RHO International Inc THETA The Leader in DF

smartDF

Quick Start Guide

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You can download the latest version of the Quick Start Guide from https://rhothetaint.com/product/smartdf/.

For questions about this document contact:

Rhotheta International Inc

Phone: +1 (954) 495-8700

General Information: info@rhothetaint.com

Product Support: service@rhothetaint.com

www.rhothetaint.com

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Definitions

Automatic direction finder (ADF): navigation device that automatically calculates and continuously displays the relative bearing of the aircraft to a radio beacon transmitting in the 190 to 1799 kHz range.

Bearing: horizontal direction to or from any point, usually measured clockwise from true north, magnetic north, or some other reference point through 360 degrees. (Source: US FAA)

Cospas-Sarsat (C-S or C/S): satellite-aided search and rescue initiative, organized as a treaty, nonprofit, intergovernmental, humanitarian cooperative of 45+ nations and agencies.

Heading (HDG): direction in which the longitudinal axis of an aircraft is pointed, usually expressed in degrees from North (true, magnetic, compass, or grid)

Line of bearing (LOB): line plotted from the fore-and-aft axis of the aircraft in the direction of a target, resulting from a relative bearing to the target.

Line of Position (LOP): line plotted from the fore-and-aft axis of the aircraft in the direction of a target, resulting from a magnetic bearing to the target.

Magnetic bearing (MB or MAG BRG): is a bearing relative to the earth's magnetic North.

Magnetic Heading (MH or MAG HDG): direction in which the longitudinal axis of an aircraft is pointed, relative to magnetic north, read from your magnetic compass. The magnetic north pole and geographic north pole are hundreds of miles apart. Also see Heading (HDG).

Radial: magnetic bearing extending from a VOR/VORTAC/TACAN

Radio direction finder (DF or RDF): an electronic device for finding the direction (bearing) to a radio source (target or emitter)

Relative Bearing (RB or REL BRG): bearing relative to the nose of the aircraft, plotted as the horizontal direction from the aircraft to (or the angle between its fore-and-aft axis and) the direction to the target. The RB is measured clockwise from 000° through 360°, 000° being its nose and 180° its tail.

Track: projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from North (true, magnetic, or grid).

True Heading: direction in which the longitudinal axis of an aircraft is pointed, relative to true north, or the geographic north pole. The magnetic north pole and geographic north pole are hundreds of miles apart.

Getting Started

Licensing

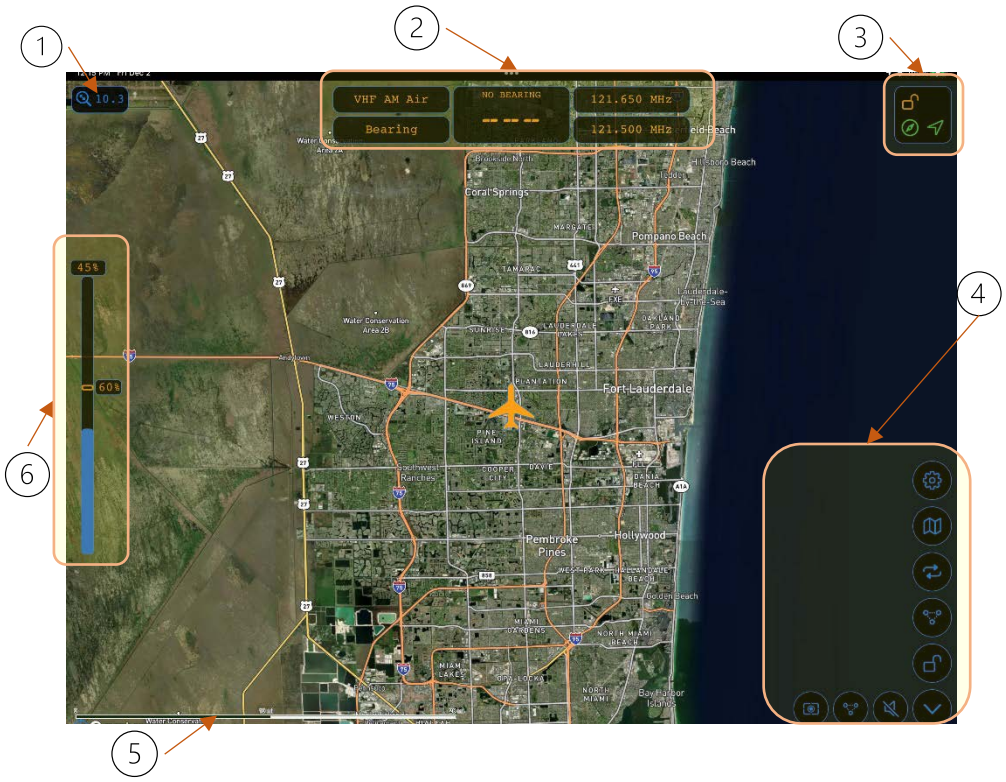
1. Rhotheta International Inc ("RHI") is committed to make your **smartDF** experience enjoyable and effective
2. The smartDF iOS application ("the app") is downloadable from the AppStore for free
3. Without a license from RHI, the app will run in trial mode for 90 days, with all its features enabled
4. After 90 days a warning will announce the trial has expired and invite the user to register the app using a license
5. 30 days before expiration, the app will invite the user to reactivate the license
6. With a license from RHI, the app will run for one (1) year, with all its features enabled
7. Upon entering the license number, RHI's Licensing Service validates the license fee has been paid for and enables the App to operate without limitations
8. For support contact RHI at +1 (954) 495-8700 or service@rhothetaint.com

DF Equipment Checkup

1. verify the RT-600 equipment (RT-600-A, RT-600-L, RT-600 AU, RT-600 DCU) is properly installed, setup and powered on
2. verify the RT-600 "EXTENDED SERIAL" option is set to "ON"
3. verify the BLE (Bluetooth Low Energy) or Wi-Fi adapter is properly installed, setup and powered on

Description of smartDF Functions

Dashboard



①	Zoom level
②	Control panel: operational band, DF mode, bearing value, main frequency, standby frequency
③	Annunciator panel: Bluetooth (BLE) Compass GPS Lock Screen
④	Menu
⑤	Map scale
⑥	Signal Level Bar Graph

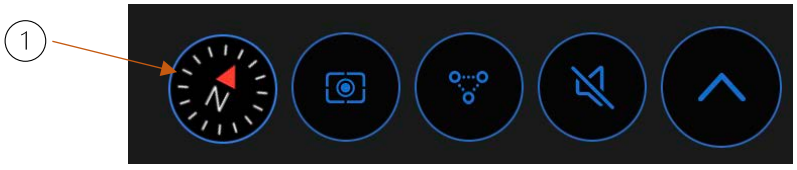
DF Control Panel

①	Active band: VHF AM Air, VHF FM Marine, UHF AM Air, Cospas-Sarsat, UHF FM, LoJack, ETS
②	Bearing value, average, RELATIVE by default, MAGNETIC if magnetic heading is available
③	Active frequency
④	Standby frequency. Tap to exchange Active <-> Standby frequencies.
⑤	DF mode: scanning, bearing, decode, filter OFF, filter ON. Tap to change mode.

Annunciator Panel

①	Lock Screen
②	Bluetooth
③	GPS
④	Compass

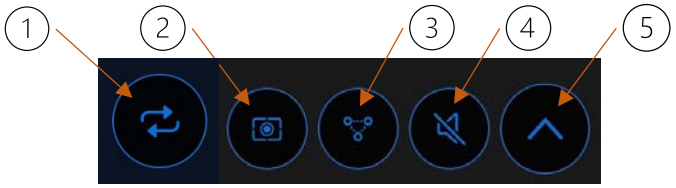
North Arrow Map Orientation Symbol



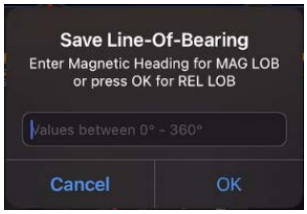
①	North Arrow Map Orientation Symbol with Letter N. Tap to set NORTH UP navigation mode.

Menu Functions

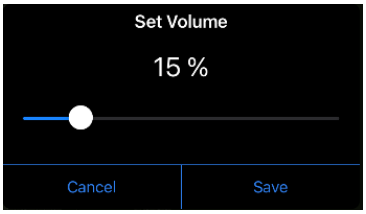
Single-Tap “Quick Access” Functions



①	Repeat Last Bearing (RPT), recalls last valid relative bearing and signal level
②	Center on map and set TRACK UP navigation mode
③	Save LOB (or LOP), enter “0” for REL BRG or enter magnetic heading for MAG BRG
④	Set Volume
⑤	Sub-Menu, to access other functions and settings



Save LOB



Set Volume

Sub-Menu Functions

Settings: export logs, delete old logs, DF and App info, advanced settings

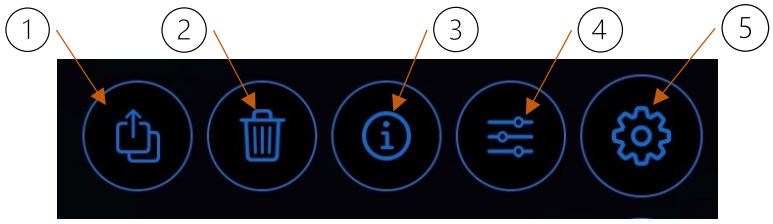
Map related functions: download and save maps, delete saved maps , select map type

Replay/Repeat functions: 1 min, 5 min, 10 min, Stop

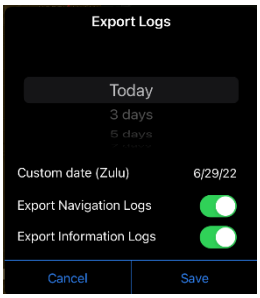
Save LOB (or LOP), enter “0” for REL BRG or enter “_ _ _” magnetic heading for MAG BRG

Lock Screen

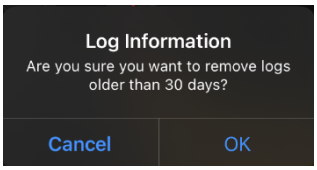
Settings



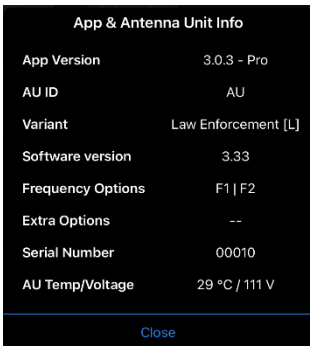
①	Export logs: DF data, GPS data, Errors
②	Delete logs older than 30 days
③	DF and App information/status
④	Advance settings
⑤	Settings sub-menu



Export Logs



Delete old logs



DF & App info

Advanced Settings

Select smartDF version: STD (Standard) or PRO

Turn ON/OFF “live” bearing cone | Turn ON/OFF “HUD” GPS info

Set Standby Frequency, in MHz

Set delay (timer) for displaying MAG BRG

Turn ON/OFF intersection area | Set intersection area radius

Set color of intersection area

Set color of Line of bearing (LOB) / Line of Positioning (LOP)

Set wireless link: BLE or WiFi

Set DF bearing offset | Set antenna (AU) position

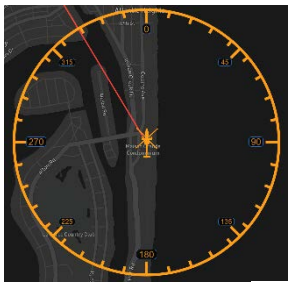
Set Map layer: Dark, Satellite, IFR Low, IFR High, VFR

Select user icon and color

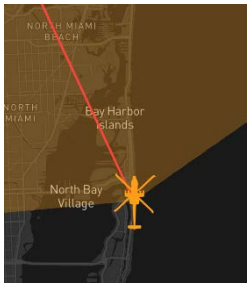
Select color for Line-of-Bearing

Turn ON/OFF the 360° Rose and select its color

Advanced settings (cont.)



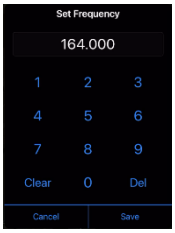
360° Rose (yellow)
LOB (red)

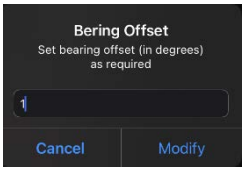


Live bearing cone (yellow)
LOB (red)

Intersection area (red)
Saved LOB (magenta)
Active LOB (red)

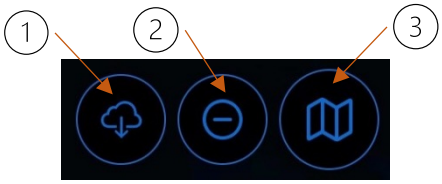
Set Standby Frequency
using Advanced Settings





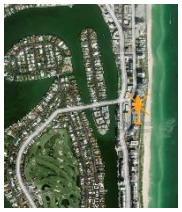
Set bearing offset

Map related functions



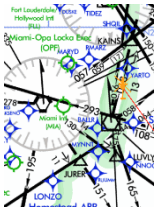
①	Download and save maps
②	Delete saved maps
③	Map related functions sub-menu
④	Map types: Dark, Satellite, IFR Low, IFR High, VFR. These functions will eventually be moved to Advanced Settings

Dark



Satellite

IFR Low



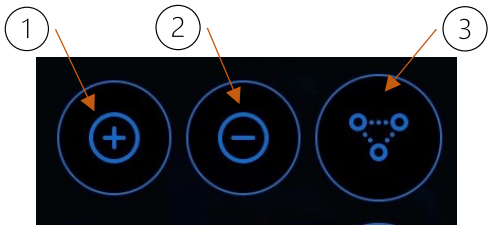
IFR High

VFR

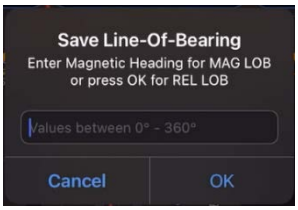
Replay/Repeat functions

①	Repeat Last Bearing (RPT), recalls last valid relative bearing and signal level
②	Replay the last 5 minutes
③	Replay the last 10 minutes
④	Stop repeat/replay
⑤	Replay/Repeat functions sub-menu

Line-of-Bearing (LOB) Managing

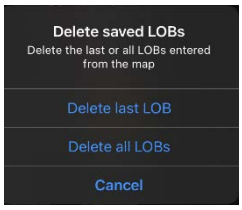


①	Add and save a line-of-bearing (LOB) on the screen/map
②	Delete a saved LOB, option to delete only the last saved LOB or all saved LOBs
③	Line-of-Bearing (LOB) managing sub-menu



Save LOB (or LOP)
Enter "0" for REL BRG
or "_ _ _" magnetic
heading for MAG BRG

Intersection area (red)
Saved LOB (magenta)
Active LOB (red)

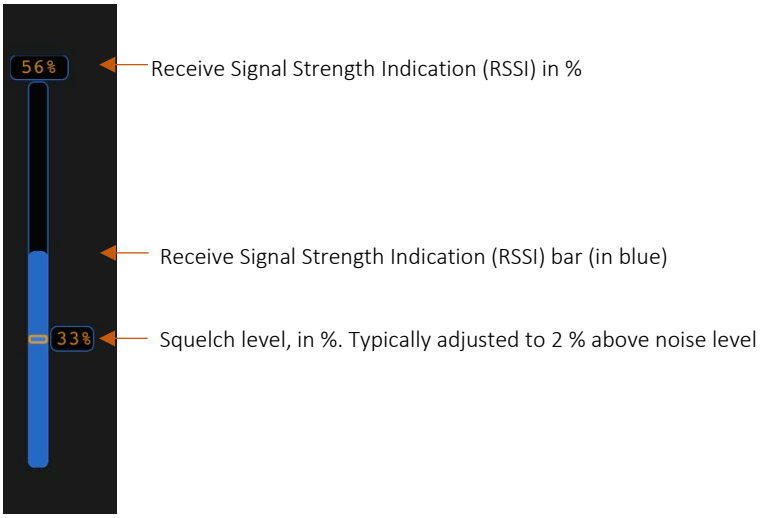


Delete saved LOB (s)

Example of MAG BRG: having entered a MAG HDG = 35° while receiving a REL BRG = 240°, the app will save a MAG LOB = 275° on the screen; also the app displays MAG BRG digital values in the control panel for a preset time (see Advanced Settings)

Then when an RB = 144° is received (in red color) a new MB = 179° gets displayed (in green color)

Signal Level Bar Graph

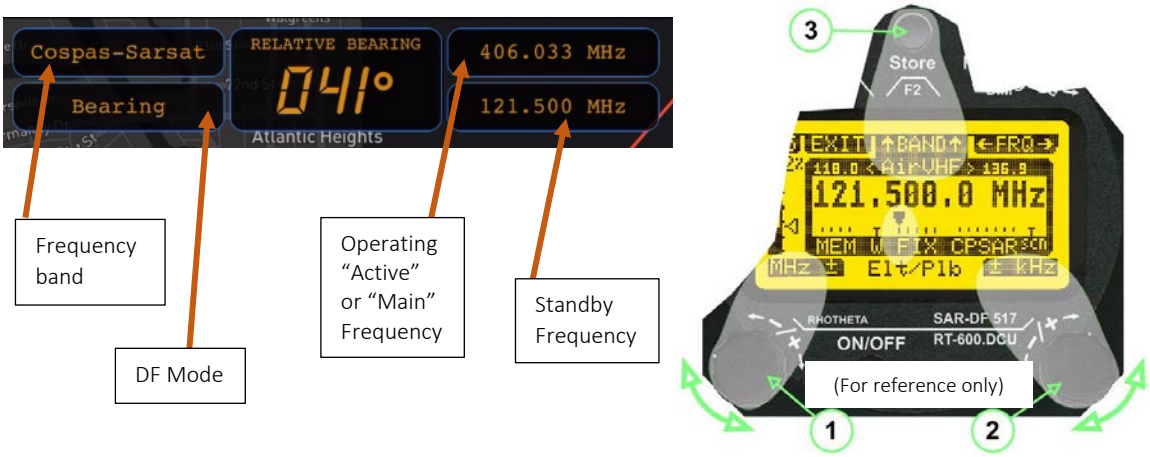


Set squelch (SQL) level(s)
Just above noise level

Annex

Frequency bands and operating frequencies

To prosecute a beacon set the appropriate frequency band and operating frequency or channel



Frequency band and operating frequency as displayed by smartDF and by the RT-600 DCU

smartDF: COSPAS-SARSAT band, Active_406.033 MHz, Standby_121.500 MHz

DCU: Air VHF band, active_121.500 MHz, no standby frequency displayed

Default bands available			OPTIONAL extended bands available		
Band designation	Frequency limits		Option	Designation	Frequency limits
VHF Emergency Band:	118.000 … 124.000 MHz	>	F1	VHF Air Band:	118.000 … 136.992 MHz
VHF Marine Band:	154.000 … 163.000 MHz	>	F2	Extended VHF Marine:	137.000 … 224.995 MHz
UHF Emergency Band:	240.000 … 246.000 MHz	>	F3	UHF Air Band:	225.000 … 399.975 MHz
COSPAS-SARSAT:	400.000 … 406.092 MHz				
UHF FM Band:	406.100 … 410.000 MHz	>	F4	Additional UHF FM:	406.100 … 470.000 MHz

Default and Optional frequency bands available with the model RT-600-A

(Optional bands should be ordered separately, contact Rhotheta)

Default bands available			OPTIONAL extended bands available		
Band designation	Frequency limits		Option	Designation	Frequency limits
VHF Emergency Band:	118.000 … 124.000 MHz	>	F1	VHF Air Band:	118.000 … 136.992 MHz
VHF Marine Band:	154.000 … 163.000 MHz	>	F2	Extended VHF Marine:	137.000 … 163.000 MHz
LoJack:	164.000 … 174.000 MHz				
ETS:	216.000 … 220.000 MHz				
COSPAS-SARSAT:	400.000 … 406.092 MHz				

Frequency bands available with the model RT-600-L

(Optional bands should be ordered separately, contact Rhotheta)

Prosecuting a Cospas-Sarsat Beacon in Bearing Mode

C-S BRG mode
As displayed by DCU
(For reference only)

Prosecuting a Cospas-Sarsat beacon on 406.025 MHz with a REL LOB of 63°

Prosecuting a Cospas-Sarsat beacon in Decode Mode

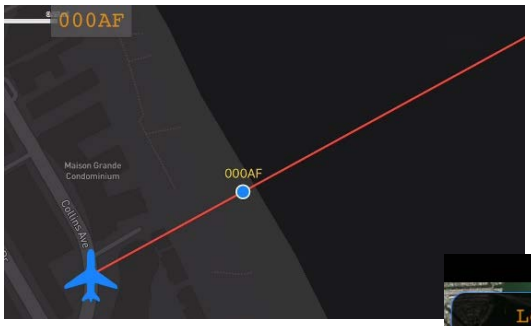
C-S DECODE mode
As displayed by DCU
(For reference only)

Decoding the beacon's Cospas-Sarsat data on 406.025 MHz

①	15-HEX-ID of the beacon in hexadecimal format.
②	Bits 25 to 112 of the C-S short message data burst Bits 25 to 144 of the C-S long message data burst. The last 8 Hex values are separated by a blank space. Bit- and Frame-synchronization hex values (Bits 1 to 24) not displayed for better readability

Prosecuting a LoJack Beacon

Set the LoJack band and frequency 173.075 MHz

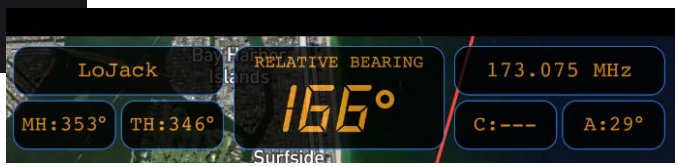


Tracking with LoJack ID = ON = 000AF
LOB is labeled with VLU # 000AF

LoJack ID = OFF mode
Displayed on DCU

LoJack ID = ON mode
Displayed on DCU

(For reference only)



Tracking with ID = OFF mode yields the best DF range when prosecuting a faraway beacon

Tracking with ID = ON allows bearing a specific VLU (ID), suppressing towers and other emitters

Prosecuting LoJack on 173.075 MHz with a REL LOB of 166°

Prosecuting Analog Beacons

Set the appropriate frequency band and operating frequency, ex. 121.500 MHz, 156.800 MHz, 216.487 MHz

Prosecuting analog beacons:

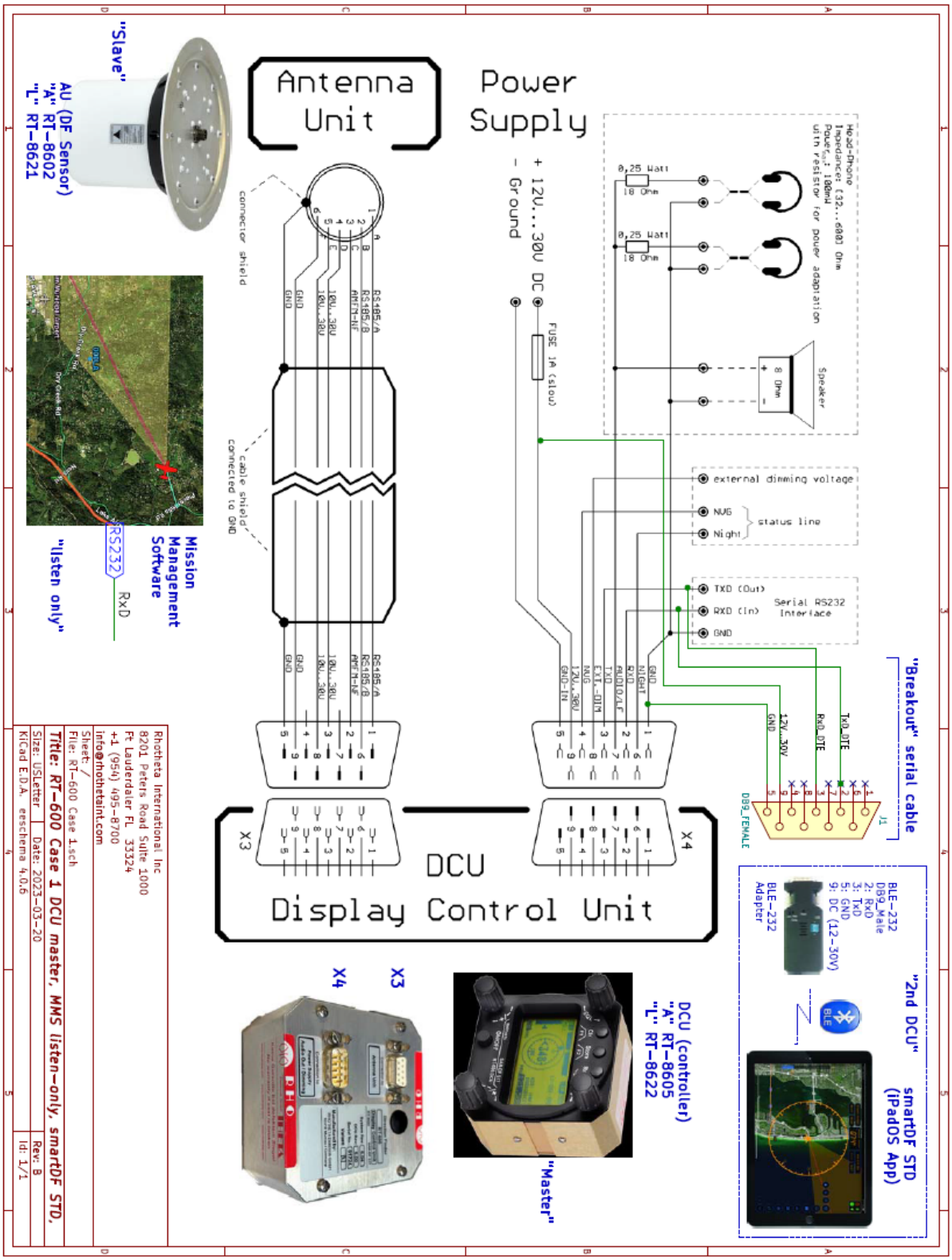
Air AM Band 121.5 MHz [REL BRG = 172°]

Marine FM Band 156.8 MHz with [REL BRG = 342°]

ETS Band 216.487 MHz [no BRG available]

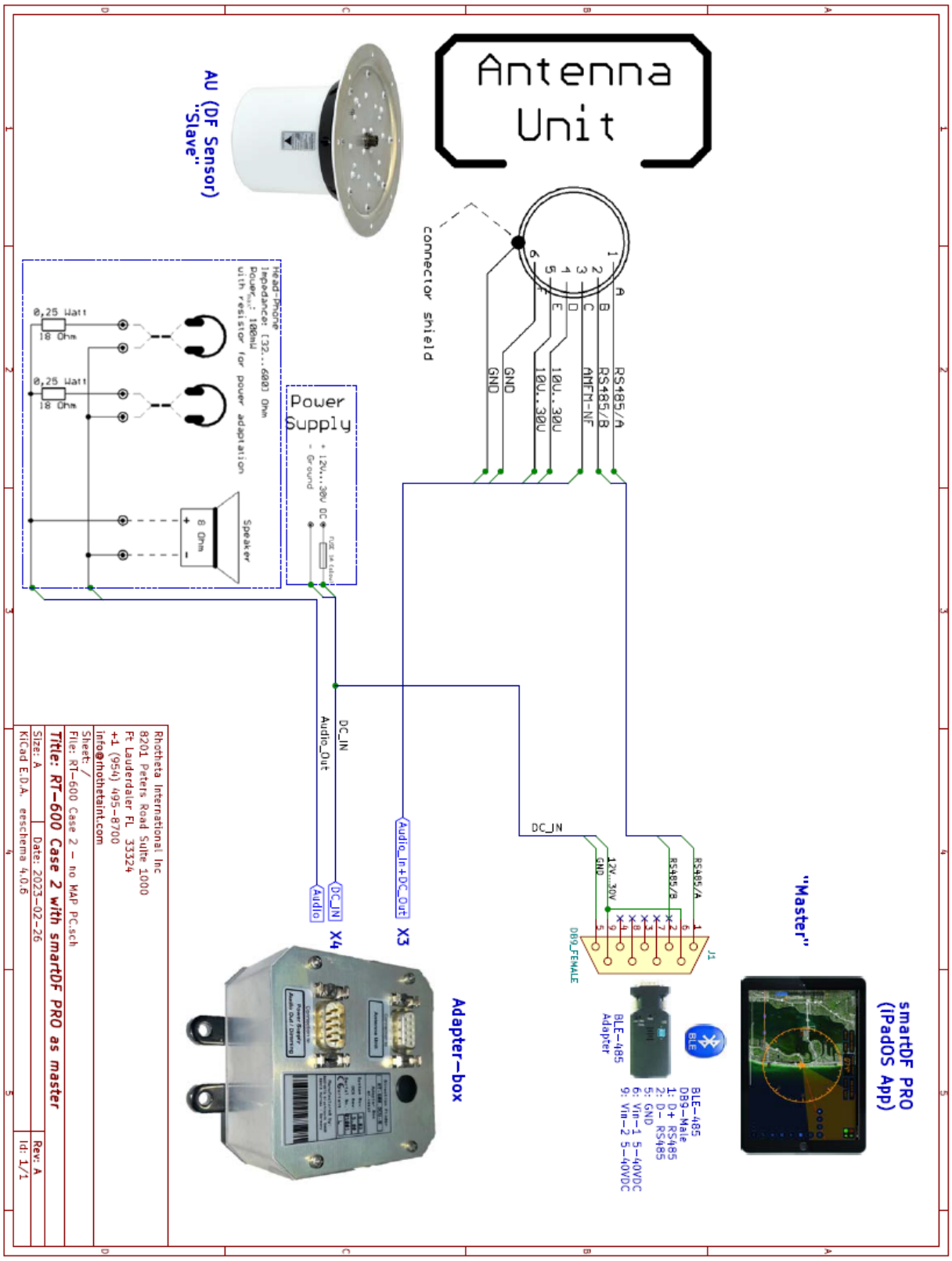
RT-600 Case 1

DCU as master, smartDF STD as “2nd DCU”, MMS/MAP as “listen-only” display



RT-600 Case 2

smartDF PRO as master, DCU-AB as adapter (interconnect) box



Cospas-Sarsat 406 MHz Channel Assignment Table

Table H.2: Cospas-Sarsat 406 MHz Channel Assignment Table

Chan. #	Centre Freq. (MHz)	Status for Type Approval of New Beacon Models		Comments Table approved by the Cospas-Sarsat Council at the CSC-43 Session – October 2009 (see Note 1)
		Date open	Date closed	
	406.007	Not available		SARP-2 limitation
	406.010	Not available		Doppler shift limitation
	-------	----------		----------
	406.019	Not available		Doppler shift limitation
A	406.022	C/S orbitography / reference		Reserved for System beacons
B	406.025	1982	1 Jan 2002	Open for beacon models submitted for TA before 01/01/02
C	406.028	1 Jan 2000	1 Jan 2007	Open for beacon models submitted for TA before 01/01/07
D	406.031	1 Jan 2016	TBD	Open for beacon models submitted for TA after 01/01/16
E	406.034			Reserved, not to be assigned
F	406.037	1 Jan 2004	1 Jan 2012	Open for beacon models submitted for TA before 01/01/12
G	406.040	1 Jan 2010	1 Jan 2017	Open for beacon models submitted for TA before 01/01/17
H	406.043			Reserved, not to be assigned
I	406.046			Reserved, not to be assigned
J	406.049	TBD	TBD	Available for future assignments / New developments
K	406.052	TBD	TBD	Available for future assignments / New developments
L	406.055			Reserved, not to be assigned
M	406.058			Reserved, not to be assigned
N	406.061	TBD	TBD	Available for future assignments / New developments
O	406.064	TBD	TBD	Available for future assignments / New developments
P	406.067			Reserved, not to be assigned
Q	406.070			Reserved, not to be assigned
R	406.073	TBD	TBD	Available for future assignments / New developments
S	406.076	TBD	TBD	Available for future assignments / New developments
	406.079	Not available		Doppler shift limitation
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	406.088	Not available		Doppler shift limitation
	406.091	Not available		SARP-2 limitation

Notes:
(1) Planned assignments may change if the Cospas-Sarsat Council determines that the beacon population in an active channel differs from the projected population.
TA Type approval
TBD To be determined