

StarSOM-6ULL EM Radiation Test

Revision 1.0, 8/2023



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Document Revision History

Revision	Date	Notes
1.0	25.08.2023	Initial

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1. Introduction

This document presents the StarSOM-6ULL family modules EM emission/radiation tests, held at the precompliance SoMLabs EMC test lab.

Performed tests checked compatibility of EUT with emission requirements defined in standard EN 55032 class B (CISPR 32) in simulated open space environment (OATS) with 3 meters antenna distance.

Full test consists of three emission measurements in X, Y and Z axes and recalculation of the results of the obtained measurements according to the formula included in EN 55032 (CISPR 32) standard.

2. Tested hardware

Test covered StarSOM-6ULL in the most extensive hardware configurations (as on picture below):

SLS06Y2_xxxC_yyyR_zzGE_qqq_r

Where:

xxx – means 528 MHz, 792 MHz or 900 MHz

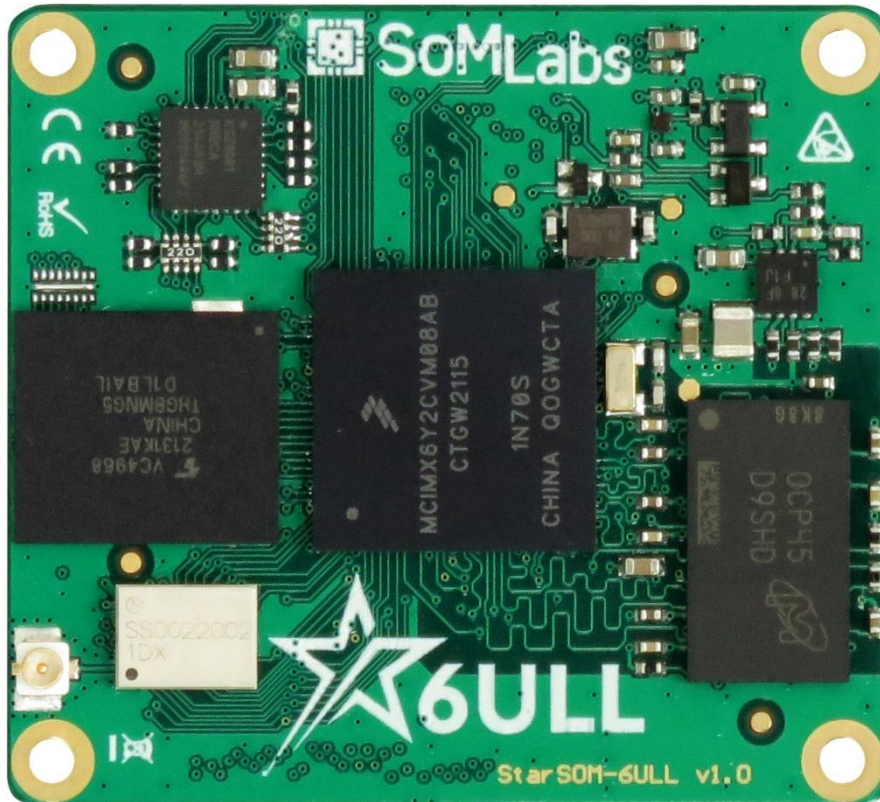
yyy – means 64, 128, 256 or 512 MB

zz – means 04, 08, 16 or 32

qqq – means 0SF, 1WB, 2ET or 3 WE (SoM is tested with RF module switched off)

r – means I, E or C

Measurements were made on the module SLS06Y2_792C_512R_08GE_3WE_E (hardware v1.0).



For testing purposes was prepared dedicated Linux system image with simple application using UART transmitters (*StarSOM-6ULL-EMC-tester-full-UART* for eMMC memory).

3. Test equipment

3.1. Standard measurements devices

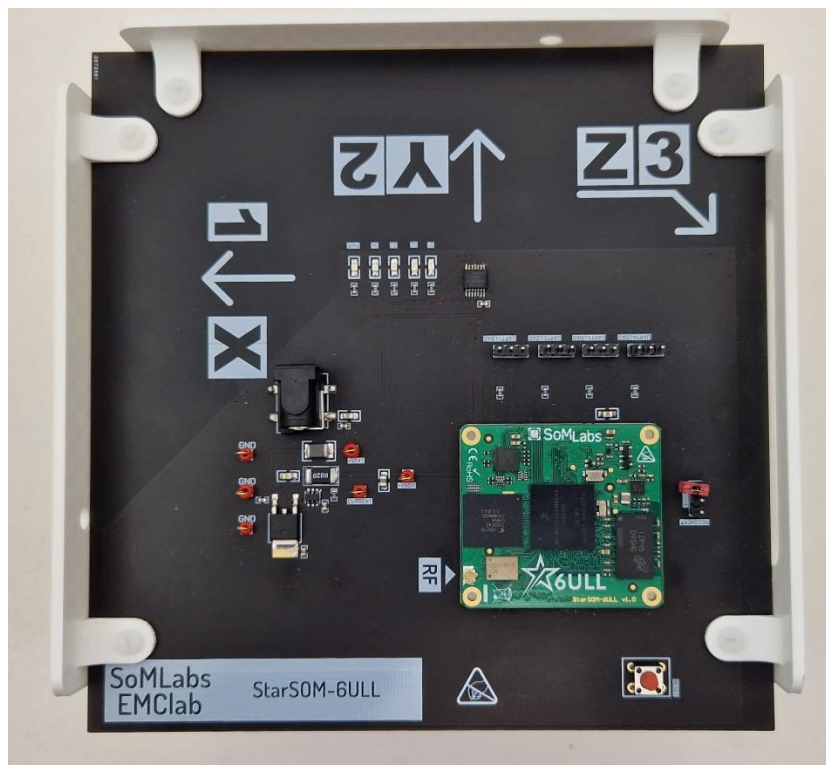
Test item	Radiated emission below 1GHz and 1-3GHz range			
Instrument	Manufacturer	Model	Serial No.	Calibration date
Spectrum analyzer	Rohde & Schwarz	FPL1003 B22, K54	102103	4.2023
CISPR32 Standarization Software	Astat	V.12/2022	-	-
GTEM chamber	Astat	GTEM250	1000007	3.2023
Coaxial cable	Bruel & Kjaer	AO-0015	23621	7.2023
Analog power supply	Korad	KA3005D	-	-

3.2. Dedicated measurement items

For the correct performance of measurements, it was necessary to develop two dedicated elements:

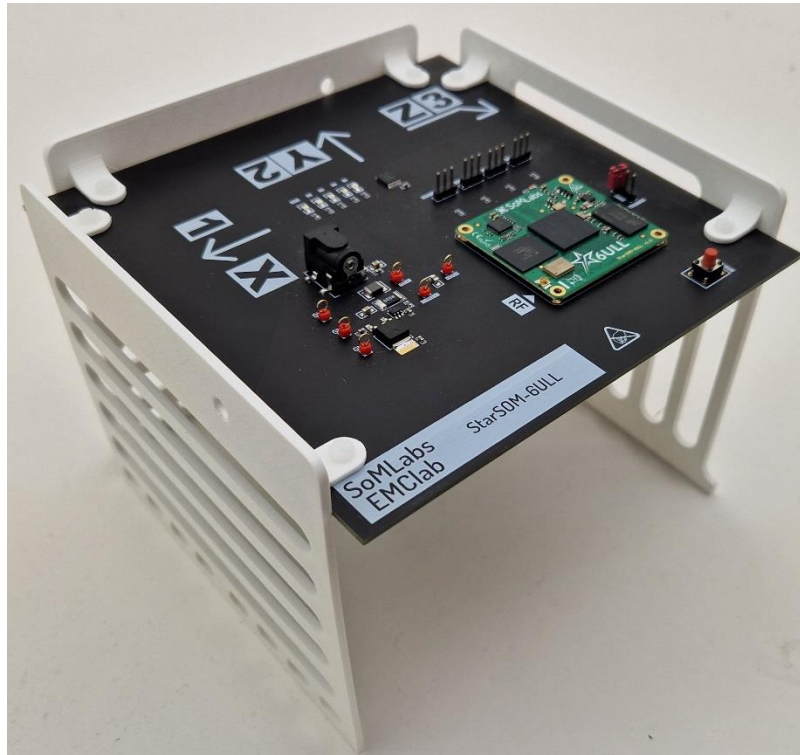
- carrier board for SoM module with basic peripherals and power supply monitor,
- mechanical stand ensuring correct module positioning inside of GTEM chamber.

Dedicated carrier board (internally called BLACK) with mounted SoM is shown on picture below.



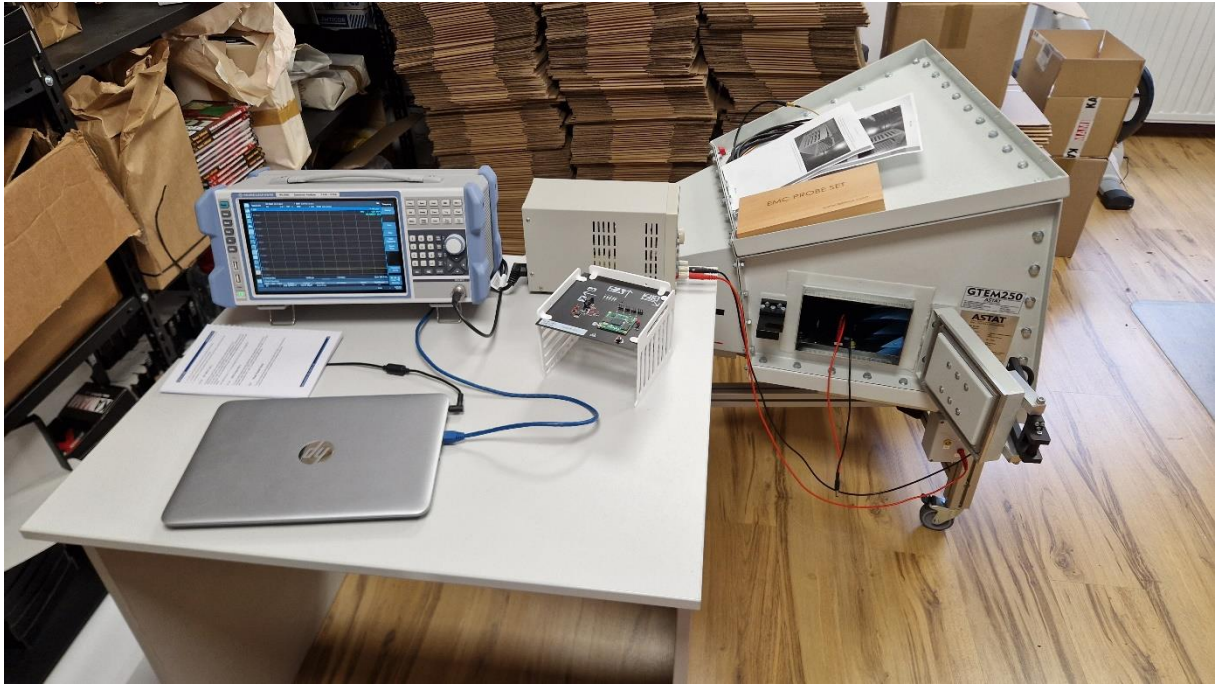
Because of testing method base on three emission measurements in X, Y and Z axes and recalculation of the results of the obtained measurements according to the formula included in EN 55032 (CISPR 32)

standard, dedicated stand was developed and produced using 3D printer as on picture below. The reference mechanical base is permanently glued inside of GTEM250 chamber.



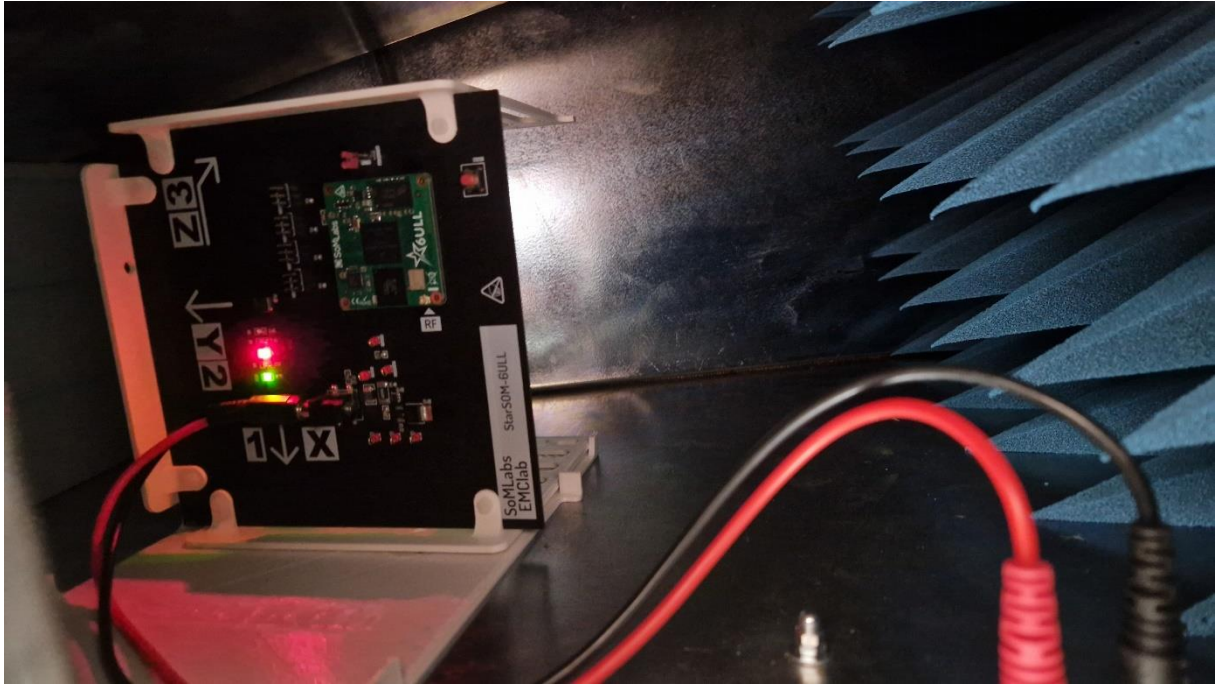
4. Measurement setup

The general view of the measuring station with the instruments used for measurements is presented below.

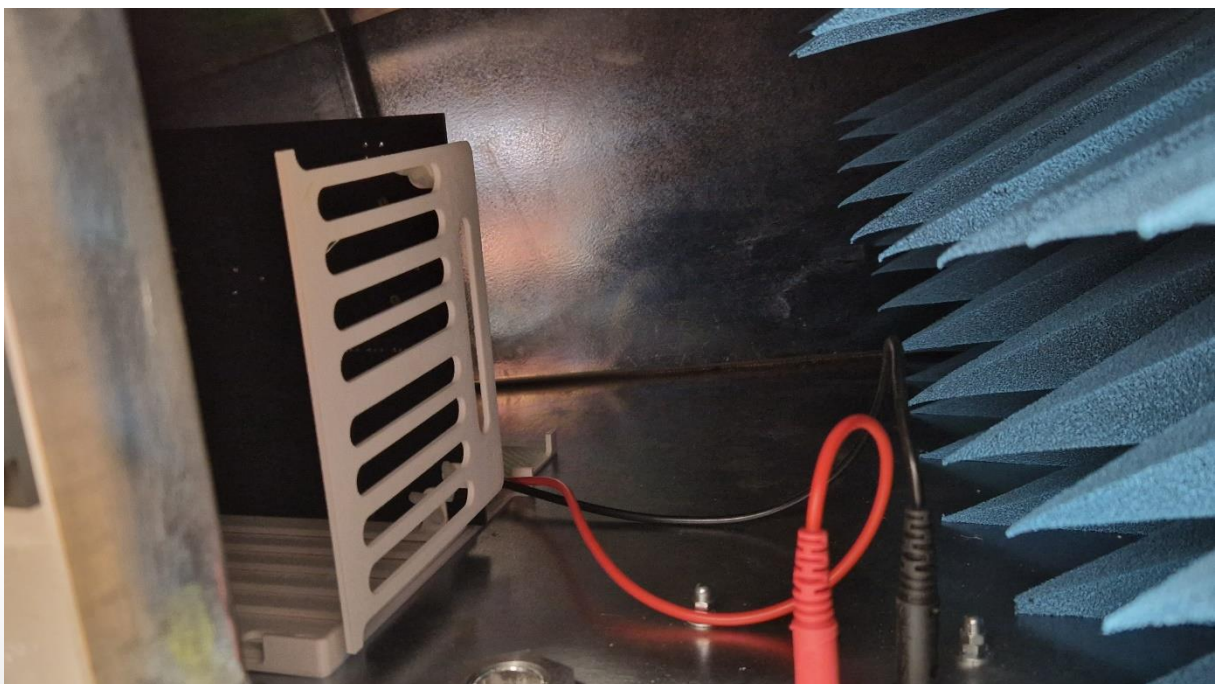


5. Test procedure

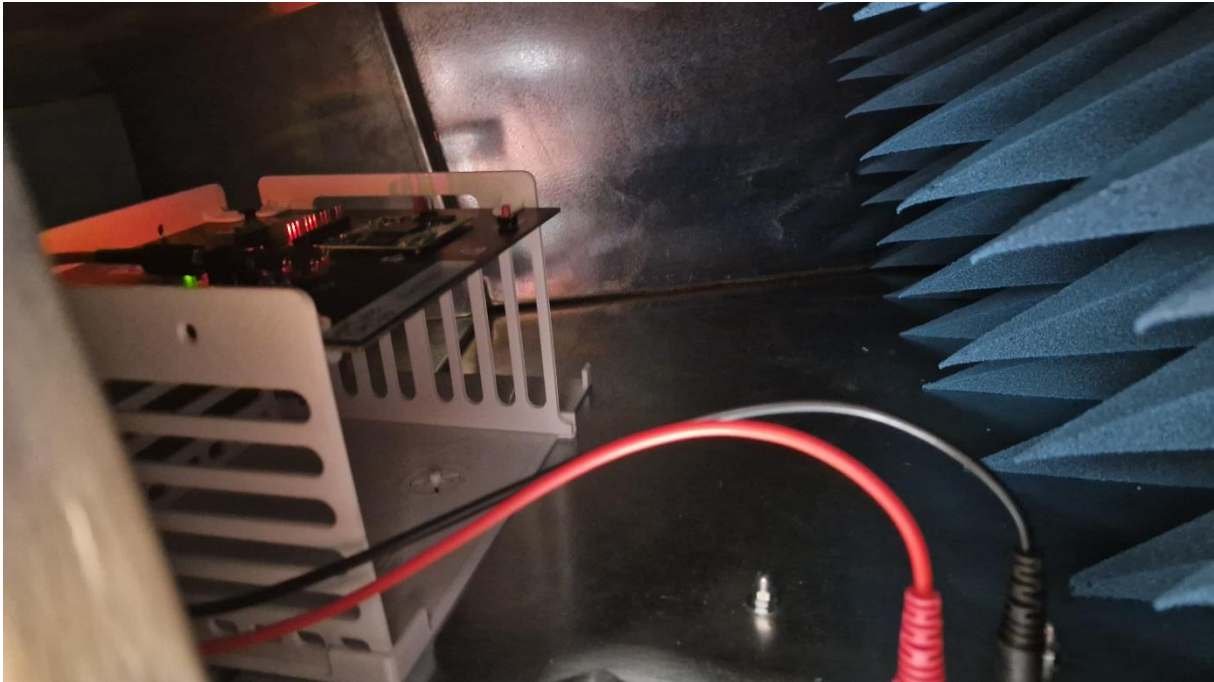
1. Spectrum analyzer was warmed up for 30 minutes since power supply on.
2. Power supply (+5V/250mA) was connected to GTEM filter.
3. The EUT was installed on BLACK testing carrier board
4. The ASTAT GTEM program was started and configured.
5. Power cables were attached to the connectors: mounted on carrier board and internal in GTEM (filtered).
6. The EUT installed on BLACK carrier board was mounted on a dedicated stand inside of GTEM in position 1 (X) – as on picture below.



7. First measurement was started from ASTAT GTEM menu (for X axis).
8. After completing the first measurement, position of EUT with BLACK carrier board was changed to position 2 (Y) – as on picture below.



9. Second measurement was started from ASTAT GTEM menu (for Y axis).
10. After completing the second measurement, position of EUT with BLACK carrier board was changed to position 3 (Z) – as on picture below.



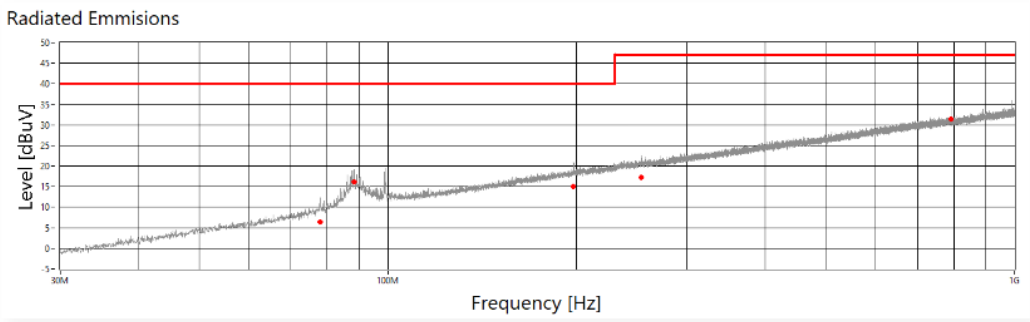
11. Third measurement was started from ASTAT GTEM menu (for Z axis).
12. After completing the third measurement, ASTAT software calculates correlated results.

6. Results

6.1. Results for 30MHz-1GHz frequency range (quasi-peak)



StarSOM-6ULL-full-UART-QP	
Operator	Andrzej Gawryluk
EUT	StarSOM-6ULL-noWiFi
Uwagi	Firmware: StarSOM-6ULL-EMC-tester-full-UART
Nazwa Firmy	SoMLabs
Limit	55032 30M-1G klasa B 3m QP
Symulowany dystans	3m



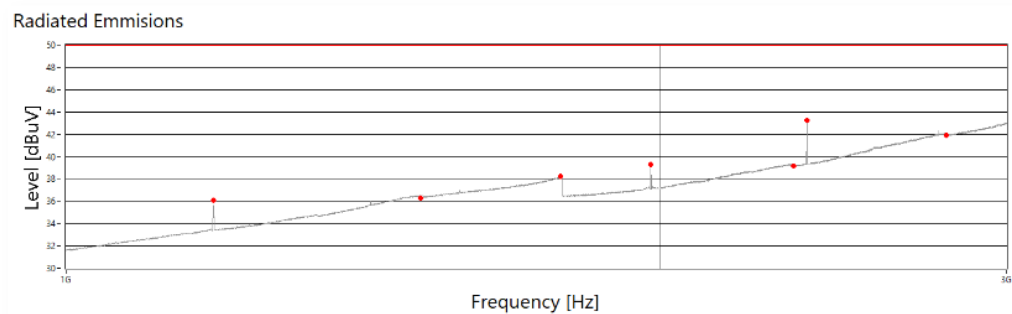
Final Scan Correlated Data

LP	Frequency[Hz]	Level[dBuV/m]	Limit[dBuV/m]	Difference[dBm]	Detector	RBW[Hz]	Pass/Failed
1	77,94M	6,47	40,00	33,53	QP	120k	pass
2	88,26M	16,17	40,00	23,83	QP	120k	pass
3	197,88M	15,03	40,00	24,97	QP	120k	pass
4	253,92M	17,22	47,00	29,78	QP	120k	pass
5	792,00M	31,49	47,00	15,51	QP	120k	pass

6.2. Results for 1-3GHz frequency range (average)



StarSOM-6ULL-full-UART-AVG	
Operator	Andrzej Gawryluk
EUT	StarSOM-6ULL-noWiFi
Uwagi	Firmware: StarSOM-6ULL-EMC-tester-full-UART
Nazwa Firmy	SoMLabs
Limit	55032 1G-3G klasa B 3m AV
Symulowany dystans	3m



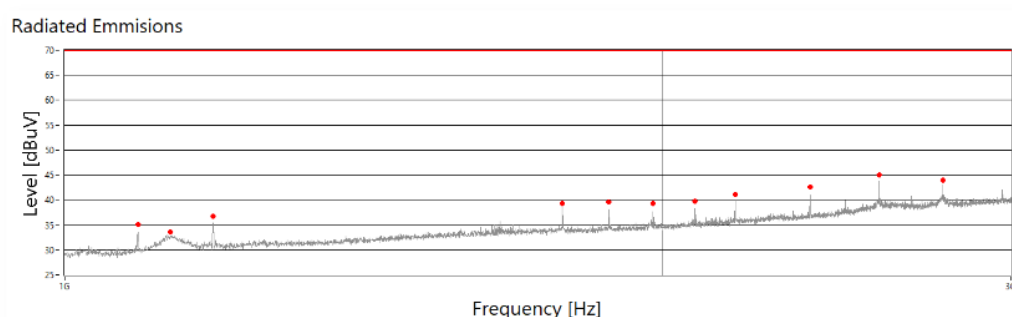
Final Scan Correlated Data

LP	Frequency[Hz]	Level[dBuV/m]	Limit[dBuV/m]	Difference[dBm]	Detector	RBW[Hz]	Pass/Failed
1	1,19G	36,12	50,00	13,88	AVG	1M	pass
2	1,51G	36,29	50,00	13,71	AVG	1M	pass
3	1,78G	38,22	50,00	11,78	AVG	1M	pass
4	1,98G	39,31	50,00	10,69	AVG	1M	pass
5	2,34G	39,17	50,00	10,83	AVG	1M	pass
6	2,38G	43,27	50,00	6,73	AVG	1M	pass
7	2,80G	41,93	50,00	8,07	AVG	1M	pass

6.3. Results for 1-3GHz frequency range (peak)



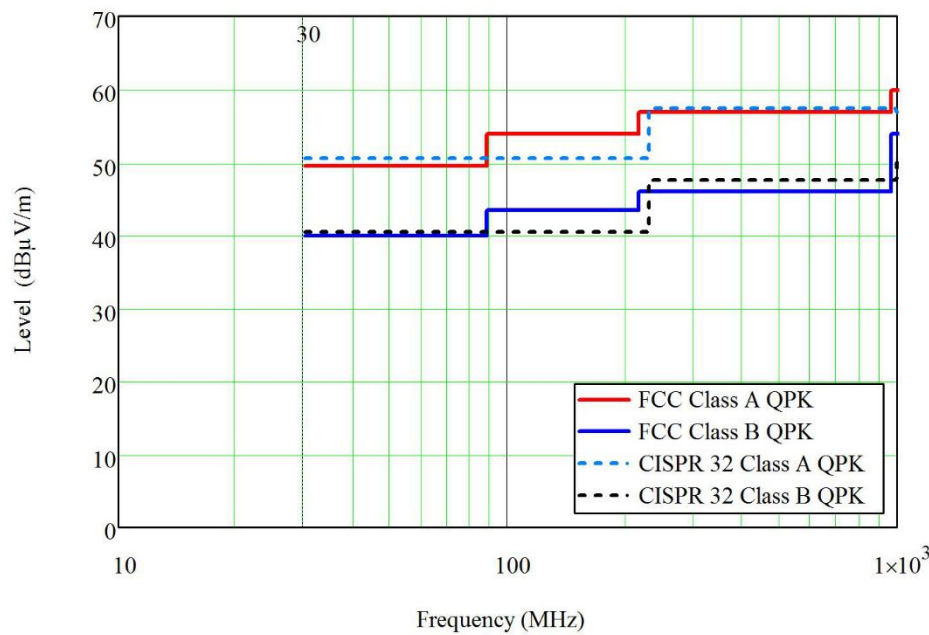
StarSOM-6ULL-full-UART-PK	
Operator	Andrzej Gawryluk
EUT	StarSOM-6ULL-noWiFi
Uwagi	Firmware: StarSOM-6ULL-EMC-tester-full-UART
Nazwa Firmy	SoMLabs
Limit	55032 1G-3G klasa B 3m PK
Symulowany dystans	3m



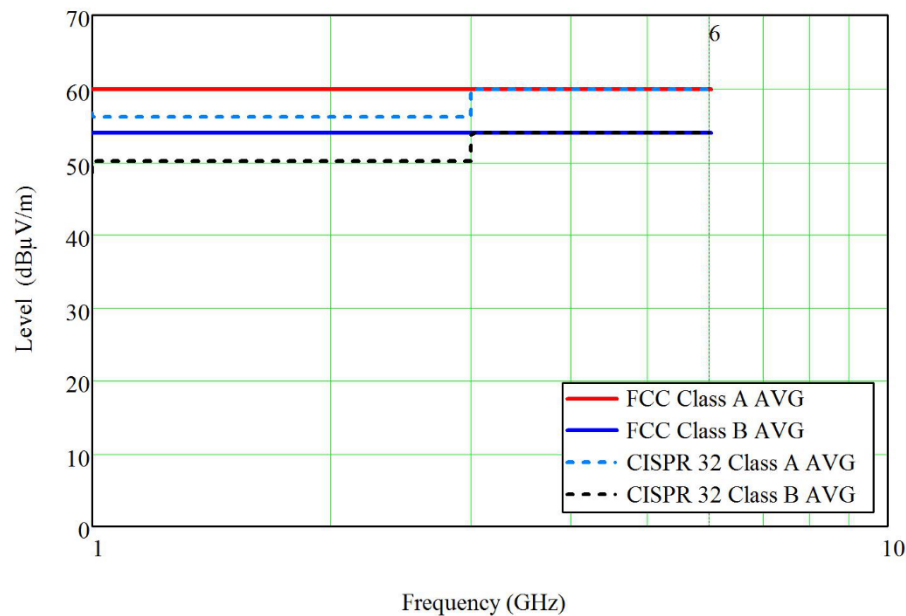
Final Scan Correlated Data

LP	Frequency[Hz]	Level[dBuV/m]	Limit[dBuV/m]	Difference[dBm]	Detector	RBW[Hz]	Pass/Failed
1	1,09G	35,09	70,00	34,91	PK	1M	pass
2	1,13G	33,58	70,00	36,42	PK	1M	pass
3	1,19G	36,78	70,00	33,22	PK	1M	pass
4	1,78G	39,31	70,00	30,69	PK	1M	pass
5	1,88G	39,53	70,00	30,47	PK	1M	pass
6	1,98G	39,34	70,00	30,66	PK	1M	pass
7	2,08G	39,77	70,00	30,23	PK	1M	pass
8	2,18G	41,07	70,00	28,93	PK	1M	pass
9	2,38G	42,56	70,00	27,44	PK	1M	pass
10	2,57G	45,01	70,00	24,99	PK	1M	pass
11	2,77G	43,99	70,00	26,01	PK	1M	pass

6.4. Reference charts



CISPR 32/FCC radiated limits for Class A and Class B in frequency range up to 1 GHz



CISPR 32/FCC radiated limits for Class A and Class B in frequency range above 1 GHz

7. Summary

The conducted and documented measurements confirm that the tested modules fully meet the requirements of EN 55032 class B (CISPR 32) emission standard.

8. Limitation on Liability

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