RADIO PERFORMANCE TEST REPORT

Test Report No. : **OT-239-RWD-028**

Reception No. : **2309002924**

Applicant : **BLUECOM Co., Ltd**

Address : **116, Venture-ro, Yeonsu-gu, Incheon, Korea**

Manufacturer : **BLUECOM Co., Ltd**

Address : **116, Venture-ro, Yeonsu-gu, Incheon, Korea**

Type of Equipment : **Bluetooth NeckBand Headset**

FCC ID. : **U3WFLEX800**

Model Name : **FLEX800**

Multiple Model Name : **N/A**

Serial number : **N/A**

Total page of Report : **35 pages (including this page)**

Date of Incoming : **September 11, 2023**

Date of issue : **September 22, 2023**

SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247***

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.

Tested by	Reviewed by	Approved by
Yun-Bok, Wi / Prj. Engineer	Tae-Ho, Kim / Chief Engineer	Jae-Ho Lee / Chief Engineer
ONETECH Corp.	ONETECH Corp.	ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

CONTENTS

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-239-RWD-028	September 22, 2023	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

Applicant : BLUECOM Co., Ltd

Address : 116, Venture-ro, Yeonsu-gu, Incheon, Korea

FCC ID : U3WFLEX800

Model Name : FLEX800

Brand Name : -

Serial Number : N/A

Date : September 22, 2023

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	Bluetooth NeckBand Headset
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 KDB 558074 D01 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (1)	Carrier Frequency Separation	Met the Limit / PASS
15.247 (a) (1) (iii)	Minimum Number of Hopping Channels	Met the Limit / PASS
15.247 (a) (1) (iii)	Average Time of Occupancy	Met the Limit / PASS
15.247 (b) (1)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	N/A (See Note)
15.203	Antenna Requirement	Met requirement / PASS

Note: This test is not performed because the EUT is operated by DC battery.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The BLUECOM Co., Ltd, Model FLEX800 (referred to as the EUT in this report) is a Bluetooth NeckBand Headset. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Bluetooth NeckBand Headset		
OPERATING FREQUENCY	Bluetooth	2 402 MHz ~ 2 480 MHz	
	Bluetooth LE	2 402 MHz ~ 2 480 MHz	
MODULATION TYPE	Bluetooth	GFSK for 1 Mbps, π/4-DQPSK for 2 Mbps, 8-DPSK for 3 Mbps	
	Bluetooth LE	GFSK for 1 Mbps, 2 Mbps	
RF OUTPUT POWER	Bluetooth	1 Mbps	0.18 dBm
		2 Mbps	2.23 dBm
		3 Mbps	2.74 dBm
	Bluetooth LE	1 Mbps	0.13 dBm
		2 Mbps	0.43 dBm
ANTENNA TYPE	PCB Antenna		
ANTENNA GAIN	1.34 dBi		
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	40 MHz		
RATED SUPPLY VOLTAGE	DC 3.7 V		

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

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5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	BLUECOM Co., Ltd	N/A	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
FLEX800	BLUECOM Co., Ltd	Bluetooth NeckBand Headset (EUT)	-
HP ProBook 450 G7	HP	Notebook PC	EUT

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5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 2 402 MHz, 2 441 MHz, and 2 480 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this report.

-. Channel List (Bluetooth)

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
0	2 402.00	27	2 429.00	54	2 456.00
1	2 403.00	28	2 430.00	55	2 457.00
2	2 404.00	29	2 431.00	56	2 458.00
3	2 405.00	30	2 432.00	57	2 459.00
4	2 406.00	31	2 433.00	58	2 460.00
5	2 407.00	32	2 434.00	59	2 461.00
6	2 408.00	33	2 435.00	60	2 462.00
7	2 409.00	34	2 436.00	61	2 463.00
8	2 410.00	35	2 437.00	62	2 464.00
9	2 411.00	36	2 438.00	63	2 465.00
10	2 412.00	37	2 439.00	64	2 466.00
11	2 413.00	38	2 440.00	65	2 467.00
12	2 414.00	39	2 441.00	66	2 468.00
13	2 415.00	40	2 442.00	67	2 469.00
14	2 416.00	41	2 443.00	68	2 470.00
15	2 417.00	42	2 444.00	69	2 471.00
16	2 418.00	43	2 445.00	70	2 472.00
17	2 419.00	44	2 446.00	71	2 473.00
18	2 420.00	45	2 447.00	72	2 474.00
19	2 421.00	46	2 448.00	73	2 475.00
20	2 422.00	47	2 449.00	74	2 476.00
21	2 423.00	48	2 450.00	75	2 477.00
22	2 424.00	49	2 451.00	76	2 478.00
23	2 425.00	50	2 452.00	77	2 479.00
24	2 426.00	51	2 453.00	78	2 480.00
25	2 427.00	52	2 454.00		
26	2 428.00	53	2 455.00		

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-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
Bluetooth [1 Mbps]	2.895	0.835	77.61	1.10
Bluetooth [2 Mbps]	2.870	0.860	76.94	1.14
Bluetooth [3 Mbps]	2.870	0.860	76.94	1.14

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Correction Factor : 10 * Log(1 / (Duty Cycle / 100))

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5.4 Configuration of Test System

Line Conducted Test: It is not need to test this requirement, because the EUT shall be operated by DC Battery.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The PCB Antenna is located on the main board of EUT and the PCB antenna is connected to the outside of the EUT by a special connector type, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied by DC Battery.	

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. MINIMUM 20 dB BANDWIDTH

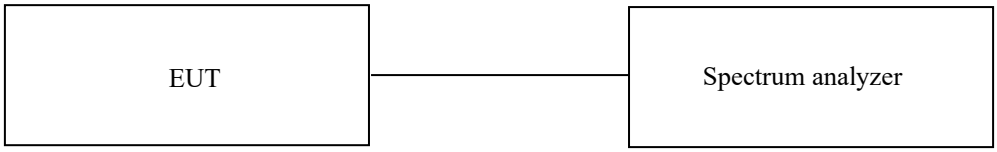
7.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 1 % to 5 % of the OBW, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



7.3 Test Date

September 14, 2023 ~ September 20, 2023

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7.4 Test data for 1 Mbps

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	1 113.90
Middle	2 441.00	1 108.90
High	2 480.00	1 108.90

7.5 Test data for 2 Mbps

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	1 113.90
Middle	2 441.00	1 108.90
High	2 480.00	1 108.90

7.6 Test data for 3 Mbps

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	1 373.60
Middle	2 441.00	1 368.60
High	2 480.00	13 73.60

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8. HOPPING FREQUENCY SEPARATION

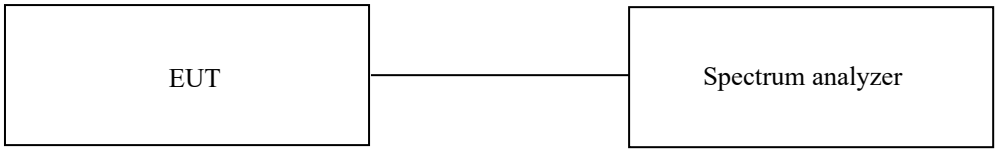
8.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 5 MHz. The analyzer is set to peak hold then a pseudo-random hopping sequence of the transmitter is captured. The mark delta function was used to measure the frequency separation between two adjacent hopping channels.



8.3 Test Date

September 14, 2023 ~ September 20, 2023

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8.4 Test data for 1 Mbps

-. Test Result : Pass

MEASURED VALUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1009.00	739.27	Separated by a minimum of 739.27 kHz

8.5 Test data for 2 Mbps

-. Test Result : Pass

MEASURED VALUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1004.00	909.07	Separated by a minimum of 909.07 kHz

8.6 Test data for 3 Mbps

-. Test Result : Pass

MEASURED VALUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
984.00	912.40	Separated by a minimum of 912.40 kHz

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9. NUMBER OF HOPPING CHANNELS

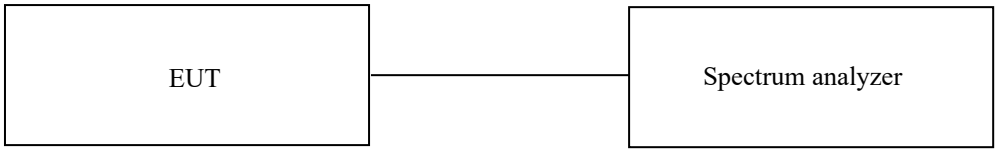
9.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

9.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 100 kHz and the resolution bandwidth is set to 300 kHz. The analyzer is set to peak hold and then complete pseudo-random hopping sequence of the transmitter is captured.



9.3 Test Date

September 14, 2023 ~ September 20, 2023

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9.4 Test data for 1 Mbps

-. Test Result : Pass

Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
1 Mbps	79	Minimum of 15	64

9.5 Test data for 2 Mbps

-. Test Result : Pass

Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
2 Mbps	79	Minimum of 15	64

9.6 Test data for 3 Mbps

-. Test Result : Pass

Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
3 Mbps	79	Minimum of 15	64

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10. TIME OF OCCUPANCY

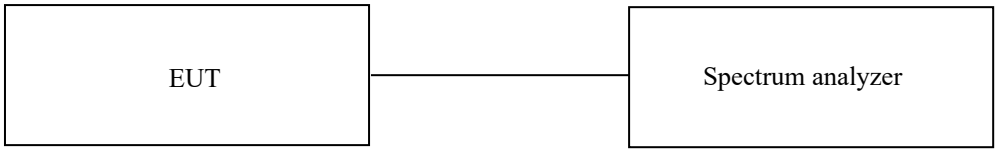
10.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The transmitter is set to operate in its normal frequency hopping mode. The center frequency of the spectrum analyzer is set to one of hopping channels near the center of the operating band and span is set to zero Hz. The sweep time is set to display one complete pulse. The mark delta function is used to measure the duration of the pulses.



10.3 Test Date

September 14, 2023 ~ September 20, 2023

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10.4 Test data for 1 Mbps

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625 μs with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second (= 1 600/2/79) for DH1, and 5.06 times (= 1 600/4/79) for DH3, and 3.38 times (= 1 600/6/79) for DH5.

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.38	10.13	31.60	121.64	400.00	PASS
DH3	1.64	5.06	31.60	262.23	400.00	
DH5	2.90	3.38	31.60	309.21	400.00	

Total dwell time is calculated as following.

Total Dwell Time = Pulse time * Hops per second with channels * period time

Remark: See next page for an overview sweep performed with peak detector.

10.5 Test data for 2 Mbps

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625 μs with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second (= 1 600/2/79) for DH1, and 5.06 times (= 1 600/4/79) for DH3, and 3.38 times (= 1 600/6/79) for DH5.

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.39	10.13	31.60	124.84	400.00	PASS
DH3	1.64	5.06	31.60	262.23	400.00	
DH5	2.87	3.38	31.60	306.54	400.00	

Total dwell time is calculated as following.

Total Dwell Time = Pulse time * Hops per second with channels * period time

Remark: See next page for an overview sweep performed with peak detector.

10.6 Test data for 3 Mbps

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625 μs with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second (= 1 600/2/79) for DH1, and 5.06 times (= 1 600/4/79) for DH3, and 3.38 times (= 1 600/6/79) for DH5.

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.39	10.13	31.60	124.84	400.00	PASS
DH3	1.64	5.06	31.60	262.23	400.00	
DH5	2.87	3.38	31.60	306.54	400.00	

Total dwell time is calculated as following.

Total Dwell Time = Pulse time * Hops per second with channels * period time

Remark: See next page for an overview sweep performed with peak detector.

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11. MAXIMUM PEAK OUTPUT POWER

11.1 Operating environment

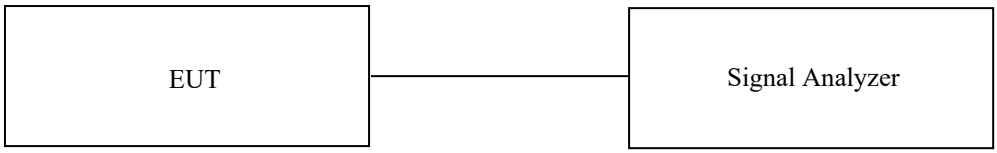
Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

11.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to ≥ DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.



11.3 Test Date

June 19, 2023 ~ July 05, 2023

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11.4 Test data for 1 Mbps

-. Test Result : Pass

-. Duty Cycle : 100 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	0.17	21.00	20.83
MIDDLE	2 441.00	0.29	21.00	20.71
HIGH	2 480.00	-0.03	21.00	21.03

Remark. Margin = Limit –Measured Value

11.5 Test data for 2 Mbps

-. Test Result : Pass

-. Duty Cycle : 100 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	1.88	21.00	19.12
MIDDLE	2 441.00	2.23	21.00	18.77
HIGH	2 480.00	2.11	21.00	18.89

Remark. Margin = Limit –Measured Value

11.6 Test data for 3 Mbps

-. Test Result : Pass

-. Duty Cycle : 100 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	2.62	21.00	18.38
MIDDLE	2 441.00	2.74	21.00	18.26
HIGH	2 480.00	2.42	21.00	18.58

Remark. Margin = Limit –Measured Value

12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

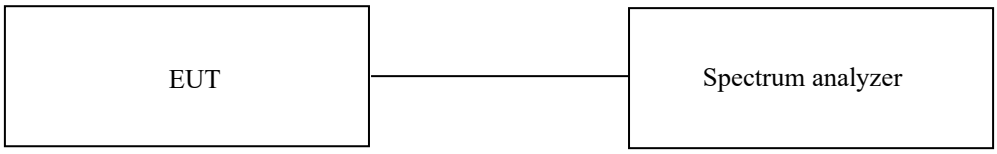
12.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

12.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz and video bandwidth is set to 300 kHz, and peak detection was used.



12.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

12.4 Test Date

September 14, 2023 ~ September 20, 2023

12.5 Test data for conducted emission

For Test data for conducted emission, Please refer to the annex.

12.6 Test data for Transmitting mode radiated emission

12.6.1 Radiated Emission which fall in the Restricted Band

12.6.1.1 Test data for 1 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 77.61 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	ATT (dB)	Duty Factor (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel											
2362.89	53.12	Peak	H	27.57	6.76	42.55	6.11	-	51.01	74.00	22.99
2324.20	41.48	Average	H	27.75	6.73	42.57	6.12	1.11	40.62	54.00	13.38
2325.49	53.06	Peak	V	27.75	6.70	42.57	6.11	-	51.05	74.00	22.95
2324.94	41.40	Average	V	27.75	6.73	42.57	6.12	1.11	40.54	54.00	13.46
Test Data for High Channel											
2493.60	53.41	Peak	H	27.51	7.07	42.50	6.11	-	51.60	74.00	22.40
2488.12	41.93	Average	H	27.52	7.07	42.50	6.11	1.11	41.24	54.00	12.76
2496.53	54.33	Peak	V	27.51	6.99	42.50	6.11	-	52.44	74.00	21.56
2484.31	42.16	Average	V	27.53	6.98	42.51	6.13	1.11	41.40	54.00	12.60

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + ATT + Duty Factor

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12.6.1.2 Test data for 2 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 76.94 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	ATT (dB)	Duty Factor (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel											
2338.54	53.28	Peak	H	27.67	6.72	42.56	6.09	-	51.20	74.00	22.80
2387.98	41.46	Average	H	27.52	7.04	42.54	6.11	1.14	40.73	54.00	13.27
2325.40	53.22	Peak	V	27.75	6.70	42.57	6.11	-	51.21	74.00	22.79
2385.69	41.59	Average	V	27.53	7.04	42.55	6.11	1.14	40.86	54.00	13.14
Test Data for High Channel											
2484.29	53.64	Peak	H	27.53	6.98	42.51	6.13	-	51.77	74.00	22.23
2484.35	42.02	Average	H	27.53	6.98	42.51	6.13	1.14	41.29	54.00	12.71
2490.32	53.93	Peak	V	27.52	7.07	42.50	6.11	-	52.13	74.00	21.87
2487.38	41.90	Average	V	27.53	7.07	42.51	6.11	1.14	41.24	54.00	12.76

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + ATT + Duty Factor

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12.6.1.3 Test data for 3 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 76.94 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	ATT (dB)	Duty Factor (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel											
2342.21	53.14	Peak	H	27.65	6.72	42.56	6.09	-	51.04	74.00	22.96
2338.35	41.53	Average	H	27.67	6.72	42.56	6.09	1.14	40.59	54.00	13.41
2331.92	53.07	Peak	V	27.71	6.70	42.57	6.11	-	51.02	74.00	22.98
2354.80	41.55	Average	V	27.59	6.69	42.56	6.09	1.14	40.50	54.00	13.50
Test Data for High Channel											
2489.14	53.89	Peak	H	27.52	7.07	42.50	6.11	-	52.09	74.00	21.91
2483.59	41.96	Average	H	27.53	6.98	42.51	6.13	1.14	41.23	54.00	12.77
2494.02	53.77	Peak	V	27.51	7.07	42.50	6.11	-	51.96	74.00	22.04
2489.18	42.00	Average	V	27.52	7.07	42.50	6.11	1.14	41.34	54.00	12.66

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + ATT + Duty Factor

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12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz

12.6.2.1 Test data for 1 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 77.61 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	Duty Factor (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
4 804.000	49.84	Peak	H	31.20	10.40	41.84	-	49.60	74.00	24.40
4 804.000	37.71	Average	H	31.20	10.40	41.84	1.11	38.58	54.00	15.42
4 804.000	49.26	Peak	V	31.20	10.40	41.84	-	49.02	74.00	24.98
4 804.000	37.57	Average	V	31.22	10.40	41.84	1.11	38.46	54.00	15.54
Test Data for Middle Channel										
4 884.000	49.31	Peak	H	31.30	10.31	41.82	-	49.10	74.00	24.90
4 884.000	37.50	Average	H	31.30	10.31	41.82	1.11	38.40	54.00	15.60
4 884.000	49.07	Peak	V	31.30	10.31	41.82	-	48.86	74.00	25.14
4 884.000	37.40	Average	V	31.30	10.31	41.82	1.11	38.30	54.00	15.70
Test Data for High Channel										
4 960.000	48.91	Peak	H	31.22	10.41	41.81	-	48.73	74.00	25.27
4 960.000	37.36	Average	H	31.23	10.41	41.81	1.11	38.30	54.00	15.70
4 960.000	49.41	Peak	V	31.23	10.41	41.81	-	49.24	74.00	24.76
4 960.000	37.40	Average	V	31.24	10.41	41.81	1.11	38.35	54.00	15.65

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Duty Factor

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12.6.2.2 Test data for 2 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 76.94 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	Duty Factor (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
4 804.000	49.50	Peak	H	31.21	10.40	41.84	-	49.27	74.00	24.73
4 804.000	37.84	Average	H	31.21	10.40	41.84	1.14	38.75	54.00	15.25
4 804.000	48.97	Peak	V	31.21	10.40	41.84	-	48.74	74.00	25.26
4 804.000	37.82	Average	V	31.20	10.40	41.84	1.14	38.72	54.00	15.28
Test Data for Middle Channel										
4 884.000	49.63	Peak	H	31.30	10.31	41.82	-	49.42	74.00	24.58
4 884.000	37.36	Average	H	31.30	10.31	41.82	1.14	38.29	54.00	15.71
4 884.000	49.19	Peak	V	31.30	10.31	41.82	-	48.98	74.00	25.02
4 884.000	37.51	Average	V	31.30	10.31	41.82	1.14	38.44	54.00	15.56
Test Data for High Channel										
4 960.000	49.17	Peak	H	31.20	10.41	41.81	-	48.97	74.00	25.03
4 960.000	37.44	Average	H	31.24	10.41	41.81	1.14	38.42	54.00	15.58
4 960.000	49.26	Peak	V	31.22	10.41	41.81	-	49.08	74.00	24.92
4 960.000	37.46	Average	V	31.21	10.41	41.81	1.14	38.41	54.00	15.59

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Duty Factor

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12.6.2.3 Test data for 3 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 76.94 %

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel										
4 804.000	49.47	Peak	H	31.20	10.40	41.84	-	49.23	74.00	24.77
4 804.000	37.62	Average	H	31.22	10.40	41.84	1.14	38.54	54.00	15.46
4 804.000	49.43	Peak	V	31.21	10.40	41.84	-	49.20	74.00	24.80
4 804.000	37.78	Average	V	31.21	10.40	41.84	1.14	38.69	54.00	15.31
Test Data for Middle Channel										
4 884.000	48.96	Peak	H	31.30	10.45	41.83	-	48.88	74.00	25.12
4 884.000	37.53	Average	H	31.30	10.31	41.82	1.14	38.46	54.00	15.54
4 884.000	49.37	Peak	V	31.30	10.31	41.82	-	49.16	74.00	24.84
4 884.000	37.55	Average	V	31.30	10.31	41.82	1.14	38.48	54.00	15.52
Test Data for High Channel										
4 960.000	49.23	Peak	H	31.20	10.41	41.81	-	49.03	74.00	24.97
4 960.000	37.33	Average	H	31.22	10.41	41.81	1.14	38.29	54.00	15.71
4 960.000	49.12	Peak	V	31.23	10.41	41.81	-	48.95	74.00	25.05
4 960.000	37.33	Average	V	31.22	10.41	41.81	1.14	38.29	54.00	15.71

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Duty Factor

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13. RADIATED EMISSION TEST

13.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

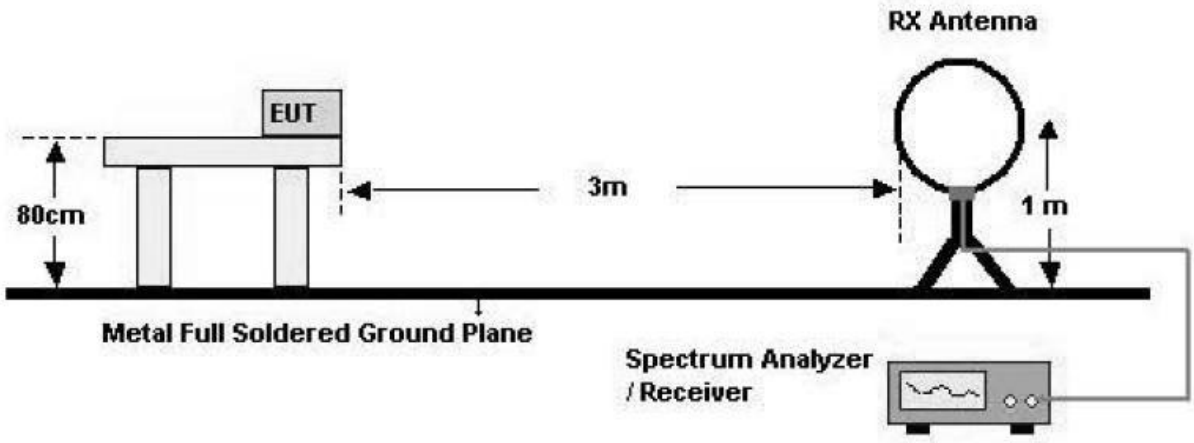
13.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

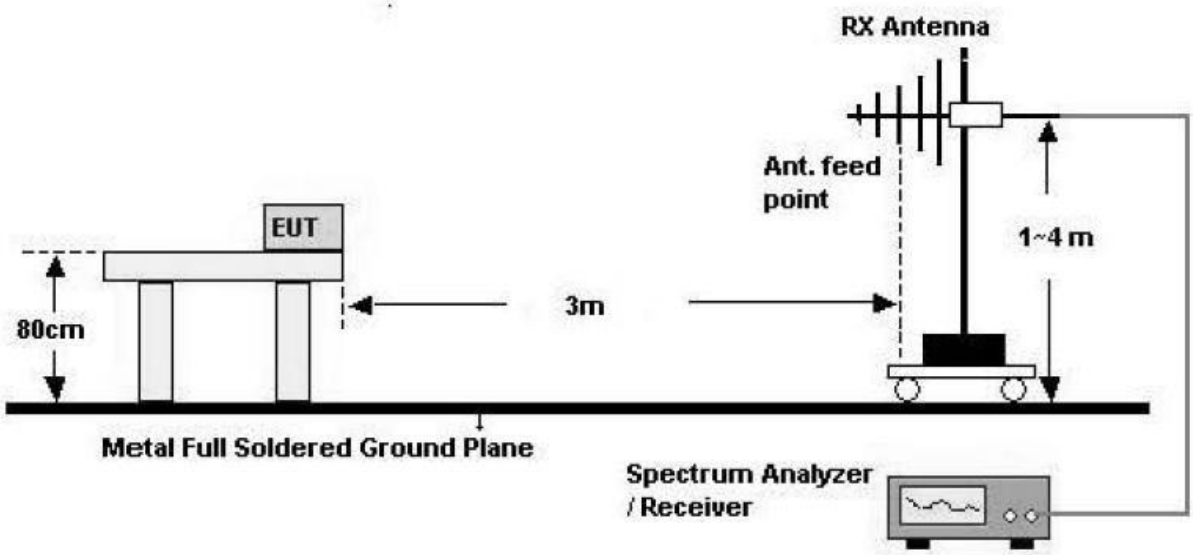
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

- Test Configuration

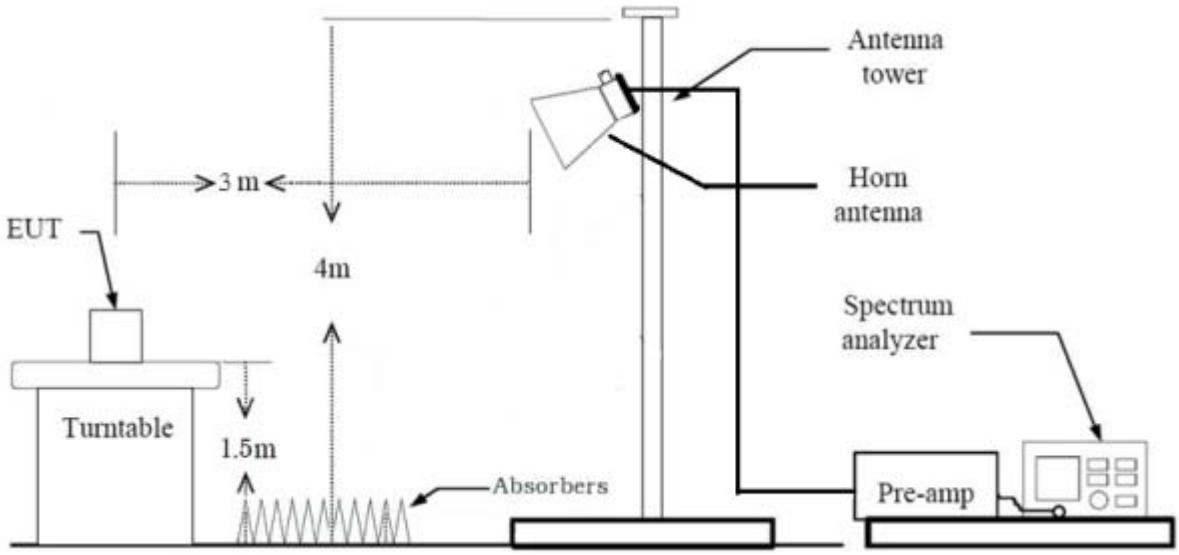
1. Below 30 MHz



2. 30 MHz - 1 GHz



3. Above 1 GHz



13.3 Test Date

September 14, 2023 ~ September 20, 2023

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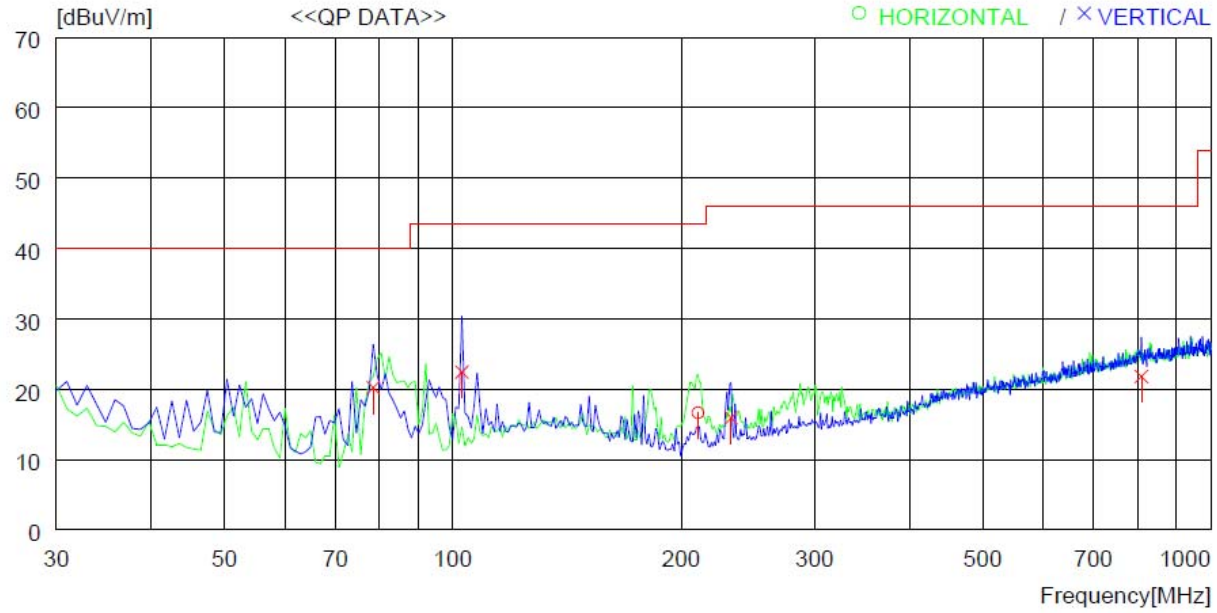
13.4 Test data for 30 MHz ~ 1 000 MHz

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Bluetooth NeckBand Headset

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	C.FACTOR [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]	COMMENT
	----- Horizontal -------								
1	210.420	31.0	-14.4	16.6	43.5	26.9	100	316	
	----- Vertical -------								
2	78.500	38.3	-18.1	20.2	40.0	19.8	100	0	
3	102.750	37.5	-15.1	22.4	43.5	21.1	100	272	
4	232.730	29.3	-13.4	15.9	46.0	30.1	200	11	
5	808.902	22.5	-0.7	21.8	46.0	24.2	200	229	

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13.5 Test data for Below 30 MHz

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

13.6 Test data for above 1 GHz

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode

1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

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14. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSV40-N	Rohde & Schwarz	Signal Analyzer	102196	Apr. 03, 2023 (1Y)
ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 06, 2023 (1Y)
WT-A3882-R10	Microwave	Cavity Band Rejection Filter	WT22040502-1	Apr. 03, 2023 (1Y)
HPF 3GHz	Rohde & Schwarz	HPF 3GHz	N/A	Jan. 17, 2023 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 14, 2023 (1Y)
SCU18	Rohde & Schwarz	Pre-Amplifer	102266	Jul. 11, 2023 (1Y)
SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Jan. 18, 2023 (1Y)
8493C	HP	Coaxial Fixed Attenuator	01925	Jul. 11, 2023 (1Y)
DT3000	Innco System	Turn Table	DT3000/093	N/A
CO3000	Innco System	Controller	CO3000/904	N/A
MA-4000XPET	Innco System	Tilt Antenna Master	MA4000/509	N/A
HLP-2008	TDK	Hybrid Antenna	131313	Apr. 05, 2023 (2Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1349	Jul. 04, 2023 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 04, 2023 (1Y)
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2022 (2Y)

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