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DEPARTMENT OF DEFENSE

JOINT SPECTRUM CENTER

ANNAPOLIS, MARYLAND 21402

PREDATOR UAV LINE-OF-SIGHT DATA LINK TERMINAL RADIO FREQUENCY TEST PLAN

Prepared for

UAV Special Mission Office (ACC/DR-UAV)
216 Sweeney Blvd, Room 109
Langley AFB, VA 23665

JSC Project Engineer

Captain Heather White, USAF

AUGUST 2003

CONSULTING REPORT

Prepared by

Steve Bonter, Young Kim, and John Smith

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This report has been reviewed by the following Alion personnel:

STEVEN W. BONTER
Project Manager, Sentel

THOMAS L. SHANHOLTZ
Division Manager, Alion

This report is approved for publication.

SAMUEL G. CARBAUGH
Colonel, USAF
Chief, Acquisition Support Division
Joint Spectrum Center

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14. ABSTRACT

The Predator Unmanned Aerial Vehicle (UAV) line-of-sight (LOS) command link (CL) and return link (RL) frequency assignments permit simultaneous operations of four General Atomics Aeronautical Systems Incorporated (GA-ASI) Predator air vehicles at Indian Springs Air Force Auxiliary Field (ISAFAF). With increased operations of RQ-1/MQ-1 Predator and the introduction of MQ-9 Hunter-Killer (Predator B®) operations, a requirement was identified for simultaneous operations of seven Predator UAVs at ISAFAF and an eighth set of frequencies for ground test. The Air Combat Command UAV Special Mission Office (ACC/DR-UAV) requested that the Joint Spectrum Center (JSC) investigate ways to satisfy the eight Predator frequency requirement. The JSC, with support from Aeronautical Systems Center (ASC/RAB) and GA-ASI, will perform transmitter emission bandwidth, transmitter broadband noise, receiver sensitivity, receiver selectivity, receiver adjacent-signal rejection, and receiver gain compression measurements of the data link terminals. This test plan was developed to support the test efforts.

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GLOSSARY

ACC	Air Combat Command
ASC	Aeronautical Systems Center
BBN	Broadband Noise
BER	Bit Error Rate
CL	Command Link
CW	Continuous Wave
F_N	Noise Figure
FSK	Frequency Shift Keyed
GA-ASI	General Atomics Aeronautical Systems Incorporated
GCS	Ground Control Station
GDT	Ground Data Terminal
GPIB	General Purpose Interface Bus
HP	Hewlett Packard
ISAFAF	Indian Springs Air Force Auxiliary Field
JSC	Joint Spectrum Center
LNA	Low Noise Amplifier
LOS	Line-of-Sight
MDS	Minimum Discernable Signal
MER	Message Error Rate
NRZ	Non-Return to Zero
NTSC	National Television System Committee
PC	Personal Computer
PSIL	Predator Systems Integration Laboratory
RF	Radio Frequency
RL	Return Link
S/N	Signal-to-Noise Ratio
UAV	Unmanned Aerial Vehicle

SECTION 1 – INTRODUCTION

The Predator Unmanned Aerial Vehicle (UAV) line-of-sight (LOS) command link (CL) and return link (RL) frequency assignments permit simultaneous operations of four General Atomics Aeronautical Systems Incorporated (GA-ASI) Predator air vehicles at Indian Springs Air Force Auxiliary Field (ISAFAF). With increased operations of RQ-1/MQ-1 Predator and the introduction of MQ-9 Hunter-Killer (Predator B®) operations, a requirement was identified for simultaneous operations of seven Predator UAVs at ISAFAF and an eighth set of frequencies for ground test. The Air Combat Command UAV Special Mission Office (ACC/DR-UAV) requested that the Joint Spectrum Center (JSC) investigate ways to satisfy the eight Predator frequency requirements.

1.1 BACKGROUND

The JSC, with support from Aeronautical Systems Center (ASC/RAB) and GA-ASI, will perform transmitter emission power and bandwidth, transmitter spurious emissions, transmitter broadband noise, receiver sensitivity, receiver selectivity, receiver adjacent-signal rejection, and receiver gain compression measurements of the data link terminals. The test results will be utilized in the environmental and Predator LOS link siting analyses, to be documented separately. This testing will occur at either the GA-ASI Rancho Bernardo, California Predator systems integration laboratory (PSIL) or the GA-ASI El Mirage, California flight facility. This test plan was developed to support the test efforts.

1.2 OBJECTIVE

The objective of this task was to develop a test plan to conduct measurements to determine the radio frequency (RF) characteristics of the Predator UAV LOS data link terminal.

1.3 APPROACH

The JSC defined testing as one of the initial steps in investigating ways to satisfy the UAV LOS frequency requirement. The required measurements identified by the JSC and ASC/RAB were transmitter emission power and bandwidth, transmitter spurious emissions, transmitter broadband noise, receiver sensitivity, receiver selectivity, receiver adjacent-signal rejection, and receiver gain compression tests. Test block diagrams, descriptions, and data sheets were prepared for use during test execution.

SECTION 2 – SYSTEM DESCRIPTION

The Predator data link system provides command and control information from the ground control station (GCS) to the UAV using the CL and payload data and status information from the UAV to the GCS using the RL. The transmitter and receiver units can be software configured to perform CL or RL functions. Each Predator utilizes two CLs and two RLs. The CL-configured terminals transfer 16-bit messages, consisting of randomized 15-bit no return to zero (NRZ) data plus one parity bit at 19.2 kbps or 200 kbps using frequency shift keyed (FSK) modulation. The RL-configured terminals are capable of transferring either National Television System Committee (NTSC) video with data subcarriers at 6.8-MHz and 7.5-MHz offset or 3.2-Mbps FSK data without the subcarriers. The RL data is transferred using the message structure described for the CL.

The GCS contains computers, voice communications equipment, displays, user interfaces, and has accommodations for the pilot and payload operator. The GCS is connected to the ground data terminal (GDT), which consists of the antenna system, a diplexer, and a custom-built low noise amplifier (LNA). The diplexer permits full-duplex operation. The LNA is utilized to reduce the impact of long RF cable runs on the system noise figure (F_N). The GDT and UAV RF configurations are shown in Figure 2-1. The data link component RF characteristics are listed in Table 2-1.[2-1]

The dual UAV data link system contains transmitters, receivers, diplexers, and a shared computer. The diplexer permits full-duplex operation. Computer parity checks are performed to validate message data, to select the optimum CL, and to discard erroneous messages.

The UAV and GDT data link transmitter amplifier final stage can be software-controlled to switch between 1-mW and 10-W output power. The 1-mW low power mode is used for ground testing. The UAV transmitter will automatically revert to 10-W if the link can not be maintained at 1-mW.

Operators can monitor data link quality with a signal strength meter, a message error rate (MER) counter, and observed video quality. The signal strength meter is an uncalibrated gauge that reads between 0 and 100 at approximately 0.5-dB per unit. The MER counter is incremented if a message parity check fails and the message is discarded. Received video quality is a subjective measure as perceived by the operators.

[2-1] *Application for Equipment Frequency Allocation (DD Form 1494) for Predator C-Band MAE UAV Medium Altitude Endurance Unmanned Aerial Vehicle*, J/F-12/7253, Washington, DC: MCEB, 9 April 2003.

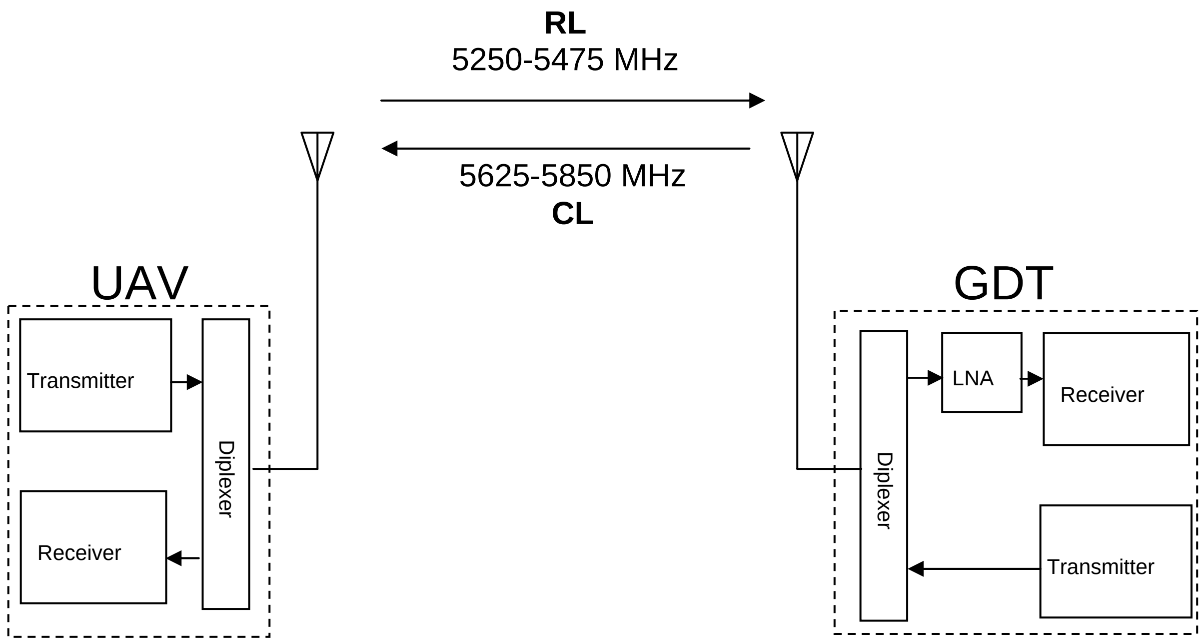


Figure 2-1. Predator System Configuration

Table 2-1. Technical Characteristics

Characteristics	Specifications			
Transmitter				
Tuning Range, MHz	5250-5850			
Tuning Increment, MHz	1 MHz			
Transmitter Power, dBm	40			
Spurious/Harmonic Attenuation dB	65			
Link Type	CL		RL	
Emission Designators	560KF1D	88K3F1D	17M0F9F	4M72F1D
Emission Bandwidth, MHz				
-3-dB	0.34	0.063	8.5	2.8
-20-dB	0.42	0.088	18.0	20.0
-40-dB	NA	0.219	NA	NA
-60-dB	1.2	0.671	46.2	66.0
Receiver				
Tuning Range, MHz	5250-5850			
RF Selectivity, MHz				
-3-dB	303			
-20-dB	375			
-60-dB	525			
1st IF Selectivity, MHz				
-3-dB	35			
-20-dB	55			
-60-dB	115			
Link Type	CL		RL	
2nd IF Selectivity, MHz				
-3-dB	1		20	
-20-dB	3.2		22.5	
-60-dB	4		28	
Sensitivity, dBm	-98	-98	-84	-86
Sensitivity Criterion	$1x10^{-6}$ BER[a]	$1x10^{-6}$ BER[a]	23-dB S/N[b]	$1x10^{-6}$ BER[a]
Noise Figure, dB	2			
Spurious Rejection, dB	50			
Diplexer				
Low-Band Port Frequency Band (MHz)	5250-5475			
Cross-Over Frequency Band (MHz)	5475-5625			
High-Band Port Frequency Band (MHz)	5625-5850			
GDT LNA				
Manufacturer	JCA Technologies			
Gain, dB	18			
Noise Figure, dB	1.8			

[a] Bit Error Rate (BER)
[b] Signal-to-Noise Ratio (S/N)

SECTION 3 – TEST PLAN

This test plan identifies the test schedule, the resources and requirements, and the test methodology.

3.1 SCHEDULE

The test event is scheduled for August 2003. Data reduction and documentation will be performed in August and September 2003.

3.2 RESOURCES AND REQUIREMENTS

The test team will require use of the test facility for up to five 12-hour days.

3.2.1 Responsibilities

The JSC will be responsible for the following:

- Develop the test plan
- Coordinate and ship test equipment
- Participate in the test team with GA-ASI and ASC/RAB personnel
- Setup and operate test equipment
- Record all test data
- Reduce the measured data
- Report on test results

GA-ASI will be responsible for the following:

- Provide test facilities
- Provide electrical power and cooling for the equipment under test
- Provide equipment under test
- Operate equipment under test
- Provide access to desired test points
- Provide technical support
- Participate in the test team with ASC/RAB and JSC personnel

ASC/RAB will be responsible for the following:

- Coordinate the efforts of JSC and GA-ASI
- Provide technical oversight
- Ensure test facility availability
- Provide two 500-ft rolls of RG-214 coaxial cable
- Participate in the test team with GA-ASI and JSC personnel

3.2.2 Personnel Requirements

The JSC will provide three engineers. GA-ASI will provide one technician. ASC/RAB will provide one engineer.

3.2.3 Equipment Requirements

The JSC is responsible for providing all measurement equipment. The required measurement equipment list is provided in Table 3-1.

GA-ASI is responsible for providing all equipment under test. The required equipment under test is identified in Table 3-2.

ASC/RAB is responsible for providing two 500-ft rolls of RG-214 double-shielded coaxial cable.

Table 3-1. JSC Equipment List

Parts List	Description	Quantity
Fixed attenuator	40-dB, 10 watts	2
Fixed attenuator	60-dB, 10 watts	1
Fixed attenuator	20-dB, 1 watt	2
Variable attenuator	0-100-dB, by decade, 1 watt	3
Variable attenuator	0-11-dB, by unit, 1watt	3
20-dB Directional Couplers	MECA 780-20-6.000	2
16-dB Directional Couplers	NARDA 3044B	2
Dummy load	50 ohms, 10 watts	1
Terminators	50 ohms, 1 watt SMA	4
RF coaxial cable	RG-214, various lengths	13
LNA	<5-dB F_N, 35-dB Gain, 3-6 GHz	1
Signal Generator	Hewlett Packard (HP) 8254A[a]	1
Spectrum Analyzer	HP 8563[a]	1
Laptop Computer	GPIB[b]-compatible software	1

[a] or similar, with operating frequency range covering 3.7-8.3 GHz
[b] General Purpose Interface Bus (GPIB)

Table 3-2. GA-ASI Equipment List

Parts List	Quantity
UAV Transceiver (including diplexer)	2
GDT Transceiver (including diplexer and LNA)	2
UAV Diplexers	2
GDT Diplexers	2
GCS half rack	2

Power supplies, cables, and cooling as required to power the transceivers, half rack, and LNA.

3.3 TEST METHODOLOGY

Test descriptions and setup block diagrams were prepared for transmitter emission bandwidth, transmitter broadband noise, transmitter spurious emissions, receiver sensitivity, receiver selectivity, receiver adjacent-signal rejection, and receiver gain compression measurements of the data link terminals.

Prior to conducting any measurements, the total system losses from the output of the unit under test to the spectrum analyzer input for each test configuration will be measured. The results of these measurements will be saved electronically; the file names of the plots are listed in Section 4 (Table 4-1).

3.3.1 Transmitter Characterization

The transmitter output power, emission bandwidth, spurious emissions (in the receive band), and broadband noise (in the receive band) measurements will be obtained by using the test configurations shown in Figures 3-1 and 3-2. The GDT transmitter will transmit at 5625 MHz, and the UAV transmitter will transmit at 5475 MHz. Transmitter output will be measured for each emission designator for in-band and out-of-band emissions for low-power and high-power modes. To protect the spectrum analyzer from burnout, the spectrum analyzer should be set for maximum internal attenuation, and then the internal attenuator will be reduced in 10-dB steps until the signal level measures approximately 10 dB below the reference level.

During in-band measurements, a 20-dB attenuator (or other value as appropriate) will be inserted between the transmitter and the spectrum analyzer, see Figure 3-1. Out-of-band measurements will utilize a diplexer as a band pass filter, see Figure 3-2, to reject the fundamental energy and enable an LNA to be used to increase the measurement dynamic range to measure the spurious emission and broadband noise (BBN) in the receive band.

The test will be conducted for four emissions: two emissions from the CL transmitter and two emissions from the RL transmitter. The plots will be saved electronically using the file names listed in Section 4 (Table 4-1).

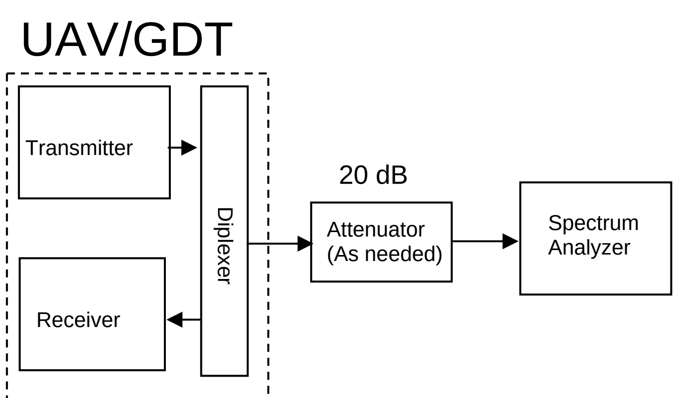


Figure 3-1. Transmitter Test Setup – In-Band Characterization

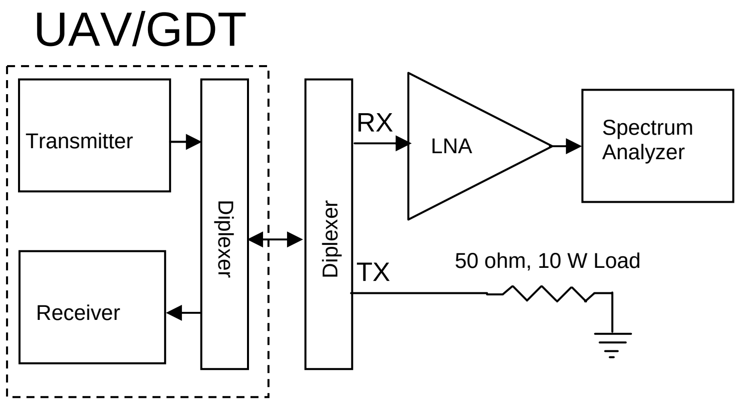


Figure 3-2. Transmitter Characterization Test Setup - Receive Band

3.3.2 Receiver Characterization

Receiver sensitivity, selectivity, adjacent signal rejection, and GDT LNA gain compression measurements will be performed. The testing will utilize a closed-system test configuration to obtain transmitter and receiver isolation. The test equipment configurations will utilize additional diplexers at each end of the path to enable independent control of the CL and RL isolations. These independent path losses are required to assure the results are dependent only on the link under test and not on the handshake message on the opposite link.

3.3.2.1 Receiver Sensitivity

The RL receiver sensitivity will be determined by using the test configuration shown in Figure 3-3. The unused ports on couplers 1, 3, and 4 must be terminated. Prior to conducting any measurements, the total measurement system losses from the UAV to the GDT (point A to point B in Figure 3-3) with the RL variable attenuator to 0-dB and the CL variable attenuator set to maximum will be measured. Also, the total measurement system losses from the UAV to the spectrum analyzer (point A to point C in Figure 3-3) will be measured. The results of the measurements will be saved electronically using the file names listed in Section 4 (Table 4-2A).

Before the test begins, a communications link will be established between the receiver and the transmitter on a frequency of 5250 MHz with the RL and CL variable attenuators set to 0-dB. The GDT receiver sensitivity test will be conducted for emissions 17M0F9F and 4M72F1D. For each test, the RL transmitter signal strength will be stepped down by 1-dB increments until the link is broken. The attenuation setting and the MER at each setting will be observed. The attenuation setting and MER for the last good link will be recorded (Section 4, Table 4-2B). Once the link is broken, the transmitter signal strength will be stepped up by 1-dB increments until the link is re-established. Then the attenuation setting and the MER will be recorded in Table 4-2B. These steps will be repeated for each combination (Section 4, Table 4-2B).

The CL receiver sensitivity will be determined by using the test configuration shown in Figure 3-4. The unused ports on couplers 1, 2, and 4 must be terminated. Prior to conducting any measurements, the total measurement system losses from the GDT to the UAV (point B to point A in Figure 3-4) with the CL variable attenuator to 0 dB and the RL variable attenuator set to maximum will be measured. Also, the total measurement system losses from the UAV to the spectrum analyzer (point B to point D in Figure 3-4) will be measured. The results of the measurements will be saved electronically, using the file names listed in Section 4 (Table 4-2A).

Before the test begins, a communications link will be established between the receiver and the transmitter on a frequency of 5625 MHz with the RL and CL variable attenuators set to 0-dB. The UAV receiver sensitivity test will be conducted for emissions 560KF1D and 88K3F1D. For each test, the CL transmitter signal strength will be stepped down by 1-dB increments until the link is broken. The attenuation setting and the MER at each setting will be observed. The attenuation setting and MER for the last good link will be recorded (Section 4, Table 4-2B). Once the link is broken, the transmitter signal strength will be stepped up by 1-dB increments until the link is re-established. Then the attenuation setting and the MER will be recorded in Table 4-2B. These steps will be repeated for each combination (Section 4, Table 4-2B).

3.3.2.2 Receiver Selectivity

The RL receiver selectivity test will be conducted for emissions 17M0F9F and 4M72F1D. The test setup is illustrated in Figure 3-5. The unused ports on couplers 3 and 4 must be terminated for this test. Prior to conducting any measurements, the total measurement system losses from the signal generator to the GDT (point F to point B in Figure 3-5) and from the signal generator to the spectrum analyzer (point F to point C in Figure 3-5) will be measured. The results of the measurements will be saved electronically using the file names listed in Section 4 (Table 4-3A).

Before the test begins, a communications link will be established between the receiver and the transmitter with the RL and CL variable attenuators set to 0-dB using emission designator 17M0F9F. The GDT receiver selectivity test will be conducted for emissions 17M0F9F and 4M72F1D. The signal generator will be tuned to the center frequency of the RL. The signal generator variable attenuator will be set to the maximum value.

The RL variable attenuator will be increased in 1-dB increments until the link is broken, and the variable attenuator setting will be noted. The RL variable attenuator will be decreased until the link is restored. The RL variable attenuator will be set 4 dB below where the link was broken. This is 3 dB above the minimal discernable signal (MDS+3 dB).

The signal generator variable attenuator will be decreased in 1-dB steps until the link is broken, and the signal generator variable attenuator setting will be recorded in Table 4-3B. The signal generator variable attenuator will be increased until the link is restored. The signal generator frequency will be increased in 2-MHz steps. These steps will be repeated until the test equipment dynamic range is exceeded. This will establish the selectivity curve for frequencies above the tuned frequency.

Repeat the test, this time tuning the signal generator below the RL tuned frequency.

Repeat the tests for emission designator 4M72F1D and record the data in Table 4-3C.

The CL receiver selectivity test will be conducted for emissions 560KF1D and 88K3F1D. The test setup is illustrated in Figure 3-6. The unused ports on couplers 1 and 2 must be terminated for this test. Prior to conducting any measurements, the total measurement system losses from the signal generator to the UAV (point H to point A in Figure 3-6) and from the signal generator to the spectrum analyzer (point H to point D in Figure 3-6) will be measured. The results of the measurements will be saved electronically using the file names listed in Section 4 (Table 4-4A). The procedures from the RL receiver selectivity test will be repeated using 200-kHz step sizes. The data will be recorded in Tables 4-4B and 4-4C.

3.3.2.3 Adjacent Signal Rejection

The RL and CL receiver adjacent signal rejection will be determined by using the test configuration shown in Figures 3-7 and 3-8.

For the RL adjacent signal rejection test, the unused ports on coupler 3 and coupler 4 must be terminated. A communications link will be established between the receiver and the desired transmitter. The desired signal transmitter will transmit at 5300 MHz. The input to the RL receiver will be adjusted to MDS+3-dB. The interferer transmitter will start transmitting at 5265 MHz. The interferer signal level will be increased until the desired link is broken. The interfering transmitter signal level at the spectrum analyzer will be recorded in Table 4-5. The desired link will be re-established by decreasing the power level of the interference source. The interference source frequency will be increased by 1 MHz, and the test will be repeated. The tests will be repeated, covering the frequency range of 5265 to 5335 MHz in 1-MHz steps. The 4 RL test combinations listed in Table 3-3 will be tested.

Table 3-3. RL Adjacent Signal Rejection Test Parameters

Test	Desired Link Emission Designator	EMI Emission Designator
1	4M72F1D	4M72F1D
2	4M72F1D	17M0F9F
3	17M0F9F	17M0F9F
4	17M0F9F	4M72F1D

For the CL adjacent signal rejection test, the unused ports on coupler 1 and coupler 2 must be terminated. A communications link will be established between the receiver and the desired transmitter. The desired signal transmitter will transmit at 5700 MHz. The input to the CL receiver will be adjusted to MDS+3 dB. The interferer transmitter will start transmitting at 5690 MHz. The interferer signal level will be increased until the desired link is broken. The interfering transmitter signal level at the spectrum analyzer will be recorded in Table 4-6. The desired link will be re-established by decreasing the power level of the interference source. The interference source frequency will be increased by 1 MHz, and the test will be repeated. The test will be repeated, covering the frequency range of 5690 to 5710 MHz in 1-MHz steps. The 4 CL test combinations listed in Table 3-4 will be tested.

Table 3-4. CL Adjacent Signal Rejection Test Parameters

Test	Desired Link Emission Designator	EMI Emission Designator
1	560KF1D	560KF1D
2	560KF1D	88K3F1D
3	88K3F1D	88K3F1D
4	88K3F1D	560KF1D

3.3.2.4 Receiver Gain Compression

The receiver gain compression test will be limited to characterizing the gain compression of the GDT LNA located between the antenna/diplexer and receiver. The LNA is used to compensate for losses that occur in the GDT cable run from the antenna and the receiver, which may be up to 500 feet. The test will be conducted utilizing the configuration illustrated in Figure 3-9.

The signal generator will be set to the RL center frequency with a –15-dBm output level. The signal generator variable attenuator will be set to the maximum value. The LNA output signal will be recorded. The signal generator variable attenuator will be decreased in 10-dB steps, with the LNA output level recorded at each step until the change in the LNA output level is less then 10 dB. The signal generator variable attenuator will be increased by 20 dB. The signal generator step attenuator will be decreased in 1-dB steps, with the LNA output level recorded for each step in Table 4-7.

The 1-dB gain compression point is a 10-dB change in the input level which produces a 9-dB change in the output level.

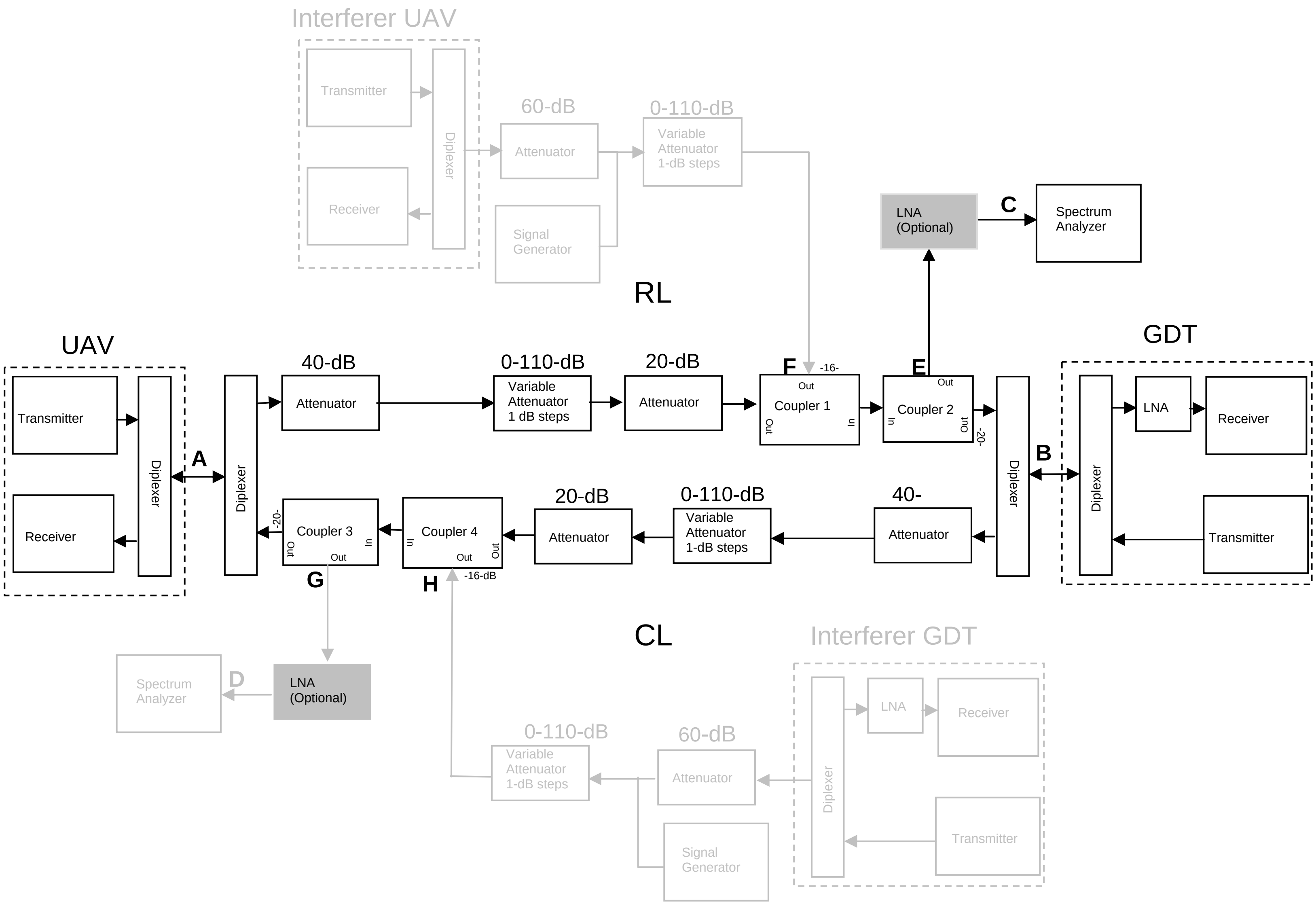


Figure 3-3. RL Receiver Sensitivity Test Setup

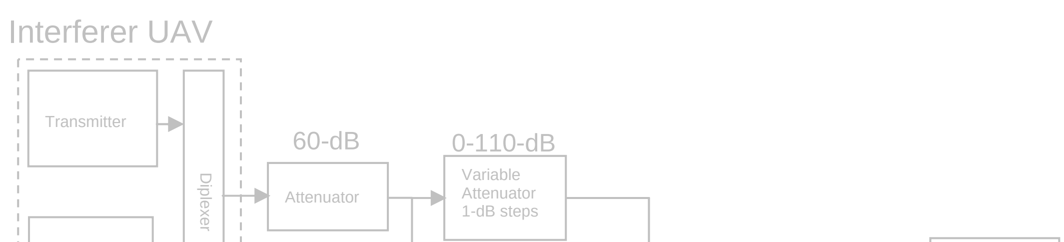
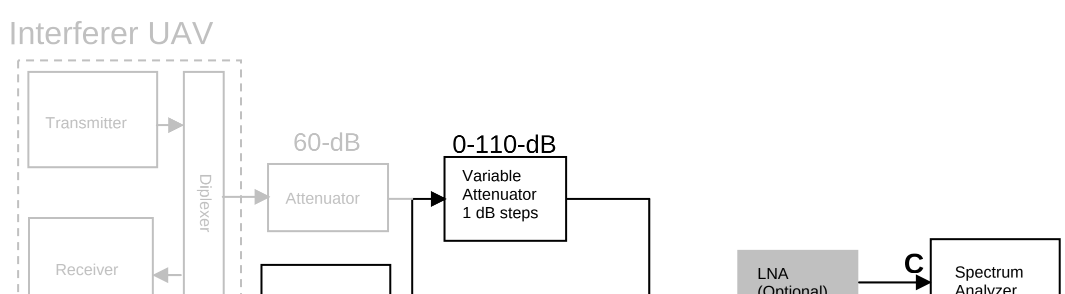


Figure 3-4. CL Receiver Sensitivity Test Setup



Out

Out

Figure 3-5. RL Receiver Selectivity Test Setup

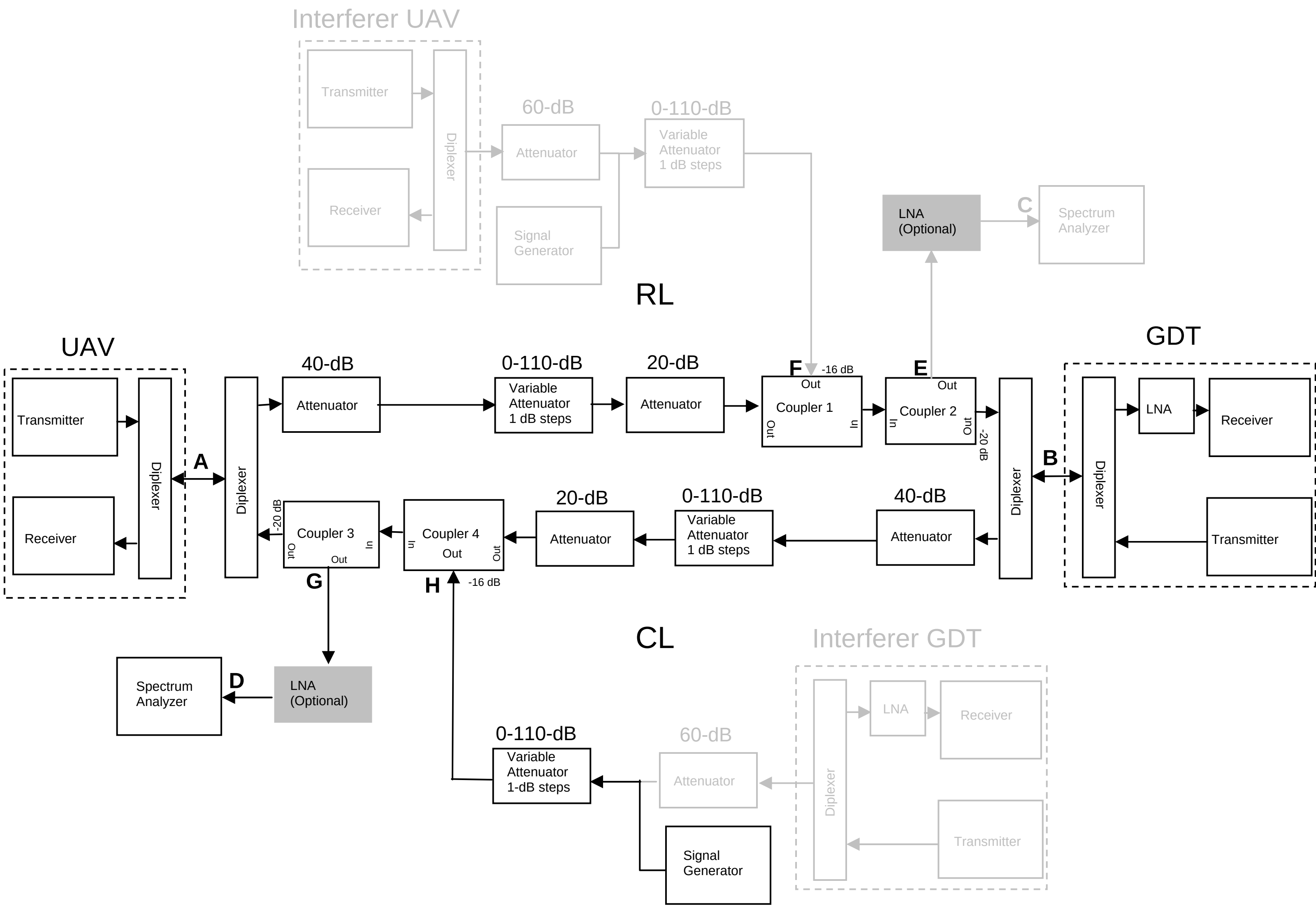


Figure 3-6. CL Receiver Selectivity Test Setup

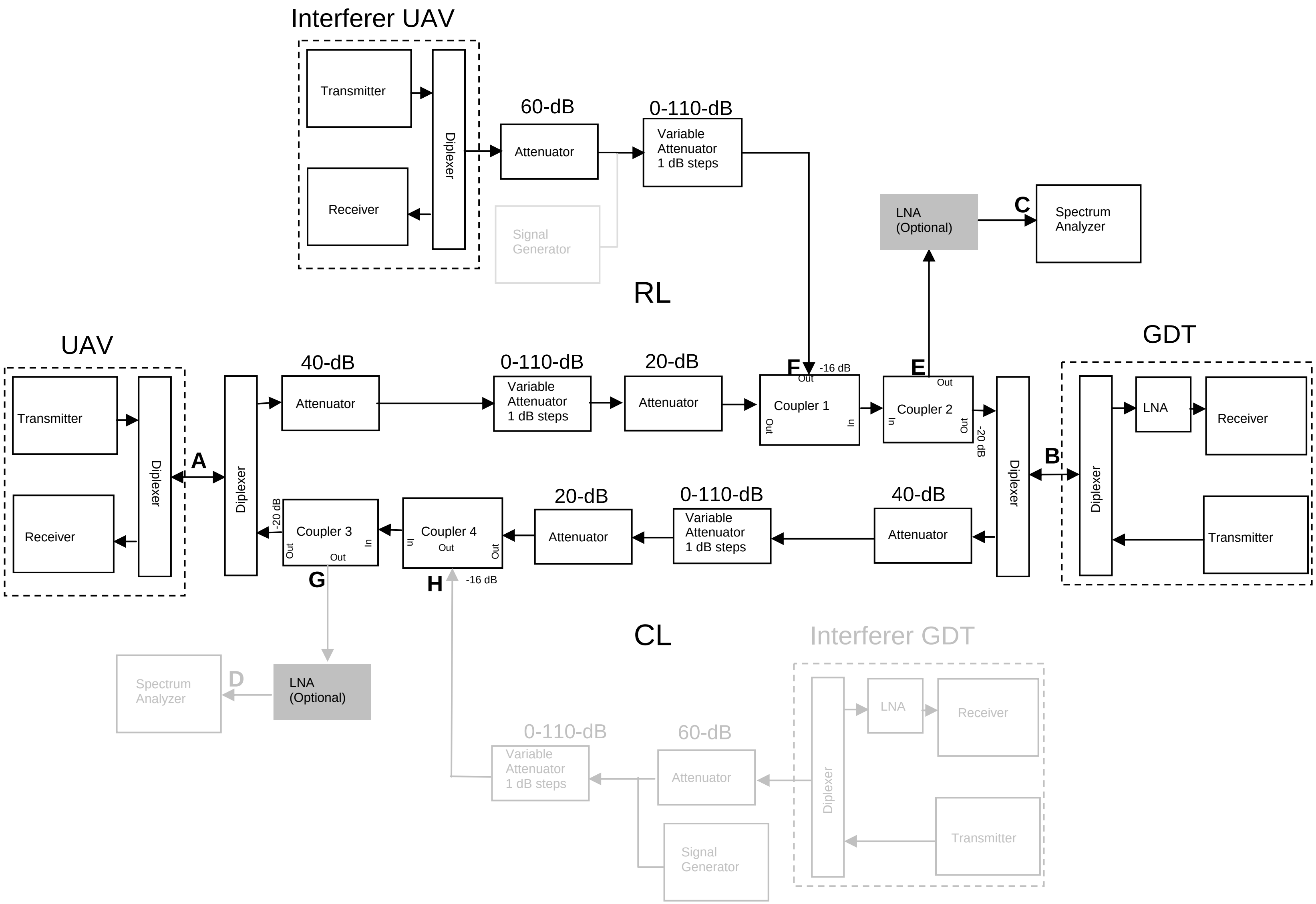
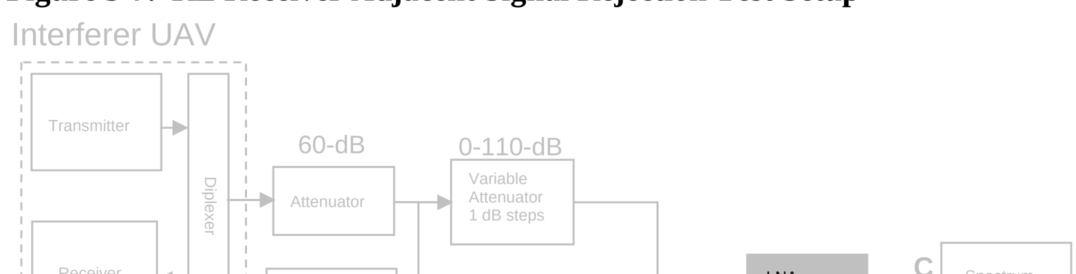


Figure 3-7. RL Receiver Adjacent Signal Rejection Test Setup



Out

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Figure 3-8. CL Receiver Adjacent Signal Rejection Test Setup

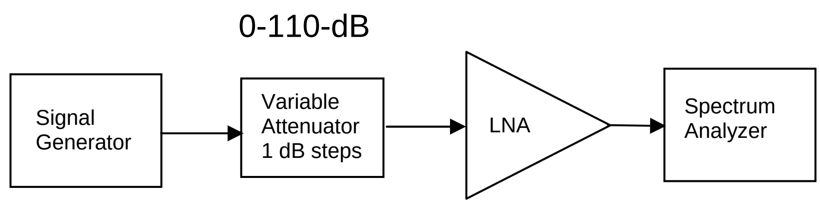

Figure 3-9. LNA Gain Compression Test Setup

SECTION 4 – TEST DATA SHEETS

Data Tables 4-1 through 4-7 will be used to record data during test execution.

Table 4-1. Transmitter Characterization File Names

Emission Plot	File name to be saved as
GDT Test Setup System losses low power in-band	Cal-GDT-lowpwr-inband
GDT Test Setup System losses high power in-band	Cal-GDT-highpwr-inband
GDT Test Setup System losses out-of-band	Cal-GDT-outofband
UAV Test Setup System losses low power in-band	Cal-UAV-lowpwr-inband
UAV Test Setup System losses high power in-band	Cal-UAV-highpwr-inband
UAV Test Setup System losses out-of-band	Cal-UAV-outofband
GDT with 560KF1D emission designator low power in-band	560K-5625-lowpwr-inband
GDT with 560KF1D emission designator low power out-of-band	560K-5625-lowpwr-outband
GDT with 88K3F1D emission designator low power in-band	88K3-5625-lowpwr-inband
GDT with 88K3F1D emission designator low power out-of-band	88K3-5625-lowpwr-outband
GDT with 560KF1D emission designator high power in-band	560K-5625-highpwr-inband
GDT with 560KF1D emission designator high power out-of-band	560K-5625-highpwr-outband
GDT with 88K3F1D emission designator high power in-band	88K3-5625-highpwr-inband
GDT with 88K3F1D emission designator high power out-of-band	88K3-5625-highpwr-outband
UAV with 17M0F9F emission designator low power in-band	17M0-5475-lowpwr-inband
UAV with 17M0F9F emission designator low power out-of-band	17M0-5475-lowpwr-outband
UAV with 4M72F1D emission designator low power in-band	4M72-5475-lowpwr-inband
UAV with 4M72F1D emission designator low power out-of-band	4M72-5475-lowpwr-outband
UAV with 17M0F9F emission designator high power in-band	17M0-5475-highpwr-inband
UAV with 17M0F9F emission designator high power out-of-band	17M0-5475-highpwr-outband
UAV with 4M72F1D emission designator high power in-band	4M72-5475-highpwr-inband
UAV with 4M72F1D emission designator high power out-of-band	4M72-5475-highpwr-outband

Table 4-2A. Sensitivity Test File Names

Emission Plot	File name to be saved as
UAV to GDT Test Setup System losses Point A to Point B	Cal-UAV-GDT-A-B
UAV to GDT Test Setup System losses Point A to Point C	Cal-UAV-GDT-A-C
GDT to UAV Test Setup System losses Point B to Point A	Cal-GDT-UAV-B-A
GDT to UAV Test Setup System losses Point B to Point D	Cal-GDT-UAV-B-D

Table 4-2B. Sensitivity Test Data Sheet

Platform	Emission Designator	Frequency (MHz)	Minimum Good Link		To establish the link	
			(dB)	(MER)	(dB)	(MER)
GDT	17M0F9F	5250				
	4M72F1D	5250				
GDT	17M0F9F	5361				
	4M72F1D	5361				
GDT	17M0F9F	5475				
	4M72F1D	5475				
UAV	560KF1D	5625				
	88K3F1D	5625				
UAV	560KF1D	5736				
	88K3F1D	5736				
UAV	560KF1D	5850				
	88K3F1D	5850				

Table 4-3A. RL Selectivity Test File Names

Emission Plot	File name to be saved as
Sig Gen to GDT Test Setup System losses Point F to Point B	Cal-SigGen-GDT-F-B
Sig Gen to GDT Test Setup System losses Point F to Point C	Cal-SigGen-GDT-F-C

Table 4-3B. 17M0F9F RL Selectivity Test Data Sheet

Radio: ___________
Date/Time: ___________
RL Attenuation for MDS+3dB: ___________ (dB)
RL Frequency: __________ (MHz)
Sensitivity: : ___________ (dBm)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Table 4-3C. 4M72F1D RL Selectivity Test Data Sheet

Radio: ___________
Date/Time: ___________
RL Attenuation for MDS+3dB: ___________ (dB)
RL Frequency: __________ (MHz)
Sensitivity: : ___________ (dBm)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Table 4-4A. CL Selectivity Test File Names

Emission Plot	File name to be saved as
Sig Gen to UAV Test Setup System losses Point H to Point A	Cal-SigGen-UAV-H-A
Sig Gen to UAV Test Setup System losses Point H to Point D	Cal-SigGen-UAV-H-D

Table 4-4B. 560KF1D CL Selectivity Test Data Sheet

Radio: ___________
Date/Time: ___________
RL Attenuation for MDS+3dB: ___________ (dB)
RL Frequency: __________ (MHz)
Sensitivity: : ___________ (dBm)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Table 4-4C. 88K3F1D CL Selectivity Test Data Sheet

Radio: __________
Date/Time: __________
RL Attenuation for MDS+3dB: __________ (dB)
RL Frequency: _________ (MHz)
Sensitivity: : __________ (dBm)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Absolute Frequency (MHz)	Delta Frequency (MHz)	Sig Gen Variable Attenuator Setting (dB)	Relative Response (dB)

Table 4-5A. RL Adjacent Signal Rejection Test Data Sheet, 17M0F9F Interference to 17M0F9F Desired

CL Attenuation__________dB
RL Attenuation_______dB
RL Signal Level @ Point C: _______dBm
Interference Signal Level with Interference Variable Attenuator @ ______dB @ Point C: ______dBm
Desired Emission Designator: 17M0F9F
EMI Emission Designator: 17M0F9F

Frequency (MHz)	Interferer Attn (dB)	Frequency (MHz)	Interferer Attn (dB)
5265		5301	
5266		5302	
5267		5303	
5268		5304	
5269		5305	
5270		5306	
5271		5307	
5272		5308	
5273		5309	
5274		5310	
5275		5311	
5276		5312	
5277		5313	
5278		5314	
5279		5315	
5280		5316	
5281		5317	
5282		5318	
5283		5319	
5284		5320	
5285		5321	
5286		5322	
5287		5323	
5288		5324	
5289		5325	
5290		5326	
5291		5327	
5292		5328	
5293		5329	
5294		5330	
5295		5331	
5296		5332	
5297		5333	
5298		5334	
5299		5335	
5300		5336	

Table 4-5B. RL Adjacent Signal Rejection Test Data Sheet, 4M72F1D Interference to 17M0F9F Desired

CL Attenuation__________dB
RL Attenuation______dB
RL Signal Level @ Point C: ______dBm
Interference Signal Level with Interference Variable Attenuator @ _____dB @ Point C: _____dBm
Desired Emission Designator: 17M0F9F
EMI Emission Designator: 4M72F1D

Frequency (MHz)	Interferer Attn (dB)	Frequency (MHz)	Interferer Attn (dB)
5265		5301	
5266		5302	
5267		5303	
5268		5304	
5269		5305	
5270		5306	
5271		5307	
5272		5308	
5273		5309	
5274		5310	
5275		5311	
5276		5312	
5277		5313	
5278		5314	
5279		5315	
5280		5316	
5281		5317	
5282		5318	
5283		5319	
5284		5320	
5285		5321	
5286		5322	
5287		5323	
5288		5324	
5289		5325	
5290		5326	
5291		5327	
5292		5328	
5293		5329	
5294		5330	
5295		5331	
5296		5332	
5297		5333	
5298		5334	
5299		5335	
5300		5336	

Table 4-5C. RL Adjacent Signal Rejection Test Data Sheet, 17M0F9F Interference to 4M72F1D Desired

CL Attenuation_________dB
RL Attenuation______dB
RL Signal Level @ Point C: ______dBm
Interference Signal Level with Interference Variable Attenuator @ _____dB @ Point C: _____dBm
Desired Emission Designator: 4M72F1D
EMI Emission Designator: 17M0F9F

Frequency (MHz)	Interferer Attn (dB)	Frequency (MHz)	Interferer Attn (dB)
5265		5301	
5266		5302	
5267		5303	
5268		5304	
5269		5305	
5270		5306	
5271		5307	
5272		5308	
5273		5309	
5274		5310	
5275		5311	
5276		5312	
5277		5313	
5278		5314	
5279		5315	
5280		5316	
5281		5317	
5282		5318	
5283		5319	
5284		5320	
5285		5321	
5286		5322	
5287		5323	
5288		5324	
5289		5325	
5290		5326	
5291		5327	
5292		5328	
5293		5329	
5294		5330	
5295		5331	
5296		5332	
5297		5333	
5298		5334	
5299		5335	
5300		5336	

Table 4-5D. RL Adjacent Signal Rejection Test Data Sheet, 4M72F1D Interference to 4M72F1D Desired

CL Attenuation__________dB
RL Attenuation______dB
RL Signal Level @ Point C: ______dBm
Interference Signal Level with Interference Variable Attenuator @ _____dB @ Point C: _____dBm
Desired Emission Designator: 4M72F1D
EMI Emission Designator: 4M72F1D

Frequency (MHz)	Interferer Attn (dB)	Frequency (MHz)	Interferer Attn (dB)
5265		5301	
5266		5302	
5267		5303	
5268		5304	
5269		5305	
5270		5306	
5271		5307	
5272		5308	
5273		5309	
5274		5310	
5275		5311	
5276		5312	
5277		5313	
5278		5314	
5279		5315	
5280		5316	
5281		5317	
5282		5318	
5283		5319	
5284		5320	
5285		5321	
5286		5322	
5287		5323	
5288		5324	
5289		5325	
5290		5326	
5291		5327	
5292		5328	
5293		5329	
5294		5330	
5295		5331	
5296		5332	
5297		5333	
5298		5334	
5299		5335	
5300		5336	

Table 4-6A. CL Adjacent Signal Rejection Test Data Sheet, 560KF1D Interference to 560KF1D Desired

CL Attenuation__________dB
RL Attenuation_______dB
CL Signal Level @ Point D: _______dBm
Interference Signal Level with Interference Variable Attenuator @ ______dB @ Point D: ______dBm
Desired Emission Designator: 560KF1D
EMI Emission Designator: 560KF1D

Frequency (MHz)	Interferer Attn (dB)
5690	
5691	
5692	
5693	
5694	
5695	
5696	
5697	
5698	
5699	
5700	
5701	
5702	
5703	
5704	
5705	
5706	
5707	
5708	
5709	
5710	

Table 4-6B. CL Adjacent Signal Rejection Test Data Sheet, 88K3F1D Interference to 560KF1D Desired

CL Attenuation__________dB
RL Attenuation______dB
CL Signal Level @ Point D: ______dBm
Interference Signal Level with Interference Variable Attenuator @ _____dB @ Point D: _____dBm
Desired Emission Designator: 560KF1D
EMI Emission Designator: 88K3F1D

Frequency (MHz)	Interferer Attn (dB)
5690	
5691	
5692	
5693	
5694	
5695	
5696	
5697	
5698	
5699	
5700	
5701	
5702	
5703	
5704	
5705	
5706	
5707	
5708	
5709	
5710	

Table 4-6C. CL Adjacent Signal Rejection Test Data Sheet, 560KF1D Interference to 88K3F1D Desired

CL Attenuation__________dB
RL Attenuation_______dB
CL Signal Level @ Point D: _______dBm
Interference Signal Level with Interference Variable Attenuator @ ______dB @ Point D: ______dBm
Desired Emission Designator: 88K3F1D
EMI Emission Designator: 560KF1D

Frequency (MHz)	Interferer Attn (dB)
5690	
5691	
5692	
5693	
5694	
5695	
5696	
5697	
5698	
5699	
5700	
5701	
5702	
5703	
5704	
5705	
5706	
5707	
5708	
5709	
5710	

Table 4-6D. CL Adjacent Signal Rejection Test Data Sheet, 88K3F1D Interference to 88K3F1D Desired

CL Attenuation_________dB
RL Attenuation______dB
CL Signal Level @ Point D: ______dBm
Interference Signal Level with Interference Variable Attenuator @ _____dB @ Point D: _____dBm
Desired Emission Designator: 88K3F1D
EMI Emission Designator: 88K3F1D

Frequency (MHz)	Interferer Attn (dB)
5690	
5691	
5692	
5693	
5694	
5695	
5696	
5697	
5698	
5699	
5700	
5701	
5702	
5703	
5704	
5705	
5706	
5707	
5708	
5709	
5710	

Table 4-7. RL LNA Gain Compression Test Data Sheet

Input Power Level (dBm)	Output Power Level (dBm)

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JSC-CR-03-062

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