



**Add value.
Inspire trust.**

Report on the EMC Testing of:

WEARABLE DEVICE

Model(s): ZSWW

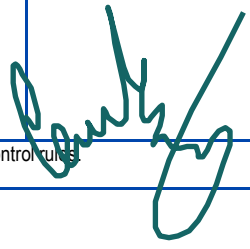
In accordance with
FCC 47 CFR Part 15B

Prepared for:

Nitto Denko Asia Technical Centre Pte Ltd
1 North Buona Vista Link
#11-07/08/09, Elementum
Singapore 139691

COMMERCIAL-IN-CONFIDENCE

Document Number: 7191356358-EEC25/01 | Issue: 01
FCC ID: 2ASICZS

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Approved By	Lim Poh Huat	09 May 2025	
Prepared By	Quek Keng Huat	08 May 2025	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD PSB document control rules.

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with the mentioned standard(s).



LA-2007-0380-A
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G
LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C
LA-2010-0464-D
LA-2018-0702-B
LA-2018-0703-G
LA-2020-0747-L

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
15 International Business Park
TÜV SÜD @ IBP
Singapore 609937

Phone : +65-6778 7777
E-mail: info.sg@tuvsud.com
<https://www.tuvsud.com/sg>
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
15 International Business Park
TÜV SÜD @ IBP
Singapore 609937
TÜV®

Page 1 of 27



Contents

1 Report Summary3

1.1 Report Modification Record3

1.2 Introduction4

1.3 Brief Summary of Results.....5

1.4 Product Information.....8

1.5 Deviations from the Standard9

1.6 EUT Modification Record.....9

1.7 Test Location(s)10

1.8 Test Facilities Registrations.....10

1.9 Supporting Equipment.....11

2 Test Details.....12

2.1 Conducted Emissions at Mains Terminals12

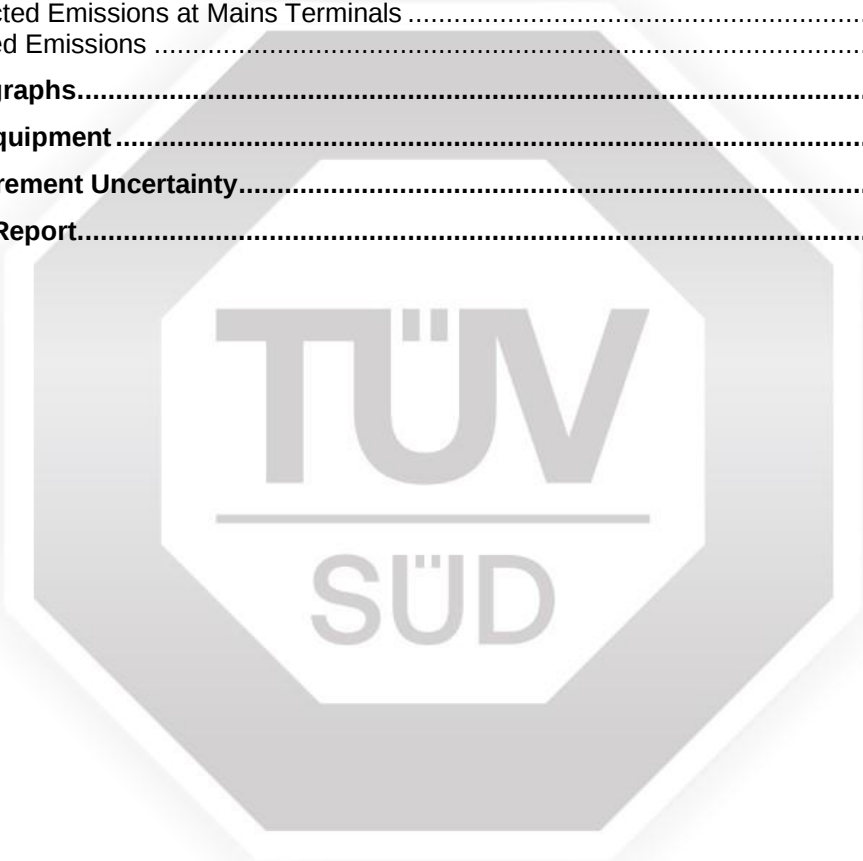
2.2 Radiated Emissions16

3 Photographs.....22

4 Test Equipment24

5 Measurement Uncertainty.....25

End of the Test Report.....27





1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	09 May 2025





1.2 Introduction

Applicant	:	Nitto Denko Asia Technical Centre Pte Ltd 1 North Buona Vista Link #11-07/08/09, Elementum Singapore 139691
Manufacturer	:	Same as applicant
Factory	:	V.S Electronics Sdn. Bhd. Plo 47, Jalan Perindustrian 1, Senai Industrial Estate II, 81400 Senai, Johor, Malaysia
Model Number(s)	:	ZSWW
Serial Number(s)	:	Nil
Number of Samples Tested	:	1
Test Sample(s) Condition	:	Good
Quotation Reference	:	5119405 & 8179354
Test Specification/Issue/Date	:	FCC 47 CFR 15B
Test Sample(s) Received Date	:	06 Sep 2018
Start of Test	:	06 Sep 2018
Finish of Test	:	20 Sep 2018



1.3 **Brief Summary of Results**

A brief summary of the tests carried out in accordance with the specifications as shown below.

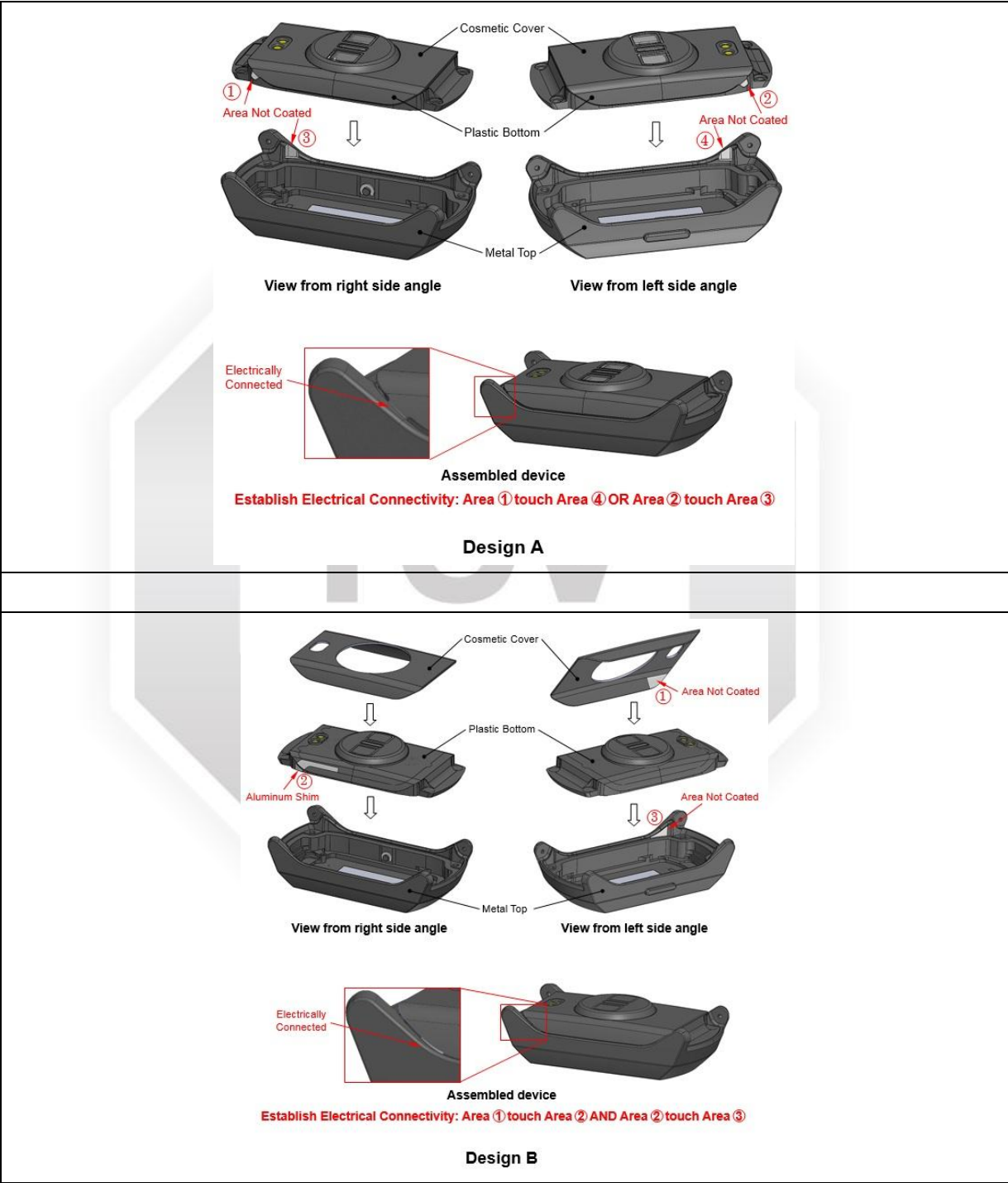
Specification Clause	Test Description	Result	Comments/Base Standard
FCC 47 CFR 15B			
15.107	Conducted Emissions at Mains Terminals (Class B)	Pass	ANSI C63.4: 2014
15.109	Radiated Emissions (Class B)	Pass	ANSI C63.4: 2014





Notes

1. Nitto Denko Asia Technical Centre Pte Ltd declares that Design A & Design B achieves the primary objective of electrically connecting the Cosmetic Cover (Material SS430) to Metal Top (Material SS316) of the device and has no variation in EMC performance. Design A was officially submitted to TUV SUD as the final product.





Notes (cont'd)

2. This report 7191356358-EEC25/01 | Issue: 01 was reproduced from TÜV SÜD PSB issued test report 7191192200-EEC18/01 | Issue: 01 dated 23 Oct 2018 to update applicant address and FCC ID to cover page.





1.4 Product Information

1.4.1 Technical Description

Description	:	The Equipment Under Test(s) (EUT(s)) is a WEARABLE DEVICE .
Microprocessor	:	Nordic Semiconductor nRF52840
Operating Frequency	:	64MHz
Clock / Oscillator Frequency	:	32.768MHz & 32MHz
Modulation	:	GFSK
Antenna Gain	:	0.0dBi
Port / Connectors	:	1 x DC Inlet
Rated Power	:	3.7VDC 120mAh 0.444Wh
Accessories	:	Charger Dock via USB



1.4.2 Test Configuration and Modes of Operation

Mode(s)	Description
Data Streaming & Charging	The EUT was exercised in the mode(s) throughout the test(s).

1.4.3 Performance Criteria and Monitoring Methods

Not Applicable.

1.5 Deviations from the Standard

Nil.

1.6 EUT Modification Record

No modifications were made.





1.7 Test Location(s)

TÜV SÜD PSB Pte Ltd
 Electrical & Electronics Centre (EEC), Product Services,
 No. 1 Science Park Drive, Singapore 118221

TÜV SÜD PSB Pte Ltd
 Electrical & Electronics Centre (EEC), Product Services,
 13 International Business Park #01-01, Singapore 609932

1.8 Test Facilities Registrations

Requirements	Registration Numbers
FCC	994109 (Test Firm Registration Number) SG0002 (Designation Number)
ISED	<u>Science Park</u> 2932I-1 (3m and 10m Semi-Anechoic Chamber) <u>International Business Park</u> 2932N-1 (10m Semi-Anechoic Chamber)
VCCI	<u>Science Park</u> R-1335 (10m ANC), G-29 (10m ANC) C-2306 (C.E @ Lab 3) T-1471 (Telecom Ports @ Lab 3) <u>International Business Park</u> R-3324 (10m ANC), G-203 (10mANC) C-4933 (C.E @ CEIBP) T-2403 (Telecom Ports @ CEIBP)
BSMI	SL2-IS-E-6001R [CNS-13803 (ISM Equipment)] SL2-IN-E-6001R [CNS-13438 (IT Equipment)] SL2-R1/R2-E-6001R [CNS-13439 (Broadcast Receivers)] SL2-A1-E-6001R [CNS-13783-1 (Household Appliances)] SL2-L1-E-6001R [CNS-14115 (Lighting Equipment)]
SABS	SABS/A-LAB/0029/2018



1.9 Supporting Equipment

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
nRF51 dongle	M/N: PCA10031 S/N: 680152872 FCC ID: Nil	Nil
Fujitsu Lifebook	M/N: SH561 S/N: R1705475 FCC ID: Nil	2..00m unshielded power cable 2.00m USB cable
Fujitsu AC adapter	M/N: SEC100P3-19.0 S/N: 10302433D FCC ID: Nil	2..00m unshielded power cable





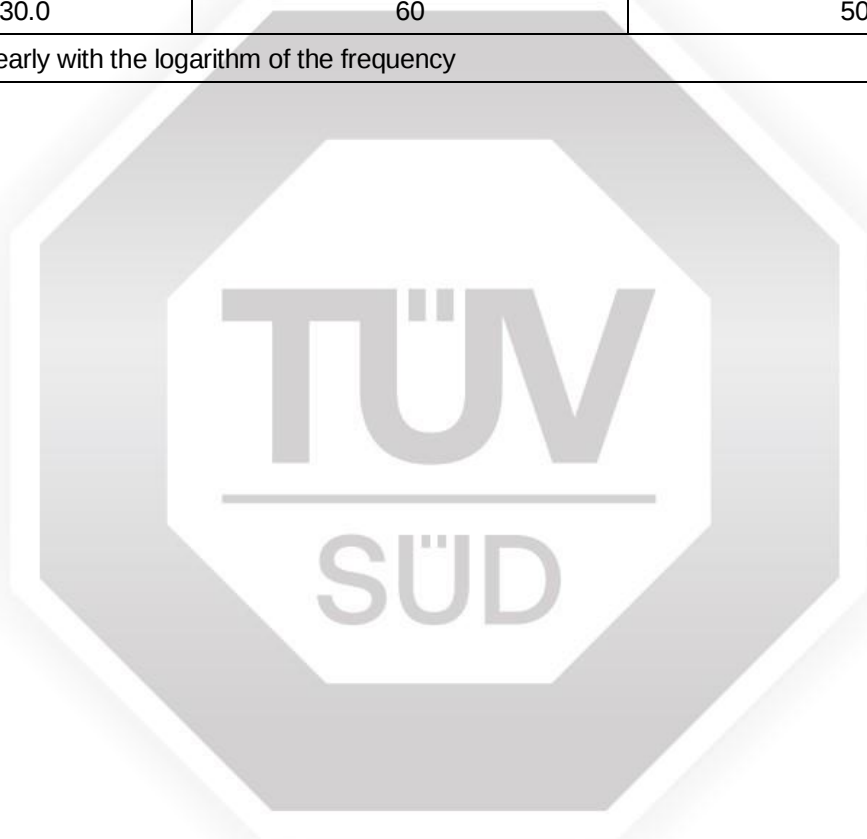
2 Test Details

2.1 Conducted Emissions at Mains Terminals

2.1.1 Test Limits

AC Mains Port (Class B)

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak (Q-P)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50
* Decreasing linearly with the logarithm of the frequency		





2.1.2 Test Setup

- 2.1.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
- 2.1.2.2 The power supply for the EUT was fed through a $50\Omega/50\mu\text{H}$ EUT LISN, connected to filtered mains.
- 2.1.2.3 The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
- 2.1.2.4 All other supporting equipment were powered separately from another LISN.

2.1.3 Test Method

- 2.1.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.
- 2.1.3.2 A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
- 2.1.3.3 High peaks, relative to the limit line, were then selected.
- 2.1.3.4 The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.
- 2.1.3.5 The measurements were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz

Q-P limit (Class B) = 60.0 dB μV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dB μV
(Calibrated for system losses)

Therefore, Q-P margin = 60.0 - 40.0 = 20.0

i.e. 20.0 dB below Q-P limit

2.1.4 Test Setup Photographs



Conducted Emissions at Mains Test Setup (Front View)



Conducted Emissions at Mains Test Setup (Rear View)



2.1.5 Test Results

The detailed of the test results are shown below.

Operating Mode	Data Streaming & Charging	Temperature	21°C
Test Input Power	120V 60Hz (Laptop Power)	Relative Humidity	59%
Line Under Test	AC Mains	Atmospheric Pressure	1025mbar
Class	B	Tested By	Dylan Lin
		Test Date	11 Sep 2018

Frequency (MHz)	Q-P Value (dBμV)	Q-P Limit (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Limit (dBμV)	AV Margin (dB)	Line
0.2091	39.7	63.2	23.5	33.7	53.2	19.5	Live
0.2094	40.1	63.2	23.1	32.5	53.2	20.7	Live
0.2137	36.9	63.1	26.2	30.9	53.1	22.2	Neutral
0.3095	38.7	60.0	21.3	29.1	50.0	20.9	Live
0.4493	34.5	56.9	22.4	24.7	46.9	22.2	Live
1.4526	29.8	56.0	26.2	24.5	46.0	21.5	Live

Notes

1.	All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst-case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: <u>150kHz - 30MHz</u> RBW: 9kHz VBW: 30kHz



2.2 Radiated Emissions

2.2.1 Test Limits

Class B

Frequency Range (MHz)	Quasi-Peak Limits (dBµV/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*
* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.	





2.2.2 Test Setup

- 2.2.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
- 2.2.2.2 The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
- 2.2.2.3 The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

2.2.3 Test Method

- 2.2.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.
- 2.2.3.2 A pre-scan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the pre-scan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
- 2.2.3.3 The test was carried out at the selected frequency points obtained from the pre-scan. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
- 2.2.3.4 A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
- 2.2.3.5 The measurements were repeated for the next frequency point, until all selected frequency points were measured.

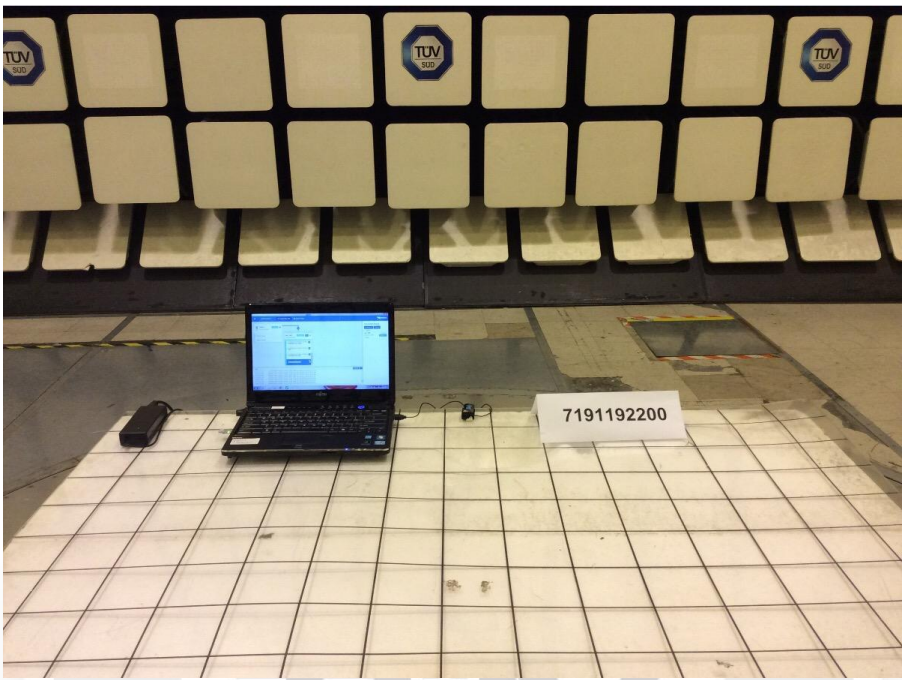
Sample Calculation Example

At 300 MHz	Q-P limit (Class B) = 37.0 dB μ V/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 31.0 dB μ V/m	
(Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 37.0 - 31.0 = 6.0	i.e. 6.0 dB below Q-P limit

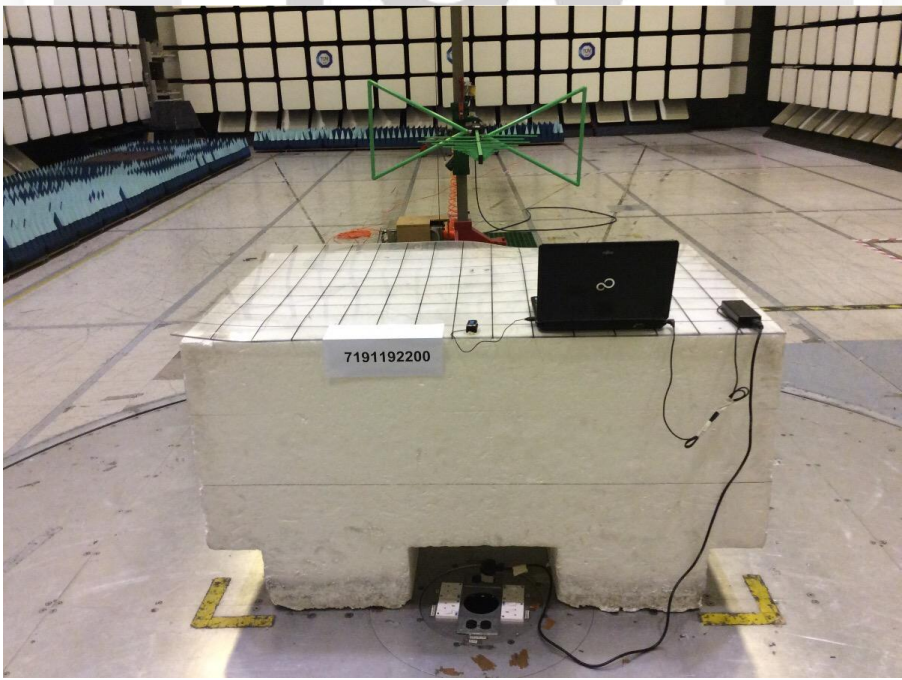


2.2.4 Test Setup Photographs

30MHz – 1GHz Test Setup



Radiated Emissions Test Setup (Front View)



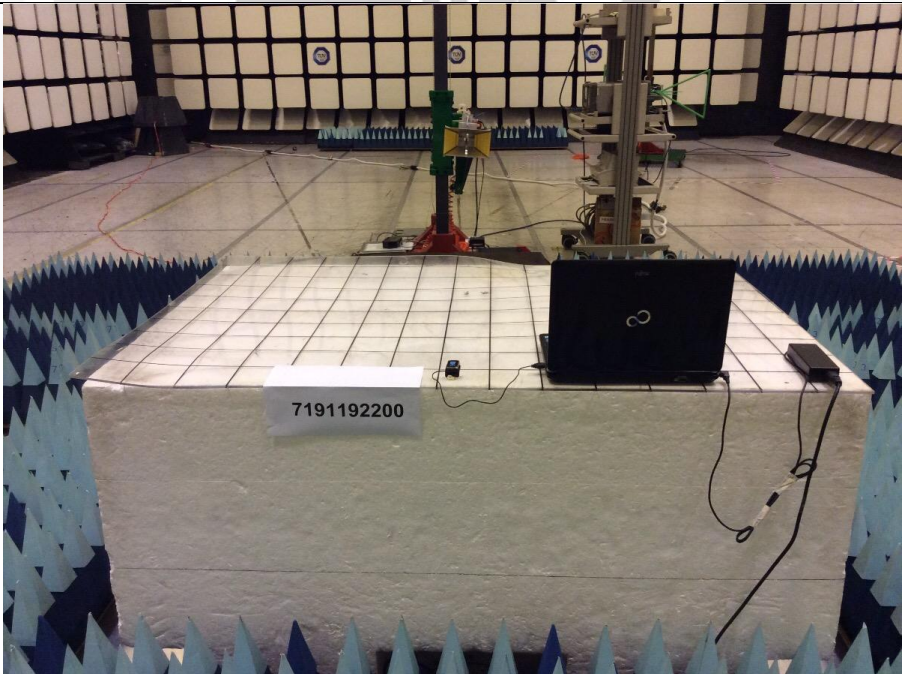
Radiated Emissions Test Setup (Rear View)



1GHz – 18GHz Test Setup



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)



2.2.5 Test Results

The detailed of the test results are shown below.

Operating Mode	Data Streaming + Charging	Temperature	23°C
Test Input Power	3.7Vdc Battery	Relative Humidity	60%
Test Distance	3m (30MHz – 1GHz) 3m (1GHz – 18GHz)	Atmospheric Pressure	1010mbar
Class	B	Tested By	Lim Kay Tak
		Test Date	06 Sep 2018

Emissions from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Limit (dBμV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarisation (H/V)
89.3940	26.6	43.5	16.9	103	227	V
106.7660	31.1	43.5	12.4	345	347	H
144.0120	31.3	43.5	12.2	210	201	H
172.6510	34.0	43.5	9.6	100	160	V
207.5000	31.4	43.5	12.2	139	47	H
242.0350	35.1	46.0	10.9	111	95	H

Emissions above 1GHz - 18GHz

Freq (GHz)	Peak Value (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
1.0102	47.5	74.0	26.5	25.8	54.0	28.2	158	207	V
1.2150	52.0	74.0	22.0	27.5	54.0	26.5	100	232	H
1.8183	50.2	74.0	23.8	26.2	54.0	27.8	122	302	H
2.2232	47.6	74.0	26.4	25.2	54.0	28.8	295	10	V
3.0299	54.9	74.0	19.1	29.0	54.0	25.0	332	351	H
7.3786	45.0	74.0	29.0	31.3	54.0	22.7	280	221	H



Notes

1.	All possible modes of operation were investigated. Only the worst-case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: <u>30MHz - 1GHz</u> RBW: 120kHz VBW: 1MHz <u>1GHz – 6GHz</u> RBW: 1MHz VBW: 3MHz





3 Photographs



Front View



Rear View



EUT Power Adapter Front View



EUT Power Adapter Rear View



4 Test Equipment

Instrument	Model	S/No	Cal Due Date
Conducted Emissions at Mains Terminals			
R&S Test Receiver – ESPI3	ESPI3	100349	05 Jan 2019
Schaffner LISN –LISN10 (EUT)	NNB42	04/10055	04 Oct 2018
Radiated Emissions			
TDK RF Solutions Hybrid Log Periodic Antenna	HLP-3003C	130237	18 May 2019
Rohde & Schwarz EMI Test Receiver	ESW44	101661	12 Dec 2019
Sonoma Preamplifier	310N	270640	10 Jul 2019
Miteq Preamplifier	AMF-2D-00500800-25-13P	2011153	04 May 2019
TDK-RF Horn Antenna	HRN-0118	130256	22 Feb 2019
EMCO Loop Antenna	6502	9108-2673	13 Nov 2019
Schwarzbeck Horn Antenna/ Pre-amplifier assembly HAP-series	BBHA 9120 C/ HAP06-18W	9120C-372/ 00000004	08 Feb 2019



5 Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2.

Test Name	Measurement Uncertainty
Conducted Emissions at Mains Terminals	9kHz to 30MHz, ±2.1dB
Radiated Emissions	30MHz to 1GHz, ±3.8dB >1GHz to 40GHz, ±4.5dB





Please note that this Report is issued under the following terms :

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.
2. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.
3. Nothing in this report shall be interpreted to mean that TÜV SÜD PSB has verified or ascertained any endorsement or marks from any other testing authority or bodies that may be found on that sample.
4. This report shall not be reproduced wholly or in parts and no reference shall be made by the Client to TÜV SÜD PSB or to the report or results furnished by TÜV SÜD PSB in any advertisements or sales promotion.
5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, 15 International Business Park TÜV SÜD @ IBP Singapore 609937.
6. The tests carried out by TÜV SÜD PSB and this report are subject to TÜV SÜD PSB's General Terms and Conditions of Business and the Testing, Certification, Validation and Verification Regulations (TCVVR) of the TÜV SÜD Group.

Effective 27 March 2024





End of the Test Report

