

Aircraft Fuselage Field Mapping Test - RF Test System
The Boeing Company

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by

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The purpose of this application is to obtain an experimental license to perform an RF test mapping of aircraft. Per CFR47 5.61, this license application is being submitted in conjunction with the STA extension of WC9XMW.

Table 1 provides a summary of the technical operation, and is followed by a more detailed technical description.

See Descriptions and Drawings for Details				
Test System	Locations	Frequency Bands		Radiated Power
HP8753C N/A with a custom dipole antenna	(1) Outdoor storage Lat: 47-52-42 N Long:122-16-52W (2) Paine Field hangar Lat 47-54-43N Long 122-16-20W (3) Boeing Field hangar Lat 47-32-20N Long 122-18-46W	Start	Stop	16 mW. ERP
		860 MHz	932 MHz	
		935 MHZ	941 MHZ	
		944 MHZ	960 MHZ	

Table 1 Summary

RF Test System for Aircraft Fuselage Field Mapping Test

Purpose: In order to investigate propagation of mobile devices when used inside airplanes, validated electromagnetic (EM) analysis tools are needed. These tools will be used to predict interior fuselage field distributions produced by emitters transmitting in the cellular and PCS bands. The first and most crucial step in this validation effort is to illuminate the interior of an essentially empty fuselage with an ideal radiator (e.g., well-matched dipole antenna) and record the response of an identical antenna sited at various test points within the cabin. This test is intended to provide sufficient data to take this first step.

Test Description: The first test is located in what is known as the “Everett Boneyard”, in the outdoor storage area adjacent to and directly east of Bldg. 40-41, on the north end of the Everett plant. The second test is located not far from the first location in an equipped plane sitting on the field near by in Paine Field. The third location of the testing is on a plane sitting in a hangar at Boeing Field in Seattle.

Swept frequency CW signals from the HP8753C network analyzer will be transmitted from the matched dipole antenna and received by an identical antenna located at the desired test point. Full 2-port scattering parameters will be recorded, comparing the transmit signal to that reflected from the transmit input and to the signal received from the remote antenna. The transmit antenna will be retained within the cabin at all times during the test and the maximum radiated power will be 16 milliwatts (mW). The transmit frequency will be continuously swept over the 860 -960 MHz range with exception of the FAA restricted bands, with a sweep time of ~ 20 seconds. Three transmit sites are envisioned: one at the fuselage center and 2 more, located roughly midway between the center and either end. All three sites will be above the cabin floor. The test will be done in a 12 hours period on any frequency on the 860 to 932 MHz and 935 MHz to 941 MHz and from 944MHz to 960 MHz., during the six month time starting May 01, 2006.

Frequency: Fuselage interior fields will be mapped from 860 to 932 MHz and 935 MHz to 941 MHz and from 944MHz to 960 MHz..

Power: Operation of this test system with a maximum ERP of 16 mW

Emissions: The emissions will be NON

Mitigation Features: All testing will be performed with the radiating antenna located inside the aircraft fuselage. The tests are being done on planes located on Boeing property. Around the first test site, there are wooded trees (see attached map). There are no known issues with using the frequency band requested on Boeing’s mentioned property during that time period. The other two sites will be done inside planes sitting on

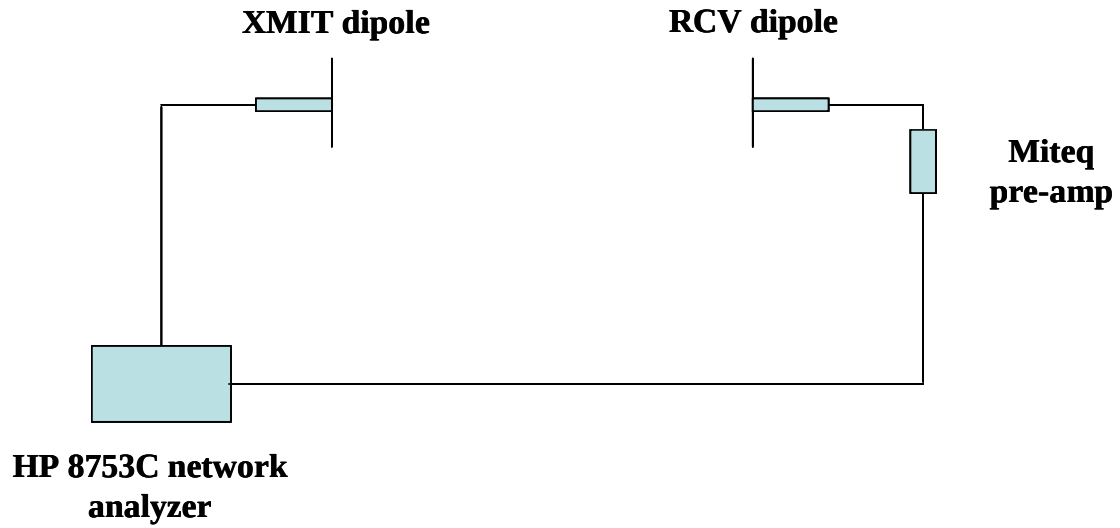
the ground with all doors closed. We previously operated tests under license WC9XMW and did not receive any complaints at the locations mentioned above. An equipment list, block diagram, site layout and pictures of the fuselage interior are attached.

Attachment 1

RF Test System Equipment List

Frequency (MHZ)	Efficiency	Gain (dBi)	Beam Width (Deg)	Antennas and Equipment Used on Range 2
860 - 932 935 - 941 944 - 960	0.80	2	90 el.ev., 360 az.	Custom made antennae : Gain: 2 dBi
Other RF Equipment Used				
RF Sources:				
Hewlett Packard 83620A (10 MHz - 20 GHz)				
Other Components:				
HP8753C network analyzer				
Miteq AFS3-00100800-14-10P4-4 pre-amplifier				
Low-loss Heliac – 10 feet				
RG-214 Coaxial Cable - 120 feet				
Transmitter Information:				
Located at various test points inside the aircraft fuselage, which is in the outdoor storage area adjacent to and directly east of Bldg. 40-41				
Signal Modulation: CW				
Maximum RF Source Power: 16 mW				
Transmission Line Loss: 2 dB				
Maximum Power at Antenna Input: 12 mW				

Attachment 2



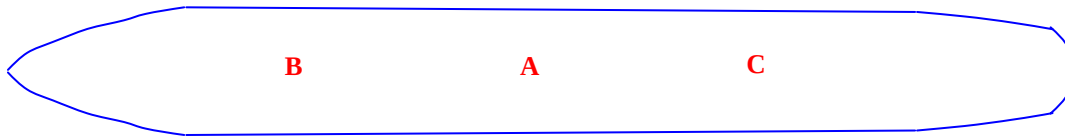
RF Test System Block Diagram

Attachment 3 (Site 1). Other 2 sites are have similar settings
Site Photos

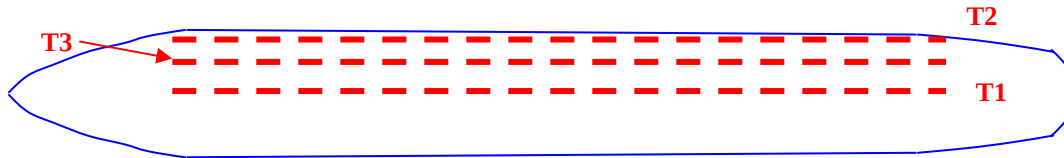


Attachment 4
Test Points

Test Points for Aircraft Fuselage Field Mapping



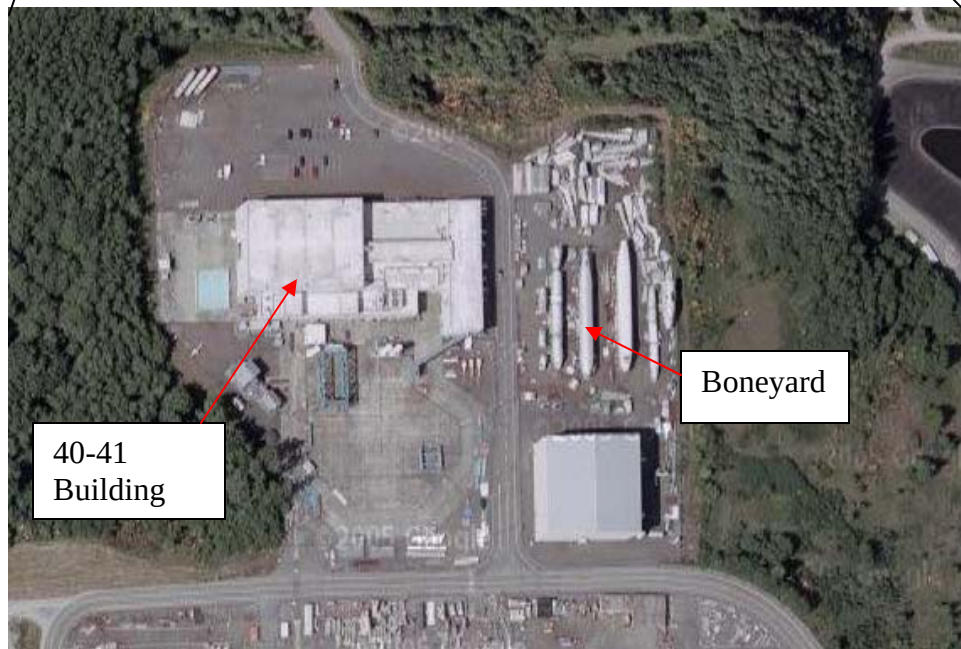
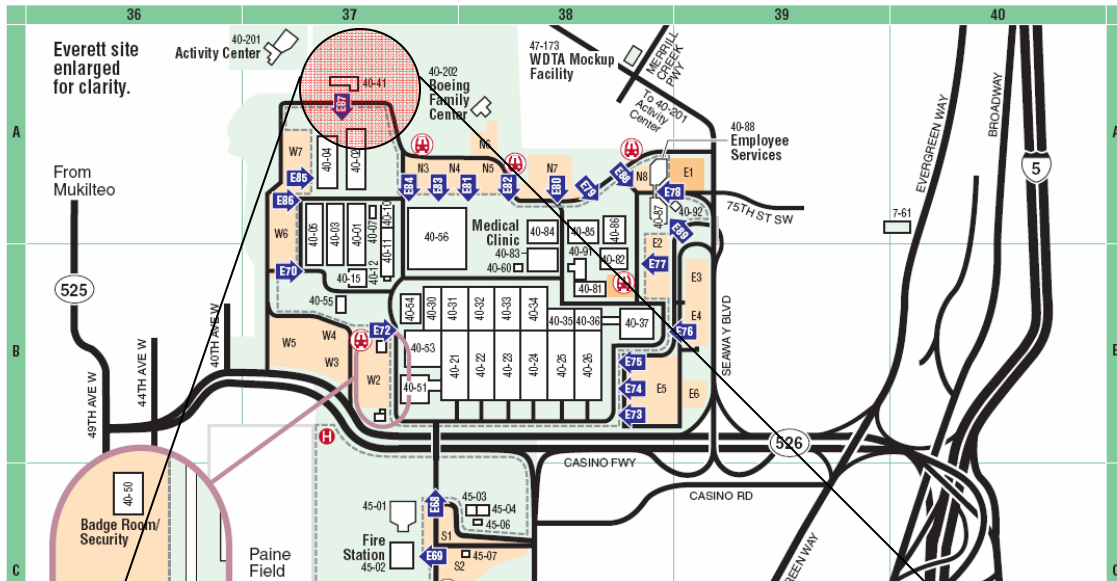
Approximate sites for excitation antenna



Approximate sites for receiving antenna – ~5-10 measurement points along each line, at a fixed height (TBD)*

*exact meas. points count will be limited according to availability of lab support personnel and other schedule constraints

Attachment 5
Site Map
Washington – Everett
 3003 West Casino Road, Everett, WA 98203



(1)

Long: 122 -16 - 50W
Lat: 47- 55 - 42N
GE: 552 ft
NAD 83

Location (3) Testing area

