AN2542
Application note

Demo board BT-HTS-Rx_V1.0 for audio receiver using Bluetooth® wireless technology

Features

- Class 2 A2DP Bluetooth® technology receiver
- 1-Vpp line-out (stereo)
- Single 3.3-V supply.

Overview

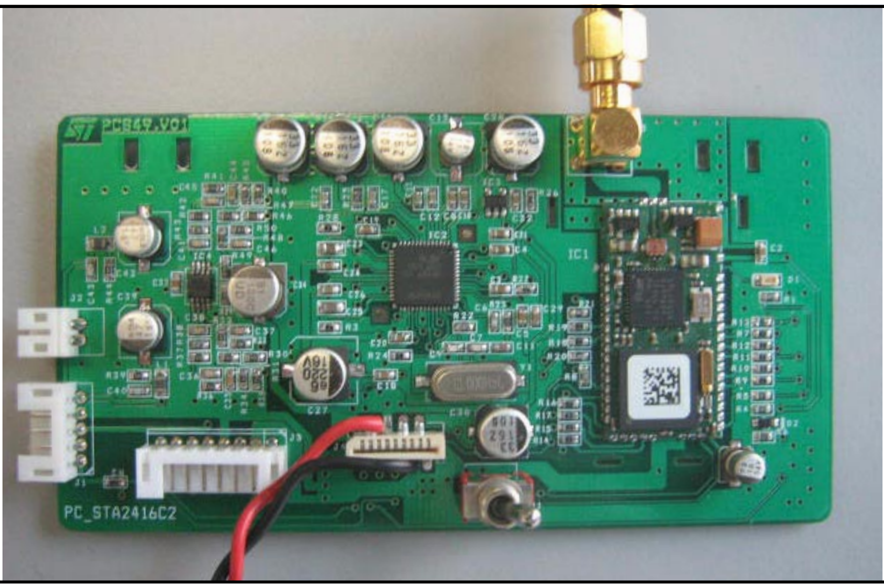
This board is designed for the evaluation of the BT-STA2416C2 receiver module in an A2DP environment. It is based on the SOUNDabout® and BLUEmagic® software of Open Interface North America and it guarantees a broad compatibility with boards from many other manufacturers as given in *Section 5: Interoperability on page 12*. A full set of certifications is given *on page 13*.

The board also accommodates the STA529 device. This is a codec with an high efficiency FFX™ class-D output stage. The line output pin is driven by the TS462 op-amp configured to filter the PWM and to scale the output to 1 Vpp.

The output signal can be used to feed an amplification stage. Both ICs (codec and op-amp) and the entire Bluetooth® technology module are designed and manufactured by STMicroelectronics.

Figure 1 shows the BT-HTS-RX_V1.0 demo board. The BT-STA2416C2 Bluetooth® technology module and the RF antenna connection are positioned on the right-hand side of the board, the STA529 codec is in the middle and the TS462 op-amp is on the left.

Figure 1. BT-HTS-RX_V1.0 demonstration board



1 Circuit description

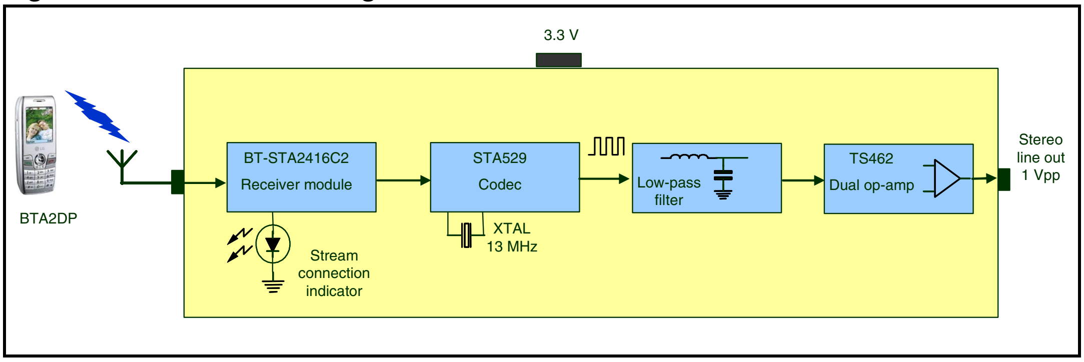
1.1 Block diagram

Figure 2 shows the block diagram of the BT-HTS-RX board. The Bluetooth® technology stream received by the RF antenna is sent to the BT-STA2416C2, a highly integrated module able to communicate wirelessly with BTA2DP sources such as cellular phones, BT Dongles and Notebook PCs.

Whilst streaming audio the receiver manages the BT data in the BT-STA2416C2 module, transferring them to the STA529, an IC comprising a digital stereo class-D audio amplifier, a DSP and a CMOS power output stage based on the FFX technology. The STA529 is dedicated to the decoding and the generation of the PWM analog output.

A low-pass filter stage cuts the high frequencies of the PWM signal before amplification to a standard line-out signal of 1 Vpp.

Figure 2. Circuit block diagram



1.2 Schematic

Figure 3, *Figure 4* and *Figure 5* make up the overall schematic. You can zoom in to see the detail or you can download the original OrCAD® and PDF files from http://www.st.com/stonline/products/applications/blocks/consumer/conb005.shtml.

Figure 3. Schematic diagram, part 1

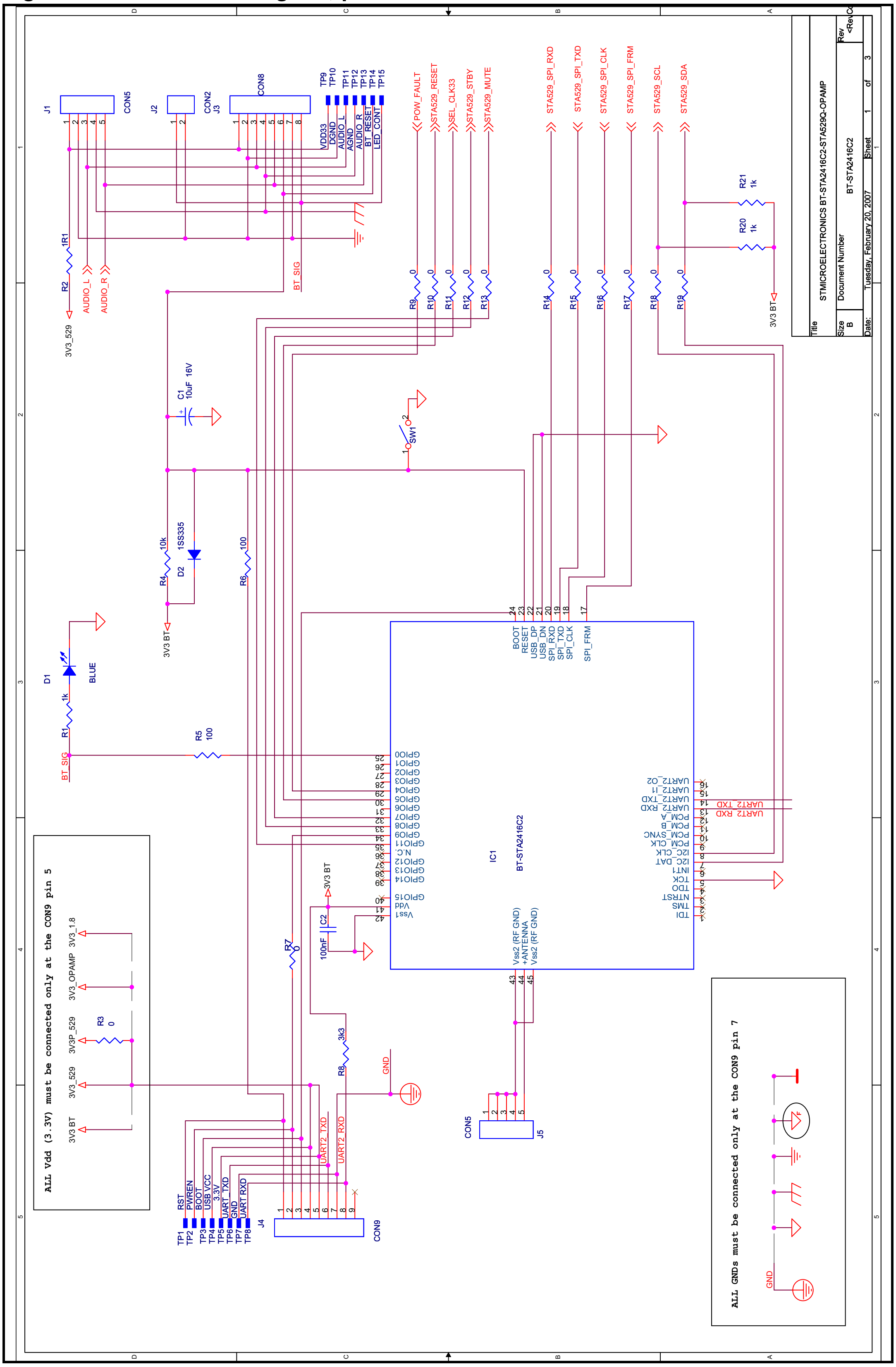


Figure 4. Schematic diagram, part 2

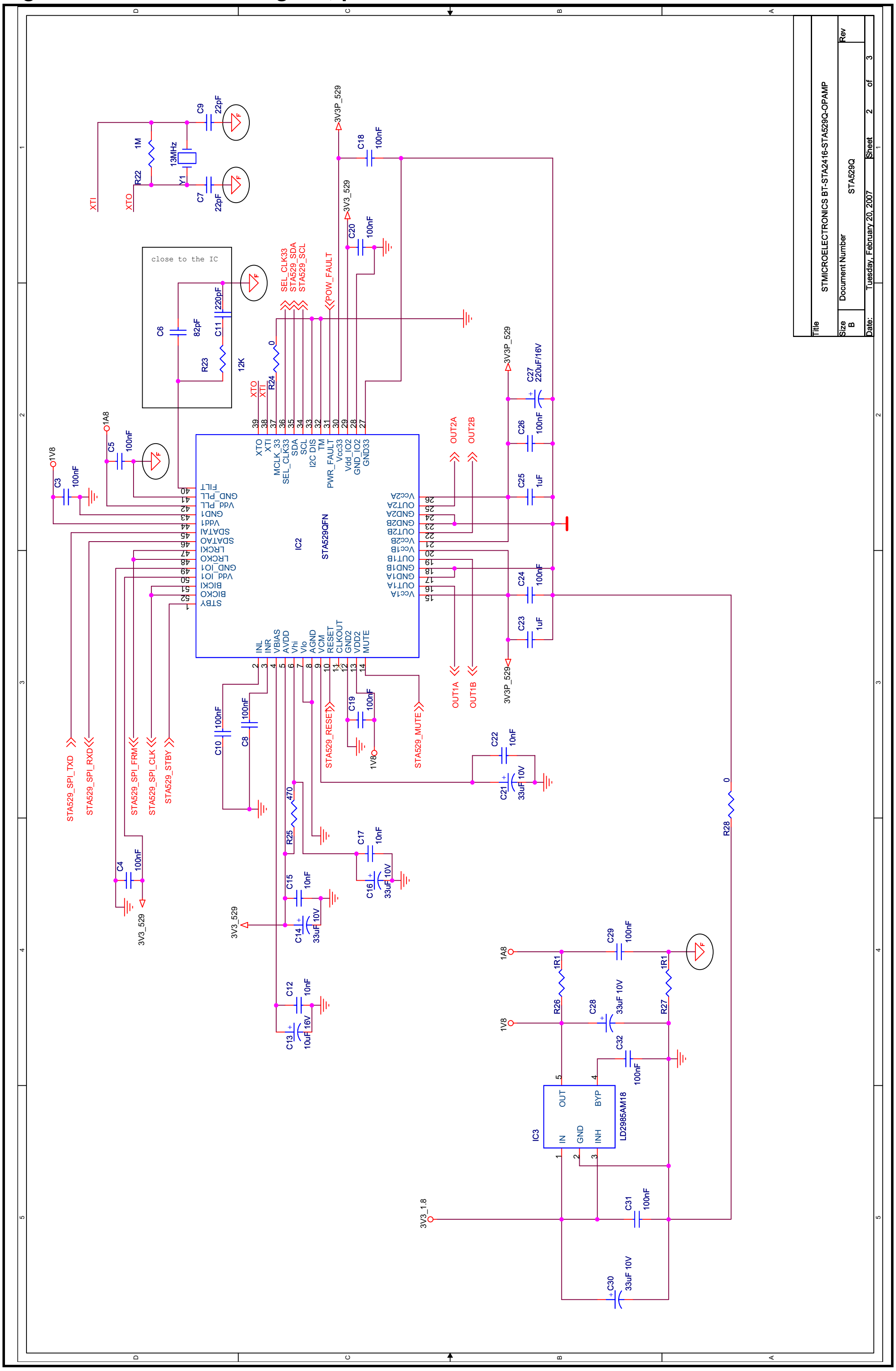
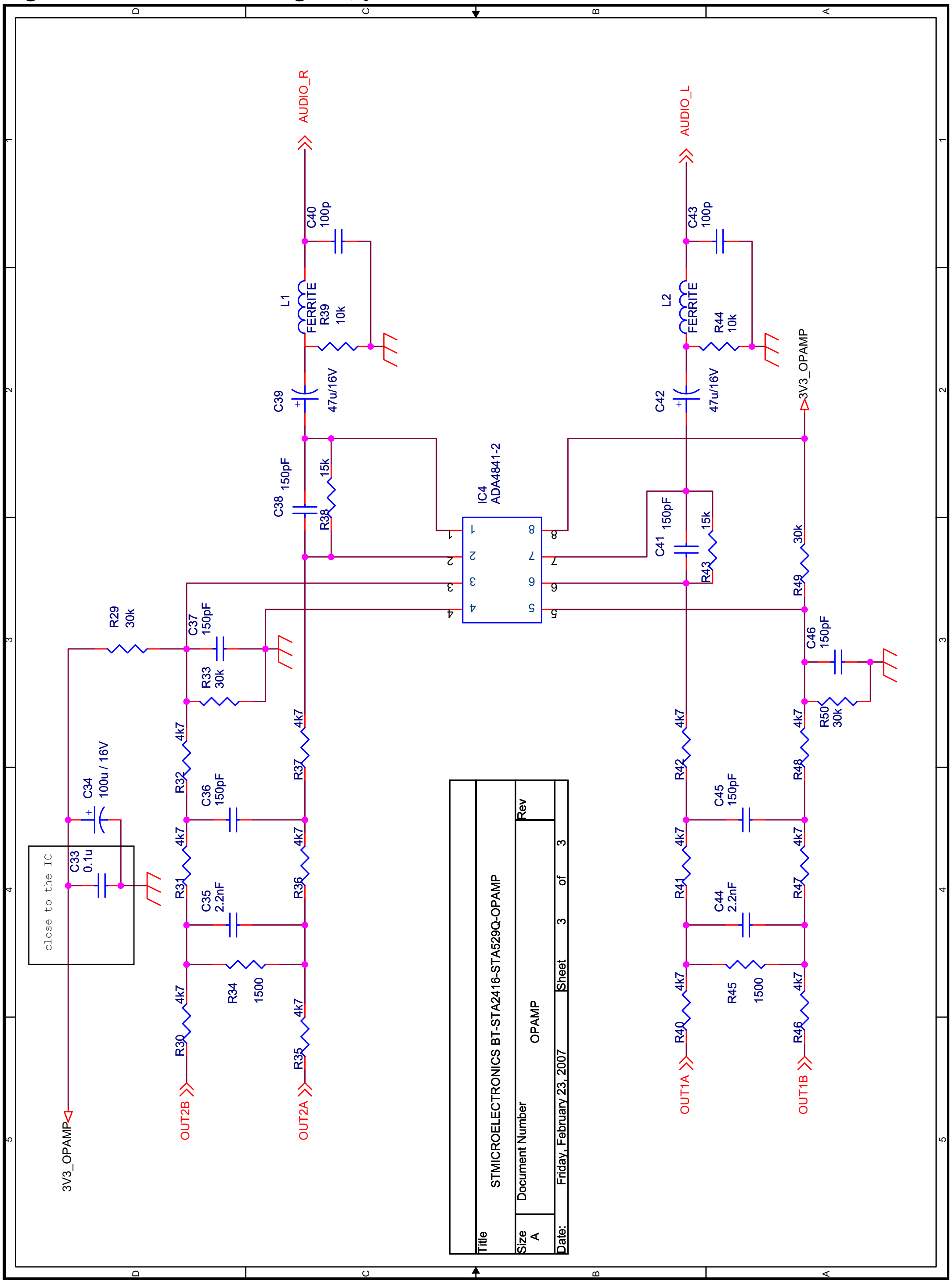


Figure 5. Schematic diagram, part 3



2 Layout

Figure 6 and *Figure 7* show the PCB layout of the top and bottom layers. The complete set of OrCAD® files can be found on the web page http://www.st.com/stonline/products/applications/blocks/consumer/conb005.shtml.

Figure 6. Top layer viewed from top side

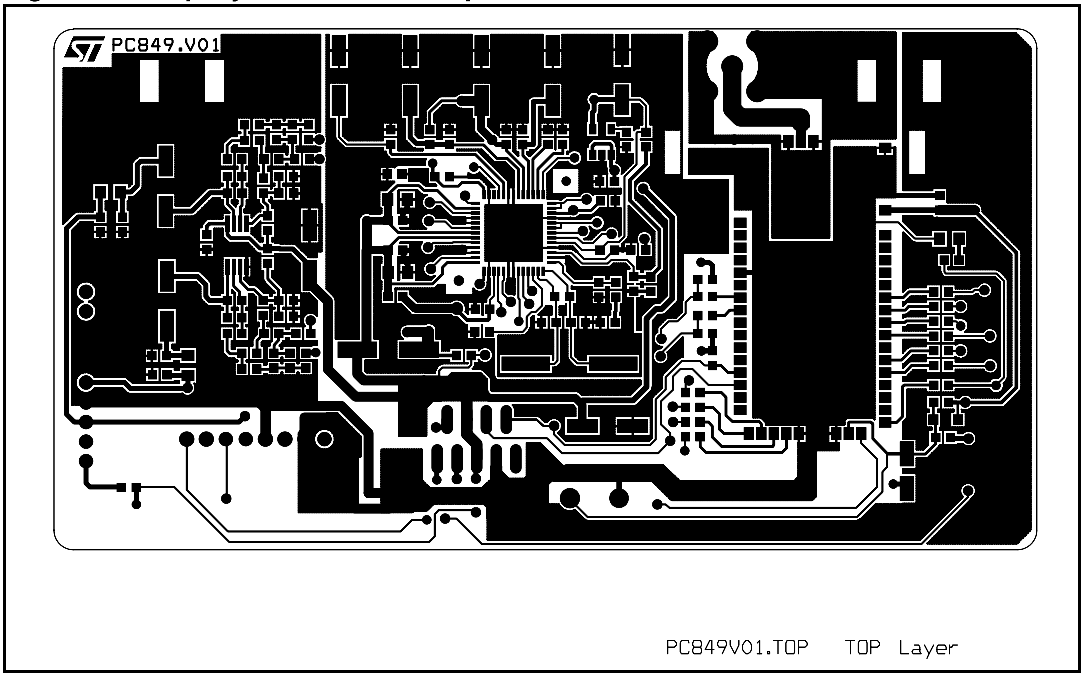
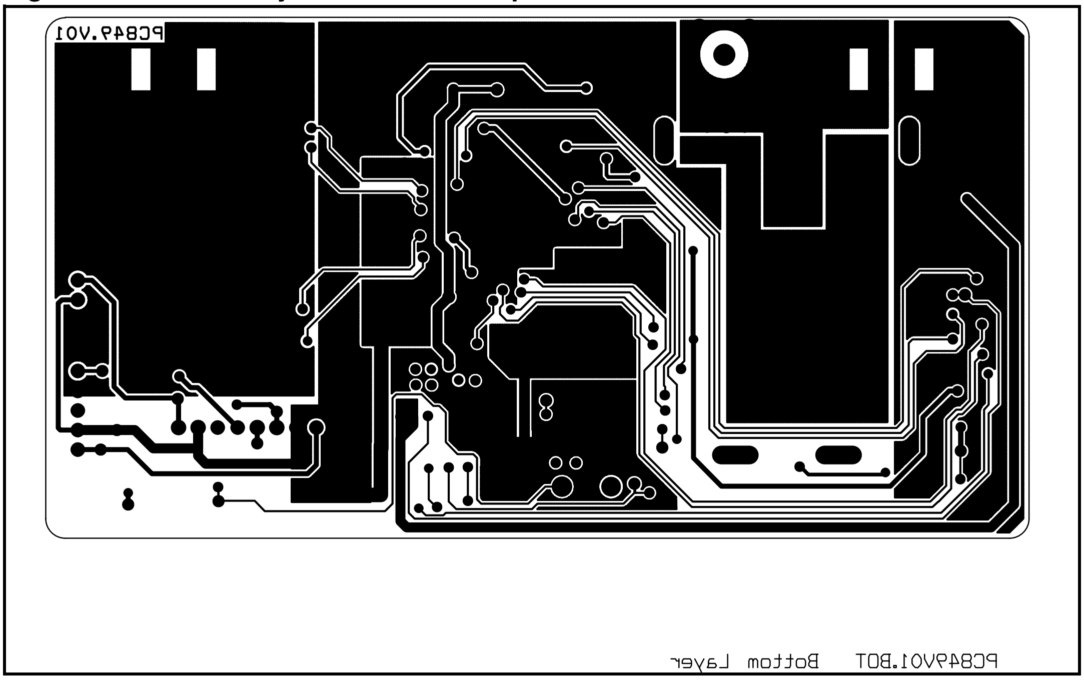


Figure 7. Bottom layer viewed from top side



3 BOM

Table 1 gives the bill of materials for the receiver board.

Table 1. **Bill of materials**

Item	Qty	Reference	Part	Footprint	Notes
1	1	C1	10 µF, 16 V	CE45	Aluminium capacitor 4.5 mm
2	14	C2,C3,C4,C5,C8,C10, C18,C19,C20,C24, C26,C29,C31,C32	100 nF	0603	
3	1	C6	82 pF	0603	
4	2	C7,C9	22 pF	0603	
5	1	C11	220 pF	0603	
6	4	C12,C15,C17,C22	10 nF	0603	
7	1	C13	10 µF, 16 V	CE66	Aluminium capacitor 6.6 mm
8	5	C14,C16,C21,C28, C30	33 µF, 10 V	CE66	Aluminium capacitor 6.6 mm
9	2	C23,C25	1 µF	0805	
10	1	C27	220 µF, 16 V	CE83	Aluminium capacitor 8.3 mm
11	1	C33	0.1 µF	0603	
12	1	C34	100 µF, 16 V	CE66	Aluminium capacitor 6.6 mm
13	2	C35,C44	2.2 nF	0603	
14	6	C36,C37,C38,C41, C45,C46	150 pF	0603	
15	2	C39, C42	47 µF, 16 V	CE66	Aluminium capacitor 6.6 mm
16	2	C40,C43	100 pF	0603	
17	1	D1	BLUE	0805	
18	1	D2	1SS335	SOD323	
19	1	IC1	BT-STA2416C2	See module specs	Provided by ST
20	1	IC2	STA529QFN	VFQFPN52	Provided by ST
21	1	IC3	LD2985AM18	SOT23-5	Provided by ST
22	1	IC4	TS462	TSSOP8	Provided by ST
23	1	J1	CON5	CN5_RA	5-pin male connector 2-mm step, right angle

Table 1. **Bill of materials**

Item	Qty	Reference	Part	Footprint	Notes
24	1	J2	CON2	CN2	2-pin connector 2-mm step, right angle
25	1	J3	CON8	CN8	8-pin connector 2-mm step, 90° angle
26	1	J4	CON9	CONN9	9-pin connector for strip (2-mm step on adjacent pin)
27	1	J5	CON5	COAX_RA	90° or right SMA connector
28	2	L1,L2	FERRITE	0805	
29	3	R1,R20,R21	1kΩ	0603	
30	3	R2,R26,R27	1R1 Ω	0603	
31	15	R3,R7,R9,R10,R11, R12,R13,R14,R15, R16,R17,R18,R19, R24,R28	0 Ω	0603	wire connection
32	3	R4,R39,R44	10 kΩ	0603	
33	2	R5,R6	100 Ω	0603	
34	1	R8	3k3 Ω	0603	
35	1	R22	1 MΩ	0603	
36	1	R23	12 kΩ	0603	
37	1	R25	470 Ω	0603	
38	4	R29,R33,R49,R50	30 kΩ	0603	
39	12	R30,R31,R32,R35, R36,R37,R40,R41, R42,R46,R47,R48	4k7 Ω	0603	
40	2	R34,R45	1500 Ω	0603	
41	2	R38,R43	15 kΩ	0603	
42	1	SW1	SW KEY-SPST	SW	2-pin switch with 5-mm step
43	1	TP1	RST	TP	Not soldered
44	1	TP2	PWREN	TP	Not soldered
45	1	TP3	BOOT	TP	Not soldered
46	1	TP4	USB VCC	TP	Not soldered
47	1	TP5	3.3 V	TP	Not soldered
48	1	TP6	UART_TXD	TP	Not soldered
49	1	TP7	GND	TP	Not soldered

Table 1. Bill of materials

Item	Qty	Reference	Part	Footprint	Notes
50	1	TP8	UART RXD	TP	Not soldered
51	1	TP9	VDD33	TP	Not soldered
52	1	TP10	DGND	TP	Not soldered
53	1	TP11	AUDIO_L	TP	Not soldered
54	1	TP12	AGND	TP	Not soldered
55	1	TP13	AUDIO_R	TP	Not soldered
56	1	TP14	BT_RESET	TP	Not soldered
57	1	TP15	LED_CONT	TP	Not soldered
58	1	Y1	13 MHz	QZ-49SX	SMD crystal (11mm x 4.8mm)

4 How to use the board

The board is simple to set up and use. Just connect the power supply to the supply wires ensuring that the red wire is 3.3 V and the black is 0 V (ground).

Connect a suitable amplifier with speakers or headphones, if desired, to the line output.

The board can communicate to any of the tested A2DP BT sources given in *Section 5: Interoperability on page 12*.

Turn on the transmitter and source equipment and the BT-HTS_RX board. When the power to the board is turned on the blue LED (D1) turns on for a short time indicating the initialization of the board. After the LED extinguishes the board is ready to operate.

Now follow this procedure.

1. Allow some time for the source device to discover the Bluetooth® technology device(s) in its neighborhood.
2. Find this demo board in the list of the discovered devices: the demo board appears with its name (HTS_RX) and/or its address (00:80:E1:00:01:00).
3. Select it and choose the “pair” option.
4. Enter the code “0000” to pair the source and the receiver. D1 again turns on with a successful connection.
5. Refresh available services.
6. Choose the only service within the list (the board only exposes the A2DP service).
7. Start streaming audio.

The two figures below are screen prints from the PC taken whilst following the above steps. The PC was running BlueSoleil™ 1.4.8.1 software by IVT Corporation for setting up and controlling the devices.

Figure 8 refers to points 2, 3 and 4 above. Here you can see all of the discovered devices. On selecting the HTS_RX demo board, its BD address appears on the left bottom of the main window. The smaller pop-up window asks for the pairing code related to the board.

Pairing is accomplished as soon as the code “0000” is confirmed, then the refreshing of the available services highlights the AV service. The BT-HTS-RX audio receiver board indicates a successful connection by turning on the blue LED after pairing.

Figure 9 shows the window during audio streaming that begins once that service is launched.

In this kind of test extra software for playing the audio is required (for example, Windows Media® player by Microsoft Corporation) since BlueSoleil™ software does not do it.

Of course, actual needs are related to the source used for the BT connection. For instance, the portable MP3 players and mobile phones that are compliant to this standard already incorporate all of the necessary items. Refer to the specific source product for further information.

Figure 8. Screen print: finding and selecting the demo board

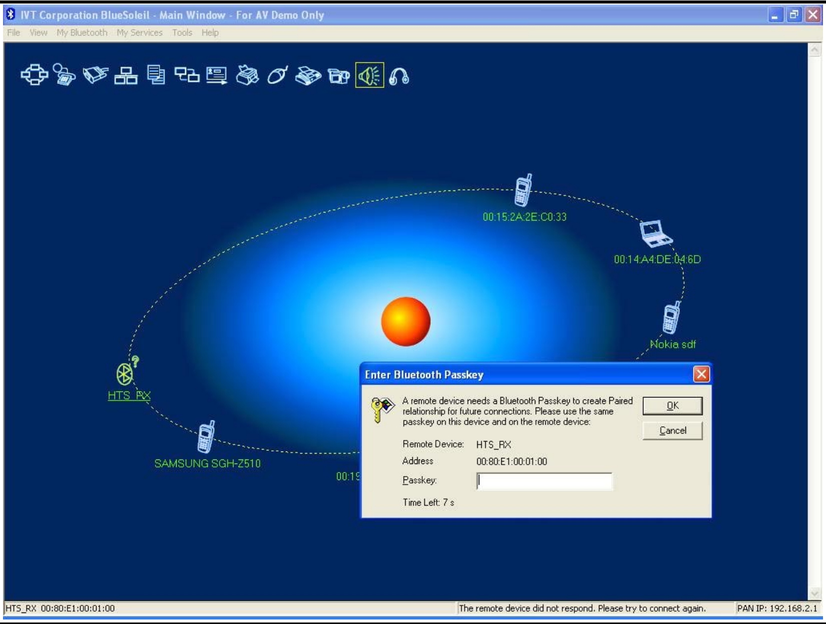
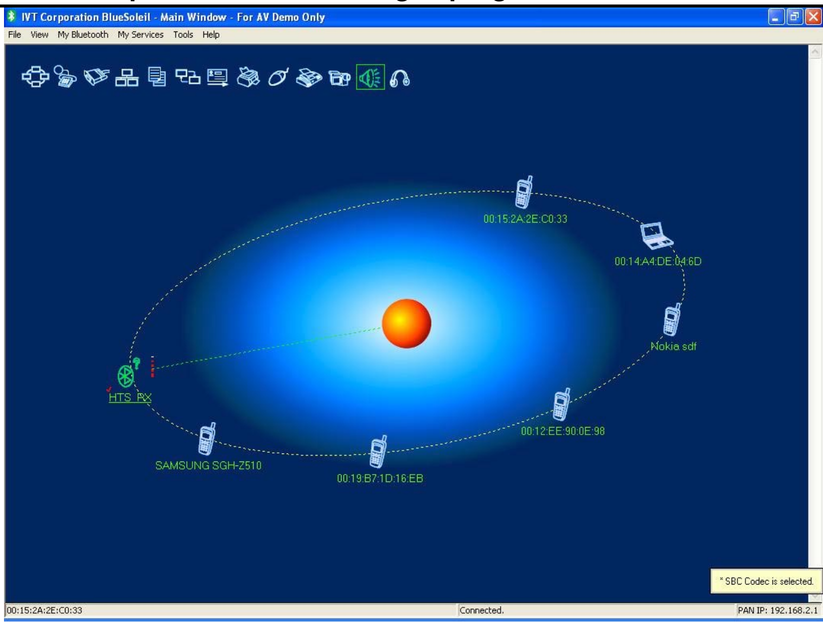


Figure 9. Screen print: audio streaming in progress



5 Interoperability

The board can accept audio from A2DP compliant audio sources. *Table 2* lists the commercial source products tested up to April 2007.

For some of these products to operate properly it may be necessary to update the firmware.

Table 2. Interoperability list

Manufacturer	Type	Model
Blackjack	PDA	
HP	PDA	IPAQ
LG	Mobile phone	GSM type
LG	Mobile phone	(EU)U890
LG	Mobile phone	Chocolate VX8500
Motorola	Mobile phone	(USA)krzr k1
Motorola	Mobile phone	V3X
Nokia	Mobile phone	8801
Samsung	Mobile phone	(China)E788
Samsung	Mobile phone	(EU)D820
Samsung	Mobile phone	(Korea)SCH-B380
Samsung	Mobile phone	(Korea)SCH-B5050
Samsung	Mobile phone	(Korea)SCH-B560
Samsung	Mobile phone	(Korea)SCH-B630
Samsung	Mobile phone	(Korea)SCH-V740
Samsung	Mobile phone	(Korea)SGH-D600
Samsung	Mobile phone	(Korea)SPH-V9600
Samsung	Mobile phone	(Korea)SPH-V9850
Samsung	MP3 Player	YP-T9B
Sony Ericsson	Mobile phone	W850i
Sony Ericsson	Mobile phone	(China)P990i
Sony Ericsson	Mobile phone	(EU)W810i
Sony Ericsson	Mobile phone	(USA)K800i
Sony Ericsson	Mobile phone	(USA)W710i
Sony Ericsson	Mobile phone	(USA)W850i

The firmware of the receiver demo board is being continually revised to include new results from our continued testing of new commercial products. Updates will be available on newer demo boards as soon as they are released. The present firmware release is marked STM849_SINK_V10_E1.0.0.

6 Certifications

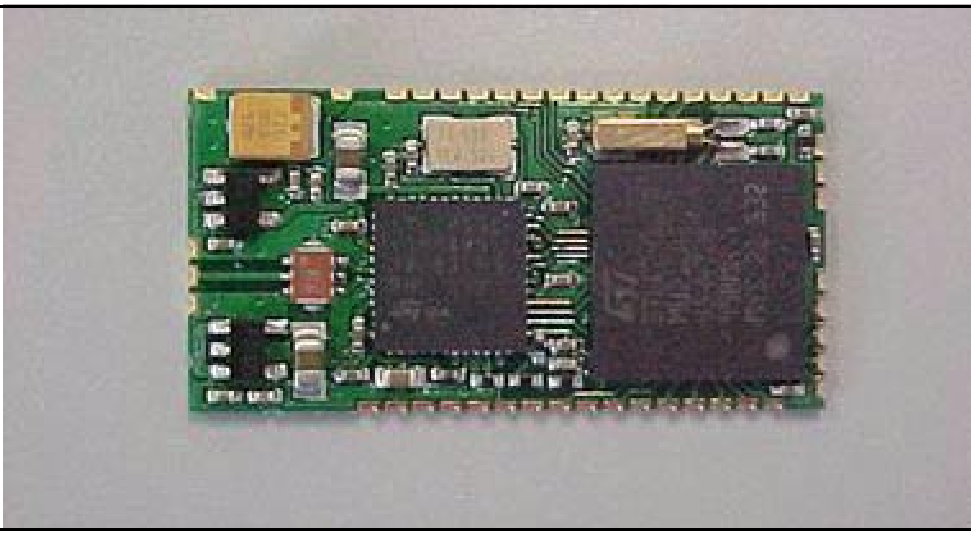
The STMicroelectronics chipset and modules are fully compliant with the BQB certifications under the PRD 2.0 standard as given in *Table 3*.

The stack, supplied by Open Interface North America, Inc. is BQB certified and provides full connectivity for our Bluetooth® wireless technology kit by supporting different profiles as given in *Table 3*.

Table 3. BQB qualified designs

Qualified designs	Manufacturer	Product ID	Product Type	Profiles	QD ID
Bluetooth® module	STMicroelectronics	BT-STA2416C2	Component	RF, BB, LM, HCI	B012535
Bluetooth® stack	Open Interface North America, Inc.	BLUEmagic® 3.0	Profile sub-system	SDP, GAP, A2DP, AVCTP, AVDTP, AVRCP, GAVDP, L2CAP	B010293

Figure 10. Bluetooth® wireless module BT-STA2416C2



7 Trademark and other acknowledgements

Bluetooth is a registered trademark of Bluetooth SIG Inc.

FFX is an STMicroelectronics proprietary digital modulation technology.

OrCAD is a registered trademark of OrCAD Systems Corporation.

BlueSoleil is a trademark of IVT Corporation.

BLUEmagic and SOUNDabout are registered trademarks of
Open Interface North America, Inc.

Windows Media® is a registered trademark of Microsoft Corporation.

8 Revision history

Table 4. Document revision history

Date	Revision	Changes
26-Apr-2007	1	First release
23-May-2007	2	Trademark updates on pages 1, 13 and 15