

Test report No:
4604ERM.014A2

Assessment report

RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1093; FCC 47 CFR Part 1.1307 FCC 47 CFR Part 1.1310

(*) Identification of item tested	Connected 6-gas pumped gas detector
(*) Trademark	MSA- The Safety Company
(*) Model and /or type reference tested	ALTAIR io 6
Other identification of the product	FCC ID: P9R-MSAALTio6
(*) Features	RFID, GNSS, BLE 5.0, LTE-M, NB-IoT
Manufacturer	MSA Innovation, LLC 1000 Cranberry Woods Drive Cranberry Township, PA 16066, USA
Test method requested, standard	FCC 47 CFR Part 2.1093 Radiofrequency radiation exposure evaluation: portable devices. FCC 47 CFR Part 1.1307: Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared. FCC 47 CFR Part 1.1310: Radiofrequency radiation exposure limits. 447498 D01 General RF Exposure Guidance v06: RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager 
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Report template No	FERMUSA_199 (*) "Data provided by the client"

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Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consist of the Altair io6 portable gas instrument is a 6 gas, pumped, and connected gas detector used to alert users to the presence of toxic or combustible gases within an area. The Altair io6 portable gas instrument has an on-board pump and will commonly be used with a sampling line of a certain length and a sampling probe to detect the presence of toxic or combustible gases some distance from the instrument operator. The Altair io6 is a connected instrument giving our customers the visibility to real time data, location, and alarms, adding to MSA's line of connected Altair io products.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Identification of the client

MSA Innovation, LLC
1100 Cranberry Woods Drive
Cranberry Township, PA 16066, USA

Document history

Report number	Date	Description
4604ERM.014	2025-12-29	First release.
4604ERM.014A1	2025-02-04	Second release. The conducted output power values and references for LTE Cat-M1 and BTLE are updated. This revised test report cancels and replaces Test Report 4604ERM.014
4604ERM.014A2	2026-02-05	Third Release. LTE Cat-M1 Band 8 has been added to the test scope. The test report has been updated accordingly, and the corresponding test results reflect this addition. This revised test report cancels and replaces Test Report 4604ERM.014A1.

Appendix A: FCC RF Exposure Evaluation

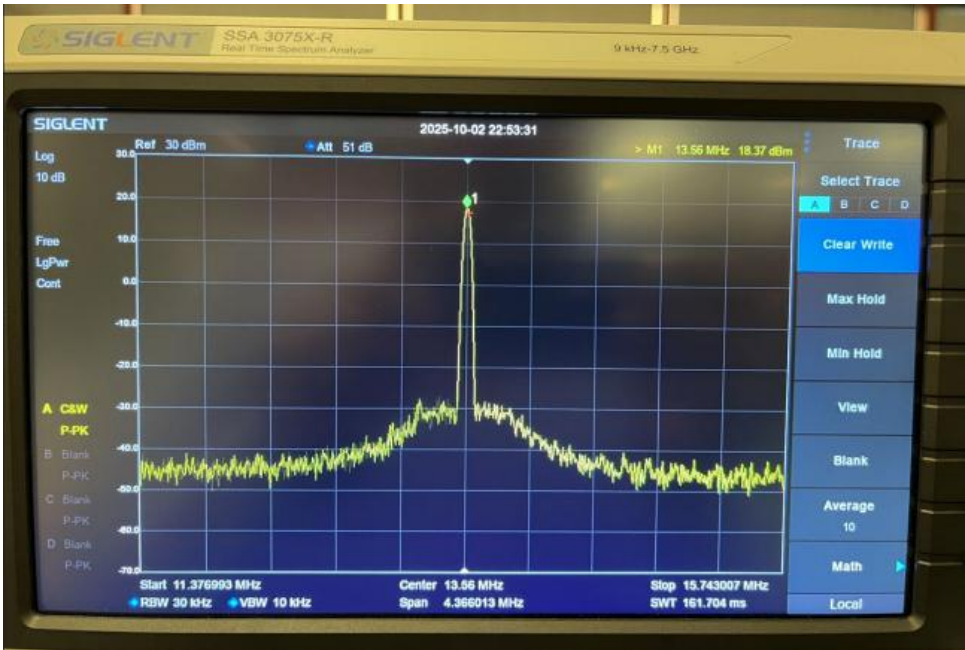
General description of the device under evaluation

The device under evaluation consists of the Altair io6 portable gas instrument is a 6 gas, pumped, and connected gas detector used to alert users to the presence of toxic or combustible gases within an area. The Altair io6 portable gas instrument has an on-board pump and will commonly be used with a sampling line of a certain length and a sampling probe to detect the presence of toxic or combustible gases some distance from the instrument operator. The Altair io6 is a connected instrument giving our customers the visibility to real time data, location, and alarms, adding to MSA's line of connected Altair io products.

According to the manufacturer, during its normal use, the separation distance between the radiating structures of the device and nearby users will be greater than 6.92 mm. In order to perform the assessment a conservative evaluation distance of 6.92 mm has been used.

The equipment specifications have been declared by the manufacturer for each supported technology are shown in Table 1. The Bluetooth values are taken from the test report of FCC ID: XPYANNAB1, and the LTE Cat-M1 values are taken from the test report of FCC ID: XPYUBX19KM01.

The RFID Maximum Conducted Power measurement results are: 18.37 dBm



Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Maximum Conducted Output Power (Incl. Tune-Up) (dBm)	Duty Cycle (%)	Time Averaged Conducted Power (dBm)	Antenna peak gain (dBi)	Maximum Averaged E.R.P (dBm)	Maximum Averaged E.R.P (mW)
LTE Cat-M1	2	1850 - 1910	22.67	1.78	5.17	0.50	-2.75	0.53
LTE Cat-M1	4	1710 - 1755	23.17	1.78	3.17	0.50	-3.85	0.41
LTE Cat-M1	5	824 - 849	23.00	1.78	5.50	1.30	4.85	3.06
LTE Cat-M1	8	880 - 915	22.51	1.78	5.01	1.30	4.16	2.61
LTE Cat-M1	12	699 - 716	22.21	1.78	4.71	1.00	7.85	6.10
LTE Cat-M1	13	777 - 787	22.62	1.78	5.12	1.30	7.35	5.44
LTE Cat-M1	26	814 - 849	22.64	1.78	5.14	1.30	5.05	3.20
BTLE	2.4 GHz	2400 - 2483.5	3.50	2.23	-13.02	0.70	-23.40	0.005
RFID	13.56	13.56	18.37	10.00	8.37	0.00	6.22	4.19

Table 1: Equipment specifications

Evaluation Results

RF Exposure SAR evaluation:

According to the 447498 D01 General RF Exposure Guidance v06 the formulas for SAR test exclusion threshold and simultaneous transmission is considered.

For the SAR test exclusion thresholds at selected frequencies and test separation distance for LTE and BTLE the following formulas are considered according to the clause 4.3.1:

- a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 3.0 \text{ for 1-g SAR, and } \leq 7.5 \text{ for 10-g extremity SAR,}^{30} \text{ where}$$

- $f_{\text{(GHz)}}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation³¹
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as *numeric thresholds* in step b) below

For the SAR test exclusion thresholds at selected frequencies and test separation distance for RFID the following formulas are considered:

- a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 3.0 \text{ for 1-g SAR, and } \leq 7.5 \text{ for 10-g extremity SAR,}^{30} \text{ where}$$

- $f_{\text{(GHz)}}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation³¹
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as *numeric thresholds* in step b) below

- b) For 100 MHz to 6 GHz and *test separation distances* > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following (also illustrated in Appendix B):³²

1) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{(MHz)}}/150)]\}$ mW, for 100 MHz to 1500 MHz

- c) For frequencies below 100 MHz, the following may be considered for SAR test exclusion (also illustrated in Appendix C):³³

- 1) For *test separation distances* > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by $[1 + \log(100/f_{\text{(MHz)}})]$
- 2) For *test separation distances* ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$

Technology	Band	Frequency (GHz)	Distance (mm)	Time average conducted power (dBm)	Time average conducted power (mW)	4.3.1.a)	4.3.1.b)1)	4.3.1.c)1)	4.3.1.c)2)
LTE	2	1.9075	6.92	5.17	3.292	0.6570	-	-	-
LTE	4	1.7525	6.92	3.17	2.075	0.3969	-	-	-
LTE	5	0.8465	6.92	5.50	3.552	0.4722	-	-	-
LTE	8	0.8980	6.92	5.01	3.170	0.4340	-	-	-
LTE	12	0.7015	6.92	4.71	2.961	0.3584	-	-	-
LTE	13	0.7845	6.92	5.12	3.254	0.4165	-	-	-
LTE	26	0.8315	6.92	5.14	3.269	0.4308	-	-	-
BTLE	-	2.402	6.92	-13.02	0.050	0.0112	-	-	-
RFID	-	0.01356	6.92	8.37	6.871	0.1156	-3.7788	-7.0578	-3.5289

Table 2: SAR Test Exclusion Threshold Evaluation Results

Simultaneous Transmission assessment:

The device under evaluation is able to transmit simultaneously LTE: Cat-M1, Bluetooth, and RFID technologies. For the simultaneous transmission at selected frequencies and test separation the following formulas are considered according to the clause 4.3.2:

- b) When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria.³⁶
- 1) $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}/x}] \text{ W/kg}$, for test separation distances $\leq 50 \text{ mm}$;
where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

Technology	Band	Frequency (MHz)	Distance (mm)	Time average conducted power (dBm)	Time average conducted power (mW)	4.3.2.b)1)	Result ($\sum$ of Pout/Pmax ratios)"
LTE	2	1907.5	6.92	5.17	3.292	0.08760	0.44
LTE	4	1752.5	6.92	3.17	2.075	0.05293	
LTE	5	846.5	6.92	5.50	3.552	0.06296	
LTE	8	898.0	6.92	5.01	3.170	0.05787	
LTE	12	701.5	6.92	4.71	2.961	0.04778	
LTE	13	784.5	6.92	5.12	3.254	0.05553	
LTE	26	831.5	6.92	5.14	3.269	0.05744	
BTLE	-	2402	6.92	-13.02	0.050	0.00149	
RFID	-	13.56	6.92	8.37	6.871	0.01542	

Table 3: Simultaneous Transmission SAR Test Exclusion Criteria

Appendix B: FCC RF Exposure information

RF Exposure evaluation

4.3.1. Standalone SAR test exclusion considerations Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.²⁸ The minimum test separation distance defined in 4.1 f) is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander. To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified, typically in the SAR measurement or SAR analysis report, by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting are required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops and tablets, etc.²⁹

- a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 3.0 \text{ for 1-g SAR, and } \leq 7.5 \text{ for 10-g extremity SAR,}^{30} \text{ where}$$

- $f_{\text{(GHz)}}$ is the RF channel transmit frequency in GHz

²⁷ Maximum conducted and radiated power should both be taken into consideration to establish the worst case aggregate maximum output power.

²⁸ Test exclusion is applied to the required test channels on a channel by channel basis.

²⁹ When SAR evaluation is required by the hotspot mode or UMPC mini-tablet procedures, that is, where an antenna is ≤ 2.5 cm from a surface or edge, the *test separation distance* from the phantom to the antenna or device enclosure, as appropriate, should be applied to determine further SAR test exclusion according to the criteria in this document. Do not use the antenna to device surface or edge distance.

³⁰ This is equivalent to the formula written as: $[(\text{max. power of channel, including tune-up tolerance, mW}) / (60 / \sqrt{f_{\text{(GHz)}}} \text{ mW})] \cdot [20 \text{ mm} / (\text{min. test separation distance, mm})] \leq 1.0$ for 1-g SAR; also see Appendix A for approximate exclusion threshold numerical values at selected frequencies and distances.

- Power and distance are rounded to the nearest mW and mm before calculation³¹
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as *numeric thresholds* in step b) below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion. b) For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following (also illustrated in Appendix B):³²

- 1) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{(MHz)}}/150)]\}$ mW, for 100 MHz to 1500 MHz
- 2) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot 10]\}$ mW, for > 1500 MHz and ≤ 6 GHz

c) For frequencies below 100 MHz, the following may be considered for SAR test exclusion (also illustrated in Appendix C):³³

- 1) For test separation distances > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by $[1 + \log(100/f_{\text{(MHz)}})]$
- 2) For test separation distances ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$
- 3) SAR measurement procedures are not established below 100 MHz.

When SAR test exclusion cannot be applied, a KDB inquiry is required to determine SAR evaluation requirements for any SAR test results below 100 MHz to be acceptable.³⁴

4.3.2. Simultaneous transmission SAR test exclusion considerations

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration. When the sum is greater than the SAR limit, the SAR to peak location separation ratio procedures described below may be applied to determine if simultaneous transmission SAR test exclusion applies. For the test exclusion to apply, the maximum output power, duty factor, and other applicable parameters used in the standalone SAR tests, must be the same or more conservative than those required for simultaneous transmission. When the maximum output power used for standalone operations is reduced in an operating mode or exposure condition during simultaneous transmission, often due to SAR or other implementation requirements, the standalone SAR tested at the higher output power may be applied to determine simultaneous transmission SAR test exclusion. Alternatively, additional standalone SAR at the reduced maximum output power applied for simultaneous transmission may be performed to determine simultaneous transmission SAR test exclusion, according to the sum of 1-g SAR or SAR to peak location separation ratio procedures. The power level of the standalone SAR used to qualify for SAR test exclusion must be clearly explained in the SAR report. When simultaneous transmission SAR test exclusion does not apply, enlarged zoom scan measurements must be performed at the maximum output power required in the power reduction modes for simultaneous transmission, within the tune-up tolerance requirements of all transmitters, for applying the volume scan post-processing procedures.³⁵

³¹ Unless stated otherwise, the same rounding requirements should be applied to all similar equations in this document.

³² These are interim SAR test exclusion provisions. More extensive considerations are necessary to address threshold discontinuity issues related to transitioning from SAR to MPE limits at intermediate distances and different frequencies. See *FNPRM* in ET Docket No. 13-84.

³³ See footnote 32.

³⁴ Certain SAR systems are beginning to support measurements at selected frequency ranges between 5 MHz and 100 MHz; however, tissue dielectric parameters and other measurement technical details remain unavailable. A KDB inquiry is required to determine the SAR measurement requirements on a case-by-case basis for individual circumstances.

³⁵ Within the tune-up tolerance, but not more than 2 dB lower than the maximum tune-up tolerance limit.

³⁶ See footnote 29; when SAR test exclusion is allowed by other published RF exposure KDB procedures, such as the 2.5 cm hotspot mode SAR test exclusion for an edge or surface, then estimated SAR is not required to determine simultaneous SAR test exclusion.

b) When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:³⁶

- 1) $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}/x}] \text{ W/kg, for test separation distances } \leq 50 \text{ mm;}$
where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.