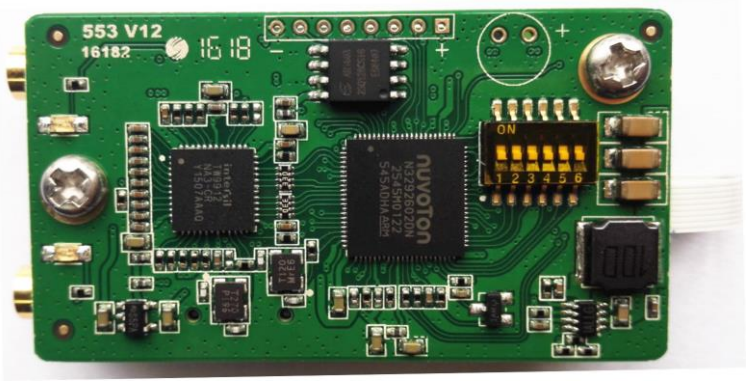
RAK553 图传模块

规格书 V2.6



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目 录

1 概述

1.1 模块概述

RAK553 是一款完全支持 IEEE802.111a/b/g/n 无线协议的超低功耗支持 CVBS 输入的智能视频模块，具有封装小、易于使用的特点。集成了对音频视频图像的采集，编码压缩，传输。采用高效的硬编码方式，强大的 WIFI 通讯模组，保证了视频的清晰，流畅度。由智能终端 Android、iphone 等设备完成音频视频的播放及显示。此外，还具有透传串口的设计。提供一路高速 UART 接口供客户功能扩展。

RAK553 内置 WIFI 模组，支持 802.11a/b/g/n 2x2 MIMO，整体模块可以支持远距离图像传输。

1.2 应用领域

- 飞行器
- 智能玩具
- 楼宇自动化
- 物流和货运管理
- 家庭安全与自动化
- 电网基站巡检

1.3 产品特性

- 强大的 WIFI 功能
  - 满足 802.11a/b/g/n 协议
  - 发射功率：≤22dBm
  - Soft AP Mode
  - 2x2 300M PHY Rate
  - 支持 Infra/Soft AP 网络类型
  - 支持多种安全认证机制：WEP64/WEP128/ TKIP/CCMP(AES)/ WEP/WPA-PSK/WPA2-PSK
  - 支持多种网络协议：TCP/UDP/ICMP/DHCP/DNS/HTTP
- 高效的视频处理
  - 支持 H.264/CIF/VGA/QVGA MJPG/RTP Stream
  - Continuous/Static JPEG/RTP Stream

- 20fps 体验流畅的视频
- 高效的硬编码技术
- Merged MJPG + MP3 Stream
- Separate MJPG + MP3 Stream
- Separate H.264 + PCMA Stream

- 输入源接口
  - 1 路透传串口和 1 路高速 UART 接口资源
  - MIC 接口
  - 视频信号接口
- 模组体积

  55mm*30mm*16.3(±0.2)mm (DIP LED)

  55mm*30mm*13.1(±0.2)mm (Without LED)

1.4 规格参数

参数	描述
视频参数	VGA(640*480) 30FPS MJPEG/H.264 压缩格式 强大的硬编码技术
传输距离	配合接收机 RAK554 工作：有效距离 1000m，较清晰流畅距离 500m 只有 RAK553 作为 AP 模式：有效距离 150m，较清晰流畅距离 100m
尺寸参数	55mm*30mm*16.3(±0.2)mm (DIP LED) 55mm*30mm*13.1(±0.2)mm (Without LED)
串口透传波特率	115200bps（默认），可通过命令修改
无线参数	满足 802.11a/b/g/n 协议，支持 Infra/Soft AP 网络类型，支持 Soft AP
电源参数	7-24V 电源,平均工作电流 150mA(输入电压为典型值:12V) 峰值电流是 300mA(输入电压为典型值:12V)
CPU	ARM926EJ-S
操作系统	Linux-2.6.35.5

2 硬件描述

2.1 模块视图

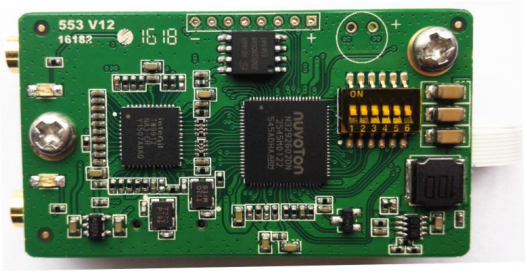


图2-1 RAK553 模块正面

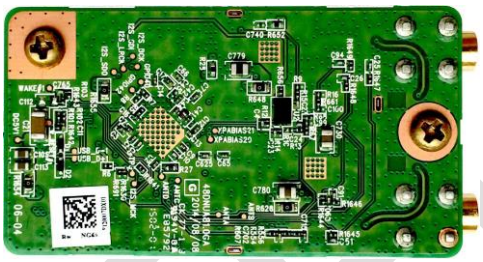


图2-2 RAK553 模块反面

2.2 模块尺寸

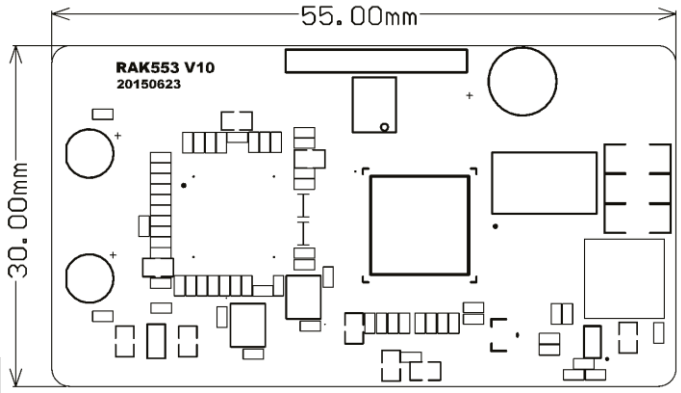
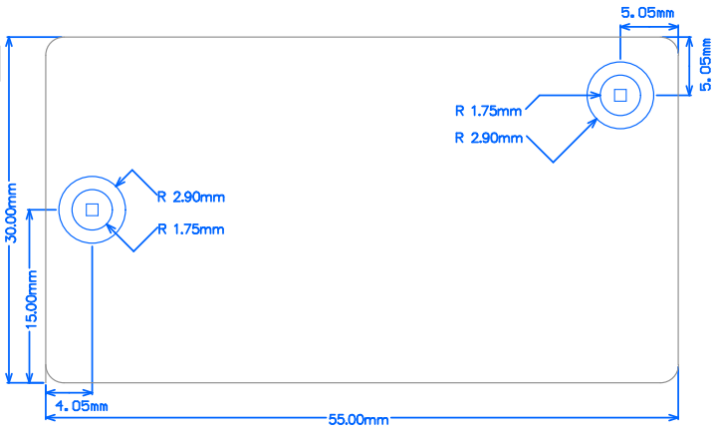


图2-3 模块平面尺寸图

2.3 安装定位孔



2.4 管脚定义

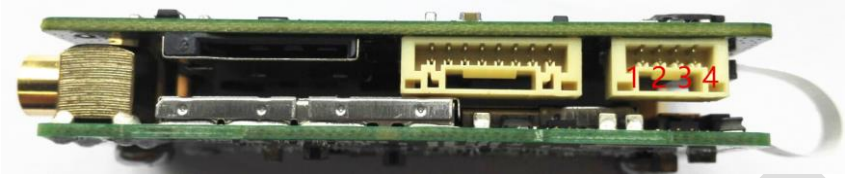


图2-4 电源接口线序

脚号	名称	描述	备注
1	VDDIN	12V 供电	P
2	VDDIN	12V 供电	P
3	GND	地	P
4	GND	地	P

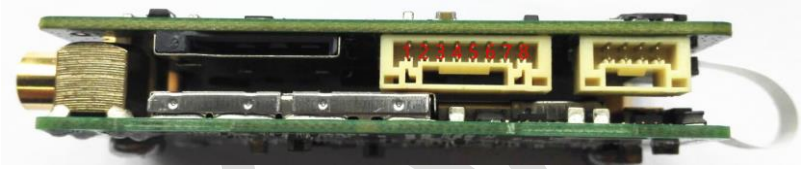
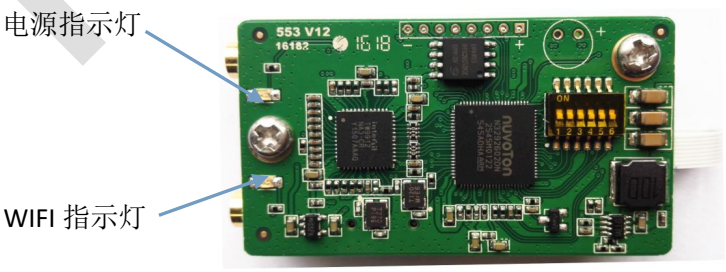


图2-5 音视频及串口接口

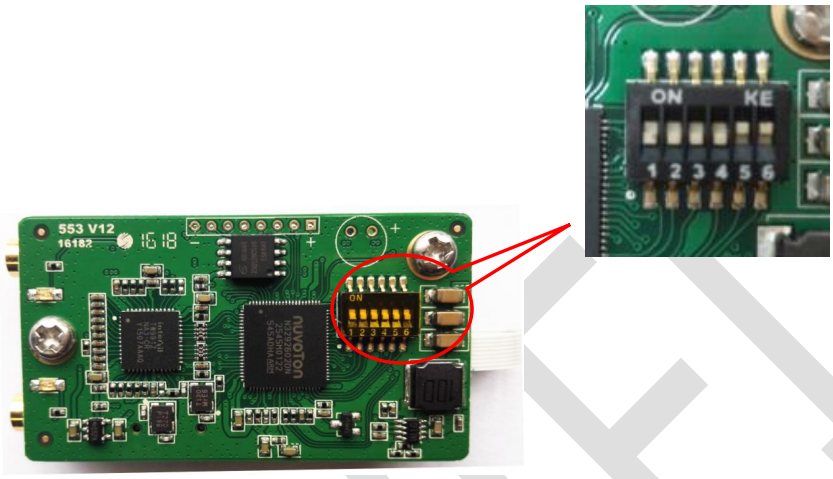
脚号	名称	描述	备注
1	NC	预留	I/O
2	NC	预留	I/O
3	HUR_TXD	高速串口发送引脚	O
4	HUR_RXD	高速串口接收引脚	I
5	LINE_IN	LINE 信号输入引脚	I
6	AV_IN	AV 信号输入引脚	I
7	GND	地	P
8	VCC12V	12V 供电	P

2.5 LED 状态



备注： LED 状态指示灯会根据实际的情况以及客户的需求调整，颜色可以更换。

2.6 拨码定义



拨码共计 6 组，ON 表示当前拨码接地，为低电平 0 。拨码处于数字边表示为高电平 1 。

拨码编码顺序用 Sw1-6 表示。功能定义如下：

Sw6	Sw5	Band	信道	工作中心频率
1	1	4	149	5745
1	0	1	48	5240
0	1	1	36	5180
0	0	4	165	5825

出厂默认是 Band4 ， 149 信道。

Sw1 你作为 WPS 的拨码控制吧，拉低后，保持 3 秒，之后马上拉高，就进入 WPS 配置状态。 进入 WPS 状态指示灯闪烁。

3 射频特性

Item	Key specifications
Chip	○ QCA AR9375
TX/RX	○ 2T2R
Frequency range	○ USA: 2.400 ~ 2.483GHz, 5.15 ~ 5.25GHz, 5.725 ~ 5.85GHz ○ Europe: 2.400 ~ 2.483GHz, 5.15 ~ 5.25GHz ○ Japan: 2.400 ~ 2.497GHz, 5.15 ~ 5.25GHz,
Modulation technique	○ 802.11 Legacy a/b/g DSSS (DBPSK, DQPSK, CCK) OFDM (BPSK, QPSK, 16-QAM, 64-QAM) DSSS (Direct Sequence Spread Spectrum) with DBPSK (Differential Binary Phase Shift Keying 1Mbps), DQPSK (Differential Quaternary Phase Shift Keying 2Mbps), and CCK (Complementary Code Keying 5.5&11Mbps), and OFDM (Orthogonal Frequency Division Multiplexing with BPSK for 6,9Mbps QPSK for 12,18Mbps 16QAM for 24,36Mbps 64QAM for 48,54Mbps) ○ 802.11n a/g
Host interface	○ USB 2.0
Channels support	○ 802.11n b/g US/Canada: 11 (1 ~ 11) Major European country: 13 (1 ~ 13) France: 4 (10 ~ 13) Japan: 11b: 14 (1~13 or 14th), 11g: 13 (1 ~ 13) ○ 802.11n a 1). US/Canada: channels (36,40,44,48,52, 149,153,157,161,165) 2). Europe: channel (36,40,44,48,52) 3). Japan: channels (36,40,44,48,52)
Operation voltage	○ 5V +/- 5%
Power consumption @25 ℃	802.11ng MCS8(40MHz) Avg 802.11na MCS8(40MHz) Avg (mA) 5V 350 756

Output Power (Typical-for each chain; with ±2dB tolerance).

This power table bases on the maximum HW capability complying with IEEE spec regardless the regulatory limitation

- **802.11a**

Test Frequencies	6-24_Target	36_Target	48_Target	54_Target
5180	21	20	19	17
5320	21	20	19	17
5500	21	20	19	17
5600	21	20	19	17
5700	21	20	19	17
5825	21	20	19	17

- **802.11b**

Test Frequencies	1/2_Target	5.5_Target	11_Target
2412	16	16	16
2437	16	16	16
2472	16	16	16

- **802.11g**

Test Frequencies	6-24_Target	36_Target	48_Target	54_Target
2412	16	16	15	14
2437	16	16	15	14
2472	16	16	15	14

- **802.11n**

Freq. Range: HT20

Test Freq	MCS 0/8	MCS 1/9	MCS 2/10	MCS 3/11	MCS 4/12	MCS 5/13	MCS 6/14	MCS 7/15
5180	21	21	21	21	20	20	19	17
5240	21	21	21	21	20	20	19	17
5320	21	21	21	21	20	20	19	17
5500	21	21	21	21	20	20	19	17
5700	21	21	21	21	20	20	19	17
5745	21	21	21	21	20	20	19	17
5825	21	21	21	21	20	20	19	17

Freq. Range: HT40

Test Freq	MCS 0/8	MCS 1/9	MCS 2/10	MCS 3/11	MCS 4/12	MCS 5/13	MCS 6/14	MCS 7/15
5190	21	21	21	21	20	20	19	17
5230	21	21	21	21	20	20	19	17
5310	21	21	21	21	20	20	19	17
5510	21	21	21	21	20	20	19	17
5670	21	21	21	21	20	20	19	17
5755	21	21	21	21	20	20	19	17
5795	21	21	21	21	20	20	19	17

Freq. Range: HT20

Test Freq	MCS 0/8	MCS 1/9	MCS 2/10	MCS 3/11	MCS 4/12	MCS 5/13	MCS 6/14	MCS 7/15
2412	16	16	16	16	15	15	14	14
2437	16	16	16	16	15	15	14	14
2472	16	16	16	16	15	15	14	14

Freq. Range: HT40

Test Freq	MCS 0/8	MCS 1/9	MCS 2/10	MCS 3/11	MCS 4/12	MCS 5/13	MCS 6/14	MCS 7/15
2412	16	16	16	16	15	15	14	14
2437	16	16	16	16	15	15	14	14
2472	16	16	16	16	15	15	14	14

EVM

The transmit modulation accuracy is measured using error vector magnitude (EVM). EVM is the magnitude of the phase difference as a function of time between an ideal reference signal and the measured transmitted signal.

- **802.11a**

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
BPSK	1/2	-5	-25
BPSK	3/4	-8	-25
QPSK	1/2	-10	-25
QPSK	3/4	-13	-25
16-QAM	1/2	-16	-25
16-QAM	3/4	-19	-28
64-QAM	2/3	-22	-30
64-QAM	3/4	-25	-31

- **802.11b**

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
DBPSK		-10	-28
DQPSK		-10	-28
CCK		-10	-28

- **802.11g**

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
BPSK	1/2	-5	-28
BPSK	3/4	-8	-28
QPSK	1/2	-10	-28
QPSK	3/4	-13	-28
16-QAM	1/2	-16	-28
16-QAM	3/4	-19	-29
64-QAM	2/3	-22	-29
64-QAM	3/4	-25	-29

- **802.11ng**

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
HT20			
(MCS0) BPSK	1/2	-5	-25
(MCS1) QPSK	1/2	-10	-26
(MCS2) QPSK	3/4	-13	-26
(MCS3) 16-QAM	1/2	-16	-26
(MCS4) 16-QAM	3/4	-19	-29
(MCS5) 64-QAM	2/3	-22	-30
(MCS6) 64-QAM	3/4	-25	-30
(MCS7) 64-QAM	5/6	-27	-31
(MCS8) BPSK	1/2	-5	-25
(MCS9) QPSK	1/2	-10	-26
(MCS10) QPSK	3/4	-13	-26

	(MCS11)	16-QAM	1/2	-16	-26
	(MCS12)	16-QAM	3/4	-19	-29
	(MCS13)	64-QAM	2/3	-22	-30
	(MCS14)	64-QAM	3/4	-25	-30
	(MCS15)	64-QAM	5/6	-27	-31
	HT40				
	(MCS0)	BPSK	1/2	-5	-26
	(MCS1)	QPSK	1/2	-10	-27
	(MCS2)	QPSK	3/4	-13	-27
	(MCS3)	16-QAM	1/2	-16	-27
	(MCS4)	16-QAM	3/4	-19	-29
	(MCS5)	64-QAM	2/3	-22	-30
	(MCS6)	64-QAM	3/4	-25	-30
	(MCS7)	64-QAM	5/6	-27	-31
	(MCS8)	BPSK	1/2	-5	-26
	(MCS9)	QPSK	1/2	-10	-27
	(MCS10)	QPSK	3/4	-13	-27
	(MCS11)	16-QAM	1/2	-16	-27
	(MCS12)	16-QAM	3/4	-19	-29
	(MCS13)	64-QAM	2/3	-22	-30
	(MCS14)	64-QAM	3/4	-25	-30
	(MCS15)	64-QAM	5/6	-27	-31
	○ 802.11na				
EVM	Modulation		Code Rate	Relative constellation error (dB) IEEE Spec (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
	HT20				
	(MCS0)	BPSK	1/2	-5	-25
	(MCS1)	QPSK	1/2	-10	-26
	(MCS2)	QPSK	3/4	-13	-26
	(MCS3)	16-QAM	1/2	-16	-26
	(MCS4)	16-QAM	3/4	-19	-29
	(MCS5)	64-QAM	2/3	-22	-30
	(MCS6)	64-QAM	3/4	-25	-30
	(MCS7)	64-QAM	5/6	-27	-31
	(MCS8)	BPSK	1/2	-5	-25
	(MCS9)	QPSK	1/2	-10	-26
	(MCS10)	QPSK	3/4	-13	-26
	(MCS11)	16-QAM	1/2	-16	-26
	(MCS12)	16-QAM	3/4	-19	-29
	(MCS13)	64-QAM	2/3	-22	-30
	(MCS14)	64-QAM	3/4	-25	-30
	(MCS15)	64-QAM	5/6	-27	-31
	HT40				
	(MCS0)	BPSK	1/2	-5	-26
	(MCS1)	QPSK	1/2	-10	-27
	(MCS2)	QPSK	3/4	-13	-27
	(MCS3)	16-QAM	1/2	-16	-27
	(MCS4)	16-QAM	3/4	-19	-29
	(MCS5)	64-QAM	2/3	-22	-30
	(MCS6)	64-QAM	3/4	-25	-30
	(MCS7)	64-QAM	5/6	-27	-31
	(MCS8)	BPSK	1/2	-5	-26
	(MCS9)	QPSK	1/2	-10	-27
	(MCS10)	QPSK	3/4	-13	-27

(MCS11) 16-QAM	1/2	-16	-27
(MCS12) 16-QAM	3/4	-19	-29
(MCS13) 64-QAM	2/3	-22	-30
(MCS14) 64-QAM	3/4	-25	-30
(MCS15) 64-QAM	5/6	-27	-31

Sensitivity (1RX with +4/-2dB tolerance, dBm)

- 802.11a

Modulation	Code Rate	IEEE Spec (1Rx dBm)	Typical (1Rx dBm)
BPSK	1/2	-82	-88
BPSK	3/4	-81	-86
QPSK	1/2	-79	-85
QPSK	3/4	-77	-83
16-QAM	1/2	-74	-79
16-QAM	3/4	-70	-77
64-QAM	2/3	-66	-73
64-QAM	3/4	-65	-70

- 802.11b

Modulation	IEEE Spec (1Rx dBm)	Typical (1Rx dBm)
DBPSK	not specified	-93
DQPSK	not specified	-91
CCK	not specified	-87

- 802.11g

Modulation	Code Rate	IEEE Spec (1Rx dBm)	Typical (1Rx dBm)
BPSK	1/2	-82	-93
BPSK	3/4	-81	-91
QPSK	1/2	-79	-89
QPSK	3/4	-77	-86
16-QAM	1/2	-74	-83
16-QAM	3/4	-70	-80
64-QAM	2/3	-66	-75
64-QAM	3/4	-65	-70

- 802.11ng

Modulation	Code Rate	IEEE Spec (1Rx dBm)	Typical (1Rx dBm)
HT20			
(MCS0) BPSK	1/2	-82	-90
(MCS1) QPSK	1/2	-79	-87
(MCS2) QPSK	3/4	-77	-86
(MCS3) 16-QAM	1/2	-74	-84
(MCS4) 16-QAM	3/4	-70	-80
(MCS5) 64-QAM	2/3	-66	-77
(MCS6) 64-QAM	3/4	-65	-72
(MCS7) 64-QAM	5/6	-64	-67
HT40			
(MCS0) BPSK	1/2	-79	-88
(MCS1) QPSK	1/2	-76	-86
(MCS2) QPSK	3/4	-74	-84
(MCS3) 16-QAM	1/2	-71	-80
(MCS4) 16-QAM	3/4	-67	-78
(MCS5) 64-QAM	2/3	-63	-73
(MCS6) 64-QAM	3/4	-62	-70
(MCS7) 64-QAM	5/6	-61	-64

	○ 802.11na HT20 Modulation Code Rate IEEE Spec (1Rx dBm) (MCS0) BPSK 1/2 -82 -89 (MCS1) QPSK 1/2 -79 -87 (MCS2) QPSK 3/4 -77 -84 (MCS3) 16-QAM 1/2 -74 -80 (MCS4) 16-QAM 3/4 -70 -77 (MCS5) 64-QAM 2/3 -66 -72
Sensitivity (1RX with +4/-2dB tolerance, dBm)	(MCS6) 64-QAM 3/4 -65 -71 (MCS7) 64-QAM 5/6 -64 -67 HT40 (MCS0) BPSK 1/2 -79 -84 (MCS1) QPSK 1/2 -76 -81 (MCS2) QPSK 3/4 -74 -79 (MCS3) 16-QAM 1/2 -71 -76 (MCS4) 16-QAM 3/4 -67 -72 (MCS5) 64-QAM 2/3 -63 -70 (MCS6) 64-QAM 3/4 -62 -67 (MCS7) 64-QAM 5/6 -61 -64
Transmit spectrum mask	◴ For transmitted spectral mask for 11a shall be less than –40dBr for fc–30MHz<f<fc+30MHz. ◴ For transmitted spectral mask for 11b shall be less than –50dBr for fc–22MHz<f<fc+22MHz. ◴ For transmitted spectral mask for 11g shall be less than –40dBr for fc–30MHz<f<fc+30MHz. ◴ For transmitted spectral mask for 11n 20MHz shall be less than –45dBr for fc–30MHz<f<fc+30MHz. ◴ For transmitted spectral mask for 11n 40MHz shall be less than –45dBr for fc–60MHz<f<fc+60MHz.
Transmit spectrum flatness	◴ For 802.11a/g the average energy of the constellations in each of spectral lines –16..-1 and +1..+16 will deviate no more than +/- 2dB from their average energy. For 802.11n 40MHz mode, the average energy of the constellations in each of spectral lines –42..-2 and +2..+42 will deviate no more than +/- 2dB from their average energy. ◴ The transmitted spectral flatness should be with in +2/- 4dB.
Transmit center frequency tolerance	◴ The transmitted center frequency tolerance shall be ±20 ppm maximum.
Receiver maximum input level	Modulation Code Rate IEEE Spec (1Rx dBm) >-30 ◴ 802.11b Modulation IEEE Spec (1Rx dBm) DBPSK >-10 DQPSK >-10 CCK >-10 ◴ 802.11g Modulation Code Rate IEEE Spec (1Rx dBm) >-20

	802.11na Modulation Code Rate IEEE Spec (1Rx dBm) >-30 802.11ng Modulation Code Rate IEEE Spec (1Rx dBm) >-20
Transfer data rate	802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: @800GI(400GI) z 20MHz BW 1 Nss: 65(72.2) Mbps maximal 2 Nss: 130(144.444) Mbps maximal z 40MHz BW 1 Nss: 135(150) Mbps maximal 2 Nss: 270(300) Mbps maximal

4 电气特性

4.1 绝对最大值

下表中给出绝对最大值，超过该最大值范围可能使模块器件受损。为避免模块及器件受损请在规定条件下进行操作。

表 3-1：参数及范围

参数	符号	数值	单位
外部电源电压	VDDIN	7~~24	V
IO 口最大输入电压	$3V3V_{in}IOMax$	3.6	V
IO 口最小输入电压	$3V3V_{in}IOMin$	-0.3	V
存储环境温度	T_{store}	-40~~+125	℃
工作温度	Toper	-20~~+65	℃

4.2 推荐工作参数

表 3-2：推荐工作参数范围

参数	符号	最小值	典型值	最大值	单位
外部电压	VDDIN	7.0	12.0	24.0	V

5 订购信息

表 5-1：订购型号

产品	描述	单托盘数量	最小包装数量
RAK553	图传模组，即插即用	12 片/tray	60 片

6 销售与服务

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7 版本更新说明

版本号	修改内容	修改日期
V0.1	修改文档格式	2014-07-09
V0.2	更新联系方式，更新文档格式	2014-08-22
V0.3	更新图片、传输距离；修改产品特性；增加订购信息、销售与服务	2014-10-24
V0.4	更新新模块的图片，尺寸及管脚定义	2015-04-07
V0.5	添加透传串口功能说明及参考设计	2015-04-17
V0.6	更新输入电压	2015-05-17
V0.7	更新新版模块实物图和相关硬件标注 更改电源参数，以及工作电流。	2015-07-13
V0.8	添加峰值工作电流	2015-07-31
V2.0	添加 LED 状态指示说明。并正式发布文档。	2015-08-31
V2.1	添加拨码定义指示说明。 1，增加信道选择功能。 2，增加 WPS 配对功能。	2015-10-11
V2.2	修改 8PIN eGH 接口 pin1 和 pin2 的定义。修改为 NC。	2015-11-11
V2.3	增加安装定位孔位置图。	2016-02-29
V2.4	删除部分错误分辨率，删除音频输入描述。	2016-8-25
V2.5	1，更新销售服务信息 2，更新产品照片	2016-11-10
V2.6	更新信道列表错误表述。	2017-03-03