ANDREAS STIHL AG & Co. KG

RF TEST REPORT

Report Type:
FCC Part 15.249 RF report

Model:
RE 100.0 PLUS CONTROL

REPORT NUMBER:
220601928SHA-001

ISSUE DATE:
October 8, 2022

DOCUMENT CONTROL NUMBER:
TTRF15.249_V1 © 2019 Intertek

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Report no.: 220601928SHA-001

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Applicant:	ANDREAS STIHL AG & Co. KG Badstrasse 115, 71336 Waiblingen. Germany
Manufacturer:	Kindclean Electric Green Technology (Suzhou) Co., Ltd. Suzhou, Jiangsu|215009
Factory:	Kindclean Electric Green Technology (Suzhou) Co., Ltd. Suzhou, Jiangsu|215009
PRODUCT NAME:	Pressure washer
TYPE/MODEL:	RE 100.0 PLUS CONTROL
FCC ID:	2ALP8RE02A

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 15 (2020): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

PREPARED BY:	**REVIEWED BY:**
Scout Gong	Eric Li
Project Engineer	Reviewer

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Content

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Revision History

Report No.	Version	Description	Issued Date
220601928SHA-001	Rev. 01	Initial issue of report	October 8, 2022

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Measurement result summary

TEST ITEM	FCC REFERENCE	RESULT
Radiated emission	15.249 & 15.209	Pass
Power line conducted emission	15.207	Pass
Assigned bandwidth (20dB bandwidth)	15.215(c)	Pass
Antenna requirement	15.203	Pass

Notes: 1: NA =Not Applicable

TEST REPORT

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	Pressure washer
Type/Model:	RE 100.0 PLUS CONTROL
Description of EUT:	The EUT is a pressure washer which equipped with 2428 MHz module, intended for domestic cleaning.
Rating:	High pressure washer: 120V AC, 13A, 60Hz, 1.5KW Remote module: 3V DC
Category of EUT:	Class B
EUT type:	☐ Table top ☒ Floor standing
Software Version:	/
Hardware Version:	/
Sample Identification No.:	0220808-23-001
Sample received date:	August 08, 2022
Date of test:	August 09, 2022~September 28, 2022

1.2 Technical Specification

Operation Frequency:	2400MHz ~ 2483.5MHz
Support Standards:	SRD
Type of Modulation:	GFSK
Product Type:	☐ Mobile ☒ Portable ☐ Fix Location
Channel Number:	1
Antenna Designation:	Integral PCB antenna
Gain of Antenna:	2.02dBi max

1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road (North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN0175
	IC Registration Lab Registration code No.: 2042B-1
	VCCI Registration Lab Registration No.: R-4243, G-845, C-4723, T-2252
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2020)
ANSI C63.10 (2013)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

1) Radiated test mode: EUT transmitted signal with antenna.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
-	-	-	-

2.5 Test environment condition:

Test items	Temperature	Humidity
Fundamental & spurious emission & Restrict band radiated emission	24°C	53% RH
Power line conducted emission	21°C	48% RH
Emission bandwidth & Transmission Time	24°C	49% RH

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2.6 Instrument list

Conducted Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	Test Receiver	R&S	ESCS 30	EC 2107	2023-07-18
☑	A.M.N.	R&S	ESH2-Z5	EC 3119	2022-11-09
☑	Attenuator	Weinschel	68-6-44	EC 3043-9	2023-02-08
☑	Shielded room	Zhongyu	-	EC 2838	2023-01-11
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	Test Receiver	R&S	ESIB 26	EC 3045	2022-10-19
☑	Bilog Antenna	TESEQ	CBL 6112B	EC 6411	2023-08-07
☑	Pre-amplifier	tonscend	tap01018050	EC 6432-1	2022-12-26
☑	Horn antenna	tonscend	bha9120d	EC 6432-2	2023-01-09
☐	Horn antenna	ETS	3117	EC 4792-1	2023-06-27
☐	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2023-07-29
☐	Pre-amplifier	R&S	AFS42-00101800 -25-S-42	EC 5262	2023-06-04
☑	Semi-anechoic chamber	Albatross project	-	EC 3048	2023-08-21
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2023-03-14
☑	Power sensor	Agilent	U2021XA	EC 5338-1	2023-03-14
☑	Vector Signal Generator	Agilent	N5182B	EC 5175	2023-03-14
☑	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2023-03-14
☑	Test Receiver	R&S	ESCI 7	EC 4501	2022-12-09
☐	Climate chamber	GWS	MT3065	EC 6021	2023-03-06
☐	Spectrum Analyzer	Keysight	N9030b	EC 6078	2023-09-07
☐	Universal Radio Communication Tester	R&S	CMW500	EC 6209	2023-01-20
☐	Signal generator	Agilent	N5182A	EC 6172	2022-11-18
☐	Signal generator	Agilent	N5181A	EC 6171	2022-11-18
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3442	2023-01-03
☑	Pressure meter	YM3	Shanghai Mengde	EC 4620	2023-09-13

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Maximum peak output power	± 0.68dB
Radiated Emissions in restricted frequency bands below 1GHz	± 4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	± 4.80dB
Emission outside the frequency band	± 4.80dB
Power line conducted emission	± 2.7dB

3 Radiated emission

Test result: **Pass**

3.1 Limit

Fundamental Frequency (MHz)	Fundamental limit (dBuV/m)	Harmonic limit (dBuV/m)
☐ 902 - 928	94	54
☒ 2400 - 2483.5	94	54
☐ 5725 - 5875	94	54
☐ 24000 - 24250	108	68

The radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits:

Frequencies (MHz)	Field Strength (microvolts/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

3.2 Measurement Procedure

For Radiated emission below 30MHz:

a) The EUT was placed on the top of a rotating turntable 0.1 meters above the ground at a 3 meter chamber room. The turntable was rotated 360 degrees to determine the position of the highest radiation.
b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c) Both X and Y axes of the antenna are set to make the measurement.
d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

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For Radiated emission above 30MHz:

a) The EUT was placed on the top of a rotating turntable 0.1 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The turntable was rotated 360 degrees to determine the position of the highest radiation.

b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c) The height of antenna is varied from one meter to four meters 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.

d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e) 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.

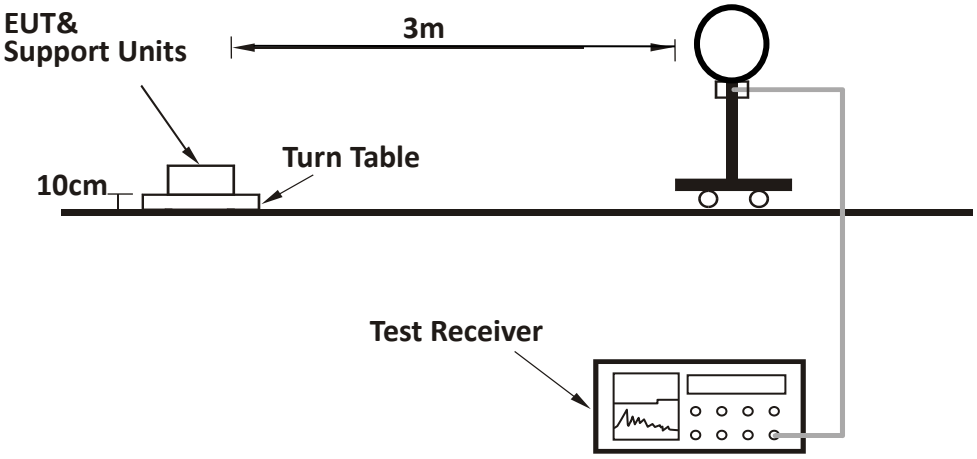
f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

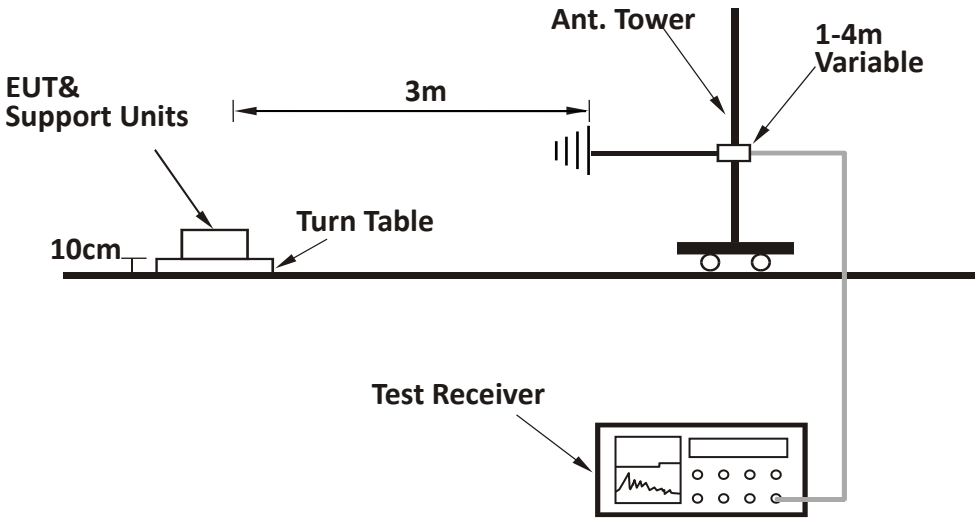
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 3 x RBW (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported

3.3 Test Configuration

For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



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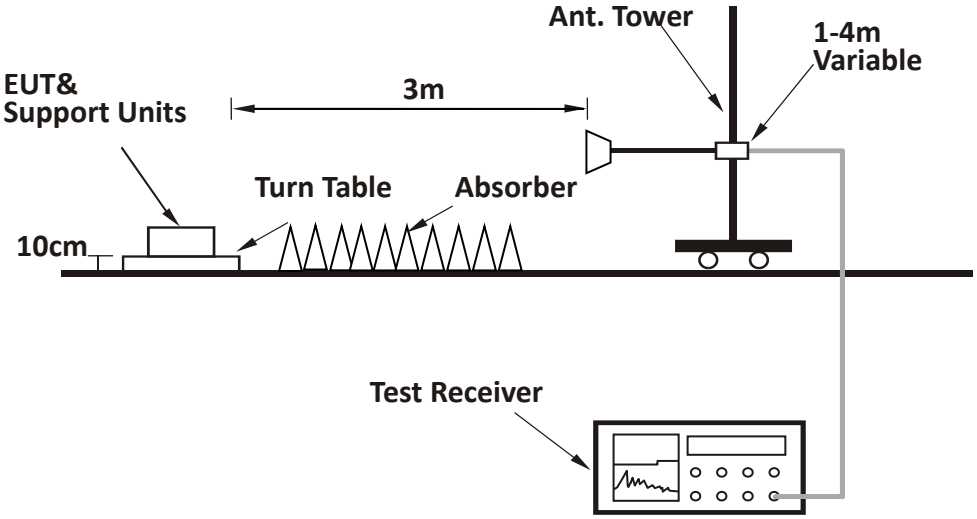
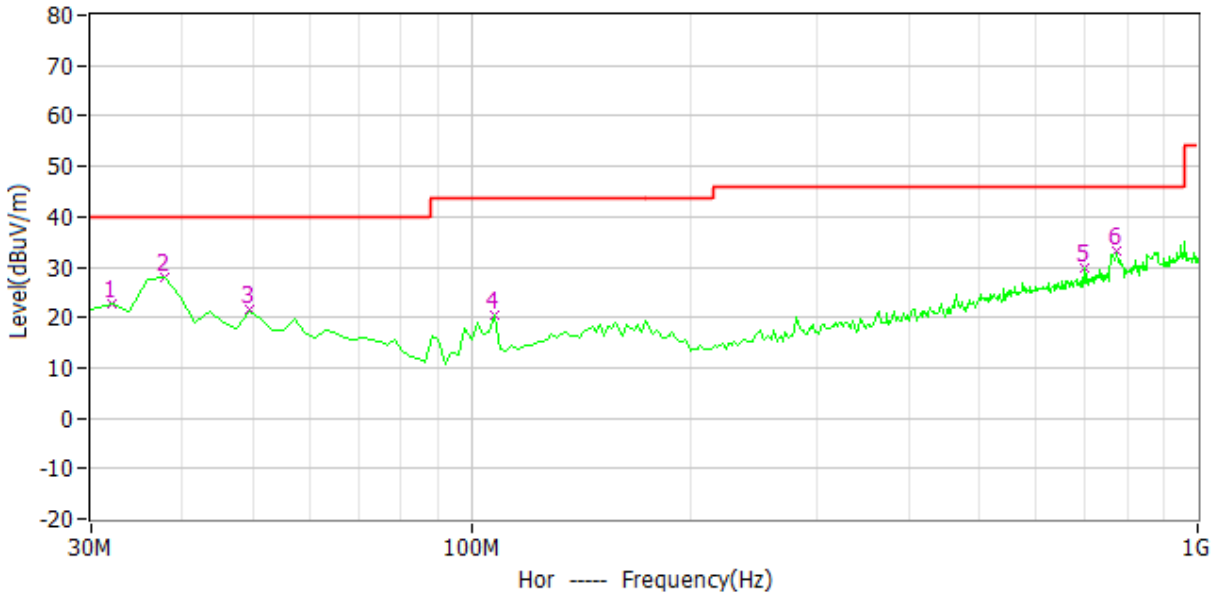
For Radiated emission above 1GHz:

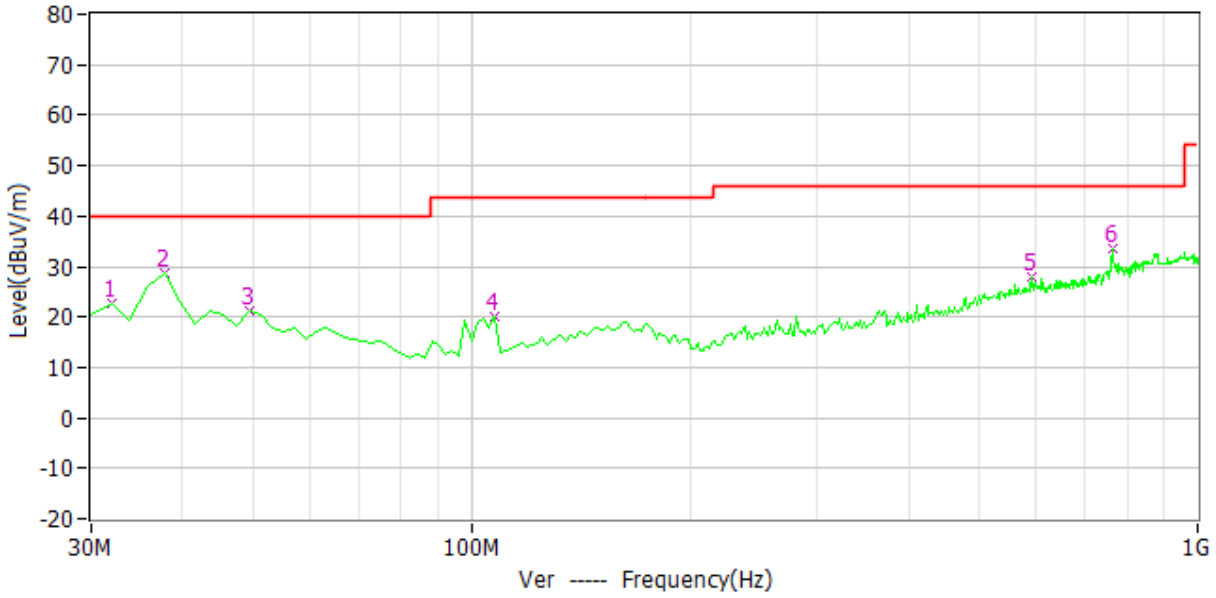


3.4 Test Results of Radiated Emissions

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:





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Test data:

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	31.94	22.80	13.00	40.00	17.20	PK
H	37.77	28.10	13.60	40.00	11.90	PK
H	49.43	21.40	14.50	40.00	18.60	PK
H	107.75	20.30	10.50	43.50	23.20	PK
H	700.64	29.90	23.50	46.00	16.10	PK
H	774.50	33.00	25.00	46.00	13.00	PK
V	31.94	22.60	13.00	40.00	17.40	PK
V	37.77	28.60	13.60	40.00	11.40	PK
V	49.43	21.20	14.50	40.00	18.80	PK
V	107.75	19.90	10.50	43.50	23.60	PK
V	591.78	28.10	22.00	46.00	17.90	PK
V	762.84	33.50	24.80	46.00	12.50	PK

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Test result above 1GHz:

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	2390.00	50.10	-22.70	74.00	23.90	PK
V	2390.00	50.10	-22.70	74.00	23.90	PK
H	2428.00	50.20	-22.50	114.00	23.80	PK
V	2428.00	50.30	-22.50	114.00	23.70	PK
H	2483.50	31.40	-22.30	74.00	42.60	PK
V	2483.50	31.60	-22.30	74.00	42.40	PK
H	4856.00	40.60	-14.10	74.00	33.40	PK
V	4856.00	41.90	-14.10	74.00	32.10	PK

Remark:

1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;
Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

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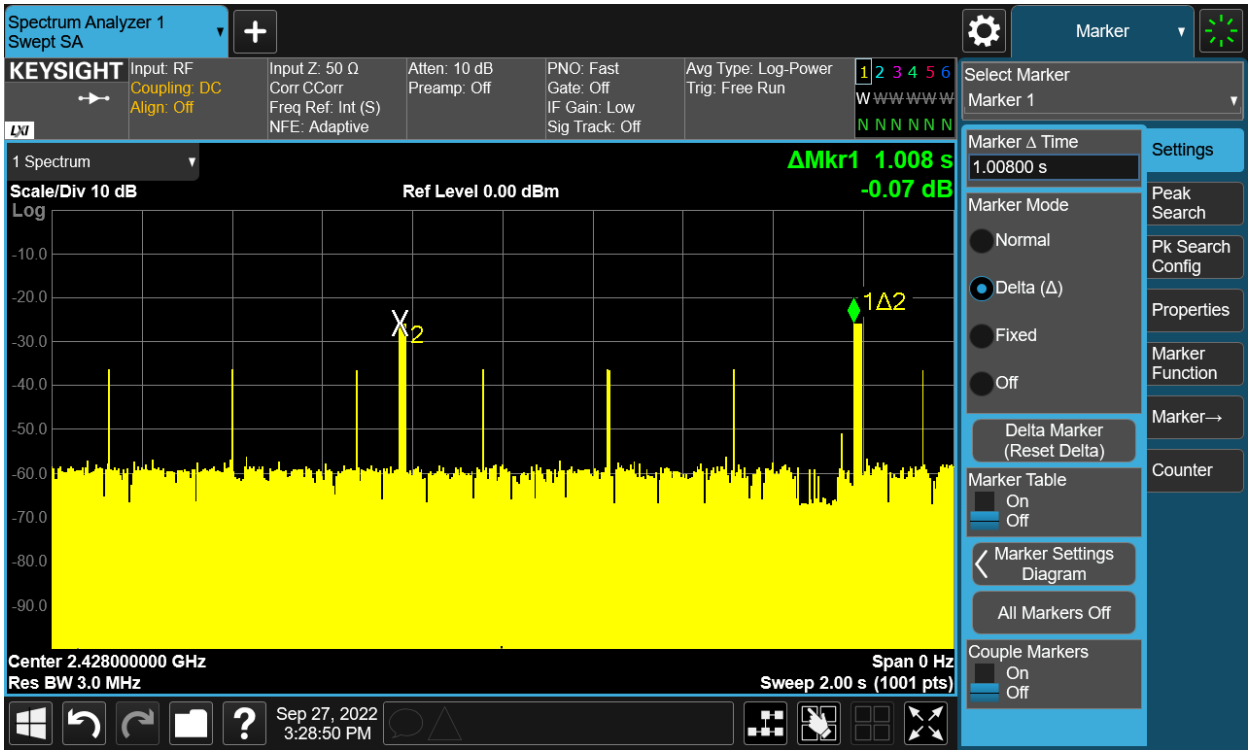
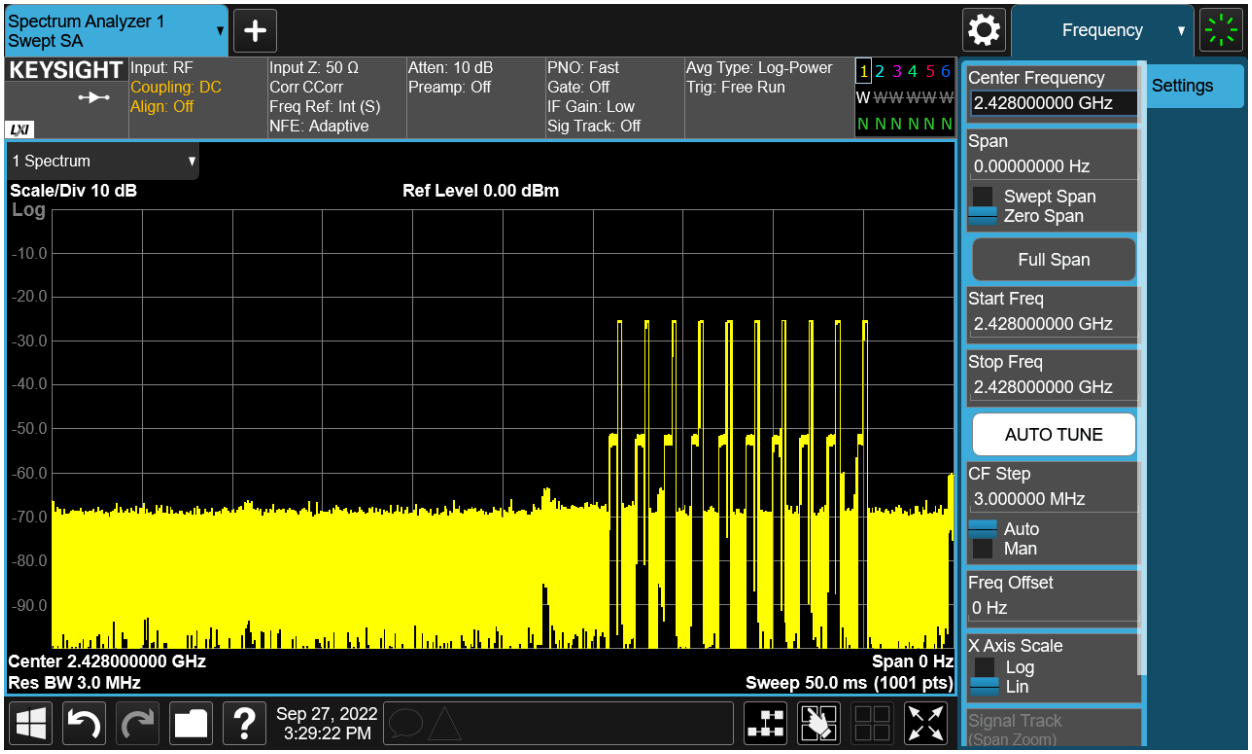
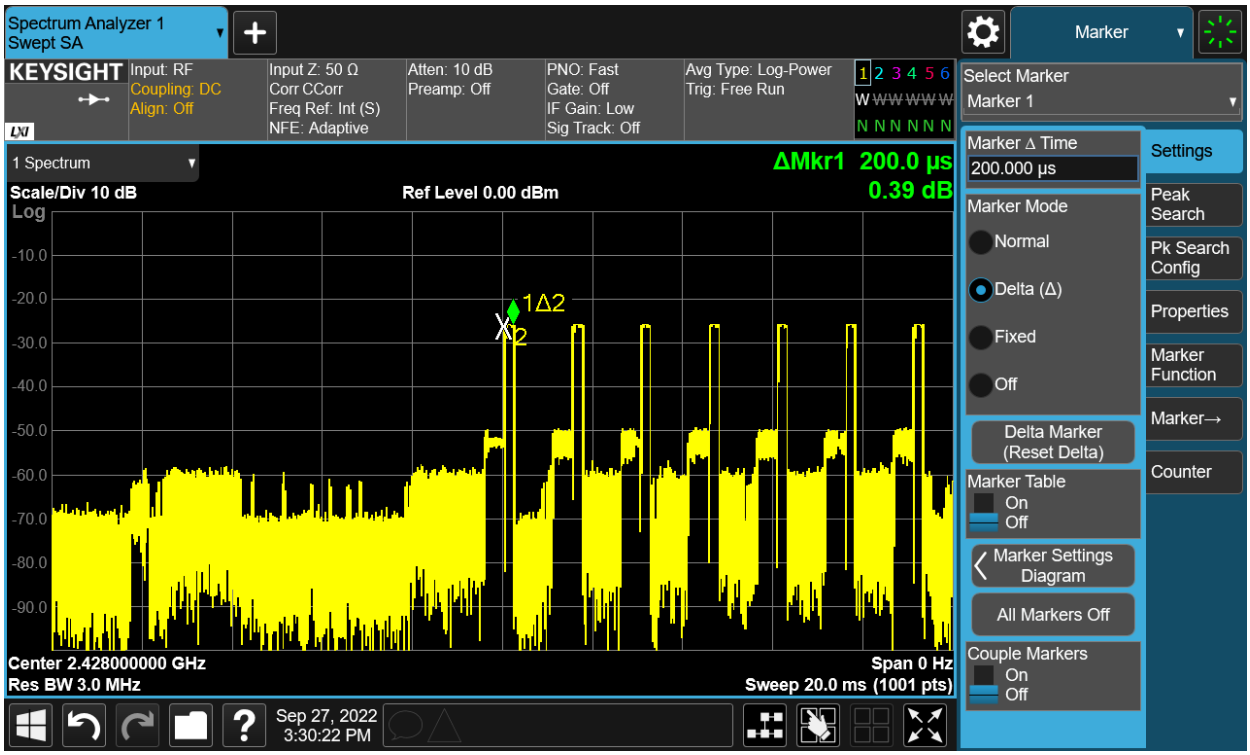
Duty Cycle:

The test data with maximum duty cycle was listed below.
The worst Duty cycle= (0.2 ms * 10)/1008 ms = 0.198%





TEST REPORT



Calculating the AV value according to the duty cycle

Antenna	Frequency (MHz)	PK Reading (dBuV/m)	Correct Factor (dB)	AV Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2428.00	50.20	-74.04	-23.84	94.00	117.84
V	2428.00	50.30		-23.85	94.00	117.85

Remark:

1. Correct Factor = 20lg (duty cycle) = 20lg (0.000198) = -74.04
2. AV Reading = PK Reading + Correct Factor
3. Margin = limit - AV Reading.

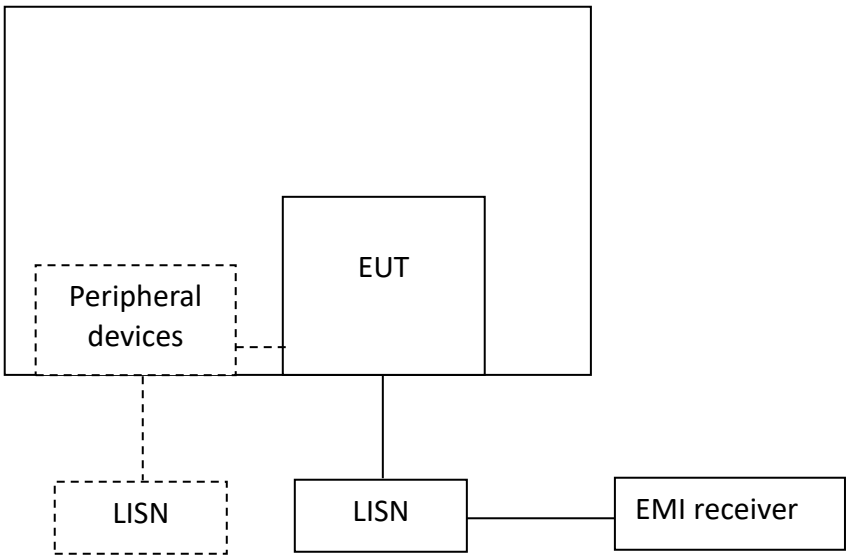
4 Power line conducted emission

Test result: **Pass**

4.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

4.2 Test Configuration



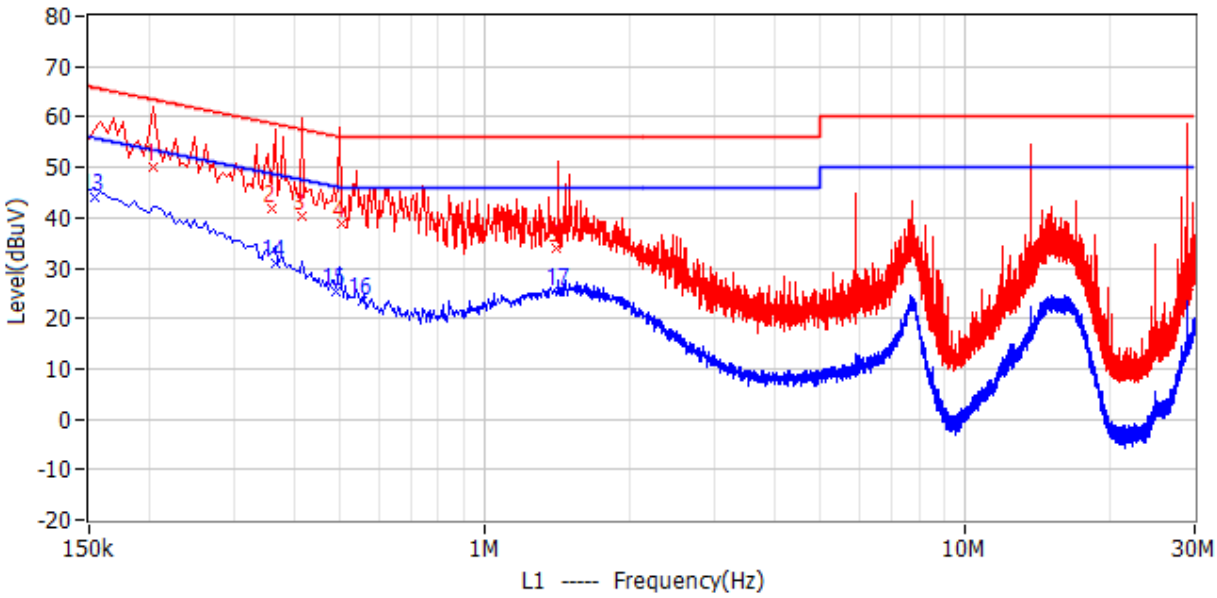
4.3 Measurement Procedure

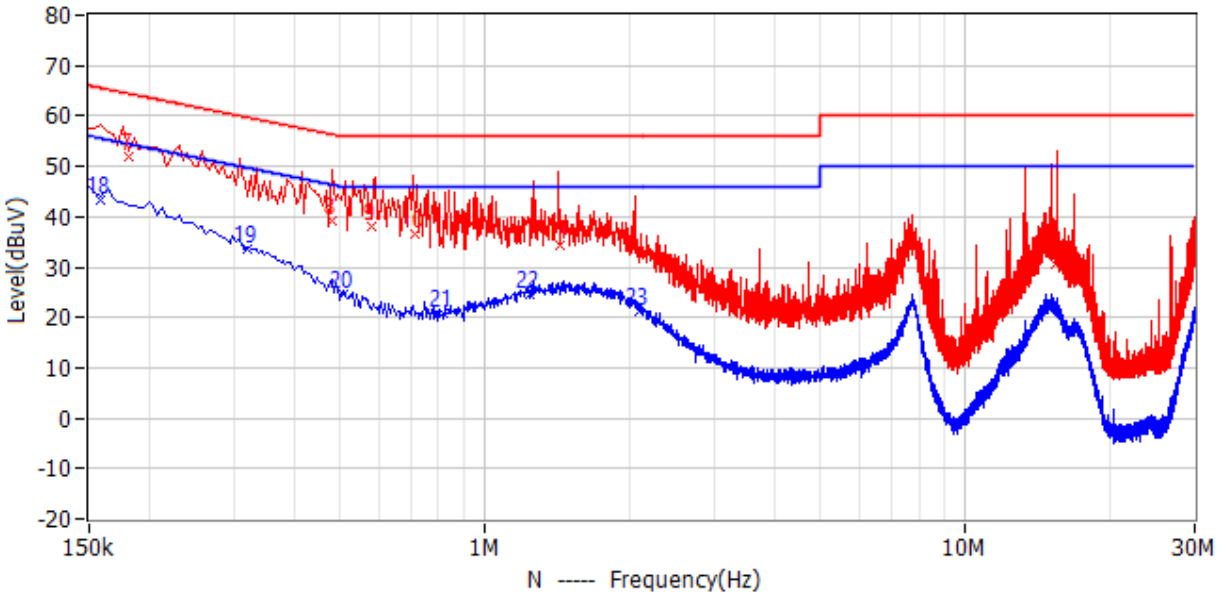
Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

4.4 Test Results of Power line conducted emission





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Test Data:

Frequency	Limit (dBuV)	Corrected Reading (dBuV)	Margin (dB)	Original Receiver Reading (dBuV)	Correct Factor (dB)	Detector	Phase
204.00kHz	63.40	49.90	13.60	43.70	6.20	QP	L1
361.50kHz	58.70	41.80	16.90	35.60	6.20	QP	L1
415.50kHz	57.50	40.30	17.20	34.10	6.20	QP	L1
501.00kHz	56.00	38.80	17.20	32.60	6.20	QP	L1
1.40MHz	56.00	33.80	22.20	27.60	6.20	QP	L1
29.11MHz	60.00	26.60	33.40	20.00	6.60	QP	L1
181.50kHz	64.40	51.90	12.50	45.70	6.20	QP	N
478.50kHz	56.40	39.30	17.10	33.00	6.30	QP	N
582.00kHz	56.00	37.90	18.10	31.60	6.30	QP	N
717.00kHz	56.00	36.40	19.60	30.10	6.30	QP	N
1.42MHz	56.00	34.20	21.80	27.90	6.30	QP	N
15.43MHz	60.00	30.60	29.40	24.10	6.50	QP	N
154.50kHz	55.80	44.00	11.80	37.80	6.20	CAV	L1
366.00kHz	48.60	30.90	17.70	24.70	6.20	CAV	L1
487.50kHz	46.20	25.50	20.70	19.30	6.20	CAV	L1
555.00kHz	46.00	23.30	22.70	17.10	6.20	CAV	L1
1.43MHz	46.00	25.20	20.80	19.00	6.20	CAV	L1
159.00kHz	55.50	43.30	12.20	37.00	6.30	CAV	N
321.00kHz	49.70	33.40	16.30	27.20	6.20	CAV	N
505.50kHz	46.00	24.50	21.50	18.20	6.30	CAV	N
820.50kHz	46.00	20.80	25.20	14.50	6.30	CAV	N
1.24MHz	46.00	24.70	21.30	18.40	6.30	CAV	N
2.09MHz	46.00	21.30	24.70	15.00	6.30	CAV	N

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

5 Assigned bandwidth (20dB bandwidth)

Test result: **Pass**

5.1 Limit

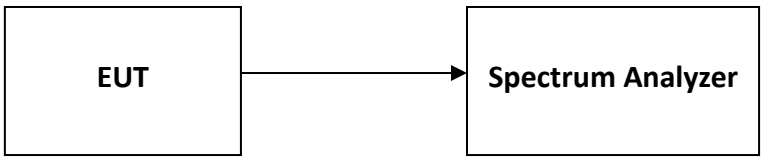
Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the allocated frequency band.

If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

5.2 Measurement Procedure

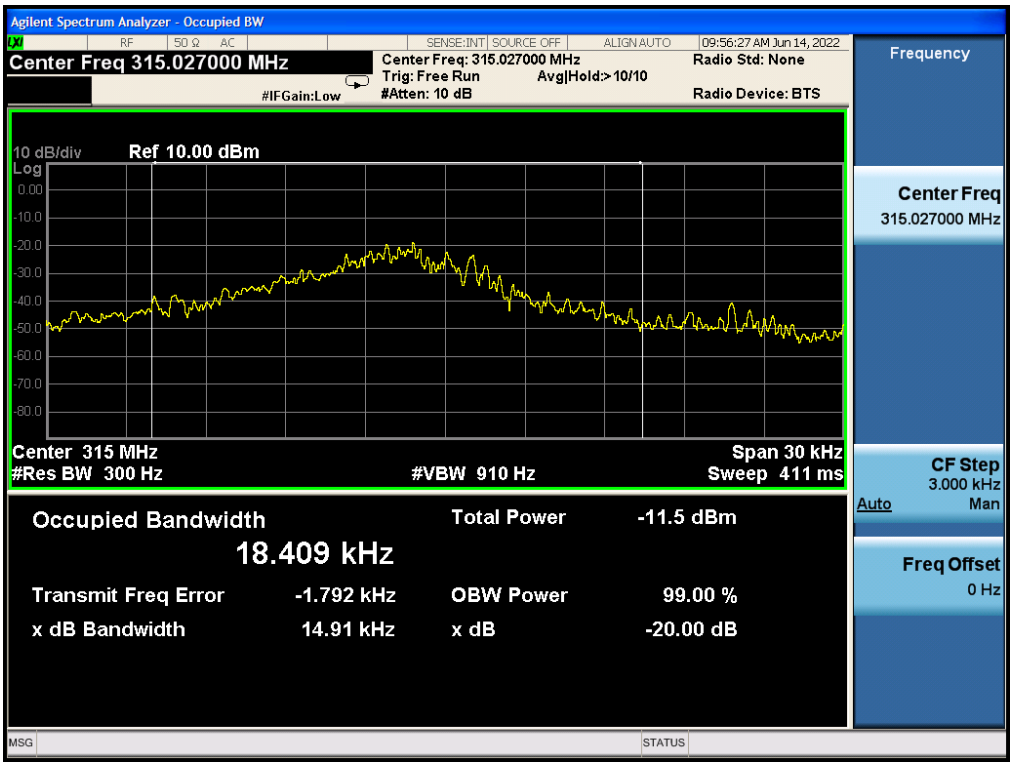
The 20dB Bandwidth is measured using the Spectrum Analyzer.
Set Span = 2 to 3 times the 20 dB bandwidth, RBW = approximately 1% of the 20 dB bandwidth, VBW>RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 2 channels (lowest and highest channel).

5.3 Test Configuration



5.4 The results

Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	F_L at 20dB BW (MHz)	F_H at 20dB BW (MHz)
2428			>2400	/
			/	<2483.5
Limit	<66.8	<66.8	F_L >2400	F_H <2483.5
Result	**Complied**			



6 Antenna requirement

Requirement:
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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Result:
EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

********** END **********