

Legacy Converter Datasheet

Sample Part Number: LTW4455-RFM-00-000

MP Part Number: LTW4455-RFM-01-000

Revision History

Revision Code	Date	description	Comments
V0.1	Sep 14, 2018	1 st Working Sample	
V1.0	Jan 02, 2020		

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1. Features

Interfaces	: UART1, USART1(UART or SPI)
Main ICs	: A31G112KU(32QFN-0505), SX1276, PD84006L
Reference Clocks	: Intergrated 26MHz clock(TCXO with frequency error= ± 2 ppm)
Model Name	: J1901 (Legacy Converter)
Manufacture	: LEETEK co., Ltd
Channel Spacing	: 12.5KHz
Frequency stability	: ± 2 ppm
Spurious Rejection	: -40dBm below
Modulation	: GFSK
Data Rate	: 512bps, 1.2Kbps
TX power	: Max 32 dBm(± 1)
Sensitivity	: -120dBm
Operating environment	: Input voltage_+12V, Temperature_-20°C~+60°C
Power consumption	: Max 10W
RF output Power	: Max 2W
RF Input Level	: Max +10dBm
Frequency Range	: FCC,IC - 450MHz ~ 470MHz CE,RCM - 420MHz ~ 470MHz
Module Size	: 95 mm x 36.7 mm x 11.7 mm (Max)
Weight	: 20g(Except the antenna.)
Package	: Metal Shield can
RoHS	: This module is compliant with the RoHS directive.
Antenna	: SMA type Antenna
Certification	: FCC - : IC - : CE - : RCM -

2. Part Number

Ordering Part Number	Description
LTW4455-RFM-00-01	Engineering sample
LTW4455-RFM-01-01	MP P/N

3. Label Information

<p>Model: J1901 (Legacy Converter) FCC ID: XXXXXXXXXX IC ID; XXXXXXXXXX This device complies with Part 90 of the FCC Rules Tested To Comply with FCC Standards</p>	
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4. Electrical Characteristics

7.1 FSK Transceiver Specification

Conditions: VDD=12V, 25 °C, FXOSC=26MHz, GFSK, FDA=4.5KHz, Bit Rate=1.2Kbps, and terminated in a matched 50 Ohm impedance, shared Rx and Tx path matching, unless otherwise specified.

FSK Receiver Specification

Symbol	Description	Conditions	Min.	Typ	Max	Unit
RFS_F_LF	LnaBoost is turned on	FDA=4.5KHz, BR=1.2Kbps		-122		dBm
CCR	Co-Channel Rejection, FSK			-9		dB
ACR	Adjacent Channel Rejection	FDA=4.5KHz, BR=1.2Kbps				dB
BI	Blocking Immunity	Offset=±1MHz		71		dB
IDDR	Supply current in Receive mode	LnaBoost On		40		mA

FSK Transmitter Low power Specification

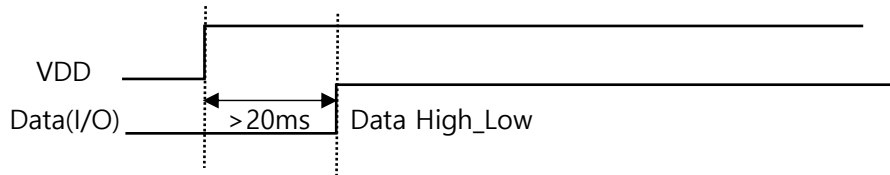
Symbol	Description	Conditions	Min.	Typ	Max	Unit
RF_OPL_1	RF output power low in 50 ohms.	Programmable with steps(1dB step).	+1	-	+16	dBm
RF_OPL_2	RF output power low in 50 ohms.	High power mode.	+18	+18.5	+19	dBm
ΔRF_T	RF power_ Temperature	From T=-20°C~+60°C		±1		dB
ACP	Adjacent channel power	EN 300 224	60	-	-	dB
IDDT_1	Supply current in Transmitter mode.				200	mA

FSK Transmitter High power Specification

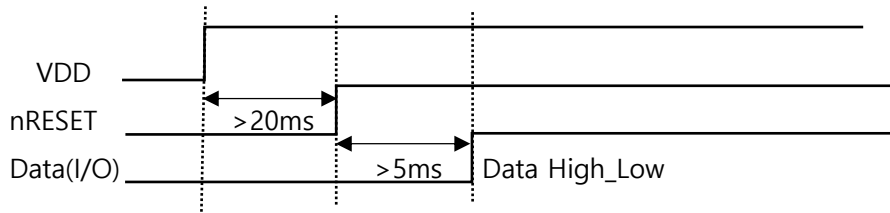
Symbol	Description	Conditions	Min.	Typ	Max	Unit
RF_OPH	RF output power high in 50 ohms.	Programmable with steps(2dB step).	+25	-	+34	dBm
Δ RF_T	RF power_Temperature	From T=-20°C~+60°C		±2		dB
ACP	Adjacent channel power	EN 300 224	60	-	-	dB
IDDT_2	Supply current in Transmitter mode.		0.3	0.5	1	A

5. Power Sequences

5.1 Power Up Sequence



5.2 Power Up Sequence(nReset)



6. Pin Description

Pin	Name	Type	Description
1	VDD	Power	Positive supply terminal
2	VDD	Power	Positive supply terminal
3	GND	Power	Ground supply terminal
4	GND	Power	Ground supply terminal
5	PB4/TXD0/SWCLK	I/O	General I/O, UART0-TX, Debug port, Ext Interrupt

6	PB5/RXD0/SWDIO	I/O	General I/O, UART0-RX, Debug port, Ext Interrupt
7	PB6/TXD1	I/O	General I/O, UART1-TX, Ext Interrupt
8	PB7/RXD1	I/O	General I/O, UART1-RX, Ext Interrupt
9	GND	Power	Ground supply terminal
10	nRESET	Input	Active-low device Reset input
11	PB0/AN8/TXD10/MOSI10	I/O	General I/O, UART10-TX, MOSI10, Boot mode, ADC, Ext Interrupt
12	PB1/AN9/RXD10/MISO10	I/O	General I/O, UART10-RX, MISO10, Boot mode ADC, Ext Interrupt
13	PB2/AN10/SCK10	I/O	General I/O, SCK10, Boot mode ADC, Ext Interrupt
14	PB3/SS10/BOOT	I/O	General I/O, SS10, Boot mode, Ext Interrupt
15	GND	Power	Ground supply terminal
16	GND	Power	Ground supply terminal
17~32	GND	Power	Ground supply terminal

7. Regulatory Approval

Certification	Standards	Laboratory	Report Number	Date
CE	Safety	KES		
	EMC	KES		
	Radio	KES		
RCM		KES		
		KES		
		KES		
FCC,	EMC	KES		
IC	Radio	KES		

8. BOOT MODE(download firmware).

8-1. Boot Mode Pins

The Module has a boot mode to program the internal flash memory.

Boot mode will be activated by setting BOOT pin to "Low" level at reset timing.

(Normal operation mode is "High" level)

Boot mode supports either UART boot or SPI boot.

UART booting uses the TXD10/RXD10 ports, and SPI booting uses the MOSI10/MISO10/SCK10/SS10 ports.

The following pins are used in boot mode.

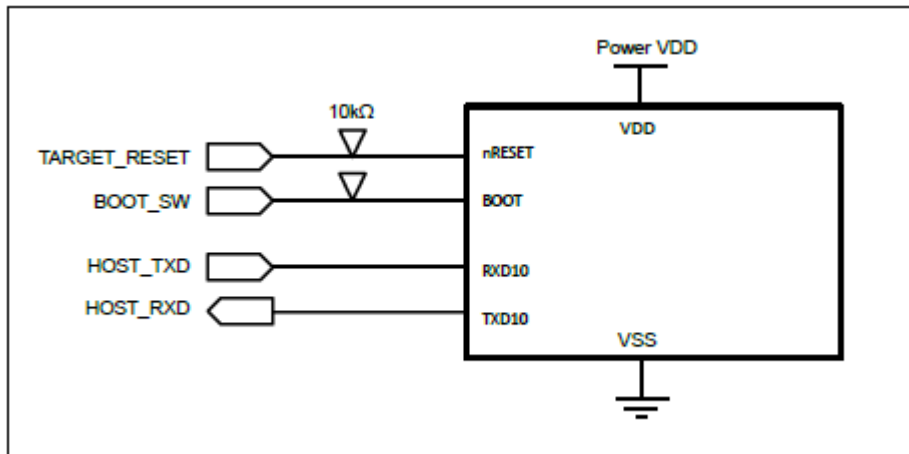
Table : Boot mode pin list

Block	Pin Name	Dir	Description
SYSTEM	nRESET	I	Reset Input signal
	BOOT/PB3	I	'0' to enter Boot mode
UART mode of USART10	RXD10/PB1	I	UART Boot Receive Data
	TXD10/PB0	O	UART Boot Transmit Data
SPI mode of USART10	SS10/PB3	I	SPI Boot Slave Selectable after Boot ROM
	SCK10/PB2	I	SPI Boot Clock Input
	MISO10/PB1	I	SPI Boot Data Input with function exchange
	MOSI10/PB0	O	SPI Boot Data Output with function exchange

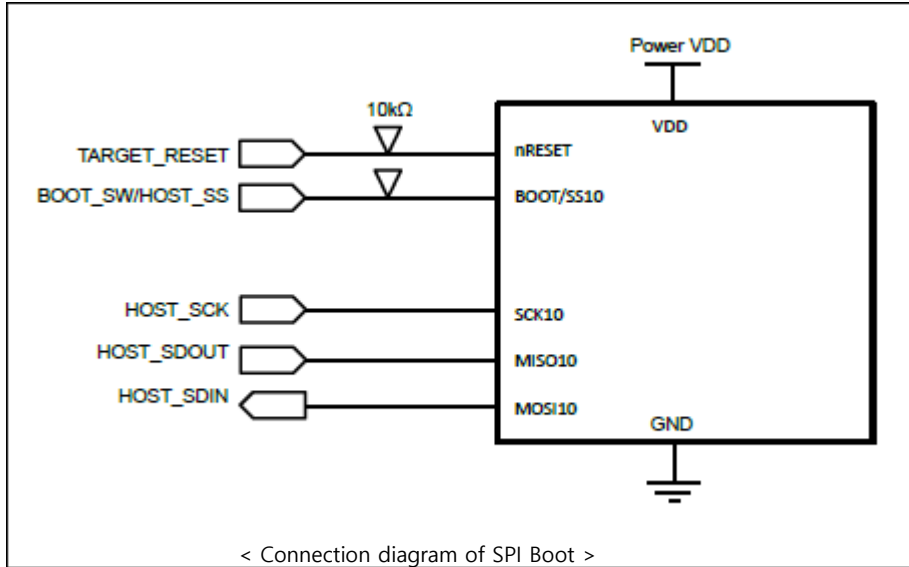
8-2. Boot Mode Connections

User can design target board using any of boot mode ports – UART or SPI mode of USART10.

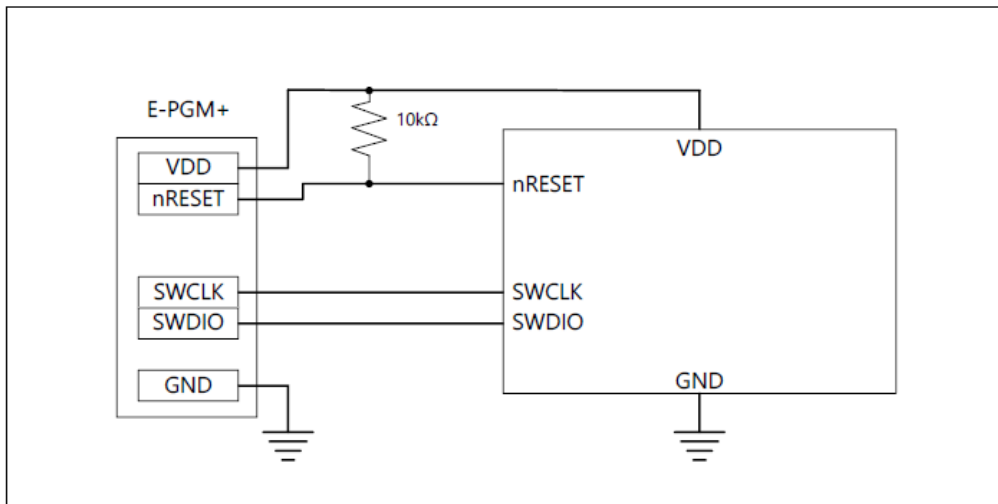
The following diagrams are some examples of connection diagrams in the boot mode.



< Connection diagram of UART Boot >



8-3. SWD Debug Mode and E-PGM+ Connections

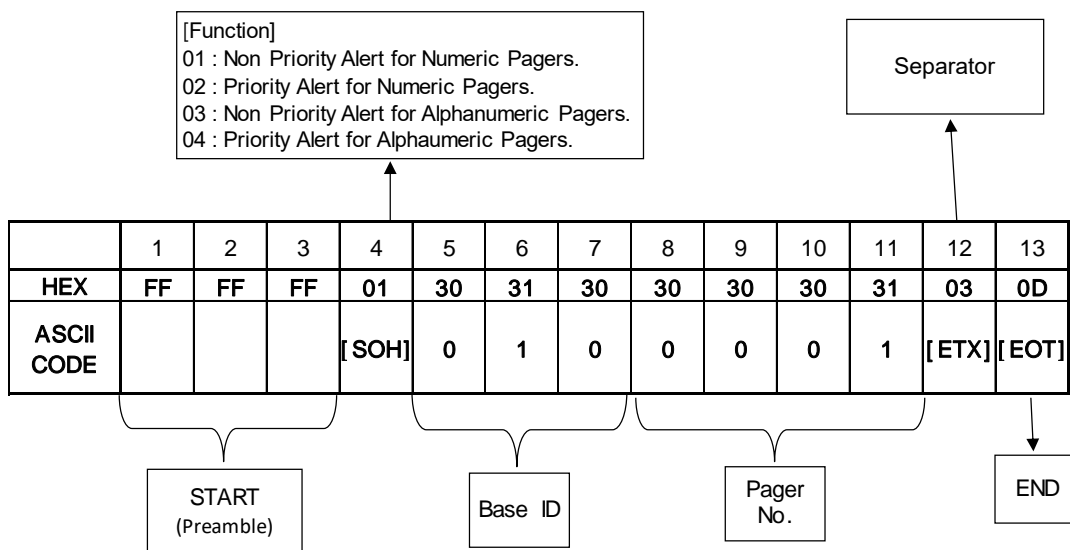


< Connection diagram of SWD debugger interface and E-PGM+ >

9. UART Communication Protocol and Data Format

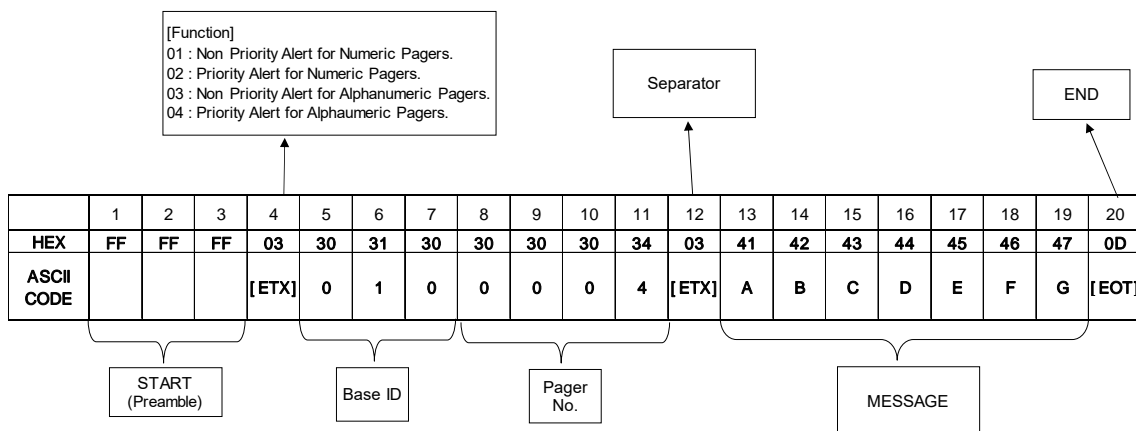
- a. Baud Rate : 19200 bps
- b. Data Bits : 8
- c. Parity Bit : None
- d. Stop bit : 1

9-1. Protocol and Data Format for Numeric Paging



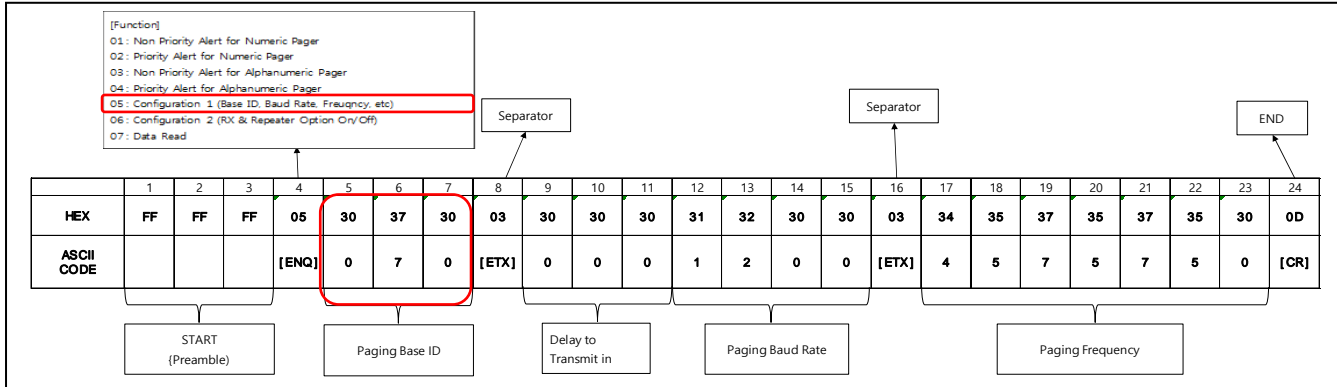
Note that the paging parameters as shown are: Base ID = 010, Pager Number = 0001

9-2. Protocol and Data Format for Alphanumeric Paging



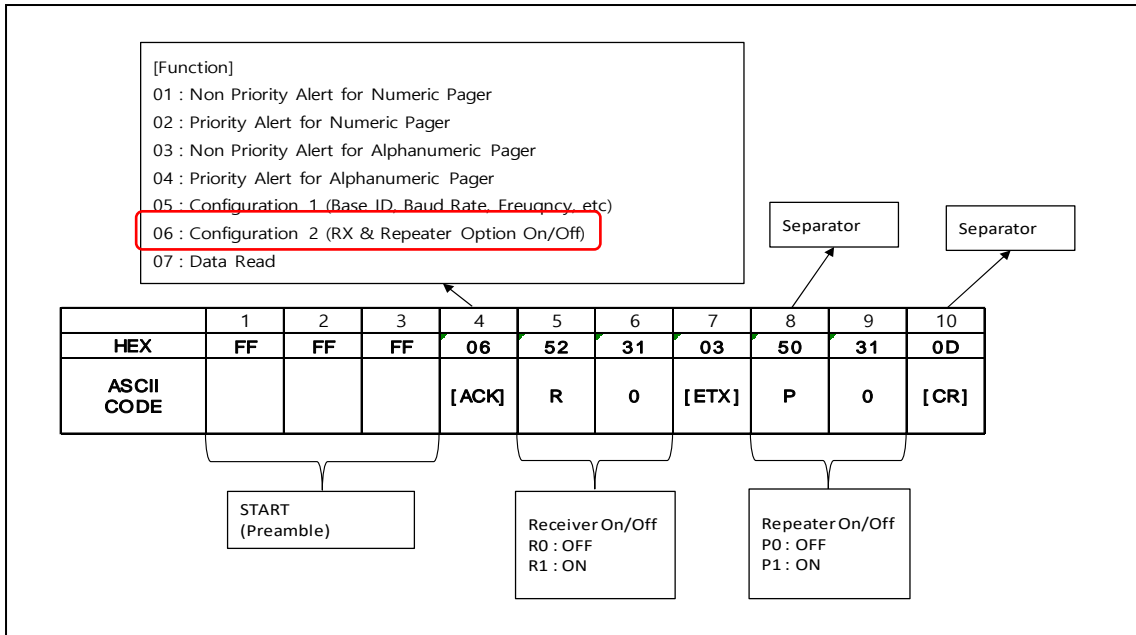
Note that the paging parameters as shown are: Base ID = 010, Pager Number = 0004, Message = ABCDEFG

9-3. Protocol and Data Format for Module Configuration

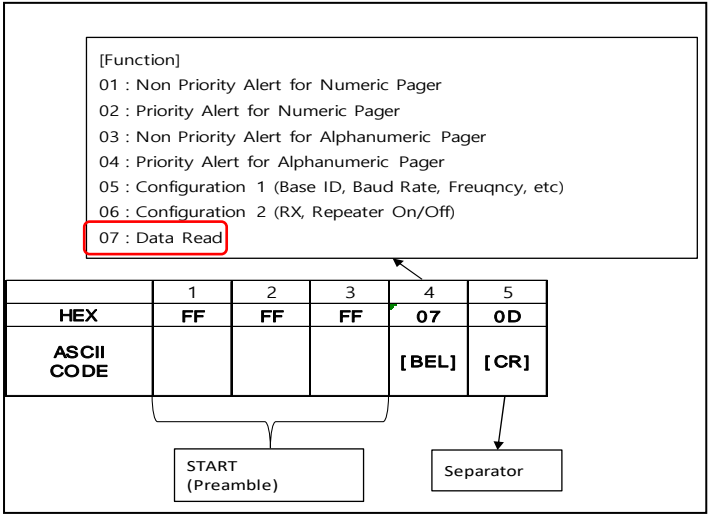


Note that the configurations for the Module as shown are: Delay to Transmit = 000(sec),

Paging Baud Rate = 1200(bps), Paging Frequency = 457.5750(MHz).



9-4. Protocol and Data Format for Module Data Read



	1	2	3	4	5	6	7	8	9	10	11	12	13
HEX	07	30	37	30	03	30	30	30	31	32	30	30	03
ASCII CODE	[BEL]	0	7	0	[ETX]	0	0	0	1	2	0	0	[ETX]

BASE ID DELAY BAUD RATE

14	15	16	17	18	19	20	21	22	23	24	25	26	27
34	35	37	35	37	35	30	03	52	31	03	50	30	03
4	5	7	5	7	5	0	[ETX]	R	1	[ETX]	P	1	[ETX]

FREQUENCY RX On/OFF REPEATER On/OFF

28	29	30	31	32	33
56	31	2E	30	30	0D
V	1	.	0	0	[CR]

POCSAG Module Version

10. AT Command

- a. Baud Rate : 19200 bps
- b. Data Bits : 8
- c. Parity Bit : None
- d. Stop bit : 1

No	Command	Usage	Description	R/W
1	AT	AT? Ex) AT?(Command) OK(Responses)	Check serial connection	R
2	AT+RES	AT+RST<CR> Ex) AT+RST<CR>(Command) OK (Responses)	Reset the module	W
3	AT+FRT	AT+FRT<CR> Ex) AT+FRT<CR>(Command) OK (Responses)	Factory Reset	W
4	AT+VER	AT+VER? Ex) AT+VER? (Command) V1.00 (Responses)	Firmware Version	R
5	AT+BPS	AT+BPS <BPS> <CR> AT+BPS? <BPS> 1:1200, 5:0512 Ex) AT+BPS<1> <CR>(Command) B:1200 (Responses) AT+BPS? (Command) B:512 (Responses)	Data Rate	R/W
6	AT+POW	AT+POW <POW> <CR> AT+POW? <POW> 0010, 0100, 0500, 2000 Ex) AT+POW<10> <CR>(Command) P:10(Responses) AT+POW?(Command) P:10mW(Responses)	TX Power	R/W
7	AT+LEV	AT+LEV <LEV> <CR> AT+LEV? <LEV> 01 ~ 50 Ex) AT+LEV<10> <CR>(Command) P:10(Responses) AT+LEV?(Command) P:10(Responses)	TX Level	R/W
7	AT+FRQ	AT+FRQ <FRQ> <CR> AT+FRQ? <FRQ> 420.0000 ~ 470.0000 Ex) AT+FRQ<457.5750> <CR>(Command) F:457.5750(Responses) AT+FRQ?(Command) F:457.5750(Reponses)	Frequency	R/W

11. Notice.

11.1 Storage Conditions

Please use this product within 6month after receipt.

- The product left more than 6months after reception, it needs to be confirmed the solderbility before used.
- The product shall be stored in non corrosive gas (Cl₂, NH₃, SO₂, Nox, etc.).
- Baking condition: 125 +5/-0 °C, 24 hours, 1 time

11.2 Handling Conditions

Be careful in handling or transporting products because excessive stress or mechanical shock may break products.

Handle with care if products may have cracks or damages on their terminals, the characteristics of products may change. Do not touch products with bear hands that may result in poor solderability.

11.3 Standard PCB Design (Land Pattern and Dimensions)

All the ground terminals should be connected to the ground patterns. Furthermore, the ground pattern should be provided between IN and OUT terminals. Please refer to the specifications for the standard land dimensions.

The recommended land pattern and dimensions is as Leetek's standard. The characteristics of products may vary depending on the pattern drawing method, grounding method, land dimensions, land forming method of the NC terminals and the PCB material and thickness. Therefore, be sure to verify the characteristics in the actual set. When using non-standard lands, contact Leetek beforehand.

11.4 Soldering Conditions :

The recommendation conditions of soldering are as in the following figure.

When products are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100 °C. Soldering must be carried out by the above mentioned conditions to prevent products from damage. Set up the highest temperature of reflow within 270 °C.

Contact Leetek before use if concerning other soldering conditions.

11.5 Cleaning :

Since this Product is Moisture Sensitive, any cleaning is not permitted.

11.6 Operational Environment Conditions :

Products are designed to work for electronic products under normal environmental conditions (ambient temperature, humidity and pressure). Therefore, products have no problems to be used under the similar conditions to the above-mentioned.

However, if products are used under the following circumstances, it may damage products and leakage of electricity and abnormal temperature may occur.

- In an atmosphere containing corrosive gas (Cl₂, NH₃, SO_x, NO_x etc.).
- In an atmosphere containing combustible and volatile gases.
- Dusty place.
- Direct sunlight place.
- Water splashing place.
- Humid place where water condenses.
- Freezing place.

If there are possibilities for products to be used under the preceding clause, consult with Leetek before actual use.

As it might be a cause of degradation or destruction to apply static electricity to products, do not apply static electricity or excessive voltage while assembling and measuring.

11.7 Input Power Capacity :

Products shall be used in the input power capacity as specified in this specifications. Inform Leetek beforehand, in case that the components are used beyond such input power capacity range.



CAUTION

PLEASE READ THIS NOTICE BEFORE USING OUR PRODUCTS.

This equipment may cause radio interference, and may not be used for personal safety.

Please make sure that your product has been evaluated and confirmed from the aspect of the fitness for the specifications of our product when our product is mounted to your product.

All the items and parameters in this product specification/datasheet/catalog have been prescribed on the premise that our product is used for the purpose, under

the condition and in the environment specified in this specification. You are requested not to use our product deviating from the condition and the environment specified in this specification.

Please note that the only warranty that we provide regarding the products is its conformance to the specifications provided herein. Accordingly, we shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.

WE HEREBY DISCLAIMS ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

The product shall not be used in any application listed below which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property. You acknowledge and agree that, if you use our products in such applications, we will not be responsible for any failure to meet such requirements.

Furthermore, YOU AGREE TO INDEMNIFY AND DEFEND US AND OUR AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF OUR PRODUCTS IN SUCH APPLICATIONS.

- Aircraft equipment.
- Aerospace equipment
- Undersea equipment.
- Power plant control equipment
- Medical equipment.
- Transportation equipment (vehicles, trains, ships, elevator, etc.).
- Traffic signal equipment.
- Disaster prevention / crime prevention equipment.
- Burning / explosion control equipment
- Application of similar complexity and/ or reliability requirements to the applications listed in the above.

We expressly prohibit you from analyzing, breaking, Reverse-Engineering, remodeling altering, and reproducing our product. Our product cannot be used for the product which is prohibited from being manufactured, used, and sold by the regulations and laws in the world.

We do not warrant or represent that any license, either express or implied, is granted under any our patent right, copyright, mask work right, or our other intellectual property right relating to any combination, machine, or process in which our products or services are used. Information provided by us regarding third-party products or services does not constitute a license from us to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from us under our patents or other intellectual property.

Please do not use our products, our technical information and other data provided by us for the purpose of developing of mass-destruction weapons and the purpose of military use.

Moreover, you must comply with "foreign exchange and foreign trade law", the "U.S. export administration regulations", etc.

Please note that we may discontinue the manufacture of our products, due to reasons such as end of supply of materials and/or components from our suppliers.

Customer acknowledges that Leetek will, if requested by you, conduct a failure analysis for defect or alleged defect of Products only at the level required for consumer grade Products, and thus such analysis may not always be available or be in accordance with your request (for example, in cases where the defect was caused by components in Products supplied to Leetek from a third party).

By signing on specification sheet or approval sheet, you acknowledge that you are the legal representative for your company and that you understand and accept the validity of the contents herein.

When you are not able to return the signed version of specification sheet or approval sheet within 90 days from receiving date of specification sheet or

approval sheet, it shall be deemed to be your consent on the content of specification sheet or approval sheet.

Customer acknowledges that engineering samples may deviate from specifications and may contain defects due to their development status.

We reject any liability or product warranty for engineering samples.

In particular we disclaim liability for damages caused by

- the use of the engineering sample other than for evaluation purposes, particularly the installation or integration in the product to be sold by you,
- deviation or lapse in function of engineering sample,
- improper use of engineering samples.

We disclaims any liability for consequential and incidental damages.

If you can't agree the above contents, you should inquire our sales.

Information on test modes and additional testing requirements

a) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).

b) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitter, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating

multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufactures should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

Additional testing, Part 15 subpart B disclaimer

The final host/module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation

as a Part 15 digital device.

The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369.

FCC Statement

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 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.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter.

FCC CAUTION:

Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

FCC ID: WDC-J1901

IC Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment.

NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

End Product Labeling

The module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

"Contains FCC ID: WDC-J1901"

"Contains IC: 7752A-J1901"

Énoncé FCC

Cet équipement a été testé et déclaré conforme aux limites pour appareils numériques de classe B, selon la section 15 des Règles de la FCC. Ces limites sont destinées à assurer une protection raisonnable contre les interférences nuisibles dans une installation résidentielle. Cet équipement génère, utilise et émet de l'énergie de fréquences radio et peut, en cas d'installation ou d'utilisation non conforme aux instructions, engendrer des interférences nuisibles pour les communications radio. Toutefois, il n'existe aucune garantie qu'une installation particulière sera à l'abri des interférences. Si cet équipement cause des interférences nuisibles à la réception radiophonique ou télévisuelle, ce qui peut être vérifié en mettant l'équipement hors, puis sous tension, l'utilisateur peut tenter de résoudre le problème de l'une des façons suivantes :

- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'équipement et le récepteur.
- Brancher l'équipement sur un circuit électrique différent de celui où le récepteur est branché.
- Consulter le fournisseur ou un technicien expérimenté dans le domaine de la radio ou de la télévision.

Cet appareil est conforme à la partie 15 des Règles de la FCC. Son utilisation est assujettie aux deux conditions suivantes : (1) Cet appareil ne doit causer aucune

interférence nuisible et (2) cet appareil doit accepter toutes les interférences reçues, y compris celles qui pourraient provoquer un fonctionnement non souhaitable.

Cet appareil et son antenne ne doivent pas être placés à proximité de toute autre antenne ou de tout autre émetteur, ni être utilisés conjointement avec ceux-ci.

MISE EN GARDE DE LA FCC :

Tout changement ou toute modification à l'équipement qui n'a pas fait l'objet d'une autorisation expresse par la partie responsable d'assurer sa conformité pourrait annuler votre droit à utiliser l'équipement.

Code FCC : WDC-J1901

Avis d'Industrie Canada sur l'exposition aux rayonnements

Cet appareil est conforme aux limites d'exposition aux rayonnements d'Industrie Canada pour un environnement non contrôlé.

REMARQUE : LE FABRICANT N'EST PAS RESPONSABLE DES INTERFÉRENCES RADIOÉLECTRIQUES CAUSÉES PAR DES MODIFICATIONS NON AUTORISÉES APPORTÉES À CET APPAREIL. DE TELLES MODIFICATIONS POURRAIENT ANNULER L'AUTORISATION ACCORDÉE À L'UTILISATEUR DE FAIRE FONCTIONNER L'APPAREIL.

Étiquetage du produit final (IC)

Le module J1901 est étiqueté avec sa propre identification FCC et son propre numéro de certification IC. Si l'identification FCC et le numéro de certification IC ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre dispositif, la partie externe du dispositif dans lequel le module est installé devra également présenter une étiquette faisant référence au module inclus.

Dans ce cas, le produit final devra être étiqueté sur une zone visible avec les informations suivantes:

« Contient module émetteur identification FCC ID : WDC-J1901 »

« Contient module émetteur IC : 7752A-J1901 »

1. The module is limited to OEM installation **ONLY**.
2. OEM integrators are responsible for ensuring that the end-user has no manual instructions to remove or install module.
3. The module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
4. Separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.