LGAI Technological Center, S.A. (APPLUS)
Campus de la UAB. Ronda de la Font del Carme, s/n.
08193 Bellaterra (Barcelona) (Spain)
T +34 93 567 20 00 / F +34 93 520 20 01
www.appluslaboratories.com

File Number **25/36402722**

TEST REPORT
Electromagnetic Compatibility

Petitioner's Reference:	LIBELIUM		
Company Address:	Avenida María Zambrano, 31. Edificio WTC - Torre Este Planta 7 CP 50018 Zaragoza.		
Represented by:	Yuri Carmona		
Equipment:	SMART SPOT AIR 4G		
Brand:	LIBELIUM	PMN:	AIR 4G
Sample #1:	-	Applus Id:	31172-000001
Result:	**complies**		
It has been tested and complies with the applicable standard. See test result summary section.			
Applicable Standard:			
EMC standard/s:	**FCC 47 CFR Part 15 Subpart B (October 2024)[1]** **ICES-003 Issue 7 – 2020 (updated October 2020)**		
[1]The latest modifications of the standard, published at the date of the tests reported in this document, have been considered.			
Dates and Test Site:	Applus Barcelona, Bellaterra		
Equipment Reception Date	March 11, 2025		
Test Initial Date:	March 19, 2025		
Test Final Date:	October 7, 2024		

Test Manager: David Camacho Gómez
Date of issue: Bellaterra, June 26, 2025

JOSE MANUEL SUAREZ ROMAN
Firmado digitalmente por JOSE MANUEL SUAREZ ROMAN
Fecha: 2025.06.27 15:15:20 +02'00'

EMC & Wireless Technical Manager
Electrical and Electronics
LGAI Technological Center S.A.

ENSAYO ISO 17025 Nº9 / LE894

The results refer only and exclusively to the sample, product or material delivered for testing, and tested under conditions stipulated in this document. The equipment has been tested under conditions stipulated by standard(s) quoted in this document. This document will not be reproduced otherwise than in full.
This is the first page of the document, which consists of 43 pages.

1 TEST RESULTS SUMMARY

Test Description	Sample #	DUT Test Modes	Req. Criteria	Results	Criteria Note
RADIO-FREQUENCY RADIATED EMISSIONS (FCC Part 15.109, ICES-003 Issue 7 (3.2.2))	#1	Mode 1	CLASS A[1]	PASS	CN3
POWER LINE CONDUCTED EMISSIONS (FCC Part 15.107, ICES-003 Issue 7 (3.2.1))	#1	Mode 1	CLASS A[1]	PASS	CN4

Note 1: According to customer, the emission test was tested by Class A limits.

The test results are shown in detail on the following pages.

The criteria to give conformity in those cases where it is not implicit in the standard or specification will be, for EMC emissions tests, a non-simple binary decision rule will be followed with a safety zone equal to the value of the uncertainty (w = U).

In this case, the upper limit of the value of the probability of false acceptance, according to ILAC G8, is 2.5 % and the criteria notes are:
CN1: The measured results are above the upper limit, even considering the uncertainty interval.
CN2: The measured results are above the specified limits, but within the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the results indicate that non-compliance is more probable than compliance.
CN3: The measured results are below the specified limits, but within the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the results indicate that compliance is more probable than non-compliance.
CN4: The measured results are within the limits, including the uncertainty interval.

2 INDEX

3 GENERAL DESCRIPTION OF TEST ITEMS

3.1 EQUIPMENT DESCRIPTION

This information has been provided by the customer and it is not covered by the accreditation. LGAI does not assume any responsibility from it.

EQUIPMENT DESCRIPTION							
Description	The Smart Spot Air 4G is a Libelium IoT device designed for air quality monitoring solutions, which allows the integration of gas and suspended particle sensors, temperature, humidity, and noise, and uses 4G for communication.						
EUT Version	**SW Version**			**HW Version**			
	V1.3.0			V2.3			
Power supply	AC		1 PH + N		230 V		50 Hz
Applicability	**Fixed Equipment**		**Vehicular Equipment**		**Portable Equipment**		
	☒		☐		☐		
Equipment Size	**Length**		**Width**		**Height**		
	271 mm		170 mm		90 mm		
Maximum internal frequency	**Maximum internal frequency** >108 MHz						

Table 1: Equipment description

I/O CABLES						
	Port #	**Name**	**Type**	**Cable length**	**Cable Shielded**	**Comments**
Description	1	Mains	AC/DC	> 3 m	Yes	Provided by customer
	2	Communications	ETH.	< 3 m	Yes	Provided by customer

Table 2: Input/output ports description

RF FEATURES					
	Communication Technology	**Radio Chipset**	**Brand**	**Module Model**	**Antenna Peak Gain**
Description	Wi-Fi 2.4 GHz	ESP32-D0WD	ESPRESSIF SYSTEMS	ESP32-WROVER-1	4.05 dBi
	Cellular	Qualcomm MDM9607	SIM Com Wireless Solutions	SIM7600G	4.87 dBi

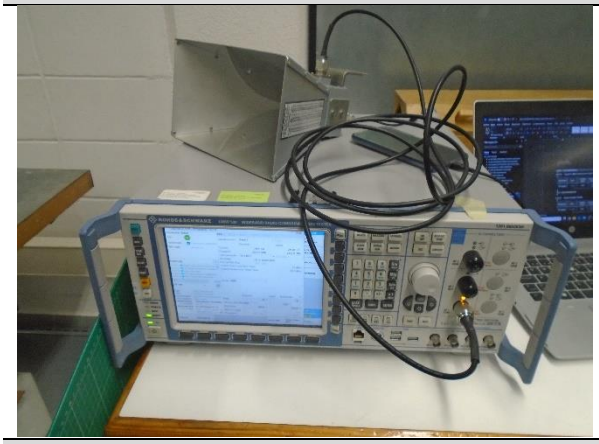
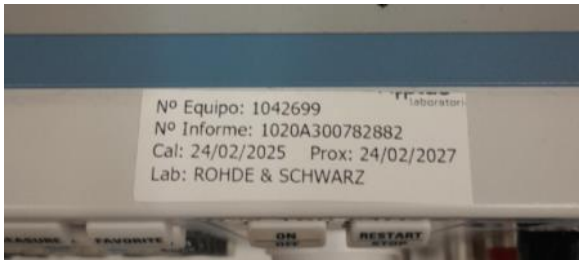
Table 3: RF Features

3.1.1 Samples

Sample #1	
	
Front View	**Rear View**
	
Top View	**Lateral View**
	
Manufacturer Label	**Applus Label**

Table 4: Sample #1 description

3.1.2 Auxiliary Equipment

Auxiliary Equipment	
	
Auxiliary Equipment 1	**Label 1 Picture**
	
Auxiliary Equipment 2	**Label 2 Picture**
	
Auxiliary Equipment 3	**Label 3 Picture**

	#AE	Name	Type	Comments
Description	1	CMW500	Radio communicator	Provided by Applus
	2	Load Box	Gas extension	Provided by customer
	3	Router Wifi	Radio communicator	Provided by customer

Table 5: Auxiliary equipment #1 description

3.1.3 DUT Modifications performed

No modifications have been performed.

Table 6: DUT modifications performed

3.2 DUT TEST MODES

DUT Operation Modes		
Mode #	**Description**	**Set-up**
1	Tx / Rx mode	Table top
2	Idle mode	

Table 7: DUT test modes

3.3 CONTROL AND MONITORING

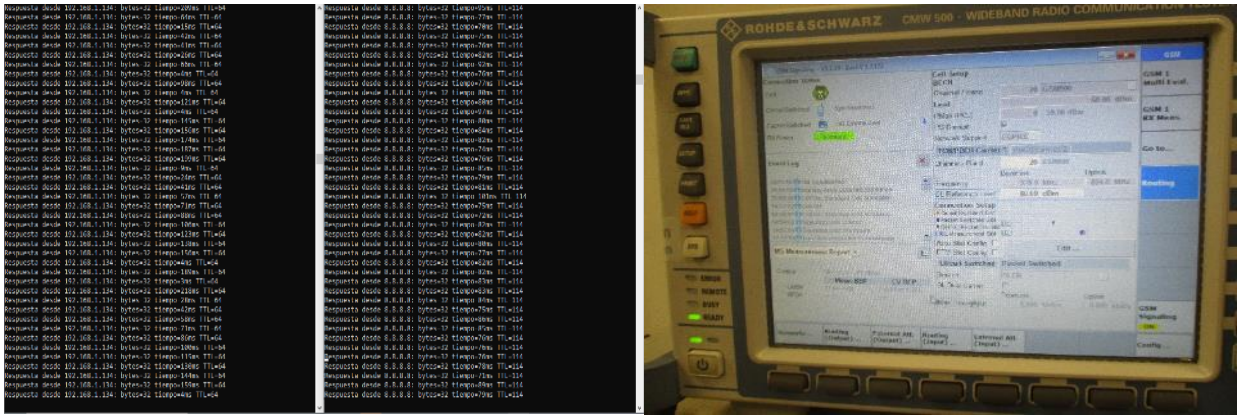


Fig. 1: SW of control and monitoring

3.4 ACCEPTANCE CRITERIA

According to standard **FCC 47 CFR Part 15 Subpart B and ICES-003 Issue 7**

3.5 TEST FACILITIES ID

TEST FACILITIES ID	
FCC Test Firm Registration Number:	507478
ISED Assigned Code:	5766A
CABID	ES0001

Table 8: Test facilities ID

3.6 COMPETENCES AND GUARANTEES

LGAI Technological Center, S.A. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 9/LE894.
In order to assure the traceability to other national and international laboratories, Applus+ Laboratories has a calibration and maintenance program for its measurement equipment.
Applus+ Laboratories guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at Applus+ Laboratories at the time of performance of the test.
Applus+ Laboratories is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test. The results presented in this Test Report apply only to the particular item under test established in this document.

General conditions:

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of Applus+ Laboratories.

4 TEST RESULTS

4.1 RADIO-FREQUENCY RADIATED EMISSIONS

4.1.1 Test Setup Required

According to standard ANSI C63.4:2014

4.1.1.1 Tabletop equipment

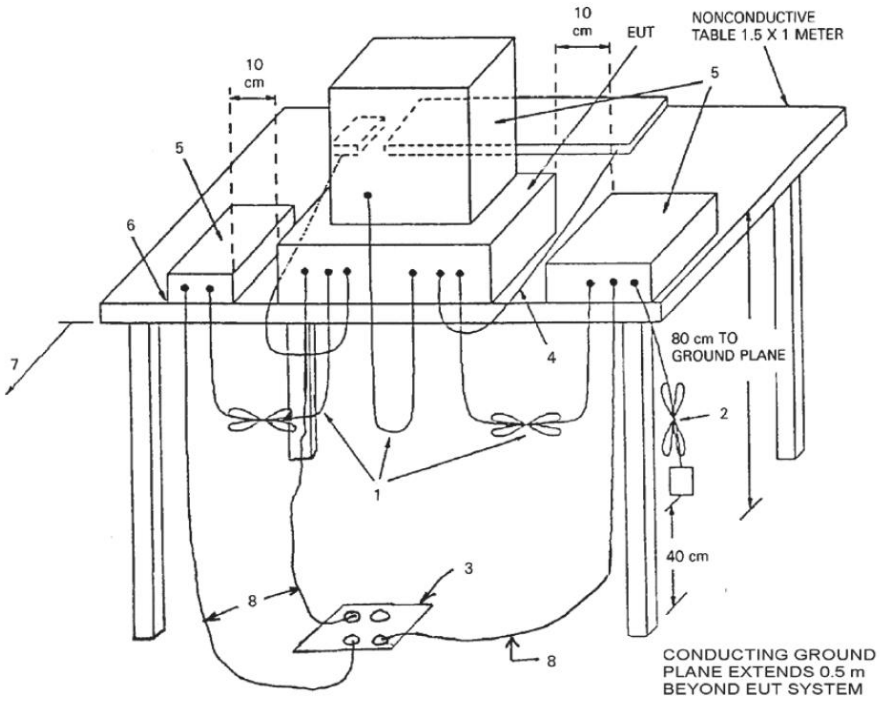


Fig. 2: Radio-frequency radiated emissions setup of table top equipment.

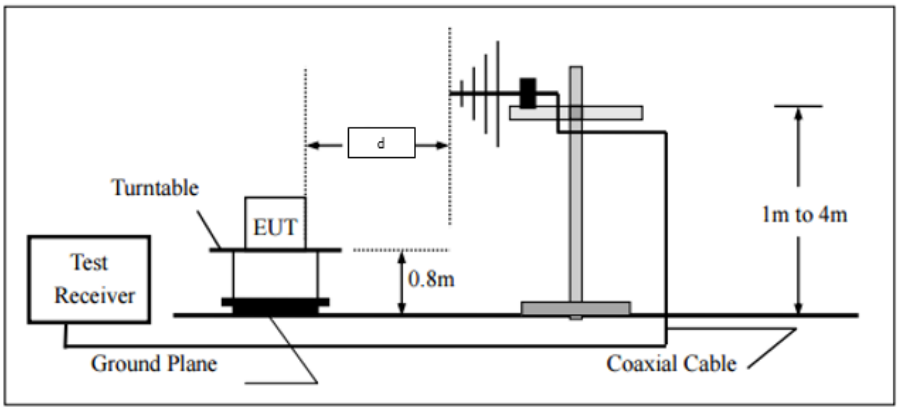


Fig. 3: Radio-frequency radiated emissions of table top equipment from 30 MHz to 1000 MHz

Distance "d" depends on test chamber.

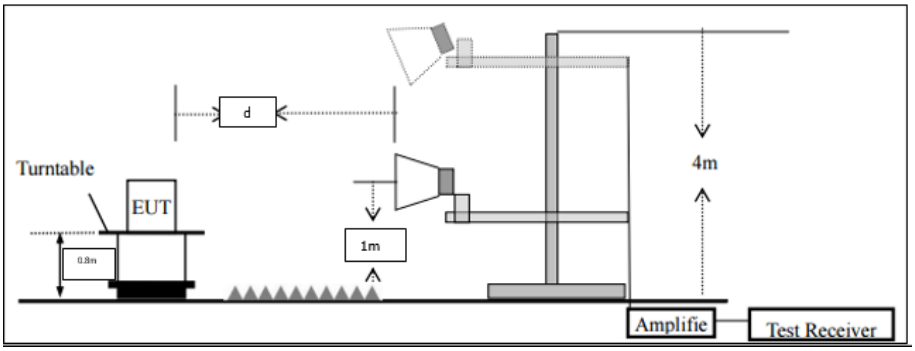


Fig. 4: Radio-frequency radiated emissions setup of table top equipment above 1 GHz

Distance "d" depends on test chamber.

4.1.1.2 Floor standing equipment

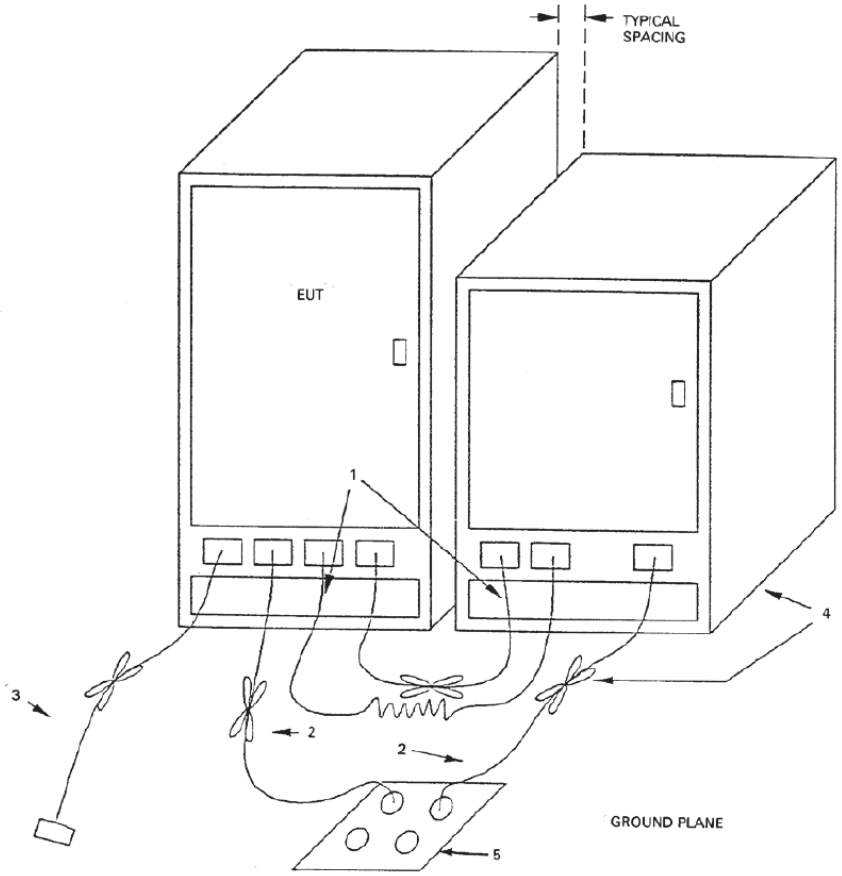


Fig. 5: Radio-frequency radiated emissions of floor-standing setup equipment.

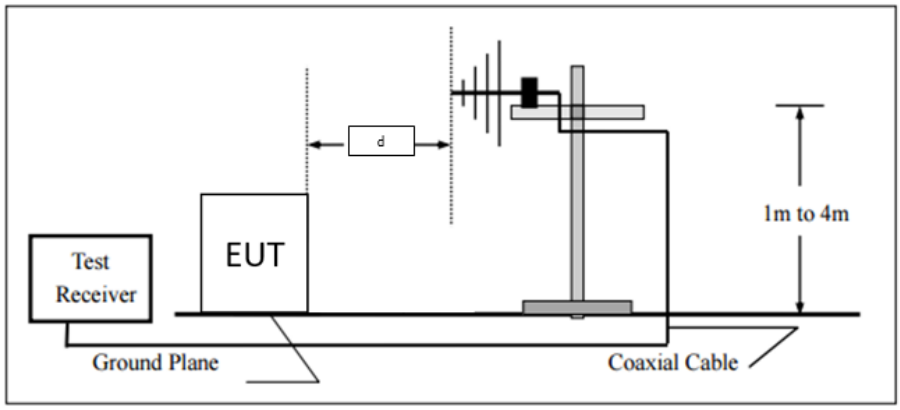


Fig. 6: Radio-frequency radiated emissions of floor-standing setup equipment from 30 MHz to 1000 MHz

Distance "d" depends on test chamber.

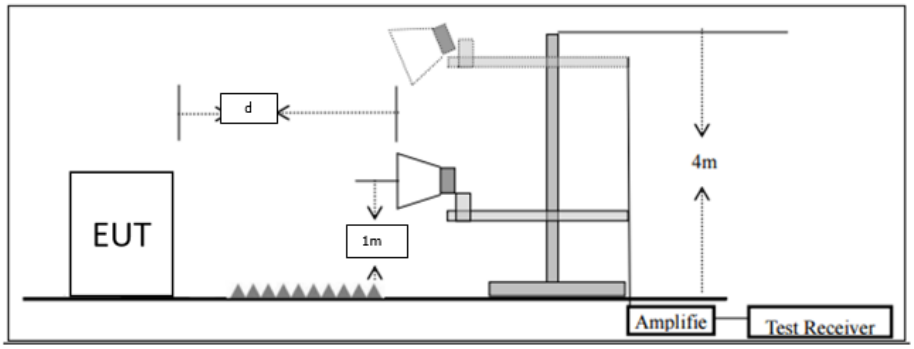


Fig. 7: Radio-frequency radiated emissions of floor-standing setup equipment above 1 GHz

Distance "d" depends on test chamber.

4.1.2 Test Procedure

The test site, 3 or 10 m semi-anechoic chamber, has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.4-2014

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1 m and 4 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received.

Pre-measurement

- The turntable rotates from 0° to 315° using 45° steps
- The antenna is polarized vertical and horizontal
- The antenna height changes from 1 m to 4 m
- At each turntable position, antenna polarization and height the receiver finds the maximum of all emissions

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position 360 º and antenna height between 1 m and 4 m
- The final measurement is done with quasi-peak detector (as described in ANSI C63.4) for 30 MHz to 1 GHz emissions test
- The final measurement is done in the position (azimuth, height and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C63.4) for 1 GHz to 18 GHz test
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factors, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is shown

Correction Factor:

Emission Level = Read Level +Corrections (Antenna Factor + Cable Loss – Amplifier Gain (if applies) + Attenuator (if applies))

4.1.3 Test Parameters

4.1.3.1 Requirements

According to FCC Part 15.109:

Class A Equipment's						
Frequency Range [MHz]	**Quasi-peak detector (QP) [dBµV/m]**		**Peak detector (PK) [dBµV/m]**		**Average detector (AVG) [dBµV/m]**	
	10 m measuring distance	3 m measuring distance[1]	8.5 m measuring distance[2]	3 m measuring distance[3]	8.5 m measuring distance[2]	3 m measuring distance[3]
30 – 288	39.0	49.5	N/A	N/A	N/A	N/A
88 – 216	43.5	54	N/A	N/A	N/A	N/A
216 – 960	46.4	56.9	N/A	N/A	N/A	N/A
960 – 1000	49.5	60	N/A	N/A	N/A	N/A
Above 1000	N/A	N/A	70.95	80	50.95	60

Table 9: Radio-frequency radiated emissions requirements – Class A equipment's

Note 1: The limits has been modified according to the applicable standard applying the formula: $L_2 = L_1 - 20log\ (d_2/d_1)$*, where:*

L_2: New Limit.
L_1: Limit at 10 meters.
d_1: 10 meters (standard distance).
d_2: 3 meters (new measurement distance).

Note 2: The limits has been modified according to the applicable standard applying the formula: $L_2 = L_1 - 20log\ (d_2/d_1)$*, where:*
L_2: New Limit.
L_1: Limit at 10 meters.
d_1: 10 meters (standard distance).
d_2: 8.5 meters (new measurement distance).

Note 3: The limits has been modified according to the applicable standard applying the formula: $L_2 = L_1 - 20log\ (d_2/d_1)$*, where:*

L_2: New Limit.
L_1: Limit at 10 meters.
d_1: 10 meters (standard distance).
d_2: 3 meters (new measurement distance).

Class B Equipment's						
Frequency Range [MHz]	**Quasi-peak detector (QP) [dBµV/m]**		**Peak detector (PK) [dBµV/m]**		**Average detector (AVG) [dBµV/m]**	
	10 m measuring distance[1]	3 m measuring distance	8.5 m measuring distance[2]	3 m measuring distance	8.5 m measuring distance[2]	3 m measuring distance
30 – 288	29.5	40	N/A	N/A	N/A	N/A
88 – 216	33.0	43.5	N/A	N/A	N/A	N/A
216 – 960	35.5	46	N/A	N/A	N/A	N/A
960 – 1000	43.5	54	N/A	N/A	N/A	N/A
Above 1000	N/A	N/A	65	74	45	54

Table 10: Radio-frequency radiated emissions requirements – Class B equipment's

Note 1: The limits has been modified according to the applicable standard applying the formula: $L_2 = L_1 - 20log\ (d_2/d_1)$*, where:*

L_2: New Limit.
L_1: Limit at 3 meters.
d_1: 3 meters (standard distance).
d_2: 10 meters (new measurement distance).

Note 2: The limits has been modified according to the applicable standard applying the formula: $L_2 = L_1 - 20log\ (d_2/d_1)$*, where:*
L_2: New Limit.
L_1: Limit at 3 meters.
d_1: 3 meters (standard distance).
d_2: 8.5 meters (new measurement distance).

According to ICES-003 Issue 7 (3.2.2):

Class A Equipment's						
Frequency Range [MHz]	**Quasi-peak detector (QP) [dBµV/m]**		**Peak detector (PK) [dBµV/m]**		**Average detector (AVG) [dBµV/m]**	
	10 m measuring distance	3 m measuring distance[1]	8.5 m measuring distance[1]	3 m measuring distance	8.5 m measuring distance[1]	3 m measuring distance
30 – 288	40.0	50.0	N/A	N/A	N/A	N/A
88 – 216	43.5	54.0	N/A	N/A	N/A	N/A
216 – 230	46.4	56.9	N/A	N/A	N/A	N/A
230 – 960	47.0	57.0	N/A	N/A	N/A	N/A
960 – 1000	49.5	60.0	N/A	N/A	N/A	N/A
Above 1000	N/A	N/A	71	80	51	60

Table 11: Radio-frequency radiated emissions requirements – Class A equipment's

Class B Equipment's						
Frequency Range [MHz]	**Quasi-peak detector (QP) [dBµV/m]**		**Peak detector (PK) [dBµV/m]**		**Average detector (AVG) [dBµV/m]**	
	10 m measuring distance	3 m measuring distance	8.5 m measuring distance[1]	3 m measuring distance	8.5 m measuring distance[1]	3 m measuring distance
30 – 288	30.0	40.0	N/A	N/A	N/A	N/A
88 – 216	33.1	43.5	N/A	N/A	N/A	N/A
216 – 230	35.6	46.0	N/A	N/A	N/A	N/A
230 – 960	37.0	47.0	N/A	N/A	N/A	N/A
960 – 1000	43.5	54.0	N/A	N/A	N/A	N/A
Above 1000	N/A	N/A	65	74	45	54

Table 12: Radio-frequency radiated emissions requirements – Class B equipment's

Note 1: The limits has been modified according to the applicable standard applying the formula: $L_2 = L_1 - 20log\ (d_2/d_1)$*, where:*
L_2: New Limit.
L_1: Limit at 3 meters.
d_1: 3 meters (standard distance).
d_2: 8.5 meters (new measurement distance).

4.1.3.2 Receiver Parameters

According to standard ANSI C63.4:2014:

Frequency Range [MHz]	Detector	Resolution Bandwidth [MHz]	Video Bandwidth [MHz]
30 – 1000	Quasi-peak (QP)	0.12	0.30
Above 1000	Peak (PK)	1	3
	Average (AVG)	1	$10 \cdot 10^{-6}$

Table 13: Receiver parameters – Radio-frequency radiated emissions

4.1.4 Test Environmental Conditions

Test Date	Technician	Supervisor	Temperature [ºC]	Humidity [%]	Atm. Pressure [mbar]
08/04/2025	P. Hernández	--	22.3	48.6	995.4
10/04/2025	J. Coll; J. M. Llauradó	--	21.1	45.3	998.7

Table 14: Test environmental conditions – Radio-frequency radiated emissions

4.1.5 Summary Test Results

Frequency Range[1] [MHz]	Equipment Class	Test Area	Distance [m]	Emissions	Results
30 – 1000	A	SAC 2	3	Limit <= QP < Limit + I	PASS
1000 – 6000	A	SAC 2	3	PK < Limit - I AVG < Limit - I	PASS
6000 – 13000	A	SAC 2	3	PK < Limit - I Limit <= AVG < Limit + I	PASS

Table 15: Summary test results – Radio-frequency radiated emissions

Note 1: Upper limit according to the fifth harmonic of the maximum internal frequency declared by the manufacturer or to 40 GHz, whichever is lower.

4.1.6 Test Setup Photographs

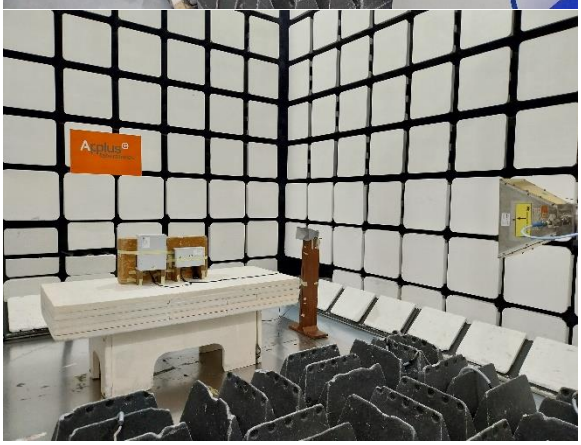
RADIO-FREQUENCY RADIATED EMISSIONS – TEST SETUP	
	
	
	

Table 16: Radio-frequency radiated emissions test setup

4.1.7 Test Results

4.1.7.1 Ambient Levels. Frequency range: 30 MHz – 1 GHz

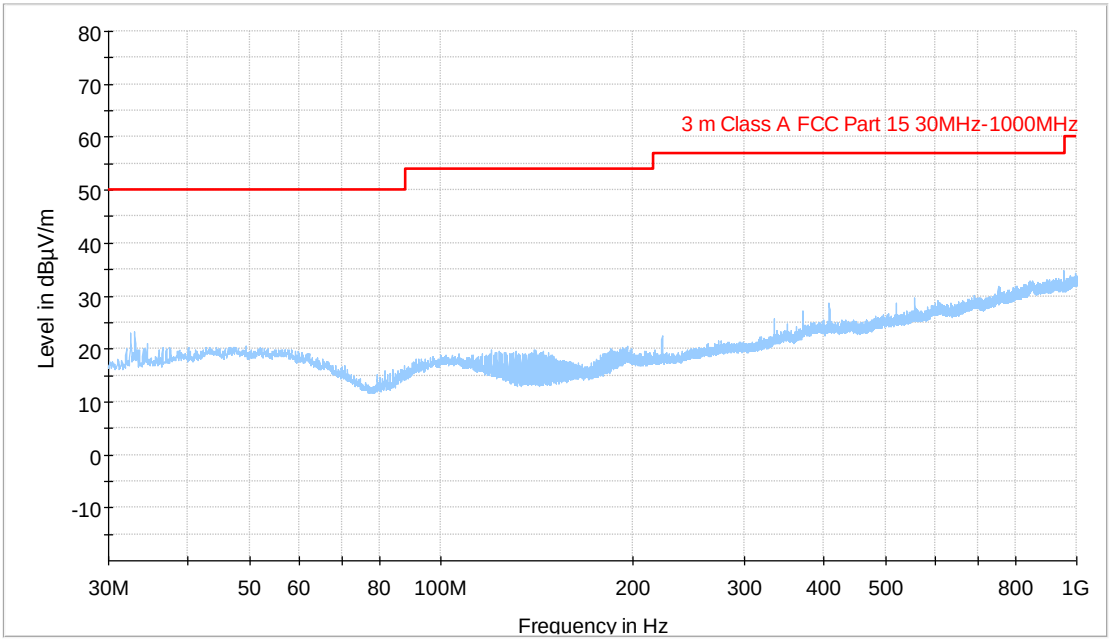


Fig. 8: Ambient level. Frequency range: 30 MHz – 1 GHz

4.1.7.2 Ambient Levels. Frequency range: 1 GHz – 6 GHz

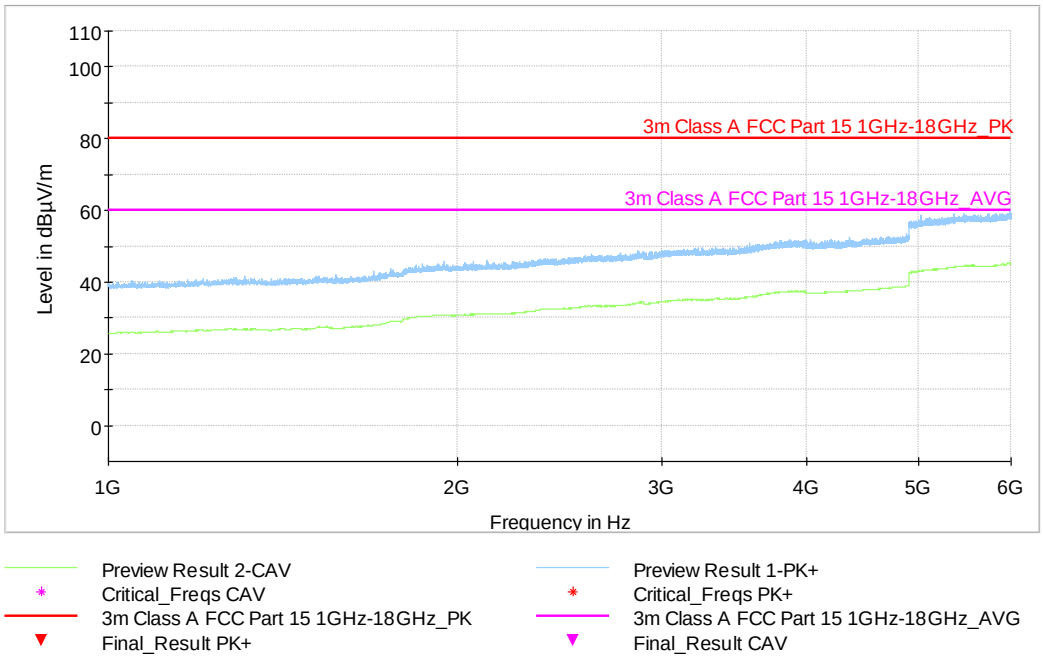


Fig. 9: Ambient level. Frequency range: 1 GHz – 6 GHz

Note: According to costumer the frequency 2.45 GHz are excluded band

4.1.7.3 Ambient Levels. Frequency range: 6 GHz – 13 GHz

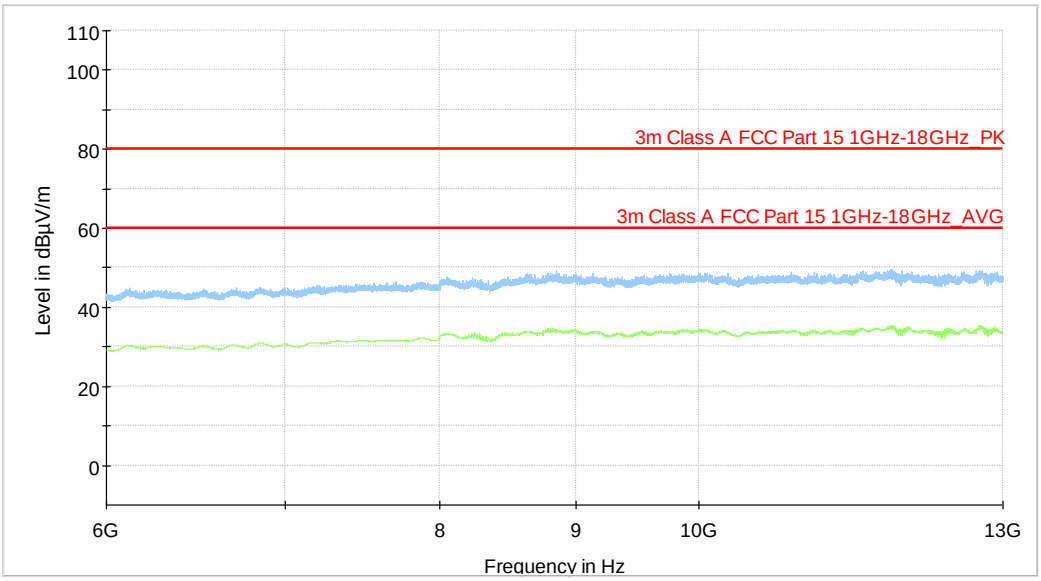


Fig. 10: Ambient level. Frequency range: 6 GHz – 13 GHz

4.1.7.4 Sample #1. Mode 1 (Pre scan-2G). Frequency range: 30 MHz – 1 GHz

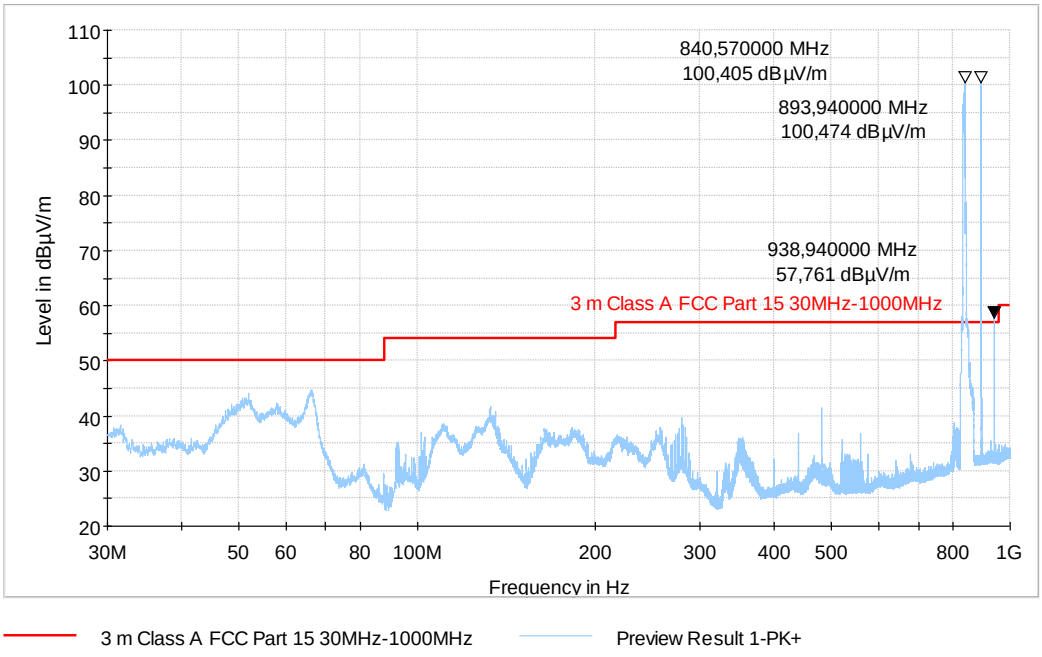


Fig. 11: Sample #1. Mode 1 (Tx/Rx). Frequency range: 30 MHz – 1 GHz

Note: According to costumer the frequency's 840.57 MHz , 893.57 MHz & 938 MHz are excluded band.

4.1.7.5 Sample #1. Mode 1 (Pre scan-3G). Frequency range: 30 MHz – 1 GHz

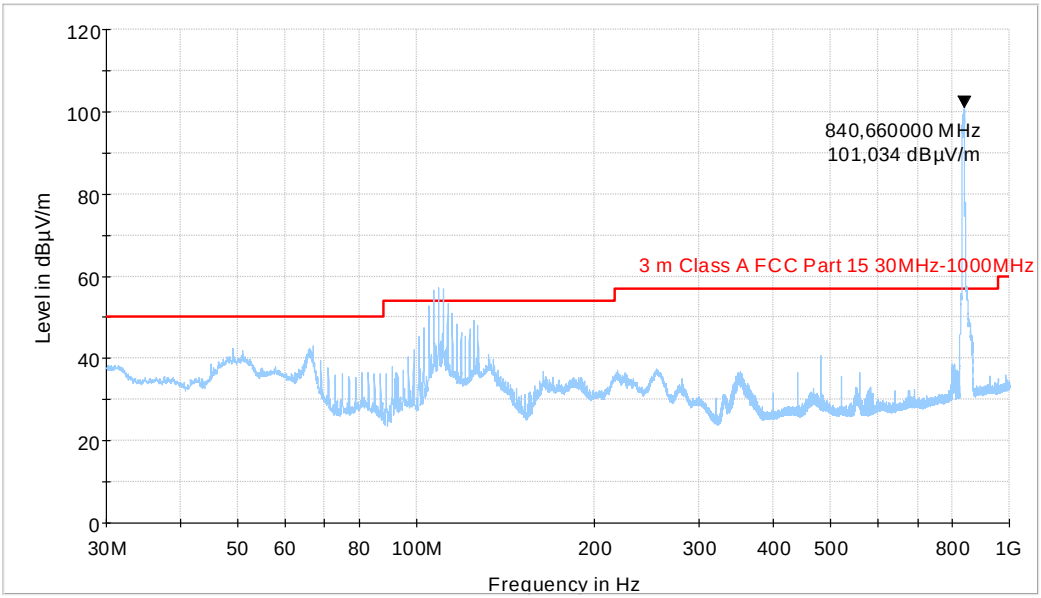


Fig. 12: Sample #1. Mode 1 (Tx/Rx). Frequency range: 30 MHz – 1 GHz

Note: According to costumer the frequency 840.66 MHz are excluded band.

4.1.7.6 Sample #1. Mode 1 (Pre scan-4G). Frequency range: 30 MHz – 1 GHz

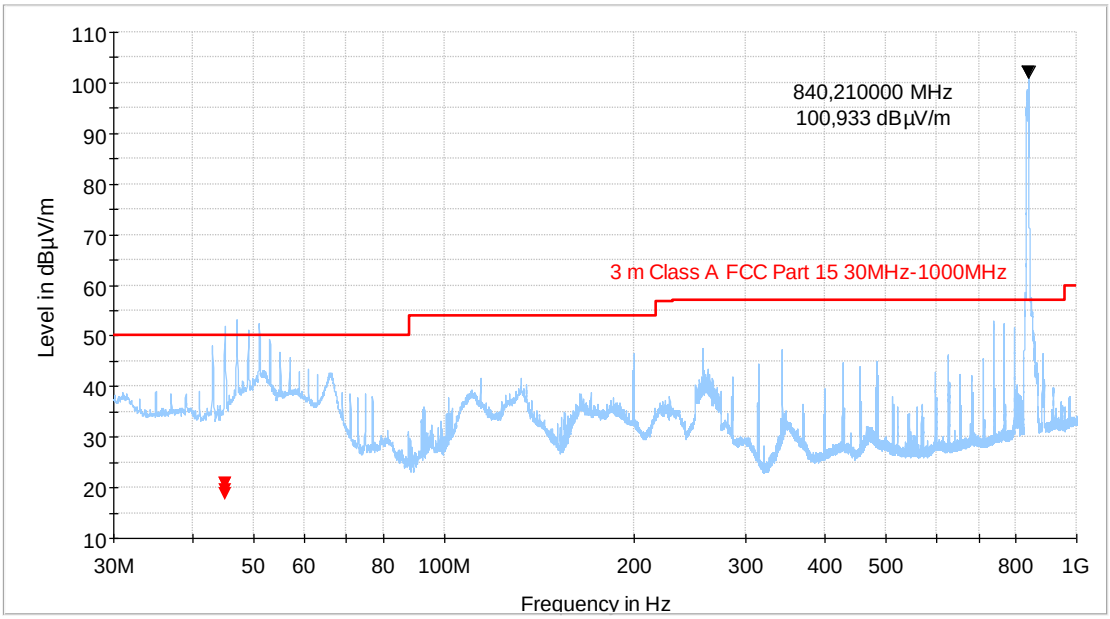


Fig. 13: Sample #1. Mode 1 (Tx/Rx). Frequency range: 30 MHz – 1 GHz

Note: According to costumer the frequency 840.21 MHz are excluded band.

4.1.7.7 Sample #1. Mode 1 (Pre scan-2G). Frequency range: 1 GHz – 6 GHz

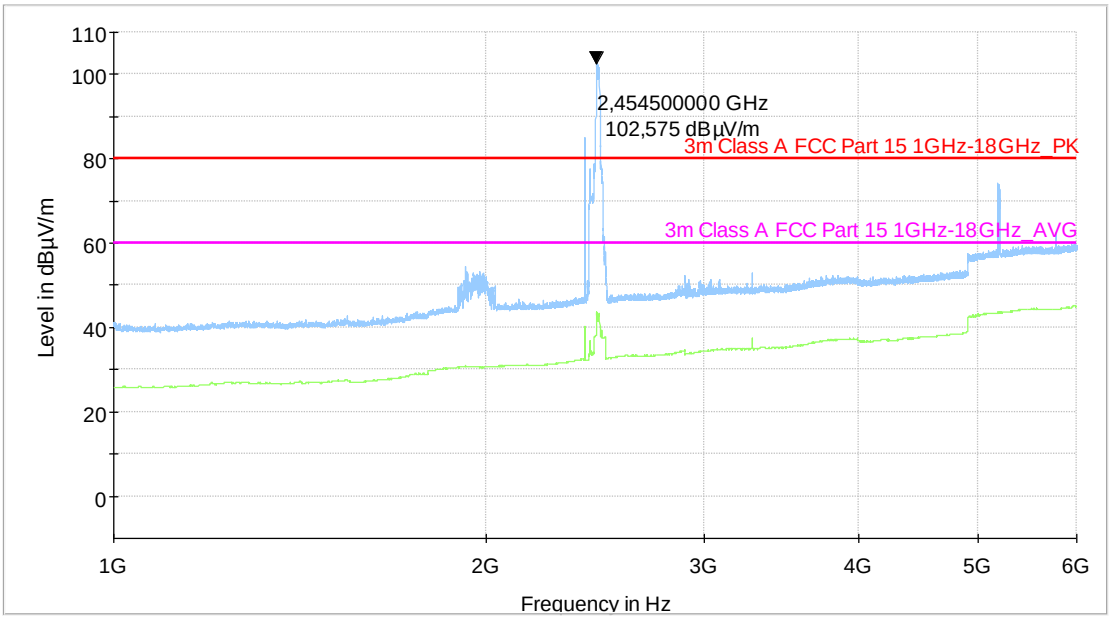


Fig. 14: Sample #1. Mode 1 (Tx/Rx). Frequency range: 1 GHz – 6 GHz

Note: According to costumer the frequency 2.45 GHz are excluded band.

4.1.7.8 Sample #1. Mode 1 (Pre scan-3G). Frequency range: 1 GHz – 6 GHz

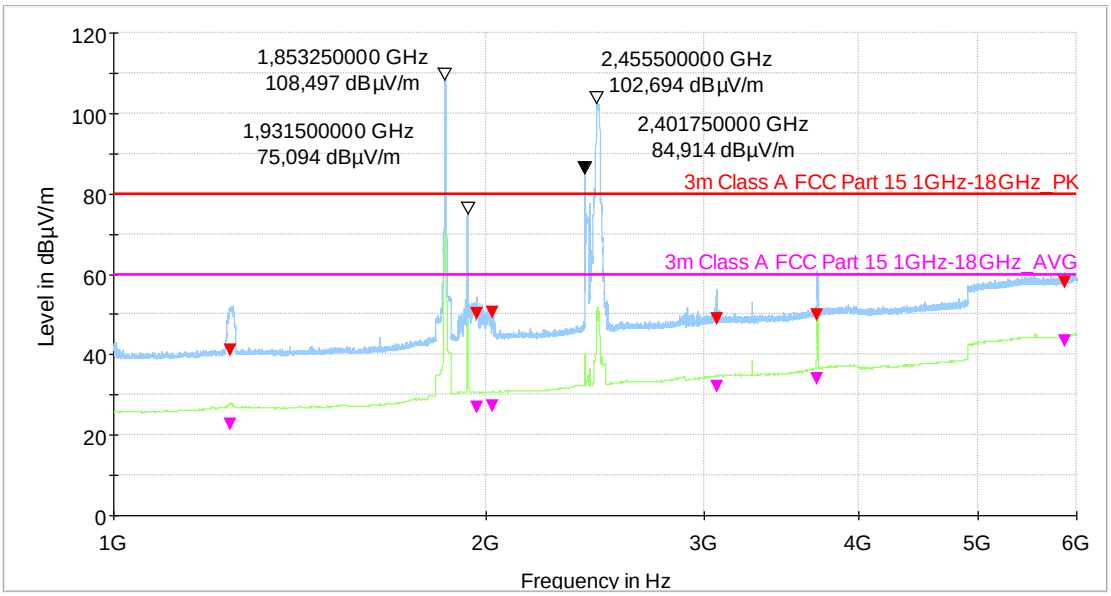


Fig. 15: Sample #1. Mode 1 (Tx/Rx). Frequency range: 1 GHz – 6 GHz

Note: According to costumer the frequency's 1.85 GHz, 2.45 GHz, 1.93 GHz and 2.40 GHz are excluded band.

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
1243.000	41.2	80	38.8	22.7	60	37.3	181.0	V	0.0
1967.000	50.1	80	29.9	27.0	60	33	212.0	H	219.0
2025.750	50.6	80	29.4	27.3	60	32.7	169.0	H	219.0
3070.750	48.8	80	31.2	31.9	60	28.1	339.0	V	332.0
3702.500	49.9	80	30.1	34.1	60	25.9	368.0	V	109.0
5876.250	57.8	80	22.2	43.5	60	16.5	294.0	H	308.0

4.1.7.9 Sample #1. Mode 1 (Pre scan-4G). Frequency range: 1 GHz – 6 GHz

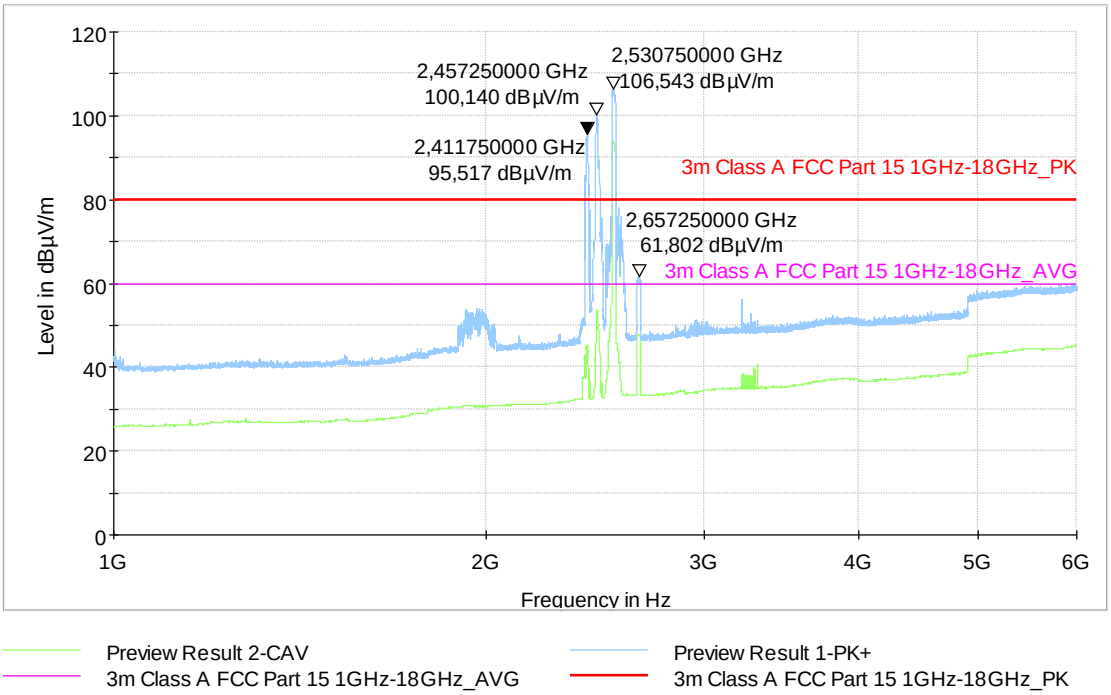


Fig. 16: Sample #1. Mode 1 (Tx/Rx). Frequency range: 1 GHz – 6 GHz

Note: According to costumer the frequency's 2.45 GHz, 2.53, 2.41 GHz and 2.65 GHz are excluded band.

4.1.7.11 Sample #1. Mode 1 (Pre scan-2G). Frequency range: 6 GHz – 13 GHz

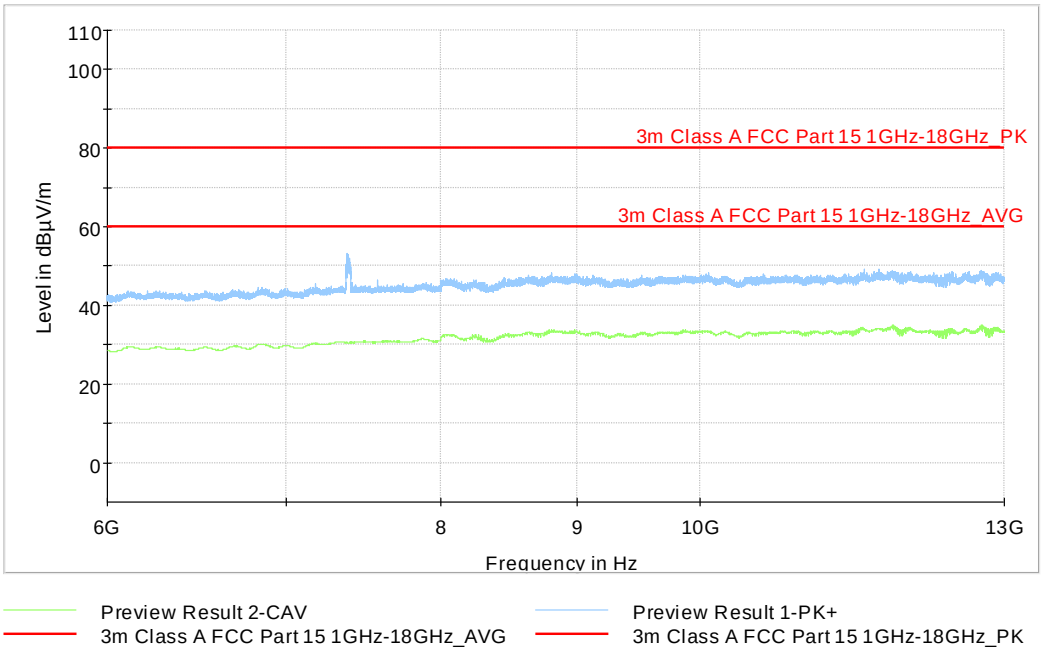


Fig. 17: Sample #1. Mode 1 (Tx/Rx). Frequency range: 6 GHz – 13 GHz

4.1.7.12 Sample #1. Mode 1 (Pre scan-3G). Frequency range: 6 GHz – 13 GHz

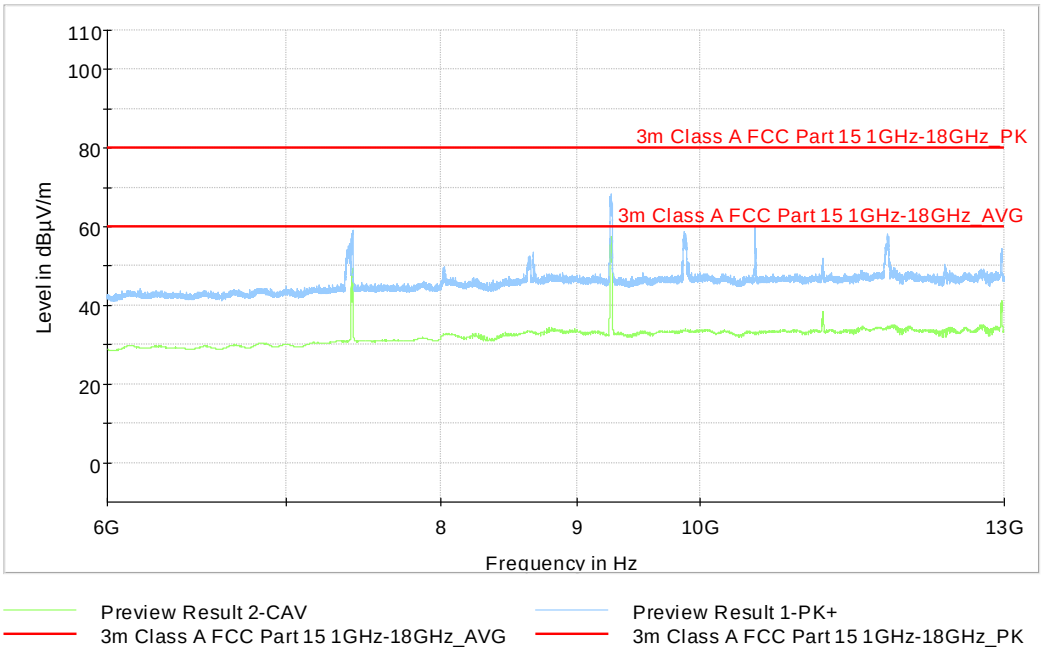


Fig. 18: Sample #1. Mode 1 (Tx/Rx). Frequency range: 6 GHz – 13 GHz

4.1.7.13 Sample #1. Mode 1 (Pre scan-4G). Frequency range: 6 GHz – 13 GHz

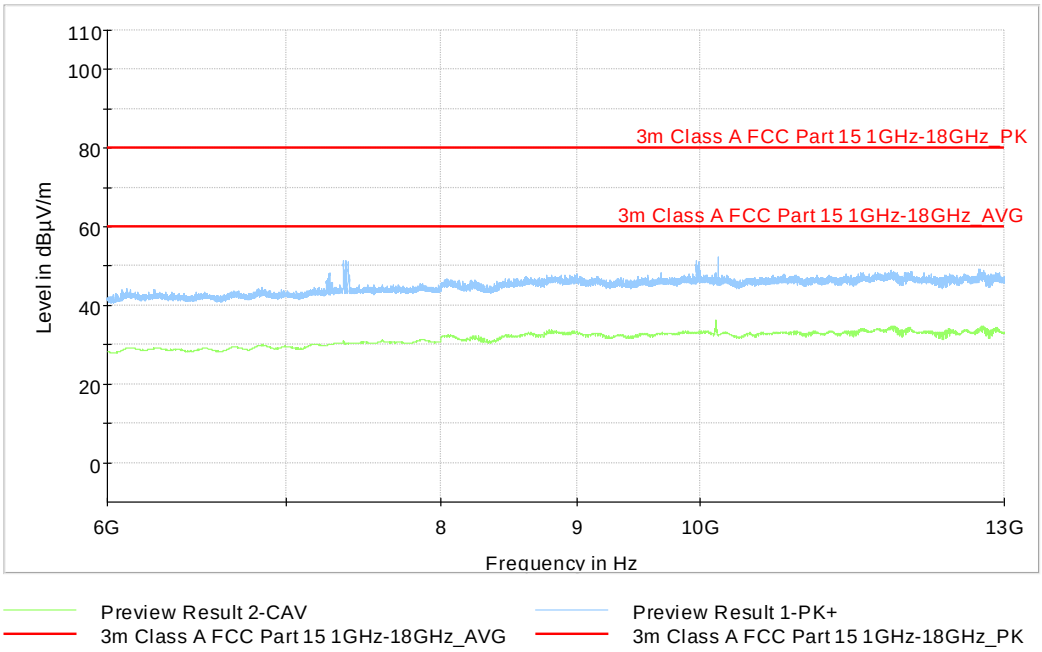


Fig. 19: Sample #1. Mode 1 (Tx/Rx). Frequency range: 6 GHz – 13 GHz

4.1.7.14 Sample #1. Mode 1 (Worst case-4G). Frequency range: 30 MHz – 1 GHz

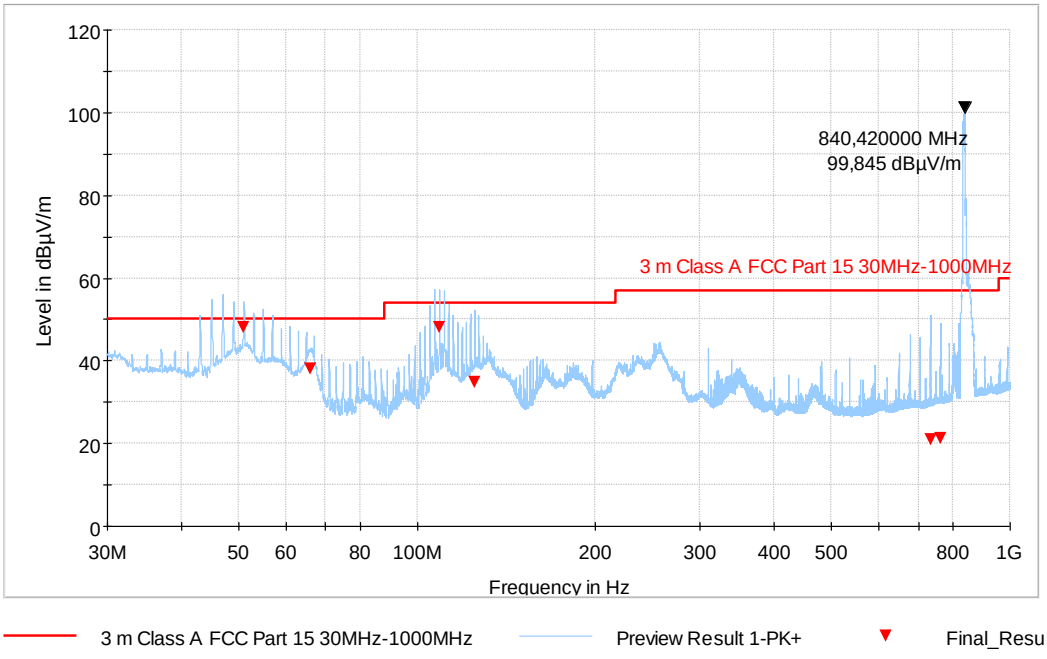


Fig. 20: Sample #1. Mode 1 (Tx/Rx). Frequency range: 30 MHz – 1 GHz

Note: According to costumer the frequency 840.40 MHz are excluded band.

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
51.000	48.2	50.0	1.8	100.0	V	173.0	18.2
65.940	38.0	50.0	12.0	400.0	H	178.0	15.3
108.990	48.0	50.0	2.0	217.0	H	150.0	16.0
125.010	34.8	54.0	19.2	241.0	H	134.0	13.6
734.100	21.0	54.0	33.0	126.0	H	233.0	27.6
762.600	21.2	57.0	35.8	105.0	H	240.0	27.9

4.1.8 Test Equipment Used

Equipment	Brand	Model	Applus Ref.	Last Calibration	Next Calibration
EMI RECEIVER	R&S	ESW 44	1042953	22/05/2024	22/05/2025
EMI RECEIVER	R&S	ESW 8	1042686	12/03/2024	12/11/2025
BILOG ANTENNA	SCHAWARZBECK	VULB 9162	1042229	25/02/2025	25/02/2026
ROTATORY JOINT	SPINNER	BN 835088	1042793	25/06/2024	25/06/2025
HORN ANTENNA	EMCO	3115	05-ER-182	28/11/2024	28/11/2025
ATENUADOR 3 DB	HUBER/SUHNER	6803.17.B	1042020	24/07/2024	24/07/2025
RF PREAMPLIFIER	BONN ELEKTRONIK	BLMA 0118-M	1041733	25/04/2024	25/04/2025
CABLE	HUBER & SUHNER	SF-106	1042875	06/02/2025	06/02/2026
CABLE	HUBER & SUHNER	SF 126E	1042899	10/03/2025	10/03/2026
RF CABLE (WALL PANEL),	--	--	104572	23/07/2024	23/07/2025
SEMIANECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	15/03/2023	15/03/2026
TEST SOFTWARE	ROHDE & SCHWARZ	EMC32 v.10.50.00	104624	--	--
MAST-TABLE CONTROLLER	COMTEST	4630 – 100	104369	--	--
ANTENNA HORN	MVG EH 1840	EH1840	1042941	29/05/2024	29/05/2025

Table 17: Test Instruments – Radio-frequency radiated emissions

4.1.9 Uncertainty

Test Type	Test Description	Uncertainty
Emissions	RADIO-FREQUENCY RADIATED EMISSIONS 30 MHz – 1 GHz	± 5.3 dB
Emissions	RADIO-FREQUENCY RADIATED EMISSIONS 1 GHz – 6 GHz	± 5.3 dB
Emissions	RADIO-FREQUENCY RADIATED EMISSIONS 6 GHz – 18 GHz	± 5.5 dB
Emissions	RADIO-FREQUENCY RADIATED EMISSIONS 18 GHz – 26 GHz	± 5.1 dB
Emissions	RADIO-FREQUENCY RADIATED EMISSIONS 26 GHz – 40 GHz	± 5.6 dB

Table 18: Radio-frequency radiated emissions measuring Uncertainties

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by a coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%.

4.2 POWER LINE CONDUCTED EMISSIONS

4.2.1 Test Setup Required

According to standard ANSI C63.4:2014

4.2.1.1 Tabletop equipment

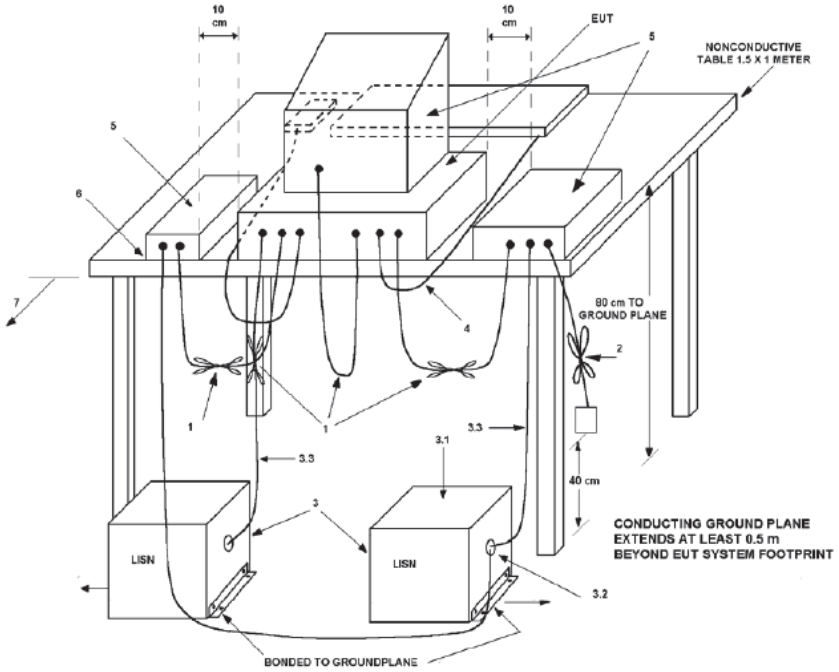


Fig. 21: Power line conducted emissions of table top equipment setup in shielded room

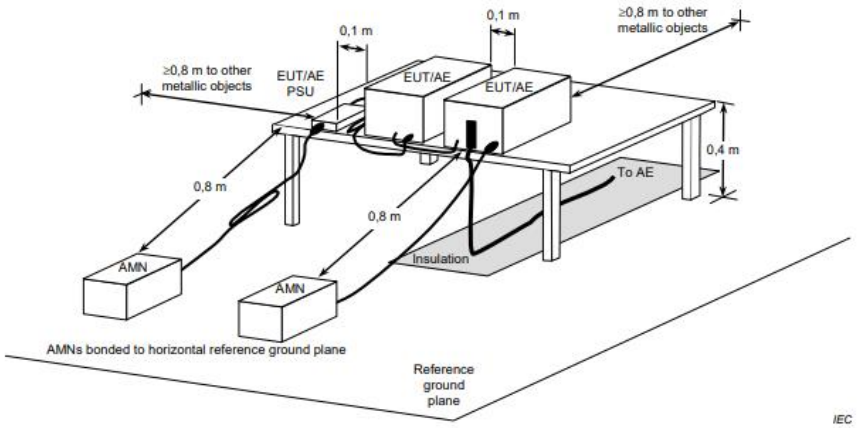


Fig. 22: Power line conducted emissions of table top equipment setup in semi anechoic chamber

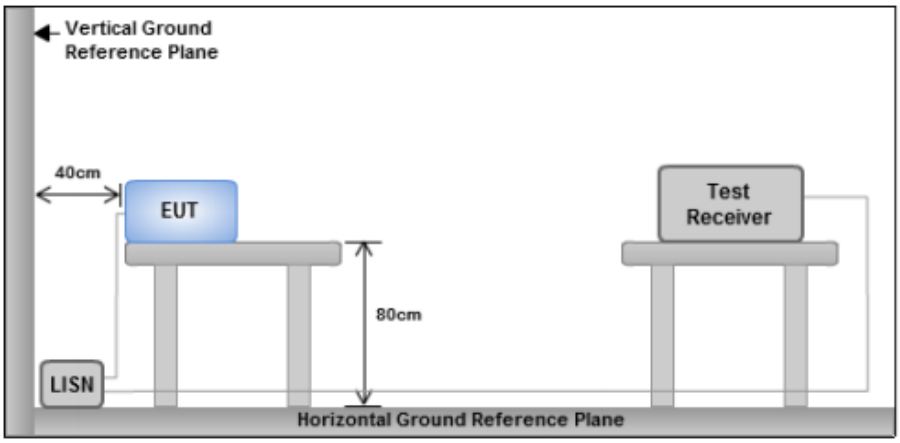


Fig. 23: Power line conducted emissions of table top equipment in shielded room

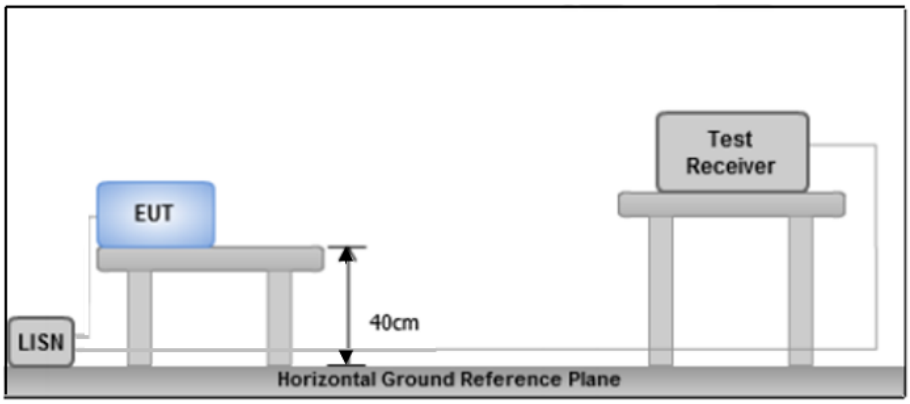


Fig. 24: Power line conducted emissions of table top equipment in in semi anechoic chamber

4.2.1.2 Floor standing equipment

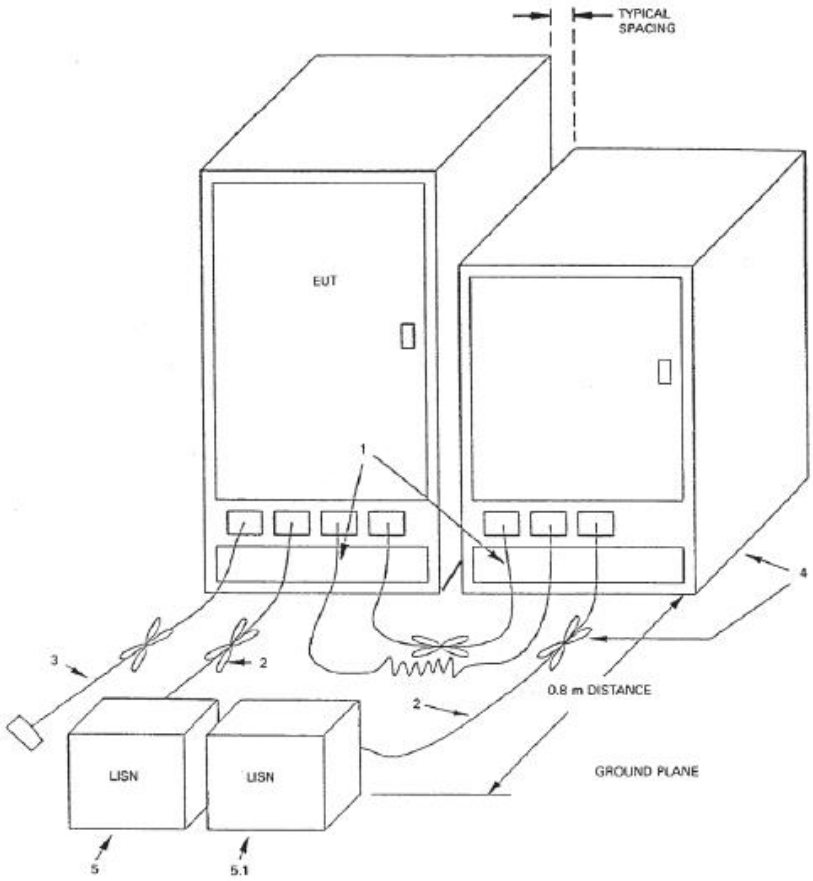


Fig. 25: Power line conducted emissions of floor-standing setup equipment

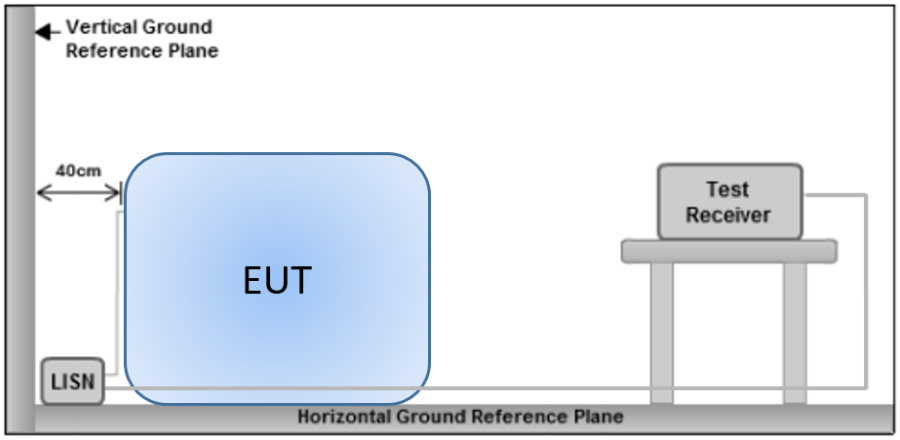


Fig. 26: Power line conducted emissions of floor-standing equipment in shielded room

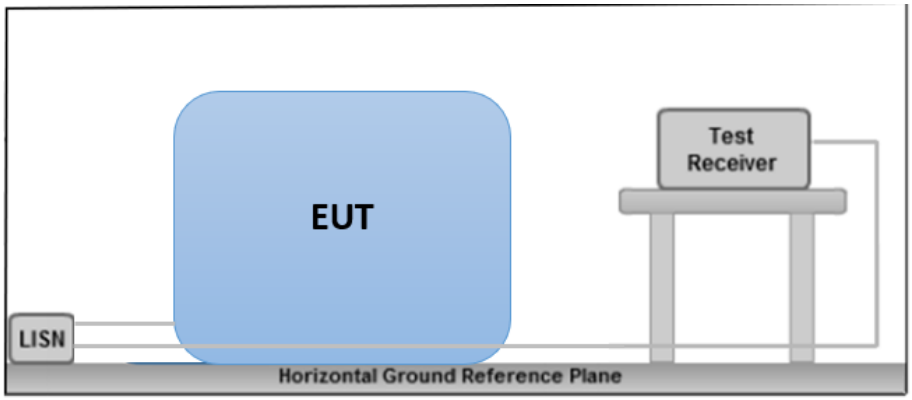


Fig. 27: Power line conducted emissions of floor-standing equipment in in semi anechoic chamber

4.2.2 Test Procedure

The device under test is arranged in table-top or floor-standing position depending on the kind of equipment and keeping the distance from the vertical or horizontal conducting plane located 40 cm to the rear or below of the device, in respective on the test chamber which is evaluated.

The device is connected to line impedance stabilization network (LISN), placed 80 cm far from the device under test and other accessories are connected to other LISN too. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.

AC conducted emission measurements are made over frequency range from 150 kHz to 30 MHz.

Pre-measurement:

- Pre-scan measurement using a peak and average detector is performed in order to show the emissions of the device under test
- Each line of the power cord is evaluated to find the maximum emissions

Final measurement:

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4
- The final measurement is done with quasi-peak and average detector (as described in ANSI C63.4)
- Final levels, frequency, measuring time, bandwidth, correction factors, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is shown

Correction Factor:

Emission Level = Read Level + Corrections (LISN factor + Cable Loss + Attenuator)

4.2.3 Test Parameters

4.2.3.1 Requirements

According to standard ANSI C63.4:2014

The conducted emissions shall not exceed the following levels:

AC main power ports of Class A Equipment's		
Frequency Range [MHz]	**Quasi-peak detector (QP) [dBµV]**	**Average detector (AVG) [dBµV]**
0.15 – 0.5	79	66
0.5 – 30	73	60

Table 19: Power line conducted emissions requirements – AC main power ports of Class A equipment's

AC main power ports of Class B Equipment's		
Frequency Range [MHz]	**Quasi-peak detector (QP) [dBµV]**	**Average detector (AVG) [dBµV]**
0.15 – 0.5	66 to 56[1]	56 to 46[1]
0.5 – 5	56	46
5 – 30	60	50

Table 20: Power line conducted emissions requirements – AC main power ports of Class B equipment's

Note 1: Decreases with the logarithm of the frequency.

4.2.3.2 Receiver Parameters

According to standard ANSI C63.4:2014

Frequency Range [MHz]	Detector	Resolution Bandwidth [kHz]
0.15 – 30	Peak (PK) Average (AV)	9
0.5 – 5		
5 – 30		

Table 21: Receiver parameters – Power line conducted emissions

4.2.4 Test Environmental Conditions

Test Date	Technician	Supervisor	Temperature [ºC]	Humidity [%]	Atm. Pressure [mbar]
19/03/2025	A. Perez	---	22.0	49.0	1004.3

Table 22: Test environmental conditions – Power line conducted emissions

4.2.5 Summary Test Results

Frequency Range [MHz]	Ports	Equipment Class	Test Area	Results
0.15 – 30 MHz	AC Mains	A	SR-2	PASS

Table 23: Summary test results – Power line conducted emissions

4.2.6 Test Setup Photographs

POWER LINE CONDUCTED EMISSIONS – TEST SETUP	
	

Table 24: Power line conducted emissions test setup

4.2.7 Test Results

4.2.7.1 Ambient Levels. AC Mains: Neutral. Frequency range: 0.15 MHz – 30 MHz

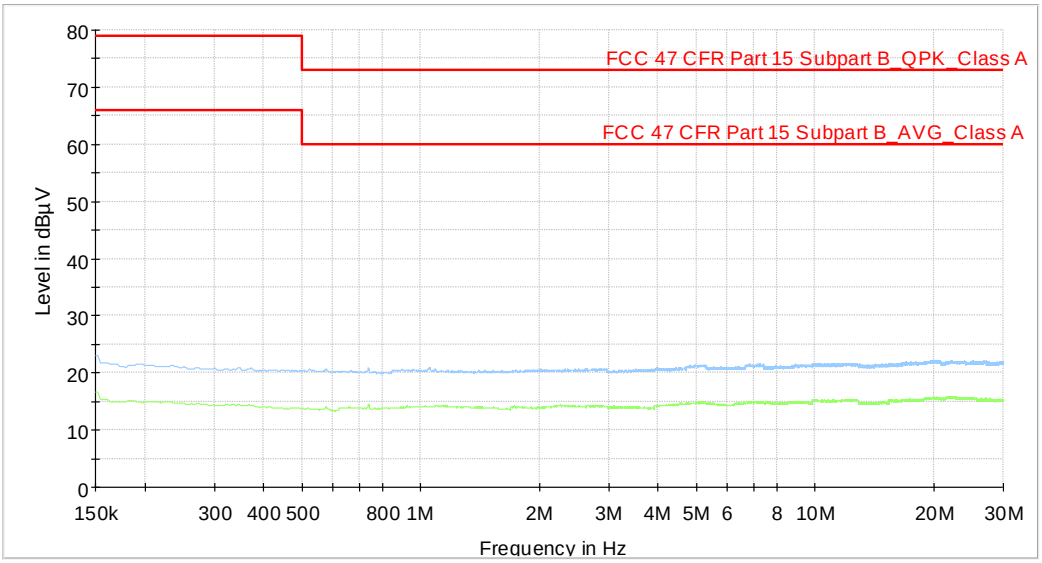


Fig. 28: Ambient level. AC Mains: Neutral. Frequency range: 0.15 MHz – 30 MHz

4.2.7.2 Ambient Levels. AC Mains: Line 1. Frequency range: 0.15 MHz – 30 MHz

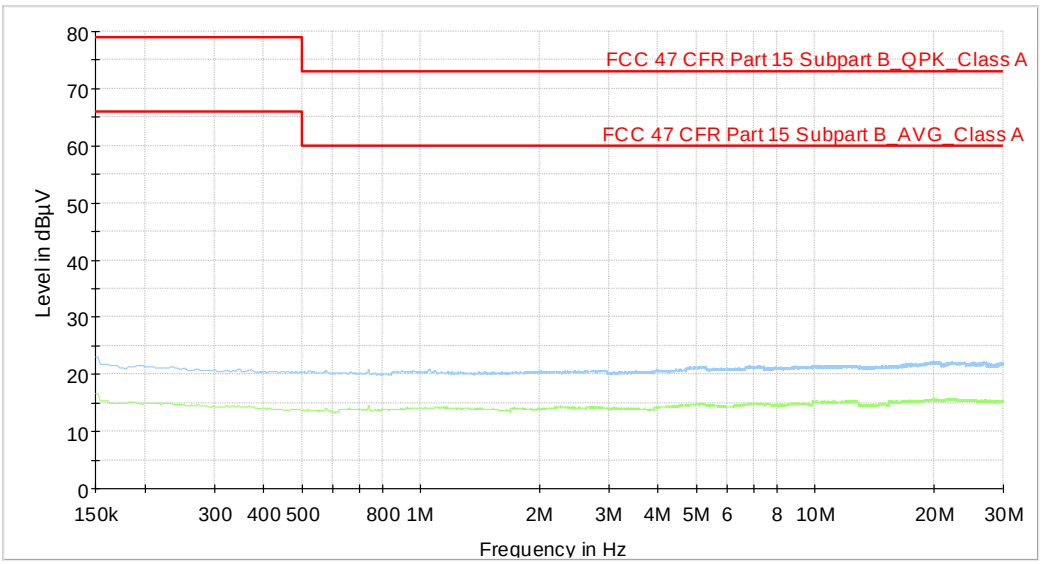


Fig. 29: Ambient level. AC Mains: Line 1. Frequency range: 0.15 MHz – 30 MHz

4.2.7.3 Sample #1. Mode 1. AC Mains: Neutral. Frequency range: 0.15 MHz – 30 MHz

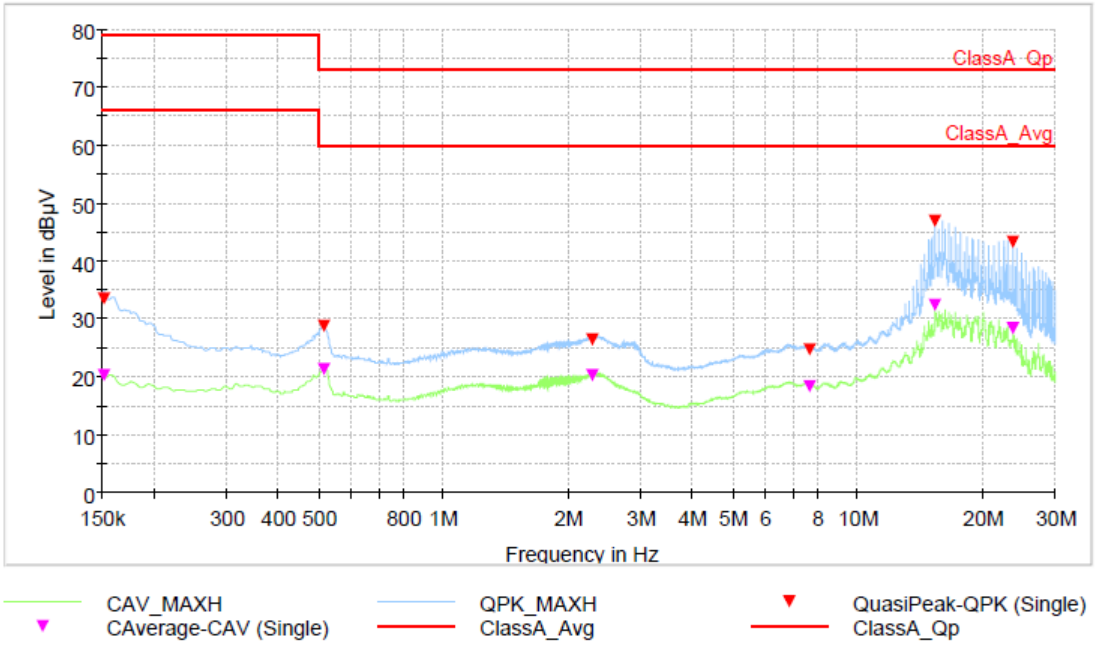


Fig. 30: Sample #1. Mode 1. AC Mains: Neutral. Frequency range: 0.15 MHz – 30 MHz

Frequency (MHz)	QuasiPeak (dBµV)	Margin - QPK (dB)	Limit - QPK (dBµV)	CAverage (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)	Line	Corr. (dB)
0.159	36.2	29.4	79.0	20.8	34.7	66.0	N	19.7
0.514	30.6	25.4	79.0	24.1	21.9	66.0	N	19.8
2.784	23.5	32.5	79.0	17.4	28.6	66.0	N	19.9
14.532	39.9	20.1	79.0	29.7	20.3	66.0	N	20.1
16.293	42.6	17.5	79.0	31.7	18.3	66.0	N	20.1
21.999	37.0	23.0	73.0	29.1	20.9	60.0	N	20.2

4.2.7.4 Sample #1. Mode 1. AC Mains: Line 1. Frequency range: 0.15 MHz – 30 MHz

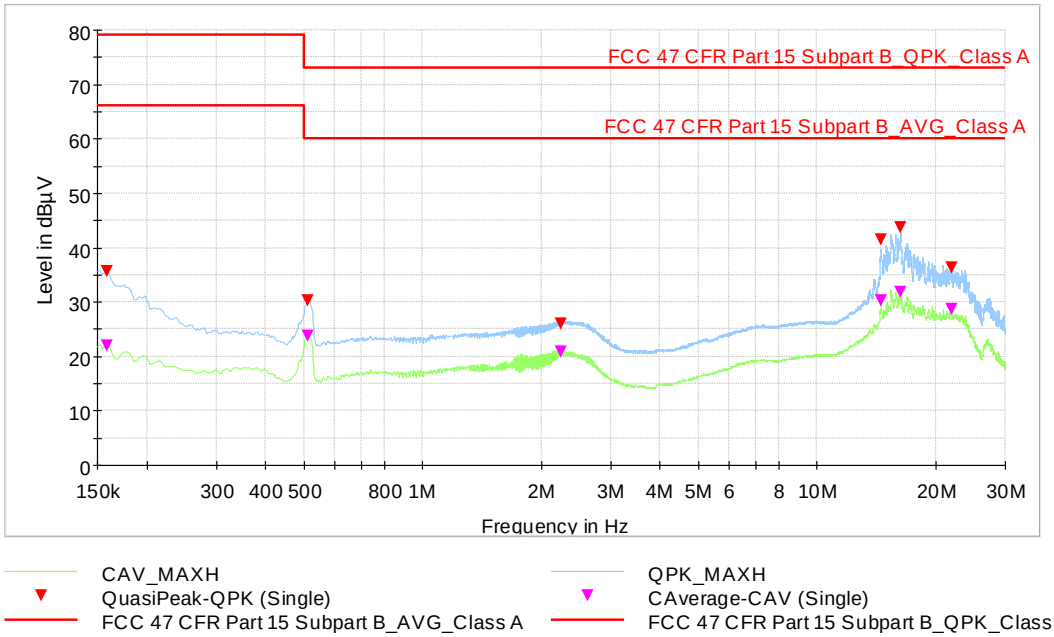


Fig. 31: Sample #1. Mode 1. AC Mains: Line 1. Frequency range: 0.15 MHz – 30 MHz

Frequency (MHz)	QuasiPeak (dBµV)	Margin - QPK (dB)	Limit - QPK (dBµV)	CAverage (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)	Line	Corr. (dB)
0.159	49	30.0	79.0	32.4	33.6	66.0	L1	19.7
0.512	53.3	25.7	79.0	43.8	22.2	66.0	L1	19.8
2.251	49.1	29.9	79.0	40.8	25.2	66.0	L1	19.9
14.527	60.4	18.6	79.0	46.2	19.8	66.0	L1	20.1
16.289	62.6	16.4	79.0	47.7	18.3	66.0	L1	20.1
21.995	49.3	23.7	73.0	38.7	21.3	60.0	L1	20.1

4.2.8 Test Equipment Used

Equipment	Brand	Model	Applus Ref.	Last Calibration	Next Calibration
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW8	1042124	12/03/2024	12/11/2025
LISN	R&S	ENV216	1042950	25/07/2024	25/07/2025
TRANSIENT LIMITER	SCHWARTZBECK	VTSD 9561	1042102	16/05/2024	16/05/2025
CABLE SR2	HUBER/SUHNER	RG-223	1042154	19/12/2024	19/12/2025
CABLE SR2	HUBER/SUHNER	RG-223	1042155	19/12/2024	19/12/2025
SHIELDED ROOM	ALBATROSS	SR-2	1042269	--	--
TEST SOFTWARE	ROHDE & SCHWARZ	EMC32 v.10.50.00	104624	25/07/2024	25/07/2025

Table 25: Test Instruments – Power line conducted emissions

4.2.9 Uncertainty

Test Type	Test Description	Uncertainty
Emissions	POWER LINE CONDUCTED EMISSIONS	± 3.4 dB

Table 26: Radio-frequency radiated emissions measuring Uncertainties

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by a coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%.