APPENDIX I
LIST OF FEATURES SELECTED BY SFS ALGORITHM

We employ an SFS algorithm to choose from the initially extracted 25 features. Table VI presents the 13 features ultimately selected by our algorithm, encompassing nine time domain features and four frequency domain features.

TABLE VI: Description of selected features.

	Feature	Description
Time domain	Mean	$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$
	Variance	$Var = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$
	Standard deviation	$SD = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}$
	Maximum	$Max = \max(x)$
	Minimum	$Min = \min(x)$
	Kurtosis	$Kurtosis = \frac{1}{n}\sum_{i=1}^{n}(\frac{x_i - \bar{x}}{\sigma})^4$
	Skewness	$Skewness = \frac{1}{n}\sum_{i=1}^{n}(\frac{x_i - \bar{x}}{\sigma})^3$
	Peak	$peak = \arg\max_{x\in[a,b]} f(x)$
	Valley	$valley = \arg\min_{x\in[a,b]} f(x)$
Frequency domain	Spectral density	$S_x(f) = \lim_{T\to\infty} \frac{1}{T}\lvert X(f)\rvert^2$
	Spectral centroid	$f_c = \frac{\sum f\cdot\lvert X(f)\rvert^2}{\sum\lvert X(f)\rvert^2}$
	Spectral bandwidth	$BW = \frac{\sum\lvert X(f)\rvert^2(f-f_c)^2}{\sum\lvert X(f)\rvert^2}$
	Spectral skewness	$Skewness = \frac{\sum(f-f_c)^3\lvert X(f)\rvert^2}{\sum\lvert X(f)\rvert^2}$

APPENDIX II
PSEUDOCODE FOR ANOMALY DETECTION ALGORITHM

Algorithm 2 offers a pseudocode of the anomaly detection function. The algorithm encompasses signal preprocessing, feature extraction, feature selection, and matching with the terminal device model. If the extracted features do not align with all models, the signal is deemed abnormal.

Algorithm 2 Anomaly detection algorithm.

function ANOMALY_DETECTION(S: new signal, *models*: models for each device)
    */*R: rising edge signal*/*
    $R \leftarrow$ Preprocess(S)
    */*Extracting 25 time and frequency domain features*/*
    $features \leftarrow$ Extract Feature(R)
    */*Using SFS algorithm to select 14 optimal features*/*
    $selected\_features \leftarrow$ Feature Selection[$features$]
    for i = 1 to $|models|$ **do**
        */*model: KNN, Linear SVM, and AutoEncoder*/*
        $is\_anomaly \leftarrow$ DetectAnomaly($models[i], selected\_features$)
        if $is\_anomaly$ **then**
            return Abnormal signal
    return Normal Signal