

TEST REPORT

EMI Test for FCC Certification of WSP-i450 Model

APPLICANT
WOOSIM SYSTEMS INC.

REPORT NO.
HCT-EM-2208-FC007

DATE OF ISSUE
August 23, 2022

Tested by
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TEST REPORT

EMI Test for
FCC Certification

REPORT NO.

HCT-EM-2208-FC007

DATE OF ISSUE

August 23, 2022

FCC ID.

QDDWSP-I450W

Applicant

WOOSIM SYSTEMS INC.

60, Sandan-ro 388beon-gil, Chwisaeng-ri, Galsan-myeon, Hongseong-gun,
Chungcheongnam-do, Republic of Korea

Product Name

Mobile Printer

Model Name

WSP-i450

Date of Test

August 08, 2022 to August 18, 2022

Test Standard Used

FCC CFR 47 PART 15 Subpart B Class B
ANSI C63.4-2014

Test Results

Refer to the present document

Manufacturer

WOOSIM SYSTEMS INC.

The result shown in this test report refer only to the sample(s) tested unless
otherwise stated.

This test results were applied only to the test methods required by the standard.

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	August 23, 2022	Initial Release

The above Test Report is not related to the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr



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1. GENERAL INFORMATION

1.1 Description of EUT

The EUT is Mobile Printer.

FCC ID	QDDWSP-I450W
Model Name	WSP-i450
Product Name	Mobile Printer
Frequency	2 402 MHz ~ 2 480 MHz (Bluetooth)
Operating Voltage	Rated voltage: DC 8.4 V, 0.8 A Travel adapter: AC 100 ~ 240 V, 50 ~ 60 Hz Battery: DC 7.2 V, 2 500 mAh
Manufacturer	WOOSIM SYSTEMS INC.

1.2 Tested System Details

All equipment descriptions used in the tested system (including inserted cards) are:

Product Name	Model Name	Serial Number	Manufacturer
Mobile Printer	WSP-i450	-	WOOSIM SYSTEMS INC.
AC Adapter	PA-1400-96	-	LITE-ON TECHNOLOGY CHANGZHOU CO., LTD
Notebook PC	NT551EAA	0WRX91IM100062P	HP
Notebook PC Adapter	A13-040N2A	-	Chicony Power Technology Co., Ltd
Gateway	TL-WR747N	-	TP Link
Gateway Adapter	T090060-2H1	-	TP Link
Serial Mouse	Serial 2 Button mouse	02031069	Radio Shack
Smart Phone 1	LM-G710EM	-	LG Electronics
Smart Phone 2	SM-N950N	R39JA08C5P	SAMSUNG



1.3 Cable Description

USB(Printer) + MSR + Charging Mode

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	DC IN	N	N/A	(P)1.5
	USB	N/A	N/A	(D)1.2
Notebook PC	RJ 45	N/A	N	(D) 1.6
	Serial(Mouse)	N/A	Y	(D) 1.8
	DC IN	N	N/A	(P) 1.8
Gateway	DC IN	N	N/A	(P) 1.8

"(D)" Data cable, "(P)" Power cable

USB(Printer) + MSR + Battery Mode

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	USB	N/A	N/A	(D)1.2
Notebook PC	RJ 45	N/A	N	(D) 1.6
	Serial(Mouse)	N/A	Y	(D) 1.8
	DC IN	N	N/A	(P) 1.8
Gateway	DC IN	N	N/A	(P) 1.8

BLUETOOTH IDLE + Charging Mode

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	DC IN	N	N/A	(P)1.5
Smart Phone 1	-	-	-	-

BLUETOOTH IDLE + Battery Mode

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	USB	N/A	N/A	(D)1.2
Smart Phone 1	-	-	-	-

NOTE. This product has a removable battery.



1.4 Noise Suppression Parts on Cable (I/O Cable)

USB(Printer) + MSR + Charging Mode

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	DC IN	N	N/A	Y	EUT End
	USB	N	N/A	Y	Both End
Notebook PC	RJ 45	N	N/A	N	N/A
	Serial(Mouse)	N	N/A	Y	Notebook End

USB(Printer) + MSR + Battery Mode

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	USB	N	N/A	Y	Both End
Notebook PC	RJ 45	N	N/A	N	N/A
	Serial(Mouse)	N	N/A	Y	Notebook End

BLUETOOTH IDLE + Charging Mode

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	DC IN	N	N/A	Y	EUT End

BLUETOOTH IDLE + Battery Mode

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	-	-	-	-	-



1.5 Test Facility

Test site is located at 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, South Korea. Those measurement facilities are constructed in conformance with the requirements of ANSI C63.4-2014. The Normalized site attenuations (30 MHz to 1 GHz) and Site validation (1 GHz to 18 GHz) were performed in accordance with the standard in ANSI C63.4-2014 and ANSI C63.4a-2017. Our laboratories are accredited and designated in accordance with the provisions of Radio Waves ACT and International Standard ISO/IEC 17025:2017. (National Radio Research Agency, CABID No. KR0032)

1.6 Calibration of Measuring Instrument

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturers recommendations for utilizing calibration equipment, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5:2017

1.7 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Test Item	Test Site (Chamber)	Expanded Uncertainty
Conducted Emission (0.15 MHz to 30 MHz)	EMI Shield Room	2.0 dB
Radiated Emission (30 MHz to 1 GHz)	3 m Semi Anechoic Chamber #2	5.1 dB
Radiated Emission (1 GHz to 18 GHz)	3 m Semi Anechoic Chamber #1	4.8 dB

2. DESCRIPTION OF TEST

2.1 Measurement of Conducted Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 7.3

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN).

If the EUT is connected to the PC through USB, the AC power-line adapter of the PC is directly connected to a line impedance stabilization network (LISN).

Other support units were connected to the power mains through another LISN.

The two LISNs provide 50 Ω / 50 μ H of coupling impedance for the measuring instrument.

b. Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.

c. The frequency range from 150 kHz to 30 MHz was searched.

Conducted Emission Limits

Frequency (MHz)	Resolution Bandwidth (kHz)	Class A		Class B	
		Quasi-Peak (dB μ V)	Average (dB μ V)	Quasi-Peak (dB μ V)	Average (dB μ V)
0.15 to 0.5	9	79	66	66 to 56*	56 to 46*
0.5 to 5	9	73	60	56	46
5 to 30	9	73	60	60	50

NOTE. Decreases with the logarithm of the frequency.

2.2 Measurement of Radiated Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 8.3

- The EUT was placed on the top of a turn table 0.8 meters above the ground at a semi-anechoic chamber.
The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from 1 m to 4 m above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 m to 4 m and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-Peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- The test-receiver system was set to Peak and Average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. (1 GHz to 40 GHz)

Radiated Emission Limits

Frequency (MHz)	Class A			Class B		
	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)
30 to 88	10	90	39.0	3	100	40.0
88 to 216	10	150	43.5	3	150	43.5
216 to 960	10	210	46.4	3	200	46.0
Above 960	10	300	49.5	3	500	54.0
Frequency (MHz)	Antenna Distance (m)	Class A		Class B		
		Peak (dBμV/m)	Average (dBμV/m)	Peak (dBμV/m)	Average (dBμV/m)	
Above 1 000	3	80	60	74	54	



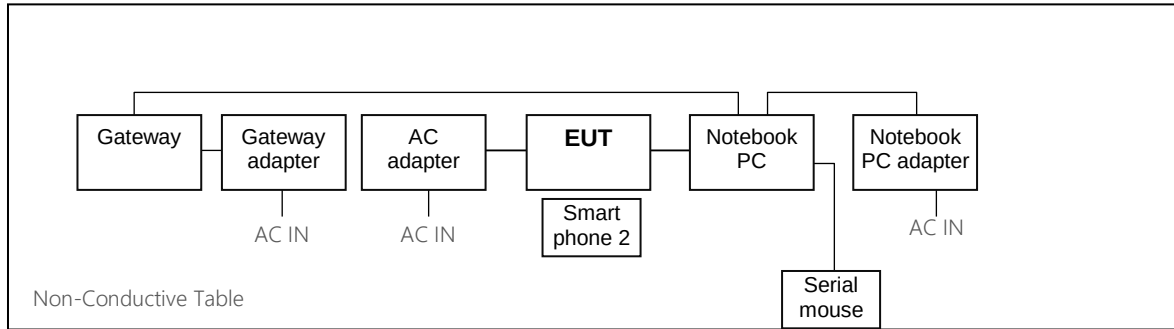
2.2.1 Frequency Range of Radiated Measurements

An unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a Radiated Emission limit is specified, up to the frequency shown in the following table

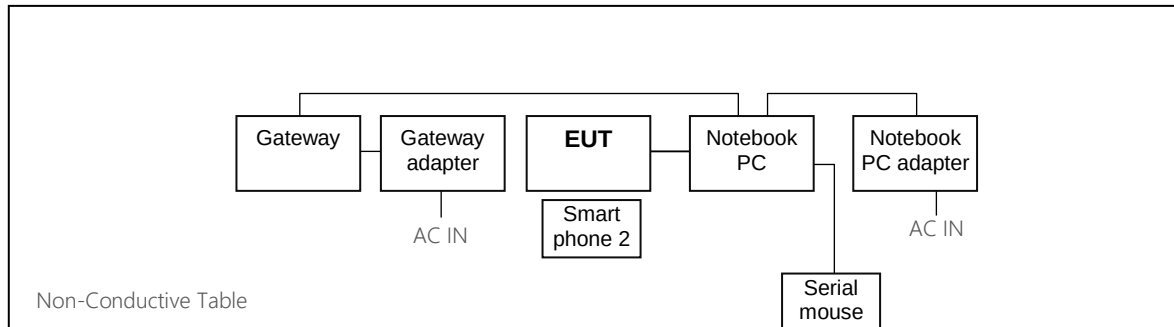
Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 to 108	1 000
108 to 500	2 000
500 to 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

2.3 Configuration of Tested System

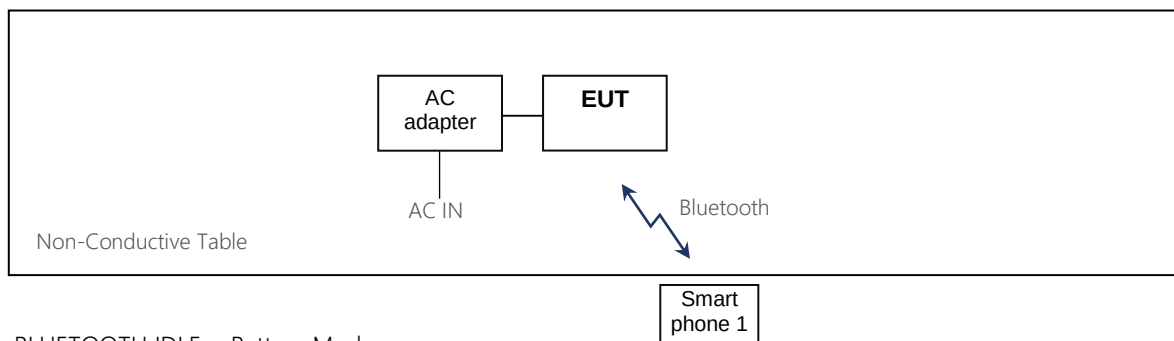
USB(Printer) + MSR + Charging Mode



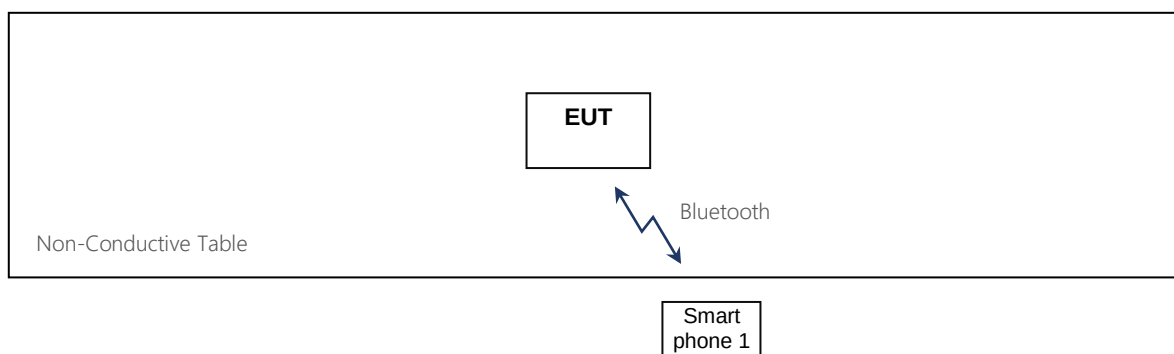
USB(Printer) + MSR + Battery Mode



BLUETOOTH IDLE + Charging Mode



BLUETOOTH IDLE + Battery Mode





3. OPERATION OF THE EUT

During preliminary test and final tests, the following operating mode was investigated.

3.1 Conducted Emission

After connecting the peripheral to the EUT, the following operating modes were tested.:

Operating Mode: BLUETOOTH IDLE + Charging Mode
 USB(Printer) + MSR + Charging Mode

3.2 Radiated Emission

After connecting the peripheral to the EUT, the following operating modes were tested.:

Operating Mode: USB(Printer) + MSR + Charging Mode
 USB(Printer) + MSR + Battery Mode
 BLUETOOTH IDLE + Charging Mode
 BLUETOOTH IDLE + Battery Mode

4. CONDUCTED EMISSION AND RADIATED EMISSION TEST SUMMARY

4.1 Conducted Emission

4.1.1 Measuring instruments

	Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
☒	EMI Test Receiver	ESR7	Rohde & Schwarz	101910	1 year	06.07.2022
☒	LISN	ENV216	Rohde & Schwarz	102245	1 year	08.23.2021
☒	LISN	ENV216	Rohde & Schwarz	100073	1 year	05.12.2022
☒	Software	EMC32	Rohde & Schwarz	-	-	-

4.1.2 Operating Condition

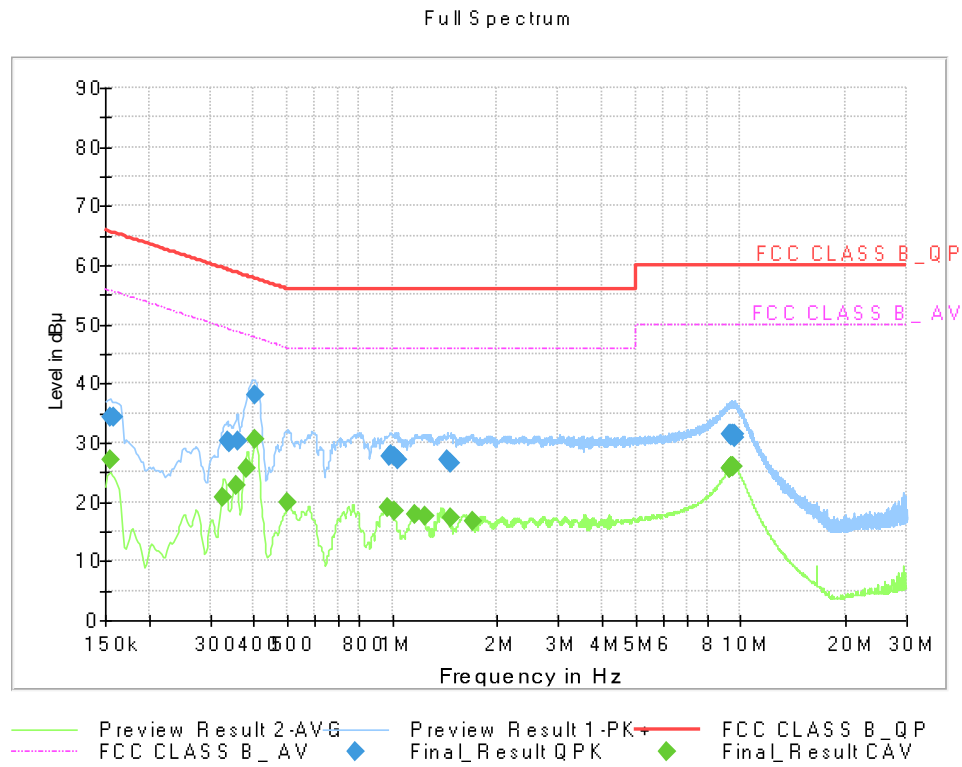
The test results of conducted emission at mains ports provide the following information:

Test Standard Used	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Frequency Range	0.15 MHz to 30 MHz
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Test Site	EMI Shield Room
Temperature	min. 22.3 °C / max. 24.6 °C
Relative Humidity	min. 52.3 % / max. 57.2 %
Test Date	August 08 / August 18, 2022

- Calculation Formula:
1. Conductor L1 = Hot, Conductor N = Neutral
 2. Corr. = LISN Factor + Cable Loss
 3. QuasiPeak or CAverage= Receiver Reading + Corr.
 4. Margin = Limit – QuasiPeak or CAverage

4.1.3 Measurement Data

Figure 1: Conducted Emission (0.15 to 30) MHz, BLUETOOTH IDLE + Charging mode, Line(L1)





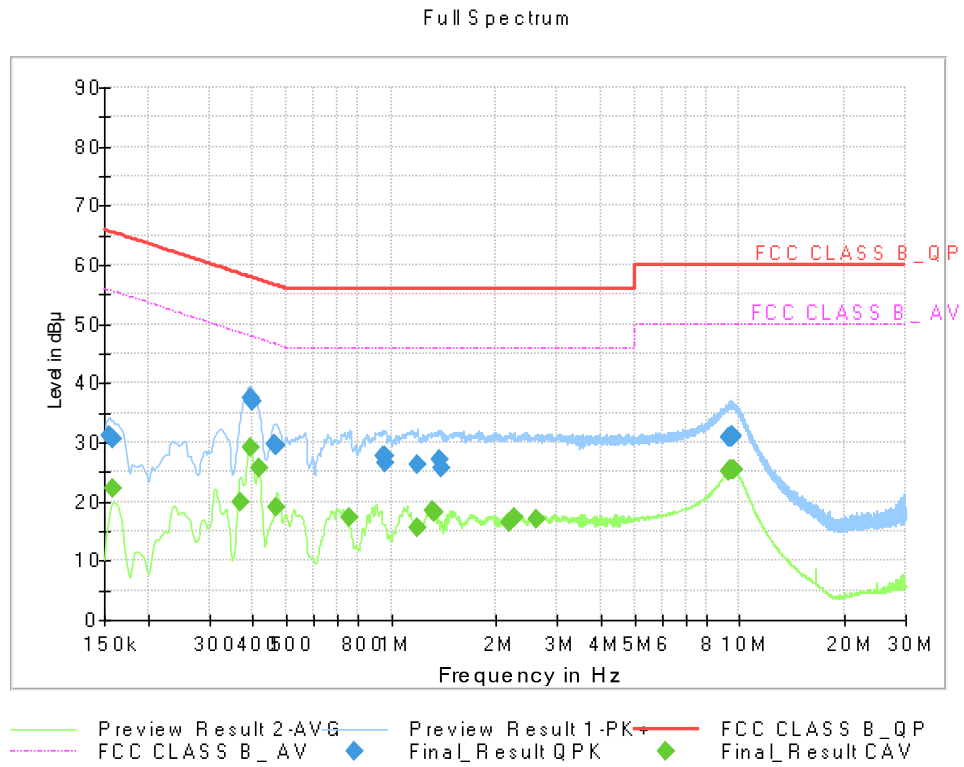
QuasiPeak Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	34.35	65.75	31.41	9.000	L1	9.6
0.1590	34.38	65.52	31.14	9.000	L1	9.6
0.3368	30.19	59.28	29.09	9.000	L1	9.6
0.3413	30.03	59.17	29.14	9.000	L1	9.6
0.3593	30.36	58.75	28.38	9.000	L1	9.6
0.4020	38.19	57.81	19.62	9.000	L1	9.6
0.9838	27.64	56.00	28.36	9.000	L1	9.6
0.9883	27.87	56.00	28.13	9.000	L1	9.6
1.0153	27.69	56.00	28.31	9.000	L1	9.6
1.0355	27.17	56.00	28.83	9.000	L1	9.6
1.4338	27.08	56.00	28.92	9.000	L1	9.6
1.4675	26.61	56.00	29.39	9.000	L1	9.6
9.3290	31.30	60.00	28.70	9.000	L1	9.8
9.4303	31.46	60.00	28.54	9.000	L1	9.8
9.4573	31.24	60.00	28.76	9.000	L1	9.8
9.5158	31.45	60.00	28.55	9.000	L1	9.8
9.5990	31.38	60.00	28.62	9.000	L1	9.8
9.6733	30.94	60.00	29.06	9.000	L1	9.8

CAverage Final Result

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	26.97	55.75	28.78	9.000	L1	9.6
0.3278	20.79	49.51	28.72	9.000	L1	9.6
0.3548	22.66	48.85	26.19	9.000	L1	9.6
0.3818	25.73	48.24	22.51	9.000	L1	9.6
0.4043	30.63	47.77	17.13	9.000	L1	9.6
0.5023	19.85	46.00	26.15	9.000	L1	9.6
0.9725	19.09	46.00	26.91	9.000	L1	9.6
1.0175	18.54	46.00	27.46	9.000	L1	9.6
1.1683	17.91	46.00	28.09	9.000	L1	9.6
1.2380	17.71	46.00	28.29	9.000	L1	9.6
1.4765	17.30	46.00	28.70	9.000	L1	9.6
1.6948	16.85	46.00	29.15	9.000	L1	9.6
9.3358	25.80	50.00	24.20	9.000	L1	9.8
9.3605	25.79	50.00	24.21	9.000	L1	9.8
9.4505	25.89	50.00	24.11	9.000	L1	9.8
9.4618	25.89	50.00	24.11	9.000	L1	9.8
9.5158	25.95	50.00	24.05	9.000	L1	9.8
9.5585	25.86	50.00	24.14	9.000	L1	9.8

Figure 2: Conducted Emission (0.15 to 30) MHz, BLUETOOTH IDLE + Charging mode, Line(N)





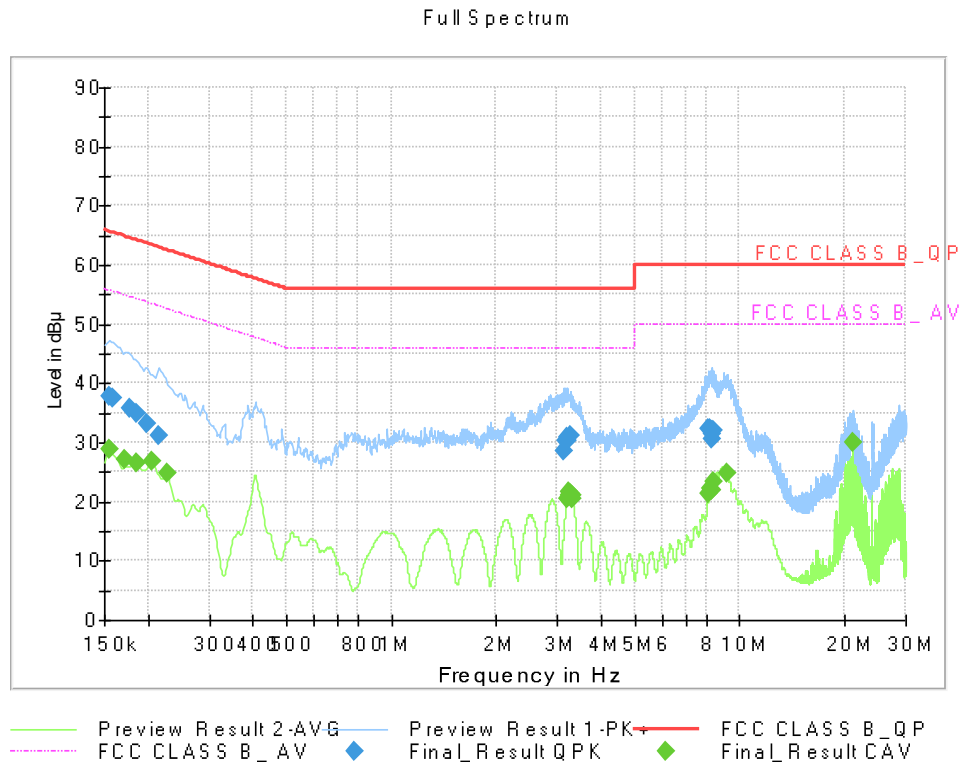
QuasiPeak Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	31.26	65.75	34.49	9.000	N	9.6
0.1590	30.60	65.52	34.91	9.000	N	9.6
0.3930	37.51	58.00	20.49	9.000	N	9.6
0.3975	36.88	57.91	21.03	9.000	N	9.6
0.4628	29.78	56.64	26.86	9.000	N	9.6
0.4695	29.33	56.52	27.19	9.000	N	9.6
0.9500	27.65	56.00	28.35	9.000	N	9.6
0.9568	27.78	56.00	28.22	9.000	N	9.6
0.9635	26.54	56.00	29.46	9.000	N	9.6
1.1885	26.15	56.00	29.85	9.000	N	9.6
1.3775	27.26	56.00	28.74	9.000	N	9.6
1.3888	25.58	56.00	30.42	9.000	N	9.6
9.3178	30.78	60.00	29.22	9.000	N	9.8
9.3808	31.01	60.00	28.99	9.000	N	9.8
9.4865	31.10	60.00	28.90	9.000	N	9.8
9.5023	31.15	60.00	28.85	9.000	N	9.8
9.5068	30.97	60.00	29.03	9.000	N	9.8
9.5113	31.09	60.00	28.91	9.000	N	9.8

CAverage Final Result

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1590	22.30	55.52	33.21	9.000	N	9.6
0.3705	19.90	48.49	28.59	9.000	N	9.6
0.3930	29.23	48.00	18.77	9.000	N	9.6
0.4155	25.70	47.54	21.83	9.000	N	9.6
0.4695	19.13	46.52	27.40	9.000	N	9.6
0.7610	17.36	46.00	28.64	9.000	N	9.6
1.1908	15.59	46.00	30.41	9.000	N	9.6
1.3100	18.48	46.00	27.52	9.000	N	9.6
1.3348	18.30	46.00	27.70	9.000	N	9.6
2.1808	16.36	46.00	29.64	9.000	N	9.6
2.2640	17.28	46.00	28.72	9.000	N	9.7
2.6263	17.12	46.00	28.88	9.000	N	9.7
9.2750	25.11	50.00	24.89	9.000	N	9.8
9.3920	25.43	50.00	24.57	9.000	N	9.8
9.4190	25.43	50.00	24.57	9.000	N	9.8
9.5203	25.41	50.00	24.59	9.000	N	9.8
9.6058	25.40	50.00	24.60	9.000	N	9.8
9.6440	25.27	50.00	24.73	9.000	N	9.8

Figure 3: Conducted Emission (0.15 to 30) MHz, USB(Printer) + MSR + Charging mode, Line(L1)





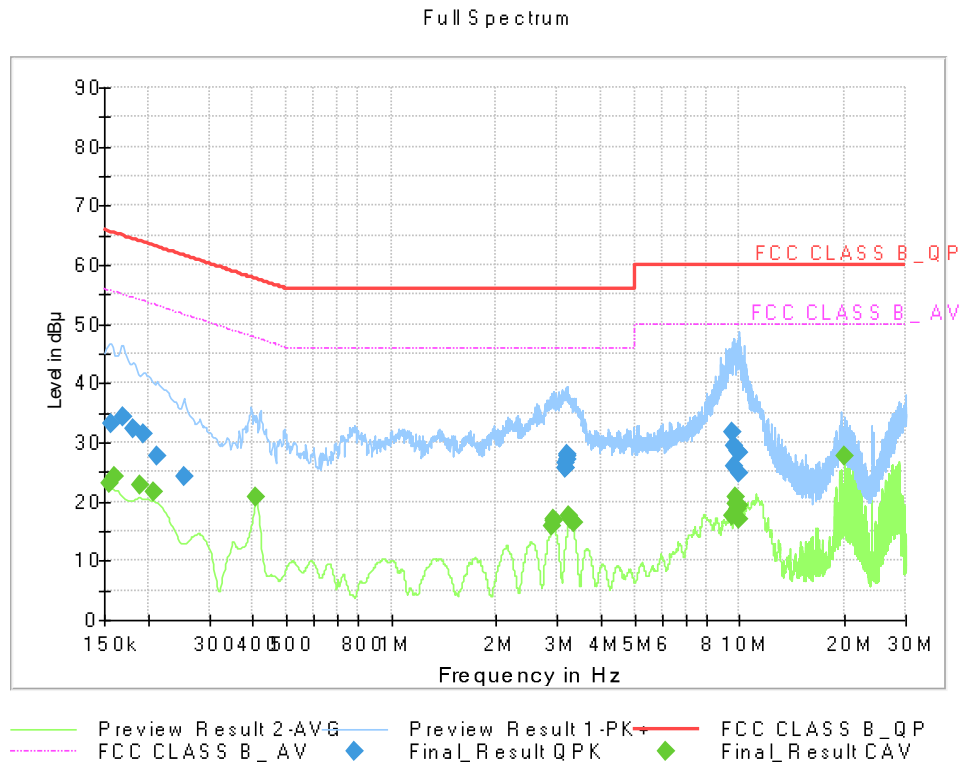
QuasiPeak Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	37.79	65.75	27.97	9.000	L1	9.6
0.1590	37.47	65.52	28.05	9.000	L1	9.6
0.1770	35.64	64.63	28.98	9.000	L1	9.6
0.1860	34.79	64.21	29.43	9.000	L1	9.6
0.1995	33.19	63.63	30.44	9.000	L1	9.6
0.2153	31.10	63.00	31.90	9.000	L1	9.6
3.1415	28.55	56.00	27.45	9.000	L1	9.8
3.1685	30.33	56.00	25.67	9.000	L1	9.8
3.1865	30.25	56.00	25.75	9.000	L1	9.8
3.1933	30.34	56.00	25.66	9.000	L1	9.8
3.2113	30.82	56.00	25.18	9.000	L1	9.8
3.2585	31.15	56.00	24.85	9.000	L1	9.8
8.1478	32.24	60.00	27.76	9.000	L1	10.0
8.2153	32.22	60.00	27.78	9.000	L1	10.0
8.2760	30.61	60.00	29.39	9.000	L1	10.0
8.2828	32.04	60.00	27.96	9.000	L1	10.0
8.3188	31.39	60.00	28.61	9.000	L1	10.0
8.4223	32.10	60.00	27.90	9.000	L1	10.0

CAverage Final Result

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	28.88	55.75	26.87	9.000	L1	9.6
0.1725	27.14	54.84	27.69	9.000	L1	9.6
0.1860	26.50	54.21	27.71	9.000	L1	9.6
0.2063	26.94	53.36	26.42	9.000	L1	9.6
0.2265	24.77	52.58	27.81	9.000	L1	9.6
3.2045	20.59	46.00	25.41	9.000	L1	9.8
3.2270	21.08	46.00	24.92	9.000	L1	9.8
3.2473	21.65	46.00	24.35	9.000	L1	9.8
3.2675	21.41	46.00	24.59	9.000	L1	9.8
3.2923	21.07	46.00	24.93	9.000	L1	9.8
3.3125	20.53	46.00	25.47	9.000	L1	9.8
8.1208	21.33	50.00	28.67	9.000	L1	10.0
8.2130	22.18	50.00	27.82	9.000	L1	10.0
8.2805	21.80	50.00	28.20	9.000	L1	10.0
8.3210	21.78	50.00	28.22	9.000	L1	10.0
8.4268	23.49	50.00	26.51	9.000	L1	10.0
9.1828	24.69	50.00	25.31	9.000	L1	10.0
21.1595	29.88	50.00	20.12	9.000	L1	10.4

Figure 4: Conducted Emission (0.15 to 30) MHz, USB(Printer) + MSR + Charging mode, Line(N)





QuasiPeak Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1568	33.28	65.63	32.36	9.000	N	9.6
0.1703	34.34	64.95	30.61	9.000	N	9.6
0.1815	32.36	64.42	32.06	9.000	N	9.6
0.1950	31.40	63.82	32.42	9.000	N	9.6
0.2130	27.73	63.09	35.36	9.000	N	9.6
0.2535	24.35	61.64	37.29	9.000	N	9.6
3.1460	25.60	56.00	30.40	9.000	N	9.8
3.1528	26.45	56.00	29.55	9.000	N	9.8
3.1775	25.62	56.00	30.38	9.000	N	9.8
3.1820	27.72	56.00	28.28	9.000	N	9.8
3.1955	27.85	56.00	28.15	9.000	N	9.8
3.2068	27.11	56.00	28.89	9.000	N	9.8
9.5518	31.80	60.00	28.20	9.000	N	10.0
9.6035	25.90	60.00	34.10	9.000	N	10.0
9.6710	29.37	60.00	30.63	9.000	N	10.0
9.8600	28.67	60.00	31.33	9.000	N	10.1
9.9163	24.72	60.00	35.28	9.000	N	10.1
9.9748	28.39	60.00	31.61	9.000	N	10.1

CAverage Final Result

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	23.01	55.75	32.75	9.000	N	9.6
0.1613	24.16	55.40	31.24	9.000	N	9.6
0.1905	22.79	54.02	31.22	9.000	N	9.6
0.2085	21.71	53.27	31.55	9.000	N	9.6
0.4088	20.83	47.67	26.84	9.000	N	9.7
2.8850	15.79	46.00	30.21	9.000	N	9.8
2.9165	17.00	46.00	29.00	9.000	N	9.8
2.9255	16.84	46.00	29.16	9.000	N	9.8
3.2293	17.60	46.00	28.40	9.000	N	9.8
3.2765	16.94	46.00	29.06	9.000	N	9.8
3.3350	16.36	46.00	29.64	9.000	N	9.8
9.4978	17.67	50.00	32.33	9.000	N	10.0
9.7228	20.69	50.00	29.31	9.000	N	10.0
9.7858	19.51	50.00	30.49	9.000	N	10.1
9.8308	18.87	50.00	31.13	9.000	N	10.1
9.9208	17.01	50.00	32.99	9.000	N	10.1
9.9613	19.27	50.00	30.73	9.000	N	10.1
20.0390	27.65	50.00	22.35	9.000	N	10.5

4.2 Radiated Emission Below 1 GHz

4.2.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
10 m Semi Anechoic Chamber #1					
☐ EMI test receiver	ESU26	Rohde & Schwarz	100241	1 year	06.14.2022
☐ Bilog Antenna	VULB 9168	SCHWARZBECK	847	2 year	05.27.2022
☐ Antenna master	MA4000-EP	INNCO systems	MA4000/283	N/A	-
☐ Turn Table	DT3000-3t	INNCO systems	DT3000/69	N/A	-
☐ Low Noise Amplifier	TK-PA01S	TESTEK	200112-L	1 year	06.14.2022
10 m Semi Anechoic Chamber #2					
☐ EMI Test Receiver	ESW44	Rohde & Schwarz	101946	1 year	07.04.2022
☐ Bilog Antenna	VULB9168	Schwarzbeck	760	2 year	02.22.2021
☐ Ant MAST	MA4000-EP	INNCO systems	-	N/A	-
☐ Ant MAST Controller	CO3000	INNCO systems	CO3000/999/ 40240317/G	N/A	-
☐ Turn Table	DDT6000/3000-5T	INNCO systems	-	N/A	-
☐ Low Noise Amplifier	TK-PA1S	TESTEK	190005-L	1 year	04.11.2022
3 m Semi Anechoic Chamber #1					
☐ EMI Test Receiver	ESU40	Rohde & Schwarz	100524	1 year	05.10.2022
☐ Bilog Antenna	VULB9168	Schwarzbeck	255	2 year	03.15.2021
☐ Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☐ Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870 /35990515/L	N/A	-
☐ Turn Table	1060	INNCO SYSTEM	-	N/A	-
☐ Turn Table controller	CO2000	INNCO SYSTEM	CO2000/095 /7590304/L	N/A	-
☐ DC Power Supply	PWS-3003D	Protek	04050810	1 year	10.27.2021
☐ Software	EMC32	Rohde & Schwarz	-	-	-
3 m Semi Anechoic Chamber #2					
☒ EMI Test Receiver	ESU40	Rohde&Schwartz	100361	1 year	09.17.2021
☒ Bilog Antenna	VULB 9168	SCHWARZBECK	01156	2 year	05.27.2022
☒ Antenna Master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☒ Antenna Master Controller	CO3000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-
☒ Turn Table	DS2000-S	INNCO SYSTEM	-	N/A	-
☒ Turn Table Controller	CO2000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-
☒ Software	EMC32	Rohde & Schwarz	-	-	-



4.2.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Frequency Range	30 MHz to 1 000 MHz
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Measurement Distance	3 m
Antenna height	1 m to 4 m
Test Site	3 m Semi Anechoic Chamber #2
Temperature	min. 23.2 °C / max. 25.7 °C
Relative Humidity	min. 51.9 % / max. 58.0 %
Test Date	August 11 / August 12, 2022

Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. QuasiPeak = Reading (Receiver Reading) + Corr.
3. Corr. (Correction Factor) = Antenna Factor + Cable Loss
4. Margin = Limit - QuasiPeak

4.2.3 Measuring Data

Figure 5: Radiated Emission (30 to 1 000) MHz, USB(Printer) + MSR + Charging Mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
37.6180	27.81	40.00	12.19	100.0	V	357.0	19.0
120.0160	31.25	43.50	12.25	100.0	V	346.0	17.1
223.9210	32.33	46.00	13.67	174.7	H	237.0	17.6
264.1580	34.70	46.00	11.30	100.0	H	330.0	19.1
816.0080	39.83	46.00	6.17	192.6	H	25.0	29.8
864.0230	38.92	46.00	7.08	100.0	H	35.0	30.1

Figure 6: Radiated Emission (30 to 1 000) MHz, USB(Printer) + MSR + Battery Mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
82.2220	30.42	40.00	9.58	103.8	V	272.0	14.8
215.8630	33.08	43.50	10.42	100.0	V	234.0	17.3
288.0200	34.35	46.00	11.65	125.1	H	190.0	19.8
304.1220	38.34	46.00	7.66	100.0	H	170.0	20.3
768.0330	39.52	46.00	6.48	193.1	H	30.0	29.2
816.0080	39.62	46.00	6.38	178.8	H	30.0	29.8



Figure 7: Radiated Emission (30 to 1 000) MHz, BLUETOOTH IDLE + Charging Mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
44.0940	28.85	40.00	11.15	100.0	V	348.0	19.7
71.8680	28.95	40.00	11.05	100.0	V	81.0	17.2
302.4560	27.72	46.00	18.28	125.1	H	359.0	20.3
527.9980	37.68	46.00	8.32	177.8	H	320.0	25.3
768.0330	38.32	46.00	7.68	100.0	H	189.0	29.2
960.0360	40.16	54.00	13.84	100.0	H	248.0	31.1

Figure 8: Radiated Emission (30 to 1 000) MHz, BLUETOOTH IDLE + Battery Mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
47.7270	20.00	40.00	20.00	393.0	V	54.0	19.9
306.7810	24.12	46.00	21.88	103.7	H	121.0	20.4
527.9980	38.23	46.00	7.77	178.4	H	-25.0	25.3
624.0280	37.82	46.00	8.18	278.9	H	306.0	27.2
768.0330	39.36	46.00	6.64	100.0	H	40.0	29.2
960.0130	40.74	54.00	13.26	100.0	H	269.0	31.1

4.3 Radiated Emission Above 1 GHz

4.3.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
3 m Semi Anechoic Chamber #1					
☒ EMI test receiver	ESU40	Rohde & Schwarz	100524	1 year	05.10.2022
☒ Horn Antenna	BBHA 9120D	SCHWARZBECK	1518	1 year	09.15.2021
☒ Power Amplifier	TK-PA18H	TESTEK	170012-L	1 year	04.21.2022
☐ Power Amplifier	TK-PA1840H	TESTEK	170030-L	1 year	02.24.2022
☐ Horn Antenna	BBHA9170	Schwarzbeck	BBHA 9170 #786	1 year	11.18.2021
☒ Antenna master	MA4640-XP-ET	INNCO Systems	-	N/A	-
☒ Antenna master controller	CO3000	INNCO Systems	CO3000/870/ 35990515/L	N/A	-
☒ Turn table	1060	INNCO Systems	-	N/A	-
☒ Turn table controller	CO2000	INNCO Systems	CO2000/095/ 7590304/L	N/A	-
☐ Low Noise amplifier	TK-PA18H	TESTEK	170034-L	1 year	02.24.2022
☐ Horn antenna	BBHA 9120D	Schwarzbeck	01836	1 year	07.21.2022
☐ Band Reject Filter	WRCJ2400/2483.5 -2370/2520-60/14SS	Wainwright Instruments	1	1 year	02.07.2022
☒ Software	EMC32	Rohde & Schwarz	-	-	-
3 m Semi Anechoic Chamber #2					
☐ EMI test receiver	ESU40	Rohde&Schwartz	100361	1 year	09.17.2021
☐ Horn Antenna	BBHA 9170	SCHWARZBECK	810	1 year	04.25.2022
☐ Power Amplifier	TK-PA1804H	TESTEK	170033-L	1 year	04.15.2022
☐ Horn Antenna	BBHA 9120D	SCHWARZBECK	296	1 year	02.17.2022
☐ Amplifier	CBLU5183530	CERNEX	24348	1 year	06.02.2022
☐ Antenna Master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☐ Antenna Master Controller	CO3000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-
☐ Turn Table	DS2000-S	INNCO SYSTEM	-	N/A	-
☐ Turn Table Controller	CO2000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-
10 m Semi Anechoic Chamber #1					
☐ EMI test receiver	ESU26	ROHDE&SCHWARZ	100241	1 year	06.14.2022
☐ Horn Antenna	BBHA 9120 D	SCHWARZBECK	1639	1 year	09.06.2021
☐ Antenna master	AS2000-PP	INNCO systems	AS2000/135/ 34270914/L	N/A	-
☐ Turn table	DT3000-3t	INNCO systems	DT3000/69	N/A	-
☐ Amplifier	CBLU1183540	CERNEX	21691	1 year	06.14.2022
10 m Semi Anechoic Chamber #2					
☐ EMI Test Receiver	ESW44	Rohde & Schwarz	101946	1 year	07.04.2022
☐ Amplifier	TK-PA6S	TESTEK	130012	1 year	01.18.2022
☐ Horn Antenna	BBHA 9120D	SCHWARZBECK	1641	1 year	06.30.2022
☐ Horn Antenna	BBHA 9120D	Schwarzbeck	1152	1 year	02.23.2022
☐ Ant MAST	MA4000-EP	INNCO systems	-	N/A	-
☐ Ant MAST Controller	CO3000	INNCO systems	CO3000/999 /40240317/G	N/A	-
☐ Ant MAST	MA4640/800 XP-ET	INNCO systems	-	N/A	-
☐ Ant MAST Controller	CO3000	INNCO systems	CO3000/951 /38590616/G	N/A	-
☐ Turn Table	DDT6000/3000-5T	INNCO systems	-	N/A	-

4.3.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Peak, CISPR-Average
Bandwidth	1 MHz
Highest Frequency	2 480 MHz
Tested Frequency Range	1 GHz to 18 GHz
Measurement Distance	3 m
Antenna height	1 m to 4 m
Test Site	3 m Semi Anechoic Chamber #1
Temperature	min. 23.1 °C / max. 24.5 °C
Relative Humidity	min. 52.3 % / max. 57.8 %
Test Date	August 16 / August 17 / August 18, 2022

- Calculation Formula:**
1. POL. H = Horizontal, POL. V = Vertical
 2. Peak or CAverage = Reading (Receiver Reading) + Corr.
 3. Corr. (Correction Factor) = Antenna Factor+ Cable Loss –Amplifier Gain
 4. Margin = Limit - Peak or CAverage

4.3.3 Measurement Data

Figure 9: Radiated Emission (1 to 18) GHz, USB(Printer) + MSR + Charging Mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1799.3200	45.6	192.6	V	63.0	-20.0	28.4	74.0
2390.9350	46.2	249.8	V	335.0	-18.5	27.8	74.0
3592.8900	47.0	100.0	V	204.0	-15.8	27.0	74.0
4780.4700	46.1	199.6	V	94.0	-11.1	27.9	74.0
5985.9550	49.3	100.0	V	78.0	-7.8	24.7	74.0
14470.5700	50.7	178.7	V	318.0	9.0	23.3	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1799.3200	24.1	192.6	V	63.0	-20.0	29.9	54.0
2390.9350	26.2	249.8	V	335.0	-18.5	27.8	54.0
3592.8900	26.6	100.0	V	204.0	-15.8	27.4	54.0
4780.4700	26.0	199.6	V	94.0	-11.1	28.0	54.0
5985.9550	30.1	100.0	V	78.0	-7.8	23.9	54.0
14470.5700	38.2	178.7	V	318.0	9.0	15.8	54.0



Figure 10: Radiated Emission (1 to 18) GHz, USB(Printer) + MSR + Battery Mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1194.6100	43.3	206.5	V	10.0	-21.3	30.7	74.0
1512.3150	42.7	199.7	V	1.0	-20.4	31.3	74.0
1798.0550	46.1	199.5	V	67.0	-20.0	27.9	74.0
3589.3300	45.5	199.6	V	342.0	-15.8	28.5	74.0
8382.6800	47.1	100.0	V	85.0	-3.0	26.9	74.0
14528.5150	50.6	149.6	H	337.0	9.0	23.4	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1194.6100	24.3	206.5	V	10.0	-21.3	29.7	54.0
1512.3150	23.9	199.7	V	1.0	-20.4	30.1	54.0
1798.0550	24.8	199.5	V	67.0	-20.0	29.2	54.0
3589.3300	26.3	199.6	V	342.0	-15.8	27.7	54.0
8382.6800	31.2	100.0	V	85.0	-3.0	22.8	54.0
14528.5150	38.0	149.6	H	337.0	9.0	16.0	54.0

Figure 11: Radiated Emission (1 to 18) GHz, BLUETOOTH IDLE + Charging Mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1151.9350	37.8	175.6	H	337.0	-21.4	36.2	74.0
1343.9900	43.1	176.6	H	348.0	-20.9	30.9	74.0
1440.0850	38.9	100.0	H	80.0	-20.6	35.1	74.0
1728.0450	38.4	100.0	V	198.0	-20.1	35.6	74.0
3945.3850	47.3	249.8	H	20.0	-14.5	26.7	74.0
17985.1125	58.8	249.8	H	295.0	17.3	15.2	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1151.9350	33.9	175.6	H	337.0	-21.4	20.1	54.0
1343.9900	40.7	176.6	H	348.0	-20.9	13.3	54.0
1440.0850	36.1	100.0	H	80.0	-20.6	17.9	54.0
1728.0450	34.3	100.0	V	198.0	-20.1	19.7	54.0
3945.3850	21.9	249.8	H	20.0	-14.5	32.1	54.0
17985.1125	46.4	249.8	H	295.0	17.3	7.6	54.0



Figure 12: Radiated Emission (1 to 18) GHz, BLUETOOTH IDLE + Battery Mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1152.1450	38.9	191.5	V	172.0	-21.4	35.1	74.0
1440.0150	40.4	150.2	H	73.0	-20.6	33.6	74.0
1631.9150	39.0	207.8	H	141.0	-20.3	35.0	74.0
3930.7950	34.5	222.5	V	83.0	-14.6	39.5	74.0
11422.1000	46.5	149.6	V	292.0	3.8	27.5	74.0
17976.6450	58.1	199.6	V	136.0	17.2	15.9	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1152.1450	35.4	191.5	V	172.0	-21.4	18.6	54.0
1440.0150	38.1	150.2	H	73.0	-20.6	15.9	54.0
1631.9150	36.1	207.8	H	141.0	-20.3	17.9	54.0
3930.7950	21.9	222.5	V	83.0	-14.6	32.1	54.0
11422.1000	34.2	149.6	V	292.0	3.8	19.8	54.0
17976.6450	46.2	199.6	V	136.0	17.2	7.8	54.0



5. APPENDIX A. TEST SETUP PHOTO

Please refer to Appendix. A and test setup photo file no. as follows;

File No.	Date of Issue	Description
HCT-EM-2208-FC007-P	August 23, 2022	Initial Release

End of report