

FCC PART 15.231
EMI MEASUREMENT AND TEST REPORT

For

Shenzhen Sunricher Technology Co.,Ltd
310,Longtaili building No.30,Avenue 4th,High Tech Sience Park,Shenzhen

FCC ID:2ACUQ2820

(M/N): SR-2820(US),SR-2820(US3),RF-RGBW-3Z,LB-2820(US3)

This Report Concerns: Original Report	Equipment Type: LED Controller
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Report No.:	BSL151228-1
Receive EUT Date/Test Date:	December 1, 2015/ December 1- January 14,,2016
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1. GENERAL INFORMATION

1.1. Report information

- 1.1.1. This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that BSL approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that BSL in any way guarantees the later performance of the product/equipment.
- 1.1.2. The sample/s mentioned in this report is/are supplied by Applicant, BSL therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.
- 1.1.3. Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through BSL, unless the applicant has authorized BSL in writing to do so.

Test Facility -

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

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	+/-1.25dB
2	RF Power, Conducted	+/-0.20dB
3	Spurious emissions, conducted	+/-0.33dB
4	All emissions, radiated (<1G)	+/-3.47dB
5	All emissions, radiated (>1G)	+/-3.82dB
6	Temperature	+/-0.5°CdB
7	Humidity	+/-2%

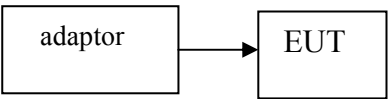
2. PRODUCT DESCRIPTION

2.1. EUT Description

Description	: LED Controller
Applicant	: Shenzhen Sunricher Technology Co.,Ltd 310,Longtaili building No.30,Avenue 4th,High Tech Sience Park,Shenzhen,China
Manufacturer	: Shenzhen Sunricher Technology Co.,Ltd 310,Longtaili building No.30,Avenue 4th,High Tech Sience Park,Shenzhen,China
Model Number	: SR-2820(US),SR-2820(US3),RF-RGBW-3Z,LB-2820(US3)
Frequency	: 868MHz
Number of Channels	: 1 Channel
Power Supply	: DC 24V
Trade:	: N/A
HW version	: HW version:2812-2813-2820-us V1
SW version	: 1.0
antenna type	: PCB
antenna gain	: 0dBi
modulation	: FSK

The series products, model name: SR-2820(US),SR-2820(US3),RF-RGBW-3Z,LB-2820(US3) have the same circuit diagram,PCB layout, software, RF Module, Features and functionality. The differences are the model name, so, we select SR-2820(US) Series to test.

2.2. Block Diagram of EUT Configuration



2.3. Support Equipment List

Name	Model No	S/N	Manufacturer	Used (Y/N)
adaptor	Fj-sw1801500e	-	fujia	Y
-	-	-	-	-

2.4. Test Conditions

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-25
Humidity (%RH)	25-75	50-63
Barometric pressure (mbar)	860-1060	950-1000

3. TEST RESULTS SUMMARY

Standard Section	Test Item	Judgment
15.207	Conducted Emission	Pass
15.203	Antenna Requirement	Pass
15.231b	Radiated Spurious Emission	Pass
15.231c	Occupied Bandwidth	Pass
15.231a	Deactivation Testing	Pass

Remark: “N/A” means “Not applicable”.

Statement 1: All testing was performed using the test procedures found in ANSI C63.4-2003.

Statement 2:

Test operating mode (1):

Under the mode of Color Running

The relevant Buttons of this EUT are already performed, and only the worst evaluated results are recorded in this report.

Test operating mode (2):

Brightness dimmer(**Brightness dimmer Worst case:Maximum brightness**)

The relevant Test operating mode of this EUT are already performed, and only the worst evaluated results are recorded in this report.

Statement 3:

(1).Brightness Button is not the same as the other keys code scheme,transmission time, long-pulse, short-pulse,duration time of period,duty cycle and average correction factor.

(2).Three kinds of brightness use not the same code scheme,transmission time,pulse,duration time of period,duty cycle and average correction factor.

(3).the keys in addition to Brightness key is the same as code scheme,transmission time, long-pulse, short-pulse,duration time of period,duty cycle and average correction factor.

Modifications

No modification was made.

4. TEST EQUIPMENT USED

EQUIPMENT/FACILITIES	MANUFACTURER	MODEL	SERIAL NO.	DATE OF CAL.	CAL. INTERVAL
Spectrum Analyzer	Rohde & Schwarz	FSP	836079/035	2015-06-17	1 Year
EMI Test Receiver	Rohde & Schwarz	ESCI	101611	2015-05-07	1 Year
EMI Test Receiver	Rohde & Schwarz	ESPI7	101391	2015-07-30	1 Year
L.I.S.N.	SCHWARZBECK	NSLK8126	8126-224	2015-05-07	1 Year
Pulse Limiter	ROHDE&SCHWARZ	ESH3-Z2	100919	2015-05-07	1 Year
Pre-Amplifier	HP	8447F OPT H64	3113A06724	2015-05-07	1 Year
Pre-Amplifier	Compliance Direction	PAP-1G18	2002	2015-05-07	1 Year
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-635	2015/08/01	1 Year
Low Loss Coaxial Cable	SCHWARZBECK	AK 9513	9513-13	2015/08/01	1 Year
Positioning Controller	YOU CHERNG CO	EM1000	10001MT04	2015/08/01	1 Year
Horn Antenna	ETS	3117	00086197	2015-06-17	1 Year
Horn Antenna	ETS	3116B	00088203	2015-06-17	1 Year
Loop Antenna	Schwarz beck	FMZB 1516	9773	2015-06-17	1 Year
Cable	PUTIANLE	Ant Cable	Cable 1	2015-07-30	1 Year
Cable	PUTIANLE	Amp Cable	Cable 2	2015-07-30	1 Year
Cable	PUTIANLE	Receiver Cable	Cable 3	2015-07-30	1 Year
Cable	PUTIANLE	L.I.S.N. Cable	Cable 4	2015-07-30	1 Year

Note:
all measurements are typically performed radiated.

5. ANTENNA REQUIREMENT

5.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

5.2. Antenna Connected Construction

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. 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The antenna used in this product is the PCB antenna. The antenna is permanently attached. Refer to the product photo.

5.3. Result

Compliance

6. CONDUCTED POWER LINE TEST

6.1. Test Equipment

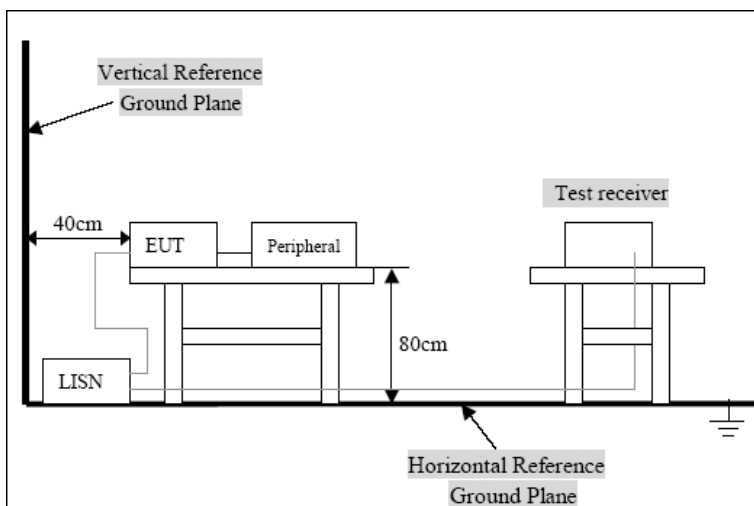
Please refer to section 4 this report.

6.2. 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 50ohm/50uh coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uh coupling impedance with 50ohm termination.

Both sides of A.C. Line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ASIN C63.4:2003 on conducted measurement. Conducted emissions were measured over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

6.3. Test Setup



For the actual test configuration, Please refer to the related items-Photos of testing

6.4. Conducted Power line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)		
Frequency Range (MHZ)	Class A QP/AV	Class B QP/AV
0.15-0.5	79/66	65-56/56-46
0.5-5.0	73/60	56-46
5.0-3.0	73/60	60-50

Note: In the above table, the tighter limit applies at the band edges.

6.5. Conducted Power Line Test Result

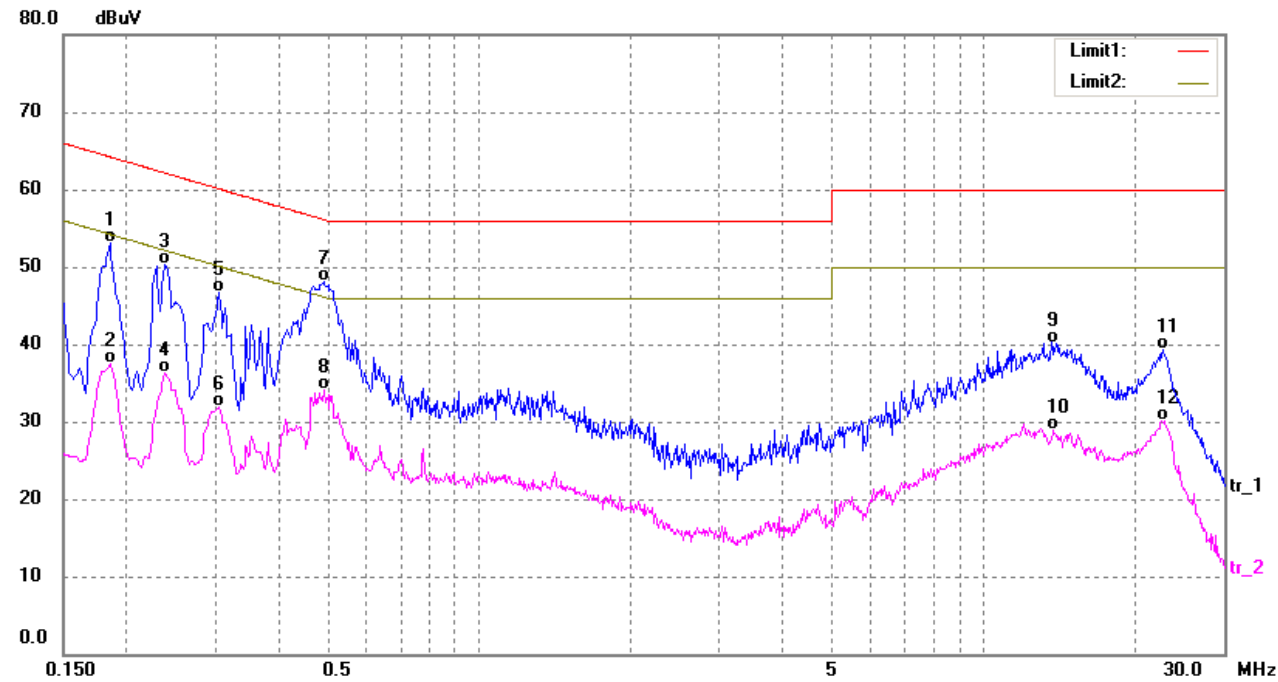
Pass

Under the mode of Color Running Button

Transmitting(Worst case mode)

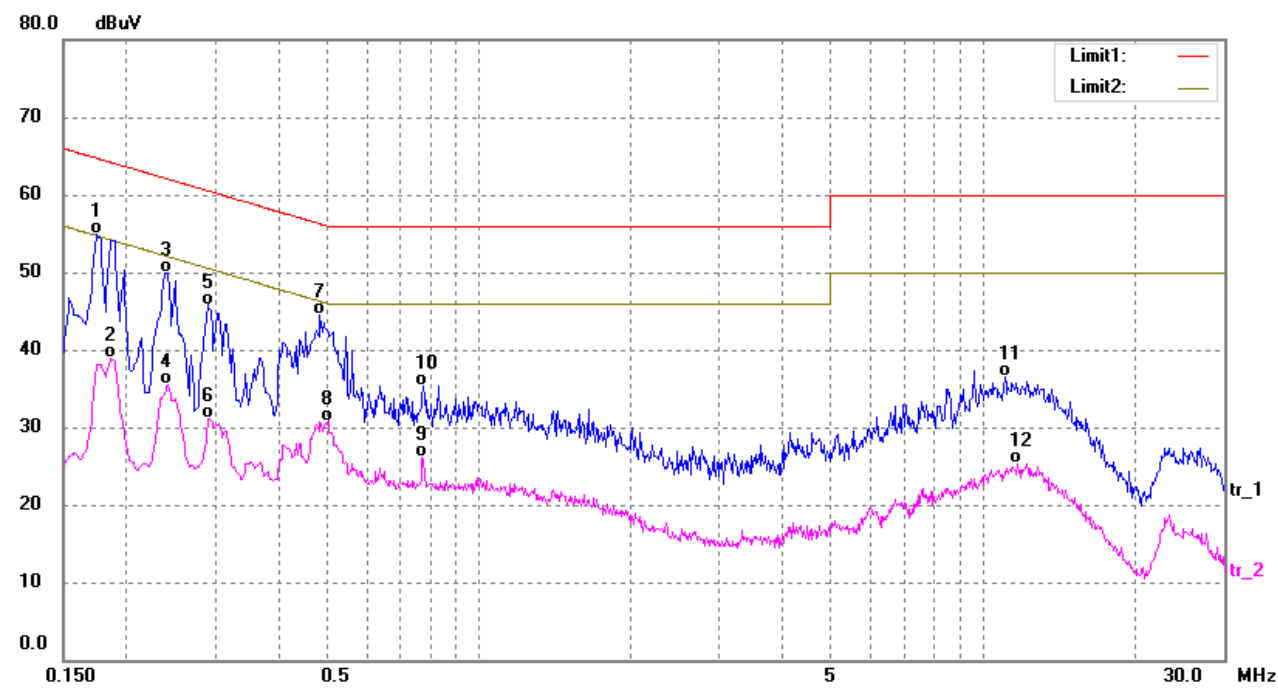
power test voltage:AC 120V/60Hz

Phase:L



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1860	40.59	12.50	53.09	64.21	-11.12	QP
2	0.1860	24.93	12.50	37.43	54.21	-16.78	AVG
3	0.2380	37.81	12.50	50.31	62.17	-11.86	QP
4	0.2380	23.84	12.50	36.34	52.17	-15.83	AVG
5	0.3060	34.13	12.50	46.63	60.08	-13.45	QP
6	0.3060	19.33	12.50	31.83	50.08	-18.25	AVG
7*	0.4940	35.59	12.50	48.09	56.10	-8.01	QP
8	0.4940	21.62	12.50	34.12	46.10	-11.98	AVG
9	13.6860	29.20	11.00	40.20	60.00	-19.80	QP
10	13.8100	17.95	11.00	28.95	50.00	-21.05	AVG
11	22.7460	27.03	12.25	39.28	60.00	-20.72	QP
12	22.8380	17.85	12.28	30.13	50.00	-19.87	AVG

Phase:N



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1740	42.33	12.50	54.83	64.77	-9.94	QP
2	0.1860	26.39	12.50	38.89	54.21	-15.32	AVG
3	0.2380	37.49	12.50	49.99	62.17	-12.18	QP
4	0.2420	22.94	12.50	35.44	52.03	-16.59	AVG
5	0.2900	33.30	12.50	45.80	60.52	-14.72	QP
6	0.2900	18.66	12.50	31.16	50.52	-19.36	AVG
7	0.4860	31.95	12.50	44.45	56.24	-11.79	QP
8	0.5020	18.30	12.50	30.80	46.00	-15.20	AVG
9	0.7740	13.32	12.77	26.09	46.00	-19.91	AVG
10	0.7780	22.56	12.78	35.34	56.00	-20.66	QP
11	11.0340	25.42	11.00	36.42	60.00	-23.58	QP
12	11.7140	14.35	11.00	25.35	50.00	-24.65	AVG

7. RADIATED EMISSION TEST

7.1. Test Equipment

Please refer to section 4 this report.

7.2. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level.

Calibrated Loop antenna is used as receiving antenna for frequencies below 30MHz, Calibrated Bilog antenna is used as receiving antenna for frequencies between 30 MHz and 1 GHz, Calibrated Horn antenna is used as receiving antenna for frequencies above 1000MHz. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4: 2003 on radiated emission measurement.

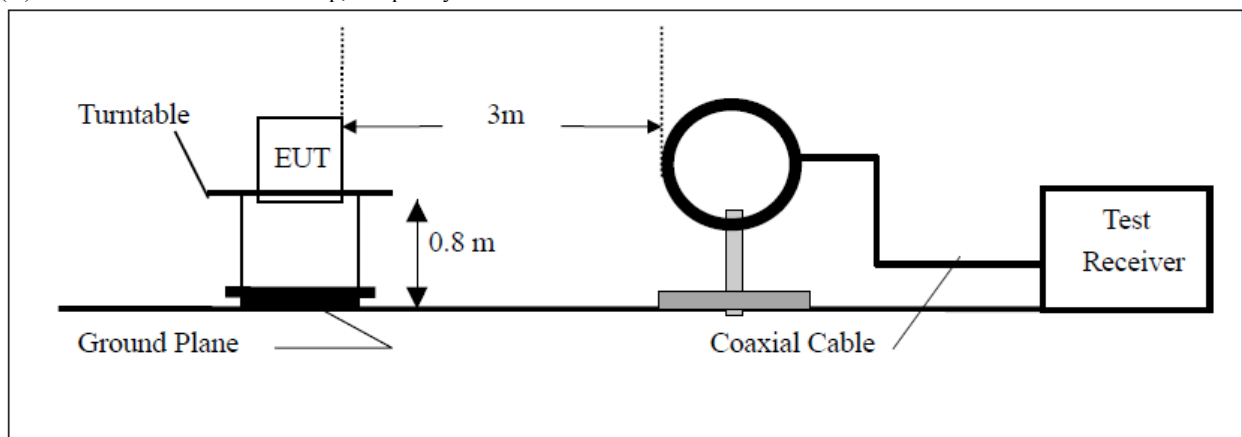
The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.

The frequency range from 9kHz to 10GHz is checked.

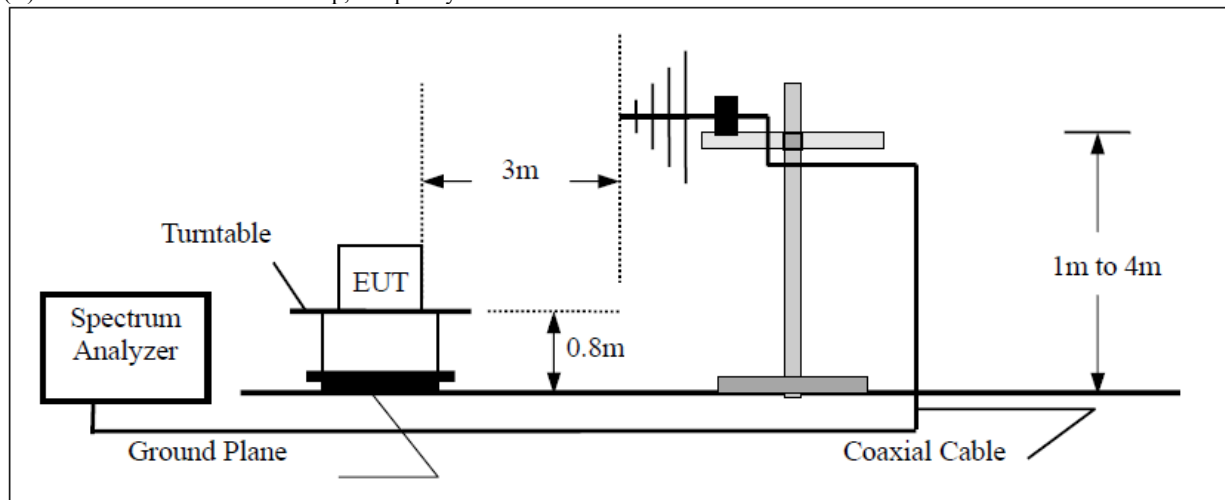
The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Peak detector and Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

7.3. Radiated Test Setup

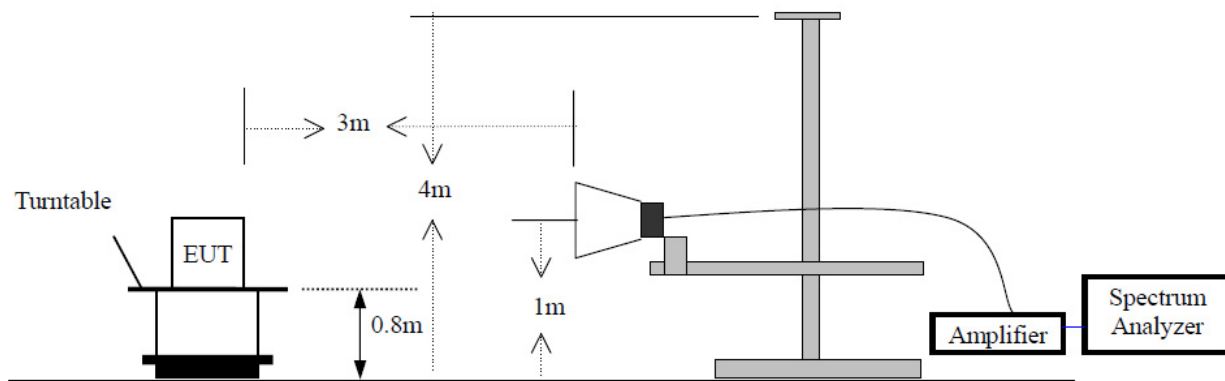
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



7.4. Radiated Emission Limit

All emission from a digital device,including any network of conductors and apparatus connected thereto,shall not exceed the level of field strength specified below :

A. Fundamental and Harmonics Radiated Emissions FCC 15.231 Limit

Fundamental Frequency (MHz)	Field Strength of fundamental (microvolts/meter)	Field Strength of Unwanted Emissions (microvolts/meter)
40.66 - 40.70	2250.00	225.00
70 - 130	1250.00	125.00
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3750.00	375.00
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12500.00	1250.00

Note:

- (1) RF Voltage (dBuV)=20 log Voltage(uV)
- (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (3) The emission limit in this paragraph os based on measurement instrumentation employing an average detector.Measurement using instrumentation with a peak detector function,corresponding to 20dB above the maximum permitted average limit.

B. Spurious Radiated Emissions.

Frequency (MHz)	Limit			The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.
	Field Strength of Quasi-peak Value (microvolts/m)	Field Strength of Quasi-peak Value (dBμV/m)	Measurement distance (m)	
0.009 - 0.490	2400/F(kHz)	/	300	
0.490 - 1.705	24000/F(kHz)	/	30	
1.705-30	30	29.5	30	
30 - 88	100	40	3	
88 - 216	150	43.5	3	
216 - 960	200	46	3	
Above 960	500	54	3	

Note: (1) RF Voltage (dBuV)=20 log Voltage(uV)

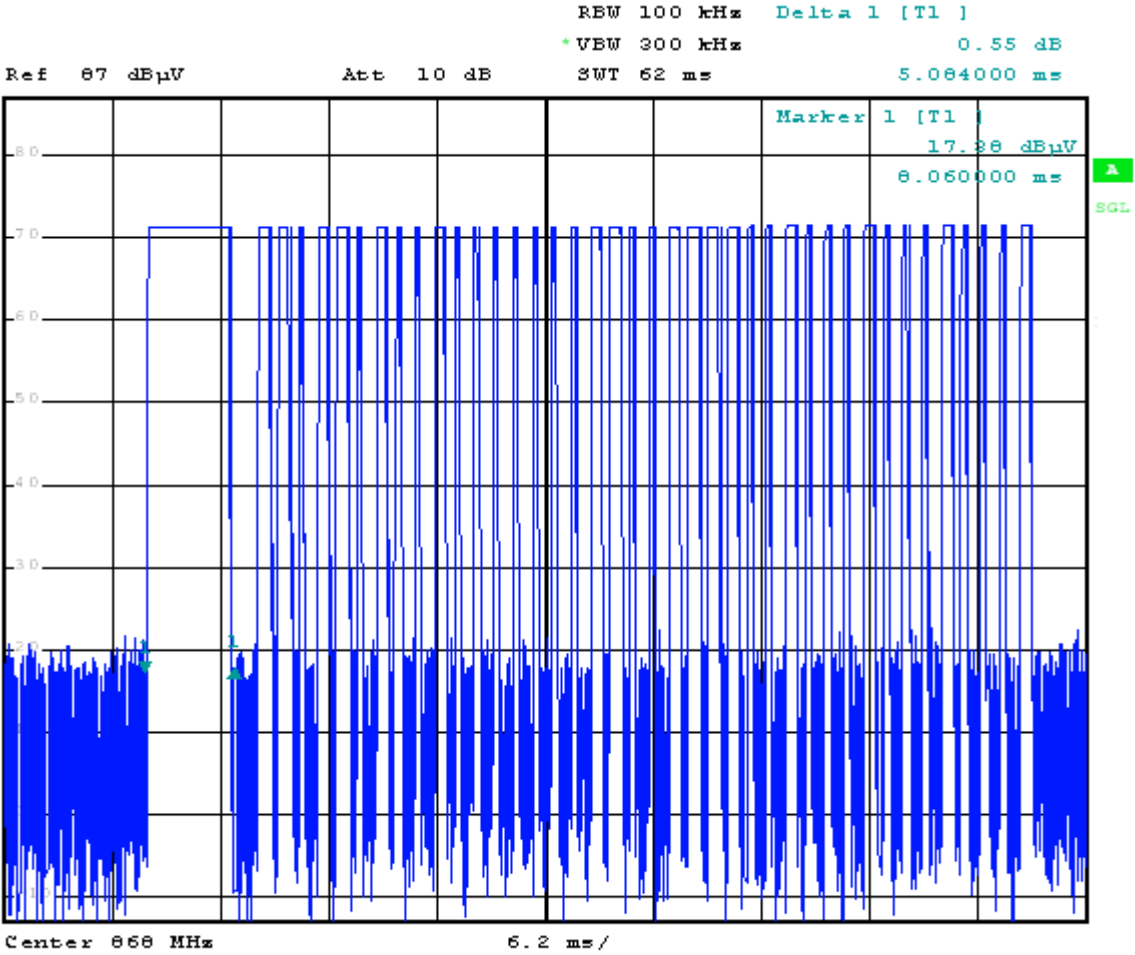
(2) In the Above Table, the tighter limit applies at the band edges.

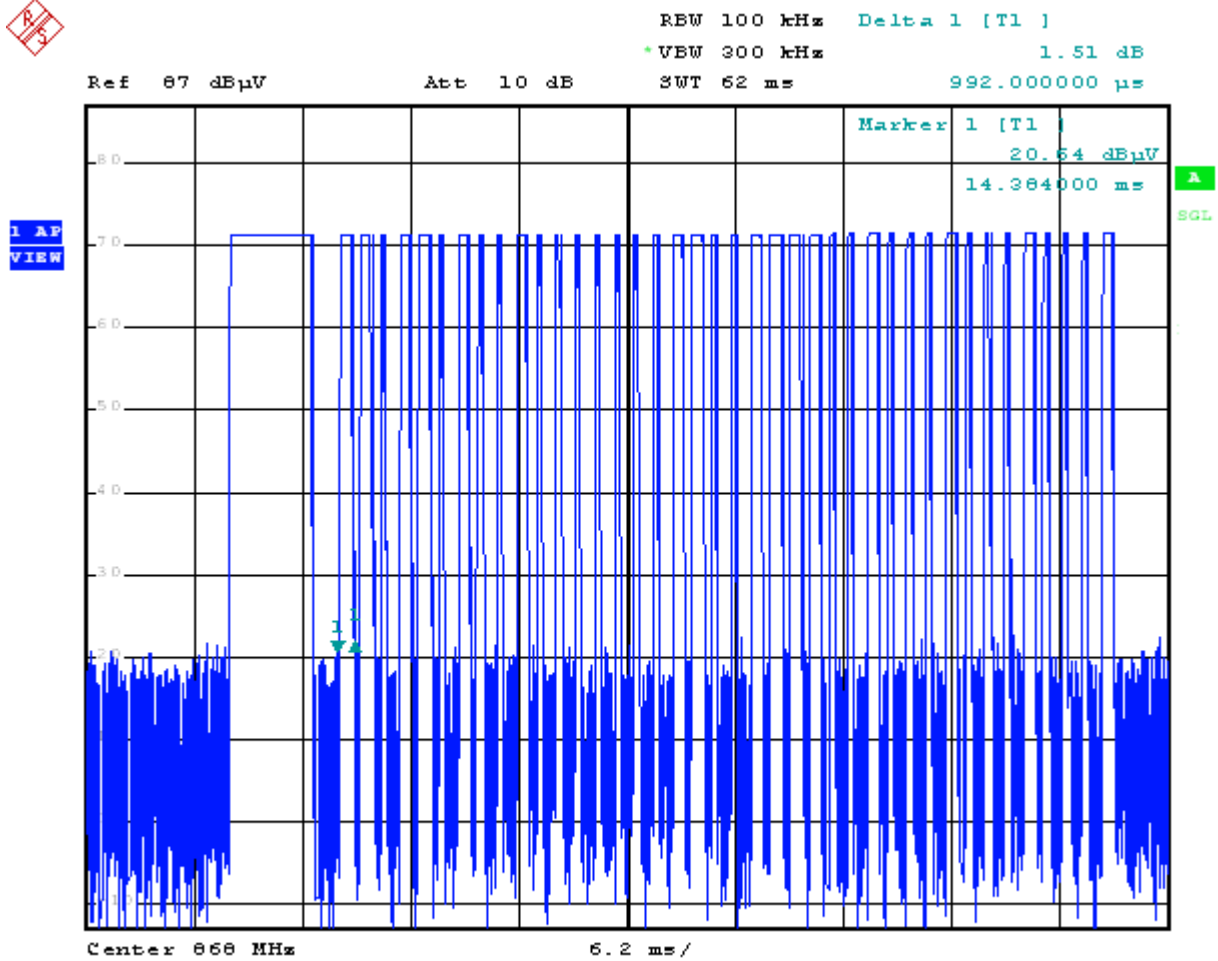
(3) Distaqnce refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

long signal and short signal time



1 AP
VIEW





The period time = 59.4 ms

Ton1=5.084ms

Ton2=0.992ms

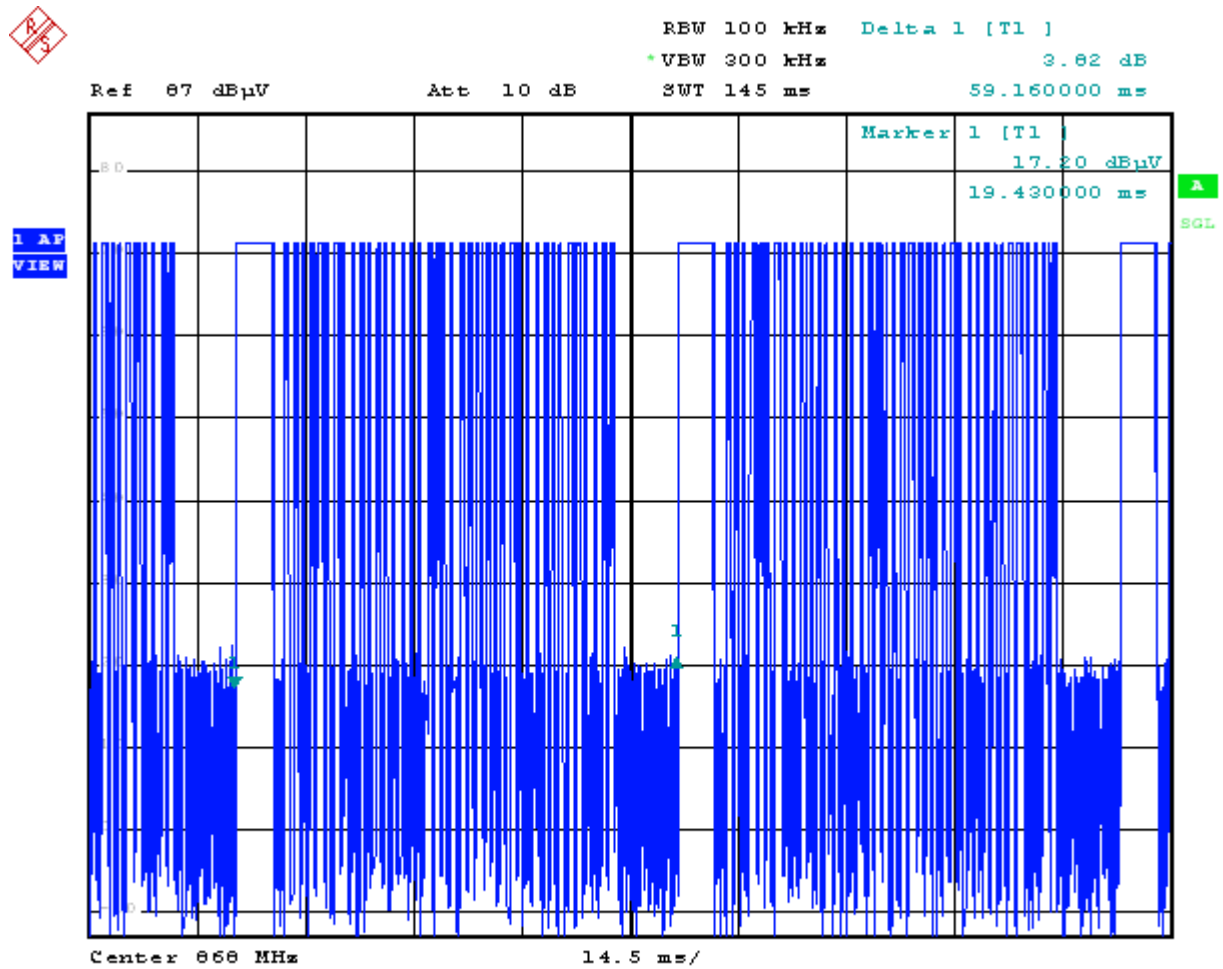
Ton of The period time = 5.084 + (0.992×40) ms=44.764ms

The duty cycle = Ton / The period time =44.764ms / 59.4ms= 0.754 ms

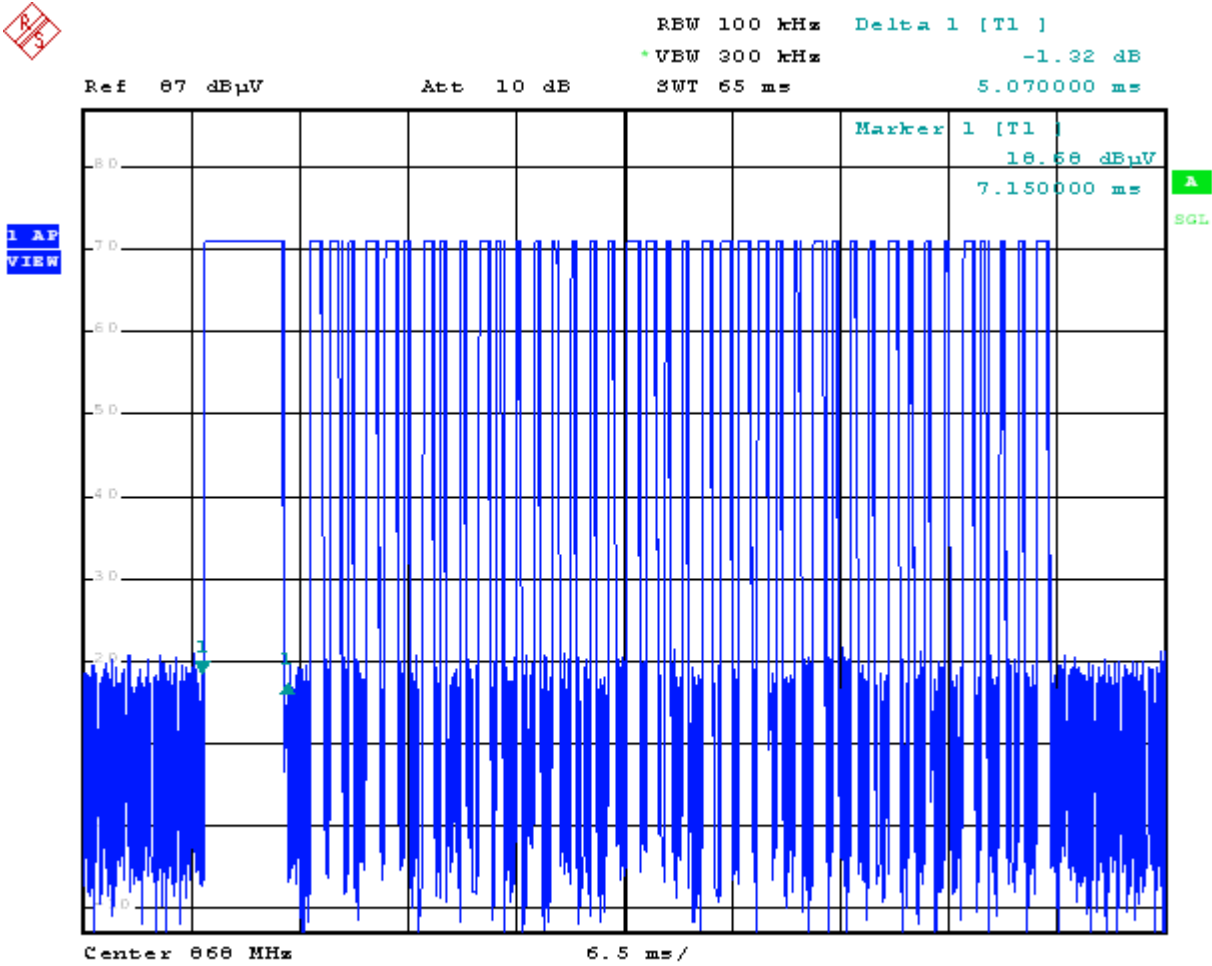
Therefore, the average factor is found by $20\log(\text{The duty cycle}) = 20\log(0.754) = -2.453\text{dB}$

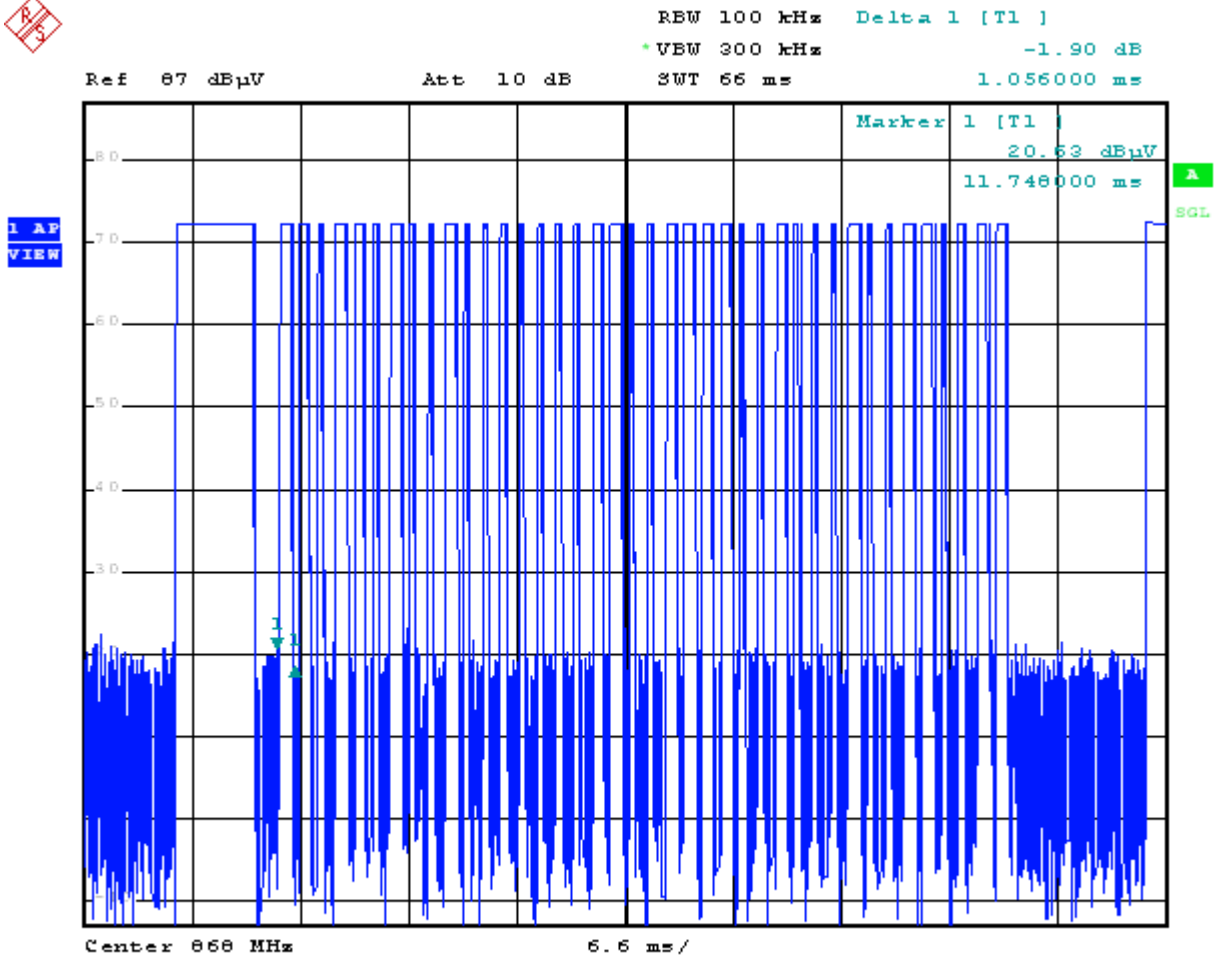
2. Brightness dimmer(Brightness dimmer Worst case:Maximum brightness)

The period time



long signal and short signal time





The period time = 59.16 ms

Ton1=5.070ms

Ton2=1.056ms

Ton of The period time = 5.070+ (1.056×40) ms=47.31ms

The duty cycle = Ton / The period time =47.31ms / 59.16ms= 0.800 ms

Therefore, the average factor is found by $20\log(\text{The duty cycle}) = 20\log(0.800) = -1.938\text{dB}$

Radiated Emissions Data

Test mode:continuous & constant TX

Test Result:PASS

1.Under the mode of Color Running Transmitting(Worst case mode)

For below 9kHz-30MHz Spurious

Freq. (MHz)	Emission(dBuV/m) PK / AV	Limits(dBuV/m) PK / AV	Margin (dB)
-	-	-	-
-	-	-	-

Note:

1. Emissions attenuated more than 20 dB below the permissible value are not reported.

For 30M-10GHz Spurious

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

HORIZONTAL

Frequency	Average Factor	Field Strength	Field Strength	Limit (PK)	Limit(AV)	State
MHz	dB	dBuV/m (PK)	dBuV/m (AV)	dBuV/m	dBuV/m	
868	-2.453	80.58	78.127	101.94	81.94	pass
1736	-2.453	57.63	55.177	81.94	61.94	pass
2604	-2.453	51.04	48.587	81.94	61.94	pass
3472	-2.453	53.85	51.397	81.94	61.94	pass
4340	-2.453	53.31	50.857	81.94	61.94	pass
434	--	34.83(QP)	--	46(QP)	--	pass

VERTICAL

Frequency	Average Factor	Field Strength	Field Strength	Limit(PK)	Limit(AV)	State
MHz	dB	dBuV/m (PK)	dBuV/m (AV)	dBuV/m	dBuV/m	
868	-2.453	75.83	73.377	101.94	81.94	pass
1736	-2.453	52.79	50.337	81.94	61.94	pass
2604	-2.453	48.75	46.297	81.94	61.94	pass
3472	-2.453	48.32	45.867	81.94	61.94	pass
4340	-2.453	48.89	46.437	81.94	61.94	pass
434	--	36.18 (QP)	--	46(QP)	--	pass

NOTE:

1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. Field Strength(AV) = Field Strength(PK)+Average Factor.
3. *: Denotes restricted band of operation.

2. Brightness dimmer(Brightness dimmer Worst case:Maximum brightness)

For below 9kHz-30MHz Spurious

Freq. (MHz)	Emission(dBuV/m) PK / AV	Limits(dBuV/m) PK / AV	Margin (dB)
-	-	-	-
-	-	-	-

Note:

- Emissions attenuated more than 20 dB below the permissible value are not reported.

For 30M-10GHz Spurious

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

HORIZONTAL

Frequency	Average Factor	Field Strength	Field Strength	Limit (PK)	Limit(AV)	State
MHz	dB	dBuV/m (PK)	dBuV/m (AV)	dBuV/m	dBuV/m	
868	-1.938	80.62	78.682	101.94	81.94	pass
1736	-1.938	57.67	55.732	81.94	61.94	pass
2604	-1.938	51.08	49.142	81.94	61.94	pass
3472	-1.938	53.89	51.952	81.94	61.94	pass
4340	-1.938	53.35	51.412	81.94	61.94	pass
434	--	35.73(QP)	--	46(QP)	--	pass

VERTICAL

Frequency	Average Factor	Field Strength	Field Strength	Limit(PK)	Limit(AV)	State
MHz	dB	dBuV/m (PK)	dBuV/m (AV)	dBuV/m	dBuV/m	
868	-1.938	75.87	73.932	101.94	81.94	pass
1736	-1.938	52.83	50.892	81.94	61.94	pass
2604	-1.938	48.79	46.852	81.94	61.94	pass
3472	-1.938	48.36	46.422	81.94	61.94	pass
4340	-1.938	48.93	46.992	81.94	61.94	pass
434	--	37.08 (QP)	--	46(QP)	--	pass

NOTE:

- Emissions attenuated more than 20 dB below the permissible value are not reported.
- Field Strength(AV) = Field Strength(PK)+Average Factor.
- *: Denotes restricted band of operation.

8. 20DB OCCUPIED BANDWIDTH

8.1. Test Equipment

Please refer to Section 5 this report.

8.2. Test Procedure

1. The EUT was tested according C63.4-2003. The radiated test was performed at FCC Registration laboratory.
2. With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna which was connected to the spectrum analyzer with the START and STOP frequencies set to the EUT's operation band.

8.3. FCC 15.231(c) 20dB Bandwidth Limit

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Therefore, the bandwidth of the emission limit is $868\text{MHz} \times 0.25\% = 2.17\text{MHz}$. Bandwidth is determined at the points 20 dB down from the modulated carrier.

8.4. Test Result

Temperature 25°C

Humidity: 55%RH

$$\text{Limit} = 868\text{MHz} \times 0.25\% = 2.17\text{MHz}$$

Test data: 46KHz

Test Result: PASS

Test operating mode: Under the mode of Color Running (Worst case mode)

Temperature 25°C

Humidity: 55%RH

$$\text{Limit} = 868\text{MHz} \times 0.25\% = 2.17\text{MHz}$$

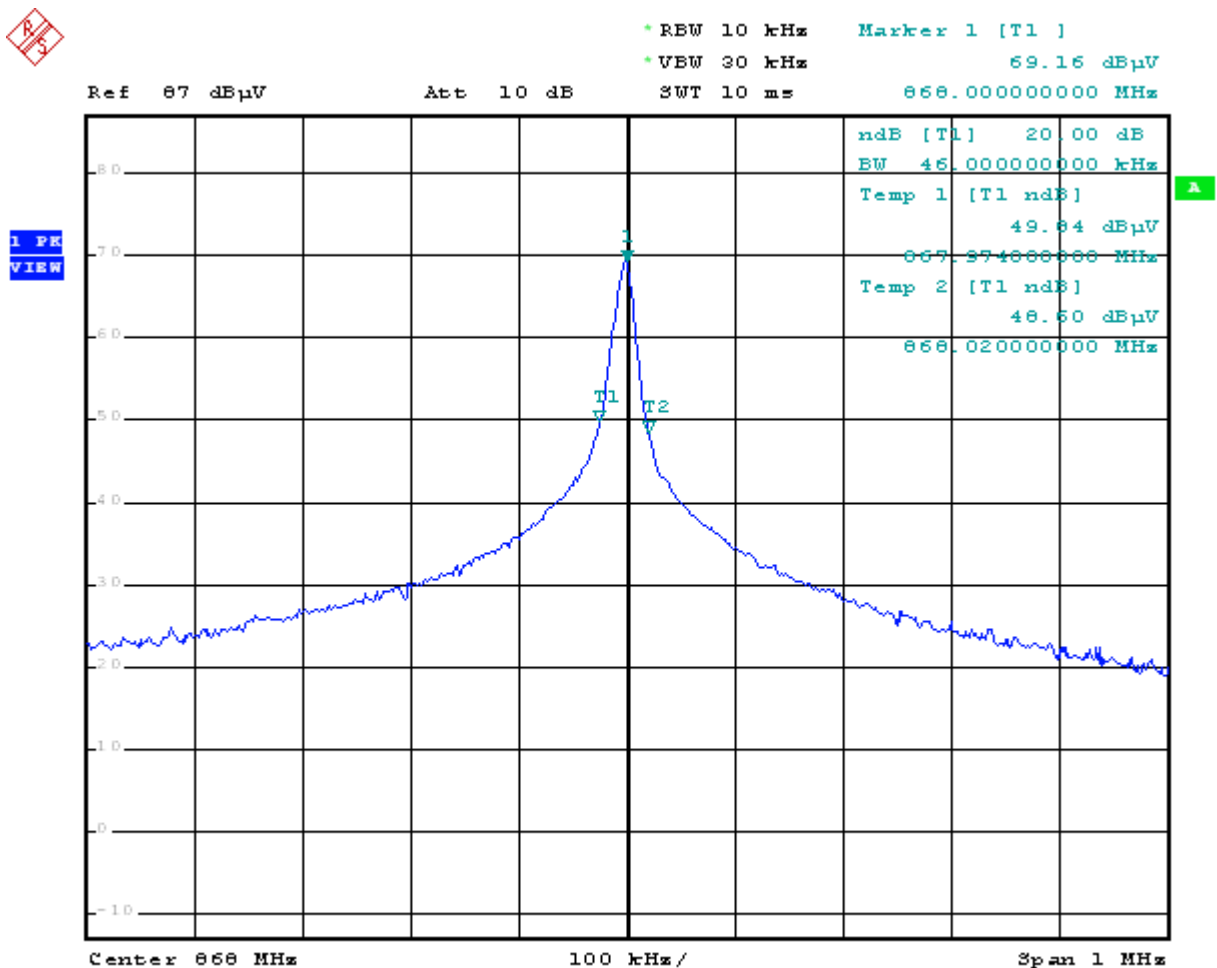
Test data: 46KHz

Test Result: **PASS**

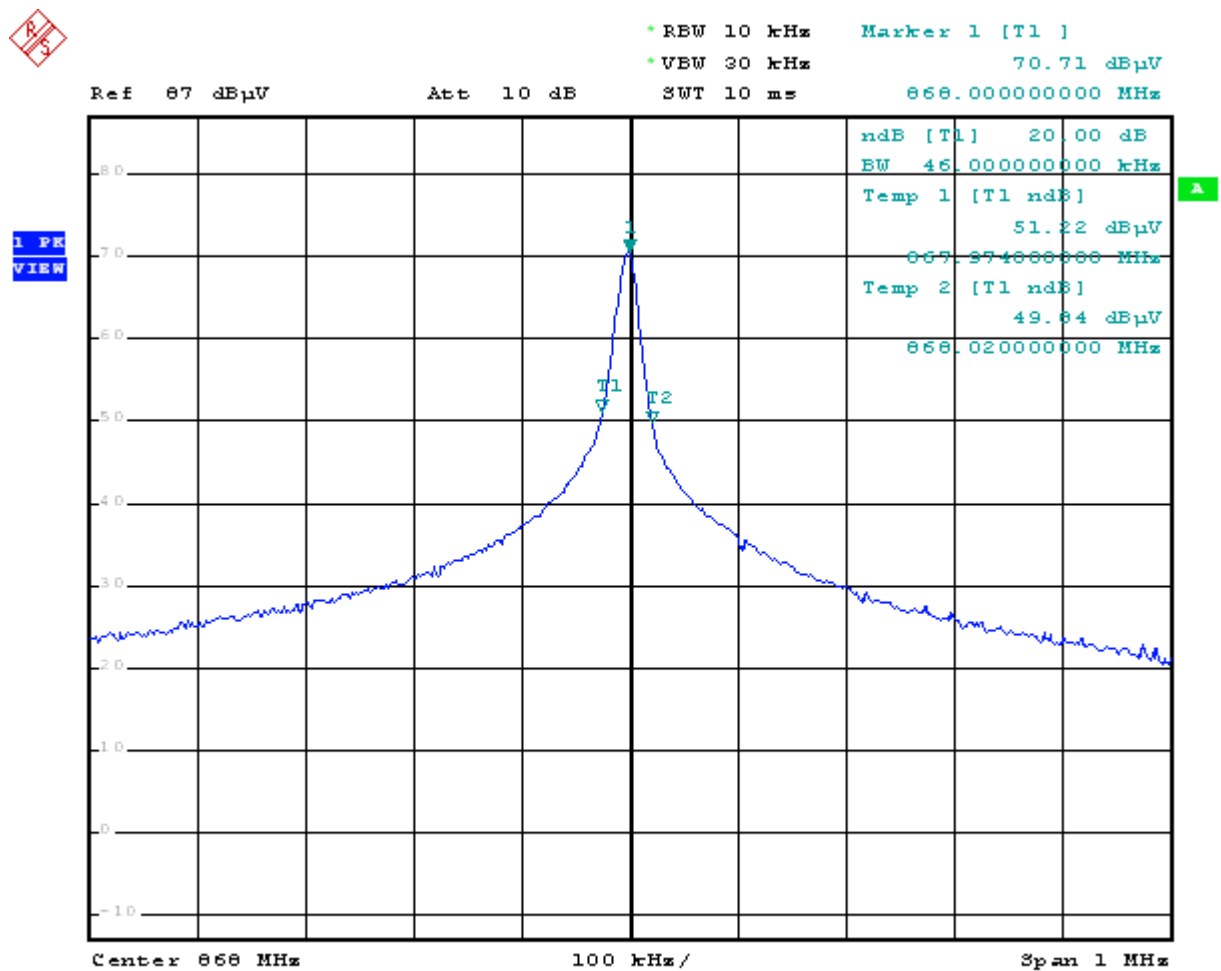
Test operating mode: Brightness dimmer(Brightness dimmer Worst case:Maximum brightness)

Test mode:unmodified for timing

Test operating mode: Under the mode of Color Running (Worst case mode)



Test operating mode: Brightness dimmer(Brightness dimmer Worst case:Maximum brightness)



9. DEACTIVATION TESTING

9.1. Test Equipment

Please refer to Section 5 this report.

9.2. Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Set center frequency=868MHz

Set SPAN=0Hz

Set RBW=100kHz

Set VBW=300kHz

Set SWEET TIME>5s

9.3. Deactivation Testing Requirement

Per 15.231(a) (1), a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

9.4. Test Result

Temperature:25℃Humidity:55%RH

this manually activated transmission stops automatically within 5 seconds.

0.252s

Test time:(the pressing times of the Key will not be Change activate time.)Test Result:PASS

Test operating mode (1): Under the mode of Color Running

Temperature:25℃Humidity:55%RH

this manually activated transmission stops automatically within 5 seconds.

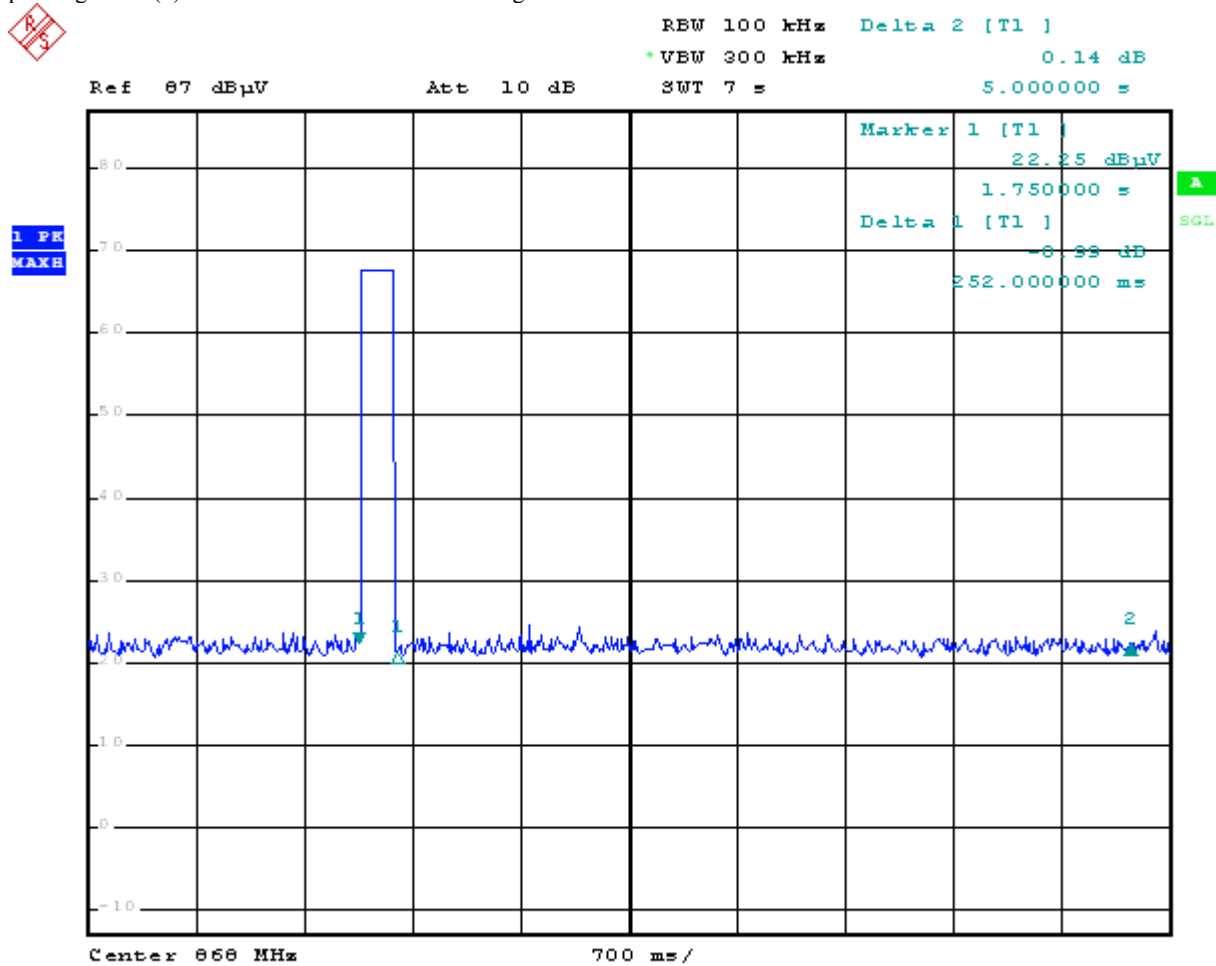
1.8s

Test time:(the pressing times of the Key will not be Change activate time.)Test Result:PASS

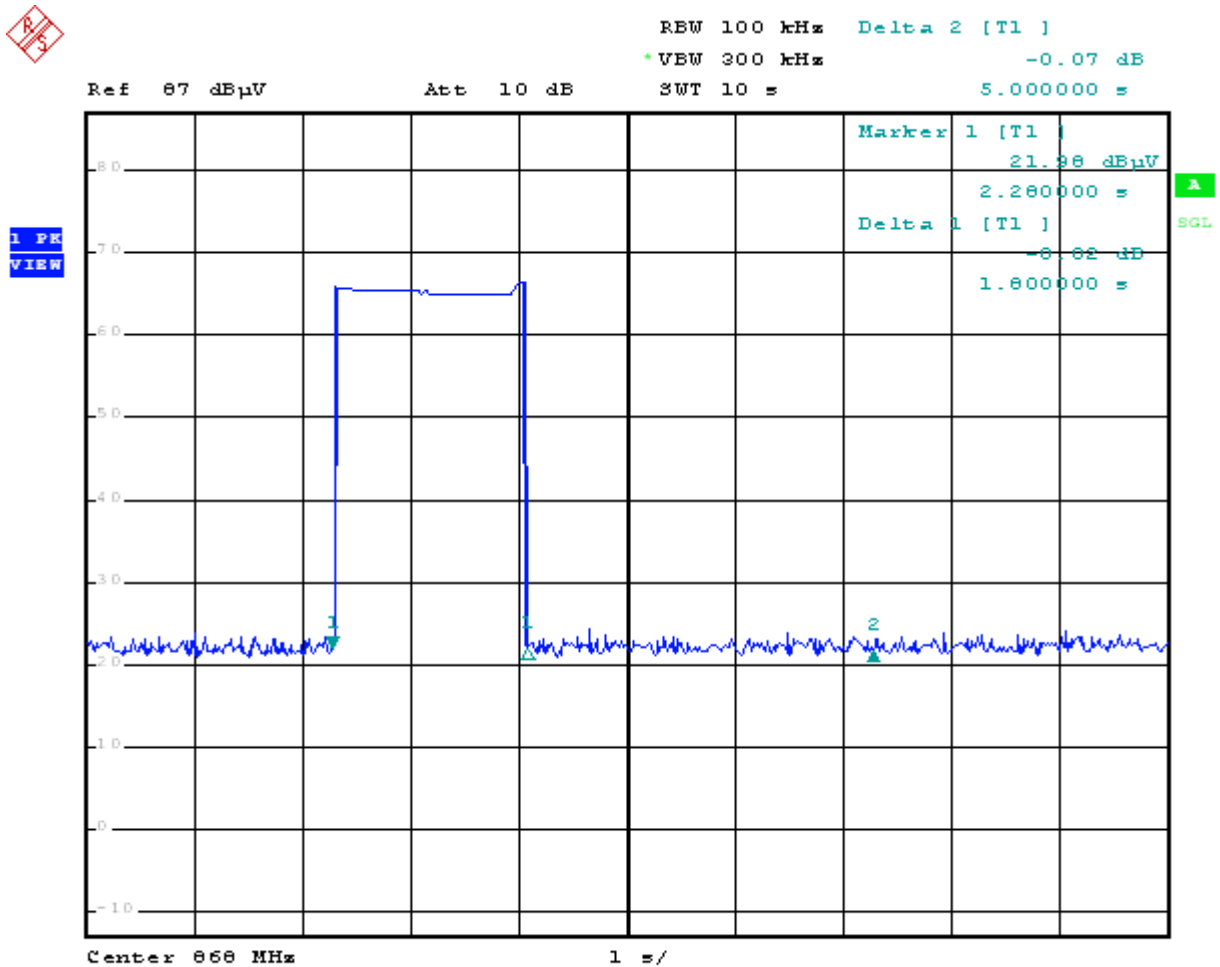
Test operating mode (2): Brightness dimmer(Brightness dimmer Worst case:Maximum brightness)

Test mode:unmodified for timing

Test operating mode (1): Under the mode of Color Running



Test operating mode (2): Brightness dimmer(Brightness dimmer Worst case:Maximum brightness)



End Of The Report