

EMC TEST REPORT – 407245-3TRFEMC

Applicant:

GHI Electronics, LLC

Product:

SITCore

Model:

SITCore SCM20xxx

Model variant(s):

FEZ Portal, SCM20260D, SC20100S,
SCM20100E, SCM20260N, FEZ Bit,
FEZ Stick, FEZ Duino, FEZ Feather

Specification:

EN 55035:2017

Date of issue: December 10, 2020

Alvin Liu, EMC/RF Specialist

Tested by

Fahar A Sukkoor, EMC/RF Specialist

Reviewed by

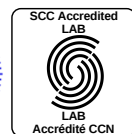


Signature



Signature

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada.
The tests included in this report are within the scope of this accreditation



Lab and test locations

Company name	Nemko Canada Inc.			
Facilities	Ottawa site: 303 River Road Ottawa, Ontario Canada K1V 1H2	Montréal site: 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8	Cambridge site: 1-130 Saltsman Drive Cambridge, Ontario Canada N3E 0B2	Almonte site: 1500 Peter Robinson Road West Carleton, Ontario Canada K0A 1L0
	Tel: +1 613 737 9680 Fax: +1 613 737 9691	Tel: +1 514 694 2684 Fax: +1 514 694 3528	Tel: +1 519 650 4811	Tel: +1 613 256-9117
Website	www.nemko.com			

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

© Nemko Canada Inc.

Table of Contents

Table of Contents	3
Section 1 Report summary	4
1.1 Test specifications	4
1.2 Exclusions	4
1.3 Statement of compliance	4
1.4 Test report revision history	4
Section 2 Engineering considerations	5
2.1 Modifications incorporated in the EUT for compliance	5
2.2 Technical judgment	5
2.3 Deviations from laboratory tests procedures	5
Section 3 Test conditions	6
3.1 Atmospheric conditions	6
3.2 Power supply range	6
Section 4 Measurement uncertainty	7
4.1 Uncertainty of measurement	7
Section 5 Information provided by the applicant	8
5.1 Disclaimer	8
5.2 Applicant/Manufacturer	8
5.3 EUT information	8
5.4 EUT setup details	9
Section 6 Summary of test results	10
6.1 Testing location	10
6.2 Testing period	10
6.3 Sample information	10
6.4 Test results	10
Section 7 Terms and definitions	11
7.1 Performance terms and definitions	11
7.2 General definitions	12
Section 8 Testing data	13
8.1 Continuous RF electromagnetic field disturbances	13
8.2 Power frequency magnetic field	17
Section 9 EUT photos	19
9.1 External photos	19

Section 1 Report summary

1.1 Test specifications

EN 55035:2017

Electromagnetic compatibility of multimedia equipment
Immunity requirements

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Unless noted in section 1.2, all testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: Test report revision history

Revision #	Date of issue	Details of changes made to test report
TRF	December 10, 2020	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

EUT model SCM20xxx, and variants: FEZ Portal, SCM20260D, SC20100S, SCM20100E, SCM20260N, FEZ Bit, FEZ Stick, FEZ Duino, FEZ Feather. FEZ Portal, FEZ Bit, FEZ Duino, and FEZ Feather, have same WiFi module on board. Other models have no WiFi module used. All model variants were tested.

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	30 % – 60 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

3.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.

Section 4 Measurement uncertainty

4.1 Uncertainty of measurement

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of $K=2$ with 95% certainty.

Section 5 Information provided by the applicant

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacturer

Applicant name	GHI Electronics, LLC
Applicant address	501 E. Whitcomb Ave, Madison Heights MI, USA48701
Manufacturer name	Same as applicant
Manufacturer address	Same as applicant

5.3 EUT information

Product	SITCore
Model	FEZ Portal
Serial number	None
Part number	SCC-FPRTL-C
Power requirements	5 V _{DC} USB-C Powered
Description/theory of operation	Development boards, SoMs, and single board computers.
Operational frequencies	8 MHz Crystal, processor running at 240 MHz
Software details	Firmware version 2.0.0.8, TinyCLR OS 2.0

5.4 EUT setup details

5.4.1 EUT Exercise and monitoring

Methods used to exercise the EUT and all relevant ports:

- EUT powered and had the complete software stack running behind it.
- Wi-Fi module was active by default.
- The display on board turned on and showed white screen.

Configuration details:

- The EUT was set up in a configuration that was expected to produce the highest amplitude emissions relative to the limit and that satisfy normal operation/installation practice by the end-user.
- The type and construction of cables used in the measurement setup were consistent with normal or typical use. Cables with mitigation features (for example, screening, tighter/more twists per length, ferrite beads) have been noted below:
 - None
- The EUT was set up in a manner that was consistent with its typical arrangement and use. The measurement arrangement of the EUT, local AE and associated cabling was representative of normal practice. Any deviations from typical arrangements have been noted below:
 - None

Monitoring details:

- Monitor the display and blinking led on board.

5.4.2 EUT test configuration

Table 5.4-1: EUT interface ports

Description	Qty.
DC power input (USB-C)	1
USB	1

Table 5.4-2: Support equipment

Description	Brand name	Serial number, Part number, Model, Revision level
Adapter	Samsung	SN: SE1F122AS/B-E, MN: EP-TA10JWE

Table 5.4-3: Inter-connection cables

Cable description	From	To	Length (m)
DC power input (USB-C)	Adapter	EUT	2.8

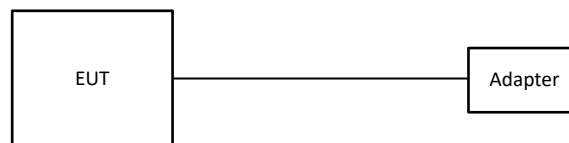


Figure 5.4-1: Block diagram

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Cambridge
-------------------	-----------

6.2 Testing period

Test start date	December 1, 2020	Test end date	December 2, 2020
-----------------	------------------	---------------	------------------

6.3 Sample information

Receipt date	October 1, 2020	Nemko sample ID number	1, 2, 4, 5, 6, 7, 8, 9, 17
--------------	-----------------	------------------------	----------------------------

6.4 Test results

Table 6.4-1: Result summary

Test description	Verdict
Enclosure ports	
Power frequency magnetic field	Pass
Continuous RF electromagnetic field disturbances, swept test	Pass
Continuous RF electromagnetic field disturbances, spot test	Pass
ESD	Not applicable ¹
Analogue/digital data ports	
Continuous induced RF disturbances	Not applicable ²
Broadband impulse noise disturbances, repetitive	Not applicable ²
Broadband impulse noise disturbances, isolated	Not applicable ²
Surges	Not applicable ²
Electrical fast transients/burst	Not applicable ²
DC network power ports	
Continuous induced RF disturbances	Not applicable ²
Surges	Not applicable ²
Electrical fast transients/burst	Not applicable ²
AC mains power ports	
Continuous induced RF disturbances	Not applicable ³
Voltage dips	Not applicable ³
Voltage interruptions	Not applicable ³
Surges	Not applicable ³
Electrical fast transients/burst	Not applicable ³

Notes: ¹ These devices are designed to be integrate into system that implement proper static protection mechanisms.

² There are no cables lengths greater than 3 m.

³ The EUT is DC powered, without a dedicated AC/DC adapter.

Section 7 Terms and definitions

7.1 Performance terms and definitions

General performance criteria, Reference Clause 8.1 of EN 55035:2017	General performance criteria are defined in 8.2, 8.3 and 8.4. These criteria shall be used during the testing of primary functions where no relevant annex is applicable. When assessing the impact of a disturbance on a function, the assessment should take into consideration the function's performance prior to the application of the disturbance and only identify as failures those changes in performance that are a result of the disturbance.
Performance criterion A, Reference Clause 8.2 of EN 55035:2017	The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Performance criterion B, Reference Clause 8.3 of EN 55035:2017	During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test. After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Performance criterion C, Reference Clause 8.4 of EN 55035:2017	Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

7.2 General definitions

7.2.1 EN 61000-4-3: (Radiated, radio-frequency, electromagnetic field)

Continuous waves (CW)	Electromagnetic waves, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information.
Electromagnetic (EM) wave	Radiant energy produced by the oscillation of an electric charge characterized by oscillation of the electric and magnetic fields.
Field strength	The term "field strength" is applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field and may be expressed as V/m, A/m or W/m ² ; any one of these may be converted into the others.
Sweep	Continuous or incremental traverse over a range of frequencies.

7.2.2 EN 61000-4-8 (Power frequency magnetic field)

Induction coil	Conductor loop of defined shape and dimensions, in which flows a current, generating a magnetic field of defined constancy in its plane and in the enclosed volume.
Immersion method	Method of application of the magnetic field to the EUT, which is placed in the centre of an induction coil.
Proximity method	Method of application of the magnetic field to the EUT, where a small induction coil is moved along the side of the EUT in order to detect particularly sensitive areas.
Ground	A flat conductive surface whose potential is used as a common reference for the magnetic field generator and the auxiliary equipment (the ground plane can be used to close the loop of the induction coil).

Section 8 Testing data

8.1 Continuous RF electromagnetic field disturbances

8.1.1 References and limits

- EN 55035:2017
- EN 61000-4-3:2006 + A1:2008 + A2:2010

Table 8.1-1: Continuous RF electromagnetic field disturbances, specification

Test specification	Performance criterion
Swept test	
80–1000 MHz, 3 V/m (unmodulated), 80 % AM (1 kHz)	A
Spot test	
1800, 2600, 3500, 5000 MHz, 3 V/m (unmodulated), 80 % AM (1 kHz)	A
Notes: None	

8.1.2 Test summary

Verdict	Pass		
Tested by	Alvin Liu	Test date	December 1, 2020

8.1.3 Notes

None

8.1.4 Setup details

Table 8.1-2: Continuous RF electromagnetic field disturbances, equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	April 10, 2021
Signal generator	Rohde & Schwarz	SMB100A	FA002968	1 year	Nov 12, 2021
Amplifier (80 –1000 MHz, 250 W)	AR	250W1000C	FA003008	—	NCR
Amplifier (1–6 GHz, 125 W)	AR	125S1G6	FA003004	—	NCR
Directional coupler (80–1000 MHz)	AR	Dc6180A	FA002973	1 year	April 08, 2021
Directional coupler (0.7–6 GHz)	AR	Dc725A	FA002994	1 year	April 08, 2021
Power sensor	Rohde & Schwarz	Nrp-6A	FA002962	1 year	Nov 13, 2021
BiConilog Antenna (26 – 2000 MHz)	EMCO	3141	FA003128	—	NCR
Horn antenna (1–18 GHz)	EMCO	3115	FA000649	1 year	Dec 18, 2020
Starprobe (0.1–6000 MHz)	AR	FI7006	FA002961	1 year	Dec 30, 2020
Notes: NCR - no calibration required					

Table 8.1-3: Continuous RF electromagnetic field disturbances, software details

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

8.1.5 Test data

Table 8.1-4: Swept frequency – Continuous RF electromagnetic field disturbances, results

Step size increment ¹	1 %
Dwell time ²	1 s
Antenna polarization	Vertical and Horizontal
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT setup configuration	Table top
EUT power input during test	5 V _{DC} USB Powered
EUT position facing antenna	Front side, back side, top side, bottom side, left side and right side
Frequency range, MHz	
80	1000
Test level, V/m ¹	
3	
Comments	
No degradation	

Notes: ¹Recognizing that a 1% step size is preferred, the frequency range can be swept incrementally with a step size not exceeding 4% of the previous frequency with a test level of twice the value of the specified test level in order to reduce the testing time for equipment requiring testing in multiple configurations and/or long cycle times.

²The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond. However, the dwell time shall not exceed 5 seconds at each of the frequencies during the scan. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.

Table 8.1-5: Spot frequencies – Continuous RF electromagnetic field disturbances, results

Dwell time ¹	5 s
Antenna polarization	Vertical and Horizontal
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT setup configuration	Table top
EUT power input during test	5 V _{DC} USB Powered
EUT position facing antenna	Front side, back side, top side, bottom side, left side and right side
Frequency, MHz	
1800	3
2600	3
3500	3
5000	3
Test level, V/m	
3	
Comments	
No degradation	
No degradation	
No degradation	
No degradation	

Notes: ¹The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond. However, the dwell time shall not exceed 5 seconds at each of the frequencies during the scan. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.

8.1.6 Setup photos

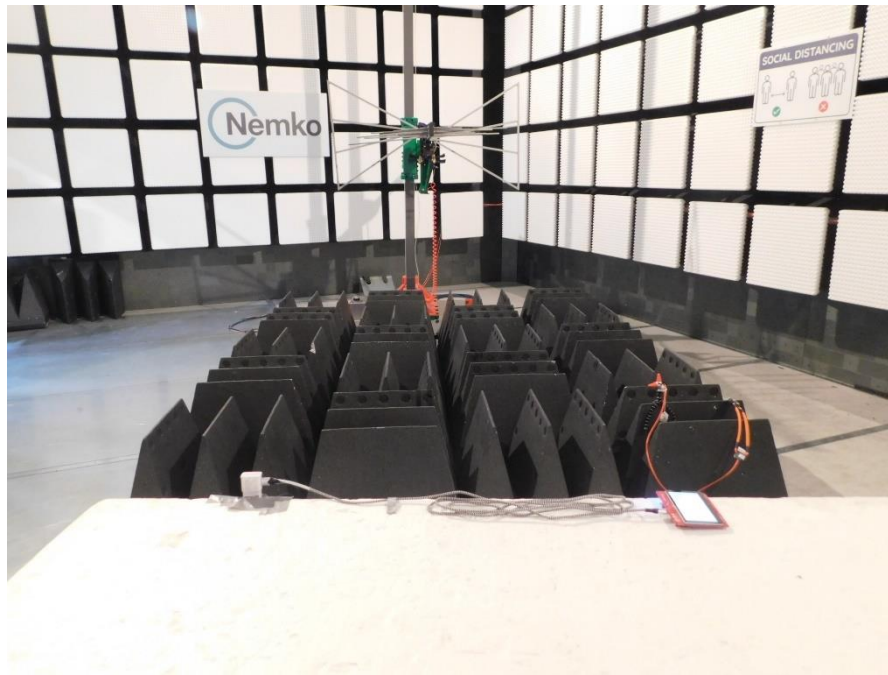


Figure 8.1-1: Continuous RF electromagnetic field disturbances, setup photo (swept test)

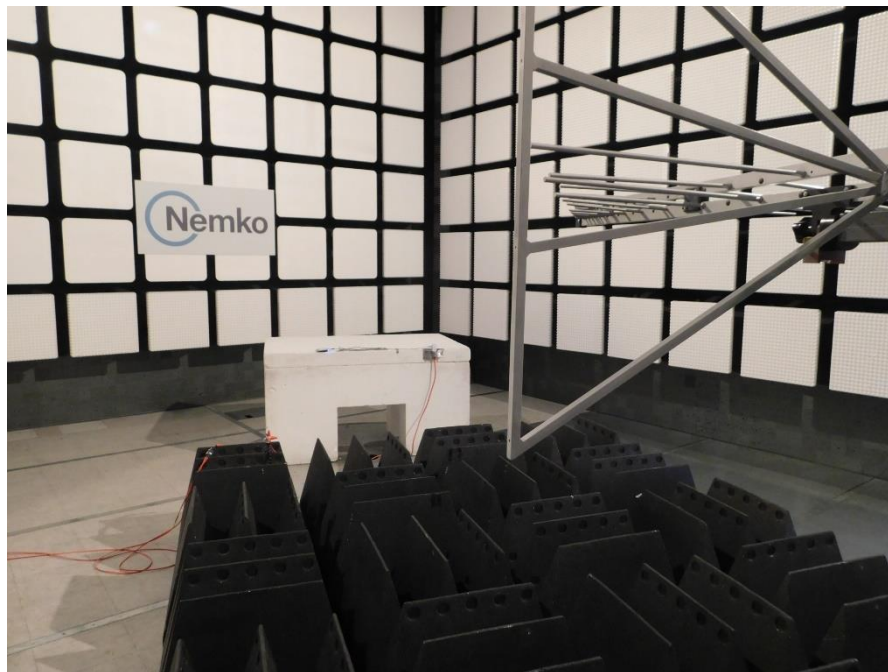


Figure 8.1-2: Continuous RF electromagnetic field disturbances, setup photo (swept test)

Setup photos, continued



Figure 8.1-3: Continuous RF electromagnetic field disturbances, setup photo (spot test)

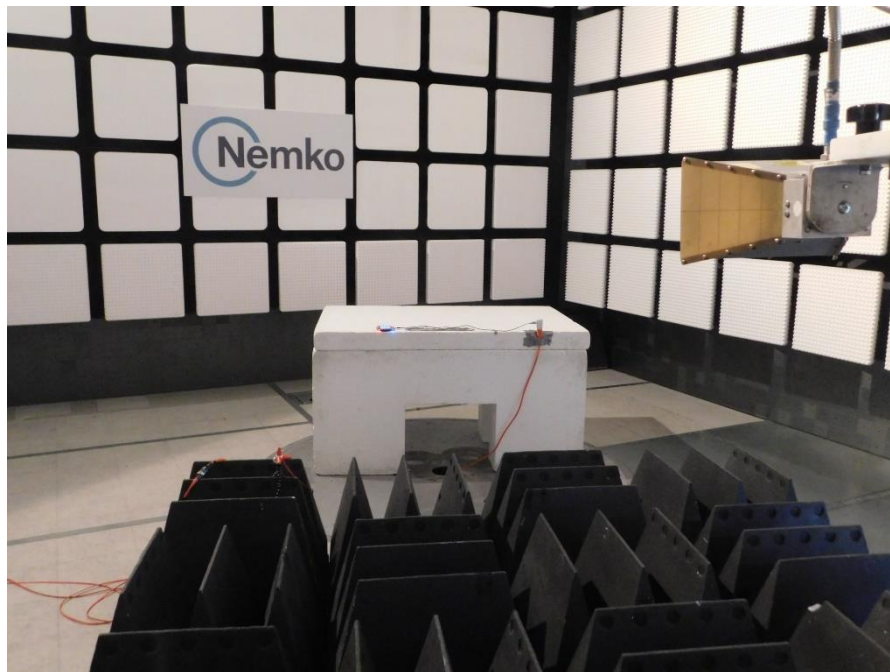


Figure 8.1-4: Continuous RF electromagnetic field disturbances, setup photo (spot test)

8.2 Power frequency magnetic field

8.2.1 References and limits

- EN 55035:2017
- EN 61000-4-8:2010

Table 8.2-1: Power frequency magnetic field specification

Test specification	Performance criterion
50 Hz, 1 A/m _{RMS}	A
Notes: Applicable only to equipment containing devices intrinsically susceptible to magnetic fields, such as CRT monitors, Hall effect elements, electro-dynamic microphones, magnetic field sensors or audio frequency transformers.	

8.2.2 Test summary

Verdict	Pass		
Tested by	Alvin Liu	Test date	December 2, 2020

8.2.3 Notes

None

8.2.4 Setup details

Table 8.2-2: Power frequency magnetic field equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Magnetic current loop	EMC Partner	MF1000-1	FA002986	1 year	December 5, 2020
AC Power source	Chroma	61609	FA003020	—	VOU
Notes: VOU - verify on use					

8.2.5 Test data

Table 8.2-3: Power frequency magnetic field results

Assessment time	5 minutes at each loop polarization
Signal frequency	50 Hz
Magnetic field test level	1 A/m
EUT power input during test	5 V _{DC} USB Powered
Loop polarization	Comments
Vertical (aligned with power line)	No degradation
Vertical (perpendicular to power line)	No degradation
Horizontal	No degradation
Notes: The EUT was arranged and connected to satisfy its functional requirements and was placed at the centre of the coil system (immersion method). Physically large products that could not be completely submerged in the magnetic field; only the sensitive devices (such as CRT monitors if they are the only sensitive parts were tested.	

8.2.6 Setup photo



Figure 8.2-1: Power frequency magnetic field setup photo

Section 9 EUT photos

9.1 External photos

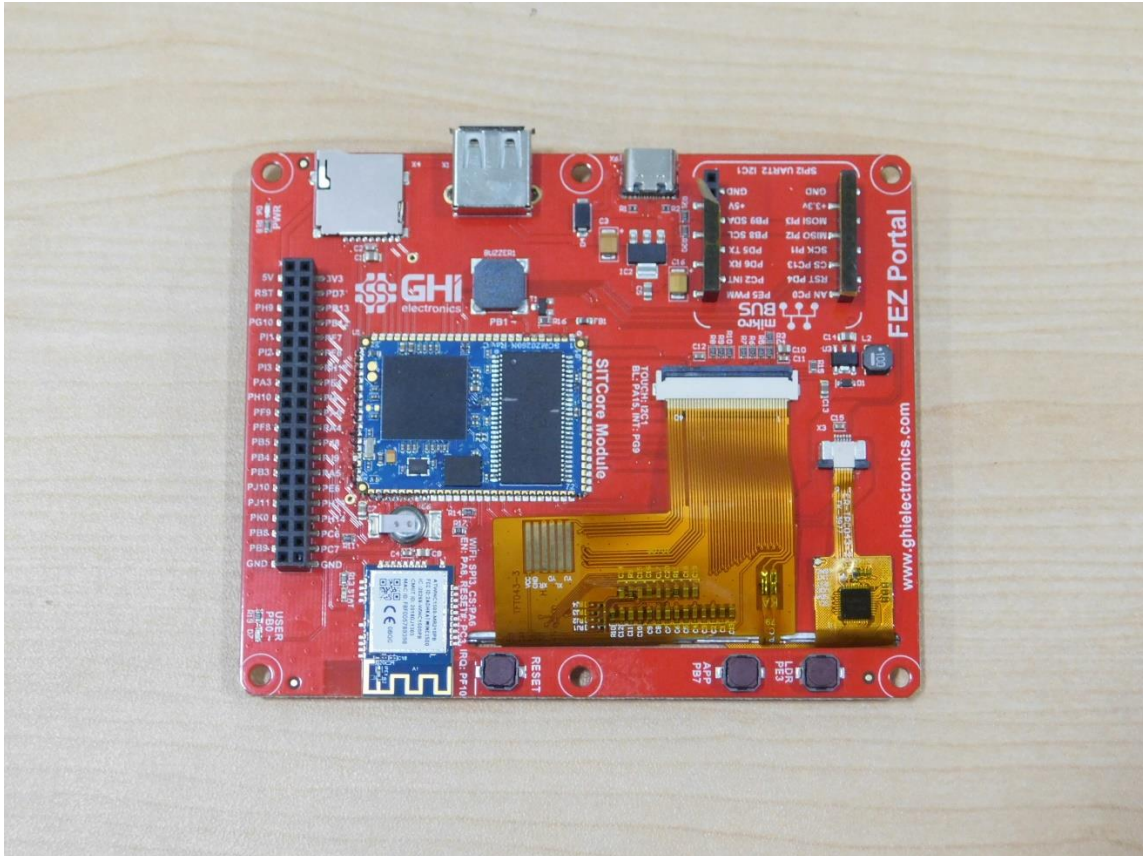


Figure 9.1-1: Top view photo

External photos continued



Figure 9.1-2: Bottom view photo

External photos continued



Figure 9.1-3: Side view photo

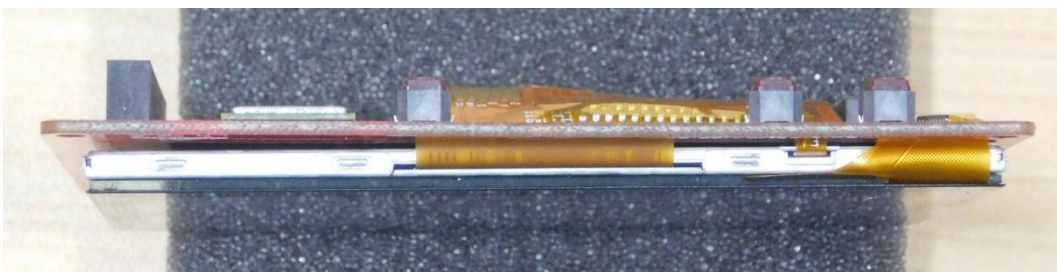


Figure 9.1-4: Side view photo



Figure 9.1-5: Side view photo



Figure 9.1-6: Side view photo

End of the test report