

FCC RADIO TEST REPORT
FCC ID: OXGZW31
IC: 10460A-ZW31

Product Name:	Smart Dimmer
Trademark:	Show Home
Model Number:	ZW31
Prepared For :	Willis Electric CO.,Ltd.
Address :	No.504-1,Chung-Hua Road, Sec.4, Hsin Chu,300 Taiwan
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Test Date:	Mar. 11 - Mar. 25, 2015
Date of Report :	Mar. 25, 2015
Report No.:	PTS1503058015F



VERIFICATION OF COMPLIANCE

Applicant:	Willis Electric CO.,Ltd.
Address	No.504-1,Chung-Hua Road, Sec.4, Hsin Chu,300 Taiwan
Manufacturer Name:	Kupoint(DongGuan)Electric Co.,Ltd
Address:	Huai De Village, HumenTown, Dong Guan, Guang Dong, China
Product Description:	Smart Dimmer
Brand Name:	Show Home
Model Name:	ZW31
Model difference:	N/A
Test procedure	ANSI C63.4-2014, CISPR 16-1-4:2010, RSS-Gen Issue 4,2014
Standards	FCC PART15.249, RSS-210 Issue 8,Dec 2010

Prepared by :

Assistant

Reviewer :

Supervisor

Approved & Authorized Signer :



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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15, Subpart C (15.249)			
RSS-Gen Issue 4 & RSS-210 Issue 8			
Standard Section	Test Item	Judgment	Remark
15.207& RSS-Gen issue 4,8.8	Conducted Emission	Pass	
15.203	Antenna Requirement	Pass	
15.249& A8.5	Radiated Spurious Emission	Pass	
15.249& A8.1	20 DB Bandwidth	Pass	
15.205& A8.5	Band Edge Emission	Pass	



1.1 TEST FACILITY

Dongguan Dongdian Testing Service Co., Ltd
Add.: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan
City, Guangdong Province, China, 523808
FCC Registration No.: 270092; IC Registration No.: 10288A-1

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	Smart Dimmer
Trade Name	Show Home
Model Name	ZW31
Serial Model	N/A
Model Difference	N/A
Product Description	The EUT is a Smart Dimmer
	Operation Frequency: 908.42MHz
	Modulation Type: FSK
	Channel number: 1 channel
	Antenna Designation: Wire antenna
	Antenna Gain(Peak): -2.1dBi
	Transmit Peak Power: 85.21 dBuV/m
	Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Power Supply	AC 120V,60Hz
HVIN	ZW31
FVIN	F_smart dimmer V1

Note:

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



2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible 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	TX

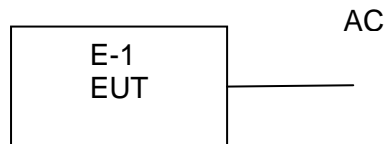
For Conducted Emission	
Final Test Mode	Description
Mode 1	TX

For Radiated Emission	
Final Test Mode	Description
Mode 1	TX

Note: For the TX mode, the EUT is configured as the continuously transmitting mode.



2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED





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
E-1	Smart Dimmer	Show Home	ZW31	N/A	EUT

Item	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 Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	EMI Test Receiver	R&S	ESU8	100316	2014/10/25	2015/10/24
2	Double Ridged Horn Antenna (0.8GHz-18GHz)	R&S	HF907	100276	2014/11/01	2015/10/31
3	Log-periodic Dipole Antenna (30MHz-1GHz)	R&S	HL223	100435	2014/11/01	2015/10/31
4	Trilog Broadband Antenna	Schwarzbeck	VULB 9163	9163-462	2014/04/12	2015/04/11
5	Signal Conditioning Unit	R&S	SCU-08	10008	2014/10/25	2015/10/24
6	Pre-amplifier	R&S	SCU-01	10049	2014/10/25	2015/10/24
7	Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	2014/11/01	2015/10/31
8	Spectrum Analyzer	Agilent	E4407B	MY45109572	2014/11/01	2015/10/31
9	RF cables	R&S	L03	RS710	2014/11/01	2015/10/31
10	RF cables	R&S	L04	RS719	2014/11/01	2015/10/31

Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Test Receiver	R&S	ESU8	100316	2014/10/25	2015/10/24
	Current Probe	R&S	EZ-17	100532	2014/10/25	2015/10/24
3	Two Line V-Network	R&S	ENV216	101109	2014/10/25	2015/10/24
4	Passive Voltage Probe	R&S	ESH2-Z3	100169	2014/10/25	2015/10/24
5	V-Network	R&S	ESH3-Z6	100694	2014/10/25	2015/10/24
6	V-Network	R&S	ESH3-Z6	100690	2014/10/25	2015/10/24
7	Artificial mains	R&S	ESH2-Z5	100309	2014/10/25	2015/10/24
8	Pulse Limiter	R&S	ESH3-Z2	101242	2014/10/25	2015/10/24
9	RF cables	R&S	L05	RS782	2014/11/01	2015/10/31



3. TEST RESULT

3.1 ANTENNA REQUIREMENT

3.1.1 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.

3.1.2 EUT ANTENNA

The EUT antenna is Wire Antenna. It's permanent attached antenna. It comply with the standard requirement.

**3.2 CONDUCTED EMISSION MEASUREMENT****3.2.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)**

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	Quasi-peak	Average	
0.15 -0.5			66 - 56 *	56 - 46 *	CISPR
0.50 -5.0			56.00	46.00	CISPR
5.0 -30.0			60.00	50.00	CISPR

0.15 -0.5			66 - 56 *	56 - 46 *	LP002.
0.50 -5.0			56.00	46.00	LP002.
5.0 -30.0			60.00	50.00	LP002.

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

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

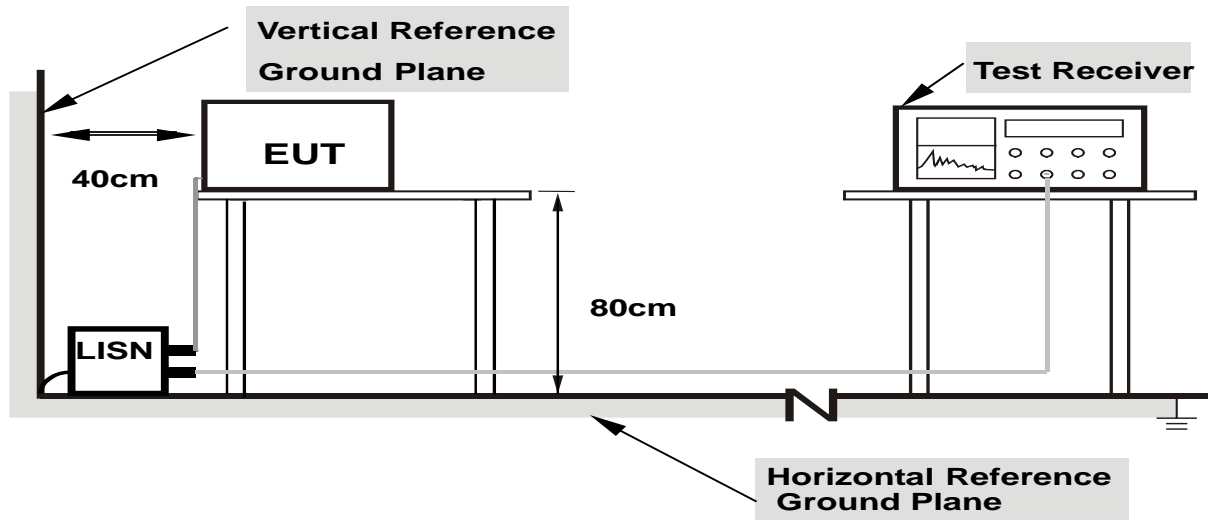
3.2.2 TEST PROCEDURE

- a. 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.
- b. 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.
- c. 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.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.2.3 DEVIATION FROM TEST STANDARD

No deviation

3.2.4 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



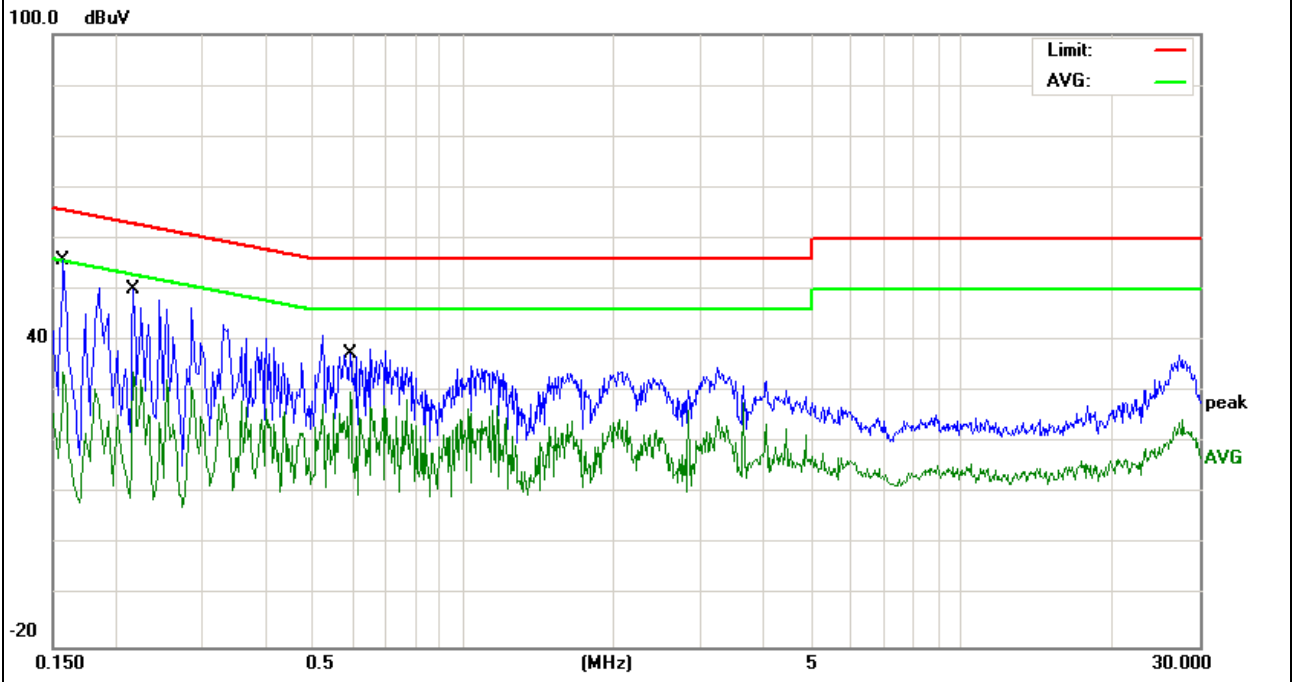
3.2.5 TEST RESULT

EUT :	Smart Dimmer	Model Name. :	ZW31
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC 120V/60Hz	Test Mode :	Mode 1

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Detector Type
0.2180	39.92	10.20	50.12	62.89	-12.77	QP
0.1580	45.93	9.88	55.81	65.56	-9.75	QP
0.5940	30.74	10.22	40.96	56.00	-15.04	QP
0.1580	24.07	9.88	33.95	55.56	-21.61	AVG
0.2180	22.37	10.20	32.57	52.89	-20.32	AVG
0.5940	19.84	10.22	30.06	46.00	-15.94	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



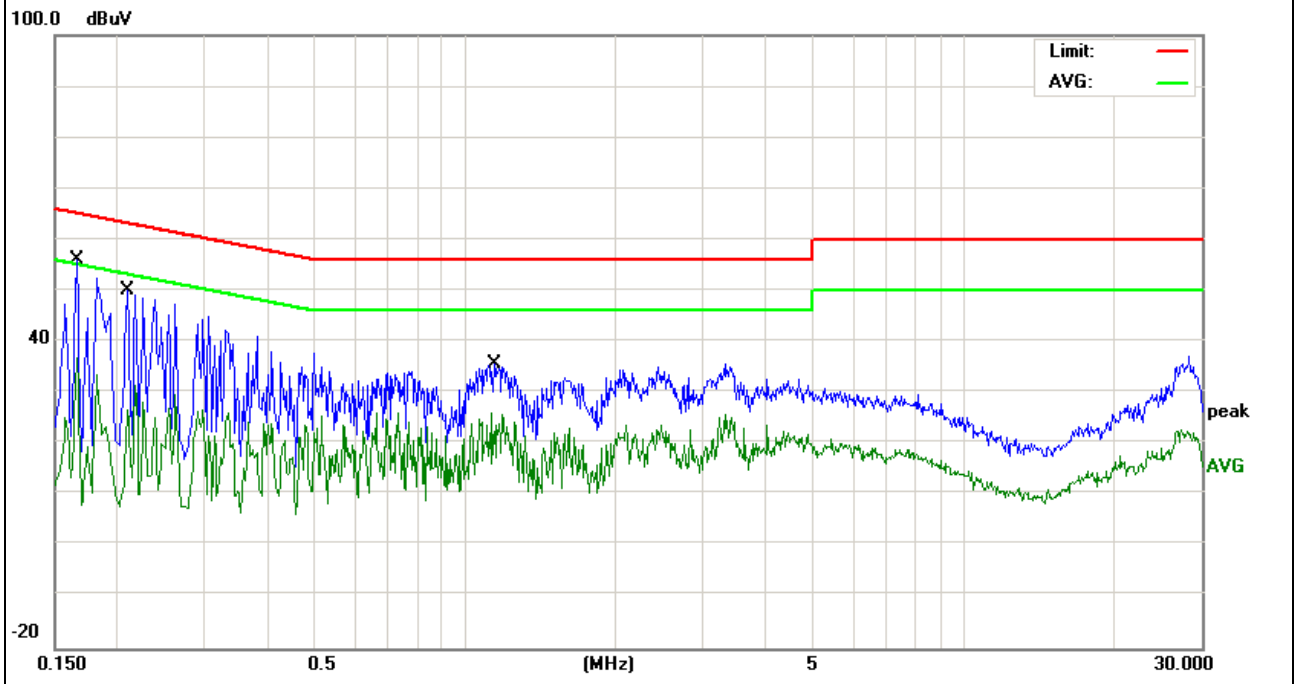


EUT :	Smart Dimmer	Model Name. :	ZW31
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC 120V/60Hz	Test Mode :	Mode 1

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Detector Type
0.1660	46.37	9.81	56.18	65.15	-8.97	QP
0.2100	40.14	9.78	49.92	63.20	-13.28	QP
1.1340	25.44	10.16	35.60	56.00	-20.40	QP
0.1660	27.16	9.81	36.97	55.15	-18.18	AVG
0.2100	19.95	9.78	29.73	53.20	-23.47	AVG
1.1340	15.76	10.16	25.92	46.00	-20.08	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.





3.3 RADIATED EMISSION MEASUREMENT

3.3.1 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
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC 15.249)

Frequency of Emission (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	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



3.3.2 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 meters above the ground at a 3m meter open area test site. 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; the height of the test antenna shall vary between 1 m to 4 m.
- 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:

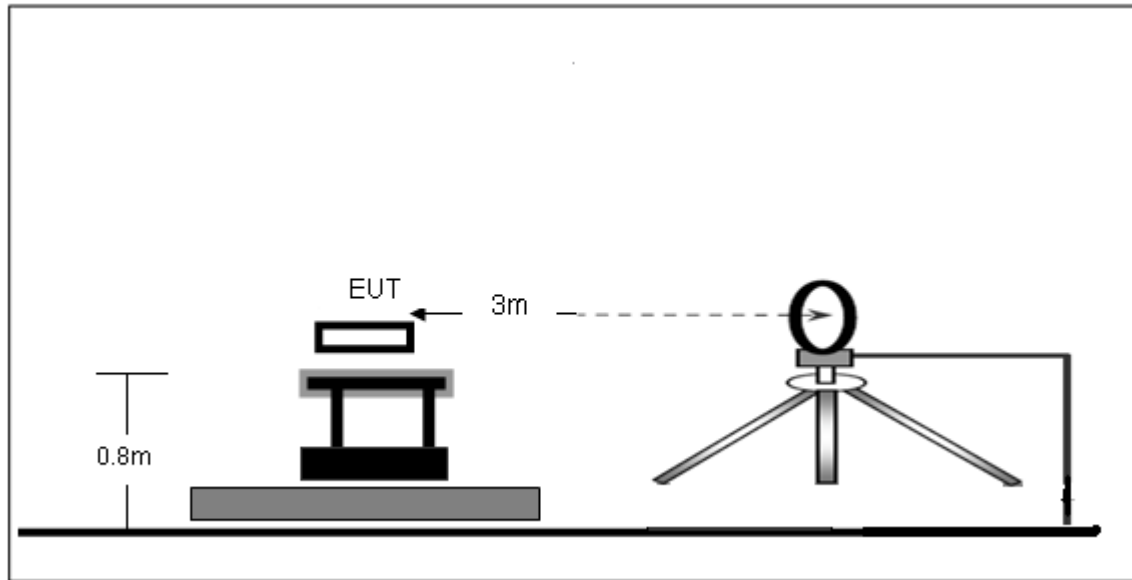
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.3.3 DEVIATION FROM TEST STANDARD

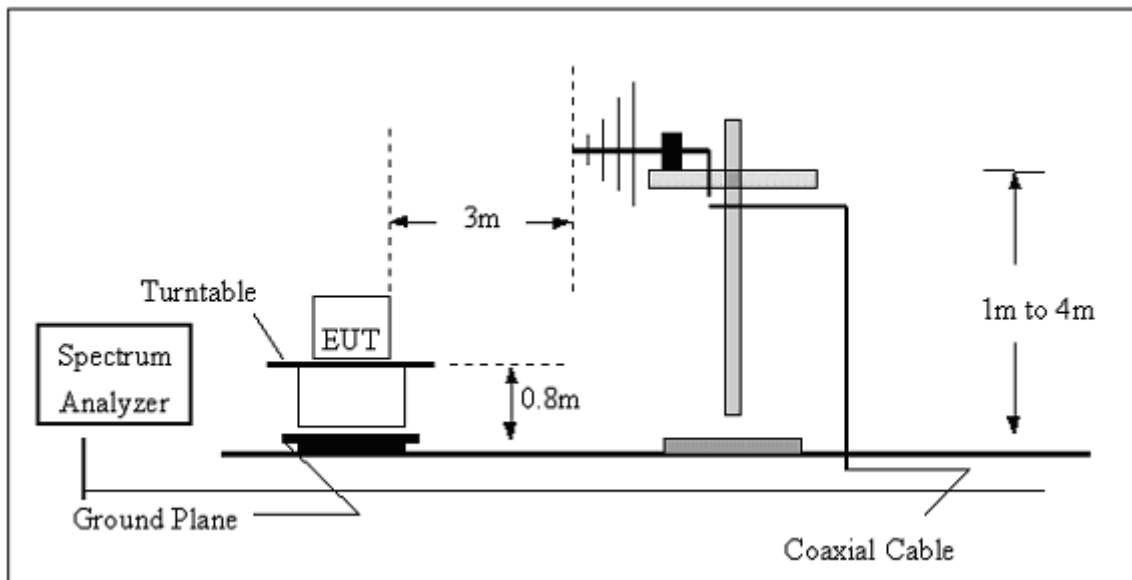
No deviation

3.3.4 TEST SETUP

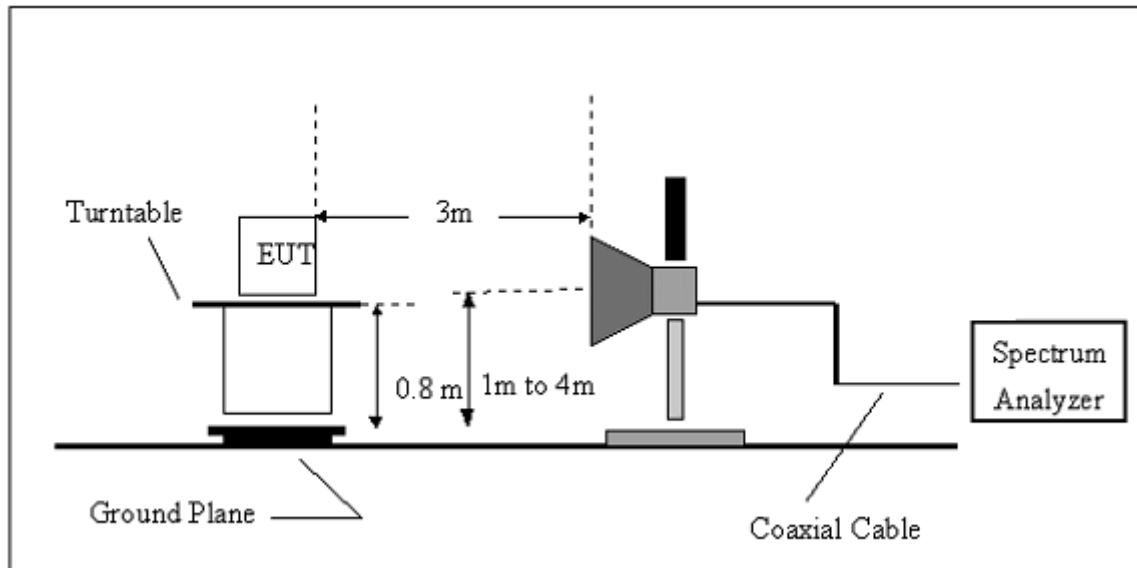
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



**3.3.5 TEST RESULTS (BLOW 30MHz)**

EUT :	Smart Dimmer	Model Name. :	ZW31
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	AC 120V
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 = $40 \log(\text{specific distance}/\text{test distance})$ (dB);

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



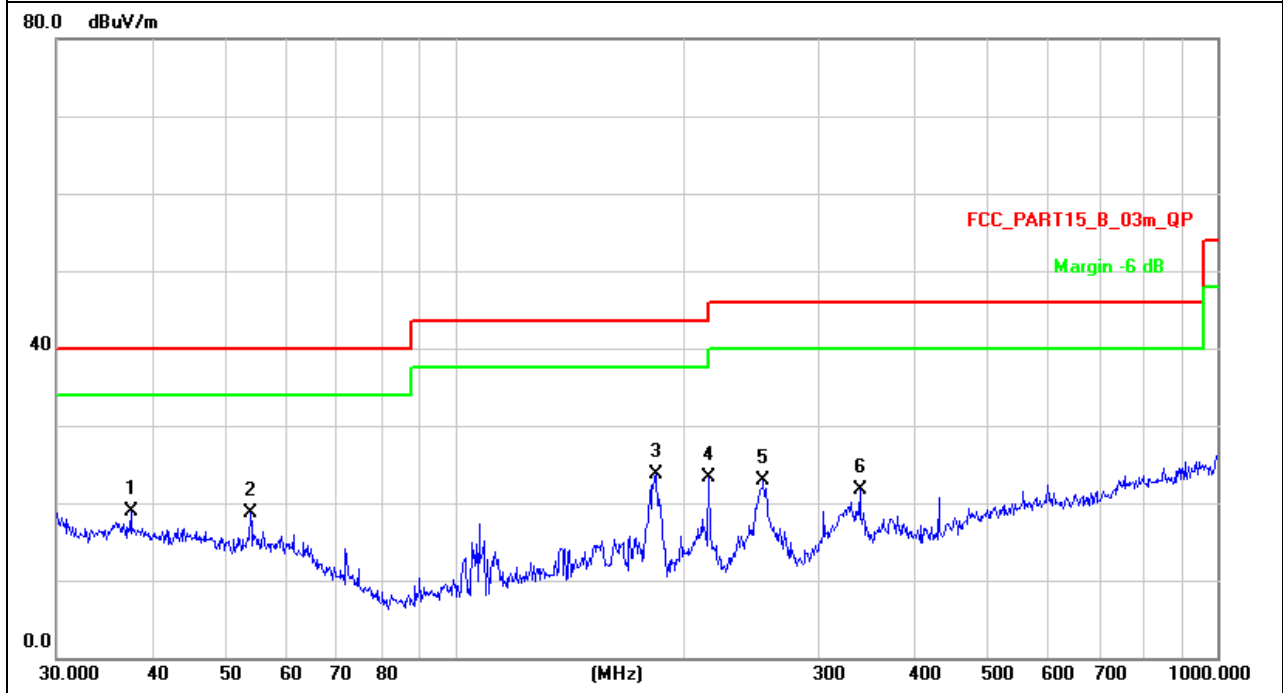
3.3.6 TEST RESULTS (BETWEEN 30 – 1000 MHZ)

EUT :	Smart Dimmer	Model Name :	ZW31
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	AC 120V
Test Mode :	TX	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
37.5479	27.55	-8.73	18.82	40.00	-21.18	QP
53.8818	29.57	-10.93	18.64	40.00	-21.36	QP
183.2005	38.44	-14.73	23.71	43.50	-19.79	QP
215.2678	39.09	-15.77	23.32	43.50	-20.18	QP
253.8367	37.06	-14.09	22.97	46.00	-23.03	QP
339.5888	33.35	-11.57	21.78	46.00	-24.22	QP

Remark:

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



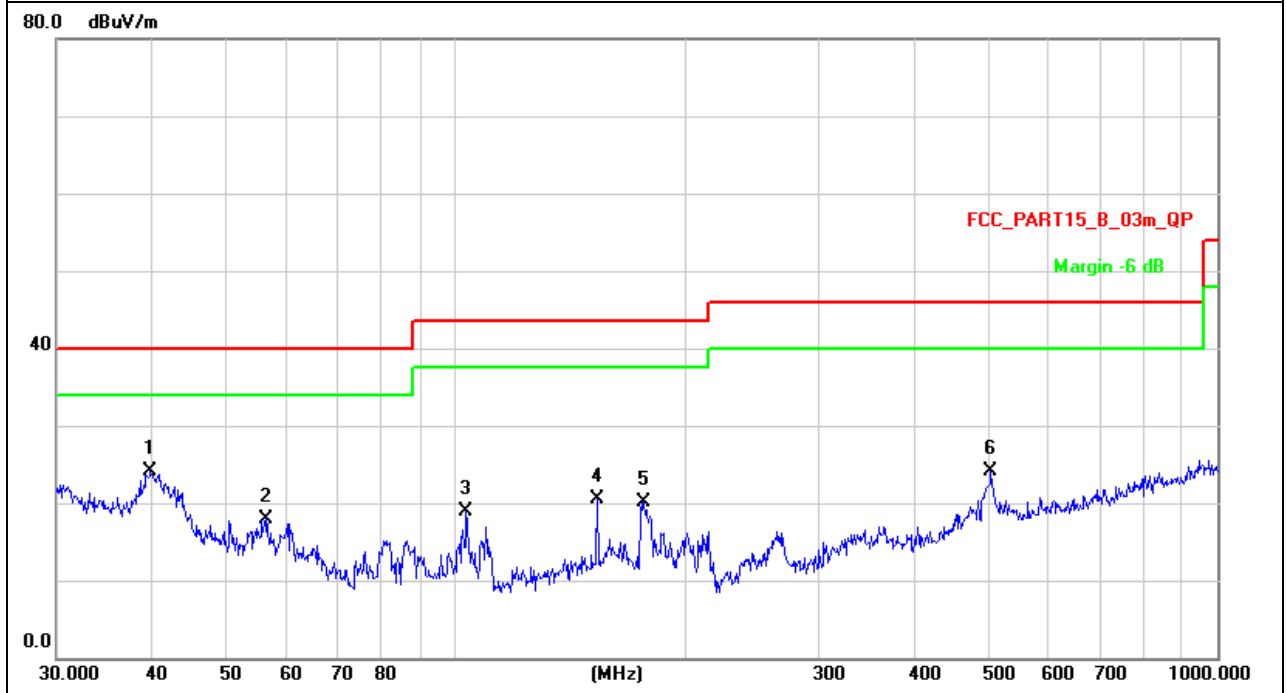


EUT :	Smart Dimmer	Model Name :	ZW31
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	AC 120V
Test Mode :	TX	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Detector Type
39.8542	32.98	-8.84	24.14	40.00	-15.86	QP
56.5929	29.25	-11.25	18.00	40.00	-22.00	QP
103.4421	35.13	-16.19	18.94	43.50	-24.56	QP
153.7385	33.34	-12.86	20.48	43.50	-23.02	QP
176.8878	34.26	-14.07	20.19	43.50	-23.31	QP
504.7062	32.25	-8.12	24.13	46.00	-21.87	QP

Remark:

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





Horizontal

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
908.39	80.56	23.11	5.95	24.41	0.00	85.21	94.00	-8.79	P

Vertical

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
908.37	72.68	23.11	5.95	24.41	0.00	77.33	94.00	-16.67	P

Remark:

Margin (dB) = Remark result (dB μ V/m) – Quasi-peak limit (dB μ V/m).

Due to the PK results are less than the AV limit already, the AV measurement is not required

3.3.7 TEST RESULTS (ABOVE 1000 MHZ)

Horizontal

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
1817.10	64.80	29.15	2.21	48.33	0.30	48.13	54.00	-5.87	P
2725.82	55.82	30.38	2.77	47.29	0.30	41.98	54.00	-12.02	P
3634.49	56.31	31.04	3.23	47.60	0.30	43.28	54.00	-10.72	P
4543.30	55.86	33.03	3.66	48.28	0.40	44.67	54.00	-9.33	P
N/A	---	---	---	---	---	---	---	---	---

Vertical

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
1817.43	65.16	29.15	2.21	48.33	0.30	48.49	54.00	-5.51	P
2726.14	55.59	30.38	2.77	47.29	0.30	41.75	54.00	-12.25	P
3634.76	56.18	31.04	3.23	47.60	0.30	43.15	54.00	-10.85	P
4543.54	55.21	33.03	3.66	48.28	0.40	44.02	54.00	-9.98	P
N/A	---	---	---	---	---	---	---	---	---

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m). Peak detector mode and average detector mode of the emission shown in Result column.



Band Edge Emission:

Due to the operating frequency of this EUT is 908.42MHz only, and its 20dB BW is just 111.82kHz, the Band Edge is not required because the allowed frequency band is 902~928MHz.

4. 20DB BANDWIDTH TEST

4.1 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= 30KHz, VBW \geq RBW, Sweep time = Auto.

4.2 DEVIATION FROM STANDARD

No deviation.

4.3 TEST SETUP





4.4 TEST RESULTS

EUT :	Smart Dimmer	Model Name :	ZW31
Temperature :	26 °C	Relative Humidity :	53%
Pressure :	1020 hPa	Test Power :	AC 120V
Test Mode :	TX		

Frequency (MHz)	20 dBc Bandwidth (KHz)
908.42	111.82

