ASR5801
datasheet

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April 30, 2020

Document Conventions	
	**Note:** Provides related information or information of special importance.
	**Caution:** Indicates potential damage to hardware or software, or loss of data.
	**Warning:** Indicates a risk of personal injury.

Document Status	
Doc Status: Released	Technical Publication: 1.0

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PRODUCT OVERVIEW

The ASR® ASR5801 is industry-lead Bluetooth and FM radio tuner into one chip and is optimized for mobile applications. Manufacturers can easily and fast integrate ASR5801 on their product.

Bluetooth Feature

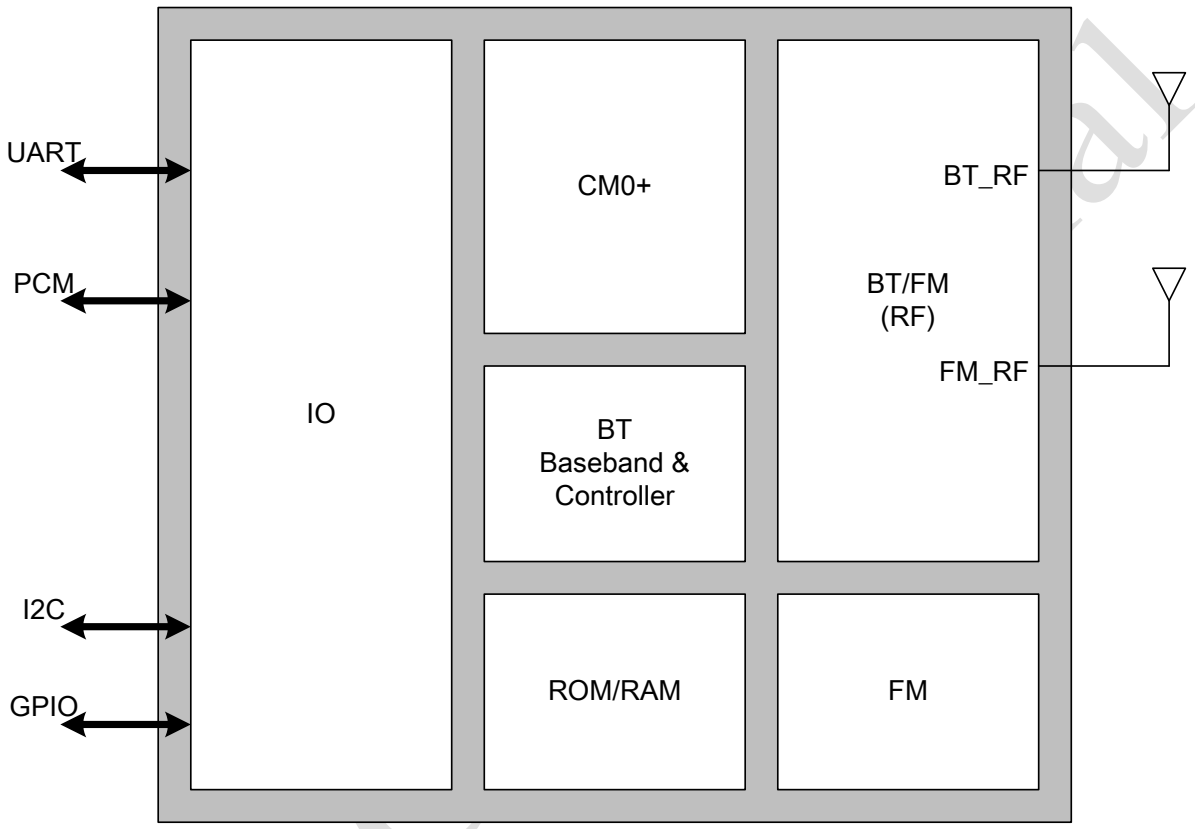
- CMOS single-chip fully-integrated radio and baseband
- CM0+ microprocessor with on-chip ROM and RAM
- Compliant with Bluetooth 5.0 specification
- Meet class 2 and class 3 transmitting power requirement, support class1 operation with external power amplifier
- Bluetooth Piconet and Scatternet support
- Provides +10dbm transmitting power
- NZIF receiver with -93dBm sensitivity
- Low power consumption
- Support BR/EDR (2M/3Mbps)
- Support VoiceOverPCM & VoHCI
- Support wireless broadcasting
- Support 7 ACL simultaneously
- Support BLE 1Mbps/2Mbps/LR
- Support 12 BLE Device
- Support High-speed UART: HCIOverUart(H4) and HCIOver3Wire (H5)

FM Feature

- CMOS single-chip fully-integrated FM tune
- Support worldwide frequency band
- 65 -108MHz
- Support flexible channel spacing mode
- 100KHz, 200KHz, 50KHz and 25KHz
- Digital low-IF tuner
- Image-reject down-converter
- High performance A/D converter
- Fully Integrated digital frequency synthesizer Support 32.768KHz Clock input
- Digital Auto Gain Control(AGC)
- I2C control bus interface

Block diagram

Figure 1 ASR5801 Block Diagram Figure



1 Part Order Numbering/Package Marking

1.1 Part Order Numbering

The current part order numbering scheme is the same as the package marking. Details see package marking (section 1.2).

Table 1 ASR5801 Part Order Options

Package Type	Part Order Number	
32-pin QFN	ASR5801	

1.2 Package Marking

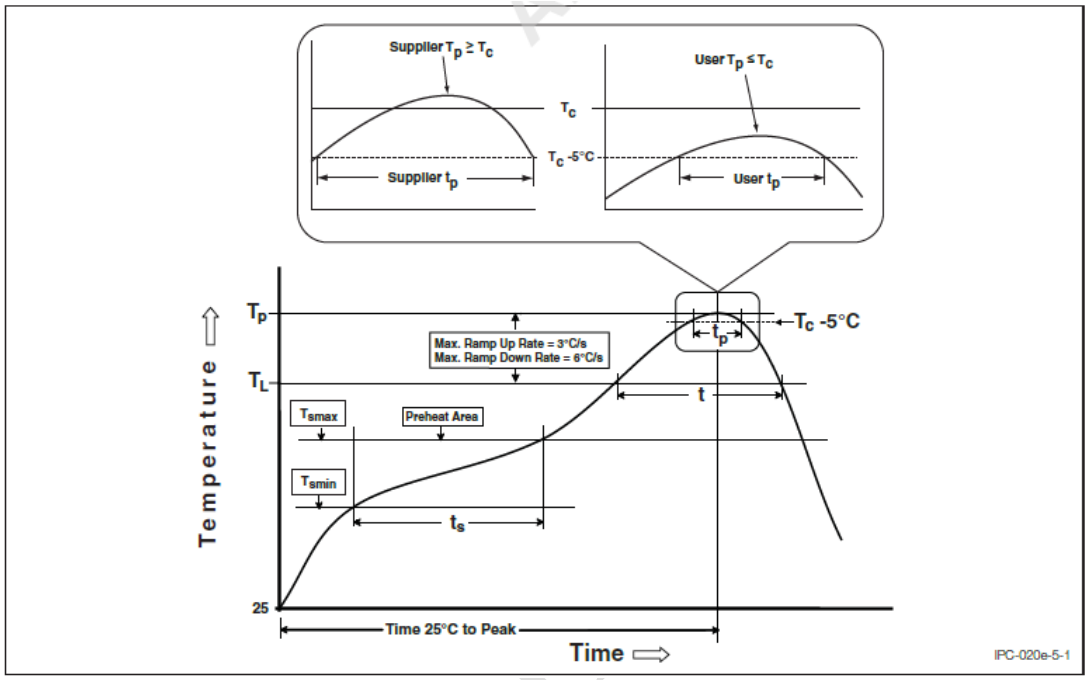
Figure 2 shows a sample Commercial package marking and pin 1 location.

Marking Content & Dimension				UNIT = mm Tolerance: +/- 0.2mm				
Item	Content	Description	Fixed/ Dynamic	Alignment	Font Type	Height	Width	Space
Line 1	LOGO	ASR Logo	Fixed	Center	NA	1.0	3.0	NA
Line 2	ASR5801	Part number	Fixed	Left	ARIAL1	0.4	0.35	0.1
Line 3	DAT010	Mark Lot Number	Dynamic	Left	ARIAL1	0.4	0.35	0.1
Line 4	YWWA258R	Date Code+assembly lot	Dynamic	Left	ARIAL1	0.4	0.35	0.1
Line 5	Pin1 dot	Pin1 dot	Fixed	Left	NA	0.5	0.5	N/A

Note: The above drawing is not drawn to scale. Location of markings is approximate.

1.3 Classification Profile (Not to scale)

Figure 3 Classification Profile



1.4 RoHS Compliant

The product does not contain lead, mercury, cadmium, hexavalent chromium, PBB&PBDE content in accordance with directive 2002/95/EC(RoHS).

1.5 ESD Sensitivity

Integrated circuits are ESD sensitive and can be damaged by static electricity. Proper ESD techniques should be used when handling these devices.

1.6 Storage Caution

1. Calculated shelf life in vacuum sealed bag 12 months at<40℃ and 90% relative humidity(RH).
2. Peak package body temperature 260℃.
3. After vacuum sealed bag is opened ,devices that will be subjected to reflow solder or other high temperature process must

a) Mounted within 168 hours of factory conditions<40℃/60%.
b) Stored at 10% RH.

1.7 Work Temperature

Commercial Grade

Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{case}	Case Operating Temperature	Top.center of package	-20		70	°C

Industrial Grade

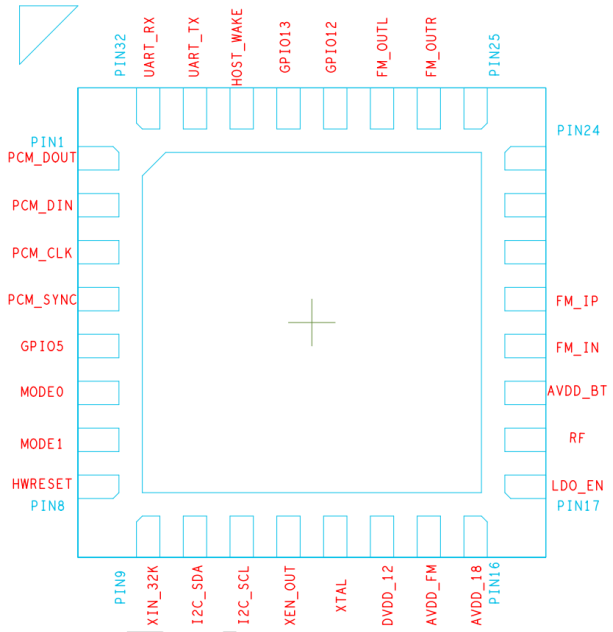
Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{case}	Case Operating Temperature	Top.center of package	-40		85	°C

2 Pin and Ball Map Views

This section provides the pinout for the ASR5801. Signals may have dedicated pins or may be available only as an alternate function of a multi-function pin.

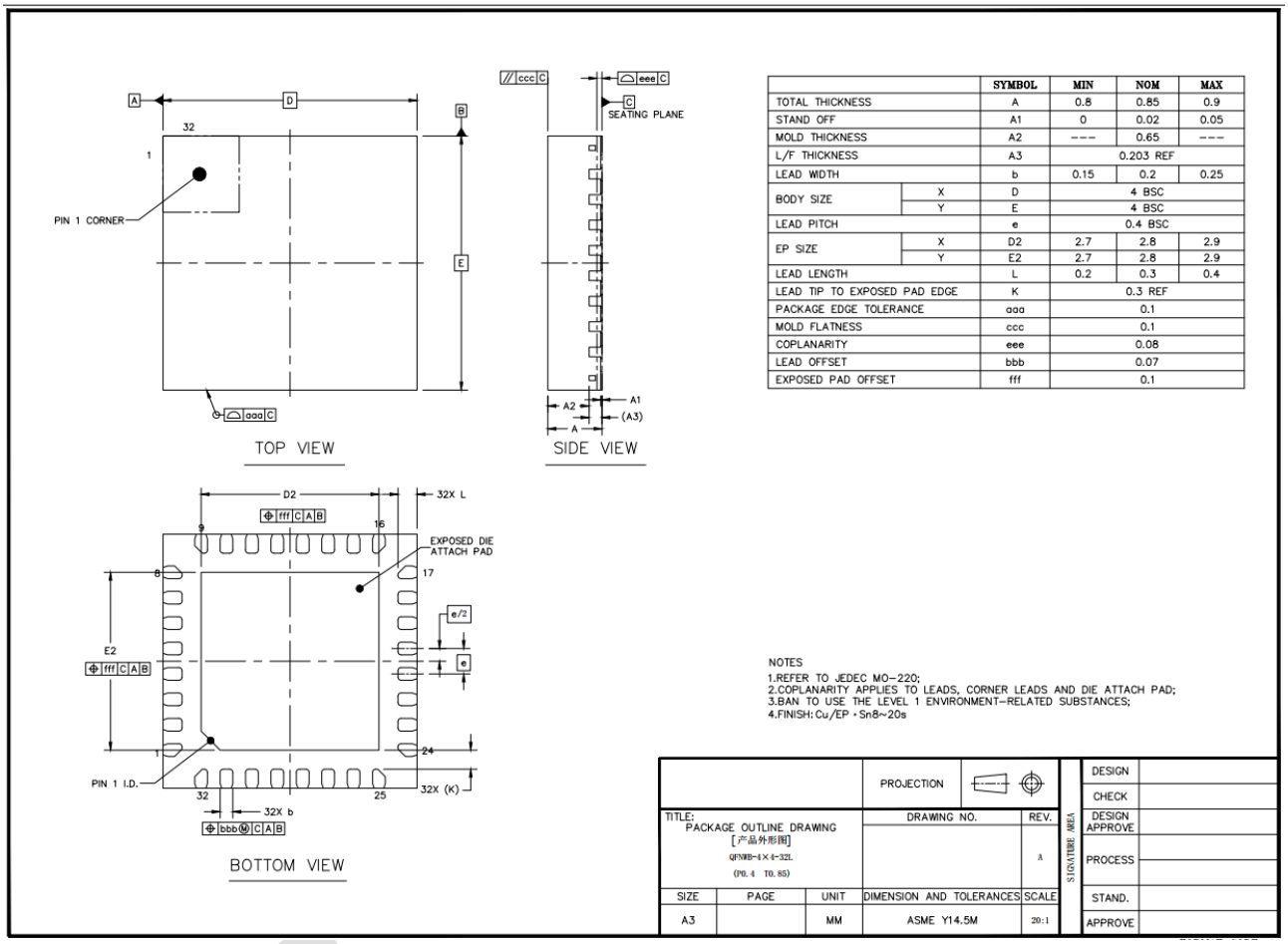
2.1 Pin Map

Figure 4 ASR5801 0.4mm pitch



2.2 Package Mechanical Drawings

Figure 5 32-pin QFN Package



		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.8	0.85	0.9
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.65	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		4 BSC	
	Y	E		4 BSC	
LEAD PITCH		e		0.4 BSC	
EP SIZE	X	D2	2.7	2.8	2.9
	Y	E2	2.7	2.8	2.9
LEAD LENGTH		L	0.2	0.3	0.4
LEAD TIP TO EXPOSED PAD EDGE		K		0.3 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.08	
LEAD OFFSET		bbb		0.07	
EXPOSED PAD OFFSET		fff		0.1	

NOTES
1.REFER TO JEDEC MO-220;
2.COPLANARITY APPLIES TO LEADS, CORNER LEADS AND DIE ATTACH PAD;
3.BAN TO USE THE LEVEL 1 ENVIRONMENT-RELATED SUBSTANCES;
4.FINISH: Cu/EP • Sn8~20s

			PROJECTION		DESIGN
TITLE: PACKAGE OUTLINE DRAWING [产品外形图] QFN5B-4×4-32L (P0.4 T0.85)			DRAWING NO.	REV.	CHECK
				A	DESIGN APPROVE
SIZE	PAGE	UNIT	DIMENSION AND TOLERANCES	SCALE	PROCESS
A3		MM	ASME Y14.5M	20:1	STAND.
					APPROVE

SIGNATURE AREA

2.3 Pin Descriptions

Table 2 shows ASR5801 pin types.

Pin Type	Description
VDD	Supply
AI	Analog Input
AO	Analog Output
DI	Digital Input
DO	Digital Output
AI/DI	Analog Input and/or Digital Input
AI/DO	Analog Input and/or Digital Output
DI/DO	Digital Input and/or Digital Output
GND	Ground
NC	Not Connected

Table 3 ASR5801 Descriptions

Pin Ref.	Pin Name	Pin Type	Function
1	PCM_DOUT	I/O	Synchronous data output
2	PCM_DIN	I/O	Synchronous data input
3	PCM_CLK	I/O	Synchronous data clock
4	PCM_SYNC	I/O	Synchronous data sync
5	GPIO5	I/O	Programmable I/O Also used as wakeup source
6	MODE0	DI	Chip Mode selection bit 0 Connect to ground
7	MODE1	DI	Chip Mode selection bit 1 Connect to ground
8	HWRESET	DI	System Reset
9	XIN_32K	DI	32.768K clock input
10	I2C_SDA	I/O	I2C interface Data signal
11	I2C_SCL	I/O	I2C interface Clock signal
12	XEN_OUT	I/O	Clock Request
13	XTAL	AI	26Mhz clock input
14	DVDD_12	AO	Digital voltage output, connected with decouple capacitor
15	AVDD_FM	VDD	FM Analog voltage input
16	AVDD_18	VDD	Analog voltage input
17	LDO_EN	AI	Internal LDO power on
18	RF	AI/AO	Bluetooth Radio signal
19	AVDD_BT	VDD	BT Analog voltage input
20	FM_IN	AI	FM LNA input port
21	FM_IP	AI	FM LNA input port
22	NC	AO	Should be not connected
23	NC	AO	Should be not connected
24	NC	AO	Should be not connected

Table 4 ASR5081 Pin Descriptions (Continued)

Pin Ref.	Pin Name	Pin Type	Function
25	NC	AO	Should be not connected
26	FM_OUTR	AO	FM DAC Right audio output
27	FM_OUTL	AO	FM DAC Right audio output
28	GPIO12	I/O	Programmable I/O Also used as UART RTS
29	GPIO13	I/O	Programmable I/O Also used as UART CTS
30	HOST_WAKE	I/O	Output to wakeup host
31	UART_TX	I/O	UART Data out
32	UART_RX	I/O	UART Data in

3 Bluetooth Section Radio Characteristics

GFSK 1Mbps Receiver	Min	TYP	Max	Unit
Sensitivity	-94	-93	-92	dBm
Max usable signal	-10	-5		dBm
co-channel selectivity @sensitivity+10dB		2.5	11	dB
adjacent channel selectivity 1MHz		-14.5	0	dB
adjacent channel selectivity 2MHz		-40.5	-30	dB
adjacent channel selectivity >=3Mhz		-45.5	-40	dB
image frequency selectivity		-30.5	-9	dB
adjacent(1Mhz) to Image		-47.5	-20	dB
out of band blocking<2GHz	-10			dBm
out of band blocking 2.0~2.4GHz	-27			dBm
out of band blocking 2.484~3.0GHz	-27			dBm
Intermodulation at 3 and 6Mhz	-39	-26.5		dBm
Spurious emission <1GHz			-57	dBm
Spurious emission 1.0~12.75GHz			-47	dBm

P1/4-DPSK 2Mbps Receiver	Min	TYP	Max	Unit
Sensitivity	-95.5	-94.5	-93.5	dBm
Max usable signal	-20	-10		dBm
co-channel selectivity @sensitivity+10dB		6.5	13	dB
adjacent channel selectivity 1MHz		-13.5	0	dB
adjacent channel selectivity 2MHz		-37.5	-30	dB
adjacent channel selectivity		-45.5	-40	dB
image frequency selectivity		-31.5	-7	dB
adjacent(1Mhz) to Image		-48.5	-20	dB

8-DPSK 3Mbps Receiver	Min	TYP	Max	Unit
Sensitivity	-91.5	-90.5	-89.5	dBm
Max usable signal	-20	-10		dBm
co-channel selectivity @sensitivity+10dB		12.5	21	dB
adjacent channel selectivity 1MHz		-8.5	5	dB
adjacent channel selectivity 2MHz		-34.5	-25	dB
adjacent channel selectivity		-44.5	-33	dB
image frequency selectivity		-26.5	0	dB
adjacent(1Mhz) to Image		-42.5	-13	dB

BLE 1Mbps Receiver	Min	TYP	Max	Unit
Sensitivity	-96.5	-95.5	-94.5	dBm
Max usable signal	-7	-5		dBm
co-channel selectivity@-67dBm	3	9	21	dB
co-channel selectivity@sensitivity+3dB		18		dB
adjacent channel selectivity 1MHz@-67dBm	-13.5	3	15	dB
adjacent channel selectivity 2MHz@-67dBm	-32	-25	-17	dB
adjacent channel selectivity @-67dBm	-46	-34	-27	dB
image frequency selectivity@-67dBm	-29	-25	-9	dB
adjacent(1Mhz) to Image@-67dBm	-36.5	-27	-15	dB
Intermodulation at 3MHz and 6Mhz@-64dBm	-50	-33	-27	dBm
out of band blocking<2GHz @-67dBm	-24	-27	-30	dBm
out of band blocking 2.003~2.399GHz @-67dBm	-29	-32	-35	dBm
out of band blocking 2.484~2.997GHz@-67dBm	-29	-32	-35	dBm
out of band blocking 3.0~12.75GHz@-67dBm	-24	-27	-30	dBm
RSSI Dynamic Range	-90		6	dBm
RSSI Accuracy			1	dB

BLE 2Mbps Receiver	Min	TYP	Max	Unit
Sensitivity	-93	-92	-91	dBm
Max usable signal	-7	-5		dBm
co-channel selectivity@-67dBm	3	9	21	dB
co-channel selectivity@sensitivity+3dB		18		dB
adjacent channel selectivity 2MHz@-67dBm	-13.5	3	15	dB
adjacent channel selectivity 4MHz@-67dBm	-32	-25	-17	dB
adjacent channel selectivity @-67dBm	-46	-34	-27	dB
image frequency selectivity@-67dBm	-29	-25	-9	dB
adjacent(1Mhz) to Image@-67dBm	-36.5	-27	-15	dB
Intermodulation at 3MHz and 6Mhz@-64dBm	-50	-33	-27	dBm
out of band blocking<2GHz @-67dBm	-24	-27	-30	dBm
out of band blocking 2.003~2.399GHz @-67dBm	-29	-32	-35	dBm
out of band blocking 2.484~2.997GHz@-67dBm	-29	-32	-35	dBm
out of band blocking 3.0~12.75GHz@-67dBm	-24	-27	-30	dBm
RSSI Dynamic Range	-90		6	dBm
RSSI Accuracy			1	dB

GFSK 1Mbps transmitter	Min	TYP	Max	Unit
Output transmitter max power	6	8	9	dBm
Output transmitter min power	-20			dBm
RF control range		30		dB
Course gain step		3		dB
fine gain step		0.5		dB
Gain variation	-3		3	dB
20dB occupied bandwidth		0.922	1	Mhz
Delta F1 avg Maximum Modulation		152		KHz
Delta F2 avg/F1 avg		0.97		
ICFT			10	KHz
carrier frequency drift rate			20	KHz
In band spurous emissions 2Mhz		-45	-20	dBm
In band spurous emissions 3Mhz		-55	-40	dBm
In band spurous emissions >3Mhz		-55	-40	dBm
out of band spurios emission <1GhZ		-55	-36	dBm
out of band spurios emission 1.0~12.75GhZ		-50	-30	dBm
out of band spurios emission 1.8~1.9GHz		-62	-47	dBm
out of band spurios emission 5.15~5.3GHz			-47	dBm
second harmonic			-30	dBm
third harmonic			-30	dBm
wideband noise <2170Mhz or >2800MHz	-145	-130		dBm/Hz

EDR(2~3Mbps) transmitter	Min	TYP	Max	Unit
Output transmitter max power	4	5	6	dBm
Output transmitter min power				dBm
RF control range		24		dB
Course gain step		3		dB
fine gain step		0.5		dB
Gain variation	-3		3	dB
RMS DEVM		6%	20%	
99% DEVM		9%	30%	
Peak DEVM		13%	25%	
In band spurous emissions 1Mhz		-35	-26	dBm
In band spurous emissions 2Mhz		-35	-20	dBm
In band spurous emissions 3Mhz		-40.5	-40	dBm
Power consumption at maximum output @1.8V			36	mA

BLE 1Mbps transmitter	Min	TYP	Max	Unit
Output transmitter max power	4	5	6	dBm
Output transmitter min power		-24		dBm
RF control range		24		dB
Course gain step		3		dB
fine gain step		0.5		dB
Gain variation	-3		3	dB
In band spurous emissions 2Mhz	-58	-45	-20	dBm
In band spurous emissions 3Mhz	-58	-50	-30	dBm
2nd harmonic	-53	-50	-45	dBm
3rd harmonic	-53	-50	-45	dBm

BLE 2Mbps transmitter	Min	TYP	Max	Unit
Output transmitter max power	4	5	6	dBm
Output transmitter min power		-24		dBm
RF control range		24		dB
Course gain step		3		dB
fine gain step		0.5		dB
Gain variation	-3		3	dB
In band spurous emissions 4Mhz	-58	-45	-20	dBm
In band spurous emissions 6Mhz	-58	-50	-30	dBm
2nd harmonic	-53	-50	-45	dBm
3rd harmonic	-53	-50	-45	dBm

4 FM Section Radio Characteristics

FM Specification	Min	TYP	Max	Unit
Frequency Range	65		108	MHz
sensitivity	-106	-104		dBm
LNA input resistance		2.4K		ohm
LNA input capacitance		8		pF
AM suppression m=0.3		60		dB
Adjacent channel selectivity 200KHz	49	53		dB
Alternate channel selectivity 400KHz	62	66		dB
spurious response rejection in band		55		dB
Max input level			17	dBm
Audio Mono SINAD	56	60		dB
audio stereo SINAD	51	55		dB
audio stereo separation delta F=75KHz		50		dB
audio output load resistance		10K		ohm
audio output load capacitance		12.5		pF
audio output voltage		80		mVrms
audio output THD		0.05%	0.10%	

5 Revision History

Table 4: Revision History

Revision	Date	Description
Rev. A	April 30, 2020	Initial Release.

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