10.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

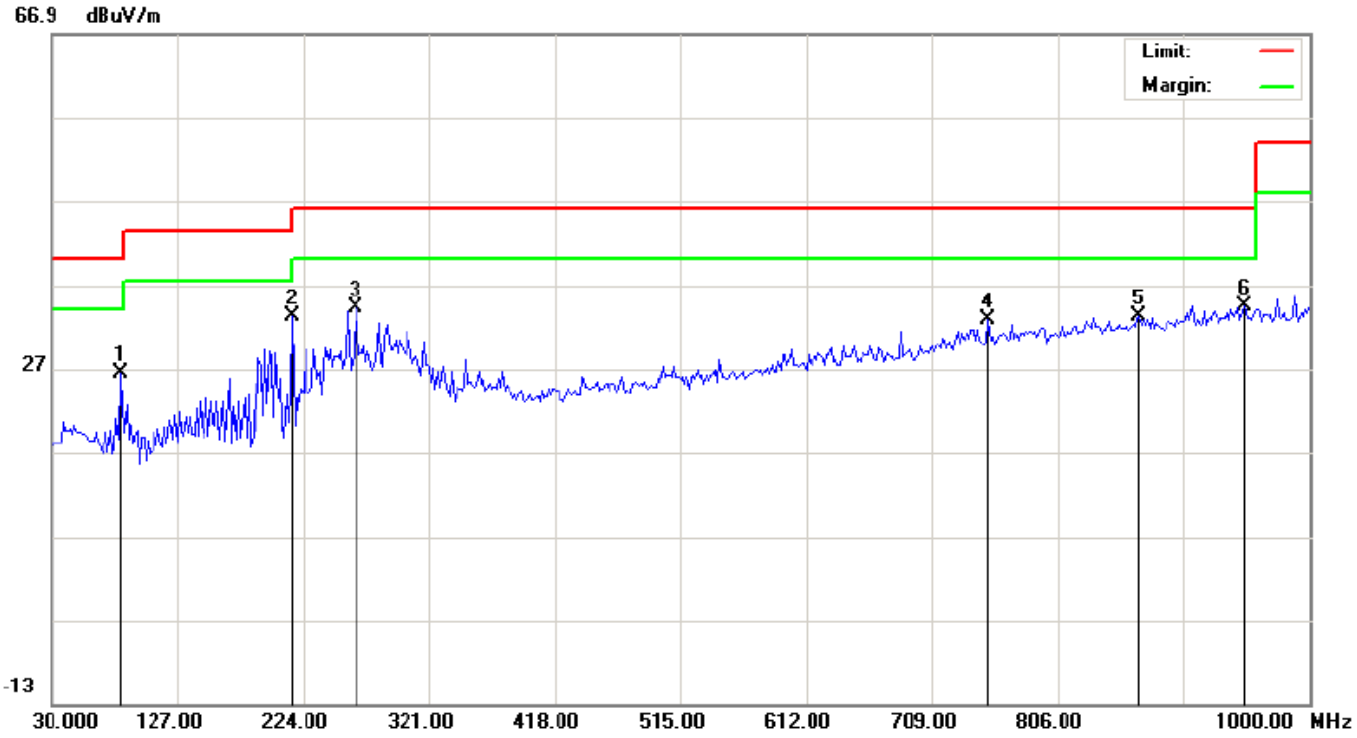
Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ

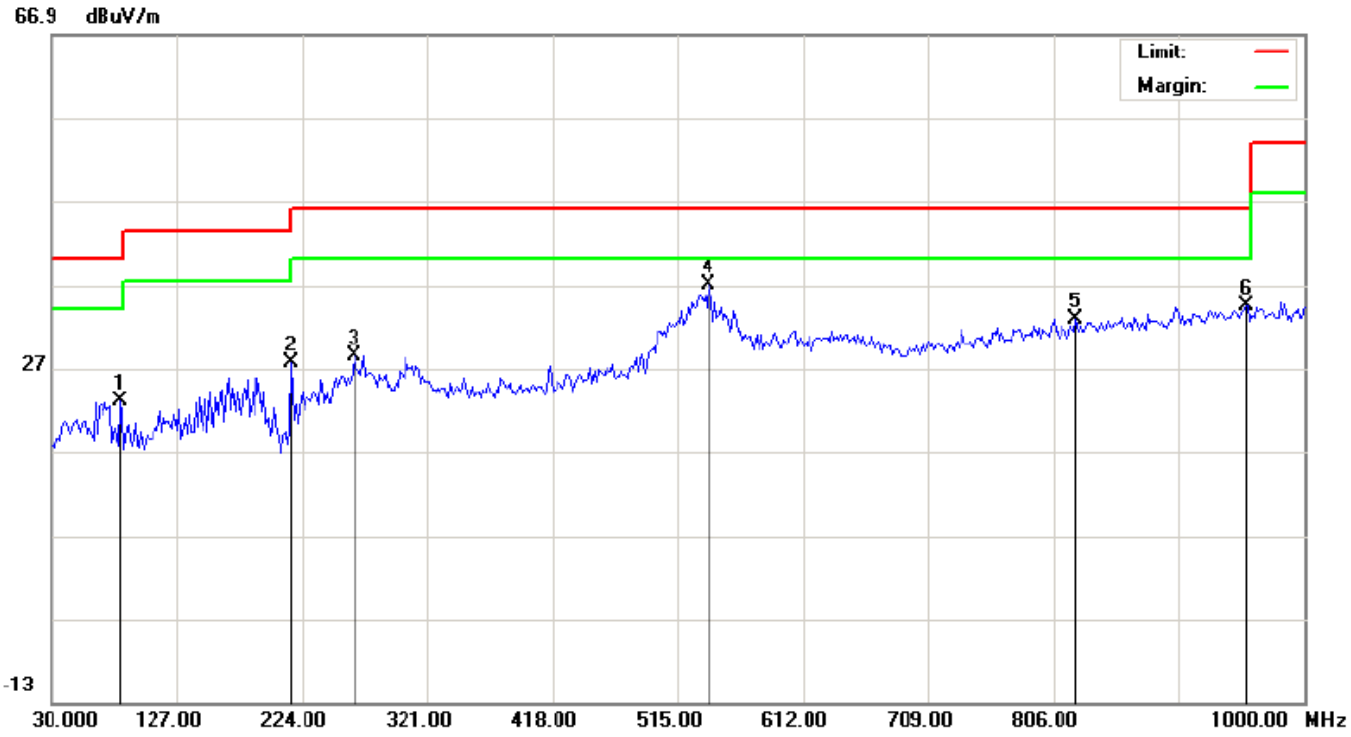
EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	25.1°C	Relative Humidity	55.5%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		83.3500	11.53	14.95	26.48	40.00	-13.52	peak			
2	*	215.9167	16.24	17.00	33.24	43.50	-10.26	peak			
3		264.4167	15.51	18.67	34.18	46.00	-11.82	peak			
4		752.6500	3.40	29.34	32.74	46.00	-13.26	peak			
5		869.0500	1.87	31.30	33.17	46.00	-12.83	peak			
6		949.8833	2.32	32.13	34.45	46.00	-11.55	peak			

RESULT: PASS

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	25.1°C	Relative Humidity	55.5%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		83.3500	7.99	14.95	22.94	40.00	-17.06	peak			
2		215.9167	10.59	17.00	27.59	43.50	-15.91	peak			
3		264.4167	9.67	18.67	28.34	46.00	-17.66	peak			
4	*	539.2500	11.32	25.76	37.08	46.00	-8.92	peak			
5		823.7833	2.16	30.72	32.88	46.00	-13.12	peak			
6		954.7333	2.20	32.17	34.37	46.00	-11.63	peak			

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2 All test modes had been pre-tested. The mode 4 is the worst case and recorded in the report.

RADIATED EMISSION ABOVE 1GHZ

EUT	Bluetooth Headphone	**Model Name**	Studio BT
Temperature	24.6°C	**Relative Humidity**	54.7%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4804.062	47.81	3.76	51.57	74.00	-22.43	peak
4804.062	34	3.70	37.7	54.00	-16.3	AVG
7206.093	44.46	7.23	51.69	74.00	-22.31	peak
7206.093	32.39	7.15	39.54	54.00	-14.46	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Bluetooth Headphone	**Model Name**	Studio BT
Temperature	24.6°C	**Relative Humidity**	54.7%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4804.062	47.81	4.89	52.7	74.00	-21.3	peak
4804.062	35.72	4.29	40.01	54.00	-13.99	AVG
7206.093	45.64	8.23	53.87	74.00	-20.13	peak
7206.093	32.31	8.57	40.88	54.00	-13.12	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	24.6°C	Relative Humidity	54.7%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4882.062	47.81	3.83	51.64	74.00	-22.36	peak
4882.062	34.72	3.05	37.77	54.00	-16.23	AVG
7323.093	44.42	7.34	51.76	74.00	-22.24	peak
7323.093	32.31	7.30	39.61	54.00	-14.39	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	24.6°C	Relative Humidity	54.7%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4882.062	47.81	4.96	52.77	74.00	-21.23	peak
4882.062	35.72	4.36	40.08	54.00	-13.92	AVG
7323.093	45.64	8.3	53.94	74.00	-20.06	peak
7323.093	32.31	8.64	40.95	54.00	-13.05	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	24.6°C	Relative Humidity	54.7%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.062	47.81	3.90	51.71	74.00	-22.29	peak
4960.062	33.96	3.88	37.84	54.00	-16.16	AVG
7440.093	45.64	6.19	51.83	74.00	-22.17	peak
7440.093	33.6	6.08	39.68	54.00	-14.32	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	24.6°C	Relative Humidity	54.7%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.062	47.81	3.93	51.74	74.00	-22.26	peak
4960.062	34.05	3.82	37.87	54.00	-16.13	AVG
7440.093	45.64	6.22	51.86	74.00	-22.14	peak
7440.093	33.61	6.10	39.71	54.00	-14.29	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note: Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor=Antenna Factor+ Cable loss-Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

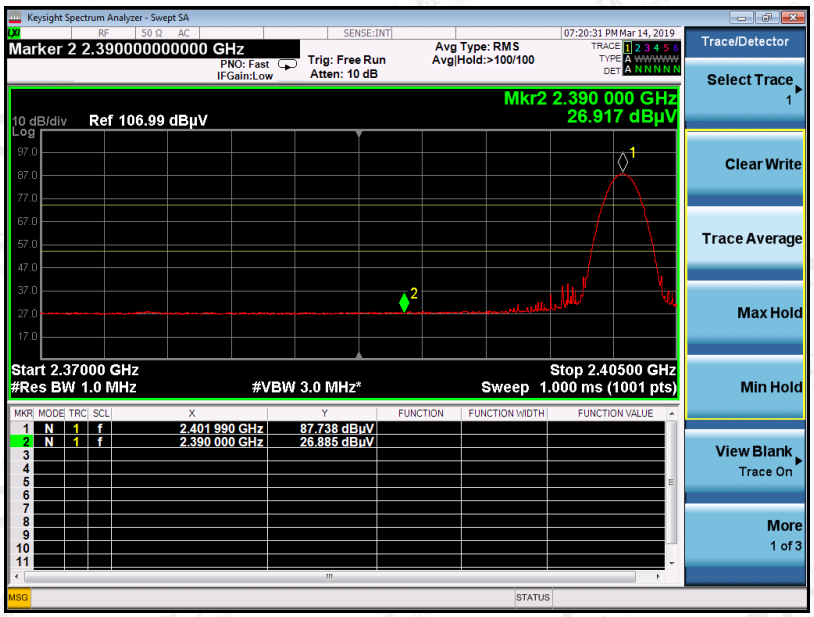
All test modes had been tested. The GFSK modulation is the worst case and recorded in the report.

TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	25.2°C	Relative Humidity	55.5%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

PK

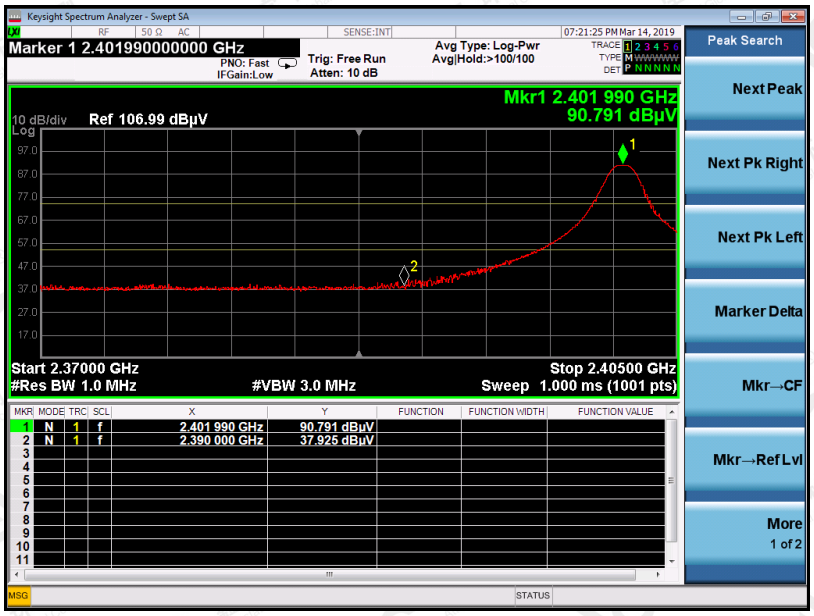
AV



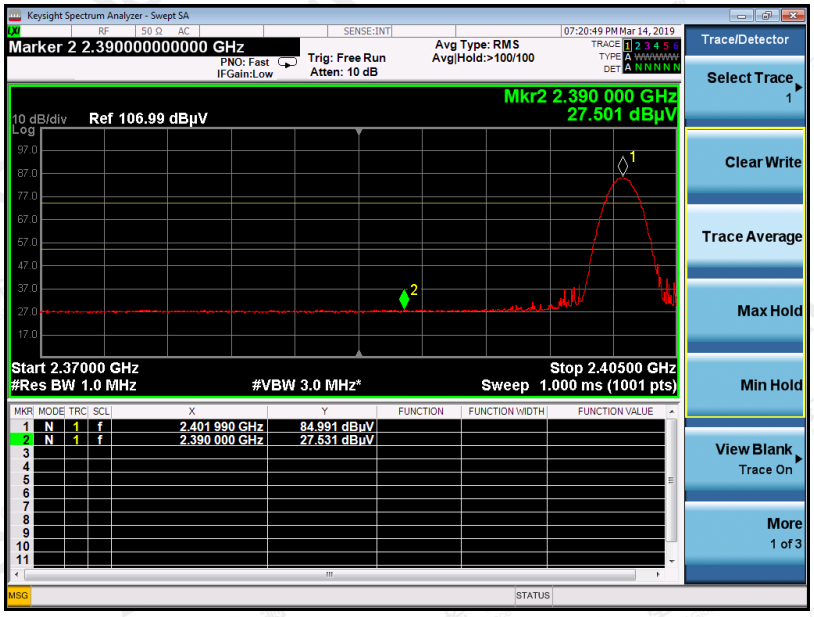
RESULT: PASS

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	25.2°C	Relative Humidity	55.5%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



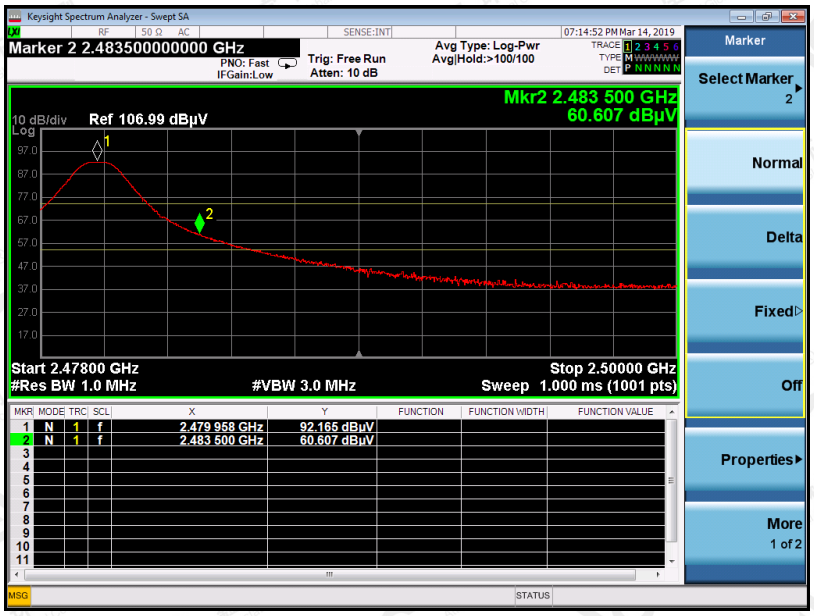
AV



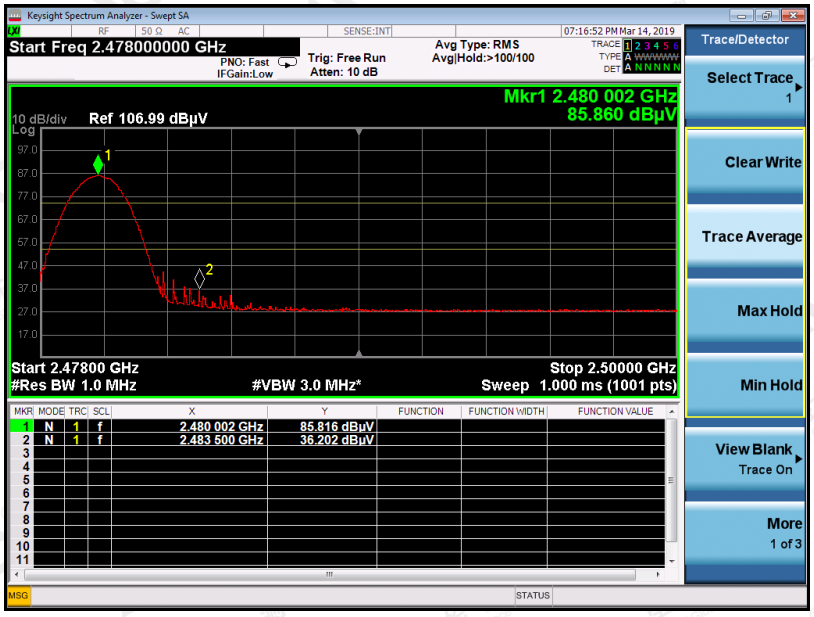
RESULT: PASS

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	25.2°C	Relative Humidity	55.5%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK



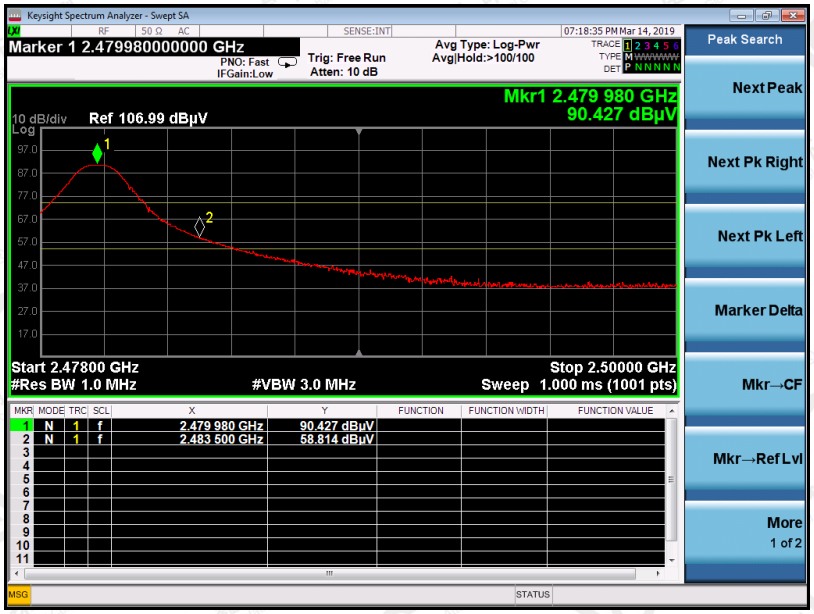
AV



RESULT: PASS

EUT	Bluetooth Headphone	Model Name	Studio BT
Temperature	25.2°C	Relative Humidity	55.5%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

PK



AV

RESULT: PASS

Note:The factor had been edited in the “Input Correction” of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(µV) to represent the Amplitude. Use the F dB(µV/m) to represent the Field Strength. So A=F. All test modes had been pre-tested. The GFSK modulation is the worst case and recorded in the report.

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

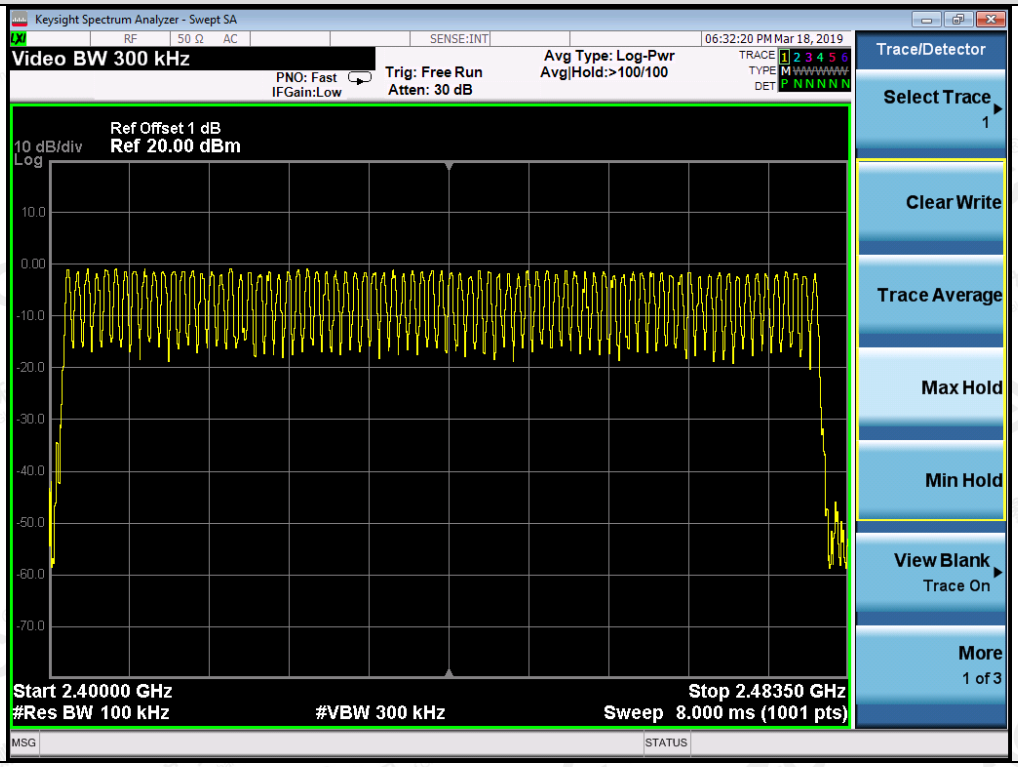
The same as described in section 6

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

Graphs	
GFSK/Hop	

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≤channel spacing and where possible RBW should be set >> 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:

Dwell time = t_{pulse} x n_{hops} / number of channels x 31.6 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 µs.

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_{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

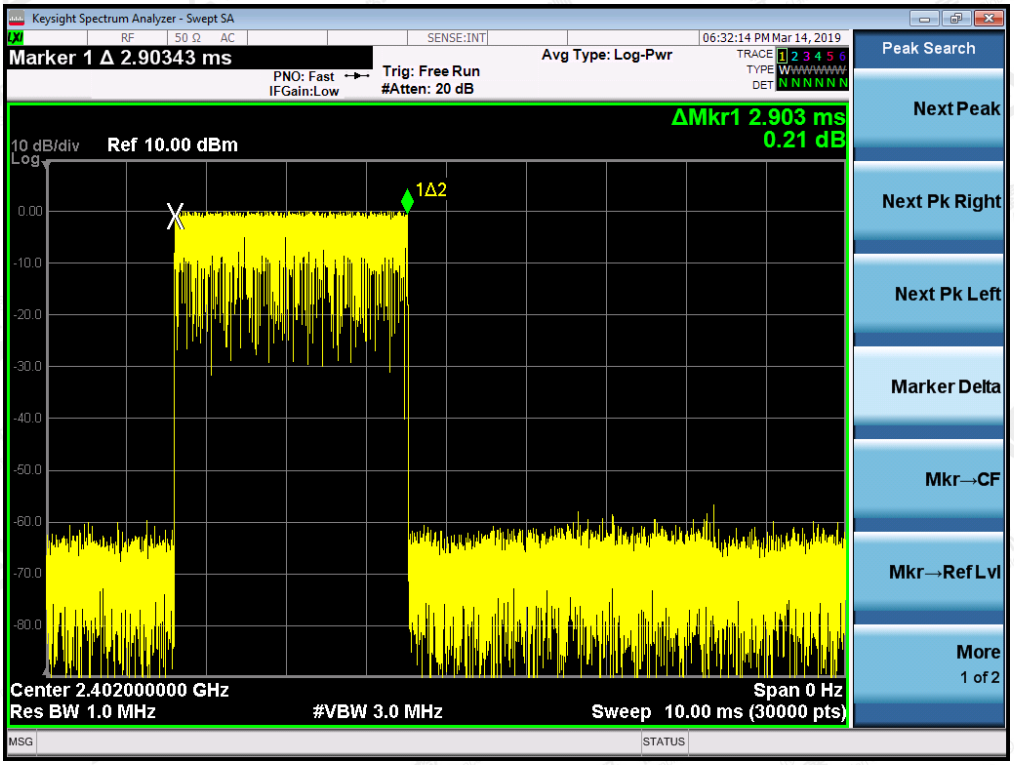
The same as described in section 6

12.4. LIMITS AND MEASUREMENT RESULT

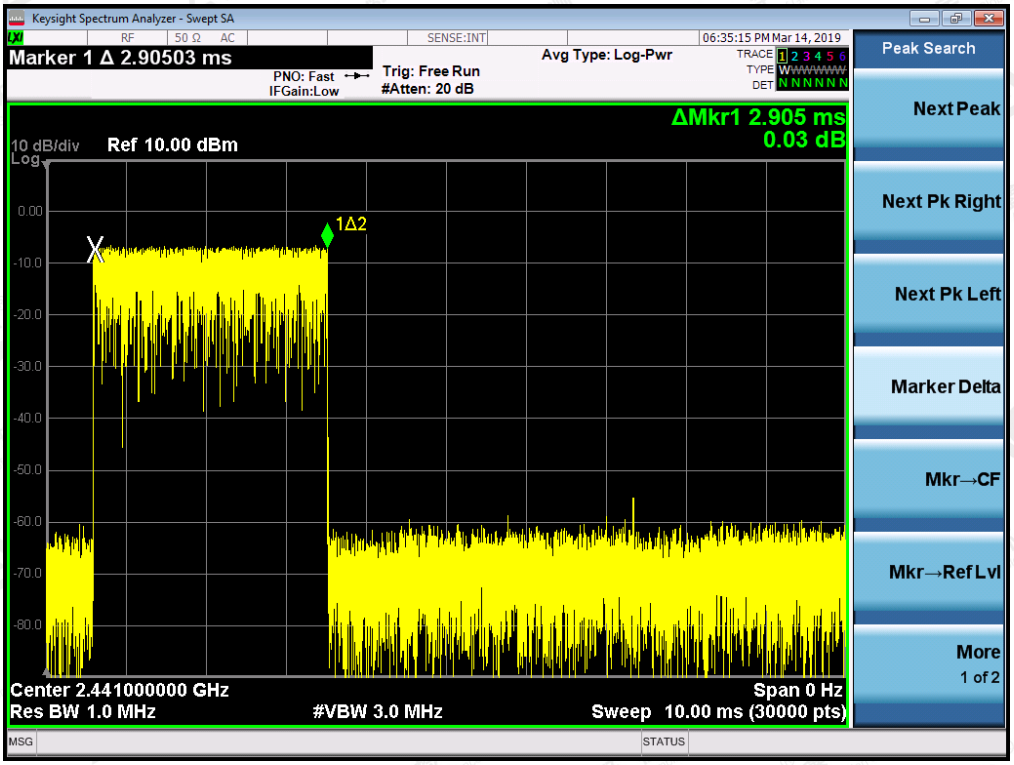
Channel.	Burst Width [ms/hop/ch]	Dwell Time[ms]	Verdict	Limit (ms)
LCH	2.903	309.654	PASS	400
MCH	2.905	309.867	PASS	400
HCH	2.896	308.907	PASS	400

Note: The GFSK modulation is the worst case and recorded in the report.

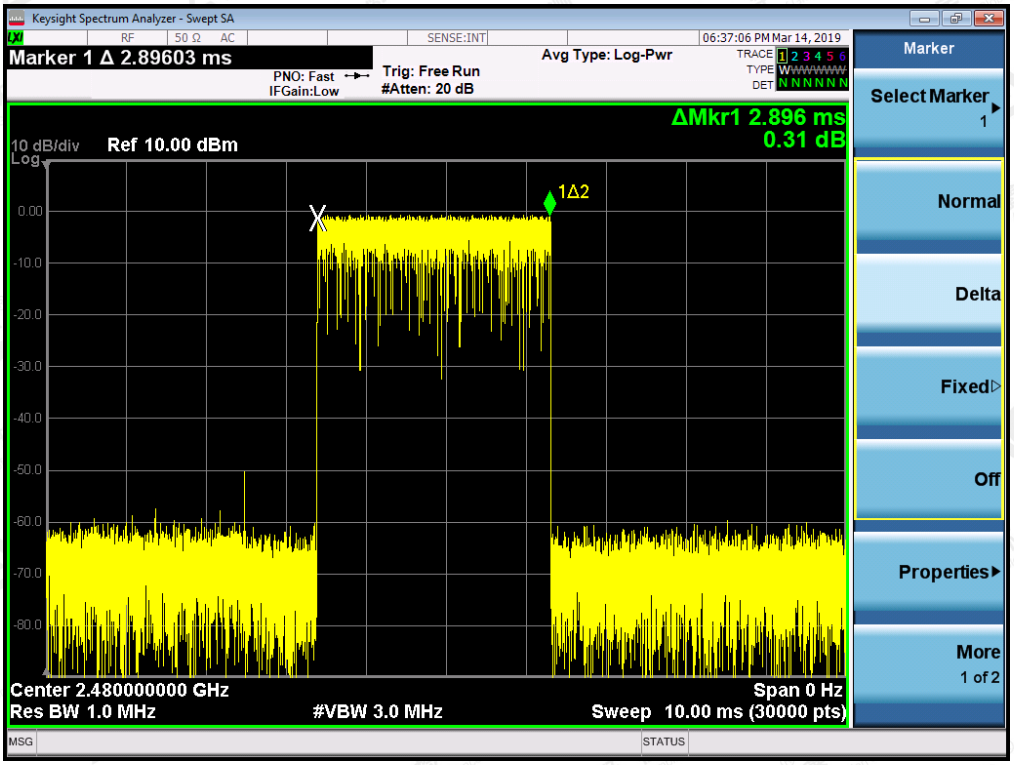
TEST PLOT OF LOW CHANNEL



TEST PLOT OF MIDDLE CHANNEL



TEST PLOT OF HIGH CHANNEL



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) ≥ 1% of the span Video (or Average) Bandwidth (VBW) ≥ 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

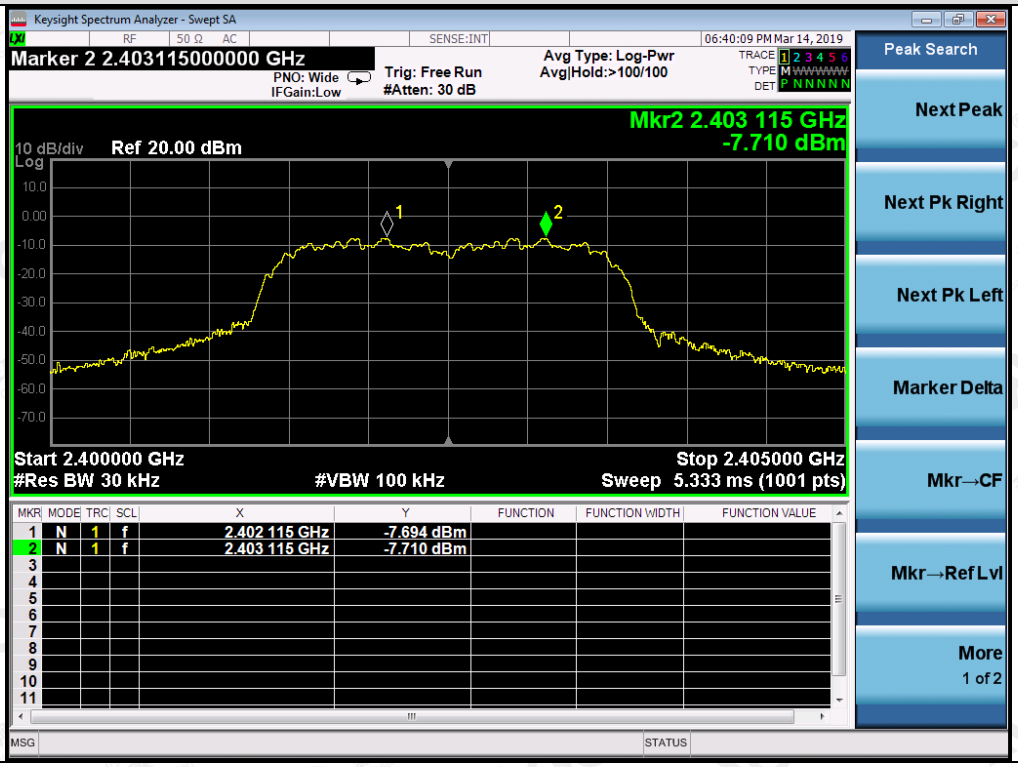
The same as described in section 6.3

13.4. LIMITS AND MEASUREMENT RESULT

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
8-DPSK	Hop	1000	PASS

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

Test Graph

Graphs	
8-DPSK/Hop	

14. FCC LINE CONDUCTED EMISSION TEST

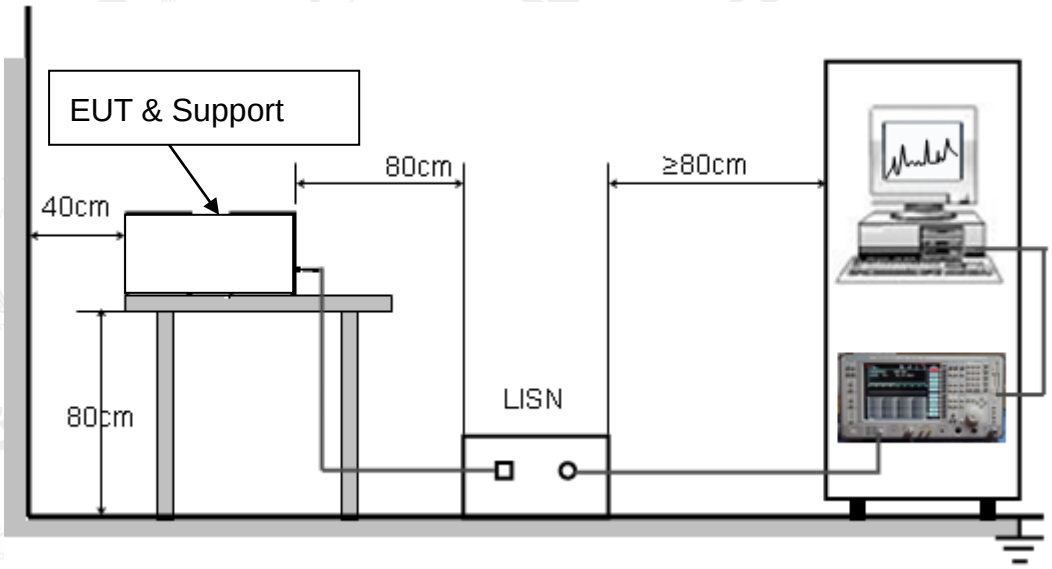
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST

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



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/60Hzpower 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.

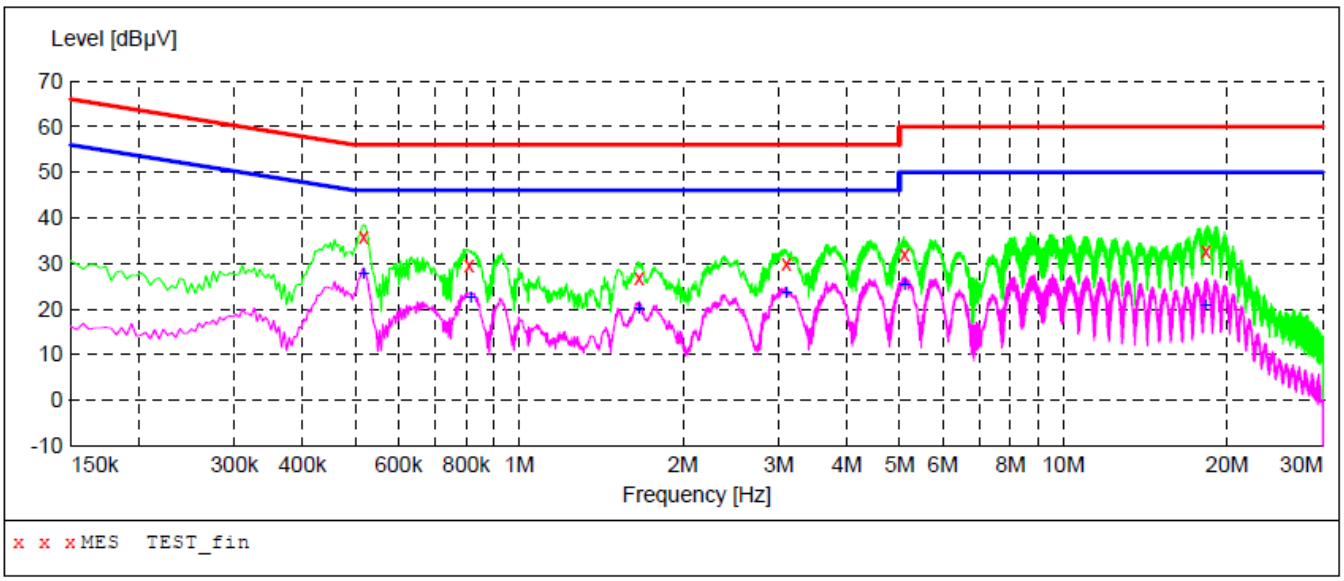
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

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.

14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

LINE CONDUCTED EMISSION TEST LINE 1-L



MEASUREMENT RESULT: "TEST_fin"

3/15/2019 9:08AM

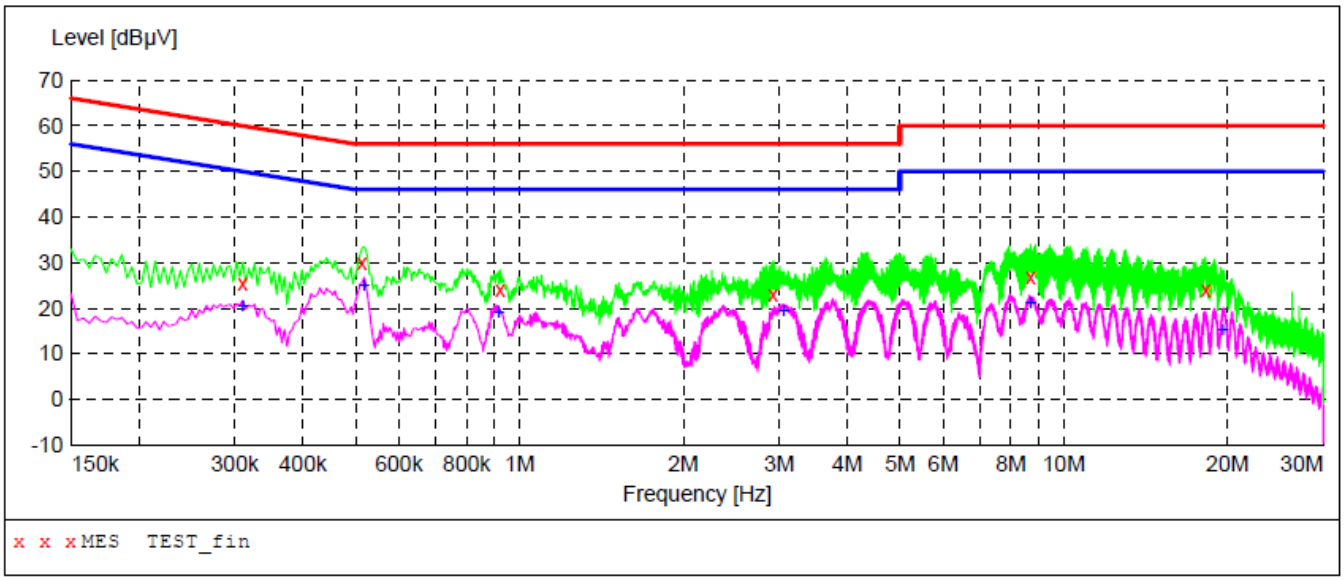
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.518000	35.90	10.3	56	20.1	QP	L1	FLO
0.810000	29.80	10.4	56	26.2	QP	L1	FLO
1.662000	27.00	10.4	56	29.0	QP	L1	FLO
3.094000	30.10	10.4	56	25.9	QP	L1	FLO
5.110000	32.20	10.4	60	27.8	QP	L1	FLO
18.262000	32.60	11.0	60	27.4	QP	L1	FLO

MEASUREMENT RESULT: "TEST_fin2"

3/15/2019 9:08AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.518000	28.00	10.3	46	18.0	AV	L1	FLO
0.814000	22.80	10.4	46	23.2	AV	L1	FLO
1.662000	20.40	10.4	46	25.6	AV	L1	FLO
3.094000	23.60	10.4	46	22.4	AV	L1	FLO
5.110000	25.50	10.4	50	24.5	AV	L1	FLO
18.238000	21.00	11.0	50	29.0	AV	L1	FLO

LINE CONDUCTED EMISSION TEST LINE 2-N



MEASUREMENT RESULT: "TEST_fin"

3/15/2019 9:04AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.310000	25.30	10.2	60	34.7	QP	N	FLO
0.514000	29.90	10.3	56	26.1	QP	N	FLO
0.922000	23.90	10.4	56	32.1	QP	N	FLO
2.922000	23.10	10.4	56	32.9	QP	N	FLO
8.690000	26.80	10.7	60	33.2	QP	N	FLO
18.226000	24.20	11.0	60	35.8	QP	N	FLO

MEASUREMENT RESULT: "TEST_fin2"

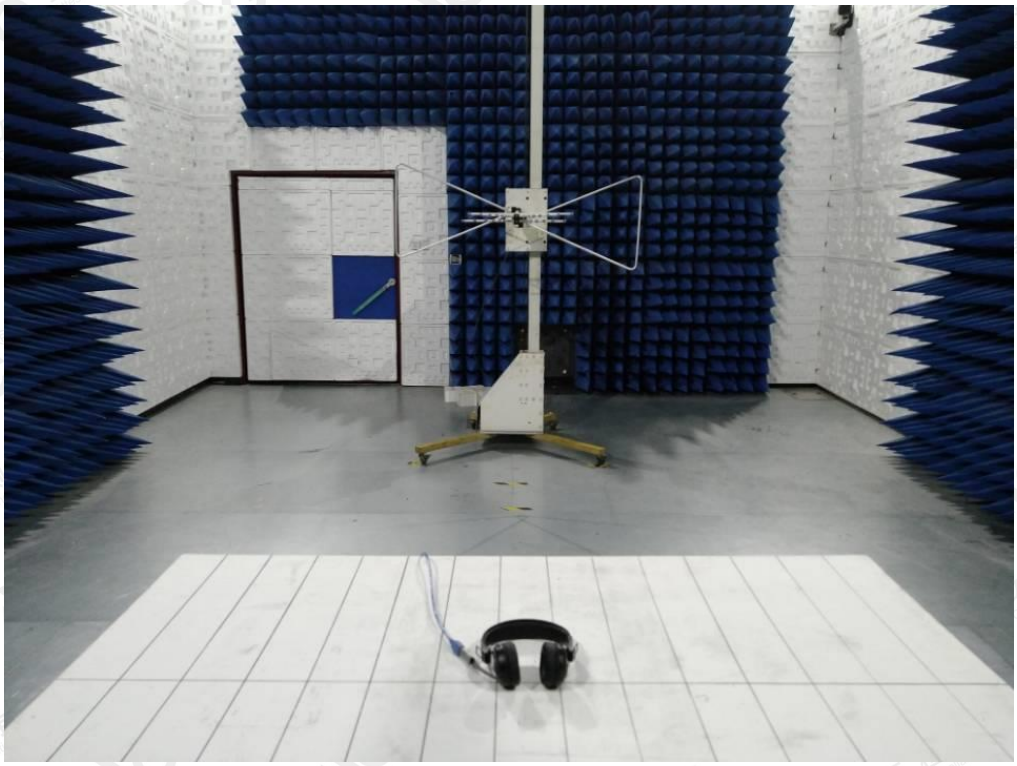
3/15/2019 9:04AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.310000	20.50	10.2	50	29.5	AV	N	FLO
0.518000	25.20	10.3	46	20.8	AV	N	FLO
0.914000	19.30	10.4	46	26.7	AV	N	FLO
3.058000	19.70	10.4	46	26.3	AV	N	FLO
8.690000	21.40	10.7	50	28.6	AV	N	FLO
19.570000	15.50	11.0	50	34.5	AV	N	FLO

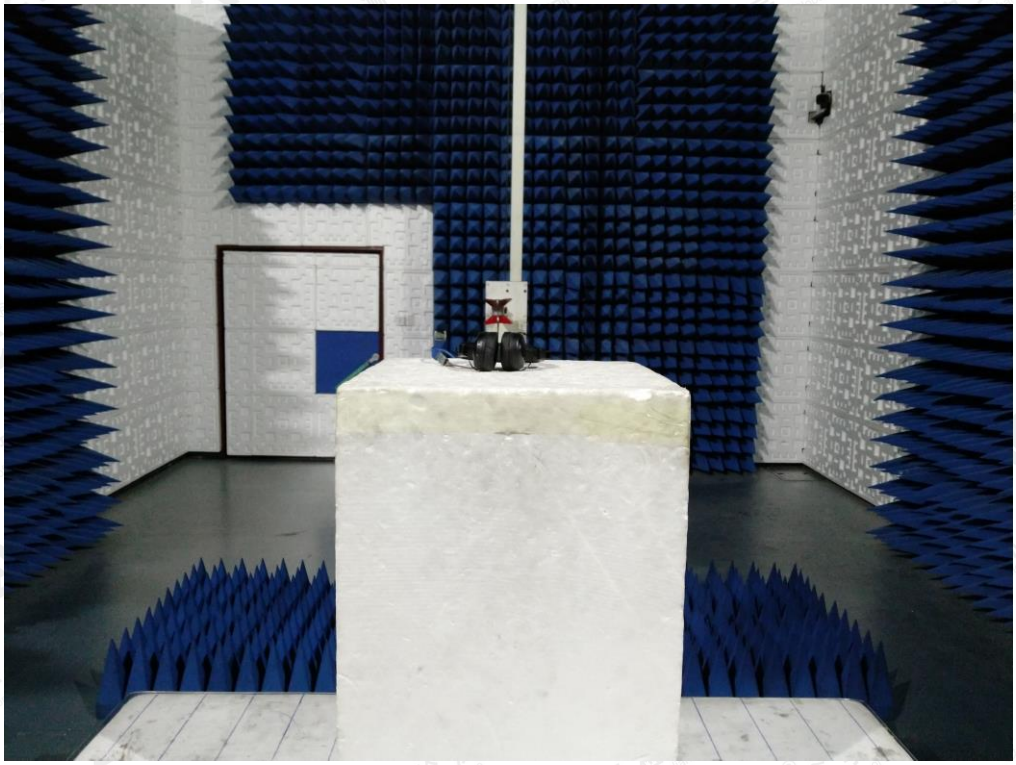
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

LINE CONDUCTED EMISSION TEST SETUP

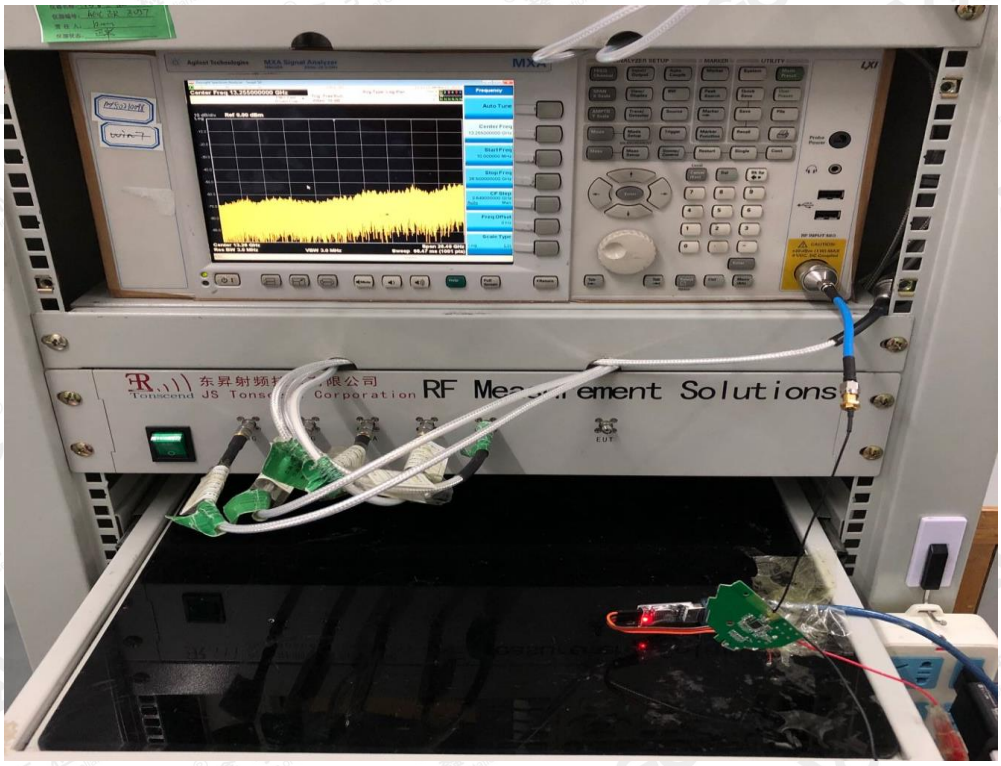
RADIATED EMISSION TEST SETUP



RADIATED EMISSION ABOVE 1G TEST SETUP



CONDUCTED TEST SETUP



APPENDIX B: PHOTOGRAPHS OF TEST SETUP

TOP VIEW OF EUT

BOTTOM VIEW OF EUT

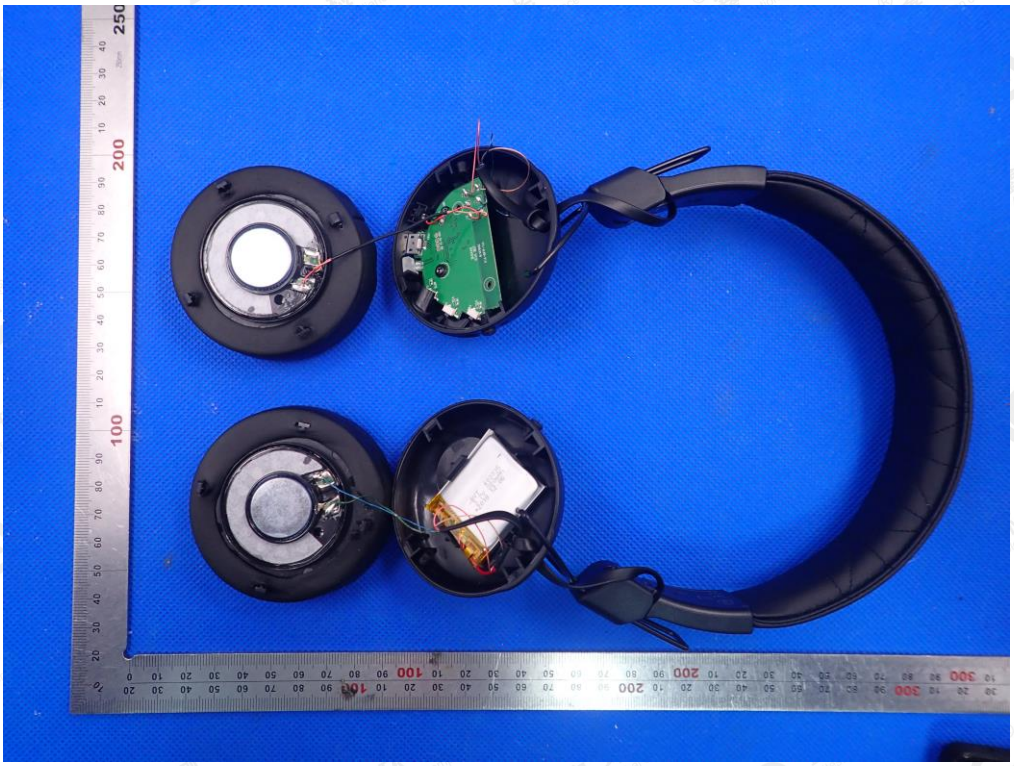
FRONT VIEW OF EUT

BACK VIEW OF EUT

LEFT VIEW OF EUT

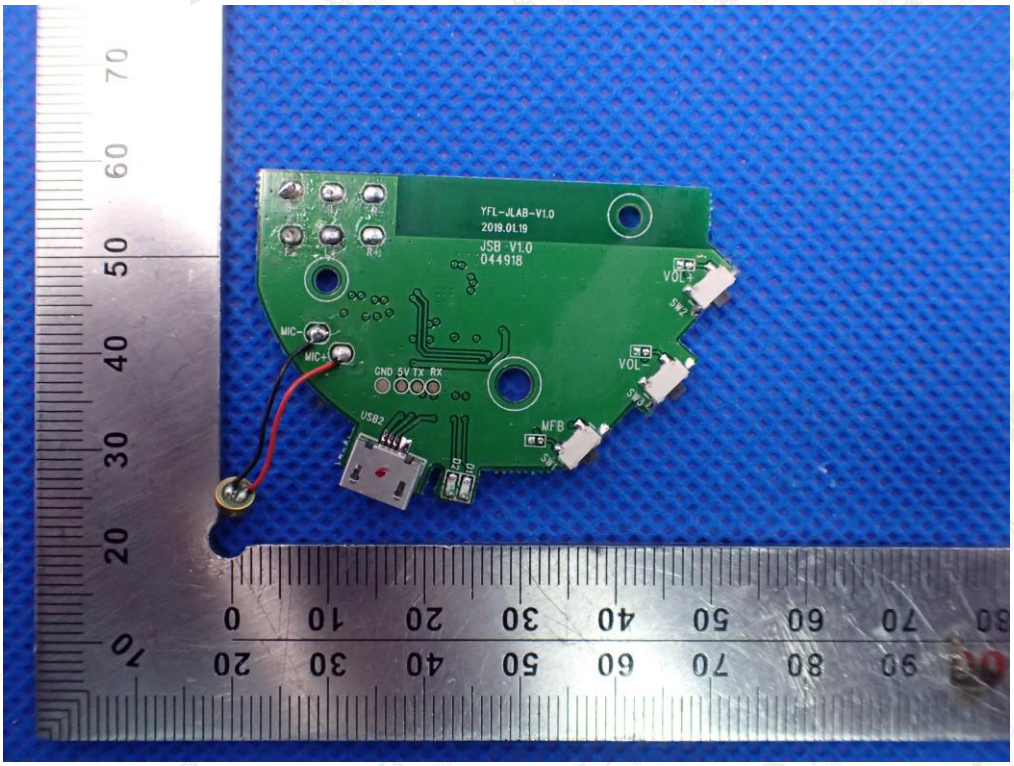
RIGHT VIEW OF EUT

OPEN VIEW OF EUT(FIGURE 1)

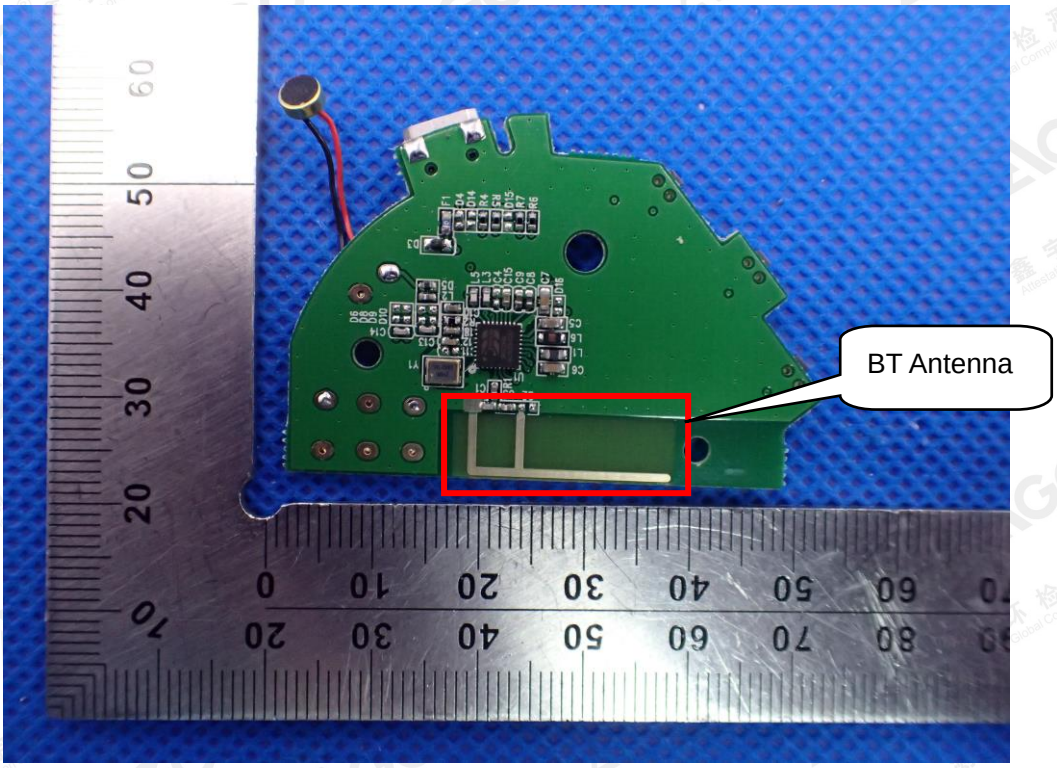


VIEW OF BATTERY

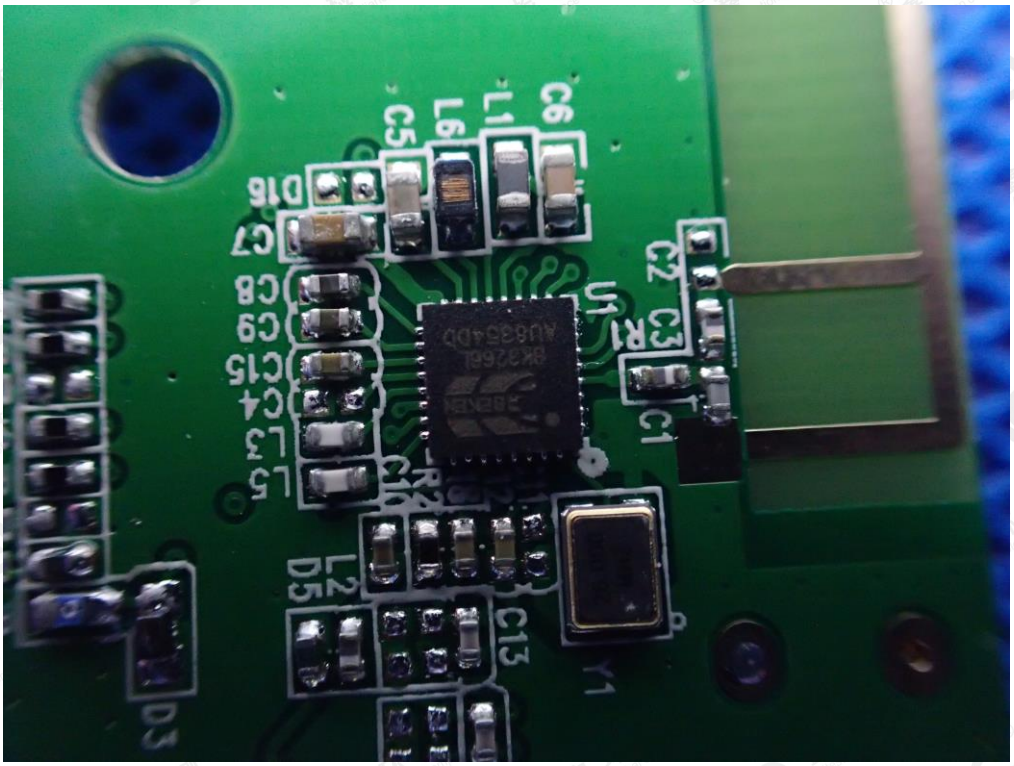
INTERNAL VIEW OF EUT(FIGURE 1)



INTERNAL VIEW OF EUT(FIGURE 2)



INTERNAL VIEW OF EUT(FIGURE 3)



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