常见EMC问题（Common EMC problems）

Common EMC issues

1. Why do electromagnetic compatibility design for products?

Answer: Meet product functional requirements, reduce commissioning time, so that products meet the requirements of electromagnetic compatibility standards, so that products will not be in the system of other equipment to generate electromagnetic interference.

2. What are the various aspects of electromagnetic compatibility design for products?

Answer: circuit design (including device selection), software design, circuit board design, shielding structure, signal line/power line filter, circuit grounding mode design.

3. In the field of electromagnetic compatibility, why always use DB (db) unit description? How many dBmV are 10mV?

A: Because the amplitude and frequency range of the description is very wide, it is easier to represent the graph with logarithmic coordinates, and DB is the unit with logarithmic representation, 10mV is 20dBmV.

4. Why does the Spectrum Analyzer not observe the electrostatic discharge and other transient disturbances?

A: Because the Spectrum analyzer is a narrowband sweep receiver, it receives only the energy within a certain frequency range

at a given moment. and electrostatic discharge, such as transient interference is a pulse interference, the spectrum range is very wide, but the time is very short, so that the spectrum analyzer in the transient interference occurs only a small part of its total energy, can not reflect the actual interference.

5. In the field of electromagnetic interference problem diagnosis, often need to use near-field probes and spectrum analyzer, how to use coaxial cable to make a simple near-field probe?

A: The outer layer (shielding layer) of coaxial cable is peeled off, the core line is exposed, and the core line is turned into a diameter and a small ring ($number turn), welded on the outer floor.

6. A device, the original electromagnetic emission intensity is 300mv/m, plus shielding box, radiation emission reduced to 3mv/m, the shielding efficiency of this chassis is how many db?

A: The shielding efficiency of this enclosure should be 40dB.

7. When designing the shielding chassis, according to what Factor chooses the shielding material?

Answer: From the point of view of electromagnetic shielding, the main consideration is the type of electric field wave shielding. For the electric field wave, the plane wave or the high frequency magnetic field wave, the general metal can satisfy the request, for the low-frequency magnetic wave, must

use the permeability high material.

8. What factors affect the shielding effectiveness of the chassis in addition to the shielding material?

Answer: Affected by two factors, one is the chassis conduction discontinuity points, such as holes, cracks and so on, the other is through the shield box of wire, such as signal cable, power cord and so on.

9. Shielding the magnetic field radiation source should pay attention to what problem?

A: Because the wave impedance of the magnetic field wave is very low, the reflection loss is very small, but the absorption loss is mainly achieved by the shielding. Therefore, we should choose permeability high shielding material. In addition, in the structural design, to make the shielding layer as far as possible from the radiation source (to increase the reflection loss), as far as possible to avoid holes, cracks and other near the source of radiation.

10. In the design of shielding structure, there is a principle: as far as possible to keep the cable in the chassis away from the gap and holes, why?

A: Because there is always a magnetic field near the cable, the magnetic field is easily leaking from the hole (regardless of the frequency of the magnetic field). Therefore, when the cable distance between the gap and the hole is very close, the magnetic leakage will occur, reduce the overall shielding

effectiveness.

11. The measurement of human bio-magnetic information is a new medical diagnosis method, this kind of biological magnetic measurement must be in the magnetic shielding room, this shielding room must be able to shield from the static magnetic field to 1GHz alternating electromagnetic field, please propose this shielding room design.

A: First consider the selection of shielding materials, due to shielding frequency is very low magnetic field, so to use high permeability materials, such as the Slope mo alloy. Because of the processing of the slope mo Alloy, the permeability will be reduced and heat treatment must be carried out. Therefore, the shielding room to be assembled, from the plate assembled. In advance, each piece of plate in accordance with the design and processing, and then heat treatment, transport to the scene, very careful to install. The joint of each plate should overlap,

The high-frequency signal on the signal cable will be coupled to the power cord (especially the part that has been filtered), resulting in the transmission exceeding the power line.

22. Why Choose power Line filter, can not blindly pursuit of small size?

A: The size of the filter is mainly determined by the inductance in the filter circuit, the smaller the inductance in the filter, the smaller the inductance, the lower the low frequency filter performance. In addition, the small size of the filter, the internal devices must be very close to each other, which will

reduce the high-frequency performance of the filter.

23. What is the insertion loss of the filter, and what method to measure the insertion loss of the filter can get the most insured results?

A: Because the filter access circuit generated by the current, voltage loss is called filter insertion loss, interference filter response frequency signal is as large as possible insertion loss. The insertion loss of the measuring filter should be measured by the condition of the ratio of the source and the load impedance to 0.1:100 (or vice versa), at which time the result of the worst condition can be obtained, which is the most insured result.

24. Generally speaking, the AC line filter can be used in the DC, but the DC line filter must not be used in the exchange of occasions, this is why?

A: DC filter used in the bypass capacitor is the DC capacitor, used in the exchange conditions may occur overheating and damage, if the DC capacitor is low pressure, but also will be penetrated and damaged. Even if these two cases do not occur, the common-mode bypass capacitor in the General DC filter has a large capacity, and it can be used in the communication situation to have excessive leakage current, which violates the safety standard.

25. What is the main function of the signal line filter, from the installation of what kind of talk, how to determine the use of what kind of installation of the signal filter?

Answer: Reduce the signal line unnecessary high-frequency components (mainly common mode), thereby reducing the electromagnetic radiation of the cable, or prevent the cable as an antenna to receive space electromagnetic interference, and conduction into the chassis. There are two ways to install on the PCB and the panel is required to filter the lower frequencies when using the structure installed on the circuit board, and when the frequency of the filter is higher, the structure of the panel will be used.

26. The maximum frequency of signals transmitted on a signal line is 30MHz, the measurement shows that the wire has a 120MHz common-mode interference current, and the common-mode radiation formula predicts that, as long as the common-mode current is suppressed 30dB, it can meet the requirements of the electromagnetic compatibility standard and need a few steps of low-pass filter circuit.

Answer: According to the question, the cut-off frequency of low-pass filter is 30MHz, and the insertion loss in 120MHz is greater than 30dB. Because the insertion loss increase rate of N-order filter is 6N per octave (db), 30MHz to 120MHz is two octave, so the cutoff frequency of N-order filter is in 30MHz, then the insertion loss is the path 120MHz (db) when 12N. To make a path of 12N 30, it is preferable to $literal, that is, the order of Low-pass filters is at least 3.

27. Why is the three-end capacitor more suitable for interference filtering?

Answer: The frequency of electromagnetic interference is often very high, therefore, the high-frequency characteristic of interference filter is very important, and the three-terminal capacitance cleverly utilizes the two-wire inductance on an electrode to form a T-type Low-pass filter, which eliminates the negative effect of the lead inductance in the traditional capacitor and enhances the high-frequency filtering characteristic, so the three-terminal capacitor is more suitable for interference filtering

28. Why is it that the heart capacitance is an ideal device for jamming filtering?

A: The heart capacitance is a three-terminal capacitor, but compared with the ordinary three-terminal capacitor, because it is directly installed in the metal panel, so its grounding inductance is smaller, almost no lead inductance effect, in addition, its input and output end by metal plate isolation, eliminate high-frequency coupling, these two characteristics determine the wear heart capacitance with close to ideal capacitance filter effect.

29. What is the difference between the magnetic cores used in EMI suppression and the cores traditionally used as inductors?

List as many ways to reduce the ground RF impedance.

A: Try to use a large conductor of the table area to reduce the resistance of the high-frequency current, to minimize the conductor, to reduce the resistance and inductance, silver plating on the conductor surface, reduce surface resistance,

multiple conductors in parallel, reduce inductance.

39. What is a lap joint, give several methods of lap up.

A: the low impedance (RF) connection between metal components is called lap joint, and the Jointing method is welding, riveting, screw connection, electromagnetic sealing gasket connection, etc.

40. How to prevent the occurrence of electrical chemical corrosion?

Answer: Select the electrochemical potential of the metal, or to contact the local environmental seal, isolating electrolyte.

41. Circuit or PCB electromagnetic compatibility design should pay special attention to the processing of key signals, the key signal here refers to those signals?

A: From the point of view of electromagnetic emission, the key signal line refers to the periodic signal, such as the local oscillator signal, clock signal, address low signal, etc. from the angle of sensitivity, the key signal refers to the signal that is sensitive to the external electromagnetic interference, such as low level analog signal.

42. Why are there often very large noise voltages on the ground and power lines of digital circuits? How to reduce the noise voltage?

A: Digital circuit work will absorb a great deal of current, these transient current flow through the power line and ground, due to the existence of power lines and ground inductance, will produce a larger recoil voltage, which is the observed noise voltage. The method of reducing the noise voltage is to reduce the inductance of the power line and ground wire, such as using grid ground, ground surface, power line surface, etc., another method is to use the appropriate decoupling capacitor (energy storage capacitor) on the power cord.

43. In practice, many strands of wire are often twisted as high-frequency conductors, which is said to reduce the RF impedance of the conductor.

A: This increases the surface area of the conductor, thus reducing the high-frequency resistance.

44. Why automatic wiring software completed circuit boards are often more radiation?

A: Automatic wiring software is generally not able to ensure that the periodic signal has a small loop area, it will produce strong radiation.

45. What are the main measures to reduce PCB electromagnetic radiation?

A: The signal (periodic signal) that produces the radiation easily has the smallest loop area. If there is a cable on the circuit board, the strong radiation circuit is far away from the input/output circuit, and the input and output circuit is

set "cleanly" to reduce the common-mode voltage on the cable.

46. How to reduce electromagnetic radiation from the selection of devices?

Answer: Select low power consumption, rise/fall along as far as possible, integration of the chip as high as possible.

47. In the use of multilayer PCB wiring, in order to avoid the digital circuit and analog circuit ground mutual interference, with two layers of ground surface respectively do digital and analog, can it? Why?

A: No, the parasitic capacitance between the two layers of ground wire is larger, there will be serious crosstalk.

48. Why do pcb layout, to make high-frequency circuit as far as possible from the I/O cable interface?

Answer: Prevent high-frequency signal coupling to the cable, form common mode voltage (current), produce strong common-mode radiation.

49. What is the problem when installing the power decoupling capacitor on the PCB of the digital circuit?

Answer: decoupling capacitance and chip power pins and ground pins form the loop area as small as possible.

50. The interconnection cable between two shielded enclosures is the main cause of radiation, and shielded cables are often

used in order to reduce the radiation of a cable. Shielding cable to effectively restrain its electromagnetic radiation must meet what conditions?

Answer: The shielding layer of the cable and the shielding chassis are 360° to meet the requirements of the dumbbell model.

51. Ferrite Magnetic Ring is an effective device to restrain the common-mode radiation of cables.

A: First of all to choose to inhibit the electromagnetic interference with the ferrite materials, and secondly, the inner diameter of the magnetic ring as small as possible, tightly wrapped cable,

The outer diameter and length of ferrite magnetic rings are as large as possible (in the condition of satisfying space requirements). The cable on the magnetic ring around more than turn, you can improve the effect of low-frequency, but high-frequency effect will be worse. The installation position of ferrite magnetic ring is close to both ends of the cable.

52. What is the problem when using twisted pair to increase the immunity to the magnetic field?

Answer: Twisted pair of two ends connected to the circuit can not be grounded at the same time, for signal reflux to provide a second path, preferably the balance circuit.

53. If the inductive load is controlled by a mechanical switch,

then when the switch is closed or disconnected, an arc discharge and electromagnetic interference will be generated on the switch contact. Is this interference serious when the switch is closed or is it disconnected?

A: critical when disconnecting.

54. Why can't the transient interference suppression device replace the filter and prevent the circuit from working abnormally?

A: The transient interference suppression device is only a very high amplitude of the pulse voltage at the top of the residual is still a pulse interference voltage, only a low amplitude, which contains a large number of high-frequency components, will affect the circuit, so can not replace the filter to prevent circuit work anomalies.

55. What are the problems when installing transient suppressor devices?

A: Ensure that the current path of the transient suppression device has the smallest impedance, so the wire on this path should be as short as possible, and the installation principle of the bypass capacitor is also suitable for the installation of the transient suppression device.

56. Describe the mechanism by which electrostatic discharge affects the circuit.

A: Double stranded electrostatic discharge on the circuit