RF Test Report

Issued Date: Feb. 08, 2021

Applicant	:	KRONOZ
Product Type	:	Smart Watch
Trade Name	:	MYKRONOZ
Model Number	:	ZeRound³ Lite, ZeRound^4 Lite
FCC ID	:	2AA7D-ZR3LE
EUT Rated Voltage	:	DC 5 V, 0.5 A
Test Voltage	:	120 Vac / 60 Hz, DC 3.8 V
Receive Date	:	Nov. 23, 2020
Test Period	:	Dec. 01, 2020 ~ Jan. 22, 2021
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Test Result	:	Complied

Testing Laboratory

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Certificate #3464.02

American Association for Laboratory Accreditation number: 3464.02

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Revision History

Rev.	Issue Date	Revisions
00	Feb. 08, 2021	Initial Issue

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1 General Information

1.1 Summary of Test Result

Standard	Item	Result	Remark
15.207	AC Power Conducted Emission	PASS	-----
15.247(d)	Transmitter Radiated Emissions	PASS	-----
15.247(b)(3)	Max. Output Power	N/A	Refer to Note 1
15.247(a)(2)	6dB RF Bandwidth	N/A	Refer to Note 1
15.247(e)	Maximum Power Spectral Density	N/A	Refer to Note 1
15.247(d)	Out of Band Conducted Spurious Emission	N/A	Refer to Note 1
15.203	Antenna Requirement	N/A	Refer to Note 1

Standard	Description
CFR47, Part 15, Subpart C §15.247	Intentional Radiators
ANSI C63. 10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63. 4: 2014	American National Standard for methods of measurement of radio – noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
KDB558074 D01 v05	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

Decision Rule

■ Uncertainty is not included.

□ Uncertainty is included.

Note 1: SZ1811Cplease refer to original report: SZ1905FR14

A Test Lab Techno Corp. tested the above equipment under the requirements outlined in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. Based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

A Test Lab Techno Corp. will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

1.2 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9 kHz ~ 150 kHz	2.7
	150 kHz ~ 30 MHz	2.7
Radiated Emission	9 kHz ~ 30 MHz	1.7
	30 MHz ~ 1000 MHz	5.7
	1000 MHz ~ 18000 MHz	5.5
	18000 MHz ~ 26500 MHz	4.8
	26500 MHz ~ 40000 MHz	4.8
Conducted Output Power	+0.27 dB / -0.28 dB	
RF Bandwidth	4.96%	
Power Spectral Density	+0.71 dB / -0.77 dB	

2 EUT Description

2.1. EUT description

Applicant	KRONOZ ROUTE DE VALAVRAN 96, GENTHOD, 1294, Switzerland	
Manufacturer	KRONOZ ROUTE DE VALAVRAN 96, GENTHOD, 1294, Switzerland	
Product Type	Smart Watch	
Trade Name	MYKRONOZ	
Model Number	ZeRound³ Lite, ZeRound^4 Lite	
Models Difference Description	The appearance and display screen are different, and ZeRound4 Lite deleted a flash component. The rest circuit diagram, layout and internal components have not been changed	
FCC ID	2AA7D-ZR3LE	
Frequency Range	2402 ~ 2480 MHz	
Modulation Type	GFSK	
Operate Temp. Range	-10 ~ +60 ℃	
Antenna information	Type	Max. Gain (dBi)
	Internal Antenna	-0.86
RF Output Power	0.00022 W	

EUT Modify Description :

Modify Description: Due to market demand, add new product model(Original: ZeRound³ Lite, Second: ZeRound^4 Lite), the difference between the models is: the appearance and display screen are different, and ZeRound4 Lite deleted a flash component. The rest circuit diagram, layout and internal components have not been changed. After the evaluation: The Conducted Emission and Radiated Emissions Blow 1G are re-tested and recorded in this report, the rest are kept the same.
Original Report: SZ1905FR14 Modify: SZ2101FR14

2.2. Channel numbers and channel list

Channel	Frequency	Channel	Frequency
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

3 Test Methodology

3.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit mode
Mode 2: Continuous TX mode

Software used to control the EUT for staying in continuous transmitting mode was programmed.
After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in TX mode only.

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “X axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

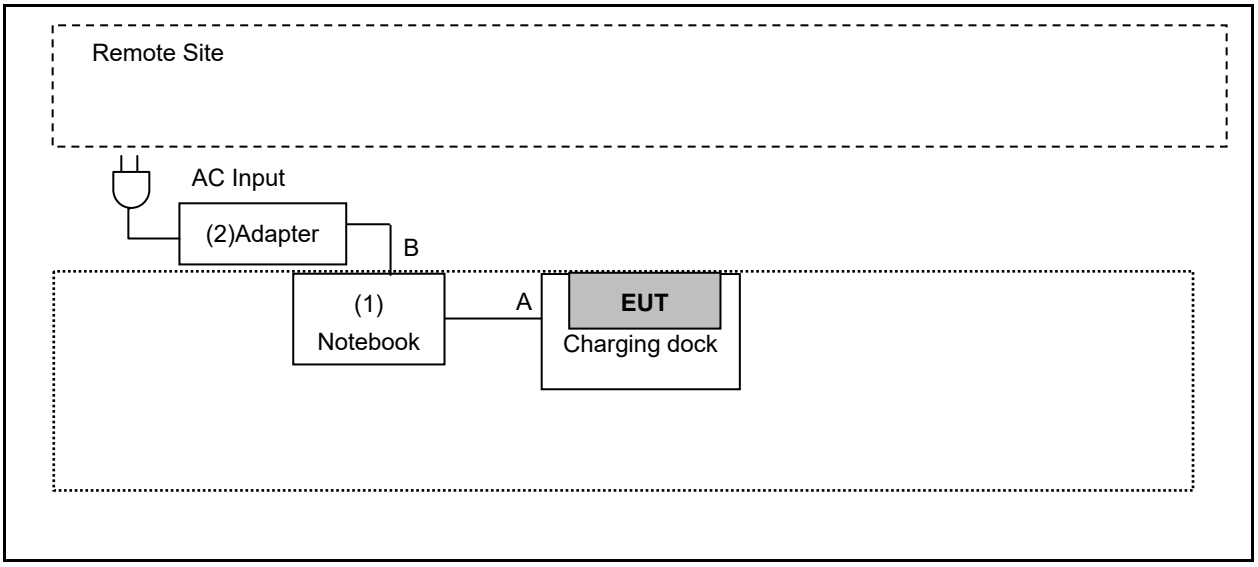
3.2. EUT Exercise Software

1	Setup the EUT shown on “Configuration of Test System Details”.
2	Turn on the power of all equipment.
3	Turn on TX function
4	EUT run test program.

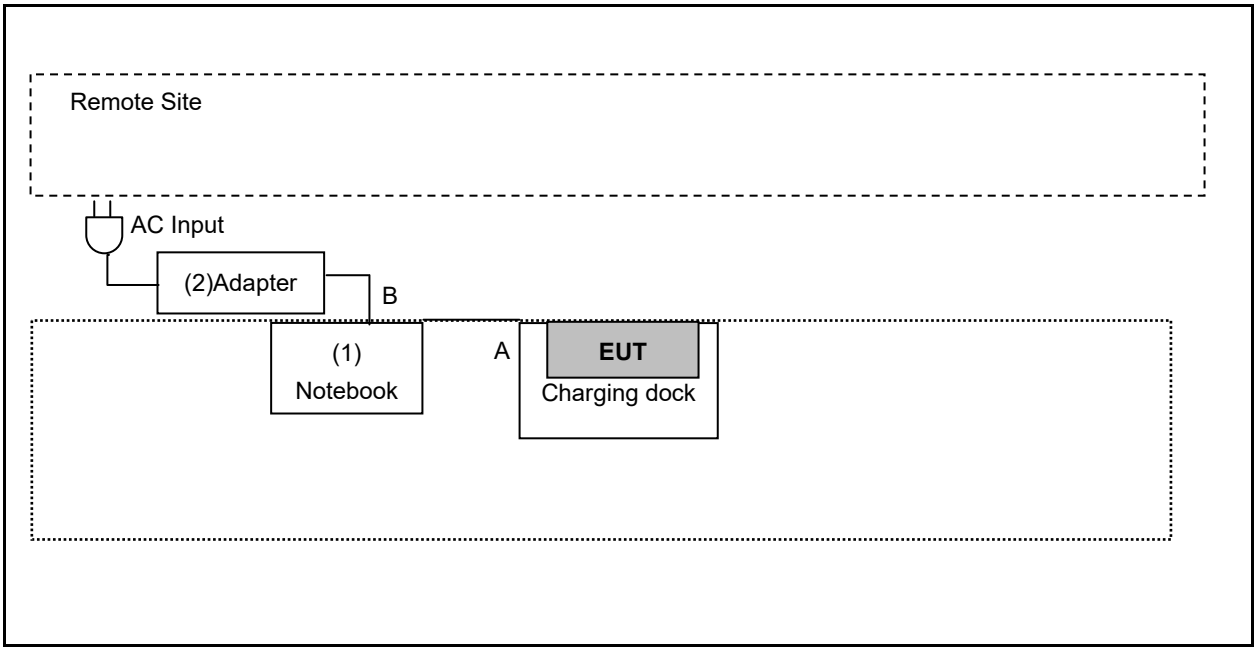
Measurement Software	
1	EZ-EMC Ver. ATL-03A1-1
2	EZ-EMC Ver ATL-ITC-3A1-1 (for Conducted Emission)

3.3. Configuration of Test System Details

Conducted Emission



Radiated Emissions



Devices Description					
Product		Manufacturer	Model Number	Serial Number	Power Cord
(1)	Notebook	Lenovo	ThinkPad E560	2015AP4354	Non-Shielded,0.8 m
(2)	AC Adapter	Chicony	ADLX65NOC3A	---	INPUT: AC 100 V to 240 V, 50 Hz / 60Hz,0.3A OUTPUT: DC 20 V, 3.25 A

3.4. Test Instruments

For Conducted Emission

Test Period: Jan. 22, 2020

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Test Receiver	R&S	ESR3	101923	09/01/2020	1 year
LISN	R&S	ENV216	101942	09/01/2020	1 year
ISN	TESEQ	ISN T800	39216	09/01/2020	1 year
RF Cable	EMCI	EMCCFD400	433LFC	09/01/2020	1 year
Test Site	ATL	CE	CE	N.C.R.	-----

For Radiated Emissions

Test Period: Dec. 01, 2021

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Preamplifier	EMCI	EMC001330	980300	09/01/2020	1 year
Preamplifier	EMCI	EMC012645SE	980318	09/01/2020	1 year
Bilog Antenna	Schwarzbeck	VULB 9168	672	10/16/2020	1 year
Horn Antenna	ETS	3117	00204949	10/16/2020	1 year
Receiver	Keysight	N9038A	MY51210179	09/01/2020	1 year
Cable	EMCI	N/A	1066LFC	09/01/2020	1 year
Cable	EMCI	N/A	160719	09/01/2020	1 year
Test Site	OuHeng	MFAC3M	RE-026	02/24/2020	1 year

Note: N.C.R. = No Calibration Request.

Measurement Software	
1	EZ-EMC Ver. ATL-03A1-1
2	EZ-EMC Ver ATL-ITC-3A1-1 (for Conducted Emission)

3.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

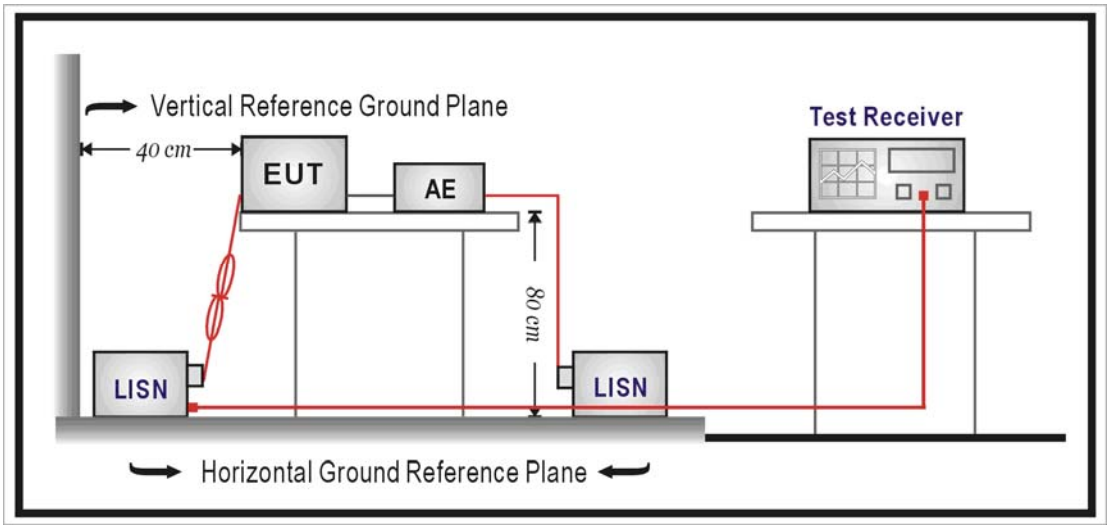
4 Measurement Procedure

4.1. AC Power Line Conducted Emission Measurement

■ **Limit**

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

■ **Test Setup**



■ **Test Procedure**

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50Ω// 50 uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 Ω// 50 uH coupling impedance with 50ohm termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12 mm insulating material.

Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150 kHz to 30 MHz then quasi-peak and average measurement was unnecessary.

The AMN shall be placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8 m from the AMN. If the mains power cable is longer than 1m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4 m. All of interconnecting cables that hang closer than 40cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1 m. All 50 Ω ports of the LISN shall be resistively terminated into 50 Ω loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

4.2. Radiated Emission Measurement

■ **Limit**

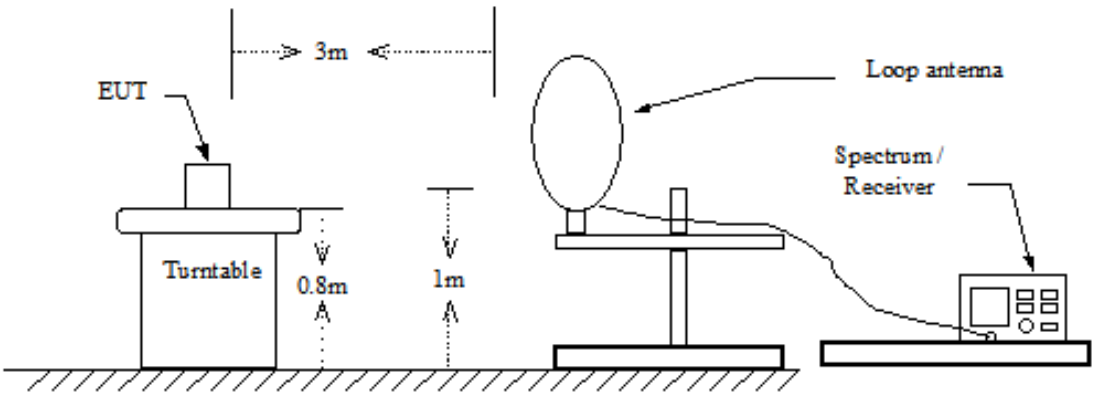
According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m at 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

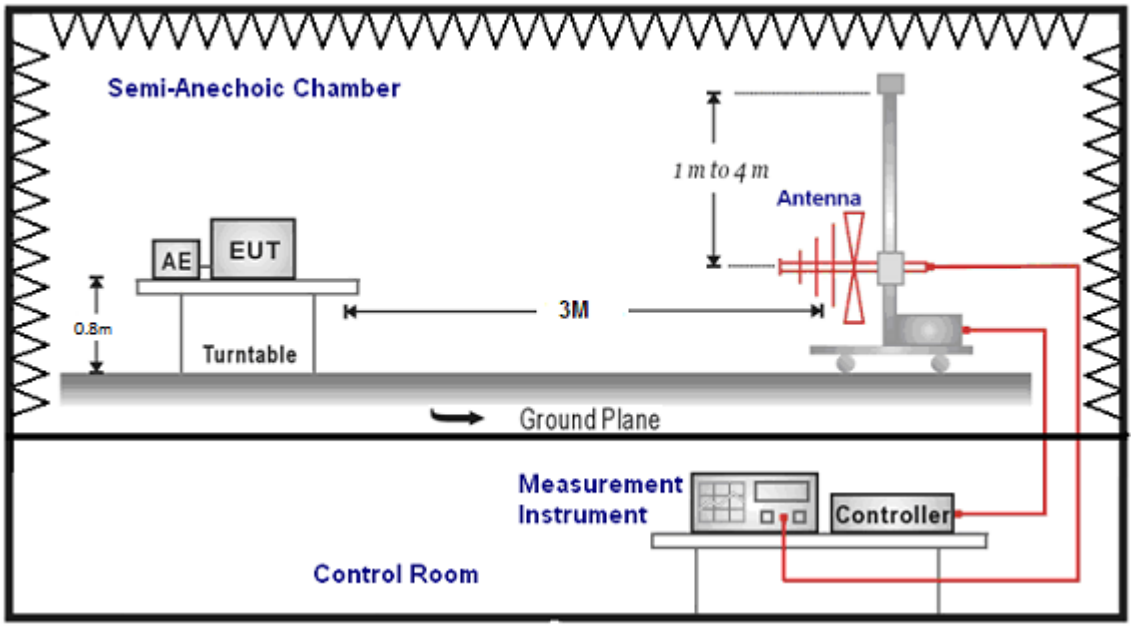
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

■ **Setup**

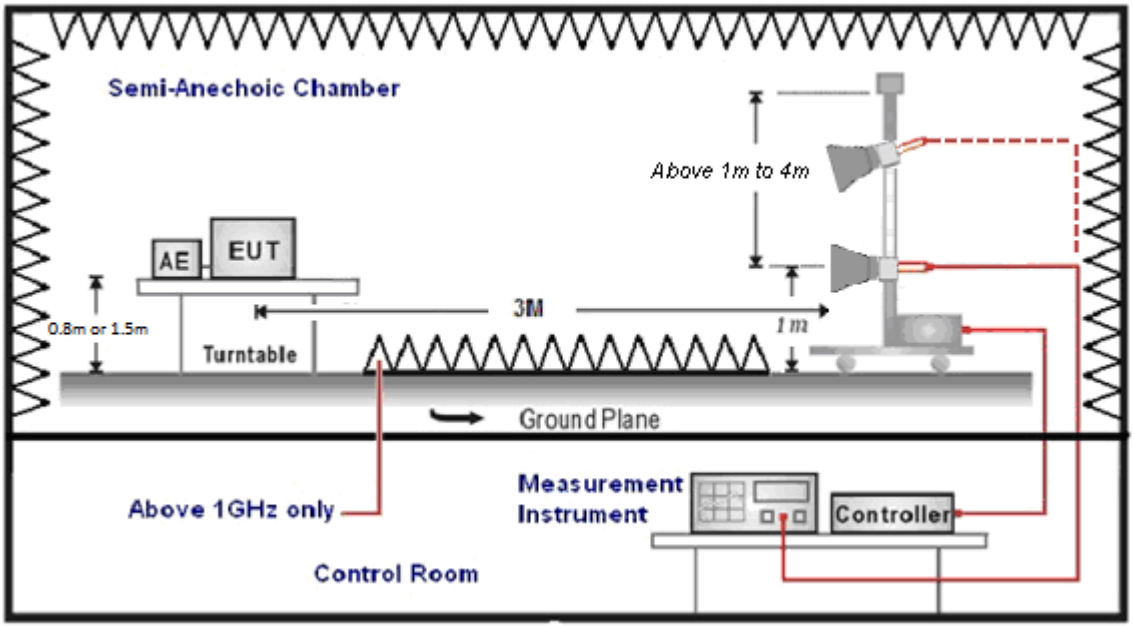
9 kHz ~ 30 MHz



Below 1 GHz



Above 1 GHz



■ **Test Procedure**

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 26.5 GHz is investigated.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements when Duty cycle >98% / 1/T for average measurements when Duty cycle <98%. A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Biconilog Antenna at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna was used in frequencies 1 – 26.5 GHz at a distance of 1 meter. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20 dB/decade).

For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts pre meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro colts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

(1) Amplitude (dBuV/m) = FI (dBuV) +AF (dBuV) +CL (dBuV)-Gain (dB)
FI= Reading of the field intensity.
AF= Antenna factor.
CL= Cable loss.
P.S Amplitude is auto calculate in spectrum analyzer.

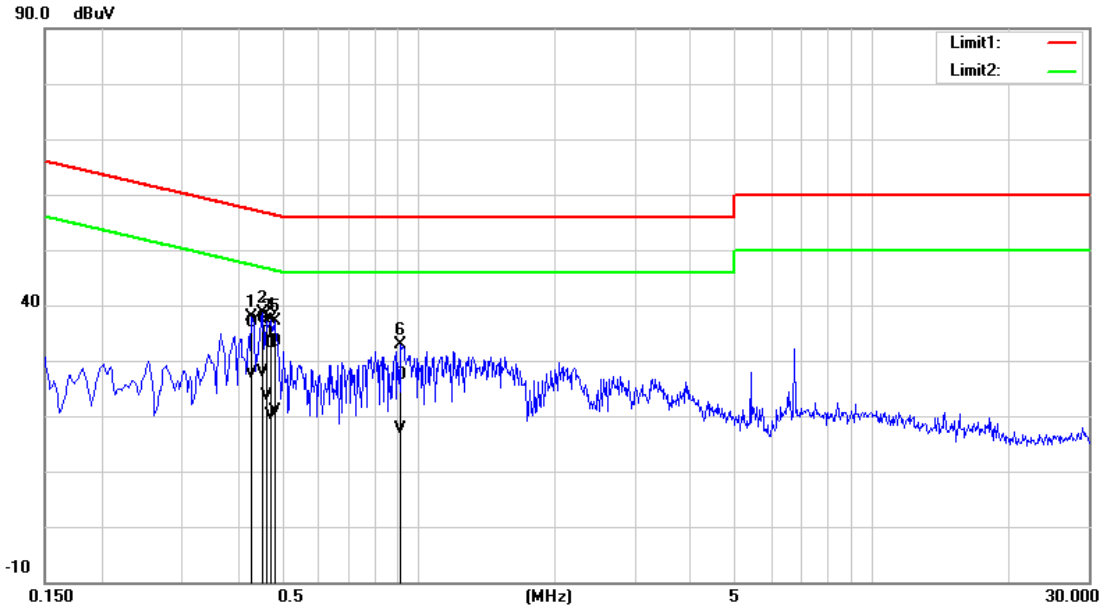
(2) Actual Amplitude (dBuV/m) = Amplitude (dBuV)-Dis(dB)
The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:
(a) For fundamental frequency : Transmitter Output < +30dBm
(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

Data of measurement within this frequency range without mark in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.

5 Test Results

Annex A. Conducted Emission

Standard:	FCC Part 15.247	Line:	L1
Test Mode:	Mode 1	Power:	AC 120 V/60 Hz
		Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Description:			



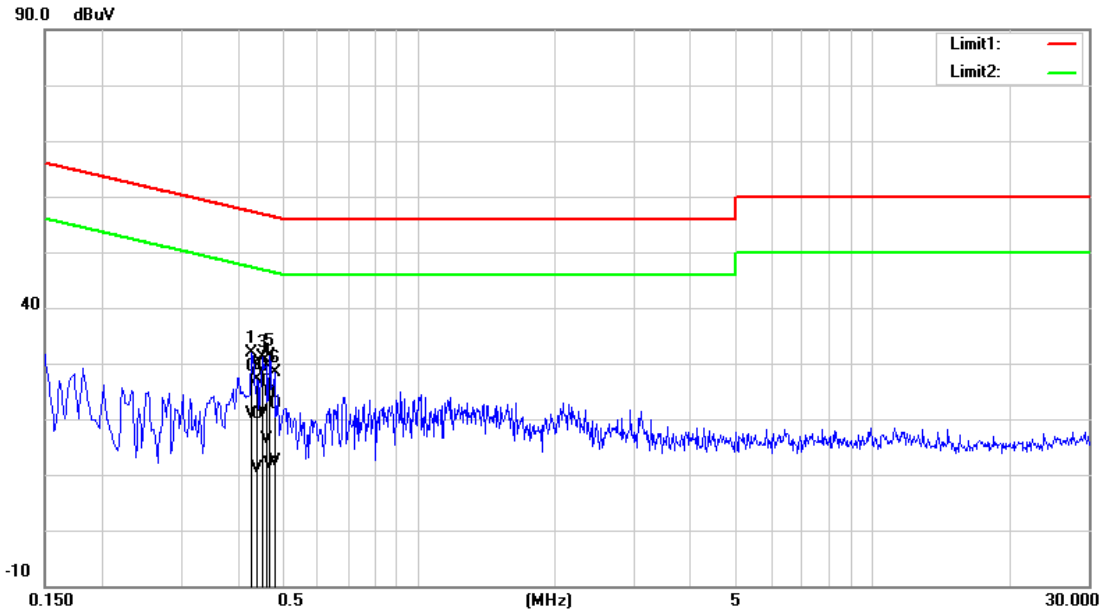
No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.4300	26.93	17.49	10.06	36.99	27.55	57.25	47.25	-20.26	-19.70	Pass
2	0.4540	27.65	17.84	10.09	37.74	27.93	56.80	46.80	-19.06	-18.87	Pass
3	0.4620	24.77	13.62	10.09	34.86	23.71	56.66	46.66	-21.80	-22.95	Pass
4	0.4740	23.13	10.12	10.10	33.23	20.22	56.44	46.44	-23.21	-26.22	Pass
5	0.4820	23.22	10.70	10.10	33.32	20.80	56.30	46.30	-22.98	-25.50	Pass
6	0.9140	17.56	7.83	9.90	27.46	17.73	56.00	46.00	-28.54	-28.27	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

For Example: 36.99=10.06+26.93

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Standard:	FCC Part 15.247	Line:	N
Test Mode:	Mode 1	Power:	AC 120 V/60 Hz
		Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.4300	19.32	10.95	9.94	29.26	20.89	57.25	47.25	-27.99	-26.36	Pass
2	0.4420	10.92	1.25	9.94	20.86	11.19	57.02	47.02	-36.16	-35.83	Pass
3	0.4540	19.53	11.22	9.94	29.47	21.16	56.80	46.80	-27.33	-25.64	Pass
4	0.4620	16.69	6.32	9.94	26.63	16.26	56.66	46.66	-30.03	-30.40	Pass
5	0.4700	14.79	1.90	9.94	24.73	11.84	56.51	46.51	-31.78	-34.67	Pass
6	0.4820	12.67	2.38	9.94	22.61	12.32	56.30	46.30	-33.69	-33.98	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).
2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Annex B. Radiated Emission Measurement

Harmonic

Below 1GHz

Standard:	FCC Part 15.247	Test Distance:	3 m
Test Mode:	Mode 1	Power:	AC 120 V/60 Hz
		Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
285.1100	35.58	-10.53	25.05	46.00	-17.35	peak	H
342.3400	37.86	-9.36	28.50	46.00	-12.48	peak	H
455.8300	36.00	-6.39	29.61	46.00	-14.82	peak	H
513.0600	41.33	-4.85	36.48	46.00	-13.19	peak	H
683.7800	30.91	-1.70	29.21	46.00	-17.82	peak	H
944.7100	28.58	1.43	30.01	46.00	-15.79	peak	H
50.3700	37.91	-11.03	26.88	40.00	-13.12	peak	V
94.9900	41.13	-15.68	25.45	43.50	-18.05	peak	V
139.6100	38.55	-10.95	27.60	43.50	-15.90	peak	V
285.1100	38.34	-10.53	27.81	46.00	-18.19	peak	V
513.0600	37.24	-4.85	32.39	46.00	-13.61	peak	V
570.2900	37.53	-3.52	34.01	46.00	-11.99	peak	V

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.