Testing & Management of Algorithms and Controls

Overview of Relevant Regulations

FIX TRADING COMMUNITY™
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Regulatory Background References for EU/UK Pertaining to Algorithmic Trading

With focus on Testing of Algorithms for Contribution to Disorderly Trading Conditions, Stress Testing & Operational Resilience

May 2026

Version 2

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1 Abstract

This document describes the regulatory requirements for testing algorithmic trading systems to ensure market stability and operational resilience. These emphasise the use of dynamic testing environments and stress tests to prevent disorderly trading conditions and support business continuity.

- **Dynamic testing environments:** Testing should simulate real market conditions with multiple algorithms interacting in shared order books, reflecting realistic price movements and order behaviours. This approach allows comprehensive scenario coverage and adaptability to system features.
- **Regulatory methodology requirements:** Firms must establish clear methodologies for developing and testing algorithms, adapting tests to the specific trading venues and updating them after significant system changes. Testing must be conducted in environments separate from production, with firms retaining full responsibility.
- **Disorderly Trading Prevention:** Firms must explicitly test their algorithms to avoid creating or contributing to disorderly trading scenarios in combination with other trading activity (including other algorithms whether their own or others). This testing must be certified by members to venues on every significant update of a trading algorithm or algorithmic trading system.
- **Stress testing** Annual self-assessments should verify that algorithms and controls withstand increased order flows and market stresses, including high messaging volumes and stressed market conditions.
- **Operational resilience and shutdown protocols:** Algorithms must be capable of shutdown according to business continuity plans without causing market disruption. Regulatory frameworks such as MiFID II, MAR, and PS21/3 guide impact tolerance definitions and testing standards to ensure orderly market function.

This document also includes a summary of key points relating to the testing, certification and governance, including implications of AI, from ESMA's **Supervisory Briefing on Algorithmic Trading in the EU** published in February 2026 and AFM's study **AI in Capital Markets: Balancing Innovation and Integrity** published in April 2026.

2 Review of Regulatory Requirements

There are varying regulatory requirements in different jurisdictions globally regarding the use and testing of algorithms. These concern protecting market integrity, avoiding creating or contributing to market disorder and not engaging in algorithmic market manipulation whether deliberate, reckless or accidental.

2.1 Testing for Contribution to Disorderly Trading Conditions

MiFID II introduced a new testing requirement to ensure that algorithms do not contribute to market disorder. The European regulators have not defined what they mean by disorderly trading conditions, and they have said that they are not going to specify the tests that investment firms should perform on their algorithms. Here we report the relevant clauses from MiFID ii RTS 6 and RTS 7. Furthermore, in the absence of clear direction from ESMA, we quote the FCA's guidance on good practice in conducting tests of this kind. FIX are developing draft business practices documents to offer guidance on suitable tests to accompany Extension Packs 292 and 295 which support contribution to market disorder test messaging and certification for algorithmic trading firms, venues and users.

The EU Market Abuse Regulation (MAR)[1] contains generic definitions of market manipulation (in Article 12) and non-exhaustive indicators of manipulative behaviour which are related to unfair and disorderly markets. These are catalogued below. It is worth noting that under MAR naïve, reckless and abusive algorithms are equally guilty and even those where orders never reached the market because they were stopped by another system can be guilty of attempted market manipulation and subject to the same penalties. The penalties as set out in MAR under article 30 are those for algorithmic market manipulation (articles 15 and 12) including up to 15% of a firm's entire turnover, up to 5M on individuals involved and industry bans. Testing for contribution to market disorder on every significant algorithm change (as is required by MiFID ii) can prove very effective at remediating this risk of large financial penalty.

2.1.1 MiFIR Level 2 Requirements

The relevant passages from RTS 6 concerning disorderly market testing are below:

Article 5 - General Methodology

1. Prior to the deployment or substantial update of an algorithmic trading system, trading algorithm or algorithmic trading strategy, an investment firm shall establish clearly delineated methodologies to develop and test such systems, algorithms or strategies.

4. The methodologies referred to in paragraph 1 shall ensure that the algorithmic trading system, trading algorithm or algorithmic trading strategy:

d) does not contribute to disorderly trading conditions…

5. An investment firm shall adapt its testing methodologies to the trading venues and markets where the trading algorithm will be deployed. An investment firm shall undertake further testing if there are substantial changes to the algorithmic trading system or to the access to the trading venue in which the algorithmic trading system, trading algorithm or algorithmic trading strategy are to be used.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02014R0596-20210101

Article 7 - Testing Environments

1. *An investment firm shall ensure that testing of compliance with the criteria laid down in Article 5(4)(a), (b) and (d) is undertaken in an environment that is separated from its production environment and that is used specifically for the testing and development of algorithmic trading systems and trading algorithms…*
2. *An investment firm may comply with the testing requirements referred to in paragraph 1 by using its own testing environment or a testing environment provided by a trading venue, a DEA provider or a vendor.*
3. *An investment firm shall retain full responsibility for the testing of its algorithmic trading systems, trading algorithms or algorithmic trading strategies and for making any required changes to them.*

Article 14 - Shutdown

3. An investment firm shall ensure that its trading algorithm or trading system can be shut down in accordance with its business continuity arrangements without creating disorderly trading conditions.

RTS 7 is intended to apply to execution venues, but it does imply one further key obligation on investment firms:

Article 10 - Testing the members' algorithms to avoid disorderly trading conditions

Trading venues shall require their members to certify that the algorithms they deploy have been tested to avoid contributing to or creating disorderly trading conditions prior to the deployment or substantial update of a trading algorithm or trading strategy and explain the means used for that testing.

2.1.2 ESMA Report on Algorithmic Trading

Further insight is offered from ESMA in their 28th September 2021 MiFID II/MiFIR review report on Algorithmic Trading[2]:

187. In view of the feedback on the definition, ESMA notes that the mere reference to "disorderly trading conditions" seemed to have provided adequate indications to investment firms on how to conduct testing. Furthermore, ***a further elaboration of the definition may fail to cover all specific risks that may derive from different algorithmic trading systems, especially considering their constant development.*** *Thus, ESMA would abstain from further prescribing a definition for "disorderly trading conditions".*

188. ESMA considers that the best way forward for including all the possible scenarios and ***granting flexibility to adapt testing to the specific feature of systems****, would be to maintain the current reference to "disorderly trading conditions" as it is.*

[2] https://www.esma.europa.eu/sites/default/files/library/esma70-156-4572_mifid_ii_final_report_on_algorithmic_trading.pdf

These make it clear that regulators are not going to provide an exhaustive list of disorderly trading conditions and that they expect firms who use algorithmic trading to focus on the most pertinent disorderly scenarios.

Some key characteristics of Dynamic Testing Environments (as applied to CLOBs - analogous functionality applies to other execution methods)

- The environment allows interaction between multiple algorithms
- Orders from multiple algorithms, including the algorithm under test, rest in the same order books
- Price movement occurs, as in the live markets, as a result of levels being penetrated by aggressive orders and passive orders being removed from the top of the order book.
- Capable of realistic emulation of live markets

FIX is drafting a document which will suggest a number of tests that may be helpful for determining whether an algorithm can, under certain conditions, contribute to market disorder. For each test, the algorithm can be passed or failed according to its disposition to contribute to disorderly trading conditions.

To pass/fail an algorithm it is recommended that thresholds be put on the algorithm's underlying activity (e.g. liquidity consumption, order cancellation, messaging rate, etc.). These types of measure can produce repeatable pass/fail results and target directly the algorithms' behaviour.

It is not recommended that algorithms be passed/failed on the basis of the price movement they cause. There are two principal reasons for this: first, it is not in general possible, in a market environment with many thousands of participants, to determine the contribution of each participant to the price movement; secondly, price impact is a highly variable consequence of algorithmic activity – the same orders can have very different impact on near-identical order books or even on the same order book with slightly different timing. This type of measure often produces non-repeatable results.

2.1.3 FCA Guidance

The FCA has clarified what it takes to be good and poor practice in relation to the use of testing environments by investment firms for ensuring that algorithms do not damage market integrity. In its guidelines on Algorithmic Trading Compliance in Wholesale Markets[3], Clause 6.12 states:

6.12 In considering the potential impact on market integrity, firms should also consider how they can examine market conduct considerations within their testing process.

Good practice

Firms who develop (or use third party) dynamic testing environments, that not only consider how their algorithmic trading strategies perform in a period of market disruption, but also assess whether their strategy further contributes (in combination with other trading activity) to market disruption.

[3] https://www.fca.org.uk/publication/multi-firm-reviews/algorithmic-trading-compliance-wholesale-markets.pdf, Feb 2018

Poor practice

Firms who conduct basic testing of their algorithmic trading strategies which only assess operational efficiency and focus on considerations such as their performance against certain benchmarks or the profit and loss of the strategy. In these cases, firms are unable to demonstrate the potential impact of their algorithmic trading strategies on market integrity.

Additionally, in the same document, the FCA says the following:

1.9 … Firms also need to consider the potential impact their algorithmic trading activity (including the combined impact of multiple algorithmic strategies) may have on the fair and effective operation of financial markets.

This is a requirement that can best be met in dynamic testing.

2.1.4 FCA Review of Algorithmic Trading Controls

With regard to UK regulated firms: On 21st August 2025 the FCA published "Multi-firm review of algorithmic trading controls: high-level observations"[4] aimed at all firms that develop and/or use algorithmic trading strategies. With respect to testing of algorithms this included the following:

Firms must maintain testing processes to identify potential issues before deployment and make sure the algorithm behaves as intended, does not contribute to disorderly trading and behaves effectively under stressed market conditions.

Many firms take a holistic approach to preventing disorderly trading behaviour of their algorithms. A key element is testing algorithms in a simulated testing environment. Along with risk controls and continuous monitoring, it is often an important way firms make sure their algorithms do not contribute to disorderly trading conditions.

Simulation testing carried out by some firms lacked sophistication or did not appear to consider a wide range of market scenarios. Similarly, some firms lacked formally documented testing policies and procedures, even though testing was taking place. Many firms had strong pre-trade and post-trade controls in place on their algorithms. However, it is important that firms ensure that algorithms are tested appropriately before deployment, to make sure they do not contribute to disorderly trading conditions and continue to work effectively in stressed market conditions.

In some firms, there was a focus on operational effectiveness, and conduct risks were more thoroughly considered during post-trade surveillance, rather than during testing. All firms should continue to review their testing techniques and ensure that conduct risks are considered throughout the development and testing process. It is also essential that firms' testing capabilities keep pace with the ever-increasing speed and complexity of their own algorithms, financial markets and technological advancements including cross-asset testing, where relevant.

[4] https://www.fca.org.uk/publications/multi-firm-reviews/algorithmic-trading-controls-high-level-observations

2.2 Stress Testing of Algorithms

The relevant passages from RTS 6 concerning stress testing of algorithms are below:

Article 5 - General Methodology

1. Prior to the deployment or substantial update of an algorithmic trading system, trading algorithm or algorithmic trading strategy, an investment firm shall establish clearly delineated methodologies to develop and test such systems, algorithms or strategies.

4. The methodologies referred to in paragraph 1 shall ensure that the algorithmic trading system, trading algorithm or algorithmic trading strategy:

> *d) … continues to work effectively in stressed market conditions…*

Article 10 - Stress Testing

As part of its annual self-assessment referred to in Article 9, an investment firm shall test that its algorithmic trading systems and the procedures and controls referred to in Articles 12 to 18 can withstand increased order flows or market stresses. The investment firm shall design such tests, having regard to the nature of its trading activity and its trading systems. The investment firm shall ensure that the tests are carried out in such a way that they do not affect the production environment. Those tests shall comprise:

(a) running high messaging volume tests using the highest number of messages received and sent by the investment firm during the previous six months, multiplied by two;

(b) running high trade volume tests, using the highest volume of trading reached by the investment firm during the previous six months, multiplied by two

2.3 MAR Considerations

EU MAR article 12

*The **placing of orders to a trading venue, including any cancellation or modification thereof**, by any available means of trading, including by electronic means, such as algorithmic and high-frequency trading strategies, and **which has one of the effects** referred to in paragraph 1(a) or (b), by:*

> *i) **disrupting or delaying the functioning of the trading system** of the trading venue or being likely to do so;*
>
> *ii) **making it more difficult for other persons to identify genuine orders on the trading system** of the trading venue or being likely to do so, including by entering orders which result in the overloading or destabilisation of the order book; or*
>
> *iii) **creating or being likely to create a false or misleading signal about the supply of, or demand for, or price** of, a financial instrument, in particular by entering orders to initiate or exacerbate a trend;"*

EU MAR annex 1

For the purposes of applying point (a) of Article 12(1) of this Regulation, and without prejudice to the forms of behaviour set out in paragraph 2 of that Article, the following non-exhaustive indicators, which shall not necessarily be deemed, in themselves, to constitute market

*manipulation, **shall be taken into account when transactions or orders to trade are examined by market participants and competent authorities**:*

*a) the extent to which orders to trade given or transactions undertaken **represent a significant proportion of the daily volume** of transactions in the relevant financial instrument, related spot commodity contract, or auctioned product based on emission allowances, **in particular when those activities lead to a significant change in their prices**;*

*b) the extent to which orders to trade given or transactions undertaken by **persons with a significant buying or selling position in a financial instrument**, a related spot commodity contract, or an auctioned product based on emission allowances, lead to significant changes in the price of that financial instrument, related spot commodity contract, or auctioned product based on emission allowances;*

*c) whether transactions undertaken lead to **no change in beneficial ownership** of a financial instrument, a related spot commodity contract, or an auctioned product based on emission allowances;*

*d) the extent to which orders to trade given or transactions undertaken or orders cancelled include **position reversals in a short period** and represent a significant proportion of the daily volume of transactions in the relevant financial instrument, a related spot commodity contract, or an auctioned product based on emission allowances, and might be associated with significant changes in the price of a financial instrument, a related spot commodity contract, or an auctioned product based on emission allowances;*

*e) the extent to which orders to trade given or transactions undertaken are **concentrated within a short time span in the trading session and lead to a price change which is subsequently reversed**;*

*f) the extent to which orders to trade given **change the representation** of the best bid or offer prices in a financial instrument, a related spot commodity contract, or an auctioned product based on emission allowances, or more generally the representation **of the order book** available to market participants, **and are removed before they are executed**; and*

*g) the extent to which orders to trade are given or transactions are **undertaken at or around a specific time when reference prices, settlement prices and valuations are calculated and lead to price changes which have an effect on such prices and valuations**.*

2.4 Operational Resilience Testing

Pursuant to PS 21/3, there is a joint paper by the Bank of England, PRA and FCA "Operational resilience: Impact tolerances for important business services March 2021"[5]

1.3) notes requirements and expectations for firms and FMIs to:

- *Identify their important business services by considering how disruption to the business services they provide can have impacts beyond their own commercial interests,*
- *Set a tolerance for disruption for each important business service (an impact tolerance); and*
- *Ensure they can continue to deliver their important business services and are able to remain within their impact tolerances during severe (or in the case of FMIs, extreme) but plausible scenarios.*

This is further clarified by the FCA definition of Important Business Service and Impact tolerance (which are different to the Bank of England/PRA versions specifically in the context of focusing on ***orderly operation of the financial markets***):

2.12) FCA definition of Important Business Service:

means a service provided by a firm, or by another person on behalf of the firm, to one or more clients of the firm which, if disrupted, could : (1) cause intolerable levels of harm to any one or more of the firm's clients; or (2) pose a risk to the soundness, stability or resilience of the UK financial system or the ***orderly operation*** *of the financial markets.*

3.19) FCA Definition of Impact Tolerance:

means the maximum tolerable level of disruption to an important business service, as measured by a length of time and in addition to any other relevant metrics, reflecting the point at which any further disruption to the important business service could cause intolerable harm to any one or more of the firm's clients or pose a risk to the soundness, stability, or resilience of the UK financial system or the ***orderly operation*** *of the financial markets.*

(note this was strengthened from *"pose an intolerable risk"* to *"pose a risk"*).

The FCA have also noted that *algo runaways* should be *explicitly* included in this Operational Resilience testing.

[5] https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/publication/2021/building-operational-resilience-impact-tolerances-for-important-business-services.pdf

With regard to timeline, all FCA firms must have fully complied with PS21/3 by 31 Mar 2025:

4.6) After Monday 31 March 2025, maintaining operational resilience will be a dynamic activity. By this point, firms and FMIs should have sound, effective, and comprehensive strategies, processes, and systems that enable them to address risks to their ability to remain within their impact tolerance for each important business service in the event of a severe but plausible disruption (or extreme disruption).

A Dynamic Testing System as already recommended as good practice for Contribution to Market Disorder Testing by the FCA is clearly an effective way to meet those requirements for operational resilience testing under PS21/3 involving orderly operation of the financial markets.

3 ESMA Supervisory Briefing on Algorithmic Trading in the EU

3.1 Introduction

On 26th February 2026 The European Securities and Markets Authority (ESMA), the EU's financial markets regulator and supervisor, published a supervisory briefing to support consistent supervision of algorithmic trading across the EU.

The briefing provides National Competent Authorities (NCAs) with practical tools and clarified expectations for supervising firms engaged in algorithmic trading under MiFID II. It focuses on key areas where supervisory practices have diverged, including pre-trade controls, governance arrangements, testing frameworks and outsourcing of algorithmic trading systems.

Given the extended use of artificial intelligence in algorithmic trading, the briefing also touches upon these emerging technological developments, outlining considerations for the use of AI. This section aims to help supervisors assess new risks and ensure that firms adopt robust and responsible approaches when deploying advanced technologies in their trading operations.

Key issues relevant to algorithm testing, certification and governance are summarized in the following sections:

3.2 Algorithmic Trading – Concepts & Definitions

3.2.1 Algorithmic Trading

(Paragraph 8) Algorithmic trading is defined in Article 4(1)(39) of MiFID II as trading in financial instruments where a computer algorithm automatically determines individual parameters of orders. Any trading in which a computer algorithm is involved determining any aspect other than merely the routing of an order to an execution venue or post-trade processing of transactions can be considered algorithmic trading. ***Even if a human would intervene in the trading process, the involvement of a computer algorithm determining any individual parameter of the order for other purposes than order routing or post-trade processing, would make this type of trading algorithmic trading.***

ESMA then notes (in paragraph 11) that algorithmic trading can include activities beyond "basic order processing" and provide further guidance in the form of a list comprising order generation logic, execution strategy selection, market condition analysis, portfolio rebalancing, risk management adjustments, liquidity detection/response and cross-asset/venue optimisation.

They follow this with comments on the role of humans and where 'human intervention' still results in trading being considered algorithmic:

(Paragraph 13) The definition of algorithmic trading in MiFID II requires "[…] limited or no human intervention […]". ESMA notes that many firms engaging in trading using computer algorithms rely on human intervention to control the trading process and risks involved. For example, a trader may be required to authorise single or multiple orders prior to submission to execution venues. ***Some firms may therefore argue they do not engage in algorithmic trading because the order would not be submitted without human intervention. However, such intervention does not negate the fact that a computer algorithm has determined individual parameters of the order(s).***

3.2.2 Algorithm

ESMA notes that without a clear definition of a specific algorithm, firms may under-report their systems and neglect necessary controls, testing, and documentation with the potential to lead to inconsistency in supervision and compliance, especially when using third-party algorithmic trading systems.

*(Paragraph 19) …**an algorithm should be understood as a computerised set of instructions or rules that autonomously determines one or more parameters of a trading order.***

*(Paragraph 20) **An algorithm is context-specific and may be tied to particular instrument(s), asset class(es), trading venue(s), or strategy(ies)**. Examples of parameters are timing, price or quantity. According to MiFID II and RTS 6/7 framework provisions, the algorithms must be testable and controllable. These practical boundaries make it possible to subject algorithms to supervisory scrutiny to ensure compliance with regulatory obligations and to safeguard market integrity*

3.2.3 Algorithmic Trading Strategy

ESMA notes the requirement for a clear, shared definition of what constitutes an algorithmic trading strategy. Any ambiguity poses challenges for both firms and supervisors, resulting in either excessively broad or unduly fragmented classifications of strategies, undermining the comparability of strategies and the effectiveness of supervision (e.g., the inability to associate specific trading behaviours, including disorderly or abusive conduct, with particular strategies). To mitigate this, they define an algorithmic trading strategy as follows:

(Paragraph 24) An algorithmic trading strategy is a set of decision logic, implemented through one or more algorithms, that autonomously pursues a defined trading objective. Trading objectives such as market making, arbitrage, or execution optimisation may be specific to market conditions, instruments, or venues. An algorithmic trading strategy must result in observable trading behaviour. Each strategy must be testable, distinguishable, and subject to supervisory scrutiny to ensure compliance and market integrity.

3.2.4 Testing of Algorithms

This section starts with a recap of the rules laid out in RTS 6 (Articles 5,6,7 and 10):

*(Paragraph 25) Firms engaged in algorithmic trading must ensure that their algorithm(s), algorithmic trading system(s) or algorithmic trading strategy(/ies) are tested **to avoid contributing to disorderly markets or facilitating abusive practices.** RTS 6 (and 7) require investment firms to conduct conformance testing, stress testing, and scenario analysis.*

ESMA then comments on the need for proportionality in testing (Paragraph 26) and the requirement for clear algorithm identification (Paragraph 27). They then cover documentation…

(Paragraph 29) Investment firms need to ensure that testing methodologies, procedures and internal authorisations to deploy algorithmic trading are well documented. Supervisors need to be able to assess compliance with the testing requirements based on this documentation. Investment firms should thus keep the documentation comprehensive and updated.

…and guidance on **material/significant changes**:

*(Paragraph 30) Testing of an algorithm, algorithmic trading system or algorithmic trading strategy is required following each 'material change' or 'substantial update' thereof. **In this regard, firms should manage the risk that a series of minor or small changes due to recalibrations could accumulate over time, when uncontrolled or unchecked, into a***

material change in the model output without it being tested. *A clarification of this terminology will enhance supervisory convergence.*

(Paragraph 31) ***A material change or substantial update is any modification that may alter the behaviour, risk profile, or compliance posture of an algorithm, algorithmic trading system or algorithmic trading strategy. Investment firms are required to timestamp, approve, and record all material changes.*** *Good practice would be to consider retesting when changes would occur to the following non-exhaustive list of aspects:*

- *Logic/Decision Rules: e.g., Altering how the algorithm determines price, timing, or quantity*
- *Execution Behaviour: e.g., Modifying order types, slicing logic, or routing mechanisms*
- *Scope: e.g., Deploying the algorithm in new instruments, venues, or asset classes*
- *Risk Controls: e.g., Changing thresholds, kill switch logic, or alert triggers*
- *External Dependencies: e.g., Replacing third-party providers or data feeds, changes to the trading systems, or changes in access arrangements.*
- *Adaptive Capabilities: e.g., Retraining or modifying machine learning components*

3.2.5 Stress Testing:

ESMA recaps the RTS 6 stress testing requirements (systems to be able to process double the volume of messages/trades from the previous 6 months) while noting this alone may be insufficient for more complex workflows:

(Paragraph 32) …While stress testing the volume of messages is relatively straight forward, ESMA recognises that stress testing of trading (i.e. the full cycle of order generation to post trade processing) is more complex. Therefore, investment firms should test their systems to evidence a reasonable level of assurance that their systems can process twice the volume of the highest volume of trading reached by the investment firm during the previous 6 months.

3.2.6 Responsibility for compliance with Algorithmic Trading Requirements in case of outsourcing, use of third-party algorithms or in a chain of entities

(Paragraph 33) In the context of algorithmic trading, it is important to distinguish between the various configurations in which algorithms are operated or provided by third parties and how the allocation of responsibility for compliance with MiFID II and RTS 6 is determined.

This is clarified further by stating:

- The investment firm remains *"fully and solely responsible for compliance with MiFID II and RTS 6"* where using third party algorithms, and that *"Outsourcing or reliance on external technology providers will not alter the firm's regulatory obligations." (Paragraph 34 and 35)*
- The investment firm has an obligation to maintain *"adequate understanding, oversight, and control over the design, testing, and operation of the algorithms it uses, and that the contractual arrangements in place provide sufficient access to information and confidence to demonstrate compliance to the competent authority." (Paragraph 35)*
- In a chain of entities where one firm creates orders and another executes them using an algorithm, *"the entity executing the orders is deemed to be engaging in algorithmic trading for the purposes of MiFID II and thus bears responsibility for ensuring RTS 6 compliance." (Paragraph 36)*. There are further examples of two firms in a chain (Paragraph 37), both using algorithms (both are covered by the regulations) and where one of them is not a MiFID investment firm (where the other assumes responsibility for both)

Paragraphs 37, 41 and 42 also describe the need for contractual arrangements/SLAs or outsourcing arrangements (as appropriate) to define the allocation of responsibilities for RTS 6 adherence.

3.2.7 Responsibility for compliance with Algorithmic Trading Requirements in case of Direct Electronic Access (DEA)

Paragraphs 38 to 40 describe the RTS 6 requirements for DEA providers and reinforces the requirement for DEA providers to ensure its clients comply with the requirements of RTS 6, even where those clients are not directly covered by RTS 6 (e.g., where they are not MIFID investment firms).

3.2.8 The EU AI Act and its interaction with algorithmic trading

Paragraphs 43 to 45 recap key elements of the AI act, specifically noting in paragraph 43 that *"When an algorithmic trading system meets the definition of an AI system it will need to comply with the requirements in the AI Act.",* linking the need to integrate AI Act requirements into firms' system monitoring and governance frameworks. Paragraph 46 positions algorithmic trading within the AI Act's risk framework, noting that *"While AI-based algorithmic trading is currently excluded from the scope as a high-risk use case under the AI Act, the scope of high-risk use cases is subject to annual review. Nevertheless, AI used in algorithmic trading may still constitute a limited risk use case depending on whether it is 'intended to interact directly with natural persons".*

ESMA then explores the implications of integrating AI into algorithmic trading workflows:

(Paragraph 47) The integration of AI has transformed algorithmic trading due to its ability to analyse vast amounts of data, identify complex patterns, and make autonomous decisions on the fly. In this regard, firms should manage the risk that a series of minor or small changes due to recalibrations could accumulate over time, when uncontrolled or unchecked, into a material change in the model output without it being tested.

This is an extremely important point as material changes can be introduced without changing the software or hardware. Recalibration, retraining and changes in data may be sufficient to trigger a material change, particularly if they mount up over time.

ESMA then covers two specific areas of RTS 6 pertaining to the use and control of AI in algorithmic trading:

- The article 9 annual assessment and validation process (Paragraph 49)
- The article 2 requirements for compliance understanding (Paragraph 50): *"on the one hand, the algorithmic trading systems and algorithms should be explainable and on the other hand, it is the investment firm's responsibility to ensure they can adequately explain how AI impacts their algorithms' decision-making."*

3.3 Pre-Trade Controls (PTCs)

ESMA then develops considerable detail on PTCs (paragraphs 54 to 99) including their expectations in regard to calibration and testing and monitoring of PTCs. Here we just draw attention to a few of the key contribution to market disorder testing issues and supporting information to maintain the focus of this paper.

3.3.1 Scope

Paragraph 58 states that *"Quotes, representing a binding commitment to buy and sell a financial instrument (Annex I, Table 1 of RTS 1), should also be subject to PTCs, as they are executable once sent to the market and can therefore entail risks as any other type of executable order. If quotes are generated through quotation algorithms the PTCs may be implemented automatically in the code of those algorithms."*

Paragraph 60 states that investment firms *"are expected to implement all the PTCs mandated in Article 15 of RTS 6, which include: i) price collars; ii) maximum order values; iii) maximum order volumes; iv) maximum message limits; and v) repeated automated execution throttles. Those should be established for each financial instrument on which algorithmic trading activity is undertaken"*

Paragraph 63 notes that the investment firm is responsible for setting up, calibrating and testing PTCs regardless of outsourcing.

Paragraph 66 states that regardless of outsourcing *"the IF should ensure that there is a designated internal function which contributes to the setting of PTCs from a risk management perspective, ensuring those are calibrated properly. Lacking such internal function ESMA is of the view that the IF would not be compliant"*

Paragraph 69 notes that *"DEA clients that engage in algo trading face an obligation to set PTCs. However, any client-level controls do not relieve DEA providers of their obligations as they must independently comply with the requirements set out in Article 20 of RTS 6, regardless of the controls put in place by their clients."*

3.3.2 Calibration, Testing & Revision

Paragraph 83 states *"The purpose of PTCs is to prevent: i) sending erroneous orders, and ii) the malfunctioning of an IF's system which could trigger disorderly markets conditions. For PTCs to be effective it is necessary for the parameters underpinning PTCs to be well calibrated. IFs are expected to set the methodology for the calibration of PTCs and document their rationale, using quantitative data"*

Paragraph 85 notes that *"certain market participants are using more advanced AI-related technology in the generation and formulation of trading signals in accordance with which the traditional algorithmic trading technology then acts to impact on-market in the form of orders, cancellations and executions, often directly with no human intervention. This technology can include reinforcement learning, deep learning, neural-networks, and GenAI. IFs should consider risks posed by trading signals generated by more advanced AI-related technology when designing PTCs."*

Paragraph 88 describes when testing of PTCs should take place, specifically:
at the time of design and calibration of PTCs and before they are deployed:

- *following any major change in the algorithm governing PTCs, when those are embedded in an algorithm,*
- *following any risk event which may indicate that PTCs may not be operating as designed or*
- *after a major change in market conditions which could render PTCs not effective.*

Paragraph 89 notes that in testing of PTCs *"It is considered a good practice for IFs to i) test PTCs following each recalibration and before their deployment and ii) monitor the effectiveness of recalibrated PTCs after their deployment".*

4 AFM Exploratory Study: AI in Capital Markets: Balancing Innovation and Integrity

AFM published this document on 13th April 2026. The study presents how AI is reshaping every stage of the trading lifecycle: pre-trade, execution, and post-trade, bringing opportunities for insight and efficiency. At the same time, it amplifies existing market integrity risks while creating new ones. Recognising that further research is needed in this fast-moving domain, market functioning will rely even more on the design of AI models, their interactions, and the context in which they operate. The findings of the study aim at opening and guiding future debate.

The key points made in the context of algo testing are captured in the following section:

Implication 3: Stress-test AI models for synchronicity

The synchronized actions of AI models that are optimised for the same microstructure signals 3might reinforce one another. When multiple participants use similar models, AI-driven responses may further intensify volatility by reacting in the same way to distress signals, especially in concentrated markets, thereby increasing the likelihood and the magnitude of market-wide dislocation. Assuming the procyclicality just described, ***it will become increasingly important to carefully test models under different scenarios (as per MiFID II RTS 6 provision), making sure they do not contribute to disorderly trading conditions****, as the potential market outcomes might become more extreme than before the widespread use of AI models. From a supervisory perspective, it is advisable to shift the attention beyond individual algorithmic strategies to the interactions between models and the conditions that produce feedback loops. From a structural perspective, addressing these vulnerabilities will require coordinated action with other authorities, including competition bodies, cybersecurity agencies, and European or international standard setters, alongside the AFM.*

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