



EMC Measurement and Test Report For

Dongguan Mingke Acoustics Technology Co., Ltd.

True wireless stereo earphone

Applicant : Dongguan Mingke Acoustics Technology Co., Ltd.

Address : 7/F Building A, No.2 Lilian Rd, TangXia Town,
DongGuan City, China

Product Name : True wireless stereo earphone

Brand Name : N/A

Model No : MK-56, MK013, MK-016, MK-015, MK017, MK009S,
MK029Plus, MK020, MK011, MK031, MK032,
MK033, MK035, MK036, MK037, M-01, M-02, M-03,
M-05, M-06, M-07, MK56, MK011, MK013,
MK013C-2.4G, MK015, MK016, MK017, MK009S,
MK029, MK029 Plus, MK020, MK031, MK032,
MK033, MK035, MK036, MK037, MK038, MK039,
M-01, M-02, M-03, M-05, M-06, M-07

Standards : ETSI EN 301 489-1 V2.2.1
ETSI EN 301 489-17 V3.2.0

Report No : MTL24052422201E01

**Date of
Receipt sample** : 2024-05-24

Date of Test : 2024-05-24 to 2024-05-27

Date of Issue : 2024-05-27

Test Result : PASS

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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Report version

Version No.	Date of issue	Description
Rev.00	/	/
/	/	/



1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

TEST REPORT DECLARATION

Applicant : Dongguan Mingke Acoustics Technology Co., Ltd.
Manufacturer : Dongguan Mingke Acoustics Technology Co., Ltd.
EUT Description : True wireless stereo earphone

- (A) Model No. : MK-56
MK013, MK-016, MK-015, MK017, MK009S, MK029Plus, MK020,
MK011, MK031, MK032, MK033, MK035, MK036, MK037, M-01,
M-02, M-03, M-05, M-06, M-07, MK56, MK011, MK013,
(B) Serial No. : MK013C-2.4G, MK015, MK016, MK017, MK009S, MK029, MK029
Plus, MK020, MK031, MK032, MK033, MK035, MK036, MK037,
MK038, MK039, M-01, M-02, M-03, M-05, M-06, M-07
(C) Power Supply : 5V⁼⁼

Test Procedure Used:

ETSI EN 301 489-1 V2.2.1 (2019-03)

ETSI EN 301 489-17 V3.2.0 (2017-03)

The devices described above have been tested by **Shenzhen MTL Testing Technology Co., Ltd** to determine the maximum emission levels emanating from the device, the severe levels that the device can endure and EUT'S performance criterion. The test results are contained in this test report. **Shenzhen MTL Testing Technology Co., Ltd.** is assumed of full responsibility for the accuracy and completeness of these tests.

This report applies to above tested sample only and shall not be reproduced in part without written approval of **Shenzhen MTL Testing Technology Co., Ltd.**

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Approved by:



Technical Director



1.2 Test Standards

The tests were performed according to following standards:

ETSI EN 301 489-1 V2.2.1 (2019-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU.

ETSI EN 301 489-17 V3.2.0 (2017-03) 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.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product maybe which result in lowering the emission/immunity should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with the standard ETSI EN 301489-1, Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.



1.4 EUT Setup and Operation Mode

The equipment under test (EUT) was configured to measure its highest possible emission/immunity level. The test modes were adapted according to the operation manual for use, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	MK-56	5V $\overline{---$

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Adapter	Dell Inc.	/	/
AUX Line	PHILIPS	/	/
USB CABLE	UGREEN	/	/
iPhone6 Plus	Apple	/	/



1.5 Performance Criteria for EMS

➤ EN 301 489-17, The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

Table 1: Performance criteria

Criteria	During test	After test
A	Shall operate as intended. (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 3). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 2). Shall be no unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3).

NOTE 1: Operate as intended during the test allows a level of degradation not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 3: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.



1.6 Measurement Uncertainty

Measurement uncertainty	
Parameter	Uncertainty
Uncertainty for Radiated Emission in 3m chamber	@30-200MHz $\pm 4.52\text{dB}$ @0.2-1GHz $\pm 5.56\text{dB}$ @1-6GHz $\pm 3.84\text{dB}$ @6-18GHz $\pm 3.92\text{dB}$
Uncertainty for Conducted Emission	@9-150kHz $\pm 3.74\text{dB}$ @0.15-30MHz $\pm 3.34\text{dB}$
Uncertainty for Harmonic test	3.26%
Uncertainty for Flicker test	4.76%
Uncertainty for RS test	21%, k=2
Uncertainty for CS test	29%, k=2
Uncertainty for ESD test	The immunity measurement system uncertainty is within standard requirement and is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
Uncertainty for EFT test	
Uncertainty for Surges test	
Uncertainty for Voltage Dips, Voltage Variations and Short Interruptions Test	
Uncertainty for PFMF test	



1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Spectrum Analyzer	Rohde & Schwarz	FSP	836079/035	2024-05-27	2025-05-26
EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2024-05-27	2025-05-26
Amplifier	Agilent	8447F	3113A06717	2024-05-27	2025-05-26
Amplifier	C&D	PAP-1G18	2002	2024-05-27	2025-05-26
Broadband Antenna	Schwarz beck	VULB9163	9163-333	2024-05-27	2025-05-26
Horn Antenna	ETS	3117	00086197	2024-05-27	2025-05-26
Loop Antenna	Schwarz beck	FMZB 1516	9773	2024-05-27	2025-05-26
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2024-05-27	2025-05-26
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2024-05-27	2025-05-26
AC LISN	Schwarz beck	NSLK8126	8126-224	2024-05-27	2025-05-26
DC LISN	Schwarz beck	NNBM8126D	279	2024-05-27	2025-05-26
8-WIRE LISN	Schwarz beck	8158	CAT3-8158-0059	2024-05-27	2025-05-26
8-WIRE LISN	Schwarz beck	8158	CAT5-8158-0117	2024-05-27	2025-05-26
Digital Power Analyzer	California Instrument	PACS-1	72831	2024-05-27	2025-05-26
Power Source	California Instrument	5001iX	25965	2024-05-27	2025-05-26
ESD Generator	LIOGCEL	ESD-203B	0170901	2024-05-27	2025-05-26
Signal Generator	Rohde & Schwarz	SMT03	100059	2024-05-27	2025-05-26
Voltage Probe	Rohde & Schwarz	URV5-Z2	100013	2024-05-27	2025-05-26
Power Amplifier	AR	150W1000	300999	2024-05-27	2025-05-26
Power Amplifier	AR	25S1G4AM1	305993	2024-05-27	2025-05-26
Transient 2000	EMC PARTNER	TRA2000	863	2024-05-27	2025-05-26
CS Immunity Tester	SCHAFFNER	NSG2070	1123	2024-05-27	2025-05-26
CDN	Luthi	CDNL-801	2655	2024-05-27	2025-05-26
Attenuator	EMCI	MA-5100/6BF2	1009	2024-05-27	2025-05-26
EMCPRO	KEYTEK	EMCPro	0509124	2024-05-27	2025-05-26
Coil	KEYTEK	F-1000-4-8	0533	2024-05-27	2025-05-26
Anechoic chamber	Albatross Projects	MCDC	----	2024-05-27	2025-05-26
CS Generator	MARCONI	2024	112260/042	2024-05-27	2025-05-26
Attenuator	FRANKONIA	75-A-FFN-06	1001698	2024-05-27	2025-05-26
CDN	FRANKONIA	CDN M2+M3	A3027019	2024-05-27	2025-05-26

Software List			
Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

*Remark: indicates software version used in the compliance certification testing



2. SUMMARY OF TEST RESULTS

Standards	Reference	Description of Test Item	Result
Draft ETSI EN 301 489-1	8.2	Radiated Emissions	Pass
	8.3	Conducted Emissions for DC Power Port	N/A
	8.4	Conducted Emissions for AC Power Port	Pass
	8.5	Harmonic Current Emissions	N/A
	8.6	Voltage Fluctuations and Flicker	Pass
	8.7	Telecommunication Ports	N/A
	9.2	Radio Frequency Electromagnetic Field	Pass
	9.3	Electrostatic Discharge	Pass
	9.4	Fast Transients, Common Mode	Pass
	9.5	Radio Frequency, Common Mode	Pass
	9.6	Transient and Surges in the Vehicular Environment	N/A
	9.7	Voltage Dips and Interruptions	Pass
	9.8	Surges	Pass

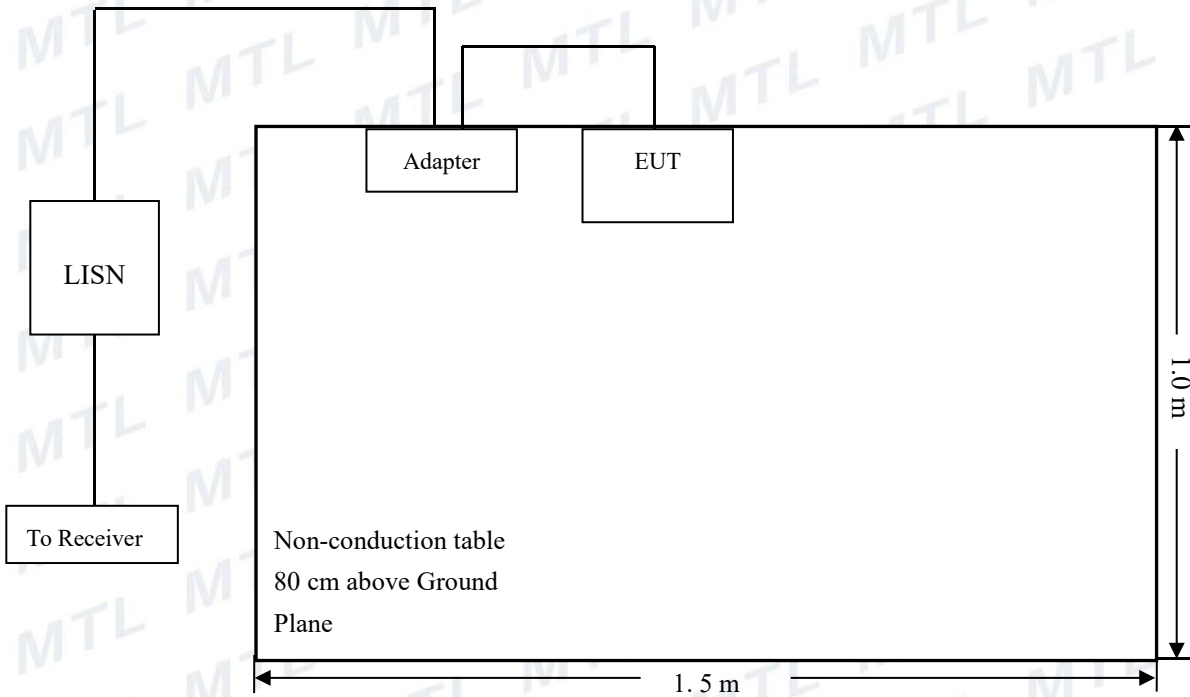
Pass: The EUT complies with the essential requirements in the standard
Fail: The EUT does not comply with the essential requirements in the standard
N/A: not applicable

3. Conducted Emissions

3.1 Test Procedure

Test is conducting under the description of EN55032 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

3.2 Basic Test Setup Block Diagram



3.3 Environmental Conditions

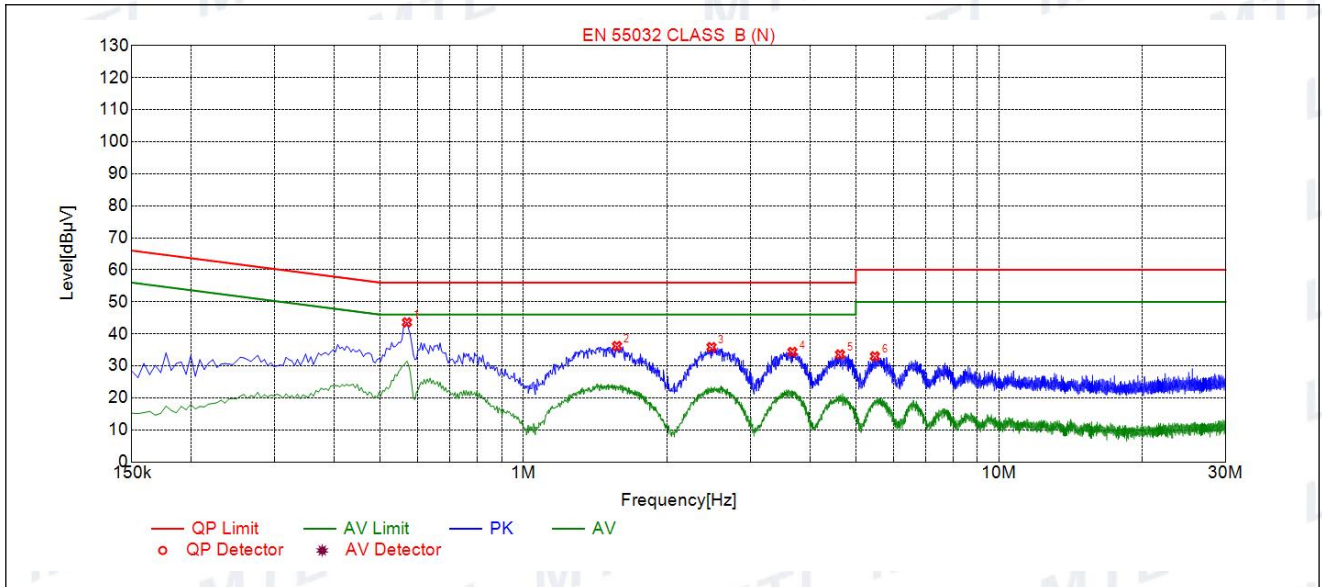
Temperature:	22 °C
Relative Humidity:	55 %
ATM Pressure:	1015 mbar

3.4 Conducted Emissions Test Data

Note: Only show the worst case in the test report



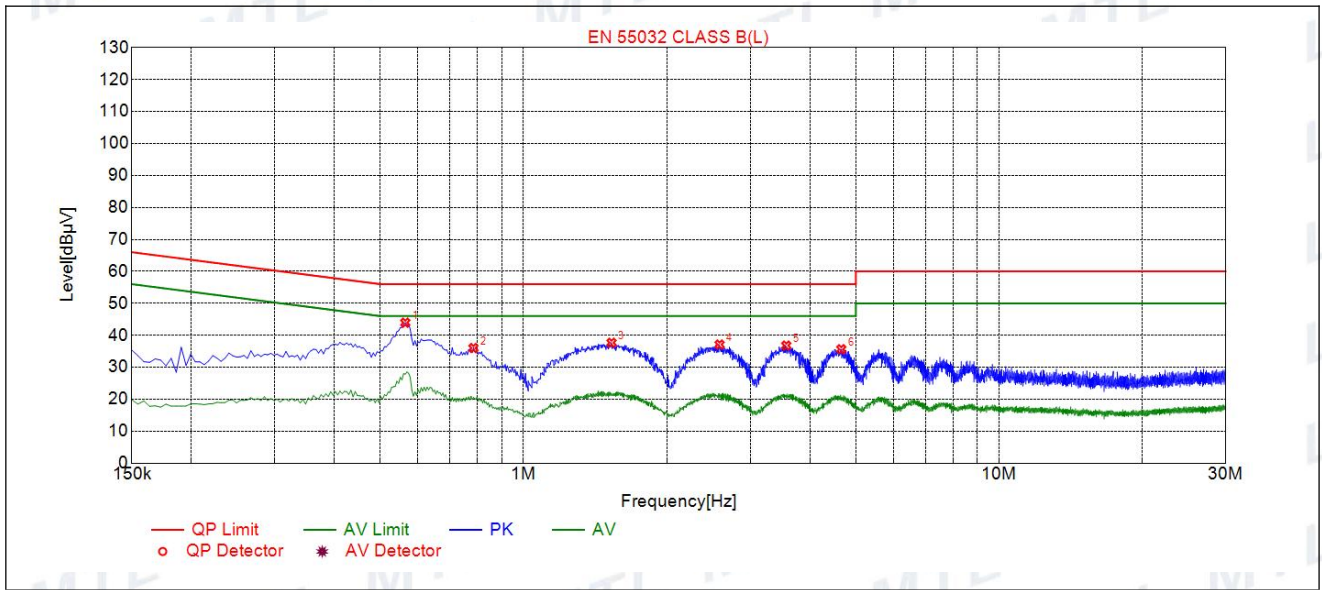
Test mode:	TM1	Polarity:	Neutral
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Suspected List								
NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Reading [dBµV]	Detector	Type
1	0.5685	43.59	20.05	56.00	12.41	23.54	PK	N
2	1.5720	36.20	20.11	56.00	19.80	16.09	PK	N
3	2.4855	35.86	20.19	56.00	20.14	15.67	PK	N
4	3.6780	34.34	20.25	56.00	21.66	14.09	PK	N
5	4.6320	33.57	20.26	56.00	22.43	13.31	PK	N
6	5.4825	32.99	20.26	60.00	27.01	12.73	PK	N



Test mode:	TM1	Polarity:	Line
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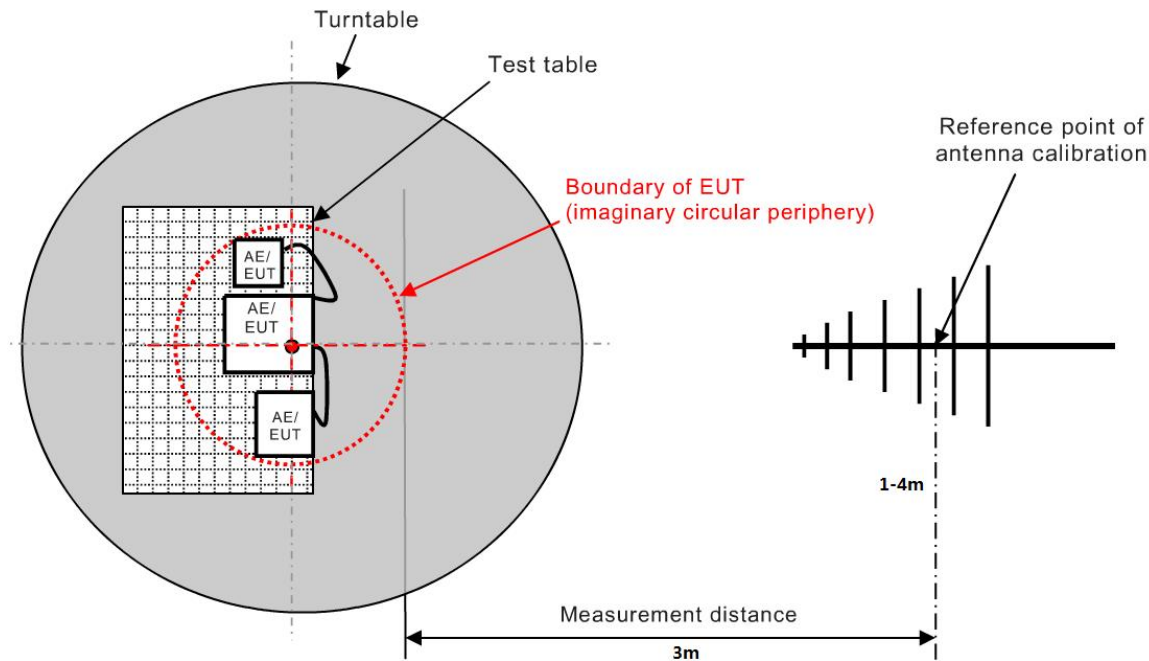


Suspected List								
NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Reading [dBµV]	Detector	Type
1	0.5640	43.95	20.06	56.00	12.05	23.89	PK	L
2	0.7845	36.01	20.05	56.00	19.99	15.96	PK	L
3	1.5315	37.67	20.11	56.00	18.33	17.56	PK	L
4	2.5845	37.10	20.20	56.00	18.90	16.90	PK	L
5	3.5700	36.79	20.25	56.00	19.21	16.54	PK	L
6	4.6590	35.64	20.26	56.00	20.36	15.38	PK	L

4. Radiated Emissions

4.1 Test Procedure

Test is conducting under the description of EN55032 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.



4.2 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of $-6\text{dB}\mu\text{V}$ means the emission is $6\text{dB}\mu\text{V}$ below the maximum limit for Class B device. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{EN 301489 Class B Limit}$$

4.3 Environmental Conditions

Temperature:	23° C
Relative Humidity:	53%
ATM Pressure:	1011 mbar

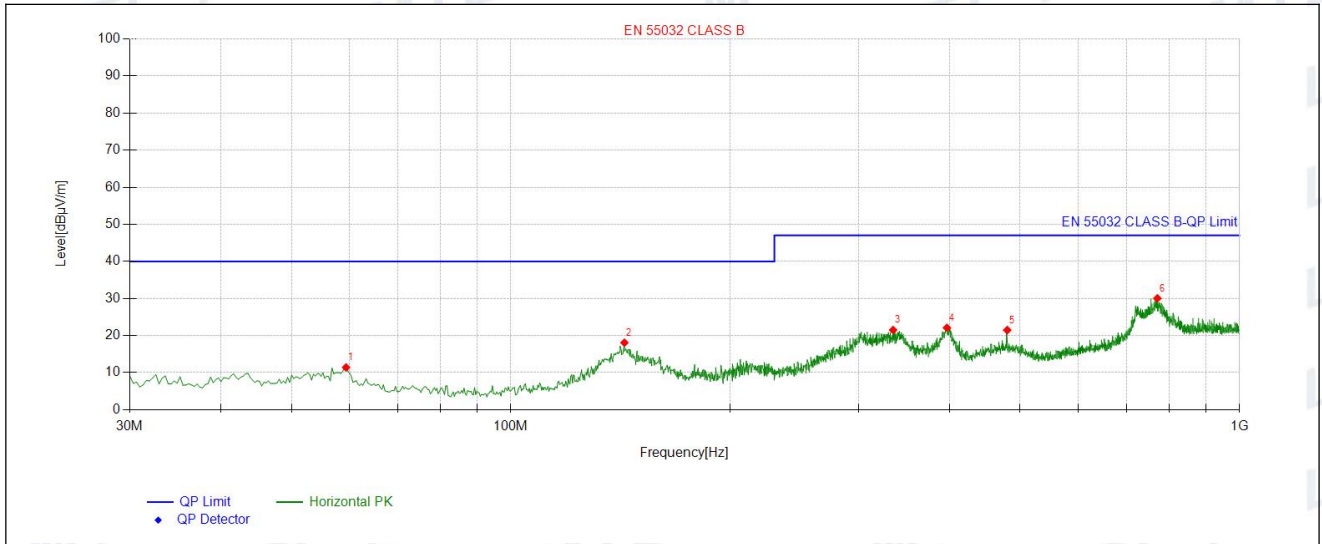


4.4 Summary of Test Results/Plots

Note: Only show the worst case in the test report

➤ 30MHz to 1GHz

Test mode:	TM1	Polarity:	Horizontal
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Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	59.433144	-18.21	29.60	11.39	40.00	28.61	100	298	Horizontal
2	143.204440	-17.84	35.91	18.07	40.00	21.93	100	351	Horizontal
3	334.68156	-16.80	38.28	21.48	47.00	25.52	100	80	Horizontal
4	396.78226	-15.19	37.26	22.07	47.00	24.93	100	209	Horizontal
5	479.90663	-13.58	35.04	21.46	47.00	25.54	100	351	Horizontal
6	771.32710	-8.10	38.12	30.02	47.00	16.98	100	283	Horizontal



Test mode:	TM1	Polarity:	Vertical
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Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	66.225408	-19.08	31.72	12.64	40.00	27.36	100	9	Vertical
2	145.14504	-17.78	40.06	22.28	40.00	17.72	100	43	Vertical
3	338.88629	-16.73	35.31	18.58	47.00	28.42	100	225	Vertical
4	397.75258	-15.16	34.77	19.61	47.00	27.39	100	141	Vertical
5	495.10836	-13.38	35.97	22.59	47.00	24.41	100	286	Vertical
6	728.30943	-8.89	37.70	28.81	47.00	18.19	100	172	Vertical



5. Harmonic Current Emissions

5.1 Test Procedure

Test is conducting under the description of EN 61000-3-2.

5.2 Test Standards

EN 61000-3-2, Clause 7.1 Limits for Class A equipment.

5.3 Environmental Conditions

Temperature:	22 °C
Relative Humidity:	48%
ATM Pressure:	1022 mbar

5.4 Harmonic Current Emissions Test Data

According to Clause 7 of EN61000-3-2, the EUT rated power is less than 75W, belong to 'equipment with a rated power of 75W or less', therefore 'limits are not specified in this edition of the standards'. It is deem to full fit the requirements of the standards.

Result: N/A



6. Voltage Fluctuation and Flicker

6.1 Test Procedure

Test is conducting under the description of EN 61000-3-3.

6.2 Test Standards

EN 61000-3-3, Limit: Clause 5.

6.3 Environmental Conditions

Temperature:	22 °C
Relative Humidity:	48%
ATM Pressure:	1022 mbar

6.4 Voltage Fluctuation and Flicker Test Data



Test mode:	TM1(worst case)
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Test Result: Pass

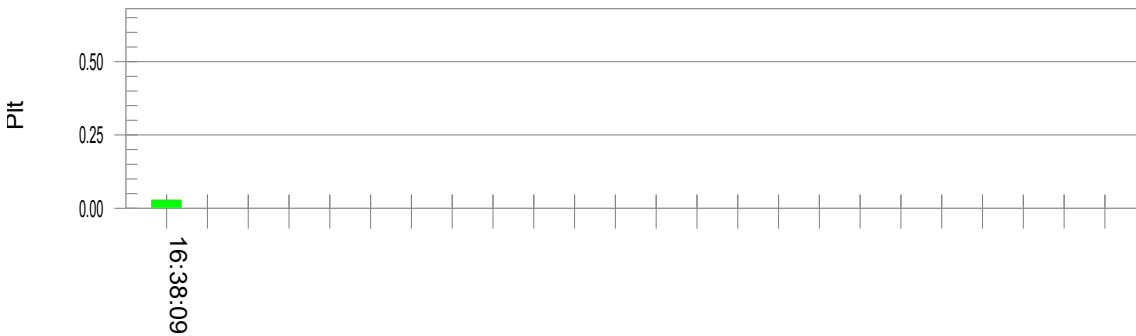
Status: Test Completed

Pst_i and limit line

European Limits



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	230.02			
T-max (mS):	0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	0.00	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.064	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.028	Test limit:	0.650	Pass



7. Electrostatic Discharge (ESD)

7.1 Test Procedure

Test is conducting under the description of EN 61000-4-2.

7.2 Test Performance

Performance Criterion:	Mode	Verdict
	TM1	B
Note:		

7.3 Environmental Conditions

Temperature:	26 °C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

7.4 Electrostatic Discharge Immunity Test Data

Test mode	TM1							
EN 61000-4-2	Test Levels (kV)							
Test Points	-2	+2	-4	+4	-6	+6	-8	+8
Air Discharge								
USB Port	A	A	A	A	A	A	A	A
LED	A	A	A	A	A	A	A	A
Button	A	A	A	A	A	A	A	A
USB Port	A	A	A	A	A	A	A	A
AV Port	A	A	A	A	A	A	A	A
Direct Contact Discharge								
/	/	/	/	/	/	/	/	/
Indirect Contact Discharge								
HCP (6 Sides)	A	A	A	A	/	/	/	/
VCP (4 Sides)	A	A	A	A	/	/	/	/

Test Result: Pass



8. Radio Frequency Electromagnetic Field (R/S)

8.1 Test Procedure

Test is conducting under the description of EN 61000-4-3.

8.2 Test Performance

Performance Criterion:	Mode	Verdict
	TM1	A
Note:		

8.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1010 mbar

8.4 Continuous Radiated Disturbances Test Data

Frequency step: 1% of fundamental

Dwell time: 1 second

Modulation: AM by 1kHz sine wave with 80% modulation depth

Test mode		TM1							
Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	A	A	A	A	A	A	A	A
1000-3000	3	A	A	A	A	A	A	A	A
3000-6000	3	A	A	A	A	A	A	A	A

Test Result: Pass



9. Fast Transients, Common Mode (EFT)

9.1 Test Procedure

Test is conducting under the description of EN 61000-4-4.

9.2 Test Performance

Performance Criterion:	Mode	Verdict
	TM1	B
Note:		

9.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1011 mbar

9.4 Electrical Fast Transients Test Data

Test Mode		TM1							
EN 61000-4-4 Test Line		Test Levels (kV)							
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0	+4.0	-4.0
AC Main Power port	L1	A	A	A	A	/	/	/	/
	L2	A	A	A	A	/	/	/	/
	PE	/	/	/	/	/	/	/	/
	L1+L2	A	A	A	A	/	/	/	/
	L1 + PE	/	/	/	/	/	/	/	/
	L2 + PE	/	/	/	/	/	/	/	/
	L1+L2+PE	/	/	/	/	/	/	/	/
Signal ports	/	/	/	/	/	/	/	/	/

Test Result: Pass



10. Surges

10.1 Test Procedure

Test is conducting under the description of EN 61000-4-5.

10.2 Test Performance

Performance Criterion:	Mode	Verdict
	TM1	B
Note:		

10.3 Environmental Conditions

Temperature:	22 °C
Relative Humidity:	53%
ATM Pressure:	1011 mbar

10.4 Surge Test Data

Test Mode		TM1			
Level	Voltage	Poll	Path	Pass	Fail
1	0.5kV	±	L-N	A	/
2	1kV	±	L-N	A	/
3	2kV	±	L-N, L-PE, N-PE	/	/
4	4kV	±	L-N, L-PE, N-PE	/	/

Test Result: Pass



11. Radio Frequency, Common Mode (C/S)

11.1 Test Procedure

Test is conducting under the description of EN 61000-4-6.

11.2 Test Performance

Performance Criterion:	Mode	Verdict
	TM1	A
Note:		

11.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1011 mbar

11.4 Continuous Conducted Disturbances Test Data

Sweep frequency range: 150kHz~80MHz

Frequency step: 1% of fundamental

Dwell time: 1 second

Test Mode		TM1		
Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	A	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test Result: Pass



12. Voltage Dips and Interruptions

12.1 Test Procedure

Test is conducting under the description of EN 61000-4-11.

12.2 Test Performance

Performance Criterion:	Mode	Verdict
	TM1	B/C
Note:		

12.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	50%
ATM Pressure:	1011 mbar

12.4 Voltage Dips And Interruptions Test Data

U: Voltage dips in % U_T (U_T is rated voltage for the EUT)

T: Test duration

Level	U	T	Phase Angle	N	Pass	Fail
1	100%	10ms	0/90/180/270	3	A	/
2	100%	20ms	0/90/180/270	3	B	/
3	30%	500ms	0/90/180/270	3	B	/
4	100%	5000ms	0/90/180/270	3	B	/

Test Result: Pass

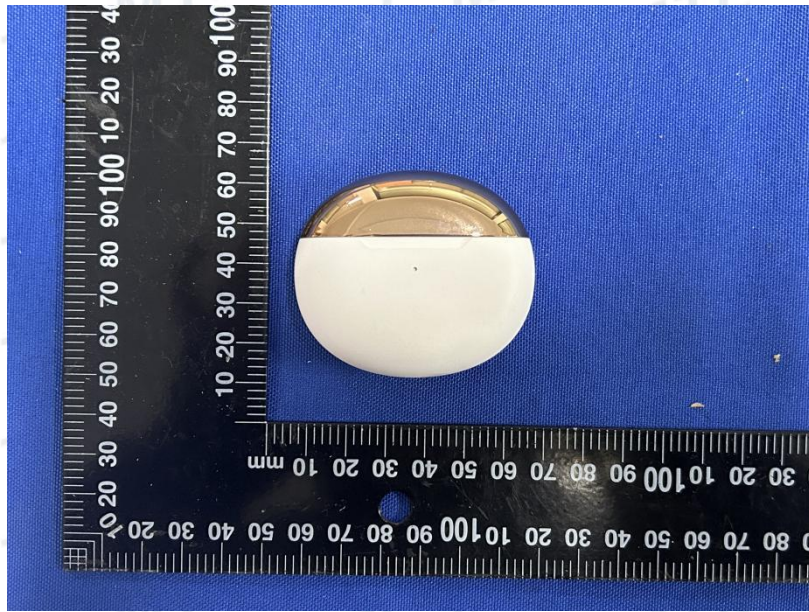


FIGURE 1

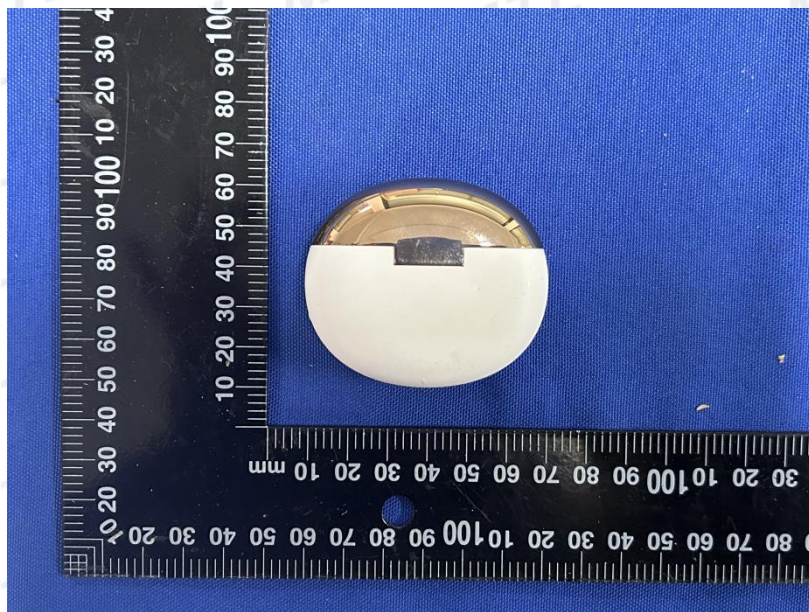


FIGURE 2

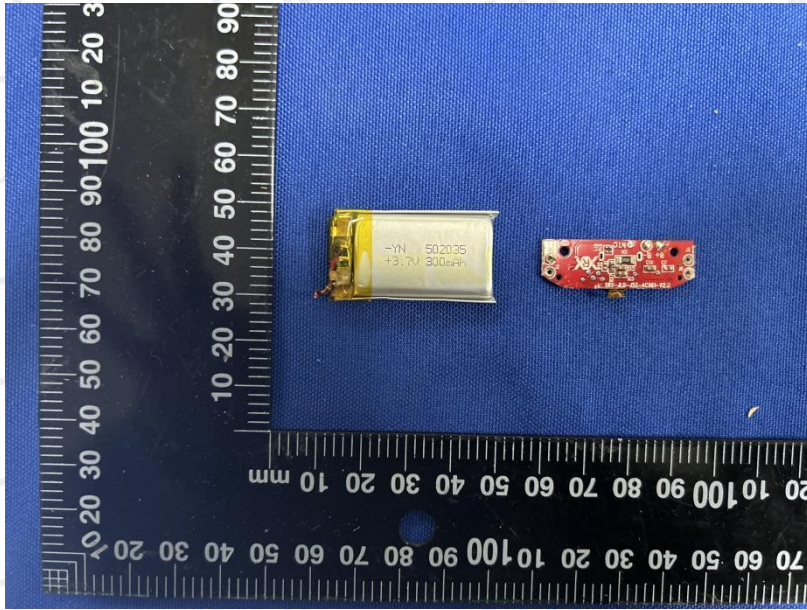


FIGURE 3



FIGURE 4

End of Report