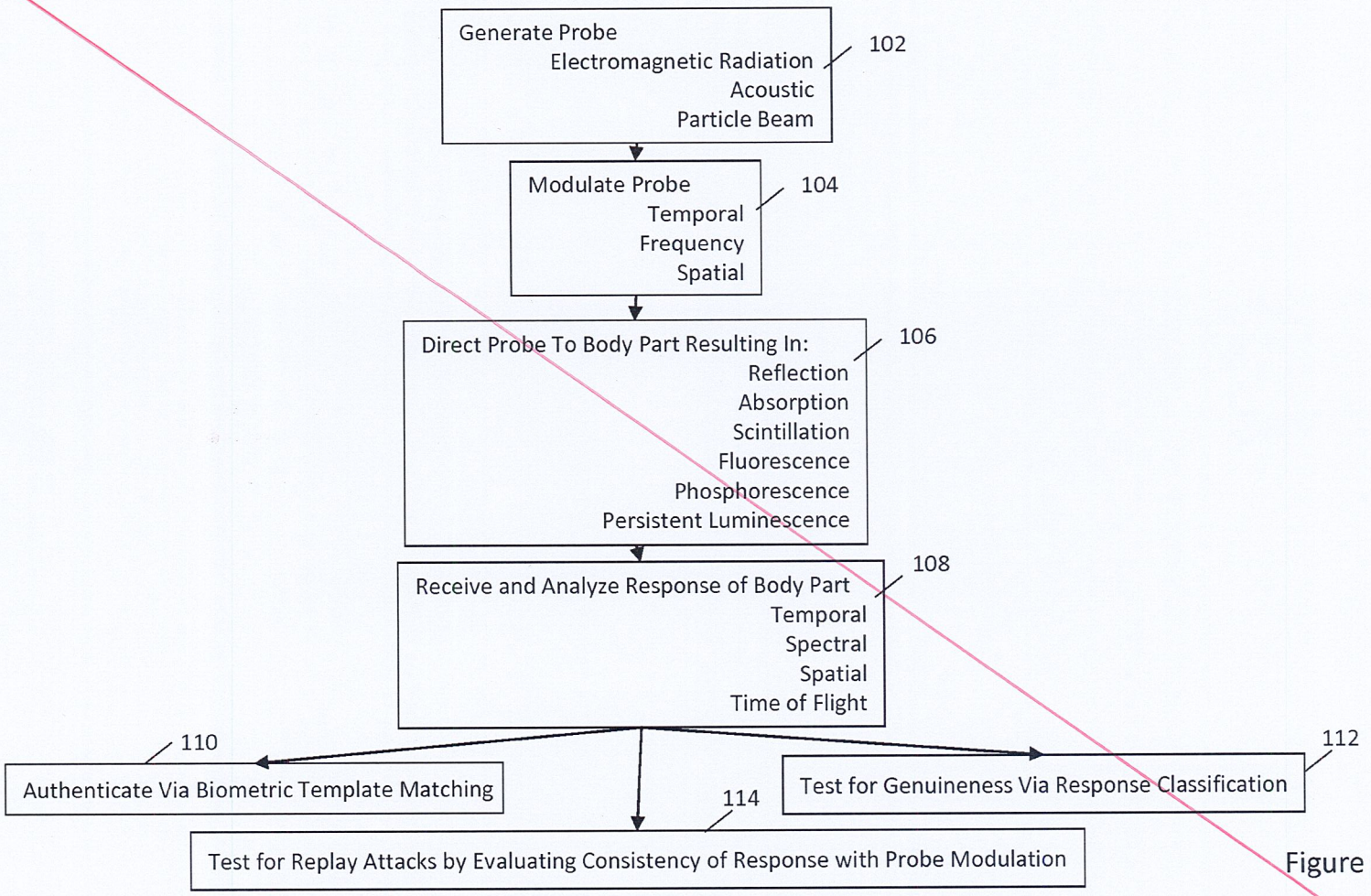

Generate Probe
Electromagnetic Radiation
Acoustic
Particle Beam
102
Modulate Probe
Temporal
Frequency
Spatial
104
Direct Probe To Body Part Resulting In:
Reflection
Absorption
Scintillation
Fluorescence
Phosphorescence
Persistent Luminescence
106
Receive and Analyze Response of Body Part
Temporal
Spectral
Spatial
Time of Flight
108
110
Authenticate Via Biometric Template Matching
112
Test for Genuineness Via Response Classification
114
Test for Replay Attacks by Evaluating Consistency of Response with Probe Modulation

Figure 1

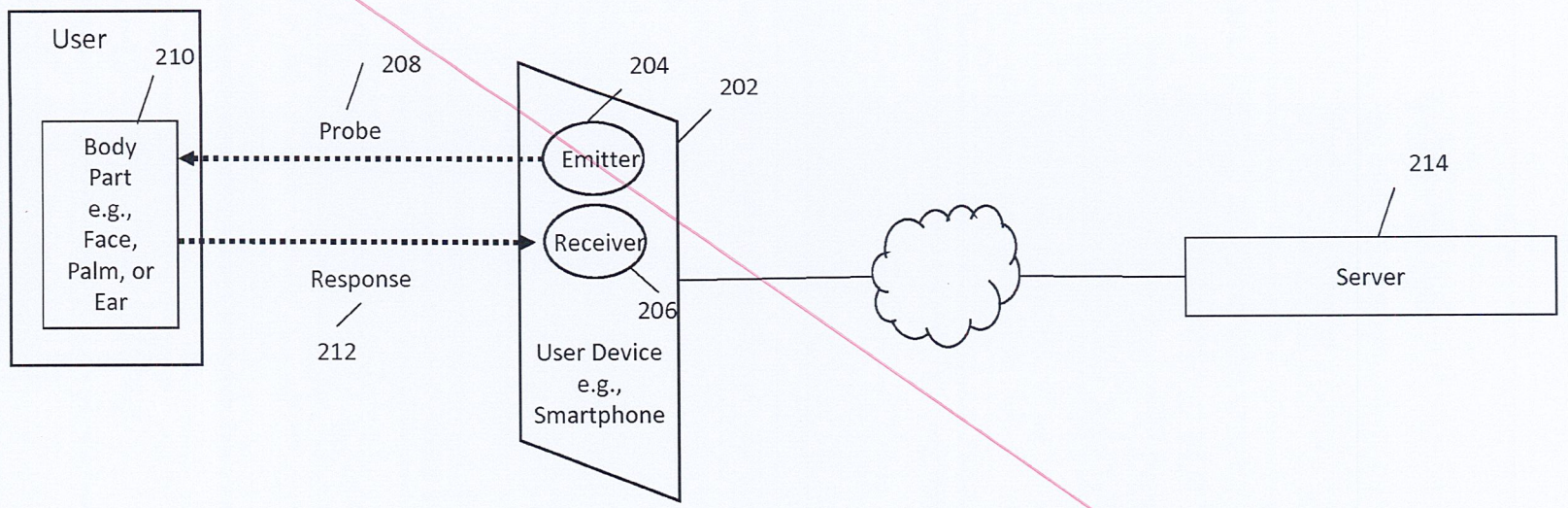

User
210
Body Part e.g., Face, Palm, or Ear
208
Probe
Response
212
204
202
Emitter
Receiver
206
User Device e.g., Smartphone
214
Server

Figure 2

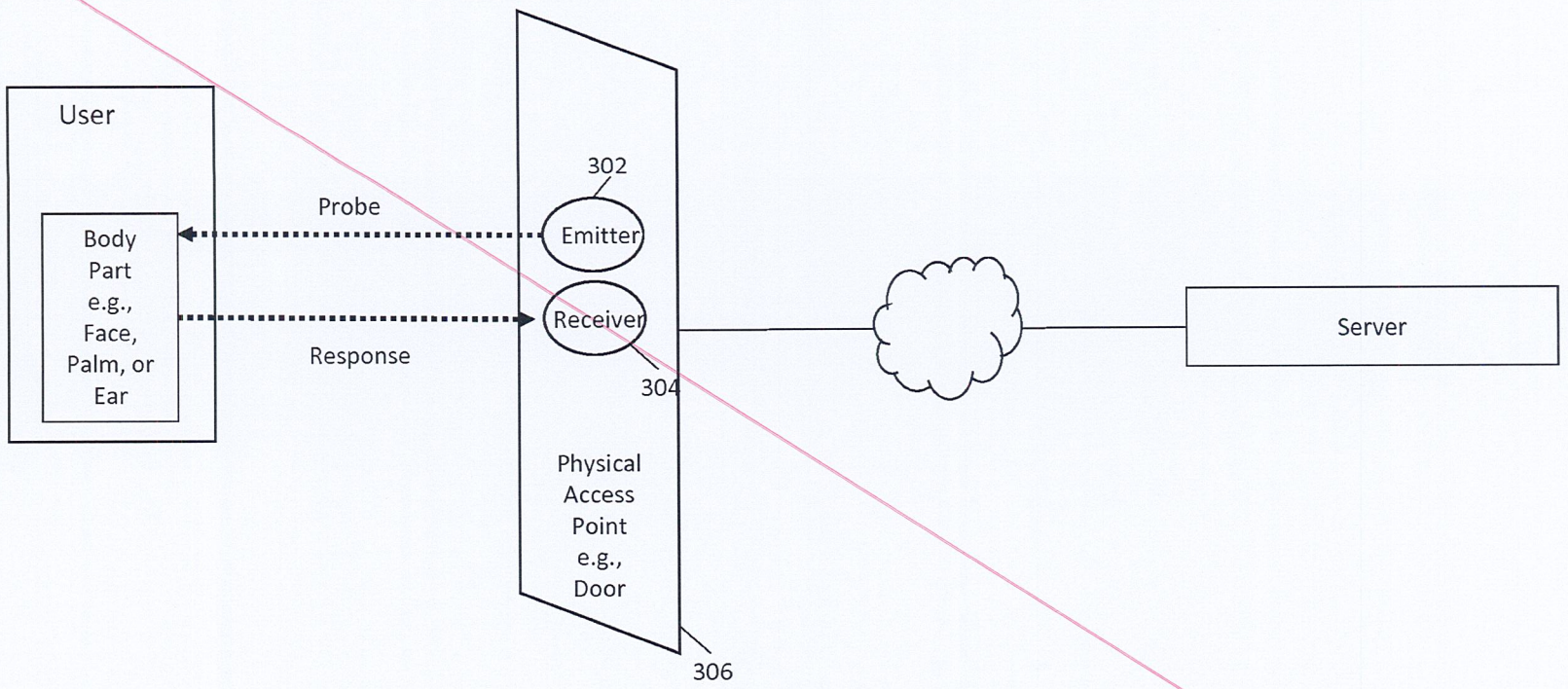

User
Body Part e.g., Face, Palm, or Ear
Probe
Response
302
Emitter
Receiver
304
Physical Access Point e.g., Door
306
Server

Figure 3

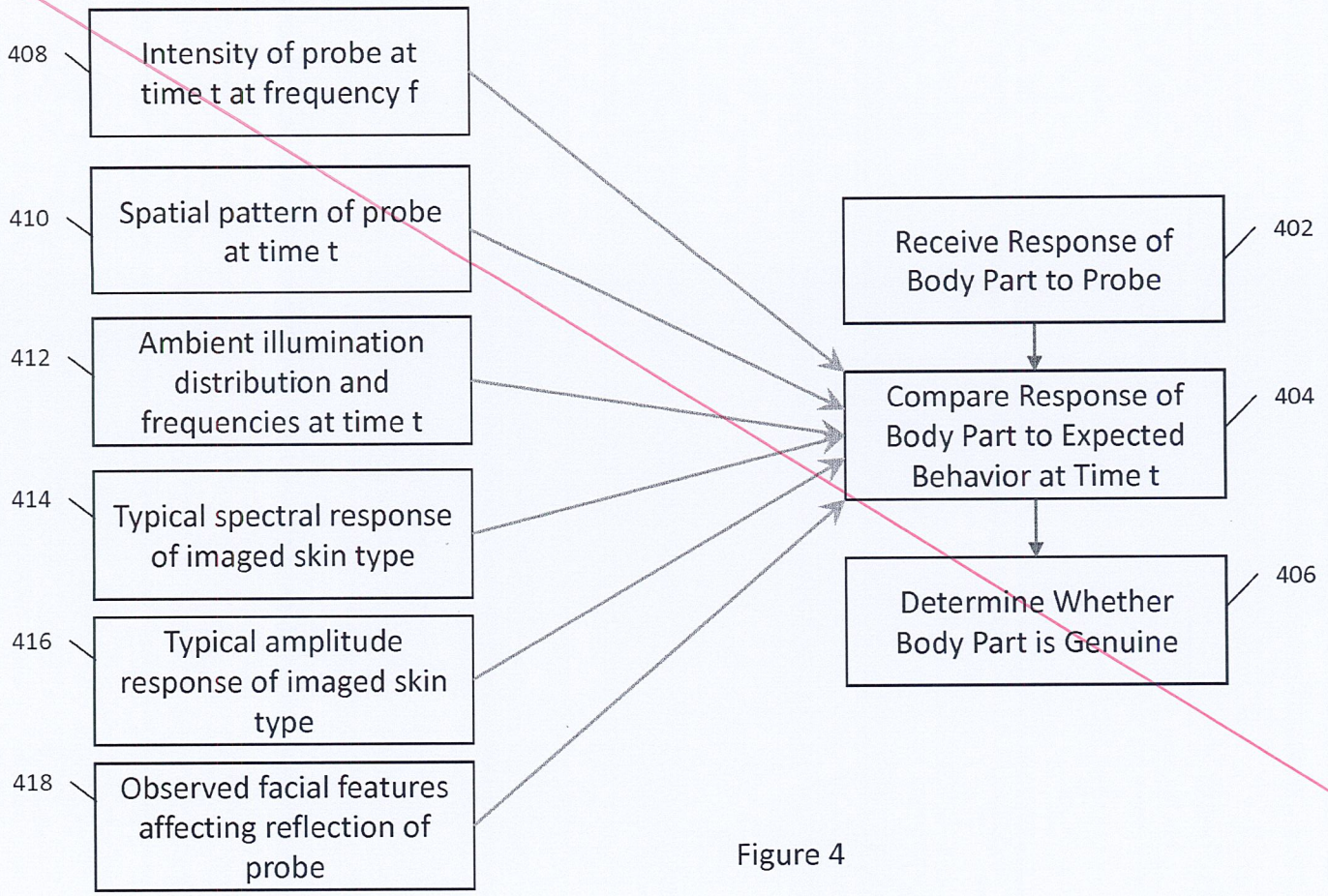

408
Intensity of probe at time t at frequency f
410
Spatial pattern of probe at time t
412
Ambient illumination distribution and frequencies at time t
414
Typical spectral response of imaged skin type
416
Typical amplitude response of imaged skin type
418
Observed facial features affecting reflection of probe
Receive Response of Body Part to Probe
402
Compare Response of Body Part to Expected Behavior at Time t
404
Determine Whether Body Part is Genuine
406

Figure 4

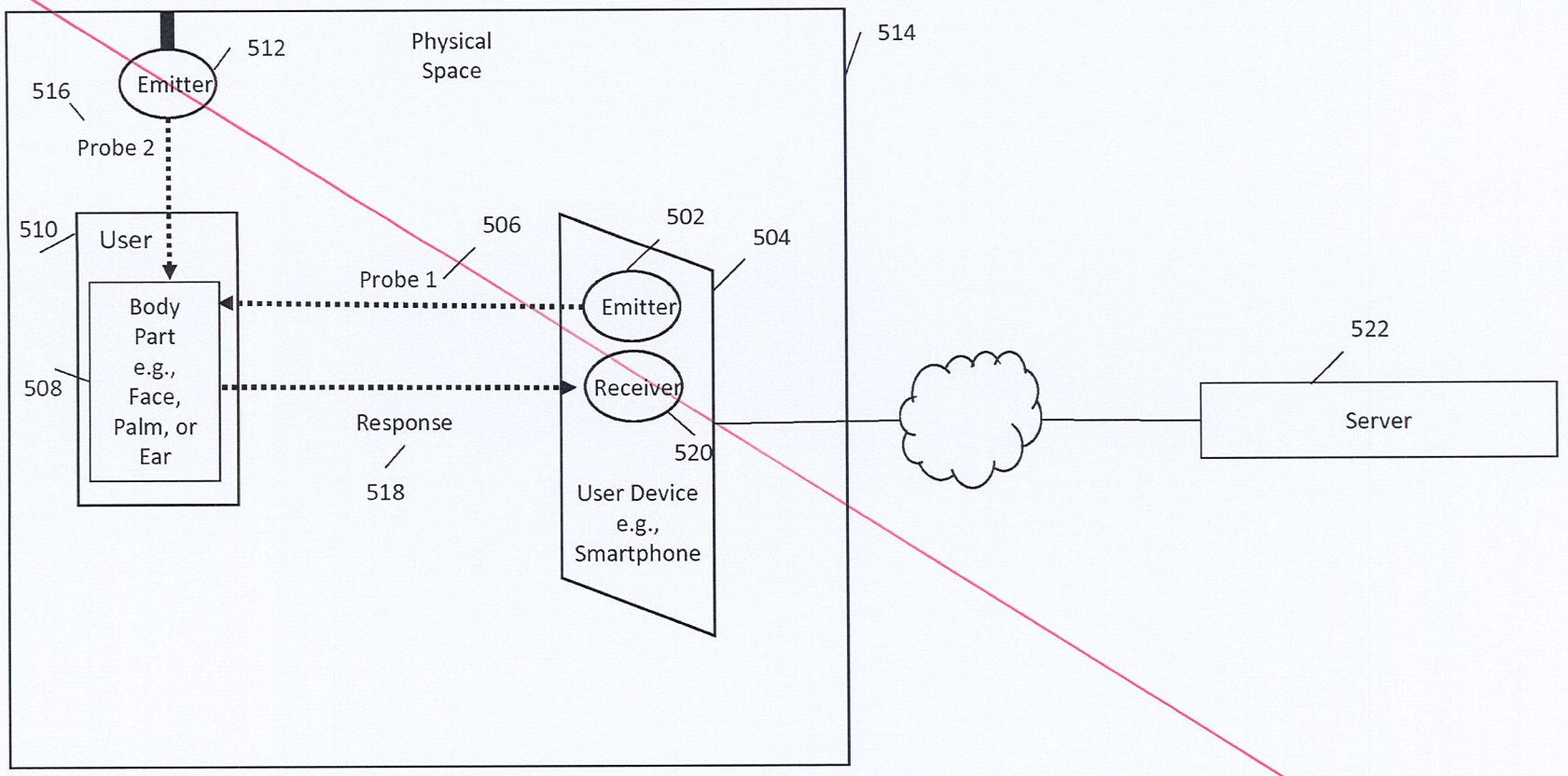

Physical
Space
514
512
Emitter
516
Probe 2
510
User
506
Probe 1
502
504
Emitter
Body
Part
e.g.,
Face,
Palm, or
Ear
508
Receiver
520
Response
518
User Device
e.g.,
Smartphone
522
Server

Figure 5

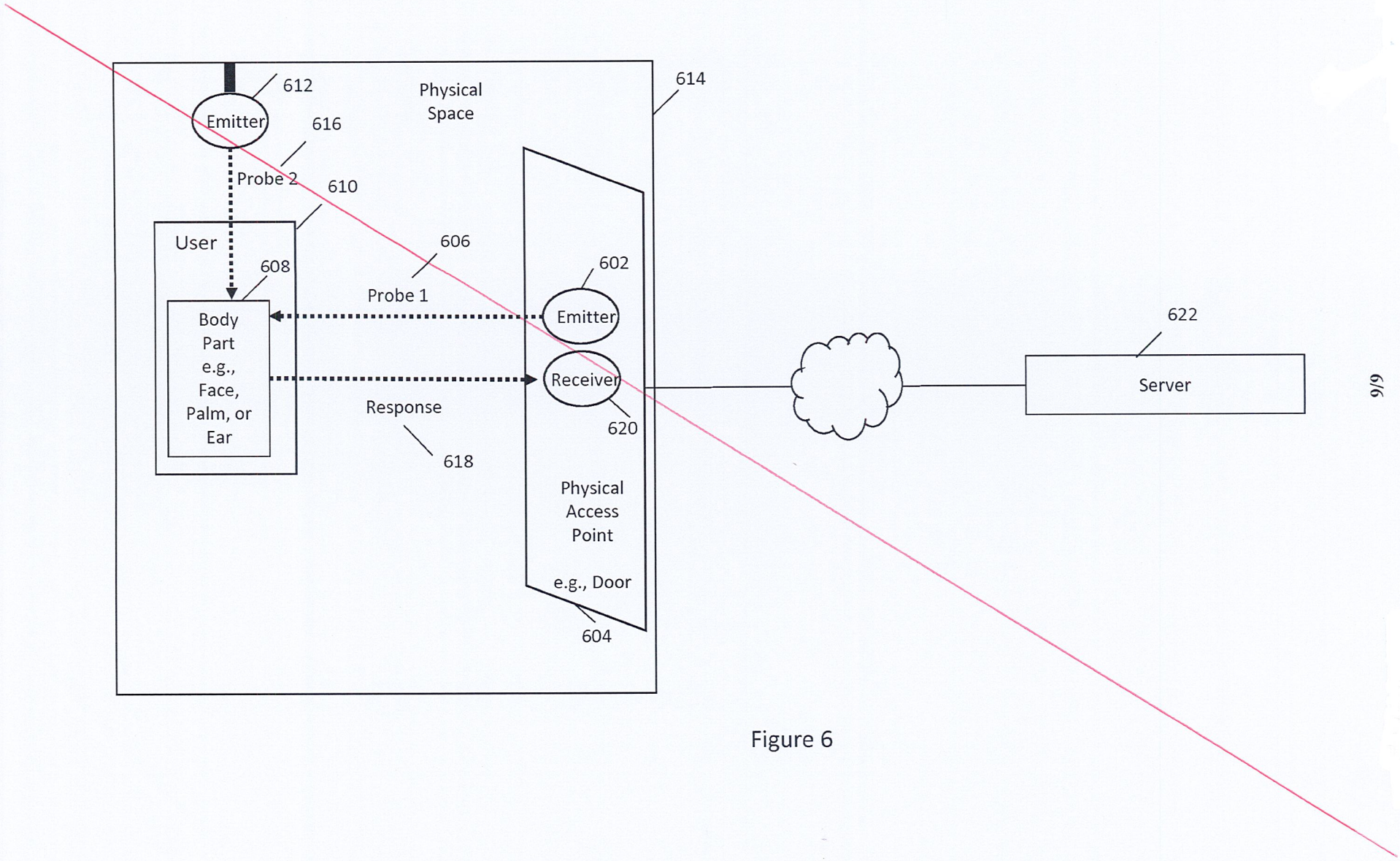

612
Emitter
616
Probe 2
610
User
608
Body Part e.g., Face, Palm, or Ear
Physical Space
614
606
Probe 1
602
Emitter
Receiver
620
Response
618
Physical Access Point
e.g., Door
604
622
Server

Figure 6

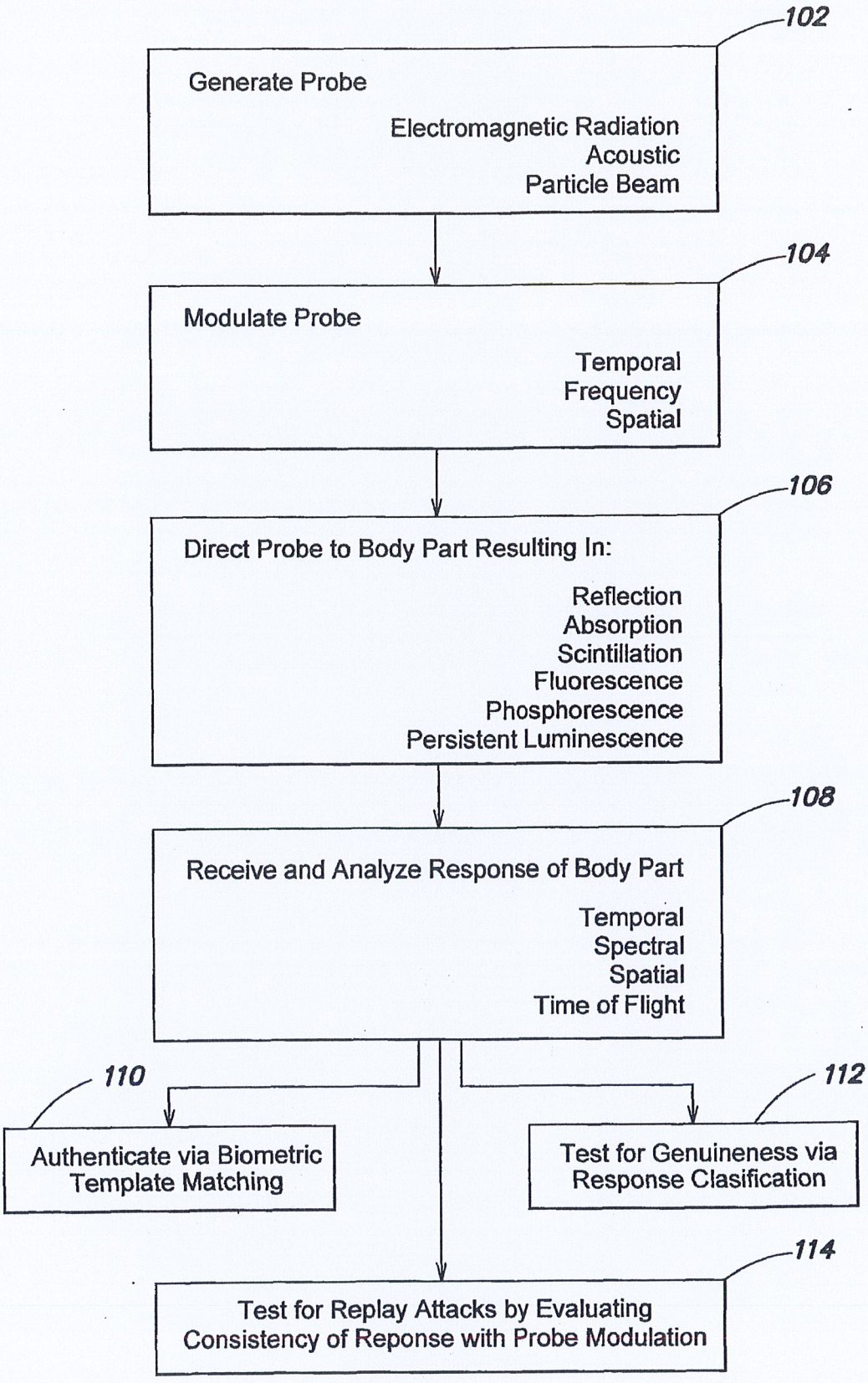

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Generate Probe
Electromagnetic Radiation
Acoustic
Particle Beam
104
Modulate Probe
Temporal
Frequency
Spatial
106
Direct Probe to Body Part Resulting In:
Reflection
Absorption
Scintillation
Fluorescence
Phosphorescence
Persistent Luminescence
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Spatial
Time of Flight
110
Authenticate via Biometric Template Matching
112
Test for Genuineness via Response Clasification
114
Test for Replay Attacks by Evaluating Consistency of Reponse with Probe Modulation

FIG. 1

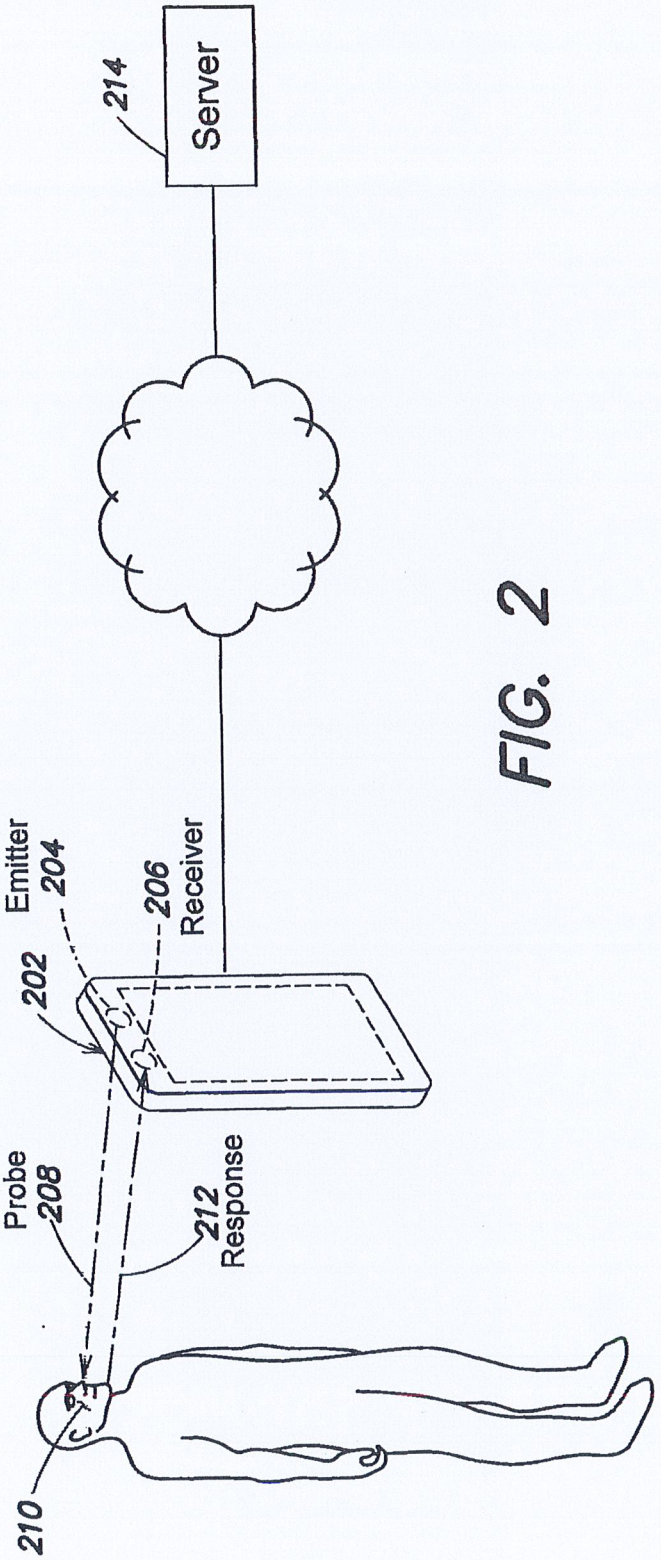

214
Server
Emitter
204
206
Receiver
202
Probe
208
212
Response
210

FIG. 2

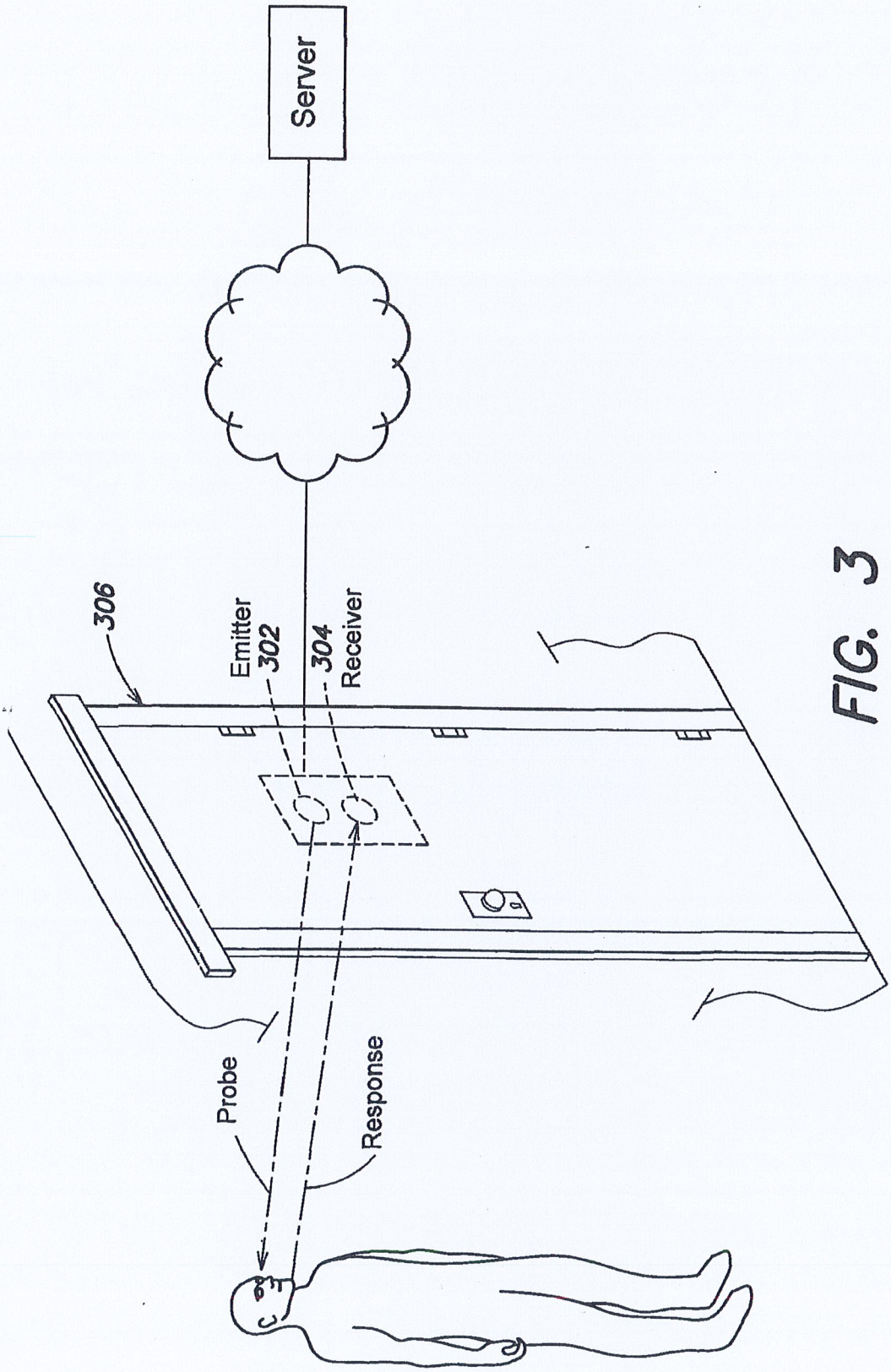


FIG. 3

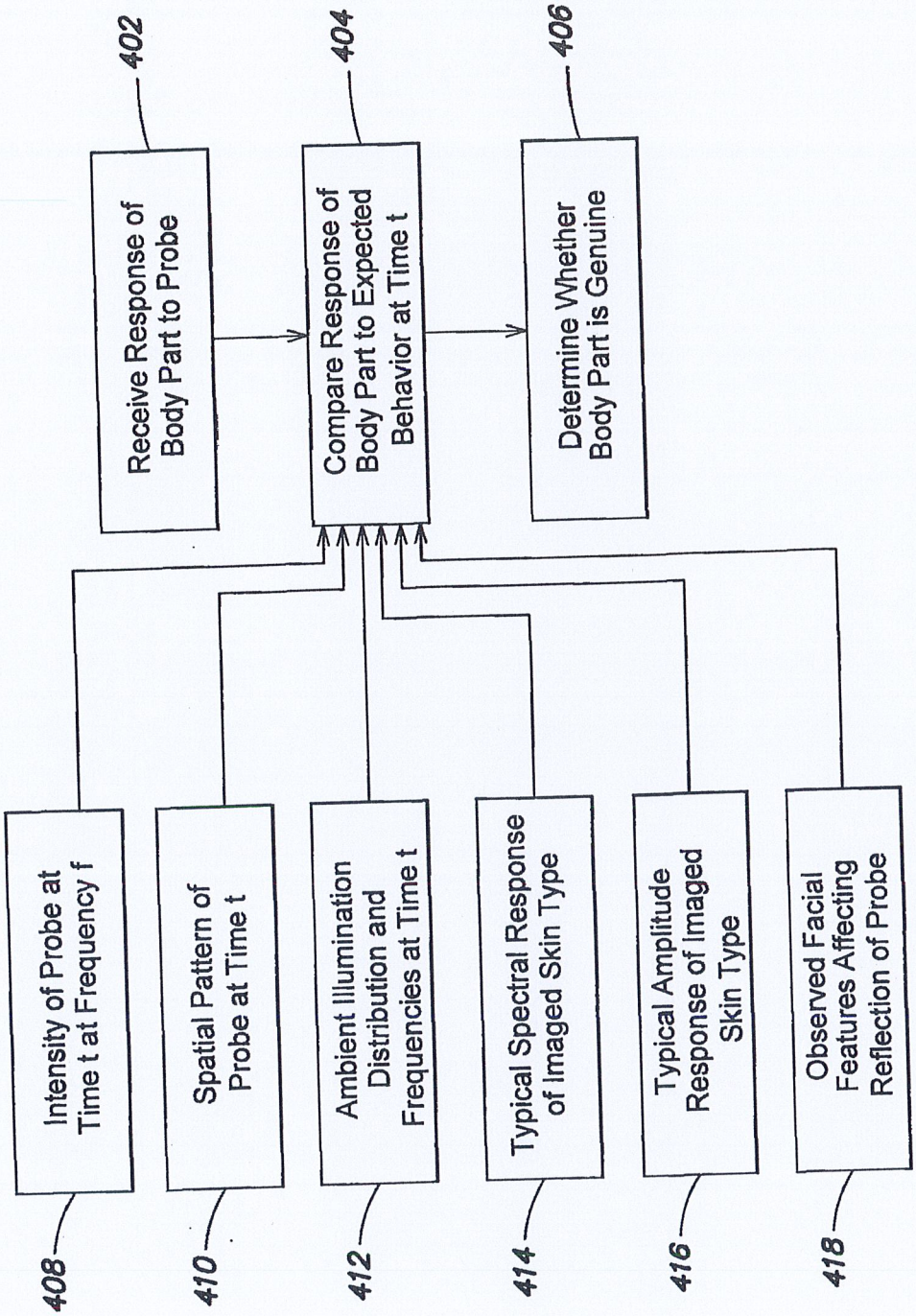

402
Receive Response of Body Part to Probe
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406
Determine Whether Body Part is Genuine
408
Intensity of Probe at Time t at Frequency f
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Spatial Pattern of Probe at Time t
412
Ambient Illumination Distribution and Frequencies at Time t
414
Typical Spectral Response of Imaged Skin Type
416
Typical Amplitude Response of Imaged Skin Type
418
Observed Facial Features Affecting Reflection of Probe

FIG. 4

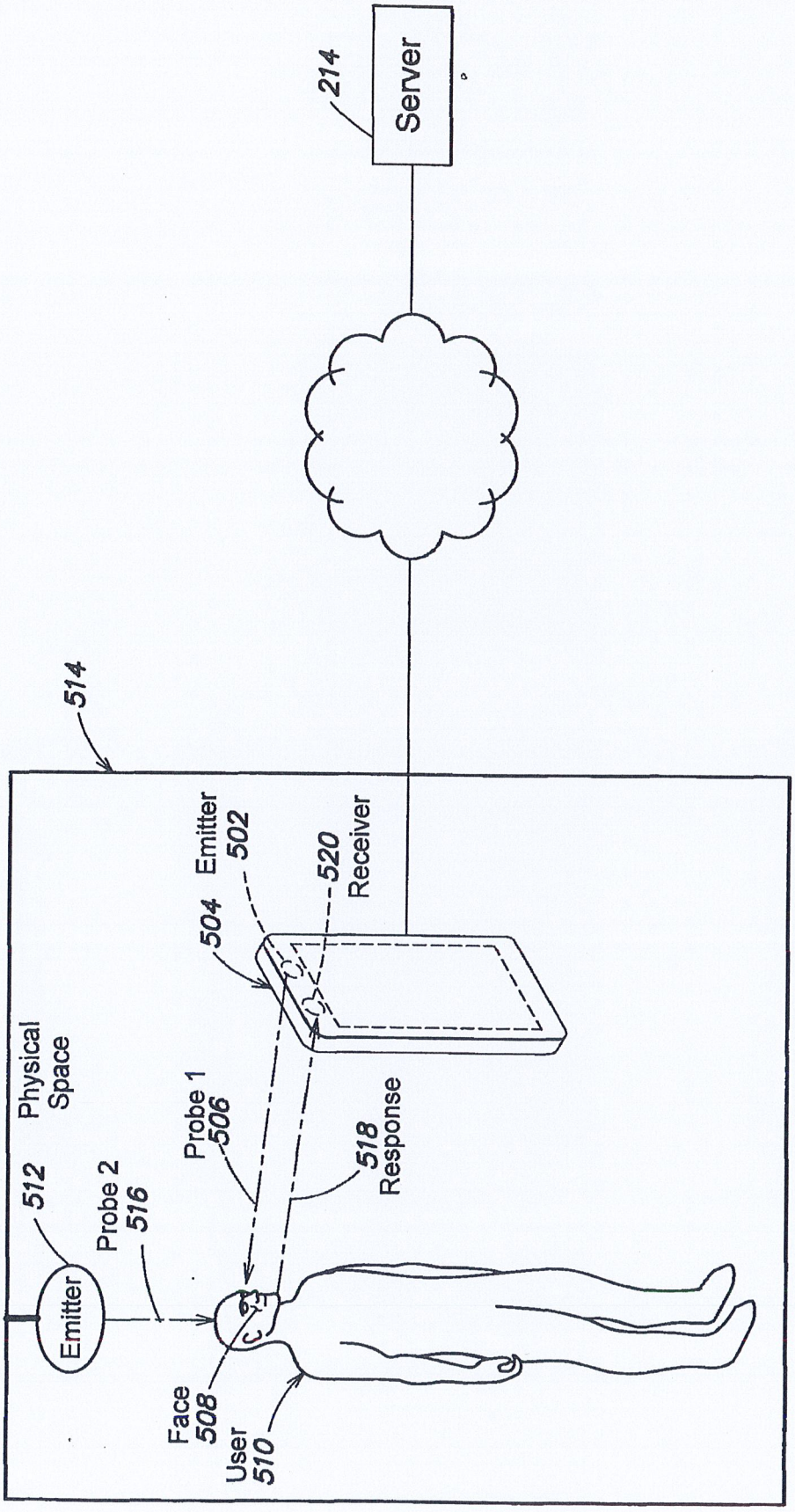

214
Server
514
Physical Space
Emitter 502
504
520 Receiver
Probe 1 506
518 Response
512
Probe 2 516
Emitter
Face 508
User 510

FIG. 5

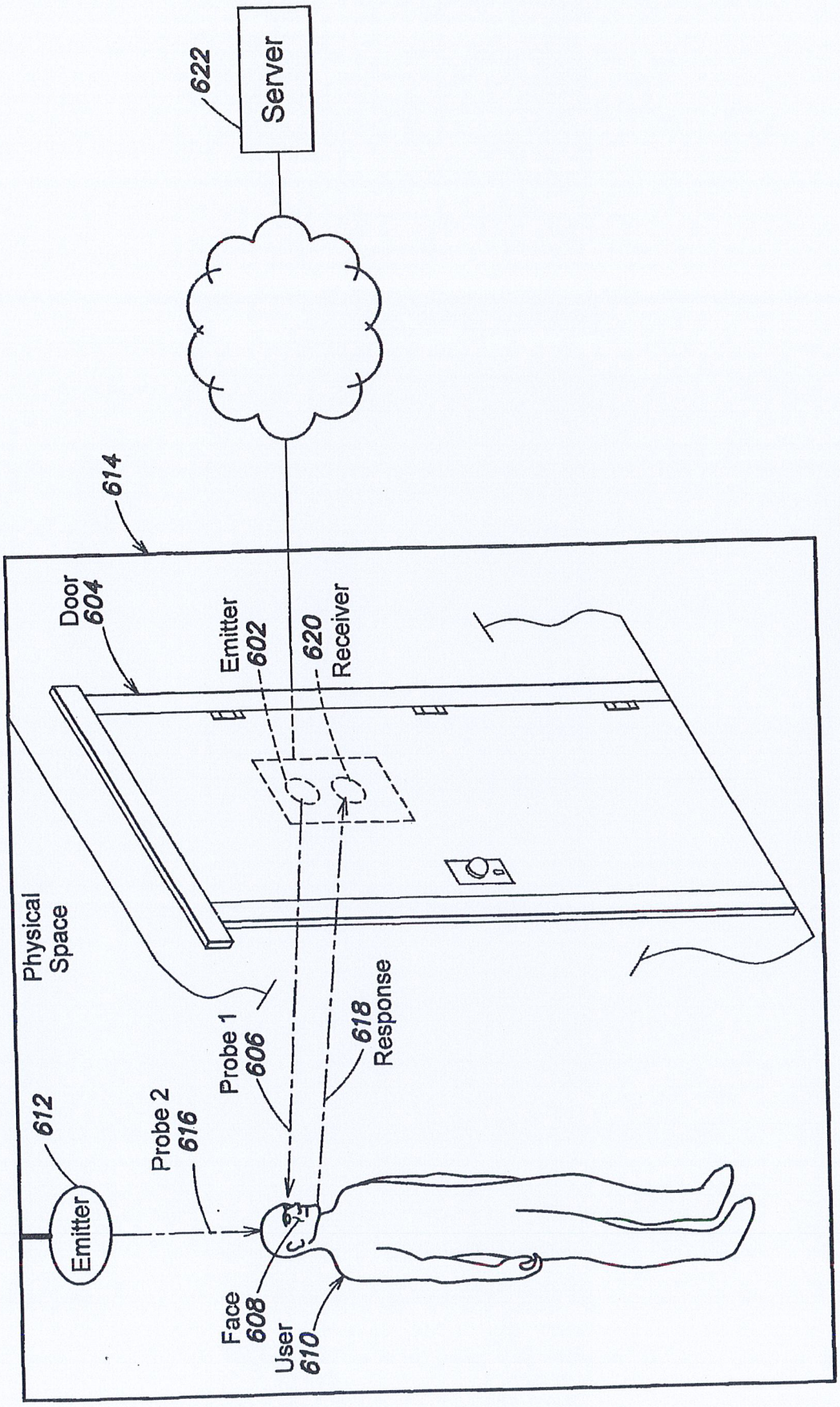

622
Server
614
Door
604
Emitter
602
620
Receiver
Physical
Space
612
Emitter
Probe 2
616
Probe 1
606
618
Response
Face
608
User
610

FIG. 6