



Parrot FC6050

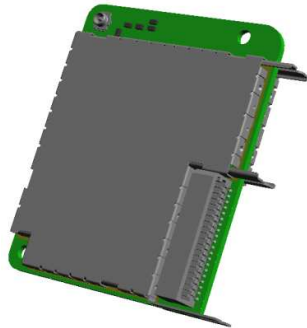
FC6050B and FC6050W

Version 1.67

August 2011

Parrot FC6050B

Full connectivity platform
Bluetooth 3.0



Application:

- Telephony
- Bluetooth 3.0
- Audio streaming
- USB, SD
- iPod management

The FC6050B includes the latest version of the Parrot Bluetooth software stack (Blues). Blues provides a very high level of compatibility with most of the phones available on the market today. It also provides phonebook and call list synchronization.

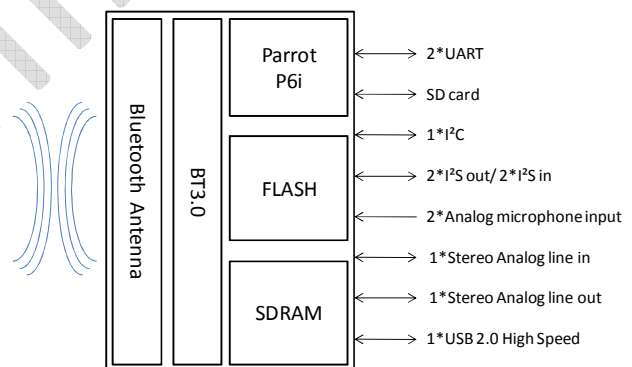
The FC6050B also includes Concertos, a Parrot proprietary database management library used for the management of audio files. Concertos facilitates management of audio from all available storage media such as USB/IPOD, SD, PHONE/A2DP. Concertos manages the media devices, builds a database with metadata, browses the compressed audio files by artist/genre/title and plays them. FC6050 offers the possibility to use a Speaker Independent Voice Recognition (SIVR) and a Text To Speech algorithm (TTS). The FC6050B software is built upon the Linux operating system. The library RAP gives the possibility to recognize song titles or artist name

FEATURES

Bluetooth 3.0 qualified module
iPod chip management,
SD card management
Piconet and scatternet support
Standard single 3.3V supply
UARTs, I²C,
USB 2.0 High Speed,
Digital audio input and output
Analog audio input and output
Module dimension 34.5 x 41.35 mm x 4.60mm
Automotive qualified.

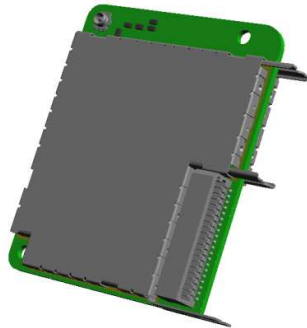
Description:

The Parrot FC6050B is a complete connectivity solution. It offers a large variety of interfaces for easy integration in most applications.



Parrot FC6050W

Full connectivity platform
 Bluetooth 3.0+HS,
 Wi-Fi (802.11 b/g/i)



Application:

- Telephony
- Wi-Fi
- Bluetooth 3.0+HS
- Audio streaming
- USB
- IPod management
- UPNP server synchronization

In addition to the features supported by the FC6050B, the FC6050W supports also WiFi connections (ad Hoc, station, AP) and Bluetooth 3.0 + HS.

FEATURES

Bluetooth 3.0+HS qualified module
 IPod chip management, Wi-Fi b/g/i/j
 Piconet and scatternet support
 Standard single 3V3 supply
 UARTs, I²C,
 USB 2.0 High Speed,
 Digital audio input and output
 Analog audio input and output
 Module dimension 34.5 x 41.35 mm x 4.60mm
 Automotive qualified.

Description:

The Parrot FC6050W is a complete connectivity solution. It offers a large variety of interfaces for easy integration in most applications.

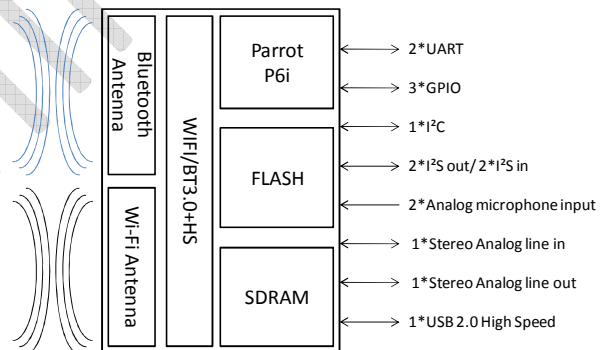


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PRELIMINARY

1 Product overview

The FC6050 is a full connectivity platform designed to ease the integration of connectivity applications in car audio systems, car telematics systems or any system requiring a complete embedded connectivity solution.



1.1 FC6050B/W features:

- **Bluetooth connectivity**
 - Bluetooth Power Class 2 Radio
 - Embedded Bluetooth V3.0+HS (FC6050W only)
 - Multiple profiles running in parallel.
 - Pairing and connection with all Bluetooth Devices: Phones, Smartphones, PDA, etc. Multiple user support: Up to 15 paired phones
- **Wi-Fi (FC6050W)**
 - IEEE 802.11b/g/i compliant (n compliant from 2012)
 - Data rates of 1–54 Mbps for 802.11g (270 Mbps starting 2012)
 - Security support for WPS, WPA2, WPA
 - Ad hoc, station, or Access Point mode
 - Up to 8 devices can simultaneously be connected in AP mode.
- **SD card management (FC6050B)**
- **Full internet access**
 - Internet Access via Wi-Fi (FC6050W only) or HSDPA using USB Dongle or modules or Bluetooth
- **UPNP server access over Wi-Fi. (FC6050W)**

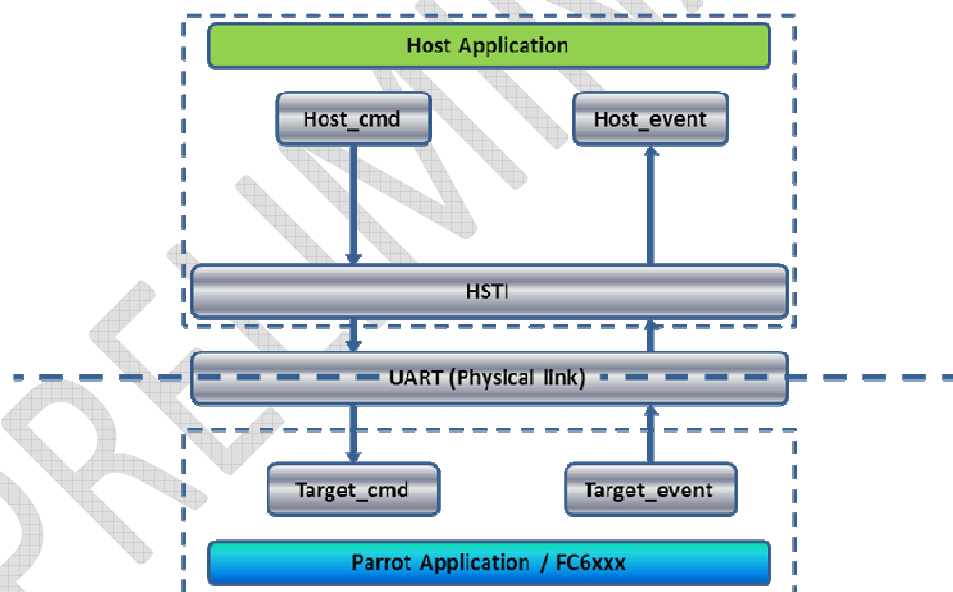


- Personal files (music, pictures, etc) can be downloaded from personal server at home to the car
- Browsing, Streaming and download interfaces
- **Phone**
 - Pick-up, Hang-up, Redial
 - Automatic answer (from host via dial command)
 - Send DTMF during calls
 - Private Mode
 - Multiparty call
- **Phone Book**
 - Automatic Phone book synchronization over Bluetooth (up to 15 paired phones, more than 10,000 contacts per phone, depending on memory available)
 - Call history (dialed number, received calls, missed calls)
 - All Synchronization Methods Supported
 - Specific behaviors applied for the best possible interoperability
 - Full Unicode for compatibility with numerous characters sets (European, Russian, Chinese, Japanese...)
- **Digital Signal Processing**
 - Microphone(s): the module can manage two configurations:
 - Single microphone
 - Two microphones with AMS (Automatic Microphone Selection): 1 for the driver and 1 for the front seat passenger. The best microphone is automatically selected during the call.
 - Noise Reduction (NR)
 - Maximal NR is 25dB.
 - Typical NR is 15dB.
 - No musical noise
 - No fluctuation of the residual noise level
 - Automatic adaptation of the Noise Reduction to the Signal-to-noise ratio (SNR) to keep the best voice quality in idle and remove more noise in noisy conditions.
 - Acoustic Echo Cancellation (AEC)
 - The level of echo attenuation, called ERLE is 45dB (measured according to the VDA process).
 - Comfort Noise feature so that the background noise is adjusted after AEC algorithm, in order to keep it constant for enhanced communication experience.
 - Possibility to accept up to 100ms of delay in the speaker path for digital amplifiers.
 - Full duplex
 - Automatic Level Control (ALC)
 - Different phones can have different Speaker volumes (up to 20dB of difference). It adapts the signal level received from the phone to the target level, quickly and precisely.
 - Equalizer
 - 9 bands equalizer for microphones and speaker paths.
 - Tuning
 - Car independent tuning if the microphone position and specifications are the same.
 - Possibility to tune all parameters of the audio algorithms according to Customer preferences.
 - Wideband speech (from 2012)
 - Support of HFP 1.6
 - All speech processing algorithms will work @ 16 kHz.



- **Audio Streaming**
 - Embedded SBC decoder
 - Embedded MP3 decoder from Thomson Licensing (optional)
 - Embedded AAC decoder from Via Licensing (optional)
 - Stereo audio output
- **Concertos**
 - Concertos is a software Library which acts as a multi-source media player.
 - Concertos enables DISCO playlist browsing on USB, iPod, SD and AVRCP1.4 devices
- **Speaker Independent Voice Recognition (SIVR)**
- **Miscellaneous**
 - Provides Phone Battery Level, Network Signal Level and Carrier Name (depends on phone) to host
 - Embedded test pattern (test commands)
- **Software Update**
 - Full standard software available (free upgrade from Parrot homepage)
 - Software can be updated via Bluetooth, USB, UART
 - Software updates provide long term compatibility with latest Phones, Smartphones, PDAs and Music players
- **External Bluetooth Antenna diagnostic**
- **HSTI**

Parrot provides a library called "HSTI" that facilitates the integration and communication with FC6050 (see §8).



Communication between the host and the FC6050 over UART

2 Software specifications

2.1 *Bluetooth stack*

- HCI (Host Controller interface),
- L2CAP (Logical Link Control and Adaptation Protocol),
- RFCOMM
- SDP (Service Discovery Protocol),
- OBEX (IrDA Object Exchange).
- Channel manager, AMP Manager, HCI AMP (BT 3.0+HS software).

2.2 *Bluetooth profile supported*

- Generic Access Profile
- Phone Management
 - HFP 0.96 - 1.0 - 1.5
 - HSP 1.0
 - SAP (SIM Access Profile, optional)
- Message Management
 - MAP 1.0
- Phone Book
 - PBAP 1.0
 - SYNC 1.1 (IrMC SYNC over BT)
 - SYNCML
 - OPP 1.0 Server/Client (Vcard 3.0)
 - GSM 07.07 AT Commands
 - Nokia synchronization protocol (MBUS)
- Multimedia
 - A2DP (Audio)
 - SBC decoding
 - (optional MP3 decoding)
 - AVDTP
 - AVRCP1.0 / AVRCP1.3 / AVRCP1.4
- Internet connectivity
 - DUN 1.1
 - BNEP, PAN
- Others
 - SPP 1.1
 - BIP
 - SDP
 - FTP 1.0
 - Image transfer over OPP
 - Software update over SPP
 - Remote configuration

2.3 FC6050W Wi-Fi summary

802.11b - 2.4GHz WiFi 11Mbps	Yes
802.11d - "World Mode"	No
802.11g - 2.4GHz WiFi 54Mbps	Yes
802.11h - 5GHz interference avoid	No
802.11i - Security	Yes
802.11j - Japan Standard	No
802.11n - 2.4GHz WiFi 150Mbps	Yes(1)
802.11y - High Power WiFi	No
Access Point support	on reset -firmware change
Ad-Hoc	Yes
Client	Yes
PAN - like Intel Cliffside multi point access	No
WPA2 / WPA	Yes
WAPI (China)	Yes(2)
Coexistence	
2.4GHz	Supported

(1): FC6050 will be capable from 2012:

- Support Wi-Fi 802.11n: Higher throughput in preparation for LTE and longer range for additional use cases.
- Ability to assist in beam forming from the external hotspot
- Supporting simultaneous AP and STA

(2) Available from 2012

3 Bluetooth 3.0+HS use cases (FC6050W)

BT3.0+HS speeds-up Bluetooth profiles (~8 times faster)

- OPP (phonebook), FTP (transfer) and BIP (pictures) profiles already available.
- PBAP (phonebook) and MAP (messaging) will be available from 2012.

4 USB Hub

The FC6050W and FC6050B have one USB port

It is mandatory to use a USB hub external to the module if more than one USB device is connected to the FC6050B/W

5 Wi-Fi features and main scenarios (FC6050W)

The Parrot module can either be configured as a Wi-Fi Access Point (AP), a Wi-Fi station (client) or can be used in ad-hoc mode. As an access point, up to 8 devices can be connected simultaneously.

The host is responsible for:

- enabling/disabling Wi-Fi
- configuring the security level (WEP, WPA, WPA2), and associated passes
- retrieving network information as needed (example: which users are connected)

The FC6050W manages the Wi-Fi network according to the host commands. Regardless, the FC6050W is responsible for:

- taking care of low-level networking tasks
- keeping the host informed of networking events

There are a lot of different possible use cases, you'll find below an overview of the main ones. For more details, please refer to the part 14

5.1 *Share internet connectivity (AP)*



Internet access granted to portable devices in the vehicle

5.2 *Bluetooth High Speed (AP and client)*



The use of the Wi-Fi radio for Bluetooth profiles (see § 3)



5.3 **Universal Plug and play (AP and client)**

Data Terminal Device



Download or stream video and audio files from a UPnP server





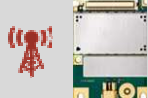









5.4 **Wi-Fi tethering (client)**



The mobile device acts as a modem and provides internet connection to the host

6 Internet connectivity solutions

The FC6050 “full connectivity” modules offer the widest range of internet sources:

Internet source	Transmission to the FC module	HW requisite
 Phone	 Bluetooth DUN	Any FC module
 Phone	 Bluetooth PAN AP	Any FC module
 NAD	 USB	FC6050 NAD module
 3G USB modem	 USB	FC6050 3G USB modem
 Phone	 Tethering over USB	FC6050
 Phone	 Tethering over WiFi	FC6050W
 Hotspot WiFi	 Tethering over WiFi	FC6050W

6.1 Internet sources - Overview

DUN, dial-up-network

The mobile device acts as a modem and provides the data to the module. DUN profile is currently widely supported on the market.

PAN, personal area network

The mobile device supporting PAN-AP (access point) provides the data directly on Bluetooth L2CAP layer in IP packets. The module acts as PAN-U (user).

NAD, network access device, optional feature

An external NAD can be integrated on the customer motherboard. Parrot module manages Telephony, data call, SAP, Phonebook and messaging features of the NAD. All these features are provided to the host using the same upper level commands. The Hardware integration and monitoring are under the customer responsibility. NAD supplier choice shall be jointly agreed with Parrot.

3G USB Dongle

Parrot currently supports over 200 3G dongles worldwide. Compatibility testing is done continually to verify interoperability with new dongles on the market. Test teams are present in the US, Europe, Japan, Korea and China.

USB Tethering

As for DUN and PAN, the device acts as a modem and provides the data to the module over USB. Feature availability is provider and OS dependant. Parrot currently supports Android, iOS, RIM and Symbian OS.

Wi-Fi Tethering

Any mobile device supporting Wi-Fi access point feature can be used by Parrot module as an additional internet source. This feature has to be enabled by the network provider.

6.2 Parrot router:

In order to provide flexible network handling and configuration, Parrot developed a router embedded on the FC6050.

It allows the host to connect any network interface available on the FC6050 (Wi-Fi, 3G modem, DUN/PAN via BT, Tethering over USB, HOST). It is configurable through a user friendly set of AT commands (Parrot's HSTI) and makes it possible to enable internet services (ftp, vnc, http, for example) on each interface.

6.3 Miscellaneous

The FC6050W needs to be informed of the provider's DNS (Domain Name Server) IP address. This information is transmitted to the FC6050W via an HSTI command.

Parrot's FC6050W does not do filtering (firewalling) on the host provided network transactions, except what may be needed for its own safety. Hence, if some filtering must be done for network operator or any other reason, it shall be done by the host. Thus, the host is responsible for the incoming network traffic. Examples include blocking incoming connections, restricting use to http and https protocols, forbidding POP/IMAP use, blocking VOIP etc. (these examples come from common phone operator contractual regulations).

7 Host to FC6050B/W interface details

The architecture relies on 4 key features:

1. **Using USB as a fast, standard physical medium** – USB is used to exchange commands, events, and user data between the host and Parrot's Wi-Fi enabled FC6050W. A USB 2.0 High Speed link has a bandwidth of 480 Megabits per second (60 Megabytes per second). Even with upper layer protocol overhead needed by the USB physical medium, there is more than enough room for a quality network connection. [As a point of reference, a typical PC network interface card (NIC) is 100Mbps. A full-blown heavy duty network server has 1000Mbps (1Giga bit per second) NICs.]
2. **Standard networking over USB protocols** - Just as serial lines have been used as the physical medium for networking for years (reference Point-to-Point Protocol), USB can be used as the physical medium for standard TCP/IP networking. CDC ECM (Communication Device Class, Ethernet Control Model) is the USB - Implementers Forum standard for such use. Using such protocols, the USB connection appears to the operating system as a Network Interface Card (NIC), ready to carry Ethernet frames. From then on, all rich TCP/IP protocol stacks are available.
3. **Parrot's HSTI library uses networking as its logical medium** - The Parrot Host Software Interface (HSTI) library (see section 8) uses a network socket interface, allowing command and event communication as on a network.
4. **An inner, user-hidden network** – This connection simply consists of just two nodes:
 - the host processor
 - Parrot's Wi-Fi enabled OEM module.

The car information and entertainment system can be referred to as the host, and Parrot's FC6050W module as the target. However, from a USB bus perspective (i.e. according to USB standard terminology):

- the host is considered a “*USB device*”
- the Parrot's FC6050W target module is considered a “*USB host*”

The USB terminology of “USB host” and “USB device” does *not* interfere with the notion of master / slave from a system perspective, but rather is a matter of hardware and operating system stack configuration.

The networking architecture *can* be done using FC6050W as an USB device, and the host as the USB host. However, in such a case, the use of USB media devices (for example, MTP or USB flash drive with media files) cannot be done by the FC6050W, even if a USB hub is used.

7.1 *UART*

Alternatively, if no USB port is available on the Host side, a serial port can be used to control the FC6050 using Parrot's HSTI command and control interface over UART.

7.2 **Protocols used**

Two types of protocols are used:

1. Standard networking over USB protocol, carrying both HTSI and internet data.
2. The Parrot's HSTI command and events protocol.

7.3 **Standard networking over USB protocol for data transmission**

The FC6050W handles a USB protocol named CDC ECM (Communication Device Class, Ethernet Control Model) for networking over USB.

CDC ECM is the USB-Implementers Forum SIG standard for networking Ethernet over USB. Widely used for cable DSL modem and USB-Ethernet dongles before the domestic use of NIC became widespread, it has been an official part of the Linux OS since 2003.

CDC ECM goal is to use a USB connection to mimic NICs cards between a USB host and a USB device, with their MAC and configurable IP addresses, able to convey any Ethernet frames. These NICs can then be set up and used as any regular network card would be. From a Linux application point of view, there isn't any difference between a USB CDC ECM network connection and a regular one. Actually, the Linux application is not even aware of physical media used (USB rather Ethernet), since this media is hidden behind the networking stack of the Linux OS.

RNDIS (Remote Network Driver Interface Specification) is Microsoft vendor-specific, non-standard way to carry Ethernet over USB. Although RNDIS is not recommended, RNDIS may be used as a replacement for CDC ECM.

8 **Software interface, HSTI Library**

The FC6050x software interface, HSTI Library, is defined by a high level command set on top of Parrot Libraries.

This interface software is based on the HSTI commands defined by Parrot. These commands are fully documented and the software library is provided by Parrot for easy implementation in the host CPU.

Some commands are used to manage Bluetooth related functions like device pairing and connection management as well as the acoustic and speech recognition functions. Other commands are used to manage Music connected on USB ports.

The HSTI Command List and Bluetooth AT Command Software Specification are available upon request.

The Bluetooth software stack, BLUES, supports Unicode, which allows the management of language accents and allows for phonebook management in any language.

8.1 **Parrot's HSTI protocol for network connectivity**

HSTI is Parrot's standard API used over its product range. It provides a rich yet simple, fully documented set of more than 250 high-level commands to pilot the FC6050. The host sends AT commands, and registers to events to be notified of changes occurring in the FC6050.

HSTI is available and used on Linux operating system.

HSTI can be used over a network socket or a serial line (UART).

Some HSTI commands are specifically designed to handle network connectivity. For examples, see the document "Parrot Host Software Interface Specification". Some networking commands are exemplified below.

The following steps are required in order for the host CPU to establish a dialog and take command of the FC6050;

1. Setup the USB link to FC6050 as CDC ECM.
2. Configure this new Ethernet interface (IP address, netmask, broadcast address). For ease of use, and since there is no added value in making these parameters dynamic, these IP parameters should be fixed in the product (example 192.168.64.1) - to be discussed with Parrot.
3. In the host application, open a standard internet socket. This socket will be used to communicate with the FC6050 via HSTI. The port used for this socket should be a fixed one, that does not interfere with any commonly used protocol (example value: 23000) – to be discussed with Parrot. From this point, regarding communication to the FC6050, the host application will not have to care about networking any more. The socket and USB network connection will be used transparently between the 2 CPUs to carry all HSTI dialog.
4. Register to HSTI events for notification. Events can either be responses from FC6050 to explicit host commands, or unsolicited, asynchronous events such as "new USB stick insertion", or "3G dongle insertion".
5. The host can then send commands to the FC6050 using the HSTI API.

Regarding networking, some additional steps are required. As an example, if the internet connectivity comes from a 3G dongle plugged into the FC6050 (see section 4, scenario 2):

- The FC6050 shall notify the host of the availability of the 3G dongle by sending an event.
- If the host decides to enable the internet connection, it prompts the user, for the PIN code. The prompt and PIN entry is done through the host user interface (screen and keyboard or touch screen).
- The host sends the PIN code to the FC6050, via an HSTI command.
- The FC6050 manages the 3G dongle, and reports connection status to the host (example: connection established, or PIN code rejected)

Some things to notice:

- The host may choose to make the internet connection available to the FC6050 Wi-Fi access point or not. In all cases, the host is in command to dynamically enable or disable capabilities via the FC6050.
- If the internet connectivity comes from the host (section 4, scenario 1), then the DNS IP address has to be sent to the FC6050, using the dedicated HSTI command.
- If the host requires internet connectivity for itself from the FC6050 (section 4, third scenario), then it should do so explicitly and query the FC6050 for the DNS address, again using the dedicated HSTI commands.
- Internet connectivity provided by the FC6050 (second and third use case) is not “all or nothing”. It can be used for;
 - Wi-Fi access point only
 - host only
 - both Wi-Fi access point and host use
 - disabled

In all relevant cases, the internet networking traffic between the host and the FC6050 will use the same network interface established before via USB CDC ECM to carry HSTI commands. This is done transparently so that applications, either on host or on the FC6050, do not need to handle it (unless of course the host application is willing to do so).

As a benefit inherited from its rooted serial line interface, the network traffic generated by the HSTI dialog is extremely low: a typical HSTI query or reply ends up in a dozen or less bytes of payload. Thus, this HSTI traffic does not interfere with the network bandwidth available to Wi-Fi users or the host.

Here is an example demonstrating a typical host-side HSTI sequence to setup Wi-Fi, choose a security level and setup a Wi-Fi network name:

```
/* set the Wi-Fi "on", Access Point mode : */
HSTI_CmdAPI_Send_WSWM(AP);
/* Send access point configuration : set the security protocol to WPA */
HSTI_CmdAPI_SendWAPC(SET, SECURITY, WPA);
/* Access point configuration : the SSID naming the Wi-Fi network is "my car network" */
HSTI_CmdAPI_SendWAPC_STR(SET, SSID, "my car network");
```

9 Memory configurations

The below table provides an idea of the standard memory configuration. This configuration shall be adjusted with Parrot team depending on your features and requirements.

FC6050B&W Configurations:				Number of Languages with VR & TTS	Memory Size	
-Telephony, Phonebook, Audio streaming, BT, Wifi						
- up to 10 phonebooks of up to 5000 contacts each, 5 numbers per contact, 300 SMS						
-Concertos: up to 4 Databases with 40 000 songs each						
RAP: voice recognition multimedia (up to 20 000 artists or albums)						
-Gracenote European or US database						
Memory Configuration	Nuance VR & SVOX TTS	Concertos	RAP(*) Gracenote can be added		FLASH (NAND)	MDDR Mbits
version 1	*	*	*	-	1Gb	256
version 2	*	✓	*	-		
version 3	✓	*	*	1 to 4	2Gb	512
version 4	✓	✓	*	1 to 12	4Gb	512
version 5	✓	✓	✓			

Notes:

- The use of some codecs require that a specific fee to be paid directly to the proper organization
- An iPod chip must be externally connected to the module (via I²C interface)
- Concertos limitation of 3 x 10.000 songs for version 2.

10 Speaker Independent Voice Recognition and Text to Speech

10.1 *Voice Recognition principles*

NUANCE VoCon 3200 V3.3 is a training-less speaker independent speech recognition engine offered on both FC6050B and FC6050W. VoCon 3200 V3.3 features include:

- Voice recognition: words are recognized without previous training
- Acoustic models provide accuracy improvement, especially for digits recognition
- Continuous voice recognition: no need for blanks between words
- New words learning (Voice tags), speaker dependent speech recognition (100 Voice tags, 2kbytes by Voice tag)
- Noise robustness and accuracy in an automotive environment: engine, click-button etc...
- Significant improvement in recognition rate
- Unsupervised speaker adaptation
- User-friendly flexibility for calling phonebook entries, digit dialing, and common command and control
- Supporting the possibility to recognize multimedia names (artists, albums, genres, playlists)
- Users can also control other vehicle functions by voice such as door locks, window motors, and climate control settings
- Simple command and control voice interfaces for AM/FM radio, TV/DAB channels and CDs replace several button presses;
 - “radio ninety seven point nine”
 - “CD play track twelve”

10.2 *Text To Speech (TTS)*

Text to Speech (TTS) on FC6050B & FC6050W is based on SVOX Automotive Speech. SVOX Automotive TTS solutions are tailored for noisy car environments and enjoy a reputation for industry-leading quality. They power many of the most advanced and successful in-dash infotainment systems in the market. SVOX TTS technology is characterized by natural and clear sound as well as unique polyglot capability – the same voice can speak multiple languages like a native speaker.

SVOX TTS is not limited in vocabulary. It can be used to confirm the orders identified by a voice recognition process or for reading vehicle commands, songs titles or phonebook entries.

Abbreviations, tags, symbols (emoticons) are converted into readable text (grapheme-to-grapheme conversion). In addition, the SVOX TTS engine contains an advanced text pre-processor that automatically handles common specifications for date and time.

SVOX provides an excellent quality prosody (i.e. sentence intonation) using state-of-the-art prosody modelling technology. Accent values, phrase types, and phrase boundary positions are taken into account for the determination of the speech melody (pitch contour) and sound durations.



Voice Recognition and TTS voice is available in both FC6050B and FC6050W for the following languages:

01) US English	08) Spanish	14) Turkish
02) CA French	09) Dutch	15) Russian
03) N.A. Spanish	10) Danish	16) Polish
04) UK English	11) Swedish	17) Czech
05) French	12) Portuguese	18) Mandarin Chinese
06) Italian	13) Brazilian Portuguese	19) Korean
07) German		20) Japanese

10.3 **Voice Recognition for Phonebook Access**

The FC6050B and FC6050W support the use of Nuance VoCon 3200 version 3.3 voice recognition algorithms to access phonebook entries. Up to 9 languages can reside simultaneously depending on the size of the flash and RAM (See section 9). Only one language can be active at a time.

10.4 **Voice Recognition for Music Data on external sources**

10.4.1 **RAP**

RAP is an optional Parrot-developed voice recognition gateway. In combination with the voice recognition option and the CONCERTOS software option it provides the user the ability to select music on multiple external sources and to operate player functionalities by voice commands. RAP allows recognition by album title, music type (genre) or artist name regardless of where the media file resides.

The voice recognition latency is, on average, 1.8 seconds for a database size of 20,000 Albums or Artists. The latency can be improved by reducing the number of Albums or Artists (~1s for 10 000). Based on trials with the French Parrot test database the voice recognition accuracy is ~ 85 %.

The maximum number of recognizable items depends on the available memory.

10.4.2 **Gracenote® for Music Data on external sources**

Gracenote's technology is being relied on by many of the world's leading consumer electronic devices and media software applications. Gracenote uses a multi-step recognition method to enable identification, categorization, and organization of digital music. Regardless of source or format, Gracenote gives music fans the tools to manage and enjoy their music collections.

10.4.2.1 **MediaVOCS TM**

MediaVOCS, provided by Gracenote, is an advanced speech-based media database. This database includes phonetic transcriptions for alternate artist, album and track names. Even common names are often multiethnic, abbreviated or nicknames which cannot be recognized by a standard voice recognition database. Based on Parrot studies, adding Gracenote MediaVOCS to the voice recognition improves the recognition rate by a factor of 33% on artist names and 16% on album names.

Gracenote MediaVOCS is available in the following languages:

US English	Italian	Canadian French
UK English	German	Mexican Spanish
French	Spanish	



10.4.2.2 Playlist Plus

Parrot also offers an additional tool from Gracenote known as Playlist Plus™. Designed to work with MediaVOCS, Playlist Plus analyzes the metadata for music brought into the vehicle and offers a variety of playlists for the music library. These playlists may be either pre-set or user customized. In addition, the user may select “More Like This” and hear other songs in the music library of a similar genre to the song currently playing.

10.4.3 Natural Language Understanding (NLU)

The Parrot FC6XX0 product line offers an advanced voice recognition system based on Grammar based NLU (Natural Language Understanding, VoCon3200 version 3.3) With NLU, the user has the ability to control various vehicle feature by voice without "being constrained" by traditional voice recognition menu trees or categories (music, phone book, ...).

All Parrot features and other vehicle functions can be controlled via voice from the press of a single “push-to-talk” (PTT) button.

With NLU, the user can skip the step of narrowing the choices:

- Selection of Phone Number from Phonebook
- “I want to call John Smith”
- “Call John Smith”
- “Call John Smith at home”
- “Call Smith at the office”
- “Call John Smith on Mobile
- Selection of Music from Music Library
- “Play something from John Mayer”
- “Play Parachutes from Coldplay”
- “Play Bob Marley” [Note: this command works even though the official artist name is “Bob Marley and the Whalers”]
- “Play Jazz”
- “Play Alternative”
- “Play Super Hits of Miles Davis

These are just a sample of what is possible with NLU.

Other features, not residing on the Parrot FC6XX0 module can also benefit from NLU. This includes use cases such as tuning of a radio station or activating a rear-camera image:

- “Tune to 97.1 Megahertz”
- “Tune to 950 AM”
- “Switch to FM”
- “Seek”
- “Play AM preset 3



10.4.3.1 Nuance Music Pre-Processor (MPP)

The Parrot RAP multimedia library option includes Nuance Music Pre-Processor (MPP) to facilitate flexible voice recognition access to music. Specifically, Nuance MPP allows the user to speak only a portion of the album title or artist name and find the intended song. Flexible music selection allows users to speak the most common variations and still be understood.

“Avia” for “Avia feat. Raz Ohara”

“Nuage” for “Nuage (Take 2)”

“Police” for “The Police”

With Nuance MPP, users can speak album titles or artist’s names that they know are present on their own music player without looking at any visual prompt.

10.4.3.2 ddG2P / CLC MP3

Nuance ddG2P MP3 and CLC MP3 are Nuance’s high speed, small footprint Graphemes to Phonemes converters (G2P, converting the text to phonetics) dedicated to the music domain.

10.5 *Remote speech to text engine*

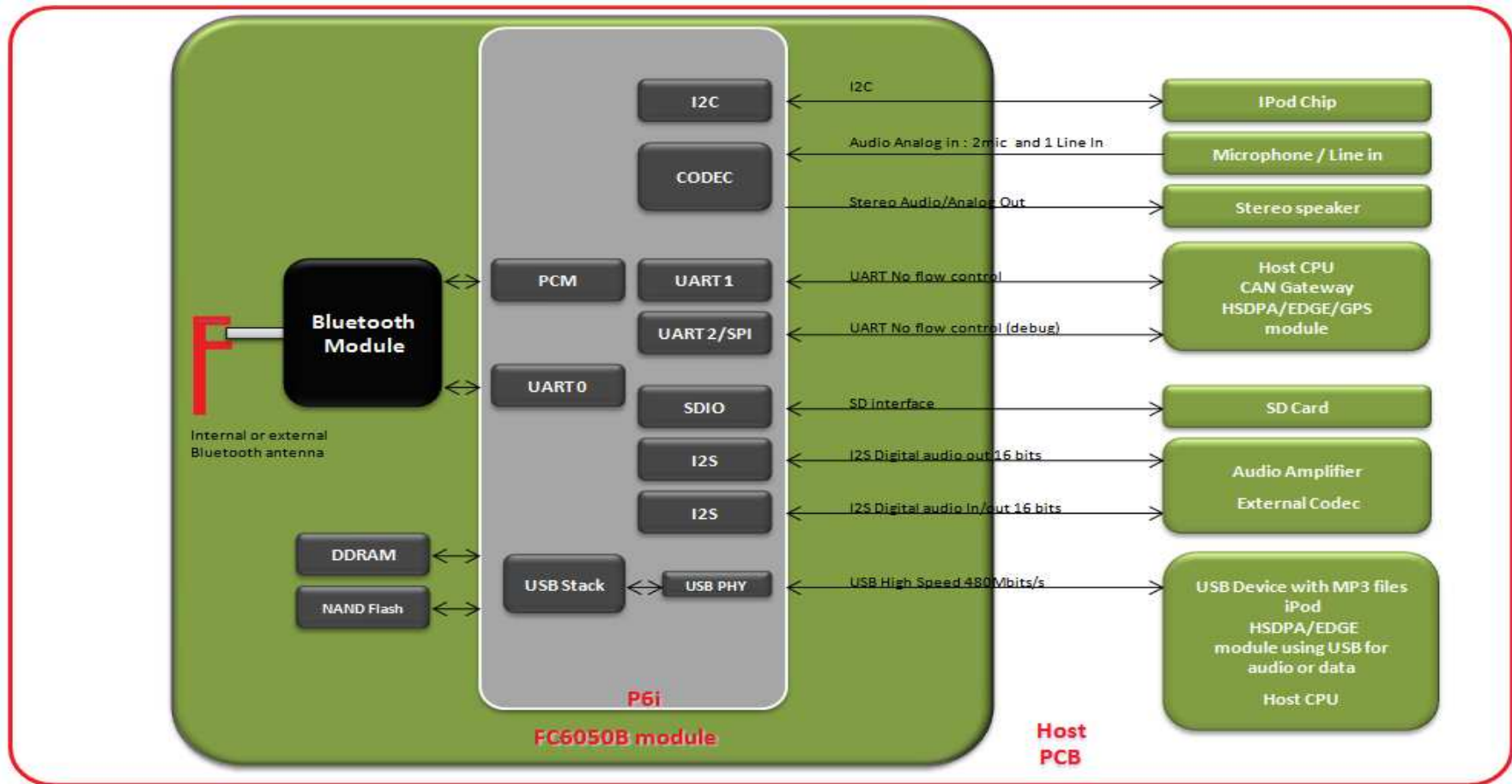
Parrot is evaluating different solutions of remote voice recognition.

Based on a client-server model, they will allow the end user to use off-board voice recognition engines, running on centralized servers, accessible through an internet connection.

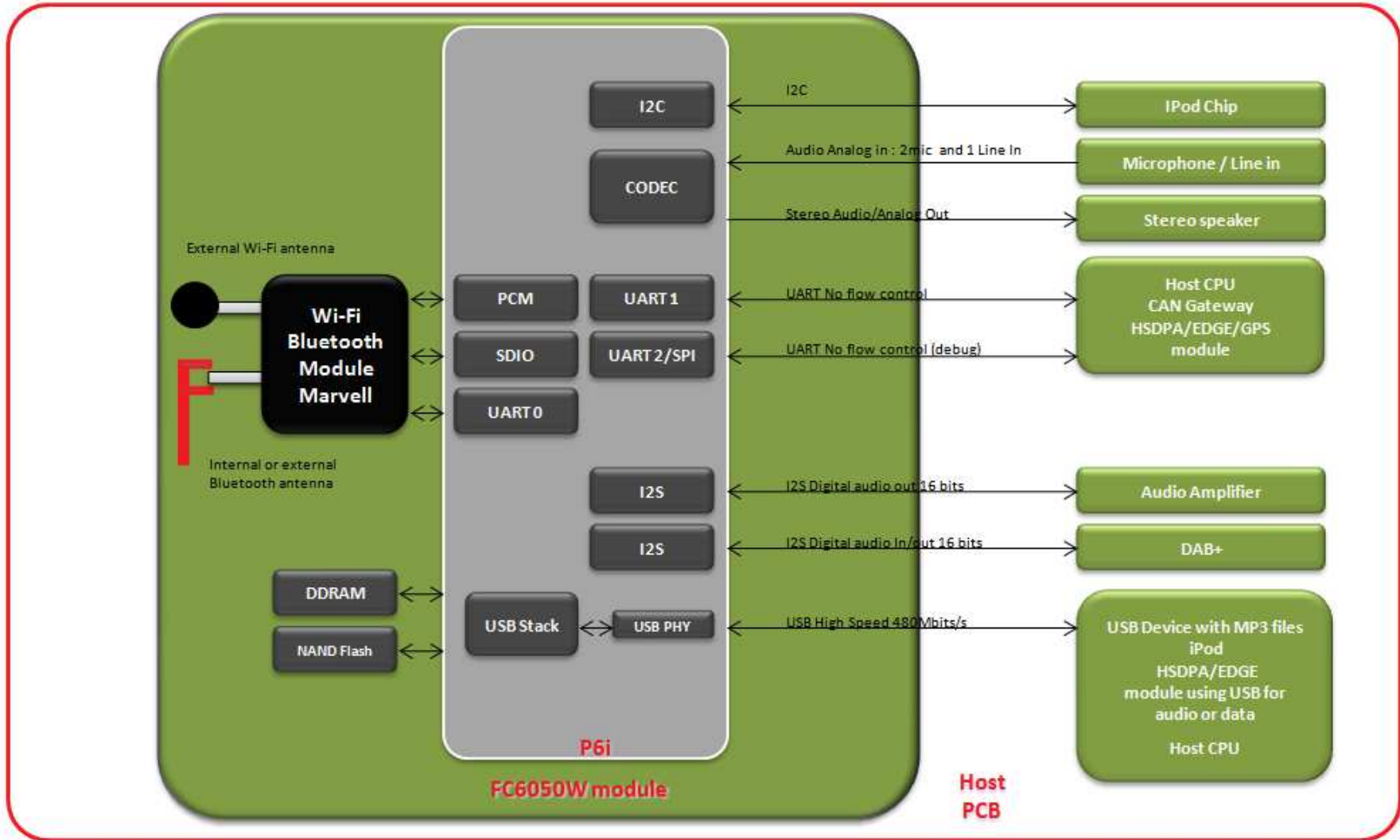
- The benchmark includes:
 - Dragon from Nuance
 - Google
 - Text Friendly
- Feature available on FC6050 from 2012.

11 Electrical specifications

11.1 Hardware architecture FC6050B



11.2 Hardware architecture FC6050W



11.3 Pinout (FC6050W and FC6050B)

11.3.1 Pinout table 40 pins version

FC6050W	FC6050B	Pin #		FC6050B	FC6050W
USB_VBUS	USB_VBUS	1	2	RESET_IPOD	RESET_IPOD
USB_DP	USB_DP	3	4	I2C_CLK	I2C_CLK
USB_DN	USB_DM	5	6	I2C_DAT	I2C_DAT
GND	GND	7	8	UART_AT_TX	UART_AT_TX
<i>USB_PWR_EN</i>	<i>SD_WP</i>	9	10	UART_AT_RX	UART_AT_RX
<i>_OVERCURRENT</i>	<i>SD_DETSW</i>	11	12	UART_DBG_TX	UART_DBG_TX
<i>USB_ID</i>	<i>SD_DAT1</i>	13	14	UART_DBG_RX	UART_DBG_RX
<i>GPIO_MUTE</i>	<i>SD_DAT0</i>	15	16	VCC	VCC
VCC	VCC	17	18	I2S_IN1	I2S_IN1
<i>I2S_IN2</i>	<i>SD_CLK</i>	19	20	I2S_OUT2	I2S_OUT2
GND	GND	21	22	I2S_OUT1	I2S_OUT1
<i>GPIO_1</i>	<i>SD_CMD</i>	23	24	I2S_SYNC	I2S_SYNC
<i>GPIO_2</i>	<i>SD_DAT3</i>	25	26	I2S_CLK	I2S_CLK
<i>GPIO_3</i>	<i>SD_DAT2</i>	27	28	I2S_MCLK	I2S_MCLK
nRESET	nRESET	29	30	BOOTS	BOOTS
LINE_OUT_L	LINE_OUT_L	31	32	LINE_OUT_R	LINE_OUT_R
MIC_PWR	MIC_PWR	33	34	GND	GND
MIC_1_P	MIC_1_P	35	36	MIC_2_P	MIC_2_P
MIC_1_N	MIC_1_N	37	38	MIC_2_N	MIC_2_N
LINE_IN_L / CTS	LINE_IN_L / CTS	39	40	LINE_IN_R / RTS	LINE_IN_R / RTS

11.3.2 FC6050W Pinout table

PIN	FUNCTION	PIN TYPE	COMMENT
1	USB_VBUS	I	USB VBUS
3	USB_DP	I/O	USB DATA +
5	USB_DM	I/O	USB DATA -
7	GND	P	Ground
9	USB_PWR_EN	O	USB Power Enable
11	USB_OVERCUR	I	USB Overcurrent
13	USB_ID	I/O	USB ID
15	GPIO_MUTE	I/O	GPIO Mute
17	VCC	P	Power supply : 3.3v
19	I2S_IN2	I	Digital audio data input 2
21	GND	P	Ground
23	GPIO_1	I/O	GPIO 1
25	GPIO_2	I/O	GPIO 2
27	GPIO_3	I/O	GPIO 3
29	nRESET	I	Discrete reset signal – active low
31	LINE_OUT_L	O	Analog audio output – Left
33	MIC_PWR	O	Microphone bias voltage
35	MIC_1_P	I	Positive microphone 1 input
37	MIC_1_N	I	Negative microphone 1 input
39	LINE_IN_L	I	Analog audio input - Left



PIN	FUNCTION	PIN TYPE	COMMENT
2	RESET_IPOD	O	IPOD Reset
4	I2C_SCL	O	I2C Clock
6	I2C_SDA	I/O	I2C Data
8	UART_AT_TX	O	AT Commands & flash update UART output
10	UART_AT_RX	I	AT Commands & flash update UART input
12	UART_DBG_TX	O	Debug UART output
14	UART_DBG_RX	I	Debug UART input
16	VCC	P	Power supply : 3.3v
18	I2S_IN1	I	Digital audio data input 1
20	I2S_OUT2	O	Digital audio data output 2
22	I2S_OUT1	O	Digital audio data output 2
24	I2S_FSYNC	O	Digital audio frame synchronization
26	I2S_CLK	O	Digital audio clock
28	I2S_MCLK	O	Digital audio master clock
30	BOOTS	I	Discrete boots mode signal – active high
32	LINE_OUT_R	O	Analog audio output - Right
34	GND	P	Ground
36	MIC_2_P	I	Positive microphone 2 input
38	MIC_2_N	I	Negative microphone 2 input
40	LINE_IN_R	I	Analog audio input - Right

12 Electrical specifications

12.1 *Absolute maximum ratings*

Operating temperature range-40°C to +85°C
 Storage temperature range.....-40°C to +125°C
 ESD sensitivity according ES-XW7T-1A278-AC±4kV

12.2 *Power Supply*

The FC6050W module is supply by a 3v3 voltage.

12.2.1 **Power Pin**

Parameter	Min	Typ	Max	Unit
Normal supply	3,2	3,3	3,6	V

12.2.2 **Power consumption**

Feature	Min	Typ	Max	Unit	Comment
Stop mode	-	18	-	mA	NReset active
Run/Standby mode	-	150	-	mA	
Hands Free and Audio streaming mode	-	210	-	mA	
Wifi Active (Labtool)	-	217	-	mA	
Wifi Packet 802.11b (Labtool)	-	295	-	mA	
Wifi Packet 802.11g (Labtool)	-	232	-	mA	
Peak current at startup	-	218	-	mA	
Peak current at startup (duration)	-	200	-	us	

12.3 *Reset pin*

nRESET should be driven Low by the Host as long as VCC is not stable within the specified range.

Parameter	Min	Typ	Max	Unit	Comment
nRESET VIL	-0,3	-	0,89	V	-
nRESET VIH	2,54	-	3,6	V	-

12.4 *Firmware Update*

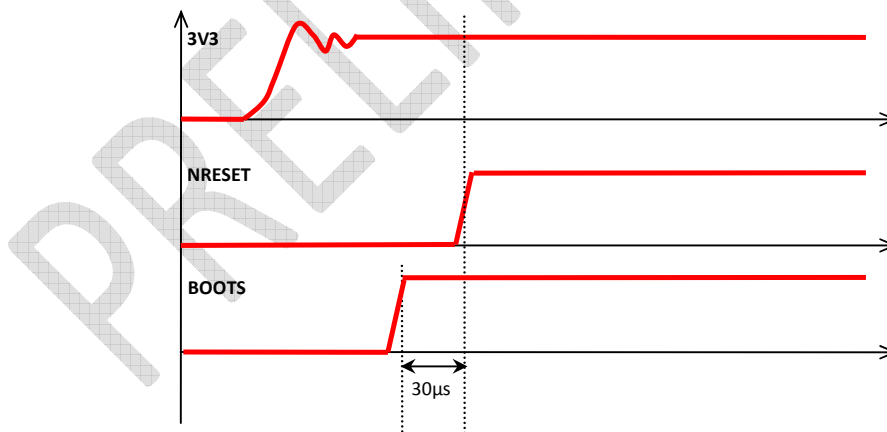
BOOTS is the Flash update signal. When **BOOTS** is high as nRESET goes high, FC6050 boot is redirected to the USB link thanks to which the flash memory can then be updated.

Parameter	Min	Typ	Max	Unit	Comment
BOOTS VIL	-0,3	-	0,5	V	-
BOOTS VIH	1	-	3,6	V	-
BOOTS internal pull-down	-	47k	-	Ohm	-

To boot in flash-update mode, the following sequence should be respected:

- When a 3V3 power source is established, pull **BOOTS** signal.
- Wait at least 30µs and release **NRESET** signal to start the flash update.

Figure: Time diagram to boot in flash-update mode



12.5 ***GPIOs***

Parameter	Min	Typ	Max	Unit	Comment
Input Voltage	-0,3	-	3,6	V	
Output Voltage	-0,3	-	3,6	V	
Input Low Voltage VIL	-0,3	-	0,89	V	
Input High Voltage VIH	2,54	-	3,6	V	
Hysteresis Voltage	0,4	-	-	V	
Low Level Output Voltage VOL	-	-	0,4	V	
High Level Output Voltage VOH	2,9	-	-	V	
Output Current	5,4	-	32	mA	

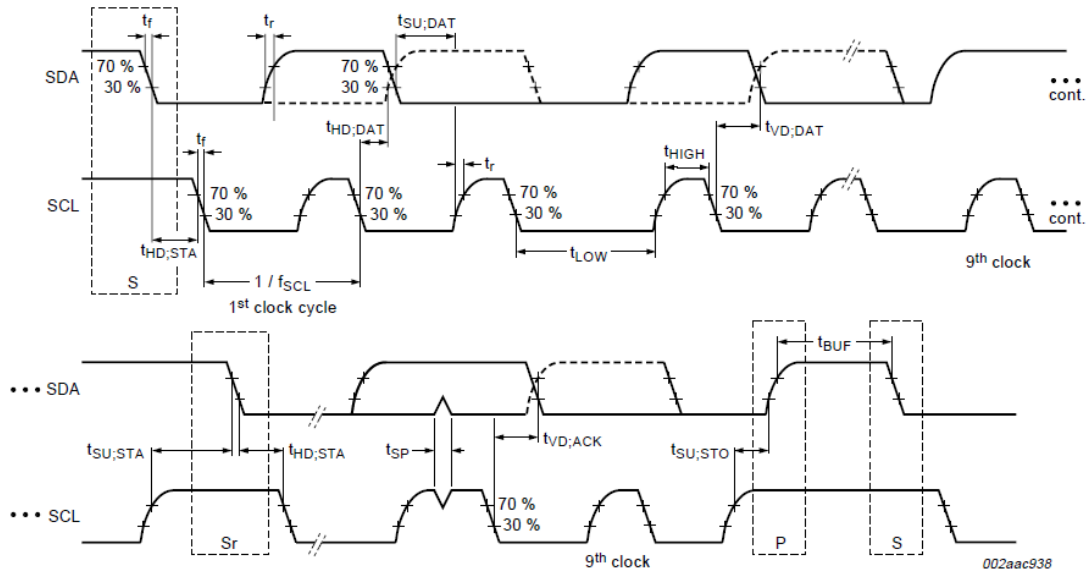
12.6 ***UART***

Parameter	Min	Typ	Max	Unit
Input high level	2,9	-	3,6	V
Input low level	-0,3	-	0,4	V
Output high level	2,9	-	3,6	V
Output low level	-0,3	-	0,4	V
Rise time	-	-	50	ns
Fall time	-	-	50	ns
Baud rate	-	-	115,2	kbps
Reception Baud rate errors	-5,48	-	4,7	%

12.7 I2C

The interface defines 2 transmission speeds:

- Normal: 100 kbps
- Fast: 400 kbps



$$V_{IL} = 0.3V_{DD}$$

$$V_{IH} = 0.7V_{DD}$$

Symbol	Parameter	Standard Mode		Fast Mode		Unit
		Min	Max	Min	Max	
fSCL	SCL clock frequency	0	100	0	400	kHz
tHD;STA	hold time; Start condition	4	-	0,6	-	uS
tLow	LOW period of SCL clock	4,7	-	1,3	-	uS
tHigh	HIGH period of SCL clock	4	-	0,6	-	uS
tsu ; STA	set-up time for a repeated START condition	4,7	-	0,6	-	uS
thd ; DAT	data hold time	5	-	-	-	uS
tsu ; DAT	data set-up time	0,25	-	0,1	-	uS
tr	Rise time of both SDA and SCL signals	-	1	-	0,3	uS
tf	fall time of both SDA and SCL signals	-	0,3	-	0,3	uS
tSU;STO	set-up time for STOP condition	4	-	0,6	-	uS
tVD;DAT	data valid time	-	3,45	-	0,9	uS
tVD;ACK	data valid acknowledge time	-	3,45	-	0,9	uS

12.8 Audio

12.8.1 Analog out

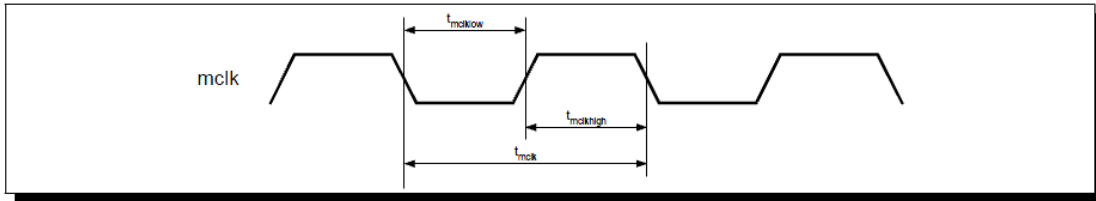
Conditions unless otherwise noted : Tamb.=25°C; Vdd =3V3					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Full scale output voltage			0.9		Vrms
Load resistor		7	10	-	kΩ
THD+N		0.02	-	0.05	%
SNR		80	-	96	dB
LR Crosstalk	F=1kHz	-	-	70	dB
	F=10kHz	-	-	70	dB
Bandwidth	-3dB	20	-	20k	Hz

12.8.2 Analog in

Conditions unless otherwise noted : Tamb.=25°C; Vdd =3V3					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Full scale input voltage	THD<n%	-	0.9	-	Vrms
Input resistance		-	10	-	kΩ
THD+N		0.02	-	0.05	dB
SNR		80	-	96	dBA
LR Crosstalk	F=1kHz	-	-	70	dB
	F=10kHz	-	-	70	dB
Bandwidth	-3dB	20	-	20k	Hz

12.8.3 Microphone input

Conditions unless otherwise-noted : Tamb.=25°C; Vcc =3V3					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Maximum input impedance		-	10	-	kΩ
Max. AC input voltage		-	-	0.9	V _{rms}
SNR, 1kHz		80	-	96	dB
THD		-	-	0.05	%
Bandwidth Low		-	-	20	Hz
Bandwidth High		20	-	-	kHz

12.9 **I2S**
Master Clock

Master clock timing specifications

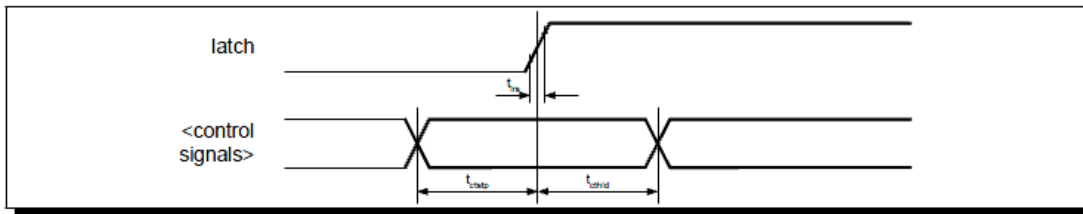
 At $T_a=25^\circ\text{C}$, $AVDD=3.3\text{V}$, $mclk_{sel} = 0$

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
<i>mclk</i> pulse width low	T_{mclk_low}	16.28 ¹³		293 ¹⁴	ns
<i>mclk</i> pulse width high	T_{mclk_high}	16.28 ¹⁵		293 ¹⁶	ns
<i>mclk</i> period	T_{mclk}	40.7		488.3	ns
<i>mclk</i> duty cycle	$MCLK_{dty}$	40		60	%

Master clock timing for 256xFs mode

 At $T_a=25^\circ\text{C}$, $AVDD=3.3\text{V}$, $mclk_{sel} = 1$

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
<i>mclk</i> pulse width low	T_{mclk_low}	10.8513		195.314	ns
<i>mclk</i> pulse width high	T_{mclk_high}	10.8515		195.316	ns
<i>mclk</i> period	T_{mclk}	27.13		325.5	ns
<i>mclk</i> duty cycle	$MCLK_{dty}$	40		60	%

Master clock timing for 384xFs mode
Control Interface

Control interface timing specifications – latched mode

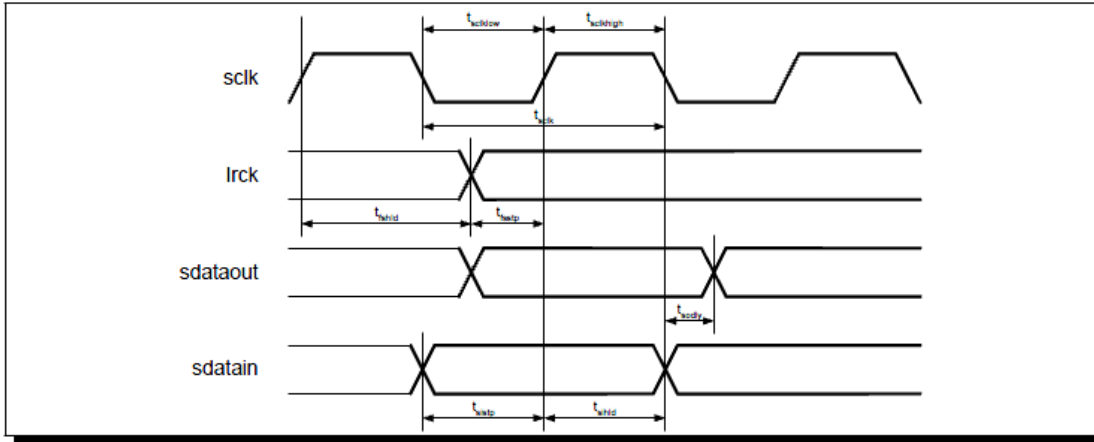
 At $T_a=25^\circ\text{C}$, $AVDD=3.3\text{V}$

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
<i>latch</i> rise time	T_{rs}			5	ns
<control signals> setup time to <i>latch</i> rising edge	T_{ctsp}	1			us
<control signals> hold time to <i>latch</i> rising edge	T_{cthd}	1			us

Control interface timing for latched mode



Digital Audio Interface



Digital audio interface timing specifications

At $T_a=25^{\circ}C$, $AVDD=3.3V$, $F_s=48kHz$, $mclkse1=0$

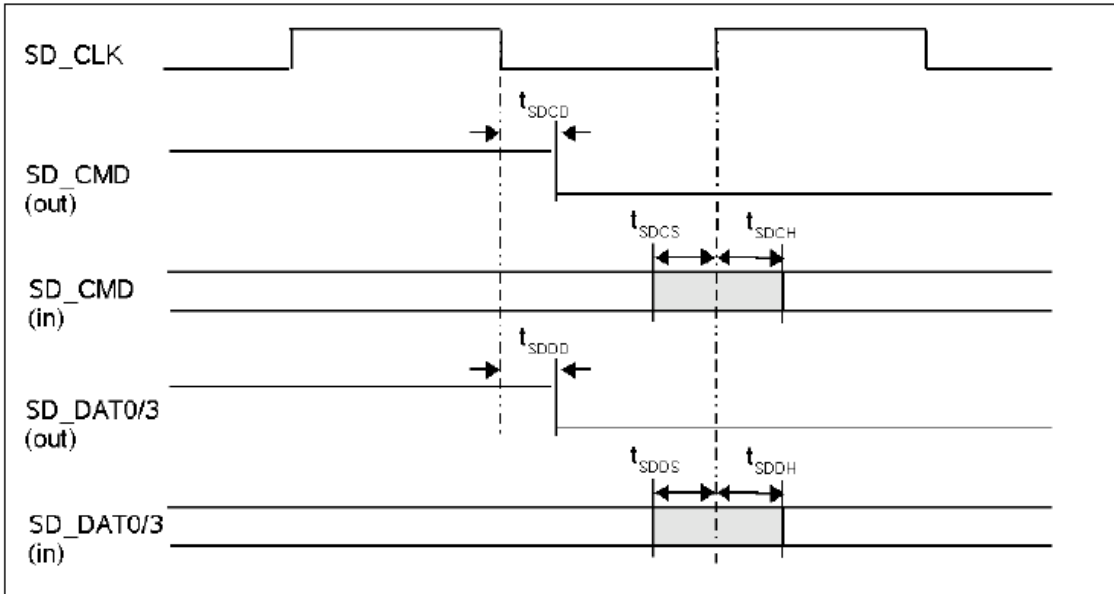
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
sclk pulse width low	T_{scklow}	10.85			ns
sclk pulse width high	$T_{sckhigh}$	10.85			ns
sclk period	T_{sck}	27.13 ¹⁷		434	ns
lrck hold time to sclk rising edge	T_{fhld}	10			ns
lrck setup time to sclk rising edge	T_{fstp}	10			ns
lrck hold time to sclk rising edge	T_{fhld}	10			ns
sdout propagation delay from sclk falling edge	T_{sody}			10	ns
sdin setup time to sclk rising edge	T_{sinp}	10			ns
sdin hold time to sclk rising edge	T_{shld}	10			ns

Digital audio interface timing for slave mode

PRELIMINARY

12.10 **SDIO**

<i>Parameter</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
SD command output delay	t_{SDCD}	-0.8	--	-0.6	ns
SD command input setup time	t_{SDCS}	1	--	--	ns
SD command input hold time	t_{SDCH}	0	--	--	ns
SD data output delay time	t_{SDOD}	-0.6	--	-0.5	ns
SD data input setup time	t_{SDDS}	0.6	--	--	ns
SD data input hold time	t_{SDDH}	0	--	--	ns



SD Timing Diagram

PREVIEW

12.11 USB

Conditions unless otherwise noted : Tamb.=25°C; Vdd =3V3; Cload=50pF					
Parameter	Conditions	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS					
<i>LOW SPEED / FULL SPEED FUNCTIONALITY</i>					
Differential receiver input sensitivity	(D+)-(D-)	0.2	-	-	V
Differential receiver common mode voltage range		0.8	-	2.5	V
Single ended receiver low level input voltage		-	-	0.8	V
Single ended receiver high level input voltage		2.0			V
Single ended receiver hysteresis		0.05		0.15	V
Low level output voltage	Rload=1.5kΩ to 3V3			0.3	V
High level output voltage	Rload=15kΩ to GND	2.8		3.6	V
<i>HIGH SPEED FUNCTIONALITY</i>					
Differential receiver input sensitivity		0.1			V
Differential receiver common mode voltage range		-0.05		0.5	V
Squelch detection threshold (differential)	Squelch threshold			0.1	V
	Un-squelch threshold	0.15			V
Low level output voltage	Rload=45Ω to GND	-0.01		0.01	V
High level output voltage	Rload=45Ω to GND	0.36		0.44	V
Idle level output voltage	Rload=45Ω to GND	-0.01		0.01	V
Chirp-J output voltage	Rload=45Ω to GND	0.7		1.1	V
Chirp-K output voltage	Rload=45Ω to GND	-0.9		-0.5	V
Transceiver input capacitance	Pin to GND	-	-	15	pF
AC CHARACTERISTICS					
<i>LOW SPEED FUNCTIONALITY</i>					
Rise time	10% to 90%	75	-	300	ns
Fall time	10% to 90%	75	-	300	ns
Differential Rise / Fall time matching		80		125	%
<i>FULL SPEED FUNCTIONALITY</i>					
Rise time	10% to 90%	4		20	ns
Fall time	10% to 90%	4		20	ns
Output signal crossover voltage		1.3		2.0	V
Differential Rise / Fall time matching		90		111.1	%
<i>HIGH SPEED FUNCTIONALITY</i>					
Differential Rise time		500			ps
Differential Fall time		500			Ps

12.12 *Wifi*

Features	Description
Frequency Band	2.4000 – 2.4835 GHz (2.4 GHz ISM Band)
Number of channels	14 channels (f=2412+n*5 MHz, n=0,...,12; channel 14=2484MHz)
Modulation	OFDM, DSSS (Direct Sequence Spread Spectrum), DBPSK, DQPSK, CCK, 16QAM, 64QAM
Supported rates	1, 2, 5.5, 11, 6, 9, 12, 18, 24, 36, 48, 54 Mbps
Maximum receive level	- 10dBm (with PER < 8%)

802.11b RF System Specifications

Parameter	Test Condition	Min	Typ	Max	Unit
Transmit Power Output		13	15	17	dBm
Receive Sensitivity	11 Mbps, 8% PER	-	-84		dBm
Transmit Frequency Offset		-	+/-10		ppm
Spectral Mask	Max. TX Power	-	40@fc±11MHz	-	dBc
		-	60@fc±22MHz		dBc
Error Vector Magnitude	Max. TX Power @ 11Mbps	-	10	-	%
Carrier Suppression	Max. TX Power	-	-25		dBc

802.11g RF System Specifications

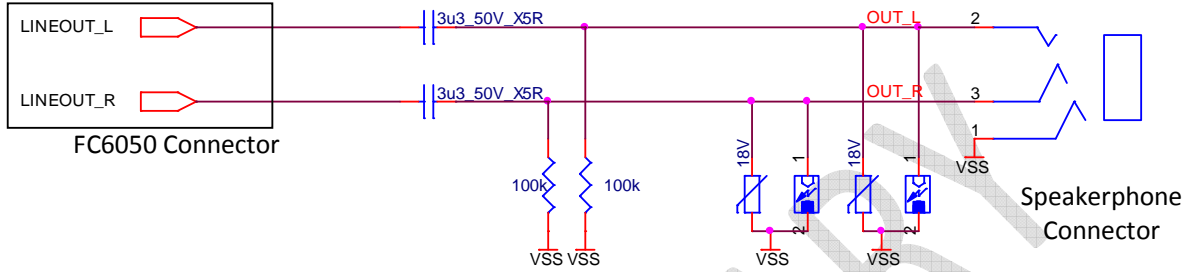
Parameter	Test Condition	Min	Typ	Max	Unit
Transmit Power Output		10	12	14	dBm
Receive Sensitivity	6 Mbps, 10% PER	-	-89	-	dBm
	9 Mbps, 10% PER	-	-88	-	dBm
	12 Mbps, 10% PER	-	-87	-	dBm
	18 Mbps, 10% PER	-	-84	-	dBm
	24 Mbps, 10% PER	-	-81	-	dBm
	36 Mbps, 10% PER	-	-77	-	dBm
	48 Mbps, 10% PER	-	-73	-	dBm
	54 Mbps, 10% PER	-	-72	-	dBm
Transmit Frequency Offset		-10	-	+10	ppm
Spectral Mask	Max. TX Power	-	-30@fc±11MHz	-	dBc
		-	-40@fc±20MHz	-	dBc
		-	-50@fc±30MHz	-	dBc
Error Vector Magnitude	Max. TX Power @ 54Mbps	-	2.8	-	%
Carrier Suppression	Max. TX Power	-	-25	-	dBc

12.13 **Bluetooth**

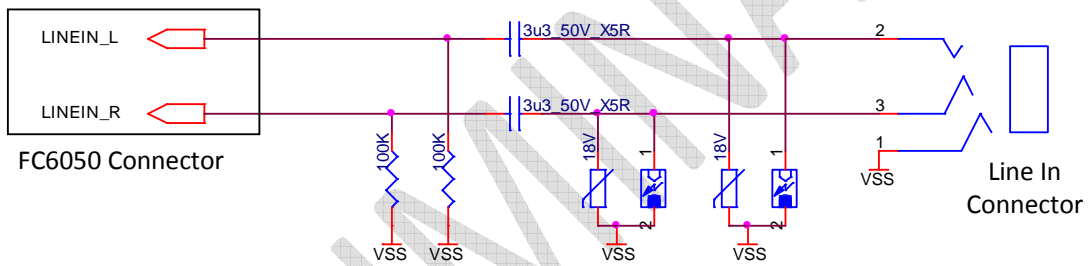
Features		Description
Frequency Band		2.4000 – 2.4835 GHz (2.4 GHz ISM Band)
Number of channels		79 channels (f=2402+k MHz, k=0,...,78)
Modulation		FHSS (Frequency Hopping Spread Spectrum), GFSK
Supported rates		1, 2, 3 Mbps
Maximum receive level		- 3dBm
Output Power		- 6dBm~4dBm
Sensitivity	For all basic rate packet types	BDR : dBm @ 0.1% BER
	$\pi/4$ DQPSK & 8DPSK	EDR : dBm @ 0.1% BER

12.14 Recommended external components schematics

12.14.1 Analog out



12.14.2 Analog in



12.14.3 Microphone input

There are 2 types of microphones:

- Passive microphones:

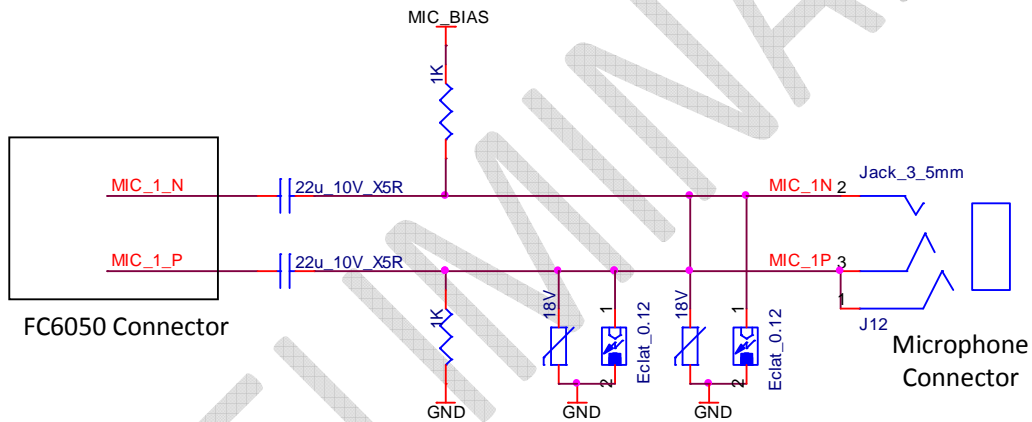
They are not amplified and have a typical sensitivity of -46dB r. 1dB/Pa.

- VDA microphones :

Those microphones have the following characteristics:

- Sensitivity: 670mV/Pa or 300mV/Pa
- Operating voltage: 8V
- Serial resistor for power supply: 680Ω

12.14.3.1 Passive microphones



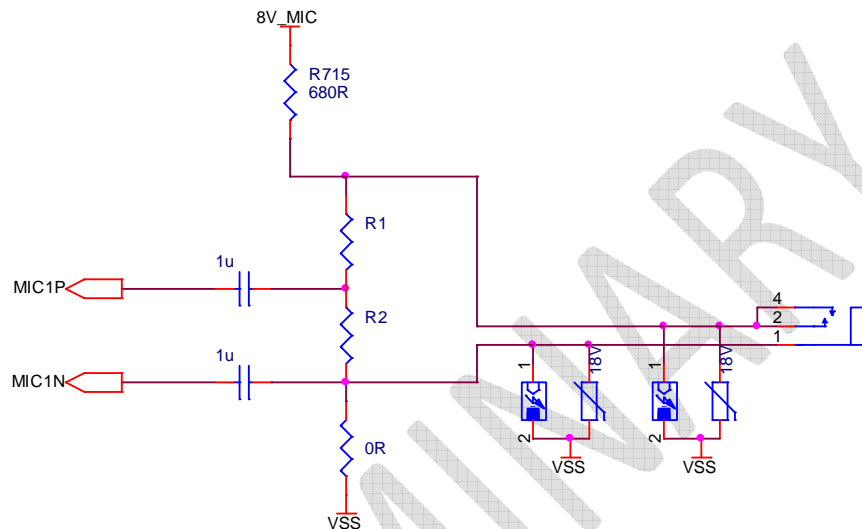
12.14.3.2 VDA microphones

The ADC gain must be set to 0dB by the Host SW via AT commands.

Furthermore the signal level of the microphone must be reduced by:

- 12dB with microphone with 670mV/Pa sensitivity
- 6dB with microphone with 300mV/Pa sensitivity

This can be done with a simple interface circuit. It is composed of a microphone bias circuit and a signal reduction circuit



We use a voltage divider (R1, R2) to reduce the signal. It is dimensioned as follows:

$R1 + R2 \approx 15k\Omega$, in order to keep the impedance of the load much higher than 680 Ω .

$-20 \cdot \text{Log} (R2 / (R1 + R2)) = \text{AdB}$, in order to attenuate the signal by AdB.

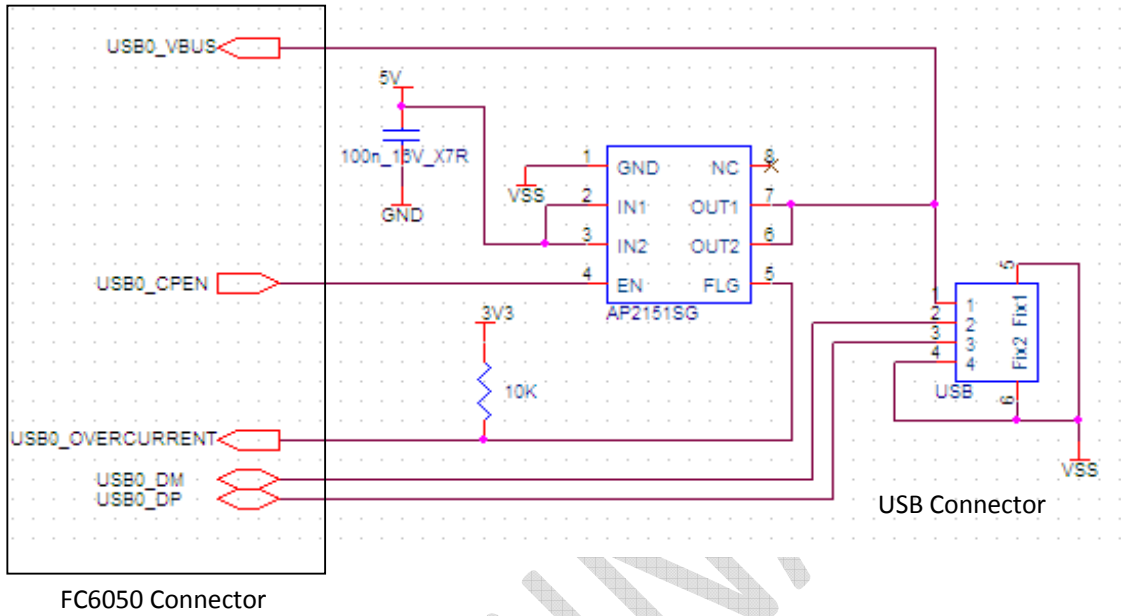
We recommend using those resistor values for correct attenuation so that we can adjust easily the tuning of SW audio parameter:

Sensitivity	300	670	mV/Pa
R1	6.8	11	k Ω
R2	6.8	3.6	k Ω
Attenuation	6	12.16	dB

There are no particular constraints on the layout of this circuit. Just make sure that the grounds of the circuit above are connected to the ground of the module.

Also, **out_P** and **out_N** need to be laid out with the same precautions as with any differential signal, i.e. placed side by side and with the shortest wires as possible. This is to avoid noise issues.

12.14.4 USB

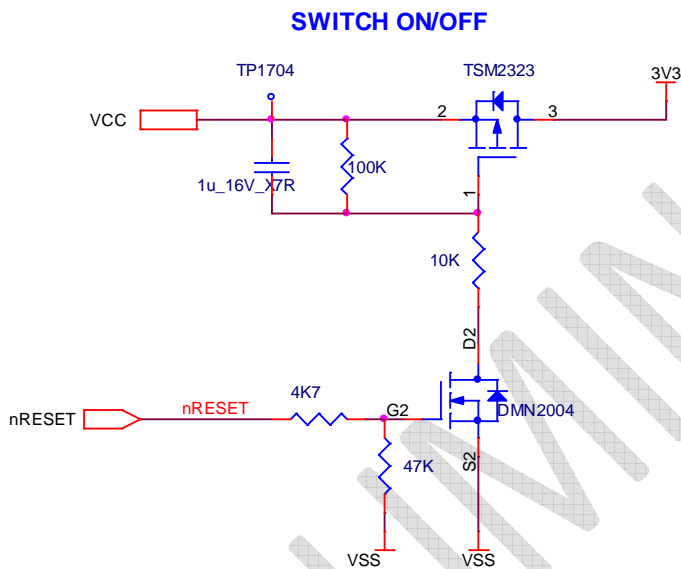


12.14.5 Supply FC6050B/W version

Recommendation on power management near the connector:
2 x 47uF capacitor

For decrease the current consumption, when FC6050B/W is not use, an input switch can be added on the 3v3 power before the main connector.

Example:



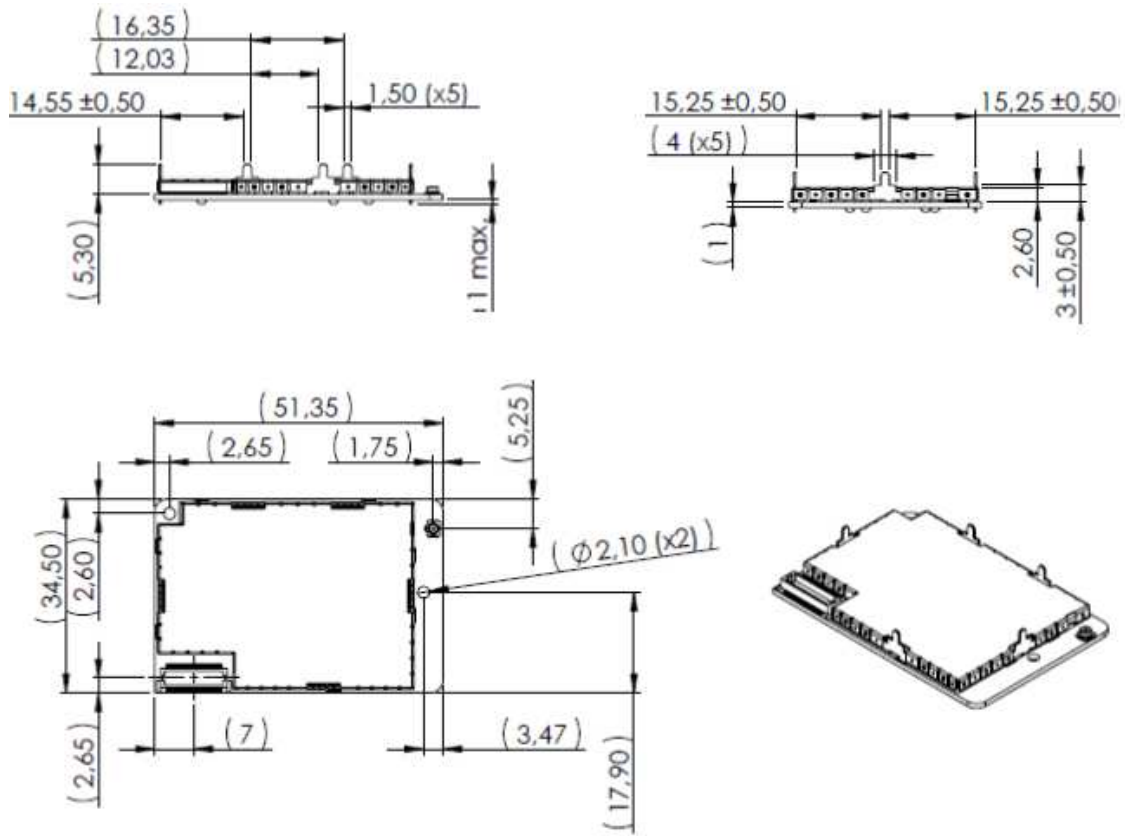
13 Mechanical specifications

The FC6050 modules will be available in two different mounting configurations, one which mounts perpendicular to the host PCB (vertical) and one which mounts parallel to the host PCB (horizontal).

The following chart describes the availability of the various versions of the FC6050B/W.

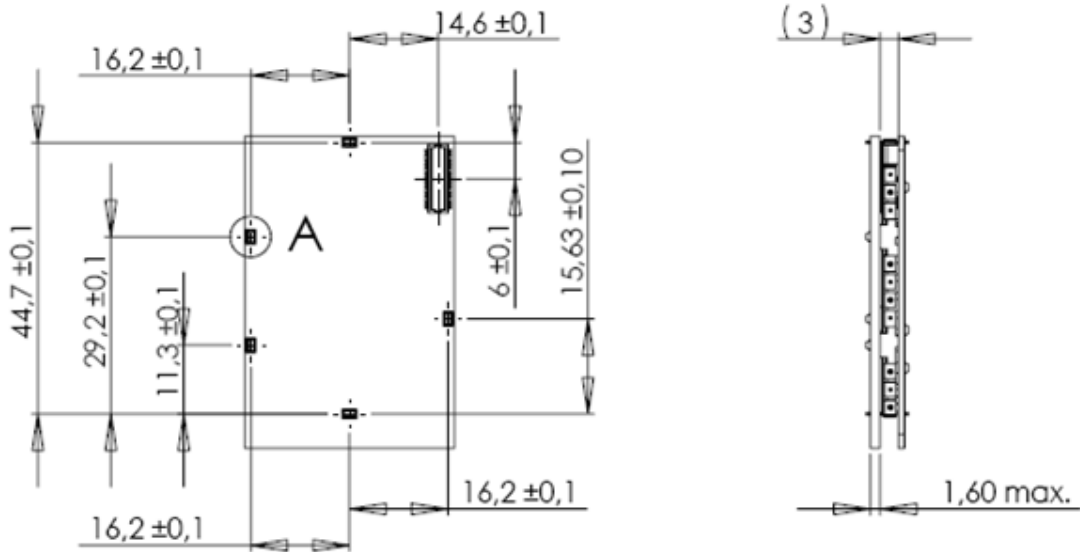
Module version	Mounting	Bluetooth antenna		Wi-Fi antenna
		Internal	external	external
FC6050B	horizontal	Yes	Yes	Yes
	vertical	Yes	Yes	Yes
FC6050W	horizontal	Yes	Yes	Yes
	vertical	Yes	Yes	Yes

13.1 **FC6050W Horizontal version**

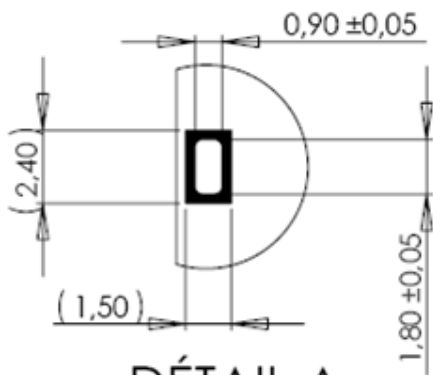


PRELIM

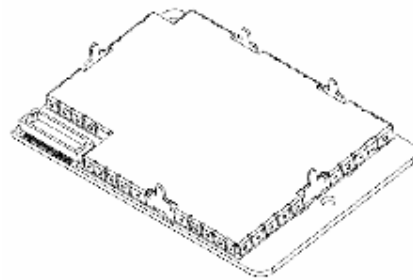
13.2 PCB footprint for FC6050W horizontal module



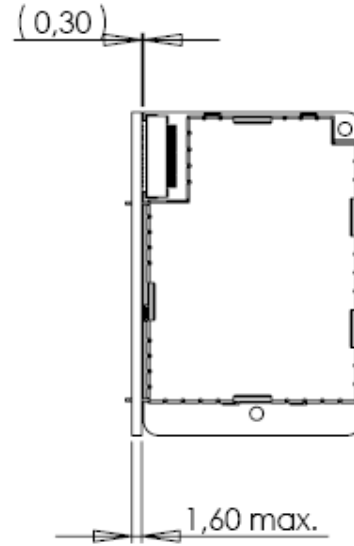
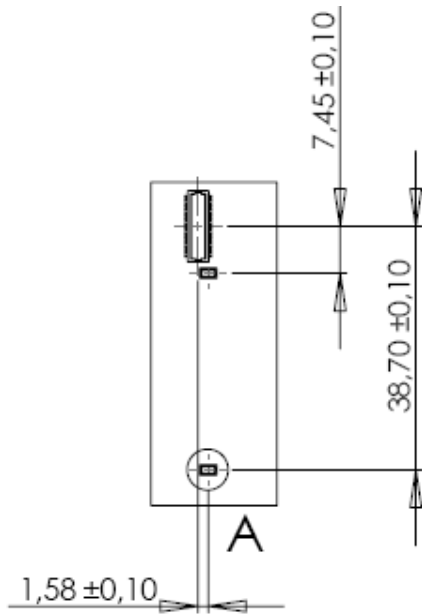
■ Plated-through hole



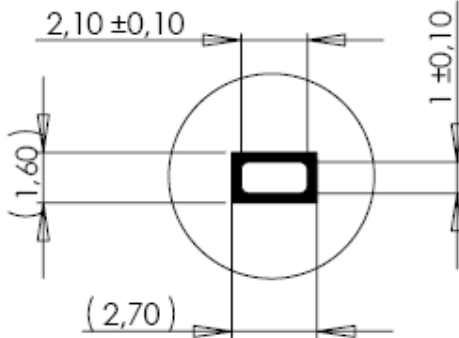
DÉTAIL A
EHELLE 5 : 1



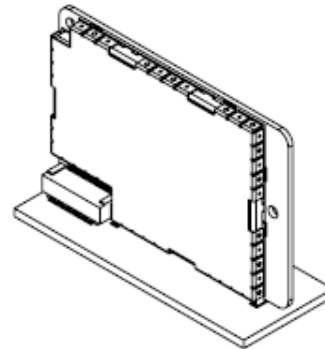
13.3 **PCB footprint for FC6050W vertical module**



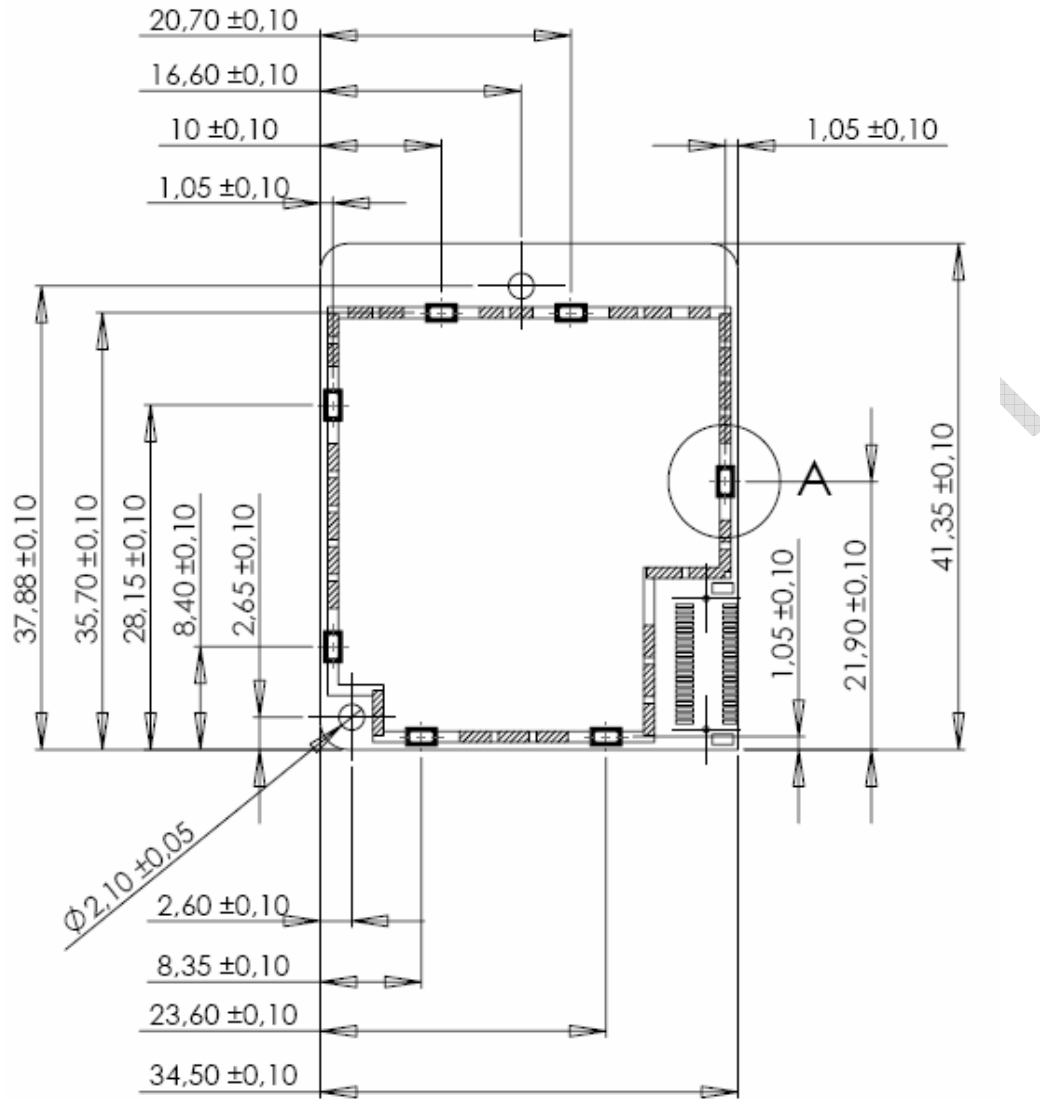
■ Plated-through hole



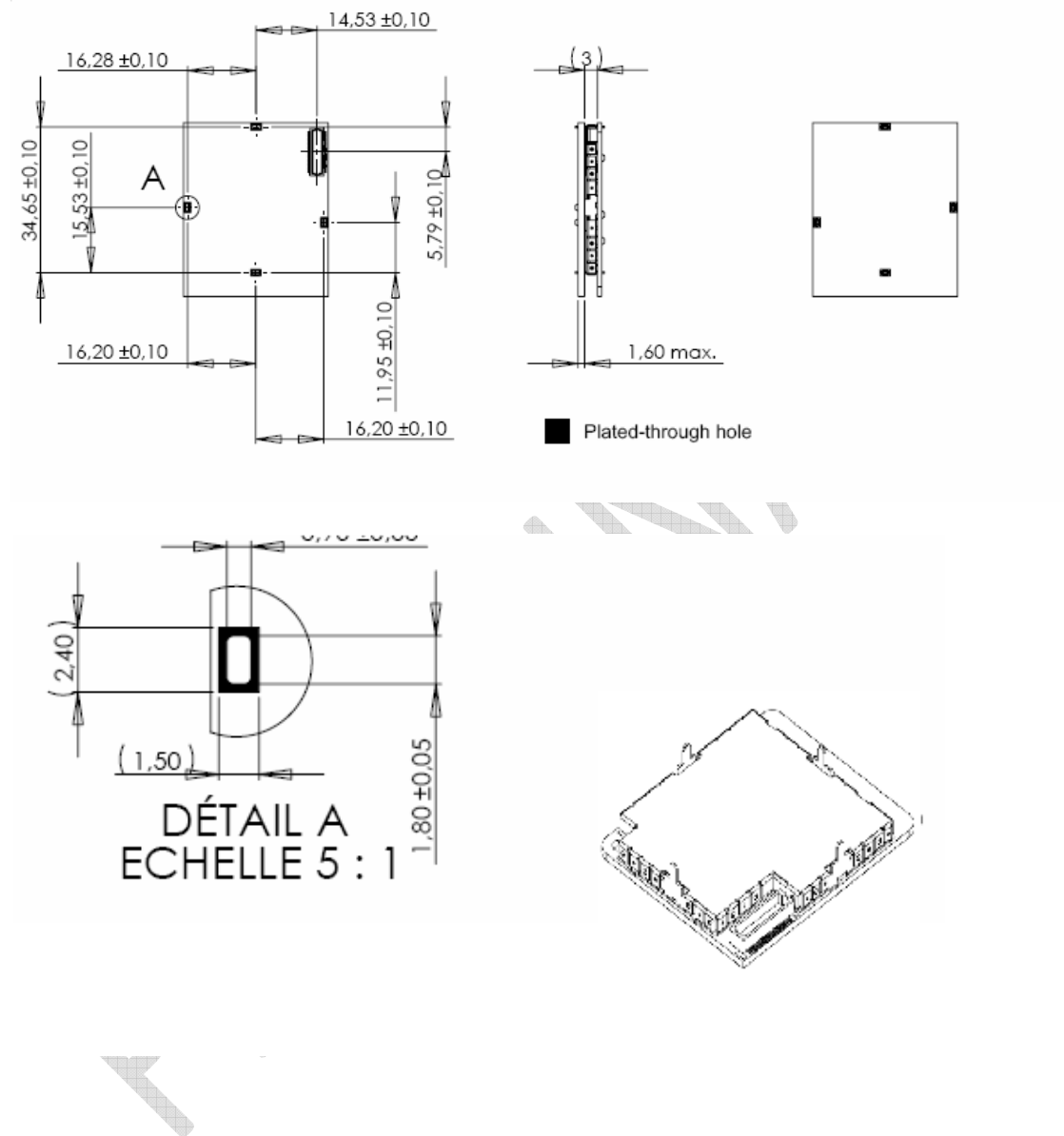
DÉTAIL A
ECHELLE 5 : 1



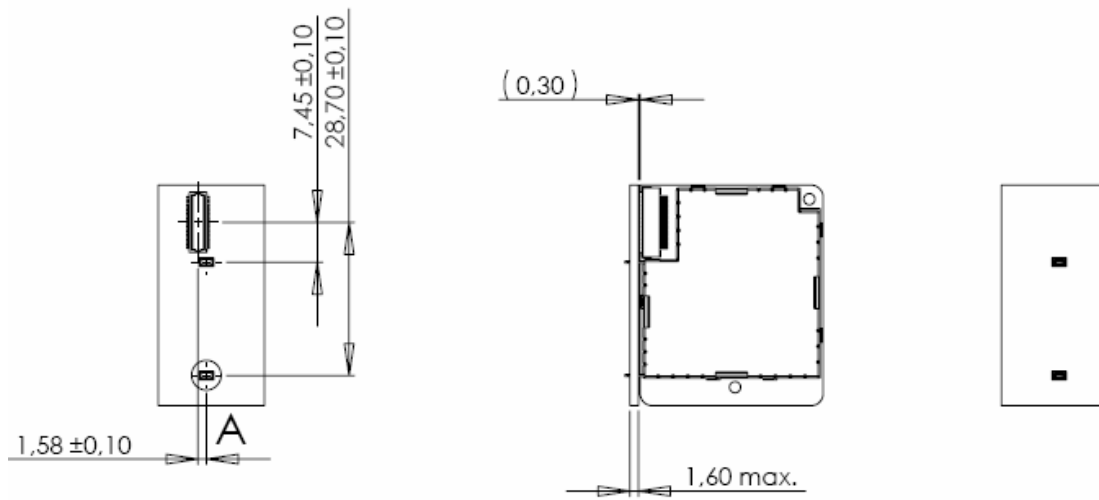
13.4 **FC6050B PCB**




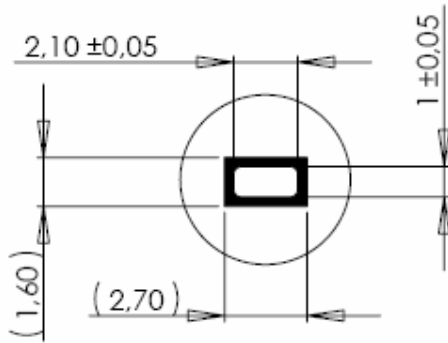
13.5 PCB footprint for FC6050B horizontal module



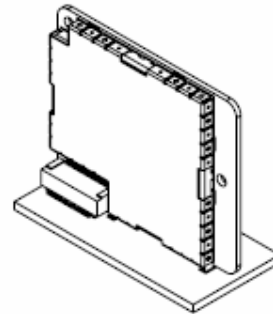
13.6 **PCB footprint for FC6050B vertical module**



 Plated-through hole



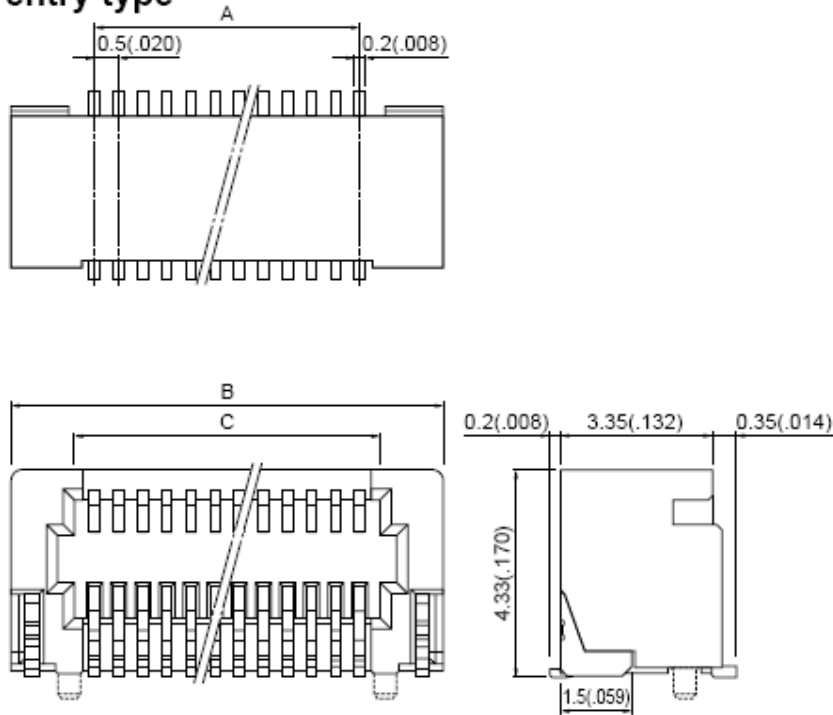
DÉTAIL A
ECHELLE 5 : 1



13.7 Connectors specifications (FC6050 B/W)

13.7.1 Vertical connector specification

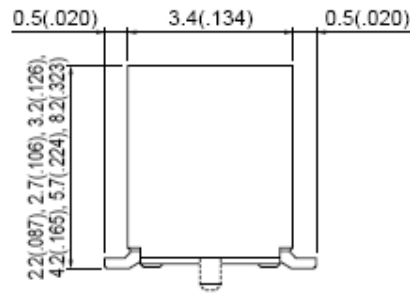
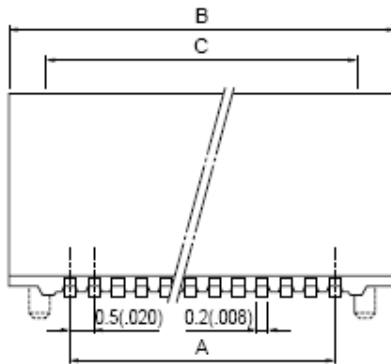
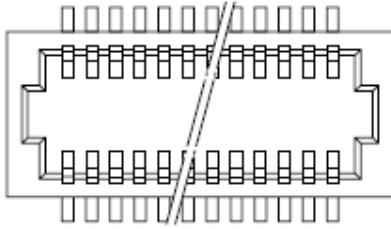
Side entry type



A	B	C	D
9.5(.374)	12.9(.508)	10.4(.409)	10.55(.415)

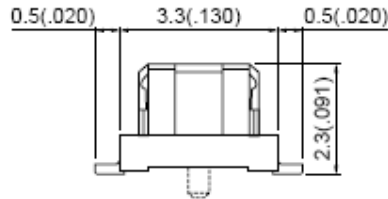
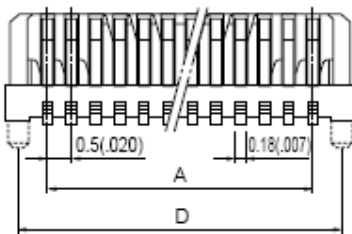
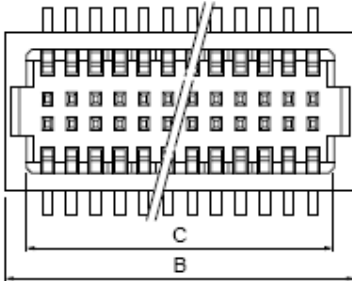
13.7.2 Horizontal connector specification

Top entry type



A	B	C	D
9.5(.374)	11.9(.469)	10.4(.409)	10.7(.421)

13.7.3 Host connectors specification



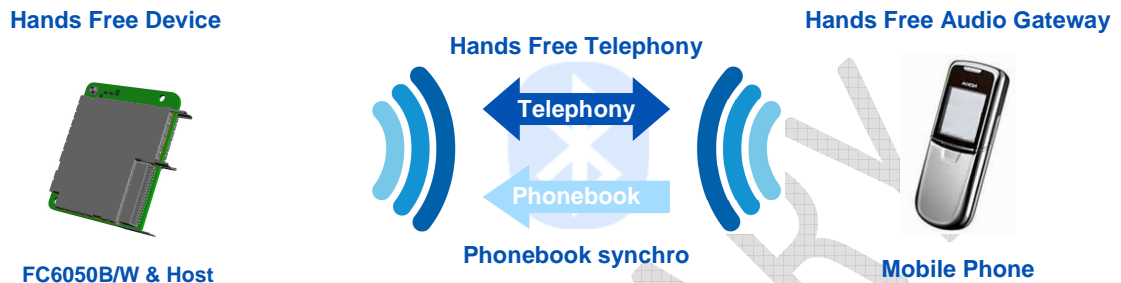
A	B	C	D
9.5(.374)	11.3(.445)	10.4(.409)	10.7(.421)

14 Connectivity use cases overview

14.1 Phone use cases

14.1.1 Head Unit (FC6050B/W) paired with Mobile phone

Handsfree telephony & Phonebook Synchronization



Connections Strategy

If the Host does not store the contact information from the last synchronization with the phonebook, the information is available for the Host at the next Module start up. Immediately after HFP connection (which is initiated with the last connected device), it is possible to place an outgoing call if requested. Once HFP initialization has finished (end of SLC/Extended SLC), the Module starts the best phonebook synchronization method available for the paired and connected phone. The Module will alert the Host that the phonebook synchronization is complete with new entries now available, and ready to be displayed on the HMI.

If an incoming/outgoing call occurs during the phonebook synchronization process, depending on the method of phonebook synchronization which is used, the process is paused. Once the call is finished, the phonebook synchronization restarts from where it has been stopped, and the call history is updated. This is transparent for the end user.

Calls Management

For incoming calls, the Caller ID data (received from phone via CLIP or CLCC) is sent to the Host to be displayed on the HMI.

HFP indicators such as signal level, battery level and network provider are forwarded to the Host to be displayed on the HMI. CIND/CIEV indicators or GSM AT Commands are used for this purpose.

Service Continuity

This feature handles the audio management of a call when the module is powered on/off:

- When the module is powered on, the module automatically connects HFP to the phone and establishes the communication ((e)SCO connection) through the speakers during the SLC.



- When the module is powered off, the module transfers the audio to the phone ((e)SCO disconnection) and disconnects the Bluetooth link.

This process ensures the Host to be immediately ready to start Handsfree usage.

Three way calling / multiple calls management

Once a call is established, if a second incoming call occurs, here is how the Host should handle the HMI:

- Green button: takes the second incoming call as active, and put the first one on hold. Press green button again to switch between the two calls.
- Red button: hangs up the active call and takes the second one as active.

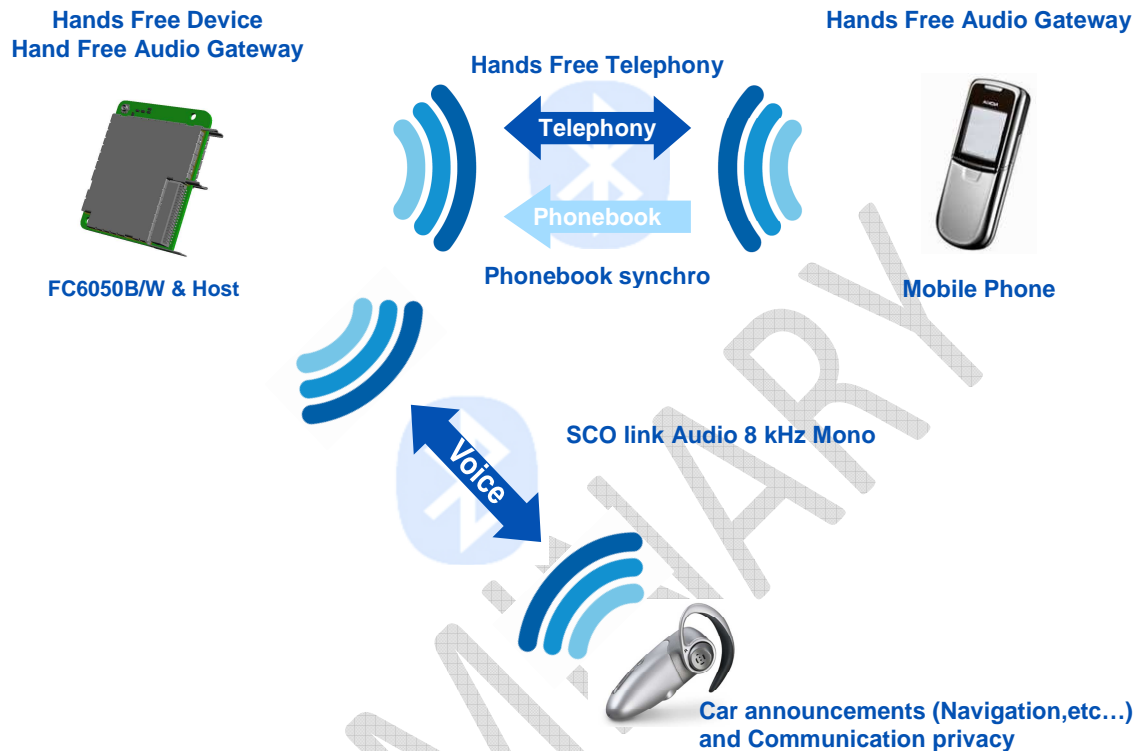
Full 3-way calling management (and multiparty calls) is optimized with phones supporting HFP1.5. Parrot supports up to 7 calls at the same time for conference call purposes.

With phones supporting HFP1.0 only, there are gaps in the specification such as:

- When the user manages the calls from the phone interface, the phone does not always notify the Module.
- When the distant party who is on hold hangs up from its side, the phone does not always notify the Module.

PRELIMINARY

14.1.2 Head Unit (FC6050B/W) simultaneously connected to Mobile phone and headset device



SCO forwarding feature (2 SCO)

The module is connected to a Headset and a phone at the same time. When requested by the user, the Module is able to forward audio from the phone to the Headset. Therefore, the communication is switched for privacy purpose. Two SCO channels are opened by the Module.

Description of the behavior:

- *Incoming call:*
 - o Pick up from the HMI will pick up the call and establish one (e)SCO with the phone and one with the Headset.
 - o Hang up from the HMI will hang up the call and release the 2nd SCO.
- *Outgoing call:*
 - o Dialing from the HMI will place the call on the phone, and once the remote party has picked up, one (e)SCO is established with the phone and one with the Headset.
 - o Hang up from the HMI will hang up the call and release the 2nd SCO.

A command is proposed on Parrot Module to handle the establishment of dual SCO, depending on user need.

14.1.3 Head Unit paired with two Mobile phones

Establish and receiving call possible on two different mobile phones



Multi HFP Feature

Parrot has developed the “Multi - HFP” feature, which enables the Module to handle two Handsfree connections at the same time. This use case is useful for people having two mobile phones, or when two users are in the car.

The Module is running phonebook synchronization on both phones, and each phone has its own phonebook available for the Host (phonebooks are not merged).

HFP indicators are available for each phone.

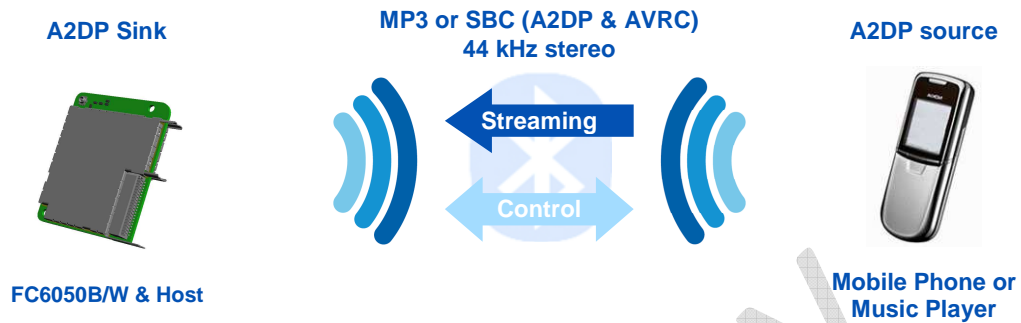
Description of the behavior:

- *First example:* two phones (P1 and P2) are connected to HFP service. The host can start dialing on P1, hang up call then start outgoing call on P2.
- *Second example:* the phone receives incoming call P1 on Module. After the end of the first call from P1 the phone P2 can receive incoming call.

The multi HFP does not manage the calls of two phones at the same time.

14.1.4 Audio Streaming and Handsfree working together

Audio Streaming from phone to Module (remotely controlled by the Module)



AVHFP Feature

Most phones now support both HFP and A2DP Source/AVRCP TG. The most difficult case is to correctly handle the AVHFP Feature (dual use of A2DP/AVRCP and HFP).

As there is no specification release by the Bluetooth SIG explaining how this multi-profile use case should operate, a whitepaper has been issued by the A/V Working Group ("*Simultaneous Use of HFP, A2DP, And AVRCP Profiles*").

Basically, the Whitepaper states that the phone should handle the streaming restart management once the call is finished (this is the main concern today):

- *Incoming call*: the AG should handle the streaming management:
 - o Pause the streaming upon indication of incoming call.
 - o Send to the HF the indicators (CIEV Call setup)
 - o Then, the HF picks up the call with ATA, communication/SCO is established
 - o Once finished (from AG or HF), the AG should restart streaming from where it has been paused.
- *Outgoing call from HF (ATD)*: the AG should also handle this in the same manner.

Nevertheless, most phones do not correctly implement the Whitepaper, and the streaming does not always restart after the call. Parrot has developed a strategy that automatically relaunches streaming in this case.

Song information availability

According to the AVRCP version supported by the music player (can be a phone or a Bluetooth Music player), the Host is updated with the following information in order to update its HMI.

AVRCP TG 1.0 (Category 1 – Music Players):

- *Mandatory commands:*
 - o Play and stop.
- *Optional Features:*
 - o Enhanced control: Next, Previous, Pause, FF, FW (most of the phones/Players supporting AVRCP1.0 support those commands).
 - o There are a lot of other features, but the phone/Bluetooth Music Players do not implement these extended commands.

AVRCP CT 1.0 (Category 1 – Parrot Module):

- At least one command of the specification is mandatory.
- Parrot has decided to implement the full Player Control (events send to the phone):
 - o Play, Pause, Stop, Next, Previous, Pause, FF, FW

AVRCP TG 1.3 (Category 1 – Music Players):

- *Mandatory commands:*
 - o Same as AVRCP TG 1.0.
- *Optional Features:*
 - o If the phone supports the Bluetooth SIG Vendor Unique Feature, only Title of the Media is mandatory for Metadata. And Playback status and change of current track shall be supported in this case.
 - o Other important features for Metadata support are Name of the Artist, Name of the Album, Genre...

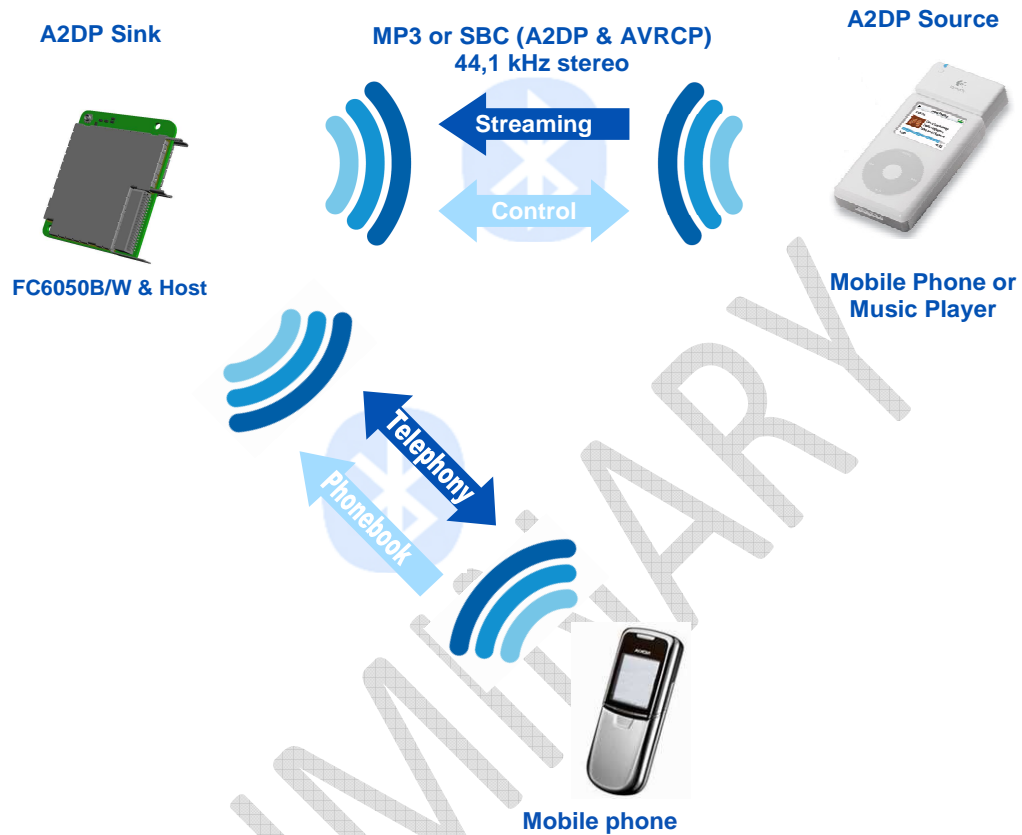
AVRCP CT 1.3 (Category 2 – Parrot Module):

- *Mandatory commands:*
 - o Same as AVRCP CT 1.0.
- *Parrot optional features implemented:*
 - o Referring to the specification, all “List of Media Attributes” are supported to be displayed on the car radio HMI.

According to the AVRCP version supported by the phone, the HMI should be implemented with information provided by the Module: Player status / Metadata for the current played song.

As member of AV Working Group, Parrot is involved with the development of those specifications.

14.1.5 Head Unit (FC6050 B/W) paired with Mobile phone and Music Player with Bluetooth dongle:



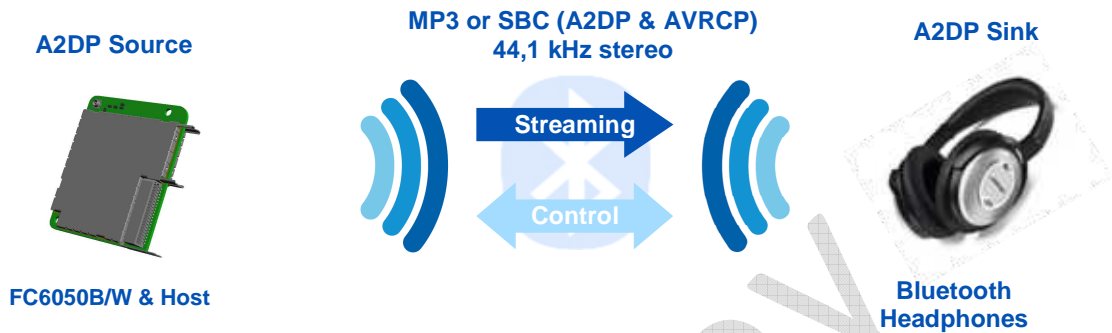
Connection Management

Parrot Module is able to maintain two Bluetooth connections: one HFP to a phone (where the phonebook synchronization is running after connection) and the other one with an A2DP SRC Music Player. From the Module point of view, there are two users connected.

As stated with the Whitepaper, in this use case, the Module handles the AVHFP because the A2DP SRC is not the connected phone. If the Bluetooth Music Player supports AVRCP TG, Parrot alerts the HMI with Playback status and Metadata.

14.1.6 Head Unit paired with a stereo Headphone

Audio Streaming from Module to a stereo headphone



Parrot Module also embeds the A2DP SRC role, and then is able to play local music files to a Sink device. Music file can be stored on a USB Flash Stick, or can be routed from an iPod/iPhone connected to the FC6050 via USB to the A2DP SNK (headphones).

14.1.7 Head Unit paired with two stereo Headphones

Audio streaming from Module to two Stereo Headphones simultaneously



(In this configuration, Concertos library is needed)

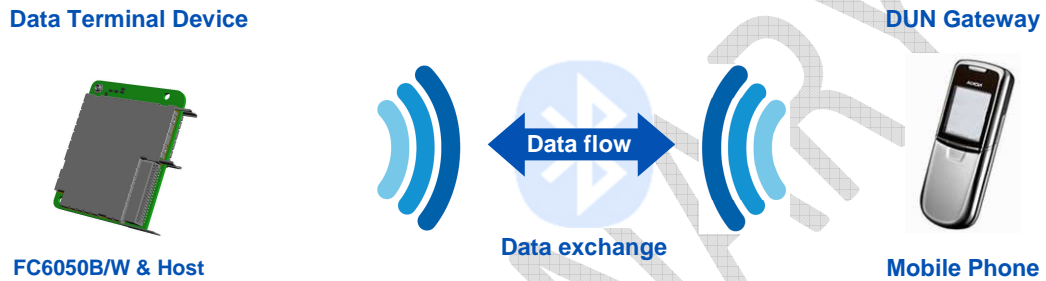


The Module manages the A2DP SRC role, and establishes two A2DP connections with two A2DP Sinks. The audio file is streamed at the same time to the two headsets.

This use case is intended for streaming audio to rear seat passengers for entertainment purposes.

14.1.8 Head Unit (FC6050 B/W) paired with Mobile phone: Data transfer

Dial Up Networking (DUN): The Head Unit (FC6050 B/W) acts as data terminal with a connected gateway device, typically a mobile phone. This allows the host to have access to internet data via the FC6050 B/W.



Multi Profile Use

Parrot handles multiple Bluetooth connections. On the same device, it is possible to set up both an HFP and a DUN connection.

According to the various Bluetooth implementations on phones, here is the description of what is possible (given no phone limitations):

- DUN only:
 - o In this case, the phone acts as a Gateway and the Module forwards the data to the Host (Data Terminal).
- HFP and DUN:
 - o If an incoming call occurs during the data transfer, there are three phone-dependent behaviors:
 - The call is established and data transfer continues without affecting bandwidth.
 - The call is established and data transfer is stopped (AG gives priority to HFP feature).
 - The remote caller reaches the voicemail of the connected phone (phone limitation).
 - o If an outgoing call is requested by the user, the behaviors above also apply.

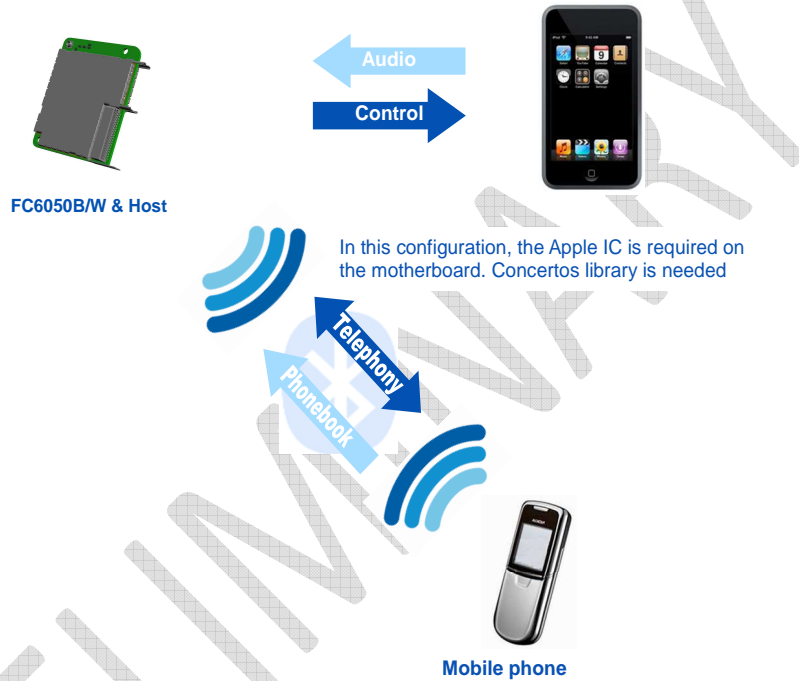
These behaviors are described, phone by phone, in the Parrot Bluetooth Compatibility Matrix with all tested phones.

14.2 **USB/iPod Use Cases**

The use cases in this section require the use of Parrot CONCERTOS, which is Parrot's Multi-Source Media Player Software Library (optional). Concertos enables DISCO playlist browsing on USB, iPod, SD and AVRCP1.4 devices and eases the switching from one source to another.

14.2.1 **Head Unit (FC6050 B/W) with an iPod connected through the USB**

USB Host and HandFree Device



iPod / iPhone Management

For iPod / iPhone management, the Module directly accesses the iPod/iPhone database via iAP. Here are the browsing modes offered by the Module:

- Artist (For all devices, including USB Mass Storage)
- Album
- Genre
- Playlist
- Title
- Podcast (only for iPod/iPhone)
- Composer
- File System (only for USB)
- Flat File System (only for USB)

Alternately, for the phonebook, UTF8 is used to communicate this database to the Host (independent of whether this is a USB or iPod database).

List of Compatible iPods

iPod Classic (3G), iPod Classic Photo (4G), iPod Classic Video (5G), iPod Classic (6G), iPod Mini (1G), iPod Nano (1G), iPod Nano (2G), iPod Nano (3G), iPod Nano (4G), iPod Touch (1G), iPod Touch (2G), iPhone, iPhone (3G).

14.2.2 iPod & iPhone use cases

The iPhone/iPhone3G can be used as a Bluetooth audio gateway and Music content at the same time. In this case,

- First, the user has to pair/connect their iPhone via Bluetooth to get the HFP features.
- Once HFP connection has been established, they can connect their iPhone to the dedicated iPod connector, and the Module handles the music browsing.

The user will have the Bluetooth HFP capacity and at the same time the possibility to browse the iPod's content.

More information about supported features are available in the Parrot Compatibility Matrix.

14.2.3 Head Unit (FC6050B/W) paired with a connected USB Mass storage device

USB Host and HandFree Device



Parrot Music Management

Once the USB flash stick is plugged in for the first time, the Module reads the USB stick content, parses music files, and gives the Host the access to the file system. Once this first parsing is finished, the Module re-parses music files, one by one, and builds the database using the Metadata included in each file. The database is built according to this new parsing.

The Parrot Module provides the same set of commands for USB or iPods devices. The implementation on the Host side is generic.

HFP and USB use at the same time

If a USB flash stick is plugged in while an HFP connection is already established with a phone, this case is handled in two separate processes. Handsfree features are available while Concertos is building the database in the background, without altering the Bluetooth link.

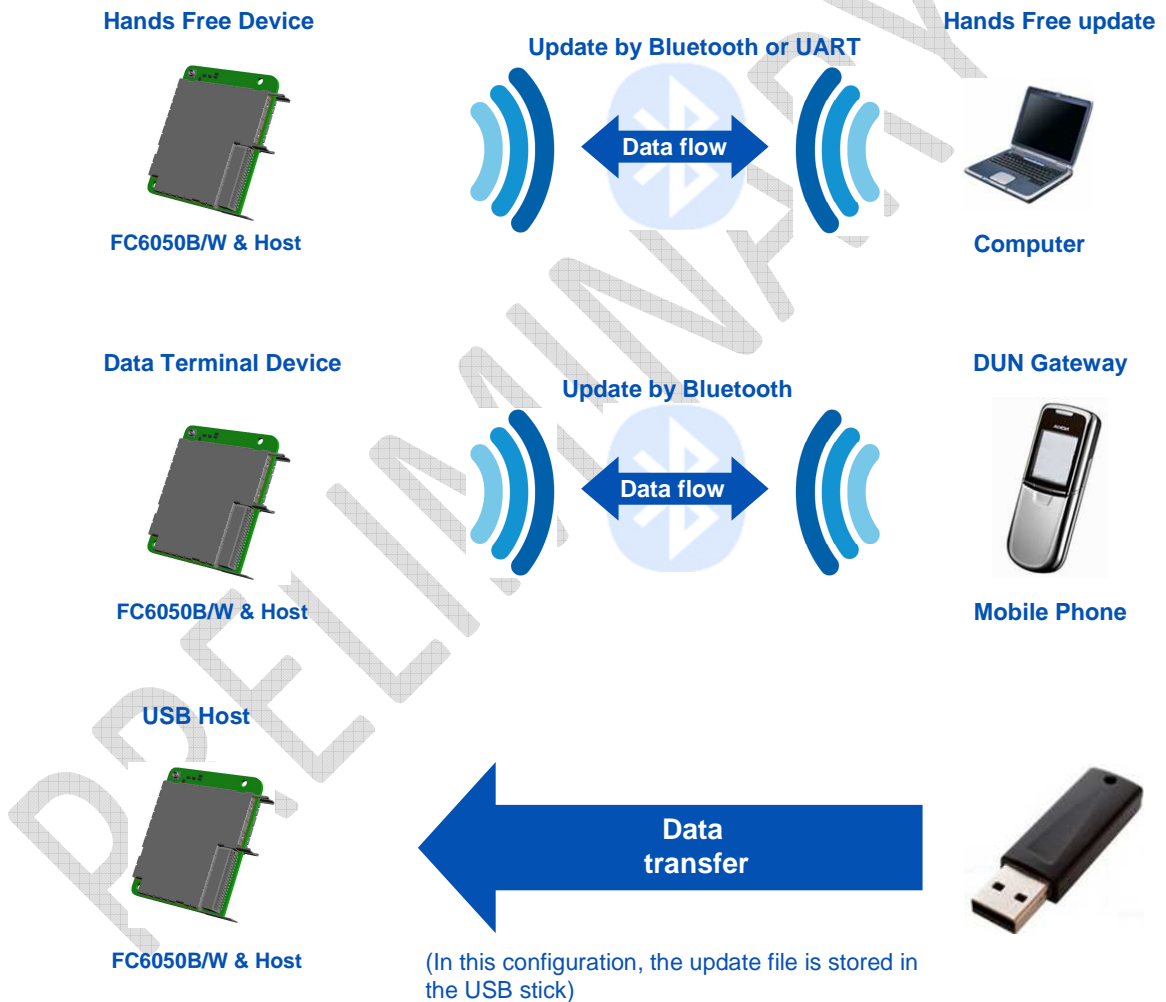
14.3 **Head unit (FC6050 B/W) BT/USB/Wi-Fi software update**

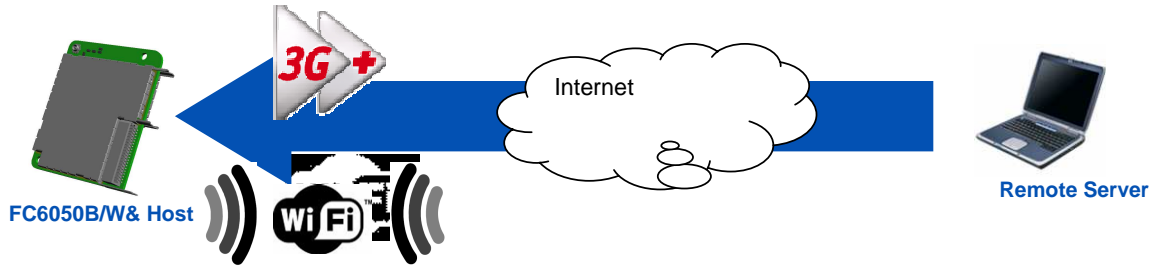
The firmware of Parrot modules can be updated in four different ways: by Bluetooth (when paired with a Bluetooth-enabled laptop), by DUN, USB or UART.

The ability to update Parrot module software in the field is a very important feature of the Parrot Module. This ensures better Bluetooth Compatibility with new phones, which are continuously being released to the market. Some of these new phones need to have a specific work-a-round when the Bluetooth specifications are not correctly implemented on the phone (i.e. non-generic Bluetooth management).

Moreover, a major software update can include a new feature/profile (such as AVRCP1.4 for instance) to give more compatibility or functionality to a car radio. This software update can immediately be flashed (by Bluetooth, USB...) into your product already out in the market.

User settings (paired devices, phonebooks...) are not erased during a software update.





Methods available

- **Bluetooth**
 - o Via SPP
 - o Via FTP
 - o Via DUN (through a mobile phone connected to a server where the new software is stored)
- **Via USB** with a standard USB flash stick.
- **Via UART** with a host CPU that sends the data
- **Via Internet:** The FC6050B/W connects a server using either a 3G dongle or a Wi-Fi connection (FC6050W). If an update is available on the server, the driver is then prompted to launch the update process. (future method)

Secured software update mechanism

When the FC6050 software is updated, the new software is copied into the Module's flash memory but the previous software is not overwritten by this copy. During this process, if an error occurs before the end of file transfer (Bluetooth disconnection, data transfer stopped, USB Stick removed...), the Module will restart with the previous software version.

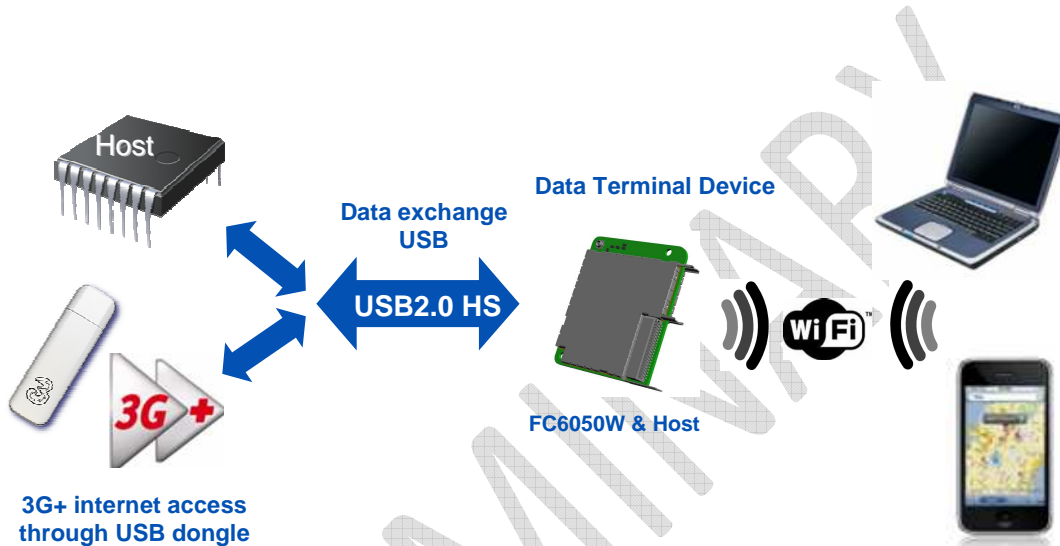
The checksum of the new software is included into this new software. If the new file is correctly written into the flash, when Module reboots, the new checksum is internally calculated and compared to the checksum of this new software. If checksum are equal, the new file will overwrite the previous one. During this process, if power supply is turned off, the remaining data will continue to be written where it had been stopped at the next boot.

14.4 **Wi-Fi use cases**

The head unit (FC6050W) is connected in Wi-Fi with a phone or a computer. It can connect to up to 8 Wi-Fi devices

14.4.1 **Wi-Fi access point**

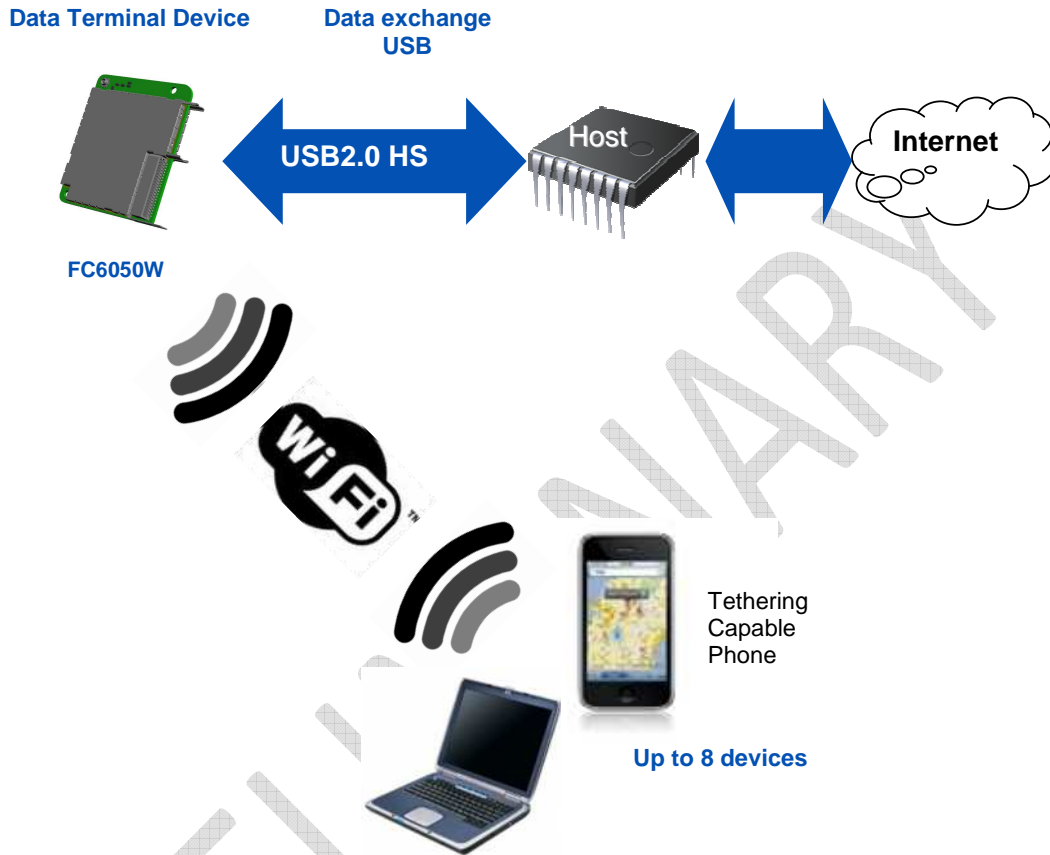
14.4.1.1 **Internet access in car through 3G+ USB dongle**



The module is connected to the internet through a 3G USB dongle. While the FC6050W only has one high speed USB port, it can support an external USB HUB (it can be a component soldered on host PWB or an external box) to support connection to both the host and the dongle.

The module then re-routes the internet data exchange to the Host and/or provides it to all the Wi-Fi connected devices (Laptop, netbook, iPhone, Google phone...) internet access can also be made available to the host.

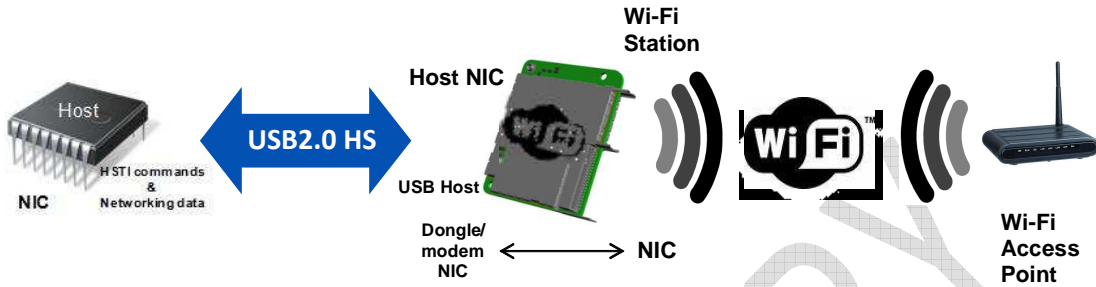
14.4.1.2 Internet access with 3G module connected to Host processor



The FC6050W module is connected to the internet through the host processor. The host processor manages a 3G module which gives the access to the internet. All data are transferred from the host processor to the FC6050W module through a high speed USB bus, the FC6050W is then an access point for all WiFi devices that need an internet connection.

14.4.2 Wi-Fi station

FC6050W is Wi-Fi station; it connects to an access point and provides internet access to the Host.



14.4.3 Internet access with mobile phone tethering

Data Terminal Device



The FC6050W module is connected to the internet through a 3G mobile phone supporting tethering over Wi-Fi. The module then routes the internet data exchange and provides internet connection to the host.

14.4.4 DLNA and UPNP

14.4.4.1 DLNA player

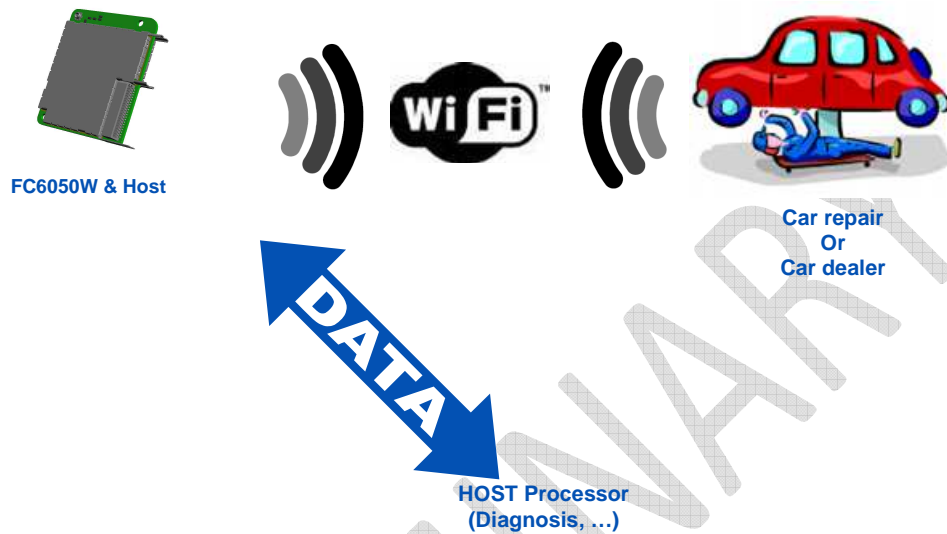
FC6050W is acting as a DLNA controller and renderer.

It is then possible to browse the media files available in the DLNA devices available in the car and play them either on streaming or after download.



14.4.5 Future use cases

14.4.5.1 Diagnose vehicle trouble codes or perform software updates at car dealership or car repair center



Connection with car dealer network

The car can be wirelessly connected to the car dealer diagnostic network at the dealership service bay. New module software can then be downloaded, or diagnosis data can be collected and sent to the car manufacturer for aggregate data analysis. The data can also be used to convince the car owner to perform preventative maintenance before costly repairs are required.

14.4.5.2 Vehicle 2 Vehicle communication

Organizations in the US and Europe are actively working to create specifications which would enable vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication. This technology can enhance safety by alerting the vehicle of hazards on the road beyond what is visible.

Based upon the final specifications, an alternate RF chip, supporting a different frequency, may be required to support this use case.



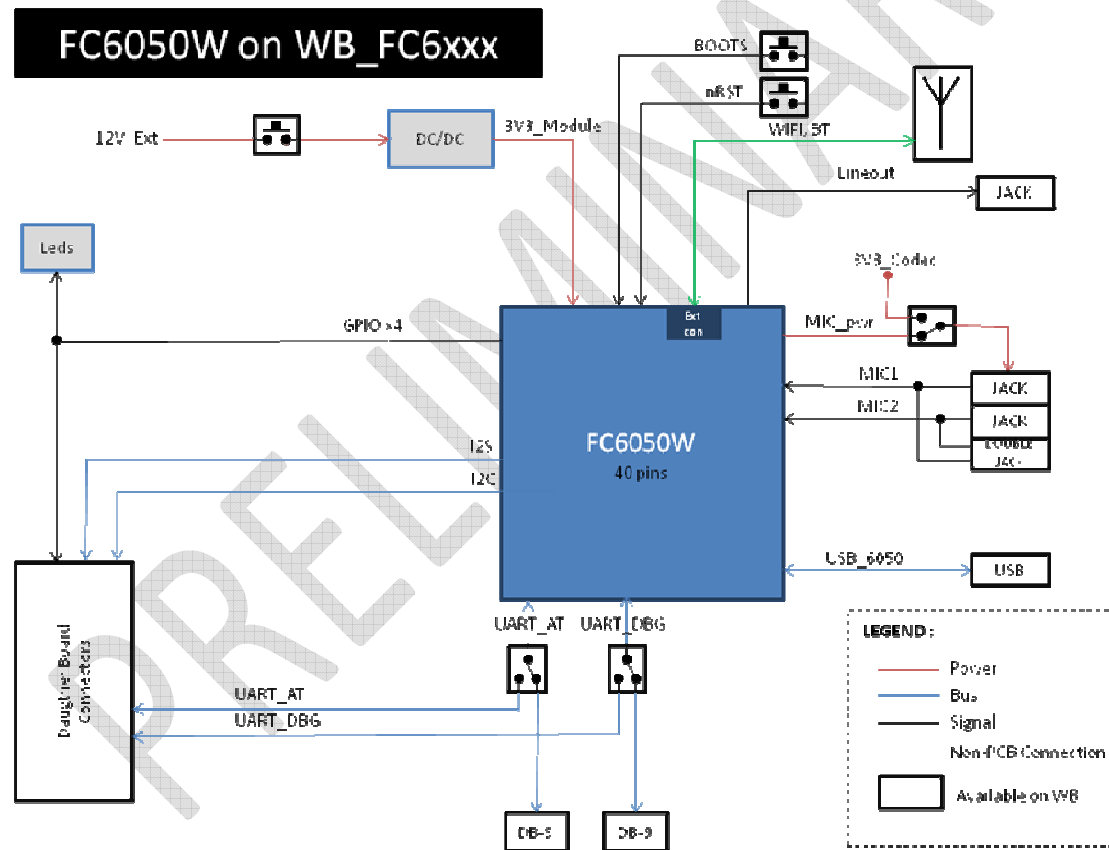
Example: the car automatically provides information to car neighborhood that there is a car crash or that there is a traffic jam ahead.

15 Workbench

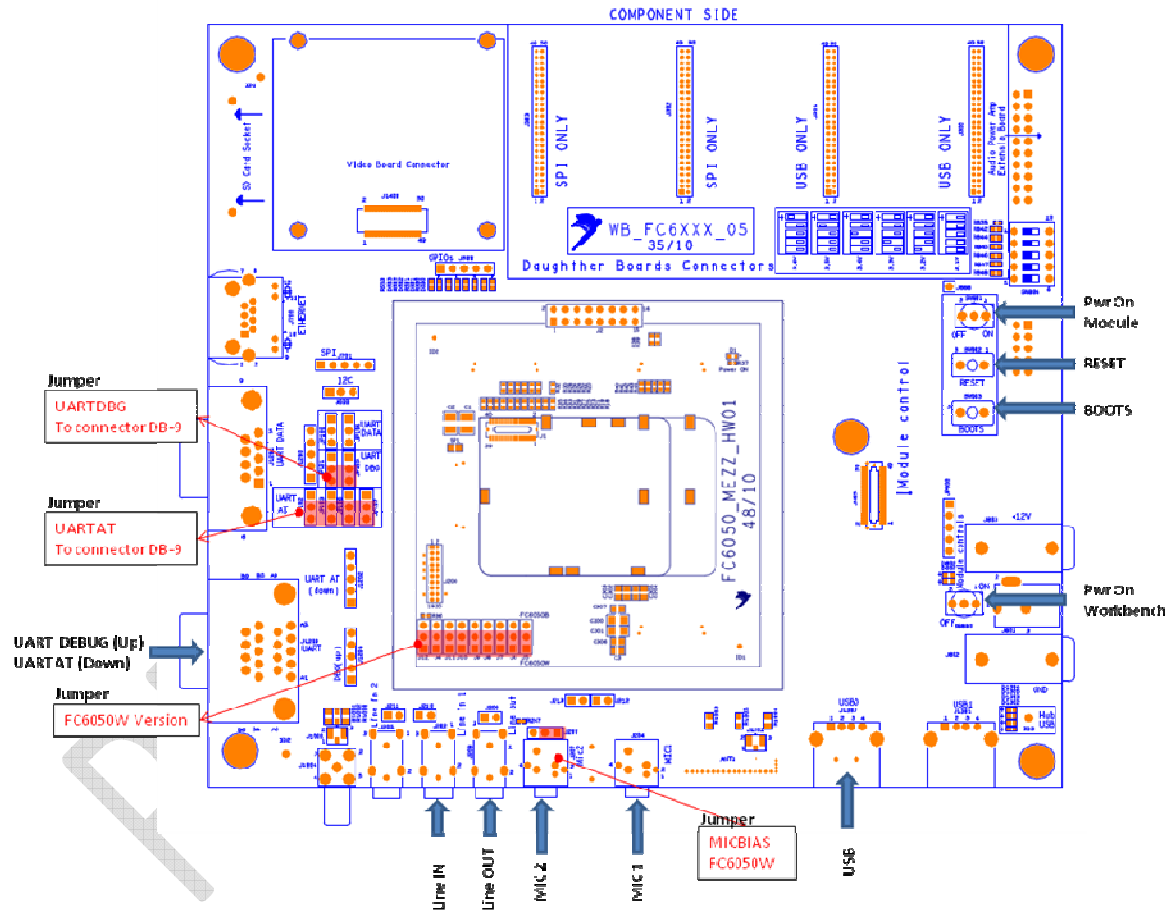
This section describes how to use FC6050 with the WB-FC6xxx_Hw02

15.1 Bloc Diagram

This diagram show all interfaces available on WB-FC6xxx to communicate with FC6050W Module



15.2 Connection & Jumpers Settings



16 Interoperability management during mass production

One of the key benefits of implementing a Parrot solution is knowing the system will have the same high level of compatibility Parrot is known for. In order to maintain the highest level of interoperability, Parrot has set up the following process:

- Parrot procures almost all available mobile telephones which are each individually tested.
- Local testing is done to account for variations in different carrier networks; Europe, USA, China, Japan & Korea
- A software team of 8 engineers focuses on the development of new Bluetooth profiles
- A dedicated software bug tracking system is used to allow testers around the world to access test results
- A dedicated software development team is available for debugging, as required
- Automated test methods which allow unmanned testing of AT Command interaction around the clock

There are two categories of phones used in testing:

1. Pilot phones (approved phones): Pilot phones are tested using the tier 1 product. This testing is done by the carmaker or Tier1. This usually includes 10 to 20 phones per region, depending on the market.
2. Compatible Phones: Compatibility Phone testing is done at the Parrot module level with approximately 500 phones per year worldwide.

Approved phones are typically highlighted by the tier 1 customer in their marketing material and customer-facing communication as examples of phones which exhibit highly compatible features. Compatible phones may include the “pilot phones” and are published in the “compatibility matrix” issued four times per year.

The following sections are intended to give you further insight pertaining to the dedicated process.

16.1 **Blues interoperability testing (compatible phones)**

- **Compatibility testing (done continually):**

Compatibility testing is done continually to verify interoperability with the Parrot Blues software. This testing is done in the US, Europe, Japan, Korea and China. Phones are targeted for testing according to the following criteria;

- All phones that are less than 18 months old
- All popular phones (even if they are older than 18 months old)



- **Pilot phone testing process for new BLUES releases (done per release):**



16.2 Pilot phone testing of the gateway (Final product)

All phones tested during the Compatibility Testing process described above don't need to be retested on the final tier 1 product (gateway). A set of pilot phones, generally around 10, are selected based on the set of features used in the product and phones which support those features. If this set of pilot phones work properly with the gateway, the HMI can be considered successfully validated for all phones with the same result found in Parrot's compatibility matrix.





The following steps are required to complete the pilot phone testing of the gateway:

- The customer will provide the set of AT commands they have implemented to control the HMI and communicate with the Parrot software (or module).
- The customer will also provide flow charts showing how the AT commands are implemented according to planned use cases.
- After review of the AT Command flow charts, Parrot will provide the list of pilot phones that support the Gateway features and thus generate all AT commands and events used in the HMI through the Gateway.

If new features are added later and a new AT command is needed, the pilot phone testing of the gateway should be repeated with a new set of pilot phones that exercise that new AT command:



The pilot phones testing is the responsibility of the tier 1 or the car maker using phones approved by Parrot according to the steps described above.

17 Approval / Certifications

17.1 ***Bluetooth 3.0+HS qualification***

17.2 ***Wi-Fi qualification***

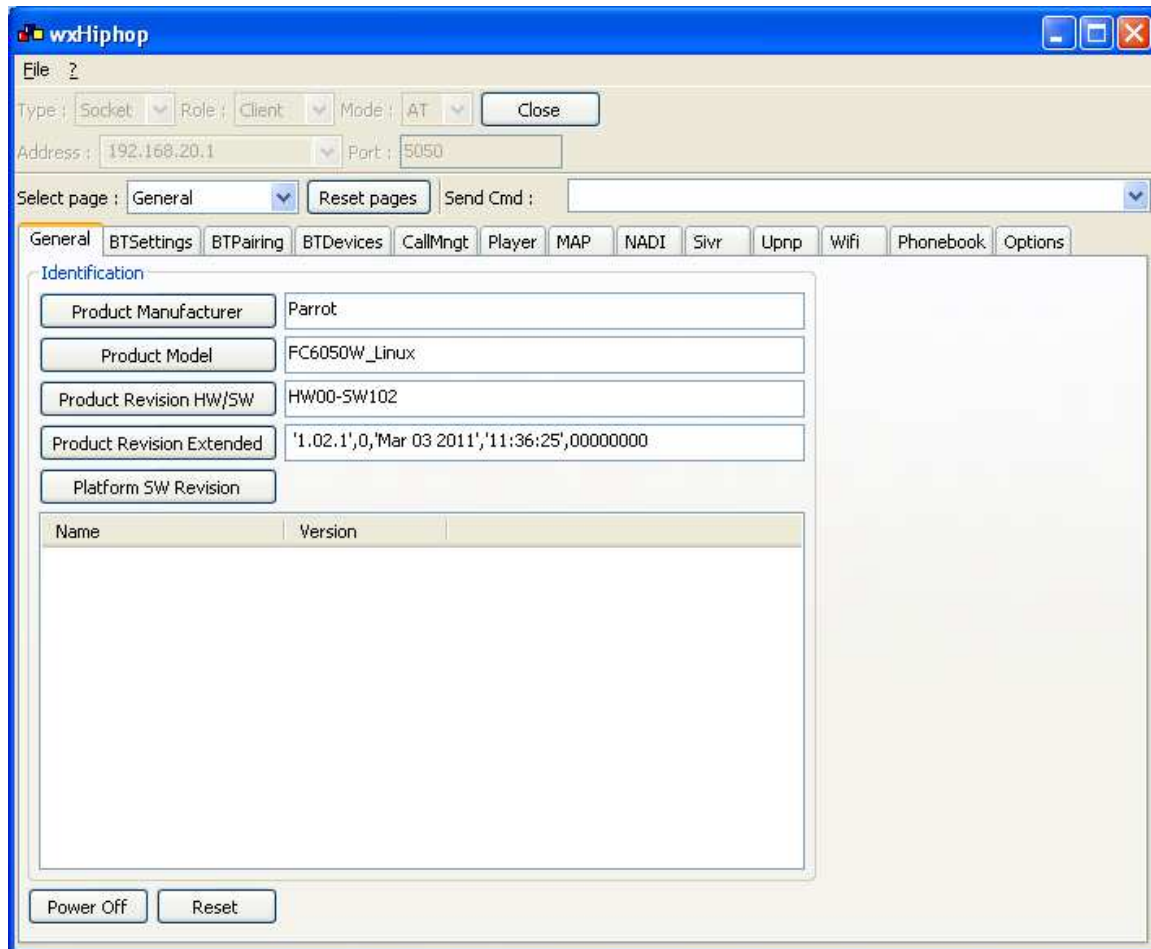
17.3 ***EMC certification***

17.4 ***RoHS declaration.***

PRELIMINARY

18 Communicate with FC6050 from PC: WxHipHop

For development purpose, WxHipHop is a windows-based software that gives the possibility to send and read the AT commands used by the FC6050 from a PC.



19 FCC and IC Requirements for module application

FCC ID: RKXFC6050W
IC : 5119A-FC6050W

In accordance with FCC Part 15, the FC6050W is listed as a limited Modular Transmitter device.

USA – User information

This intends to inform how to specify the FCC ID of our module “FC6050W” on the product. Based on the Public Notice from FCC, the host device should have a label which indicates that it contains our module. The label should use wording such as: “Contains FCC ID: RKXFC6050W”

Any similar wording that expresses the same meaning may be used.

The label of the host device should also include the below FCC Statement. When it is not possible, this information should be included in the User Manual of the host device.

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

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

Canada – User information

This intends to inform how to specify the IC ID of our module “FC6050W” on the product. According to Canadian standards “RSS 210” and “RSS Gen” , the host device should have a label which indicates that it contains our module. The label should use wording such as: “Contains IC ID: 519A-FC6050W

Any similar wording that expresses the same meaning may be used.

The label of the host device should also include the below IC Statement.

When it is not possible, this information should be included in the User Manual of the host device.

“Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.”

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.