronics, Inc | NCR | NCR | GEMC 223 |
| Emissions Software | 0.1.97 | TUV SUD Canada, Inc | NCR | NCR | GEMC 58 |