WCS Module User Manual

This document contains necessary information to setup and implement this module into different end products.

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WCS Module User Manual

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1 Scope

1.1 Identification

This document contains information to setup and implement this module into different end products.

The product identification ID is cB-0720-02.

1.2 System overview

The system is implemented with HW and SW that builds up a headphone application to be mounted into receiver units + HW and SW to be mounted into a base unit.

The basic functionality:

1. Serve as intercom between the two receiver units.

2. Act as a Bluetooth headset/hands-free with the possibility to receive calls through the receiver. This connection is done using a standard external Bluetooth phone supporting the headset and/or the hands-free profile.

3. Hifi-quality sound is sent from the base unit to both receivers.

4. Serve as intercom between the base unit and one of the receivers (e.g. walkie-talkie functionality).

5. Sending prioritized audio messages (e.g. GPS information) from the base unit to one of the receivers.

The solution is based on the new Cambridge Silicon Radio BC03 – MM (Multi Media) chipset in order to create an optimum solution with regards to cost, size and power consumption. This chipset represents the most current Bluetooth technology of today.

1.3 Document overview

The document lists the mechanical, electrical and functional characteristics of the system.

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2 Referenced documents

[1] connectBlue Environmental Standard, cBProject-0202-03(1), 2002-02-04, connectBlue AB.

[2] Advanced Audio Distribution Profile, Adopted version 1.0, 2003-05-25, Bluetooth SIG.

[3] Specification of the Bluetooth System, Profiles, Version 1.1, 2001-02, Bluetooth SIG.

[4] Hands-free Adopted Profile, Version 1.0, 2003-04-29, Bluetooth SIG

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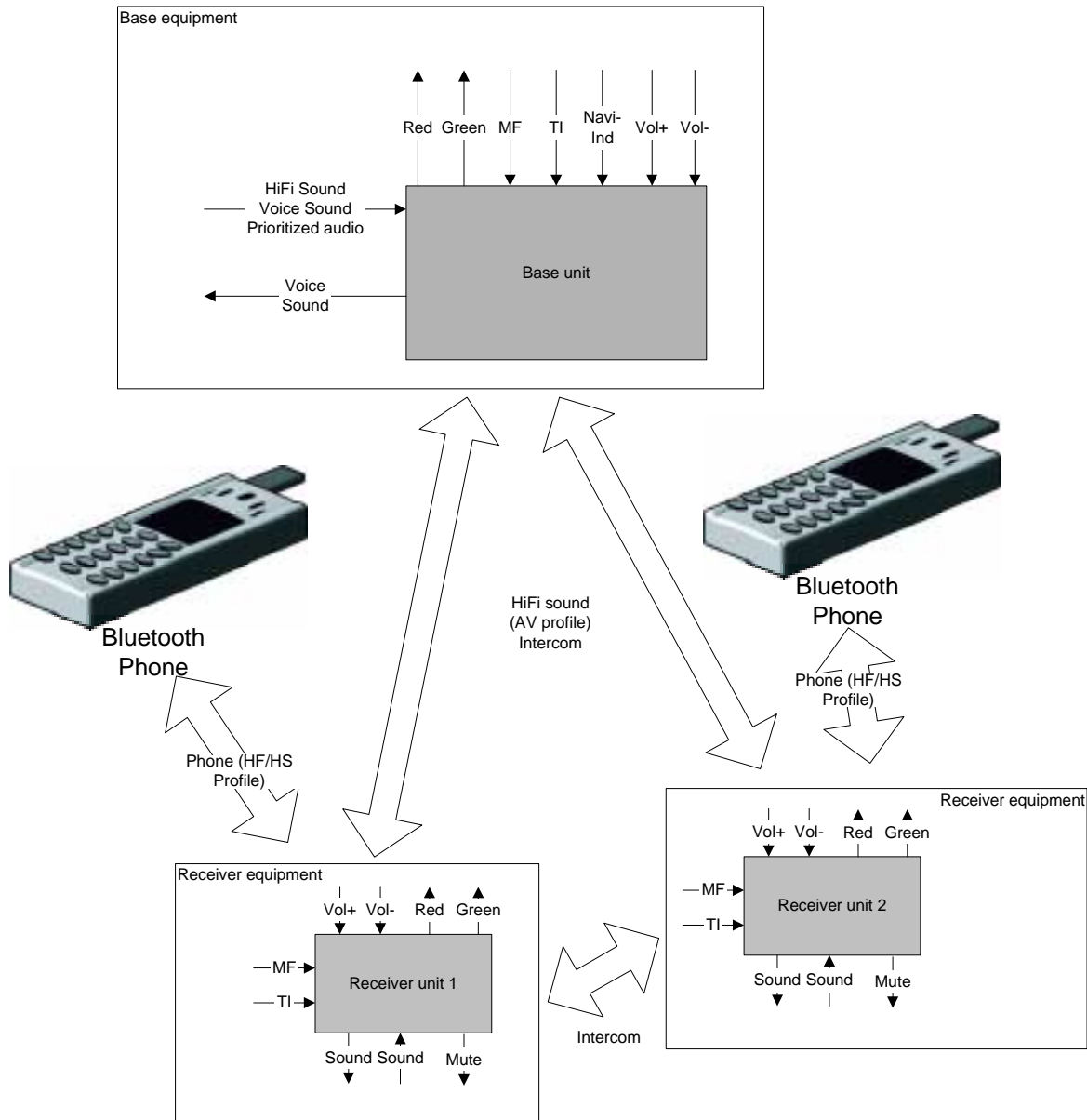# 3 Characteristics

3.1 System Overview

Figure 1 - Overview of the system

The "gray" modules are the Bluetooth units developed in this project. They are interfacing to the surrounding equipment using analog sound inputs/outputs and programmable IO pins used as input

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and output to control the module. "Red" (LED-GREEN in the pinning list, section 3.4), "Green" (LED-GREEN) and "Mute" (NF-MUTE) are outputs and MF (MULTI-FUNCTION), VOL+ (VOL-DOWN), VOL- (VOL-UP) and Talk Indicator (TALK-IND) are inputs (see below for the functionality of these pins).

Priorities
The different sessions have the following priorities (i.e. a session with a higher priority will interrupt one with a lower priority).

1. Phone call

2. Prioritized audio messages

3. Intercom between the base-unit and one receiver.

4. Intercom between the receivers.

5. HiFi audio

3.2 Functional requirements for the Receivers

3.2.1 Bluetooth Profiles Used and Required

The receiver functionality developed is using the Bluetooth Headset Profile, Headset Role and the Hands-free Profile, Hands-free role, as described in reference [3] and reference [4]. It also support the Advanced Audio Distribution Profile acting as an Audio Sink, see reference [2].

The unit may be interfaced over Bluetooth to external devices (e.g. phones) supporting the Bluetooth Headset Profile, Audio Gateway Role or the Bluetooth Hands-free Profile, Audio Gateway Role.

3.2.2 General Module Interface

On the receiver there are 3 input pins, volume+ (VOL-UP), volume- (VOL-DOWN) and a multi-function input (MULTI-FUNCTION) used as the main user inputs (later called VOL+, VOL- and MF inputs). These may be used in different combinations to initiate different actions. Some actions may be initiated by keeping an input activated for a certain amount of time.

There is Talk Indicator input pin (TALK-IND, later called TI), which must be generated by the host electronic on the receiver. The TI shall move from inactive to active when the receiver user starts to talk. The TI shall move back from active to inactive when the when the user stops to talk AND when no sound is heard in NF Out left and NF out right.

A Mute output pin (NF-MUTE) is used to mute the sound when required. When active the sound shall be muted by the host electronics.

Two LED output pins (red and green) and the ability to generate sound on the sound output are used as indicators. It uses both LED combinations and blinks respective the sound to indicate multiple modes and other indications.

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See Figure 1 for an overview of how the Bluetooth module is interfacing the rest of the Receiver electronics.

The user interface consists of three main modes.

- Setup (indicated with very fast green blinks on the LED PIO). Later called LED-Setup.

- Idle (indicated with slow green blinks on the LED PIO). Later called LED-Idle.

- Pairing (indicated with fast green blinks on the LED PIO). Later called LED-Pair.

- Connected (indicated with permanent green light on the LED PIO). Later called LED-Connect.

The LED PIOs and sounds are also used to indicate if a user action was successful or not. Two different indications are used:

- Successful operation. A "light" sound (OK sound) and a very long blink with the green LED PIO. Later called IND-Success.

- Unsuccessful operation. A "dark" sound (Fail sound) and red LED PIO flashes three times. Later called IND-Fail.

To indicate an incoming call from a phone an internally generated ring sound is used (later called IND-Ring).

The idea behind the user interface is that all normal actions are made with the MF input or no inputs at all. More specialized functions are made with the volume inputs.

3.2.3 Power on and shut down the receiver

The receiver is powered up by activating the MF input more than 2 seconds. Now the receiver starts in setup mode and issues an IND-Success indication. When the module is started the Mute pin is activate and then it will be set inactive during normal operation. The Power On pin is set to active to control the power supply.

Activating the MF input more than 2 seconds shut down the receiver (in all modes except when there is an ongoing phone call). When the receiver is ready to power down, the IND-Fail indication is issued. To get rid of click sounds, the Mute pin is activated. After the MF input is deactivated the system waits for 1 second and finally the PowerOn pin is deactivated to shut down the board.

3.2.4 Setting up the receiver

After the receiver is powered up the receiver is in setup mode, now pairing of the receiver can be performed.

To leave the setup mode activate the MF input shortly. The receiver goes into idle mode.

3.2.4.1 Pairing the receiver

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Pairing is performed in setup mode only.

3.2.4.1.1 Pairing with a phone

Activate the VOL+ input shortly (less than 2 seconds). The receiver goes into pairable mode (indicated by LED-Pair) and the receiver will be discoverable for other units. Initiate the pairing from the phone (the method for doing this is dependant on the phone used). Use the hard-coded PIN code value for the receiver ("0000").

The receiver will stay pairable for 60 seconds.

At a successful pairing a "successful operation" is indicated by IND-Success. If the pairing fails an "unsuccessful operation" is indicated (IND-Failure).

After a pairing (successful or unsuccessful), the receiver returns to the setup state.

3.2.4.1.2 Pairing with another Receiver

Activate the VOL+ input on the first receiver shortly (<2 seconds). The receiver goes into pairable mode (indicated by LED-Pair) and the receiver will be discoverable for other units.

Activate the VOL+ input long (>2 seconds) on the second receiver. The receiver will enter pairing mode and will start to search for the other receiver (indicated by LED-Pair).

At a successful pairing a "successful operation" is indicated (IND-Success). If the pairing fails an "unsuccessful operation" is indicated (IND-Fail).

After a pairing (successful or unsuccessful), the receiver returns to the setup state.

3.2.4.1.3 Pairing with the Base Unit.

Activate the VOL+ input shortly (less than 2 seconds). The receiver goes into pairable mode (indicated by LED-Pair) and the receiver will be discoverable for other units. Initiate the pairing from the Base Unit (see section 3.3).

3.2.4.1.4 Remove pairing information

Activating VOL- long (>2s) will remove all pairing information from the receiver. A "successful operation" is indicated (IND-Success). This is only allowed in the SETUP state.

3.2.5 Receiver Operation States

The receiver may be in six different states:

1. Setup state. This is the initial state. Pairing of the receiver can be performed. Indicated on the LED PIOs by LED-Setup.

2. Idle state. No communication links are active. Indicated on the LED PIOs by LED-Idle.

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3. Intercom state. Intercom between the two receivers is active. Indicated on the LED PIOs by LED-Connect.

4. Phone state. An active phone call is connected. Indicated on the LED PIOs by LED-Connect.

5. AV state. An active Hifi quality sound session is active. Indicated on the LED PIOs by LED-Connect.

6. Walkie-talkie state. An active intercom session between the base unit and the receiver is active. Indicated on the LED PIOs by LED-Connect. (This state can only exist in one of the receivers, the one first paired with the base unit)

Observe that a prioritized audio message session will use an active HiFi or walkie-talkie session for transmitting the information to the receiver. If there is no active session, a walkie-talkie session will be created, i.e. there is no specific prioritized audio message session in the receiver.

3.2.6 Intercom State Functionality

Intercom state may be entered from either AV state or Idle state. The Talk Indicator (TI) is used to initiate and leave the Intercom state.

3.2.6.1 Entering intercom state initiated from the receiver

1. The TI activity is not monitored if no other receiver is paired with the current receiver.

2. The receiver monitors the TI (if in Idle or AV mode only). If TI moves from inactive to active the receiver will try to establish an intercom session to the other receiver.

3. If there is an on-going AV session this session will immediately be closed down before the intercom session is established.

4. If the establishment fails the IND-Fail indication is issued and the control is moved back to the previous state. If the previous state was the AV state the AV session will be re-established (the AV sound is faded in). If the previous state was Idle and the TI is active a retry is performed once every 8-20 seconds (randomly).

3.2.6.2 Entering intercom state initiated from the other receiver

1. If we are in the Phone state the incoming request is rejected.

2. If we are in the AV state the AV session will be closed down.

3. The incoming request is accepted, the receiver is set to the Intercom state.

3.2.6.3 Closing down an intercom session

1. The TI is monitored continuously.

2. If the previous state (the state before entering Intercom) was the Idle state and the TI been inactive for more than 120 sec (or 10 sec if a request to initiate an AV session was received

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during the Intercom session) the Intercom session is terminated and the receiver is moved to Idle state.

3. If the previous state was the AV State and the TI been inactive for more than 10 sec the Intercom session is terminated.
An AV connection is initiated and faded in. If successful, the unit is moved to the AV State. If unsuccessful an IND-Fail is issued and the unit is moved to the Idle state.

For the operation on an incoming phone call or a request to initiate an intercom session with the base unit see sections 3.2.7 and 3.2.9.

3.2.7 Phone State Functionality

3.2.7.1   Receiving an incoming phone call on a receiver

1. The phone connects to the receiver and issues a request to accept a call.

2. An ongoing intercom session or AV session is interrupted.

3. An internal generated ring signal (IND-Ring) is played in the receiver.

4. Activate the MF input shortly to reject the call.

5. The call will automatically be accepted after 5 seconds. The unit is moved to the Phone state.

3.2.7.2   Stopping a phone call

1. The call is stopped either by activating the MF input for more than 2s or when the calling phone is canceling the call.

2. If previous state (the state before the Phone issued the call) was the AV state, an AV session will be re-established, the sound is faded in and the unit is moved to the AV state. If unsuccessful an IND-Fail is issued and the unit is moved to the Idle state.

3. If an intercom session was active when the phone call was initiated the intercom session will automatically be re-established if the talk indicator (TI) is active. Otherwise the unit is moved to the Idle state.

4. If an intercom session with the base unit was active when the phone call was initiated the unit will be moved to the Idle state.

5. If the previous state was the Idle state the unit is moved to the Idle state.

3.2.7.3   Transferring a phone call to and from the phone

1. An ongoing phone call is transferred to the phone by a short activation of the MF input. The unit is moved to the previous state except for an intercom session with the base unit when it is moved to the Idle state instead.

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2. If the unit is in the Idle state a phone call is transferred back from the phone to the receiver by an activation of the MF input.

3.2.8 AV State Functionality

The AV state is always initially initiated from the base unit (or other AV device). Initial procedure:

1. The Receiver receives a request to initiate an AV session.

2. If the Receiver is in any other state than the Idle state the request will be rejected.

3. If the Receiver is in the Idle state the request will be accepted and the Receiver is moved to the AV state. If unsuccessful an IND-Fail is issued and the unit stays in the Idle state.

For the operation on an incoming phone call, a request to initiate an intercom session with the base unit or a request to initiate an Intercom session see sections 3.2.6, 3.2.9 and 3.2.7.

3.2.9 Walkie-talkie (Intercom with the Base Unit) State Functionality

Walkie-talkie state may be entered from either Intercom state, AV state or Idle state. The walkie-talkie state is always initiated from the base unit and can only exist in the first receiver to be paired with the base unit.

3.2.9.1 Entering Walkie-talkie State

This is always initiated from the base unit.

1. If we are in the Phone state the incoming request is rejected.

2. If we are in the AV state or Intercom state the ongoing session will be interrupted.

3. The incoming request is accepted, the receiver is set to the Walkie-talkie state.

3.2.9.2 Closing down a walkie-talkie session

This is always initiated from the base unit.

1. The termination request is accepted.

2. The receiver is moved to Idle state.

For the operation on an incoming phone call see section 3.2.7.

3.2.10 Low battery indication

The battery voltage is monitored and three warning levels are used.

Level 1 (below 3.6 V). One low battery sound is played and single red flash on the LED PIOs is displayed periodically (every 60 s). Called IND-Battery1.

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Level 2 (below 3.5 V). Two low battery sounds are played and two red flashes on the LED PIOs are displayed periodically (every 60 s). Called IND-Battery2.

Level 3 (below 3.4 V). Three low battery sounds are played and three red flashes on the LED PIOs are displayed periodically (every 60 s). Called IND-Battery3.

When the battery voltage goes below 3.3 V the receiver is shut down.

3.2.11   Volume Control

There is NO volume control management available on the Bluetooth Unit. All volume control is performed locally on the receiver by the receiver's audio electronics. When the VOL+ and VOL-inputs are activated in connected mode (AV, Phone and Intercom state), no actions are taken by the Receiver Unit.

3.3 Functional requirements for the Base Unit

3.3.1 General

The Base Unit is using the same Bluetooth unit as the Receivers but with a different firmware.

3.3.2 Bluetooth Profiles Used and Required

The Base Unit functionality is developed using the Advanced Audio Distribution Profile, acting as an Audio Source, see reference [2].

3.3.3 General Interface

The Base Unit communicates to its host using programmable inputs and outputs. See Figure 1 for an overview of how the Bluetooth unit is interfacing other parts of the base unit electronics.

It is using the same basic inputs as the Receiver (see section General Module Interface) with the following additional input:

- A navigation indication input (NAVI-IND) later called NI.

It is using the same basic indicators as the Receiver (see section General Module Interface) with the following additional indicators:

- LED-Success. Indicated by three green flashes on the LED PIOs.

- LED-Fail. Indicated by three red flashes on the LED PIOs.

3.3.4 Base Unit Operation States

The Base Unit may be in three different states:

1. Idle state. This is the initial state. No communication activity. Indicated by LED-Idle.

2. AV state. A HiFi quality sound session is active. Indicated by LED-Connect.

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3. Walkie-talkie state. An intercom session with a receiver is active. Indicated by LED-Connect.

Prioritized audio messages (e.g. navigation information from GPS) does not use a separate state. Instead the information is sent via walkie-talkie or AV.

3.3.5 AV State

AV state may be entered from the Idle state. MF is used to initiate and leave the Intercom state. This state is indicated by LED-Connect.

3.3.5.1 Establish an AV session

1. If MF moves from inactive to active the base unit will try to establish an AV session.

2. If the establishment succeeds the IND-Success indication is issued and the Base Unit is moved to the AV state.

3. If the establishment fails the IND-Fail indication is issued and the control is moved back to the Idle state. If MF is still active a retry is performed once every 30 seconds.

4. A receiver may request to set-up the AV connection. When the connection request is accepted the Base Unit is moved to the AV state

3.3.5.2 Establish an AV session initiated from a receiver

This is performed when a receiver wants to re-connect after it has interrupted an AV session due to an incoming phone call or an intercom session.

1. The base unit receives a request to initiate an AV session.

2. If the base unit is in any other state than the Idle state the request will be rejected.

3. If the Receiver is in the Idle state the request will be accepted and the base unit is moved to the AV state.

3.3.5.3 Stopping an AV session

If the MF drops from active to inactive the AV connections will be terminated and the unit moves to the Idle state.

If a receiver requests to terminate the AV connection (e.g. the receiver is moved out of range, receives a phone call or is powered off) the base unit is moved to the Idle state.

3.3.6 Idle State

The Base Unit is moved to Idle state if both the MF and TI drops from active to inactive state. All open connections to the receivers are closed down.

As long as TI is high a retry to set up a walkie-talkie session is performed every 5 seconds.

As long as MF is high a retry to set up the AV connection is performed every 30 seconds.

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If VOL- goes high all pairing information is erased. IND-Success indication is issued when finished.

The Idle stat is indicated by LED-Idle.

3.3.7 Pairing State

Pairing state may be entered from the Idle state only.

1. Pairing state is entered when VOL+ is moved inactive to active state.

2. If two receivers already are paired no searching will be performed and an LED-Fail indication will be issued. To perform a successful pairing the pairing information has to be erased (see 3.3.6).

3. In pairing state the Base Unit is searching for a Receiver in pairable state. If a receiver is found the predefined key (0000) is used to pair with the receiver and LED-Success is indicated.

4. If it was the first receiver paired it will be stored as the first receiver. If it was the second it will be stored as the second receiver. If no second receiver is used and a the first receiver has to be re-paired the pairing information has to be erased (see 3.3.6).

5. The searching is active for 60 seconds and if the searching fails the LED-Fail indication is issued.

6. In all cases the Base Unit is moved back to idle state when finished.

3.3.8 Walkie-talkie State

Walkie-talkie state may be entered from either AV state or Idle state. The walkie-talkie state is never initiated from a receiver and will only connect to the first receiver paired with the base unit.

3.3.8.1 Entering Walkie-talkie State

This is always initiated from the base unit.

1. If TI moves from inactive to active the base unit will try to establish an intercom session with the first receiver paired with the base unit.

2. If there is an on-going AV session this session will immediately be closed down before the intercom session with the first receiver paired with the base unit is established.

3. If the establishment succeeds the LED-Success indication is issued and the Base Unit is moved to the walkie-talkie state.

4. If the establishment fails the LED-Fail indication is issued and the control is moved back to the Idle state. If TI is still active a retry is performed once every 5 seconds.

3.3.8.2 Closing down an intercom session with the first receiver paired with the base unit

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1. The TI and NI are monitored continuously.

2. When both the TI and NI become inactive the intercom session with the first receiver paired with the base unit is terminated.

3. If the previous state was the Idle state or the MF is inactive the base unit is moved to Idle state.

4. If the previous state was the AV State and the MF is active an AV connection is initiated. If successful, the unit is moved to the AV State. If unsuccessful an LED-Fail is issued and the unit is moved to the Idle state.

The intercom session with the first receiver paired with the base unit can be terminated from the receiver if it receives a phone call. Then the termination request is accepted and the base unit is moved to the Idle state. If the TI is still active a retry to establish an intercom session with the first receiver paired with the base unit is performed every 5 seconds.

3.3.9 Prioritized Audio Messages functionality

The prioritized audio messages (e.g. navigation information from GPS) functionality does not have an own state. It uses the active session to transmit the info to the receiver(s). The NI becomes active before the navigation info is sent and goes inactive when the info is finished.

1. If an AV session is active the navigation info is sent to the receivers using that.

2. If an intercom session with the first receiver paired with the base unit session is active the navigation info is sent using that.

In both cases the Bluetooth unit does not actively use the NI.

If the base unit is in the Idle state and the NI becomes active an intercom session with the first receiver paired with the base unit is established and the navigation info is sent using that. The intercom session with the first receiver paired with the base unit is terminated according to 3.3.8.2.

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3.4 Electrical interface requirements

3.4.1 Overview
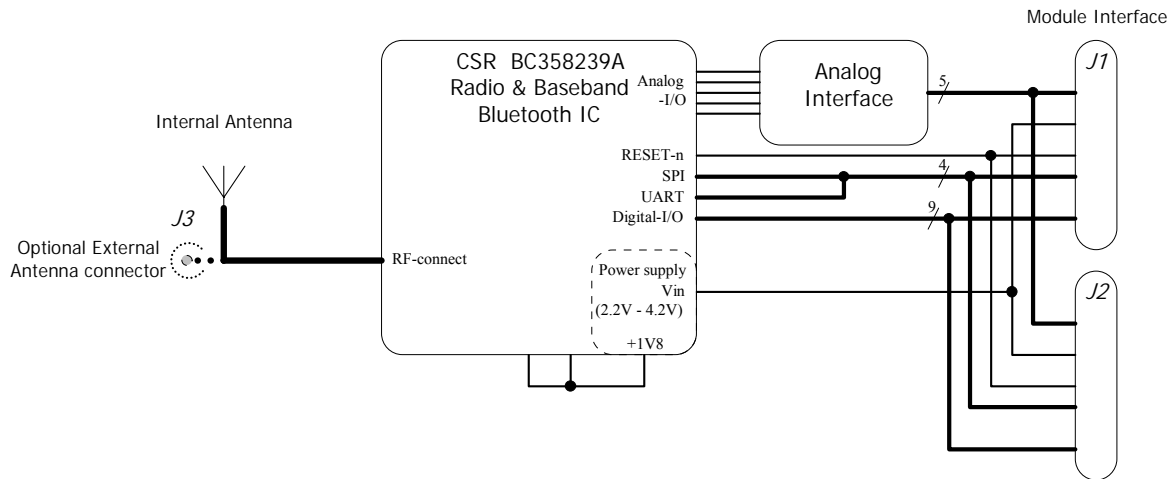
Figure 2 - HW Block Diagram

The Bluetooth unit is based on the Cambridge Silicon Radio Bluecore3 Multimedia chip (BC358239A). This chip includes a processor (for the Bluetooth stack and application), a DSP (for handling of the audio encoding/decoding) and the necessary analog to digital and digital to analog converters.

The unit will use 3 inputs and 2 LED ouputss (red + green light) as a user interface with the functionality described previously. These will be connected in a connector (J1 and j2) and not mounted on the board. The buttons are directly connected to the CPU.

The audio in will come into the system from connected to the connector. There is a possibility for separate left and right channel sound input.

The audio out will be feed from the system separated into a left and a right channel.

The unit will also have a connector to an 8 bits A/D converter included in the base band circuit that is used to check the battery voltage.

There are 2 connectors available on the unit:

- 30 poles flex film connector with base functionality (J1). The flex film connector pin usage is designed to be compatible with the generation 1 module wherever possible. Se tables below for exceptions from this.

- 30 poles Board-to-Board connector mounted on the bottom side of the unit (J2).

3.4.2 Audio Signal Interface

The Audio output signals can has the following behavior:

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1. AC or DC coupled differential output capable of driving $2V_{pp}$ into 600 Ω, maximum load impedance is 22 Ω.
   DC bias level is 0.8 V

The Audio-input signals has the following behavior:

1. Differential line input, input impedance 130 kΩ.

Use the left channel for mono input signal is needed only (e.g. inside the receivers).

Connector pin nr.	Pin Name	Type	Description
1	NF-OUT-INVL	Audio Output	Left audio output.
2	NF-OUT-L	Audio Output	Left audio output.
3	NF-OUT-INVR	Audio Output	Right audio output.
4	NF-OUT-R	Audio Output	Right audio output.
5	MIC-INPUT-INVL	Audio Input	Left audio input. Used when mono only is required.
6	MIC-INPUT-L	Audio Input	Left audio input. Used when mono only is required.
27	MIC-INPUT-INVR	Audio Input	Right audio input. Required for stereo input. Replaces a VCC pin on generation 1.
28	MIC-INPUT-R	Audio Input	Right audio input. Required for stereo input. Replaces a GND pin on generation 1.

3.4.3 Analog IO

The analog input signal level is between 0 – 5.5 V. This input is used for battery supervision.

Connector pin nr.	Pin Name	Type	Description
8	AN-IN	Analog Input	Connected to Bluecore3-MM via a resistive voltage divider.

3.4.4 Logic level SPI-communication

This interface is used for debugging and FW download purposes.

Connector pin nr.	Pin Name	Type	Description

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9	SPI-MISO	SPI	
10	SPI-CLK	SPI	
11	SPI-MOSI	SPI	
12	SPI-CSB	SPI	
14	RESET-N	Digital IO	Reset. Active low.

3.4.5 Digital IO

The module digital interface voltage input levels are logic level CMOS i.e. VIL < 0.3 x VCC VIH > 0.7 x VCC.

All digital I/O-signals have weak pull down and will function as inputs after reset until reconfigured by software.

Connector pin nr.	Pin Name	Type	Description
15	NAVI-IND	Digital IO	Input. Active high.
16	TALK-IND	Digital IO	Input. Active high. See section 3.2 for the functionality of the pin.
17	POWER-ON	Digital IO	Output. Active high. Controls the power supply unit.
18	NF-MUTE	Digital IO	Output. Active low. Used to mute the audio amplifier when needed.
19	LED-GREEN	Digital IO	Output. Active high. See section 3.2 for the functionality of the pin.
20	LED-RED	Digital IO	Output. Active high. See section 3.2 for the functionality of the pin.
21	MULTI-FUNCTION	Digital IO	Input. Active high. See section 3.2 for the functionality of the pin.
22	VOL-DOWN	Digital IO	Input. Active high. See section 3.2 for the functionality of the pin.
23	UP	Digital IO	Input. Active high. See section 3.2 for the functionality of the pin.

3.4.6 Power Connections

The module supply voltage can be between 3 – 3.3 V. The +3V signal on pin 24 will be connected to VCC internally on the module.

Connector pin nr.	Pin Name	Type	Description
7	GND	Power	Module GND

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13	GND	Power	Module GND
24	+3V	Power	Power output from onboard regulator
25	VCC	Power	Positive supply voltage
26	VCC	Power	Positive supply voltage
29	GND	Power	Module GND
30	GND	Power	Module GND

3.5 Mechanical Requirements

3.5.1 PCB Outlines

The size of the unit is 22 by 35 mm.
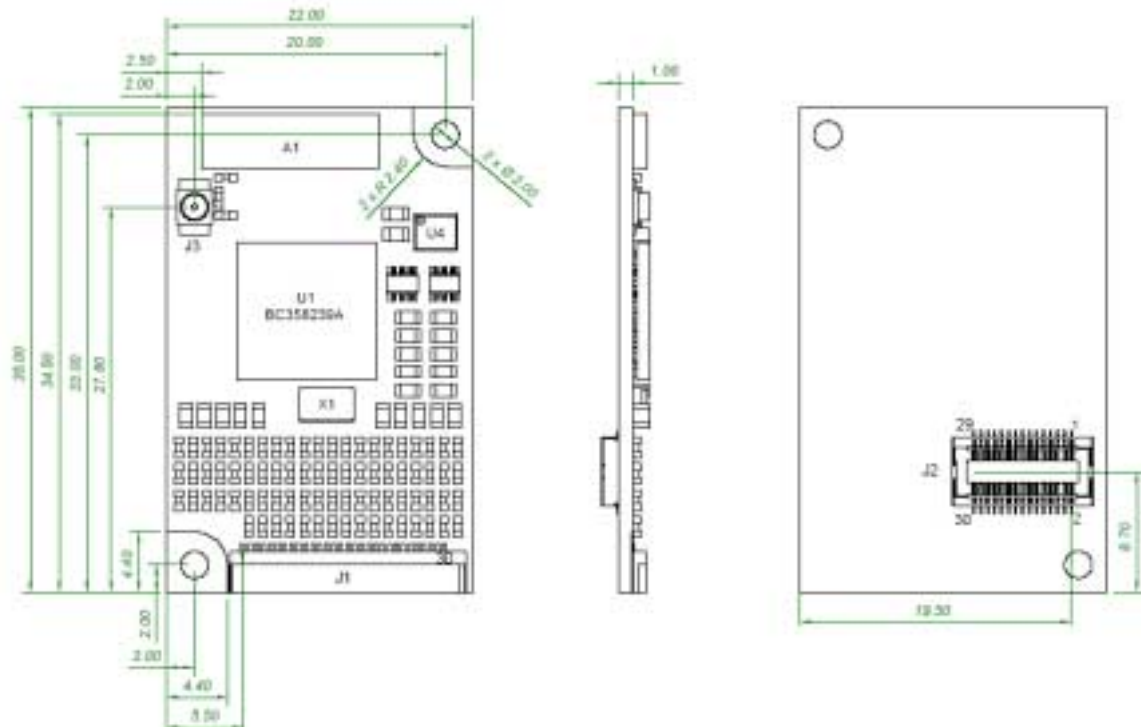
Figure 3 - PCB outline

3.5.2 Mounting

Two connectors are available:

1. 30-pol flex film connector, 0.5 pitch, on the topside of the board.

2. Board-to-Board connector Molex 54722-0307. Mounted on the bottom side of the board.

For the pining numbering see the drawing in Figure 3.

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There are two mounting holes available on the board (see Figure 3).

3.5.3 Environmental requirements

The environmental requirement follows the *connectBlue Environmental Standard* [1].

The operating temperature range with guaranteed radio performance is from -25°C to +85°C.

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4 Regulatory

4.1 FCC Compliance

4.1.1 FCC Statement

This device complies with RF-exposure evaluation for portable devices in FCC rules section 2.1093.

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna

- Increase the separation between the equipment and receiver

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected

- Consult the dealer or an experienced radio/TV technician for help

4.1.2 Labeling Requirements for End Product

For an end product using the OEM Serial Port Adapter or the OEM Bluetooth Enabler there must be a label containing, at least, the following information:

> This device contains
> FCC ID PVH072002

The label must be affixed on an exterior surface of the end product such that it will be visible upon inspection in compliance with the modular approval guidelines developed by the FCC.

Where the module will be installed in final products larger than 8 cm x 10 cm following statement has to be placed ONTO the device.

"This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:

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(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation."

In case, where the final product will be installed in locations where the end-consumer is not able to see the FCC ID and/or this statement, the FCC ID and the statement shall also be included in the end-product manual.

4.1.3 Caution

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

4.2 IC Compliance

"Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received,

including interference that may cause undesired operation."

4.3 Safety

Must be supplied by a limited power source in according to EN 60950-1. In this case no fire enclosure is necessary. But the installer is responsible for the correct electrical installation!

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5 Document history

Version	Date	Comment
1	2005-03-29	Initial version

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Appendix 1 – Receiver State Chart

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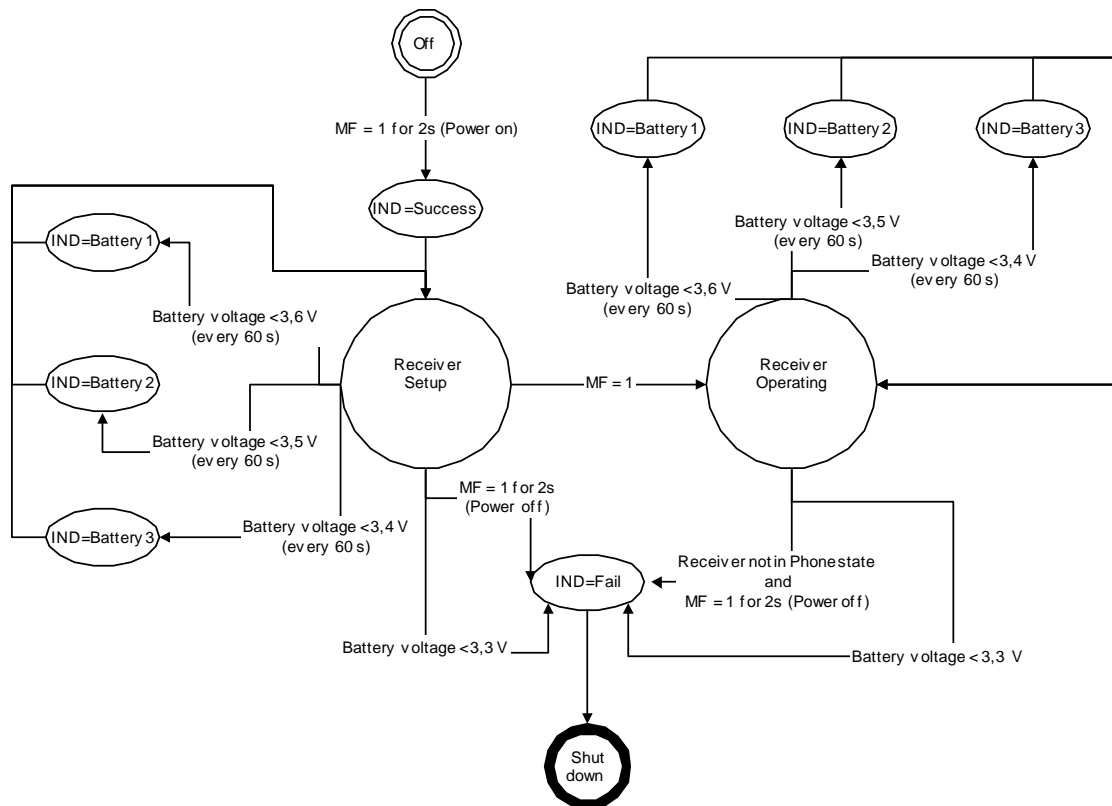
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Appendix 2 – Receiver Operating State Chart

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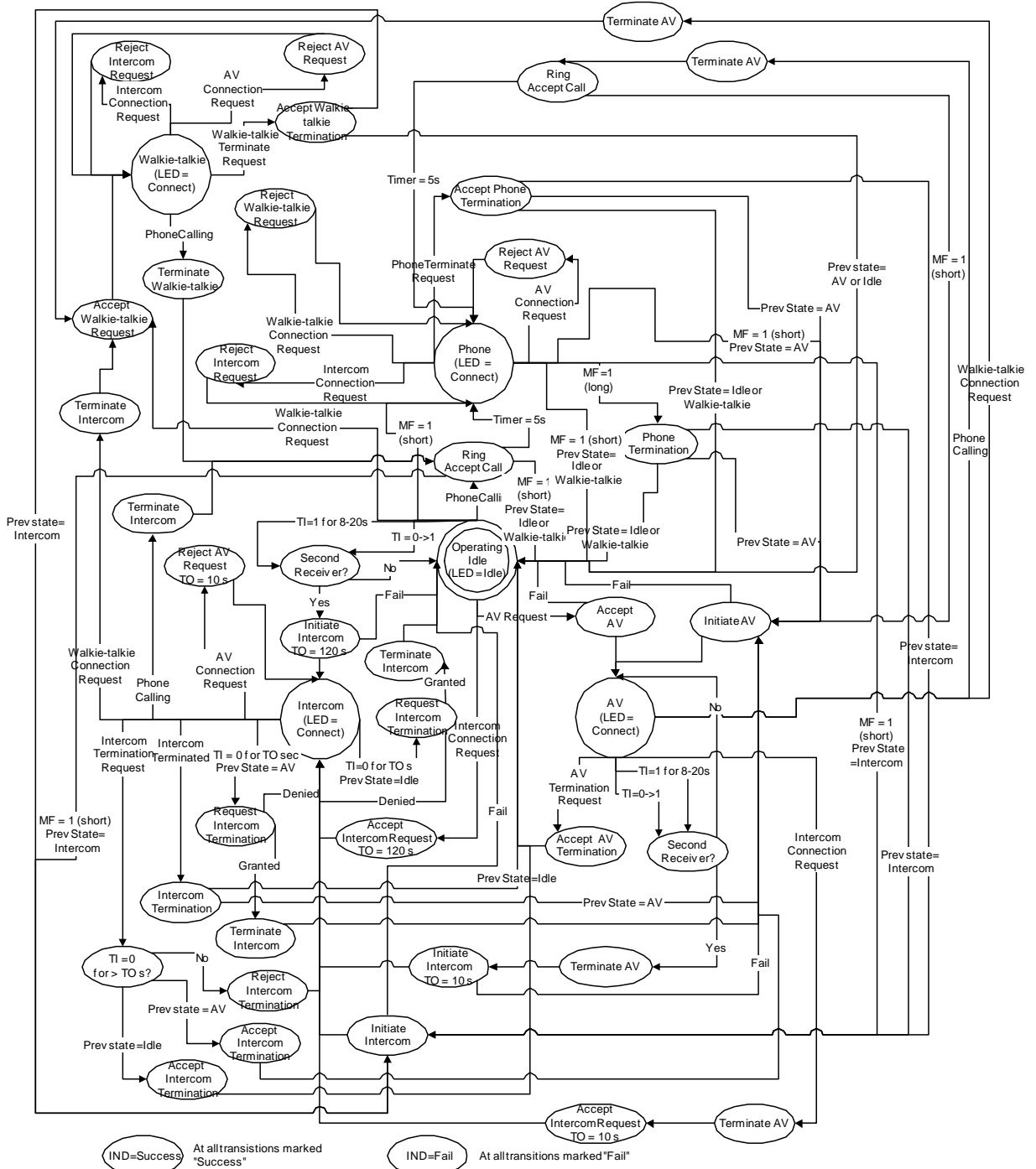
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Appendix 3 – Receiver Setup State Chart

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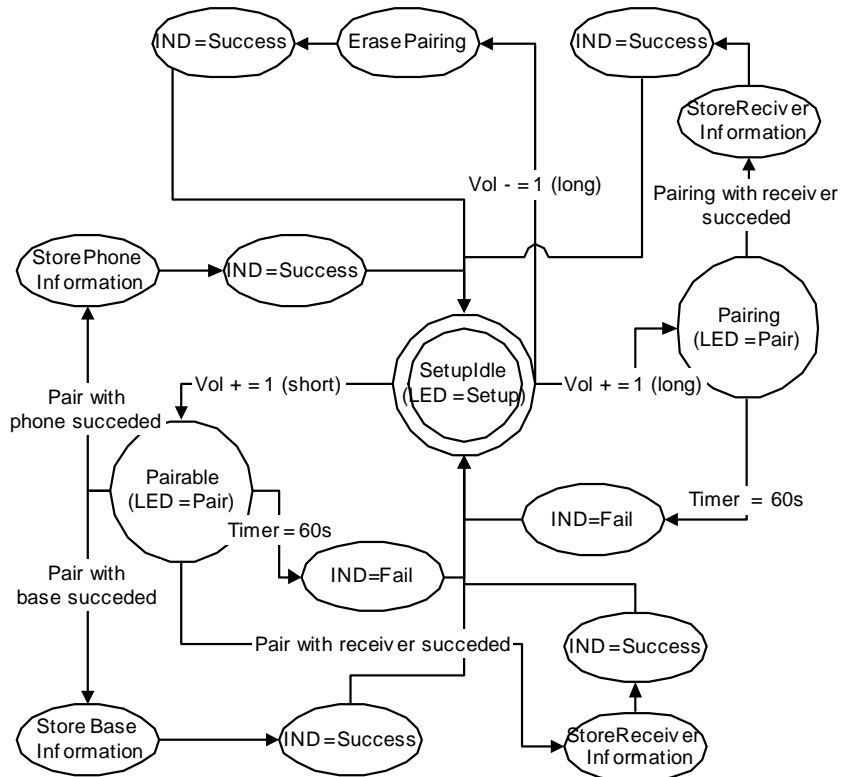
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Appendix 4 – Base Unit State Chart

Prev state = AV and MF = 1

Prev state = Idle or MF = 0

Reject AV Connection

AV Connection Request

Accept Walkie-talkie Terminattion

Accept AV (SR) Terminattion

Walkie-talkie Termination Request

SendGPS Info

AV Termination Request

Terminate AV (SR)

TerminateWalkie-talkie

TI = 1->0 and NI = 0

NI = 1->0 and TI = 0

Walkie-talkie (LED = Connect)

NI = 0->1

NI = 0->1

MF=1->0 or TI=0->1

AV (SR) (LED = Connect)

Accept AV (SR) Connection

SendGPS Info

SendGPS Info

Success

Yes

Prev state = AV and MF = 1

Success

Success and NI = 1

Initiate AV (SR)

Yes

Second Receiver?

Terminate AV (FR)

TI = 0->1

Accept AV (FR) Connection

InitiateWalkie-talkie

Second Receiver?

MF= 0->1

NI = 0->1

AV (FR) (LED = Connect)

TI = 1 for 5s

NI = 0->1

MF=1 for 30s

AV Connection Request

No

StoreSR Information

Fail

Fail

No

Success

AV Connection Request

TI = 0->1

Idle (LED = Idle)

MF=0->1

MF=1 for 30s

Initiate AV (FR)

Yes

StoreFR Information

No

Second Receiver?

Vol+=1

AV Termination Request

MF=1->0

Terminate AV (FR)

Success

Fail

Vol-=1

Success

Accept AV (FR) Termination

Pairing (LED=Pair)

FR = First Receiver
SR = Second Receiver

Erase Pairing

IND=Fail

Timer=60s or 2Receivers paired

IND=Success — At all transistions marked "Success"

IND=Fail — At all transitions marked "Fail"