Lightning Immunity Requirements of ITU-T K.20 and K.21

The Telecommunication Standardization Sector of the International Telecommunication Union (ITU-T) has developed fundamental testing methods to help predict the survivability of network and customer based switching equipment to various environmental conditions. These standards are recognized in many places throughout Europe and the Far East.

ITU-T K.20 and K.21 are the two ITU-T standards applicable for most telecommunication equipment to be connected to the network. ITU-T K.20 primarily focus on switching equipment powered by the central office, while ITU-T K.21 focus on customer premise equipment. Although both standards also contains requirements and testing methods for power induction and power contact, this application note will only focus on the lightning immunity requirement portion.

ITU-T K.20 covers telephone exchanges and switching centers. There are two levels to ITU-T K.20, a lower and a higher level. The equipment has to only meet one of the two levels in order to be compliant under the K.20. The equipment that is used in an unexposed environment is covered in the lower level. Unexposed environment is where over-voltage and over currents are expected to be small and external protectors are not necessary. Equipment that is used in a more exposed environment is covered in the higher level. More exposed environment is where over-voltage and over-current are higher and external line protectors are necessary. Guidelines for determining which environment the equipment falls under can be found in ITU-T K.11. Figure 1 shows the test connection block diagram for the ITU-T K.20 lightning simulation. Table 1 lists the ITU-T K.20 lightning simulation test.

ITU-T K.21 covers desk-borne equipment. The equipment can be in an exposed or unexposed environment. The standard assumes that equipment in exposed environment has external line protectors installed and equipment in unexposed environment has none. This means that testing under the ITU-T K.21 standard is conducted with and without external line protectors. Figure 2 shows the test connection block diagram for the ITU-T K.21 lightning simulation. Table 2 lists the ITU-T K.21 lightning simulation test.

Test #	Connection Figure 1	Open Circuit Voltage (V)	Short Circuit Current (A)	Number of Tests (Note 2)	Added Protection	Acceptance Criteria
1	A and E B earthed	1000 10x700µs	25 5x310µs	10	None	A
2	B and E A earthed	1000 10x700µs	25 5x310µs	10	None	A
3	A+B and E	1000 10x700µs	50 5x310µs (Note 1)	10	None	A
4	A and E B earthed	4000 10x700µs	100 5x310µs	10	Primary	A
5	B and E A earthed	4000 10x700µs	100 5x310µs	10	Primary	A
6	A+B and E	4000 10x700µs	200 5x310µs (Note 1)	10	Primary	A

Table 1 - ITU-T K.20 Lightning Simulation

Notes:
1. This is a simultaneous surge. The specified current is the resultant current (sum of terminal A and terminal B) with respect to ground (terminal E).
2. The time interval between multiple applications should be 1 minute. In the case of pulse tests, the polarity should be reversed between consecutive pulses.
3. All other terminals are connected to earth ground.

Test #	Connection Figure 1	Open Circuit Voltage (V)	Short Circuit Current (A)	Number of Tests (Note 2)	Added Protection	Acceptance Criteria
1	T1 and A T2 and B	1500 10x700µs	75 5x310µs	10	None	A
2	T1 and A T2 and B	4000 10x700µs	200 5x310µs	10	Primary	A
3	T1 and A (Note 3)	1000 10x700µs	25 5x310µs (Note 1)	10	None	A
4	T1 and B (Note 3)	1000 10x700µs	25 5x310µs	10	None	A
5	T1 and A (Note 3)	4000 10x700µs	100 5x310µs	10	Primary	A
6	T1 and B (Note 3)	4000 10x700µs	100 5x310µs (Note 1)	10	Primary	A

Table 2 - ITU-T K.21 Lightning Simulation

ITU-T requires that the EUT withstands the lightning test without damage or disturbance and operates properly after the test (Acceptance criteria level A).

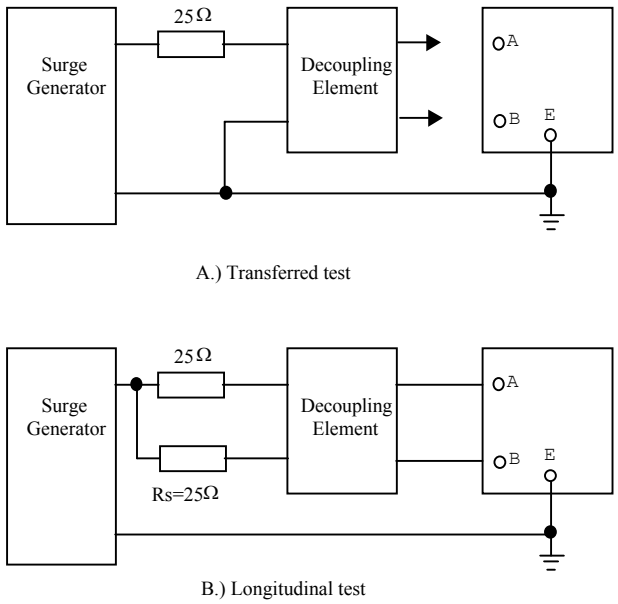

Figure 1 - Test Connection Block Diagram for ITU-T K.20 Lightning Simulation

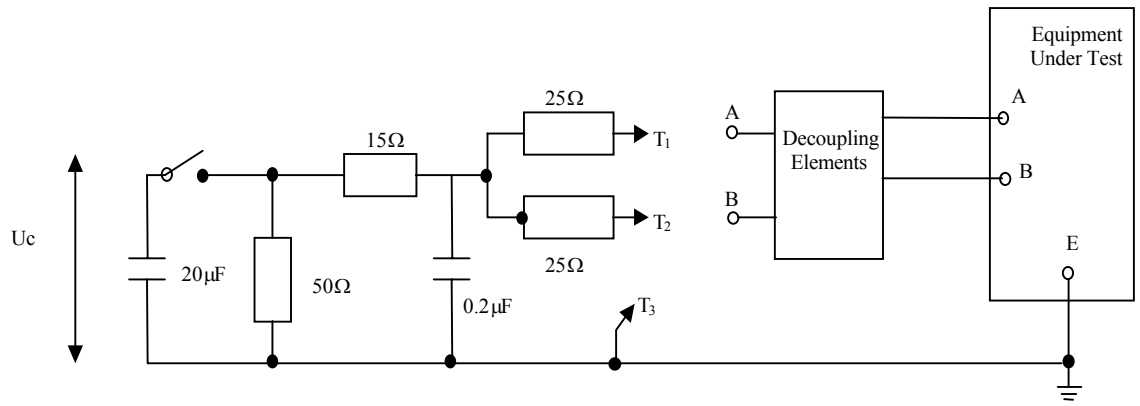

Figure 2 - Test Condition Block Diagram for ITU-K.21 Lightning Simulation