

RADIO TEST REPORT

FCC ID: 2AJNW-CW902

Product : Robotic Vacuum Cleaner

Trade Mark : N/A

Model Name : CW902

Family Model : CC902

Report No. : S19102903202001

Prepared for

Guangdong BONA Robot Corporation Limited
(Building A、 B、 C)No.30 Haogang Avenue, Dagang Town, Nansha
District, Guangzhou 511470, P.R. China

Prepared by

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TEST RESULT CERTIFICATION

Applicant's name : Guangdong BONA Robot Corporation Limited
Address : (Building A、 B、 C)No.30 Haogang Avenue, Dagang Town,
Nansha District, Guangzhou 511470, P.R. China

Manufacturer's Name : Guangdong BONA Robot Corporation Limited
Address : (Building A、 B、 C)No.30 Haogang Avenue, Dagang Town,
Nansha District, Guangzhou 511470, P.R. China

Product description

Product name..... : Robotic Vacuum Cleaner

Model and/or type reference : CW902

Family Model : CC902

Rating(s)..... : DC 3V from battery

Standards : FCC Part15.249

Test procedure..... ANSI C63.10-2013

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test..... :

Date (s) of performance of tests..... : 29 Oct. 2019 ~16 Mar. 2020

Date of Issue..... : 16 Mar. 2020

Test Result..... : **Pass**

Testing Engineer :



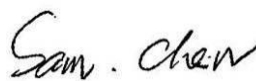
(Allen Liu)

Technical Manager :



(Jason Chen)

Authorized Signatory :



(Sam Chen)

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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15, Subpart C (15.249)			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	Pass	
15.203	Antenna Requirement	Pass	
15.249 15.209	Radiated Spurious Emission	Pass	
15.249(2)	Frequency Tolerance	Pass	
15.249(a)	Fundamental Measurement	Pass	
15.205	Band Edge Emission	Pass	
15.215	Occupied Bandwidth	Pass	

1.1 TEST FACILITY

All measurement facilities used to collect the measurement data are located at
1/F, Building E, Fenda Science Park Sanwei, Xixiang, Bao'an District
Shenzhen, Guangdong, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

CNAS-Lab. : The Laboratory has been assessed and proved to be in compliance with
CNAS-CL01:2006 (identical to ISO/IEC 17025:2005)
The Certificate Registration Number is L5516.

IC-Registration : The Certificate Registration Number is 9270A.
CAB identifier:CN0074

FCC- Accredited : Test Firm Registration Number: 463705.
Designation Number: CN1184

A2LA-Lab. : The Certificate Registration Number is 4298.01
This laboratory is accredited in accordance with the recognized
International Standard ISO/IEC 17025:2005 General requirements for
the competence of testing and calibration laboratories.
This accreditation demonstrates technical competence for a defined
scope and the operation of a laboratory quality management system
(refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Name of Firm : Shenzhen NTEK Testing Technology Co., Ltd.

Site Location : 1/F, Building E, Fenda Science Park Sanwei, Xixiang, Bao'an District
Shenzhen, Guangdong, China

1.2 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 %.

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 1.38\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Robotic Vacuum Cleaner	
Trade Mark	N/A	
Model Name	CW902	
Family Model	CC902	
Model Difference	All models are the same circuit and RF module, In addition to model	
Product Description	The EUT is a Robotic Vacuum Cleaner	
	Operation Frequency:	2470.55-2470.55MHz
	Modulation Type:	FSK
	Antenna Designation:	PCB Antenna
	Antenna Gain(Peak)	2 dBi
Based on the application, features, or specification exhibited in User's Manual. More details of EUT technical specification, please refer to the User's Manual.		
Channel List	Please refer to the Note 2.	
Adapter	N/A	
Battery	DC 3V*2AAA	
HW Version	WIN_REMOTE_V1	
SW Version	BL601_REMOTE_V1.1	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

Channel	Frequency(MHz)
01	2470.55

3.

Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	PCB Antenna	N/A	2	Antenna

2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	CH01
Mode 2	Normal link

For Radiated Spurious Emission

Pretest Mode	Description
Mode 1	CH01

For Conducted Emission

Final Test Mode	Description
Mode 1	CH01
Mode 2	Normal link

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



EUT

2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note

Item	Cable Type	Shielded Type	Ferrite Core	Length	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation& Conducted Test equipment

	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4407B	MY45108040	2019.05.13	2020.05.12	1 year
2	Spectrum Analyzer	Agilent	N9020A	MY49100060	2019.08.28	2020.08.27	1 year
3	Spectrum Analyzer	R&S	FSV40	101417	2019.08.28	2020.08.27	1 year
4	Test Receiver	R&S	ESPI7	101318	2019.05.13	2020.05.12	1 year
5	Bilog Antenna	TESEQ	CBL6111D	31216	2019.04.15	2020.04.14	1 year
6	50Ω Coaxial Switch	Anritsu	MP59B	6200983705	2018.05.19	2020.05.18	2 year
7	Horn Antenna	EM	EM-AH-10180	2011071402	2019.04.15	2020.04.14	1 year
8	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	803	2019.04.15	2020.04.14	1 year
9	Amplifier	EMC	EMC051835SE	980246	2019.08.06	2020.08.05	1 year
10	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	055	2019.04.15	2020.04.14	1 year
11	Power Meter	DARE	RPR3006W	15100041SN084	2019.08.06	2020.08.05	1 year
12	Test Cable (9KHz-30MHz)	N/A	R-01	N/A	2017.04.21	2020.04.20	3 year
13	Test Cable (30MHz-1GHz)	N/A	R-02	N/A	2017.04.21	2020.04.20	3 year
14	High Test Cable(1G-40G Hz)	N/A	R-03	N/A	2017.04.21	2020.04.20	3 year
15	High Test Cable(1G-40G Hz)	N/A	R-04	N/A	2017.04.21	2020.04.20	3 year
16	Filter	TRILTHIC	2400MHz	29	2017.04.19	2020.04.18	3 year
17	temporary antenna connector (Note)	NTS	R001	N/A	N/A	N/A	N/A

Note:

We will use the temporary antenna connector (soldered on the PCB board) When conducted test
And this temporary antenna connector is listed within the instrument list

3. ANTENNA REQUIREMENT

3.1 STANDARD REQUIREMENT

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

3.2 EUT ANTENNA

The EUT antenna is permanent attached PCB antenna (Gain: 2dBi). It comply with the standard requirement.

3.3 CONDUCTED EMISSION MEASUREMENT

3.3.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

Frequency(MHz)	Conducted Emission Limit	
	Quasi-peak	Average
0.15-0.5	66-56*	56-46*
0.5-5.0	56	46
5.0-30.0	60	50

Note: 1. *Decreases with the logarithm of the frequency

2. The lower limit shall apply at the transition frequencies

3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

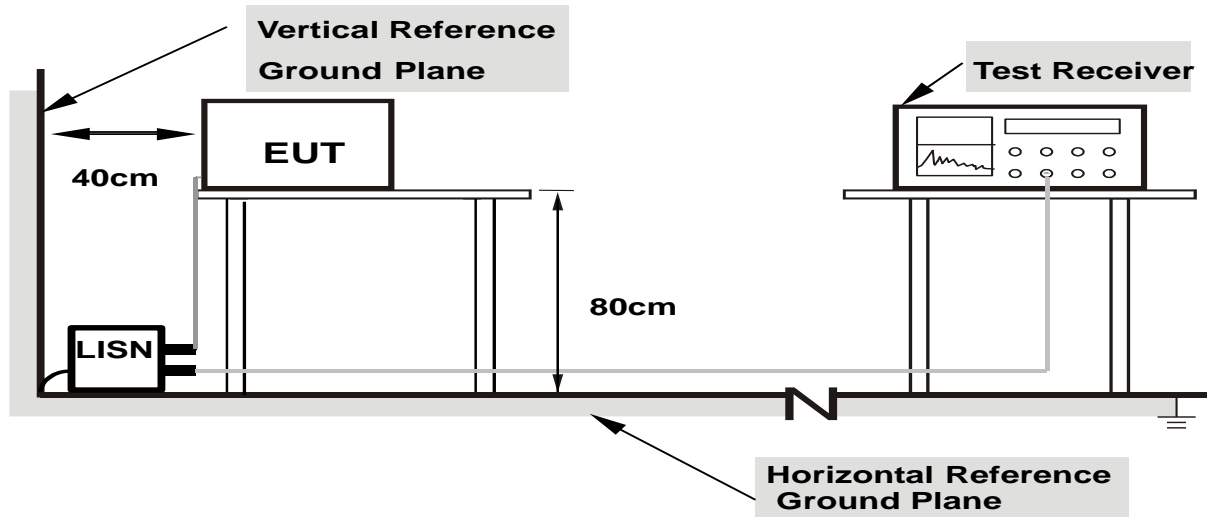
3.3.2 TEST PROCEDURE

- The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.2.5 TEST RESULT

EUT :	Robotic Vacuum Cleaner	Model Name. :	CW902
Temperature :	25 °C	Relative Humidity :	55%
Pressure :	1010hPa	Phase :	L
Test Voltage :	N/A	Test Mode :	N/A

Note: this product is battery powered and not suitable for AC terminal conduction test

3.4 RADIATED EMISSION MEASUREMENT

3.4.1 Radiated Emission Limits (FCC 15.209)

Frequencies (MHz)	Field Strength (micorvolts/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
Frequency (MHz)	Limit (dBuV)	
30~88	40	3
88~216	43.5	3
216~960	46	3
960 -10000	54.00	3
*902 - 928	94.00	3

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).
- (3) *Note: This is the limit for the fundamental frequency.

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC 15.249)

Frequency of Emission (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)
2400-2483.5	50	500

Notes:

- (1) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.4.2 TEST PROCEDURE

- a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

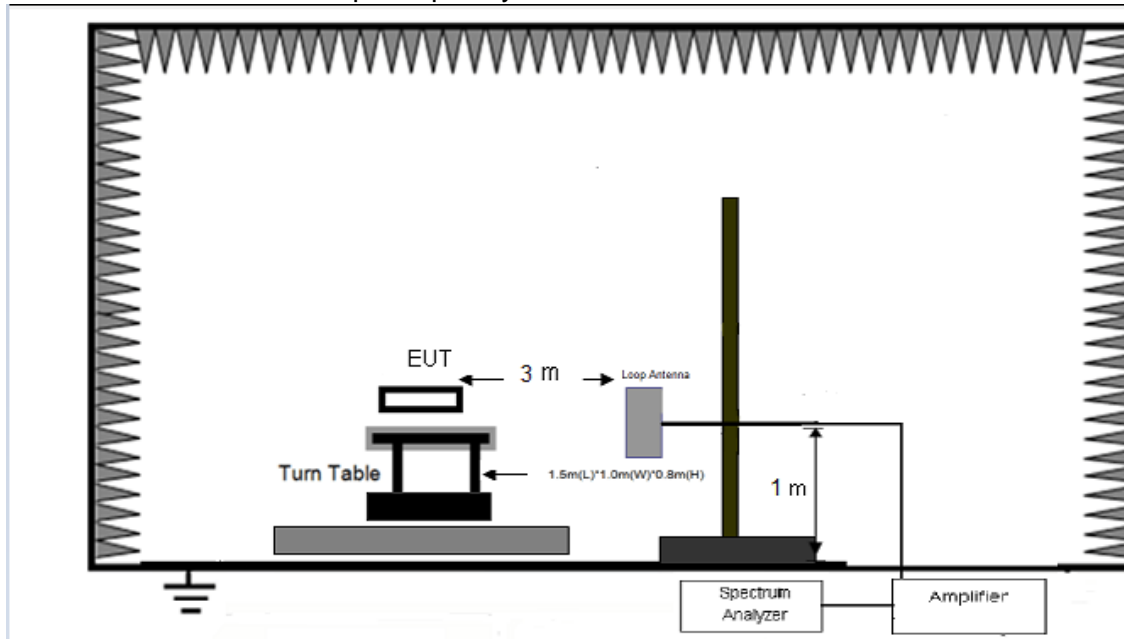
Note:

Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

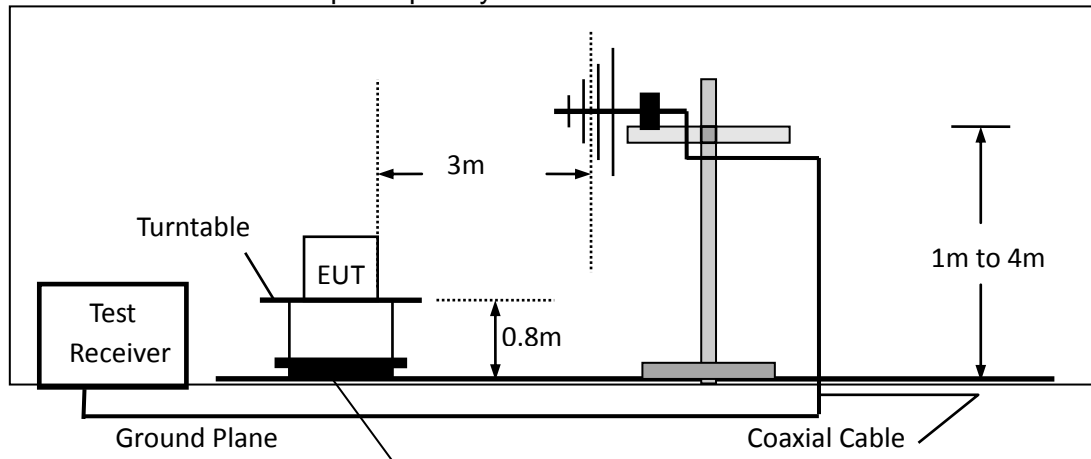
3.4.3 DEVIATION FROM TEST STANDARD

No deviation

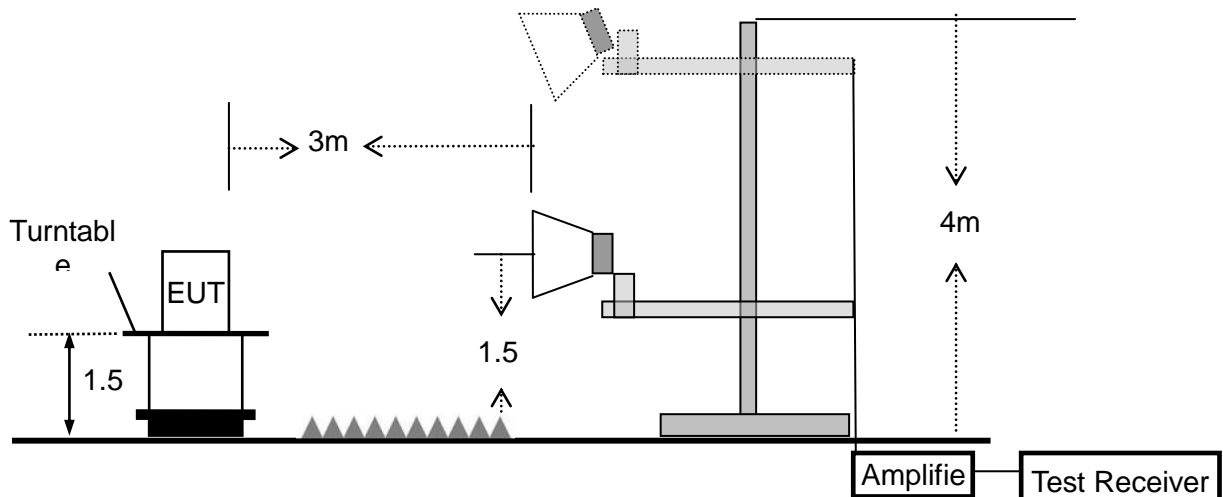
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.4.4 TEST RESULTS (BELOW 30MHz)

EUT :	Robotic Vacuum Cleaner	Model Name. :	CW902
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 3V from battery
Test Mode :	TX	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $20 \log (\text{specific distance}/\text{test distance})(\text{dB})$;

Limit line = specific limits(dBuv) + distance extrapolation factor.

3.4.5 TEST RESULTS (BELOW 1000 MHz)

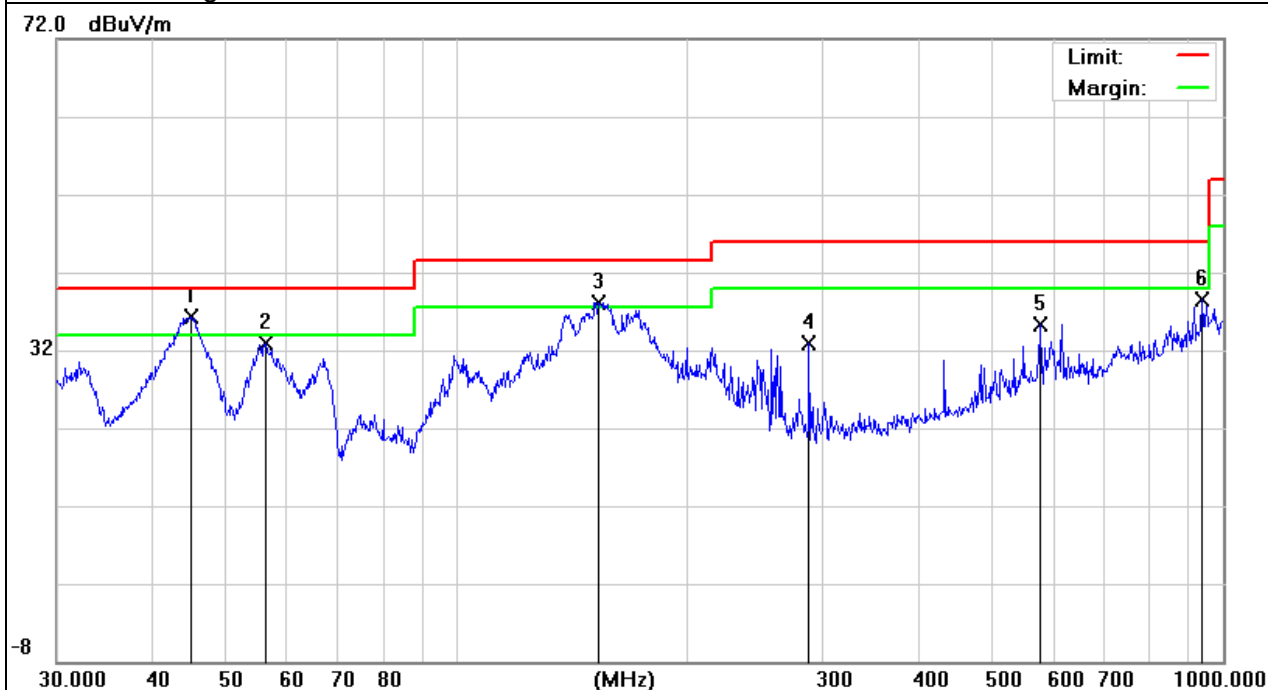
EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 3V from battery
Test Mode :	Model 1	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
44.9006	25.00	11.38	36.38	40.00	-3.62	QP
56.1974	26.44	6.44	32.88	40.00	-7.12	QP
152.6641	26.37	11.82	38.19	43.50	-5.31	QP
287.9904	18.50	14.32	32.82	46.00	-13.18	QP
576.6443	13.36	21.94	35.30	46.00	-10.70	QP
938.8326	10.49	27.96	38.45	46.00	-7.55	QP

Remark:

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

Factor Including Cable loss and antenna coefficient



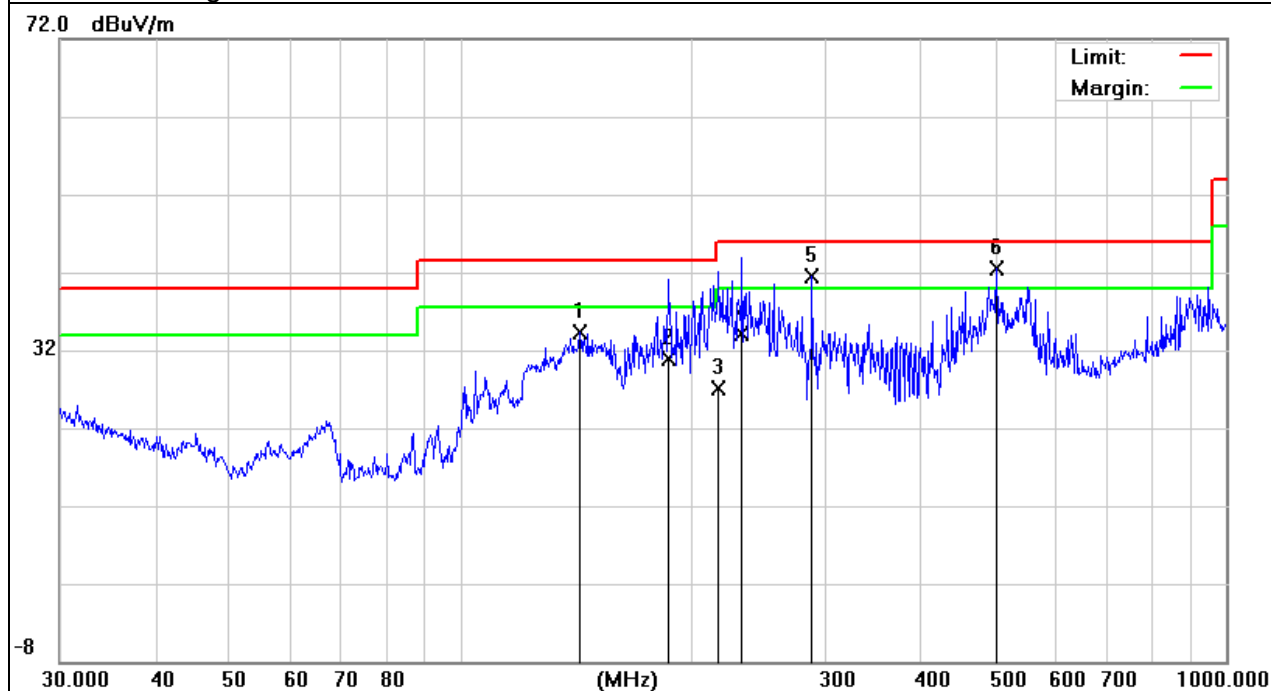
EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 3V from battery
Test Mode :	Model 1	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
143.3259	22.09	12.17	34.26	43.50	-9.24	QP
187.0958	21.42	9.48	30.90	43.50	-12.60	QP
217.5443	16.68	10.42	27.10	46.00	-18.90	QP
233.3487	23.02	11.08	34.10	46.00	-11.90	QP
287.9904	27.16	14.32	41.48	46.00	-4.52	QP
501.1788	21.79	20.64	42.43	46.00	-3.57	QP

Remark:

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

Factor Including Cable loss and antenna coefficient



3.4.6 TEST RESULTS (ABOVE 1000 MHZ)

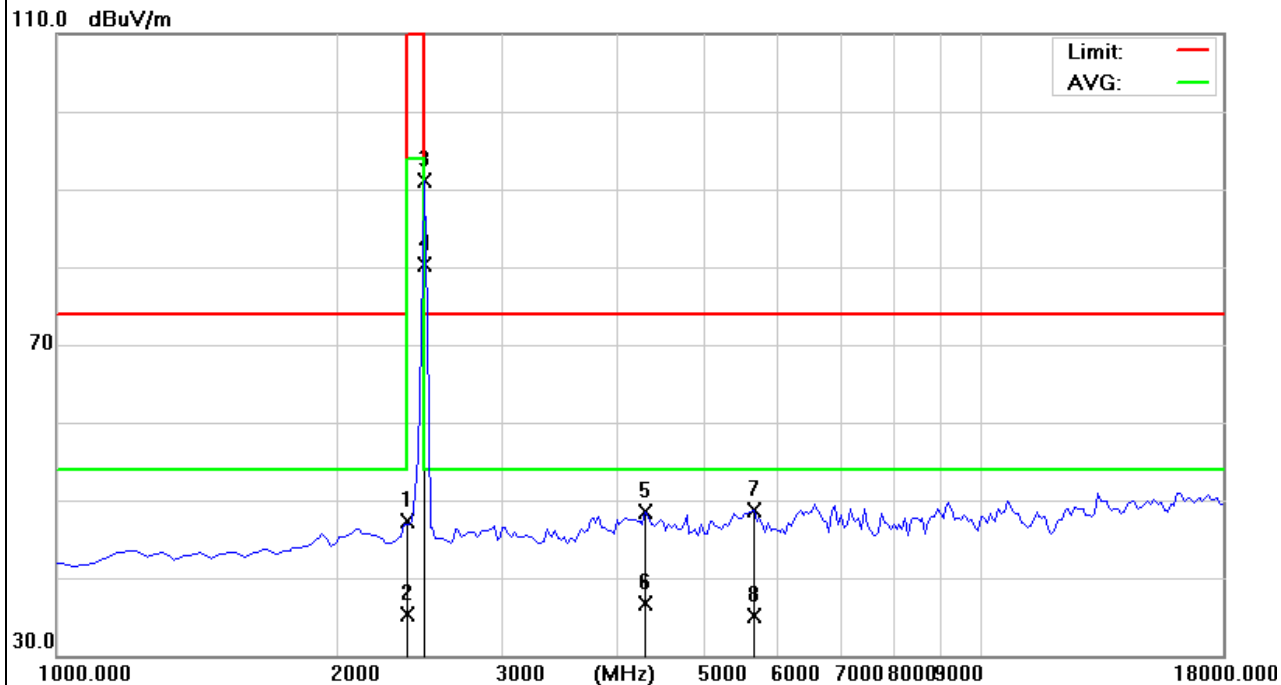
EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 3V from battery
Test Mode :	Model 1	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2400.000	42.77	4.53	47.30	74.00	-26.70	peak
2400.000	30.80	4.53	35.33	54.00	-18.67	AVG
2470.550	86.43	4.73	91.16	114.0	-22.84	peak
2470.550	75.52	4.73	80.25	94.00	-13.75	AVG
4315.000	36.66	11.77	48.43	74.00	-25.57	peak
4315.000	24.88	11.77	36.65	54.00	-17.35	AVG
5632.500	35.42	13.36	48.78	74.00	-25.22	peak
5632.500	21.81	13.36	35.17	54.00	-18.83	AVG

Remark:

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

No emission above 18GHz.



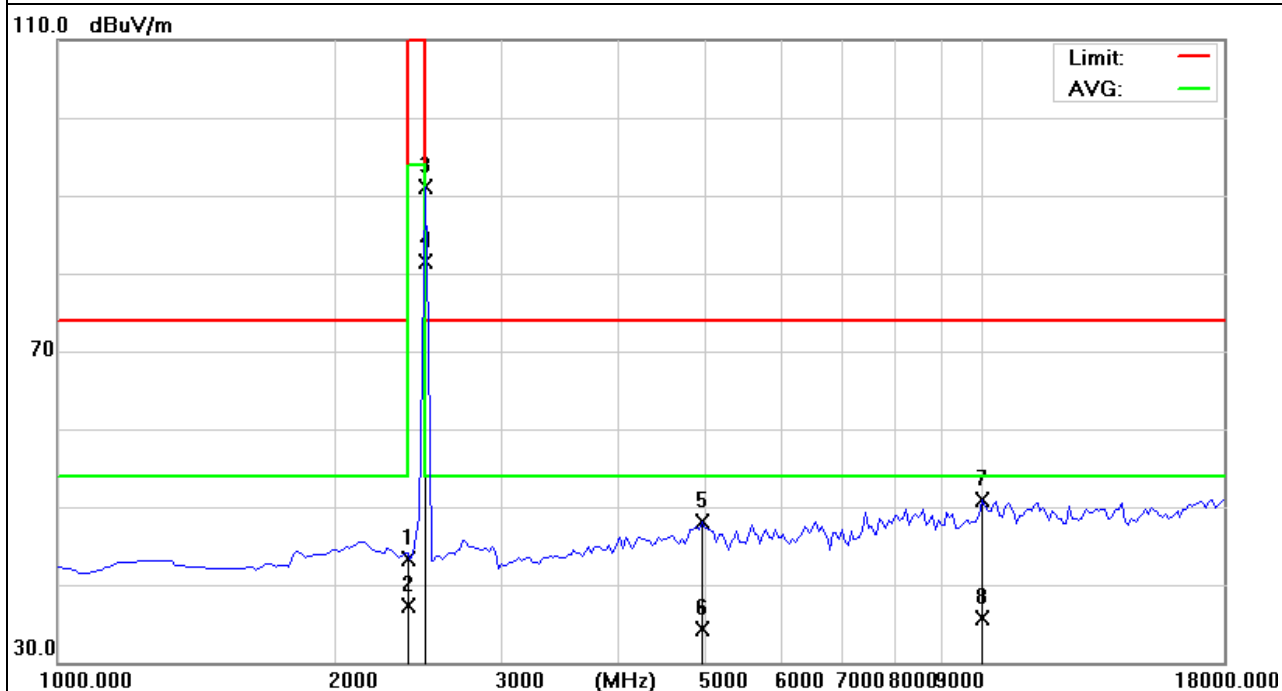
EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 3V from battery
Test Mode :	Model 1	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2400.000	38.86	4.53	43.39	74.00	-30.61	peak
2400.000	32.72	4.53	37.25	54.00	-16.75	AVG
2470.550	86.29	4.73	91.02	114.0	-22.98	peak
2470.550	76.71	4.73	81.44	94.00	-12.56	AVG
4952.500	34.90	13.27	48.17	74.00	-25.83	peak
4952.500	20.98	13.27	34.25	54.00	-19.75	AVG
9882.500	31.63	19.26	50.89	74.00	-23.11	peak
9882.500	16.43	19.26	35.69	54.00	-18.31	AVG

Remark:

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

No emission above 18GHz.



Note: EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report(X orientation).

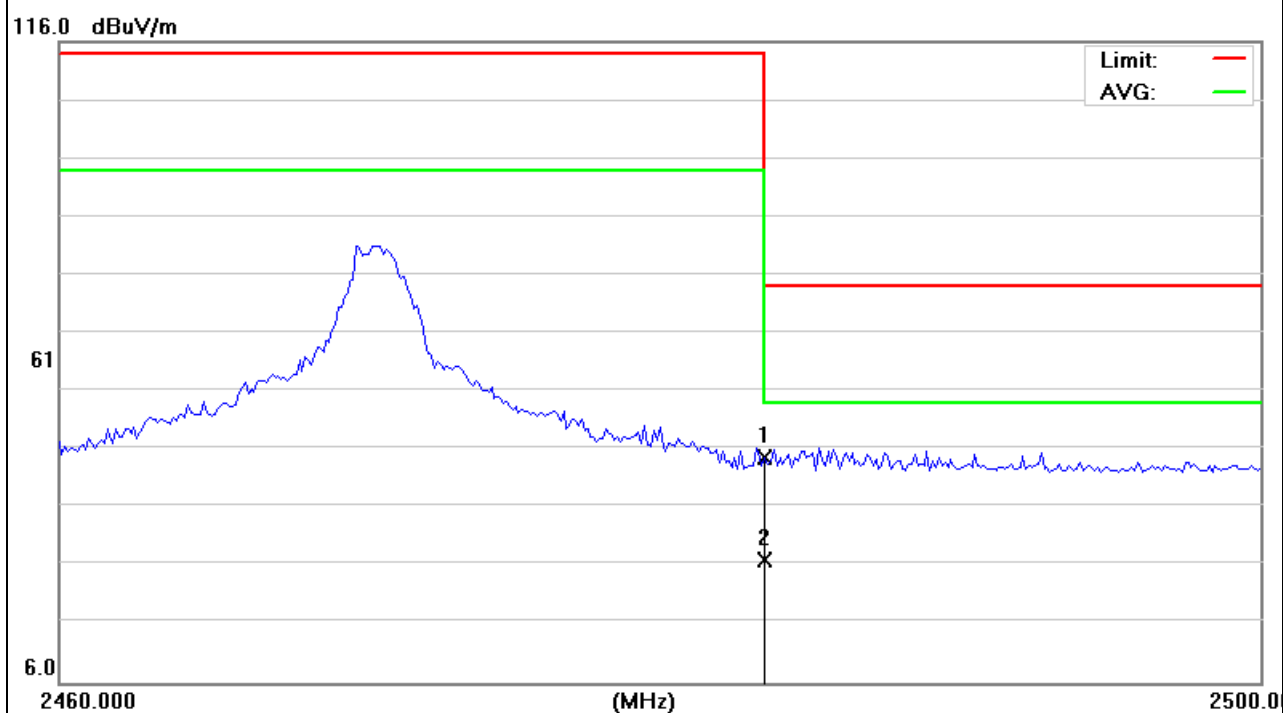
3.4.7 TEST RESULTS (RESTRICTED BANDS REQUIREMENTS)

EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 3V from battery
Test Mode :	TX-2470.55MHz	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	40.00	4.75	44.75	74.00	-29.25	peak
2483.5	22.27	4.75	27.02	54.00	-26.98	AVG

Remark:

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

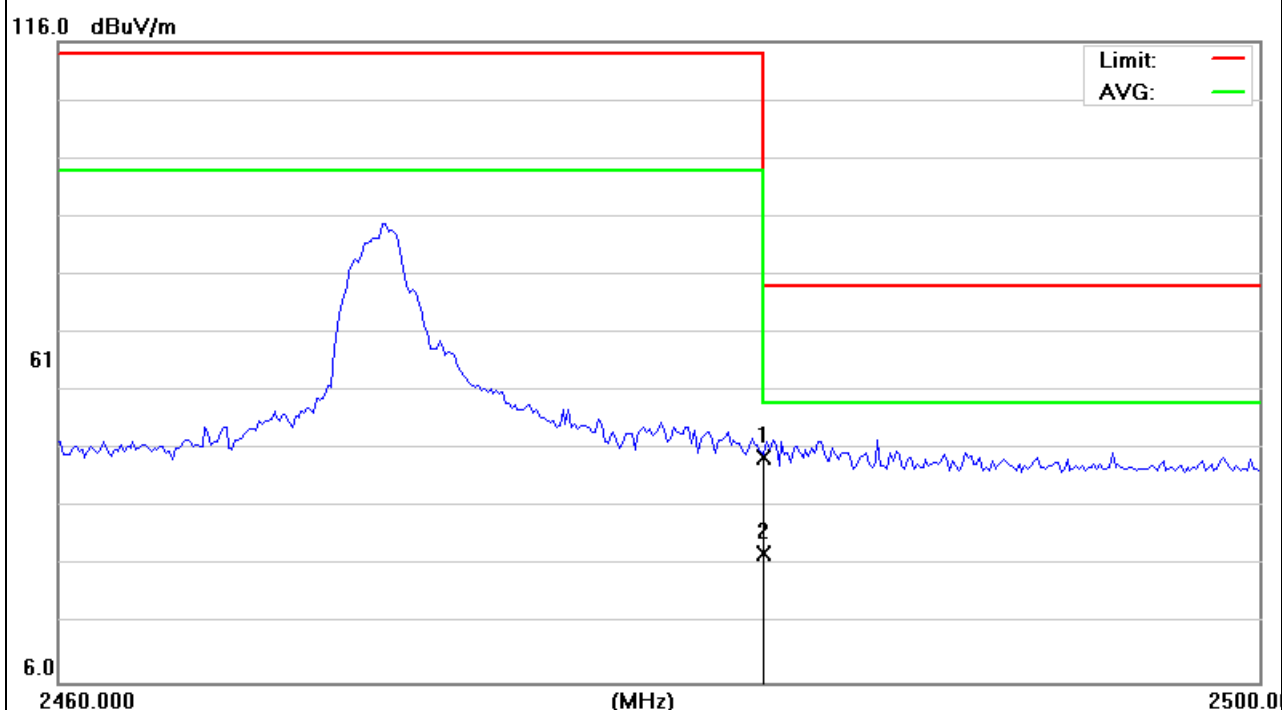


EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 3V from battery
Test Mode :	TX-2470.55MHz	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.5	40.00	4.75	44.75	74.00	-29.25	peak
2483.5	23.27	4.75	28.02	54.00	-25.98	AVG

Remark:

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



4. FREQUENCY TOLERANCE

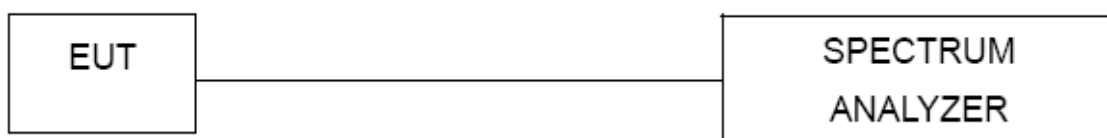
4.1 FREQUENCY TOLERANCE LIMITS

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.001\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

4.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting : RBW= 10KHz, VBW \geq RBW, Sweep time = Auto.

4.3 TEST SETUP



4.4 TEST RESULTS

EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	26 °C	Relative Humidity :	53%
Pressure :	1020 hPa	Test Power :	DC 3V from battery
Test Mode :	Model 1		

2470MHz

Voltage (V)	Frequency(MHz)	Reading(MHz)	Frequency Tolerance	LIMIT
2.55	2470.55	2470.56	0.000405%	$\pm 0.001\%$
3.0	2470.55	2470.57	0.000810%	$\pm 0.001\%$
3.45	2470.55	2470.53	-0.000810%	$\pm 0.001\%$

Temperature (°C)	Frequency(MHz)	Reading(MHz)	Frequency Tolerance	LIMIT
-20	2470.55	2470.56	0.000405%	$\pm 0.001\%$
-10	2470.55	2470.57	0.000810%	$\pm 0.001\%$
0	2470.55	2470.54	-0.000405%	$\pm 0.001\%$
10	2470.55	2470.53	-0.000810%	$\pm 0.001\%$
20	2470.55	2470.56	0.000405%	$\pm 0.001\%$
30	2470.55	2470.53	-0.000810%	$\pm 0.001\%$
40	2470.55	2470.54	-0.000405%	$\pm 0.001\%$
50	2470.55	2470.56	0.000405%	$\pm 0.001\%$

5. BANDWIDTH TEST

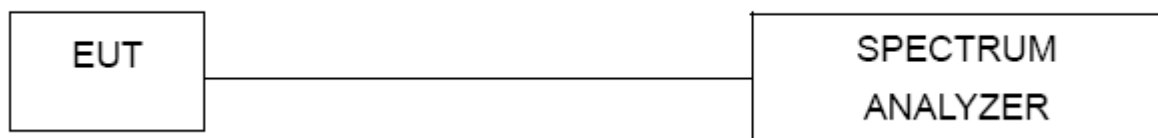
5.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW= 100KHz, VBW \geq RBW, Sweep time = Auto.

5.1 DEVIATION FROM STANDARD

No deviation.

5.1 TEST SETUP



6. TEST RESULTS

EUT :	Robotic Vacuum Cleaner	Model Name :	CW902
Temperature :	26 °C	Relative Humidity :	53%
Pressure :	1020 hPa	Test Power :	DC 3V from battery
Test Mode :	Model 1		

Test Channel	Frequency (MHz)	20 dBc Bandwidth (MHz)
CH01	2470.55	0.553

2470.55 MHz

