TCCxxxx
Android
ALL
V1.7E
Wi-Fi Display Guide

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Telechips

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Revision History

Date	Version	Description
2013-01-03	0.1	Initial
2013-02-26	1.0	update
2013-05-21	1.1	update
2013-05-28	1.1	Add latency
2013-06-07	1.2	Update
2013-07-03	1.3	Update & add tesing phone(source) list
2013-08-30	1.5	
2014-02-11	1.6	Update for Kitkat
2013-03-29	1.7	Add HDCP 2.x comment

TABLE OF CONTENTS

Contents

1 Introduction

Wi-Fi Display is peer-to-peer wireless mirroring standard created by the Wi-Fi Alliance. Wi-Fi Display connected via Wi-Fi Direct. You can find explanation of Wi-Fi Display(Miracast) at below link.

http://www.wi-fi.org/wi-fi-certified-miracast%E2%84%A2

Telechips Wi-Fi Display solution supports source/sink device at one device.

If you have some question about Wi-Fi, please refer to Wi-Fi document.

2 How to porting another Wi-Fi module

Telechips Wi-Fi Display solution is based on Android 4.4.2. If you want to use another Wi-Fi module except that we support modules, Your module's Wi-Fi driver and wpa_supplicant support the Android 4.2 first.

Because we support many Wi-Fi modules, we have property to support optional function, for example, persistent go.

For example, Realtek wifi, you can find some property as below file.

device/telechips/tcc893x-common/wifi/realtek.mk

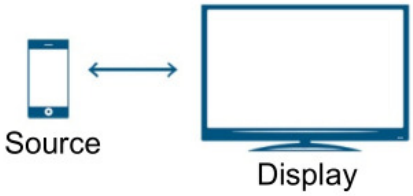
```
….
PRODUCT_PROPERTY_OVERRIDES += \
tcc.wifi.p2p.persistent = 1 \
….
```

So if you want to use your Wi-Fi, please add property you want.

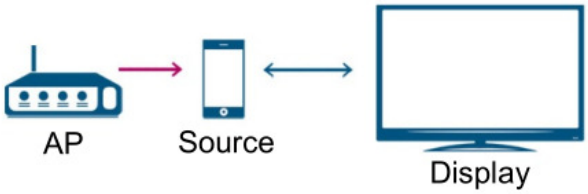
3 Topology

We support below four topologies. However, In topology 4, we suggest that Display's AP connection is disconnecedt. This is provided by Sink application. You can find more detail in 6. Concurrent mode.

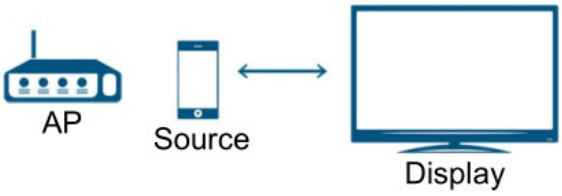
Topology 1: Direct Source to Display
No AP present



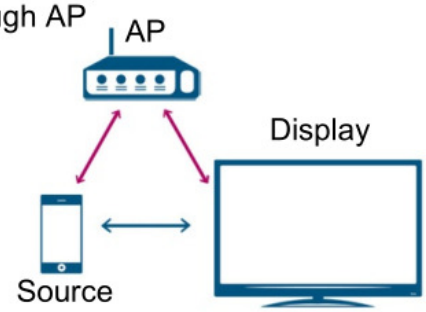
Topology 2: Source with access to AP and direct connection to Display
Content may be streamed from AP to Source to Display



Topology 3: Direct Source to Display, AP present, but not connected
AP may be aware of Wi-Fi Miracast devices, but it is not connected to them



Topology 4: Source and Display connected to each other and to AP
Source may stream content from itself or through AP



4 Wi-Fi Display Specification

Below table is the Wi-Fi Display status on Telechips platform.

Functions and Services	WFD Source		Primary Sink		Secondary Sink(O)	
	Spec	Telechips	Spec	Telechips	Spec	Telechips
WFD Device Discovery	M	support	M	support	M	don't support
WFD Service Discovery	O	don't support	O	don't support	O	
WFD Capability negotiation	M	support	M	support	M	
WFD Coupled Sink Operation	O	don't support	O	don't support	O	
WFD Connection Setup, with a WFD Sink	M	support	M	support	M	
WFD Session establishment, with a WFD Sink	M	support	M	support	M	
Encode and packetization of the captured Display	M	support	N/A	N/A	N/A	
Transport of multiplexed audio and video payload	M	support	M	support	N/A	
De-multiplex, de-packetization and decode of received audio and video payload	N/A	N/A	M	support	N/A	
Rendering of decoded video on local display panel or a display panel that is attached to a WFD Sink	N/A	N/A	M	support	N/A	
Power Save mechanisms	M	support[1)]	M	support[1)]	M	
Session termination	M	support	M	support	M	
Encode and packetization of captured audio	M	support	N/A	N/A	N/A	
Transport of video payload without audio	O	support	M	support	N/A	
Transport of audio payload without video	O	don't support	O	don't support	M	
Multiplex video and audio payload	M	support	N/A	N/A	N/A	
De-packetization and decode of received audio payload that is not multiplexed with video payload	N/A	N/A	O	support	M	
Rendering of decoded audio on local speakers or speakers attached to a WFD Sink	N/A	N/A	M	Support	M	
Link Content Protection	O	support	O	support[2)]	O	
Time Synchronization	O	don't support	O	don't support	O	
Concurrent WLAN operation	O	support[3)]	O	support[3)]	N/A	
Persistent WFD group	O	support	O	support	O	
AV Stream Control using RTSP	M	support	M	support	M	
AV Audio Stream Routing Control during	O	don't support	O	don't support	O	

Coupled Sink Operation						
User Input Back Channel	O	don't support	O	don't support	N/A	
Preferred Display mode	O	don't support	O	don't support	N/A	
Remote I2C Read/Write	O	don't support	O	don't support	N/A	
WFD Standby / resume	O	don't support	O	support	O	

This table referred to Wi-Fi Display Technical Specification Table 3-1.

M: Mandatory item of Miracast, O: optional item of Miracast

1) Power save mechanism is dependent on Wi-Fi module

2) To support HDCP 2.x, you must need HDCP 2.x patch. If you want to know about DRM like HDCP 2.x, please contact to Telechips CS.

Note. If your device supports WFD Sink or Source with HDCP 2.x and output WFD's video or audio via HDMI, you must apply HDCP 1.x

3) Concurrent WLAN operation is dependent on Wi-Fi module

5 Miracast

The Miracast is the name of Wi-Fi Alliance certified program for Wi-Fi Display.

We have tested Miracast Sink/Source pre-test, not real test. The below table is the pass item list of Miracast Sink and Source device.

Item	
common	4.1.1
	4.1.2
	4.1.3
	4.1.4
Sink	6.1.1
	6.1.2
	6.1.3
	6.1.7
	6.1.8
	6.1.9
	6.1.17a
	6.1.19
	6.1.21
Source	5.1.1
	5.1.2
	5.1.3
	5.1.16
	5.1.17a

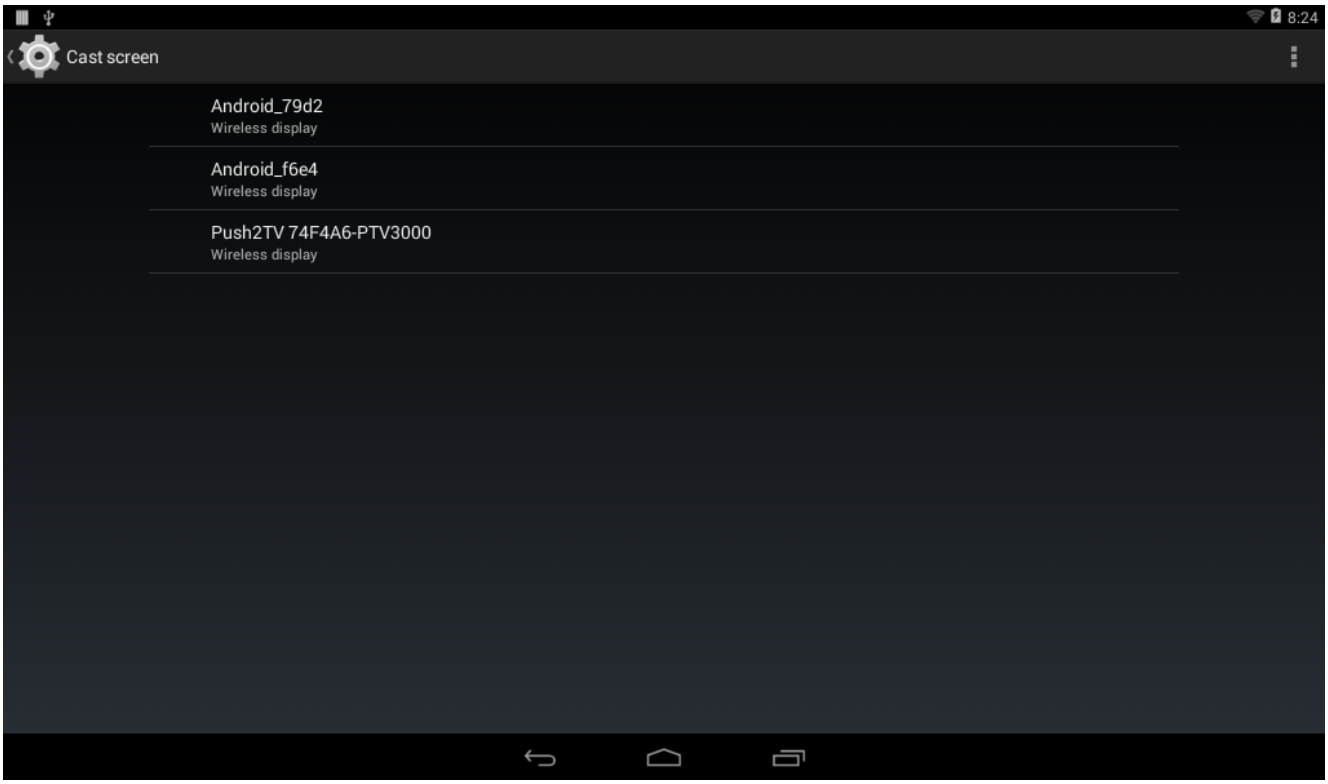
	5.1.18
	5.1.20

6 How to use Wi-Fi Display

Wi-Fi display is consisted of two devices: source and sink.
Source device's role is the sending captured data and RTSP server. And sink device's role is the receiving data and RTSP client. If you want to use Wi-Fi display source, you just enter 'Cast screen' menu. Wireless display menu is located Settings->Display->Cast screen. If you want to use Wi-Fi display sink, just execute WFDSink application.
Telechips Wi-Fi Display solution supports source/sink device at one device.

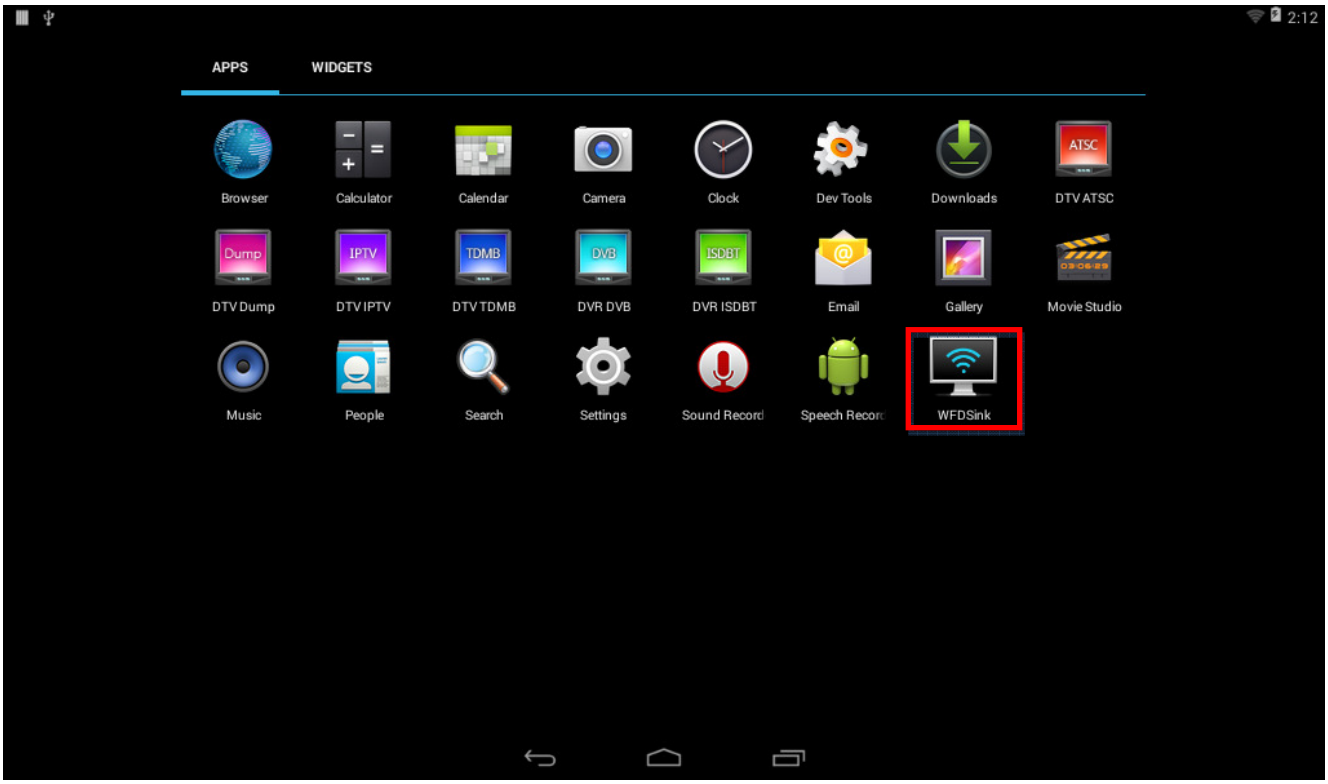
7.1 Source

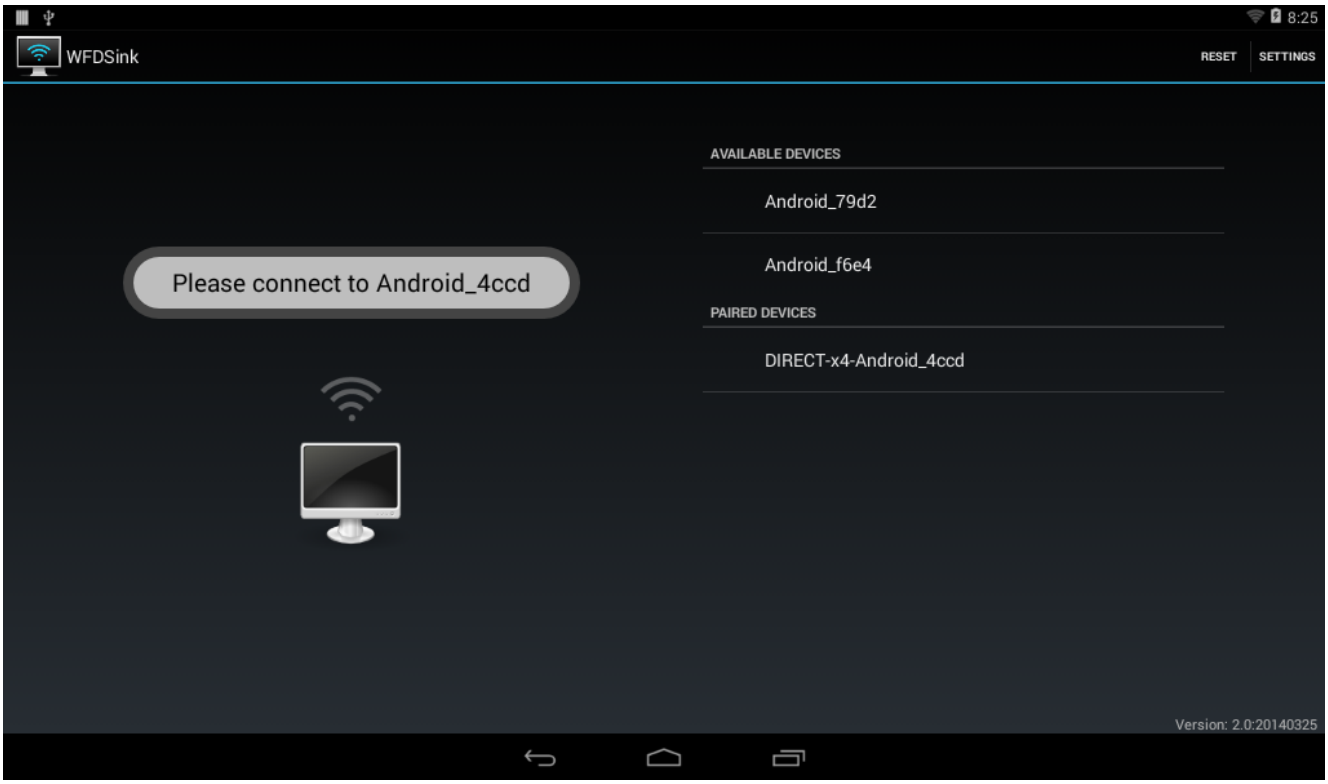
If you want to use Wi-Fi Display source, you can find 'Cast screen' menu as below picture.



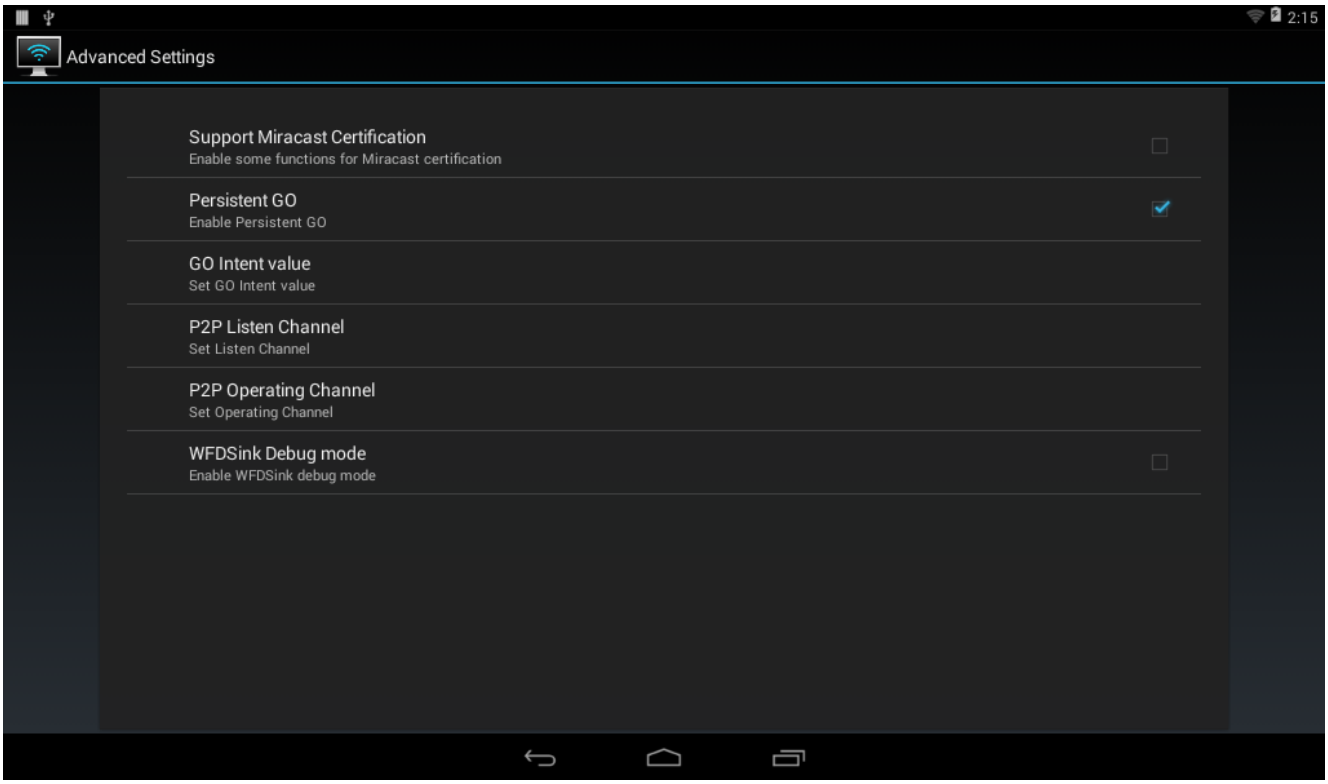
7.2 Sink

You can find Wi-Fi Display sink application as blow picture. If you execute WFDSink, you can use Wi-Fi Display sink. This application turn on Wi-Fi or Wi-Fi Direct automatically.





This is the Advanced Settings menu.

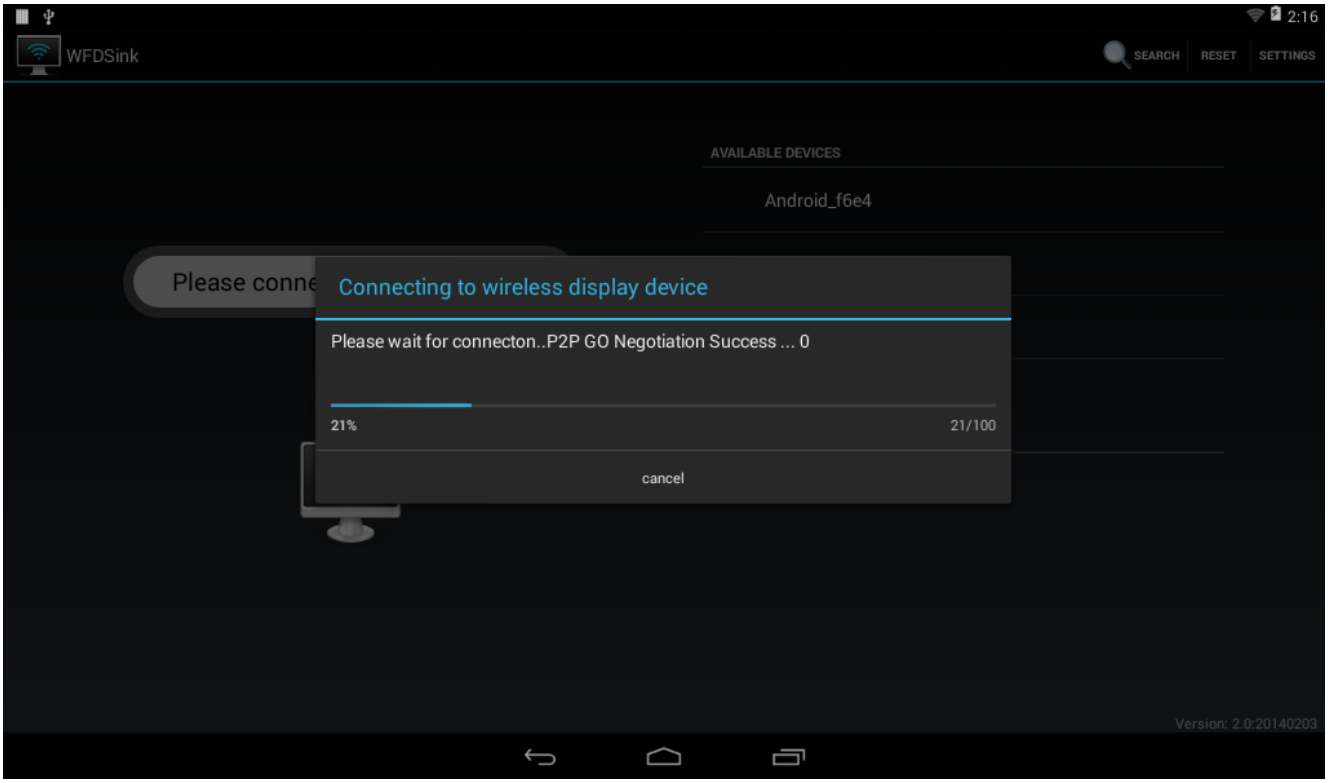


- Support Miracast Certification : this is the same in Source device.
- Persistent GO
- GO intent value: The default value of Sink device is 0(minimum)
- P2P Listen Channel
- P2P Operation Channel
- WFDSink Debug mode: if image is eng mode, this is enabled, This option shows

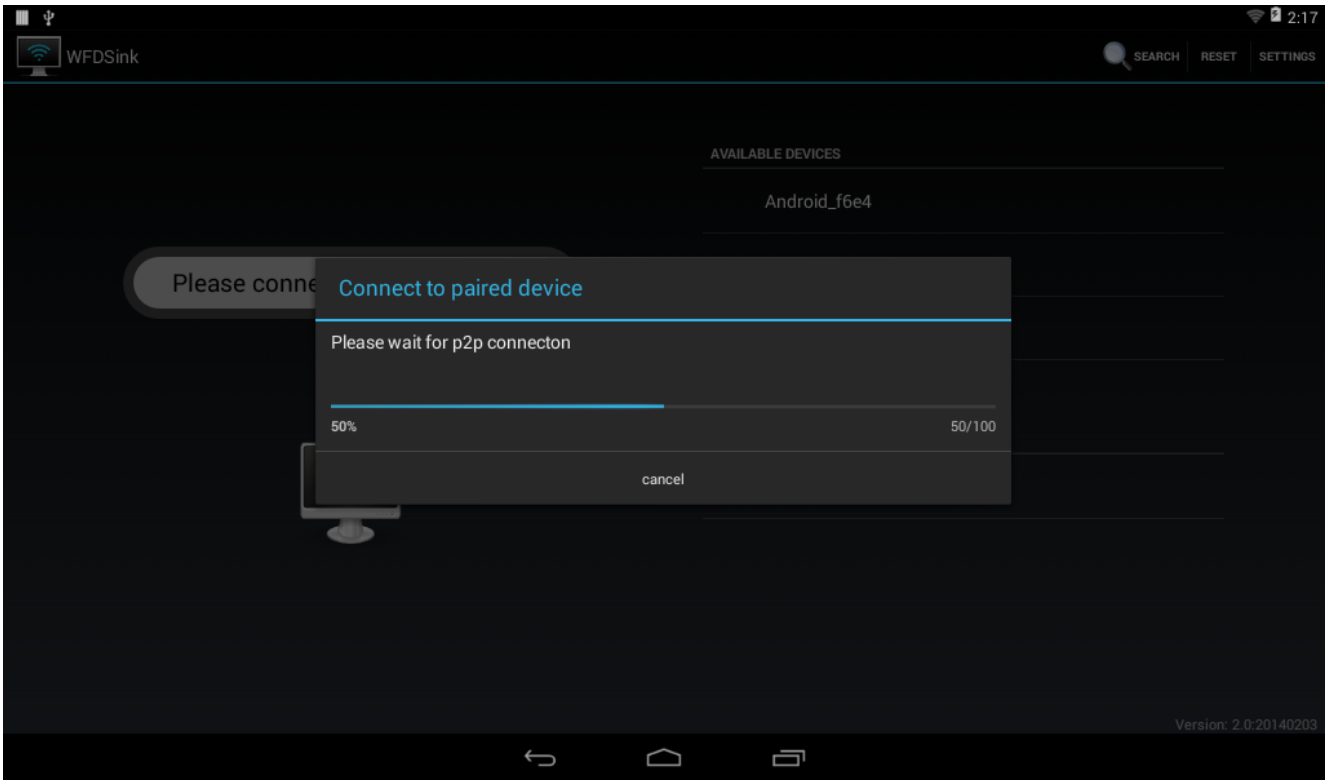
Settings and debug message in WFDSink only activated when eng mode.

If source device requests connection to sink device, connection dialog pup up automatically. This is Automatic PBC, you can select normal PBC in SETTINGS menu.

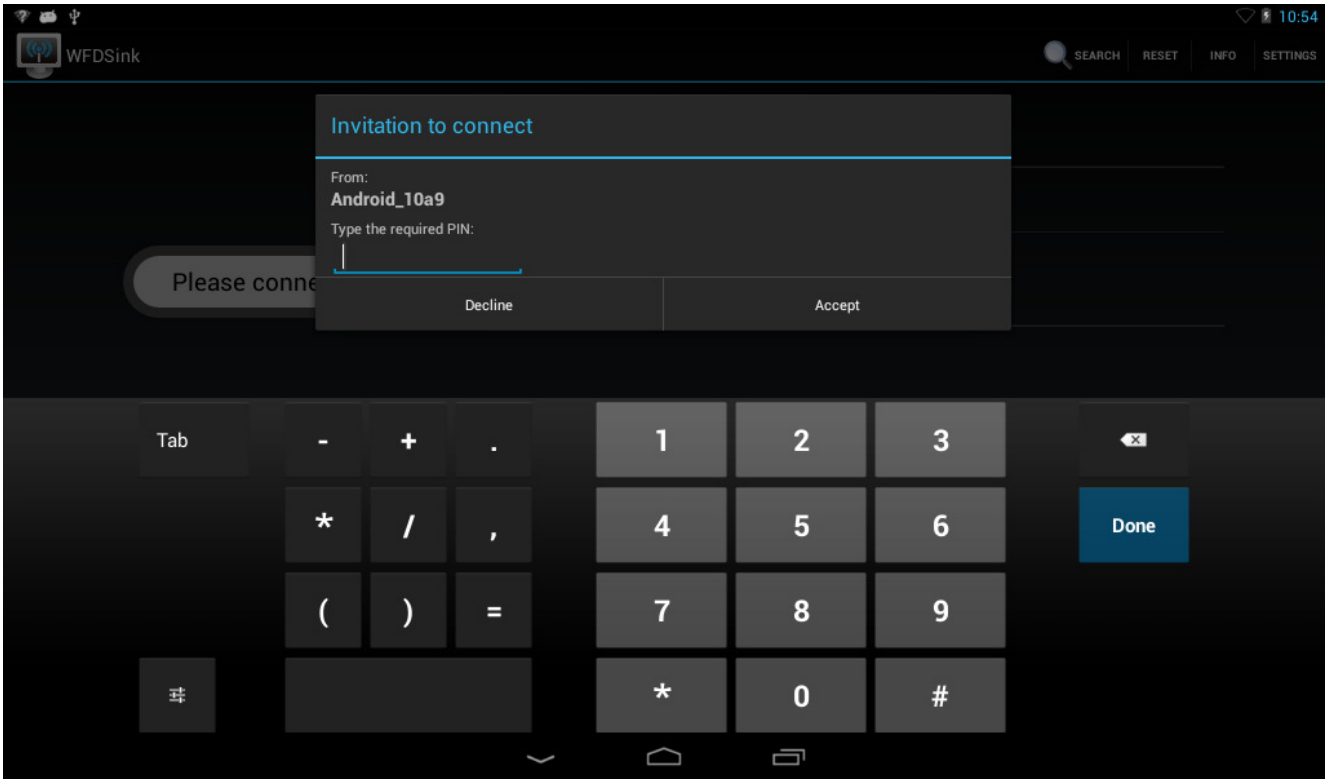
Below picture is automatic PBC(default)



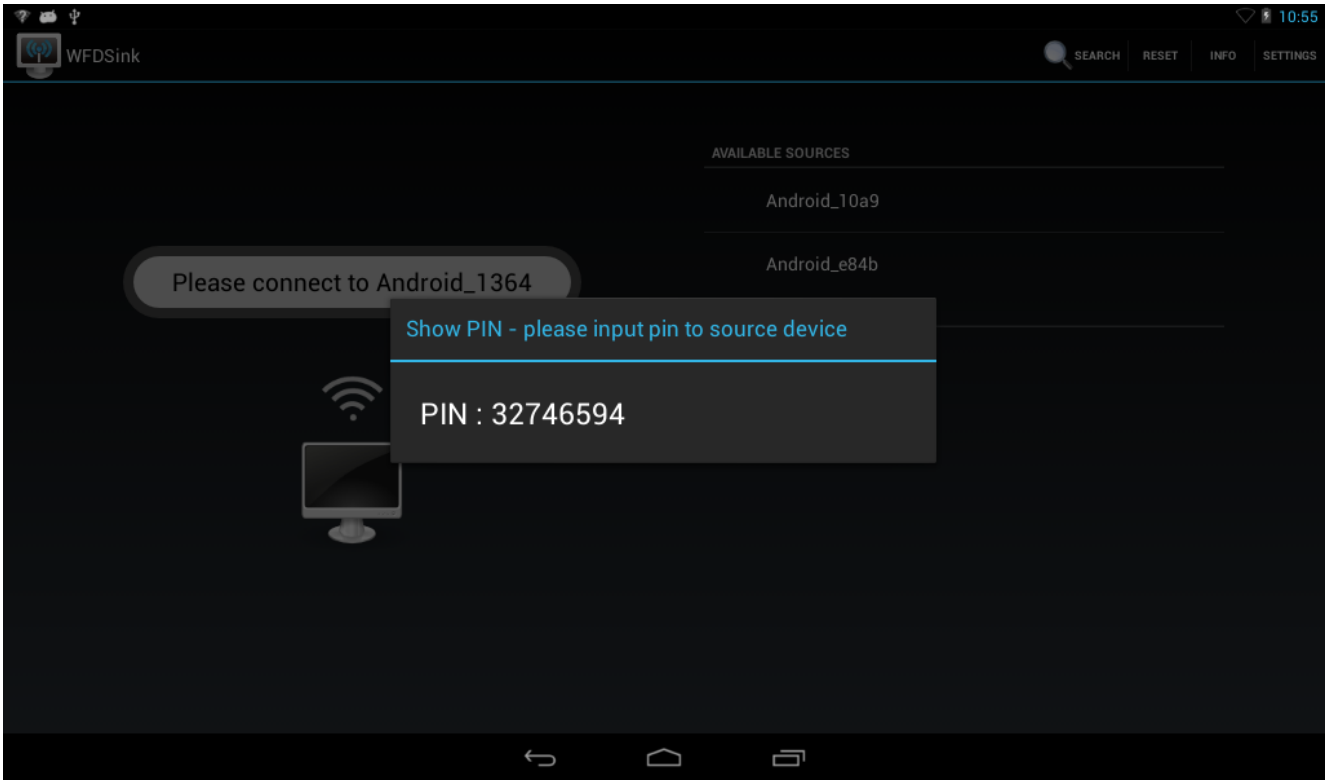
When you connect sink two times, persistent connection will work as below



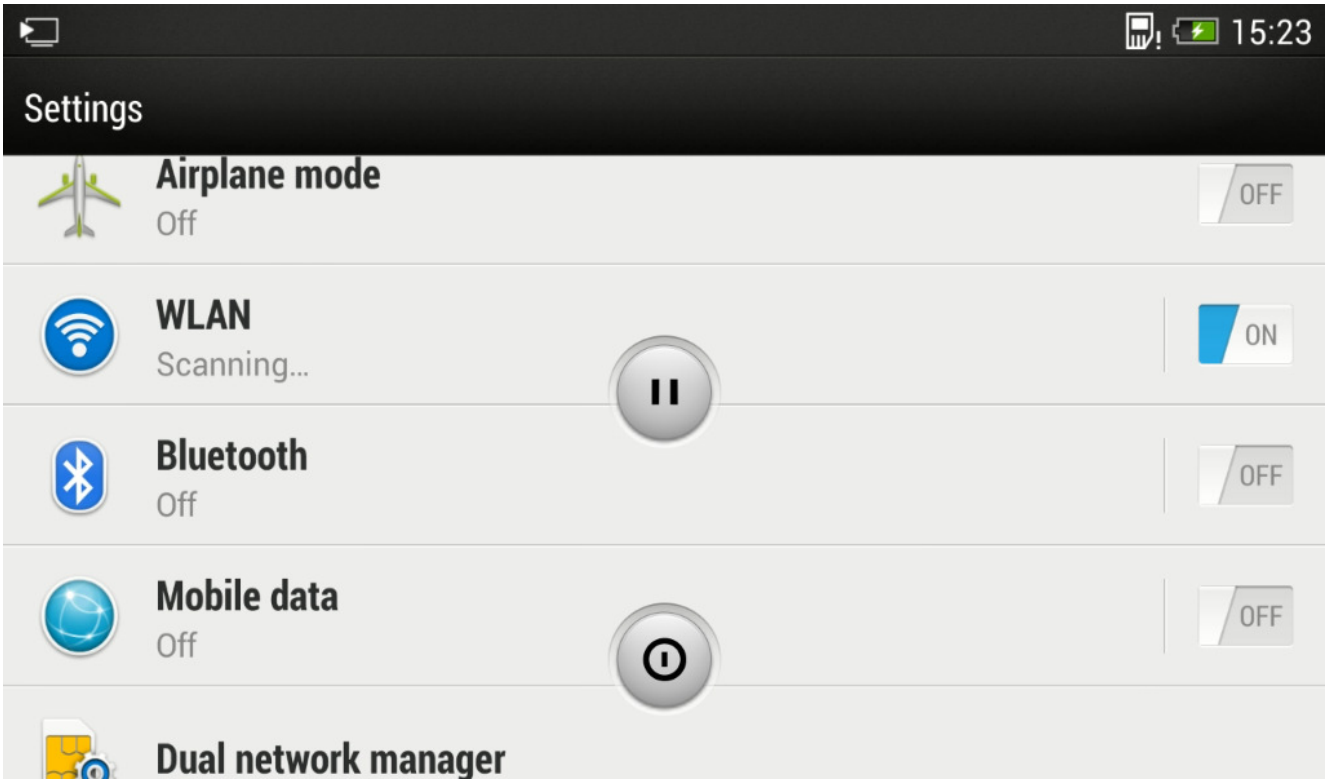
When source device selects DISPLAY, Sink device will show as below.



When source device selects KEYPAD, Sink device will show as below.



If you touch screen twice, you can see below picture.(The first touch is show up navigation bar). There are two buttons. Below button is ‘shutdown’ button. If you click this button, WFDSink application closed and disconnect Wi-Fi display connection. The other button is ‘pause/resume’ button. When you click this button, rendering screen is stopped.



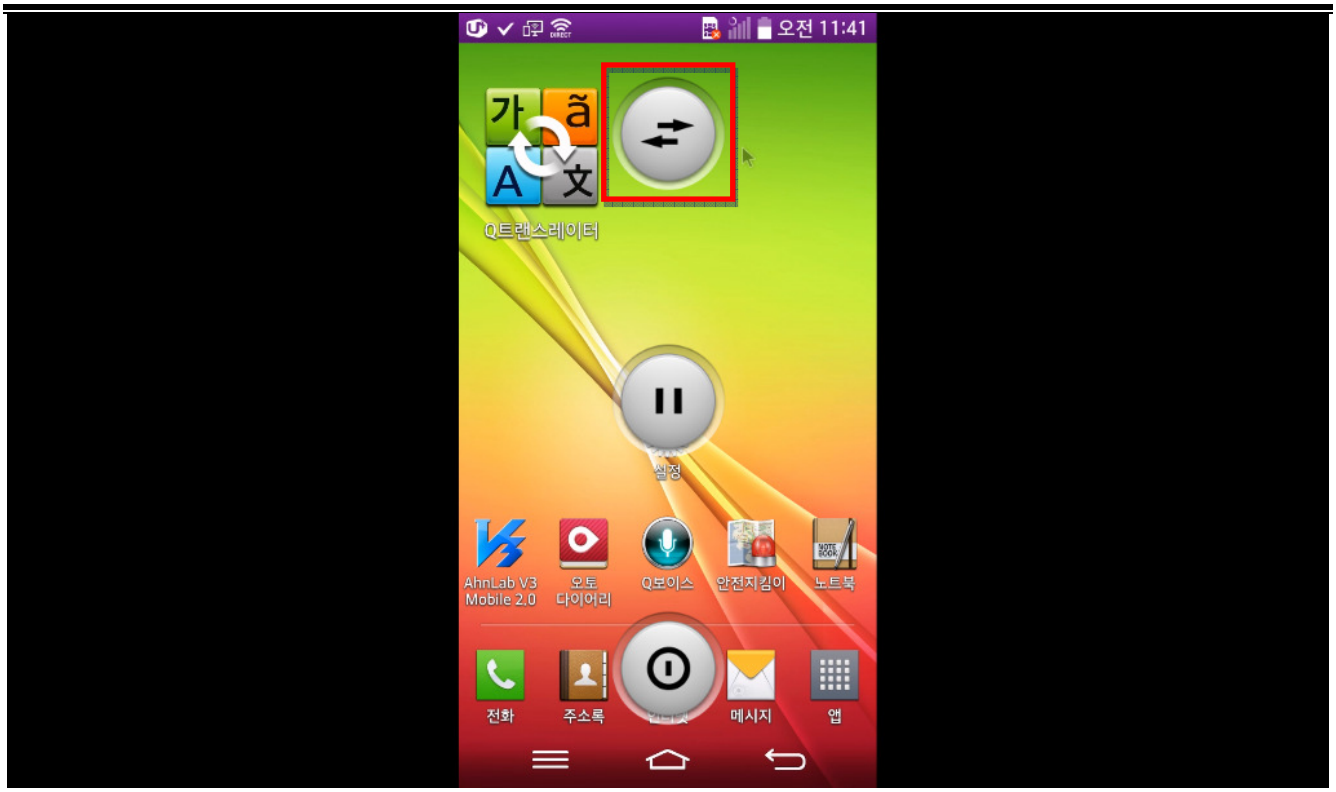
In Eng build, you can see extra information as below. It will be disappeared when you build user mode.
If you enable WFDSink Debug mode in Settings, you can see debug messages.

6.1.1 UIBC(User Input Back Channel)

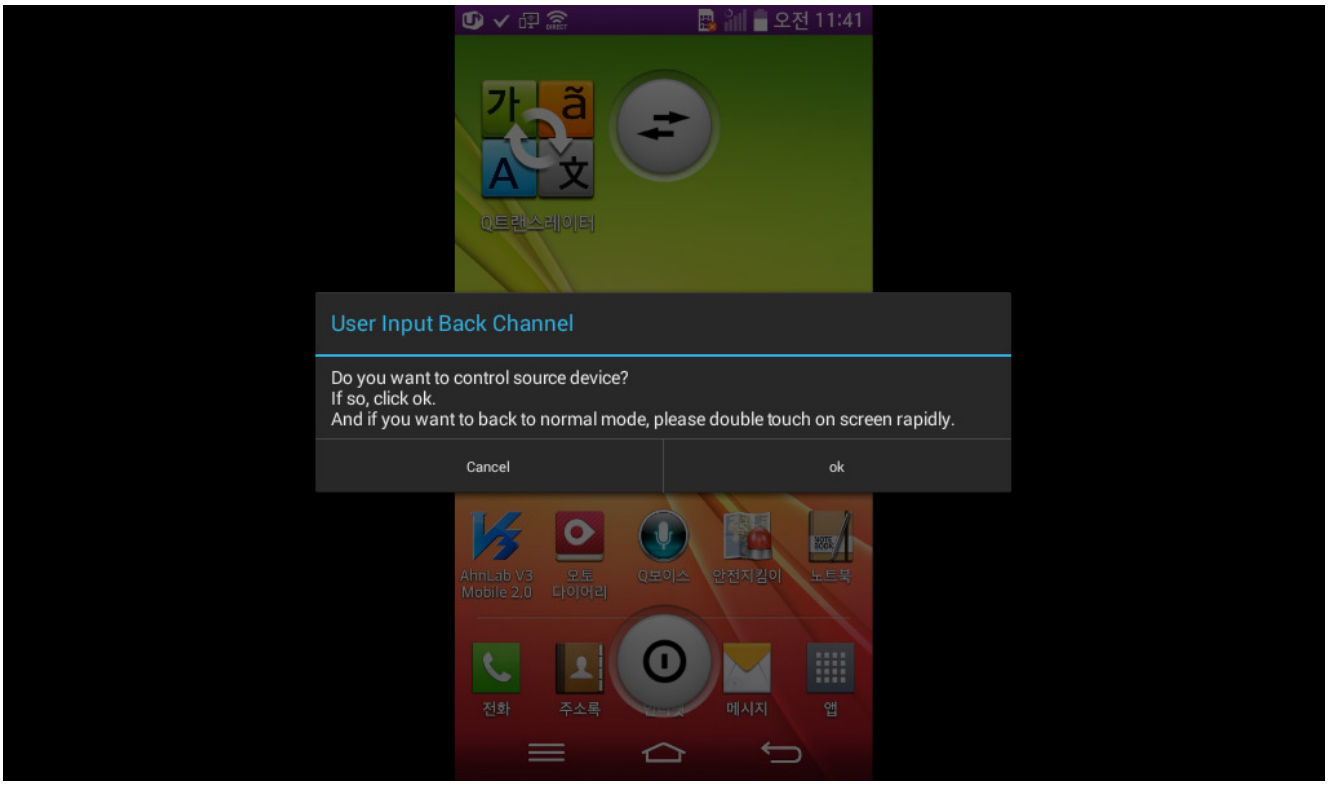
The User Input Back Channel(UIBC) is an optional WFD feature that when implemented facilitates communication of user input to a User Interface, present at the WFD Sink, to the WFD Source.
Telechips WFD Sink supports UIBC only ‘Generic’ category, single touch.

If WFD Source device doesn’t support UIBC, this function doesn’t use. When we test with commertial mobile phone, it is to hard to find support UIBC. We’ve tested LG Optimus G2 and Intel WiDi

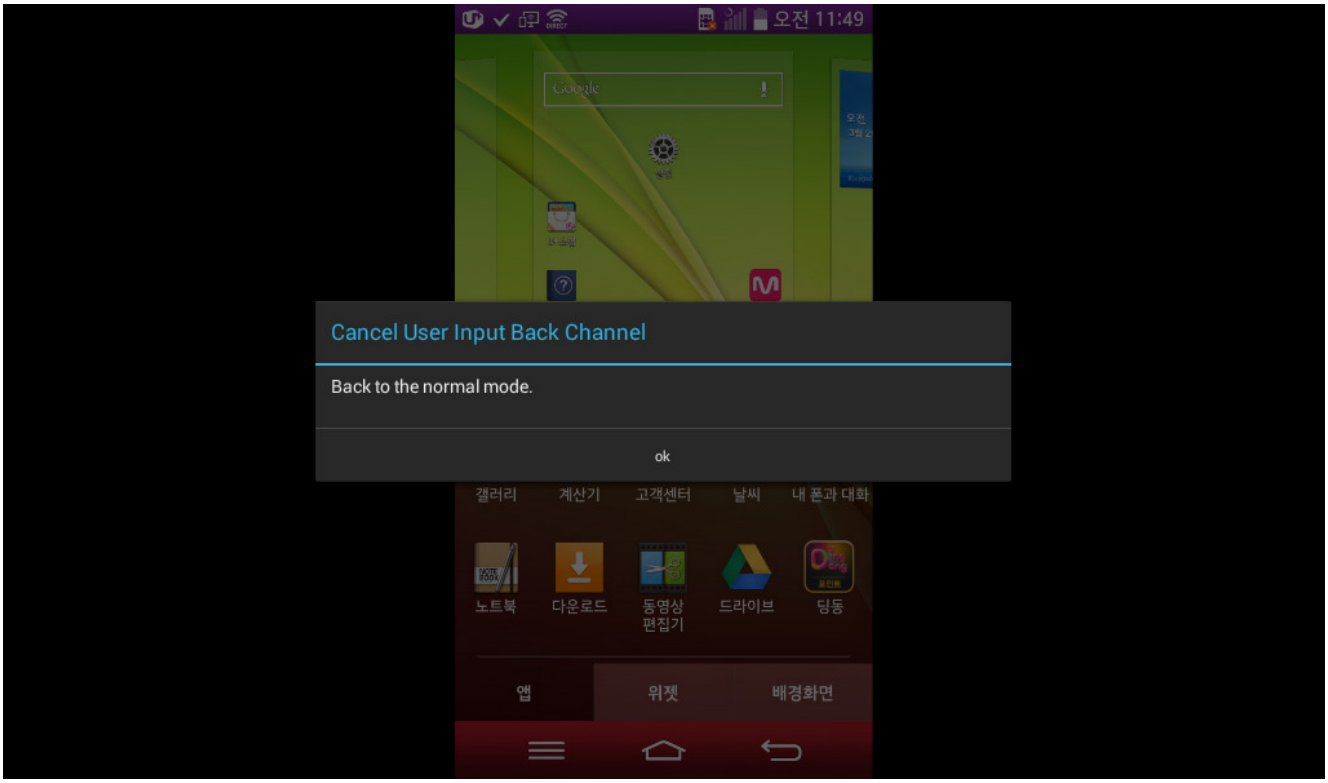
If WFD Sink and WFD Source success with UIBC negotiation, you can find below picture’s button when you touch or mouse click on WFDSink application. The first button is UIBC enable button.



Below picture is when click UIBC enable button.



Below picture is when UIBC mode cancel.



7 Latency

Below table is the our latency results. Sink device connect to TV. We tested this in real environment.

TV	Sink	Source	Latency(ms) Min/Max/Avg
Coby TV	TCC8925 HDMI Dongle	LG Optimus G	160
			200
			176
		Nexus 4	130
			200
			168
		TCC8930 demo board	150
			200
			177
	TCC8935 HDMI Dongle	LG Optimus G	160
			200
			172
		Nexus 4	130
			200
			171
		TCC8930 demo board	150
			200
			170
LG Smart TV	TCC8925 HDMI Dongle	LG Optimus G	220
			400
			331
		Nexus 4	180
			330
			241
		TCC8930 demo board	240
			340
			285
	TCC8935 HDMI Dongle	LG Optimus G	240
			340
			283
		Nexus 4	230
			330
			285
		TCC8930 demo board	200
			290
			253

8 Compatibility

This chapter describes compatibility of Telechips Wi-Fi Display platform.

10.1 Miracast Interoperability Event in 2013

Telechips participates in Miracast Interoperability Event. This section describes summary of Miracast Interoperability Event. This event was checking for compatibility. We cannot assure whether there is no problem with below vendor or not. The firmware might be different from mass production. We provide this for your reference. The compatibility means that Wi-Fi Display connection is okay or not and audio/video play or not(without HDCP). We didn't test for a long time and video/audio quality.

8.1.1 Tested Source Device

Vendor	Device type(Source device)
BlackBerry	Mobile phone
nVidia	Tablet
AMD	Notebook
Intel	Notebook
SonyMobile	Mobile phone
Toshiba	Tablet
Microsoft	Notebook
Marvel	Tablet
MotorolaMobility	Mobile phone
SharpMobile	Mobile phone
Qualcomm	Mobile phone

8.1.2 Tested Sink Device

Vendor	Device type(Sink device)
Marvel	Reference board
Realtek	Dongle
Mediatek	Dongle
Cavium	Box
Funia	TV
Qualcomm	Box
WesternDigital	Box
Toshiba	TV
Sony	TV
Sharp	TV
TPVision	TV

10.2 Commercial Source phone compatibility test with Telechips Sink device

Tested mobile phones
CoolPad(don't support)
Dalkele(don't support)
Galexy S3(GT-I9300)
HTC One (This device might support HDCP, but cannot connect HDCP. This is the same with other. We connect to no HDCP)
MTK6577(don't support)
Mtk6589(don't support)
Nexus 4(LG-E960)
Oppo x909(don't support)
Optimus G Pro(F240)
Optimus G(F180S)(don't support)
Sony LT291 Xperia
Nubia Z5(don't support)
小米2(don't support)
LG Optimus G2
Galaxy Note 3
Galaxy S4
Nexus 5