

PAMS Technical Documentation

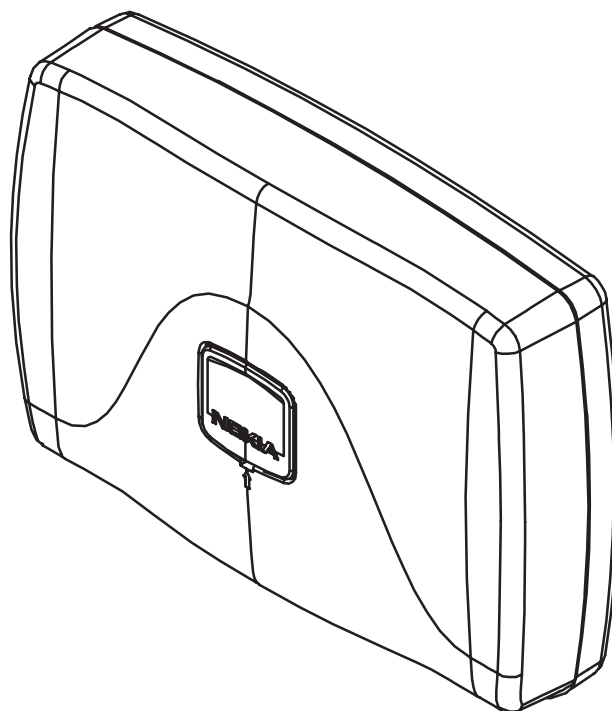
HFU-2 Handsfree Unit

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| Code: 0200948 | 9 |

Introduction

The HFU-2 is a handsfree unit for DCT3 compatible handportable phones. It provides rapid charging for the phone, a possibility to use HF-operation and connections to the data-card and handset unit. The HF box can be connected directly to the Mobile holder MCC-1 via the external cable.



Technical Summary

The HFU-2 has connections to car battery, car ignition sense, car radio muting, antenna motor control, data-card, handset HSU-1, external speaker and microphone. The unit has a System-connector that provides an interface to the Mobile holder MCC-1 via the external cable.

The unit consists of a rapid charger, HF-microphone- and speaker amplifiers, interface to handset, - datacard and -phone, voltage regulators and control circuit (microprocessor).

The HFU-2 is always connected to the car battery. To save the car battery, HFU-2 goes in to the sleep mode if the car is not running and/or the phone is not connected.

List of Modules

| Name of module | Type code | Material code | Notes |
|----------------|-----------|---------------|------------------------------|
| HF unit | HFU-2 | 0694049 | Advanced handsfree unit |
| HF module | ED2 | 0200948 | ED2 Advanced hadsfree module |
| Assembly parts | MHFU-2 | 0261602 | Mechanical Parts |

Operation

Phone not connected (sleep mode):

When the phone is not connected the current consumption of the device has been minimized. The switching mode power supply (SMPS) and audio circuits has been turned off. HFU-2 is only waiting a phone to be connected.

Phone connected (active mode):

When the phone is connected to the HFU-2 it goes into the active mode. In the active mode the device provides charging current to the phone. It also can provide hands free call option using the external speaker and the external microphone or micspeaker unit. If more private call wants to be made, the phone itself can be used as a handset without losing the external antenna connection or with handset (option).

The phone controls all functions of HFU-2. In the active mode the HFU-2 sends all state transitions to phone via mbus.

HFU-2 also provides car radio mute function during call.

HFU-2 can control the mobile antenna motor if it is installed to the car.

Supply Voltage and Power Consumption

| Conn. / pin | Line Symbol | Minimum | Typical / Nominal | Maximum | Unit / Notes |
|-------------|-------------|---------|-------------------|---------|---------------------|
| X300 / 6 | GND | | 0 | | VDC |
| X300 / 1 | VB | 8.0 | | 16 | VDC (working) |
| X300 / 1 | VB | 10.8 | 13.5 | 16 | VDC (spec. fulfill) |
| X300 / 1 | VB | 0.05 | 1 | 2 | IDC/A (operating) |
| X300 / 1 | VB | 0.2 | 0.8 | 1 | IDC/mA (sleep mode) |

Charging voltage limits within current specifications fulfilled

| Conn. / pin | Line Symbol | Minimum | Typical / Nominal | Maximum | Unit / Notes |
|-------------|-------------|---------|-------------------|---------|--------------|
| X200 / 7 | GND | 0 | 0 | 0.1 | VDC |
| X200 / 2 | +10VA | 9.50 | 10.0 | 10.55 | VDC |
| X200 / 2 | +10VA | | 11 | 200 | IDC / mA |

| Conn. / pin | Line Symbol | Minimum | Typical / Nominal | Maximum | Unit / Notes |
|---------------|-------------|---------|-------------------|---------|-------------------|
| X100 / 5,6,11 | GND | 0 | 0 | 0.1 | VDC |
| X100 / 8,9 | V_IN | 3 | | 8.5 | VDC |
| X100 / 12 | VB | 8 | | 16 | VDC / car battery |
| X100 / 12 | VB | | | 500 | IDC / mA |

Audio Specifications, electrical

| | Minimum | Typical / Nominal | Maximum | Unit / Notes |
|---|---------|-------------------|---------|-----------------------|
| Max speaker output power at distortion=1%, 1 kHz sine | 3.0 | 3.1 | | W / Rload = 8 ohm |
| HF-speaker amplifier gain | 27 | 29 | 31 | dB |
| PSRR, XEAR line | -60 | -68 | | dB |
| CMRR, XEAR-SGND to speaker | -50 | -55 | | dB |
| HF-mic amplifier gain | 27 | 30 | 33 | dB |
| Mic level at XMIC-SGND, (clipping level) | 2000 | | 2800 | mVpp |
| Mic distortion at XMIC-SGND, at Vo = 100 mVrms, 1 kHz | | 0.15 | 0.4 | % |
| Noise voltage, HFMIC | | | 5 | uVrms psfometric |
| PSRR, XMIC | -60 | -67 | | dB |
| Crosstalk XEAR-SGND to XMIC | | -55 | -45 | dB / electrical, 1kHz |

HFS-12 Audio Specifications, acoustic

| | Minimum | Typical / Nominal | Maximum | Unit / Notes |
|---|----------|-------------------|---------|--|
| Electroacoustic transfer function (RX) dBPa/1V/0.5m | 11 | 15 | 19 | dBPa / 1V at system connector is theoretical level |
| Speaker distortion level at XEAR-SGND, d=5% | | 354 | | mVrms |
| HF-speaker: SPL, approximate over 500 ... 3000 Hz | 87 -4 | 89 -2 | 91 0 | dB / 1W / 1m dBPa / 0.5W at 0,5m |
| Equivalent input noise, XEAR | | | 10 | uVrms psfometric |
| Total noise, HF speaker | | 200 | 400 | uVrms psfometric |

HFM-8 Audio Specifications, acoustic

| | Minimum | Typical / Nominal | Maximum | Unit / Notes |
|--|---------|-------------------|---------|------------------|
| Electroacoustic transfer function (TX) dBV/dBPa/0.5m | -28 | -24 | -20 | dBV/-5dBPa/0.5m |
| Total noise, XMIC-SGND | | 140 | 300 | uVrms psfometric |

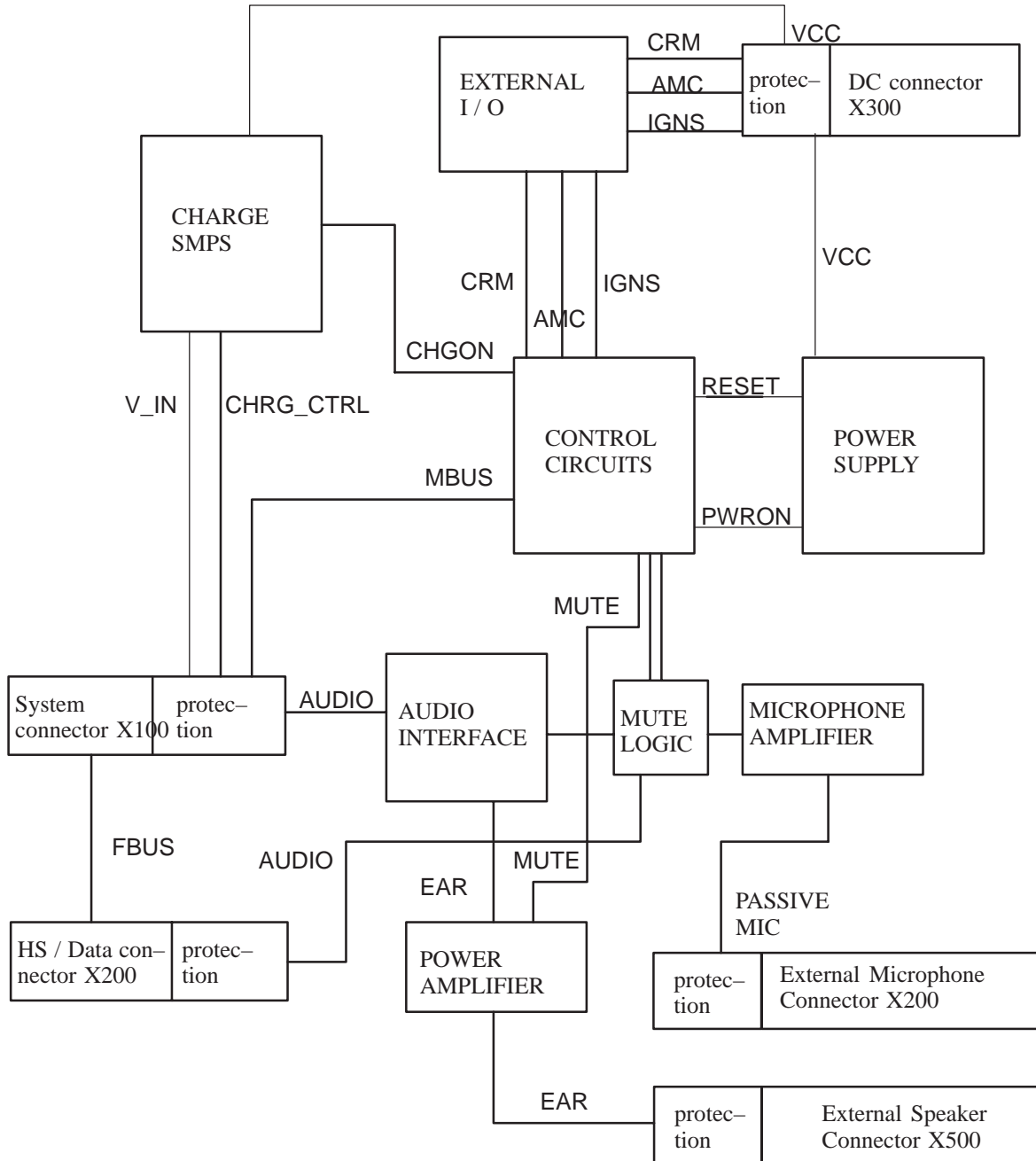
Audio signal levels

| Signal name / conn. / pin | Minimum | Typical / Nominal | Maximum | Unit / Notes |
|---------------------------|---------|-------------------|---------|--------------|
| XEAR / X100 / 4 | | 80 | 354 | mVrms |
| SGND / X100 / 3 | | 0 | | mVrms |
| XMIC / X100 / 2 | | 60 | 990 | mVrms |
| HFMIC / X400 / 2 | | 2.0 | | mVrms |
| SPEAKER / X500 / 1 & 2 | | 0.75 | 5 | V rms |

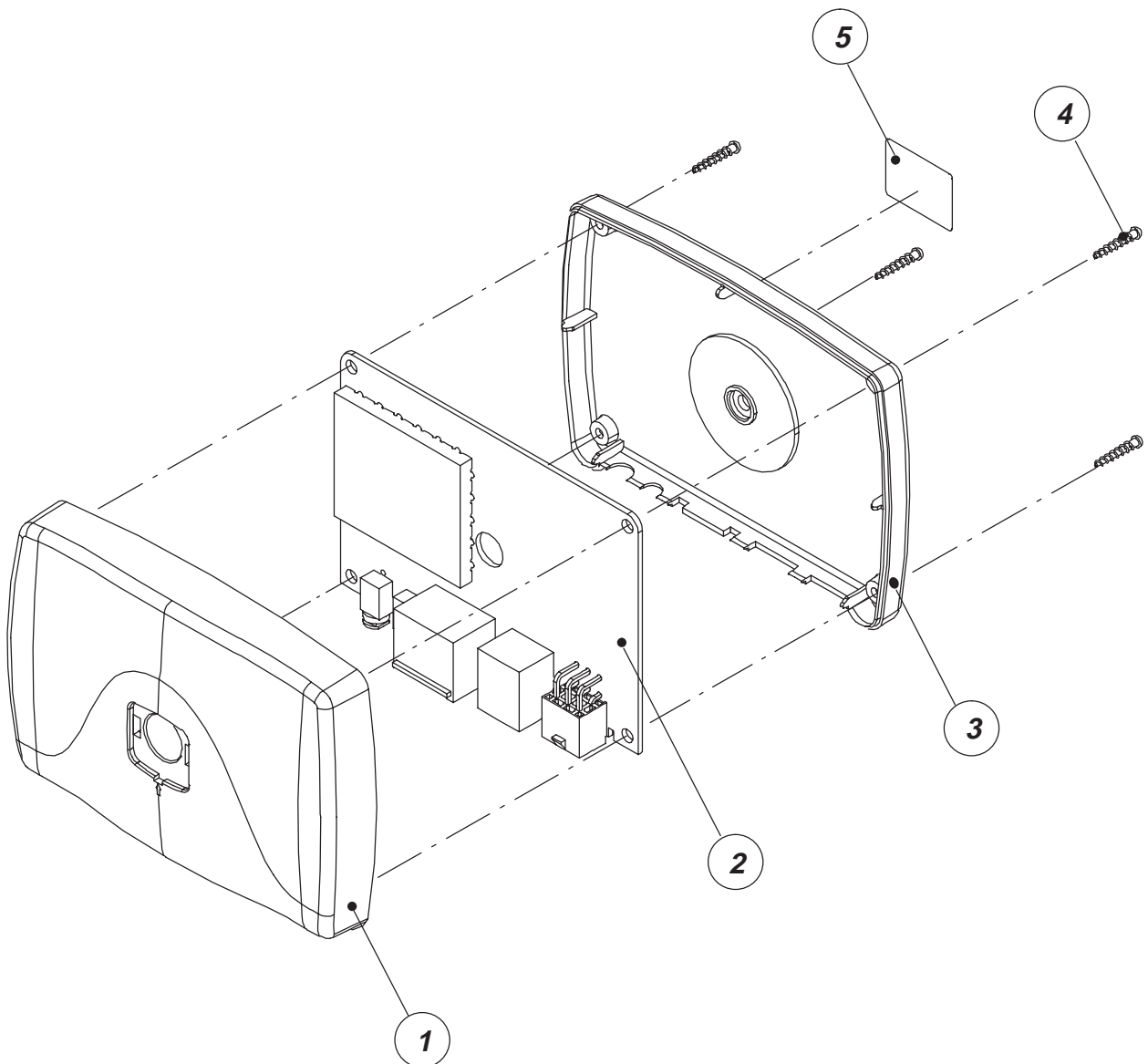
Signals and Connections

| Connector Name | Code | Notes | Specifications / Ratings |
|--------------------------|------|---|--------------------------|
| System connector | X100 | Charge, Mbus, Fbus, audio lines, VB | Modular 15 pin. |
| Handset / Data connector | X200 | Mbus, Fbus, Handset audio- lines, Hshook, 10V | Modular 10 pin. |
| Car connector | X300 | +VB, -VB, ign. sense, car radio mute, antenna motor control | 2 X 3 Power conn. |
| HFMIC connector | X400 | External microphone | 2.5 mm jack |
| EXT. SPEAKER connector | X500 | External speaker | 3.2 mm jack |

Block Diagram



Exploded View of HFU-2



Parts list of ED2 (EDMS Issue 5.1)

Code: 0200948

| ITEM | CODE | DESCRIPTION | VALUE | TYPE |
|------|---------|---------------|--------|------------------|
| R200 | 1415960 | Melf resistor | 33.2 k | 1 % 0.2 W 0204 |
| R201 | 1412409 | Chip resistor | 1.5 k | 5 % 0.1 W 0805 |
| R202 | 1430051 | Chip resistor | 4.7 k | 5 % 0.063 W 0603 |
| R203 | 1413829 | Chip resistor | 10 | 5 % 0.1 W 0805 |
| R204 | 1413829 | Chip resistor | 10 | 5 % 0.1 W 0805 |
| R205 | 1419007 | Chip resistor | 0.22 | 2 % 1210 |
| R206 | 1413635 | Chip resistor | 100 k | 5 % 0.1 W 0805 |
| R207 | 1416393 | Melf resistor | 221 k | 1 % 0.2 W 0204 |
| R209 | 1430001 | Chip resistor | 100 | 5 % 0.063 W 0603 |
| R210 | 1415791 | Melf resistor | 100 | 1 % 0.2 W 0204 |
| R211 | 1413716 | Chip resistor | 220 k | 5 % 0.1 W 0805 |
| R212 | 1416273 | Melf resistor | 150 k | 1 % 0.2 W 0204 |
| R213 | 1430065 | Chip resistor | 10 k | 5 % 0.063 W 0603 |
| R214 | 1430089 | Chip resistor | 120 k | 5 % 0.063 W 0603 |
| R215 | 1430105 | Chip resistor | 560 k | 5 % 0.063 W 0603 |
| R216 | 1415664 | Melf resistor | 27.4 k | 1 % 0.2 W 0204 |
| R218 | 1412328 | Chip resistor | 820 | 5 % 0.1 W 0805 |
| R219 | 1416798 | Melf resistor | 681 | 1 % 0.2 W 0204 |
| R222 | 1410003 | Chip resistor | 33 k | 1 % 0.1 W 0805 |
| R223 | 1410001 | Chip resistor | 22 k | 1 % 0.1 W 0805 |
| R224 | 1414283 | Chip resistor | 100 k | 1 % 0.1 W 0805 |
| R225 | 1414283 | Chip resistor | 100 k | 1 % 0.1 W 0805 |
| R226 | 1413716 | Chip resistor | 220 k | 5 % 0.1 W 0805 |
| R227 | 1430051 | Chip resistor | 4.7 k | 5 % 0.063 W 0603 |
| R228 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R233 | 1430015 | Chip resistor | 470 | 5 % 0.063 W 0603 |
| R240 | 1430001 | Chip resistor | 100 | 5 % 0.063 W 0603 |
| R245 | 1415960 | Melf resistor | 33.2 k | 1 % 0.2 W 0204 |
| R246 | 1414406 | Chip resistor | 5.6 k | 5 % 0.1 W 0805 |
| R270 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R300 | 1430071 | Chip resistor | 22 k | 5 % 0.063 W 0603 |
| R301 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R302 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R303 | 1430071 | Chip resistor | 22 k | 5 % 0.063 W 0603 |
| R304 | 1412409 | Chip resistor | 1.5 k | 5 % 0.1 W 0805 |
| R306 | 1430071 | Chip resistor | 22 k | 5 % 0.063 W 0603 |
| R307 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R310 | 1412261 | Chip resistor | 100 | 5 % 0.1 W 0805 |
| R311 | 1430073 | Chip resistor | 27 k | 5 % 0.063 W 0603 |
| R312 | 1430073 | Chip resistor | 27 k | 5 % 0.063 W 0603 |
| R313 | 1430065 | Chip resistor | 10 k | 5 % 0.063 W 0603 |
| R315 | 1430065 | Chip resistor | 10 k | 5 % 0.063 W 0603 |
| R316 | 1430051 | Chip resistor | 4.7 k | 5 % 0.063 W 0603 |

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|------|---------|---------------|--------|------------------|
| R317 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R319 | 1430079 | Chip resistor | 47 k | 5 % 0.063 W 0603 |
| R321 | 1430071 | Chip resistor | 22 k | 5 % 0.063 W 0603 |
| R323 | 1414536 | Chip resistor | 200 k | 1 % 0.1 W 0805 |
| R324 | 1410003 | Chip resistor | 33 k | 1 % 0.1 W 0805 |
| R325 | 1430035 | Chip resistor | 1.0 k | 5 % 0.063 W 0603 |
| R327 | 1414536 | Chip resistor | 200 k | 1 % 0.1 W 0805 |
| R328 | 1410003 | Chip resistor | 33 k | 1 % 0.1 W 0805 |
| R331 | 1430065 | Chip resistor | 10 k | 5 % 0.063 W 0603 |
| R332 | 1430055 | Chip resistor | 6.8 k | 5 % 0.063 W 0603 |
| R333 | 1430055 | Chip resistor | 6.8 k | 5 % 0.063 W 0603 |
| R334 | 1414536 | Chip resistor | 200 k | 1 % 0.1 W 0805 |
| R335 | 1410003 | Chip resistor | 33 k | 1 % 0.1 W 0805 |
| R336 | 1430095 | Chip resistor | 220 k | 5 % 0.063 W 0603 |
| R337 | 1430095 | Chip resistor | 220 k | 5 % 0.063 W 0603 |
| R350 | 1430035 | Chip resistor | 1.0 k | 5 % 0.063 W 0603 |
| R351 | 1430065 | Chip resistor | 10 k | 5 % 0.063 W 0603 |
| R352 | 1430047 | Chip resistor | 3.3 k | 5 % 0.063 W 0603 |
| R353 | 1430065 | Chip resistor | 10 k | 5 % 0.063 W 0603 |
| R380 | 1430095 | Chip resistor | 220 k | 5 % 0.063 W 0603 |
| R400 | 1430043 | Chip resistor | 2.2 k | 5 % 0.063 W 0603 |
| R402 | 1430073 | Chip resistor | 27 k | 5 % 0.063 W 0603 |
| R403 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R404 | 1430095 | Chip resistor | 220 k | 5 % 0.063 W 0603 |
| R405 | 1430167 | Chip resistor | 47 | 5 % 0.063 W 0603 |
| R406 | 1430047 | Chip resistor | 3.3 k | 5 % 0.063 W 0603 |
| R407 | 1430035 | Chip resistor | 1.0 k | 5 % 0.063 W 0603 |
| R408 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R409 | 1430043 | Chip resistor | 2.2 k | 5 % 0.063 W 0603 |
| R410 | 1430043 | Chip resistor | 2.2 k | 5 % 0.063 W 0603 |
| R411 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R412 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R415 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R416 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R417 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R421 | 1430035 | Chip resistor | 1.0 k | 5 % 0.063 W 0603 |
| R422 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R423 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R425 | 1430087 | Chip resistor | 100 k | 5 % 0.063 W 0603 |
| R426 | 1430142 | Chip resistor | 4.7 | 5 % 0.063 W 0603 |
| R427 | 1430142 | Chip resistor | 4.7 | 5 % 0.063 W 0603 |
| R429 | 1430167 | Chip resistor | 47 | 5 % 0.063 W 0603 |
| R430 | 1430167 | Chip resistor | 47 | 5 % 0.063 W 0603 |
| R431 | 1414533 | Chip resistor | 56 k | 1 % 0.1 W 0805 |
| R432 | 1415230 | Melf resistor | 11.0 k | 1 % 0.2 W 0204 |
| R433 | 1414276 | Chip resistor | 47 k | 1 % 0.1 W 0805 |
| R434 | 1414276 | Chip resistor | 47 k | 1 % 0.1 W 0805 |

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|------|---------|----------------|--------|-----------------------|
| R435 | 1430095 | Chip resistor | 220 k | 5 % 0.063 W 0603 |
| R436 | 1430159 | Chip resistor | 22 | 5 % 0.063 W 0603 |
| R437 | 1414276 | Chip resistor | 47 k | 1 % 0.1 W 0805 |
| R438 | 1430043 | Chip resistor | 2.2 k | 5 % 0.063 W 0603 |
| R439 | 1415230 | Melf resistor | 11.0 k | 1 % 0.2 W 0204 |
| R440 | 1416266 | Melf resistor | 140 k | 1 % 0.2 W 0204 |
| R441 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R442 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R443 | 1430071 | Chip resistor | 22 k | 5 % 0.063 W 0603 |
| R444 | 1430167 | Chip resistor | 47 | 5 % 0.063 W 0603 |
| R446 | 1430039 | Chip resistor | 1.5 k | 5 % 0.063 W 0603 |
| R447 | 1430071 | Chip resistor | 22 k | 5 % 0.063 W 0603 |
| R449 | 1430043 | Chip resistor | 2.2 k | 5 % 0.063 W 0603 |
| R465 | 1415939 | Melf resistor | 22.1 k | 1 % 0.2 W 0204 |
| R466 | 1430055 | Chip resistor | 6.8 k | 5 % 0.063 W 0603 |
| R467 | 1430001 | Chip resistor | 100 | 5 % 0.063 W 0603 |
| R468 | 1430001 | Chip resistor | 100 | 5 % 0.063 W 0603 |
| R469 | 1430001 | Chip resistor | 100 | 5 % 0.063 W 0603 |
| R471 | 1430053 | Chip resistor | 5.6 k | 5 % 0.063 W 0603 |
| R472 | 1430053 | Chip resistor | 5.6 k | 5 % 0.063 W 0603 |
| R473 | 1430053 | Chip resistor | 5.6 k | 5 % 0.063 W 0603 |
| C201 | 2503072 | Electrol. cap. | 470 u | 20 % 16 V 10x16 |
| C202 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C203 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C205 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C206 | 2505261 | Electrol. cap. | 220 u | 20 % 25 V 8.5x11.5 |
| C207 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C208 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C209 | 2503072 | Electrol. cap. | 470 u | 20 % 16 V 10x16 |
| C210 | 2503072 | Electrol. cap. | 470 u | 20 % 16 V 10x16 |
| C211 | 2604093 | Tantalum cap. | 2.2 u | 20 % 35 V 6.0x3.2x2.5 |
| C212 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C213 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C214 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C218 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C219 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C220 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C221 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C301 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C304 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C306 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C308 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C309 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C316 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C318 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C321 | 2320059 | Ceramic cap. | 100 p | 5 % 50 V 0603 |
| C322 | 2320059 | Ceramic cap. | 100 p | 5 % 50 V 0603 |

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|------|---------|----------------|-------|-----------------------|
| C323 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C326 | 2320107 | Ceramic cap. | 10 n | 5 % 50 V 0603 |
| C329 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C334 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C335 | 2505261 | Electrol. cap. | 220 u | 20 % 25 V 8.5x11.5 |
| C338 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C339 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C340 | 2320107 | Ceramic cap. | 10 n | 5 % 50 V 0603 |
| C400 | 2320069 | Ceramic cap. | 270 p | 5 % 50 V 0603 |
| C402 | 2320079 | Ceramic cap. | 680 p | 5 % 50 V 0603 |
| C403 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C404 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C405 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C406 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C407 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C408 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C409 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C410 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C412 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C413 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C414 | 2320107 | Ceramic cap. | 10 n | 5 % 50 V 0603 |
| C415 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C416 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C417 | 2320107 | Ceramic cap. | 10 n | 5 % 50 V 0603 |
| C418 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C419 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C420 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C421 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C422 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C423 | 2320107 | Ceramic cap. | 10 n | 5 % 50 V 0603 |
| C425 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C427 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C428 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C429 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C430 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C431 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C432 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C433 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C434 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C435 | 2310791 | Ceramic cap. | 33 n | 20 % 50 V 0805 |
| C436 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C437 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C438 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C439 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C440 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C441 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C442 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |

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|------|---------|-----------------------------------|--------------|---------------------------------------|
| C443 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C444 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C445 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C446 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C447 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C449 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C450 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C453 | 2320063 | Ceramic cap. | 150 p | 5 % 50 V 0603 |
| C454 | 2320091 | Ceramic cap. | 2.2 n | 5 % 50 V 0603 |
| C455 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| C456 | 2604431 | Tantalum cap. | 10 u | 20 % 16 V 6.0x3.2x2.5 |
| C457 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C458 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C460 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C465 | 2320083 | Ceramic cap. | 1.0 n | 5 % 50 V 0603 |
| C466 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C467 | 2604209 | Tantalum cap. | 1.0 u | 20 % 16 V 3.2x1.6x1.6 |
| C470 | 2310784 | Ceramic cap. | 100 n | 10 % 25 V 0805 |
| C490 | 2320043 | Ceramic cap. | 22 p | 5 % 50 V 0603 |
| L200 | 3609001 | Coil | 100 u | 10 % Q=20/796 kHz Q20/796 kHz 8X11 |
| L201 | 3609001 | Coil | 100 u | 10 % Q=20/796 kHz Q20/796 kHz 8X11 |
| L301 | 3641262 | Ferrite bead 30r/100mhz 2a | 1206 | 1206 |
| L302 | 3641262 | Ferrite bead 30r/100mhz 2a | 1206 | 1206 |
| L303 | 3641262 | Ferrite bead 30r/100mhz 2a | 1206 | 1206 |
| L304 | 3641262 | Ferrite bead 30r/100mhz 2a | 1206 | 1206 |
| L400 | 3641262 | Ferrite bead 30r/100mhz 2a | 1206 | 1206 |
| L401 | 3641262 | Ferrite bead 30r/100mhz 2a | 1206 | 1206 |
| Z300 | 4507733 | Cer.reson 1.0mhz+-0.5% 8.0x5.0smd | | 8.0x5.0smd |
| Z400 | 3640035 | Filt z>450r/100m 0r7max 0.2a 0603 | | 0603 |
| Z401 | 3640035 | Filt z>450r/100m 0r7max 0.2a 0603 | | 0603 |
| Z402 | 3640035 | Filt z>450r/100m 0r7max 0.2a 0603 | | 0603 |
| V200 | 4110195 | Zener diode | BZX84 | 5 % 18 V 0.3 W SOT23 |
| V201 | 4200917 | Transistor | BC848B/BCW32 | nnp 30 V 100 mA SOT23 |
| V202 | 4211423 | MosFet | MTB30 | D2PAK |
| V203 | 4108639 | Diode x 2 | BAS28 | 75 V 250 mA SOT143 |
| V204 | 4200909 | Transistor | BC858B/BCW30 | pnp 30 V 100 mA SOT23 |
| V205 | 4110074 | Schottky diode | STPS340U | 40 V 3 A SOD6 |
| V207 | 4200917 | Transistor | BC848B/BCW32 | nnp 30 V 100 mA SOT23 |
| V208 | 4200917 | Transistor | BC848B/BCW32 | nnp 30 V 100 mA SOT23 |
| V300 | 4200917 | Transistor | BC848B/BCW32 | nnp 30 V 100 mA SOT23 |
| V301 | 4200917 | Transistor | BC848B/BCW32 | nnp 30 V 100 mA SOT23 |
| V302 | 4100285 | Diode x 2 | BAV99 | 70 V 200 mA SER.SOT23 |
| V304 | 4200917 | Transistor | BC848B/BCW32 | nnp 30 V 100 mA SOT23 |
| V306 | 4100285 | Diode x 2 | BAV99 | 70 V 200 mA SER.SOT23 |
| V307 | 4200917 | Transistor | BC848B/BCW32 | nnp 30 V 100 mA SOT23 |

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|------|---------|----------------------------------|--------------|-----------------------|
| V309 | 4100285 | Diode x 2 | BAV99 | 70 V 200 mA SER.SOT23 |
| V310 | 4100285 | Diode x 2 | BAV99 | 70 V 200 mA SER.SOT23 |
| V311 | 4210096 | Transistor | BCP54 | npn 45 V 1.5 A SOT223 |
| V312 | 4100285 | Diode x 2 | BAV99 | 70 V 200 mA SER.SOT23 |
| V313 | 4210020 | Transistor | BCP69-25 | pnp 20 V 1 A SOT223 |
| V314 | 4200917 | Transistor | BC848B/BCW32 | npn 30 V 100 mA SOT23 |
| V315 | 4100218 | Trans. supr. | LDP24A | 100 V 30A/40 ms AG |
| V318 | 4108639 | Diode x 2 | BAS28 | 75 V 250 mA SOT143 |
| D300 | 4370315 | IC, MCU | | QFP44 |
| D400 | 4309431 | IC, 4 x bi.switch | 4066 | SO14S |
| N200 | 4340127 | Mic29152 reg ld adj 1.5a | to263-5 | TO263-5 |
| N201 | 4305733 | IC, 4 x comp | LM2901 | SO14S |
| N202 | 4340067 | IC, regulator | LP2951 | 3.3 V 100 mA |
| N204 | 4340067 | IC, regulator | LP2951 | 3.3 V 100 mA |
| N400 | 4301182 | IC, 2 x op.amp. | LM2902 | SO14S |
| N401 | 4340125 | L2726 2xop.amp pw5w1a 4-28v | so20w | SO20W |
| N402 | 4301199 | IC, 2 x op.amp. | LM2904 | SO8S |
| S001 | 9510365 | RF shield dmd02481 hfu-1 | | |
| X100 | 5400087 | Modular jack 15pol f p2.04 | 90deg | 90DEG |
| X200 | 540Y031 | Use code 5400103 | | |
| X300 | 540Y021 | Use code 5400093 | | |
| X400 | 5409057 | Jack 2.5mm+sw+lock f 4pol str. s | | SM |
| X500 | 5409059 | Jack 3.5mm+sw+lock f 3pol str. s | | SM |
| | 9854195 | PCB ED2 110.0X75.01.6 D 4/PA | | |
| | 9854195 | PC board | ED2 | 110.0x75.01.6 d 4/pa |