

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)**

To:

see form PCT/ISA/220

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/B2018/050858

International filing date (day/month/year)
12.02.2018

Priority date (day/month/year)
10.02.2017

International Patent Classification (IPC) or both national classification and IPC
INV. H01Q17/00 H01Q15/00

Applicant
HPS - HIGH PERFORMANCE STRUCTURES, GESTAO E

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:



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Date of completion of this opinion

see form
PCT/ISA/210

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - the international application in the language in which it was filed.
 - a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. forming part of the international application as filed:
 - in the form of an Annex C/ST.25 text file.
 - on paper or in the form of an image file.
 - b. furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. furnished subsequent to the international filing date for the purposes of international search only:
 - in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
 - on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
4. In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-15</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>14, 15</u>
	No: Claims	<u>1-13</u>
Industrial applicability (IA)	Yes: Claims	<u>1-15</u>
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

1 Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 Reference is made to the following documents:

- D1 Chandrika Sudhendra ET AL: "An Ultra Wide Band Radar Absorber Based on Square Patch Resistive FSS", Proc. 7th annual Antenna Test and Measurement Society International Conference-ATMS 2014, 6 February 2014 (2014-02-06), pages 1-5, XP055399140, Chennai, India
Retrieved from the Internet:
URL:https://atmsindia.org/tech_papers/2014/20_FULL_PAPER_An_Ultra_Wide_Band_Radar_Absorber_Based_on_Square_Patch_Resistive_FSS.docx
[retrieved on 2017-08-16]
- D2 SUDHENDRA CHANDRIKA ET AL: "A novel ultra wide band Radar Absorber based on hexagonal resistive patch FSS", 2013 IEEE APPLIED ELECTROMAGNETICS CONFERENCE (AEMC), IEEE, 18 December 2013 (2013-12-18), pages 1-2, XP032737454,
DOI: 10.1109/AEMC.2013.7045118
- D3 SUDHENDRA CHANDRIKA ET AL: "A novel ultra wide band radar absorber with reduced thickness for circular polarization", 2014 INTERNATIONAL CONFERENCE ON ADVANCES IN ELECTRONICS COMPUTERS AND COMMUNICATIONS, IEEE, 10 October 2014 (2014-10-10), pages 1-4, XP032718000,
DOI: 10.1109/ICAEECC.2014.7002410
- D4 HUI ZHAO ET AL: "Study on the transmission characteristics of a double layered complementary frequency selective surface", 2016 11TH INTERNATIONAL SYMPOSIUM ON ANTENNAS, PROPAGATION AND EM THEORY (ISAPE), IEEE, 18 October 2016 (2016-10-18), pages 731-734, XP033053319,
DOI: 10.1109/ISAPE.2016.7834062

- D5 US 4 038 660 A (CONNOLLY THOMAS M ET AL) 26 July 1977
(1977-07-26)
- D6 US 4 860 023 A (HALM RUDOLF [NL]) 22 August 1989
(1989-08-22)
- D7 Arup Ray ET AL: "A Dual Tuned Complementary Structure
Frequency Selective Surface for WLAN Applications",
Journal of Microwaves, 20 June 2012 (2012-06-20), pages
144-153, XP055266427,
DOI: 10.1590/S2179-10742012000100012
Retrieved from the Internet:
URL:<http://www.scielo.br/pdf/jmoea/v11n1/a12v11n1.pdf>
[retrieved on 2016-04-18]

1.2 Reply to the PCT direct letter

- 1.3 The applicant has requested to have the present application processed under PCT Direct (PCT Guidelines B-IV, 1.2.1). Account taken of the applicant's comments submitted with the PCT Direct letter of 13-03-2018, this Authority considers that the claims do not meet the requirements of the PCT due to
- lack of clarity (Article 6 PCT) and
 - lack of inventive step (Article 33(3) PCT).

- 1.4 The applicant argues that none of the documents D1-D4 discloses a frequency selective structure (FSS) that has a thermal insulation function, which renders the subject-matter of claim 1 novel over any one of D1-D4 (Article 33(2) PCT).
The examiner agrees to this finding and therefore considers D1-D4 only for the assessment of inventive step.

- 1.5 In order to assess the application for inventive step, D5 (Fig. 1) disclosing a Jaumann absorber with a protective layer is considered to be the closest prior art. In order to protect the Jaumann absorber from thermal radiation a skilled

person would use an infrared thermal shield made of a frequency selective structure of periodic square patches as disclosed by D6 (Fig. 3 and column 2, lines 31-47), thereby arriving at a thermal MLI and RF absorber blanket as defined in claim 1, which renders the subject-matter of claim 1 not inventive (Article 33(3) PCT) as elaborated in detail below.

- 1.6 As a basis for the amendment of claim 1 "*Thermal multi-layer insulation and radio-frequency absorber blanket having a top layer for blocking infrared and visible radiation*" the applicant refers to paragraph 2 of the description. However, said amendment is not supported by paragraph 2 and therefore leads to a loss of the priority date claimed from PT109906 (Article 8(2)(a) PCT).

Paragraph 2 literally states "*MLI blankets are essential to the current space technology, and have been in use since the first days of space exploration. A prior art MLI is composed of metalized polymer layers, the purpose of which is to block radiation concentrated in the infrared (IR) and visible spectral ranges,*" thereby referring to prior art MLI blankets having multiple layers, which all together block the IR and visible radiation. Interpreting this disclosure such that the MLI blanket subject to the present application has a top layer, which alone blocks the IR and visible radiation goes beyond the disclosure of paragraph 2.

It seems more appropriate to take paragraph 66 of the description as a basis for such an amendment. However, paragraph 66 ("*... the outermost metallic layer (the metallic FSS) acts as an IR shield*") refers to the outermost layer, which in the context of the entire disclosure could be interpreted as the upper layer, wherein said outermost layer is an IR shield and is quiet about the blockage of the visible radiation.

In order to avoid a loss of the priority, claim 1 should be carefully amended, such that there is a basis provided by the description of the parent application.

1.7 Inventive Step (Article 33(1) and 33(3) PCT)

1.8 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-13 does not involve an inventive step in the sense of Article 33(3) PCT.

1.9 Independent claim 1

1.9.1 D5 is regarded as being the prior art closest to the subject-matter of claim 1, and discloses a radio-frequency absorber blanket having a top layer for blocking visible radiation (Fig. 1, el. 2-10), comprising:

- I. one or more intermediate resistive layers for RF absorption (Fig. 1, el. 8);
- II. a lower RF ground layer (Fig. 1, el. 2).

1.9.2 The subject-matter of claim 1 therefore differs from this known RF absorber blanket in that

- A. the RF absorber blanket comprises a thermal multi-layer insulation blanket for blocking infrared radiation, and
- B. an upper layer comprising a patterned frequency-selective structure (FSS) coating whose capacitance is tuned in function of the RF frequency band to be absorbed;

1.9.3 The problem to be solved by the present invention may therefore be regarded as how to protect the RF absorber blanket from thermal radiation.

1.9.4 Document D5 (Fig. 1, el. 10 and column 6, lines 31-38) discloses a protective radome, which at least blocks visible radiation from the RF absorber blanket. D6 (Fig. 3 and column 2, lines 31-47) teaches that a FSS layer of square metallic patches can be used as a thermal shield to block IR radiation from a covered structure of a satellite. A skilled person would use the teachings of D6 in the protective layer of absorber blanked of D5 in a normal design step in order to protect the absorber structure from thermal radiation, thereby arriving at a thermal MLI and RF absorber blanket as defined in claim 1.

1.9.5 A similar argumentation applies when departing from any one of D1 (Fig. 1 and section II.), D2 (Figs. 1, 2, Tab. 1, and sections II. and III.), and D3 (Fig. 1 and sections I. and II.) disclosing Jaumann-type multi-layer RF absorbers, wherein the respective lossy layers are structured by periodic frequency selective patterns. It is obvious for a skilled that the sensitive outer resistive patch layer must be protected from environmental hazards in a practical application, which is typically done using a protective radome layer, which a skilled person would improve by the IR blocking metallic FSS structure as disclosed by D6 in order to protect any of the RF absorber blankets of D1-D3 from thermal radiation.

1.9.6 As a consequence, the subject-matter of claim 1 is not inventive with respect to any one of D1-D3, D5 in combination with D6 (Article 33(3) PCT).

1.10 Dependent claims

1.10.1 Documents D5 and/or D6 disclose

- I. (claims 2 and 3) use a polymeric film such as polyimide or Kapton with a patterned metallic coating (D6, Fig. 3 and column 2, lines 31-47),
- II. (claim 7) a patterned frequency selective structure obtained by etching (D6, column 3, lines 55-59),
- III. (claim 8) a patterned frequency selective structure obtained by laser cutting (D6, column 6, lines 14-20),
- IV. (claim 9) a grid of unconnected square patches (D6, Fig. 3),
- V. claim (10) one to five resistive intermediate layers (D6, Fig. 1, el. 8),
- VI. claim (12) an adhesive layer to bond the multi-layer structure (D5, column 5, lines 45-53) ,

thereby anticipating the features of claims 2, 3, 7-10, and 12.

Consequently, the subject-matter of claims 2, 3, 7-10, and 12 is not inventive with respect to D5 and D6 (Article 33(3) PCT).

1.10.2 Using vacuum deposited aluminum (VDA) to form the metallic coating of the upper layer as defined in claim 4 or to form the ground layer as subject to claim 13 is a well-known solution exemplarily disclosed by D6 (column 2, lines

48-58) as one among four alternative methods to fabricate a thin metal coating on a polymer carrier and does therefore not involve an inventive skill. Thus, the subject-matter of claims 4 and 13 lacks an inventive step with respect to D5 and D6 (Article 33(3) PCT).

1.10.3 D1-D3 and D5 are quiet about the specific realization of the patterned resistive sheets. However, it would be obvious for a skilled person to

- I. (claims 5 and 11) use a polyimide film loaded with carbon, and
- II. (claim 6) use a polyimide film patterned with black Kapton

to form the patterned FSS structure of the upper layer or any of the intermediate layers. Said features are well-known solutions in the technical field for forming layered patterned planar structures and do not provide any surprising or synergetic effect.

Therefore, the subject-matter of claims 5, 6, and 11 is not inventive with respect to any one of D1-D3 and D5 in combination with D6 (Article 33(3) PCT).

1.10.4 Although D4 (Figs. 4, 5) and D7 (Fig. 1-3 and Figs. 6-8) disclose dual-layer complementary FSS structures, which are intransparent for IR and visible radiation, there is no hint in either of said documents that such a complementary FSS structure could be used as a thermal multi-layer insulation blanket.

D6 disclosing a FSS of square metallic patches used to block IR radiation is also quiet about using a complementary FSS.

Hence, the subject-matter of claims 14 and 15 appears inventive in light of the cited prior art (Article 33(3) PCT).

Re Item VII

2 Certain defects in the international application

2.1 The features of claims 1-15 are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

- 2.2 Expressions in parenthesis are reserved for reference signs, which do not limit the scope of protection and might be removed by a national office. Acronyms and abbreviations, such as e.g. "*MLI*", "*RF*", or "*TM*" to indicate trademarks should be provided between commas such as e.g. "*multi-layer insulation, MLI, and radio-frequency, RF,...*" (Rule 6.2(b) PCT).
- 2.3 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1-D7 is not mentioned in the description, nor are these documents identified therein.

Re Item VIII

3 Certain observations on the international application

- 3.1 The application does not meet the requirements of Article 6 PCT, because claims 1 and 2 are not clear.
- 3.2 The functional features "*.. blanket having a top layer for blocking infrared and visible radiation*" and "*layer(s) for RF absorption*" in apparatus claim 1 should be clearly indicated as such e.g. by using a formulation like "*... is/are configured for...*" in order to meet the requirements of Article 6 PCT.
- 3.3 The difference between the terms "*top layer*" and "*upper layer*" used in claims 1 and 2 is unclear, thereby rendering the definition of the subject-matter of said claim unclear (Article 6 PCT).
In particular it is unclear whether said terms refer to the same layer or define different layers. According to the teachings of the description they have been interpreted to refer to the same layer. If this actually is the case, said layer should be unambiguously defined as e.g. "*upper layer*" throughout all claims.