



ANT+ Device Profile

Tire Pressure Monitor



Preliminary - Subject to Change

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Revision History

Revision	Effective Date	Description
1.0_Alpha.001	March 2018	Creation of document
1.0_Alpha.002	March 2018	<p>Address comments from Mark @ SRAM: Background page requirement now 1/33 pages Represent pressure in signed millibars instead of unsigned. Correct open channel command profile specific format to match common pages. Remove references to controller ID in the open channel command Define relationship between device number, upper nibble extended device number, and a device's 32-bit serial number Replace references to other profiles with ANT+ tire pressure Switch alarm high and alarm low fields Rearrange position enum Pressure change alert page timespan units to 1/1024 seconds Add temperature data page. Send as a background page</p>
1.0_Alpha.003	April 2018	<p>Switching between ½ Hz and 4 Hz Removed current tire pressure valid values restriction Reduced precision of tire pressure change timespan to 1/32 seconds</p>
1.0_Alpha.004	April 2018	<p>Clarified that the channel period should be switched between 0 and 7 Update Transmission pattern diagram Remove unused pages Remove unused enumeration values</p>
1.0_Beta.001	May 2018	<p>Certifiable version Remove channel period switching</p>

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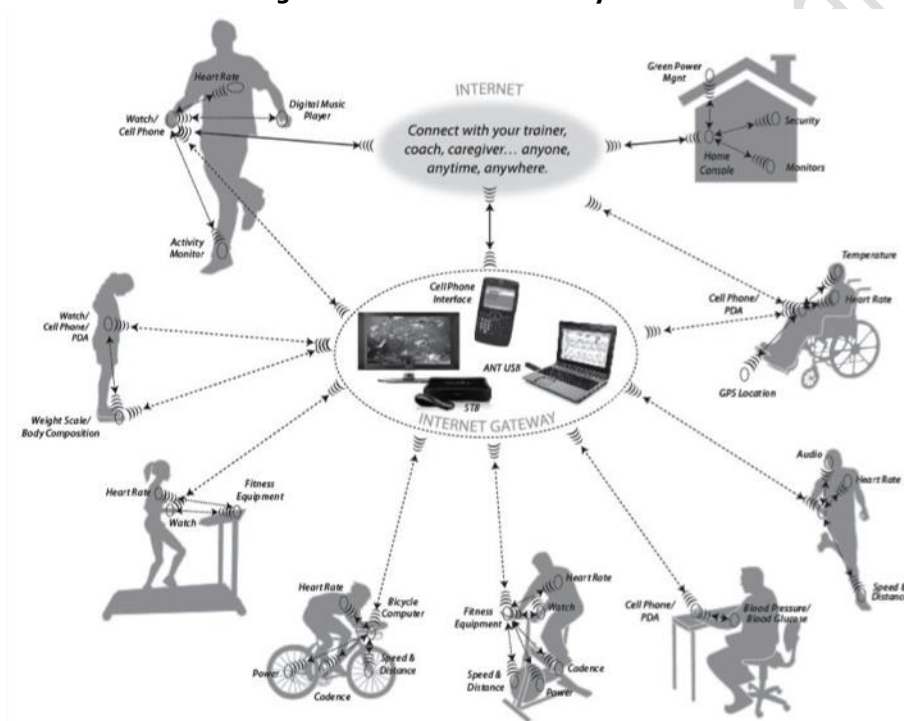
1 Overview of ANT+

The ANT+ Managed Network is comprised of a group of devices that use the ANT radio protocol and ANT+ Device Profiles to determine and standardize wireless communication between individual devices. This management of device communication characteristics provides interoperability between devices in the ANT+ network.

Developed specifically for ultra low power applications, the ANT radio protocol provides an optimal balance of RF performance, data throughput and power consumption.

ANT+ Device Profiles have been developed for devices used in personal area networks and can include, but are not limited to, devices that are used in sport, fitness, wellness, and health applications. Wirelessly transferred data that adheres to a given device profile will have the ability to interoperate with different devices from different manufacturers that also adhere to the same standard. Within each device profile, a minimum standard of compliance is defined. Each device adhering to the ANT+ Device Profiles must achieve this minimum standard to ensure interoperability with other devices.

Figure 1-1. ANT+ Device Ecosystem



This document details the wireless communication between devices adhering to this ANT+ Device Profile. The typical use case of the device(s), wireless channel configuration, data format(s), minimum compliance for interoperability, and implementation guidelines are also detailed.

IMPORTANT:

If you have received this document you have agreed to the terms and conditions of the Adopter's Agreement and have downloaded the ANT+ Managed network key. By accepting the Adopter's Agreement and receiving the ANT+ device profiles you agree to:

Implement and test your product to this specification in its entirety

To implement only ANT+ defined messages on the ANT+ managed network

2 Related Documents

Refer to current versions of the listed documents. To ensure you are using the current versions, check the ANT+ website at www.thisisant.com or contact your ANT+ representative.

1. ANT Message Protocol and Usage
2. ANT+ Common Data Pages

3 Using This Document

This profile document defines the requirements, recommendations, best practices, and allowances for certified ANT+ products. As a developer, use the document to identify requirements that need to be met to make your product ANT+ compliant. Use the SimulANT+ Profile Verification Suite with the certification requirement markers (Figure 3-1) in this document to test that requirements are met before submitting your product for ANT+ certification.



Figure 3-1. ANT+ Certification Requirement Marker

Each requirement in the profile is marked with a test number in bold square brackets [**XX_XXXX**]. Profile verification tests for master (sensor) devices are prefixed with '**MD_**' whereas slave (display) devices are marked as '**SD_**'. As you run the tests on SimulANT+, you can check back to the requirements in this document to understand and fix test failures. Section 8 outlines the tests that you can run using SimulANT+ to verify your product's ANT+ compliance, and points to the sections in the document that explain the individual requirements covered in each test. Requirements marked as [self-verify] do not have a related SimulANT+ Profile Verification Test and must be verified manually.

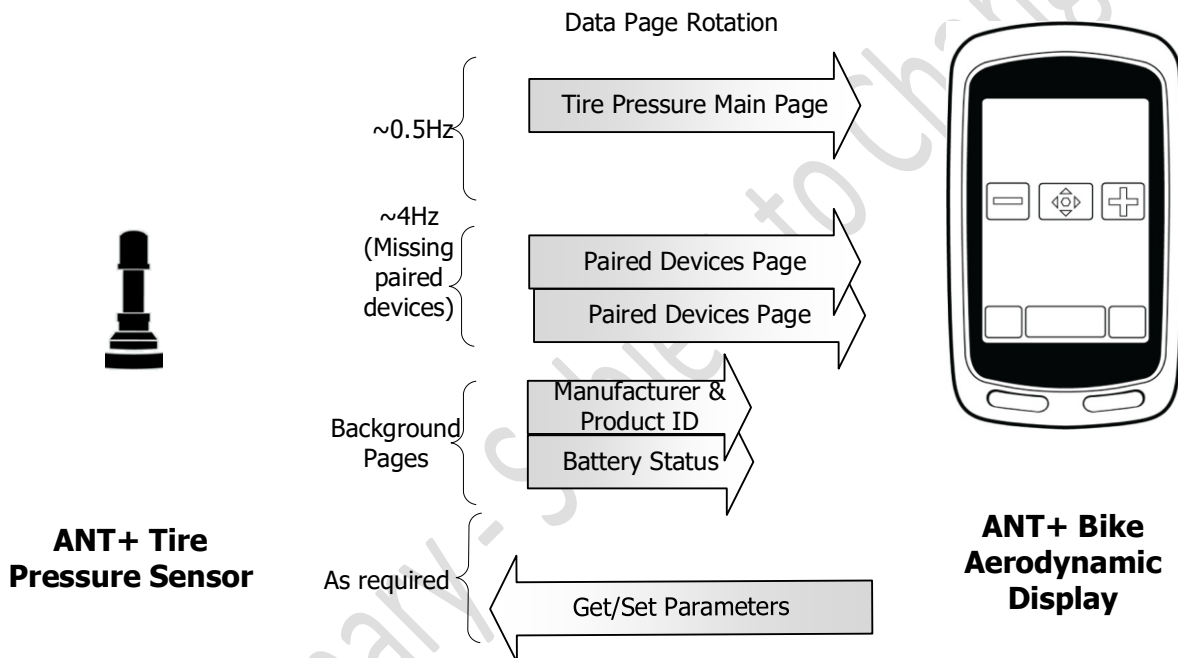


4 Overview of Tire Pressure Monitoring System Use Case

An ANT+ tire pressure sensor is a device that allows the gauge pressure of a tire to be reported wirelessly to a display device in real time. Displays may configure high and low-pressure alarms on the tire pressure monitor. When the alarm threshold is reached, the sensor alerts the display of the alarm state.

Sensors may independently choose to begin transmitting at a higher message rate in response to internal events, such as if an alarm state is triggered, or if pumping is detected.

A display may configure the barometric pressure defaulted to on the sensor, as well as the tire position on the bike. A typical tire pressure monitoring system will include 2 tire pressure monitors (one for the front wheel, and one for the rear wheel), and one display.



5 Channel Configuration

The channel configuration parameters of the tire pressure monitor and all other ANT-enabled devices are defined by the ANT protocol. Refer to the ANT Message Protocol and Usage document for more details.

5.1 Master Channel Configuration

The ANT+ tire pressure monitor **shall [self-verify]** establish its ANT channel as shown in Table 5-1.

Table 5-1. ANT Channel Configuration for ANT+ Tire Pressure Monitor (i.e. Master)

Parameter	Value	Comment
Channel Type	Master (0x10)	Within the ANT protocol the master channel (0x10) allows for bi-directional communication channels and utilizes the interference avoidance techniques and other features inherent to the ANT protocol.
Network Key	ANT+ Managed Network Key	The ANT+ Managed Network Key is governed by the ANT+ Managed Network licensing agreement.
RF Channel Frequency	57 (0x39)	RF Channel 57 (2457MHz) is used for the ANT+ tire pressure monitor.
Transmission Type	Set MSN to 0 (0x0) or MSN of extended device number. Set LSN to 5 (0x5)	ANT+ devices follow the transmission type definition as outlined in the ANT protocol. This transmission type cannot use a shared channel address and must be compliant with the global data messages defined in the ANT protocol
Device Type	48 (0x30)	An tire pressure device shall [self-verify] transmit its device type as 0x30. Please see the ANT Message Protocol and Usage document for more details.
Device Number	1-65535	This is a two-byte field that allows for unique identification of a given tire pressure monitor. It is imperative that the implementation allow for a unique device number to be assigned to a given device. NOTE: The device number for the transmitting sensor shall [self-verify] not be 0x0000.
Channel Period	65535 counts	Data is transmitted every 65535/32768 seconds (0.5 Hz).

5.1.1 Channel Type

As communication in two directions is required, the channel type **shall [self-verify]** be set to bidirectional master (0x10). The bidirectional master channel is also used to enable the interference avoidance features inherent to the ANT protocol.

5.1.2 Transmission Type

The most significant nibble of the transmission type may optionally be used to extend the device number from 16 bits to 20 bits. In this case, the most significant nibble of the transmission type becomes the most significant nibble of the 20-bit device number.

5.1.3 Device Number

The device number needs to be as unique as possible across production units. An example of achieving this specification is to use the lowest two bytes of the serial number of the device for the device number of the ANT channel ID; ensure that the device has a set serial number.

The device number of the tire pressure monitor **shall [self-verify]** not be 0x0000. Care should be taken if the device number is derived from the lower 16-bits of a larger serial number. In this case, ensure that serial numbers that are multiples of 0x10000 (65536) are handled correctly such that the device number is not set to 0.



5.2 Slave Channel Configuration

The device expected to receive data from a tire pressure monitor **shall [self-verify]** configure an ANT channel with its channel parameters set as listed in Table 5-2.

Table 5-2. ANT Channel Configuration for ANT+ Tire Pressure Display (i.e. Slave) Device

Parameter	Value	Comment
Channel Type	Slave (0x00)	The tire pressure monitor is a master device; therefore, the display device must be configured as the slave. Bidirectional communication is required.
Network Key	ANT+ Managed Network Key	The ANT+ Managed Network Key is governed by the ANT+ Managed Network licensing agreement.
RF Channel Frequency	57 (0x39)	RF Channel 57 (2457MHz) is used for the ANT+ Tire Pressure
Transmission Type	0 for pairing	The transmission type must be set to 0 for a pairing search. Once the transmission type is learned, the receiving device should remember the type for future searches. To be future compatible, any returned transmission type is valid. Future versions of this spec may allow additional bits to be set in the transmission type.
Device Type	48 (0x30)	48 (0x30) – indicates search for an ANT+ tire pressure monitor. Please see the ANT Message Protocol and Usage document for more details.
Device Number	1 – 65535 0 for searching	Set the Device Number parameter to zero to allow wildcard matching. Once the device number is learned, the receiving device should remember the number for future searches. Please see the ANT Message Protocol and Usage document for more details.
Channel Period	65535 counts	Data is transmitted from the ANT+ tire pressure monitor every 65535/32768 seconds (0.5 Hz) and must be received at this rate.
Search Timeout	(Default = 30 seconds)	The default search timeout is set to 30 seconds in the receiver. This timeout is implementation specific and can be set by the designer to the appropriate value for the system.

5.2.1 Transmission Type

The most significant nibble of the transmission type may optionally be used to extend the device number from 16 bits to 20 bits. In this case, the most significant nibble of the transmission type becomes the most significant nibble of the extended 20-bit device number. Therefore, a wildcard pairing scheme **shall [self-verify]** always be used by a display that does not know the transmission type of the tire pressure monitor that it is searching for.

5.2.2 Channel Period

The channel period is set such that the display device **shall [self-verify]** receive data at the full message rate (0.5 Hz). Since the display may send status change messages on any given channel period, the display device must be configured to receive all messages transmitted.



6 Message Payload Format

6.1 ANT+ Message Data Formats

All ANT messages have an 8-byte payload. For ANT+ messages, the first byte contains the data page number and the remaining 7 bytes are used for sensor-specific data.

Table 6-1. ANT+ General Message Format

Parameter	Value	Comment
0	Data Page Number	1 Bytes
1-7	Sensor Specific Data	7 Bytes

6.2 Data Page Types

Table 6-2. Data Page Types

Data Page Type	Data Page	Description	Minimum Transmission Rate	Direction
Main Data Pages	Tire Pressure Main	Current tire pressure, capabilities, and alarm state	0.5 Hz	Pressure Sensor → Display
Required Background Pages	Manufacturer's Identification	Manufacturer ID, Model Number, and Hardware Revision of the Tire Pressure Sensor.	1/33 messages	Pressure Sensor → Display
	Product Information	Software Version and Serial Number.	1/33 messages	
	Battery Status	Battery Status Information.	1/33 messages	
Configuration Pages	Get/Set Parameters	Get and set tire pressure monitor configuration parameters	On Request, As Needed	Pressure Sensor → Display, Display → Pressure Sensor
Optional Common Pages	Request Data Page	Used to request a page	As needed	Display → Pressure Sensor
	Open Channel Command	Command to open a channel	As needed	
	Paired Devices Page	Used to report missing required sensors	As needed	Pressure Sensor → Display

6.3 Transmission Patterns

The ANT+ tire pressure monitor transmits at a rate of 1 data pages every 2 seconds. The main data page and the required background data pages must be included in the regular broadcast transmission pattern for a tire pressure monitor.

It is recommended that a background page is interleaved once every 9 data pages. For example, to transmit required common pages 80 and 81, optional data page 82, and another common page (e.g. common page 85 – memory level) use the transmission pattern illustrated in Figure 6-1. If fewer pages are used, then it is recommended that the same pattern is

used, and the individual pages be sent more often. If additional common pages are interleaved, then care must be taken to meet the requirement: all background pages **shall [self-verify]** be transmitted at least once every 33 messages.

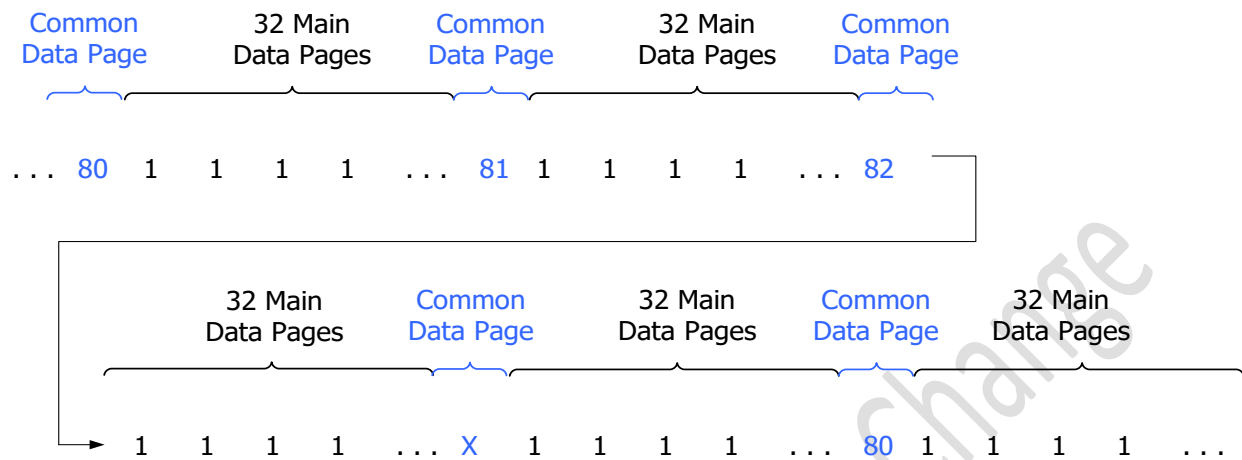


Figure 6-1. Regular Broadcast Transmission Pattern with Optional Data Pages

Figure 5-1 shows the transmission pattern for an ANT+ tire pressure monitor implementing four different background pages (pages 80, 81, 82 and X). One background page is interleaved every 9 data pages, and each background data page is transmitted at least once every 33 messages.



6.4 Data Page 1 – Tire Pressure Main Page (0x01)

Data page 1 is one of the main data pages broadcast from an ANT+ tire pressure monitor. All devices **shall [self-verify]** send this page at a 0.5 Hz rate. All fields in this message **shall [self-verify]** be set as described in Table 6-3.

Table 6-3. Data Page 1 Format – Tire Pressure Main Page

Byte	Description	Length	Value	Units	Range or Rollover
0	Data Page Number	1 Byte	Data Page Number = 1 (0x01)	N/A	N/A
1	Position	4 bits (0:3)	The location of the sensor on the vehicle	N/A	0-2
	Alarm State	4 bits (4:7)	The current state of the sensor	N/A	0-2
2	Capabilities	1 Byte	See section 6.4.3	N/A	N/A
3	Reserved	1 Byte	Set to 0xFF	N/A	N/A
4	Reserved	1 Byte	Set to 0xFF	N/A	N/A
5	Reserved	1 Byte	Set to 0xFF	N/A	N/A
6	Tire Pressure LSB	2 Byte	The current tire pressure 0x8000 – Invalid	Millibar	+/- 32767
7	Tire Pressure MSB				

6.4.1 Position

The location of the sensor on the vehicle.

Table 6-4. Sensor Position Enum

Value	Description
0	Unknown position
1	Front Wheel
2	Rear Wheel
3-15	Reserved, do not use

6.4.2 Alarm State

The current state of the sensor.

Table 6-5. Alarm State Enum

Value	Description
0	All is well
1	High Pressure Alarm
2	Low Pressure Alarm
3-15	Reserved

6.4.3 Capabilities

The capabilities and settings of the sensor.

Table 6-6. Capabilities Bitfield

Bit	Capability	Value	Description
0	Requires Barometric Pressure	0	Does not currently require barometric pressure
		1	Please set barometric pressure
1	Transmission Rate	0	Transmitting at 0.5 Hz
		1	Reserved, do not use
2-7	Reserved	0	Capability not set
		1	Reserved, do not use

6.4.4 Current Tire Pressure

The current pressure of the tire in millibars relative to the atmospheric pressure. Also known as gauge pressure.

6.5 Data Page 16 – Get/Set Parameters Data Page (0x10)

Data page 16 can be used by a display to set a number of parameters on the tire pressure monitor. Data page 16 can also be requested from a tire pressure monitor to determine its current configurations. All fields in this message **shall [self-verify]** be set as described in Table 6-3.



Table 6-7. Data Page 16 Format – Get/Set Parameters Data Page

Byte	Description	Length	Value	Units	Range or Rollover
0	Data Page Number	1 Byte	Data Page Number = 16 (0x10)	N/A	N/A
1	Position	4 bits (0:3)	The location of the sensor on the vehicle	N/A	0-2
	Apply	4 bits (4:7)	See section 6.5.1.	N/A	N/A
2	Current Barometric Pressure LSB	2 Bytes	The ambient barometric pressure. 0x8000 – Invalid Valid values: +/- 10,000 millibar	millibar	+/- 32767
3	Current Barometric Pressure MSB				
4	Low Pressure Alarm LSB	2 Bytes	The pressure at which the low-pressure alarm is triggered. 0x8000 – Disable	sec	0-65535
5	Low Pressure Alarm MSB				
6	High Pressure Alarm LSB	2 Bytes	The pressure at which the high-pressure alarm is triggered. 0x8000 – Disable	millibar	+/- 32767
7	High Pressure Alarm MSB				

6.5.1 Apply

Specifies which of the settings to apply when sent from a display. Set to 0x0 when sent from a tire pressure monitor. If a parameter is set to apply, the tire pressure monitor **shall [self-verify]** apply the parameters as specified in the page. If a display requests the updated parameters page, the display **shall [self-verify]** respond with the updated settings.



Table 6-8. Set Parameters - Apply Bitfield

Bit	Capability	Value	Description
0	Set Position	0	Ignore setting
		1	Apply setting
1	Set Barometric Pressure	0	Ignore setting
		1	Apply setting
2	Set High Pressure Alarm	0	Ignore setting
		1	Apply setting
3	Set Low Pressure Alarm	0	Ignore setting
		1	Apply setting

6.5.2 Position

The location of the sensor on the vehicle. See Table 6-4.

6.5.3 Current Barometric Pressure

The ambient pressure of the atmosphere outside of the tire.

6.5.4 High Pressure Alarm

The tire pressure at which a high-pressure alarm is triggered.

6.5.5 Low Pressure Alarm

The tire pressure at which a low-pressure alarm is triggered.

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6.6 Data Page 2 – 15, 17 – 63: Reserved for Future Use

Data pages 3 to 15, and 17 to 63 are reserved for future main data page definitions. These pages **shall [self-verify]** not be transmitted.



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6.7 Required Common Pages

Common pages are pages that can be sent/received from any ANT+ device that has its channel configured to send/receive them. This is indicated via the transmission type channel parameter. See the ANT+ Common Pages document for details of all common data pages.

6.7.1 Common Page 80 (0x50) – Manufacturer's Identification

Common data page 80 **shall [self-verify]** transmit the manufacturer's ID, model number, and hardware revision.

Refer to the ANT+ Common Pages document for details of this page.

6.7.2 Common Page 81 (0x51) – Product Information

Common data page 81 transmits the device's software revision and its 32-bit serial number.

Refer to the ANT+ Common Pages document for details of this page.

6.7.3 Common Page 82 (0x52) – Battery Information

Common data page 82 transmits the device's battery status.

Refer to the ANT+ Common Pages document for details of this page.



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6.8 Optional Common Pages

6.8.1 Common Page 70 (0x46): Request Data Page

Common Data Page 70 allows an ANT+ device to request a specific data page from the ANT+ tire pressure monitor. The request data page **shall [self-verify]** be sent using an acknowledged message by the display and **shall [self-verify]** be formatted as shown in Table 6-9.

Table 6-9. Common Data Page 70

Byte	Description	Length	Value	Units
0	Command ID	1 Byte	70 (0x46) – Data Page Request	N/A
1	Reserved	1 Byte	Value = 0xFF	N/A
2	Reserved	1 Byte	Value = 0xFF	N/A
3	Descriptor Byte 1	1 Byte	Allows subpages to be requested within the requested data page. Valid Values: 0 – 254 Invalid: 255 (0xFF)	N/A
4	Descriptor Byte 2	1 Byte	Allows subpages to be requested within the requested data page. Valid Values: 0 – 254 Invalid: 255 (0xFF)	N/A
5	Requested Transmission Response	1 Byte	Describes transmission characteristics of the data requested. Bit 0-6: Number of times to transmit requested page. Bit 7: Setting the MSB means the device replies using acknowledged messages if possible. Special Values: 0x80 - Transmit until a successful acknowledge is received. 0x00 – Invalid	N/A
6	Requested Page Number	1 Byte	Page number to transmit.	N/A
7	Command Type	1 Byte	Value = 1 (0x01) for Request Data Page	N/A

6.8.1.1 Descriptor Bytes 1 & 2

The descriptor byte fields are used to describe requested subpages. As no subpages are used within this device profile, these bytes should be set to invalid.

6.8.1.2 Requested Transmission Response

The tire pressure monitor should be able to support all requested transmission response types; however, the ANT+ Tire Pressure Monitoring System Device Profile further stipulates that the display shall [self-verify] only request broadcast messages from a tire pressure sensor.

Refer to the ANT+ Common Pages document for more details on the request data page and possible requested transmission response types.



6.8.1.3 Common Page 82 (0x52): Battery Status

Common data page 82 transmits the device's battery voltage and status.

Refer to the ANT+ Common Pages document for details of this page.

6.8.1.4 Other Common Data Pages

Other common data pages that are listed in the ANT+ Common Pages document can be sent from the ANT+ tire pressure monitor or display as appropriate. Other common data pages are implemented at the discretion of the developer.

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6.8.2 Common Page 74 (0x4A): Open Channel Command

Data page 74 is transmitted from a device to another device as an acknowledge message to command the second device to open a master ANT+ device profile channel. Note that not all ANT+ devices support the open channel command, and that ANT+ devices that do support this command may only support specific ANT+ device types.

An ANT+ tire pressure sensor may transmit an open channel command for the device type specified by the paired devices page of a tire pressure sensor to pass the sensor pairing information about which sensors to connect to.

Table 6-10. Data Page 74 Format – Open Channel Command Format

Byte	Description	Length	Value	Units	Range
0	Data Page Number	1 Byte	74 (0x4A) – Open Channel Command	N/A	N/A
1	Device Number (LSB)	2 Bytes	Lower 16 bits of the extended device number.	N/A	1-65535
2	Device Number (MSB)				
3	Upper Nibble Extended Device Number	4 bits (0:3)	Upper Nibble of the 20-bit Extended Device Number.	N/A	0-15
	Channel Type	1 bit (4)	0 – Slave 1 – Master	N/A	N/A
	Reserved	3 bits (5:7)	Set to 0	N/A	N/A
4	Device Type	1 Byte	The device type of the desired ANT+ profile.	N/A	N/A
5	RF Frequency	1 Byte	The RF frequency specified by the relevant ANT+ device profile.	MHz	N/A
6	Channel Period (LSB)	2 Bytes	The channel period specified by the relevant ANT+ device profile.	N/A	N/A
7	Channel Period (MSB)				

6.8.2.1 Channel Type

Specifies whether the receiving device should open a master or slave channel.

In the case of master, the serial number can be ignored.

6.8.2.2 Serial Number

The extended device number of the display.

6.8.2.3 Device Type

The device type field specifies which ANT+ device profile channel the receiving device should open. The receiving device should open a channel with the channel parameters specified by that ANT+ device profile. All message transmitted over the opened ANT+ channel should conform to the ANT+ device profile specification.

6.8.2.4 RF Frequency

This field specifies which RF frequency the channel should be opened on. The device transmitting the open channel command should ensure that the RF frequency transmitted in the command is in accordance to the relevant ANT+ device

profile. Devices receiving this message should open a channel on the RF frequency specified in the command regardless of the ANT+ device profile specification for the sake of future compatibility.

6.8.2.5 Channel Period

This field specifies which channel period the channel should be opened to match. The device transmitting the open channel command should ensure that the channel period transmitted in the command is in accordance to the relevant ANT+ device profile. Devices receiving this message should open a channel on the channel period specified in the command regardless of the ANT+ device profile specification for the sake of future compatibility.

6.8.2.6 Extended Device Number

All master channels open on a particular device should transmit the same 32-bit device number: upper nibble of the transmission type (MSN extended device number), and serial number (as transmitted in the Product Information page). The 2-byte device number, used in the channel ID of the ANT+ aero master channel, **shall [self-verify]** be the least significant 2 bytes of the serial number, whereas the upper nibble extended device number **shall [self-verify]** represent bits 16 to 19 of the serial number.



6.8.3 Common Page 86 (0x56): Paired Devices

The paired devices common data page allows a device to describe other ANT devices it is paired to, and communicate the status of those devices.

This page may be sent from an ANT+ tire pressure sensor to an ANT+ tire pressure display periodically, or on request. The page reports which devices the sensor needs to connect to. To indicate to a display that 'pass pairing' is requested, set the channel state to unpaired, the device number and transmission type to zero, and the device type to the device type of the ANT+ device that is being searched for.

A sensor may indicate the need for multiple sensors by setting the total number of connected devices, and sending multiple different paired devices pages, with different device indices, as the main page, to reflect the different device types that are being searched for.

Table 6-11. Common Data Page 86 – Paired Devices

Byte	Description	Length	Value	Units
0	Data Page Number	1 Byte	0x56 – Common Page 86	N/A
1	Peripheral Device Index	1 Byte	If multiple peripheral devices are in the system, this field provides an index to which device is being referenced.	N/A
2	Total Number of connected devices	1 Byte	Provides the total number of peripheral devices in a system.	
3	Channel State	1 Byte	Bit 7: Paired/Unpaired 1 – paired 0 – not paired Bits 3:6: Connection State 0 – closed channel 1 – searching 2 – synchronised 3:F – reserved Bits 0:2: Network Key 0 – public 1 – private 2 – ANT+ Managed 3 – ANT-FS key 4:7 – reserved	N/A
4	Peripheral Device ID: Device Number LSB	2 Bytes	Provides the Device Number of the peripheral device indexed in byte 1	N/A
5	Peripheral Device ID: Device Number MSB			
6	Peripheral Device ID: Transmission Type	1 Byte	Provides the Transmission Type of the peripheral device indexed in byte 1	N/A
7	Peripheral Device ID: Device Type	1 Byte	Provides the Device Type of the peripheral device indexed in byte 1	N/A

6.8.3.1 Peripheral Device Index

If more than one peripheral device is included in the system, the collector device can index each device using this number. For example, a remote listening to both an HRM and GPS device may index HRM to the value 0 and the GPS to value 1.

6.8.3.2 Channel State

Indicates if there is a paired device or not, and if so, what state the channel is currently in.

6.8.3.3 Peripheral Device ID

Bytes 4 through 7 provide the channel ID of the paired/not paired peripheral device indexed in byte 1. If there is an unpaired peripheral device in the system, wildcards will feature in the channel ID.

An invalid value of 0xFF may be used for proprietary/custom peripheral devices.

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7 Minimum Requirements

7.1 ANT+ Tire Pressure Monitor

Table 7-1 specifies all the pages that **shall [self-verify]** be supported by the aerodynamic sensor.

Table 7-1. Required Data Elements of the Tire Pressure Monitoring System

Required Data Page	Transmission Requirements
Data Page 1 – Tire Pressure Main Data Page	0.5 Hz
Data Page 16 – Get/Set Parameters Data Page	Receive, decode, and apply
Common Page 70 – Request Data Page	Receive, decode, and respond
Common Page 80 – Manufacturer’s Identification	1/33 messages
Common Page 81 – Product Information	1/33 messages
Common Page 82 – Battery Status	1/33 messages

7.2 ANT+ Tire Pressure Display

Table 7-2. Required Data Elements of the Tire Pressure Monitoring System

Required Data Page	Transmission Requirements
Data Page 1 – Tire Pressure Main Data Page	Receive, decode, and display
Optional Data Pages	
Data Page 16 – Get/Set Parameters Data Page	Transmit as needed

7.2.1 Additional Requirements

In addition to the requirements outlined in sections 19.1 and 19.2, the following general requirements apply:

- A [device] **shall [self-verify]** only send broadcast messages to the display and **shall [self-verify]** not send acknowledged or burst messages. However, a display **shall [self-verify]** decode (and display) data sent as acknowledged messages from the sensor.
- A display **shall [self-verify]** not decode any unexpected burst messages that are sent from the sensor and **shall [self-verify]** handle this situation gracefully.
- A display **shall [self-verify]** not decode reserved bytes in received data pages.
- The display **shall [self-verify]** handle gracefully the receipt of undefined data pages
- If the display requires a data page from the asset tracker, the display **shall [self-verify]** only request broadcast messages.
- The display **shall [self-verify]** handle invalid data gracefully.
- A sensor **shall [self-verify]** not open any other master channel on the ANT+ Network Key except that the channel conforms to an ANT+ Device Profile.



7.2.2 Tire Pressure Monitor Interoperability Icon

The ANT+ interoperability icons inform the end user of the product's capabilities. This icon indicates to the user that this specific device will transmit/receive tire pressure information, and that it is interoperable with other devices that carry the same icon.

An ANT+ tire pressure monitor or display that meets the minimum compliance specifications and has been certified may use the icon shown in Figure 7-1 on packaging, documentation, and marketing material.



Figure 7-1. ANT+ Tire Pressure Monitor Interoperability Icon

8 Profile Verification Tests

Table 8-1. Profile Verification Tests for the Tire Pressure Monitor

<input checked="" type="checkbox"/>	Certification Test	Relevant Document Sections
	Self-verify	Self-verify all requirements

Table 8-2. Profile Verification Tests for the Tire Pressure Display

<input checked="" type="checkbox"/>	Certification Test	Relevant Document Sections
	Self-verify	Self-verify all requirements

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