Vion IMS QTof LC-HDMS^E QC System Suitability Test

Analytical Professional Services, Waters Corporation, Wilmslow, UK

BENEFITS

This document describes a SST (System Suitability Test). Routinely using this test will allow you to monitor system performance.

Critical parameters can be judged from comparison data like

- Solvent background level
- Stability of retention time
- Stability of CCS
- Mass accuracy

WATERS SOLUTIONS

Vion® IMS QTof™

UNIFI™

EUanalytical_support@waters.com

KEYWORDS

Vion IMS QToF, UNIFIi, System Suitability Test, LCMS-QC, IMS, HDMS^E

INTRODUCTION

This document is designed to help you test the complete LC-IMS-MS system prior to routine use. This test is designed so that stringent quality criteria (mass accuracy, collisional cross section [CCS] accuracy, RT stability, peak separation and solvent background) are assessed using a Waters certified standard solution (Vion Test Mix) in a 5 minutes run. This can help users to assess the status of their instrument as there is no Lockmass or calibration check in UNIFI for Vion. The method enables screening for 9 substances using the mass and CCS value as quality criteria. The method can also display and identify matched fragments, to further demonstrate the system's screening capabilities.

Waters recommends that you routinely perform this or a similar test to maintain the highest levels of confidence in your data.

Checklist

- Check solvents and run the ACQUITY LC system start-up to prime LC system and wash syringes
- Create a new analysis
- Run Auto setup
- Go to initial conditions
- Inject 3 blanks and 6 Vion Test Mix
- Review the report and ensure system meets performance criteria

Standards

Waters Part# 186008462 Vion Test Mix 2 x 1 mL ampoule

LC conditions

Column:	2.1 x 50mm ACQUITY BEH C18 1.7 µm
Column temp.:	50 °C
Sample temp.:	10 °C
Inj. volume:	1 µL
Flow rate:	500 µL/min.
Mobile phase A:	0.1% formic acid in water
Mobile phase B:	0.1% formic acid in acetonitrile
Wash	0.1% formic acid in acetonitrile
Purge	0.1% formic acid in water
Seal wash	90:10 Water / methanol
Gradient	See Table

MS conditions

System	Vion® IMS Qtof™
Ionization mode	ESI^+ (ESI^-)
Acquisition mode	$HDMS^E$, sensitivity mode
Acquisition range	*m/z* 50-1000
Capillary voltage	0.80 kV (2.5 kV)
Collision energy	20-40 eV ramping with Ar

EXPERIMENTAL

LCMS QC Analysis parameters

Before you run the SST for the first time, import the analysis method, report template, sample list, custom fields, and library. Refer to the KCS article WKB92598 "How to import the system suitability test materials for Vion IMS QTof?". Refer to the *Table 1* for the Reference Compound details in order of elution.

Ensure that the Vion MS setup is complete. Setup the LC system to the recommended LC conditions.

Prime the LC system using the system start-up function. For further information and details on the system start-up and the instrument setup, please refer to the Waters document "715005134_Waters Vion IMS QTof UPLC Screening System – Customer Familiarization Guide" pages 13-18 and 21-24 respectively.

Use the following LC gradient for the analysis:

Time (min)	Flow rate (mL/min)	%A	%B	Curve
0.00	0.500	95	5	Initial
0.50	0.500	95	5	6
1.50	0.500	75	25	6
2.00	0.500	75	25	6
3.50	0.500	30	70	6
3.90	0.500	30	70	6
4.00	0.500	95	5	6

Table 1: LC gradient used for the SST

Preparation of LCMS QC reference standard and blank sample

Dilute 1:10 the Vion Test Mix in 95:5 water:acetonitrile + 0.1% formic acid. Prepare a blank sample with 95:5 water:acetonitrile + 0.1% formic acid.

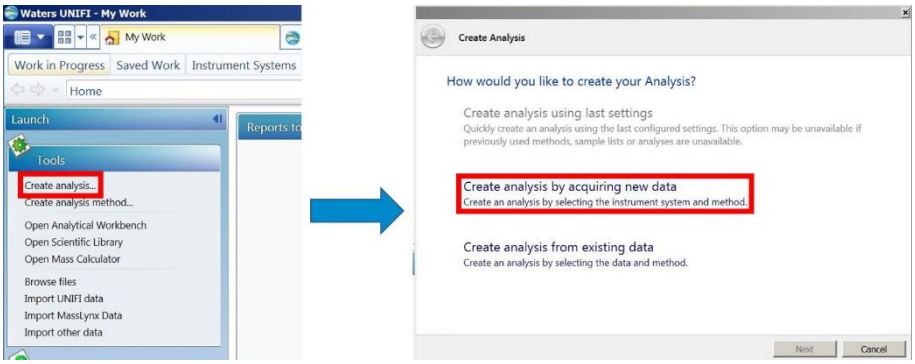
Prepare the lock mass and the calibration standard and ensure fluidics bottle B contains sufficient lock mass solution. Details for preparing the lock mass and the calibration major mix can be found in KCS articles WKB92649 and WKB22696.

Component	Formula	Exact Mass $[M+H]^+$	CCS (pos) [Å²]	Exact Mass $[M-H]^-$	CCS (neg) [Å²]	Concentration µg/mL
Sulfaguanidine	$C_7H_{10}N_4O_2S$	215.0597	146.8	213.0452	145.2	0.5
Acetaminophen	$C_8H_9NO_2$	152.0706	130.4	150.0561	131.5	1
Caffeine	$C_8H_{10}N_4O_2$	195.0877	138.2	n/a	n/a	0.15
Val-Tyr-Val	$C_{19}H_{29}N_3O_5$	380.2180	191.7	378.2034	192.5	0.25
Leucine Enkephalin	$C_{28}H_{37}N_5O_7$	556.2766	229.8	554.2620	225.3	0.25
Sulfadimethoxine	$C_{12}H_{14}N_4O_4S$	311.0809	168.4	309.0663	170.1	0.1
Verapamil	$C_{27}H_{38}N_2O_4$	455.2904	208.8	n/a	n/a	0.02
Reserpine	$C_{33}H_{40}N_2O_9$	609.2807	252.3	607.2661	265.2	0.06
Terfenadine	$C_{32}H_{41}NO_2$	472.3210	228.7	n/a	n/a	0.02

Table 2: Vion Test Mix content in order of elution

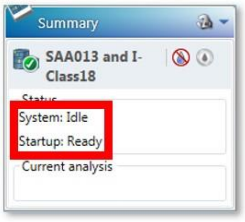
DATA ACQUISITION

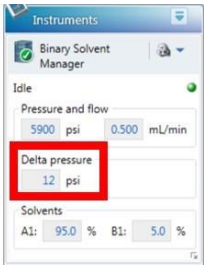
From the My Work pane, click **Create analysis**, and then select **Create analysis by acquiring new data**.



Browse for the sample list (Vion LC-MS QC SST) and analysis method (Vion LC-HDMSE QC SST), specifying an analysis name and description.

From the newly created analysis tab, open the console pane by clicking on the green tick at bottom right. Switch the MS to operate. From the summary menu, select *"Go to initial conditions"*. The system should display *"Idle"*, and the status *"Ready"*. Wait for the Binary Solvent Manager delta pressure to be ≤ 20 PSI (≤1.37 bar). as shown in the figure below.

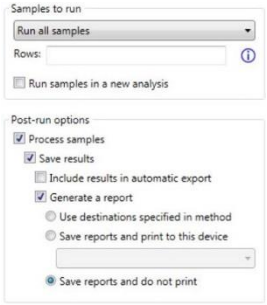




If necessary, amend the sample list vial position for the blank and the Vion Test Mix.

Click on the green start button to initiate the analysis.

Select *"Run all samples"* and make sure the options are ticked as depicted in the figure below



When the analysis is complete, click the **Report** tab and evaluate the results against the criteria defined in the "Results Evaluation" section. The report will use the following custom fields.

Name	Description	Formula
Average Peak Width in seconds	Average Chromatographic Peak Width in seconds of QC sample type	AVG(Chromatographic width,Sample type="QC")*60
RMS ppm error	RMS ppm error of QC sample type	(SUM(Mass error^2,Sample type="QC") / COUNT(Mass error,Sample type="QC"))^0.5
RMS CCS error %	RMS CCS error % of QC sample type	SUM(Collision cross section delta^2,Sample type="QC") / COUNT(Collision cross section delta,Sample type="QC")^0.5

RESULTS EVALUATION

After you have run the test, evaluate the results against the specifications in the table below:

Criteria	Specitication
Mass accuracy	Better than 2 ppm RMS across all injections for all nine compounds
CCS accuracy	Better than 2% RMS across all injections for all nine compounds
Retention time stability	Less than 3 seconds (0.05 minutes) RMS for the replicates
Peak width	Less than 3 seconds (0.05 minutes), measured as FWHM
BPI baseline level (solvent background)	Below 5% when evaluating the signal as XIC of the detected components in the "2: HD TOF MS" function (see figure 1 below).

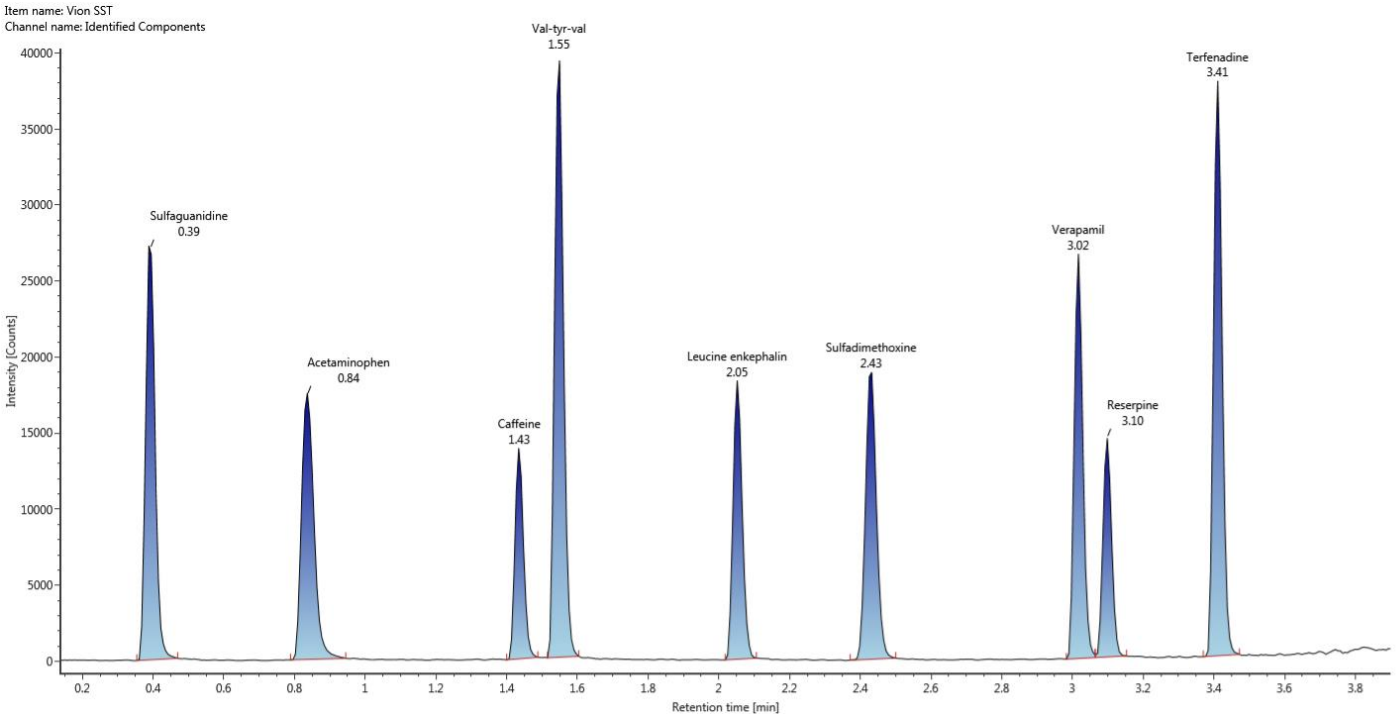


Figure 1: Typical Vion IMS QTof LC-HDMS^E system suitability test chromatogram

If the mass and/or CCS accuracy acceptance criteria are not met, it is required to rerun the Vion Auto setup. In case of poor chromatographic performance, prepare fresh mobile phases and inspect the LC flow path for potential leaks or blockages. Rerun the SST.

The SST can be run in negative ion mode by changing the ionisation polarity to negative ion and the capillary voltage as indicated in the Experimental section. The targeted substances in the purpose tab must be re-imported to update the negative CCS adduct values as indicated in table 2. Note that caffeine, verapamil, and terfenadine are not detected in negative ion mode.