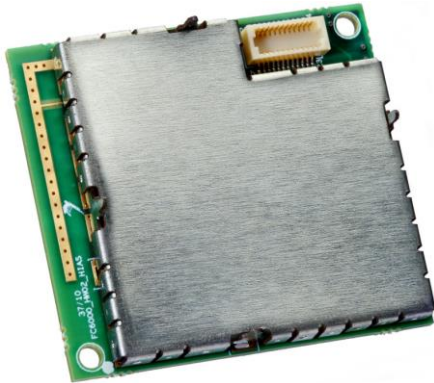# FC6000+

Version 1.3

October 2015

Confidential Information

Parrot FC6000+

All in one multimedia module
Dual mode Bluetooth 3.0 and 4.0 (BLE)

FEATURES

Bluetooth 3.0 and 4.0 qualified module
Wide band speech
3.3V & 1.8V power supply
UART, I²S, I2C,
GPIO,
USB 2.0 High Speed
Digital audio input and output
Analog microphone input
Analog output
Up to 10 paired phones
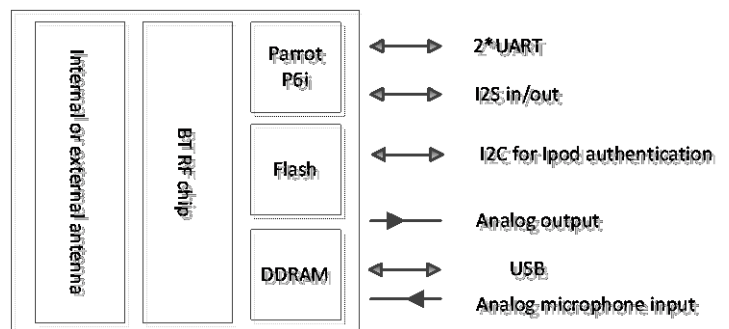Small size module (32 x 36 mm)
Automotive qualified

Application:

- Telephony
- Internet access (through DUN or PAN)
- Audio Streaming
- Multimedia Connectivity via USB
- Voice Recognition / Text To Speech

The FC6000+ integrates the latest version of the Parrot Bluetooth stack (Blues). Blues gives to the customer a very high level of compatibility with most of the phones available on the market and provide phonebook and list synchronization. FC6000+ offers the possibility to use a Speaker Independent Voice Recognition (SIVR) and a Text To Speech algorithm (TTS).

Description:

Parrot FC6000+ is a fully integrated Bluetooth phone connectivity solution powered by a Parrot P6i with 416 MIPS with an internal CODEC and NR/AEC signal processing. It integrates a large variety of interfaces for an easy integration in most of the applications.
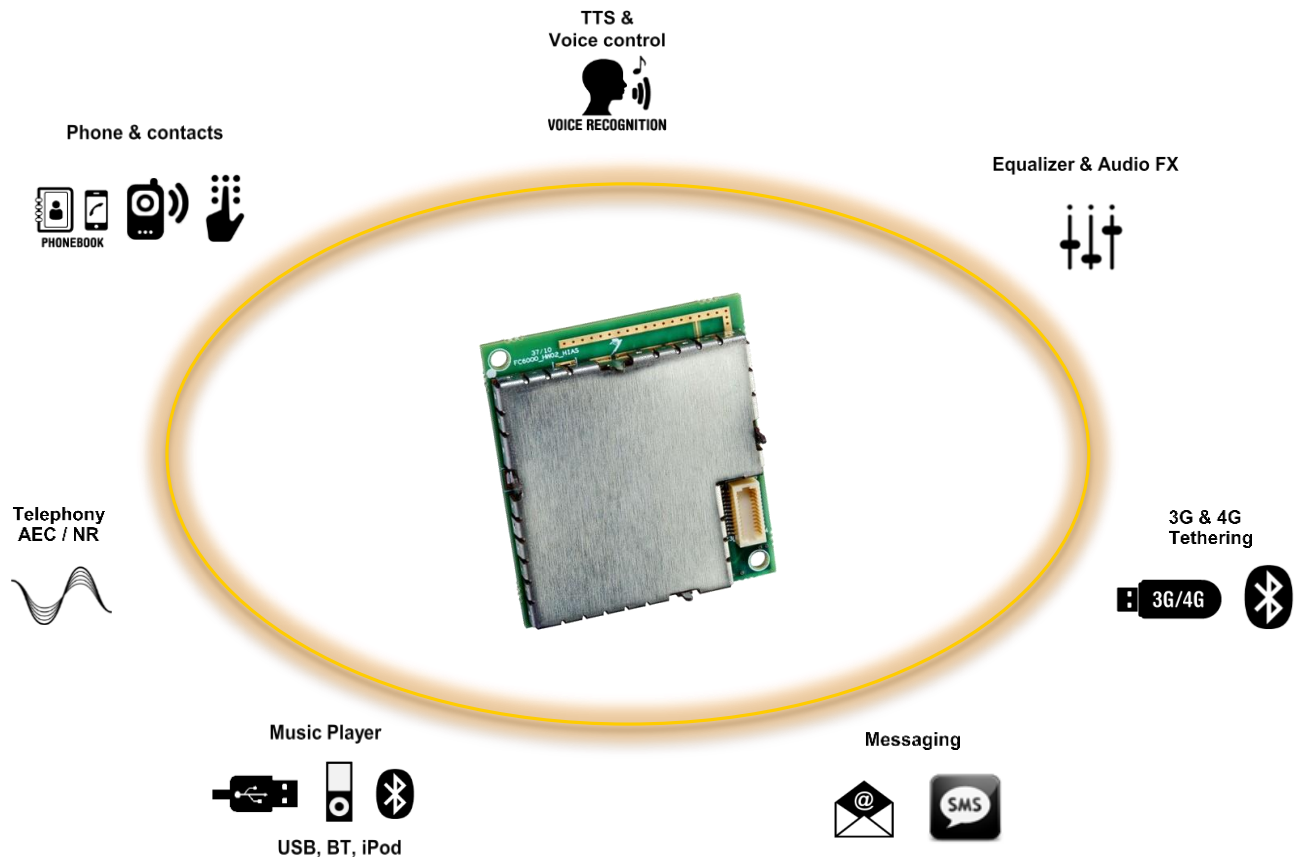
Table of contents

DATASHEET FC6000+

1 Product overview

The FC6000+ is a feature-rich Bluetooth platform dedicated for the integration of Bluetooth in car audios, car telematics systems or any systems requiring a complete embedded multimedia solution.

FC6000+ features are:

- **BT4.0 Enhanced Bluetooth connectivity**
    - Bluetooth Power Class 2 Radio
    - Embedded Bluetooth 1.0, v1.2, v2.0+EDR, v2.1+EDR & v3.0 & v4.0 compliant
    - Bluetooth 4.0 LE* Ready
    - Embedded profiles
    - Compatible with most of Bluetooth phones
    - **iAP over Bluetooth:** control of Apple devices (in combination with analog audio out)* depending of usecase **not applicable for FC6000+ config0**
    - Pairing and connection with all Bluetooth Devices: Phones, Smartphones, PDA …
    - Multiple users support: Up to 10 paired phones depending on Flash memory size.
    - Multiple connections (up to 3 device connected at the same time)
    - Multiple profiles

- **Phone**

- Phone call management (HFP 0.96, 1.0, 1.5, 1.6, 1.7 & HSP 1.0) including accept/end/initiate/reject calls
- Double HFP
- Call continuance,
- Place call on hold
- Multi-call
- Caller Line Identifier
- Call history (dialed number, received calls, missed calls)
- Redial
- Automatic answer, (from host via pickup command)
- Private mode
- Send DTMF during calls, network signal levels as well as carrier name and multi user support (up to 5 paired phones).

- **Phone Book**
  - Automatic Phone book synchronization over Bluetooth (up to 5x2500 contacts; depending on the Flash memory size)
  - Call history (dialed number, received calls, missed calls)
  - All Synchronization Methods
  - Full Unicode for compatibility with numerous characters sets, 22 languages are available for phonebook sorting (European, Russian, Chinese, Japanese…)

- **Digital Signal Processing**
  - Microphone: the module can manage:
    - Single microphone **except for FC6000+ config0**
    - Two microphones **only for FC6000+ config0** 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.
    - Tuning does not depend on car
  - 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
    - Tuning is independent of the car model.
  - Automatic Level Control (ALC)
    - Different phones can have different Speaker volumes (up to 20dB of difference). ALC adapts the signal level received from the phone to the target level, quickly and precisely.
  - Equalizer
    - 9 bands equalizer for microphone 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 (HFP 1.6 & 1.7)
  - All algorithms work @ 16 kHz.
  - True audible telephony quality improvement
- VDA (Verband der Automobilindustrie)
  - Parrot speech processing algorithm are designed to comply with VDA 1.6 standard
  - Parrot has its own laboratory and VDA test ring to measure the following:
    - Levels
    - Loudness
    - Frequency response
    - In-band/Out-of-band signals
    - Idle channel noise
    - Activation
    - Echo performance

    Other test like TMOS or in noise measurement can be performed with Parrot partners

    These tests were all successful on Parrot modules

- **Additional Audio Algorithms** (under development)
  - Loudness
  - Virtual Bass
  - Spatialization

- **Audio Streaming**
  - Embedded SBC decoder
  - Embedded MP3 decoder from Thomson Licensing (optional)
  - Embedded AAC decoder from Via Licensing (optional)
  - Stereo audio output

- **Speaker Independent Voice Recognition**
  - Parrot has a strong expertise and background in voice processing. A solid and long-lasting partnership with Nuance is in place.
  - About 22 languages are available for speaker dependent voice prompt (including Japanese, Latin, Russian, Arabic, Pinyin and Chinese character sets)

- **Miscellaneous**
  - Provide Phone Battery Level and Network Level, Carrier Name (depends on phones)

- **Software Update**
  - Full standard Software available
    - Software update available through Bluetooth, USB(**not possible for FC6000+ config0**), UART
  - Very large compatibility with Phones, Smart phones, PDAs, Music players

- **Concertos**
  - Concertos is a software Library which acts as a multi-source media player.

➢ Concertos enables DISCO playlist browsing on USB/MTP, iPod and AVRCP1.6 devices

- **External Bluetooth Antenna connection diagnostic**

- **HSTI**
  In order to facilitate communication between the FC6000+ and your product host microprocessor, Parrot has created and provides the HSTI Library. The HSTI library is the software application programming interface (API) to integrate the FC6000+ command and control within the software of the host processor.
  HSTI is backward compatible with former AT commands. Few adaptations may be considered due to the improvements in the new modules generation. Application notes are available.
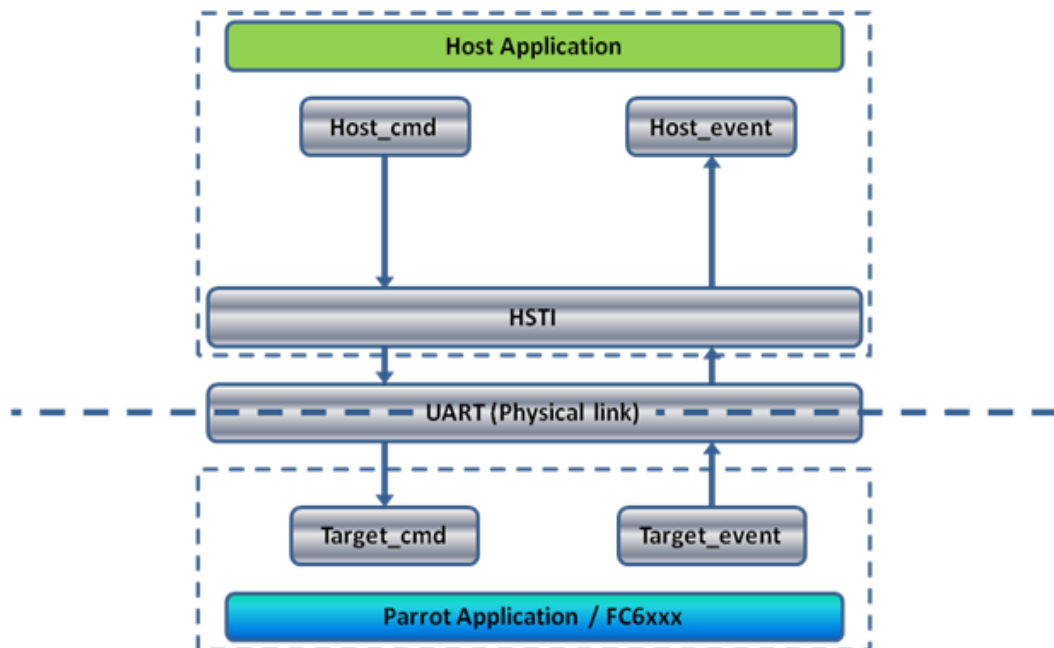
Notes: Also possible via USB link through socket.

2 Software specifications

2.1 Bluetooth stack

- HCI (Host Controller interface) 3.0 and 4.0,
- 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 software).
- HCI Read Encryption Key Size command (BT 3.0 software).

2.2 Bluetooth profile supported

- Generic Access Profile
- Phone Management
  - HFP 0.96 / 1.0 / 1.5 / 1.6 / 1.7
  - Multi-HFP[1]
  - HSP 1.0 / 1.2
  - SAP (SIM Access Profile) 1.1[2]

- Message Management
  - MAP 1.0

- Phone Book
  - PBAP 1.0 / 1.1 / 1.2
  - SYNC 1.1 (IrMC SYNC over BT)
  - SYNC ML profile
  - OPP Server/Client (Vcard 3.0) 1.0 / 1.1 / 1.2
  - GSM 07.07 AT Commands
  - Nokia synchronization protocol

- Multimedia
  - A2DP (Audio) 1.2
  - SBC decoding
  - MP3 decoding(optional)
  - AVDTP 1.2
  - AVRCP 1.0 / AVRCP 1.3 / AVRCP 1.4 / AVRCP 1.6

- Others
  - SPP 1.1
  - BNEP, PAN 1.0
  - FTP 1.0 / 1.1 / 1.2
  - Image transfer over OPP[3]
  - DUN 1.1
  - Software update over FTP
  - Secure Simple Pairing

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[1] Only For Nand Version
[2] Only For Nand Version
[3] Only For Nand Version

2.3 Multimedia Player "concertos"

- ➢ CONCERTOS, Parrot Music Media Player Library
  Concertos is the new music library developed by Parrot to ease the management of music files. Concertos uses DISCO and Tango MMP Parrot libraries; DISCO organizes the music stored on external sources connected to the FC6000+ and creates a database of playable music files; Tango MMP is the high quality audio player.
  Album cover art and meta data available in DISCO database

- ➢ USB
  USB 2.0 high speed transceiver
  Compliant with USB devices supporting Mass Storage Class

- ➢ IPod / iPhone / iPad connectivity
  IAP (iPod Accessory Protocol) for browsing from HMI
  Album cover art download
  For this use case, the Apple Authentication IC needs to be laid out by customer on the host motherboard.

- ➢ Bluetooth Audio Streaming
  The solution embeds on the ASIC and SBC encoder and decoder (optional: MP3 and AAC decoder) and necessary profiles for Audio Streaming over Bluetooth. Bluetooth A2DP Audio Streaming is the simplest way to allow users to listen to music files stored on their compatible device via their car stereo. The playback is controlled on the remote device thanks to the AVRCP profile. (AVRCP 1.4 and 1.6 in the future).
  IAP over Bluetooth is also supported in order to control the stream from an Pod or iPhone.

- ➢ Audio decoder

Format	File extension	Sample frequency (kHz)	Bit rate (kbps)
MP3 (MPEG1 Layer3)	.mp3	32/44.1/48	32, 40, 48, 56, 64, 80, 96, 112, 128, 160, 192, 224, 256, 320
AAC	.mp4/.aac/.m4a	16/22.5/32/44.1/48	16 to 320
SBC		16/22.5/32/44.1/48	16 to 320
WMA	.wma	16/22.5/32/44.1/48	VBR supported, CBR 5 to 320
WMA	.wma	16/22.5/32/44.1/48	
WMA Pro, Lossless	.wma	16/22.5/32/44.1/48	
Ogg Vorbis	.ogg	44.1/48	
WAV	.wav	16/22.5/32/44.1/48	
AAC LC, HE, HEv2		Frequency from 8 to 48khz	
AC3		48	448
FLAC	.flac	16/22.5/32/44.1/48	

2.4 Software interface

The FC6000+ 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.

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 phonebook management in any language.

2.5 Memory configurations

FC6000+ options and configurations						Capacity (typical case)				
Configurations	USB 2.0 Audio Player & 4G dongle	VR & TTS for Contact	VR & TTS Contact & Music	FLASH	RAM	Vcards synced (total)	Songs synced	Embeded Languages	Contact recognized by voice	Artist or albums recognized by voice
Config 0 : base	✘	✘	✘	64Mb	256 Mb	2500	-	-	-	-
Config 1 : USB	✔	✘	✘	1Gb	256 Mb	5000	30000	-	-	-
Config 2 : VR	✘	✔	✘	1Gb	256 Mb	5000	-	1 to 4	1500	-
Config 3 : USB+	✔	✘	✘	2Gb	256 Mb	5000	100000	-	-	-
Config 4 : VR+	✘	✔	✘	2Gb	256 Mb	5000	-	1 to 9	1500	-
Config 5 : Full	✔	✔	✔	2Gb	512 Mb	5x2500	100000	1 to 4	2500	20000
Config 6 : Full+	✔	✔	✔	4Gb	512 Mb	5x2500	100000	1 to 12	2500	20000

2.6 Speaker independent Voice recognition

2.6.1 Voice Recognition principles

2.6.1.1 Description

VoCon 3200 is NUANCE training-less speaker independent speech recognition algorithm.

- Speaker independent
- Grapheme-to-phoneme context-dependent models provide accuracy improvement, especially for digits and contact names recognition on one hand and multimedia items on another.
- Words models for a better precision, 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 and Word Error Rate (WER)
- Unsupervised speaker adaptation

2.6.1.2 Operation
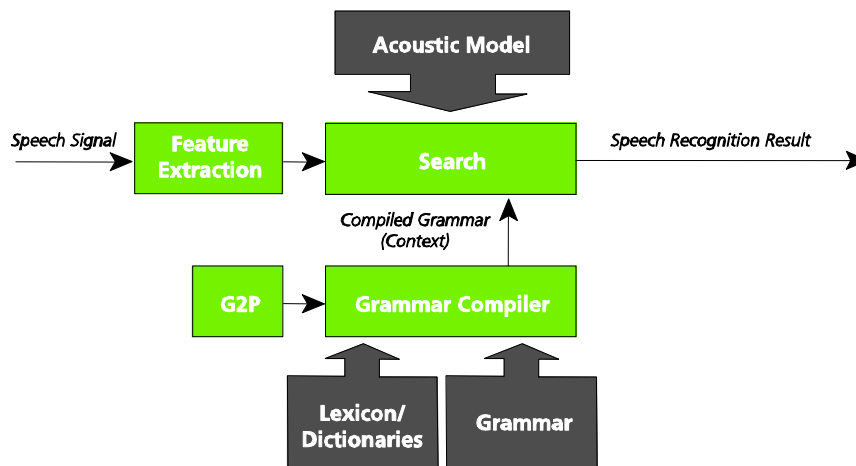
During a voice recognition process, "Feature Extraction" module decomposes the signal. The module "Search" looks for the equivalent text using the modules "G2P" and "Grammar to compile". These two modules are using the libraries "Acoustic Model", "Lexicon" and "Grammar".

Module G2P ensures equivalence between the graphemes and the phonemes.

For each language is associated an acoustic model ("Acoustic Model"), a grammar and a lexicon ("Grammar" and "Lexicon").

System feedback is realized by a screen display and/or sounds (synthesized voice, chime, pre-recorded voice prompts…).

Operation is ended by a final action (phone number dialing, radio station tuning…).

2.6.2 Test To Speech (TTS)

Text to Speech (TTS) on FC6000+ is based on SVOX Automotive Speech or Vocalizer Expressive that could be supported.

SVOX Automotive TTS solutions are tailored for noisy car environments and enjoy a reputation for industry-leading quality. It powers many of the most advanced and successful in-dash infotainment systems in the market. SVOX TTS technology is characterized by natural and clear sound.

It 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.

Dedicated prompt can be offer according to customer requirement (tuned prompt or recorded prompt).

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

The engine provides an excellent quality prosody (i.e. sentence intonation) using state-of-the-art prosody modeling 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 for 22 languages: (Preliminary)

01) US English 02) CA French 03) N.A. Spanish 04) UK English 05) French 06) Italian 07) German	08) Spanish 09) Dutch 10) Danish 11) Swedish 12) Portuguese 13) Brazilian Portuguese 14) Turkish	15) Russian 16) Polish 17) Czech 18) Mandarin Chinese 19) Korean 20) Japanese 21) Australian English 22) Arabic

2.6.3 Voice control: Main use cases

2.6.3.1 VR for Phonebook & contact

Recognize the synchronized phonebook entries (name & surname).

2.6.3.2 VR for Music

Recognize artists, albums, genres, playlists, radios: regardless of where the media file resides.
- o "iPod play Ben Harper"
- o "frequency ninety seven point nine"

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

Gracenote (option)
This 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.

MediaVOCS TM (option)
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 error 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	Dutch
UK English	German	Portuguese
French (EU & CND)	Spanish (EU & MEX)	Mandarin
Japanese	Russian	

Nuance Music Pre-Processor (option)
The Parrot SOPRANO 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 are artist's names that they know are present on their own music player without looking at any visual prompt.

2.7 Other features

Messaging (SMS, Email, MMS)
FC6000+ supports the MAP profile which allows handling of SMS and e-mails.

Personal Information Management (PIM)
- Calendar
- Tasks
- Notes

Data Connectivity (Internet) via Bluetooth and USB
- FC6000+ supports the DUN and PAN profiles to enable a data channel made available to the Host CPU. An easy user interface with automatic connection is available.
- USB tethering: use data connection from your connected smartphone or from a 3G/3G+/LTE dongles

3 USB Hub

The FC6000+ has one USB port **not applicable for FC6000+ config0**
It is mandatory to use a USB hub external to the module if more than one USB device is connected to the FC6000+

4 Electrical specifications

ALL ELECTRICAL SPECIFICATIONS COULD BE UPDATED WITHOUT NOTIFICATION.

4.1 Hardware architecture

4.1.1 FC6000+ config0 Hardware architecture
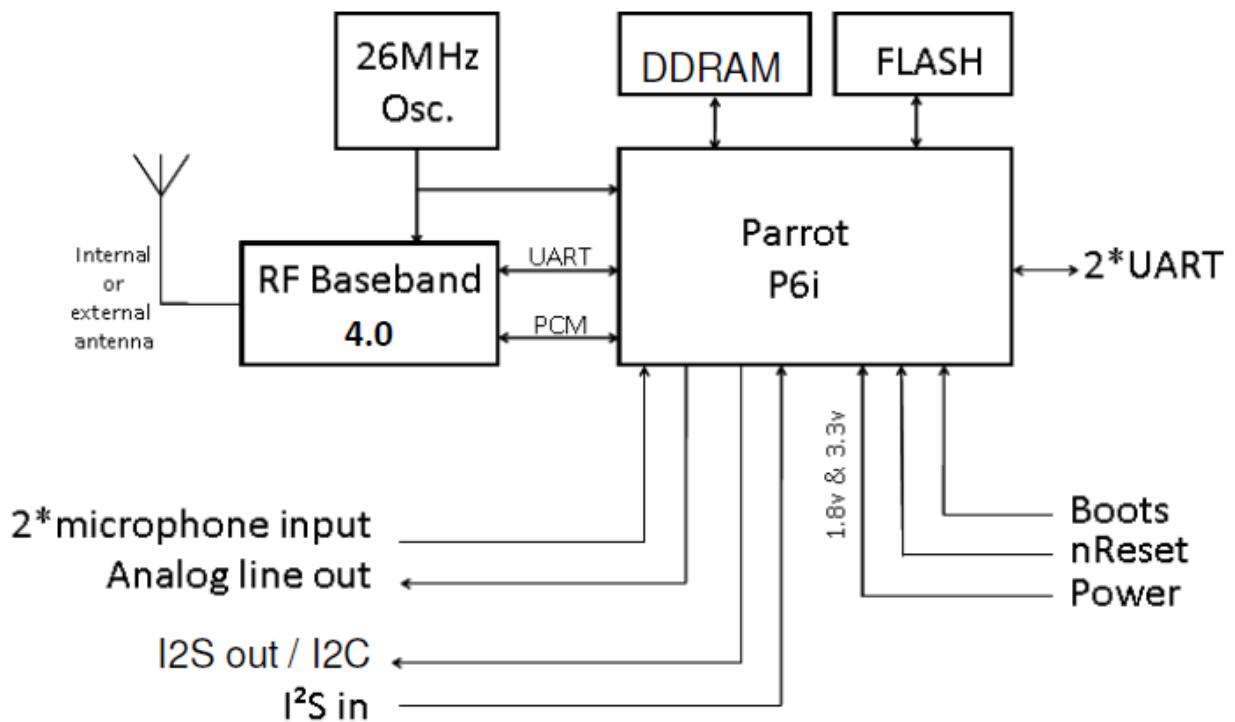
4.1.2 FC6000+ from config1 to config6 Hardware architecture

4.2 Pin-out

4.2.1 FC6000+ config0 Pin-out diagram :

4.2.2 FC6000+ from config1 to config6 Pin-out diagram :

4.2.3 Pin out table

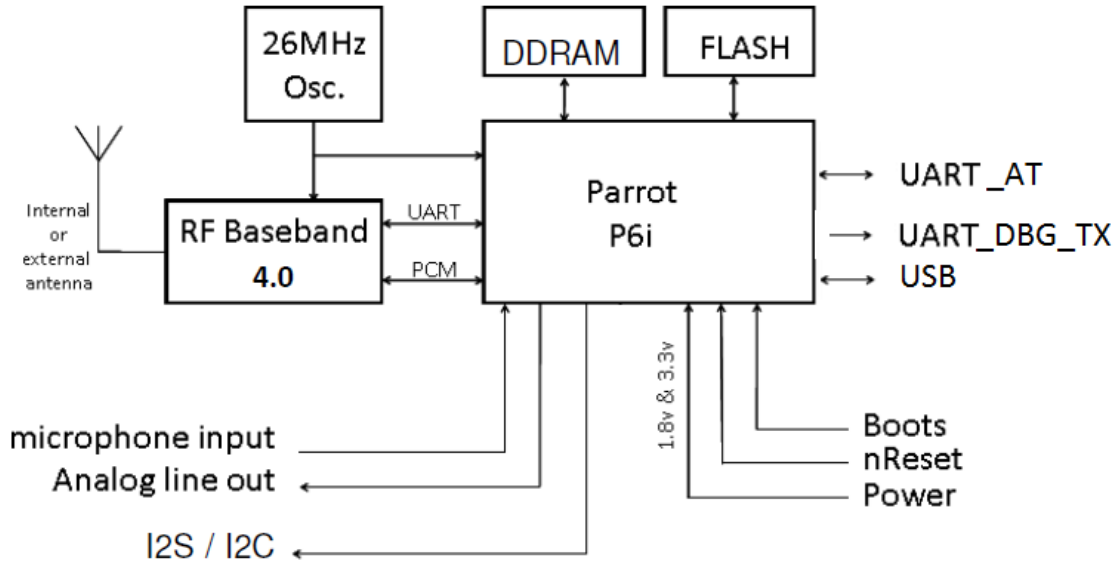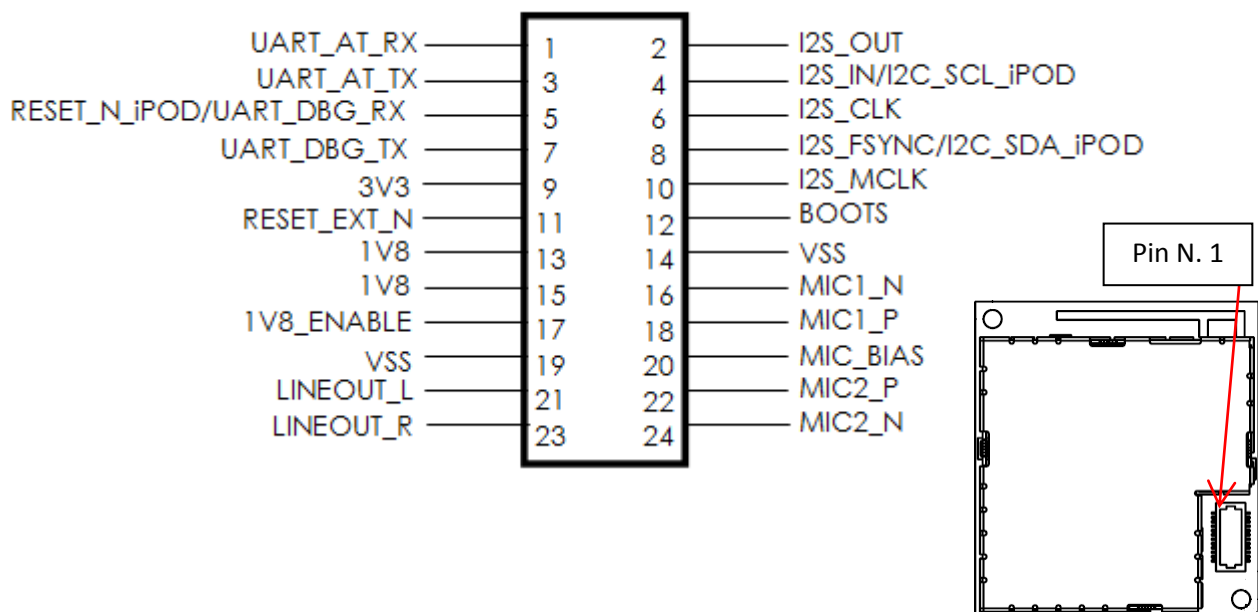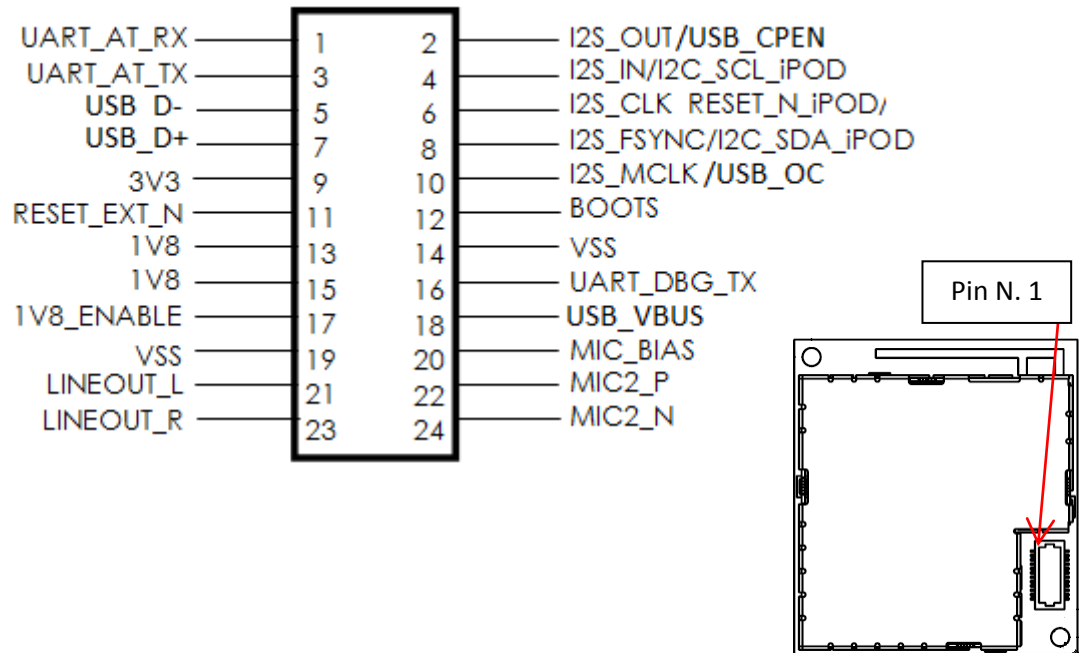| PIN	SIGNAL Config 1 to 6	SIGNAL Config 0	PIN TYPE	FUNCTION	Voltage Rating (V)	
					Min	Max
1	UART_AT_RX	UART_AT_RX	I	AT Commands & flash update UART input	-0.3	3.6
2	I2S_OUT*	I2S_OUT*	O	Digital audio data output	VSS	P3V3[1]
2	USB_CPEN	N.A	O	VBUS Power Enable	-0,3	3,6
3	UART_AT_TX	UART_AT_TX	O	AT Commands & flash update UART output	VSS	P3V3[1]
4	I2S_IN*	I2S_IN*	I	Digital audio data input	-0.3	3.6
4	I2C_iPOD_SCL*	I2C_iPOD_SCL*	IO	I2C Clock bus for iPod chip communication	-0.3	3.6
5	USB_DM	N.A	IO	DATA USB -	-0,3	2,5
5	N.A	UART_DBG_RX	I	Debug Uart input	-0, 3	3.6
5	N.A	RESET_N_iPOD	O	Activate the chip iPod on the host side	-0.3	3.6
6	RESET_N_iPOD	N.A	O	Activate the chip iPod on the host side	-0.3	3.6
6	I2S_CLK*	I2S_CLK*	O	Digital audio main clock (master mode only)	VSS	P3V3[1]
7	USB_DP	N.A	IO	DATA USB +	-0,3	2,5
7	N.A	UART_DBG_TX	O	Debug UART output	VSS	P3V3[1]
8	I2S_FSYNC*	I2S_FSYNC*	IO	Digital audio synchronization clock (master mode only)	-0.3	3.6
8	I2C_iPOD_SDA*	I2C_iPOD_SDA*	IO	I2C Data bus for iPod chip communication	-0.3	3.6
9	P3V3	P3V3	P	Positive power supply : 3,3V	-0.3	3.6
10	I2S_MCLK*	I2S_MCLK*	O	Digital audio master clock (master mode only)	VSS	P3V3[1]
10	USB_OC	N.A	I	VBUS over current	-0,3	3,6
11	RESET_EXT_N	RESET_EXT_N	I	Reset signal – Active Low	-0.3	3.6
12	BOOTS	BOOTS	I	Boot mode selection signal – Active High	-0.3	3.6
13	P1V8	P1V8	P	Positive power supply : 1V8	-0.3	1.92
14	VSS	VSS	P	Power supplies ground	0	0
15	P1V8	P1V8	P	Positive power supply : 1V8	-0.3	1.92
16	UART_DBG_TX	N.A	O	Debug UART output	VSS	P3V3
16	N.A	MIC1_N	AI	Negative differential Microphone input 1	-0.3	3.8
17	1V8_ENABLE	1V8_ENABLE	O	1V8 Power Supply Enable signal – Active High	VSS	P3V3[1]
18	USB_VBUS	N.A	P	USB VBUS	-0,3	5,25
18	N.A	MIC1_P	AI	Positive differential Microphone input 1	-0.3	3.8
19	VSS	VSS	P	Power supplies ground	0	0
20	MIC_BIAS	MIC_BIAS	AO	Microphones bias voltage	2.5	3.0
21	LINEOUT_L	LINEOUT_L	AO	Analog audio stereo output, left channel	VSS	2.8
22	MIC2_P	MIC2_P	AI	Positive differential Microphone input 2	-0.3	3.8
23	LINEOUT_R	LINEOUT_R	AO	Analog audio stereo output, right channel	VSS	2.8
24	MIC2_N	MIC2_N	AI	Negative differential Microphone input 2	-0.3	3.8

Legend:	**I**	*Input*	**AI**	*Analog Input*
	O	*Output*	**AO**	*Analog Output*
	IO	*Input/Output*	**P**	*Power*

*I2S and I2C pins are multiplexed. Both features cannot be used in same time.

1: P3V3 correspond at value applied on power input 3V3 of Parrot module.

4.2.4 Unconnected pins device

PIN	FUNCTION	PIN TYPE	COMMENT
1	UART_AT_RX	I	Must be used
2	I2S_OUT*/USB_CPEN	O	Left Open
3	UART_AT_TX	O	Must be used
4	I2S_IN / I2C_iPOD_SCL*	IO	Left Open
5	USB_D- (**UART_DBG_RX for FC6000+ config0**)	I	Left Open (Connect to Test Point)
6	I2S_CLK*/RESET_N_iPOD	O	Left Open
7	USB_D+(**UART_DBG_TX for FC6000+ config0**)	IO	Left Open(Connect to Test Point)
8	I2S_FSYNC / I2C_iPOD_SDA*	IO	Left Open
9	P3V3	P	Must be used
10	I2S_MCLK*/USB_OC	O	Left Open
11	RESET_EXT_N	I	Must be used
12	BOOTS	I	Left Open
13	P1V8	P	Must be used
14	VSS	P	Must be used
15	P1V8	P	Must be used
16	UART_DBG_TX(**MIC1_N for FC6000+ config0**)	I	Left Open(Connect to Test Point)
17	1V8_ENABLE	O	Left Open
18	USB_VBUS(**MIC1_P for FC6000+ config0**)	I	Left Open
19	VSS	P	Must be used
20	MIC_BIAS	O	Left Open
21	LINEOUT_L	O	Left Open
22	MIC2_P	I	Left Open
23	LINEOUT_R	O	Left Open
24	MIC2_N	I	Left Open

*I2S and I2C pins are multiplexed. Both features cannot be used in same time.

4.3 Absolute Maximum ratings

Operating temperature range ....-40°C to +85°C
Storage temperature range ....-40°C to +125°C
Voltage on Vcc with respect to Vss .... 3.2V to 3.6V
ESD sensitivity ....±3kV HBM / ±300V MM

4.4 Power consumption (T°=25°C, 1.8V provided by LDO)

The following power consumption has been checked on a few production samples over the whole temperature range between -40°C and +85°C

4.4.1 Power consumption on 3.3V Power Supply (Preliminary)

Stop mode (reset pin low).. <10mA
Run mode (waiting for commands)... <50mA
Hands free and audio streaming mode... <150mA
Max Peak current at startup 320mA

4.4.2 Power consumption on 1.8V Power Supply (Preliminary)

Stop mode (reset pin low).. 0mA
Run mode (waiting for commands)... <150mA
Hands free and audio streaming mode... <250mA
Max Peak current at startup 500mA

4.5 Electrical characteristics

| Conditions unless otherwise noted: T=-40°C to +85°C, Vcc= 3.2V to 3.6V					
Parameter	Conditions	Min.	Typ.	Max.	Unit
3V3 power supply		3.2	3.3	3.6	V
1V8 power supply		1.73	-	1.92	V

5 Mechanical specifications

The following chart describes the availability of the various versions of the FC6000+.

For all versions, the legs of the shielding have to be soldered onto the host PCB in order to ensure mechanical assembly and EMC performances.
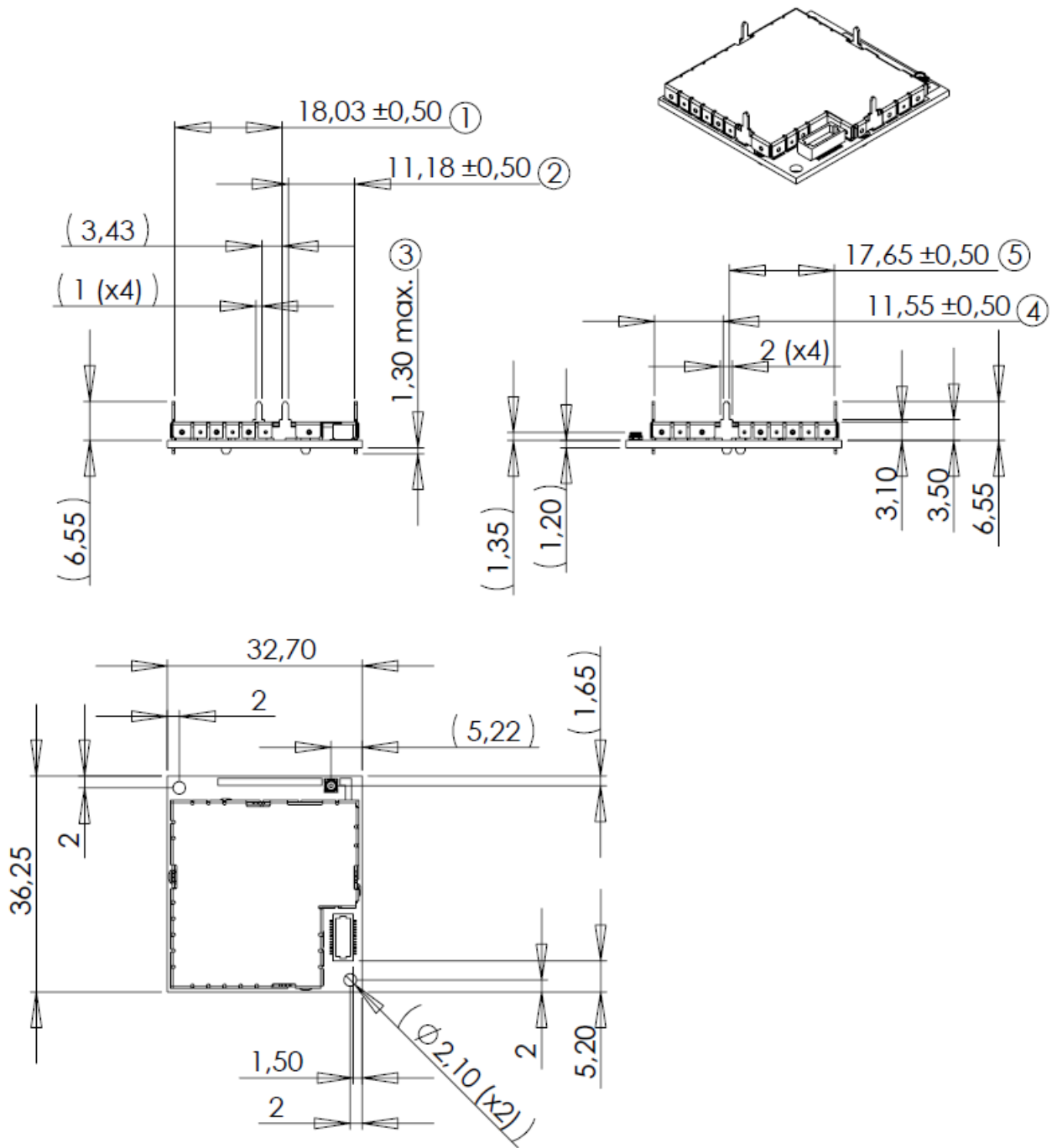
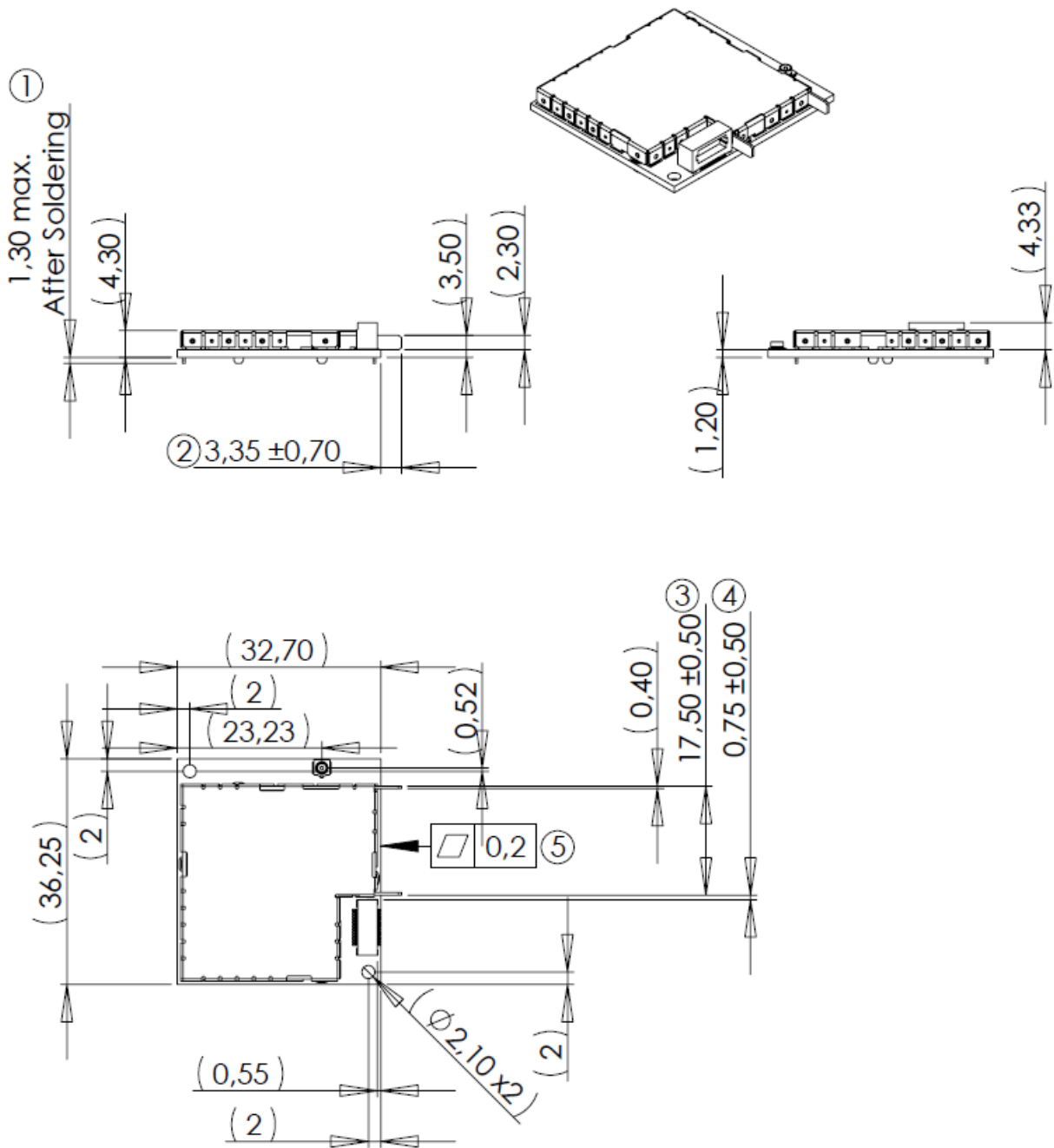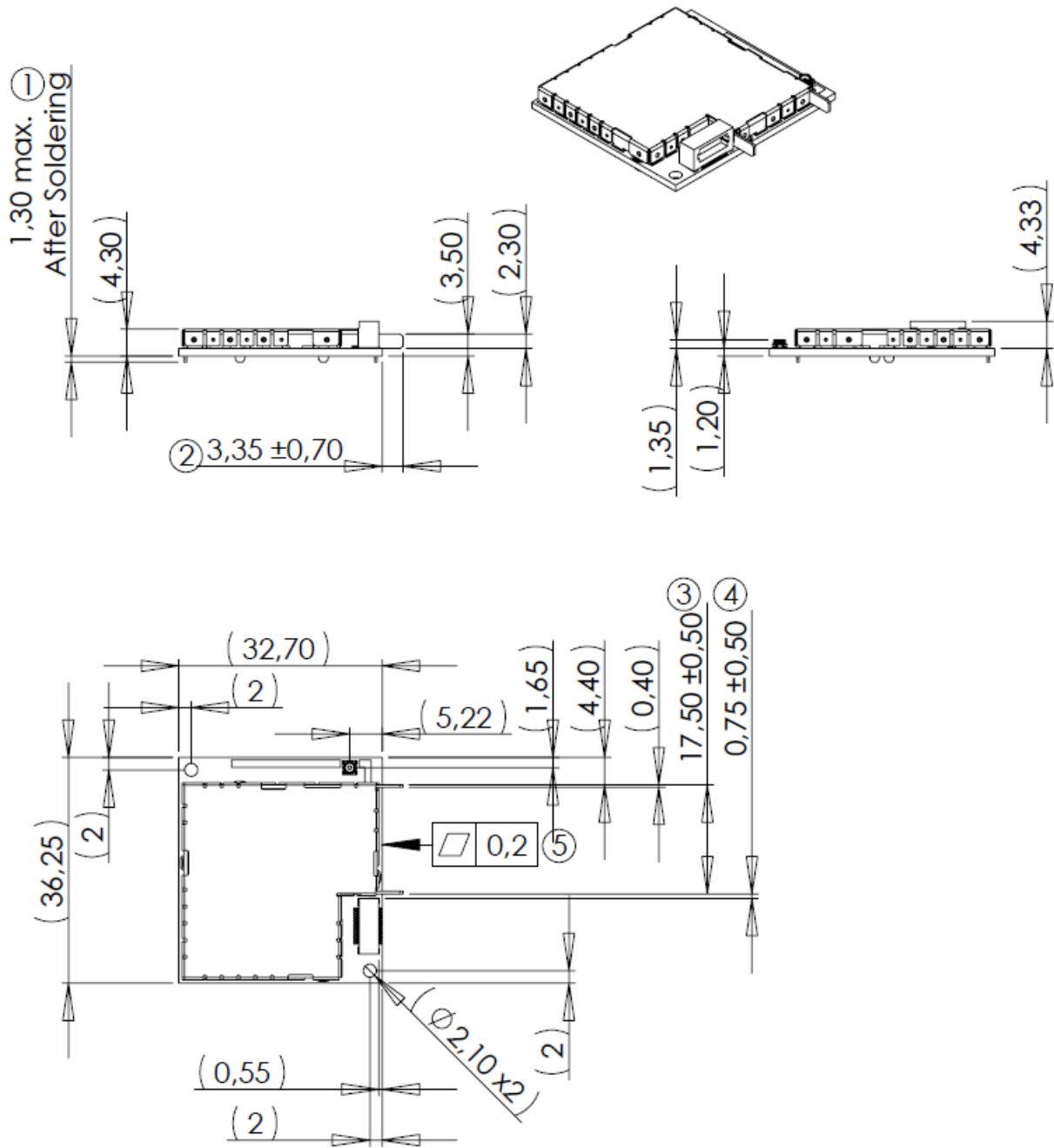| Module version	Mounting	Bluetooth antenna	
		Internal	external
FC6000+	horizontal	Yes	Yes
	vertical	Yes	Yes

5.1 Horizontal module with external antenna
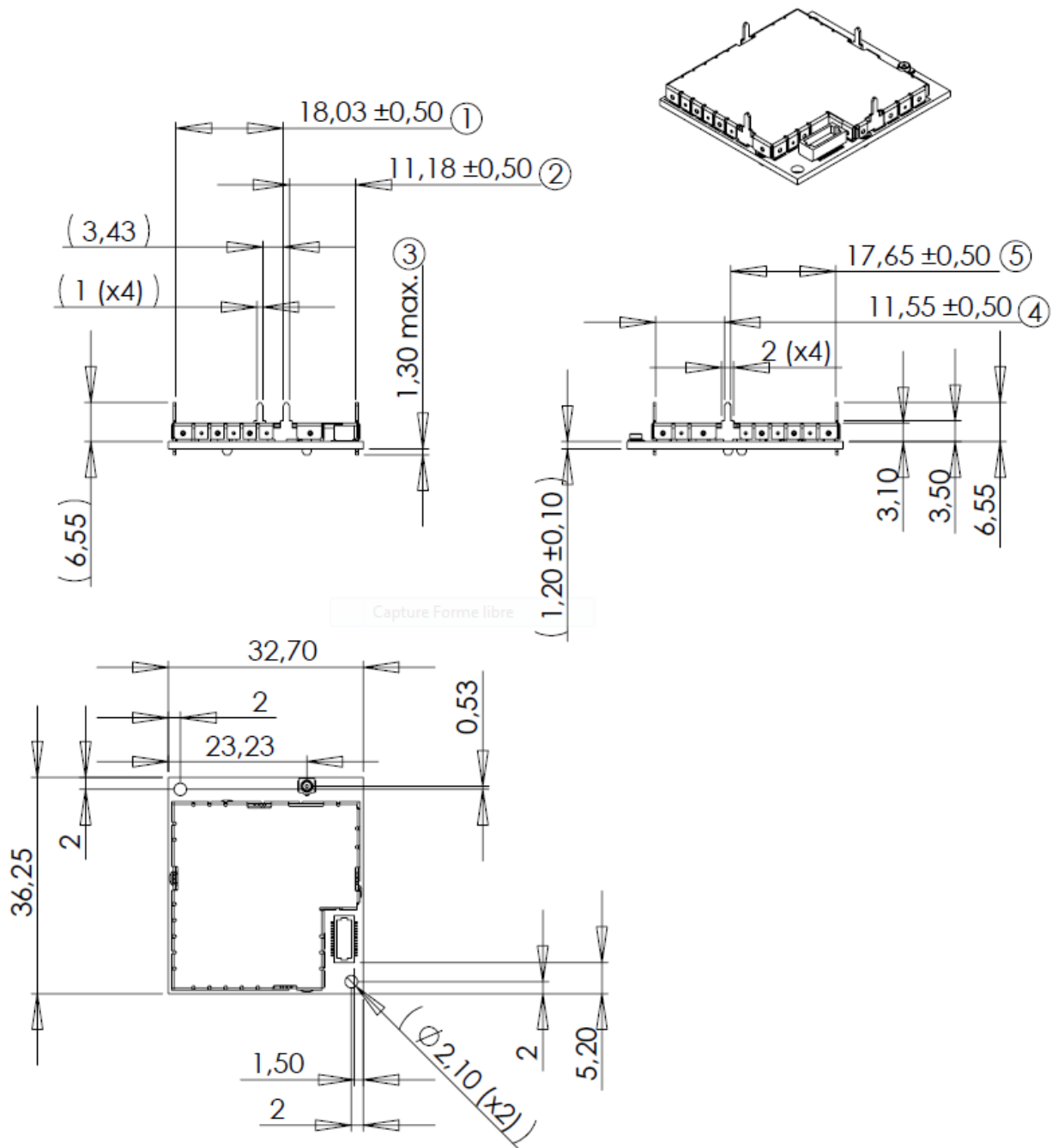
5.2 Horizontal module with internal antenna

5.3 Vertical module with external antenna
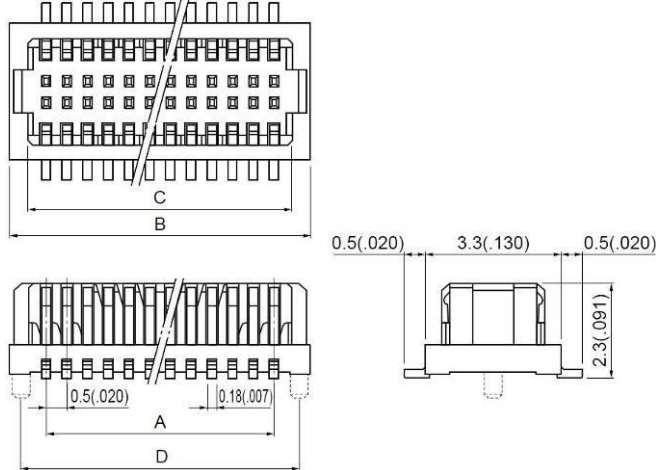
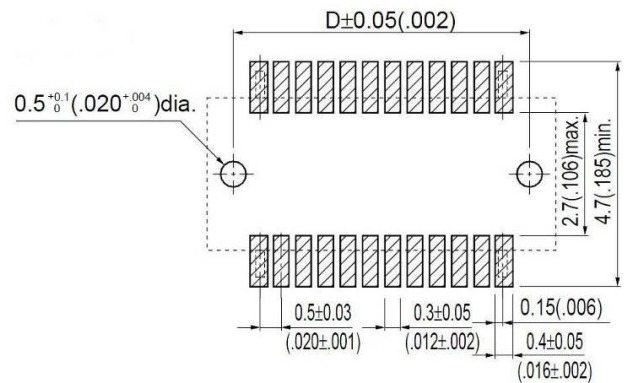## 5.4 Vertical module with internal antenna

5.5 Module connectors

5.5.1 Connector on mother board

JST reference: *24R-JMCS-G-(B)-TF*

Mechanical overview:

Recommended PCB footprint:

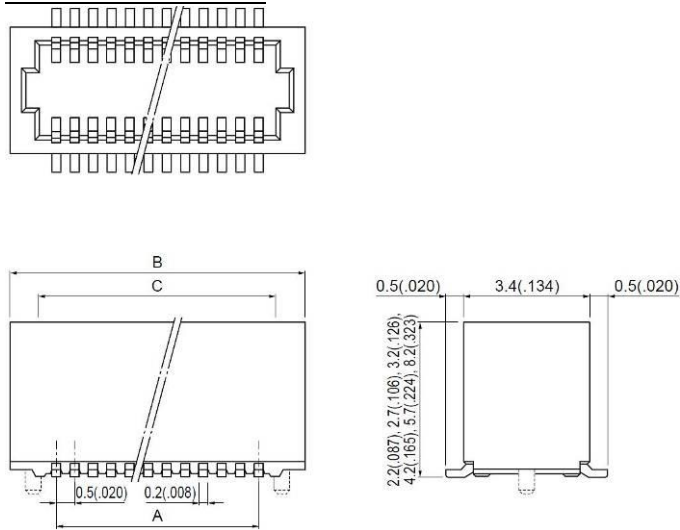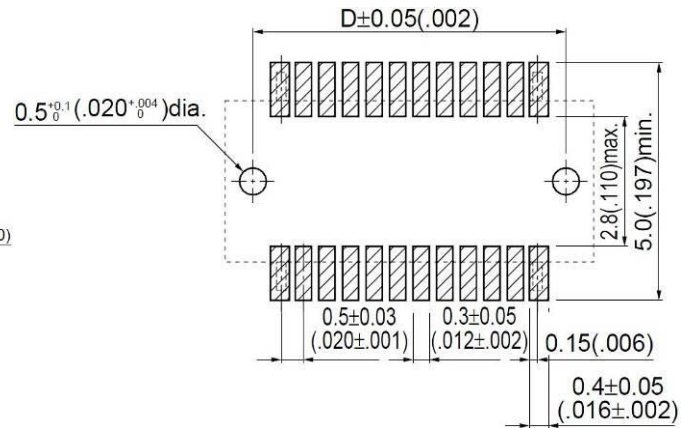| Cir- cuits	Model No.		Dimensions mm(in.)				Q'ty / reel
	Without bosses	With bosses	A	B	C	D	
24	**24R-JMCS-G-TF (S)**	**24R-JMCS-G-B-TF (S)**	5.5(.217)	7.3(.287)	6.4(.252)	6.7(.264)	2,500

5.5.2 Horizontal modules connector

JST reference: _24P3.5-JMCS-G-TF (Top entry type)_

Mechanical overview:

Recommended PCB footprint:
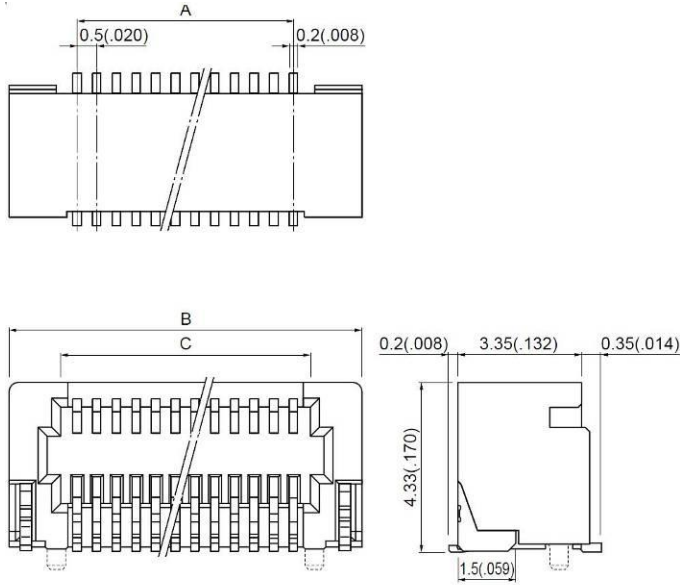

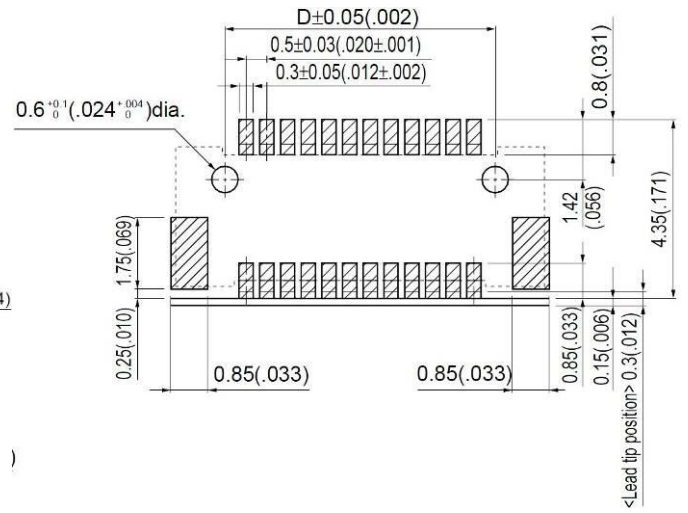| Circuits	Model No.				Dimensions (mm)			
	Stacking height (mm)				A	B	C	D
	3.0	3.5	4.0	4.5				
24	—	24P3.5-JMCS-G-TF	—	—	5.5	7.9	6.4	—

5.5.3 Vertical modules connector

JST reference: *24PS-JMCS-G-1B-TF (Side entry type)*

Mechanical overview: Recommended PCB footprint:

Circuits	Model No.	Dimensions (mm)				Q'ty / reel
		A	B	C	D	
24	24PS-JMCS-G-1B-TF	5.5	8.9	6.4	6.55	1,500

5.5.4 Radio connector

<u>*Only on external antenna product: JST reference*</u>**:** *AYU1-1P-02676-120*
This connector must be connected to a radio antenna.
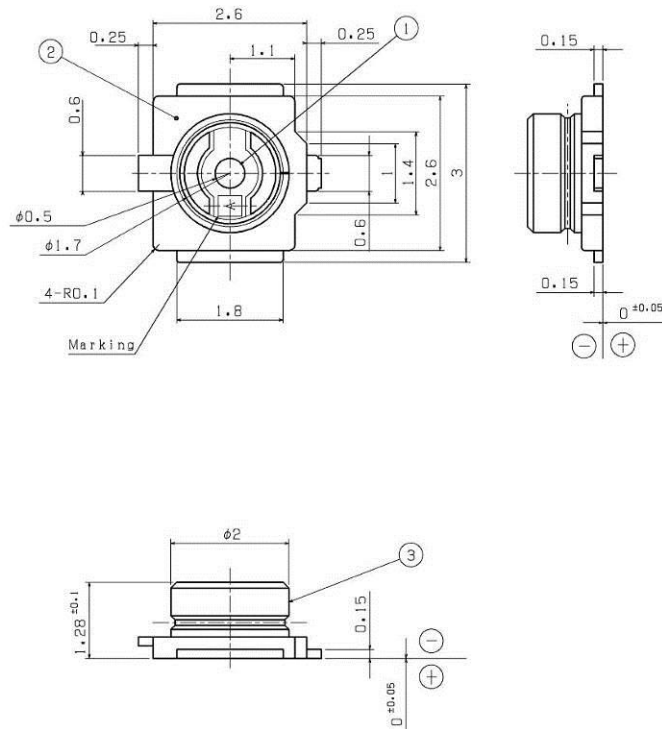
<u>*Only on internal antenna product: I-PEX reference:*</u> 20549-001E
This switch is only used in production for testing purpose.
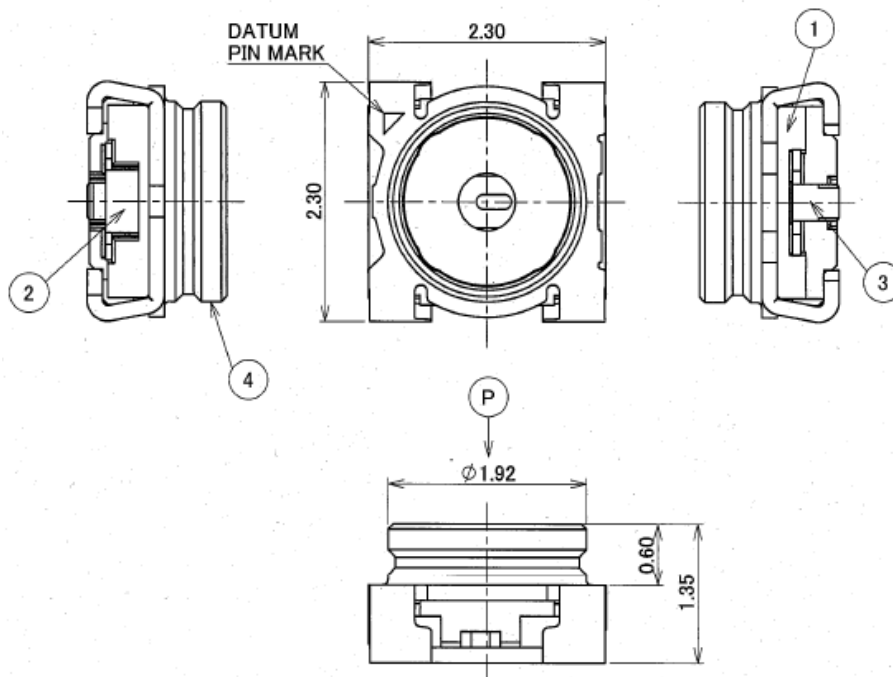
5.6 Motherboard Mechanical Integration

Mechanical constraints for the integration on the mother board are detailed below.

5.6.1 Mechanical integration – Horizontal version:

DÉTAIL A
ECHELLE 4 : 1

Plated-through hole
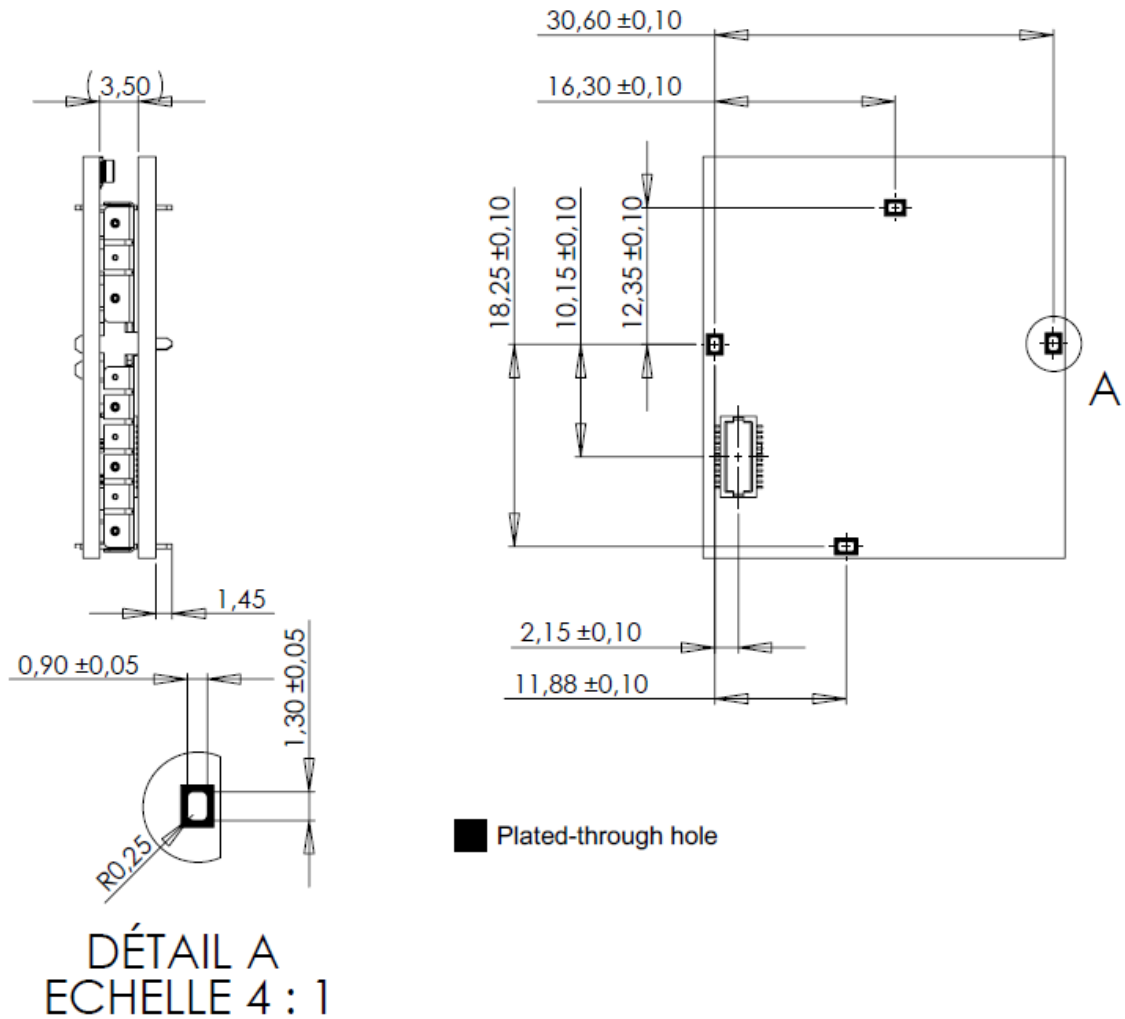
5.6.2 Mechanical integration – Vertical version:

■ Plated-through hole

DÉTAIL A
ECHELLE 4 : 1
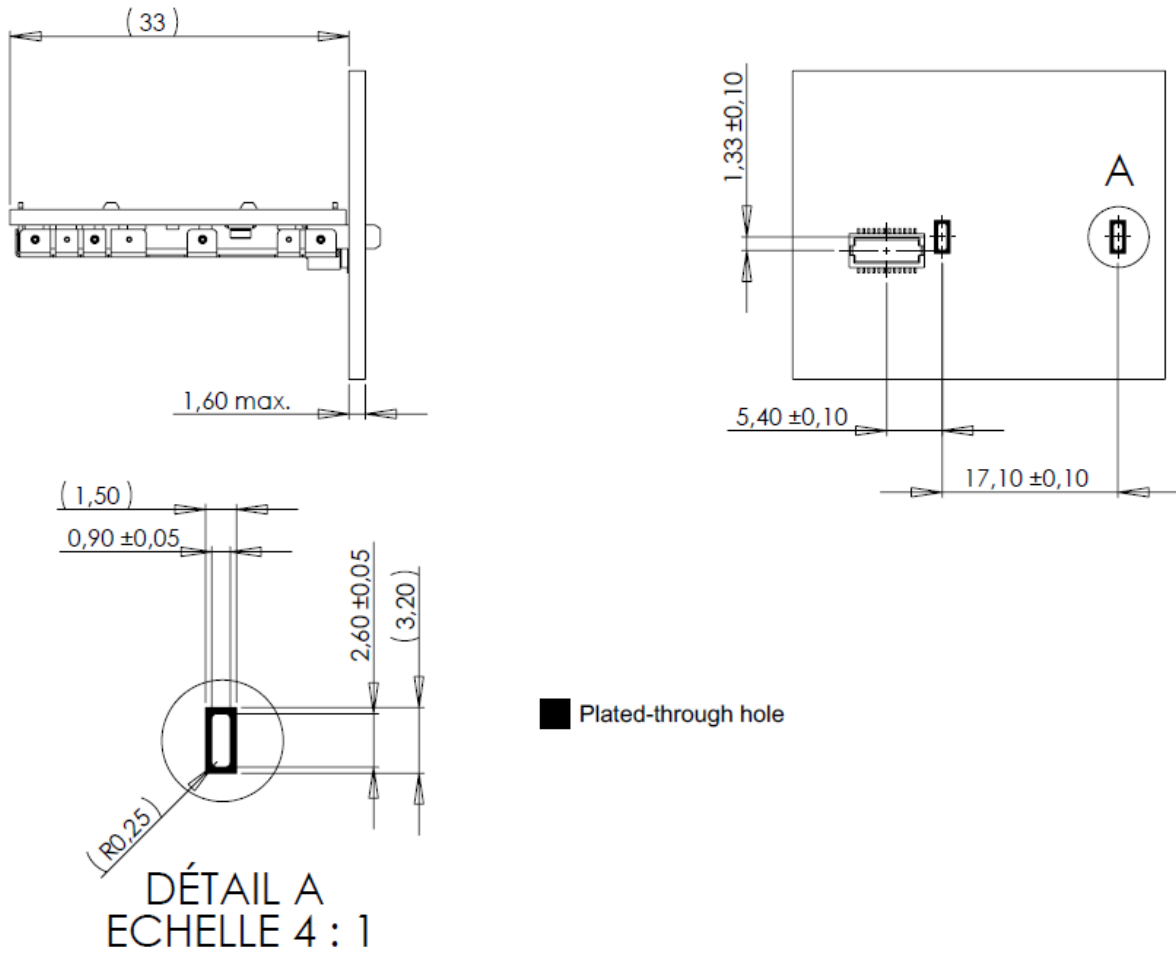
6   Available tools

6.1 Workbench

6.1.1 Diagram

To be added WB and mezzanine
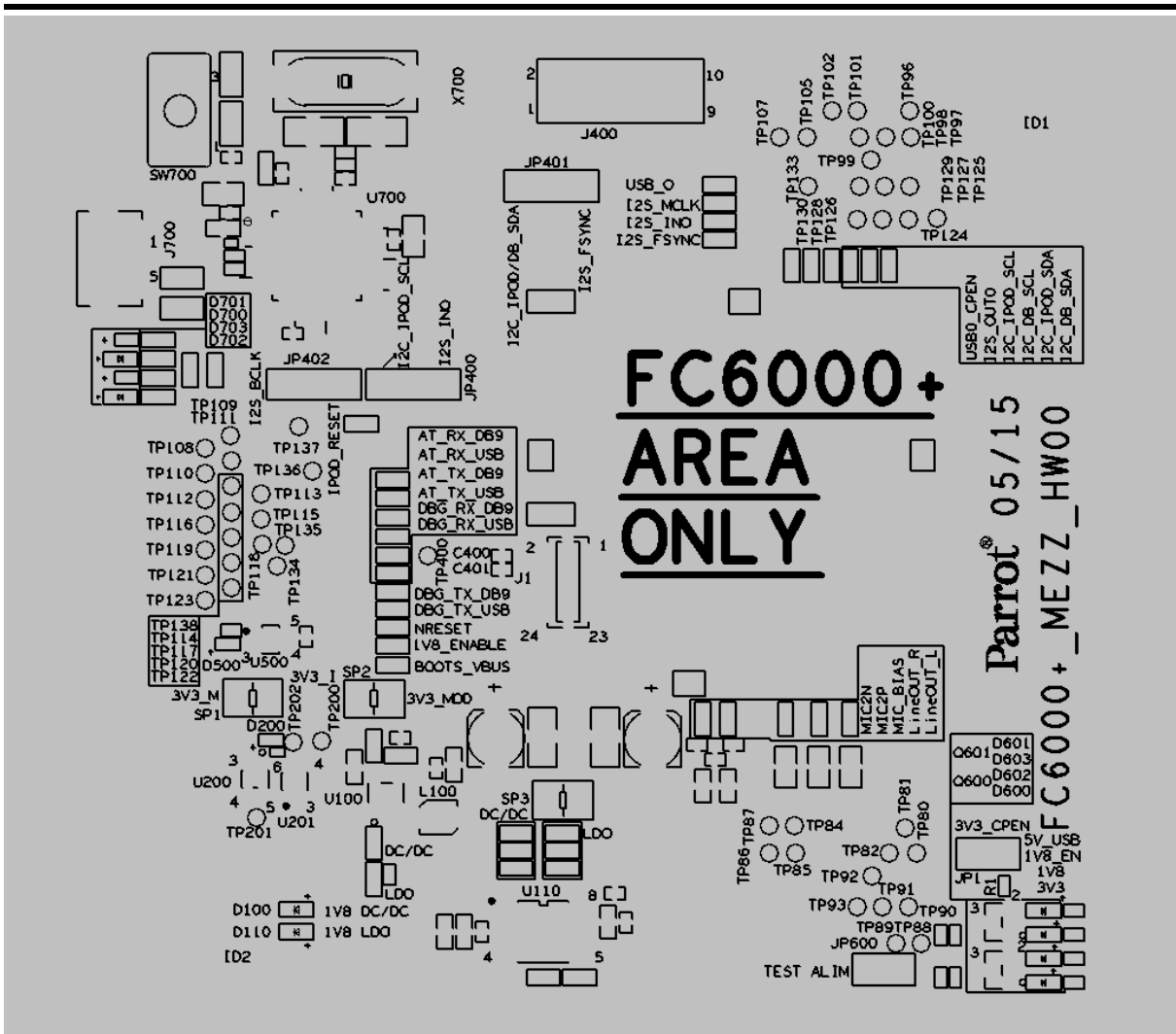
6.1.2 Schematics

The workbench schematic will be provided on demand

6.2 WxHipHop

WxHipHop is a Windows based software that gives the possibility to send and read the AT commands used by the FC6000+.
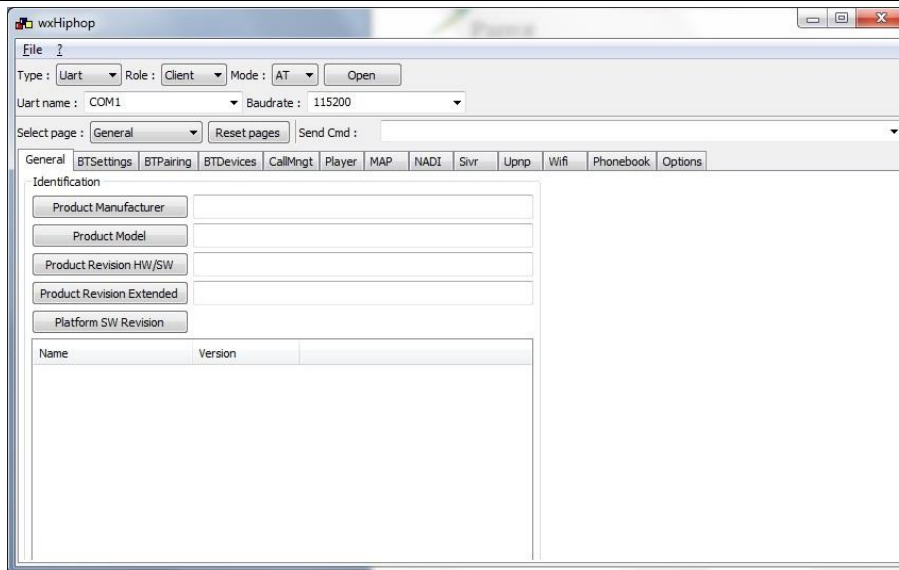
6.3 WxFlasher

WxFlasher is a Windows based software that gives the possibility to flash and to update the software of the FC6000+.

7 Approval and certification

7.1 FC6000+

7.1.1 CE declaration

We, Parrot SA 174 quai de Jemmapes 75010 Paris France, declare under our responsibility that our product (Parrot FC6000+) is in conformity with the Radio and Telecommunication Equipment directive 1999/5/EC R&TTE according to the essentials requirements and respect the standard listed below :
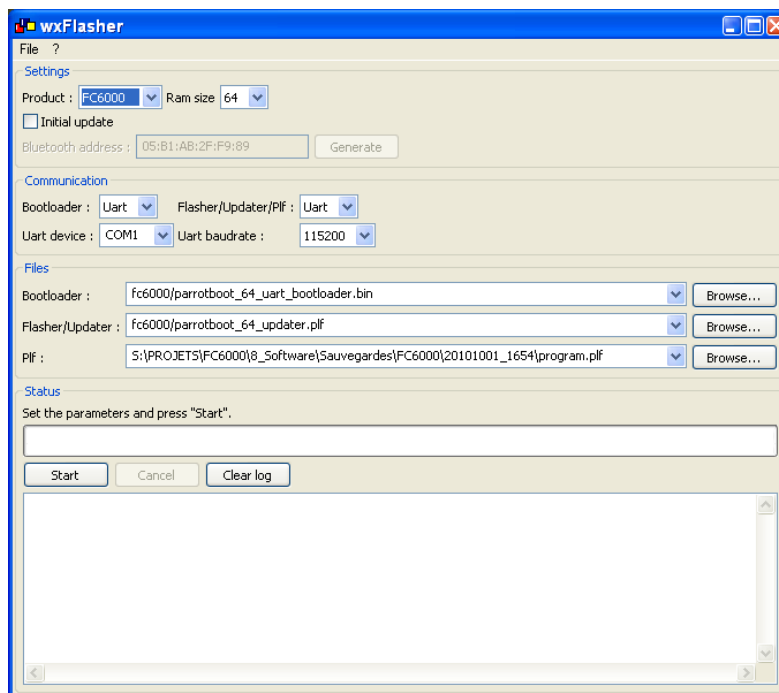
3.1-a) Electrical Safety	EN60950-1:2006/A11:2009/A1:2010/A12:2011
EMF	EN50371 (06/2002)
	EN62311 (2008)
3.1-b) EMC	EN301 489-1 V1.9.2
	EN301 489-17 V2.2.1
3.2 Radio	EN300 328 V1.8.1
3.3 RoHS	EN62321:2009

7.1.2 FCC and IC requirements for module application

FCC ID: 2AGKOFC6000P
IC: 20878-FC6000P
In accordance with FCC Part 15, the FC6000+ is listed as a Modular Transmitter device.

USA – User information
OEM integrators and end-users must be provided with transmitter operating conditions for satisfying RF exposure compliance. If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AGKOFC6000P".

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
OEM integrators and end-users must be provided with transmitter operating conditions for satisfying RF exposure compliance. If the IC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 20878-FC6000P".

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.

8 Use Cases

A. Bluetooth HFP & A2DP/AVRCP use cases overview:

a. Head Unit paired with Mobile phone

Handsfree telephony & Phonebook Synchronization

Hands Free Device

Audio unit

Hands Free Telephony

Telephony

Phonebook

Phonebook & call lists synchro

Hands Free Audio Gateway

Mobile Phone

Connections Strategy

If the Host does not store the last synchronized phonebook, it is always available for the Host at Module start up. Right after HFP connection (which is initiated to 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 on the phone. The Module alerts the Host that the updated phonebook with new entries is 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 (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.

b. Head Unit connected to Mobile phone and Multiparty call
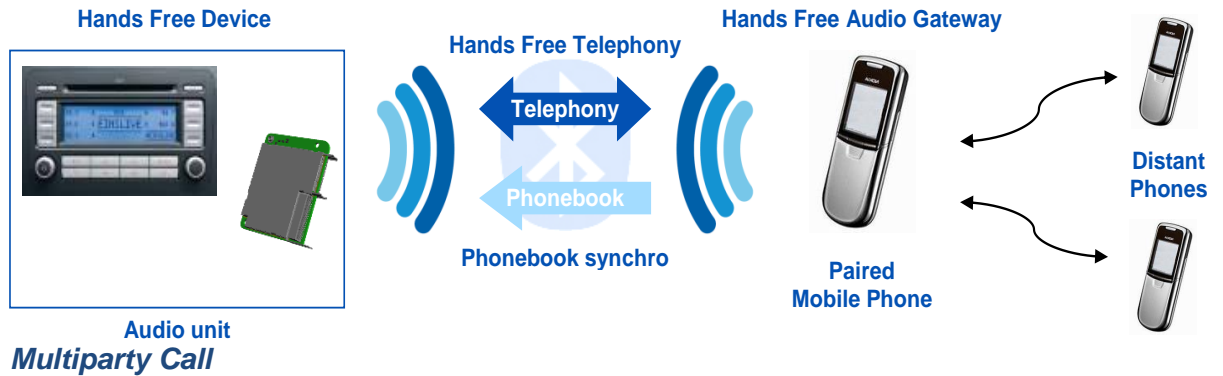
Multiparty Call

Three way calling / multiple calls management

Full 3-way calling management (and multiparty calls) is optimized with phones supporting HFP1.5.

Parrot also support up to 7 concurrent / conference calls.
Host can control those calls by holding and releasing calls, switching active/hold state between two calls and adding a given call to a multiparty conference call as per HFP 1.5 specification.

Conference call behavior is dependent on the features advertised by the phones during the SDP.

c. 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", 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.

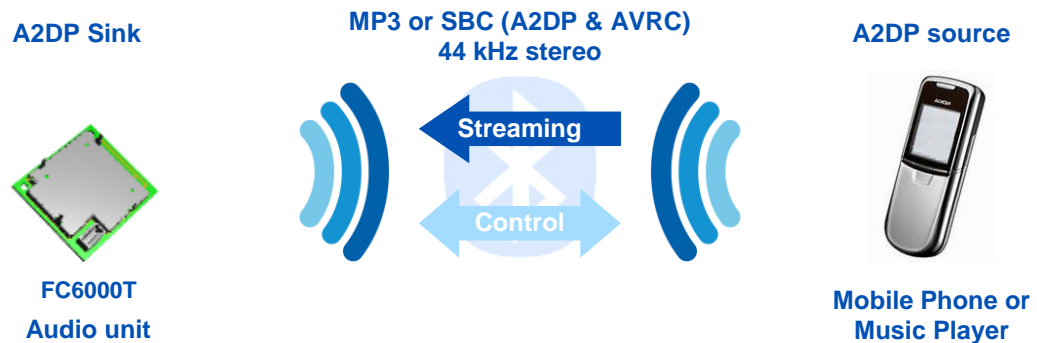Description of the behavior:
- *First example:* two phones (P1 and P2) are connected to HFP service. The host can start dialing on P1, hang up call then start outgoing call on P2.
- *Second example:* the phone receives incoming call P1 on Module. After the end of the first call from P1 the phone P2 can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

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

d. Audio Streaming and Handsfree working together

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

A2DP Sink

MP3 or SBC (A2DP & AVRC) 44 kHz stereo

A2DP source

Streaming

Control

FC6000T
Audio unit

Mobile Phone or Music Player

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 on 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 re-launches 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 should be supported.
- 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 perimeter 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 perimeter 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.

AVRCP TG 1.4 (Category 1 – Music Players):
- *Mandatory commands:*
    o Same perimeter 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 1.4 (Category 2 – Parrot Module):
- *Mandatory commands:*
    o Same perimeter 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.
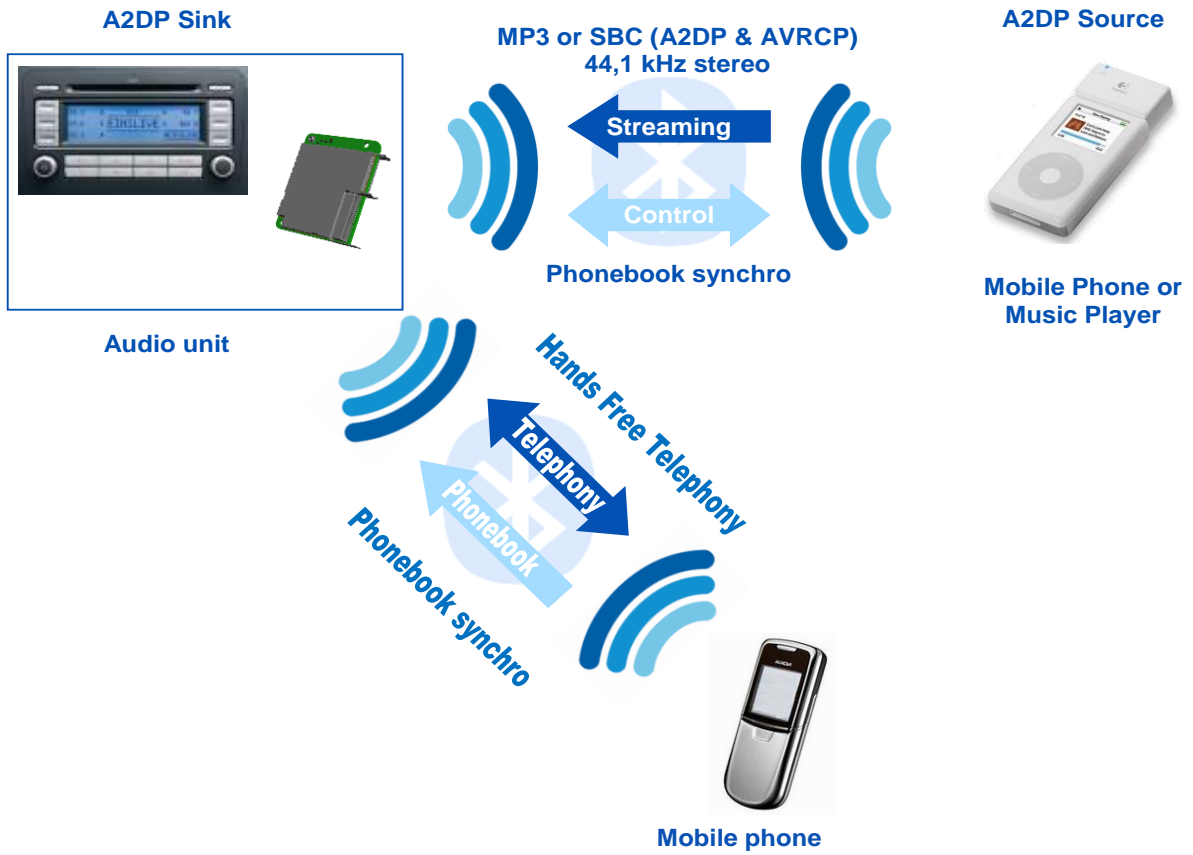
As member of AV Working Group, Parrot is involved with the development of those specifications.

e. Head Unit paired with Mobile phone and USB audio in parallel:

USB Host and HandFree Device

Audio from USB key or iPod

Audio unit

Telephony

Phonebook

Mobile phone

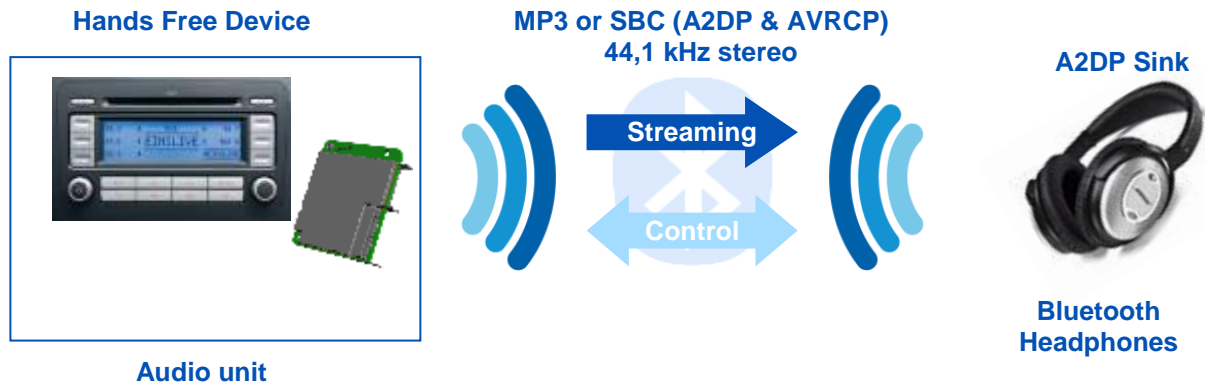### f. Head Unit paired with Mobile phone and Music Player with BT integrated or Bluetooth dongle:

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.
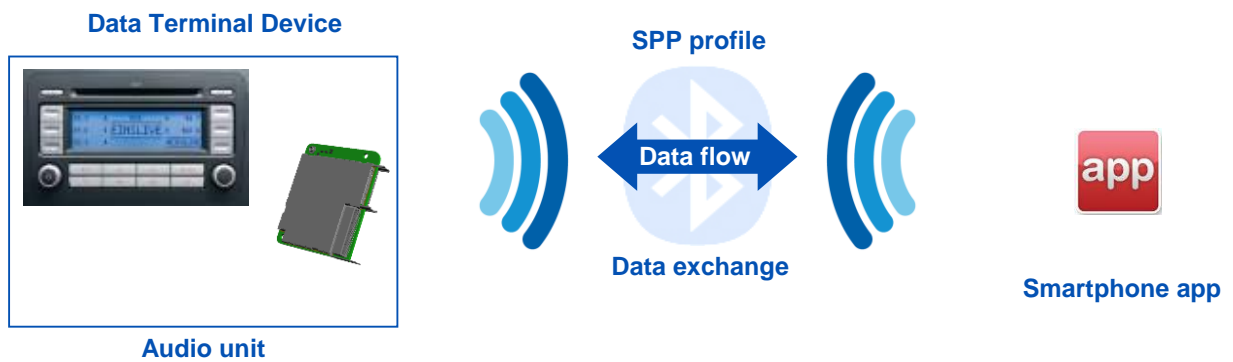
g. Head Unit paired with a stereo Headphone

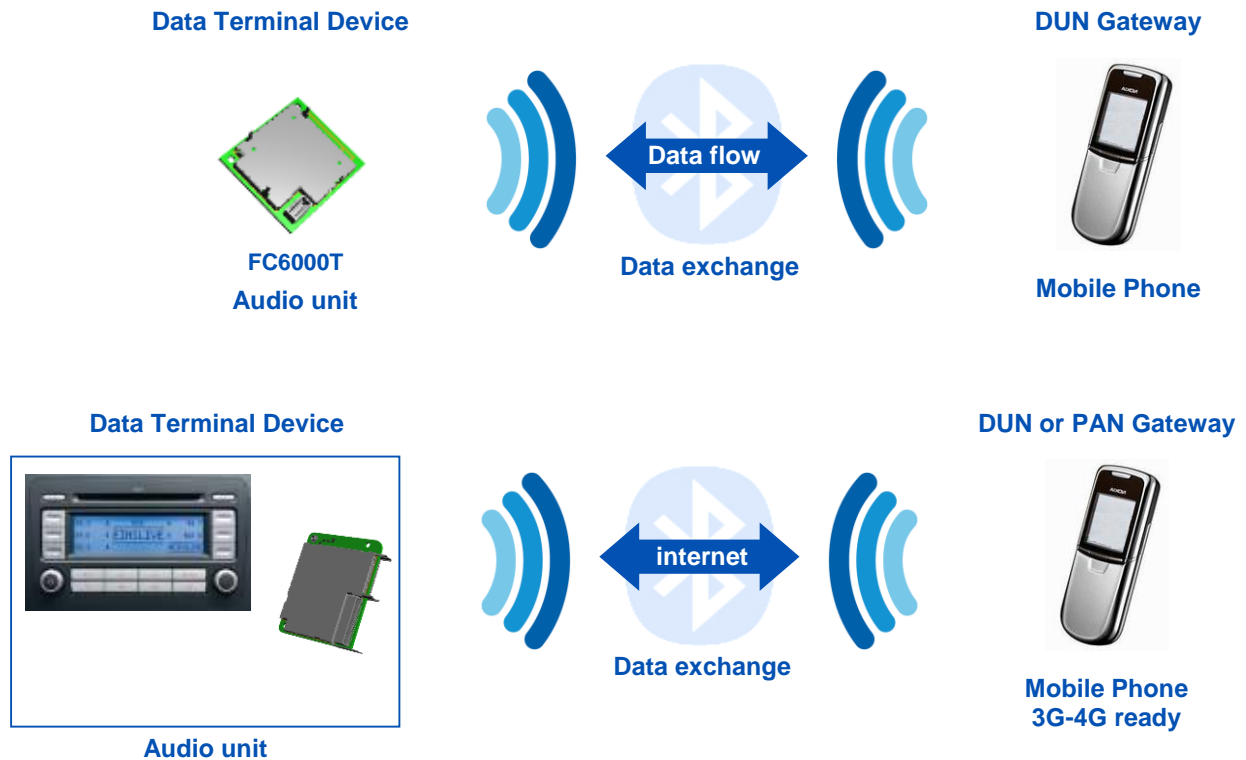Audio Streaming from Module to a stereo headphone

Parrot Module also embeds the A2DP SRC role, and then is able to play local music files to a Sink device.

h. Serial Port Profile:

i. Head Unit paired with Mobile phone: Data transfer

Dial Up Networking: The Head Unit acts as data terminal with a connected gateway device, typically a mobile phone.

Data Terminal Device

FC6000T
Audio unit

Data flow

Data exchange

DUN Gateway

Mobile Phone

Data Terminal Device

Audio unit

internet

Data exchange

DUN or PAN Gateway

**Mobile Phone
3G-4G ready**

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 behaviors:
    - ▪ The call is established and data transfer continues without bandwidth diminution.
    - ▪ The call is established and data transfer is stopped (AG gives priority to HFP feature).
    - ▪ The distant caller reaches the voice mail of the connected phone (phone limitation).
  - o If an outgoing call is requested by the user, the behaviors above also apply.

Those behaviors are described, phone by phone in the Parrot Bluetooth Compatibility Matrix with all tested phones.
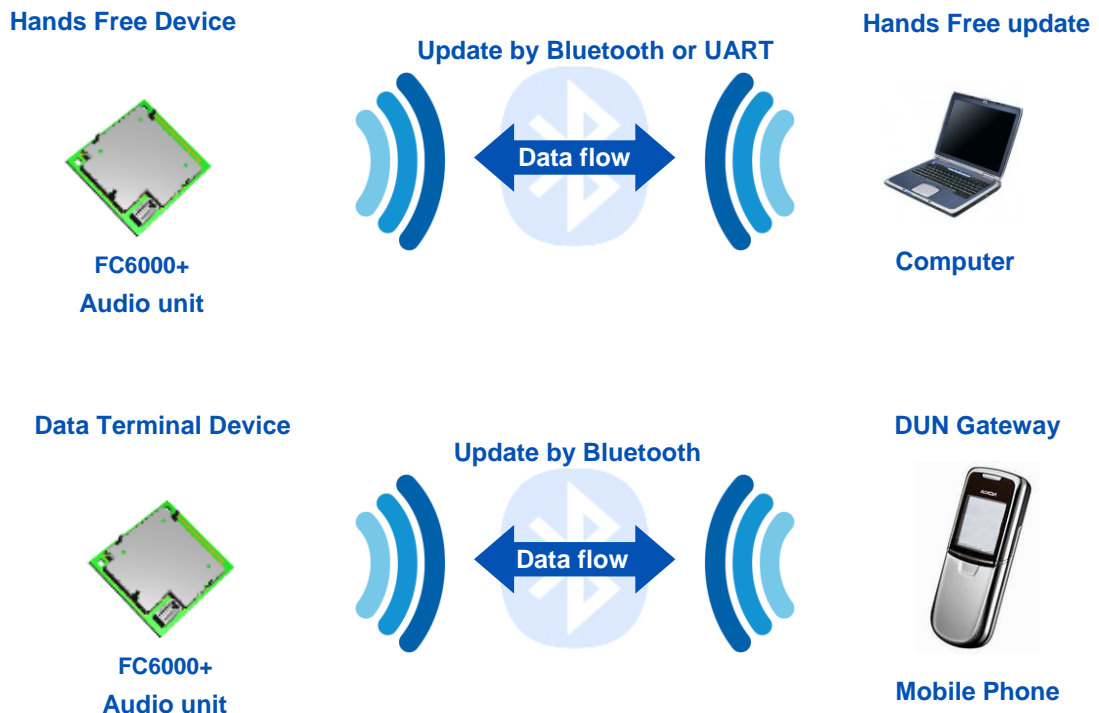
B. Head unit BT/UART software update

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

This is a very important feature of the Parrot Module. This ensures better Bluetooth Compatibility with new phones coming on the Market. Some of these new phones need to have a specific workaround 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, UART...) into your product already out in the market.

After the update, user settings (paired devices, phonebooks...) are not erased. This process is transparent for the user.

Hands Free Device   **Update by Bluetooth or UART**   **Hands Free update**

Data flow

FC6000+
Audio unit   **Computer**

Data Terminal Device   **Update by Bluetooth**   **DUN Gateway**

Data flow

FC6000+
Audio unit   **Mobile Phone**

Methods available
- Bluetooth
  - o Via FTP
- Via UART with a host CPU that send the data
- Via USB

Secured update mechanism

The new software is copied into the flash Module's memory but the previous software is not affected by this copy. During this process, if an error occurs before the end of file transfer (Bluetooth disconnection, data transfer stopped…), 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 will reboots, the new checksum internally calculated is compared the checksum of this new software. If checksum are equals, the new file will overwrite the previous one. During this process, if power supply is turned off, the remaining data will be continuing to be written where it has been stopped at the next boot.