

Radio frequency identification sheet material (variations)

The group of inventions relates to the field of radio-frequency identification, in particular, to materials containing radio-frequency tags in their layers and intended for printing and stamping by commonly available printing methods.

The following terms and abbreviations will be used hereinafter.

Radio frequency identification (abbr. RFID) is a method of transmitting wireless information in which the data stored in so-called transponders or RFID tags by means of radio signals are read or written. Generally, the RFID tags are passive, in other words, they do not include batteries.

Chip – an integrated (micro)circuit is a microelectronic device with the complexes of input resistances and/or building networks made of the semiconductor plate. The chip processes signals when receiving and transmitting information by means of the radio frequency communication with a reader, it contains a protected memory, user memory, a unique identification number, it may contain a processor for cryptography processing, programmable space to run microprograms, etc.

The antenna is a conductor configuration, which geometrically and technically is made in accordance with the type of chip used. The antenna can be closed (HF range) and open type (UHF range). The antenna comes in different shapes: the circle, oval, square, rectangle, and other free geometric shapes. The antenna's shape is designed in accordance with the specification of the chip used. The antenna is made of materials containing conductive substances, such as aluminum, copper, silver, tin, gold, graphite, and other materials. The antenna is to be applied on the substrate made of thin-film, synthetic materials, and paper by etching, silk screen printing (screen printing), thermal transfer, stamping, inkjet, offset, as well as flexographic and digital printing with special inks.

The RFID inlay is a part of the RFID product that consists of the substrate and contains at least one chip and one antenna. The location of the antennas and chips can be either synchronous relative to the sides of the sheet material with the radiofrequency tag or asynchronous, depending on the intended design and configuration of the future RFID product. The additional components can be located on the inlay, for example, capacitors, resistors, sensors, microcontrollers, etc.

The RFID tag is a combination of the chip and antenna.

The RFID product is a final product, containing an RFID tag, for example, a card, tag, label, sticker, packaging, bracelet, or other forms of the product that can be obtained by cutting it from the sheet of RFID material that includes an RFID inlay.

The RFID reader is a device designed to exchange data with RFID products, for example, information reading and writing.

The closest group of claimed inventions analog is a sheet material with radio frequency identification, known from patent JP 5916028, which is a paper of standardized sizes formats
5 A0-A10, B0-B10, as well as Japanese paper size formats (JIS).

The expansion of the sheet materials arsenal is a technical problem the group of inventions aimed to solve.

The technical result is the creation of a technical solution as an alternative to the known solution.

10 The claimed technical solution makes it possible to produce a sheet material suitable for commercial printing with a sheet feed, including the modern digital presses HP Indigo, Canon ImagePress, Konica Minolta AccurioPRESS, Ricoh Pro, Xerox iGen 5, and others.

The claimed technical result is achieved due to the fact that the sheet material with radio frequency identification is made in the form of the rectangular sheet with a layer for printing, the
15 length of 450-485 mm and the width of 300-330 mm, it contains an antenna and a chip located inside the sheet, furthermore, one of the sheet angles is made as geometrically different from three others.

The claimed technical result is also achieved due to the fact that the sheet material with radio frequency identification is made in the form of the rectangular sheet with the layer for
20 printing, the length of 700-750 mm, the width of 500-530 mm and contains an antenna and a chip placed inside the sheet, furthermore, one from the angles of the sheet is made as geometrically different from three others.

The inventions group is explained using Fig. 1-3, which shows:

Fig. 1 is a general view of sheet material with twenty-four radio frequency tags;

25 Fig. 2 – general view of the sheet material with one radio frequency tag;

Fig. 3 – layer material sectional view.

Positions 1-16 are shown in Fig. 1-3:

- 1 – sheet material;
- 2 – the place of the radio frequency identification tag (RFID tag);
- 30 3 – the smaller side of the sheet;
- 4 – the larger side of the sheet;
- 5 – the distance from the smaller side of the sheet to the antenna;
- 6 – the distance from the large side of the sheet to the antenna;
- 7 – the distance between the centers of the adjacent antennas located horizontally;
- 35 8 – the distance between the centers of the adjacent vertically located antennas;

- 9 – antenna length;
- 10 – antenna width;
- 11 – geometrically different angle;
- 12 – beveled angle size;
- 5 13 – printing layer;
- 14 – synthetic plastic adhesive layer;
- 15 – chip;
- 16 – antenna.

The sheet material with the radio frequency identification, according to the first variant, is made in the form of rectangular sheet 1 with a length of 450-485 mm — the large side of sheet 4 — and a width of 300-330 mm — the smaller side of sheet 3, while one of the angles of the sheet is made using geometrically different angle 11 from the three others.

The sheet material with radio the frequency identification, according to the second variant, is made in the form of the rectangular sheet 1 with a length of 700-750 mm — the large side of the sheet 4 — and a width of 500-530 mm — the smaller side of the sheet 3, while one of the angles of the sheet is made using geometrically different angle 11 from the three others.

Geometrically different angle 11 is a positional angle and it ensures the correct location of the sheet at various stages of the final product production by printing plants: typing, stamping, and die-cutting. The position angle, in contrast to the graphically plotted angle, is more convenient and universal, as it allows to check the correct location of the sheet in the middle of the stack. The position angle can be made with a bevel, for example, 3-50 mm in size or at an angle, for example, 10-80°, including 45°. The position angle can be made in the form of a fillet or a notch, for example, a semicircular, triangular or rectangular shape. The position angle can be made in any other way, which makes it possible to determine the correct position of the sheet in the bundle.

The device is a sandwich structure (Fig. 3), in which the first layer for printing 13, the layer of synthetic plastic adhesive 14, the chip 15 (not shown in Fig. 1), the layer with the antenna 16 on the substrate, the second layer of the synthetic plastic adhesive composition 14, the second layer for printing 13. Printing layer 13 can be made of offset, craft or recycled paper, cardboard, synthetic paper, represents the PET (Polyethylene terephthalate), PVC (Polyvinyl chloride), PP (Polypropylene), PE (Polyethylene), natural or synthetic fabric, the artificial leather on the basis of PVC (Polyvinyl chloride) or PU (Polyurethane), or the layer of another suitable material. The sheet material can be either white or painted in any color; have markings, patterns or inscriptions; have a textured surface or additional coating, including a primer, which provides better retention of paint on the surface.

The substrate where antenna 16 and chip 15 are located can be made, for example, of PET, special paper, or another suitable flexible material. Antenna 16 can be made by means of etching or aluminum sputtering, alloys based on copper, silver, tin, gold, graphite, or other conductive materials suitable for chip 15's operation.

5 MIFARE Ultralight C, MIFARE Ultralight EV1, MIFARE Ultralight Nano, NTAG 215, NTAG DNA, ICODE SLIX 2, UCODE 8, UCODE DNA, and others can be used as chip 15.

As such, antenna 16 and chip 15 are placed inside sheet 1.

Antenna 16, in this particular case, is made in a rectangular form and has a length of 10-100 mm and a width of 10-70 mm. What's more, in this example, distance 5 from the smaller
10 side of the sheet to the edge of the antenna 16 is 10-30 mm, while distance 6 from the larger side of the sheet to the edge of the antenna 16 is 30-40 mm.

Antenna 16 can be made as a round shape and has a radius of 15-60 mm, as well as a square shape with a side length of 15-60 mm or any other suitable shape.

Depending on the purpose, more than one antenna 16 with a chip 15 can be located in the
15 sheet. Twenty-four RFID tags, which respectively comprise twenty-four antennas 16 on the substrate, are shown in Fig. 1. In this case, distance 7 between the centers of adjacent horizontally located antennas 16 is 80-100 mm, and distance 8 between the centers of adjacent vertically arranged antennas is 50-60 mm. In general, there can be from 1 to 150 RFID tags, for example, 1, 2, 4, 8, 16, 24, 25, 36, 48, 50, 72, while the positioning and geometry of the antennas
20 and chips are determined by the future shape of the final product.

LEDs, sensors, transducers, thin-film batteries, and other electronic components can also be placed inside sheet 1.

Positional elements can be located inside the sheet, whereby the induction sensors find the location of the RFID tags for positioning the sheet during printing, cutting, or other necessary
25 operations in punching and other printing machines. The resulting sheet thickness varies from 0.15 mm to 1.0 mm.

The machine-readable unique sheet number can be applied on each sheet, for example, the barcode, QR code, and other graphic elements. The tags located on the RFID sheet are linked by this number. When forming a print file, the unique numbers of RFID tags located inside the
30 sheet material are known to the printing house in advance, which makes it possible to print this information in one pass, thereby avoiding additional manipulations for reading data from RFID tags and their subsequent additional application of graphics to RFID products.

After printing, the sheet material with radio frequency identification can be further processed, for example, partial foil stamping, varnishing, application of laminating films based
35 on BOPP (biaxially oriented polypropylene film), PVC, PET.

The sheet material with radio frequency identification can have a front and back side made of one or different grades and colors of paper, or contain the paper on one side and synthetic material on the other side, fabric, or have a siliconized layer on one side and other combinations, including those containing the metallized layers, magnetic layers, and other materials.

The sheet 1 is shown in Fig. 1 with a size of 325 mm by 480 mm with a geometrically different angle of 10 mm by 10 mm made at a 45° angle.

The sheet material is used as follows.

The sheet material is to be placed in the equipment for printing images. The bevel of one of the angles 11 is necessary for the sheet material positioning when printing. The sheet material is placed in the machine for subsequent high-precision cutting of products of various shapes or other processing (folding, embossing, embossing, etc.) after printing.

The claimed sheet material can be used to produce classic paper cards with an RFID tag: transport cards, key cards (Skipass, hotel, office), parking cards, labels, tags, postcards, packages, stickers, and other similar products containing the RFID tag inside.

CLAIMS

1. The sheet material with the radio frequency identification is *characterized by the fact that* it is made in the form of the rectangular sheet with a layer for printing, a length of 450-
5 485 mm and a width of 300-330 mm, and it contains an antenna and a chip, placed inside the sheet, while one of the angles of the sheet is made as geometrically different from the three others.
2. The sheet material with the radio frequency identification is *characterized by the fact that* it is made in the form of the rectangular sheet with a layer for printing, a length of 700-
10 750 mm and a width of 500-530 mm, and it contains an antenna and a chip, placed inside the sheet, while one of the angles of the sheet is made as geometrically different from the three others.
3. The material according to p. 1-2 *is characterized by the fact that* the geometrically different angle is made with a bevel.
- 15 4. The material according to p. 3 *is characterized by the fact that* the geometrically different angle is made with a bevel with dimensions of 3-50 mm.
5. The material according to p. 3 *is characterized by the fact that* the geometrically different angle is made with a bevel at an angle 10-80°.
6. The material according to p. 1-2 *is characterized by the fact that* the geometrically
20 different angle is rounded.
7. The material according to p. 1-2 *is characterized by the fact that* the differing angle is made with a recess.
8. The material according to p. 1-2 *is characterized by the fact that* it includes more than one antenna with a chip.
- 25 9. The material according to p. 1-2 *is characterized by the fact that* it includes additional electronic components.