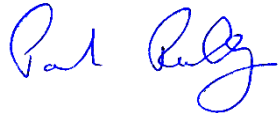


Confidential Report

Project Num	22E10132-1b
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Test Report By	Michael Kirby
FCC Test Firm Registration	409640
ISED CAB identifier:	IE0001
Date	19 th Oct 2022
EUT Description	NFC Module
FCC ID	SCC8371A
IC ID	5137A-8371A
Authorised by	Paul Reilly
Authorised Signature:	

TEST SUMMARY

Emissions were assessed to the following standards:

FCC CFR 47 Part 15
Federal Communications Commission: Part 15 Radio Frequency Devices

RSS Gen Issue 5 Amendment 1 Mar 2019
RSS-210 Issue 10 Dec 2019

The equipment complies with the requirements according to the following standards.

FCC Part Section(s)	RSS Part Section(s)	TEST PARAMETERS	Test Result
15.203		Antenna Requirement	Pass
15.225	RSS-210 B6	Spectrum Mask	Pass
15.225(d), 15.209	RSS-Gen 8.9	Limit outside band 13.11-14.01MHz	Pass
15.225e	RSS-210 B6	Frequency Stability	Pass
15.207	RSS-Gen 8.8	Conducted Emissions	Pass
	RSS-Gen 8.11	Occupied Bandwidth	Pass

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF COMPLIANCE ENGINEERING IRELAND LTD

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1 EUT Description

Model:	837-1A
Type:	NFC reader
FCC ID:	SCC837
Test Standards:	47 CFR, Part 15.225
Type of radio:	Stand-alone
Transmitter Type:	ASK 13.56MHz
Operating Frequency Range(s):	13.56MHz
Number of Channels:	1
Antenna:	Integral
Power configuration:	3.6 Vdc battery
Oper. Temp Range:	5° C to +35° C
Classification:	DXX
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

The EUT was an NFC reader operating at 13.56MHz.
The EUT forms part of a larger host (Nordic HH83-8371A).
This report concerns test on the EUT with the HH83 as support equipment.

1.1 EUT Operation

Operating Conditions during Test:

The equipment under test was operated during the measurement under the following conditions:

The EUT was operated in normal modulated mode for all tests (i.e. transmitter always operational)

The EUT was powered from the internal battery of Nordic ID HH83 (with all other radios off) which operated as support equipment

Note for Conducted Emissions on the mains, the HH83 host (containing the EUT) was placed on a charging cradle which was plugged directly into the LISN

All tests were carried out on a single sample (sample #1).

1.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: +15 to +35 ° C
Humidity: 20-75 %

Modifications

No modifications were required in order to pass the test specifications.

1.3 Date of Test

The tests were carried out on one sample (Sample #01) of the EUT on dates 3rd and 4th Oct 2022 .

1.4 Description of Test Methods

Tests were performed manually, and no special software was used

1.5 Electromagnetic Emissions Testing

The guidelines of CISPR 16-4 were used for all uncertainty calculations, estimates and expressions thereof for EMC testing. A copy of Compliance Engineering Ireland Ltd.'s policy for EMC Measurement Uncertainty is available on request.

RF Requirements: Spurious emissions in accordance with FCC CFR 15.107, 15.109 and 15.209. Tests were carried out to the requirements of CISPR 16-4 and ANSI C63.4-2014.

1.6 Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for the conducted emissions test was ± 3.5 dB.

The measurement uncertainty (with a 95% confidence level) for the radiated emissions test was ± 5.3 dB (from 30 to 100 MHz), ± 4.7 dB (from 100 to 300 MHz), ± 3.9 dB (from 300 to 1000 MHz) and ± 3.8 dB (from 1 GHz to 40 GHz).

1.7 Antenna Requirements

According to FCC 47 CFR 15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

* The antennas of this E.U.T are internal to the unit and are permanently attached.

*The E.U.T Complies with the requirement of 15.203

2 Emissions Measurements

2.1 Conducted Emissions Measurements

The EUT was connected to a 12v DC adapter Manufacturer Kings Model KSS12_120_1000B, which was connected to the mains through a LISN and measurements were carried out using a Receiver over the frequency range 150KHz to 30MHz.

2.2 Radiated Emissions Measurements

Radiated Power measurements were made at the Compliance Engineering Ireland Ltd anechoic chamber located in Dunshaughlin, Co. Meath, Ireland to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

The EUT was centred on a motorized turntable, which allows 360 degree rotation. A measurement antenna was positioned at a distance of 3 metres as measured from the closest point of the EUT. The radiated emissions were maximised by configuring the EUT, by rotating the EUT and by raising and lowering the antenna from 1 to 4 meters. Emissions below 30MHz were measured using a loop antenna. In this case the resolution bandwidth was 200Hz for frequencies below 150KHz and RBW was 9KHz for frequencies above 150KHz.

Emissions between 30MHz and 300MHz were measured using a bi-conical antenna. Emissions between 300MHz and 1GHz were measured using a bi-log antenna. In both cases the resolution bandwidth was 120KHz.

3.0 Results for Conducted emissions

Ambient Temp 21.6deg C RH =31.2%

Mains Conducted Emissions results

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.1523	41.12	-24.82	Live
Average	0.3908	27.97	-21.15	Live
Average	0.7980	16.33	-29.67	Live
Quasi-Peak	1.2908	21.38	-34.62	Live
Average	1.316	15.79	-30.21	Live
Average	1.318	15.88	-30.12	Live
Average	1.320	15.83	-30.17	Live
Average	1.322	15.81	-30.19	Live
Average	2.393	16.48	-29.52	Live
Quasi-Peak	13.560	22.69	-37.31	Live
Quasi-Peak	21.120	29.56	-30.44	Live
Average	21.534	20.80	-29.2	Live

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.1523	41.31	-24.63	Neutral
Average	0.3908	27.88	-21.24	Neutral
Average	0.7980	16.48	-29.52	Neutral
Quasi-Peak	1.2908	20.97	-35.03	Neutral
Average	1.3155	14.34	-31.66	Neutral
Average	1.3178	14.32	-31.68	Neutral
Average	1.3200	14.28	-31.72	Neutral
Average	1.3223	14.30	-31.7	Neutral
Average	2.3933	14.95	-31.05	Neutral
Quasi-Peak	13.5600	19.37	-40.63	Neutral
Quasi-Peak	21.1200	26.81	-33.19	Neutral
Average	21.5340	17.59	-32.41	Neutral

Ref Appendix B for scans

Result: Pass

4.0 Results for Radiated emissions

4.1 Carrier Power

Limit as per 15.225

Frequency	Level	Antenna Factor	Cable Loss	Final Field Strength	Detector	Emission Limit	Margin	Pass / Fail
MHz	dBuV	dB	dB	dBuV/m		dBuV/m	dB	P/F
13.56	45.83	8.25	0.1	54.18	Peak	124	69.82	Pass

Note1 as the pulse rate (1/period) is less than 20Hz, a peak detector measurement as per 15.35a was used

Note 2

Field strength 54.18dBuV/m @ 3m

Limits are for 30m

Correction for distance $40 \cdot \log(3/30) = -40\text{dB}$ as per RSS Gen 6.5

$54.18\text{dBuV/m @}3\text{m} - 40 = 14.18\text{ dBuV/m @} 30\text{m}$

Result: Pass

4.2 Mask

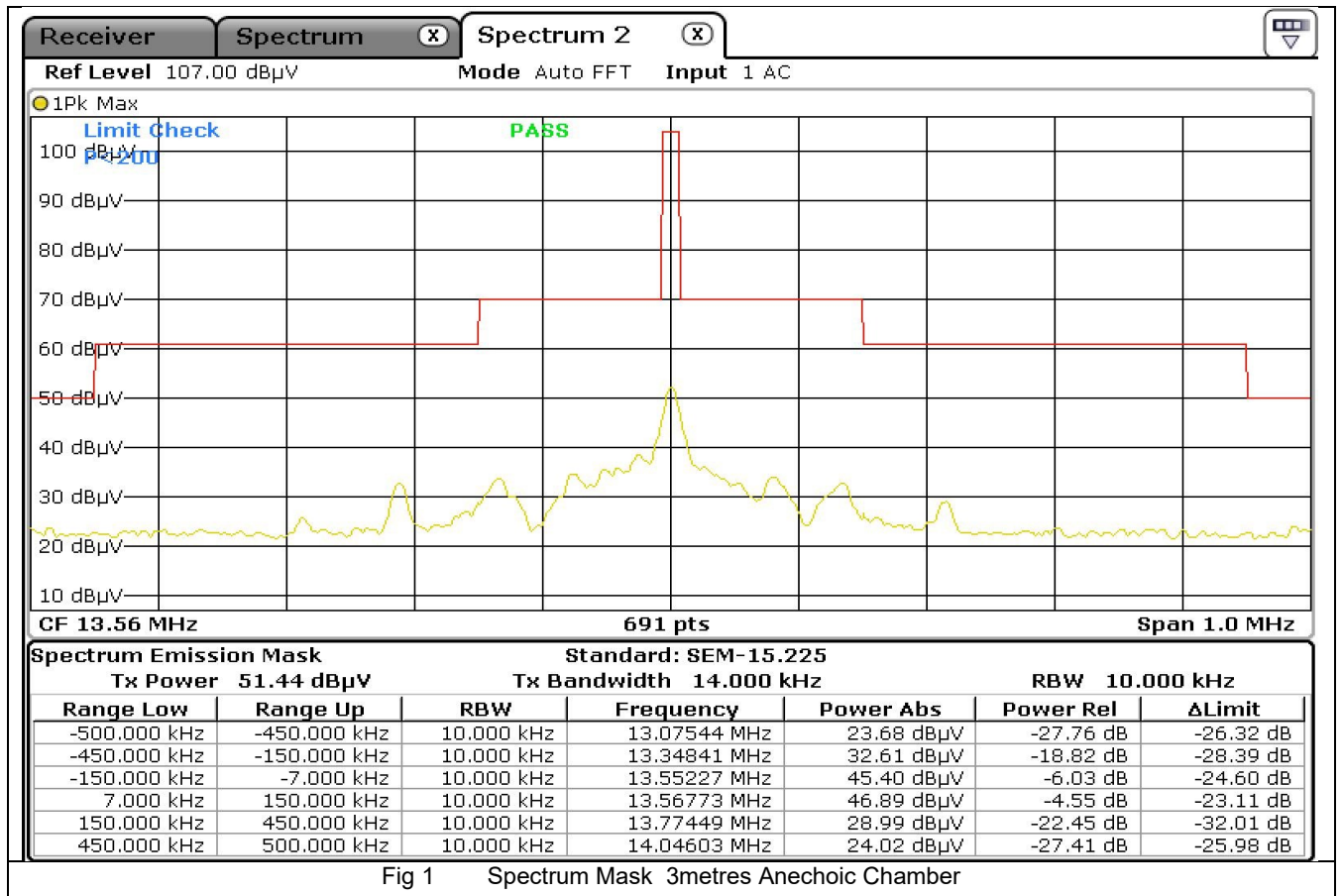


Fig 1 Spectrum Mask 3metres Anechoic Chamber

Test result Pass

4.3 Duty Cycle

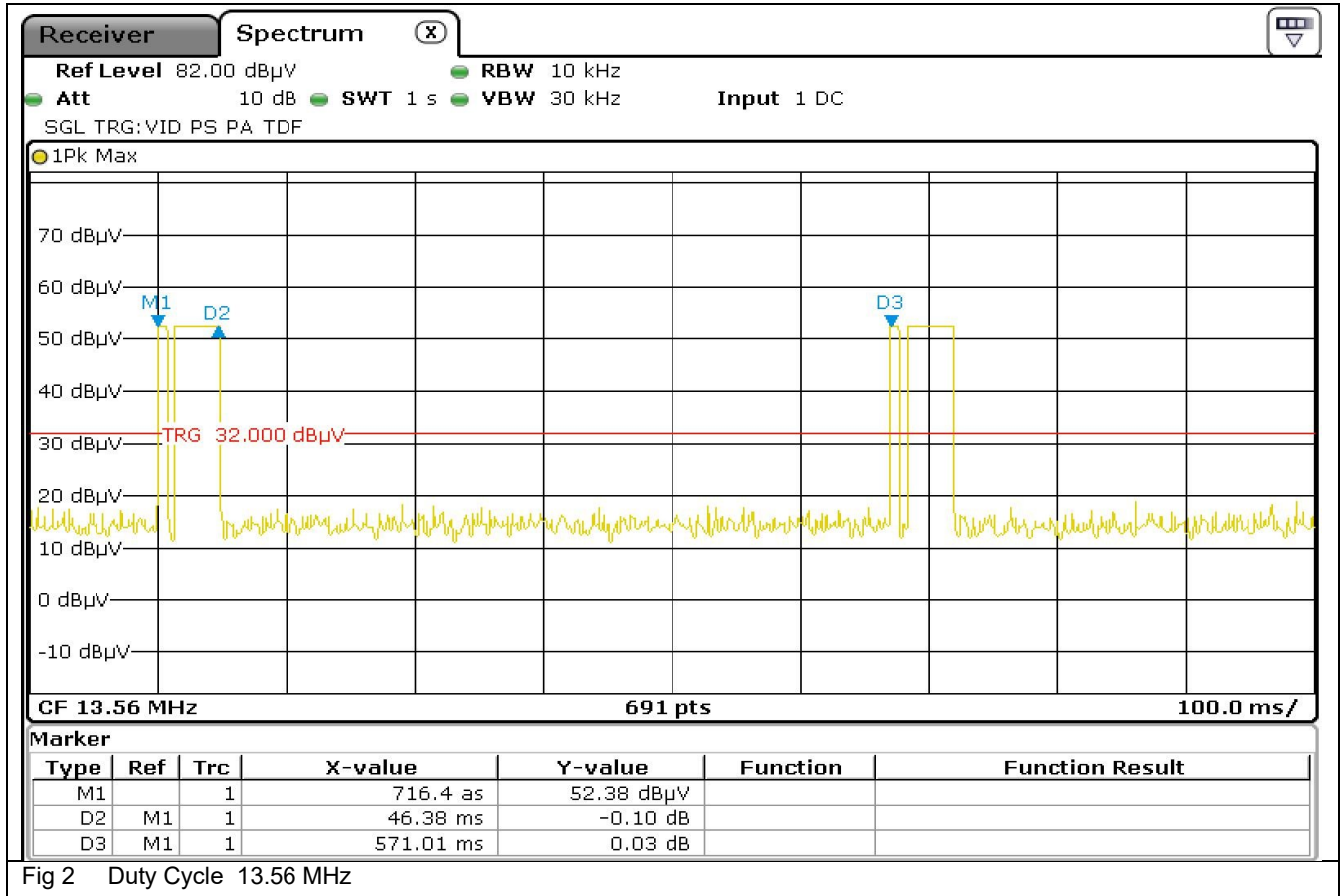


Fig 2 Duty Cycle 13.56 MHz

Pulse repetition rate = $1/574\text{ms}$ = 1.7Hz

4.4 Spurious Emissions Measurements 9kHz -30MHz

Frequency	Level	Antenna Factor	Cable Loss	Final Field Strength	Detector	Spurious Emission Limit	Margin	Pass / Fail
MHz	dBuV	dB	dB	dBuV/m		dBuV/m	dB	P/F
*0.0091	56.9	13.6	0.1	70.6	Average	128.42	57.82	Pass
*0.0183	51.22	11.78	0.1	63	Average	122.36	59.36	Pass
*0.0196	49.22	11.78	0.1	61	Average	121.76	60.76	Pass
*0.0234	48.74	10.86	0.1	59.6	Average	120.22	60.62	Pass
*0.06	56.18	9.72	0.1	65.9	Average	112.04	46.14	Pass
*0.071	39.51	9.69	0.1	49.2	Average	110.58	61.38	Pass
*0.081	41.51	9.69	0.1	51.2	Average	109.42	58.22	Pass
*0.252	70.51	9.49	0.1	80	Average	99.58	19.58	Pass

* background

Spurious Emissions which are harmonics of the fundamental at 13.56MHz

Frequency	Level	Antenna Factor	Cable Loss	Final Field Strength Peak	Detector	Limit	Margin	Pass / Fail
MHz	dBuV	dB	dB	dBuV/m		dBuV/m	dB	P/F
27.12	9.98	6.32	0.1	16.4	Peak	69.54	53.14	Pass

Note as the pulse rate (1/period) is less than 20Hz, a peak detector measurement as per 15.35a was used

Appendix A shows the results of the scans in the anechoic chamber.

Result: Pass

4.5 Measurements 30MHz to 1GHz

4.5.1 Spurious Emissions which are not harmonics of the fundamental

Frequency MHz	Quasi Peak Level dBuV/m	Antenna Polarity	Antenna Factor dB	Cable loss dB	Final Field Strength Quasi Peak dBuV/m	Quasi Peak Limit dBuV/m	Margin dB
97.23	8.5	Vertical	9.3	1.1	18.9	43.5	24.6
194.46	-12.4	Vertical	14	1.2	2.8	43.5	40.7
91.32	-3.5	Horizontal	9.2	1.1	6.8	43.5	36.7
100.89	-7.4	Horizontal	9.5	1.1	3.2	43.5	40.3
147.57	9.4	Horizontal	11.7	1.2	22.3	43.5	21.2
391.23	-6.3	Vertical	16	1.6	11.3	46.0	34.7
731.16	-6.1	Vertical	21.4	2.1	17.4	46.0	28.6
391.23	-6.4	Horizontal	16	1.6	11.2	46.0	34.8
736.29	-5.5	Horizontal	21.5	2.1	18.1	46.0	27.9

Appendix A shows the results of the scans in the anechoic chamber.

Result: Pass

4.5.2 Spurious Emissions which are harmonics of the fundamental

Frequency MHz	Peak Level dBuV/m	Antenna Polarity	Antenna Factor dB	Cable loss dB	Final Field Strength Peak dBuV/m	Limit	Margin dB
40.68	6.8	Vertical	11	0.9	18.7	40.0	21.3
40.68	5.9	Horizontal	11	0.9	17.8	40.0	22.2

Note as the pulse rate (1/period) is less than 20Hz, a peak detector measurement as per 15.35a is used

Appendix A shows the results of the scans in the anechoic chamber.

Result: Pass

4.6 Frequency Stability Temperature Testing

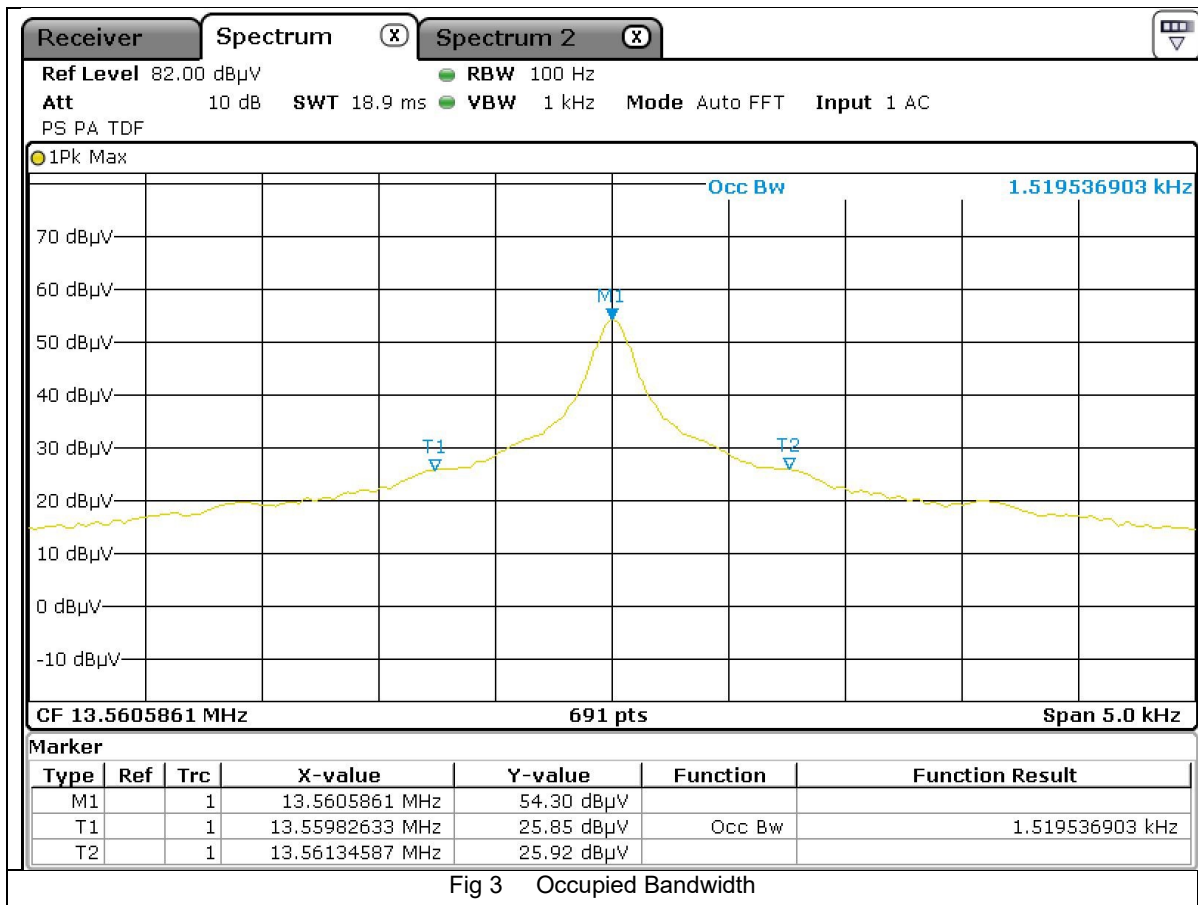
(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery

The EUT was supplied from the internal rechargeable battery of the HH83 product which could not be removed. The HH83 battery was fully charged prior to the test.

Temp Deg C	Supply V dc	Frequency MHz	Variation %	Limit %	Result
50	3.6	13.560536	-0.0005	0.01	Pass
40	3.6	13.560543	-0.0005	0.01	Pass
30	3.6	13.560579	-0.0002	0.01	Pass
20	3.6	13.560608	0	0.01	Pass
10	3.6	13.560679	0.0005	0.01	Pass
0	3.6	13.560635	0.0002	0.01	Pass
-10	3.6	13.560628	0.0001	0.01	Pass
-20	3.6	13.560598	-0.0001	0.01	Pass

Result: Pass

4.7 99% Occupied Bandwidth



13.56MHz Occupied Bandwidth = 1.52KHz

Test Result Pass

5. Measurement Uncertainties

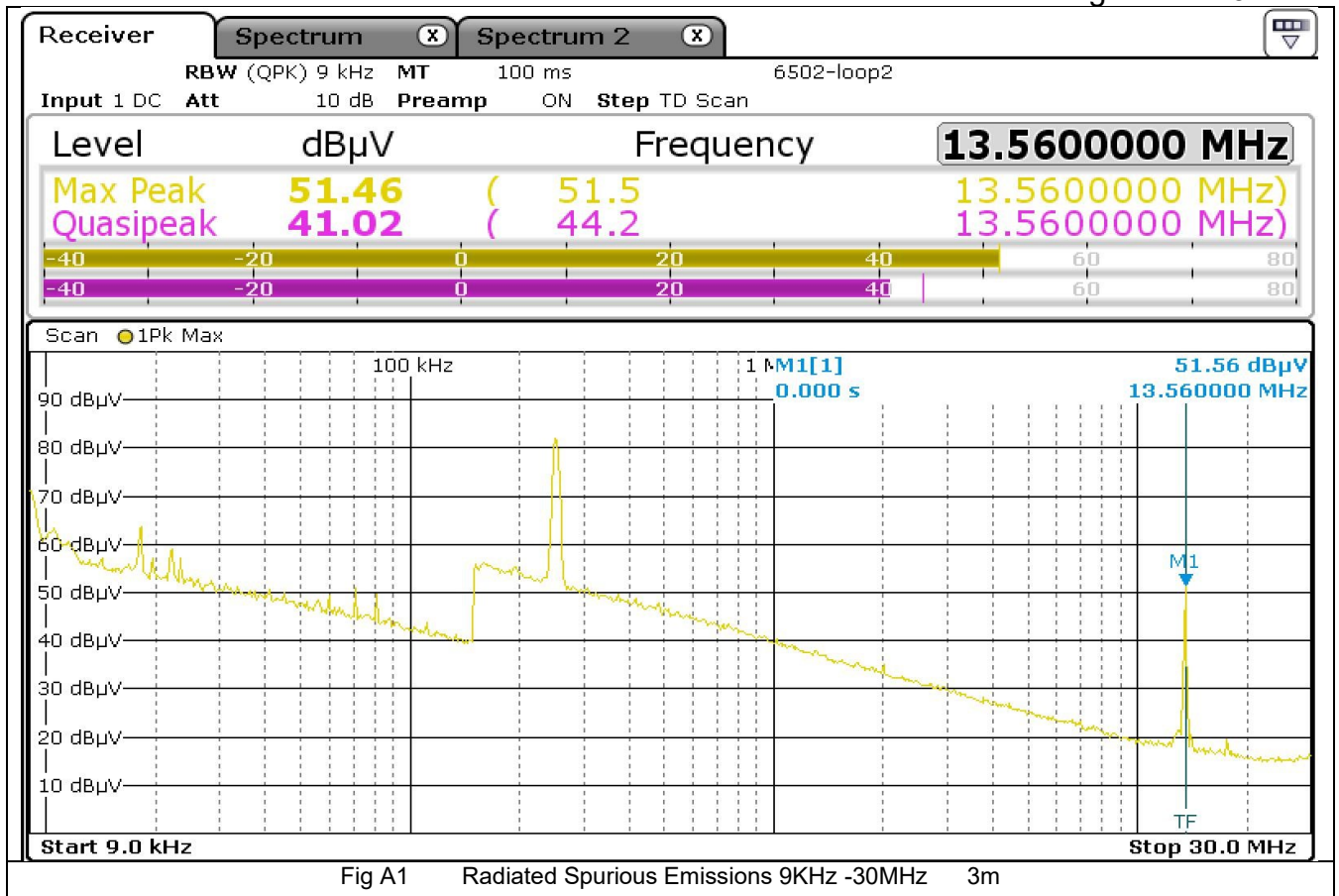
Measurement	Uncertainty
Radio Frequency	+/- 5×10^{-7}
Maximum Frequency Deviation	+/- 1.7 %
Radiated Emission 30MHz-100MHz	+/- 5.3 dB
Radiated Emission 100MHz-300MHz	+/- 4.7 dB
Radiated Emission 300MHz-1GHz	+/- 3.9 dB
Radiated Emission 1GHz-40GHz	+/- 3.8 dB
Occupied Bandwidth	± 5%
Conducted RF power	± 1.23 dB
Conducted Spurious Emission of transmitter	± 2.14 dB
Conducted Emissions of Receivers	± 2.14 dB
RF level of uncertainty for a given BER	± 1.23 dB
Temperature	± 0.2 °C
Humidity	± 4% RH
Frequency	±0.01 ppm
Duty Cycle	+/- 5 %

Table 1: Measurement Uncertainties

The measurement uncertainties stated were calculated with a k=2 for a confidence level of 95.45%.

The test data can be compared directly to the specification limit to determine compliance, as the calculated measurement uncertainty meets the requirements of the applicable specification.

Appendix A: Spurious Emissions Scans



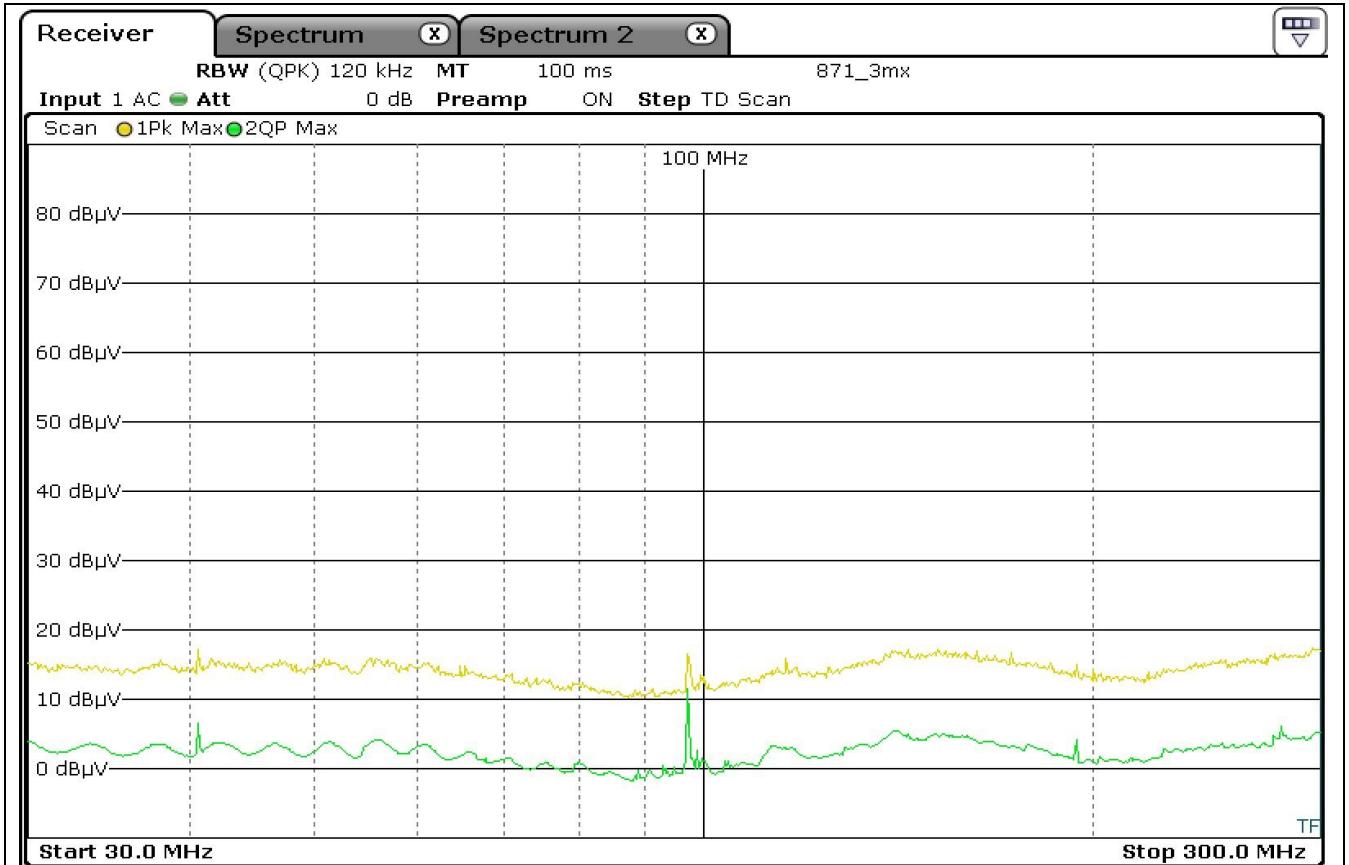


Fig A2 Radiated Emissions 30MHz-300MHz Vertical 3metres Anechoic Chamber

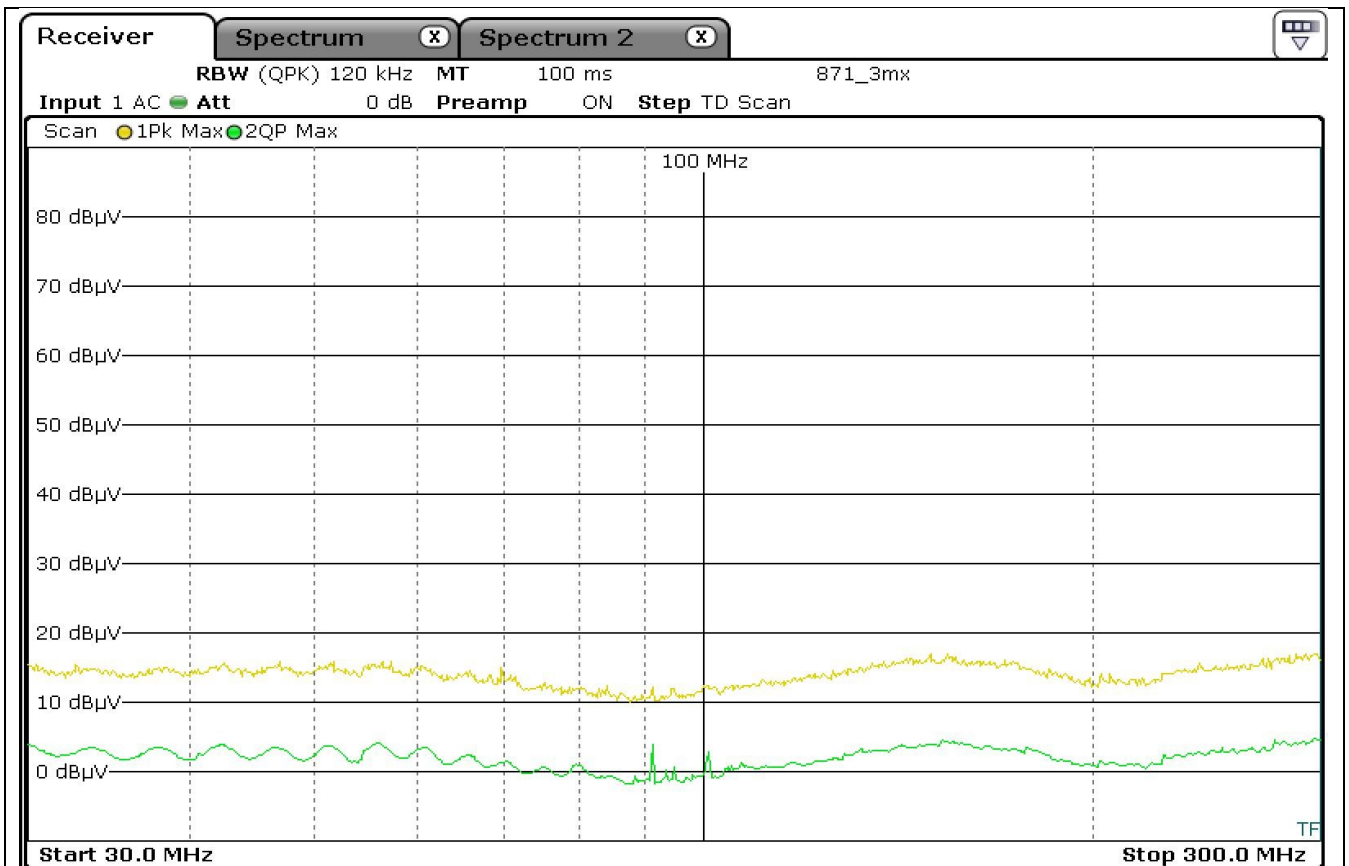
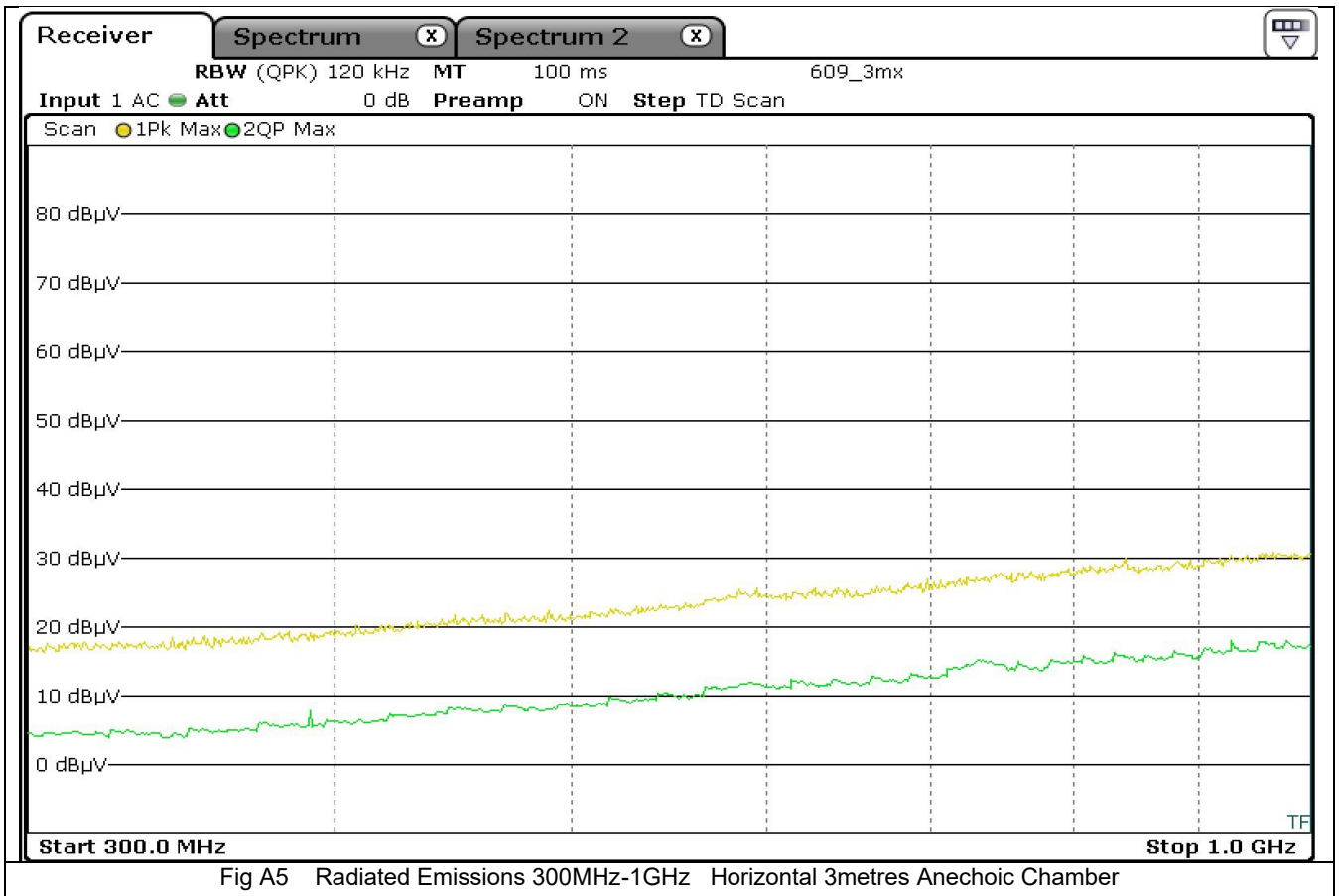
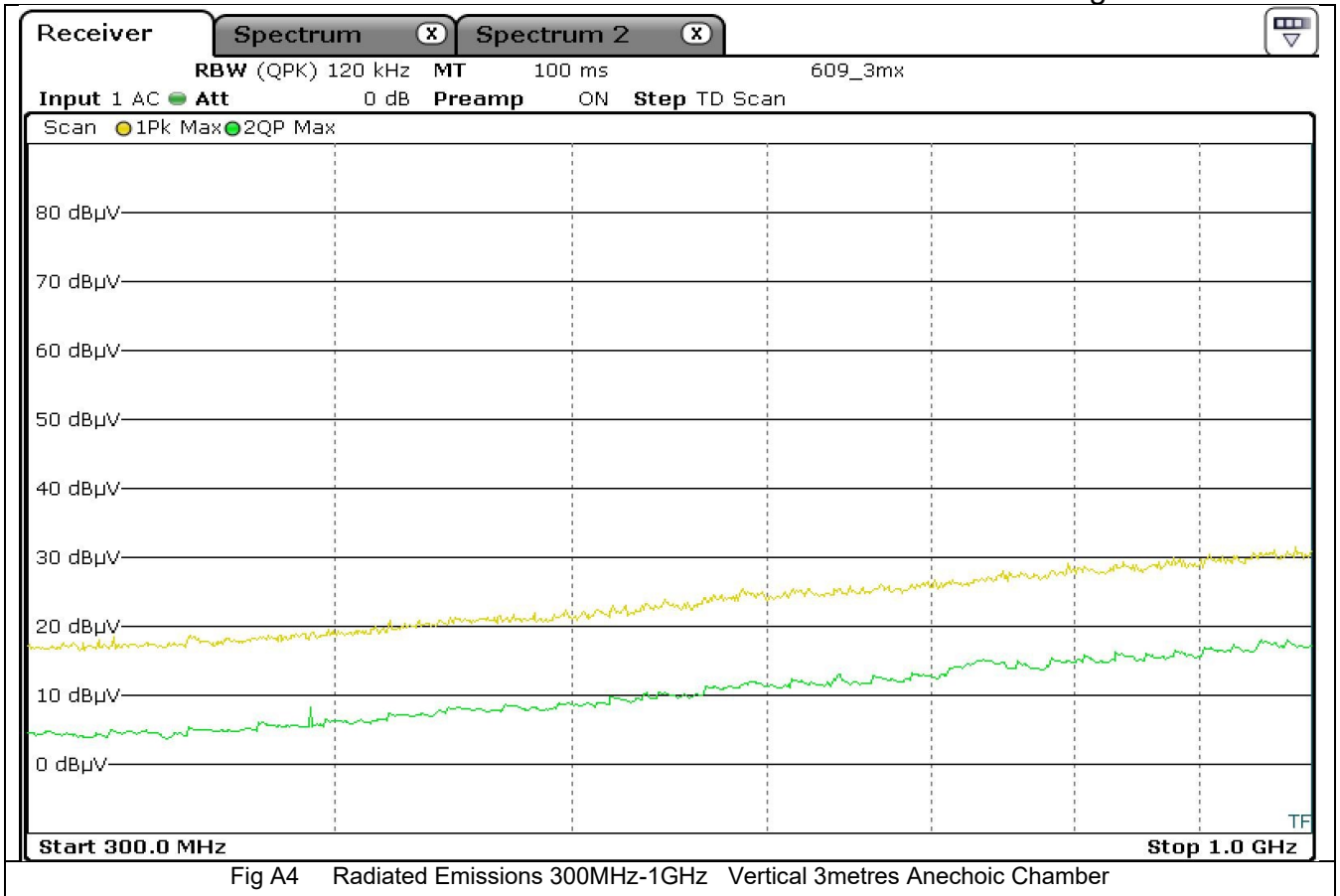


Fig A3 Radiated Emissions 30MHz-300MHz Horizontal 3metres Anechoic Chamber



Appendix B Conducted Emissions on the mains

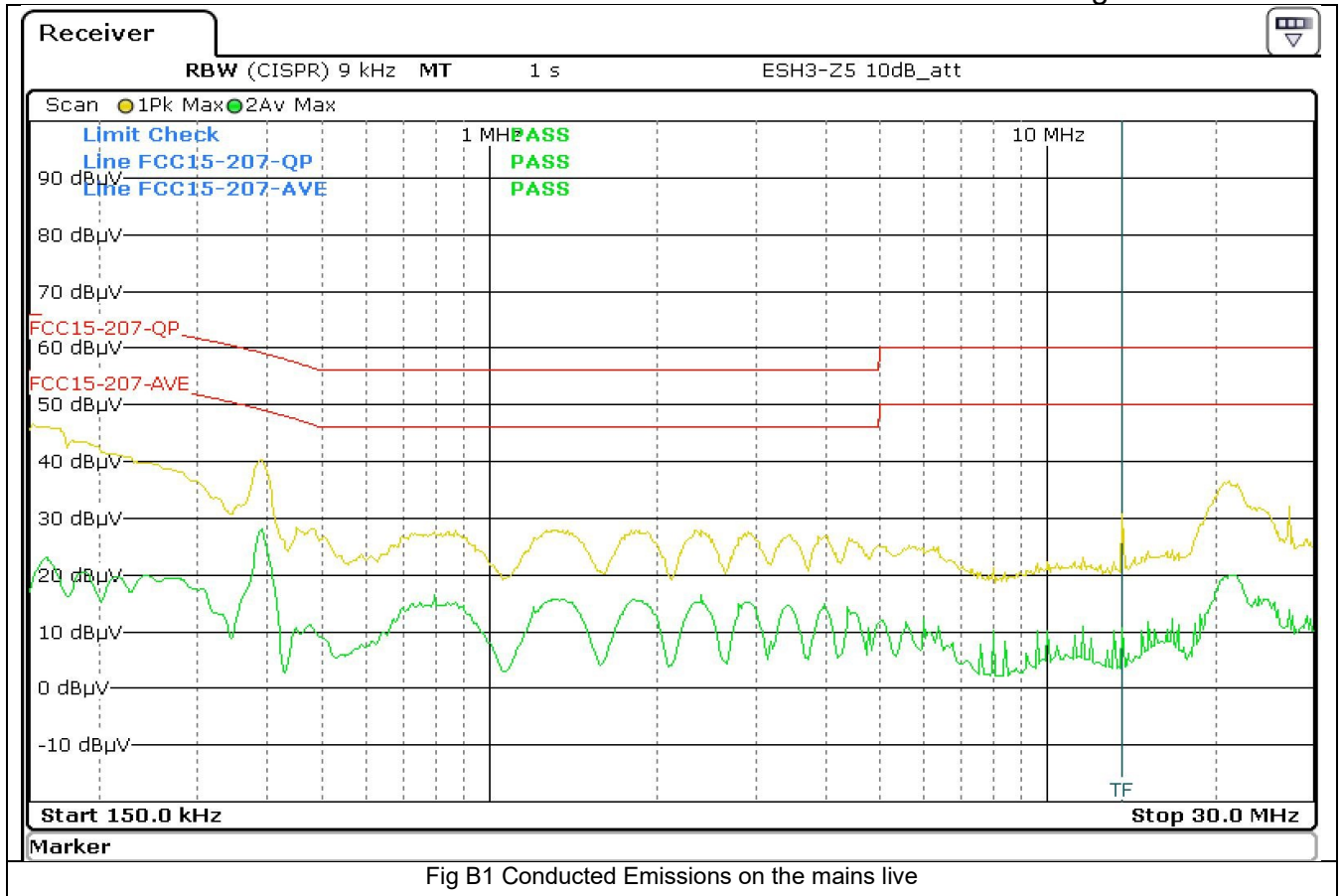


Fig B1 Conducted Emissions on the mains live

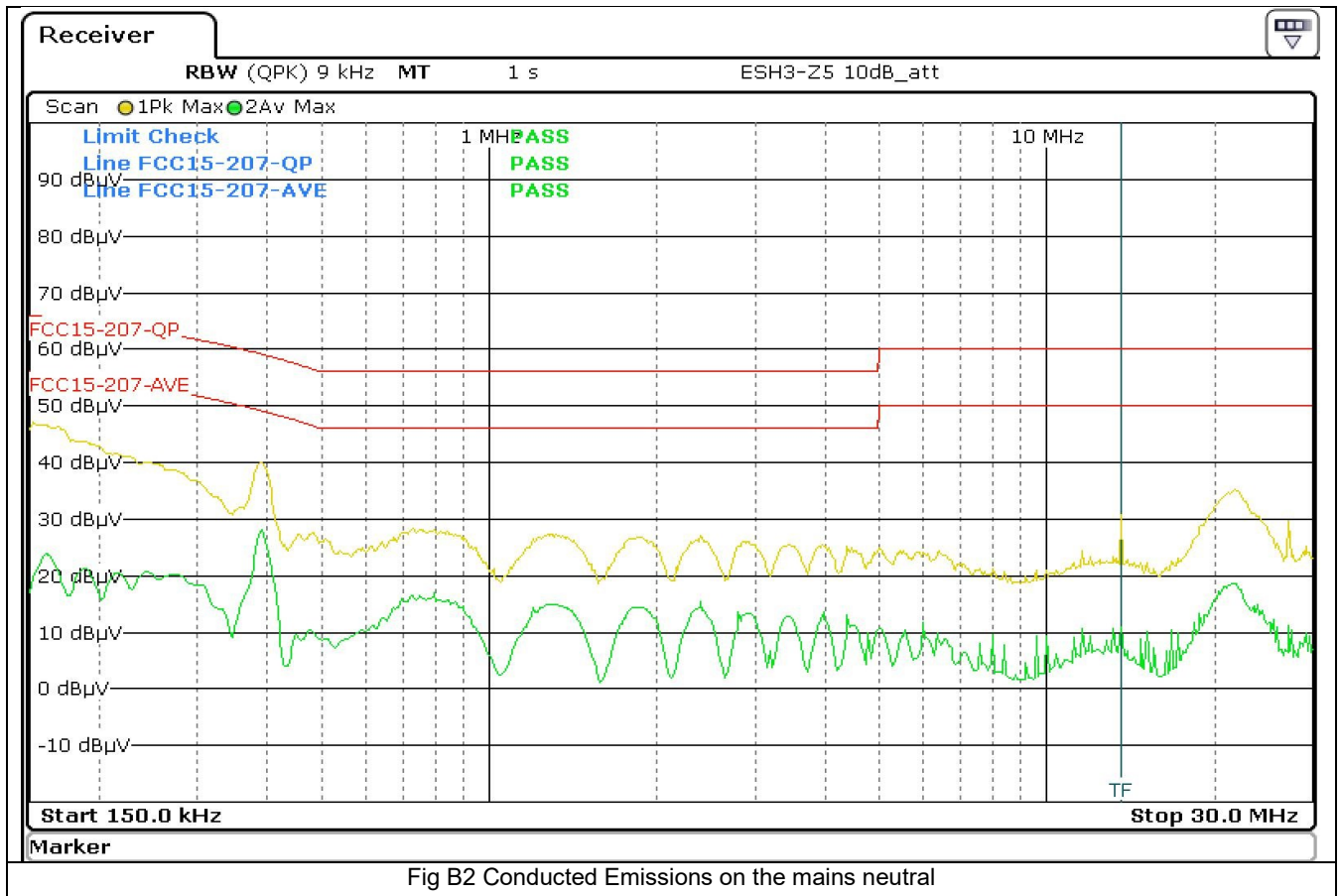
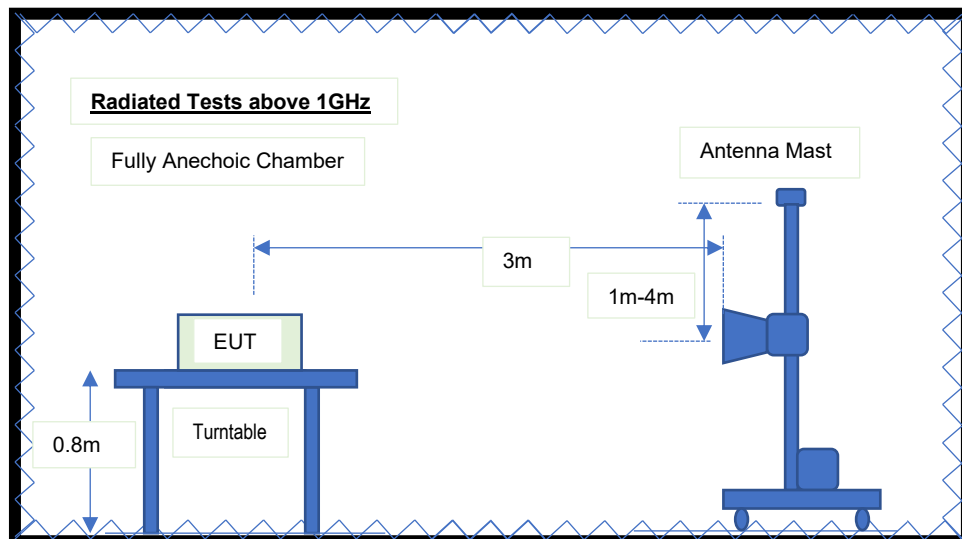
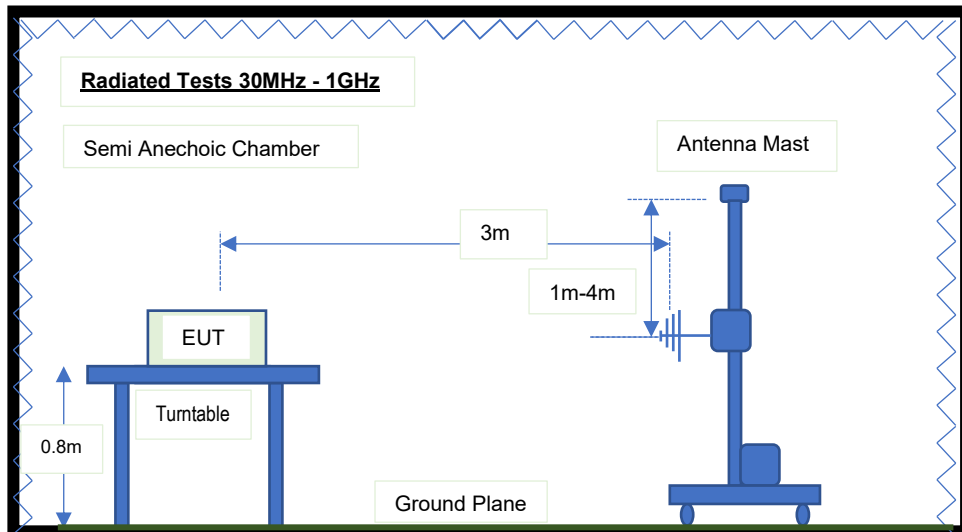


Fig B2 Conducted Emissions on the mains neutral

Appendix C List of Test Equipment

Instrument	Manufacturer	Model	Serial Num	CEI Ref	Cal Due Date	Cal Interval Months
Microwave Preamplifier	Hewlett Packard	83017A	3123A00175	805	30-Sep-23	12
Spectrum Analyser 30Hz-40GHz	Rohde& Schwarz	FSP40	100053	850	10-Dec-24	36
Test Receiver 3.6GHz	Rohde& Schwarz	ESR	1316.3003k03-101625-s	869	28-May-23	36
LISN	Rohde & Schwarz	ESH3-Z5	825460/003	604	16-Feb-23	36
Antenna Horn	EMCO	3115	9905-5809	655	21-Jan-24	24
Loop Antenna	EMCO	6502	2233	1065	13-Nov-23	36
Fully Anechoic Chamber	CEI	FAR 3M	906	906	23-Jul-25	36
Anechoic Chamber	CEI	SAR 10M	845	845	17-May-25	36
Antenna Biconical	Schwarzbeck	VHBB 9124	9124 667	871	06-Oct-24	36
Antenna Log Periodic	Chase	UPA6108	1072	609	09-Sep-24	36
Antenna Horn Standard Gain 18-26.5GHz	A-info	LB-42-25-C-KF	J2021091103028	877	05-Oct-23	12
Cable Ntype 10m				963	29-Jul-23	12
Cable Ntype 2m				828	29-Jul-23	12
Cable purple Ktype 1.8m				917	29-Jul-23	12
Cable Ntype 10m				914	29-Jul-23	12
Cable HF Ktype 1.5m				705	29-Jul-23	12

Appendix D Test Setup



End of Report