Information Paper

HKATS Risk Functions Enhancement ("PTRM 2.0")

CONTENTS

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SECTION I: INTRODUCTION

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1. The current version of Pre-Trade Risk Management ("PTRM") system in the derivatives market - HKATS Risk Functions was introduced in April 2016. In these years, PTRM have provided the derivatives market not only a Kill Switch function but also an automatic stop function by allowing Clearing Participants ("CP") / Exchange Participants ("EP") to set risk limits across several pre-trade and at-trade Prescribed Risk Controls. The current PTRM functions are widely regarded as an effective backstop at the Exchange level being complementary to EP's own pre-trade risk controls.

2. The system promotes and supports stability in the derivatives market with its usage and settings regularly reviewed by Hong Kong Exchanges and Clearing Limited ("HKEX") together with the EPs. During these years, HKEX have also been seeking for more specific Prescribed Risk Controls to mitigate various potential trading risks. After listening to the feedbacks from market practitioners, HKEX plan to enhance the current PTRM system with a tentative rollout in the 4th quarter of 2021.

3. The proposed enhancement aims to provide additional risk management tools on managing intra-day exposures, one to address the build-up of trade exposures within a configurable short period of time, and another one to provide a more granular intraday exposure management in term of the number of derivatives contract quantities upon different types of products separately, in contrast to the current solution to count the intraday exposures aggregating across all derivatives products for the whole business day in term of Unit Margin Rates ("UMR"). In addition, minor enhancements on the current Prescribed Risk Controls will also be included. For a list of the current scope of Prescribed Risk Controls against the ones after the proposed enhancements, please refer to **APPENDIX A: SUMMARY OF FUNCTIONS AND FEATURES** for details.

4. The proposed enhancement functions are listed below:
    a. Additional Prescribed Risk Controls:
        - Execution Throttle Limits;
        - Intraday Position Limits.
    b. Other Prescribed Risk Control and Functional Enhancements:

- Maximum Combo Size Limits and Maximum Block Trade Size Limits as enhancements on the existing Maximum Order Size Limits;
- Order Exposure Reference Counters;
- Active User Reference Counters.

Please refer to **SECTION II: ENHANCED FUNCTIONAL FEATURES** for details in the enhancements.

5. HKEX proposed all other existing functions and Prescribed Risk Controls listed below to be retained after the tentative rollout:

    a. Risk Limit Manager and Trading Unit login sessions and their respective connectivity and access right arrangements;

    b. Pre-Trade Limit Group ("PTLG") structures previously created and maintained by EPs and their respective settings;

    c. Existing Prescribed Risk Controls[1] and their respective risk limit settings.

6. The current minimum requirements for the designated PC of the PTRM Graphical User Interface ("PTRM GUI") is revised below to reflect the most up-to-date software and hardware information. EPs are recommended to review the specifications of their designated PTRM GUI PCs before the rollout by making reference to the following revised recommendation regarding the software and hardware specifications.

PTRM GUI Specifications (Recommended PC Requirement)

	Current Recommendation	Revised Recommendation
Processor	Intel Core i3-550 3.2GHz or Higher	Intel Core i3 6th Generation 3.2GHz or Higher
RAM	4 GB	
Extra Storage	10GB	
Network Adapter	100Mbps full-duplex	
OS	Microsoft Windows 10 (64 bit)	
Layered Software	JAVA 8 See Java System Requirements: http://java.com/en/download/help/sysreq.xml	
	Anti-virus software	
Supporting Browser	Windows Google Chrome (Version to be advised and notified by HKEX to EPs	

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[1] Maximum Order Size Check, Maximum Order Rate Check and Maximum Intraday Exposure Check.

		from time to time)	
Bandwidth Usage	Less than 1 Mbps of existing SDNET/2 or HKEX Service Network circuit per session	Approximately 1 Mbps of existing SDNET/2 or HKEX Service Network circuit per session Note: Higher bandwidth consumption per PTRM GUI connection is estimated when more tradables (i.e., Instrument Tradables as per the current Maximum Order Size Check) are defined in the PTLG. Please refer to **Point 16 in Section II** for details

Table 1

7. It is proposed to introduce 3 additional OMNet Application Programming Interface ("OAPI") return codes in response to the following new Prescribed Risk Controls as their corresponding order rejection messages:

    a. Execution Throttle Limits;

    b. Intraday Position Limits;

    c. Maximum Block Trade Size Limits.

    It is estimated that OAPI program change by EPs / Vendors are not required, provided their programs can handle properly the current OAPI return codes of the current PTRM version. However, EPs/Vendors are highly advised to check on their readiness to receive the new return codes before the proposed Market Rehearsal event. For details, please refer to **SECTION III: IMPLEMENTATION**.

8. This information paper presents an overview of the enhanced PTRM system for the derivatives market and its implementation. More details will be covered in due course before the rollout through the following information / activities to be arranged by HKEX for all EPs:

    a. the release of HKATS OAPI specifications regarding new OAPI return codes for the new PTRM functions;

    b. the provision of briefing sessions;

    c. the provision of training sessions for the new PTRM functions;

    d. the revised version of HKATS Risk Functions (PTRM) User's Guide including the enhanced functions;

    e. Market Rehearsal.
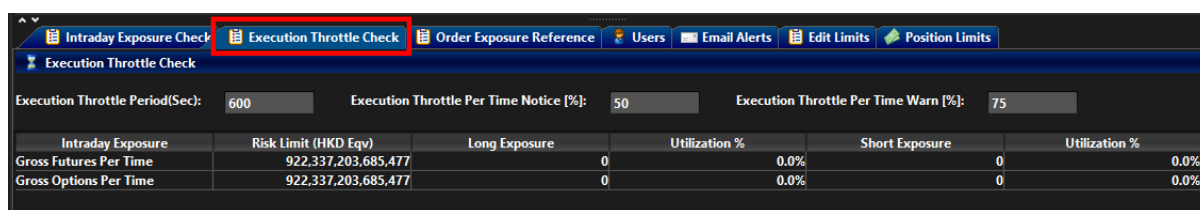
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SECTION II: ENHANCED FUNCTIONAL FEATURES
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A. Execution Throttle Limits

9. Execution Throttle is an at-trade[2] risk check that allows EPs to set exposure limits for trades done aggregating across all derivatives products by their respective UMRs in terms of HKD over a configurable short period of time (300 - 600 seconds).

Figure 1

10. The value of trade exposure will be calculated by multiplying the traded quantity with the corresponding UMR for each instrument and reset every user-configurable period of time on a moving-window basis[3]. The trade exposure values will be accumulated per PTLG and displayed in four risk counters being checked against the corresponding limit settings by Risk Limit Managers:

Execution Throttle Counters	Formula
Gross Futures Long Per Time	Traded Futures Long Quantity x Long UMR
Gross Futures Short Per Time	Traded Futures Short Quantity x Short UMR
Gross Options Long Per Time	(Bought Calls Quantity x Long UMR) + (Sold Puts Quantity x Short UMR)
Gross Options Short Per Time	(Sold Calls Quantity x Short UMR) + (Bought Puts Quantity x Long UMR)

Table 2

Being different from the existing Maximum Intraday Exposure Check, Execution Throttle will not include order exposures and block trade exposures.

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[2] An "At-trade" risk check is performed after orders are submitted into the order book.

[3] The moving windows are sized by dividing the user-configured period of time by 10.

11. Being similar to the existing arrangements for Maximum Intraday Exposure Check, Risk Limit Managers can choose to be notified by the configurable notification and warning levels before a limit is breached. If a limit set is breached, the corresponding PTLG will then be blocked and subsequent orders will be rejected. A manual unblock action will then be required to lift the breach restriction.

B. Intraday Position Limits

12. Intraday Position Limits are at-trade risk checks that accumulate exposures from orders and/ or trades in term of the derivatives contract quantities upon different types of products in the current business day.

Tradable	Calculation	Open Buy	Open Sell	Traded Bought	Traded Sold	Traded Net	Total Buy	Total Sell	Total Net Buy	Total Net Sell	Block Trade Bought	Block Trade Sold
HSI FUTURES	QUANTITY	0	0	0	0	0	0	0	0	0	0	0
STOCK CALL OPTION	QUANTITY	0	0	0	0	0	0	0	0	0	0	0
STOCK PUT OPTION	QUANTITY	0	0	0	0	0	0	0	0	0	0	0
HHI FUTURES	QUANTITY	0	0	0	0	0	0	0	0	0	0	0

Figure 2

13. Risk Limit Managers may apply a set of quantity exposure limits for each Instrument Tradable (Type or Class Level). There are 11 counters against 11 limits per tradable for configuration:
   a. Open Buy/ Sell counters;
   b. Traded Bought/ Sold counters;
   c. Traded Net counters;
   d. Total Buy/ Sell counters;
   e. Total Net Buy/ Sell counters;
   f. Block Trade Bought/ Sold counters.

   Please refer to **APPENDIX B - FORMULAS FOR INTRADAY POSITION LIMITS COUNTERS** for the formula used in each counter.

14. Limit amendments can be applied immediately in the "Edit Limits" tab of PTRM GUI as an intraday change. The addition or removal in instrument tradables will take effect next-day.

Tradable	Calculation	Max Ord...	Max Bloc...	Open Buy	Open Sell	Traded B...	Traded S...	Traded N...	Total Buy	Total Sell	Total N...	Total Ne...	Block Tr...	Block Tr...
HSI - FUTURES	QUANTITY	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,33...	922,337...	922,337...	922,337...
HSI - PUT OPTIONS	QUANTITY	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337...	922,337...	922,337...
HSI CALL OPTION	QUANTITY	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,33...	922,337...	922,337...	922,337...
HSI FUT TIME SPREAD (S=1)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HSI FUT TIME SPREAD (S=2)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HSI FUT TIME SPREAD (S=3)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HSI FUT TIME SPREAD (S=4)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Figure 3

The counters will be reset to zero at the start of each business day. Good-Till-Cancelled and Good-Till-Date orders will then be reloaded and added back into the respective Open Buy, Total Buy, Total Net Buy and/ or Open Sell, Total Sell, Total Net Sell counters.

15. Being similar to the existing Maximum Intraday Exposure Check, Risk Limit Managers can choose to be notified by the configurable notification and warning levels before a limit is breached. If a limit of a tradable is breached, the corresponding product(s) of that tradable will then be blocked and subsequent orders **for the specific tradable** will be rejected. A manual unblock action will then be required to lift the breach restriction.

Higher Bandwidth Consumption By Intraday Position Limits

16. EPs are reminded to note that Intraday Position Limits consume a higher amount of bandwidth for updating the relevant risk limits and counters if a large number of Instrument Tradables is created for more granular controls. It is **not** advised to leave the "Edit Limits" **or** the "Position Limits" tabs open to avoid unnecessary consumption in the bandwidth. The more the Instrument Tradables being added, the higher the PTRM GUI bandwidth consumption and display latency will be observed. It is estimated that an extra of 1Mbps of bandwidth per 40 Instrument Tradables defined per PTLG will be consumed when leaving the "Edit Limits" **or** the "Position Limits" tab open.

C. **Enhancements on Maximum Order Size Check**

17. Since the rollout of PTRM in 2016, the Maximum Order Size Check applies only to outright orders, whereas Standard Combinations (e.g., calendar spreads), Tailor-Made Combinations and Block Trades were not included in the Maximum Order Size Check. With the enhancement, Standard Combinations, Tailor-Made Combinations and Block Trades will be included in the Maximum Order Size Check.

18. Upon the enhancement in Maximum Order Size Check and the introduction of the new aforementioned risk check - Intraday Position Limits, the current "Order Size Limits" tab will be renamed into "Edit Limits" for the settings of Maximum Order Size Limits, Maximum Combo Size Limits, Maximum Block Trade Size Limits and Maximum Intraday Position Limits for Risk Limit Managers to manage these settings in one single tab.

Tradable	Calculation	Max Ord...	Max Bloc...	Open Buy	Open Sell	Traded B...	Traded S...	Traded N...	Total Buy	Total Sell	Total N...	Total Ne...	Block Tr...	Block Tr...
HSI - FUTURES	QUANTITY	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337...	922,337...	922,33...	922,337...	922,337...	922,337...
HSI - PUT OPTIONS	QUANTITY	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337...	922,337...	922,337...	922,337...	922,337...	922,337...
HSI CALL OPTION	QUANTITY	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337,...	922,337...	922,337...	922,33...	922,337...	922,337...	922,337...
HSI FUT TIME SPREAD (S=1)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HSI FUT TIME SPREAD (S=2)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HSI FUT TIME SPREAD (S=3)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HSI FUT TIME SPREAD (S=4)	QUANTITY	922,337,...	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Figure 4

Risk Limit Managers can set Maximum Order Size Limits, Maximum Block Trade Size Limits and Intraday Position Limits by product type or class within the same tradable under the "Edit Limits" tab. Maximum Combo Size Limits shall be set separately upon a newly introduced Combo Tradable by combo type or class for the specific Standard Combinations or Tailor-Made Combinations.

19. Maximum Order Size, Maximum Block Trade Size, Maximum Combo Size Checks are all pre-trade and non-accumulative as the checks are performed before an order enters the central order book. A rejection will occur if the quantity check fails. A breach on the limits will not render a block on the particular PTLG or Instrument Tradable.

20. Risk Limit Managers can stipulate Maximum Combo Sizes for Standard Combinations and Tailor-Made Combinations by using the newly introduced Combo Tradables.

D. Order Exposure Reference Counters

21. Order Exposure Reference Counters will allow EPs to monitor the open order exposures by showing only the open order components (excluding the trade components) of the original Maximum Intraday Exposure Formula:

Order Exposure Reference Counters	Formula
Gross Futures Long	Open Futures Long Quantity x Long UMR
Gross Futures Short	Open Futures Short Quantity x Short UMR
Gross Options Long	(Open Buy Calls Quantity x Long UMR) + (Open Sell Puts Quantity x Short UMR)
Gross Options Short	(Open Sell Calls Quantity x Short UMR) + (Open Buy Puts Quantity x Long UMR)

Table 3

There will not be any associated limits to be set by Risk Limit Managers for Order Exposure Reference Counters as these counters are for reference only.

22. The counters will be reset to zero at start of each business day. Exposures by Good-Till-Cancelled and Good-Till-Date orders will then be reloaded and added back into the respective counters.

E. Active User Reference Counters

23. Active User Reference Counters will allow EPs to monitor the number of active users under each PTLG. For a user-defined PTLG, the counter represents the number of assigned active Trading IDs being effective for a business day. For a Base PTLG, the number represents both the number of assigned active Trading IDs to the Base PTLG appearing in the "Users" tab and unassigned active Trading IDs in "User Picker List".

24. The counter will be displayed in front of each PTLG as shown below:

Participants Pre Trade Limits Group	Breaches	Warnings	Notices	Pos Lir
HKHKFE				
HKC				
HK				
[0]	0	0	0	
[3]	0	0	0	
[2]	0	0	0	
[9]	0	0	0	
[1]	0	0	0	
[2]	0	0	0	

Figure 5

F. HKATS Risk Functions User's Guide

25. EP are reminded that all the functional and technical characteristics cited in this Information Paper are tentative and are subject to change and modification. HKEX endeavours to provide EPs with prompt updates in due course and in the HKATS Risk Functions User's Guide before the rollout.

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SECTION III: IMPLEMENTATION
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The implementation of the PTRM enhanced functions requires the preparations by all EPs. EPs should take note of the following:

A. **Hardware and Software Procurement**

26. EPs should review and upgrade (if applicable) the hardware and software for the current designated PTRM GUI PC in accordance with the minimum hardware and software requirements revised in **Table 1 of SECTION I: INTRODUCTION** before the proposed Market Rehearsal event.

27. PTRM GUI PCs used to connect to the current production PTRM system are expected to be compatible after the rollout. HKEX strongly advise all Risk Limit Manager/ Trading Unit users to ensure their connections to the PTRM System with their respective PTRM GUI User IDs before the proposed Market Rehearsal, to prepare for a smooth connection during the event.

B. **PTRM Infrastructure and Connectivity**

28. HKEX proposed that the currently assigned gateway URLs and ports for all PTRM login IDs remain unchanged. Risk Limit Manager and Trading Unit users shall use their production PTRM login IDs and passwords for the connection of PTRM GUI after the rollout.

29. The current SDNET/2 and HKEX Service Network circuits and settings for production PTRM GUI connections are expected to remain unchanged after the rollout. Bandwidth consumption per PTRM GUI connection after the rollout is still estimated to be approximately 1Mbps. A higher bandwidth consumption per PTRM GUI connection is estimated at the time when the "Edit Limits" tab or the "Position Limits" tab is kept open for updates and monitoring.

C. **EP's existing PTRM Risk Limits after Rollout**

30. It is proposed that the existing PTRM risk limits and settings by EPs will be retained after the rollout. Risk limit settings for the new Prescribed Risk Controls will be pre-set by HKEX at

922,337,203,685,477. EPs are required to complete the limit settings of these new Prescribed Risk Controls within a given calibration period after the rollout.

D. OAPI[4] Readiness

31. Apart from the existing 4 PTRM related OAPI return codes, there will be 3 new OAPI return codes to be introduced (see **Table 4** below).   EPs/ Vendors are advised to assess and ensure they have necessary technical supports and reserve sufficient resources to develop or modify, if necessary, their OAPI programs for the new OAPI return codes before the Market Rehearsal event.

(-850010) _New!_ **User has exceeded Execution Throttle limit**	• User has breached an Execution Throttle Limit and the transaction is rejected.
(-850012) _New!_ **User has exceeded Max. Block Trade Size limit**	• User has breached a Max. Block Trade Size limit and the transaction is rejected.
(-850014) _New!_ **User has exceeded Position limit**	• User has exceeded an Intraday Position limits and the transaction is rejected.
(-850002) _Existing_ **User is in a blocked Pre-trade Risk state**	• Triggered by the "Stop Button" and the "Kill Switch". • User in a blocked Pre-Trade Risk State is not allowed to place any new order or order modification.
(-850004) _Existing_ **User has breached Maximum Order Rate Limit**	• User has breached "Maximum Order Rate Limit" and the order is rejected.
(-850006) _Existing_ **User has breached Maximum Intraday Exposure Limit**	• User has breached at least one "Maximum Intraday Exposure Limit" and the order is rejected.
(-850008) _Existing_ **User has exceeded Maximum Order Size Limit**	• User has exceeded "Maximum Order Size Limit" and the order is rejected.

Table 4

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[4] OAPI herein represents HKATS OAPI program developed by an EP or Vendor

32. EPs/ Vendors are strongly recommended to assess or test their OAPI readiness for the new OAPI return codes by utilising HKATS End-To-End Test Environment prior to the Market Rehearsal event. Details of the testing arrangement and schedule will be announced in due course.
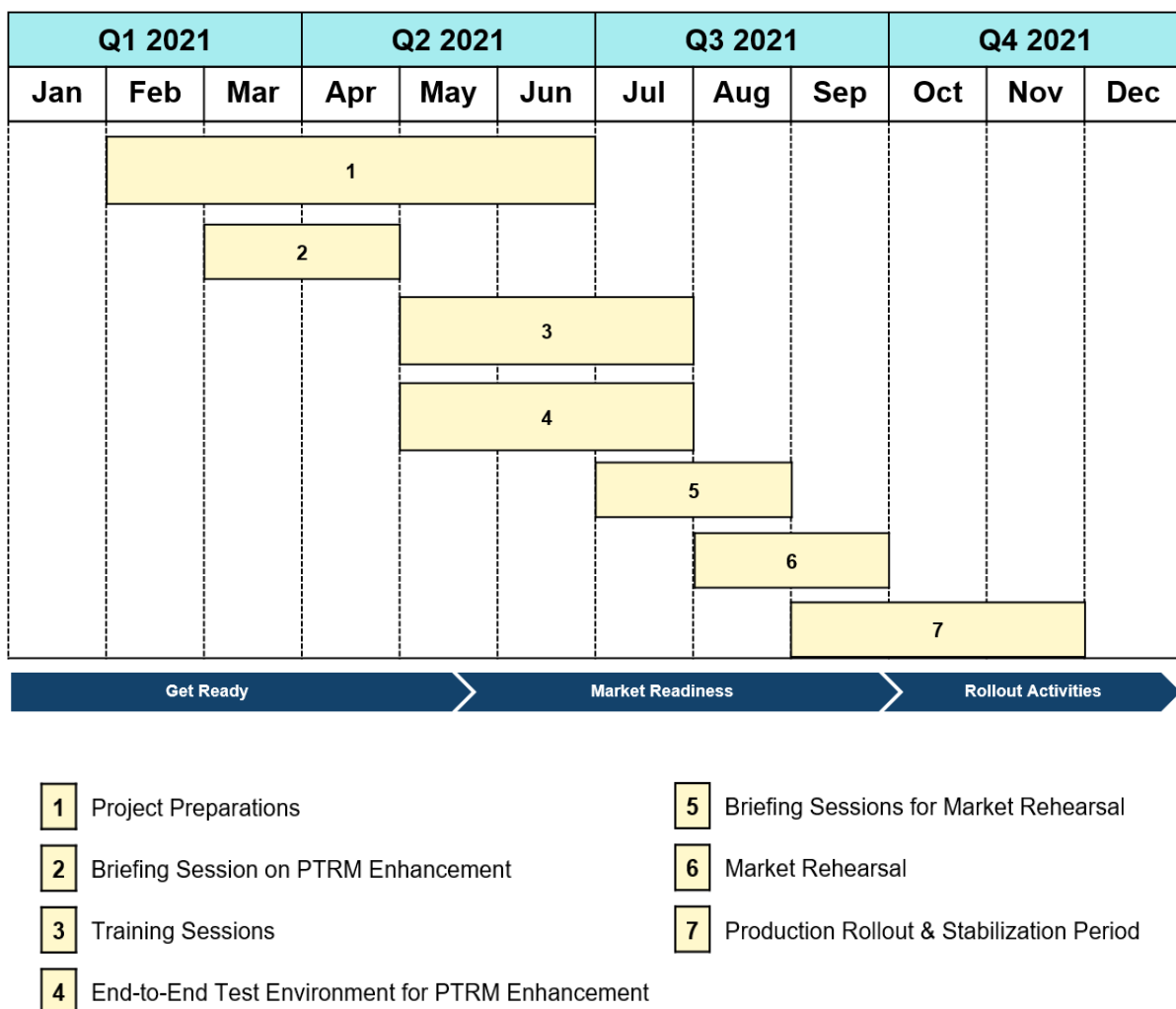
E. PTRM GUI Training Sessions

33. HKEX will provide training sessions on the new PTRM functions to all EP nominated Risk Limit Manager and Trading Unit users tentatively in the 2nd quarter of 2021.

F. Production Preparations & Market Rehearsals

34. HKEX plan to conduct production readiness tests for the market in the 3rd quarter of 2021.

35. As the final preparation before the production rollout, Market Rehearsal will be conducted in the 3rd quarter of 2021. Risk Limit Manager and Trading Unit users from EPs will be required to participate in the Market Rehearsal to confirm and declare their readiness prior to the rollout.

G. Tentative Implementation Schedule

36. EPs are advised to make reference to the following tentative implementation schedule for the necessary preparations regarding the PTRM enhancement initiative.

1	Project Preparations	5	Briefing Sessions for Market Rehearsal
2	Briefing Session on PTRM Enhancement	6	Market Rehearsal
3	Training Sessions	7	Production Rollout & Stabilization Period
4	End-to-End Test Environment for PTRM Enhancement		

Figure 6

SECTION IV: ENQUIRIES

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37. For enquiries and further clarification on the proposed PTRM enhancement, please contact us by email to hkatssupport@hkex.com.hk and clearingpsd@hkex.com.hk or call our hotlines[5]:

   (+852) 2211 6360 (Trading)
   (+852) 2979 7222 (Post Trade)

38. A designated web corner has been set up at the HKEX website for all Upgrade related information. Participants should refer to the "Pre-Trade Risk Management (PTRM) System in Derivatives Markets" web corner for most up-to-date information.

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[5] All calls to our HKATS and DCASS hotlines would be recorded. Please refer to the following link for HKEX privacy policy statement: http://www.hkex.com.hk/Global/Exchange/Privacy-Policy?sc_lang=en

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APPENDIX A: SUMMARY OF FUNCTIONS AND FEATURES

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A. Prescribed Risk Controls

Risk Check	Remark	Risk Limit Migration Arrangement after Rollout
Maximum Intraday Exposure Limits	• Existing functions to be retained	• EP's current limit settings will be migrated to the new version
Maximum Order Rate Limit		
Maximum Order Size Limits	• Existing function to be retained	• EP's current limit settings will be migrated to the new version
Maximum Combo Size Limits	• New functions	• EPs have to add relevant Combo Tradables for the settings after the rollout
Maximum Block Trade Size Limits	• New functions	• Maximum Block Trade Size Limits will be initially set at 9,223,337,203,685,477
Execution Throttle Limits	• New functions	• Initial limits will be set at 9,223,337,203,685,477
Intraday Position Limits		

B. Emergency Buttons

Emergency Button	Remark
Stop Button	• Existing functions to be retained
Unstop Button	
Mass Cancellation Button	
Kill Switch	

C. Other Functions

Function	Remarks
Order Exposure Reference Counter	• New functions for EP's reference
Active User Reference Counter	

APPENDIX B: FORMULAS FOR INTRADAY POSITION LIMITS COUNTERS

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Intraday Position Limits Counters	Formula
Open Buy	The current number of open contracts on the buy side (Exclude Block Trade)
Open Sell	The current number of open contracts on the sell side (Exclude Block Trade)
Traded Bought	The current number of traded contracts on the buy side (Exclude Block Trade)
Traded Sold	The current number of traded contracts on the sell side (Exclude Block Trade)
Total Buy	Open Buy + Traded Bought (Exclude Block Trade)
Total Sell	Open Sell + Traded Sold (Exclude Block Trade)
Traded Net	Absolute value of (Traded Bought – Traded Sold)
Total Net Buy	Open Buy + Traded Bought – Traded Sold (Exclude Block Trade)
Total Net Sell	Open Sell + Traded Sold – Traded Bought (Exclude Block Trade)
Block Trade Bought	The current number of traded block trade contracts on the buy side
Block Trade Sold	The current number of traded block trade contracts on the sell side