ANT+ Device Profile

Running Dynamics

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Revision History

Revision	Effective Date	Description
1.0_M.001	04/04/2017	Initial Release.
1.1	07/17/2018	Clarify bit ordering in tables Added verification tests, and requirement markers Added 'Using This Document' section

Table of Contents

List of Tables

List of Figures

List of Equations

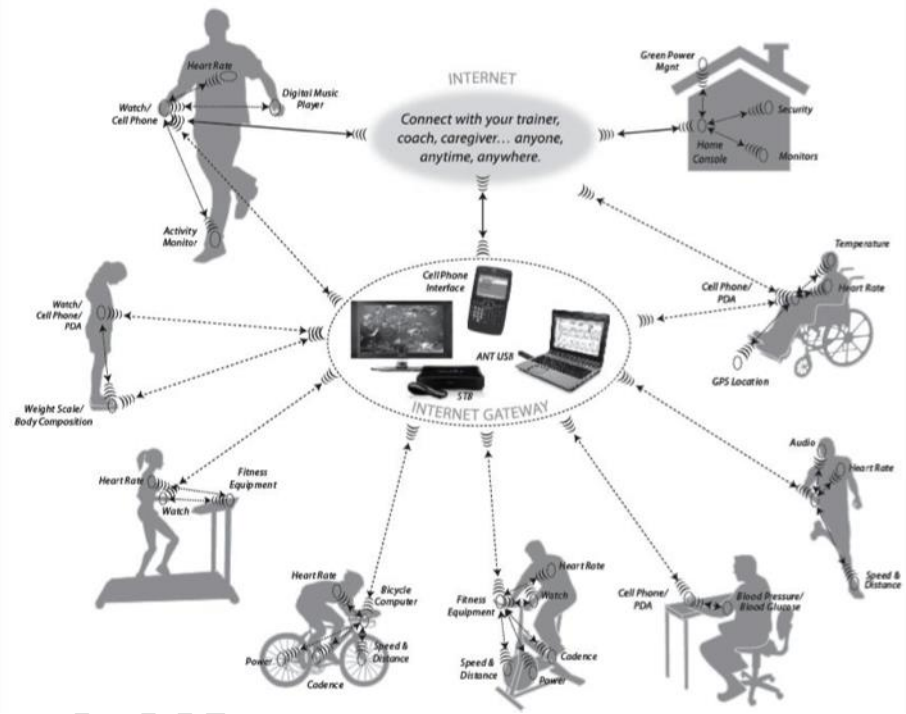
1 Overview of ANT+

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. ANT+ Device Profile - Heart Rate
4. FIT SDK 16.70 or higher

3 Using This Document

This profile document defines the requirements, recommendations, best practices, and allowances for certified ANT+ products. As a developer, use this 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 (transmitter) devices are prefixed with "**MD_**" whereas slave (receiver) 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 - Profile Verification Tests** 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 Running Dynamics Use Case

ANT+ Running Dynamics (RD) sensors are devices that allow a user to monitor their running form in real-time. These devices may take the form of a sensor pod or a chest-worn heart rate strap. The ANT+ Running Dynamics profile defines the transmission of the metrics listed in Table 4-1 from an ANT+ Running Dynamics sensor to a display. An ANT+ Running Dynamics display receives and displays real-time running dynamics metrics to the user, and may transmit back additional running dynamics information to the sensor to allow for calculation of specific metrics.

The ANT+ Running Device profile document defines ANT communication for both standalone running dynamics sensors and hybrid heart rate and running dynamics sensors. For hybrid heart rate running dynamics sensors, a dedicated handshaking procedure is defined over the ANT+ Heart Rate profile to initiate and open a running dynamics channel. This allows for hybrid sensors to operate as heart rate monitors until running dynamics information is specifically requested by a display device.

Both types of sensors supported in this profile transmit running dynamics data. The ANT+ Heart Rate-Running Dynamics (HR-Running Dynamics) profile defines communication for hybrid heart rate running dynamics sensors. The ANT+ Running Dynamics defines communication for standalone running dynamics sensors.

Table 4-1. Running Dynamics Metrics

Metric	Resolution
Cadence	0.03125 strides/min
Vertical Oscillation	0.25 mm
Ground Contact Time	ms
Stance Time %	0.25 %
Step Count	steps
Ground Contact Balance	0.03125 %
Vertical Ratio	0.03125 %
Step Length	mm

4.1 ANT+ Running Dynamics Sensor

ANT+ Running Dynamics sensors communicate with compatible ANT+ Runnings Dynamics displays for real-time transmission of the metrics listed in Table 4-1. The sensor may also transmit additional data such as the sensor's battery status and manufacturer/product information. Bidirectional communication is allowed but optional, where the display sends speed data to the sensor for further calculations of specific fields.

4.2 ANT+ Heart Rate-Running Dynamics Sensor

ANT+ Heart Rate-Running Dynamics (HR-Running Dynamics) sensors communicate with a compatible ANT+ HR-Running Dynamics display to provide real-time feedback about the user's running form as well as their current heart rate. Typically HR-running dynamics sensors are straps that are worn around the chest.

HR-running dynamics sensors differ from the standalone running dynamics sensors described above because communication is initiated on the ANT+ Heart Rate profile, and transitions to also communicating running dynamics data on the ANT+ Running Dynamics channel (refer to Section 4.4 for more details). Furthermore, bidirectional communication is required and the display must periodically send data back to the sensor to maintain connection over the ANT+ Running Dynamics channel (refer to Figure 4-1).

The first display to send a configuration command to the HR-Running Dynamics sensor establishes control of the device for the session, and transmits speed metrics data back to the sensor. Multiple displays may receive running dynamics data at a time, but only the session leader sends data back to the sensor. Control of the session is released when a session leader's speed metrics page is not received for a defined timeout (> 10 seconds). Please refer to the ANT+ Heart Rate Device Profile for more details regarding the transmission of heart rate data.

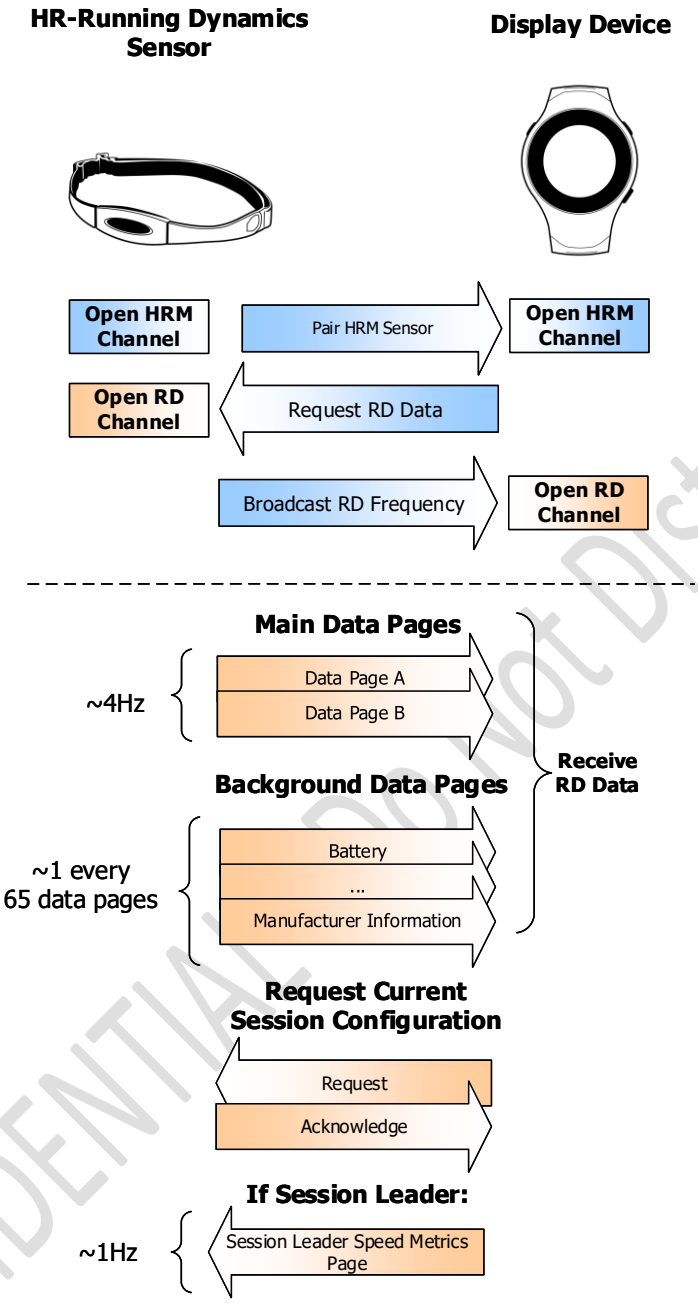


Figure 4-1. ANT+ HR-Running Dynamics Use Case

4.3 ANT+ Running Dynamics / HR-Running Dynamics Display

ANT+ Running Dynamics / HR-Running Dynamics display devices are generally personal worn display devices (i.e fitness watch). These devices can display real-time running dynamics data while connected to a running dynamics sensor. Running dynamics and heart rate data may also be stored on the device for later analysis.

The ANT+ Running Dynamics / HR-Running Dynamics profiles allow for transmission of running dynamics data to multiple display devices simultaneously.

4.4 Assigning a Session Leader for Bidirectional Communication

Bidirectional communication between the sensor and one display device is allowed for both the ANT+ HR-Running Dynamics (required) and ANT+ Running Dynamics (optional) profiles. This allows a single display to transmit measured speed (i.e. gathered from GPS data or another source) back to the running dynamics sensor for calculation of additional metrics.

For the ANT+ HR-Running Dynamics profile, bidirectional communication is required to keep the ANT+ Running Dynamics channel open. The first display to pair to the sensor over the ANT+ HR channel will be the session leader and request the sensor to open the ANT+ Running Dynamics channel. Once the sensor begins transmitting running dynamics data over that channel, other display devices may also pair to receive running dynamics data. The session leader is required to transmit back periodically to the sensor to maintain the ANT+ Running Dynamics channel or it **shall [MD_RD_004]** timeout.

For the ANT+ Running Dynamics profile, displays may pair to the ANT+ Running Dynamics channel without transmitting data back to the sensor. By default, a Running Dynamics sensor **shall [MD_RD_001]** set it's session leader field to invalid. The first display to request to be the session leader **shall [SD_RD_004]** transmit data back to the sensor (any additional displays **shall [SD_RD_003]** only receive running dynamics data). A display **shall [SD_RD_001]** not send any messages to a sensor if bidirectional communication is not supported. A Running Dynamics sensor **shall [MD_RD_002]** indicate whether bidirectional communication is supported through the use of a bidirectional support flag.

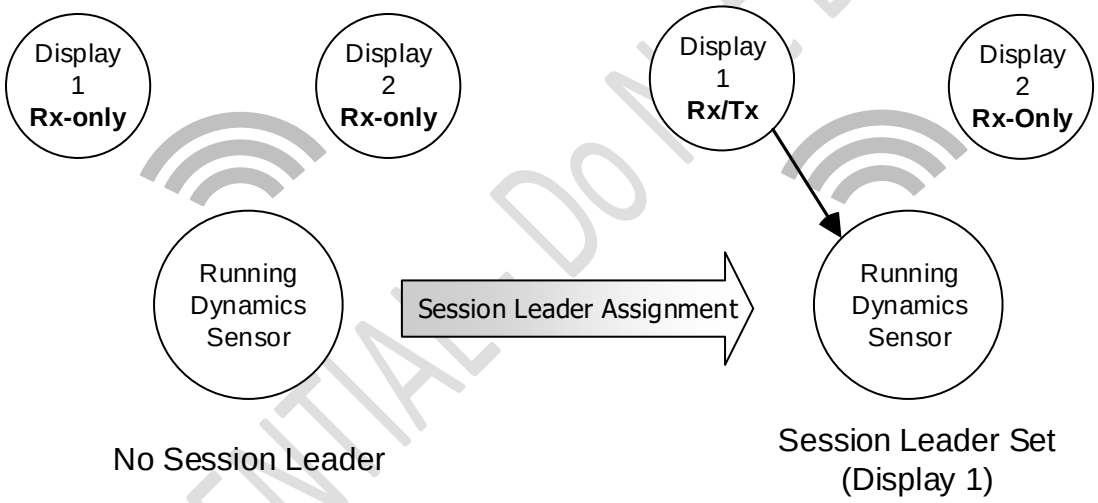


Figure 4-2. Session Leader Assignment

4.4.1 ANT+ Running Dynamics – Assigning a Session Leader

4.4.1.1 Session Leader Assignment – Sensor Behaviour

A sensor supporting the ANT+ Running Dynamics profile that supports bidirectional communication and assigning a session leader **shall [MD_RD_003] [MD_RD_004]** function as described in Figure 4-3. The exact timeout length required for the sensor before removing the session leader is set by the manufacturer (allows for optimization of maintaining session leader assignment in non-ideal RF environments). The session leader timeout length **shall [self-verify]** be greater than 5 seconds (allows for at least 5 missed messages on the back channel).

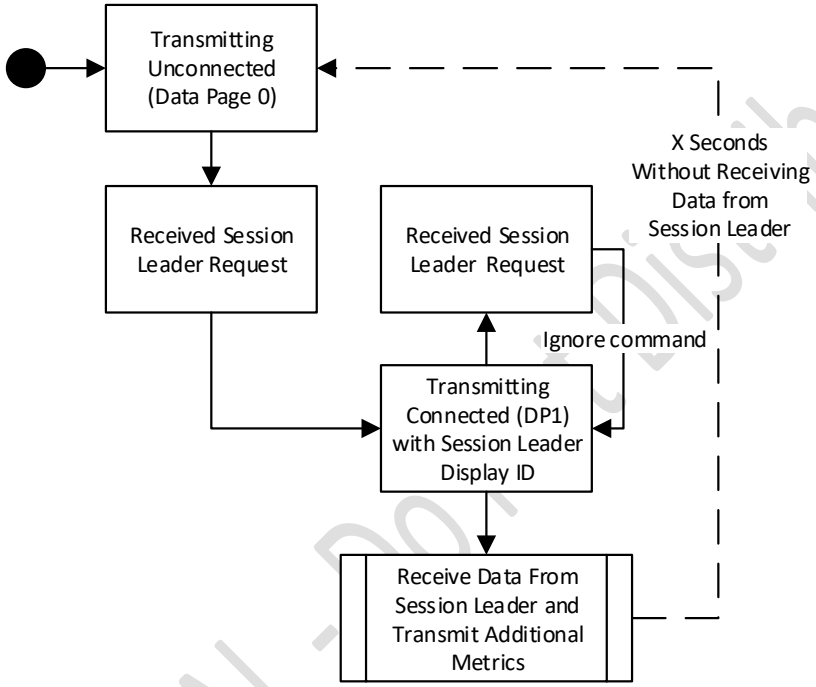


Figure 4-3. Session Leader Assignment – Sensor Logic

4.4.1.2 Session Leader Assignment – Display Behaviour

An ANT+ Running Dynamics display that supports bidirectional communication and transmission of speed data back to the running dynamics sensor **shall [SD_RD_003]** function as defined in Figure 4-4 below.

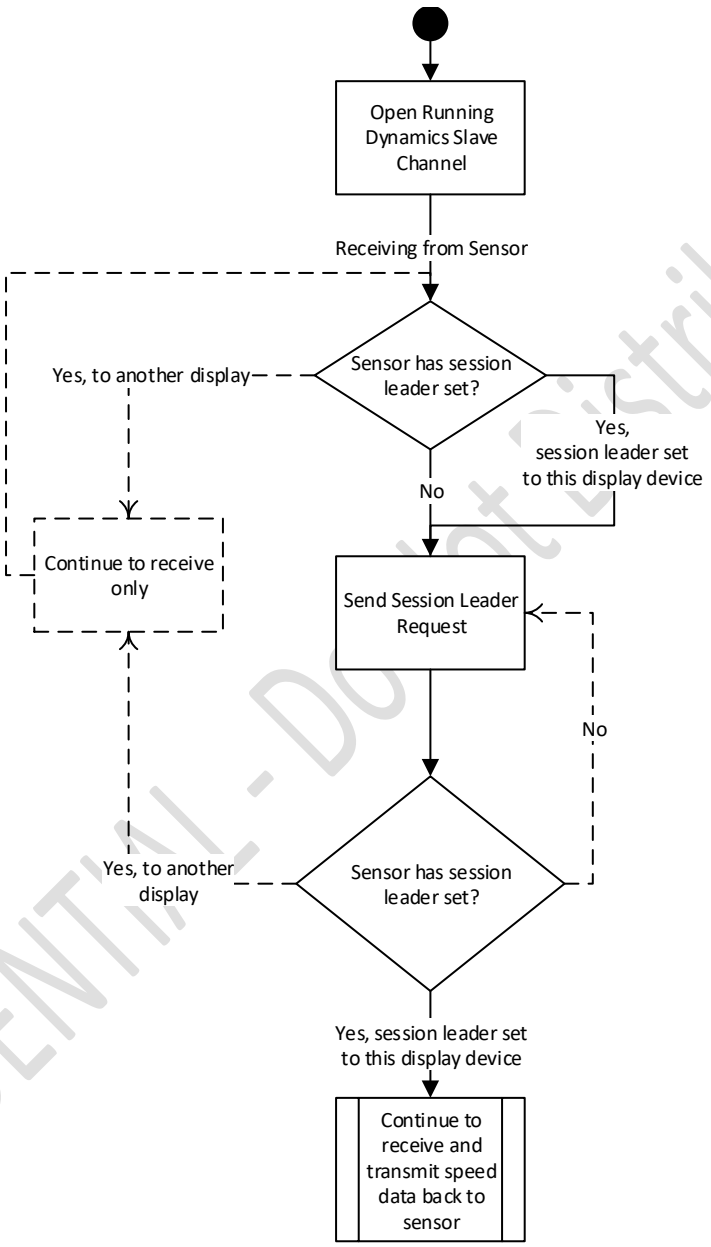


Figure 4-4. Session Leader Assignment – Display Logic

4.4.2 HR-Running Dynamics – Assigning a Session Leader

4.4.2.1 Assigning a Session Leader – Sensor Behaviour

An ANT+ HR-Running Dynamics sensor **shall [MD_HRR_001] [MD_HRR_002]** function as defined in Figure 4-5 below.

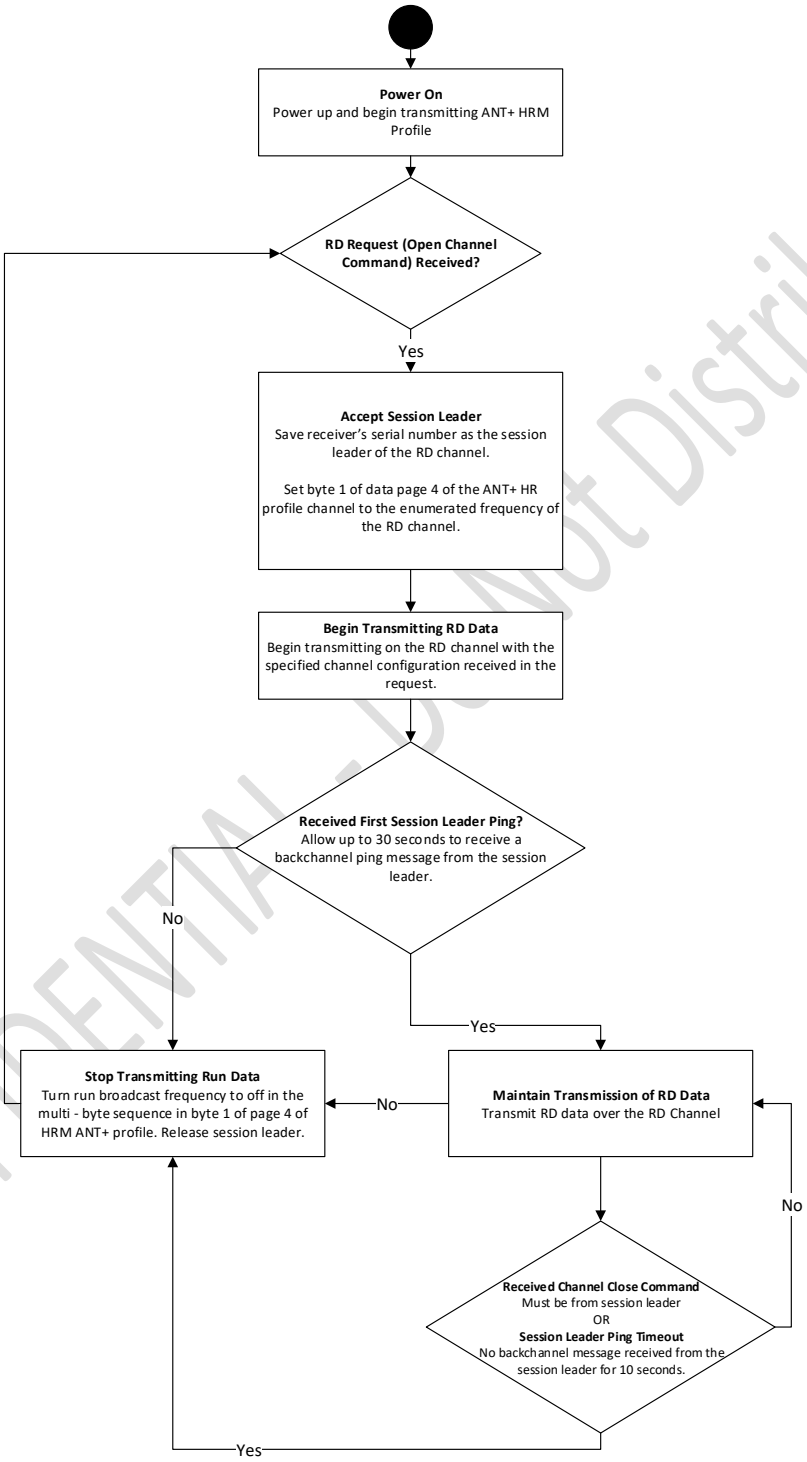


Figure 4-5. HR-Running Dynamics Session Leader Assignment– Sensor Logic

4.4.2.2 Assigning a Session Leader – Display Behaviour

An ANT+ HR-Running Dynamics display **shall [SD_HRR_001] [SD_HRR_002] [SD_HRR_003]** function as defined in Figure 4-6 below.

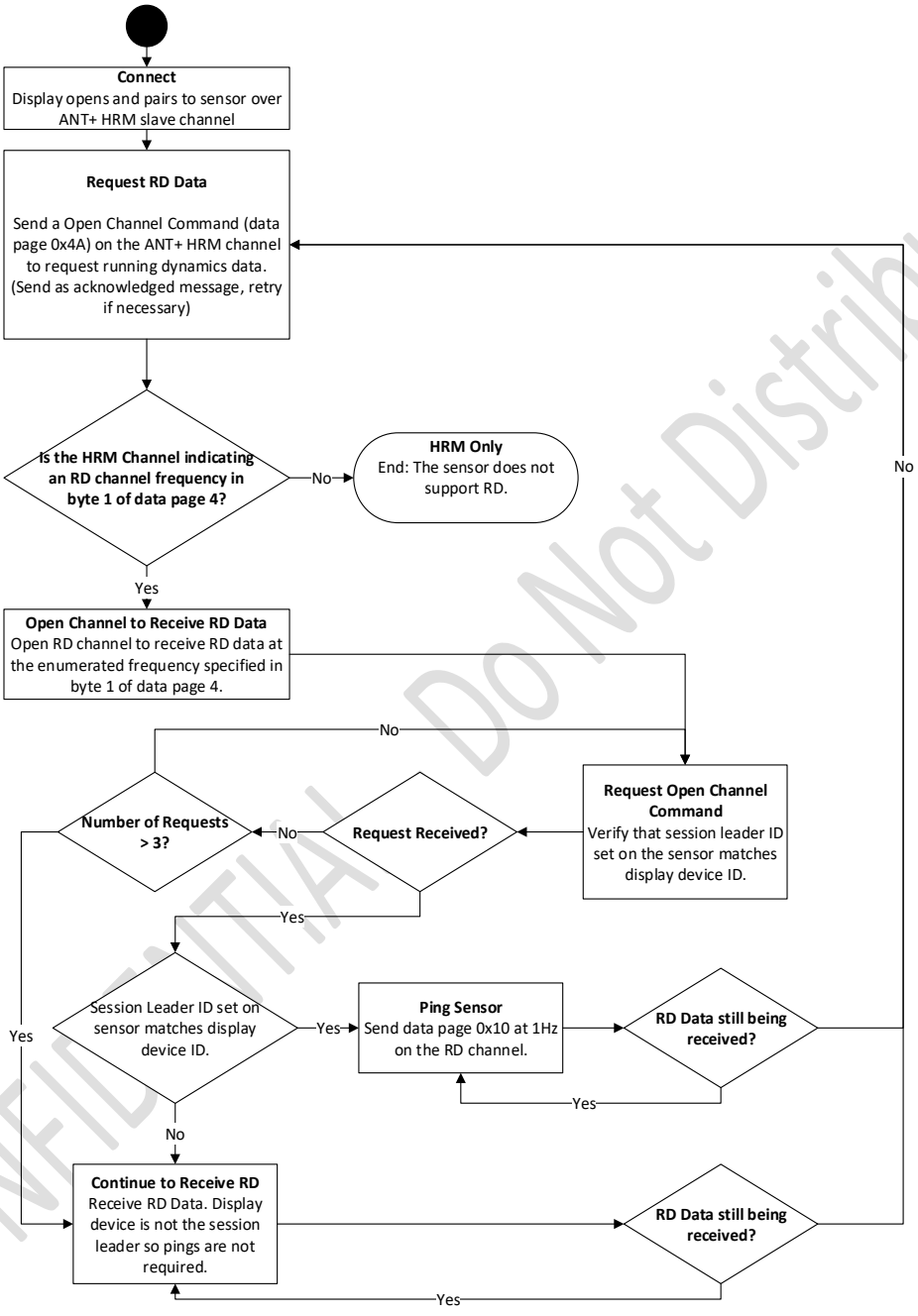


Figure 4-6. HR-Running Dynamics Session Leader Assignment– Display Logic

5 Channel Configuration

The channel configuration parameters of the ANT+ Running Dynamics sensor, ANT+ HR-Running Dynamics sensor, and all other ANT-enabled devices are defined by the ANT protocol. Refer to the ANT Message Protocol and Usage document for more details.

Please refer to section 4.1 for the ANT+ Running Dynamics channel configuration and section 4.2 for the ANT+ HR-Running Dynamics channel configuration.

5.1 ANT+ Running Dynamics Channel Configuration

5.1.1 Slave Channel Configuration

The device expected to receive data from an ANT+ Running Dynamics sensor **shall [SD_0002] [SD_0003]** configure an ANT channel with its channel parameters set as listed in Table 5-1.

Table 5-1. ANT Channel Configuration for ANT+ Running Dynamics Display (i.e. Slave) Device

Parameter	Value	Comment
Channel Type	Slave (0x00)	The ANT+ Running Dynamics sensor 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+ Running Dynamics sensor
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	30 (0x1E)	30 (0x1E) – indicates search for an ANT+ Running Dynamics sensor. 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	4096 counts	Data is transmitted from the ANT+ Running Dynamics sensor every 4096/32768 seconds (8 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.

5.1.1.1 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 [SD_0002]** always be used by a display that does not know the transmission type of the ANT+ Running Dynamics sensor that it is searching for.

5.1.1.2 Channel Period

The channel period is set such that the display device **shall [SD_0003]** receive data at the full message rate (8 Hz).

5.1.2 Master Channel Configuration

The ANT+ Running Dynamics **shall [MD_0001]** establish its ANT channel as shown in Table 5-2.

Table 5-2. ANT Channel Configuration for ANT+ Running Dynamics Sensor (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+ Running Dynamics sensor.
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	30 (0x1E)	An ANT+ Running Dynamics sensor device **shall [MD_0001]** transmit its device type as 0x1E. 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 ANT+ Running Dynamics sensor. 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	4096 counts	Data **shall [MD_0003]** be transmitted every 4096/32768 seconds (8 Hz).

5.1.2.1 Channel Type

As communication in two directions is required, the channel type is set to bidirectional master (0x10). The bidirectional master channel is also used to enable the interference avoidance features inherent to the ANT protocol.

5.1.2.2 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.

5.1.2.3 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 ANT+ Running Dynamics sensor **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 ANT+ HR-Running Dynamics Channel Configuration

Refer to Heart Rate profile document for Heart Rate channel parameters.

Some of the parameters listed in the HR-Running Dynamics channel configuration are configurable through Data Page 74 – Open Channel Command (0x4A). This page is sent from the HR-Running Dynamics display to an HR-Running Dynamics sensor as an acknowledge message after successfully pairing over the ANT+ HRM channel.

5.2.1 Slave Channel Configuration

The display device expected to receive data from an ANT+ HR-Running Dynamics sensor over an ANT+ Running Dynamics channel must configure an ANT channel with its channel parameters set as listed in Table 5-3.

Table 5-3. ANT Channel Configuration for ANT+ HR-Running Dynamics Display (i.e. Slave) Device

Parameter	Value	Comment
Channel Type	Slave (0x00)	The HR-Running Dynamics device is configured as a slave device. 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	03, 39, 61 or 75	Allowed RD RF channels are: 2403MHz, 2439MHz, 2461MHz, 2475MHz
Transmission Type	0 for pairing	Transmission type set to zero pairing and once paired the receiver should remember the type for future searches.
Device Type	30 (0x1E)	30 (0x1E) – indicates search for an ANT+ HR-Running Dynamics sensor. 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.
Message Period	8070 counts	Run pages will be transmitted from the strap every 8070 counts (approx. 4.06 Hz)

5.2.1.1 RF Channel Frequency

Table 5-4 below maps the allowed RF frequencies to a one-byte enum which will be sent in Data Page 74 – Open Channel Command (0x4A) from the display to the sensor. If the sensor does not already have a session leader, it will open an ANT+ running Dynamics channel using the RF Frequency specified in the enum, a channel period of 8070, and a device type of 30. The sensor will also begin to transmit the one-byte enum channel configuration in the first byte of data page 4 over the HRM channel. This will allow receivers that did not become session leader to know on which frequency the ANT+ Running Dynamics channel is being broadcasted.

Table 5-4. ANT+ HR-Running Dynamics – RD Channel RF Enumeration List

Value	RF Frequency
0	Invalid
1	2403MHz
2	2439MHz
3	2475MHz
4	2461MHz

5.2.1.2 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 extended 20 bit device number. Therefore, a wildcard pairing scheme **shall [SD_0002]** always be used by a display that does not know the transmission type of the ANT+ HR-Running Dynamics sensor that it is searching for.

5.2.2 Master Channel Configuration

The ANT+ HR-Running Dynamics **shall [MD_0001]** establish its ANT channel as shown in Table 5-5.

Table 5-5. ANT Channel Configuration for ANT+ HR-Running Dynamics Sensor (i.e. Master)

Parameter	Value	Comment
Channel Type	Transmit (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	03, 39, 75, or 61	Possible RD channels are: 03, 39, 75, 61
Transmission Type	1 (0x01)	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	30 (0x1E)	An ANT+ HR-Running Dynamics sensor device **shall [MD_0001]** transmit its device type as 0x1E. 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 ANT+ HR-Running Dynamics sensor. 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 set to 0x0000.
Message Period	8070 Counts	Run pages will go out every 8070 counts (approx 4.06 Hz)

5.2.2.1 RF Channel Frequency

The RF Channel **shall [MD_HRR_001] [SD_HRR_001]** be set to the RF Frequency mapped in the one-byte enum that is received form the session leader display in data page 74. The enum will then be sent in the manufacturer specific byte of the HR data page 4. This will allow receivers that did not become session leader to know where the run channel is being broadcasted. Refer to table Table 5-4. ANT+ HR-Running Dynamics – RD Channel RF Enumeration List for the enum's settings.

5.2.2.2 Channel Type

As communication in two directions is required, the channel type is set to bidirectional master (0x10). The bidirectional master channel is also used to enable the interference avoidance features inherent to the ANT protocol.

5.2.2.3 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.

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

Messages in the ANT+ device profile include main pages, command pages, and background pages.

Please refer to section 5.2.1 for Running Dynamics Message formats and 5.2.2 for HR-Running Dynamics Message Formats.

6.2.1 Running Dynamics Data Pages

Main data pages contain the main data included in the default transmission pattern of the device. Data pages 0 and 1 are the required main data pages for an ANT+ device and **shall [MD_0006]** be transmitted by default. All supported pages **shall [MD_0008]** be transmitted following the minimum transmission requirements as defined in the tables below.

Table 6-2. Main Data Pages

Data Page #	Name	Transmission Requirements
0	Running Dynamics A	1/2 Messages (~2Hz)
1	Running Dynamics B	1/2 Messages (~2Hz)

Command pages are sent from the display to the ANT+ device when required.

Table 6-3. Command Data Pages

Data Page #	Name	Transmission Requirements
16	Session Leader Speed Metrics	1/2 Messages (~2HZ)
32	Session Leader Request	Transmitted as an acknowledged message (refer to Section ANT+ Running Dynamics – Assigning a Session Leader)

Background data pages contain slow changing data and are interleaved in the regular transmission pattern at a slow rate (once every 65 messages). All background pages defined in this document are common pages. Background data pages include page 80, 81 and optionally page 82. Refer to the ANT+ Common Pages Document for details. Supported background pages (including 80 and 81) **shall [MD_0013]** also be transmitted by the ANT+ device on request by the display.

Table 6-4. Common Data Pages

Data Page #	Name	Transmission Requirements
80	Manufacturer Information	1/260 Messages (Also requestable)

81	Product Information	1/260 Messages (also requestable)
82	Battery Status	1/260 Messages (also requestable)

6.2.2 HR-Running Dynamics Data Pages

Main data pages contain the main data included in the default transmission pattern of the device. Data pages 0 and 1 are the main data pages for an ANT+ device. Data page 0 is required and transmitted by default, while data page 1 is optional and can be interleaved within the regular transmission of data page 0 data at ~2Hz. All supported pages **shall [MD_0008]** be transmitted following the minimum transmission requirements as defined in the tables below.

Refer to the Heart Rate profile document for Heart Rate data page types.

Table 6-5. Main Data Pages

Data Page #	Name	Transmission Requirements
0	Running Dynamics A	~4Hz if Running Dynamics B page is not implemented. ~2Hz if Running Dynamics B page is implemented.
1	Running Dynamics B	~2Hz

Command pages are sent from the display to the ANT+ device when required.

Table 6-6. Command Data Pages

Data Page #	Name	Transmission Requirements
16	Back Channel Page	~1Hz
74	Open Channel Command Message Format	Transmitted from the display to the sensor as an acknowledge message (over the HR profile). Transmitted from the sensor to the display upon request from the display.
75	Close Session Message	Transmitted from the display to the sensor as an acknowledge message.

Background data pages contain slow changing data and are interleaved in the regular transmission pattern at a slow rate (once every 65 messages). All background pages defined for HR-Running Dynamics are common pages. Background data pages include page 80, 81 and page 82. Refer to the ANT+ Common Pages Document for details. Supported background pages (including 80, 81, and 82) **shall [MD_0013]** also be transmitted by the ANT+ device on request by the display.

Table 6-7. Common Data Pages

Data Page #	Name	Transmission Requirements
80	Manufacturer Identification	1/260 Messages (also requestable)
81	Product Information	1/260 Messages (also requestable)
82	Battery Status	1/260 Messages (also requestable)

6.3 Transmission Patterns

The ANT+ Running Dynamics and HR-Running Dynamics sensors transmit at a rate of 4 and 8 data pages every second respectively. The main data pages and the required background data pages must be included in the regular broadcast transmission pattern.

It is recommended that a background page is interleaved once every 65 data pages. For example in running dynamics, to transmit required common pages 80, 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 ensure that all background pages **shall [MD_0008]** still be transmitted at least once every 260 messages. Please refer to the section 5.3.1 for the Running Dynamics transmission pattern and section 5.3.2 for the HR-Running Dynamics transmission pattern.

6.3.1 Running Dynamics Transmission Pattern

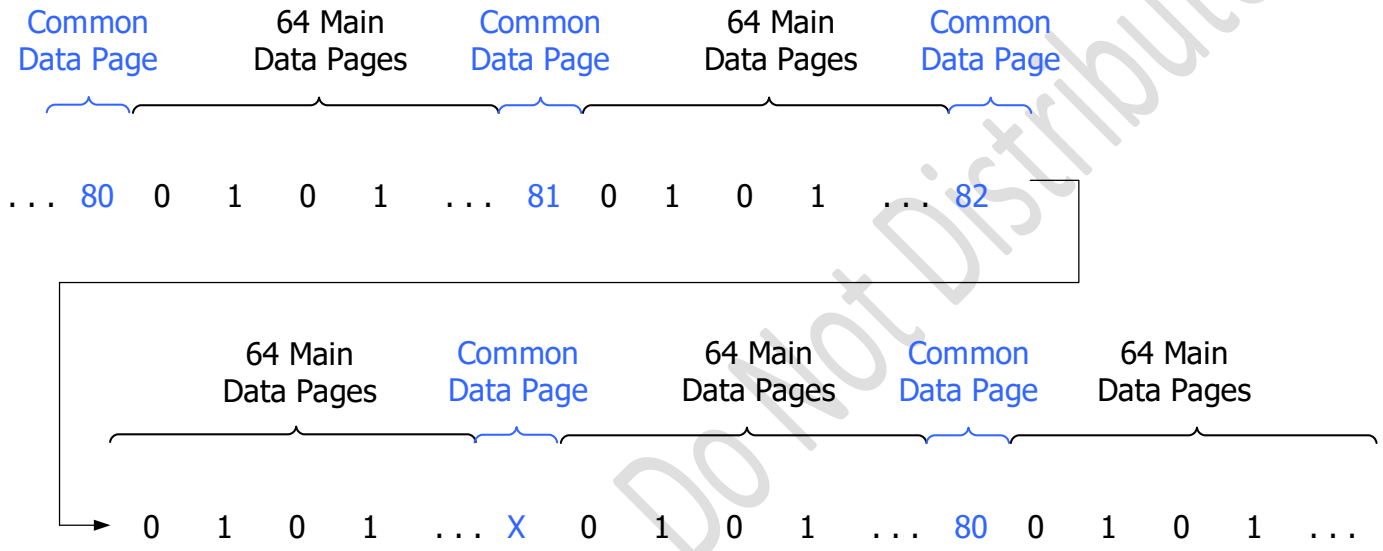


Figure 6-1. Regular Broadcast Transmission Pattern with Optional Data Pages for Running Dynamics

Figure 5-1 shows the transmission pattern for an ANT+ Running Dynamics sensor implementing four different background pages (pages 80, 81, 82 and X). One background page is interleaved every 65 data pages, and each background data page is transmitted at least once every 260 messages.

6.3.2 HR-Running Dynamics Transmission Pattern

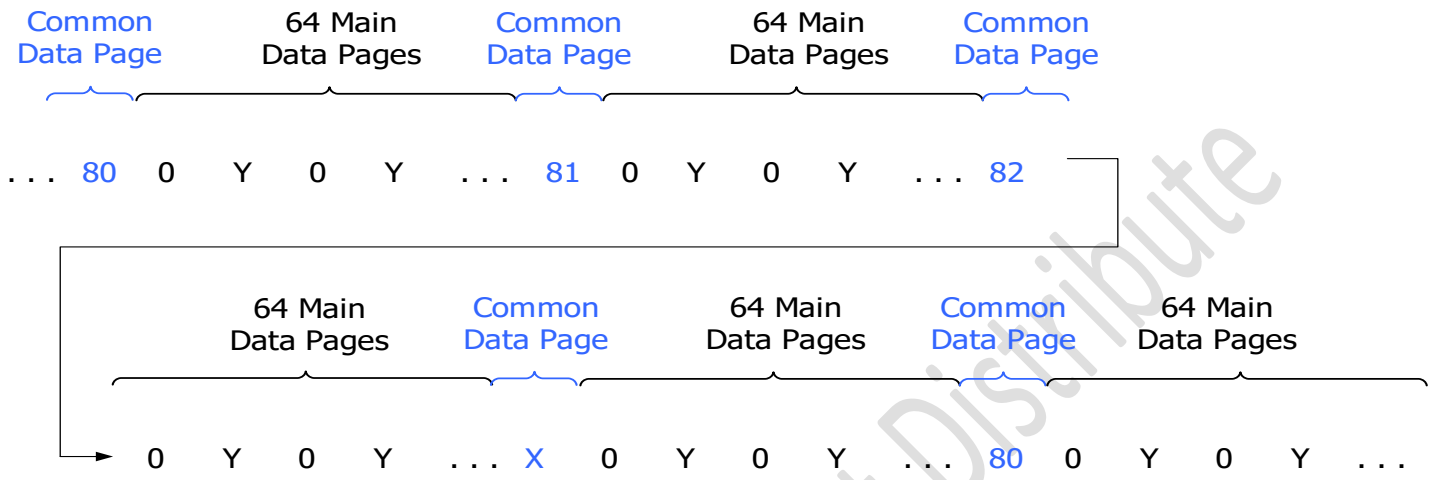


Figure 6-2. Regular Broadcast Transmission Pattern with Optional Data Pages for HR-Running Dynamics

Figure 6-2 shows the transmission pattern for an ANT+ HR-Running Dynamics sensor implementing four different background pages (pages 80, 81, 82, and X). One background page is interleaved every 65 data pages, and each background data page is transmitted at least once every 260 messages.

If the Running Dynamics B data page is required, interleave data page 1 with data page 0. In order to represent this pattern in the figure above, replace data page Y with data page 1.

If Running Dynamics B data page is not required, continuously send data page 0 throughout the 64 main data page transmission sequence. In order to represent this pattern in the figure above, replace data page Y with data page 0.

6.4 Data Page 0 – Running Dynamics A (0x00)

This page is required for Running Dynamics and HR-Running Dynamics.

Data page 0 is one of the main data pages broadcast from an ANT+ Running Dynamics sensor. All Running Dynamics sensors **shall [MD_0008]** send this page at a ~2 Hz rate. All fields in this message **shall [MD_0010]** be set as described in Table 6-8.

Table 6-8. Data Page 0 Format – Running Dynamics A

Byte	Description	Length	Value	Units	Range or Rollover
0	Data Page Number	1 Byte	Data Page Number = 0 (0x00)	N/A	N/A
1	Cadence	1 Byte	Filtered Instantaneous Cadence 0 = Invalid/No Motion Detected	strides/min	0-255 strides/min
2	Fractional Cadence	5 Bits (0:4)	Fractional Filtered Instantaneous Cadence	0.03125 strides/min	0.00000-0.96875 strides/min
	Walking Flag	1 Bit (5)	0 = Running 1 = Walking	N/A	N/A
	Bidirectional Channel Support	1 Bit (6)	0 = Not Supported 1 = Supported NOTE: This field is only used for Running Dynamics, not HR-Running Dynamics.	N/A	N/A
	Reserved	1 Bit (7)	Reserved, Set to 0.	N/A	N/A
3	Vertical Oscillation (LSB)	1 Byte	Filtered Instantaneous Vertical Oscillation 0 = Invalid/No Motion Detected	mm	0-2047mm
4	Vertical Oscillation (3 MSBits)	3 Bits (0:2)			
	Fractional Vertical Oscillation	2 Bits (3:4)	Fractional Filtered Instantaneous Vertical Oscillation	0.25mm	0.00-0.75mm
	Ground Contact Time (3 LSBits)	3 Bits (5:7)	Filtered Instantaneous Ground Contact Time 0 = Invalid/No Motion Detected	ms	0-2047ms
5	Ground Contact Time (MSB)	1 Byte			
6	Stance Time %	7 Bits (0:6)	Filtered Instantaneous Stance Time Percentage 0 = Invalid/No Motion Detected 101-127% = Reserved, Do Not Use	%	0-100%
	Fractional Stance Time % (1 LSBit)	1 Bit (7)	Fractional Filtered Instantaneous Stance Time Percentage	0.25%	0.00-0.75%
7	Fractional Stance Time % (1 MSBit)	1 Bit (0)			
	Step Count	7 Bits (1:7)	Step Count (Rollover Field)	steps	127 steps

6.4.1 Instantaneous Cadence

The instantaneous cadence is measured in strides/minute. A value of 0 indicates an invalid measurement, or no motion detected.

Cadence = Instantaneous Cadence + Instantaneous Fractional Cadence

0.00000-255.0 strides/minute (Resolution: 0.03125 strides/min)

6.4.2 Walking Flag

Indicates if the user is walking or running.

6.4.3 Bidirectional Channel Support

This field is only used for Running Dynamics, not HR-Running Dynamics.

Indicates whether this RD-Pod supports session leader assignment and receiving session leader speed metrics.

6.4.4 Instantaneous Vertical Oscillation

Vertical Oscillation is a measurement of the sensor's vertical displacement over the course of a step.

Vertical Oscillation = Instantaneous Vertical Oscillation + Fractional Vertical Oscillation

0.00-2047.00mm (Resolution: 0.25mm)

6.4.5 Instantaneous Ground Contact Time

Ground Contact Time is a measurement of the amount of time spent on the ground over the course of a step.

0-2047ms (Resolution: 1 ms)

6.4.6 Instantaneous Stance Time %

Stance time is the percentage of time that ground contact is made relative to the time for one stride.

E.g. If Time for One Stride = 666 ms, and Ground Contact Time is 280 ms:

Stance Time % = (280 ms/ 666 ms) * 100 % = 42%

Stance Time % = Instantaneous Stance Time % + Instantaneous Fractional Stance Time %

0.00-100.00% (Resolution 0.25%)

6.4.7 Step Count

Rollover field. If displayed, displays are required to keep track of total accumulated step count.

6.5 Data Page 1 – Running Dynamics B (0x01)

This page is required for Running Dynamics and is optional for HR-Running Dynamics.

Data page 1 is one of the main data pages broadcast from an ANT+ Running Dynamics sensor. All fields in this message **shall [MD_0010]** be set as described in Table 6-9.

Table 6-9. Data Page 1 Format – Running Dynamics B

Byte	Description	Length	Value	Units	Range or Rollover
0	Data Page Number	1 Byte	Data Page Number = 1 (0x01)	N/A	N/A
1	Ground Contact Balance	7 Bits (0:6)	Filtered Instantaneous Ground Contact Balance 0 = Invalid/No Motion Detected 101-127% = Reserved, Do Not Use	%	0-100%
	Fractional Ground Contact Balance (LSBit)	1 Bit (7)	Fractional Filtered Instantaneous Ground Contact Balance	0.03125 %	0.00000-0.96875%
2	Fractional Ground Contact Balance (4 MSBits)	4 Bits (0:3)			
	Vertical Ratio (4 LSBits)	4 Bits (4:7)	Vertical Ratio 101-127% = Reserved, Do Not Use	%	0-100%
3	Vertical Ratio (3 MSBits)	3 Bits (0:2)			
	Fractional Vertical Ratio	5 Bits (3:7)	Fractional Vertical Ratio	0.03125%	0.00000-0.96875%
4	Step Length (LSB)	1 Byte	Step Length	mm	0-8191mm
5	Step Length (5 MSBits)	5 Bits (0:4)			
	Module Orientation	1 Bit (5)	0 = Right Side Up 1 = Upside Down	N/A	N/A
	Reserved	2 Bits (6:7)	Reserved, Set to 0b11	N/A	N/A
6	Session Leader ID (LSB)	1 Byte	Session Leader ID (1-65534) 0 = Invalid, No Session Leader Set NOTE: For HR-Running Dynamics, always set to invalid (0xFFFF)	N/A	1-65535
7	Session Leader ID (MSB)	1 Byte			

6.5.1 Ground Contact Balance

Ground Contact Balance represents the balance in Ground Contact Time between the users left and right feet.

Ground Contact Balance = Instantaneous Ground Contact Balance + Instantaneous Fractional Ground Contact Balance

0.00000-100.00%

6.5.2 Vertical Ratio

Vertical Ratio is the ratio of Vertical Oscillation to Stride Length.

Vertical Ratio = Instantaneous Vertical Ratio + Instantaneous Fractional Vertical Ratio

0.00000-100.00%

6.5.3 Step Length

Step length is the length of a user's stride from one footfall to the next.

0-8191mm (Resolution 1mm)

6.5.4 Module Orientation

Right Side Up vs. Upside Down. Will trigger warning on display device.

0 = Right Side Up

1 = Upside Down

6.5.5 Session Leader ID

This field is only required for Running Dynamics and is not used in HR-Running Dynamics.

The ID of the currently assigned session leader. Set to 0x0000 if a session leader is not assigned. Refer to Section ANT+ Running Dynamics – Assigning a Session Leader.

6.6 Data Page 16 – Session Leader Speed Metrics (0x10)

Data page 16 is the data page transmitted from the assigned session leader to the ANT+ Running Dynamics sensor or ANT+ HR-Running Dynamics sensor on the back channel. The session leader **shall [SD_RD_004]** transmit this page at least ~2Hz (in response to 1/2 messages). All fields in this message **shall [SD_0007]** be set as described in Table 6-10.

Table 6-10. Data Page 16 Format – Session Leader Speed Metrics

Byte	Description	Length	Value	Units	Range or Rollover
0	Data Page Number	1 Byte	16 (0x10) – Data Page Request	N/A	
1	Horizontal Speed	4 Bits (0:3)	Instantaneous Horizontal Speed Invalid = 0x0F	m/s	0-14 m/s
1	Fractional Horizontal Speed (4 LSBits)	4 Bits (4:7)	Fractional Instantaneous Horizontal Speed Invalid = 0xFF	1/256 m/s	0-0.996 m/s
2	Fractional Horizontal Speed (4 MSBits)	4 Bits (0:3)			
2	Reserved	4 Bits (4:7)	Value = 0x0F	N/A	N/A
3	Reserved	1 Byte	Value = 0xFF	N/A	N/A
4	Reserved	1 Byte	Value = 0xFF	N/A	N/A
5	Reserved	1 Byte	Value = 0xFF	N/A	N/A
6	Reserved	1 Byte	Value = 0xFF	N/A	N/A
7	Reserved	1 Byte	Value = 0xFF	N/A	N/A

6.6.1 Instantaneous Horizontal Speed

Horizontal Speed + Fractional Horizontal Speed

0.00000-14.996m/s

6.7 Data Page 32 – Session Leader Request (0x20)

This page is only required for Running Dynamics and is not used in HR-Running Dynamics.

Data page 32 is the data page transmitted from an unassigned slave device to request to become the session leader of an ANT+ Running Dynamics sensor (if the sensor is currently indicating it does not have an assigned session leader, Section 6.5.5). This data page **shall [SD_RD_002]** be transmitted as an acknowledged message from the slave device, and may be retried if an acknowledgement is not received. All fields in this message **shall [SD_0007]** be set as described in Table 6-11.

Table 6-11. Data Page 32 Format – Session Leader Request

Byte	Description	Length	Value	Units	Range or Rollover
0	Data Page Number	1 Byte	32 (0x20) – Data Page Request	N/A	N/A
1	Session Leader ID (LSB)	2 Bytes	Unique 16-bit ID of the slave device. Invalid: 0x0000	N/A	1-65535
2	Session Leader ID (MSB)				
3	Reserved	1 Byte	Value = 0xFF	N/A	N/A
4	Reserved	1 Byte	Value = 0xFF	N/A	N/A
5	Reserved	1 Byte	Value = 0xFF	N/A	N/A
6	Reserved	1 Byte	Value = 0xFF	N/A	N/A
7	Reserved	1 Byte	Value = 0xFF	N/A	N/A

6.7.1 Session Leader ID

Unique 16-bit ID of the slave device.

Note: Sensor manufacturer's must verify that invalid Session Leader IDs (0x0000) are not used.

6.8 Data Pages 2-15, 17-31, 33-63: Reserved for Future Use

Data pages 2-15, 17-31, 33-63 are reserved for future main data page definitions.

6.9 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.

6.9.1 Data Page 74 – Open Channel Command (0x4A)

This page is only required for the ANT+ HR-Running Dynamics profile and is not used for the ANT+ Running Dynamics profile.

Data page 74 **shall [SD_HRR_001]** be transmitted from an HR-Running Dynamics display to an HR-Running Dynamics sensor as an acknowledged message over the ANT+ HRM channel after successfully pairing. The data page **shall [MD_HRR_002]** then transmitted from the sensor to the display as a response to the request from the display.

Table 6-12. 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	Session Leader ID (LSB)	3 Bytes	Lower 3 bytes of serial number.	N/A	N/A
2	Session Leader ID				
3	Session Leader ID (MSB)				
4	Device Type	1 Byte	Must be set to 30	N/A	N/A
5	RF Frequency	1 Byte	Valid RF Settings 2400 MHz + X MHz 03=2403 MHz 39=2439 MHz 61=2461 MHz 75=2475 MHz	MHz	N/A
6	Channel Period (LSB)	2 Bytes	**Shall [SD_HRR_001][MD_HRR_001]** be set to: 8070	N/A	N/A
7	Channel Period (MSB)				

6.9.1.1 Session Leader ID

Recommended to use lower 3 bytes of unique serial number of the display.

6.9.1.2 Device Type

Device type field **shall [SD_0001] [MD_HRR_001]** be set to 30 (0x1E) for the ANT+ Running Dynamics channel.

6.9.1.3 RF Frequency

Shall [SD_HRR_001] [MD_HRR_001] use one of the listed frequencies. Refer to Table 6-12.

Specify which channel on the 2.4GHz band to use for the RD channel.

If the sensor does not already have a session leader, it will open a RD channel using the specified RF Frequency, a channel period of 8070, and a device type of 30. The sensor will also begin to transmit a one-byte enum in the first byte of data page 4 of the ANT+ HRM channel. This enum will contain the aforementioned 3 fields (RF Frequency, channel period, and a device type) of the Run channel configuration.

6.9.1.4 Channel Period

Shall [SD_HRR_001] [MD_HRR_001] be set to 8070.

6.9.2 ANT+ HRM Profile: Data Page 4 – Previous Heart Beat (0x04)

Data page 4 is one of the main data pages broadcast from an ANT+ HR-Running Dynamics sensor on the ANT+ HRM device profile. This page allows the heart rate monitor to transmit the measured time of the previously measured heartbeat. This format provides a level of redundancy in the transmitted data stream and allows for a more robust form of calculating R-R intervals. All fields in this message **shall [MD_0010]** be set as described in Table 6-13.

Table 6-13. Data Page 4 Format – Previous Heart Beat

Byte	Description	Length	Value	Units	Range or Rollover
1	RD Frequency/ Manufacturer Specific	1 Byte	If the sensor supports RD: The sensor **shall [MD_HRR_001] [SD_HRR_001]** set the value in this byte to the frequency Set to 0xFF if not used. 0-Invalid, RD Channel Not Open 1-2403MHz 2-2439MHz 3-2475MHz 4-2461MHz	N/A	N/A
			If the sensor does not support RD: Byte 1 will contain manufacturer specific data, as this is the specification of the HRM profile. Therefore, if byte 1 does not contain one of the frequencies defined above, the receiver must NOT interpret this data, unless custom behavior is defined for a specific manufacturer. Set to 0xFF if not used.		
2	Previous Heart Beat Event Time LSB	2 Bytes	Represents the time of the previous valid heart beat event.	1/1024 second	63.999s
3	Previous Heart Beat Event Time MSB				

6.9.2.1 RD Frequency/Manufacturer Specific

This field describes the frequency on which the RD channel is operating.

Value	RF Frequency
0	Invalid
1	2403
2	2439
3	2475
4	2461

In the case that a sensor does not support RD, this byte will contain manufacturer specific data, as this is the specification of the HRM profile. Therefore, if byte 1 does not contain one of the frequencies defined above, the receiver must NOT interpret this data, unless custom behavior is defined for a specific manufacturer.

6.10 Optional Common Data Pages

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

Common Data Page 70 allows an ANT+ device to request a specific data page from another ANT+ device. 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 6-14.

Table 6-14. Common Data Page 70

Byte	Description	Length	Value	Units
0	Data Page Number	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

6.10.1.1 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.

6.10.1.2 Requested Transmission Response

The Running Dynamics sensor should be able to support all requested transmission response types; however, the ANT+ Running Dynamics Device Profile further stipulates that the display **shall [self-verify]** only request broadcast messages from a Running Dynamics sensor.

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

6.10.2 Common Page 82 (0x52): Battery Status

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

6.10.3 Common Page 88 (0x58): Sensor Location

Common Data Page 88 allows an ANT+ sensor to indicate its worn location on the user (i.e. for the ANT+ Running Dynamics device profile, it allows the display device to determine if it is communicating with a torso-worn or waist-worn sensor.)

This common page is optional, and may be requestable from the sensor. If used, the data in common page 88 **shall [MD_0010]** be formatted as shown in Table 6-15.

Table 6-15. Common Data Page 88

Byte	Description	Length	Value	Units
0	Data Page Number	1 Byte	88 (0x58) – Sensor Location	N/A
1	Reserved	1 Byte	Value = 0xFF	N/A
2	Reserved	1 Byte	Value = 0xFF	N/A
3	Reserved	1 Byte	Value = 0xFF	N/A
4	Reserved	1 Byte	Value = 0xFF	N/A
5	Reserved	1 Byte	Value = 0xFF	N/A
6	Reserved	1 Byte	Value = 0xFF	N/A
7	Body Location Enum	1 Byte	Refer to FIT SDK (body_location enum)	N/A

6.10.3.1 Body Location Enum

Refers to the body_location enum in the FIT SDK.

6.10.4 Other Common Data Pages

Other common data pages that are listed in the ANT+ Common Pages document can be sent from the ANT+ Running Dynamics sensor or ANT+ HR-Running Dynamics Sensor. Other common data pages are implemented at the discretion of the developer.

7 Minimum Requirements

ANT+ Running Dynamics and HR-Running Dynamics sensors/displays shall behave as described in this document. In summary, the pages marked as required in Tables 7-1 and 7-2 **shall [MD_0006] [MD_0008] [SD_0012]** be transmitted and received complying with the transmission and reception requirements. The pages marked as optional must also meet specified transmission and reception requirements if they are included. All fields are required for all messages unless they are specifically marked as optional in the data page descriptions.

7.1 Running Dynamics

Table 7-1 Data Elements of Running Dynamics Sensors/Displays

Required Data Pages	Transmission Requirements
Data Page 0	Sent as main data page at ~2 Hz. Refer to section 6.2.1.
Data Page 1	Sent as main data page at ~2 Hz. Refer to section 6.2.1.
Data Page 16	Sent as command data page at ~2Hz. Refer to section 6.2.1.
Data Page 32	Sent as acknowledged command data page (refer to section ANT+ Running Dynamics – Assigning a Session Leader)
Data Page 80	Placed in background page rotation. Refer to section 6.2.1.
Data Page 81	Placed in background page rotation. Refer to section 6.2.1.
Optional Data Pages	**Transmission Requirements**
Data Page 70	Receive and respond to requests for pages.
Data Page 82	Placed in background page rotation. Refer to section 6.2.1.
Data Page 88	Placed in background page rotation. May be requestable. Refer to section 6.2.2.

7.2 HR-Running Dynamics

Table 7-2 Data Elements of HR-Running Dynamics Sensors/Displays

Required Data Pages	Transmission Requirements
Data Page 0	Sent as main data page at ~4 Hz if Data Page 1 is not implemented. Sent as main data page at ~2 Hz if Data Page 1 is implemented. Refer to section 6.2.2.
Data Page 16	Sent as command data page at ~1 Hz. Refer to section 6.2.2.
Data Page 74	Transmitted from the display to the sensor as an acknowledged message (over the HR profile). Transmitted from the sensor to the display upon request from the display. Refer to section 6.2.2.
Data Page 4	Sent as main data page at ~ 2 Hz. Refer to section 6.2.2.

Optional Data Pages	Transmission Requirements
Data Page 1	Sent as main data page at ~4Hz. Refer to section 6.2.2.
Data Page 70	Receive and respond to requests for pages.
Data Page 82	Placed in background page rotation. Refer to section 6.2.2.
Data Page 88	Placed in background page rotation. May be requestable. Refer to section 6.2.2.

ANT+ Interoperability Icons

7.3 Running Dynamics/HR-Running Dynamics Interoperability Icons

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 heart rate information, and that it is interoperable with other devices that carry the same icon.

An ANT+ Running Dynamics device (sensor or display) that meets the minimum compliance specifications and has been certified may use one of the applicable icons shown below.

Figure 7-1. ANT+ Running Dynamics Interoperability Icon

Figure 7-2. ANT+ Heart Rate-Running Dynamics Interoperability Icon

8 Profile Verification Tests

Table 8-1 Profile Verification Tests for Running Dynamics Sensor

☑	Certification Test	Relevant Document Sections
	MD_0001 ANT Channel Parameter Test	5.1.2 Master Channel Configuration 5.2.2 Master Channel Configuration
	MD_0003 ANT Channel Period Test	5.1.2 Master Channel Configuration
	MD_0006 Required Data Pages Test	6.1.2 Running Dynamics Data Pages
	MD_0008 Transmission Pattern Test	6.2.1 Running Dynamics Data Pages 6.2.2 HR-Running Dynamics Data Pages 6.3 Transmission Patterns 6.4 Data Page 0 – Running Dynamics A
	MD_0010 Reserved Fields Test	6.4 Data Page 0 – Running Dynamics A 6.5 Data Page 1 – Running Dynamics B 6.1.2 ANT+ HRM Profile: Data Page 4 – Previous Heart Beat (0x04) 6.2.3 Common Page 88 (0x58): Sensor Location
	MD_0013 Data Page Request Test	6.2.1 Running Dynamics Data Pages 6.2.2 HR-Running Dynamics Data Pages
	MD_RD_001 Default Session Leader ID Invalid	4.4 Assigning a Session Leader for Bidirectional Communication
	MD_RD_002 Bidirectional Channel Support	4.4 Assigning a Session Leader for Bidirectional Communication
	MD_RD_003 Session Leader ID Set	4.4.1 Session Leader Assignment – Sensor Behaviour
	MD_RD_004 Reset Session Leader ID	4.4 Assigning a Session Leader for Bidirectional Communication 4.4.1 Session Leader Assignment – Sensor Behaviour

Table 8-2 Profile Verification Tests for HR-Running Dynamics Sensor

☑	Certification Test	Relevant Document Sections
	MD_0001 ANT Channel Parameter Test	5.1.2 Master Channel Configuration 5.2.2 Master Channel Configuration
	MD_0003 ANT Channel Period Test	5.1.2 Master Channel Configuration
	MD_0006 Required Data Pages Test	6.1.2 Running Dynamics Data Pages
	MD_0008 Transmission Pattern Test	6.2.1 Running Dynamics Data Pages 6.2.2 HR-Running Dynamics Data Pages 6.3 Transmission Patterns 6.4 Data Page 0 – Running Dynamics A
	MD_0010 Reserved Fields Test	6.4 Data Page 0 – Running Dynamics A 6.5 Data Page 1 – Running Dynamics B 6.1.2 ANT+ HRM Profile: Data Page 4 – Previous Heart Beat (0x04) 6.2.3 Common Page 88 (0x58): Sensor Location
	MD_0013 Data Page Request Test	6.2.1 Running Dynamics Data Pages 6.2.2 HR-Running Dynamics Data Pages
	MD_HRR_001 Session Leader ID set	4.4.2 HR-Running Dynamics – Assigning a Session Leader 6.1.1 Data Page 74 – Open Channel Command (0x4A)
	MD_HRR_002 Reset Session Leader ID	4.4.2 HR-Running Dynamics – Assigning a Session Leader 6.1.1 Data Page 74 – Open Channel Command (0x4A)

Table 8-3 Profile Verification Tests for the Running Dynamics Display

☑	Certification Test	Relevant Document Sections
	SD_0001 ANT Channel Parameter Test	6.1.1.2 Device Type
	SD_0002 Transmission Type	5.1.1 Slave Channel Configuration 5.2.1 Slave Channel Configuration
	SD_0003 Channel Period Test	5.1.1 Slave Channel Configuration
	SD_0007 Reserved Fields Test	6.6 Data Page 16 – Session Leader Speed Metrics (0x10) 6.7 Data Page 32 – Session Leader Request (0x20)
	SD_0012 Required Data Pages Test	6.2.1 Common Page 70 (0x46): Request Data Page
	SD_RD_001 Bidirectional Messaging Support	4.4 Assigning a Session Leader for Bidirectional Communication
	SD_RD_002 Session Leader Request Valid ID I	6.7 Data Page 32 – Session Leader Request (0x20)
	SD_RD_003 Session Leader Request Valid ID II	4.4 Assigning a Session Leader for Bidirectional Communication 4.4.1 ANT+ Running Dynamics – Assigning a Session Leader
	SD_RD_004 Minimum Bidirectional Channel Frequency	4.4 Assigning a Session Leader for Bidirectional Communication 6.6 Data Page 16 – Session Leader Speed Metrics (0x10)

Table 8-4 Profile Verification Tests for the HR-Running Dynamics Display

☑	Certification Test	Relevant Document Sections
	SD_0001 ANT Channel Parameter Test	6.1.1.2 Device Type
	SD_0002 Transmission Type	5.1.1 Slave Channel Configuration 5.2.1 Slave Channel Configuration
	SD_0003 Channel Period Test	5.1.1 Slave Channel Configuration
	SD_0007 Reserved Fields Test	6.6 Data Page 16 – Session Leader Speed Metrics (0x10) 6.7 Data Page 32 – Session Leader Request (0x20)
	SD_0012 Required Data Pages Test	6.2.1 Common Page 70 (0x46): Request Data Page
	SD_HRR_001 Session Leader ID I	4.4.2 HR-Running Dynamics – Assigning a Session Leader 6.1.1 Data Page 74 – Open Channel Command (0x4A)
	SD_HRR_002 Session Leader Request Valid ID II	4.4.2 HR-Running Dynamics – Assigning a Session Leader
	SD_HRR_003 Minimum Bidirectional Channel Frequency	4.4.2 HR-Running Dynamics – Assigning a Session Leader