



INFORMATION PAPER

FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)

Seventh meeting of FSMP Working Group

Johannesburg, South Africa, 6 to 13 September 2018

Agenda Item 7: Interference From Non-Aeronautical Sources

Radiated and conducted emissions test results performed on LED Bulbs disturbing VHF frequency band

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SUMMARY

Further to recent VHF interference cases reported on airports which were caused by malfunctioning Light Emitting Diode (LED) bulbs, this paper provides some results of emission characterization tests performed on two of the identified LED lamps.

1. INTRODUCTION

Various interference cases caused by Light Emitting Diode (LED), both tubes and bulbs, were reported during previous meetings, refer to FSMP WG 4: WP 22 “LED lighting interference to aviation VHF communications” and FSMP WG 5 : Presentation 1 “LED Lighting Interference Examples”.

For this later case, VHF communications were disturbed at certain Airport gates in two different airports (Milwaukee and Nashville), in both cases, an increase in the noise floor in the 100-150 MHz frequency band was noticed.

Long and considerable researchs were necessary to identify the source of the interference, particularly due to differences between day and night condition. Finally sources were determined to be LED bulbs installed in the airport. These LEDs seems affected by malfunctioning of their power regulators, while be stamped as compliant with CISPR 15 Standard (Comité international spécial des perturbations radioélectriques - EMI Test System - Emissions from Luminaries and Ancillary Devices).

As some on these LED bulbs were get back after the investigation made on the airport, it was proposed to raise a Laboratory Test in order to define their emissions characterization.

2. DISCUSSION

Two specific LEDs bulbs identified as disturbing the VHF band in US airport were sent to the Airbus laboratory in order to be tested.

Part number : PAR38/LEDG9/2

Lamps were identified as A & B

The tests were run according to EN 55015 standard for radiated and conducted emissions, and adapted with RTCA DO160 bandwidth.



Figure 1: Typical view (left) and reference (right) of tested LED lamps

One standard filament lamp (Philips 53W, EU market) was used and tested for comparison purpose.

Various test cases were defined,

TEST OBJECTIVE/CASE ID	TEST TITLE	REQUIREMENTS COVERED
Case 1	Filament lamp conducted emission (reference)	EN 55015 §4.3.1
Case 2	Filament lamp radiated emission (reference)	EN 55015 §4.4.2
Case 3	LED lamp conducted emission	EN 55015 §4.3.1
Case 4	LED lamp radiated emission	EN 55015 §4.4.2

And various configurations were tested : side face facing antenna, front face facing antenna, 1 lamp, 2 lamps, power supply wire long/short, vertical/horizontal.

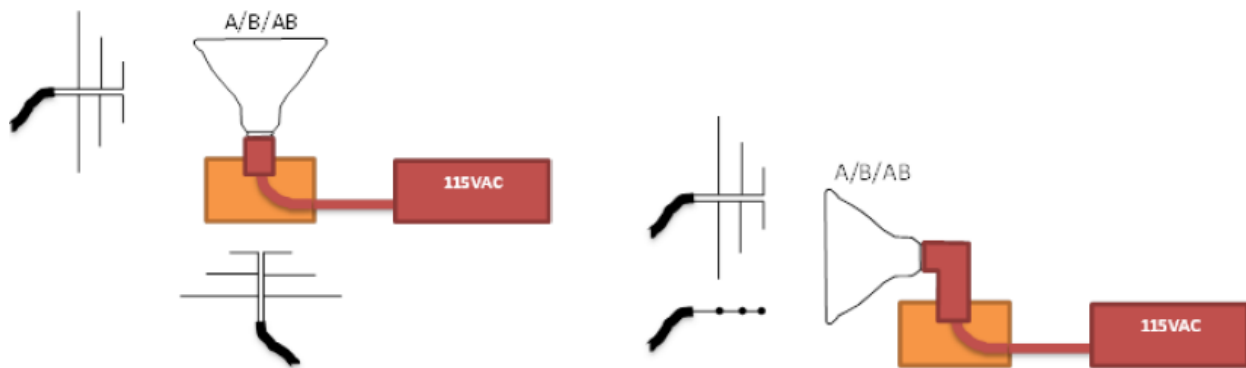


Figure 2: examples of tested configurations

3. EXTRACT OF SOME OF THE TEST RESULTS

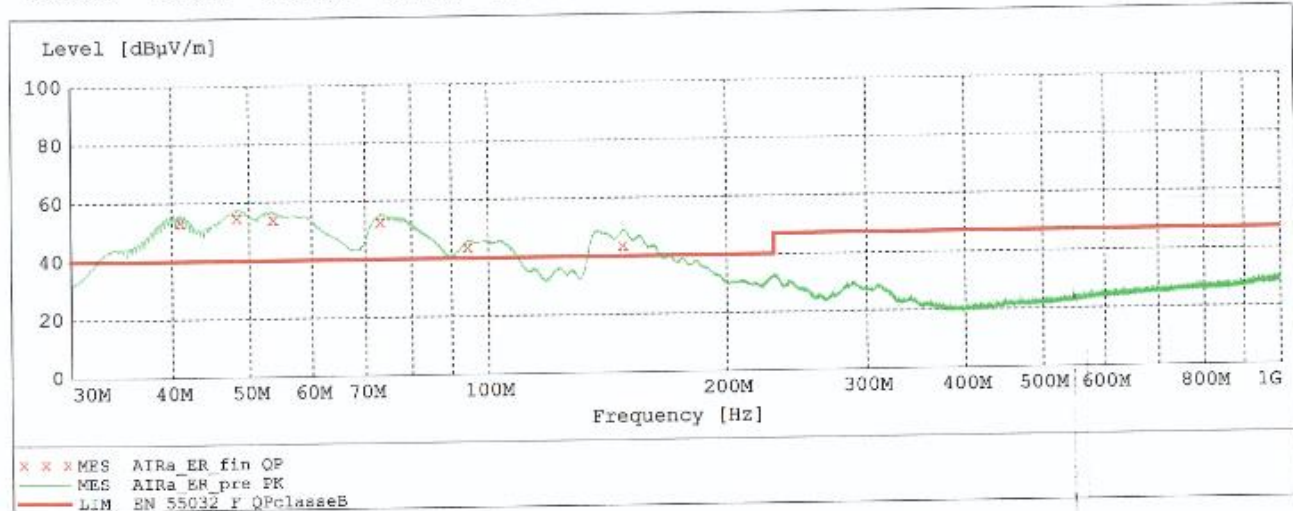
3.1 Vertical lights A & B



Light A :**SCAN TABLE: "EN 55032 Field 9160"**

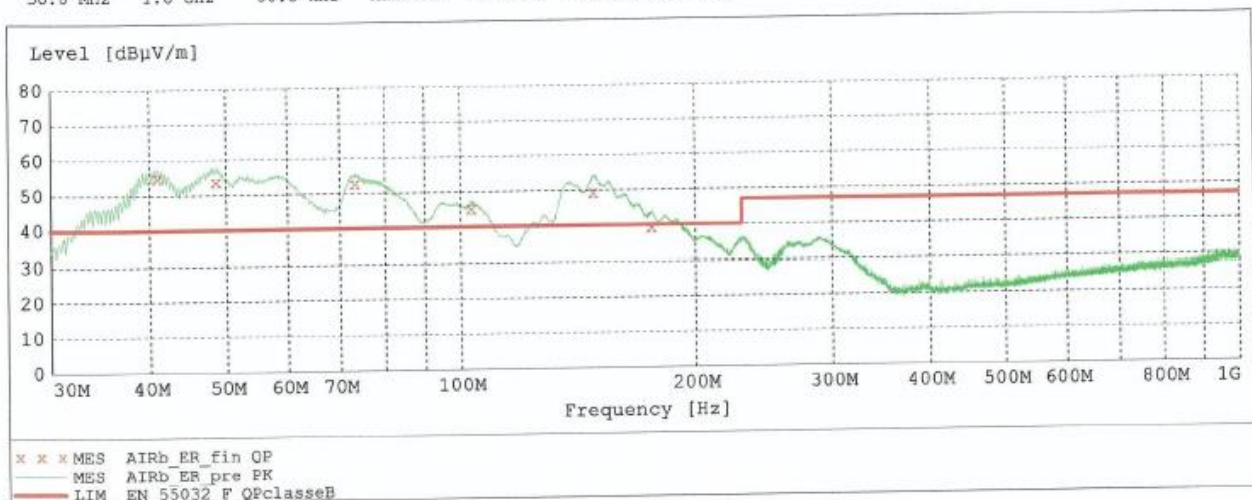
Short Description: EN 55022 Field Strength

Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
30.0 MHz	1.0 GHz	80.0 kHz	MaxPeak	10.0 ms	120 kHz	VULB9160

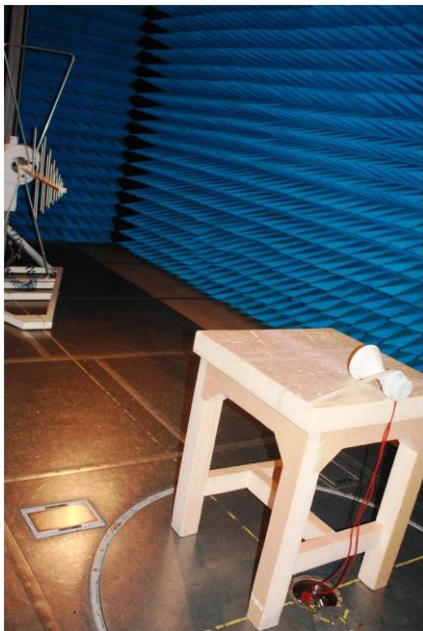
**Light B :****SCAN TABLE: "EN 55032 Field 9160"**

Short Description: EN 55022 Field Strength

Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
30.0 MHz	1.0 GHz	80.0 kHz	MaxPeak	10.0 ms	120 kHz	VULB9160

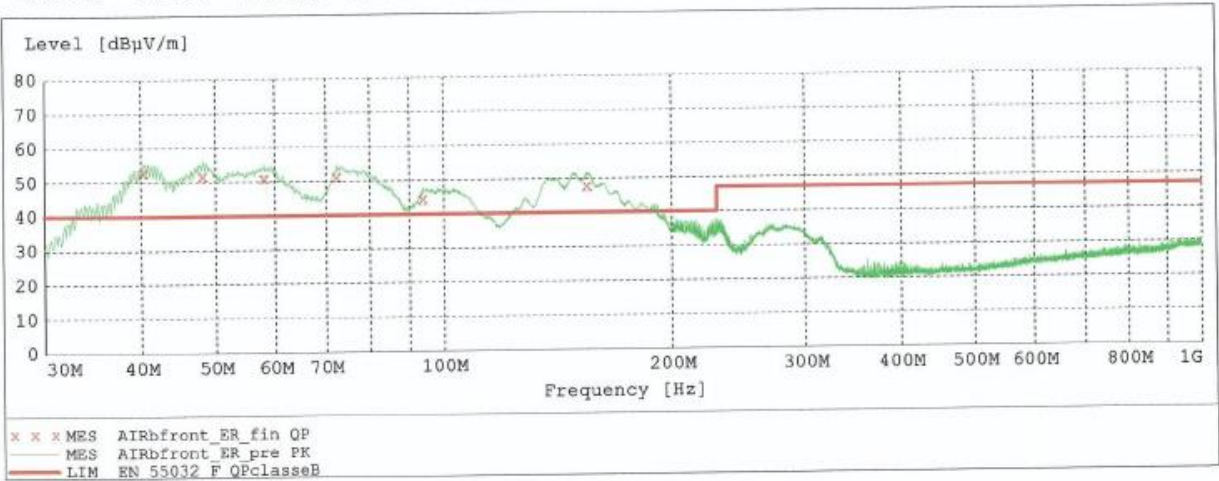


3.2 Horizontal light A

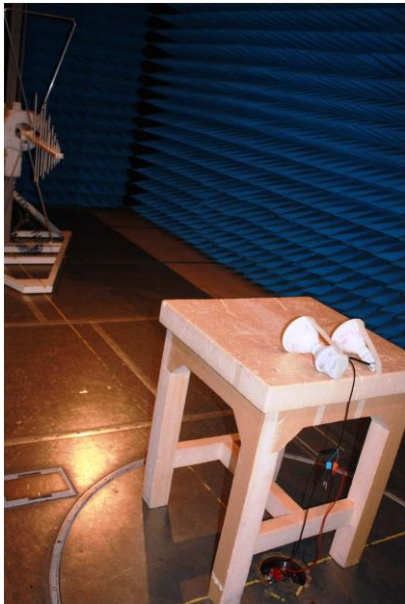


SCAN TABLE: "EN 55032 Field 9160"

Short Description:		EN 55022 Field Strength				
Start	Stop	Step	Detector	Meas.	IF	Transducer
Frequency	Frequency	Width		Time	Bandw.	
30.0 MHz	1.0 GHz	80.0 kHz	MaxPeak	10.0 ms	120 kHz	VULB9160

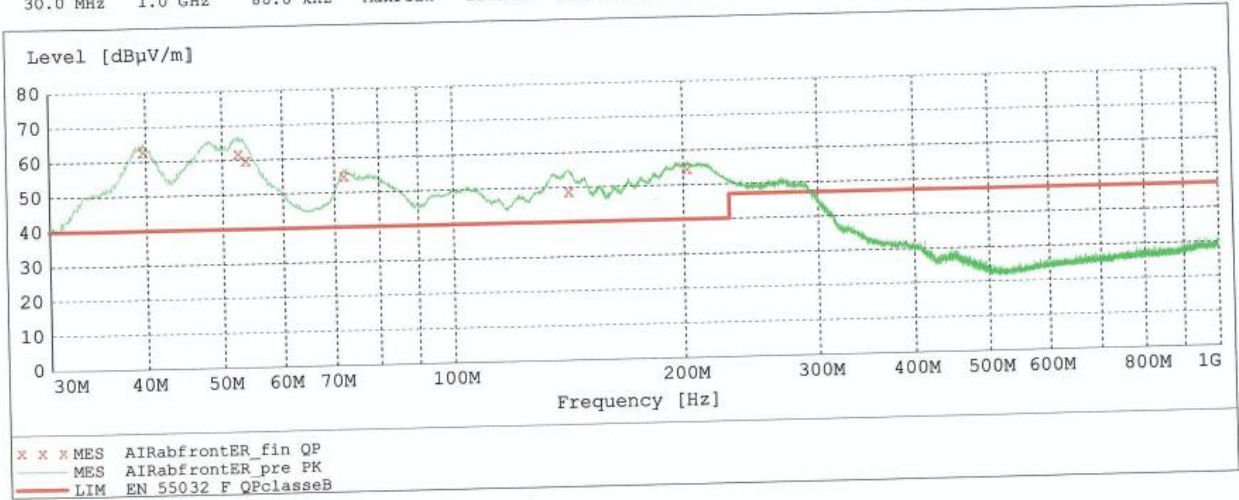


3.3 Dual horizontal lights A + B



SCAN TABLE: "EN 55032 Field 9160"

Short Description:			EN 55022 Field Strength			
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency 30.0 MHz	Frequency 1.0 GHz	Width 80.0 kHz	MaxPeak	10.0 ms	120 kHz	VULB9160

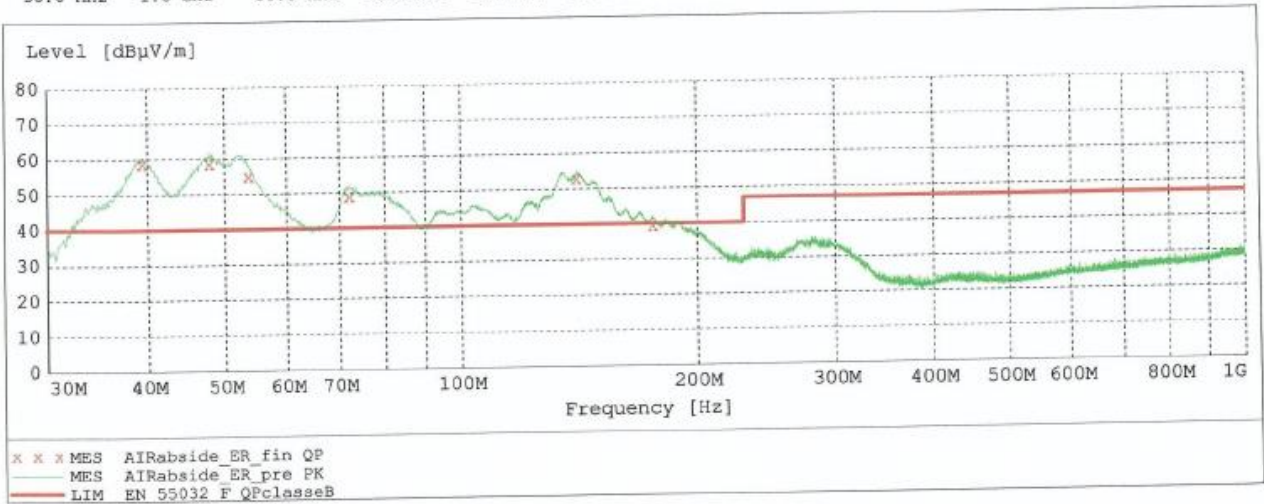


3.4 Dual vertical lights A + B



SCAN TABLE: "EN 55032 Field 9160"

Short Description:			EN 55022 Field Strength			
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency 30.0 MHz	Frequency 1.0 GHz	Width 80.0 kHz	MaxPeak	10.0 ms	120 kHz	VULB9160



4. CONCLUSION

Test performed on these two specific lamps highlight an effect of Radiated emissions in the VHF band :

- Single lamp:
 - Up to 200 MHz
 - Typical emission => 50 dB μ V/m
 - Maximum => 60 dB μ V/m below 100 MHz
- Double lamps:
 - A typical increase factor was noticed => +10 dB μ V/m up to 200 MHz

Modification of the length of the power supply cables, shield of the cables, as well as orientation of these cables do not affect significantly the results.

Test performed on these two specific lamps on conducted emissions do not highlight an effect on the VHF band.

Considering the current performances of the on board VHF receivers regarding sensitivity (typically -107dBm), a distance of 250 meters shall be necessary between the A/C and one of these two specific lamps in order to avoid interference signal.

This distance increase to 450 meters if we consider these two specific lamps due to the cumulative factor.

These two lamps show a non compliance with the emission standard requirements .The source or root cause of this non compliance concerning the Radiated emissions requirement is unknown (design, manufacturing process, other..) .

5. ACTION BY THE MEETING

The meeting is invited to note and review the content of this paper, and decide any further action or info.

— END —