

TECHNICAL REPORT



Report No: EMC2003020-01

File Reference No: 2020-03-17

Applicant:

Product: Bluetooth Speaker

Brand Name: N/A

Model No: P329.333, P329.335, P329.336, P329.337

Test Standards: ETSI EN301 489-1 v 2.2.3 (2019-11)
ETSI EN301 489-17 v 3.1.1 (2017-02)

Test Result: The EMC testing has been performed on the submitted samples and found in compliance with council RE Directive 2014/53/EU

Approved By

Jack Chung

Jack Chung

EMC Manager

Dated: March 17, 2020

Results appearing herein relate only to the sample tested

The technical reports is issued errors and omissions exempt and is subject to withdrawal at

SHENZHEN TIMEWAY TESTING LABORATORIES

Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West,
Tong Le Village, Nanshan District, Shenzhen, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com



Special Statement:

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meet with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L2292

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of testing Laboratories.

FCC-Registration No.: 744189

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 744189.

Industry Canada (IC) —Registration No.:5205A

The EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 5205A.

A2LA (Certification Number:5013.01)

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA). Certification Number:5013.01

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1. General Information

1.1 Notes

The test results of this report relate exclusively to the test item specified in 1.5. The TIMEWAY Lab does not assume Responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the TIMEWAY Lab.

1.2

Testing Laboratory

SHENZHEN TIMEWAY TESTING LABORATORIES.

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Site on File With the Federal Communications and Commission – United States

Registration Number: 744189

For 3m Anechoic Chamber

Site Listed with Industry Canada of Ottawa, Canada

Registration Number: IC: 5205A

For 3m Anechoic Chamber

1.3 Details of Applicant

1. 4 Application Details

Date of Receipt of Application: March 05, 2020

Date of Receipt of Test Item: March 05, 2020

Date of Test: March 05, 2020 ~ March 17, 2020

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1.5 Test Item

Shenzhen, China

Brand Name: N/A

Model No.

Additional Model No.: P329.333, P329.335, P329.336, P329.337

Additional Brand Name: N/A

Description: Bluetooth Speaker

Additional Information

Frequency: 2402-2480MHz for Bluetooth

Number of Channels: 79 channels for Bluetooth EDR/BDR and 40 Channels for Bluetooth Low Energy (BLE)

Channel Spacing: 1MHz for Bluetooth EDR/BDR and 2MHz for Bluetooth Low Energy

Antenna Designation: PCB Antenna and the maximum Gain of this antenna is 0.58dBi;

Type of Modulation: Bluetooth: GFSK, $\pi/4$ DQPSK, 8DPSK

Extreme Temp. Tolerance: -20°C to 40°C

Input: DC5V

Battery: DC3.7V, 300mAh Li-ion battery

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1.6 List of Ports

Port	Description	Classification ¹	Maximum cable Length	Cable Type
N/A				

Note ¹ports shall be classified as ac power, dc power or signal/control port.

²Maximum cable length corresponding to the appropriate ports shall be classified as $\leq 3\text{m}$ or $> 3\text{m}$.

1.7 Ancillary and Peripheral Devices

Description	Designation	Serial No.	Manufacturer
N/A	-	--	--

List of Peripheral Devices Used for Testing

Description	Designation	Serial No.	Manufacturer
N/A			

Note: An Equipment (apparatus) used in connection with a receiver or transmitter is considered as an ancillary Equipment (apparatus) if:

- The equipment is intended for use in conjunction with a receiver or transmitter to provide additional operational and/or control features to the radio equipment. (e.g. to extend control to another position or location); and
- The equipment cannot be used on a stand alone basis to provide user functions independently of a receiver or transmitter; and
- The receiver or transmitter to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

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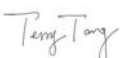
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1.8 Test Standards

ETSI EN 301 489-1 v 2.2.3 (2019-11)
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;
Part 1: Common technical requirements;
Harmonised Standard for ElectroMagnetic Compatibility
ETSI EN 301 489-17 v 3.1.1 (2019-11)
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;
Part 17: Specific conditions for Broadband Data Transmission Systems;
Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU

1.9 Test or Witness Test Engineering


Test By: _____
Printing Name: Terry Tang

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2. Technical Test

2.1 Summary of Test Results

No deviations from the technical specification(s) were ascertained in the course of the tests Performed	
Final Verdict: (Only "Passed" if all Measurements are "Passed")	Pass

2.2 Test Report

Emission (EMI)

EMI Phenomenon	Port	Requirement		EUT Setup	Result	Applicability
		Standard	Basic Standard			
Conducted Interference Voltage	AC Mains	ETSI EN 301489-1: 2019-11 Clause 8.4	EN 55032:2015	Refer to Section 4	Complies	Applicable
Radiated Interference Field Strength 30~6000MHz	Enclosure	ETSI EN 301489-1: 2019-11 Clause 8.2	EN 55032:2015	Refer to Section 4	Complies	Applicable
Harmonic Current Emissions	AC Mains Input Port	ETSI EN 301489-1: 2019-11 Clause 8.5	EN 61000-3-2:2014	Refer to Section 4	Complies	Not Applicable
Flicker & Voltage Fluctuation	AC Mains Input Port	ETSI EN 301489-1: 2019-11 Clause 8.6	EN 61000-3-3:2013	Refer to Section 4	Complies	Not Applicable

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Immunity (EMS)

EM3 Phenomenon	Port	Requirement		EUT Setup	Result	Applicability
		Standard	Basic Standard			
Electronic Discharge (ESD)	Enclosure	ETSI EN 301489-1: 2019-11 Clause 9.3	EN 61000-4-2: 2009	Refer to Section 4	Complies	Applicable
RF-Electro-Magnetic Field (80-6000MHz)	Enclosure	ETSI EN 301489-1: 2019-11 Clause 9.2	EN 61000-4-3: 2006	Refer to Section 4	Complies	Applicable
Fast Transients, Burst	Power Line AC/DC	ETSI EN 301489-1: 2019-11 Clause 9.4	EN 61000-4-4: 2012	Refer to Section 4	Complies	Not Applicable
Surge	Power Line (1 phase)	ETSI EN 301489-1: 2019-11 Clause 9.8	EN 61000-4-5: 2014	Refer to Section 4	Complies	Not Applicable
Transients & Surge Vehicular Environment	Power Line (Car Charge)	ETSI EN 301489-1: 2019-11 Clause 9.6	ISO 7637-1/2 (12/24VDC)	Refer to Section 4	Complies	Not Applicable
RF Common Mode (0.15-80MHz)	Power Line AC/DC signal Lines	ETSI EN 301489-1: 2019-11 Clause 9.5	EN 61000-4-6: 2014	Refer to Section 4	Complies	Applicable
Vol. Dips, Interruptions & Fluctuations (AC Power)	Input & Output AC Ports only	ETSI EN 301489-1: 2019-11 Clause 9.7	EN 61000-4-11 2004	Refer to Section 4	Complies	Applicable

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N/A=Not Applicable

-Performance criteria A for immunity tests with phenomena of a continuous nature;

Communication between the EUT and Bluetooth device in the front of pings should not drop during the test.

-Performance criteria B for immunity tests with phenomena of a transient nature;

N/A

-Performance criteria C for immunity tests with power interruptions exceeding a certain time.

N/A

Note: For details see subclause 6.1 ETSI EN 301 489-17

2.3 Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

Test Item	Uncertainty
Conducted Emissions	3.6dB
Radiated Emissions	4.7dB (Below 1GHz); 5.0dB (above 1GHz)
Harmonic Current Emission	1.2%
Voltage Fluctuations and Flicker	1.5%
Electrostatic Discharge	The waveform of voltage: 1.6%; Time: 3.1%
RF Electromagnetic Field	3.1dB
Electrical Fast Transients	The waveform of voltage: 1.5%; Time: 2.9%
Surge	The waveform of voltage: 1.5%; Time: 2.9%
RF Common Mode	3.9dB
Voltage Dips and Interruptions	The waveform of voltage: 1.5%; Time: 2.9%

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Clause 8.2 Emission Test – Radiated Emission

This test assesses that ability of ancillary equipment to limit their internal noise from being radiated from the enclosure.

According to EMC basic standard (EN 55032)

Measurement according to EMC basic standard, The test results correspond to the 3m Semi-Anechoic Chamber results.

The EUT and its simulators are placed on a turntable which is 0.8 meter above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna is set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to EN55032: 2015 on radiated measurement.

Radiated emissions were investigated over the frequency range from 30MHz to 1 GHz using a receiver bandwidth of 120kHz.

Radiated emissions were investigated over the frequency range from 30MHz to 6 GHz

Radiated Emission was performed at an antenna to EUT distance of 3 meters.

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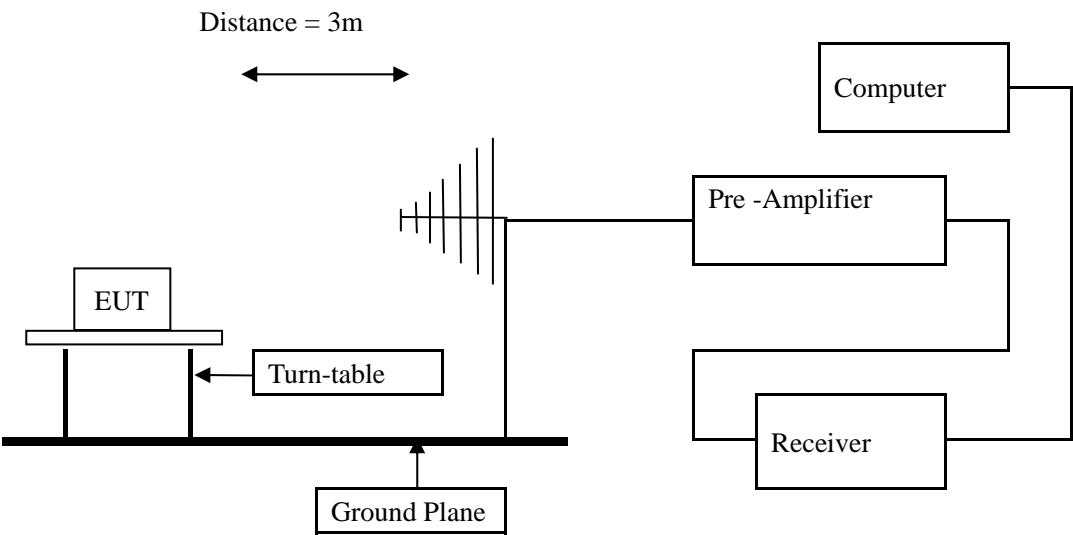
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Radiated Emission Test

Block diagram of Test setup



Power line conducted Emission Limit

Frequency Range (MHz)	Distance (m)	Quasi-Peak limits (dB μ V/m)
30-230	10/3	30.0/40.0
230-1000	10/3	37.0/47.0
1000-3000	3	50 (AV) /70 (PK)
3000-6000	3	54 (AV) /74 (PK)

Note: The lower limit shall apply at the transition frequencies

Test result:

Pass

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A: Radiated Disturbance (30MHz----1000MHz)

EUT Operating Environment

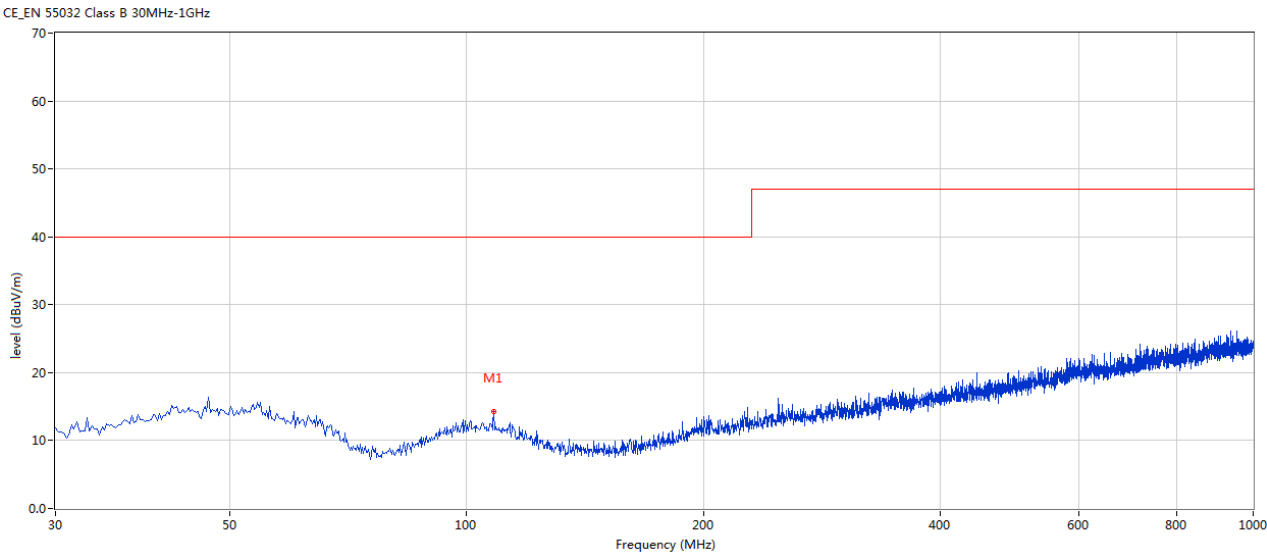
Temperature: 25℃ Humidity: 55%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Communication by Bluetooth

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	108.308	14.25	-13.43	40.0	-25.75	Peak	200.00	100	H	Pass

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B: Radiated Disturbance (30MHz----1000MHz)

EUT Operating Environment

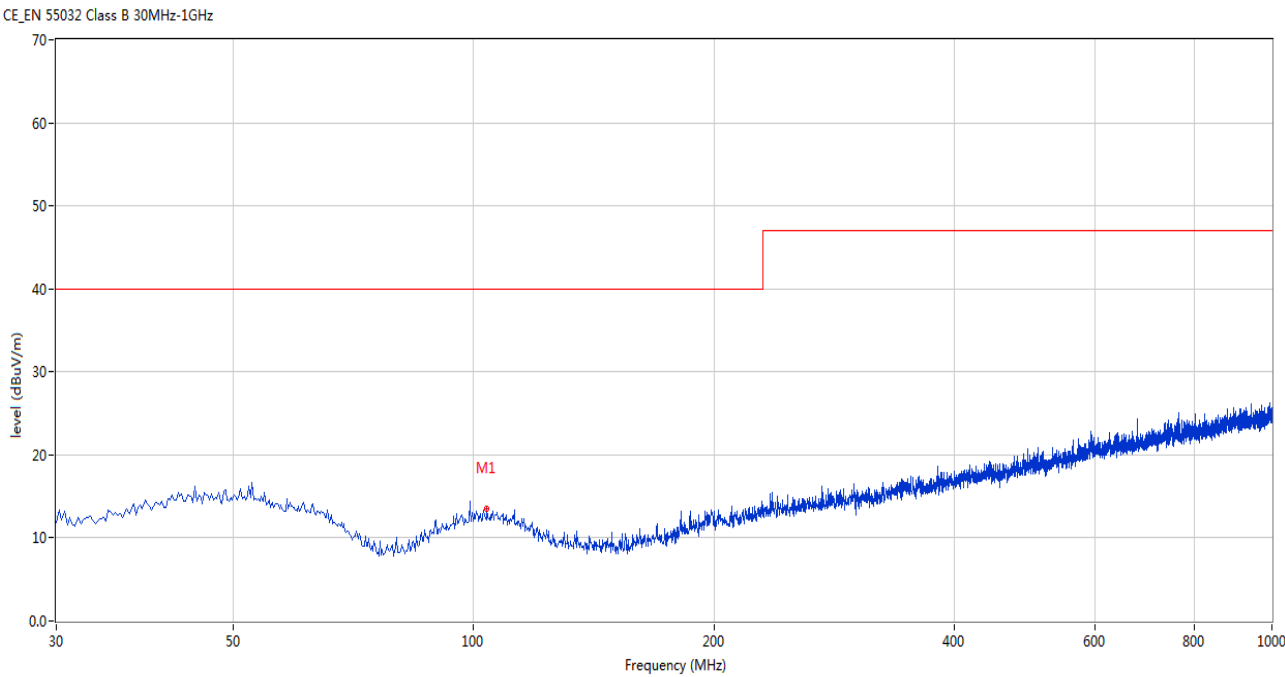
Temperature:25℃ Humidity: 55%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Communication by Bluetooth

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	103.944	13.51	-13.33	40.0	-26.49	Peak	286.00	200	V	Pass

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C: Radiated Disturbance (1000MHz---6000MHz)

EUT Operating Environment

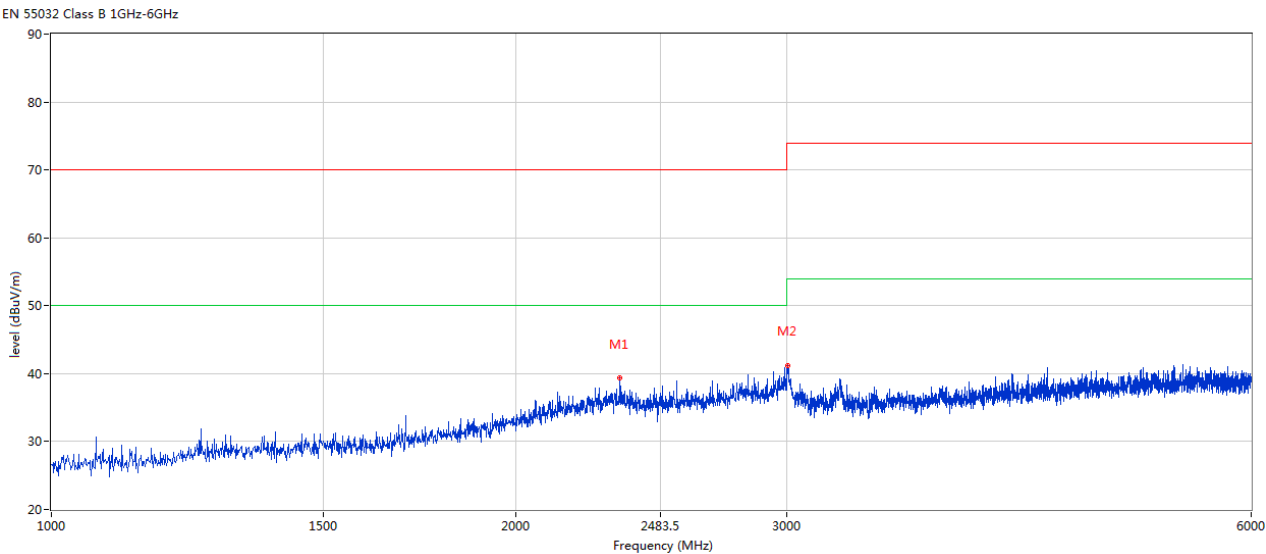
Temperature: 25℃ Humidity: 55%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Communication by Bluetooth

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	2338.415	39.37	-3.34	70.0	-30.63	Peak	15.00	100	H	Pass
2	3002.000	41.25	-2.63	74.0	-32.75	Peak	15.00	100	H	Pass

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D: Radiated Disturbance (1000MHz---6000MHz)

EUT Operating Environment

Temperature:25°C Humidity: 55%RH Atmospheric Pressure: 101 kPa

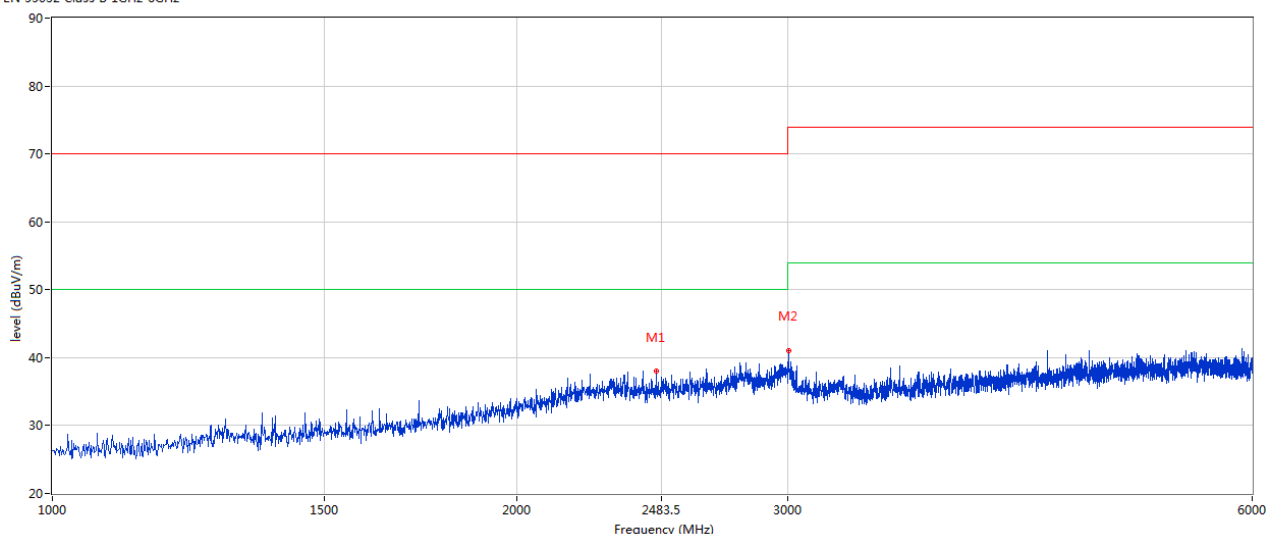
EUT set Condition: Communication by Bluetooth

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual

EN 55032 Class B 1GHz-6GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	2463.384	38.01	-3.57	70.0	-31.99	Peak	9.00	100	V	Pass
2	3003.249	41.08	-2.63	74.0	-32.92	Peak	13.00	100	V	Pass

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Clause 8.3 DC Power Input/output Ports Conducted Emissions

Test Method:

According to EMC Basic Standard (EN 55032) and the Artificial Mains Networks (AMN) shall be connected to a DC power source.

The measurement frequency range extends from 150 kHz to 30 MHz. When the EUT is a transmitter operating at frequencies below 30 MHz, then the exclusion band for transmitters applies (see clause 4.3) for measurements in the transmit mode of operation.

For emission measurements on DC output ports the relevant port shall be connected via an AMN to a load drawing the rated current of the source.

Temperature: 25°C

Humidity: 53% RH

Test Mode: Communication by Bluetooth

Note: Not applicable

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Clause 8.4 AC Line Conducted Emissions

According to EMC Basic Standard (EN 55032)

1. For the table top EUT the distance to the reference ground plane (wall) should be 40 cm.
2. AC input line plugged into LISN.

Results

Power Line (L, N)	EUT Operating mode or operating mode no.	Detector (Peak, AV, QP)	Additional (scan-) Information (e.g. Pre-test Fast scan, Maxhold, Final measurement.)	Result (Passed / Failed)
L=>GND	Communication by BT	QP & AV	--	Pass
N=>GND	and Charging	QP & AV	--	Pass

The frequency spectrum from 0.15MHz to 30MHz was investigated. All readings are quasi -peak values with a resolution bandwidth of 9 kHz

Temperature: 25°C
Humidity: 53% RH

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A: Conducted Emission on Live Terminal (150kHz to 30MHz)

EUT Operating Environment

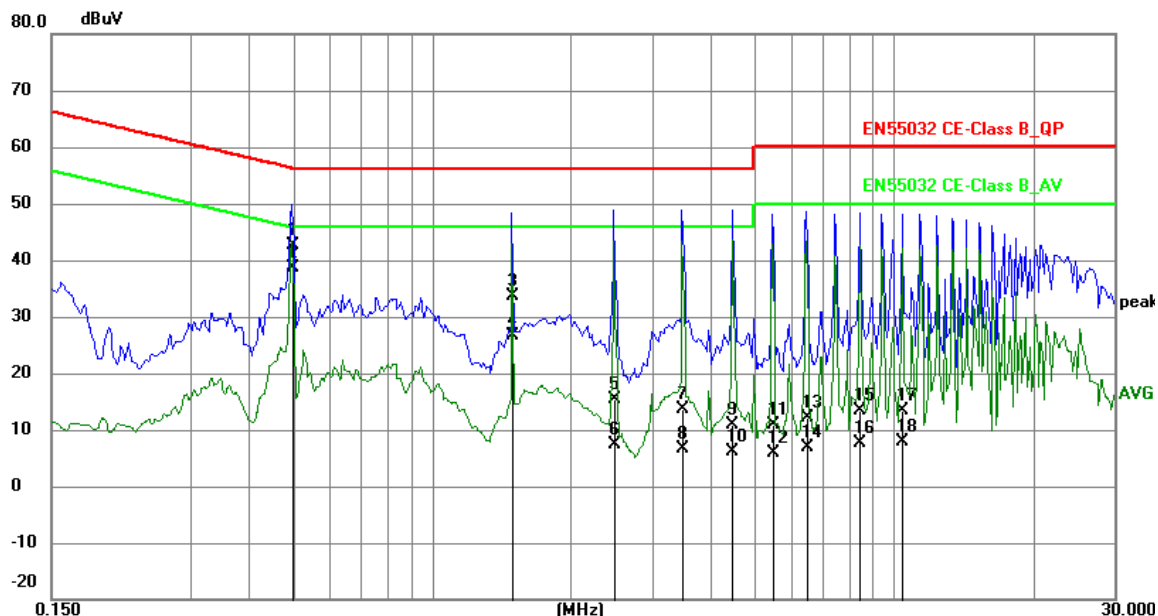
Temperature: 25°C Humidity: 75%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Communication by Bluetooth and Charging

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.4971	32.95	9.77	42.72	56.05	-13.33	QP	P
2	0.4971	28.74	9.77	38.51	46.05	-7.54	AVG	P
3	1.4877	23.93	9.79	33.72	56.00	-22.28	QP	P
4	1.4877	16.91	9.79	26.70	46.00	-19.30	AVG	P
5	2.4822	5.64	9.82	15.46	56.00	-40.54	QP	P
6	2.4822	-2.38	9.82	7.44	46.00	-38.56	AVG	P
7	3.4758	3.84	9.86	13.70	56.00	-42.30	QP	P
8	3.4758	-3.27	9.86	6.59	46.00	-39.41	AVG	P
9	4.4703	0.89	9.91	10.80	56.00	-45.20	QP	P
10	4.4703	-3.89	9.91	6.02	46.00	-39.98	AVG	P
11	5.4608	0.88	9.95	10.83	60.00	-49.17	QP	P
12	5.4608	-4.03	9.95	5.92	50.00	-44.08	AVG	P
13	6.4554	2.16	9.99	12.15	60.00	-47.85	QP	P
14	6.4554	-3.10	9.99	6.89	50.00	-43.11	AVG	P
15	7.4850	21.66	10.03	31.69	60.00	-28.31	QP	P
16	7.4850	3.07	10.03	13.10	50.00	-36.90	AVG	P
17	9.4935	19.50	10.13	29.63	60.00	-30.37	QP	P
18	9.4935	5.21	10.13	15.34	50.00	-34.66	AVG	P

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B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)

EUT Operating Environment

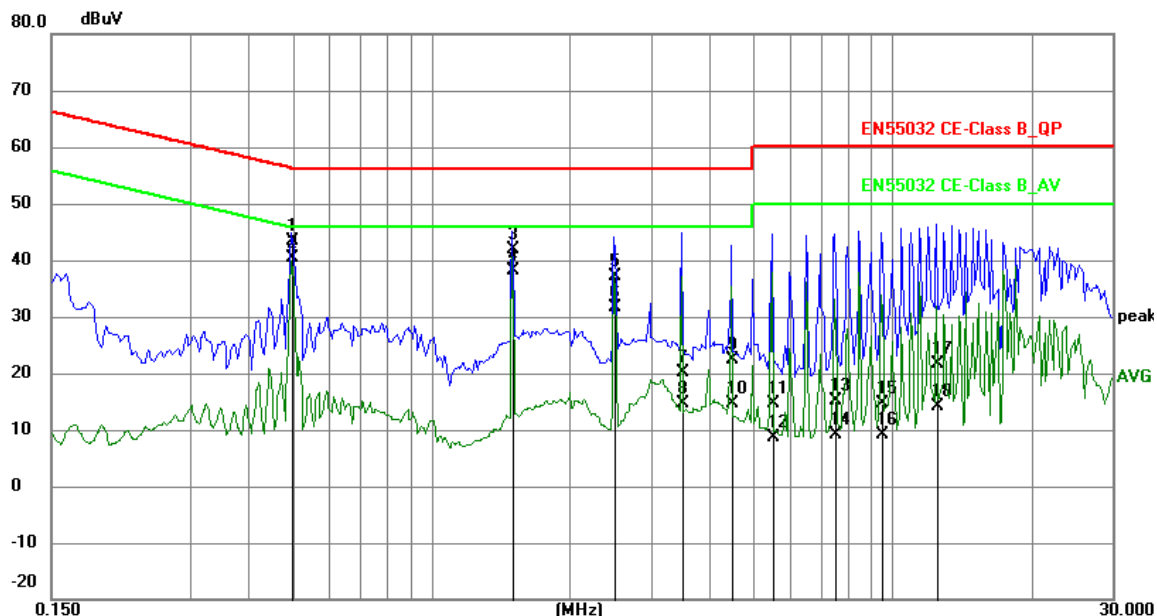
Temperature: 25°C Humidity: 75%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Communication by Bluetooth and Charging

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.4971	33.55	9.77	43.32	56.05	-12.73	QP	P
2	0.4971	30.67	9.77	40.44	46.05	-5.61	AVG	P
3	1.4955	32.20	9.79	41.99	56.00	-14.01	QP	P
4	1.4955	28.22	9.79	38.01	46.00	-7.99	AVG	P
5	2.4939	27.32	9.82	37.14	56.00	-18.86	QP	P
6	2.4939	21.89	9.82	31.71	46.00	-14.29	AVG	P
7	3.4953	10.22	9.86	20.08	56.00	-35.92	QP	P
8	3.4953	4.69	9.86	14.55	46.00	-31.45	AVG	P
9	4.4898	12.56	9.91	22.47	56.00	-33.53	QP	P
10	4.4898	4.70	9.91	14.61	46.00	-31.39	AVG	P
11	5.4921	4.64	9.95	14.59	60.00	-45.41	QP	P
12	5.4921	-1.39	9.95	8.56	50.00	-41.44	AVG	P
13	7.4889	5.14	10.03	15.17	60.00	-44.83	QP	P
14	7.4889	-0.83	10.03	9.20	50.00	-40.80	AVG	P
15	9.4818	4.50	10.13	14.63	60.00	-45.37	QP	P
16	9.4818	-1.07	10.13	9.06	50.00	-40.94	AVG	P
17	12.4536	11.29	10.27	21.56	60.00	-38.44	QP	P
18	12.4536	3.74	10.27	14.01	50.00	-35.99	AVG	P

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Clause 8.5 Harmonic Current Emissions

This test was performed as per EMC Basic Standard EN61000-3-2 :2014

Environmental conditions: Temperature: 22°C; Humidity: 52%RH

EUT Operating Mode: --

Results

Port	EUT Operating mode or operating mode no.	Result (Passed / Failed)
AC Input	--	N/A

Table 1 - Limit of Harmonics Current Measurement

Limits for Class A equipment	
Harmonics order (n)	Max. permissible harmonics current (A)
Odd harmonics	
3	2.3
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \leq n \leq 39$	$0.15 \times 15/n$
Even harmonics	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23 \times 8/n$

Note:

- For Class A equipment, the harmonics of the input current shall not exceed the absolute values given in table 1.
- For Class B equipment, the harmonics of the input current shall not exceed the values given in table 1 multiplied by factor of 1, 5.

Table 2 - Limit of Harmonics Current Measurement

Limits for Class C equipment	
Harmonics order (n)	Max. permissible harmonics current expressed as a percentage of the input current at the fundamental frequency (A)
Odd harmonics only	

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2	2
3	$30 \times \lambda^*$
5	10
7	7
9	5
$11 \leq n \leq 39$	3

Note: The harmonic current limits of lighting equipment shall not exceed the relative limits given in table 2.

Table 3 - Limit of Harmonics Current Measurement		
Limits for Class D equipment		
Harmonics order (n)	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
Odd harmonics only		
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
$13 \leq n \leq 39$	$3.85/n$	See table 1
$11 \leq n \leq 39$	3	

Note: The harmonic of the input current shall not exceed the values that can be derived form table 3.

Test Equipment

Please refer to Section 6 this report.

Test Procedure

- The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.
- The EUT is classified as follows:
 - Class A Balanced three-phase equipment and all other equipment, except that stated in one of the following classes.
 - Class B Portable tools.
 - Class C Lighting equipment, including dimming devices.
 - Class D Equipment having an input current with “special wave shape” and an active input power, $P \leq 600W$

Note: Due to the input power less than 75W. This test item is not applicable.

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Clause 8.6 Flicker and Voltage Fluctuation

This test was performed as per EMC Basic Standard EN 61000-3-3: 2013

Environmental conditions: Temperature: 25°C; Humidity: 52%RH

EUT Operating Mode: --

Results

Port	EUT Operating mode or operating mode no.	Result (Passed / Failed)
AC Input	--	N/A

Limits of Voltage Fluctuation and Flicks Measurement

Test Item	Limit	Note
P_{st}	1.0	Pst means short-term flicker indicator
P_{lt}	0.65	Plt means long-term flicker indicator
T_{dt} (ms)	500	Tdt means maximum time that dt exceeds 3%.
d_{max} (%)	4	Dmax means maximum relative voltage change.
dc (%)	3.3	Dc means relative steady-state voltage change.

Test Equipment

Please refer to Section 6 this report.

Test Procedure

- The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.
- During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT 10 minutes and the observation period for long-term flicker indicator is 2 hours.

Note: Tests need not be made on equipment which is unlikely to produce significant voltage fluctuations or flicker.

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Clause 9.2 Immunity Test – Radiated, RF Electromagnetic Field

According to EMC Basic Standard (EN 61000-4-3[9])

Operating Mode: Communication by Bluetooth

Environmental conditions: Temperature: 24°C; Humidity: 50%RH

Type of Port: Enclosure

Performance Criterion: CT/CR

The distance between the turn-table axis and Tx&Rx-antenna is 3m.

Field strength = 3V/m

Start Frequency = 80MHz Stop Frequency = 6000MHz

Frequency Step = lin 1MHz

The test signal is amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1000 Hz

Results

Frequency (MHz)	Antenna Polarity	Radiation to	Reaction of the EUT During and after test	Result
80-6000	Horizontal	Front	No reactions recognized	Pass
80-6000	Vertical	Front	No reactions recognized	Pass
80-6000	Horizontal	Rear	No reactions recognized	Pass
80-6000	Vertical	Rear	No reactions recognized	Pass
80-6000	Horizontal	Left	No reactions recognized	Pass
80-6000	Vertical	Left	No reactions recognized	Pass
80-6000	Horizontal	Right	No reactions recognized	Pass
80-6000	Vertical	Right	No reactions recognized	Pass

Note: Performance criteria A observed.

Test Equipment

Please refer to Section 6 this report.

Test Procedure

The EUT and load, which are placed on a table that is 0.8 meter above ground, are placed with one coincident with

The calibration plane such that the distance from antenna to the EUT was 3 meters.

Both horizontal and vertical polarization of the antenna and four sides of the EUT are set on measurement.

Audio output was monitored to judge the EUT performance criteria.

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Clause 9.3 Electrostatic Discharge

According to EMC basic standard (EN61000-4-2[10])

Operating Mode: Communication by Bluetooth

Environmental conditions: Temperature: 25°C; Humidity: 55%RH

Type of Port: Enclosure, USB Port, Switch, Micro-USB Port, Speaker Net,

Performance Criterion: TT/TR

For the table top EUT the distance to the reference ground plane should be 80 cm.

Direct contact discharge on conducting surfaces of EUT

Indirect air discharge on insulating surfaces of EUT

±2kV, ±4kV direct discharge & ±2kV, ±4kV, ±8kV air discharge

Test Results

Item	Contact Discharge to conducted surfaces and to coupling planes		Air Discharge at insulating surfaces
	Direct Contact Discharge	Indirect Contact Discharge	
Test Voltage	Reaction of EUT / Result	Reaction of EUT / Result	Reaction of EUT / Result
+2kV	n.r.r Passed	n.r.r Passed	n.r.r Passed
-2kV	n.r.r Passed	n.r.r Passed	n.r.r Passed
+4kV	n.r.r Passed	n.r.r Passed	n.r.r Passed
-4kV	n.r.r Passed	n.r.r Passed	n.r.r Passed
+8kV	-	-	n.r.r Passed
-8kV	-	-	n.r.r Passed

Remarks: n.r.r. = no reaction recognized

Performance Criteria A observed and No any function degraded during the tests.

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Clause 9.4 Fast Transients Common Mode

According to EMC basic standard (EN61000-4-4 [11])

Operating Mode: Communication by Bluetooth

Environmental conditions: Temperature: 24°C; Humidity: 51%RH

Type of Port: AC mains power input/output port

Performance Criterion: TT/TR

For the table top EUT the distance to the reference ground plane should be 10 cm.

The test level for ac mains power input ports shall be 1kV open circuit.

Test Setup

Burst on Power Line (direct injection)

Test Results

Adjustment on UCS 500 M4: Trigger “AUTO”, Burst length: 15ms					Test Time:	60s for every voltage and polarity		
						120s for every voltage and polarity		
Testing on power Line (direct injection)		Reaction of The Test Object During and after Test						Result
Test Voltage	Repetition Frequency	L1 =>GND (+=>GND)	L2=> GND	L3=> GND	N=> GND	PE=> GND	L1, N, => GND	
-0.5kV	5kHz	n.r.r	N/A	N/A	n.r.r	N/A	n.r.r	Pass
+0.5kV	5kHz	n.r.r	N/A	N/A	n.r.r	N/A	n.r.r	Pass
-1.0kV	5kHz	n.r.r	N/A	N/A	n.r.r	N/A	n.r.r	Pass
+1.0kV	5kHz	n.r.r	N/A	N/A	n.r.r	N/A	n.r.r	Pass

Remarks: n.r.r. = no reaction recognized, N/A = not applicable.

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Clause 9.5 RF Common Mode

According to EMC basic standard (EN61000-4-6 [10])

Operating Mode: Communication by Bluetooth

Environmental conditions: Temperature: 26°C; Humidity: 53%RH

Type of Port: AC mains power input/output port

Performance Criterion: CT/CR

Start Frequency = 150kHz Stop Frequency = 80MHz

Frequency Step = 50kHz in the range of 150kHz-5MHz

1% increment in the range of 5MHz-80MHz

The test signal is amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1000 Hz

Test Setup

Injection via CDN or BIC clamp

Test Results

Injection On	Injection Via	Reaction of the EUT During and after test	Result
AC input power line	CDN	No reactions recognized	Pass

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Clause 9.6 Transients and Surges in the Vehicular Environment

The test method shall be in accordance with ISO 7637-2 [8] for 12/24 V DC powered equipment

Environmental conditions: Temperature: 24°C; Humidity: 50%RH

EUT: Communication by Bluetooth

Type of Port: DC power input port

Performance Criterion: TT/TR

Test Requirement:

a) Pulse 3a and 3b, level III, with the test time reduced to 20 min for each;

Pulse 4, level III, 10 pulses, with the characteristics as follows:

$V_s = -6.5V$; $V_a = -2.5 V$; $t_6 = 25 ms$; $t_7 = 20 ms$; $t_8 = 20ms$; $t_9 = 5 s$; $t_{10}=50ms$, $t_{11}=20ms$, pulse cycle time: 60 s

b) Pulse 1, level III: $t_1 = 2,5 s$; $t_2=200ms$, $t_3=50 \mu s$ 10 pulses;

Pulse 2, level III: $t_1 = 2,5 s$; 10 pulses;

Both a) and b) shall be done as the manufacturer does not require the radio equipment to have a direct connection to the 12/24 V main vehicle battery

Test Result:

N/A

For 12V system

Test Pulse Number	Test Voltage	Test Level	Number of test pulses or test time	Reaction of EUT during and after Test	Test result
1	-75 V	III	10pulses	n.r.r- performance criteria A observed	N/A
2a	+37 V	III	10pulses	n.r.r- performance criteria A observed	N/A
2b	+10 V	III	10pulses	n.r.r- performance criteria A observed	N/A
3a	-112 V	III	20min	n.r.r- performance criteria A observed	N/A
3b	+75 V	III	20min	n.r.r- performance criteria A observed	N/A
4	-6 V	III	10pulses	n.r.r- performance criteria A observed	N/A

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For 24V system

Test Pulse Number	Test Voltage	Test Level	Number of test pulses or test time	Reaction of EUT during and after Test	Test result
1	-450 V	III	10pulses	n.r.r- performance criteria A observed	N/A
2a	+37 V	III	10pulses	n.r.r- performance criteria A observed	N/A
2b	+20 V	III	10pulses	n.r.r- performance criteria A observed	N/A
3a	-150 V	III	20min	n.r.r- performance criteria A observed	N/A
3b	+150 V	III	20min	n.r.r- performance criteria A observed	N/A
4	-12 V	III	10pulses	n.r.r- performance criteria A observed	N/A

Note: EUT not used in a vehicle, this test item not applicable.

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Clause 9.7 Voltage Dips and Interruption

According to EMC basic standard (EN61000-4-11 [13])

Operating Mode: Communication by Bluetooth

Environmental conditions: Temperature: 23°C; Humidity: 50%RH

Type of Port: AC mains power input/output port

Performance Criterion: TT/TR

For the table top EUT the distance to the reference ground plane should be 80 cm.

The test of voltage dip level shall be- a vol. Reduction of the supply vol. 0% for 10ms and 20ms and 30% for 500ms

The test of voltage interruption level shall be- a vol. Reduction of the supply vol. 0% for 5000ms

Test Results

For each test 3 repetitions in an interval of 10s time for decrease or increase of supply voltage: T down/up
< 5uS(due to switching)

Voltage Dips

Terminal Supply Voltage	Start by Trigger Angle (AC)	Duration of Test Voltage	Test Voltage	Reaction of EUT during and after Test	Result
U_1		T_{U2}	U_2		
100% U_N : 230V	0°	10ms	0% U_N : 0V	n.r.r- performance criteria A observed	Pass
100% U_N : 230V	0°	20ms	0% U_N : 0V	n.r.r- performance criteria A observed	Pass
100% U_N : 230V	0°	500ms	70% U_N : 161V	n.r.r- performance criteria A observed	Pass
Voltage Interruption					
100% U_N : 230V	0°	5000ms	0% U_N : 0V	n.r.r- performance criteria B observed	Pass

n.r.r- no reaction recongnized

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Clause 9.8 Surges Common & Differential Mode (1-phase)

According to EMC basic standard (EN61000-4-5 [14])

Operating Mode: Communication by Bluetooth

Environmental conditions: Temperature: 23°C; Humidity: 50%RH

Type of Port: AC mains power input/output port

Performance Criterion: TT/TR

For the table top EUT the distance to the reference ground plane should be 80 cm.

1KV open circuit for common mode & 0.5kV open circuit for differential mode.

Test Results

5 pulses for each polarity and test voltage, alternating and negative/positive, triggered in case of AC- powerline: 0°, 45°, 90° 180°, 270°, referred to the line frequency. (L1)

Repetition rate is 1 per min.

Test Voltage	Reaction of the test object during and after test by trigger angle/pulse no.(coupling on DC-lines =>trigger angle not relevant).					Result
	0°/pulse no1, 2	45°/pulse, no.3, 4	90°/pulse, no. 5, 6	180°/pulse, no. 7, 8	270°/pulse, no. 9, 10	
Capacitive coupling on AC line: L1=>N or DC lines lines +=>- (Ri=2 Ω /C =18uF)						
-0.5kV	No reaction	No reaction	No reaction	No reaction	No reaction	Pass
+0.5kV	Recognized	Recognized	Recognized	Recognized	Recognized	
-1.0kV	No reaction	No reaction	No reaction	No reaction	No reaction	Pass
+1.0kV	Recognized	Recognized	Recognized	Recognized	Recognized	
-2.0Kv	N/A	N/A	N/A	N/A	N/A	N/A
+2.0kV						
- kV	N/A	N/A	N/A	N/A	N/A	N/A
+kV						

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3.0 CE Mark label specification

Text of the mark is black or white in color and is left justified. Labels are printed in indelible ink on permanent adhesive backing and shall be affixed at a conspicuous location on the EUT or silk-screened onto the EUT.



Mark Location: Rear enclosure

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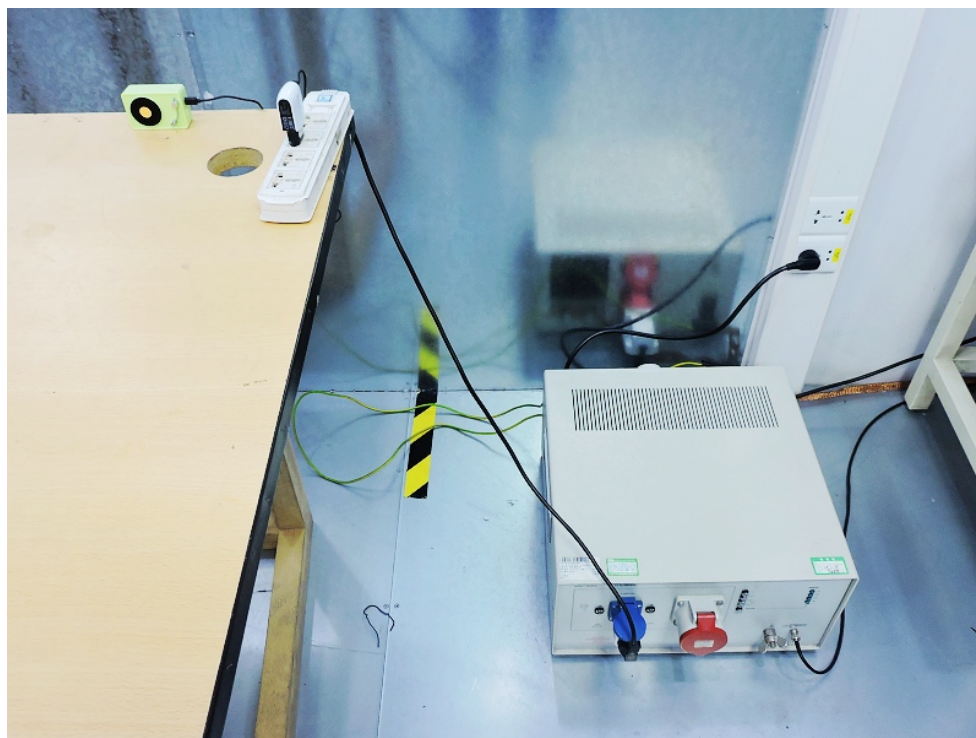
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4. Photographs – Test Setup

4.1 Photograph – Conducted Test Setup



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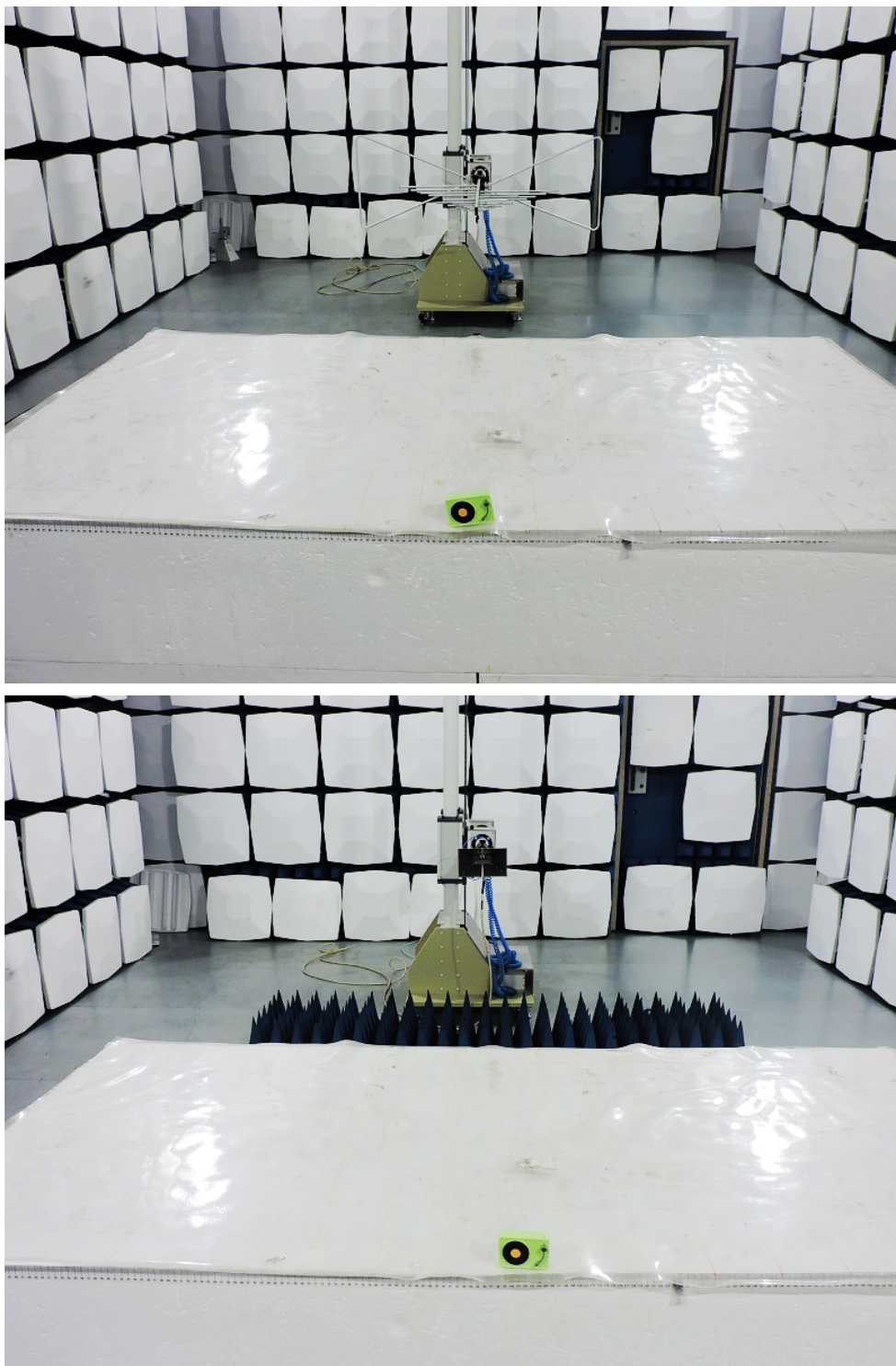
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4.2 Radiated Emission Test Setup

Photograph –Radiated Emission Test Setup



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4.3 Photograph –ESD Test Setup



4.4 Photograph –EFT/B, Surge, Voltage Dips Test Setup



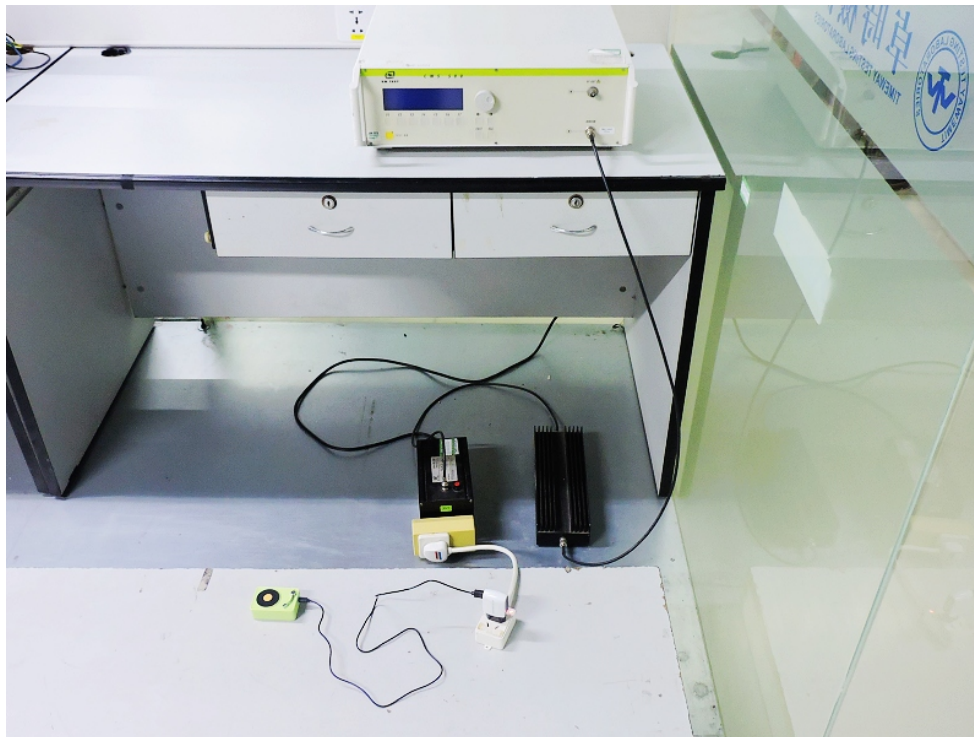
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4.5 Photograph –CS Test Setup



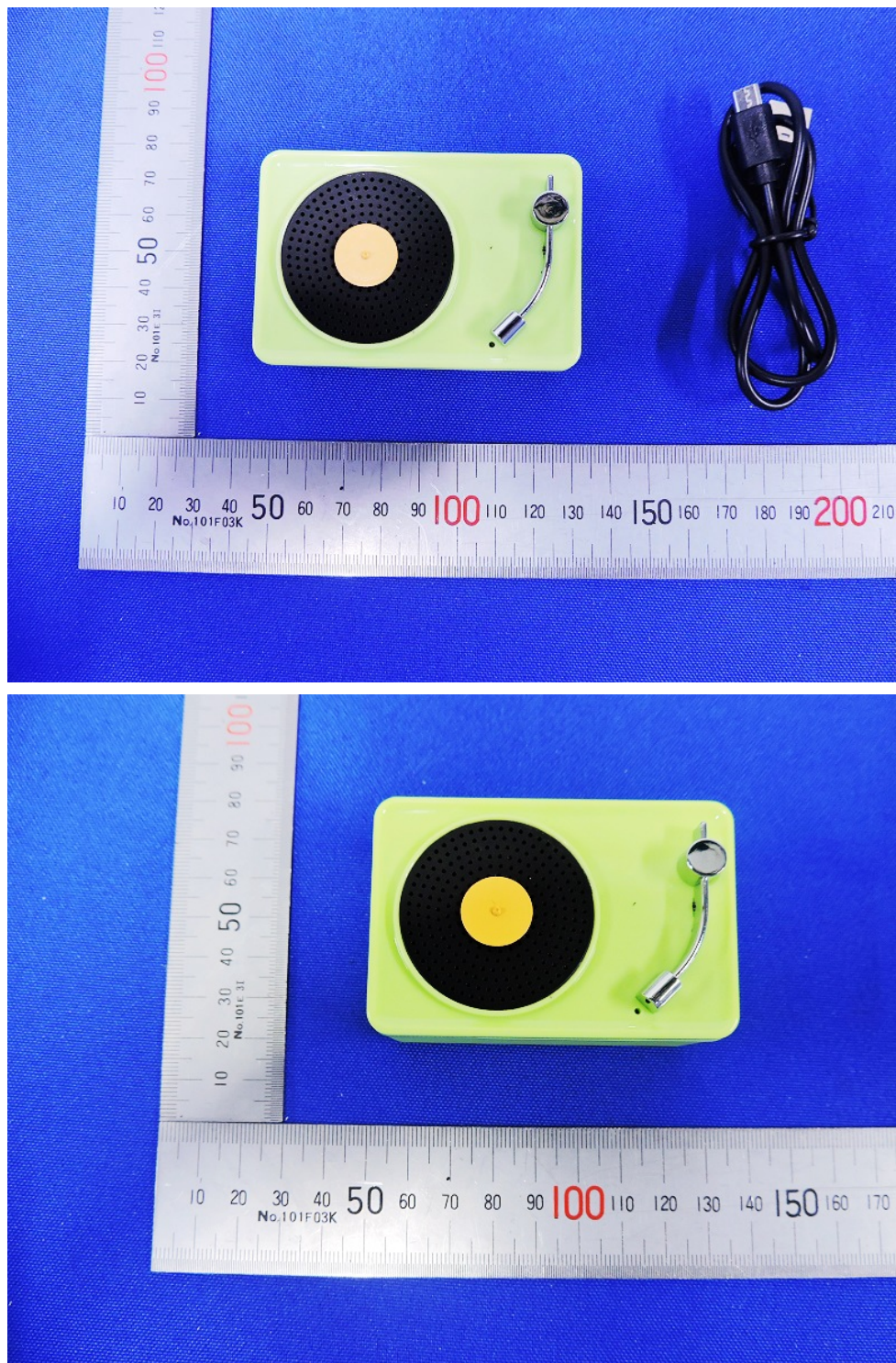
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5.0 Photographs – EUT



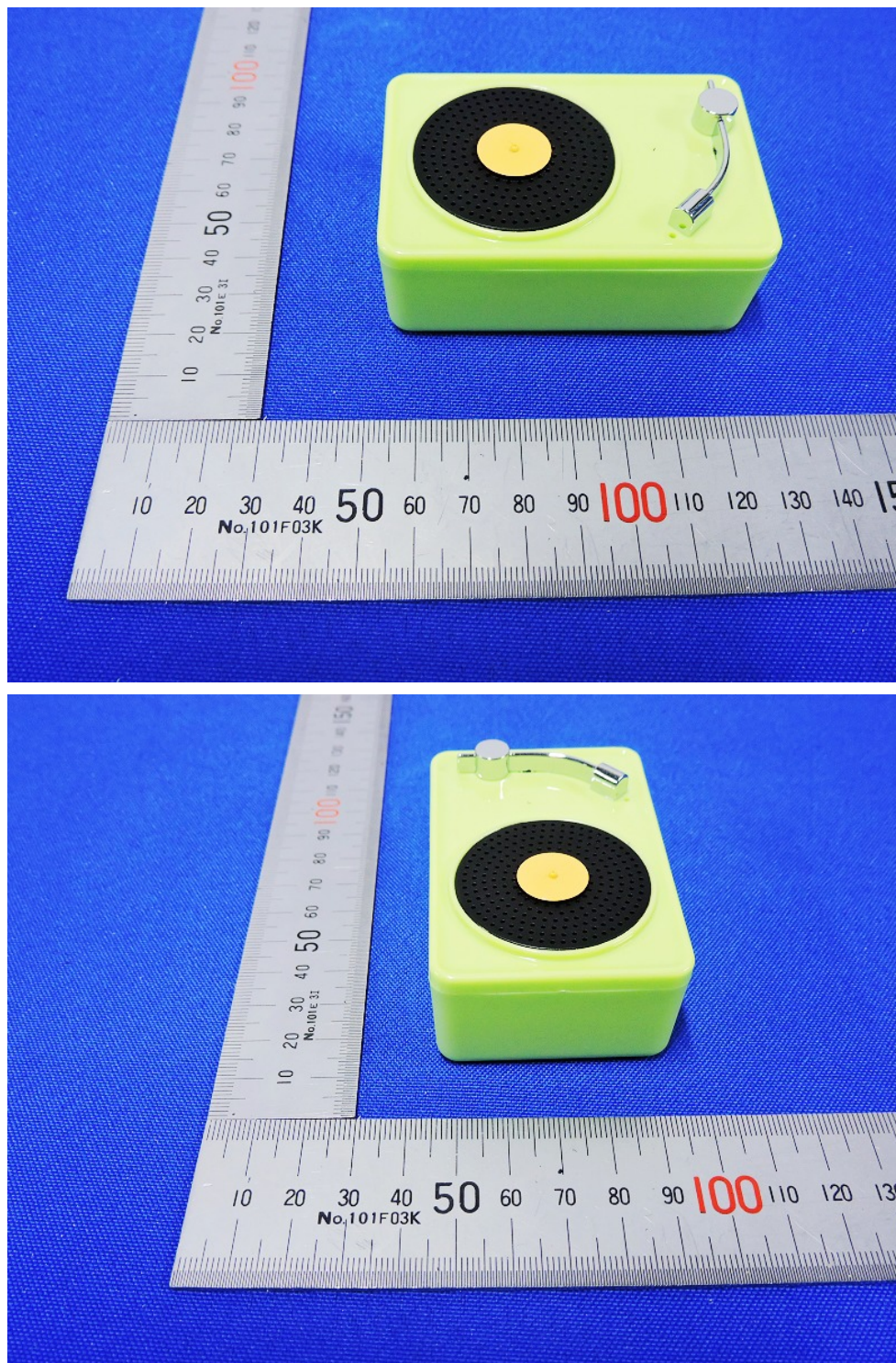
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Photographs – EUT



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Photographs – EUT



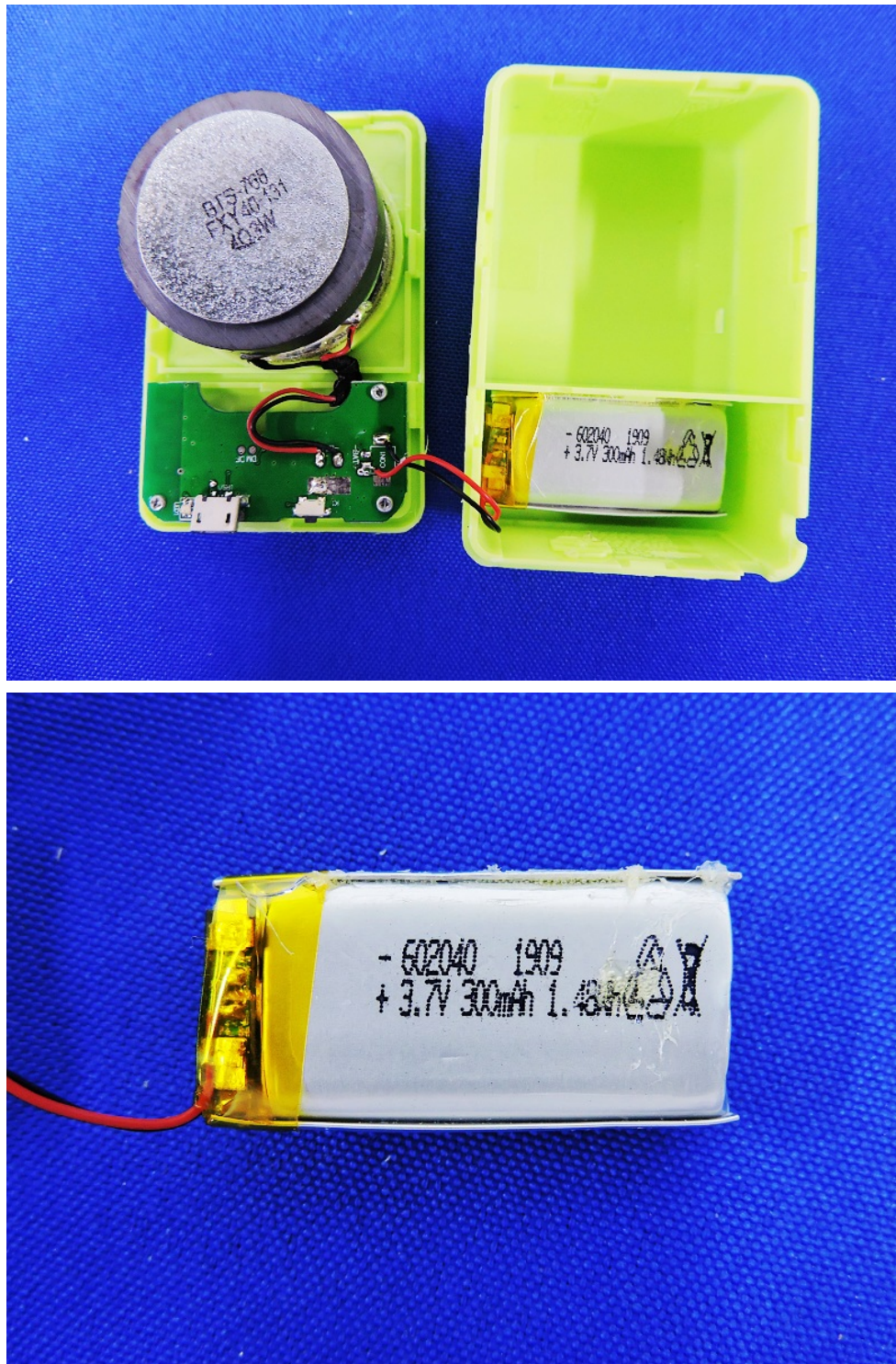
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Photographs – EUT



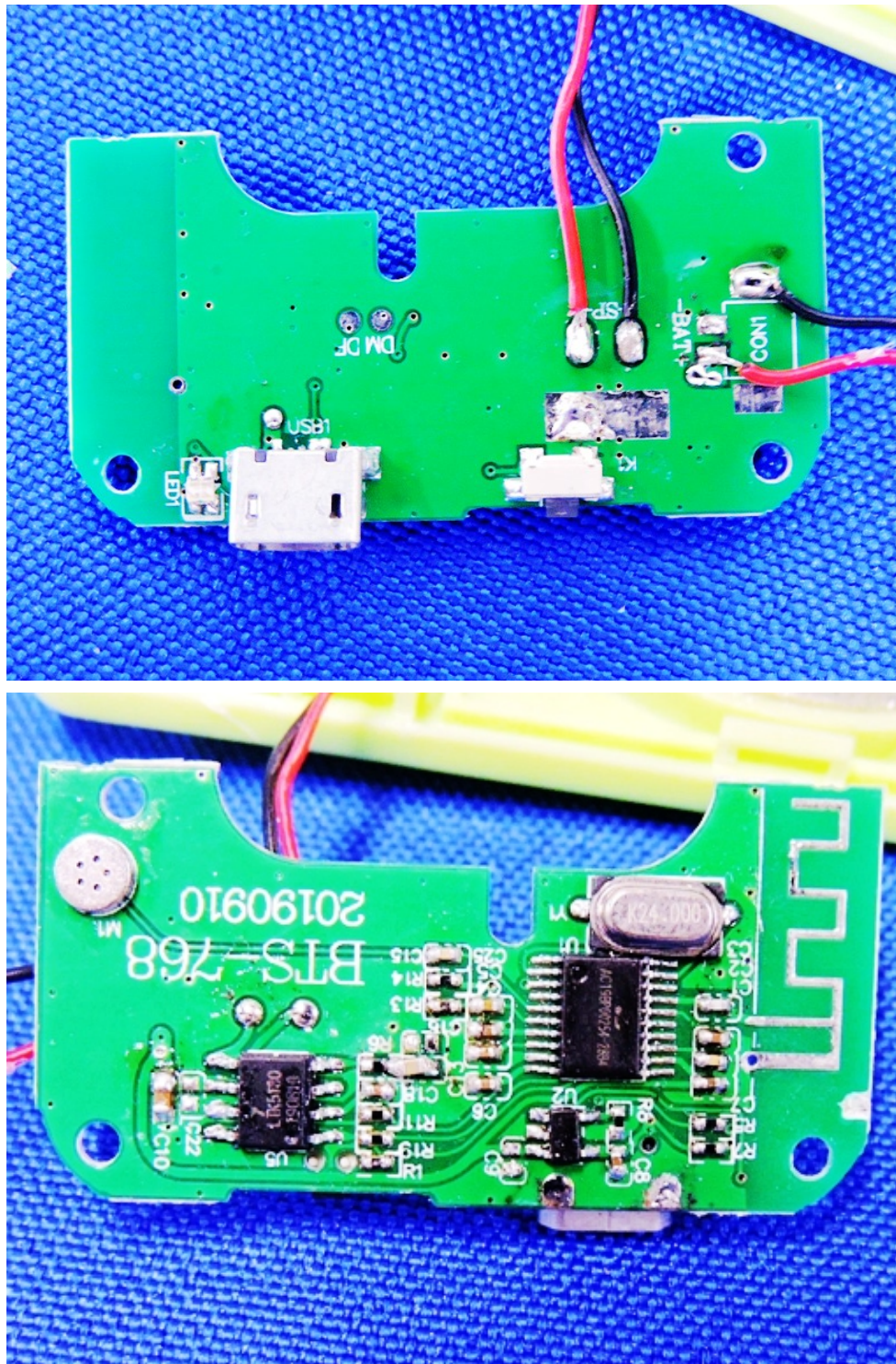
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6.0 List of Measurement Equipment

6.1 Conducted Emission Test

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
EMI Test Receiver	ESH3	860905/006	RS	2019.06.21	1 Year
Spectrum Analyzer	ESA-L1500A	US37451154	HP	2019.06.21	1 Year
LISN	NNB42	00012	SCHFFNER	2020.01.06	1 Year

6.2 Radiated Disturbance Test

Name	Model No	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
EMI Test Receiver	ESPI 3	100379	RS	2019.06.21	1 Year
Spectrum Analyzer	E4407B	MY50441392	HP/Agilent	2019.06.21	1 Year
Amplifier	BBV9743	#218	HP/Agilent	2019.06.21	1 Year
Bilog Antenna	VULB9163	9163/340	Schwarebeck	2018.07.04	3 Year
Horn Antenna	BBHA 9120D	9120D-631	RS	2018.07.09	3 Year
Amplifier	8449B	3008A00160	HP/Agilent	2019.06.21	1 Year

6.3 Harmonic & Flicker Test

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
Harmonics Flicker Test System	PACS-1	72305	CI	2019.09.28	1 Year
5K VA AC Power Source	5001iX	56060	CI	2019.09.28	N/A

6.4 ESD Test

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
ESD Simulator	DITO	0404-24	EM TEST	2019.06.21	1 Year

6.5 RF field Strength Susceptibility

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
Signal Generator	SMT03	100059	RS	2019.06.21	1 Year
Power Meter	NRVS	---	RS	2019.06.21	1 Year

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Voltage Probe	URV5-Z2	100012	RS	2019.06.21	1 Year
Voltage Probe	URV5-Z2	100013	RS	2019.06.21	1 Year
Power Amplifier	150W1000	300999	AR	2019.06.21	1 Year
Power Amplifier	25S1G4AM1	305993	AR	2019.06.21	1 Year
Field Probe	CBL6111C	2576	Holaday	2019.06.21	1 Year
Bilog Antenna	MCDC	---	Chase	2019.06.21	1 Year

6.6 Electrical Fast Transient/Burst (EFT/B) Immunity test

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
EFT Generator	UCS 500 M4	0304-42	EM TEST	2019.06.21	1 Year
Power Source	MV2616	0104-14	EM TEST	2019.06.21	1 Year

6.7 Surge Test

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
Ultra Compact Simulator	UCS 500 M4	0304-42	EM TEST	2019.06.21	1 Year
Power Source	MV2616	0104-14	EM TEST	2019.06.21	1 Year

6.8 Conducted Immunity Test

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
Continuous Wave Simulator	CWS 500C	0407-05	EM TEST	2019.06.21	1 Year

6.9 Voltage Dips/Interruption Immunity Test

Name	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Cycle
Ultra Compact Simulator	UCS 500 M4	0304-42	EM TEST	2019.06.21	1 Year
Power Source	MV2616	0104-14	EM TEST	2019.06.21	1 Year

End of the report

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