**OPL029 ForexClear – Deliverables FX Options Risk Model**

**Business Requirements Document**

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1. Product Scope
   1. Instruments
      1. FX Options

***Table 1 – NON-EM Product Scope***

|  |  |
| --- | --- |
| Item | Definition |
| Product | LCH Deliverable FX Options (single leg or package) |
| Option Style | European Vanilla |
| Underlying Asset | Eligible LCH Spot |
| Expiry Range | Minimum: 1 business day  Maximum: 2 years |
| Cut Times | New York: 10:00 (local time)  Tokyo: 15:00 (local time) |

* + 1. FX Spot and Forward

***Table 2 – FX Spot and Forward scope***

|  |  |
| --- | --- |
| Item | Definition |
| Product | LCH Spot or Forward (single leg or package) |
| Tenor Range | Minimum: Spot  Maximum: 2 years |
| Settlement | Physical delivery via CLS |

* + 1. Currencies

***Table 3 – Currency Pair***

|  |
| --- |
| Currency Pair |
| EUR/USD |
| EUR/CHF |
| EUR/GBP |
| EUR/JPY |
| GBP/USD |
| AUD/USD |
| USD/CHF |
| USD/JPY |

* + 1. Product Conventions

***Table 4 – Currency Pair Conventions***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Item | EUR  /USD | EUR  /CHF | | EUR  /GBP | | EUR  /JPY | | GBP  /USD | | AUD  /USD | | USD  /CHF | | USD  /JPY | |
| **Base currency** | EUR | EUR | | EUR | | EUR | | GBP | | AUD | | USD | | USD | |
| **Term currency** | USD | CHF | | GBP | | JPY | | USD | | USD | | CHF | | JPY | |
| **Spot quote basis** | Term per Base | | | | | | | | | | | | | | |
| **Pip size** | 0.0001 | 0.0001 | | 0.0001 | | 0.01 | | 0.0001 | | 0.0001 | | 0.0001 | | 0.01 | |
| **Spot** | T+2 | T+2 | | T+2 | | T+2 | | T+2 | | T+2 | | T+2 | | T+2 | |
| **Business day calendars** | TE, FD | TE, SZ | | TE, GB | | TE, JN | | GB, FD | | AU, FD | | FD, SZ | | FD, JN | |
| **Option VM currency** | USD | EUR | | EUR | | EUR | | USD | | USD | | USD | | USD | |
| **Option premium CCY** | Either the base currency, the term currency or USD’ | | | | | | | | | | | | | | |
| **Premium VM Currency** | Always Option Premium currency | | | | | | | | | | | | | | |
| **Option premium date** | Spot or Forward | | | | | | | | | | | | | | |
| **Premium-Included Delta** | No | | Yes | | Yes | | Yes | | No | | No | | Yes | | Yes |

1. 24 Hour Risk Operations Model
2. 1. Margin Runs

***Table 5 – Margin Run Schedule***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Margin run Id | Margin Run Time (LDN/EST/TKY) | Time Zone Alignment | Internal Reports | External Reports | Market Data Refresh | Margin Run Type |
| 1 | **02:00** / 21:00 / 11:00 | LDN | Yes | No | Yes | ION |
| 2 | **07:00** / 02:00 / 16:00 | LDN | Yes | Yes | Yes | Event Driven ITD (TKY Cut, Excess cover) |
| 3 | **11:00** / 06:00 / 20:00 | LDN | Yes | Yes | Yes | ITD |
| 4 | 15:00 / **10:00** / 00:00 | NYC | Yes | Yes | Yes | Even Driven ITD (Cut) |
| 5 | 18:00 / **13:00** / 03:00 | NYC | Yes | Yes | Yes | ITD |
| 6 | 22:00 / **17:00** / 07:00 | NYC | Yes | No | Yes | ITD |
| 7 | **00:00** / 19:00 /09:00 | LDN | Yes | Yes | No | EOD |

Notes for table 5

* Time in bold are reference time for margin run kick off.
* Status of proposed schedule versus current EM schedule:
* New MR: 1 and 6
* Modified MR: 2, 3 and 4
* Identical MR: 5 and 7
* ITD is the period between end of ION period and EOD Margin run completion. MR 2-6 run in ITD mode.
* For reports marked with \*, only market data reports are required.

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| --- | --- |
| BR 1 - Execute Margin Run | As a ForexClear Risk User:  I want to execute a series of margin runs during the day so that I can have an up to date picture of risk that the service is managing.  Acceptance criteria:   1. ION, ITD and EOD margin runs commence at the times listed in **Table 5** above. 2. The margin run timing is aligned with the time zone alignment listed in **Table 5:**   if ‘time alignment zone’ is LDN the LDN time from ‘margin run time’ is used,  if ‘time alignment zone’ is EST the EST time from ‘margin run time’ is used  if ‘time alignment zone’ is TKY the TKY time from ‘margin run time’ is used)   1. The latest market data snap (see **BR 29**) is used for each event driven margin runs. 2. The EOD market data snap (see **BR 29**) will be used for the EOD margin run. 3. Market data BRD (**BR 9**) covers the requirements for EOD data snap at EST time 4. Real Time Registration must not be affected by a margin run. 5. Post CLS session, all trades settled in the CLS session become dead and are no longer included in any Margin calculation (IM and VM). This is effective on receipt of CLS notification of completion of pay out. 6. The trade population submitted to the margin run and reporting will not change once submitted. 7. All margin runs adhere to the following processing:   Total liabilities are calculated as per **BR 143, BR 144 and BR 145**  Calculated liabilities are monitored against limits as per **BR 178**  Margin Run Liabilities are approved/rejected as per **BR 174** and **BR 175**.   1. Once liabilities are calculated and approved, the relevant reports are generated (as defined in **Table 5**). 2. Sensitivities are calculated at each Margin run, as per the following rules   Sensitivities calculated are those described in **BR 148 - BR 169**  Aggregation and bucketing approach for the sensitivities is defined described in **BR 146, BR 147**   1. Stress Testing are calculated at each MR, as per **BR139** and **BR141**. 2. The Event driven Post-Cut margin runs are run at the times listed in **Table 5** above but also contingent on events completion rules, as follows:   If the event has not completed before the scheduled start time the margin run will be delayed until the event has completed. Once the event has completed the margin run will start  If the margin run is delayed by more than 5 minutes due to the event, then a notification emails should be send out to notify ForexClear Support, Ops and Risk teams about the delay as well to confirm start and finish times of the subsequent margin run that follows the delay. Post-cut margin runs contingency will be dependent on all the processesrelated to the exercise expiry process being completed (see **exercise/expiry BRD**)  Margin Run 2 will be an ITD margin run. Execution of Margin Run 2 will be contingent on excess cover being received from Calypso (Current functionality) and completion of TKY cut processing (Cut + auto ex/ex + post cut trade processing if any).   1. All live trades (NDFs, Options, Spots and Fwds) will be included in the margin run 2. Trades scope is defined at margin run start time. 3. All calculations and reporting linked to a margin are based and only based on the margin run trade population. |
| BR 2 - Delay margin run | As a ForexClear Risk User  I want the ability to delay a margin run so that no liabilities, reports or margin calls are generated until the margin run is released  Acceptance criteria:   1. Works in same way as the EM service 2. This hold in margin run needs to be managed by the Support team (i.e. MUREX team). |
| BR 3 - Margin run manual audit report | As a ForexClear Risk User  I want a full audit record of manual actions in the margin run so that I have a full audit record of manual interventions.  Acceptance criteria:   1. Works in same way as the EM service 2. All requests, approvals and rejections are stored with the Margin Run records for later reference. |
| BR 4 - Monitor margin runs | As a ForexClear Risk User  I want the ability to view the status of a margin run so that the team can monitor progress and any issues  Acceptance criteria:   1. Works in same way as the EM service (MR02 datamart extract) |
| BR 5 - Margin run error notification | As a ForexClear Risk User  I want an alert to be raised for Margin Run errors so that the appropriate teams are notified of the problem.  Acceptance criteria:   1. Email sent (within 5 minutes of failure) to the ForexClear Risk team. 2. Errors include: 3. Failure to start the margin run 4. Failure to complete the margin run within a configurable time |
| BR 6 - Margin run reference | As a ForexClear Risk User  I want each margin run to have a unique reference number so that margin runs can be easily identified  Acceptance criteria:   1. Works in same way as the EM service |
| BR 7 - Margin run tolerance checks | As a ForexClear Risk User  I want tolerances in place at all margin runs so that if these rules are breached a ForexClear risk user has to manually approve the margin run  Acceptance criteria:   1. A 4 eyes validation is required 2. To change the limits and/or turn feature on/off ForexClear risk management send the request by email to ForexClear support. ForexClear Support team is in charge of updating the limits in the system. ForexClear Risk management provides to Forexclear support a file in the system format to upload. 3. Tolerances in place are those detailed in **BR 177** 4. Limits currently in place for the EM service are described in this document. |
| BR 8 - Sensitivity calculations | As a ForexClear Risk User  I want to calculate a full set of sensitivities at every margin run so that these can be reported and monitored  Acceptance criteria:   1. Sensitivities calculated are those described in **BR 148 - BR 169** 2. Aggregation and bucketing approach for the sensitivities is defined described in **BR 146, BR 147** 3. Trade population is the same as the MR trade scope (**BR 1**) |
| BR 9 - Margin run stress testing | As a ForexClear Risk User:  I want to calculate stress testing at each margin run so that I can perform risk analytics of the results  Acceptance criteria:   1. At each margin run, perform all stress testing related steps as per **BR 108 - BR 118**. 2. Results are stored. 3. Trade population is the same as the MR trade scope (**BR 1**) 4. Latest market data set is used in calculating stress testing (**BR 1**) |
| BR 10 - Run ad-hoc margin run | As a ForexClear Risk User:  I want the ability to run an ad-hoc margin run so that I can calculate liabilities at any time during ForexClear opening hours and update them  Acceptance criteria:   1. Able to perform an ad-hoc margin run at any time during opening hours 2. Ad-hoc margin run is same as ITD margin run (or ION depending on the state of ForexClear margin and whether excess cover has been received from Calypso) as per **BR 1** |

* 1. Currency Holidays

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| BR 11 - Calendar update margin impact | As a ForexClear Risk User:  I want any changes to calendar to be followed by a re-calculation of liabilities so that liabilities are kept up to date  Acceptance criteria:   1. Any calendar update should be followed by a restart of the system until a fix is in place (Murex cache issue) 2. A margin run is required immediately post calendar update to rebase line the liabilities as per **BR 10** 3. Latest market data set is used   Note:  This requirement is due to cache issue in Murex |

* 1. Collateral balances

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| BR 12 - PPS reconciliation | As a ForexClear Risk User:  I want to receive collateral level from Calypso in near real time so that I can monitor against the liabilities  Acceptance criteria:   1. Collateral is broken down by type i.e. cash and non cash 2. Collateral is reconciled against liabilities for all member’s accounts: **H**, **F**, and **B**. (Clients account reconciliation for EM remain unchanged) 3. Liabilities for H account are calculated as per **BR 142** 4. Liabilities for F account are calculated as per **BR 105** 5. Liabilities for B account are calculated as per **BR 138** 6. Collateral levels view is refreshed at least every 5 minutes from Calypso to show the latest level of collateral for all member’s accounts (i.e. accounts H, F, and B) 7. All collateral levels are in USD-equivalent. 8. Excess cover messages are similar to EM (Please refer to DSS and BAU for EM) |

* 1. Trade Capture

Any trade that has passed the eligibility validation checks will be recorded in a real-time Murex trade summary, irrespective of whether it is Novated / Rejected as part of the Incremental Risk Check process (**BR 23**) or was subject to an Exercise / Expiry, Fixing or Settlement event.

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| BR 13 - Trade Summary in Murex | As a ForexClear Risk User, I want every trade received for clearing to appear in a real time summary view in Murex so that at every point in time I have a view of the trades subject to the ForexClear validation checks.  Acceptance criteria:   1. The entire population of trades for the day received for clearing shows up in Murex 2. The type of trade data to be displayed is in line with the current Murex trade blotter for EM contracts 3. Trade population is updated in real time (Current Murex Simulation functionality) 4. Trades that fixed / exercised or expired / settled are included with the correct typology (see **BR 16**) and other trade information 5. It is possible to sort trade data by any of the fields in the trade summary view 6. Screenshot of current Murex screen for EM: Simulation with LCH\_RISK user      1. Current field “Face notional” is renamed to “Base Notional” 2. Current field “Other notional” is renamed to “Term Notional” 3. Current field “Face currency” is renamed to “Base Currency” 4. Current field “Other currency” is renamed to “Term Currency 5. Current field “Price” is calculated as 6. Price = Term Notional/Base Notional 7. Following new option-specific fields need to be added: 8. Option type as “Call/Put” 9. Expiry date 10. Strike 11. Trade type is displayed under the “Typology” field 12. Non-deliverable forward contracts have a typology “NDF” 13. Deliverable forward contracts have a typology “FWD” 14. Deliverable spot contracts have a typology “SPT” 15. Option contracts have a typology “FXO” 16. Trade status is displayed under the “Status” field 17. Novated trades have a status “Ins” 18. Cancelled trades have a status “Cncl” 19. Exercised / Expired (FXO) or Fixed (FX Forward) trades have a status “Mod” (Mod is a Murex convention) 20. Settled trades have a status “Dead” 21. Trade event is displayed under the “Last event” field 22. Trades fixed are linked to event “Fixing” 23. Trades exercised / expired are linked to event “Exe / Exp” 24. Trades settled are linked to event “Settlement” 25. Trades compressed and the new trade created on the back of this process are linked to event “Compression”. 26. “Last event” field is blank for any other trade. 27. All trade with trade date in the past are displayed |

* 1. Trade Validation

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| BR 18 - Trade Eligibility: Underlying Maturity FX Spot | As a ForexClear Risk User, I want the FX Option underlying maturity to be included in the validation criteria so that I can reject an FX Option trade not eligible for clearing on this basis.  Acceptance criteria:   1. **Only FX Spot** are accepted as underlying of an option contract for phase 1. Forward will be added in later phase. 2. An FX Option contract on FX Spot underlying is valid and passes this validation check. 3. The corresponding rejection message (see **Ops BRD**) is sent back for a trade rejected on the basis of this validation check |
| BR 19 -Underlying Maturity: Spot vs. Forward | As a ForexClear Risk User, I want the FX Option underlying to be classified as either FX Spot or FX Forward so that I can use this information in performing the underlying maturity validation check.  Acceptance criteria:   1. An FX Option underlying is classified as FX Spot or FX Forward depending on the time between trade expiry date and trade settlement date. 2. For the set of currency pairs in scope for go-live as listed in Table 3, a FX Spot trade is one where:   Trade Settlement Date = FXO Expiry Date + FX Spot lag   1. For the set of currencies in scope for go-live as listed in Table 3, a FX Forward trade is one where:   Trade Settlement Date > FXO Expiry Date + FX Spot lag   1. FX Spot Lag follows the calendar convention in Table 4 for each currency pair. 2. Trade for which the underlying maturity is less than spot are not eligible   Trade Settlement Date < FXO Expiry Date + FX Spot lag |

|  |  |
| --- | --- |
| BR 20 - Trade Eligibility: Settlement Date | As a ForexClear Risk User, I want the FX trade settlement date to be included in the trade eligibility check so that I can reject trades that do not match the minimum required time remaining to settlement.  Acceptance criteria:   1. FX Spot and FX Forward trades are accepted in BAU only if:   Trade Settlement Date > Trade Submission Date   1. FX Spot and FX Forward trades are accepted in DMP where:   Trade Settlement Date ≥ Trade Submission Date   1. All trades are rejected in BAU and DMP if:   Trade Settlement Date < Trade Submission Date   1. FX Option trades are accepted only if:   Trade Expiry Date > Trade Submission Date   1. FX Forward or FX Option trades are accepted only if:   Trade Settlement Date ≤ Spot date + 2 Years (Spot convention is defined in Table 4)  Notes:  The above imply that:   * We don’t accept same day expiry FX Option trades (neither in BAU nor in DMP) * No trades with maturity over 2Y from spot date are eligible * Trades past their settlement date are not eligible * In BAU, we can accept FX Spot and FX Forward trades settling from tomorrow onwards (would be needed for trading down) * In DMP, we can accept same day FX Spot and FX Forward settlement trades (would be needed for rolling cashflows in a DMP or settlement failure situation) * Spot date is calculated as per spot convention defined in Table 4 |
| BR 21 - Trade Validation: Risk Checks | As a ForexClear Risk User,  I want to perform simultaneously a set of risk checks on trades that passed eligibility checks (BR 18 to BR 20) so that I can accept/reject trades  Acceptance criteria:   1. An Incremental Risk Check (IRC. see BR 23) is performed for both counterparties in a trade(s) 2. A Settlement Limit Check (SLC, see BR 24) is performed for both counterparties in a trade(s) 3. The overall Risk Check is performed within 10seconds (please refer to Ops BRD) to ensure trade novation/rejection is completed within the required time frame 4. Trade risk checks (see BR 23 – BR 24) are performed after all eligibility checks are successfully passed 5. Trade eligibility checks are performed as per BR 18 to BR 20 6. If the overall Risk Check is passed then the trades are novated 7. If the overall Risk Check is failed then the trades are rejected 8. Trades are novated/rejected within 10 seconds when submitted on SEF and 60 seconds when submitted off-SEF. |
| BR 187 – Trade Packages | As a ForexClear User,  I want the ForexClear system to accept packages of trades so that risk checks (**BR 23 and 24**) are performed on a package basis  Acceptance criteria:   1. The overall risk check (BR 21) is performed for the entire package at once 2. If the risk check is passed then all the trades in the package are accepted 3. If the risk check is failed than all the trades in the package are rejected |

* 1. Trade Cancelation

|  |  |
| --- | --- |
| BR 22 - Trade Cancellation: Risk Check | As a ForexClear Risk User, I want trade cancellation request to be subject to risk checks so that so that only trades that pass risk checks are cancelled.    Acceptance criteria:   1. Trade risk checks (see **BR 21**) for trade cancellations request are performed. 2. If the overall Risk Check is passed then the trade cancellation is processed and the trade becomes dead. 3. If the overall Risk Check is failed then the trade cancellation is rejected and the trade continues to be live |

1. Real Time Registration
2. 1. Trade Registration Fund (TRF)

The Trade Registration Fund framework is not in scope for phase 1.

* 1. Incremental Risk Check (IRC)

|  |  |
| --- | --- |
| BR 23 - Trade Validation Risk Checks: IRC | As a ForexClear Risk User, I want to perform an Incremental Risk Check (IRC) on trades that passed eligibility checks so that I only register trades that lead to total portfolio liability covered by total collateral for both counterparties.  Acceptance criteria:   1. IRC check is performed at margin account level (House account for FXO) 2. IRC is performed in real time 3. IRC Amount is calculated as the incremental risk amount generated by the new trade/package received   IRC Amount = TOTAL LIABILITIES - PREVIOUS TOTAL LIABILITIES   1. IRC is passed only if   Eq 1. TOTAL LIABILITIES ≤ TOTAL COLLATERAL + CREDIT TOLERANCE  OR  Eq 2. TOTAL LIABILITIES < PREVIOUS TOTAL LIABILITIES  , otherwise it is failed   1. Total Liabilities-reducing trades are always accepted as per Eq 2. 2. Total Liabilities are defined in **BR 142** 3. Total collateral defined in **BR 171** 4. Credit tolerance defined in **BR 27** 5. For packages, the IRC is performed for the entire package population at once in an all or nothing basis 6. If the system failed to perform a calculation for any reason, the system will apply a default IRC Amount corresponding to X% of the trade notional in USD equivalent (Conversion uses the last spot rate in the system). X is configurable and will be set at launch. 7. Default IRC amount are applied until next margin run at which point liabilities will be correctly calculated |

|  |  |
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| BR 24 - Trade Validation Risk Checks: SLC | As a ForexClear Risk User, I want to perform a Settlement Limit Check (SLC) on trades that passed eligibility checks (**BR 18** to **BR 20**) so that I can reject trades that lead to settlement limit breaches.  Acceptance criteria:   1. SLC is passed only if   FxSETH\_CCY1\_DATE ≤ TSLH\_CCY1  AND FxSETH\_CCY2\_DATE ≤ TSLH\_CCY2  OR  FxSETH\_CCY1\_DATE ≤ PREVIOUS FxSETH\_CCY1\_DATE  AND FxSETH\_CCY2\_DATE ≤ TSLH\_CCY2  OR  FxSETH\_CCY1\_DATE ≤ TSLH\_CCY1  AND FxSETH\_CCY2\_DATE ≤ PREVIOUS FxSETH\_CCY2\_DATE  OR  FxSETH\_CCY1\_DATE ≤ PREVIOUS FxSETH\_CCY1\_DATE  AND FxSETH\_CCY2\_DATE ≤ PREVIOUS FxSETH\_CCY2\_DATE  , otherwise it is failed   1. FxSETH\_CCY\_DATE is the settlement exposure for a given House account (H), Currency, and settlement Date combination calculated as per **BR 98** 2. FxSETH\_CCY\_DATE at date T is only calculated for trades with settlement date SD T + 2 business days. 3. TSLH\_CCY is the total settlement limits for a given House account H and Currency combination (**BR 25**) 4. For packages, the SLC is performed simultaneously for all trade in the package and all trades must pass the SLC check before then package can be novated 5. If for any reason SLC calculation is failing, the system will estimate a worst case settlement exposure assuming settlement of the pay in only for the given settlement date(s) 6. Default SLC amount are applied until next margin run at which point liabilities will be correctly calculated |
| BR 25 - Total settlement limit (TSL) | As a ForexClear Risk user:  I want to calculate the total settlement limit (TSL) for a member so that I can manage the settlement risk.  Acceptance criteria:   1. Calculate and store six numbers for AUD, CHF, EUR, GBP, JPY, and USD in local currency for each member 2. TSL will always result in a non-negative value 3. TSL is calculated in real time 4. TSL is calculated at member House account level   where  SPA is defined in **BR 79**  is the Market Liquidity Available as per **BR 26** |
| BR 26 - Market Liquidity Available (MLA) | As a ForexClear Risk user:  I want to define user editable market liquidity available (MLA) for each member so that I can calculate and manage the settlement risk.  Acceptance criteria:   1. Store six numbers for AUD, CHF, EUR, GBP, JPY, and USD in local currency for each member (. 2. Ability by ForexClear Risk team to edit the figures subject to a four eyes validation. 3. MLA will be quoted as an non-negative integer 4. MLA will be adjusted by an MLA adjustment factor according to the internal credit score (ICS) of the member as noted by **Table 6** 5. Ability to edit the MLA adjustment factor subject to a four eyes validation.   ***Table 6: Internal credit score adjusted market liquidity table***   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **ICS** | **1-4** | **5** | **6** | **7** | **8** | **9-10** | | **MLA adjustment** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | |

* 1. Credit Tolerances

LCH.Clearnet provides Credit Tolerances to members to facilitate trade registration. Credit Tolerances are assigned at mnemonic level, taking into account the credit worthiness of the Member as represented by the Internal Credit Score (ICS) of the Member Group it belongs to. Credit tolerances cap amounts apply at Member Group level depending on the Member Group ICS.

The Credit Tolerance framework in a combined EM + NON-EM ForexClear service will work as it currently does: a member’s overall Total Liability can be allowed to increase up to Total Collateral + Credit Tolerance, following which a margin call will be issued.

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| BR 27 - Credit Tolerance Configuration | As a ForexClear Risk User  I want the ability to apply credit tolerances and cap amounts ITD for ForexClear members so that members collateral is inflated of credit tolerances  Acceptance criteria:   1. Process similar to current EM service and apply to both EM and NON-EM options i.e. no change (Refer to DSS) 2. Credit tolerances are applied during intraday only (i.e. when the system is in ION or ITD mode as per **Table 5** |
| BR 28 - Margin call trigger ITD | As a ForexClear Risk User  I want the ability to perform margin calls so that ForexClear remain covered for all liabilities  Acceptance criteria:   1. Process similar to current EM service and apply to both EM and NON-EM options i.e no change (Refer to DSS) 2. Margin call triggered when total liability exceed total collateral (**BR 12**) plus credit tolerance (**BR 27**) 3. Total liability is as per **BR 143**, **BR 144**, and **BR 145** 4. Margin call corresponds to Total Liability + 50% MER 5. MER is as per **BR 94** |

1. Liability Calculations
2. 1. Data for Liability Calculations and Valuation
      1. FX Spot and Forward prices

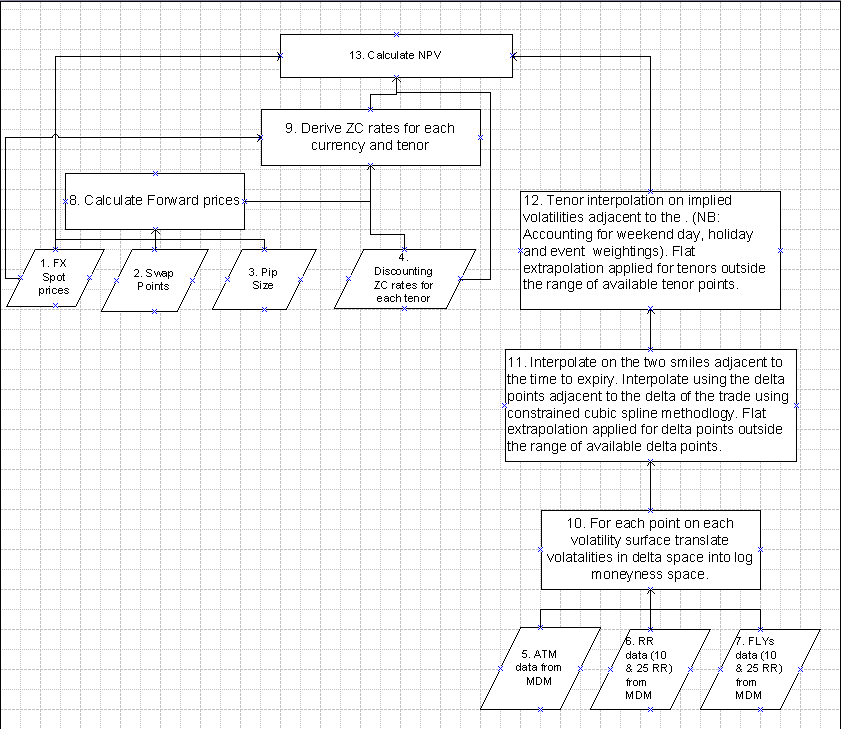
|  |  |
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| BR 29 - Data Snap | As a ForexClear Risk User:  I want the ForexClear system to retrieve the latest LCH enriched spot rates, FX swap points and IR Curves for all currency pairs in scope, from the market data management system (MDM) so that I can calculate the value of eligible products.  Acceptance criteria:   1. Data snap occurs every 30 minutes in BAU, every 5 mins in DMP, as per the EM service (See Market Data BRD, **BR 2, 8** and **42**) 2. Spot rates and swap points for the following currency pairs are snapped:  * AUDUSD * EURUSD * GBPUSD * USDCHF * USDJPY  1. USD FEDFUND, EUR EONIA, CHF TOIS, JPY TONA, AUD AONIA, and GBP SONIA zero curves are snapped 2. FX swap points rates for the following tenors should be snapped:  * O/N * T/N * S/N * 1W * 2W * 1M * 2M * 3M * 6M * 9M * 1Y * 18M * 2Y  1. The list of tenors is configurable |
| BR 30 - ZC back out from FXC Forward prices | As a ForexClear Risk User:  I want the ForexClear system to back out the relevant ZC curves so that I can correctly calculate value of eligible products.  Acceptance criteria:   1. For USD-based currency pairs (i.e. USD/CCY), the corresponding FX ZC curve corresponding to the term currency, for each tenor is calculated as: 2. For non-USD-based currency (i.e. CCY/USD), the ZC curve corresponding to the base currency, for each tenor is calculated as:   Where,   * + Represents the Libor zero rate between spot date and trade settlement date (based on linear interpolation of continuously compounded zero rates where required). Z is sourced in **BR 29**   + represents the accrual factor between spot and settlement date   + F and S are as follow   1. Where S is the relevant spot rate and the Pip Size is defined, by currency pair, according to **Table 4** and swap point are retrieve as per **BR 29**  1. Tenors are defined as follow:    * O/N    * T/N    * S/N    * 1W    * 2W    * 1M    * 2M    * 3M    * 6M    * 9M    * 1Y    * 18M    * 2Y 2. Day count convention in Zero coupon rate is ACT/365. This is configurable per currency |
| BR 31 - FX curve set up | As a ForexClear Risk User:  I want to build an FX curve for every currency eligible so that I can value FX Options, spot and forward  Acceptance criteria:   1. Zero curve are constructed for the following tenor set:  * O/N * T/N * S/N * 1W * 2W * 1M * 2M * 3M * 6M * 9M * 1Y * 18M * 2Y * 3Y * 4Y * 5Y  1. Tenor from O/N to 2Y are sourced with swap points as per **BR 29** 2. Tenor from 3Y to 5Y are sourced from the LIBOR curve for the relevant currency (**BR 29)** as per mapping in **Table 7** (Discount curve) 3. USD FEDFUND, EUR EONIA, CHF TOIS, JPY TONA, AUD AONIA, and GBP SONIA zero curves are snapped with the following priorities: 4. USDFEDFUND  * Deposit - OIS * Swap – USD FEDFUND A 3M  1. EUR EONIA  * Deposit – CASH * Swap – EUR EONIA A 3M  1. CHF TOIS  * Deposit – CASH  1. JPY TONA  * Deposit – OIS * Dep.Gen – JPY DEPOSIT OIS  1. AUD AONIA  * Deposit – OIS * Swap – AUD AONIA Q 3M * AUD DEPOSIT A/365  1. GBP SONIA  * Swap – GBP SONIA S 6M * Deposit - CASH  1. USD, AUD, CHF, EUR, GBP, and JPY LIBOR par curves are snapped with the following priorities: 2. USD STD    * Short Fut. – CME EURUSD 3M    * Swap – USD LIBOR A 3M    * FRA.Gen – USD 6M LIBOR    * Deposit - CASH 3. EUR STD  * Short Fut. – EUR EURIBOR 3M * Swap – EURIBOR A 6M * Deposit - CASH  1. CHF STD  * Short Fut. – LIFFE EURCHF 3M * Swap – CHF LIBOR A 6M * Deposit - CASH  1. JPY STD  * Swap – JPY LIBOR S 6M * Dep.Gen – JPY DEPOSIT (LIBOR) * Deposit - CASH  1. AUD STD  * Short Fut. – SFE BAB 90D * Swap – AUD BBSW S 6M * Deposit - CASH  1. GBP STD  * Short Fut. – LIFFE EURGBP 3M * Swap – GBP LIBOR S 6M * Deposit - CASH  1. Linear interpolation is used between tenor points on the zero IR curves 2. Flat extrapolation before the 1st tenor point, and beyond the last tenor point. |

* + 1. Volatility Surfaces

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| BR 32 - Volatility Data Snap | As a ForexClear Risk User:  I want the ForexClear system to retrieve the latest LCH enriched volatility surface for all currency pairs in scope so that I can calibrate my volatility surface  Acceptance criteria:   * Volatility surfaces are obtained from the Market Data Management system as part of the scheduled snap (See market data BRD, **BR 2, 8** and **42**) * USD/CHF, USD/JPY. EUR/USD, ERU/CHF, EUR/JPY, AUD/USD. GBP/USD. GBP/EUR * The following tenors should be snapped: * O/N * 1W * 2W * 1M * 2M * 3M * 6M * 9M * 1Y * 18M * 2Y * RR (Risk reversal) and FLY (Butterfly) for delta 10 and 25 and ATM are snapped from the market data system * Data snap occurs every 30minutes in BAU, every 5 mins in DMP, as per the EM service. |
| BR 33 - Volatility Surface Definition | As a ForexClear Risk User:  I want each volatility surface to be converted from ATM, RRs and FLYs into delta space so that I can then define scenarios in this form.  Acceptance criteria:   1. Volatility surface are retrieved from the Market Data Management system (**BR 32**) 2. Conversion to delta space should use the following equations:   Where,  is the implied volatility corresponding to a Call/Put with delta δ  are coming from **BR 32**  are coming from **BR 32**   1. Each volatility surface should be defined using the following points:    1. ATM    2. Call 10, Call 25    3. Put 10, Put 25    4. Each volatility surface is defined on the following tenors:       * ON       * 1W       * 2W       * 1M       * 2M       * 3M       * 6M       * 9M       * 1Y       * 18M  * 2Y |
| BR 34 - Weekend Weighting | As a ForexClear Risk User:  I want to apply a different volatility weighting over the weekends so that I can account for the fact that implied volatility quotes are annualised and there is more volatility on weekdays than on weekends  Acceptance criteria:   * A weight can be assigned to weekend days * A weight can be assigned independently to a Saturday or a Sunday * At service launch, weekend day weightings are set to 10% (this weighting should, however, remain configurable) |
| BR 35 - Holiday and event Weighting | As a ForexClear Risk User:  I want to apply a different volatility weighting over the holidays and some specific events so that I can account for the fact that implied volatility quotes are annualised and there is more volatility on some days.  Acceptance criteria:   * This will be used in DMP situation or on ad-hoc basis * Weight will be entered by a risk person and subject to four eyes check before being used in the calculation * Weighting is applied on a currency pair basis * Weighting will be numerical (0.5=50%) |
| BR 36 - Volatility Surface Axes Translation | As a ForexClear Risk User:  I want the ForexClear system to translate each volatility surface to log-moneyness space so that I can value an FX Option  Acceptance criteria:   1. Volatility surface has been defined in delta space (see **BR 33**), 2. For each point on the volatility surface, a log-moneyness will be calculated 3. Log-moneyness calculation differ depending on the delta being included in the calculation or not (Premium-included delta is defined by currency pair in **Table 4**) 4. Log-Moneyness for AUDUSD, EURUSD and GBPUSD (Premium-included delta set to No) will be calculated for each point along the volatility surface as follows:   Where,  F=Forward price corresponding to tenor of vol surface  σ=Implied Volatility  δ=Delta corresponding to point on vol surface  =Foreign interest rate  Time to expiry  Inverse Cumulative Normal Distribution  FX Spot Rate  Natural Logarithm   1. Log-Moneyness for USDCHF, USDJPY, EURCHF,EURGBP and EURJPY (Premium-included delta set to yes) will be calculated for each point along the volatility surface as follows:   Where,  F=Forward price corresponding to tenor of vol surface  σ=Implied Volatility  δ=Delta corresponding to point on vol surface  =Foreign interest rate  Time to expiry  Option Value (as per **BR 39**), in term currency  FX Spot Rate  Inverse Cumulative Normal Distribution  Natural Logarithm   1. Two unique sets of simulated volatility surfaces should be created   Example of conversion to log-moneyness can be found in the attached |
| BR 37 - Vol Surface Interpolation | As a ForexClear Risk User:  I want to interpolate along each volatility surface using a log-moneyness (**BR 36**) and time to expiry as input so that I can use the correct implied volatility in an option’s NPV calculation.  Acceptance criteria:   1. Follow following steps:    1. Tenor interpolation: Linear in variance space (Murex’s out of the box V²T model), whilst accounting for weekend day weightings (as specified in above **BR 34** and holidays and event weightings (**BR 35**). Flat extrapolation before first tenor and beyond last tenor    2. Delta interpolation: the quoted deltas are converted into log-moneyness values (**BR 36**) and the interpolation is done in this log moneyness space using the constrained cubic spline methodology (**See Methodology document for details**). Flat extrapolation is applied outside quoted points.      1. Interpolation is to be performed first on the two smiles adjacent to the time to expiry (using constrained cubic spline) and then tenor interpolation is performed on the two resultant implied volatilities |
| BR 38 - Pre-Computing of constants for interpolation | As a ForexClear Risk User,  I would like to pre-compute the constants used in the constrained cubic spline interpolation methodology for each volatility surface used in IM calculations so that I can reduce the time taken for each interpolation to take place.  Acceptance Criteria:   1. Each time scenarios used in IM calculations are updated, the constants a, b, c and d (see methodology in **BR 37**) for each volatility surface in each scenario are to be re-calculated and made available to the real-time pricing engine. 2. Pre-computing of constants for each vol surface should follow the same process defined in the Constrained Cubic Spline methodology document (v1.1). |

* 1. Valuation
     1. NPV

***Figure 1 NPV Calculation***



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| --- | --- | --- |
| **Step** | **BR** | |
| 1-7 | BR 29 | |
| 8 | BR 30 | |
| 9 | BR 30 | |
| 10 | BR 36 | |
| 11 | BR 37 | |
| 12 | BR 37 | |
| 13 | BR 39 | |
| BR 39 - Valuation: FX Options | | As a ForexClear Risk User:  I want the ForexClear system to calculate the Net Present Value of FX Options that I can correctly calculate the value of each trade.    Acceptance criteria:   1. NPV is calculated using the Garman-Kohlhagen model (Refer to methodology document for details) 2. The market data used to price an FX Option should include the spot *rate*, 2 FX ZC curves, 1 discounting ZC curve and a volatility surface for the trade currency pair – Refer to market data BRD for source 3. Each FX Option NPV is calculated using market instruments corresponding to the table below:   ***Table 7 – Currency pair reference curve for valuation***   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Currency Pair** | **Vol Surface** | **VM Currency** | **Base Curve** | **Term Curve** | **Discount Curve** | | **AUD/USD** | AUD/USD | USD | AUD LIBOR | USD LIBOR | USD FFUND | | **EUR/CHF** | EUR/CHF | EUR | EUR LIBOR | CHF LIBOR | EUR EONIA | | **EUR/GBP** | EUR/GBP | EUR | EUR LIBOR | GBP LIBOR | EUR EONIA | | **EUR/JPY** | EUR/JPY | EUR | EUR LIBOR | JPY LIBOR | EUR EONIA | | **EUR/USD** | EUR/USD | USD | EUR LIBOR | USD LIBOR | USD FFUND | | **GBP/USD** | GBP/USD | USD | GBP LIBOR | USD LIBOR | USD FFUND | | **USD/CHF** | USD/CHF | USD | USD LIBOR | CHF LIBOR | USD FFUND | | **USD/JPY** | USD/JPY | USD | USD LIBOR | JPY LIBOR | USD FFUND |  1. When pricing an FX Option, Linear interpolation should be applied to the ZC curves between tenor points using actual days divided by 365. 2. When pricing an FX Option, interpolation of the volatility surface should be applied consistent with **BR 37** 3. FX Options are valued up until exercise expiry decision is determined.  * If Exercised: The FX Option is valued as per **BR 41** * If Expired: The FX option value is Nil (0)  1. NPV calculation is stored in real time and for each margin run | |
| BR 40 - Valuation: FX Option Premium | | As a ForexClear Risk User:  I want the ForexClear system to calculate the Net Present Value of FX Premiums.  Acceptance criteria:   1. Up until premium payment date, the option premium is discounted using the relevant OIS curve for the premium currency. 2. Discounting is applied using:   Where:   * PD=Premium settlement date * VD=Valuation date * Λ=Accrual factor between two days * =Discount ZC rate (using OIS curve) * OIS curve is the one of the premium currency as per table below and sourced from (**BR 29**):   ***Table 8 – Premium currency and discount curve***   |  |  | | --- | --- | | **Currency** | **Discount Curve** | | EUR | EUR EONIA | | JPY | JPY TONA | | USD | USD FEDFUND | | CHF | CHF TOIS | | GBP | GBP SONIA | | AUD | AUD AONIA | | |
| BR 41 - Valuation: FX Cash Products | | As a ForexClear Risk User:  I want the ForexClear system to calculate the Net Present Value of FX Spots and Forwards using Murex’s out of the box “Discounted Spot" and “FX Forward” models.  Acceptance criteria:   1. Each FX Spot/Forward NPV is calculated using market instruments corresponding to the table below:   ***Table 9 – Currency pair reference curve for valuation***   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Currency Pair** | **Spot Rate** | **VM Curr** | **Base Curve** | **Term Curve** | **Discount Curve** | | **AUD/USD** | AUD/USD | USD | AUD LIBOR | USD LIBOR | USD FFUNDS | | **EUR/CHF** | EUR/CHF | EUR | EUR LIBOR | CHF LIBOR | EUR EONIA | | **EUR/GBP** | EUR/GBP | EUR | EUR LIBOR | GBP LIBOR | EUR EONIA | | **EUR/JPY** | EUR/JPY | EUR | EUR LIBOR | JPY LIBOR | EUR EONIA | | **EUR/USD** | EUR/USD | USD | EUR LIBOR | USD LIBOR | USD FFUNDS | | **GBP/USD** | GBP/USD | USD | GBP LIBOR | USD LIBOR | USD FFUNDS | | **USD/CHF** | USD/CHF | USD | USD LIBOR | CHF LIBOR | USD FFUNDS | | **USD/JPY** | USD/JPY | USD | USD LIBOR | JPY LIBOR | USD FFUNDS |  1. When pricing an FX Spots/Forwards, Linear interpolation should be used in between tenor points on the zero IR curves | |

* 1. Variation Margin (VM)

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| BR 43 - Variation Margin (VM) calculation | As a ForexClear Risk user:  I want the ForexClear system to calculate Variation Margin (VM) so that I can account for the change in portfolio net present value throughout the day.  Acceptance criteria:   1. Variation margin is calculated as:  * VMITD = ITD NPV – Previous days EOD NPV * VMEOD = EOD NPV – Previous days EOD NPV  1. Market data used in VM calculation should be that of the latest market data refresh as defined in **Table 5** 2. VM of an option trade is calculated in the VM currency of the currency pair as per **Table 4** 3. VM of an option’s premium is calculated in the same currency as the premium, as per **Table 4** 4. NPV is calculated as per section **4.1.3** 5. MTM for an Option is calculated as per **BR 39** 6. MTM for a cash product (FX Spot or Forward) is calculated as per **BR 41** 7. MTM of the premium is calculated as per **BR 40** 8. VM is calculated on all live trades until spot date EOD inclusive i.e. any transaction with maturity < spot are excluded from VM calculation 9. VM for cancelled trade correspond to the reversal of the previous EOD MTM 10. Variation Margin is calculated at each IRC calculation and for each margin run. |
| BR 44 - Variation Margin conversion in USD | As a ForexClear Risk user:  I want to convert the VM into USD so that I can aggregate the VM in the total liability calculation  Acceptance criteria:   1. VM is calculated as per **BR 43** 2. Market data used in VM calculation should be that of the latest market data refresh as defined in **Table 5** 3. Conversion of VM currency to USD is performed at latest FX spot exchange rate |
| BR 45 - VM EOD cash postings | As a ForexClear Risk user:  I want to feed EOD VM postings to Calypso in VM currency so that VM is settled in the denominated currency  Acceptance criteria:   1. VM is calculated as per **BR 43** 2. Market data used in EOD VM calculation should be that of the EOD market data refresh as defined in **Table 5** 3. VM is sent to Calypso in denominated VM currency 4. VM is posted to Calypso as per current service 5. VM in USD for NON-EM is fungible with VM in USD of the EM service |

* 1. Price Alignment Interest (PAI)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BR 95 - PAI Calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the PAI once a day at EOD, for each VM currency so that I can calculate the interest accrued on VM payments.  Acceptance Criteria:   1. PAI is calculated as:   Where  is PAI calculated at margin account level at each EOD margin run  = PAI Par Rate at date t  = MTM total value of the Counterparty’s portfolio after valuation at previous EOD  = Accrual Factor (Business Day Count Fraction - used to convert the PAI rate from an annual rate to a daily rate).  Is following business day after . LCH Calendar is used as the reference calendar in the determination of a good business day.   1. PAI Par Rate for the corresponding VM currency is retrieved from table below.  |  |  |  | | --- | --- | --- | | **Currency** | **PAI Rate Used** | **Accrual Factor** | | USD | USD Fed Fund | 360 | | GBP | GBP SONIA | 365 | | JPY | JPY TONAR | 365 | | CHF | CHF TOIS | 360 | | AUD | AUD AONIA | 365 | | EUR | EUR EONIA | 360 |  1. PAI postings to Calypso are in VM currency. |
| BR 96 - PAI Calculated in USD equivalent | As a ForexClear Risk User:  I want to calculate a USD equivalent PAI amount so that I can include this in reports and Total Liability calculations  Acceptance criteria:   1. For any PAI calculated that is not in USD this is converted into USD equivalent 2. USD equivalent PAI is the sum of the USD equivalent in all currencies 3. PAI is calculated as per BR 95 4. FX rates used are those in latest market data refresh |

1. Initial Margin
2. 1. Historical Scenario Initialisation

Example of scenario generation can be found [here](Examples/Scaling%20Example.xlsx).

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| BR 51 – Historical Market data and risk factor set | As a ForexClear Risk user:  At service launch I want to load a set of EOD prices for the past 2566 business days so that I can calculate 2500 scenarios for each risk factor which use 5-day returns and take into account a period of 60 days for a volatility seed.  Acceptance criteria:   1. For each currency pair in scope, there are the following risk factors  * FX Spot Rate for all currency against USD (Table 3): EUR/USD, GBP/USD, USD/CHF, USD/JPY, AUD/US * All points along a volatility surface (defined in BR 33), in delta space * Call and Put * Delta 10, 25 and ATM * Fixed set of tenros (see bullet point 2 below) * For each currency in scope, there is an FX curve, as defined in BR 31 * The following curve used in the pricing of various products: * USD FEDFUND, EUR EONIA, CHF TOIS, JPY TONA, AUD AONIA, GBP SONIA discounting curves as snapped in BR 29 * USD LIBOR as snapped in BR 29  1. ZC Curves from BR 31 and volatility from BR 33 will be translated into a fixed tenor space using a standard linear interpolation (Flat extrapolation before first tenor and beyond last tenor). Fixed tenors bucket will be as follow and starting from valuation date:1D, 7D, 14D, 30D, 60D, 91D, 182D, 273D, 365D, 547D, 730D |

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| BR 52 - Initial Returns | As a ForexClear Risk user:  At service launch I want to use the market data above (BR 51) to calculate 2560 5-day returns for each risk factor so that I can produce a distribution of potential risk factor moves.  Acceptance criteria:   1. Unscaled returns for spot rates, interest rates and implied volatilities to be calculated as:   where,  = return calculated at time *t*  = price (or rate, yield etc) at time *t*  = holding period assumed (ie. five days)   1. This data should be stored  * Holding period is configurable. |
| BR 53 - EWMA Volatility seed | As a ForexClear Risk user:  At service launch I want the ForexClear system to calculate the EWMA volatility seed for all spot rate and interest rate risk factors (BR 30) so that I can begin to create a EWMA time series for the relevant risk factors.  Acceptance criteria:   * The seed for each risk factor is calculated as the standard deviation of the oldest 60 unscaled returns. Unscaled returns are calculated in BR 52. * The EWMA seed is a one off calculation to initiate EWMA volatility time series (BR 55)  1. Standard Deviation to be calculated as:   Where,  = seed volatility  = unscaled return (Unscaled returns are calculated in **BR 52)** at time  = mean unscaled return (Unscaled returns are calculated in **BR 52)** over the *n* days prior to the last scenario date  = first business day prior to the last scenario date  = number of observations (ie. 60)  **Note**:  At service launch, seed volatility should be used to start the time series. Subsequent scenarios EWMA are initiated at service launch and increment daily at EOD (BR 55). |

* 1. IM scenario increment

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| BR 54 - IM Scenario increment at EOD | As a ForexClear Risk user:  I want to increment the historical scenarios by the latest 5 day returns observed on the IM risk factor set at each EOD so that I can have an updated set of historical scenarios  Acceptance criteria:   1. Generation of new scenario occurs daily after each EOD market data snap (5pm NY time - Refer to **Market data BRD, BR 2**) and before each EOD margin run (Midnight London time - **Table 5)** 2. Returns are calculated as per **BR52** 3. This data should be stored 4. The system retain the most recent 2500 historical scenarios i.e. oldest scenario dropped, newest added |
| BR 55 - EWMA Volatility increment at EOD | As a ForexClear Risk user:  I want the ForexClear system to create a time series of EWMA volatility for spot and zero curves factors in my risk factor set (**BR 51**) so that I can measure the forward volatility at the time each historical scenario occurred and apply volatility scaling to my historical scenarios  Acceptance Criteria:   1. All spot and IR curves are sourced from the EOD market data snap 2. Generation of new EWMA occurs daily after each EOD market data snap (5pm NY time - Refer to **Market data BRD, BR 2**) and before each EOD margin run (Midnight London time - **Table 5)** using the latest scenario set (**BR 54**) 3. The EWMA calculation is defined as:   where,  = volatility at time *t*  = unscaled return at time *t as per* **BR 52**  = EWMA decay factor (set to 0.97 initially)   1. Seed volatility should be used to start the time series and subsequent scenarios EWMA are intiiated at service launch as per **BR 53** and increment daily at EOD. 2. This data should be stored. 3. The system retains the most recent 2500 historical scenarios i.e. oldest scenario dropped, newest added. 4. is configurable |

* 1. Initial Margin

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| BR 46 - Initial Margin | As a ForexClear Risk user:  I want the ForexClear system to calculate the Initial Margin of a member’s portfolio so that the CCP is protected against a default of this member  Acceptance criteria:   1. Initial margin is the maximum of the Core IM model (**BR 183**) and the IM Floor model (**BR 50**) 2. Initial margin for client accounts will be based on a 7 day holding period calculated using the square root of time () – Same as current service 3. Initial margin is calculated at each IRC check (**BR 23**) and each margin run (**Table 5**) |

* + 1. Core IM

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| BR 183 – Core IM Portfolio Margining | As a ForexClear Risk user:  I want the ForexClear system to calculate the Core IM for NON-EM currencies, EM currencies and both groups combined so that I can assess my risk and comply with regulatory requirements  Acceptance criteria:   1. Currency pairs are split in two groups: EM and NON-EM 2. EM currencies group is composed of the current twelve ForexClear live currency pairs: USD/BRL, USD/CLP, USD/COP, USD/CNY, USD/IDR, USD/INR, USD/KRW, USD/MYR, USD/PEN, USD/PHP, USD/RUB, USD/TWD 3. Non-EM group will be composed of the proposed eight currency pairs: AUD/USD, USD/CHF, EUR/USD, GBP/USD, USD/JPY, EUR/GBP, EUR/JPY, EUR/CHF 4. Core Initial Margin will be calculated as follow:   Where  is the IM for all currency pairs (EM and Non-EM) in ForexClear combined in a single portfolio for a given margin account.  is the IM of the Non-EM group  of currency pairs for a given margin account.  is the IM of the EM group  of currency pairs for a given margin account.  is the portfolio margin parameter that can vary between 1 (Full portfolio margin) and 0 (No Portfolio Margin)   1. IM for each group is calculated as per **BR 49** 2. α is a floating number (3,2) and can take any value between 0 and 1 up e.g. 0.75 |
| BR 49 – Core IM calculation for each portfolio margin group | As a ForexClear Risk user:  I want the ForexClear system to calculate the Core IM model for each portfolio margin group so that I can calculate Core Initial Margin under portfolio margining rules  Acceptance criteria:   1. P&L vectors are calculated as per **BR 48** using simulated scenarios calculated in **BR 61** 2. Core IM is calculated for each group of currencies and the combination of the two groups: EM, Non-EM and both combined 3. The IM for each group is defined as the average of the largest *N* losses in the corresponding P&L vector tail for each group (Expected shortfall model) 4. N takes the default value of 7 but is configurable 5. The following condition must be respected: |
| BR 56 – Core IM scaled scenarios | As a ForexClear Risk user:  I want the ForexClear system to create a distribution of scaled returns so that I can calculate generate a set of simulated market data   1. Generation of scaled scenario occurs daily at EOD after **BR 54** and **BR 55** completed. 2. All spot rates against USD and IR curves in market data set **BR 51** are scaled using the formula:   where,  = scaled return at time *t*  = unscaled return at time *t*  = volatility at time *t* (As per **BR 55**)  = volatility at valuation date (as per **BR 53**)  = historical volatility weighting (set to 0.5 initially)   1. The scaled returns will be stored for use in the next EOD margin run and until the next EOD Margin run (exclusive) (**BR 1**) 2. HVW is configurable 3. Scaled scenarios are generated for the most recent 2500 scenarios available in **BR 54** 4. FX implied Volatility are not scaled. |
| BR 61 – Core IM Clean simulated scenarios | As a ForexClear Risk User:  After each market data refresh I want to generate a final set of Core IM simulated scenarios so that I can calculate IM with fresh market data  Acceptance criteria:   1. Simulated FX spot are calculated as per **BR 58** using scaled scenario calculated in **BR 56** 2. Simulated Interest rate are calculated as per **BR 58** using scaled scenario calculated in **BR 56** 3. Simulated implied volatility are calculated as per **BR 58** using raw historical returns as per **BR 54.** De-arbing is perforemed on all simulated volatily surface for every scenario as per **BR 60** using simulated FX spot and IR ZC simualted scenario from **BR 56** |

* + 1. IM Floor

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| BR 185 – IM Floor Portfolio Margining | As a ForexClear Risk user:  I want the ForexClear system to calculate the IM Floor for NON-EM currencies, EM currencies and both groups combined so that I can assess my risk and comply with regulatory requirements  Acceptance criteria:   1. Currency pairs are split in two groups: EM and NON-EM 2. EM currencies group is composed of the current twelve ForexClear live currency pairs: USD/BRL, USD/CLP, USD/COP, USD/CNY, USD/IDR, USD/INR, USD/KRW, USD/MYR, USD/PEN, USD/PHP, USD/RUB, USD/TWD 3. Non-EM group will be composed of the proposed eight currency pairs: AUD/USD, USD/CHF, EUR/USD, GBP/USD, USD/JPY, EUR/GBP, EUR/JPY, EUR/CHF 4. Core Initial Margin will be calculated as follow:    1. Where    2. is the IM for all currency pairs (EM and Non-EM) in ForexClear combined in a single portfolio for a given margin account    3. is the IM of the Non-EM group  of currency pairs for a given margin account    4. is the IM of the EM group  of currency pairs for a given margin account    5. is the portfolio margin parameter that can vary between 0 (Full portfolio margin) and 1 (No Portfolio Margin) 5. IM for each group is calculated as per **BR 47** 6. Y is a floating number (3,2) and can take any value between 0 and 1 up e.g. 0.75 |
| BR 47 – IM Floor calculation for each portfolio margin group | As a ForexClear Risk user:  I want the ForexClear system to calculate the IM Floor for each portfolio margin group so that I can calculate Initial Margin Floor under portfolio margining rules  Acceptance criteria:   1. P&L vectors are calculated as per **BR 48** 2. IM Floor P&L vectors are calculated using simulated scenarios calculated in **BR 186** using IM Floor simulated scenarios as per **BR 186** 3. IM Floor is calculated for each group of currencies and the combination of the two groups: EM, Non-EM and both combined 4. The IM for each group is defined as the average of the largest *N* losses in the corresponding P&L vector tail for each group (Expected shortfall model) 5. N takes the default value of 7 but is configurable 6. The following condition must be respected: |
| BR 57 – IM Floor Scaling | As a ForexClear Risk user:  I want to create another distribution of scaled returns so that I can calculate a set of simulated scenario for the IM Floor model  Acceptance criteria:   1. Generation of scaled scenario occurs daily after **BR 54** and **BR 55** completed. 2. All spot rate and zero rate in my risk factor set **(BR 51)** are scaled using the formula:   where,  = scaled return at time *t*  = unscaled return at time *t*  = QV percentile of volatilities from the 2500 scenarios previous to *t.* QV set to 75% and is configurable   1. The scaled returns will be stored for use in the next EOD margin run and until the next EOD Margin run (exclusive) (**BR 1**) 2. Scaled scenarios are generated for the most recent 2500 scenarios available in **BR 54** |
| BR 186 – IM floor Clean simulated scenarios | As a ForexClear Risk User:  After each market data refresh I want to generate a final set of Core IM simulated scenarios so that I can calculate IM with fresh market data  Acceptance criteria:   1. Simulated FX spot are calculated as per **BR 58** using scaled scenario calculated in **BR 57** 2. Simulated Interest rate are calculated as per **BR 58** using scaled scenario calculated in **BR 57** 3. Simulated implied volatility are calculated as per **BR 58** using raw historical returns as per **BR 54.** De-arbing is perforemed on all simulated volatily surface for every scenario as per **BR 60** using simulated FX spot and IR ZC simualted scenario from **BR 57** |

* 1. IM Scenarios valuation

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| BR 48 – IM P&L Vector | As a ForexClear Risk User:  I want the ForexClear system to calculate each margin account P&L for each of the simulated scenarios so that I can calculate IM  Acceptance criteria:   1. Portfolio P&L under IM or IM floor model for a given scenario is calculated as:   where,  = simulated portfolio P&L in USD for scenario *t*  = simulated value of the portfolio at scenario *t* in USD  = Base value of the portfolio in USD  AND  = simulated value of trade *i* in scenario *t* in USD under corresponding pricing model (**BR 39, BR 40, BR 41**). The value of each trade *i* at scenario *t* is converted into USD using simulated spot rates (**BR 61**)  = number of trades in the portfolio   1. P&L vectors calculation is broken down by currency pair for each margin account and scenario in order to calculate the IM for each group of currencies. 2. P&L vectors should be stored for reporting purposes 3. Market data used in scenario *t* are the simulated scenarios in **BR 61** 4. Market Data used in scenario 0 are the latest market data snap loaded for a margin run. |
| BR 58 - Simulated historical scenarios | As a ForexClear Risk user:  I want to create a set of simulated historical scenarios so that I can calculate IM and FxSet.  Acceptance criteria:   1. Each simulated scenario should be identifiable by a scenario ID and the scenario start and end dates 2. The simulated scenarios should be stored. 3. Simulated scenarios must be refresh at each market data refresh:    * Generate a new batch of historical scenarios. Market data refresh schedule provided in **Table 5**    * Before each EOD margin run, for use from EOD margin kick off onward, using latest scenario generated in **BR 58**. 4. Simulated FX spot are calculated using following relative returns formula:   =  where,  = simulated price for FX spot rate at time *t*  = market price (or rate, yield, implied vol etc) at valuation date  = scaled return at time *t*   1. Simulated interest rates, simulated scenarios are calculated as follow   where  = simulated price (yield) at time *t*  = market price (yield) at valuation date  = scaled return at time *t*   1. Simulated FX implied volatilities scenarios are calculated as follow     where  = simulated implied vol at time *t*  = Volatility quote at valuation date  = Unscaled return at time *t* |
| BR 60 - Volatility Surface De-Arbitraging | As a ForexClear Risk User:  I want to run the de-arbing process so that the volatility surfaces used in our pricing are coherent.  Acceptance criteria:   1. I want the de-arbing process to be run on each volatility surface submitted 2. I want the resulting volatility surfaces to be stored. Resulting volatility surfaces will have no arbitrages 3. A log of all changes made to the volatility surfaces as a part of the de-arbing process should be kept 4. In order to perform de-arbing surfaces will be translated into log-moneyness space using **BR 36** |

* 1. Backtesting

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| BR 62 - IM Backtesting | As a ForexClear Risk User:  I want to backtest the IM on a daily basis so that I can assess the suitability of the IM methodology.  Acceptance criteria:   1. As at EOD, I want to calculate the clean and dirty P&L of the past 1, 5 and 7 (rolling) business days. 2. Dirty PnL is defines as follows: 3. Clean PnL is defines as follows:   where  = Dirty PnL for past n business days (t,t-n)  Market Value using latest market data at time t and portfolio at time t.  = Market Value using market data as at t-n and portfolio as at time t-n.  = Market Value using latest market data at time t and portfolio as at time t-n.   1. Backtesting is performed at margin level and is performed on the final IM number (**BR 46**) 2. Clean and dirty P&L are calculated and stored at margin level 3. This calculation needs to be available for model validation before 5am London time. |
| BR 63 - FXSet Backtesting | As a ForexClear Risk User:  I want to Backtest the FXset model on a daily basis so that I can assess the suitability of the IM methodology.  Acceptance criteria:   1. Backtesting is calculated daily. 2. Backtesting of FXSet consist in comparing the FXSet calculation at the start of the day for the given day (**BR 98**) to the effective settlement calculated at expiry time (**BR 72**) for the identical set of trades |

1. Margin Add-ons
2. 1. Sovereign Risk Margin (SRM)

**\*\* SRM methodology is subject to changes \*\***

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| BR 64 - SRM add-on new components | As a ForexClear Risk User:  I want to add a new component to the SRM liability on at every margin run and each IRC calculation so that it is used in the determination of the SRM liability  Acceptance criteria:   1. SRM liability is the minimum liability of the current SRM (Min of default or regime) and the stress SRM (New component) 2. and are calculated as per current EM NDF service per currency pair and summed at margin account level. 3. is a new component of the SRM liability 4. calculation works as follow:    1. A set of N scenarios are defined as per **BR 65**    2. Portfolio is revalue under each scenario t and scenario P&L is calculated as follow:   where,  is the simulated Net Present Value (NPV) of trade *i* in scenario *t*  is the base NPV of trade *i* calculated with latest market data refresh  is the number of trades in the margin account ()  is the scenario defined in **BR 65**   * 1. The liability corresponds to the worst Stress loss over IM for each margin account   Where  is the worst stress loss generated by every scenario defined in **BR 65**  is the IM of the account () as calculated in **BR 46**   * 1. result is capped to 0   2. Revaluation of each trade in the is as per **BR 39, BR 40,** and **BR 41** |
| BR 65 - SRM Scenarios | As a ForexClear Risk User:  I want to maintain a set of scenarios in the ForexClear system in a controlled way so that I can calculate SRM  Acceptance criteria:   1. Number of scenario can vary from 0 to 100 2. Shocks in each scenarios can be defined on FX Spot (5) and FX volatility risk factor (11 tenor \* 5 delta \* 8 currency pair) 3. Shocks on all risk factors are defined in relative terms e.g. 2% 4. Shocks are applied to current market data set as **per BR 58** (FX Spot) and **BR 59** (Implied volatilities) |

* 1. Settlement Management Margin (SMM)

**\*\* SMM add-on is replacing the previous SLM add-on, it has not been approved yet by the internal governance and is therefore subject to changes \*\***

Equation 1

Where:

SRC = Settlement Risk Cost

SVM = Settlement Variation Margin

Equation 2

Where:

= Settlement Risk Cost fixed component

= Settlement Risk Cost simulation component

Equation 3

Where:

= spread from the SRC Spread Matrix in **Table 10** for currency *Ccy* (in basis points)

= settlement requirement for currency *Ccy* (where a pay-in obligation is a negative value) on day *t*

= FX spot rate expressed as amount of USD per 1 unit of *Ccy*

= Prefunding is amount of collateral lodged at central banks

Equation 4

Where:

j = Scenario used in FxSET

= FX spot rate expressed as amount of USD per 1 unit of *Ccy* used in scenario j

= Settlement Risk Cost simulated for currency *Ccy* under scenario j

Equation 5

Where:

= Settlement exposure calculated using the FxSet model for currency *Ccy*, day *t* and under scenario *j*

= SPA from the SRC Spread Matrix in **Table 10** for currency *Ccy*

= Spread from the SRCSpread Matrix in **Table 10** for currency *Ccy*

Equation 6

Where:

= Current mark to market

= Mark to market value of trade at SD-2 end of day

= Current FX Spot price quoted in Ccy -USD

= FX Spot price as at EOD SD-2 quoted in Ccy-USD

i = Trade number

n = Number of trades with known settlement obligations yet to settle

Figure 2 – SRC calculation window

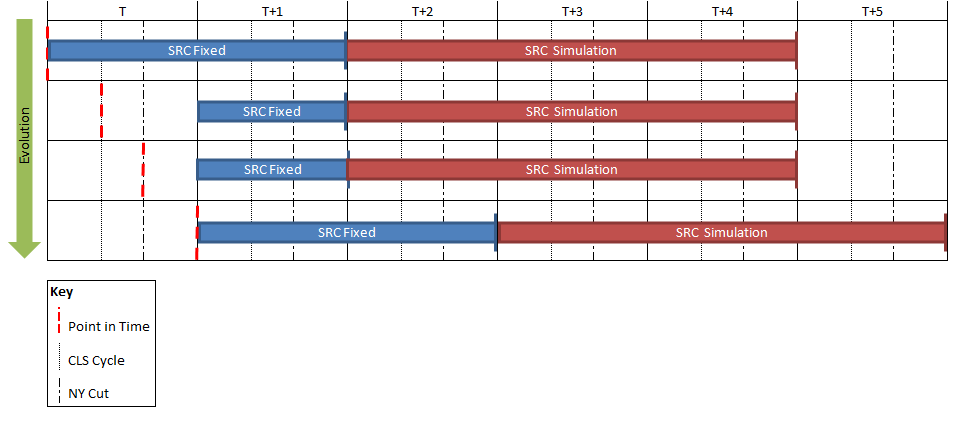


Table 10 – SRC Spread Matrix

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Currency | AUD | CHF | EUR | GBP | JPY | USD |
| SPA (local Ccy million) | 80 | 80 | 160 | 120 | 0 | 360 |
| Spread (bps) | 10 | 20 | 15 | 20 | 20 | 20 |

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| BR 66 - Calculate SMM | As a ForexClear Risk User:  I want to be able to calculate the at each IRC check and margin run so that I can include it as an IM add-on in the total liabilities  Acceptance criteria:   1. SMM is the sum of SRC and SVM (**Equation 1**)   Where  is defined in **BR 67**  is defined in **BR 68**   1. is in USD |
| BR 67 - Calculate SRC | As a ForexClear Risk User:  I want to be able to calculate the so that I can include it as part of the SMM liability  Acceptance criteria   1. SRC is the sum of and (**Equation 2**)   Where:  is defined in **BR 69**  is defined in **BR 73**   1. SRC is in USD |
| BR 68 - Calculate SVM | As a ForexClear Risk User:  I want to be able to calculate the so that I can include it as part of the SMM liability  Acceptance criteria   1. SVM is the difference in the MTM at t and MTM at SD-2 EOD (**Equation 6**)     Where:  = current MTM as calculated in **BR 41** for trade i  = defined in **BR 80**  = defined in **BR 78**  = defined in **BR 81**  i = the trade number  n n = the total number of trades with known settlement obligations yet to settle   1. SVM is in USD 2. SVM is only calculated on trades between SD-2 EOD and settlement |
| BR 69 - Calculate | As a ForexClear Risk User:  I want to be able to calculate the so that I can include it as part of the SRC liability  Acceptance criteria   1. is calculated as per **Equation 3**   Where:  is defined in **Table 10**  is defined in **BR 72**  is defined in **BR 75**  is defined in **BR 88**   1. is only calculated on trades whom settlement obligations are known. 2. Trade population on which is calculated rolls at EOD (see **Figure 2**). 3. Settlement obligations between T and T+1 are netted. 4. Settlement obligations are calculated as per **BR 72** |
| BR 71 - Store questionnaire and their responses | *Q1: Please provide your views on the bid-to-mid spread (in basis points) that would be incurred in executing next-day trades for the notional amounts indicated over a 12 hour period under stress market conditions.*  *Q2: Please provide your views on the amount of delta (in local currency millions) that can be traded with 24 hours under stress market conditions.*    *Q3: Please provide your views on the proportional increase in spread for trading 1 week ATM for the sizes indicated under stress market conditions.*  *Q4: Please provide your views on the proportional increase in spread for trading ATM vega risk for the sizes indicated under stress market conditions.*  *Q5: Please provide your views on the proportional increase in 25-delta risk-reversal spread for trading rega risk for the sizes indicated under stress market conditions.*  *Q6: Please provide your views on the proportional increase in 25-delta butterfly spread for trading sega risk for the sizes indicated under stress market conditions.*  Responses:  Q1:   1. One response per CCY (AUD, CHF, EUR, GBP, JPY, USD) per member can be stored 2. Response is an integer value and units of the value are basis point   Q2:   1. One response per CCY pair (EUR/USD, USD/JPY, EUR/JPY, AUD/USD, GBP/USD, USD/CHF, EUR/CHF, EUR/GBP) per defined pillar points ($5bn, $10bn, $15bn, $20bn) per member can be stored 2. Response is numerical and can be specified in up to 4decimal places   Q3:   1. One response per CCY pair (EUR/USD, USD/JPY, EUR/JPY, AUD/USD, GBP/USD, USD/CHF, EUR/CHF, EUR/GBP) per defined pillar points ($0.25m, $0.5m, $1m, $2m) per member can be stored 2. Response is numerical value and can be specified in up to 4decimal places   Q4:   1. One response per CCY pair (EUR/USD, USD/JPY, EUR/JPY, AUD/USD, GBP/USD, USD/CHF, EUR/CHF, EUR/GBP) per defined pillar points ($1m, $2m, $5m, $10m) per member can be stored 2. Response is numerical value and can be specified in up to 4decimal places.   Q5 and Q6:   1. One response per CCY pair (EUR/USD, USD/JPY, EUR/JPY, AUD/USD, GBP/USD, USD/CHF, EUR/CHF, EUR/GBP) per defined pillar points ($0.1m, $0.2m, $0.5m, $1.0m) per member can be stored 2. Response is numerical value and can be specified in up to 4decimal places.   Questionaire:   * Initial set of Qs to be included in the questionnaire are provided below. * More Qs may be added in the future and so the questionnaire set up needs to be configurable such that more questions can be added as well as having the ability to change/remove existing questions.   All:   1. Is future proofed such that can store responses from a large number of members 2. One response per member 3. If no response is received from a member a blank entry is stored (i.e. 0 is not the default value) 4. Responses to be stored in an Excel document maintained by ForexClear Risk |
| BR 72 - Retrieve Settlement Obligations | As a ForexClear Risk User:  I want to be able to retrieve the settlement obligations so that I can use them in the SMM calculation  Acceptance criteria:   1. Settlement obligations are retrieved for all trades whom settlements are known (see **Figure 2**)    * Prior to the CLS cycle on T settlement obligations are retrieved for T and T+1    * Post CLS cycle on T settlement obligations are retrieved for T+1    * At EOD on T trade population rolls and settlement obligations for T+1 and T+2 are retrieved 2. Settlement obligations are negative for a pay-in obligation (CLS receives monies from member) and positive for a pay-out obligation (CLS pays out monies to the member). 3. System needs to be able to retrieve these settlement obligation figures in real time. 4. T is based on the system date/time at time of calculation and T+1 is the business day following T (LCH calendar used for reference to assess business days). 5. Settlement obligations are in line with the settlement obligations issues in the PIPO schedule (CLS BRD) and are calculated in real time. 6. Settlement obligations are in local Ccy. |
| BR 73 - Calculate | As a ForexClear Risk User:  I want to be able to calculate the so that I can include it as part of the SRC liability  Acceptance criteria   1. is calculated as per **Equation 4**   Where:  is defined in **BR 76**  is defined in **BR 78**  j is each scenario used in the FxSET model – stressed and historical (**BR 58, BR 98**)   1. is the worst USD equivalent SRC over all scenarios, j *(*stressed and historical), used in the FxSET model 2. Trade scope is defined in **BR 77** |
| BR 74 - Calculate the SRC Spread matrix | As a ForexClear Risk User:  I want to be able to calculate SRC slippage matrix so that I can use it in the SRC calculation.  Acceptance criteria:   1. For each notional size/settlement provision threshold/tier and currency, calculate the median value of the member responses received for Q1 in the Questionnaire detailed in **BR 71**   Q1 is as follows: *Please provide your views on the bid-to-mid spread (in basis points) that would be incurred in executing next-day trades for the notional amounts indicated over a 12 hour period under stress market conditions.*   1. Resulting median results need to be stored in a matrix format such as the one shown in **Table 10** 2. Median results are integers and in basis points 3. The resulting median results matrix is termed SRC slippage matrix. This is how it will be referenced in other BRs. 4. The matrix needs to be configurable. 5. It will be updated manually on quarterly basis. |
| BR 75 - Retrieve | As a ForexClear Risk User:  I want to be able to retrieve the so that I can use it in the calculation  Acceptance criteria:   1. The FX Rate from the latest market data snap is retrieved 2. Rate is expressed as amount of USD per 1 unit of Ccy |
| BR 76 - Calculate | As a ForexClear Risk User:  I want to be able to calculate the so that I can include it as part of the liability  Acceptance criteria   1. is calculated as per **Equation 5**     Where:  is defined in **BR 77**  is defined in **BR 79**  is defined in **BR 70** |
| BR 77 - Calculate | As a ForexClear Risk User:  I want to be able to calculate the so that I can include it as part of the liability  Acceptance criteria   1. For each settlement day, *i*, a simulated exposure is calculated under each simulation scenario, *j (*stressed and historical), for each Ccy 2. Settlement exposure is in local currency 3. Settlement exposure is calculated using the FxSET model (BR 98) 4. Settlement exposure is calculated for i = 2 to 4 (see Figure 2)    * Prior to the CLS cycle on T settlement obligations are calculated for T+2, T+3 and T+4    * At EOD on T trade population rolls and settlement obligations for T+3, T+4 and T+5 are calculated 5. T is based on the system date/time at time of calculation and T+1 is the business day following T (LCH calendar used for reference to assess business days). |
| BR 78 - Retrieve | As a ForexClear Risk User:  I want to be able to retrieve theso that I can use it in the calculation  Acceptance criteria:   1. The FX Rate from the from the scenario*, j,* which is being simulated is retrieved 2. Rate is expressed as amount of USD per 1 unit of Ccy |
| BR 79 - SPA | As a ForexClear Risk user:  I want to store [[1]](#footnote-1)[1] amounts in local Ccy so that I can manage my settlement provisions amount  Acceptance criteria:   1. SPA limits are defined in local currency in **Table 10** for each of the currencies (AUD, CHF, EUR, GBP, JPY, and USD) in scope of the NON-EM service. 2. SPA limits are the sum of Cash and CCSL for each currency 3. Each SPA limit has to be a non-negative number. 4. **Table 10** needs to be configurable such that SPA limits for more currencies can be added in this table, as more currencies may be added to this NON-EM service in the future. 5. **Table 10** needs to be configurable such that each SPA limits defined in this table is editable. 6. Any changes made to Table 10 are subject to 4 eyes validation and need to be tracked through an audit trail. |

* 1. Liquidity Risk Margin (LRM)

The Liquidity Risk Margin encapsulates the liquidity cost of hedging large/concentrated positions within the defaulter’s portfolio or alternatively, the risk that the defaulter’s portfolio may take longer than five days to close out.

As part of its settlement risk management framework, ForexClear will maintain settlement provisions in each currency. Once settlement obligations become known after the trades have exercised or expired, some of the provisions may be used in which case the settlement provisions will need to be rebalanced and this is also captured within the LRM.

Equation 7

Equation 8

Each member’s portfolio LRM is calculated as follows:

Equation 9

Equation 10

Equation 11

Equation 12

Equation 13

and,

= portfolio IM (expressed as a negative value, ie. liability)

= multiplier from Delta IMM Matrix to account for size of

= delta for currency pair CcyPair (for a 1 unit shift in spot price, expressed in USD equivalent)

= sum of the vega by tenor for currency pair CcyPair excluding tenors less than or equal to 1 week (for a 1% parallel shift in ATM vols, expressed in USD equivalent)

= sum of the rega by tenor for currency pair CcyPair (for a 0.1% change in the 25-delta and 10-delta risk reversals, expressed in USD equivalent)

= sum of the sega by tenor for currency pair CcyPair (for a 0.1% change in the 25-delta and 10-delta butterflies, expressed in USD equivalent)

= vega for currency pair CcyPair and Tenor (for a 1% change in vol)

= rega for currency pair CcyPair and Tenor (for a 0.1% change in vol)

= sega for currency pair CcyPair and Tenor (for a 0.1% change in vol)

= spread from the ATM Spread Matrix for currency pair CcyPair and relevant Tenor (in vols)

= spread from Rega Spread Matrix for currency pair CcyPair and relevant Tenor (in vols)

= spread from Sega Spread Matrix for currency pair CcyPair and relevant Tenor (in vols)

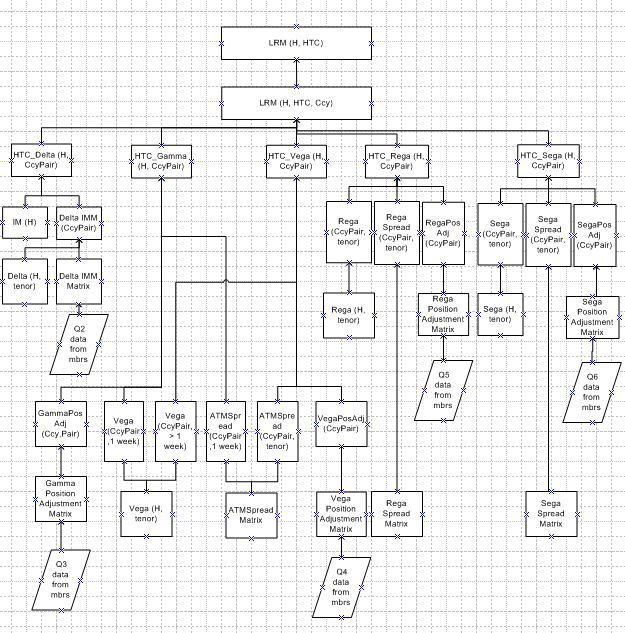
= multiplier to account for the size of

= multiplier to account for the size of

= multiplier to account for the size of

= multiplier to account for the size of

Figure 3 - LRM Diagram(Disregard old HTC label)

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|  |  |
| --- | --- |
| BR 82 - Calculate LRM | As a ForexClear Risk User:  I want to be able to calculate the so that I can assess the margin on the portfolio.  Acceptance criteria:   1. LRM is calculated at margin account level at each IRC calculation and each margin run 2. LRM is the sum of the LRM calculated at currency pair level for each margin account () 3. is calculated as follow   = + + +   1. LRM delta at currency pair level is calculated using the following formula     where  is calculated as follow:   * 1. The first step to compute this LRM is to split the portfolio in sub portfolios that contain all the trades relative to a given currency pair.   2. For each sub portfolio, we compute the Initial Margin per currency pair and a multiplier per currency pair   3. is the aggregated FX spot delta in base currency broken down by currency pair as calculated in **BR 149**   4. is the multiplier fetched from Delta IMM Matrix (**Table 11**)      + Flat extrapolation before first threshold and beyond last threshold      + in tenor space is the tenor on which the largest absolute bucketed forward delta (**BR 151**) is observed In this currency pair      + is interpolated linearly in threshold space * is Initial Margin at margin account level for a given currency pair and is calculated in **BR 46**  1. LRM Gamma at currency pair level is calculated using the following formula     where   * is the 1W Vega sensitivity is calculated as per **BR 157** * is the 1W ATM spread retrieved from ATM spread matrix (**BR 86, Table 16**) * Is calculated as follow:  1. is calculated as per **BR 157** 2. is linearly interpolated in the Gamma Position Adjustment Matrix (**BR 86, Table 12**)based on on the 1W vega thresholds 3. Flat extrapolation before first tenor and beyond last tenor 4. LRM Vega is calculated as follow 5. If ,      1. If ,   Where:   * is the sum of the vega by tenor for currency pair *CcyPair* excluding tenors less or equal than 1 week (Vega by bucket is calculated in **BR 157** * is the spread from the ATM Spread Matrix for currency pair *CcyPair* and relevant *Tenor* shown in **BR 86, Table 16.** * is calculated as follow:   + is interpolated linearly in the Vega Position Adjustment Matrix (4 decimal places) in **BR 86, Table 13** on .   + Flat extrapolation before first threshold and beyond last threshold   **Note**:  Refers to summation of all vegas where the vega 0 and tenor is greater than 1 week.  refers to summation of all vegas where the vega> 0 and tenor is greater than 1 week.   1. LRM Sega is calculated as follow: 2. , 3. ,   where   * is calculated as per **BR 169** with a bump on the 25 delta points only * is retrieved from Sega spread matrix shown in **BR 86, Table 18** for each tenor * is the position adjustment multiplier calculated as follow:   + is interpolated linearly in the Sega Position Adjustment Matrix (4 decimal places) in **BR 86, Table** **15** on .   + Flat extrapolation before first threshold and beyond last threshold   **Notes:**  refers to summation of Segas at each tenor were Sega for the tenor is 0.  refers to summation of Segas at each tenor were Sega for the tenor is 0.   1. LRM Rega is calculated as follow 2. , 3. ,   Where:   * is calculated as per **BR 168** with a bump on the 25 delta points only * is retrieved from Rega spread matrix shown in **BR 86, Table 17** for each tenor * is the position adjustment multiplier calculated as follow:   + is interpolated linearly in the Rega Position Adjustment Matrix (4 decimal places) in **BR 86, Table 14** on .   + Flat extrapolation before first threshold and beyond last threshold   **Notes:**  refers to summation of Regas at each tenor were Rega for the tenor is 0.  refers to summation of Regas at each tenor were Rega for the tenor is 0. |
| BR 83 - Calculate the Delta IMM matrix | As a ForexClear Risk User:  I want to be able to calculate Delta IMM matrix so that I can use it in the LRM calculation.  Acceptance criteria:   1. For each delta threshold and currency pair, calculate the median value of the member responses received for Q2 in the Questionnaire detailed in **BR 71.**   Q2 is as follows: *Please provide your views on the amount of delta (in local currency millions) that can be traded with 24 hours under stress market conditions.*   1. Resulting median results need to be stored in a matrix format such as the one shown in **Table 11** and this matrix needs to be labelled as Delta IMM Matrix. 2. Median results need to be calculated up to 4 decimal places. |
| BR 84 - Calculate the Position Adjustment Matrices | As a ForexClear Risk User:  I want to be able to calculate:   * Gamma Position Adjustment matrix * Vega Position Adjustment matrix * Rega Position Adjustment matrix * Sega Position Adjustment matrix   so that I can use them in the LRM calculation.  Acceptance criteria:   1. Gamma Position Adjustment Matrix  * For each 1 week ATM threshold and currency pair, calculate the median value of the member responses received for Q3 in the Questionnaire detailed in **BR 71.**   Q3 is as follows: *Please provide your views on the proportional increase in spread for trading 1 week ATM for the sizes indicated under stress market conditions*   * Resulting median results need to be stored in a matrix format such as the one shown in **Table 12** and this matrix needs to be labelled as Gamma Position Adjustment Matrix. * Median results need to be calculated up to 4 decimal places  1. Vega Position Adjustment Matrix  * For each ATM vega threshold and currency pair, calculate the median value of the member responses received for Q4 in the Questionnaire detailed in **BR 71.**   Q4 is as follows: *Please provide your views on the proportional increase in spread for trading ATM vega risk for the sizes indicated under stress market conditions. .*   * Resulting median results need to be stored in a matrix format such as the one shown in **Table** 13and this matrix needs to be labelled as Vega Position Adjustment Matrix. * Median results need to be calculated up to 4 decimal places.  1. Rega Position Adjustment Matrix  * For each rega threshold and currency pair, calculate the median value of the member responses received for Q5 in the Questionnaire detailed in **BR 71.**   Q5 is as follows: *Please provide your views on the proportional increase in 25-delta risk-reversal spread for trading rega risk for the sizes indicated under stress market conditions.*   * Resulting median results need to be stored in a matrix format such as the one shown in **Table 14** and this matrix needs to be labelled as Rega Position Adjustment Matrix. * Median results need to be calculated up to 4 decimal places.  1. Sega Position Adjustment Matrix  * For each sega threshold and currency pair, calculate the median value of the member responses received for Q6 in the Questionnaire detailed in **BR 71**   Q6 is as follows: *Please provide your views on the proportional increase in 25-delta butterfly spread for trading sega risk for the sizes indicated under stress market conditions .*   * Resulting median results need to be stored in a matrix format such as the one shown in **Table 15** and this matrix needs to be labelled as Sega Position Adjustment Matrix. * Median results need to be calculated up to 4 decimal places. |
| BR 85 - Calculate Spread Matrices | As a ForexClear Risk User:  I want to be able to calculate:   * ATM Spread Matrix * Rega Spread Matrix * Sega Spread Matrix   for each currency pair and tenor so that I can use the Spread in the LRM calculation  Acceptance criteria:   1. ATM Spread Matrix  * ATM volatility spread for a given currency pair and tenor in the matrix is calculated as follows:   Where  obtained from member submitted quotes  obtained from member submitted quotes   1. Resulting matrix of the ATM volatility spreads for each currency pair and tenor should be laid out in the matrix form such as the one shown **Table 16**.    * Volatility spreads need to be stored to 4 decimal places.    * Tenor buckets need to be configurable as the ForexClear Risk team may need to add/change them in the future.    * This matrix needs to be configurable as it will be updated by the ForexClear Risk team on quarterly basis.    * ATM volatility spread quarterly results represent the average ATM volatility spread per maturity bucket per currency observed during the previous quarter. 2. Rega Spread Matrix  * Rega volatility spread for a given currency pair and tenor in the matrix is calculated as follows:   Where  obtained from member submitted quotes  obtained from member submitted quotes   * + Resulting matrix of the Rega volatility spreads for each currency pair and tenor should be laid out in the matrix form such as the one shown **Table 17**.   + Volatility spreads need to be stored to 4 decimal places.   + Tenor buckets need to be configurable as the ForexClear Risk team may need to add/change them in the future.  1. Sega Spread Matrix  * Sega volatility spread for a given currency pair and tenor in the matrix is calculated as follows:   Where  obtained from member submitted quotes  obtained from member submitted quotes   * Resulting matrix of the Sega volatility spreads for each currency pair and tenor should be laid out in the matrix form such as the one shown **Table 18**. * Volatility spreads need to be stored to 4 decimal places. * Tenor buckets need to be configurable as the ForexClear Risk team may need to add/change them in the future. |
| BR 86 - Upload Static Data Matrices | As a ForexClear Risk User:  I want to upload:   * Delta IMM Matrix * 4 x Position Adjustment Matrices * 3 x Spread Matrices   Into the risk system so that I can use them in the LRM calculation.  Acceptance criteria:   1. ForexClear Support will upload the matrices (using an upload file for each matrix) calculated in **BR 83-BR 85** 2. All of these matrices need to be editable, as they may be updated on quarterly and ad-hoc basis by the ForexClear Risk team. 3. All matrices need to be configurable to allow for changes/additions to currencies, currency pairs, notional size, tiers for sensitivities in the Position Adjustment Matrices and tenors in the Spread Matrices 4. Resulting matrices should be stored in the ForexClear system as per **Table 11 to Table 18** 5. Values in all matrices can be defined to 4 decimal places 6. All matrices will be subject to a 4-eyes check before uploading into the system 7. The system will automatically track changes made to the matrices and create an audit trail detailing the changes made and who by |
| BR 87 - Questionnaire distribution list | As a ForexClear Risk User:  I want a distribution list for all recipients of the Liquidity Survey Questionnaire so that I can send the survey out to the required audience each quarter  Acceptance criteria:   1. Distribution list to be maintained by ForexClear Risk team in a s/sheet. |
| BR 88 - Lookup Prefunded Amounts | As a ForexClear Risk User:  I want to check whether a member has submitted any prefunding monies so that I can take this into account in LRM calculation.  Acceptance criteria:   1. I want to be able to look up prefunding amounts received from each member (at House (H) account level) for each currency. 2. Prefunding transactions will always be in local currencies. |

Table 11 – Delta IMM Matrix by currency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Delta (USD mil. Equiv.) | 5000 | 10,000 | 15,000 | 20,000 |
| 1W | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 1M | 1.0900 | 1.0900 | 1.0900 | 1.0900 |
| 2M | 1.1800 | 1.1800 | 1.1800 | 1.1800 |
| 3M | 1.2600 | 1.2600 | 1.2600 | 1.2600 |
| 6M | 1.2600 | 1.2600 | 1.2600 | 1.2600 |
| 1Y | 1.2600 | 1.2600 | 1.2600 | 1.2600 |
| 2Y | 1.2600 | 1.2600 | 1.2600 | 1.2600 |

Table 12 – Example Gamma Position Adjustment Matrix

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Vega 1wk (USD mil. Equiv. | EUR  /USD | USD  /JPY | EUR  /JPY | AUD  /USD | GBP  /USD | USD  /CHF | EUR  /CHF | EUR  /GBP |
| 0.25 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.50 | 1.2500 | 1.2500 | 1.3500 | 1.3500 | 1.2500 | 1.2500 | 1.3500 | 1.3500 |
| 1.00 | 1.5000 | 1.5000 | 1.7000 | 1.7000 | 1.5000 | 1.5000 | 1.7000 | 1.7000 |
| 2.00 | 2.0000 | 2.0000 | 2.4000 | 2.4000 | 2.0000 | 2.0000 | 2.4000 | 2.4000 |

Table 13 – Example Vega Position Adjustment Grid

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Vega (USD mil. Equiv. | EUR  /USD | USD  /JPY | EUR  /JPY | AUD  /USD | GBP  /USD | USD  /CHF | EUR  /CHF | EUR  /GBP |
| 1 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 2 | 1.0200 | 1.0200 | 1.0500 | 1.0500 | 1.0200 | 1.0200 | 1.0500 | 1.0500 |
| 5 | 1.0400 | 1.0400 | 1.1000 | 1.1000 | 1.0400 | 1.0400 | 1.1000 | 1.1000 |
| 10 | 1.0800 | 1.0800 | 1.2000 | 1.2000 | 1.0800 | 1.0800 | 1.2000 | 1.2000 |

Table 14 – Example Rega Position Adjustment Grid

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rega (USD mil. Equiv. | EUR/ USD | USD/ JPY | EUR/ JPY | AUD/ USD | GBP/ USD | USD/ CHF | EUR/ CHF | EUR/ GBP |
| 0.1 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.2 | 1.0200 | 1.0200 | 1.0500 | 1.0500 | 1.0200 | 1.0200 | 1.0500 | 1.0500 |
| 0.5 | 1.0400 | 1.0400 | 1.1000 | 1.1000 | 1.0400 | 1.0400 | 1.1000 | 1.1000 |
| 1.0 | 1.0800 | 1.0800 | 1.2000 | 1.2000 | 1.0800 | 1.0800 | 1.2000 | 1.2000 |

Table 15 – Example Sega Position Adjustment Grid

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sega (USD mil. Equiv. | EUR/ USD | USD/ JPY | EUR/ JPY | AUD/ USD | GBP/ USD | USD/ CHF | EUR/ CHF | EUR/ GBP |
| 0.1 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.2 | 1.0200 | 1.0200 | 1.0500 | 1.0500 | 1.0200 | 1.0200 | 1.0500 | 1.0500 |
| 0.5 | 1.0400 | 1.0400 | 1.1000 | 1.1000 | 1.0400 | 1.0400 | 1.1000 | 1.1000 |
| 1.0 | 1.0800 | 1.0800 | 1.2000 | 1.2000 | 1.0800 | 1.0800 | 1.2000 | 1.2000 |

Table 16 – Example ATM Spread Matrix

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tenor | EUR  /USD | USD  /JPY | EUR  /JPY | AUD  /USD | GBP  /USD | USD  /CHF | EUR  /CHF | EUR  /GBP |
| 1W | 0.5000 | 0.6500 | 0.7000 | 0.5100 | 0.5000 | 0.7500 | 1.2500 | 0.6800 |
| 1M | 0.2000 | 0.2000 | 0.3600 | 0.2300 | 0.2300 | 0.3100 | 0.6800 | 0.3000 |
| 2M | 0.1800 | 0.1900 | 0.3500 | 0.2700 | 0.2300 | 0.3000 | 0.6000 | 0.2500 |
| 3M | 0.1500 | 0.1900 | 0.3300 | 0.2600 | 0.1800 | 0.3000 | 0.5500 | 0.2500 |
| 6M | 0.1500 | 0.1600 | 0.3000 | 0.2200 | 0.1700 | 0.2500 | 0.4600 | 0.2100 |
| 9M | 0.1500 | 0.1500 | 0.3300 | 0.2000 | 0.2200 | 0.2600 | 0.4500 | 0.2100 |
| 1Y | 0.1500 | 0.1900 | 0.3200 | 0.2000 | 0.2500 | 0.2700 | 0.4600 | 0.2000 |
| 18M | 0.1500 | 0.1900 | 0.3000 | 0.2700 | 0.2000 | 0.2800 | 0.4300 | 0.2200 |
| 2Y | 0.1500 | 0.2100 | 0.3000 | 0.3300 | 0.2000 | 0.3000 | 0.4100 | 0.2200 |

Table 17 – Example Rega Spread Matrix

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tenor | EUR  /USD | USD  /JPY | EUR  /JPY | AUD  /USD | GBP  /USD | USD  /CHF | EUR  /CHF | EUR  /GBP |
| 1W | 0.3500 | 0.0500 | 0.2500 | 0.3700 | 0.3500 | 0.6800 | 0.4500 | 0.5000 |
| 1M | 0.1500 | 0.1400 | 0.2500 | 0.1600 | 0.1500 | 0.2300 | 0.4000 | 0.2000 |
| 2M | 0.0800 | 0.1300 | 0.2400 | 0.2000 | 0.1500 | 0.2000 | 0.4000 | 0.1900 |
| 3M | 0.1100 | 0.1300 | 0.2300 | 0.1800 | 0.1400 | 0.2100 | 0.3500 | 0.1700 |
| 6M | 0.1000 | 0.1000 | 0.2100 | 0.1300 | 0.1400 | 0.1900 | 0.3100 | 0.9000 |
| 9M | 0.1000 | 0.1100 | 0.2200 | 0.1400 | 0.1500 | 0.1600 | 0.3000 | 0.1500 |
| 1Y | 0.1000 | 0.1000 | 0.2300 | 0.1300 | 0.1700 | 0.1700 | 0.2900 | 0.1500 |
| 18M | 0.1200 | 0.1000 | 0.2000 | 0.1900 | 0.1600 | 0.2000 | 0.2600 | 0.1500 |
| 2Y | 0.1400 | 0.1300 | 0.2000 | 0.2400 | 0.1400 | 0.1600 | 0.7500 | 0.1600 |

Table 18 – Example Sega Spread Matrix

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tenor | EUR  /USD | USD  /JPY | EUR  /JPY | AUD  /USD | GBP  /USD | USD  /CHF | EUR  /CHF | EUR  /GBP |
| 1W | 0.2500 | 0.2700 | 0.3600 | 0.2600 | 0.2500 | 0.4100 | 0.6200 | 0.4000 |
| 1M | 0.0900 | 0.1000 | 0.1800 | 0.1100 | 0.1100 | 0.1600 | 0.3500 | 0.1400 |
| 2M | 0.0900 | 0.0900 | 0.1800 | 0.1300 | 0.1100 | 0.1500 | 0.3000 | 0.1300 |
| 3M | 0.0800 | 0.0700 | 0.1800 | 0.1300 | 0.1100 | 0.1500 | 0.2600 | 0.1200 |
| 6M | 0.0800 | 0.0800 | 0.1500 | 0.1100 | 0.1100 | 0.1300 | 0.2400 | 0.1000 |
| 9M | 0.0800 | 0.0800 | 0.1600 | 0.1100 | 0.1100 | 0.1300 | 0.2500 | 0.1000 |
| 1Y | 0.0800 | 0.0800 | 0.1600 | 0.1100 | 0.1300 | 0.1400 | 0.2100 | 0.1000 |
| 18M | 0.0900 | 0.1400 | 0.1400 | 0.1400 | 0.1100 | 0.1300 | 0.2000 | 0.1200 |
| 2Y | 0.0100 | 0.1500 | 0.1500 | 0.1900 | 0.1000 | 0.1100 | 0.2000 | 0.1300 |

* 1. Credit Risk Margin (CRiM)

|  |  |
| --- | --- |
| BR 92 - Calculate CRiM | As a ForexClear Risk User:  I want to calculate CRiM so that I can include in the liability for this amount.  Acceptance criteria:   1. Works in same way as the EM service i.e. CRiM multipliers is applied based on the member credit rating (BR 93)      1. CRiM Multiplier is applied to the total IM of the portfolio as follow 2. IM for margin account (A) is calculated as per **BR 46**. 3. CRIM is calculated in real time and at each margin run 4. Store above CRiM Table in the same way as the EM service 5. CRiM multipliers need to be uploaded in a file that can be fed into Murex    * ForexClear Risk team will drop a file into the system    * ForexClear support will load the file    * Sign off required by Risk team for any changes |
| BR 93 - Upload Members Credit Rating | As a ForexClear Risk User:  I want to load and store internal credit score for each member I can look up a CRiM multiplier  Acceptance criteria:   1. Credit ratings are uploaded manually as a one off for new members joining the service 2. Credit score are reconciled automatically from source file provided by Group risk (to be confirmed and agreed with Group Risk or RRM) and available in \\filpr1\Public\_shares\FTP\_ROOT\RISK\_PRD\RRM\_CSV\RISK\_OPERATIONS\ Source file name is: ***Lch\_Credit\_Scores.csv*** 3. Credit score are updated daily in production (before kicking off Margin run number 2, **Table 5**). 4. If a rating has changed, the margin run is paused and risk approval is required (see **BR 174**, **BR 177**) 5. Audit trail is available |

* 1. Minimum Excess Requirement (MER)

|  |  |
| --- | --- |
| BR 94 - Calculate MER | As a ForexClear Risk User:  I want to calculate MER buffer so that I can issue a liability for this amount  Acceptance criteria:   1. MER is calculated as follow   is calculated as per **BR 89**  X is configurable and will be equal to 50% at launch   1. MER Buffer is across the ForexClear service as a whole. 2. SMM liability component is included in both SOD and ITD peak liabilities used in the calculation of the MER Buffer. SMM is calculated as per **BR 66** 3. MER is in USD 4. X is configurable 5. is configurable 6. is configurable |

|  |  |
| --- | --- |
| BR 89 - Calculate completion margin for each margin account level | As a ForexClear Risk User:  I want to calculate the Completion Margin for each margin account at each EOD margin run so that I can calculate MER  Acceptance criteria:   1. Completion margin is floored to 0 and calculated as follow 2. is calculated as follow:   Where represent the live trade population for the given margin account  is the IM calculated in **BR 91**  is the IM calculated in **BR 46** |
| BR 90 - Trade population excluding trades to be fixed or settled the next day | As a ForexClear Risk User:  I want to identify the trades due to be settled (deliverables) or due to be fixed (non deliverables) the next day so that I can calculate an IM exclusive of these trades  Acceptance criteria:   1. All deliverable trades due to be settled the next day are excluded from current portfolio 2. All Non-deliverable trades due to be fixed the next day are excluded from current portfolio |
| BR 91 - FXO IM exclusive | As a ForexClear Risk User:  I want to calculate an IM exclusive of trades to be settled or fixed the next day so that I can calculate a completion margin  Acceptance criteria:   1. IM is calculated as per **BR 46** 2. Trade population in scope for IM exclusive calculation is as per **BR 90** 3. Result is in USD |

1. Settlement Risk Management

**\*\*\*ALL RATES AND TRADES MUST BE BASE/TERM CONVENTION!\*\*\***

***Table 19 - FxSET Simulated Cash flow Logic***

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Direction** | **Base currency** | **Term currency** |
| **Spot / Forward** | **Long** |  |  |
| **Short** |  |  |
| **Call** | **Long** |  |  |
| **Short** |  |  |
| **Put** | **Long** |  |  |
| **Short** |  |  |

***Table 20: Internal credit score adjusted market liquidity table***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ICS** | **1-4** | **5** | **6** | **7** | **8** | **9-10** |
| **MLA adjustment** | **1.0** | **0.9** | **0.8** | **0.7** | **0.6** | **0.5** |

|  |  |
| --- | --- |
| BR 98 - Calculate FxSET for each settlement date, currency, and each House (H) account portfolio | As a ForexClear Risk user:  I want to calculate the FXSet for each House (H) account level so that I can manage settlement risk exposures.  Acceptance criteria:   1. ,0) 2. is defined in **BR 99** 3. is defined in **BR 100** 4. FxSET is calculated for each House (H) account portfolio level for each currency and settlement date. 5. Settlement dates scope are defined per currency and starts from Spot date (Spot item in **Table 4**) to the maximum settlement date eligible in the service and are dependent on the currency calendar (**Table 4**) 6. FxSET is calculated at each risk run (**Table 5**) and each SLC calculation (**BR 24**) 7. Example calculations, are located in the attached |
| BR 99 - Calculate Largest Simulated Settlement Exposure for each settlement date, currency, and each House (H) account level portfolio) | As a ForexClear Risk user:  I want to calculate the largest simulated settlement exposure for each settlement date, currency, and each House (H) account level portfolio so that I can manage settlement risk exposures.  Acceptance criteria:  where   * + is the largest simulated settlement exposure of the portfolio for currency *c* and for settlement date   + is the simulated settlement exposure of the portfolio at scenario date *t* for currency *c* and for settlement date as per **BR 101**  1. The tail size (N) of the expected shortfall measure is set to 1 at launch but needs to be configurable as it may change in the future. 2. A is the count of negative |
| BR 100 - Calculate Largest Stressed Settlement exposure for each currency, each settlement date and each House (H) account level) | As a ForexClear Risk user:  I want to calculate the largest Stressed Settlement exposure for each currency pair, settlement date, House (H) account portfolio level so that I can manage settlement risk exposures.  Acceptance criteria:      where   * is stressed settlement exposure for each portfolio, currency c, settlement date SD * = Settlement exposure for each portfolio, currency c, settlement date SD and stress test s |
| BR 101 - Calculate Simulated Settlement Exposure for each settlement date, under each simulation date, each currency and each House (H) account level portfolio | As a ForexClear Risk user:  I want to calculate the simulated settlement exposure under each simulation date, each settlement date, currency and each House (H) account portfolio level portfolio so that I can manage settlement risk exposures.  Acceptance criteria:  where  = simulated settlement exposure of the portfolio at scenario date *t* , for currency *c* and for settlement date  = simulated settlement exposure of trade *i* (**BR 103**) at scenario date *t,*  for currency *c* and for settlement date  = Cumulative VM of trade *i* (excluding premiumVM) at scenario/simulation date *t,*  for currency *c* and for settlement date  = Cumulative VM relating to premium *p* for currency *c* and for premium date =  = Option Premium relating to premium *p* for currency *c* and for premium date =  is calculated in **BR 40** |
| BR 102 - Calculate Stressed Settlement Exposure for each settlement date, under each stress test, each currency and each House (H) account level portfolio | As a ForexClear Risk user:  I want to calculate the stressed settlement exposure under each stress test s for each settlement date, currency and each House (H) account portfolio level portfolio so that I can manage settlement risk exposures.  Acceptance criteria:  where  = stressed settlement exposure the portfolio at stress test s for currency *c* and for settlement date  =stressed settlement exposure of trade *i* (**BR 104**) of at stress test s for currency *c* and for settlement date  = Cumulative VM of trade *i* (excluding premium VM) at each stress test s, for currency *c* and for settlement date  = Cumulative VM relating to premium *p* for currency *c* and for premium date = calcaulted in **BR 39**  = Option Premium relating to premium *p* for currency *c* and for premium date =  is calculated in **BR 40** |
| BR 103 - Calculate Simulated settlement exposure of trade *i* at scenario date *t* for currency *c* and for settlement date | As a ForexClear Risk user:  I want to calculate Simulated settlement exposure of trade *i* at scenario date *t* for currency *c* and for settlement date so that I can manage settlement risk exposures.  Acceptance criteria:  Logic for = Simulated settlement exposure of trade *i* at scenario date *t* for currency *c* and for settlement date is detailed below and in **Table 19**   1. For Long Spot/Forward position,   = , if c = base currency  = -if if c = term currency  = 0, otherwise   1. For Short Spot/Forward trade,   = -if currency c = base currency  = if if currency c = term currency  = 0, otherwise   1. For long call FX option trade,   = , if currency i = base currency and  = -if currency i = term currency and  = 0, otherwise   1. For short call FX option trade,   = - , if currency i = base currency and  = if currency i = term currency and  = 0, otherwise   1. For long put FX option trade,   = -if currency i = base currency and  = if currency i = term currency and if  = 0, otherwise   1. For short put FX option trade,   = , if currency i = base currency and if  = -if currency i = term currency and  = 0, otherwise  where  = the notional of the contract for the base currency  = the notional of the contract for the term currency;  = the strike rate of the contract  = bid/ask spread parameter for each currency pair used under the historical simulation methodology.  = the simulated spot rate for simulation and can be retrieved from **BR 58** for each simulation date .  for each currency pair and is set to a default value of 0bps but it needs to be editable as it may need to be changed in the future.  is for each currency pair and is stored value and is a decimal value out to six decimal places |
| BR 104 - Calculate Stressed settlement exposure of trade *i* at stress test s for currency *c* and for settlement date | As a ForexClear Risk user:  I want to calculate Stressed settlement exposure of trade *i* at stress test s for currency *c* and for settlement date so that I can manage settlement risk exposures.  Acceptance criteria:  Logic for = Simulated settlement exposure of trade *i* at stress test s for currency *c* and for settlement date is detailed below and in **Table 19**.   1. For Long Spot/Forward position,   = if currency c = base currency  = -if if currency c = term currency  = 0, otherwise   1. For Short Spot/Forward trade,   = -if currency c = base currency  = ), if if currency c = term currency  = 0, otherwise   1. For long call FX option trade,   = if currency i = base currency and  = -if currency i = term currency and  = 0, otherwise   1. For short call FX option trade,   = -if currency i = base currency and  = if currency i = term currency and  = 0, otherwise   1. For long put FX option trade,   = -if currency i = base currency and  = if currency i = term currency and if  = 0, otherwise   1. For short put FX option trade,   = if currency i = base currency and if  = -if currency i = term currency and  = 0, otherwise  where  = the notional of the contract for the base currency  = the notional of the contract for the term currency;  = the strike rate of the contract  = bid/ask spread parameter for each currency pair used under the historical simulation methodology.  = stressed spot rate for scenario s and can be retrieved from **BR 112** for each scenario s.   1. for each currency pair and is set to a default value of 0bps but it needs to be editable as it may need to be changed in the future. 2. is for each currency pair and is stored value and is a decimal value out to six decimal places |

1. Stresses scenarios calculation

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| BR 111 - Calculate stress scenario results | As a ForexClear Risk User:  I want to calculate stress scenario results at each scheduled margin run time so that I can monitor the member exposures against the size of the default fund.  Acceptance criteria:   1. Stress scenario results are calculated and reported at each scheduled margin run as defined in **Table 5** 2. The latest set of simulated stressed market data as per **BR 112** and **BR 113** is used in the stress scenario results 3. The latest set of live trades as at margin run time consistent with margin run trade population is used in the stress scenario results calculation 4. Stress scenarios results are stored and ready to be reported at each margin run 5. is the stress PnL for scenario i for a given omnibus account A, and is calculated as the difference between a stressed NPV and a base NPV   Where:  is calculated for each stress scenario (**BR 110**) and each omnibus account A.  is as per **BR 39**, **BR 40**, and **BR 41** using scenarios from **BR 113**  is as per **BR 39**, **BR 40**, and **BR 41**   1. stored in the system and a positive number for profit and negative for loss 2. Calculation is performed at trade level 3. Calculation is aggregated at margin account level (House (H) account) by currency |

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| BR 112 - Create set of simulated scenarios | As a ForexClear Risk User:  I want to be able to generate a set of simulated stressed market data so that I can calculate stressed NPV.  Acceptance criteria:   1. Scenarios shocks that are loaded daily from the system (**BR 110**) are applied to live market data set as per **BR 58** 2. Mapping with scenario for shock application   Where:  = simulated price  = current price in market data set  = returns defined in scenario shock  = shock defined in relative terms  = shock defined in absolute terms |
| BR 113 - Clean set of simulated stress scenarios | As a ForexClear Risk User:  I want to be able to generate a clean set of simulated stress scenarios so that in can calculate stressed NPV.  Acceptance criteria:   1. Simulated stress scenarios (**BR 112**) are checked and de-arb’ed as per **BR 58** and **BR 60** |

1. Liabilities

Liabilities components in the coming BR are defined as follow:

1. is Initial Margin calculated at margin account level for the EM service and is calculated as per the DSS
2. is SRM calculated at margin account level for the EM service and is calculated as per the DSS
3. is LRM calculated at margin account level for the EM service and is calculated as per the DSS
4. is Initial Margin calculated at House (H) account level for the NON-EM service and is calculated as per **BR 46**
5. is SRM calculated at House (H) account level for the NON-EMservice and is calculated as per **BR 64**
6. is LRM calculated at House (H) account level for the NON-EM service and is calculated as per **BR 82**
7. is combined (combined for both NON-EM and EM service) CRiM calculated at member level and is calculated as per **BR 46**
8. is SMM calculated at HOUSE level for the NON-EM service and is calculated as per **BR 66**
9. is VM in EOD mode calculated at House (H) account level for the NON-EM service and is calculated as per **BR 43**
10. is VM in EOD mode calculated at House (H) account level for the EM service and is calculated as per **BR 43**
11. is calculated at House (H) account level for the EM service and is calculated as per BR 95.
12. is calculated at House (H) account level for the NON-EM service and is calculated as per BR 95.
13. is NSA calculated at margin) account level for the EM service and is calculated as per EM DSS document.
14. is calculated as per **BR 94**

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| BR 140 - Determine liabilities to send to banking | As a ForexClear Risk User:  I want to communicate the liabilities to the banking system in real time so that the liabilities can be reflected correctly in banking  Acceptance criteria:   1. Liabilities value to send to banking is the minimum of the total liability (**BR 142**) or MIN TL (**BR 141**) => same as for Current EM service 2. Liabilities are sent to banking at margin account level – similar to EM service 3. Liabilities are send to banking as soon as updated in the ForexClear system 4. Liabilities are sent to Calypso in USD |
| BR 141 - Calculate minimum liability | As a ForexClear Risk User:  I want to calculate Minimum Total Liability (MIN TL) in USD equivalent so that ForexClear total liabilities is set to a minimum amount  Acceptance criteria:   1. MIN TL is reset at start of Day (SOD) 2. If at any point ITD (real time) the Total liability (**BR 142**) is greater than MIN TL is reset and equal to total liability. 3. At SOD |
| BR 142 - Calculate total liability | As a ForexClear Risk User:  I want to calculate Total Liability so that ForexClear can assess members risks and margin accordingly  Acceptance criteria:   1. TL is calculated as follow depending on status of the ForexClear schedule(**BR 1**)    * In the EOD Margin run (Current EOD Mode), TL is calculated as per **BR 143**    * Until excess cover messages are received from Calypso , TL is calculated as per **BR 144**    * After excess cover messages have been received and until EOD margin run completion (Current ITD mode), TL is calculated as per **BR 145** 2. Total liability are capped to 0 |
| BR 143 - Calculate total liability at EOD | As a ForexClear Risk User:  I want to calculate Total Liability at each EOD (EOD MR) so that ForexClear can determine liabilities to be sent to the Calypso system at EOD  Acceptance criteria:   1. Calculated at margin account level (H account for House and omnibus level for clients) 2. Market data used is from the EOD market data snap 3. All components in the above formula are calculated as at EOD margin run. 4. VM component is expressed in USD as per **BR 45** 5. PAI component is expressed in USD as per **BR 96** 6. Total liability is negative and capped to 0. |
| BR 144 - Calculate total liability ION | As a ForexClear Risk User:  I want to calculate Total LiabilityION at each margin run during ION State so that ForexClear can determine liabilities to be sent to the banking system  Acceptance criteria:   1. Market data used is from the most recent market data snap 2. Calculated at account level 3. VM component is expressed in USD as per **BR 45** 4. PAI component is expressed in USD as per **BR 96** 5. Total liability is negative and capped to 0. 6. ION state is the period between EOD Margin run completion until CLS cycle complete **and** Excess cover message received from Calypso (BR 12) |
| BR 145 - Calculate total liability ITD | As a ForexClear Risk User:  I want to calculate Total LiabilityITD at each ITD (including event driven) margin run so that ForexClear can determine liabilities to be sent to the banking system  Acceptance criteria:   1. Market data used is from the most recent market data snap 2. Calculated at account level 3. VM component is expressed in USD as per **BR 43** 4. PAI component is expressed in USD as per **BR 96** 5. Total liability is negative and capped to 0 6. ITD is the period between end of ION period and EOD Margin run completion. |

1. Greeks

**\*\* Methodology document to be provided with full details of the required calculations \*\***

For this section, the below notations will be used:

= simulated value of position *i* in Term currency

= notional of position *i* in base currency

= FX forward rate between spot date and trade settlement date expressed as term per one unit of base currency

= FX spot rate expressed as term per one unit of base currency

= FX trade rate expressed as term per one unit of base currency

= Time (in years) from regular spot date to trade expiry date

= 1 for calls, -1 for puts

= FX implied volatility (based on interpolation of the underlying scenario’s volatility surface. Linear interpolation used in time-space and log moneyness-space)

= natural logarithm

= Cumulative Normal Distribution function

= base currency zero coupon swap rate between spot date and trade settlement date (based on linear interpolation of continuously compounded zero rates where required). ZC curves to be used based on conventions outlined in **Table 9**.

= term currency zero coupon swap rate between spot date and trade settlement date (based on linear interpolation of continuously compounded zero rates where required). ZC curves to be used based on conventions outlined in **Table 9**.

    = discounting zero coupon rate (dictated by the VM currency) between valuation date and trade settlement date (based on linear interpolation of continuously compounded zero rates where required) . ZC curves to be used based on conventions outlined in **Table 9**.

= accrual factor based on appropriate day count convention between dates *a* and *b*

= valuation date

= regular spot date

= trade settlement date

And

* 1. Aggregation Methodology

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| BR 146 – Greeks Aggregation Methodology | As a ForexClear Risk User:  I want the ForexClear system to aggregate sensitivities on a portfolio level so that I can view risk across an entire portfolio  Acceptance criteria:   1. Given a sensitivity (*Greek*), in currency *ccy* for a trade *i*, portfolio sensitivity (for *ccy*) should be calculated as:   Where,  is the sensitivity across the whole portfolio, in currency *ccy*  is the sensitivity for trade *i*, in currency *ccy*  =Number of trades in portfolio |

* 1. Bucketing Methodology

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| BR 147 - Greeks Bucketing Methodology | As a ForexClear Risk User:  I want the ForexClear system to use linear bucketing on certain sensitivities such that, where appropriate, I can see where certain risks lie on a portfolio.  Acceptance criteria:   1. Sensitivities should be allocated to the following tenors:    * 1W    * 2W    * 1M    * 2M    * 3M    * 6M    * 9M    * 1Y    * 18M    * 2Y 2. If a trade maturity date falls on one of the above tenors, it’s sensitivities are wholly allocated to that tenor 3. If a trade maturity date falls between tenors, it’s sensitivities are partially allocated to the previous tenor and partially allocated to the next tenor using a standard linear methodology. 4. If a trade falls before the first tenor/after the last tenor then it’s sensitivities are applied wholly to the first/last tenor. |

* 1. Spot Delta

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| BR 148 - Spot delta Calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the change in trade value following a one unit (or 100% relative) change in the underlying spot rate for each trade.  Acceptance criteria:   1. Spot delta for an option *i* to be calculated in base currency (*ccy*)as: 2. Spot delta for an FX Forward *i* to be calculated in base currency (*ccy*)as: 3. Premium-included delta is defined by currency pair in **Table 4** |
| BR 149 - Spot delta Aggregation | As a ForexClear Risk User:  For each portfolio, I want to aggregate the trade deltas per currency pair in base currency, to provide an overall spot delta per portfolio.  Acceptance criteria:   1. Portfolio spot delta should equal the sum of each trade’s individual spot delta **BR 148** 2. Portfolio spot delta aggregation should be calculated as per **BR 146** |

## 

* 1. Forward Delta

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| BR 150 - Forward delta Calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the change in trade value following a one unit (or 100% relative) change in the underlying forward rate for each trade.  Acceptance criteria:   1. Forward delta for trade *i* to be calculated in base currency (*ccy*) as: 2. Forward delta for an FX Forward trade *i* to be calculated in base currency (*ccy*) as: 3. Premium-included delta is defined by currency pair in **Table 4** |
| BR 151 - Forward delta bucketing | As a ForexClear Risk User:  For each portfolio, I want the ForexClear system to bucket each trade’s forward delta, per currency so that I can see a high-level view of my forward delta risk  Acceptance criteria:   1. Forward delta calculation is as per **BR 150** 2. Forward delta bucketing should be calculated as per **BR 147**. |

* 1. Gamma

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| BR 152 - Gamma Calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the gamma for an option where the option gamma is the change in spot delta given a 1% change in the underlying spot rate.  Acceptance criteria:   1. Gamma for each trade *i* to be calculated in base currency (ccy)as: |
| BR 153 - Gamma Aggregation | As a ForexClear Risk User:  For each portfolio, I want to aggregate the trade gammas per currency, to provide an overall gamma per portfolio.  Acceptance criteria:   1. Portfolio gamma should equal the sum of each trade’s individual gamma. 2. Portfolio gamma should be calculated as per **BR 146** |
| BR 154 - Gamma bucketing | As a ForexClear Risk User:  For each portfolio, I want to bucket each trade’s gamma, per currency, using the methodology outlined in **BR 147**  Acceptance criteria:   1. Portfolio gamma should equal the sum of each trade’s individual gamma. |

* 1. Vega

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| BR 155 - Vega Calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the vega for an option such that the vega is defined as the change in option value given a 1% absolute increase in the input implied volatility so that I can measure the P&L risk of a change in implied volatility.  Acceptance criteria:   1. Vega for each option *i* to be calculated in base currency (*ccy*) as: |
| BR 156 - Vega Aggregation | As a ForexClear Risk User:  I want the ForexClear system to calculate a portfolio’s vega (per currency pair) where the portfolio vega is defined as the change in portfolio value given a 1% absolute increase across the whole volatility surface so that I can view each portfolios sensitivity to a change in implied volatiltiy.  Acceptance criteria:   1. Vega is calculated as per **BR 155** 2. Portfolio vega equal to the sum of each trade’s vega 3. Portfolio vega should be calculated using aggregation of trade vega as per **BR 146** |
| BR 157 - Vega bucketing | As a ForexClear Risk User:  I want the ForexClear system to calculate a portfolio’s vega per tenor, per currency pair so that I can view my risk to a change in implied volatility across the whole vol surface.  Acceptance criteria:   1. Method for bucketing should be as outlined in **BR 147** |

* 1. Theta

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| BR 158 - Theta calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the theta for each option such that the theta is defined as the change in option value given a 1-day decrease in time to expiry.  Acceptance criteria:   1. Theta for each option *i* to be calculated in base currency (ccy) as: |
| BR 159 - Theta aggregation | As a ForexClear Risk User:  I want the ForexClear system to calculate the theta for a portfolio so that I can see overall time decay risk  Acceptance criteria:   1. Portfolio theta should be calculated using aggregation as outlined in **BR 146** |

* 1. Rho(f/d)

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| BR 160 - Rho(f/d) calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the rhos for each trade where the rhod(f) is the change in trade NPV subject to a 1% increase in the domestic (foreign) ZC rate.  Acceptance criteria:   1. Rho for each option *i* to be calculated in base currency (ccy) as: |
| BR 161 - Rho(f/d) bucketing | As a ForexClear Risk User:  I want the ForexClear system to calculate the rhos for each portfolio, bucketed by tenor so that I can view my curve risk.  Acceptance criteria:   1. Rho for each curve is calculated as per the bucketing methodology as per **BR 147** |

* 1. Vanna

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| BR 162 - Vanna calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the vanna for each option trade such that the vanna is defined as the change in option vega subject to a one unit change in the underlying spot rate.  Acceptance criteria:   1. Vanna for each option *i* to be calculated in base currency (ccy) as: |
| BR 163 - Vanna bucketing | As a ForexClear Risk User:  I want the ForexClear system to calculate a portfolio’s vanna per tenor, per currency pair so that I can view my risk to a change in the underlying spot rate across the whole vol surface.  Acceptance criteria:   1. Vanna is calculated by trade as per **BR 162** 2. Vanna by tenor should be calculated by bucketing of trade vanna as per **BR 147** |
| BR 164 - Vanna aggregation | As a ForexClear Risk User:  I want the ForexClear system to calculate a portfolio’s vanna, per currency pair so that I can the total risk of my portfolio to a change in the underlying spot rate.  Acceptance criteria:   1. Vanna is calculated by trade as per **BR 162** 2. Portfolio Vanna should be calculated by aggregation of trade vanna as per **BR 146.** |

* 1. Volga

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| BR 165 - Volga calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the volga for each option trade so that Volga is defined as the change in option vega subject to a one unit change in implied volatility. .  Acceptance criteria:   1. Volga for each option *i* to be calculated in base currency (ccy) as: |
| BR 166 - Volga bucketing | As a ForexClear Risk User:  I want the ForexClear system to calculate a portfolio’s volga per tenor, per currency pair so that I can view my risk to a change in implied volatility across the whole vol surface.  Acceptance criteria:   1. Volga by currency pair (**Table 3**) and tenor should be calculated by bucketing of trade volga as per **BR 147** |
| BR 167 - Volga aggregation | As a ForexClear Risk User:  I want the ForexClear system to calculate a portfolio’s volga, per currency pair so that I can the total risk of my portfolio to a parallel shift to each volatility surface  Acceptance criteria:   1. Portfolio Volga should be calculated by aggregation of trade volga as per **BR 146** |

* 1. Rega

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| BR 168 - Rega calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the Rega for each risk-reversal quote so that I can calculate LRM and manage risk in the portfolio  Acceptance criteria:   1. The Rega for each volatility surface should be defined in a matrix per currency pair such that each column corresponds to the rega for a particular risk reversal quote and each row corresponds to each tenor. ( 2. The Rega is calculated using a simulation based approach as follows:   Where,  =Rega of the portfolio for currency pair *ccypair*, delta quote δ and tenor *t*  =Value of the portfolio (in base currency) after increasing the risk-reversal quote corresponding to currency pair *ccypair*, delta quote δ and tenor *t* by 0.1%, ie  =Current value of the portfolio (in base currency)   1. Rega is defined as the change in option value subject to a 10bps absolute increase in the corresponding risk-reversal 2. Valuation model is as per BR 39 3. Rega is calculated for each tenor and delta (10,25) (**Table 21**)     **Note**: Rega calculated in Murex under Smile scenario ‘MX\_REGA’ |

* 1. Sega

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| BR 169 - Sega calculation | As a ForexClear Risk User:  I want the ForexClear system to calculate the sega for each butterfly quote such that the sega is defined as the change in option value subject to a 10bps absolute increase in the corresponding butterfly  Acceptance criteria:   1. The sega for each volatility surface should be defined in a matrix per currency pair such that each column corresponds to the sega for a particular butterfly quote and each row corresponds to a tenor. 2. The sega should be calculated using a simulation based approach as follows:   Where,  =Sega of the portfolio for currency pair *ccypair*, delta quote δ and tenor *t*  =Value of the portfolio (in base currency) after increasing the butterfly quote corresponding to currency pair *ccypair*, delta quote δ and tenor *t* by 0.1%, ie  =Current value of the portfolio (in base currency)   1. The sega is defined as the change in option value subject to a 10bps absolute increase in the corresponding butterfly 2. Valuation model is as per BR 39 3. Sega is calculated for each tenor and delta (10,25) (**Table 21**)   **Note**: Sega calculated in Murex under Smile scenario ‘MX\_SEGA’ |

Table 21 – Rega/Sega sensitivity calculation output

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **USD (in thousand USD)** | | |
| **Tenor** | **Rega10** | **Rega25** | **Sega10** | **Sega25** |
| **1W** | 1,399 | 1,554 | -508 | -1,867 |
| **1M** | 773.1 | 859 | 843 | 1,637 |
| **2M** | 1,384 | 1,538 | -592 | -603 |
| **3M** | 1,016 | 1,129 | -587 | 862 |
| **6M** | -1,324 | -1,471 | 1,504 | 192 |
| **9M** | 1,016 | 1,129 | 386 | -1,142 |
| **1Y** | -594 | -660 | -1,420 | -1,966 |
| **18M** | 207 | 230 | -120 | -65 |
| **2Y** | 1,724 | 1,915 | -613 | 226 |
| **TOTAL** | **5,601** | **6,223** | **-1,107** | **-2,726** |

1. Risk Monitoring
   1. Intraday Monitoring

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| BR 170 - Liabilities Consistency Checks | As a ForexClear Risk User:  I want a set of consistency checks to be performed on member liabilities during ForexClear operating hours so that abnormal liabilities behaviour can be flagged.  Acceptance criteria:   1. Net VM across all margin account is close to zero      1. For every margin account, each liability component except for VM has a non-positive value   IM ≤ 0  LRM ≤ 0  SRM ≤ 0  CRiM ≤ 0  SMM ≤ 0  MER ≤ 0   1. For every margin account, Total Liability as defined by the sum of components below is non-positive:   TOTAL LIABILITY ≤ $0  Where Total Liability is taken from **BR 142**   1. The full set of liabilities consistency checks are performed after every incremental risk check 2. The full set of liabilities consistency checks are performed after every margin run 3. The liability components in the consistency checks are expressed in USD-equivalent 4. A breach to any limit in any account, this is immediately escalated and acknowledged by ForexClear CEO, COO, and Head of Risk.   ***Questions & Comments:***  The checks are performed at House as well as Client accounts and omnibus level |
| BR 171 - Collateral Level Reporting | As a ForexClear Risk User:  I want visibility on the evolution in the level of collateral for every member account so that I can control changes and thus be able to flag potential abnormalities.  Acceptance criteria:   1. Throughout ForexClear operating hours, a real time view shows the following information for each H , B, C and F account (**BR 12**) 2. The latest level of collateral (updated at least every 5 minutes from Calypso) in USD-equivalent 3. The EOD level of collateral as at EOD Margin run and provided by Calypso 4. The ***Total collateral*** figure is broken down by type as **cash** or **non cash** (New feature) |

* 1. Real Time

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| BR 172 - Real Time Trade Registration Monitoring | As a ForexClear Risk User:  I want tolerance and consistency checks to be applied in real time trade registration so that trades are accepted irrespective of the check status but the status can be flagged.  Acceptance criteria:   1. Tolerance checks (see **BR 178 - Margin Run Limits for Tolerance Check**) are applied following every Risk Check performed in the real time registration process 2. Consistency checks (see **BR 170** - Liabilities Consistency Checks) are applied following every Risk Check performed in the real time registration process 3. If any tolerance or consistency check(s) is failed for any margin account, this is flagged up (see **BR 173**). 4. Tolerance and consistency checks are only for notification purposes and so failing any of the does not result in trade rejection |



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| BR 173 - Real Time Trade Registration: Breach Notification | As a ForexClear Risk User:  I want breaches to the tolerance and / or consistency checks to be notified so that I can investigate their cause.  Acceptance criteria:   1. If any tolerance check(s) is (are) failed for any margin account, this is flagged up in the Proxy Accounts Feed and Proxy Trades Feed through a Tolerance breach flag 2. If any consistency check(s) is (are) failed for any Omnibus account, this is flagged up in the Proxy Accounts Feed and Proxy Trades Feed through a Consistency breach flag 3. If any tolerance or consistency check is failed for any margin account, an alert e-mail is automatically generated and sent to a configurable e-mail distribution list as soon as technically possible (within 30sec), containing the following information: 4. Service 5. Date & Time 6. =Omnibus 7. For each breach driver: Check Type (tolerance / consistency) | Breach Driver Check Name | Level | Limit |

* 1. Margin Run Monitoring and Limits

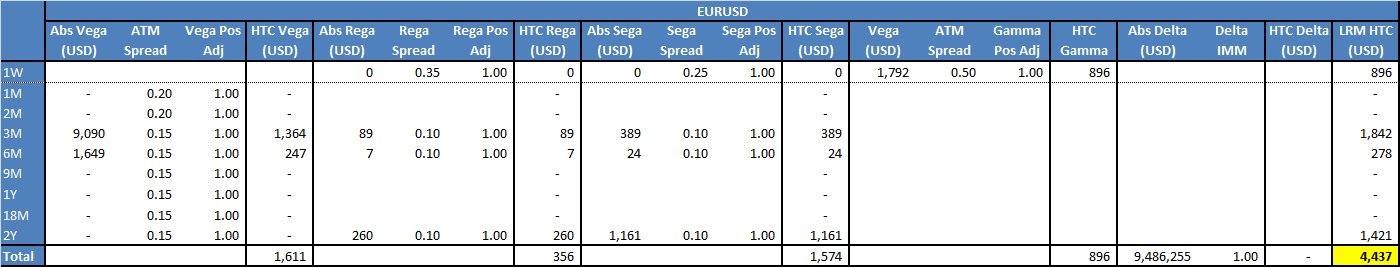
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| BR 174 - Margin Run Approval | As a ForexClear Risk User:  I want every margin run (scheduled or ad-hoc – **BR 1** and **BR 10**) to pass through an approval stage before it closes so that calculations are validated.  Acceptance criteria:   1. In line with current setup for EM service, every margin run with a status ‘COMPLETED’ subsequently goes into ‘PENDING\_APPROVAL’ stage 2. Liabilities consistency checks (see **BR 170**) are always performed as a step 1 of the ‘PENDING\_APPROVAL’ stage, prior to any tolerance checks if applicable (see **BR 177**). 3. If any consistency check is failed, the margin run is automatically rejected (‘ABORTED’ status), no liabilities are sent downstream, and this is escalated to ForexClear CEO and Head of Risk as soon as technically possible (within 5 minutes) 4. If any tolerance checks (**BR 177**) failed then the Margin run goes into PENDING APPROVAL waiting for a Risk user to manually approve or reject the margin run 5. In line with current process applicable in EM service, a 4-eye manual approval / rejection process is applied and two different users have to provide approval / rejection 6. Only users who belong to a configurable list of authorised approvers (RISK users) can approve/reject a margin run 7. In line with current EM service, an OSP validation screen is available to approve / reject liabilities 8. Similar to current EM service, a liabilities components report is available to view, which contains the following information for every live member account: 9. ForexClear Member 10. Account (H/C) 11. Portfolio ( House (H) account House (H) account) 12. Liability Type (see questions & comments below) 13. Currency 14. Current Level 15. Previous Level 16. Absolute Change (in the equivalent Currency above) 17. Absolute Change (in %) 18. Absolute Limit (in the equivalent Currency above) 19. Absolute Change Limit (in %) 20. % Change Limit 21. Liability Type Description 22. In line with current EM service, the liabilities components report highlights any breaches to tolerance levels if applicable 23. Liability Types to include are Total IM (see **BR 143, BR 144, BR 145**) plus any additional ones on which there are tolerance checks applied (see **BR 177**). 24. If approved (manually or automatically), a margin run status updates into ‘APPROVED’ and eventually into ‘CLOSED’, following which liabilities and other risk numbers calculated (**BR 143, BR 144, BR 145**) are communicated downstream as soon as technically possible 25. If rejected (manually or automatically), a margin run status updates into ‘CLOSED, and no liabilities nor other risk numbers are communicated downstream (including no reports are produced) |
| BR 177 - Margin Run Limits Checks | As a ForexClear Risk User:  I want to be able to define Limits checks for margin run approval so that I can control the approval of liabilities calculated in the margin run prior to the margin run process completing.  Acceptance criteria:   1. Tolerance checks are applied for every margin run in an ‘auto-approval mode subject to tolerance checks’ (see **BR 175**). 2. Tolerance checks are applied to the combined liability component from deliverable and non-deliverable portfolio 3. Tolerance checks are applied at Member H and C levels: 4. Total IM absolute level, expressed in USD, where      1. Total IM relative change, expressed in %, where 2. Total IM absolute change, expressed in USD, where   IM   1. LRM vs IM, expressed in %, where 2. SRM vs IM, expressed in %, where 3. VM relative to IM, expressed in %, where   Where   1. SMM absolute level 2. DFAM absolute level   Where DFAM is defined in (**Default Fund BRD – BR 14**)   1. Stress scenario definition different from previous day (DF BRD - **BR 1**) 2. Additionally the following check is performed on every mnemonic 3. Credit Score   Group Risk published credit score <> ForexClear Credit Score (**BR 93**)   1. In line with current EM service, if any level is above the corresponding limit, then the tolerance check for the margin run is failed; else it is passed (see **BR 179**). |
| BR 178 - Margin Run Limits for Tolerance Check | As a ForexClear Risk User:  I want to be able to define a set of limits for tolerance checks so that they can be compared to the corresponding amounts subject to tolerance checks.  Acceptance criteria:   1. The following limits are defined: 2. IM\_ABS\_USD   The limit is defined in USD.   1. IM\_CHG\_PCT   The limit is defined in percentage points.   1. IM\_CHG\_USD   The limit is defined in USD.   1. LRM\_IM\_PCT   The limit is defined in percentage points.   1. SRM\_IM\_PCT   The limit is defined in percentage points.   1. VM\_IM\_PCT   The limit is defined in percentage points.   1. SMM\_USD   The limit is defined in USD.   1. DFAM\_USD   The limit is defined in USD and correspond to x% depending on member internal credit score (as per **BR 134**) of the default size (calculated in **BR 126**)   1. In line with current EM service, for each tolerance check component, a configurable limit can be defined and stored in the system. Tolerance check limits can be updated one at a time, or in bulk through a file. 2. In line with current EM service, tolerance check limits are expressed in USD or in %, whichever applies. 3. In line with current EM service, tolerance check limits can be generic i.e. apply to all member mnemonic accounts, or only to a specific margin account; Specific limits take priority to generic limits 4. For limits set at member mnemonic level, the member + account combination is automatically validated by the system to ensure it exists in the current list of live accounts. If it does not exist, an error message indicates the break and any amendments are not saved, else the limits update is accepted. 5. Limit updates take effect from the next margin run. |
| BR 179 - Margin run manual approval when tolerance check fails | As a ForexClear Risk User:  I want to be able to define dependency between amounts versus limits for the tolerance checks for margin runs (see **BR 174**) so that a failure require the margin run to be manually approved  Acceptance criteria:   1. For each tolerance check metric below, the amount (as defined in **BR 174**) is within limit (as defined in **BR 178**), and so the check is passed, only if the corresponding condition from the list below is met: 2. SMM < SMM\_USD 3. DFAM < DFAM\_USD 4. Total IM = 5. If for any metric above the amount is over the limit, then the check is failed 6. If a check failed, then the approval mode (**BR 174**) switch to manual and a risk user is asked to manually approve the margin run (**BR 174**) 7. If all checks are passed and the approval mode (**BR 174**) is automatic, then the margin run is auto approved |

* 1. ION / ITD / EOD Margin runs

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| BR 180 - Margin Run OSP Views | As a ForexClear Risk User:  I want to be able to see, in Murex (Datamart extractions currently in place for EM), the liabilities and static information following margin runs so that I can perform risk analysis.  Acceptance criteria:   1. As per current EM process, OSP datamart extractions are available for the latest and a range of past margin runs through queries to the datamart tables 2. The following data extractions are available: 3. MR Status (as per current MR02\_MR\_STATUS) 4. MR Scope -> as per current MR04\_MR\_SCOPE with the following amendments:    1. include trade type (Option / Forward / EM) 5. MR Tail Scenario Details -> as per current MR05\_IM\_TAIL for EMs with the following amendments: 6. include separate ‘PL’, ‘PL\_SCN’, ‘SCN\_DTE\_STR’ and SCN\_DTE\_END’ columns for deliverable portfolio 7. name columns so that it is explicit if they correspond to deliverable or non-deliverable portfolio 8. Add column that indicates the source of the IM i.e. Mid Vol or Quant Vol 9. MR Liabilities Breakdown -> as per current MR06\_LB\_VALUES for EMs with the following amendments: 10. include breakdown for deliverable portfolio in line with currently existing ones for EMs 11. SMM, VMHoliday rows to be added 12. All margins will be shown in USD equivalent 13. LRM Explain -> MR08\_NDF\_IMM will remain to explain LRM delta component 14. A new LRM extract is requested to analyse other LRM components (see **BR 181** for details) 15. SRM Explain -> No change to current MR\_SRM extraction, new currencies will be displayed in this extract 16. MR IM Breakdown -> as per current MRR\_IM with the following amendments:   - include all currency pairs   1. MR VM Breakdown -> as per current MRR\_VM with the following amendments: 2. include deliverable portfolios |
| BR 181 - Margin Run OSP Views: LRM Explain | As a ForexClear Risk User:  I want to be able to see in Murex an LRM explain for every margin account at every margin run so that I can validate the calculation performed.  Acceptance criteria:   1. A LRM explain views at margin account level is available for all currencies (deliverable and non deliverable) 2. The current MR06 LRM Explain view shows the set of information required to validate LRM delta, there is no change required to this extract 3. A new LRM extract will show the information used in the LRM calculation as per  **Table** **23** for every currency pair and margin account 4. The source of parameters and calculation is detailed in **BR 82** |

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| BR 182 - Margin Run Datamart Views: FxSET Explain | As a ForexClear Risk User:  I want to be able to see in Murex a full FxSET explain for every margin account at every margin run so that I can validate the calculation performed.  Acceptance criteria:   1. For a given combination (Report Date, Risk Run Id, Mnemonic, Account), the view contains the following information:   - Settlement Date  - Simulation Type  - Simulation End Date  - Exposure\_Ccy1  - Exposure\_Ccy2  - Exposure\_Ccy3  - Exposure\_Ccy4  - Exposure\_Ccy5  - Exposure\_Ccy6   1. All exposure values are local currency integer numbers 2. Simulation Type is {Simulated, Stressed}, where “Simulated” refers to the calculation detailed in **BR 99** and “Stressed” refers to the calculation detailed in **BR 100** 3. Simulation End Date is, for each simulation type, the end date corresponding to the scenario applied (see **BR 58** for details) 4. The view is available for every risk run: either scheduled (as per **Table 1**) or ad-hoc 5. Currencies referred to in the Exposure fields are configurable (can be added / removed) 6. Settlement Date is between T+2 onwards (i.e. trades included are all those settling in more than 1 day) 7. The most recent 10 settlement dates are displayed. |

Table 23 – Example NON-EM LRM Explain - Vega OSP view: example for a currency pair



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| Philip Willis | ForexClear Change and Test | Sign-Off |
| David Gavini | ForexClear Support and Development | Sign-Off |
| Sean Cody | FX Options Project Manager | Review |
| David Fitzgerald | ForexClear Business Operations | Review |
| Henry Weindling | ForexClear Onboarding | Review |
| Denise Holder | Compliance | Review |
| Simon Close | ForexClear Risk | Author / Review |
| Loic Moreau | ForexClear Risk | Author / Review |

1. [1] Previously referenced as PSL [↑](#footnote-ref-1)