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# FCC Test Report

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Report No.: AGC00174210901FE02A

**FCC ID** : XBE-LAXXIO

**APPLICATION PURPOSE** : Class II permissive change

**PRODUCT DESIGNATION** : LA33IO

**BRAND NAME** : LINAK

**MODEL NAME** : LA33IO

**APPLICANT** : LINAK A/S

**DATE OF ISSUE** : Jun. 01, 2023

**STANDARD(S)** : FCC Part 15.247

**REPORT VERSION** : V1.0

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**REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jun. 01, 2023	Valid	Initial Release

**Note:** The original test report AGC00174210901FE02 (dated Dec. 03, 2021 and tested from Sep. 17, 2021 to Dec. 02, 2021) was modified on Jun. 01, 2023, including the following changes and additions:

- Change the device Product Designation;
- Change the device Model Name;
- Change the device Hardware Version;
- Change the device Software Version;
- PCB Layout adopted for component changes for the control functions. RF Portion (Bluetooth) remains fully identical;

Based on the above changes, additional tests for Radiated Emission and Peak Output Power.

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### 1. VERIFICATION OF COMPLIANCE

<b>Applicant</b>	LINAK A/S
<b>Address</b>	Group Headquarters, Smedevænget 8, Guderup DK-6430 Nordborg, Denmark
<b>Manufacturer</b>	LINAK A/S
<b>Address</b>	Group Headquarters, Smedevænget 8, Guderup DK-6430 Nordborg, Denmark
<b>Factory</b>	LINAK A/S
<b>Address</b>	Group Headquarters, Smedevænget 8, Guderup DK-6430 Nordborg, Denmark
<b>Product Designation</b>	LA33IO
<b>Brand Name</b>	LINAK
<b>Test Model</b>	LA33IO
<b>Date of receipt of test item</b>	Nov. 28, 2022
<b>Date of test</b>	Nov. 28, 2022 to Dec. 09, 2022 and Jun. 01, 2023
<b>Deviation</b>	No any deviation from the test method
<b>Condition of Test Sample</b>	Normal
<b>Test Result</b>	Pass
<b>Report Template</b>	AGCRT-US-BLE/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC part 15.247.

Prepared By	 <hr/> Cool Cheng (Project Engineer)	Jun. 01, 2023
Reviewed By	 <hr/> Calvin Liu (Reviewer)	Jun. 01, 2023
Approved By	 <hr/> Max Zhang (Authorized Officer)	Jun. 01, 2023

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## 2. GENERAL INFORMATION

### 2.1. PRODUCT DESCRIPTION

The EUT is designed as a “LA33IO”. It is designed by way of utilizing the GFSK technology to achieve the system operation.

A major technical description of EUT is described as following

<b>Operation Frequency</b>	2.402GHz to 2.480GHz
<b>RF Output Power</b>	-2.877dBm (Max)
<b>Bluetooth Version</b>	V5.1
<b>Modulation</b>	BR <input type="checkbox"/> GFSK, EDR <input type="checkbox"/> $\pi/4$ -DQPSK, <input type="checkbox"/> 8DPSK BLE <input checked="" type="checkbox"/> GFSK 1Mbps <input type="checkbox"/> GFSK 2Mbps
<b>Number of channels</b>	40 Channels
<b>Antenna Designation</b>	Omnidirectional Antenna (Comply with requirements of the FCC part 15.203)
<b>Antenna Gain</b>	-2.10dBi
<b>Hardware Version</b>	10CS33500033000-A
<b>Software Version</b>	02023029v1.0
<b>Power Supply</b>	DC 24V~DC 48V

### 2.2. TABLE OF CARRIER FREQUENCIES

Frequency Band	Channel Number	Frequency
2400~2483.5MHz	0	2402 MHz
	1	2404 MHz
	:	:
	38	2478 MHz
	39	2480 MHz

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### **2.3. RELATED SUBMITTAL(S)/GRANT(S)**

This submittal(s) (test report) is intended for **FCC ID: XBE-LAXXIO** filing to comply with the FCC Part 15.247 requirements.

### **2.4. TEST METHODOLOGY**

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

### **2.5. SPECIAL ACCESSORIES**

Refer to section 5.2.

### **2.6. EQUIPMENT MODIFICATIONS**

Not available for this EUT intended for grant.

### **2.7. ANTENNA REQUIREMENT**

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device. For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

### 3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	$U_c = \pm 2.9$ dB
Uncertainty of Radiated Emission below 1GHz	$U_c = \pm 3.9$ dB
Uncertainty of Radiated Emission above 1GHz	$U_c = \pm 4.9$ dB
Uncertainty of total RF power, conducted	$U_c = \pm 0.8$ dB
Uncertainty of RF power density, conducted	$U_c = \pm 2.6$ dB
Uncertainty of spurious emissions, conducted	$U_c = \pm 2.7$ %
Uncertainty of Occupied Channel Bandwidth	$U_c = \pm 2$ %

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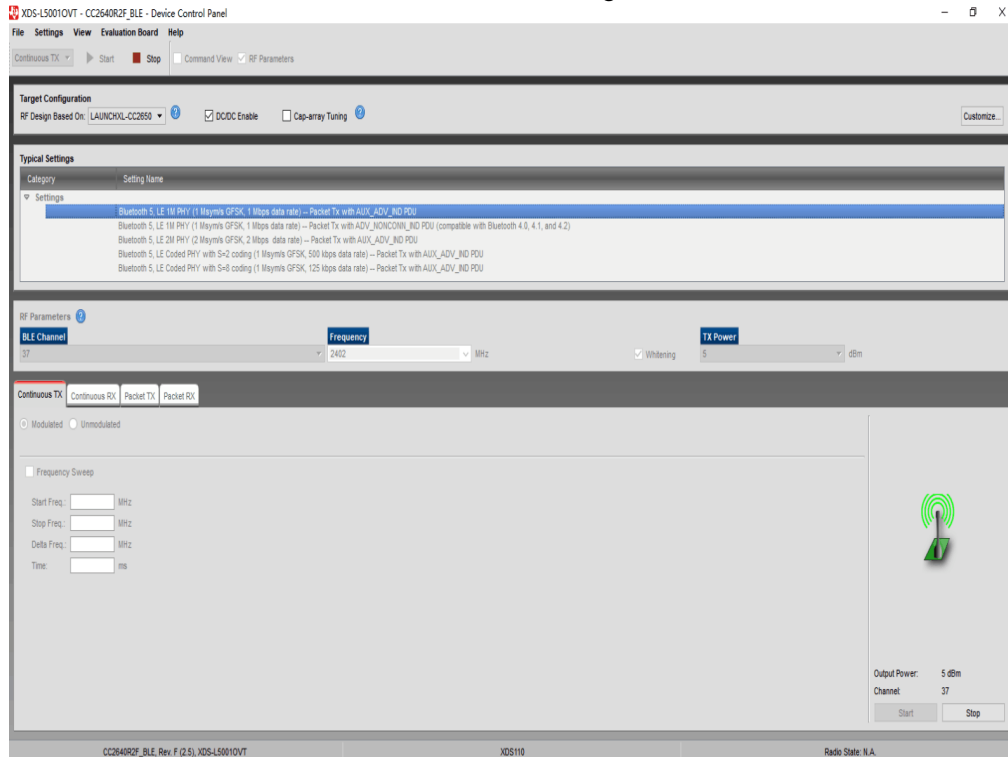
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#### 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX_2402MHz_GFSK_1Mbps
2	Middle channel TX_2440MHz_GFSK_1Mbps
3	High channel TX_2480MHz_GFSK_1Mbps

- Note: 1. Only the result of the worst case was recorded in the report, if no other cases.  
 2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.  
 3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

#### Software Setting



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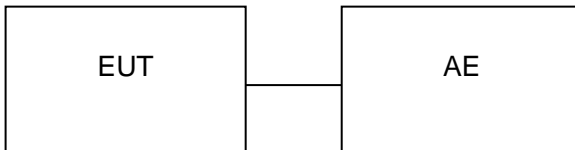
## 5. SYSTEM TEST CONFIGURATION

### 5.1. CONFIGURATION OF TESTED SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



### 5.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	LA33IO	LA33IO	XBE-LAXXIO	EUT
2	Control Box	USB TO TTL	N/A	AE

### 5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(3)	Peak Output Power	Compliant
15.209	Radiated Emission	Compliant

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## 6. TEST FACILITY

<b>Test Site</b>	Attestation of Global Compliance (Shenzhen) Co., Ltd
<b>Location</b>	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
<b>Designation Number</b>	CN1259
<b>FCC Test Firm Registration Number</b>	975832
<b>A2LA Cert. No.</b>	5054.02
<b>Description</b>	Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA

### TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Apr. 14, 2021	Apr. 13, 2022
Test Receiver	R&S	ESCI	10096	Mar. 28, 2022	Mar. 27, 2023
EXA Signal Analyzer	Agilent	N9010A	MY53470504	Dec. 07, 2020	Dec. 06, 2021
EXA Signal Analyzer	Agilent	N9010A	MY53470504	Aug. 04, 2022	Aug. 03, 2023
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
2.4GHz Filter	EM Electronics	N/A	N/A	Mar. 18, 2022	Mar. 19, 2024
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
Attenuator	ZHINAN	E-002	N/A	Aug. 04, 2022	Aug. 03, 2024
Horn Antenna	SCHWARZBECK	BBHA9170	768	Oct. 09, 2019	Oct. 08, 2021
Horn Antenna	SCHWARZBECK	BBHA9170	768	Oct. 07, 2021	Oct. 08, 2023
Horn Antenna	SCHWARZBEC	BBHA9170	768	Oct. 31, 2021	Oct. 30, 2023
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Active Loop Antenna (9K-30Mhz)	ZHINAN	ZN30900C	18051	Mar. 12, 2022	Mar. 11, 2024
Double-Ridged Waveguide Horn	ETS	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Double-Ridged Waveguide Horn	ETS	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Preamplifier Assembly	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
Preamplifier Assembly	ETS	3117PA	00225134	Sep. 01, 2022	Sep. 02, 2024
Wideband Frequency Antenna	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 08, 2021	Jan. 07, 2023
Test Software	FARA	EZ-EMC	Ver.RA-03A	N/A	N/A

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## 7. PEAK OUTPUT POWER

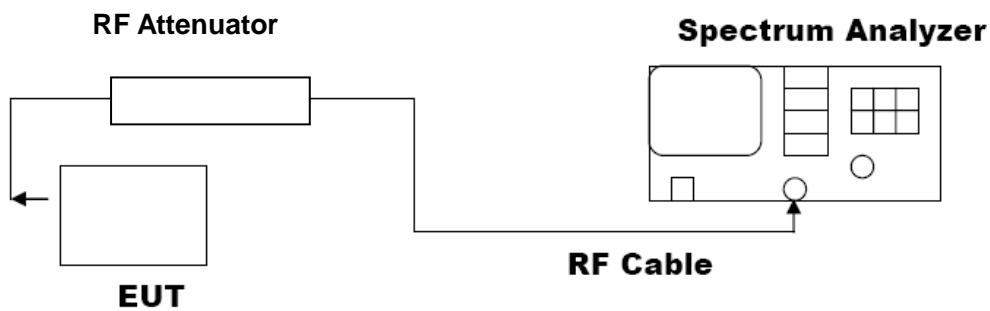
### 7.1. MEASUREMENT PROCEDURE

For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2.  $RBW \geq DTS$  bandwidth.
3.  $VBW \geq 3 * RBW$ .
4.  $SPAN \geq VBW$ .
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

### 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) PEAK POWER TEST SETUP



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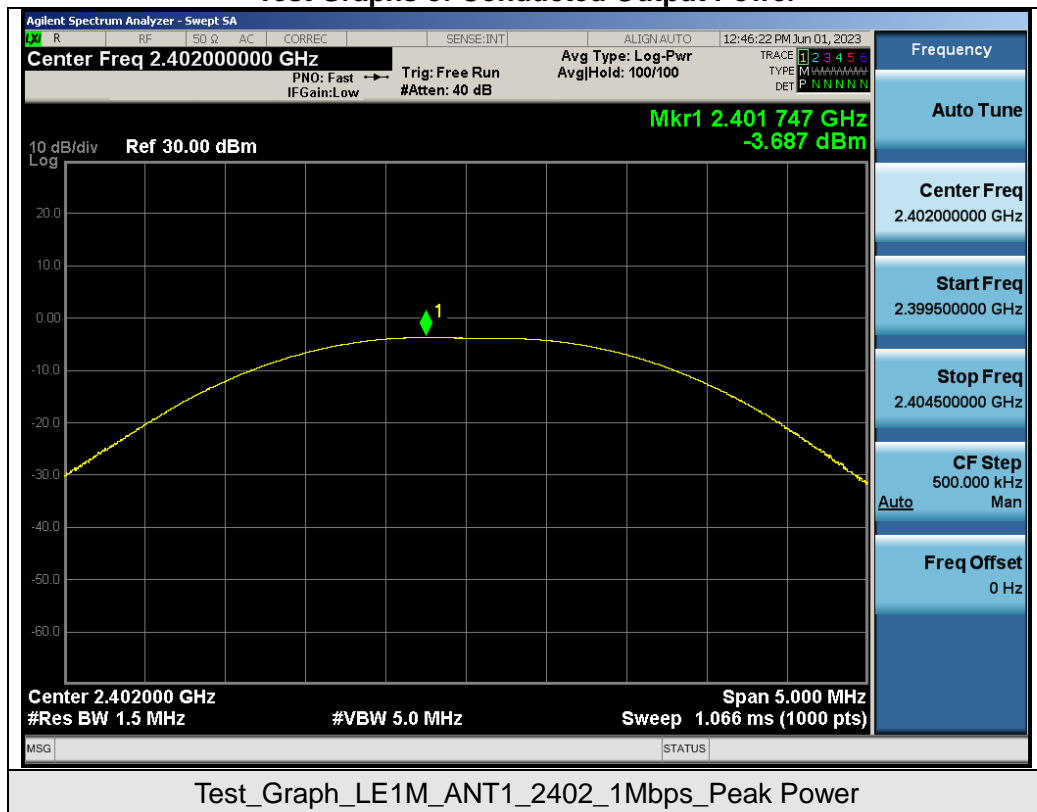
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### 7.3. LIMITS AND MEASUREMENT RESULT

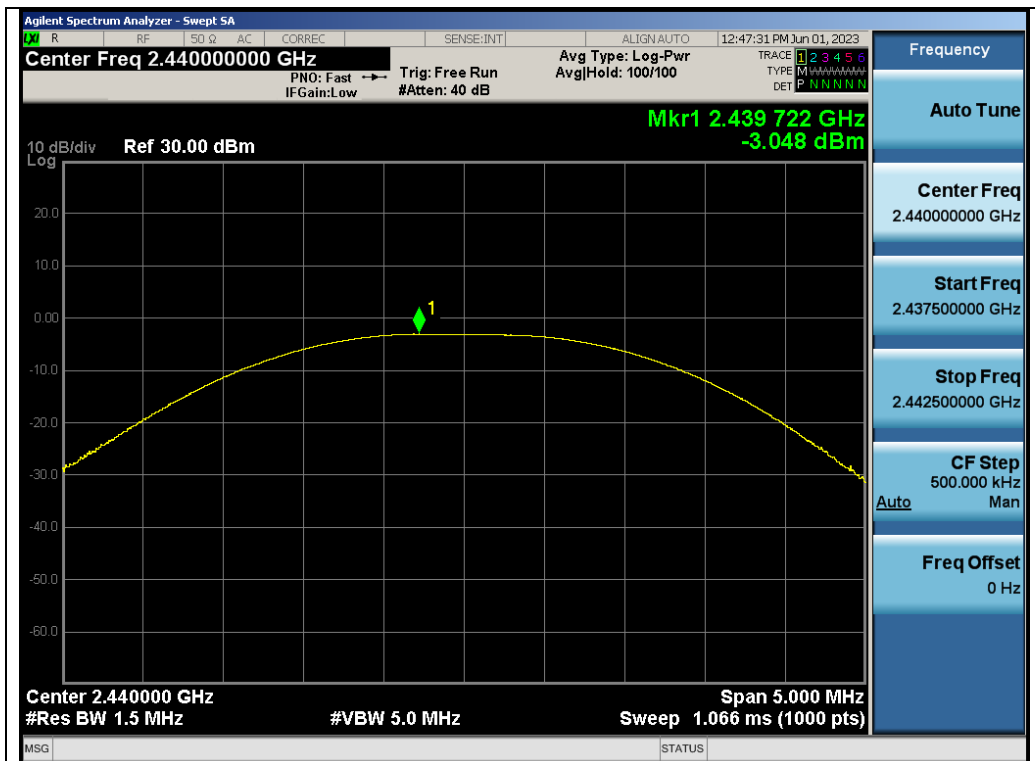
Test Data of Conducted Output Power				
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
GFSK 1M	2402	-3.687	≤ 30	Pass
	2440	-3.048	≤ 30	Pass
	2480	-2.877	≤ 30	Pass

### Test Graphs of Conducted Output Power

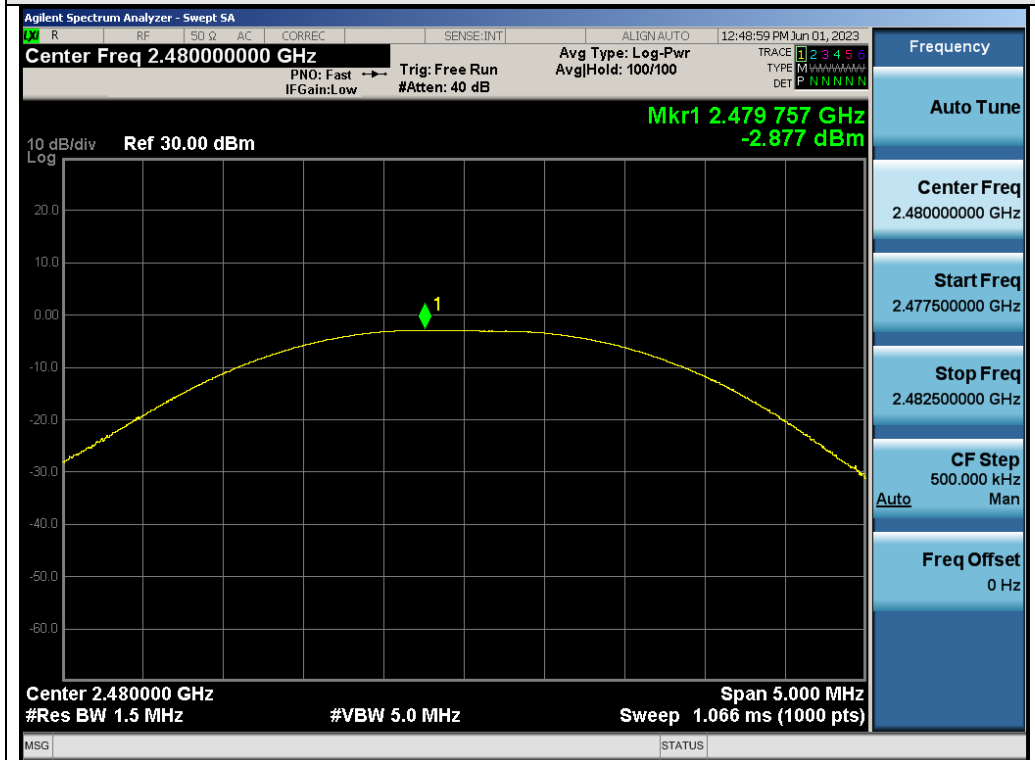


Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_Peak Power

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Test\_Graph\_LE1M\_ANT1\_2440\_1Mbps\_Peak Power



Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_Peak Power

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## 8. RADIATED EMISSION

### 8.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. 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. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions 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.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

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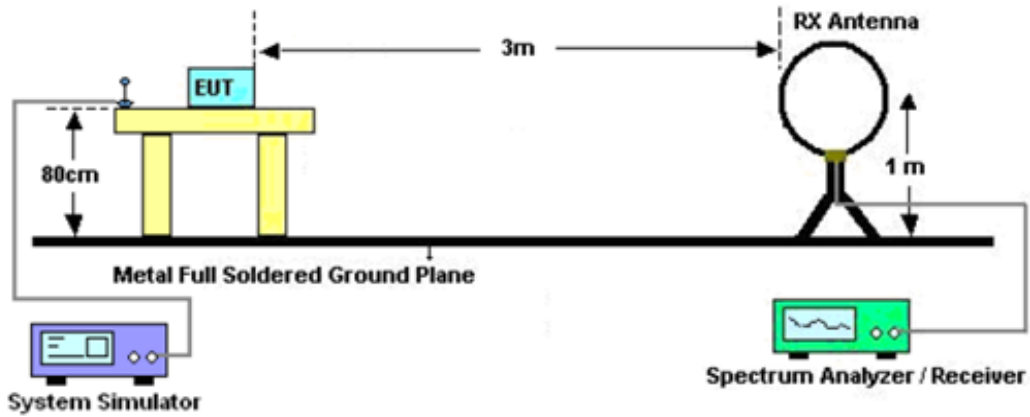
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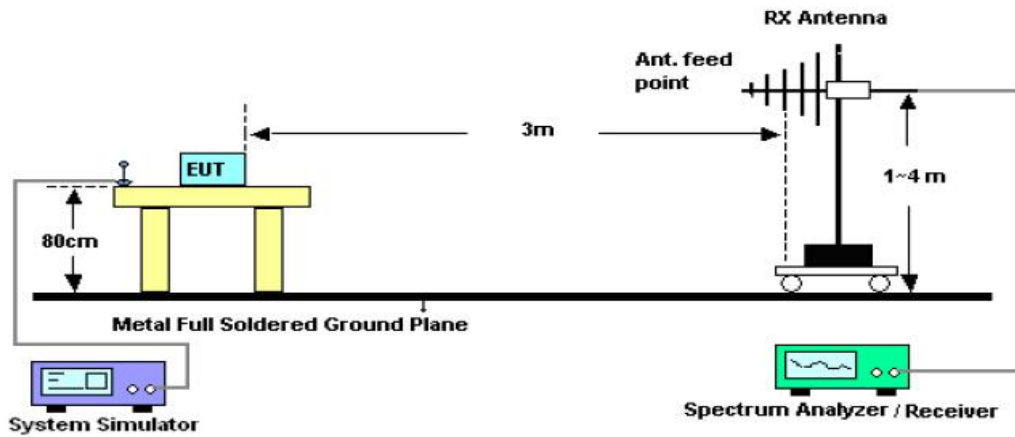


8.2. TEST SETUP

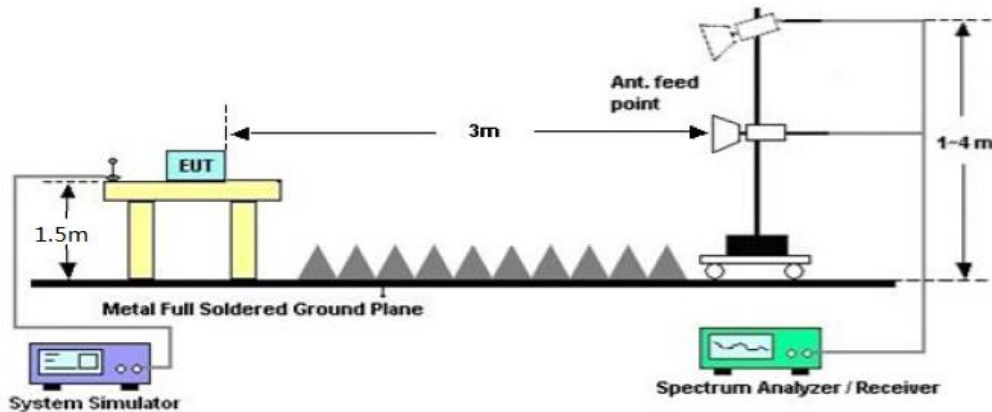
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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**8.3. LIMITS AND MEASUREMENT RESULT**

15.209 Limit in the below table has to be followed

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

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

**8.4. TEST RESULT**

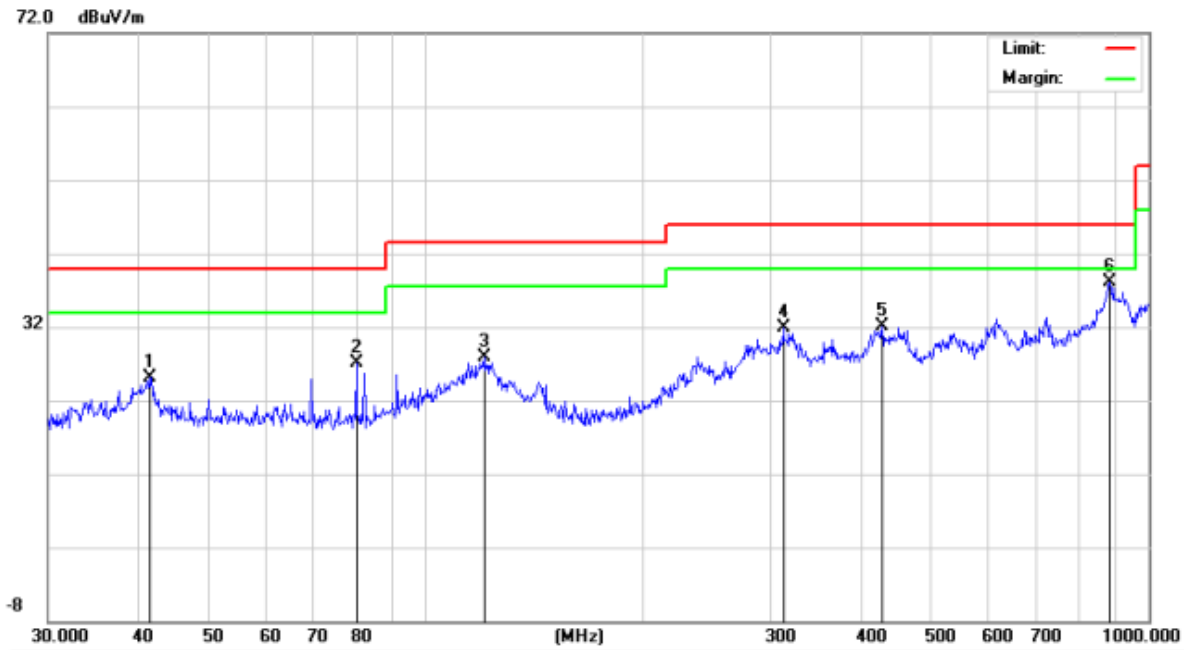
**Radiated emission below 30MHz**

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

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**Radiated emission from 30MHz to 1000MHz**

<b>EUT</b>	LA33IO	<b>Model Name</b>	LA33IO
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	57%
<b>Pressure</b>	985hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 3	<b>Antenna</b>	Horizontal

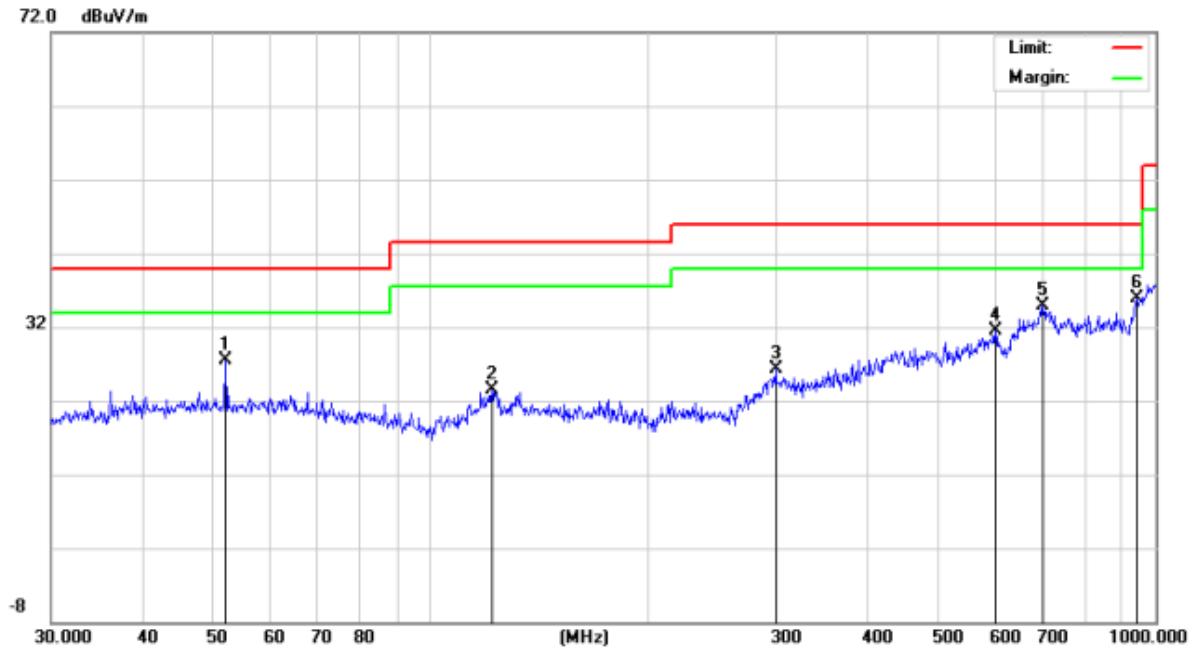


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		41.4215	10.24	14.92	25.16	40.00	-14.84	peak
2		80.0806	13.04	14.12	27.16	40.00	-12.84	peak
3		120.2766	6.02	21.83	27.85	43.50	-15.65	peak
4		312.1792	6.11	25.72	31.83	46.00	-14.17	peak
5		428.0192	5.52	26.52	32.04	46.00	-13.96	peak
6	*	884.5028	6.08	31.96	38.04	46.00	-7.96	peak

**RESULT: PASS**

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EUT	LA33IO	Model Name	LA33IO
Temperature	25°C	Relative Humidity	57%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		52.2079	10.54	17.02	27.56	40.00	-12.44	peak
2		121.5486	6.77	16.66	23.43	43.50	-20.07	peak
3		299.3158	5.59	20.81	26.40	46.00	-19.60	peak
4		601.4265	5.47	25.96	31.43	46.00	-14.57	peak
5		699.3046	4.98	30.02	35.00	46.00	-11.00	peak
6	*	942.1305	4.79	31.02	35.81	46.00	-10.19	peak

**RESULT: PASS**

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

2. All test modes had been tested. The mode 3 is the worst case and recorded in the report.

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**Radiated emission above 1GHz**

<b>EUT</b>	LA33IO	<b>Model Name</b>	LA33IO
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	57%
<b>Pressure</b>	985hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 1	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
4804.000	48.79	0.08	48.87	74	-25.13	peak
4804.000	36.54	0.08	36.62	54	-17.38	AVG
7206.000	44.91	2.21	47.12	74	-26.88	peak
7206.000	33.04	2.21	35.25	54	-18.75	AVG

Remark:

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

<b>EUT</b>	LA33IO	<b>Model Name</b>	LA33IO
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	57%
<b>Pressure</b>	985hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 1	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
4804.000	46.87	0.08	46.95	74	-27.05	peak
4804.000	35.94	0.08	36.02	54	-17.98	AVG
7206.000	43.14	2.21	45.35	74	-28.65	peak
7206.000	32.01	2.21	34.22	54	-19.78	AVG

Remark:

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

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<b>EUT</b>	LA33IO	<b>Model Name</b>	LA33IO
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	57%
<b>Pressure</b>	985hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 2	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	49.31	0.14	49.45	74	-24.55	peak
4880.000	38.54	0.14	38.68	54	-15.32	AVG
7320.000	45.71	2.36	48.07	74	-25.93	peak
7320.000	35.26	2.36	37.62	54	-16.38	AVG

Remark:

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

<b>EUT</b>	LA33IO	<b>Model Name</b>	LA33IO
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	57%
<b>Pressure</b>	985hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 2	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	47.57	0.14	47.71	74	-26.29	peak
4880.000	38.42	0.14	38.56	54	-15.44	AVG
7320.000	44.37	2.36	46.73	74	-27.27	peak
7320.000	35.61	2.36	37.97	54	-16.03	AVG

Remark:

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

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<b>EUT</b>	LA33IO	<b>Model Name</b>	LA33IO
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	57%
<b>Pressure</b>	985hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 3	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	48.73	0.22	48.95	74	-25.05	peak
4960.000	37.94	0.22	38.16	54	-15.84	AVG
7440.000	45.12	2.64	47.76	74	-26.24	peak
7440.000	33.37	2.64	36.01	54	-17.99	AVG

Remark:

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

<b>EUT</b>	LA33IO	<b>Model Name</b>	LA33IO
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	57%
<b>Pressure</b>	985hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 3	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	46.85	0.22	47.07	74	-26.93	peak
4960.000	37.41	0.22	37.63	54	-16.37	AVG
7440.000	43.34	2.64	45.98	74	-28.02	peak
7440.000	34.07	2.64	36.71	54	-17.29	AVG

Remark:

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

## RESULT: PASS

### Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Margin=Emission Level-Limit.

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

**APPENDIX A: PHOTOGRAPHS OF TEST SETUP**

Refer to the Report No.: AGC00174210901AP02A

**APPENDIX B: PHOTOGRAPHS OF EUT**

Refer to the Report No.: AGC00174210901AP03A

**----END OF REPORT----**

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