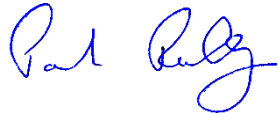


**Confidential Report**

<b>Project Num</b>	20E8588-1b
<b>Quotation</b>	Q19-1405-1
<b>Prepared For</b>	Nordic ID Oy
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<b>Tested By</b>	Michael Kirby
<b>Test Report By</b>	Michael Kirby
<b>FCC Test Firm Registration</b>	409640
<b>ISED CAB identifier:</b>	IE0001
<b>Date</b>	8 <sup>th</sup> Apr 2020
<b>EUT Description</b>	NFC Module
<b>FCC ID</b>	SCC837
<b>IC ID</b>	5137A-837
<b>Authorised by</b>	<b>Paul Reilly</b>
<b>Authorised Signature:</b>	

## 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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**Exhibit A – Technical Report**

Table of Contents

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<b>1.0</b>	<b>EUT DESCRIPTION .....</b>	<b>4</b>
<b>1.1</b>	<b>EUT OPERATION.....</b>	<b>5</b>
<b>1.2</b>	<b>MODIFICATIONS .....</b>	<b>5</b>
<b>1.3</b>	<b>DATE OF TEST .....</b>	<b>5</b>
<b>1.4</b>	<b>EMISSIONS TESTING.....</b>	<b>6</b>
<b>1.4.1</b>	<b>MEASUREMENT UNCERTAINTY .....</b>	<b>6</b>
<b>2.0</b>	<b>EMISSIONS MEASUREMENTS.....</b>	<b>7</b>
<b>3.0</b>	<b>RESULTS FOR CONDUCTED EMISSIONS.....</b>	<b>9</b>
<b>4.0</b>	<b>RESULTS FOR RADIATED EMISSIONS .....</b>	<b>10</b>
	 Appendix A Radiated Emissions Scans	 17
	Appendix B Conducted Emissions Scans	21
	Appendix C List of Test Equipment	23

## 1.0 EUT Description

<b>Model:</b>	837
<b>Type:</b>	NFC reader
<b>FCC ID:</b>	SCC837
<b>Test Standards:</b>	47 CFR, Part 15.225
<b>Type of radio:</b>	Stand-alone
<b>Transmitter Type:</b>	ASK 13.56MHz
<b>Operating Frequency Range(s):</b>	13.56MHz
<b>Number of Channels:</b>	1
<b>Antenna:</b>	Integral
<b>Power configuration:</b>	3.6 Vdc battery
<b>Oper. Temp Range:</b>	5° C to +35° C
<b>Classification:</b>	DXX
<b>Test Methodology:</b>	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).  
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

### **Environmental conditions**

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

Temperature: +15 to +35 ° C

Humidity: 20-75 %

## 1.2 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 of the EUT on dates 28<sup>th</sup> Feb 2020.

## 1.4 Description of Test Methods

Tests were performed manually, and no special software was used

#### **1.4 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.

##### **1.4.1 Measurement Uncertainty**

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

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

## **2 Emissions Measurements**

### **2.1 Conducted Emissions Measurements**

The EUT was connected to 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.

## 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



### 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	0.1590	44.31	-21.43	Live
Quasi-Peak	0.1950	41.26	-23.45	Live
Quasi-Peak	0.2288	38.88	-24.87	Live
Quasi-Peak	0.2580	38.42	-24.49	Live
Quasi-Peak	0.389	40.80	-18.39	Live
Average	0.389	37.65	-11.54	Live
Average	0.713	25.75	-20.25	Live
Average	0.744	25.69	-20.31	Live
Average	0.778	24.98	-21.02	Live
Quasi-Peak	0.789	28.51	-27.49	Live
Average	0.809	24.65	-21.35	Live
Quasi-Peak	13.560	41.09	-18.91	Live
Average	21.525	33.54	-16.46	Live
Average	21.527	33.40	-16.6	Live
Average	21.530	33.42	-16.58	Live

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.1590	44.23	-21.51	Neutral
Quasi-Peak	0.1950	41.38	-23.33	Neutral
Quasi-Peak	0.2288	39.02	-24.73	Neutral
Quasi-Peak	0.2580	38.58	-24.33	Neutral
Quasi-Peak	0.3885	41.07	-18.12	Neutral
Average	0.3885	37.79	-11.4	Neutral
Average	0.7125	24.85	-21.15	Neutral
Average	0.7440	24.98	-21.02	Neutral
Average	0.7778	24.07	-21.93	Neutral
Quasi-Peak	0.7890	27.22	-28.78	Neutral
Average	0.8093	23.96	-22.04	Neutral
Quasi-Peak	13.5600	40.42	-19.58	Neutral
Average	21.5250	32.91	-17.09	Neutral
Average	21.5273	32.74	-17.26	Neutral
Average	21.5295	32.85	-17.15	Neutral

Ref Appendix B for scans

**Result: Pass**

#### 4.0 Results for Radiated emissions

Ambient Temp 20deg C RH =42%

#### 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/m	dB	dB	dBuV/m		dBuV/m	dB	P/F
13.56	43.55	8.25	0.1	51.9	Peak	124	72.1	Pass

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

**Result: Pass**

### 4.2 Mask

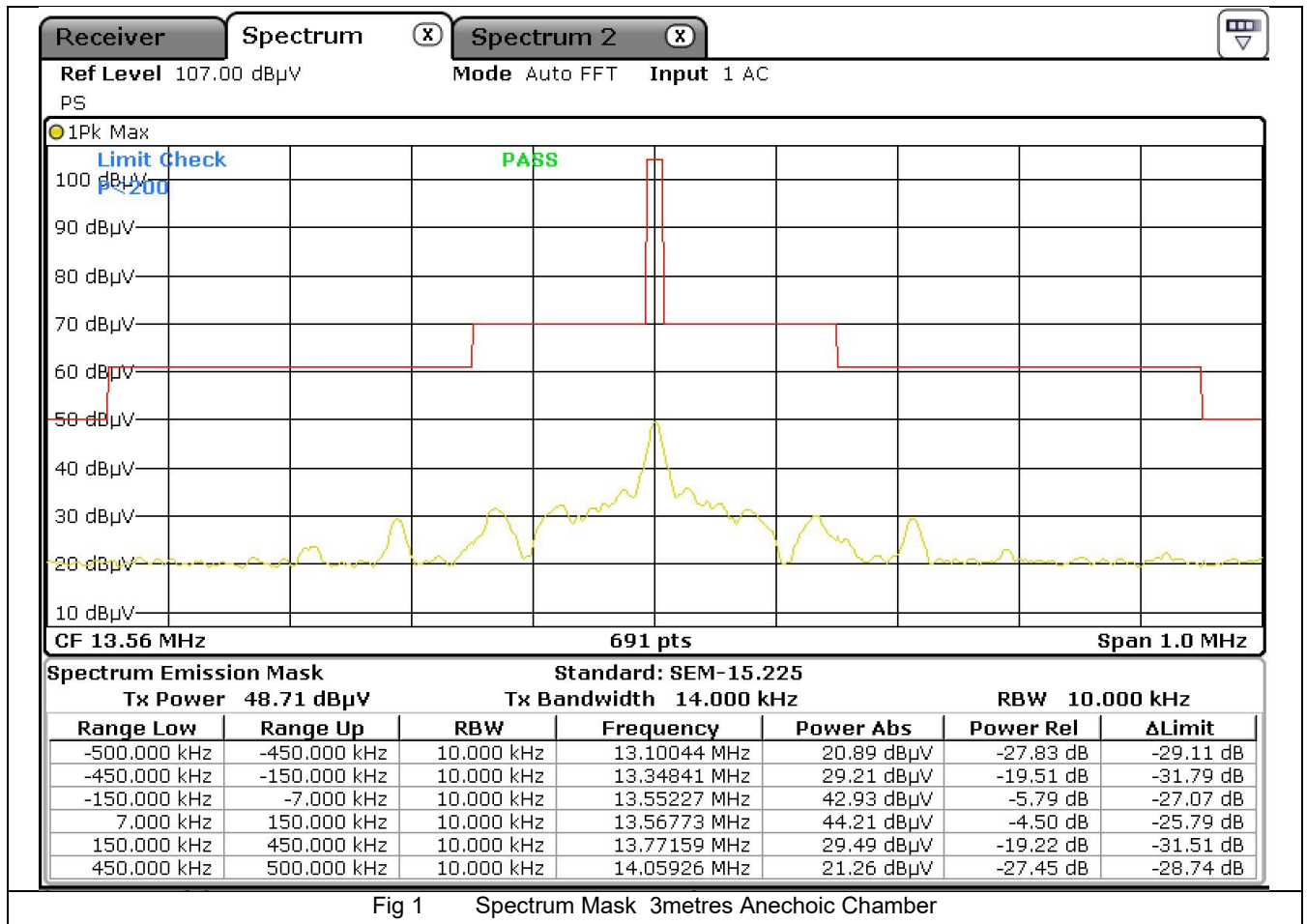
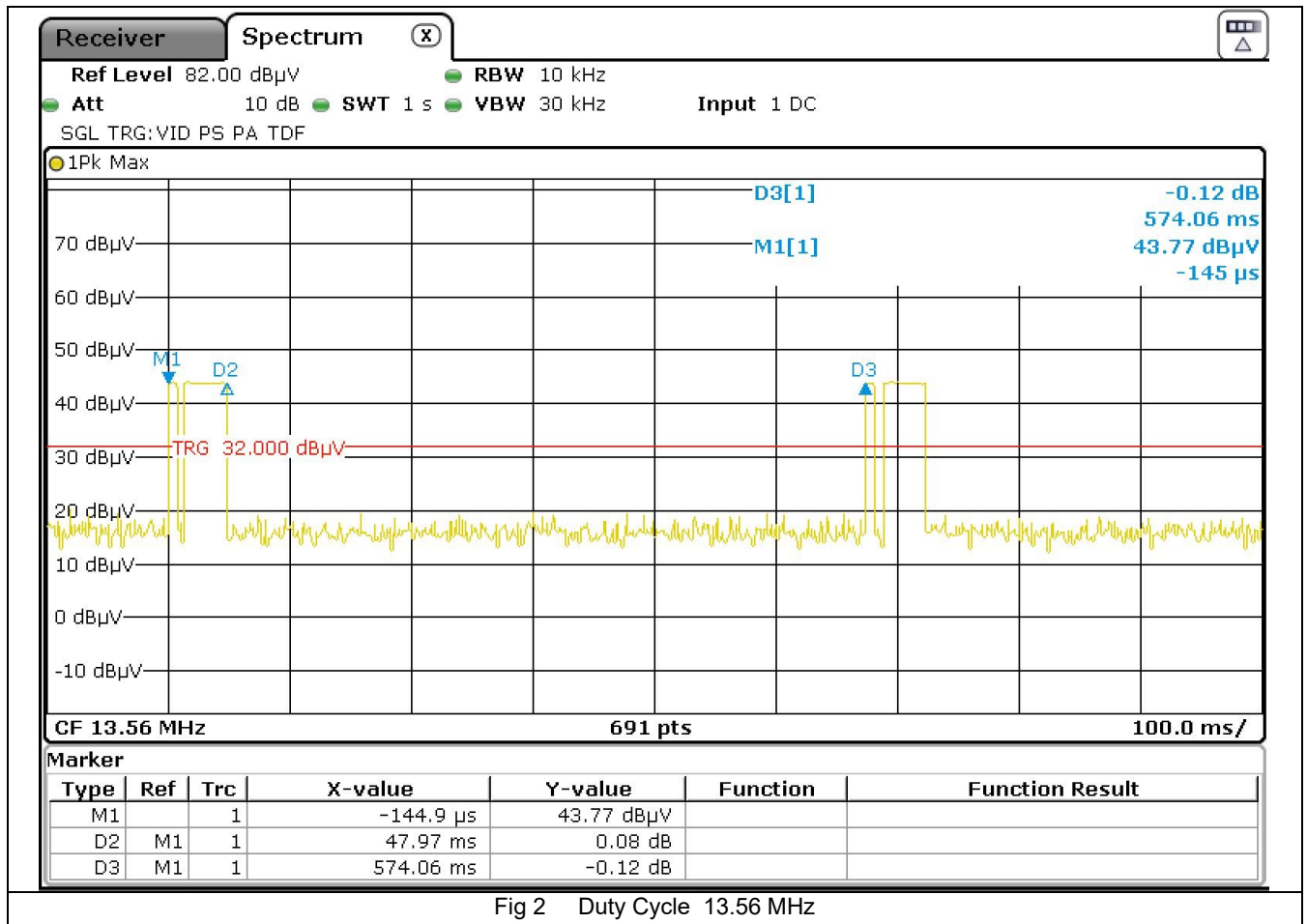


Fig 1 Spectrum Mask 3metres Anechoic Chamber

Test result Pass

### 4.3 Duty Cycle



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

#### 4.4 Spurious Emissions Measurements 9kHz -30MHz

##### 4.4.1

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
*0.01	49.3	13.6	0.1	63	Average	127.6	64.6	Pass
*0.016	40.12	11.78	0.1	52	Average	123.52	71.52	Pass
*0.018	36.12	11.78	0.1	48	Average	122.5	74.5	Pass
*0.02	38.04	10.86	0.1	49	Average	121.58	72.58	Pass
*0.022	35.04	10.86	0.1	46	Average	120.76	74.76	Pass
*0.252	53.11	9.49	0.1	62.7	Average	99.58	36.88	Pass

\* background

##### 4.4.2 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	8.28	6.32	0.1	14.7	Peak	69.54	54.84	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
55.68	-2.7	Vertical	6.7	0.2	4.2	40.0	35.8
154.65	-6.9	Vertical	11.2	0.2	4.5	43.5	39.0
299.7	-7.1	Vertical	12.9	1.2	7	46.0	39.0
39.06	-11	Horizontal	15.3	0.2	4.5	40.0	35.5
56.37	-2.2	Horizontal	6.7	0.2	4.7	40.0	35.3
154.53	-6.2	Horizontal	11.2	0.2	5.2	43.5	38.3

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 at 13.56MHz

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	3.6	Vertical	14.2	0.2	18	40.0	22.0
40.68	-0.4	Horizontal	14.2	0.2	14	40.0	26.0

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

Ambient Temp 19.3deg C RH =38%

(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

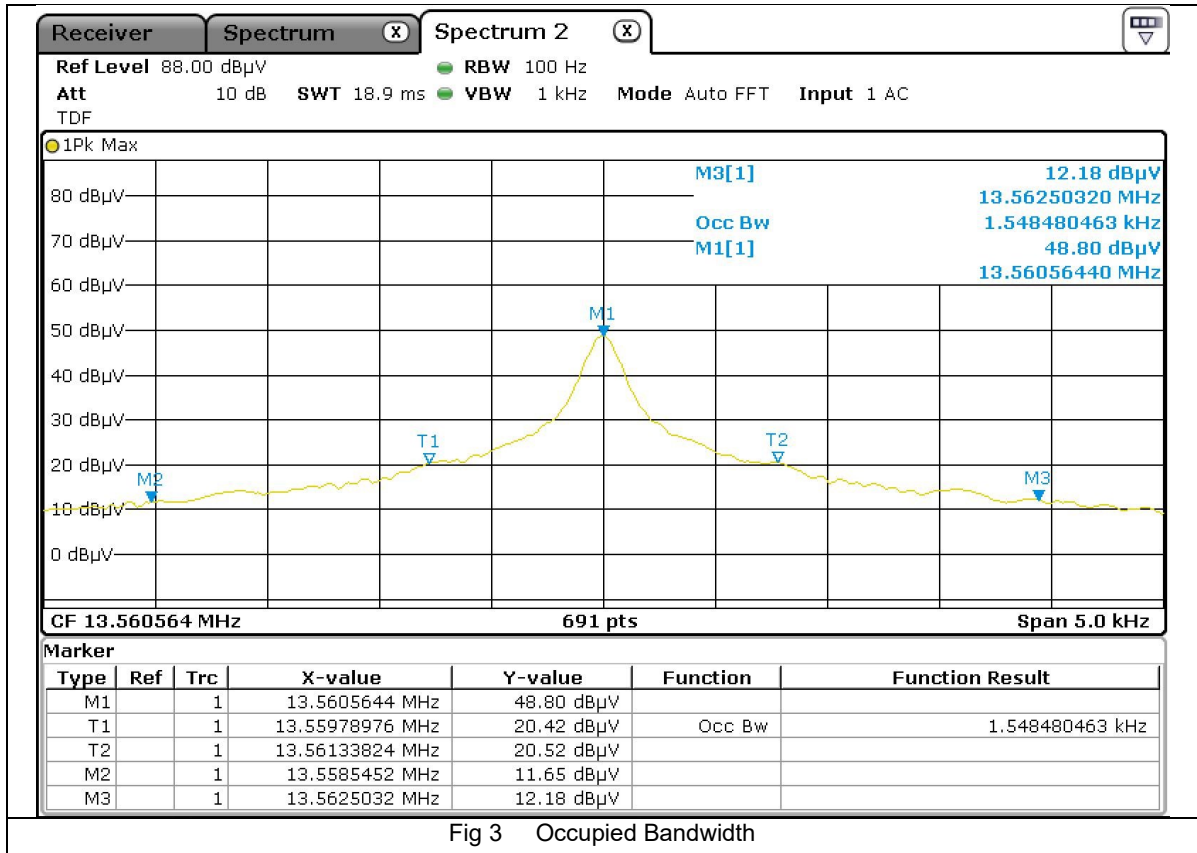
The EUT was supplied from the internal rechargeable battery of the HH83 product which could not be removed. The HH8 battery was fully charged prior to the test.

Temp Deg C	Supply V dc	Frequency MHz	Variation %	Limit %	Result
50	3.6	13.56058	-0.0007	0.01	Pass
40	3.6	13.560609	-0.0005	0.01	Pass
30	3.6	13.560638	-0.0003	0.01	Pass
20	3.6	13.560674	0	0.01	Pass
10	3.6	13.560706	0.0002	0.01	Pass
0	3.6	13.560714	0.0003	0.01	Pass
-10	3.6	13.560709	0.0003	0.01	Pass
-20	3.6	13.560671	0	0.01	Pass

**Result: Pass**

### 4.7 99% Occupied Bandwidth

Ambient Temp 20deg C RH =42%

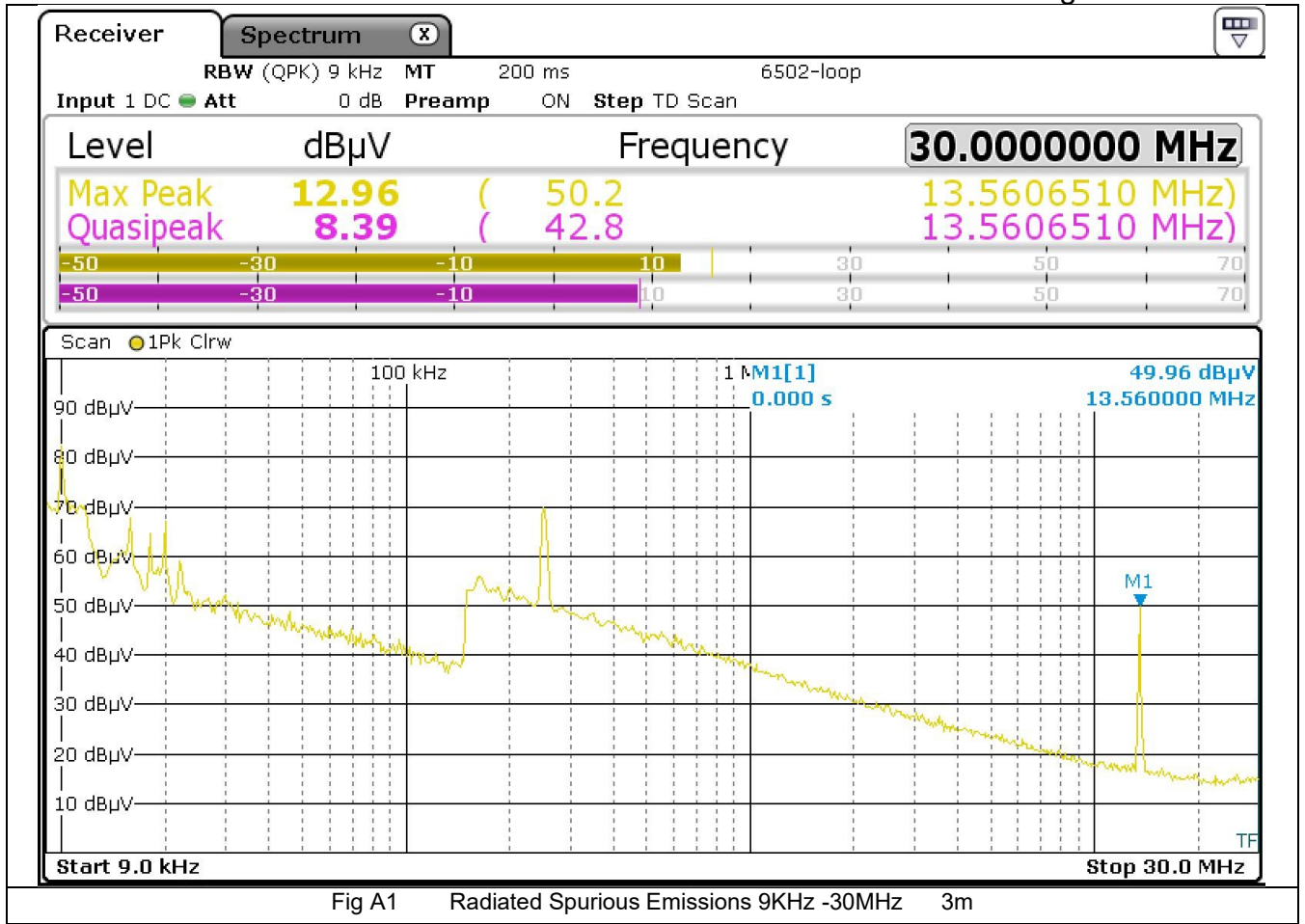


13.56MHz Occupied Bandwidth = 1.55KHz



**Appendix A:**

**Test Results**



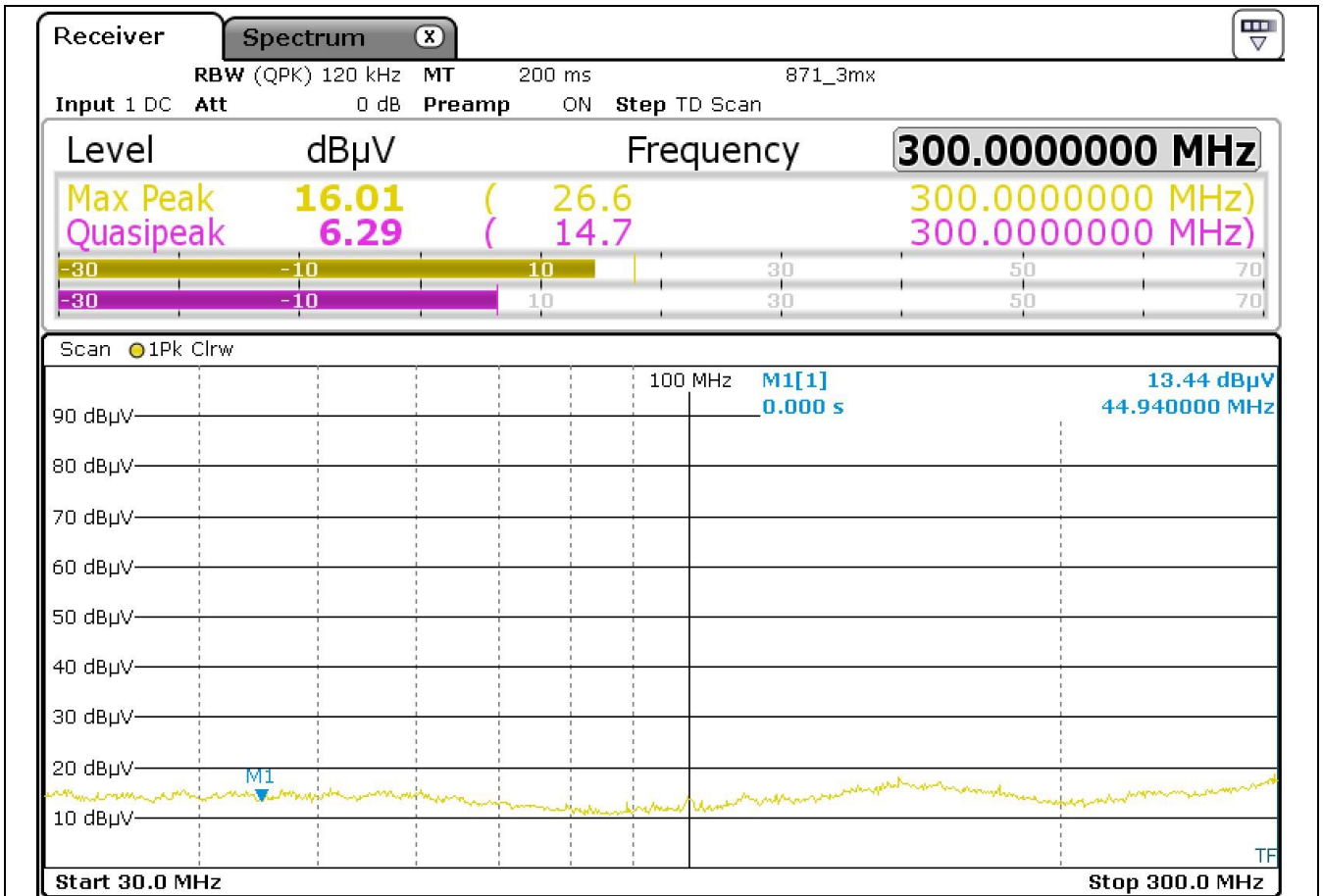


Fig A2 Radiated Emissions 30MHz-300MHz Vertical 3metres Anechoic Chamber

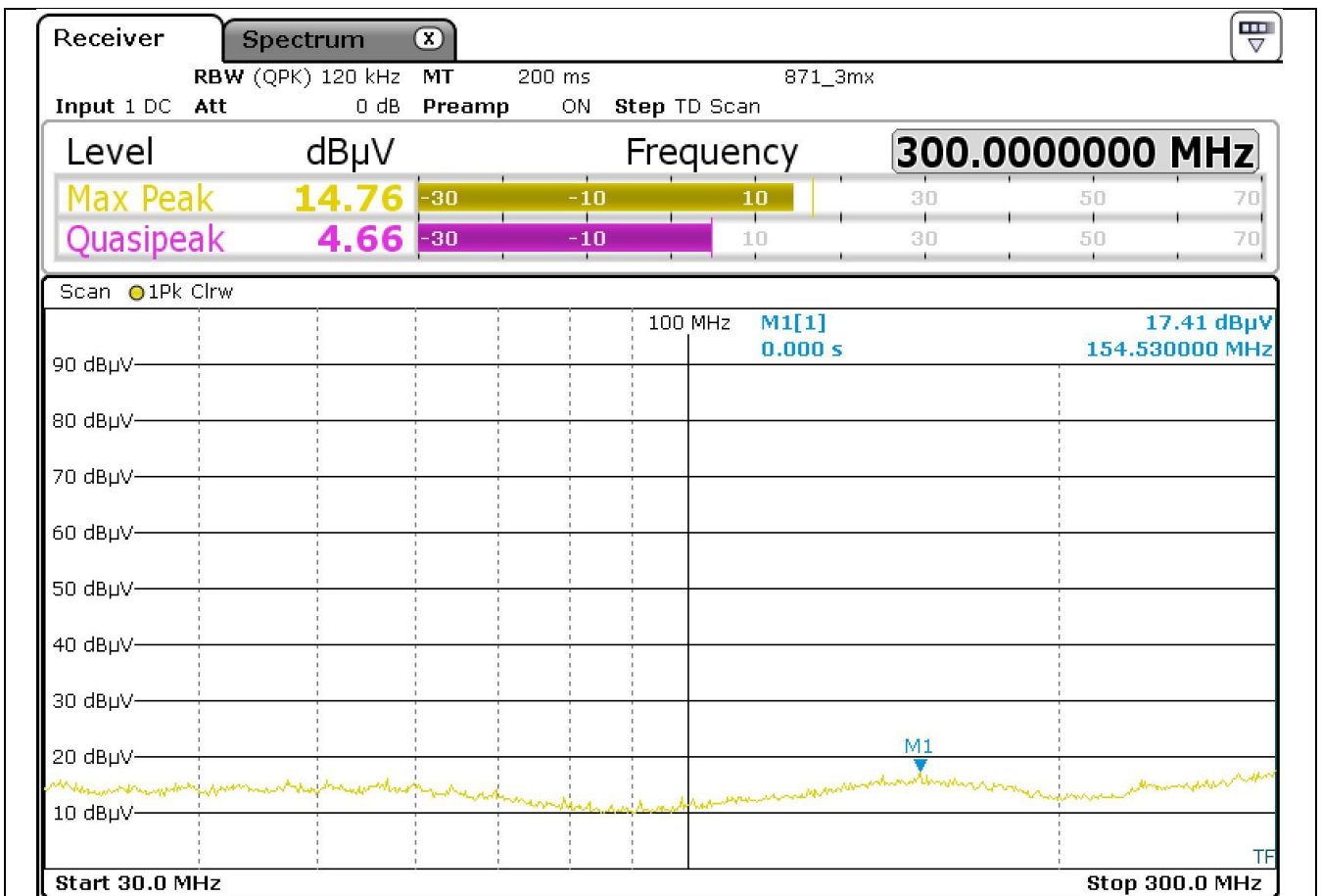


Fig A3 Radiated Emissions 30MHz-300MHz Horizontal 3metres Anechoic Chamber

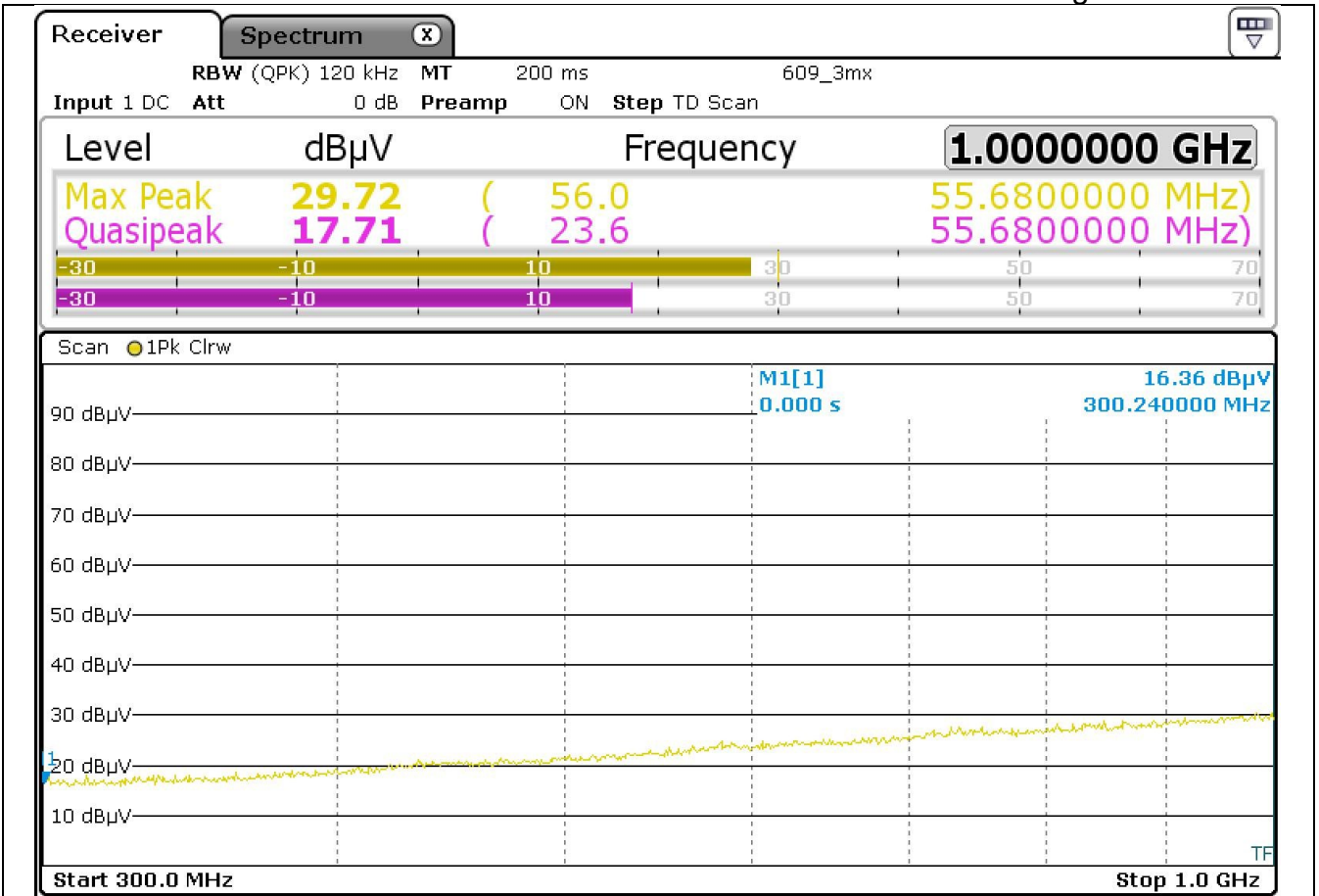


Fig A4 Radiated Emissions 300MHz-1GHz Vertical 3metres Anechoic Chamber

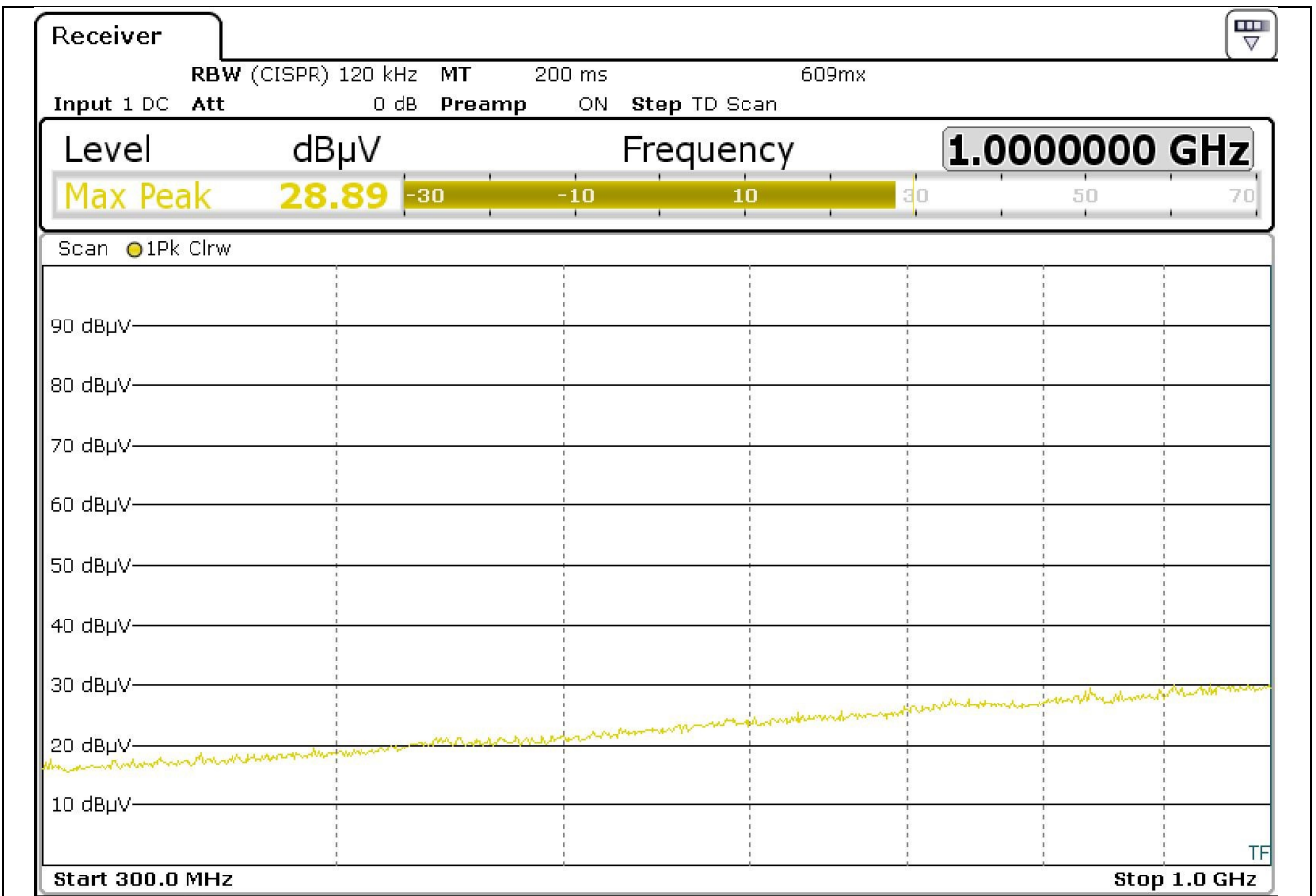


Fig A5 Radiated Emissions 300MHz-1GHz Horizontal 3metres Anechoic Chamber

## **Appendix B**

### **Conducted Emissions on the mains**

Receiver

RBW (QPK) 9 kHz MT 1 s ESH3-Z5 10dB\_att

Input 1 DC Att 10 dB Preamp OFF Step TD Scan

Level dB $\mu$ V Frequency **30.000000 MHz**  
Quasipeak **11.87** -20 0 20 40 60 80 100

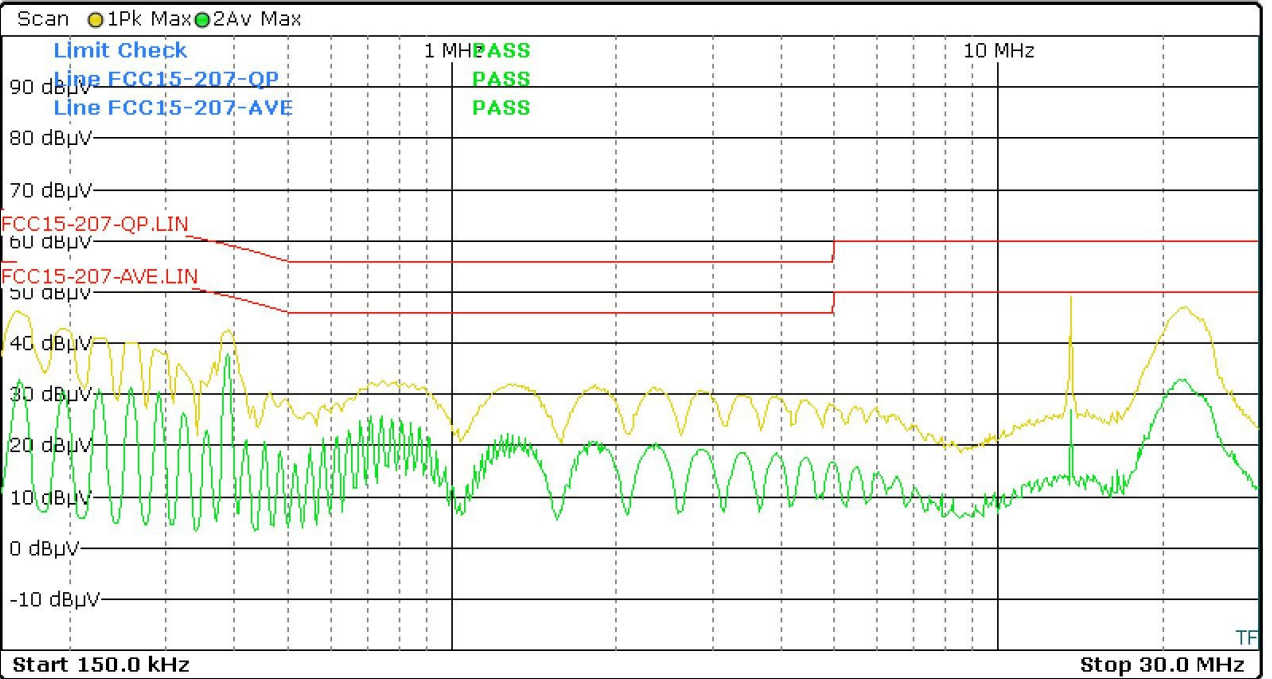


Fig B1 Conducted Emissions on the mains live

Receiver

RBW (QPK) 9 kHz MT 1 s ESH3-Z5 10dB\_att

Input 1 DC Att 10 dB Preamp OFF Step TD Scan

Level dB $\mu$ V Frequency **30.000000 MHz**  
Quasipeak **9.46** -20 0 20 40 60 80 100

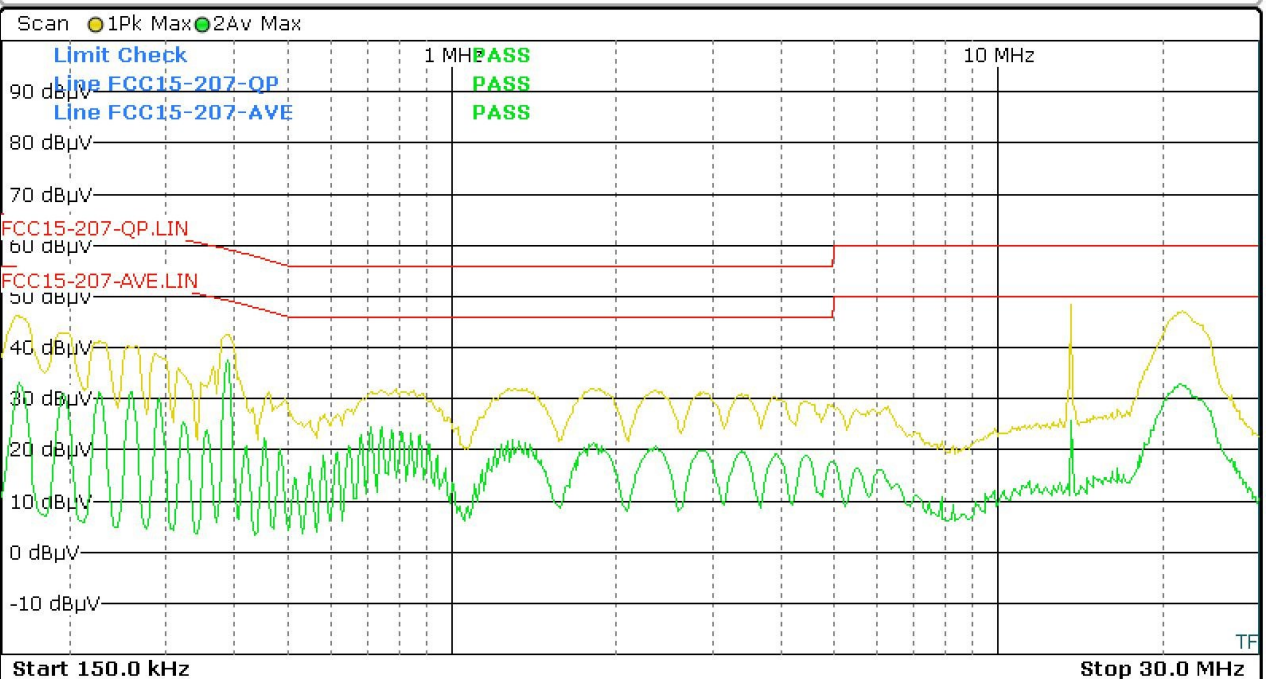


Fig B2 Conducted Emissions on the mains neutral

### Appendix C

#### List of Test Equipment

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Num</b>	<b>CEI Ref</b>	<b>Cal Due Date</b>	<b>Cal Interval Months</b>
Test Receiver 3.6GHz	Rohde& Schwarz	ESR	1316.3003k03-101625-s	869	07-Jun-20	36
Anechoic Chamber	CEI	SAR 10M	845	845	16-Mar-22	36
Antenna Log Periodic	Chase	UPA6108	1072	609	03-Sep-21	36
Loop Antenna	EMCO	6502	9609-3099	821	07-Nov-20	36
Antenna Biconical	Schwarzbeck	VHBB 9124	9124 667	871	03-Sep-21	36
LISN	Rohde& Schwarz	ESH3-Z5	825460/003	604	16-Feb-22	36

End of Report