In connection with this technical problem it is also required that the process should be simple to implement and allow a reduction in the complexity and corresponding production costs of the said devices to be calibrated.

These results are achieved according to the present invention by the provision of a process ~~according to the characteristic features of Claim 1.~~for automatically calibrating, according to pre-defined specification values of a plurality of calibration parameters (Gm-min-spec; Gm-max-spec; Ti; Vi; Bi), a wideband microwave module comprising at least one basic alignment circuit each comprising at least one filter, followed by at least one variable amplifier, by a variable attenuator and by a variable equalizer, the voltage input/s of which can be controlled, being supplied with frequency signals lying within different bands (Bi) and operating at different temperatures (Ti), and for which at least the following calibration parameters have been defined according to specification values:

- temperatures T1,T2, ... Ti at which test cycles of the automatic calibration cycle must be performed;
- nominal start-of-procedure input voltages (V1i,V2i,V3i,V4i,V5i, V6i,V7i);
- Gm-max-spec = Maximum gain of the alignment circuit/s, according to specification, for each band;
- Gm-min-spec = Minimum gain of the alignment circuit/s, according to specification, for each band;

there being provided an intermediate frequency conversion block, which performs conversion to the intermediate frequency of the signal incoming from the alignment circuit/s and which has an output;

characterized in that it comprises the following steps:

20) initial configuration of a PLC controller with storage of the said start-of-procedure input voltages (V1i,V2i,V3i,V4i, V5i,V6i,V7i) in a static memory of the PLC controller itself;

30) automatic application of the said start-of-procedure input voltages (V1i,V2i,V3i,V4i,V5i,V6i,V7i) to the respective input points of the respective amplifier/s, attenuator/s, and equalizer/s of the basic alignment circuit/s ;

31) introduction, into the PLC memory, of pre-defined values of calibration parameters of the calibration cycle which are specific for

each microwave module to be calibrated and comprise at least:

- the number N_B of bands (B_i) of the microwave module to be calibrated; there being provided three frequency sub-bands, plus one direct band;
- the temperature values Ti at which the test cycles of the calibration cycle are to be performed;

40) CALIBRATION CYCLE upon variation of the temperature:

41) for each pre-defined temperature Ti = T1,T2,T3

42) setting the temperature of the microwave module to the test temperature T=Ti;

50) Calibration of the variable equalizers of the at least one basic alignment circuit for each band for which the microwave module must operate;

51) application of a test signal to the input of an input block connected to an antenna for each frequency band (Bi) of the signals input into the module;

51a) measurement of the slope of the gain of the alignment circuit or of the slope of the amplitude of the signal in the band Bi at the output of the intermediate frequency conversion block,

52) COMPARISON between the slope measured and a characteristic slope of a design specification:

52a) slope measured > slope of the design specification?

YES-> reduction of the slope of the operating band (Bi) by suitably modifying the voltages (V6) and (V7) applied to respective adjustment points of the equalizer for the band (Bi); and repetition of the comparison cycle (51a, 52, 52a;52b) ;

NO->

52b) slope measured < slope of the design specification?

YES-> increase of the slope of the operating band (Bi) by suitably modifying the voltages (V6) and (V7) at the respective adjustment points of the equalizer for the band (Bi); and repetition of the comparison cycle (51a, 52, 52a;52b);

NO->

53) repetition of the cycle (51-52) for each band (Bi) of the input signals;

70) Calibration of the amplifier/s and the attenuator/s of the basic alignment circuit/s;

71) for each frequency of the bands (Bi);

72) measurement of the average gain ($Gm1, Gm2..., Gm_{NB}$) of the transfer function of the microwave module between the input of the input block and the output of the frequency conversion block;

73) calculation of the value $Gm\text{-}max = max(Gm1, Gm2, ...Gm_{NB})$;

74) calculation of the value $Gm\text{-}min = min(Gm1, Gm2, ...Gm_{NB})$;

75) comparison between Gm-max and the specification value Gm-max-spec;

75a) Gm-max > Gm-max-spec?

YES-> the amplification is decreased and the attenuation is increased in the basic alignment circuit for the band B_i corresponding to Gm-max by adjusting the input voltage (V1) of the associated amplifier/s and the input voltage/s (V4,V5) of the associated attenuator/s;
repetition of the cycle (72,73,74,75+75a);

NO->

76) Comparison between Gm-min and the specification value Gm-min-spec

76a) Gm-min < Gm-min-spec?

YES-> the amplification is incremented and the attenuation is decreased in the basic alignment circuit for the band (B_i) corresponding to Gm-min by adjusting the input voltage (V1) of the associated amplifier/s and the input voltage/s (V4,V5) of the associated attenuator/s;
repetition of the cycle (72,73,74,75,76,76a);

NO->

80) Storage of the values of the said adjusted input voltages (V1,V4,V5) corresponding to respective values of the temperature (Ti)

in the memory of the PLC;

90) Repetition of the entire cycle for each temperature (Ti).

140) Start of an automatic test procedure;

150) Generation of a test sheet of the microwave module.

Further details may be obtained from the following description of a non-limiting example of embodiment of the subject of the present invention provided with reference to the accompanying drawings in which:

Figure 1: shows the circuit diagram of an example of a microwave module to be calibrated;

Figure 2: shows the circuit diagram of an example of embodiment of a variable amplifier for an alignment circuit according to the present invention;

Figure 3: shows the circuit diagram of an example of embodiment of a variable attenuator for an alignment circuit according to the present invention;

Figure 4: shows the circuit diagram of an example of embodiment of a variable equalizer for an alignment circuit according to the present invention;

Figure 5: shows the flow diagram illustrating the process for calibrating a microwave module according to the present invention;

Figures 6, 7 and 8: show the block diagram of a comb generator during calibration and the respective graphs for its output before and after calibration; and

Figures 9, 10 and 11: show the block diagram of a synthesized generator during calibration and the respective graphs for its output before and after calibration.