

EMC TEST REPORT – 407245-2TRFEMC

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

Specifications:

◆ EN 55032:2012/AC:2013

Date of issue: December 10, 2020

Alvin Liu, EMC/RF Specialist

Tested by

Fahar A Sukkoor, EMC/RF Specialist

Reviewed by



Signature



Signature

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The tests included in this report are within the scope of this accreditation

Lab locations

Company name	Nemko Canada Inc.			
Facilities	Ottawa site:	Montréal site:	Cambridge site:	Almonte site:
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	Ottawa, Ontario	Pointe-Claire, Québec	Cambridge, Ontario	West Carleton, Ontario
	Canada	Canada	Canada	Canada
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Test site registration	Organization	Recognition numbers and location		
	FCC/ISED	FCC: CA2040; IC: 2040A-4 (Ottawa/Almonte); FCC: CA2041; IC: 2040G-5 (Montreal); CA0101 (Cambridge)		
Website	www.nemko.com			

Limits of responsibility

Note that this report's results 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 this report.

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

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Section 1 Report summary

1.1 Test specifications

EN 55032:2012/AC:2013

Electromagnetic compatibility of multimedia equipment – Emission 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.

Applicant claims all models are variants of one another.

All models were prescanned on radiated emission test, worst case emissions model FEZ Portal was identified and went through full test program.

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 present document, the nominal voltage shall be the declared voltage, or any of the stated 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.

Table 4.1-1: Measurement uncertainty calculations

Measurement		U_{CISPR} dB	U_{lab} dB			
			Ottawa	Montreal	Cambridge	Almonte
Conducted disturbance at AC mains and other port power using a V-AMN	(9 kHz to 150 kHz)	3.8	2.9	2.8	2.8	N/A
	(150 kHz to 30 MHz)	3.4	2.3	2.2	2.2	N/A
Conducted disturbance at telecommunication port using AAN	(150 kHz to 30 MHz)	5.0	4.3	4.3	4.3	N/A
Conducted disturbance at telecommunication port using CVP	(150 kHz to 30 MHz)	3.9	2.9	2.8	2.8	N/A
Conducted disturbance at telecommunication port using CP	(150 kHz to 30 MHz)	2.9	1.4	1.1	1.1	N/A
Conducted disturbance at telecommunication port using CP and CVP	(150 kHz to 30 MHz)	4.0	3.1	3.0	3.0	N/A
Disturbance power	(30 MHz to 300 MHz)	4.0	3.7	3.7	3.7	N/A
Radiated disturbance (electric field strength at an OATS or in a SAC)	(30 MHz to 1 GHz)	6.3	5.7	5.5	5.5	5.5
Radiated disturbance (electric field strength in a FAR)	(1 GHz to 6 GHz)	5.2	4.8	5.1	4.8	N/A
Radiated disturbance (electric field strength in a FAR)	(6 GHz to 18 GHz)	5.5	5.1	5.0	4.7	N/A

Notes: Compliance assessment:

If U_{lab} is less than or equal to U_{CISPR} then:

- compliance is deemed to occur is no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{CISPR} then:

- compliance is deemed to occur is no measured disturbance level, increased by $(U_{\text{lab}} - U_{\text{CISPR}})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{\text{lab}} - U_{\text{CISPR}})$, exceeds the disturbance limit

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 within this section and its impact 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

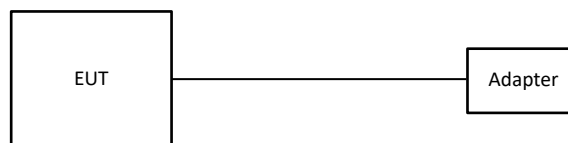


Figure 5.4-1: Block diagram

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 1, 2020

6.3 Sample information

Receipt date October 1, 2020 Nemko sample ID number 4072450017

6.4 Test results

Table 6.4-1: Result summary for Class B equipment

Standard	Clause	Test description	Verdict
EN 55032:2012/AC:2013	A4.2	Radiated emissions at frequencies up to 1 GHz measured at 3 m distance	Pass
EN 55032:2012/AC:2013	A5.1 and A5.2	Radiated emissions at frequencies above 1 GHz measured at 3 m distance	Pass
EN 55032:2012/AC:2013	A9.1 and A9.2	Conducted emissions from AC mains power ports	Not applicable ¹

Notes: ¹The EUT is DC powered, without a dedicated AC/DC adapter.

Section 7 Terms and definitions

7.1 Product classifications and definitions

7.1.1 EN 55032 – Equipment classification

Equipment classification	Equipment intended primarily for use in a residential environment shall meet the Class B limits. All other equipment shall comply with the Class A limits. Broadcast receiver equipment is class B equipment. The user documentation and/or manual shall contain details of any special measures required to be taken by the purchaser or user to ensure EMC compliance of the EUT with the requirements of this publication (EN 55032). One example would be the need to use shielded or special cables. Class A equipment shall have the following warning in the instructions for use to inform the user of the risk of operating this equipment in a residential environment: Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment, this equipment may cause radio interference.
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7.2 General definitions

7.2.1 Equipment type

Multimedia Equipment (MME)	Equipment that is information technology equipment, audio equipment, video equipment, broadcast receiver equipment, entertainment lighting control equipment or combinations of these.
Information technology equipment [ITE]	Equipment having a primary function of either (or a combination of) entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer. Examples include data processing equipment, office machines, electronic business equipment and telecommunication equipment.
Audio equipment	Equipment which has a primary function of either (or a combination of) generation, input, storage, play, retrieval, transmission, reception, amplification, processing, switching or control of audio signals
Video equipment	Equipment which has a primary function of either (or a combination of) generation, input, storage, display, play, retrieval, transmission, reception, amplification, processing, switching, or control of video signals.
Broadcast receiver equipment	Equipment containing a tuner that is intended for the reception of broadcast services These broadcast services are typically television and radio services, including terrestrial broadcast, satellite broadcast and/or cable transmission.
Entertainment lighting control equipment	Equipment generating or processing electrical signals for controlling the intensity, color, nature or direction of the light from a luminaire, where the intention is to create artistic effects in theatrical, televisual or musical productions and visual presentations.

General definitions, continued

7.2.2 Port type

AC mains power port	Port used to connect to the mains supply network - Equipment with a DC power port which is powered by a dedicated AC/DC power converter is defined as AC mains powered equipment
Antenna port	Port, other than a broadcast receiver tuner port (3.1.8), for connection of an antenna used for intentional transmission and/or reception of radiated RF energy.
Broadcast receiver tuner port	Port intended for the reception of a modulated RF signal carrying terrestrial, satellite and/or cable transmissions of audio and/or video broadcast and similar services - This port may be connected to an antenna, a cable distribution system, a VCR or similar device.
DC network power port	Port, not powered by a dedicated AC/DC power converter and not supporting communication, that connects to a DC supply network. - Equipment with a DC power port which is powered by a dedicated AC/DC power converter is considered to be AC mains powered equipment. - DC power ports supporting communications are considered to be wired networks ports, for example Ethernet ports which include Power Over Ethernet (POE).
Enclosure port	Physical boundary of the EUT through which electromagnetic fields may radiate.
Optical fibre port	Port at which an optical fibre is connected to an equipment.
RF modulator output port	Port intended to be connected to a broadcast receiver tuner port in order to transmit a signal to the broadcast receiver.
Signal/control port	Port intended for the interconnection of components of an equipment under test, or between an equipment under test and local associated equipment and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it) - Examples include RS-232, Universal Serial Bus (USB), High-Definition Multimedia Interface (HDMI), IEEE Standard 1394 ("Fire Wire")
Wired network port	Point of connection for voice, data and signaling transfers intended to interconnect widely-dispersed systems by direct connection to a single-user or multi-user communication network (for example CATV, PSTN, ISDN, xDSL, LAN and similar networks) - These ports may support screened or unscreened cables and may also carry AC or DC power where this is an integral part of the telecommunication specification.

7.2.3 Definitions

Information technology equipment (ITE)	Any equipment: - Which has a primary function of either (or a combination of) entry, storage, display, retrieval, transmission, processing, switching, or control, of data and of telecommunication messages and which may be equipped with one or more terminal ports typically operated for information transfer; - With a rated supply voltage not exceeding 600 V. It includes, for example, data processing equipment, office machines, electronic business equipment and telecommunication equipment.
Telecommunications/network port	Point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks (e.g. public switched telecommunications networks (PSTN) integrated services digital networks (ISDN), x-type digital subscriber lines (xDSL), etc.), local area networks (e.g. Ethernet, Token Ring, etc.) and similar networks NOTE A port generally intended for interconnection of components of an ITE system under test (e.g. RS-232, IEEE Standard 1284 (parallel printer), Universal Serial Bus (USB), IEEE Standard 1394 ("Fire Wire"), etc.) and used in accordance with its functional specifications (e.g. for the maximum length of cable connected to it), is not considered to be a telecommunications/network port under this definition.

Section 8 Testing data

8.1 Radiated emissions

8.1.1 References and limits

- EN 55032:2012/AC:2013: Section A.2

Table 8.1-1: Requirements as per for radiated emissions for Class B

Facility	Frequency range [MHz]	Measurement		limits [dBμV/m]
		Distance [m]	Detector type/ bandwidth	
OATS/SAC	30–230	3	Quasi Peak/120 kHz	40.0
	230–1000			47.0
FSOATS	1000–3000	3	CAverage/1 MHz	50.0
	3000–6000			54.0
FSOATS	1000–3000	3	Peak/1 MHz	70.0
	3000–6000			74.0

- Notes:
- OATS – Open Area Test Site, SAC – Semi Anechoic Chamber, FSOATS – Free Space Open Area Test Site
 - Where there is a step in the applicable limit, the lower value was applied at the transition frequency.

8.1.2 Test summary

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

8.1.3 Notes

- The spectral plots within this section are a summation of vertical and horizontal scans. The spectral plots within this section have been corrected with all relevant transducer factors.
- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector. Additionally, where less than 6 measurements per detector have been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- The spectrum was scanned to 6 GHz according to the EUT highest digital operating frequency and radio operational frequencies.

Table 8.1-2: Maximum frequency test range based on the highest digital operating frequency

Highest internal frequency [F _x]	Highest measured frequency
F _x ≤ 108 MHz	1 GHz
108 MHz < F _x ≤ 500 MHz	2 GHz
500 MHz < F _x ≤ 1 GHz	5 GHz
F _x > 1 GHz	5 × F _x up to a maximum of 6 GHz (CISPR 32) 5 × F _x up to a maximum of 40 GHz (ANSI C63.4)

- Notes:
- Highest internal frequency [F_x] – highest fundamental frequency generated or used within the EUT or highest frequency at which it operates. This includes frequencies which are solely used within an integrated circuit.

8.1.4 Setup details

Port under test	Enclosure Port
EUT power input during test	5 V _{DC} USB-C Powered
EUT setup configuration	Table top
Test facility	Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1–4 m
Turntable position	0–360°
Measurement details	A preview measurement was generated with the receiver in continuous scan or sweep mode while the EUT was rotated and the antenna adjusted to maximize radiated emission. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings.

Resolution bandwidth	Measurements below 1 GHz: 120 kHz, Measurements above 1 GHz: 1 MHz
Video bandwidth	Measurements below 1 GHz: 300 kHz, Measurements above 1 GHz: 3 MHz
Detector mode	Measurements below 1 GHz: Peak (Preview), Quasi-peak (Final) Measurements above 1GHz: Peak (Preview), Peak and CAverage (Final)
Trace mode	Max Hold
Measurement time	100 ms

Table 8.1-3: Radiated emissions equipment list

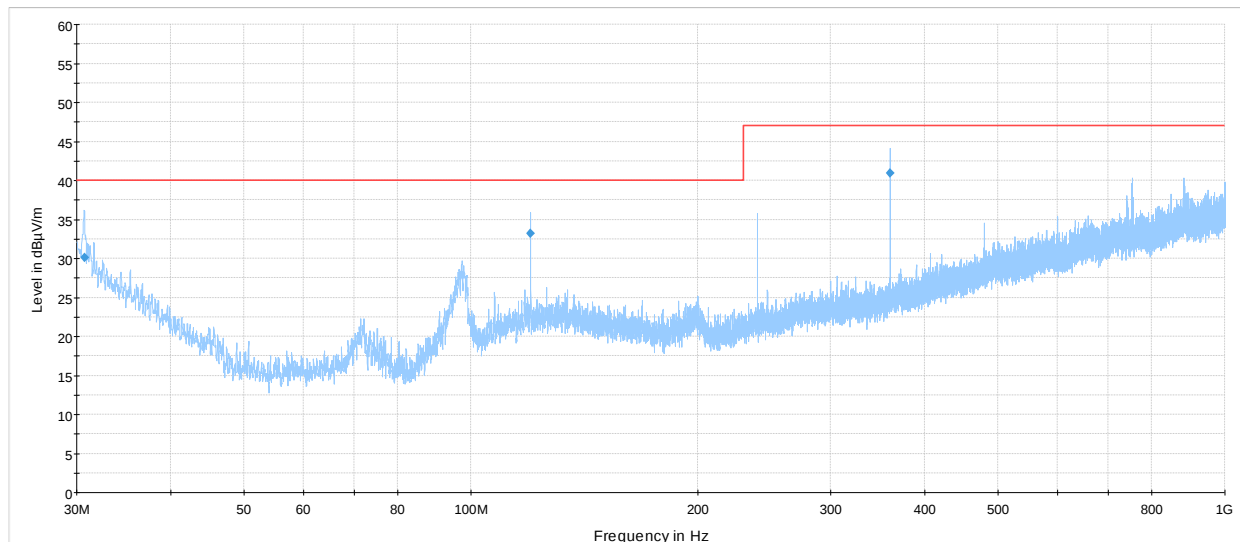
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	November 12, 2021
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	April 10, 2021
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
Bilog antenna (30–2000 MHz)	SUNAR	JB1	FA003010	1 year	March 17, 2021
Horn antenna (1–18 GHz)	ETS Lindgren	3117	FA002911	1 year	March 11, 2021
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002956	1 year	March 26, 2021

Notes: NCR - no calibration required

Table 8.1-4: Radiated emissions test software details

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

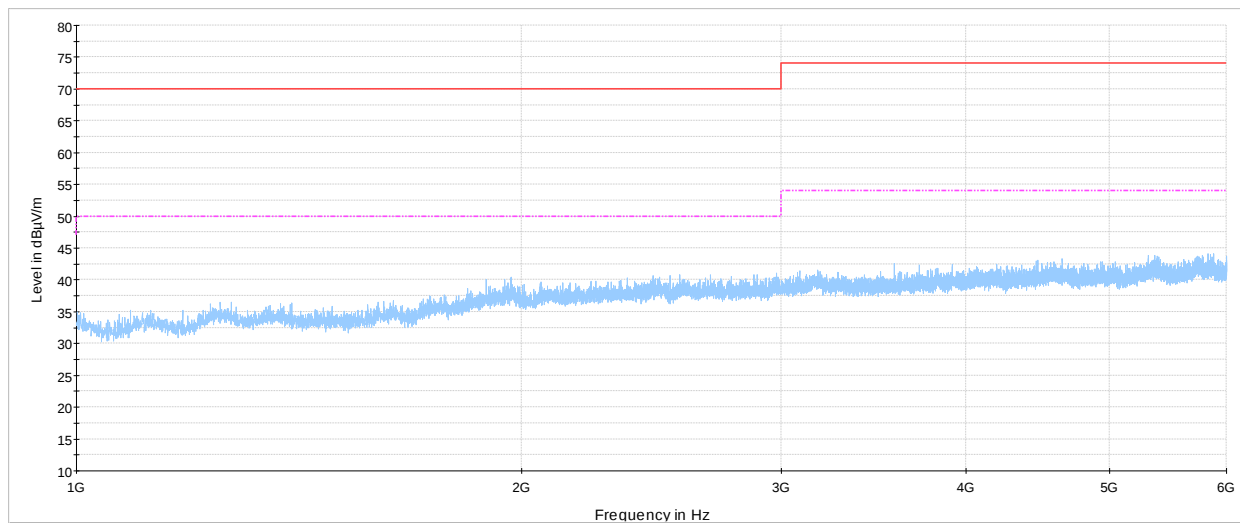
8.1.5 Test data



NEX-407245 Radiated Emissions 30-1000 MHz #17

Preview Result 1-PK+
 CISPR 32 Limit - Class B, Quasi-Peak, 3 m
 Final_Result QPK

Figure 8.1-1: Radiated emissions spectral plot (30 to 1000 MHz)



NEX-407245 Radiated Emissions 1-6 GHz #17

Preview Result 1-PK+
 CISPR 32 Limit - Class B, Peak, 3 m
 CISPR 32 Limit - Class B, Average, 3 m

Figure 8.1-2: Radiated emissions spectral plot (1 to 6 GHz)

Test data continued

Table 8.1-5: Radiated emissions results

Frequency (MHz)	Quasi-Peak field strength ^{1 and 3} (dBμV/m)	Quasi-Peak limit (dBμV/m)	Quasi-Peak margin (dB)	Correction factor ² (dB)
30.729	30.1	40.0	9.9	24.6
119.995	33.2	40.0	6.8	18.7
359.997	40.9	47.0	6.1	20.2

Notes: ¹ Field strength (dBμV/m) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)
² Correction factor = antenna factor ACF (dB) + cable loss (dB) – amplifier gain (dB)
³ Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Sample calculation: 30.1 dBμV/m (field strength) = 5.5 dBμV (receiver reading) + 24.6 dB (Correction factor)

8.1.6 Setup photos



Figure 8.1-3: Radiated emissions setup photo – below 1 GHz

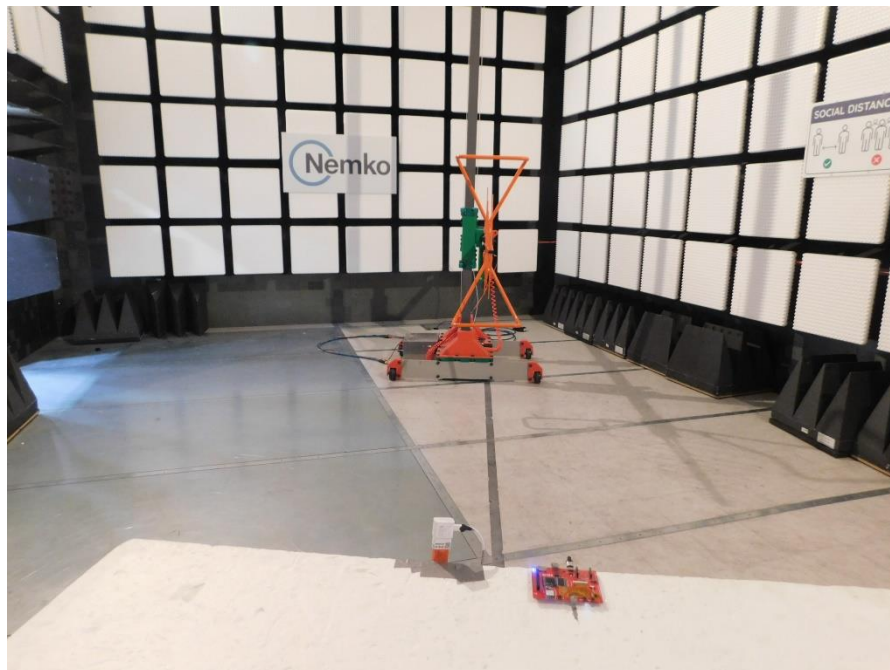


Figure 8.1-4: Radiated emissions setup photo – below 1 GHz

Setup photos continued

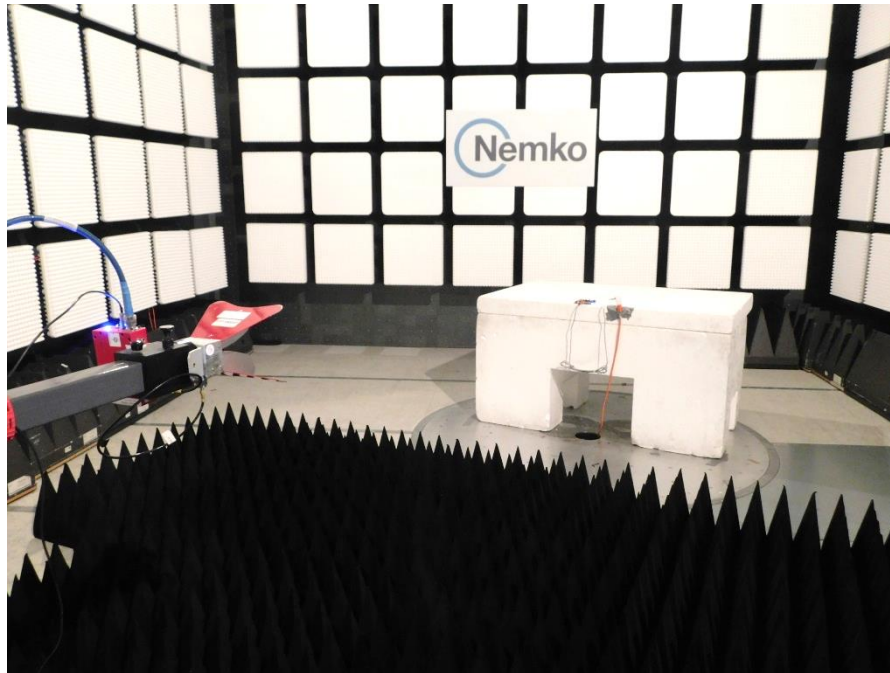


Figure 8.1-5: Radiated emissions setup photo – above 1 GHz

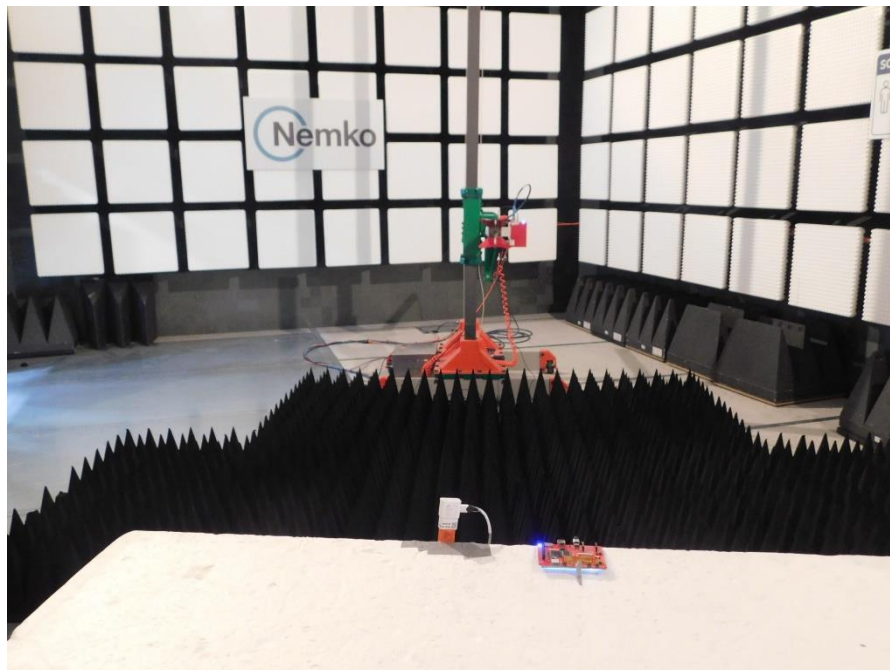


Figure 8.1-6: Radiated emissions setup photo – above 1 GHz

Section 9 EUT photos

9.1 External photos

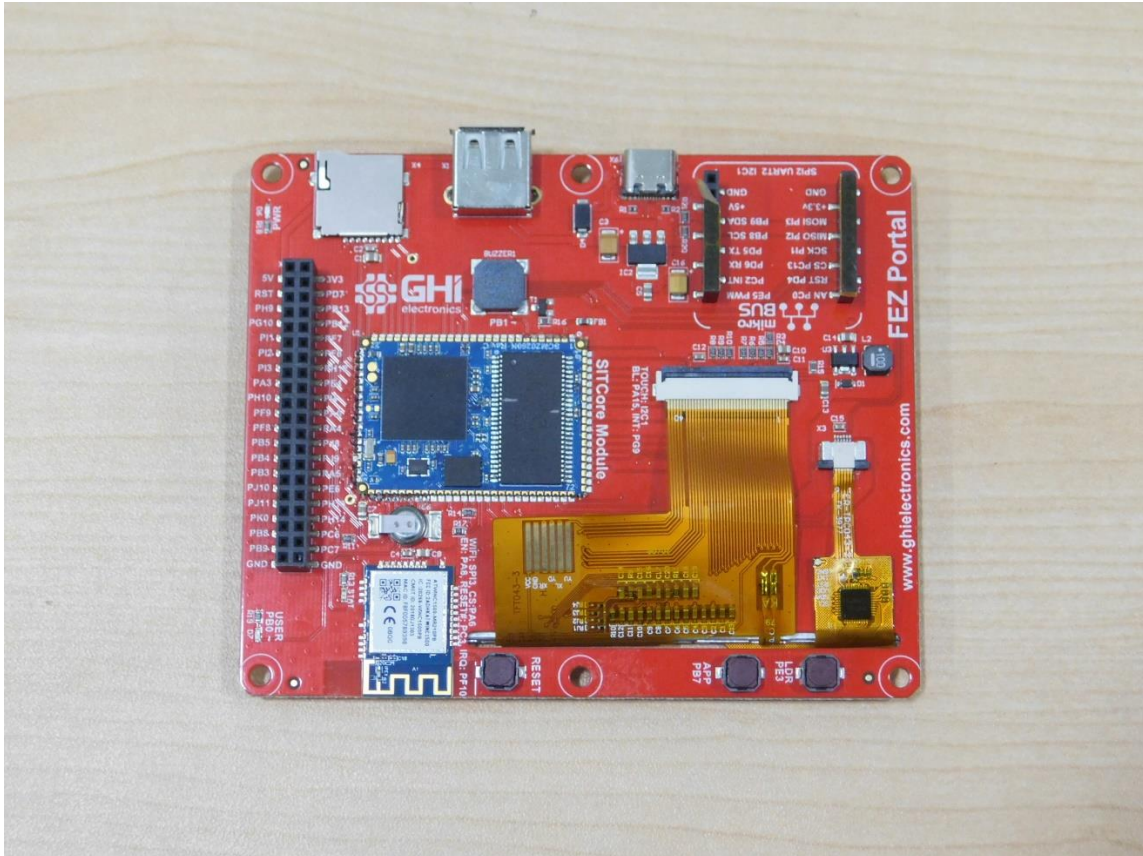


Figure 9.1-1: Top view photo

External photos continued



Figure 9.1-2: Bottom view photo

External photos continued



Figure 9.1-3: Side view photo

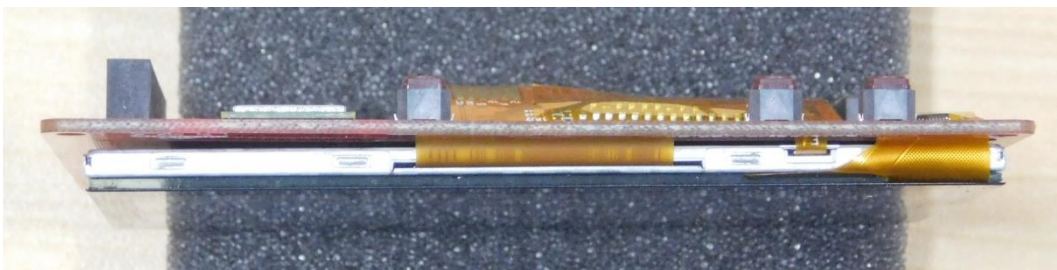


Figure 9.1-4: Side view photo



Figure 9.1-5: Side view photo



Figure 9.1-6: Side view photo

End of the test report