Test Report

Applicant:	Astera LED-Technology GmbH
Address of Applicant:	Stahlgruberring 36, 81829 Munich, Germany
Manufacturer:	Astera Manufacturing Limited
Address of Manufacturer:	Rm. 201, Huazhong Indutrial Park, No. 12 South Huancheng Road, Bantian Street, Longgang District, 518129 Shenzhen, China

Equipment Under Test (EUT)

Product Name:	Stage Luminaires
Model No.:	FP1, FP2
Trade Mark:	ASTERA
FCC ID:	X55FP
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	August 05, 2019
Date of Test:	August 05-October 10, 2019
Date of report issued:	December 12, 2019
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Robinson Lo
Laboratory Manager

2 Version

Version No.	Date	Description
00	*December 12, 2019*	*Original*

Prepared By: ***Date:*** *December 12, 2019*

Project Engineer

Check By: ***Date:*** *December 12, 2019*

Reviewer

3 Contents

Page

4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Remarks:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *Test according to ANSI C63.10:2013*

Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

5 General Information

5.1 General Description of EUT

Product Name:	Stage Luminaires
Model No.:	FP1, FP2
Serial No.:	N/A
Test sample(s) ID:	GTS201912000096-1
Sample(s) Status:	Engineer sample
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK
Antenna Type:	PIFA Antenna
Antenna gain:	7.0dBi(Declare by applicant)
Power supply:	DC 14.4V Adaptor: PS1065-240T2B250 Input: 100-240V~, 50-60Hz, 1.8A Output: DC 24V, 2.5A, 60W Max

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2440MHz
The Highest channel	2480MHz

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode.

Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.

5.3 Description of Support Units

None.

5.4 Deviation from Standards

None.

5.5 Abnormalities from Standard Conditions

None.

5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383.

● **IC —Registration No.: 9079A**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

5.7 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 26 2019	June. 25 2020
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 26 2019	June. 25 2020
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 26 2019	June. 25 2020
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 26 2019	June. 25 2020
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 26 2019	June. 25 2020
9	Coaxial Cable	GTS	N/A	GTS211	June. 26 2019	June. 25 2020
10	Coaxial cable	GTS	N/A	GTS210	June. 26 2019	June. 25 2020
11	Coaxial Cable	GTS	N/A	GTS212	June. 26 2019	June. 25 2020
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 26 2019	June. 25 2020
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 26 2019	June. 25 2020
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 26 2019	June. 25 2020
15	Band filter	Amindeon	82346	GTS219	June. 26 2019	June. 25 2020
16	Power Meter	Anritsu	ML2495A	GTS540	June. 26 2019	June. 25 2020
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 26 2019	June. 25 2020
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 26 2019	June. 25 2020
19	Splitter	Agilent	11636B	GTS237	June. 26 2019	June. 25 2020
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 26 2019	June. 25 2020
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 20 2018	Oct. 19 2019
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 20 2018	Oct. 19 2019
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 20 2018	Oct. 19 2019
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 26 2019	June. 25 2020

Conducted Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 26 2019	June. 25 2020
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 26 2019	June. 25 2020
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June. 26 2019	June. 25 2020
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 26 2019	June. 25 2020
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 26 2019	June. 25 2020
9	ISN	SCHWARZBECK	NTFM 8158	GTD565	June. 26 2019	June. 25 2020

RF Conducted Test:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	June. 26 2019	June. 25 2020
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 26 2019	June. 25 2020
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 26 2019	June. 25 2020
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 26 2019	June. 25 2020
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 26 2019	June. 25 2020
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 26 2019	June. 25 2020
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 26 2019	June. 25 2020
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 26 2019	June. 25 2020

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 26 2019	June. 25 2020
2	Barometer	ChangChun	DYM3	GTS255	June. 26 2019	June. 25 2020

7 Test results and Measurement Data

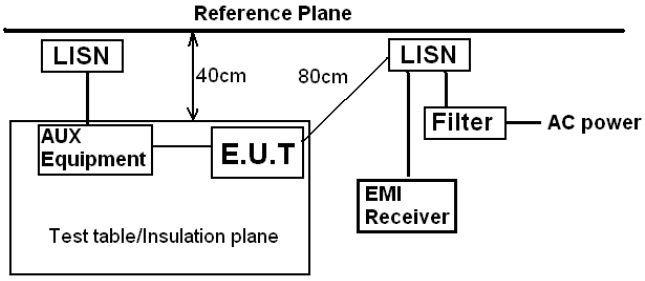
7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)

15.203 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, 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.

7.2 Conducted Emissions

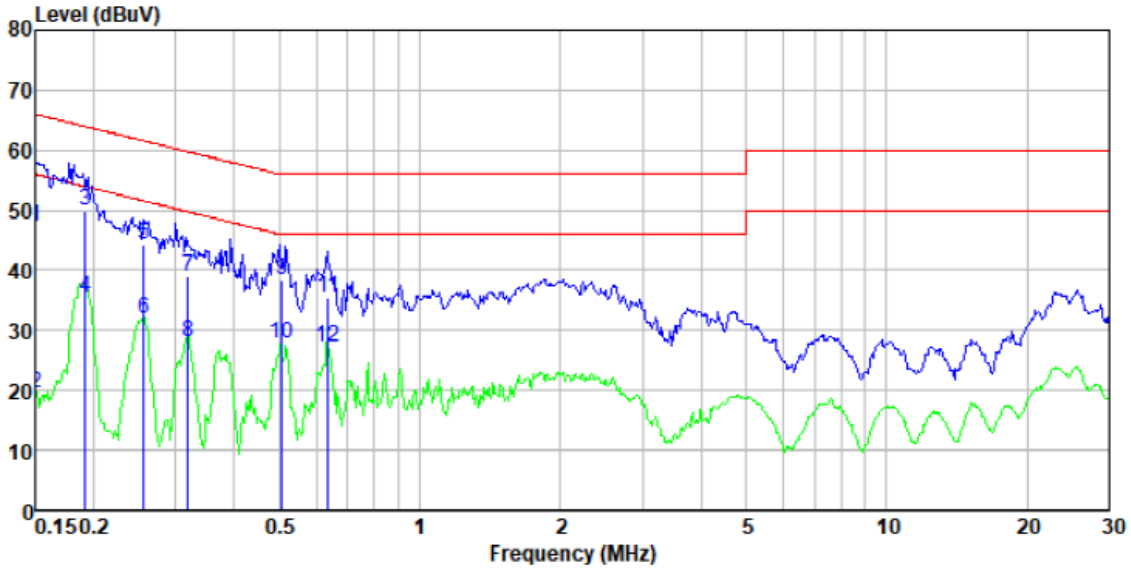
Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Class / Severity:	Class B
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 * Decreases with the logarithm of the frequency.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test procedure:	1. The E.U.T 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. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. 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 ANSI C63.10:2013 on conducted measurement.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test environment:	Temp.: 24 °C / Humid.: 54% / Press.: 1012mbar
Test voltage:	AC 120V, 60Hz
Test results:	Pass

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

Measurement data:

FP1:

Line:

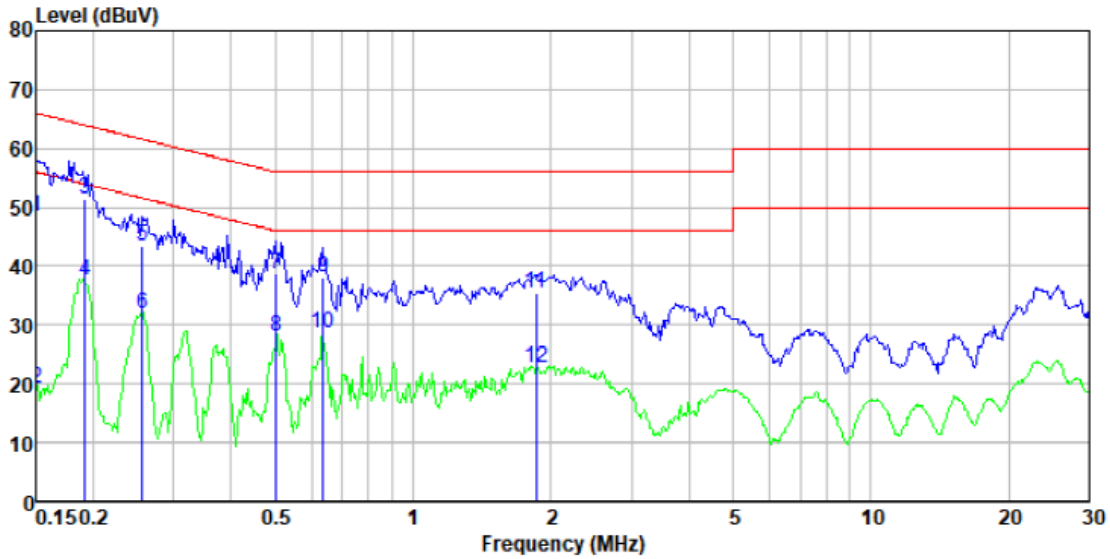


Condition : FCC PART15 CLASSB QP LINE

EUT name : Stage lunminaires
Test Model : FP1
Test Mode : 2.4G TX
T & H : 24℃ 54%
Test Voltage: 120V/60Hz
Test Enginee: Sam
Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	46.90	0.40	0.07	47.37	66.00	-18.63	QP
2	0.150	18.91	0.40	0.07	19.38	56.00	-36.62	Average
3	0.192	49.30	0.40	0.11	49.81	63.93	-14.12	QP
4	0.192	35.05	0.40	0.11	35.56	53.93	-18.37	Average
5	0.256	43.71	0.40	0.10	44.21	61.56	-17.35	QP
6	0.256	31.36	0.40	0.10	31.86	51.56	-19.70	Average
7	0.318	38.58	0.39	0.10	39.07	59.75	-20.68	QP
8	0.318	27.49	0.39	0.10	27.98	49.75	-21.77	Average
9	0.507	37.85	0.31	0.11	38.27	56.00	-17.73	QP
10	0.507	27.40	0.31	0.11	27.82	46.00	-18.18	Average
11	0.637	35.02	0.28	0.12	35.42	56.00	-20.58	QP
12	0.637	26.63	0.28	0.12	27.03	46.00	-18.97	Average

Neutral:



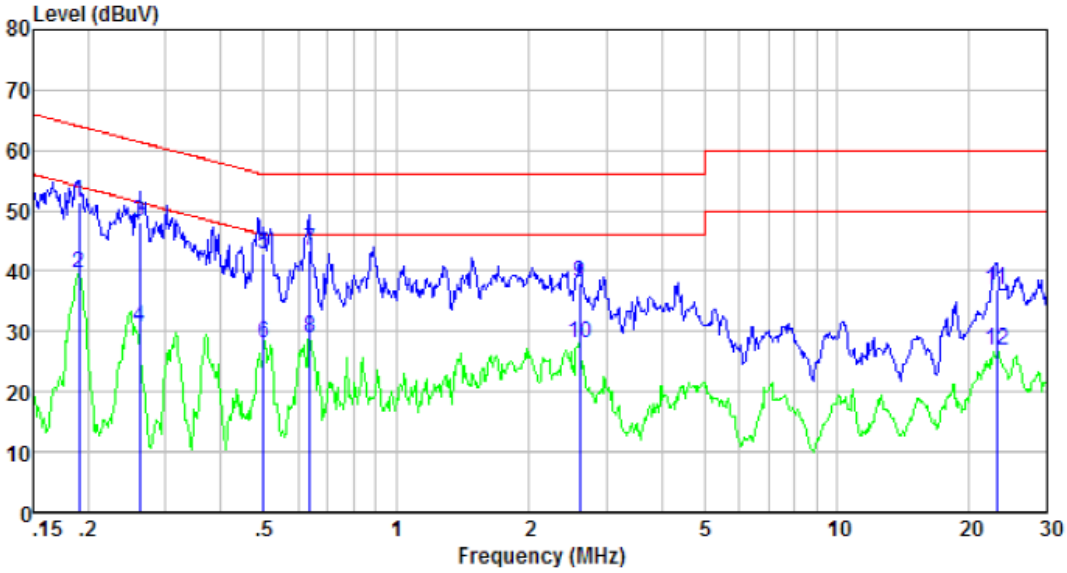
Condition : FCC PART15 CLASSB QP NEUTRAL

EUT name : Stage 1unminaires
Test Model : FP1
Test Mode : 2.4G TX
T & H : 24℃ 54%
Test Voltage: 120V/60Hz
Test Enginee: Sam
Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	47.98	0.40	0.07	48.45	66.00	-17.55	QP
2	0.150	18.78	0.40	0.07	19.25	56.00	-36.75	Average
3	0.192	50.76	0.40	0.11	51.27	63.93	-12.66	QP
4	0.192	36.96	0.40	0.11	37.47	53.93	-16.46	Average
5	0.256	43.03	0.40	0.10	43.53	61.56	-18.03	QP
6	0.256	31.33	0.40	0.10	31.83	51.56	-19.73	Average
7	0.502	38.25	0.31	0.11	38.67	56.00	-17.33	QP
8	0.502	27.58	0.31	0.11	28.00	46.00	-18.00	Average
9	0.637	37.59	0.28	0.12	37.99	56.00	-18.01	QP
10	0.637	28.24	0.28	0.12	28.64	46.00	-17.36	Average
11	1.858	35.08	0.20	0.17	35.45	56.00	-20.55	QP
12	1.858	22.47	0.20	0.17	22.84	46.00	-23.16	Average

FP2:

Line:

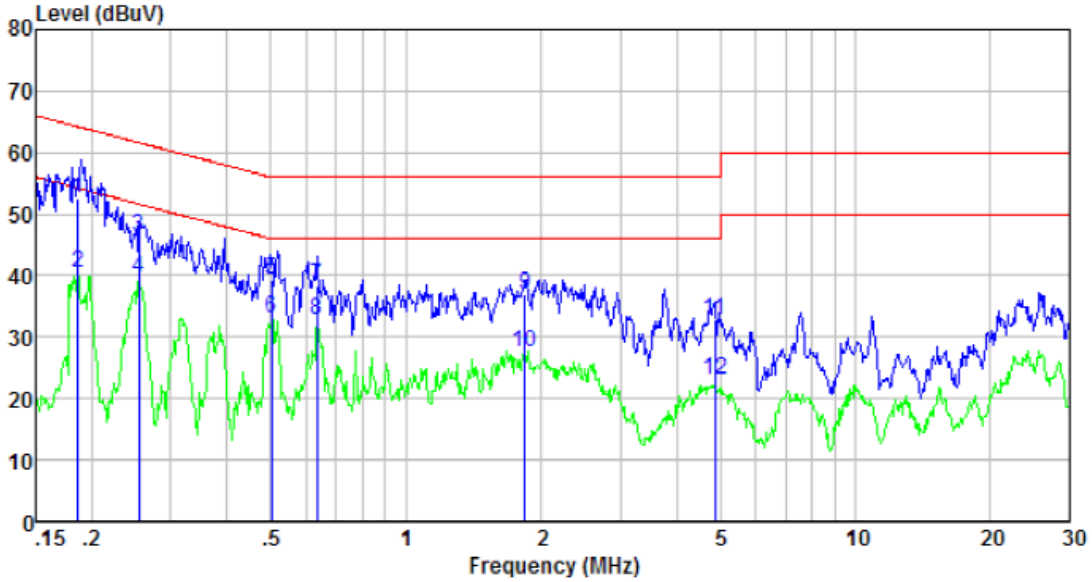


Condition : FCC PART15 CLASSB QP LISN-2017 LINE

EUT name : Stage lumminaires
Test Model : FP2
Test Mode : 2.4G TX
T & H : 24℃ 54%
Test Voltage: 120V/60Hz
Test Enginee: Sam
Remark :

	Freq	Read Level	Cable Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.190	50.93	0.10	0.50	51.43	64.02	-12.59	QP
2	0.190	38.92	0.10	0.50	39.42	54.02	-14.60	Average
3	0.262	47.69	0.10	0.50	48.19	61.38	-13.19	QP
4	0.262	30.25	0.10	0.50	30.75	51.38	-20.63	Average
5	0.499	42.37	0.11	0.43	42.80	56.01	-13.21	QP
6	0.499	27.68	0.11	0.43	28.11	46.01	-17.90	Average
7	0.637	43.12	0.12	0.40	43.52	56.00	-12.48	QP
8	0.637	28.53	0.12	0.40	28.93	46.00	-17.07	Average
9	2.608	37.56	0.18	0.38	37.94	56.00	-18.06	QP
10	2.608	27.69	0.18	0.38	28.07	46.00	-17.93	Average
11	23.018	36.22	0.23	0.56	36.78	60.00	-23.22	QP
12	23.018	26.37	0.23	0.56	26.93	50.00	-23.07	Average

Neutral:



Condition : FCC PART15 CLASSB QP LISN-2017 NEUTRAL

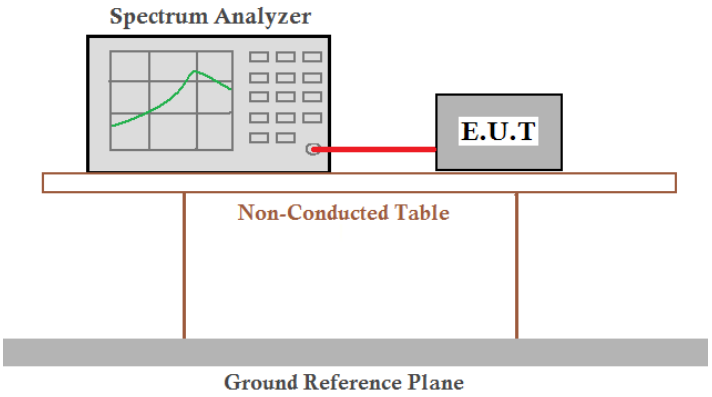
EUT name : Stage lunminaires
Test Model : FP2
Test Mode : 2.4G TX
T & H : 24℃ 54%
Test Voltage: 120V/60Hz
Test Enginee: Sam
Remark :

	Freq	Read Level	Cable Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.186	51.98	0.10	0.50	52.48	64.20	-11.72	QP
2	0.186	40.00	0.10	0.50	40.50	54.20	-13.70	Average
3	0.255	45.81	0.10	0.50	46.31	61.60	-15.29	QP
4	0.255	39.17	0.10	0.50	39.67	51.60	-11.93	Average
5	0.502	38.93	0.11	0.42	39.35	56.00	-16.65	QP
6	0.502	32.64	0.11	0.42	33.06	46.00	-12.94	Average
7	0.634	38.12	0.12	0.40	38.52	56.00	-17.48	QP
8	0.634	32.49	0.12	0.40	32.89	46.00	-13.11	Average
9	1.839	36.52	0.17	0.37	36.89	56.00	-19.11	QP
10	1.839	27.14	0.17	0.37	27.51	46.00	-18.49	Average
11	4.874	32.34	0.17	0.37	32.71	56.00	-23.29	QP
12	4.874	22.56	0.17	0.37	22.93	46.00	-23.07	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss

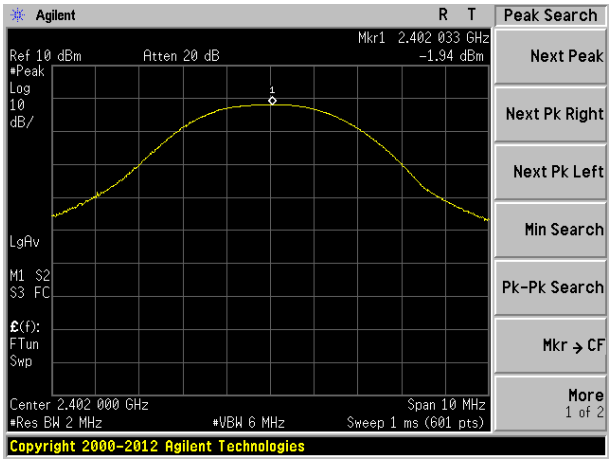
7.3 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	29dBm
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

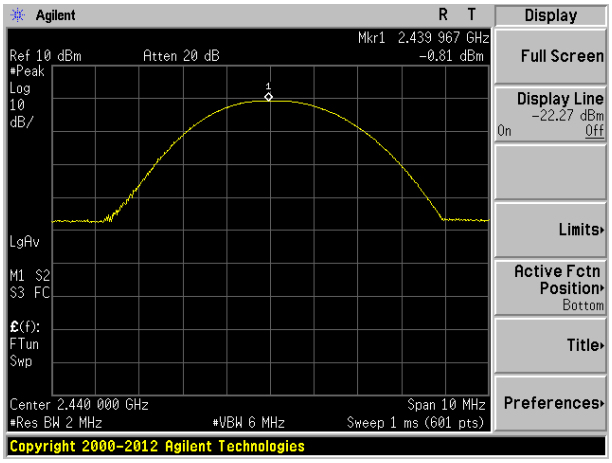
Measurement Data

Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-1.94	29dBm	Pass
Middle	-0.81		
Highest	0.12		

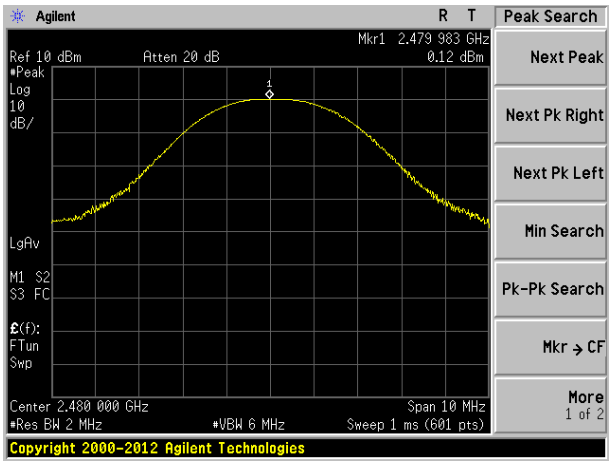
Test plot as follows:



Lowest channel

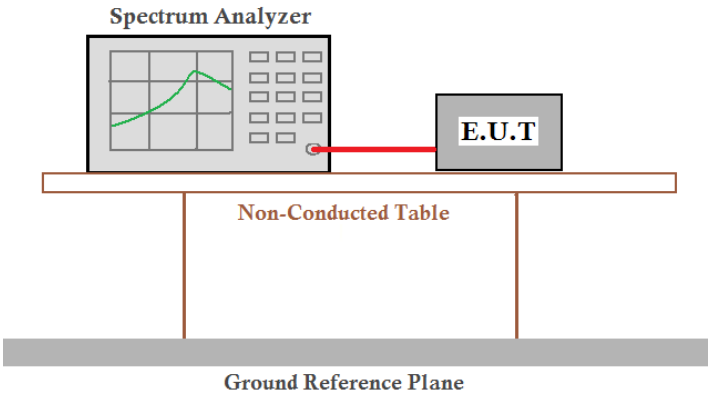


Middle channel



Highest channel

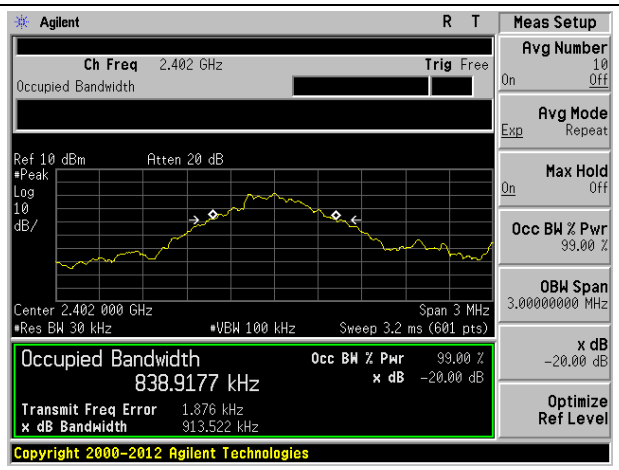
7.4 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

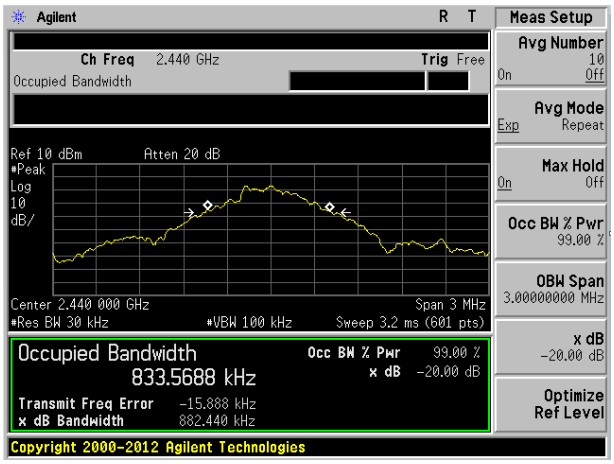
Measurement Data

Test channel	20dB Emission Bandwidth (kHz)	Result
Lowest	914	Pass
Middle	882	
Highest	885	

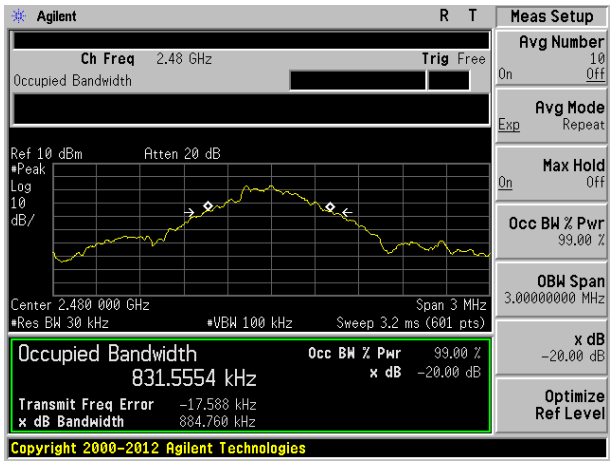
Test plot as follows:



Lowest channel

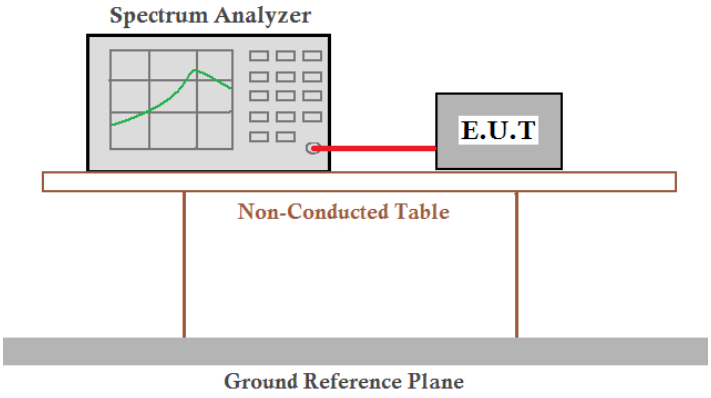


Middle channel



Highest channel

7.5 Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak
Limit:	20dB bandwidth
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

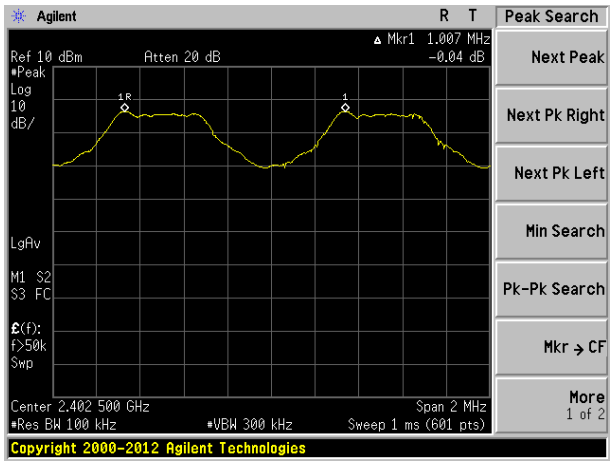
Measurement Data

Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1007	914	Pass
Middle	1003	914	Pass
Highest	1003	914	Pass

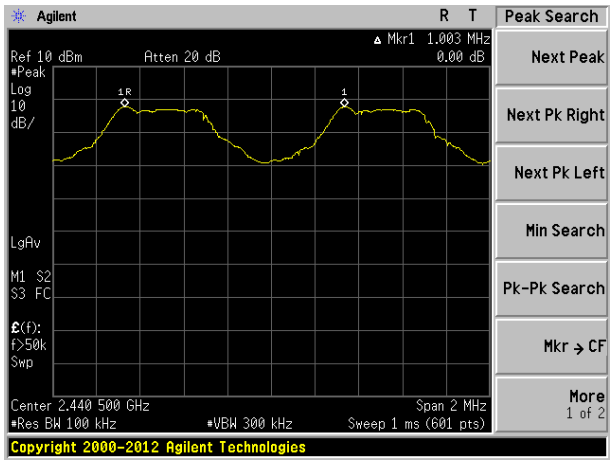
Note: According to section 7.4

20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
914	914

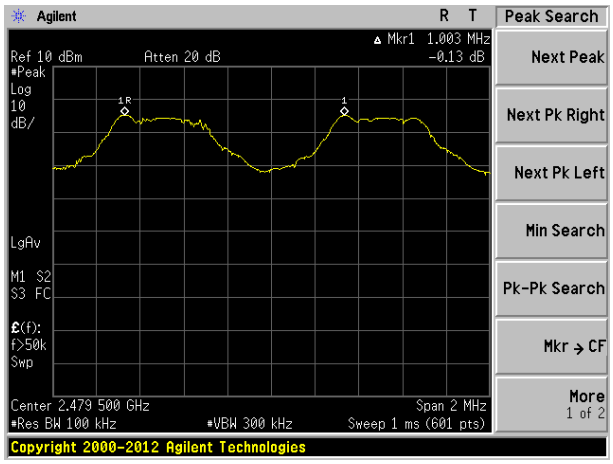
Test plot as follows:



Lowest channel

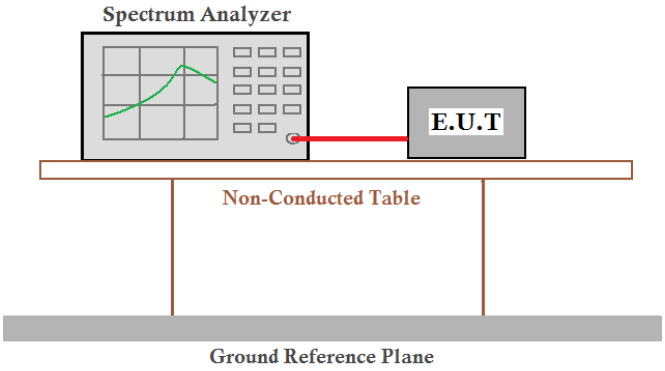


Middle channel



Highest channel

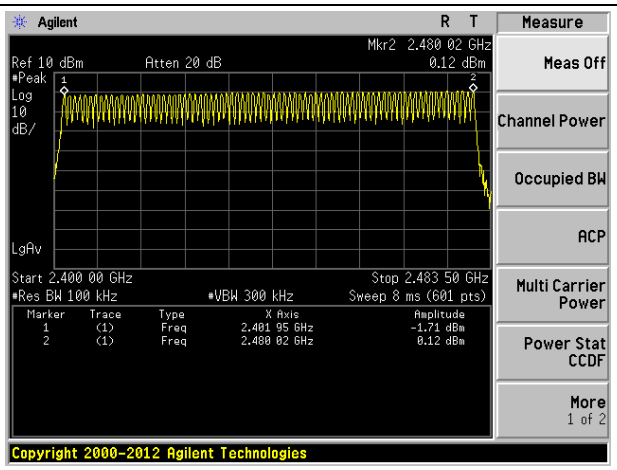
7.6 Hopping Channel Number

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

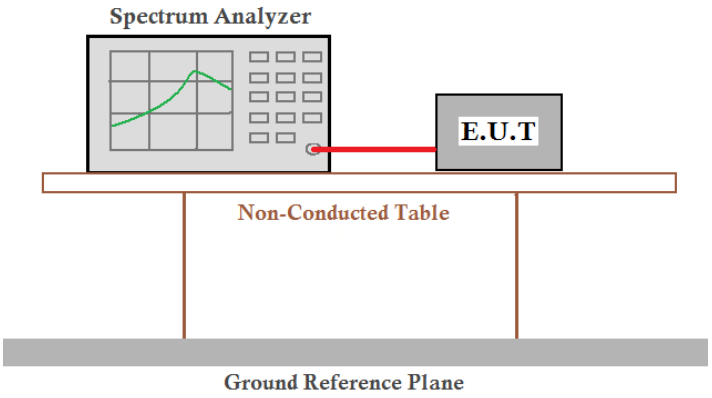
Measurement Data:

Hopping channel numbers	Limit	Result
79	15	Pass

Test plot as follows:



7.7 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Frequency	Dwell time(ms)	Limit(ms)	Result
2402MHz	120.000	400	Pass
2440MHz	120.544	400	Pass
2480MHz	121.056	400	Pass

Remarks:

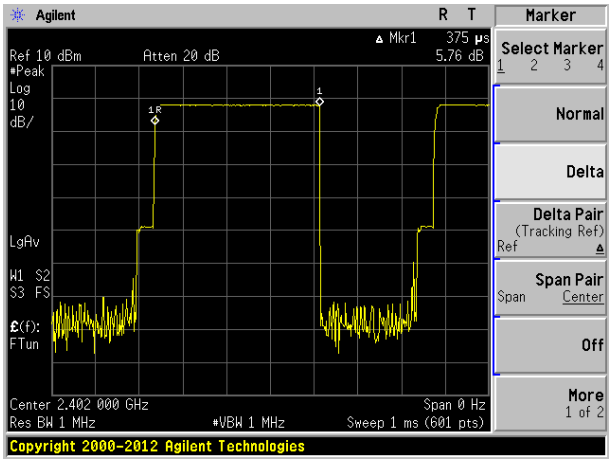
The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

2402MHz time slot=0.3750(ms)*(1600/ (2*79))*31.6=120.000ms

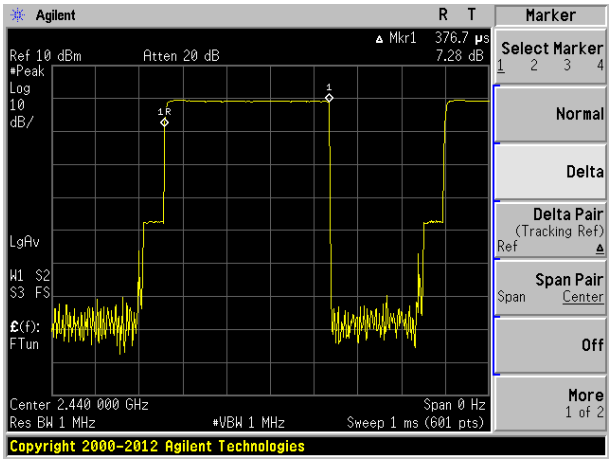
2440MHz time slot=0.3767(ms)*(1600/ (2*79))*31.6=120.544ms

2480MHz time slot=0.3783(ms)*(1600/ (2*79))*31.6=121.056ms

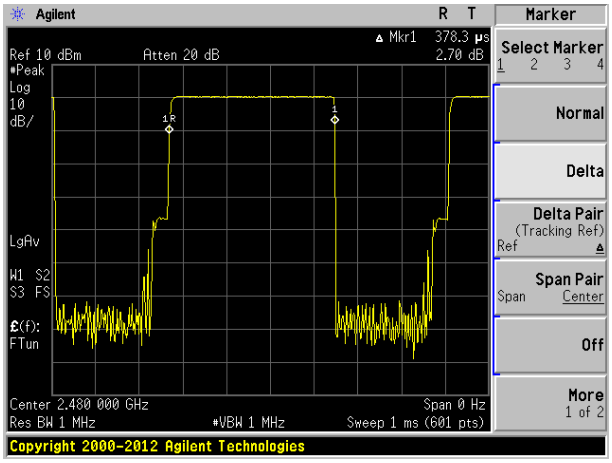
Test plot as follows:



2402MHz



2440MHz



2480MHz

7.8 Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)/g/h requirement:

a(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

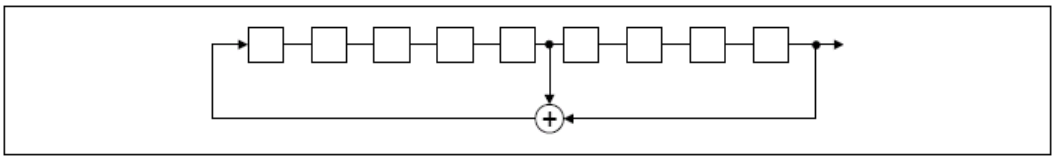
(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

EUT Pseudorandom Frequency Hopping Sequence

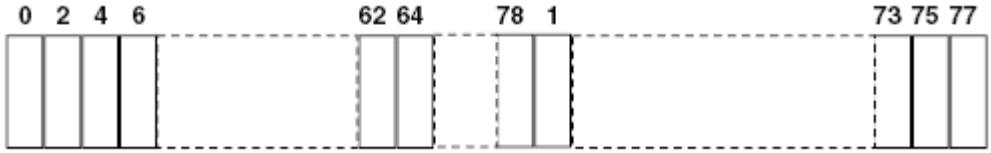
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- *Number of shift register stages: 9*
- *Length of pseudo-random sequence: 2^9 -1 = 511 bits*
- *Longest sequence of zeros: 8 (non-inverted signal)*



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



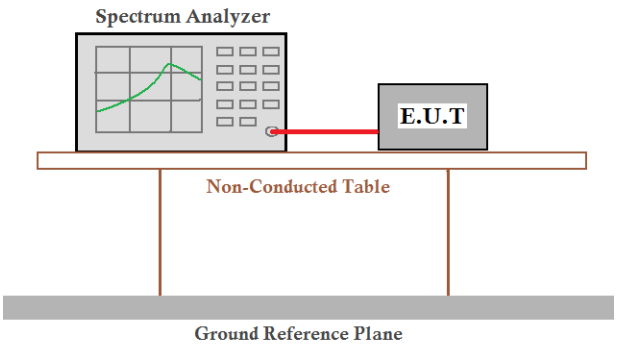
Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

it permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted.

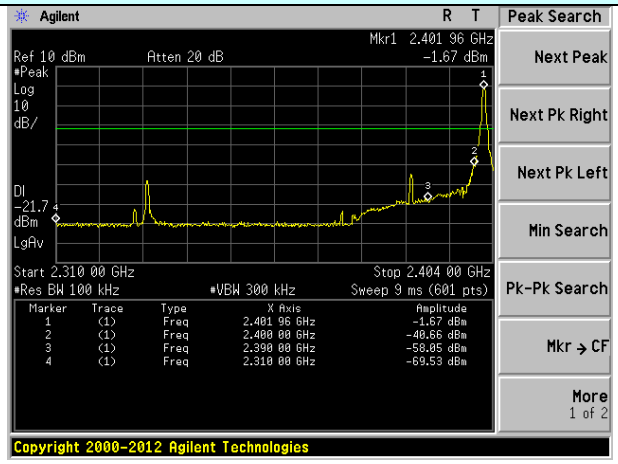
7.9 Band Edge

7.9.1 Conducted Emission Method

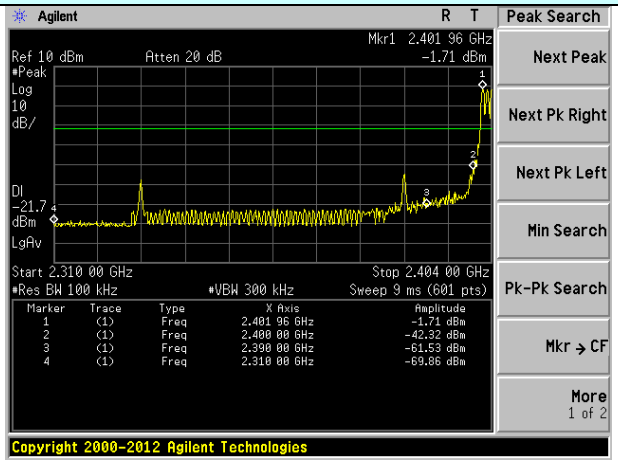
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Test plot as follows:

Test channel:	Lowest channel

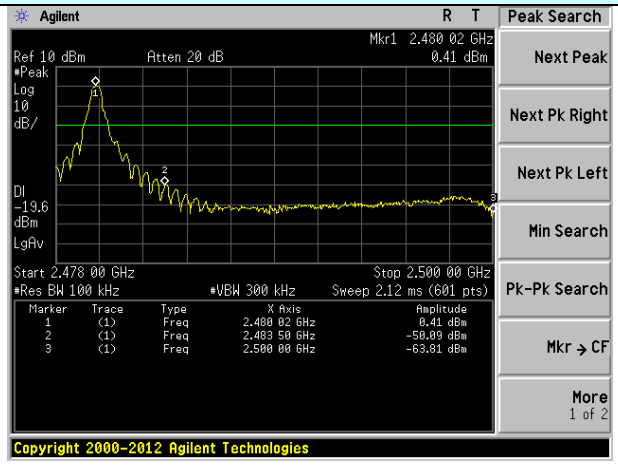


No-hopping mode

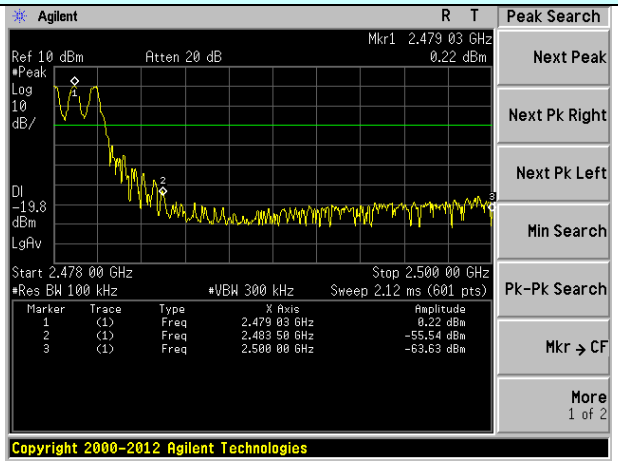


Hopping mode

Test channel:	Highest channel

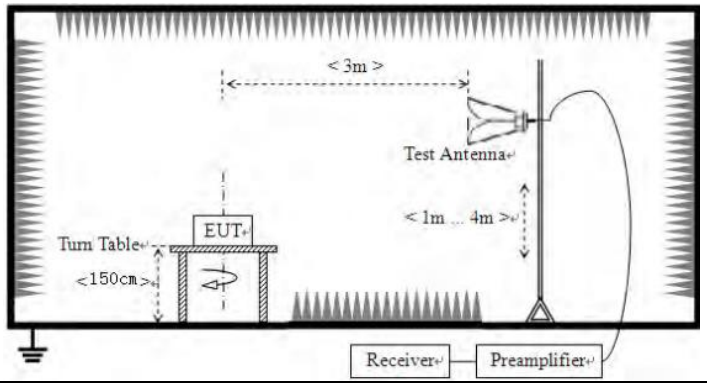


No-hopping mode



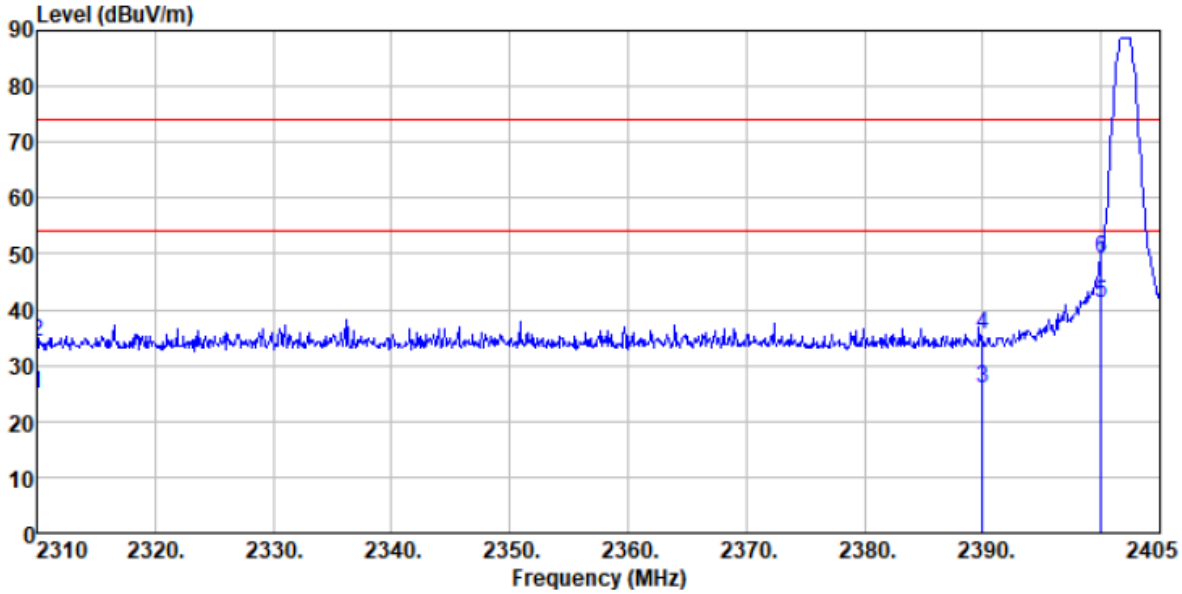
Hopping mode

7.9.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>All of the restrict bands were tested, only the worst band’s (2310MHz to 2500MHz) data was showed.</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.00</td><td>Average Value</td></tr>
<tr><td>74.00</td><td>Peak Value</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td> 
</td></tr>
<tr><td>Test Procedure:</td><td>1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height 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.
4. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</td></tr>
<tr><td>Test Instruments:</td><td>Refer to section 6.0 for details</td></tr>
<tr><td>Test mode:</td><td>Refer to section 5.2 for details</td></tr>
<tr><td>Test results:</td><td>Pass</td></tr>
</table>

Measurement Data
FP1:

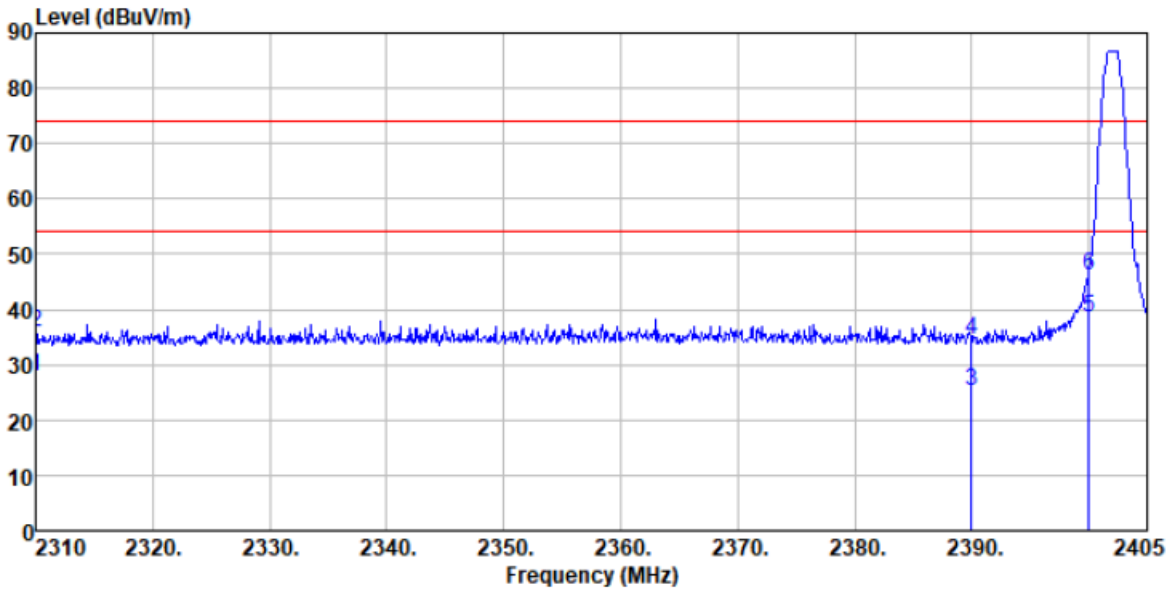
Antenna Polarity:	Horizontal	Test channel:	Lowest



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2310.000	28.54	27.21	36.95	6.19	24.99	54.00	-29.01	Average
2	2310.000	37.89	27.21	36.95	6.19	34.34	74.00	-39.66	Peak
3	2390.000	29.13	27.41	37.01	6.31	25.84	54.00	-28.16	Average
4	2390.000	38.77	27.41	37.01	6.31	35.48	74.00	-38.52	Peak
5	2400.000	44.54	27.44	37.01	6.33	41.30	54.00	-12.70	Average
6	2400.000	52.43	27.44	37.01	6.33	49.19	74.00	-24.81	Peak

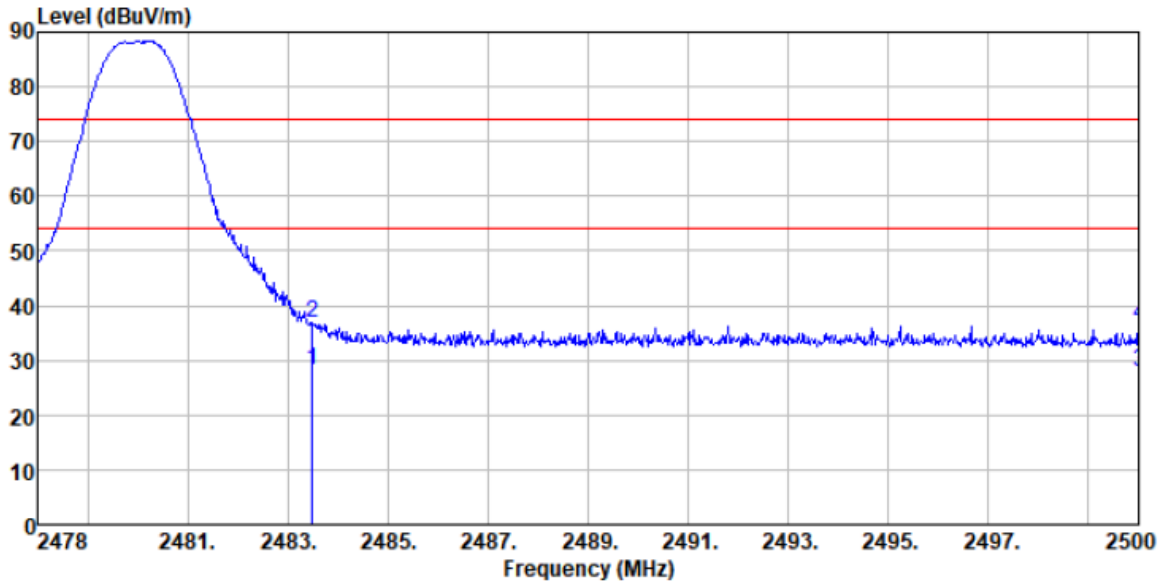
Antenna Polarity:	Vertical	Test channel:	Lowest



Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2310.000	31.55	27.21	36.95	6.19	28.00	54.00	-26.00	Average
2	2310.000	39.42	27.21	36.95	6.19	35.87	74.00	-38.13	Peak
3	2390.000	28.69	27.41	37.01	6.31	25.40	54.00	-28.60	Average
4	2390.000	37.91	27.41	37.01	6.31	34.62	74.00	-39.38	Peak
5	2400.000	41.89	27.44	37.01	6.33	38.65	54.00	-15.35	Average
6	2400.000	49.54	27.44	37.01	6.33	46.30	74.00	-27.70	Peak

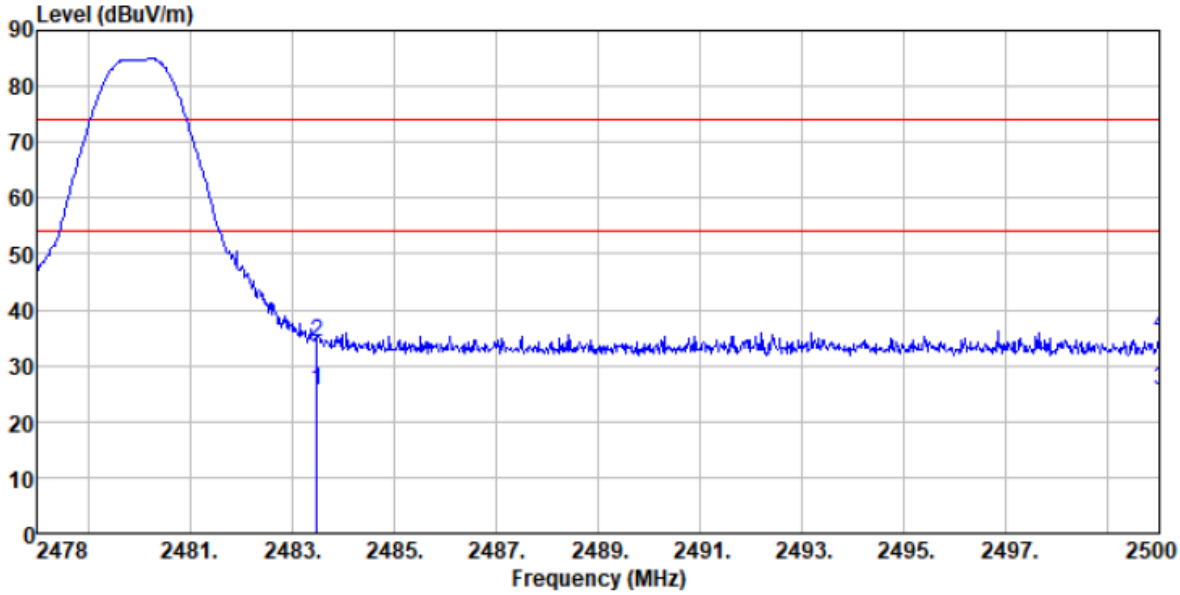
Antenna Polarity:	Horizontal	Test channel:	Highest



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2480MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.500	31.32	27.66	37.07	6.45	28.36	54.00	-25.64	Average
2	2483.500	39.77	27.66	37.07	6.45	36.81	74.00	-37.19	Peak
3	2500.000	30.90	27.70	37.09	6.47	27.98	54.00	-26.02	Average
4	2500.000	39.29	27.70	37.09	6.47	36.37	74.00	-37.63	Peak

Antenna Polarity:	Vertical	Test channel:	Highest



Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2480MHz

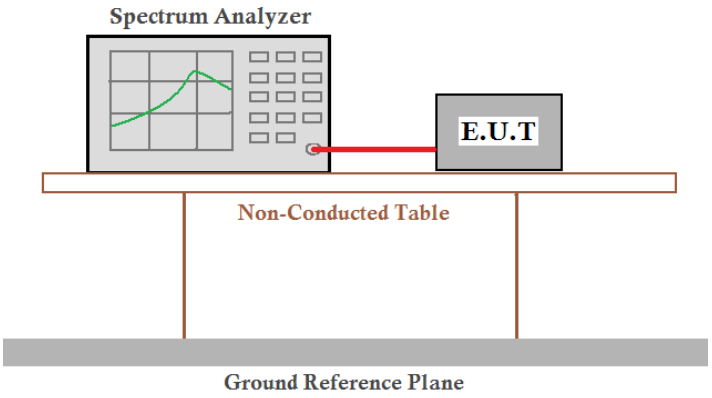
	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.500	28.66	27.66	37.07	6.45	25.70	54.00	-28.30	Average
2	2483.500	37.11	27.66	37.07	6.45	34.15	74.00	-39.85	Peak
3	2500.000	28.44	27.70	37.09	6.47	25.52	54.00	-28.48	Average
4	2500.000	38.45	27.70	37.09	6.47	35.53	74.00	-38.47	Peak

Remarks:

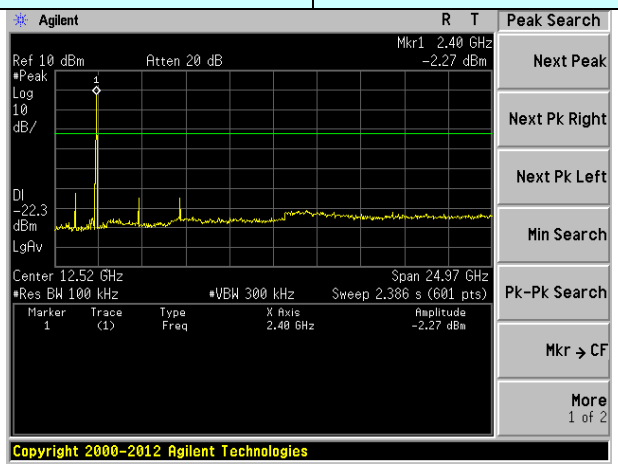
1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.*

7.10 Spurious Emission

7.10.1 Conducted Emission Method

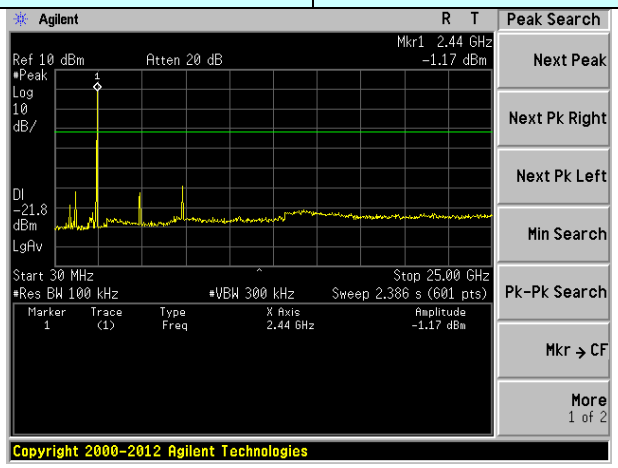
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Test channel:	Lowest channel



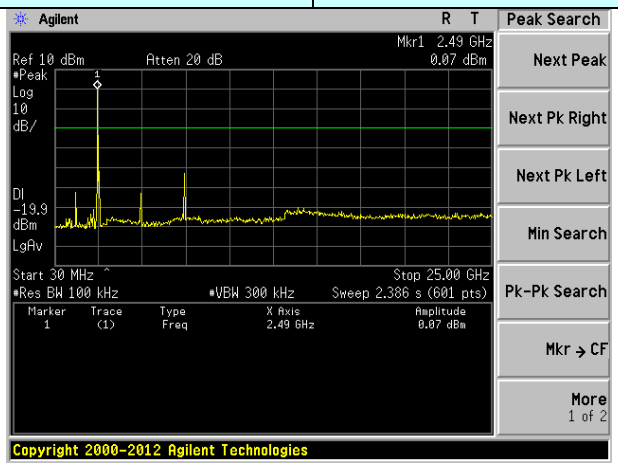
30MHz~25GHz

Test channel:	Middle channel



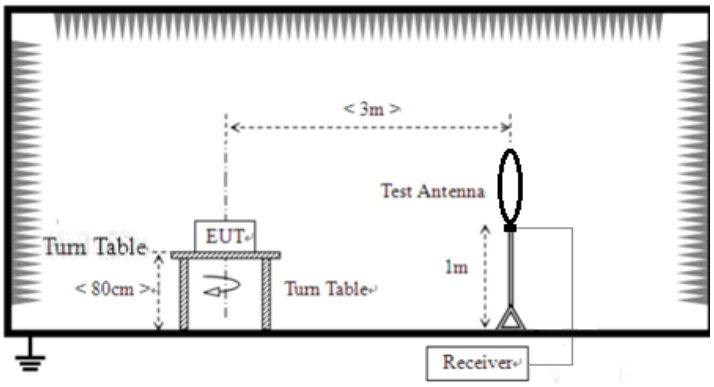
30MHz~25GHz

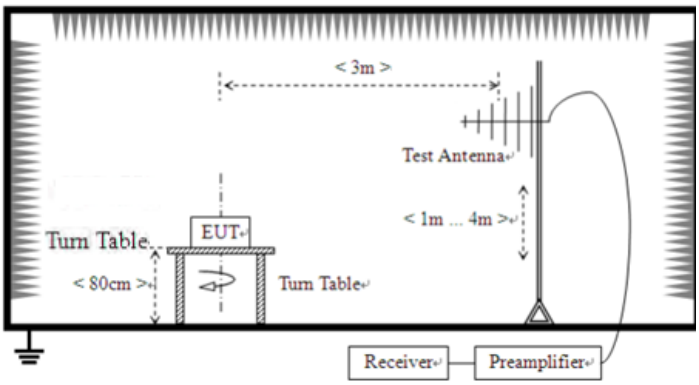
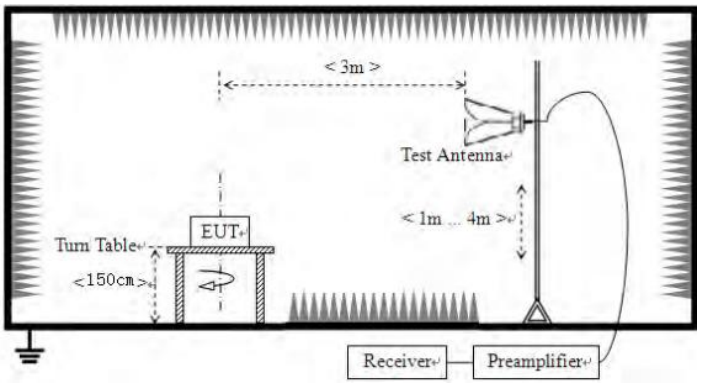
Test channel:	Highest channel



30MHz~25GHz

7.10.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>9KHz-150KHz</td><td>Quasi-peak</td><td>200Hz</td><td>600Hz</td><td>Quasi-peak</td></tr>
<tr><td>150KHz-30MHz</td><td>Quasi-peak</td><td>9KHz</td><td>30KHz</td><td>Quasi-peak</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(KHz)</td><td>QP</td><td>30m</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>QP</td><td>30m</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="7">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions from 9kHz to 30MHz
 
</td></tr>
</table>

	For radiated emissions from 30MHz to1GHz  For radiated emissions above 1GHz  					
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test environment:	Temp.:	24-25 °C	Humid.:	48-49%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Measurement data:

Remarks:

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.
2. There are measurements in 18~25GHz, but they are not recorded in the report due to only the bo ttom noise

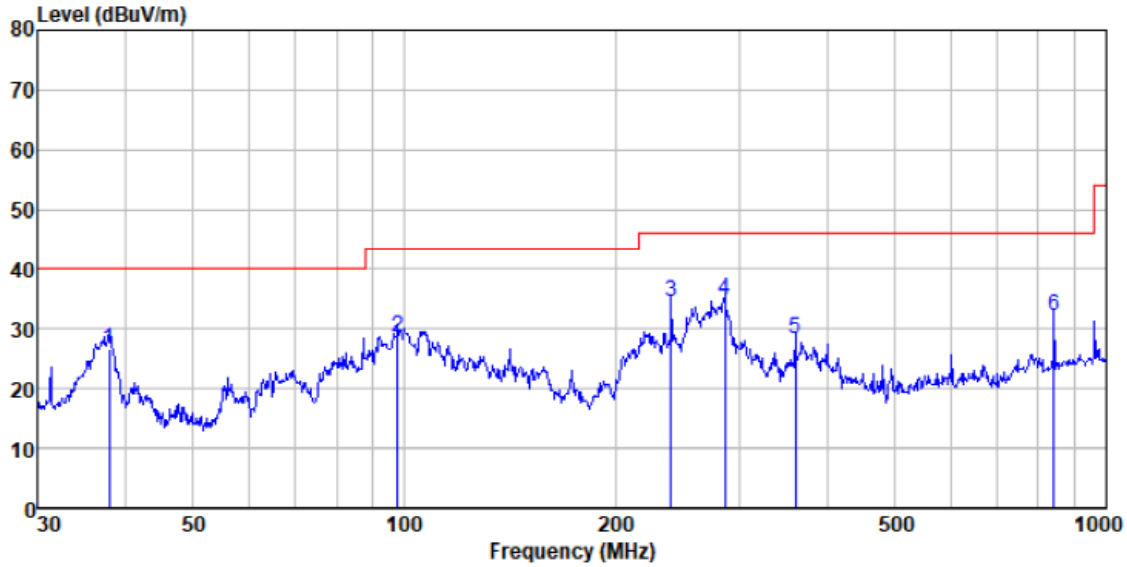
■ **9kHz~30MHz**

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

■ **Below 1GHz**

FP1:

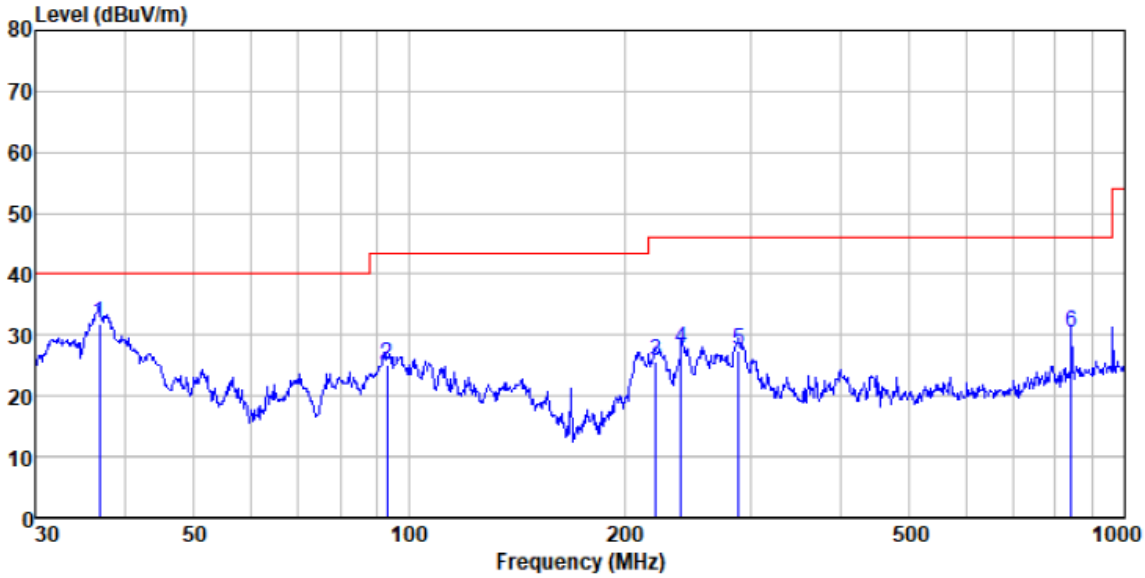
Antenna Polarity:	Horizontal	Test channel:	Lowest



Condition : FCC PART15 CLASS B 3m HORIZONTAL
EUT : Stage luminaires
Test Model : FP1
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2402MHz

	Freq	ReadAntenna Level	Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	37.945	49.22	12.30	35.54	0.64	26.62	40.00	-13.38	QP
2	97.798	52.49	11.73	36.70	1.17	28.69	43.50	-14.81	QP
3	239.987	58.34	11.56	37.37	2.07	34.60	46.00	-11.40	QP
4	285.978	57.09	13.01	37.41	2.29	34.98	46.00	-11.02	QP
5	360.448	48.45	14.68	37.48	2.67	28.32	46.00	-17.68	QP
6	842.130	43.62	21.67	37.61	4.63	32.31	46.00	-13.69	QP

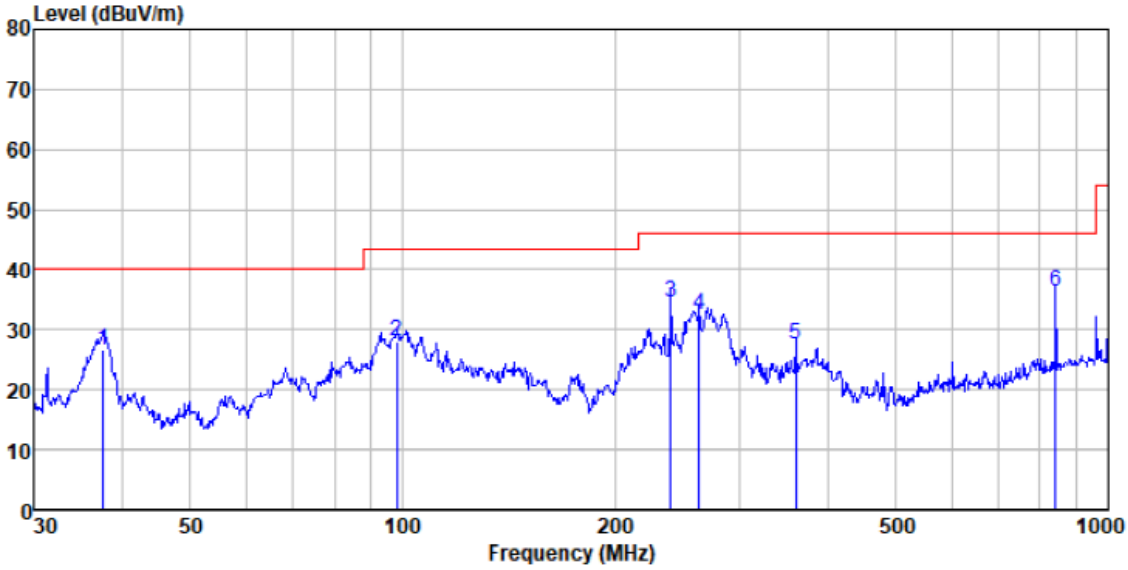
Antenna Polarity:	Vertical	Test channel:	Lowest



Condition : FCC PART15 CLASS B 3m VERTICAL
EUT : Stage luminaires
Test Model : FP1
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2402MHz

	Freq	ReadLevel	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	36.895	55.65	11.20	35.48	0.63	32.00	40.00	-8.00	QP
2	93.113	49.75	10.98	36.66	1.14	25.21	43.50	-18.29	QP
3	221.392	50.22	10.88	37.35	1.97	25.72	46.00	-20.28	QP
4	239.987	51.40	11.56	37.37	2.07	27.66	46.00	-18.34	QP
5	289.002	49.58	13.11	37.41	2.31	27.59	46.00	-18.41	QP
6	842.130	41.82	21.67	37.61	4.63	30.51	46.00	-15.49	QP

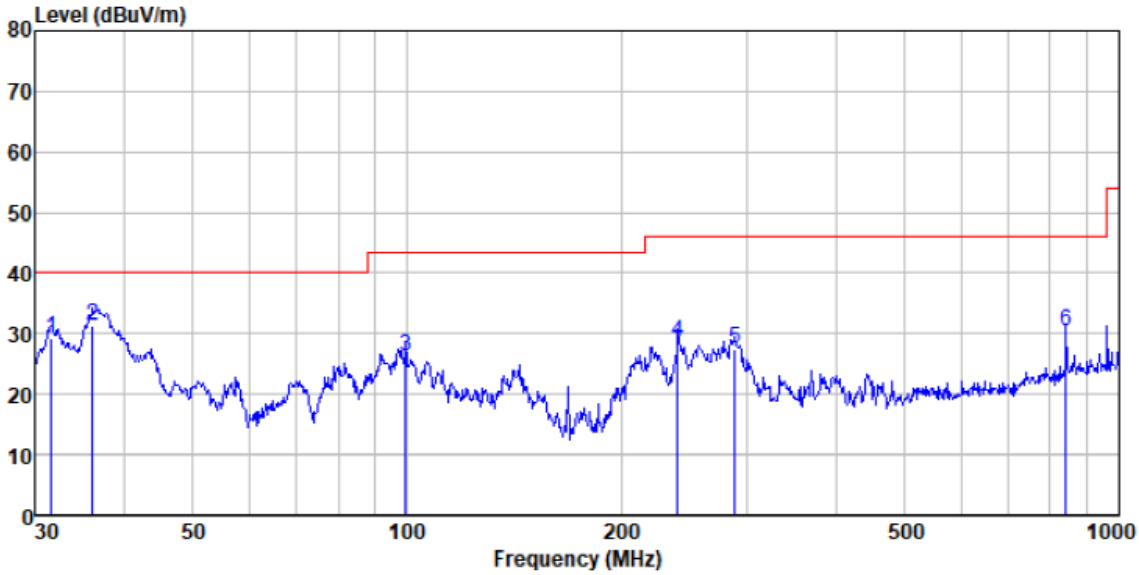
Antenna Polarity:	Horizontal	Test channel:	Middle



Condition : FCC PART15 CLASS B 3m HORIZONTAL
EUT : Stage luminaires
Test Model : FP1
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	37.680	49.03	12.30	35.53	0.64	26.44	40.00	-13.56	QP
2	98.142	51.95	11.73	36.71	1.18	28.15	43.50	-15.35	QP
3	239.987	58.34	11.56	37.37	2.07	34.60	46.00	-11.40	QP
4	262.896	55.31	12.24	37.39	2.19	32.35	46.00	-13.65	QP
5	360.448	47.45	14.68	37.48	2.67	27.32	46.00	-18.68	QP
6	842.130	47.62	21.67	37.61	4.63	36.31	46.00	-9.69	QP

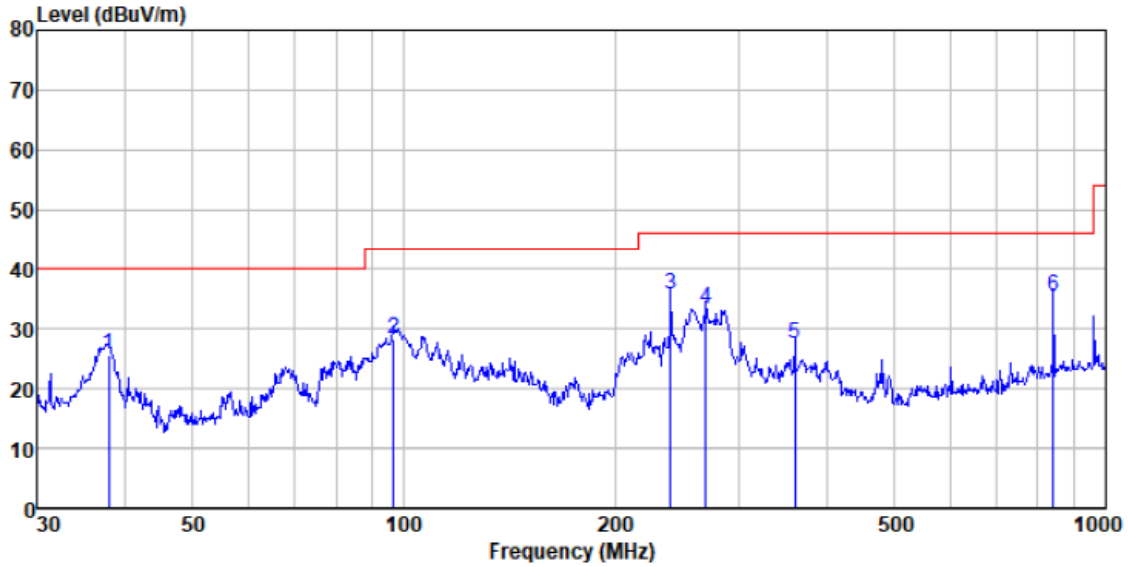
Antenna Polarity:	Vertical	Test channel:	Middle



Condition : FCC PART15 CLASS B 3m VERTICAL
EUT : Stage luminaires
Test Model : FP1
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	31.620	52.47	11.25	35.12	0.57	29.17	40.00	-10.83	QP
2	36.127	54.94	11.20	35.43	0.62	31.33	40.00	-8.67	QP
3	99.528	50.14	11.73	36.72	1.19	26.34	43.50	-17.16	QP
4	239.987	52.40	11.56	37.37	2.07	28.66	46.00	-17.34	QP
5	289.002	49.58	13.11	37.41	2.31	27.59	46.00	-18.41	QP
6	842.130	41.82	21.67	37.61	4.63	30.51	46.00	-15.49	QP

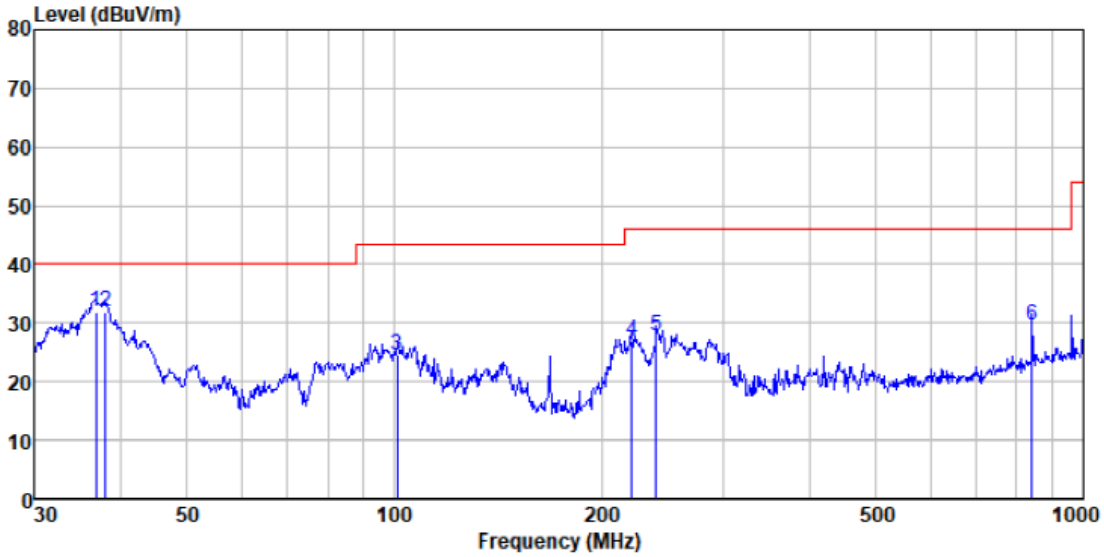
Antenna Polarity:	Horizontal	Test channel:	Highest



Condition : FCC PART15 CLASS B 3m HORIZONTAL
EUT : Stage luminaires
Test Model : FP1
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2480MHz

	Freq	ReadLevel	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	37.945	48.22	12.30	35.54	0.64	25.62	40.00	-14.38	QP
2	96.775	52.46	11.35	36.69	1.17	28.29	43.50	-15.21	QP
3	239.987	59.34	11.56	37.37	2.07	35.60	46.00	-10.40	QP
4	269.428	56.05	12.53	37.40	2.22	33.40	46.00	-12.60	QP
5	360.448	47.45	14.68	37.48	2.67	27.32	46.00	-18.68	QP
6	842.130	46.62	21.67	37.61	4.63	35.31	46.00	-10.69	QP

Antenna Polarity:	Vertical	Test channel:	Highest

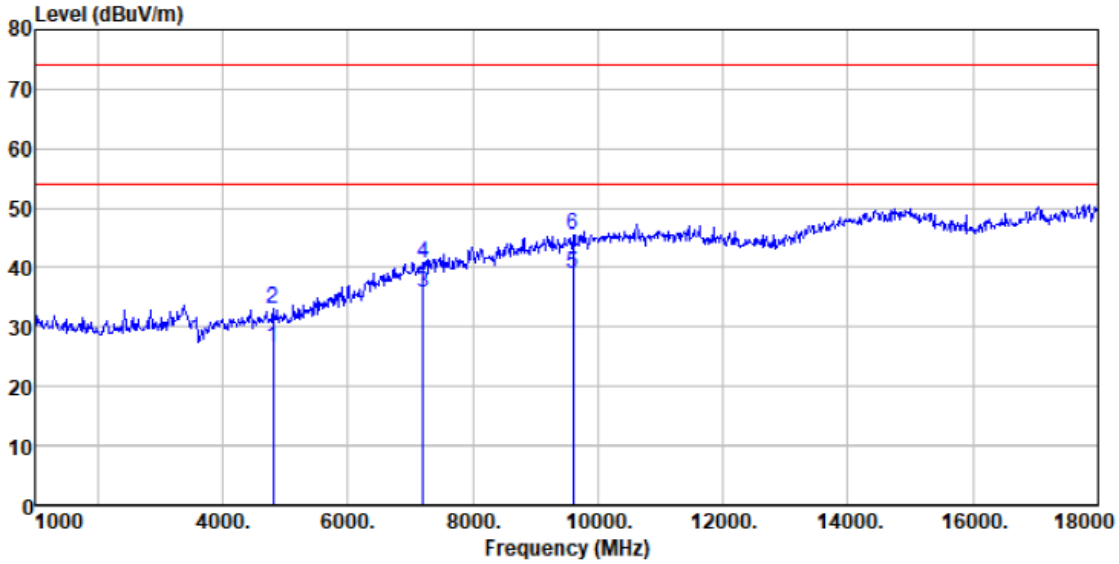


Condition : FCC PART15 CLASS B 3m VERTICAL
EUT : Stage luminaires
Test Model : FP1
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2480MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	36.895	55.65	11.20	35.48	0.63	32.00	40.00	-8.00	QP
2	38.078	54.52	12.30	35.55	0.64	31.91	40.00	-8.09	QP
3	100.934	47.91	12.10	36.73	1.20	24.48	43.50	-19.02	QP
4	221.392	51.22	10.88	37.35	1.97	26.72	46.00	-19.28	QP
5	239.987	51.40	11.56	37.37	2.07	27.66	46.00	-18.34	QP
6	842.130	40.82	21.67	37.61	4.63	29.51	46.00	-16.49	QP

■ **Above 1GHz**

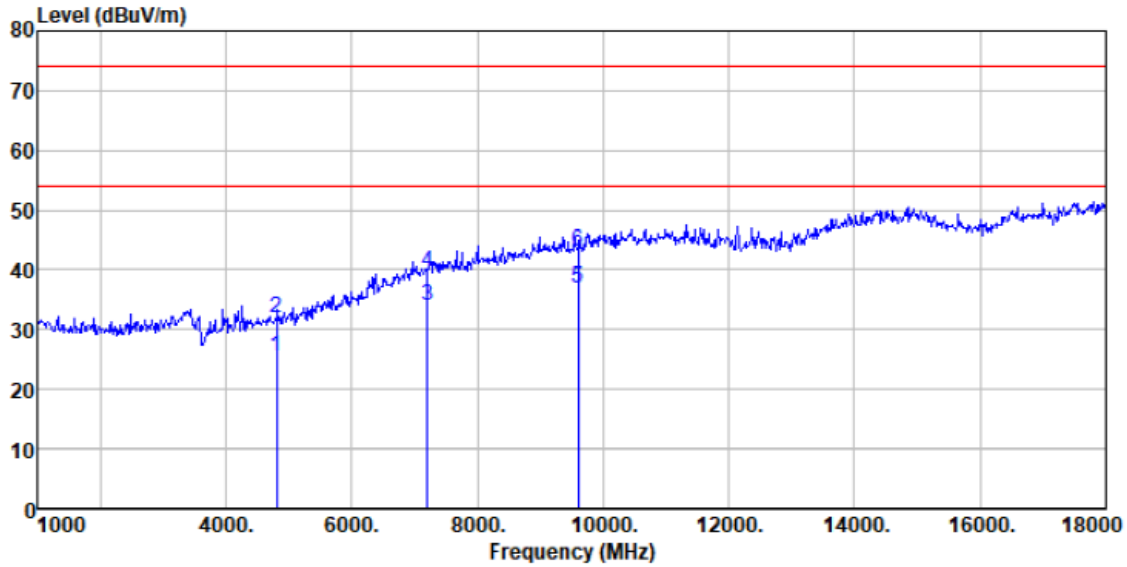
Antenna Polarity:	Horizontal	Test channel:	Lowest



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP1
T&H : 24°C 49%
Test voltage : AC120V 60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4804.000	23.38	31.35	37.58	9.36	26.51	54.00	-27.49	Average
2	4804.000	29.82	31.35	37.58	9.36	32.95	74.00	-41.05	Peak
3	7206.000	23.95	35.89	35.44	11.21	35.61	54.00	-18.39	Average
4	7206.000	29.02	35.89	35.44	11.21	40.68	74.00	-33.32	Peak
5	9608.000	23.27	37.74	34.96	12.91	38.96	54.00	-15.04	Average
6	9608.000	29.82	37.74	34.96	12.91	45.51	74.00	-28.49	Peak

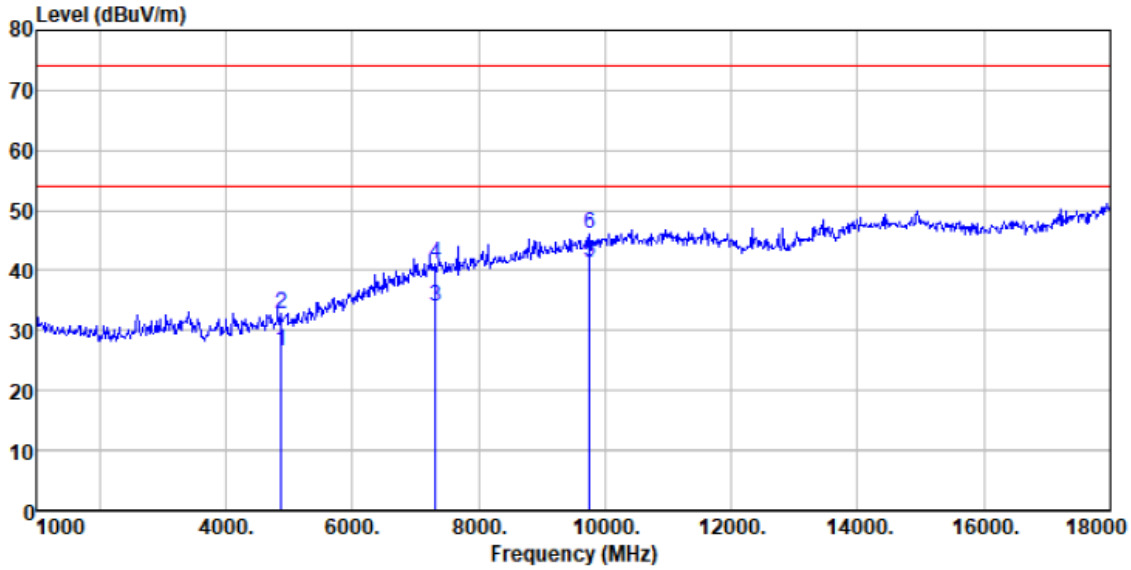
Antenna Polarity:	Vertical	Test channel:	Lowest



Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4804.000	22.37	31.35	37.58	9.36	25.50	54.00	-28.50	Average
2	4804.000	28.70	31.35	37.58	9.36	31.83	74.00	-42.17	Peak
3	7206.000	22.41	35.89	35.44	11.21	34.07	54.00	-19.93	Average
4	7206.000	27.98	35.89	35.44	11.21	39.64	74.00	-34.36	Peak
5	9608.000	21.33	37.74	34.96	12.91	37.02	54.00	-16.98	Average
6	9608.000	27.39	37.74	34.96	12.91	43.08	74.00	-30.92	Peak

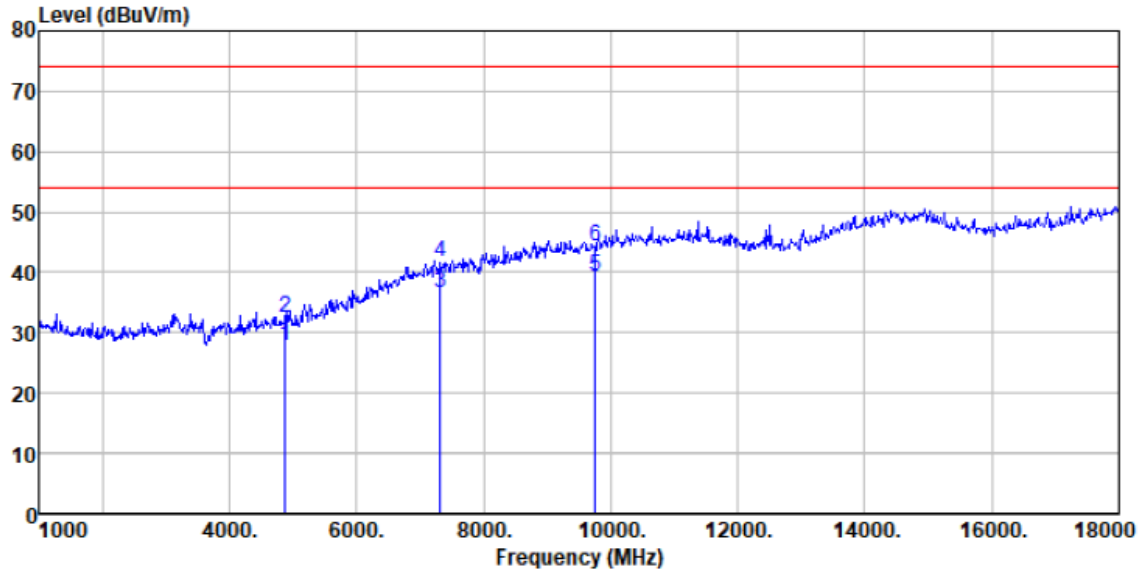
Antenna Polarity:	Horizontal	Test channel:	Middle



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4880.000	23.20	31.48	37.59	9.42	26.51	54.00	-27.49	Average
2	4880.000	29.46	31.48	37.59	9.42	32.77	74.00	-41.23	Peak
3	7320.000	22.01	36.17	35.47	11.30	34.01	54.00	-19.99	Average
4	7320.000	28.91	36.17	35.47	11.30	40.91	74.00	-33.09	Peak
5	9760.000	25.24	38.07	35.09	13.01	41.23	54.00	-12.77	Average
6	9760.000	30.11	38.07	35.09	13.01	46.10	74.00	-27.90	Peak

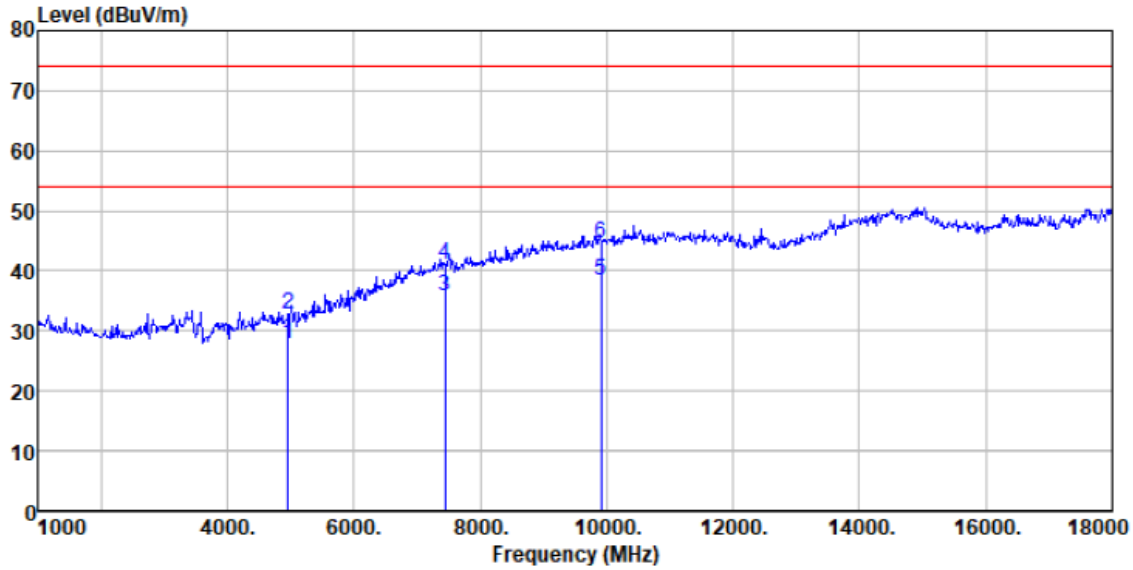
Antenna Polarity:	Vertical	Test channel:	Middle



Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4880.000	24.44	31.48	37.59	9.42	27.75	54.00	-26.25	Average
2	4880.000	29.15	31.48	37.59	9.42	32.46	74.00	-41.54	Peak
3	7320.000	24.52	36.17	35.47	11.30	36.52	54.00	-17.48	Average
4	7320.000	29.77	36.17	35.47	11.30	41.77	74.00	-32.23	Peak
5	9760.000	23.13	38.07	35.09	13.01	39.12	54.00	-14.88	Average
6	9760.000	28.26	38.07	35.09	13.01	44.25	74.00	-29.75	Peak

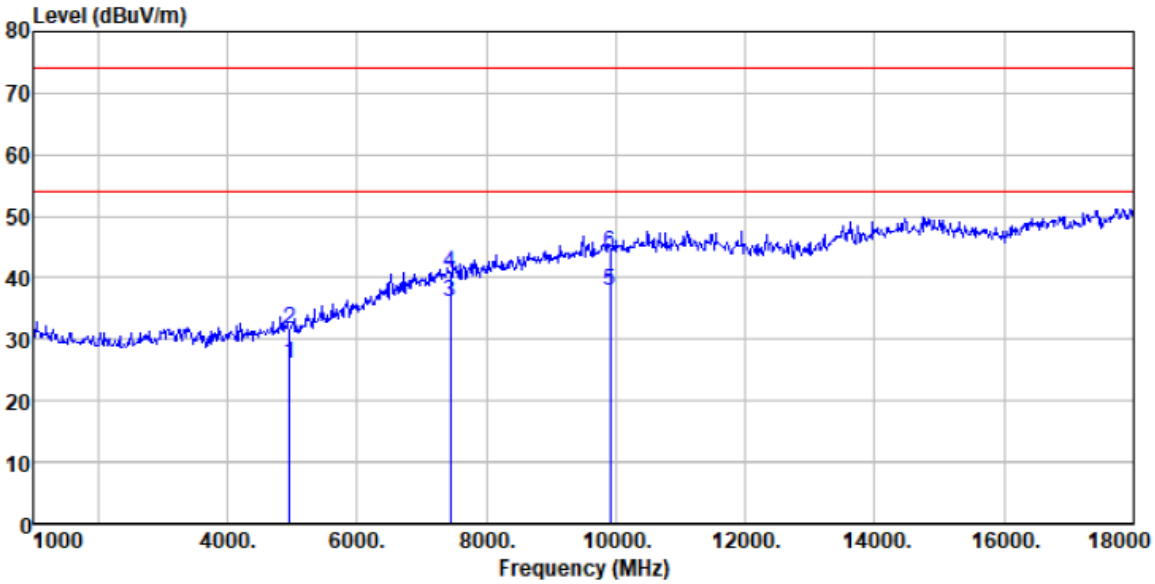
Antenna Polarity:	Horizontal	Test channel:	Highest



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2480MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4960.000	24.19	31.63	37.60	9.48	27.70	54.00	-26.30	Average
2	4960.000	29.22	31.63	37.60	9.48	32.73	74.00	-41.27	Peak
3	7440.000	23.31	36.46	35.49	11.39	35.67	54.00	-18.33	Average
4	7440.000	28.59	36.46	35.49	11.39	40.95	74.00	-33.05	Peak
5	9920.000	22.01	38.42	35.23	13.13	38.33	54.00	-15.67	Average
6	9920.000	28.15	38.42	35.23	13.13	44.47	74.00	-29.53	Peak

Antenna Polarity:	Vertical	Test channel:	Highest



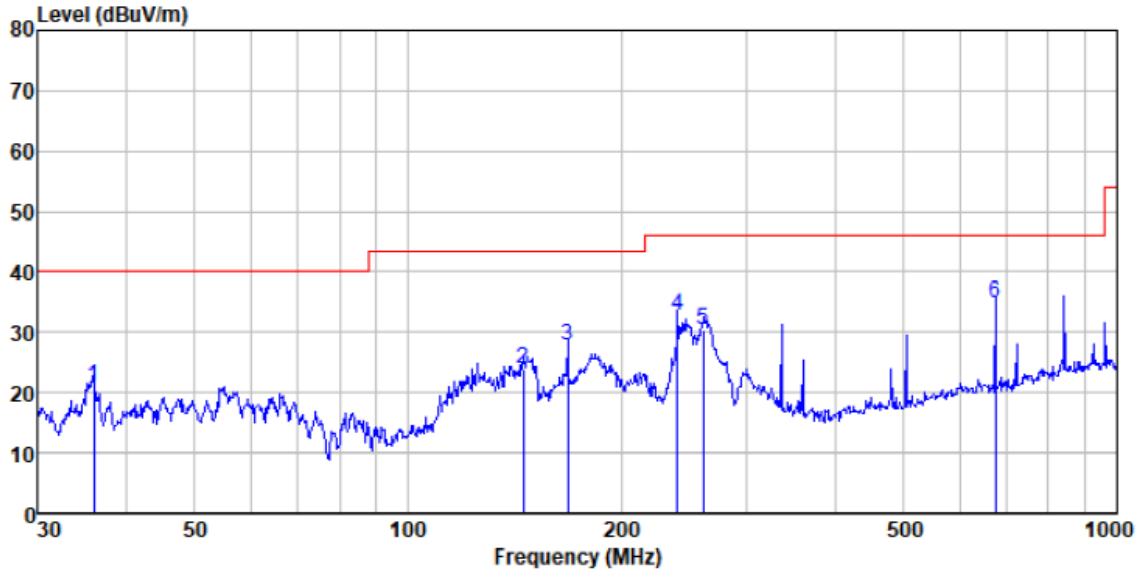
Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP1
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2480MHz

	Freq	ReadAntenna Level	Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4960.000	22.55	31.63	37.60	9.48	26.06	54.00	-27.94	Average
2	4960.000	27.97	31.63	37.60	9.48	31.48	74.00	-42.52	Peak
3	7440.000	23.60	36.46	35.49	11.39	35.96	54.00	-18.04	Average
4	7440.000	28.51	36.46	35.49	11.39	40.87	74.00	-33.13	Peak
5	9920.000	21.60	38.42	35.23	13.13	37.92	54.00	-16.08	Average
6	9920.000	27.63	38.42	35.23	13.13	43.95	74.00	-30.05	Peak

FP2:

■ **Below 1GHz**

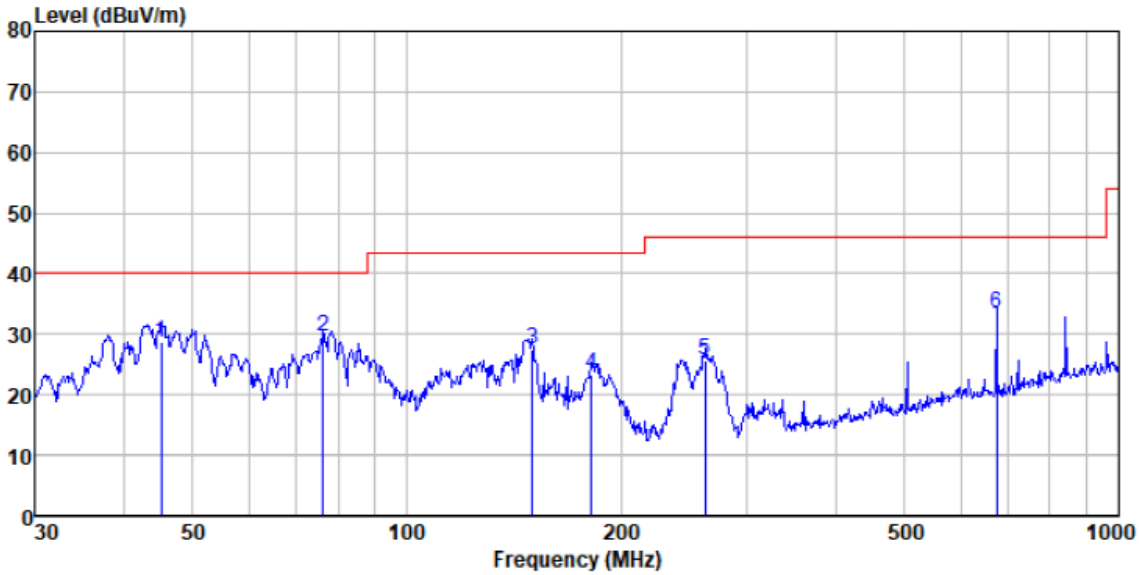
Antenna Polarity:	Horizontal	Test channel:	Lowest



Condition : FCC PART15 CLASS B 3m HORIZONTAL
EUT : Stage luminaires
Test Model : FP2
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	36.001	44.56	11.20	35.42	0.62	20.96	40.00	-19.04	QP
2	145.351	52.02	7.43	37.05	1.54	23.94	43.50	-19.56	QP
3	167.824	54.80	8.33	37.18	1.67	27.62	43.50	-15.88	QP
4	239.987	56.54	11.56	37.37	2.07	32.80	46.00	-13.20	QP
5	261.058	53.38	12.24	37.39	2.18	30.41	46.00	-15.59	QP
6	672.845	48.74	19.65	37.61	3.99	34.77	46.00	-11.23	QP

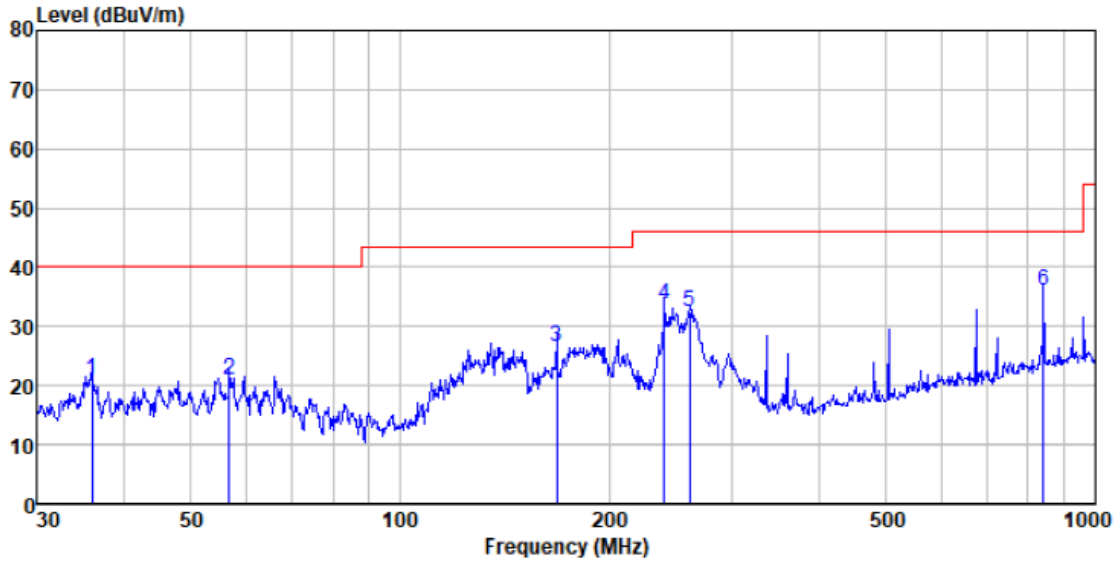
Antenna Polarity:	Vertical	Test channel:	Lowest



Condition : FCC PART15 CLASS B 3m VERTICAL
EUT : Stage luminaires
Test Model : FP2
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	45.217	51.76	12.25	35.95	0.72	28.78	40.00	-11.22	QP
2	76.244	57.78	7.33	36.51	1.00	29.60	40.00	-10.40	QP
3	150.011	55.35	7.50	37.08	1.57	27.34	43.50	-16.16	QP
4	181.920	50.15	8.80	37.25	1.75	23.45	43.50	-20.05	QP
5	261.975	48.63	12.24	37.39	2.18	25.66	46.00	-20.34	QP
6	672.845	47.44	19.65	37.61	3.99	33.47	46.00	-12.53	QP

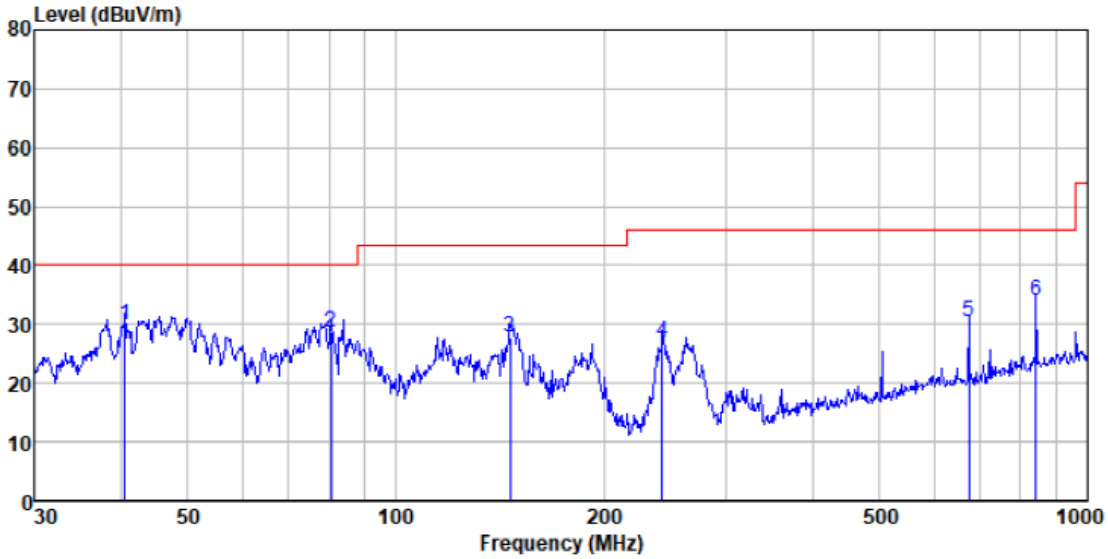
Antenna Polarity:	Horizontal	Test channel:	Middle



Condition : FCC PART15 CLASS B 3m HORIZONTAL
EUT : Stage luminaires
Test Model : FP2
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	36.001	44.56	11.20	35.42	0.62	20.96	40.00	-19.04	QP
2	56.792	44.72	11.67	36.28	0.83	20.94	40.00	-19.06	QP
3	167.824	53.80	8.33	37.18	1.67	26.62	43.50	-16.88	QP
4	239.987	57.54	11.56	37.37	2.07	33.80	46.00	-12.20	QP
5	261.058	55.38	12.24	37.39	2.18	32.41	46.00	-13.59	QP
6	842.130	47.24	21.67	37.61	4.63	35.93	46.00	-10.07	QP

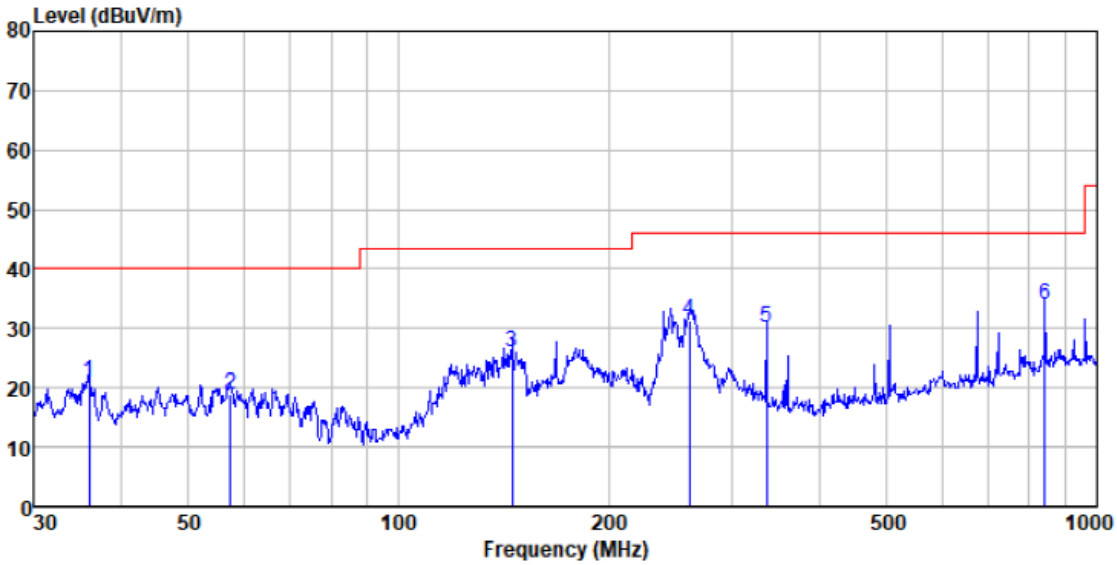
Antenna Polarity:	Vertical	Test channel:	Middle



Condition : FCC PART15 CLASS B 3m VERTICAL
EUT : Stage luminaires
Test Model : FP2
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	40.559	52.53	12.27	35.70	0.67	29.77	40.00	-10.23	QP
2	80.644	56.99	7.30	36.55	1.03	28.77	40.00	-11.23	QP
3	146.374	55.96	7.43	37.06	1.55	27.88	43.50	-15.62	QP
4	242.525	50.45	11.66	37.37	2.08	26.82	46.00	-19.18	QP
5	672.845	44.44	19.65	37.61	3.99	30.47	46.00	-15.53	QP
6	842.130	45.17	21.67	37.61	4.63	33.86	46.00	-12.14	QP

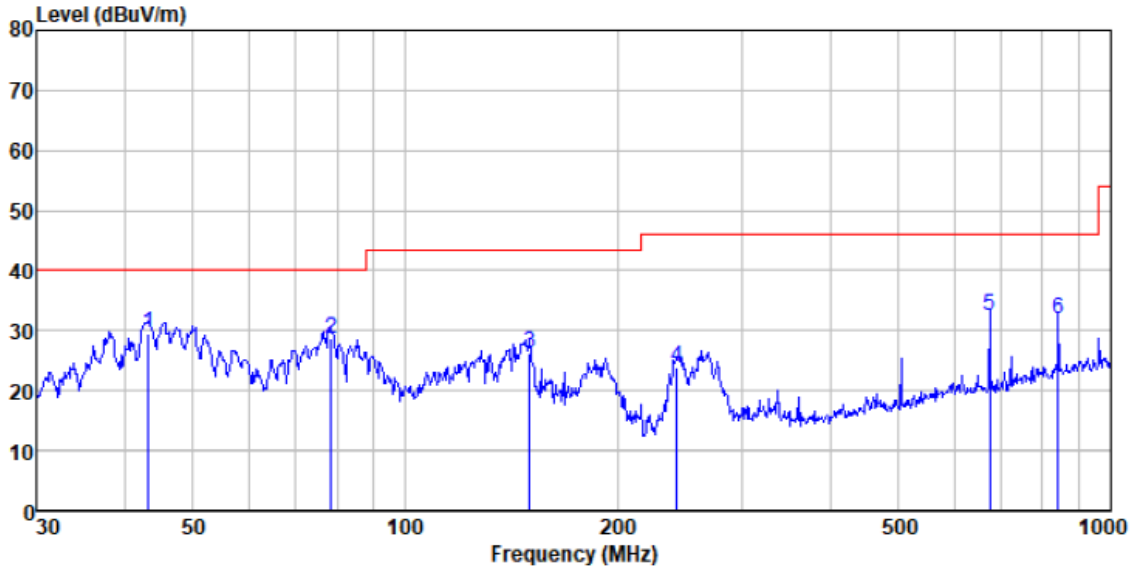
Antenna Polarity:	Horizontal	Test channel:	Highest



Condition : FCC PART15 CLASS B 3m HORIZONTAL
EUT : Stage luminaires
Test Model : FP2
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2480MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	36.001	44.56	11.20	35.42	0.62	20.96	40.00	-19.04	QP
2	57.392	42.61	11.67	36.29	0.84	18.83	40.00	-21.17	QP
3	145.351	54.02	7.43	37.05	1.54	25.94	43.50	-17.56	QP
4	261.058	54.38	12.24	37.39	2.18	31.41	46.00	-14.59	QP
5	336.035	50.93	14.21	37.46	2.55	30.23	46.00	-15.77	QP
6	842.130	45.24	21.67	37.61	4.63	33.93	46.00	-12.07	QP

Antenna Polarity:	Vertical	Test channel:	Highest

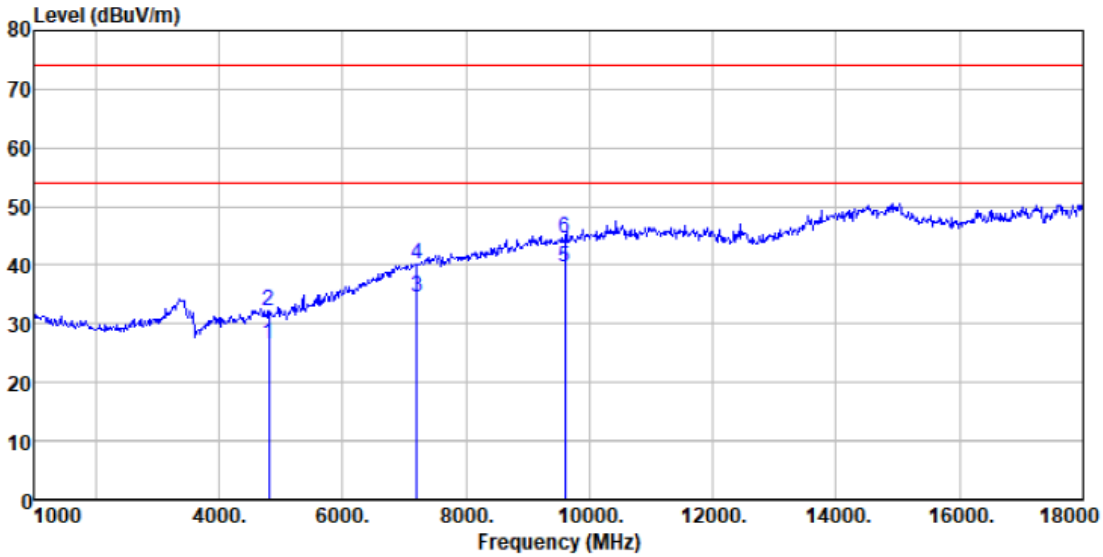


Condition : FCC PART15 CLASS B 3m VERTICAL
EUT : Stage luminaires
Test Model : FP2
Test Mode : TX Mode
T&H : 25℃ 48%
Test Engineer: Bourne
Test Voltage : 120V/60Hz
CH : 2480MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	43.202	52.32	12.27	35.84	0.70	29.45	40.00	-10.55	QP
2	78.413	56.71	7.33	36.53	1.01	28.52	40.00	-11.48	QP
3	150.011	54.35	7.50	37.08	1.57	26.34	43.50	-17.16	QP
4	242.525	47.45	11.66	37.37	2.08	23.82	46.00	-22.18	QP
5	672.845	46.44	19.65	37.61	3.99	32.47	46.00	-13.53	QP
6	842.130	43.17	21.67	37.61	4.63	31.86	46.00	-14.14	QP

■ **Above 1GHz**

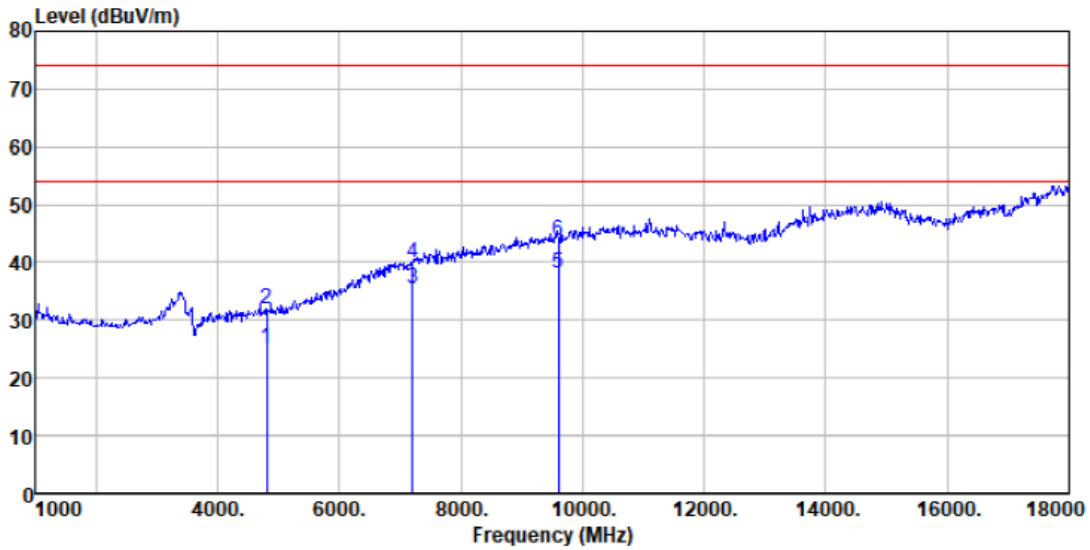
Antenna Polarity:	Horizontal	Test channel:	Lowest



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP2
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4804.000	23.37	31.35	37.58	9.36	26.50	54.00	-27.50	Average
2	4804.000	28.91	31.35	37.58	9.36	32.04	74.00	-41.96	Peak
3	7206.000	22.79	35.89	35.44	11.21	34.45	54.00	-19.55	Average
4	7206.000	28.60	35.89	35.44	11.21	40.26	74.00	-33.74	Peak
5	9608.000	23.88	37.74	34.96	12.91	39.57	54.00	-14.43	Average
6	9608.000	29.00	37.74	34.96	12.91	44.69	74.00	-29.31	Peak

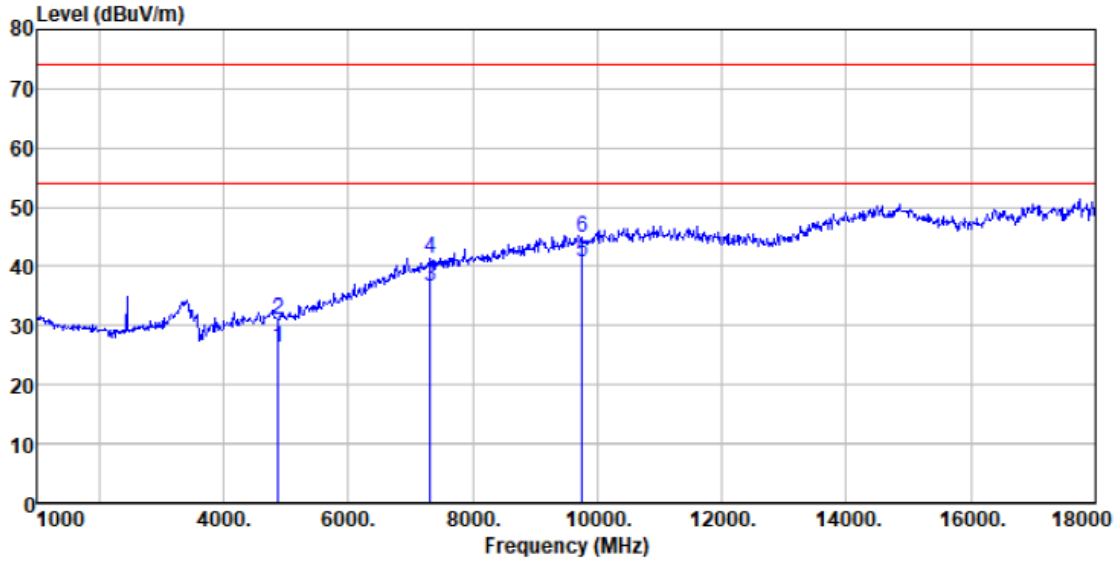
Antenna Polarity:	Vertical	Test channel:	Lowest



Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP2
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2402MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4804.000	22.08	31.35	37.58	9.36	25.21	54.00	-28.79	Average
2	4804.000	28.81	31.35	37.58	9.36	31.94	74.00	-42.06	Peak
3	7206.000	23.65	35.89	35.44	11.21	35.31	54.00	-18.69	Average
4	7206.000	28.10	35.89	35.44	11.21	39.76	74.00	-34.24	Peak
5	9608.000	22.29	37.74	34.96	12.91	37.98	54.00	-16.02	Average
6	9608.000	27.88	37.74	34.96	12.91	43.57	74.00	-30.43	Peak

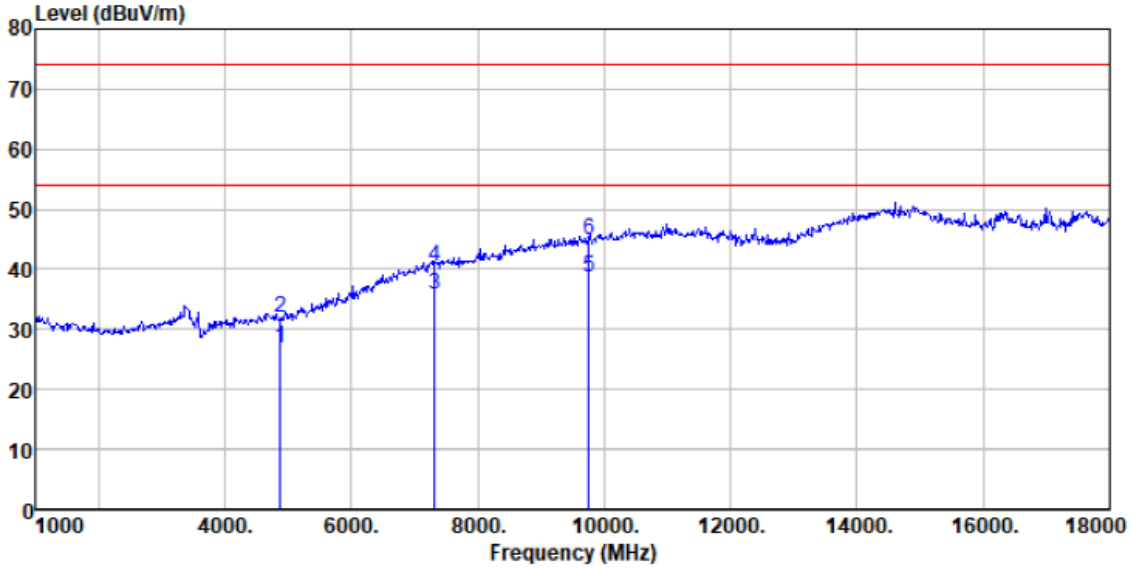
Antenna Polarity:	Horizontal	Test channel:	Middle



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP2
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4880.000	22.84	31.48	37.59	9.42	26.15	54.00	-27.85	Average
2	4880.000	27.56	31.48	37.59	9.42	30.87	74.00	-43.13	Peak
3	7320.000	24.61	36.17	35.47	11.30	36.61	54.00	-17.39	Average
4	7320.000	29.32	36.17	35.47	11.30	41.32	74.00	-32.68	Peak
5	9760.000	24.88	38.07	35.09	13.01	40.87	54.00	-13.13	Average
6	9760.000	28.89	38.07	35.09	13.01	44.88	74.00	-29.12	Peak

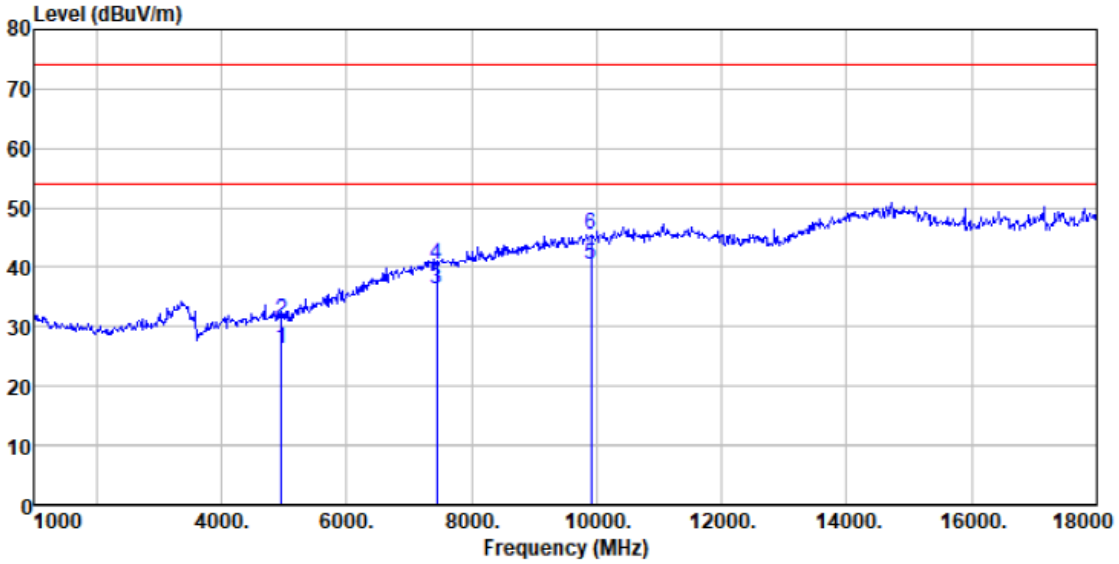
Antenna Polarity:	Vertical	Test channel:	Middle



Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP2
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2440MHz

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4880.000	23.58	31.48	37.59	9.42	26.89	54.00	-27.11	Average
2	4880.000	28.56	31.48	37.59	9.42	31.87	74.00	-42.13	Peak
3	7320.000	23.77	36.17	35.47	11.30	35.77	54.00	-18.23	Average
4	7320.000	28.38	36.17	35.47	11.30	40.38	74.00	-33.62	Peak
5	9760.000	22.55	38.07	35.09	13.01	38.54	54.00	-15.46	Average
6	9760.000	28.97	38.07	35.09	13.01	44.96	74.00	-29.04	Peak

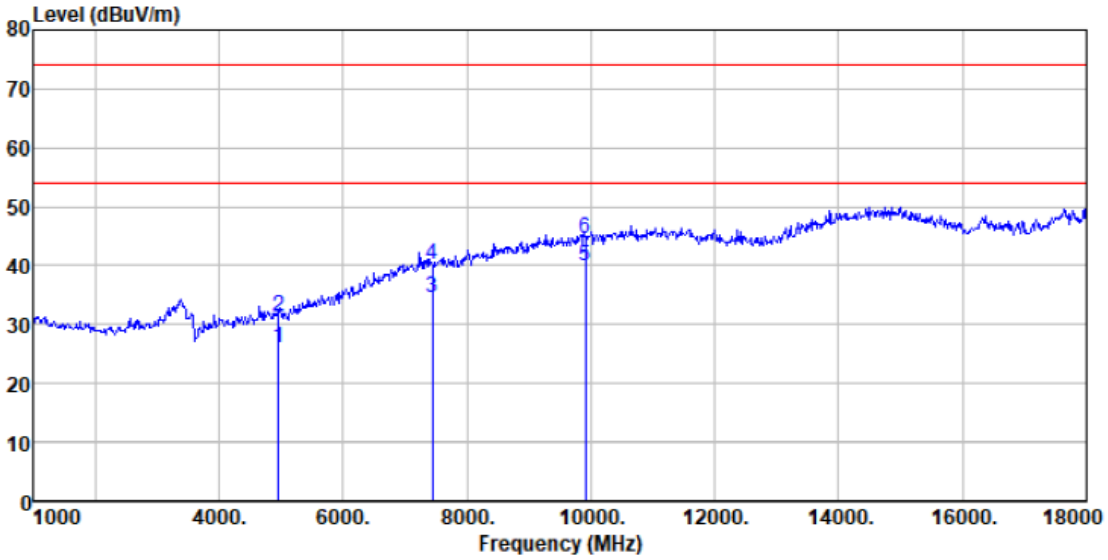
Antenna Polarity:	Horizontal	Test channel:	Highest



Condition : FCC PART 15 (PK) 3m HORIZONTAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP2
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2480MHz

	Freq	ReadLevel	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4960.000	22.76	31.63	37.60	9.48	26.27	54.00	-27.73	Average
2	4960.000	27.45	31.63	37.60	9.48	30.96	74.00	-43.04	Peak
3	7440.000	23.85	36.46	35.49	11.39	36.21	54.00	-17.79	Average
4	7440.000	28.19	36.46	35.49	11.39	40.55	74.00	-33.45	Peak
5	9920.000	24.02	38.42	35.23	13.13	40.34	54.00	-13.66	Average
6	9920.000	29.10	38.42	35.23	13.13	45.42	74.00	-28.58	Peak

Antenna Polarity:	Vertical	Test channel:	Highest



Condition : FCC PART 15 (PK) 3m VERTICAL
EUT : Stage luminaires
Test Mode : Charging + 2.4GHz TX mode
Test Engineer: Lee
Model : FP2
T&H : 24℃ 49%
Test voltage : AC120V 60Hz
CH : 2480MHz

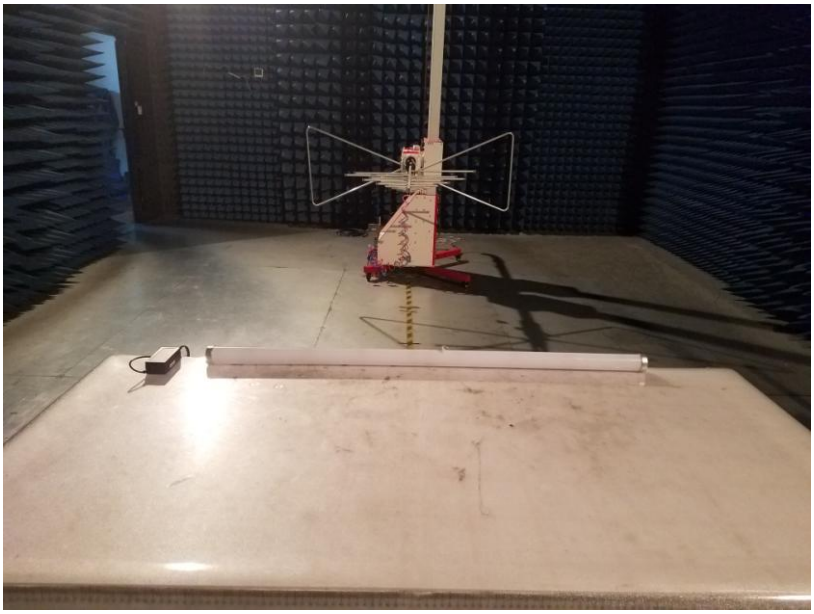
	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4960.000	22.38	31.63	37.60	9.48	25.89	54.00	-28.11	Average
2	4960.000	27.69	31.63	37.60	9.48	31.20	74.00	-42.80	Peak
3	7440.000	22.14	36.46	35.49	11.39	34.50	54.00	-19.50	Average
4	7440.000	27.79	36.46	35.49	11.39	40.15	74.00	-33.85	Peak
5	9920.000	23.43	38.42	35.23	13.13	39.75	54.00	-14.25	Average
6	9920.000	28.31	38.42	35.23	13.13	44.63	74.00	-29.37	Peak

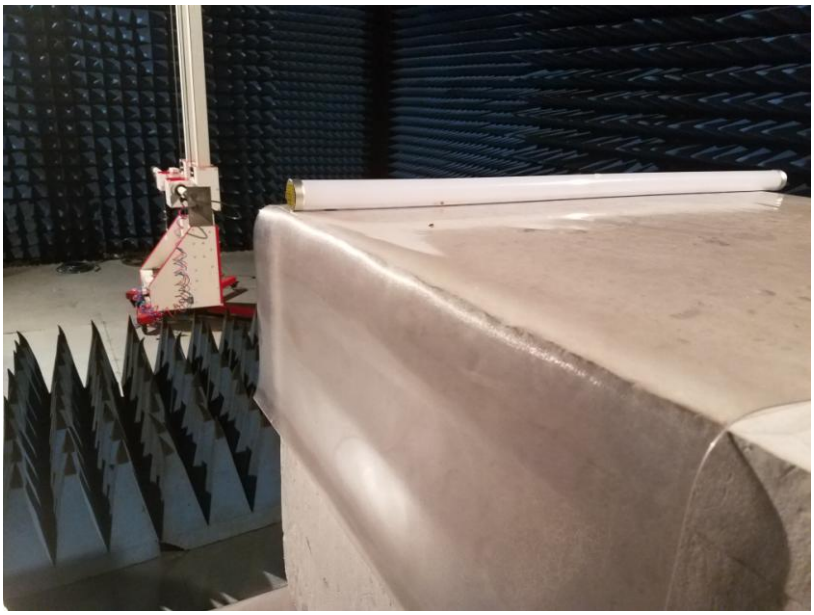
Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

8 Test Setup Photo

Radiated Emission





Conducted Emission

9 EUT Constructional Details

Reference to External picture and Internal picture for details.

------End------