



EMI test at Port San Antonio Airport, Texas, USA

Abstract

The aim of the EMI test is to demonstrate that the use of T-PED (transmitting –Portable Electronic device) does not cause disturbances on any aircraft systems. Such test is carried out before installation/ activation of the onboard mobile telephony system on each retrofit aircraft.

The EMI test is mandated from purely aeronautical requirements and must be carried out to be able to operate the “Mobile OnAir” service onboard the aircraft.

The EMI test will be carried out on a retrofitted Airbus aircraft A340 at Port San Antonio Airport, Texas, USA. The test is scheduled sometimes between October 2012 and March 2013.

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I. Purpose of the test

The electromagnetic interference susceptibility test shall be performed in order to demonstrate that the use of T-PED (transmitting –Portable Electronic device) does not cause disturbances on any aircraft system and it has to be done prior to the installation/ activation of the onboard mobile telephony system.

The test is necessary due to the intentional electromagnetic emissions of mobile telephony system and it needs to be performed for the airworthiness certification of wireless services onboard aircraft. Results from such test will provide supporting data for the determination of allowing specific T-PED technology operation.

The test shall be performed, as wireless service in the aircraft is different from usual aircraft certification process due to major points:

- The wireless service spectrum is separated from the aircraft electromagnetic spectrum. Consequently, a direct influence on the aircraft navigation and communication systems is not expected, but a susceptibility investigation is considered necessary as the electromagnetic field levels in the close vicinity of the signal sources might raise to levels, which non essential equipment is not qualified against.
- Additionally, this service usually exceeds the emission limits for aircraft electronic equipment for functional purposes.

The test procedure applied for testing is in accordance with the EUROCAE document “guidance for the use of portable electronic devices (PED) on board aircraft”¹.

Note the test does not involve the use of the NCU or the onboard-BTS.

II. Description of the EMI test

The EMI test consists of two phases:

First phase: a continuous wave is transmitted between 5 to 10 seconds through a broadband antenna (e.g. mono-cone antenna) at a given antenna location in the aircraft cabin, starting at the lowest frequency and finishing at the highest frequency. After transmitting to a frequency the signal moves onto the next frequency. When the test is completed for a given location, the antenna is placed to another location and the same process applied.

The test will be done at the e-bay, the flight deck and at different locations within the aircraft cabin (i.e.; passenger’s seats, doors, windows) meaning it will be repeated at least 10 times.

¹ EUROCAE ED-130 : Guidance for the use of portable electronic devices (PEDs) on-board aircraft



Figure 1; example of test antenna at flight deck position

Second phase: once the first test cycle is done, a second test cycle will be done using a single 200 Hz signal providing a pulse modulation (pulse duration of 625 microseconds and a duty cycle of 5 milliseconds) and applying the same methodology than the first test phase, i.e. antenna placed at different locations within the aircraft and transmission of signal going from the lowest to the highest frequency.

The bandwidth of pulse modulated signal is around 10 KHz.

Figure 2 shows an example of the transmitted pulse signal.

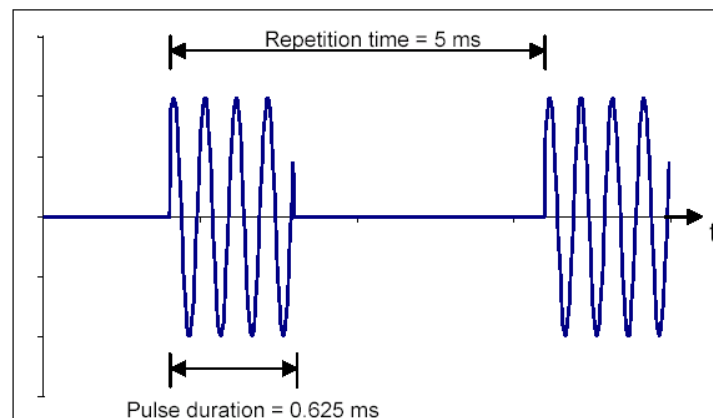


Figure 2: Example of transmit signal

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- **Test frequencies**

The below table provides a wish list of the test frequencies:

Table 1: wish list of test frequencies

Block	Test frequencies (MHz)								
CDMA_1	410	415	420	425	430				
	450	455	460	465	470	475			
	480	485	490	495					
GSM_1	776	784	792	800	808	816	824	832	840
	848	856	864	872	880	888	896	904	912
	920	928	936	944	952	960			
PDC	1430	1444	1458	1472	1486	1500	1514		
GSM_2	1710	1727	1744	1761	1778	1795	1812	1829	1846
	1863	1880	1897	1914	1931	1948	1965	1982	1999
UMTS	2020								
	2110	2130	2160	2180					
UMTS 2600	2500	2525	2550	2575					
	2600	2625	2650	2675	2700				

Note 1: the frequency gap between each step must be no greater than 1 % of the frequency transmitted (e.g. for 900 MHz testing, a step of less than 9 MHz is required). Nevertheless the test frequencies can be shifted if necessary.

Note 2: each frequency is used once every 45-60 minutes

The whole test excluded engine run will last around 7 hours.

- **Power level**

The power level transmitted within the aircraft cabin will be:

- 45 dBm e.i.r.p. for the lower frequencies (i.e. 900 MHz and below)
- 42 dBm e.i.r.p. for the frequencies at 1800 MHz and at 2.1 GHz)
- 39 dBm e.i.r.p. at 2.6 GHz

Table 1 provides the maximum possible power level at 3 kilometres from the aircraft taking into account:

- 10 dB attenuation due to the aircraft
- Egli propagation model (Height of antenna onboard = 4m, Height of BS = 30 metre)

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Table 2: estimated power level at 3 km away

Frequency band	Power level (dBm) at 1 km away
450 MHz	-83.52
900 MHz	-89.74
1800 MHz	-98.80
2.1 GHz	-99.90
Note: no additional attenuations due to building were added	

III. EMI test location and date

The EMI test will be performed on a retrofitted Airbus aircraft A340 between October 2012 and March 2013. As the communication and navigation are among the systems being evaluated, the aircraft should be placed outside the hangar.

The test could occur during the night where airport activity is expected to be low.

The EMI test will be performed at Port San Antonio Airport, Texas whose GPS coordinates are around:

Latitude: 29° 23.2717'N

Longitude : 98° 34.4854'W



Figure 3: snapshot of the test area