

AR9000 User Guide

The AR9000 full range 9-channel receiver features DSM2™ technology and is compatible with all Spektrum™ and JR® aircraft radios that support DSM2 technology including JR12X, JRX9303, Spektrum DX7, Spektrum DX6i, Spektrum DX5e, Spektrum Module Systems.

Note: The AR9000 receiver is not compatible with the Spektrum DX6 parkflyer transmitter.

Features:

- **9-Channel Full Range Receiver**
- **Patented MultiLink™ receiver technology with up to 4 receivers**
- **Includes two internal and one remote receiver**
- **Two type of failsafe SmartSafe™ and Preset Failsafe**
- **QuickConnect™ with Brownout Detection**
- **Flight Log Compatible (optional)**

Applications

Full Range Up to 9 channel aircraft including:

All types and sizes of glow, gas and electric powered airplanes

All types and sizes of no-powered gliders

All types and sizes of glow, gas and electric powered helicopters

Note: Not for use in airplanes that have full carbon fuselages.

Specifications:

- Type:** DSM2 Full Range Receiver
- Channels:** 9
- Modulation:** DSM2
- Dimension (WxLxH):** 1.25 X 1.90 X .55 in (31 x 48.4 x 13.9mm)
- Weight:** .53 oz (15 g) main receiver
- Input Voltage Range:** 3.5–9.6V
- Resolution:** 2048
- Compatibility:** All DSM2 Aircraft Transmitters and Module Systems

Receiver

The AR9000 incorporates two internal receivers, and requires one external receiver (included) offering the security of multi path RF redundancy. Two internal receivers are located on the main PC board, while a third external receiver must be attached to the main board with an extension. Additionally an optional fourth receiver can be added offering the ultimate in RF link security and redundancy. By locating each receiver in slightly different locations in the aircraft, each receiver is exposed to its own RF environment, greatly improving path diversity (the ability for the receiver to see the signal in all conditions).

Antenna Polarization

For optimum RF link performance it's important that the antennas be mounted in an orientation that allows for the best possible signal reception when the aircraft is in all possible attitudes and positions. This is known as antenna polarization. The antennas should be oriented perpendicular to each other; typically vertical and horizontal and at different angles (see Receiver Installation below). The remote receiver antenna should be mounted in a position perpendicular at least 2 inches away from the main receiver's antenna using double-sided foam tape.

Receiver Installation in Aircraft

In gas and glow aircraft install the main receiver using the same method you would use to install a conventional receiver in your aircraft. Typically, wrap the main receiver in protective foam and fasten it in place using rubber bands or hook and loop straps. Alternately, in electric airplanes or helicopters, it's acceptable to use thick double-sided foam tape to fasten the main receiver in place. The AR9000 requires at least one remote receiver to operate. Mounting this remote receiver in a slightly different location, even just inches away from the primary receivers, gives tremendous improvements in path diversity. Essentially, each receiver sees a different RF environment and this

is key to maintaining a solid RF link, even in aircraft that have substantial conductive materials (e.g. larger gas engines, carbon fiber, pipes, etc.), which can weaken the signal. Using servo tape, mount the remote receiver keeping the remote antennas at least 2 inches away from the primary antennas. Ideally, the antennas will be oriented perpendicularly to each other. In airplanes, we've found it best to mount the primary receiver in the center of the fuselage on the servo tray and to mount the remote receiver to the side of the fuselage or in the turtle deck. A fourth antenna can be added for additional RF link security.



In helicopters, there is generally enough room on the servo tray to achieve the necessary separation. If necessary a mount can be fashioned using clear plastic to mount the external receiver.



Important: Y-Harnesses and Servo Extensions

When using a Y-harness or servo extensions in your installation, it's important to use standard non-amplified Y-harnesses and servo extensions as this can/will cause the servos to operate erratically or not function at all. Amplified Y-harnesses were developed several years ago to boost the signal for some older PCM systems and should not be used with Spektrum equipment. Note that when converting an existing model to Spektrum be certain that all amplified Y-harnesses and/or servo extensions are replaced with conventional non-amplified versions.

Binding

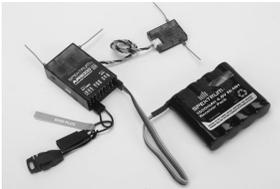
The AR9000 receiver must be bound to the transmitter before it will operate. Binding is the process of teaching the receiver the specific code of the transmitter so it will only connect to that specific transmitter.

1. To bind an AR9000 to a DSM2 transmitter, insert the bind plug in the BATT/BIND port on the receiver.

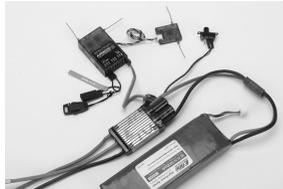


Note: To bind an aircraft with an electronic speed controller that powers the receiver through the throttle channel (ESC/BEC), insert the bind plug into the BATT/BIND port in the receiver and the throttle lead into the throttle (THRO) port. Proceed to Step #2.

2. Power the receiver. Note that the LED on the receiver should be flashing, indicating that the receiver is in bind mode and ready to be bound to the transmitter.



Shown using a separate receiver pack. (Battery can be plugged into any open port.)



Shown using an ESC/BEC and a flight pack.

3. Move the sticks and switches on the transmitter to the desired failsafe positions (low throttle and neutral control positions).



4. Follow the procedures of your specific transmitter to enter Bind Mode, the system will connect within a few seconds. Once connected, the LED on the receiver will go solid indicating the system is connected.
5. Remove the bind plug from the BATT/BIND port on the receiver before you power off the transmitter and store it in a convenient place.
6. After you've set up your model, it's important to rebind the system so the true low throttle and neutral control surface positions are set.

IMPORTANT: Remove the bind plug to prevent the system from entering bind mode the next time the power is turned on.

Failsafe functions

The Powersafe features two types of failsafe: SmartSafe and Preset Failsafe.

SmartSafe

This type of failsafe is recommended for most types of aircraft. Here's how SmartSafe works.

When the transmitter and receiver are turned on the receiver connects to the transmitter and normal control of all channels occurs. If loss of signal occurs, SmartSafe drives the throttle servo only to its preset failsafe position (low throttle) that was set during binding. All other channels hold their last position. When the signal is regained, the system immediately regains control.

Preset Failsafe

Preset failsafe is ideal for sailplanes and is preferred by some modelers for their glow- and gas-powered aircraft.

When the transmitter and receiver are turned on and the receiver connects to the transmitter normal control of all channels occurs. If loss of signal occurs Preset failsafe drives all servos to

their preset failsafe positions. For sailplanes it's recommended that the spoilers/flaps deploy to de-thermalize the aircraft, preventing a flyaway. Some powered modelers prefer to use this failsafe system to program a slight turn and low throttle to prevent their aircraft from flying away. When the signal is regained, the system immediately regains control.

Programming SmartSafe

During the binding process the bind plug is left in throughout the process and is removed only after the receiver connects to the transmitter. After the connection is made, confirmed by operating the servos, the bind plug can be removed. The receiver is now programmed for SmartSafe.

Programming Preset Failsafe

During the binding process the bind plug is inserted in the bind port, then the receiver is powered up. The LEDs in each receiver should blink, indicating that the receiver is in bind mode. Now before binding the receiver to the transmitter and with the receiver in bind mode, remove the bind plug. The LEDs will still be blinking. With the control sticks and switches in the desired failsafe positions, bind the transmitter to the receiver. Follow the procedures of your specific transmitter to enter Bind Mode. The system should connect in less than 15 seconds. The receiver is now programmed for preset failsafe.

Note: Failsafe positions are stored via the stick and switch positions on the transmitter during binding.

Receiver Power Only

- With SmartSafe or Preset Failsafe, when the receiver only is turned on (no transmitter signal is present), the throttle channel has no output, to avoid operating or arming the electronic speed control.
- All other channels are driven to their preset failsafe positions set during binding.

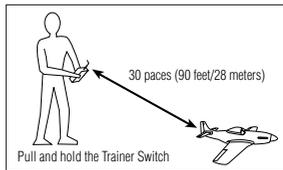
Note: Some analog servos may coast slightly even though no signal is present. This is normal.

Plugging in the Leads

Plug the servo leads into the appropriate servo ports in the receiver noting the polarity of the servo connector.

Range Testing

Before each flying session and especially with a new model, it is important to perform a range check. All Spektrum aircraft transmitters incorporate a range testing system which, when activated, reduces the output power, allowing a range check.



1. With the model restrained on the ground, stand 30 paces (approx. 90 feet/28 meters) away from the model.
2. Face the model with the transmitter in your normal flying position and place your transmitter into range check mode.
3. You should have total control of the model with the button depressed at 30 paces (90 feet/28 meters).
4. If control issues exist, call the Spektrum Service Center in the U.S. at 1-877-504-0233 for further assistance. In the UK or Germany use one of the following addresses.
 - European Union: +49 4121 46199 66 (Deutschland)
 - or email service@horizonhobby.de
 - +44 (0) 1279 641 097 (United Kingdom)
 - or email sales@horizonhobby.co.uk

Advanced Range Testing

For sophisticated models that have significant conductive material in them, the Advanced range test using a flight log is recommended. The advanced range check will confirm that the internal and remote receivers are operating optimally and that the installation (position of the receivers) is optimized for the specific aircraft. This Advanced Range Check allows the RF performance of each receiver to be evaluated and to optimize the locations of the remote receiver.

Advanced Range Test

1. Plug a Flight Log (SPM9540 - optional) into the data port in the AR9000 and turn on the system (Tx and Rx).
2. Advance the Flight Log until F- frame losses are displayed by pressing the button on the Flight Log.
3. Have a helper hold your aircraft while observing the Flight Log data.
4. Standing 30 paces away from the model, face the model with the transmitter in your normal flying position and put your transmitter into range test mode. This causes reduced power output from the transmitter.
5. Have your helper position the model in various orientations (nose up, nose down, nose toward the Tx, nose away from the Tx, etc.) while your helper watches the Flight Log noting any correlation between the aircraft's orientation and frame losses. Do this for 1 minute. The timer on the transmitter can be used here.

Receiver Power System Requirements

Inadequate power systems that are unable to provide the necessary minimum voltage to the receiver during flight have become the number one cause of in-flight failures. Some of the power system components that affect the ability to properly deliver adequate power include

- Receiver battery pack (number of cells, capacity, cell type, state of charge)

- The ESC's capability to deliver current to the receiver in electric aircraft

- The switch harness, battery leads, servo leads, regulators etc.

The AR9000 has a minimum operational voltage of 3.5 volts; it is highly recommended the power system be tested per the guidelines below.

Recommended Power System Test Guidelines

If a questionable power system is being used (e.g. small or old battery, ESC that may not have a BEC that will support high-current draw, etc.), it is recommended that a voltmeter be used to perform the following tests.

Note: The Hangar 9 Digital Servo & Rx Current Meter (HAN172) or the Spektrum Flight Log (SPM9540) is the perfect tool to perform the test below.

Plug the voltmeter into an open channel port in the receiver and with the system on, load the control surfaces (apply pressure with your hand) while monitoring the voltage at the receiver. The voltage should remain above 4.8 volts even when all servos are heavily loaded.

Note: The latest generations of Nickel-Metal Hydride batteries incorporate a new chemistry mandated to be more environmentally friendly. These batteries when charged with peak detection fast chargers have tendencies to false peak (not fully charge) repeatedly. These include all brands of NiMH batteries. If using NiMH packs, be especially cautious when charging, making absolutely sure that the battery is fully charged. It is recommended to use a charger that can display total charge capacity. Note the number of mAh put into a discharged pack to verify it has been charged to full capacity.

QuickConnect™ With Brownout Detection

Your AR9000 features QuickConnect with Brownout Detection.

- Should an interruption of power occur (brownout), the system will reconnect immediately when power is restored (QuickConnect).
- The LED on the receiver will flash slowly indicating a power interruption (brownout) has occurred.
- Brownouts can be caused by an inadequate power supply (weak battery or regulator), a loose connector, a bad switch, an inadequate BEC when using an Electronic speed controller, etc.
- Brownouts occur when the receiver voltage drops below 3.5 volts thus interrupting control as the servos and receiver require a minimum of 3.5 volts to operate.

How QuickConnect With Brownout Detection Works

- When the receiver voltage drops below 3.5 volts the system drops out (ceases to operate).
- When power is restored the receiver immediately attempts to reconnect to the last two frequencies that it was connected to.
- If the two frequencies are present (the transmitter was left on) the system reconnects typically about 4/100 of a second.

QuickConnect with Brownout Detection is designed to allow you to fly safely through most short duration power interruptions, however, the root cause of these interruptions must be corrected before the next flight to prevent a crash.

- Note:** If a brownout occurs in flight it is vital that the cause of the brownout be determined and corrected.

Flight Log (SPM9540 Optional)

The Flight Log is compatible with the AR9000. The Flight Log displays overall RF link performance as well as the individual internal and external receiver link data. Additionally it displays receiver voltage.

Using the Flight Log

After a flight and before turning off the receiver or transmitter, plug the Flight Log into the Data port on the AR9000. The screen will automatically display voltage e.g. 6v2= 6.2 volts.

- Note:** When the voltage reaches 4.8 volts or less, the screen will flash indicating low voltage.

Press the button to display the following information:

- A – Antenna fades on internal antenna A
- B – Antenna fades on internal antenna B
- L – Antenna fades on the left external antenna
- R – Antenna fades on the right external antenna
- F – Frame loss
- H – Holds

- Note:** --- (three dashed lines) will appear if the antenna is not attached

Antenna fades—represents the loss of a bit of information on that specific antenna. Typically it's normal to have as many as 50 to 100 antenna fades during a flight. If any single antenna experiences over 500 fades in a single flight, the antenna should be repositioned in the aircraft to optimize the RF link.

Frame loss—represents simultaneous antenna fades on all attached receivers. If the RF link is performing optimally, frame losses per flight should be less than 20. A hold occurs when 45 consecutive frame losses occur. This takes about one second. If a hold occurs during a flight, it's important to evaluate the system, moving the antennas to different locations and or checking to be sure the transmitter and receivers are all working correctly.

- Note:** A servo extension can be used to allow the Flight Log to be plugged in more conveniently. On some models, the Flight Log can be plugged in, attached and left on the model using double-sided tape. Mounting the Flight Log conveniently to the side frame is common with helicopters.

Tips on Using Spektrum 2.4GHz

ModelMatch™

Some Spektrum and JR transmitters offer a patent pending feature called ModelMatch. ModelMatch prevents the possibility of operating a model using the wrong model memory, potentially preventing a crash. With ModelMatch each model memory has its own unique code (GUID) and during the binding process the code is programmed into the receiver. Later, when the system is turned on, the receiver will only connect to the transmitter if the corresponding model memory is programmed on screen.

- Note:** If at any time you turn on the system and it fails to connect, check to be sure the correct model memory is selected in the transmitter. Please note that the DX5e and Aircraft Modules do not have ModelMatch.

While your DSM equipped 2.4GHz system is intuitive to operate, functioning nearly identically to 72MHz systems, following are a few common questions from customers.

- Q: Which do I turn on first, the transmitter or the receiver?**

A: If the receiver is turned off first—all servos except for the throttle will be driven to their preset failsafe positions set during binding. At this time the throttle channel doesn't output a pulse position preventing the arming of electronic speed controllers or in the case of an engine powered aircraft the throttle servo remains in its current position. When the transmitter is then turned on the transmitter scans the 2.4GHz band and acquires two open channels. Then the receiver that was previously bound to the transmitter scans the band and finds the GUID (Globally Unique Identifier code) stored during binding. The system then connects and operates normally.

If the transmitter is turned on first—the transmitter scans the 2.4GHz band and acquires two open channels. When the receiver is then turned on for a short period (the time it takes to connect) all servos except for the throttle are driven to their preset failsafe positions while the throttle has no output pulse. The receiver scans the 2.4GHz band looking for the previously stored GUID and when it locates the specific GUID code and confirms uncorrupted repeatable packet information, the system connects and normal operation takes place. Typically this takes 2 to 6 seconds.

- Q: Sometimes the system takes longer to connect and sometimes it doesn't connect at all?**

A: In order for the system to connect (after the receiver is bound) the receiver must receive a large number of consecutive uninterrupted perfect packets from the transmitter in order to connect. This process is purposely critical of the environment ensuring that it's safe to fly when the system does connect. If the transmitter is too close to the receiver (less than 4 ft.) or if the transmitter is located near metal objects (metal TX case, the bed of a truck, the top of a metal work bench, etc.) connection will take longer and in some cases connection will not occur as the system is receiving reflected 2.4GHz energy from itself and is interpreting this as unfriendly noise. Moving the system away from metal objects or moving the transmitter away from the receiver and powering the system again will cause a connection to occur. This only happens during the initial connection. Once connected the system is locked in and should a loss of signal occur (failsafe) the system connects immediately (4ms) when signal is regained.

- Q: I've heard that the DSM system is less tolerant of low voltage. Is this correct?**

A: All DSM receivers have an operational voltage range of 3.5 to 9.6 volts. With most systems this is not a problem as in fact most servos cease to operate at around 3.8 volts. When using multiple high-current draw servos with a single or inadequate battery/power source, heavy momentary loads can cause the voltage to dip below this 3.5-volt threshold thus causing the entire system (servos and receiver) to brown out. When the voltage drops below the low voltage threshold (3.5 volts), the DSM receiver must reboot (go through the startup process of scanning the band and finding the transmitter) and this can take several seconds. Please read the receiver power requirement section as this explains how to test for and prevent this occurrence.

- Q: Sometimes my receiver loses its bind and won't connect requiring rebinding. What happens if the bind is lost in flight?**

A: The receiver will never lose its bind unless it's instructed to. It's important to understand that during the binding process the receiver not only learns the GUID (code) of the transmitter but the transmitter learns and stores the type of receiver that it's bound to. If the transmitter is placed into bind mode, the transmitter looks for the binding protocol signal from a receiver. If no signal is present, the transmitter no longer has the correct information to connect to a specific receiver and in essence the transmitter has been "unbound" from the receiver. We've had several DX7 customers that use transmitter stands or trays that unknowingly depress the bind button and the system is then turned on losing the necessary information to allow the connection to take place. We've also had DX7 customers that didn't fully understand the range test process and pushed the bind button before turning on the transmitter also causing the system to "lose its bind."

Age Recommendation:	14 years or over. This is not a toy. This product is not intended for use by children without direct adult supervision.
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Warranty Period

Exclusive Warranty- Horizon Hobby, Inc., (Horizon) warrants that the Products purchased (the "Product") will be free from defects in materials and workmanship for a period of 1 year from the date of purchase by the Purchaser.

Limited Warranty

(a) This warranty is limited to the original Purchaser ("Purchaser") and is not transferable. REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. This warranty covers only those Products purchased from an authorized Horizon dealer. Third party transactions are not covered by this warranty. Proof of purchase is required for warranty claims. Further, Horizon reserves the right to change or modify this warranty without notice and disclaims all other warranties, express or implied.

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(c) Purchaser Remedy- Horizon's sole obligation hereunder shall be that Horizon will, at its option, (i) repair or (ii) replace, any Product determined by Horizon to be defective. In the event of a defect, these are the Purchaser's exclusive remedies. Horizon reserves the right to inspect any and all equipment involved in a warranty claim. Repair or replacement decisions are at the sole discretion of Horizon. This warranty does not cover cosmetic damage or damage due to acts of God, accident, misuse, abuse, negligence, commercial use, or modification of or to any part of the Product. This warranty does not cover damage due to improper installation, operation, maintenance, or attempted repair by anyone other than Horizon. Return of any goods by Purchaser must be approved in writing by Horizon before shipment.

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If you as the Purchaser or user are not prepared to accept the liability associated with the use of this Product, you are advised to return this Product immediately in new and unused condition to the place of purchase.

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Safety Precautions

This is a sophisticated hobby Product and not a toy. It must be operated with caution and common sense and requires some basic mechanical ability. Failure to operate this Product in a safe and responsible manner could result in injury or damage to the Product or other property. This Product is not intended for use by children without direct adult supervision. The Product manual contains instructions for safety, operation and maintenance. It is essential to read and follow all the instructions and warnings in the manual, prior to assembly, setup or use, in order to operate correctly and avoid damage or injury.

Questions, Assistance, and Repairs

Your local hobby store and/or place of purchase cannot provide warranty support or repair. Once assembly, setup or use of the Product has been started, you must contact Horizon directly. This will enable Horizon to better answer your questions and service you in the event that you may need any assistance. For questions or assistance, please direct your email to productsupport@horizonhobby.com, or call 877.504.0233 toll free to speak to the Product Support department.

Inspection or Repairs

If this Product needs to be inspected or repaired, please call for a Return Merchandise Authorization (RMA). Pack the Product securely using a shipping carton. Please note that original boxes may be included, but are not designed to withstand the rigors of shipping without additional protection. Ship via a carrier that provides tracking and insurance for lost or damaged parcels, as Horizon is not responsible for merchandise until it arrives and is accepted at our facility. A Service Repair Request is available at www.horizonhobby.com on the "Support" tab. If you do not have internet access, please include a letter with your complete name, street address, email address and phone number where you can be reached during business days, your RMA number, a list of the included items, method of payment for any non-warranty expenses and a brief summary of the problem. Your original sales receipt must also be included for warranty consideration. Be sure your name, address, and RMA number are clearly written on the outside of the shipping carton.

Warranty Inspection and Repairs

To receive warranty service, you must include your original sales receipt verifying the proof-of-purchase date. Provided warrantly conditions have been met, your Product will be repaired or replaced free of charge. Repair or replacement decisions are at the sole discretion of Horizon Hobby.

Non-Warranty Repairs

Should your repair not be covered by warranty the repair will be completed and payment will be required without notification or estimate of the expense unless the expense exceeds 50% of the retail purchase cost. By submitting the item for repair you are agreeing to payment of the repair without notification. Repair estimates are available upon request. You must include this request with your repair. Non-warranty repair estimates will be billed a minimum of ½ hour of labor. In addition you will be billed for return freight. Please advise us of your preferred method of payment. Horizon accepts money orders and cashiers checks, as well as Visa, MasterCard, American Express, and Discover cards. If you choose to pay by credit card, please include your credit card number and expiration date. Any repair left unpaid or unclaimed after 90 days will be considered abandoned and will be disposed of accordingly. Please note: non-warranty repair is only available on electronics and model engines.

Electronics and engines requiring inspection or repair should be shipped to the following address:	Horizon Service Center <p>4105 Fieldstone Road Champaign, Illinois 61822</p>
All other Products requiring warranty inspection or repair should be shipped to the following address:	Horizon Product Support <p>4105 Fieldstone Road Champaign, Illinois 61822</p>

Please call 877-504-0233 or e-mail us at productsupport@horizonhobby.com with any questions or concerns regarding this product or warranty.

European Union:

Electronics and engines requiring inspection or repair should be shipped to one of the following addresses:

Horizon Hobby UK <p>Units 1-4 Ployters Rd Slaple Tye, Harlow Essex CM18 7NS United Kingdom</p>	<p>Please call +44 (0) 1279 641 097 or email sales@horizonhobby.co.uk with any questions or concerns regarding this product or warranty.</p>
Horizon Technischer Service <p>Hamburger Str. 10 25335 Elmshorn Germany</p>	<p>Please call +49 4121 46199 66 or email service@horizonhobby.de with any questions or concerns regarding this product or warranty.</p>

FCC Information

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.

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

This product contains a radio transmitter with wireless technology which has been tested and found to be compliant with the applicable regulations governing a radio transmitter in the 2.400GHz to 2.4835GHz frequency range.
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Declaration of Conformity

(in accordance with ISO/IEC 17050-1)

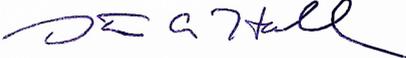
No. HH20081023	
Product(s):	AR9000 Receiver
Item Number(s):	SPMAR9000
The object of declaration described above is in conformity with the requirements of the specifications listed below, following the provisions of the European R&TTE directive 1999/5/EC:	

EN 300-328, v1.7.1 ERM requirements for wideband transmission systems operating in the 2.4 GHz ISM band

EN 301 489-1 v.1.6.1 General EMC requirements for Radio equipment
EN 301 489-17 v.1.2.1

Signed for and on behalf of:

Horizon Hobby, Inc.
Champaign, IL USA
Oct. 23, 2008

Steven A. Hall Vice President International Operations and Risk Management Horizon Hobby, Inc.	
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Instructions for Disposal of WEEE by Users in the European Union

This product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.



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US patent number 7,391,320. Other patents pending.