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January 28, 2016

<u>**VIA E-MAIL**</u>

Brent J. Fields
Secretary
Securities and Exchange Commission
100 F Street, N.E.
Washington, DC 20549-1090

Re: **Securities Exchange Act Release No. 34-76613 (December 10, 2015), 80 FR
        78262 (December 16, 2015) (SR-NYSEMKT-2015-89) (the "Proposal")**

Dear Mr. Fields:

NYSE MKT LLC ("NYSE MKT" or the "Exchange") appreciates the opportunity to respond to
the comment letter submitted by Kermit Kubitz in connection with the Exchange's proposal to
amend its rules to provide that the co-location services offered by the Exchange include three
time feeds and to amend the NYSE MKT Equities Price List and the NYSE Amex Options Fee
Schedule to reflect the proposed changes.[1] For the reasons set forth in this response, the
Exchange believes that Mr. Kubitz' arguments do not present the Securities and Exchange
Commission ("Commission") staff with any reasons not to find that the Proposal is consistent
with Section 6(b) of the Securities Exchange Act of 1934, as amended (the "Act"), in general,
and furthers the objectives of 6(b)(5) of the Act, in particular.[2]

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[1]   <u>See</u> Letter from Kermit Kubitz, dated January 6, 2016. The Exchange also proposed to
        amend the Exchange's rule to provide that co-location services include four bundles of
        co-location services, called the "Partial Cabinet Solution" bundles. Mr. Kubitz did not
        comment on that aspect of the Proposal. The Exchange's affiliates New York Stock
        Exchange LLC and NYSE Arca, Inc. submitted the same proposed rule change. <u>See</u>
        Securities Exchange Act Release Nos. 76612 (December 10, 2015), 80 FR 78269
        (December 16, 2015) (SR-NYSE-2015-53) and 76616 (December 10, 2015), 80 FR
        78275 (December 16, 2015) (SR-NYSEArca-2015-102).

[2]   15 U.S.C. 78f(b)(5).

Summary of the Time Feed Proposal

The proposed rule change would provide that Users[3] may purchase access to three time feeds, each of which provides a feed with the current time of day using one of three different time protocols: GPS Time Source, the Network Time Protocol feed ("NTP"), and Precision Timing Protocol ("PTP").[4]

Global Positioning System ("GPS") is a time and location system maintained by the United States government. The Exchange accesses the GPS Time Source feed through dedicated equipment and subscribing Users connect to the feed over dedicated cables. For the NTP and PTP time feeds, the Exchange routes the GPS data through dedicated equipment that reformats the GPS data into NTP and PTP.[5] Subscribing Users connect to PTP over dedicated cables and NTP over the Liquidity Center Network ("LCN"), a local area network available in the data center.

The Exchange's co-location services allow a User to request a physical cabinet to house its servers and other equipment in the data center. A User has the option of receiving an entire cabinet that is dedicated solely to that User ("dedicated cabinet") or a partial cabinet available in increments of eight-rack units of space ("partial cabinet").[6] Connectivity to all three time protocols would be available for dedicated cabinets. Due to technical limitations, connectivity to the NTP and PTP would be available for partial cabinets, but connectivity to GPS would not. The Exchange does not propose to make connectivity to GPS available for partial cabinets because the proximity of the GPS and power connections into a partial cabinet would expose GPS to interference from the cable power connections, interfering with the delivery of the GPS data.

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[3] For purposes of the Exchange's co-location services, a "User" means any market participant that requests to receive co-location services directly from the Exchange. See Securities Exchange Act Release No. 76009 (September 29, 2015), 80 FR 60213 (October 5, 2015) (SR-NYSEMKT-2015-67). The Exchange operates a data center in Mahwah, New Jersey (the "data center") from which it provides co-location services to Users.

[4] The time feeds are unrelated to trading on the Exchange or the Exchange's data feeds. Time feeds are used to receive time and to synchronize clocks between computer systems or throughout a computer network. A User may opt to connect to a time feed for various reasons, including record keeping or measuring response times.

[5] The reformatting equipment is programmed by the vendor to generate NTP and PTP time feeds that comply with industry standards. The Exchange does not program or manage the reformatting of the GPS data into NTP and PTP.

[6] See Securities Exchange Act Release Nos. 62961 (September 21, 2010), 75 FR 59299 (September 27, 2010) (SR-NYSEAmex-2010-80), and 71131 (December 18, 2013), 78 FR 77750 (December 24, 2013) (SR-NYSEMKT-2013-103).

Response to Comment Letter

Mr. Kubitz raises various points in his comment letter related to the potential for GPS "spoofing," *i.e.* a third party interfering with a GPS satellite feed from a distance. We address each in turn.

First, Mr. Kubitz states that it is "not clear" whether the Users of partial cabinets who do not have access to the GPS time feed "have any special vulnerability to some sort of feed failure." He notes that "[i]f there are any potential vulnerabilities resulting from partial time feed access, the Exchange . . . should identify and mitigate or have plans to mitigate any resulting market risk or unfairness."[7]

To the best of the Exchange's knowledge, Users that connect to the NTP or PTP, rather than the GPS Time Source, do not have a special vulnerability to feed failure, irrespective of whether they utilize a partial or dedicated cabinet. GPS is the source information for all three time feeds. For NTP and PTP, the Exchange routes the GPS data through dedicated equipment that reformats the GPS data to propagate the NTP and PTP. If the GPS feed were compromised by spoofing, the NTP and PTP would be compromised to the same extent. The Exchange is not aware of any method by which the NTP and PTP could be "spoofed" if the GPS feed is not compromised. Accordingly, the Exchange believes that providing connectivity to the GPS Time Source for dedicated cabinets, but not for partial cabinets, is not designed to permit unfair discrimination between customers, issuers, brokers, or dealers.

Second, Mr. Kubitz, quoting testimony of Dr. Todd Humphreys before the House Subcommittee on Homeland Security, notes the importance of the GPS feed to trading:

> An unassuming set of antennas on the roof of these data centers carry unsecured civil GPS signals directly into the core of the matching engine network. Slaved to a once-per-second synchronization pulse from a GPS-disciplined clock, the individual servers in the network apply time stamps to the trades they execute.[8]

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[7] See Letter from Kermit Kubitz, dated January 6, 2016. The Exchange believes that the reference to "partial time feed access" refers to time feed access by a User with a partial cabinet, i.e. a User that does not have connectivity to GPS.

[8] Id. See also "Statement on the Vulnerability of Civil Unmanned Aerial Vehicles and Other Systems to Civil GPS Spoofing," by Dr. Todd E. Humphreys, The University of Texas at Austin, Submitted to the Subcommittee on Oversight, Investigations and Management of the House Committee on Homeland Security (July 18, 2012), at https://homeland.house.gov/files/Testimony-Humphreys.pdf (the "Humphreys Submission").

Mr. Kubitz continues, however, by noting that "this is not news to the major stock exchanges. Todd [Humphreys] talks about how he met with senior executives from some exchanges and feels that they have taken precautions against GPS spoofing." In fact, a review of his submission to the House Subcommittee shows that Dr. Humphreys actually uses the Exchange's affiliate the New York Stock Exchange as an example of the major exchanges' precautions.[9]

Taken together, the statements from Mr. Kubitz and the testimony that he cites would suggest that Mr. Kubitz' concern is whether Users that purchase access to the GPS, NTP and PTP time feeds are at a greater risk of GPS spoofing than the Exchange itself, given that the Exchange has precautions in place. The Exchange believes that such Users do not face greater risk, because a User that purchases access to the GPS, NTP or PTP time feeds provided by the Exchange benefits from the same precautions as the Exchange's production environment. The Exchange uses the same GPS time feed equipment, including antennas and receivers, for its production environment and to provide time feeds to Users. The Exchange therefore believes that its proposal would remove impediments to, and perfect the mechanisms of, a free and open market and a national market system and, in general, protect investors and the public interest.

Third, Mr. Kubitz, again quoting Dr. Humphreys, argues that co-located high frequency traders have not taken precautions against GPS spoofing and remain vulnerable to an attack:

> High frequency traders whose servers are co-located with the matching engines at major exchanges may be more vulnerable to GPS spoofing. In the NYSE and some other exchanges, these co-located customers are offered either a timing feed from the exchange's system time or a direct feed from GPS antennas on the roof. Many co-located customers, distrustful of the exchange's system time, opt for the direct GPS feed.[10]

It is not clear to the Exchange whether Mr. Kubitz' reference to a "direct GPS feed" is to connectivity to time feeds provided by the Exchange or by third parties. In either case, his argument does not call the Proposal into question.

More specifically, if we assume that Mr. Kubitz is referring to connectivity to time feeds provided by the Exchange, Mr. Kubitz' argument does not stand up to examination because, as noted above, the Exchange uses the same GPS time feed equipment for its production environment and to provide time feeds to Users. A User that purchases access to a time feed provided by the Exchange benefits from the same precautions as the Exchange's production environment. Accordingly, such User would not be more vulnerable to GPS spoofing simply because it used a time feed provided by the Exchange, and thus providing connectivity to time feeds is not designed to permit unfair discrimination between customers, issuers, brokers, or dealers.

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[9]   See Humphreys Submission, at 7.

[10]   See Letter from Kermit Kubitz, dated January 6, 2016.

If, instead, Mr. Kubitz means to reference GPS time feeds provided to Users by third parties, his statement is not relevant to the Exchange's Proposal, which only discusses connectivity to time feeds provided by the Exchange.[11] What measures third parties may or may not have in place regarding connectivity to GPS time feeds is not within the scope of the Proposal.

Mr. Kubitz continues by arguing that "if a GPS spoofing event were to corrupt data," co-located high-frequency traders "would run for the exit doors quickly."[12] The Exchange cannot speak to what decisions co-located high-frequency traders would make if a GPS spoofing event were to corrupt data, irrespective of whether the connectivity to the data were provided by the Exchange or third parties. However, it believes that, if correct, Mr. Kubitz' assertion would actually argue in favor of the Proposal since, as discussed, a User that purchases access to a time feed provided by the Exchange benefits from the same precautions as the Exchange's production environment.

Finally, Mr. Kubitz calls for a Commission investigation and report to the SEC Equity Market Structure Committee

> on any risks associated with provision or non-provision of time feeds, and likely impacts if there is a failure of these feeds. If substantial, up to 50% of market volumes, come from algorithmic of HFT trading, [sic] risks of systems dependent upon data feeds, including time feeds, should be identified and mitigated. Measures to prevent failure, hacking, or spoofing of all important data feeds, including time and GPS feeds should be provided by all exchanges providing such services as part of their market services, in order to insure that data failures do not cause market failures.

This suggestion, which encompasses all exchanges and all data feeds, is well beyond the scope of the Exchange's proposal to provide Users with connectivity to time feeds. Likewise, a report on what measures the Exchange and its affiliates New York Stock Exchange LLC and NYSE Arca, Inc. have in place to prevent failure, hacking or spoofing of all data feeds does not belong in a rule filing, as it would impair the effectiveness of those measures. The Exchange would be happy to participate in any Commission investigation on the risks discussed. However, it believes that such an investigation should be independent of, and not delay approval of, the current Proposal.

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[11] The Exchange notes that there are no third party GPS antennas on the data center roof.

[12] See Letter from Kermit Kubitz, dated January 6, 2016; see also Humphreys Submission, at 7.

The Exchange appreciates the opportunity to respond to Mr. Kubitz' comment letter and respectfully requests the Commission approve the Proposal.

Very truly yours,