Midway Airport Terminal Development Program

VHF / UHF

Air Interface Technical Specification

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RECORD OF AMENDMENTS

Revision Level	Date	Pages Changed
Rev. 0	November 20, 2001	Initial Release
Rev. 1	December 12, 2001	All Sections Updated
Rev. 2	December 14, 2001	Updated: Sections 2.1 and 2.2 Tables 2-1 and 2-2 Tables 2-3 and 2-5
Rev.3	December 17, 2001	Section 2.1 and 2.2 Tables 2-3, 2-4, 2-5 and 2-6
Rev. 4	June 15, 2002	Section 2.1 Table 2.3, 2.4, 2.5 and 2.6

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1. INTRODUCTION

1.1 Scope

This document provides the detailed performance specifications and production test requirements for Midway Airport VHF/UHF Air Interface System. This system shall be used in the Midway Airport Terminal Development Program, Passive Radio Support System.

1.2 Overview

The Midway Airport Air Interface System (MAAIS) shall operate as a on channel repeater, transmitting downlink and uplink signals into and out of the new Midway Airport Terminal.

The MAAIS shall feed off-air signals into an existing Passive Radio Distribution system constructed of RADIAX® cable and antennas. The MAAIS shall operate as the only active assembly within the entire system. Reference the Appendix for the UHF and VHF system block diagram.

2. SPECIFICATIONS

2.1 Electrical

The MAAIS shall operate on eleven (11) UHF uplink and downlink channels and five (5) VHF uplink and downlink channels within the 400 MHz band and 150 MHz band, respectively. Two (2) channels in the VHF band shall operate as simplex channels. Reference Table 2-1 and 2-2 below for exact downlink and uplink frequencies. The MAAIS shall operate as a on channel repeater. Off-air signals received in the downlink path shall be amplified for an output of a +29 dBm per channel and a +27dBm per channel respectively for both the UHF and VHF bands. These signals shall be fed into the Midway Airport Passive Radio Support System for distributing RF signals throughout the new Midway terminal. RF signals received in the uplink path from the Passive Radio Support System shall be fed into the MAAIS, and then amplified for an output of a +19 dBm per channel for both the UHF and VHF bands. These signals shall then be transmitted to the various donor sites in and around the new airport terminal. Note that the MAAIS shall be equipped with an a AGC for high uplink receive signals.

The MAAIS shall be equipped to operate with six (6) separate antenna ports for accommodating off-air signals and two (2) ports shall be provided for routing signals into and out of the passive radio support system. The MAAIS shall operate from 120 Volts, singel phase AC source. All required AC electrical cords shall be equipped with US male plugs. An internal On/Off switch for powering the MAAIS shall be provided. An LED shall indicate when power is applied to a given amplifier. Additionally, each amplifier shall be equipped with an LED function alarm showing the operating condition of the amplifier module. The MAAIS equipment cabinet shall be equipped with a temperature alarm for monitoring the temperature within the cabinet. Reference Table 2-3 through 2-6 for MAAIS detail electrical specifications.

In addition to the requirements listed above, the filter isolation requirements listed in Appendix shall also be meet in both the VHF and UHF band system.

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Table 2-1: MAAIS UHF Frequency List

Frequency Channels	Downlink Frequency (MHz)	Uplink Frequency (MHz)
1	460.4000	465.4000
2	460.6000	465.6000
3	460.6250	465.6250
4	462.9500	467.9500
5	462.9750	467.9750
6	476.3125	479.3125
7	476.5625	479.5625
8	476.7875	479.7875
9	477.0875	480.0875
10	477.4125	480.4125
11	477.6375	480.6375

Table 2-2: MAAIS VHF Frequency List

Downlink Frequency (MHz)	Uplink Frequency (MHz)
154.010	153.770
154.130	153.950
*154.220	*154.220
154.295	153.830
*154.385	*154.385

*Simplex Frequencies

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Table 2-3: MAAIS UHF Electrical Specifications

Downlink Path Parameters	**Specifications**
Frequency	Reference Table 2-1
Number of Downlink and Uplink Frequency Channels	11
Frequency Passband / Channel	25 kHz
Passband Ripple	< 1.0 dB
Gain	105 dB
Gain Adjustment	30 dB, in 2 dB steps
Output Power Per Channel @ Antenna Port	≥ +29 dBm
Output 1 dB Compression Point @ Antenna Port	≥ +29 dBm
Output IP3 @ Antenna Port	Not Applicable (See Note 1 Below)
Output In-Band Spurious @ Antenna Port	≤ +0.0 dBm
Out-of-Band Spurious @ Antenna Port	≤ -48 dBm @ 1.675 MHz from Band Edge
Group Delay	TBD
VSWR	1.5:1
Impedance	50 Ω
Power Supply	120 VAC, Single Phase
Alarm Types	Amplifier Module Alarm & Cabinet Temperature Alarm

Note 1: Output IP3 is not applicable for channelized Amplifiers. In lieu of an Intermodulation Test an adjacent channel test shall be performed to verify selectivity of the channelized Filters. Filter selectivity shall provide a Carrier-to-Intermodulation (C/I) of ≥ 30 dB within the filter passband.

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Table 2-4: MAAIS UHF Electrical Specifications

Uplink Path Parameters	**Specifications**
Frequency	Reference Table 2-1
Number of Frequency Channels	11
Frequency Passband / Channel	25 kHz
Passband Ripple	< 1.0 dB
Gain	105 dB
Gain Adjustment	30 dB, in 2 dB steps
Power Output / Channel @ Antenna Port	≥ +19 dBm
Output 1 dB Compression Point @ Antenna Port	≥ +19 dBm
Output IP3 @ Antenna Port	Not Applicable (See Note 1 Above)
VSWR	1.5:1
Impedance	50 Ω
In-Band Spurious	≤ -10 dBm
Out-Band Spurious	≤ -45 dBm @ 1.675 MHz from Band Edge
Group Delay	TBD
Noise Figure	≤ 7.0 dB (Over Gain Range)
Power Supply	120 VAC, Single Phase

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Table 2-5: MAAIS VHF Electrical Specifications

Downlink Path Parameters	**Specifications**
Frequency	Reference Table 2-2
Number of Frequency Channels	5
Frequency Passband / Channel	25 kHz
Passband Ripple	< 1.0 dB
Gain	95 dB
Gain Adjustment	30 dB, in 2 dB steps
Power Output / Carrier @ Antenna Port	≥ +27 dBm
Output 1 dB Compression Point @ Antenna Port	≥ +27 dBm
Output IP3 @ Antenna Port	Not Applicable (See Note 2 Below)
In-Band Spurious @ Antenna Port	≤ -3 dBm
Out-Band Spurious @ Antenna Port	≤ -60 dBm @ 60 kHz From the Band Edge
Group Delay	TBD
VSWR	1.5:1
Impedance	50 Ω
Power Supply	120 VAC, Single Phase
Alarm Types	Amplifier Module Alarm & Cabinet Temperature Alarm

Note 2: Output IP3 is not applicable for channelized Amplifiers. In lieu of an Intermodulation Test an adjacent channel test shall be performed to verify selectivity of the channelized Filters. Filter selectivity shall provide a Carrier-to-Intermodulation (C/I) of ≥ 30 dB within the filter passband.

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Table 2-6: MAAIS VHF Electrical Specifications

Uplink Path Parameters	**Specifications**
Frequency	Reference Table 2-1
Number of Frequency Channels	5
Frequency Passband / Channel	25 kHz
Passband Ripple	< 1.0 dB
Gain	95 dB
Gain Adjustment	30 dB, in 2 dB steps
Power Output / Carrier @ Antenna Port	≥ +19 dBm
Output 1 dB Compression Point @ Antenna Port	≥ + 19 dBm
Output IP3 @ Antenna Port	Not Applicable (See Note 2 Above)
VSWR	1.5:1
Impedance	50 Ω
In-Band Spurious @ Antenna Port	≤ -10 dBm
Out-Band Spurious @ Antenna Port	≤ -54 dBm @ 60 kHz From the Band Edge
Group Delay	TBD
Noise Figure	≤ 7.0 dB (Over Gain Range)
Power Supply	120 VAC, Single Phase

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2.2 Mechanical

The MAAIS shall be housed in two (2) equipment racks equipped with 19" rails. Cables into the racks shall be accessible from the top and bottom of the rack. The racks shall be equipped with a rear door that latches. The racks shall be light gray in color. The equipment racks shall not exceed a size of 70"x 25"x 32". The equipment rack shall also be sized as needed to install two (2) existing equipment trays. Each tray shall be 19"x 14"x 5.25" (WxDxH).

The MAAIS shall be equipped with Type-N female connectors. These connectors shall be placed for easy access for mating jumper cables entering the rack from the top or bottom. All switches for power shall be placed for easy access. All alarm LEDs or diplay shall be placed for easy identification. Labels shall be provided showing both UHF and VHF downlink and uplink paths. Labels shall also be provided for areas that are hazardous. A laminated schematic shall also be placed inside the racks for reference.

Each MAAIS equipment rack shall be equipped with one power cable supplying the required power needed for the amplifier modules. This power cable shall be four (4) meters in length and equipped with a factory installed US AC standard male connector. Reference Table 2-7 for the detail mechanical specification summary.

Table 2-7: MAAIS Mechanical Specifications

Rack Quantity	2
Rack Size (max.)	70"x25"x32"
Weight	250 kg
Rack Power Cable Length	4 m
RF Connectors	Type-N Female
Required Labels	UHF and VHF RF Path Hazardous Areas On/Off Switch Alarm Indicators
Laminated Schematic	1 Per Rack
AC Power Cable Type	3 Conductors
AC Male Plug Type	US Standard, 3 Prongs
MTBF	> 50,000 hrs

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2.3 Environmental

The MAAIS shall meet the following environmental conditions listed in Table 2-8.

Table 2-8: MAAIS Environmental Specifications

Storage Temperature	-40 °C to +70°C
Operating Temperature	-20 °C to +50°C
Relative Humidity	5% to 95%, non-condensing
Shock and Vibration	Equipment Shall Withstand The Shock and Vibration During Shipment without Damage.
Electro-Magnetic Interface/Electro-Magnetic Compatibility	Package Equipment so all emissions emanating within or outside the MAAIS meets FCC Standards.

3.0 TEST DATA REQUIREMENTS

Test data shall be provided to Andrew verifying compliance with each requirement contained herein three weeks prior to Andrew Systems Engineer coming out to witness the system test. Testing may be performed at lab ambient environmental conditions.

Test data of the downlink and uplink parameters shall be documented at each UHF and VHF frequencies listed in Tabel 2-1 and 2-2. Test data plots shall be provided when appropriate in lieu of data in a table form. Worse case performance shall be noted on the plots. Adjacent channel testing shall be performed in lieu of a tow-tone intermodulation test. Adjacent channel testing shall be performed using a unwanted carrier 25 kHz away from a wanted carrier. Isolation test shall also be measured in the VHF and UHF bands. The isolation specifications are listed in the Appendix. The following isolation test shall be performed in both the VHF and UHF bands.

- **Downlink Rx to Uplink Tx Isolation Measured @ Antenna Ports.** (This test shall be performed with the Cross-Band Couplers connected. A 63 dB attenuator shall be placed between each coupler for the UHF band test and a 50 dB attenuator shall be placed between each coupler for the VHF band test. Each passband RF signal shall be injected into the Rx antenna port and the signal level shall be measured at the Tx antenna port. Use inband signals levels at a –69 dBm in the VHF band and use signal levels at a –78 dBm in the UHF band. This test shall be performed using the maximum Gain setting. **Note, the simplex channels shall not oscillate.**)

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- **Uplink Tx to Downlik Rx Isolation Measured @ Cross Band Ports.** (This test shall be performed with the antenna ports connected. A 65 dB attenuator shall be placed between each antenna port for the UHF band test and a 56 dB attenuator shall be used between antenna ports for the VHF band test. The RF signals shall be injected at the uplink port of the cross band coupler and measured at the downlink port of the cross band coupler. Use inband signals at a –76 dBm in the VHF band and use signal levels at a –82 dBm UHF band. This test shall be performed using the maximum Gain setting. **Note, the simplex channels shall not oscillate.**)

- **Uplink Tx Isolation in Downlink Rx Path**. (Reverse isolation test. Use inband transmit signals at a –20 dBm in both the VHF and UHF band. This test shall be performed using the maximum Gain setting.)

- **Downlink Rx Isolation in Uplink Tx Path.** (Reverse isolation test. Use inband receive signals at a –40 dBm in both the VHF and UHF band. This test shall be performed using the maximum Gain setting.)

NOTE: Isolation test in the UHF band will need to be duplicated for both sets of antennas.

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