

Antenna Sharing Hub User's Guide

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Revision	Date	Description	Affected sections
A	12/11/2018	Changes for tool to support 10 RETs and related firmware changes	All
С	07/11/2019	Added 2.1.1 Current Alarm thresholds for operators	2.1.1(new)
D	02/17/2020	Changes in tool UI for release 1.2 with support for site reports	All
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1. INTRODUCTION TO ANTENNA SHARING HUB

1.1 Antenna Sharing

Deployed multiport antennas consisting of two or more internal RET elements typically has a single AISG Port interface allowing the control by one BTS/RRH controller. Antenna Sharing is the ability of a multiport antenna to allow independent control of its internal RET elements to two or more operators.

In some regions, operators are forced to share elements within the networks including antennas due to aesthetic and/or site space limitations. The ANDREW Antenna Sharing Hub or ASH solves the problem where deployed multiport antennas are not capable of providing antenna sharing.

The ANDREW ASH allows internal RET elements of multiport antennas to be shared across multiple BTS/RRH controllers.

1.2 ANDREW Antenna Sharing Hub

The main features of ANDREW ASH are:

- 1. Antenna RET elements can be shared across six independent BTS/RRH controllers.
- 2. All BTS/RRH control ports are female AISG four pin RS-485 ports with surge protection level 20kV/8kA. Control ports are labeled 'A', 'B','C', 'D', 'E' and 'F'.
- 3. All BTS/RRH control ports can be independently configured to support either AISG 2.0/3GPP SRET (Device Type 0x01) or MRET (Device Type 0x11) modes using ANDREW Antenna Sharing Configuration Tool Software.
- 4. All BTS/RRH control ports supports AISG 2.0/3GPP protocol release versions 6 14 when allowed by connected Antenna RET.
- Supports up to 24 RET elements from any number of Antenna devices in SRET and MRET modes daisy chained at ASH output port when two or more BTS/RRH control ports are in use. Supports up to 12 Ret elements when a single BTS/RRH control port in use.
- Supports ANDREW COMMRET1, COMMRET2, CP RET and Legacy Argus Antennas in their default protocol mode MRET or SRET. No additional configuration steps to ANDREW Antennas are required for use with ANDREW Antenna Share Hub Hardware. ANDREW ASH will not modify attached Antenna's default protocol mode, configuration and other internal settings.
- 7. Configurable access levels of "Full Control" or "Restricted Access" on a per BTS/RRH control port basis.
- 8. Antenna Sharing is applied on a per Antenna Model basis. Up to 16 different configurable Antenna Sharing settings can be programmed and stored in the ASH. See use scenarios section.
- 9. Antenna Sharing will default all RET elements Full Control access be visible to all BTS/RRH control ports for ANDREW's Antenna Models without an Antenna Sharing configuration.
- 10. Packet forwarding and AISG 2.0/3GPP protocol translation between BTS/RRH controllers and daisy chained Antenna RETs.

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2. INSTALLATION OF ANTENNA SHARING HUB

2.1 Installation

The ANDREW Antenna Sharing Hub hardware is designed to be installed in an unprotected outdoor environment. All hardware required for the installation is included with the product.

The Antenna Sharing Hub hardware can be installed in any orientation, however, orienting the ASH with its AISG connectors facing down is preferred whenever practical. This ensures an extra measure of protection against weather exposure that is independent of installation workmanship.

The ASH is intended to be installed between RRH/BTS controllers and the Antenna RETs. Although a DTMA is considered an Antenna device it should not be connected at ASH output port, but instead DTMA's RET output should be connected to ASH RRH/BTS control ports.

2.1.1 High/Low Current Alarm Thresholds for Operators

For operators with High Current Alarm Thresholds, the optimum setting is dependent on the number of radios, the number of RETs, and the types of RETs being used. However, to ensure no alarms are reported, even in worst case conditions, ANDREW recommends high current thresholds of **500mA for 24V** radios, and **850mA for 12V** radios.

Low Current Alarm Thresholds should be **0mA**.

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Figure 1 Andrew Antenna Sharing Hub Installation

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2.2 Use Scenarios

Antenna Sharing use case examples are illustrated here using two ANDREW EGYHHTT-65B-R6 and a six port ANDREW ASH. Note one antenna sharing configuration for model EGYHHTT-65B-R6 has been previously programmed and stored in the ASH.

2.2.1 Scenario 1. All control ports in MRET mode.

An antenna sharing configuration for the Antenna Model EGYHHTT-65B-R6 is programmed into the ANDREW ASH where all control ports are configured to AISG2.0/3GPP MRET protocol mode. Antenna Sharing Mapping is as follows:

Band R1 to Control Port A Band R2 to Control Port B Band B1 to Control Port C Band B2 to Control Port D Band G1 to Control Port E Band Y1 to Control Port F.





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2.2.2 Scenario 2. All control ports in SRET mode.

An antenna sharing configuration for the Antenna Model EGYHHTT-65B-R6 is programmed into the ANDREW ASH where all control ports are configured to AISG2.0/3GPP SRET protocol mode. Antenna Sharing Mapping is as follows:

Band R1 to Control Port A Band R2 to Control Port B Band B1 to Control Port C Band B2 to Control Port D Band G1 to Control Port E Band Y1 to Control Port F.





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2.2.3 Scenario 3. Mixed MRET/SRET mode control ports.

An antenna sharing configuration for the Antenna Model EGYHHTT-65B-R6 is programmed into the ANDREW ASH where all control ports are configured to both AISG2.0/3GPP SRET/MRET protocol modes. Antenna Sharing Mapping is as follows:

Band R1 to Control Port A Band R2 to Control Port B Band B1 to Control Port C Band B2 to Control Port D Band G1 to Control Port E Band Y1 to Control Port F





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2.2.4 Scenario 4. Mixed RETs mapping.

ANDREW ASH supports multiple antenna sharing configuration variants not only the before mentioned scenarios. In this last example, a mixed RET antenna sharing configuration for the Antenna Model EGYHHTT-65B-R6 is programmed into the ANDREW ASH. When ANDREW ASH detects an EGYHHTT-65B-R6 antenna it will replicate the RETs to its control ports as illustrated below.

This configuration for this scenario in the Antenna Sharing configuration tool is shown in the Figure 11.



Figure 5 EGYHHTT-65B-R6 Antenna Sharing Scenario 4

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3. CONFIGURATION OF THE ANTENNA SHARING HUB

3.1 Antenna Sharing Hub Configuration Tool

The Antenna Sharing Hub Configuration Tool is the PC software used to communicate with the ANDREW ASH hardware. The PC software uses the ANDREW ATC200-LITE-USB portable controller hardware and runs on Windows operating systems (Windows 7 or higher). Visit ANDREW website at <u>www.andrew.com</u> to download the latest Antenna Sharing Hub Configuration software.

ATC200-LITE-USB is used as the interface between a local PC/laptop running Antenna Sharing Hub Configuration Tool and the ANDREW ASH hardware. The ATC200-LITE-USB provides signal level conversion from the PC/laptop to RS-485 as well as power to the ASH hardware.



Figure 6 ATC200-LITE-USB connected to ANDREW Antenna Sharing Hub on control port C.

ATC200-LITE-USB controller can be connected to any ASH's RRH/BTS control ports: A, B, C, D, E or F as shown in the Figure above. The LEDs on ATC200-LITE-USB indicates power and data communication. It is equipped with a USB port, as well as a RS-232 serial port for flexibility in connecting to a PC.

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Figure 7 ATC200-LITE-USB Controller End Panels

The Antenna Sharing Hub Configuration Tool can be used in two modes:

- 1. In **Online mode**, the ASH Configuration Tool provides direct management of the hub. The operator can:
 - a. view, edit, or delete antenna model configurations stored on the hub
 - b. view or edit the current BTS/RRH control port protocol modes (MRET, SRET)
 - c. download a new antenna model configuration
 - d. update the ASH software
 - e. perform all functions available in Offline mode
- 2. In Offline mode, the ASH Config Tool allows an operator to
 - a. create and save new antenna model configurations
 - b. edit and save previously created antenna model configurations

Online mode is described in more detail in <u>Section 3.2</u>, while Offline mode is described in <u>Section 3.3</u>.

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3.2 Antenna Sharing Hub Configuration Tool (Online mode)

In Online mode of operation, a physical connection to any ANDREW ASH RRH/BTS control port is required using ATC-LITE-USB hardware. Communication activities between Antenna Sharing Hub Configuration Tool and the ANDREW ASH will not interfere with on-going activities from RRH/BTS controllers. However, ASH hardware will perform a board-level reset whenever new or existing Antenna Sharing Configurations are modified and applied.

The following sections provide step-by-step instruction on how to navigate through ASH Configuration Tool in Online mode.

3.2.1 Launching Antenna Sharing Hub configuration tool

An Antenna Sharing Hub Configuration Tool icon will be available on the PC's desktop after completing the software installation. Click on the Antenna Sharing Hub configuration tool icon (as shown in the picture below) from the desktop.



The startup screen for the tool is as follows.

🥏 Antenna Shai	ring Hub - Con	figuratio	n Tool 1.17							-	×
Connect	Refresh	Load	Save	Execute	Options	Reports	About				
Connect:			gaia	Antonna	Sharing Configurat	ion for:					
Antenn	a Model	Pres	ent Config	Antenne	sharing conligurat						
				AISG Pr (click on	rotocol Mode Setti buttons to change)	ngs Aisg	Alsg B) AISG C SRET	AISG D	AISG E	AISG F
						AISG	Alsg B	AISG C	AISG D	AISG E	AISG (F)
0	Delete Configu	uration		D (Clear All Mapping RET <-> AlSG)	I	1			Save Config	juration
Hub View	Files Viev	N									
Hub status Not (Connected		COM Port	сом1	Active Hub AISG F	rotocol Mode	s A B		D	E	F

Figure 8 Antenna Sharing Configuration Tool User's Interface

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3.2.2 Setting up Antenna Sharing Hub configuration tool

Under User Preference Settings, select the Serial COM port to be used to communicate with ANDREW ASH hardware.

Preferences							
User Preference Settings for the Configuration Tool							
Sonnecting to Antenna Sharing Hub							
Use COM port COM1 [Communications Port]							
🛃 Antenna Sharing Mapping							
 Allow RETs to be assigned to Multiple AISG control ports (1) Enable the Restricted Operator Access option when mapping RETs (1) Allow empty antenna configuration (1) 							
Security and Privacy							
Password protection enabled							
Save							

Figure 9 Antenna Sharing Hub Configuration Tool Preferences

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3.2.3 Connecting with Antenna Sharing Hub

Click on the 'Connect' tool bar button to establish connection to the Antenna Sharing Hub. Once connected the tool retrieves all relevant data and displays the Antenna Sharing Hub details and the antenna models currently configured and discovered on ANDREW ASH.

Antenna Sharing Hub - Configuration Tool 1.17		- 🗆 ×
Disconnect Refresh	Execute Options Reports About Image: Specific stress stres	
Connect: CP00018CN1049285A94 🕕	Antenna Sharing Configuration for EGYHHTT-65B-R6	
Antenna Model Present Config		
G04400-1 Test EGYHHTT-65B-R6 SBJAHH-1D65C-DL	AISG Protocol Mode Settings (click on buttons to change) AISG (A) AISG (B) AISG (C) AI	ISG D AISG E AISG F
	RET1 (R1) 694 - 862 MHz	
	RET2 (R2) 880 - 960 MHz 🥥	
	RET3 (G1) 1427 - 1518 MHz	0
	RET4 (B1) 1695 - 2180 MHz	
	RET5 (B2) 1695 - 2180 MHz	
	RET6 (Y1) 2490 - 2690 MHz	O
Delete Configuration	Clear All Mapping	Execute
Hub View Files View		Configuration
Hub status Connected COM Port C	OM1 Active Hub AISG Protocol Modes SRET B SRET C SRET	

Figure 10 Antenna Sharing Hub Configuration Tool online and connected to COM1

Each of the antenna model shown in the "Hub View" list in the figure above has the following details (description of columns 'Present' and 'Config').

- 'EGYHHTT-65B-R6' is shown as that it has configuration and there is a device with this model connected to the ASH.
- 'SBJAH4-1D65C-DL' is shown as that it has configuration and there are no devices of this model connected to ASH.
- '604400-1 Test' is shown as that it has no configuration and there is a device with this model connected to the ASH.

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Select an antenna model from the 'Hub view' list to display the configured antenna sharing mapping between the BTS/RRH control ports to the Antenna RET elements as shown in Figure 10.

Connect: CP00018CN1049285B94 (1)	Antenna Sharing Configuration for EGYHHTT-65B-R6						
Antenna Model Present Config							
🗉 604400-1 Test 🖌 🖌	AISG Protocol Mode Settings AISG A AISG A AISG A AISG A						
🗏 EGYHHTT-65B-R6 🛛 🖌 🖌	(click on buttons to change)						
00US44190200123R1 🛈	SRET MRET SRET MRET SRET MRET						
00US44190200123R2 🛈							
00US44190200123G1 (1)							
00US44190200123B1 📵							
00US44190200123B2 🛈	RET1 (R1) 694 - 862 MHz						
00US44190200123Y1 🛈	RET2 (R2) 880 - 960 MHz						
SBJAHH-1D65C-DL Product Number: COM Hardware Version: 1 Software Version: 001.0 Protocol Mode: SRET Subunits: 1	Image: Name of the system Image: Constraint of the system Image: Constrate Image: Constraint of the system						
 Delete Configuration Hub View Files View 	Clear All Mapping (RET <-> AISG)						

Figure 11 Configuration for Antenna Model 'EGYHHTT-65B-R6' depicting Scenario 4. Mixed RETs mapping.

The configuration shown for the antenna model 'EGYHHTT-65B-R6' in the figure 11 (above) uses the scenario 4 Mixed Rets mapping described in the section 2.2.4.

Also the clicking on the plus icon before the 'EGYHHTT-65B-R6' model name will display an expanded list of antenna device serial numbers based on the protocol mode (SRET/MRET) that are connected to the ASH. A window with device details is displayed when mouse is moved over the information icon at the end of the serial number as shown in the figure above.

3.2.4 Changing configuration for Antenna Sharing Hub

The Antenna Sharing for the chosen Antenna Model can be configured by selecting one of three possible access policies on each cell. These are:

- 1. Full Access
- 2. Restricted Access, or
- 3. No Access

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AISG 2.0/3GPP Procedure	Full Access	Restricted Access
RET Discoverable	YES	YES
Reset Software	YES	YES
Get Alarm Status	YES	YES
Get Information	YES	YES
Clear Active Alarms	YES	YES
Read User Data	YES	YES
Write User Data	YES	YES
Alarm Subscribe	YES	YES
Self Test	YES	NO
Software Download	YES	NO
Vendor Specific Procedures	YES	YES
Set Device Data	YES	YES
Get Device Data	YES	YES
Calibrate	YES	NO
Send Configuration Data	YES	YES
Set Tilt	YES	NO
Get Tilt	YES	YES
Antenna Get Number of Antennas	YES	YES

Table below shows the Access Policy enforced by ANDREW ASH hardware for Full and Restricted Accesses.

Note: RET device is not discoverable through AISG2.0/3GPP device scan procedures under No Access Policy.

Table 1 AISG 2.0/3GPP Procedure Support versus Access Policy

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With continuous mouse click on the same cell, user can navigate and select the desired access policy. Navigation of the changes in the access policies on a clicked cell are as follows.

$(Full Access) \rightarrow (Restricted Access) \rightarrow (No Access) \rightarrow (Full Access)$	ss)
---	-----

If the user had unselected the setting 'Enable the Restricted Operator Access option when mapping RETs' from the 'Preferences' window as described in section 3.2.2, the navigation of the changes in the access policies on a clicked cell are as follows.

(Full Access) → (N) (N) Antenna Sharing Hub - Configuration Tool 1.17	lo Access)→
Disconnect Refresh	ExecuteOptionsReportsAboutImage: Security of the
Connect: CP00018CN1049285A94 () Antenna Model Present Config	Antenna Sharing Configuration for 604400-1 Test
E 604400-1 Test ✓ ✓ E GYHHTT-658-R6 ✓ ✓ SBJAHH-1D65C-DL ✓ ✓	AISG Protocol Mode Settings (click on buttons to change) AISG (A) AISG (B) AISG (C) AISG (D) AISG (E) AISG (F) SRET
	AISG (A) AISG (B) AISG (C) AISG (D) AISG (E) AISG (F) RET1 (R1) 824 - 960 MHz (O) (O) </td
	RET2 (R2) 824 - 960 MHz O O R O O RET3 (Y1) 1710 - 2170 MHz O O R O O PET4 (Y2) 1710 - 2170 MHz O O R O O
	RET5 (Y3) 1710 - 2170 MHz Image: Constraint of the second
Delete Configuration Hub View Files View	Clear All Mapping (RET <-> AISG) Execute Configuration
Hub status Connected COM Port	COM1 Active Hub AISG Protocol Modes A SRET B SRET C SRET D SRET SRET

Figure 12 Antenna Sharing Access Level available for the chosen Antenna Model Online Mode

There is a popup menu available on a right click on the cell to select the access policy (Full Access, Restricted Access and No Access).

To store the changes to the Antenna Sharing Configuration for the chosen Antenna Model to a file, click the 'Execute configuration' button. In Online mode, the User has the option to send these changes to the connected ASH hardware

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and/or also save to file as shown in Figure 13. The configuration data saved to a given file will have the extension name .dat.

Confi Antenna Sharing Hub - Confi	iguration Tool 1.17							_	×
Disconnect Refresh	Load Save	Execute	Options Options Preferences	Reports Tools	About Help				
Connect: CP00018CN1049285	A94 🚯	Antenna	Antenna Sharing Configuration for 604400-1 Test						
Antenna Model	Present Config	AISG Pro (click on)	otocol Mode Sett buttons to change)	ings AISG	A AISG B) AISG C	AISG D	AISG E	AISG (F)
	Che File C	Save to Ar name: Program File: Send to Ar	ttenna Sharing Cor (x86)\Commscope\A ntenna Sharing Hu	nfiguration File InternaSharingH b Send	(.dat) Browse	ALSG C R R R R R R R R	AISG D	AISG E	AISG F
Delete Configur Hub View Piles View	ration	I) M	iear All Mapping ET <-> AISG)					Execut	e uration
Hub status Connected	COM Port	сом1	Active Hub AISG	Protocol Modes	S A SRET B	SRET C SR		T E SRET	

Figure 13 Storing changes to the Antenna Sharing Configuration Online mode.

Once the configuration is sent to ASH, a confirmation message is displayed as shown in Figure 14 below. The ASH will restart and the tool will show the status of ASH connection status.



Figure 14 Confirmation message for sending configuration to ASH and/or file.

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3.2.5 Using offline features in online mode

When connected to ASH, user can generate configuration using the 'File View' tab (offline mode). Select the 'Files View' tab and select the antenna model from the list to configure. Make changes to the default configuration by clicking on the cell for changing access policies and click on buttons (AISG protocol mode settings) for changing the BTS/RRH control port protocol modes as shown in the Figure 155 below.

Antenna Sharing Hub - Configuration Tool 1.17		- 🗆 X
Disconnect Refresh	ExecuteOptionsReportsAboutImage: Second	
Colort the Antonno Madel	Antenna Sharing Configuration for EGYHHTT-65A-R6	
EGRZZHHTTV4-65D	AISG Protocol Mode Settings AISG (A) AISG (B	AISG C AISG D AISG E AISG F
	(click on buttons to change)	
		Sher Sher Sher Sher
EGV4-65A-R4-V1		
B FGV/654-FL-C3-4	AISG (A) AISG (B	AISG (C) AISG (D) AISG (E) AISG (F)
B FGVV658-FL-C3-4	RET1 (R1) 694 - 862 MHz	\odot \odot \odot
B FGVV65D-FL-C3-4		
EGVVPX310.11BTD		
EGYHHTT-65A-R6 🖋	RET3 (G1) 1427 - 1518 MHz 🤡 🤡	
EGYHHTT-65B-R6	RET4 (B1) 1695 - 2180 MHz 🥥 🧭	 Image: Image: Ima
EGYHHTT65B-R6V1	RET5 (B2) 1695 - 2180 MHz	
EGZHHTT-65A-R6		
EGZHHTT-65B-R6	RET6 (Y1) 2490 - 2690 MHz	
EGZV4-65D-R6		
🗄 EGZV5-65D-R6-V2		
EGZV5-65D-R6		
☑ F-65C-R1		
■ FF-65B-R1-1-5		
■ FF-65B-R1		
■ FF-65C-R1		
FFF-65C-R3	(RET <-> AISG)	Configuration
Hub View		
Hub status Connected COM Port	COM1 Active Hub AISG Protocol Modes ASRET	3 SRET C SRET D SRET E SRET

Figure 15 Generating Antenna Sharing Configuration using offline feature in online mode.

To store the changes for the selected antenna model, click on the 'Execute Configuration' button. The user will be prompted to send the changes to the connected ASH hardware and/or to save to a file as shown in Figure 13.

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3.2.6 Protocol modes in configuration for Antenna Sharing Hub

The BTS/RRH control port protocol modes (SRET and MRET) for a selected antenna model can be changed for a given configuration by clicking on the buttons on the 'AISG Protocol Mode Settings' section as shown in the Figure 16 below.

Antenna Sharing Configuration for EGYHHTT-65A-R6								
AISG Protocol Mode Settings	AISG (A)	AISGB	AISGC	AISG D	AISG	AISG (F)		
(click on buttons to change)	SRET	MRET	SRET	SRET	SRET	SRET		

Figure 16 Changing BTS/RRH Control port protocol modes for given antenna model.

When connected to the ASH the current active protocol modes on the ASH's BTS/RRH control ports are shown in the section 'Active Hub AISG Protocol Modes' as shown in the Figure 17 below.

Active Hub AISG Protocol Modes	B SRET	C SRET	D SRET	E SRET	F SRET
--------------------------------	--------	--------	--------	--------	--------

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Figure 17 Current active BTS/RRH Control port protocol modes on ASH.



3.2.7 Editing saved configuration from file

To load and edit the configuration from a file, click on the 'Load' tool bar button under 'Configuration' group. Open file dialog is displayed for the user to select the configuration file (.dat extension) and click the 'Open' button. If the configuration that being loaded has an antenna model available in the selected tab (Hub View), the model is selected, and the configuration is displayed.

If the loaded configuration does not have an antenna model in the 'Hub View' list, then the following message is displayed.



Figure 18 Message for non-availability of antenna model for loaded configuration from file.

The configuration can be changed and sent to ASH and/or saved to a file through 'Execute Configuration' button click.

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3.2.8 Site Reports

Reports about the configurations and its details available in the connected ASH device are generated through the 'Reports' menu under 'Tools'. The report generate window allows the user to specify a file name or use the file name provided. The generated report file is of type pdf format and opened in the pdf viewer provided in the window as shown in Figure 21. The page size, orientation, margins, adding header footers for each of the PDF pages in the generated file be changed in PDF settings section. All report files (*.pdf) are available under the folder named 'HubReportFiles' in the ASH configuration tool installation folder.

Note: This feature requires an installed PDF viewer software, such as the Acrobat Reader with browser extension.

Antenna Sharing Hub Reports	—		\times
Generate Report for ASH: Report File Name:	Genera	ate Repo	rt
PDE Settings			
Page Size: A4 Page Orientation: Portrait			~
Add Header (Report PDF file name)			_
Page Margins			
Left 10 Pt Right 10 Pt Top 10 Pt Bottom 10 Pt			
			~
PDF Viewer			
			Ť

Figure 19 Site Report generate with viewer.

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Figure 20 Confirmation message for report generation.

					<u></u>		
erate Report for ASH: Rep	oort File Name:				-		
0018CN104928594 AS)3.pdf	Gene	erate Repo	rt			
)F Settings							
ige Size: A4	2	Page	Orientation	Portrait	t		v
🛙 Add Header (Report PDF file	e name)	✓ A	Add Footer (Page Num	ber)		
age Margins							
aft 10 Pt Right 10 P	t Top 10	Pt Bot	tom 10	0+			
		11 000					
Antenna Sharing Hub (AS	SH) Site Report File: ASH_Rep) Site Report	port-000018CN1	04928594_200603.	pdf			
Antenna Sharing Hub (AS	6H) Site Report File: ASH_Re Site Report	port-000018CN1	04928594_200603.	pdf			
Antenna Sharing Hub (AS Antenna Sharing Hub (AS ASH Serial Number ASH Hardware Version ASH Sharware Version) Site Report File: ASH_Re 0 Site Report 000018CN10492859 1 001.077.065	port-000018CN1	04928594_200603.	pdf			
Antenna Sharing Hub (AS Antenna Sharing Hub (AS ASH Serial Number ASH Hardware Version ASH Software Version ASH Num Antenna Model Configurations	Site Report File: ASH_Re 0 Site Report 000018CN10492859 1 001.077.065 7	port-000018CN1	04928594_200603.	pdf			
Antenna Sharing Hub (A Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Num Antenna Model Configurations ASH Num Antenna Connected	Site Report File: ASH_Re 0 Site Report 000018CN10492859 1 001.077.065 7 3	port-000018CN1	04928594_200603.	pdf			
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes	Site Report File: ASH_Re 0 Site Report 000018CN10492859 1 001.077.065 7 3 AISG-A	Port-000018CN1	04928594_200603.	pdf AISG-D	AISG-E	AISG-F	
Antenna Sharing Hub (AS Antenna Sharing Hub (AS ASH Serial Number ASH Hardware Version ASH Software Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes	Site Report File: ASH_Re 0 Site Report 1 00018CN10492859 1 001.077.065 7 3 AISG-A SRET	Port-000018CN1 14 AISG-8 SRET	04928594_200603.	pdf AISG-D SRET	AISG-E SRET	AISG-F SRET	
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Software Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes Summary	6H) Site Report File: ASH_Re 000018CN10492859 1 001.077.065 7 3 AISG-A SRET Antenna	AISG-B SRET Model	04928594_200603. ABG-C SRET Antenna(s) G	AISG-D SRET smeeted	AISG-E SRET Configuratio	AISG-F SRET n Available	
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Software Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes Summary	SH) Site Report File: ASH_Re 000018CN10492859 1 001.077.065 7 3 AISG-A SRET Antenna COMMRET2	AISG-8 SRET Model e_IOT_10	04928594_200603. ABG-C SRET Antenna(s) G NO	AISG-D SRET mnected	AISG-E SRET Configuratio YE	AISG-F SRET n Available S	
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Software Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes Summary	Site Report File: ASH_Re 0 000018CN10492850 1 001.077.065 7 3 AISG-A SRET Antenna COMMMET2 EGRZV4544	AISG-8 SRET Model 4,007_10 15DR944	ABG-C SRET Antenna(s) C NO	AISG-D SRET mnected	AISG-E SRET Configuratio YE YE	AISG-F SRET n Available S	
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Software Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes Summary	SH) Site Report File: ASH_Re 000018CN10492859 1 001.077.065 7 3 AISG-A SRET Antenna COMMRET2 EGR2V4544 EGR224441 MINESS	Port-000018CN1 4 AISG-8 SRET Model =,001,90 1500594 TV4-65D 6051	04928594_200603. ABG-C SRET Antenna(s) C NO NO NO	AISG-D SRET senected	AISG-E SRET Configuratio YE YE	AISG-F SRET n Available 5 5	
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Software Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes Summary	Site Report File: ASH_Re 000018CN10492859 1 001.077.065 7 3 AISG-A SRET Antenna COMMMETZ EGRZY4546 EGRZY4546 BRWA25465	Port-000018CN1 4 AISG-8 SRET Model =, J07, 30 150R594 TV4-65D 6051 3330-M	AISG-C SRET Antenna(s) C NO NO YES	AISG-D SRET wnnected	AISG-E SRET Configuration YE YE NC	AISG-F SRET n Available 5 5 5 5	
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes Summary	Site Report File: ASH_Re 000018CN10492850 1 001.077.065 7 3 AISG-A SRET Antenna COMMMETZ EGRZY4546 EGRZY4546 RRW421464 RRW421464	AISG-8 SRET Model 4.07_10 ISOR9H4 5330-R6 5330-R6 5330-R6	ABG-C SRET Antenna(s) C NO NO YES VES	AISG-D SRET wnnected	AISG-E SRET Configuratio YE YE NC YE YE	AISG-F SRET n Available S S S S S S S S	
Antenna Sharing Hub (AS Antenna Sharing Hub (ASH ASH Serial Number ASH Hardware Version ASH Num Antenna Model Configurations ASH Num Antennas Connected ASH Operator Port Protocol Modes Summary	SH) Site Report File: ASH_Re 000018CN10492850 1 001.077.065 7 3 AISG-A SRET Antenna COMMRET2 EGRZV4546 EGRZ25HTT HI0051 RRV421H42 RRV421H42 RRV421H42	AISG-8 SRET Model 4_07_10 ISON944 5330-R8 5300-R8 5300	ABG-C SRET Antenna(s) C NO NO YES NO YES NO	AISG-D SRET wnnected	AISG-E SRET Configuration YE YE NG YE YE YE YE YE YE	AISG-F SRET n Available 5 5 5 5 5 5 5 5 5 5	

Figure 21 Generated report open in the viewer.

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3.2.9 Firmware update for Antenna Sharing Hub

When the tool connects to the ASH (Connect tool bar button click), the firmware version from the ASH is compared to the bundled firmware version. If there is a need for updating the firmware on the ASH, tool displays the message with descending timer value as shown in the Figure 22 below.

Hub Fi	mware Update	×					
	Antenna Sharing Hub Device CP00018CN1049285A94 requires firmware update!						
A	Hub device FW Version: 001.074.034 (10/7/2019 8:12:00 AM) Available FW Version: 001.075.071 (1/20/2020 11:55:00 AM)						
	Approximate update time is 5 minutes						
	Do you wish to proceed with the Firmware Update?						
	Firmware Update will start in (26) seconds						
	Yes No						

Figure 22 Firmware update notification message for ASH during connection.

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On the elapse of the timer value on the message or the user click on 'Yes' button, the firmware update to the ASH will proceed as shown in the Figure 23 below.

Antenna Sharing Hub - Configuration Tool 1.17		-							
Disconnect Refresh	ExecuteOptionsReportsAboutImage: Security of the								
Connect: CP00018CN1049285A94 ① Antenna Sharing Configuration for 604400-1 Test									
Antenna Model Present Config G04400-1 Test EGYHHTT-65B-R6 RZZVV-65A-R6H4 SBJAHH-1D65C-DL	AISG Protocol Mode Settings (click on buttons to change) AISG A AISG B SRET SRET AISG A AISG B RET1 (R1) 824 - 960 MHz RET2 (R2) 824 - 960 MHz RET2 (R2) 824 - 960 MHz RET3 (Y1) 1710-2170 MHz RET4 (Y2) 1710 - 2170 MHz RET5 FIGWARE Update 60/118 KB (51.3%) RET6 (Y4) 1710 - 2170 MHz	AISG C AISG D AISG E AISG F SRET SRET SRET SRET AISG C AISG D AISG E AISG F AISG C AISG D AISG E AISG F O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O							
RET6 (Y4) 1710 - 2170 MHz Image: Construction Image: Conste									

Figure 23 Firmware update progress for connected ASH.

On completion of the firmware update, following confirmation message is displayed as shown in the Figure 24 below. Once the firmware update is complete the ASH will restart.

Firmware	Update	×
1	Firmware update on Hub Device[CP00018CN1049285A94] completed successfully	
	ОК	

Figure 24 Confirmation message on the successful completion of firmware update.

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3.3 Antenna Sharing Hub Configuration Tool (Offline mode)

In Offline mode, the Antenna Sharing Hub Configuration Tool software can be used to generate antenna sharing configuration files for supported ANDREW Antenna Models.

3.3.1 Launching Antenna Sharing Hub configuration tool

After the launch of the tool software select the 'Files View' tab to view the antenna models supported by the current software.

Configuration Antenna Sharing Hub - Configuration	n Tool 1.17					-	_	×
Connect Refresh	Save Execute	Options	Reports	About				
Hub	Configuration	Preferences	Tools	Help				
Select the Antenna Model	Antenna S	haring Configuration	on for:					
2CPX208B-V1.12								
2CPX2088-V1						-	-	
2CPX2088-V2 15	AISG Pro	tocol Mode Settin	igs Also	AISG (B)	AISG C A			AISG (F)
2CPX208R-V3	(Click on b	uttons to change)	SRET	SRET	SRET	SRET	SRET	SRET
B 2H-33A-R2								
2HH-33A-R4								
2HH-38A-R4-V2			AISG (A	A) AISG (B)	AISG C			
2HH-38A-R4								
2NPX210R-V1.15								
2NPX210R-V1								
2UNPX203.6R2								
2UNPX206.12R2								
2UPX210B-T2								
3-H24A-3XR-SR								
🗟 3-H24A-3XR				_				
🗟 3H-24A-R3-SR								
🗟 3H-24A-R3								
🗟 3X-C70B-3XR								
🗟 3X-V65A-3XR								
🗄 3X-V65S-C3-3XR								
🗟 3X-V65S-G-3XR								
🗟 3X-V65S-GC3-3XR								
🗟 604400-1 Test	Cle	ar All Mapping					Save	uration
B 605914		AISO)						
Hub View Files View								
Hub status Not Connected	COM Port COM1	Active Hub AISG Pr	otocol Modes	AB	C		E	F

Figure 25 Antenna Sharing Configuration Tool Offline mode

Select an antenna model from the "Files View" list to begin the antenna sharing mapping procedure. On selection, the default configuration gives Full Access of all RET elements on all BTS/RRH control ports. See Figure 26.

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🗲 Antenna Sharing Hub - Configuration Tool 1.17	- 🗆 X
Connect Refresh	Execute Options Reports About ion Preferences Tools Help
Select the Antenna Model	Antenna Sharing Configuration for 604400-1 Test
 3H-24A-R3-SR 3H-24A-R3 3X-C70B-3XR 3X-V65A-3XR 3X-V65S-C3-3XR 	AISG Protocol Mode Settings (click on buttons to change) AISG A A
	AISG (A) AISG (B) AISG (C) AISG (C) AISG (F)
🖻 604400-1 Test	RET1 (R1) 824 - 960 MHz 📀 📀 📀 🥥
₿ 605814	RET2 (R2) 824 - 960 MHz 📀 🥥 🥥 🥥
8 636136-1	RET3 (Y1) 1710 - 2170 MHz
CommRET_IOT_3	
CommRET_IOT_6	RE14 (Y2) 1/10 - 21/0 MHz
ARGUS-RET-IOT	RETS (Y3) 1710 - 2170 MHz 🥥 🧭 🧭 🧭
	RETG (Y4) 1710 - 2170 MHz 📀 🥥 🧭 🧭
CCVVPX305.10R	
CCVVPX305.10R2-	
CCVVPX308.11R-C	
CCVVPX308.11R	
CCVVPX308.11R2	
CCVVPX310.11R	Clear All Mapping Save
П СШ2-65П-РА-1	
Hub View Files View	
Hub status Not Connected COM Port C	COM1 Active Hub AISG Protocol Modes A B C D E F

Figure 26 Default Antenna Sharing Access Policies.

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3.3.2 Changing configuration for antenna model

The same procedure used in Online mode applies when changing Antenna Sharing for a particular Antenna Model in Offline mode. Click on the individual cell multiple times until desired Access policy is displayed. See Figure 27.

The BTS/RRH control port protocol modes (SRET and MRET) for a selected antenna model can be changed for a given configuration by clicking on the buttons on the 'AISG Protocol Mode Settings' section

Contenna Sharing Hub - Cont	iguration Tool 1.17						-	×
Connect Refresh	Load Save Exe Configuration	Preferences	Reports A Tools H	bout ? Help				
Select the Antenna Model	Ant	tenna Sharing Configuratio	on for 604400-1 T	est				
 3H-24A-R3-SR 3H-24A-R3 3X-C70B-3XR 3X-V65A-3XR 3X-V65S-C3-3XR 3X-V65S-G-3XR 3X-V65S-GC3-3XR 3X-V65S-GC3-3XR 604400-1 Test 605814 636136-1 	All (cli	SG Protocol Mode Settin ick on buttons to change) ET1 (R1) 824 - 960 MHz ET2 (R2) 824 - 960 MHz ET3 (V1) 1710 - 2170 MHz	Ngs Alsg A SRET	AISG B MRET AISG B R R R	AISG C SRET	AISG D SRET	AISG E SRET	AISG F SRET
CommRET_IOT_3	RE	ET4 (Y2) 1710 - 2170 MHz	<u></u>	®	0	O	0	<u> </u>
CCF CCHH-65A-R4 CCV4PX310.11R-C	RE	ET5 (Y3) 1710 - 2170 MHz ET6 (Y4) 1710 - 2170 MHz	<u></u>	®	0	0	0	S
	,	Clear All Mapping (RET <-> AISG)					Save Config	guration
Hub status Not Connected	COM Port COM1	Active Hub AISG Pr	rotocol Modes	B	C		E	F

Figure 27 Antenna Sharing Access Level available for the chosen Antenna Model Offline Mode.

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3.3.3 Saving configuration for antenna model

A generated Antenna Sharing Configuration for an antenna model can be saved as a .dat file and used to configure the ASH hardware by any AISG2.0/3GPP-compliant RRH/BTS controller. Refer to the section 3.4 for more details.

To save the configuration, select the 'Save Configuration' button and enter a meaningful name for the configuration file. The configuration data file with extension .dat is a binary file.

	Save As										×
	← → · ↑	« Antenn	aSharingHi	ub Configu	rationTool	> HubCor	nfigurationFiles	~	ල් Search HubCont	figurationFiles	Q
	Organize 🔻 No	ew folder									?
	Pictures			*	^ Nar	me	^		Date modified	Type	
	📕 ATCLite Rele	ase oldUSB									
	Decuments	00000			M	604400-1 T	est_1.dat		2/14/2020 11:29 AM	DAT File	
	O Documents										
	ScreenCaptu	res									
	Spiritual										
	📥 OneDrive - Co	mmScope									
	This PC										
	🧊 3D Objects										
Antenna Sharing Hub - Configuration Tool 1.17	Desktop				× <						>
	File name:	604400-11	Test.dat								~
Connect Refresh Load Save Execute	Save as type:	Antenna S	hare Data F	iles(.dat) (*	.dat)						~
Hub Configuration	Pr ^ Hide Folders								Save	Cance	
Select the Antenna Model Antenna	Sharing Configuration for 6	04400-1 Te	est								
P-212M-C2-KT											
■ 4P-212M-C2				-							
AISG P	otocol Mode Settings	AISG (A)	AISG (B)	AISG (C)		AISG (E)	AISG (F)				
P-4M-A2-V2	buttons to change)	SRET	MRET	SRET	SRET	SRET	SRET				
B 4P-4M-A2											
🗟 604400-1 Test 🧪		AISC	AISC B	AISC	AISC	AISC	AISC E				
8 605814		Auso (N)		Also C	Also O	Also C					
B 636136-1 RET1 (F	 824 - 960 MHz 	\mathbf{i}	R		S	\bigcirc	\bigcirc				
CommRET_IOT_3 RET2 (I	2) 824 - 960 MHz	\bigcirc	R	\bigcirc	0	0	O				
CommRET_IOT_6	1) 1710 - 2170 MHz	0	R	0	0	0	0				
e 6P-2L4M-A3	2) 1710 0170 MUz		õ								
E 6P-6M-A3	2) 1/10-21/0 MH2			<u> </u>							
RETS (3) 1710 - 2170 MHz		R	$\mathbf{\overline{v}}$		$\mathbf{\otimes}$	$\mathbf{\otimes}$				
RETG (1)	4) 1710 - 2170 MHz	\bigcirc	R	0			I				
BP-8M-D4											
CCHH-65A-R4											
CCV4PX310.11R-C											
CCV4PX310.11R											
R CCVVPX305.10R							·				
B CCVVPX305.10R2-											
	lear All Mapping RET <-> AISG)					Save Confi	guration				
					l	Com	90.000				
Hub View Files View											
Hub status Not Connected COM Port COM1	Active Hub AISG Protocol	Modes 🖲	B			E	F				

Figure 28 Saving Antenna Sharing Configuration .dat files.

3.3.4 Editing saved configuration from file

To load and edit the configuration from a file, click on the 'Load' tool bar button under 'Configuration' group. Open file dialog is displayed for the user to select the configuration file (.dat extension) and click the 'Open' button. If the configuration that being loaded has an antenna model available in the selected tab (Files View), the model is selected and the configuration is displayed.

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If the loaded configuration does not have an antenna model in the 'Files View' list, then the following message is displayed.





The configuration can be changed and saved to file using the 'Save Configuration' button click.

3.4 Downloading Antenna Sharing Configurations Using Third Party Controllers

Any AISG2.0/3GPP-compliant BTS/RRH controller can be utilized to send a new antenna model configuration to the Antenna Sharing Hub. This can be accomplished in two ways:

- Using AISG 2.0 software download. The controller must simply use the .dat binary file, created by the Antenna Sharing Hub Configuration Tool, as the payload for the software download to any addressed RET behind the ASH unit. (Note that the commanding operator port must have the Full Access Policy enforced.) The hub will recognize the command payload as a new configuration, intercept and store the data, and reboot with the new configuration applied.
- 2. Using **AISG 2.0 Send Configuration Data** (for SRET) or **AISG 2.0 Antenna Send Configuration Data** (for MRET). Again, the controller will use the .dat file as the payload for the configuration command, and the command can be addressed to any RET behind the ASH unit. (The commanding operator port can have Full Access or Restricted Access Policy enforced.) The hub will recognize the command payload as a new configuration, intercept and store the data, and reboot with the new configuration applied.

After the hub antenna sharing configuration has changed, it is best for all controllers connected to the hub to re-scan for RETs as RET access may have changed.

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4. APPENDIX

4.1 Acronyms

3GPP	Third generation partnership project		
ADC	Analog to Digital Converter		
AISG	Antenna interface standards group		
ASH	ANDREW Antenna Share Hub Hardware		
ALD	Antenna line device		
BTS	Base terrestrial station		
CLI	Command Line Interface		
CPU	Central Processor Unit		
DAC	Digital to Analog Converter		
DISC	Disconnect		
FCS	Frame check sequence		
FFS	For further study		
FRMR	Frame reject		
FW	Firmware		
HDLC	High-level data link control		
HW	Hardware		
I2C	Inter-Integrated Circuit		
I-FRAME	Information frame		
ISO	International standards organization		
ITU	International telecommunications union		
LOC	Layer one converter		
MRET	Multiple-antenna remote electrical tilt		
MSRET	Multiple Single DET remote electrical tilt		
	Multiple Single-RET remote electrical tilt		
NRM	Normal response mode		
NRM P	Normal response mode Poll bit		
NRM P P/F	Normal response mode Poll bit Poll/Final bit		
NRM P P/F REJ	Normal response mode Poll bit Poll/Final bit Reject		
NRM P P/F REJ RET	Normal response mode Poll bit Poll/Final bit Reject Remote electrical tilt		
NRM P P/F REJ RET RETU	Normal response mode Poll bit Poll/Final bit Reject Remote electrical tilt Remote electrical tilt		

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RF	Radio Frequency	
RNR	Receiver not ready	
RR	Receiver ready	
SBT	Smart Bias Tee	
SDD	Software design document	
SRET	Single-antenna remote electrical tilt	
SNRM	Set normal response mode	
SQA	Software quality assurance	
SRS	Software requirements specification	
TBD	To be determined	
ТСР	Time consuming procedure	
UA	Unnumbered acknowledgement	
UART	Universal Asynchronous Receiver/Transmitter	
uP	Micro Processor	
XID	Exchange identification	

4.2 Known Limitation and Constraints

ANDREW Antenna Share Hub Hardware acts as a Proxy between BTS/RRH Controllers and daisy chained Antenna internal RETs. Because ANDREW ASH has no control over response time of every Antenna internal RETs there are scenarios where strict compliance with AISG 2.0/3GPP response time cannot be achieved. Here, we list known issues measured during ANDREW internal stressed qualification testing.

1. It will take slightly longer to complete an AISG software download to an Antenna RET when it is connected behind the ASH. Measured time estimates for COMMRET1 and COMMRET2 Antennas are shown below.

Antenna RET System	AISG Download Without ASH	AISG Download Thru ASH
COMMRET2	10min	15min
COMMRET1 (EGYHHTT-65B-R6)	15min	20min

Table 2 Estimated AISG2.0/3GPP Software Download Times

- 2. If an antenna RET is in a protocol mode different from configured RRH/BTS control port protocol mode, due to the protocol translation, AISG2.0/3GPP responses could exceed 1 second.
- 3. The ASH Ghost RET is operational within 3 seconds after an ASH's board level reset. However, mapped RETs at ASH BTS/RRH control ports will not be operational until AISG2.0/3GPP device scan is completed at ASH output port in the event of an ASH board level reset.

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