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Engineering and Engineering Sciences

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DEVELOP PROCEDURES TO ASSESS INTERNAL MOISTURE LOADS

Request for Quotation No. R-CHI-00874

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ACKNOWLEDGEMENTS

Section 5 of the project was funded by Steven Winters Associates through a contract from the Department of Housing and Urban Development. The authors of this report gratefully acknowledge important contributions by Mr. Florian Antretter, Germany (Fraunhofer Collaborator), and Mika Salonvaara, (ASHRAE T.C. 4.4 member).   The continued financial support of the U.S. Department of Energy (Marc LaFrance, DOE Program Manager) to the moisture control research at the Oak Ridge National Laboratory has made this project possible.

Indoor Environment Analysis

In this part of the report, the analysis of the HUD measured field data was performed. The monitored field data was compiled into the data base of test house characteristic information established in Task 4 by Steven Winters staff (Dianne Griffins and Lois Arena). This data was then subsequently processed analyzed and plotted out as per the requirements of the project.

In this section the ASHRAE SPC 160 standard on Criteria for Moisture-Control Design Analysis in Buildings will be briefly described. More details can be located in the recently published standard. The three analytical indoor environment prediction methods as provided in the ASHRAE SPC 160 standard will be differentiated and two of these will be subsequently used and compared against the actual measured data. The three ASHRAE SPC 160 methods include:

1) The Simple method

In this method the design indoor humidity according to the simplified method is a function of the average daily outdoor temperature and is shown in Table 1 (also see Figure 1):

Table 1: Design Indoor RH, Simplified Method

Daily Average Outdoor Temperature, °C	Design RH, % (Based on °C)	Daily Average Outdoor Temperature, °F	Design RH, % (Based on °F)
Below −10°C	40%	Below 14°F	40%
−10°C ≤ $T_{o,\,daily}$ ≤ 20°C	40% + ($T_{o,\,daily}$ + 10)	14°F ≤ $T_{o,\,daily}$ ≤ 68°F	40% + ($T_{o,daily}$ − 14)/1.8
Above 20°C	70%	Above 68°F	70%

Note: $T_{o,\,daily}$ = Daily average outdoor temperature

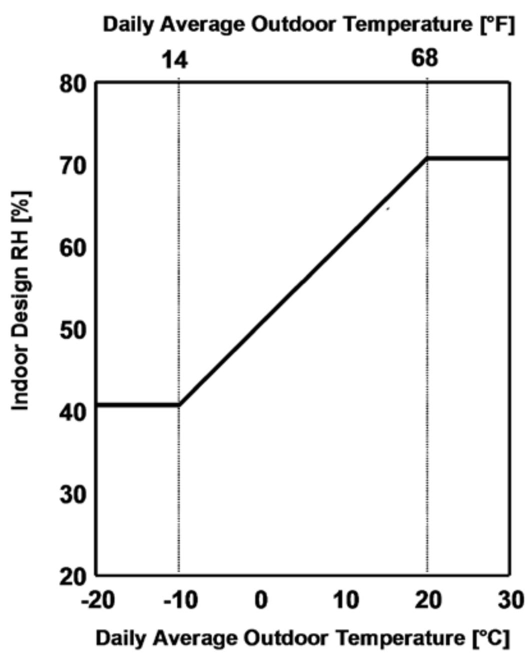

Figure 1: Design Indoor RH, Simplified Method

2) The Intermediate method

In this method the indoor design humidity is determined from hourly exterior weather data, building specific data and the type of HVAC equipment. The operational requirements of the HVAC equipment is also set in the ASHRAE 160P standard.

In the cases where cooling and dehumidification equipment is not present or not the operating indoor vapor pressure for moisture design purposes is determined using the following mass balance equation:

$$p_i = p_{o,\,24h} + \frac{c\,m}{Q} \quad (1)$$

Where

p_i = indoor vapor pressure, Pa (in. Hg)

$p_{o,\,24h}$ = 24-hour running average outdoor vapor pressure, Pa (in. Hg)

c = 1.36 × 105 Pa·m3/kg (10.7 in. Hg·ft3/lb) = design moisture generation rate, kg/s (lb/h) (in accordance with ASHRAE 160 Standard Sections 4.3.2.1.1 and 4.3.2.1.2)

Q = design ventilation rate, m^3/s (cfm) (in accordance with Sections 4.3.2.1.3 and 4.3.2.1.4)

The design values for residential moisture generation are based on the expected number of occupants. For design purposes, a minimum of two occupants is assumed, with an additional occupant for each bedroom in addition to the master bedroom. Design moisture generation rates are given in Table 2. If the home contains a jetted tub installed in a room without an automatically controlled (e.g., humidistat) exhaust fan, add 1.3 L/day or 0.15 × 10–4 kg/s (0.12 lb/h).

For other occupancies, moisture generation design values shall be appropriate for the intended use of the building. If the appropriate moisture generation rates are not available for the intended use, the Simplified Method (Section 4.3.1). In this project, the actual number of occupants are used in the analysis.

Table 2: Moisture Generation Rates

Number of Bedrooms	Number of Occupants	Moisture Generation Rate		
1 bedroom	2	8 L/day	0.9×10^{-4} kg/s	0.7 lb/h
2 bedrooms	3	12 L/day	1.4×10^{-4} kg/s	1.1 lb/h
3 bedrooms	4	14 L/day	1.6×10^{-4} kg/s	1.3 lb/h
4 bedrooms	5	15 L/day	1.7×10^{-4} kg/s	1.4 lb/h
Additional bedrooms	+1 per bedroom	+1 L/day	$+0.1 \times 10^{-4}$ kg/s	+0.1 lb/h

Design ventilation is to be used for the calculation of design indoor vapor pressure. The design ventilation rate to be used is the expected continuous ventilation rate. For intermittent ventilation systems, ventilation effectiveness shall be accounted for according to ANSI/ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings.

In Buildings without a designed ventilation system, the following default ventilation rates are used for purposes of calculating the design indoor vapor pressure (Equation 4-1). B-9
For new Building, standard construction, a default air exchange rate of 0.2 ach applies:

$$Q = 5.6 \times 10–5V m3/s \quad (2)\ (SI)$$

where V is the building volume (m3) or

$$Q = 0.0033V \text{ cfm} \quad (3)\ (I\text{-}P)$$

where V is the building volume (ft3).

For new Buildings, airtight construction, a default air exchange rate of 0.1 ach applies:

$$Q = 2.8 \times 10–5V m3/s \quad (4)\ (SI)$$

where V is the building volume (m3) or

$$Q = 0.0017V \text{ cfm} \quad (5)\ (I\text{-}P)$$

where V is building volume (ft3).

If the air-conditioning equipment is running and is controlled solely by thermostat, the design indoor humidity is derived from the following equation:

$$wi = 0.004 + 0.4w0 \quad (6)$$

where:
wi = indoor design humidity ratio, kg/kg, (lb/lb)
w0 = mean coincident design outdoor humidity ratio for cooling, 1% annual basis, kg/kg, (lb/lb)

If the building is air conditioned with humidity-controlled equipment, the indoor humidity design conditions is the specified humidity control setting or the humidity calculated with Equation 6, whichever is lower. If no humidity control setting is specified, the control setting used is 50% RH.

If the building is designed to be dehumidified with humidity-controlled dehumidification equipment and cooling equipment is not present or not operating, the indoor design humidity used is the the humidity control setting or the humidity calculated with Equation 1, whichever is lower. If no humidity control setting is specified, the control setting used is 50% RH.

3) Full parameter calculation

Full parametric evaluation of indoor humidity requires comprehensive inputs to support the analysis of the hygrothermal response and dynamic hygrothermal flux contribution of building elements, finishes, and furniture (hygric buffering). The analysis includes thermal and mass balances and normally require complex simulation algorithms and time-step intervals that capture hygrothermal response of sensitive materials and conditions. Required inputs include the following:

a. Hygrothermal properties of building materials, finishes, and furniture

b. Design initial moisture conditions
c. Design indoor temperatures
d. Design ventilation rates
e. Design moisture generation rates
f. Effect of active dehumidification systems
g. Design pressure data
h. Design weather data
i. Design rain loads

The analysis for the full parameter calculation is performed using a minimum of ten consecutive years of weather data or using the moisture design reference years weather data. The weather data shall include hourly data for the following:
a. Dry bulb air temperature
b. Vapor pressure, dew-point temperature, wet bulb temperature, relative humidity, or humidity ratio
c. Total solar insolation on a horizontal surface
d. Average wind speed and direction
e. Rainfall
f. Cloud index

The reason that third method (full parameter calculation) was not deployed was due to the enormous amount of effort involved in performing the analysis for even one home. The geometrical exactness of the building, partition of the rooms, orientation, type of windows, size of each window, size of each room, as well as the complete weather data sets was not available for each building. It was determined that the effort lacked the resources needed to perform this activity and as such, it would not be investigated in this project.

Work Approach

The work performed in this activity is critical as it is intended to assist the validation of the design methods currently recommended in the ASHRAE 160 standard for setting the thermal and moisture design loads.

In past research performed, by Dr. Karagiozis, in the area of moisture engineering the critical importance of the use of indoor design data was demonstrated. For example the research conducted by Karagiozis (2005) in collaboration with Lstiburek and Straube on the development of guidelines for implementing vapor retarder control for the recent IEC codes found the vapor retarder recommendationsto be strongly dependent on the interior temperature and relative humidity. Guidelines were developed depending on the level of the interior relative humidity and temperature.

The house characteristics compiled by Steven Winters for each of the 60 homes was used in the analysis and validation of the first two ASHRAE SPC 160 methods. This activity was extensive as it required each analysis to include the locally measured exterior temperature and relative humidity, house size, number of bedrooms, and number of inhabitants. The simple and intermediate methods were developed and compared to all the interior measured locations.

Data compiled in the field tests were analyzed to identify the potential relationships between the data and the measured internal humidity levels with respect to the two SPC 160 methods.

The purpose of the project was to compare the computed internal moisture loads within ASHRAE 160P design methods for each of the three climate region for which field data was collected. The data was processed such that the accuracy of two of three calculation methods were compared to the data and recommendations for improvements to these methods was offered.

Analysis of Field Data

In this section of the report, additional analysis was performed on the measured field data to determine the characteristic behavior of both thermal and moisture interior loads.

The IECC (International Energy Conservation Code) climate map depicting the 8 distinct climate zones is shown in Figure 2

This map shows the the three climate zones with 20 homes measured in each zone:

Zone 2: Florida
Zone 5: New York
Zone 4: Oregon and Washington

These climates have very distinct hygrothermal behaviors, and we chosen to provide a large variation of hygric loading.

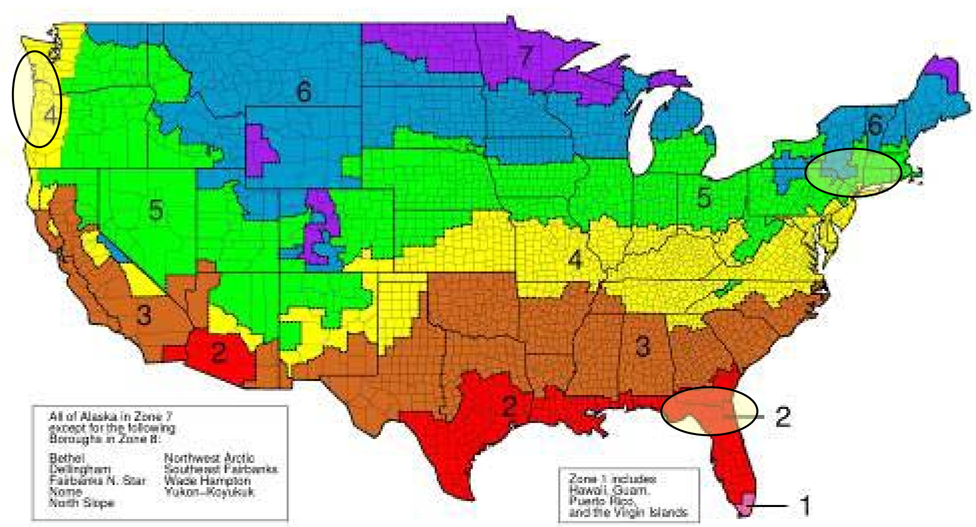

Figure 2: International Energy Conservation Code Climate Zones

To understand the fundamental differences of the interior climate, two houses were randomly selected and histograms of the moisture concentration differences between indoor and exterior were plotted on one graph and the interior vapor pressure histogram is plotted out in the other graph.

Figures 3 through 26 show the interior moisture loads in 6 of the field homes. Two homes were selected from each of the three climate zones. House 1 and 20 show interior conditions for a hot and humid climate (Zone 2), House 25 and 35 show conditions for the cold climate zones (Zone 5) and House 43 and 59 show interior conditions for a mixed rainforest climate (Zone 4).

In Zone 2, the results show that the median vapor pressure is closer to 2000 Pa (hot and humid climate). The yearly averaged absolute humidity is approximately 11 g/m3 for all interior rooms while the exterior is 15.5 g/m3. Figures 3 and 7, clearly indicate that from the histogram of the difference in air moisture content (interior – exterior) that a large amount of dehumification is occurring for approximately 60 to 70 % of the time. Interestingly, the results from Figure 5 and 9 show that the moisture content of the air is the same through-out the rooms, however there are some temperature differences as shown as depicted in the relative humidity box plots in Figures 6 and 10.

In Zone 5, the results show that the median interior vapor pressure is closer to 1000 Pa for the cold climate. This is approximately half of the interior vapor pressure of that shown previously in Zone 2. The yearly averaged absolute humidity is approximately 7.5 g/m3 for all interior rooms while the exterior is 5 g/m3. This indicates a net increase in moisture content of the interior air. Figures 11 and 15, clearly indicate that from the histogram of the difference in air moisture content (interior – exterior) that a large amount of dehumification is occurring for approximately 40 to 50 % of the time. Interestingly, the results from Figure 13 and 17 show that the moisture content of the air is the same through-out the room (if the basement results are not included), however there are also some temperature differences as shown as depicted in the relative humidity box plots in Figures 14 and 18.

In Zone 4, the results show that the median vapor pressure is closer to 1400 Pa for the cool rainforest climate. The yearly averaged absolute humidity is approximately 10.5 g/m3 for all interior rooms while the exterior is 7.0 g/m3. Figures 19 and 23, clearly indicate that from the histogram of the difference in air moisture content (interior – exterior) that a limited amount of dehumification is occurring. Interestingly, the results from Figure 25 and 29 show that the moisture content of the air is the same through-out the rooms (higher in the bedrooms). The relative humidity box plots show the highest measured relative humidity indoors over a full year period than in both Zones 2 and Zone 5. The relative humidity is above 60 % for a large portion of the time in Zone 4.

Additional comparison to depict the moisture loading as a function of the number of occupants, number of bedrooms, the type of HVAC equipment, and location are shown in Appendix D.

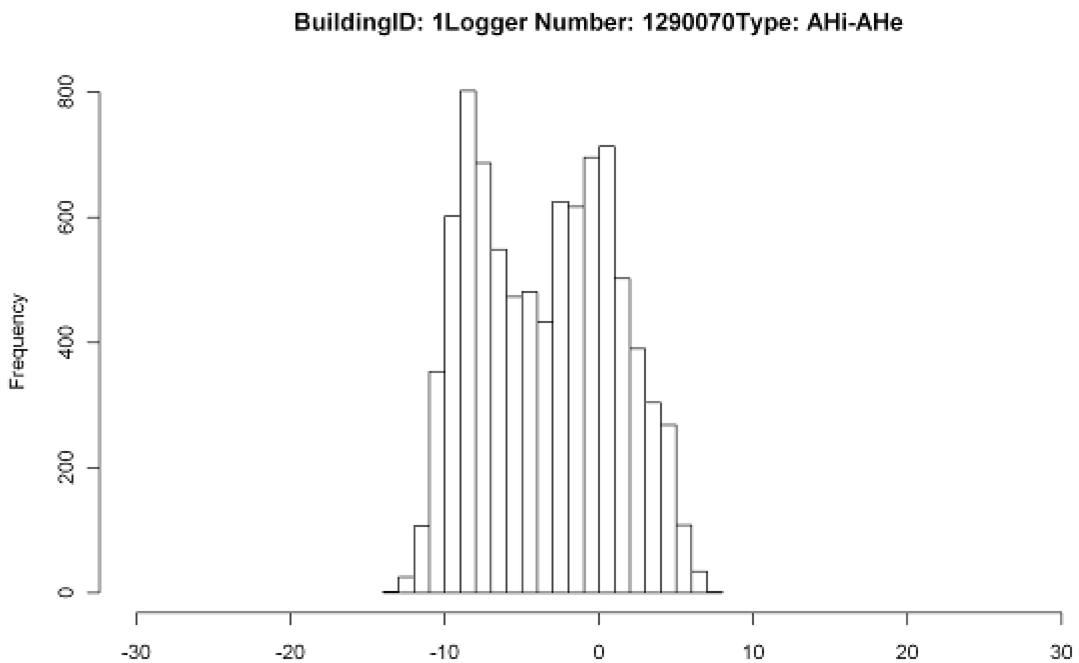

Figure 3: Frequency Plot for the difference in Moisture concentration (Inside –Outside) g/m^3 for House 1

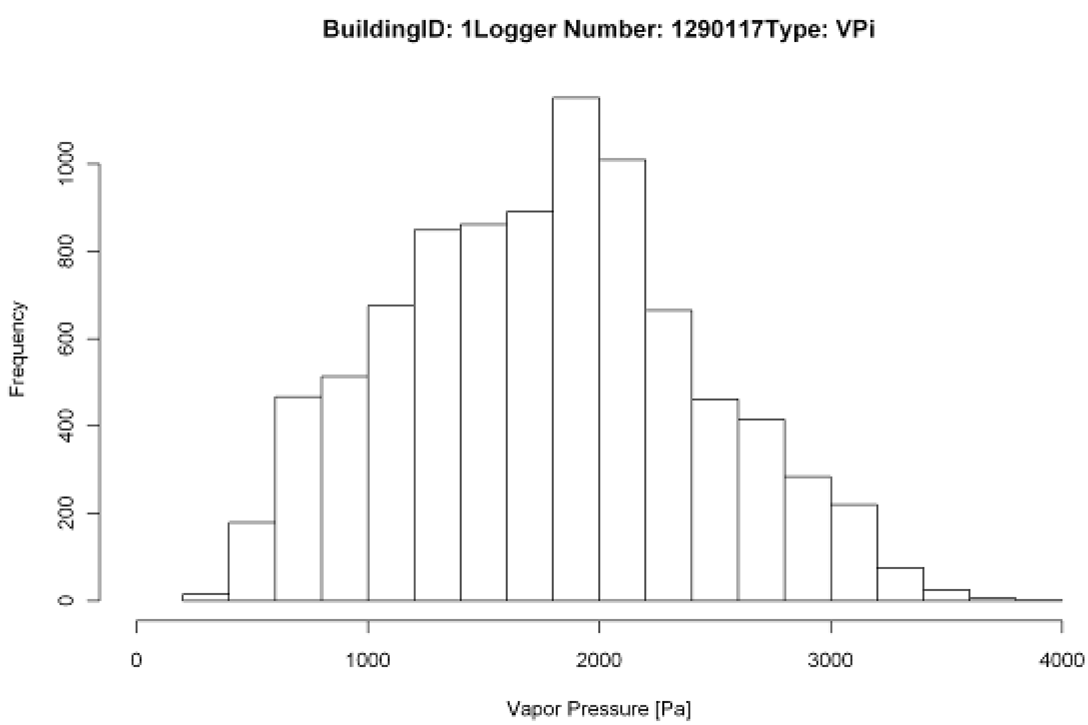

Figure 4: Frequency Plot for the Interior Vapor Pressure (Pa) for House 1

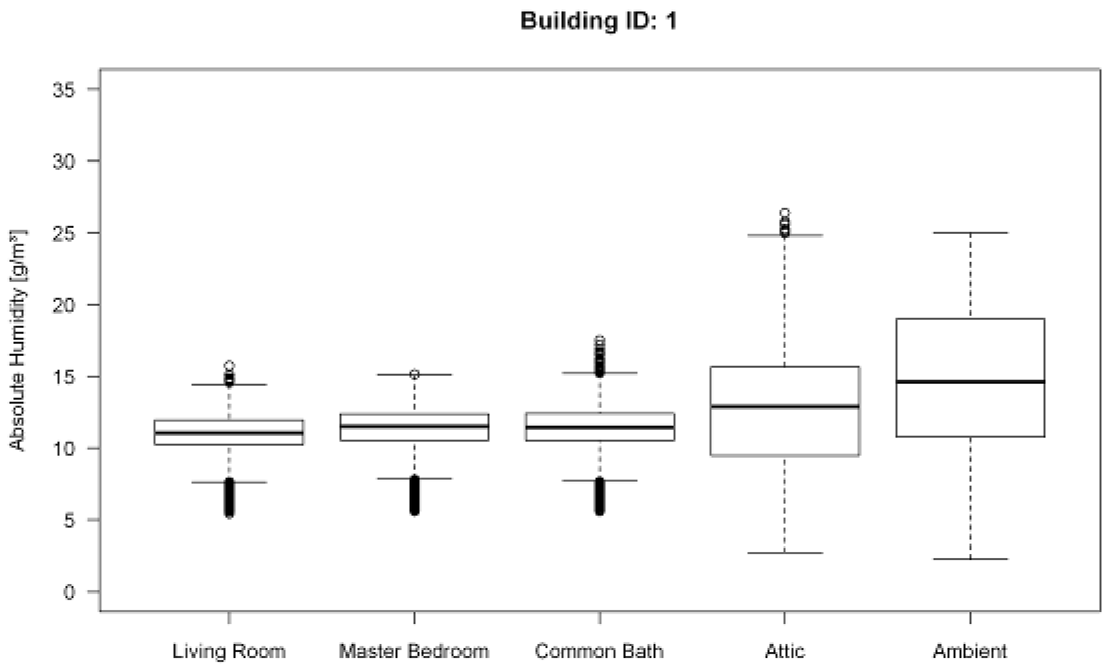

Figure 5: Box Plot for the absolute Humidity for House 1

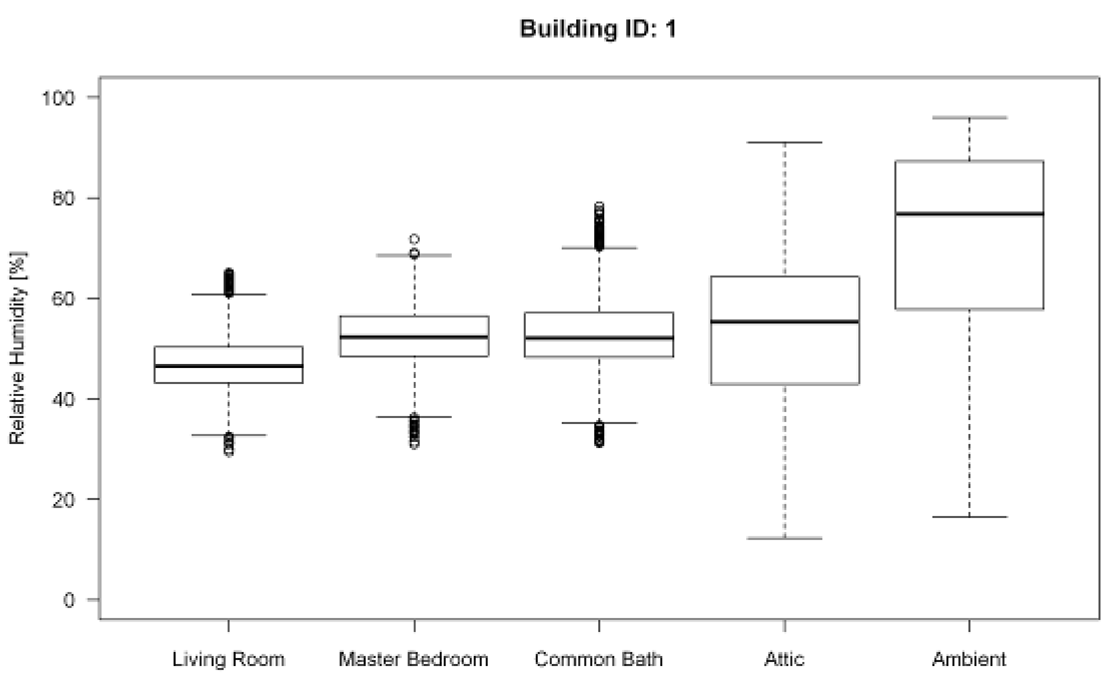

Figure 6: Box Plot for the Interior Relative Humidity (-) for House 1

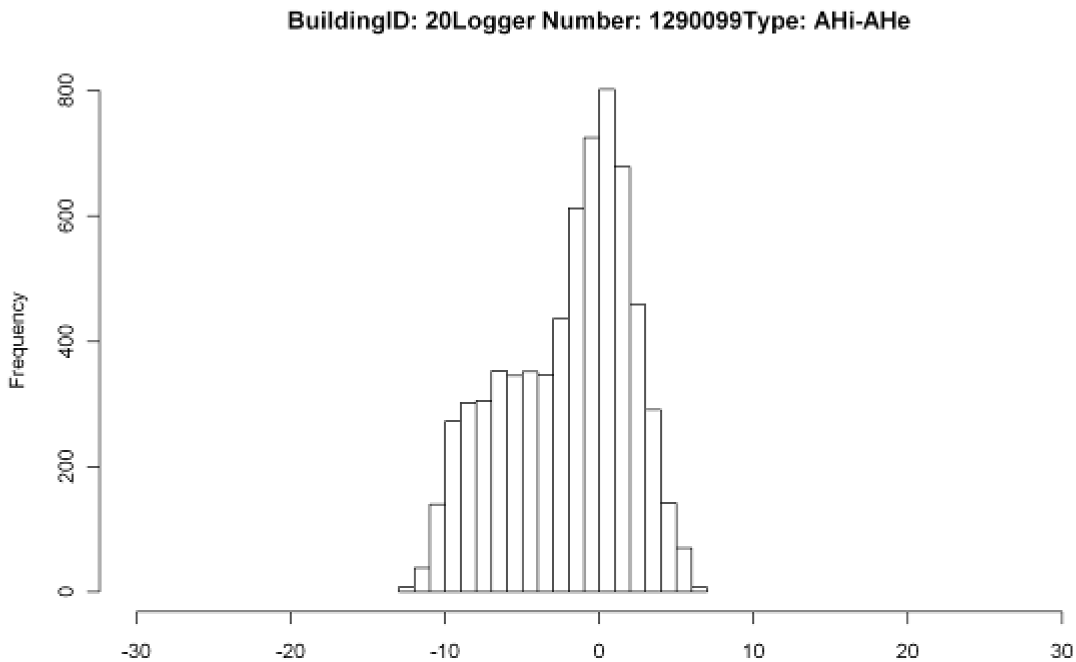

Figure 7: Frequency Plot for the difference in Moisture concentration (Inside –Outside) g/m^3 for House 20

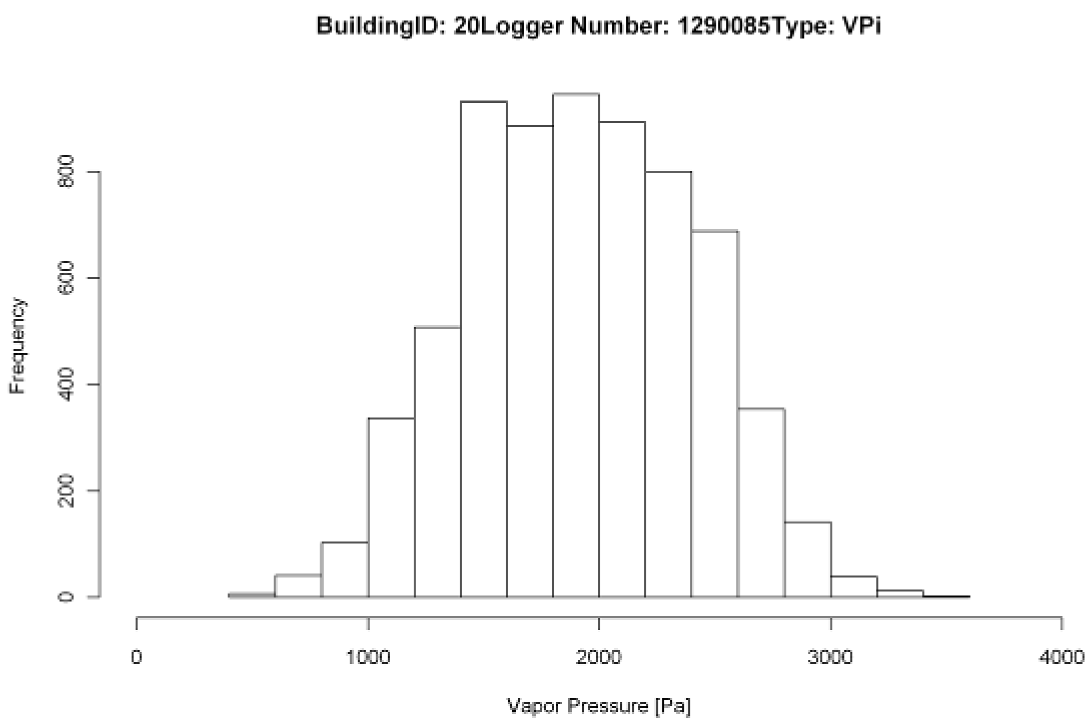

Figure 8: Frequency Plot for the Interior Vapor Pressure (Pa) for House 20

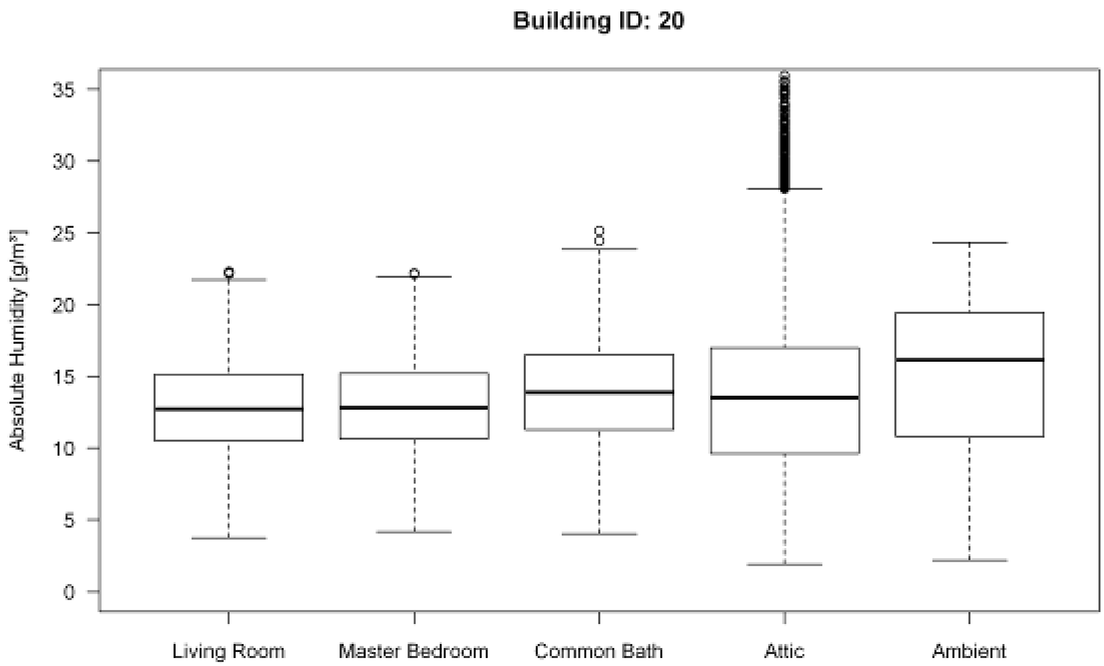

Figure 9: Box Plot for the absolute Humidity for House 1

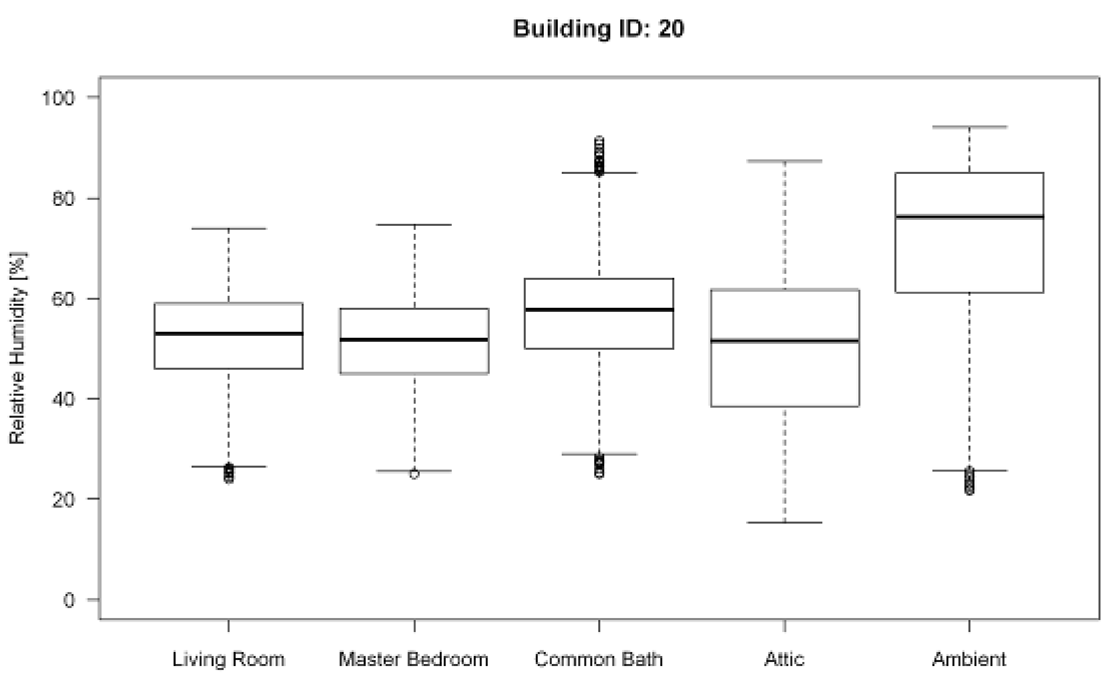

Figure 10: Box Plot for the Relative Humidity (%) for House 20

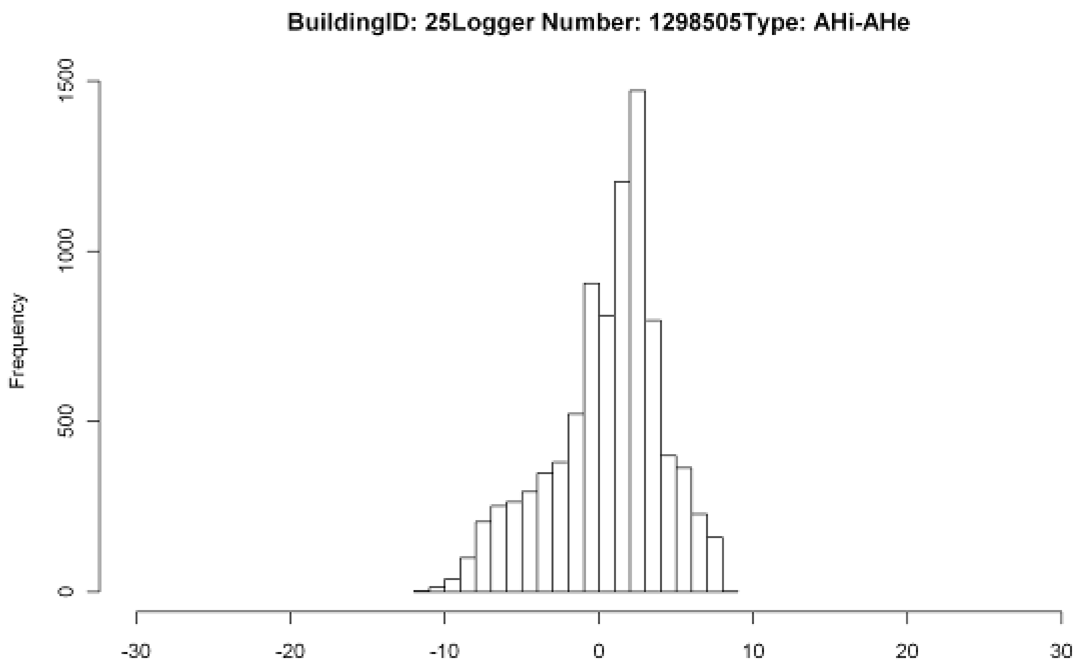

Figure 11: Frequency Plot for the difference in Moisture concentration (Inside –Outside) g/m^3 for House 25

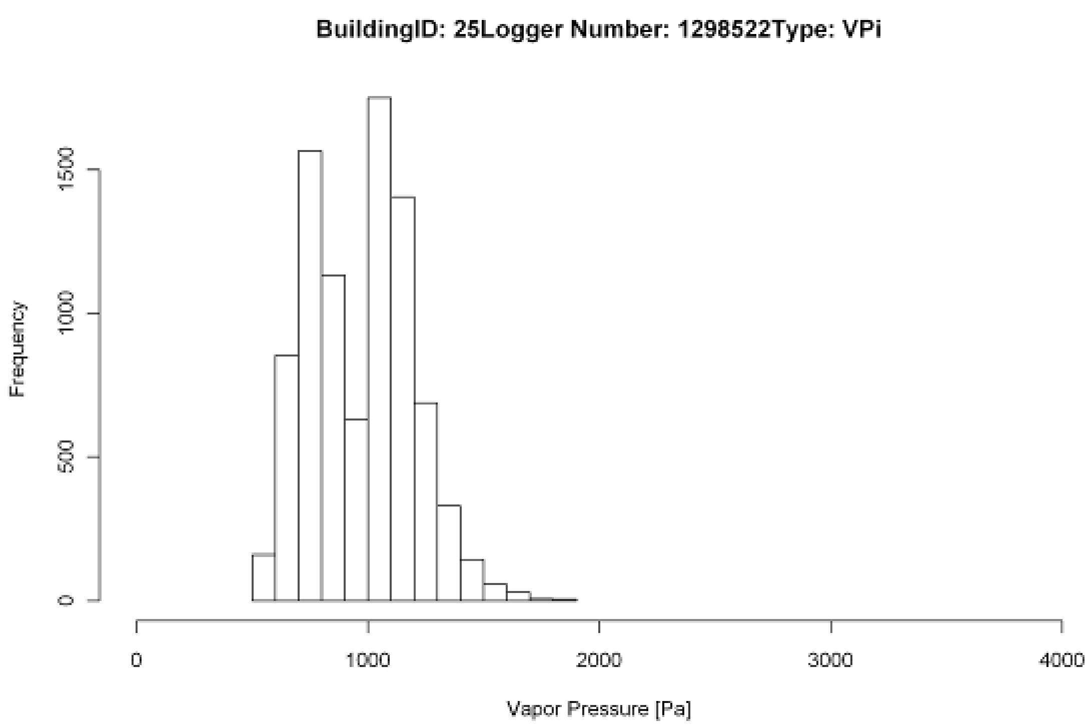

Figure 12: Frequency Plot for the Interior Vapor Pressure (Pa) for House 25

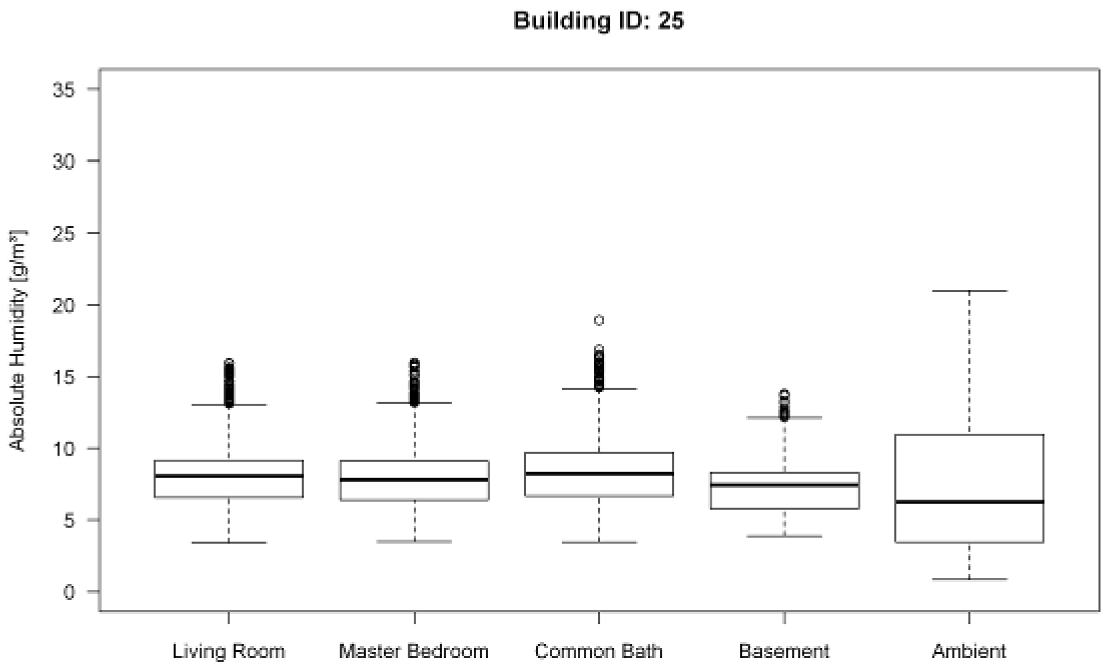

Figure 13: Box Plot for the absolute Humidity for House 25

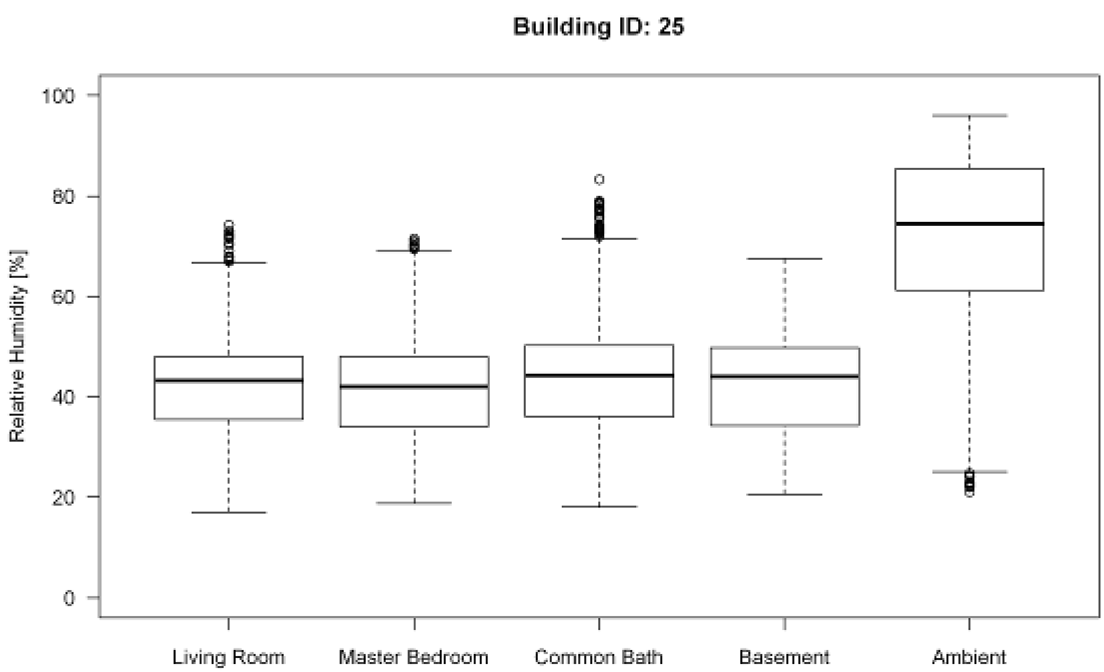

Figure 14: Box Plot for the Relative Humidity (%) for House 25

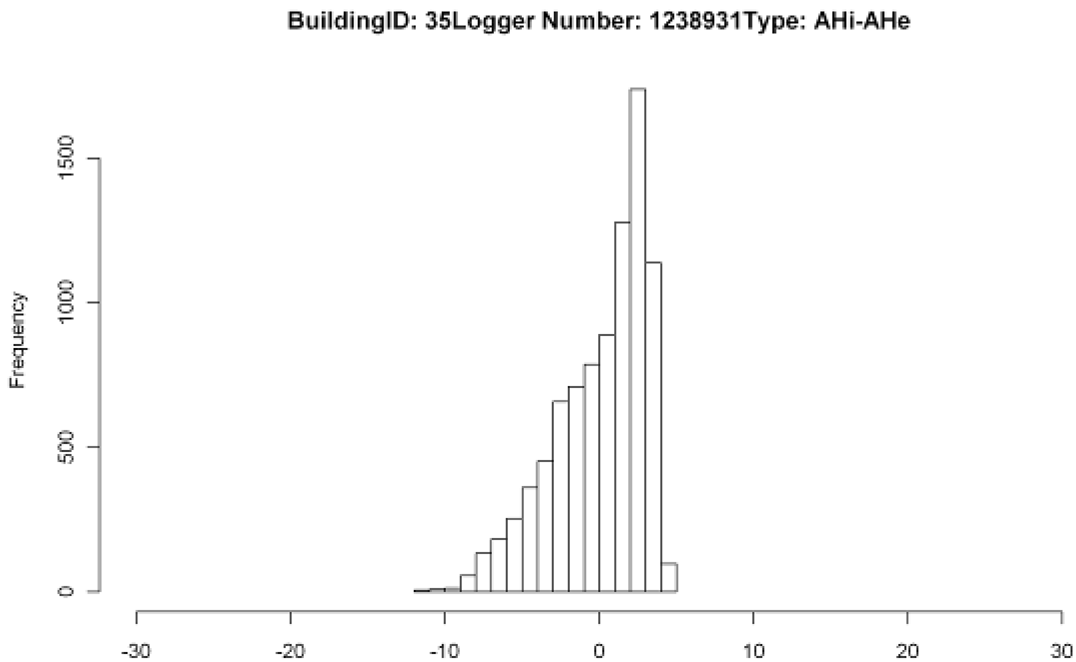

Figure 15: Frequency Plot for the difference in Moisture concentration (Inside –Outside) g/m^3 for House 35

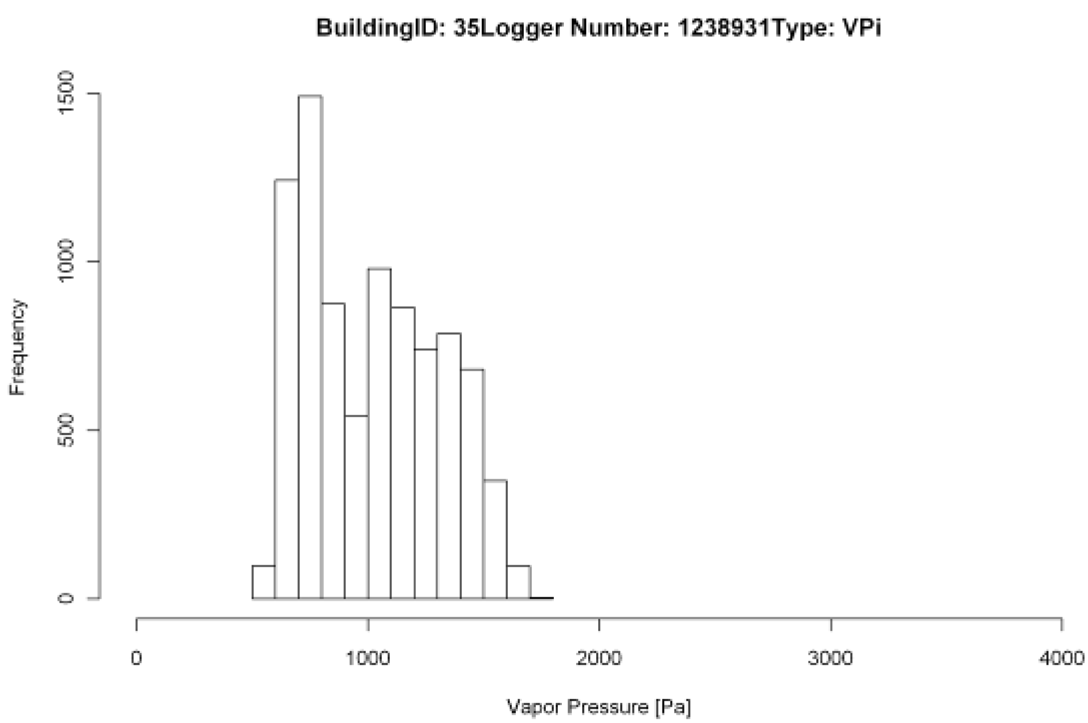

Figure 16: Frequency Plot for the Interior Vapor Pressure (Pa) for House 35

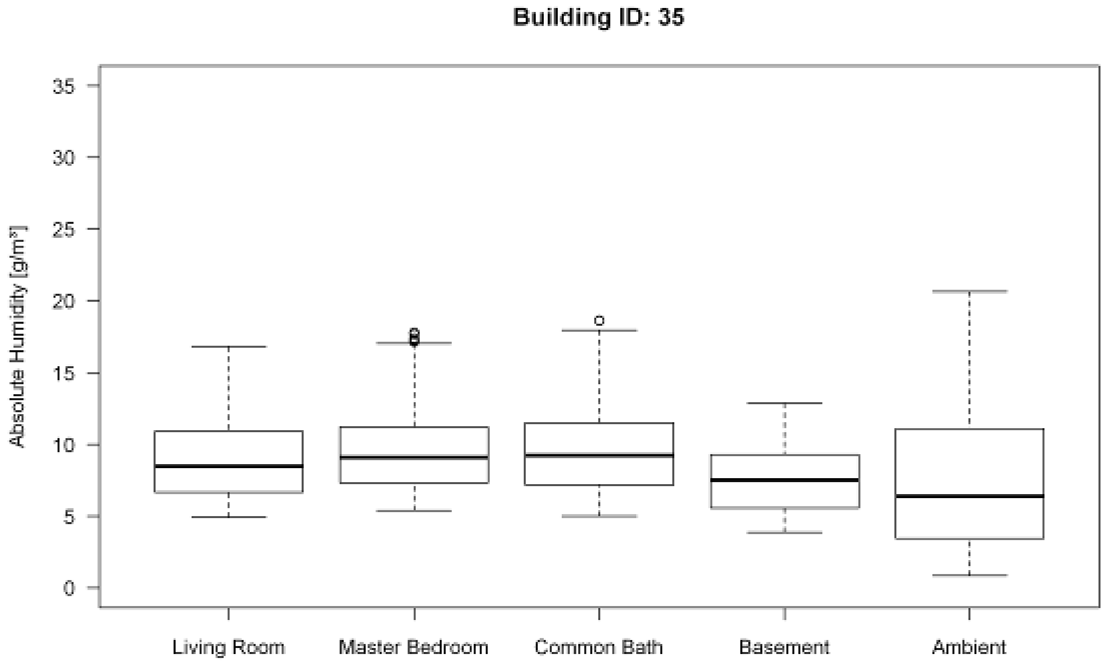

Figure 17: Box Plot for the absolute Humidity for House 35

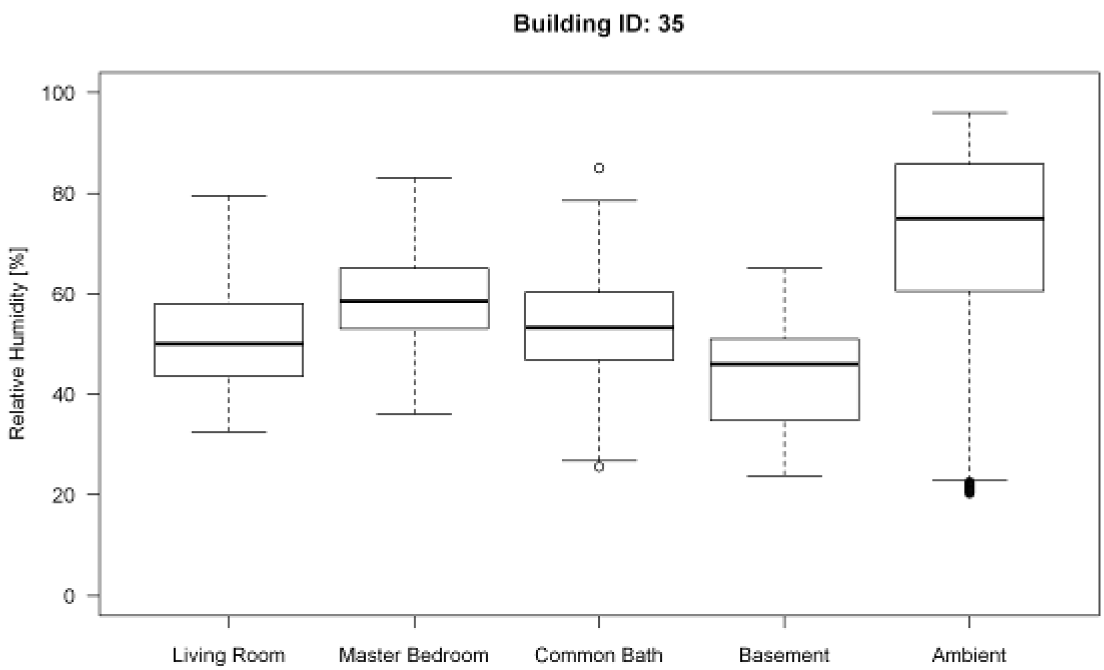

Figure 18: Box Plot for the Relative Humidity (%) for House 35

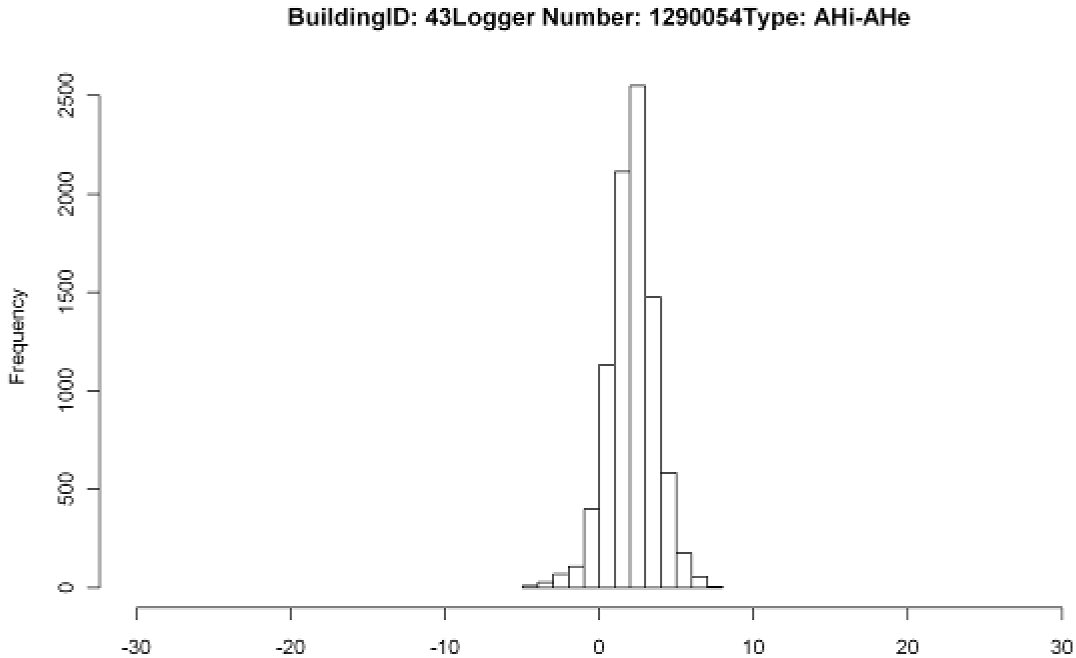

Figure 19: Frequency Plot for the difference in Moisture concentration (Inside –Outside) g/m^3 for House 43

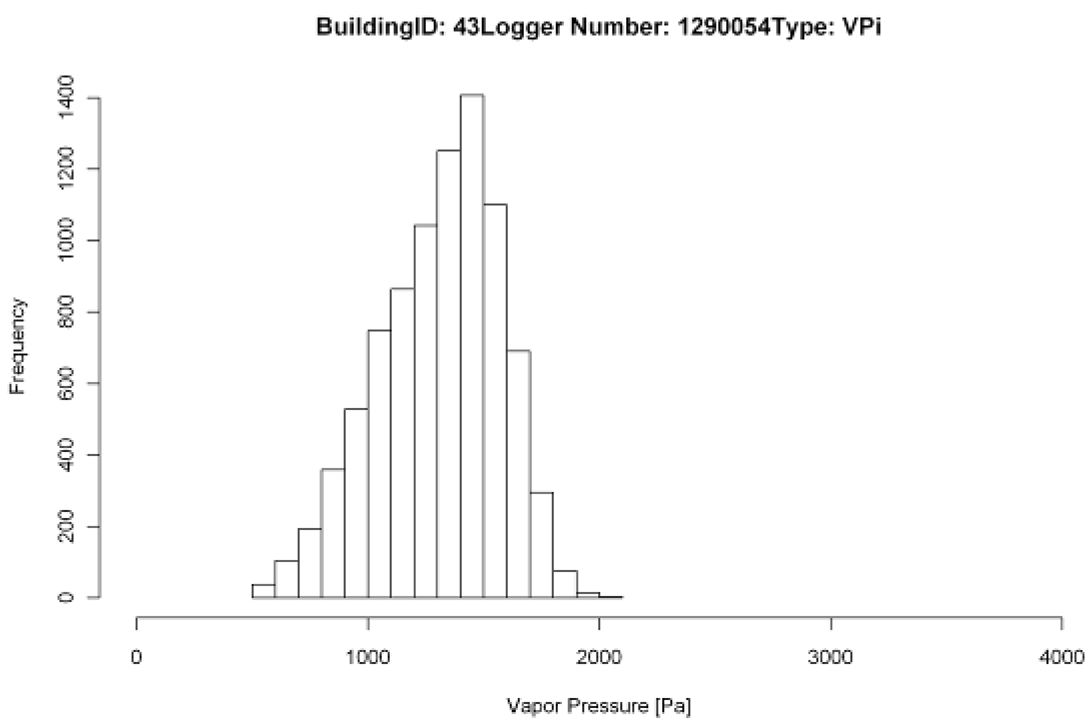

Figure 20: Frequency Plot for the Interior Vapor Pressure (Pa) for House 43

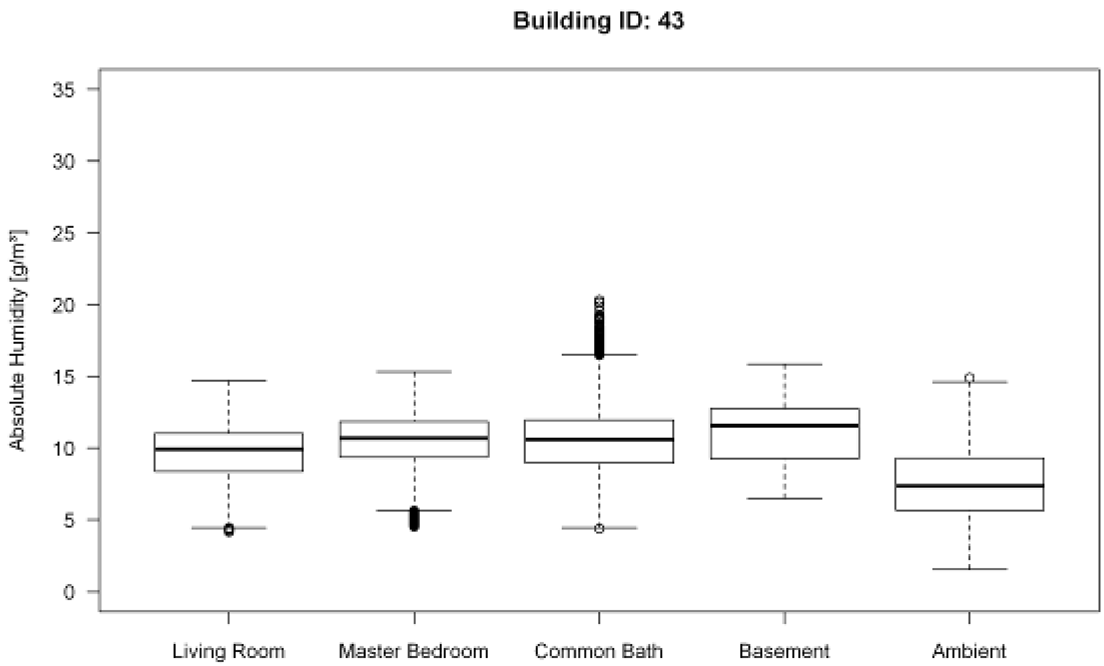

Figure 21: Box Plot for the absolute Humidity for House 43

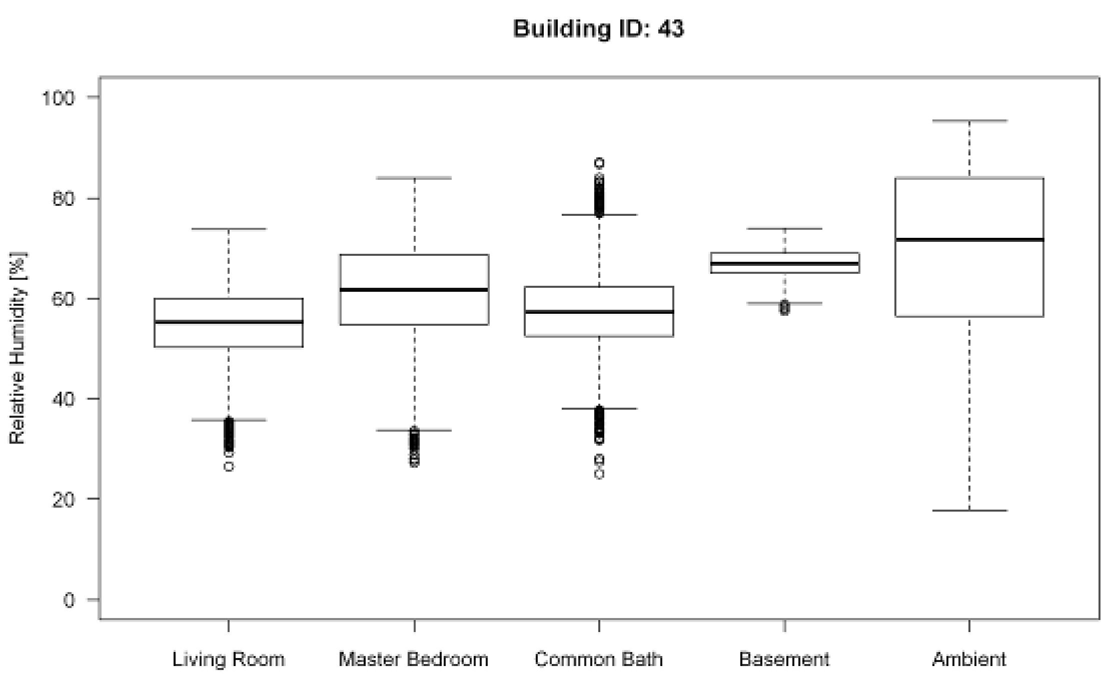

Figure 22: Box Plot for the Relative Humidity (%) for House 43

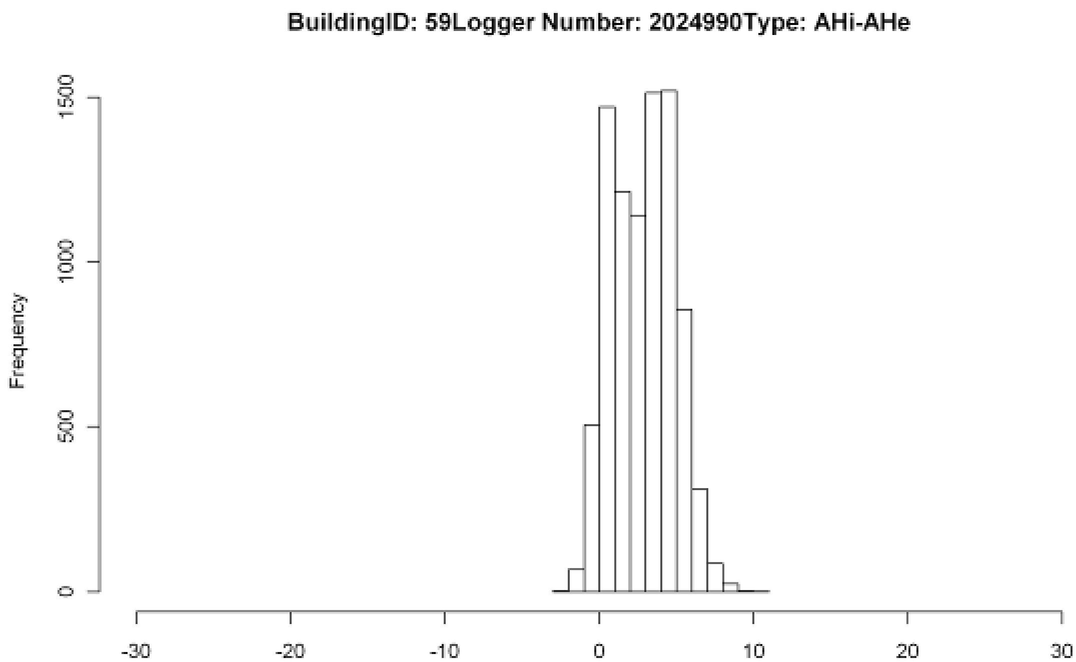

Figure 23: Frequency Plot for the difference in Moisture concentration (Inside –Outside) g/m^3 for House 59

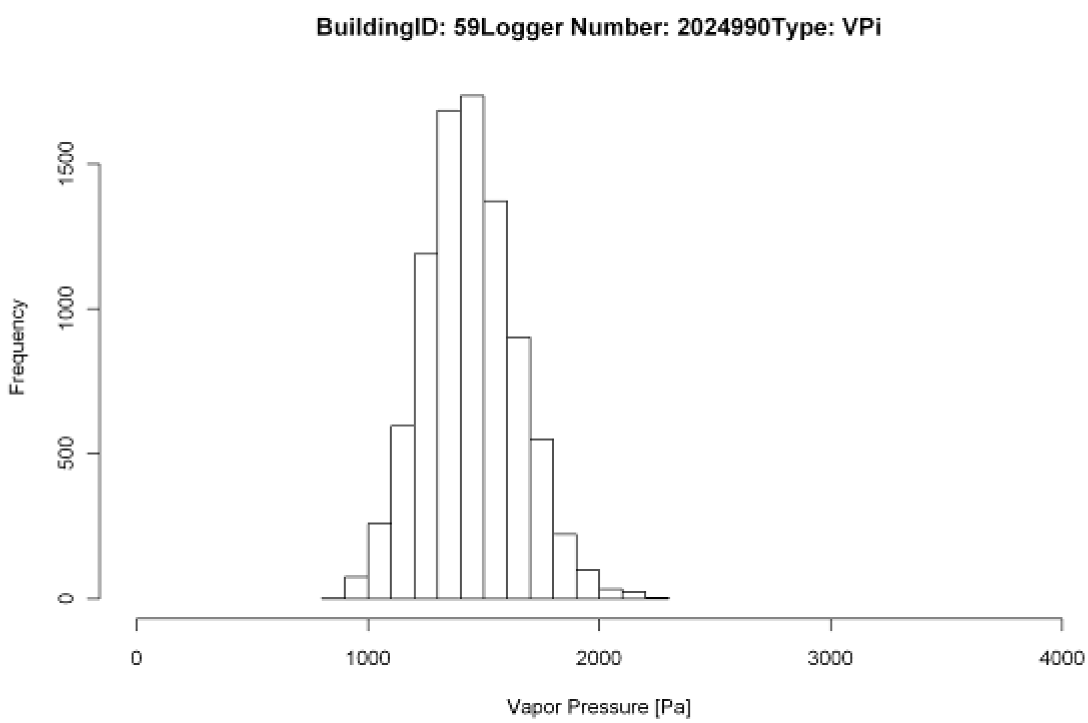

Figure 24: Frequency Plot for the Interior Vapor Pressure (Pa) for House 59

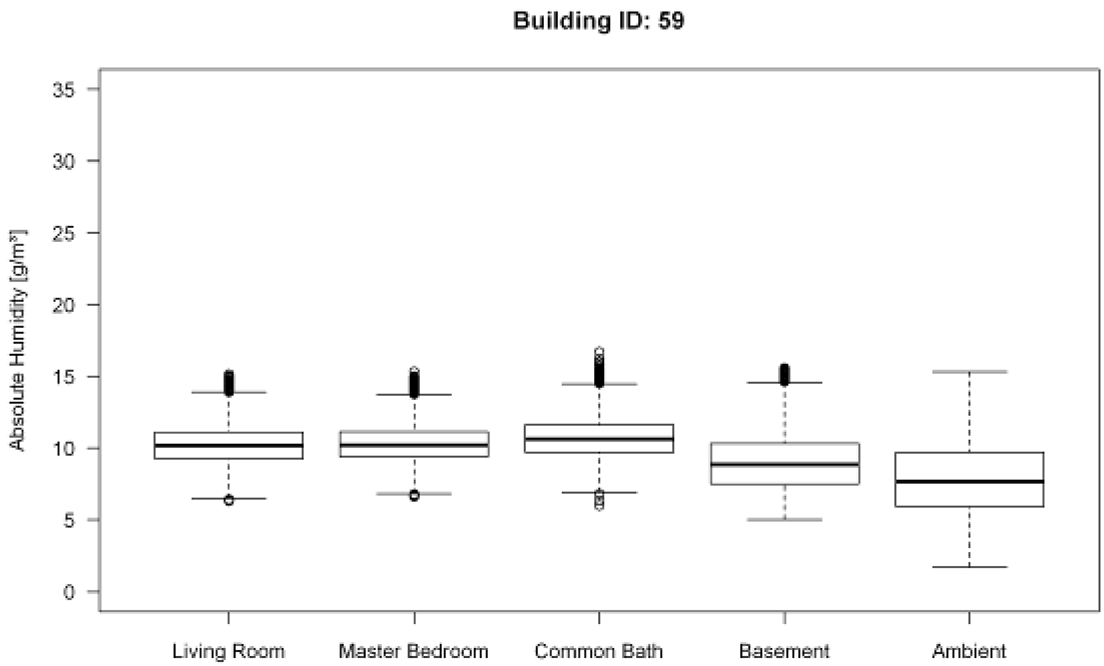

Figure 25: Box Plot for the absolute Humidity for House 59

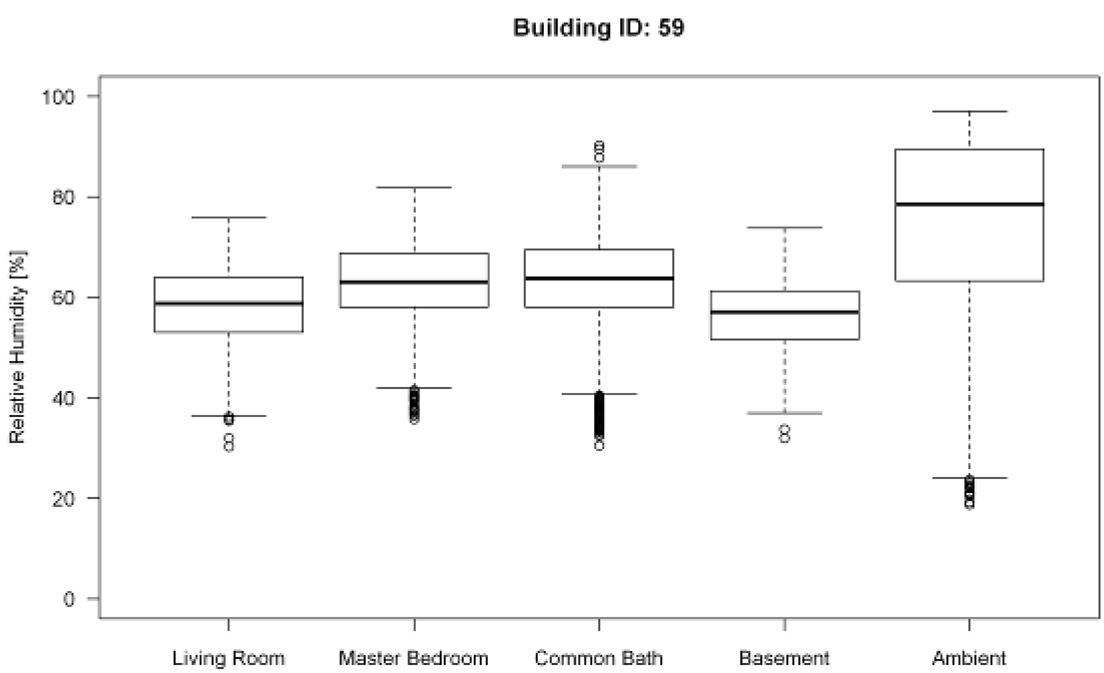

Figure 26: Box Plot for the Relative Humidity (%) for House 59

Results
Method 1: Simple Method.

In Appendix A, results are shown for comparing the simple ASHRAE SPC 160 Standard method (method 1) against the measured field data. Results are shown comparing the interior relative humidity and temperatures for both measurements and predictions. All of the monitored data from the rooms are displayed by shown a time running average. The resulting temperature and relative humidity from Method 1 (Simple) are presented for all the 60 buildings.

The overall observation is that method 1 over-predicts by a substantial amount the relative humidity in the homes in Zone 2 (Buildings 1 through 20) (hot and humid) especially for the spring and summer periods. The agreement between method 1 and field monitored data is bad during this period. The disagreement is approximately 20 % in relative humidity. At the same time the predicted temperatures were approximately 5 to 7 ºC lower than the measured data. During the winter months the agreement between method 1 (Simple) and field data was better within 5 % of the relative humidity and 2 ºC in temperature).

For Zone 5 (Buildings 21 to 40), the agreement between Zone 5 and the ASHRAE Simple method is somewhat better. During the fall period (October till end of December) good agreement in the predicted relative humidity was found for most of the homes. However, measured indoor air temperatures in the winter period were substantially lower up to º5 C .

In Zone 4 (Buildings 42 to 61) the predicted temperatures are substantially higher up to 3.5 ºC higher than those measured during the period spanning between October till middle of April. Relative humidities are also substantially over-predicted by the simple method for Zone 4.

Method 2: Intermediate Method.

In Appendix B, the results are shown for all 60 buildings, twenty from each of the three climate zones for the intermediate method. The agreement between measured and predicted relative humidities is improved, as the number of inhabitants, size of building and other parameters as described in section of the ASHRAE methods is included in the intermediate method. While in some cases, very good agreement between measured and predicted relative humidity is observed, limited agreement between predictions and field data is found.

However the intermediate method improves the agreement between predictions and field data in all three climate zones.

Method 2: Intermediate Modified ANK Method.

In Appendix C, the results are shown for all 60 buildings, twenty from each of the three climate zones for the intermediate method with a minor modification. The temperature is allowed to reach a maximum of 26.9 ºC rather than 23.9 ºC. In addition the RH was fixed at a maximum of 80 %. The predicted results follow the all important trends of the field data.

While additional improvements could be made, providing set-point temperature adjustments as a function of the climate zone annual temperatures, this was not the objective of the project.

The agreement between measured and predicted relative humidities was remarkably improved, allowing the intermediate modified ANK method to be applicable to all climate zones. This improvement permitted better agreement between measured field data and predictions in both the interior thermal and moisture conditions across all climate zones.

Conclusions:

Indoor field data are presented on the comparison of the two most applicable ASHRAE SPC 160 methods for predicting the interior conditions for hygrothermal modeling.

Data for sixty homes have been used in the comparative analysis and are presented in this report. The ASHRAE simple method was found to overestimate the hygric loads for a substantial period of time during the year. Differences between measured values were highest for IECC Zone 2 (hot and mixed climates). While this method allows yearly diurnal effects to take place, it was found to work best in the other two climates (IECC Zone 4 and 5).

The ASHRAE intermediate method was investigated for the same 60 homes. The results show better agreement especially for the mixed climate zones. The major limitation was that the set point temperature conditions were not appropriate for the hot and humid climates. A modified intermediate method that allowed the maximum to increase from 23.9 to 26.9 ºC showed better comparison between field and predictions.

From the analysis of the data, it is proposed that the modified ANK intermediate method be used for hygrothermal simulation analysis. Additional improvements such as including the average outdoor temperature as an influencing parameter for interior temperature set point condition should be investigated further.

The data sets measured by Steven Winter Associaties in this HUD sponsored project was found to be valuable to test two out of the three ASHRAE interior hygric loads. It is expected that these data sets and the analysis performed will be used to direct further upgrades of the ASHRAE SPC 160 standard.

APPENDIX A

ASHRAE Simple Method

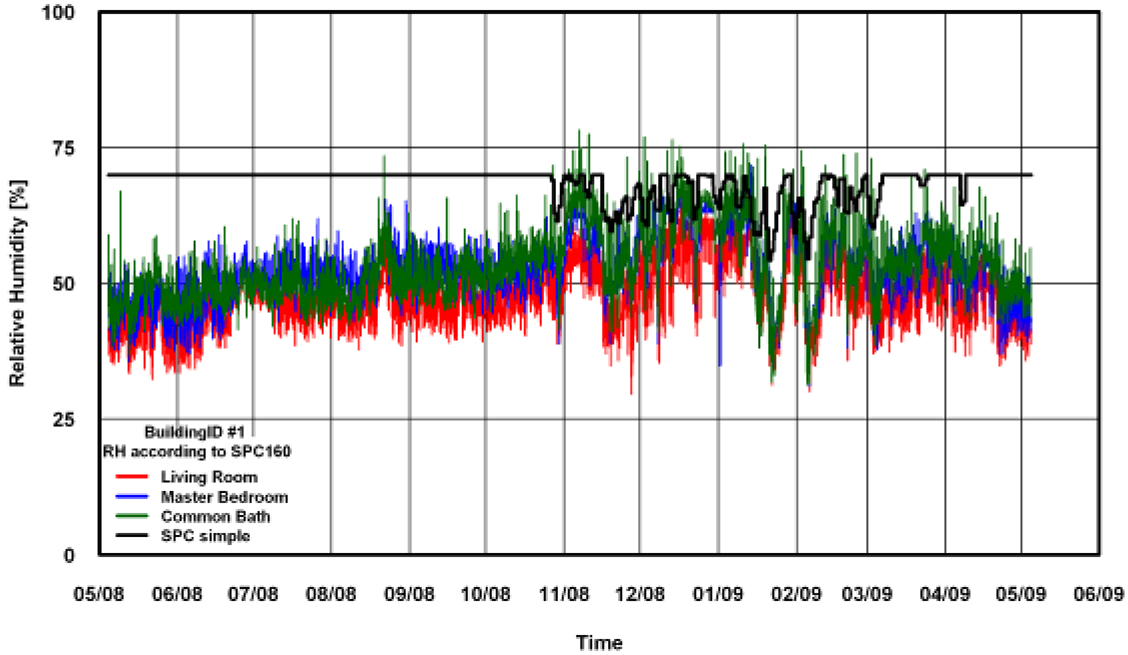

Figure 27: RH Comparison of SPC 160 Simple Method for Building # 1

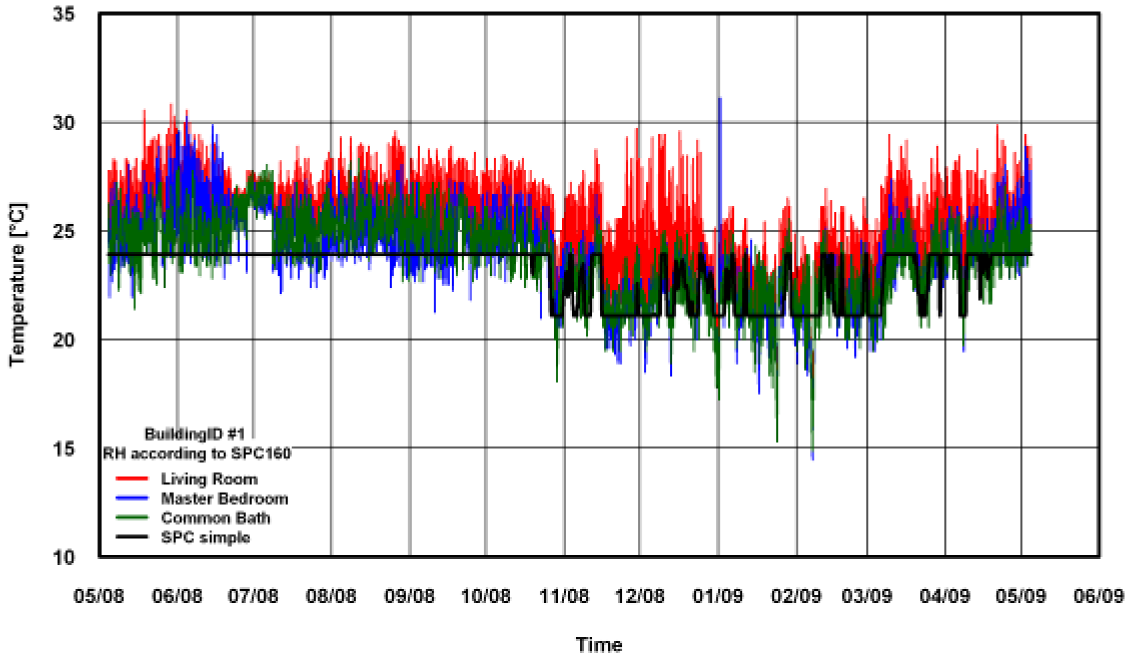

Figure 28: Temperature Comparison of SPC 160 Simple Method for Building # 1

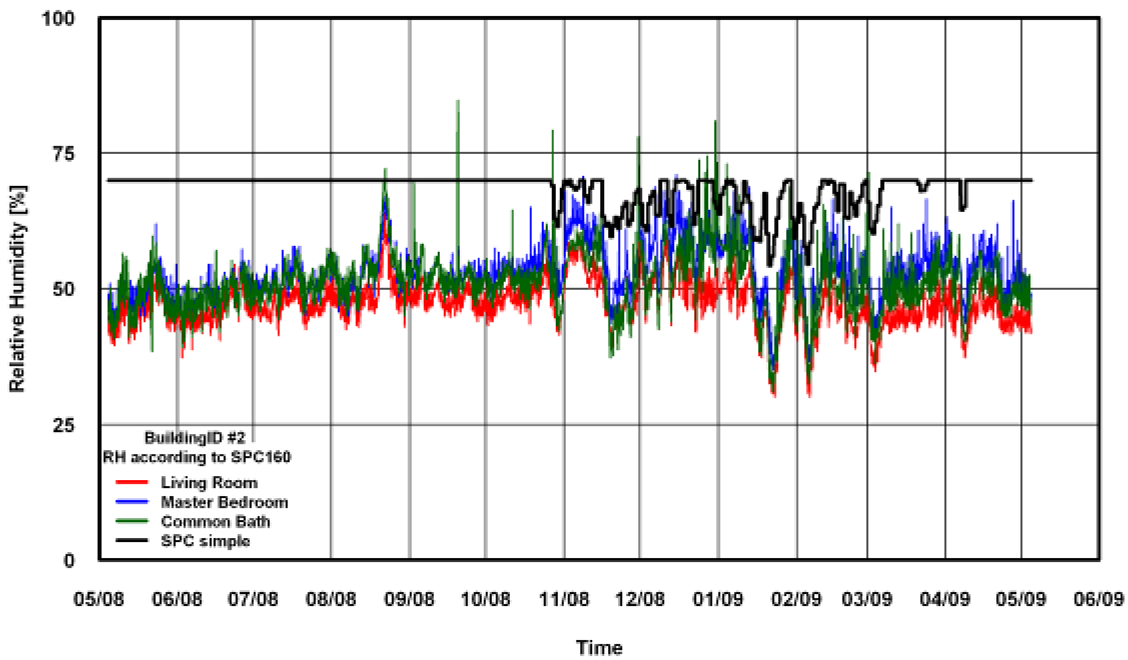

Figure 29: RH Comparison of SPC 160 Simple Method for Building # 2

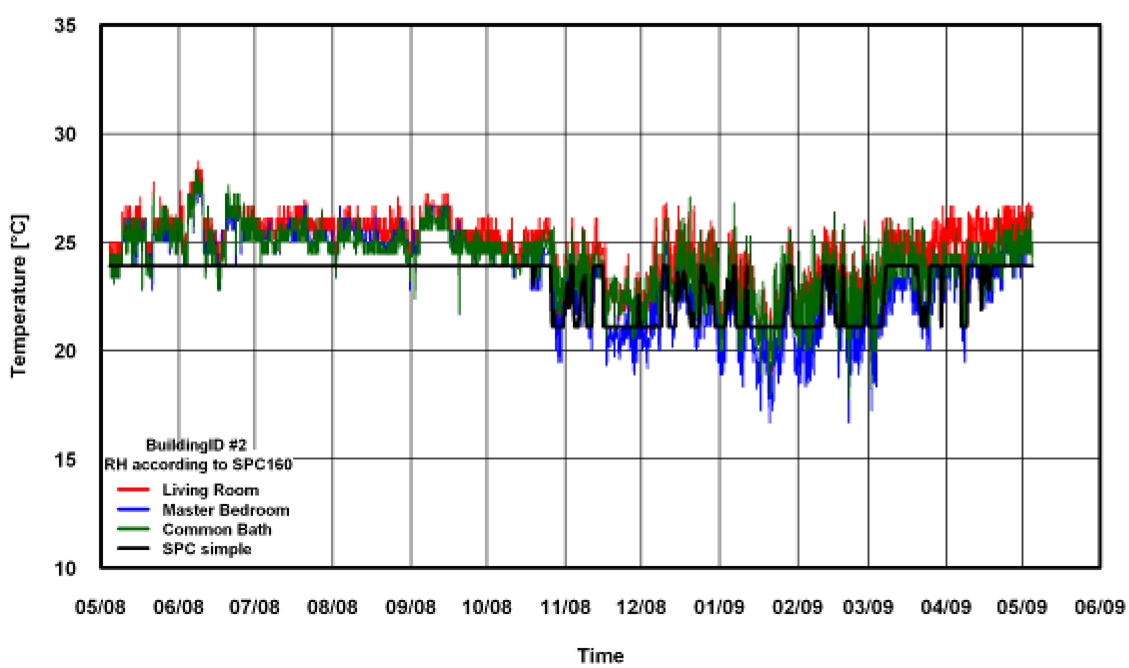

Figure 30: RH Comparison of SPC 160 Simple Method for Building # 2

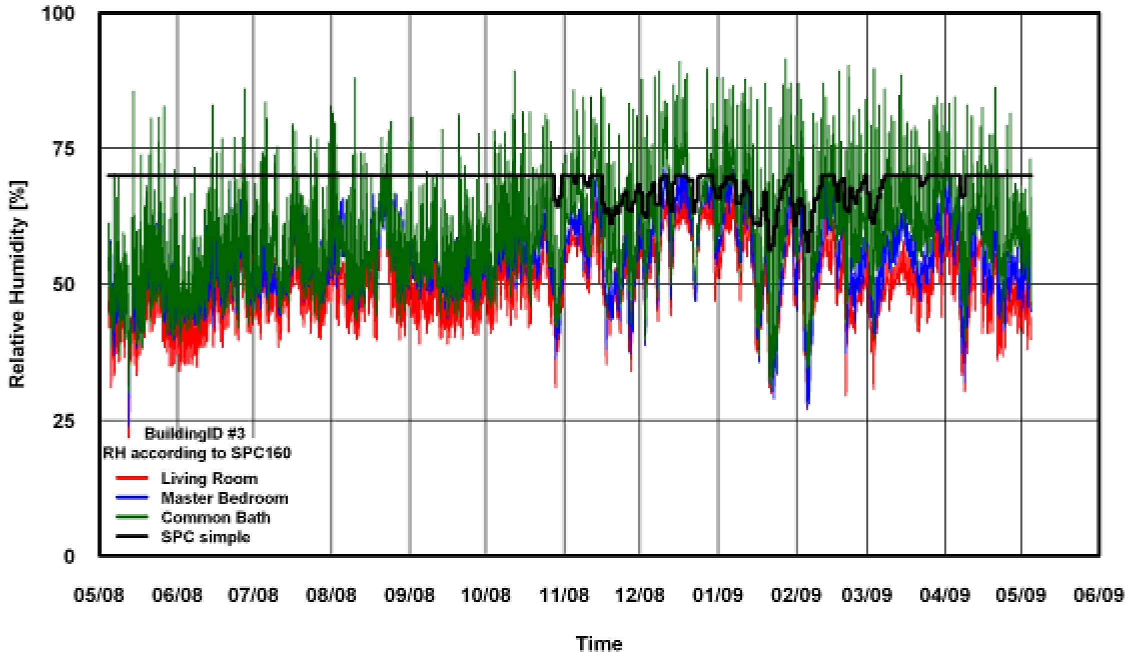

Figure 31: RH Comparison of SPC 160 Simple Method for Building # 3

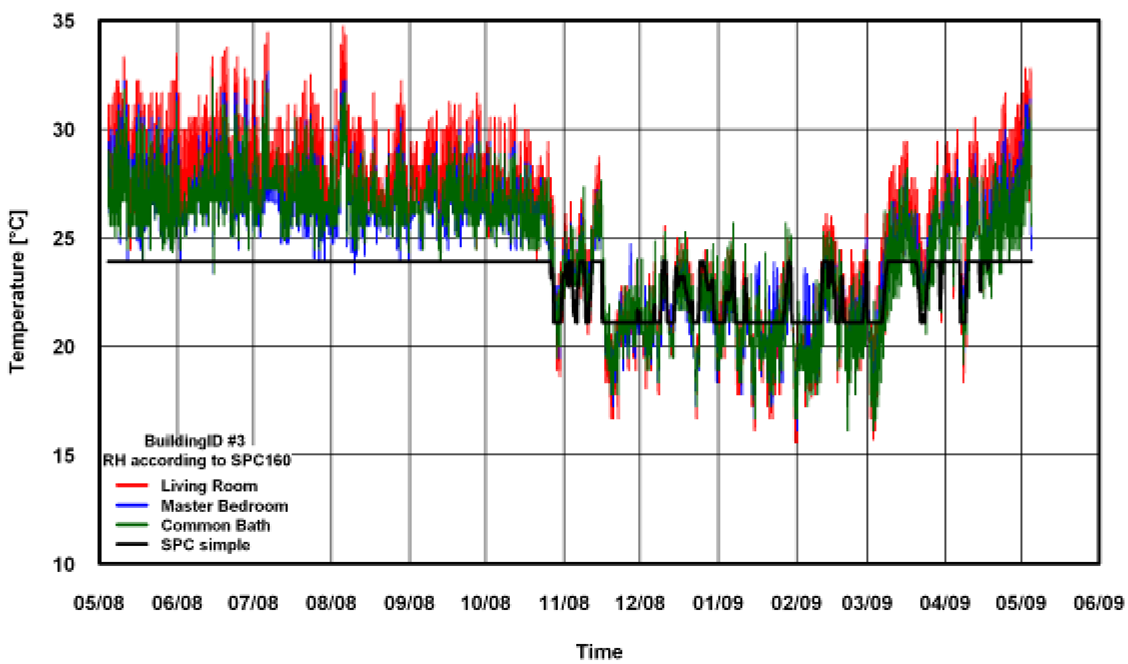

Figure 32: RH Comparison of SPC 160 Simple Method for Building # 3

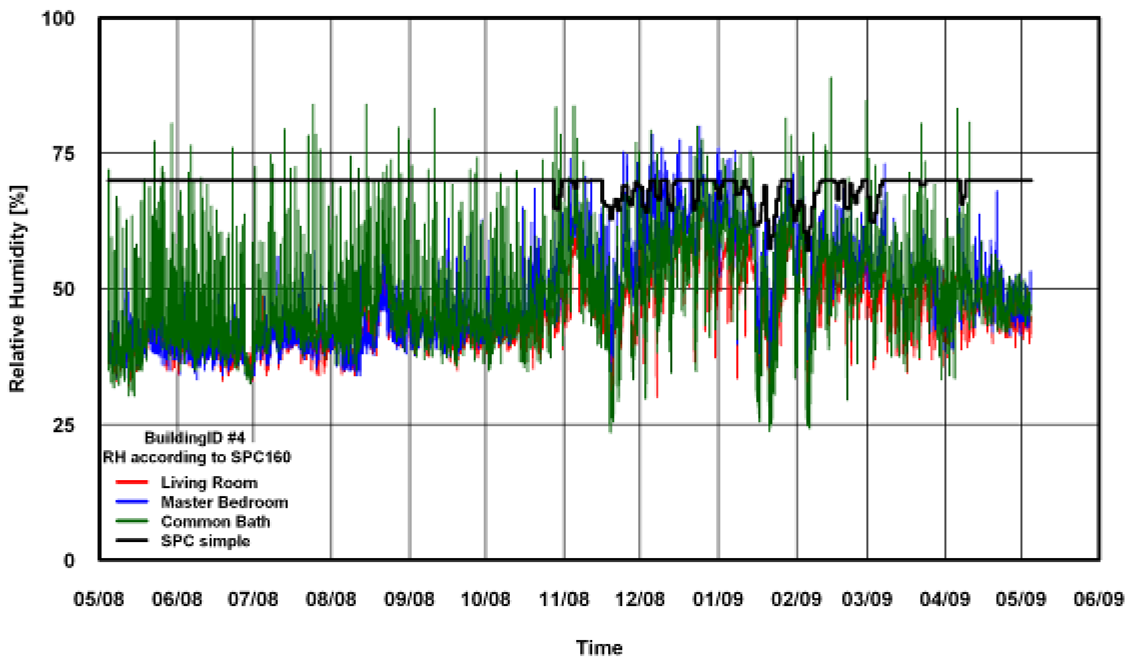

Figure 33: RH Comparison of SPC 160 Simple Method for Building # 4

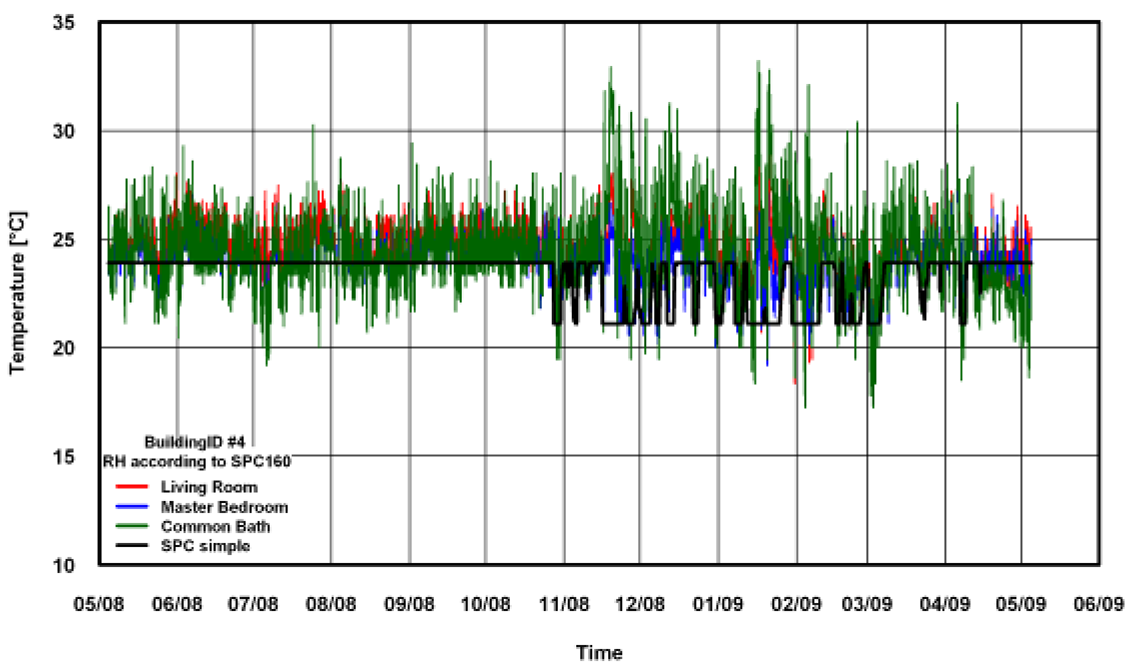

Figure 34: RH Comparison of SPC 160 Simple Method for Building # 4

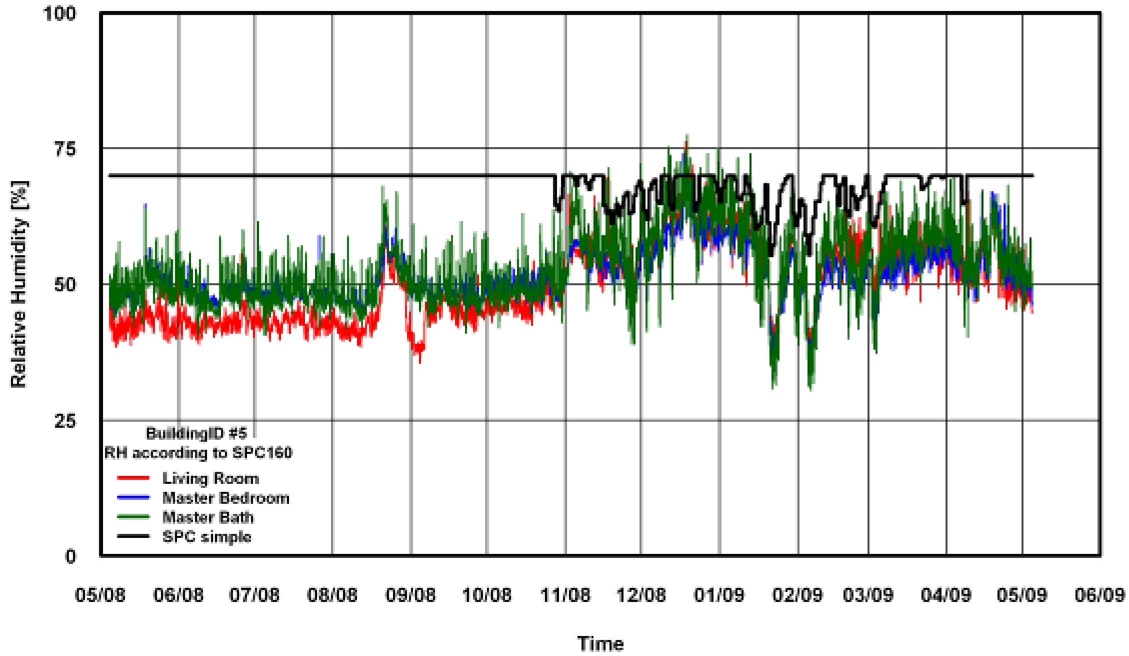

Figure 35: RH Comparison of SPC 160 Simple Method for Building # 5

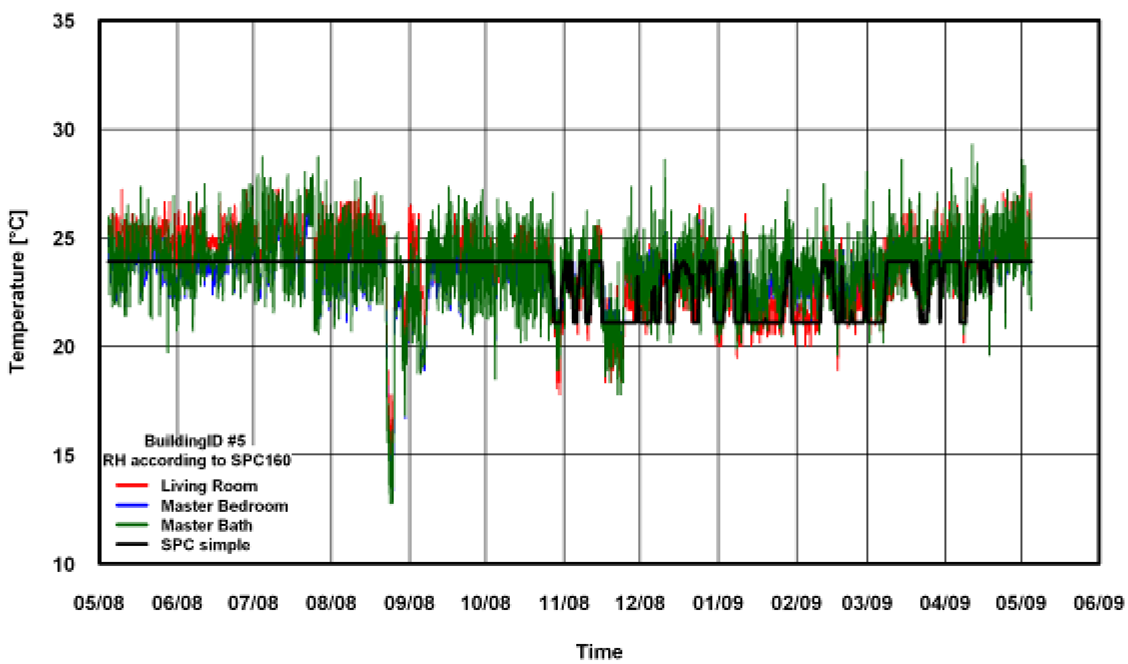

Figure 36: RH Comparison of SPC 160 Simple Method for Building # 5

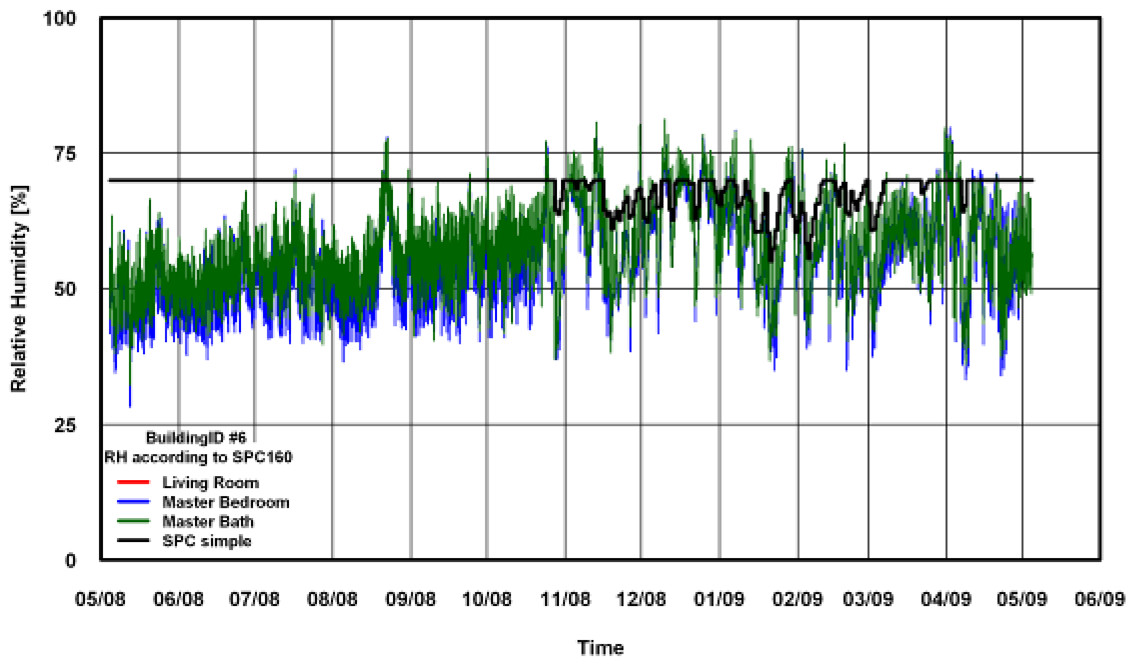

Figure 6: RH Comparison of SPC 160 Simple Method for Building # 6

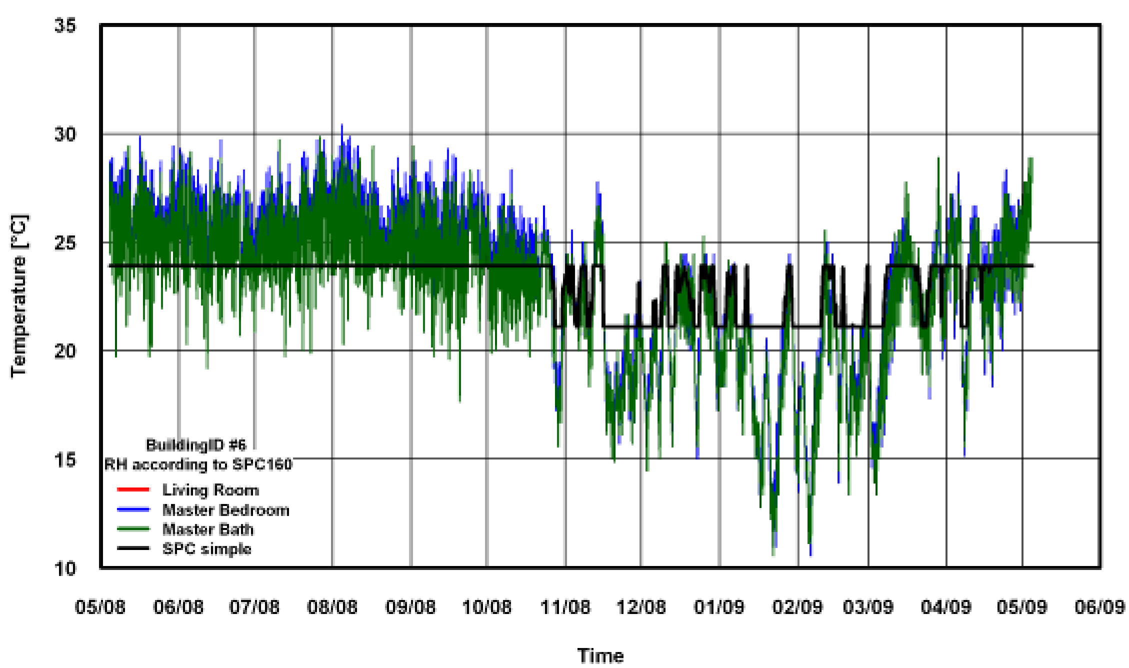

Figure 37: RH Comparison of SPC 160 Simple Method for Building # 6

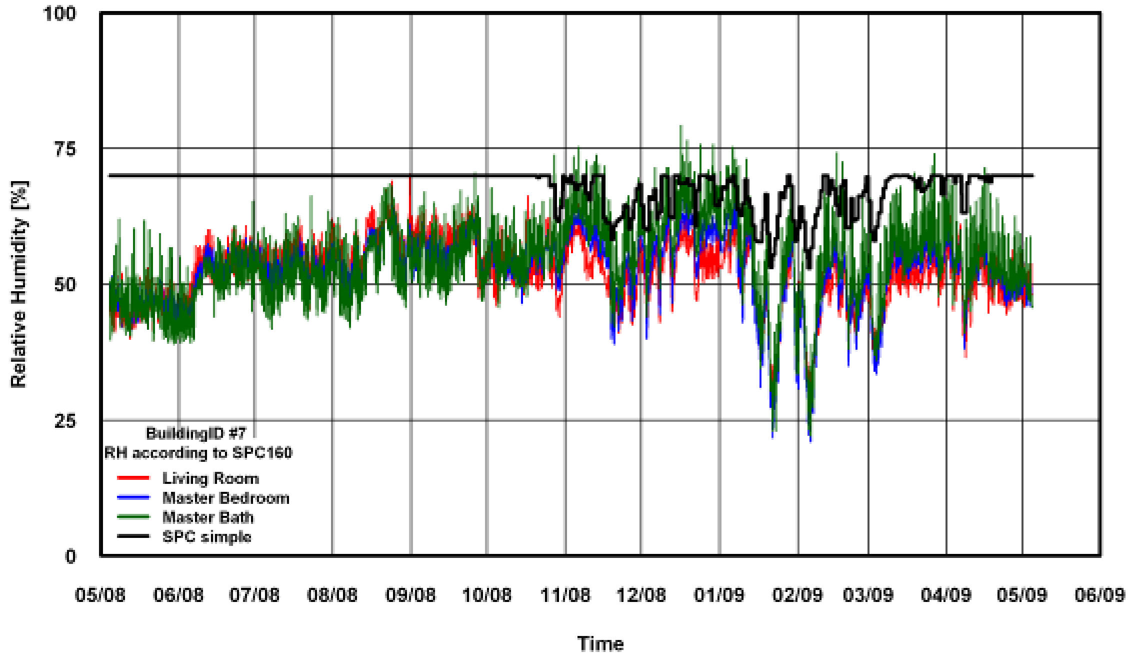

Figure 38: RH Comparison of SPC 160 Simple Method for Building # 7

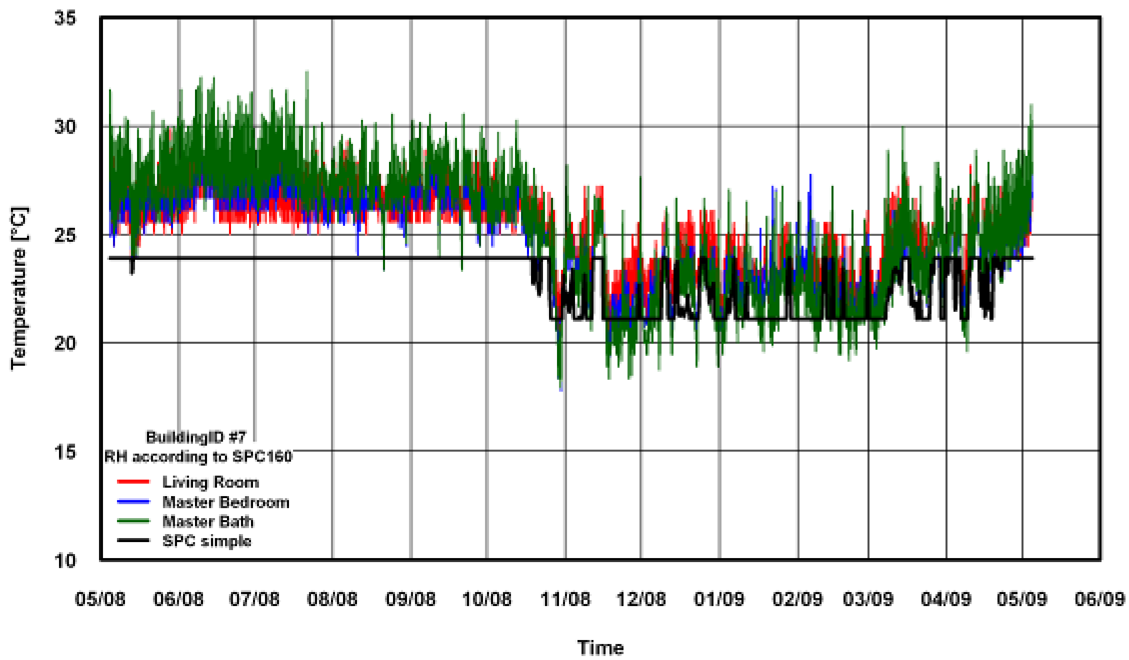

Figure 39: Temperature Comparison of SPC 160 Simple Method for Building # 7

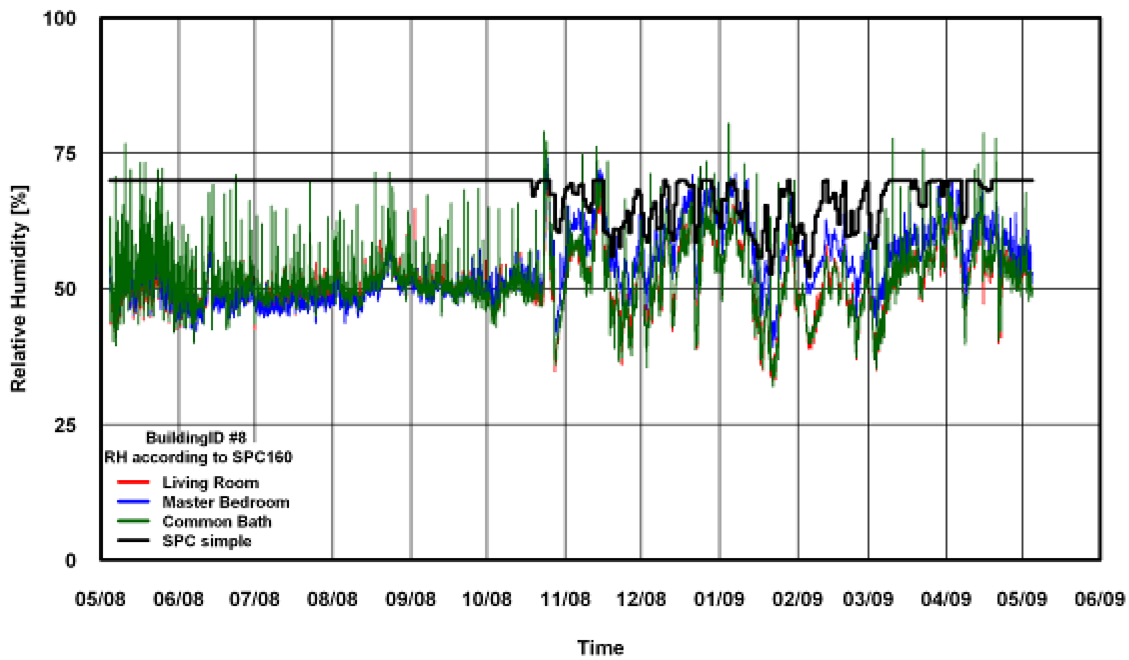

Figure 40: RH Comparison of SPC 160 Simple Method for Building # 8

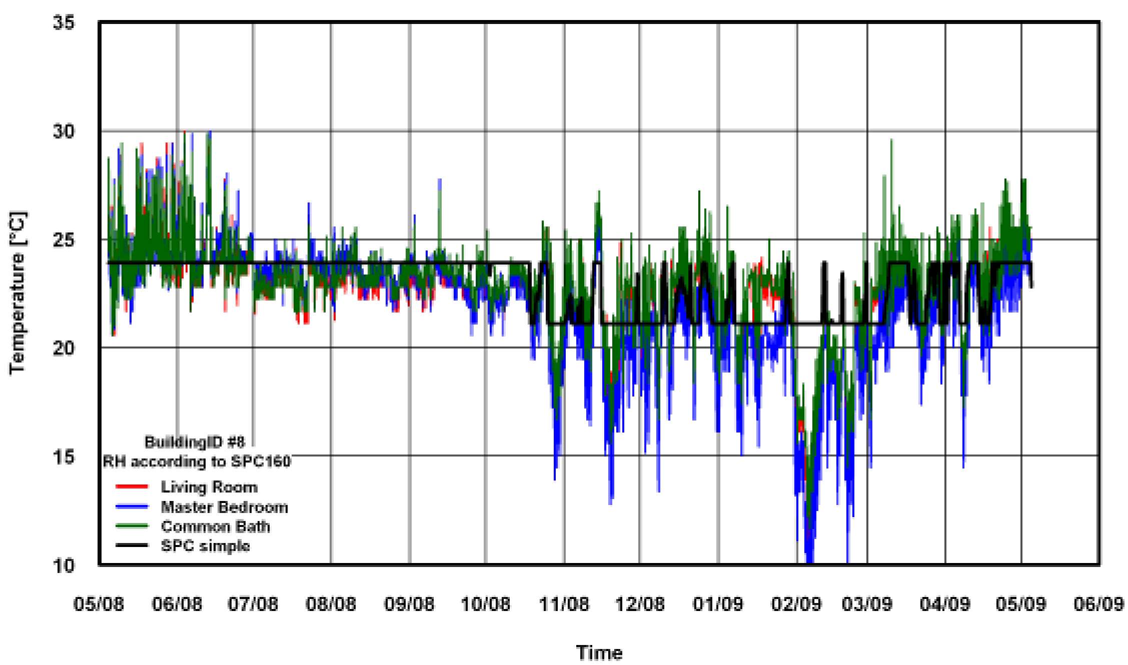

Figure 41: Temperature Comparison of SPC 160 Simple Method for Building # 8

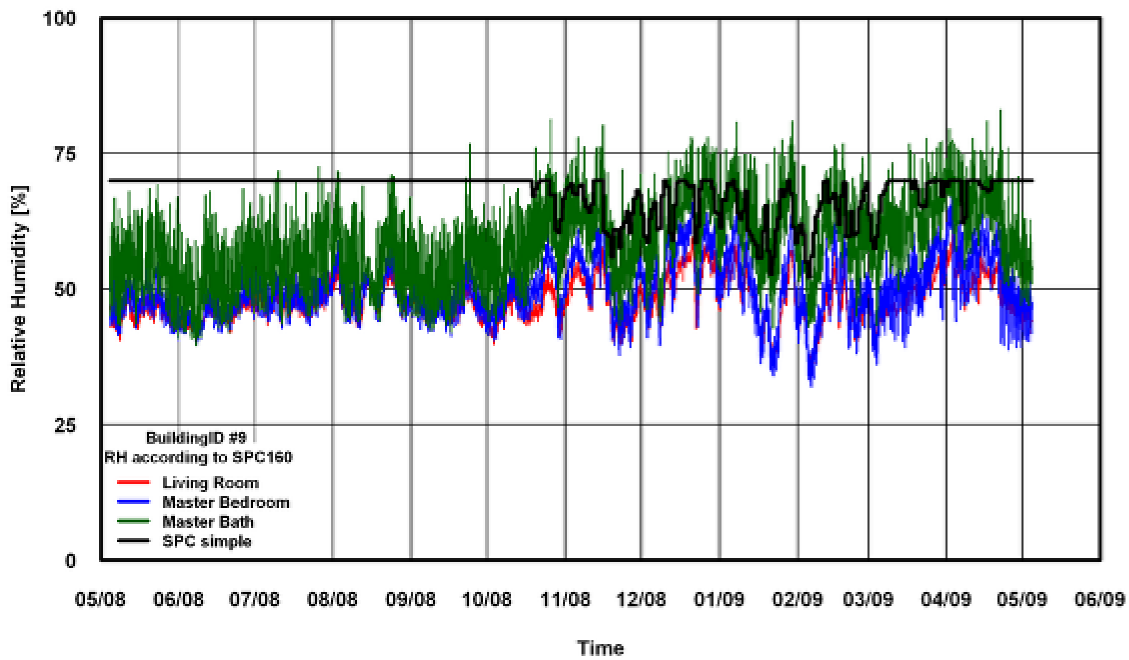

Figure 42: RH Comparison of SPC 160 Simple Method for Building # 9

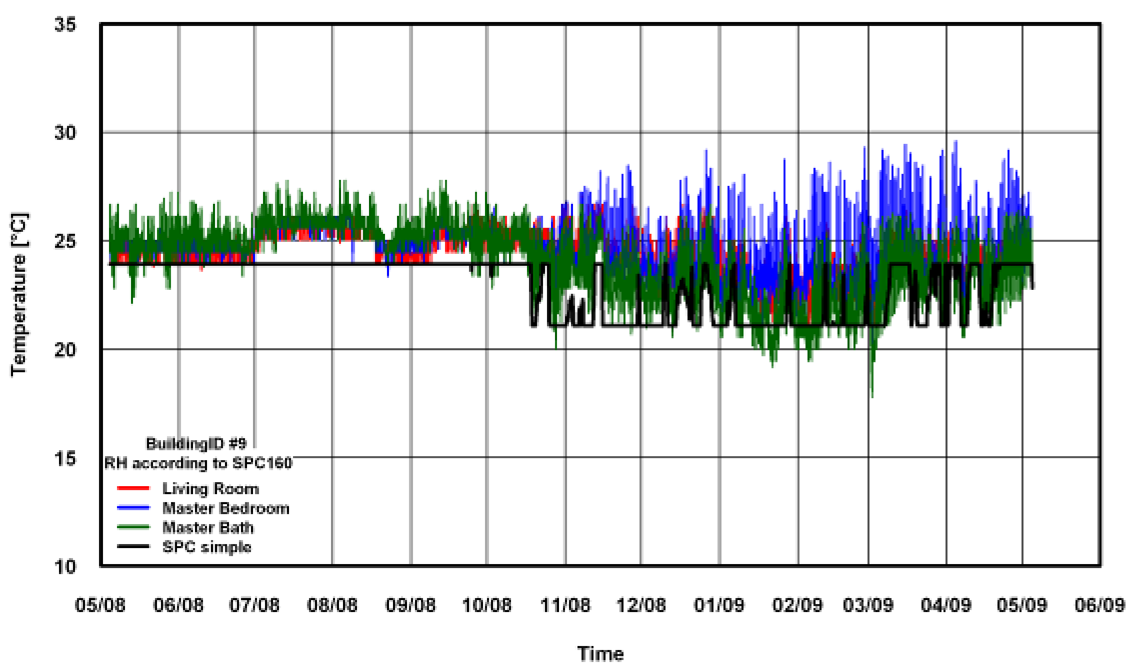

Figure 43: Temperature Comparison of SPC 160 Simple Method for Building # 9

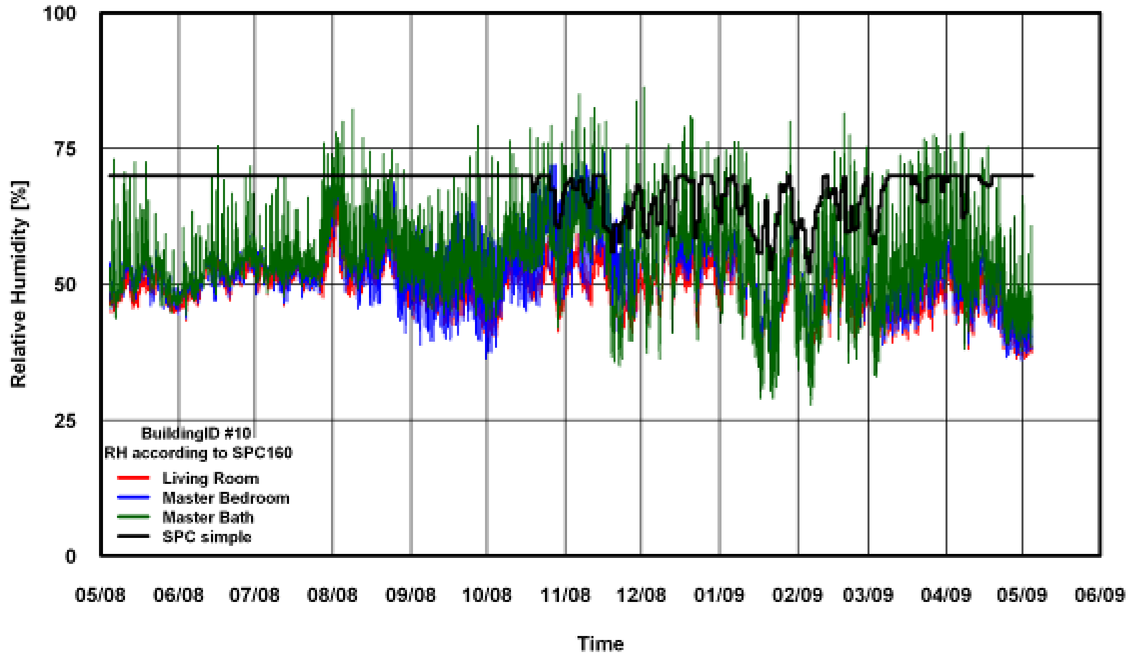

Figure 44: RH Comparison of SPC 160 Simple Method for Building # 10

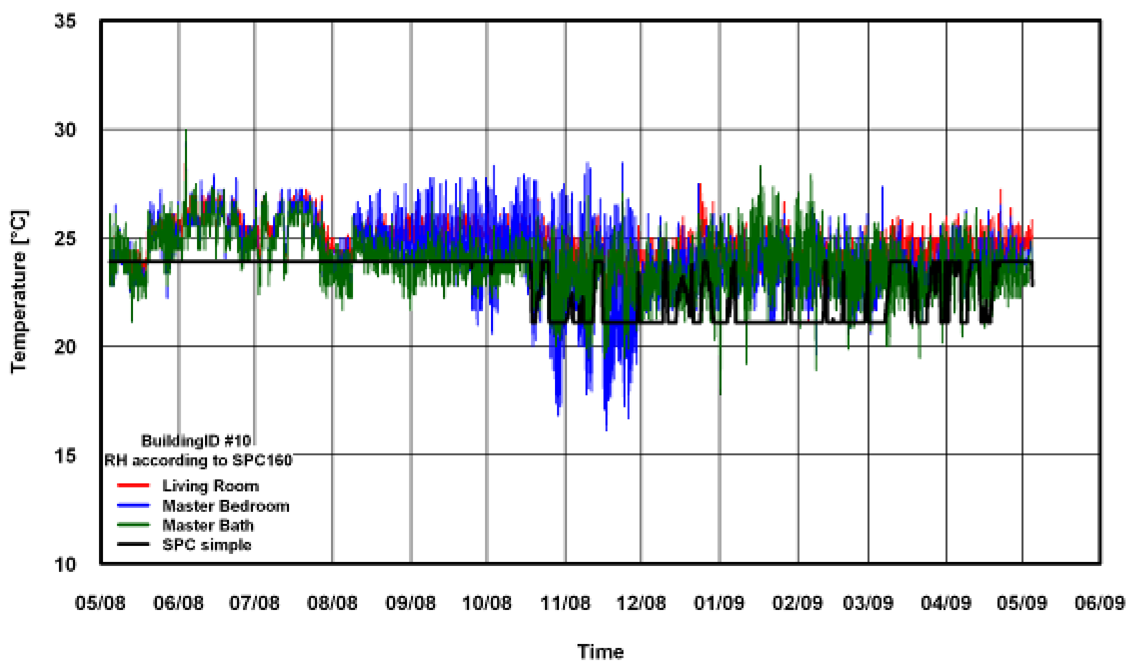

Figure 45: Temperature Comparison of SPC 160 Simple Method for Building # 10

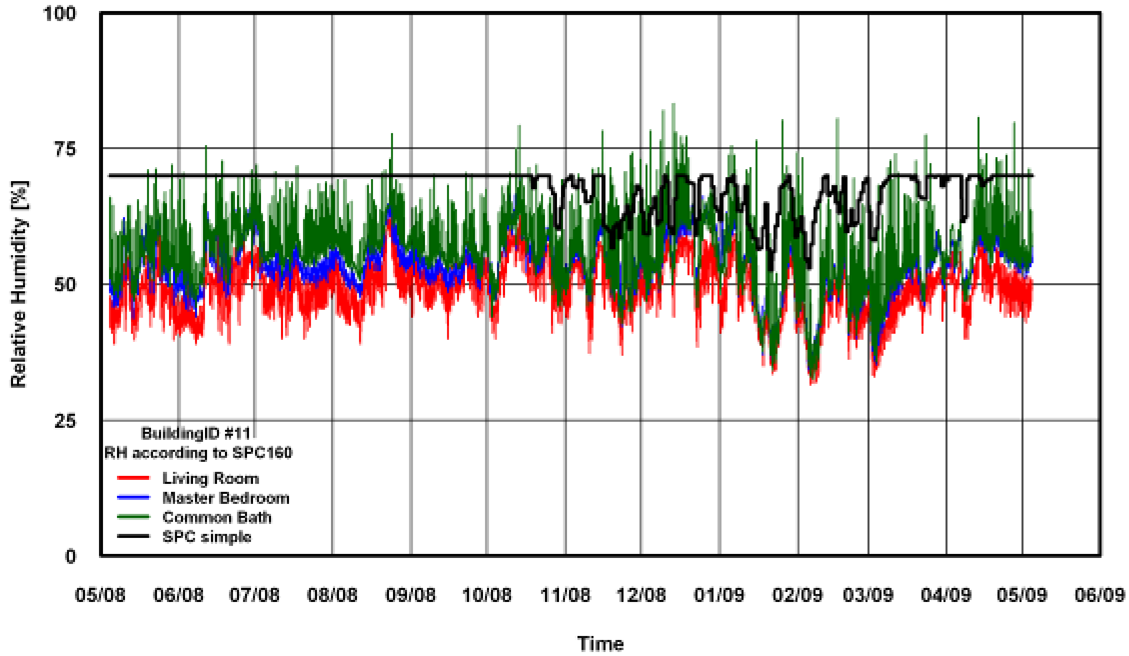

Figure 46: RH Comparison of SPC 160 Simple Method for Building # 11

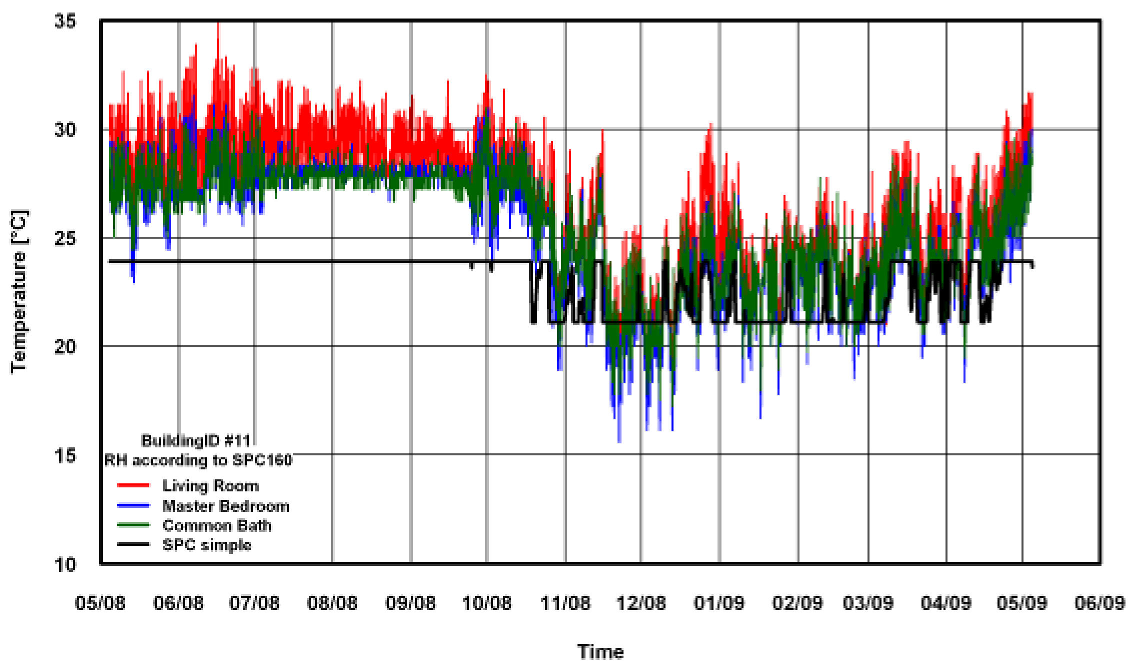

Figure 47: Temperature Comparison of SPC 160 Simple Method for Building # 11

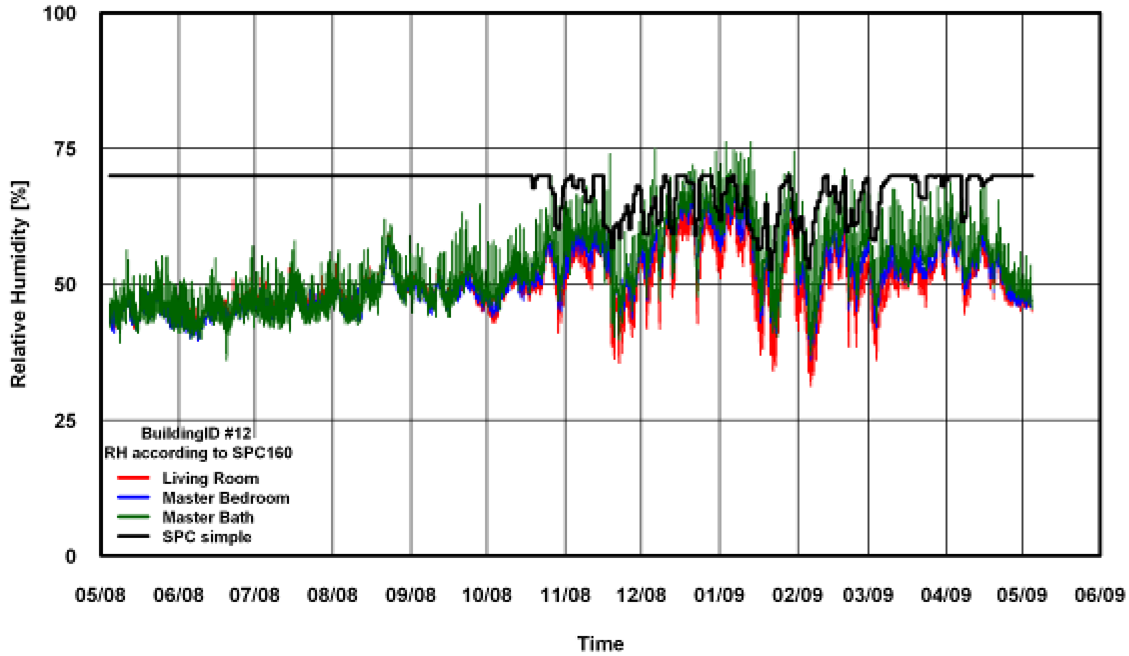

Figure 48: RH Comparison of SPC 160 Simple Method for Building # 12

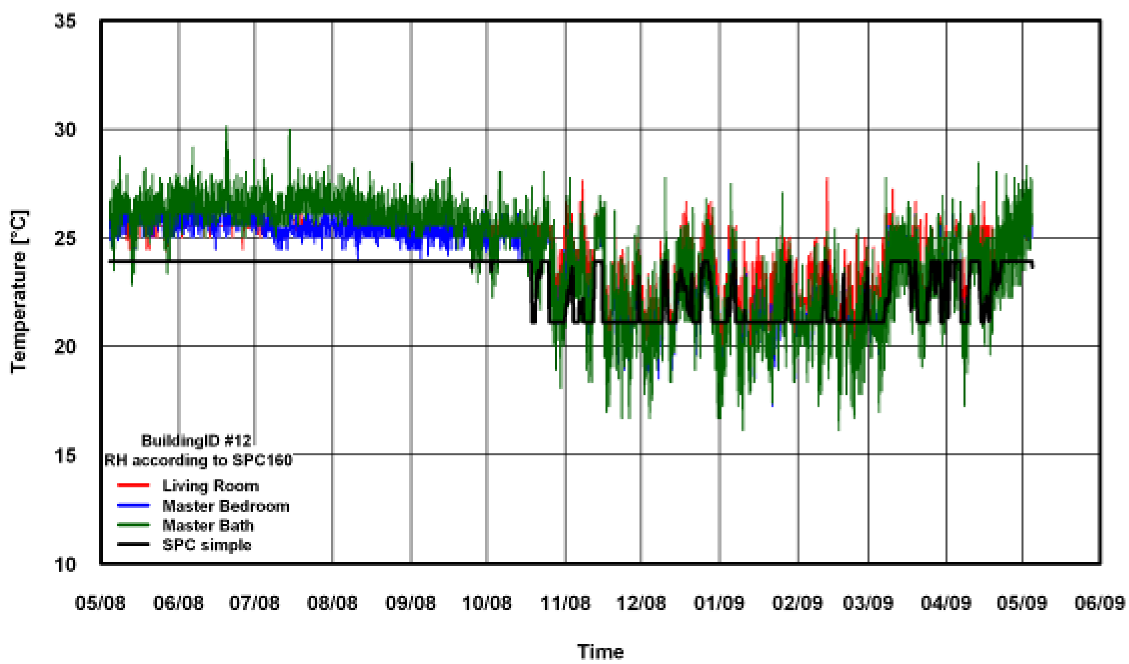

Figure 49: Temperature Comparison of SPC 160 Simple Method for Building # 12

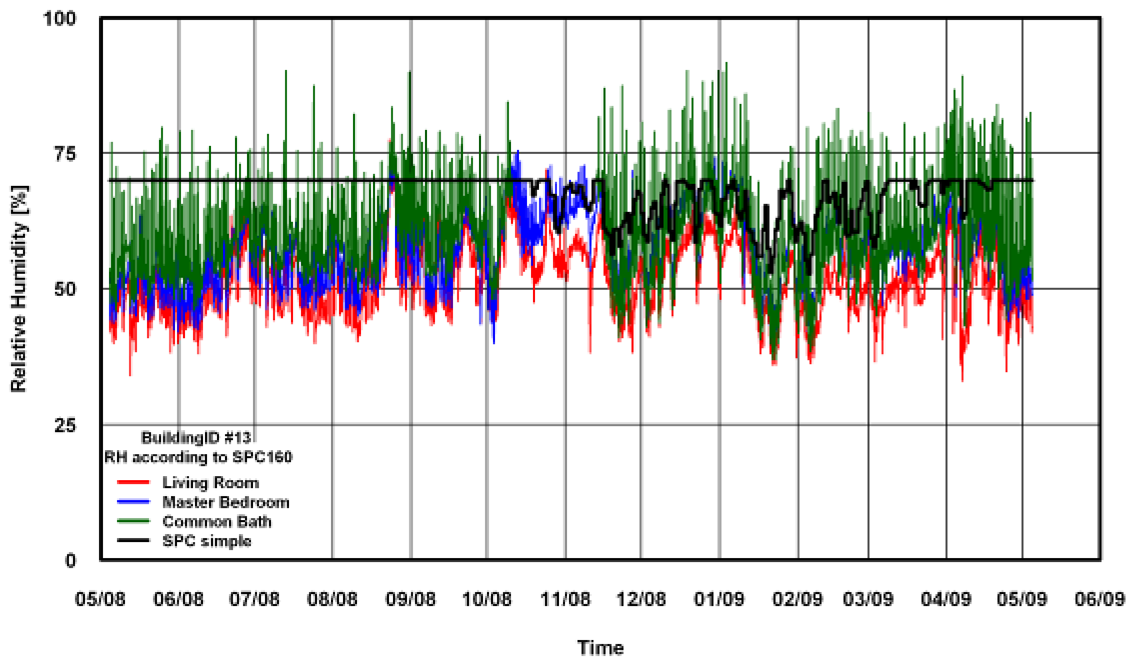

Figure 50: RH Comparison of SPC 160 Simple Method for Building # 13

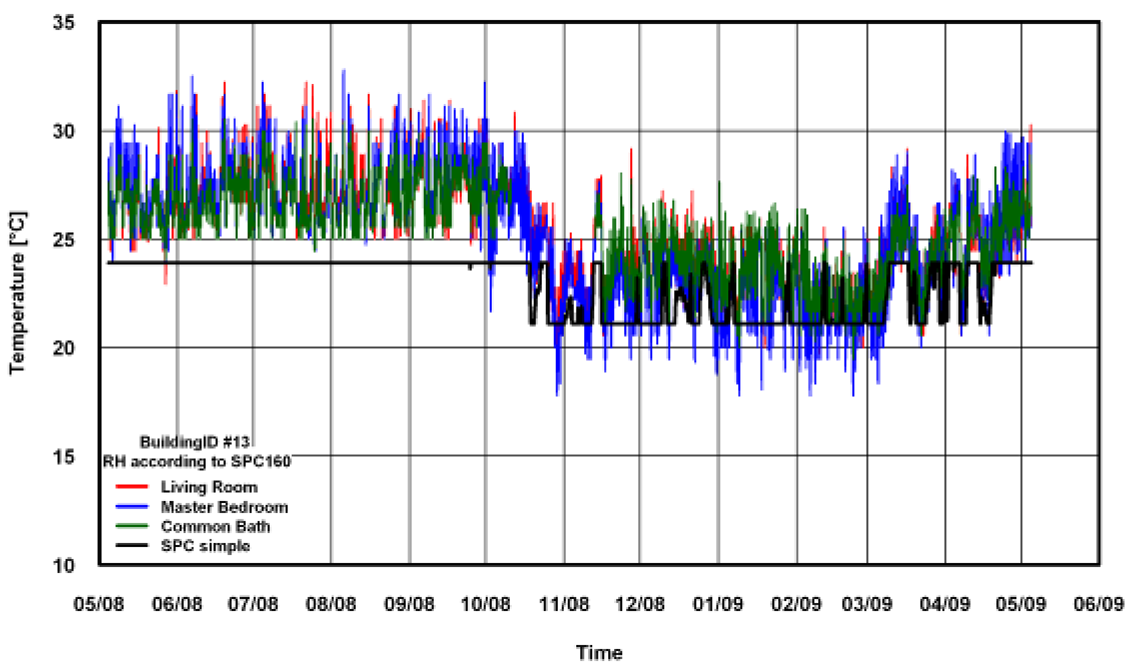

Figure 51: Temperature Comparison of SPC 160 Simple Method for Building # 13

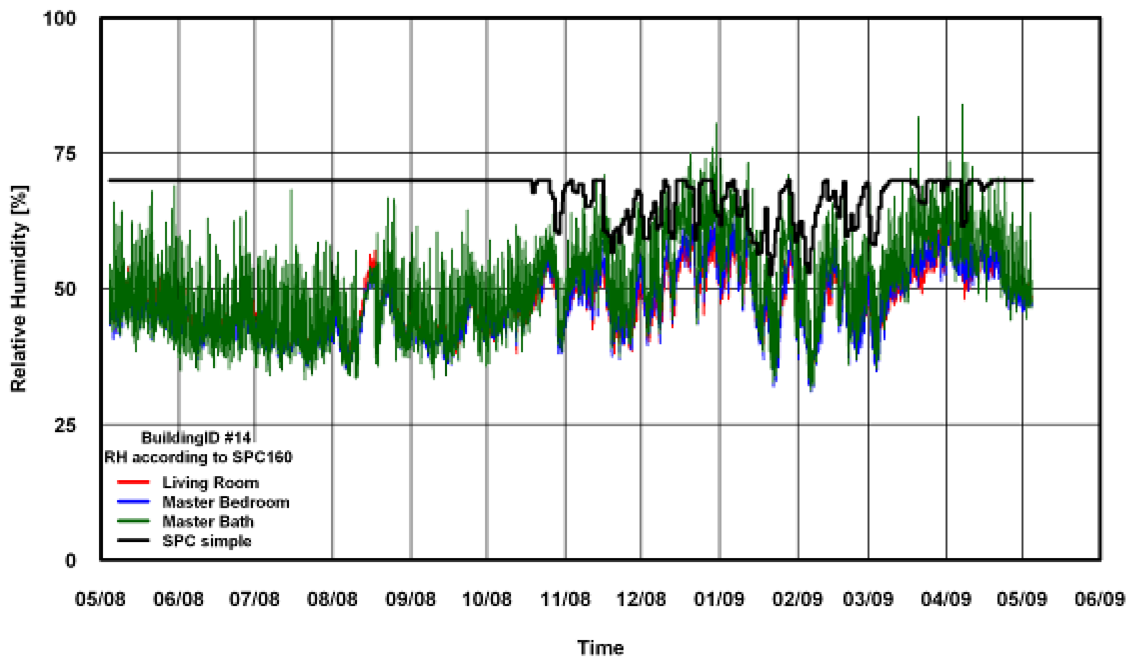

Figure 52: RH Comparison of SPC 160 Simple Method for Building # 14

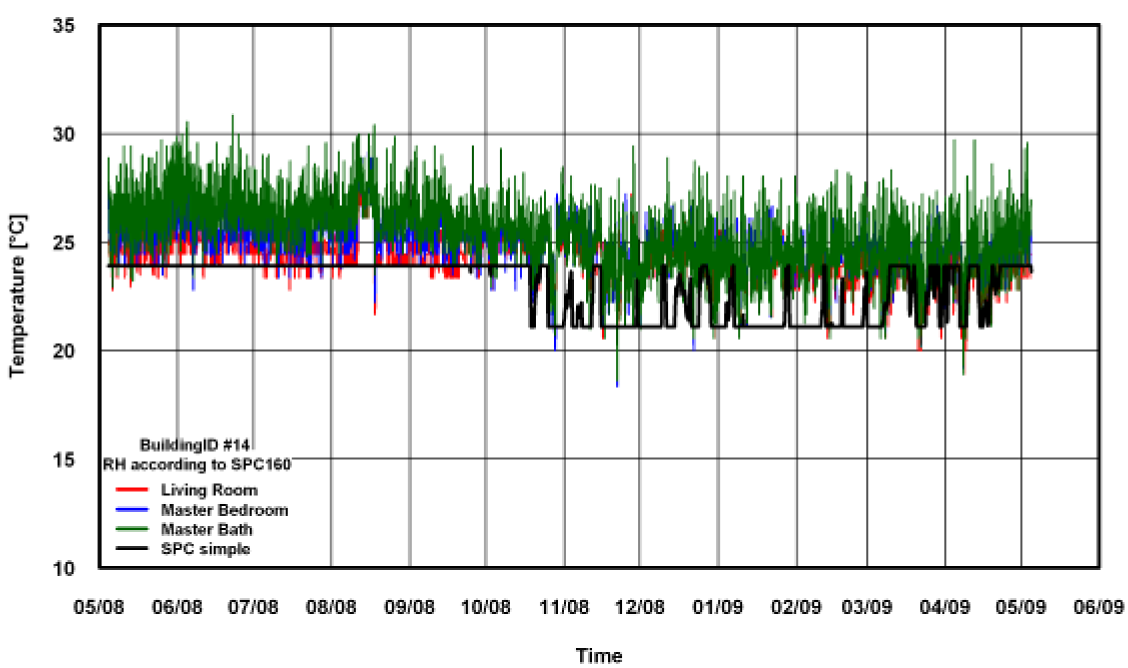

Figure 53: Temperature Comparison of SPC 160 Simple Method for Building # 14

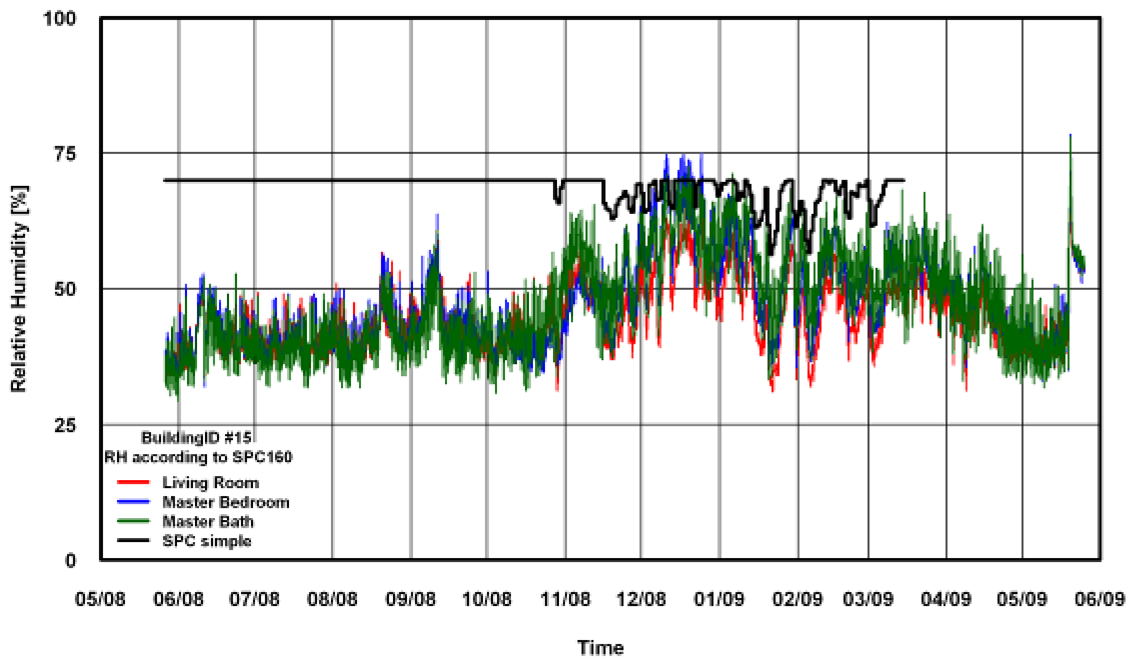

Figure 54: RH Comparison of SPC 160 Simple Method for Building # 15

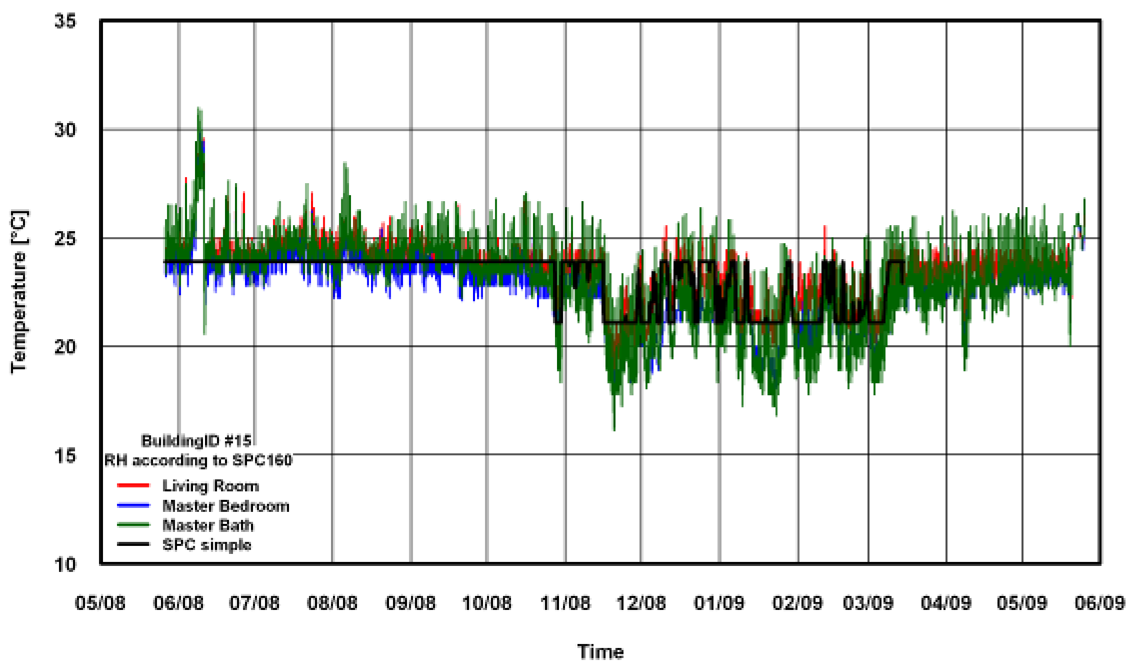

Figure 55: Temperature Comparison of SPC 160 Simple Method for Building # 15

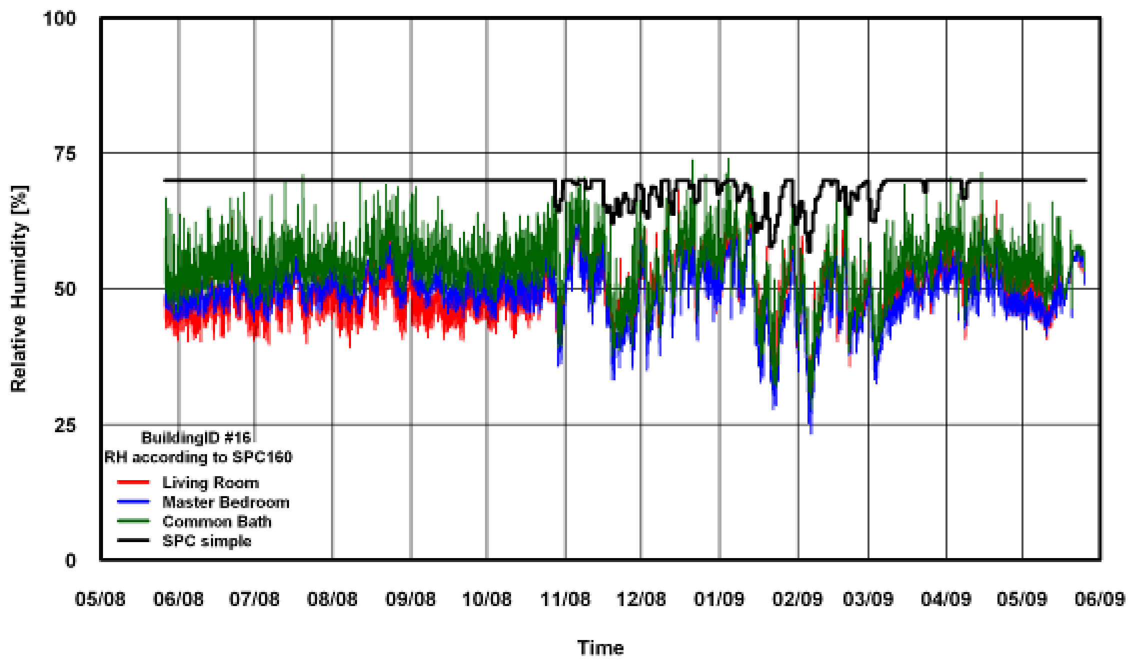

Figure 56: RH Comparison of SPC 160 Simple Method for Building # 16

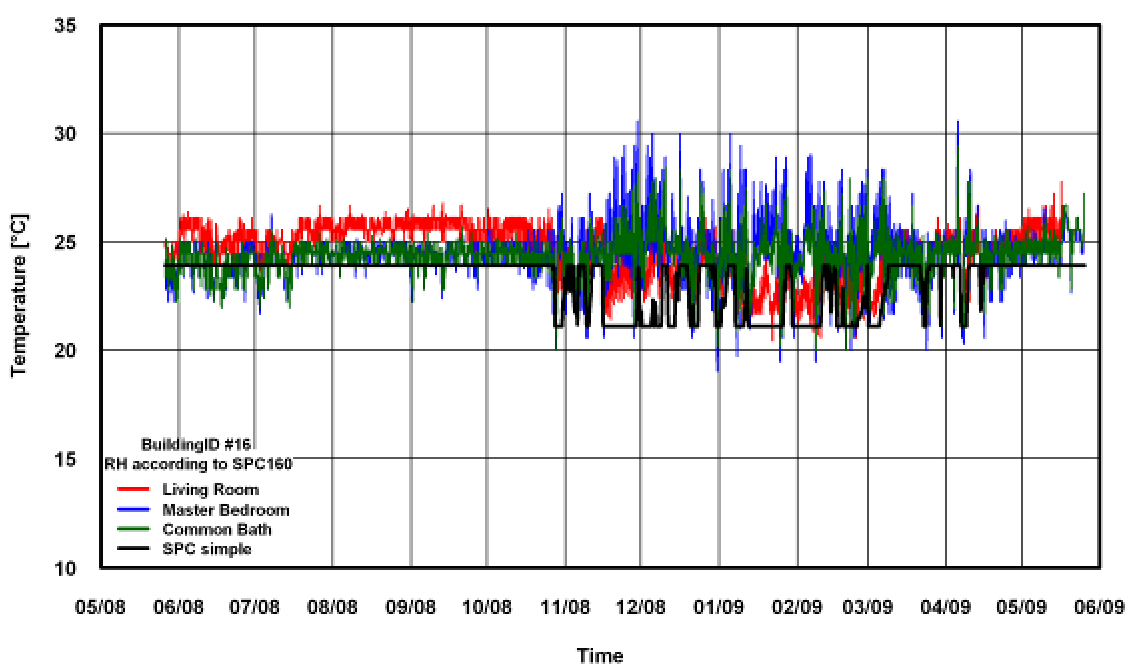

Figure 57: Temperature Comparison of SPC 160 Simple Method for Building # 16

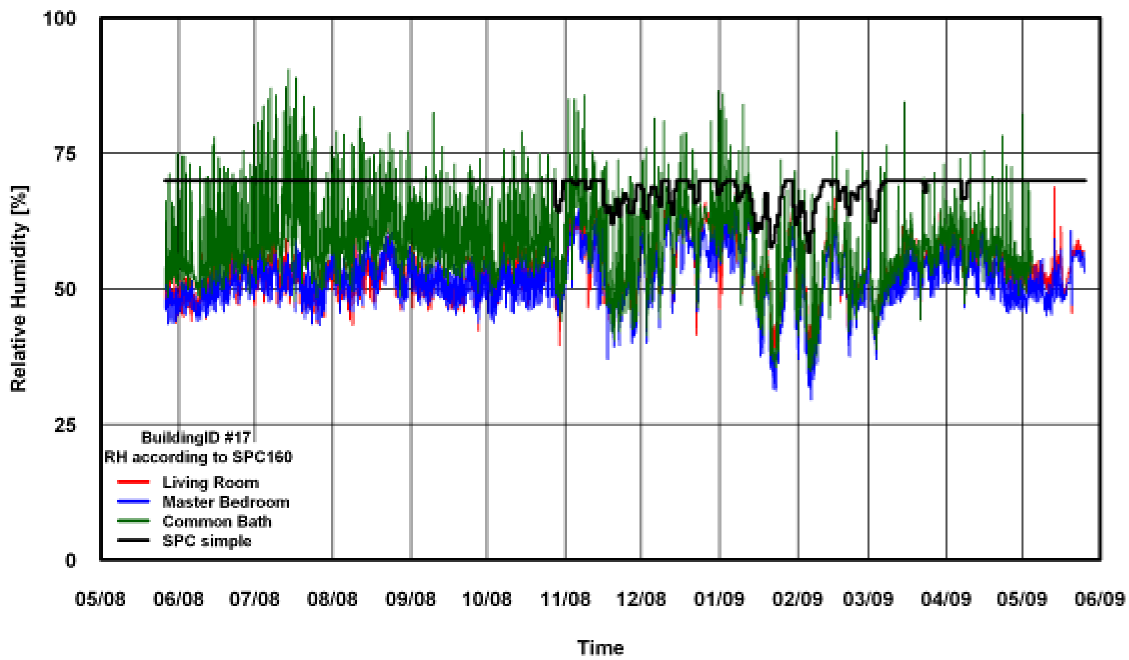

Figure 58: RH Comparison of SPC 160 Simple Method for Building # 17

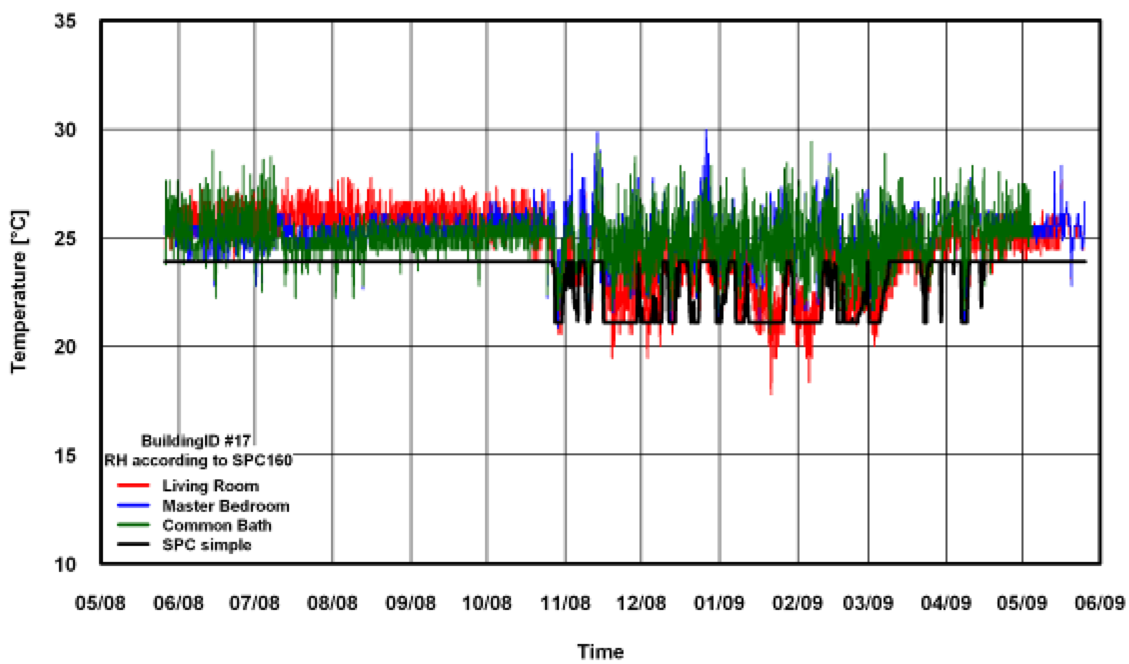

Figure 59: Temperature Comparison of SPC 160 Simple Method for Building # 17

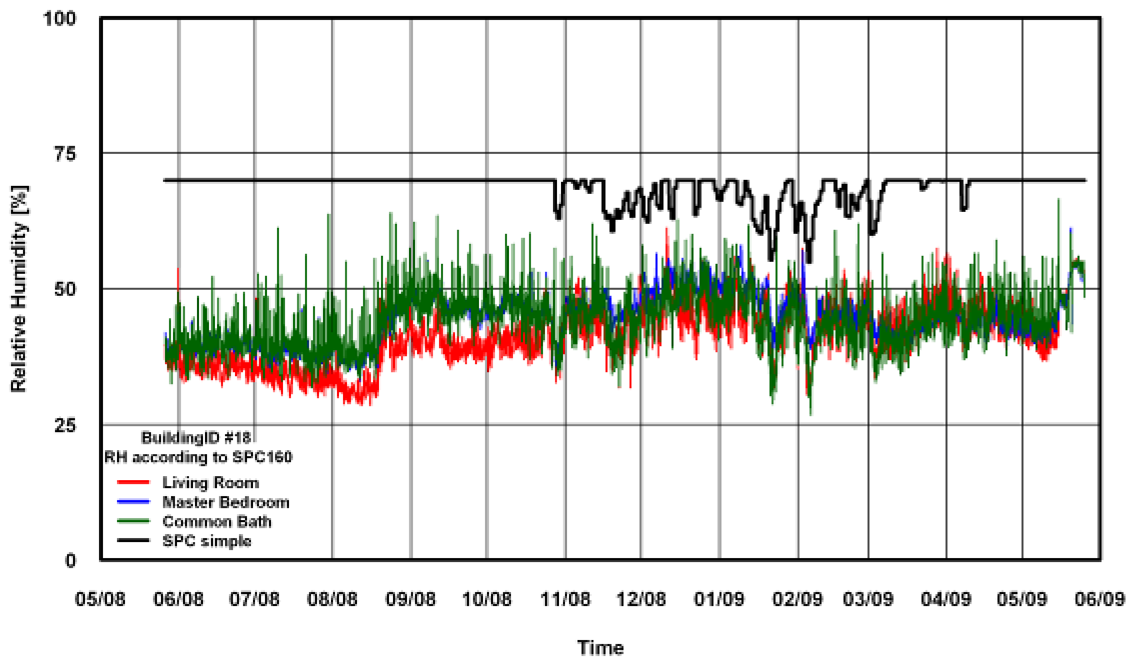

Figure 60: RH Comparison of SPC 160 Simple Method for Building # 18

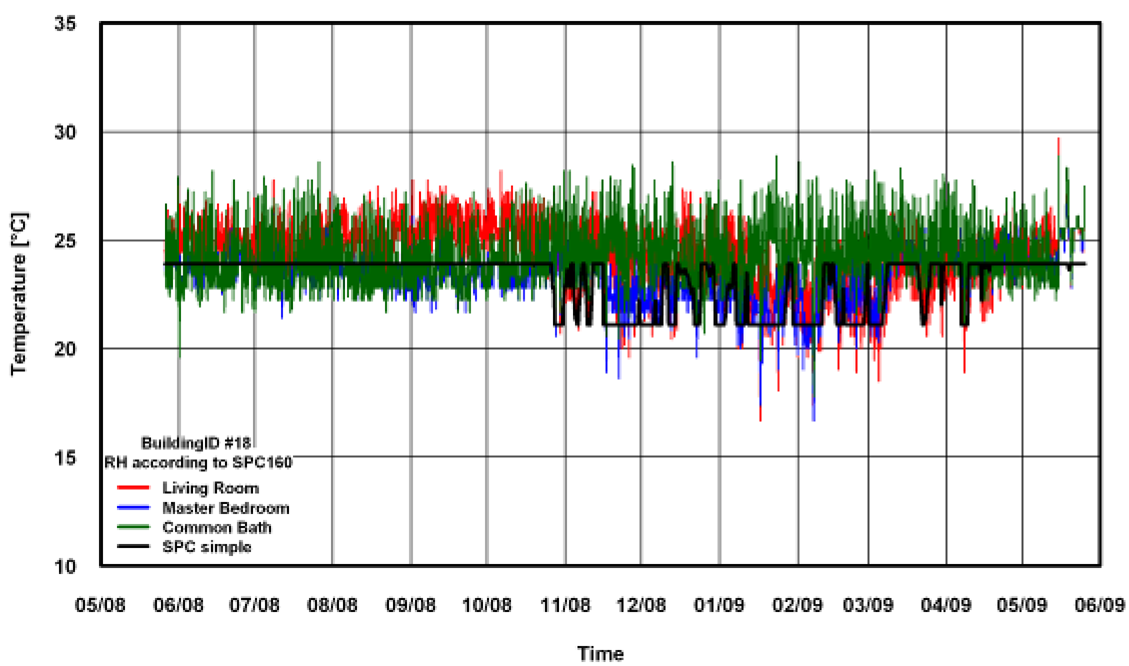

Figure 61: Temperature Comparison of SPC 160 Simple Method for Building # 18

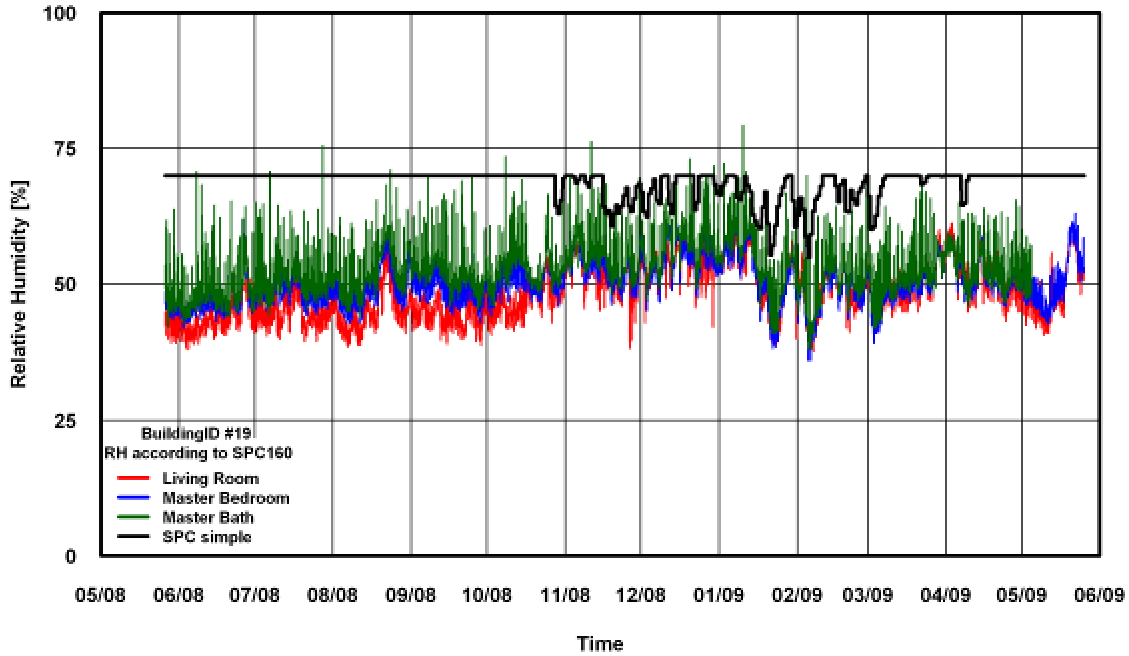

Figure 62: RH Comparison of SPC 160 Simple Method for Building # 19

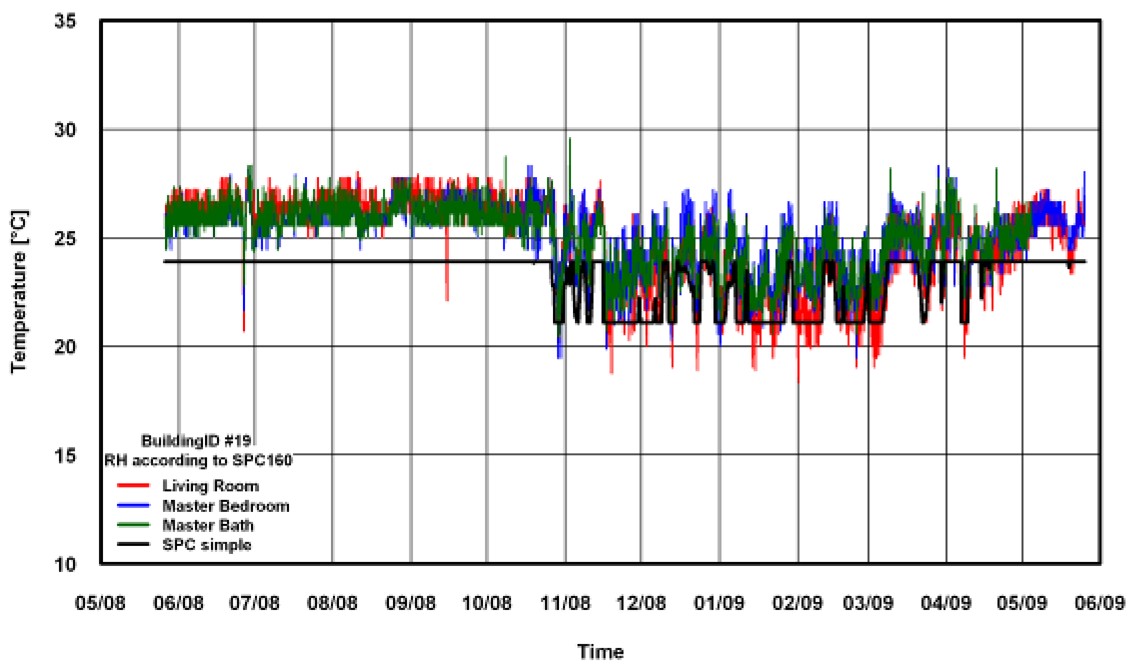

Figure 63: Temperature Comparison of SPC 160 Simple Method for Building # 19

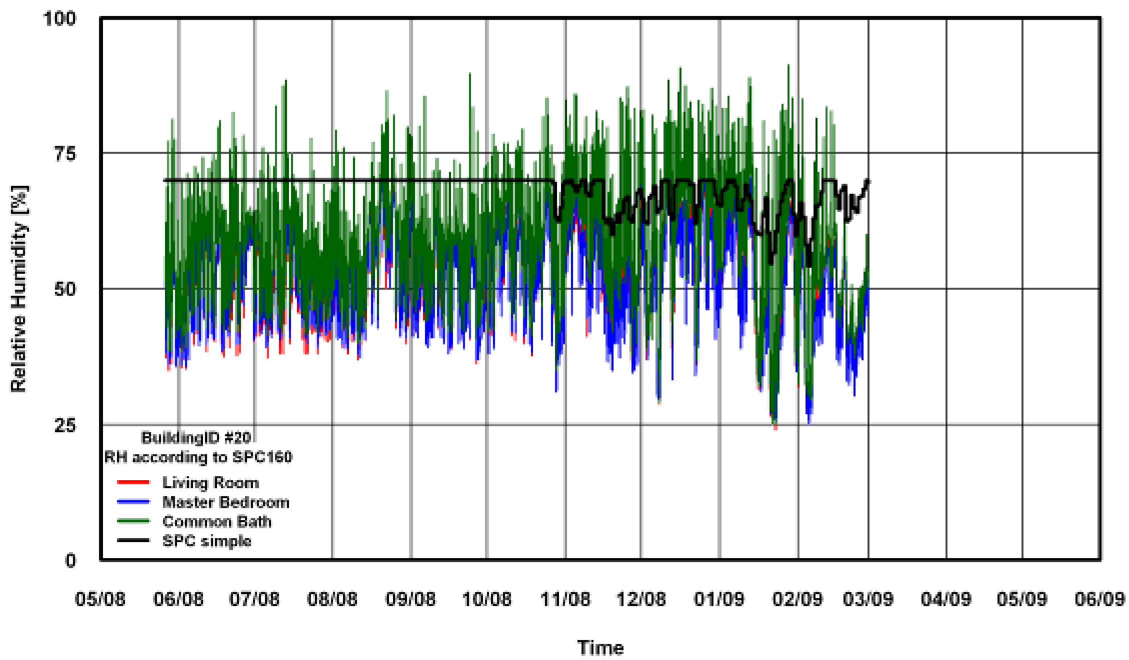

Figure 64: RH Comparison of SPC 160 Simple Method for Building # 20

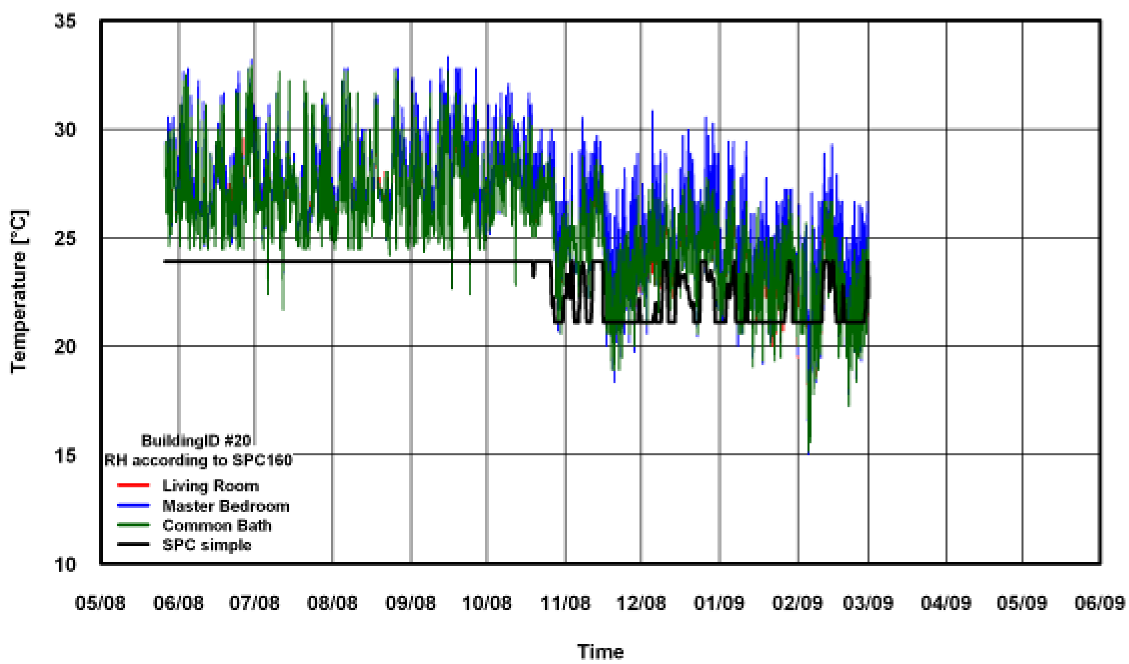

Figure 65: Temperature Comparison of SPC 160 Simple Method for Building # 20

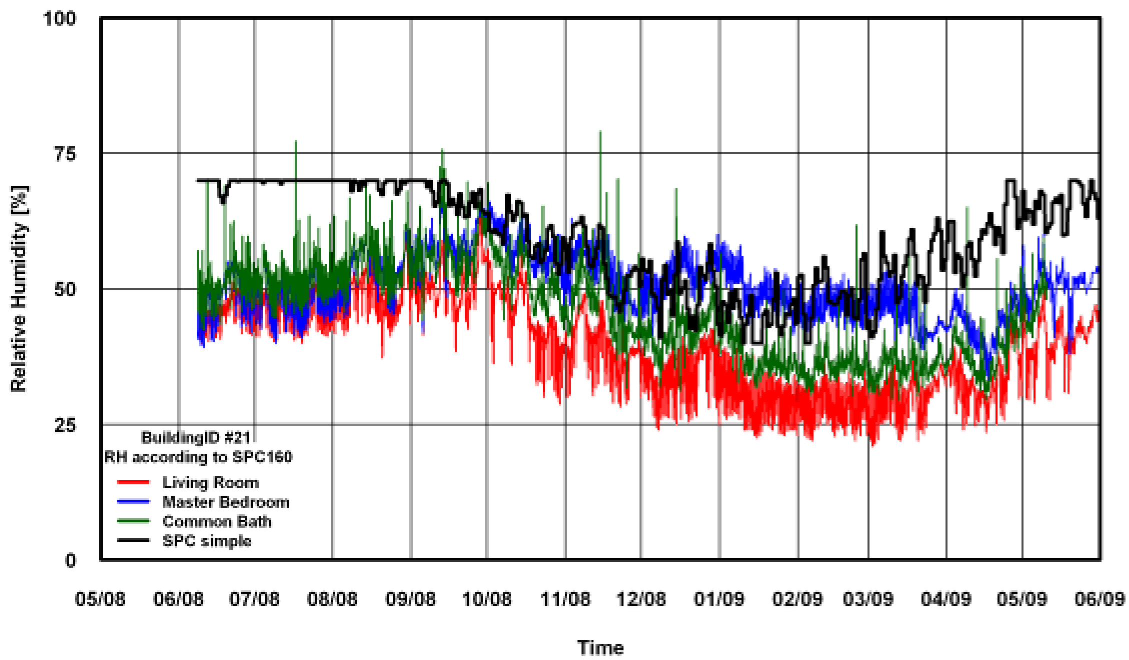

Figure 66: RH Comparison of SPC 160 Simple Method for Building # 21

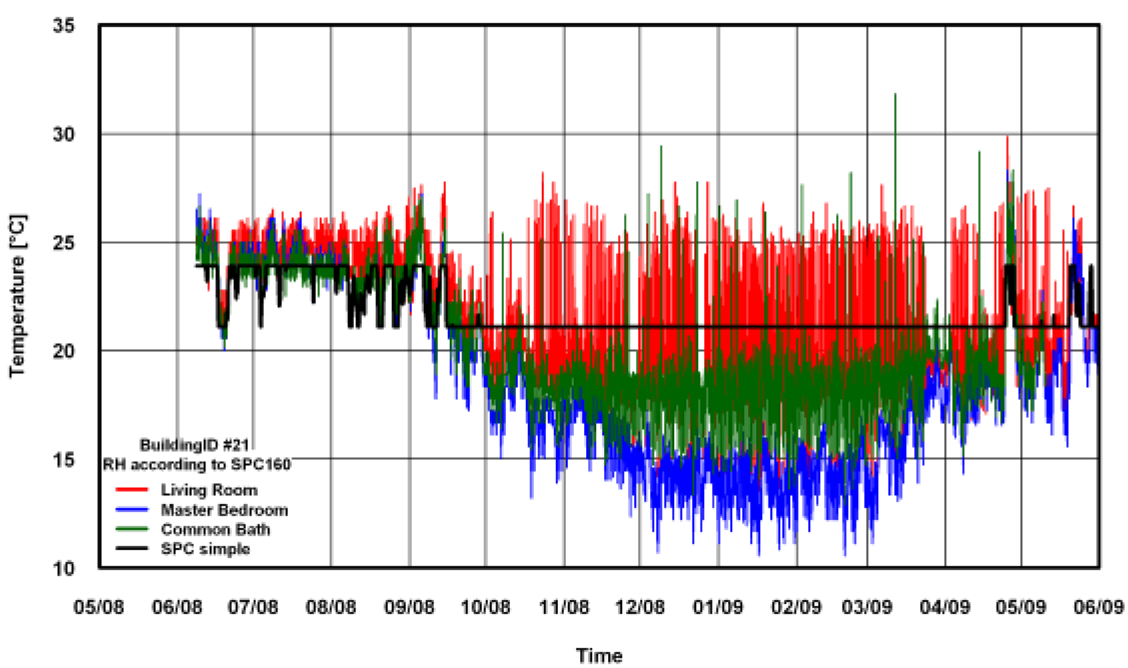

Figure 67: Temperature Comparison of SPC 160 Simple Method for Building # 21

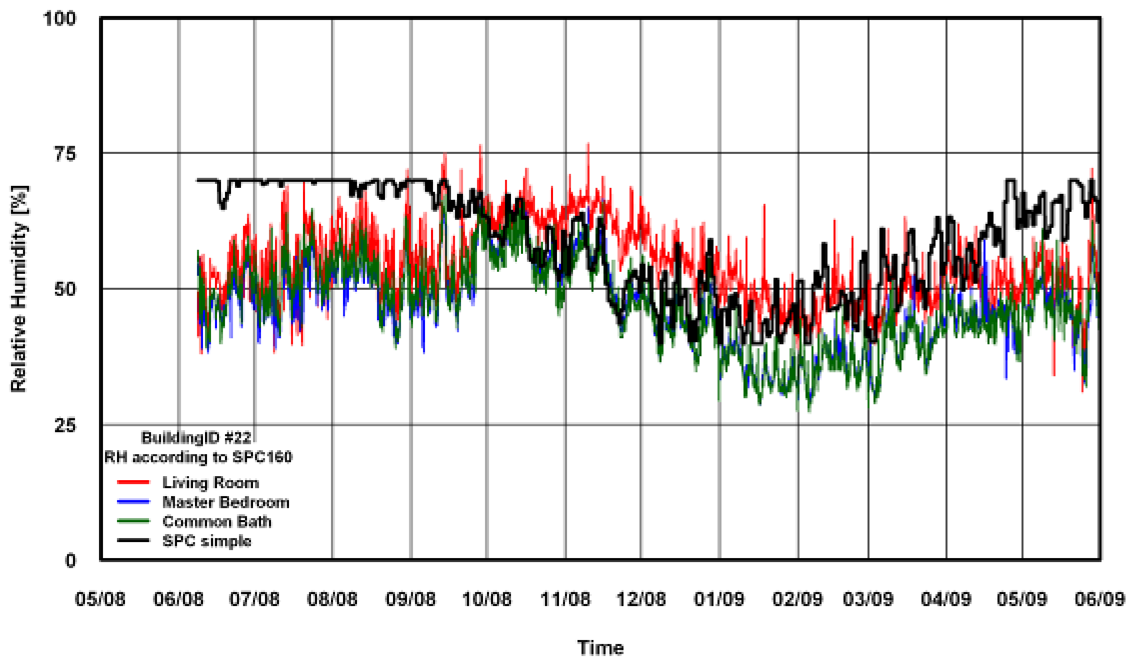

Figure 68: RH Comparison of SPC 160 Simple Method for Building # 22

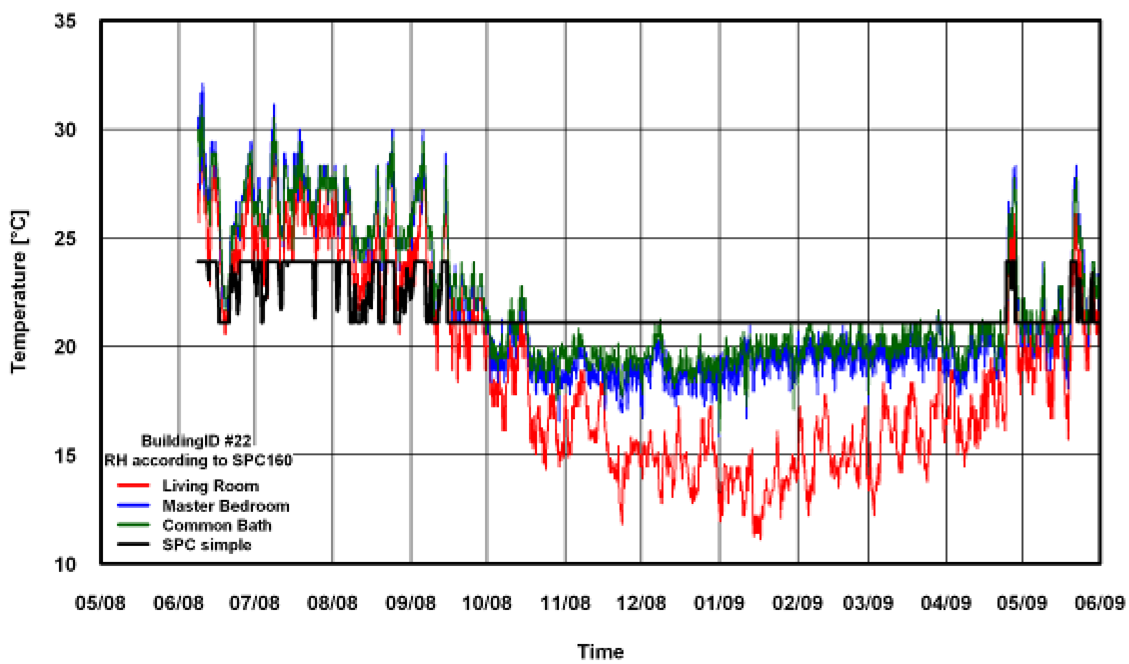

Figure 69: Temperature Comparison of SPC 160 Simple Method for Building # 22

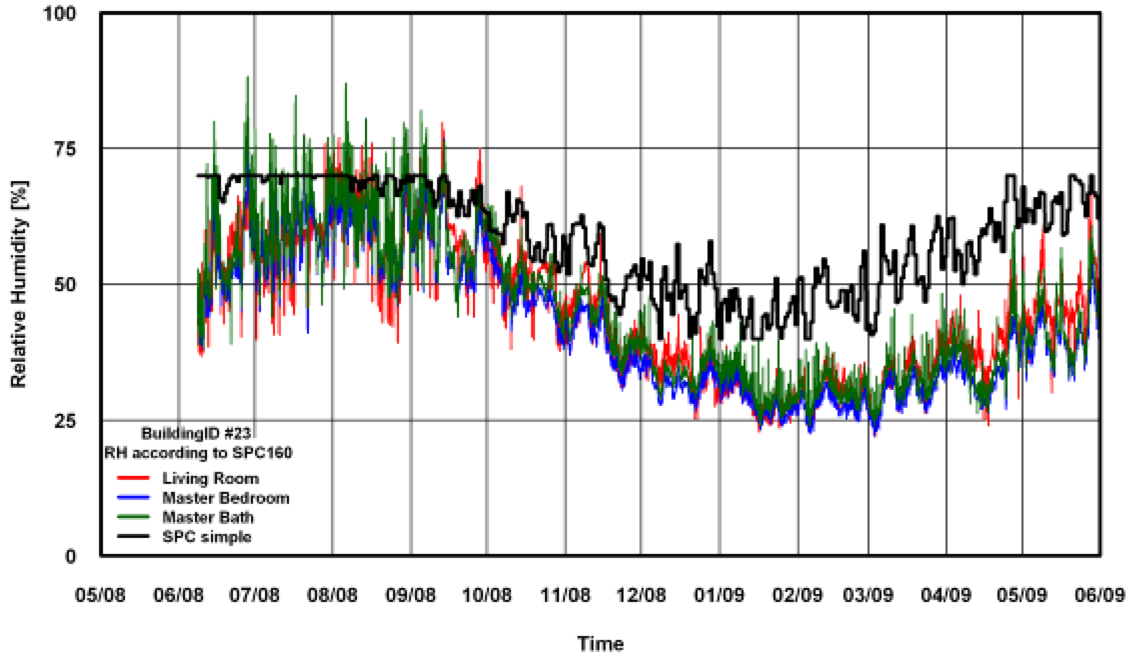

Figure 70: RH Comparison of SPC 160 Simple Method for Building # 23

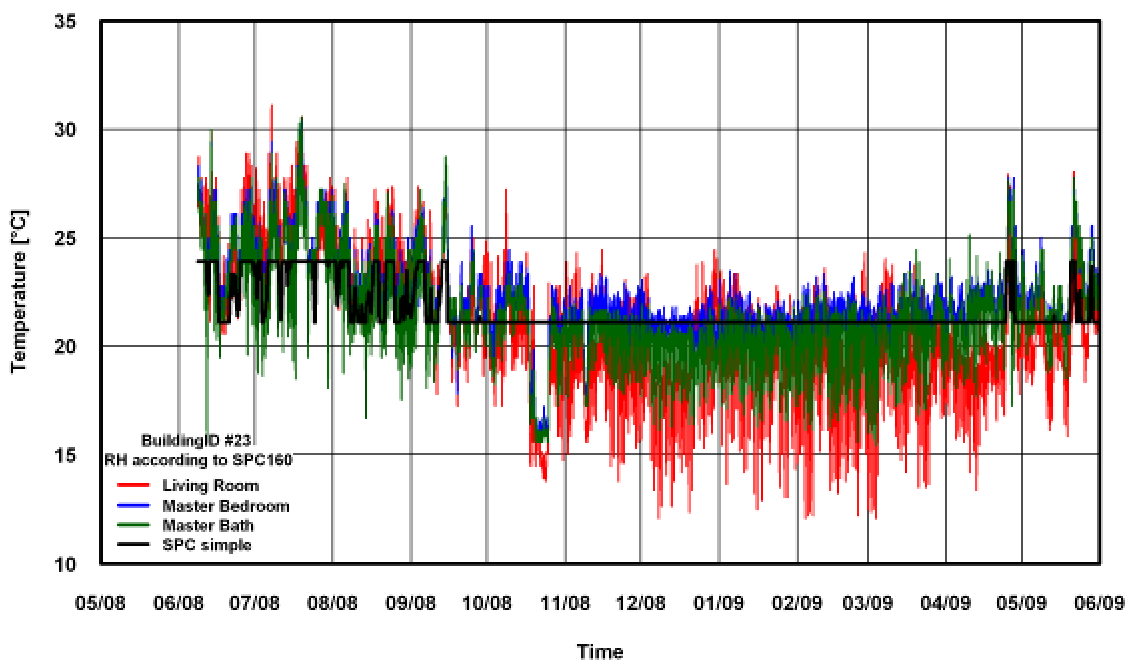

Figure 71: Temperature Comparison of SPC 160 Simple Method for Building # 23

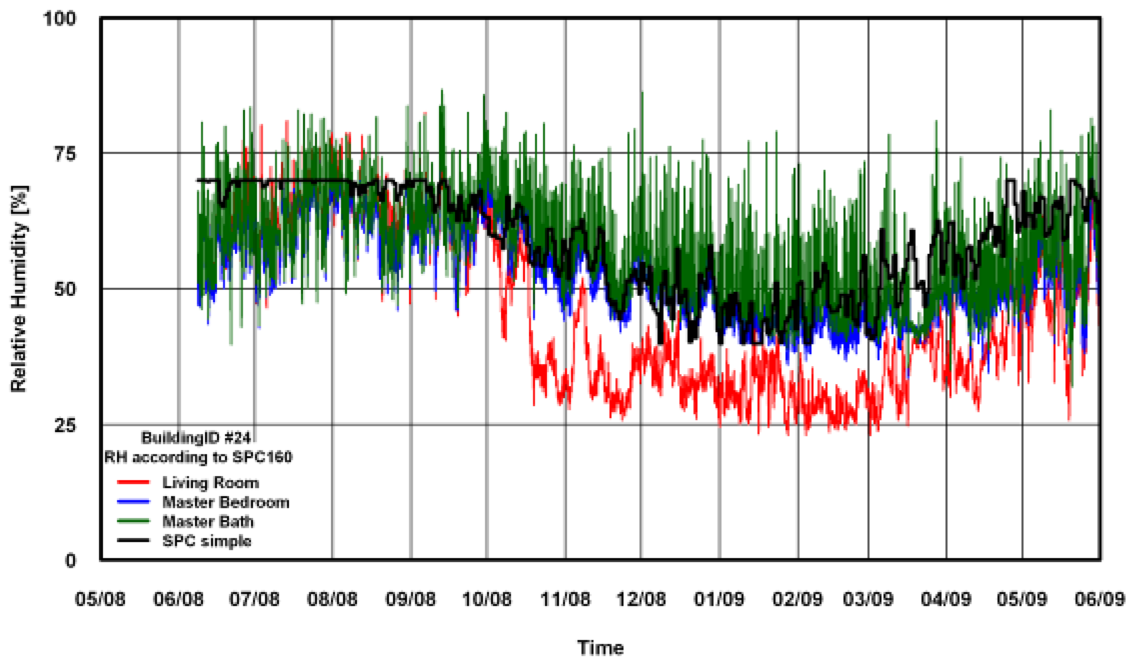

Figure 72: RH Comparison of SPC 160 Simple Method for Building # 24

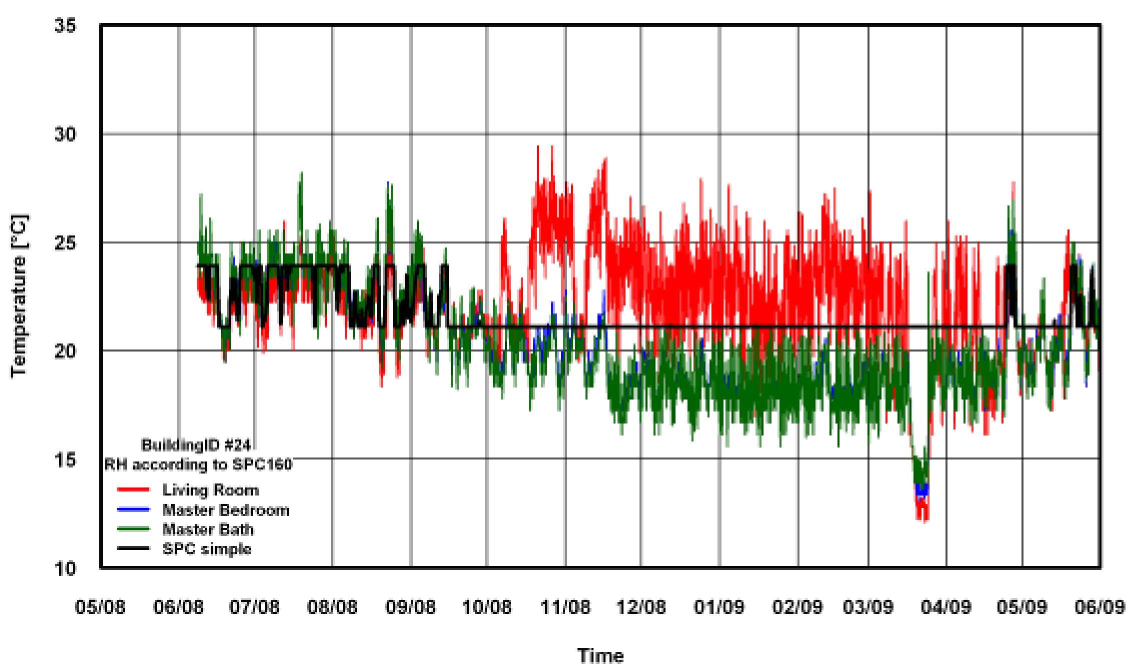

Figure 73: Temperature Comparison of SPC 160 Simple Method for Building # 24

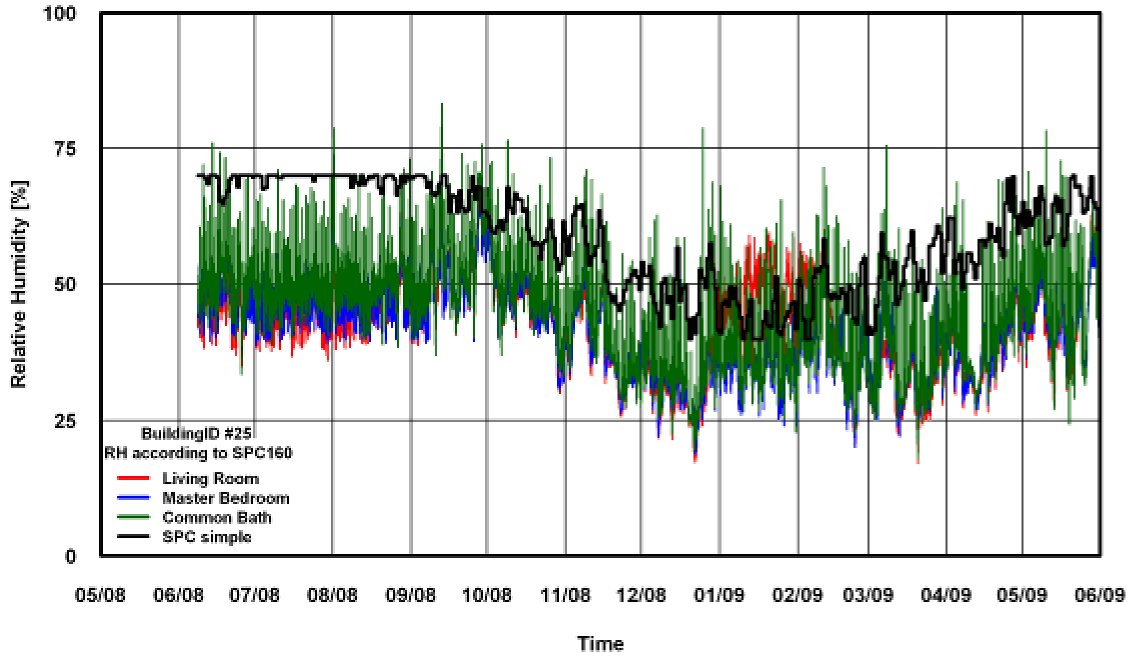

Figure 74: RH Comparison of SPC 160 Simple Method for Building # 25

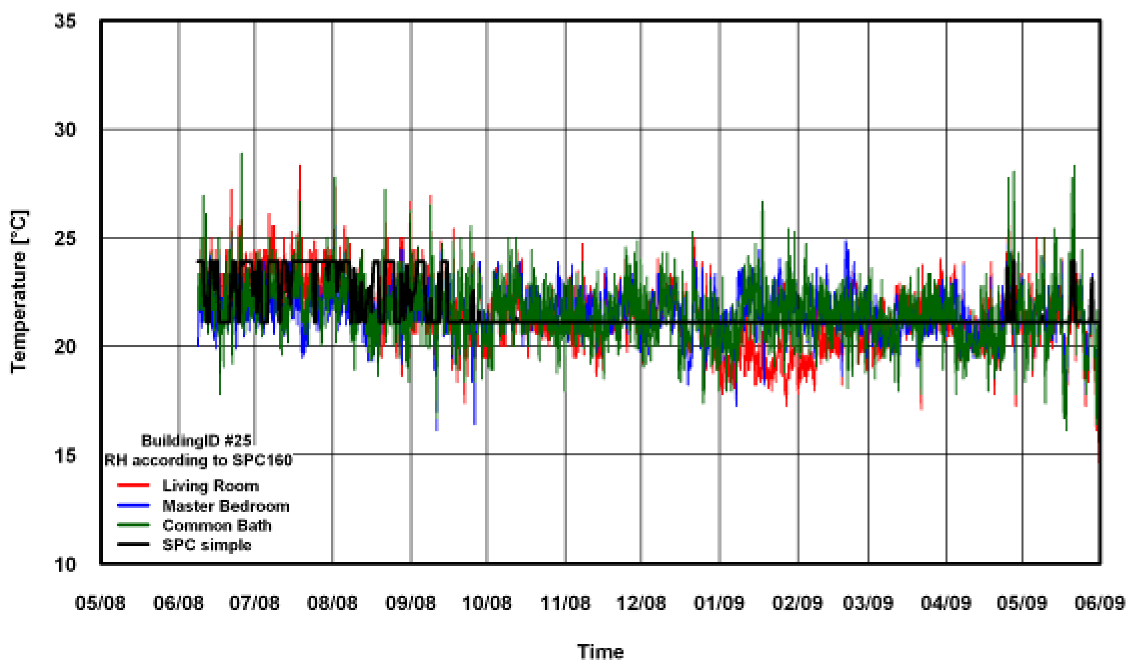

Figure 75: Temperature Comparison of SPC 160 Simple Method for Building # 25

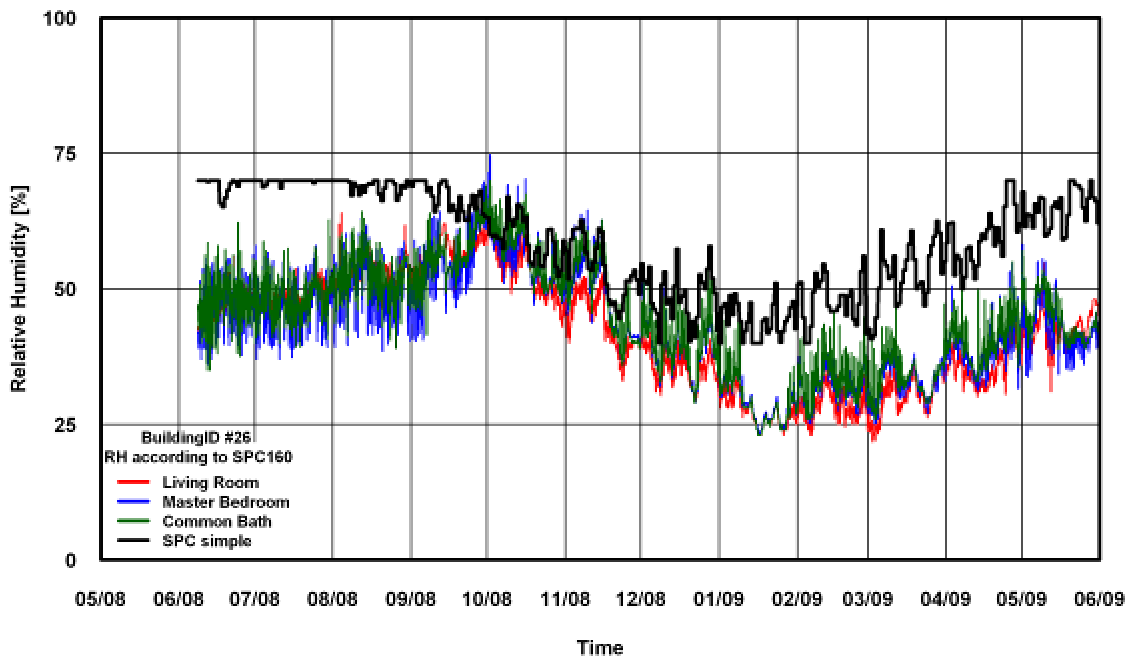

Figure 76: RH Comparison of SPC 160 Simple Method for Building # 26

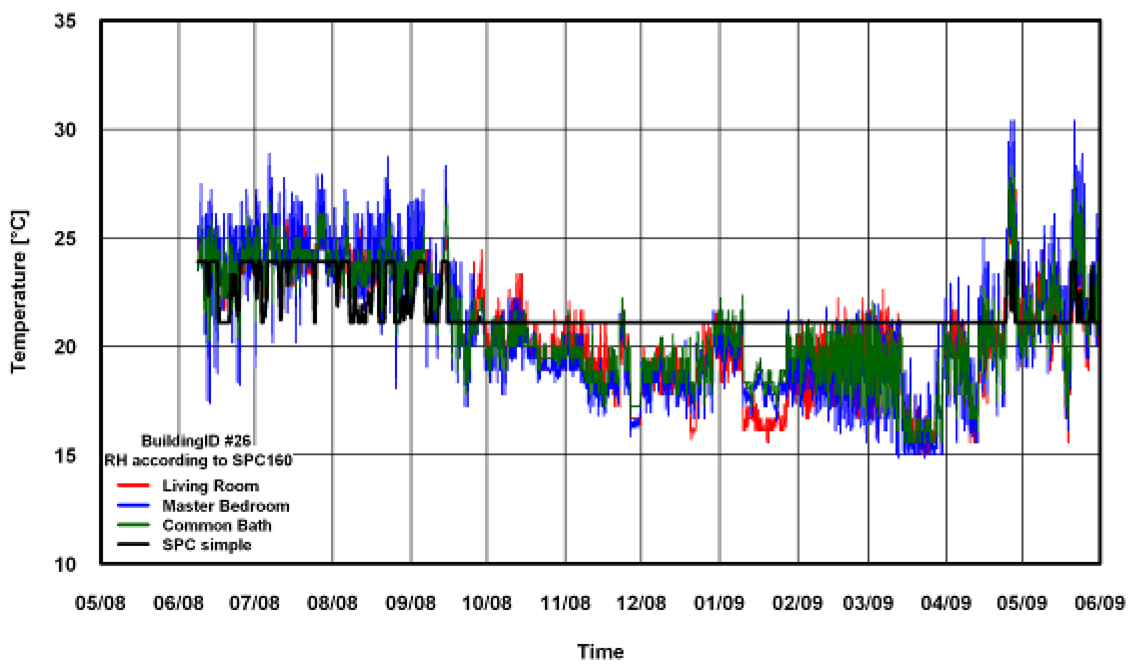

Figure 77: Temperature Comparison of SPC 160 Simple Method for Building # 26

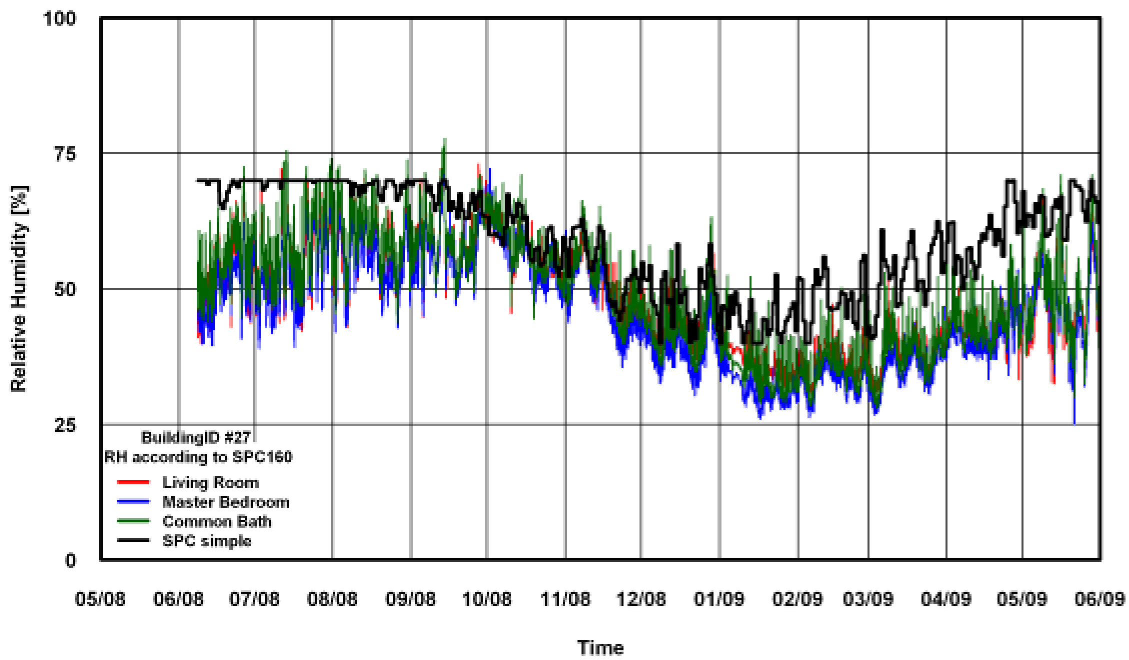

Figure 78: RH Comparison of SPC 160 Simple Method for Building # 27

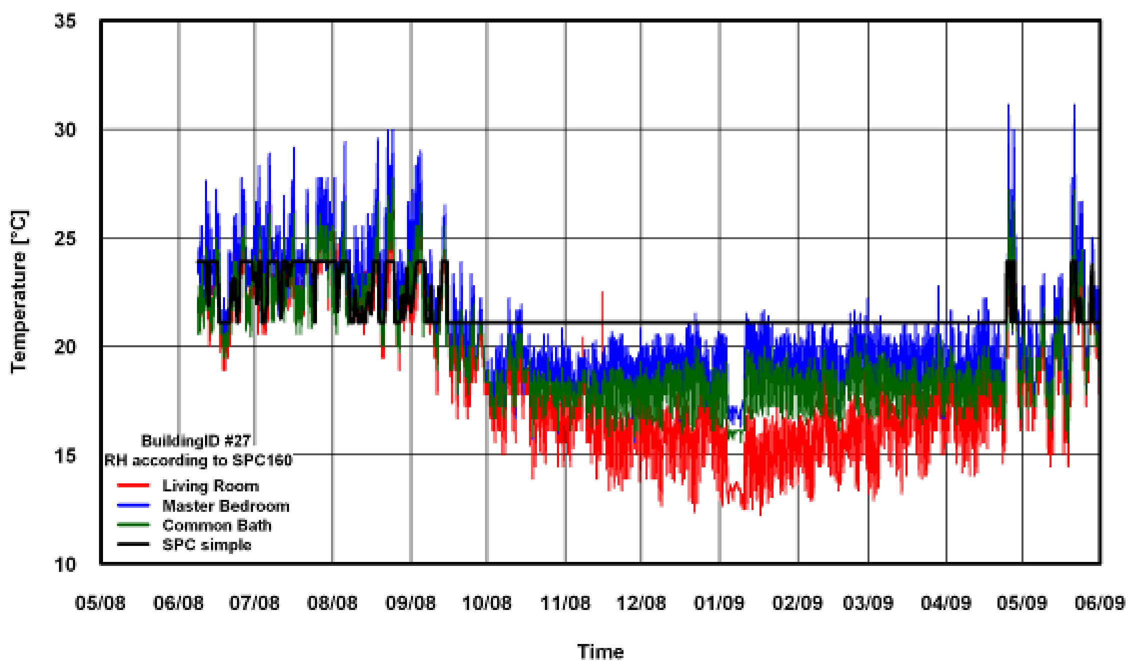

Figure 79: Temperature Comparison of SPC 160 Simple Method for Building # 27

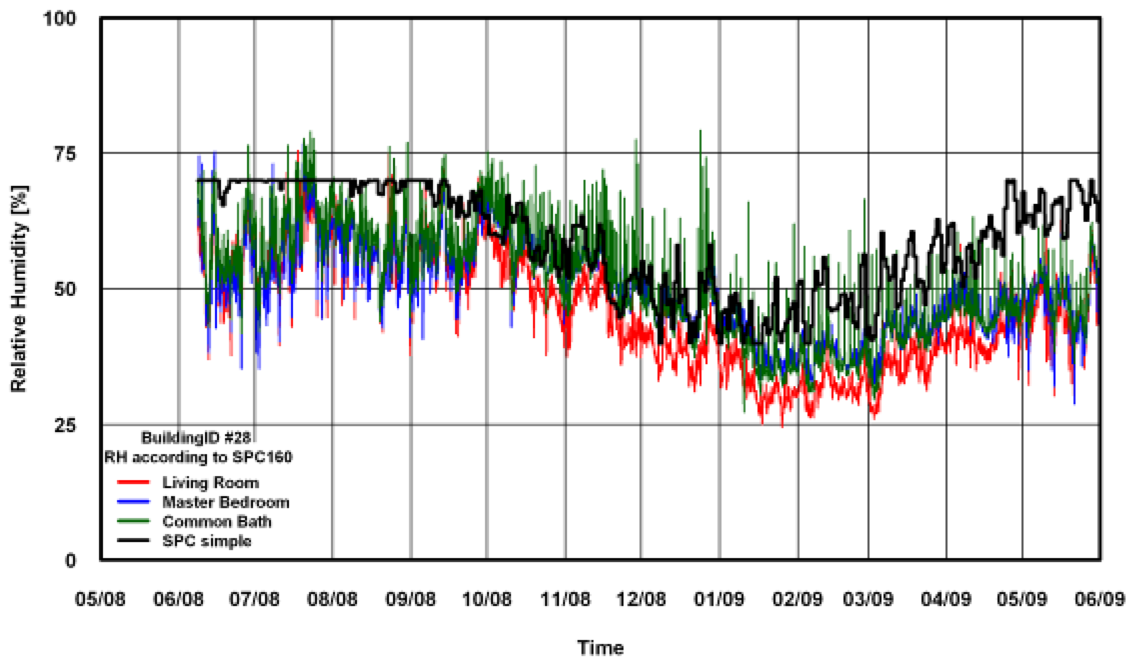

Figure 80: RH Comparison of SPC 160 Simple Method for Building # 28

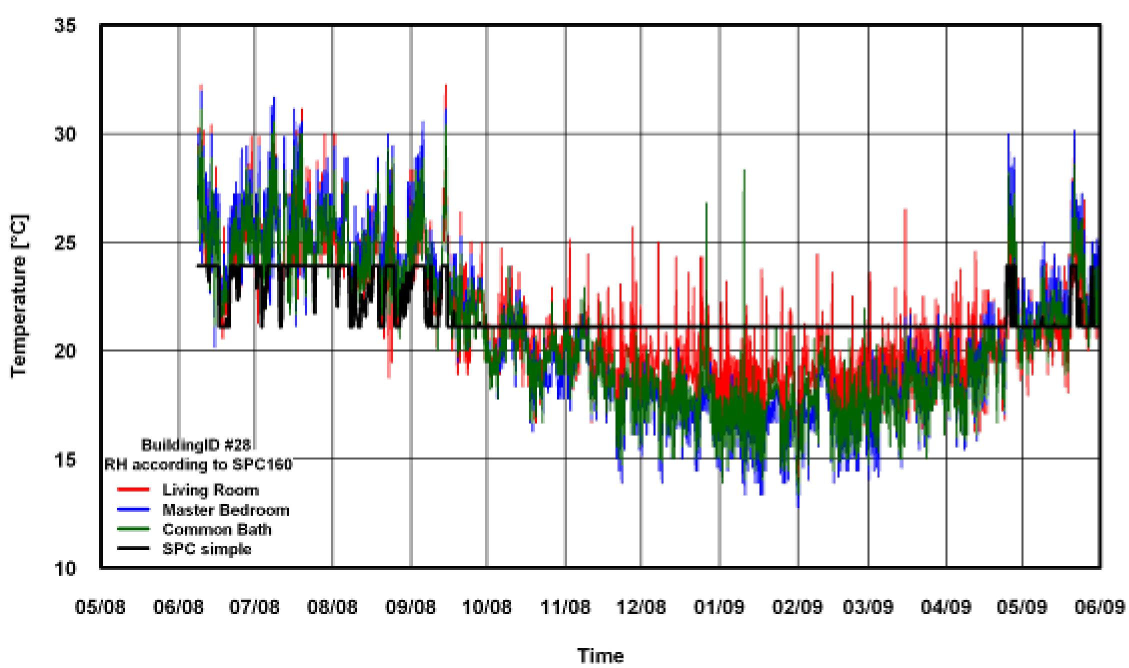

Figure 81: Temperature Comparison of SPC 160 Simple Method for Building # 28

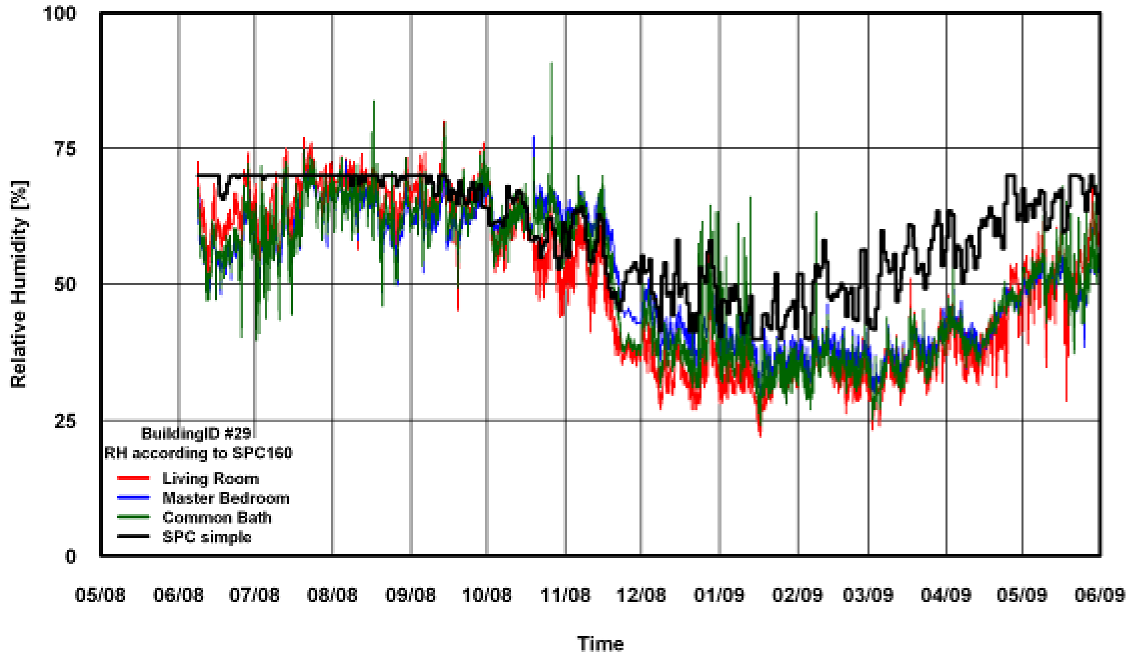

Figure 82: RH Comparison of SPC 160 Simple Method for Building # 29

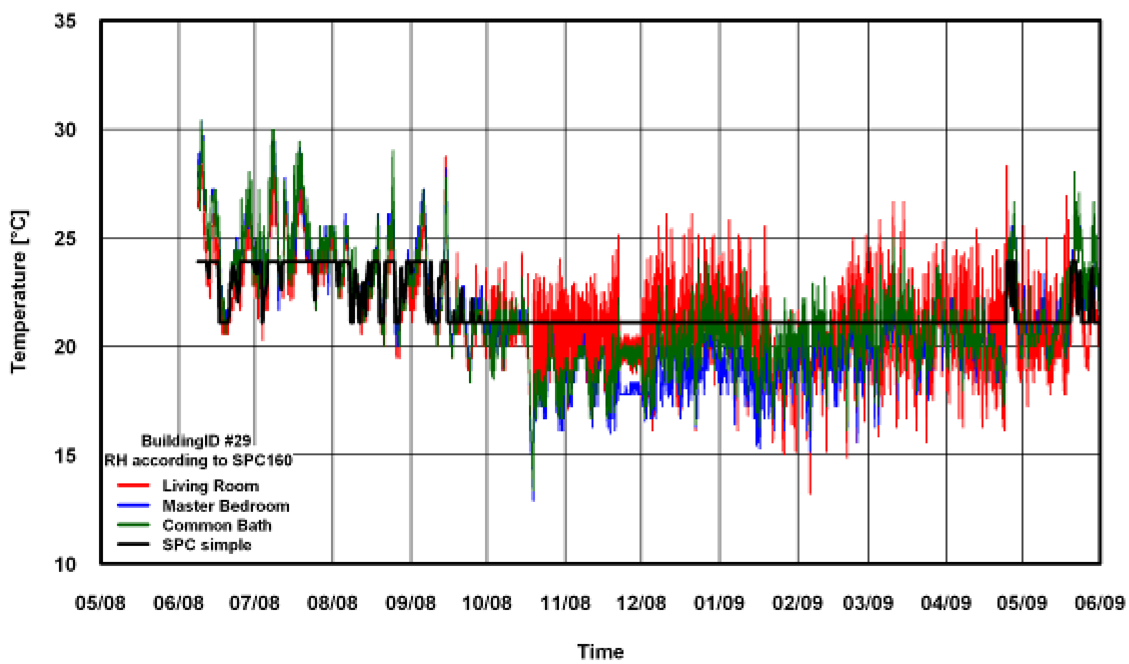

Figure 83: Temperature Comparison of SPC 160 Simple Method for Building # 29

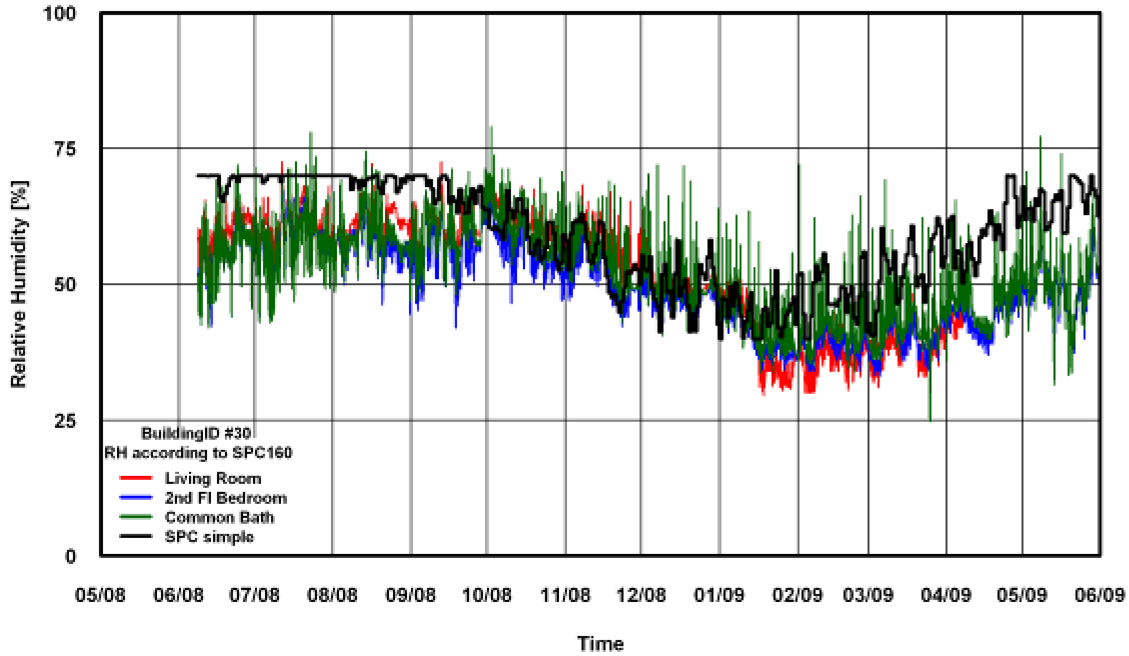

Figure 84: RH Comparison of SPC 160 Simple Method for Building # 30

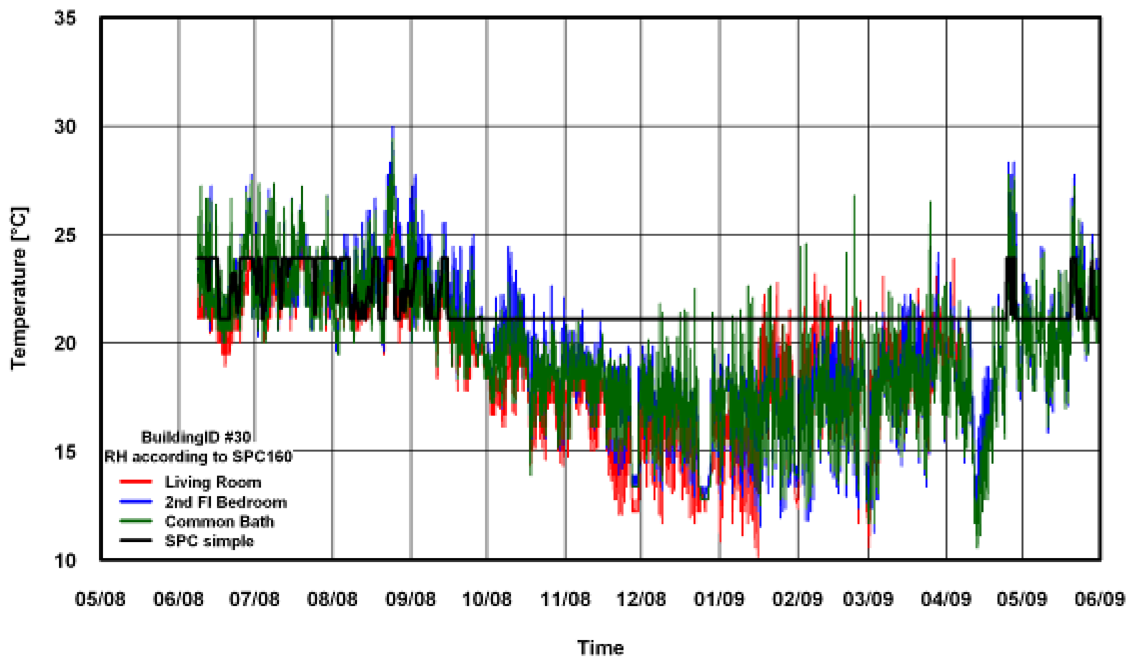

Figure 85: Temperature Comparison of SPC 160 Simple Method for Building # 30

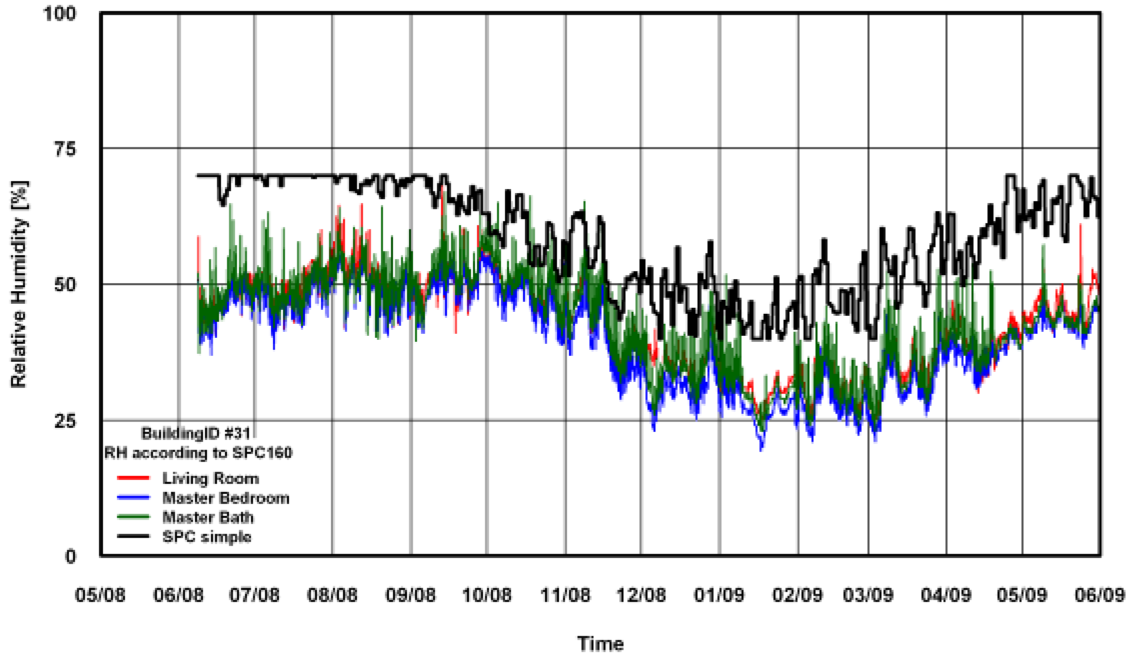

Figure 86: RH Comparison of SPC 160 Simple Method for Building # 31

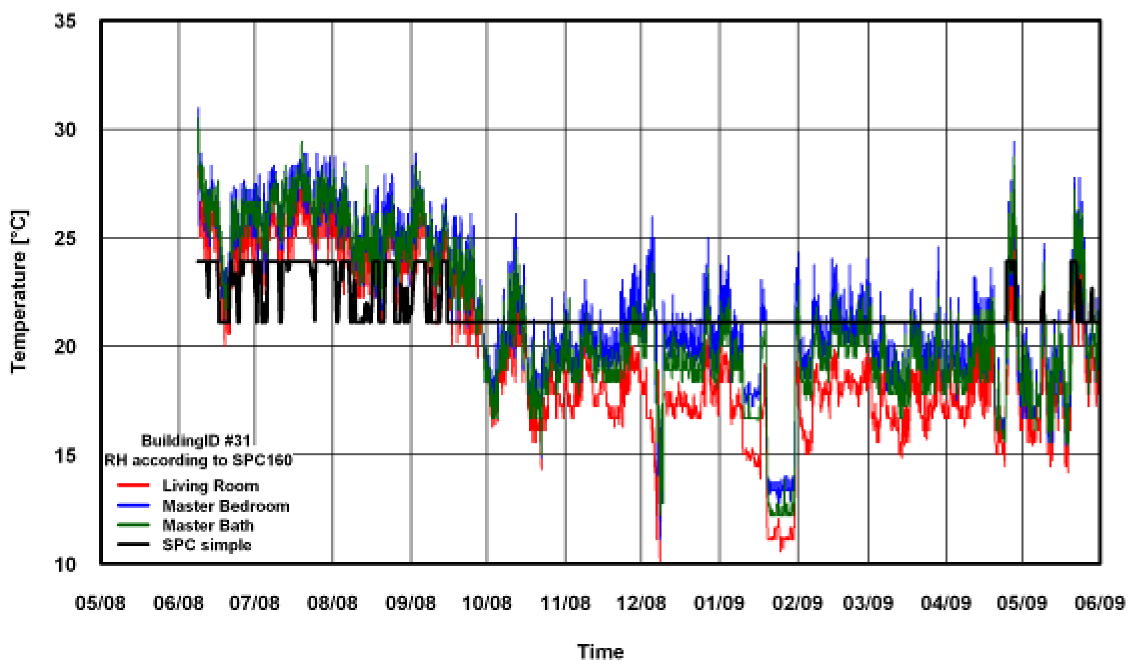

Figure 87: Temperature Comparison of SPC 160 Simple Method for Building # 31

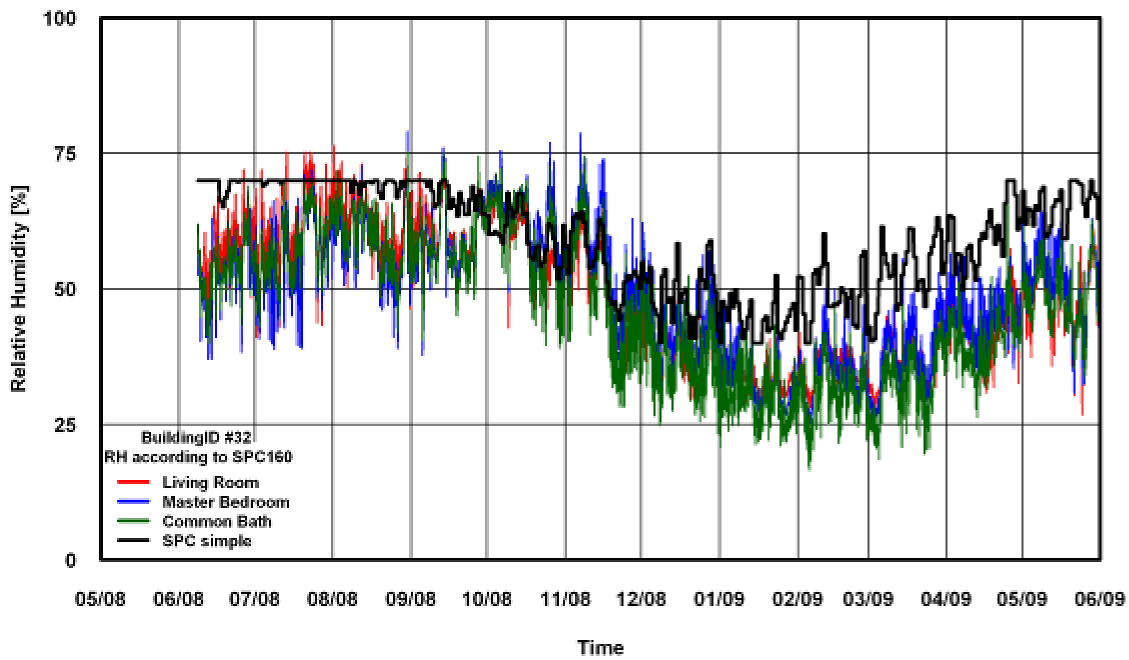

Figure 88: RH Comparison of SPC 160 Simple Method for Building # 32

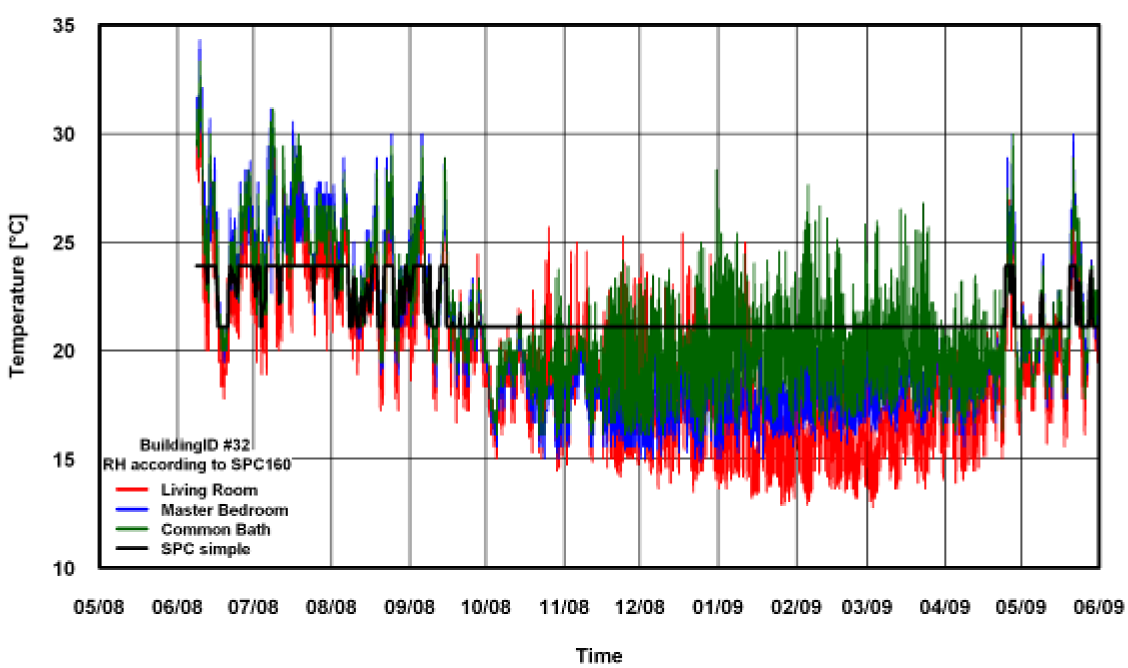

Figure 89: Temperature Comparison of SPC 160 Simple Method for Building # 32

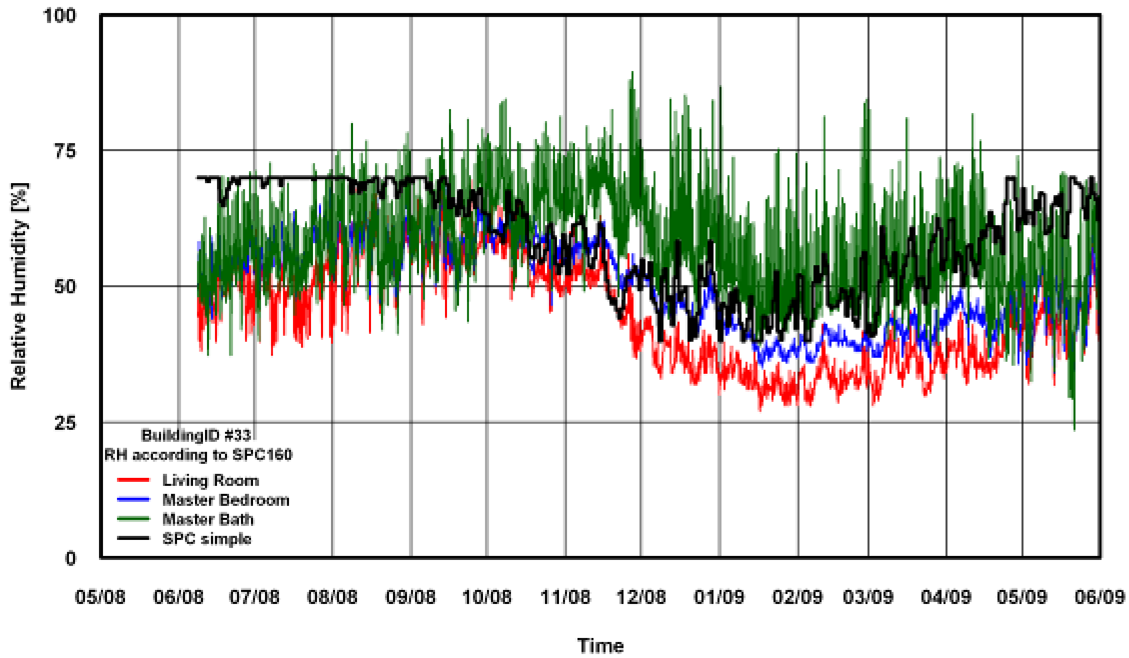

Figure 90: RH Comparison of SPC 160 Simple Method for Building # 33

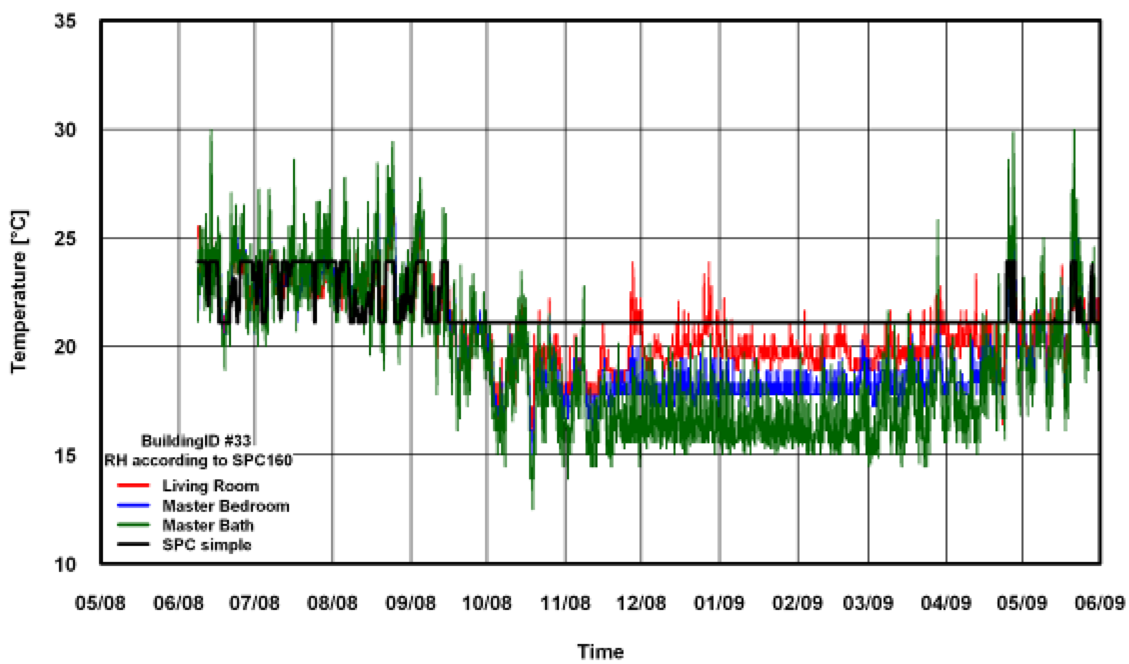

Figure 91: Temperature Comparison of SPC 160 Simple Method for Building # 33

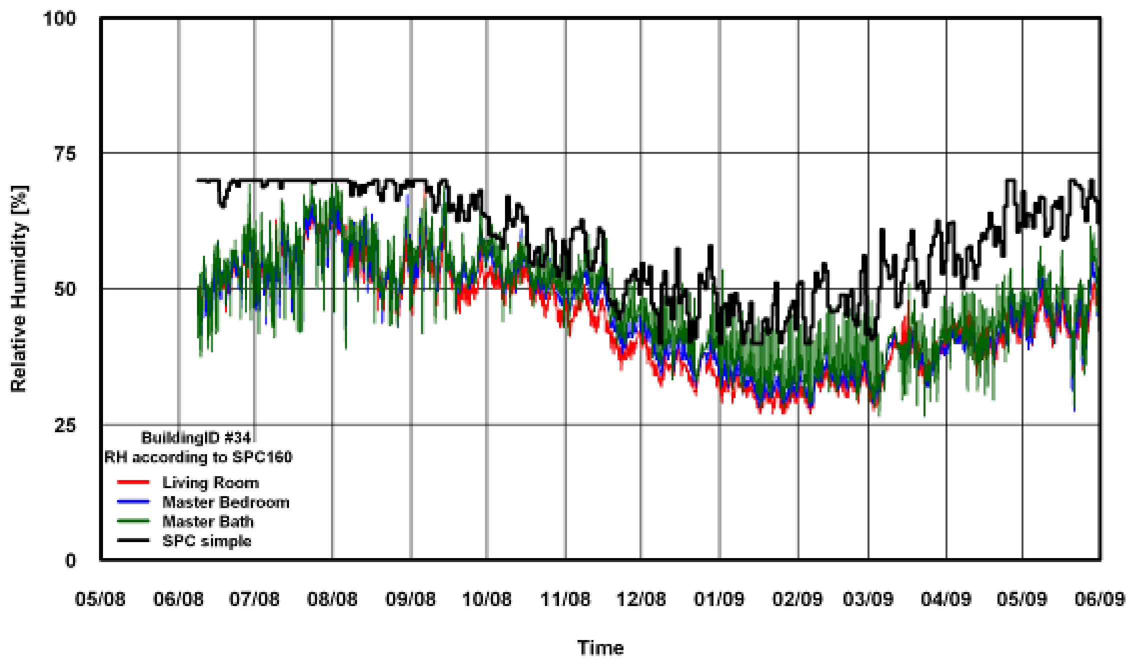

Figure 92: RH Comparison of SPC 160 Simple Method for Building # 34

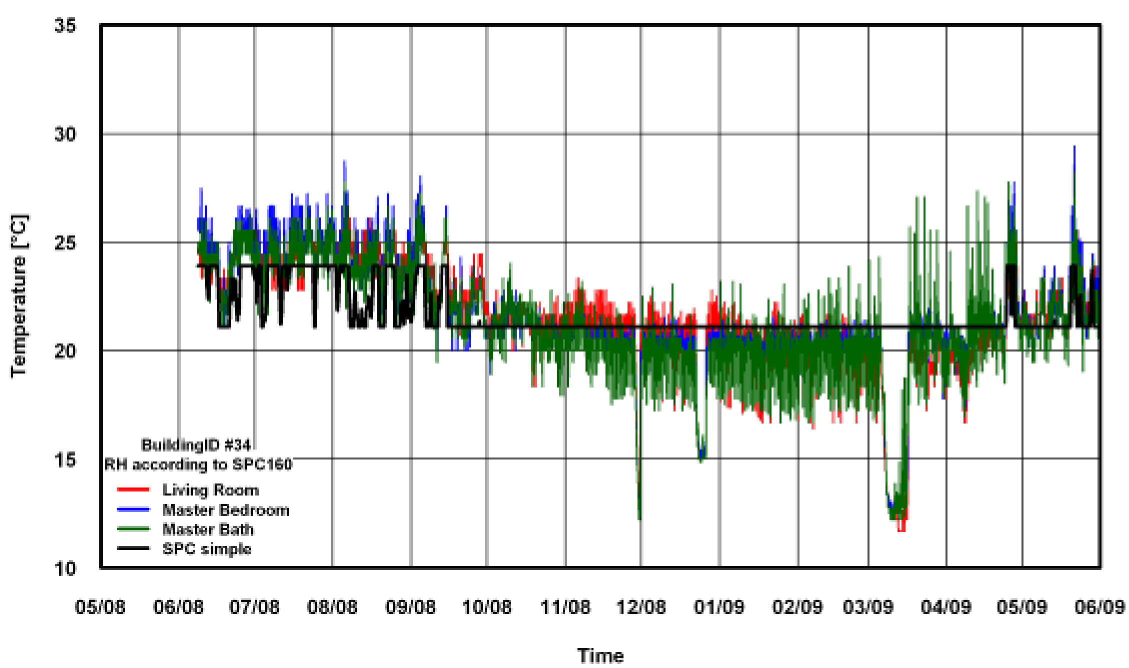

Figure 93: Temperature Comparison of SPC 160 Simple Method for Building # 34

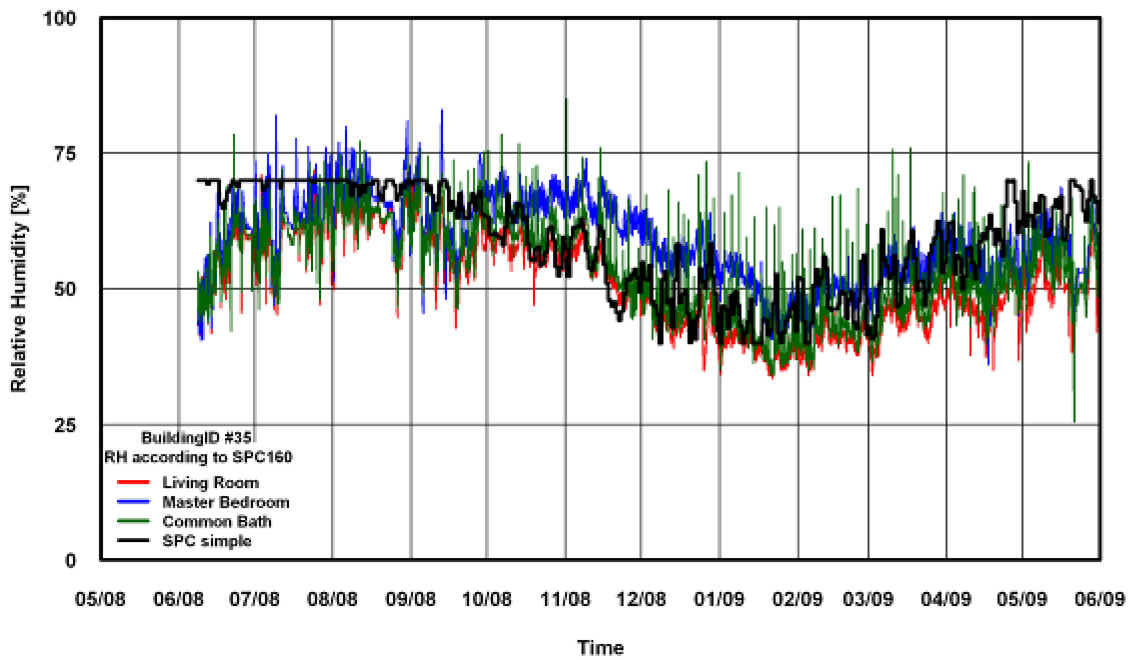

Figure 94: RH Comparison of SPC 160 Simple Method for Building # 35

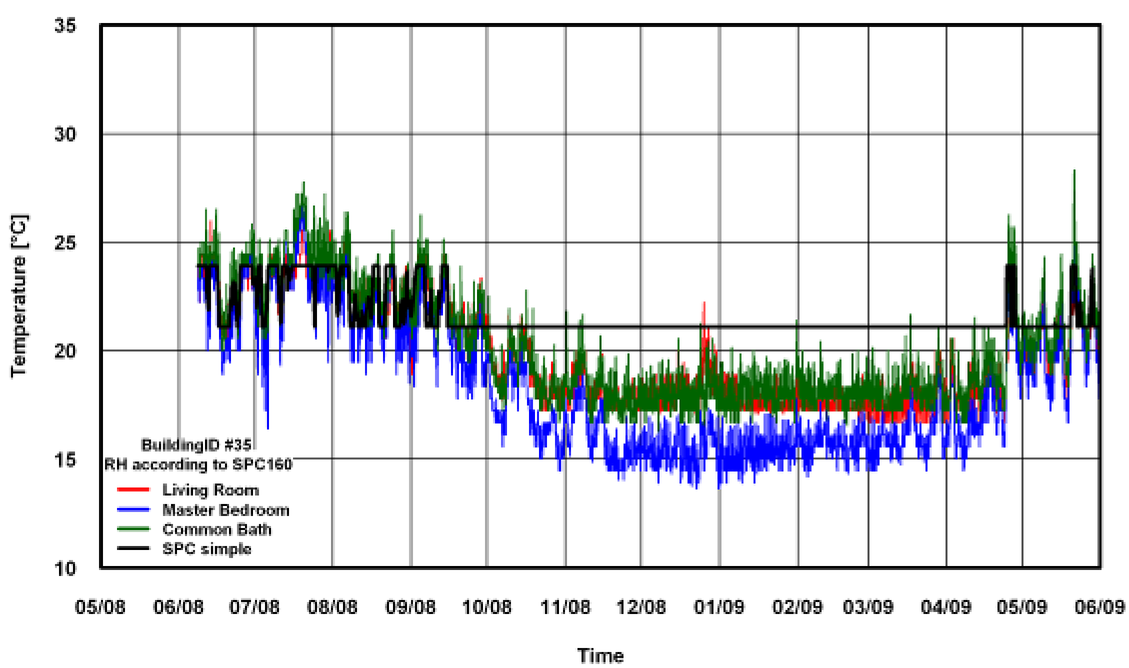

Figure 95: Temperature Comparison of SPC 160 Simple Method for Building # 35

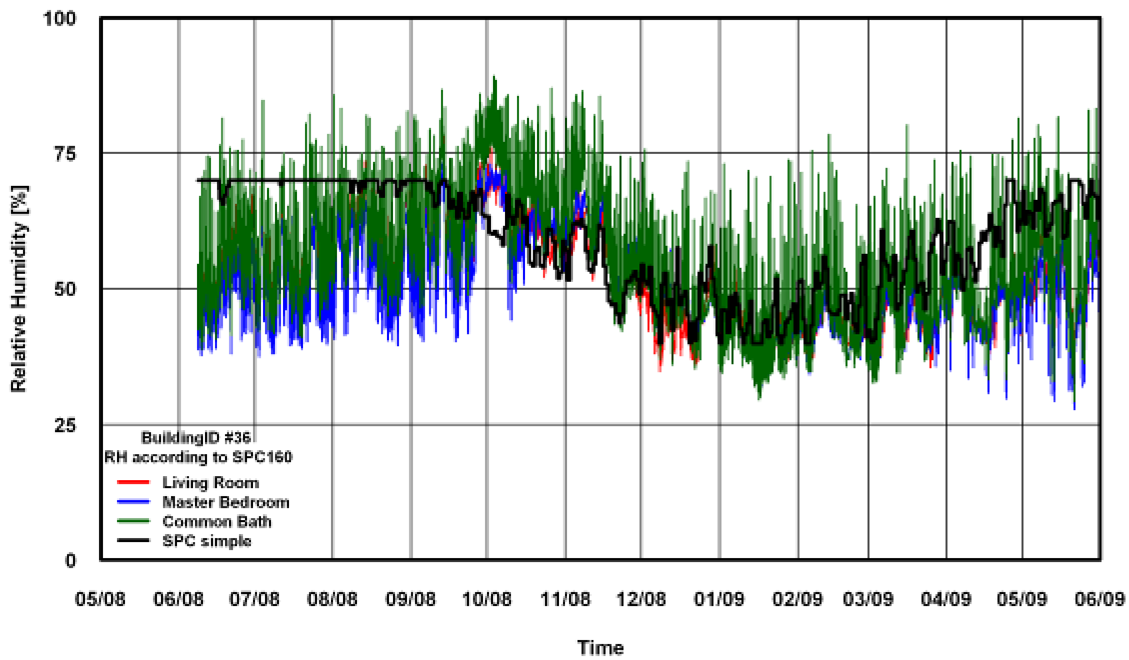

Figure 96: RH Comparison of SPC 160 Simple Method for Building # 36

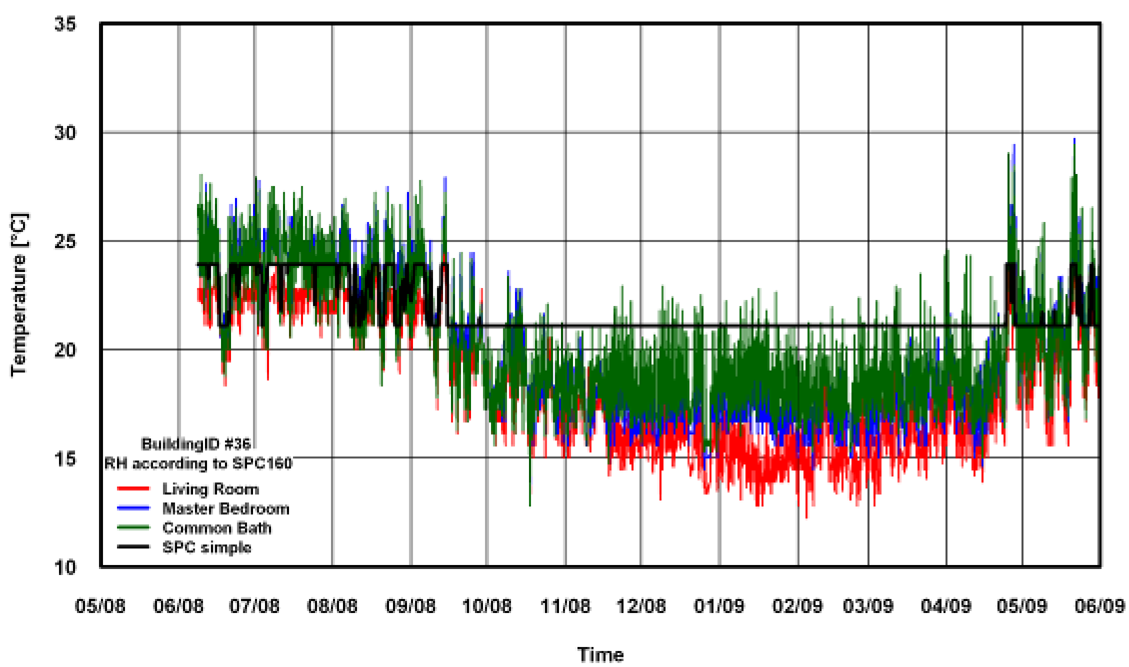

Figure 97: Temperature Comparison of SPC 160 Simple Method for Building # 36

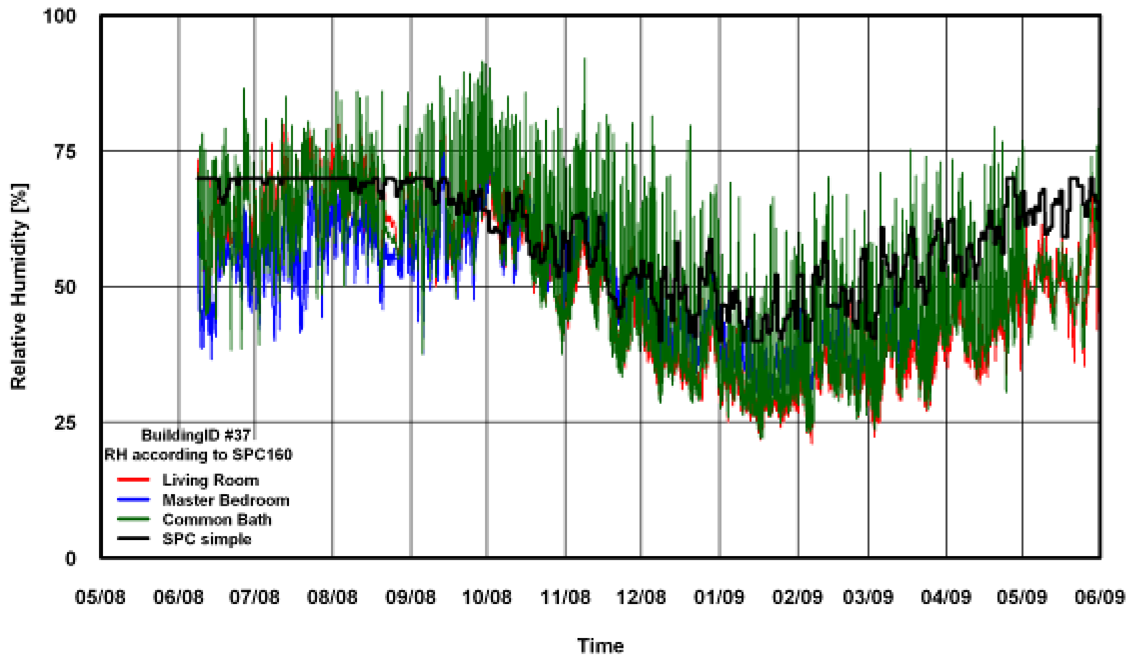

Figure 98: RH Comparison of SPC 160 Simple Method for Building # 37

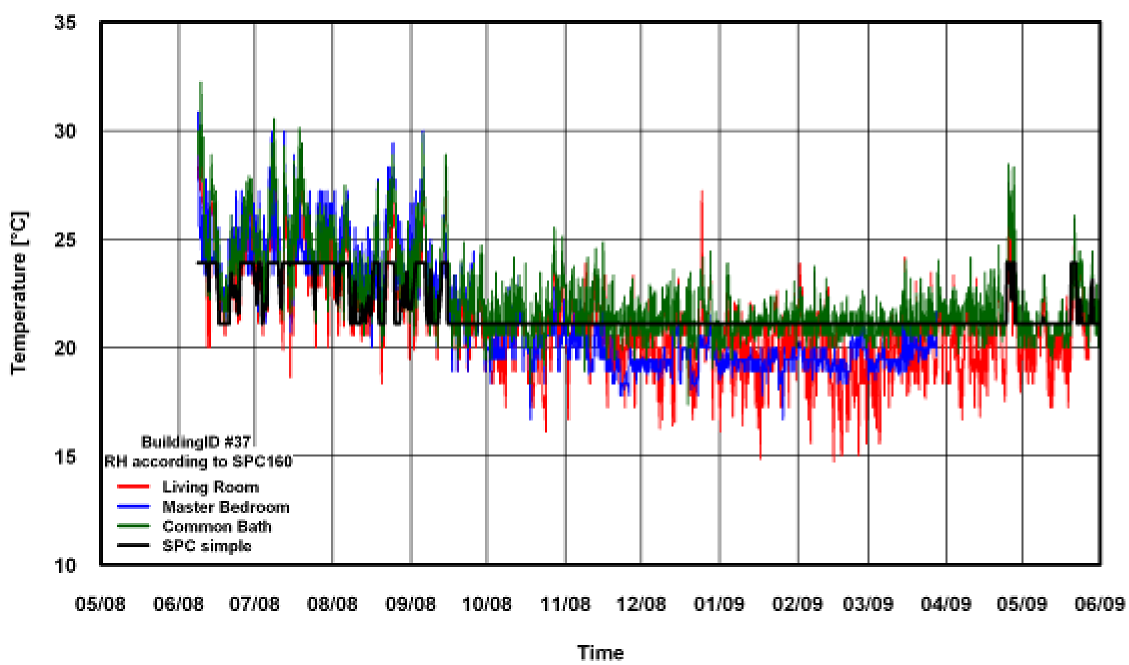

Figure 99: Temperature Comparison of SPC 160 Simple Method for Building # 37

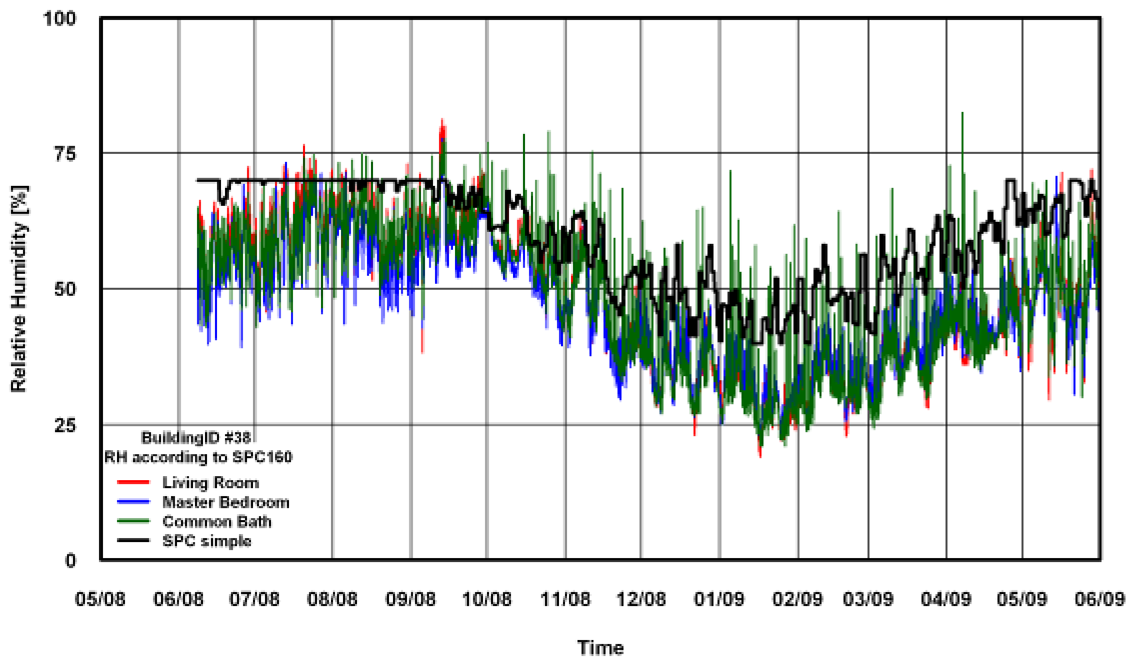

Figure 100: RH Comparison of SPC 160 Simple Method for Building # 38

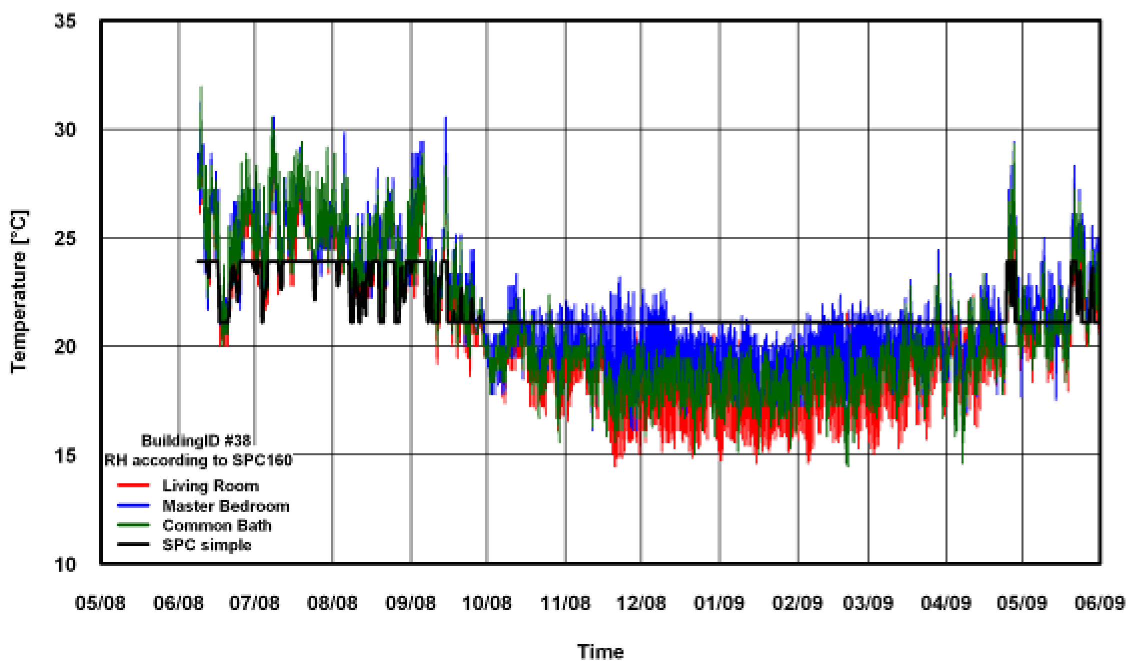

Figure 101: Temperature Comparison of SPC 160 Simple Method for Building # 38

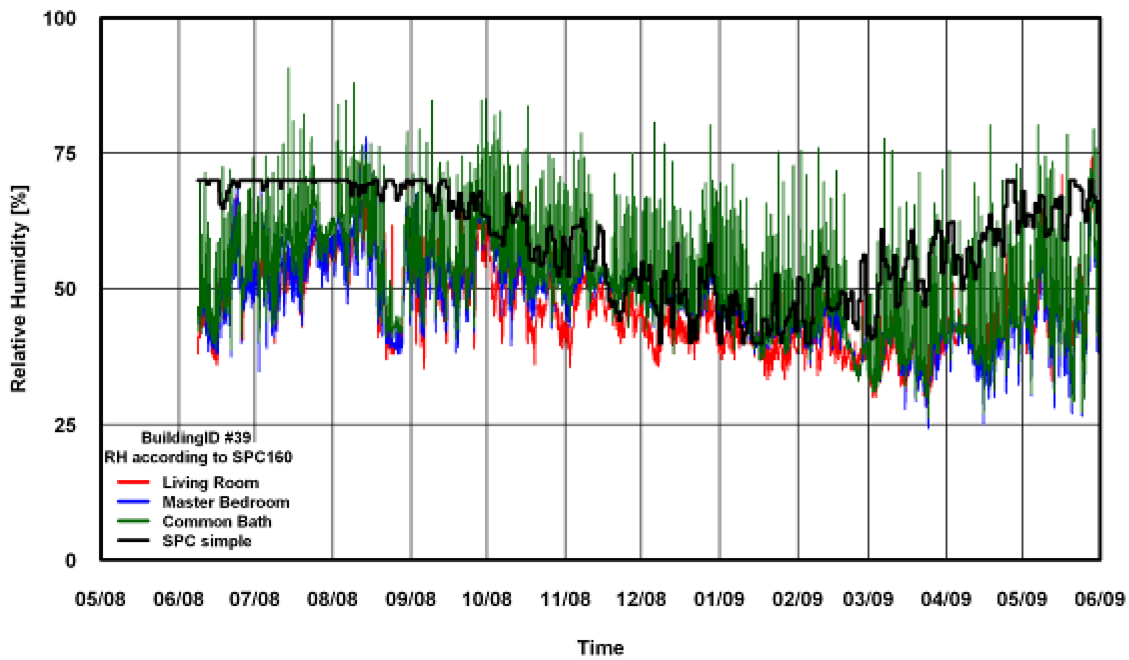

Figure 102: RH Comparison of SPC 160 Simple Method for Building # 39

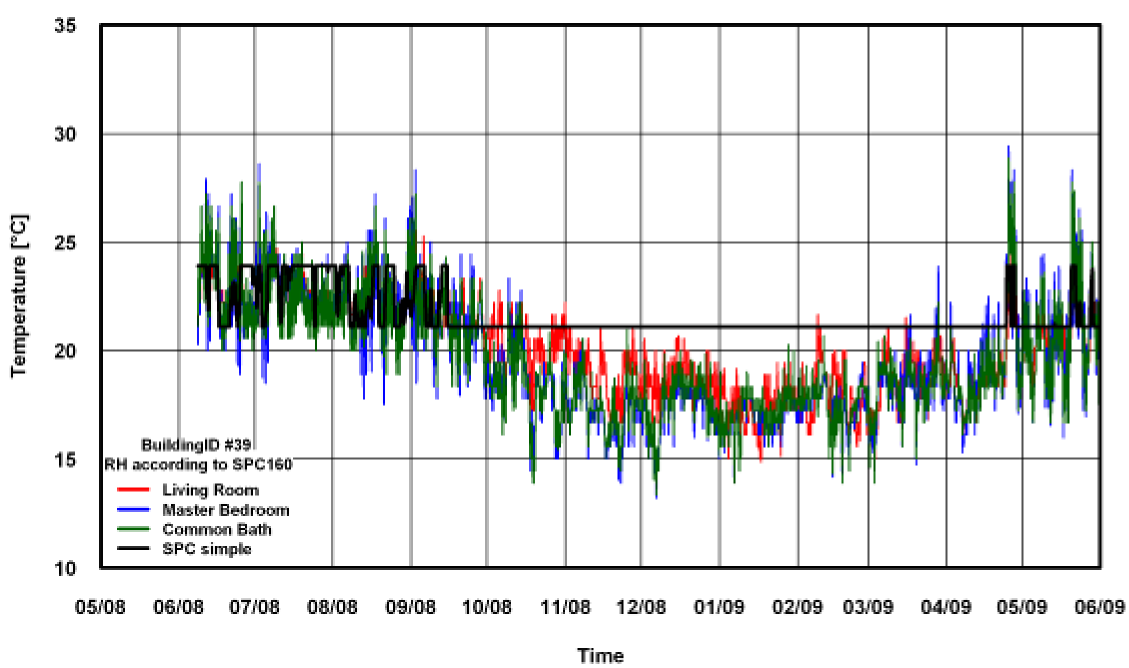

Figure 103: Temperature Comparison of SPC 160 Simple Method for Building # 39

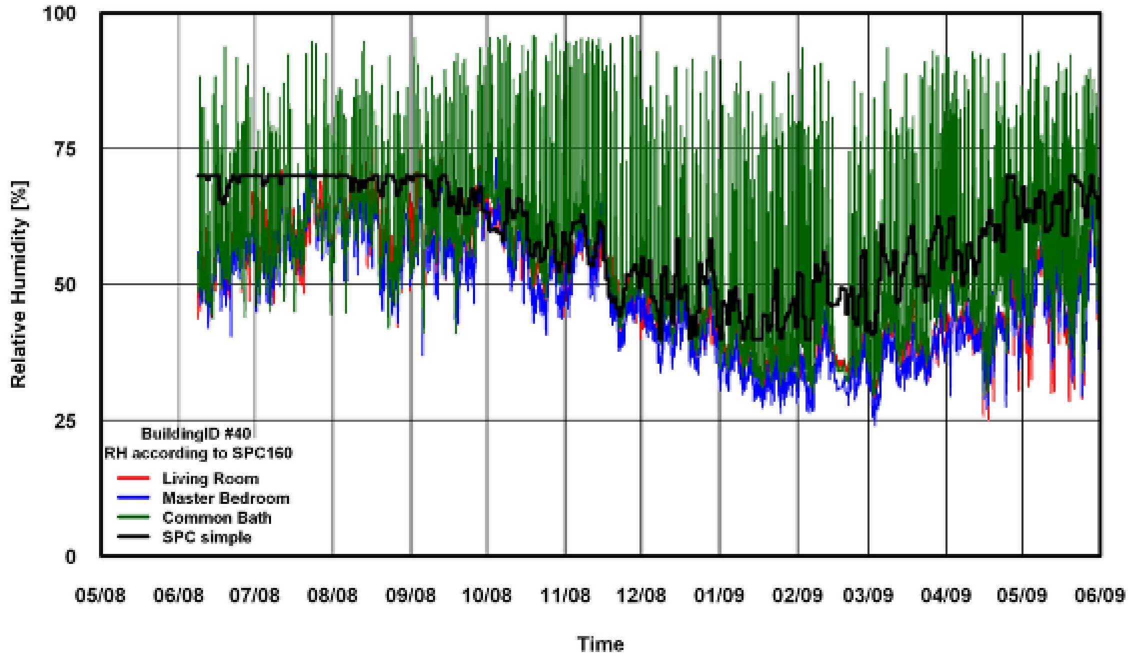

Figure 104: RH Comparison of SPC 160 Simple Method for Building # 40

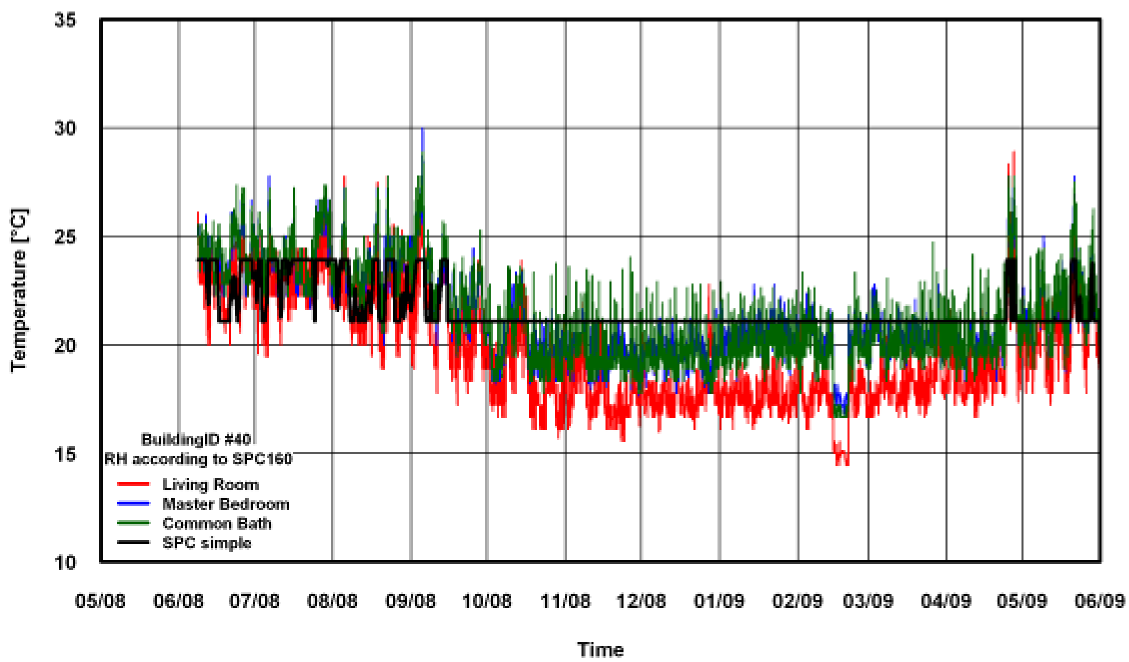

Figure 105: Temperature Comparison of SPC 160 Simple Method for Building # 40

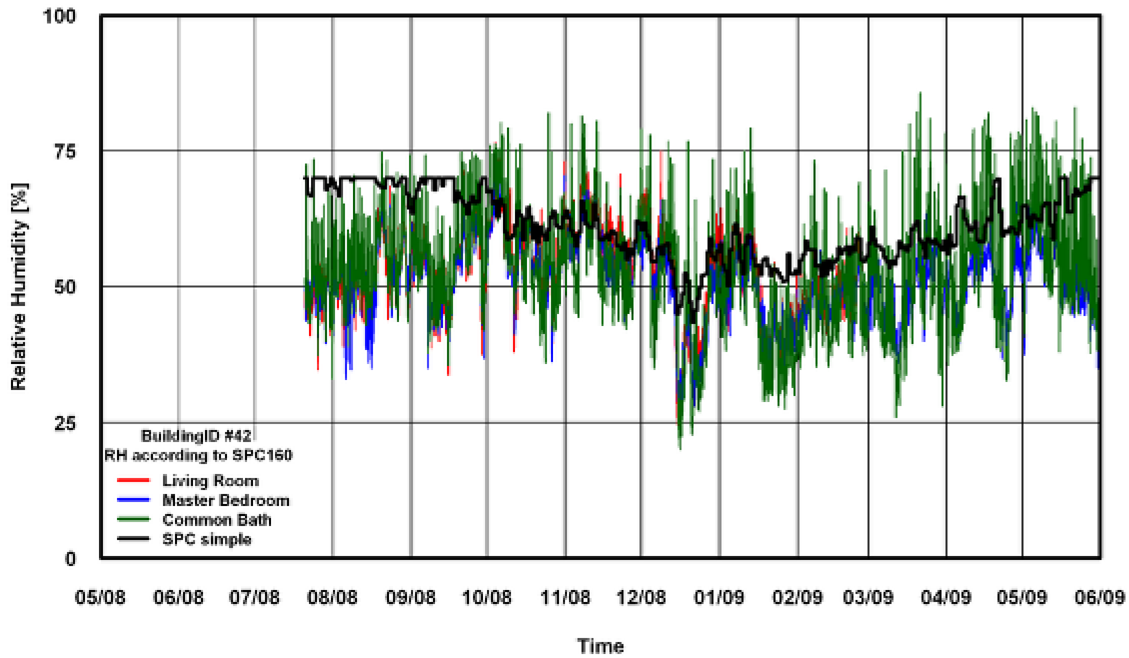

Figure 106: RH Comparison of SPC 160 Simple Method for Building # 42

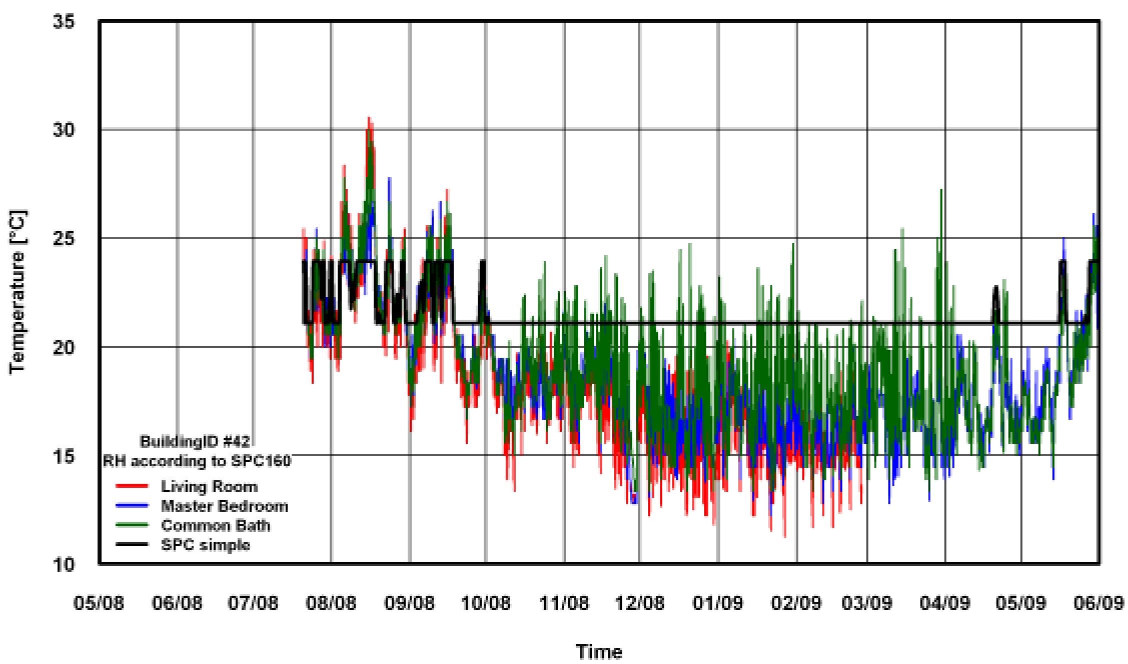

Figure 107: Temperature Comparison of SPC 160 Simple Method for Building # 42

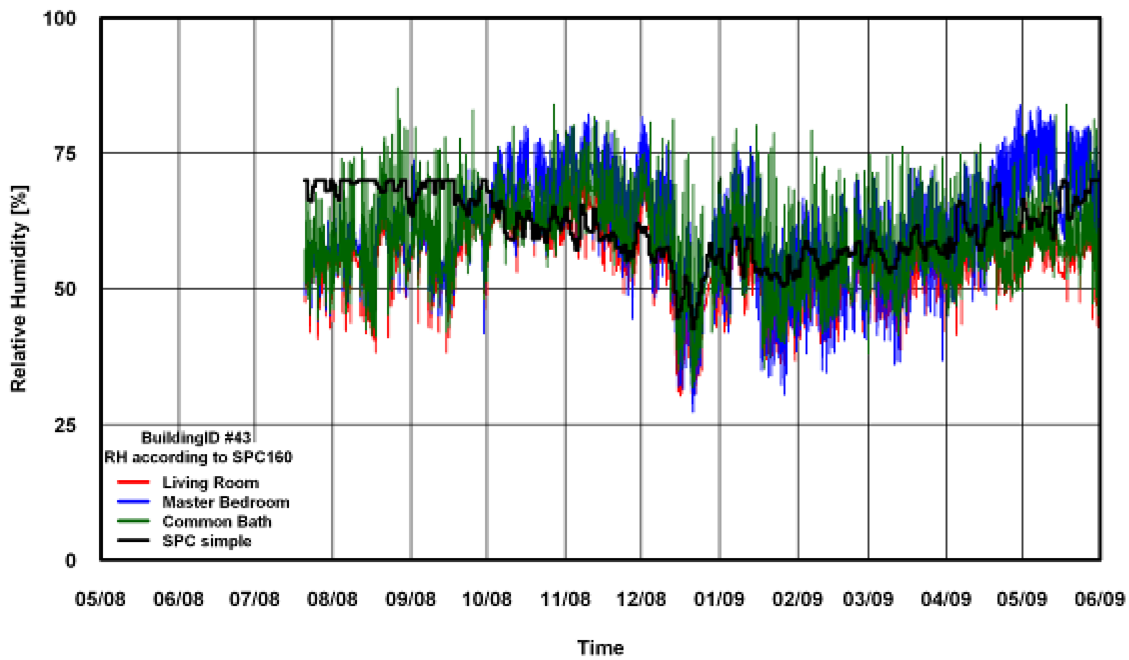

Figure 108: RH Comparison of SPC 160 Simple Method for Building # 43

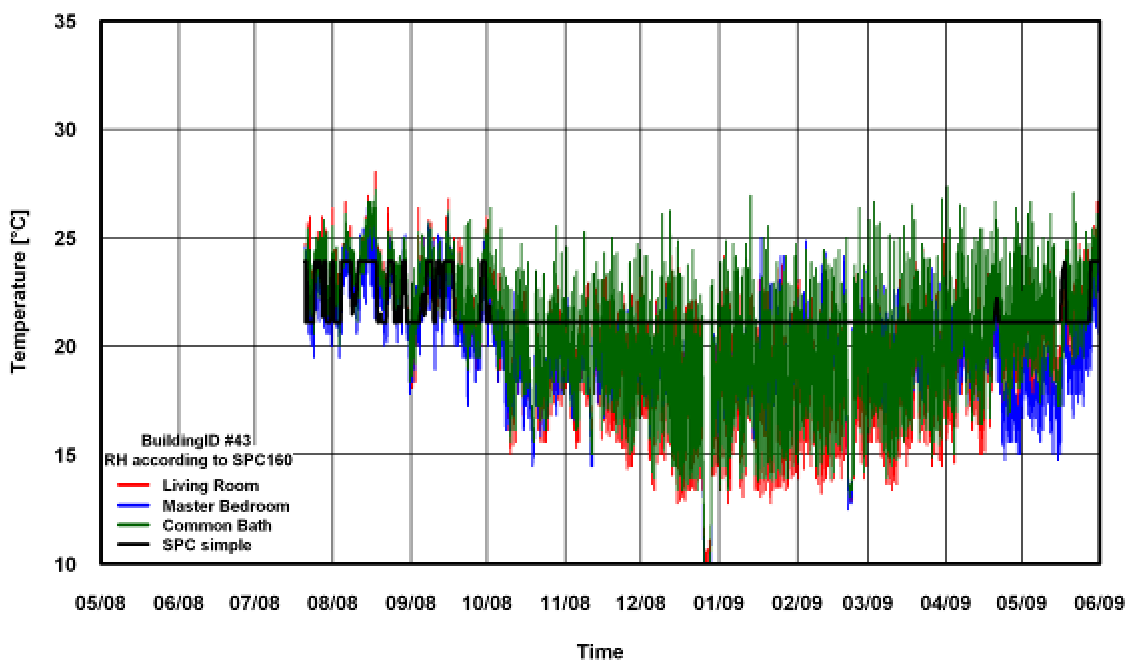

Figure 109: Temperature Comparison of SPC 160 Simple Method for Building # 43

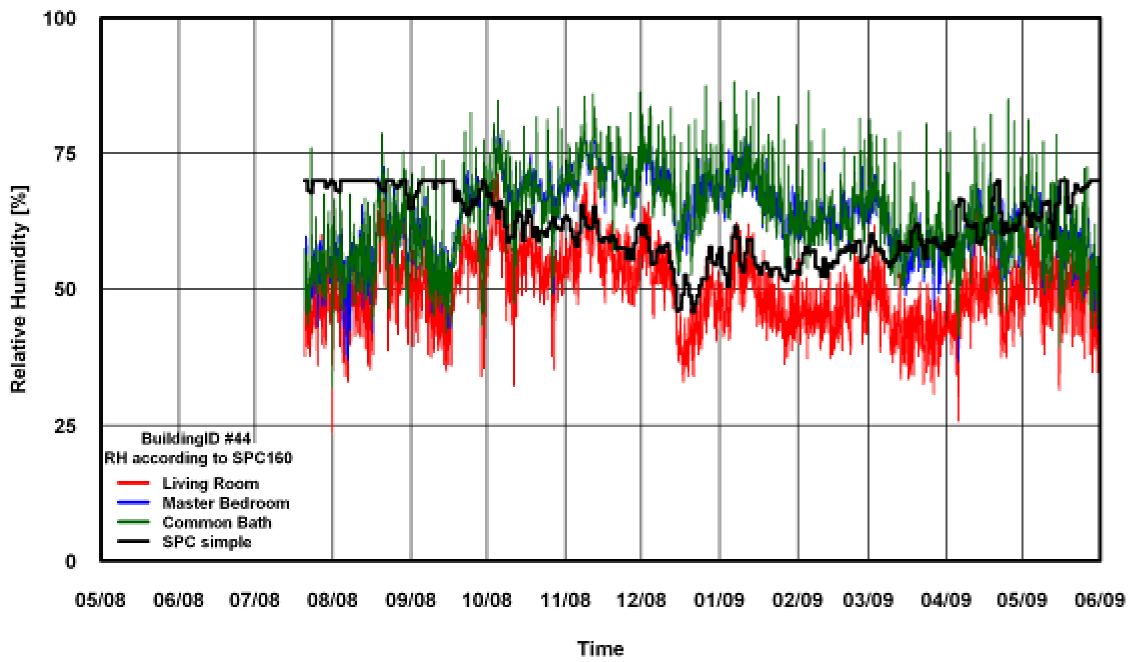

Figure 110: RH Comparison of SPC 160 Simple Method for Building # 44

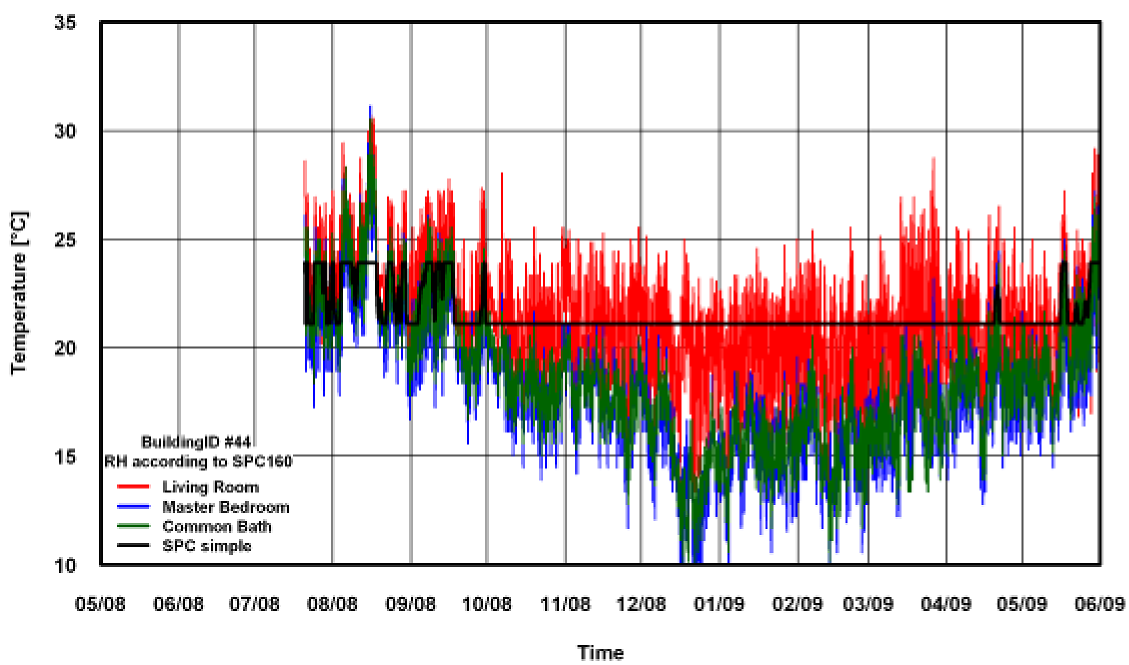

Figure 111: Temperature Comparison of SPC 160 Simple Method for Building # 44

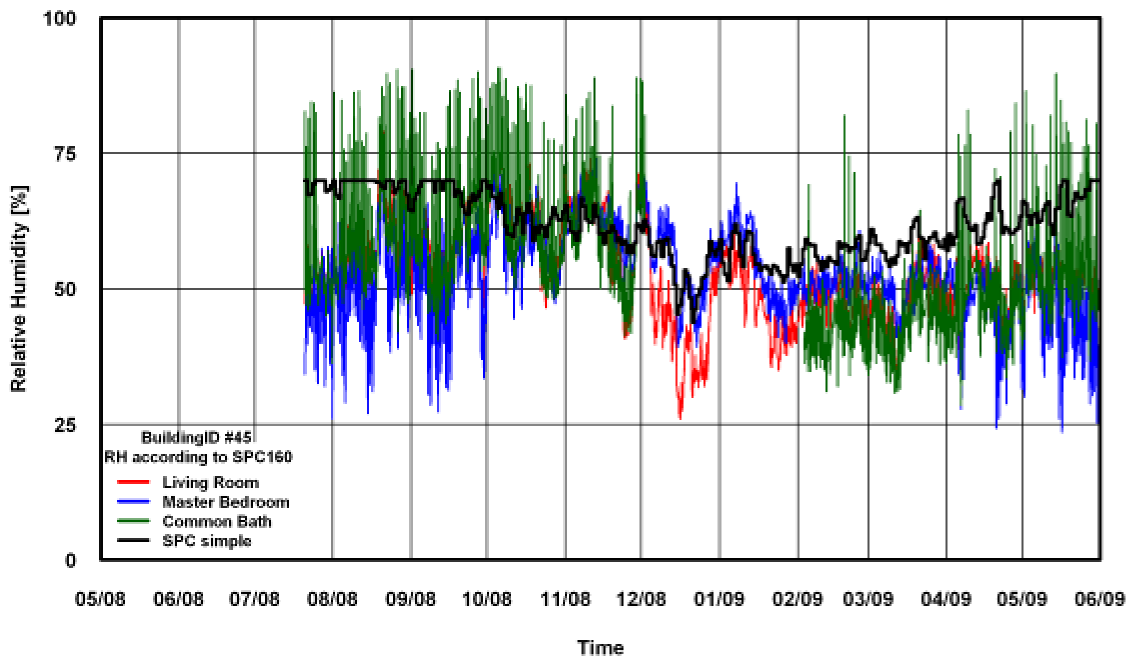

Figure 112: RH Comparison of SPC 160 Simple Method for Building # 45

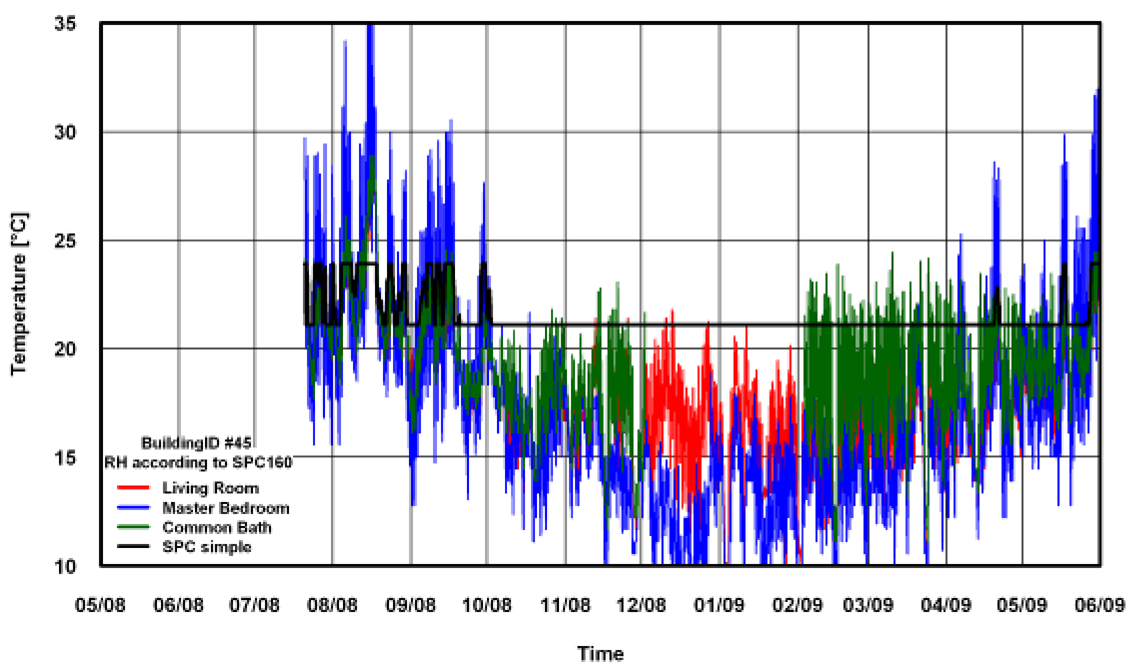

Figure 113: Temperature Comparison of SPC 160 Simple Method for Building # 45

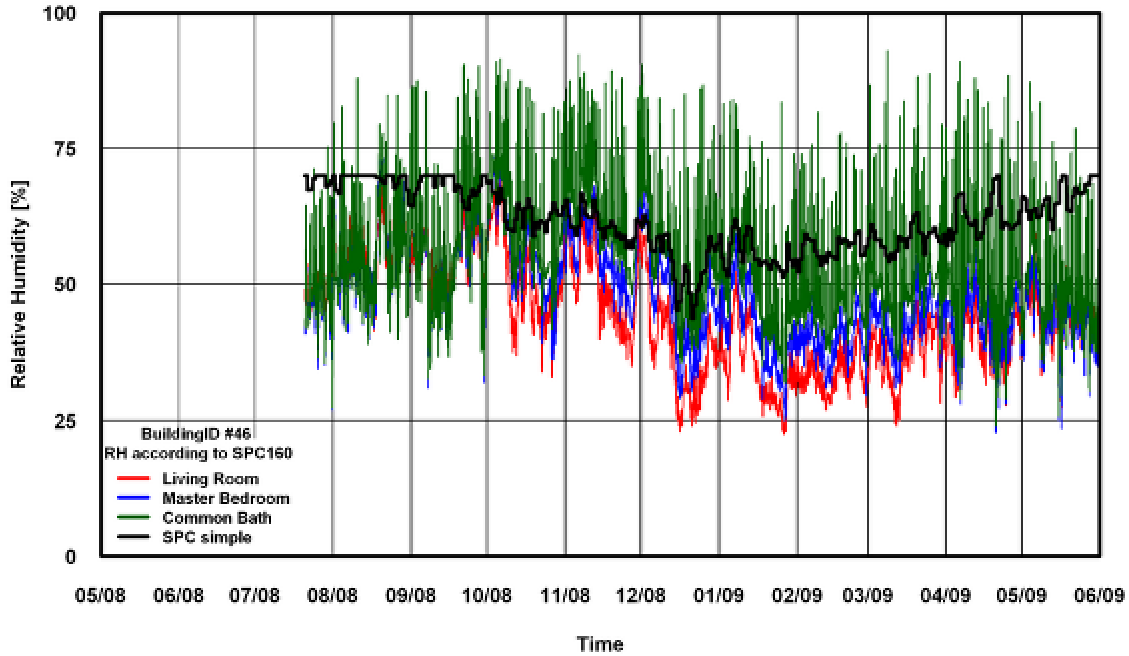

Figure 114: RH Comparison of SPC 160 Simple Method for Building # 46

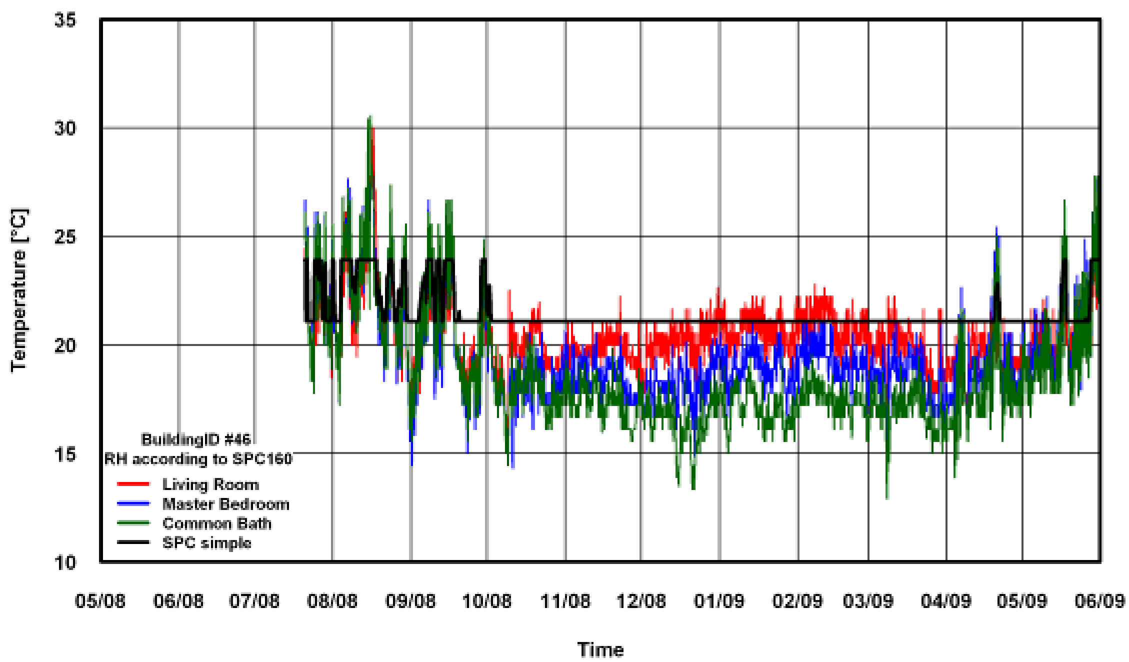

Figure 115: Temperature Comparison of SPC 160 Simple Method for Building # 46

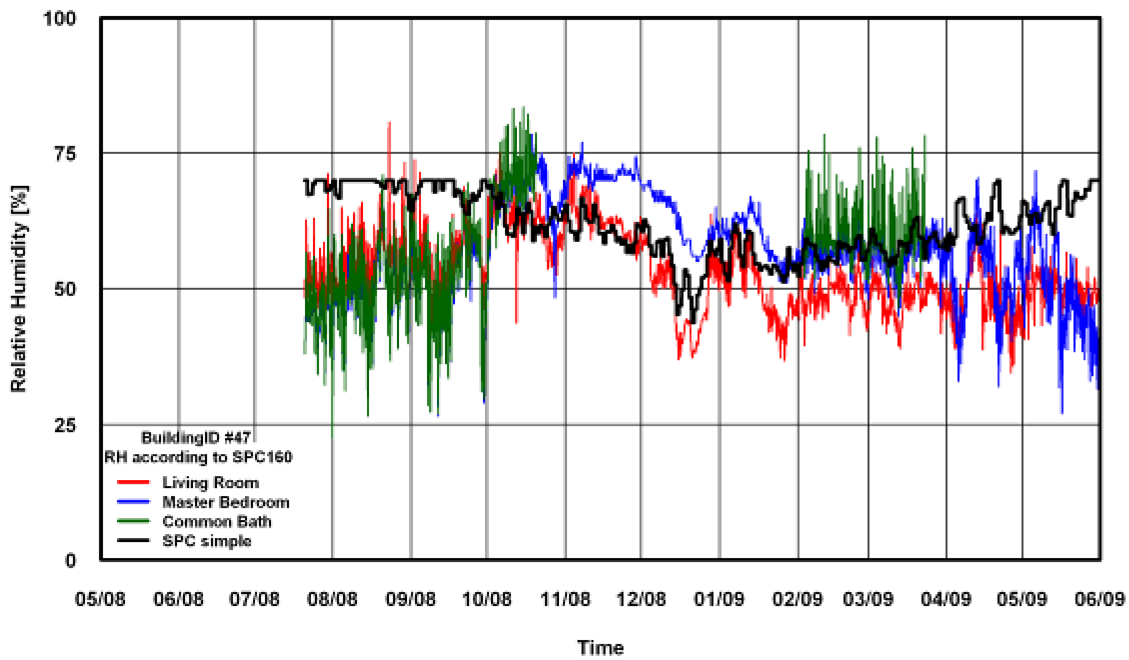

Figure 116: RH Comparison of SPC 160 Simple Method for Building # 47

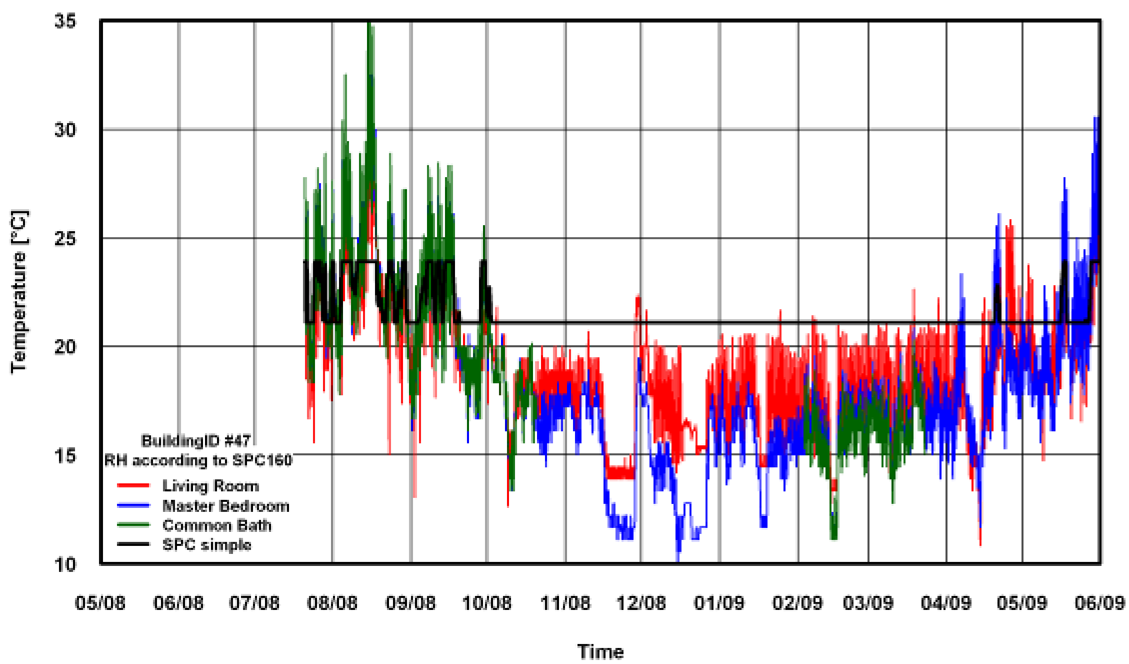

Figure 117: Temperature Comparison of SPC 160 Simple Method for Building # 47

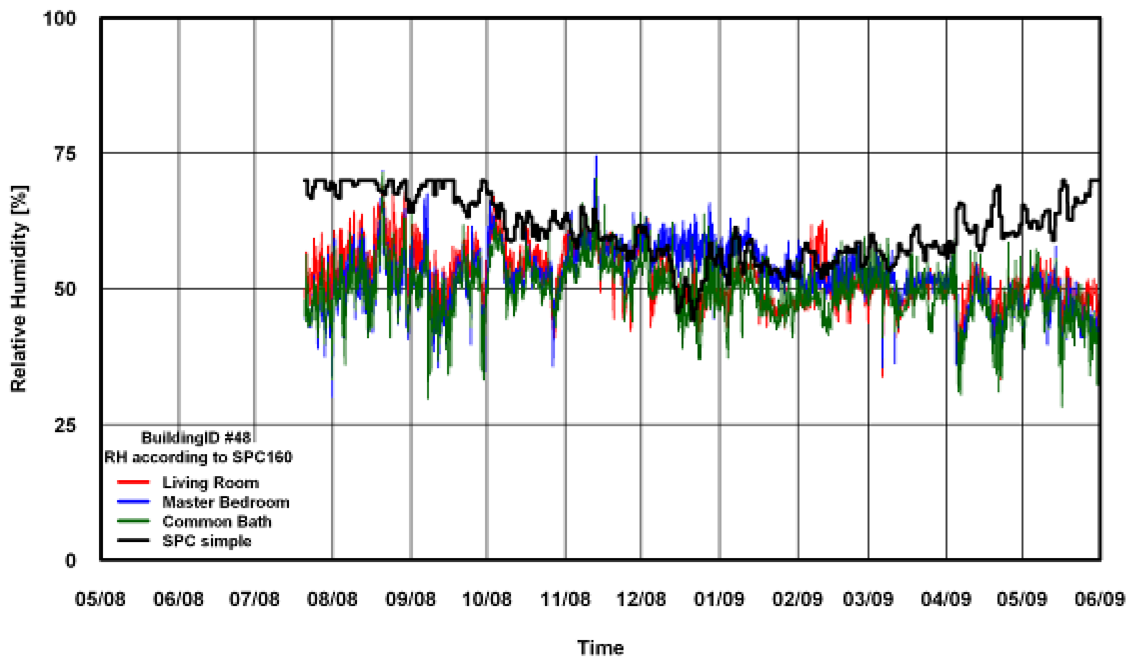

Figure 118: RH Comparison of SPC 160 Simple Method for Building # 48

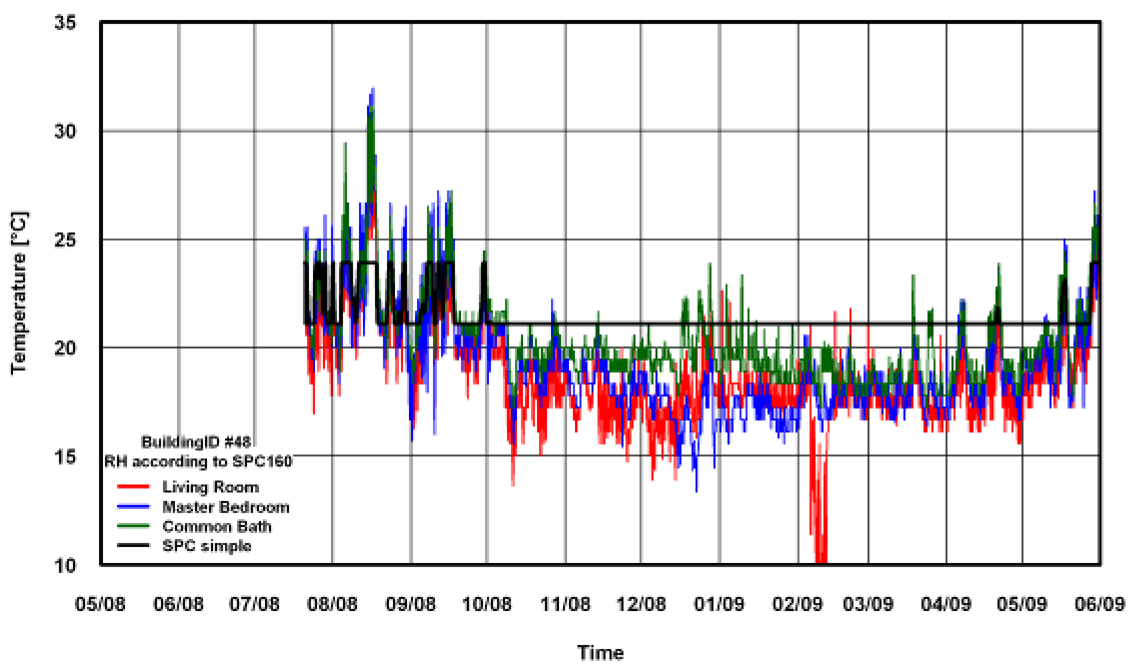

Figure 119: Temperature Comparison of SPC 160 Simple Method for Building # 48

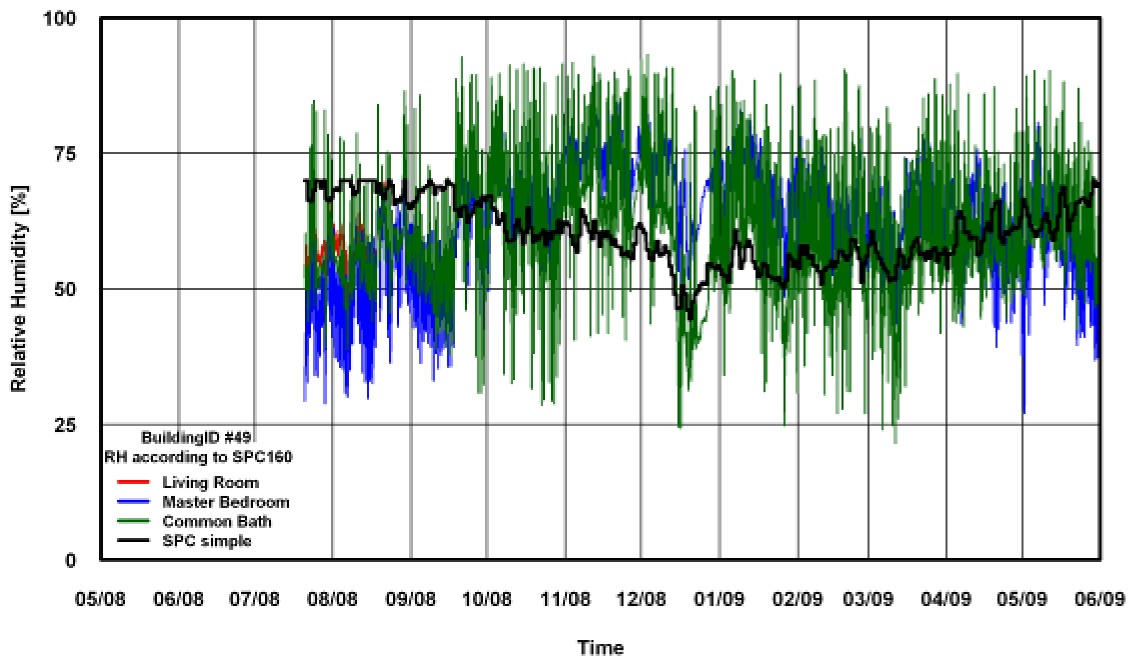

Figure 120: RH Comparison of SPC 160 Simple Method for Building # 49

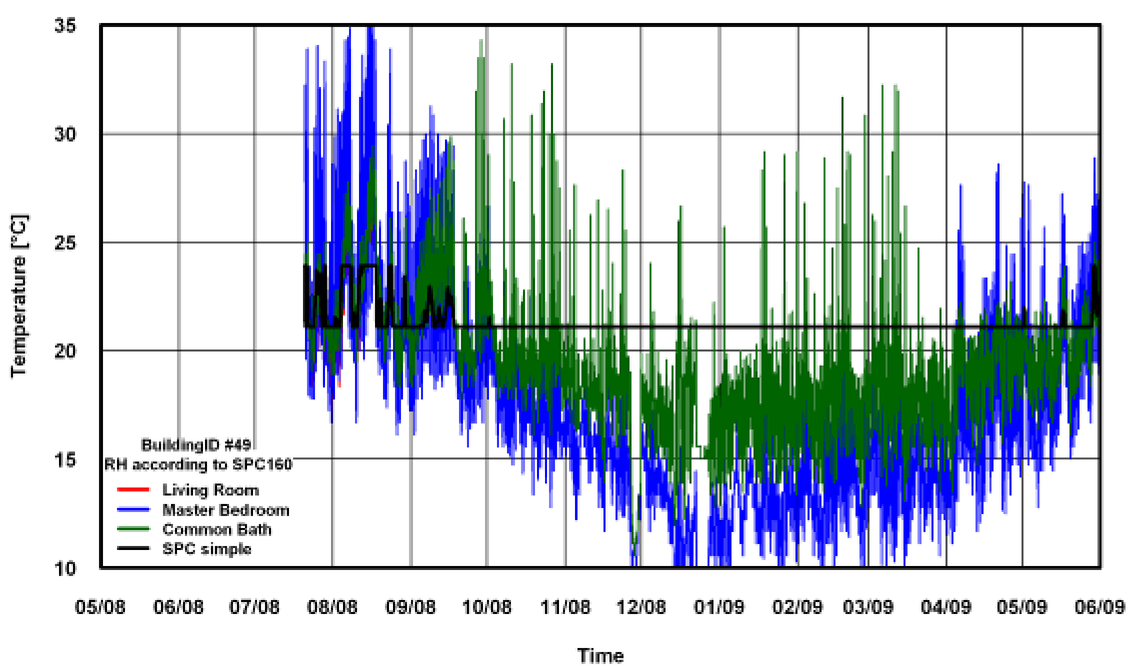

Figure 121: Temperature Comparison of SPC 160 Simple Method for Building # 49

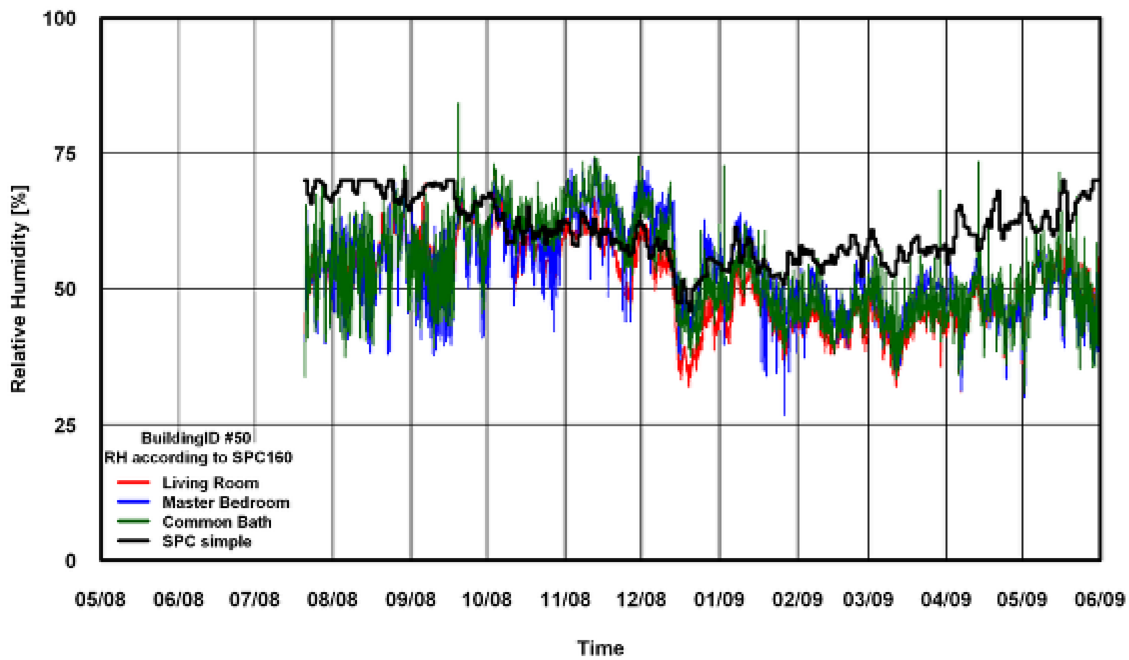

Figure 122: RH Comparison of SPC 160 Simple Method for Building # 50

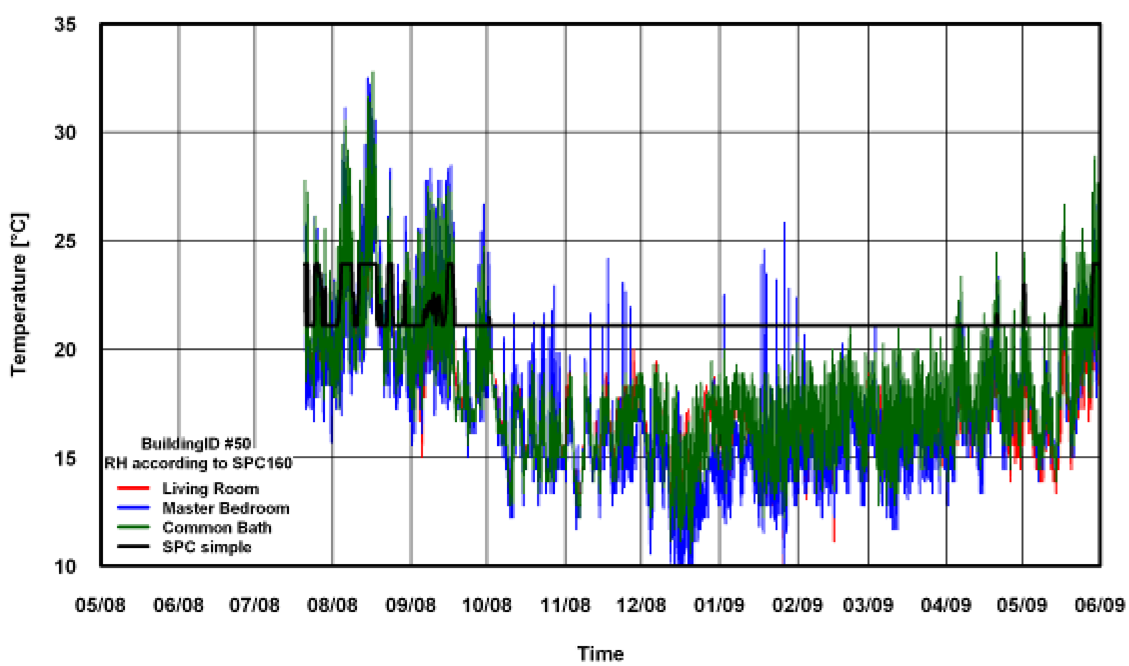

Figure 123: Temperature Comparison of SPC 160 Simple Method for Building # 50

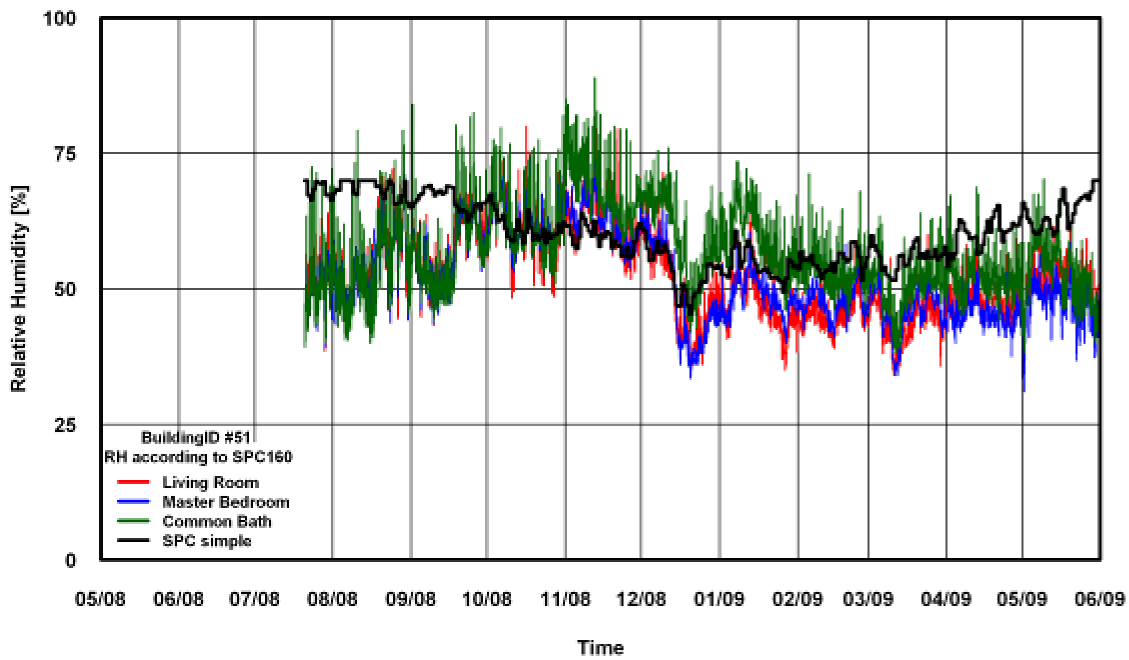

Figure 124: RH Comparison of SPC 160 Simple Method for Building # 51

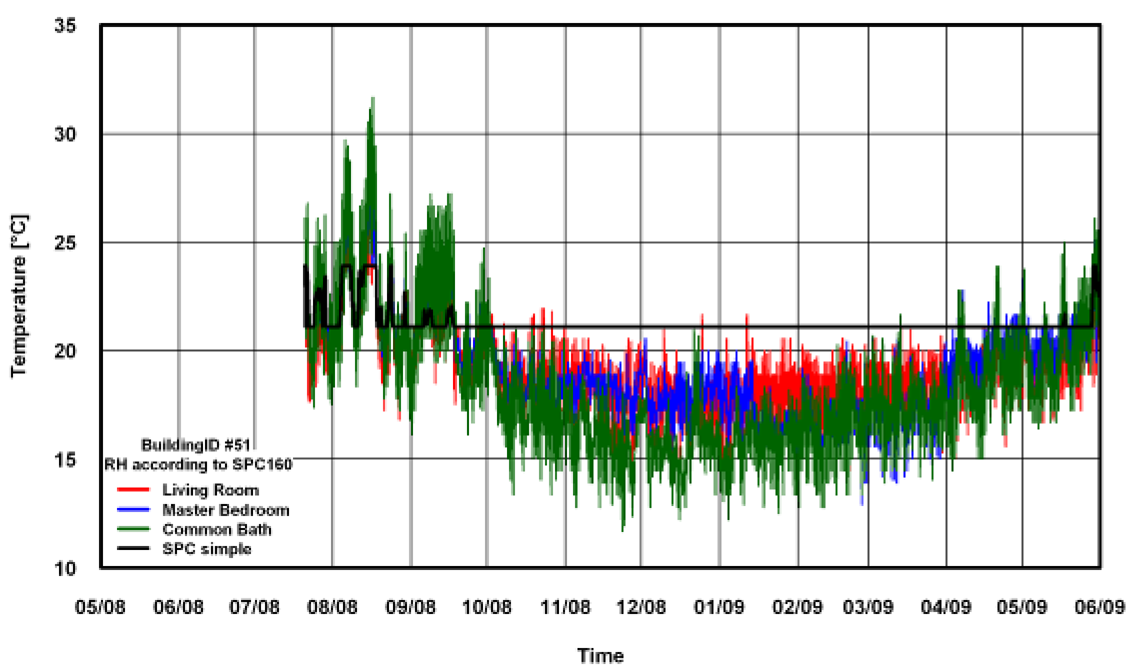

Figure 125: Temperature Comparison of SPC 160 Simple Method for Building # 51

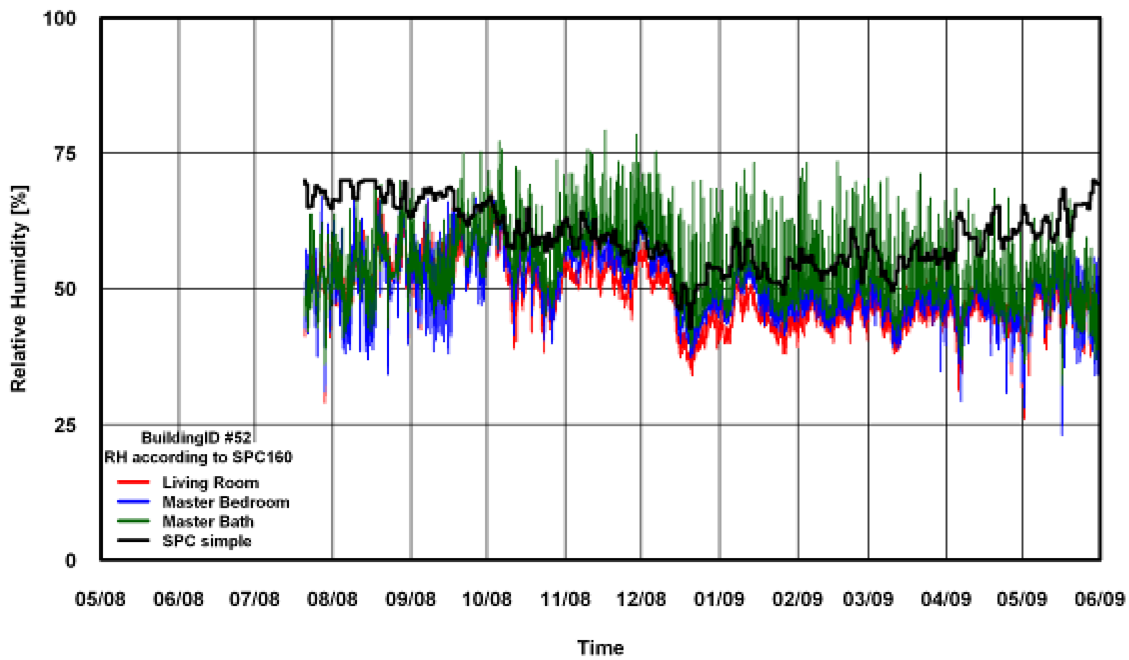

Figure 126: RH Comparison of SPC 160 Simple Method for Building # 52

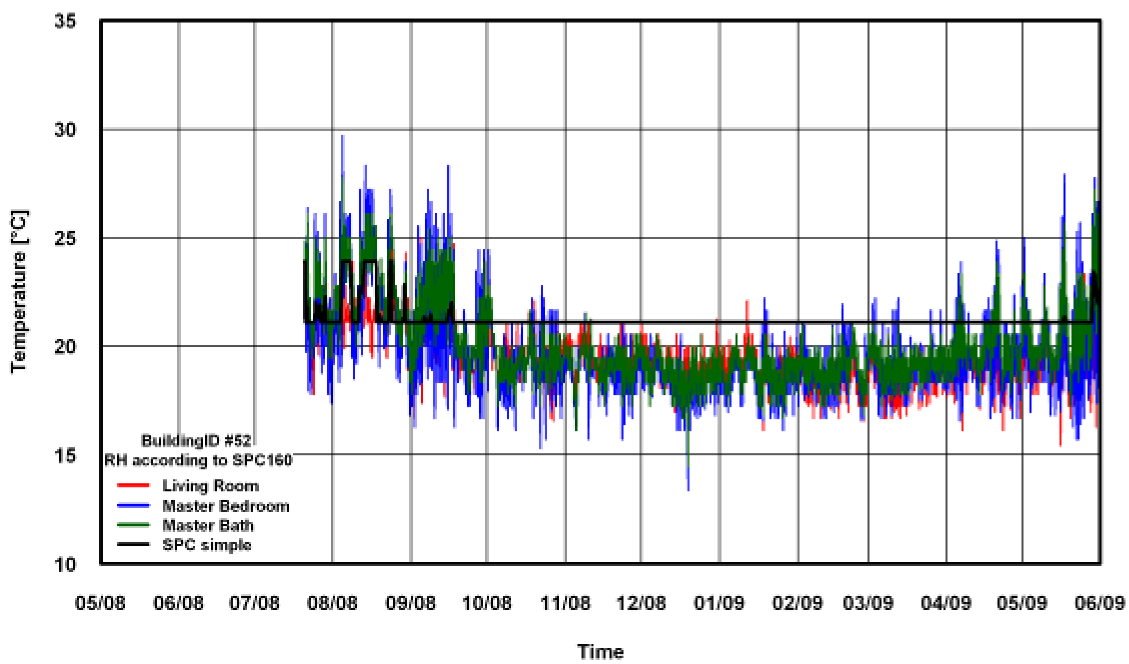

Figure 127: Temperature Comparison of SPC 160 Simple Method for Building # 52

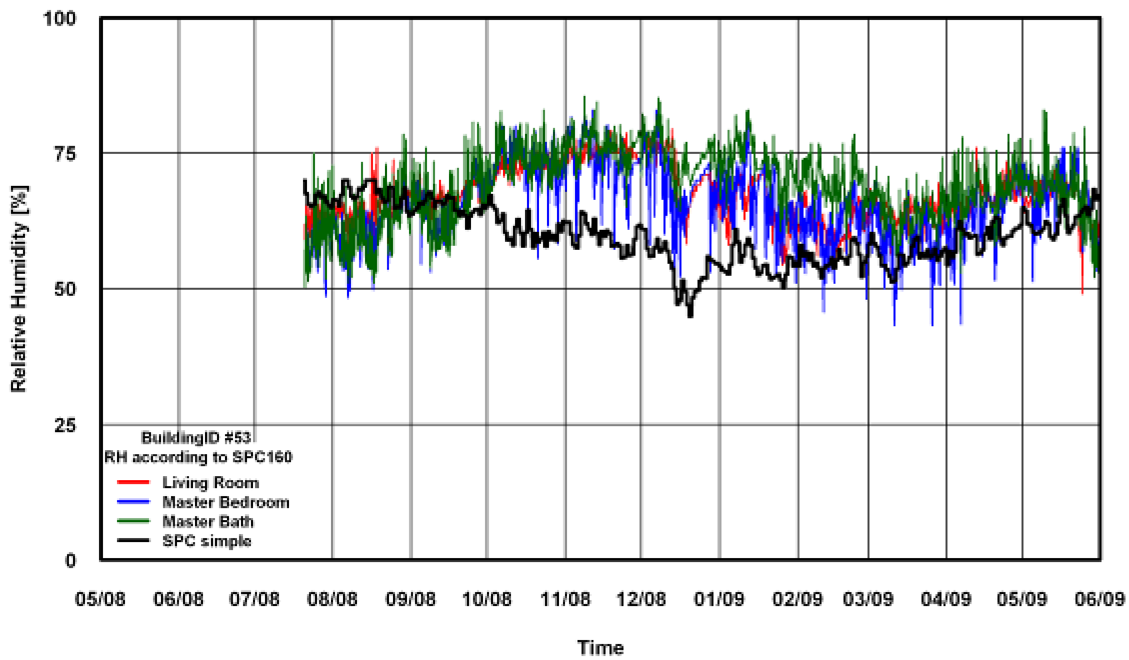

Figure 128: RH Comparison of SPC 160 Simple Method for Building # 53

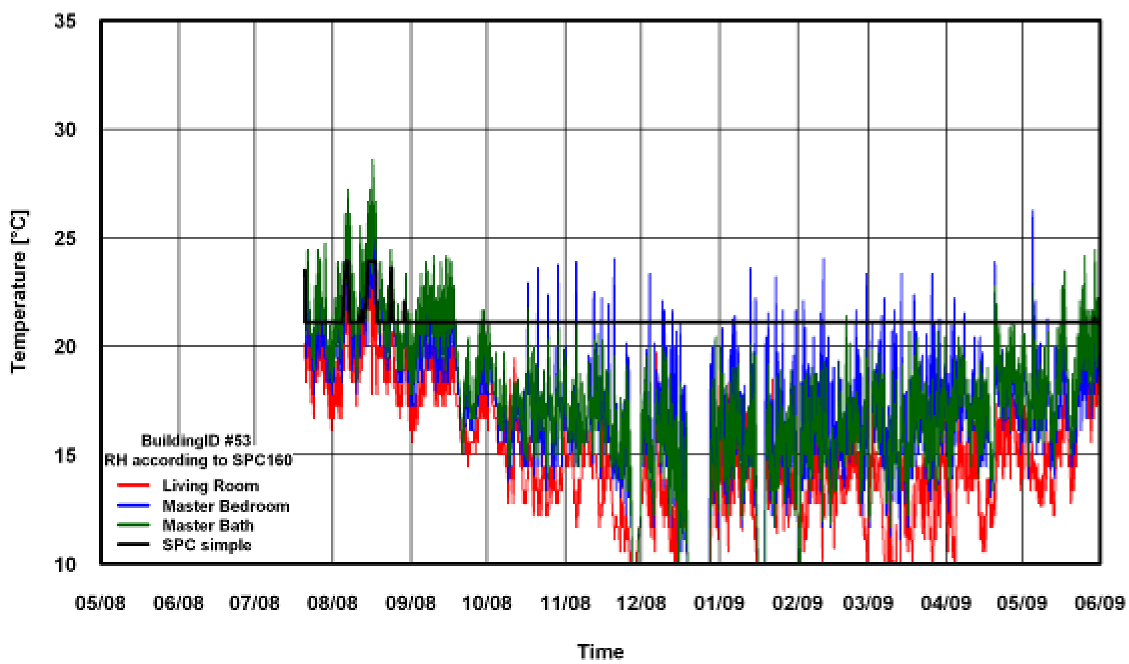

Figure 129: Temperature Comparison of SPC 160 Simple Method for Building # 53

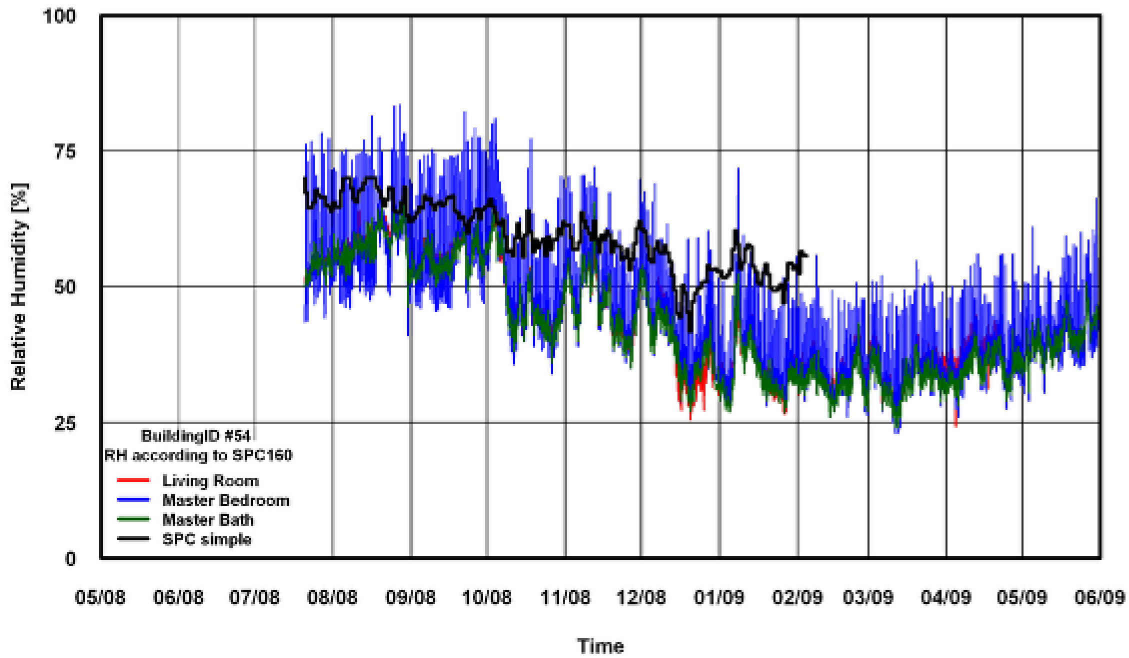

Figure 130: RH Comparison of SPC 160 Simple Method for Building # 54

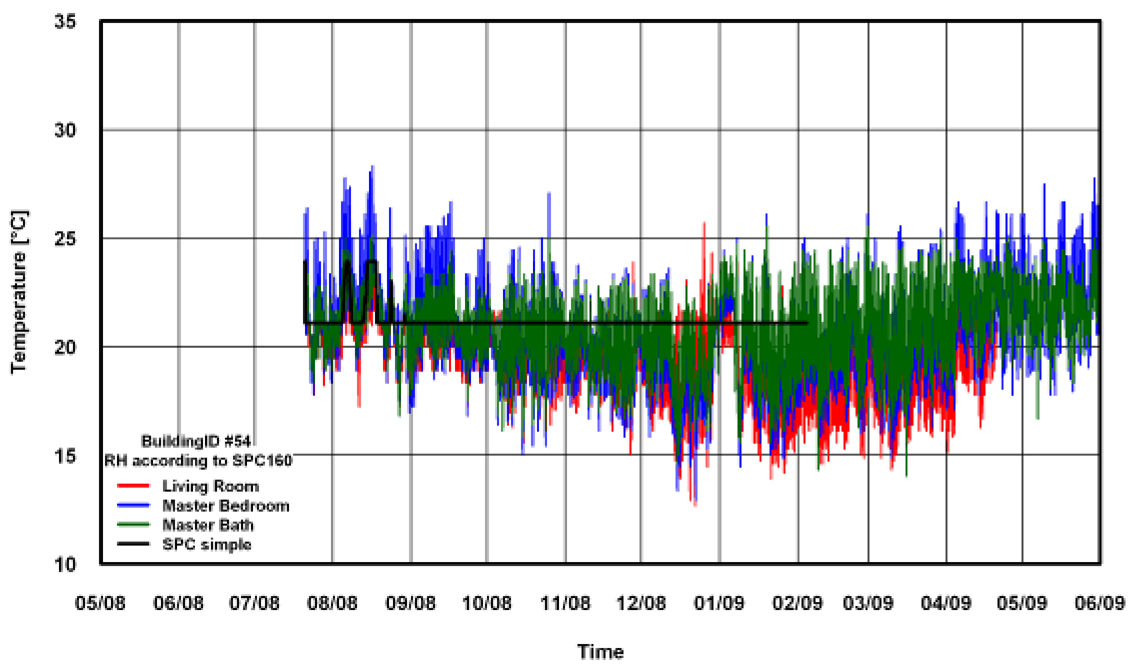

Figure 131: Temperature Comparison of SPC 160 Simple Method for Building # 54

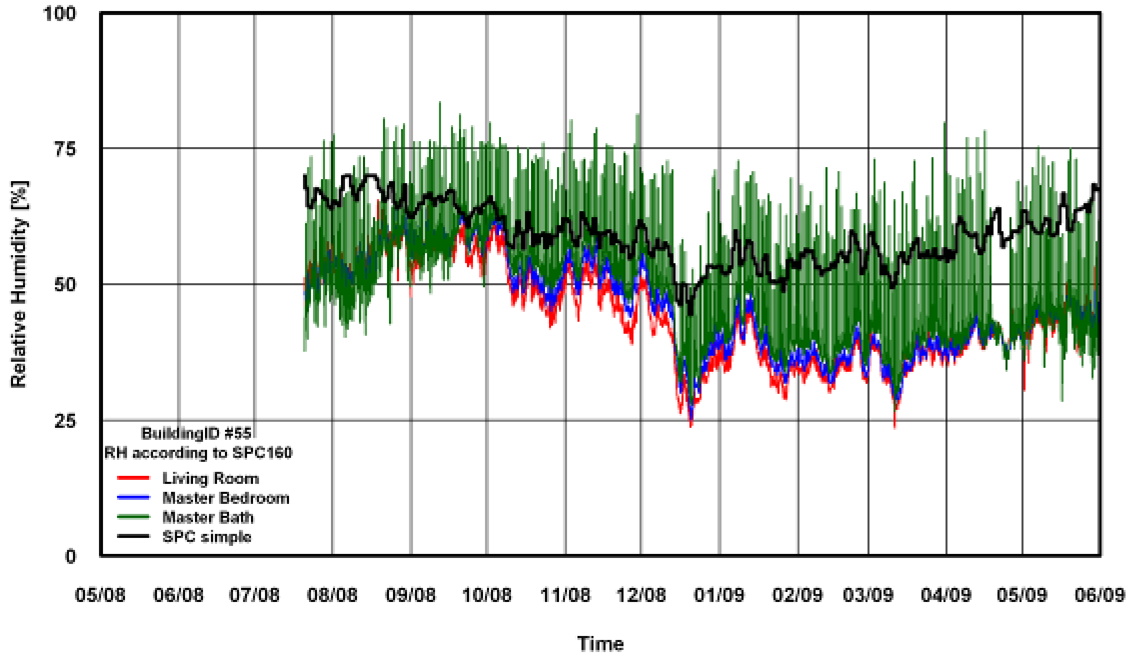

Figure 132: RH Comparison of SPC 160 Simple Method for Building # 55

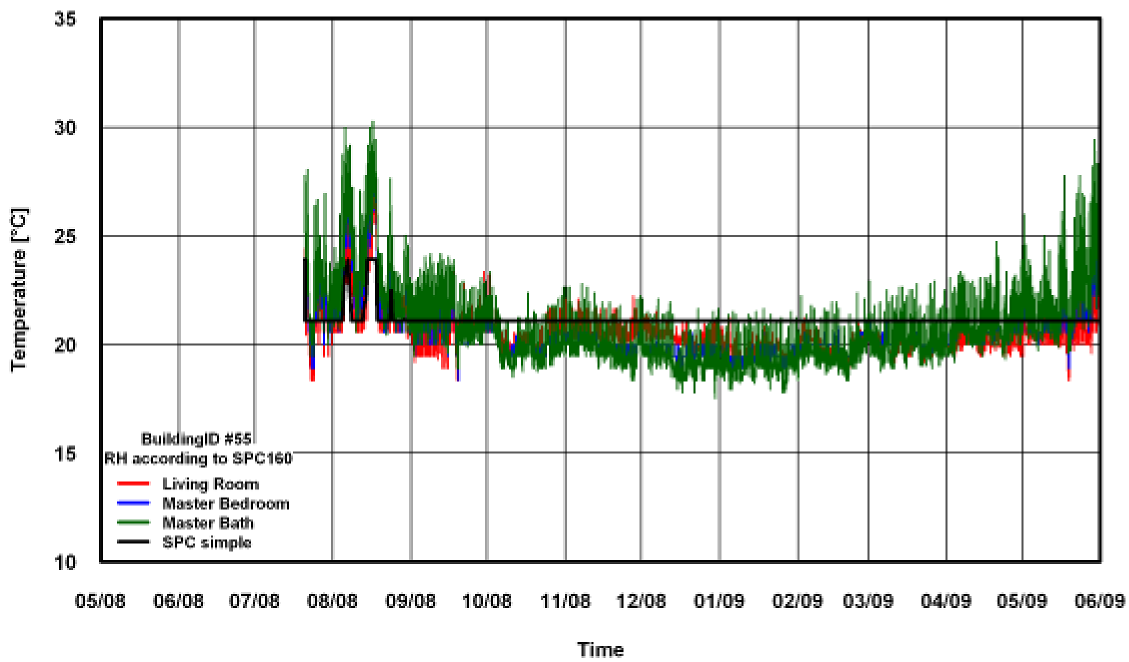

Figure 133: Temperature Comparison of SPC 160 Simple Method for Building # 55

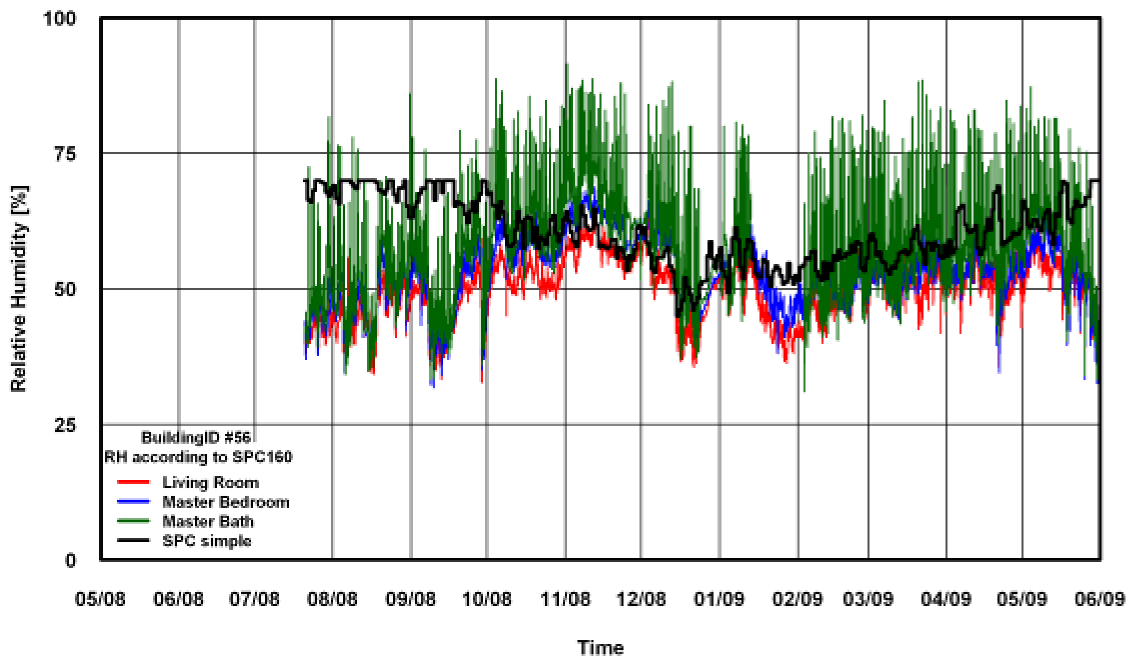

Figure 134: RH Comparison of SPC 160 Simple Method for Building # 56

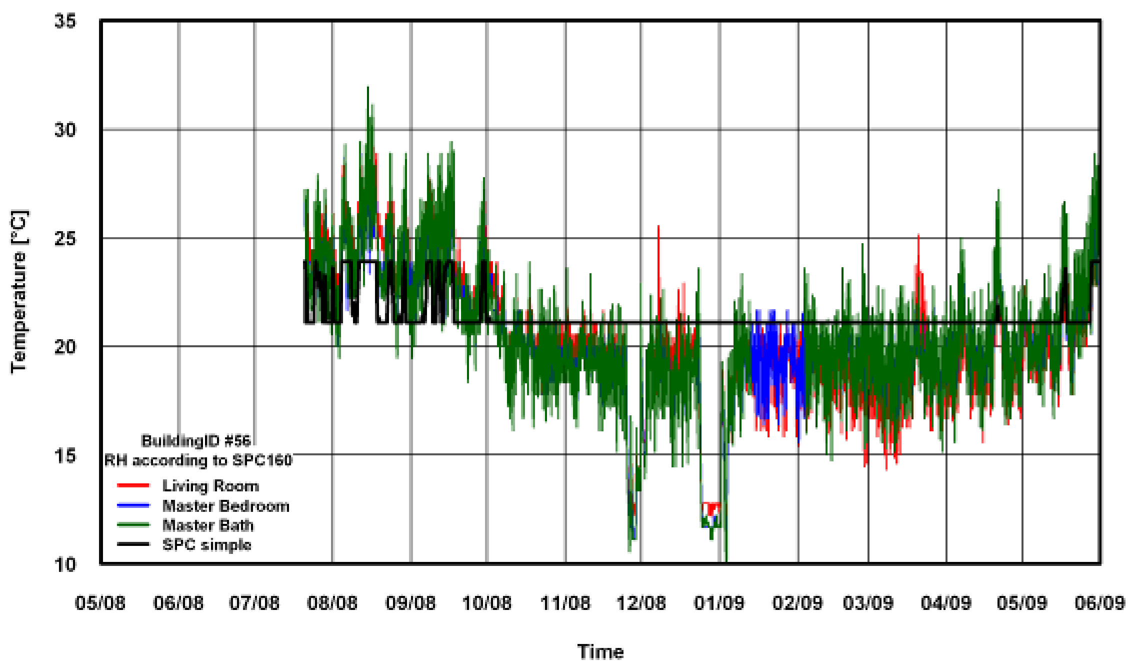

Figure 135: Temperature Comparison of SPC 160 Simple Method for Building # 56

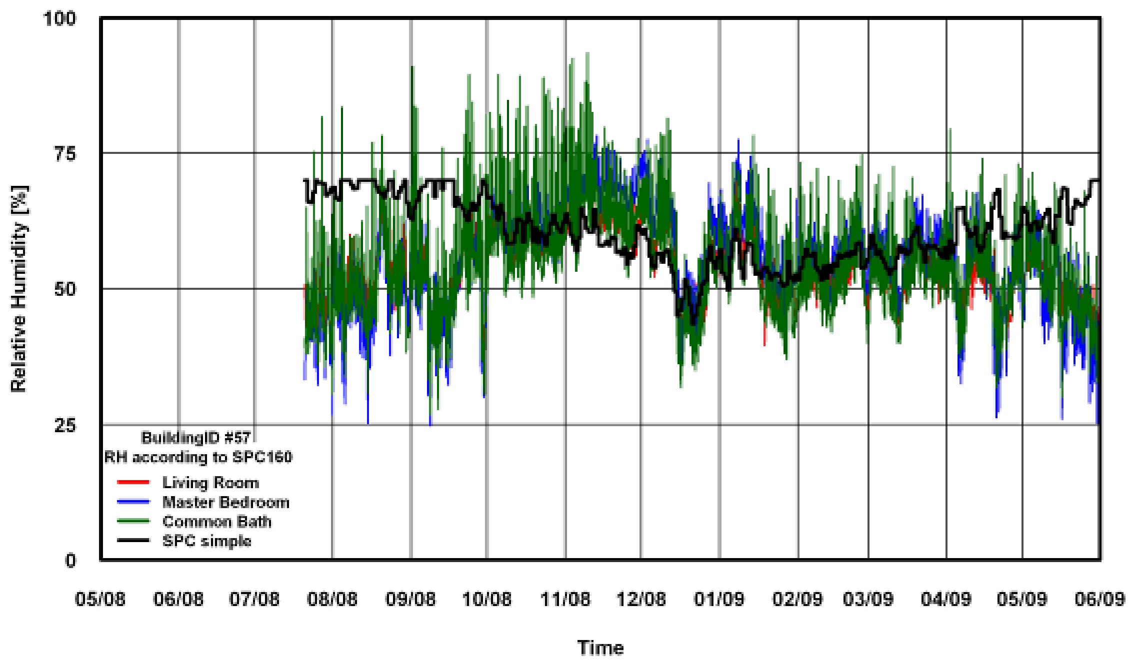

Figure 136: RH Comparison of SPC 160 Simple Method for Building # 57

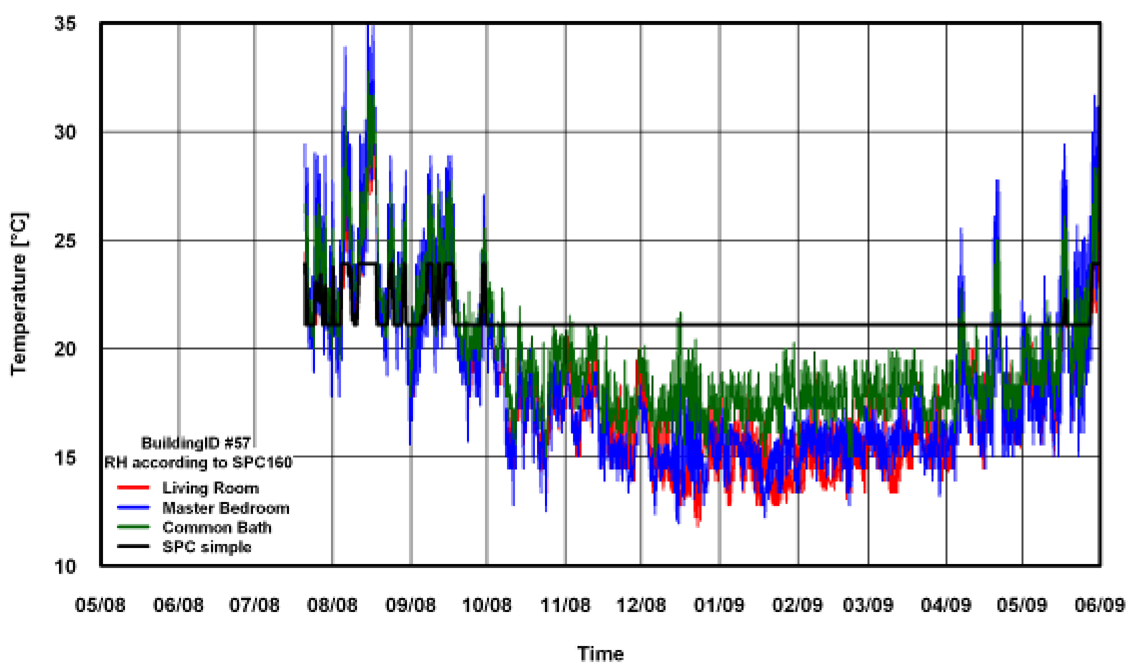

Figure 137: Temperature Comparison of SPC 160 Simple Method for Building # 57

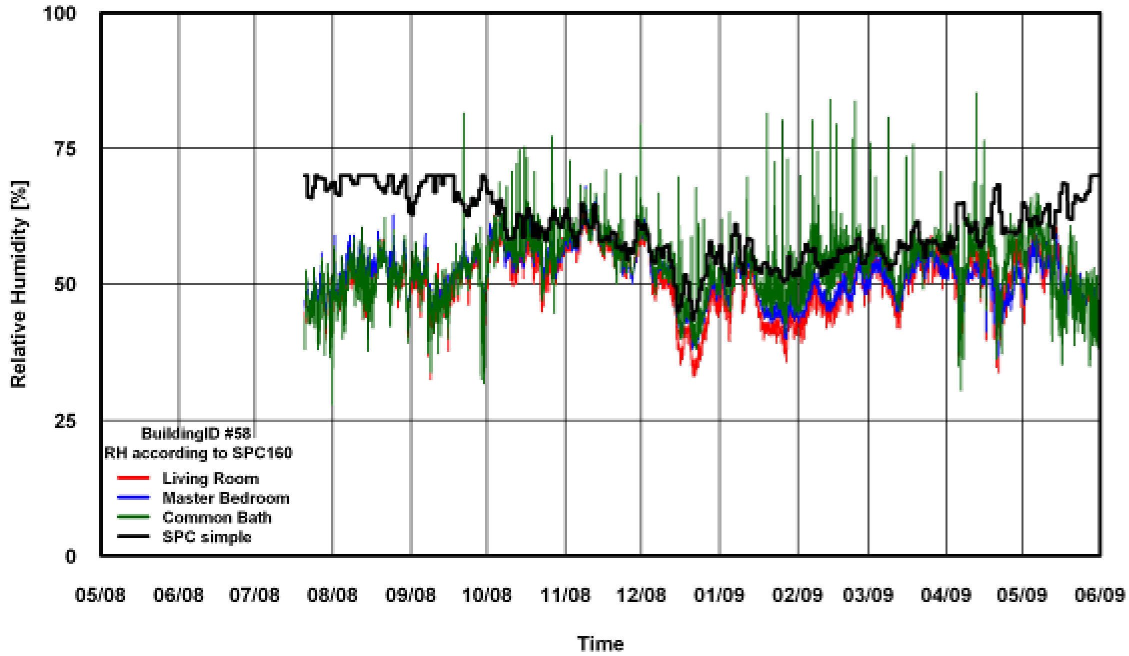

Figure 138: RH Comparison of SPC 160 Simple Method for Building # 58

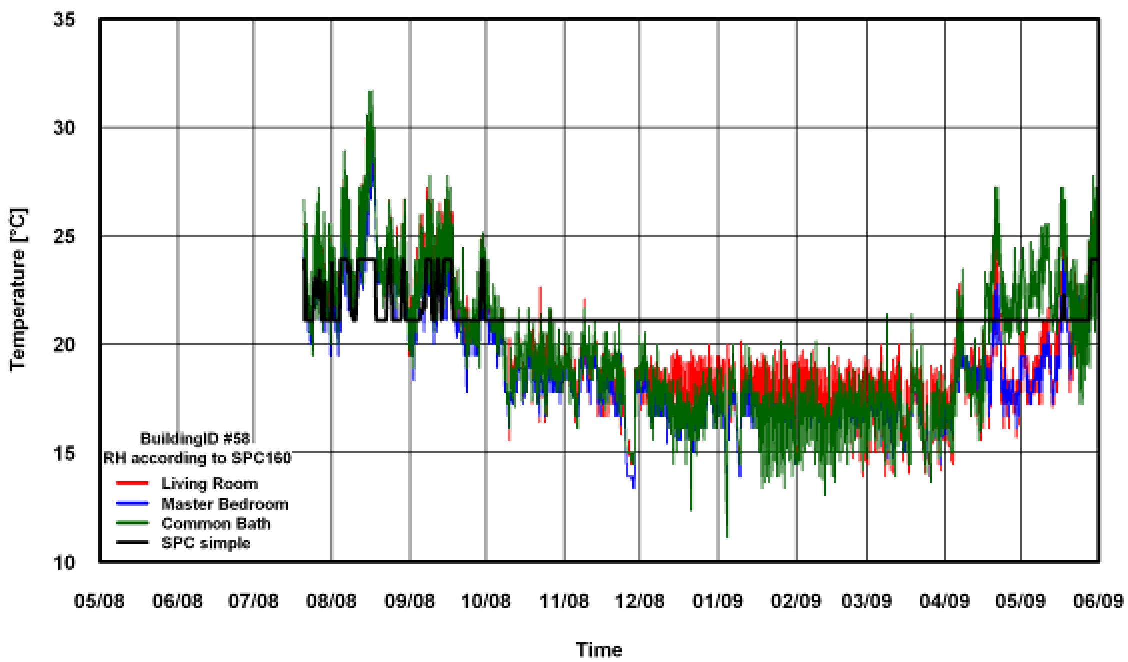

Figure 139: Temperature Comparison of SPC 160 Simple Method for Building # 58

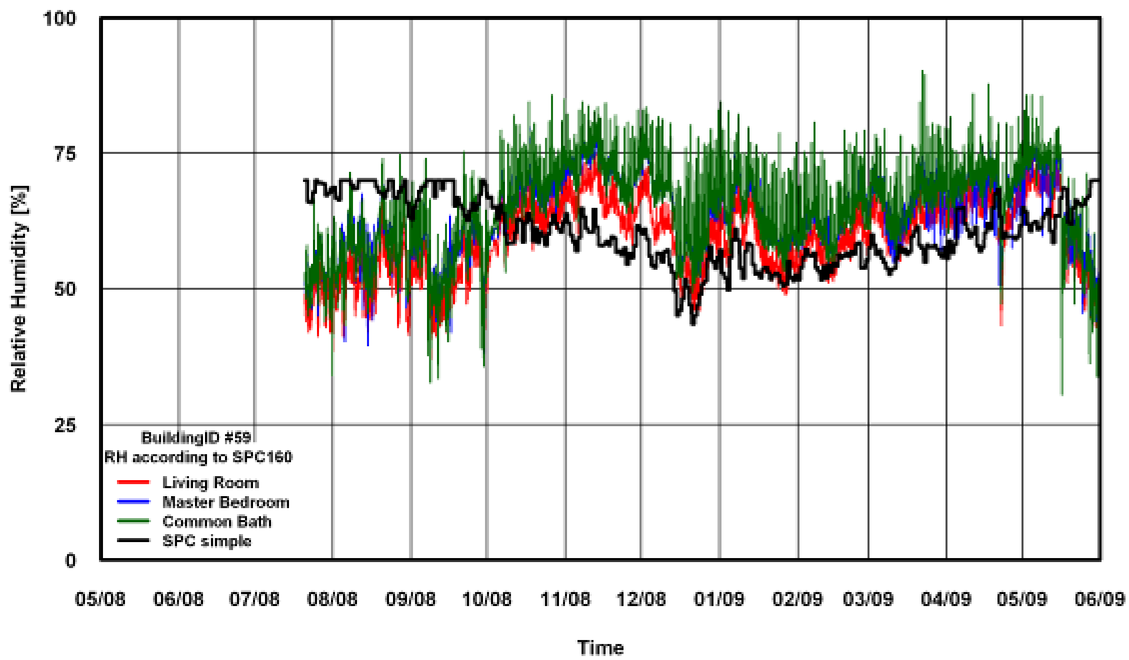

Figure 140: RH Comparison of SPC 160 Simple Method for Building # 59

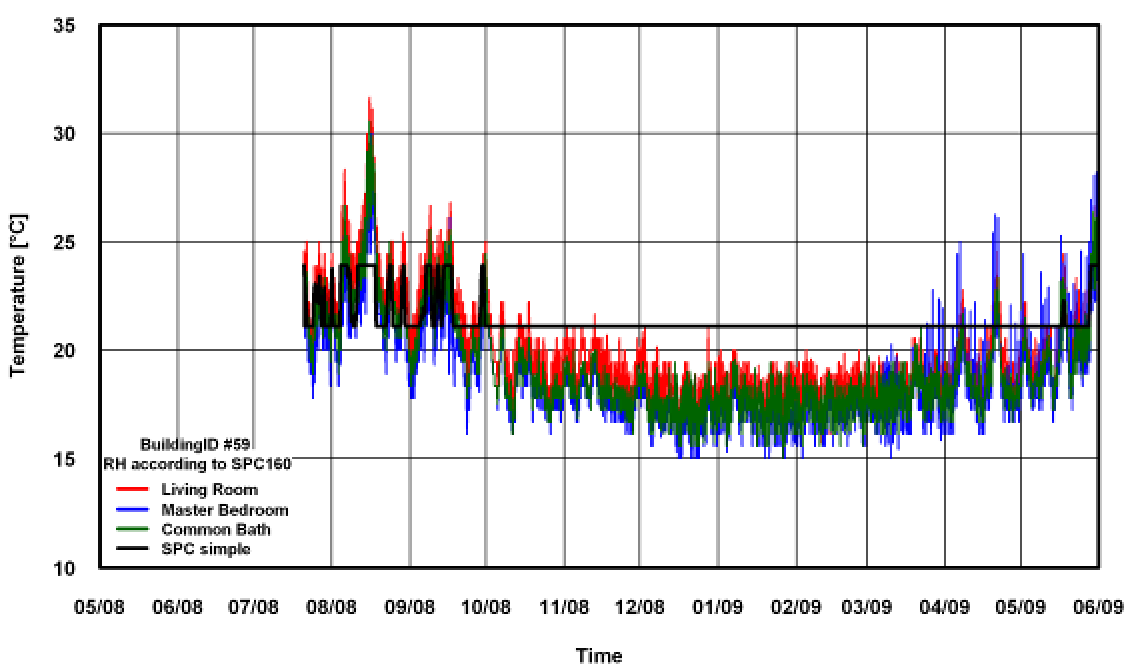

Figure 141: Temperature Comparison of SPC 160 Simple Method for Building # 59

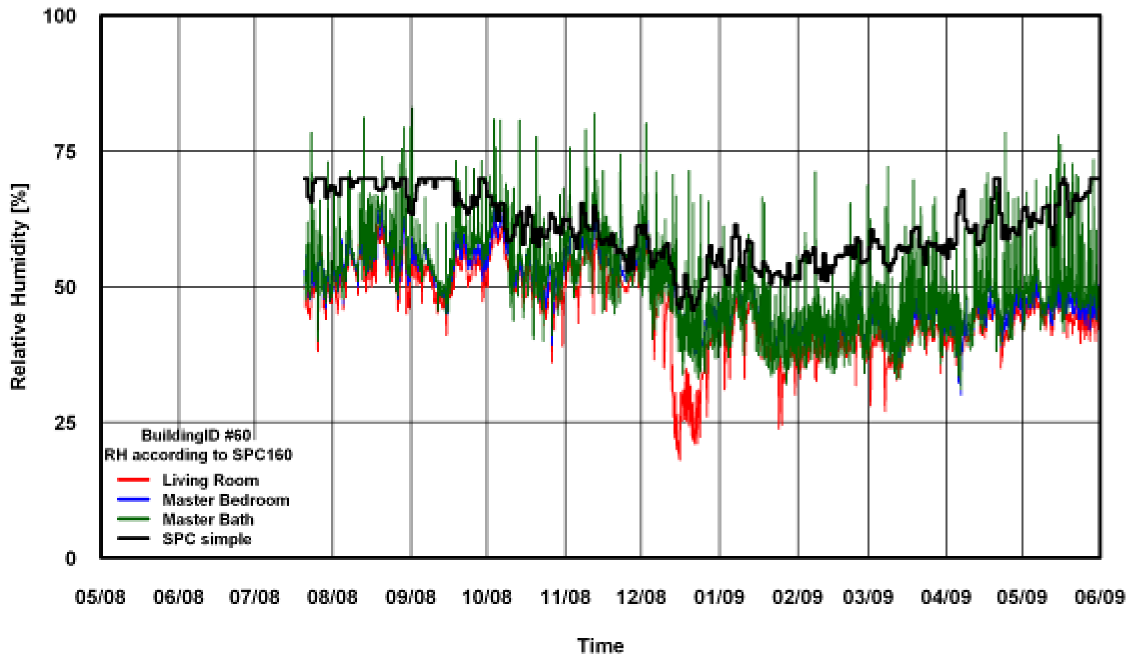

Figure 142: RH Comparison of SPC 160 Simple Method for Building # 60

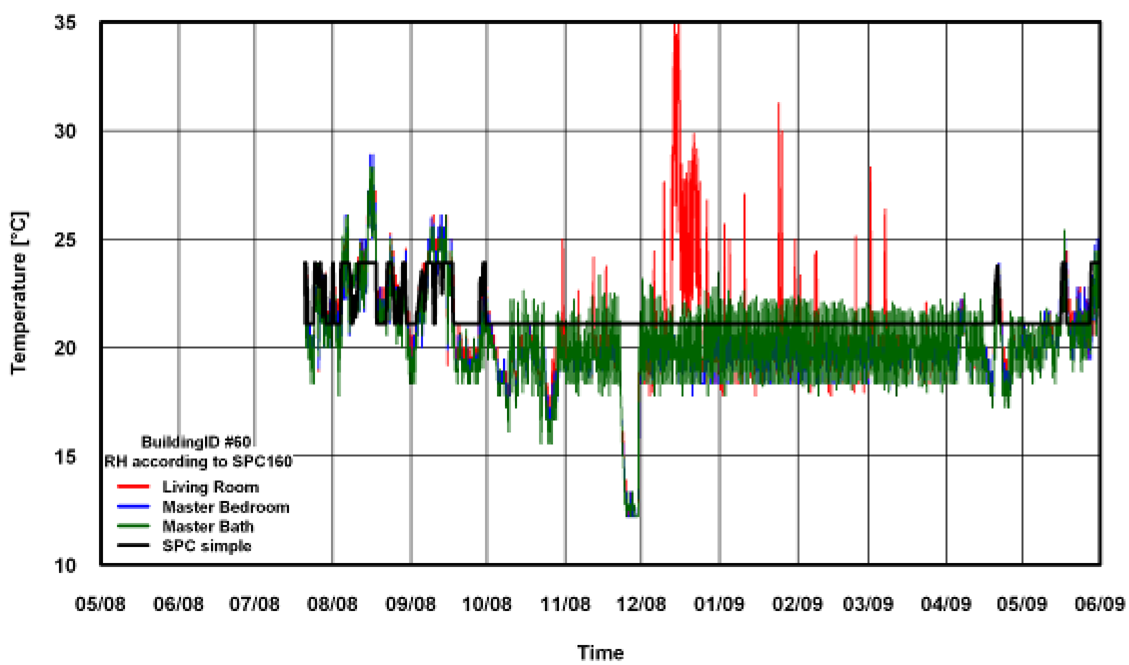

Figure 143: Temperature Comparison of SPC 160 Simple Method for Building # 60

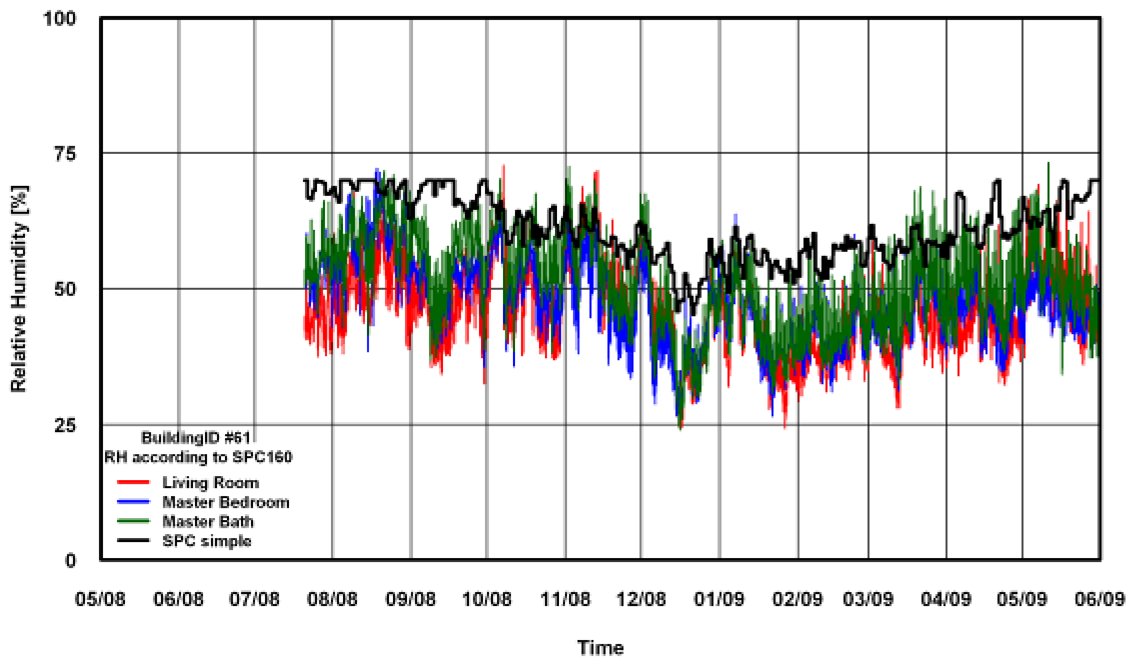

Figure 144: RH Comparison of SPC 160 Simple Method for Building # 61

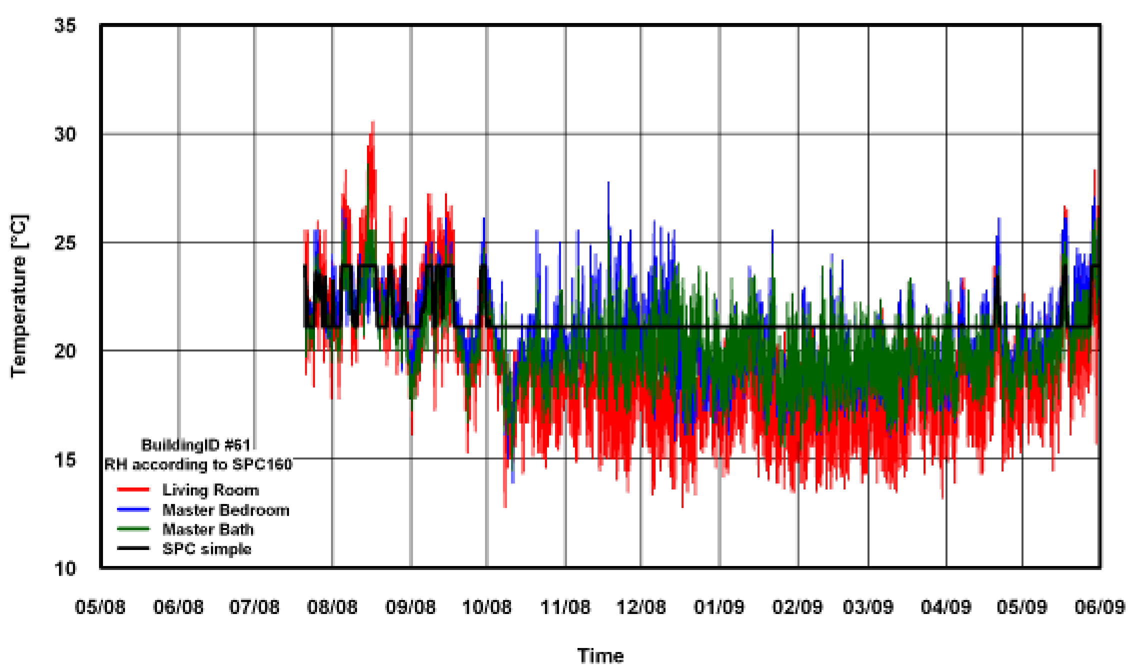

Figure 145: Temperature Comparison of SPC 160 Simple Method for Building # 61

APPENDIX B

ASHRAE Intermediate Method

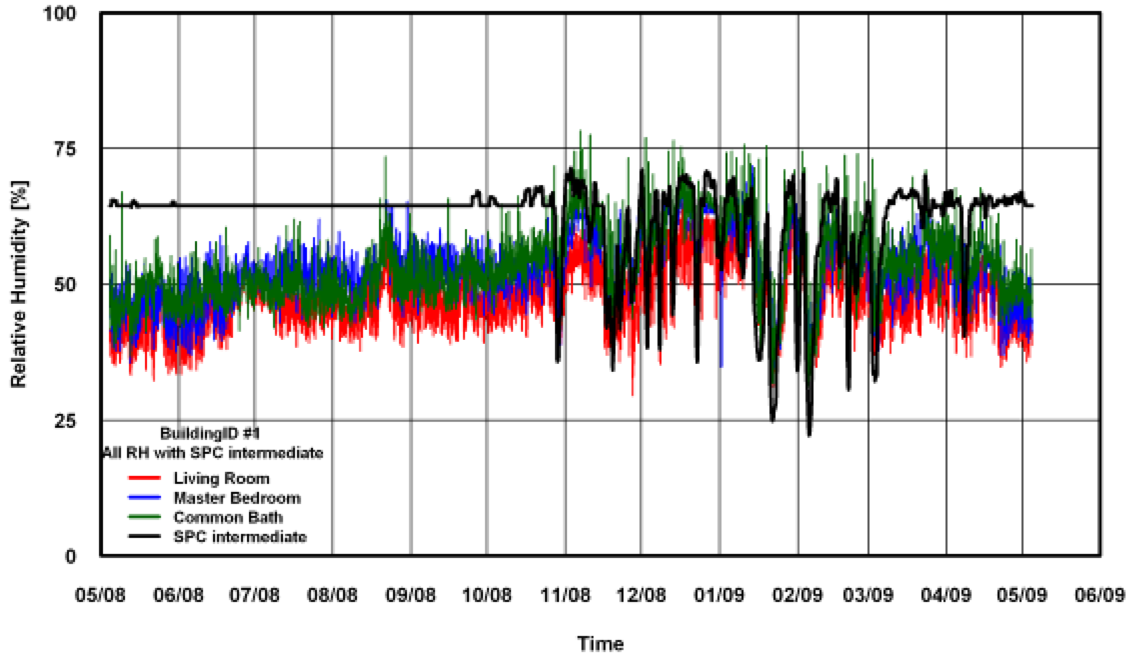

Figure 146: RH Comparison of SPC 160 Intermediate Method for Building # 1

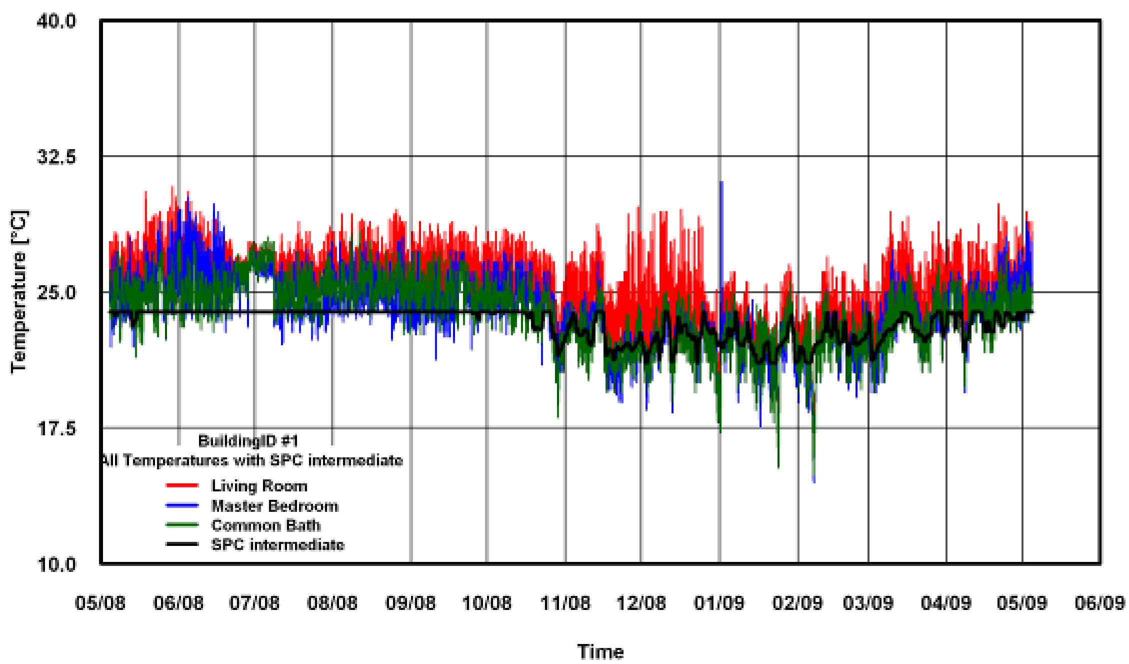

Figure 147: Temperature of SPC 160 Intermediate Method for Building # 1

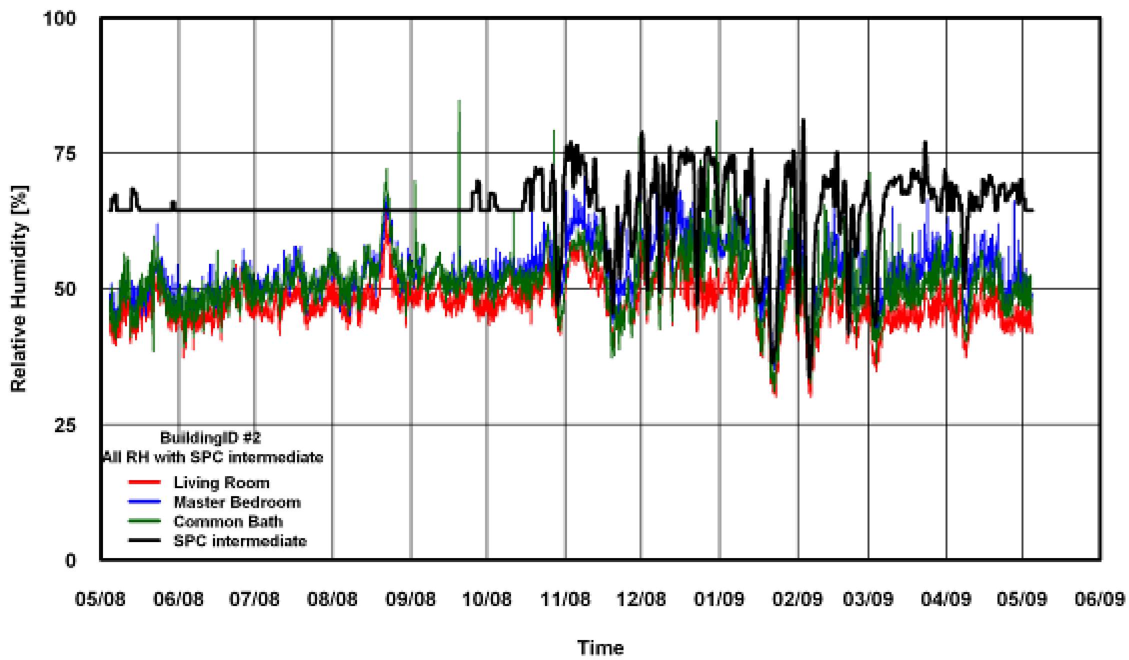

Figure 148: RH Comparison of SPC 160 Intermediate Method for Building # 2

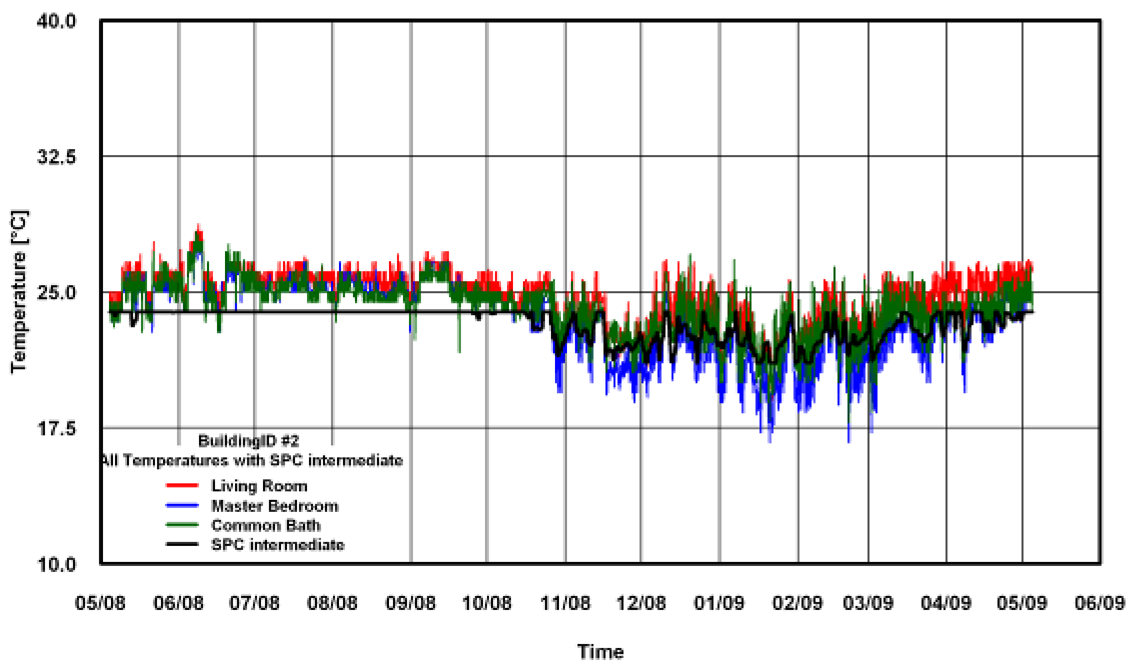

Figure 149: Temperature of SPC 160 Intermediate Method for Building # 2

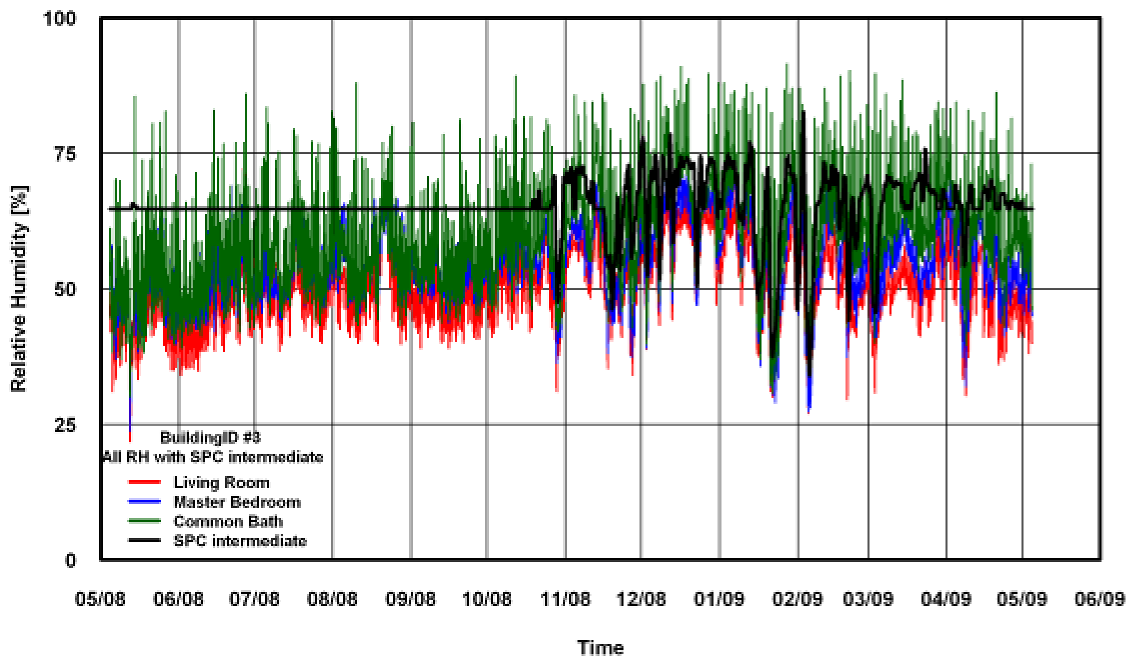

Figure 150: RH Comparison of SPC 160 Intermediate Method for Building # 3

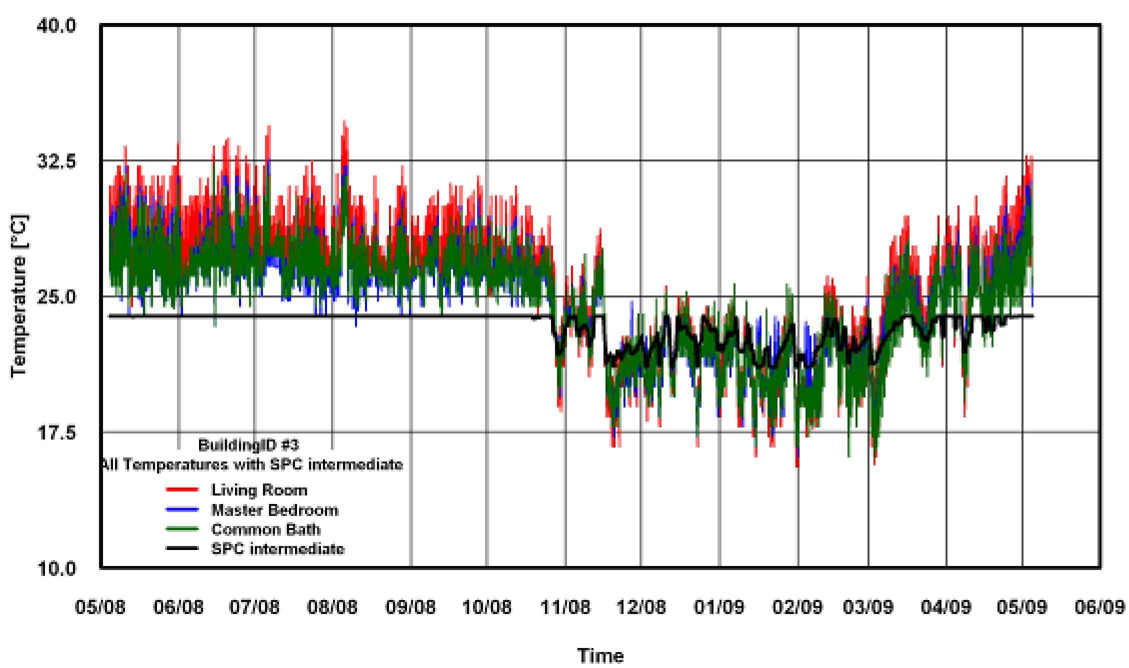

Figure 151: Temperature of SPC 160 Intermediate Method for Building # 3

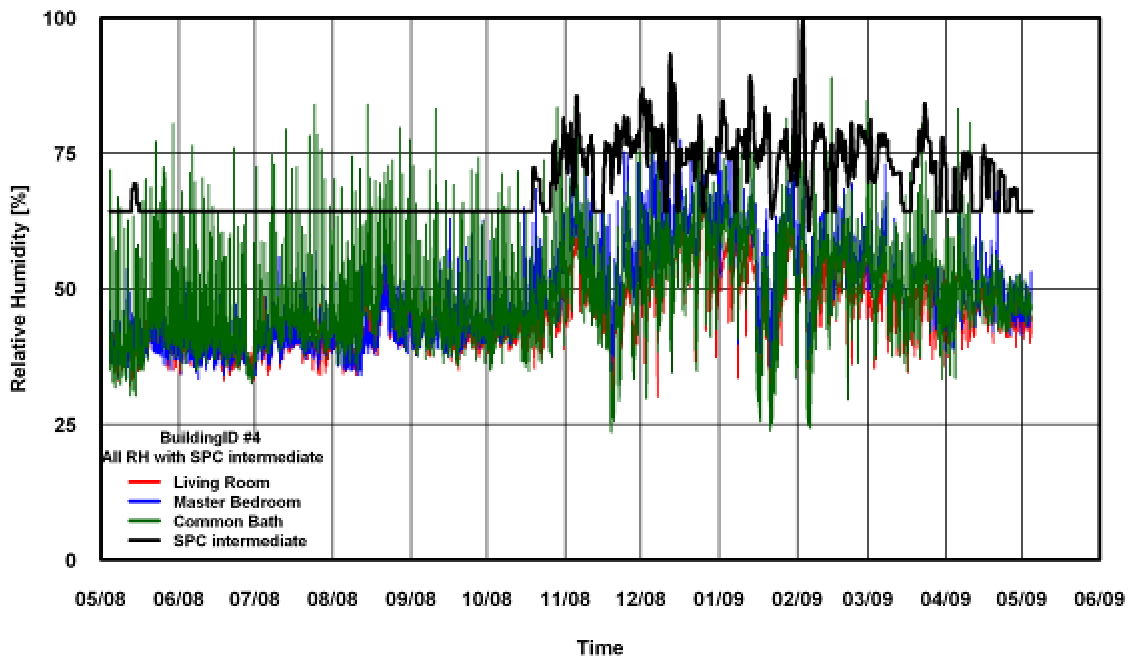

Figure 152: RH Comparison of SPC 160 Intermediate Method for Building # 4

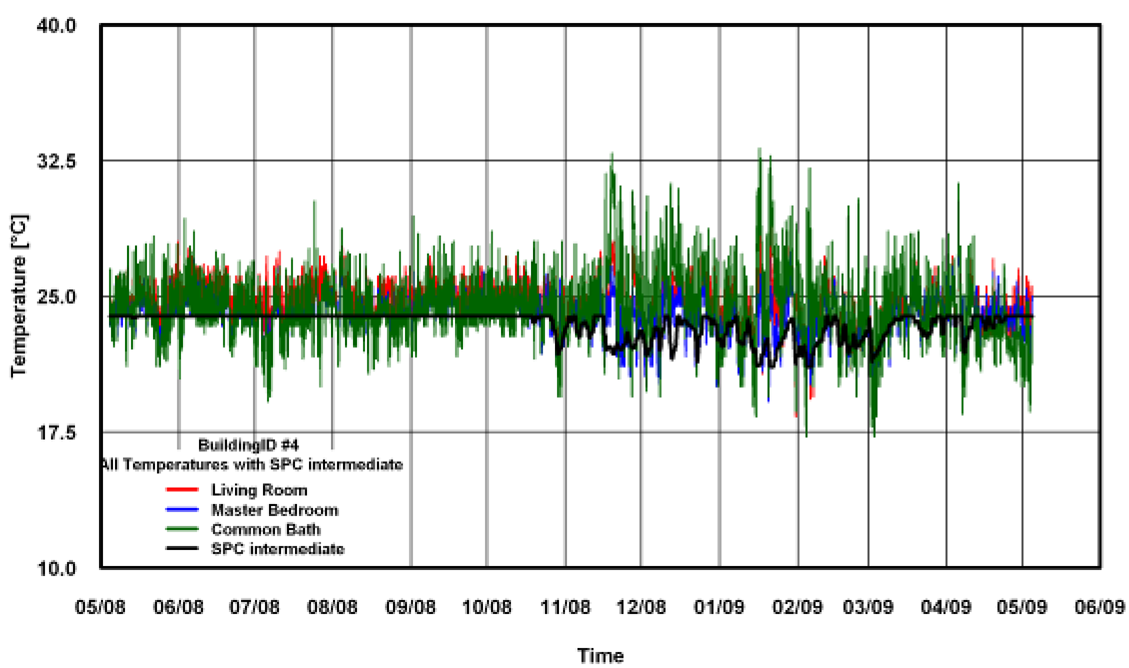

Figure 153: Temperature of SPC 160 Intermediate Method for Building # 4

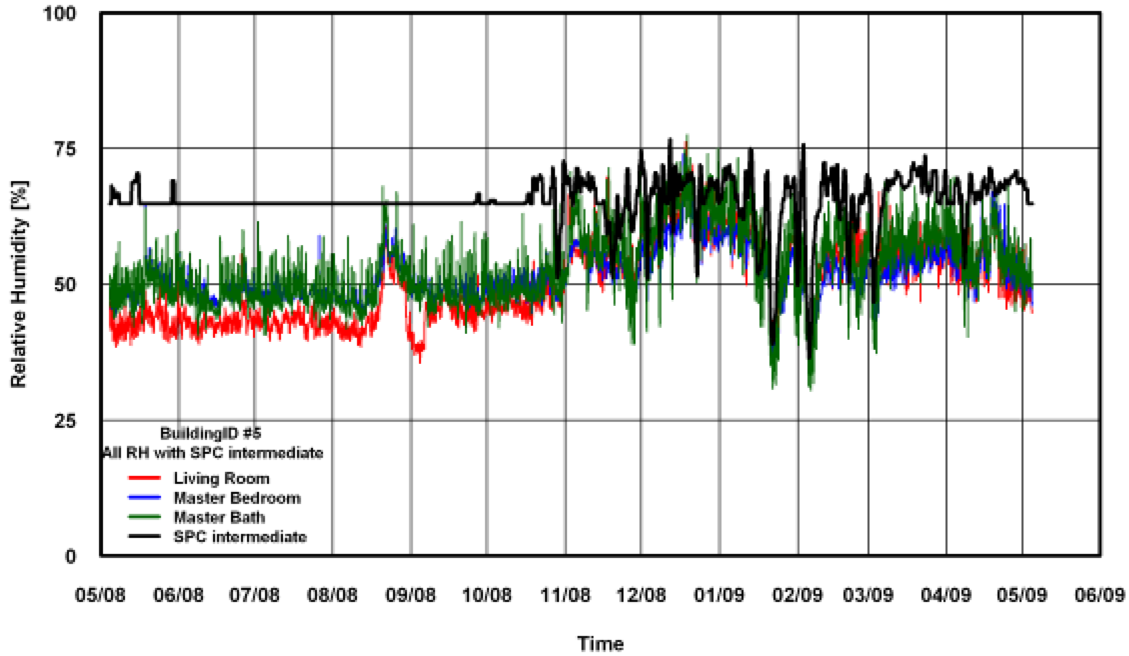

Figure 154: RH Comparison of SPC 160 Intermediate Method for Building # 5

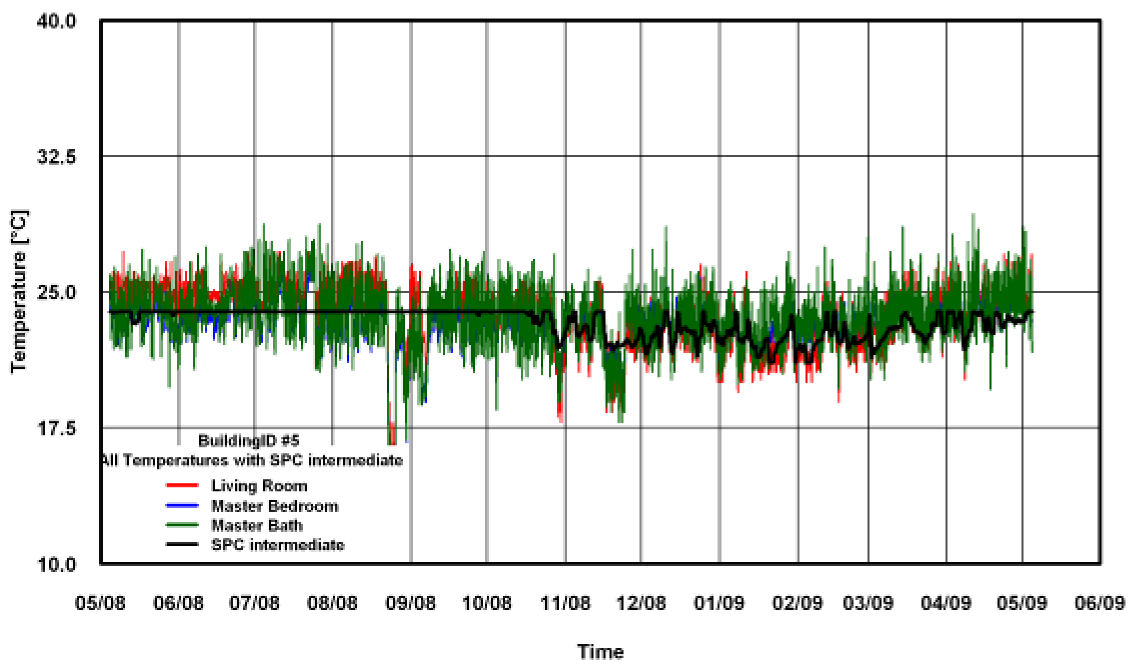

Figure 155: Temperature of SPC 160 Intermediate Method for Building # 5

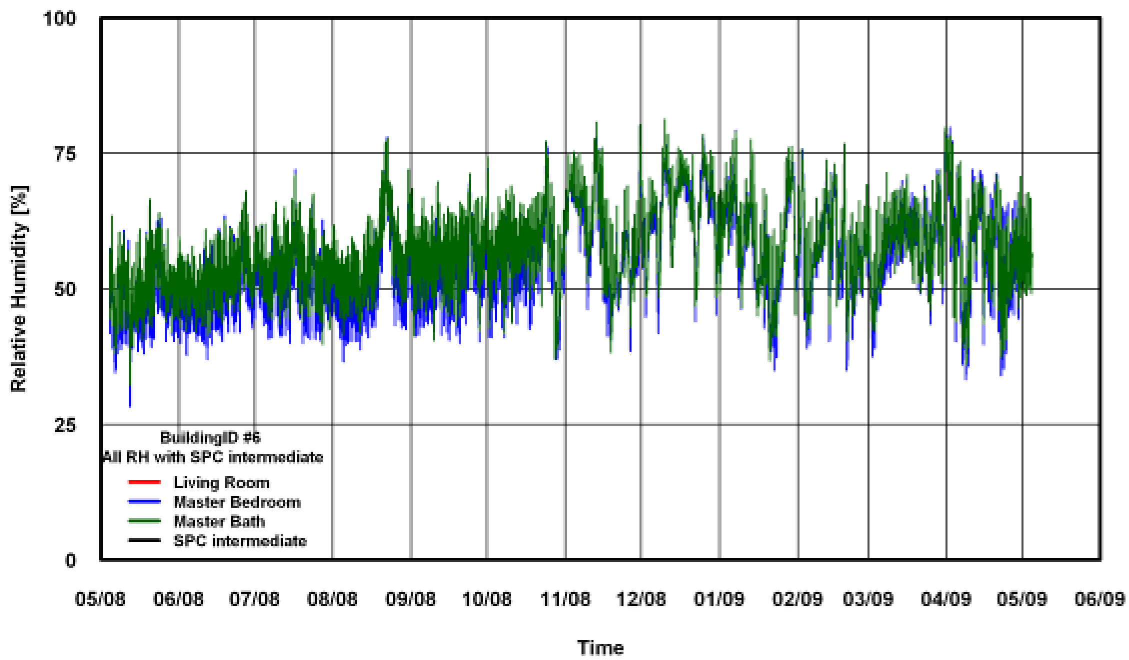

Figure 156: RH Comparison of SPC 160 Intermediate Method for Building # 6

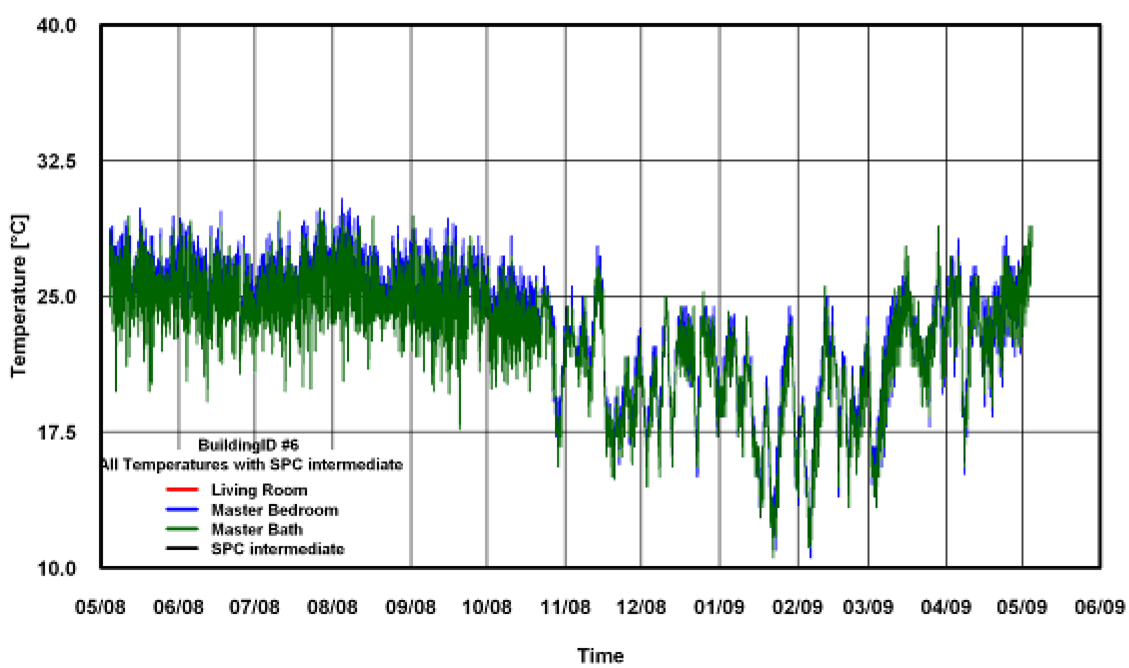

Figure 157: Temperature of SPC 160 Intermediate Method for Building # 6

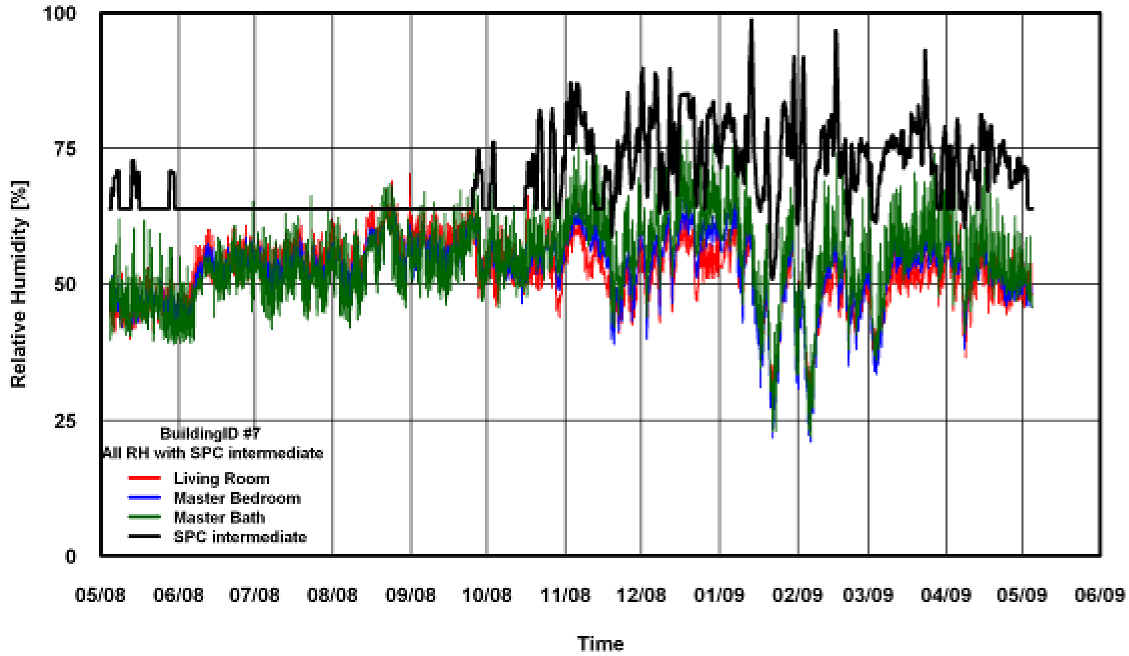

Figure 158: RH Comparison of SPC 160 Intermediate Method for Building # 7

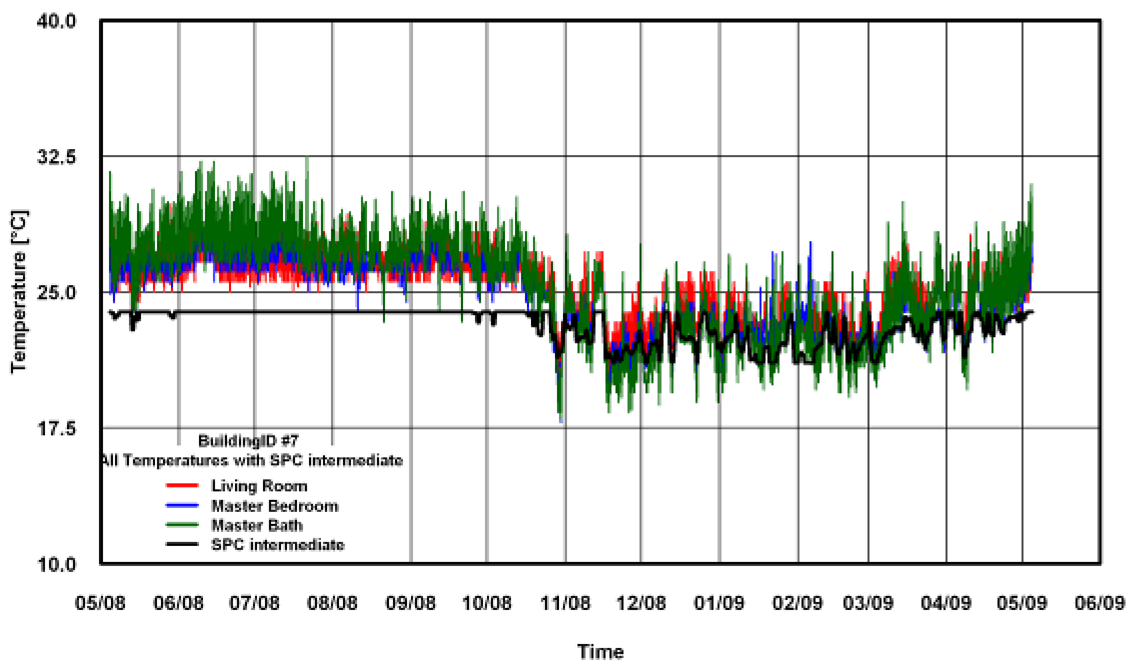

Figure 159: Temperature of SPC 160 Intermediate Method for Building # 7

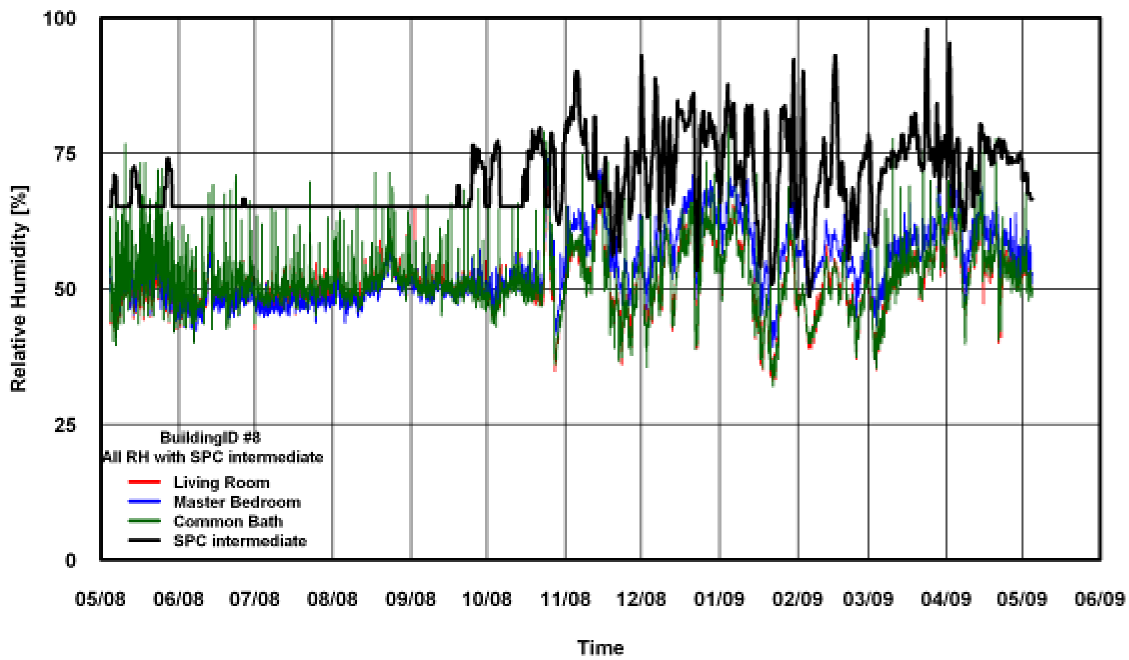

Figure 160: RH Comparison of SPC 160 Intermediate Method for Building # 8

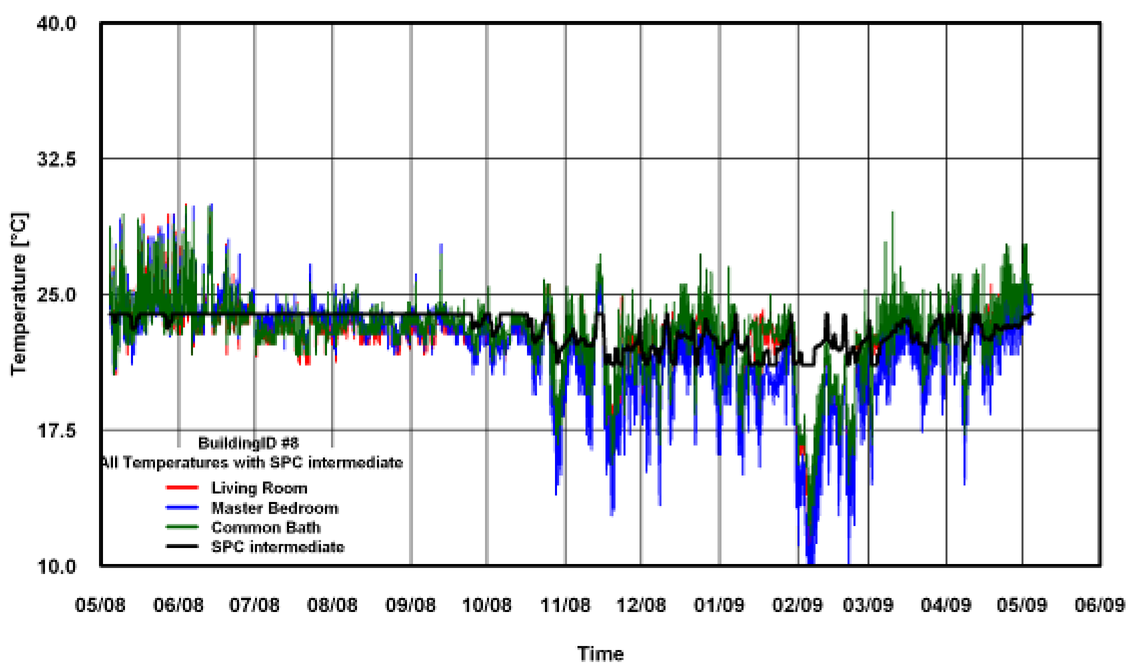

Figure 161: Temperature of SPC 160 Intermediate Method for Building # 8

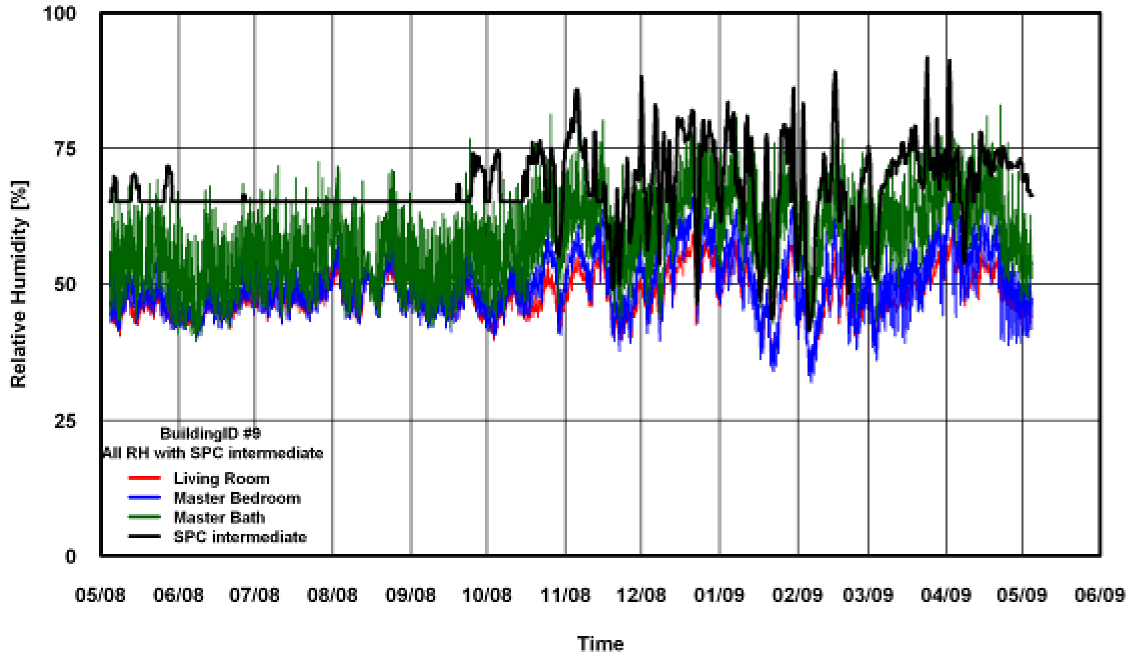

Figure 162: RH Comparison of SPC 160 Intermediate Method for Building # 9

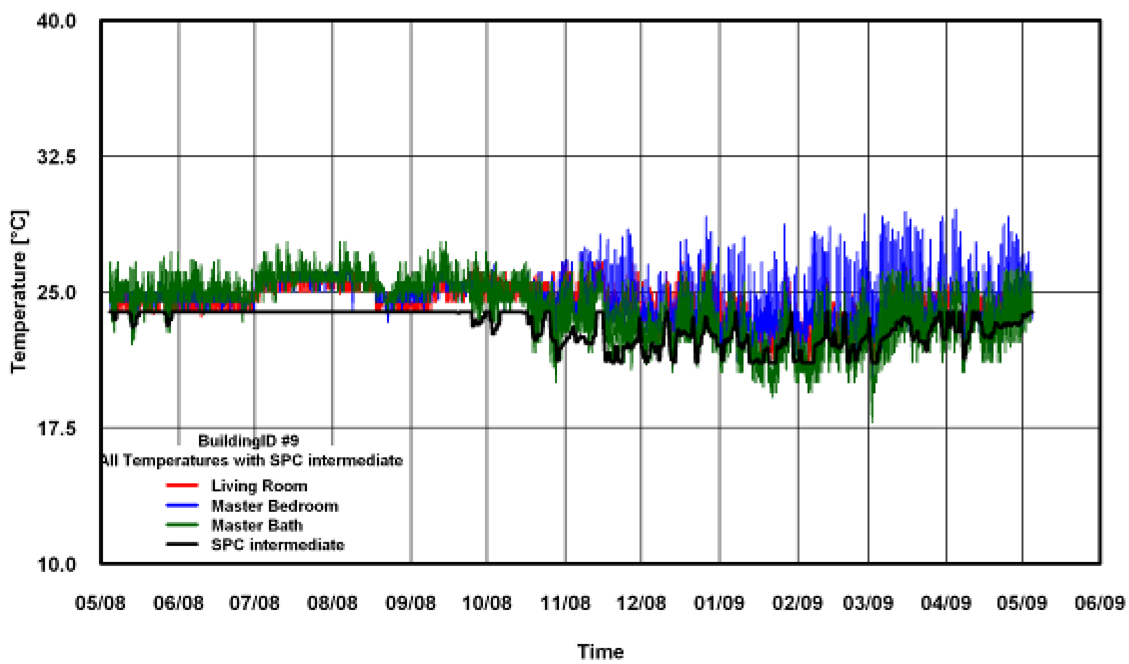

Figure 163: Temperature of SPC 160 Intermediate Method for Building # 9

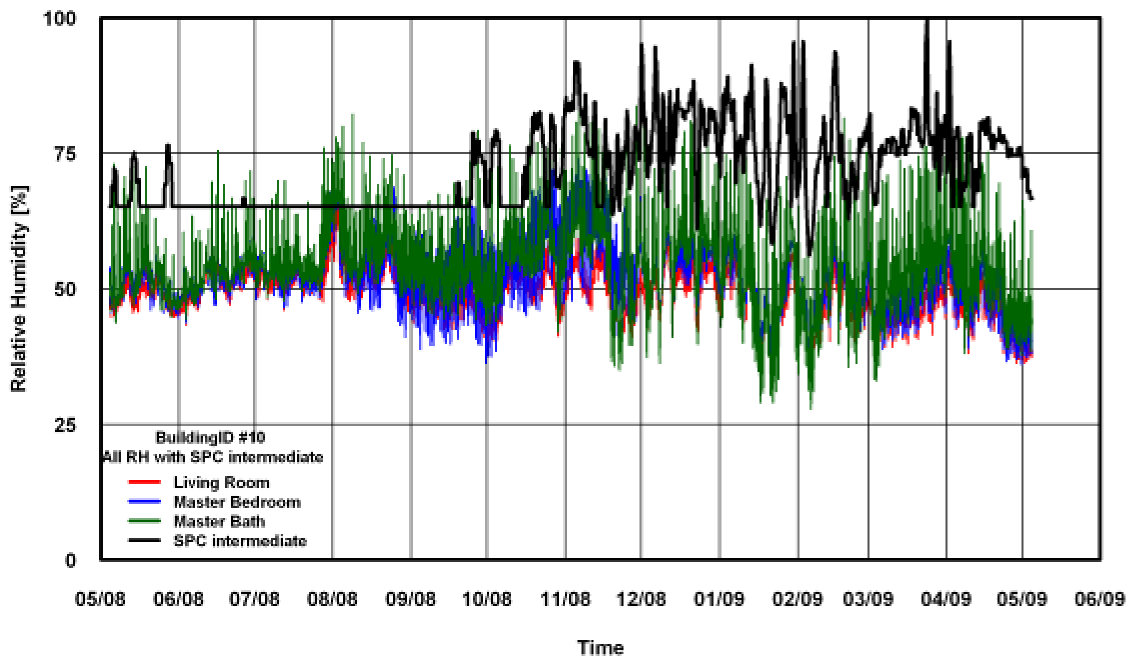

Figure 164: RH Comparison of SPC 160 Intermediate Method for Building # 10

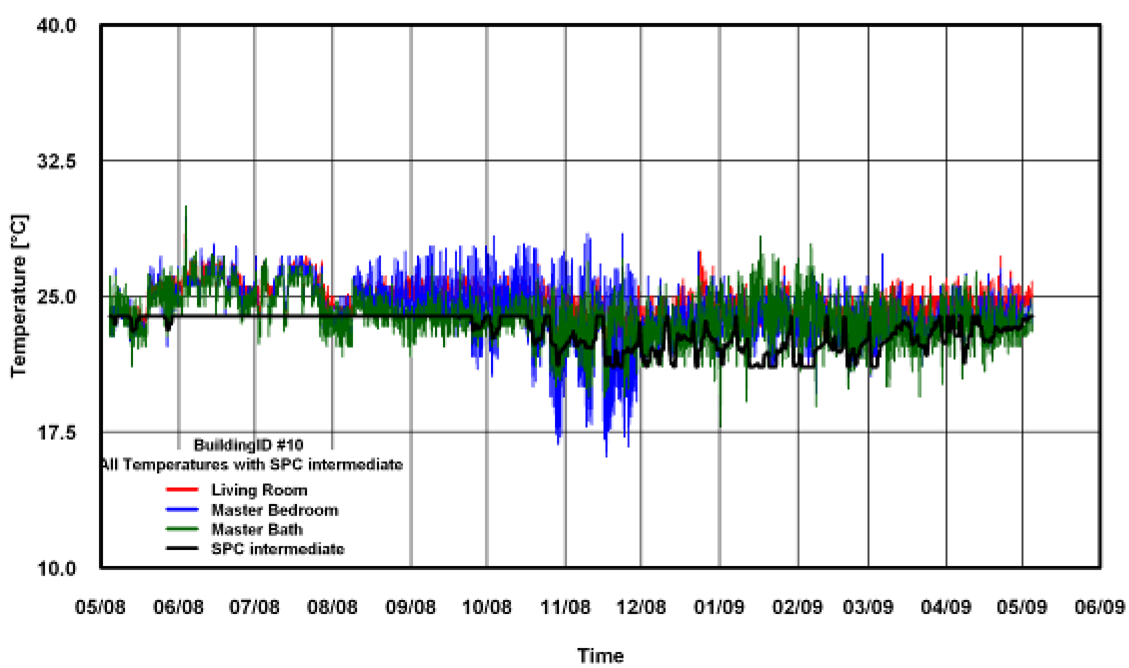

Figure 165: Temperature of SPC 160 Intermediate Method for Building # 10

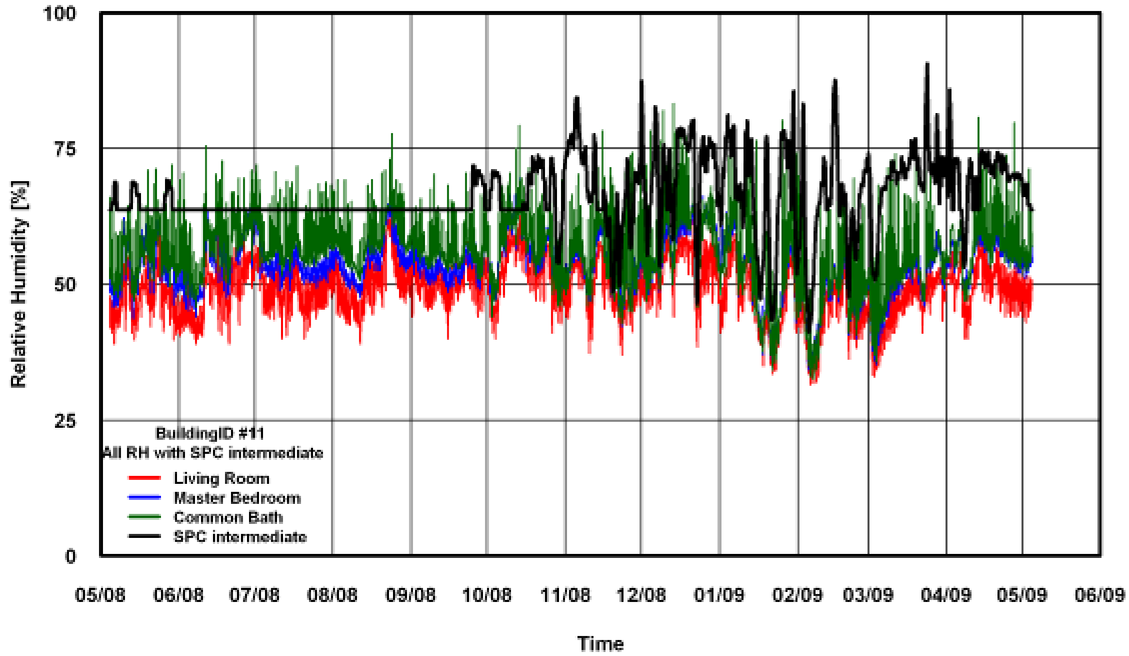

Figure 166: RH Comparison of SPC 160 Intermediate Method for Building # 11

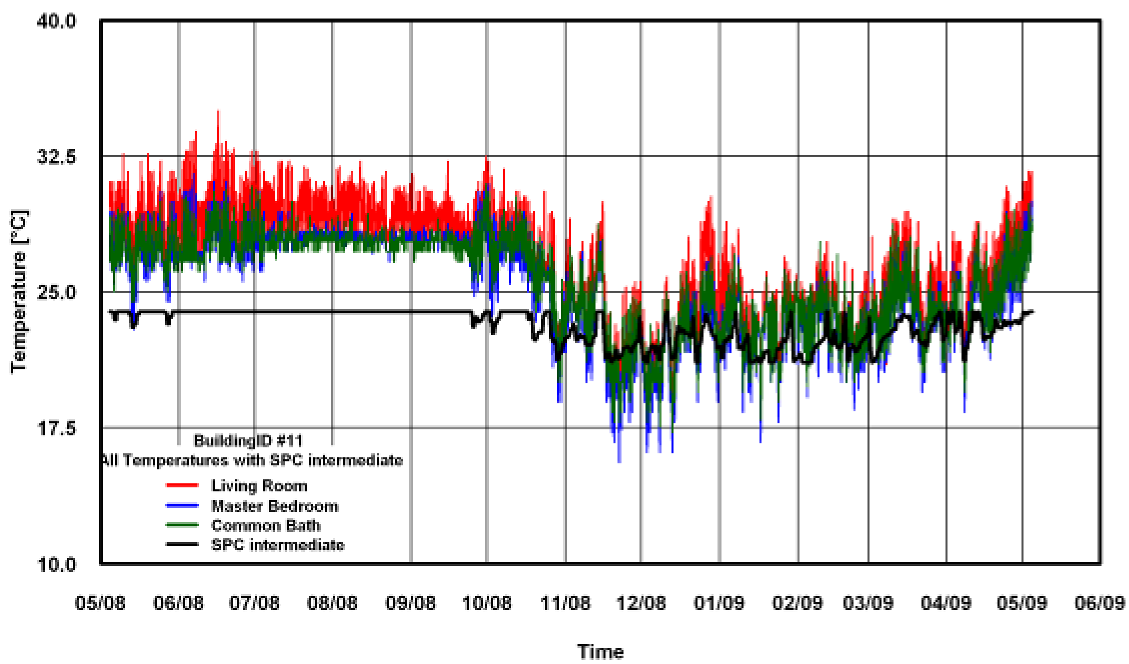

Figure 167: Temperature of SPC 160 Intermediate Method for Building # 11

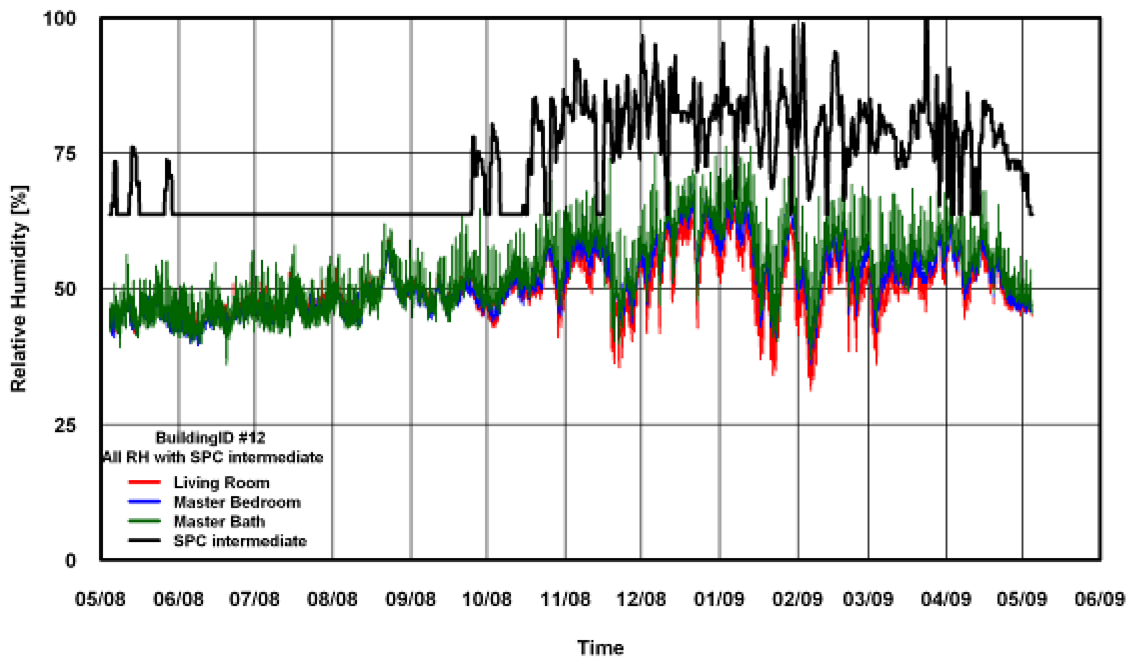

Figure 168: RH Comparison of SPC 160 Intermediate Method for Building # 12

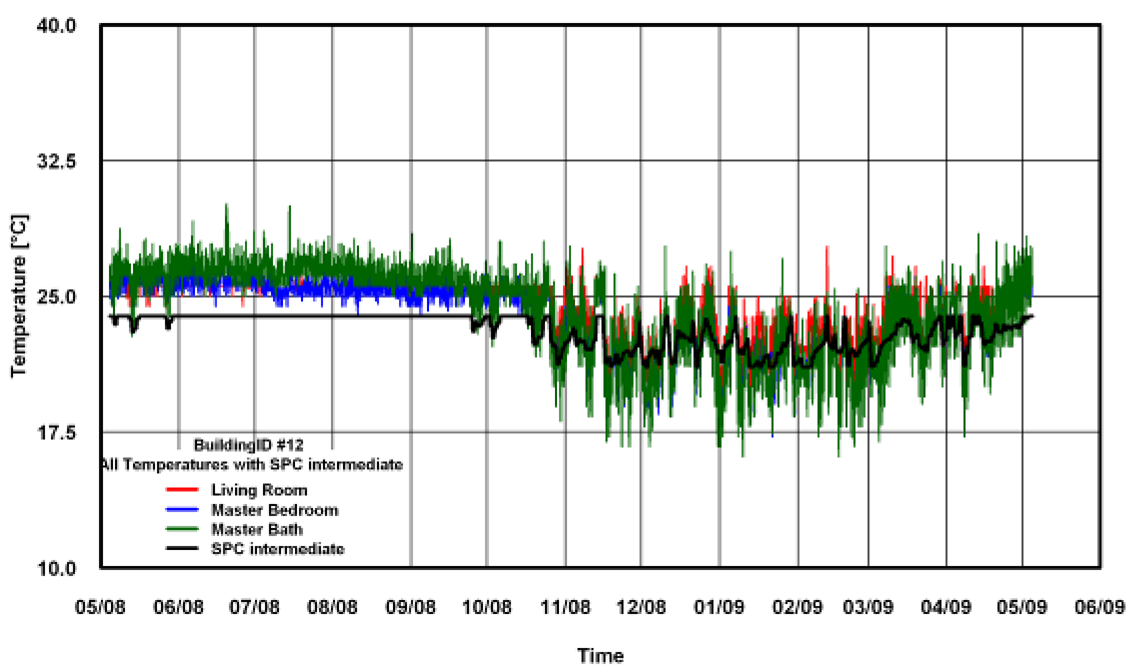

Figure 169: Temperature of SPC 160 Intermediate Method for Building # 12

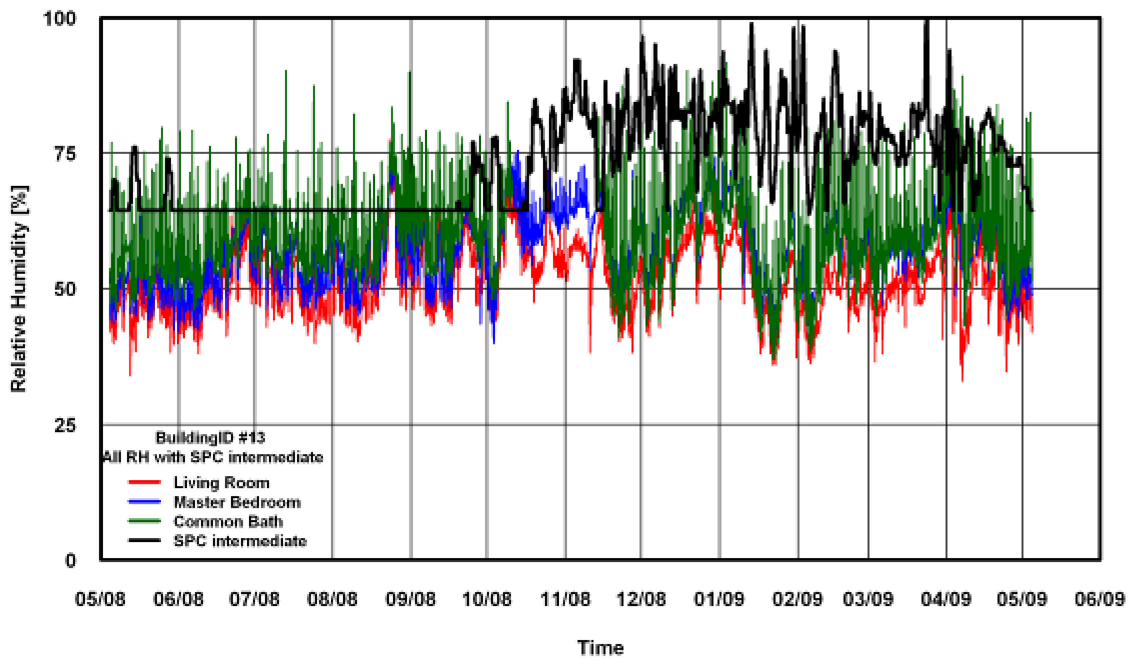

Figure 170: RH Comparison of SPC 160 Intermediate Method for Building # 13

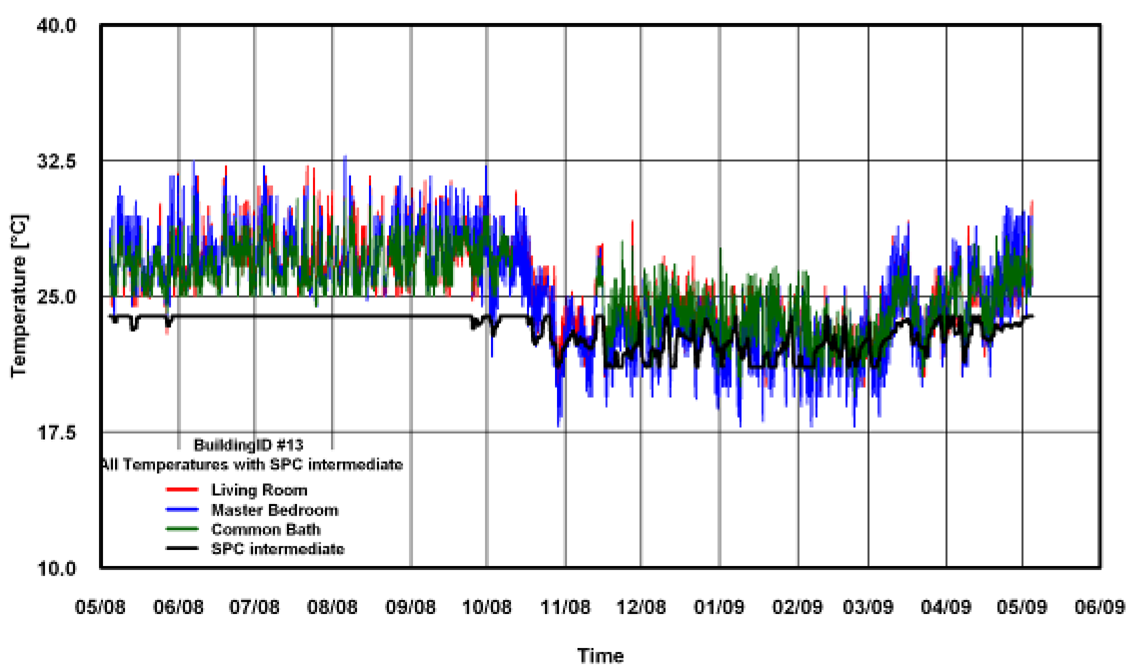

Figure 171: Temperature of SPC 160 Intermediate Method for Building # 13

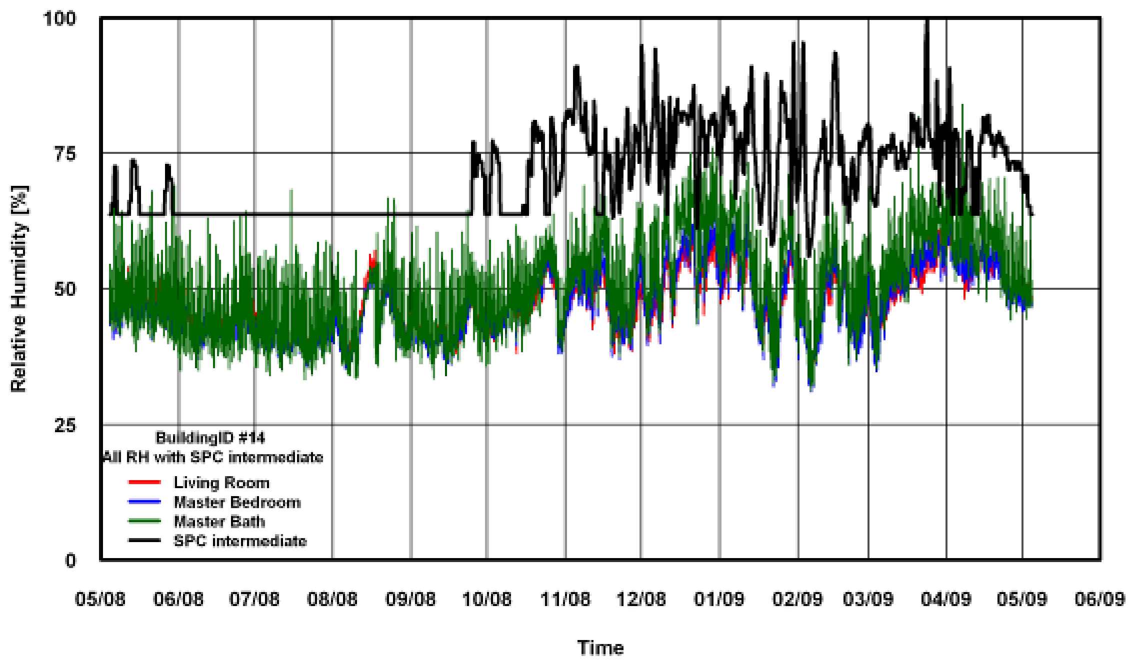

Figure 172: RH Comparison of SPC 160 Intermediate Method for Building # 14

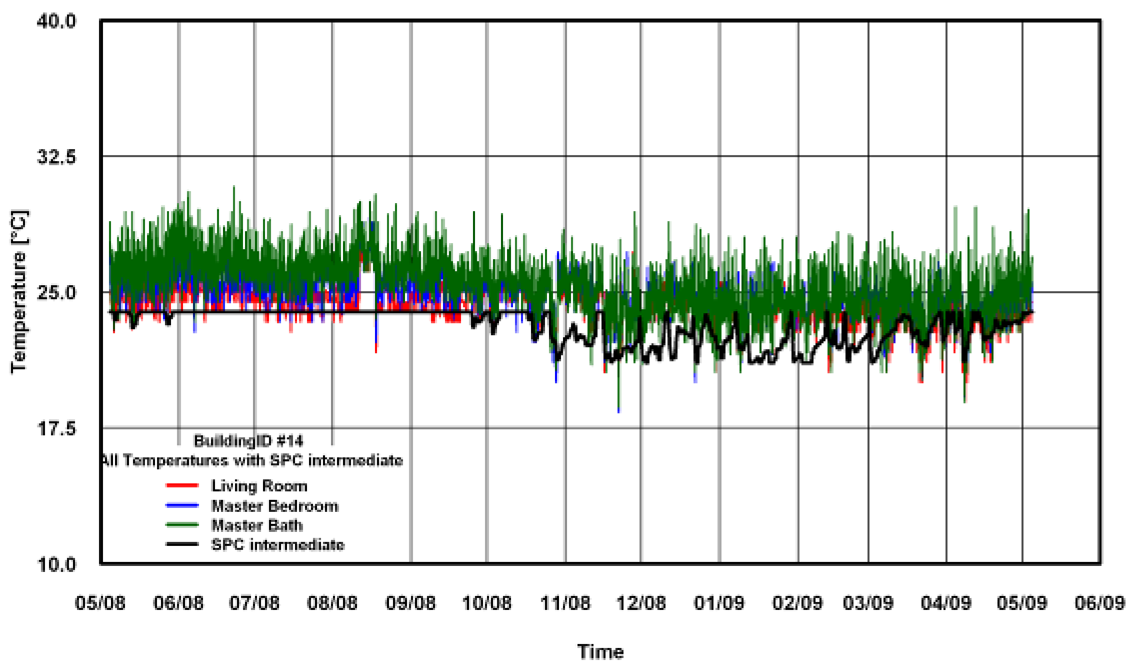

Figure 173: Temperature of SPC 160 Intermediate Method for Building # 14

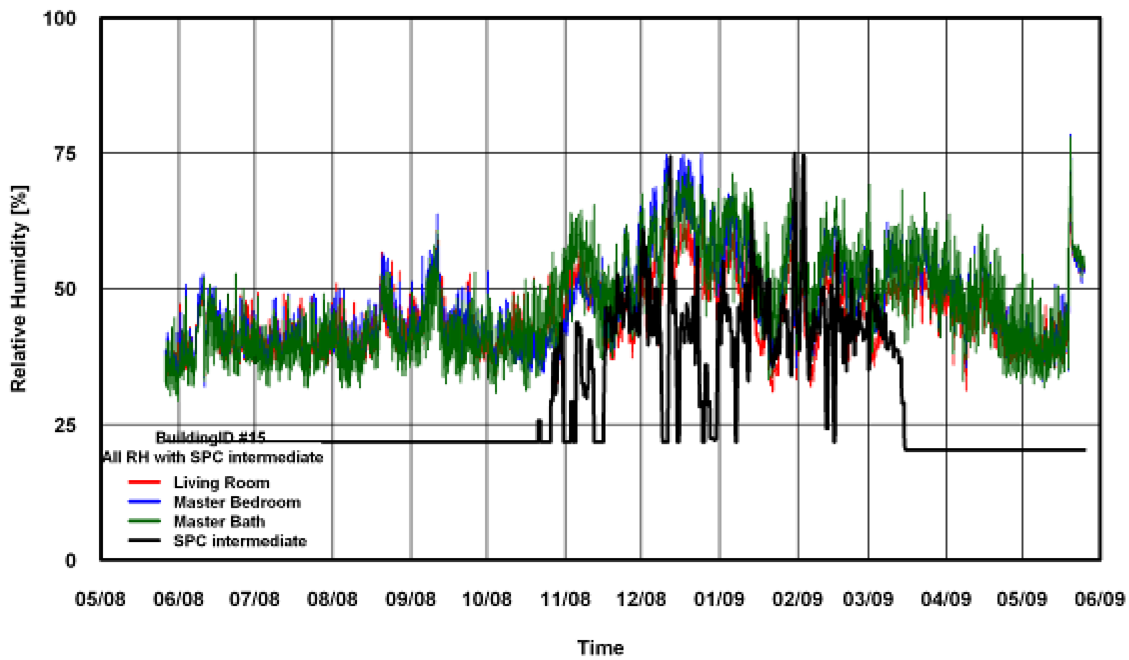

Figure 174: RH Comparison of SPC 160 Intermediate Method for Building # 15

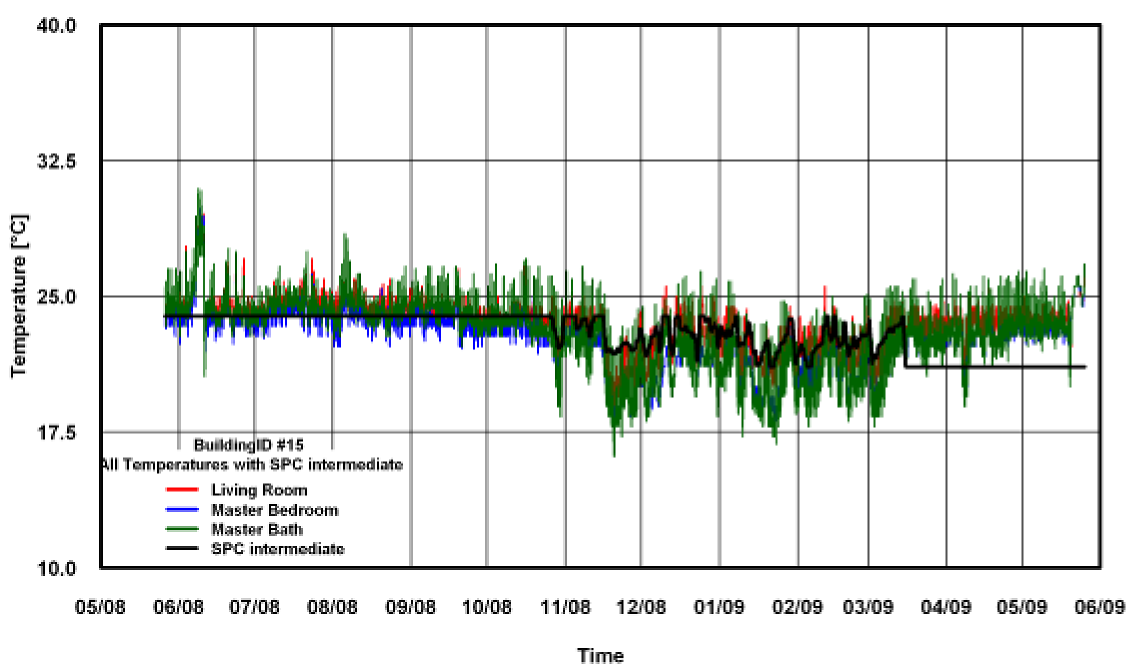

Figure 175: Temperature of SPC 160 Intermediate Method for Building # 15

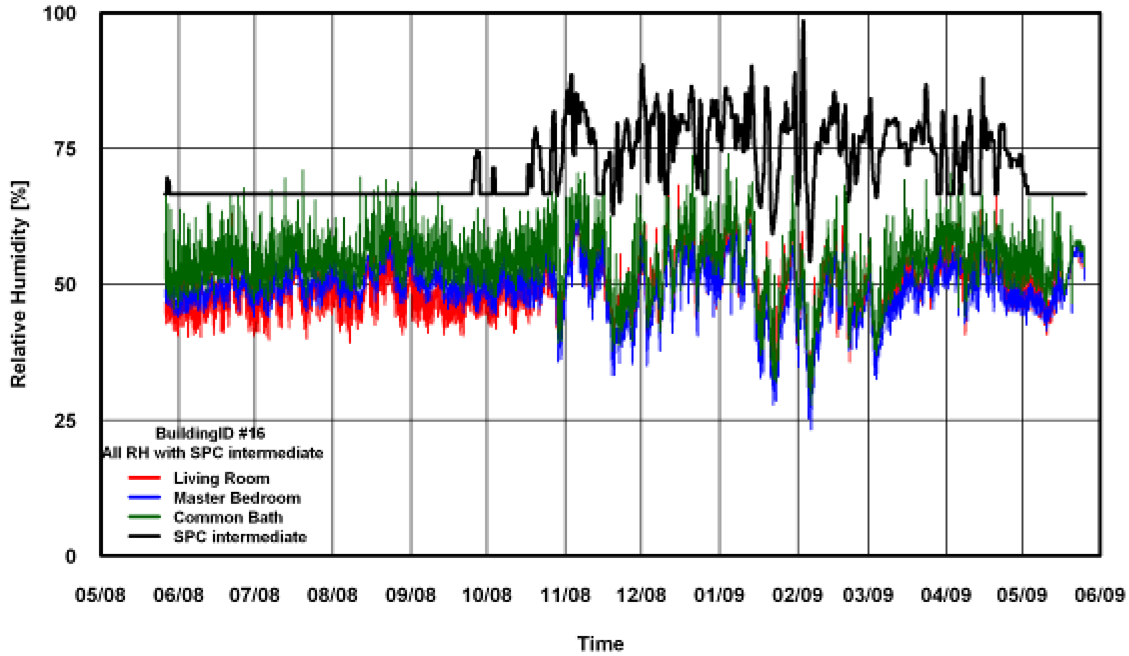

Figure 176: RH Comparison of SPC 160 Intermediate Method for Building # 16

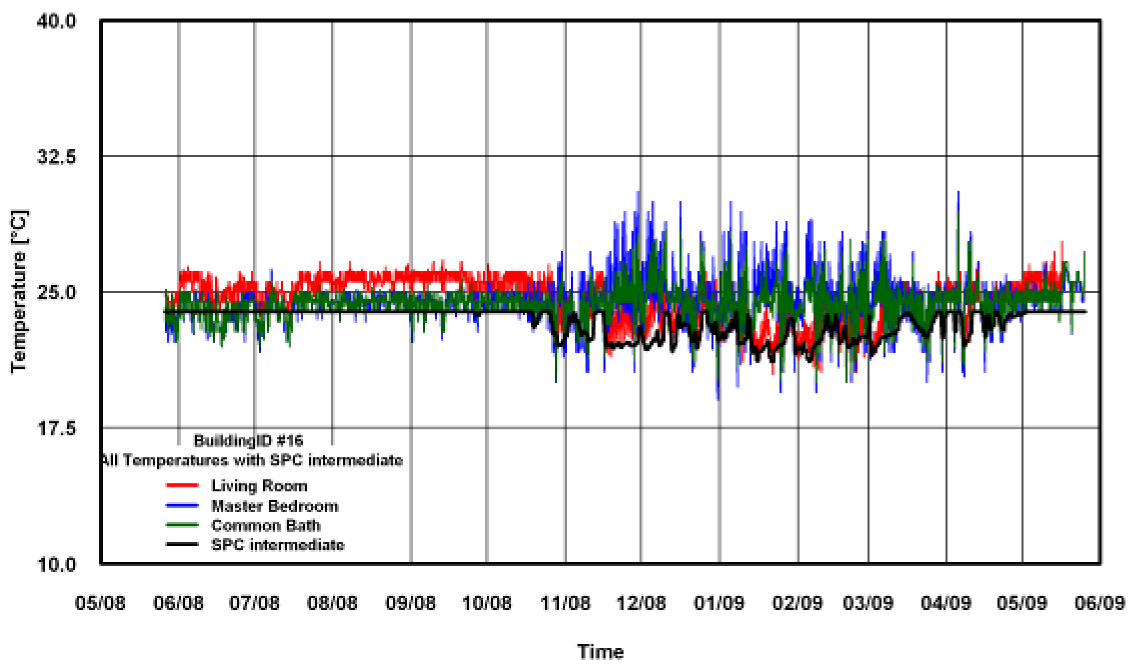

Figure 177: Temperature of SPC 160 Intermediate Method for Building # 16

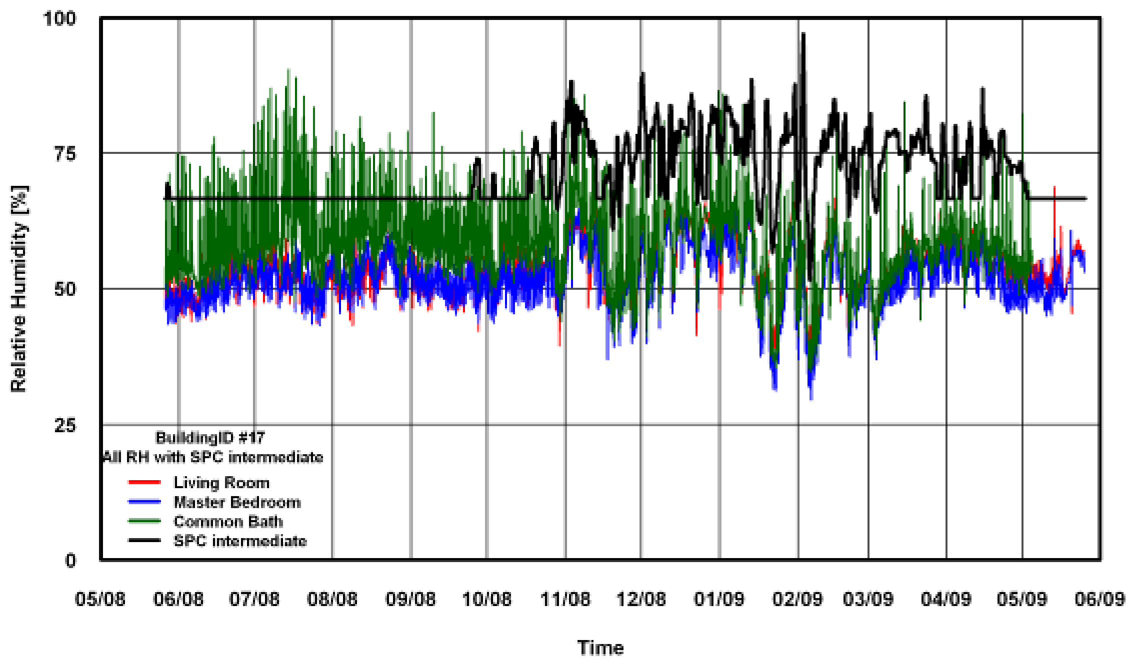

Figure 178: RH Comparison of SPC 160 Intermediate Method for Building # 17

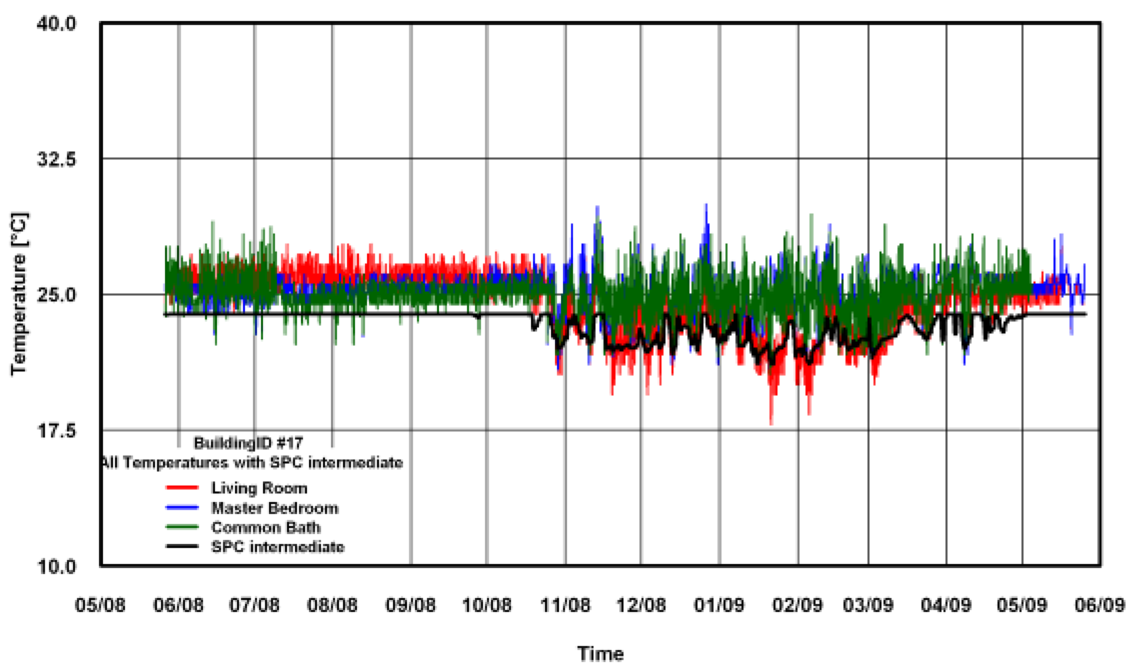

Figure 179: Temperature of SPC 160 Intermediate Method for Building # 17

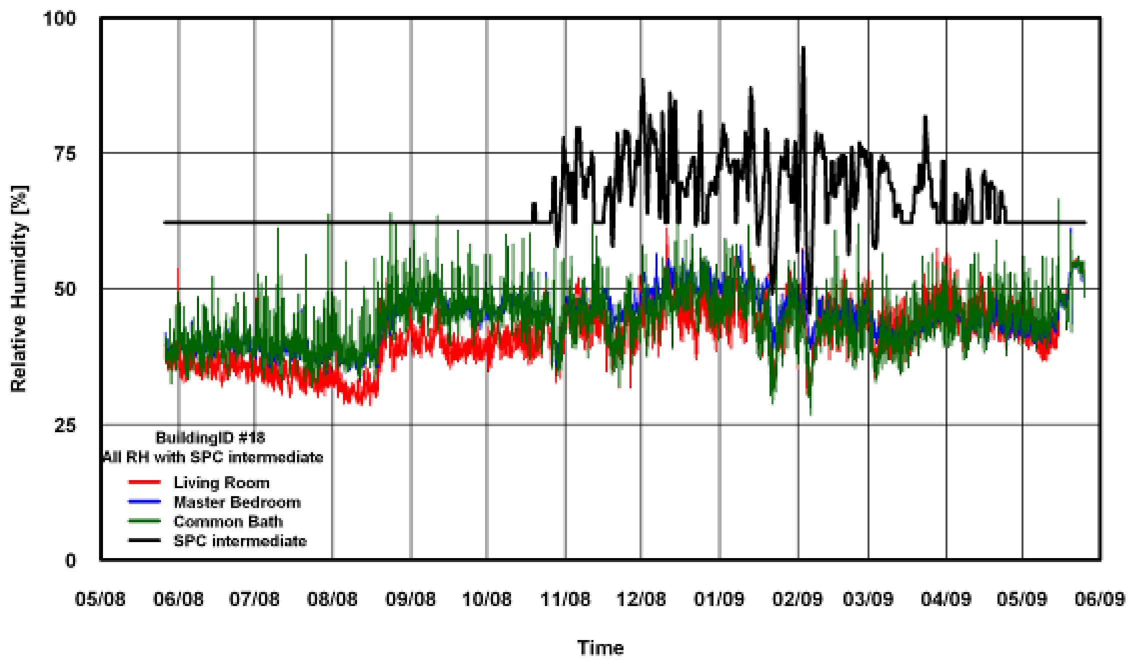

Figure 180: RH Comparison of SPC 160 Intermediate Method for Building # 18

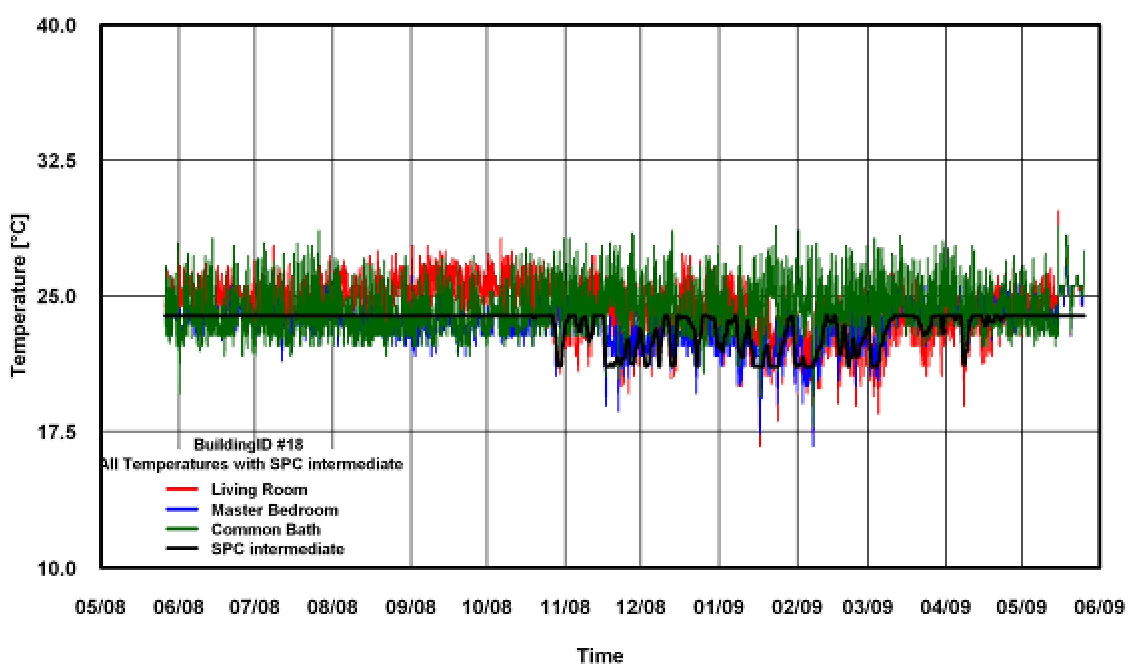

Figure 181: Temperature of SPC 160 Intermediate Method for Building # 18

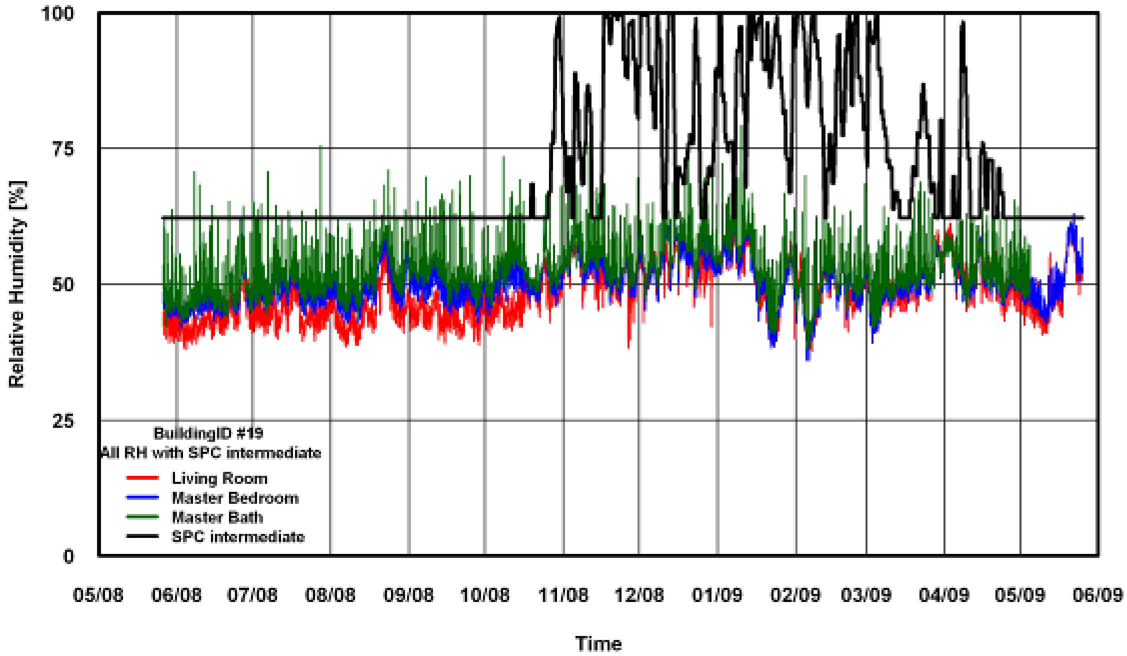

Figure 182: RH Comparison of SPC 160 Intermediate Method for Building # 19

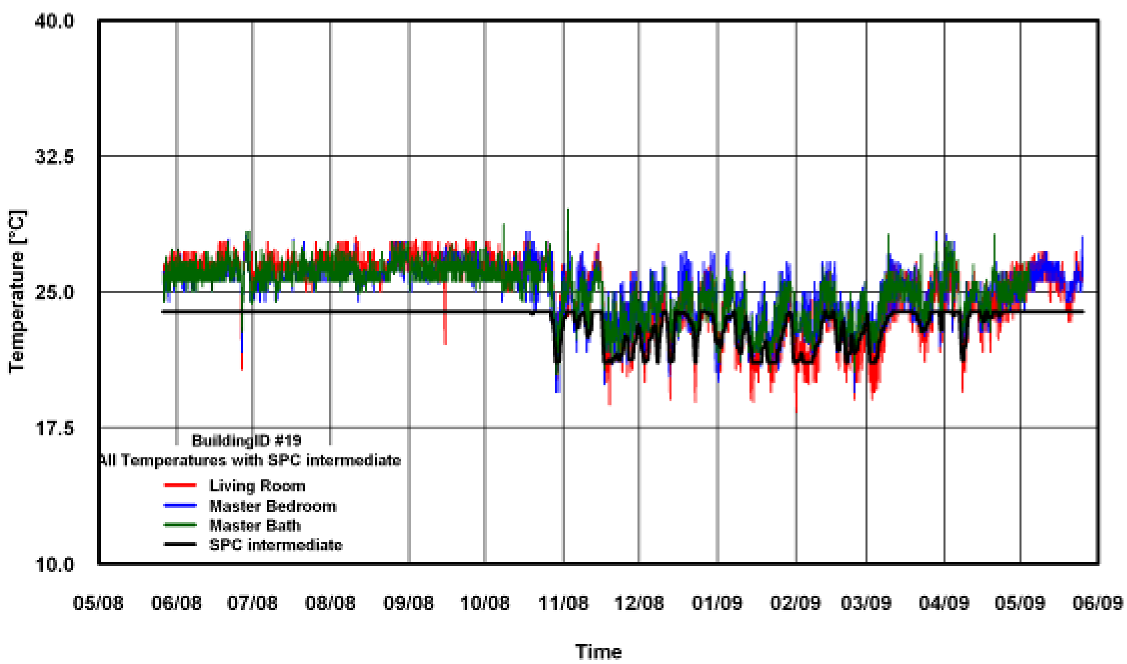

Figure 183: Temperature of SPC 160 Intermediate Method for Building # 19

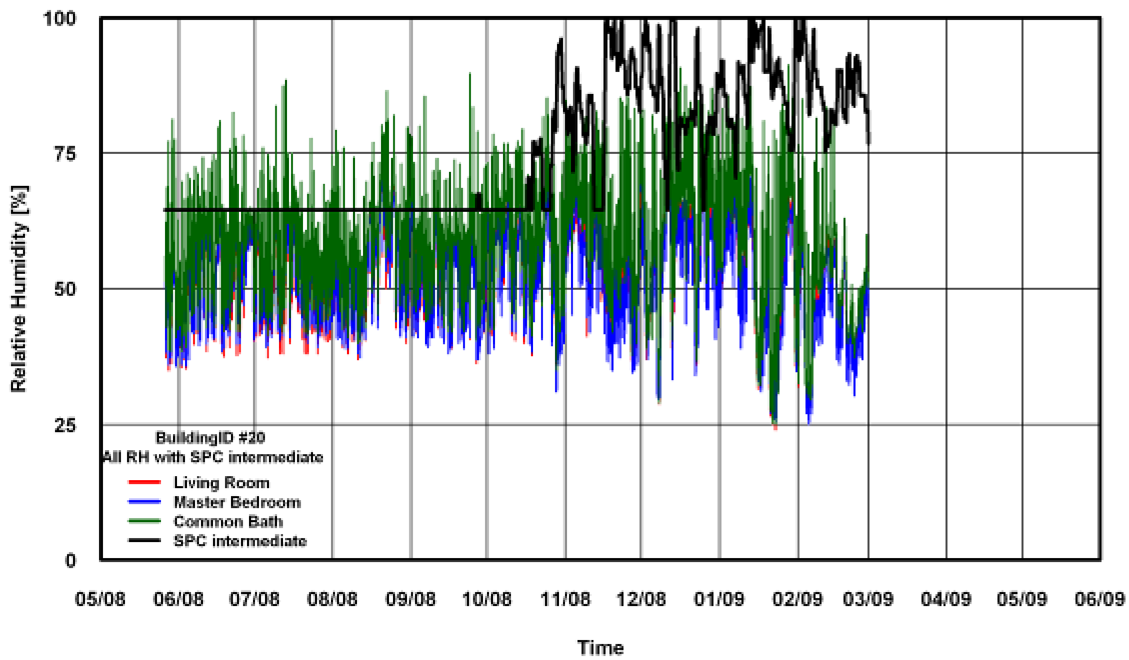

Figure 184: RH Comparison of SPC 160 Intermediate Method for Building # 20

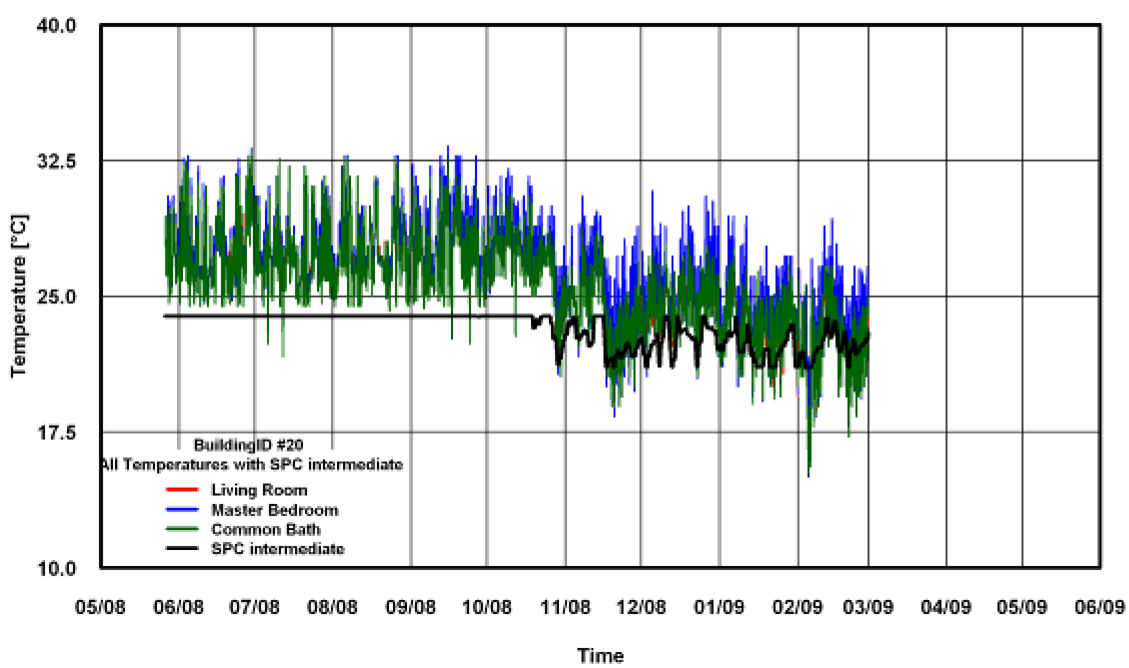

Figure 185: Temperature of SPC 160 Intermediate Method for Building # 20

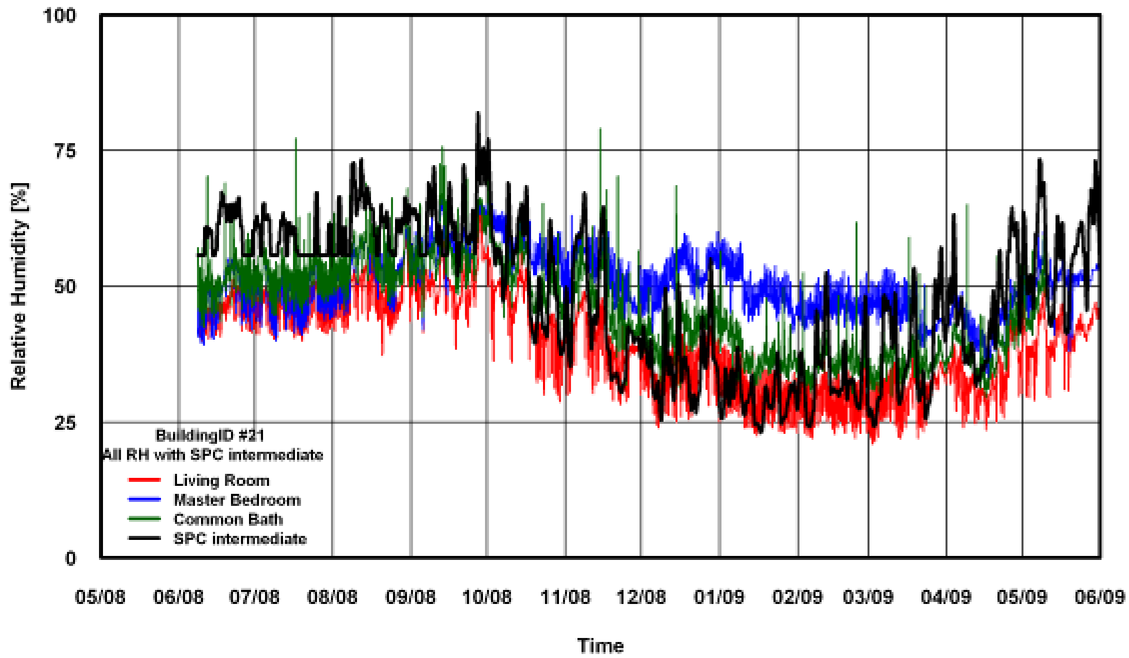

Figure 186: RH Comparison of SPC 160 Intermediate Method for Building # 21

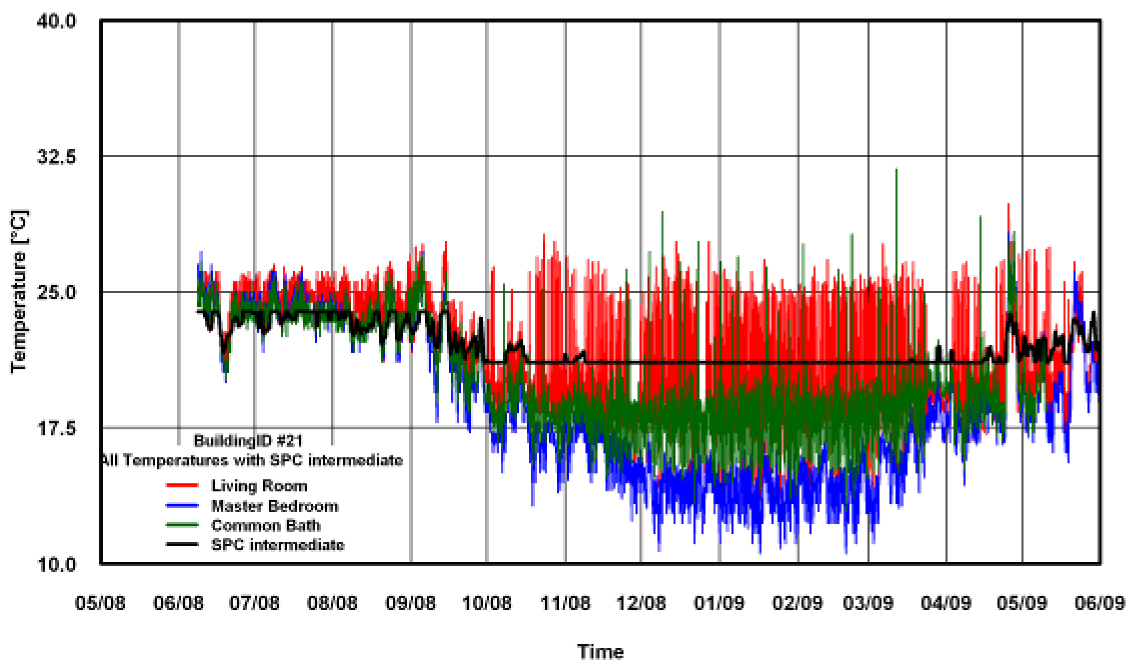

Figure 187: Temperature of SPC 160 Intermediate Method for Building # 21

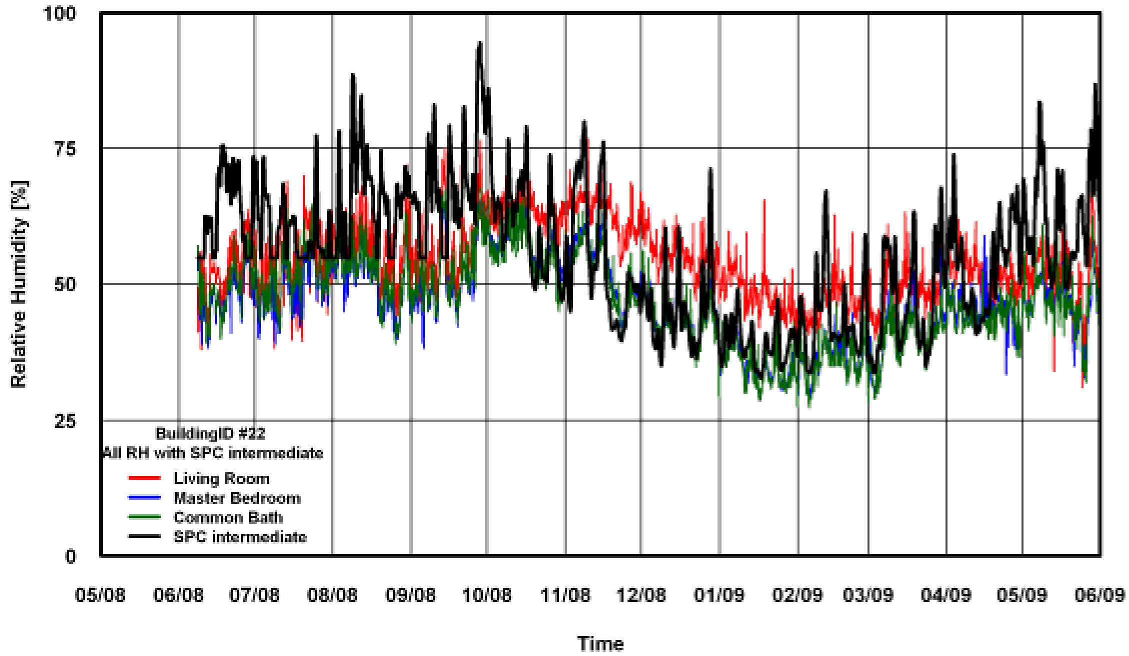

Figure 188: RH Comparison of SPC 160 Intermediate Method for Building # 22

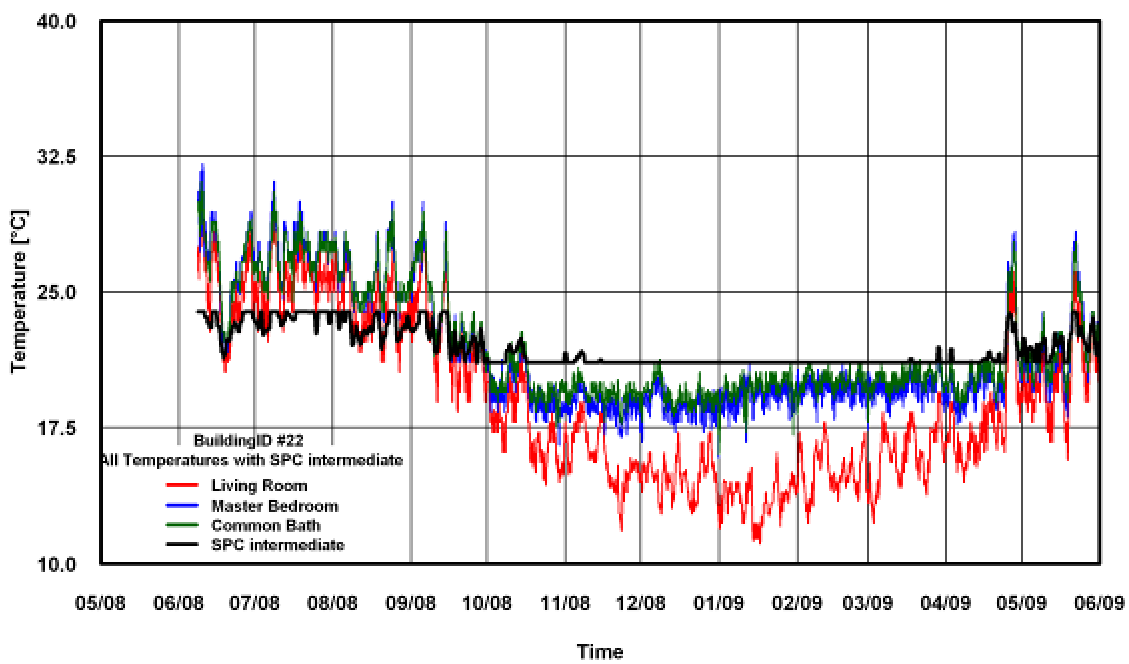

Figure 189: Temperature of SPC 160 Intermediate Method for Building # 22

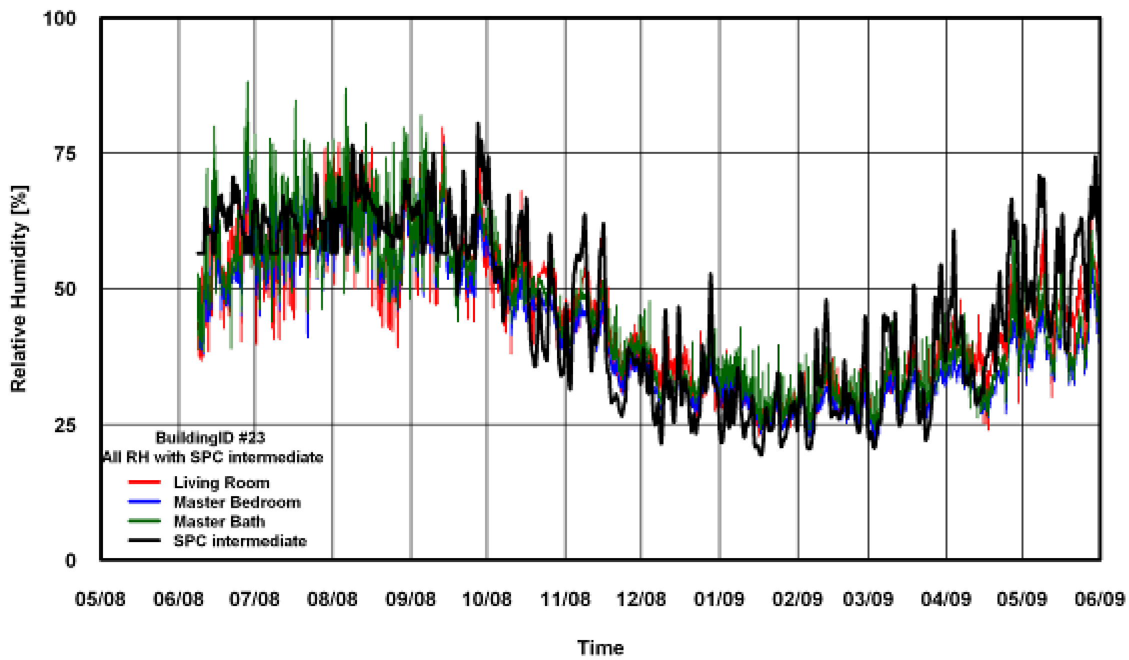

Figure 190: RH Comparison of SPC 160 Intermediate Method for Building # 23

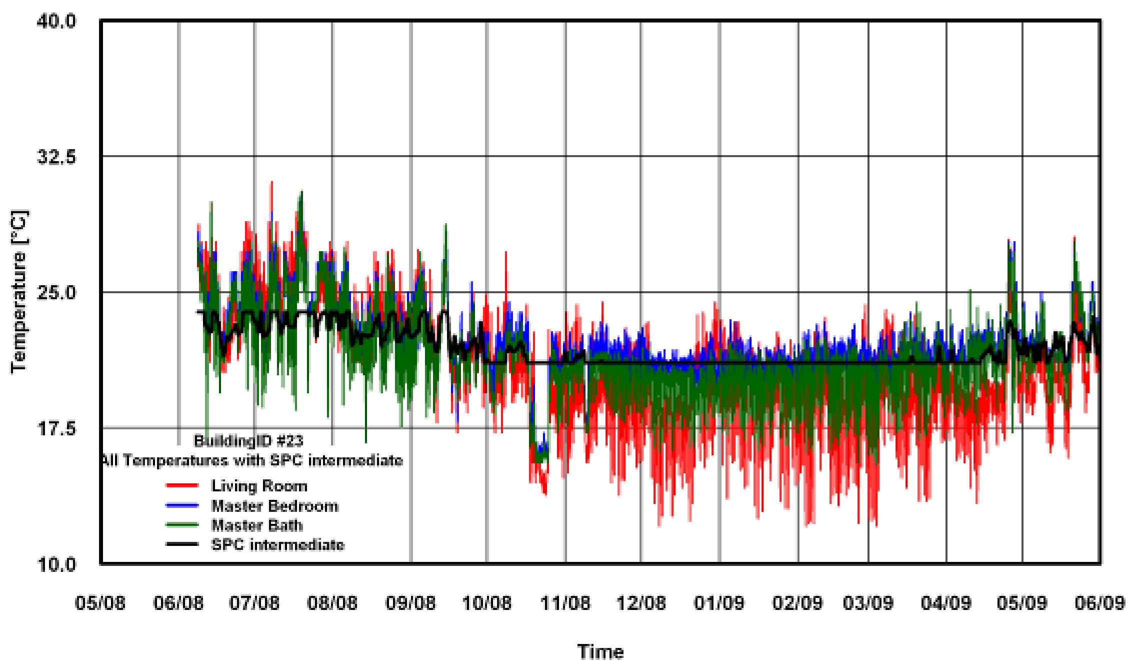

Figure 191: Temperature of SPC 160 Intermediate Method for Building # 23

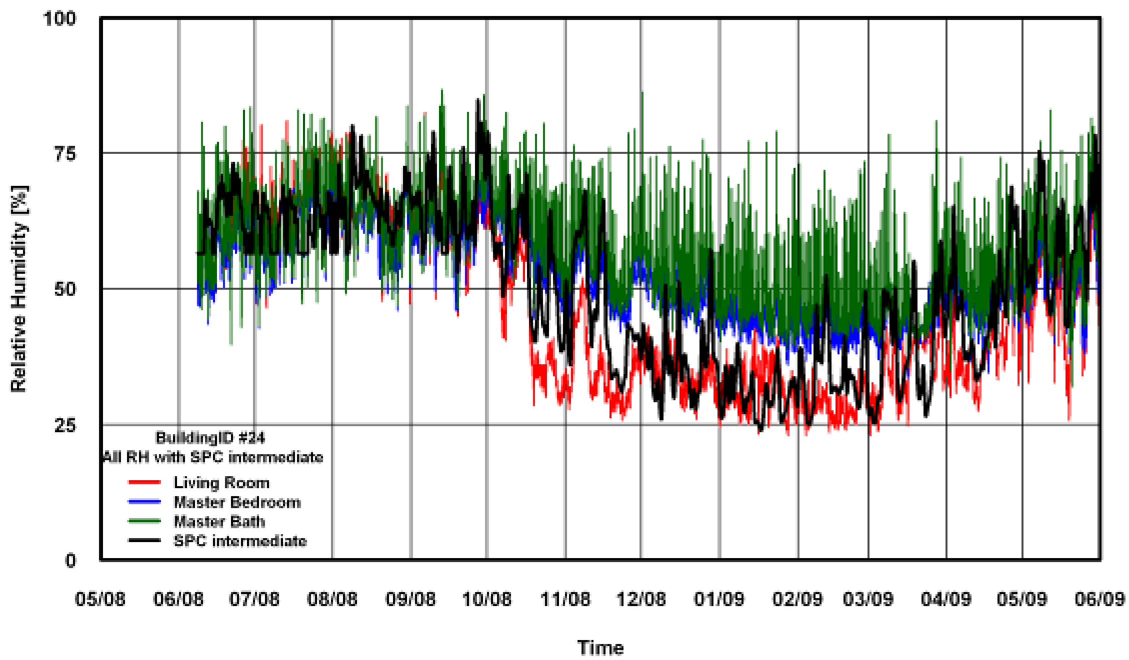

Figure 192: RH Comparison of SPC 160 Intermediate Method for Building # 24

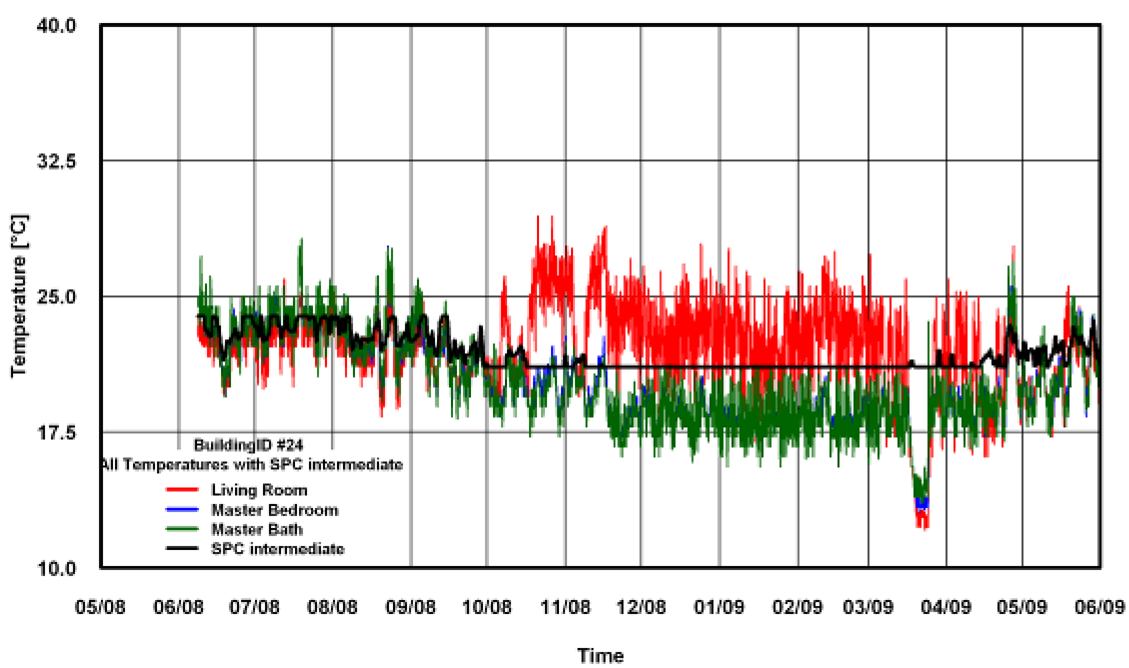

Figure 193: Temperature of SPC 160 Intermediate Method for Building # 24

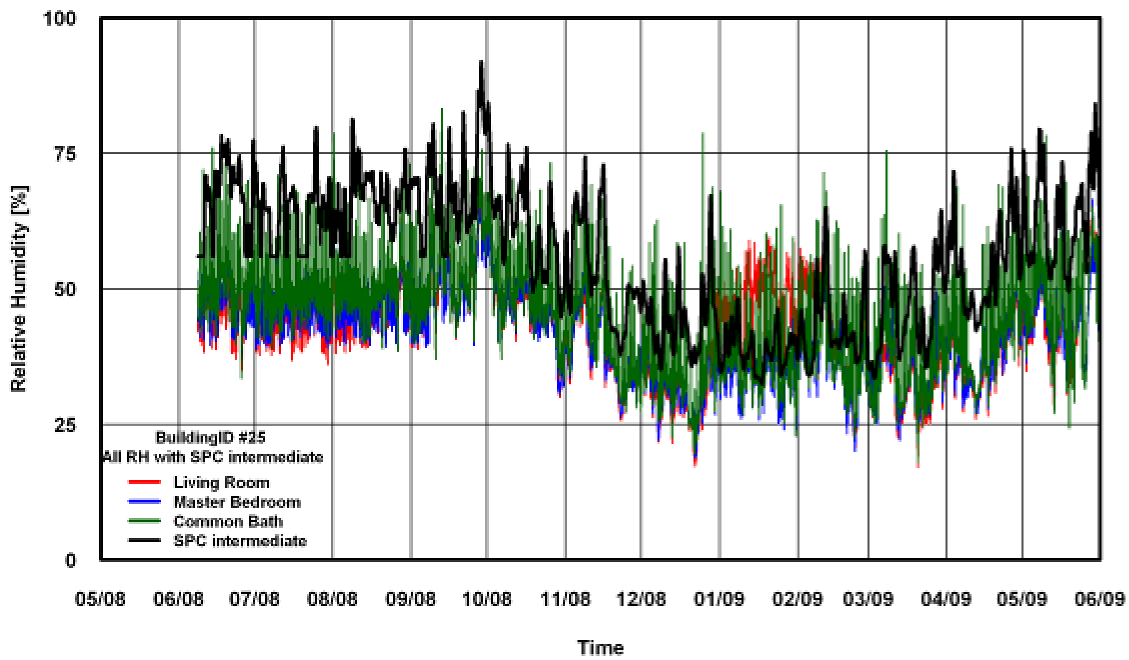

Figure 194: RH Comparison of SPC 160 Intermediate Method for Building # 25

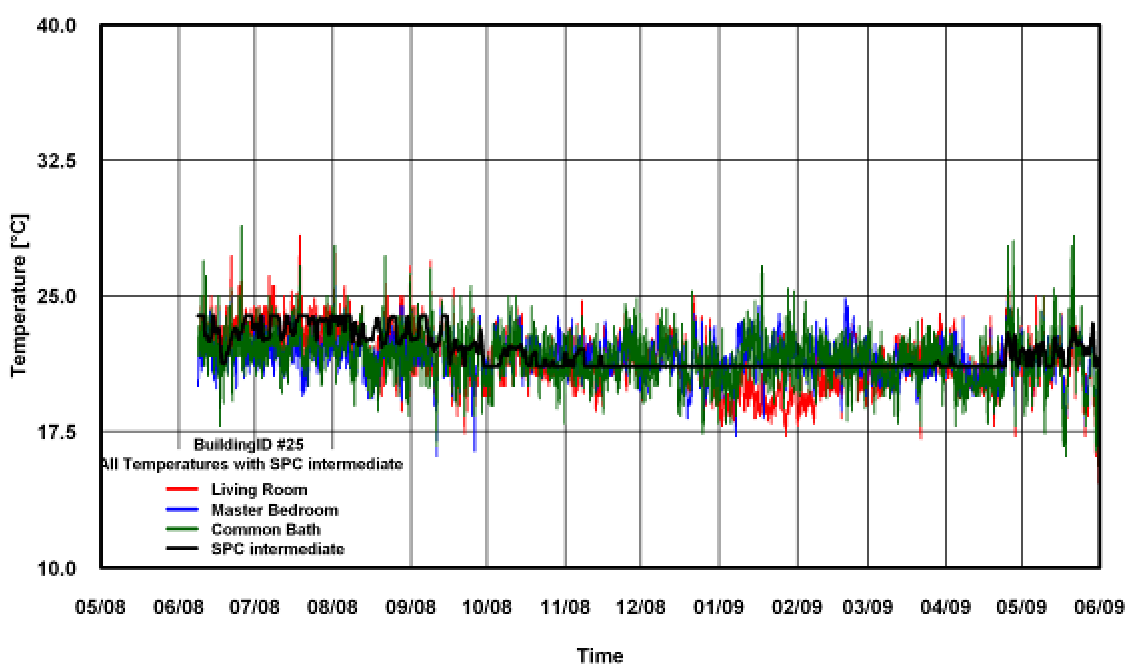

Figure 195: Temperature of SPC 160 Intermediate Method for Building # 25

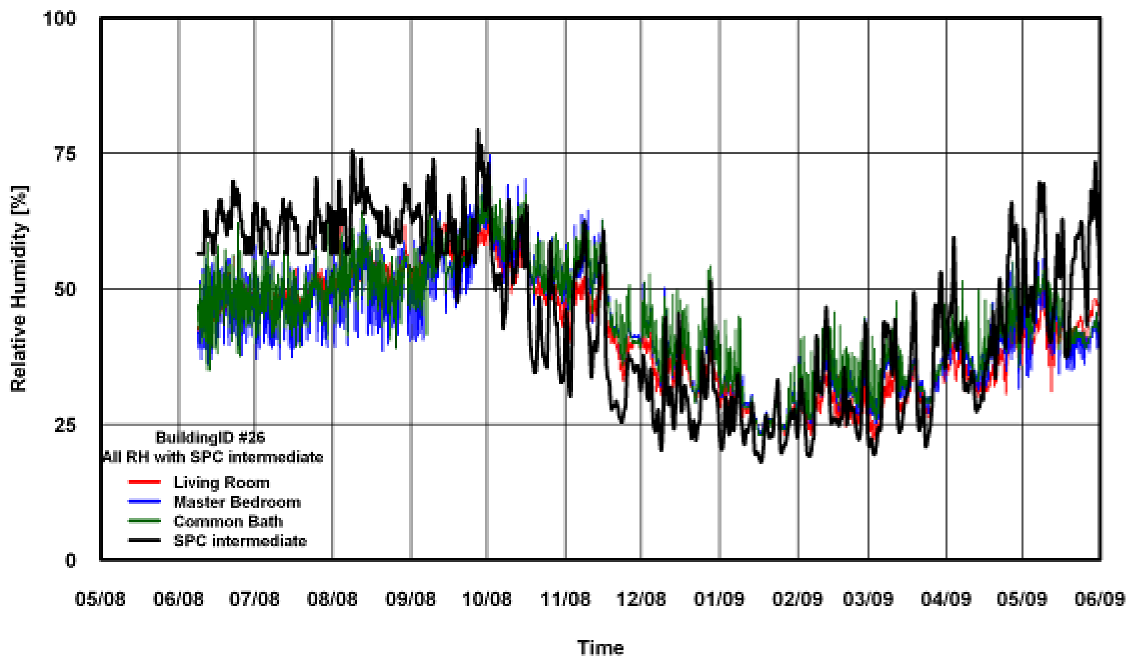

Figure 196: RH Comparison of SPC 160 Intermediate Method for Building # 26

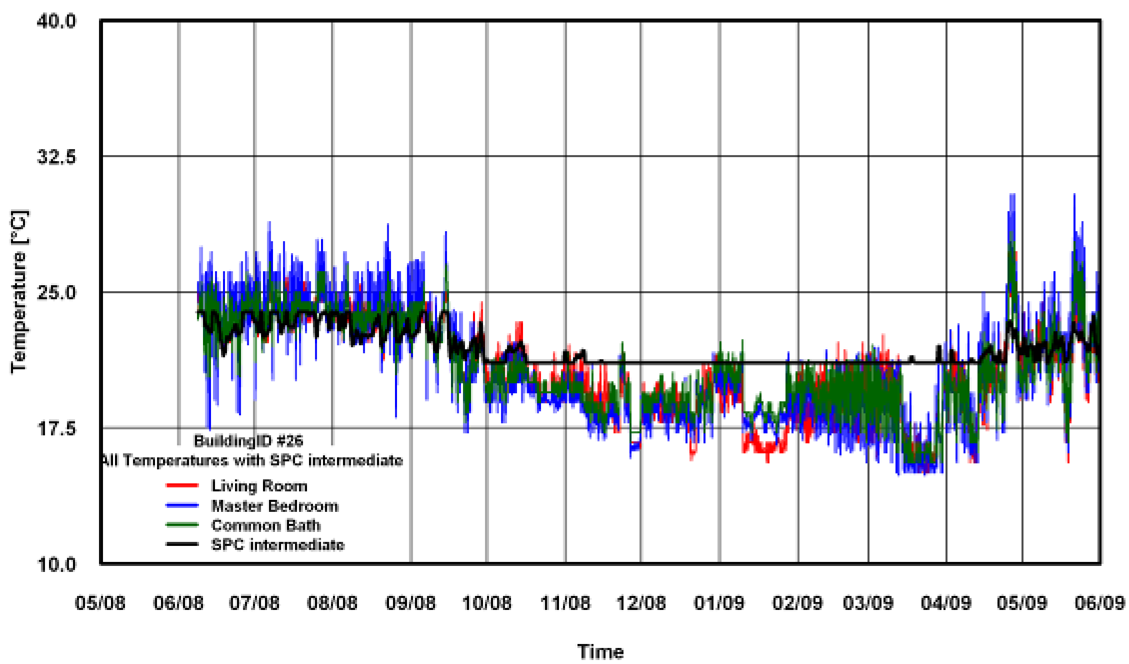

Figure 197: Temperature of SPC 160 Intermediate Method for Building # 26

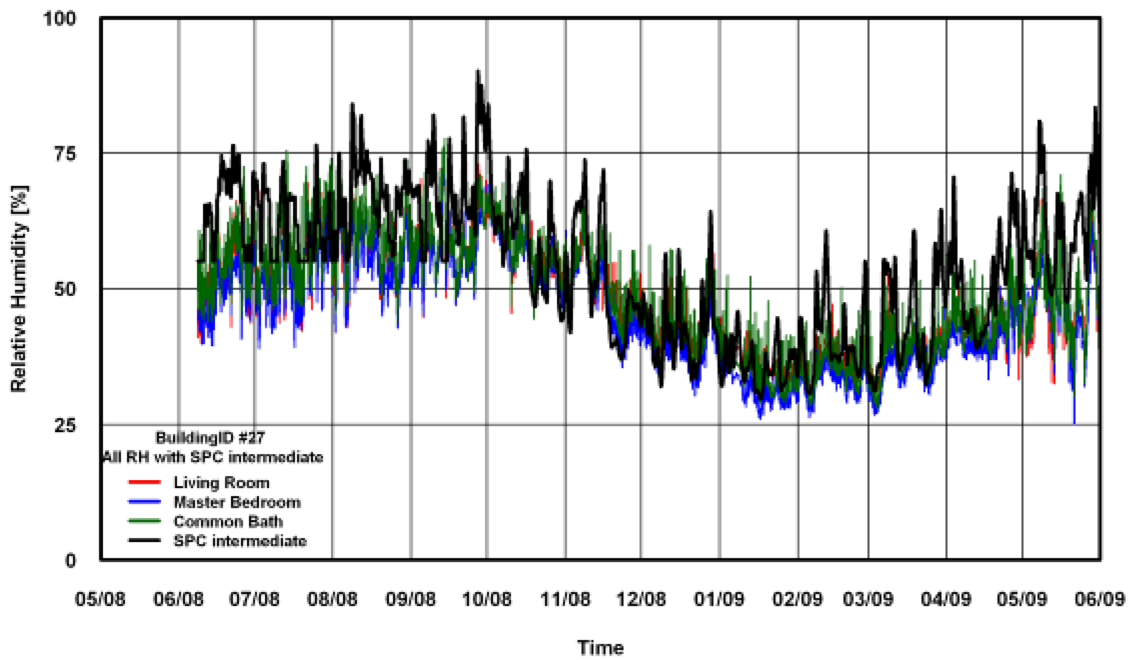

Figure 198: RH Comparison of SPC 160 Intermediate Method for Building # 27

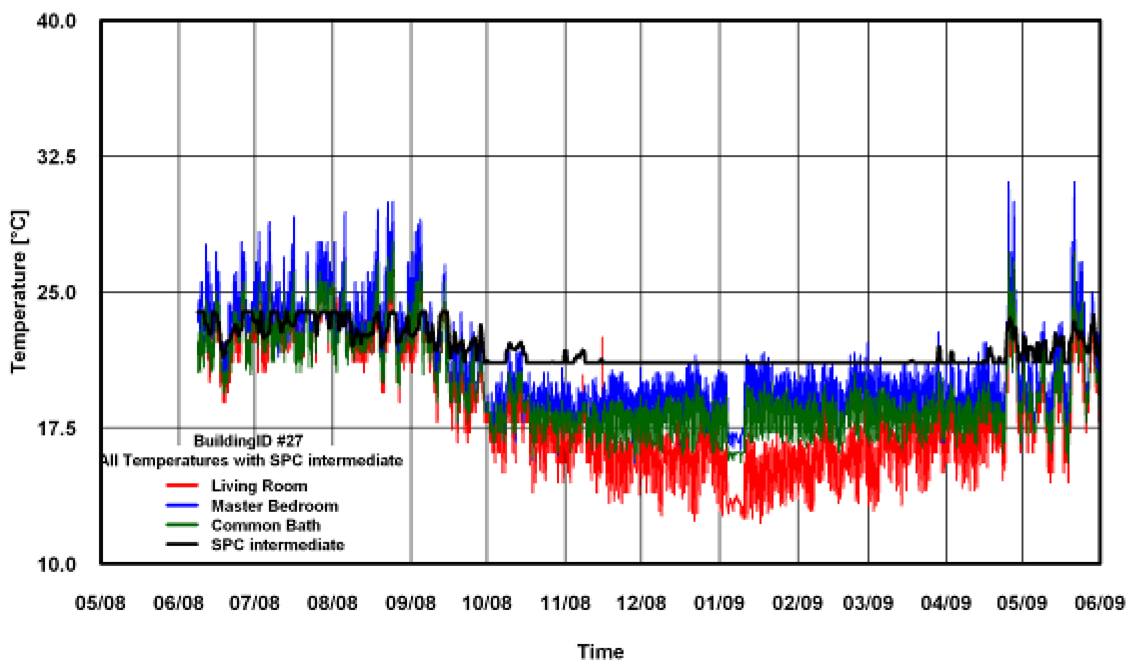

Figure 199: Temperature of SPC 160 Intermediate Method for Building # 27

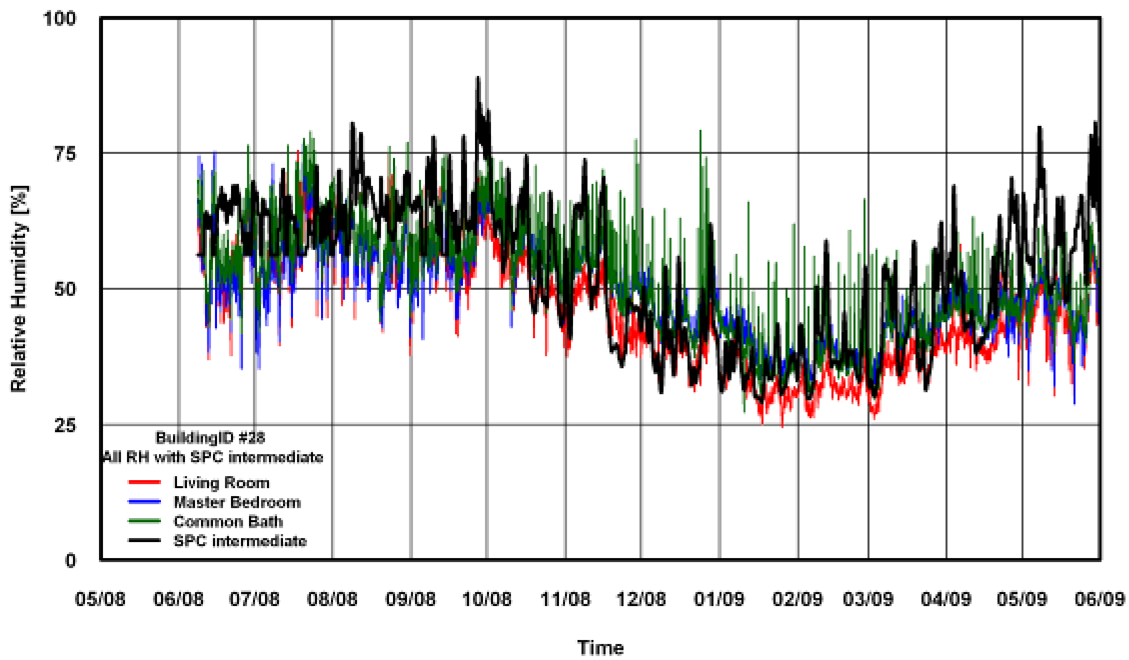

Figure 200: RH Comparison of SPC 160 Intermediate Method for Building # 28

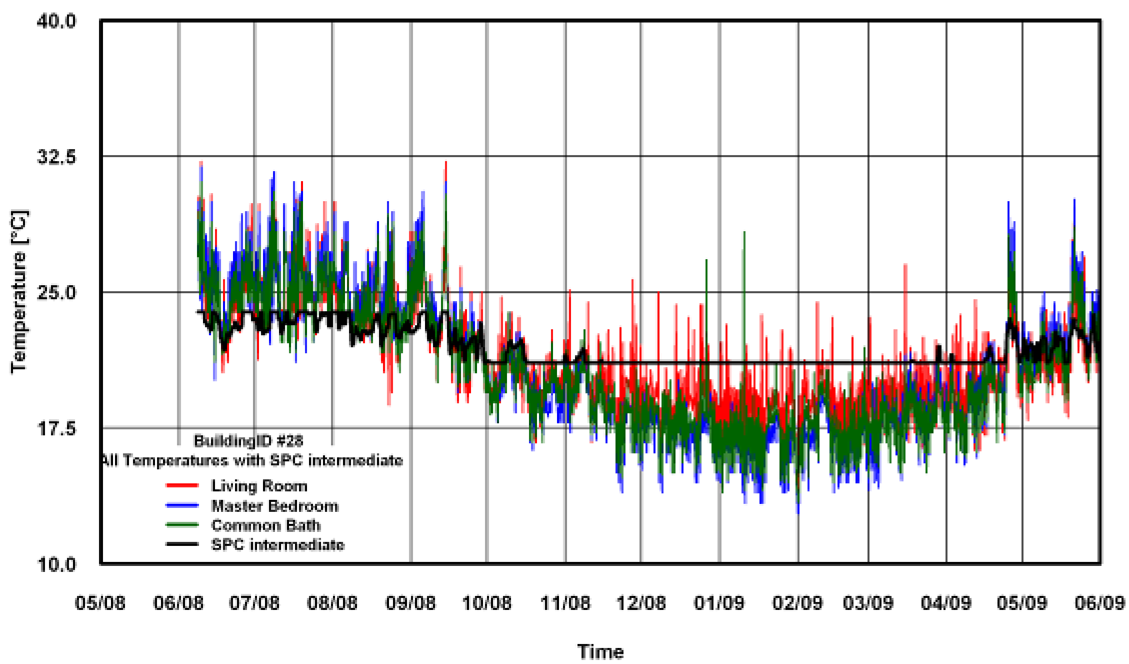

Figure 201: Temperature of SPC 160 Intermediate Method for Building # 28

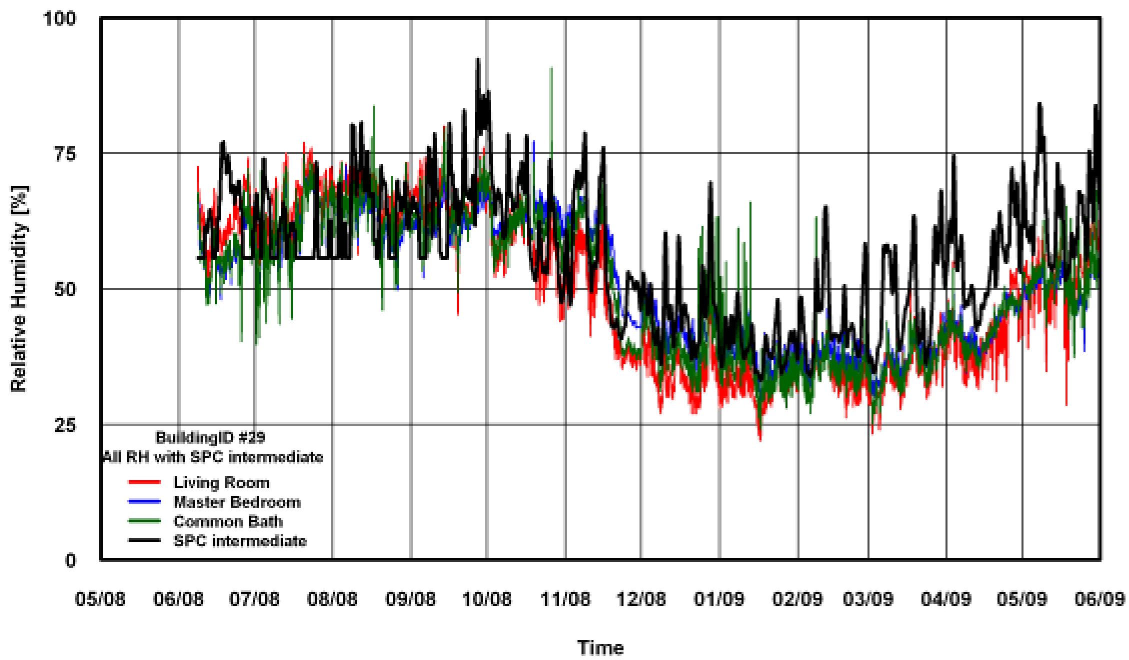

Figure 202: RH Comparison of SPC 160 Intermediate Method for Building # 29

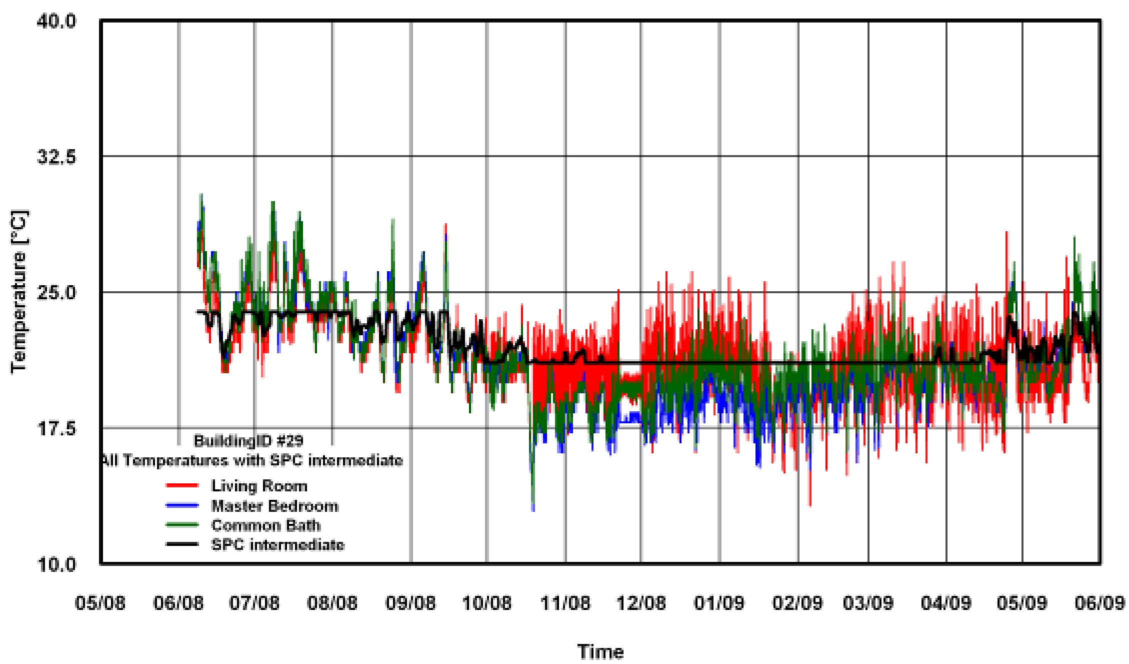

Figure 203: Temperature of SPC 160 Intermediate Method for Building # 29

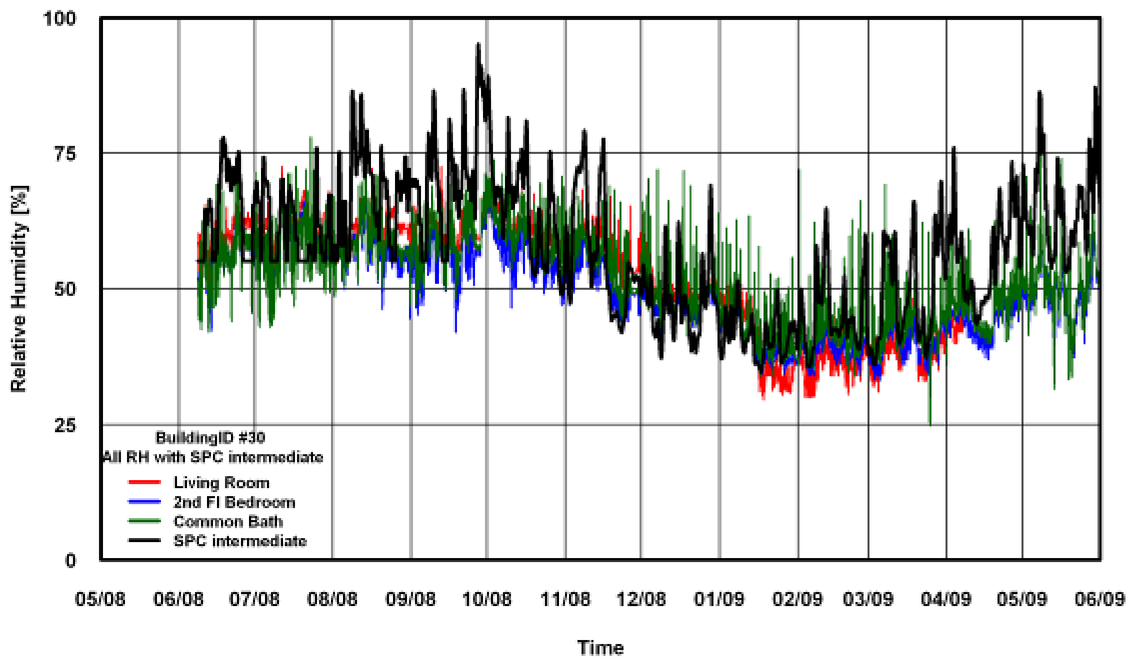

Figure 204: RH Comparison of SPC 160 Intermediate Method for Building # 30

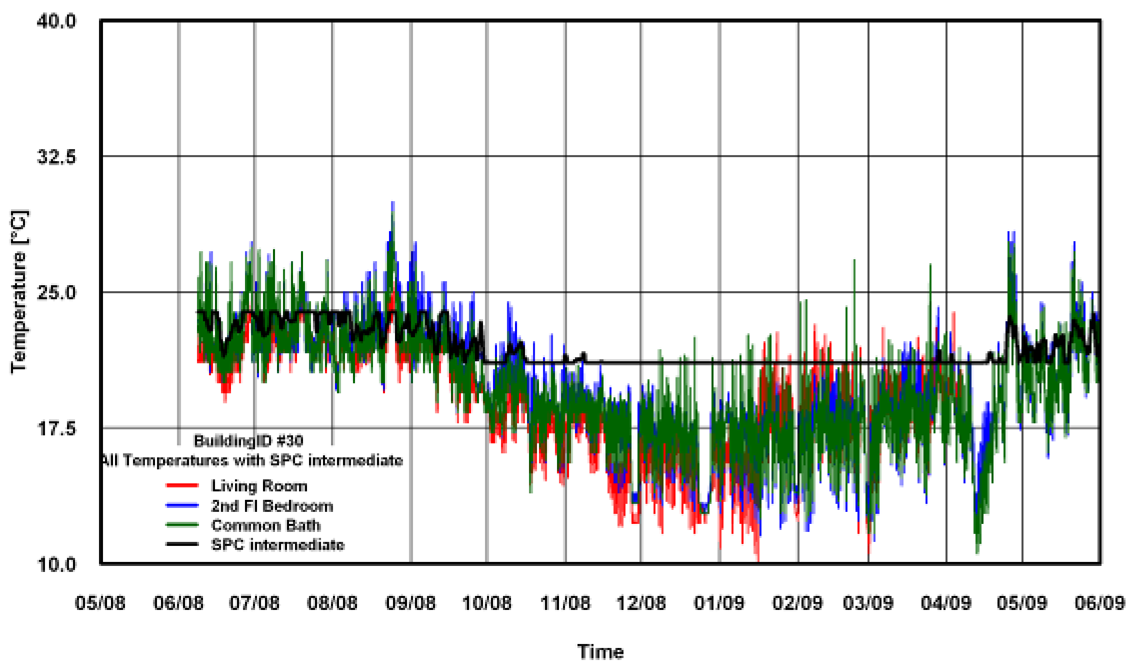

Figure 205: Temperature of SPC 160 Intermediate Method for Building # 30

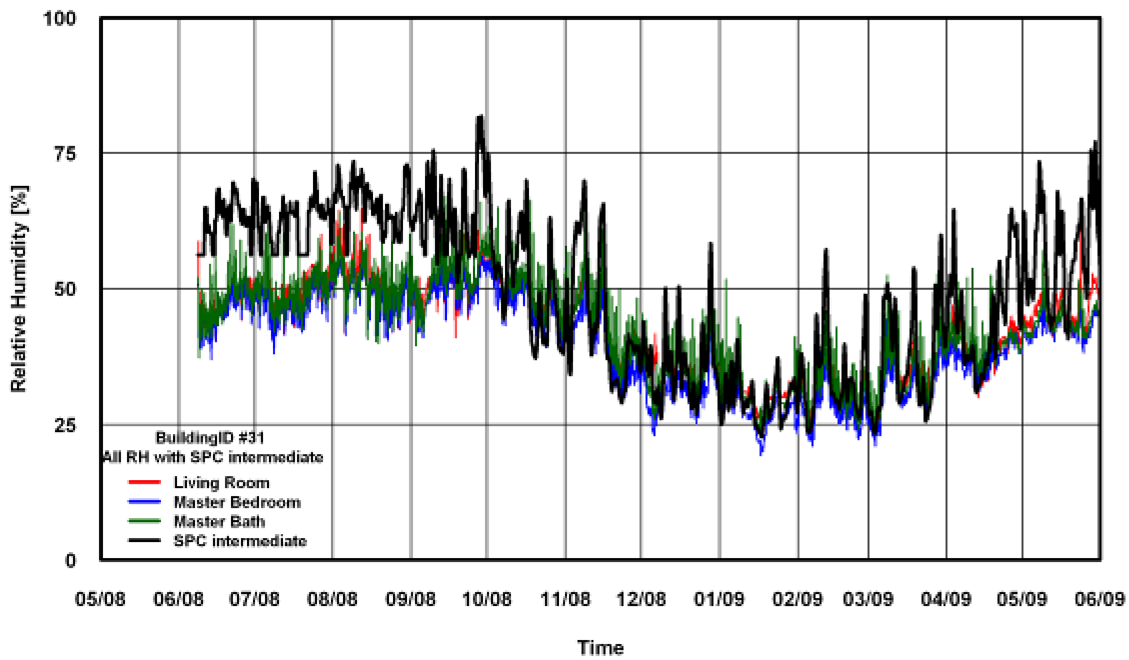

Figure 206: RH Comparison of SPC 160 Intermediate Method for Building # 31

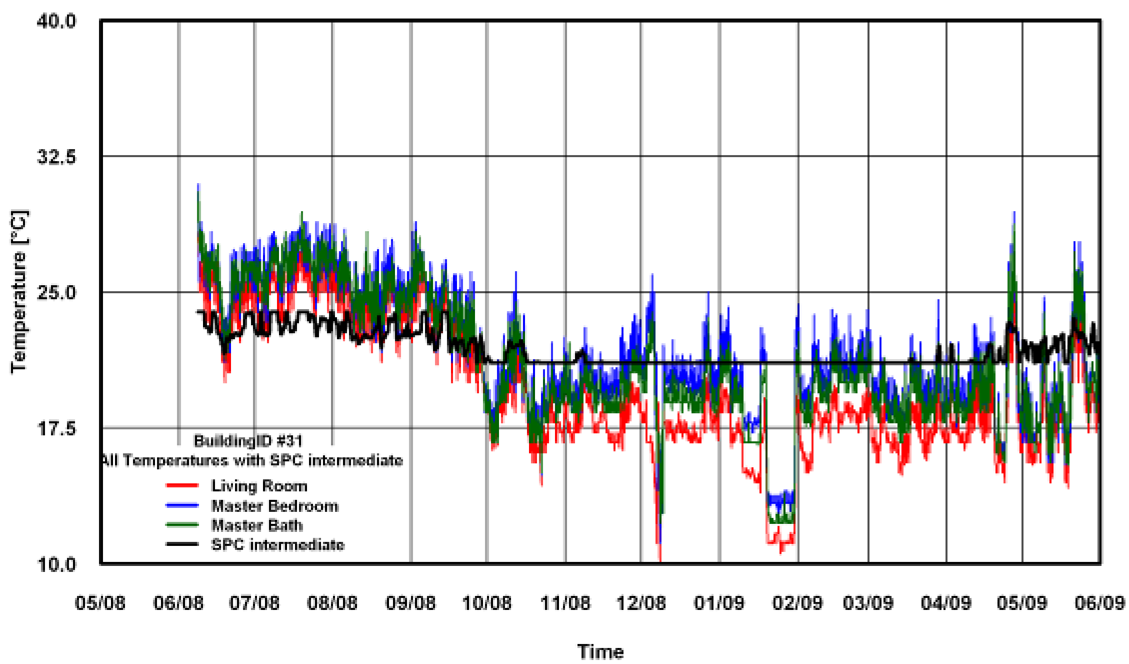

Figure 207: Temperature of SPC 160 Intermediate Method for Building # 31

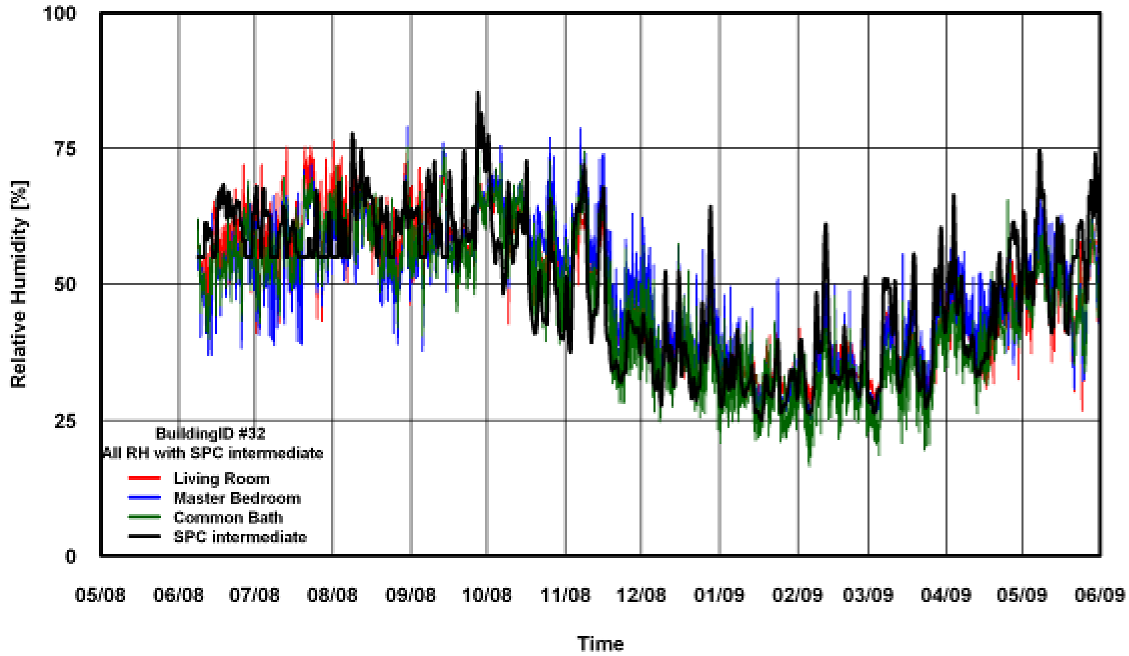

Figure 208: RH Comparison of SPC 160 Intermediate Method for Building # 32

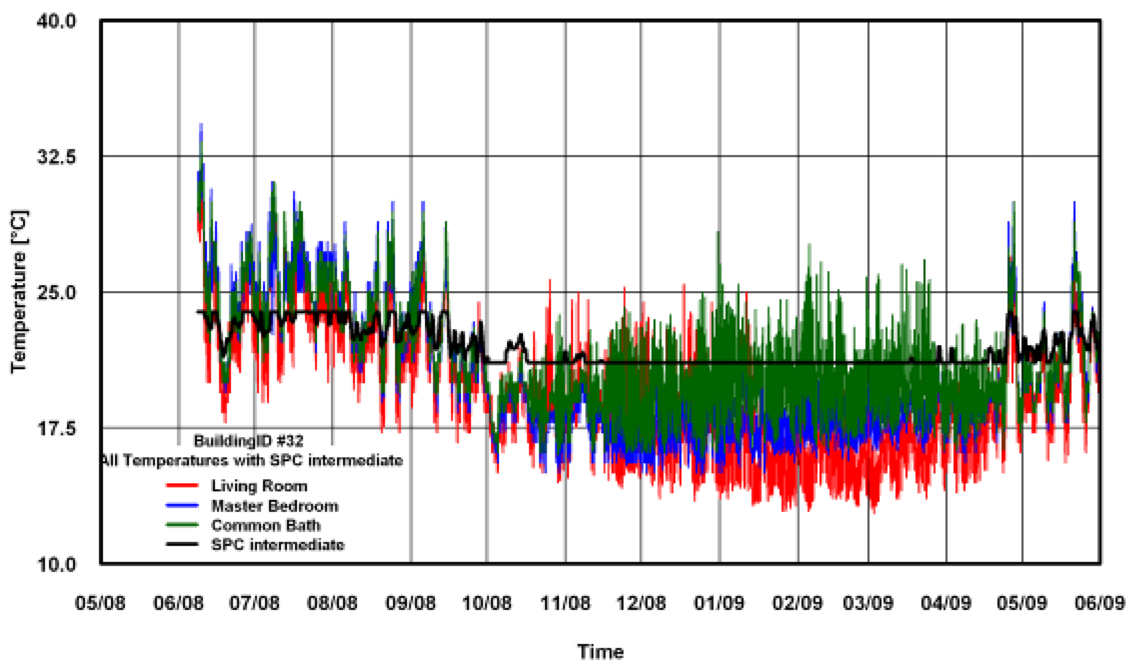

Figure 209: Temperature of SPC 160 Intermediate Method for Building # 32

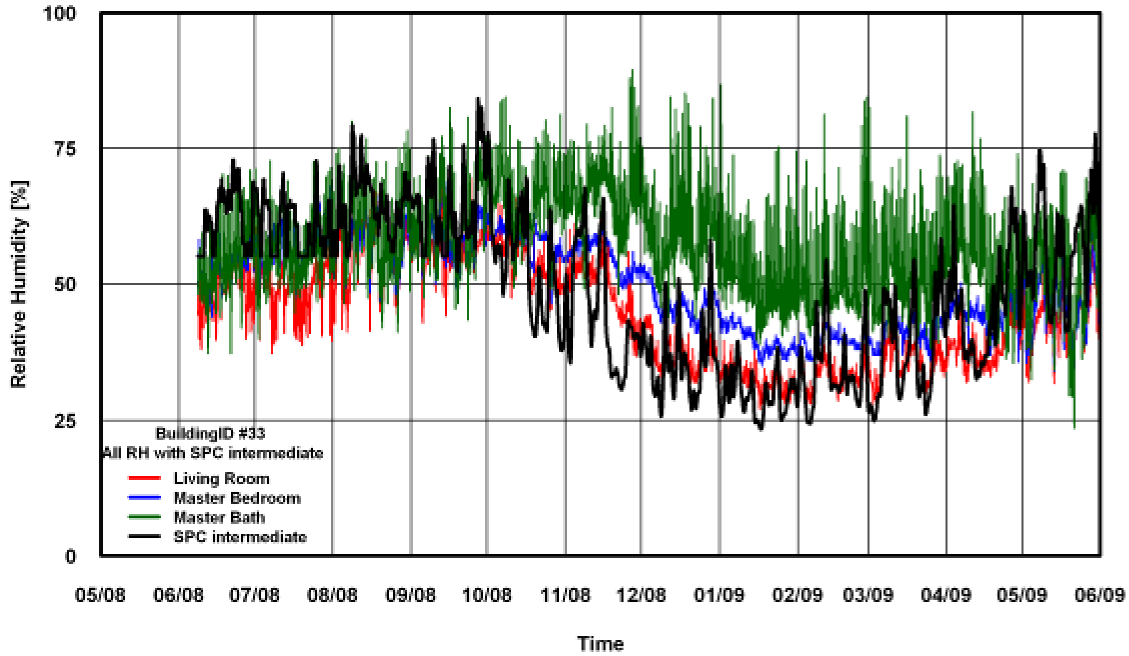

Figure 210: RH Comparison of SPC 160 Intermediate Method for Building # 33

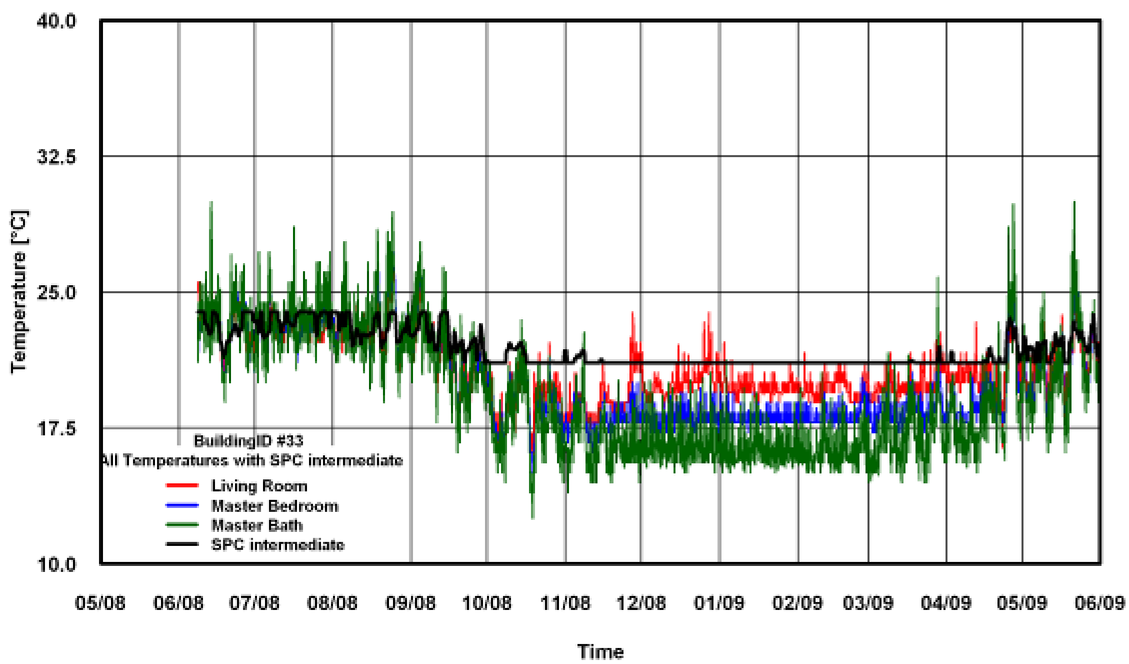

Figure 211: Temperature of SPC 160 Intermediate Method for Building # 33

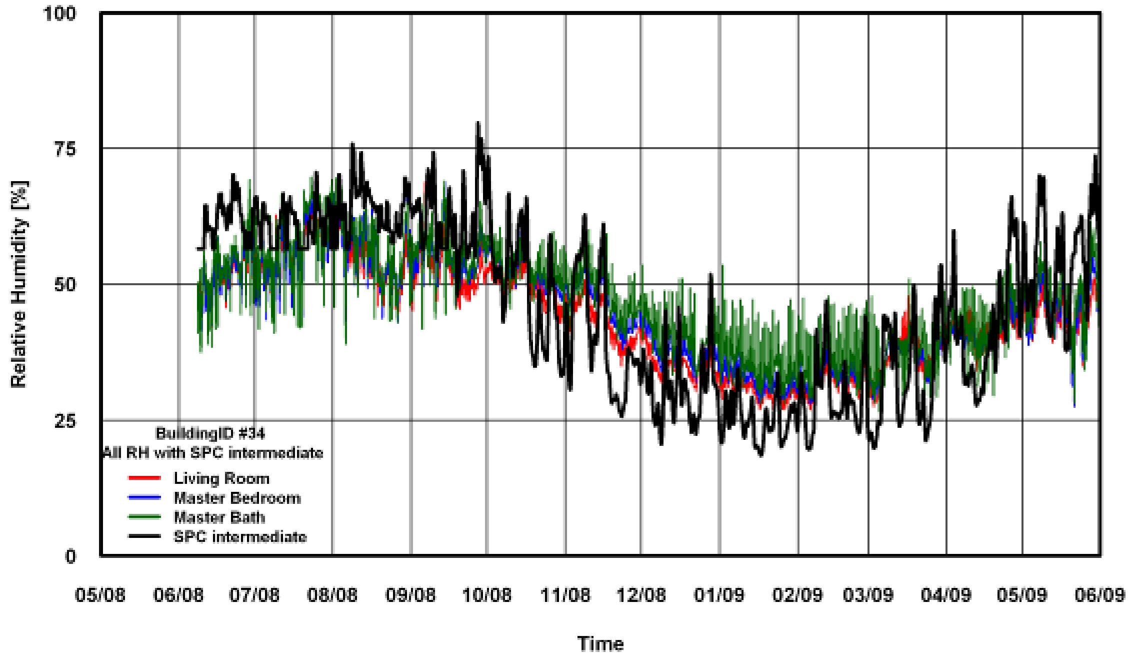

Figure 212: RH Comparison of SPC 160 Intermediate Method for Building # 34

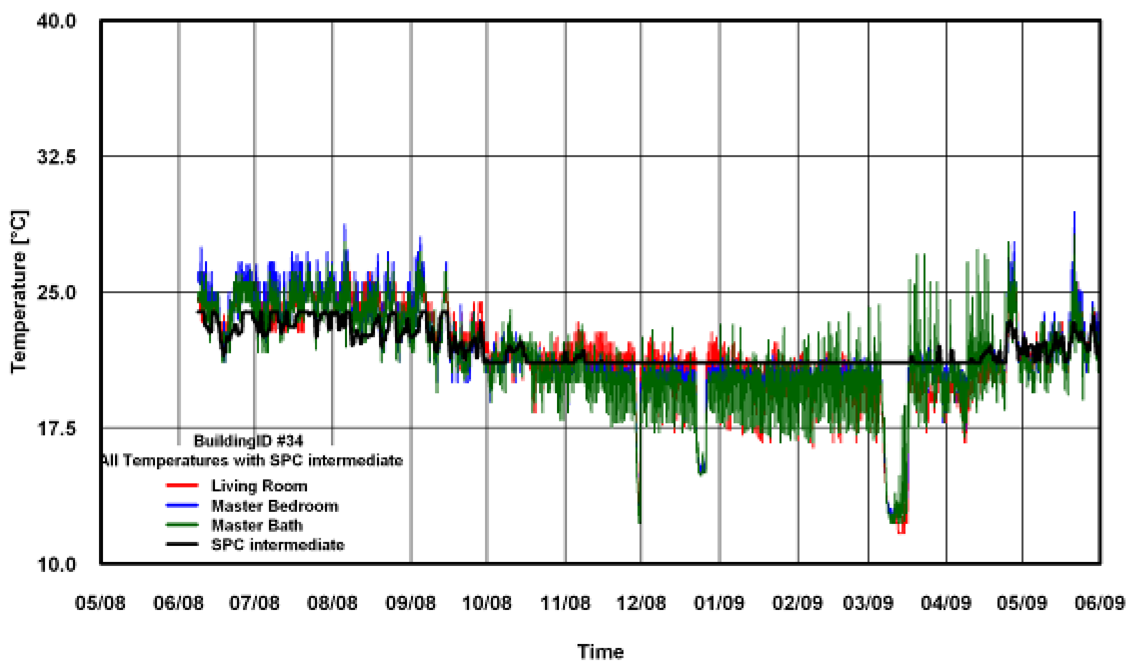

Figure 213: Temperature of SPC 160 Intermediate Method for Building # 34

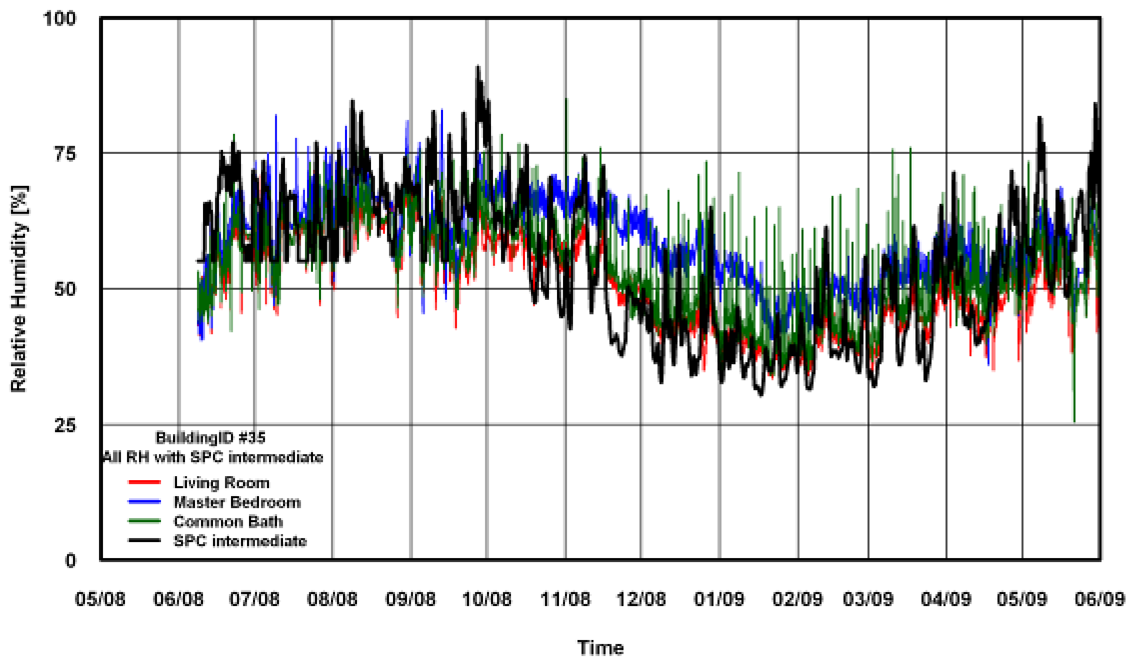

Figure 214: RH Comparison of SPC 160 Intermediate Method for Building # 35

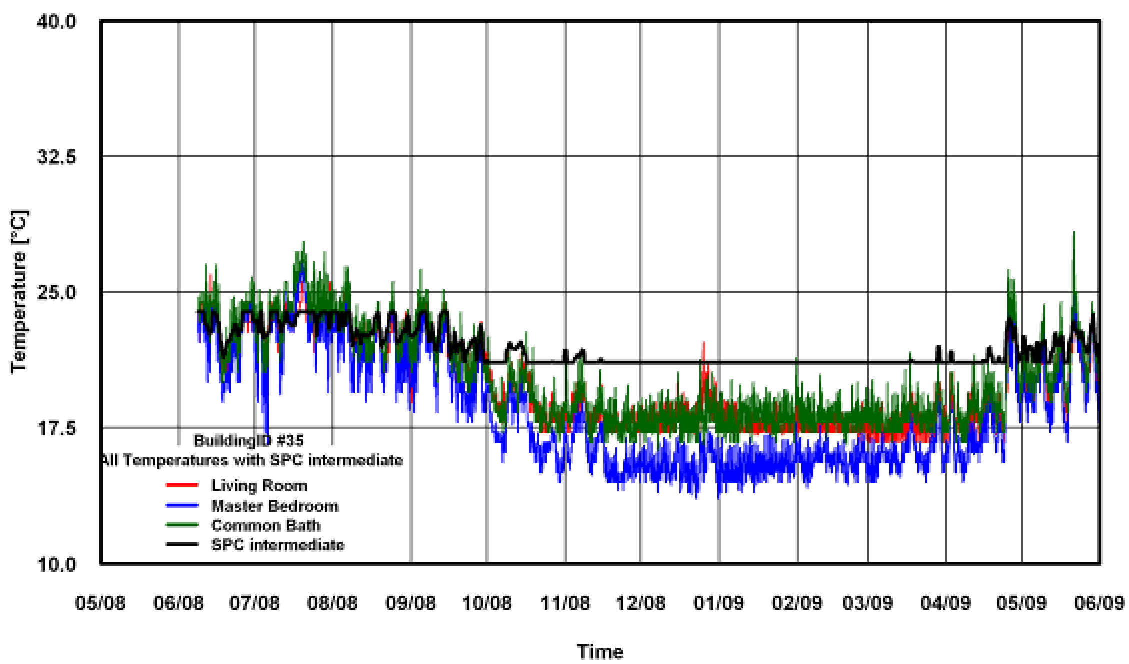

Figure 215: Temperature of SPC 160 Intermediate Method for Building # 35

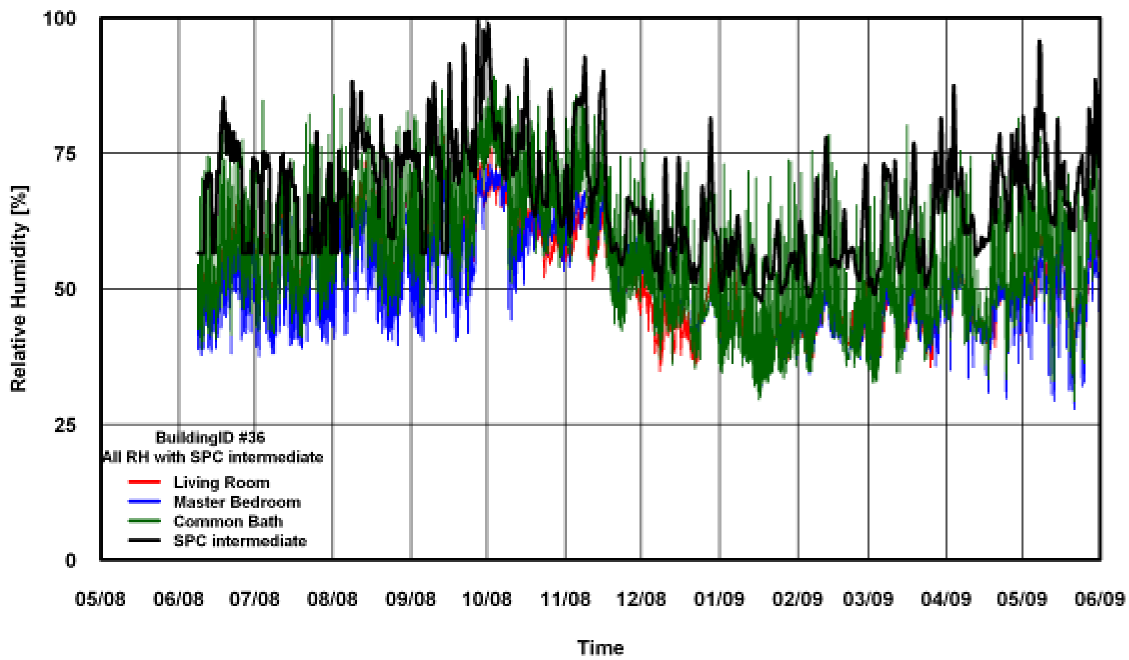

Figure 216: RH Comparison of SPC 160 Intermediate Method for Building # 36

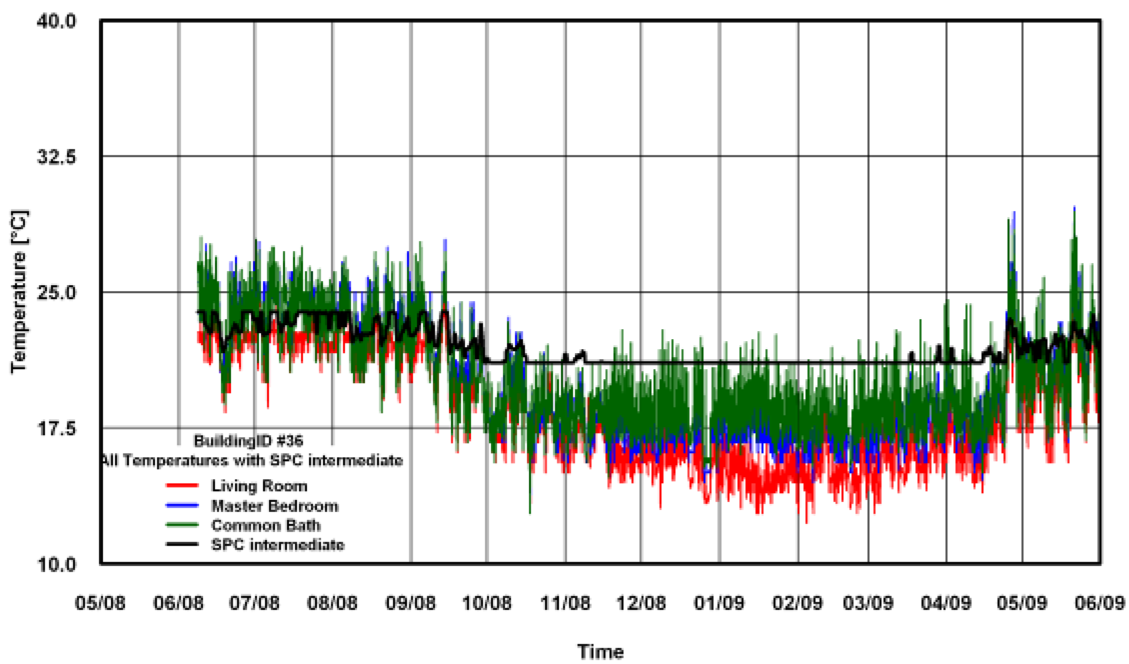

Figure 217: Temperature of SPC 160 Intermediate Method for Building # 36

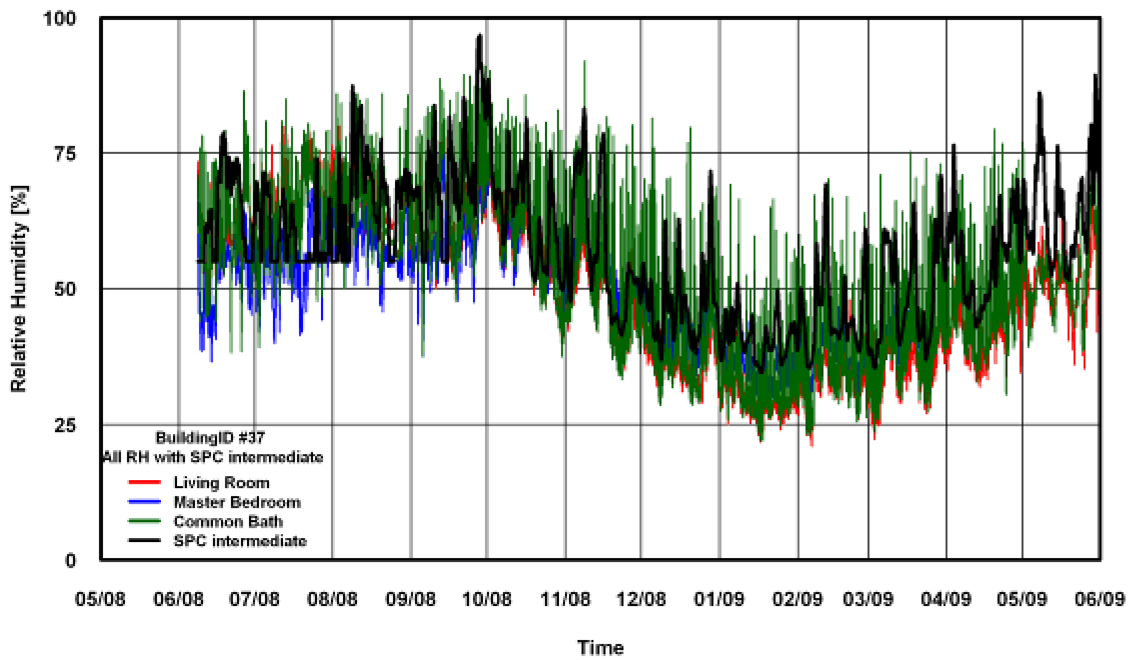

Figure 218: RH Comparison of SPC 160 Intermediate Method for Building # 37

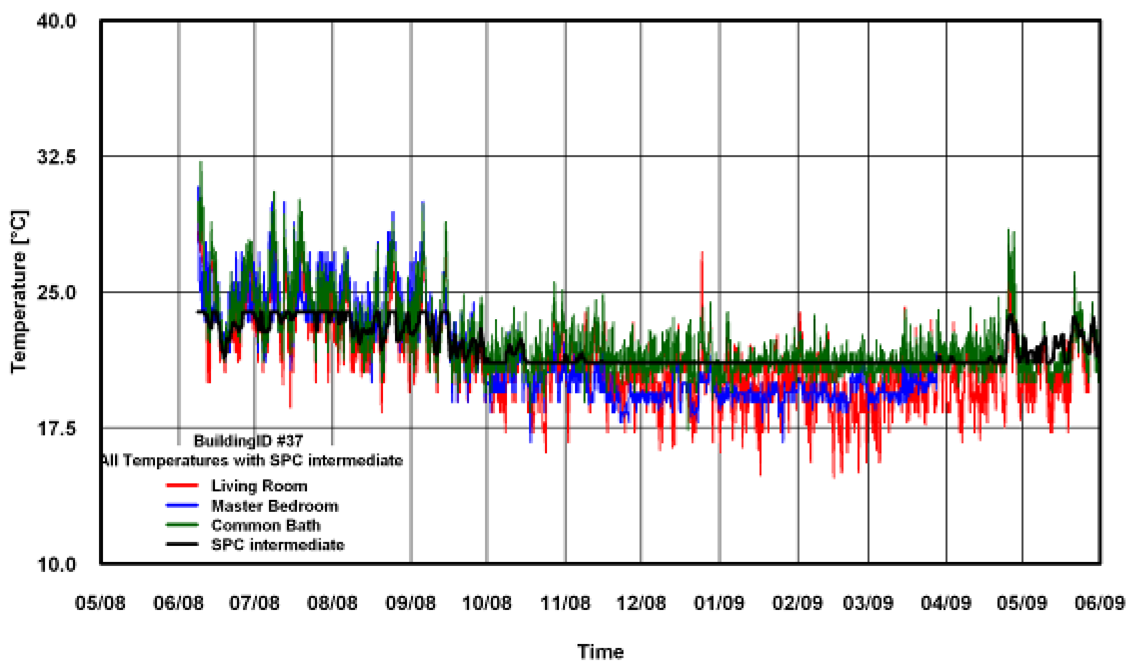

Figure 219: Temperature of SPC 160 Intermediate Method for Building # 37

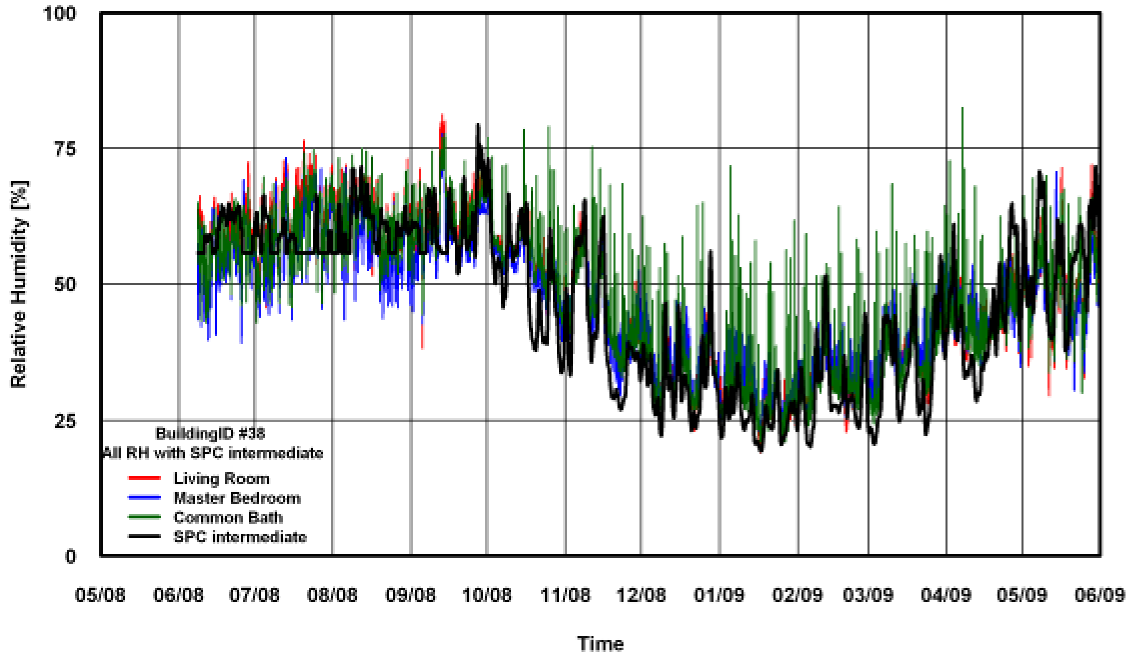

Figure 220: RH Comparison of SPC 160 Intermediate Method for Building # 38

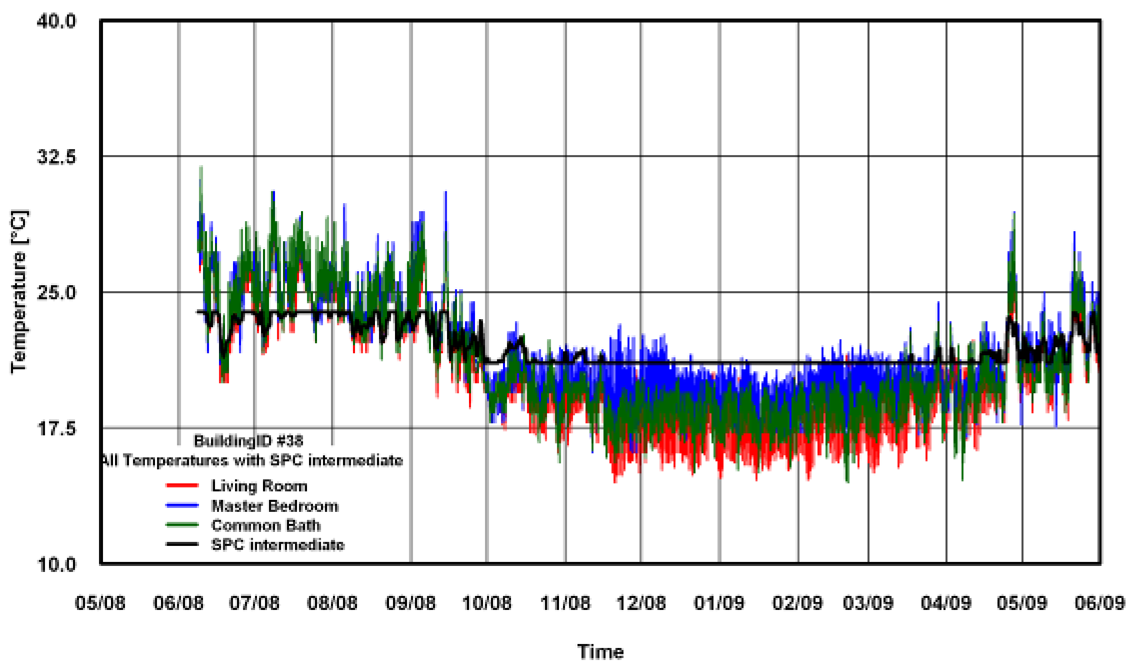

Figure 221: Temperature of SPC 160 Intermediate Method for Building # 38

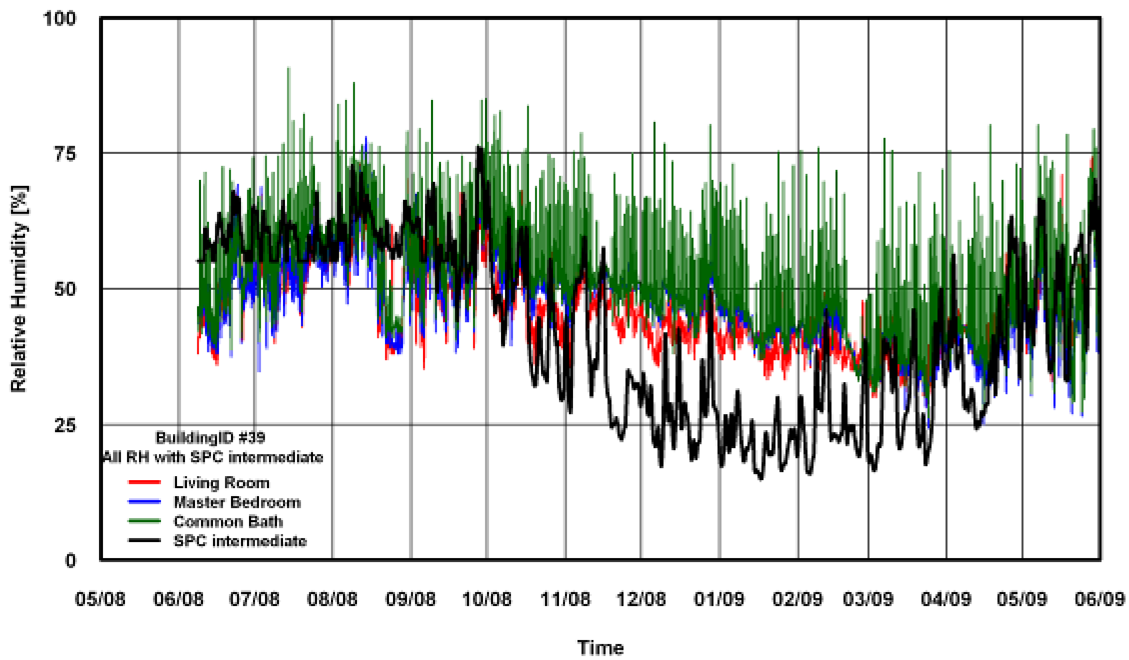

Figure 222: RH Comparison of SPC 160 Intermediate Method for Building # 39

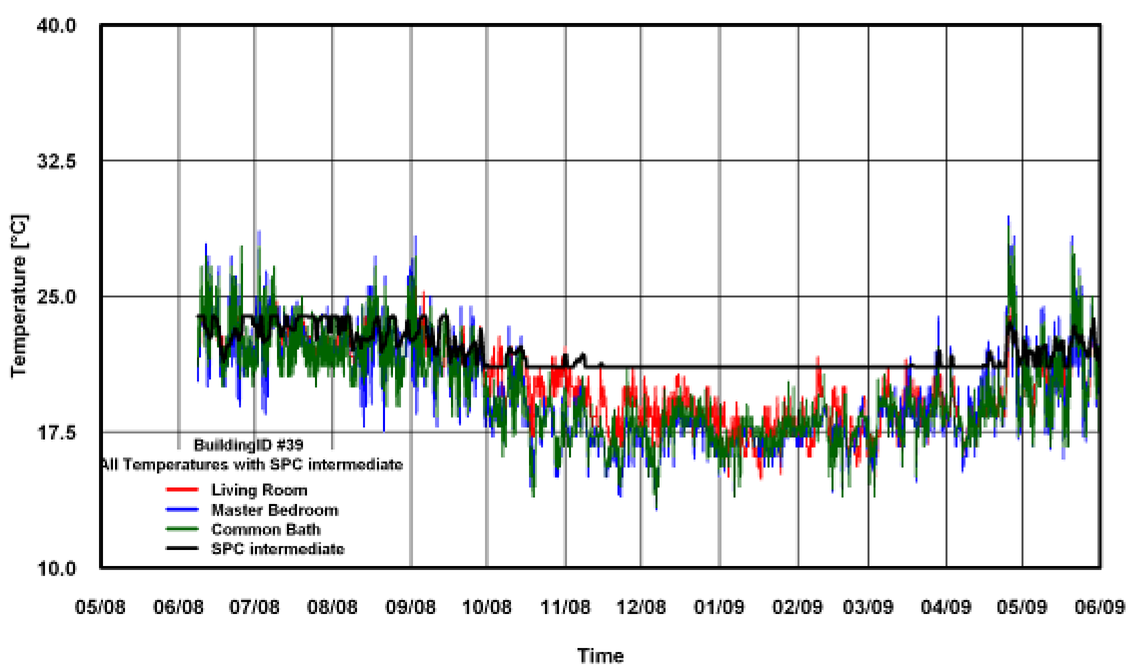

Figure 223: Temperature of SPC 160 Intermediate Method for Building # 39

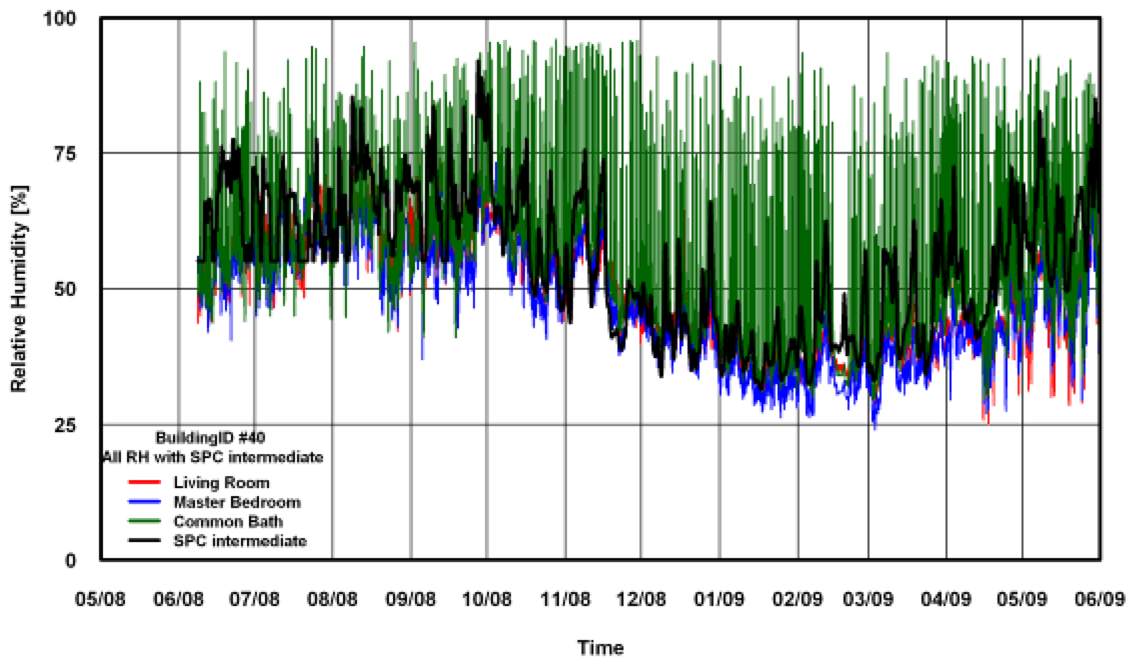

Figure 224: RH Comparison of SPC 160 Intermediate Method for Building # 40

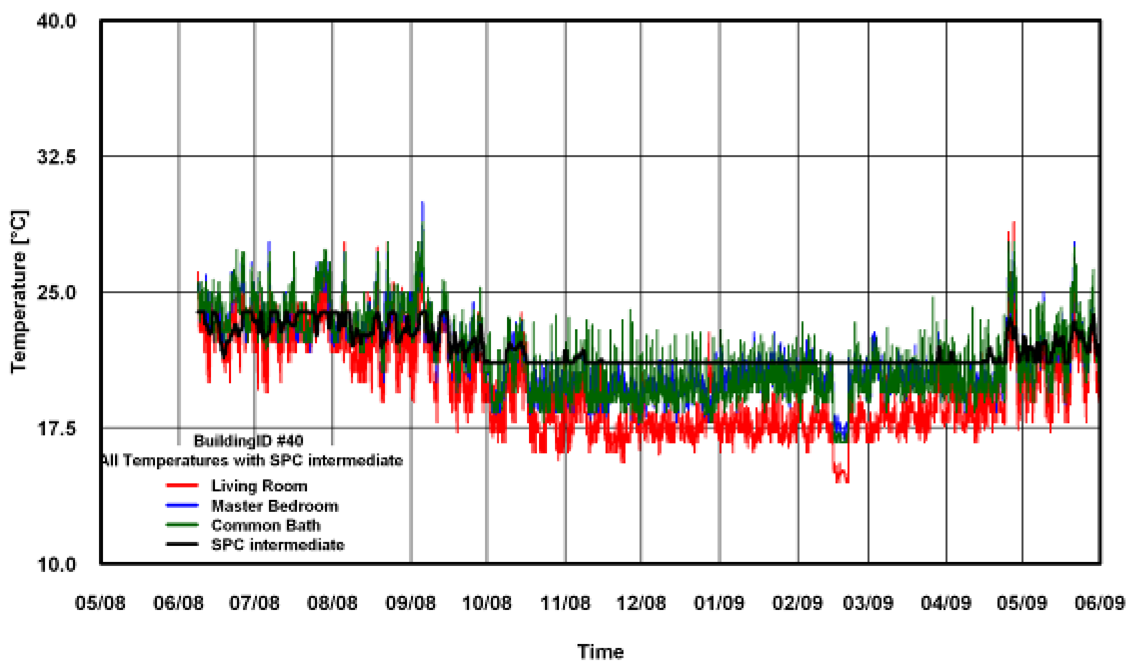

Figure 225: Temperature of SPC 160 Intermediate Method for Building # 40

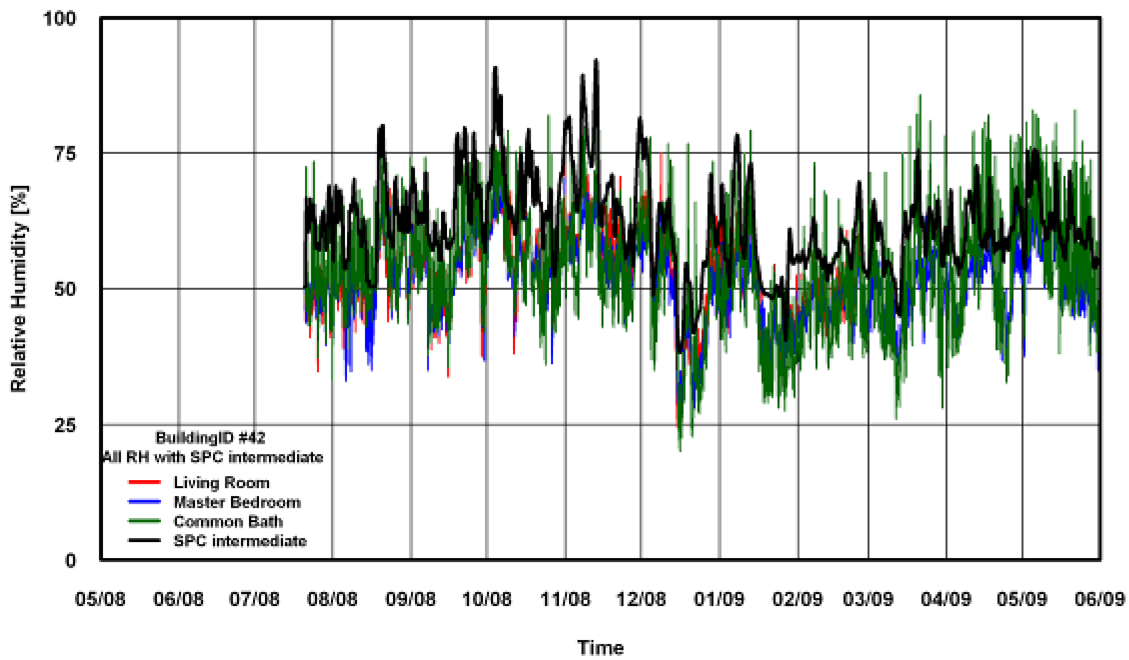

Figure 226: RH Comparison of SPC 160 Intermediate Method for Building # 42

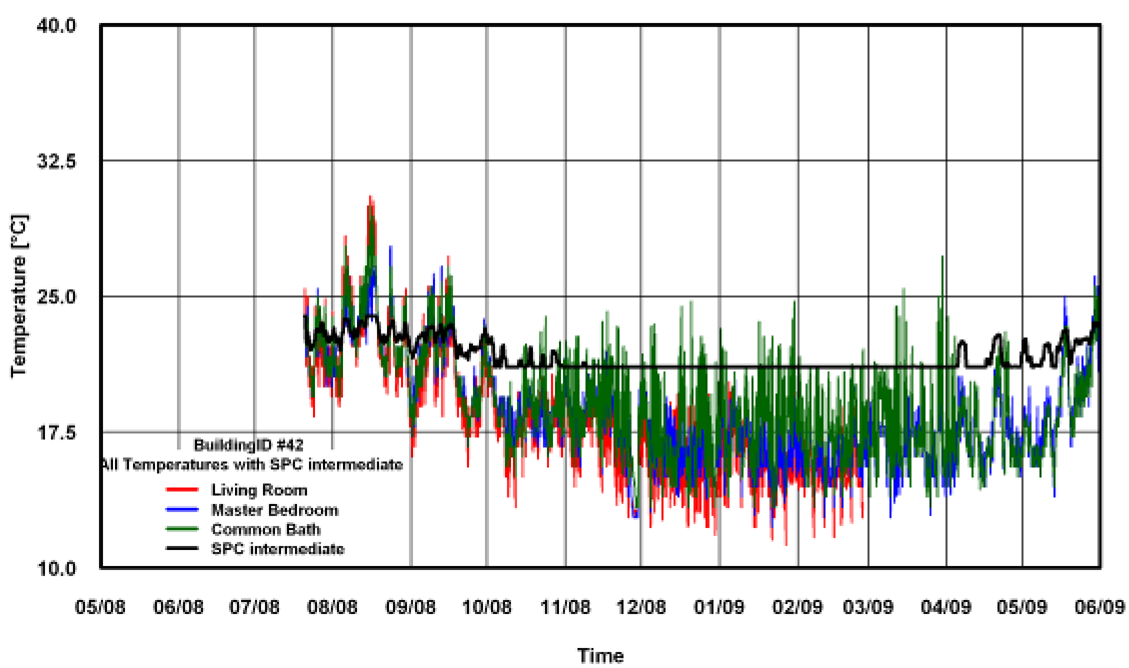

Figure 227: Temperature of SPC 160 Intermediate Method for Building # 42

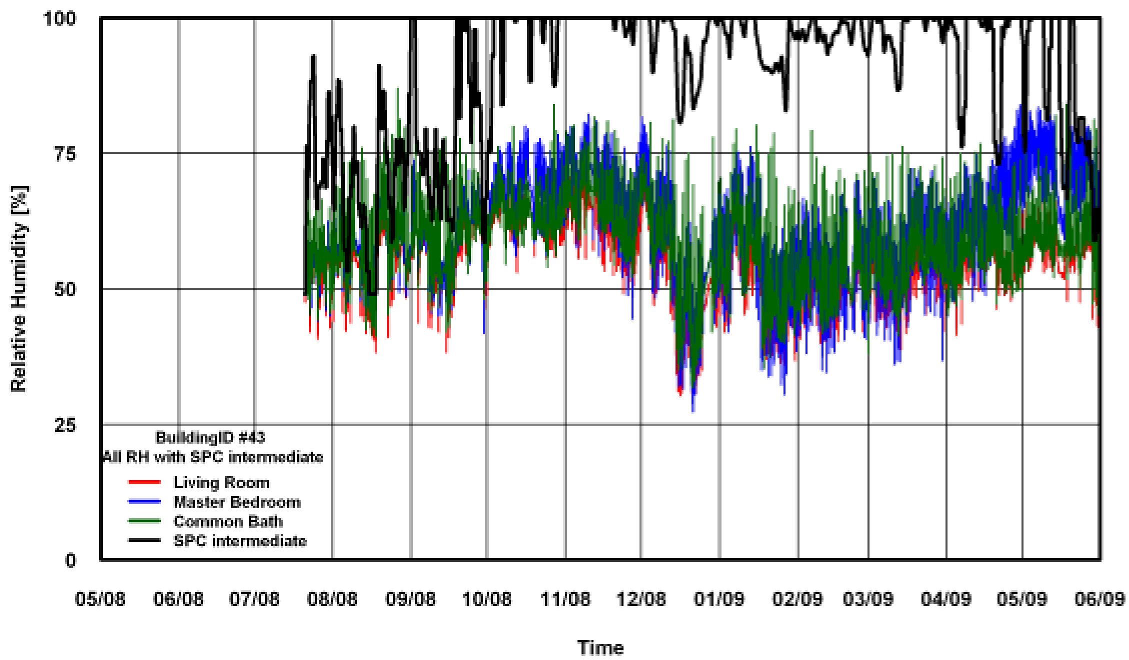

Figure 228: RH Comparison of SPC 160 Intermediate Method for Building # 43

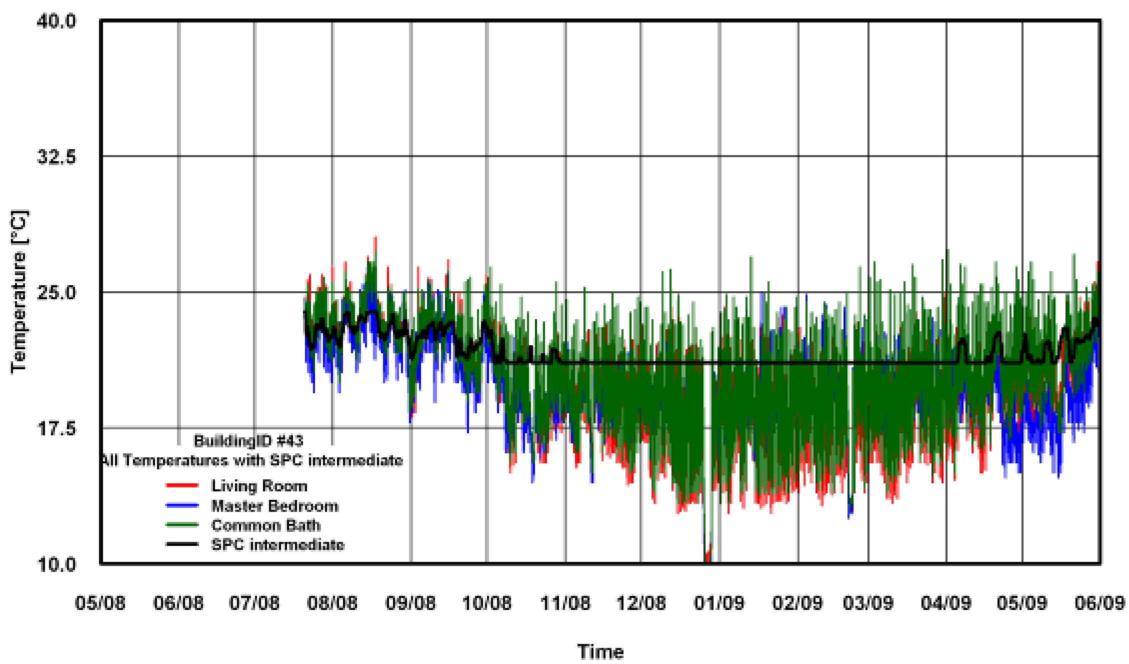

Figure 229: Temperature of SPC 160 Intermediate Method for Building # 43

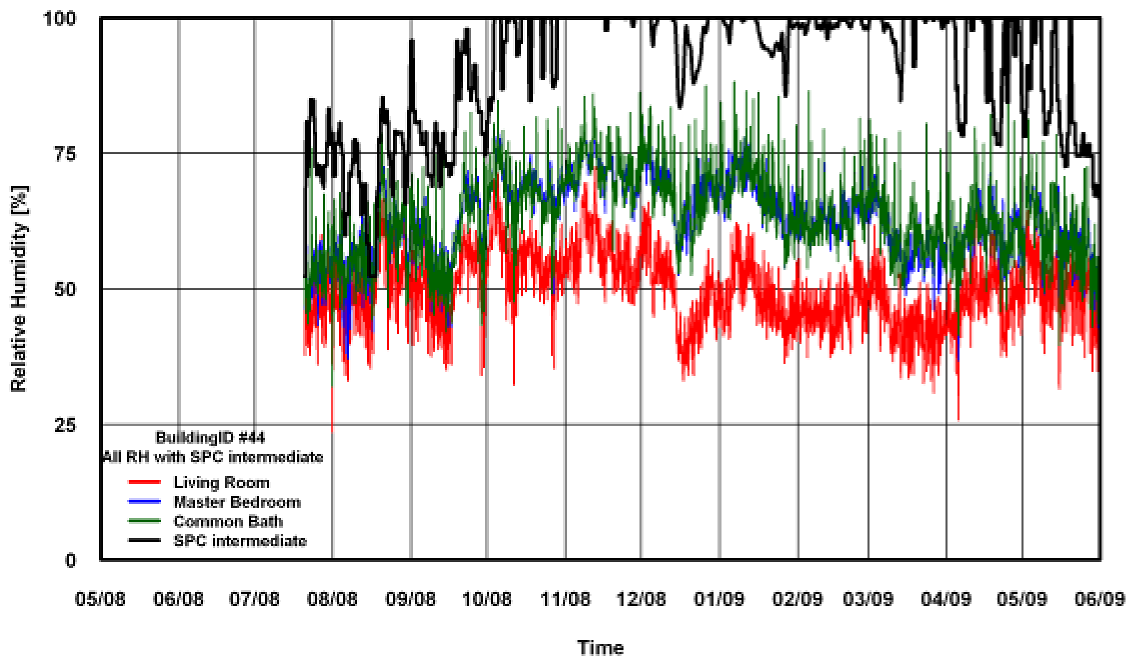

Figure 230: RH Comparison of SPC 160 Intermediate Method for Building # 44

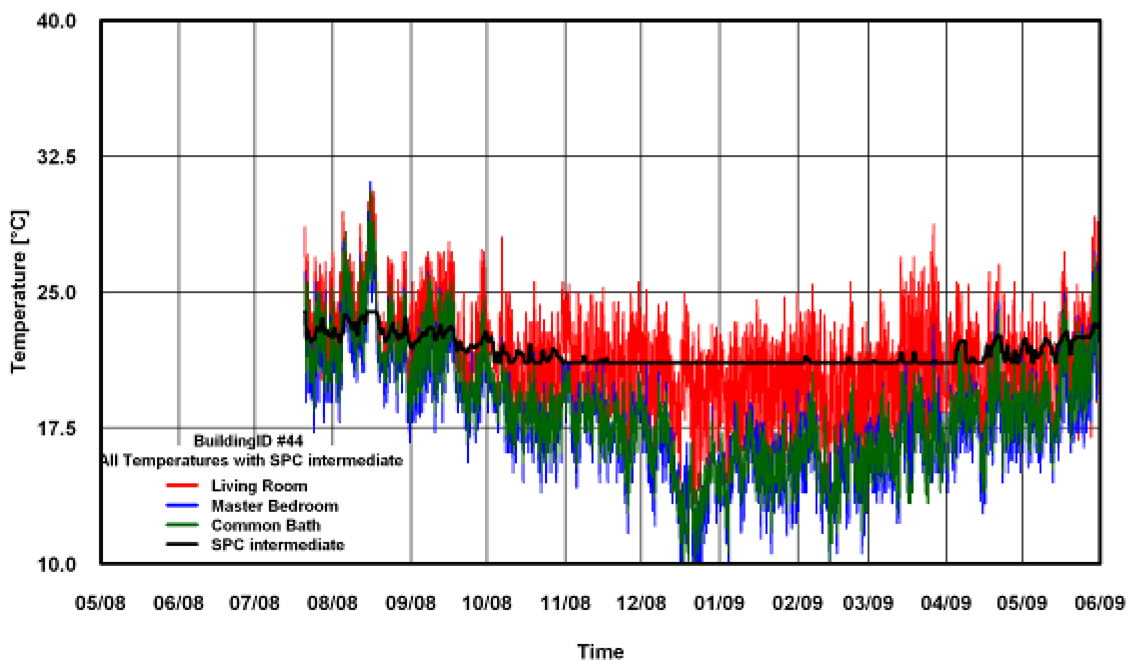

Figure 231: Temperature of SPC 160 Intermediate Method for Building # 44

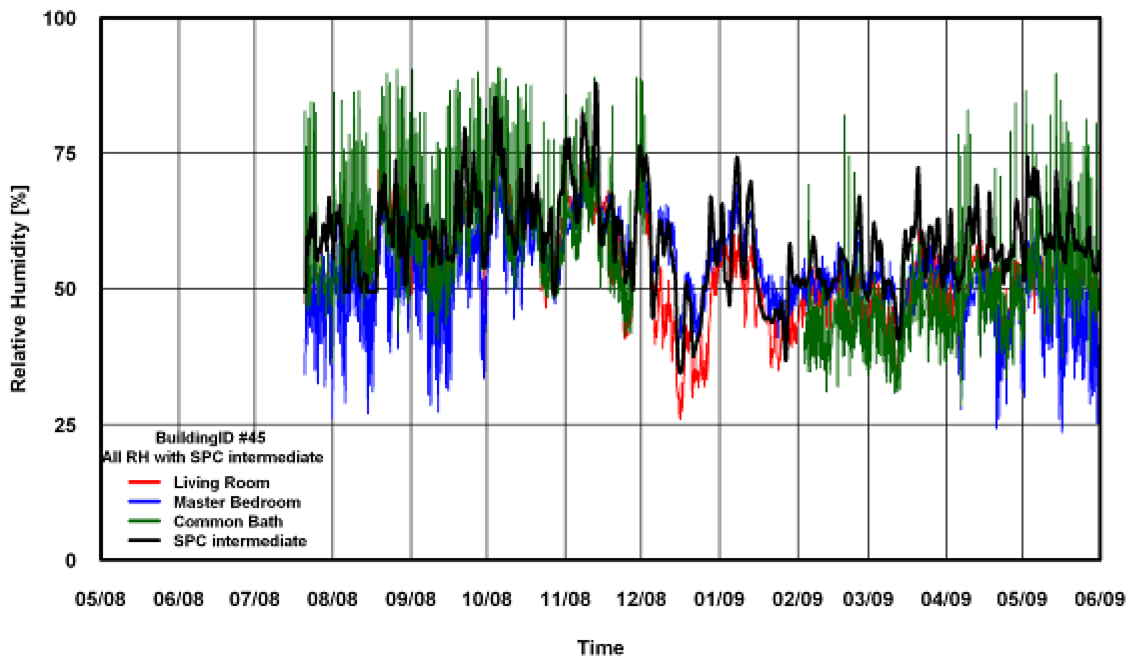

Figure 232: RH Comparison of SPC 160 Intermediate Method for Building # 45

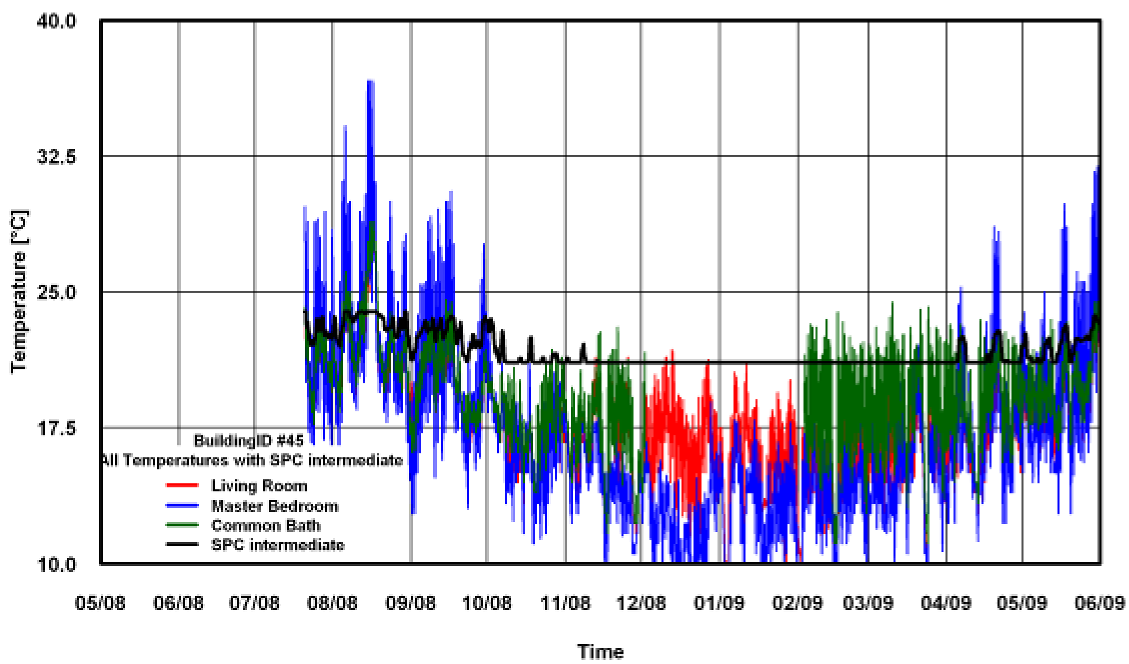

Figure 233: Temperature of SPC 160 Intermediate Method for Building # 45

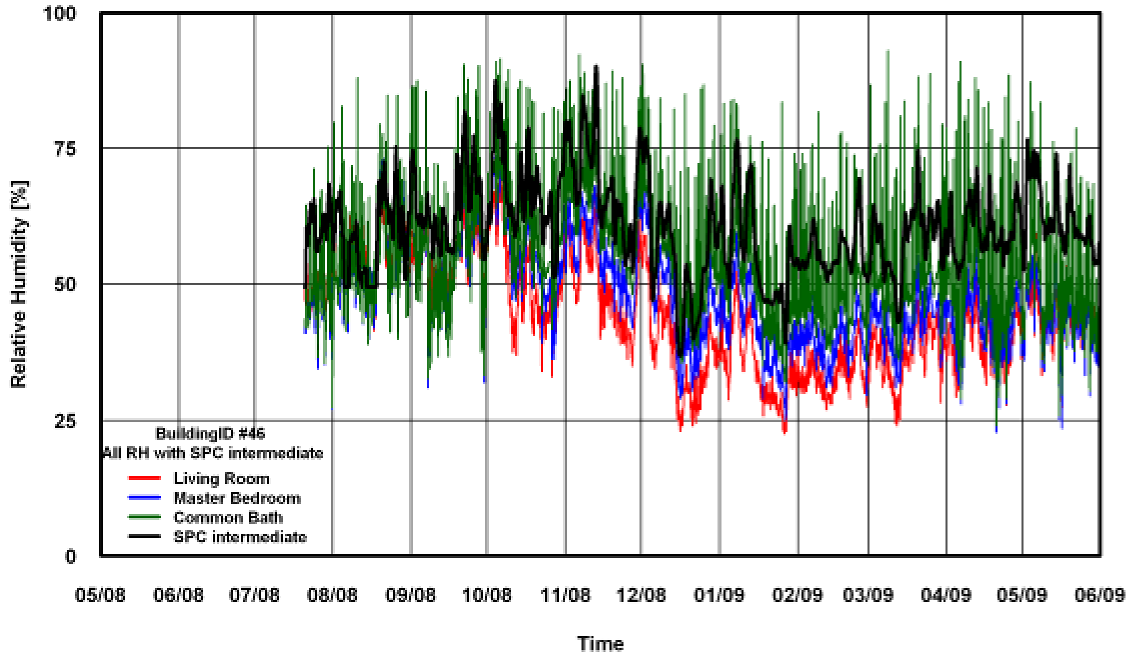

Figure 234: RH Comparison of SPC 160 Intermediate Method for Building # 46

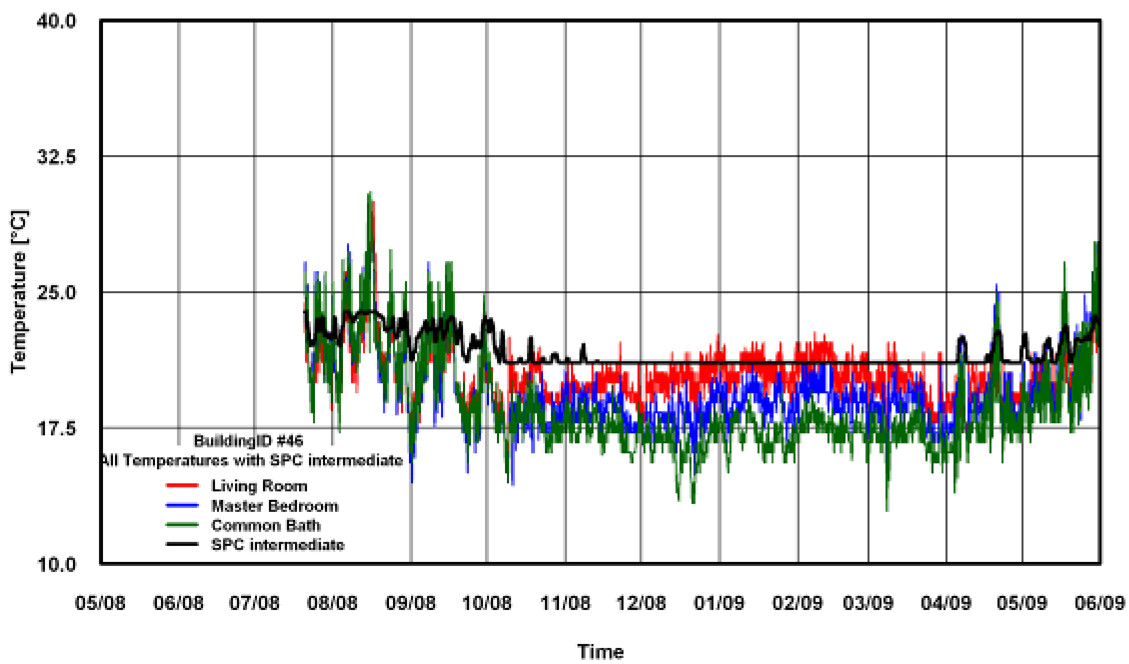

Figure 235: Temperature of SPC 160 Intermediate Method for Building # 46

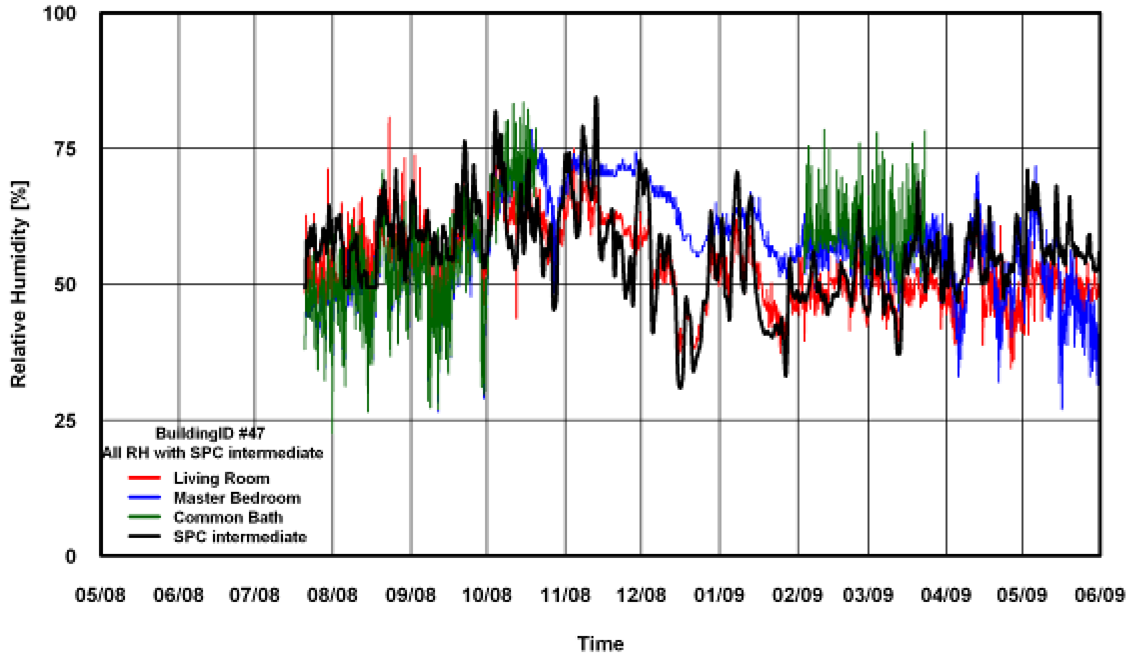

Figure 236: RH Comparison of SPC 160 Intermediate Method for Building # 47

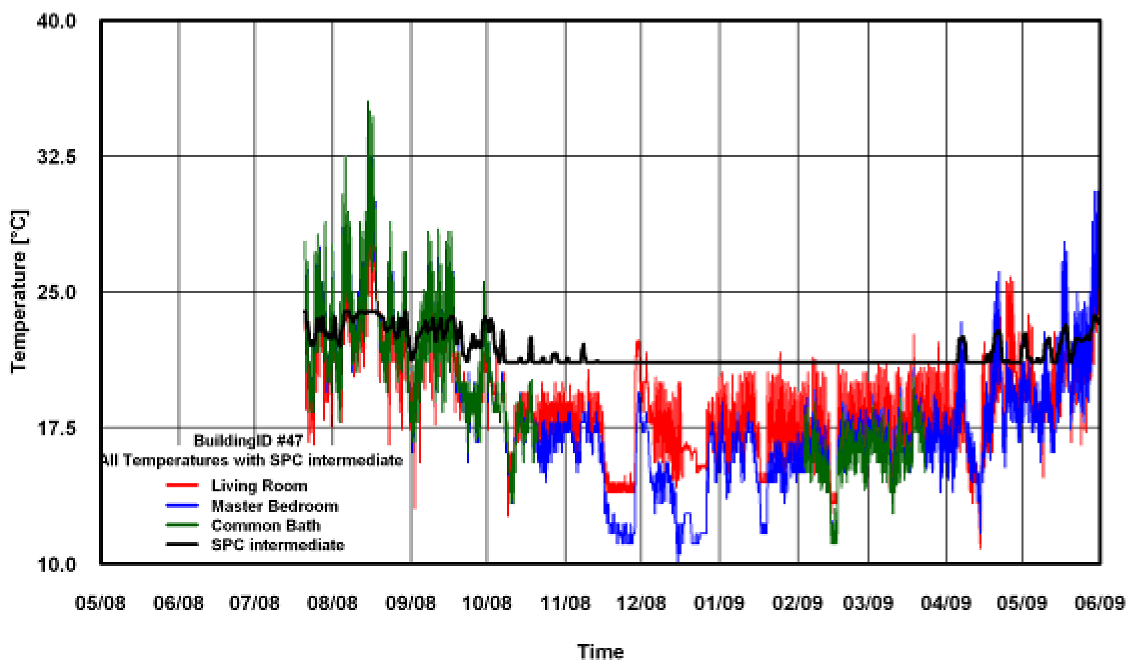

Figure 237: Temperature of SPC 160 Intermediate Method for Building # 47

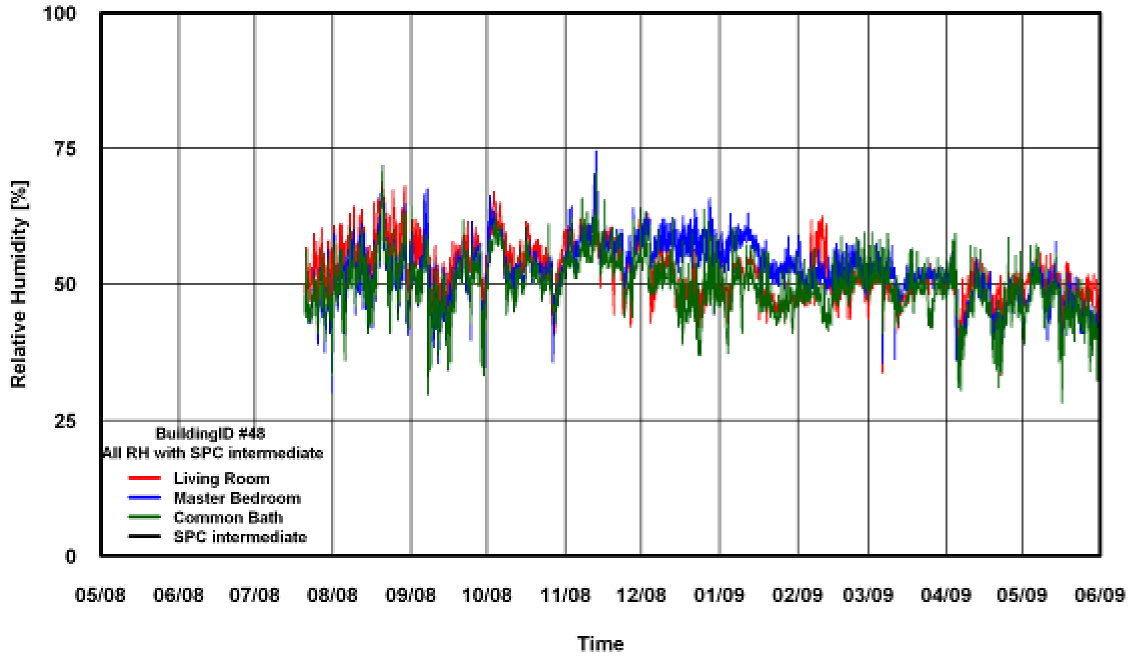

Figure 238: RH Comparison of SPC 160 Intermediate Method for Building # 48

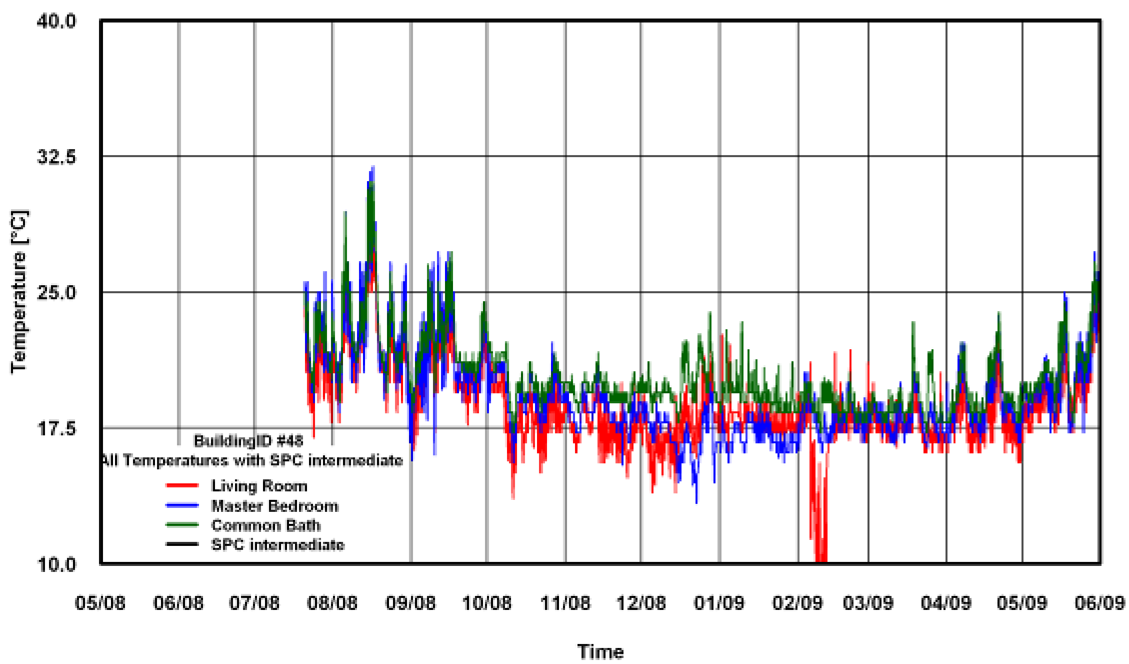

Figure 239: Temperature of SPC 160 Intermediate Method for Building # 48

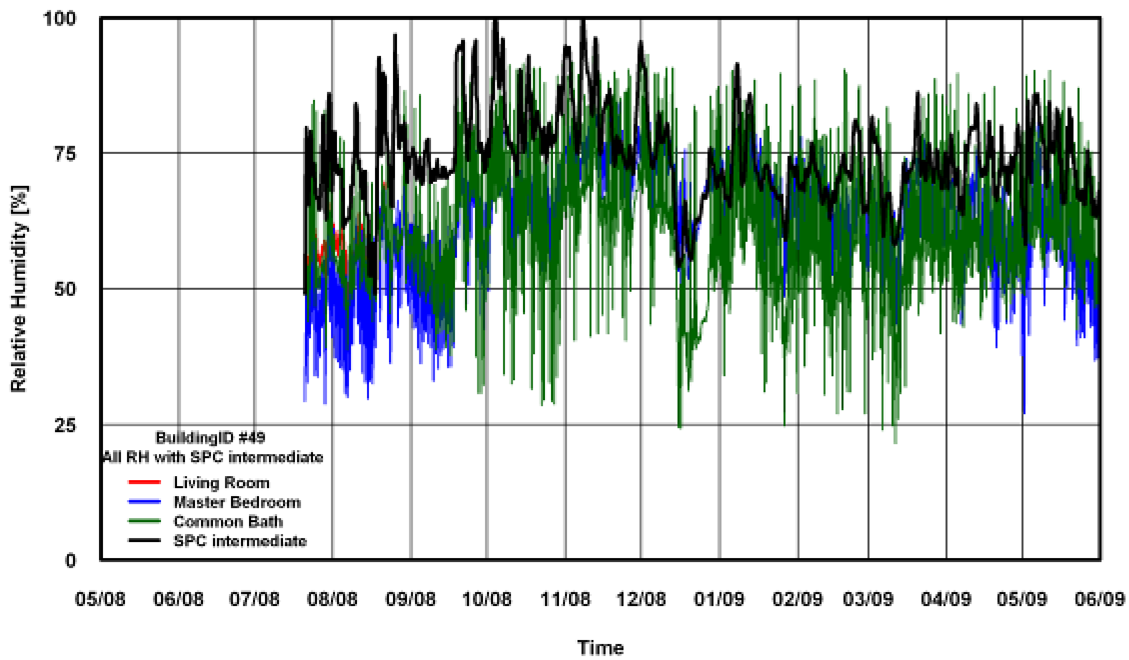

Figure 240: RH Comparison of SPC 160 Intermediate Method for Building # 49

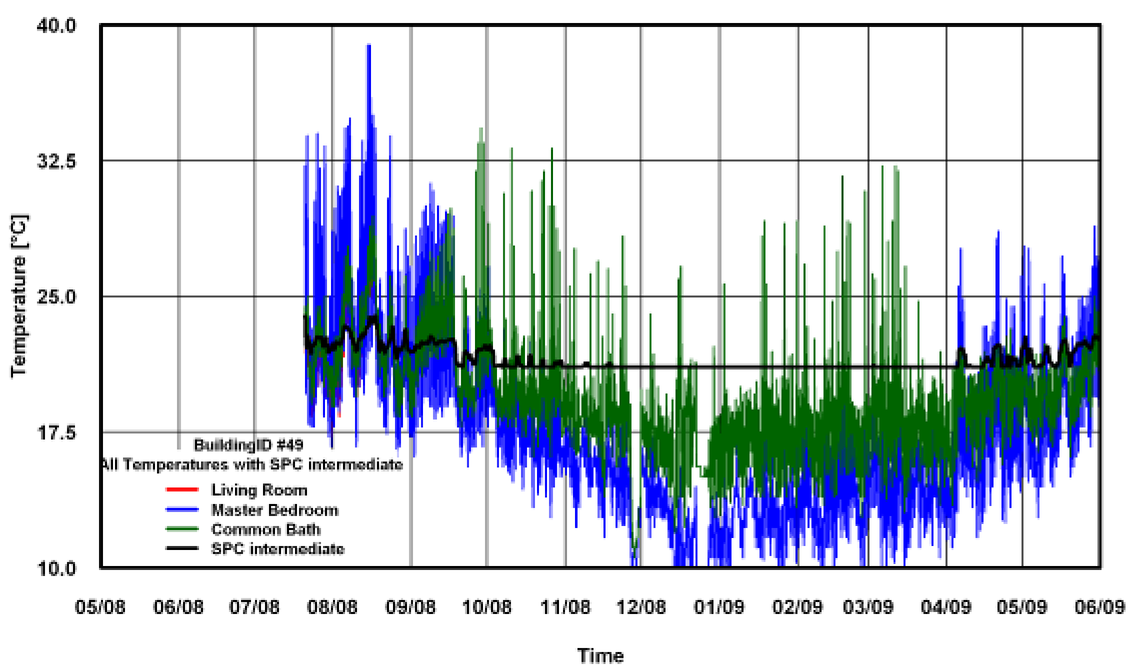

Figure 241: Temperature of SPC 160 Intermediate Method for Building # 49

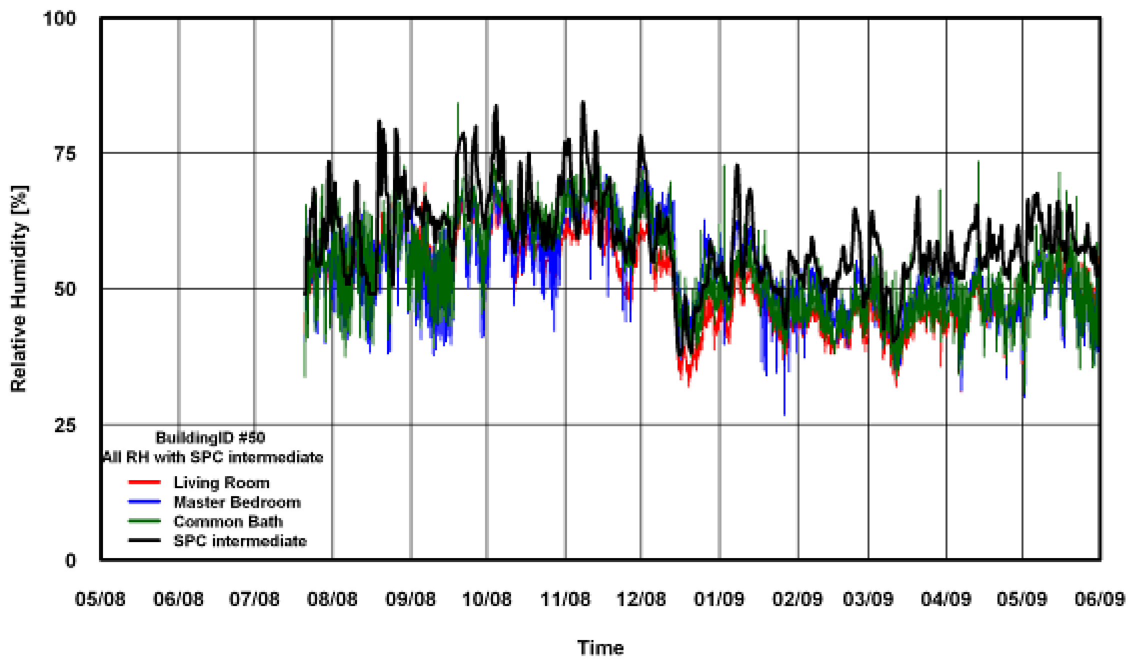

Figure 242: RH Comparison of SPC 160 Intermediate Method for Building # 50

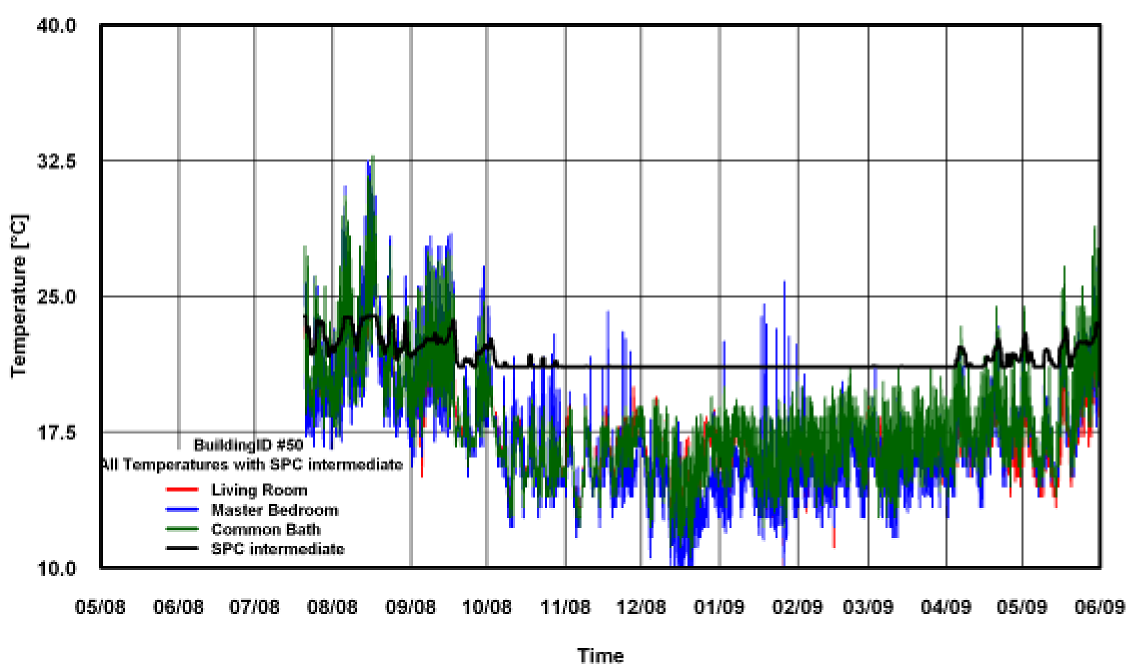

Figure 243: Temperature of SPC 160 Intermediate Method for Building # 50

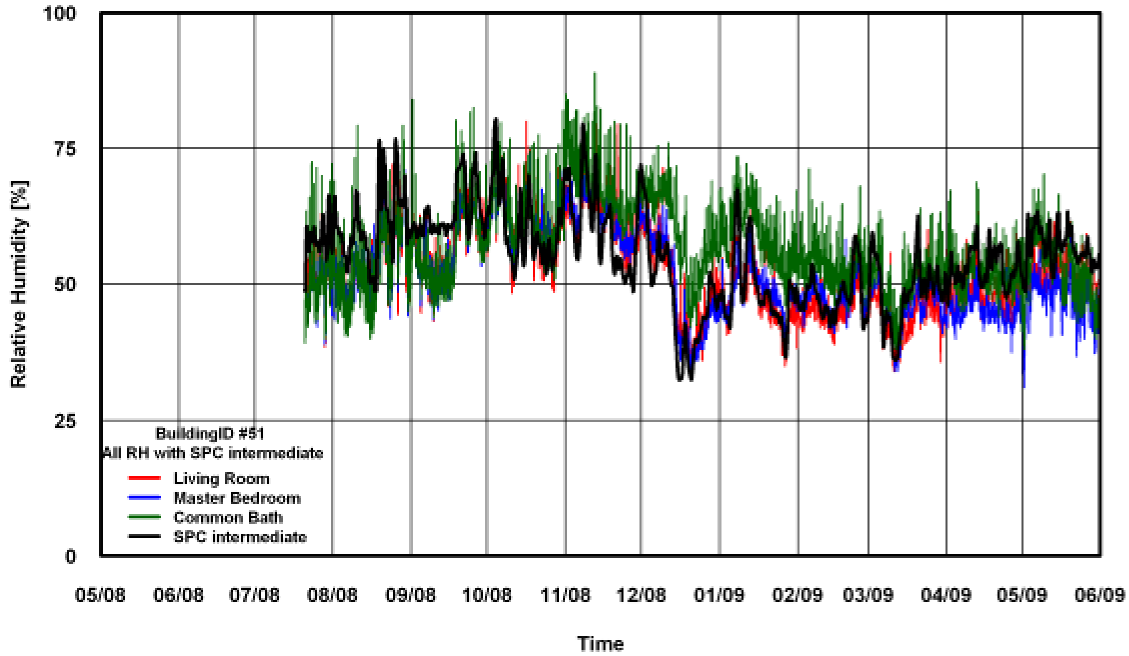

Figure 244: RH Comparison of SPC 160 Intermediate Method for Building # 51

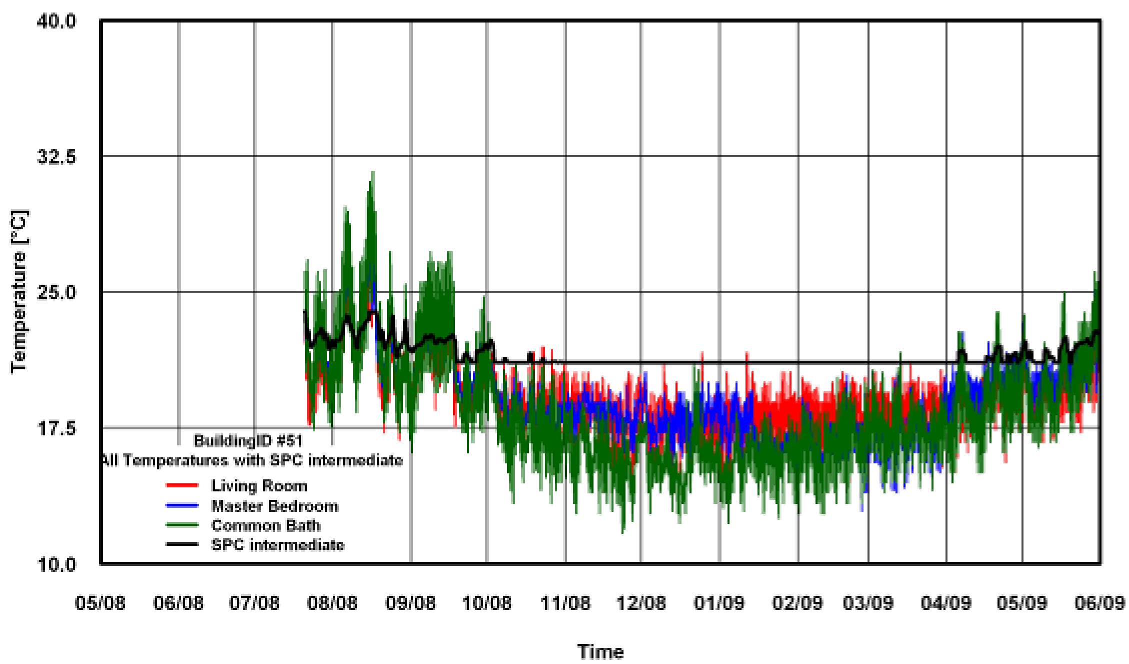

Figure 245: Temperature of SPC 160 Intermediate Method for Building # 51

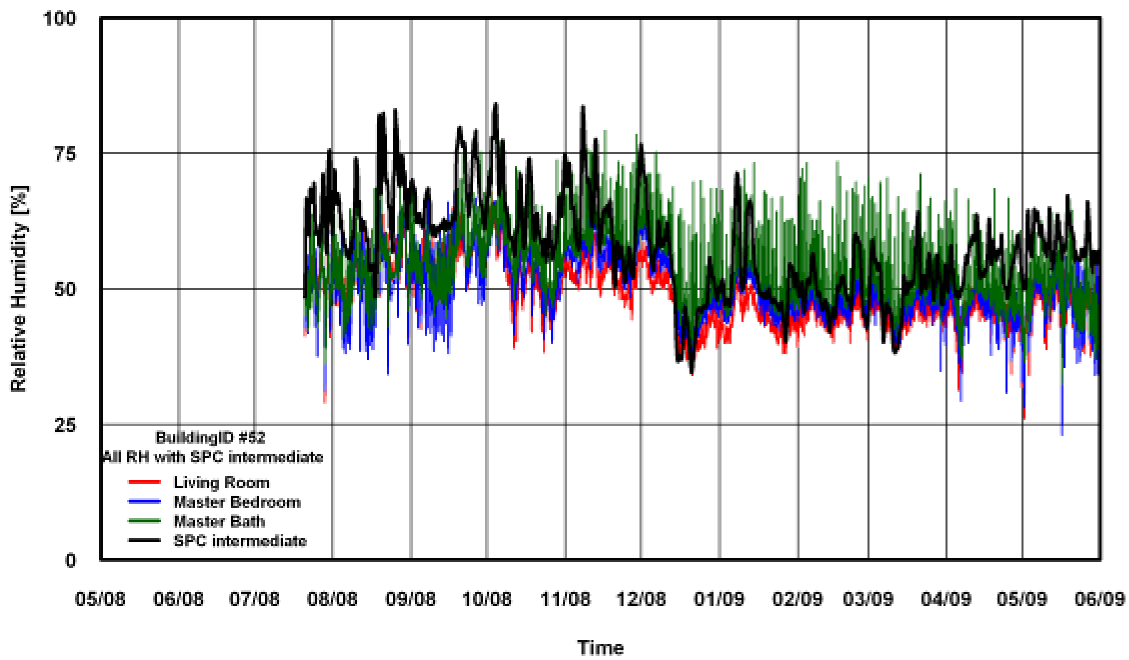

Figure 246: RH Comparison of SPC 160 Intermediate Method for Building # 52

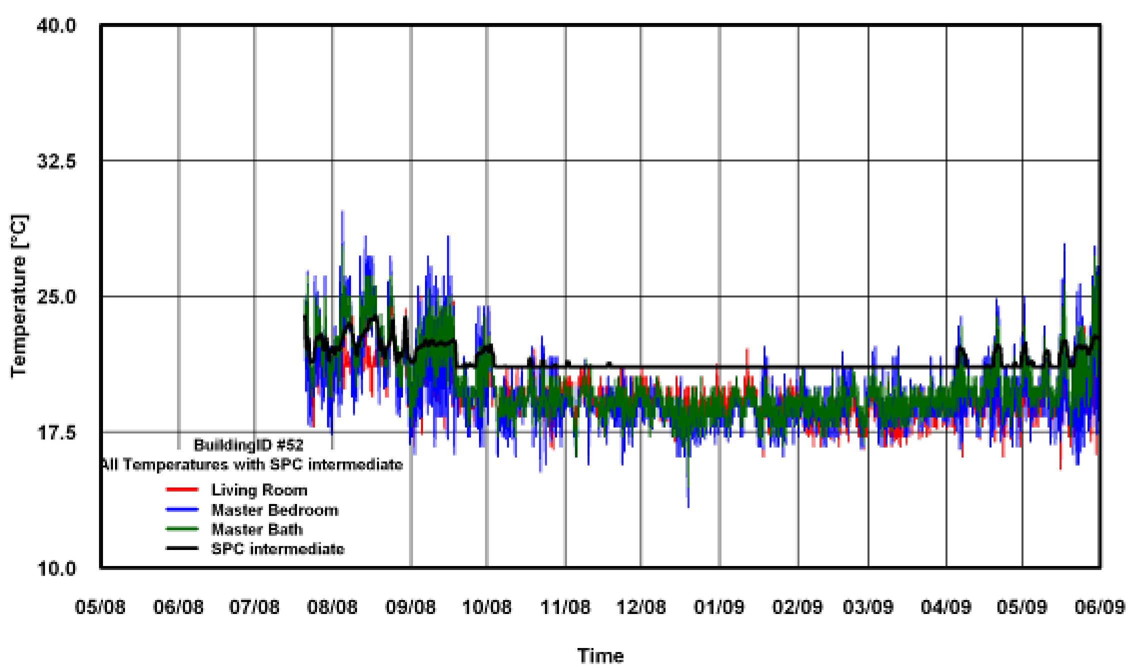

Figure 247: Temperature of SPC 160 Intermediate Method for Building # 52

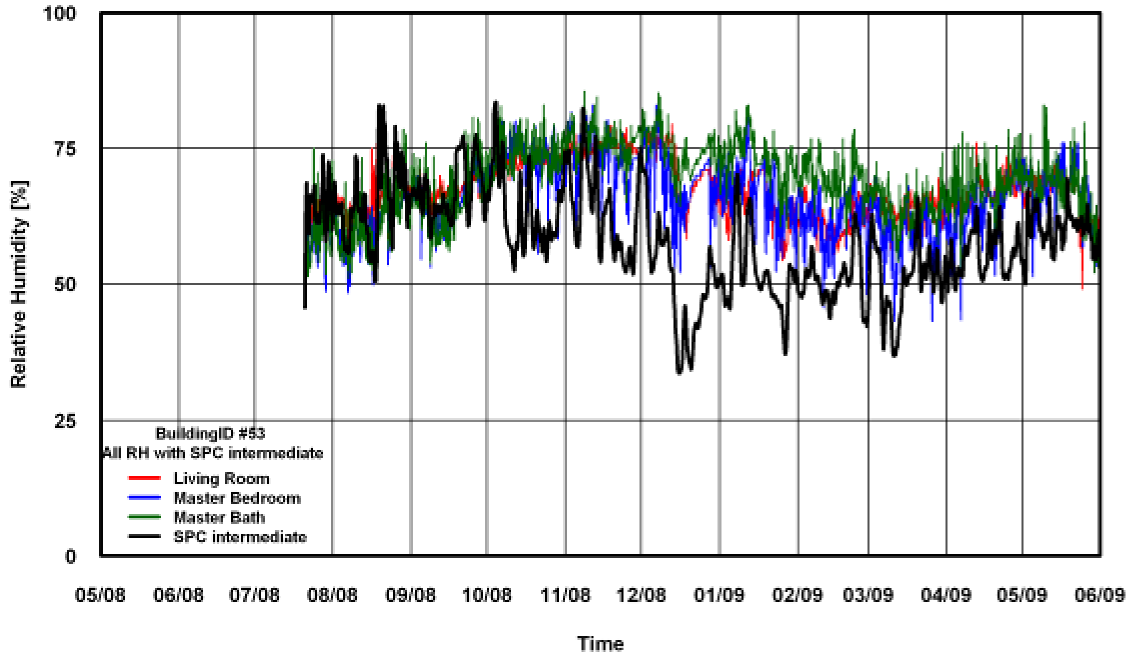

Figure 248: RH Comparison of SPC 160 Intermediate Method for Building # 53

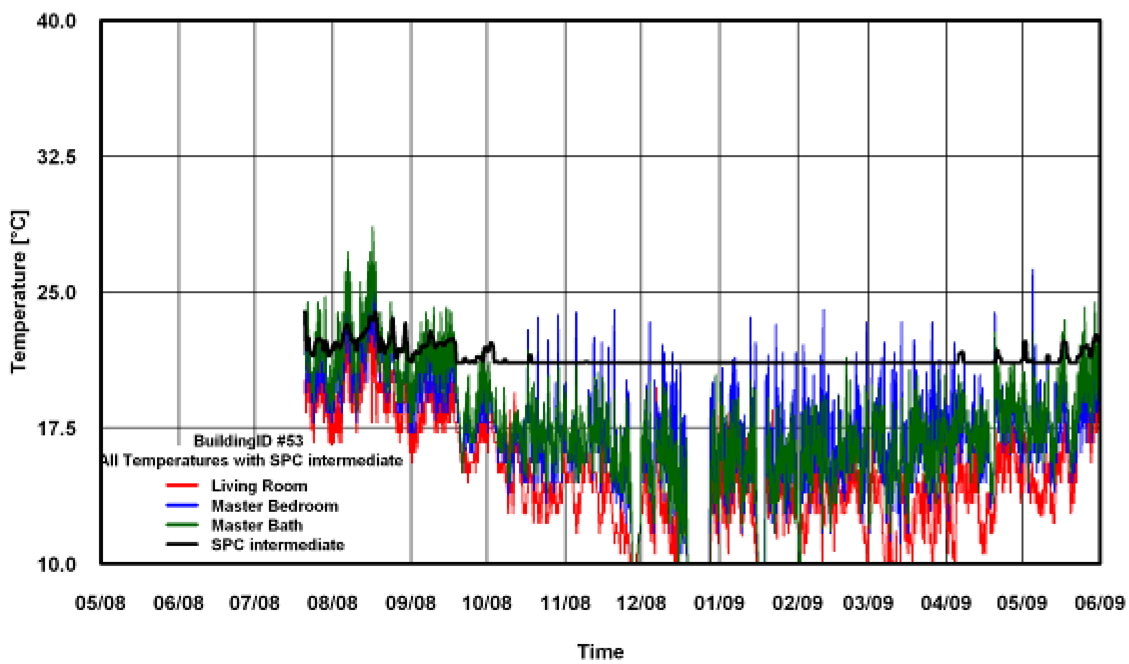

Figure 249: Temperature of SPC 160 Intermediate Method for Building # 53

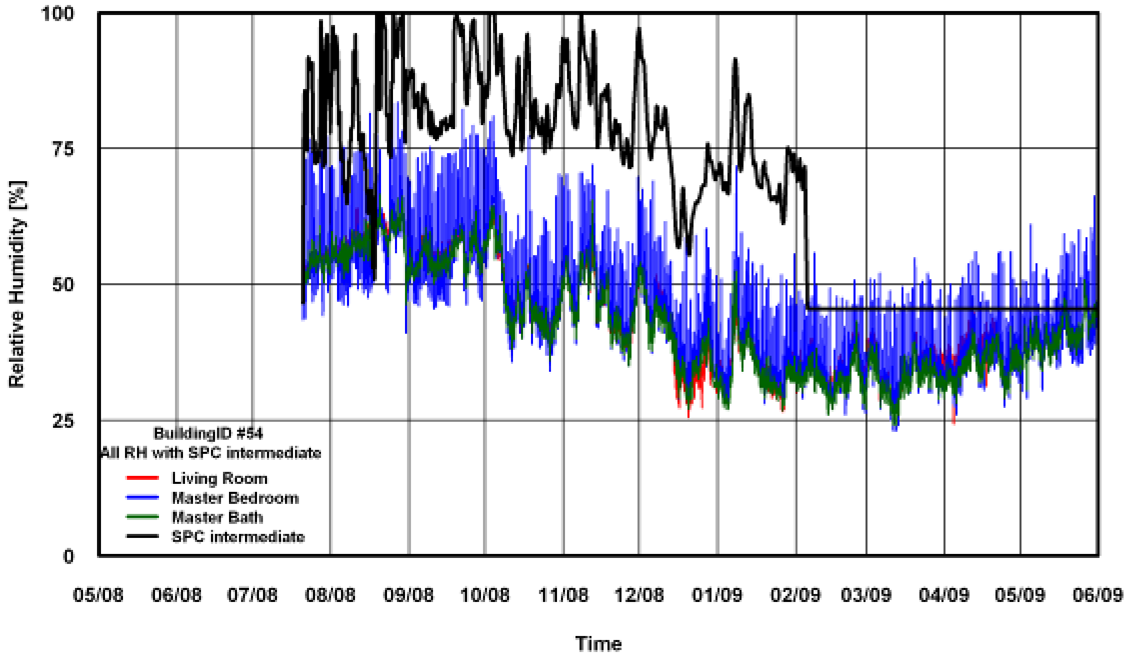

Figure 250: RH Comparison of SPC 160 Intermediate Method for Building # 54

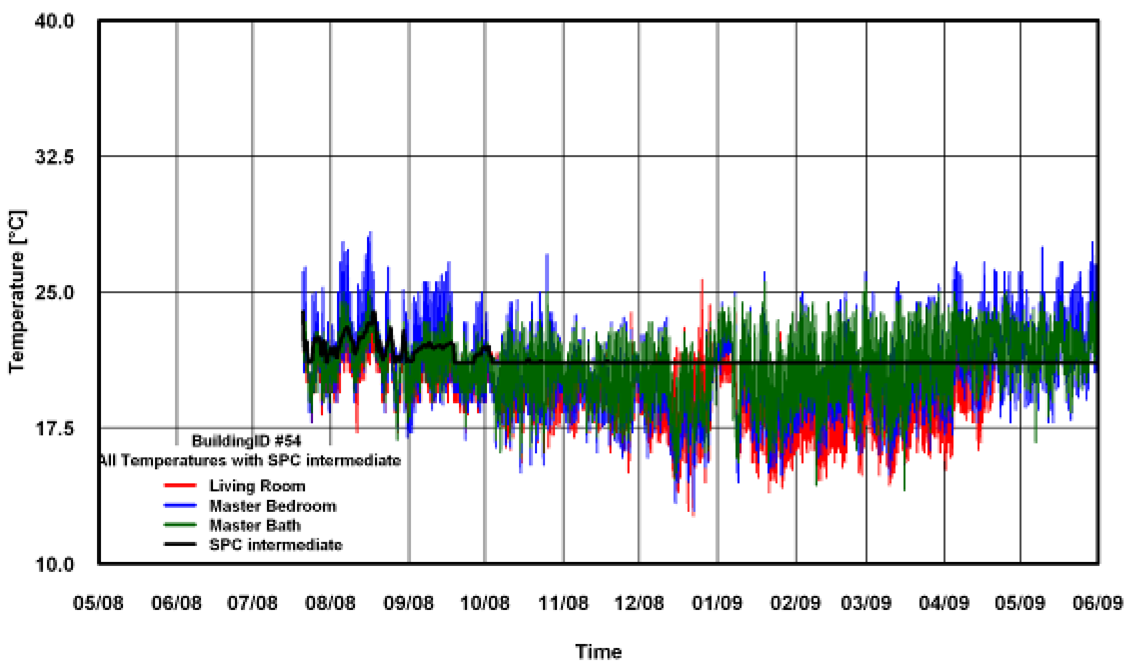

Figure 251: Temperature of SPC 160 Intermediate Method for Building # 54

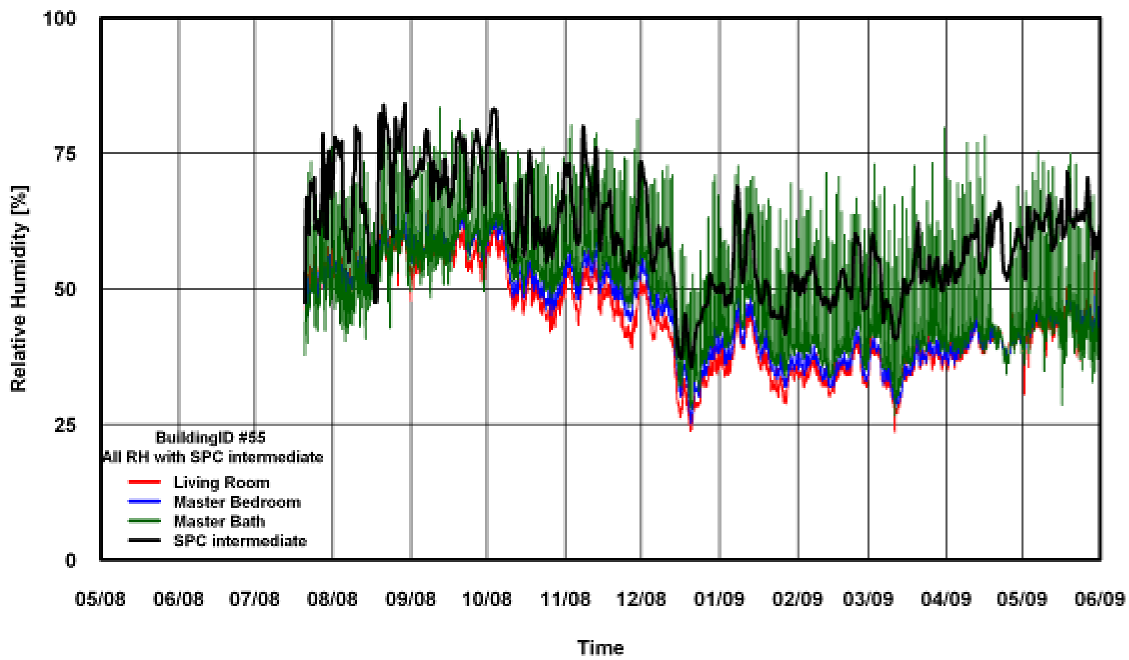

Figure 252: RH Comparison of SPC 160 Intermediate Method for Building # 55

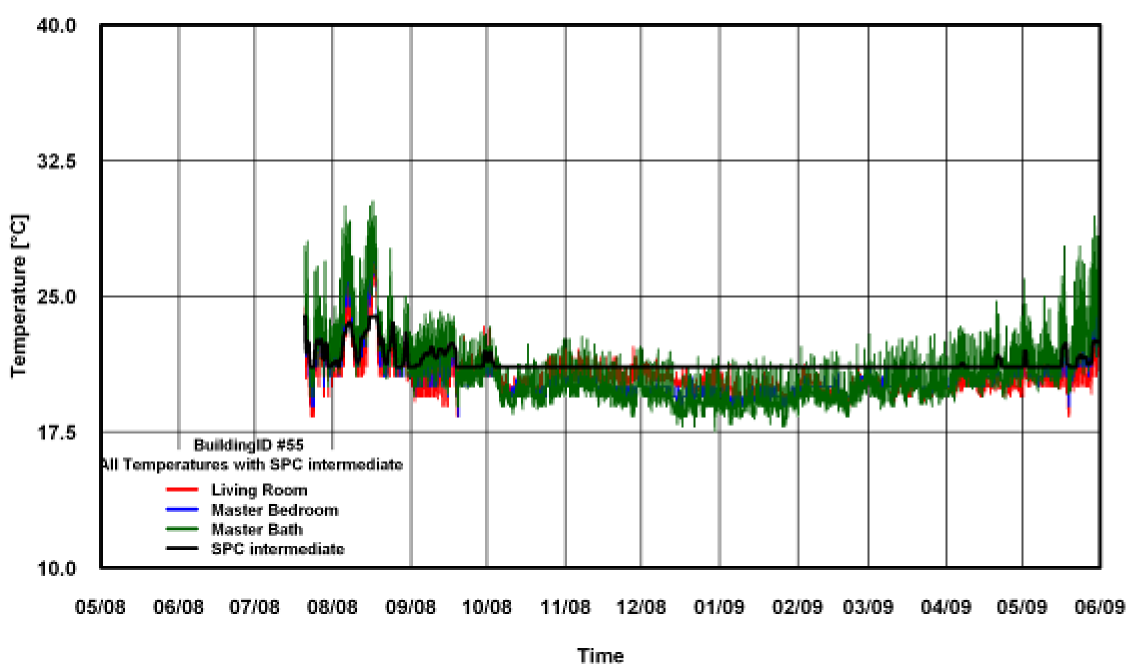

Figure 253: Temperature of SPC 160 Intermediate Method for Building # 55

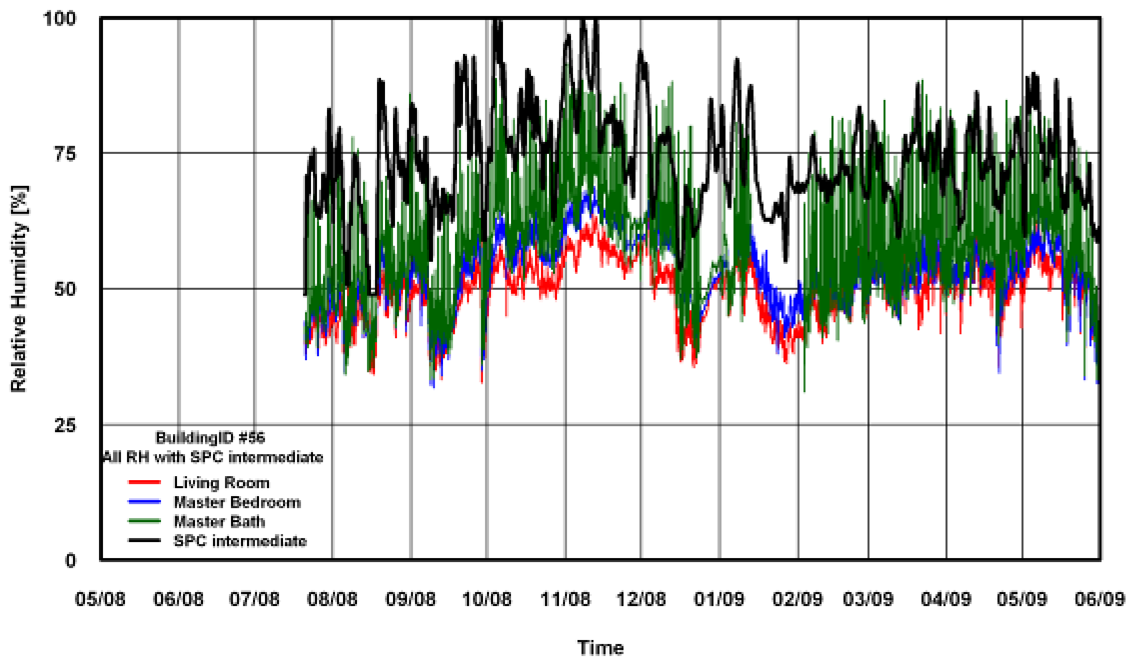

Figure 254: RH Comparison of SPC 160 Intermediate Method for Building # 56

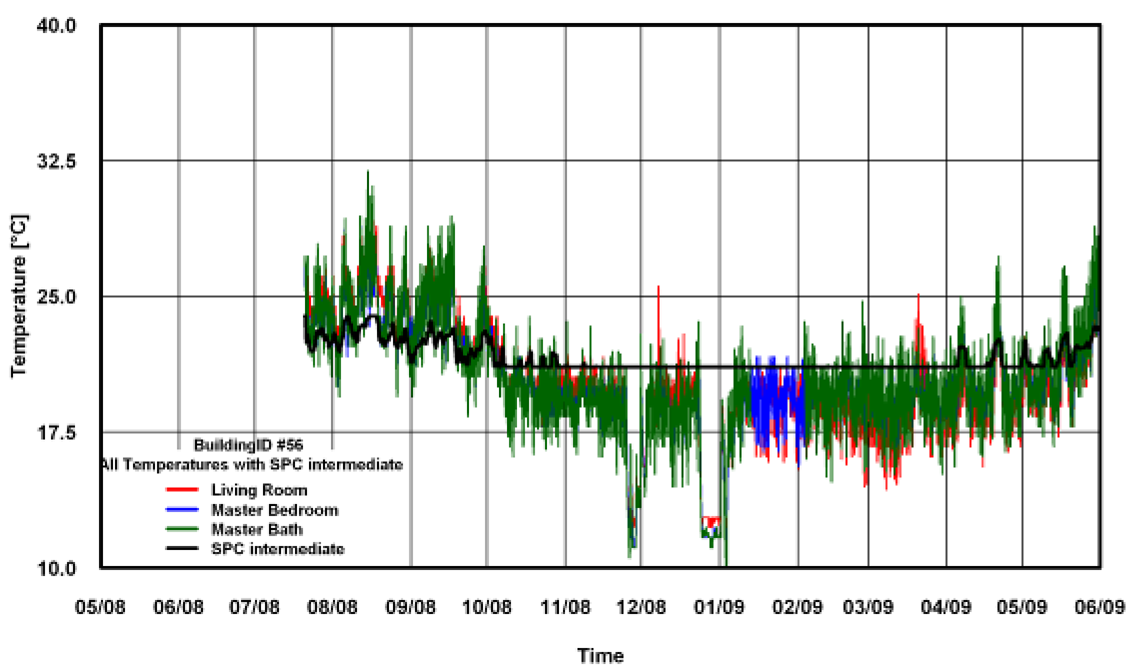

Figure 255: Temperature of SPC 160 Intermediate Method for Building # 56

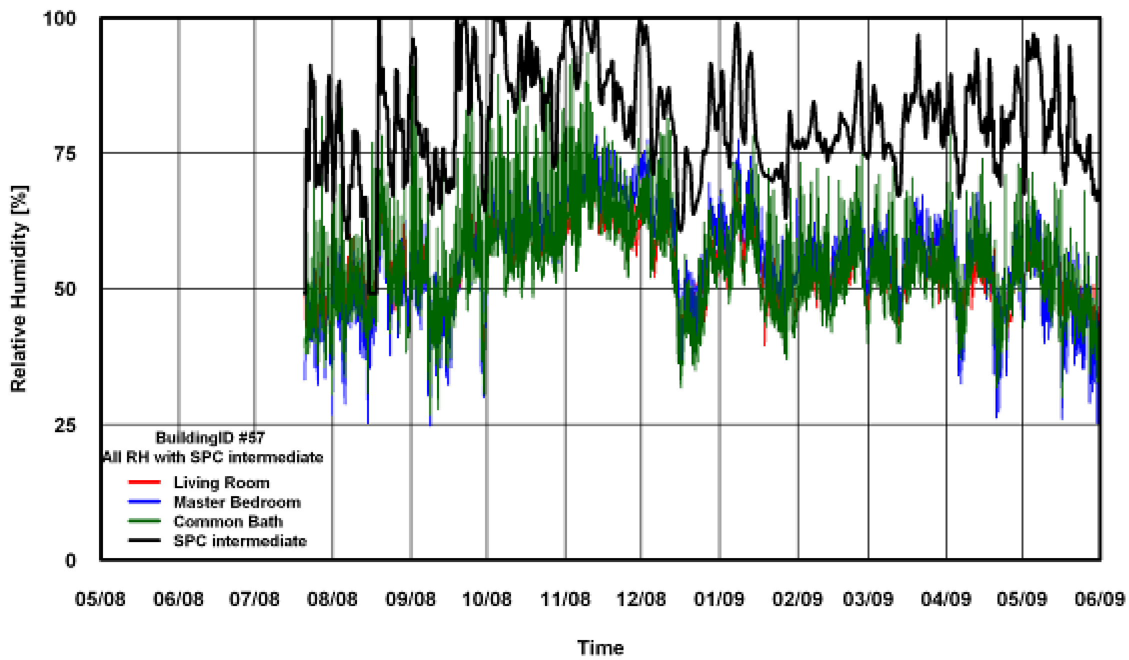

Figure 256: RH Comparison of SPC 160 Intermediate Method for Building # 57

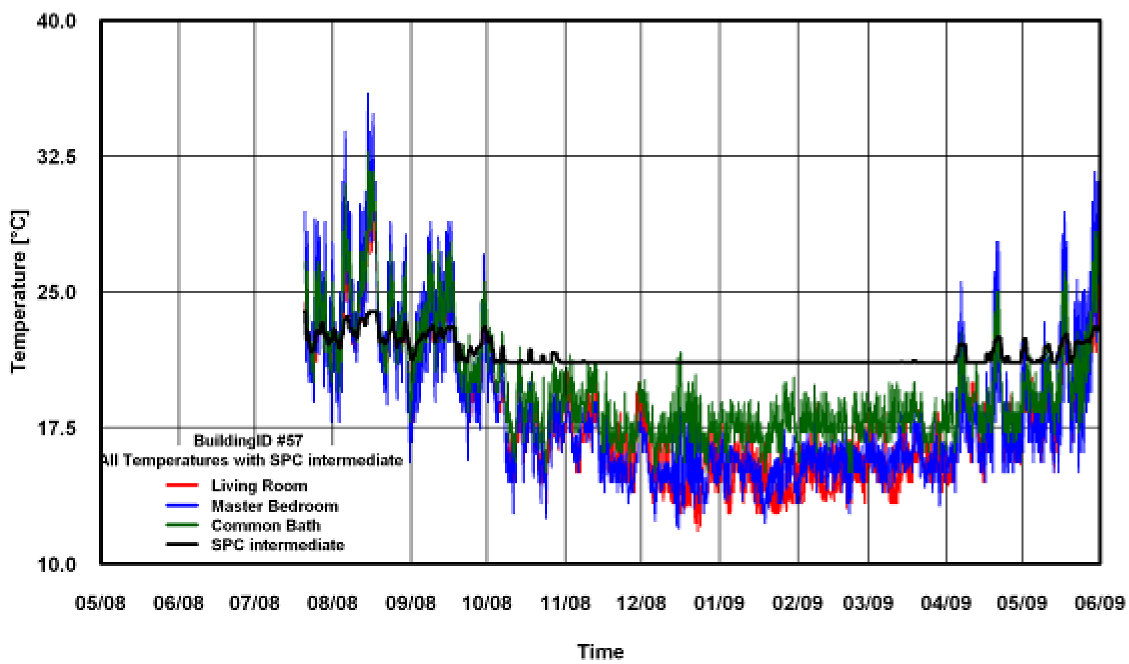

Figure 257: Temperature of SPC 160 Intermediate Method for Building # 57

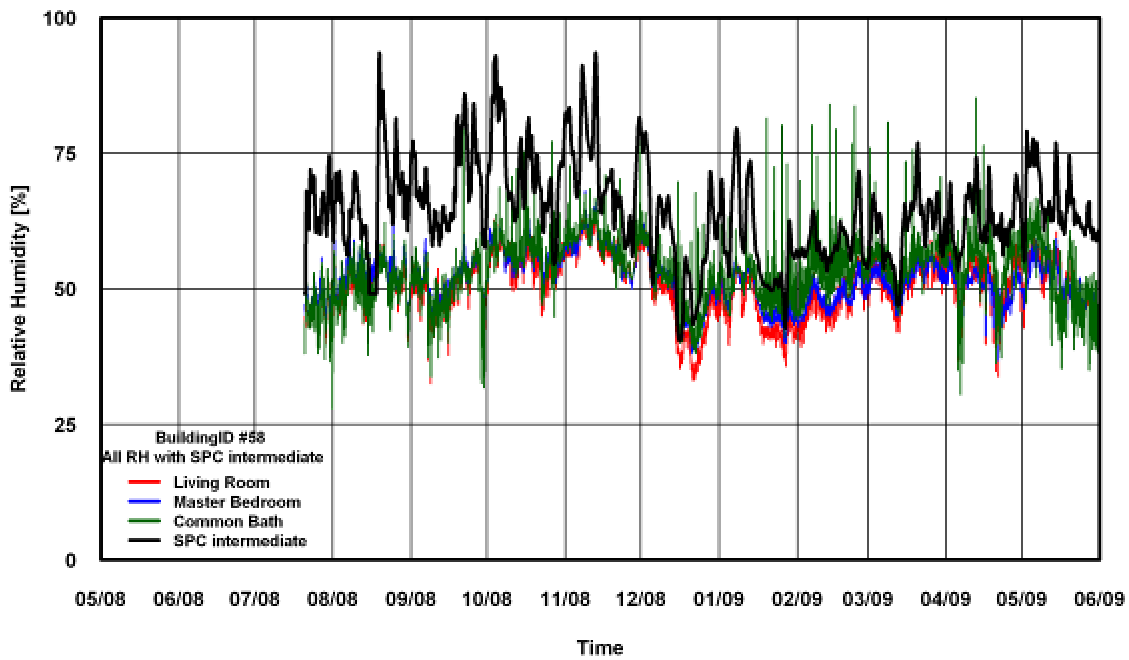

Figure 258: RH Comparison of SPC 160 Intermediate Method for Building # 58

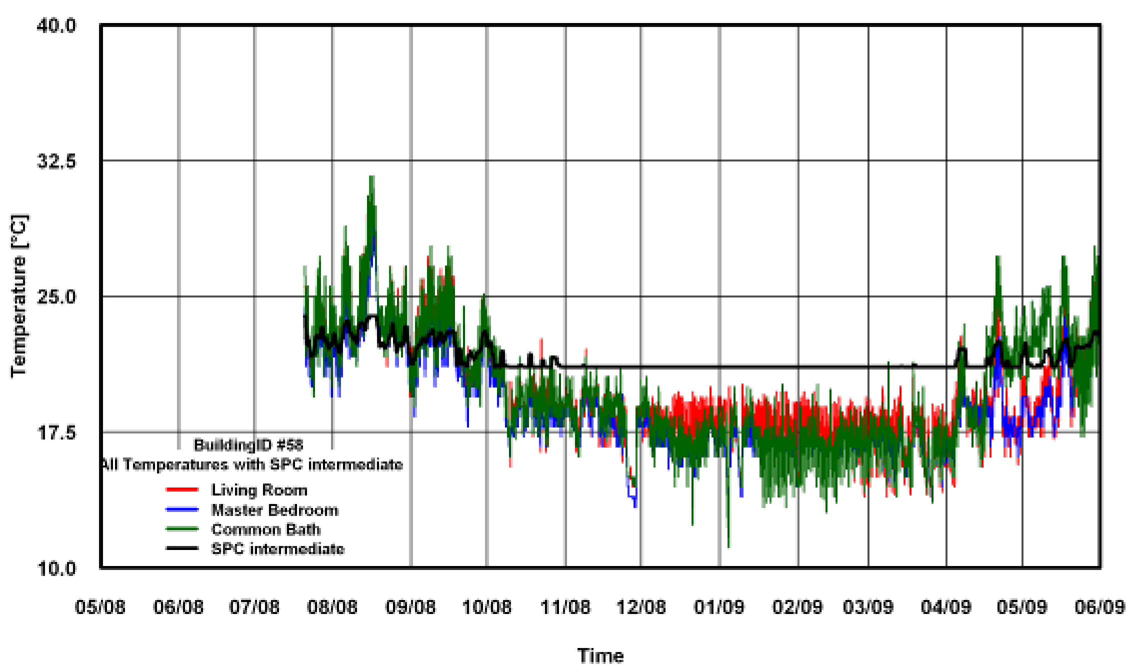

Figure 259: Temperature of SPC 160 Intermediate Method for Building # 58

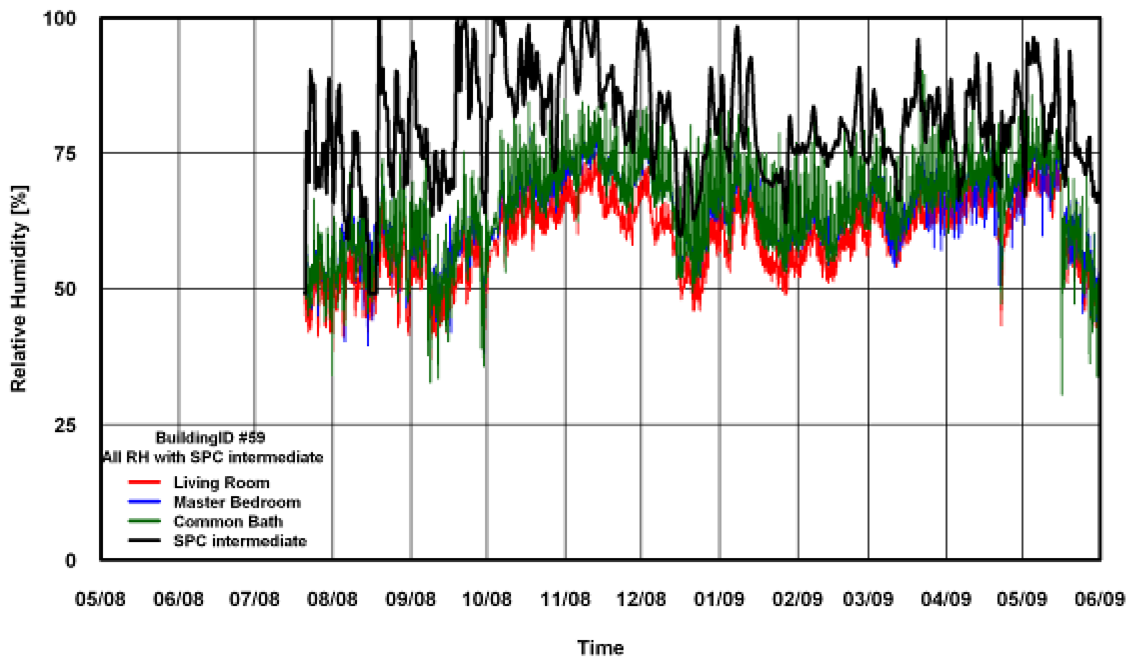

Figure 260: RH Comparison of SPC 160 Intermediate Method for Building # 59

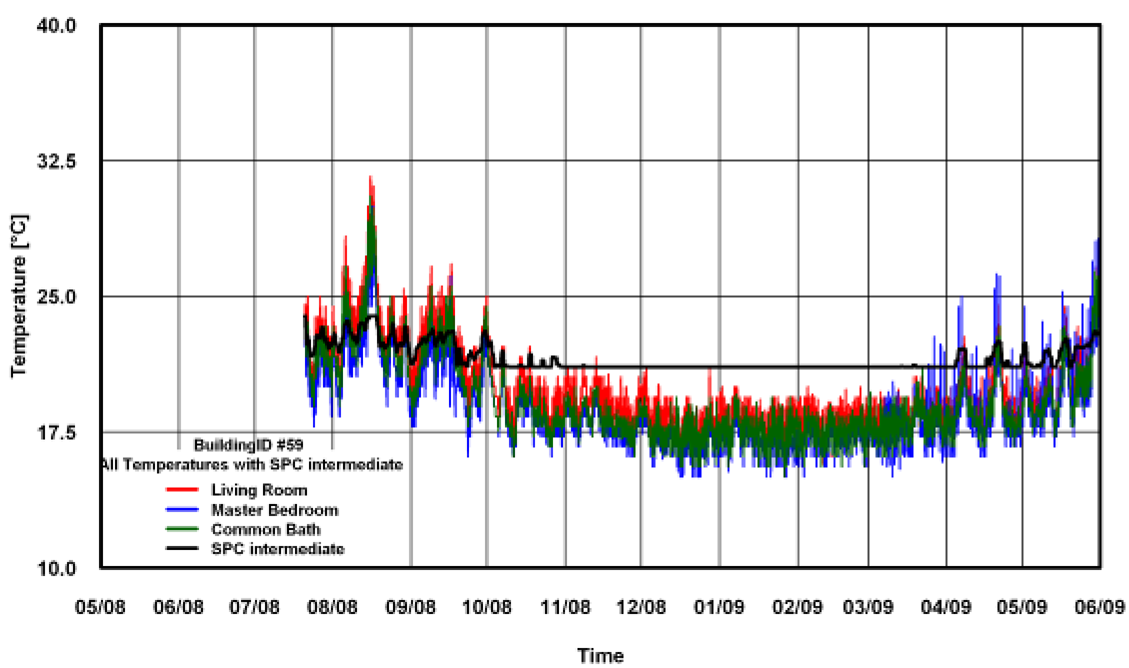

Figure 261: Temperature of SPC 160 Intermediate Method for Building # 59

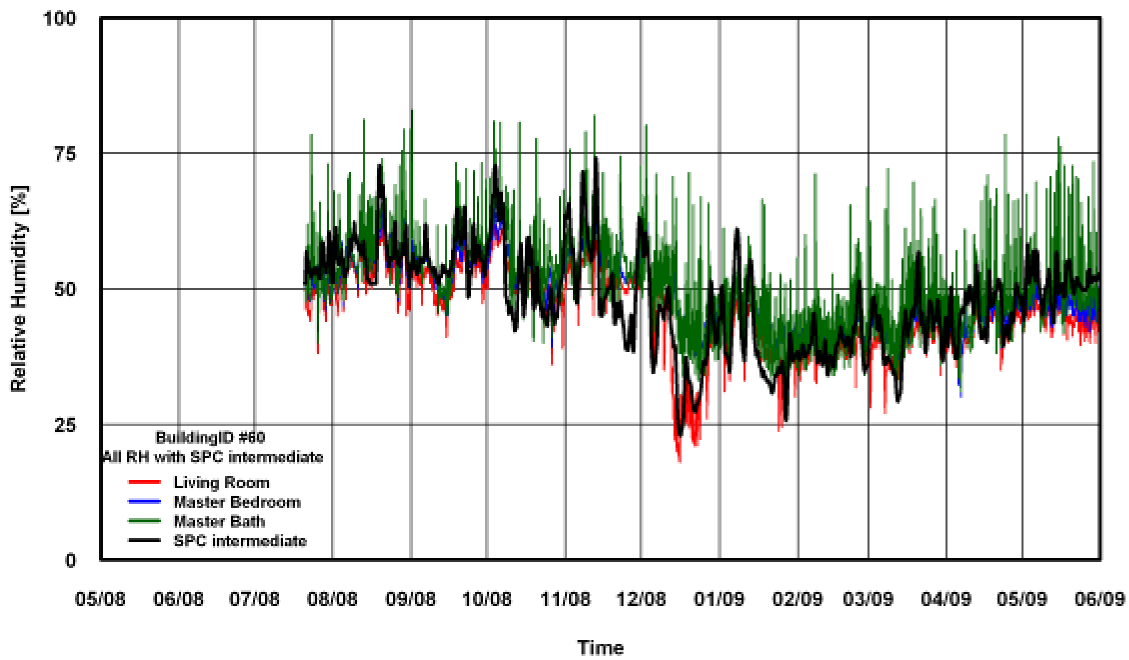

Figure 262: RH Comparison of SPC 160 Intermediate Method for Building # 60

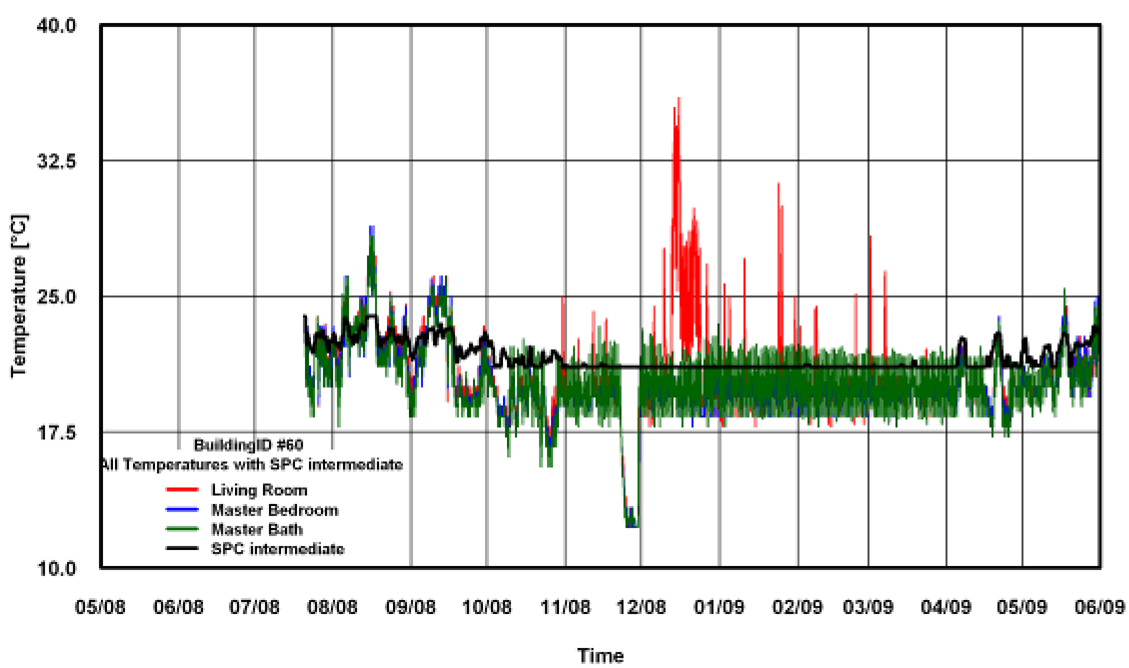

Figure 263: Temperature of SPC 160 Intermediate Method for Building # 60

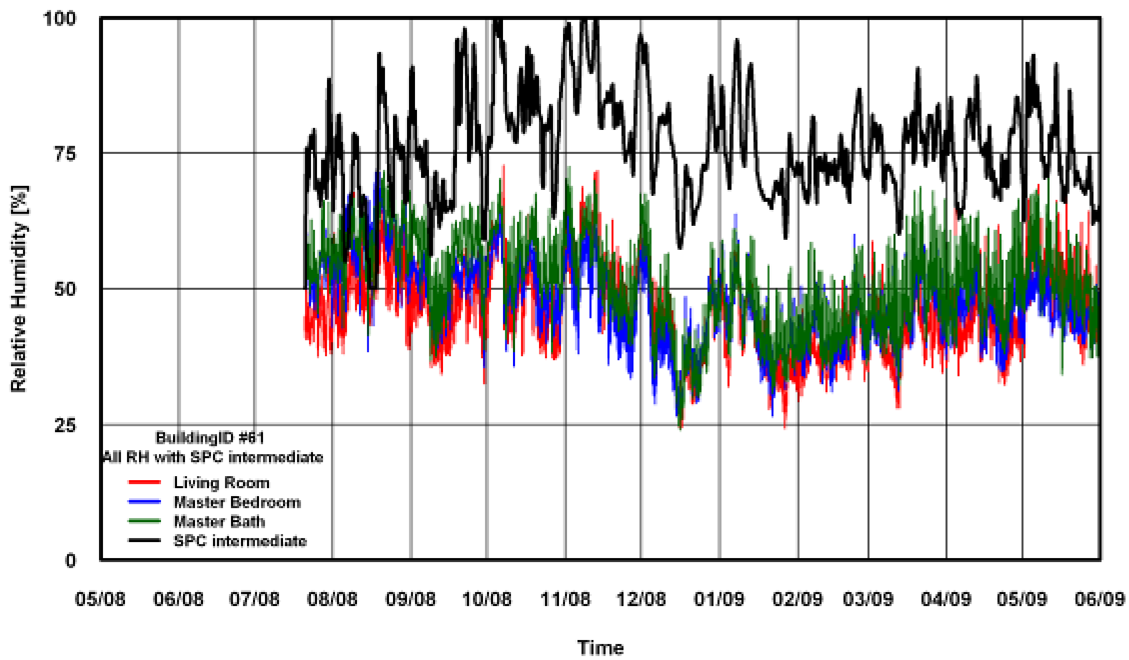

Figure 264: RH Comparison of SPC 160 Intermediate Method for Building # 61

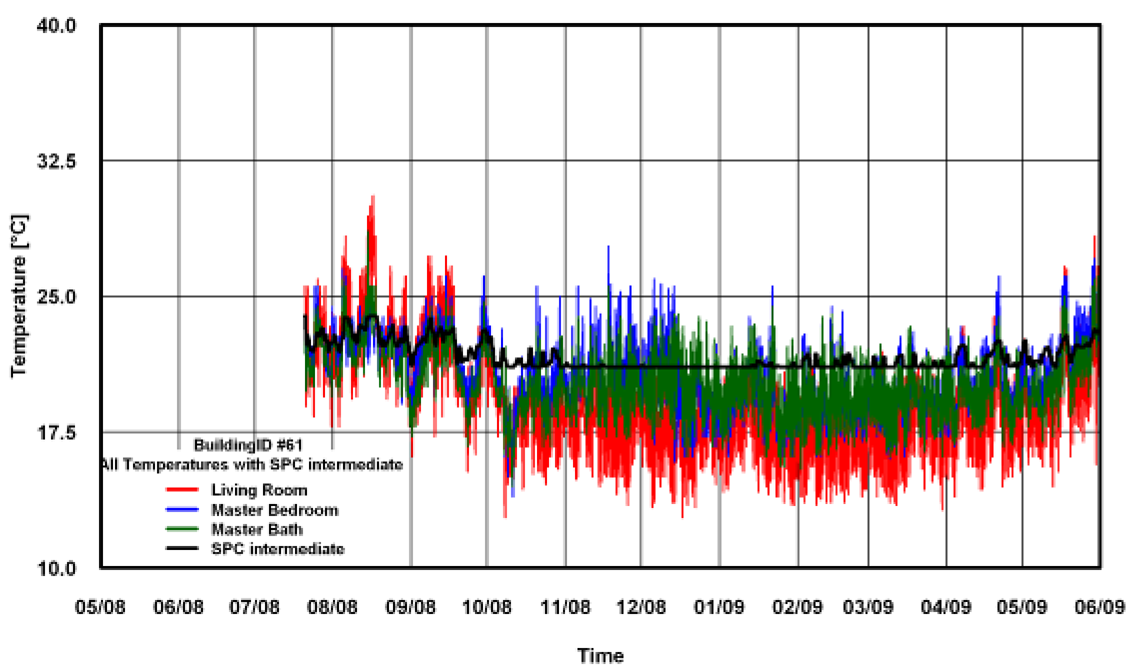

Figure 265: Temperature of SPC 160 Intermediate Method for Building # 61

APPENDIX C

ASHRAE Intermediate ANK Modified Method

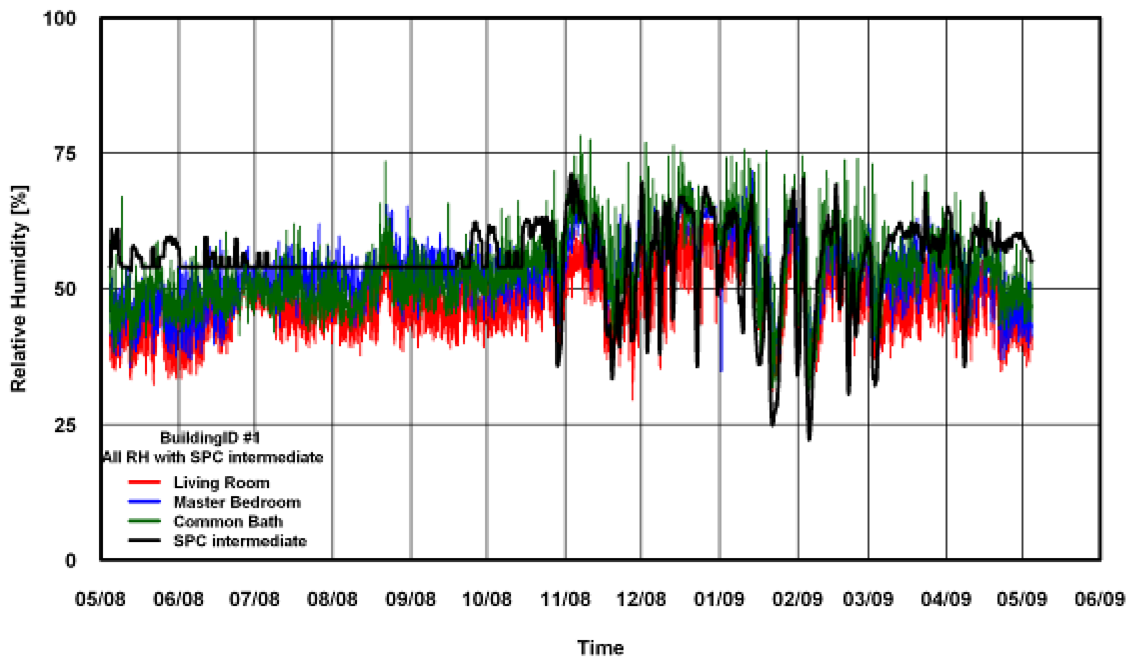

Figure 266: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 1

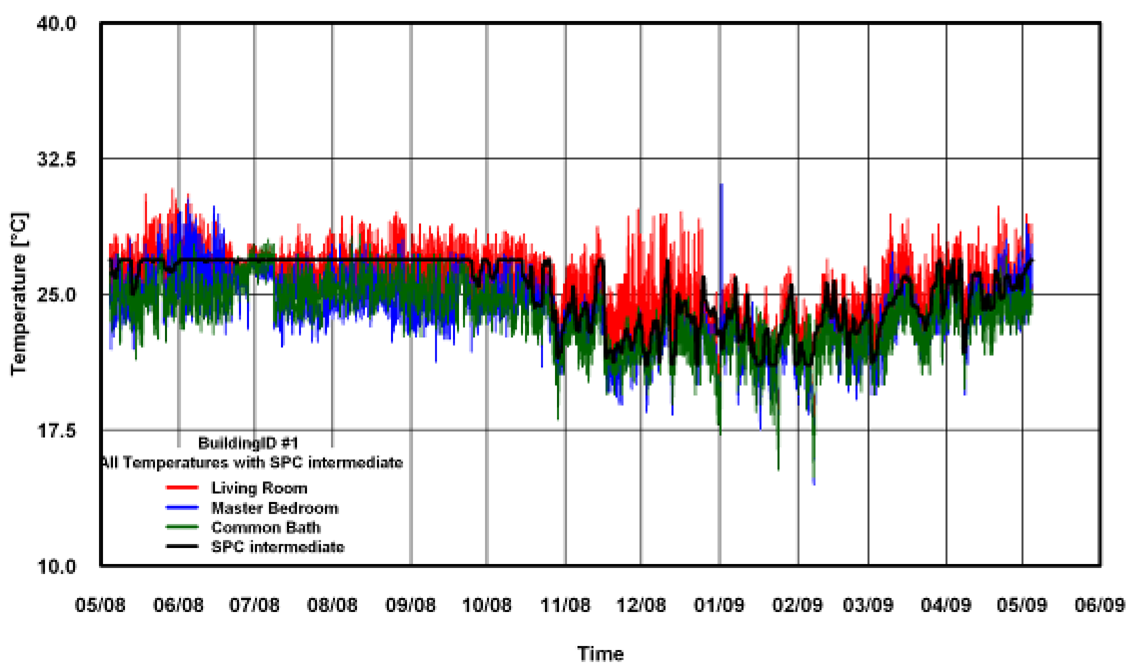

Figure 267: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 1

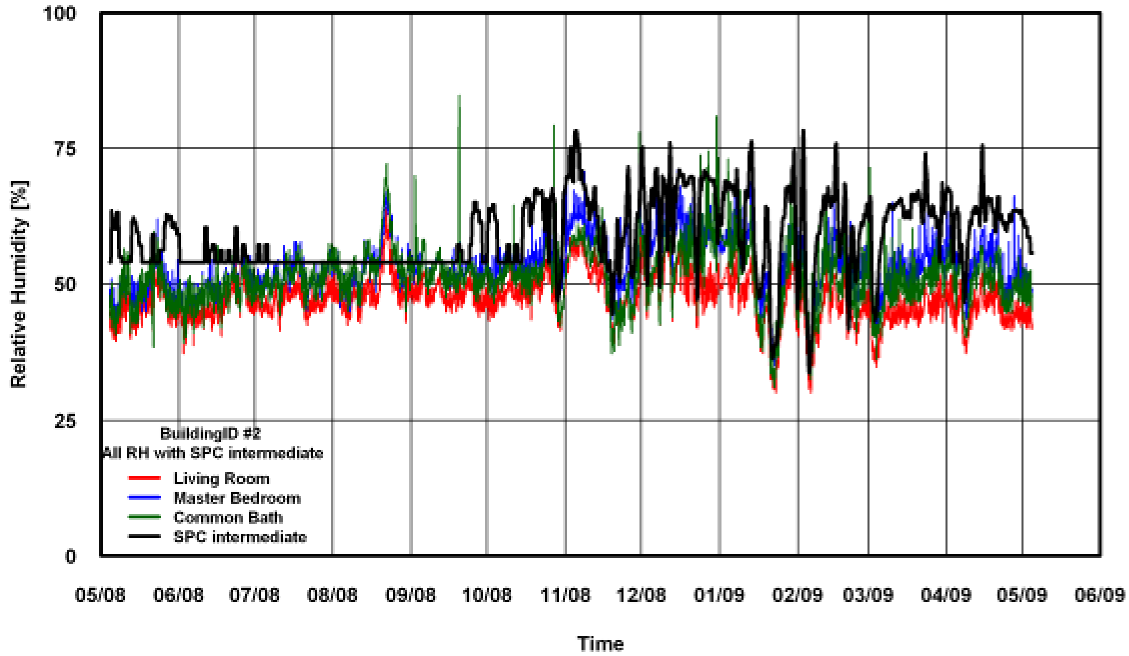

Figure 268: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 2

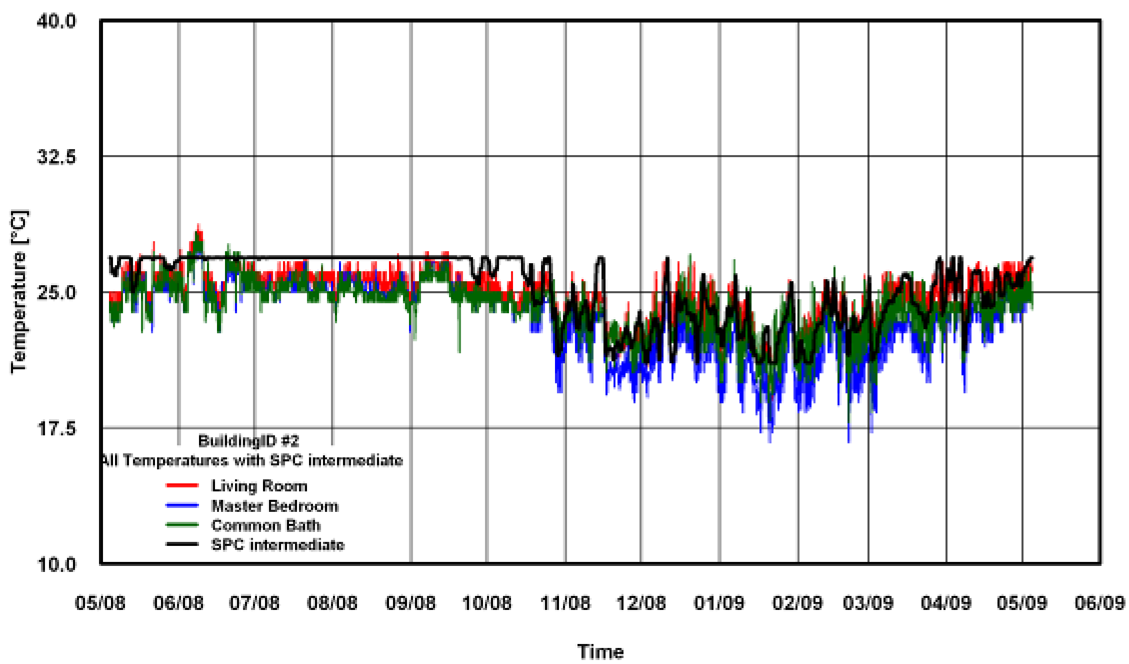

Figure 269: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 2

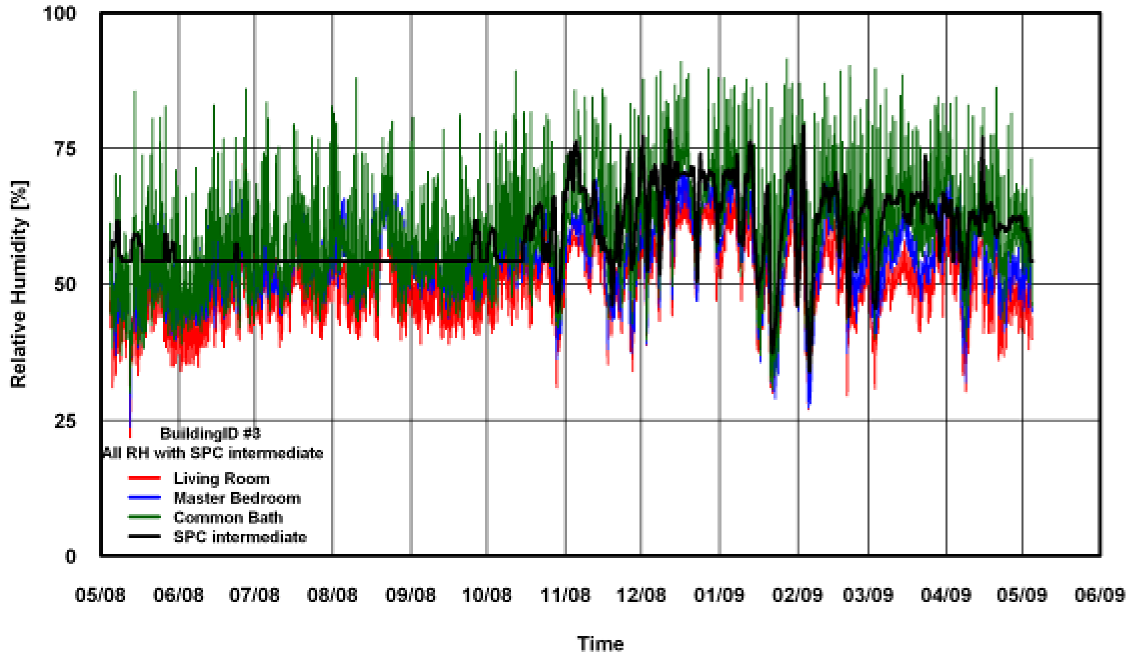

Figure 270: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 3

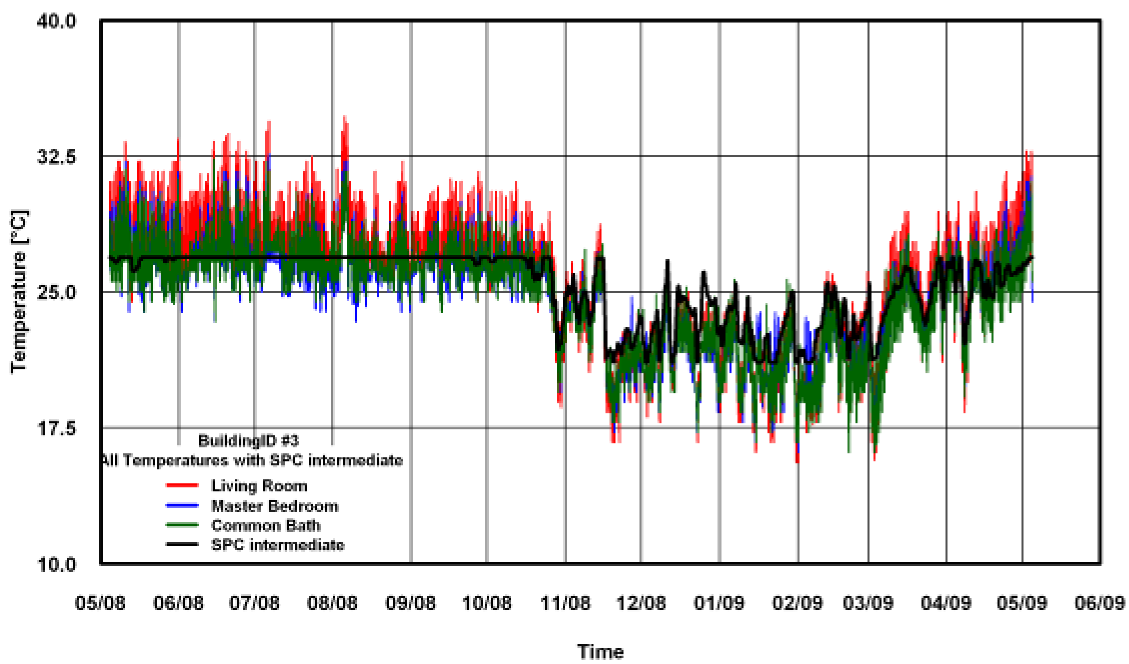

Figure 271: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 3

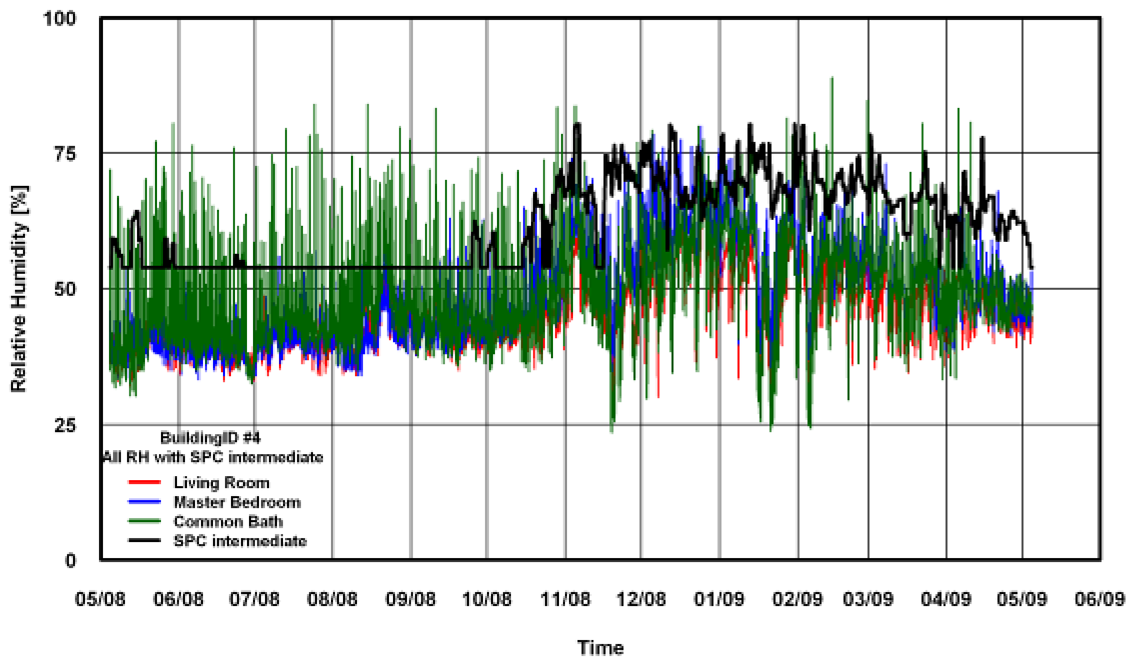

Figure 272: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 4

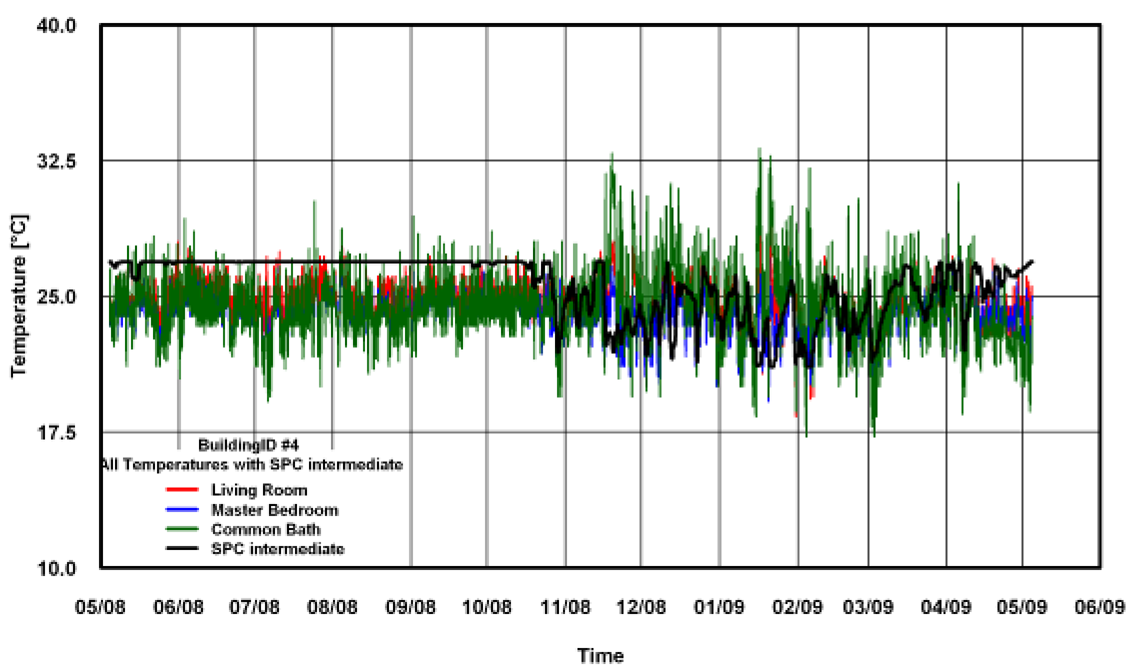

Figure 273: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 4

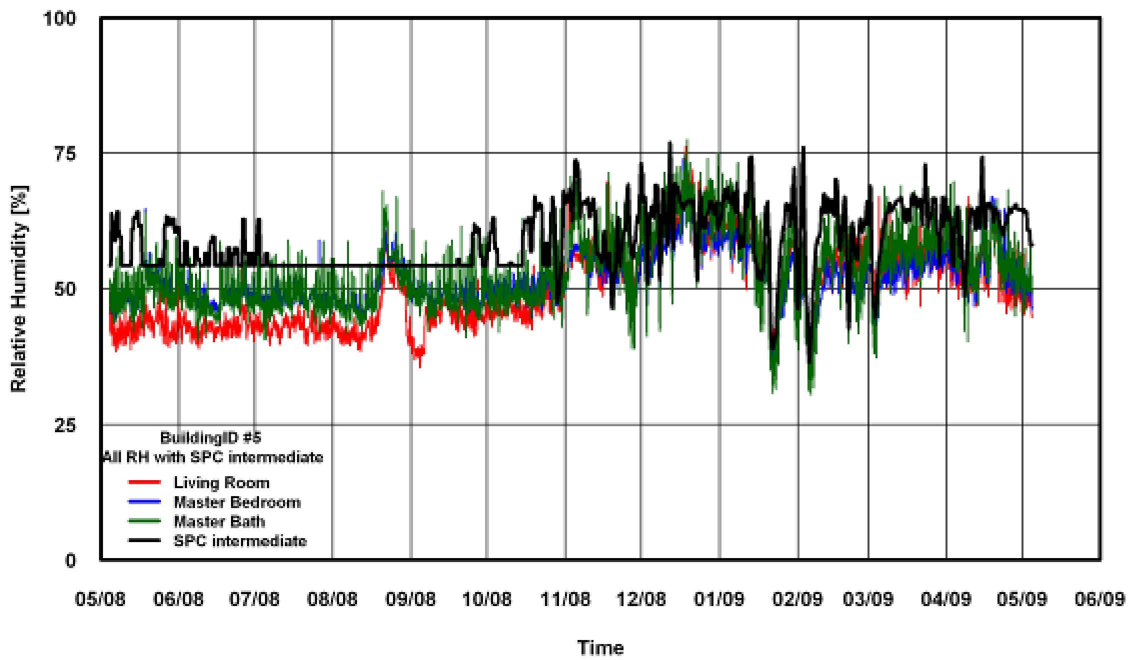

Figure 274: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 5

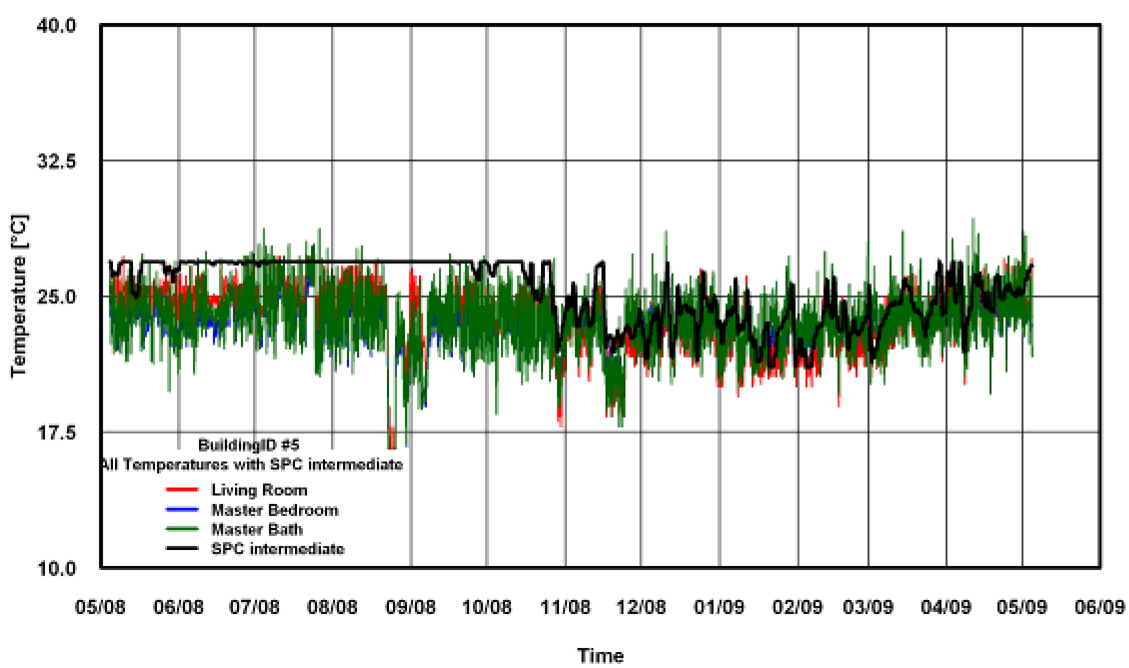

Figure 275: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 5

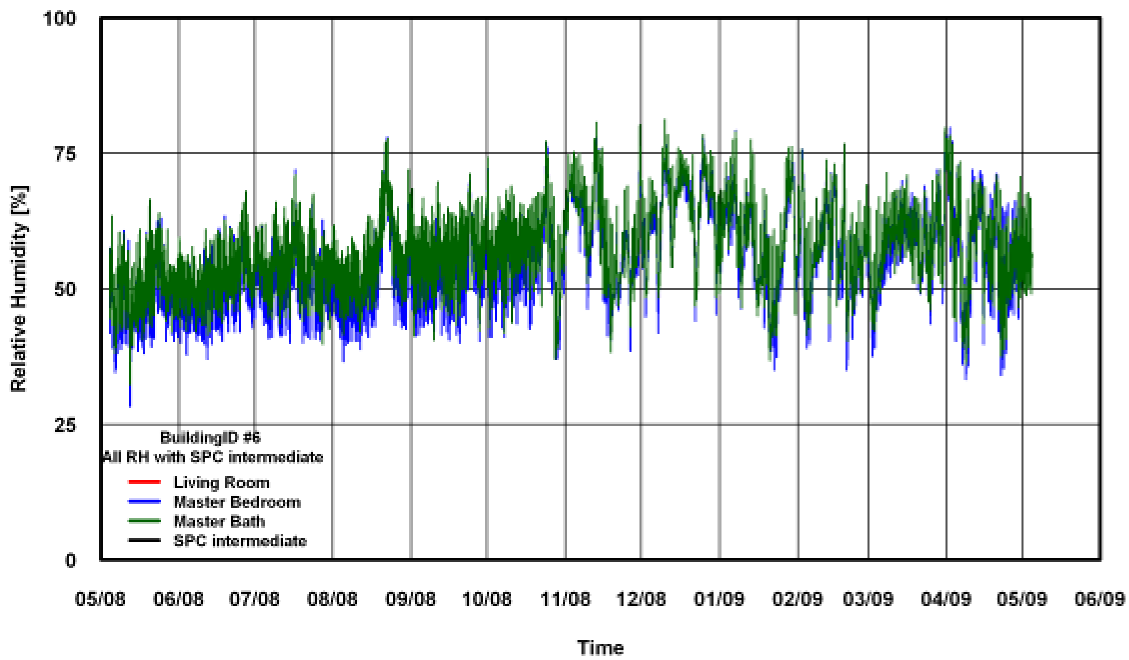

Figure 276: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 6

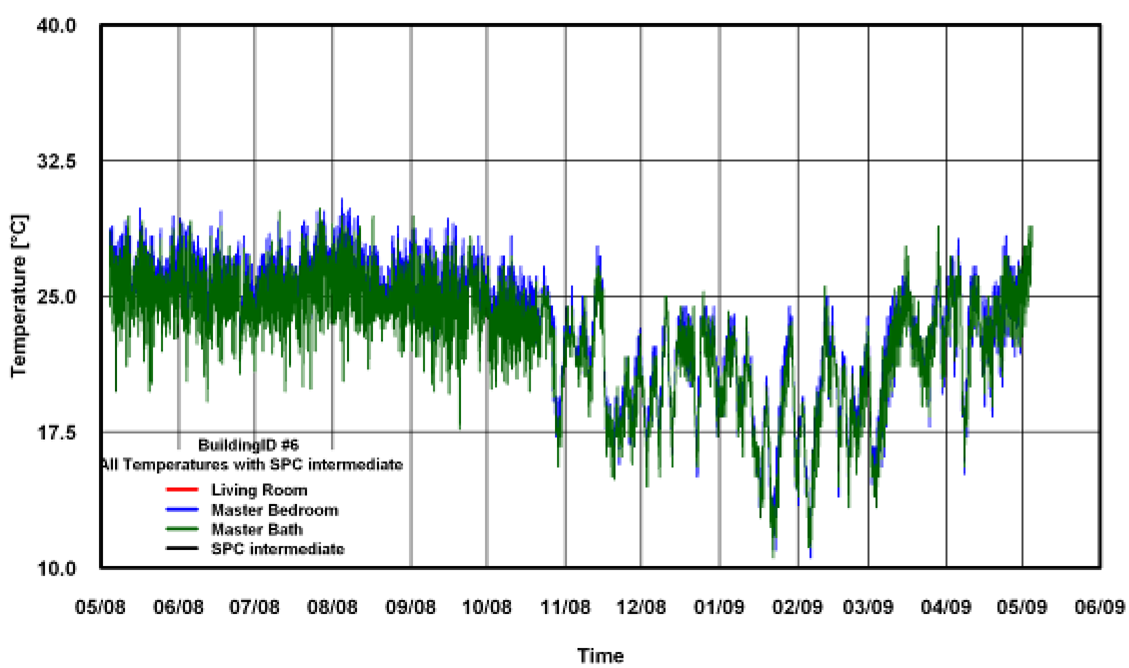

Figure 277: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 6

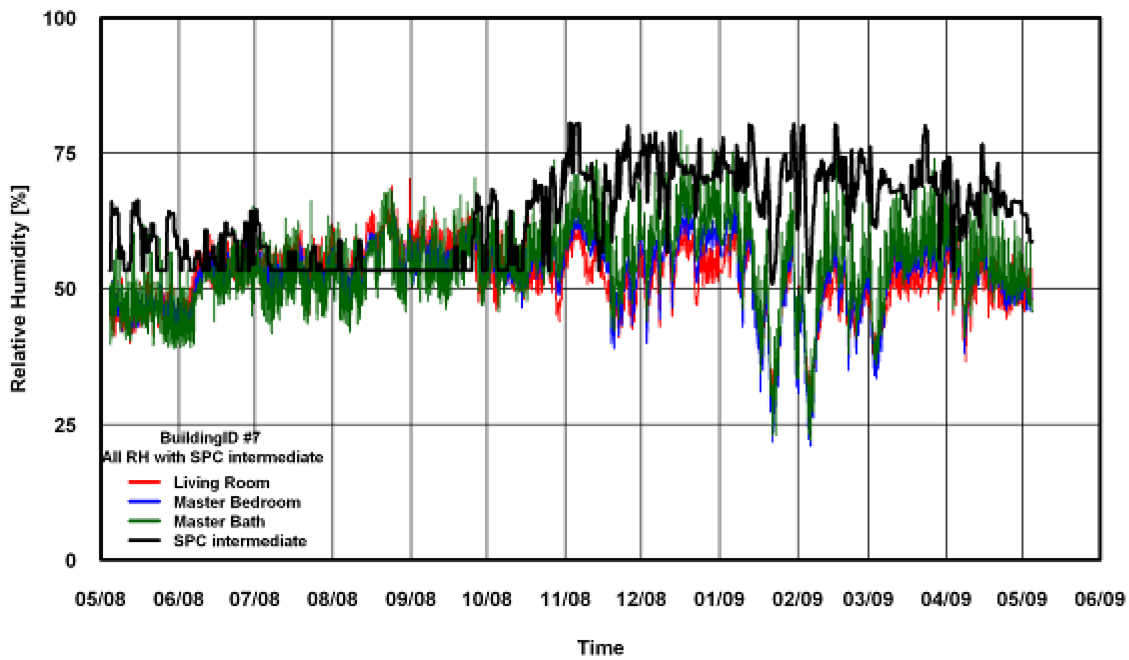

Figure 278: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 7

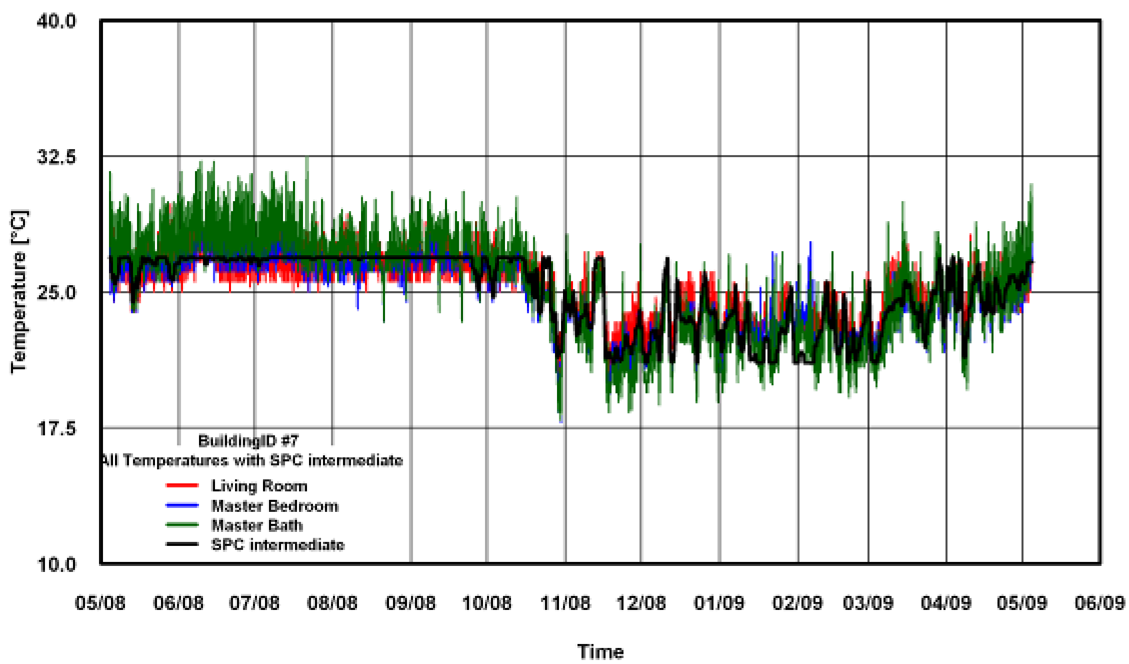

Figure 279: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 7

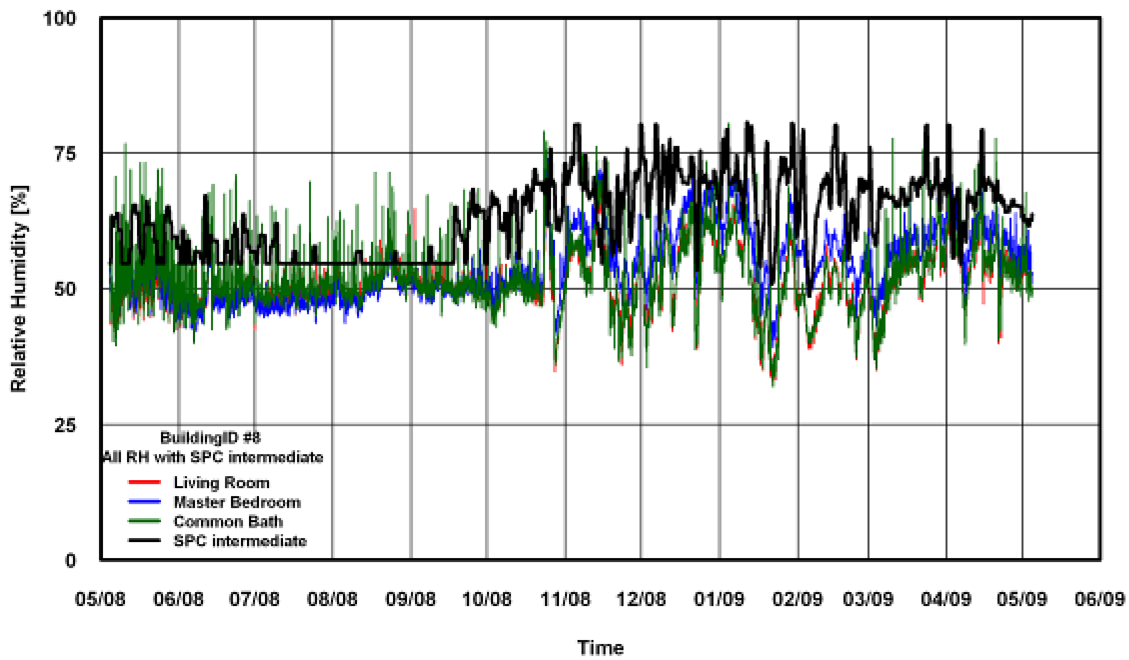

Figure 280: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 8

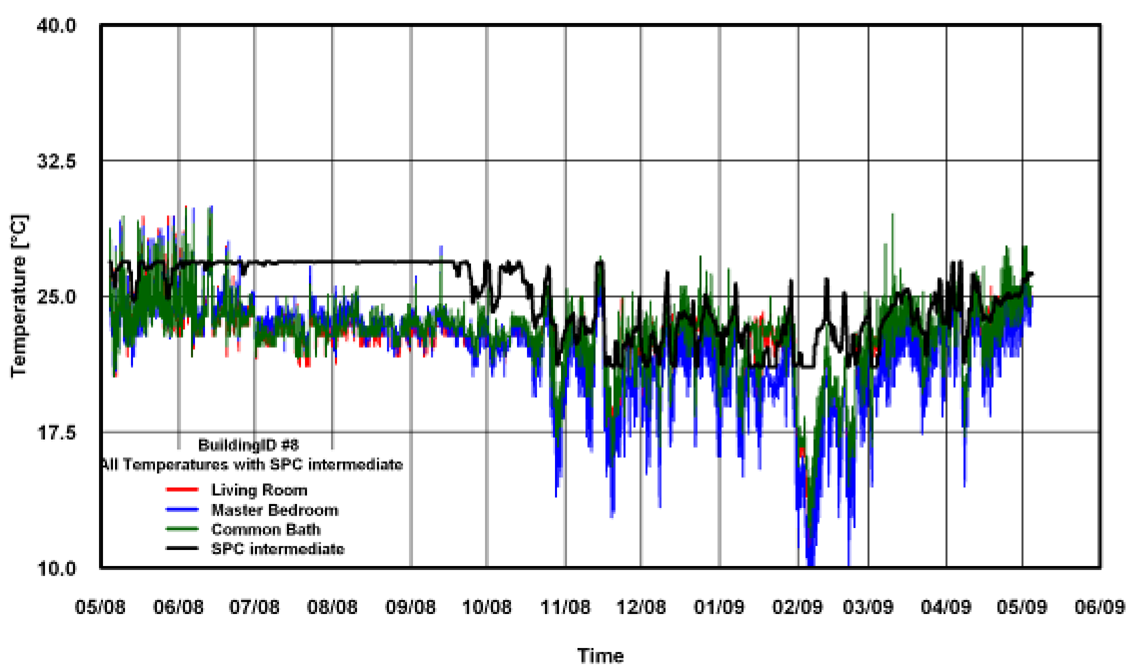

Figure 281: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 8

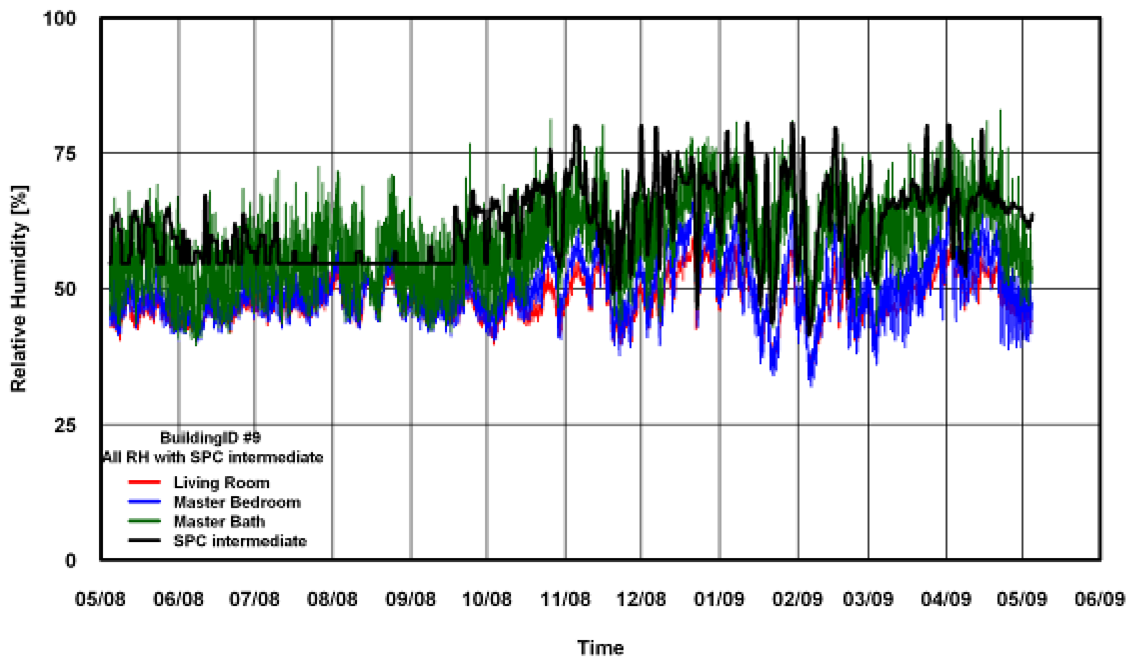

Figure 282: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 9

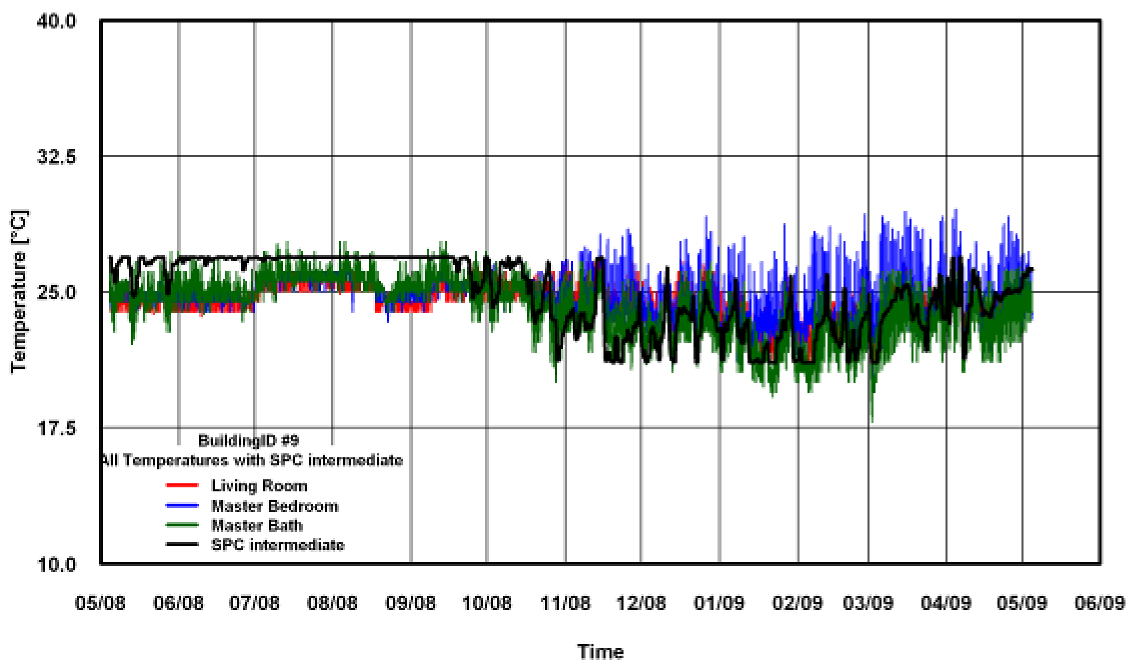

Figure 283: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 9

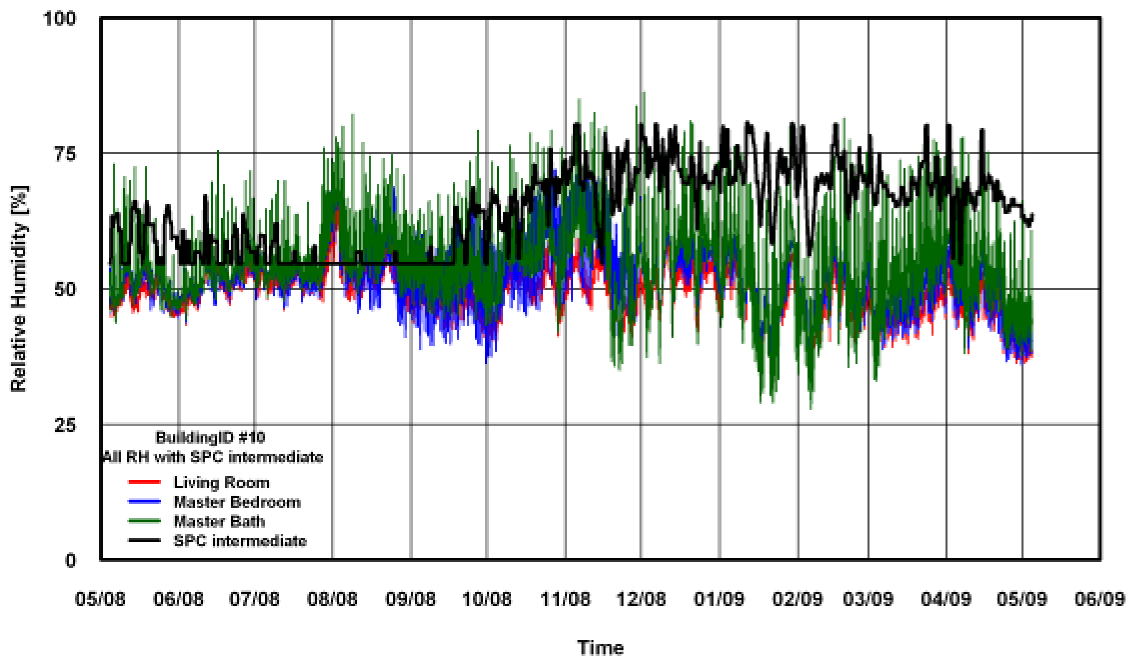

Figure 284: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 10

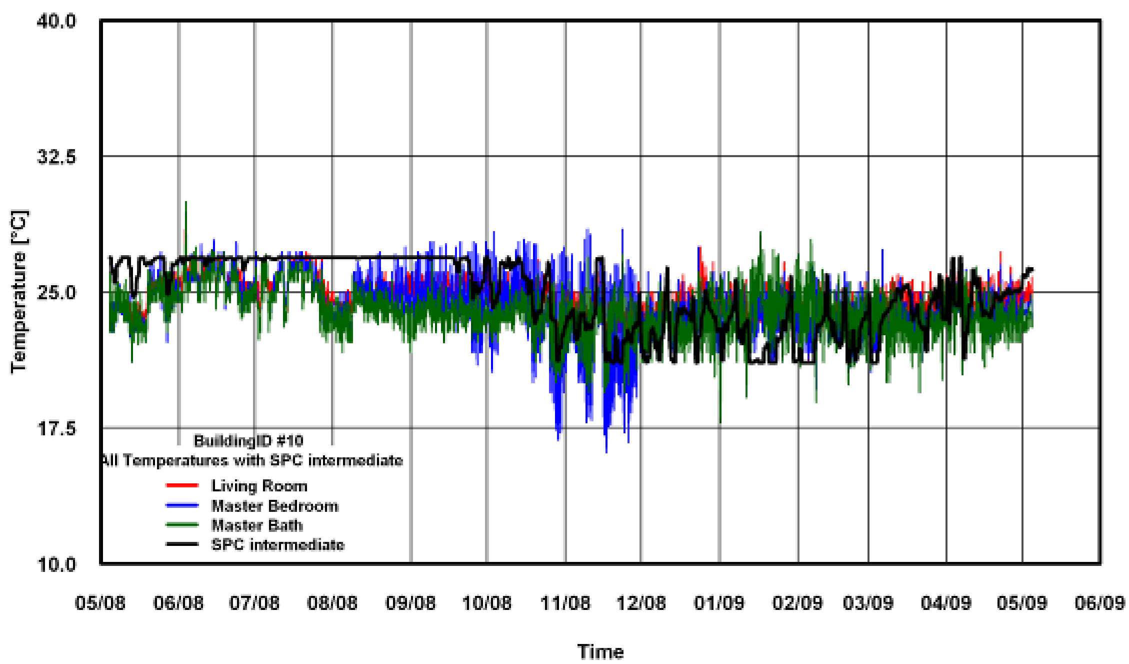

Figure 285: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 10

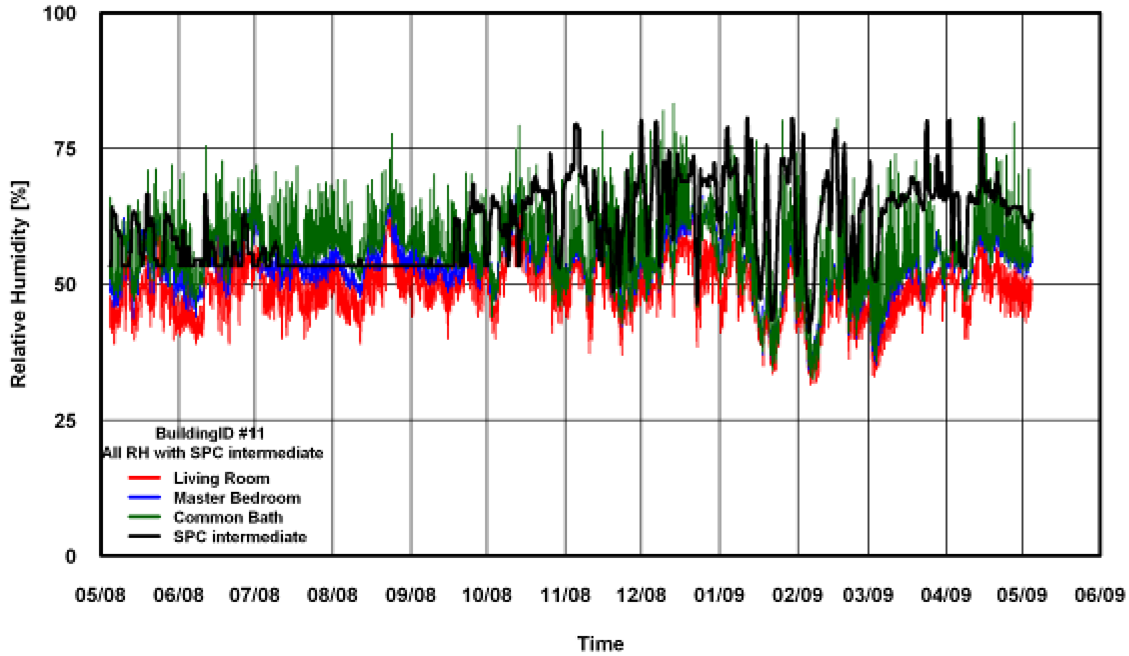

Figure 286: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 11

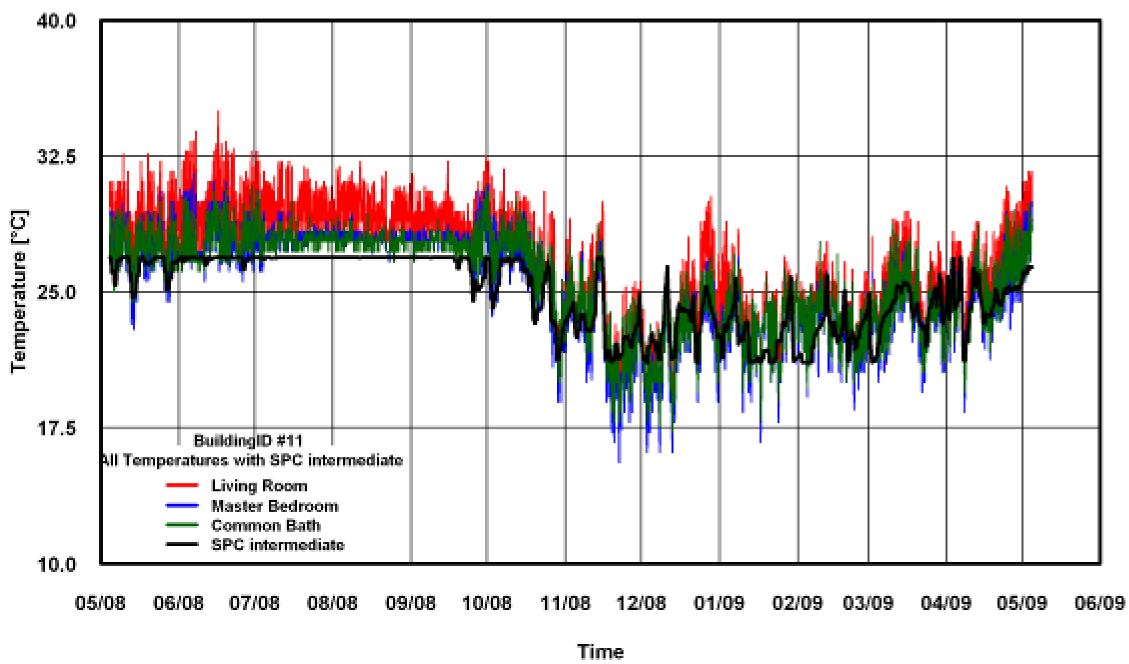

Figure 287: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 11

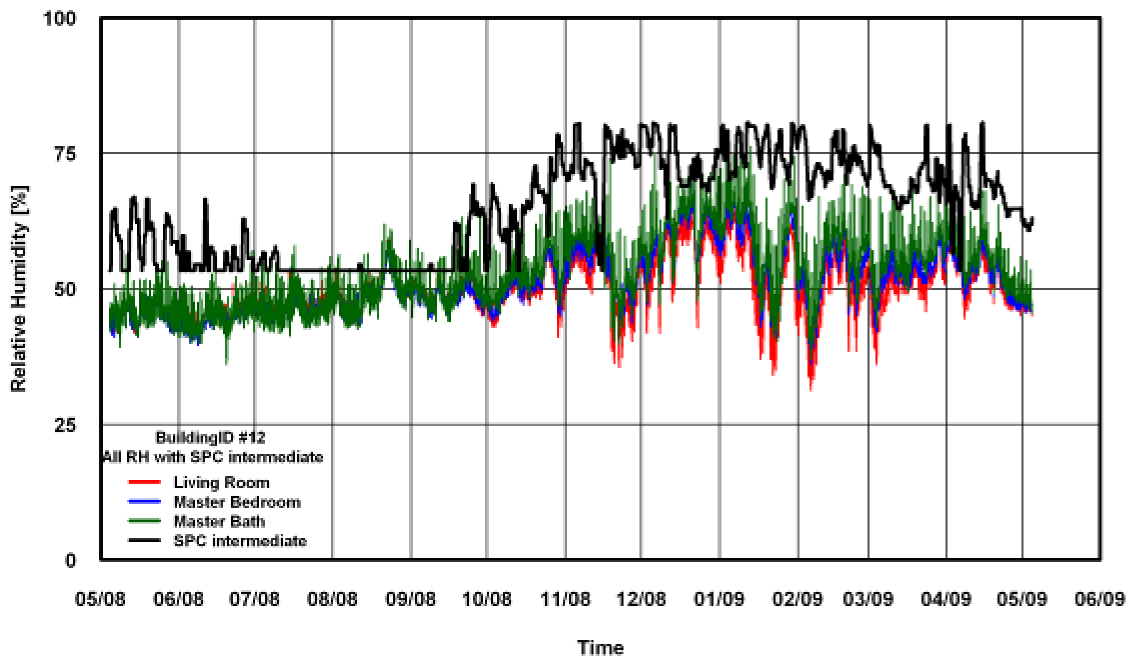

Figure 288: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 12

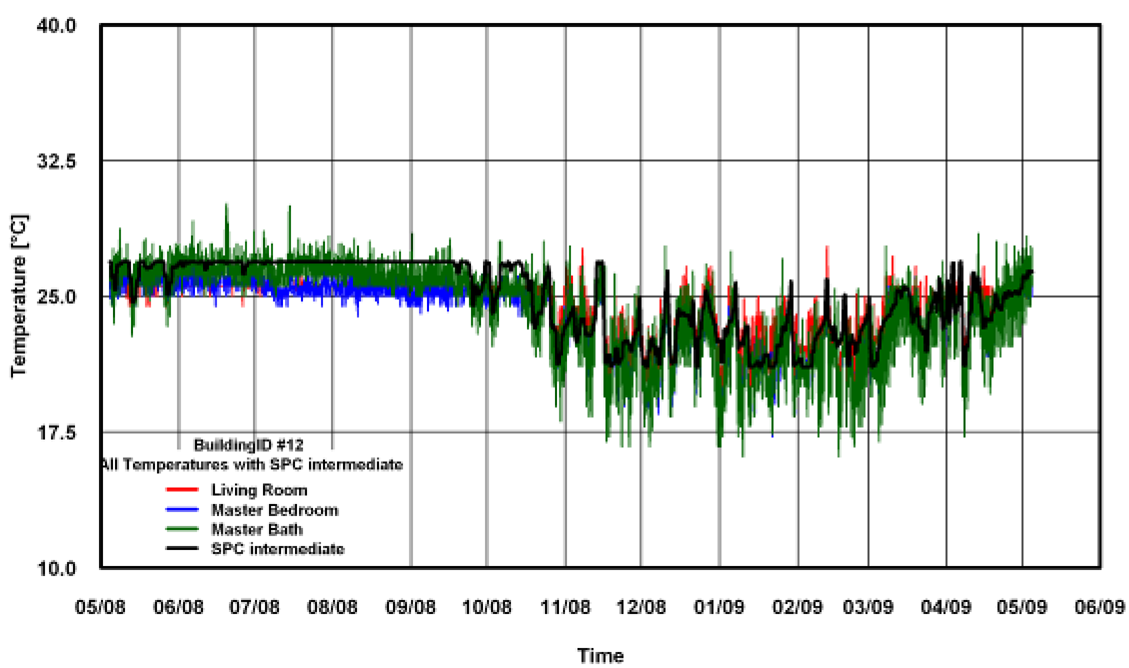

Figure 289: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 12

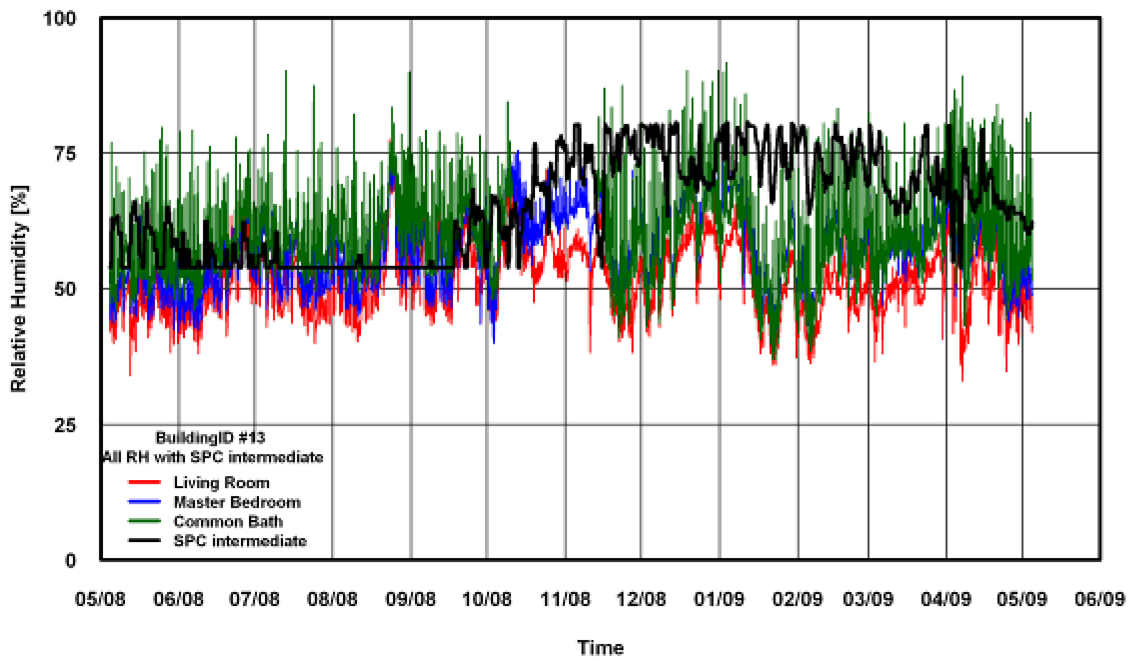

Figure 290: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 13

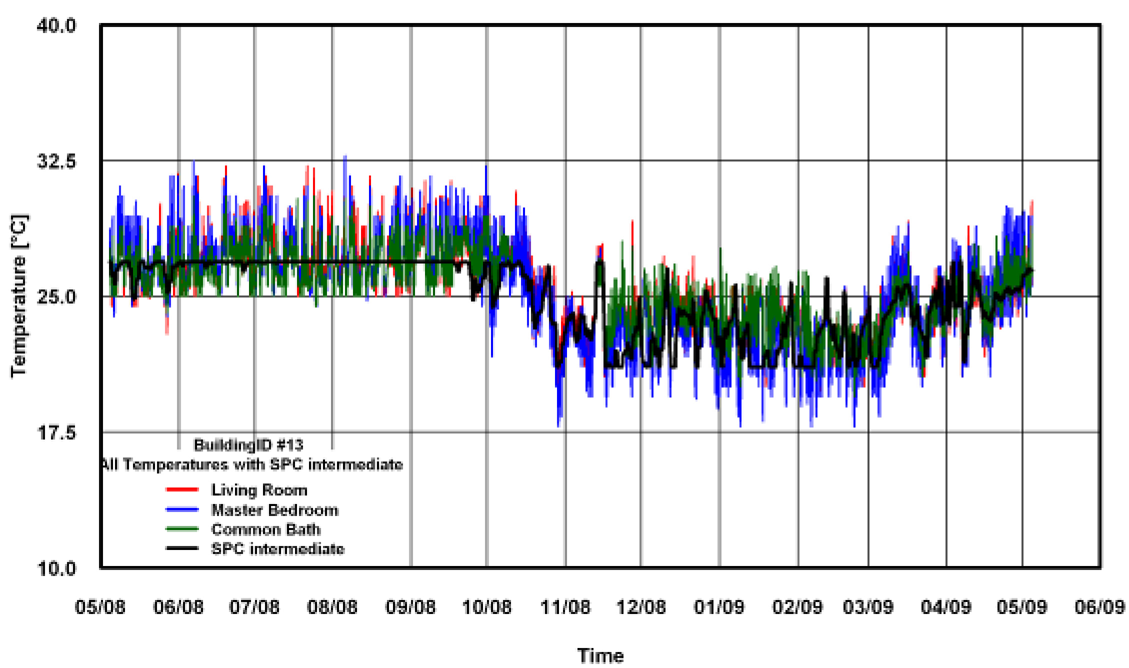

Figure 291: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 13

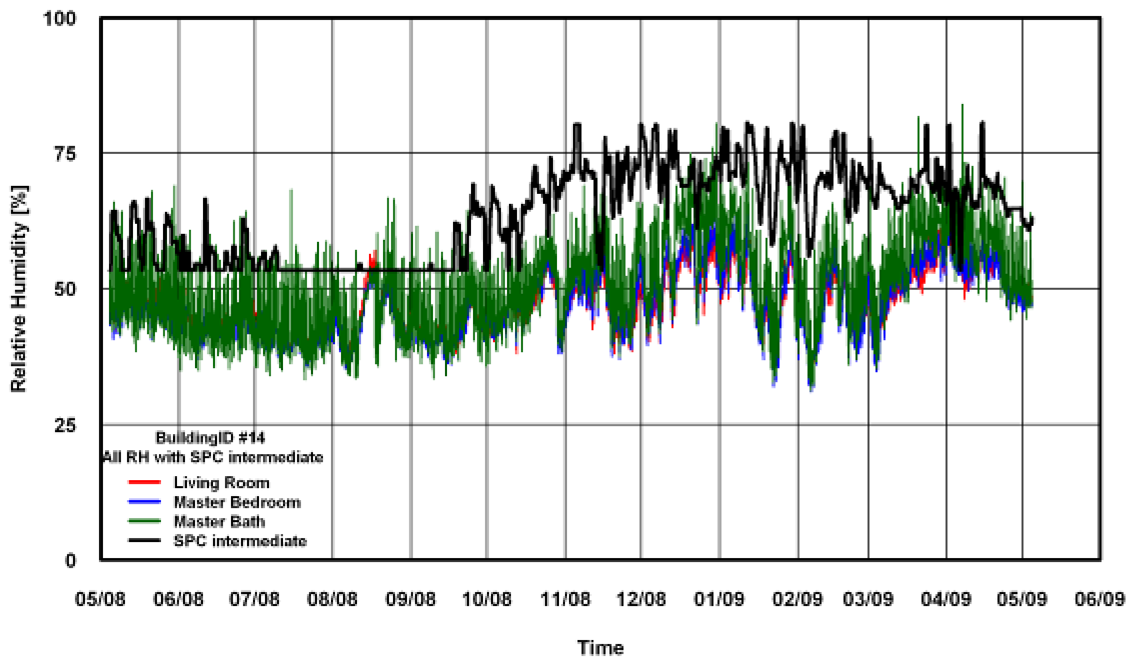

Figure 292: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 14

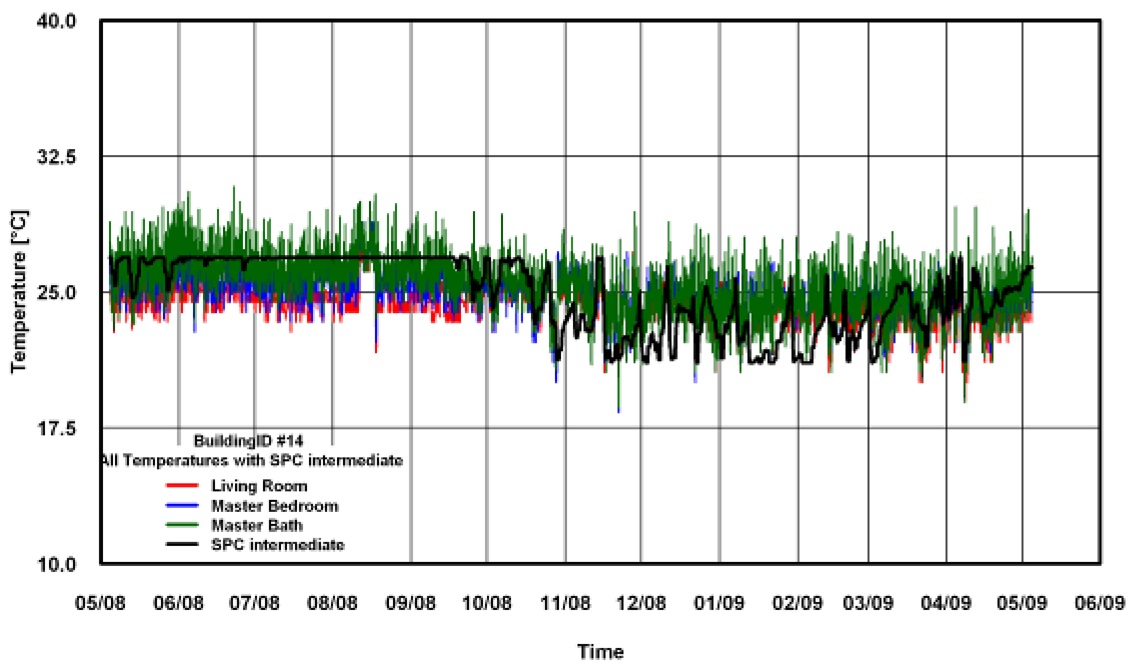

Figure 293: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 14

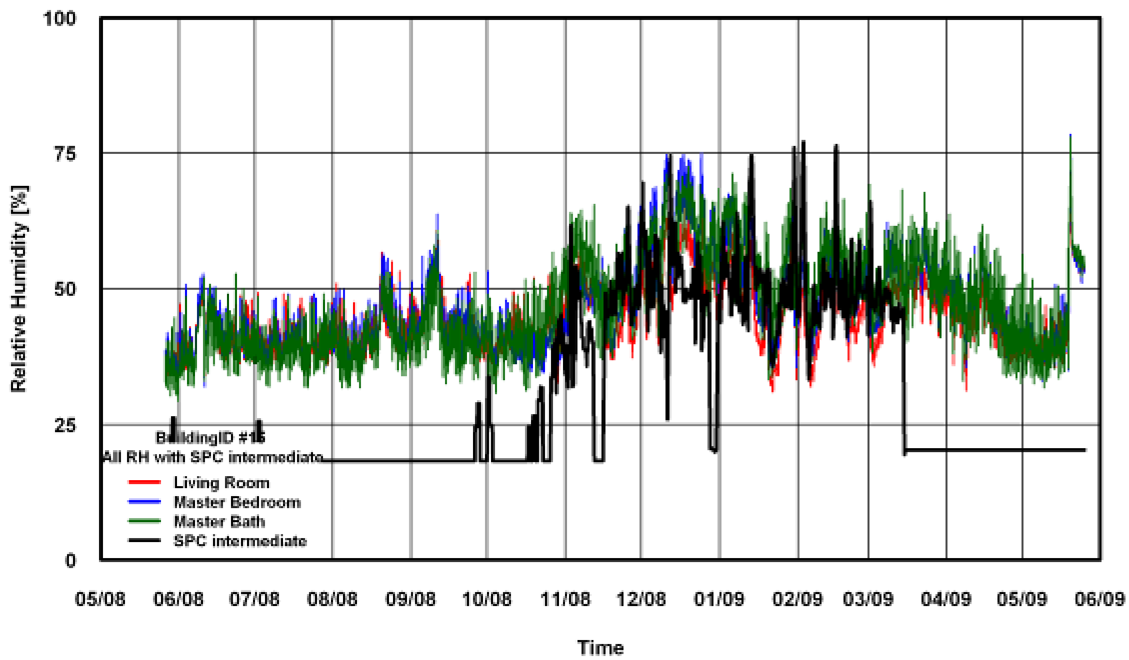

Figure 294: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 15

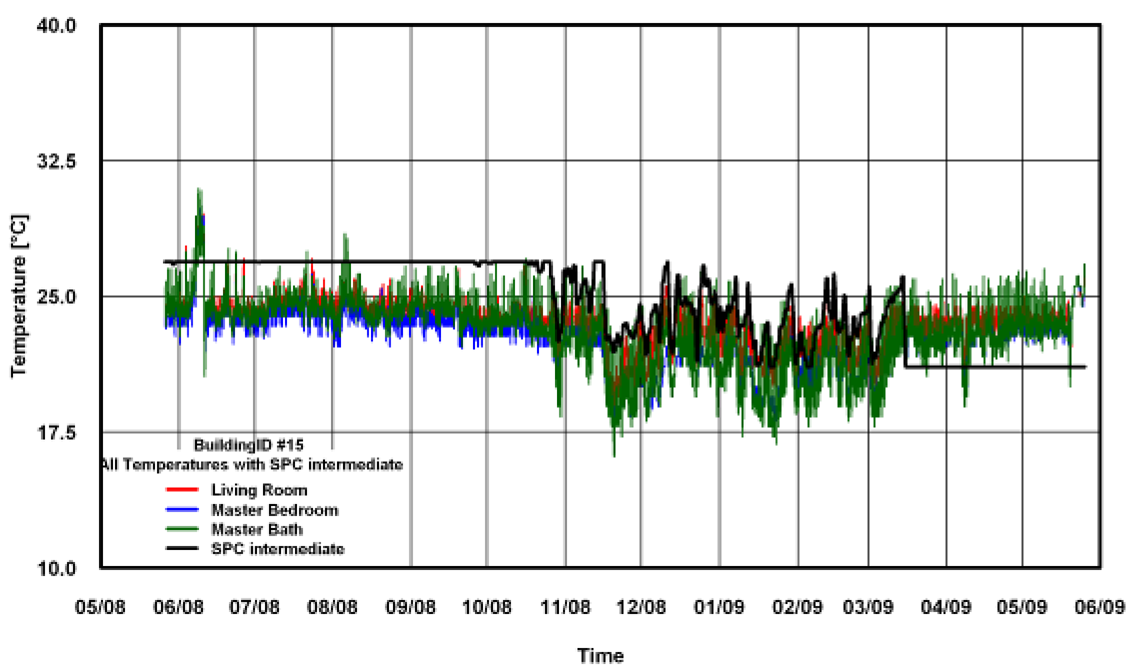

Figure 295: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 15

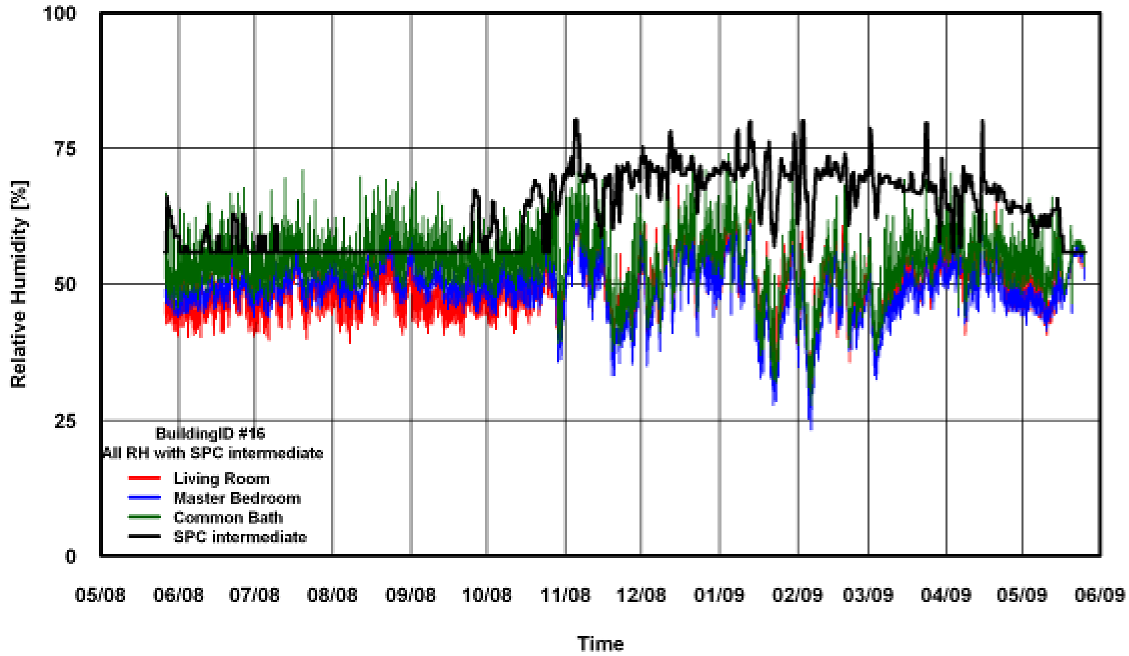

Figure 296: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 16

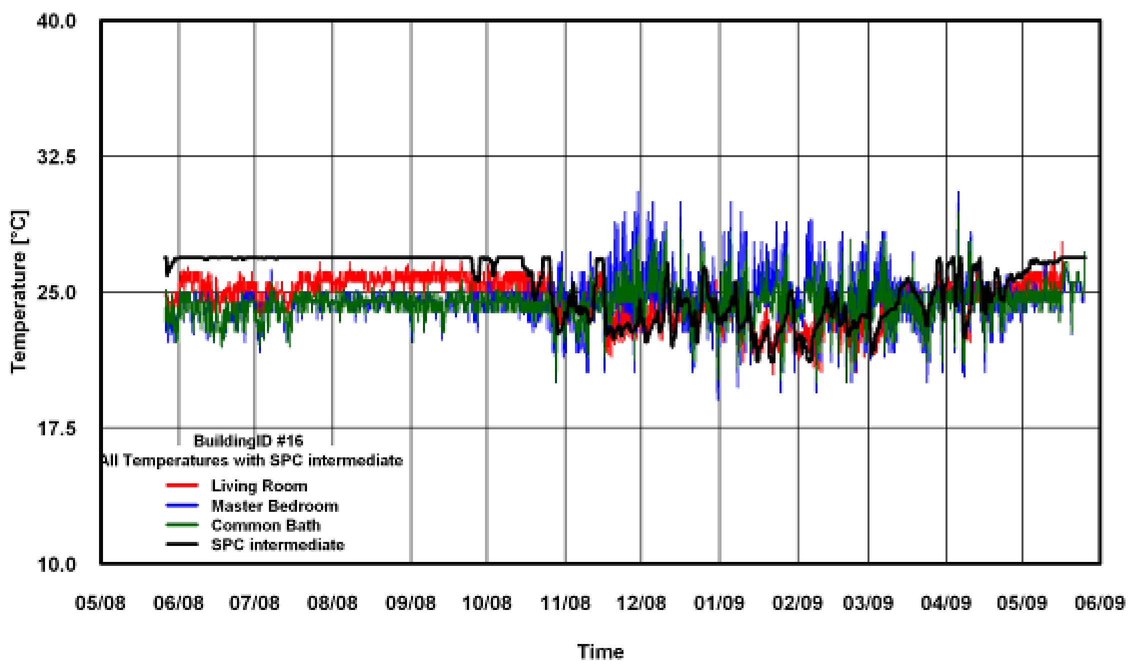

Figure 297: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 16

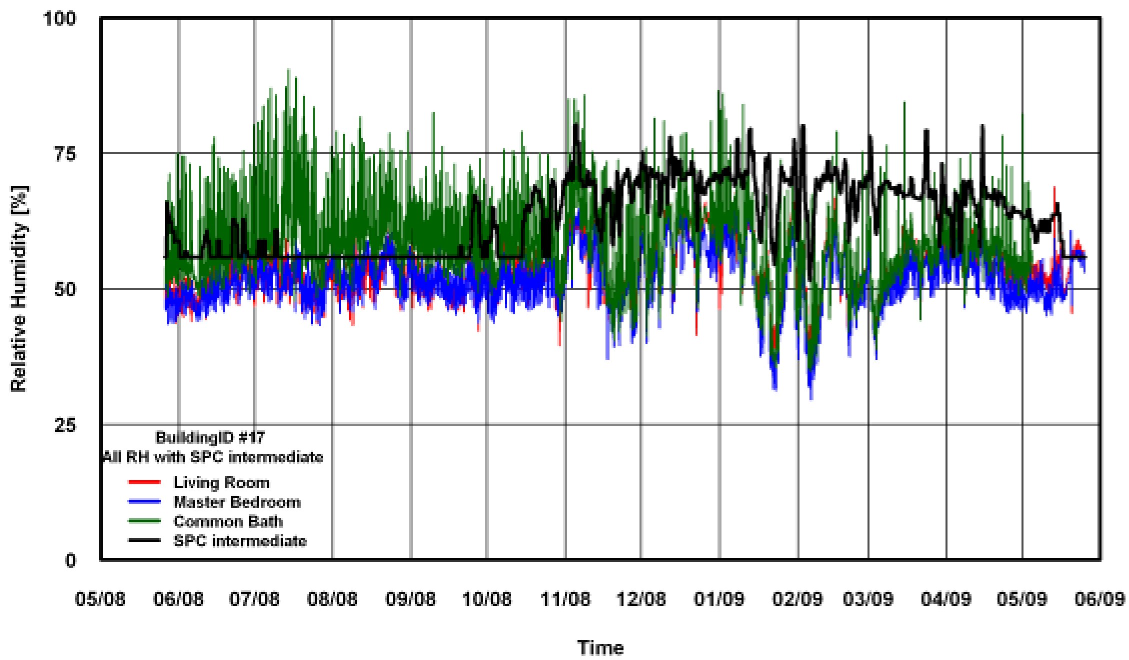

Figure 298: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 17

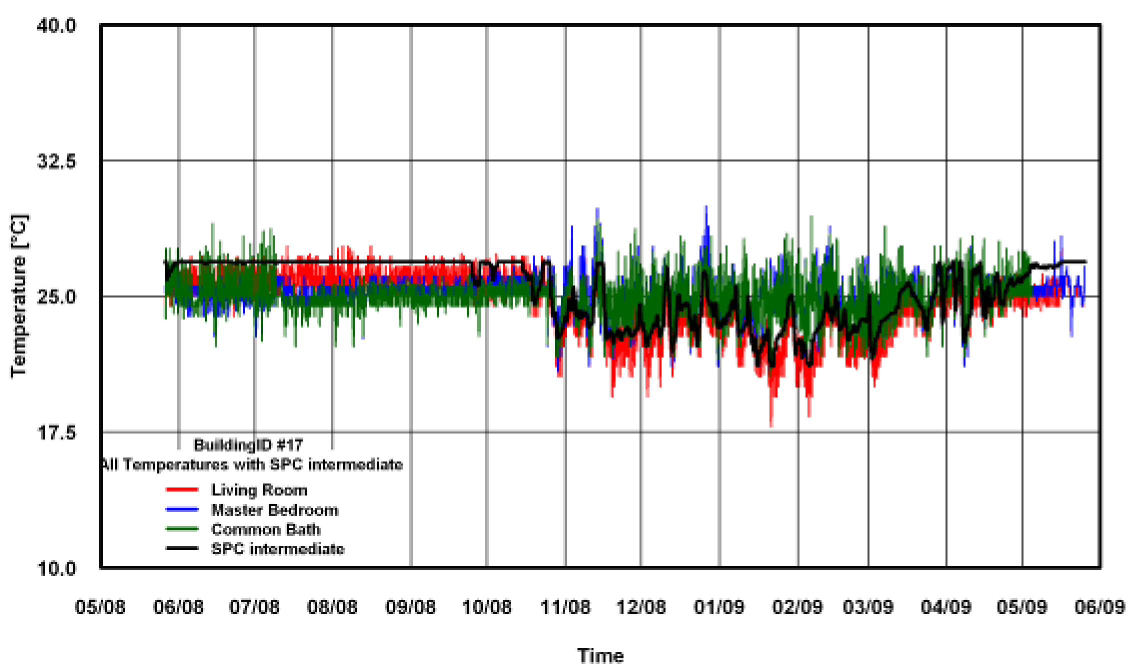

Figure 299: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 17

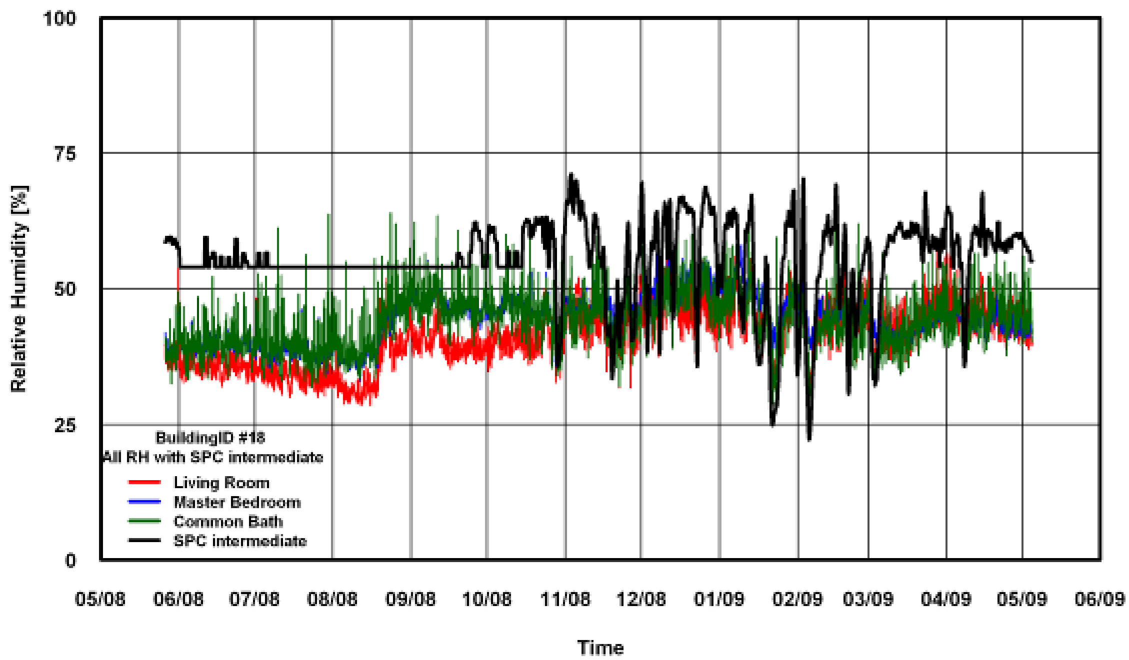

Figure 300: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 18

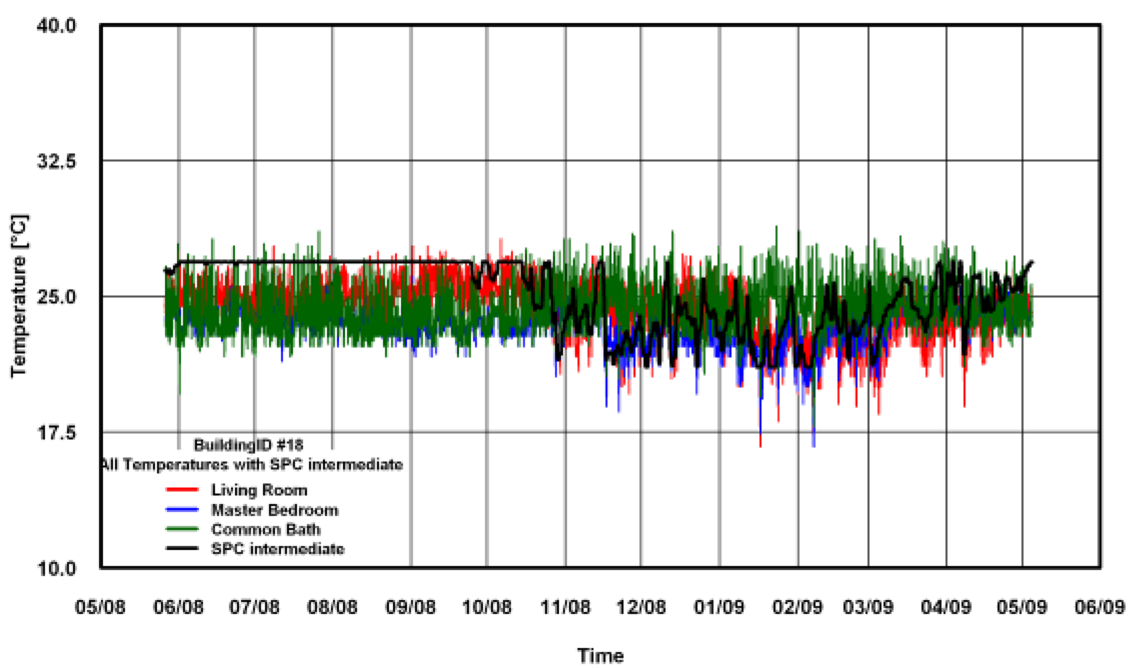

Figure 301: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 18

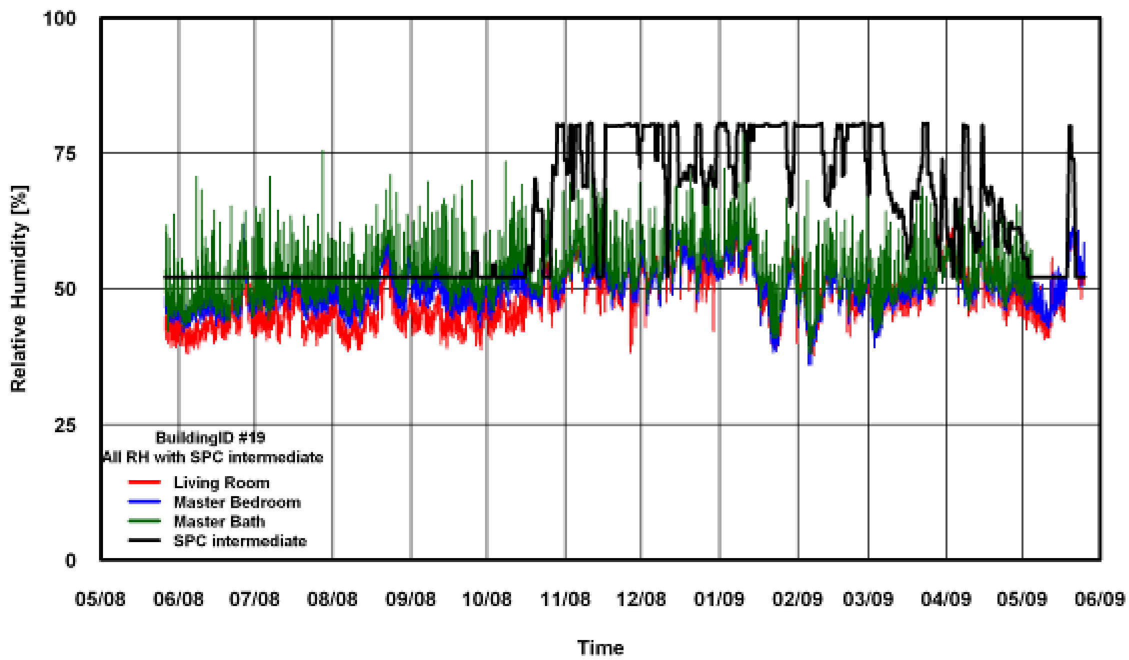

Figure 302: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 19

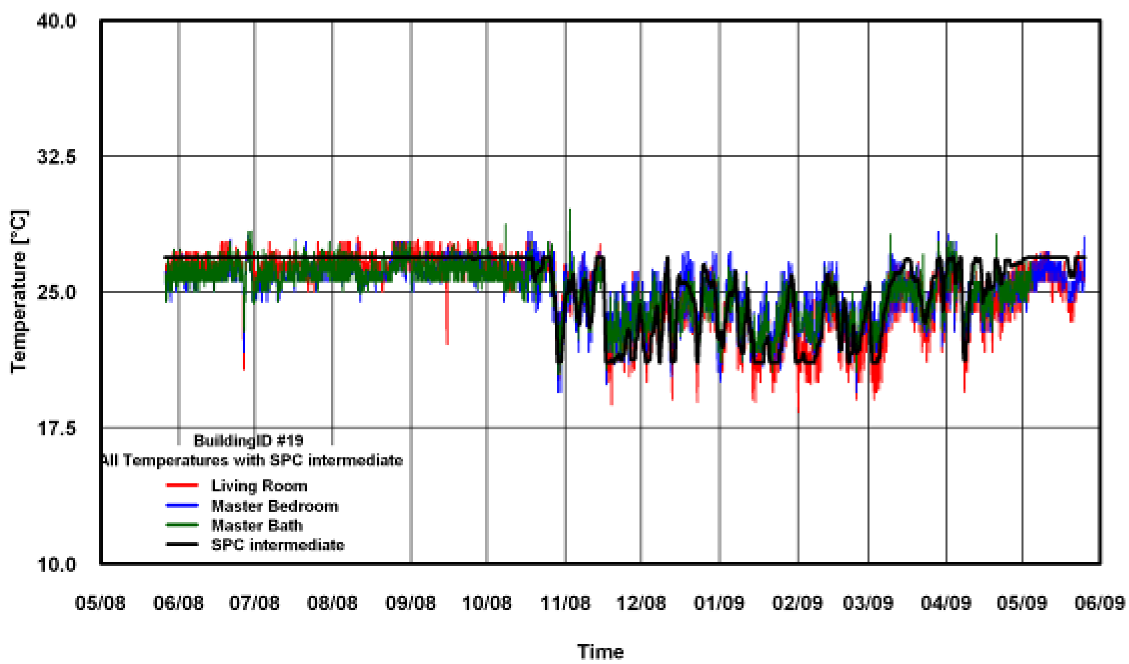

Figure 303: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 19

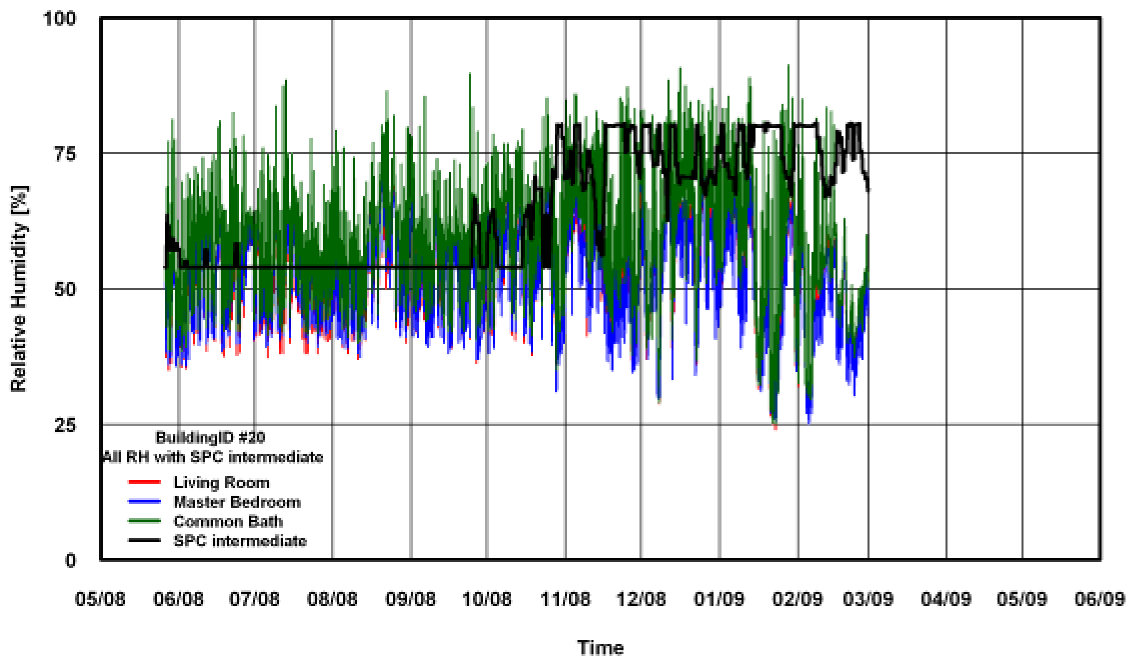

Figure 304: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 20

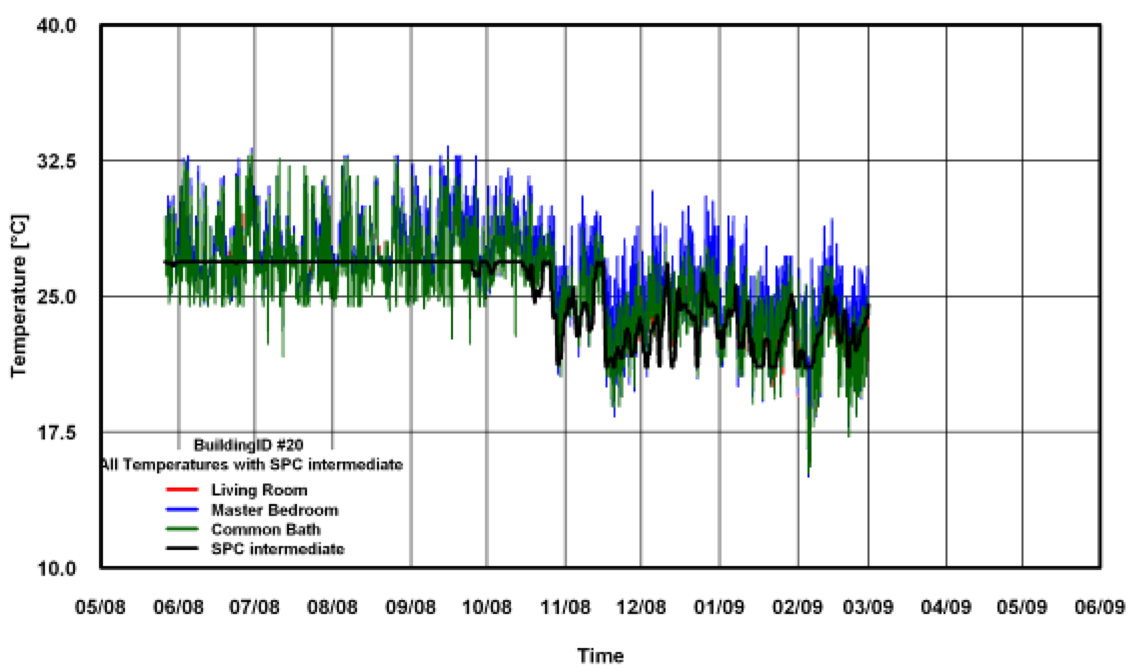

Figure 305: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 20

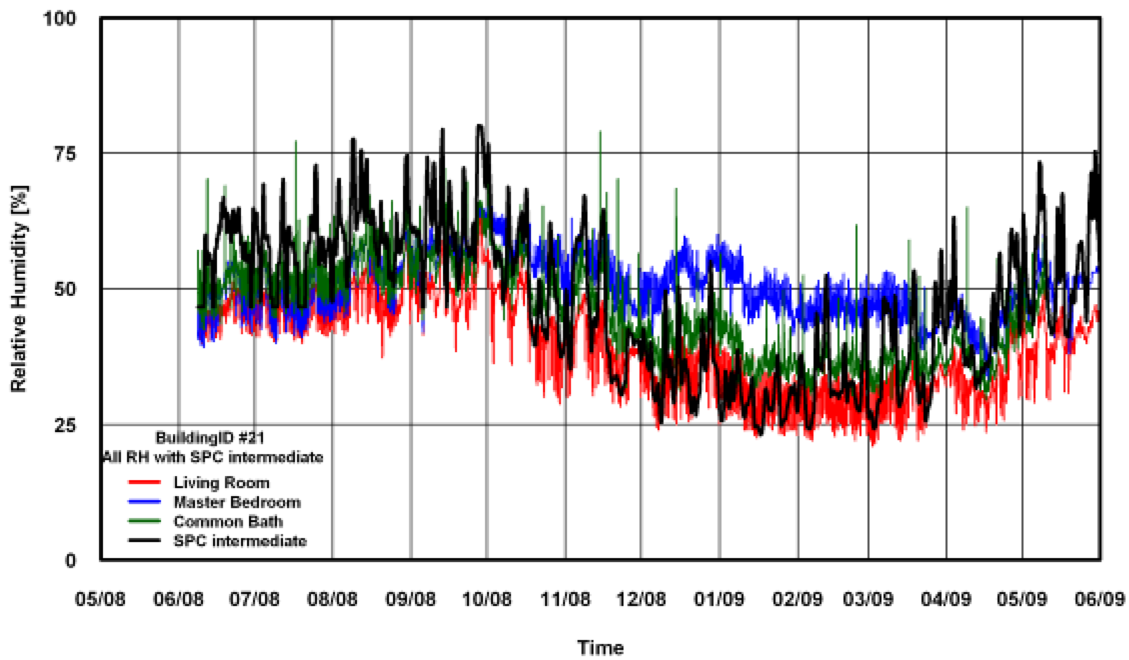

Figure 306: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 21

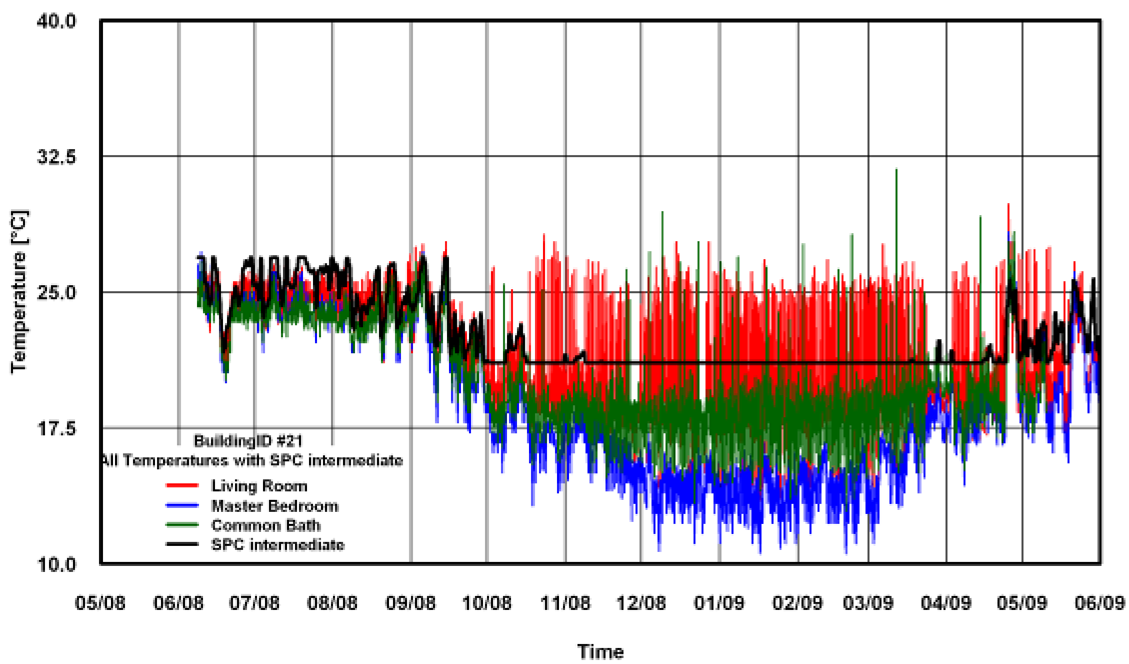

Figure 307: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 21

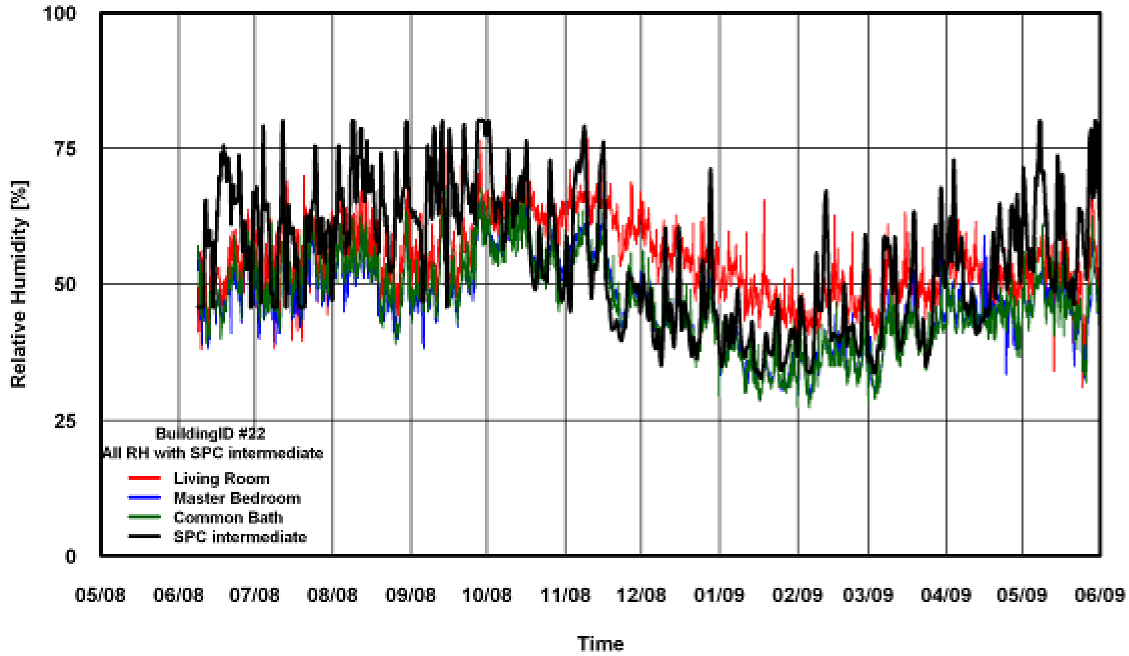

Figure 308: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 22

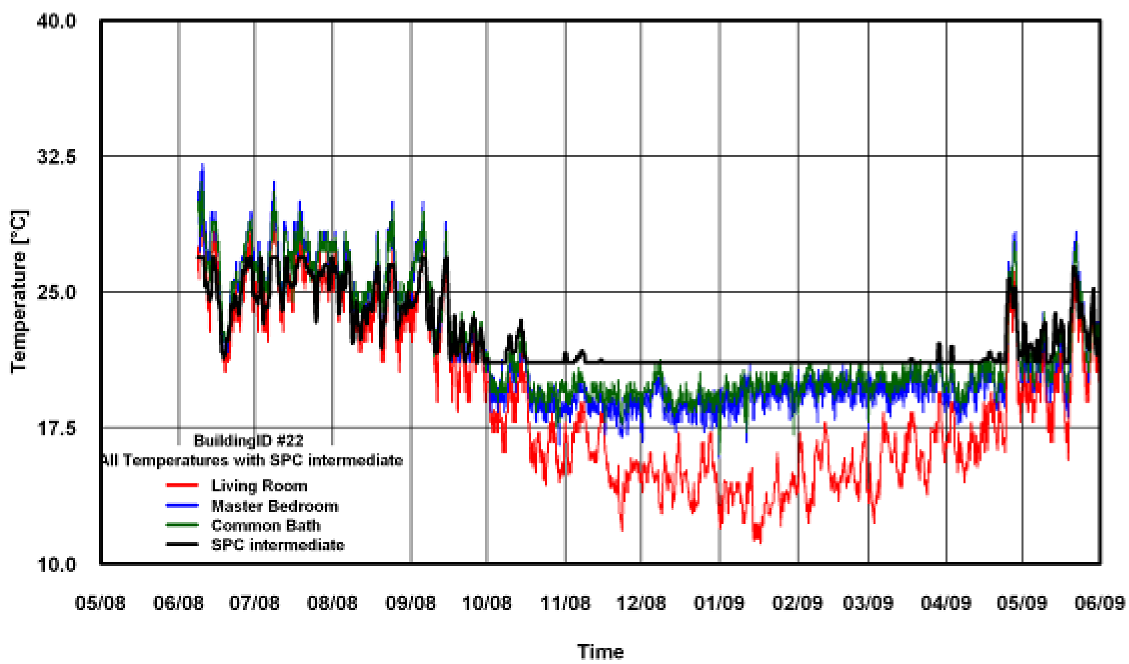

Figure 309: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 22

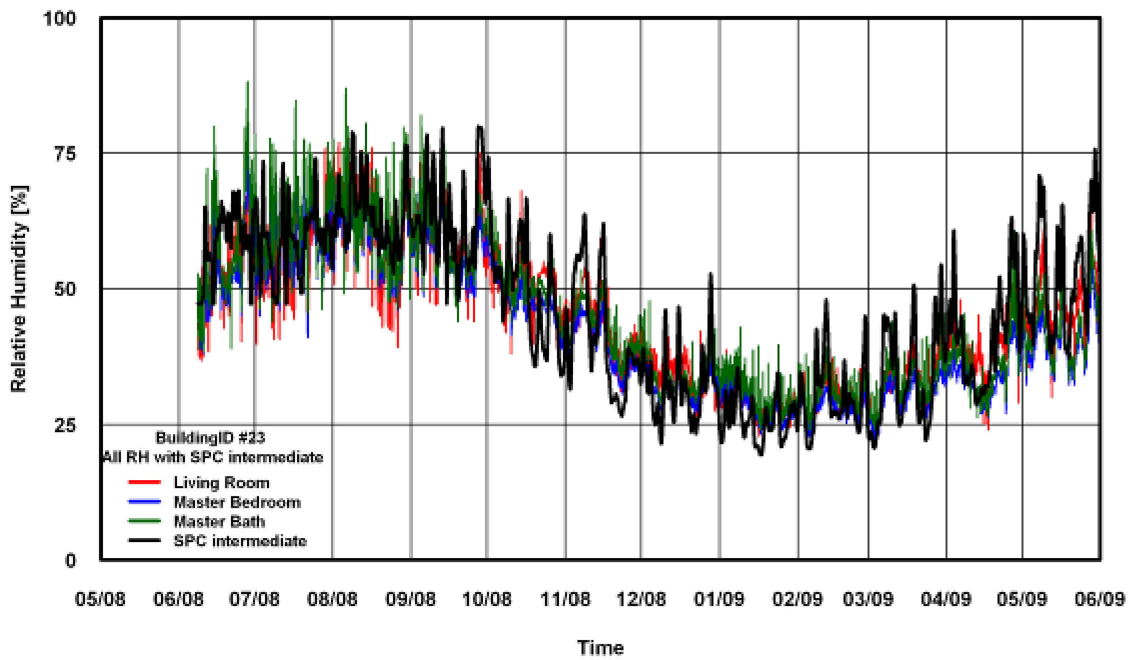

Figure 310: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 23

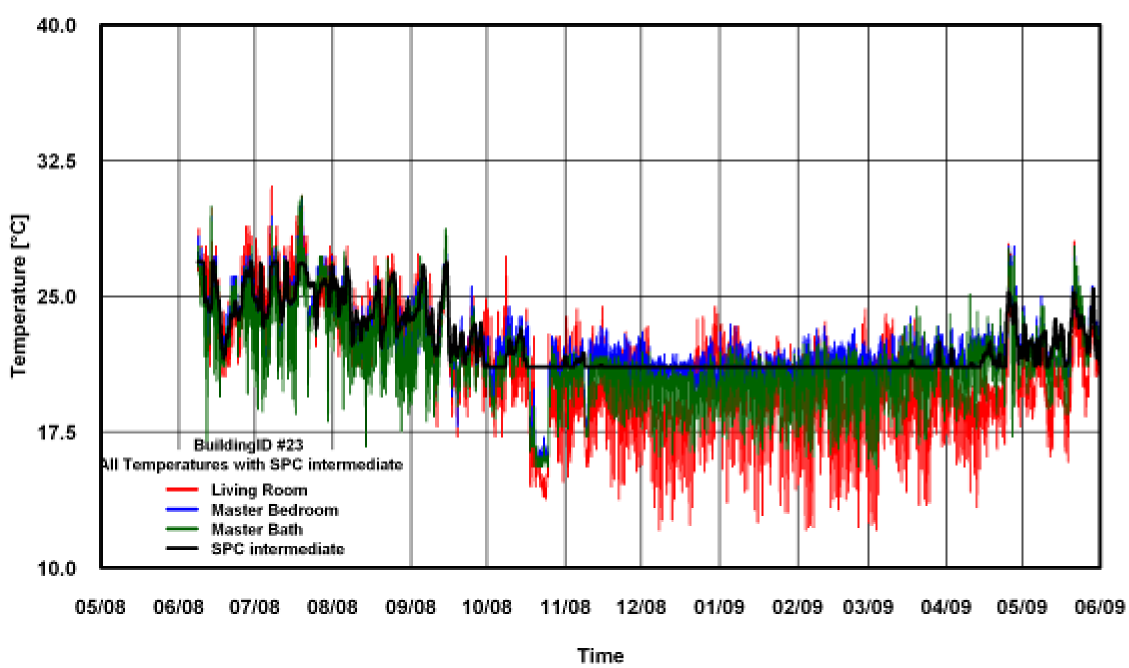

Figure 311: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 23

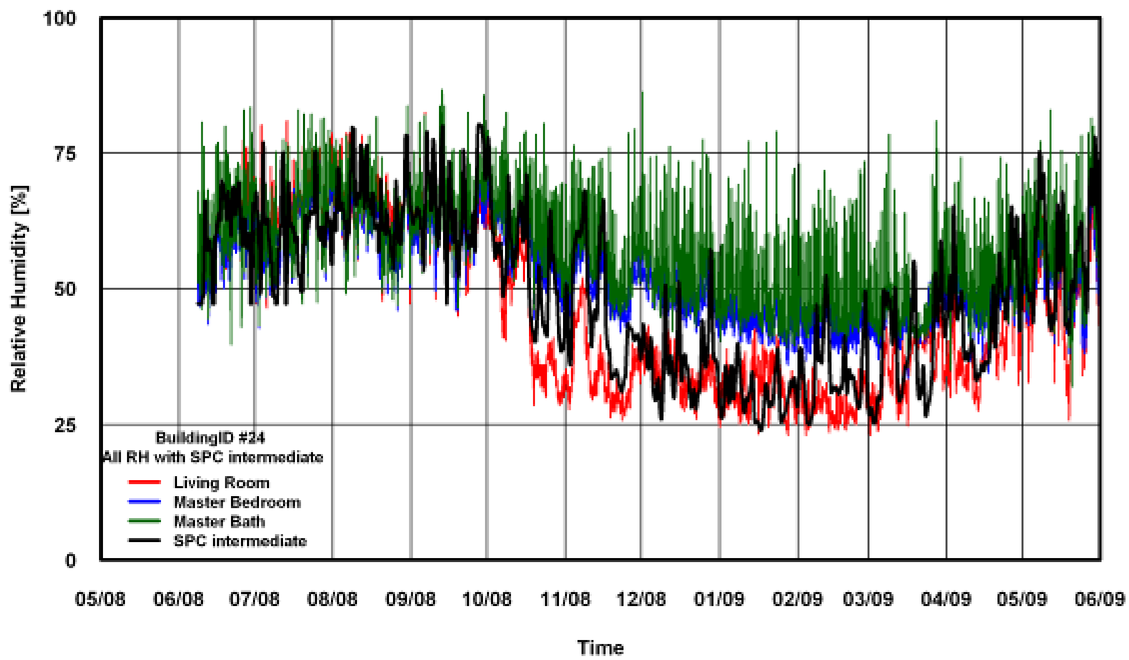

Figure 312: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 24

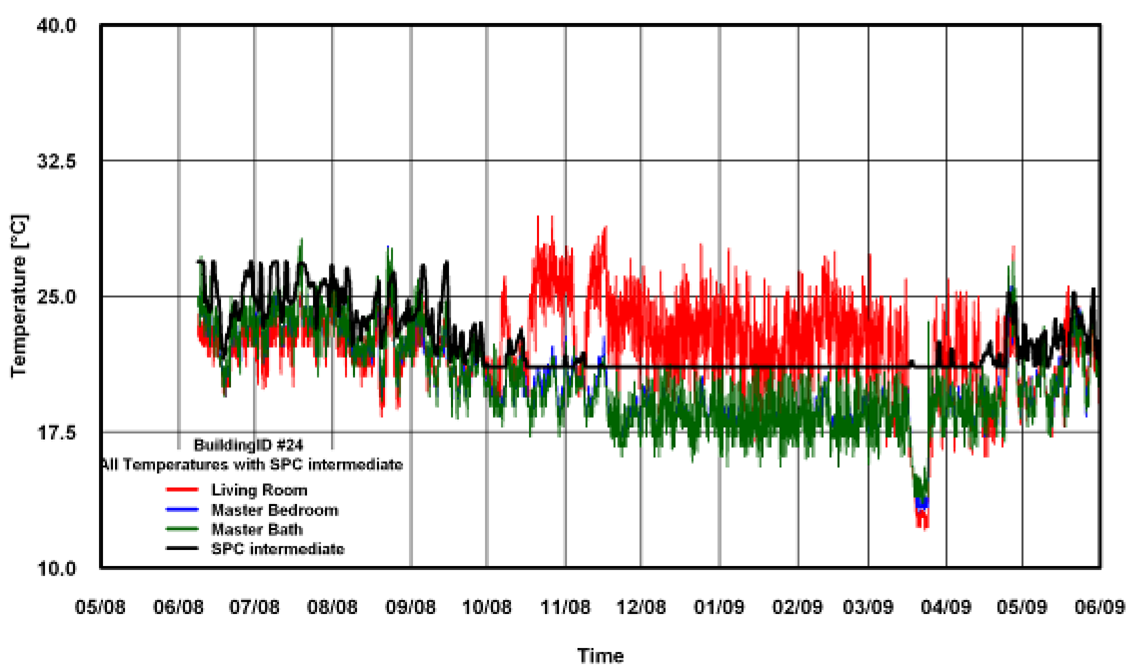

Figure 313: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 24

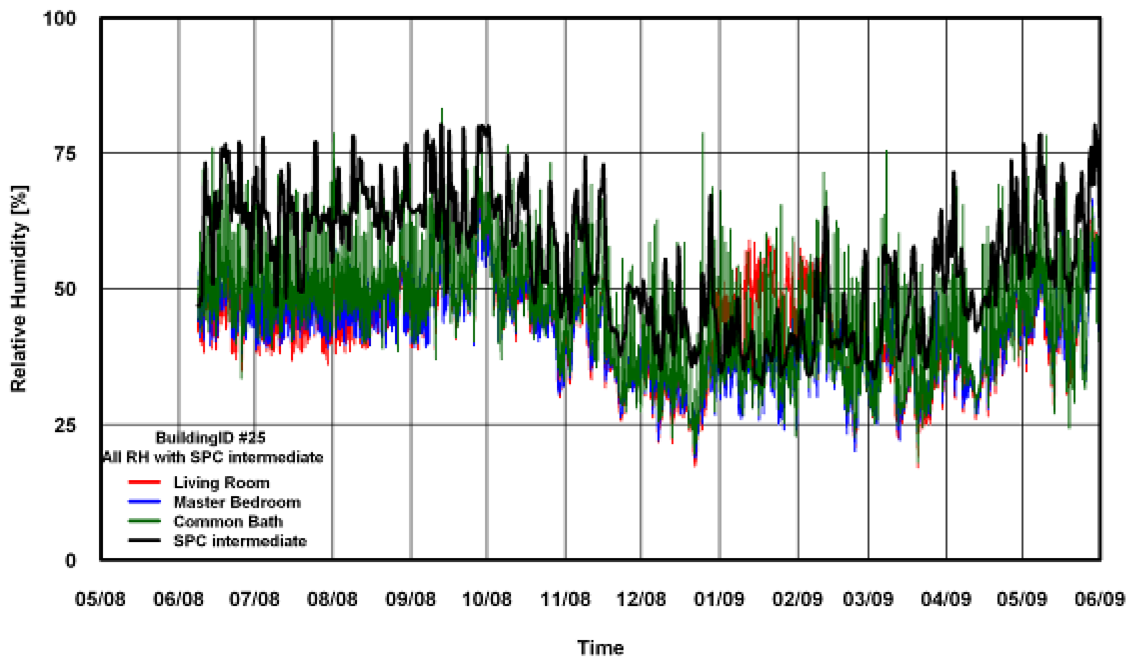

Figure 314: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 25

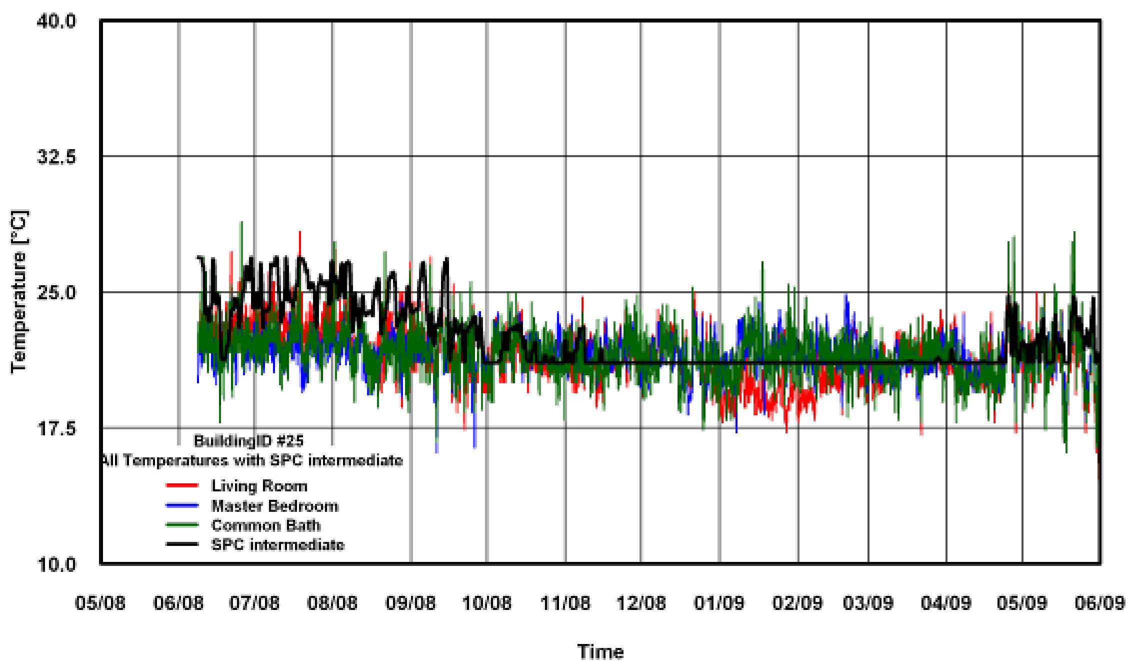

Figure 315: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 25

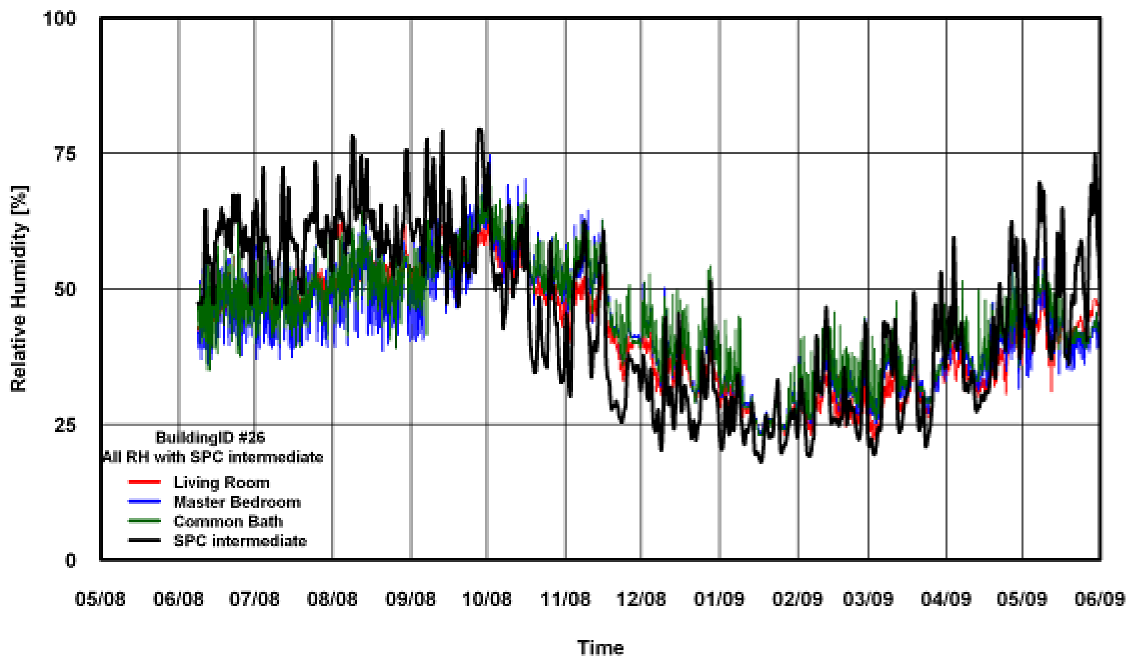

Figure 316: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 26

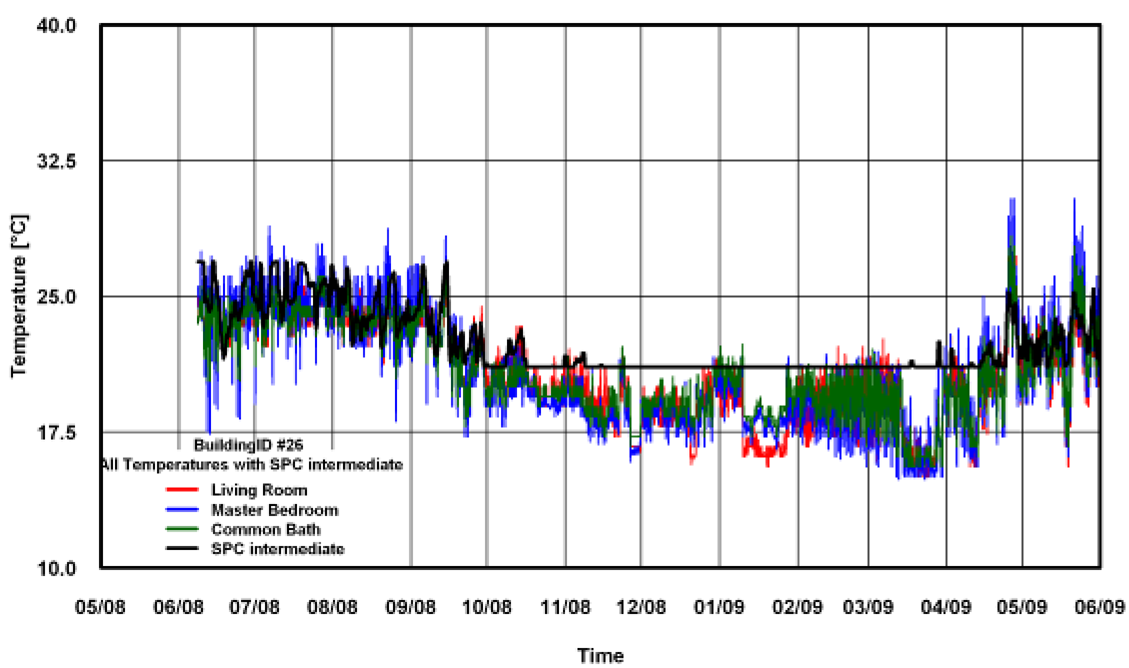

Figure 317: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 26

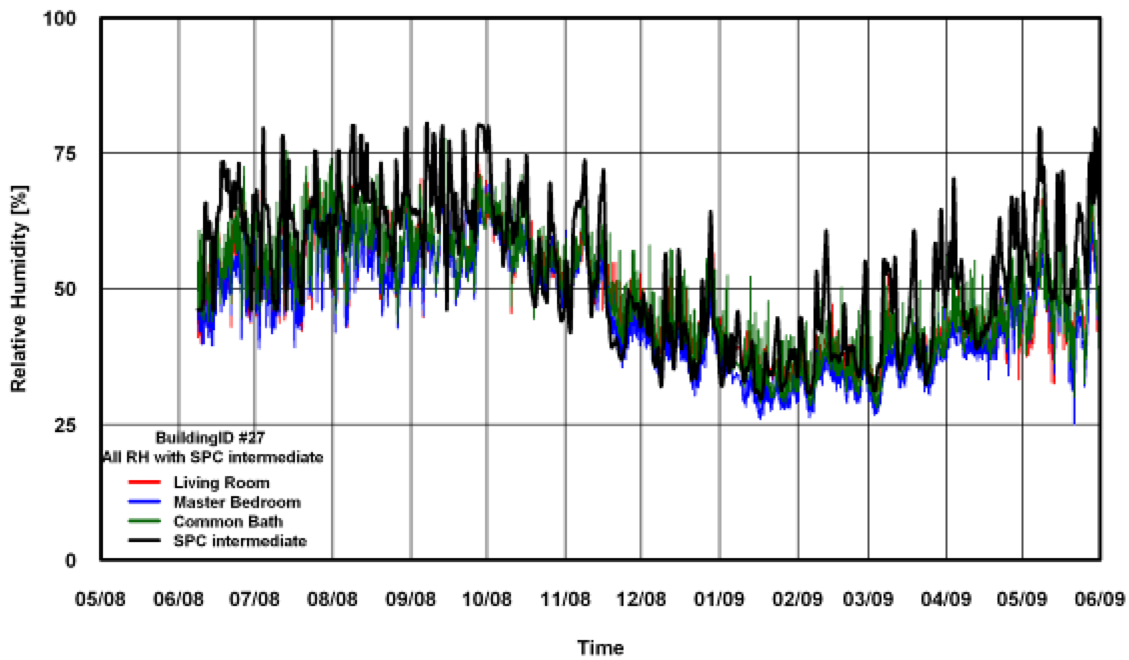

Figure 318: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 27

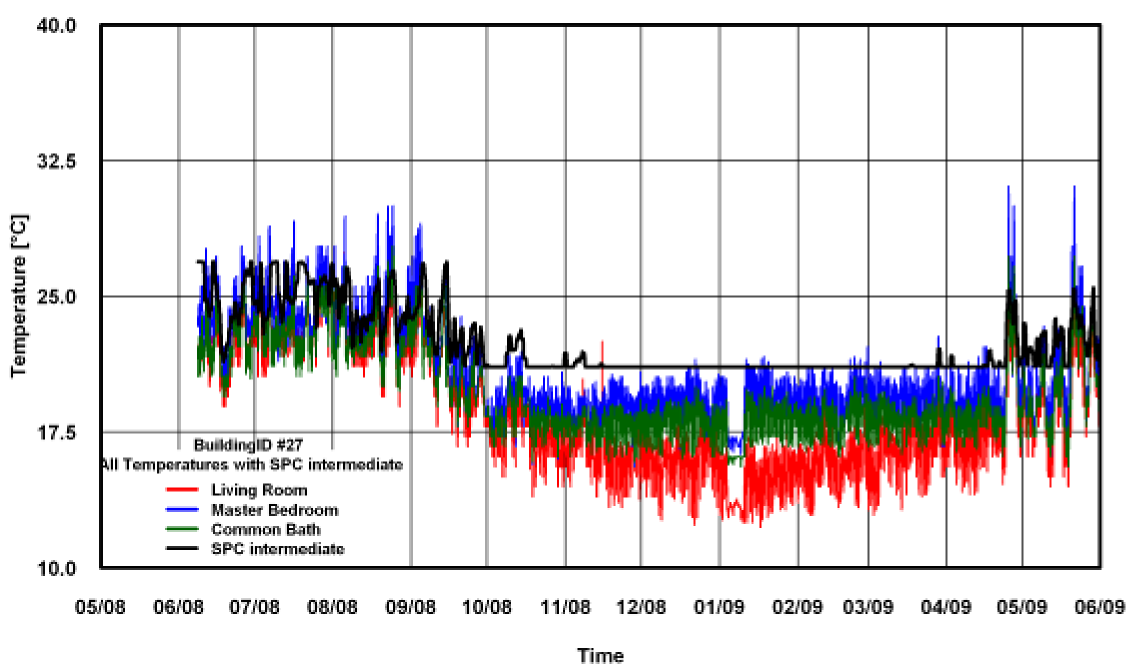

Figure 319: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 27

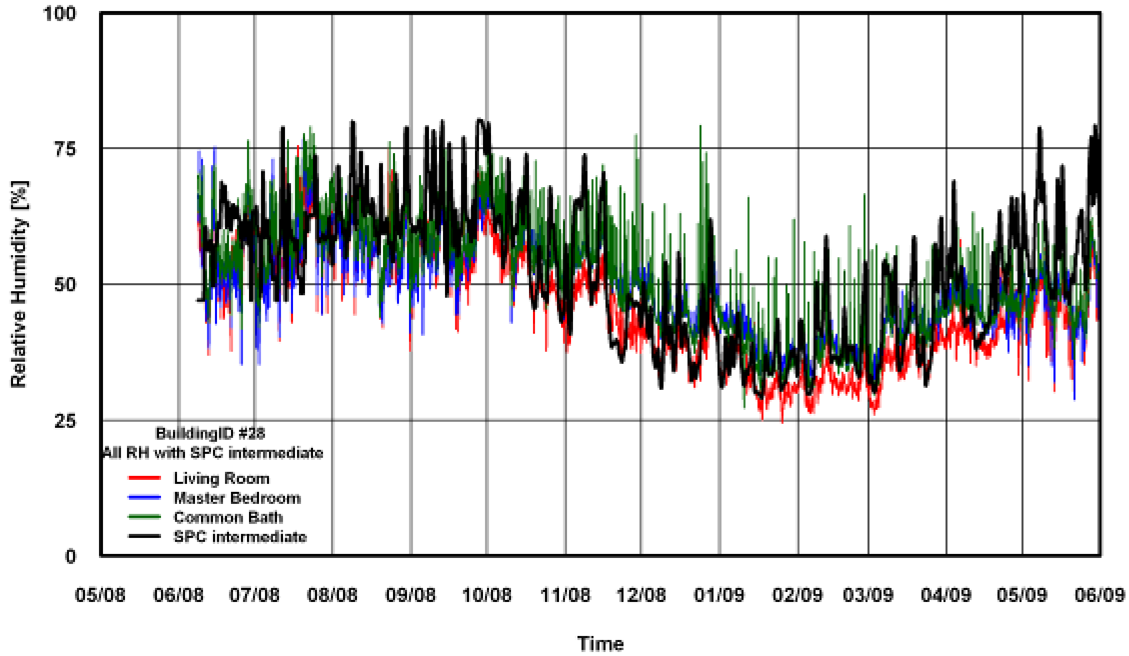

Figure 320: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 28

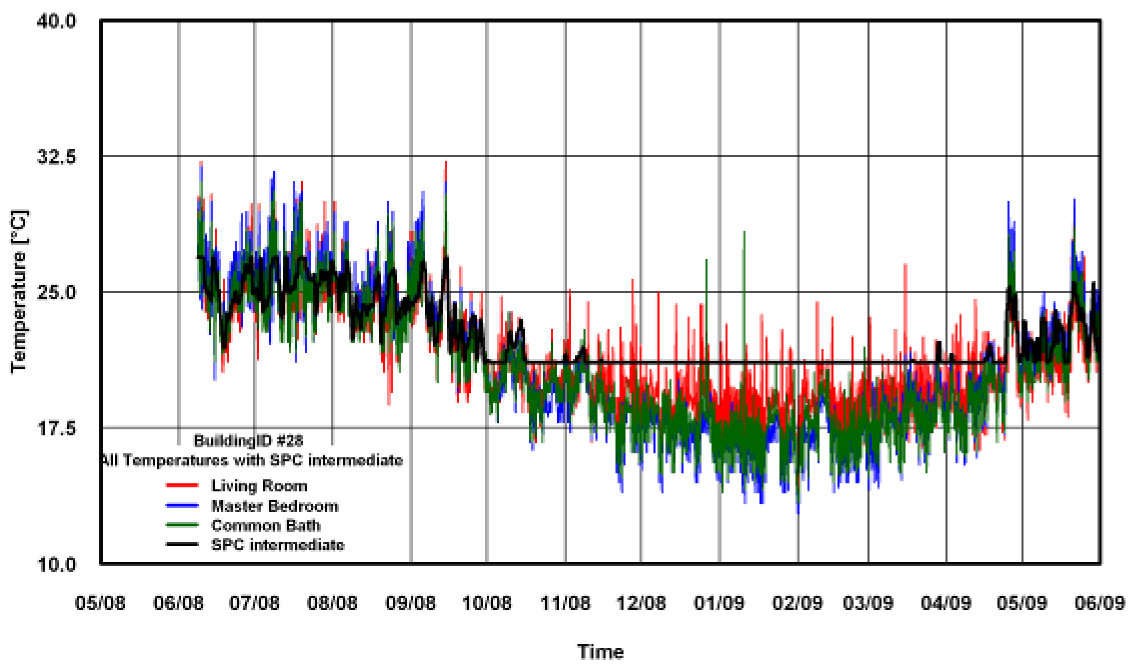

Figure 321: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 28

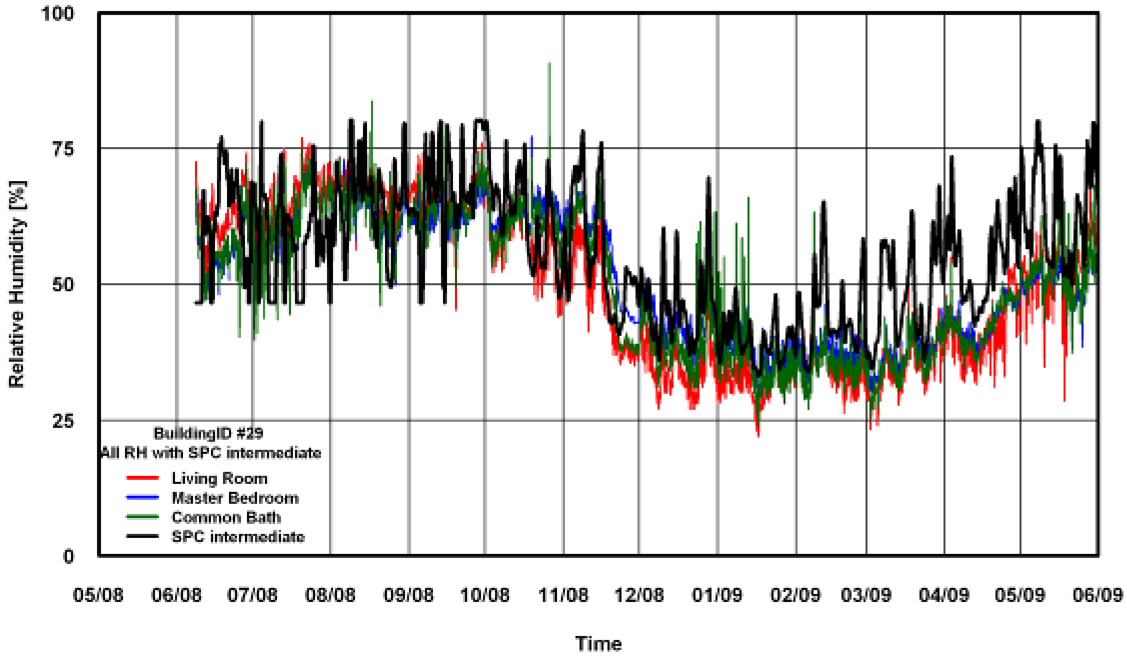

Figure 322: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 29

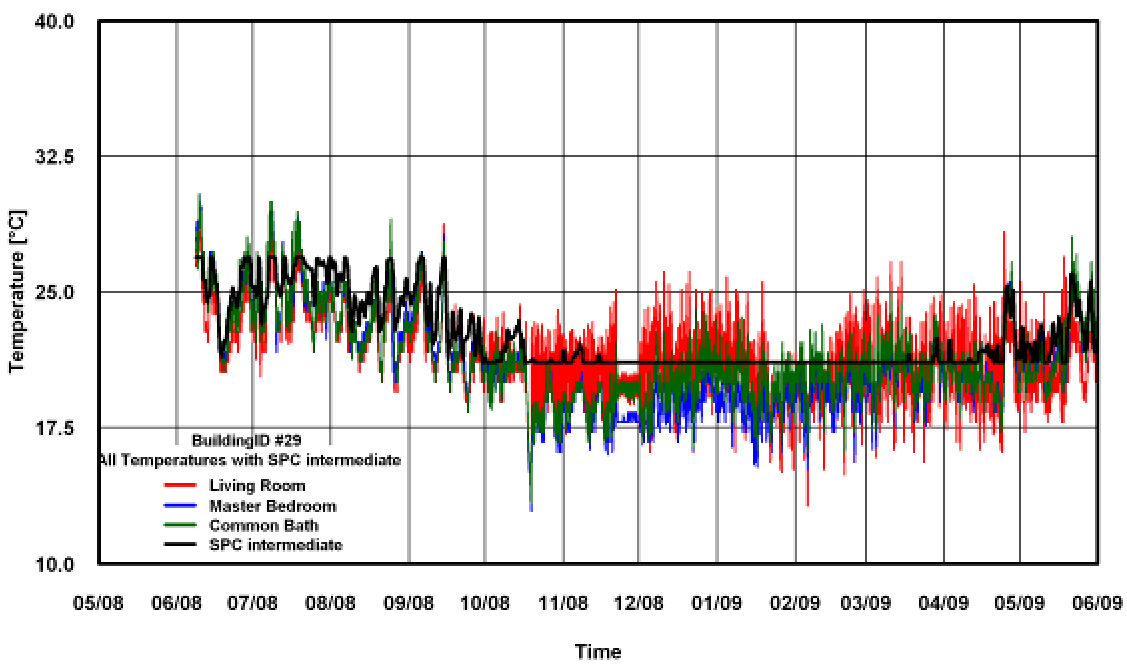

Figure 323: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 29

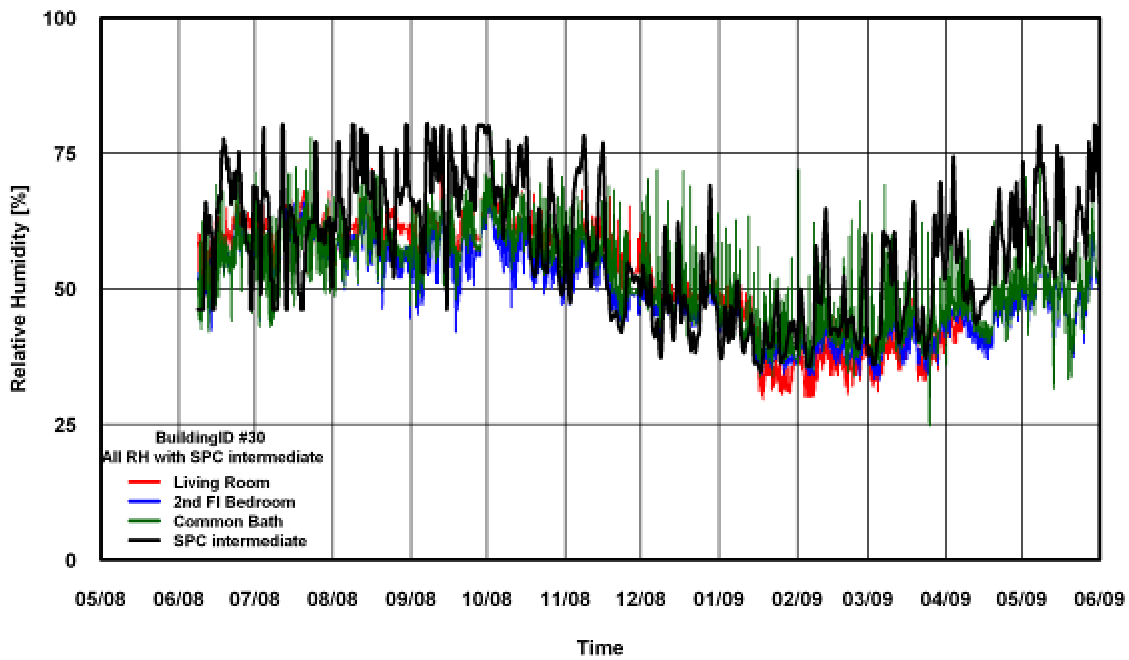

Figure 324: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 30

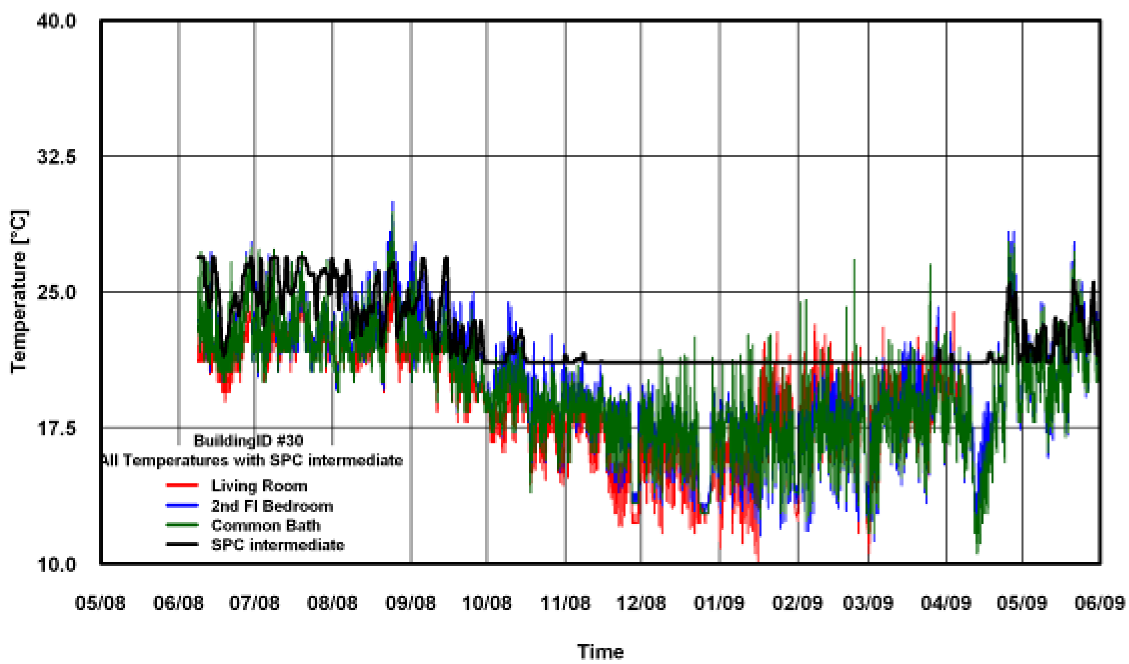

Figure 325: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 30

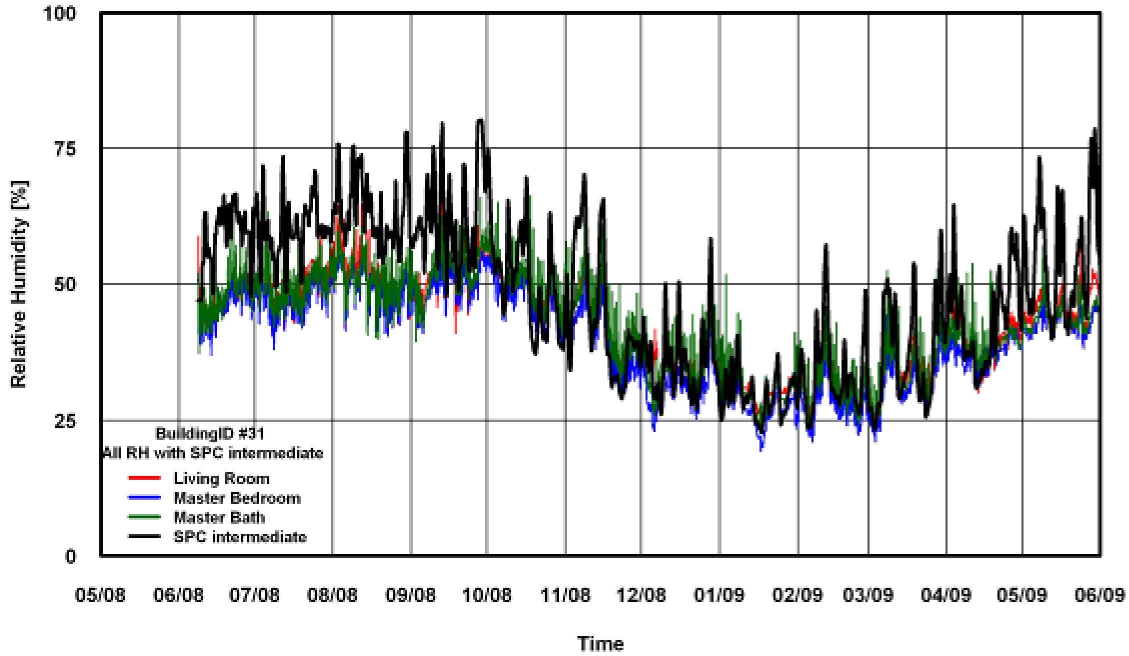

Figure 326: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 31

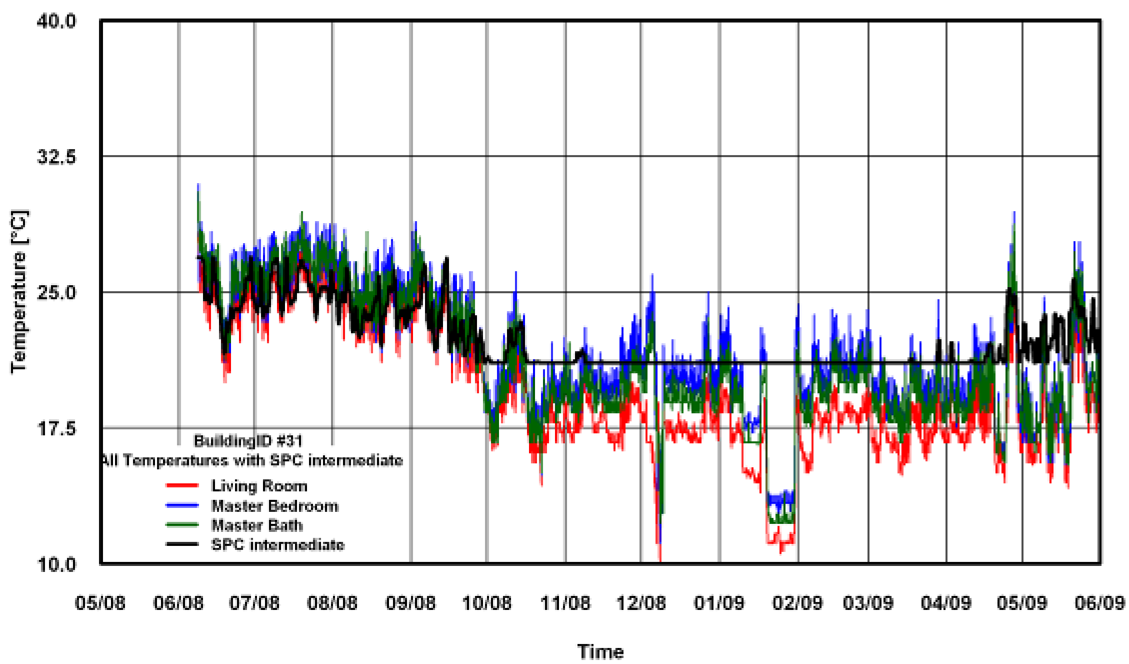

Figure 327: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 31

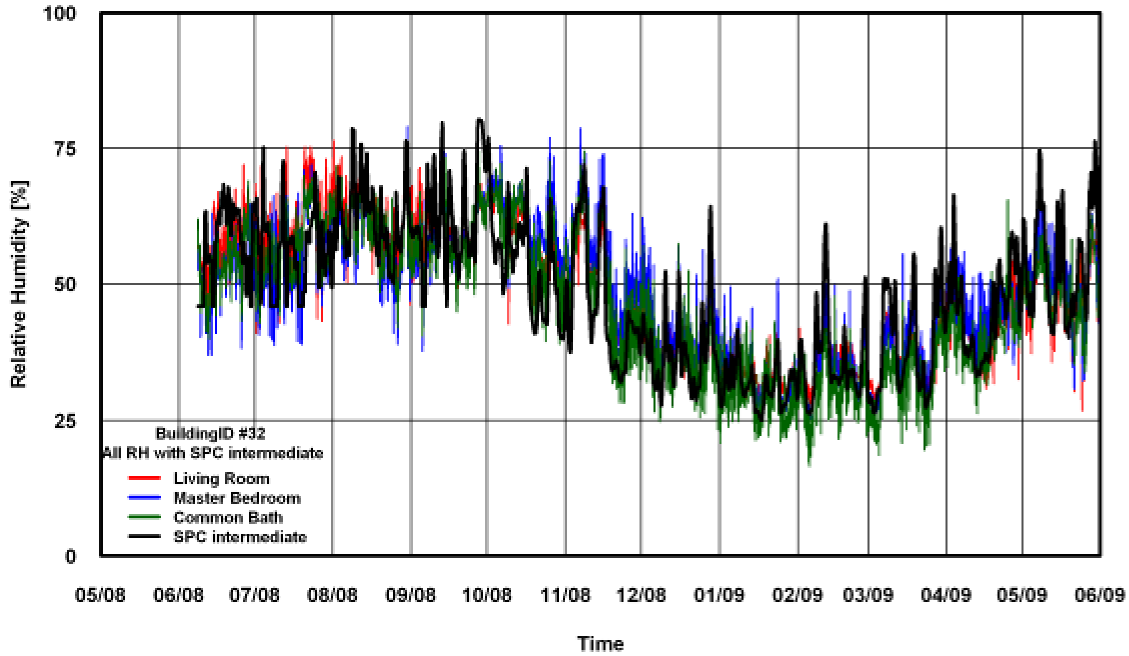

Figure 328: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 32

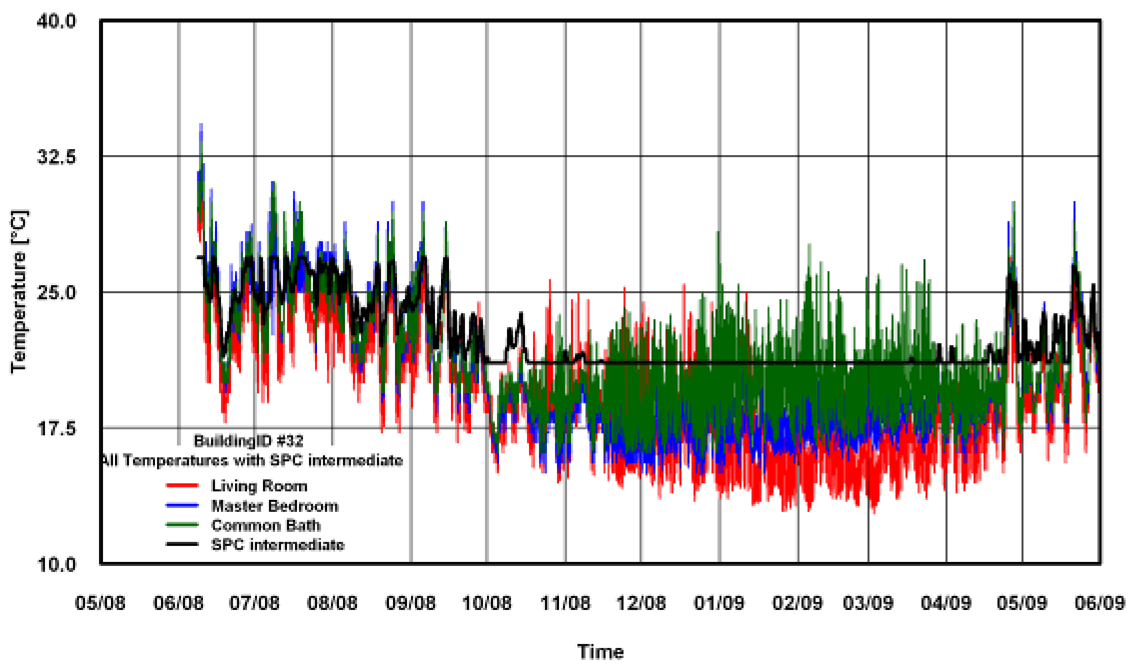

Figure 329: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 32

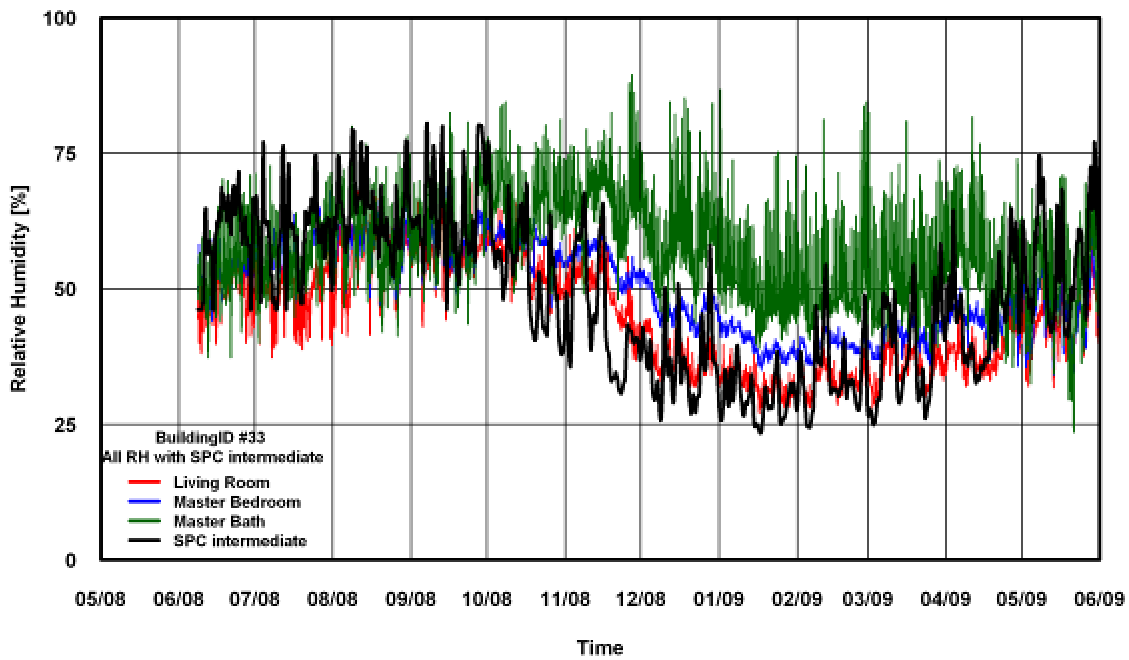

Figure 330: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 33

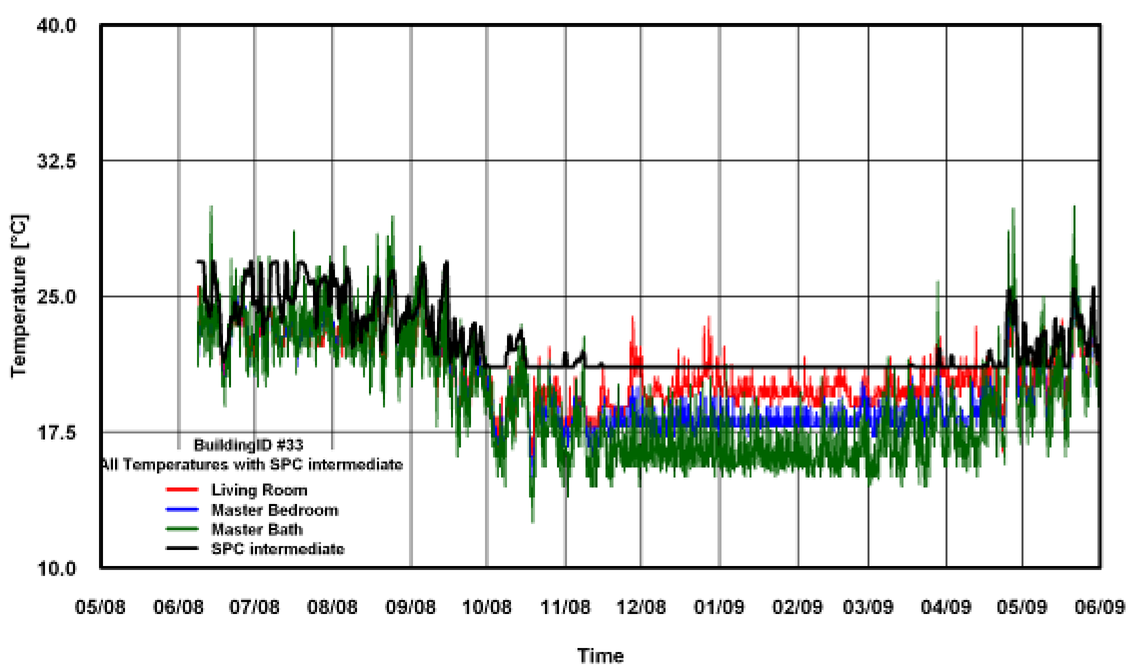

Figure 331: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 33

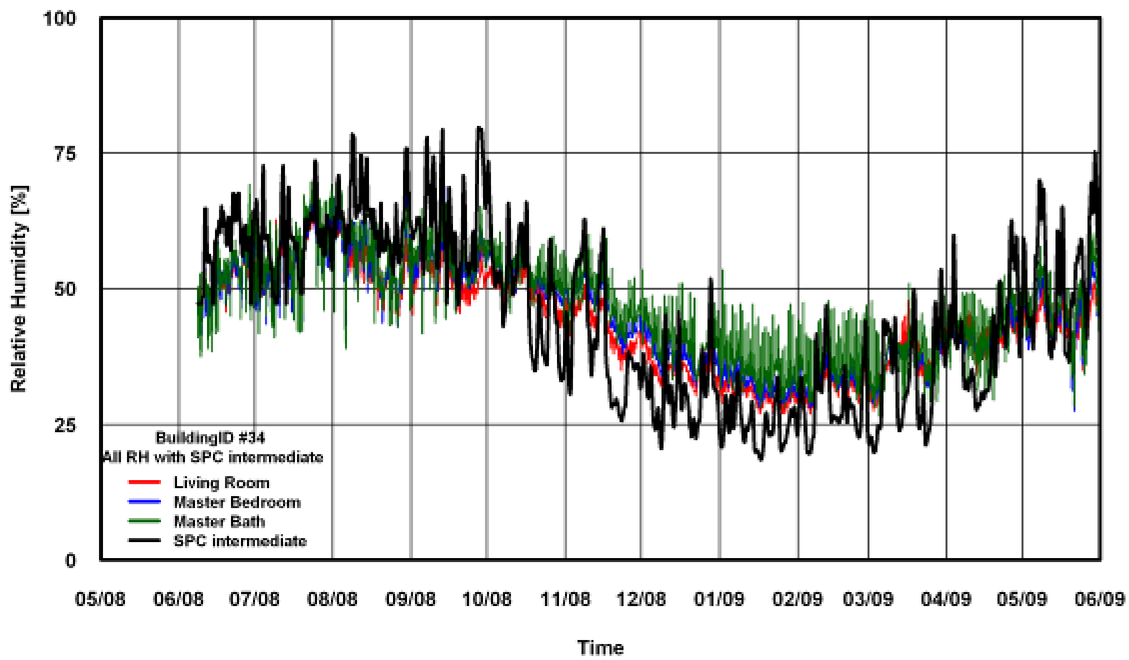

Figure 332: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 34

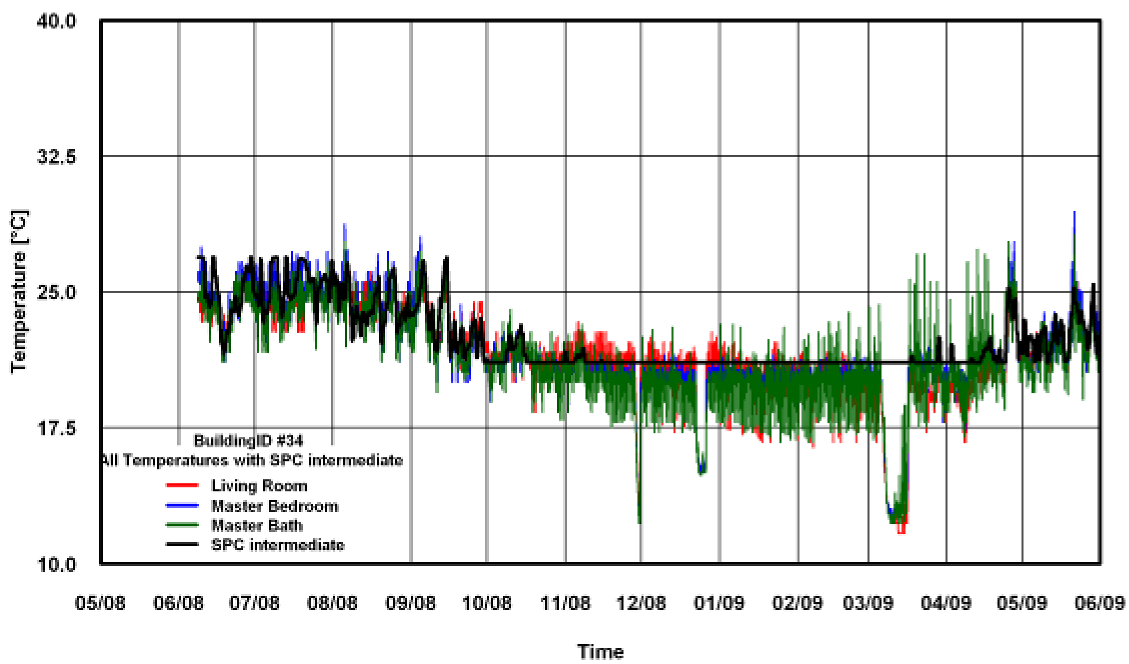

Figure 333: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 34

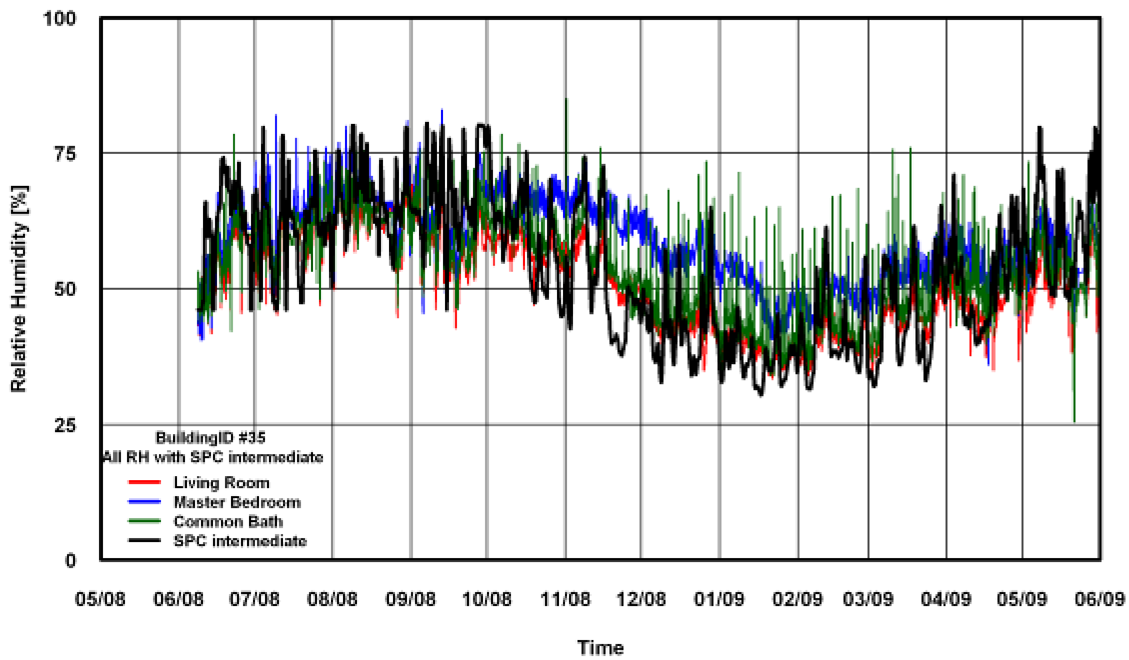

Figure 334: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 35

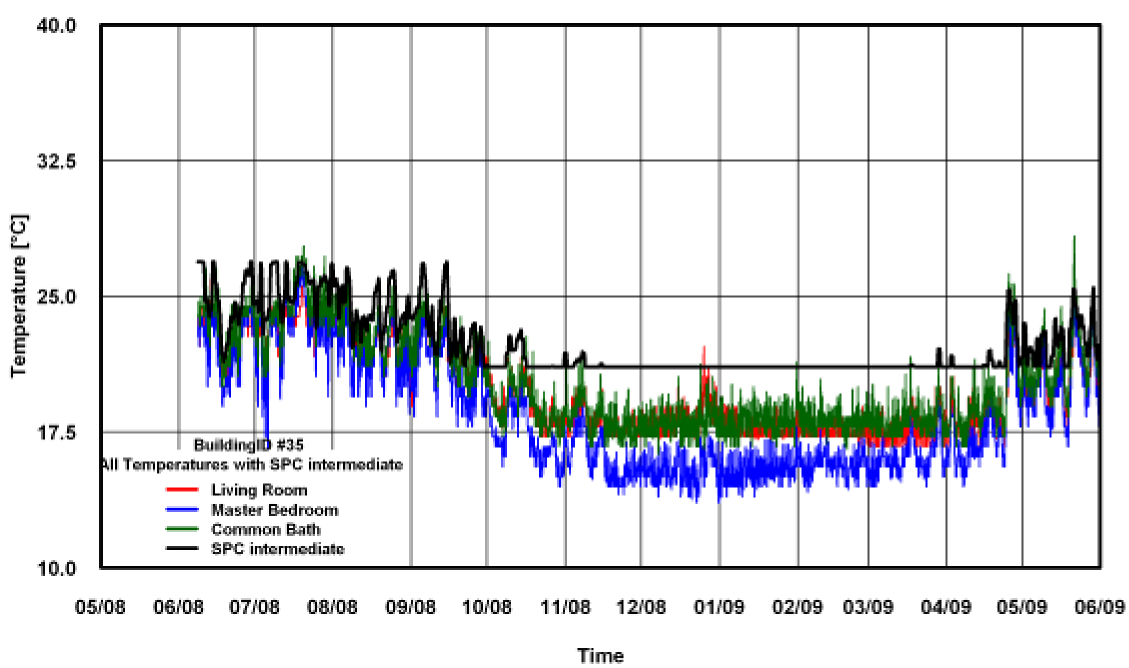

Figure 335: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 35

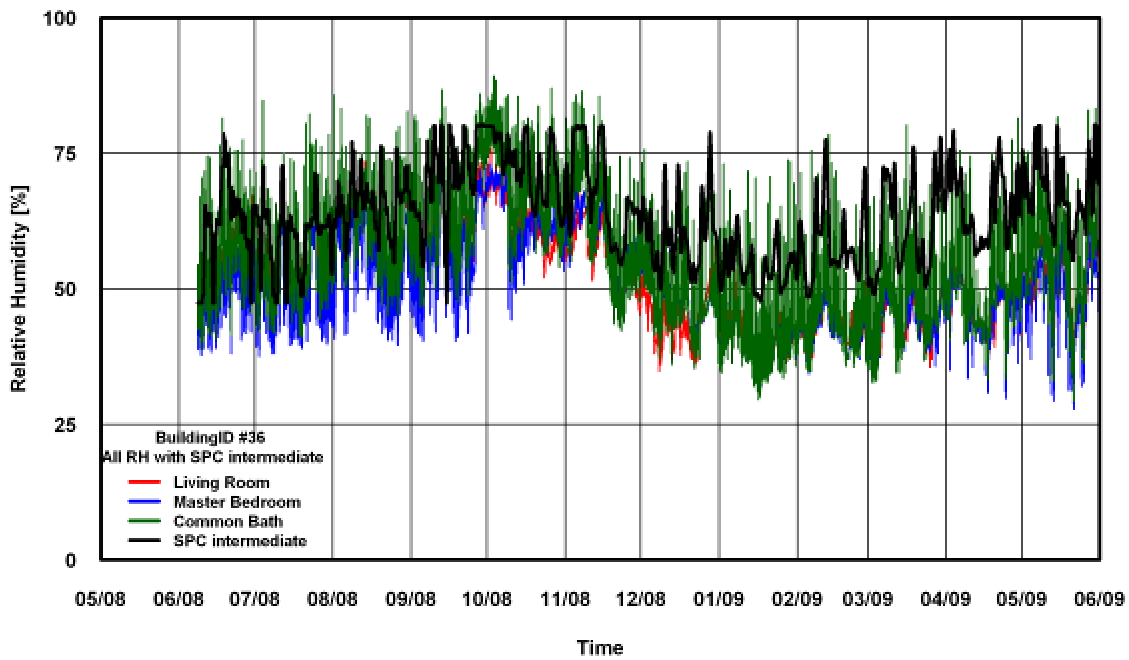

Figure 336: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 36

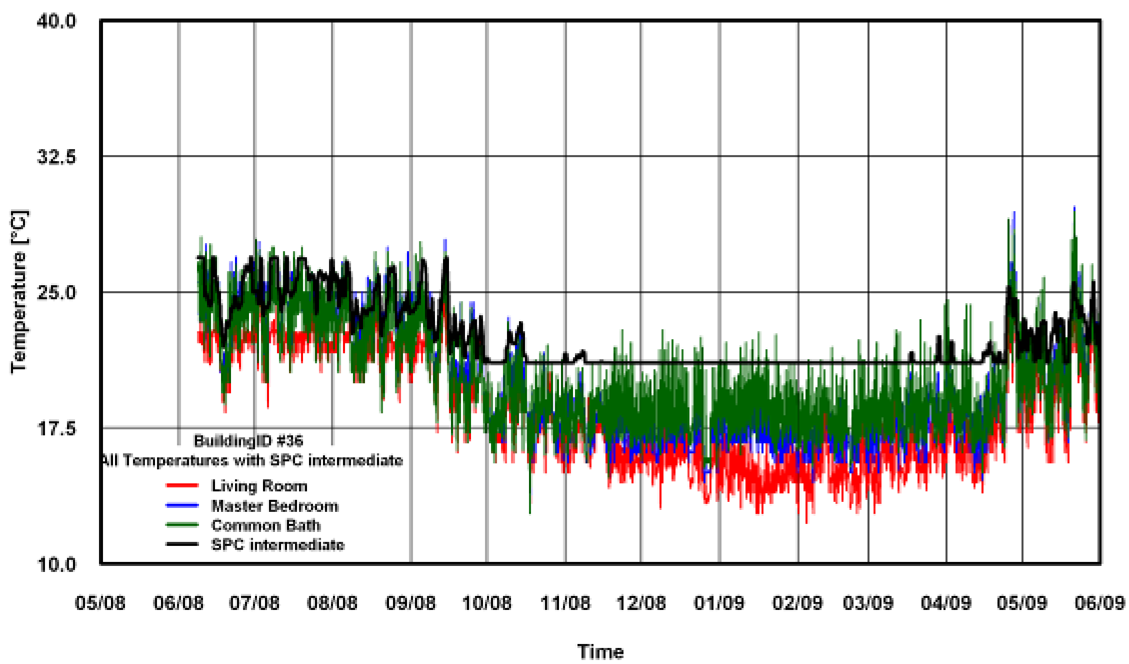

Figure 337: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 36

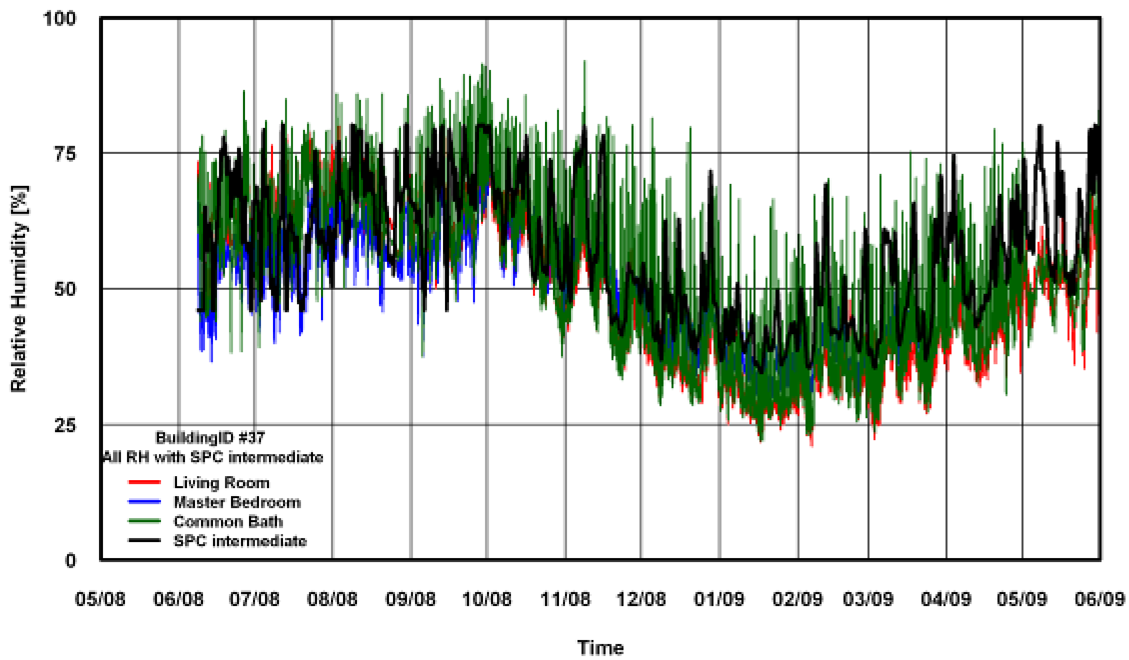

Figure 338: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 37

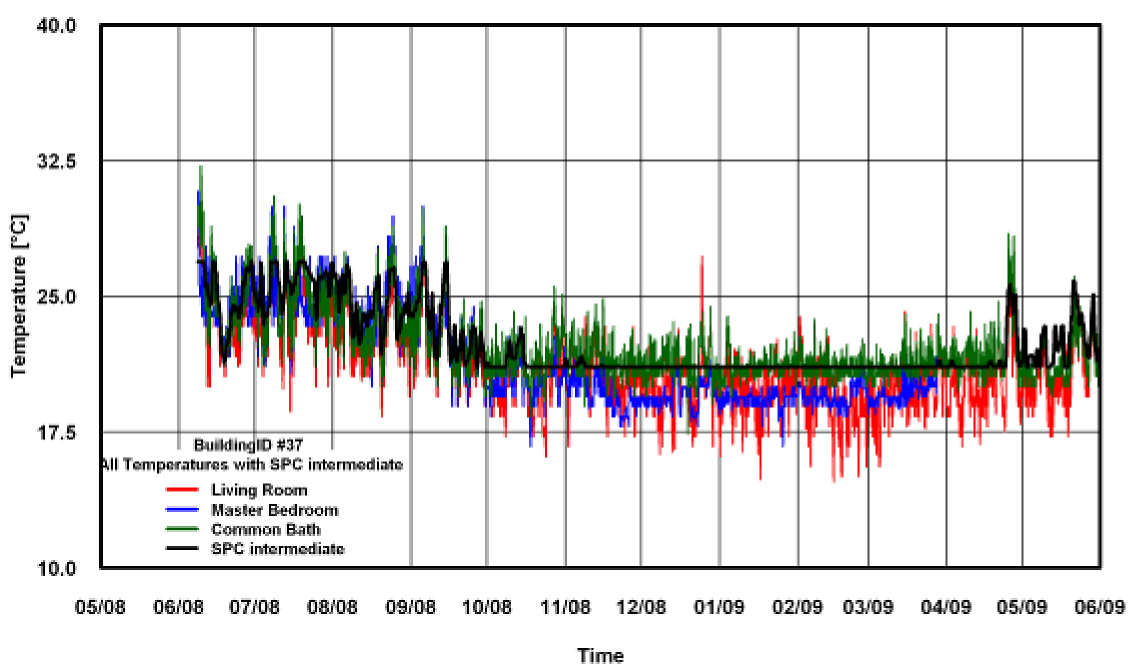

Figure 339: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 37

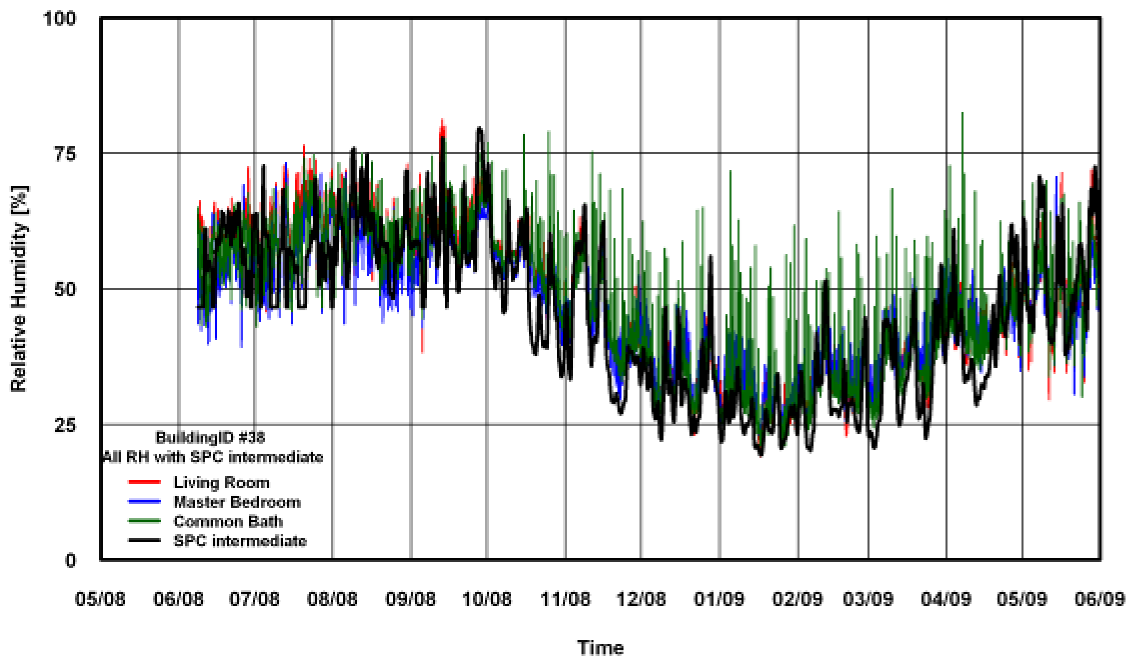

Figure 340: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 38

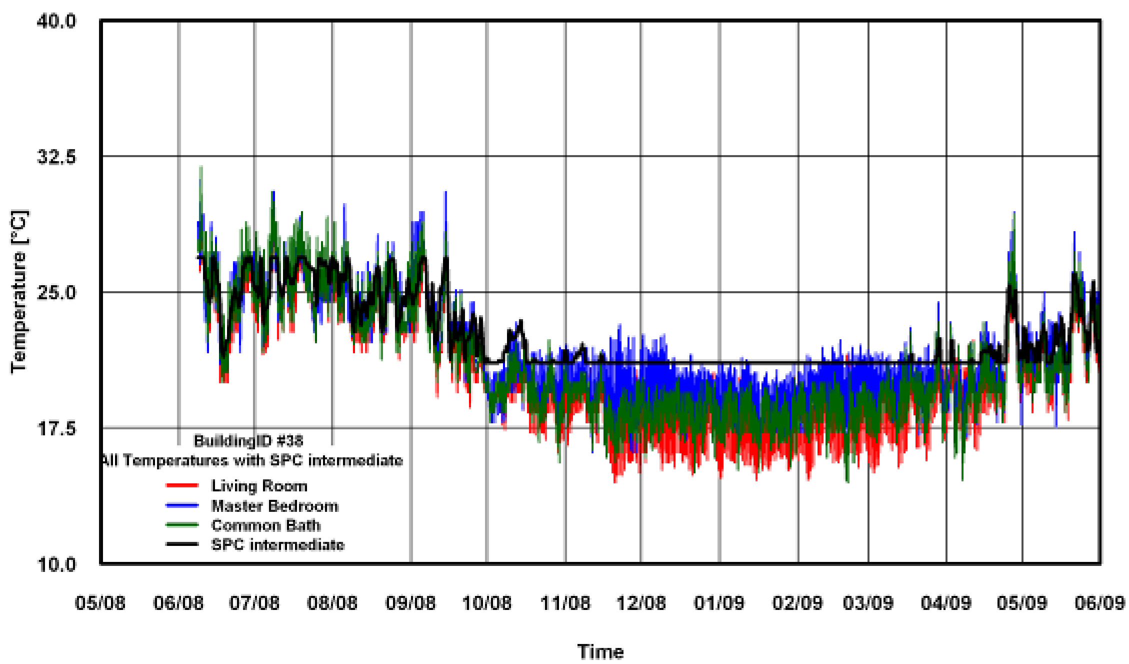

Figure 341: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 38

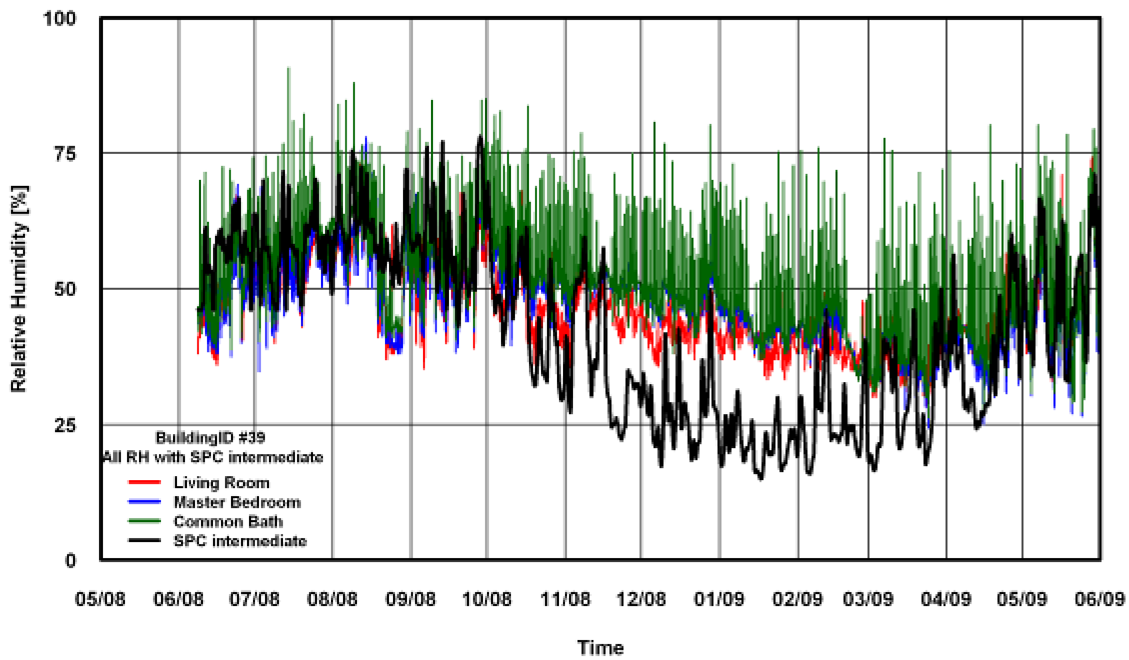

Figure 342: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 39

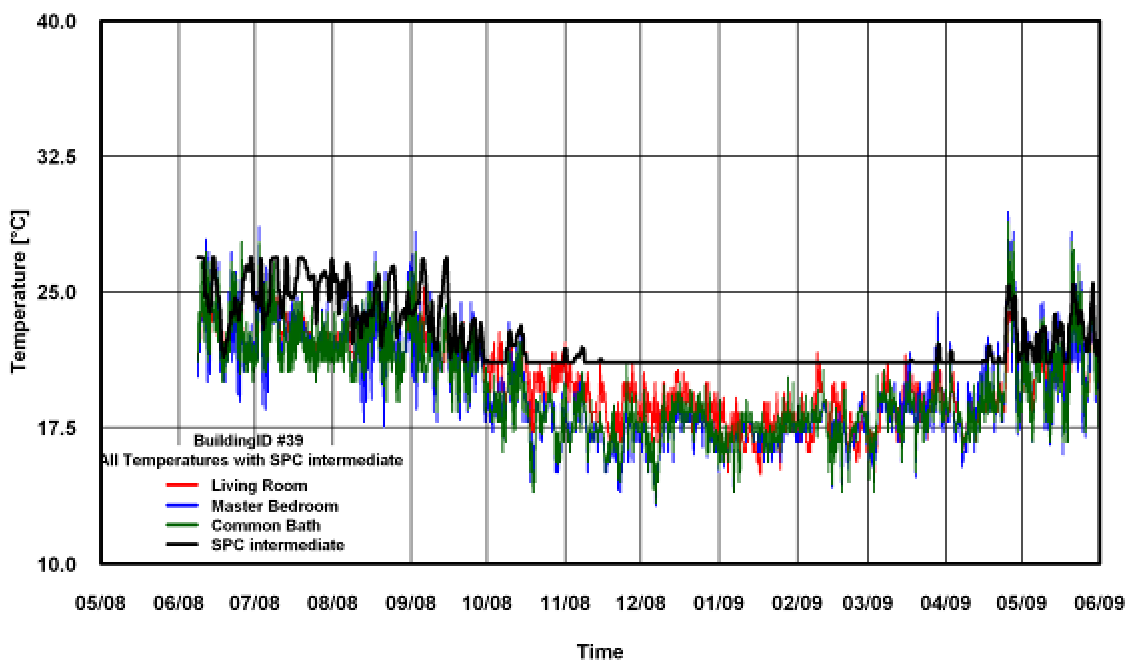

Figure 343: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 39

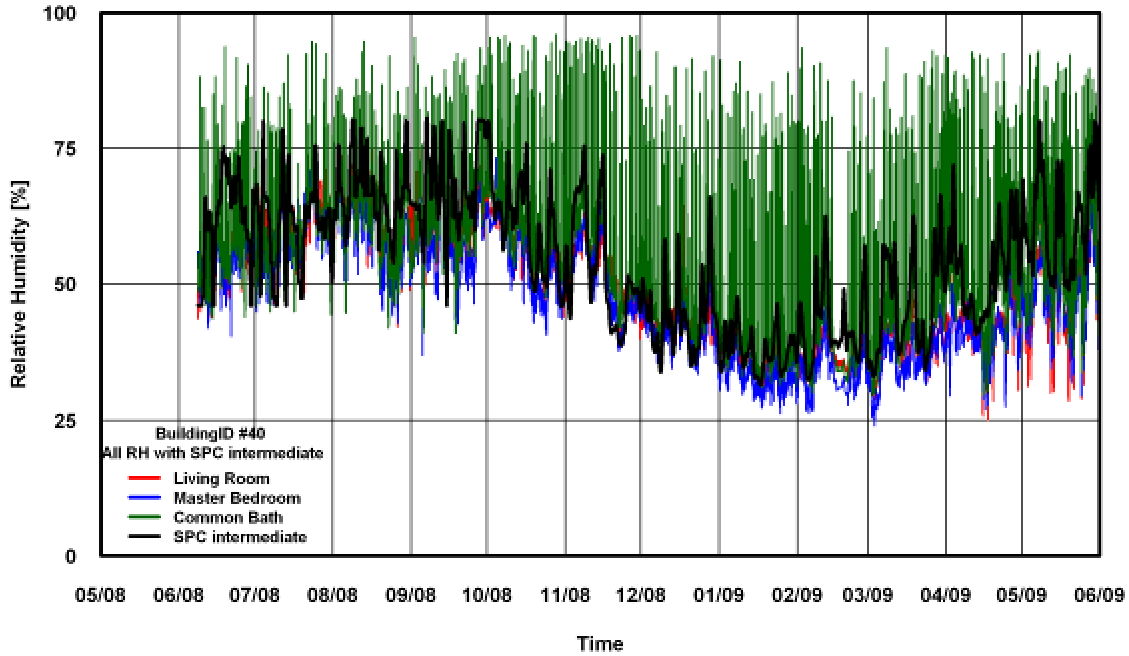

Figure 344: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 40

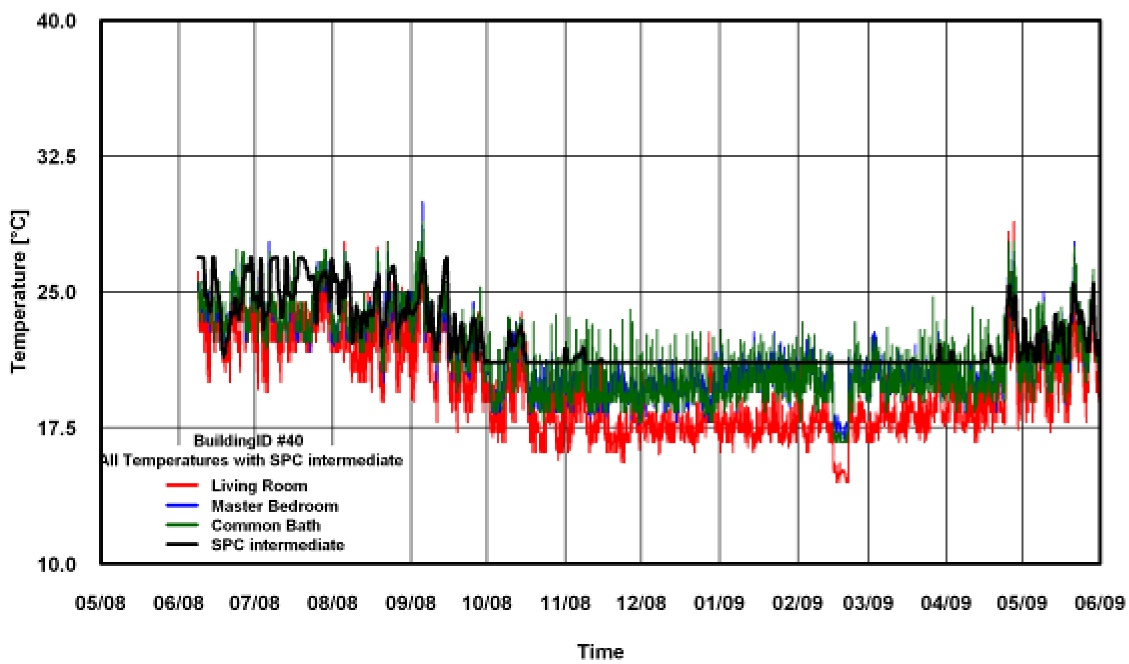

Figure 345: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 40

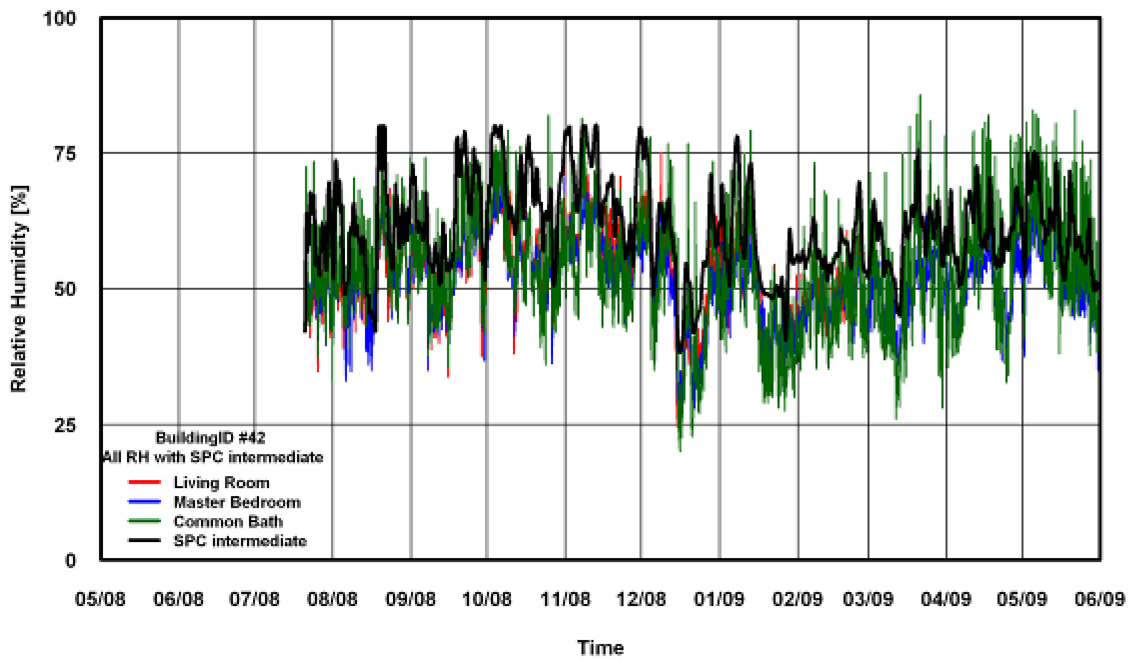

Figure 346: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 42

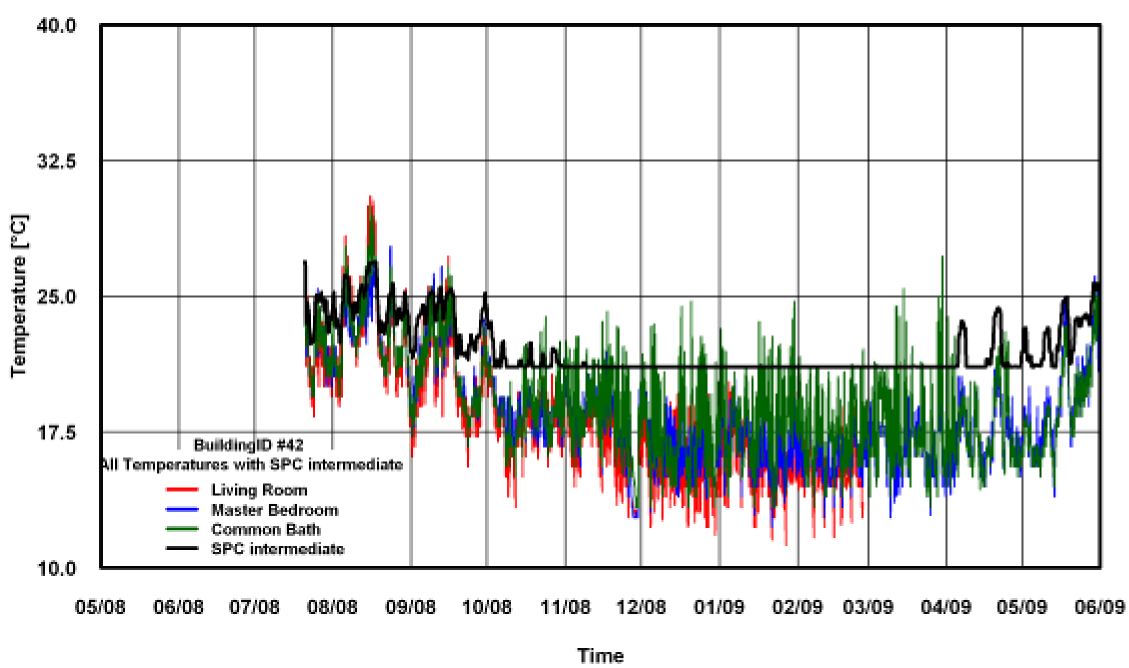

Figure 347: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 42

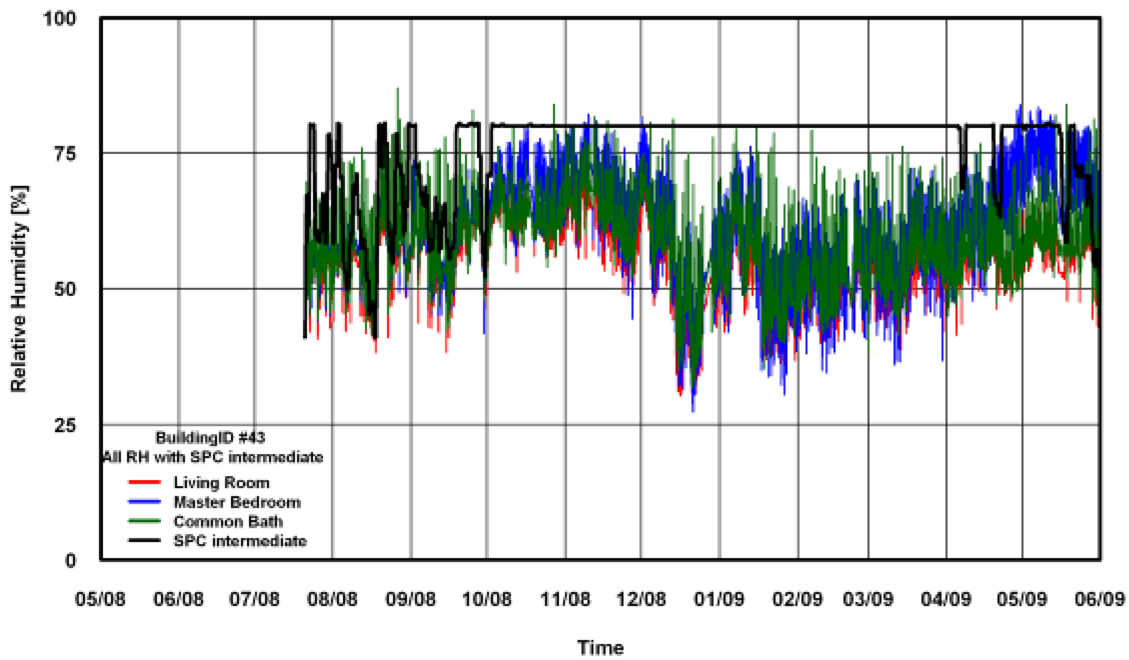

Figure 348: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 43

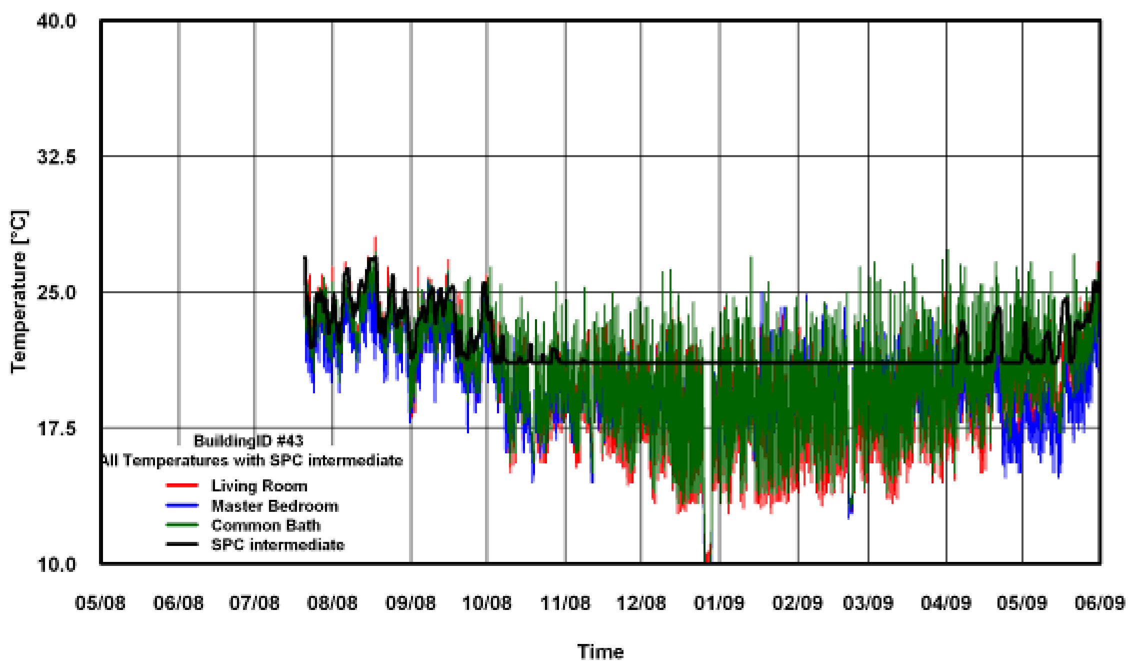

Figure 349: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 43

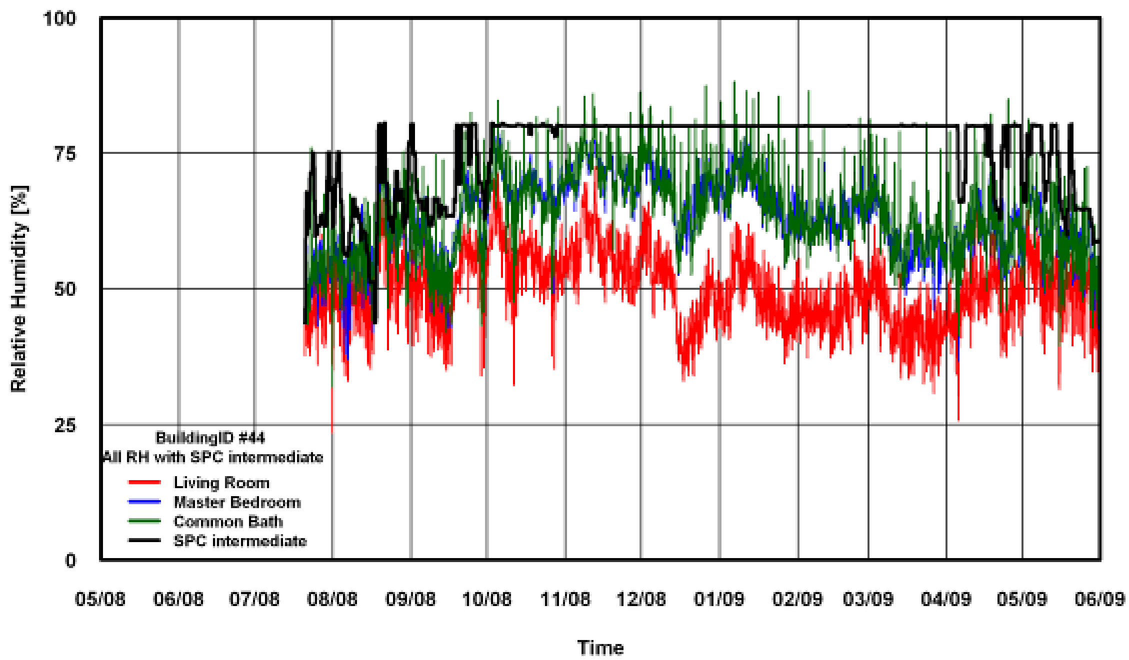

Figure 350: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 44

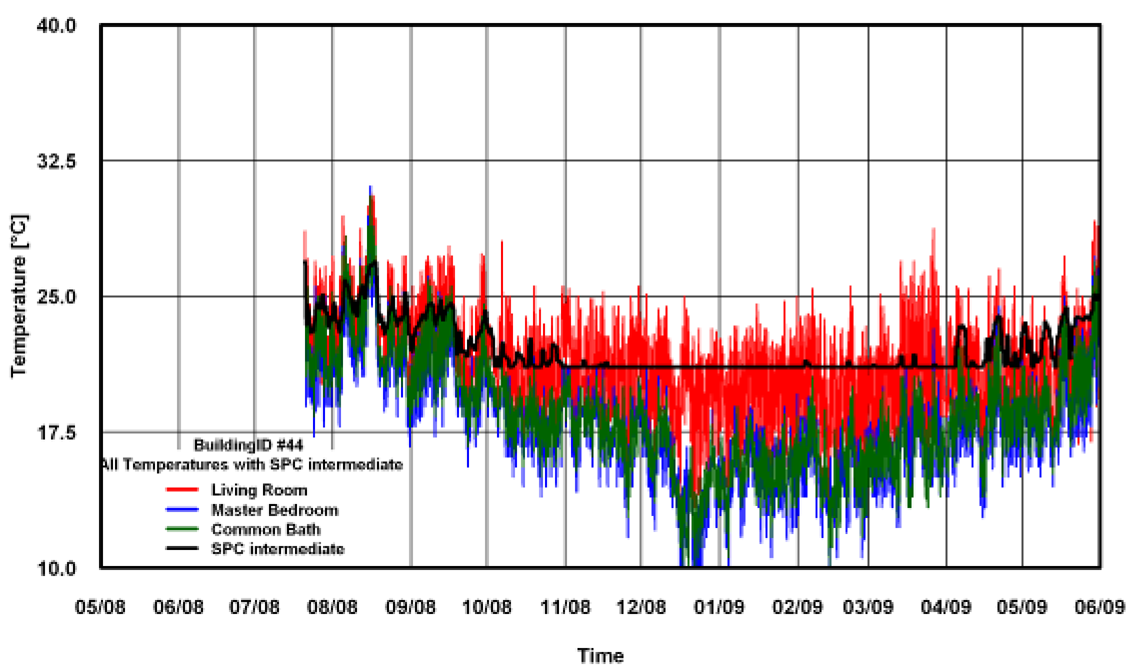

Figure 351: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 44

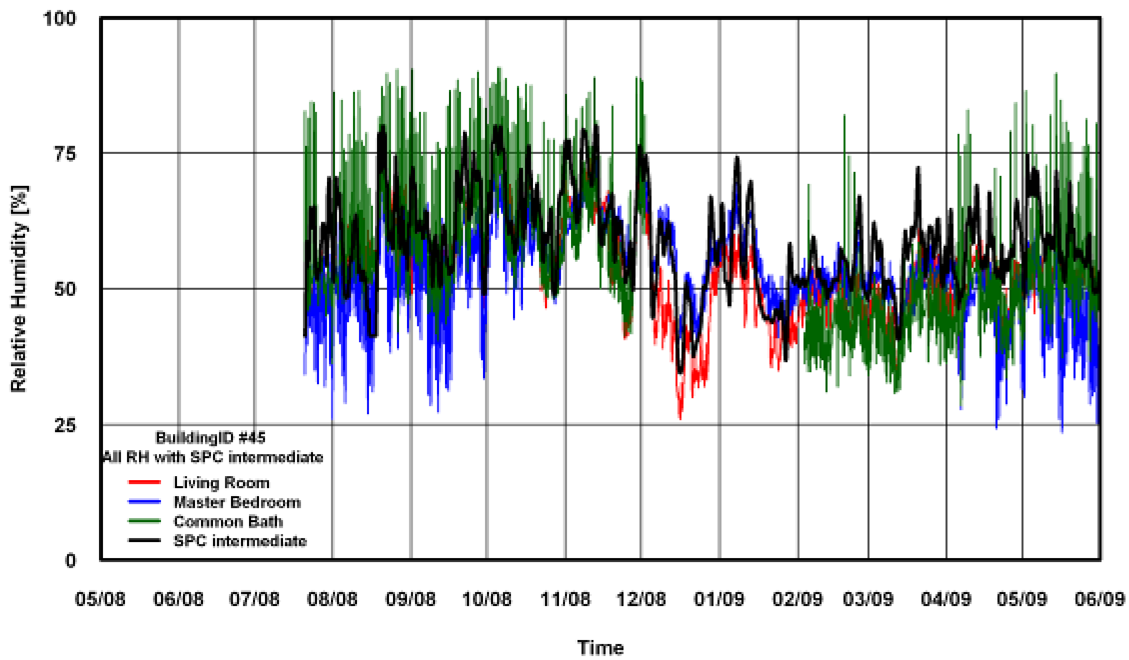

Figure 352: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 45

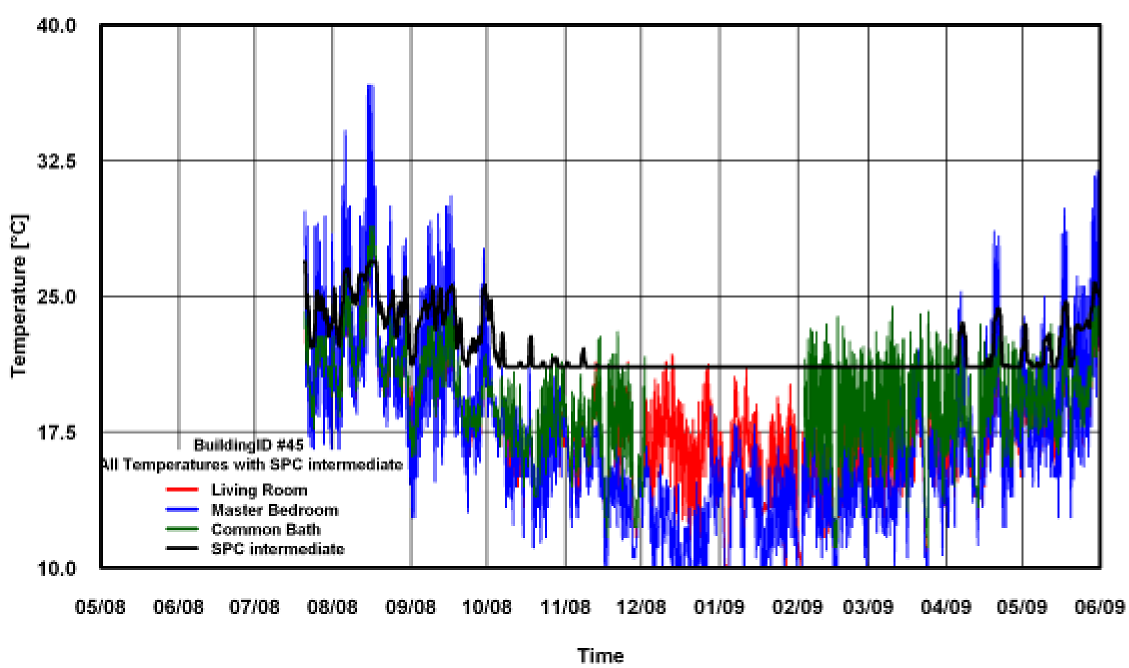

Figure 353: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 45

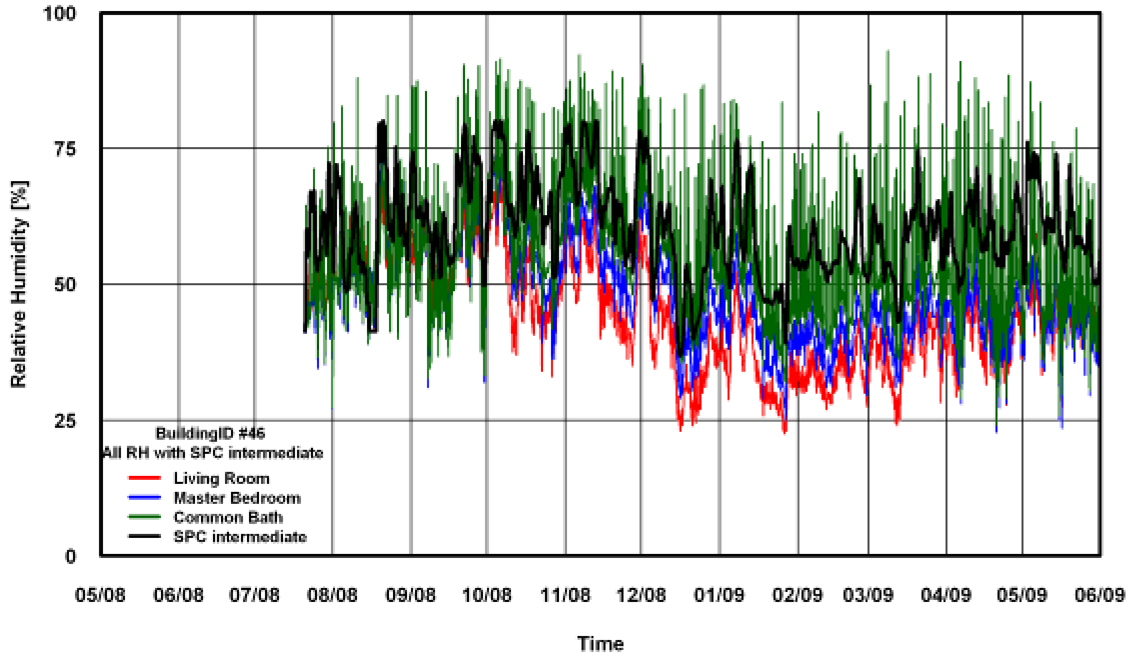

Figure 354: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 46

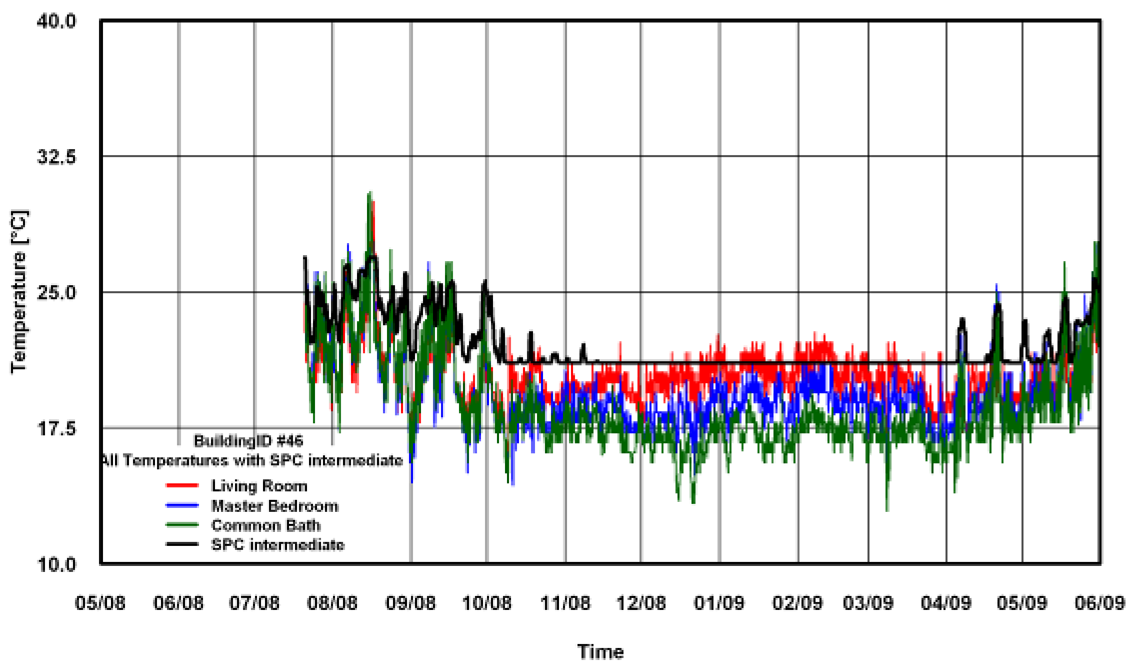

Figure 355: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 46

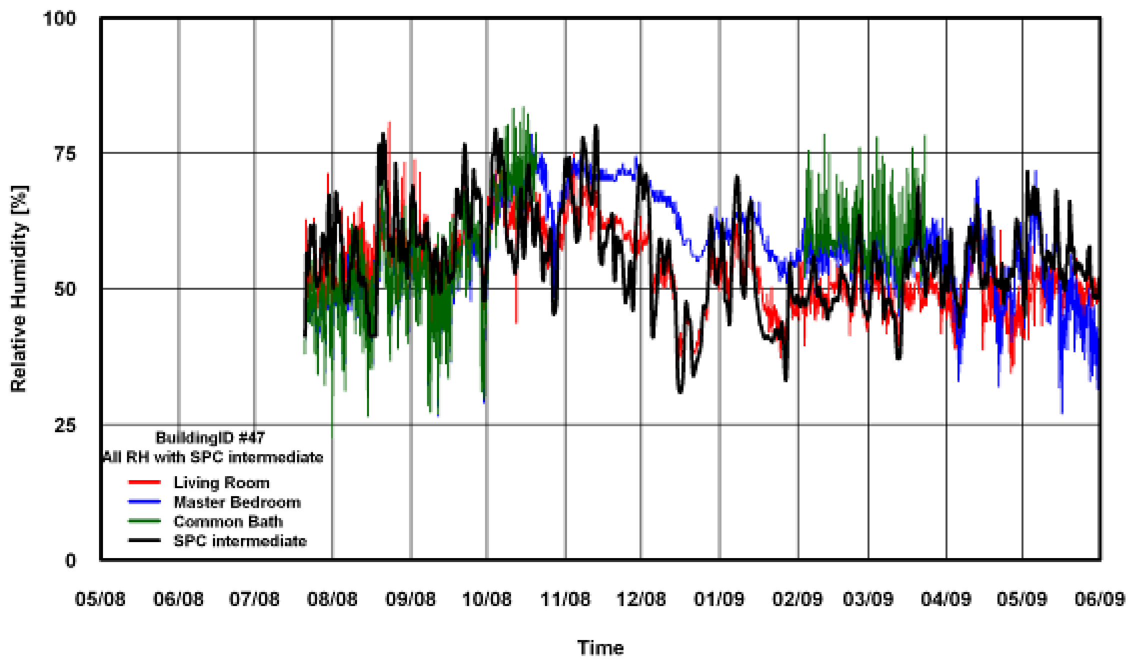

Figure 356: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 47

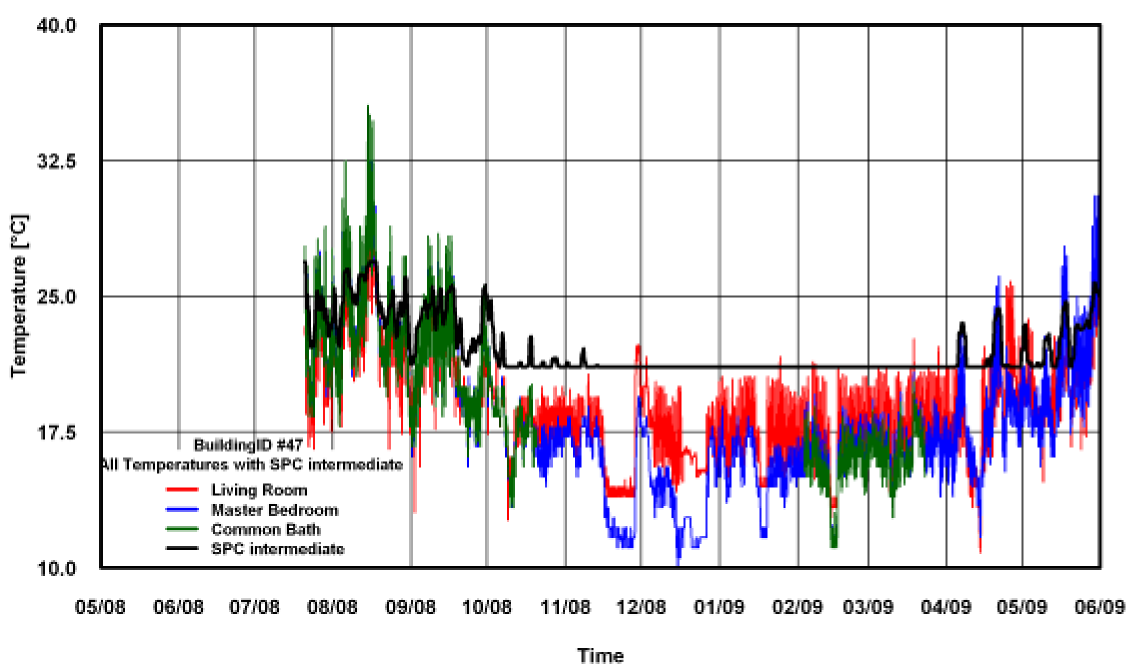

Figure 357: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 47

Figure 358: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 48

Figure 359: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 48

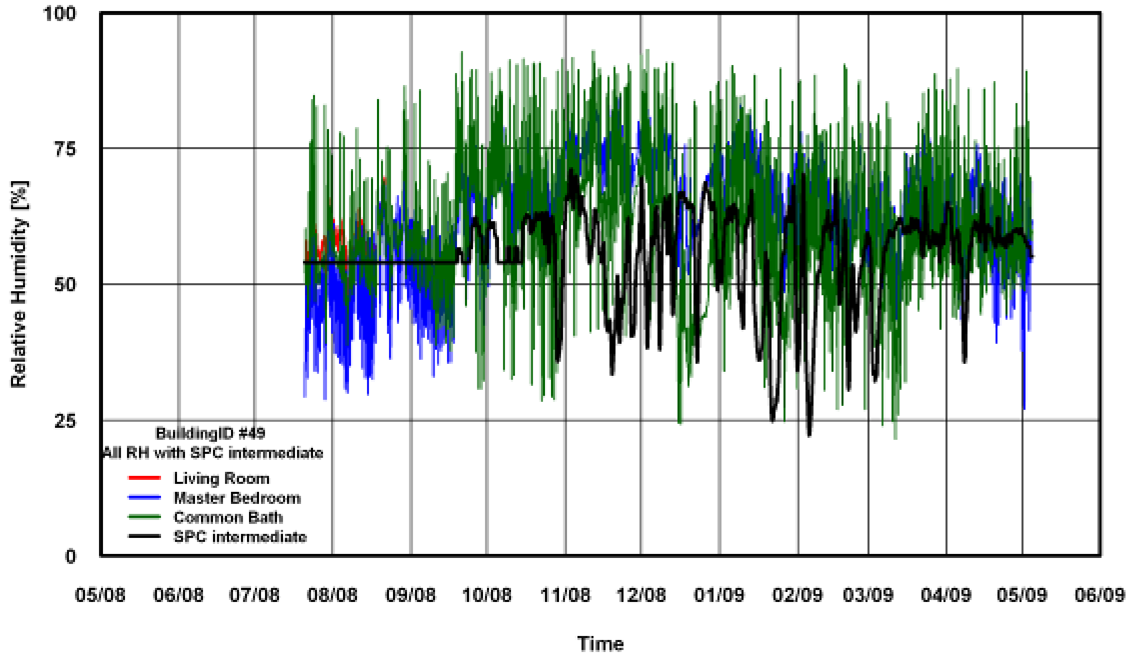

Figure 360: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 49

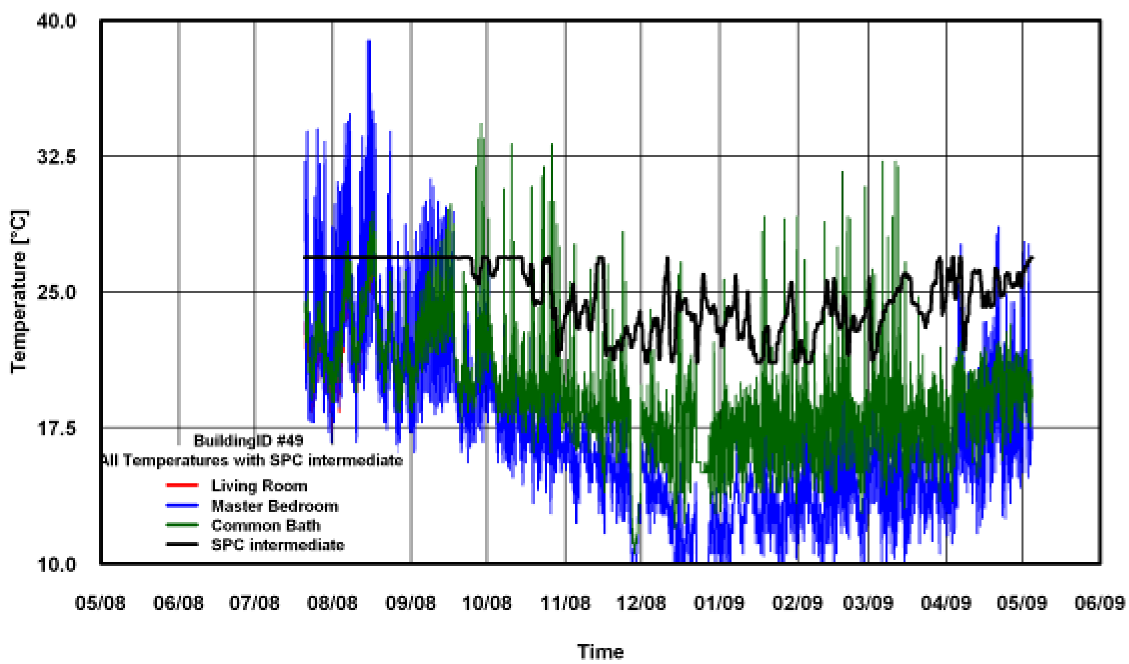

Figure 361: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 49

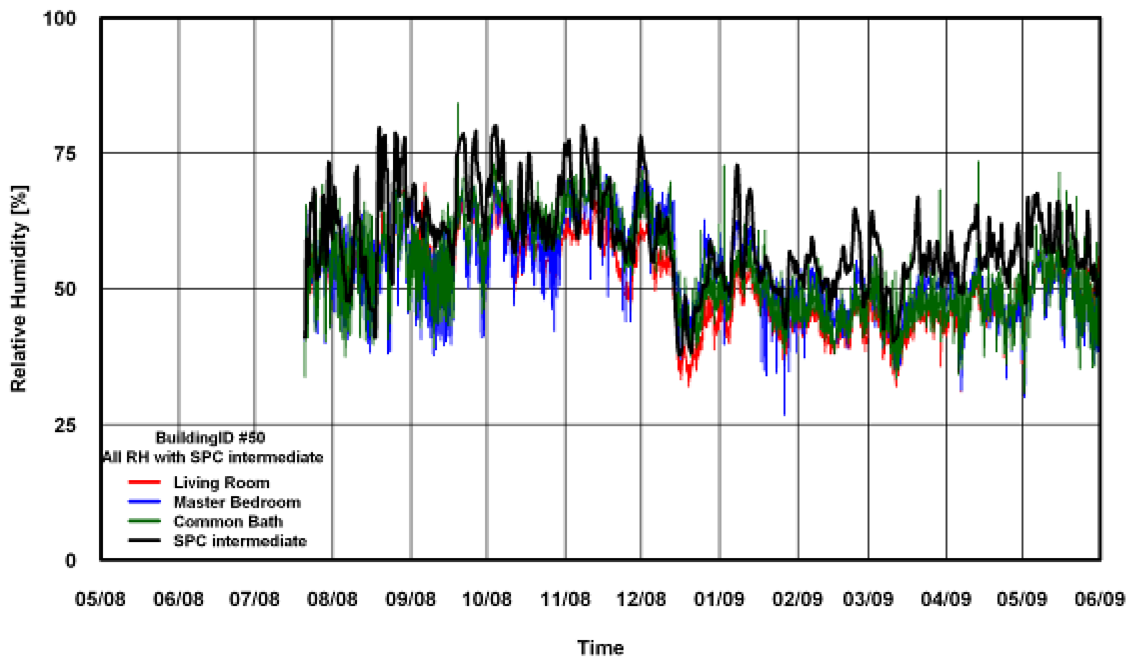

Figure 362: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 50

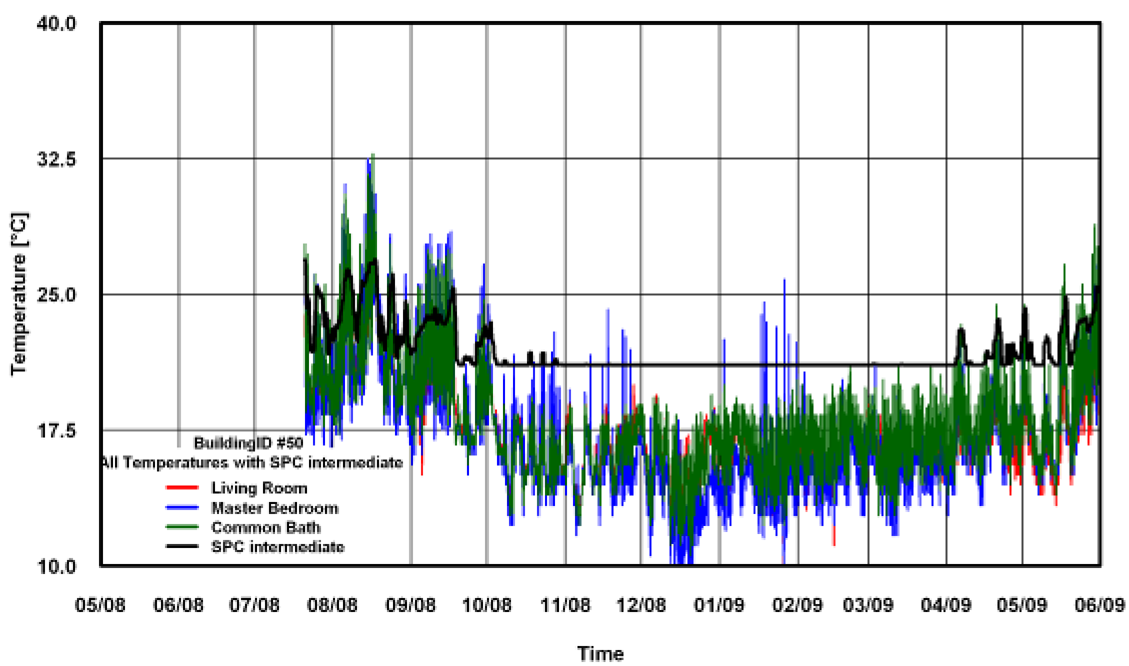

Figure 363: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 50

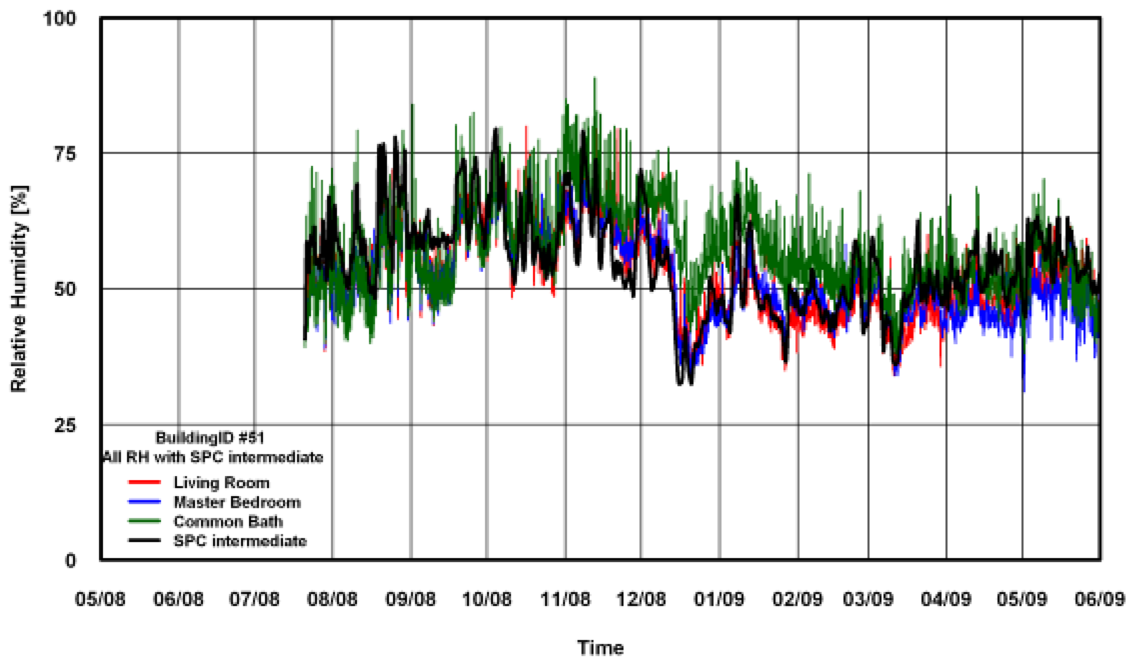

Figure 364: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 51

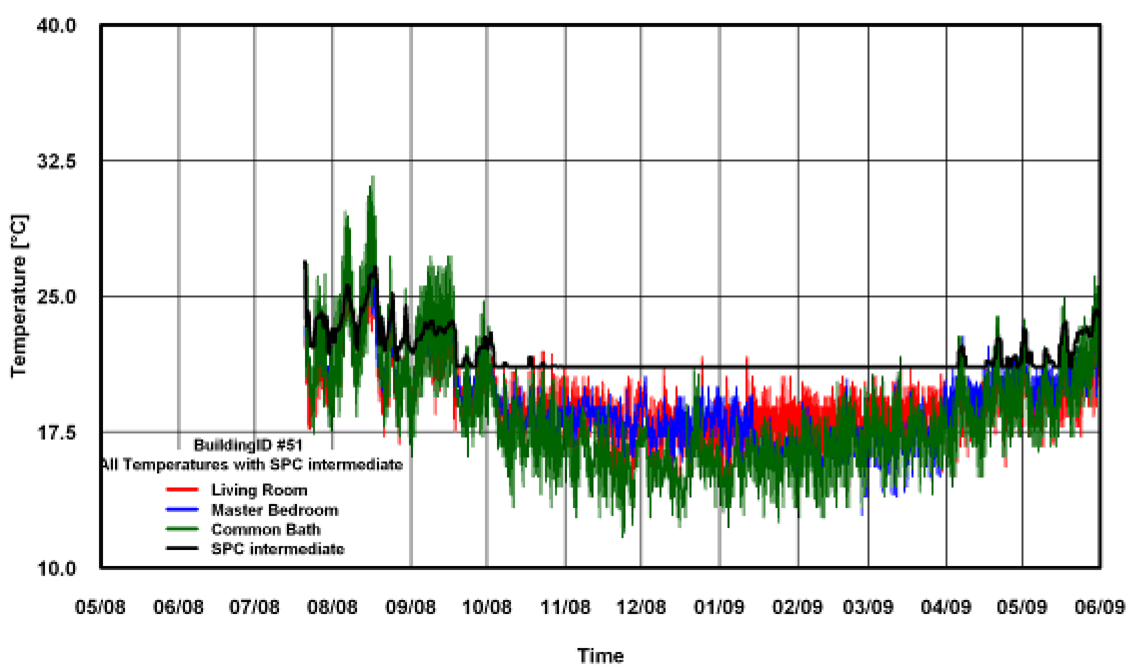

Figure 365: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 51

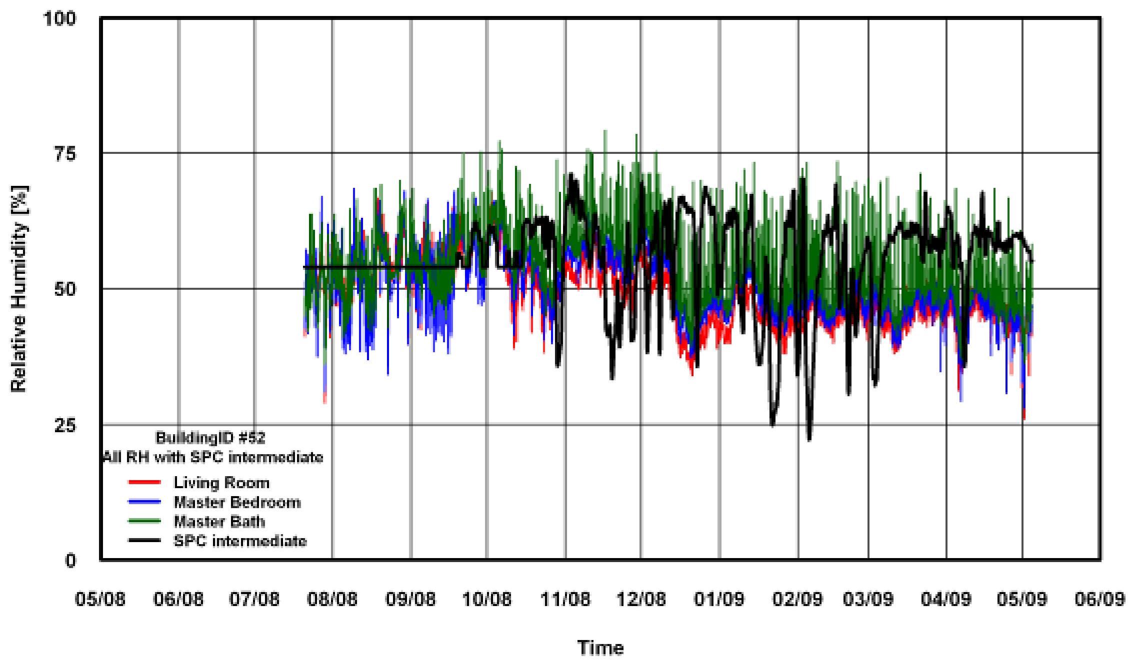

Figure 366: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 52

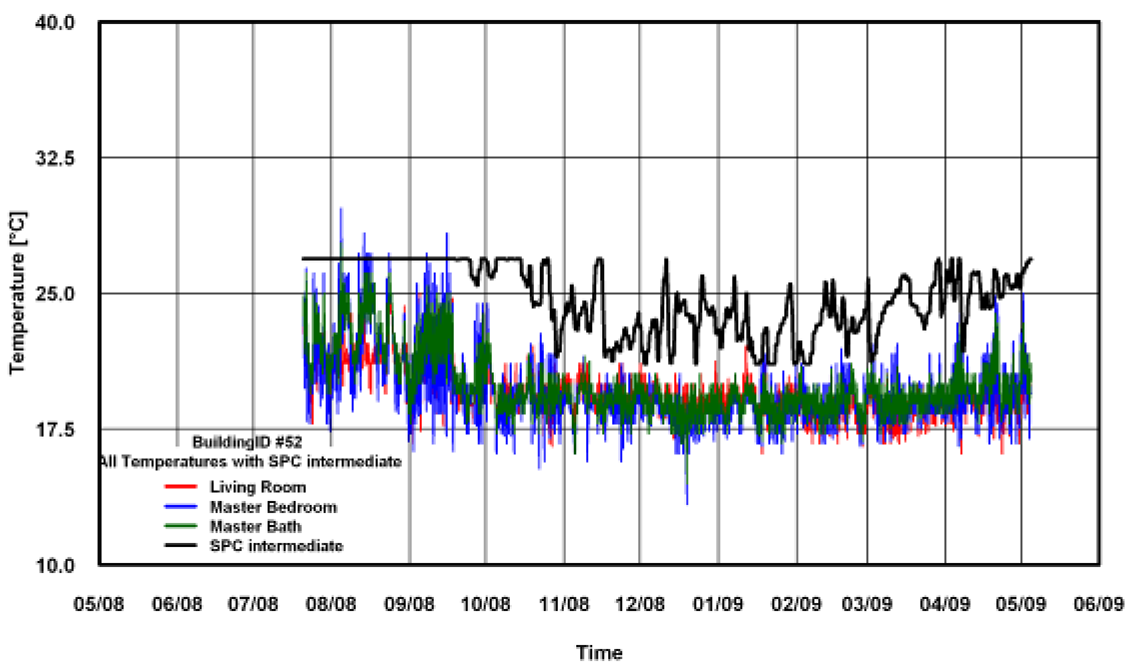

Figure 367: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 52

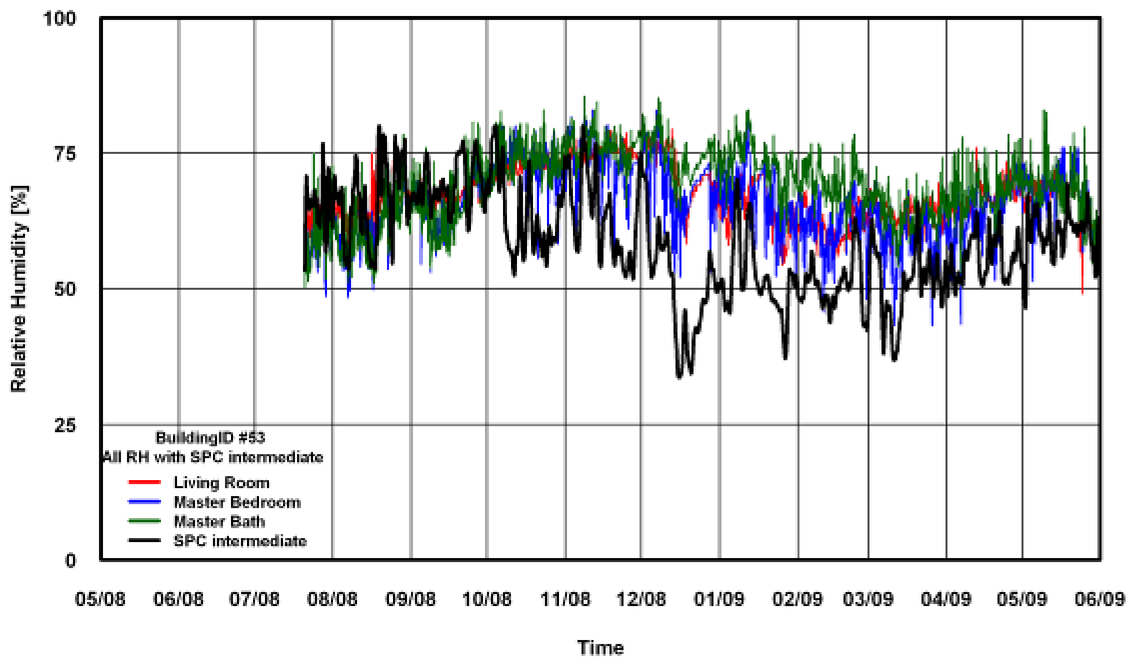

Figure 368: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 53

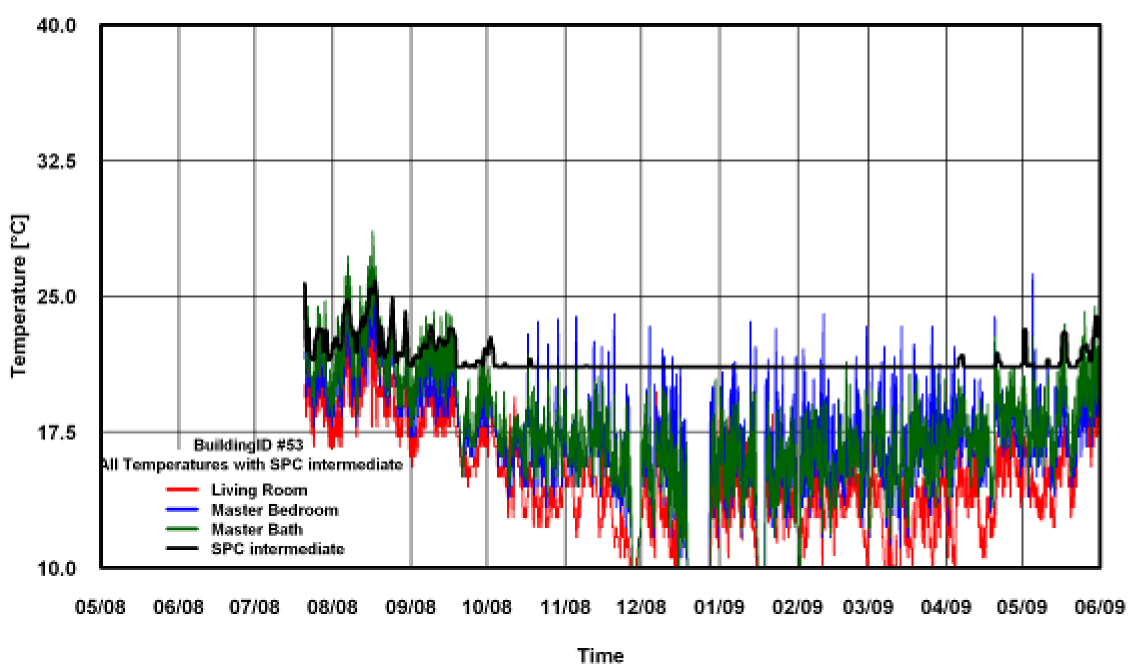

Figure 369: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 53

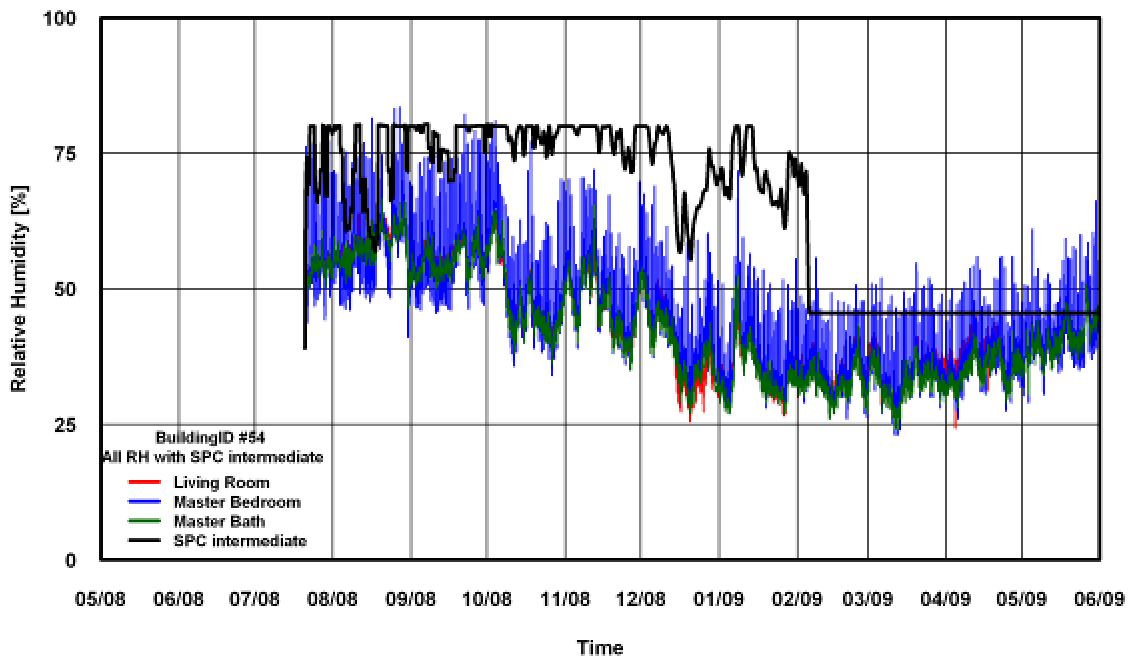

Figure 370: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 54

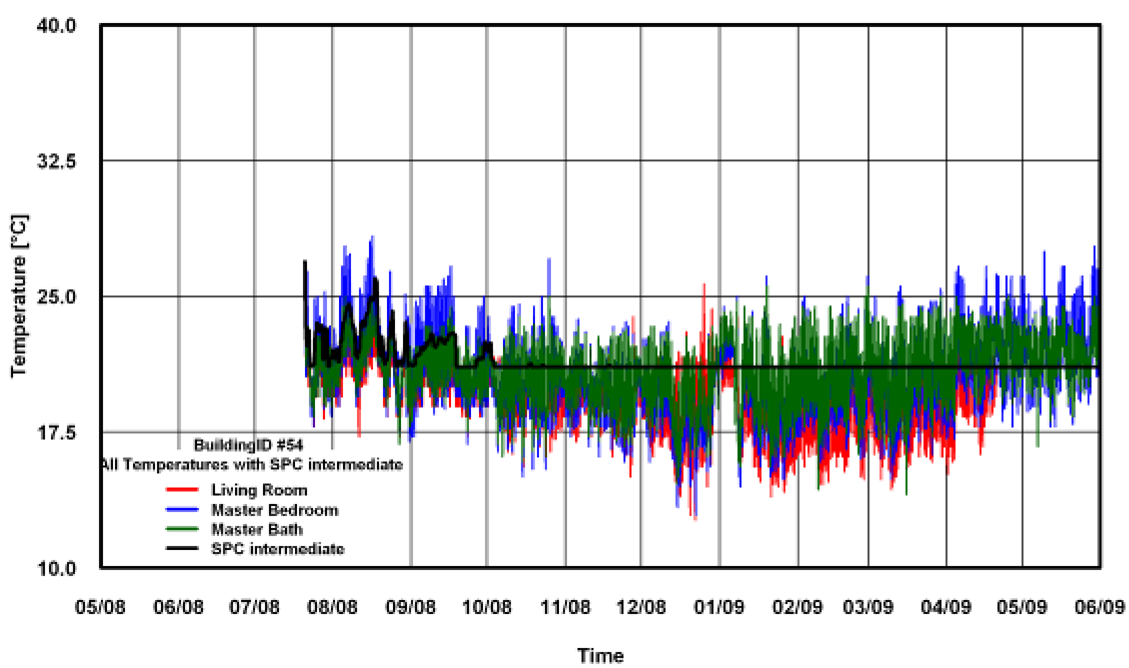

Figure 371: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 54

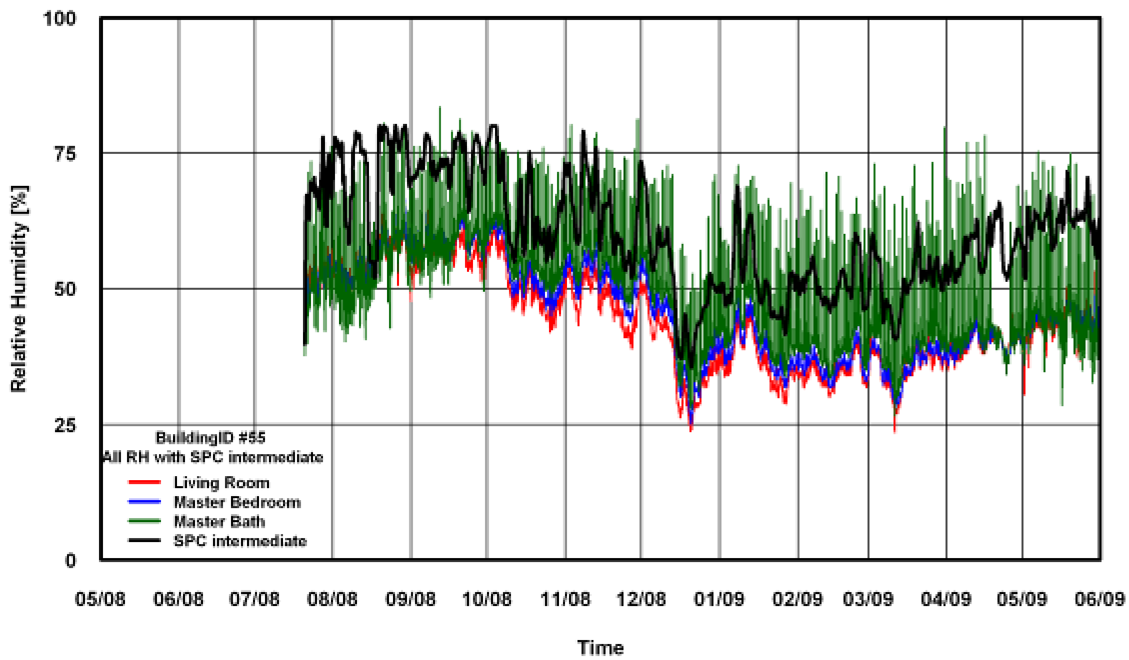

Figure 372: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 55

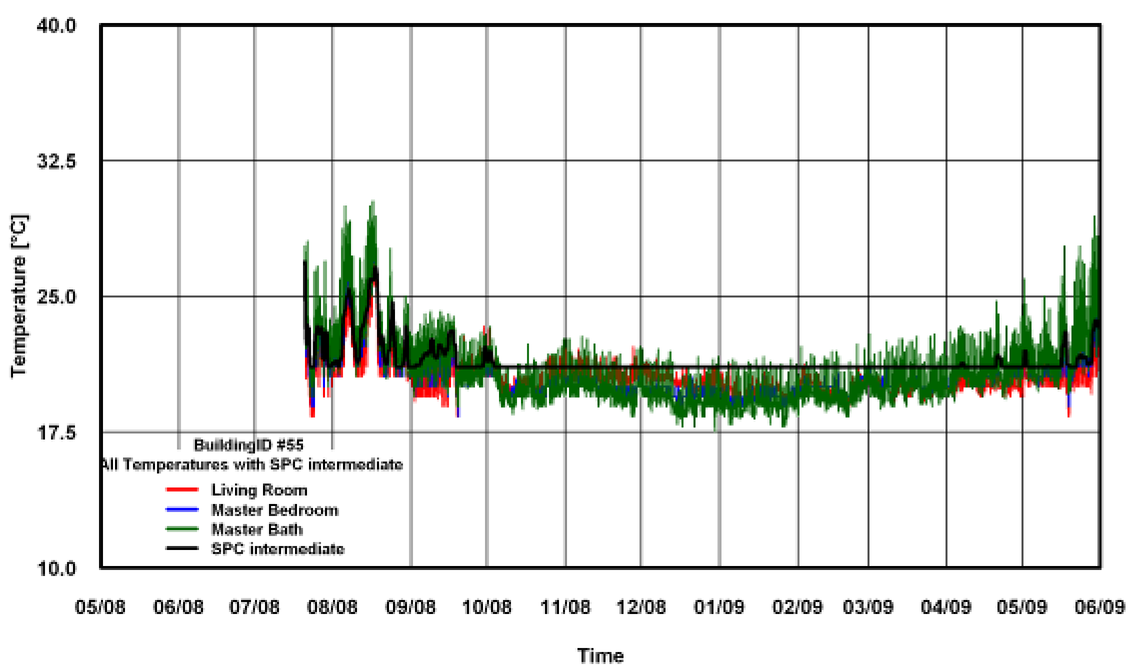

Figure 373: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 55

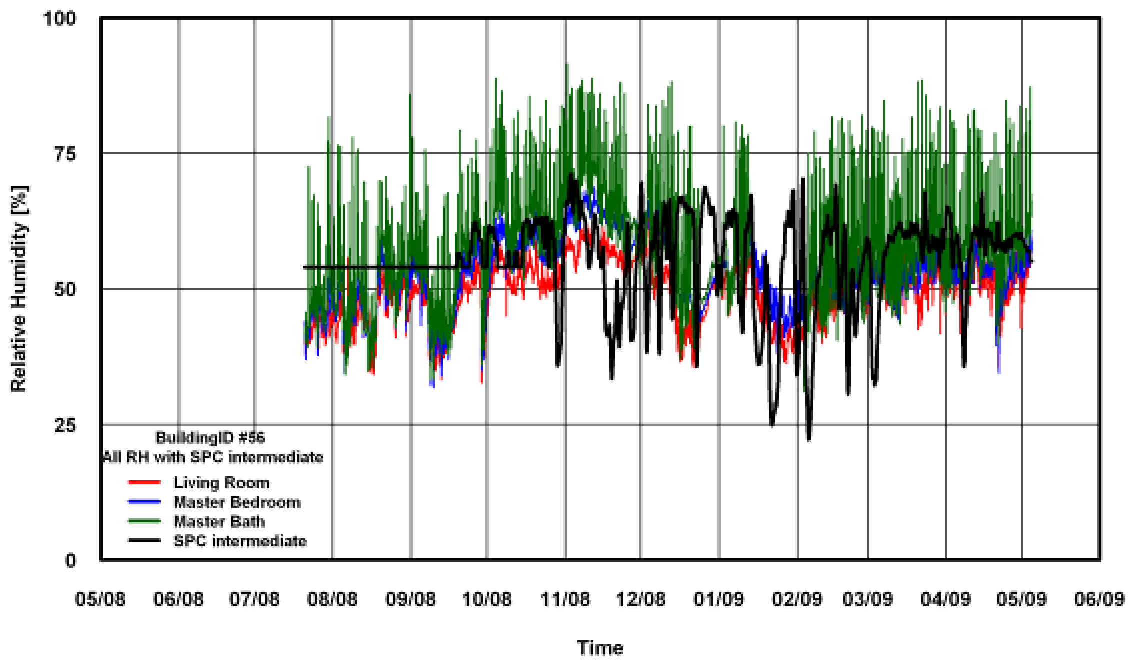

Figure 374: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 56

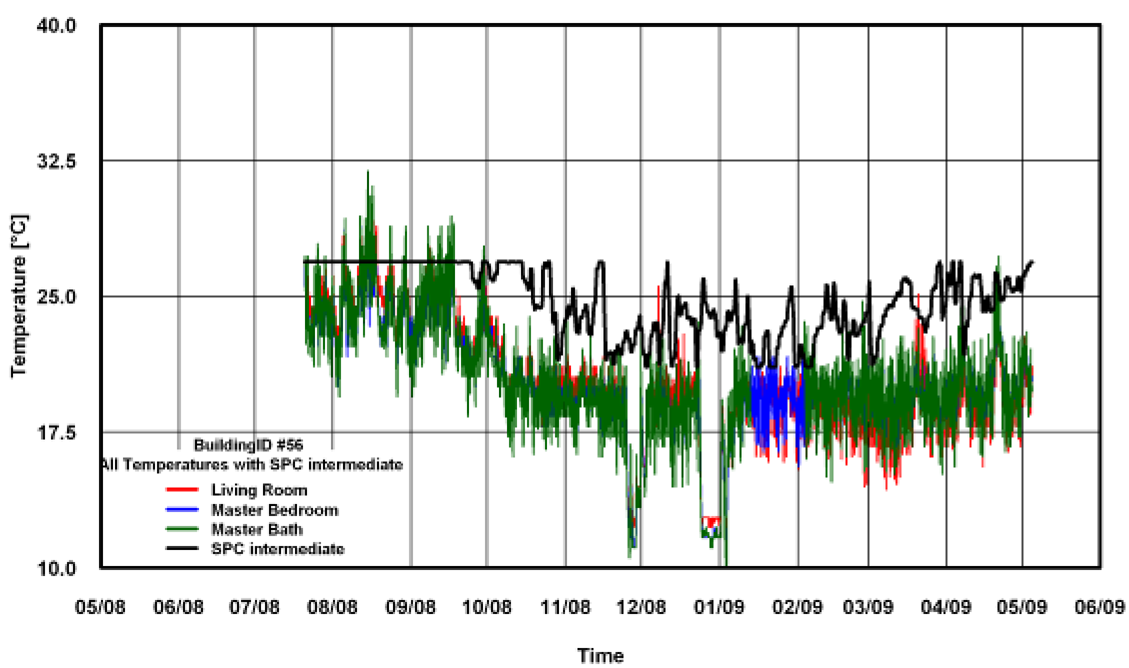

Figure 375: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 56

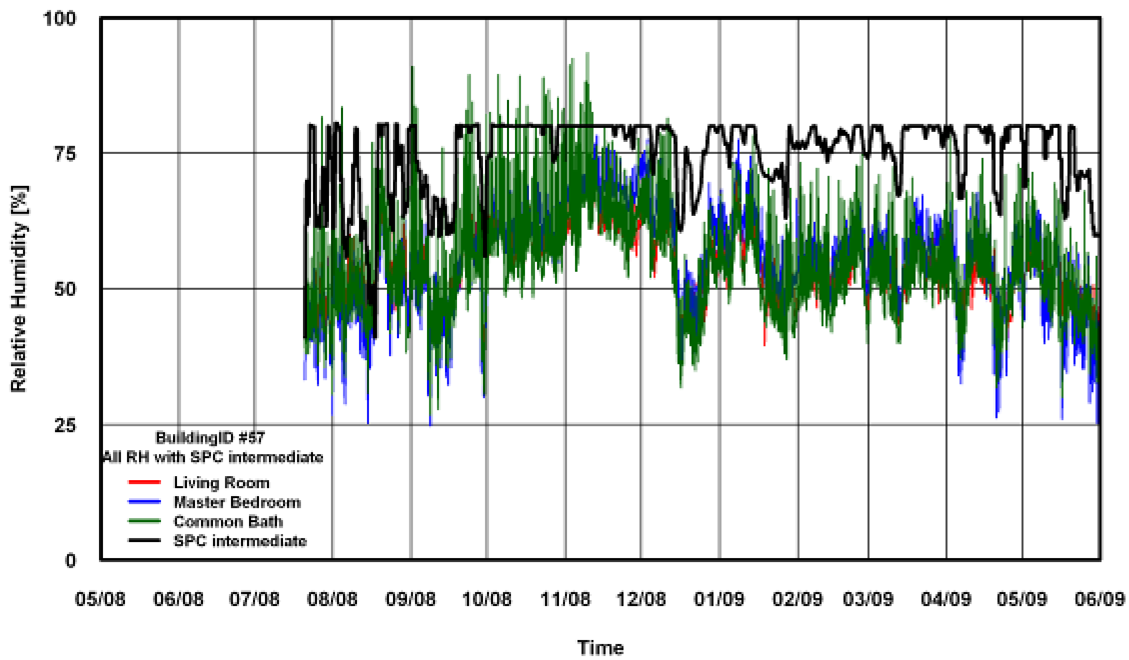

Figure 376: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 57

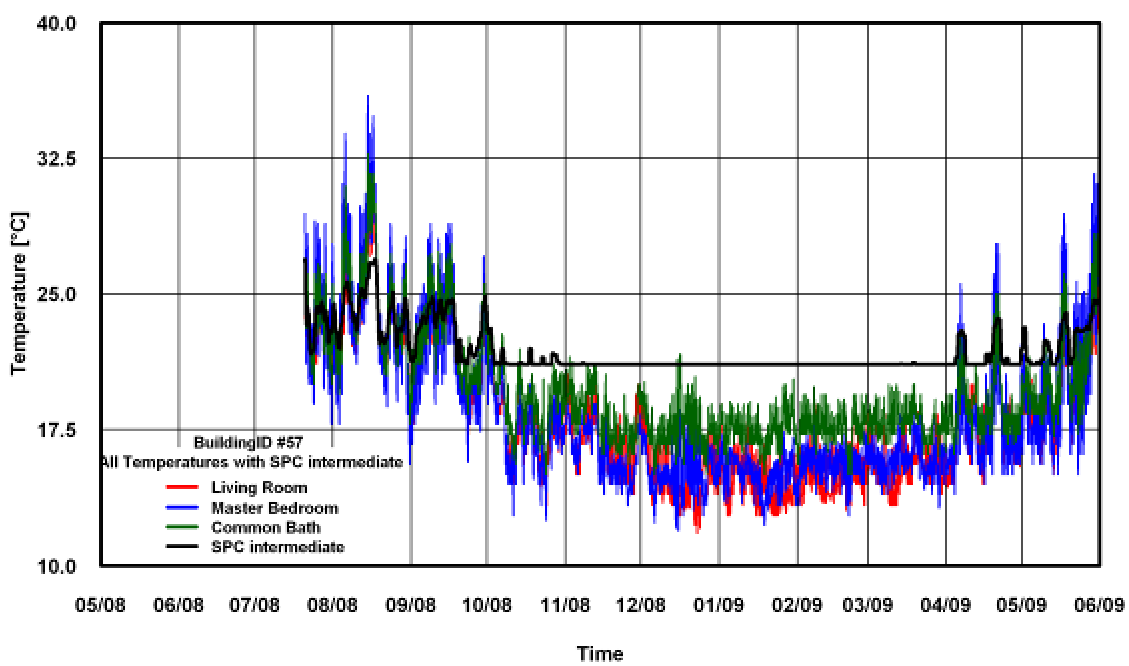

Figure 377: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 57

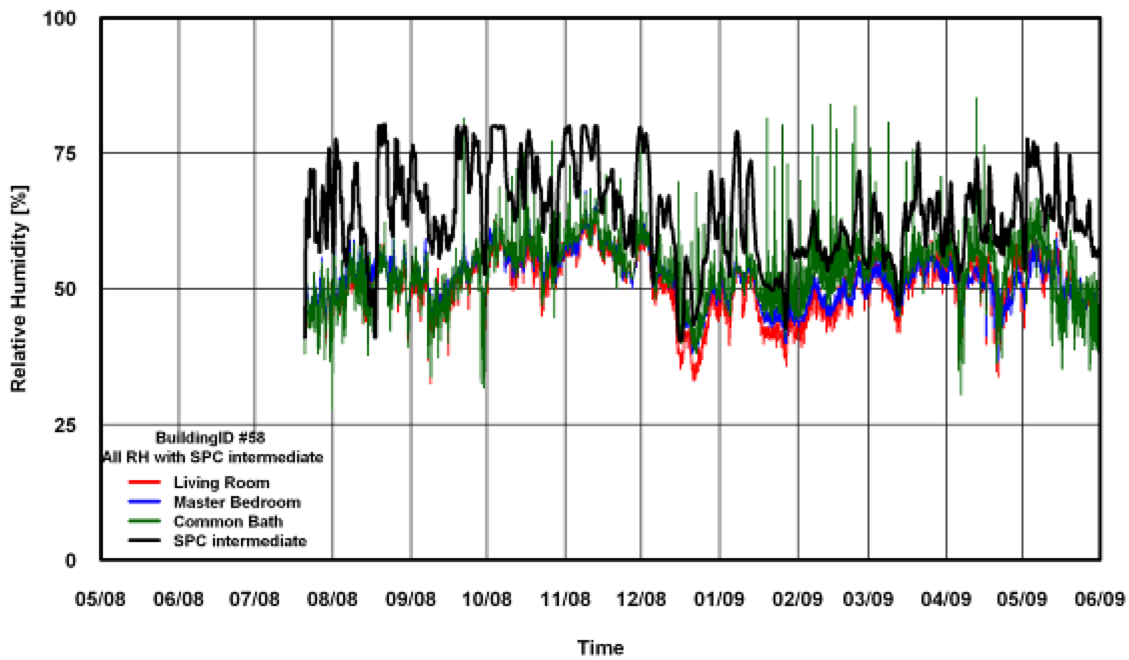

Figure 378: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 58

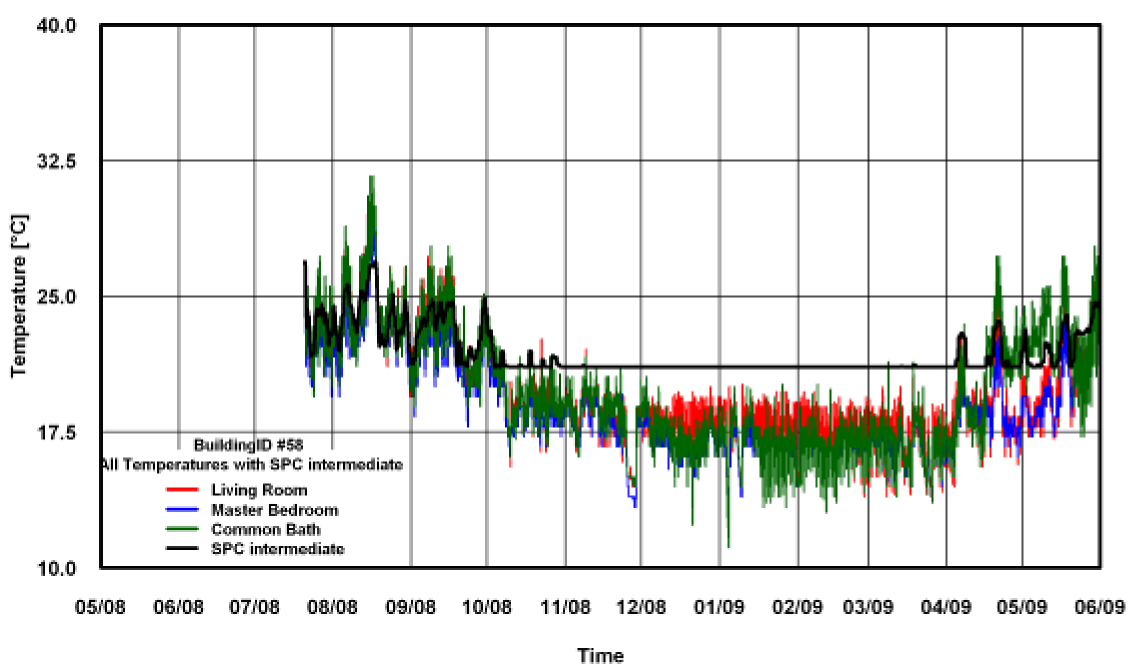

Figure 379: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 58

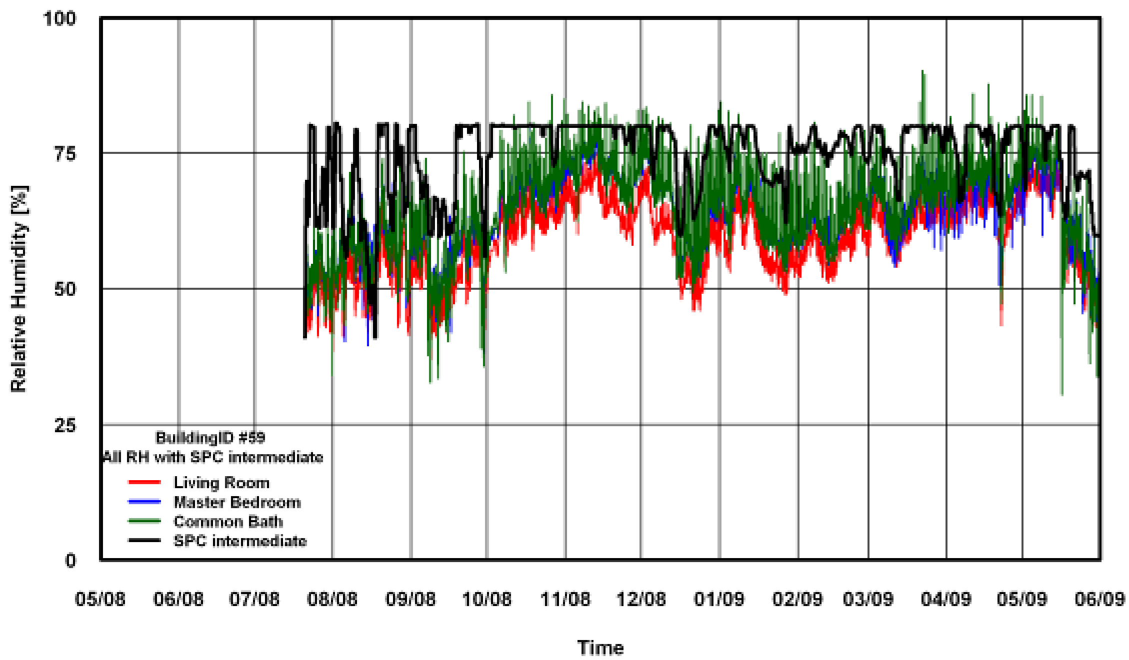

Figure 380: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 59

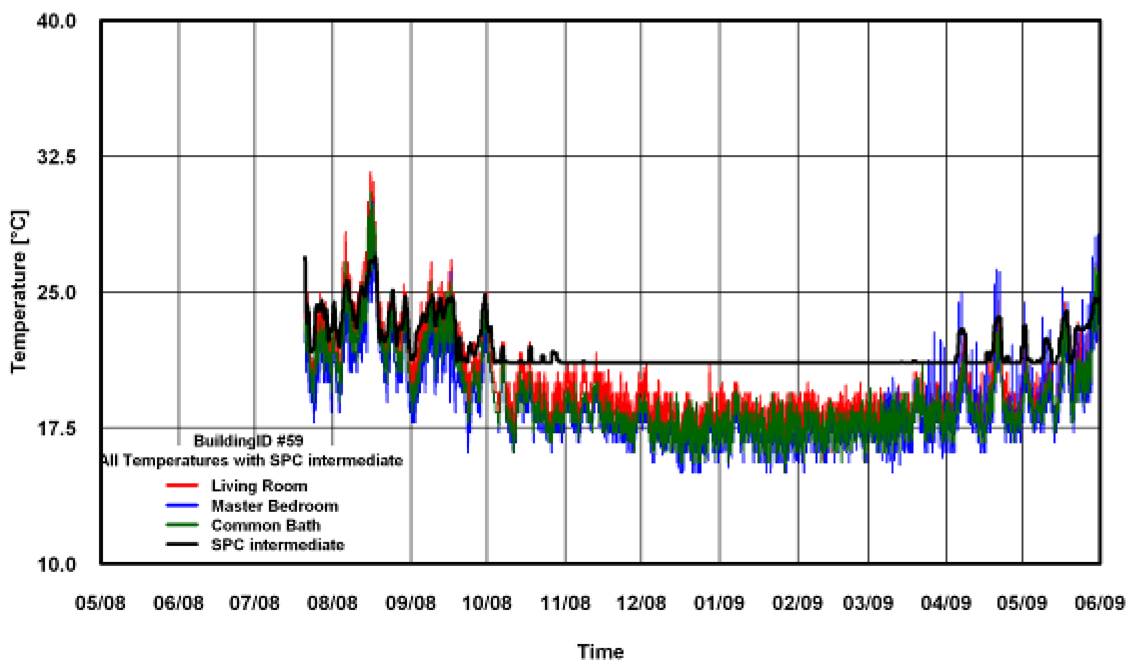

Figure 381: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 59

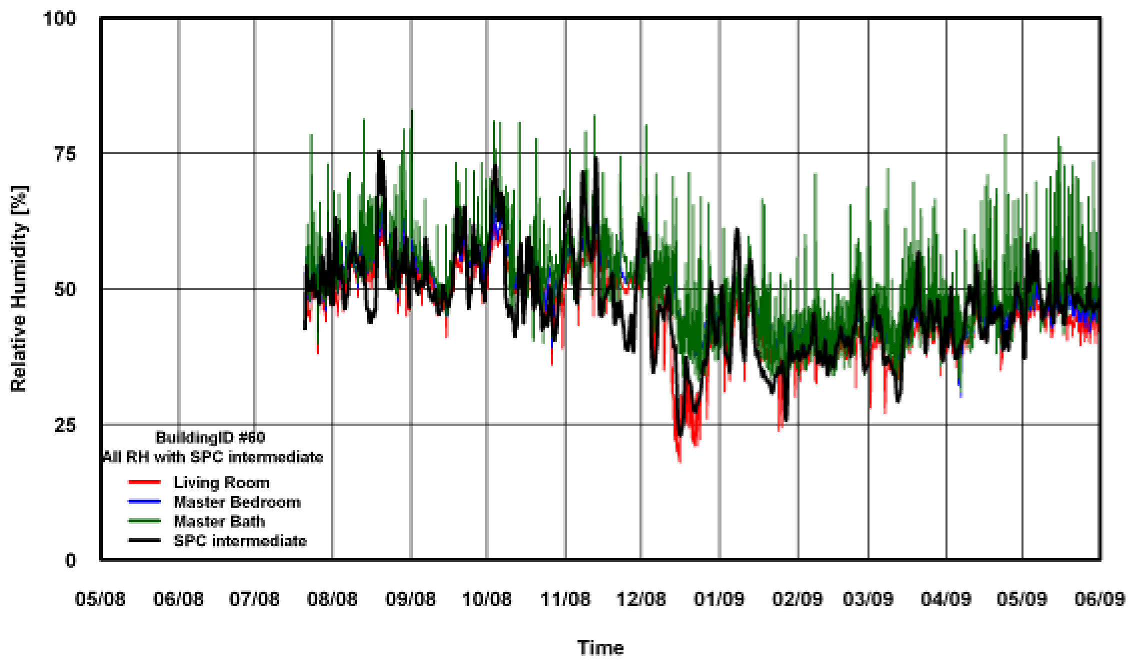

Figure 382: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 60

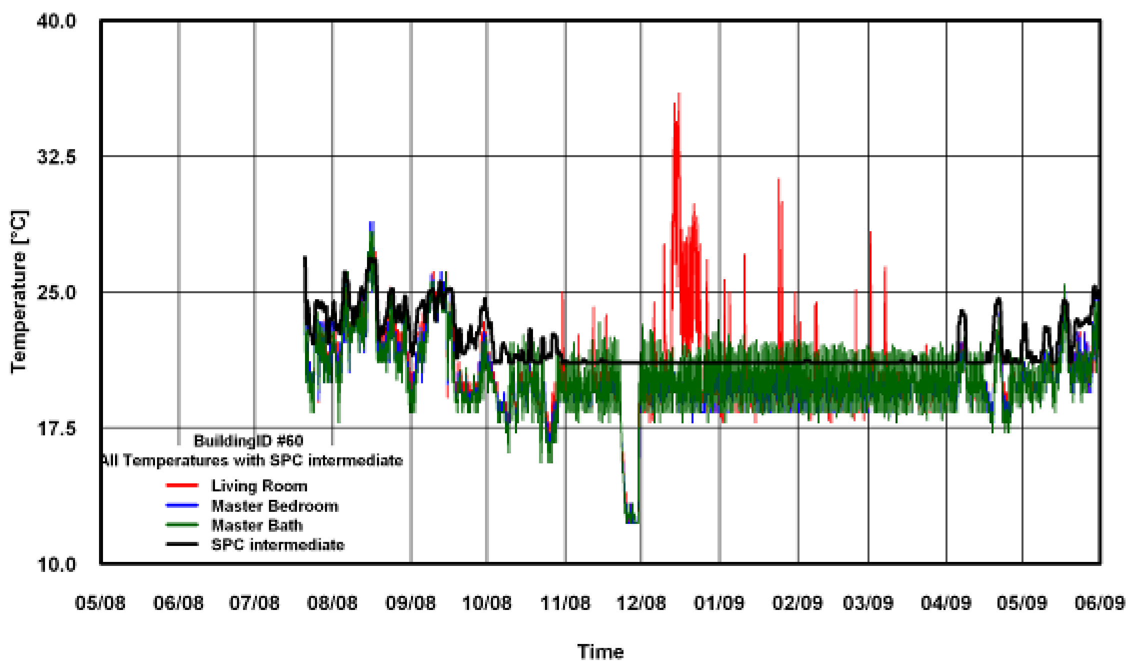

Figure 383: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 60

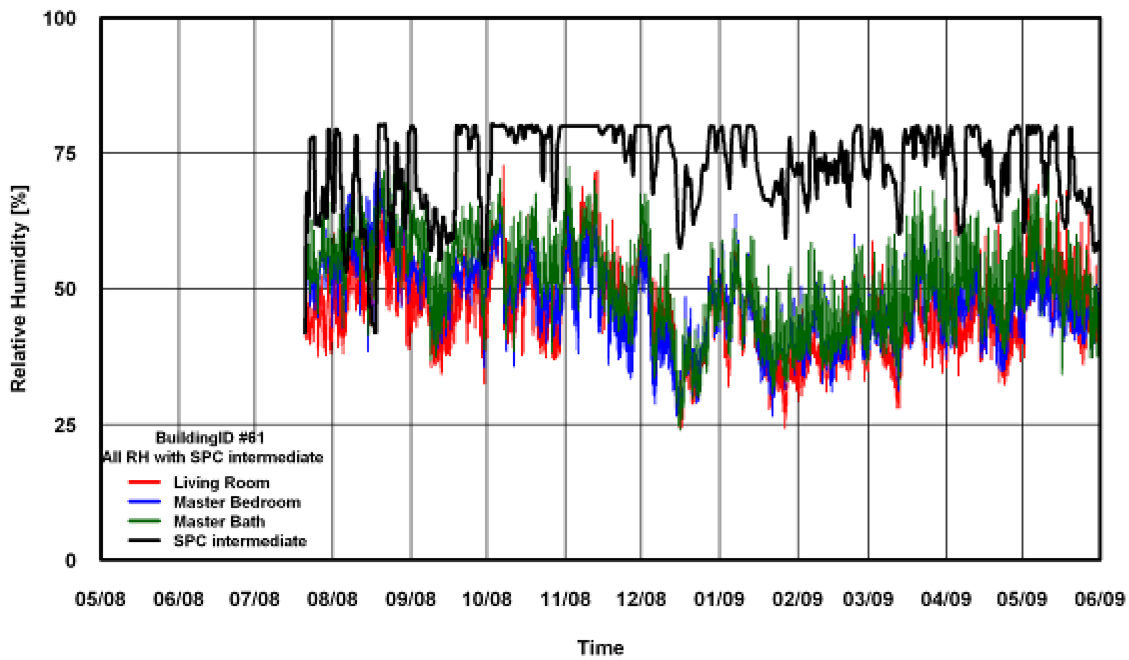

Figure 384: RH Comparison of SPC 160 Intermediate ANK Modified Method for Building # 61

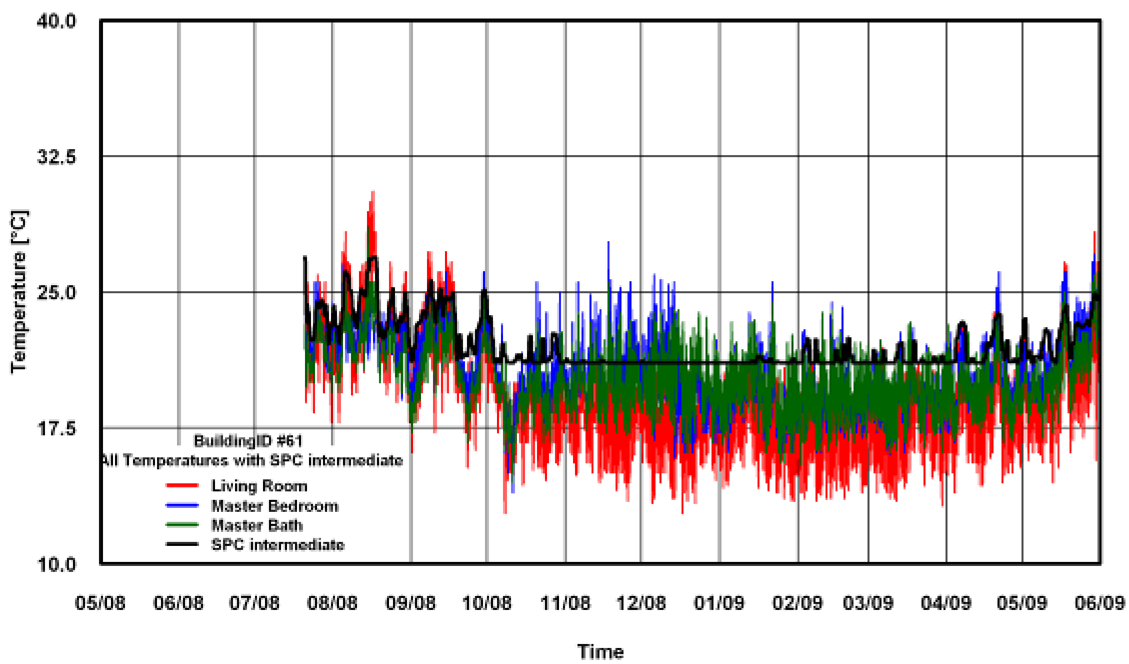

Figure 385: Temperature of SPC 160 Intermediate ANK Modified Method for Building # 61

APPENDIX D

Additional Analysis

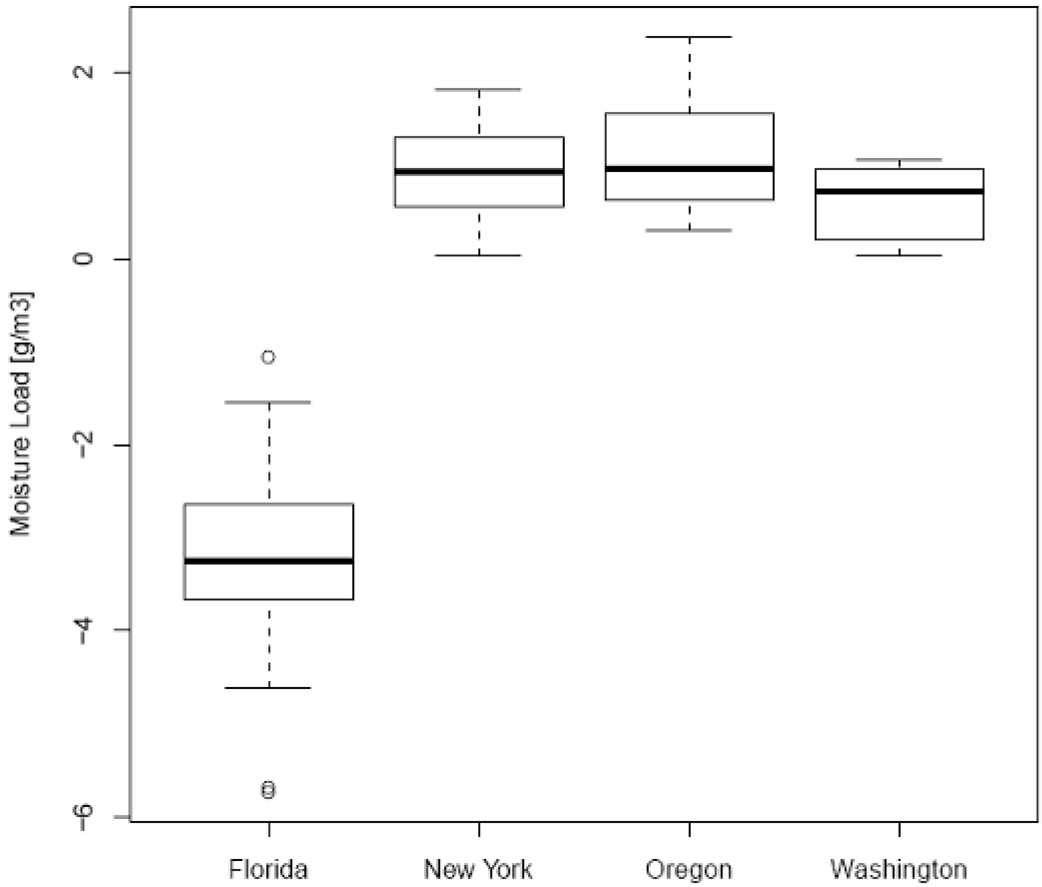

Figure 386: Impact of location on Moisture Load (g/m^3)

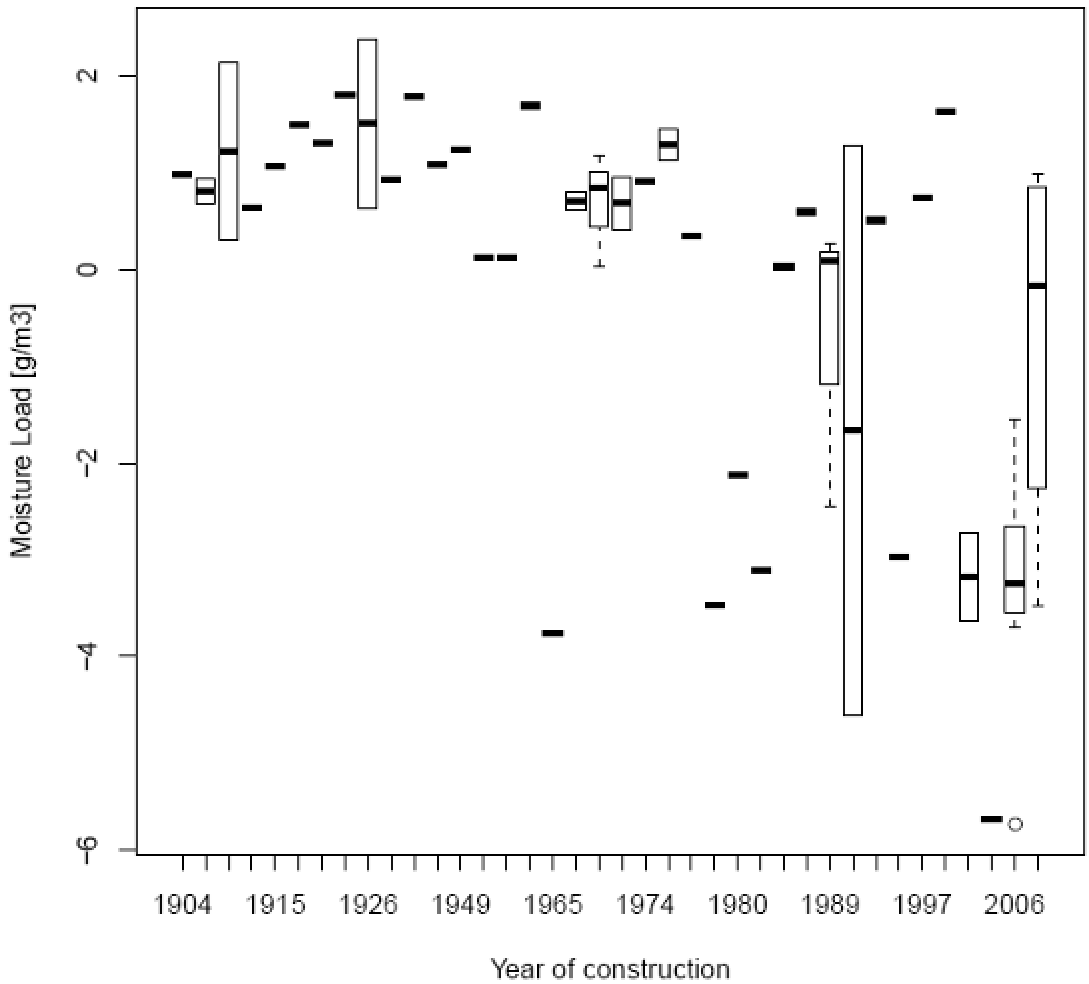

Figure 387: Impact of Year of Construction on Moisture Load (g/m^3)

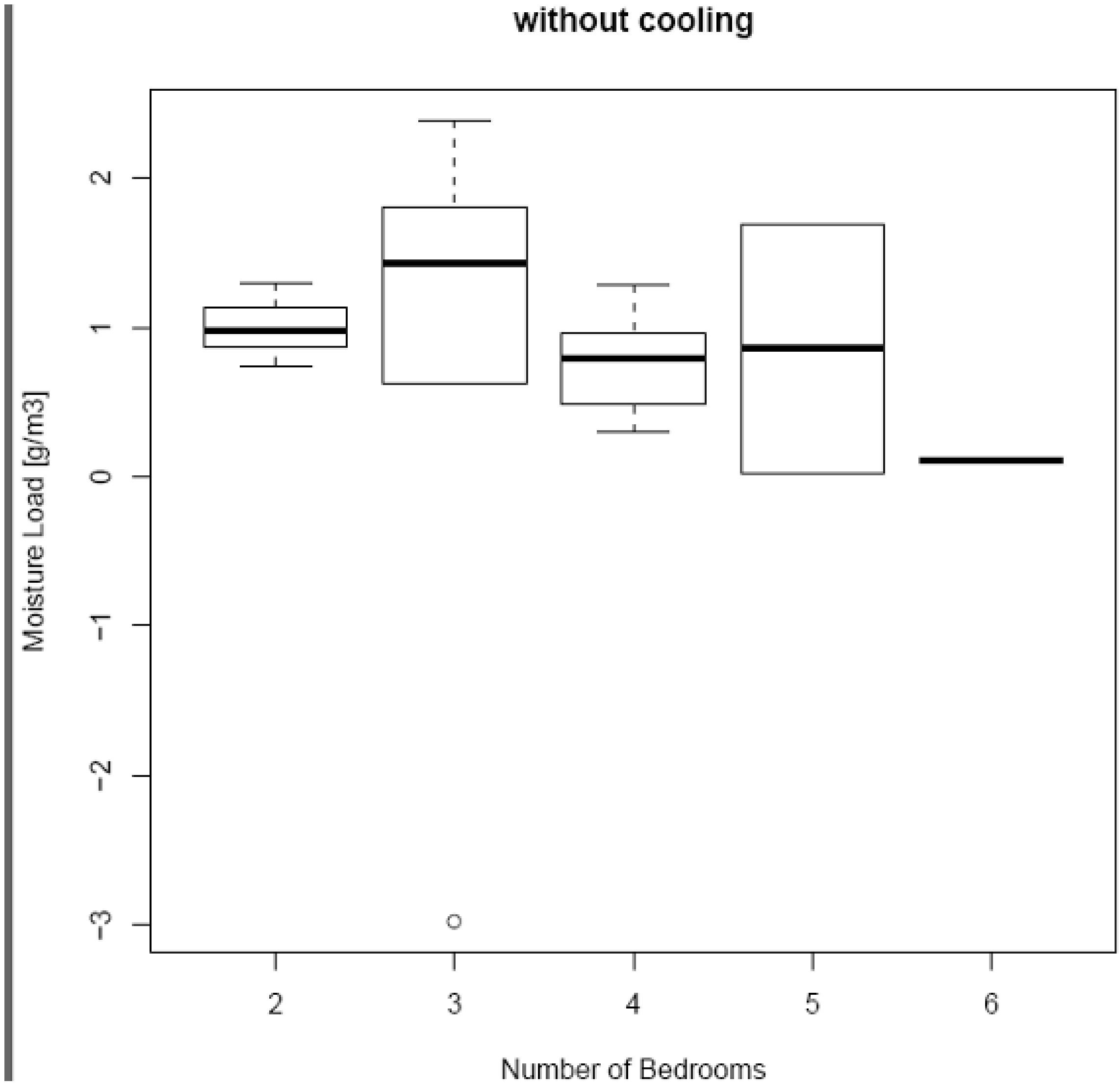

Figure 388: Impact of Number of Bedrooms on Moisture Load (g/m^3)

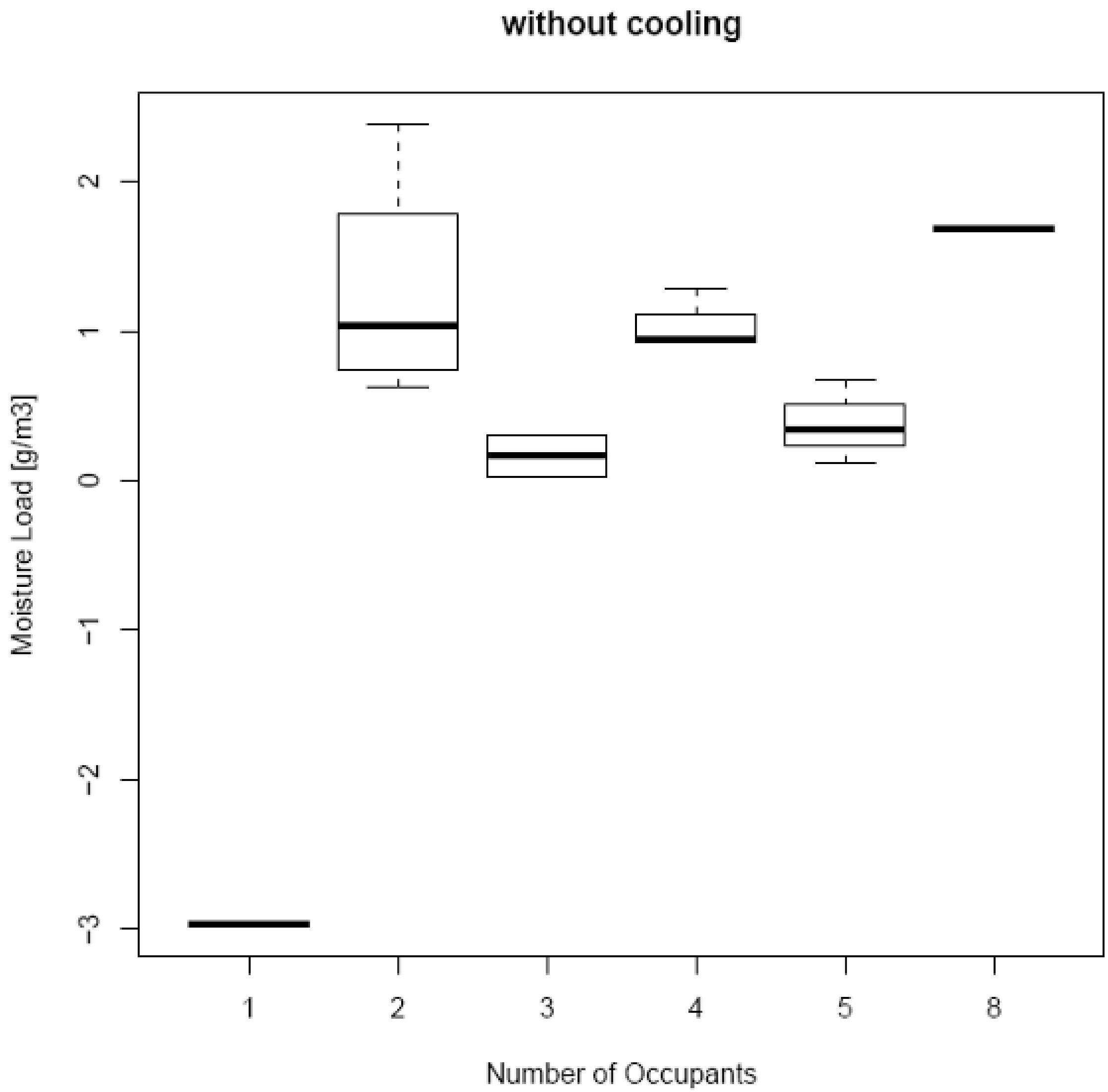

Figure 389: Impact of Number of Occupants on Moisture Load (g/m^3)

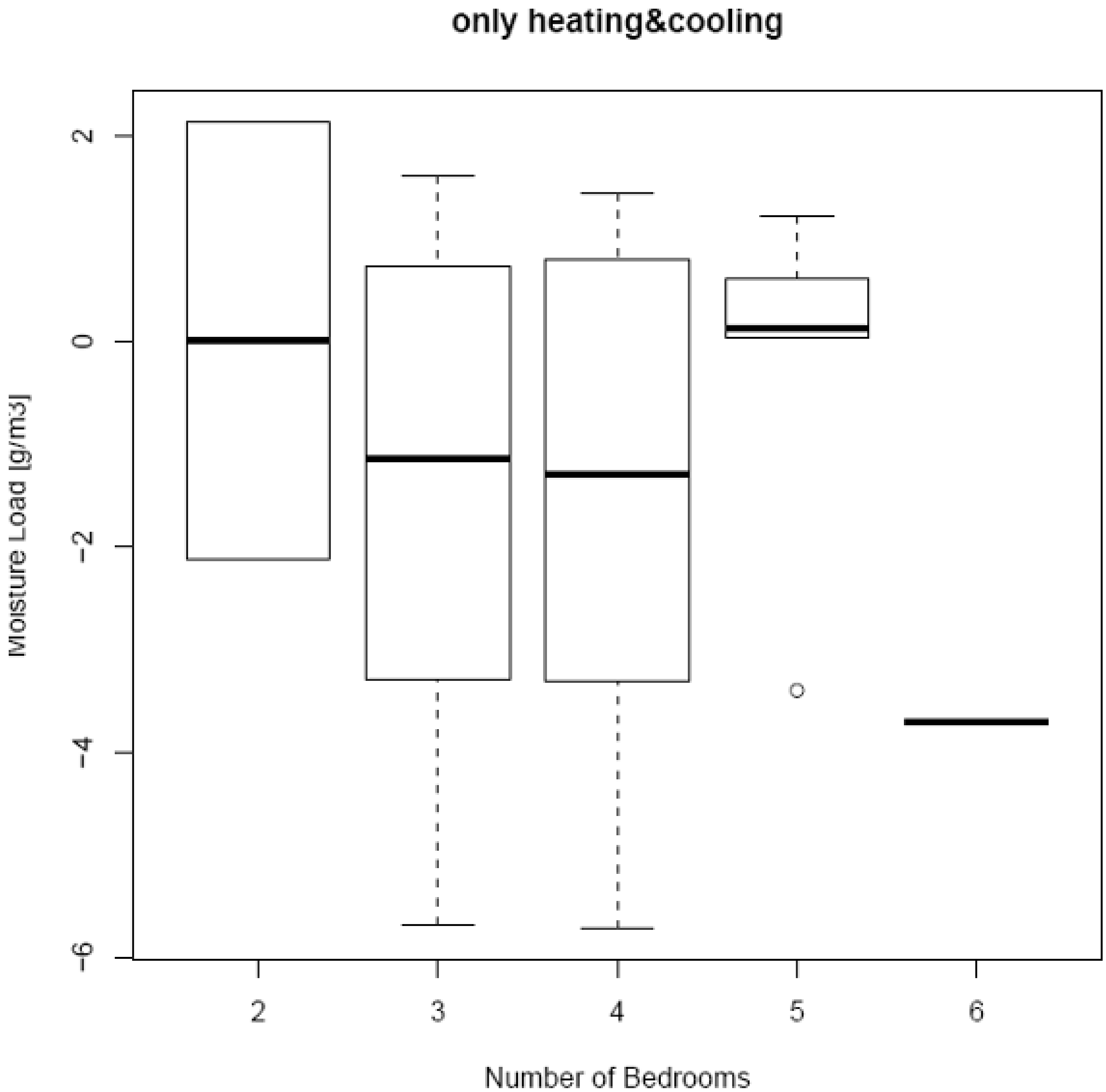

Figure 390: Impact of Number of Bedrooms on Moisture Load (g/m^3)

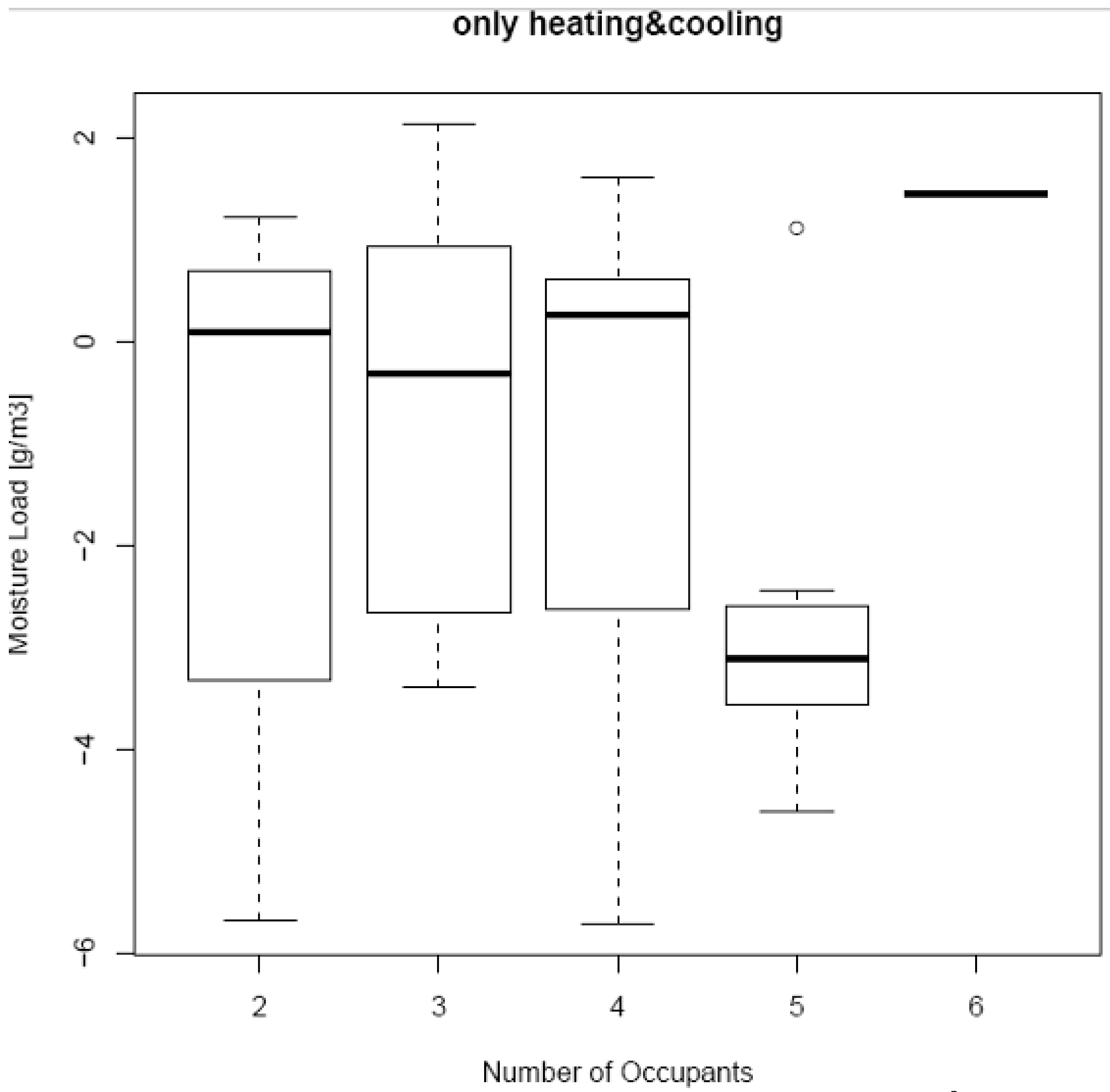

Figure 391: Impact of Number of Occupants on Moisture Load (g/m^3)

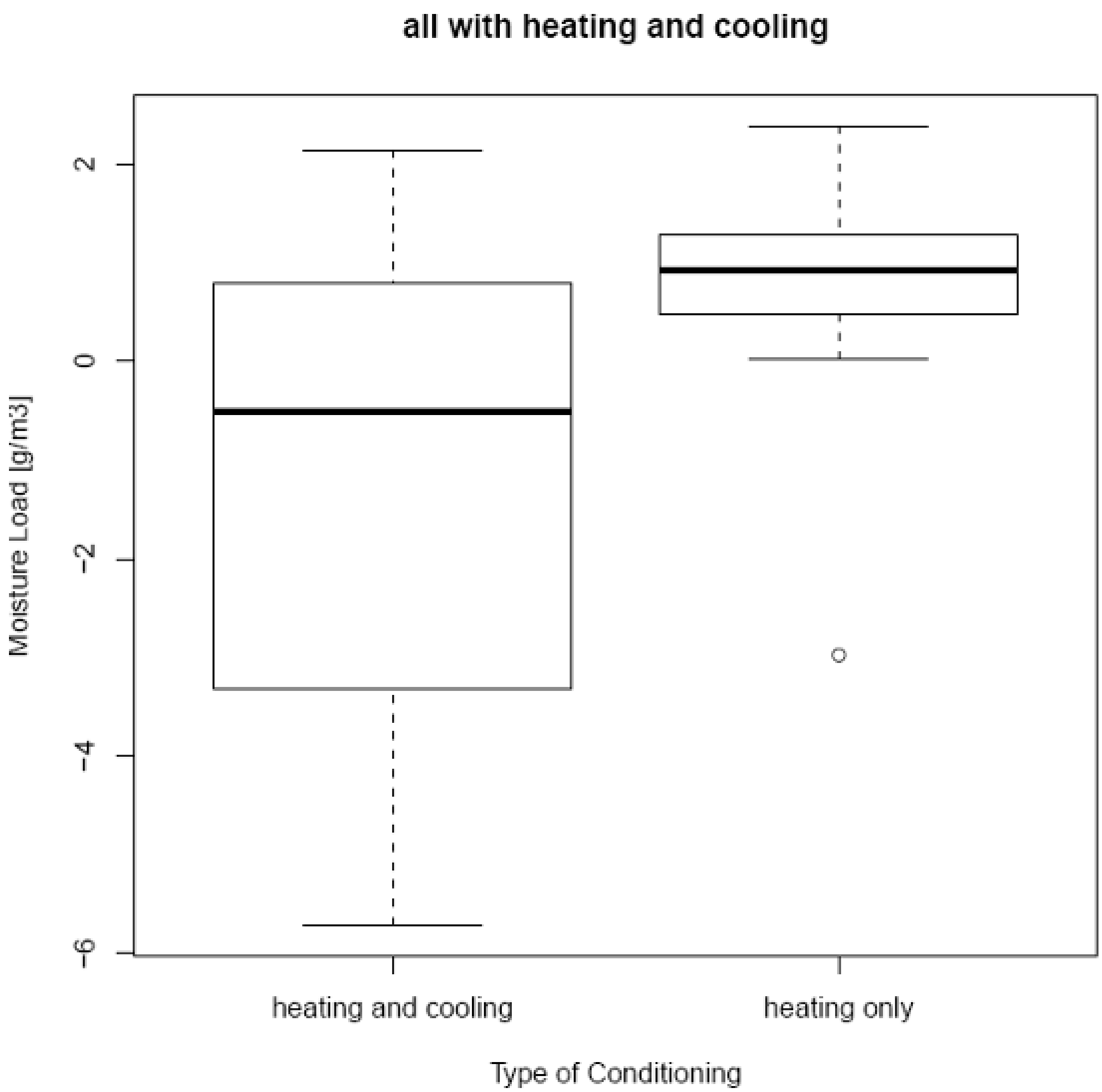

Figure 392: Impact of Type of Conditioning on Moisture Load (g/m^3)