

Solutions TEST REPORT

Test Report No.: UL-RPT-RP-14929091-216-FCC/ISED

Applicant *	:	Octagon I/O Ltd		
Model No. / PMN*	:	SIGNAL LIVE HUB		
FCC/ISED ID: * : (G E E		Cellular Contains FCC ID: XMR201903EG25G Contains IC: 10224A-201903EG25G BLE FCC ID: 2A7VH-CSL-101 BLE IC: 28833-CSL101		
Technology *	:	Intermodulation – Cellular (4G) + BLE		
Test Standard(s) :		FCC 47 CFR Parts, 15.209(a), 15.247 & FCC 47 CFR Part 22 Subpart H, Part 24 and Part 27 ISED RSS-Gen, RSS-130, RSS-132, RSS-133, RSS-139 & ISED RSS-247		
		For details of applied	d tests r	efer to test result summary
 This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH. The results in this report apply only to the sample tested. The test results in this report are traceable to the national or international standards. Test Report Version 1.2 supersede Version 1.3 with immediate effect Test Report No. UL-RPT-RP-14929091-216-FCC/ISED Version 1.3, Issue Date 11 February 2025 replaces Test Report No. UL-RPT-RP-14929091-216-FCC/ISED Version 1.2, Issue Date 13 JUNE 2024, which is no longer valid. Result of the tested sample: PASS All information marked with a (*) were provided by customer / applicant or authorized representative 				
Zá	ig			2 Cms
Prepared by: Muhammad Faiq Khan Title: Project Engineer Date: 11 February 2025		imad Faiq Khan er 025		Approved by: Rachid Acharkaoui Title: Operations Manager Date: 11 February 2025
	Ak	kS Deutsche Akkreditierungsstelle D-PL-19381-02-00	This la The tes accord	boratory is accredited by DAkkS. Sts reported herein have been performed in ance with its' terms of accreditation.

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<u>1. Customer Information *</u>

1.1.Applicant Information

Company Name:	Octagon I/O Ltd	
Company Address:	5.02A Mermaid House, London EC4V 3DS, United Kingdom	
Contact Person:	Liliana Cortina	
Contact E-Mail Address:	ess: Liliana.cortina@converge.io	
Contact Phone No.:	+44 (0)20 3808 3115	

1.2. Manufacturer Information

Company Name:	Octagon I/O Ltd
Company Address:	5.02A Mermaid House, London EC4V 3DS, United Kingdom
Contact Person: Liliana Cortina	
Contact E-Mail Address: Liliana.cortina@converge.io	
Contact Phone No.:	+44 (0)20 3808 3115



2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247	
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247	
Specification Reference:	47CFR15.209	
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.209	
Specification Reference:	47CFR22	
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 22 Subpart H (Public Mobile Services)	
Specification Reference:	47CFR24	
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 24 (Personal Communication Services), Subpart E.	
Specification Reference:	47CFR27	
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 27 (Miscellaneous Wireless Communications Services)	
Specification Reference:	RSS-130 Issue 2 February 2019	
Specification Title:	Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz	
Specification Reference:	RSS-132 Issue 3 January 2013	
Specification Title:	Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869- 894 MHz	
Specification Reference:	RSS-133 Issue 6 January 2018	
Specification Title:	2 GHz Personal Communications Services	
Specification Reference:	RSS-139 Issue 4 September 2022	
Specification Title:	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz	
Specification Reference:	RSS-247 Issue 3, August 2023	
Specification Title:	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	
Specification Reference:	RSS-Gen – Issue 5 April 2018	
Specification Title:	General Requirements for Compliance of Radio Apparatus	



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Location

Location of Testing:	UL International Germany GmbH
	Hedelfinger Str. 61
	70327 Stuttgart
	Germany
Test Firm Registration:	399704
Company Number.	22511
CABID:	DE0008

Date information

Order Date:	11 August 2023		
EUT arrived:	19 September 2023		
Test Dates: 04 December 2023			
EUT returned:	-/-		



2.2. Summary of Test Results

Measurement	ISED Reference (RSS-)	FCC Reference (47CFR)	Complied	Did not comply
Transmitter Out of Band Radiated Emission ⁽¹⁾	RSS 130 § 4.7 RSS 132 §5.5 RSS 133 § 6.5 RSS 139 § 6.6 RSS-GEN § 6.5, 6.6, 6.13, 8.9 & 8.10 RSS-247 5.5	Part 2.1053, 15.247(d), 15.209(a) 22.917(a)(b) 24.238(a) & 27.53(h)	\boxtimes	
C: COMPLIED N.C.: NOT COMPLIED N.P.: NOT PERFORMED N.A.: NOT APPLICABLE				

Decision rule:

Where not otherwise specified or communicated in writing, statements of conformity (e.g. Pass/Fail) are established according to the following decision rule: considering the ILAC G8:2019 chapter 4.2.1 (simple acceptance rule). This leads to a maximum 50% of false accept or false reject when the measured value equals the tolerance limit. See ILAC-G8:09/2019 for further details.

Note(s):

1. As per applicant's declaration a pre-Certified modules weas integrated therefore, only partial testing was performed for intermodulation of Cellular (3G/4G) and BLE 2.4 GHz technology. The tested bands and worst-case parameters were defined by the customer.

2.3. Methods and Procedures

Reference:	ANSI C63.26-2015	
Title:	American National Standard for Compliance Testing of Transmitters	
	Used in Licensed Radio Services.	
Reference:	FCC KDB 971168 D01 v03r01, April 9 2018	
Title:	Measurement Guidance for Certification of Licensed Digital Transmitters	
Reference:	ANSI C63.10-2013	
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	
Reference:	ANSI C63.4-2014	
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.	
Reference:	FCC KDB 996369 D04 Module Integration Guide v02 October 13, 2020	
Title:	Modular Transmitter Integration Guide Guidance for Host Product Manufacturers	

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.



3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT) *

Brand Name:	Converge	
Model Name or Number:	SIGNAL LIVE HUB	
Serial Number:	N/A (Radiated RF Test Sample)	
Hardware Version Number:	V1	
Firmware Version Number:	N/A	
HVIN:	v1	
FVIN:	N/A	
FCC ID:	Cellular: Contains FCC ID: XMR201903EG25G BLE: FCC ID: 2A7VH-CSL-101	
ISED ID:	Cellular Contains IC: 10224A-201903EG25G BLE: IC: 28833-CSL101	

3.2. Description of EUT *

The equipment under test was a cellular gateway with Cellular (4G) and Bluetooth Low Energy (BLE) operations.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.



3.4. Additional Information Related to Testing *

Technology Tested:	Cellular – (3G/4G)			
Power Supply Requirement(s):	3.6 V DC / 3 A max v	nax via Internal Battery		
	200-240 V AC from N	200-240 V AC from Mains via AC DC adapter		
Transmit Frequency Range:	Uplink: 1850 MHz – 1	19510 MHz		
Transmit Frequency Range:	Uplink: 1/10 MHz – 1	2155 MHZ		
Iransmit Frequency Range:	Downlink: 824 MHz – 84			
			- (111)	
Transmit Frequency Range:	Channel ID	Channel Number	Frequency (MHz)	
	Middle (Note 1)	18900	1880	
Transmit Frequency Range:	Channel ID	Channel Number	Frequency (MHz)	
LTE FDD4	Middle (Note 1)	20175	1732.5	
Transmit Frequency Range:	Channel ID	Channel Number	Frequency (MHz)	
LTE FDD5	Middle (Note 1)	20525	836.5	
Antenna Gain:	4 dBi			
Antenna Type:	e: Rectangular patch antenna			
Antenna Details:	Pulse Electronics W3906B0100			
Technology Tested:	Bluetooth – Low Energy			
Type of Radio Device:	Transceiver			
Tested Data Rate(s) & Modulation(s):	2 Mbps (GFSK)			
Declared Antenna Gain:	2 dBi			
Antenna Type:	Internal Antenna			
Antenna Details:	Ceramic Patch Antenna			
Transmit Channels Tested:	Channel ID	Channel Number	Frequency (MHz)	
	Bottom	0 (Note 1)	2400.2	
^(Note 1) The Host Product testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation and channel per frequency. LTE bands 2,4 and 5 are selected to be tested as it is typical operation bands.				

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. Support Equipment (In-house)

ltem	Description	Brand Name	Model Name or Number	Serial Number
1	Test Laptop with	HP	ProBook 650	5CG614419V

B. Support Equipment (Manufacturer supplied) *

Item Description Bran	ame Model Name or Number Serial Number
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1	-/-	-/-	-/-	-/-

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

⊠ Traffic mode: LTE-FDD2 | Middle Channel | Max PWR + BLE Low Channel

(Established communication link with base station simulator)

☑ Traffic mode: LTE-FDD4 | Middle Channel | Max PWR + BLE Low Channel

(Established communication link with base station simulator)

☑ Traffic mode: LTE-FDD5 | Middle Channel | Max PWR + BLE Low Channel

(Established communication link with base station simulator)

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

EUT Power Supply:

• The EUT was powered with 3.6 V DC via fully charged internal battery.

Test Mode Activation:

- The EUT can be connected with the Test laptop via USB-C cable supplied by the customer. The cables were only used to set the EUT in respective modes and was removed during measurements.
- The test modes were activated using the test software / Radio Tool "nRF Connect V 3.7.1" supplied by the customer. This test software / Radio Tool was installed on the test laptop to enable continuous transmission and to select the required power levels and the test channels.
- Device was in continuous communication with CMW 500 Base station.

Radiated Measurements:

- As per the applicant's declaration &/operational description of the EUT, the EUT is a tabletop equipment for its intended application. Therefore, EUT's test setup placement was performed in accordance with ANSI C63.10 section 6.2.3.2 & section 6.12 Figure 4.
- Before starting final radiated spurious emission measurements "worst case verification" with the EUT in Standing-position & Laying-position was performed by Lab.
- The EUT in Standing-position was found to be the worst case therefore this report includes relevant results.
- Radiated measurements below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set at 100 cm.
- Radiated measurements above 30 MHz were performed with the EUT positioned on the turn table and rotating 360° while the antenna height varies from 1 to 4 m over the measurement frequency range.
- R&S® EMC32 V11.30 Software was used for the Radiated spurious emission measurements.



5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.



5.2. Test Results

5.2.1. Transmitter Radiated Emissions / Transmitter out of band Radiated Emission

Test Summary:

Test Engineer:	Muhammad Faiq Khan Test Date:		04 December 2023	
Test Sample Serial Number:	N/A (Radiated RF Test Sample)			
Test Site Identification	SR 1/2			

FCC Reference:	47 CFR Parts 15.247(d), 15.209(a), Part 22.917(a), Part 24.238(a), Part 27.53(h) & Part 2.1053
ISED Reference:	RSS-130 § 4.7, RSS-132 § 5.5, RSS-133 § 6.5, RSS-139 § 6.6 , , RSS-247 5.5 & RSS-GEN § 6.13 & 8.9
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3. 6.5 and 6.6 KDB 971168 Section 6.1 referencing ANSI C63.26:2015 section 5.7
Frequency Range:	30 MHz to 26.5 GHz

Environmental Conditions:

Temperature (°C):	18.9
Relative Humidity (%):	34.3

Note(s):

- 1. Final measurements were performed in a semi-anechoic chamber SR1/2 (Asset Number 1603665) with absorber on the floor at a distance of 3 meters. Pre-scans above performed, and a marker placed on the highest measured level of the appropriate plot. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
- 2. Pre-scans were performed, and markers placed on the highest measured levels. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- 3. The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.
- 4. The radiated emissions measurements from 30 MHz till 18 MHz were performed with the EUT set to the following modes.
 - LTE-FDD2 | Middle Channel | Max PWR + BLE Bottom channel
 - LTE-FDD4 | Middle Channel | Max PWR + BLE Bottom channel
 - LTE-FDD5 | Middle Channel | Max PWR + BLE Bottom channel
- 5. The measurement above 18 GHz was only performed with following mode.
 - LTE-FDD2 | Middle Channel | Max PWR + BLE Bottom channel



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<u>Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)</u> <u>Test Setup:</u>





<u>Transmitter Radiated Emissions (continued)</u> <u>Results: LTE-FDD2 | Middle Channel | Max PWR + BLE | Bottom Channel | Max PWR</u>

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarization	Result
1045.933333	-36.25	-13.00	23.25	Horizontal	Complied
1358.150000	-29.17	-13.00	16.17	Vertical	Complied
1569.183333	-46.40	-13.00	33.40	Vertical	Complied
2922.883333	-20.81	-13.00	7.81	Horizontal	Complied
5641.000000	-31.65	-13.00	18.65	Horizontal	Complied

Plot: 30 MHz – 18 GHz: LTE-FDD2 | Middle Channel | Max PWR + BLE | Bottom Channel | Max PWR



Notes: The peaks 1.879 GHz and 2.4 GHz are the fundamental frequencies of the tested channel.

<u>Transmitter Radiated Emissions (continued)</u> <u>Results: LTE-FDD4 | Middle Channel | Max PWR + BLE | Bottom Channel | Max PWR</u>

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarization	Result
1062.616667	-19.84	-13.00	6.84	Vertical	Complied
1337.566667	-36.06	-13.00	23.06	Vertical	Complied
2670.300000	-36.71	-13.00	23.71	Vertical	Complied
2796.533333	-23.05	-13.00	10.05	Vertical	Complied
4803.666667	-39.14	-13.00	26.14	Horizontal	Complied
4940.000000	-39.59	-13.00	26.59	Vertical	Complied
7000.333333	-32.76	-13.00	19.76	Vertical	Complied
10260.333333	-29.06	-13.00	16.06	Vertical	Complied

Plot: 30 MHz – 18 GHz: LTE-FDD4 | Middle Channel | Max PWR + BLE | Bottom Channel | Max PWR



Notes: The peaks 1.734 GHz and 2.4 GHz are the fundamental frequencies of the tested channel.

Transmitter Radiated Emissions (continued)

Results: LTE-FDD5 | Middle Channel | Max PWR + BLE 2.4 GHz | Bottom Channel | Max PWR

Frequency	Level	Limit	Margin	Antenna	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	Polarization	
4162.000000	-41.64	-13.00	28.64	Vertical	Complied

Plot: 30 MHz – 18 GHz: LTE-FDD5 | Middle Channel | Max PWR + BLE 2.4 GHz | Bottom Channel | Max PWR



Notes: The peaks 838.59 MHz and 2.4 GHz are the fundamental frequencies of the tested channel.



Transmitter Radiated Emissions (continued)

Results: LTE-FDD2 | Middle Channel | Max PWR + BLE | Bottom Channel | Max PWR

Frequency	Antenna	Level	Limit	Margin	Result
(MHz)	Polarization	(dBµV/m)	(dBµV/m)	(dB)	
No critical emissions were detected					

Plot: 18 GHz – 26.5 GHz: LTE-FDD2 | Middle Channel | Max PWR + BLE 2.4 GHz | Bottom Channel | Max PWR



6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Confidence Level (%)	Calculated Uncertainty	
Radiated Spurious Emissions	95%	±3.10 dB	

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.



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7. Used equipment

Test site: SR 1/2

ID	Manufacturer	Туре	Model	Serial	Calibration Date	Cal. Cycle (months)
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	18/07/2023	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	18/07/2023	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	43
496	Rohde & Schwarz	Antenna, log periodical	HL050	100297	22/08/2022	24
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	13/07/2023	12
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	13/07/2023	18
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	15/10/2019	55
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421- T161	n/a	n/a
681	Maturo	Antenna mast, tilting	BAM4.5-P	402/0718.1	n/a	n/a



8. Report Revision History

Version	Revision Det	ails			
Number	Page No(s)	Clause	Details		
1.0	-	-	Initial Version		
	Page No(s)	Clause	Details		
	5	2.1	Standard version updated		
1 1	7	2.2	Note updated		
1.1	9	9 3.4 Note updated		Note updated	
	19	7	Equipment calibration information updated Test setup photos separated from report		
1.2	1	-	Correction of PMN		
	7	3.1	Correction of PMN		
Test Report Version 1.3 supersede Version 1.2 with immediate effect Test Report No. UL-RPT-RP-14929091-216-FCC/ISED Version 1.3, Issue Date 11 February 2025 replaces Test Report No. UL-RPT-RP-14929091-216-FCC/ISED Version 1.2, Issue Date 13 JUNE 2024, which is no longer valid.					
	Page No(s)	Clause	Details		
1.3	1	Cover	Update ISED ID		
	8	3.1	Update ISED ID		

--- END OF REPORT ---

