FZ09396-100

User’s Manual

Notice:
This device complies with Part 15 of FCC Rules and Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

Warning:
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device is to be used only for mobile and fixed applications. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTE:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help
- The host device shall also comply with the certification labeling requirements of each of the modules it contains.
- A reference to the enclosed module displaying its FCC and IC ID certification number.
- Recommended wording:
    * Contains FCC ID: W2Z-02000001
    * Contains IC ID: 7736B-02000001

This products Standard shall be applied to the Wireless LAN module(DWM-W078)
本規格は、無線LANモジュール(DWM-W078)について規定する。

Contents.

SYM.	GROUP NO.	DWG.NO.
S	19	0980

1.Product Summary
製品概要

1-1. Scope

2.4 GHz WLAN module with integrated antenna
(IEEE802.11 b/g/n supported)

2.4GHz帯 アンテナー体 無線LANモジュール
(IEEE802.11 b/g/n 準拠)

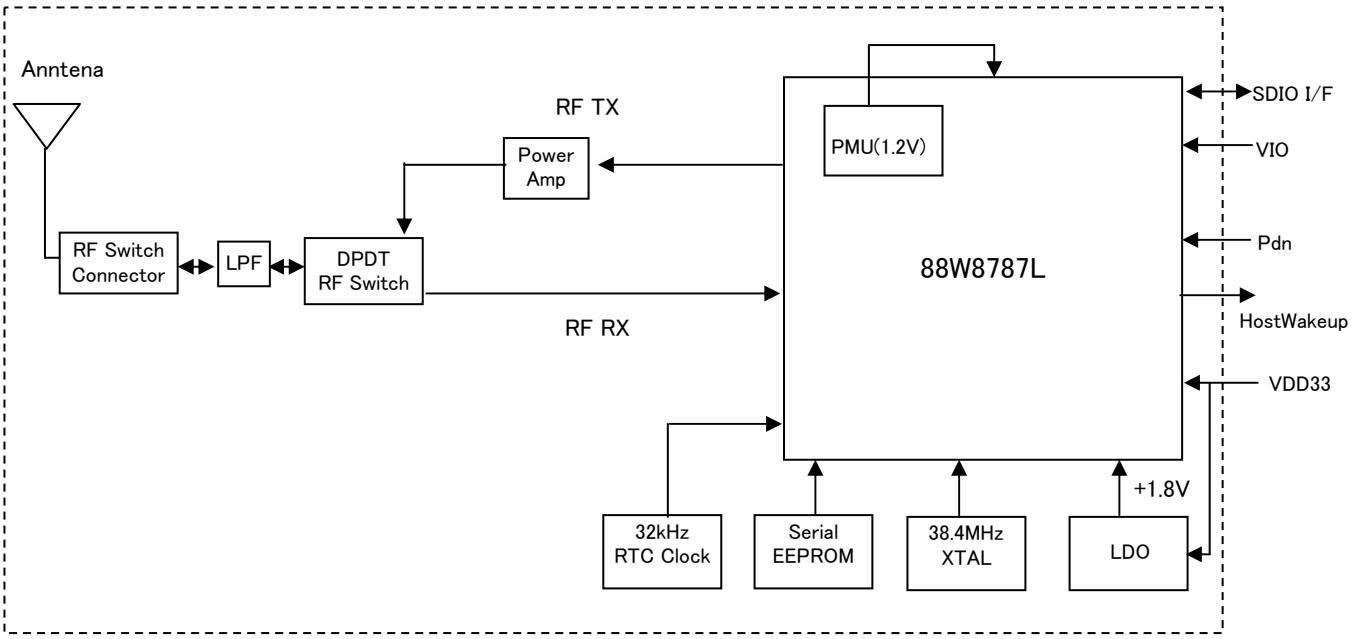
1-2. General explanation

Standard	IEEE802.11b/g/n
Frequency	2.4-2.4835GHz
Host Interfase	SDIO ver2.0
Frequency Bandwidth	20MHz
Weight	0.5g typ

・Chipset: MARVELL Semiconductor Inc. 88W8787L(CPS Package)
・Modulation Types: DBPSK, DQPSK and CCK with 802.11b mode
OFDM(BPSK, QPSK, 16-QAM and 64-QAM) with 802.11g/n mode
・Data rate: 1,2,5.5 and 11 with 802.11b mode
6,9,12,18,24,36,48 and 54 with 802.11g mode
MCS0-7 with 802.11n mode
・Security: WEP(64 and 128bits), WPA-PSK(TKIP/AES) and WPA2-PSK(TKIP/AES)

2.Hardware Specification

2-1. Block diagram
ブロック図



2-2. Environmental condition
環境条件

1) Operating environment
動作環境条件

Operating temperature range
動作温度範囲 : −20 ～ 70 ℃

Operating humidity range
動作湿度範囲 : 20%～80%(None dew) 結露無き事

2) Storage environment
保存環境条件

Storage temperature range
保存温度範囲 : −30 ～ 85 ℃

Storage humidity range
保存湿度範囲 : 20%～85%(None dew) 結露無き事

2-3. Power supply

No	Symbol	Value			UNIT
		MIN.	TYP.	MAX.	
1	VDD33	2.97	3.30	3.63	V
2	VIO	1.62	1.80	1.98	V
		2.50	2.60	2.70	V
		2.97	3.30	3.63	V

3.Electrical Characteristics
電気的特性

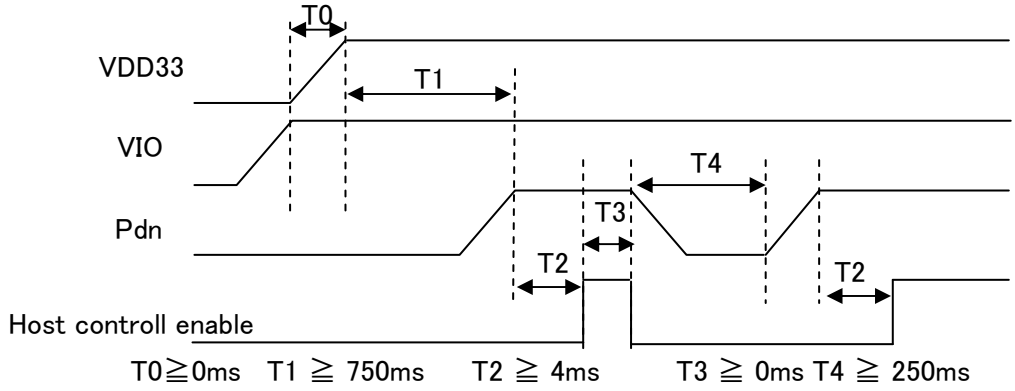
3-1. Channel Plan チャンネルプラン

IEEE802.11b/g/n(HT20)

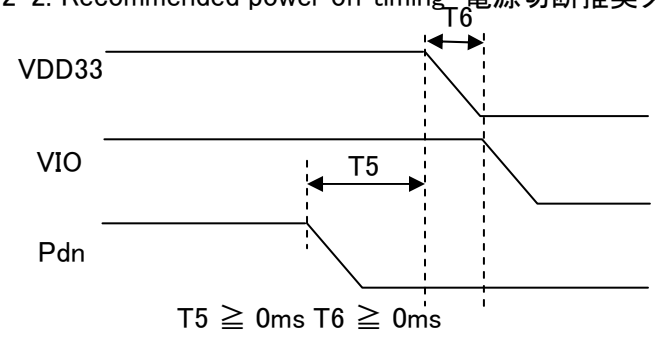
CH ID	Freq	CH ID	Freq	CH ID	Freq
1	2412 MHz	6	2437 MHz	11	2462 MHz
2	2417 MHz	7	2442 MHz	12	2467 MHz
3	2422 MHz	8	2447 MHz	13	2472 MHz
4	2427 MHz	9	2452 MHz		
5	2432 MHz	10	2457 MHz		

3-2. Power Sequence
電源仕様

3-2-1. Recommended power on timing 電源投入推奨タイミング



3-2-2. Recommended power off timing 電源切断推奨タイミング

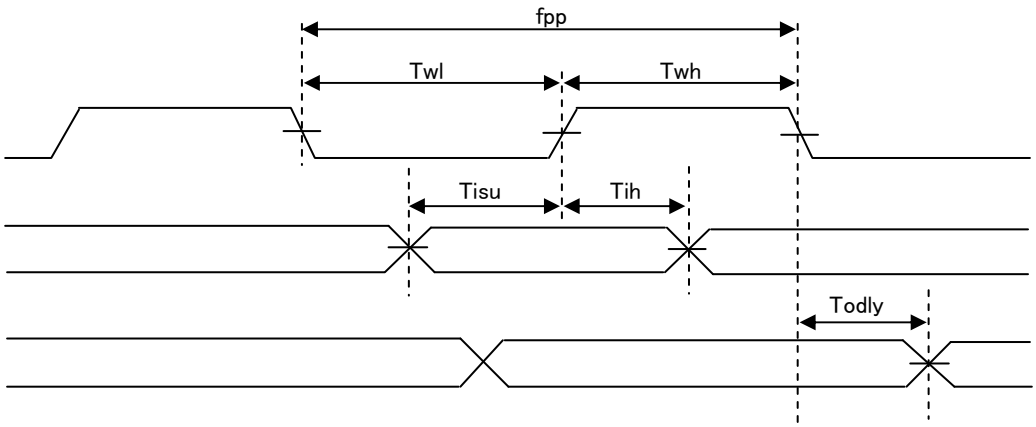


3-3. Interface specification (SDIO)

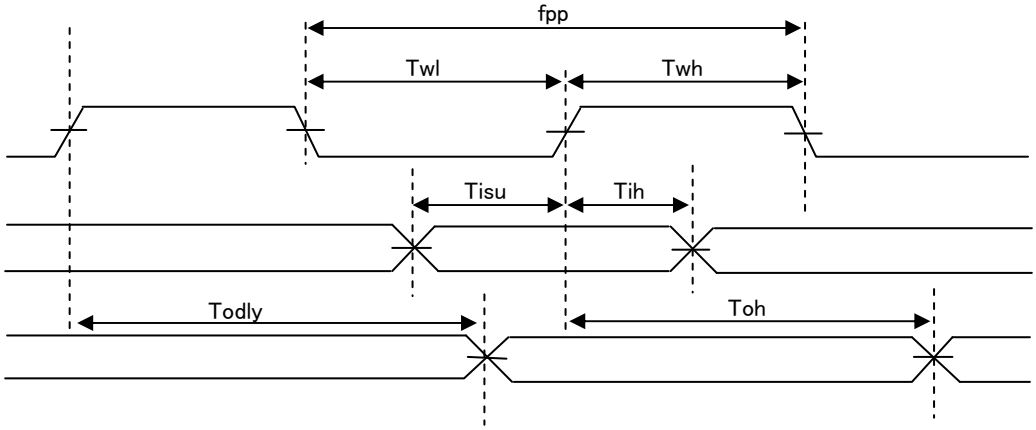
Parameter	Min	Typ	Max	Units
Input high voltage	0.7*VIO	–	VIO+0.3	V
Input low voltage	−0.3	–	0.3*VIO	V
Input hysteresis	200	–	–	mV
Output high voltage	VIO−0.4	–	–	V
Output low voltage	–	–	0.4	V

3-4. SDIO Protocol Timing

3-4-1 Normal Mode



3-4-2 High Speed Mode



3-4-3. SDIO Timing Data

Symol	Parameter	Mode	Min	Typ	Max	Units
fpp	Clock Frequency	Normal	0	–	25	MHz
		High Speed	0	–	50	MHz
Twl	Clock Low Time	Normal	10	–	–	ns
		High Speed	7	–	–	ns
Twh	Clock High Time	Normal	10	–	–	ns
		High Speed	7	–	–	ns
Tisu	Input Setup Time	Normal	5	–	–	ns
		High Speed	6	–	–	ns
Tih	Input Hold Time	Normal	5	–	–	ns
		High Speed	2	–	–	ns
Todly	Output Delay Time	–	–	–	7.33	ns
Toh	Output Hold Time	High Speed	2.5	–	–	ns

3-5. Current consumption
消費電流

TX mode
送信時消費電流

Standard	Data rate	Current Consumption(mA)					
		VDD33		VIO			
				3.3V		1.8V	
		Typ.	Max.	Typ.	Max.	Typ.	Max.
802.11b @14dBm	11Mbps	220	260	0.33	–	0.092	–
802.11g @12dBm	54Mbps	220	260	0.33	–	0.070	–
802.11n @12dBm	HT20 MCS7	220	260	0.33	–	0.051	–

RX mode
受信時消費電流

Standard	Data rate	Current Consumption(mA)					
		VDD33		VIO			
				3.3V		1.8V	
		Typ.	Max.	Typ.	Max.	Typ.	Max.
802.11b	11Mbps	140	180	0.33	–	0.391	–
802.11g	54Mbps	140	180	0.33	–	1.600	–
802.11n	HT20 MCS7	140	180	0.33	–	1.500	–

Power Save Mode

Standard	Current Consumption(mA)		
	VDD33	VIO	
		3.3V	1.8V
	Typ.	Typ.	Typ.
DTIM=1	4.103	0.546	0.001
DTIM=3	1.662	0.586	0.001
Deep sleep	0.400	0.603	0.001
Pdn	0.053	0.349	0.183

3-6. Antenna specification (Referential specification)
アンテナ特性(参考特性)

DSC set installed
DSCセット組み込み時

Standard	MIN	TYP	MAX	Unit
Frequency Band 周波数帯域	2412	—	2472	MHz
Impedance インピーダンス		Nominal 50 公称 50		Ω
VSWR	—	2.5	3.0	

※アンテナ共振周波数調整はDSCセット組み込みで行っております。
モジュール単体特性での保証ではございません。
疑義が生じた場合、DSCセット組み込みを行い確認を行う事とする。
Antenna resonant frequency is adjusted with DSC set installed.
This does not guarantee specification of the module alone.
In case of doubt, verification will be perfomed with DSC set installed.

3-7. Receiver characteristics
受信特性

1)Minimum Receiver Sensitivity
最小受信感度 (Ta=25℃)

Standard	Data rate	MIN.	TYP.	MAX.	Unit	PER
802.11b	1 Mbps	–	-94	-80	dBm	8 %
	2 Mbps	–	-91	-80	dBm	8 %
	5.5 Mbps	–	-88	-76	dBm	8 %
	11 Mbps	–	-84	-76	dBm	8 %
802.11g	6 Mbps	–	-87	-82	dBm	10 %
	9 Mbps	–	-87	-81	dBm	10 %
	12 Mbps	–	-85	-79	dBm	10 %
	18 Mbps	–	-83	-77	dBm	10 %
	24 Mbps	–	-80	-74	dBm	10 %
	36 Mbps	–	-79	-70	dBm	10 %
	48 Mbps	–	-73	-66	dBm	10 %
	54 Mbps	–	-71	-65	dBm	10 %
802.11n HT20	MCS0	–	-86	-82	dBm	10 %
	MCS1	–	-83	-79	dBm	10 %
	MCS2	–	-81	-77	dBm	10 %
	MCS3	–	-79	-74	dBm	10 %
	MCS4	–	-75	-70	dBm	10 %
	MCS5	–	-71	-66	dBm	10 %
	MCS6	–	-69	-65	dBm	10 %
	MCS7	–	-67	-64	dBm	10 %

2)Maximum Receiver Sensitivity
最大受信感度 (Ta=25℃)

Standard	Data rate	MIN.	TYP.	MAX.	Unit	PER
802.11b	1M, 2M	-4	–	–	dBm	8%
	5.5M, 11M	-10				
802.11g	6M～54M	-20	–	–	dBm	10%
802.11n HT20	MCS0～7	-20	–	–	dBm	10%

3-8. Transmitter characteristics ／ 送信特性

1)Output Target Power Levels
出力レベル

The difference of the output is within ±2.5dB. (Ta=25℃)
出力公差は、±2.5dB以内(Ta=25℃)の事

1) - 1 2.4GHz Band
11b (DSSS)

Ch	Freq. (MHz)	Target Power (dBm)			
		1M	2M	5.5M	11M
1	2412	14	14	14	14
2	2417	14	14	14	14
3	2422	14	14	14	14
4	2427	14	14	14	14
5	2432	14	14	14	14
6	2437	14	14	14	14
7	2442	14	14	14	14
8	2447	14	14	14	14
9	2452	14	14	14	14
10	2457	14	14	14	14
11	2462	14	14	14	14
12	2467	14	14	14	14
13	2472	14	14	14	14

1) - 2 2.4GHz Band
11g (OFDM)

Ch	Freq. (MHz)	Target Power (dBm)							
		6M	9M	12M	18M	24M	36M	48M	54M
1	2412	10	10	10	10	10	10	10	10
2	2417	12	12	12	12	12	12	12	12
3	2422	12	12	12	12	12	12	12	12
4	2427	12	12	12	12	12	12	12	12
5	2432	12	12	12	12	12	12	12	12
6	2437	12	12	12	12	12	12	12	12
7	2442	12	12	12	12	12	12	12	12
8	2447	12	12	12	12	12	12	12	12
9	2452	12	12	12	12	12	12	12	12
10	2457	12	12	12	12	12	12	12	12
11	2462	10	10	10	10	10	10	10	10
12	2467	12	12	12	12	12	12	12	12
13	2472	12	12	12	12	12	12	12	12

1) – 3 2.4GHz Band
11n/HT20 (OFDM)

Ch	Freq. (MHz)	Target Power (dBm)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	2412	10	10	10	10	10	10	10	10
2	2417	12	12	12	12	12	12	12	12
3	2422	12	12	12	12	12	12	12	12
4	2427	12	12	12	12	12	12	12	12
5	2432	12	12	12	12	12	12	12	12
6	2437	12	12	12	12	12	12	12	12
7	2442	12	12	12	12	12	12	12	12
8	2447	12	12	12	12	12	12	12	12
9	2452	12	12	12	12	12	12	12	12
10	2457	12	12	12	12	12	12	12	12
11	2462	10	10	10	10	10	10	10	10
12	2467	12	12	12	12	12	12	12	12
13	2472	12	12	12	12	12	12	12	12

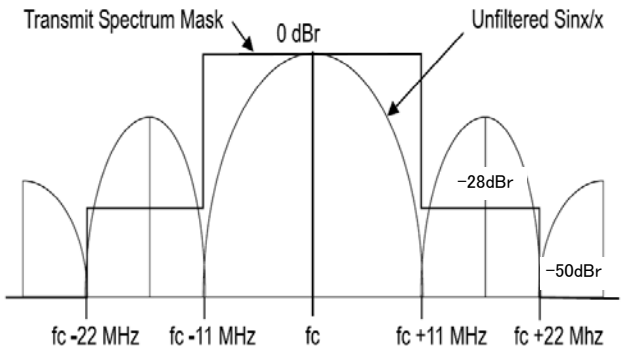
2)EVM

ITEM			Max		Unit	
11b		1 Mbps	-9	35.0	dB	%
11b		2 Mbps	-9	35.0	dB	%
11b		5.5 Mbps	-9	35.0	dB	%
11b		11 Mbps	-9	35.0	dB	%
11g		6 Mbps	-5	56.2	dB	%
11g		9 Mbps	-8	39.8	dB	%
11g		12 Mbps	-10	31.6	dB	%
11g		18 Mbps	-13	22.4	dB	%
11g		24 Mbps	-16	15.8	dB	%
11g		36 Mbps	-19	11.2	dB	%
11g		48 Mbps	-22	7.9	dB	%
11g		54 Mbps	-25	5.6	dB	%
11n	HT20	MCS0	-5	56.2	dB	%
11n	HT20	MCS1	-10	31.6	dB	%
11n	HT20	MCS2	-13	22.4	dB	%
11n	HT20	MCS3	-16	15.8	dB	%
11n	HT20	MCS4	-19	11.2	dB	%
11n	HT20	MCS5	-22	7.9	dB	%
11n	HT20	MCS6	-25	5.6	dB	%
11n	HT20	MCS7	-28	4.0	dB	%

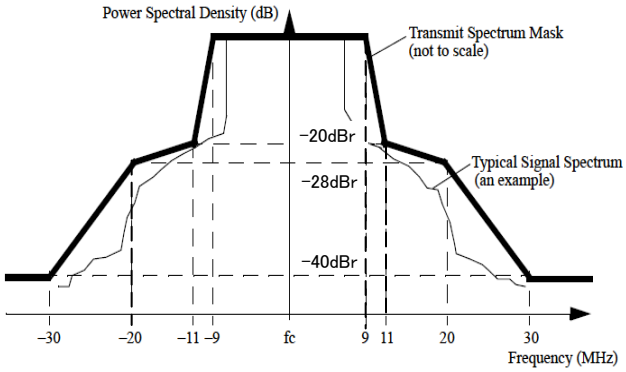
3)Spectrum Mask

ITEM		Max	Unit
DS	0MHz～±11MHz	0	dBr
DS	f±11MHz～±22MHz	-28	dBr
DS	f±22MHz～	-50	dBr
OFDM	0MHz～±9MHz	0	dBr
OFDM	f±11MHz	-20	dBr
OFDM	f±20MHz	-28	dBr
OFDM	f±30MHz	-40	dBr
HT20	0MHz～±9MHz	0	dBr
HT20	f±11MHz	-20	dBr
HT20	f±20MHz	-28	dBr
HT20	f±30MHz	-45	dBr

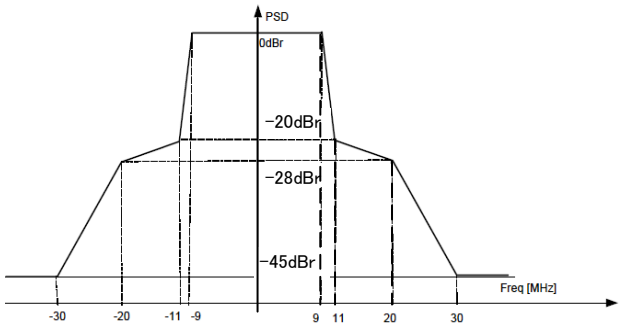
<DS>



<OFDM>



<HT20>



4)Frequency Accuracy
周波数偏差

Condition	Min	Typ	Max	Unit
Ta = 25℃	-10	-	10	ppm
Ta =-20℃～70℃	-25	-	25	ppm

DWG.NO.
0980 1

4.Measurement method
測定方法

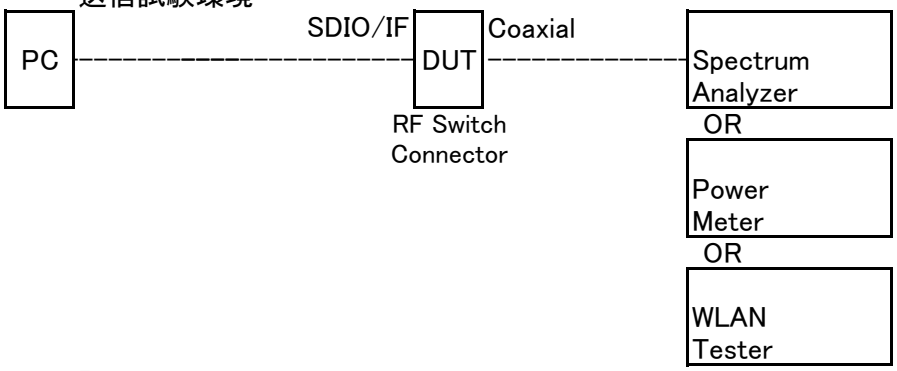
Standard test shall be conducted under the following conditions. However, if no question arises as to judgment, the test can be conducted in the range of temperature 20℃-30℃
and relative humidity 45%-70%.
Measurement needs to be performed in a shield room.
標準試験は、下記の条件で行うものとする。但し、判定に疑義を生じない場合は、温度20℃～30℃
相対湿度45%～70%の範囲にて試験してもよい。
測定は、シールドルーム内で行うこと。

Temperature 温度 : 25±3℃

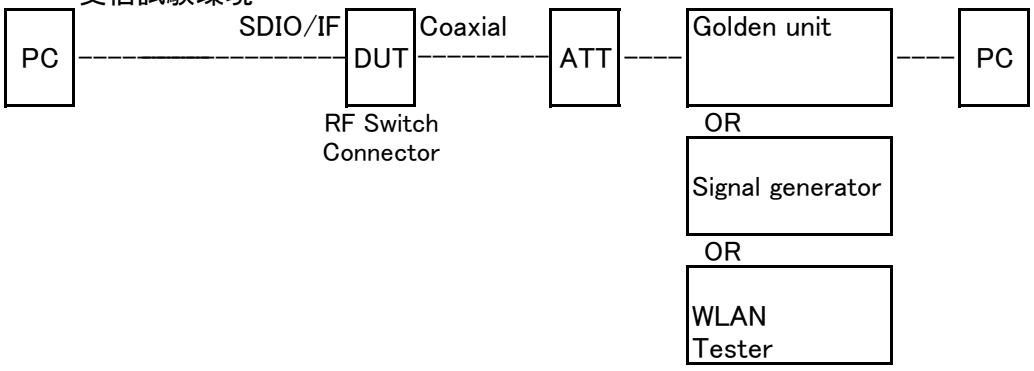
Humidity 湿度 : 65±10%

Power supply voltage 3.3V : Refer to 2-3. 2-3を参照の事
電源電圧

4-1. TX test condition.
送信試験環境



4-2. RX test condition
受信試験環境



DWG.NO.
0980 1

5. Mechanical Specifications
機械的仕様

5-1. Dimension
寸法

9.0mm×19.5mm, t= 1.6mm MAX

5-2. Weight
重量

Typical 0.5g

5-3. Terminal number and name
端子・端子名

Connector model
コネクタ型名： 14FZ-SM1-GAN-TB JST

No.	Name	Type	Function
1	Pdn	IN	H/W reset
2	VIO	POWER	I/F power supply
3	SD_CMD	IO	SDIO command
4	SD_D0	IO	SDIO data 0
5	SD_D1	IO	SDIO data 1
6	GND	GND	GND
7	SD_CLK	IO	SDIO clock
8	GND	GND	GND
9	SD_D3	IO	SDIO data 3
10	SD_D2	IO	SDIO data 2
11	GND	GND	GND
12	VDD33	POWER	Main power supply 3.3V
13	VDD33	POWER	Main power supply 3.3V
14	Host WakeUp	OUT	Host wake up

6.Reliability Test
信頼性試験

NO	Item 項目	Test Conditions 試験条件	
1	Low temperature storage 低温放置	Operates properly after 1000 hours at −30℃, followed by more than 2 hours at ambient temperature/humidity. −30℃、1000時間放置、その後常温常湿中に取り出し、2時間以上放置後に、正常に動作する事。	Test condition: No condensing 試験条件:露無き事。
2	High temperature storage 高温放置	Operates properly after 1000 hours at +85℃, followed by more than 2 hours at ambient temperature/humidity. ＋85℃、1000時間放置、その後常温常湿中に取り出し、2時間以上放置後に、正常に動作する事。	
3	High temperature humidity storage 高温高湿放置	Operates properly after 1000 hours at +85℃, 85%RH followed by more than 2 hours at ambient temperature/humidity . ＋85℃、85%RHにて1000時間放置、その後常温常湿中に取り出し、2時間以上放置後に正常に動作する事。	
4	Low temperature operation 低温動作	Operates properly after 500 hours at −20℃, followed by more than 2 hours at ambient temperature/humidity . −20℃で、500時間通電放置、その後常温常湿中に取り出し、2時間以上放置後に、正常に動作する事。	
5	High temperature operation 高温動作	Operates properly after 500 hours at +70℃, followed by more than 2 hours at ambient temperature/humidity. ＋70℃で、500時間通電放置、その後常温常湿中に取り出し、2時間以上放置後に、正常に動作する事。	
6	High temperature humidity operation 高温高湿動作	Operates properly after 1000 hours at +60℃, 90%RH followed by more than 2 hours at ambient temperature/humidity . ＋60℃、90%RHにて1000時間通電放置、その後常温常湿中に取り出し、2時間以上放置後に正常に動作する事。	
7	Thermal impact test 熱衝撃試験	Operates properly after 100 cycles where one cycle is −30℃/30 min and +85℃/30min. −30℃/30分、+85℃/30分を1サイクルとして、100サイクル実施後、正常に動作する事。	
8	Electrostatic discharge 静電気放電	±2.0kV applied to connector terminal and antenna terminal ±2.0kV、印加箇所;コネクタ端子、アンテナ端子	Test conditions/試験条件: Non operating state/製品非動作状態 Discharged capacity /放電容量:100pF Discharged resistance /放電抵抗:1.5kΩ Application ／印加回数:3回
9	Drop test 落下試験	Alone 単体落下: Free drop three times on hard wooden board from 50 cm. Must operate normally. Appearance: no functional damage. 木板に対して、50cm高さより自然落下。3回。JIS C 60068-2-32に従う。 動作上問題なき事。/外観:実使用上問題なき事。	
		Packaged 梱包落下: Total five drops on bottom and sides of carton on hard wooden board from 50 cm. Must operate normally. Appearance: no functional damage. 木板に対して、50cm高さより自然落下。 梱包箱底面及び側面 計5回	
10	Vibration test 振動試験	Must operate normally after vertical and two horizontal direction vibration for 2 hrs each at frequency 10−50 Hz, amplitude 1.5 mm P−P. 振動周波数 10～50Hzにて、振幅1.5mmP−Pとし、上下:2h, 左右:2h, 前後:2hにて加振後、正常に動作する事。	
11	Package vibration test 梱包振動試験	Must operate normally after testing under conditions listed below. 欄外に示す条件にて試験を行い、試験後正常に動作する事.	

Package vibration test conditions./梱包振動試験条件

Frequency[Hz]	Level[(ms^2)^2/Hz]	Slope[dB/oct]	Test Direction	Test Duration
3	0.048	−	Three directions X,Y,Z 3方向	4 hours each direction 各方向 4時間
3～6	−	+13.75		
6～18	1.15	−		
18～40	−	−9.34		
40	0.096	−		
40～200	−	−1.29		
200	0.048	−		

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