

Pentastar Aviation Avionics Department

EMC TEST PLAN Number 13GT-001

Electromagnetic Compatibility (EMC)

Revision: A
Date: 2/25/2014

T-PED testing for Wireless Data Technologies of IEEE 802.11a/b/g/n

Aircraft Information:

Manufacturer:	Gulfstream
Model #:	G-IV
Serial #:	
Registration:	

This Test Plan has been accomplished satisfactory:

Tested By: _____
(Print)

Date: _____

Frequency Bands Tested: 2.4GHz (Yes/No) / 5GHz (Yes/No)

Tested By: _____
(Signature)

Test Location: _____

REVISIONS

Please see change Bar on RH side of page for the latest revision.

REV	PAGES	DESCRIPTION	APPROVED BY	DATE
IR	All	Initial Release	C. McClure	11/12/2013
A	All	Added systems additions to Table 3 and Appendix E. Clarified language, corrected typos.	C. McClure	2/25/2014

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1. INTRODUCTION

This FAA approved EMC (Electromagnetic Compatibility) ground test by means of Supplemental Type Certification (STC) is intended to evaluate airplane system performance with transmitting portable electronic device (T-PED) technology for determination of operator allowance. Appendix D identifies all the acronyms used in this document.

EMC aims to ensure that equipment items or systems will not interfere with or prevent each other's correct operation through spurious emission and absorption of EMI.

The test signals account for intentional transmitting signal representing the T-PED technology. The test signal will be placed in specified locations and indicated in Appendix A. While transmissions are being made from the test signal source, qualified personnel will be in the flight deck observing if any of the aircraft systems show any susceptibility. Susceptibility is determined as compared to the Pass/Fail criteria identified in the test plan with descriptive wording along with the threshold to determine if the susceptibility could be tolerated.

Airplane systems under test are all the systems required for type certification or by the operating rules, or whose improper functioning would reduce safety must be evaluated. Included in these systems are those that have been typically classified as "critical", "essential", and "non-essential but required for dispatch.

T-PED testing is for the following Wireless Network (IEEE 802.11a/b/g/n) Protocol / Frequency / Baud Rate:

1. 802.11a (5 GHz / 54 Mbps)
2. 802.11b (2.4 GHz / 11 Mbps)
3. 802.11g (2.4 GHz / 54 Mbps)
4. 802.11n (2.4 GHz and 5 GHz / 54 Mbps to 600 Mbps)

Note: 2.4 GHz (2400 to 2483.5 MHz) / 5 GHz (5250 to 5350 MHz and 5470 to 5825 MHz)

If your aircraft only has a 2.4GHz Wi-Fi system then only perform testing for that frequency band.

If your aircraft has a dual band 2.4 GHz and 5GHz then you must test for both bands.

1.1 Appendix List:

The following list describes each of the Appendices used in this document.

Appendix A – Test Locations

Identifies the 3 zones where the Transmitter Emulators must be located for testing.

Appendix B – 2.4GHz

Is a simplified block diagram of the Transmitter Emulator (TE) set up used for 2.4 GHz frequency band.

Appendix C – 5 GHz

Is a simplified block diagram of the Transmitter Emulator (TE) set up used for 5 GHz frequency band.

Appendix D – Acronyms

List identifies all acronyms and abbreviation used

Appendix E – Equipment List

The list of equipment installed on a G-IV which is tested when the Transmitter Emulators are actively transmitting.

2. TESTING DETERMINATION

This STC was original certified with the use of this test plan. All of the items in Appendix E identified with “N/A” where required for the initial STC process. For follow-on use, the items identified as “N/A” would not be required to be tested unless your equipment list is different. Any equipment that is different or has a different Model or Part Number is required to be tested with the Transmitter Emulators functioning. Once you have completed your equipment list review and noted the results in Appendix E, your aircrafts equipment list is completed. Now you can markup, revise the EMC TEST MATRIX Table 4 for equipment you are testing.

Use the EMC TEST MATRIX (see section 3.5.4, Table 4) and mark the victim systems that do not need to be tested based upon your Appendix E mark ups.

Only those systems that have changed from the original Type Certificated configuration that perform Major, Hazardous or Catastrophic safety functions or those required by operating rules are required to be tested.

Your aircraft may have additional equipment that may need to be tested. Recoding the equipment you have tested is important to document the test results for the equipment installed on the day of the test.

2.1 Step – One

Mark up Appendix E. Compare your equipment list with equipment list identified in Appendix E. Note which equipment is the same and what is different. If all of the equipment is the same, consider the aircraft compliant and no testing is required.

2.2 Step – Two

Determine the aircraft existing Wi-Fi system(s) installed on the aircraft and note information in Section 3.5. Proper identification of the system installed to determine the frequencies to be tested 2.4GHz and or 5GHz.

2.3 Step - Three

Mark up EMC TEST MATRIX. Some will not need to be tested, some will, this will help track what systems need to be tested. For example if your aircraft has a different TCAS system that was certified during the STC process, your TCAS system must be checked. If your VHF communications equipment is the same, then no testing of the VHF communications are required.

3. TEST PROCEDURES

3.1 GENERAL

1. The technician accomplishing this test procedure should have a working knowledge of the existing aircraft avionics/electrical systems and 3 (or more) PC compatible computers (laptops) using Windows XP/Vista/7/8.
2. Read this test procedure in its entirety prior to starting the testing.
3. In the applicable test step results space, enter PASS or FAIL after the complete EMC Test Matrix at the end has been completed. If a test is not applicable to the aircraft configuration enter N/A.
4. Ensure all maintenance safety precautions are observed prior to performing any of the tests required by this document.
5. Since communication and navigation are among the systems being evaluated, the airplane will be required to be outside of the hanger and at least 500 feet from any large metallic structures. In addition, aircraft engines runs may be required. Electrical and hydraulic power must be available throughout the test.
6. A basic test setup is shown in the **Figure 1**.

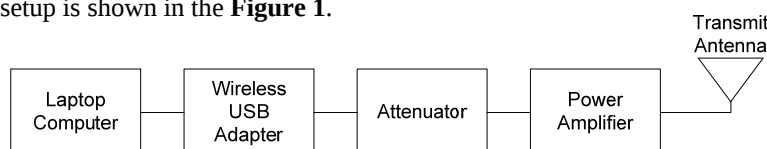


Figure 1 - Basic Test Setup

3.2 CAUTION: Exposer to Radio Frequency Radiation

Since the RF radiated field can be hazardous to personnel, the admittance of people in the vicinity of the tests should be minimized. Observers and visitors shall only be allowed onboard the aircraft in company of the test personnel. While the wireless system antennas transmitting, a minimum distance for personnel shall be established. **Maintain at least 12" from any transmitting antenna.**

3.3 TEST EQUIPMENT

Test equipment needed is standard industry Avionics ramp test equipment to test aircraft systems and Transmitter Emulators that provide high level of RF to flood the area of Wi-Fi signals are necessary to complete the testing. Transmitter Emulators for the two frequency bands (2.4 GHz and 5 GHz) are identified in Appendix B and Appendix C respectfully. The suggested test equipment is identified below.

1. Ground power unit or auxiliary power unit.
2. TCAS (or use real aircraft targets) / ATC/DME Ramp Tester: IFR-6000, ATC-601, TCAS-201, or TR-220 (or equivalent)
3. Pitot-Static Ramp Tester.
4. NAV/VOR/ILS/MKR Ramp Tester: NAV-402, IFR-4000, or T-36C (or equivalent)
5. VHF Comm transceiver and HF Comm transceiver to test the aircraft's VHF and HF communication system (another aircraft will suffice).
6. 3 Laptops with Wi-Fi network cards and USB ports.
7. PDA w/Wi-Fi capabilities (e.g. Apple itouch)
8. Optional - More Laptops and Transmitter Emulators (TE) could be used to reduce test duration.
9. TE Equipment for 802.11 b/g/n for band 2.4 GHz requires the following:
 - a. See Appendix B for block diagram for 2.4 GHz.
 - b. USB Adapter, such as PowerLink P/N: PL-18N
 - c. 2 Watt Amplifier, such as L-Com M/N: HA2402GXI-NF
 - d. 6db Attenuator, such as Mini-Circuits P/N: BW-N6W5+
 - e. Omni Directional WLAN Antenna (4 dBi), such as L-Com M/N: HGV-2404U

Note: The above 2 watt Wi-Fi Amplifiers used with the 4 dBi gain antenna below meets the test requirements of transmitting emulator with radiated power of 36 dBm (4 watts EIRP).

10. TE Equipment for 802.11 a/n for band 5.2 GHz requires the following:
 - a. See Appendix C for block diagram for 5 GHz.
 - b. USB Adapter, such as StarTech USB Adapter P/N: USB300WN2X2D
 - c. 3 Watt Amplifier, such as L-Com P/N: HA5803I
 - d. Omni Directional WLAN Antenna (3 dBi), such as L-Com P/N: HGV-2458-03U
11. Note: The above 3 watt Wi-Fi Amplifiers used with the 3 dBi gain antenna below meets the test requirements of transmitting emulator with radiated power of 36 dBm (4 watts EIRP).
12. Wi-Fi Field Level Monitor:

- Once the Transmitter Emulator (TE) is built up, a test to insure functionality is required.
- A Spectrum Analyzer or a hand held RF Strength Meter should be used to verify the TE is transmitting the expected 4 watts EIRP.

NOTE: This test meets the FAA Policy No. PS-ANM-25-13 test requirements. All Transmitter Emulator locations MUST be tested per Transmitter Emulator locations and at the frequencies and channels depicted in the EMC Test Matrix. This procedure will now address using one Wi-Fi Transmitter Emulator at the specified Transmitter Emulator zones.

3.4 TEST EQUIPMENT RECORD

Test equipment used to test aircraft installed systems which require periodic calibration shall have been calibrated within the last twelve months. No testing shall be performed with test equipment that has exceeded this calendar time limit. Blanks are provided to add additional equipment if needed. Please identify the equipment and calibration date of the equipment used in the Table below.

Table 1 – Calibrated Test Equipment

Description	Model No.	Serial No.	Calibration Expired Date
TCAS / ATC / DME Ramp Testers			
Air Data Pitot-Static Ramp Testers			
NAV/VOR/MKR Ramp Testers			
H.P. Power Meter 100MHz – 18 GHz			
Spectrum Analyzer 50 KHz – 21 GHz			
VSWR Meter 25 – 3300 MHz			

Record transmitter emulator test equipment Manufacturer, model numbers and other pertinent information, such as antenna gain. (Items shown are suggested models; if your test equipment differs please amend the list and add to it)

Table 2 – Transmitter Emulator Test Equipment

Description	Model	Manufacturer	Information
RF EMF Meter	480846	Extech Instruments	8 GHz
Lap Top	Any	Any	Windows XP or Vista/7/8

USB Adapter	PL-18N	Powerlink	For 2.4 GHz
6 db Attenuator	BW-N6W5+	Mini-Circuits	DC-18 GHz
2 Watt Amplifier	HA2402GXI-NF	L-Com	For 2.4 GHz
WLAN Antenna (4 dBi)	HGV-2404U	L-Com	For 2.4 GHz
USB Adapter	USB300WN2X2D	StarTech	For 5.8 GHz
3 Watt Amplifier	HA5803I	L-Com	For 5.8 GHz
WLAN Antenna (3 dBi)	HGV-2458-03Y	L-Com	For 5.8 GHz

3.5 AIRCRAFTS ROUTER / Wi-Fi

Record the aircrafts Wireless Local Area Network router / Wi-Fi / WAP:

Parameters	WLAN -1	WLAN -2 (If installed)	WLAN-3 (If installed)
Manufacturer:			
Model:			
Part Number:			
Serial Number:			
802.11 ()			
TX Frequency(s)			

3.5.1 LAPTOP TEST SETUP W/TRANSMITTER EMULATOR

1. At the laptops with and without Transmitter Emulators positions. Set-up laptops to communicate with the Router's Wireless Access Point (WAP). The laptop should detect any available wireless network in the vicinity. At each of the laptops in the Windows system tray, locate the Wireless Network Connection icon. Double click on the icon. From the Wireless Network Connection Status screen select the View Wireless Networks button. The router should be displayed as one of the available wireless networks on the Wireless Network Connection screen. If router is not shown as an available network select Refresh network list. If not shown as connected, select to Connect to this network via the Wireless Network Connection screen.

NOTE: Do not close Wireless Network Connection screen.

2. At the laptops, initiate a ping test by performing the following steps:
 - a. On the Desktop select Start and select Run
 - b. In the **OPEN:** field on the RUN window, type **cmd** (and then CR - Carriage Return)
 - c. Verify that the DOS command window is displayed.
 - d. At the command prompt type (**C:/ ping_ -t 192.168.1.1**). This starts Wi Fi communication between laptops and the router. To cancel use CTRL C.

Note, **Reply** messages from the Cabin Router should be displayed in the DOS command window for successful contact. **Request timed out** messages in the DOS command window means no response from the router. To end ping testing (which will occur later), press the **Ctrl** and **C keys** on the keyboard together.

3. All laptops with and without the Transmitter Emulators should be pinging with the router.
4. With PDA with Wi-Fi search for a Wireless Access Point. The router should be displayed as one of the available wireless networks on the Wireless Network Connection screen. Select the router, run the Network Ping application with the router's IP address **192.168.1.1**. **At the bottom of the Network Ping program select continuous ping ON and select Start above.**

Note: IP Address shown (192.168.1.1) is a sample, use the IP address of the aircrafts installed router.

3.5.2 TEST EQUIPMENT AND AIRCRAFT TEST SETUP

At the completion of each of the test condition/step, verify the WLAN connection is not lost (no **Request timed out** messages in the DOS command window) at the laptop computers. If the Laptop with the Test Emulator disconnects or Time outs, reconnect that test laptop and repeat test condition under test. If the PDA with the Wi-Fi connection pinging the aircrafts Wi-Fi disconnects, reconnect and repeat test condition under test.

Relocate the aircraft to a location on the airfield where the engines maybe operated (idle power only) and the SATCOM antenna has a clear view of the satellite constellation. This is required for establishing a SATCOM phone call and for GPS NAV receiver system operation. Apply electrical power to the aircraft's electrical system.

1. Set-up the TCAS/ATC ramp test to simulate an intruding aircraft scenario (or use real aircraft targets). The intruding aircraft should approach from the left and slightly above the test aircraft if real aircraft targets are not used.
2. If installed, enter in the Flight Management (in Both FMSs) an active flight plan so that navigation data may be displayed on the navigation displays/indicator for testing.
3. If applicable, start the APU and bring its generator on-line.

Close all cabin and cargo doors. Electrical cords may be routed through the cockpit side window to power test equipment.

1. Make sure the following systems are operational (See table below):

Table 3 – Aircraft Systems

a. Compass	q. Terrain Awareness and Warning System (TAWS or EGPWS)
b. Standby Instruments	r. Weather Radar System
c. Air Data Computing System	s. Passenger Address (PA) System
d. Radio Altimeter System	

e. TCAS/ACAS System f. Flight Management System (if installed) g. Autopilot/Flight Director System h. Electronic Flight Instrument System (EFIS) / Navigation Data Indicators i. VHF Communication System j. HF Communication System (if installed) k. Automatic Direction Finder (ADF) System l. VHF Navigation System m. GPS Navigation System (if installed) n. Distance Measuring System (DME) o. In-Flight Entertainment (IFE) System (if installed) p. Fuel Quantity Indicating System (FQIS)	t. Aircraft Hydraulic System(s) u. Pitot and Static Anti-ice System v. Window and Windshield Anti-ice System w. Landing Lights, and Taxi Lights x. Position Lights (strobe) y. Anti-collision Lights z. Cockpit lights and Passenger compartment lights (if applicable) - aa. Engine/APU Fire Detection System - bb. Slat/Flap Position indicator(s) - cc. Pitch Trim System - dd. Stall Warning System - ee. Cockpit Voice Recorder - ff. Engine Instruments - gg. SATCOM (if installed) - hh. Caution/Warning Systems ii. Landing Gear Indicators - jj. Pressurization System
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3.5.3 EMC TEST

Special notes before Proceeding:

This test will be conducted in two phases.

The first phase of testing requires set up and use of the above test set up so the Router Wi-Fi is operating and the Test PEDS are located and operating in each zone. Simply verify the units are pinging the aircraft Wi-Fi (WAP).

The second phase requires aircraft systems testing. With the Transmitter Emulator (TE) located in the aircraft and operating, test the various systems.

Ensure each Transmitter Emulator (TE) is emitting RF, observe the TX Red LED for sporadic illumination (random frequent flashes). The illumination indicates proper operation. The RX Green LED will be continuously illuminated. Note RF hazards of personnel in close proximity to the transmitting antenna.

Use the EMC Test Matrix and place the TE in each of the zones and test per the frequency and channels.

Check the boxes to track completed sections. This is to be used in conjunction with the following section.

Following the Test Matrix is the sign off portion. This is used on conjunction with the Test Matrix. This procedure is used to verify the source (TE) does not affect the victim (Aircraft System). After all tests are completed, mark with PASS, FAIL or NA and include any comments.

If a system is not installed place a N/A on the comment line of the test condition.

An optional approach may be to consider what can be accomplished in the hanger with power cart and what needs to be accomplished on the ramp, what tests need to be run with the APU, and what tests need to be run with engines running.

3.5.4 EMC Test Matrix

Using the data from Appendix E, markup the following Table -4. (Reference Section 2 for more detailed instructions)

Notes: Frequency Band: (1) = 2.4 to 2.48 GHz, (2) = 5.25 to 5.35 GHz
Zones: (1) Cockpit, (2) Forward Cabin, (3) Aft Cabin
TE (Transmitting Emulator)

Table 4 – EMC TEST MATRIX

Frequency Band		1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	
Channel		3	3	3	6	6	6	11	11	11	3	3	3	6	6	6	11	11	11
Location		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Victim	Source	TE-1	TE-2	TE-3	TE-1	TE-2	TE-3	TE-1	TE-2	TE-3	TE-1	TE-2	TE-3	TE-1	TE-2	TE-3	TE-1	TE-2	TE-3
	Aircraft Trim Systems																		
	Flight Management System																		
	Warning and Caution Systems																		
	Fire Detection System																		
	Radio Altimeter System																		
	Aircraft Stall Computer System																		
	EGPWS/TAWS																		
	Transponder System																		
	TCAS/ACAS System																		
	Cockpit Audio System																		
	VHF Comms																		
	HF Comms																		
	GPS Reception																		
	ADF Receivers																		
	DME Transceivers																		
	VOR Receivers																		
	Localizer/Glideslope Receivers (ILS)																		
	Marker Beacons																		
	Autopilot/Flight Director																		
EFIS																			
Standby Instruments																			
Compass																			
Aircraft Lighting																			

Note EMC Test Matrix is continued on next page.

Table 4 (Continued)

[illegible]

Please use the space below for any comments:

[illegible]

3.5.5 EMC Testing

The following provides testing requirement details and the pass / fail criteria. If the system does not need to be tested write N/A in the Comment section and strike out the Pass / Fail Row. If your system is different please note here also.

See example below:

PASS		FAIL	
COMMENTS: N/A			

TRIM SYSTEMS

Exercise/operate the primary and secondary pitch trim, tailplane emer (Horz Stab trim), aileron trim, and rudder trim. While operating the TE per the matrix, verify that there are no adverse effects to trim operation or indication.

PASS		FAIL	
COMMENTS:			

FLIGHT MANAGEMENT SYSTEMS

Initialize and set-up a flight plan on FMS No. 1 & 2 while operating the TE per the matrix and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

WARNING & CAUTION SYSTEM

Press the Warning & Caution Panel TEST (Check operation with both BRIGHT and DIM switch selections) switch while operating the TE per the matrix. and verify that there are no adverse effects. Verify no erroneous warning while operating the TE per the matrix.

PASS		FAIL	
COMMENTS:			

FIRE DETECTION SYSTEM

Perform a self-test of the Fire Detection System using the rotary switch panel in the overhead while operating the TE per the matrix and verify that there are no adverse effects and the Fire Detect Fail annunciators do not illuminate.

PASS		FAIL	
COMMENTS:			

RADIO ALTIMETER

Observe the RAD ALT indication while performing a RAD ALT test (via Pilot and Copilot Test Switches). While operating the TE per the matrix and during the self test, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

STALL COMPUTER

Observe the Stall Indicators while operating the TE per the matrix and verify that there are no adverse effects. Perform a STALL self test and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

EGPWS/WINDSHEAR

Perform an EGPWS self-test (TAWS) and verify no adverse effects while the TE is operating per the matrix. Verify proper operation on the EGPWS/Windshear (nuisance alerts).

PASS		FAIL	
COMMENTS:			

TRANSPONDER

On the Pilot's RTU set Transponder 1 & 2 code to 1200 and select the Transponder from STBY to ON. Press the IDENT switch for Transponder 1 and verify that the Ident is observed by a Transponder tester while operating the TE is operating per the matrix, repeat with Transponder 2. Return the Transponders to STBY.

PASS		FAIL	
COMMENTS:			

TCAS

Verify that the operation of the TCAS (using real aircraft target or test equipment) is not affected by the operation of the TE per the matrix. (nuisance targets or alerts).

PASS		FAIL	
COMMENTS:			

COCKPIT/CABIN AUDIO

Establish interphone (select both Pilot & Copilot Audio panels to S.T. & C'PIT for interphone) communications between the pilot and copilot. Verify that there are no adverse effects while operating the TE per the matrix, perform a cockpit to Cabin Page while operating the TE per the matrix, and verify the audio is clear and audible.

NOTE: Verify operation with all MIC Sources (including Oxygen Mask MIC)

PASS		FAIL	
COMMENTS:			

VHF COMMS

Transmit on each VHF Comm while operating the TE per the matrix and verify that there are no adverse effects. Test on the five (5) frequencies listed below. VHF COM hand held or local tower may be used to verify proper transmission. Assure frequencies are clear prior to transmission. Limit transmissions to less than five seconds.

Frequencies:

118.000	120.000	122.725	133.975	135.000
MHz	MHz	MHz	MHz	MHz

Note: Local frequencies that are close to the below test frequencies may be used. Frequencies used must be recorded below.

Alternate Frequencies Tested:

While operating the TE per the matrix, monitor all of the VHF COM frequencies at 1 MHz increments from 118.000 MHz to 136.975 MHz for broken squelch. Verify that there are no adverse effects.

COM 1 / COM 2 / COM 3

118.0, 119.0, 120.0, 121.0, 122.0, 123.0, 124.0, 125.0, 126.0, 127.0, 128.0, 129.0, 130.0, 131.0, 132.00, 133.00, 134.0, 135.0, 136.0 and 136.975

PASS		FAIL	
COMMENTS:			

H.F. COMMS

Transmit for less than twenty seconds on the 2 HF frequencies using HF #1 and HF #2 (if installed) while operating the TE per the matrix, and verify that there are no adverse effects.

5100.0 MHz AM, 12111.1 MHz (Listed for example)

Note: Local frequencies test frequencies may be used. Frequencies used must be recorded below.

Alternate Frequencies Tested:

While operating the TE per the matrix, monitor the following HF COM frequencies on HF #1 and HF #2 for broken squelch. Verify that there are no adverse effects. NOTE: The squelch level may need to be adjusted for each frequency.

2.851 MHz 3.281 MHz 6.640 MHz 8.933 MHz 10.075 MHz

11.342 MHz 13.348 MHz 17.925 MHz 21.931 MHz

PASS		FAIL	
COMMENTS:			

GPS(s)

While operating the TE per the matrix, select display the status pages of the GPS systems and verify normal operation of the GPS system and that the reception is not affected.

PASS		FAIL	
COMMENTS:			

ADF RECEIVERS (s)

Tune ADF receivers to a local frequency and select ADF bearing pointers for display. Monitor ADF pointers for accuracy and listen to ADF audio verify that there are no adverse effects while operating the TE per the matrix.

PASS		FAIL	
COMMENTS:			

DME TRANSCEIVER(s)

Using a local VOR (or test equipment) and selecting the VOR HOLD Function, verify that the distance indication of the DME is accurate and not affected by the operation of the TE per the matrix,

PASS		FAIL	
COMMENTS:			

VOR (s)

Tune the NAV receivers to the ramp tester frequency, select the VHF NAV as navigation source and verify that there are no adverse effects to VOR indications on the EFIS system. Slew CDI via the test set and verify needles move appropriately. While monitoring the NAV audio, verify that the operation of the TE per the matrix, does not affect the NAV audio. Recommend three (3) frequencies (Low/Mid/High)

Note Frequencies used: _____, _____, _____.

PASS		FAIL	
COMMENTS:			

LOCALIZER/GLIDESLOPE

Tune the NAV receivers to the ramp tester frequency, select the VHF NAV as navigation source and verify that there are no adverse effects to ILS indication on the EFIS system. Slew Localizer and glideslope needles via the test set and verify needles move appropriately. While monitoring the NAV audio, verify that the operation of the TE per the matrix, does not affect the NAV audio. Recommend three (3) frequencies (Low/Mid/High)

Note Frequencies used: _____, _____, _____.

PASS		FAIL	
COMMENTS:			

Marker Beacons (OM, MM & IM)

Using the test equipment, simulate a Marker Beacon signal for OM, MM and IM. While monitoring the Marker Beacon (OM, MM & IM) indications and audio, verify that the operation of the TE per the matrix, does not affect the Marker Beacon indications and audio.

PASS		FAIL	
COMMENTS:			

AUTOPILOT / FLIGHT DIRECTOR

Engage the autopilot & yaw damper and couple (check both couple side 1 and then side 2) to the ILS system. Slew Localizer and glideslope needles via the test set and verify needles move appropriately and the autopilot/flight director track appropriately. Verify that the operation of the TE per the matrix does not affect on the operation of the autopilot / FD.

PASS		FAIL	
COMMENTS:			

EFIS

Observe the EFIS displays (Pitch, Roll, Heading, Heading pointers & etc indications) for any abnormalities while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

STANDBY ALTITUDE, AIRSPEED & ATTITUDE IND.

Monitor the standby altitude, airspeed and attitude indicators while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

STAND BY COMPASS

Observe the stand-by compass display for any abnormalities while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

AIRCRAFT LIGHTING

Turn on all aircraft lighting: Landing Lights, Strobe Lights, Beacon Lights, NAV Lights, Pulsating & Recognition Lights, and monitor for anomalies.

PASS		FAIL	
COMMENTS:			

COCKPIT LIGHTING

Operate the pilot and copilot cockpit lights (Overhead, Instruments, Side/Center, C/B Panel test controls/switch) and dimming while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

COCKPIT VOICE RECORDER (CVR)

Connect a standard aircraft headset to the CVR Headset jack and monitor the CVR audio. On the CVR PANEL press the TEST button. Verify Audio tone (with clicking which means that the CVR is switching to different MICs). Speaking normally into the Cockpit MIC and verify cockpit audio is heard. While operating the TE per the matrix, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

CLOCK

Observe the operation of the Pilots and Copilots clock for any anomalies while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

EMERGENCY LIGHTING

With main aircraft batteries on, place Emergency Lights Switch to ON. Verify that all Exit signs and Emergency lighting illuminate. While operating the TE per the matrix, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

IFE (If installed)

Operate the Airshow system and Monitors. Verify normal operations with the IFE.

PASS		FAIL	
COMMENTS:			

DEFIBULATOR (If installed)

Operate the Defibulator. Verify normal operation and normal voice features (if voice features are available). While operating the TE per the matrix, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

Pull L & R Static heater and L & R Pitot Heat circuit breakers located in the respective overhead bus prior to connecting the Pitot Static Tester to the aircraft.

Connect a Pitot Static Tester to the pilot and copilot Pitot Static Ports. Set the Tester to 10kft, 250kts.

AIR DATA

Verify normal AIR DATA (ALT, A/S, MACH & VS) on pilot's and copilot's ALT, A/S, MACH & VS indicators. Also verify standby Altimeter and Airspeed indicators. While operating the TE per the matrix, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

ALTITUDE PRESELECTOR

Verify normal Altitude Preselector operation. Select Preselector to 1000 feet above the altitude observed (@29.92). Move the Altimeters Baro Adjustment knob until the Altimeter altitude reaches the Preselector altitude. Verify that the Altitude Preselector audio warns that the altitude is captured. (Alternate test method - the Pitot/Static tester may be used to show the Altitude capture). Couple side 1 and side 2 for the system to operate. While operating the TE per the matrix, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

With the aircraft outside, taxi the aircraft engines at idle and test the following test conditions:

THRUST REVERSER SYSTEM (if installed)

Deploy T/Rs. Verify normal deploy, Lock and Unlock indications. Verify that operating the TE PER THE MATRIX, does not interfere with T/R operation.

PASS		FAIL	
COMMENTS:			

HYDRAULIC EQUIPMENT

Exercise/operate the Air Brake and Slats/Flaps and Standby pump. Verify normal Hydraulic system indications (Qty & Pressure). Verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

FUEL SYSTEMS

Exercise/operate the Booster Pumps, Xfer Pumps, Xfer Valves and Cross Feed Valves. Verify no adverse effects. Verify associated annunciators illuminate when pumps and transfer is activated.

PASS		FAIL	
COMMENTS:			

FUEL QUANTITY INDICATING SYSTEMS

Monitor the Fuel Quantity indicators while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

GENERATORS

Select one Generator off and on at a time. Repeat for the other generator. Monitor the generator systems while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

ANTI-ICE SYSTEMS

Exercise/operate anti-ice systems (**Pay attention!!** Quickly operate system while complying with system limitations. Refer to GAC MM for operation.): Pilot and Copilot Windshield Heat, Airframe Heat, Pilot and Copilot Pitot Heat, and Eng 1 Inlet heat and Eng 2 Inlet heat while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

WEATHER RADAR SYSTEM

Exercise the Wx mode of the Weather Radar System while operating the TE per the matrix, and verify that there are no adverse effects such as false returns. (*Warning cones or caution tape should be placed in front of the aircraft at least a 5 foot radius. Ensure that all personal are not in front and to the cockpit sides of the aircraft when performing Weather Radar testing.*)

PASS		FAIL	
COMMENTS:			

CABIN CLIMATE EQUIPMENT

Exercise/operate the Air Conditioner & Bleed Air system (Cold & Hot), while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

CABIN PRESSURIZATION

Exercise the Cabin pressurization system. Verify that the aircraft pressurizes, while operating the TE per the matrix, and verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

Taxi Aircraft to a FOD free area on the field for Takeoff power Engine runs. Ensure the Wind component complies with the engine manufacturing wind component limitations.

ENGINE OPERATION (@Reduced T/O power)

Ensure area for engine run operation is clear of FOD. Advance power on the 1 Engine to a reduced Takeoff thrust (approx. 94.0%) setting. Stabilize for 30 secs. Observe Engine for normal operation and all Engine Indications. Select 1 Engine to Idle. Repeat test for the Engine 2. While operating the TE per the matrix, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

APU OPERATION (IF INSTALLED)

Start the APU. Select/verify the APU Generator to ON. Check normal APU indications (N1, T5 & AMPS) Select the APU GEN OFF. While operating the TE per the matrix, verify that there are no adverse effects.

PASS		FAIL	
COMMENTS:			

OTHER TESTS PERFORMED

Perform any other test deemed necessary while operating the Passenger Entertainment System. (Attach additional pages if necessary)

After test all test are completed, reset all circuit breakers and reconfigure the Aircell system as necessary.

COMMENTS

Provide any comments as desired below: (attach additional pages if necessary)

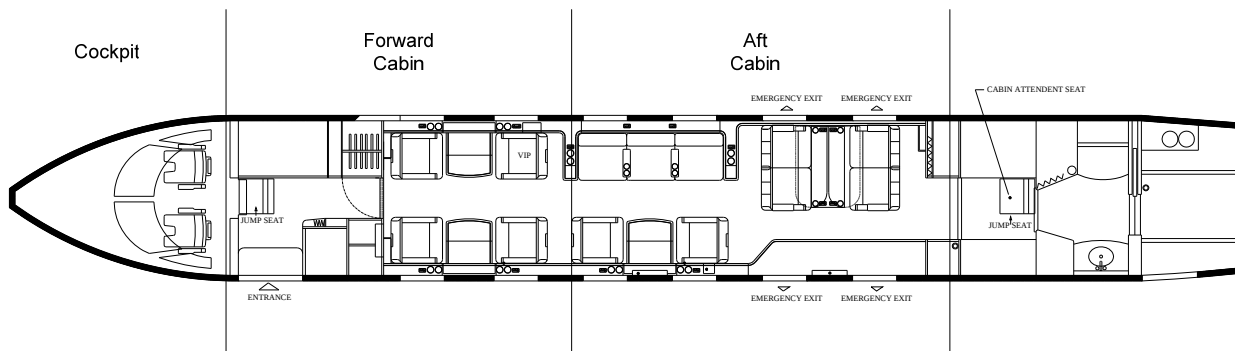
SIGN OFF

When you are satisfied with the performance of all systems, print your name, date and sign off the title page (1) of this test plan.

END OF TEST

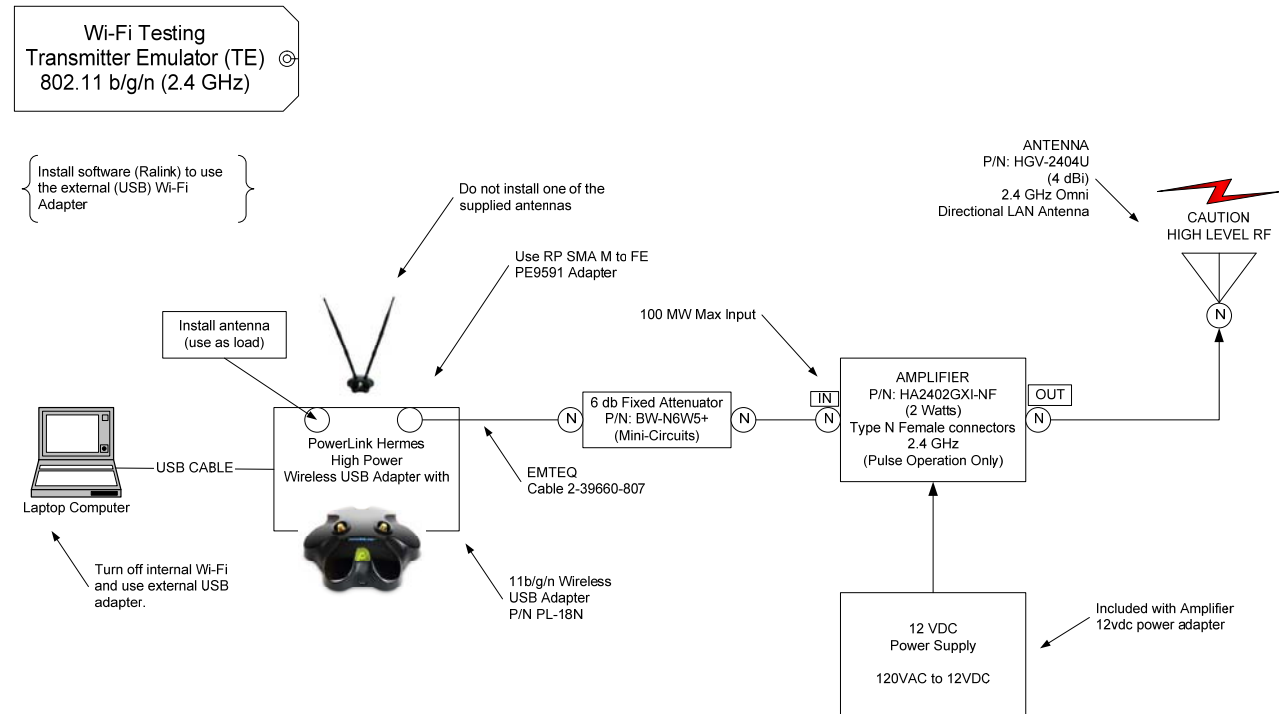
4. APPENDIX A (Test Locations)

Appendix A identifies the locations of the location of the test signals. There are three (3) test locations. They are the Cockpit (Zone 1), Forward Cabin (Zone 2), and Aft Cabin (Zone 3).



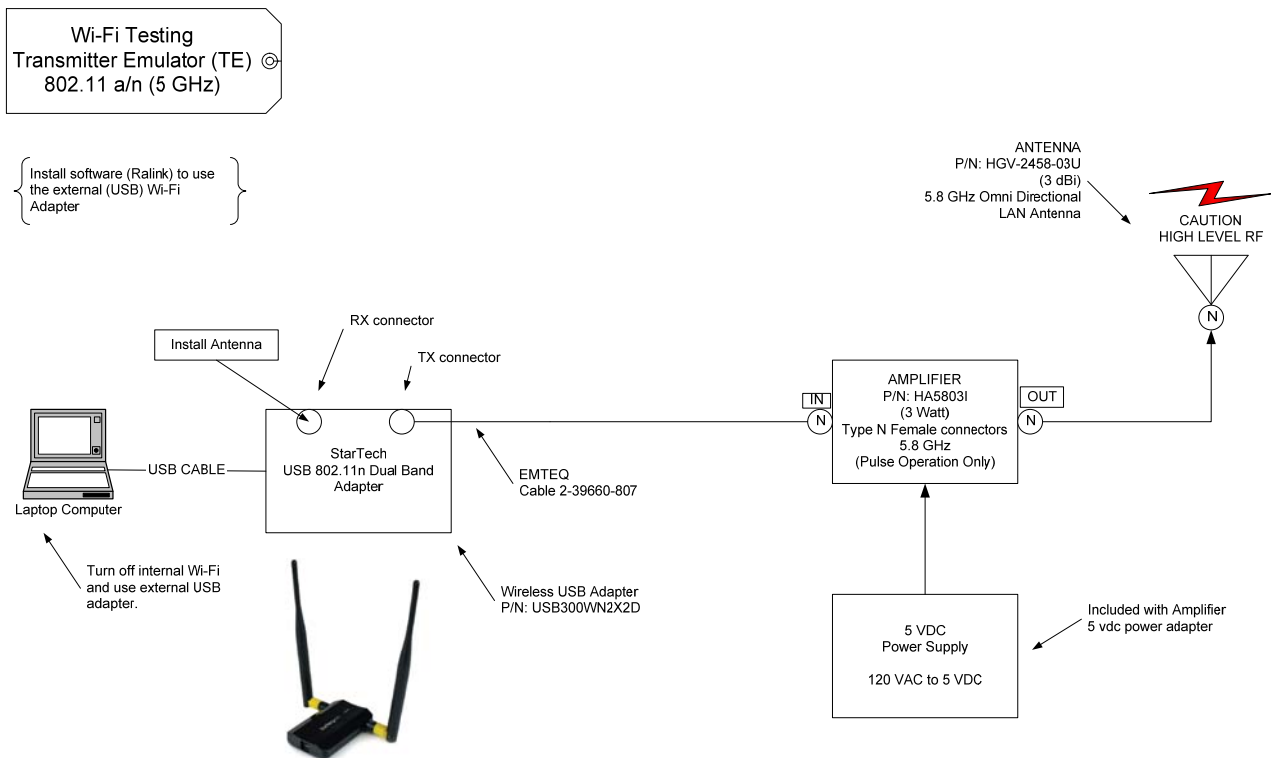
5. APPENDIX B (2.4 GHz Transmitter Emulator)

Appendix B identifies 802.11 b/g/n (2.4GHz) Transmitter Emulator



6. APPENDIX C (5 GHz Transmitter Emulator)

Appendix C identifies 802.11 a/n (5 GHz) Transmitter Emulator



7. APPENDIX D (Acronyms)

Appendix D identifies all acronyms and abbreviations used in this document.

ACAS	Aircraft Collision Avoidance System	MM	Middle Marker
ADF	Automatic Direction Finder	NAV	Navigation
APU	Auxiliary Power Unit	N/A	Not Applicable
ATC	Air Traffic Control	OM	Outer Marker
ATT	Attitude	PA	Passenger Address
A/S	Airspeed	PC	Personnel Computer
C/B	Circuit Breaker	PDA	Personal Digital Assistant
COMM	Communications	PED	Portable Electronic Device
CVR	Cockpit Voice Recorder	RAD ALT	Radio Altimeter
dB	Decibel isotropic	RF	Radio Frequency
DME	Distance Measuring Equipment	RTU	Radio Tuning Unit
DMU	Data Management Unit	RX	Receiver
EFIS	Electronic Flight Information System	SATCOM	Satellite Communications Systems
EGPWS	Enhance Ground Proximity Warning System	STC	Supplemental Type Certificate
EIRP	Effective Isotropic Radiated Power	SBB	Swift Broad Band
EMC	Electromagnetic Compatibility	TBD	To Be Determined
EFIS	Electronic Flight Instrument System	TCAS	Traffic Collision Avoidance System
EMI	Electromagnetic Interference	TE	Transmitting Emulator
FAA	Federal Aviation Administration	T/O	Take Off
FD	Flight Director	T-PED	Transmitting Portable Electronic Device
FDR	Flight Data Recorder	T/R	Thrust Reverse
HDG	Heading	TX	Transmitter
FMS	Flight Management System	USB	Universal Serial Bus
FQIS	Fuel Quantity Indicating System	VHF	Very High Frequency
GHz	Gigahertz	VOR	VHF Omnidirectional Range
GPS	Global Positioning System	VS	Vertical Speed
HF	High Frequency	WAP	Wireless Access Point
IEEE	Institute of Electrical and Electronics Engineers	Wi-Fi	Any wireless local area network
IFE	In Flight Entertainment	WLAN	Wireless Local Area Network
ILS	Instrument Landing System	WPAN	Wireless Personal Area Network (*)
IM	Inner Marker	WWAN	Wireless Wide Area Network
LAN	Local Area Network		
L & R	Left and Right		
MHz	Megahertz		
MKR	Marker Beacon		

(*) Blue Tooth 802.15

8. APPENDIX E (Equipment List)

Appendix E identifies all equipment tested for the original STC. Compare your aircrafts equipment list for any differences. If the equipment is different insert the correct Model/Part number and check the box (X) for "Testing Required". If your equipment is the same, no need to test the equipment. If more room is need to identify your equipment tested, add additional sheets as required and attach to the completed test form for record keeping of what equipment was tested with the emulators.

This Appendix may be revised at a later date to incorporate more equipment, once tested.

Items marked "TBD" (To Be Determined) identifies equipment expected to be tested in the future, but have not been tested or incorporated in this revision of the EMC Test Plan 13GT-001.

Aircraft Base Line Equipment List for this STC is Gulfstream G-IV S/N: 1017.

Identify the aircraft Make/Model/Serial No.: _____

System	Description	QTY	Model	Part Number	Testing Required (X)
Power Plant	Rolls Royce Tay	2	Mark 611-8		N/A
Power Plant	Full Authority Digital Engine Control (FADEC)				N/A
Power Plant	Engine Instruments (Primary)				N/A
APU	Honeywell	1	GTCP36-150		N/A
Hydraulic Power	Hydraulic Systems Combined/Flight	1			N/A
Engine Indications	Data Acquisition Unit	2	DA-884	7007580-901	N/A
Flight Controls	Hydraulic Power				N/A
Electrical Power	Emergency Light Batteries	2		1159SCAV402-1	N/A
Electrical Power	Standby Electrical Power Generator	1		63195	N/A
Standby Inst.	Standby Airspeed	1		44105-K2013	N/A
Standby Inst.	Standby Altimeter	1		44707-B2261	N/A
Standby Inst.	Standby Horizon	1		H341AUM	N/A
Standby Inst.	Standby Engine Indicator	1		1159SCF412-11	N/A
Standby Inst.	Standby Electrical Power Indicator	1		1159SCF417-1	N/A
Fire Protection	Smoke Detector (Baggage)	1		30-231-20	N/A
Indicating/Recording	Audible Tone System	1		1159SCAV370-2	N/A
Indicating/Recording	Micro Quick Access Recorder	1			
CVR	Cockpit Voice Recorder	1	A100	93-A100-30	N/A
FDR	Flight Data Recorder	0			
ATT/HDG/NAV	Laseref II Inertial Reference Unit	3		HG1075AE04	N/A
ATT/HDG/NAV	Mode Select Unit	1		CG1227AC01	N/A
NAV	Flux Valve			520-8030-001	
EFIS (SPZ-8400)	Aircraft S/N 1252 + and or ASC-345		SPZ-8400		TBD
EFIS (SPZ-8000)	Digital Automated Flight Control System		SPZ-8000	System Name	N/A

EFIS (SPZ-8000)	Display Unit	6	DU-880	4053000-901	N/A
EFIS (SPZ-8000)	Symbol Generator	3	SG-884	7008570-905	N/A
EFIS (SPZ-8000)	Display Controller	2	DC-884	7007540-946	N/A
EFIS (SPZ-8000)	Fault Warning Computer	2	FC-880	7007484-905	N/A
EFIS (SPZ-8000)	Data Acquisition Unit	2	DA-884	7007580-901	N/A
EFIS (SPZ-8000)	Dimming Panel	1	DP-884	7007543-902	N/A
EFIS (SPZ-8000)	Digital Air Data Computer	2	AZ-810	7000700-964	N/A
Flight Controls	Performance Computer	2	PZ-800	7004609-930	N/A
Flight Controls	Servo	2	SM-600	4015373-704	N/A
Flight Controls	Trim Servo	1	TM-260	7000260-602	N/A
Flight Controls	Flight Guidance Computer	2	FZ-820	7003974-907	N/A
Flight Controls	Flight Guidance Panel (Controller)	1	GP-820	7007546-902	N/A
Flight Controls	Turn Pitch Controller	1	PC-880	7007990-902	N/A
Flight Controls	Autothrottle Servo	2	SM-810	7009025-913	N/A
Flight Controls	Stall Warning Computer	2		965-0041-036	N/A
Flight Controls	Performance Computer	2	PZ-800	7004609-925	N/A
Flight Management	FMS Controller Display Unit	2	CD-810	7007549-902	N/A
Flight Management	Data Loader	1	DL-900	7016600-902	N/A
Flight Management	FMS Navigation Computer	2	NZ-2000	7018879-01002	N/A
NAV	Digital Air Data Computer	2	AZ-810	7000700-964	N/A
NAV	GPS Receiver	2		HG2021GD02	N/A
NAV	Navigation Receiver	2	VIR-432	622-7194-201	N/A
NAV	DME Receiver	2	DME-442	622-7309-101	N/A
NAV	ADF Receiver	2	ADF-462	622-7382-101	N/A
NAV	Heads Up Display (if installed)				TBD
ATC	ATC Transponder	2	TDR-94D	622-9210-308	N/A
TCAS	Traffic Collision Avoidance System	1	RT-951	7517900-55002	N/A
EGPWS	EGPWS	1	MK-V	965-0976-003-218-218	N/A
Radio Altimeter	Radio Altimeter	2	RT-300	7001840-922	N/A
COMM	VHF Communication Transceiver	3	VHF-42()	822-1116-001	N/A
COMM	Intercom systems / Audio systems	2			
COMM	Audio Control Panel	2		522-2867-000	N/A
COMM	HF Transceiver	2	728U-2	622-5462-002	N/A
COMM	HF Control Panel	1	514-8	622-5463-001	N/A
COMM	HF Transceiver	2	HF-9032	622-8128-003	TBD
COMM	SELCAL	1		NA138-714A	N/A
COMM	PA Speaker Amplifier	1		M2060E	N/A

[illegible]

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