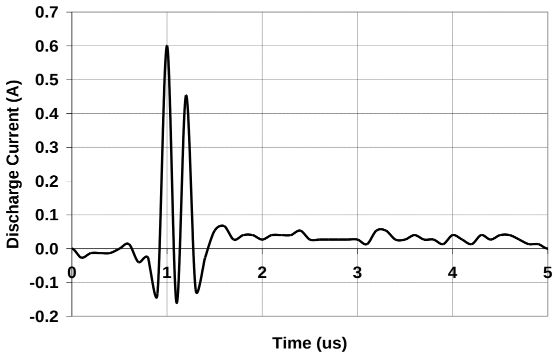
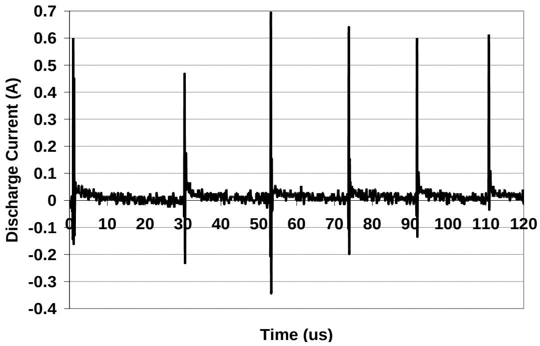
Figure 11 shows the second scenario of pulse burden circuits. In this circuit, it was pure resistive burden that parallel an 2.7 MΩ and 300 kΩ resistors, and in series with resistor of 2.7 MΩ.

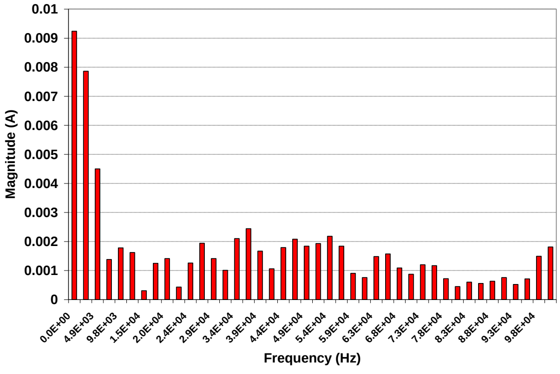
Figure 12 shows the first sample current waveform of measurement result for the second scenario of pulse burden circuit. Figure 12(a) is the first single waveform of discharge pulse. In this waveform, the discharge pulse was occurred in time of around 1 μs, and the specific discharge wave would cease in time of around 2 μs. Figure 12(b) is the multiple waveform of discharge pulse. In this waveform, the discharge pulses were occurred in time of 30, 54, 74, 92 and 111 μs, after the first pulse. The average different time among pulses was 20 μs. Figure 12(c) is the short range of frequency response. The magnitude would increase locally in frequency of 26855, 36621 and 53711 Hz, and Figure 12(d) is the long range one. The magnitudes of discharge current would decrease slightly as the frequency increased.



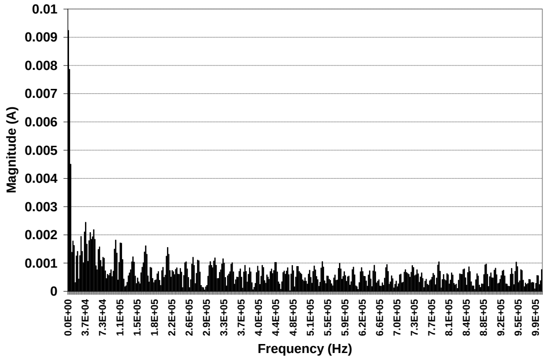
(a) First single waveform



(b) Multiple waveform



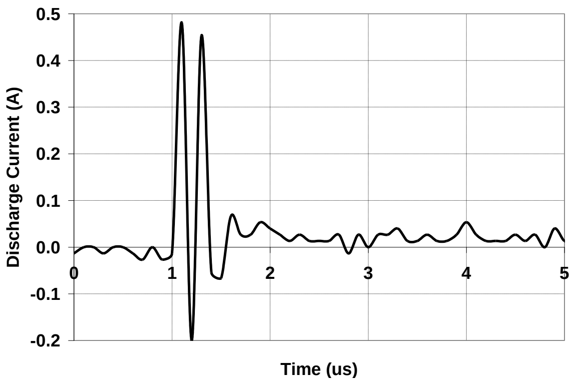
(c) Short range of frequency response



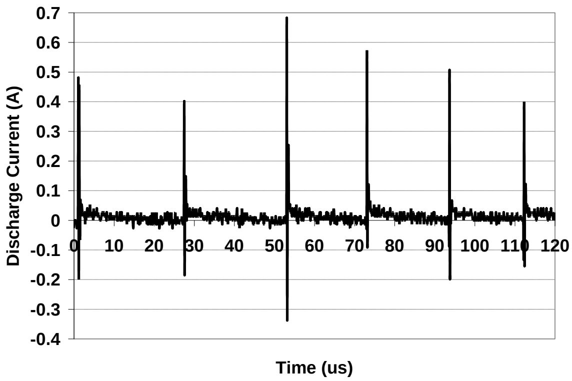
(d) Long range of frequency response

Figure 12. First sample current waveform result for the second scenario of pulse burden circuit

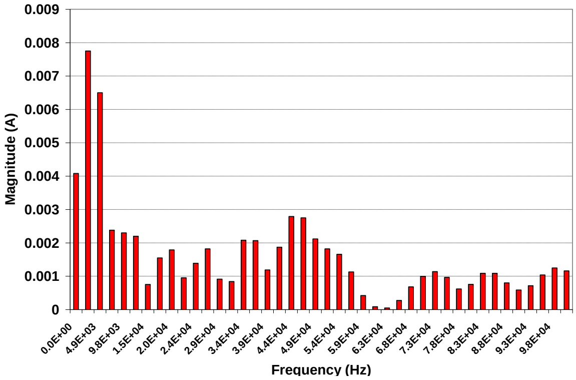
Figure 13 shows the second sample current waveform of measurement result for the second scenario of pulse burden circuit. Figure 13(a) is the first single waveform of discharge pulse. In this waveform, the discharge pulse was occurred in time of around 1 μs, and the specific discharge wave would cease in time of around 2 μs. Figure 13(b) is the multiple waveform of discharge pulse. In this waveform, the discharge pulses were occurred in time of 27.5, 53, 73, 94 and 112 μs, after the first pulse. The average different time among pulses was 22.24 μs. Figure 13(c) is the short range of frequency response. The magnitude would increase locally in frequency of 26855, 36621 and 46387 Hz, and Figure 13(d) is the long range one, where the magnitudes of discharge current would decrease slightly as the frequency increased.



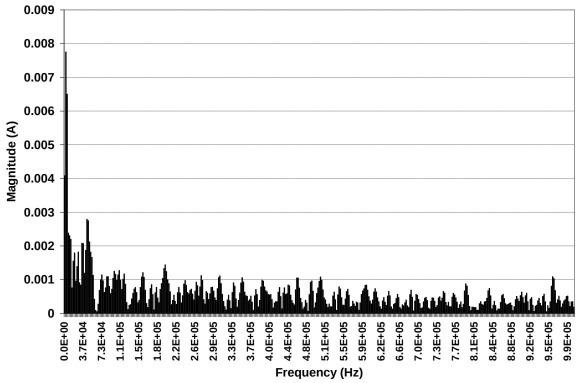
(a) First single waveform



(b) Multiple waveform



(c) Short range of frequency response



(d) Long range of frequency response

Figure 13. Second sample current waveform result for the second scenario of pulse burden circuit

Figure 14 shows the third scenario of pulse burden circuits. In this circuit, it was pure 2.7 MΩ resistive burden that series with 300 kΩ resistor and series 15x10 μF in parallel. Those component were parallel connection with the resistor of 2.7 MΩ.

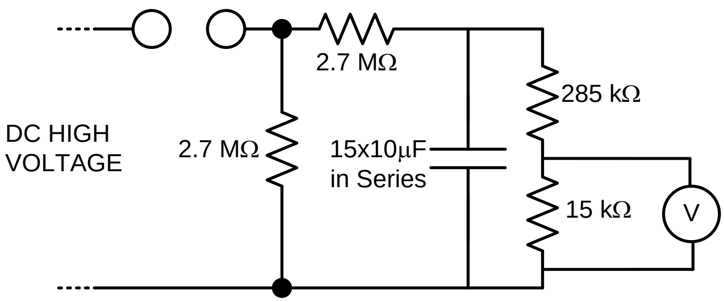
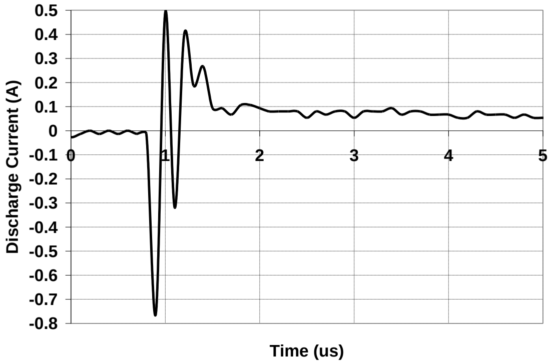
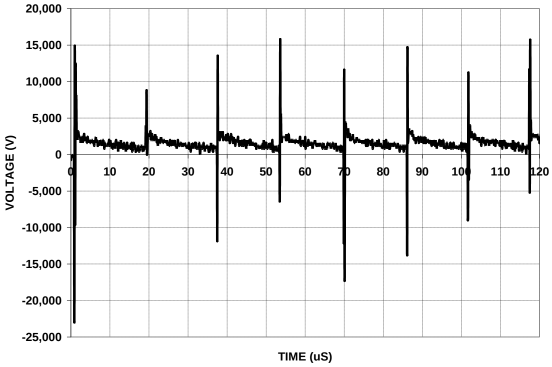


Figure 14. Third scenario of pulse burden as short capacitive-resistive circuit

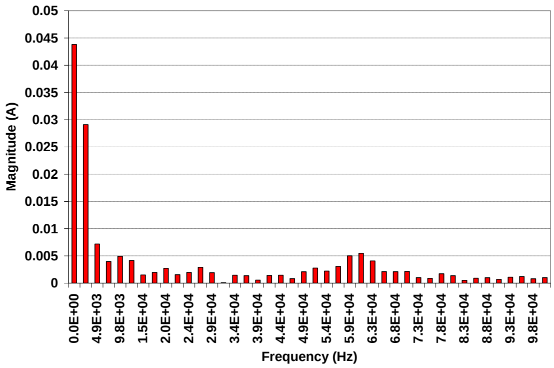
Figure 15 shows the first sample current waveform of measurement result for the third scenario of pulse burden circuit. Figure 15(a) is the first single waveform of discharge pulse. In this waveform, the discharge pulse was occurred in time of around 1 μs, and the specific discharge wave would cease in time of around 2 μs. Figure 15(b) is the multiple waveform of discharge pulse. In this waveform, the discharge pulses were occurred in time of 27.5, 53, 73, 94 and 112 μs, after the first pulse. The average different time among pulses was 22.24 μs. Figure 15(c) is the short range of frequency response. The magnitude would increase locally in frequency of 61035 Hz, and Figure 15(d) shows the long range one, where the magnitudes of discharge current would decrease slightly as the frequency increased.



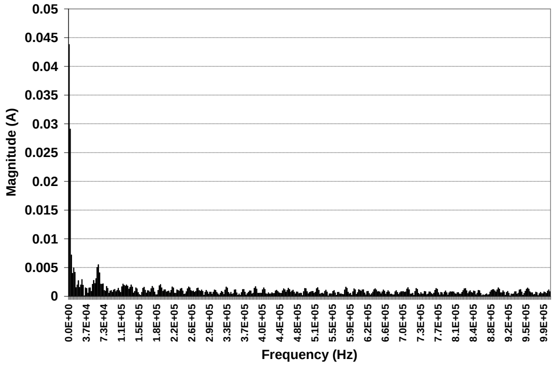
(a) First single waveform



(b) Multiple waveform



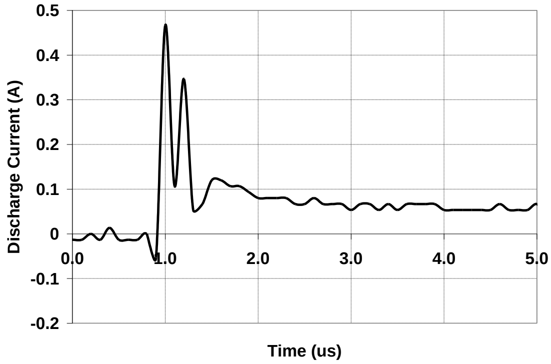
(c) Short range of frequency response



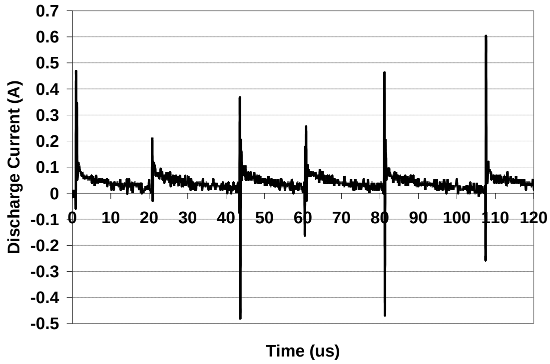
(d) Long range of frequency response

Figure 15. First sample current waveform result for the third scenario of pulse burden circuit

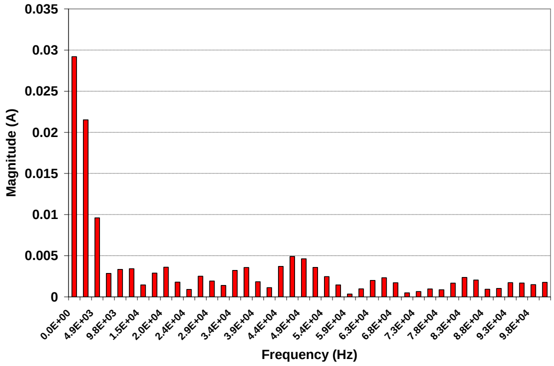
Figure 16 shows the second sample current waveform of measurement result for the third scenario of pulse burden circuit. Figure 16(a) is the first single waveform of discharge pulse. In this waveform, the discharge pulse was occurred in time of around 1 μs, and the specific discharge wave would cease in time of around 2 μs. Figure 16(b) is the multiple waveform of discharge pulse. In this waveform, the discharge pulses were occurred in time of 21, 43.6, 61, 81 and 107.6 μs, after the first pulse. The average different time among pulses was 21.32 μs. Figure 16(c) is the short range of frequency response. The magnitude would increase locally in frequency of 36621 and 48828 Hz, and Figure 16(d) is the long range, that similar to the previous one.



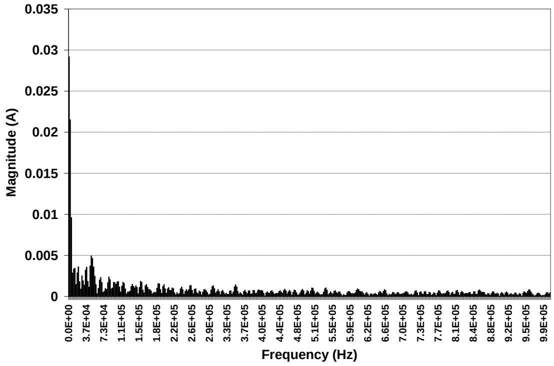
(a) First single waveform



(b) Multiple waveform



(c) Short range of frequency response



(d) Long range of frequency response

Figure 16. Second sample current waveform result for the third scenario of pulse burden circuit

Figure 17 shows the fourth scenario of pulse burden circuit. In this circuit, it was pure 2.7 MΩ resistive burden that series with 300 kΩ resistor that shunted by 15x10 μF in parallel.

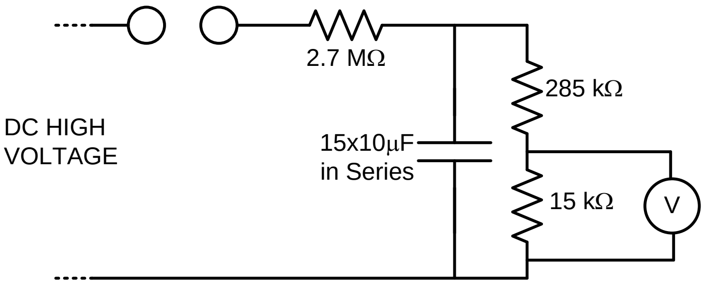
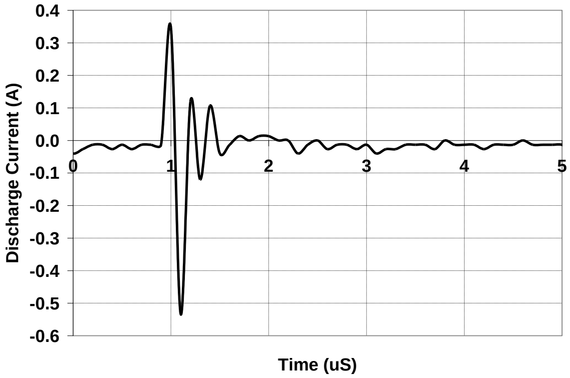


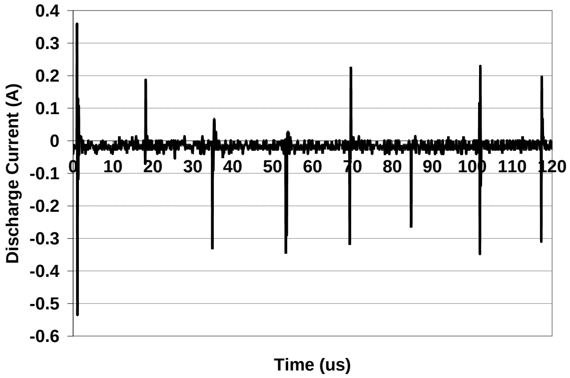
Figure 17. Fourth scenario of pulse burden as long capacitive-resistive circuit

Figure 18 shows the first sample current waveform of measurement result for the fourth scenario of pulse burden circuit. Figure 18(a) shows the first single waveform of discharge pulse. In this waveform, the discharge pulse was occurred in time of around 1 μs, and the specific discharge wave would cease in time of around 2 μs. Figure 18(b) shows the multiple waveform of discharge pulse. In this waveform, the discharge pulses were occurred in time of 0.9, 21.1, 39.3, 56.1, 72.3, 89.9, 104.3 and 118.3 μs, after the first pulse. Nevertheless, almost pulses were negative values. The average different time among pulses was 16.8 μs. Figure 18(c) is the short range of frequency response. The magnitude would increase locally in frequency of

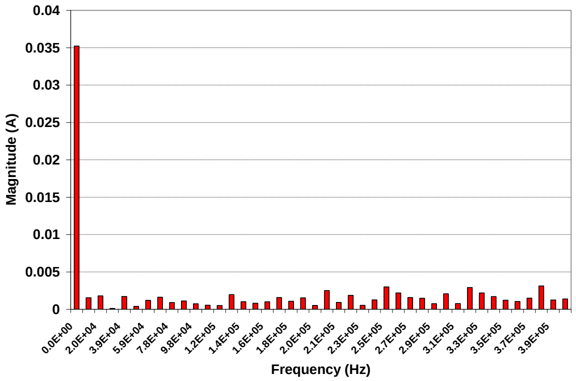
26855 Hz, and Figure 18(d) is the long range one, where the current magnitudes remained relatively high.



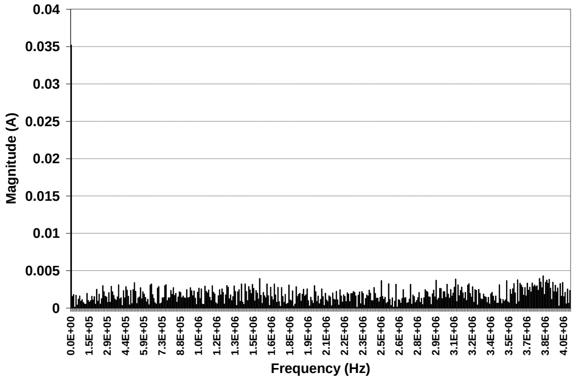
(a) First single waveform



(b) Multiple waveform



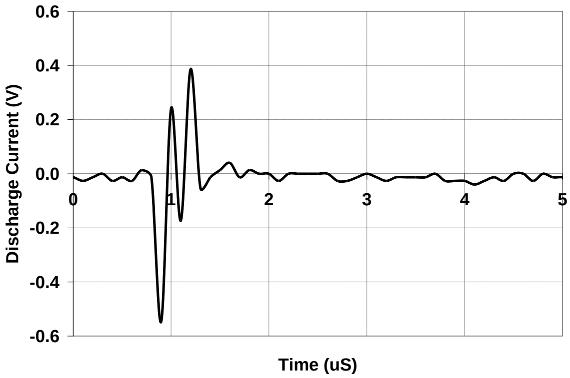
(c) Short range of frequency response



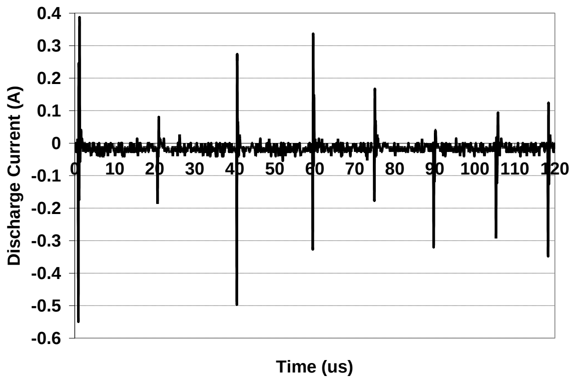
(d) Long range of frequency response

Figure 18. First sample current waveform result for the fourth scenario of pulse burden circuit

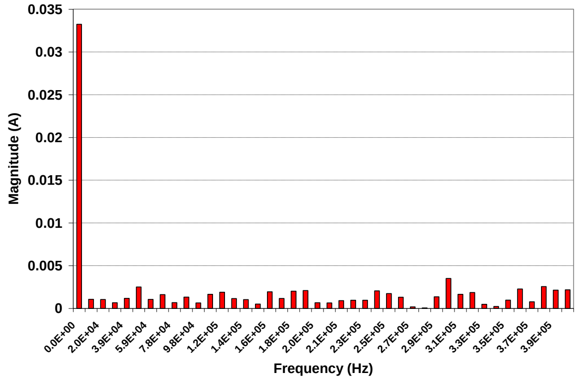
Figure 19 shows the second sample current waveform of measurement result for the fourth scenario of pulse burden circuit. Figure 19(a) is the first single waveform of discharge pulse. In this waveform, the discharge pulse was occurred in time of around 0.75 μs, and the specific discharge wave would cease in time of around 1.5 μs. Figure 19(b) is the multiple waveform of discharge pulse. In this waveform, the discharge pulses were occurred in time of 0.9, 20.7, 40.5, 59.5, 74.9, 89.7, 105.3 and 118.3 μs, after the first pulse. Nevertheless, almost pulses were negative values. The average different time among pulses was 16.8 μs. Figure 19(c) is the short range of frequency response. The magnitude would increase locally in frequency of 48828 Hz, and Figure 19(d) is the long range one, where the current magnitudes remained relatively high.



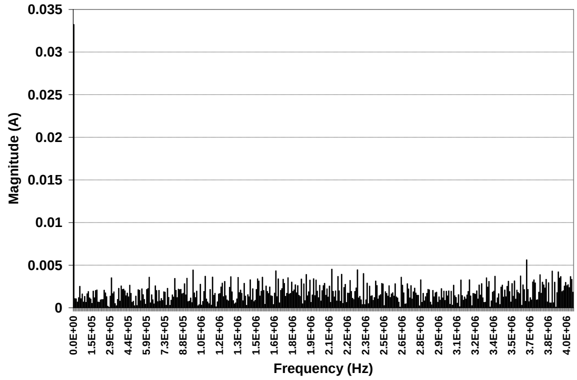
(a) First single waveform



(b) Multiple waveform



(c) Short range of frequency response



(d) Long range of frequency response

Figure 19. Second sample current waveform result for the fourth scenario of pulse burden circuit

Table 1. Time of discharge and frequency response due to some circuit scenarios

Scenario	Impulse burdens	Times of discharge (μs)	Averages different time of discharge (μs)	Frequencies of increasing magnitude locally (Hz)
1	Short pure resistive circuit	31, 51, 67, 86, 101, 116	17	34180, 43945, 61035
		26, 45, 66, 83, 98, 111	17	31738, 48828, 61035
2	Long pure resistive circuit	30, 54, 74, 92, 111	20	26855, 36621, 53711
		27.5, 53, 73, 94, 112	22.24	26855, 36621, 46387
3	Short resistive-capacitive circuit	27.5, 53, 73, 94, 112	22.24	61035
		21,43.6, 61, 81, 107.6	21.32	36621, 48828
4	Short resistive-capacitive circuit	0.9, 21.1, 39.3, 56.1, 72.3, 89.9, 104.3, 118.3	16.8	26855
		0.9, 20.7, 40.5, 59.5, 74.9, 89.7, 105.3, 118.3	16.8	48828

Based on some discharge waveforms of testing results, it is observed that the waveforms with the pure resistive burdens would trend to be symmetrical to almost on positive parts. On the other hand, the waveforms with the resistive and capacitive dominated burdens would be shorter, i.e. around 16.8 μs, than those resistive dominated burdens, i.e. around 17 μs – 22.24 μs in average. The wave frequency response of discharge on the capacitive dominated burdens would be more declivous than those on the resistive dominated burdens. The latter characteristics are indicated by the specific capacitive dominated property. Table 1 lists the tabulation of the time of discharge and frequency response due to some circuit scenarios. Based on the table, the dominated capacitive existence made the repetitive discharge would be shorter than those the dominated resistive existence. The capacitive property that store charge was expected as cause the latter characteristics.

4. Conclusion

Almost all of the first discharge were occurred in around from 1 μs to 2 μs. The waveforms with the pure resistive burdens would trend to be symmetrical to almost on positive parts. On the other hand, the waveforms with the resistive and capacitive dominated burdens would be shorter than those resistive dominated burdens. The wave frequency response of discharge on the capacitive dominated burdens would more declivous than those on the resistive dominated burdens. The latter characteristics are indicated by the specific capacitive dominated property. The dominated capacitive existence made the repetitive discharge would be shorter than those the dominated resistive existence. The capacitive property that store charge was expected as cause the latter characteristics.

5. Acknowledgments

We would like to express the deepest appreciation to The Institute for Research and Community Service, National Institute of Technology (ITENAS), which has supported the funding in the research.

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Waluyo was born in Magelang, Indonesia in 1969. He received B.Eng., M.Eng., and Doctor Degrees in electrical engineering from Bandung Insitute of Technology (ITB), Indonesia, in 1994, 2002 and 2010 respectively. Since 2003, he is a Lecturer at Department of Electrical Engineering, National Institute of Technology (Itenas) Bandung, Indonesia. His research interests include of high voltage phenomena. He received Best Lecturer in Kopertis IV in 2013.

Syahrial was born in Lirik, Sumatera, Indonesia in 1969. He received B.Eng., Degree in electrical engineering from National Insitute of Technology (Itenas) Bandung, Indonesia, in 2000, and M.Eng. Degree in electrical engineering from Bandung Insitute of Technology (ITB), Indonesia, in 2004. Since 2005, he is a Lecturer at Department of Electrical Engineering, National Institute of Technology (Itenas) Bandung, Indonesia. His research interests include of electrical machines.

Sigit Nugraha was born in Subang, West Java, Indonesia. He is currently senior university student and doing final project at The Department of Electrical Engineering, National Institute of Technology (Itenas) Bandung, Indonesia.

Yudhi Permana JR was born in Padang, West Sumatera, Indonesia. He is currently senior university student and doing final project at The Department of Electrical Engineering, National Institute of Technology (Itenas) Bandung, Indonesia.