

Prüfbericht-Nr.: Test report no.:	CN21OZR9 001	Auftrags-Nr.: Order no.:	168346070	Seite 1 von 23 Page 1 of 23
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2021-12-06	
Auftraggeber: Client:	Tymphany Acoustic Technology HK Limited RM.1521,15/F. ,BLOCK A,HI-TECH INDUSTRIAL CENTRE,5-21 PAK TIN PAR STREET,TSUEN WAN,N.T. ,HONG KONG			
Prüfgegenstand: Test item:	M18/M12 Wireless Jobsite Speaker			
Bezeichnung / Typ-Nr.: Identification / Type no.:	2891-20 (Trademark: )			
Auftrags-Inhalt: Order content:	Test Report			
Prüfgrundlage: Test specification:	CFR47 FCC Part 15: Subpart C Section 15.247			
Wareneingangsdatum: Date of sample receipt:	2021-11-16	See EUT photo document		
Prüfmuster-Nr.: Test sample no:	HS211114-001-002 HS211114-001-003			
Prüfzeitraum: Testing period:	2021-11-17 - 2021-11-29			
Ort der Prüfung: Place of testing:	Hwa-Hsing (Dongguan) Testing Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:			genehmigt von: authorized by:	
Datum: Date:	2022-01-14 Signed by: Chris Chen		Ausstellungsdatum: Issue date:	2022-01-14 Signed by: Lin Lin
Stellung / Position:	Section Manager		Stellung / Position:	Reviewer
Sonstiges / Other:	FCC ID: 2A3U52891-20			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				

Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER

RESULT: Pass

5.1.3 99% BANDWIDTH

RESULT: Pass

5.1.4 20dB BANDWIDTH

RESULT: Pass

5.1.5 CARRIER FREQUENCY SEPARATION

RESULT: Pass

5.1.6 NUMBER OF HOPPING FREQUENCY

RESULT: Pass

5.1.7 TIME OF OCCUPANCY

RESULT: Pass

5.1.8 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH

RESULT: Pass

5.1.9 RADIATED SPURIOUS EMISSION

RESULT: Pass

5.1.10 CONDUCTED EMISSION

RESULT: Pass

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results of Bluetooth BR/EDR mode

2 Test Sites

2.1 Test Facilities

Hwa-Hsing (Dongguan) Testing Co., Ltd.

No.101, Bld N1, Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China

FCC Registration No.: 915896

Note: The tests at the test site have been conducted under the supervision of a TÜV engineer.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radiated emission below 30MHz:				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	Rohde&Schwarz	ESCI 7	100962	2022/01/05
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2022/04/14
Test software	FARAD	FARAD	EZ_EMCV1.1.4. 2	N/A
Loop Antenna	EMCI	HLA 6121	45745	2022/04/13
Preamplifier	EMCI	EMC001340	980201	2022/09/12
Frequency Range below 1GHz:				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	Rohde&Schwarz	ESCI 7	100962	2022/01/05
Broadband antenna	Schwarzbeck	VULB 9168	00937	2022/04/15
Signal Amplifier	Com-power	PAM-103	18020051	2022/03/14
Attenuator	Rohde&Schwarz	TS2GA-6dB	18101101	N/A
Test software	FARAD	FARAD	EZ_EMCV1.1.4. 2	N/A
Frequency Range 1-18GHz:				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Horn Antenna	Schwarzbeck	BBHA 9170	01959	2022/04/15
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	00025	2022/03/14
Spectrum	Keysight	N9020A	MY51240612	2022/09/12
AC Line Conducted Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESR3	102680	2022/09/12
Artificial Mains Network	R&S	ENV216	101445	2022/09/12
Test software	FARAD	EZ EMC	N/A	N/A
RF Conducted test system				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
Spectrum	Keysight	N9020A	MY51240612	2022/09/12
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2022/09/12
Power Meter 10Hz~18GHz	Tonscend	JS0806-2	188060126	2022/09/12
Signal generator	Keysight	E4421B	GB40051020	2022/09/12
Signal generator	Keysight	N5182A	MY47420944	2022/09/12
Test Software	Tonscend	JS0806-2	NA	NA

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (conducted)	± 2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 2.66 dB
Temperature	± 1 °C
Humidity	± 5 %
Voltage (DC)	± 1 %
Voltage (AC, <10kHz)	± 2 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The **Hwa-Hsing (Dongguan) Testing Co., Ltd.** Test facility located at No.101, Bld N1, Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a **M18/M12 Wireless Jobsite Speaker**, which supports Bluetooth BR&EDR wireless technology.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment:	M18/M12 Wireless Jobsite Speaker
Type Designation:	2891-20
Trademark:	
FCC ID:	2A3U52891-20
Testing Voltage:	DC 18V From Adapter input 120VAC, 60Hz; or DC 18V from Battery
Adapter	Model: E054-1A180300HU Input: 100-240V~, 50/60Hz, 1.5A Output: DC18V, 3.0A
Antenna Type:	PCB Layout Antenna
Antenna Gain:	4.26 dBi
Technical Specification of Bluetooth BR/EDR	
Operating Frequency:	2402 MHz to 2480 MHz
Type of Modulation:	GFSK(BR), $\pi/4$ -DQPSK(EDR), 8DPSK(EDR)
Channel Number:	79 channels
Channel Separation:	1MHz

Table 3: RF Channel and Frequency of Bluetooth BR/EDR

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
0	2402.00	20	2422.00	40	2442.00	60	2462.00
1	2403.00	21	2423.00	41	2443.00	61	2463.00
2	2404.00	22	2424.00	42	2444.00	62	2464.00
3	2405.00	23	2425.00	43	2445.00	63	2465.00
4	2406.00	24	2426.00	44	2446.00	64	2466.00
5	2407.00	25	2427.00	45	2447.00	65	2467.00
6	2408.00	26	2428.00	46	2448.00	66	2468.00
7	2409.00	27	2429.00	47	2449.00	67	2469.00
8	2410.00	28	2430.00	48	2450.00	68	2470.00
9	2411.00	29	2431.00	49	2451.00	69	2471.00
10	2412.00	30	2432.00	50	2452.00	70	2472.00
11	2413.00	31	2433.00	51	2453.00	71	2473.00
12	2414.00	32	2434.00	52	2454.00	72	2474.00
13	2415.00	33	2435.00	53	2455.00	73	2475.00
14	2416.00	34	2436.00	54	2456.00	74	2476.00
15	2417.00	35	2437.00	55	2457.00	75	2477.00
16	2418.00	36	2438.00	56	2458.00	76	2478.00
17	2419.00	37	2439.00	57	2459.00	77	2479.00
18	2420.00	38	2440.00	58	2460.00	78	2480.00
19	2421.00	39	2441.00	59	2461.00		

Test frequencies are lowest channel: 2402 MHz, middle channel: 2441 MHz and highest channel: 2480 MHz for General 2.4GHz

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Bluetooth transmitting mode (BR & EDR mode)
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- B. On, Transmitting on Hopping channel
- C. On, Normal Operation(BT Link)
- D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- | | |
|-------------------------|-----------------|
| - Application Form | - User Manual |
| - Operation Description | - Block Diagram |
| - Schematics | - Rating Label |
| - PCB Layout | - Parts List |

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model 2891-20 in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 4: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N
Laptop	Lenovo	ThinkPad X280	SL10P97665
Mobile Phone	Samsung	Samsung Galaxy S4	N/A
Dummy load	--	--	--

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

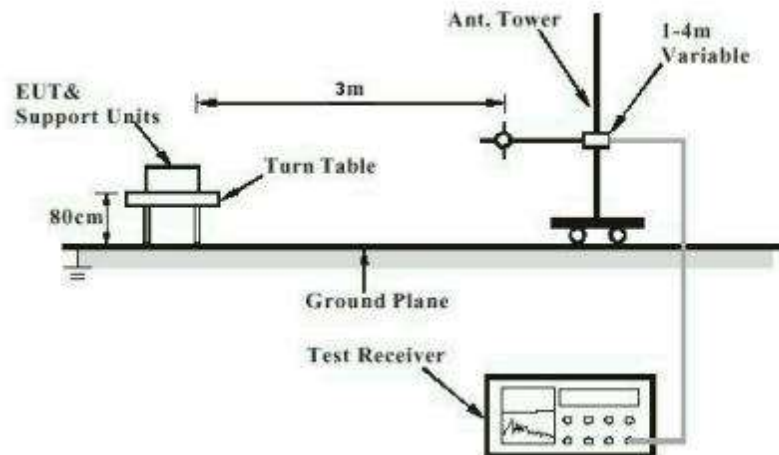


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

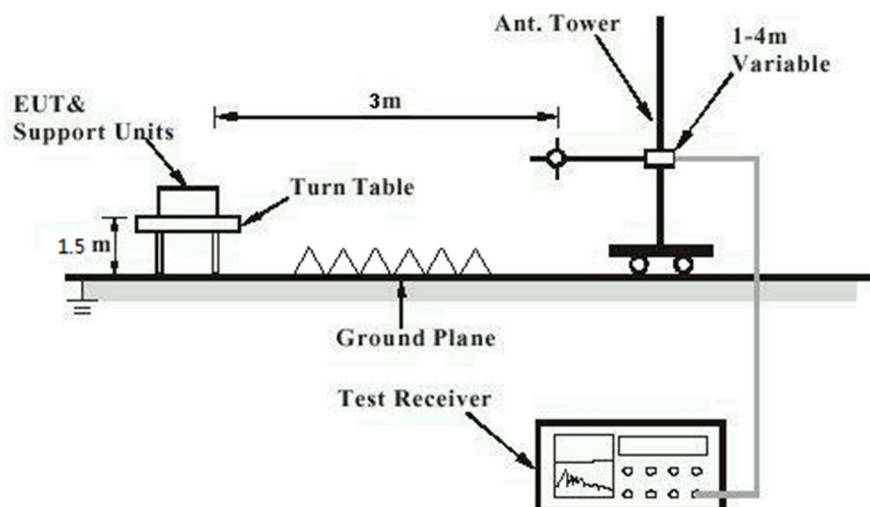


Diagram of Measurement Configuration for Mains Conduction Measurement

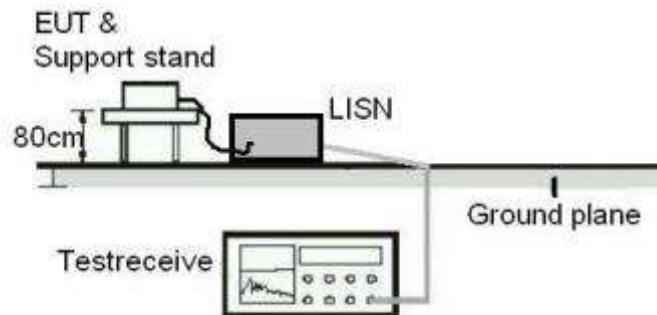
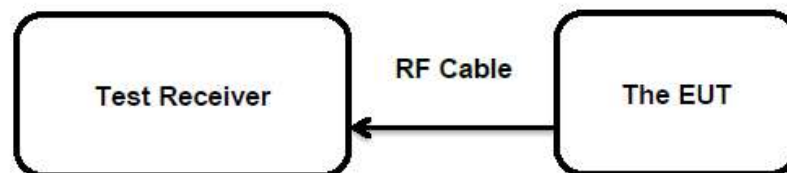


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(b)(4) and Part 15.203

According to the manufacturer declared, the EUT has a Integral antenna, the directional gain of antenna is 4.26 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

5.1.2 Maximum Peak Conducted Output Power

RESULT:
Pass
Test Specification

Test standard	: FCC Part 15.247(b)(1)&(3)
Basic standard	: ANSI C63.10: 2013
Limits	: FHSS < 0.125 Watts, DSSS < 1.0 Watts
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-19
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101 kPa

Table 5: Test Result of Maximum Peak Conducted Output Power, Bluetooth BR & EDR

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
GFSK (BR)	2402.0	-4.37	0.0003656	< 0.125
	2441.0	-3.05	0.0004955	
	2480.0	-1.77	0.0006653	
Maximum Measured Value		-1.77	0.0006653	

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
8DPSK (EDR)	2402.0	-4.17	0.0003828	< 0.125
	2441.0	-4.14	0.0003855	
	2480.0	-1.10	0.0007762	
Maximum Measured Value		-1.10	0.0007762	

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G): 4.26 dBi
 $e.i.r.p. = P_{(Peak\ power)} + G$, which is far below the 125 mW

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5.1.3 99% Bandwidth

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(a)
Basic standard	: ANSI C63.10: 2013
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-19
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

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5.1.4 20dB Bandwidth

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(a)(1)
Basic standard	: ANSI C63.10: 2013
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-19
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

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5.1.5 Carrier Frequency Separation

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(a)(1)
Basic standard	: ANSI C63.10: 2013
Limits	: $\geq 25\text{kHz}$ or 2/3 of 20dB bandwidth, whichever is greater
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-19
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: B
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

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5.1.6 Number of Hopping Frequency

RESULT:**Pass****Test Specification**

Test standard	: FCC part 15.247(a)(1)(iii)
Basic standard	: ANSI C63.10: 2013
Limits	: ≥ 15 non-overlapping channels
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-19
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: B
Ambient temperature	: 24.8 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.7 Time of Occupancy

RESULT:**Pass****Test Specification**

Test standard	: FCC part 15.247(a)(1)(iii)
Basic standard	: ANSI C63.10: 2013
Limits	: < 0.4s
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-19
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: B
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

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5.1.8 Conducted Spurious Emissions Measured in 100 kHz Bandwidth**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.247(d)
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-19
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix B.

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5.1.9 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) & FCC Part 15.205
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Section 8.9 & 8.10
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2021-11-19 to 2021-11-23
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: Refer to test result
Relative humidity	: Refer to test result
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

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5.1.10 Conducted Emission**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.207(a)
Basic standard	: ANSI C63.10: 2013
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.207(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-11-22
Input voltage	: DC 18V from Adapter (Adapter input AC 120V/60Hz)
Operation mode	: C
Earthing	: Not connected
Ambient temperature	: 22 °C
Relative humidity	: 64 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

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