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RESOLUTION No. 6

"Risk management procedures in the Securities System and other related issues"

Codified to include the decisions dated 16.3.2015, 18.5.2015, 26.10.2015, 24.09.2018, 29.10.2018, 26.11.2018 and 25.01.2019 of the Board of Directors

THE BOARD OF DIRECTORS

OF ATHENS EXCHANGE CLEARING HOUSE S.A. (ATHEXCLEAR)

(Meeting 113/6-2-2015)

Having regard to the provisions of § 1.4, § 2.4.12, § 2.7¹, § 4.2, § 4.3, § 5.1, § 5.2, § 5.4.1, § 5.4.2, § 6.6 and § 6.8.1, Section II of the Rulebook for Clearing Transactions in Book-Entry Securities (henceforth the "Rulebook")

HEREBY RESOLVES AS FOLLOWS

PART 1. Scope & Definitions

1.1 Scope

1. This Resolution sets out the risk management procedures of the Securities System in implementation of the Rulebook and other relevant issues.

2. In particular, the Resolution specifies the following matters:

- a. Calculation of the Margin Requirement of § 6.6 and § 6.8.1, Section II of the Rulebook.
- b. Definition of Acceptable Collateral for meeting the Margin Requirement of § 4.2, Section II of the Rulebook.

- c. Rules for calculating the Default Fund of § 5.2, § 5.4.1 and § 5.4.2, Section II of the Rulebook.
- d. The Cash Holdings of § 1.4 and § 5.1, Section II of the Rulebook.
- e. Methodology for calculating the Margin Provision Requirements and Intraday Risk of § 6.6 and § 6.8.1, Section II of the Rulebook.
- f. Provision of information for the management of related risk concentrations as per § 2.4.12, Section II of the Rulebook.

1.2 Definitions

1. The terms and definitions used in this Resolution shall have the same meaning as the corresponding terms and definitions in the Rulebook and in the Market Rulebook², unless otherwise expressly stipulated.
2. In all cases, the provisions of this Resolution shall be construed in accordance with the rules and principles set out in paragraph 5 of the Scope of the Rulebook.

PART 2. Calculation of the Margin Requirement of § 6.6 and the Intraday Risk of § 6.8.1, Section II of the Rulebook

2.1 Calculation of the Margin requirement of § 6.6, Section II of the Rulebook

1. The Margin requirement is calculated for each Clearing Account following the finalization of positions for the purpose of verifying the adequacy of the Collateral of the respective Account and assigning the Credit Limits of § 6.7, Section II of the Rulebook.
2. The Margin requirement is calculated on the basis of the provisions of § 6.6, Section II of the Rulebook as these provisions are further specified in this Resolution, and is based on the calculation of the loss that would be caused by an adverse change in the value of the positions corresponding to a Clearing Account during the time it would take to close such positions in the worst case scenario with a certain level of confidence, as such levels are determined by means of the Margin calculation parameters of § 2.2.
3. In addition to the above, a special Margin requirement (hereinafter "Pre-Admission Margin") is obligatory in the case of non-finalized positions arising from the Pre-Admission transactions of ATHEX Resolution 35 in accordance with the specific provisions of § 2.4 hereof. For the purposes of this resolution, non-finalized positions of Pre-Admission transactions of ATHEX Resolution 35 (hereinafter "non-finalized Pre-Admission positions") refer to the offset positions that arise from Pre-Admission transactions carried out within the relevant trading period in accordance with the Pre-Admission procedure, until these are finalized upon listing approval and the commencement of trading of the respective (pending listing) transferable securities on the ATHEX Market. The method of calculating the "Pre-Admission Margin" is described in § 2.4 hereof.
4. ATHEXClear shall at any time be entitled to modify the calculation and valuation methods for any variable used to determine Margin for the purpose of protecting the market. ATHEXClear shall also be entitled at any time to increase the Margin requirements not only for all Clearing Accounts but also for individual Accounts, and to set a deadline for meeting such requirements, particularly taking into consideration any imminent Risks.³

2.2 Margin calculation parameters of § 6.6, Section II of the Rulebook

1. The parameters used by the model to calculate Risk and consequently also Margin requirement are:

- the Specific Risk Coefficient of a transferable security (ϵ_i),
- the General Risk Coefficient of a transferable security (γ_i) and
- the window classes (correlation groups) comprising transferable securities to which offsetting of the General Risk shall be applied.

2. The Specific and General Risk Coefficients of stocks, ETFs and warrants are determined per transferable security in accordance with § 2.3.

3. The Specific and General Risk Coefficients of bonds are determined on the basis of the segment to which they belong, as these are announced by ATHEXClear and in accordance with § 2.3.

4. In the case of transferable securities belonging to the "Under Surveillance" segment, as defined in the Market Rulebook, the Specific Risk Coefficient is set at 100% and the General Risk Coefficient at 0%.

If a transferable security is placed in the "Under Surveillance" segment, the Coefficients will be set at the above rates. In cases where securities cease to belong to the "Under Surveillance" segment, the Coefficients will be determined by the competent department of ATHEXClear by applying the methodology of § 2.3.⁴

5. In the case of transferable securities characterized as having low trading activity, the Specific Risk Coefficient is set at 100% and the General Risk Coefficient at 0%. Transferable securities with low trading activity are those securities that do not satisfy the minimum number of business days with non-zero trading volume which must exist during the preceding 12-month period.⁵

6. Specifically with respect to transferable securities whose trading is suspended, the Specific Risk Coefficient is set at 100% and the General Risk Coefficient at 0%, except in the following cases:

- temporary suspension due to the taking of corporate actions, and
- suspension due to the late, according to provisions in force, notification by the issuer of the transferable securities to Athens Exchange. In such cases, the Coefficients shall be set at the above rates, provided the suspension lasts for a period longer than two (2) business days.

For the purpose of lifting the trading suspension, the Coefficients will be set by the competent department of ATHEXClear through implementation of the terms of paragraphs 2 to 4, as applicable.

7. For the admission to trading of a new transferable security, the Coefficients will be set by the competent department of ATHEXClear through implementation of the terms of paragraphs 2 to 4, as applicable.

8. For the admission to trading of pre-emptive rights on shares, the Specific Risk Coefficient shall be equal to the sum of the Specific and General Risk Coefficients of the underlying share multiplied by a leverage ratio in accordance with the specific procedures of ATHEXClear, while the General Risk Coefficient shall be equal to 0.

9. In the case of transferable securities pending listing, for which the Pre-Admission procedure is being carried out in accordance with ATHEX Resolution 35, the General Risk Coefficient shall be equal to 0%, while the Specific Risk Coefficient will be determined by the competent department of ATHEXClear by using the methodology of § 2.3, as applicable.⁶

2.3 Methodology for Determining and Adjusting Parameters used in Margin Calculation as per § 6.6, Section II of the Rulebook

1. The parameters used in calculating the Margin of § 2.2 are regularly reviewed and adjusted on a quarterly basis within a time limit of ten (10) business days from the beginning of each calendar month or on an extraordinary basis, by applying the calculation methodology detailed in the following paragraphs and the specific procedures of ATHEXClear. For each adjustment, ATHEXClear shall announce the new parameter values and when they are to be applied.⁷
2. ATHEXClear shall also conduct backtesting on a daily basis to verify Margin adequacy, in accordance with § 2.6.1 of this Resolution, as well as a sensitivity analysis on a monthly or more frequent basis in order to assess the Margin calculation model, in accordance with § 2.6.2 of this Resolution, and, in cases of insufficient coverage on the basis of its specific procedures, shall carry out an extraordinary adjustment to the parameter values or adjust their calculation methodology, each time announcing when any changes are to be applied.
3. The methodology for calculating the parameter values that are taken into account in the Margin calculation model is based on the following data.

a) Confidence Level

This is the Confidence Level on the basis of which the calculated Margin should – on the evidence of statistical tests performed – cover the relevant exposures.

The Confidence Level is set at 99.0%.

b) Clearing Period Time Frame

This is the period of time that is estimated will elapse from the last commitment and valuation of Collateral and the securing of the Risk entailed by the position up until its final closure. More specifically:

- b.1) Risk management parameters are first calculated and subsequently reviewed on a regular basis so that on the basis of historical data they cover 2-day changes with the above confidence level.
- b.2) To address cases of increased risk concentration, as per paragraph 8, § 6.6, Section II of the Rulebook, which may further increase the time period from the last commitment and valuation of Collateral and the securing of the Risk entailed by positions up until their final closure, a mechanism is applied for the constant testing and extraordinary adjustment of the Specific Risk Coefficient of a transferable security for an individual Clearing Account and/or for the entire Market.
- b.3) In particular, the following tests and extraordinary adjustments are applied:
 - (a) Extraordinary adjustment of the Specific Risk Coefficient of a transferable security for an individual Clearing Account.

ATHEXClear shall increase, on both a daily and Intraday basis, the Specific Risk Coefficient of a transferable security for an individual Clearing Account by applying a scale factor, when the following two cumulative criteria are met:

- i. the net (non-offset) volume of transactions in the transferable security which are cleared through the relevant Account is higher, on the basis of a certain percentage scale, than the average daily volume of transactions for the 30-day period preceding the calculation day, and
- ii. the value of the above net volume exceeds a certain amount.

(b) Extraordinary adjustment of the Specific Risk Coefficient of a transferable security for all Clearing Accounts.

ATHEXClear shall increase, on both a daily and Intraday basis, the Specific Risk Coefficient of a transferable security for all Clearing Accounts by applying a scale factor, when the following two cumulative criteria are met:

- i. the sum of net buy volumes of transactions in the transferable security in all Clearing Accounts is higher, on the basis of a certain percentage scale, than the average daily volume of transactions for the 30-day period preceding the calculation date, and
- ii. the value of transactions in the transferable security exceeds a certain amount.

b.4) The test performed during the Market session takes into account transactions already executed, whereas the test performed after finalization of transactions concluded in the respective session takes into account all existing positions, as these have arisen per trading day from transactions concluded up to and including that session.

b.5) The scale factor is set in such a way as to reflect the total number of days from the last commitment and valuation of Collateral and the securing of the Risk entailed by a position up until its final closure. The scale factors, the quantitative criteria applied for the following tests, as well as the transferable securities to which they are applied, shall be published on ATHEXClear's website.

b.6) In the event of concurrence of adjustment instances (a) and (b) of subparagraph b.3, the greater of the two adjusted Coefficients shall be applied.

b.7) The above adjustments do not apply to transferable securities for which the Specific Risk Coefficient before or after application of the scale factor is equal to or greater than 100%.

b.8) By way of exception to the adjustment instances of the preceding paragraphs, in special cases that do not entail increased Risk in the market, such as placements or corporate actions (including stock splits) accompanied by an increased volume of transactions though without an increase in the associated Risk, the adjustment envisaged for the case in question shall not be applied, taking also into account the necessary circumstances and conditions of the market.

c) Time Frame for Calculating Historical Volatility

This is the time period whose historical changes will be used to estimate the parameters with the above confidence level.

c.1) The changes taken into account when calculating historical volatility relate to observations of non-zero trading volume as follows:

- existence of a minimum number of non-zero trading volume days during the preceding twelve (12) months, which are weighted with a coefficient of 75%, and
- provided the required number of business days with non-zero trading volume is sufficient, a total number of two hundred and fifty (250) observations must be reached by making up any shortfall from the time period that has been set as the observation supplementation period.
- In order to consider the 3-month period from the last five (5) years to be representative of stressed market conditions in accordance with ATHEXClear procedures, it must have at least thirty (30) observations, which will be weighted with a coefficient of 25%.

For these periods, the relevant parameters are calculated by using the confidence level, the clearing period time frame and the smoothing factor (λ) in accordance with 3a, 3b and 3f.⁸

c.2) The Margin parameters for transferable securities for which there are no available data that would allow application of one of the above methods are calculated on the basis of data for the past twelve (12) months. In such cases, a reserve equal to 25% is added to the parameters, so that it can be temporarily exhausted in periods when estimated Margin requirements rise significantly.

d) In the case of warrants, the Specific Risk Coefficient is determined on the basis of an estimate of the maximum possible price change of each warrant. To determine the Specific Risk Coefficient, certain data are taken into account which relate to the warrant, such as the number of transferable securities which the warrant holder is entitled to acquire, the exercise prices/dates, the expiry date and closing price of the warrant, as well as more specific data relating to the transferable security which the warrant holder is entitled to acquire, such as its General and Specific Risk Coefficients, price volatility and closing price.

e) Offsetting Position Risk

For the purpose of calculating the Margin of § 6.6, Section II of the Rulebook, a window class (correlation group) is set up which comprises:

- (a) shares and
- (b) equity index ETFs.

More specifically:

e.1) The General Risk Coefficient for transferable securities that do not belong to a window class is set at 0. The General and Specific Risk Coefficients for transferable securities belonging to a window class will be determined on the basis of the degree of correlation between each transferable security and an index that is selected as being representative of

the securities comprising that class, in accordance with the specific procedures of ATHEXClear, while their sum will be at least equal to the expected changes of the same security with the above confidence level. Moreover, in order to ensure that the amount of Margin reductions due to Risk offsetting does not exceed 80% of the difference in relation to the sum of the Margin for each transferable security computed separately, the Specific Risk Coefficient is set in such a way that it is equal to at least 20% of the expected changes in the transferable security with the above confidence level.⁹

e.2) At the time of each regular adjustment and/or on any other extraordinary basis, ATHEXClear checks the degree of correlation between the above transferable securities and excludes, in accordance with its procedures, those that do not show a significant and reliable correlation. In the event of a revision of the composition of the above index which results in fulfilment of the relevant criteria by new transferable securities, as well as in cases where new transferable securities that meet the above criteria are accepted for clearing, the competent department of ATHEXClear will check their degree of correlation and calculate the General and Specific Risk Coefficients in accordance with the above methodology, specifying whether they will be included in the window class, as well as the values of the relevant parameters. In the event that a transferable security does not meet the above criteria, it will be removed from the window class and the Specific and General Risk Coefficients will be adjusted accordingly, on the basis of the above methodology.

e.3) ATHEXClear also checks its offsetting of transferable securities, at least annually or more frequently if deemed necessary, using historical and extreme changes in accordance with its procedures. The instruments belonging at any time to a window class will be announced by ATHEXClear on its website.

f) Smoothing Factor (λ) for Historical Volatility (which is announced)

The smoothing factor relates to the degree of weighting of observations that enter into the calculation of the variability in the returns of an asset, giving, depending on the value of the factor, more or less increased weight to more recent observations.¹⁰

2.4 Methodology for Calculating Margin as per § 6.6, Section II of the Rulebook

1. Margin is calculated daily per Clearing Account for the pending transactions of each Clearing Account and derives from the sum of the General Risk (GR), the Specific Risk (SR) and the profit or loss (Mark-to-Market) which results from the valuation of open positions at the last available closing prices (MM).

$$\text{Margin}_T = (\text{GR}_T + \text{SR}_T + \text{MM}_T)$$

where

T = calculation day

The calculation period includes Market trading days (t) on which transactions that remain pending on the calculation day (T) were executed.

2. For those days during which there are non-finalized Pre-Admission positions, the Pre-Admission Margin is calculated daily as the sum of the Specific Pre-Admission Risk (SPR_T^P) and the profit or loss (Mark-to-Market) deriving from the valuation of all non-finalized Pre-Admission positions per Clearing Account, which arise as above up until the calculation day, at the last available closing prices (MM_T^P). In every case, the Pre-Admission Margin cannot be less than zero. It is calculated as follows:

$$\text{Pre-Admission Margin} = \max(0, SPR_T^P + (MM_T^P))$$

So, the total Margin is equal to:

$$\text{Margin}_T = (GR_T + SR_T + MM_T) + \max(0, SPR_T^P + (MM_T^P))^{11}$$

2.4.1. Calculation of General Risk

1. For Margin purposes, the General Risk is calculated for each Clearing Member's Clearing Account as follows:

a) First, the Net Quantity of Non-Offset Purchases (NQNOP) or Sales (NQNOS) of the specific transferable security is determined for each trading day (t) of the calculation period as follows:

- i) If, for each trading day (t) of the calculation period, the volume (in units) of purchases of a specific transferable security, the clearing of which has been undertaken by a Clearing Member for the relevant Clearing Account, is greater than the volume of sales of the same transferable security each trading day (t) of the period in question, this difference constitutes the Net Quantity of Non-Offset Purchases (NQNOP).
- ii) Conversely, if for each trading day (t) of the calculation period the volume (in units) of sales of a specific transferable security, the clearing of which has been undertaken by a Clearing Member for the relevant Clearing Account, is greater than the volume of purchases of the same transferable security each trading day (t) of the period in question, this difference constitutes the Net Quantity of Non-Offset Sales (NQNOS).

b) Subsequently, the NQNOP or NQNOS for each trading day (t) of the calculation period, for each Clearing Member's Clearing Account, is multiplied by the final closing price of the relevant transferable security on the calculation day (T) and a Daily Value of Non-Offset Purchases (DVNOP) or Sales (DVNOS) is calculated for each transferable security and for each Clearing Member and relevant Clearing Account for each trading day (t) of the calculation period.

c) In the case of Greek government bonds, the closing price for the calculation of the Daily Value of Non-Offset Purchases (DVNOP), the Daily Value of Non-Offset Sales (DVNOS) and the MM, for each calculation day (T), shall be the closing price as officially announced for the respective day by the Bank of Greece. If there is no relevant announcement for a certain bond, the closing price is calculated on the basis of the closing price of the bond having the most similar characteristics. In such a case, ATHEXClear shall announce all related issues on the website it has designated.

d) In the case of a detachment of rights in execution of a corporate action, for the purpose of calculating the Risk of transactions corresponding to dates prior to such detachment, the closing price shall be adjusted on the basis of the corporate action. In the case of a dividend detachment, for the purpose of calculating the Risk of transactions corresponding to dates prior to such detachment, the dividend amount shall be added to the closing price. The calculation is made according to the following formula:

$$A_{i,t} = \left(\sum_k \alpha_{i,k} - \sum_k \pi_{i,k} \right) \cdot P_{i,T} \text{ if } \sum_k \alpha_{i,k} > \sum_k \pi_{i,k}$$

$$\Pi_{i,t} = \left(\sum_k \pi_{i,k} - \sum_k \alpha_{i,k} \right) \cdot P_{i,T} \text{ if } \sum_k \alpha_{i,k} < \sum_k \pi_{i,k}$$

where

i = transferable security

$A_{i,t}$ = DVNOP of transferable security i for trading day t,

$\Pi_{i,t}$ = DVNOS of transferable security i for trading day t,

k = transactions on trading day t in transferable security i,

$P_{i,T}$ = final closing price of transferable security i on calculation day T,

$\alpha_{i,k}$ = purchases of transferable security i in units for trading day t,

$\pi_{i,k}$ = sales of transferable security i in units for trading day t.

2. The General Risk (GR) for each Clearing Account in respect of each trading day (t) of the calculation period is calculated according to the following formula:

$$GR_t = \sum_g \left[\left| \sum_i (A_{i,t} \cdot c_i) - \sum_i (F_{i,t} \cdot c_i) \right| \right]$$

where

GR_t = General Risk of trading day t,

i = transferable security belonging to window class g,

g = window class

$A_{i,t}$ = DVNOP of transferable security i for trading day t which belongs to window class g

$\Pi_{i,t}$ = DVNOS of transferable security i for trading day t which belongs to window class g

γ_i = General Risk Coefficient of transferable security i as determined in accordance with § 2.2.

3. The General Risk (GR) for each Clearing Member's Clearing Account is equal to the sum of the General Risk of the relevant Account of each trading day for all trading days (t) of the calculation period, according to the following formula:

$$GR_T = \sum_t G_t$$

2.4.2. Calculation of Specific Risk

1. The Specific Risk (SR) for each Clearing Account in respect of each trading day (t) of the calculation period is calculated according to the following formula:

$$SR_t = \sum_i [A_{i,t} \cdot \min(100\%, \varepsilon_i)] + \sum_i (\Pi_{i,t} \cdot \varepsilon_i)$$

where

SR_t = Specific Risk of trading day t,

i = transferable security,

A_{i,t} = DVNOP of transferable security i for trading day t,

Π_{i,t} = DVNOS of transferable security i for trading day t,

ε_i = Specific Risk Coefficient of transferable security i as determined in accordance with § 2.2.

2. The Specific Risk (SR) for each Clearing Member's Clearing Account is equal to the sum of the Specific Risk of the relevant Account of each trading day for all trading days (t) of the calculation period, according to the following formula:

$$SR_T = \sum_t SR_t$$

3. Specifically in the case of non-finalized Pre-Admission positions, the Specific Risk is calculated as:

$$SR_T^P = \sum_i [A_i \cdot \min(100\%, \varepsilon_i)] + \sum_i (\Pi_i \cdot \varepsilon_i)$$

where

SR_T^P = Specific Risk of non-finalized Pre-Admission positions from transactions carried out via the Pre-Admission procedure up until calculation day T,

i = transferable security traded under the Pre-Admission procedure,

A_i = the value of Non-Offset Purchases of transferable security i for all days of Pre-Admission transactions,

Π_i = the value of Non-Offset Sales of transferable security i for all days of Pre-Admission transactions,

ε_i = Specific Risk Coefficient of transferable security i as determined in accordance with § 2.2.¹²

2.4.3. Calculation of Mark-To-Market

1. Mark-To-Market (MM) is calculated as follows:

a) On the basis of calculation day (T), the following data is collected for each Clearing Member's Clearing Account and for each transferable security (i) for which the Clearing Member undertook clearing transactions during the calculation period:

- i) The value of all purchases and the value of all sales of the transferable security in respect of the relevant Account during the calculation period, on the basis of the prices at which the transactions were effected.
- ii) The values that these transactions would have had, valued at the final closing price of the transferable security on calculation day (T). For this purpose, the volume (in units) of transferable securities purchased through the relevant Clearing Account during the calculation period is multiplied by the final closing price of the transferable security and the volume (in units) of transferable securities sold through the relevant Account during the calculation period is multiplied by the final closing price of the transferable security.
- iii) In the case of a detachment of rights in execution of a corporate action, for the purpose of calculating the Risk of transactions corresponding to dates prior to such detachment, the closing price shall be adjusted on the basis of the corporate action. In the case of a dividend detachment, for the purpose of calculating the Risk of transactions corresponding to dates prior to such detachment, the dividend amount shall be added to the closing price.

b) The MM for each transferable security (MM_i) shall be the difference between:

- i) the difference between the value of Sales of the transferable security (i) for the Calculation Period, valued at final closing prices (Π'_{T,i}), and the value of Sales in the same period (Π_{T,i}), and
- ii) the difference between the value of Purchases of the transferable security (i) for the Calculation Period, valued at final closing prices (A'_{T,i}), and the value of Purchases in the same period (A_{T,i})

$$MM_i = (\Pi'_{T,i} - \Pi_{T,i}) - (A'_{T,i} - A_{T,i})$$

c) The Clearing Account MM is set as the sum of the MM of all transferable securities for which the Clearing Member undertook clearing transactions in the relevant Clearing Account during the calculation period.

2. In the case of transferable securities pending listing, for which the Pre-Admission procedure is being applied, MM_T^P is calculated in a corresponding manner, namely:

$$MM_T^P = (\Pi'_{T,i} - \Pi_{T,i}) - (A'_{T,i} - A_{T,i})^{13}$$

2.5 Methodology for Calculating Intraday Risk as per § 6.8.1, Section II of the Rulebook

1. During a Market session, the Credit Limit used up on the basis of unfilled orders entered in the Market by a Market Member and the transactions concluded by the latter during that session shall be

gradually subtracted from the Credit Limit of each Clearing Member per Clearing Subaccount and Market Member.

2. For this purpose, Intraday Risk (R_{day}) is calculated as the aggregate Risk arising from active orders (R_{orders}) and from trades already concluded (R_{trades}), as calculated in accordance with § 2.5.1 and § 2.5.2 respectively.

$$R_{day} = R_{orders} + R_{trades}$$

More specifically,

- a) when each order is entered, the new Order Risk (R_{orders}) is calculated by adding the Risk from the new order to the existing Risk. If the total Intraday Risk (R_{day}) is covered by the Clearing Member's Credit Limit per Clearing Subaccount and Market Member, the order shall be recorded in the order book, otherwise it shall be rejected.
- b) after each order cancellation, the new Order Risk (R_{orders}) is calculated by subtracting the Risk that had been added by the cancelled order.
- c) when an order is executed, the new Order Risk (R_{orders}) is calculated by subtracting the Risk that had been added by the executed order, while the new Trading Risk (R_{trades}) is calculated by adding the Risk arising from the new trade.

2.5.1. Calculation of Order Risk

1. Order risk (R_{orders}) is the risk assumed by a Clearing Member from orders that remain active during the trading session. It is computed prior to the entry of each order per Clearing Subaccount held by the Clearing Member and Market Member to which it has assigned a Credit Limit as follows:

$$R_{orders} = \sum_i \{ \sum_j [A_{orders,ji} \cdot (\gamma_i + \varepsilon_i)] + \sum_j [\Pi_{orders,ji} \cdot (\gamma_i + \varepsilon_i)] \}$$

where

i = transferable security

j = order of transferable security i

$A_{orders,ji}$ = value of buy order j of transferable security i

$\Pi_{orders,ji}$ = value of sell order j of transferable security i

γ_i = General Risk Coefficient of transferable security i, as determined in accordance with § 2.2

ε_i = Specific Risk Coefficient of transferable security i, as determined in accordance with § 2.2

In the case of market orders and at-the-close orders, the value of buy orders and sell orders is calculated on the basis of the price of the last transaction or, if no transactions have been carried out on the trading day, on the basis of the opening price.

2.5.2. Calculation of Trading Risk

1. Trading risk (R_{trades}) is the risk assumed by a Clearing Member from transactions concluded during the trading session. It is computed after the execution of each transaction per Clearing Subaccount held by the Clearing Member and Market Member to which a Credit Limit has been assigned, as follows:

$$R_{trades} = \left| \sum_i \left[\sum_j (A_{ij} \cdot \gamma_i) - \sum_j (\Pi_{ij} \cdot \gamma_i) \right] \right| + \sum_i \left| \left[\sum_j (A_{ji} \cdot \varepsilon_i) - \sum_j (\Pi_{ji} \cdot \varepsilon_i) \right] \right|$$

where

i = transferable security

j = trade in transferable security i

A_{ji} = value of buy trade j of transferable security i

Π_{ji} = value of sell trade j of transferable security i

γ_i = General Risk Coefficient of transferable security i , as determined in accordance with § 2.2

ε_i = Specific Risk Coefficient of transferable security i , as determined in accordance with § 2.2

2.6 Testing of Margin Calculation Model and Parameters

2.6.1. Backtesting

1. ATHEXClear assesses Margin coverage on a daily basis by performing a retrospective comparison between observed results and anticipated results deriving from the use of the Margin model. This test is performed for all Clearing Accounts and cleared transferable securities, in order to assess whether there are any exceptions with regard to Margin coverage.
2. The basic principle underpinning this backtesting is that the Margin calculated for each Clearing Account is taken into consideration. Using actual market prices, the cost of closing a position is calculated. The divergence between these two values is assessed both at a Clearing Account level and overall, on the basis of its frequency and magnitude.

2.6.2. Sensitivity Analysis

1. ATHEXClear performs sensitivity analysis of its Margin model's coverage under various market conditions, using historical data from actual stressed market conditions and hypothetical data for possible stressed market conditions.
2. The analysis is a methodology to investigate concealed shortcomings that cannot be revealed through backtesting. Its purpose is to ascertain how the key parameters and assumptions of the Margin model are shaped in different scenarios, in order to establish the model's sensitivity to errors when determining such parameters and assumptions.

PART 3. Definition of Acceptable Collateral for the purpose of meeting Margin Requirements as per § 4.2, Section II of the Rulebook

3.1 Acceptable Collateral¹⁴

1. The following are considered to be acceptable collateral in the sense of § 4.2, Section II of the Rulebook:

- 1) cash in euros,
- 2) ATHEX-listed stocks with a 3-month average daily trading value greater than the limit set and announced by ATHEXClear, which constitute underlying assets of Futures Contracts on the ATHEX Derivatives Market or belong to the FTSE/ATHEX-LARGE CAP or FTSE/ATHEX-MID CAP indices with the exception of stock issued by "HELLENIC EXCHANGES - ATHENS STOCK EXCHANGE S.A. HOLDING".

In cases where a transferable security is switched to a different index in accordance with the provisions of the ATHEX Rulebook, the security in question shall no longer be acceptable as Margin and, if already provided as Margin, shall cease to be included in the calculation of the relevant Margin.

In the event of suspension of trading of Futures on the ATHEX Derivatives Market, in accordance with the provision of the ATHEX Rulebook, the underlying transferable security shall no longer be acceptable as Margin and, if already provided as Margin, shall cease to be included in the calculation of the relevant Margin.

- 3) ATHEX-listed units in the segment of Exchange Traded Funds (hereinafter "ETF units"), with a 3-month average daily trading value greater than the limit set and announced by ATHEXClear.

In cases where a transferable security is switched to a different index in accordance with the provisions of the ATHEX Rulebook, the security in question shall no longer be acceptable as Margin and, if already provided as Margin, shall cease to be included in the calculation of the relevant Margin.

2. The 3-month average daily trading value of each security is checked on a daily basis against the limit set by ATHEXClear. If the 3-month average daily trading value is lower than the limit set, the security shall cease to be acceptable as Margin as of the effective date of the new list of eligible collaterals announced by ATHEXClear.

3. In order for ATHEXClear to receive collateral in accordance with articles 6.7 and 6.8, Section II of the Rulebook, the Clearing Member must declare the method of collateral allocation per Clearing Account. For the receipt of collateral in the form of cash and in the form of transferable securities, the declaration is electronically communicated to ATHEXClear via the System.¹⁵

4. For the release of collateral received by ATHEXClear in the form of cash or transferable securities, in accordance with par. 5, article 4.5, Section II of the Rulebook, the Clearing Member makes a declaration of release which is electronically transmitted to ATHEXClear via the System.¹⁶

The collateral is returned, when having been provided in the form of cash, on the business day following the declaration day, unless the competent services of ATHEXClear deem it necessary to return the collateral earlier for the purpose of meeting obligations in connection with the System¹⁷, while when provided in the form of transferable securities, on the day of the declaration.

3.2 Collateral Valuation¹⁸

Collateral is valued at its market value on the basis of the prices stipulated in § 3.2.1, followed by application of the Haircuts of § 3.2.2 and Concentration Limits of § 3.2.3.

3.2.1. Collateral Valuation Prices

1. For the purpose of testing Collateral adequacy following the finalization of positions pursuant to § 6.7, Section II of the Rulebook, stocks and ETF units are valued on the basis of the last available closing price on the market in which they are traded.
2. In every case, transferable securities that have been issued by the Clearing Member that provides them as Collateral or by an entity belonging to the same group as the Clearing Member that provides them as collateral, are valued at zero.

3.2.2. Haircuts

1. The Haircuts used in the valuation of collateral are determined, in accordance with the methodology set out in the following paragraphs, per transferable security or category of financial instrument and are published on the ATHEXClear website.
2. Haircuts are reviewed and adjusted on a quarterly basis at the beginning of each calendar quarter, applying the methodology set out in the following paragraphs and the specific procedures of ATHEXClear. Following each regular adjustment, ATHEXClear shall announce the new Haircut values and when they are to take effect.
3. ATHEXClear also runs monthly backtesting to assess the adequacy of Haircuts in accordance with the methodology of § 3.3 and, in the event of inadequate coverage, as determined by its specific procedures, it shall perform an extraordinary adjustment of their value and/or adjust the methodology used for their calculation and/or modify the list of acceptable Collateral, announcing each time when these are to take effect.
4. The methodology for calculating Haircut values is based on the following data.
 - 1) Confidence Level

This is the confidence level on the basis of which, with the use of statistical tests, the Haircut value of Collateral must be greater than its value upon liquidation. The Confidence Level is set at 99.0%.¹⁹
 - 2) Collateral Liquidation Time Frame

i) This is the period of time that is estimated will elapse between the last valuation of the collateral committed and its liquidation. For the purpose of determining the “Collateral Liquidation Time Frame”, categories of liquidity have been created, in accordance with the specific procedures of ATHEXClear, to which Collateral is assigned on the basis of its characteristics and liquidity.

ii) A Collateral Liquidation Time Frame value, which may not be less than two (2) days, is set for each liquidity category. The Haircut is calculated in such a way that, based on historical data, it covers – with the above confidence level – changes corresponding to a period of time equal to the Collateral Liquidation Time Frame.

iii) ²⁰

3) Time Frame for Calculating Historical Volatility

This is the time period whose historical changes will be used to estimate Haircuts with the above confidence level.

The changes taken into account when calculating historical volatility relate to observations of non-zero trading volume as follows:

- existence of a minimum number of non-zero trading volume days during the preceding twelve (12) months, and
- provided the required number of business days with non-zero trading volume is sufficient, a total of two hundred and fifty (250) observations must be reached by making up any shortfall from the time period that has been set as the observation supplementation period.²¹

i) To ensure that the historical data used in the calculation of historical volatility include a period of stressed conditions, while resulting in the computation of stable and prudent Haircuts that limit procyclicality, two (2) periods are taken into account for estimating parameters:

- The last twelve (12) months.
- One 3-month period from the last five (5) years which is chosen as being representative of stressed market conditions, in accordance with the procedures of ATHEXClear.

ii) Haircuts are calculated for the aforesaid periods by using the confidence level and clearing period time frame as these are defined above.

iii) The final parameter is calculated by applying a weighting factor of 75% to the parameter for the last 12 months and a weighting factor of 25% to the parameter for the period of stressed market conditions. In order for the 3-month period from the last five (5) years to be considered representative of stressed market conditions, it must have data for at least thirty (30) days.²²

iv) In every case, the final parameter shall be set at least equal to the parameter for the last 12 months.

v) If no data are available for a period representative of stressed market conditions, a reserve equal to 25% shall be added to the Haircuts.

4) Smoothing Factor (λ) for Historical Volatility (which is announced)

The smoothing factor relates to the degree of weighting of observations that enter into the calculation of volatility, giving, depending on the value of the factor, more or less increased weight to more recent observations.²³

3.2.3. Collateral Concentration Limits

1. In implementation of § 4.2, Section II of the Rulebook, Concentration Limits are set in accordance with the provisions of the following paragraphs. The Concentration Limit values are determined by the competent bodies of ATHEXClear and posted on its website:

- a. For stocks and ETFs that are acceptable as Collateral, a maximum quantity is set per security, which will be valued for the purpose of covering the Margin requirement for each Clearing Account and corresponds to a percentage of the issue.
- b. For the purpose of verifying the adequacy of Collateral after the finalization of positions, a percentage of Margin requirement is set per Clearing Account which must be covered with cash on a daily basis.
- c. For each banking group that issues Collateral, the percentage of the final haircut value of Collateral held by ATHEXClear (Collateral committed for Margin, including contributions to the Default Fund) which is covered by Collateral of an issuer belonging to each aforesaid group shall be calculated on a daily basis, taking into account the respective haircut value after implementation of the measures under item a. In the event that this coverage rate exceeds 10%, the Collateral in question shall cease to be considered acceptable. Collateral that has been committed prior to implementation of the measure shall continue to be valued in the normal manner, while in cases where a large amount of certain Collateral has been provided which does not cover Margin requirements, ATHEXClear may force its release and set a deadline for this purpose.
- d. For shares and ETFs which are acceptable as Collateral, a further limit is set for each security as the maximum market value that will be assessed after application of the haircut for covering the Margin requirement of each Clearing Account.²⁴ The aforesaid limit is reviewed and adjusted on a monthly basis at the beginning of each calendar month and is set as the 5% lowest value of transactions according to the liquidation time frame of each share or ETF of the past 5-year period.²⁵

3.3 Haircut Backtesting²⁶

1. ATHEXClear assesses the adequacy of Haircuts by conducting a comparison between the Haircut applied in the previous test period and the historical changes in the value of each item of Collateral. The divergence between these two magnitudes is assessed, per each item of Collateral and in total, on the basis of the number of exceptions as well as the percentage and amount of overruns.

PART 4. Rules for Calculating the Default Fund as per § 5.2, § 5.4.1 and § 5.4.2, Section II of the Rulebook.

4.1 Default Fund Calculation Period as per § 5.4.2, Section II of the Rulebook

1. The size of the Default Fund is calculated on a monthly basis and for the purposes hereof the term “calculation periods” refers to the periods from the first day to the last day of each month in a calendar year.

4.2 Contribution Rate as per § 5.4.1, Section II of the Rulebook

1. The Contribution Rate (a) of § 5.4.1, Section II of the Rulebook is set at least equal to 100%.
2. During the regular or extraordinary adjustment of the size of the Default Fund following checks carried out by ATHEXClear in accordance with § 5.4.2, Section II of the Rulebook and the specific provisions set out in § 4.3 of this Resolution, the Contribution Rate may be increased so that, taking into consideration the adjusted Default Fund, it meets the respective requirements. The Contribution Rate applied in each case will be posted on the website of ATHEXClear along with the new size of the Default Fund.

4.3 Resource Adequacy Testing

4.3.1. Stress tests to determine the adequacy of the Default Fund size

1. ATHEXClear applies a methodology to test whether the size of the Default Fund would be adequate, for every day in the test period, to cover losses in excess of Margin under extreme but plausible market conditions (stress testing), which may arise in the event of default of a Clearing Member to which the System has the greatest risk exposure or of the second and third Clearing Members, if their cumulative exposure is higher, taking into account the dependencies of their groups, in accordance also with its specific procedures, while it also tests the adequacy of the Default Fund in the event of default of a Clearing Member that issues financial instruments cleared by ATHEXClear.
2. When adjusting the Default Fund, ATHEXClear applies the above testing methodology to the new size of the Default Fund for a test period that is equal to the calculation period. In the event of inadequacy, ATHEXClear shall modify the Contribution Rate of § 4.2 of this Resolution, adjusting the size of the share account of each Clearing Member so that, taking into consideration the adjusted Default Fund, the respective deficit is covered.
3. ATHEXClear applies the above methodology on a daily basis to test the current size of the Default Fund for the previous day (test period). In the event of inadequacy, it takes a decision to cover the deficit by increasing the available resources to at least the above level by no later than the margin call of the following day, which may involve an extraordinary increase of the Default Fund and/or an increase in Margin for one or more Clearing Accounts.

4.3.2. Stress tests to determine the adequacy of total financial resources

1. ATHEXClear applies a methodology to test whether the size of the Default Fund and the Special Own Resources of ATHEXClear would be adequate to cover the loss in the event of a default of the Clearing Members ranking first and second in terms of exposure, taking into account the dependencies of their groups, in accordance also with its specific procedures.

2. When adjusting the Default Fund, ATHEXClear applies the above testing methodology to the new size of the Default Fund and the Special Own Resources it will hold, for a period that is equal to the calculation period (test period). In the event of inadequacy, ATHEXClear shall modify the Contribution Rate of § 4.2 of this Resolution, adjusting the size of the share account of each Clearing Member and/or increasing the Special Own Resources so that, taking into consideration the adjusted size of total financial resources, the respective deficit is covered.
3. ATHEXClear applies the above methodology on a daily basis to test the current size of the Default Fund and Special Own Resources it holds for the previous day (test period). In the event of inadequacy, it takes a decision to cover the deficit by increasing the available resources to at least the above level by no later than the margin call of the following day, which may involve an extraordinary increase of the Default Fund and/or an increase in the Margin for one or more Clearing Accounts and/or an increase in Special Own Resources.
4. At quarterly or more frequent intervals, ATHEXClear also plans and performs reverse stress testing under extreme conditions, tailored to the specific Risks of the markets and the products it clears, the aim of which is to ascertain under which market conditions the credit risk coverage provided by the combination of Margin, Default Fund and other financial resources may be inadequate. The purpose of the reverse stress tests in extreme conditions is to identify market conditions that go beyond those that are considered plausible. The results and analysis of the reverse stress tests in extreme conditions are used to help establish extreme but plausible stress test scenarios.

4.3.3. *Liquidity stress tests to determine the adequacy of realizable financial resources*

1. ATHEXClear applies a methodology to analyze and monitor its liquidity Risk management framework by conducting stress tests under extreme conditions on its realizable financial resources on a daily basis. In the event of inadequacy, in accordance also with its specific procedures, it shall take a decision to cover the deficit by increasing its available resources to an acceptable level as soon as is practicable, which may involve an extraordinary increase of the Default Fund, an increase in the Margin that must be covered by cash for one or more Clearing Accounts, an increase of Special Own Resources or the securing of liquidity lines with credit institutions.
2. At quarterly or more frequent intervals, ATHEXClear also plans and performs reverse stress testing under extreme conditions, tailored to the specific Risks of the markets and the products it clears, the aim of which is to ascertain under which market conditions the liquidity risk coverage provided by its total realizable resources may be inadequate. The purpose of the reverse stress tests in extreme conditions is to identify market conditions that go beyond those that are considered plausible. The results and analysis of the reverse stress tests in extreme conditions are used to help establish extreme but plausible liquidity risk stress test scenarios.

4.4 Adjustment of Default Fund share account due to corporate actions or other events involving Clearing Members as per § 5.2, Section II of the Rulebook

1. In the event of a merger of Clearing Members or of other related corporate actions, the Default Fund share account of the Member retaining such capacity shall be set equal to the sum of all share

accounts of all merged Members up until the next regular or extraordinary adjustment of the Default Fund. At the next regular or extraordinary adjustment of the Default Fund, for the purpose of determining the share account of the Member retaining such capacity, the share account is first calculated for the Member having such capacity for that part of the calculation period prior to the merger, taking into consideration the Margin of the Clearing Accounts of all merged Members, and then the share account is calculated for the Member that retains such capacity for that part of the calculation period after the merger, taking into consideration only the Margin of the Clearing Accounts of the Member retaining such capacity. For the purpose of finally determining the share account of the Member that retains such capacity, the share accounts resulting from the above calculations shall be taken into consideration, based on the number of days of each above period.

2. In cases where a Clearing Account is transferred to another Clearing Member, at the next regular or extraordinary Default Fund adjustment and for the purpose of determining the share account of the Member to whom the account is transferred, such member's share account shall be computed for that part of the calculation period prior to the transfer, taking into account the Margin of the Account being transferred, while its share account for that part of the calculation period after the transfer shall also be calculated. For the purpose of finally determining the share account of the Member to whom the Account is transferred, the share accounts resulting from the above calculations shall be taken into consideration, based on the number of days of each above period.
3. In cases where a Clearing Account is cancelled, including its transfer to another Member, for the purpose of determining the share account of the Clearing Member whose Clearing Account has been cancelled, at the next regular or extraordinary Default Fund adjustment, its share account shall be calculated without taking into account the Margin of the Clearing Account that has been cancelled.

PART 5. Cash holdings of § 1.4 and § 5.1, Section II of the Rulebook

5.1 Cash Holdings

1. The cash holdings of ATHEXClear which correspond to Collateral in the form of cash provided by Clearing Members, as well as the cash holdings of the Default Fund and Special Own Resources, are kept by ATHEXClear in an account it holds as a Target 2 Direct Participant at the Bank of Greece.
2. The cash holdings of ATHEXClear which correspond to other financial resources are kept by ATHEXClear in accounts at the Bank of Greece and at credit institutions in accordance with the investment policy and the terms laid down in article 45 of Regulation (EU) 153/2013.

PART 6. Provision of information for the management of related Risk concentrations as per § 2.4.12, Section II of the Rulebook

6.1 Provision of information

1. ATHEXClear shall monitor the size and progress of open positions at a Clearing Account level and, where there are indications of a possible increase in Risk concentration, particularly with regard to clients who clear trades through different Clearing Members, it shall ask Clearing Members, in

implementation of § 2.4.12, Section II of the Rulebook, to provide additional information to enable the identification, control and management of related Risk concentrations.

2. Such information shall primarily comprise data that enable the identification of Clearing Members' clients, the positions they hold, as well as the quantity and type of collateral they have provided to the Clearing Member.

This Resolution is effective as of 16.2.2015.

This Resolution is to be posted on the website of ATHEXClear.

¹ The preamble was amended as above by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

² Par. 1 of article 1.2 was amended as above by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

³ A new par. 3 was added to article 2.1 and the previous par. 3 was renumbered as 4 by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

⁴ Par. 4 of article 2.2 was amended as above by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

⁵ A new par. 5 was added to article 2.2 and the previous par. 5 was renumbered as 6 as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

⁶ Par. 8 of article 2.2 was added by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

⁷ Par. 1 of article 2.3 was replaced as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

⁸ Sub-item c.1) of item c), par. 3, article 2.3 was replaced as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

⁹ The second sentence of sub-item e.1) of item e), par. 3, article 2.3 was replaced as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

¹⁰ Item f) of par. 3, article 2.3 was added as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

¹¹ Par. 2 of article 2.4 was added by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

¹² Par. 3 of article 2.4.2 was added by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

¹³ Par. 2 of article 2.4.3 was added by virtue of Decision 162/24.09.2018 of the Board of Directors with effect as of 24.09.2018.

¹⁴ Article 3.1 was amended as above by virtue of Decision 117/18.5.2015 of the Board of Directors with effect as of 2.6.2015.

¹⁵ Paragraph 3, article 3.1 of Part 3 was amended as above by virtue of Decision 125/26.10.2015 of the Board of Directors with effect as of 9.11.2015.

¹⁶ The first sentence of subparagraph 4, article 3.1 of Part 3 was replaced as above by virtue of decision no. 165/26.11.2018 of the Board of Directors of ATHEXClear with effect as of 10.12.2018.

¹⁷ Paragraph 4 of article 3.1 was amended as above by virtue of Decision 125/26.10.2015 of the Board of Directors with effect as of 9.11.2015.

¹⁸ Article 3.2 was added as above by virtue of Decision 117/18.5.2015 of the Board of Directors with effect as of 2.6.2015.

¹⁹ The second sentence of item 1) of subparagraph 4, par. 3.2.2 was replaced as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

²⁰ Sub-item iii) of item 2, subparagraph 4, par. 3.2.2 was abolished as above by virtue of Decision 164/29.10.2018 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk parameters (January 2019).

²¹ The second part of item 3) of subparagraph 4, par. 3.2.2 was added as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

²² The second sentence of sub-item (iii) of item 3), subparagraph 4, par. 3.2.2 was added as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

²³ Item 4) of subparagraph 4, par. 3.2.2 was added as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

²⁴ The first sentence of item d. of subparagraph 1, par. 3.2.3 was added as above by virtue of decision no. 167/25.01.2019 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk management parameters (April 2019).

²⁵ Item d) of subparagraph 1, par. 3.2.3 was added as above by virtue of Decision 164/29.10.2018 of the Board of Directors of ATHEXClear with effect as of the next regular calculation of risk parameters (January 2019).

²⁶ Article 3.3 was added as above by virtue of Decision 117/18.5.2015 of the Board of Directors with effect as of 2.6.2015.