Portable Hi-End Internet Radio player with anti-jitter sample-rate converter	Northeastern University

TI university program
technology for tomorrow's innovators
TEXAS INSTRUMENTS

TI Innovation Challenge 2016 Project Report

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In the last decade of the 20th cent there were significant progress in silicon microchip technology in terms of integration and energy efficiency. It is allowed to built variety of devices in a portable stand alone format from quadrocopters and robots to a highly efficient medical devices. Although the portable digital audio was forgotten by technology enthusiasts but it seems available IC can easily be put together result in hi-end portable audio player. Incredible progress in semiconductor theory and technology allowed certain vendors reach almost theoretical edge in developing OPA very close to ideal, theoretical. Internet-of-Things technology offers very tempting opportunity to incorporate an internet radio option and firmware update “other-the-air” while jitter reduction feature insure the highest reliability of income numeric data transferred through the Internet.
The portable audio player which incorporate micro DAC/headphone amplifier combo, two DC/DC converters for acquiring bipolar 5v supplied from 3.7v of LI-battery result in true audiophile DAP with incredible sound quality that very close to studio standards. To make it possible we used in the DAC an outstanding and now scarcely available, special audio grade electrolytic capacitors made in Japan at late decade of 20th century until discontinuation in 2006 and called Black Gate as the graphite used in its manufacturing.
The goal of that work was to incorporate the latest semiconductor technology and trends into hi-end audiophile player in the portable variant.

Qty.	**List all TI analog IC or TI processor part number and URL**	**1) Explain where it was used in the project? 2) What specific features or performance made this component well-suited to the design?**
Ex: 1	CC3200MODR1M2AMOBR	1) These two microprocessors acquired internet radio stream and converted it to audio numeric data. We used McASP port and built-in routines. 2) This IoT chip used for future firmware update over wi-fi 3) The compact design and low energy consumption in listening and stand-by mode make it possible to use it in portable device
Ex: 2	LM6172IM/NOPB	Basically we tested several OPA and selected this as truly neutral characteristic of output sound 1) Wide Unity-Gain Bandwidth 100MHz 2) Low Supply Current 2.3mA/Channel 3) High Output Current 50mA/channel 4) Specified for ±5V Operation
Ex : 1	PCM1794ADB	Selected this device as a **delta sigma Highest Performance Stereo DAC, tested several variations of similar ICs** 1) Dynamic Range: 129 dB (4.5 V RMS, Stereo) 2) THD+N: 0.0004% 3) improved tolerance to clock jitter 4) balanced current outputs 5) Differential Current Output: 7.8 mA p-p 6) 8× Oversampling Digital Filter: Stop-Band Attenuation: –130 dB, Pass-Band Ripple: ±0.00001 dB 7) Sampling Frequency: 10 kHz to 200 kHz

		8) System Clock: 128, 192, 256, 384, 512, or 768 fS with autodetect 9) Accepts 16-Bit and 24-Bit Audio Data 10) PCM Data Formats: Standard, I2S, and Left-Justified 11) Digital De-Emphasis 12) Digital Filter Rolloff: Sharp or Slow
Ex: 1	TPS63002DRCT	1) Up to 96% Efficiency 2) Device Quiescent Current less than 50 µA 3) ideal for portable battery-powered equipment 4) high switching frequency allows the use of small external components enabling a small solution size
Ex: 1	TPS63700DRCT	1) Up to 84% Efficiency 2) ideal for portable battery-powered equipment 3) switching frequency of typically 1.4 MHz allows the use of small external components enabling a small solution size
Ex: 1	LM317LID	1) Input Regulation Typically 0.01% Per Input-Voltage Change 2) Output Regulation Typically 0.5% 3) Ripple Rejection Typically 80 dB
Ex: 1	SRC4192IDB	Selected this device as the best conforming to our prototype experimental conditions that is allowed the highest flexibility with great tolerance to different incoming data. 1) pin-programmed device 2) Automatic Sensing of the Input-to-Output Sampling Ratio 3) THD+N: –140 dB (0-dbFS Input, BW = 20 Hz to fS/2) 4) Attenuates Sampling and Reference Clock Jitter 5) High-Performance, Linear-Phase Digital Filtering with Stop Band Attenuation Greater than 140 dB 6) Flexible audio interfaces, Supports I^2S 7) operate from a single 3.3-V power supply 8) Supports Input and Output Sampling Rates Up to 212 kHz 9) Supports 24 or 16-Bit Input and Output Data
Ex: 1	THS6012	This driver surprisingly suit all the highest standards we were looking for. 1) Insured 400 mA minimum output current into 25-Ω Load. 2) Low Distortion 3) -72 dB 3rd Order Harmonic Distortion at f = 1 MHz, 25-Ω Load, and 20 VPP 4) Independent Power Supplies for Low Crosstalk 5) Wide Supply Range ±4.5 V to ±16 V