



element

MSA Innovation, LLC

Altair io4

FCC 2.1093:2022

Bluetooth LE

2G/LTE

RFID

Report: MSAS0022.19, Issue Date: March 14, 2022



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CERTIFICATE OF EVALUATION

Last Date of Evaluation: March 14, 2022
MSA Innovation, LLC
EUT: Altair io4

RF Exposure Evaluation

Standards

Specification	Method
FCC 2.1093:2022	FCC 447498 D01 General RF Exposure Guidance v06

Results

Method Clause	Description	Applied	Results	Comments
4.3.1	SAR Test Exclusion	Yes	Pass	None
4.3.2	Simultaneous Transmission SAR Test Exclusion	Yes	Pass	None

Deviations From Evaluation Standards

None

Approved By:

Donald Facteau, Process Architect

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing

REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

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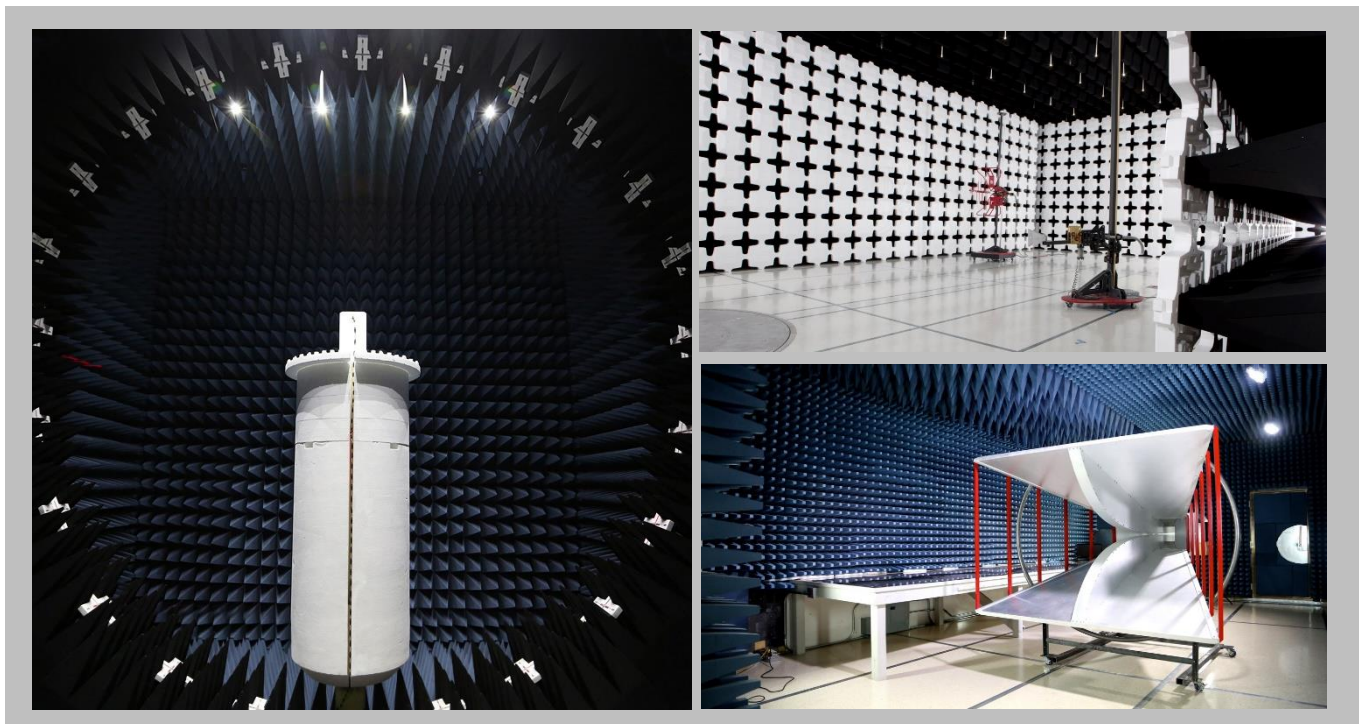
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FACILITIES



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A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
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US0158	US0175	US0017	US0191	US0157



PRODUCT DESCRIPTION

Client and Equipment Under Evaluation Information

Company Name:	MSA Innovation, LLC
Address:	1100 Cranberry Woods Road
City, State, Zip:	Cranberry Township, PA 16066
Evaluation Requested By:	Dustin Morris
EUT:	Altair io4
Date of Evaluation:	3/14/2022

Information Provided by the Party Requesting the Evaluation

Functional Description of the Equipment:

The Altair io 4 Gas detector is a cloud connected handheld device that can simultaneously detect up to 4 different gases. Local user notification of alarms and gas readings is provided via a 1.8 inch display, audible alerts, vibration, and multi-color LEDs.

The Altair io4 utilizes LTE-M connectivity for connection to our own MSA Innovation, LLC io Grid Live Monitor cloud platform for remote emergency alerts, configuration, OTA firmware updates and datalogging among some of its features. In certain configurations, an LTE module that utilizes a 2G fallback is also utilized.

GNSS is used for location awareness and reporting.

Bluetooth is used for configuration and setup.

RFID is used for check in and check out of the detectors by individual users.

The following tables show the low duty cycle analysis. More detailed information can be found in the operational description duty cycle document uploaded with this application.

SARA-R412M-02B Model RF Exposure Summary:

Radio	Max Duty Cycle: over 6 minutes	Max Duty Cycle: over 30 minutes	Max Rated Power
Bluetooth – BT121 - A	0.25%	0.25%	8 dBm
RFID – ST95HF	9%	9%	7 dBm
LTE-M – SARA-R412M-02B* • Bands 2/4/5/12/13	0.06%	0.15%	25 dBm
2G – SARA-R412M-02B* • GSM (850 MHz) • E-GSM (900 MHz) • DCS (1800 MHz) • PCS (1900 MHz)	0.79%	0.21%	GSM– 33.25 dBm DCS/PCS – 30.25 dBm

* NOTE: Only LTE-M or 2G will be enabled at any given time.

Distance from Person to Antennas Summary:

Radio Type	Enclosure Distance	Total Distance
BLE	13.2 mm	13.2 mm
LTE	8.3 mm	8.3 mm
RFID	30.4 mm	30.4 mm

PRODUCT DESCRIPTION



Objective:

To demonstrate compliance with FCC RF exposure requirements for 2.1093 portable devices.

RF Exposure Condition



The following RF Exposure conditions were used for the assessment documented in this report:	
Intended Use	Portable
Location on Body (if applicable)	Head/Torso
How is the Device Used	The Altair io4 is handheld or hung on the body of the user.
Radios Contained in the Same Host Device	2G/LTE FCC ID: XPYUBX18ZO01 Bluetooth LE FCC ID: QQQBT121 RFID
Simultaneous Transmitting Radios	2G/LTE, RFID Bluetooth LE, RFID
Body Worn Accessories	N/A
Environment	General Population/Uncontrolled Exposure

SAR TEST EXCLUSION



OVERVIEW

Human exposure to RF emissions from portable devices (47 CFR §2.1093) used with the radiating antenna closer than 20 cm to the user requires Specific Absorption Rate (SAR) to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation.

COMPLIANCE WITH FCC 2.1093

47 CFR §1.1307

“(b)(1) Requirements. (i) With respect to the limits on human exposure to RF provided in §1.1310 of this chapter, applicants to the Commission for the grant or modification of construction permits, licenses or renewals thereof, temporary authorities, equipment authorizations, or any other authorizations for radiofrequency sources must either:

(A) Determine that they qualify for an exemption pursuant to §1.1307(b)(3);

(B) Prepare an evaluation of the human exposure to RF radiation pursuant to §1.1310 and include in the application a statement confirming compliance with the limits in §1.1310; or

(C) Prepare an Environmental Assessment if those RF sources would cause human exposure to levels of RF radiation in excess of the limits in §1.1310.

The EUT will be used with a separation distance of less than 20 centimeters between the radiating antenna and the body of the user or nearby persons and must therefore be considered a portable transmitter per 47 CFR 2.1093(b).

47 CFR §2.1093

“(b) For purposes of this section, the definitions in §1.1307(b)(2) of this chapter shall apply. A portable device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that the RF source’s radiating structure(s) is/are within 20 centimeters of the body of the user.”

COMPLIANCE WITH FCC KDB 447498 D01 General RF Exposure Guidance v06

“KDB 447498 D01 General RF Exposure Guidance v06” provides the procedures, requirements, and authorization policies for mobile and portable devices.

Standalone radio SAR test exclusion is covered under section 4.3.1. 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 Thresholds are met as shown in the Limits section below.

Simultaneous transmission SAR test exclusion is covered under section 4.3.2. 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.

SAR TEST EXCLUSION

LIMITS

Limits for General Population /Uncontrolled Exposure: 47 CFR 1.1310 (c)

The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

For 100 kHz to 6 GHz and test separation distances ≤ 50 mm, the SAR test exclusion thresholds are 1-g for head and body SAR and 10-g SAR for extremity SAR.

ASSESSMENT (KDB 447498 D01 GENERAL RF EXPOSURE GUIDANCE V06)

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:

$$\left[\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \right] \cdot [\sqrt{f(\text{GHz})}] = \begin{matrix} 3.0 \text{ for 1-g SAR} \\ 7.5 \text{ for 10-g extremity SAR} \end{matrix}$$

Where:

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

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 4.1f) is applied to determine SAR test exclusion.

The SAR Test Exclusion Threshold is summarized in the following table(s):

The separation distance of 8.3 mm was used for all radios as an absolute worst case.

Radio	Transmit Frequency (MHz)	Max Rated Power	Duty Cycle	Minimum Separation Distance (mm)	Exclusion Threshold	Limit	Compliant
RFID	13.56	7 dBm	9.0%	8.3	0.5	236.7	Yes

The information in the table above was obtained from:

The rated value was used in these calculations and the tune-up tolerance is included in the rated power. From client supplied information and the operational description duty cycle analysis submitted with this application.

Radio	Transmit Frequency (MHz)	Max Rated Power	Duty Cycle	Minimum Separation Distance (mm)	Exclusion Threshold	Limit	Compliant
Bluetooth LE	2480	8 dBm	0.3%	8.3	0.0	3.0	Yes

The information in the table above was obtained from:

SAR TEST EXCLUSION



The rated value was used in these calculations and the tune-up tolerance is included in the rated power. From client supplied information and the operational description duty cycle analysis submitted with this application. FCC ID: QQQBT121.

Radio	Transmit Frequency (MHz)	Max Rated Power	Duty Cycle	Minimum Separation Distance (mm)	Exclusion Threshold	Limit	Compliant
2G: PCS	1900	30.25 dBm	0.8%	8.3	1.4	3.0	Yes
2G: GSM	850	33.25 dBm	0.8%	8.3	1.9	3.0	Yes
2G: E-GSM	900	33.25 dBm	0.8%	8.3	1.9	3.0	Yes
2G: DCS	1800	30.25 dBm	0.8%	8.3	1.4	3.0	Yes

The information in the table above was obtained from:

The rated value was used in these calculations and the tune-up tolerance is included in the rated power. From client supplied information and the operational description duty cycle analysis submitted with this application. FCC ID: XPYUBX18ZO01.

Radio	Transmit Frequency (MHz)	Max Rated Power	Duty Cycle	Minimum Separation Distance (mm)	Exclusion Threshold	Limit	Compliant
LTE: B5	849	25 dBm	0.2%	8.3	0.1	3.0	Yes
LTE: B4	1755	25 dBm	0.2%	8.3	0.1	3.0	Yes
LTE: B2	1910	25 dBm	0.2%	8.3	0.1	3.0	Yes
LTE: B13	787	25 dBm	0.2%	8.3	0.1	3.0	Yes
LTE: B12	716	25 dBm	0.2%	8.3	0.0	3.0	Yes

The information in the table above was obtained from:

The rated value was used in these calculations and the tune-up tolerance is included in the rated power. From client supplied information and the operational description duty cycle analysis submitted with this application. FCC ID: XPYUBX18ZO01.

Evaluator: Brian Fahey

ESTIMATED SAR

METHOD OF EVALUATION – SIMULTANEOUS TRANSMISSION CONFIGURATION

KDB 447498 D01 General RF Exposure Guidance v06, Section 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:

1)
$$\frac{[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})]}{[\sqrt{f(\text{GHz})}/x]}, \text{ for test separation distances } \leq 50\text{mm};$$

where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is $> 50 \text{ mm}$.

This SAR estimation formula has been considered in conjunction with the SAR Test Exclusion Thresholds to result in substantially conservative SAR values of $= 0.4 \text{ W/kg}$. When SAR is estimated, the peak SAR location is assumed to be at the feed-point or geometric center of the antenna, whichever provides a smaller antenna separation distance, and this location must be clearly identified in test reports. The estimated SAR is used only to determine simultaneous transmission SAR test exclusion; it should not be reported as the standalone SAR. When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see also KDB Publication 690783 D01). For situations where the estimated SAR is overly conservative for certain conditions, the test lab may choose to perform standalone SAR measurements, then use the measured SAR to determine simultaneous transmission SAR test exclusion. Estimated SAR values at selected frequencies, distances, and power levels are illustrated in Appendix D.

In the tables below, the estimated stand-alone SAR for the radio(s) capable of simultaneous transmission is listed. The estimated values have been summed and compared to the SAR limit. The result of the calculation is well below the limit therefore the unit is excluded from simultaneous SAR evaluation and deemed compliant with FCC RF exposure requirements.

The separation distance of 8.3 mm was used for all radios as an absolute worst case.

ESTIMATED SAR



Radio	Band	Transmit Frequency (GHz)	Test Separation (mm)	Output Power (mW)	Duty Cycle	Estimated SAR (W/kg)	Specification (W/kg)
2G	GSM	0.85	8.3	16.7	0.0079	0.3	1.6
RFID		0.01356	8.3	0.5	0.09	0	1.6
Estimated Summed SAR						0.3	1.6

The information in the table above was obtained from:
See standalone document above.

Radio	Band	Transmit Frequency (GHz)	Test Separation (mm)	Output Power (mW)	Duty Cycle	Estimated SAR (W/kg)	Specification (W/kg)
Bluetooth LE		2.48	8.3	0	0.0025	0	1.6
RFID		0.01356	8.3	0.5	0.09	0	1.6
Estimated Summed SAR						0	1.6

The information in the table above was obtained from:
See standalone document above.

End of Test Report