

11. NUMBER OF HOPPING FREQUENCY

11.1. MEASUREMENT PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer Start = 2.4GHz Stop = 2.4835GHz
4. Set the Spectrum Analyzer as RBW>=1%span, VBW>=RBW.

11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

11.3. MEASUREMENT EQUIPMENT USED

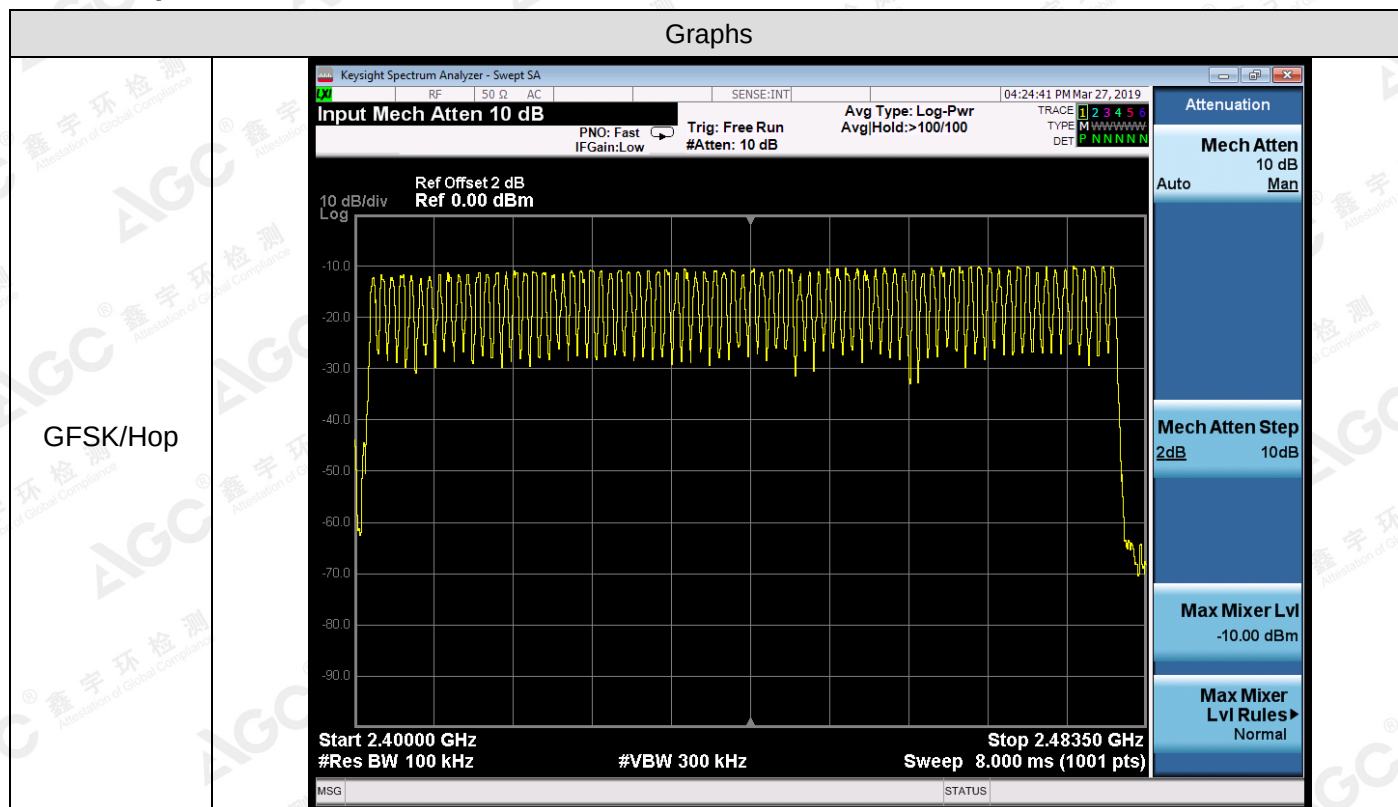
The same as described in section 6

11.4. LIMITS AND MEASUREMENT RESULT

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	79	PASS

Note: All modes were tested, only the worst case record in the report.

Test Graph



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12. TIME OF OCCUPANCY (DWELL TIME)

12.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.
2. RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel.
4. Detector function: Peak. Trace: Max hold.
5. Use the marker-delta function to determine the transmit time per hop.
6. Using the following equation:

The dwell time is calculated with the following formula:

$$\text{Dwell time} = t_{\text{pulse}} \times n_{\text{hops}} / \text{number of channels} \times 31.6 \text{ s}$$

Where:

t_{pulse} is the measured pulse time (pls. refer the plots of the spectrum analyser above) [s],
 n_{hops} is the number of hops per second in the actual operating mode of the transmitter [1/s].

The hopping rate of the system is 1600 hops per second and the system uses 79 channels. For this reason one time slot has a length of 625 μ s.

With the used hopping mode (DH5) a packet need 5 timeslots for transmitting and the next timeslot for receiving. So the system makes in worst case 266,67 hops per second in transmit mode ($n_{\text{hops}} = 266.667$ 1/s)

12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

12.3. MEASUREMENT EQUIPMENT USED

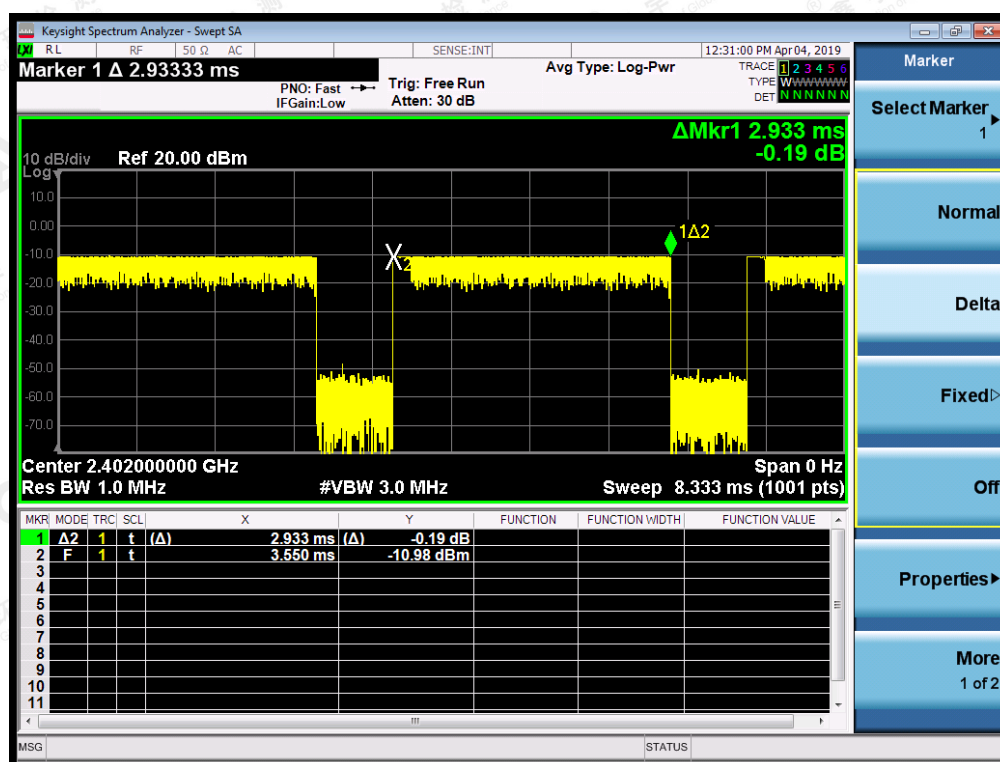
The same as described in section 6

12.4. LIMITS AND MEASUREMENT RESULT

Channel.	Burst Width [ms/hop/ch]	Dwell Time[ms]	Verdict	Limit (ms)
LCH	2.933	312.854	PASS	400
MCH	2.933	312.854	PASS	400
HCH	2.933	312.854	PASS	400

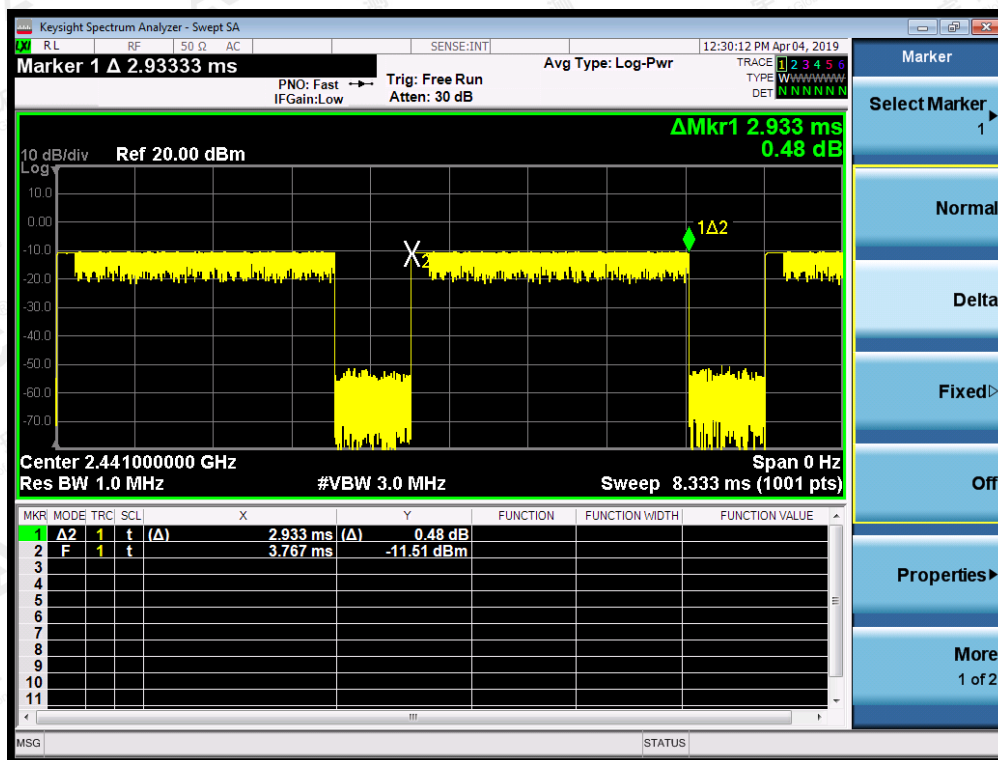
Note: The $\pi/4$ -DQPSK modulation is the worst case and recorded in the report.

TEST PLOT OF LOW CHANNEL

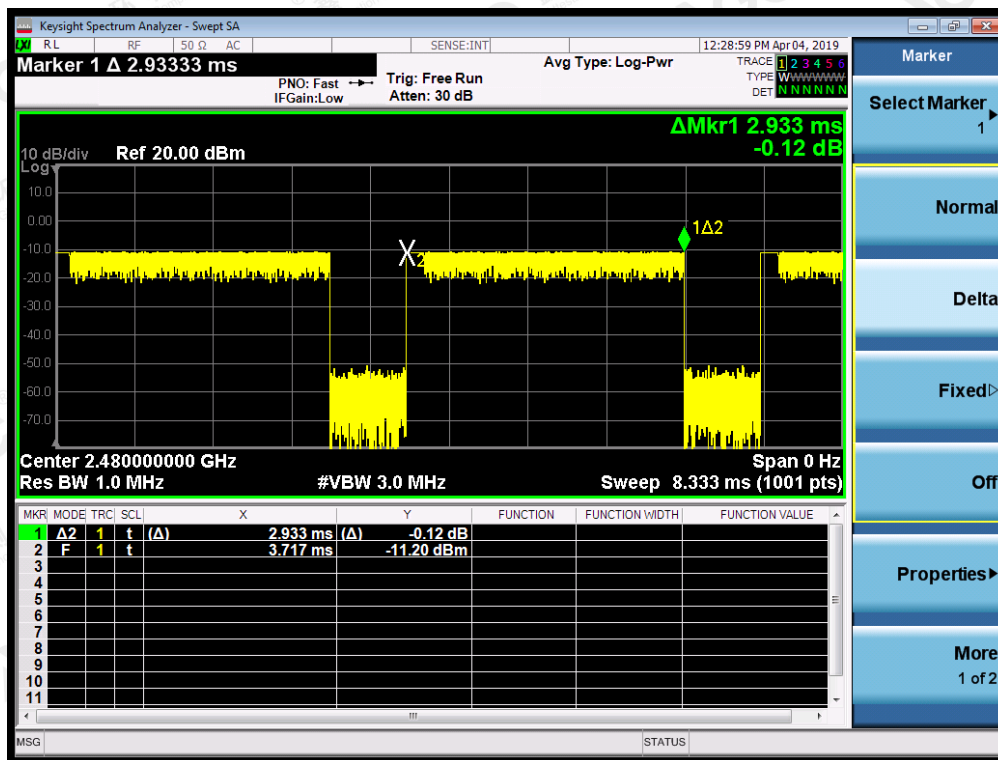


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TEST PLOT OF MIDDLE CHANNEL



TEST PLOT OF HIGH CHANNEL



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13. FREQUENCY SEPARATION

13.1. MEASUREMENT PROCEDURE

1. Place the EUT on the table and set it in transmitting mode
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer
3. Set Span = wide enough to capture the peaks of two adjacent channels Resolution (or IF) Bandwidth (RBW) $\geq 1\%$ of the span Video (or Average) Bandwidth (VBW) $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold

13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 6.2

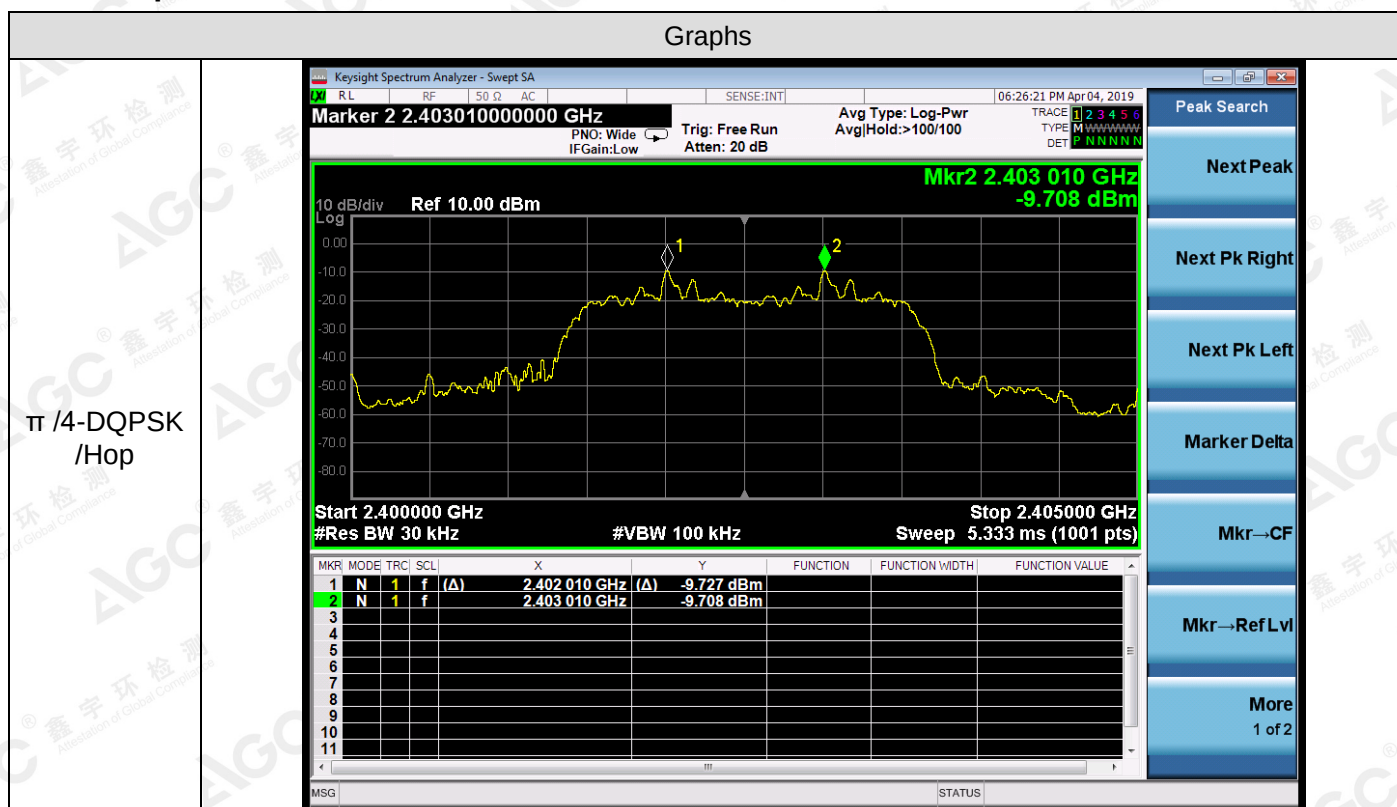
13.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.3

13.4. LIMITS AND MEASUREMENT RESULT

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
π /4-DQPSK	Hop	1	PASS

Test Graph



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14. FCC LINE CONDUCTED EMISSION TEST

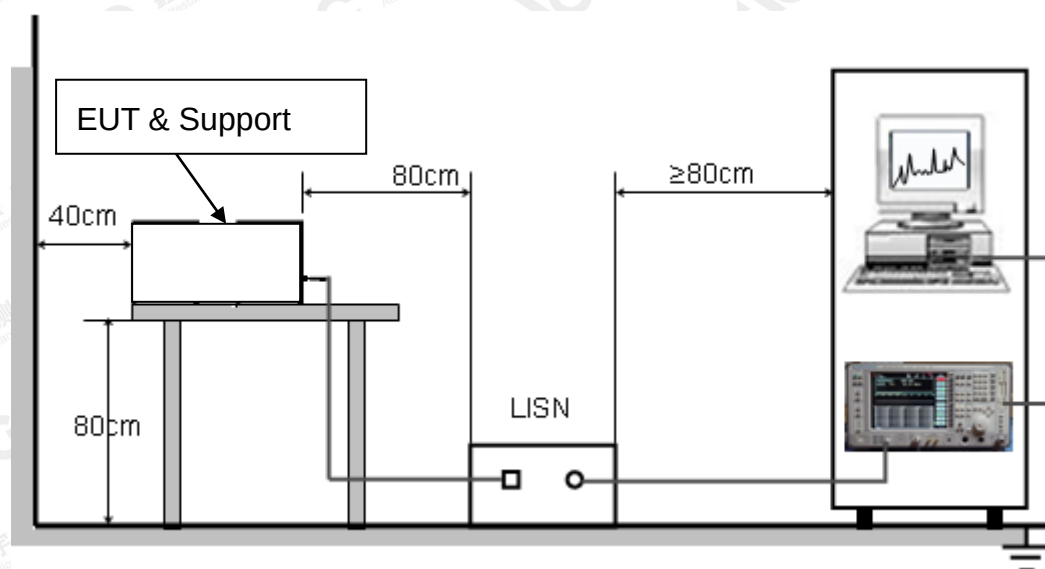
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



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14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC charging voltage by adapter which received 120V/60Hz power by a LISN..
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

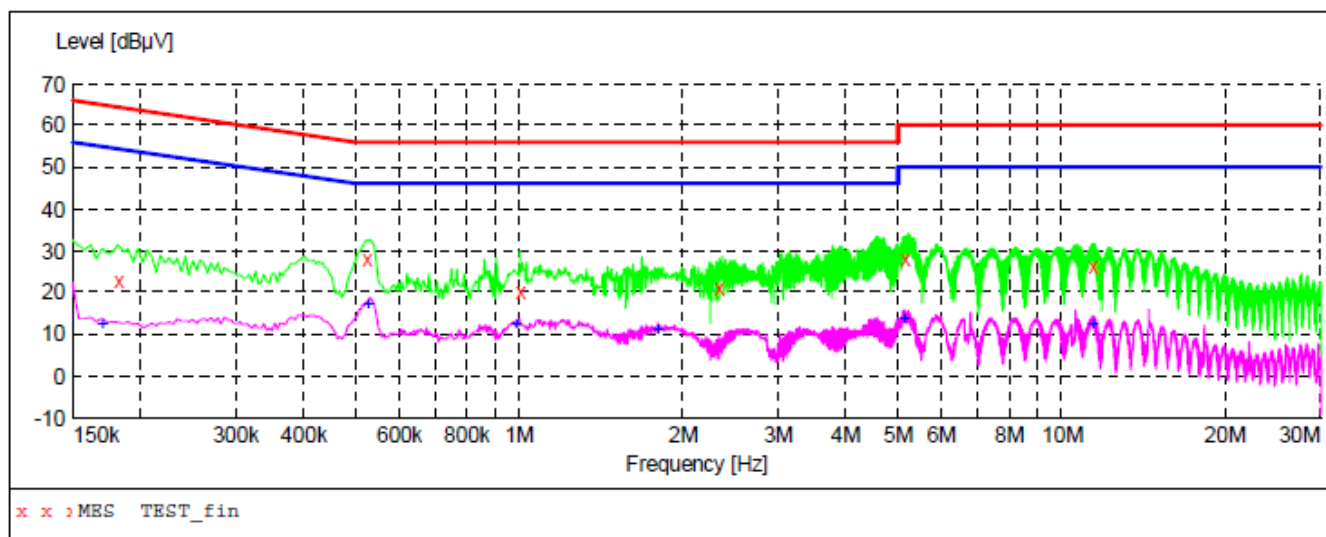
1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

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14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

The mode name of **MI-E004B**

LINE CONDUCTED EMISSION TEST LINE 1-L



MEASUREMENT RESULT: "TEST_fin"

4/4/2019 9:21AM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.182000	22.70	10.3	64	41.7	QP	L1	FLO
0.522000	28.20	10.3	56	27.8	QP	L1	FLO
1.002000	20.40	10.4	56	35.6	QP	L1	FLO
2.326000	21.20	10.4	56	34.8	QP	L1	FLO
5.110000	28.00	10.4	60	32.0	QP	L1	FLO
11.390000	26.20	10.8	60	33.8	QP	L1	FLO

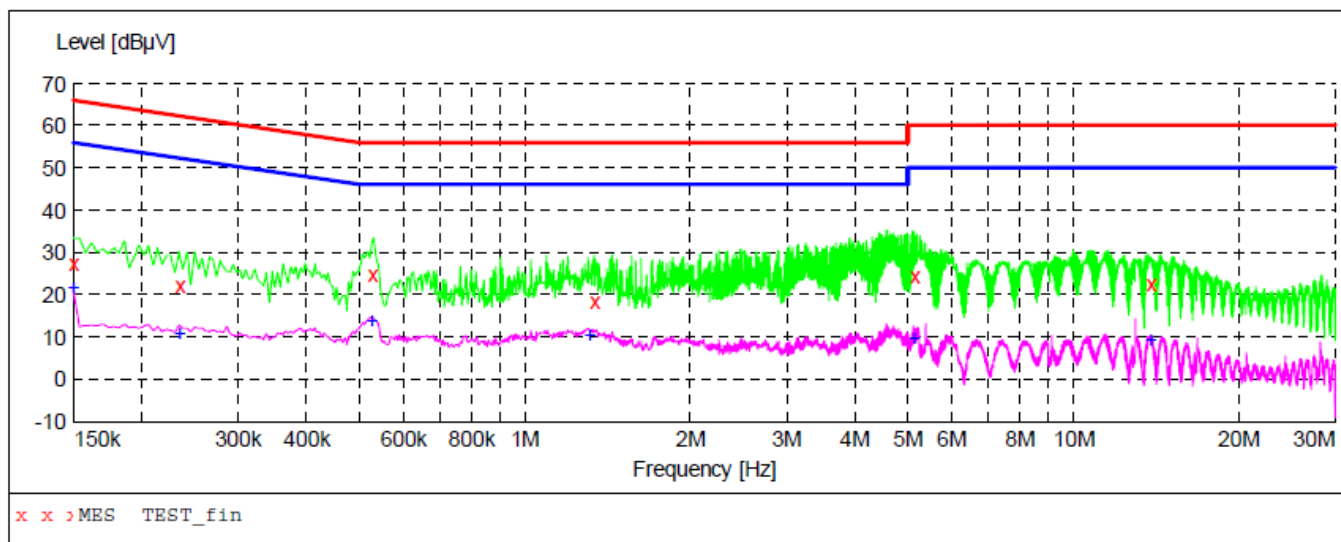
MEASUREMENT RESULT: "TEST_fin2"

4/4/2019 9:21AM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.170000	12.30	10.3	55	42.7	AV	L1	FLO
0.526000	17.40	10.3	46	28.6	AV	L1	FLO
0.986000	12.20	10.4	46	33.8	AV	L1	FLO
1.802000	11.10	10.4	46	34.9	AV	L1	FLO
5.110000	13.80	10.4	50	36.2	AV	L1	FLO
11.390000	12.60	10.8	50	37.4	AV	L1	FLO

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LINE CONDUCTED EMISSION TEST LINE 2-N



MEASUREMENT RESULT: "TEST_fin"

4/4/2019 9:17AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	27.30	10.3	66	38.7	QP	N	FLO
0.234000	22.10	10.3	62	40.2	QP	N	FLO
0.526000	25.00	10.3	56	31.0	QP	N	FLO
1.338000	18.40	10.4	56	37.6	QP	N	FLO
5.122000	24.30	10.4	60	35.7	QP	N	FLO
13.834000	22.70	10.9	60	37.3	QP	N	FLO

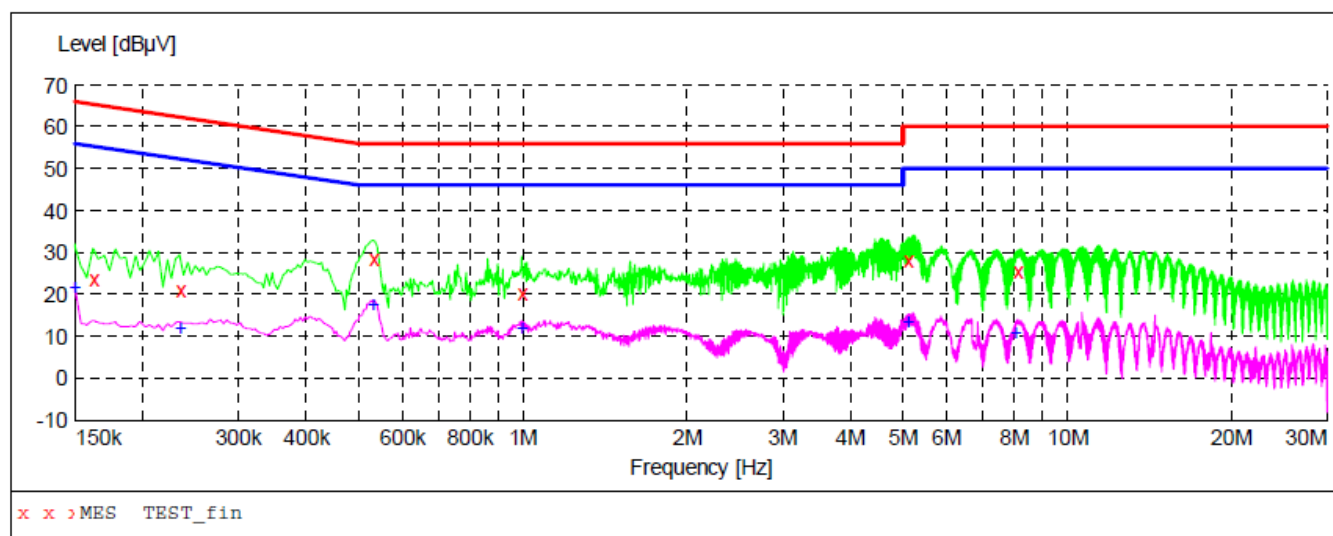
MEASUREMENT RESULT: "TEST_fin2"

4/4/2019 9:17AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	21.60	10.3	56	34.4	AV	N	FLO
0.234000	11.10	10.3	52	41.2	AV	N	FLO
0.526000	13.90	10.3	46	32.1	AV	N	FLO
1.310000	10.60	10.4	46	35.4	AV	N	FLO
5.122000	9.80	10.4	50	40.2	AV	N	FLO
13.834000	9.40	10.9	50	40.6	AV	N	FLO

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The mode name of **UZ-E004B**
LINE CONDUCTED EMISSION TEST LINE 1-L



MEASUREMENT RESULT: "TEST_fin"

4/4/2019 9:25AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.162000	23.50	10.3	65	41.9	QP	L1	FLO
0.234000	21.20	10.3	62	41.1	QP	L1	FLO
0.530000	28.70	10.3	56	27.3	QP	L1	FLO
0.994000	20.30	10.4	56	35.7	QP	L1	FLO
5.090000	28.10	10.4	60	31.9	QP	L1	FLO
8.090000	25.40	10.7	60	34.6	QP	L1	FLO

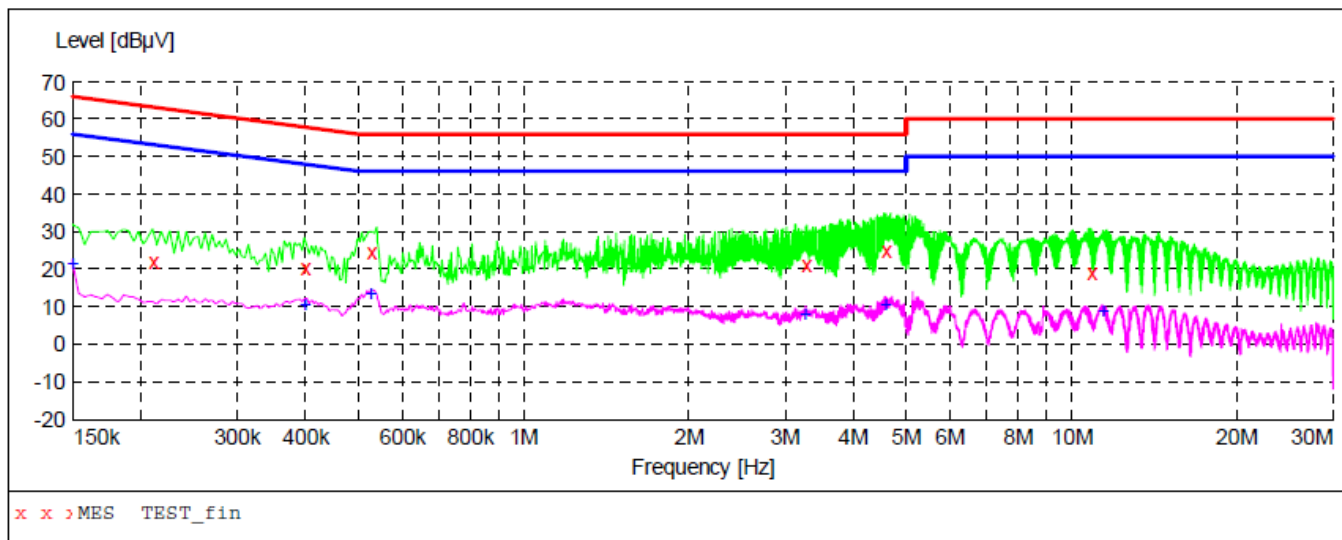
MEASUREMENT RESULT: "TEST_fin2"

4/4/2019 9:25AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	21.80	10.3	56	34.2	AV	L1	FLO
0.234000	12.30	10.3	52	40.0	AV	L1	FLO
0.530000	17.70	10.3	46	28.3	AV	L1	FLO
0.994000	12.00	10.4	46	34.0	AV	L1	FLO
5.090000	13.70	10.4	50	36.3	AV	L1	FLO
8.054000	11.00	10.7	50	39.0	AV	L1	FLO

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LINE CONDUCTED EMISSION TEST LINE 2-N



MEASUREMENT RESULT: "TEST_fin"

4/4/2019 9:29AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.210000	22.10	10.3	63	41.1	QP	N	FLO
0.398000	20.20	10.3	58	37.7	QP	N	FLO
0.526000	24.70	10.3	56	31.3	QP	N	FLO
3.270000	21.10	10.4	56	34.9	QP	N	FLO
4.582000	24.90	10.4	56	31.1	QP	N	FLO
10.870000	19.10	10.8	60	40.9	QP	N	FLO

MEASUREMENT RESULT: "TEST_fin2"

4/4/2019 9:29AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	21.50	10.3	56	34.5	AV	N	FLO
0.398000	10.90	10.3	48	37.0	AV	N	FLO
0.526000	13.70	10.3	46	32.3	AV	N	FLO
3.262000	8.20	10.4	46	37.8	AV	N	FLO
4.582000	10.60	10.4	46	35.4	AV	N	FLO
11.434000	9.20	10.8	50	40.8	AV	N	FLO

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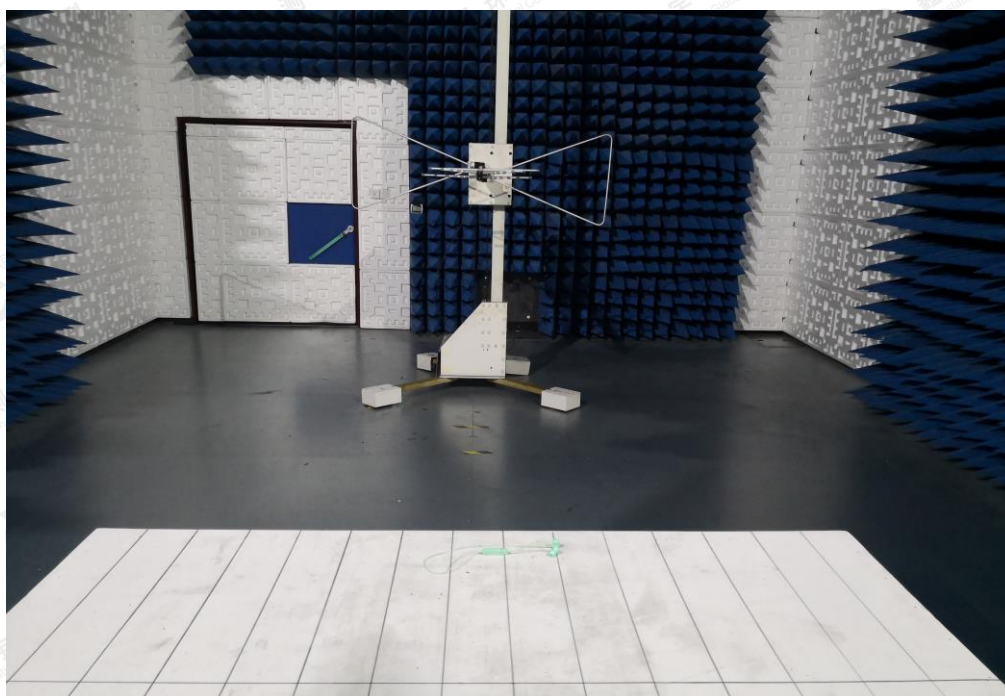
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

The mode name of MI-E004B

LINE CONDUCTED EMISSION TEST SETUP



RADIATED EMISSION TEST SETUP



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RADIATED EMISSION ABOVE 1G TEST SETUP

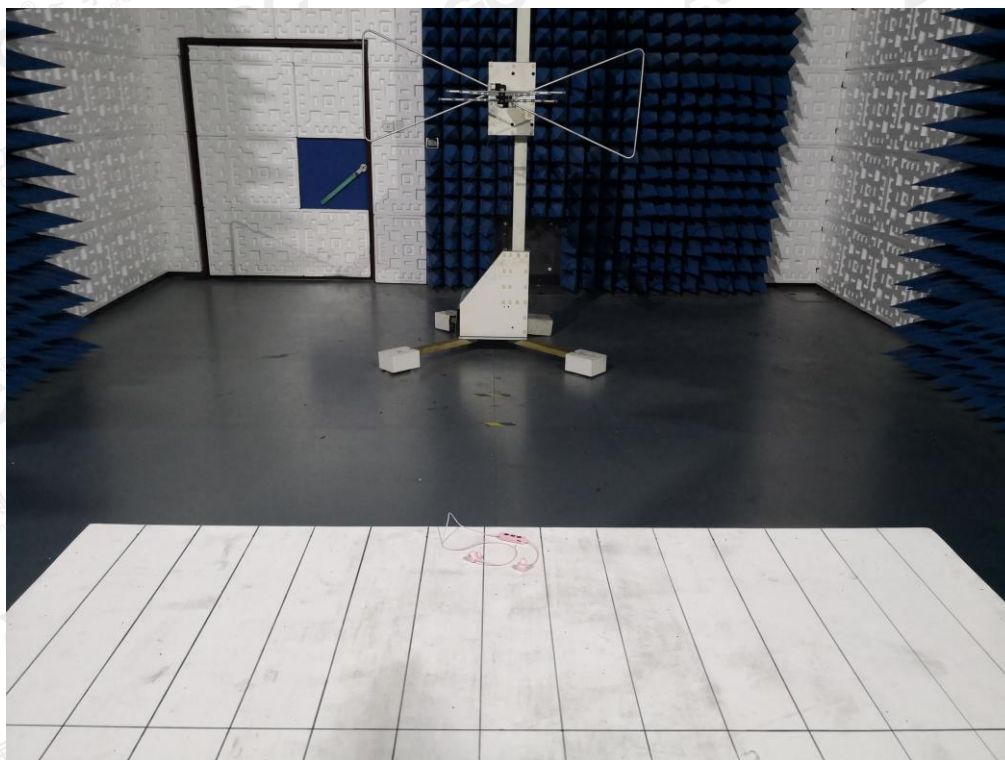


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The mode name of UZ-E004B
LINE CONDUCTED EMISSION TEST SETUP

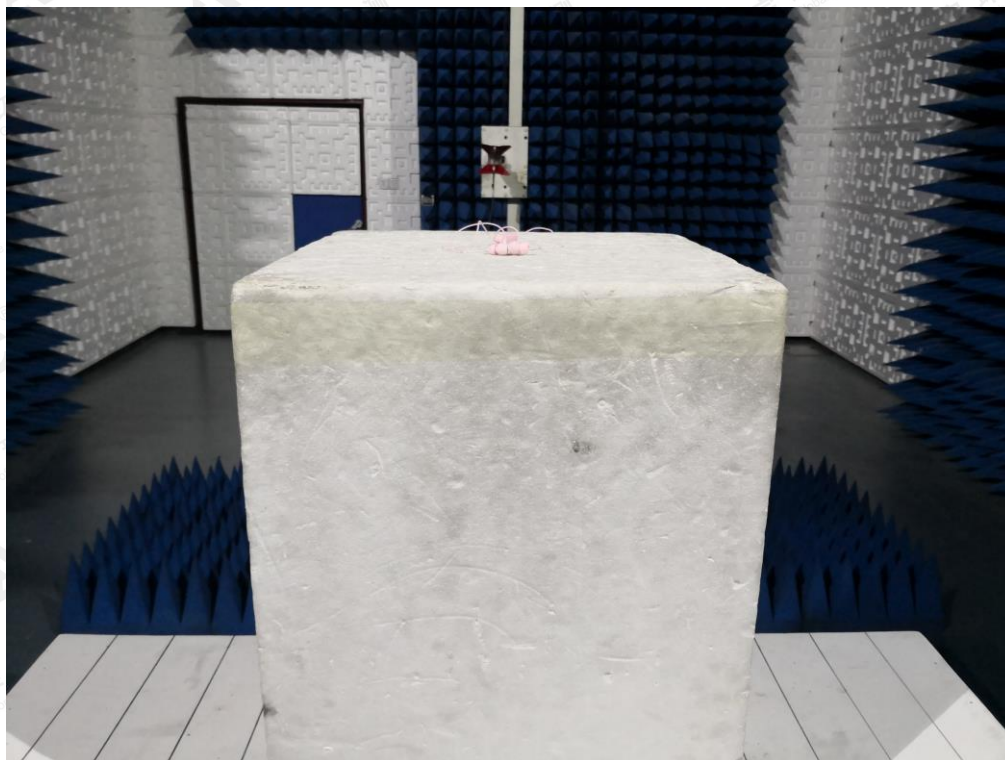


RADIATED EMISSION TEST SETUP



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RADIATED EMISSION ABOVE 1G TEST SETUP



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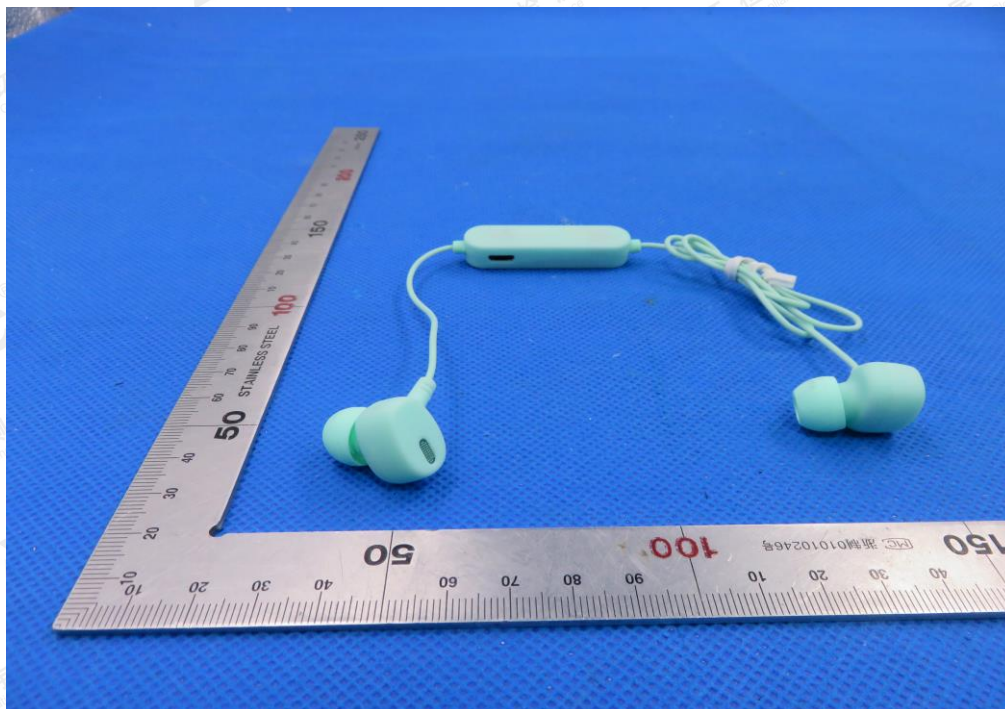
APPENDIX B: PHOTOGRAPHS OF TEST SETUP

The mode name of MI-E004B

ALL VIEW OF EUT

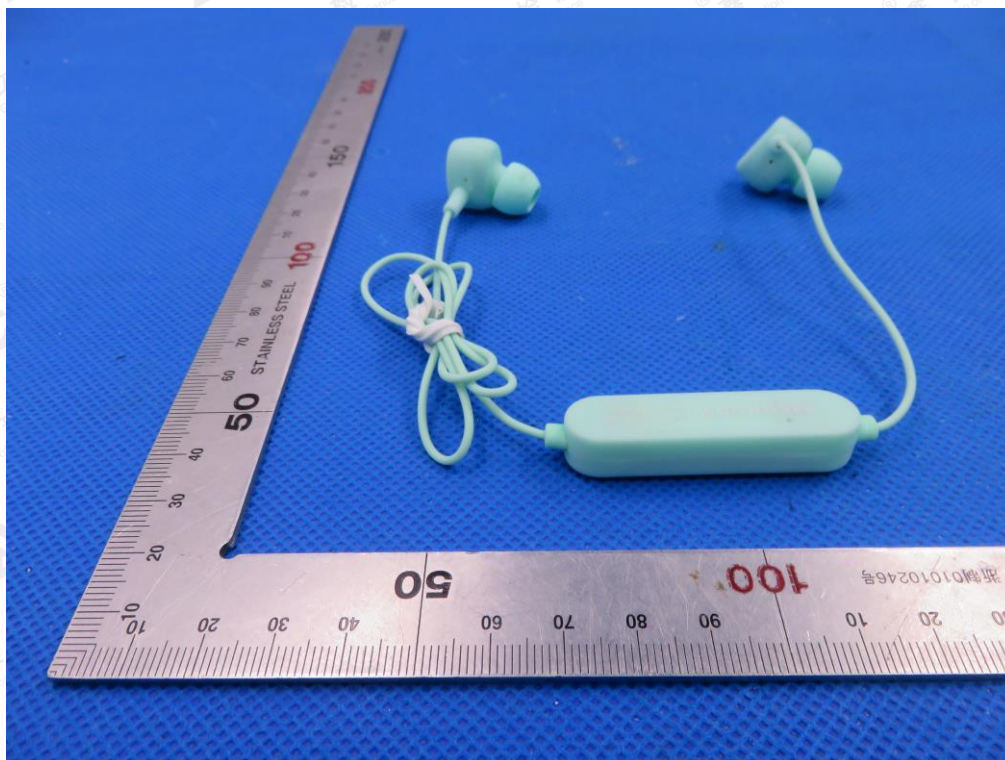


TOP VIEW OF EUT

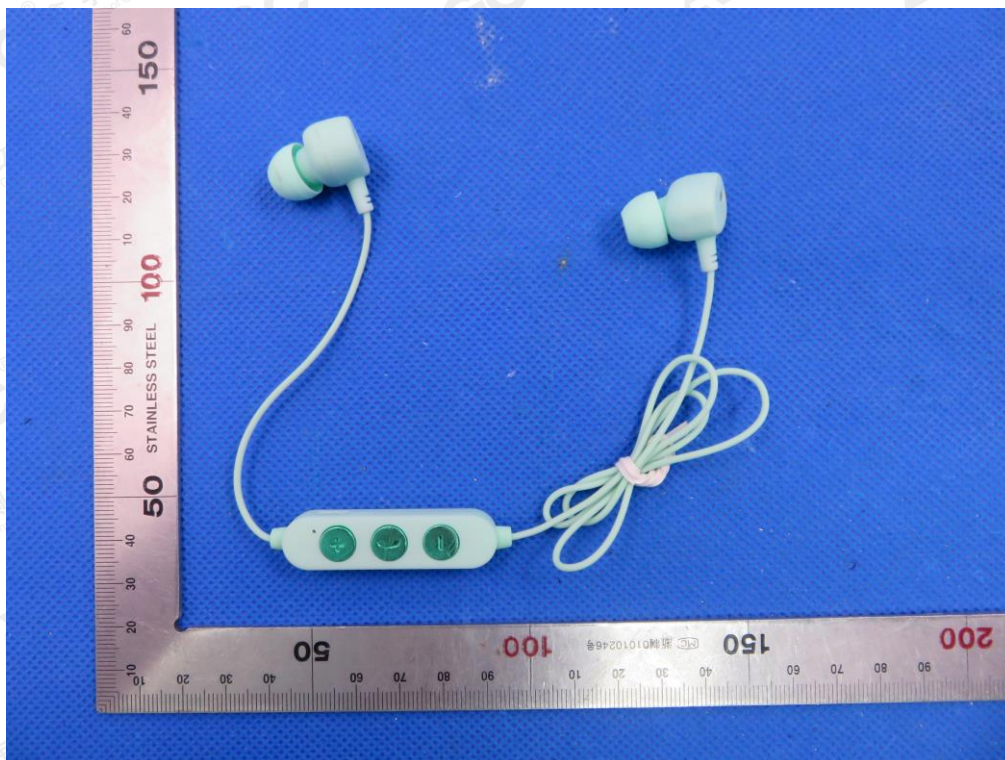


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BOTTOM VIEW OF EUT

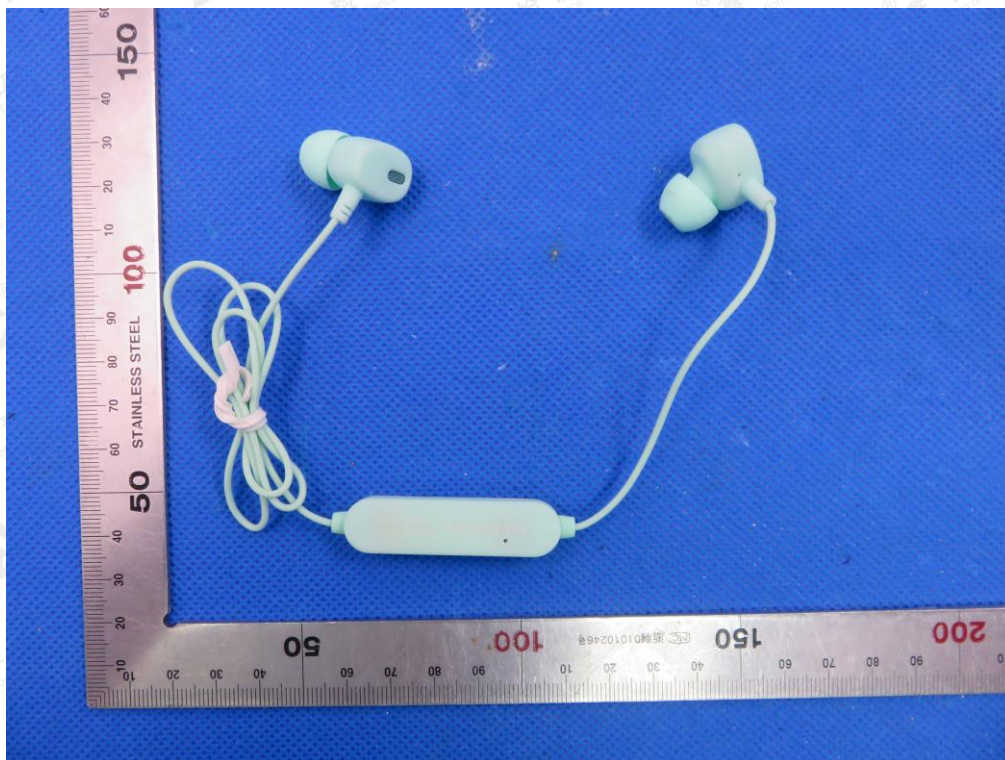


FRONT VIEW OF EUT

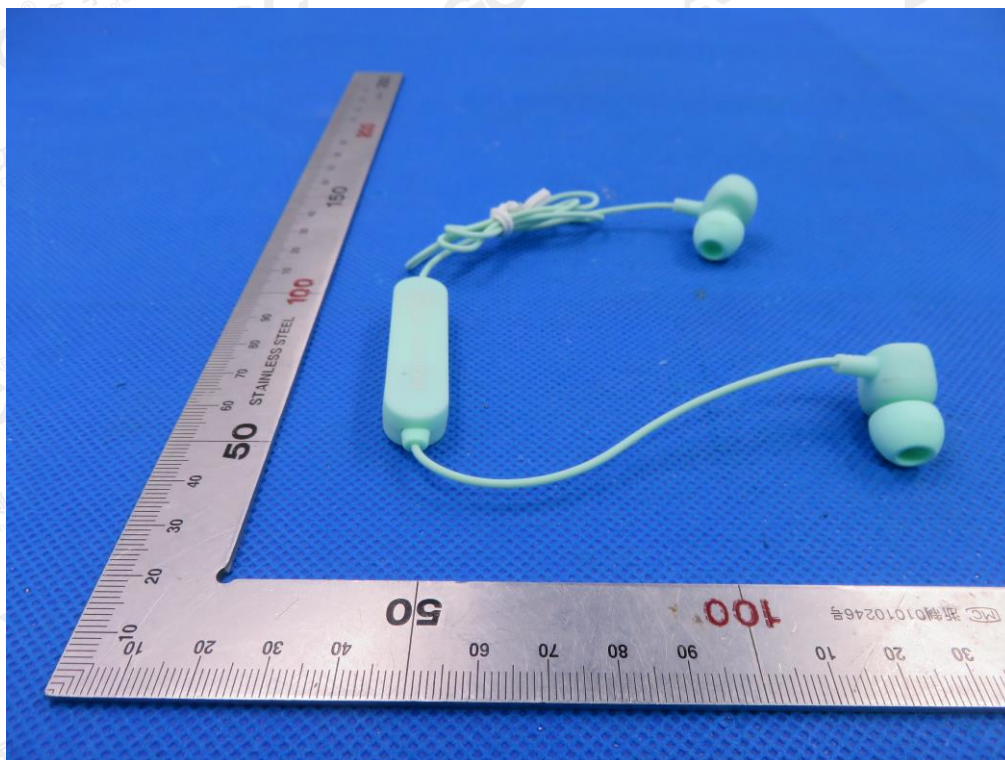


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BACK VIEW OF EUT

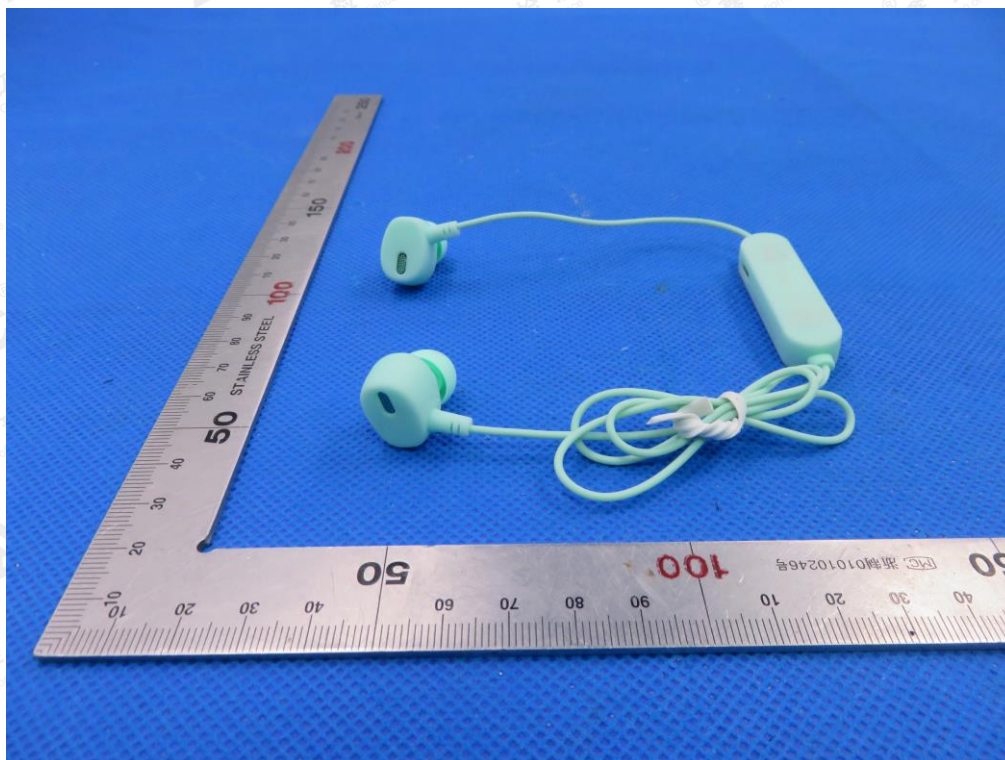


LEFT VIEW OF EUT

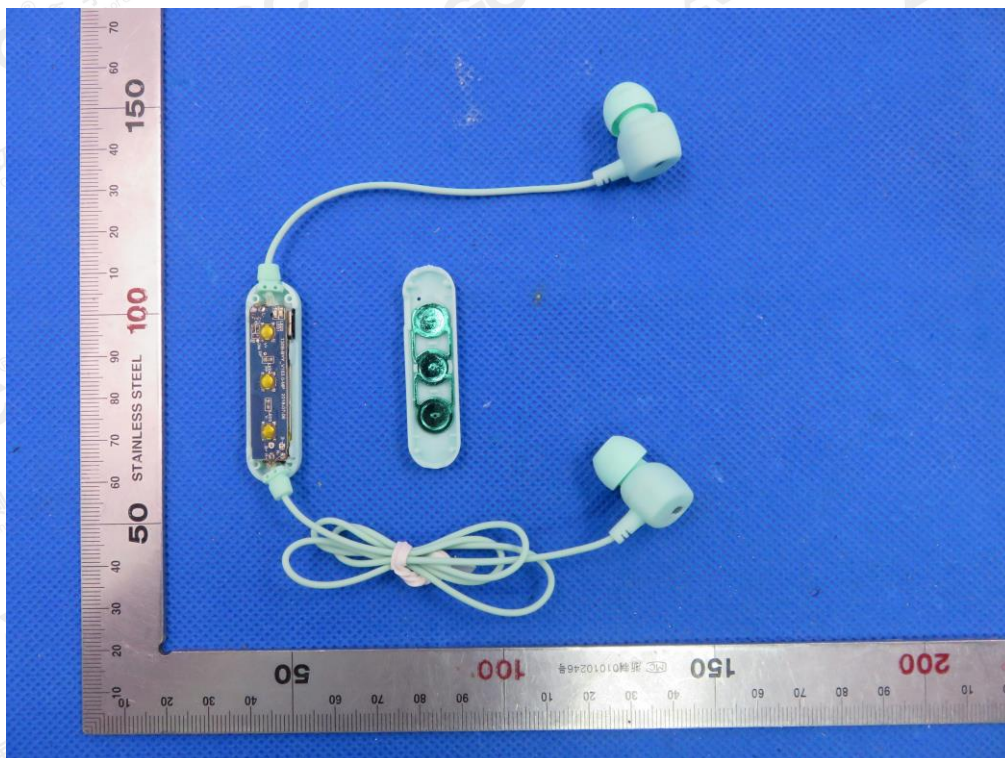


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RIGHT VIEW OF EUT

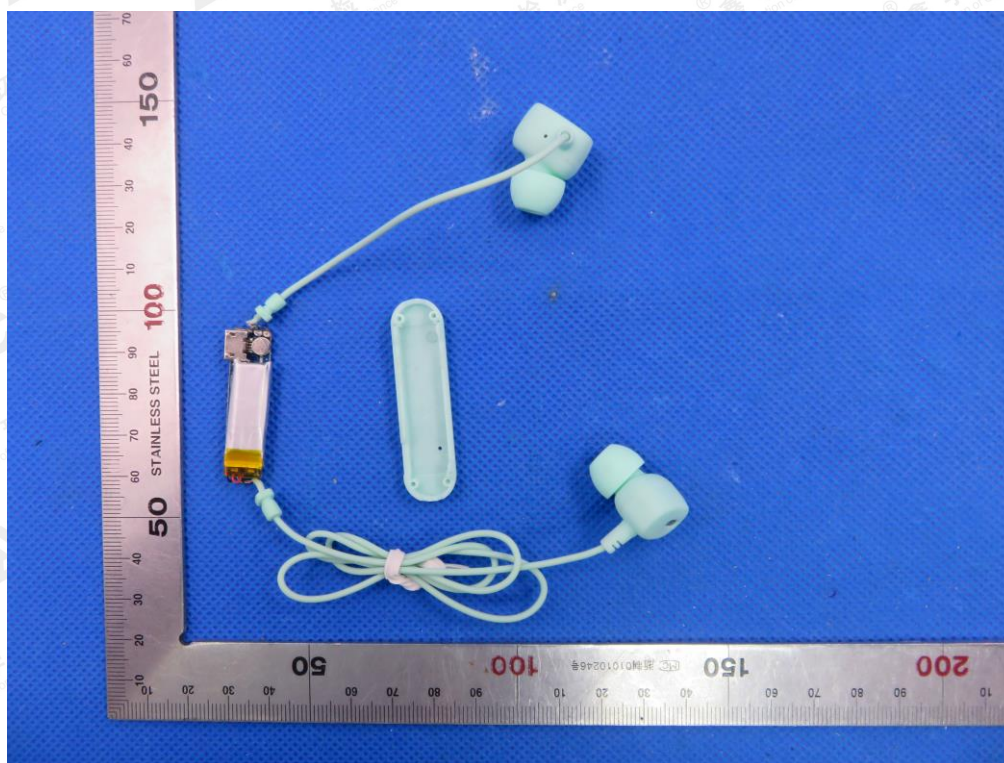


OPEN VIEW OF EUT(FIGURE 1)

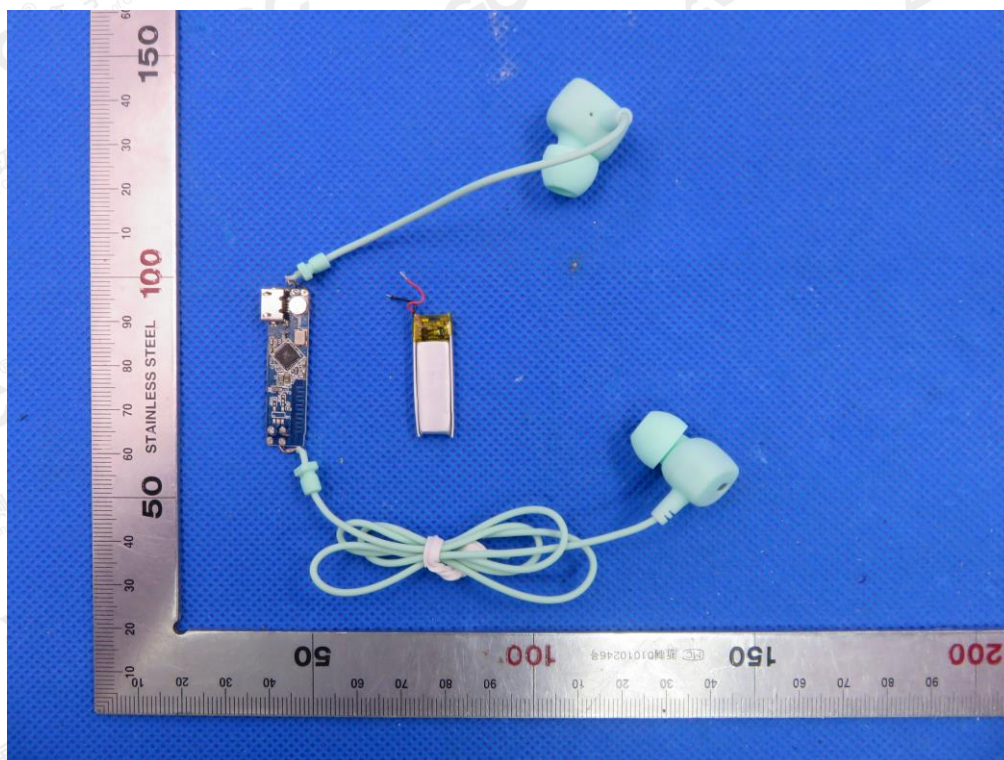


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OPEN VIEW OF EUT(FIGURE 2)



OPEN VIEW OF EUT(FIGURE 3)

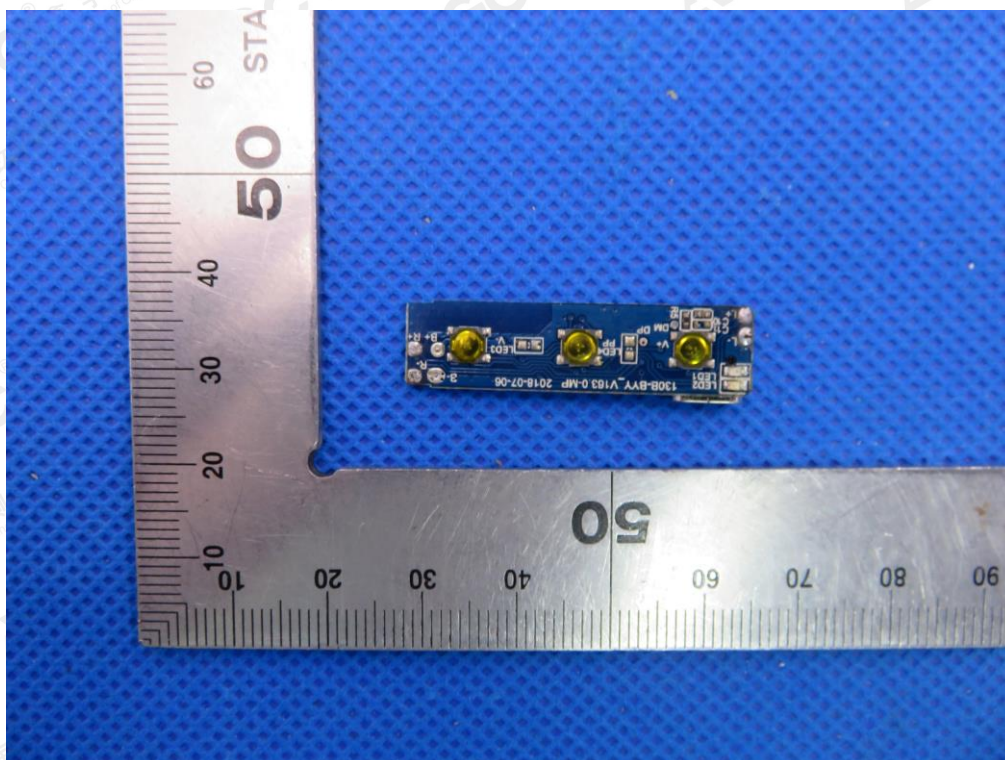


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VIEW OF BATTERY

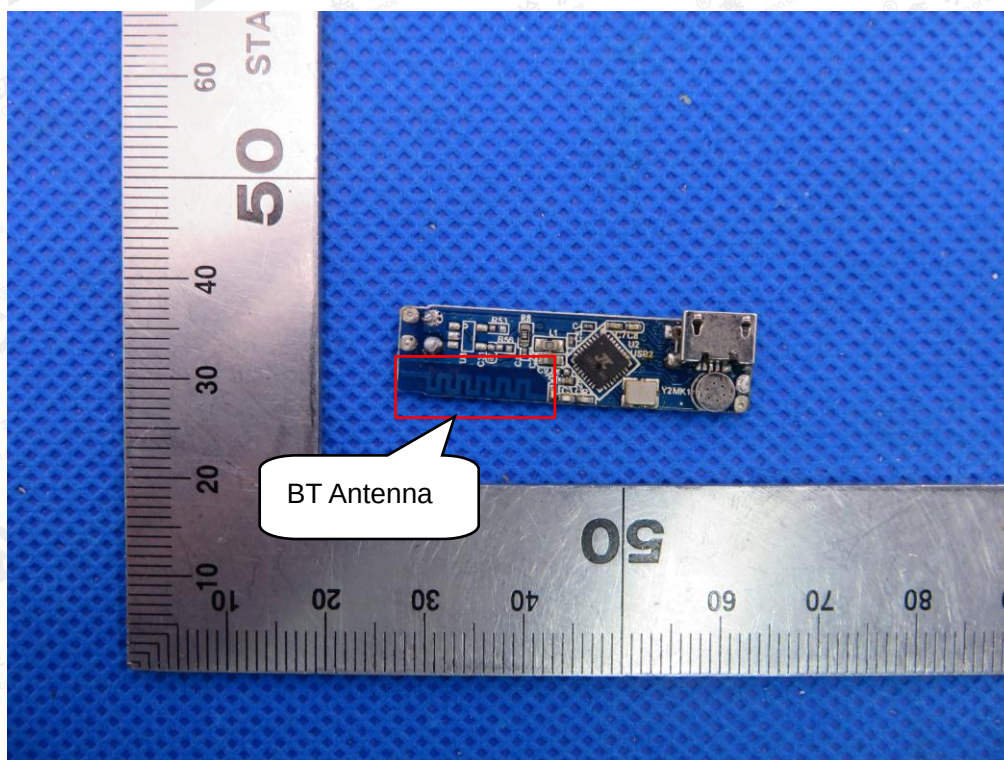


INTERNAL VIEW OF EUT(Figure 1)

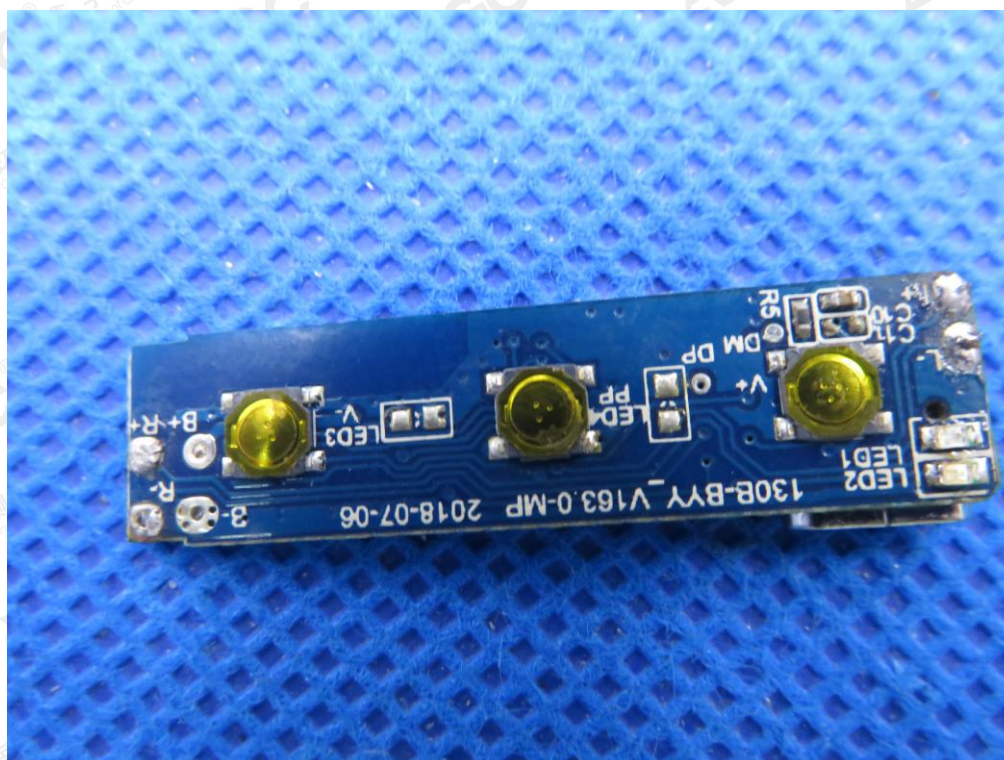


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INTERNAL VIEW OF EUT(FIGURE 2)

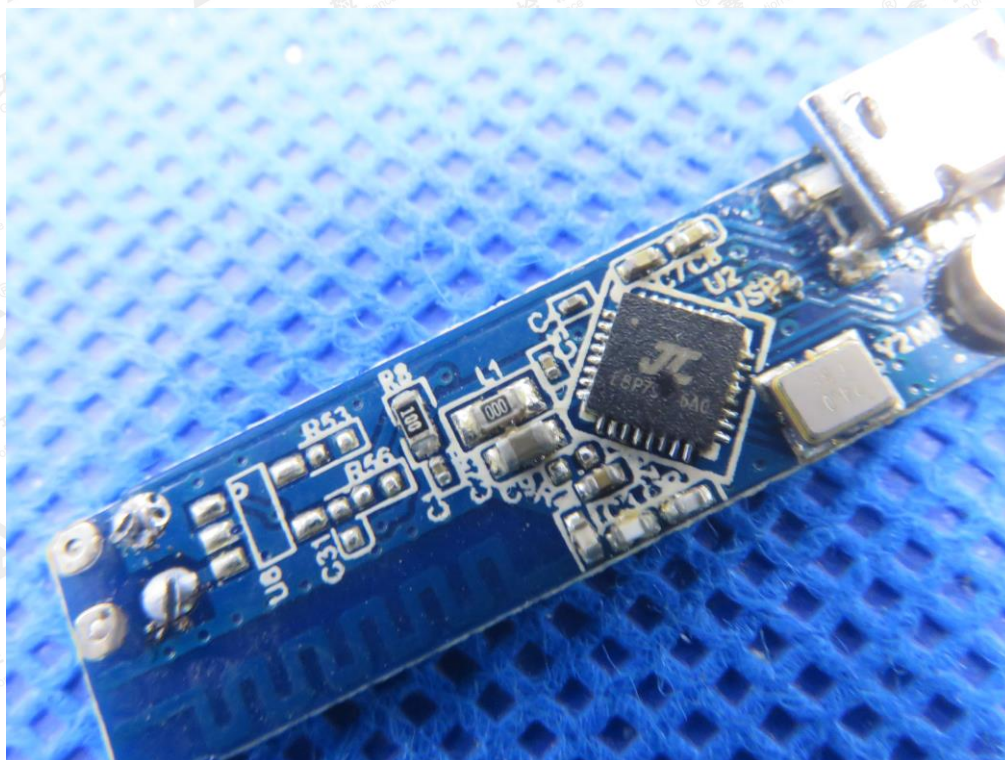


INTERNAL VIEW OF EUT(FIGURE 3)



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INTERNAL VIEW OF EUT(Figure 4)

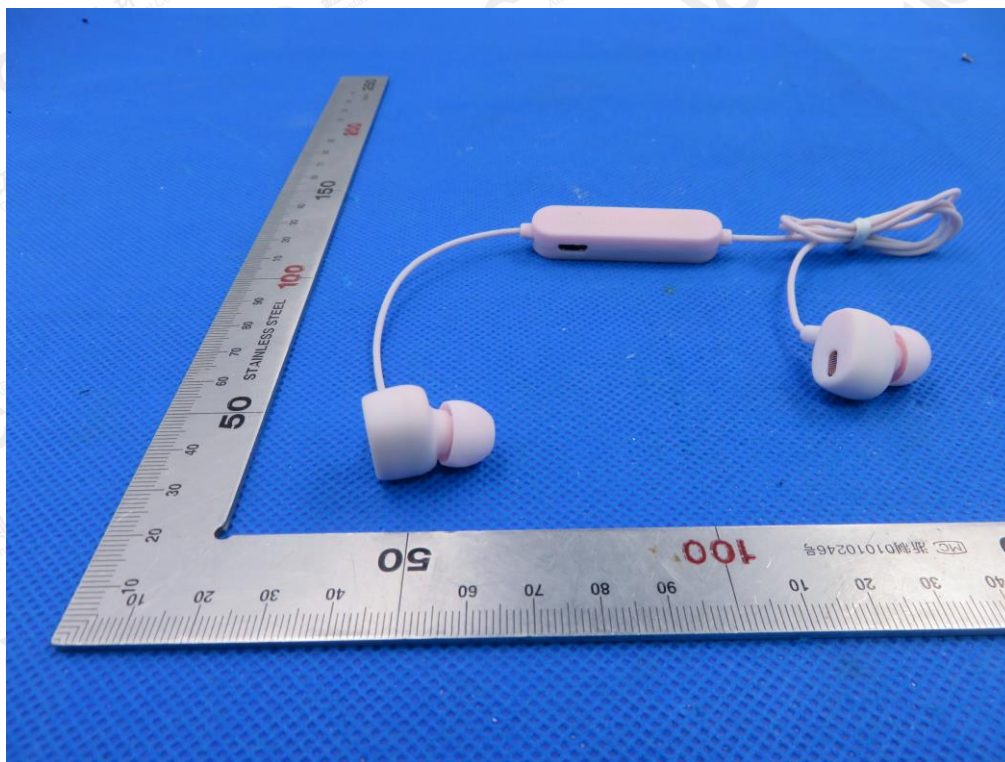


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The mode name of UZ-E004B
ALL VIEW OF EUT

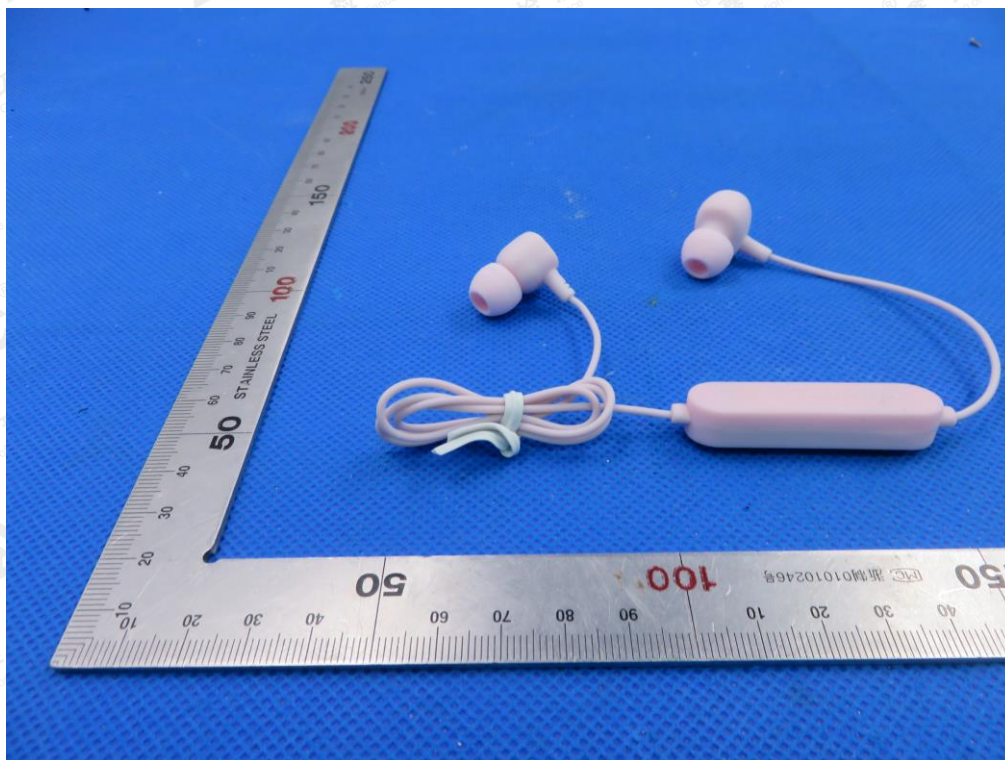


TOP VIEW OF EUT

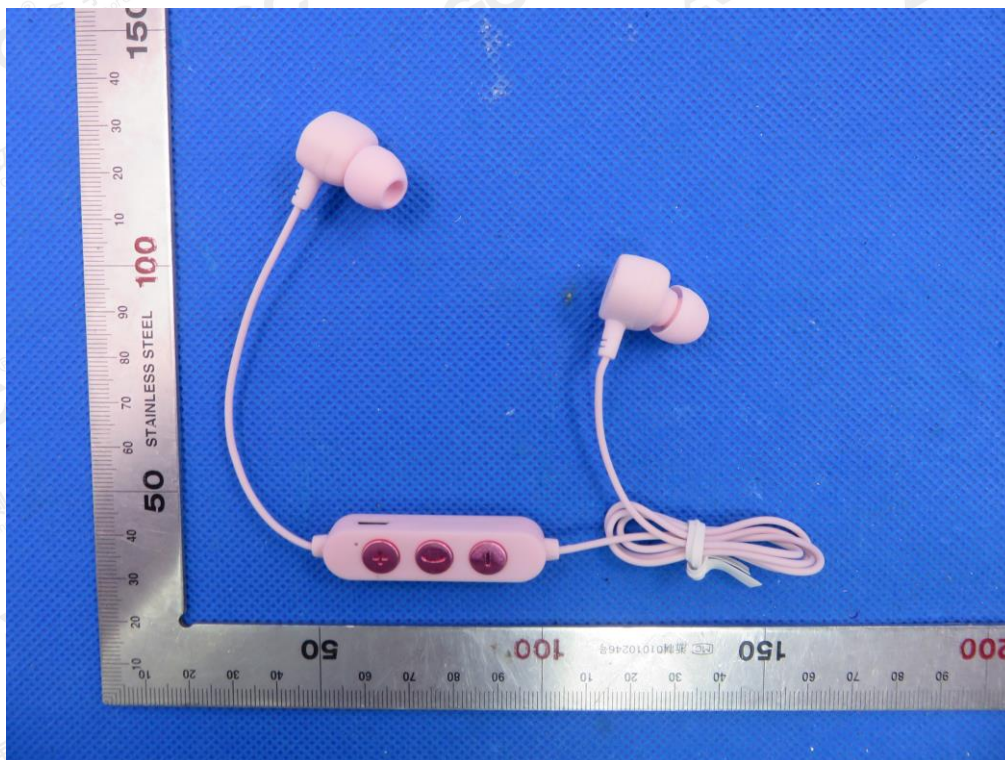


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BOTTOM VIEW OF EUT

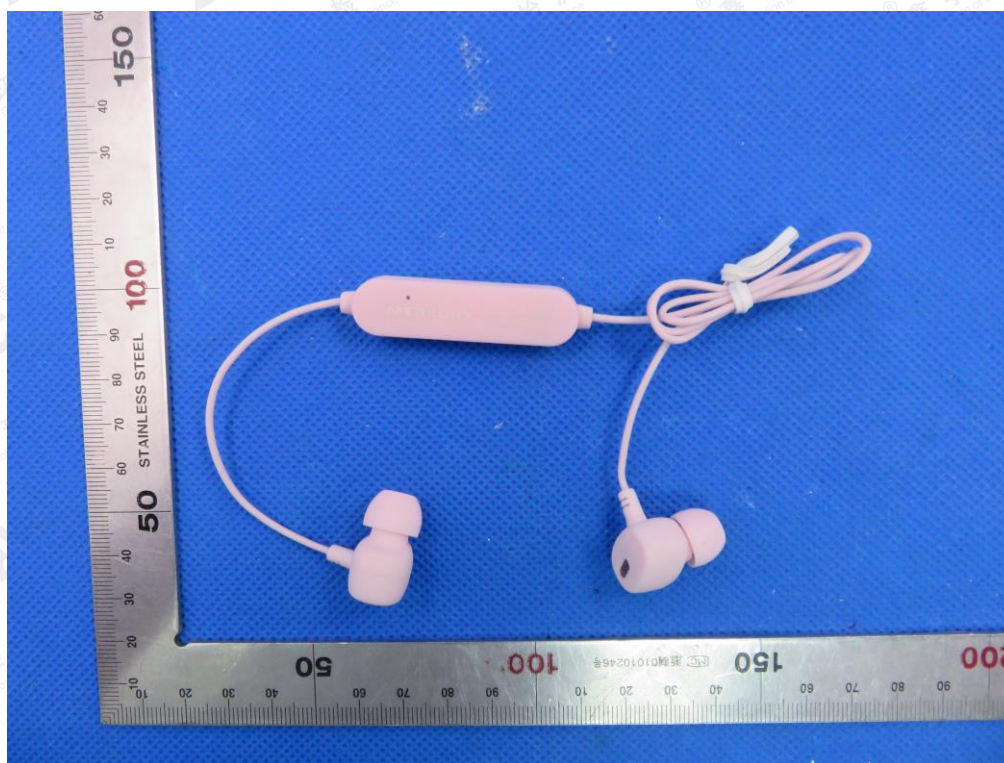


FRONT VIEW OF EUT

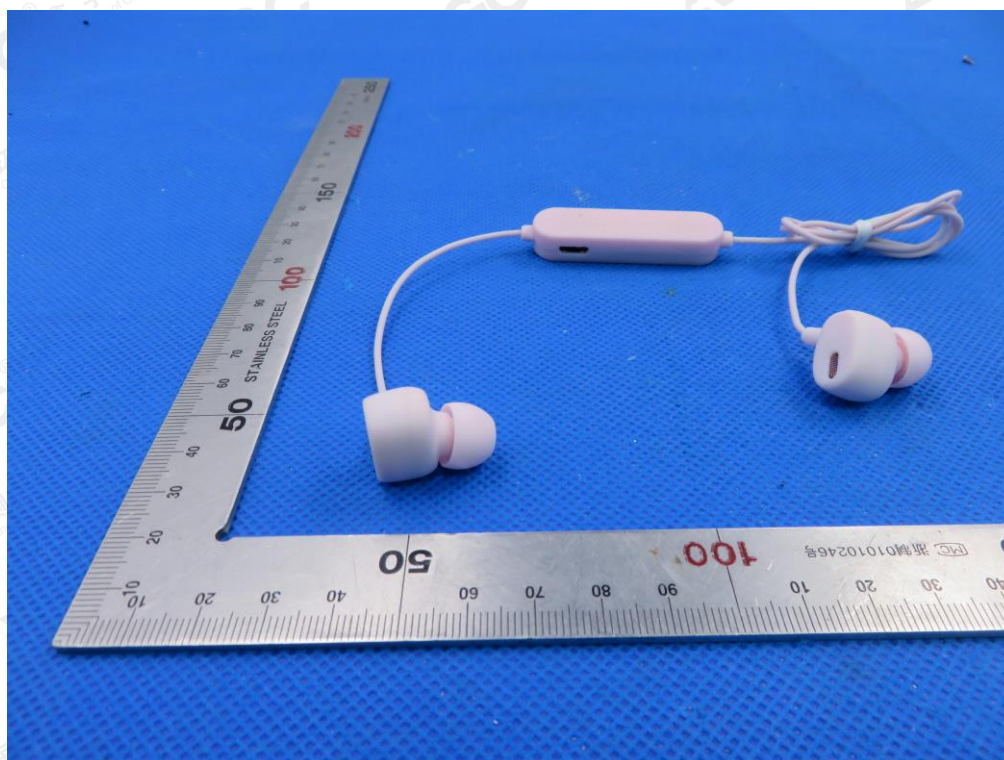


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BACK VIEW OF EUT



LEFT VIEW OF EUT

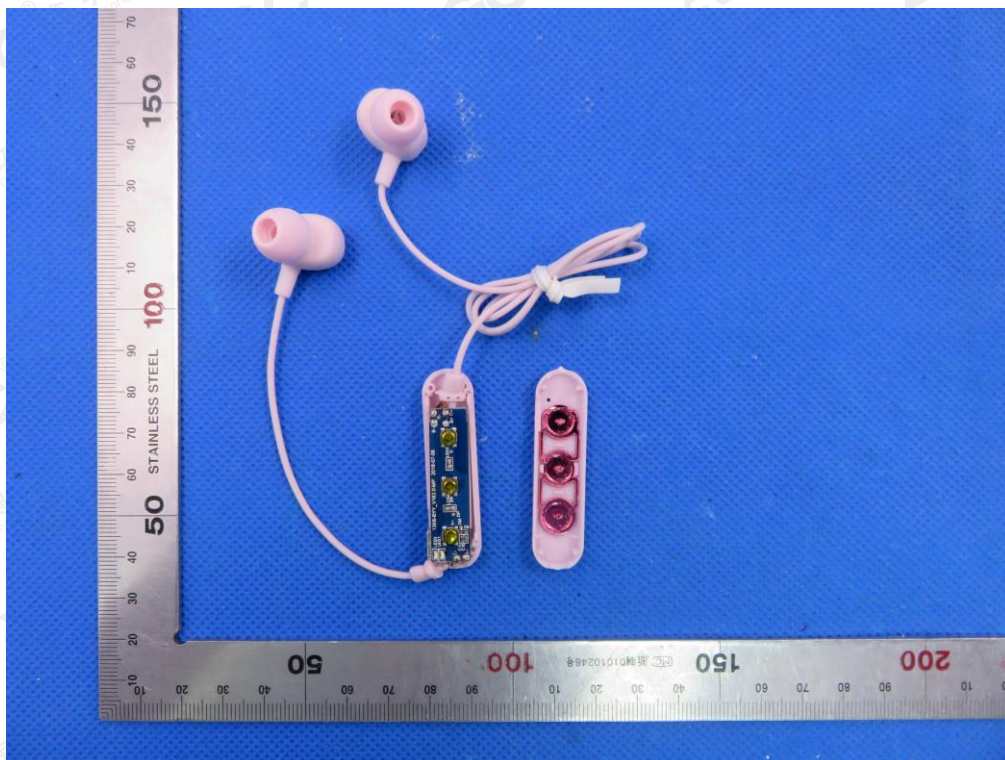


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RIGHT VIEW OF EUT

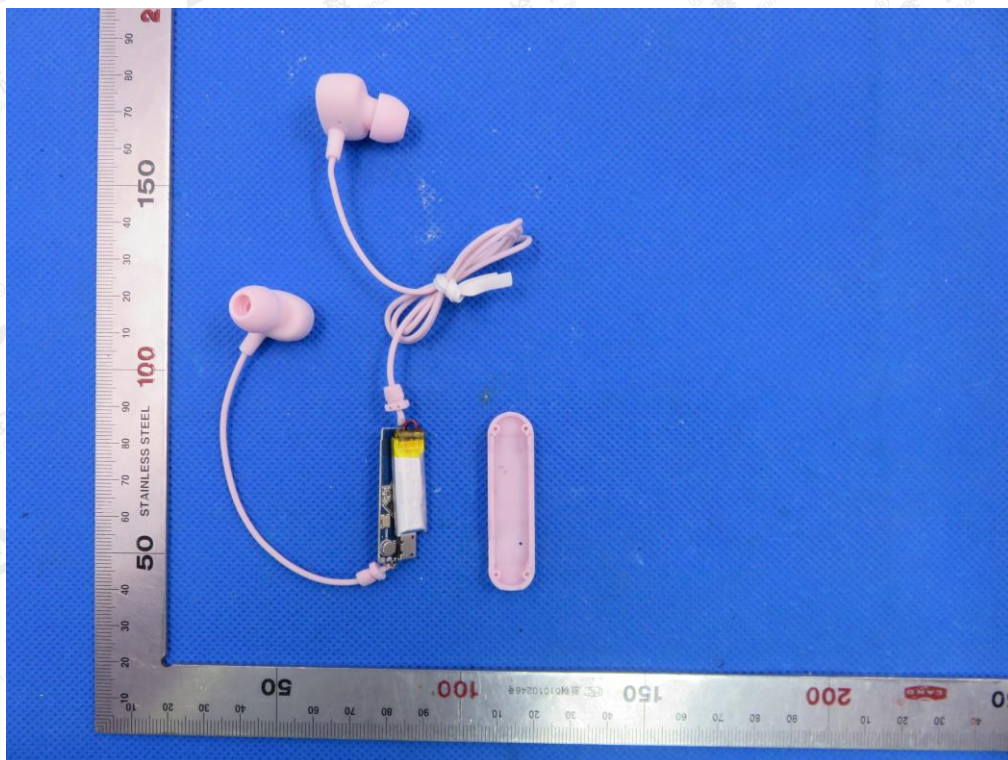


OPEN VIEW OF EUT(FIGURE 1)

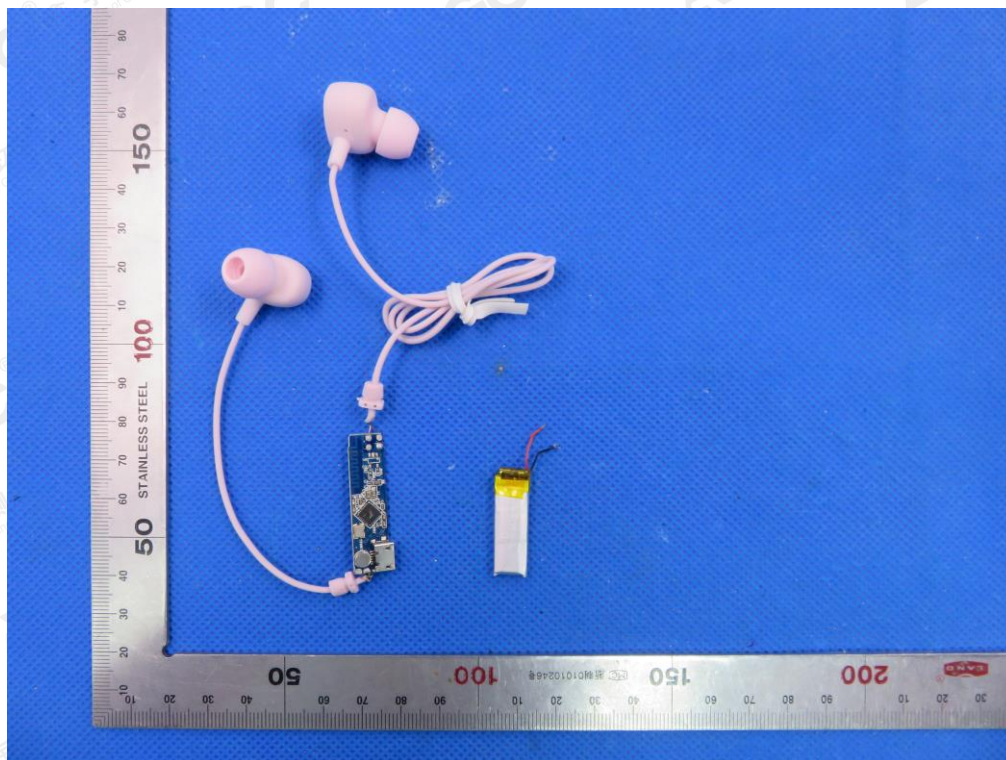


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OPEN VIEW OF EUT(FIGURE 2)

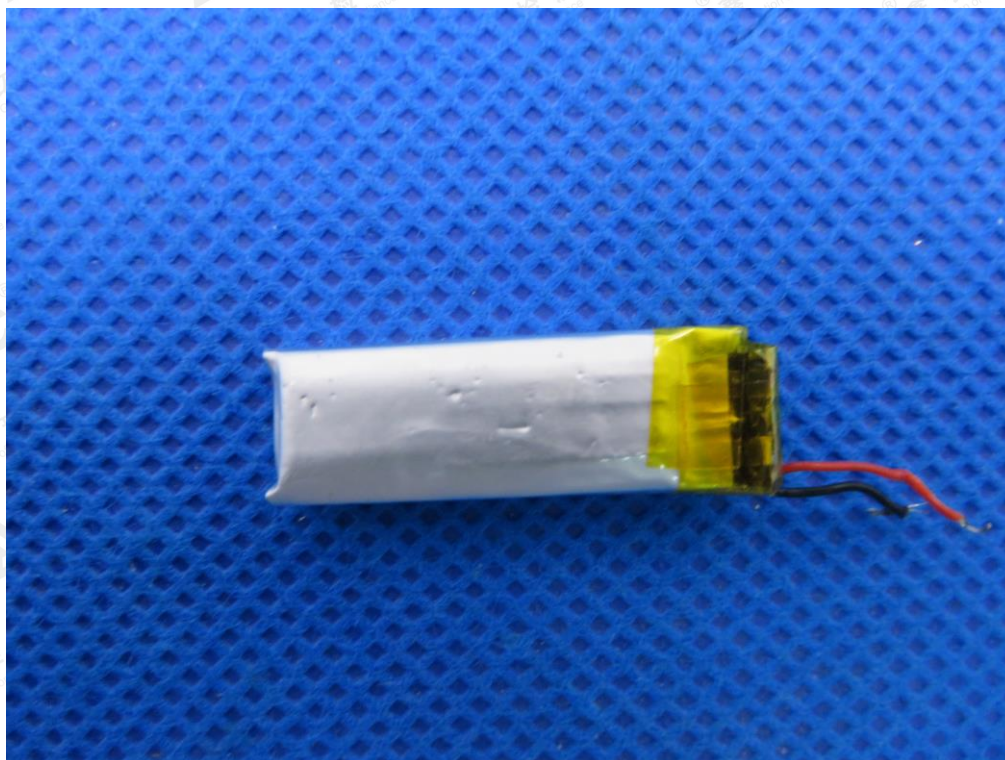


OPEN VIEW OF EUT(FIGURE 3)

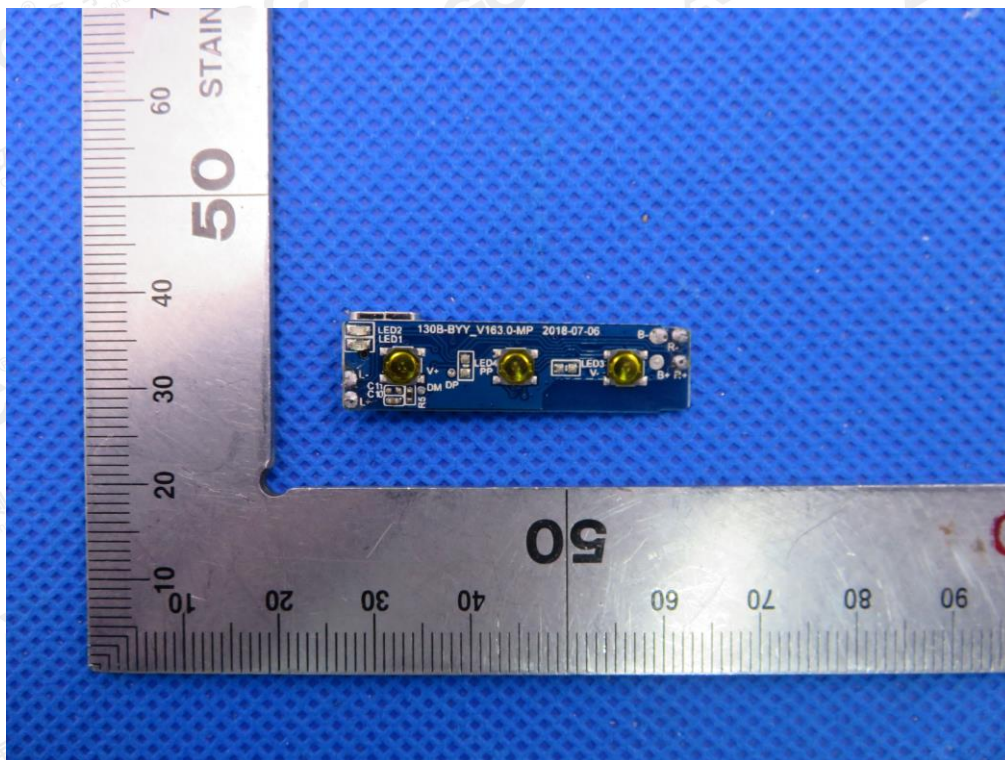


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VIEW OF BATTERY

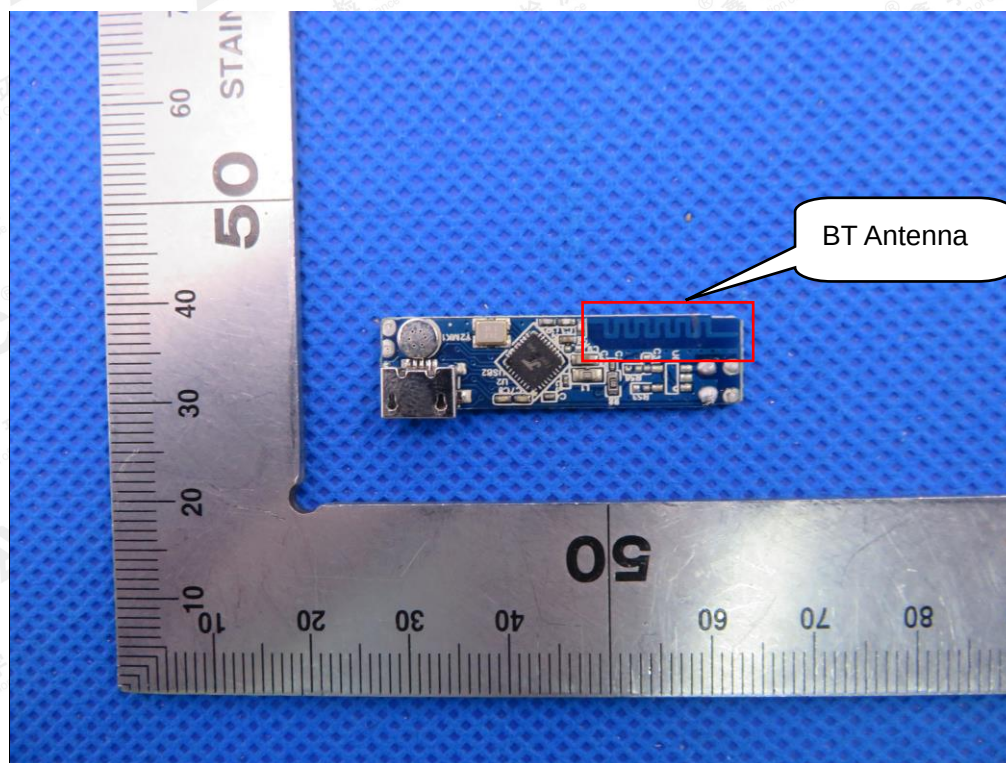


INTERNAL VIEW OF EUT(Figure 1)

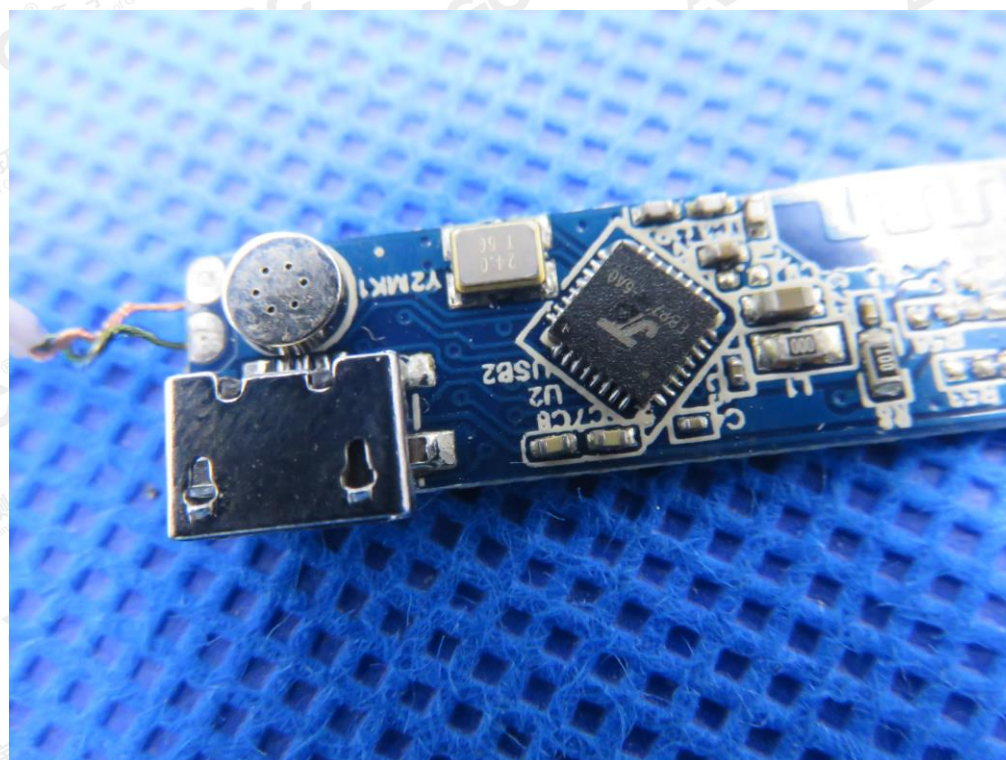


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INTERNAL VIEW OF EUT(FIGURE 2)



INTERNAL VIEW OF EUT(FIGURE 3)



-----END OF REPORT-----

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