

RF Test System Information for Boeing Tulsa

Exhibit 1 Summary See Descriptions & Drawings for Details

Test System	Location	Frequency Band	Radiated Power
Compact Range	B004 - Metal Hanger	0.3023 to 18.0023GHz	+27dBm
Transmission/Reflection Table	B004 or B064	2.0 to 18.0GHz	+20dBm
Parallel Plate - TEM Cell	B004 - Metal Hanger	0.1 to 6.0GHz	+20dBm
Station 1 - Transmission	B064 - Metal Building	10.0GHz	+19dBm
Station 2 - Transmission	B064 - Metal Building	8.0 to 12.0GHz	+20dBm
Station 3 - Reflection	B064 - Metal Building	2.0 to 18.0GHz	+20dBm
Station 6 - Transmission	B064 - Metal Building	9.4GHz	+15dBm

Exhibit 1

COMPACT RANGE

Purpose: This test facility is used to measure Radar Cross Section (RCS) as well as antenna patterns.

Equipment: This test system utilizes an instrumentation radar attached to a single transmit/receive antenna which illuminates a collimating reflector. This equipment generates a high quality RF test environment inside an absorber lined metal room.

Frequency: Operation from 0.3 to 18.0GHz is requested for this experiment. The system rests at 1.5 or 12.0GHz whenever the chamber doors are open.

Power: Operation with a +27dBm source is requested for this experiment.

Emissions: Emissions will be a sequence of frequency modulated pulses.

Shielding: The low gain (5 to 12dBi) feed illuminates a parabolic sector reflector. The collimated rays are normally shielded from the exterior by a metallic absorber covered door, a sheetrock wall, 2 additional 12' metal lined sheetrock walls, an 8' sheetrock wall and a metal hangar shell. An open chamber door and an open hangar door are rare occurrences. See *Compact Range (B004)* figure for pictorial view.

Exhibit 1

TRANSMISSION/ REFLECTION TABLE (B004 or B064)

Purpose: This test set is used to extract complex RF material properties derived from reflectivity and transmissivity characteristics.

Equipment: This test system utilizes a Hewlett Packard 8510C network analyzer system coupled to two antennas, one which transmits RF and one which receives RF. This system is housed inside a metal building. Normal lab operation of the HP8510C utilizes the single sweep mode where the frequency range of interest is stepped, the data is collected and the source is put on hold. In the hold mode, no power is emitted. A typical acquisition time is approximately 40 seconds or less with the frequency continually being incremented.

Frequency: Operation from 2.0 to 18.0GHz is requested for this experiment.

Power: Operation with a +20dBm source is requested for the experiment. Typical operation utilizes the power setting at 0dBm in B004 and +10dBm in B064.

Emissions: Emissions will be frequency modulated.

Shielding: This system operates inside a metal building (B064) and a metal hanger (B004). For the reflection system, the transmitting antenna (5 to 18dBi) is pointed into a 12in square sample in an absorber covered area providing reduced upper hemispherical emissions. See *Transmission/Reflection Table (B004 or B064)* figure for pictorial view. For the transmission table (B004), the transmit antenna is pointed down into a 12in diameter sample and some energy is transmitted through the sample and measured while the remaining energy is reflected up into the building.

Exhibit 1

PARALLEL PLATE

Purpose: This device is a reflectivity measurement system which is used to measure material properties as well as absorption performance and 2D radar cross section.

Equipment: This test system utilizes a Hewlett Packard 8510C network analyzer configuration with RF coupled into a parallel plate transmission line test fixture. Test samples are positioned between the plates for measurement evaluation. Approximately 70 percent of the plates external edges are terminated using resistive materials, thereby attenuating emissions. Normal lab operation of the HP8510C utilizes the single sweep mode where the frequency range of interest is stepped, the data is collected and the source is put on hold. In the hold mode, no power is emitted. A typical acquisition time is approximately 40 seconds or less with the frequency continually being incremented.

Frequency: Operation from 0.1 to 6.0GHz is requested for this experiment.

Power: Operation with a +20dBm source is requested for this experiment. Typical operation utilizes the power setting at 0dBm.

Emissions: Emissions will be frequency modulated.

Shielding: The radiation from the edges is unfocused and diffuse, with a gain of less than 0dBi. The system is located inside 8' high sheetrock walls and a metal hangar building. The metal hangar doors are rarely open. See the *Parallel Plate – TEM Cell (B004)* figure for pictorial view.

Exhibit 1

Station 1 – Transmissivity Test Set

Purpose: This test set is utilized to indicate RF insertion loss for absorber development and production processes.

Equipment: These test sets utilize M/A Com GaAs products (MA86677) Gunn diode sources coupled to a transmit antenna. Antennas are in close proximity for measuring the transmission characteristics of the material.

Frequency: Operation at 10 GHz is requested for this experiment.

Power: Operation with a +19dBm source is requested for the experiment

Emissions: Emissions will be unmodulated.

Shielding: This system is operated inside a metal building with few doors and windows. The transmitting antenna is pointed directly into a receiving antenna. Emissions are reduced by absorber masks behind the receive and transmit antennas. See *Stations 1 and 6 (B064)* figure for a pictorial view.

Exhibit 1

Stations 2 and 3 (B064)

Purpose: These test sets are used to extract RF material properties derived from reflectivity and transmissivity characteristics.

Equipment: These test systems utilizes a Hewlett Packard 8510C network analyzer system coupled to two antennas, one which transmits RF and one which receives RF. This system is housed inside a metal building. Normal lab operation of the HP8510C utilizes the single sweep mode where the frequency range of interest is stepped, the data is collected and the source is put on hold. In the hold mode, no power is emitted. A typical acquisition time is approximately 40 seconds or less with the frequency continually being incremented.

Frequency: Operation from 2.0 to 18.0GHz is requested for this experiment.

Power: Operation with a +20dBm source is requested for the experiment. Typical operation utilizes the power setting at +10dBm.

Emissions: Emissions will be frequency modulated.

Shielding: This system operates inside room constructed of sheetrock and metal studs which is housed inside a metal building. For the reflection system (Station 3), the transmitting antenna (5 to 18dBi) is pointed into a 12 to 16in square sample in an absorber covered area providing reduced upper hemispherical emissions. See *Transmission/Reflection Table (B004 or B064)* figure for pictorial view. For the transmission table (Station 2), the transmit antenna is pointed into a similar receive antenna. Each of these antennas is backed by an absorber mask. Some of the energy is transmitted through the sample and measured, some of the energy is absorbed while the remaining energy is reflected into the building.

Exhibit 1

Station 6 – Transmissivity Test Set

Purpose: This test set is utilized to indicate RF insertion loss for absorber development and production processes.

Equipment: These test sets utilize M/A Com GaAs products (MA86626) Gunn diode sources coupled to a transmit antenna. Antennas are in close proximity for measuring the transmission characteristics of the material.

Frequency: Operation at 9.4GHz is requested for this experiment.

Power: Operation with a +15dBm source is requested for the experiment

Emissions: Emissions will be unmodulated.

Shielding: This system is operated inside of a room which is housed inside a metal building. There are few doors in this building. The transmitting antenna is pointed down into a receive antenna, reducing the upper hemisphere emissions. See *Station 1 and 6 (B064)* figure for a pictorial view.

Exhibit 2

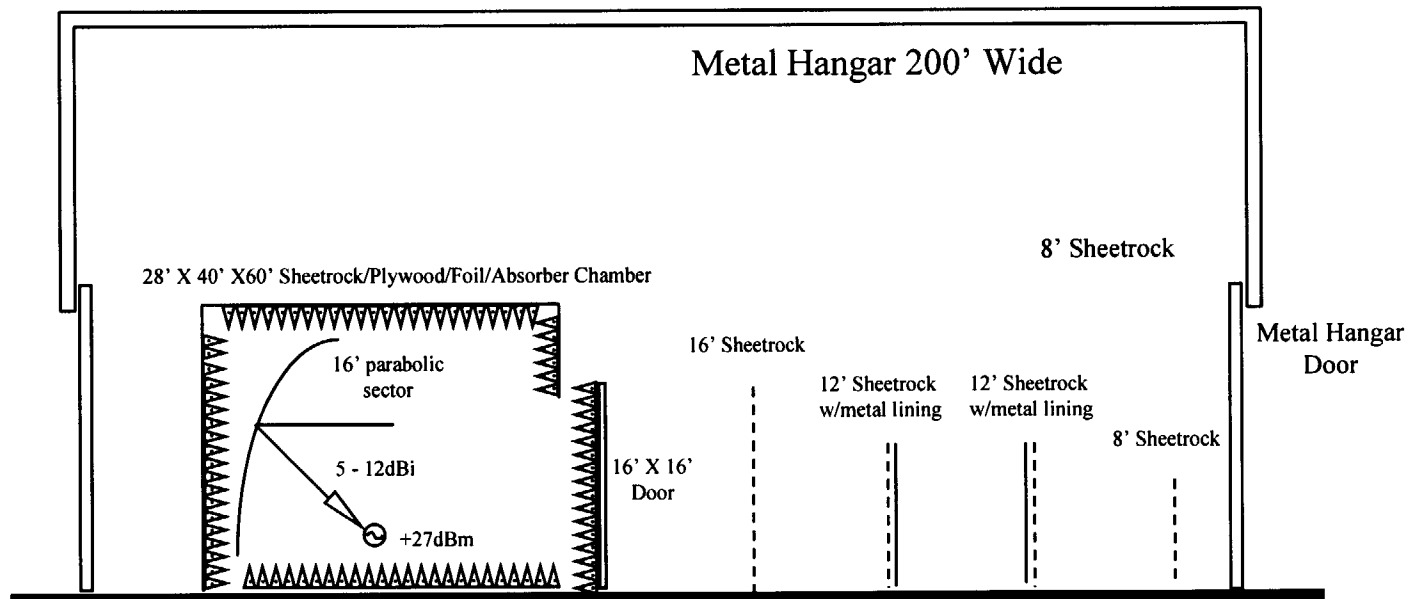
This authorization will be used to fulfill the following government contracts:

DAAH23 - 00 - C - A001 for the RAH 66 Comanche Helicopter program

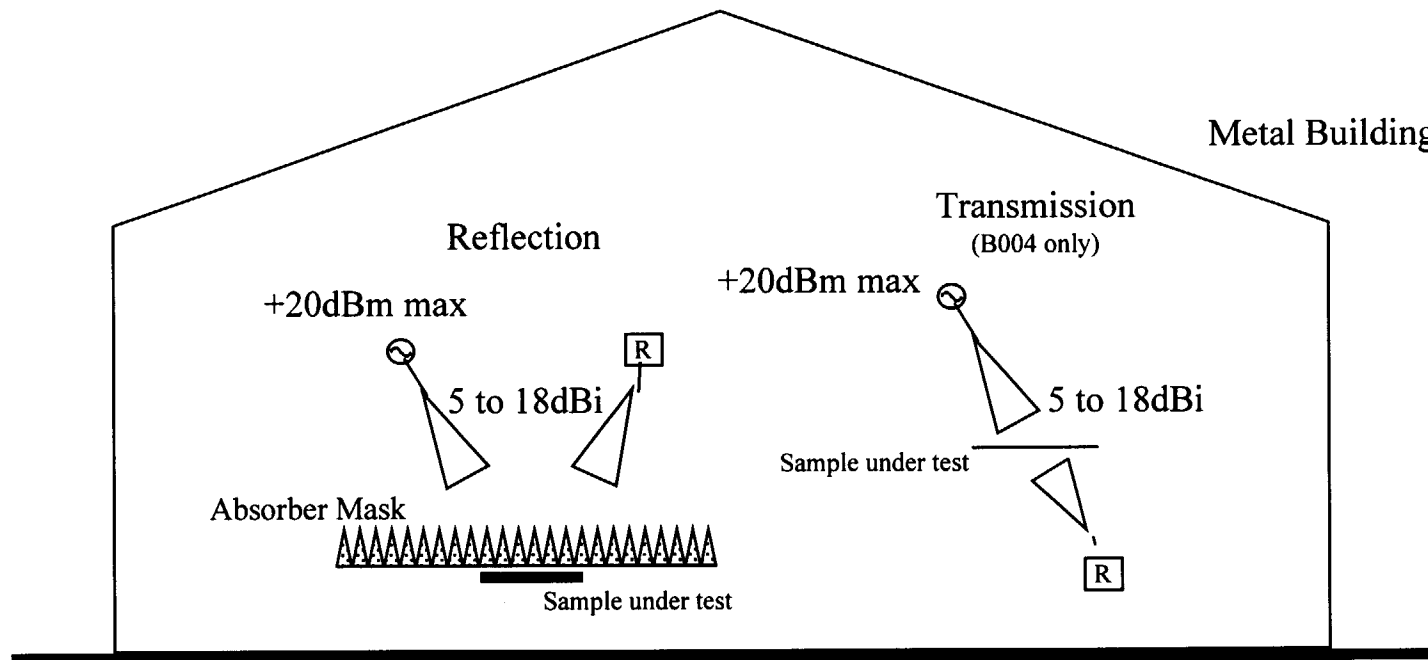
N00019 - 97 - C - 37 for the Joint Strike Fighter (JSF) program

The tests described in Exhibit 1 will be used primarily to validate core treatments for the above listed programs.

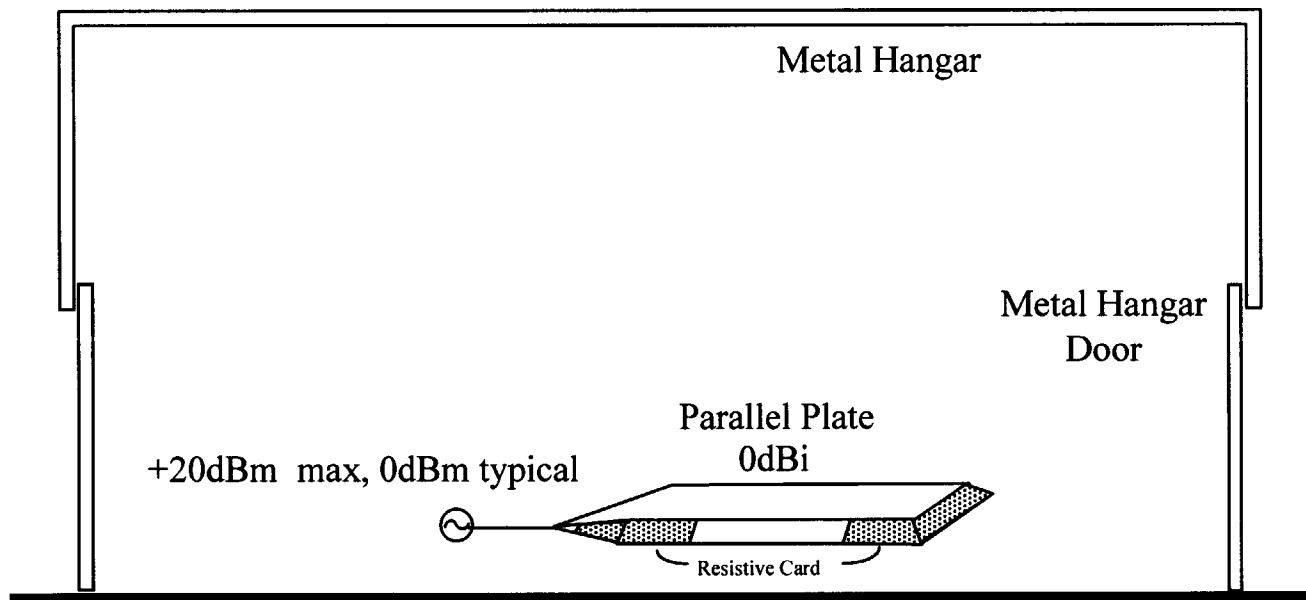
Compact Range (B004)



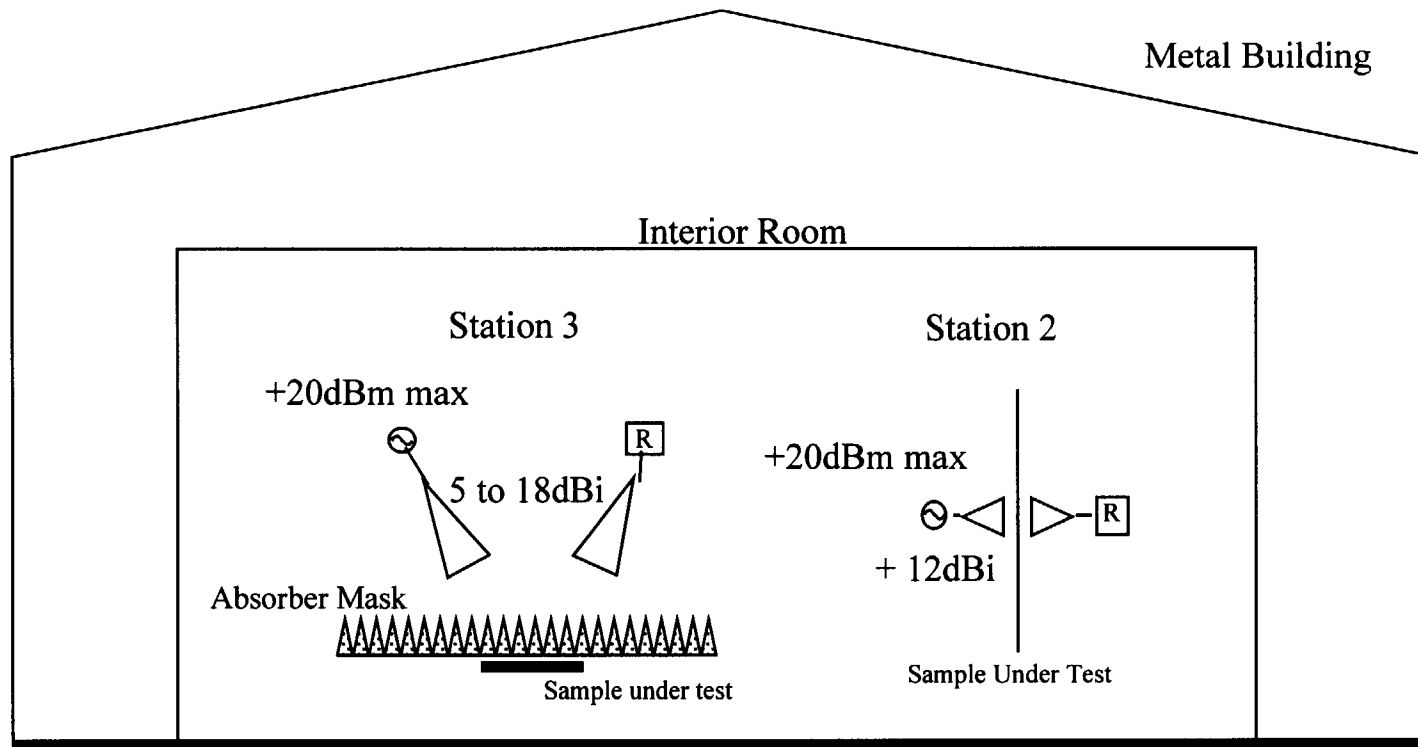
Transmission/Reflection Table (B004 or B064)



Parallel Plate - TEM Cell (B004)



Stations 2 and 3 (B064)



Stations 1 and 6 (B064)

