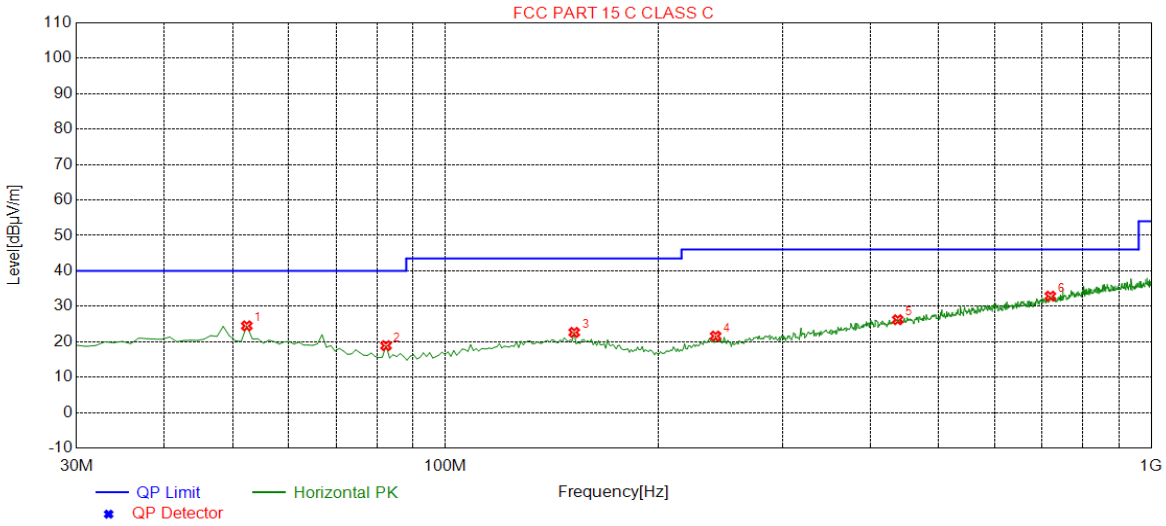
RADIATED EMISSION BELOW 1GHZ

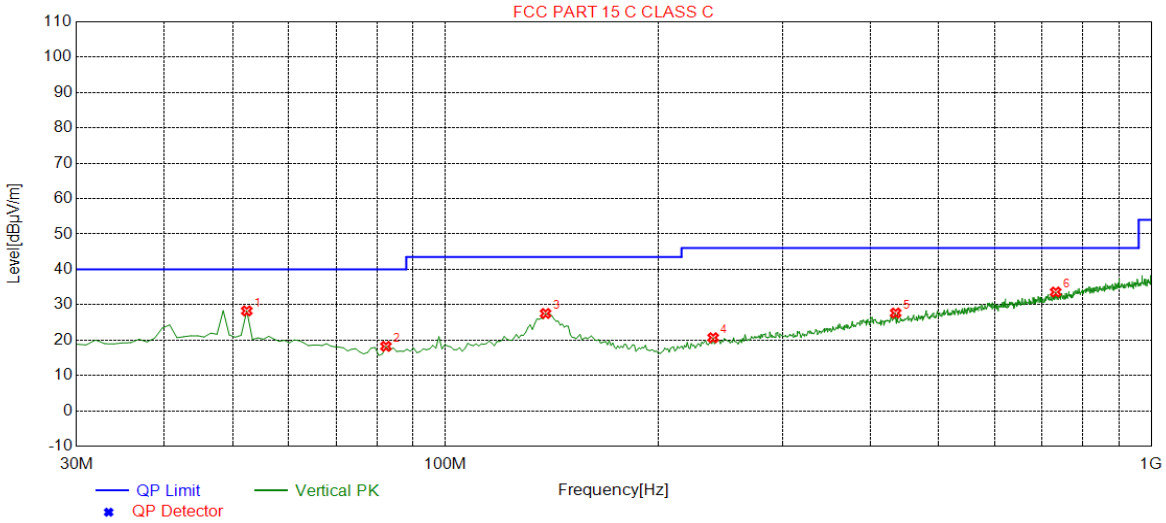
EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 4	**Antenna**	Horizontal



NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	52.3100	24.48	14.49	40.00	15.52	100	278	Horizontal
2	82.3800	18.90	10.17	40.00	21.10	150	119	Horizontal
3	152.2200	22.64	14.90	43.50	20.86	150	1	Horizontal
4	241.4600	21.60	14.83	46.00	24.40	150	171	Horizontal
5	437.4000	26.21	20.69	46.00	19.79	150	198	Horizontal
6	719.6700	32.87	26.45	46.00	13.13	100	106	Horizontal

RESULT: PASS

EUT	Bluetooth Speaker	Model Name	Harmony
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	52.3100	28.26	14.49	40.00	11.74	100	351	Vertical
2	82.3800	18.23	10.17	40.00	21.77	100	285	Vertical
3	138.6400	27.53	14.78	43.50	15.97	100	26	Vertical
4	239.5200	20.68	14.81	46.00	25.32	150	291	Vertical
5	434.4900	27.66	20.63	46.00	18.34	100	271	Vertical
6	732.2800	33.59	26.78	46.00	12.41	100	285	Vertical

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 Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	47.83	0.08	47.91	74	-26.09	peak
4804.000	42.3	0.08	42.38	54	-11.62	AVG
7206.000	41.74	2.21	43.95	74	-30.05	peak
7206.000	34.83	2.21	37.04	54	-16.96	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	46.43	0.08	46.51	74	-27.49	peak
4804.000	40.17	0.08	40.25	54	-13.75	AVG
7206.000	37.52	2.21	39.73	74	-34.27	peak
7206.000	31.46	2.21	33.67	54	-20.33	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 2	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4882.000	48.65	0.14	48.79	74	-25.21	peak
4882.000	42.2	0.14	42.34	54	-11.66	AVG
7323.000	41.42	2.36	43.78	74	-30.22	peak
7323.000	35.6	2.36	37.96	54	-16.04	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 2	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4882.000	46.65	0.14	46.79	74	-27.21	peak
4882.000	40.31	0.14	40.45	54	-13.55	AVG
7323.000	39.79	2.36	42.15	74	-31.85	peak
7323.000	33.06	2.36	35.42	54	-18.58	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
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
4960.000	48.45	0.22	48.67	74	-25.33	peak
4960.000	41.59	0.22	41.81	54	-12.19	AVG
7440.000	40.87	2.64	43.51	74	-30.49	peak
7440.000	34.22	2.64	36.86	54	-17.14	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
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
4960.000	46.12	0.22	46.34	74	-27.66	peak
4960.000	39.13	0.22	39.35	54	-14.65	AVG
7440.000	38.28	2.64	40.92	74	-33.08	peak
7440.000	31.51	2.64	34.15	54	-19.85	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.

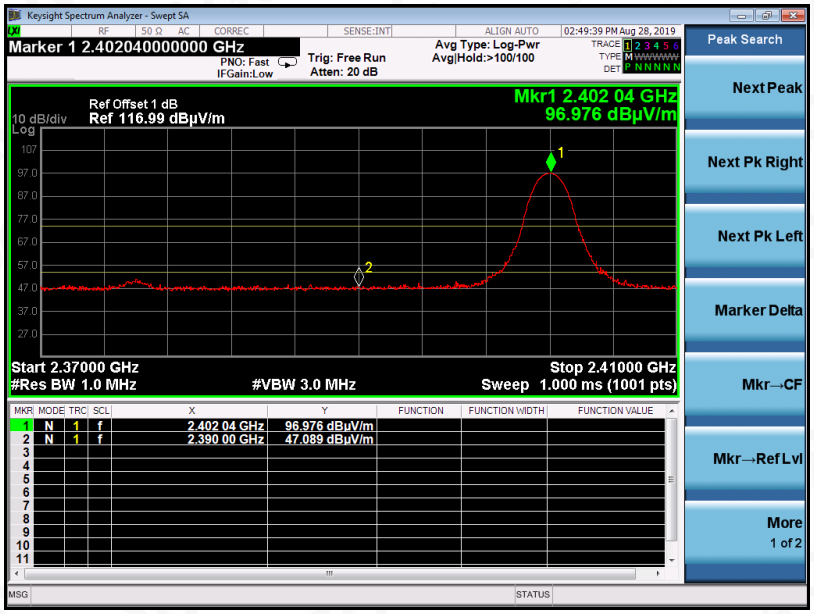
The “Factor” value can be calculated automatically by software of measurement system.

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

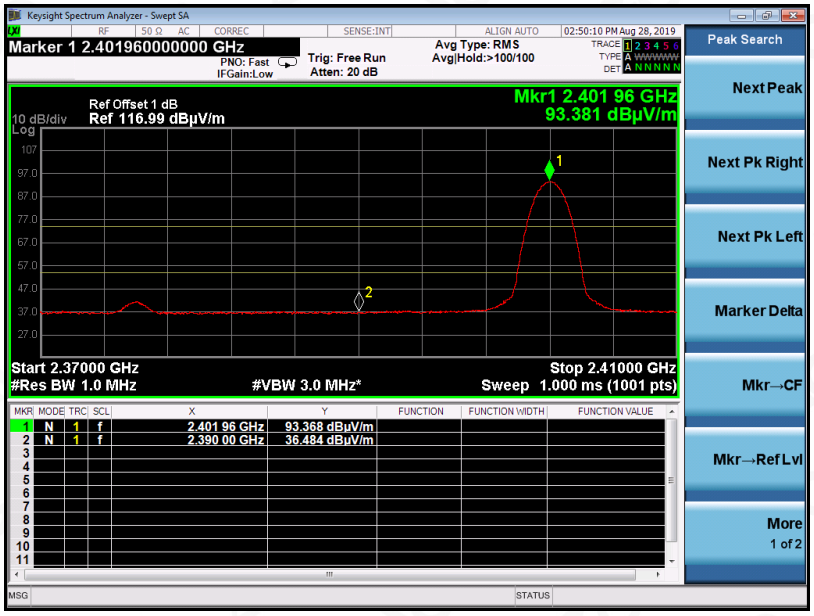
TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

PK



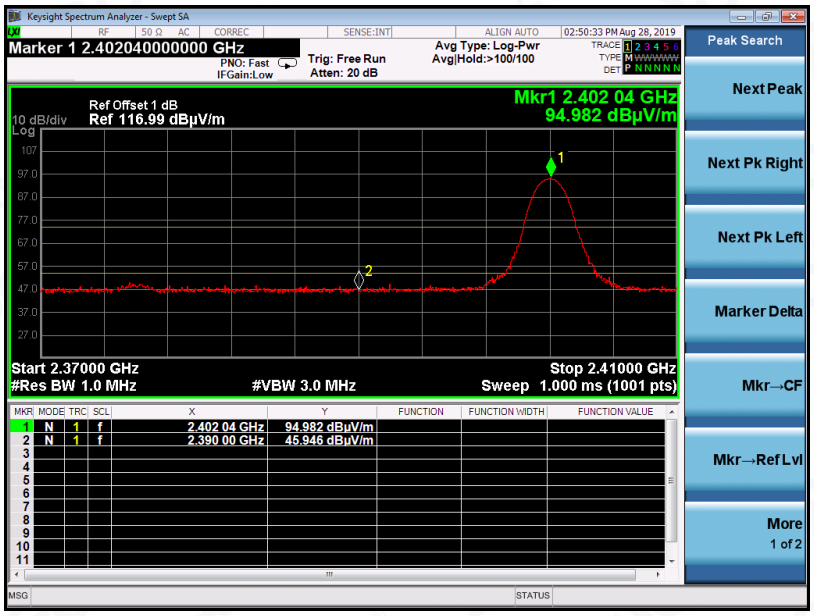
AV



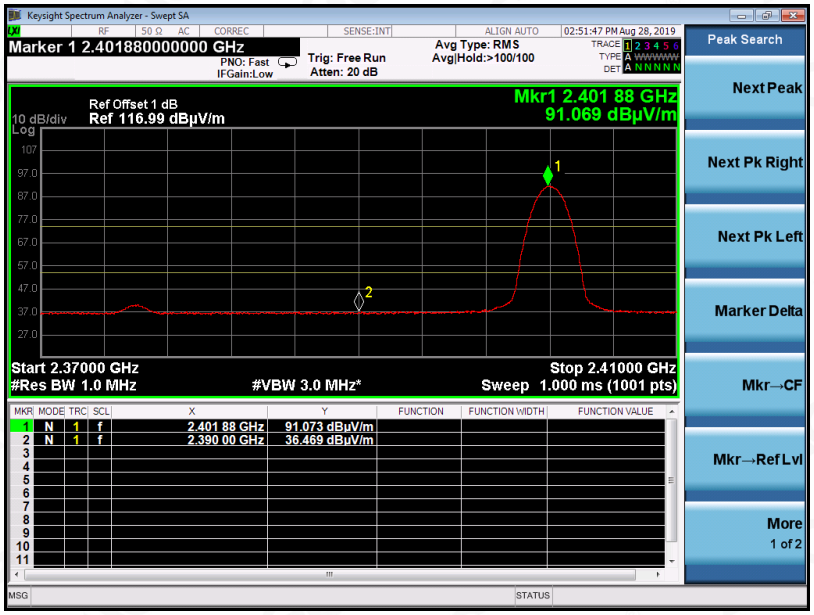
RESULT: PASS

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Vertical

PK



AV



RESULT: PASS

EUT	Bluetooth Speaker	**Model Name**	Harmony
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna**	Horizontal

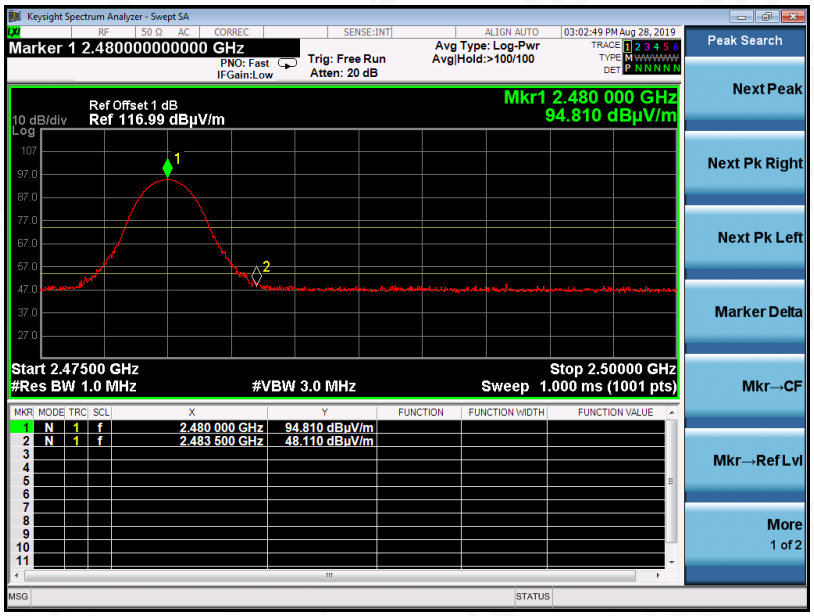
PK

AV

RESULT: PASS

EUT	Bluetooth Speaker	Model Name	Harmony
Temperature	25°C	Relative Humidity	55.4%
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

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

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW ≥ RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.
4. Allow the trace to stabilize.

11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

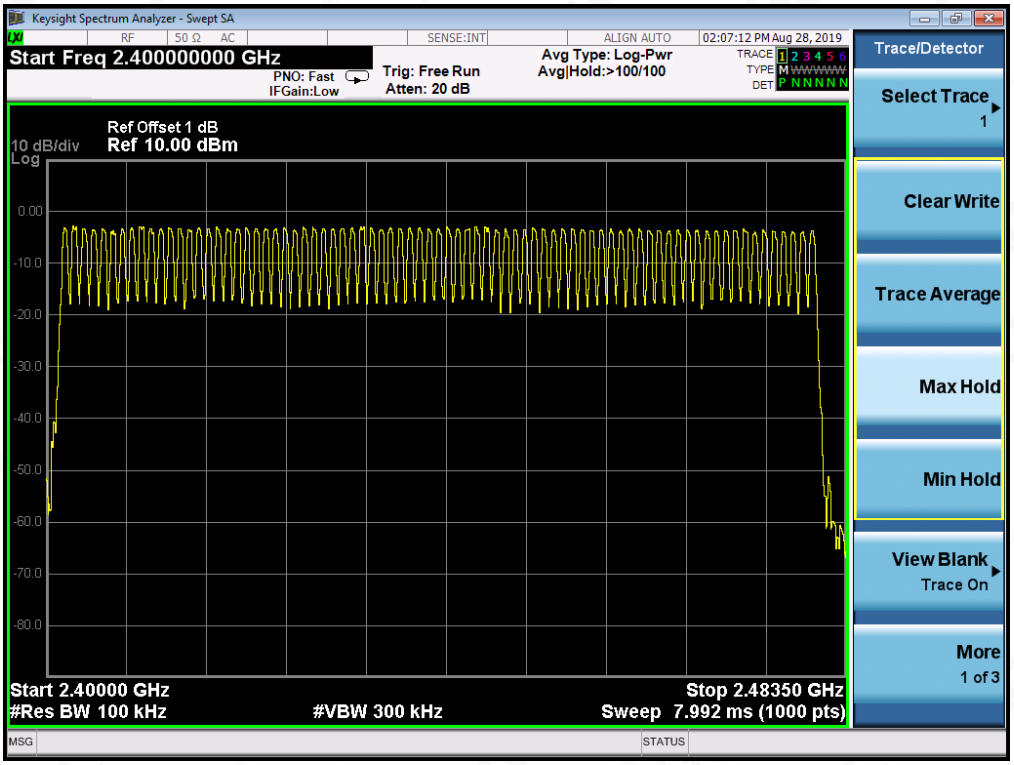
11.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

11.4. LIMITS AND MEASUREMENT RESULT

TOTAL NO. OF HOPPING CHANNEL	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT
	>=15	79	PASS

TEST PLOT FOR NO. OF TOTAL CHANNELS



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

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; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak. Trace: Max hold.
5. Use the marker-delta function to determine the transmit time per hop.
6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:
   (Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)
7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

12.3. MEASUREMENT EQUIPMENT USED

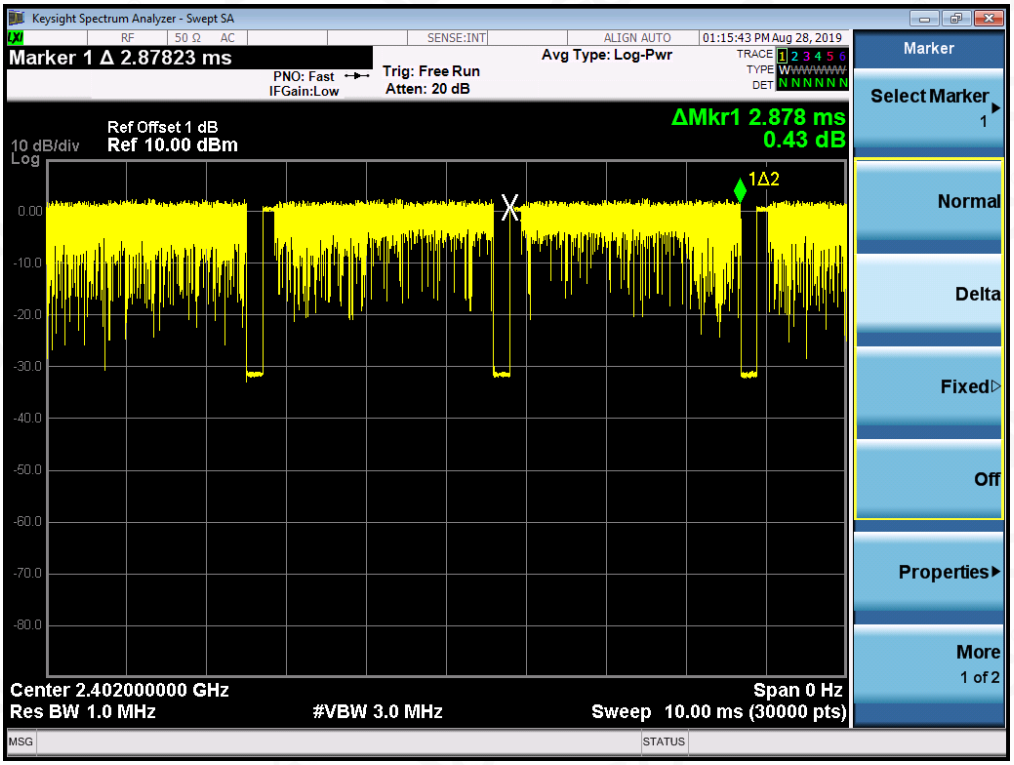
The same as described in section 6

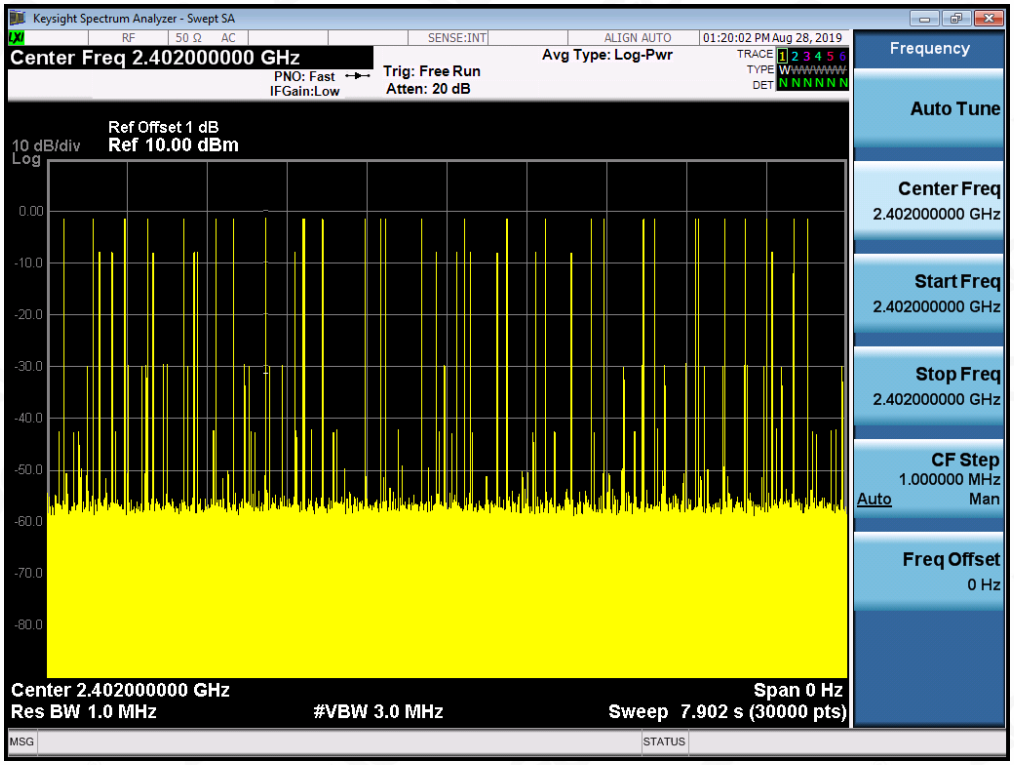
12.4. LIMITS AND MEASUREMENT RESULT

Channel	Time of Pulse for DH5 (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)
Low	2.878	28*4	322.34	400
Middle	2.879	30*4	345.48	400
High	2.874	29*4	333.38	400

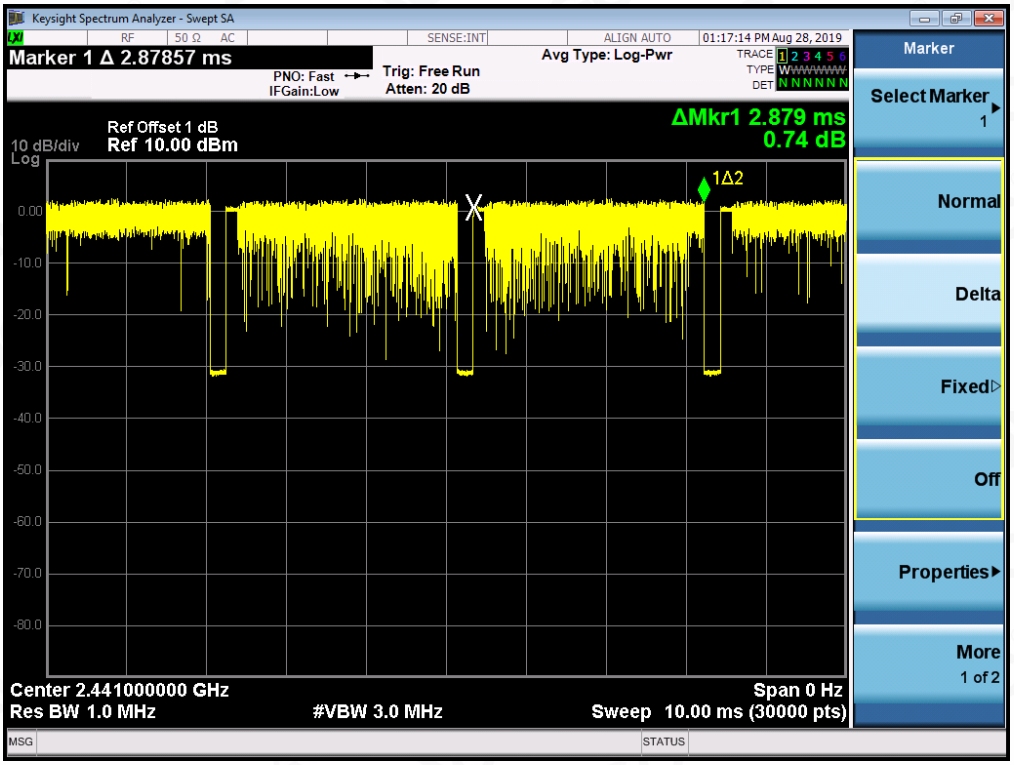
Note: The 8-DPSK modulation is the worst case and recorded in the report.

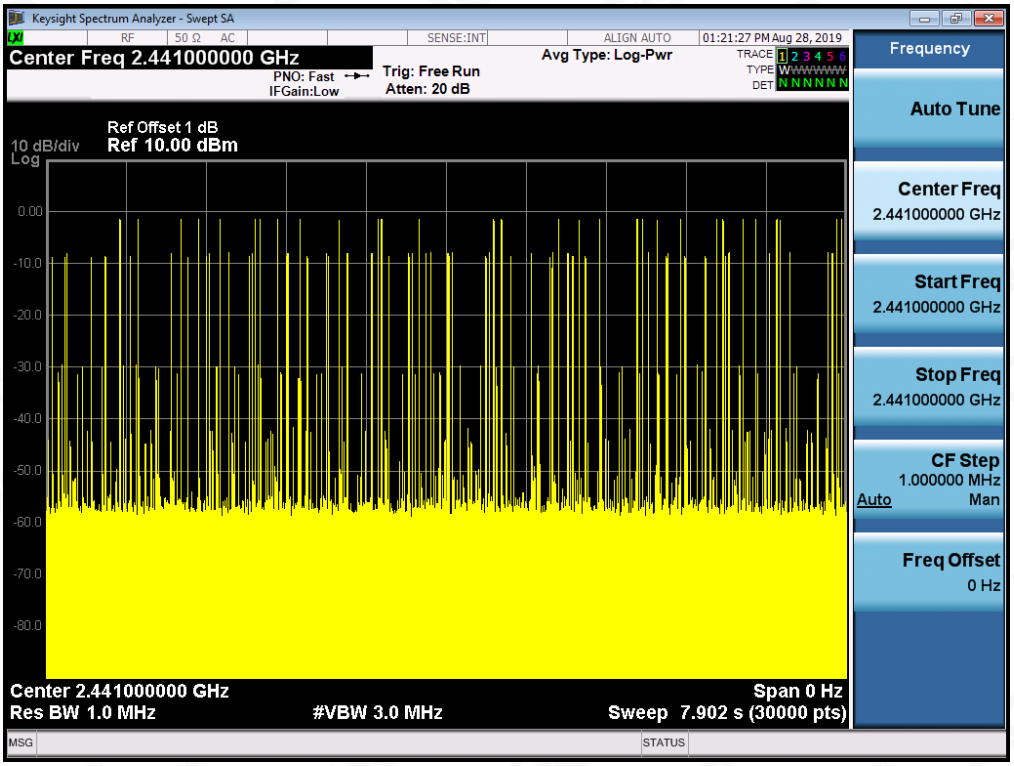
TEST PLOT OF LOW CHANNEL



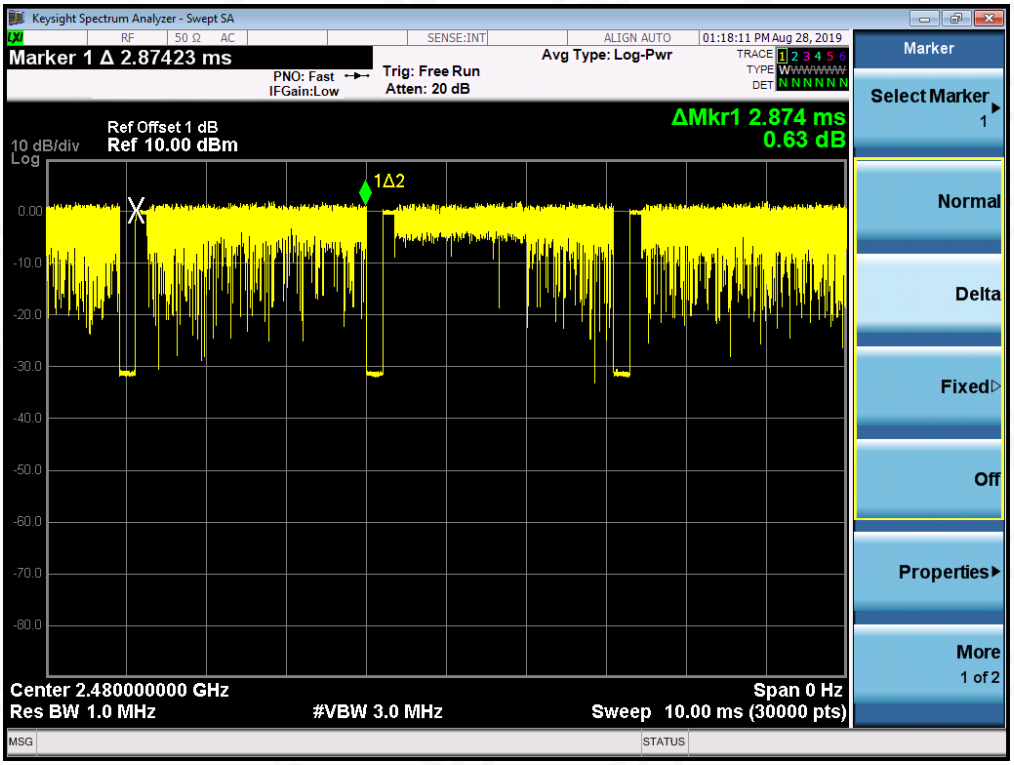


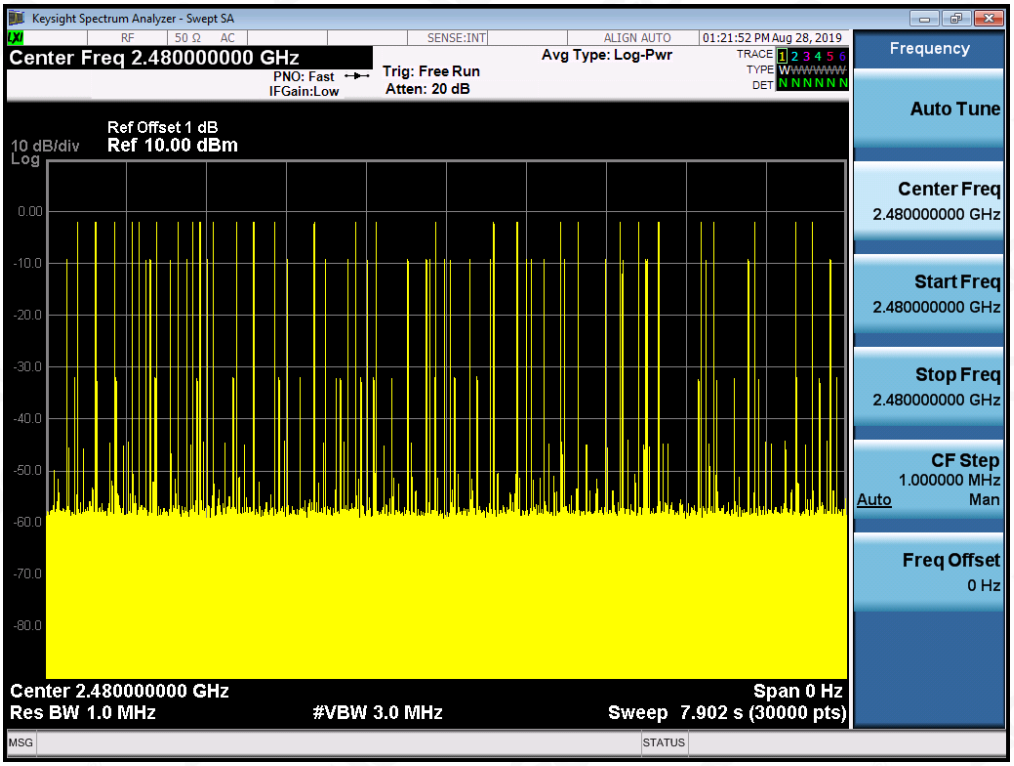
TEST PLOT OF MIDDLE CHANNEL





TEST PLOT OF HIGH CHANNEL





13. FREQUENCY SEPARATION

13.1. MEASUREMENT PROCEDURE

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

1. Span: Wide enough to capture the peaks of two adjacent channels.
2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. Video (or average) bandwidth (VBW) ≥ RBW.
4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 6.2

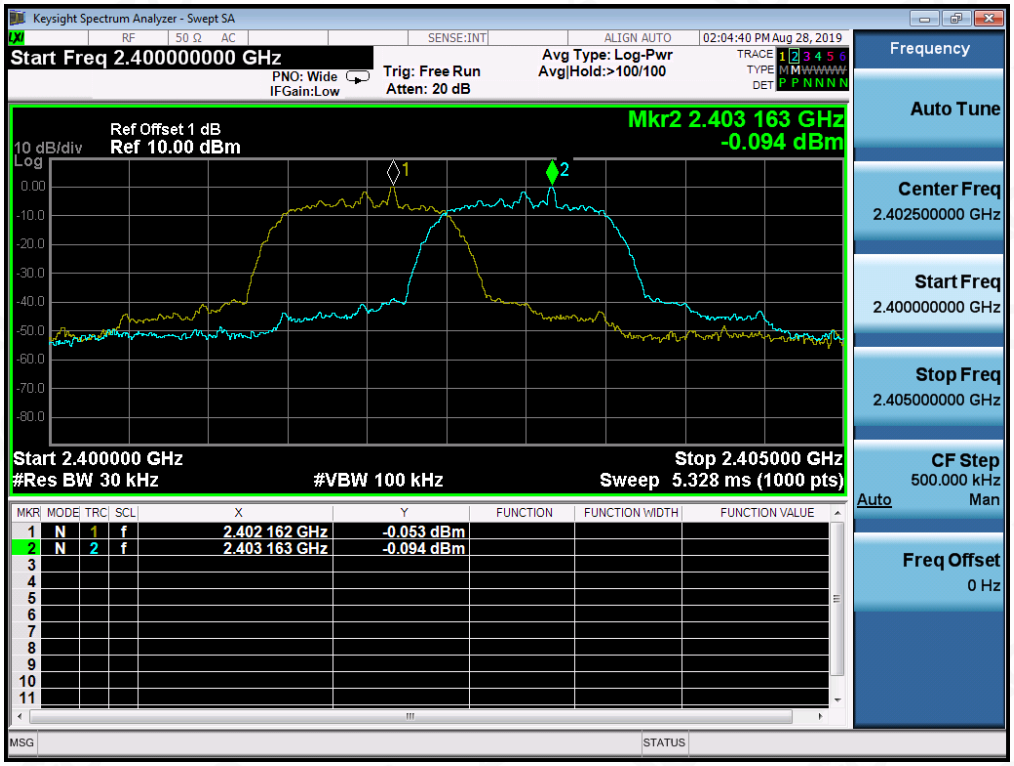
13.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.3

13.4. LIMITS AND MEASUREMENT RESULT

CHANNEL	CHANNEL SEPARATION	LIMIT	RESULT
	KHz	KHz	Pass
CH01-CH02	1001	>=25 KHz or 2/3 20 dB BW	

TEST PLOT FOR FREQUENCY SEPARATION



Note: The 8-DPSK modulation is the worst case and recorded in the report.

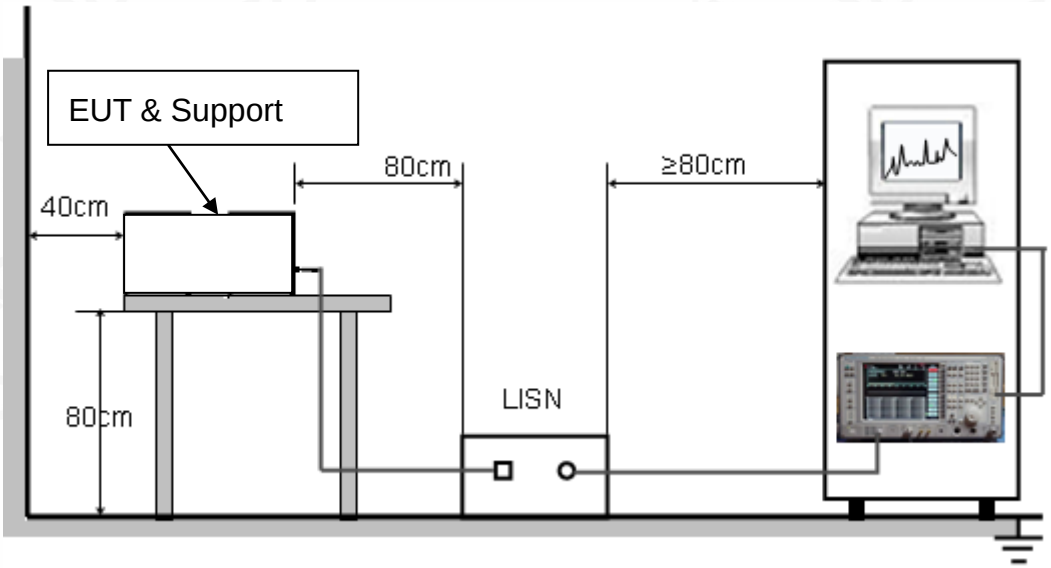
14. FCC LINE CONDUCTED EMISSION TEST

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 5V power from adapter which received AC120V/60Hz power from 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.

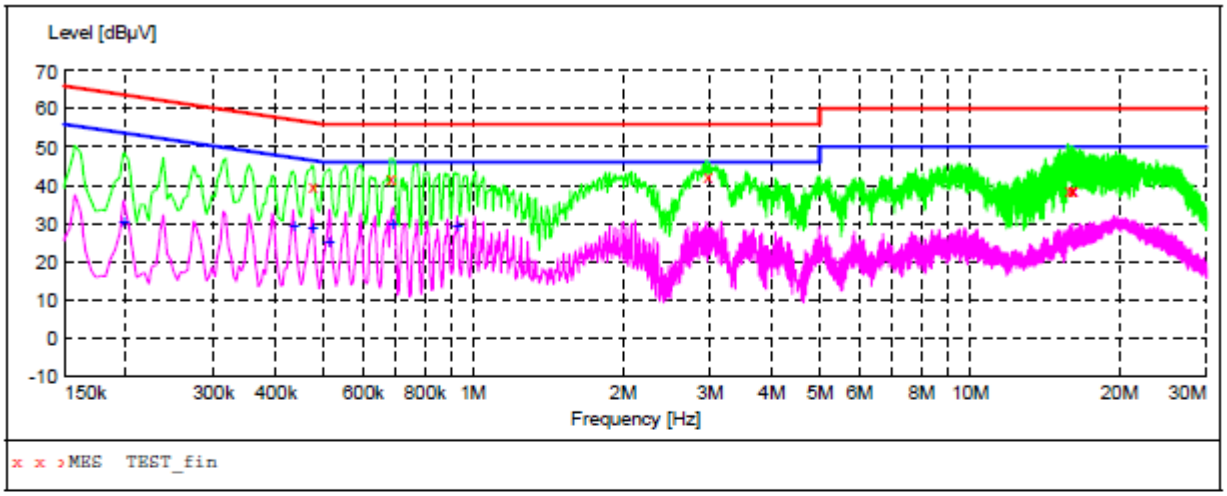
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

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"

8/22/2019 7:36PM

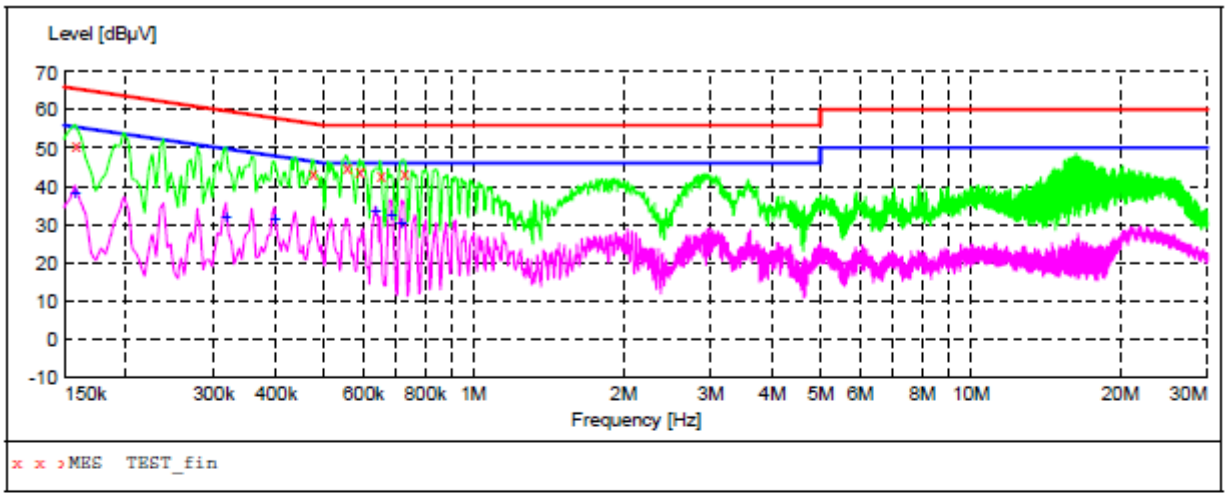
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.474000	40.00	11.0	56	16.4	QP	L1	FLO
0.682000	41.80	10.4	56	14.2	QP	L1	FLO
2.958000	42.40	11.5	56	13.6	QP	L1	FLO
15.774000	38.70	12.2	60	21.3	QP	L1	FLO
16.042000	38.90	12.2	60	21.1	QP	L1	FLO
16.078000	38.90	12.2	60	21.1	QP	L1	FLO

MEASUREMENT RESULT: "TEST_fin2"

8/22/2019 7:39PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.198000	30.20	10.9	54	23.5	AV	L1	FLO
0.434000	29.30	10.6	47	17.9	AV	L1	FLO
0.474000	28.80	11.0	46	17.6	AV	L1	FLO
0.514000	25.10	11.1	46	20.9	AV	L1	FLO
0.690000	29.70	10.4	46	16.3	AV	L1	FLO
0.930000	29.30	11.2	46	16.7	AV	L1	FLO

Line Conducted Emission Test Line 2-N



MEASUREMENT RESULT: "TEST_fin"

8/22/2019 7:32PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	50.70	10.8	66	14.9	QP	N	FLO
0.474000	43.30	11.0	56	13.1	QP	N	FLO
0.554000	45.10	10.9	56	10.9	QP	N	FLO
0.590000	44.20	10.8	56	11.8	QP	N	FLO
0.650000	42.80	10.5	56	13.2	QP	N	FLO
0.722000	43.60	10.4	56	12.4	QP	N	FLO

MEASUREMENT RESULT: "TEST_fin2"

8/22/2019 7:32PM

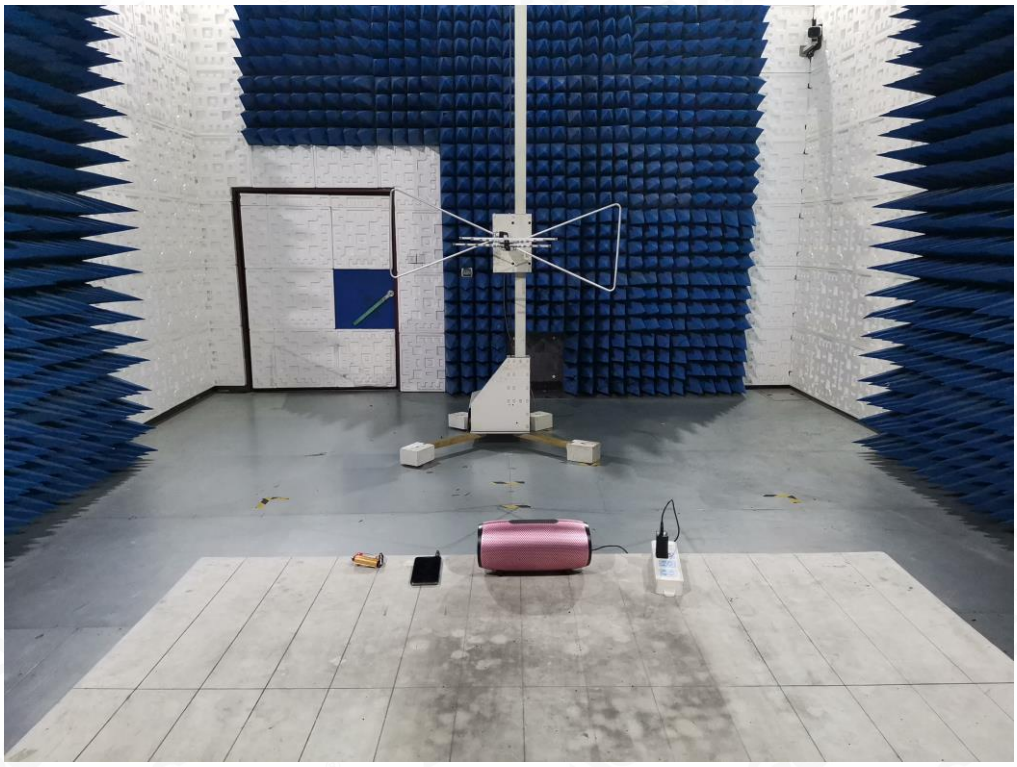
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	38.40	10.8	56	17.2	AV	N	FLO
0.318000	32.20	10.8	50	17.6	AV	N	FLO
0.398000	31.30	10.3	48	16.6	AV	N	FLO
0.634000	33.50	10.6	46	12.5	AV	N	FLO
0.686000	32.60	10.4	46	13.4	AV	N	FLO
0.718000	30.50	10.4	46	15.5	AV	N	FLO

RESULT: PASS

Note: All the test modes had been tested, the mode 1 was the worst case. Only the data of the worst case would be record in this test report.

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST SETUP BELOW 1GHZ

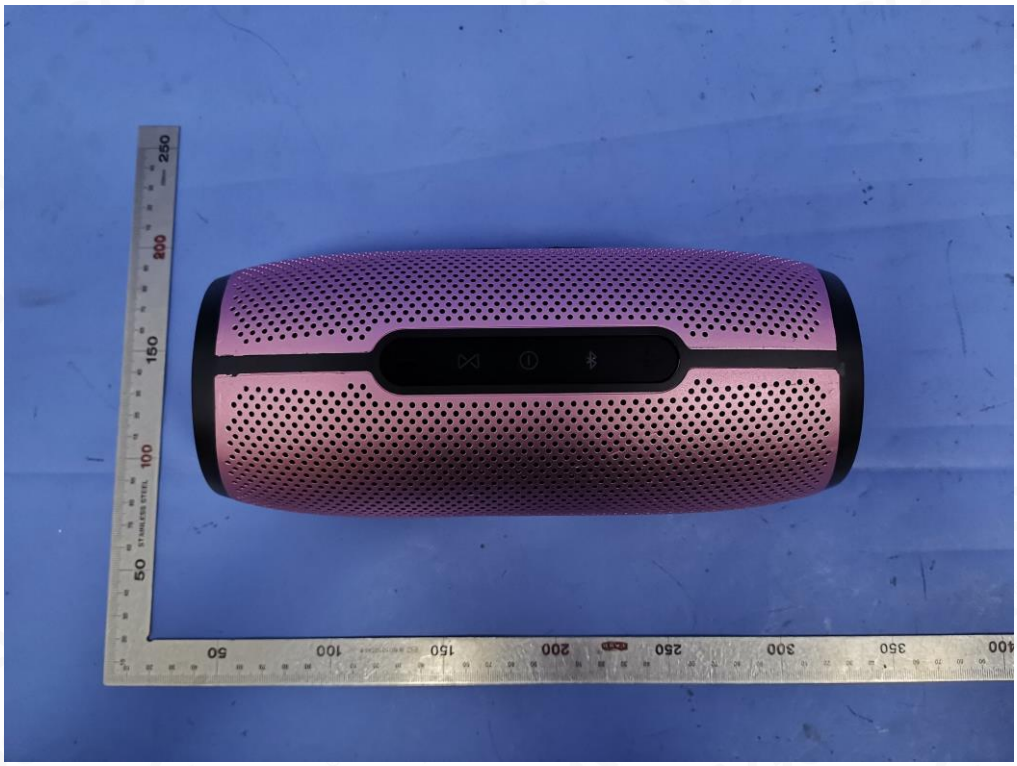


RADIATED EMISSION TEST SETUP ABOVE 1GHZ

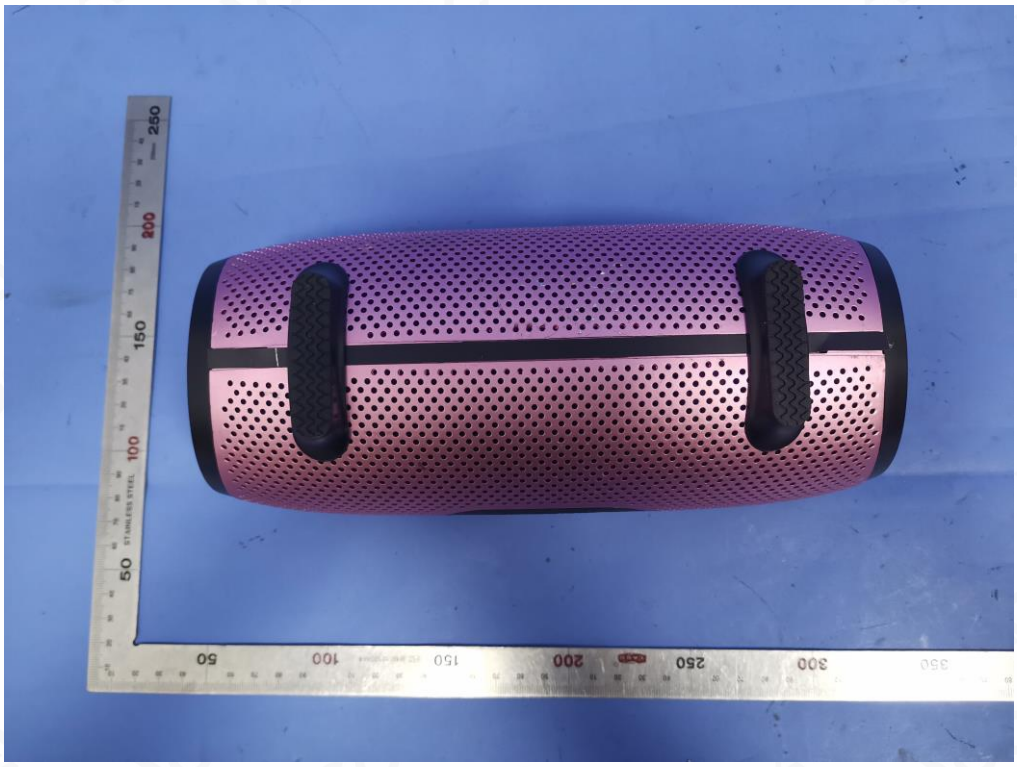
CONDUCTED EMISSION TEST SETUP

APPENDIX B: PHOTOGRAPHS OF EUT

TOP VIEW OF EUT

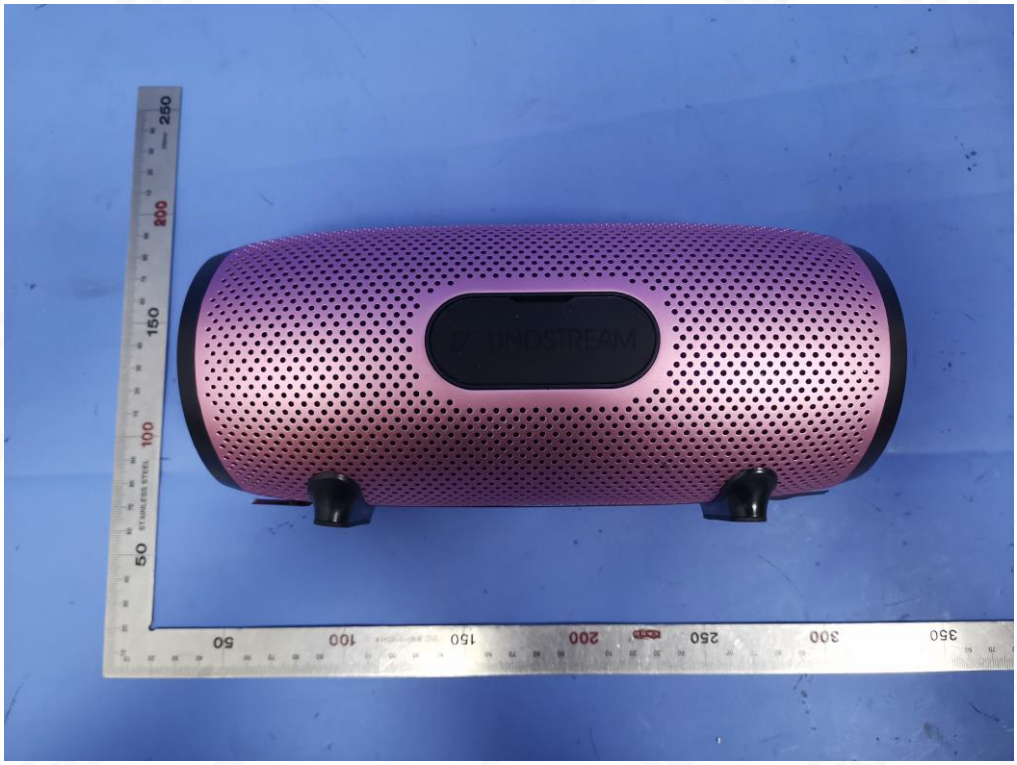


BOTTOM VIEW OF EUT

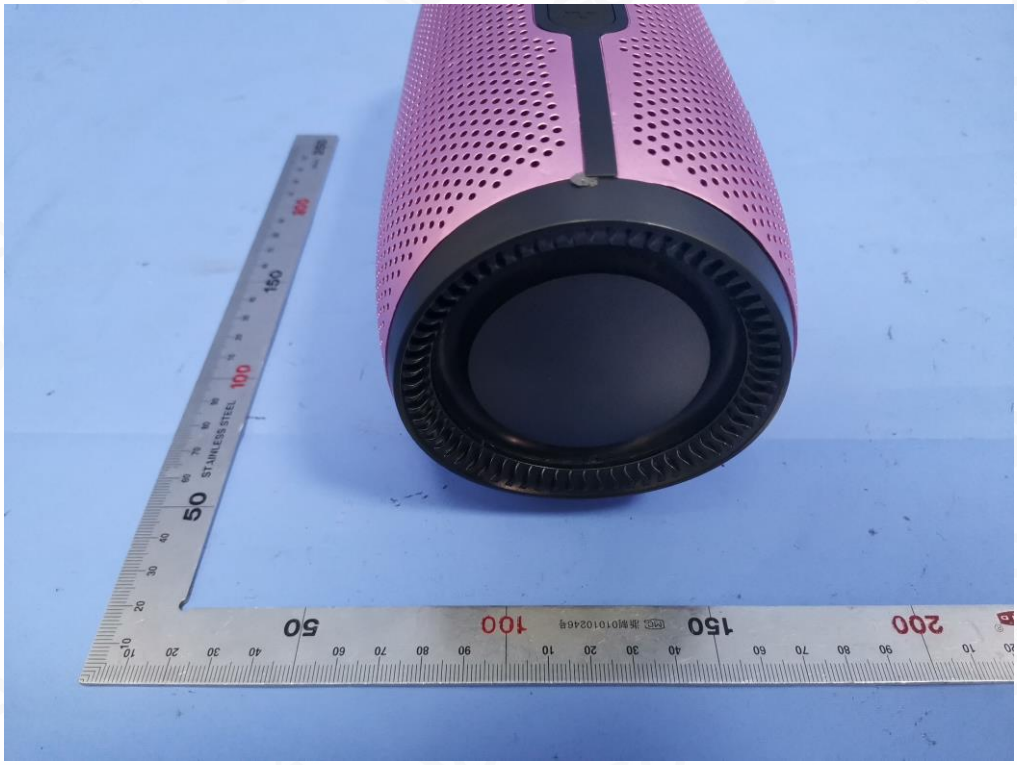


FRONT VIEW OF EUT

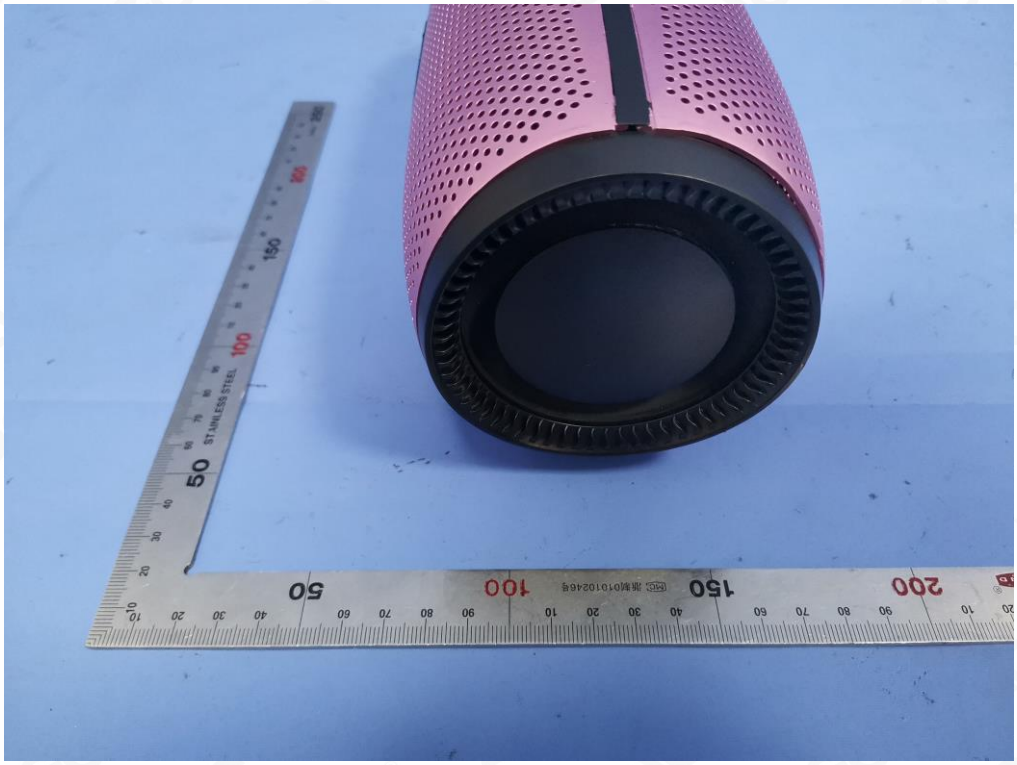
BACK VIEW OF EUT



LEFT VIEW OF EUT

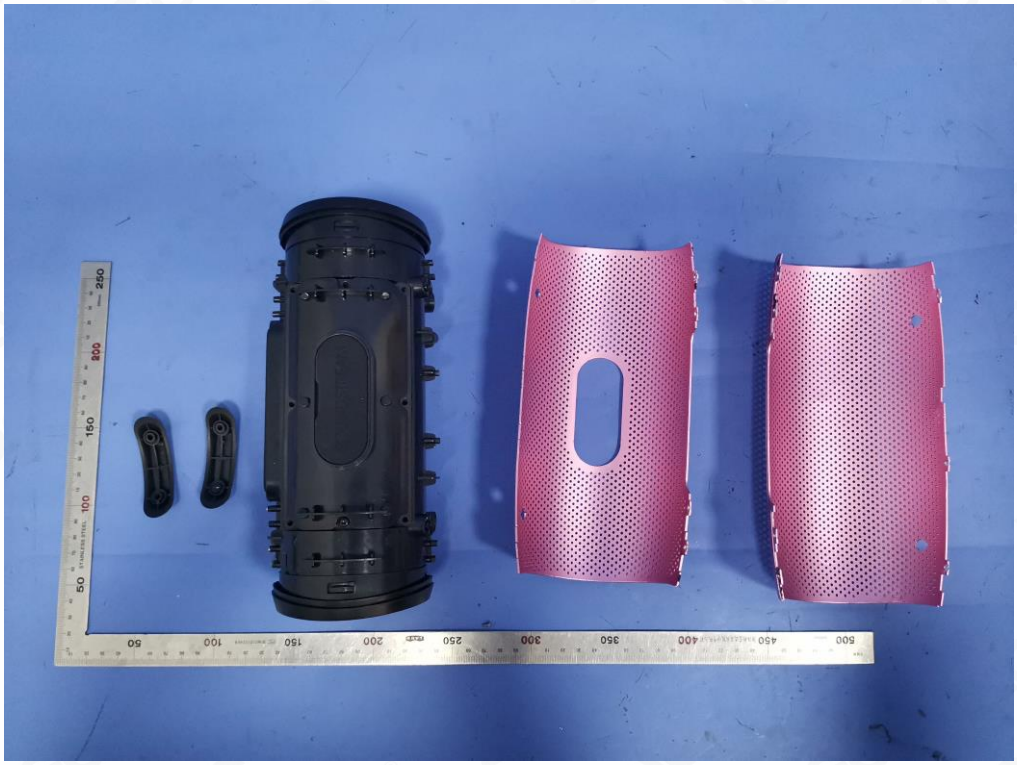


RIGHT VIEW OF EUT

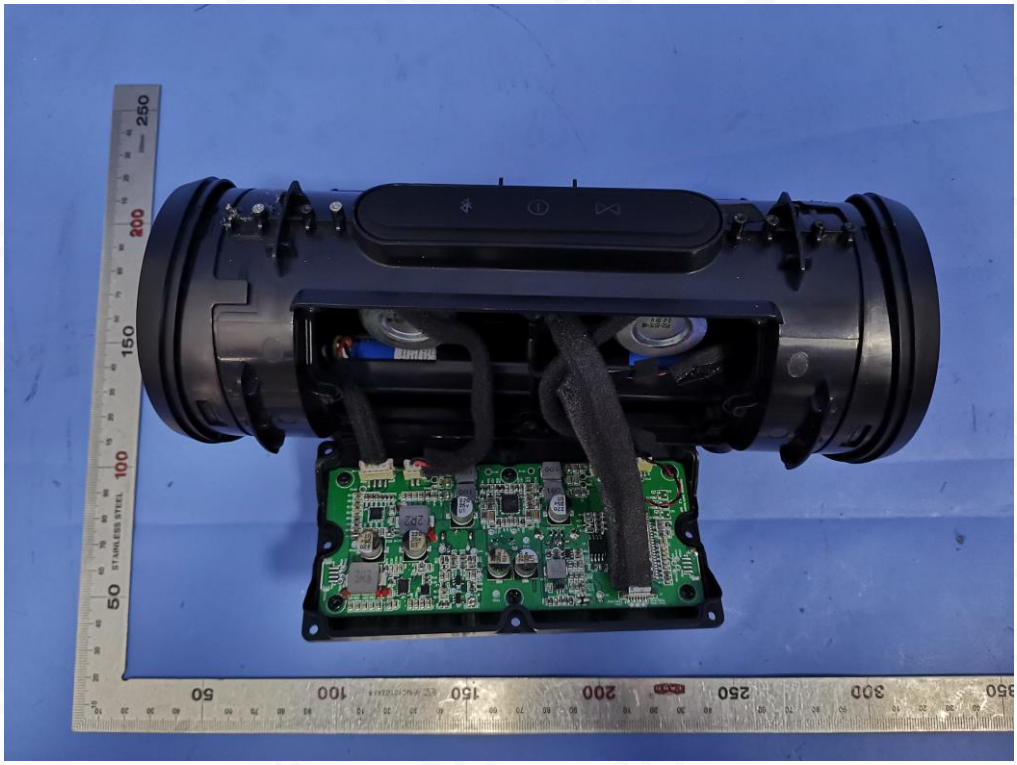


VIEW OF EUT(PORT)

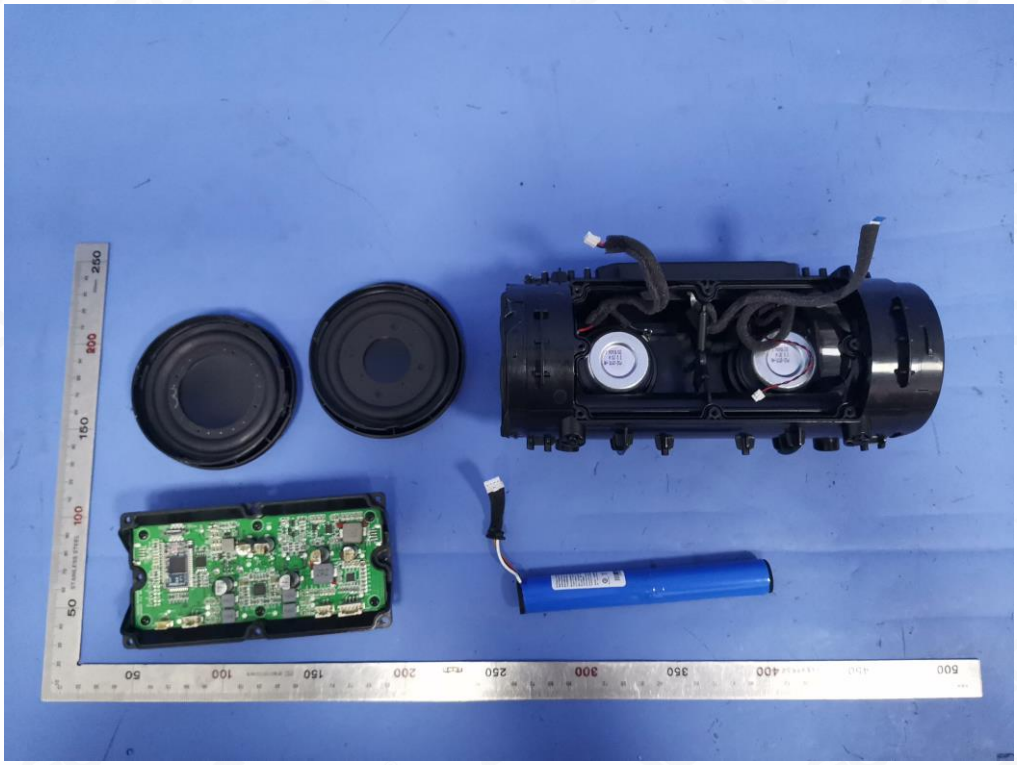
OPEN VIEW OF EUT-1



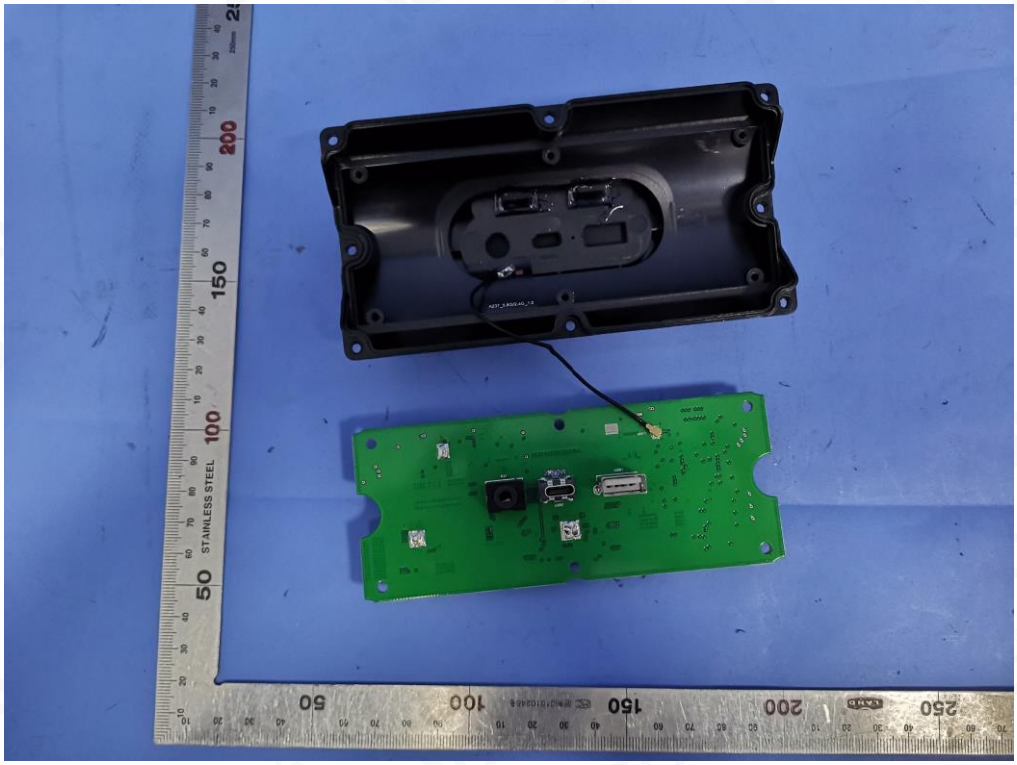
OPEN VIEW OF EUT-2



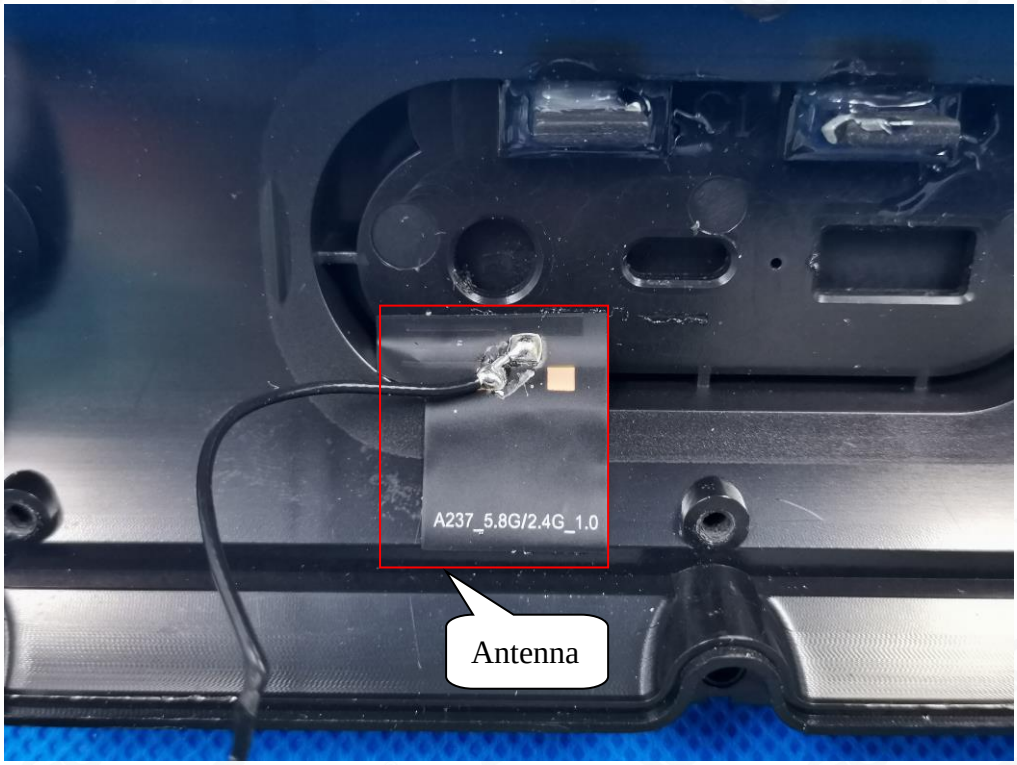
OPEN VIEW OF EUT-3



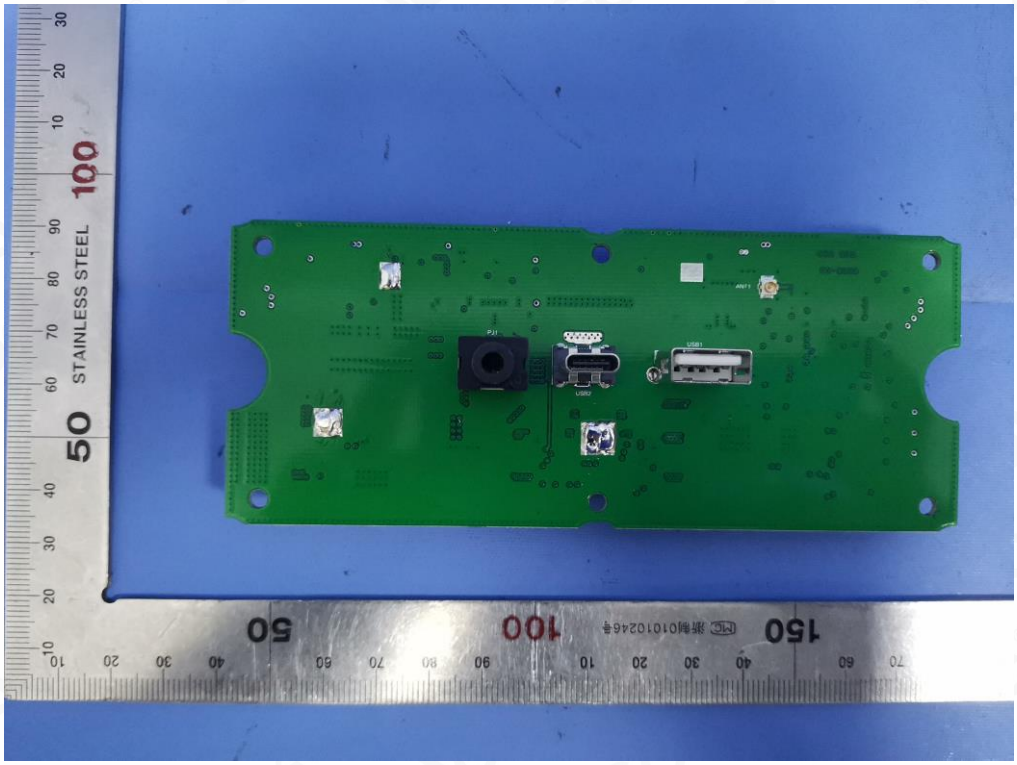
OPEN VIEW OF EUT-4



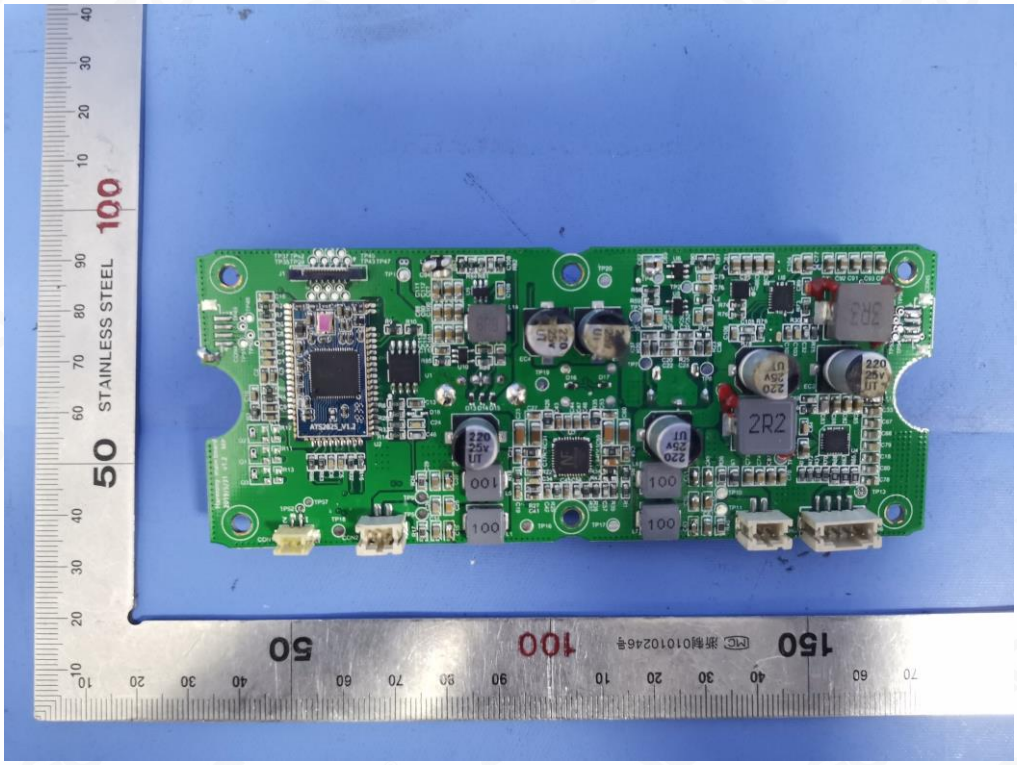
OPEN VIEW OF EUT-5



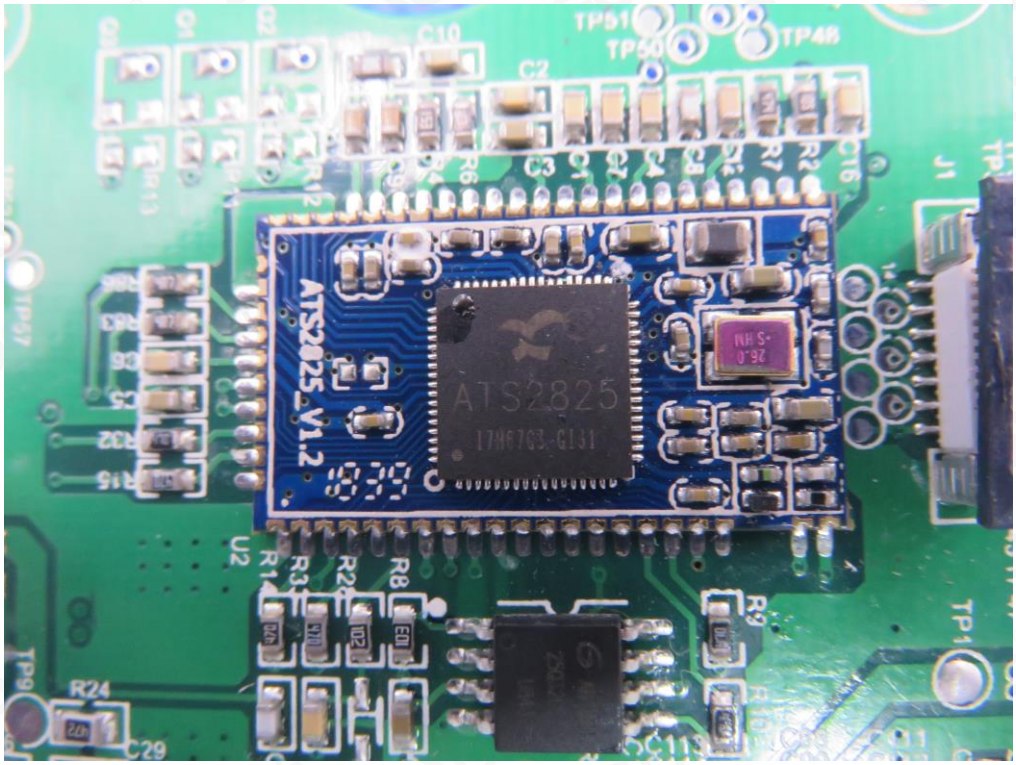
INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



INTERNAL VIEW OF EUT-3



VIEW OF BATTERY-1

VIEW OF BATTERY-2

----END OF REPORT----