ANT+ Device Profile

CORE Temp

Copyright Information and Usage Notice

Revision History

Revision	Effective Date	Description
Draft 0.2.6	August 2020 – March 2021	Preliminary version(s)
Beta 0.1.0	April 2021	Beta profile CORE Temp

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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.

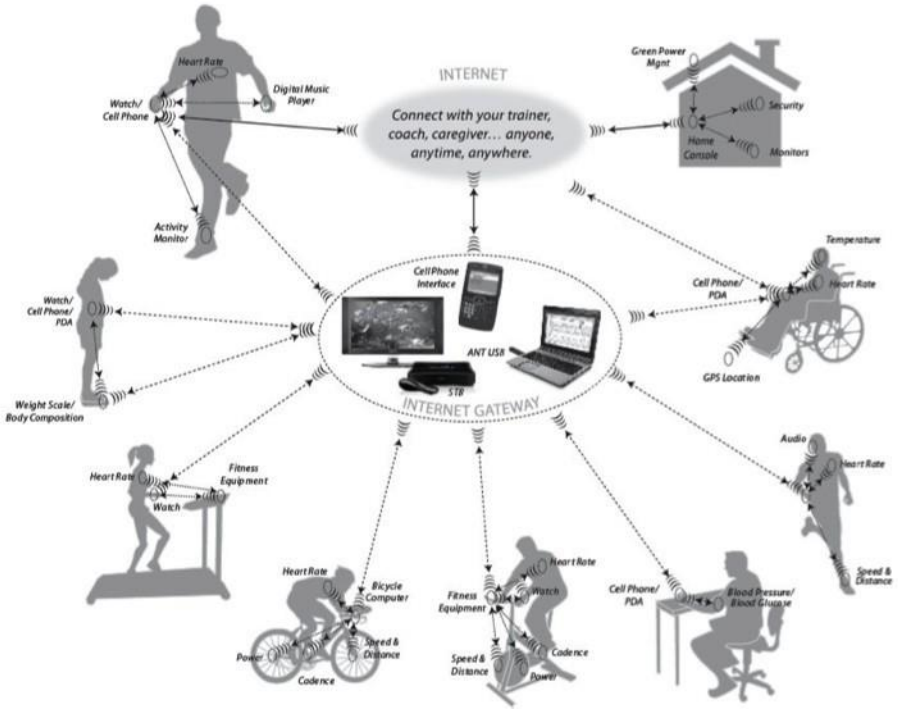

Figure 1-1. ANT+ Device Ecosystem

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. ANT+ Fitness Equipment Device Profile

3 Overview of CORE Temp Device Use Case

The ANT+ CORE Body Temperature sensor is a device that allows a person's CORE body temperature to be measured and monitored with a high level of accuracy. The CORE Temp data can be used for health, safety and sport performance applications where constant monitoring gives valuable information and alerts.

Note: devices that have lower level of accuracy such as common skin temperature monitors that estimate CORE Temp should qualify their data setting the Data Quality field on Page 0 Byte 2 set to Poor (bits 0:1 00) indicating that the data may not be as reliable as a device with higher accuracy such as e-pill, rectal probes or devices based on energy transfer technology.

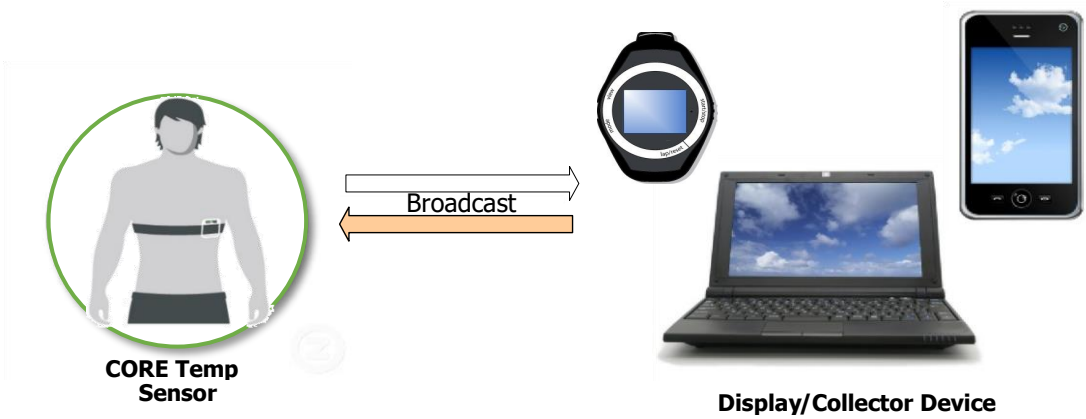

Figure 3-1. ANT+ CORE Temp Sensor Use Case

3.1 Broadcast Use Case

Figure 3-2 below illustrates the typical ANT+ CORE Temp sensor broadcast use case. The CORE Temp sensor transmits main data pages at a default 2Hz rate. Main data pages include general information about the device capabilities, and temperature data. Some device-specific information, such as battery status and manufacturer information, is transmitted at slower rates in the background data pages (i.e., at least once every 129 data pages). The display may also request data pages from the CORE Temp sensor. For more details on requesting data pages refer to the ANT+ Common Pages document.

The CORE Temp sensor allows a default transmission rate of 2 Hz.
On receiving a request for data from a display device, data is transmitted at the default rate of 2 Hz.

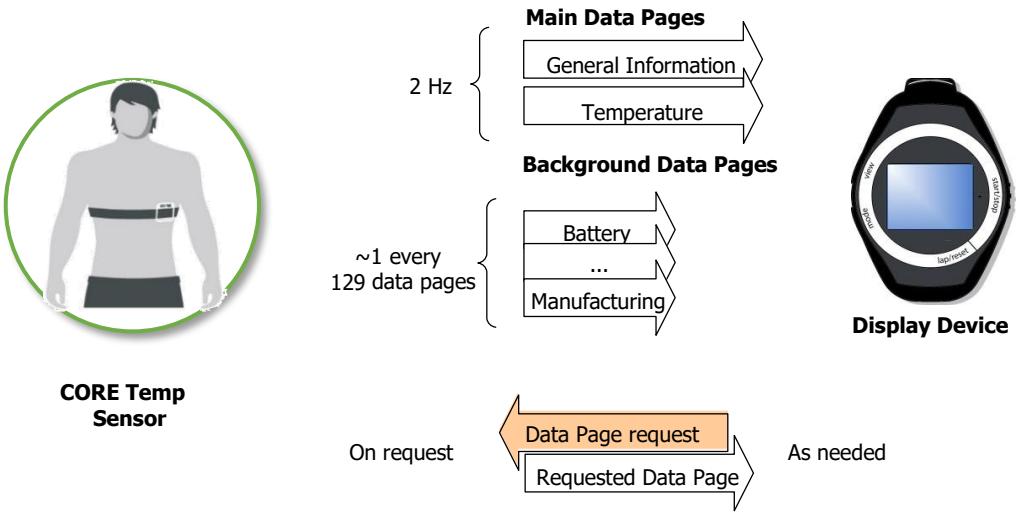

Figure 3-2. Standard Use Case of an ANT+ CORE Temp Sensor and Real Time Display

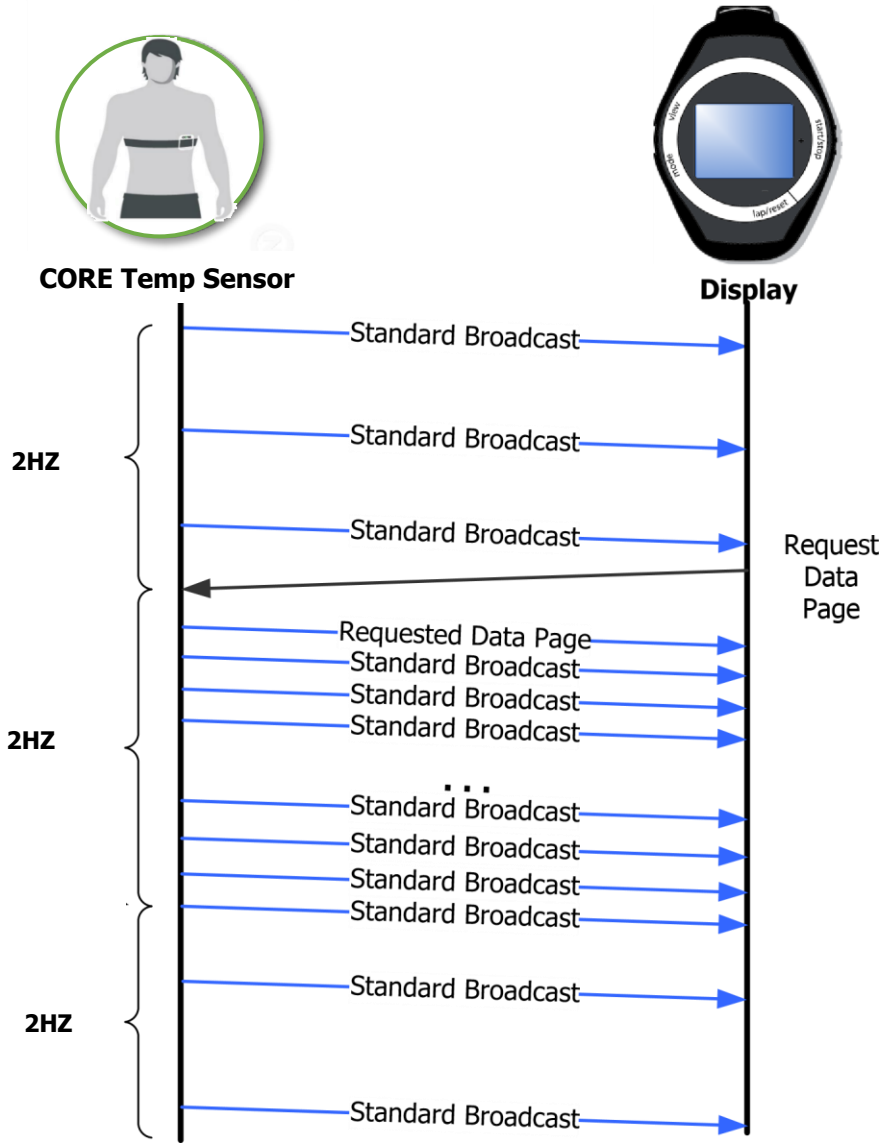

Figure 3-3. ANT+ CORE Temp Sensor 2 Hz Default Message Rate Requirements

4 Channel Configuration

The channel configuration parameters of the CORE Temp 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.

4.1 Slave Channel Configuration

The device receiving data from an ANT+ CORE Temp sensor must configure an ANT channel with its channel parameters set as listed in Table 4-1.

Table 4-1. ANT Channel Configuration for CORE Temp Display (i.e. Slave) Device

Parameter	Value	Comment
Channel Type	Slave (0x00)	The CORE Temp 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+ CORE Temp device
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 may 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	**127 (0x7F)**	**127 (0x7F)** – indicates search for an ANT+ CORE Temp device. 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	**16384** counts	Data is transmitted from the CORE Temp device every **16384** seconds (2 Hz) and must be received at this rate.
Search Timeout	(recommended = 45 seconds)	The recommended search timeout is set to 45 seconds in the receiver. This allows sufficient time for a 2 Hz master to be found. This timeout is implementation specific and can be set by the designer to the appropriate value for the system.

4.1.1 Channel Period

The channel period is set such that the display device shall receive data at the full message rate 2Hz.

4.2 Master Channel Configuration

The ANT+ CORE Temp sensor shall establish its ANT channel as shown in Table 4-2.

Table 4-2. ANT Channel Configuration for CORE Temp Sensor (i.e. Master)

Parameter	Value	Comment
Channel Type	Master (0x10)	Within the ANT protocol the master channel (0x10) allows for bidirectional 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+ CORE Temp sensor.
Transmission Type	Bits 0:3 - 5 (0x05) Bits 4:7 – ext'd device #	ANT+ devices will follow the transmission type definition as outlined in the ANT protocol: The lower nibble shall be set to 0x05. The upper nibble may be used to extend the device number
Device Type	**127 (0x7F)**	A CORE Temp sensor shall transmit its device type as 0x7F. 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 CORE Temp sensor. It is imperative that the implementation allows for a unique device number to be assigned to a given device. **NOTE:** The master device number shall not be set to 0x0000.
Channel Period	**16384** counts	Data is transmitted every **16384** seconds 2Hz.

4.2.1 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.

4.2.2 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 parameter; ensure that the device has a set serial number.

The device number of the CORE Temp sensor shall not be set to 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.

The device number may be extended using the upper nibble of the transmission type. Refer to the ANT Message Protocol and Usage document.

4.2.3 Channel Period

The default channel period may be set at 2Hz.

5 Message Payload Format

5.1 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 5-1. ANT+ General Message Format

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

5.2 Data Page Types

Multiple data pages are supported in the ANT+ CORE Temp device profile. These pages are divided into four distinct types of data:

- Main Data Pages: consist of a basic temperature page transmitted by default at 2 Hz.
- Background Data Pages: consist of common pages containing information about the CORE Temp sensor, transmitted at a slow interleave rate, or on request from the display.
- Request Data Page: sent from a display to request data from the CORE Temp sensor.

5.2.1 Main Data Pages

There are two main data pages: the general information (page 0) and CORE Temp page (page 1). These are required pages and must be sent from every ANT+ CORE Temp device at a minimum rate of 2 Hz while in the default state. This is the default data page for the ANT+ CORE Temp device.

Other main data pages may be developed in future revisions.

5.2.2 Background Data Pages

Background data pages give background information, such as manufacturer information and battery voltage. All ANT+ CORE Temp device background pages defined in this document consist of common pages and must be implemented. These pages shall be interleaved at a rate of 1 per 129 messages and shall be sent on request.

5.2.3 Request Data Page

The request data page allows the display device to request data from the CORE Temp sensor. The sensor shall be able to respond to requests for data pages. Recommend that data pages 0 as well as pages 80, 81 are requestable.

5.3 Data Page 0 – General Information

Data page 0 is a main data page broadcast from an ANT+ CORE Temp device and provides general information about the device's capabilities. All CORE Temp sensors must be able interleave data page 0 once at least once per 32 channel periods (i.e., once per 16 seconds) with all supported main data pages at the default transmission rate. All fields in this message shall be set as described in Table 5-2.

Table 5-2. Data Page 0 Format – General Information

Byte	Description	Length	Value	Units	Min/Max
0	Data Page Number	1 Byte	Data Page Number = 0 (0x00)	N/A	N/A
1	Reserved	1 Byte	Set to 0xFF	N/A	N/A
2	Data Quality	1 Byte	Optional – (0xFF if not used) BIT 0:1 Bit 00 –Poor Bit 01 –Fair Bit 10 –Good Bit 11 –Excellent Bits 2:7 – Reserved. All set to 0	N/A	N/A
3	Transmission Info	1 Byte	Bit field. Refer to Table 5-3.	N/A	N/A
4	Supported Pages LSB	4 Bytes	Bit Field representing main data pages supported. Bit position refers to page number. Bits 2:31 – Reserved. Set to 0. Bit 1 – Page 1 Support Bit 0 – Page 0 Support	N/A	N/A
5	Supported Pages				
6	Supported Pages				
7	Supported Pages MSB				

5.3.1 Data Quality

An ANT+ Core Temp sensor may provide data that is very accurate or be in a state or device type where accuracy may be lower. Such as when the CORE Temp sensor device is first worn, the sensor will provide a value with poor data quality until a few minutes pass and the *signal* computed from the device has higher confidence of the value transmitted is of higher accuracy. If a sensor is based on estimation from skin temperature that may not provide an accurate result with confidence, they should set the Data Quality to Poor.

The data quality values are enumerated 0 to 3 with values of: Poor, Fair, Good, Excellent.

The CORE Temp display device can take care to represent the data quality to correspond to the CORE Temp value displayed. Display examples of using colors or flashing/alternating digits with '-' to show the current data may be deemed not currently accurate.

Table 5-3. Example Data Quality visual displays

Data Quality	Text Color on Black background	Text Color on White	Optional Dashes to indicate quality
Bit 00 -Poor	Dark gray	Light gray	36.64° alternate flash 3-.--°
Bit 01 –Fair	Gray	Gray	36.64° alternate flash 36.--°
Bit 10 –Good	Light gray	Dark gray	36.64° alternate flash 36.6-°
Bit 11 –Excellent	White	Black	36.64° solid / no flash

5.3.2 Transmission Info

This field provides transmission characteristics of the CORE Temp sensor as described in Table 5-4.

Table 5-4. Transmission Info Bit Field Description

Bit	Description	Values
6:7	**Heart Rate**	00 – Heart Rate not supported
		01 – Heart Rate supported, Not Set
		10 – Heart Rate supported & Source Set
		11 - Reserved
4:5	Local Time	00 – Local Time not supported
		01 – Local Time Supported, Not Set
		10 - Local Time Supported & Set
		11 - Reserved
2:3	UTC Time	00 – System Time not supported
		01 – UTC Time Supported, Not Set
		10 - UTC Time Supported & Set
		11 - Reserved
0:1	Default Transmission Rate	00 – default transmission rate of 2 Hz
		01 - Reserved
		10 – Reserved
		11 – Reserved

5.3.2.1 Heart Rate Supported

An ANT+ CORE Temp sensor may optionally support receiving heart rate data for increase accuracy and responsiveness, particularly during intensive physical activities. This field is used to indicate if a heart rate signal source is currently set.

A display may set a heart rate source including a HRM ANT+ ID using the Common Page 74: Open Channel Command (0x4A).

5.3.2.2 Local Time and UTC Time

An ANT+ CORE Temp sensor may optionally support local time and UTC time. This field is used to determine if local/UTC time is supported on the sensor. Additionally, this field is used to indicate if the local/UTC time on the sensor is currently set.

5.3.2.3 Default Transmission Rate

This field indicates the default transmission rate of the CORE Temp sensor. Currently the value is fixed at 2 Hz.

5.3.3 Heart Rate

An ANT+ CORE Temp sensor may be able to provide higher accuracy if the heart rate signal is used particularly during high intensity activity. A CORE Temp sensor can read an ANT+ Heart Rate monitor profile with a given ANT id.

The CORE Temp display may respond to the Page 0 info bit: **Heart Rate supported, Not Set** by providing the associated ANT id of the in use paired heart rate monitor. This is achieved by using the standard **Common Page 74: Open Channel Command (0x4A).** Recommended to only respond to 'heart rate supported, not set' a few times before disregarding that the given ID is failing the auto-pairing operation.

Responding with a heart rate sensor id will perform an 'auto-pairing' function for heart rate data to a CORE Temp sensor. Not responding is valid, however this can result in lower core body temperature accuracy during physical activities.

5.3.3.1 Heart Rate Response

To perform the auto-pairing of the CORE Temp Sensor to the Heart Rate monitor, the Display Device can utilize the Common Page 74: Open Channel Command (0x4A) specifying the heart rate monitor ANT id to pair with.

Table 5-5. Common Page 74: Open Channel Command (0x4A)

Byte	Description	Length	Value	Units	Range
0	Data Page Number	1 Byte	74 (0x4A) – Open Channel Command	N/A	N/A
1	Serial Number (LSB)	3 Bytes	Lower 2 bytes of serial number.	N/A	N/A
2	Serial Number				
3	Serial Number (MSB)				
4	Device Type	1 Byte	The device type of the desired ANT+ profile. For Heart Rate monitor use: 120	N/A	N/A
5	RF Frequency	1 Byte	The RF frequency specified by the relevant ANT+ device profile. For Heart Rate monitor use: 57	N/A	N/A
6	Channel Period (LSB)	2 Bytes	The channel period specified by the relevant ANT+ device profile. For Heart Rate monitor use: 8070	N/A	N/A
7	Channel Period (MSB)				

5.3.3.2 Serial Number ID

It is recommended to use lower 2 bytes of unique serial number of the display which should be able to be used as the Heart Rate Monitor ANT id to pair with. The upper byte is typical the transmission type and set to 0.

5.3.3.3 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. The Device Type value of 120 should be used for pairing a standard Heart Rate monitor.

5.3.3.4 RF Frequency

This field specifies which RF frequency the channel should be opened on. The ANT+ Heart Rate profile uses the RF Frequency value of 57. 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.

5.3.3.5 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. The Channel Period for a Heart Rate monitor is 8070.

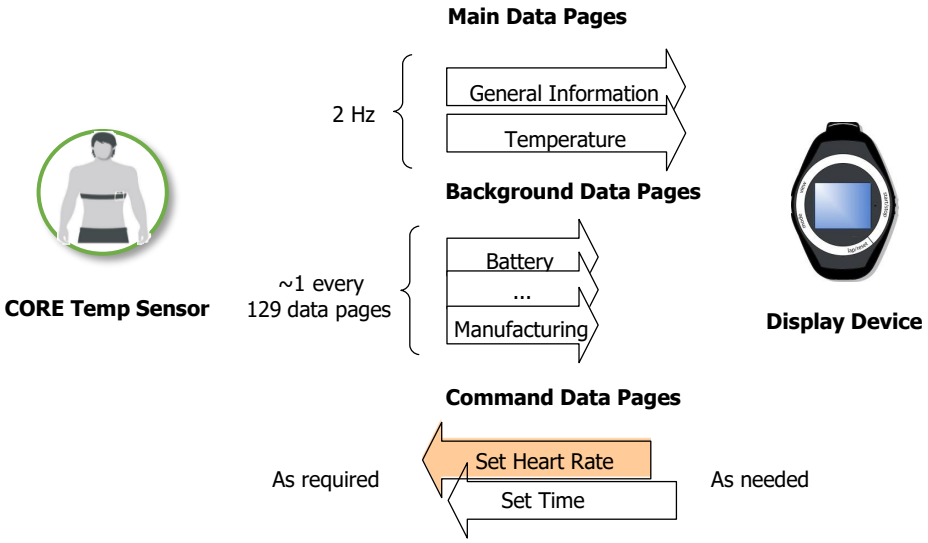

Figure 5-1. Auto pairing heart rate monitor workflow

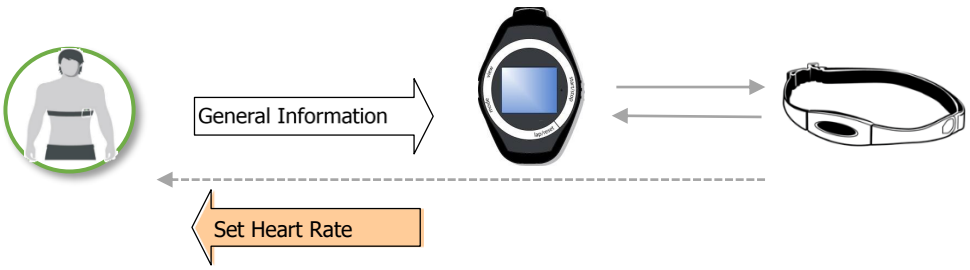

Figure 5-2. Heart rate monitor auto pairing via Display device

5.3.4 Supported Pages

The supported pages field indicates the main data pages supported by the ANT+ CORE Temp sensor. Support for data page 0 shall always be required, as such; bit 0 shall be set to 1.

CORE Temp sensors shall set bit 1 to indicate support for main data page 1.

Future revision may allow for other types of data to be transmitted; however, currently no other pages are defined and the remaining bits (2:31) shall be set to 0.

5.4 Data Page 1 – CORE Temp

Data page 1 is a main data page broadcast from an ANT+ CORE Temp device to send CORE temperature information. Currently, all devices must be able to send this page and it shall be sent interleaved with main data page 0 at the default transmission rate. All fields in this message shall be set as described in Table 5-6.

Table 5-6. Data Page 1 Format – Temperature

Byte	Description	Length	Value	Units	Min/Max
0	Data Page Number	1 Byte	Data Page Number = 1 (0x01)	N/A	N/A
1	Reserved	1 Byte	Set to 0xFF	N/A	N/A
2	Event count	1 Byte	increments with each measurement	N/A	N/A
3	Skin Temperature LSB	1.5 Bytes	**Optional:** Signed Integer representing Skin Temperature (0x800 invalid – or not supported) Skin temperature = Value / 20	0.05°C	-102.35 to 102.35
4 (bits 4:7)	Skin Temperature MSN				
4 (bits 0:3)	Reserved LSN	1.5 Bytes	(0x800 invalid – or not supported)	N/A	0 to 0xFFF
5	Reserved MSB				
6	**CORE Temperature** LSB	2 Bytes	Signed Integer representing the current CORE Temperature (0x8000 invalid)	0.01°C	-327.67 to 327.67
7	**CORE Temperature** MSB				

5.5 Data Pages 2 – 63: Reserved for Future Use

Data pages 2 to 63 are reserved for future data page definitions.

5.6 Required Common Data Pages

Common data pages are pages that can be sent/received from any ANT+ device that has a transmission type indicating it can interpret paginated data. See the ANT+ Common Data Pages document for more details.

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

Common data page 80 transmits the manufacturer's ID, model number, and hardware revision.

Table 5-7. Common Data Page 80

Byte	Description	Length	Value	Units
0	Data Page Number	1 Byte	0x50 – Common Page 80	N/A
1	Reserved	1 Byte	Value = 0xFF	N/A
2	Reserved	1 Byte	Value = 0xFF	
3	HW Revision	1 Byte	To be set by the manufacturer.	N/A
4	Manufacturer ID LSB	2 Bytes	Contact the ANT+ Alliance for a current list of manufacturing IDs, or to be assigned a manufacturing ID.	N/A
5	Manufacturer ID MSB			
6	Model Number LSB	2 Bytes	To be set by the manufacturer.	N/A
7	Model Number MSB			

For the current list of Manufacturer Identification values, or if you wish to be added to this list, please contact the ANT+ Alliance at antalliance@thisisant.com.

5.6.2 Common Page 81 (0x51) – Product Information

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

Table 5-8. Common Data Page 81

Byte	Description	Length	Value	Units
0	Data Page Number	1 Byte	0x51 – Common Page 81	N/A
1	Reserved	1 Byte	Value = 0xFF	N/A
2	Reserved	1 Byte	Value = 0xFF	N/A
3	SW Revision	1 Byte	To be set by the manufacturer.	N/A
4	Serial Number (Bits 0 – 7)	4 Bytes	The lowest 32 bits of the serial number. Value 0xFFFFFFFF to be used for devices without serial numbers.	N/A
5	Serial Number (Bits 8 – 15)			
6	Serial Number (Bits 16 – 23)			
7	Serial Number (Bits 24 – 31)			

5.6.3 Common Page 70 (0x46) – Request Data Page

The request data page allows the ANT+ CORE Temp display device to request a specific broadcast data page from the CORE Temp sensor. For more details refer to the ANT+ Common Pages document.

The request page is sent as an acknowledged message from a display.

The CORE Temp sensor must be able to respond to requests for all data pages described in this document. However, other pages may be requested by a display that may not be supported. In these cases, the CORE Temp sensor may not respond at all and continue to send data according to this device profile. Any display that plans to use this data page shall handle this "no response" case elegantly. The contents of this data page are detailed in Table 5-9; however, for more details on using this page, refer to the ANT+ Common Pages Document.

Table 5-9. Common Data Page 70 Format

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 Value = 2 (0x02) for Request ANT-FS session (not supported)	N/A

5.6.3.1 Descriptor Bytes 1 & 2

The descriptor byte fields are used to describe requested subpages. Currently no subpages are defined within this profile and these bytes shall be set to invalid (0xFF) if requesting a main data page.

5.6.3.2 Requested Transmission Response

When requesting a data page from the sensor device, the **ANT+ display shall only request broadcast message types**. Acknowledged or burst message types shall not be requested.

5.6.3.3 Requested Page Number

When requesting a data page from the CORE Temp sensor, the display uses this field to indicate the page number requested.

5.6.3.4 Command Type

When requesting a data page from the CORE Temp sensor, this field shall be set to 0x01. All other command types including an ANT-FS session are currently not supported and requests will be ignored.

5.6.4 Other Common Data Pages

Other common data pages that are listed in the ANT+ Common Data Pages document can be sent from the ANT+ CORE Temp sensor. Other common data pages are implemented in the CORE Temp sensor at the discretion of the developer.

6 Transmission Requirements

The ANT+ CORE Temp sensor shall transmit main data pages by default. Main data pages shall be transmitted at 2Hz. Each main data page shall be interleaved at least once per 32 channel periods (i.e. once per 16 seconds at 2Hz). Note that an ANT+ CORE Temp display should handle this latency appropriately.

Background data pages shall be interleaved at least once every 129 channel periods (once per 64 seconds at 2 Hz).

All data pages shall be transmitted on a display's request.

Currently, only main data pages 0 and 1 are supported. Main data page 0 is a required main data page. The recommended transmission is page 1 highest priority with page 0 transmitted every 32 messages, with a common page transmitted every 129 messages.

7 File Transfer

The ANT+ CORE Temp Device Profile supports file transfer between the CORE Temp sensor and display devices. Data shall be stored on an ANT+ CORE Temp device using the Flexible & Interoperable Data Transfer (FIT) Protocol.

For more details on the FIT protocol, refer to the Flexible & Interoperable Data Transfer (FIT) Protocol and FIT File Types documents.

7.3 FIT Data

A CORE Temp display device can store ANT+ CORE Temp Sensor data using the FIT Protocol.

7.3.1 Activity FIT File

Data shall be stored on an ANT+ CORE Temp Sensor using the FIT Protocol. CORE Temp data is stored in a FIT activity file. The activity file must contain the FIT file_id, activity, session, lap and record messages and device messages as described in the FIT File Types document and outlined in Table 7-1, 7-2, 7-3 and Table 7-4.

Table 7-1. Activity FIT File Messages and Session Fields

FIT Message	FIT Fields	Required	Type	Description
file_id	type	Y	file (enum)	Activity file (=4)
	manufacturer	Y	manufacturer (UINT16)	Refer to SDK
	product	Y	UINT16	Managed by manufacturer
	serial_number	Y	UINT32z	Managed by manufacturer
	time_created	Y	date_time (UINT32)	File creation time
	number	N	UINT16	File identifier
activity	timestamp	Y	date_time (UINT32)	Seconds since UTC 00:00 Dec 31 1989 If <0x10000000 = system time
	local_timestamp	N	local_date_time (UINT32)	Local time.
	num_sessions	Y	UINT16	Indicates total number of sessions included in the activity file
	type	Y	activity (enum)	Refer to SDK
	event	Y	event (enum)	Refer to SDK
	event_type	Y	event_type (enum)	Refer to SDK
session	timestamp	Y	date_time (UINT32)	Seconds since UTC 00:00 Dec 31 1989 If <0x10000000 = system time
	start_time	Y	date_time (UINT32)	Seconds since UTC 00:00 Dec 31 1989 If <0x10000000 = system time
	total_elapsed_time	Y	UINT32	Total number of msec since timer started (includes pauses)
	sport	Y	sport (enum)	Set to generic if sport type is unknown
	event	Y	event (enum)	Refer to SDK
	event_type	Y	event_type (enum)	Refer to SDK
	avg_core_temperature	N	UINT16	Average CORE Temp (0.01°C)
	min_core_temperature	N	UINT16	Minimum CORE Temp (0.01°C)
	max_core_temperature	N	UINT16	Maximum CORE Temp (0.01°C)

As indicated in the "Required" column, not all of the listed fields shall be included in the device file.

Table 7-2. Activity FIT File Lap and Record Fields

FIT Message	FIT Fields	Required	Type	Description
lap	timestamp	Y	date_time (UINT32)	Seconds since UTC 00:00 Dec 31 1989 If <0x10000000 = system time
	event	Y	event (enum)	Refer to SDK
	event_type	Y	event_type (enum)	Refer to SDK
	avg_core_temperature	N	UINT16	Average CORE Temp (0.01°C)
	max_core_temperature	N	UINT16	Maxium CORE Temp (0.01°C)
	min_core_temperature	N	UINT16	Minium CORE Temp (0.01°C)
record	timestamp	Y*	date_time [UINT32]	Seconds since UTC 00:00 Dec 31 1989 If <0x10000000 = system time
	core_temperature	Y	UINT16	CORE Temp (0.01°C)
device_info	timestamp	Y*	date_time (UINT32)	Seconds since UTC 00:00 Dec 31 1989 If <0x10000000 = system time

Table 7-3. Activity FIT File Device Fields

FIT Message	FIT Fields	Required	Type	Description
	device_type	N	device_type (UINT8)	127 (0x7F) for ANT+ CORE Body Temperature monitor
	manufacturer	N	manufacturer (UINT16)	Managed by ANT+
	serial_number	N	UINT32	Managed by manufacturer
	product	N	UINT16	Managed by manufacturer
	software_version	N	UINT16	Managed by manufacturer
	hardware_version	N	UINT8	Managed by manufacturer
	sensor_position	N	body_location (enum)	Used to indicate the location of the sensor on the body (e.g. left chest)
	descriptor	N	string	Used to describe the sensor location on the body (e.g. apical)
	battery_status	N	battery_status (UINT8)	new/good/ok/low/critical

* Only required if optional message included

7.3.3 Other FIT Files

Refer to the FIT File Types document for details on other FIT files that may be useful for ANT+ Core Temp applications. These may include (but are not limited to):

- Settings file – contains user profile information and preferences such as gender, height, weight, stride length, logging interval, etc.

Refer to the FIT File Types document for more details on these file types.

7.3.4 CORE Temp Developer FIT Fields

CORE Temp currently uses Developer fields until the introduction of new appropriate fields into the FIT file eco system is accepted.

Table 7-4. CORE Temp Developer FIT Field Formats

FIT Message	Required	Field Name	Units	Data Type	Native Field Id
session	N	avg_core_temperature	°C	DATA_TYPE_FLOAT	**208**
	N	min_core_temperature	°C	DATA_TYPE_FLOAT	**209**
	N	max_core_temperature	°C	DATA_TYPE_FLOAT	**210**
lap	N	avg_core_temperature	°C	DATA_TYPE_FLOAT	**158**
	N	min_core_temperature	°C	DATA_TYPE_FLOAT	**159**
	N	max_core_temperature	°C	DATA_TYPE_FLOAT	**160**
record	Y	core_temperature	°C	DATA_TYPE_FLOAT	**139**
	N	skin_temperature	°C	DATA_TYPE_FLOAT	None

8 Minimum Requirements

8.1 Broadcast

The ANT+ CORE Temp sensor must support real time broadcast of CORE temp data as outlined in the following sections.

8.1.1 Minimum Transmission Timing Requirements

The ANT+ CORE Temp sensor shall transmit at a default rate of 2Hz.

Each main data page 0 shall be interleaved at least once per 32 channel periods (i.e. once per 16 seconds).

Background data page shall be interleaved at least once every 129 channel periods (i.e. once per 64 seconds).

All data pages shall be transmitted on a display's request.

8.1.2 Minimum Data Page Requirements

Table 8-1 summarizes the data page requirements of the ANT+ CORE Temp sensor.

Table 8-1. Required Data Elements of the ANT+ CORE Temp Sensor

Required Data Page	Transmission Requirements
Data Page 0	At least once every 32 data pages
Data Page 1	At least once every 4 data pages
Data Page 80, 81	Once every 129 data pages or on request

The ANT+ CORE Temp display shall be able to interpret these pages and appropriately handle the maximum latency of a single update every 30 seconds.

8.2 FIT File Requirements

The ANT+ CORE Temp device shall support FIT monitoring files. The FIT activity files shall contain, at a minimum, the FIT messages and fields outlined in Table 8-2.

Table 8-2. Minimum FIT device File Messages and Fields

FIT Message	FIT Fields	Required	Type	Value/Units
file_id	type	Y	file (enum)	Activity File (= 4)
	manufacturer	Y	manufacturer (UINT16)	ANT+ managed. Contact antalliance@thisisant.com for details
	product	Y	UINT16	Managed by manufacturer
	serial_number	Y	UINT32	Managed by manufacturer
	time_created	Y	date_time (UINT32)	
	number	Y	file_subtype file_duration	File_subtype = 1 (activity) Refer to Table 8-2
activity	timestamp	Y	date_time	Time of measurement recording
	core_temperature	Y	UINT16	CORE Temperate (0.01°C)

8.3 ANT+ CORE Temp Device 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 CORE Temp information, and that it is interoperable with other devices that carry the same icon.

An ANT+ CORE Temp sensor or display that meets the minimum compliance specifications and has been certified may use the icon shown in Figure 8-1 on packaging, documentation, and marketing material.

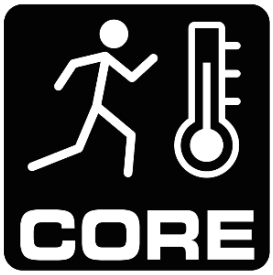

Figure 8-1. ANT+ CORE Temp Device Interoperability Icon

9 CORE Temp Implementation notes

9.1 Why CORE Temp vs environmental temperature

The CORE Temp profile is based on the environmental temperature with a few differences. Any implementation of the environmental temperature profile can be quickly converted to the CORE Temp profile.

Why not use the environmental profile: CORE Temperature is an important vital that requires differentiating it from environmental temperature as it pertains to a person's health and physiological responses vs the environment, they are in.

9.2 Differences between CORE Temp and Environmental temperature Profile

The CORE Temp profile is based on the environmental temperature with a few differences noted in Table 9-1.

Table 9-1. Key Differences between CORE Temp and Environmental temperature Profiles

Field	CORE Temp	Environmental temperature	Notes
Device Type	127 (0x7F)	19 (0x10)	
Broadcast Rate	2Hz	0.5Hz to 4Hz	All transmissions set at 2Hz **(16384** counts)
Data Page 0 interleave rate	interleave data page 0 once at least once per 32	alternate data page 0 and page 1	
Page 1	CORE Temp	Temperature	##.##°C
Page 1	Skin temperature	24-hour Low Temp	**Optional** Skin Temp = Value / 20 *0.05°C resolution*
Page 1	reserved	24-hour High Temp	
Page 0	Data Quality CORE Temp data quality 0 to 3, poor, fair, good, excellent	reserved	**Optional** CORE Temp data quality 0 to 3, poor to excellent 0xFF if not used
Page 0	Heart Rate	reserved	Request Heart Rate
Page 0 Heart Rate Response	Optional Response: Paired in use HRM ANT id	N/A	**Optional** Display device HRM id
Fit File	core_temperature avg_core_temperature min_core_temperature max_core_temperature	temperature	All references for 'temperature' can be replaced with 'core_temperature'
Interoperability icon			

9.3 Example Code

For ConnectIQ example code see: github.com/CoreBodyTemp/ConnectIQ-CoreTemp