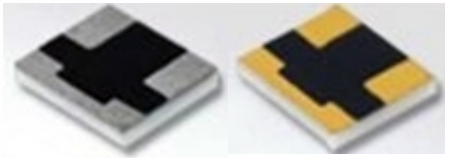
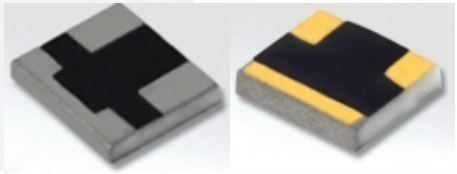
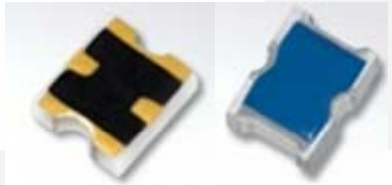




Temperature Compensation Attenuator

USA ,Europe, China, Korea, Taiwan
Invention Patents



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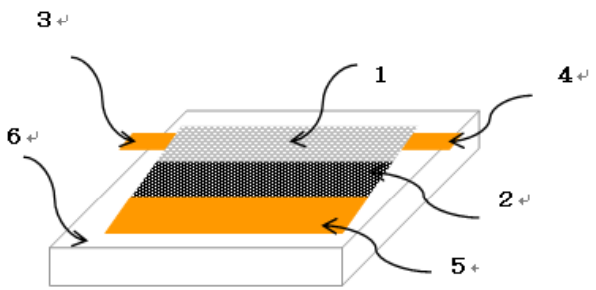
Application Theory:

When temperature compensation attenuator is applied to high frequency & microwave active circuit, losses such as the gain of output power frequency characteristics caused by temperature change can be largely compensated.

Structure Diagram:



Technological Innovation:

1)Unique temperature compensation circuit configuration;

With innovative microstrip circuit configuration, Yantel temperature compensation attenuator have more advantages over traditional circuit equivalents for applications requiring wide frequency band, high power and big attenuation.

Yantel technologically innovative RF components enjoy internationally excellent RF performance comprehensive international patent production and the complete series .Besides frequency point 20GHz, one works very well and the attenuation compensation by temperature change is 2 times bigger than other equivalent.

2)Professional RF circuit design & excellent RF characteristics satisfying the need of national defense and military market such as mobile communication systems ,radar ,SATCOM and microwave communication ;

Serialization is adapted including total seven series and over 300P/n. Frequency band includes DC-6GHz, DC-12GHz, DC-18GHz, DC-20GHz and 16-36GHz; Attenuation varies from 1dB to 10dB and every attenuation has at least 7 kinds of slopes ; Rated power can be chosen form 100mW,200mW,2W and 5W(the max average power for global SMT product series).

3)Yantel passive component guarantees real time and accurate gain compensation for RF PA without extra IP3;

4) Green temp. comp. attenuator is available of which the lead content directly complys to RoHs requirement;

Key Patents

★ US Utility Patents(all granted)
US7,362,196 B2
US7, 528,677 B2
US7,629,861 B2
US7,990,230 B2

★ European Patent (granted)
1750369

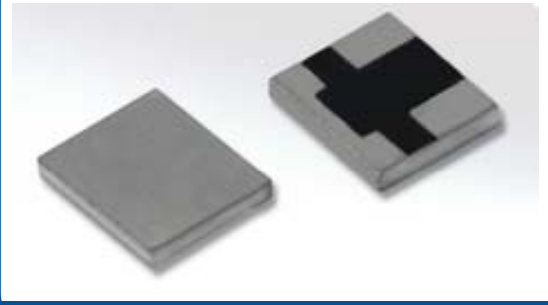
★ Chinese Invention Patent(granted)
#ZL200410027307.7

★ Republic of Korea Patent(granted)
10-0956103

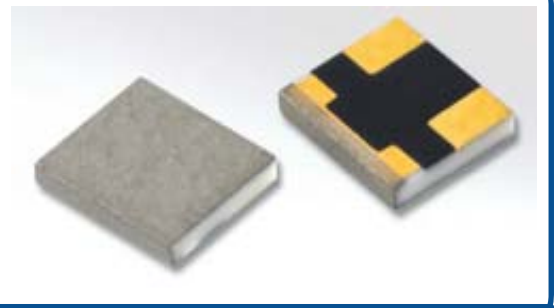
★ Taiwan Patent(granted)
I 257110

Yantel Complete Series

DC~6GHz、DC~12.4GHz、
DC~18GHz , 200mW、2W
Gold Terminal, planar & Tin Terminal, planar



DC~6GHz、DC~12.4GHz
100mW、 200mW、2W
Tin terminal, single wrap for ground only



DC~6GHz、DC~12.4GHz
100mW、 200mW、2W
Gold terminal, single wrap for ground only

DC~6GHz、DC~12.4GHz
100mW、 200mW、2W
Tin terminal, tripe wrap

DC~20GHz、200mW
Thin film & thick film
Gold/tin terminal, single wrap for ground only

16~36GHz， 200mW
Thin film & thick film
Gold/tin terminal, single wrap for ground only

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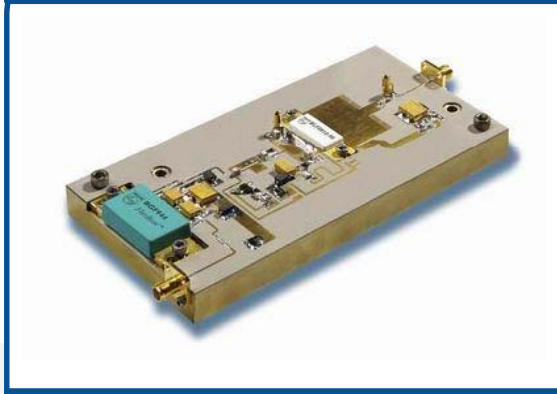
Applications:

Satellite Communication

Wireless & Microwave Communication

Phase Array Radar



TR Component、PA Module

RF Passive Module

Aerospace

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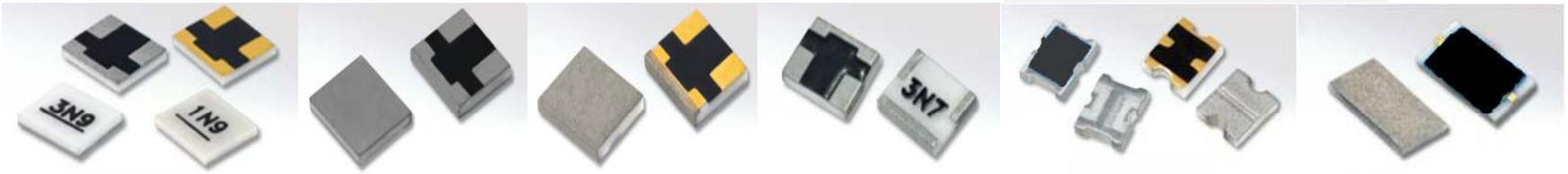
MOODY INTERNATIONAL CERTIFICATION UKAS QUALITY MANAGEMENT 014 RoHS

Temperature Compensation Attenuator



TCA …… DC~6GHz, 2W, 50 Ohms
STCA …… DC~6GHz, 100mW, 50 Ohms, 0805 size
MTCA …… DC~12.4GHz, 200mW, 50 Ohms
HTCA …… DC~18GHz, 200mW, 50 Ohms
WTCA …… DC~20GHz, 200mW, 500mW,50 Ohms
KTCA …… 16~36GHz, 200mW, 50 Ohms
BTCA …… DC~6GHz, 2W,75 Ohms
BSTCA …… DC~6GHz, 100mW, 75 Ohms, 0805 size
PTCA …… DC~3GHz, 2W,50 Ohms (positive temp. comp. coefficient)
ETCA …… DC~3GHz, 2W,50 Ohms (N10~N16)

TCA series

Specifications

- Frequency range: DC to 6GHz
- Power rating: 2W
- Size: 3.1×3.7×0.53(mm), type I
- Operating temperature: -55℃ to 150℃
- Impedance: 50Ω

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
TCA0601N*	1	N3~N9	-0.003~ -0.009	1.20	±0.5
TCA0602N*	2	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0603N*	3	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0604N*	4	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0605N*	5	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0606N*	6	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0607N*	7	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0608N*	8	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0609N*	9	N3~N10	-0.003~ -0.010	1.20	±0.5
TCA0610N*	10	N3~N10	-0.003~ -0.010	1.20	±0.5

ETCA series

Specifications

- Frequency range: DC to 3GHz
- Operating temperature: -55℃ to 150℃
- Temperature coefficient code: N10~N16
- Power rating: 2W
- Size: 4.06×3.68×0.5(mm)

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
ETCA0303N*	3	N10~N16	-0.01~ -0.016	1.30	±0.5
ETCA0304N*	4	N10~N16	-0.01~ -0.016	1.30	±0.5
ETCA0305N*	5	N10~N16	-0.01~ -0.016	1.30	±0.5
ETCA0306N*	6	N10~N16	-0.01~ -0.016	1.30	±0.5

STCA series

Specifications

- Frequency range: DC to 6GHz
- Operating temperature: -55℃ to 150℃
- Impedance: 50Ω
- Power rating: 100mW
- Size: 1.25×2.0×0.45(mm), type III

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
STCA0601N*	1	N3~N7	-0.003~ -0.007	1.20	±0.5
STCA0602N*	2	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0603N*	3	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0604N*	4	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0605N*	5	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0606N*	6	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0607N*	7	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0608N*	8	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0609N*	9	N3~N9	-0.003~ -0.009	1.20	±0.5
STCA0610N*	10	N3~N9	-0.003~ -0.009	1.20	±0.5

MTCA series

Specifications

- Wide frequency range: DC to 12.4GHz
- Operating temperature: -55℃ to 150℃
- Impedance: 50Ω
- Power rating: 200mW
- Size: 1.52×1.91×0.28(mm), type II

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
MTCA1201N*	1	N3~N7	-0.003~ -0.007	1.30	±0.5
MTCA1202N*	2	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA1203N*	3	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA1204N*	4	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA1205N*	5	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA1206N*	6	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA1207N*	7	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA1208N*	8	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA1209N*	9	N3~N9	-0.003~ -0.009	1.30	±0.5
MTCA12010N*	10	N3~N9	-0.003~ -0.009	1.30	±0.5

HTCA series

Specifications

- Wide frequency range:

DC to 18GHz

- Operating temperature:

-55℃ to 150℃

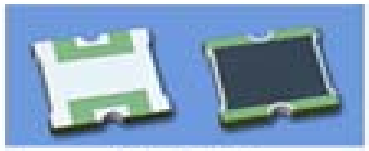
- Impedance: 50Ω
- Power rating: 200mW
- Size: 1.52×1.91×0.28(mm), type II

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
HTCA1801N*	1	N3~N7	-0.003~ -0.007	1.30	±0.5
HTCA1802N*	2	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA1803N*	3	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA1804N*	4	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA1805N*	5	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA1806N*	6	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA1807N*	7	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA1808N*	8	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA1809N*	9	N3~N9	-0.003~ -0.009	1.30	±0.5
HTCA18010N*	10	N3~N9	-0.003~ -0.009	1.30	±0.5

WTCA series

Specifications

- Wide frequency range: DC to 20 GHz
- Operating temperature: -55℃ to 150℃
- Impedance: 50Ω
- Power rating: 200mW
- Size: 1.52×1.78×0.28(mm)



SMT Package

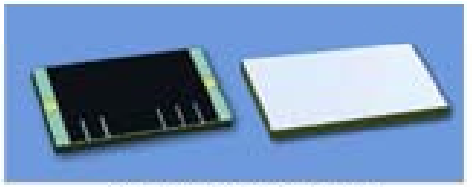
Gold,WB2 Package

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
WTCA2001N*	1	N3~N7	-0.003~ -0.007	1.30 Max DC-10GHz @25℃ 1.45 Max 10-20GHz @25℃	±0.5
WTCA2002N*	2	N3~N9	-0.003~ -0.009		±0.5
WTCA2003N*	3	N3~N9	-0.003~ -0.009		±0.5
WTCA2004N*	4	N3~N9	-0.003~ -0.009		±0.5
WTCA2005N*	5	N3~N9	-0.003~ -0.009		±0.5
WTCA2006N*	6	N3~N9	-0.003~ -0.009		±0.5
WTCA2007N*	7	N3~N9	-0.003~ -0.009		±0.5
WTCA2008N*	8	N3~N9	-0.003~ -0.009		±0.5
WTCA2009N*	9	N3~N9	-0.003~ -0.009		±0.5
WTCA20010N*	10	N3~N9	-0.003~ -0.009		±0.5

KTCA series

Specifications

- Wide frequency range: 16 to 36 GHz
- Operating temperature: -55℃ to 150℃
- Impedance: 50Ω
- Power rating: 200mW
- Size: 3.05×1.65×0.28(mm)



Gold,WB1 Package

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
KTCA3601N*	1	N3~N7	-0.003~ -0.007	1.35	±0.5
KTCA3602N*	2	N3~N9	-0.003~ -0.009	1.35	±0.5
KTCA3603N*	3	N3~N9	-0.003~ -0.009	1.35	±0.5
KTCA3604N*	4	N3~N9	-0.003~ -0.009	1.35	±0.5
KTCA3605N*	5	N3~N9	-0.003~ -0.009	1.35	±0.5
KTCA3606N*	6	N3~N9	-0.003~ -0.009	1.35	±0.5

PTCA series

(Thermal compensation characteristics with positive coefficients)

Specifications

- Frequency range: DC to 3GHz
- Power rating: 2W
- Size: 3.1×3.7×0.53(mm), type I
- Operating temperature: -55℃ to 150℃
- Impedance: 50 or 75Ω

Model	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Attenuation Accuracy (dB)
PTCA0301P*	1	N3~N9	+0.003~ +0.009	1.20	±0.5
PTCA0302P*	2	N3~N9	+0.003~ +0.009	1.20	±0.5
PTCA0303P*	3	N3~N9	+0.003~ +0.009	1.20	±0.5
PTCA0304P*	4	N3~N9	+0.003~ +0.009	1.20	±0.5
PTCA0305P*	5	N3~N9	+0.003~ +0.009	1.20	±0.5
PTCA0306P*	6	N3~N9	+0.003~ +0.009	1.20	±0.5

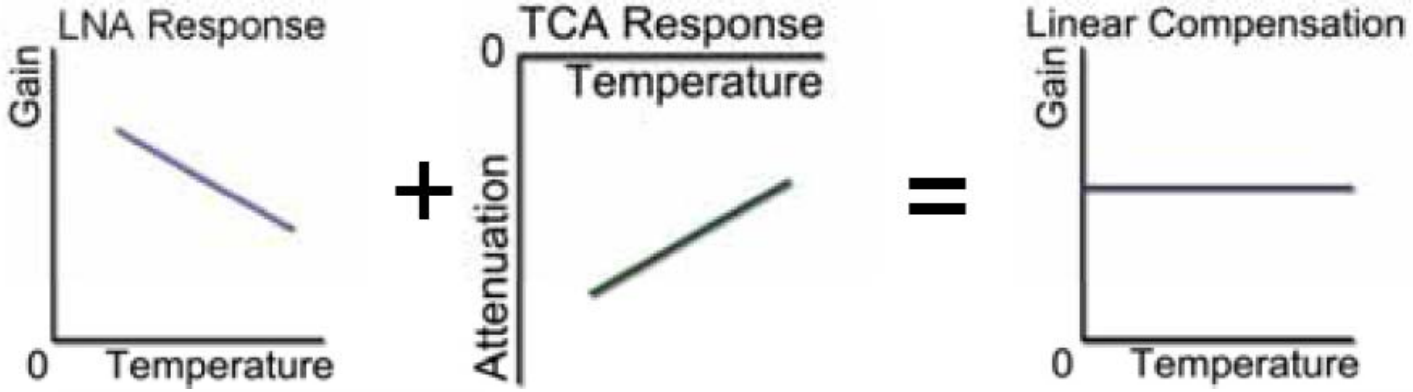
Use Table III below for a reference showing what tests are included when requesting Group A, B, or C designators.

Table III: Testing Procedures to be Included

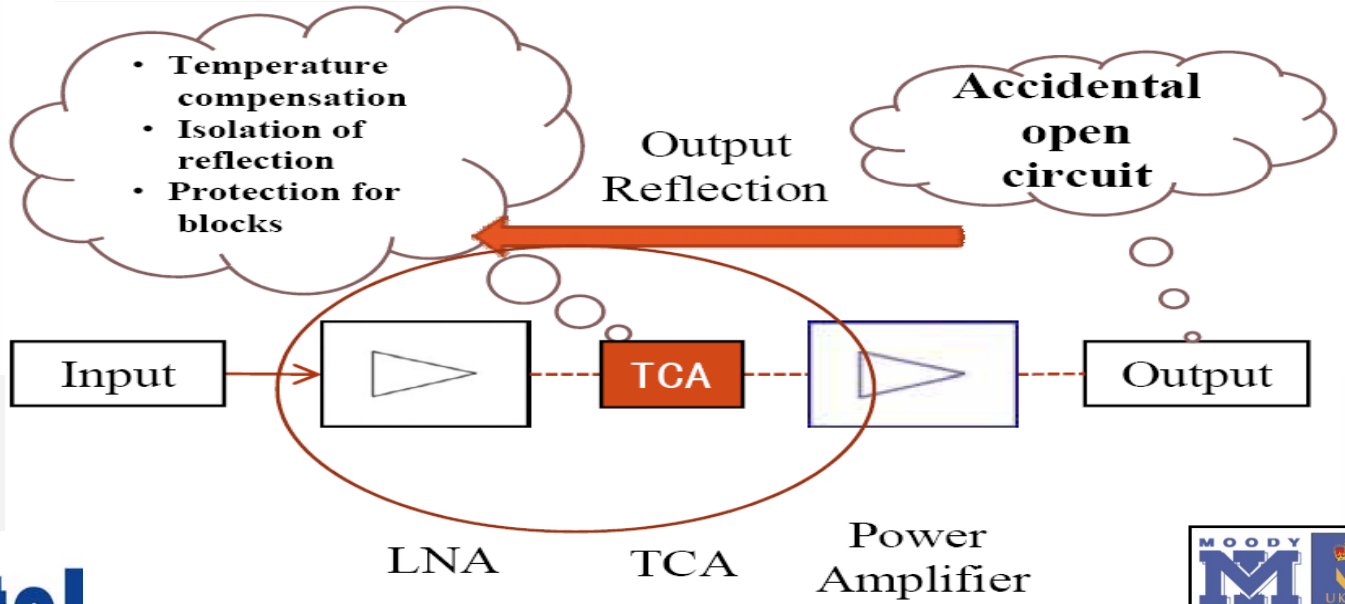
	Group A	Group B	Group C
Pre-Cap Inspection	✓	✓	✓
Initial RF Testing	✓	✓	✓
Visual Mechanical	✓	✓	✓
Thermal Shock	✓	✓	✓
After Thermal Shock (ATS) RF Testing	✓	✓	✓
168 Hour Burn-In	✓	✓	✓
After Burn-In (ABI) Final RF Testing	✓	✓	✓
PDA % RF Test Comparison	✓	✓	✓
TCA Testing	HRT & HRM only	HRT & HRM only	HRT & HRM only
Low Temperature Operation		✓	✓
After Low Temperature Operation RF Testing		✓	✓
High Temperature Bake		✓	✓
Terminal Adhesion Test		✓	✓
Bondability Test		WB1 or G only	WB1 or G only
Solderability Test		✓	✓
Pre Burn-In (PBI) RF Testing		✓	✓
Life Test 1000 hour Burn-In		✓	✓
After Burn-In Life Test (ABIL) RF Test		✓	✓
Pre-Qual Burn-In (QBI) RF Test			✓
Qualification 1000 hour Stepped Pulse Burn-In			✓
After Qual. Burn-In (AQBI) RF Testing			✓

Application Diagram

- Improving the temperature characteristics of LNA



- In case of open circuit, the added TCA can isolate the return loss from Output and proetct the LNA.



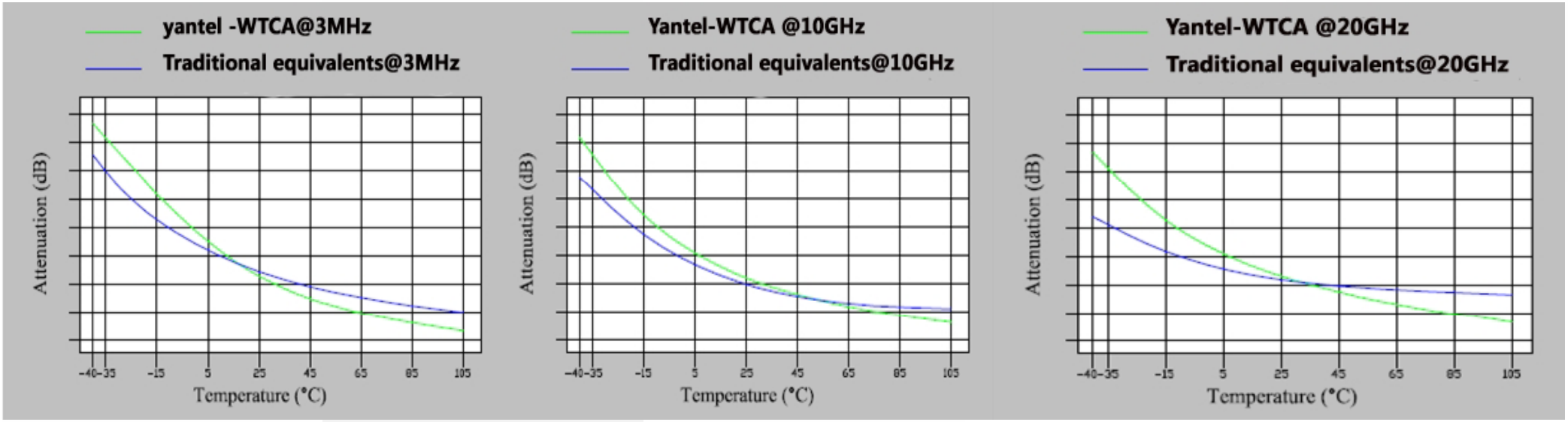
Innovative Technology

About compensation characteristics @3M,10G and 20G, Yantel WTCA(DC-20G) has several advantages over traditional equivalents.

1.Wider positive and negative temperature compensation range

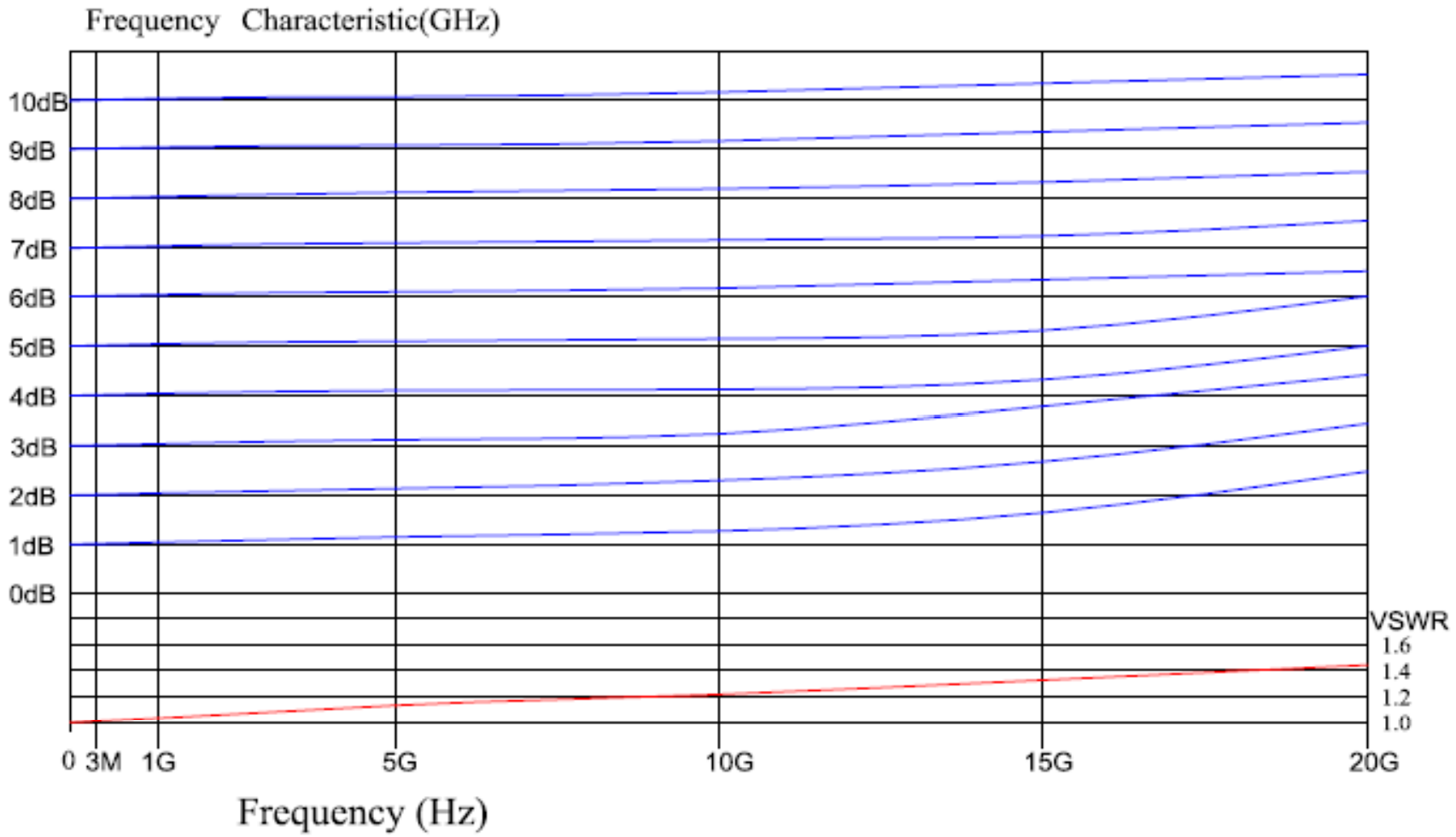
2.Larger and better positive and negative change

3.Lower insertion loss within the frequency band and better response flatness



Frequency Characteristics

WTCA Series @1~10dB（25 ℃）



Characteristics Advantages

- Frequency range: DC~6 GHz, DC~12.4 GHz, DC~18GHz , DC~20GHz , 16 ~36GHz
- Power rating: 100mW, 200mW, 2W,5W
- Impedance: 50Ω or 75Ω.
- Operating temperature: -55 ℃ to +150 ℃
- There are 10 attenuations from 1dB to 10dB, and 7 variation slope characteristics per attenuation, which are N3, N4, N5, N6, N7, N8 and N9, totally 70 different combinations of temperature correction characteristics. In addition, bigger variation slopes such as N10 and N11 can be customized by request.
- Adopting 100% laser trimming, high attenuation accuracy.
- High reliability. Adopting advanced thick or thin film technology through firing @ 850 ℃.
- Zero distortion, and no phase changes and time delay caused by temperature variation.
- Temperature compensation and RF isolation, which are more suitable for multi-stage power amplifiers.
- No extra IP3 exists and suitable for linear power amplifier.

Complete Solution of Variation Slope Characteristics for Every Attenuation

Custom Services

*N1, N2, N11, etc. can be customized based on customers' requirement.
*0.5dB, 10dB or higher attenuation can be customized accordingly.

Model	Frequency Range (GHz)	Attenuation (dB)	Temperature Coefficient Code	Temperature Coefficient of Attenuation (dB/dB/℃)	Max. VSWR (:1) @1GHz	Max. Input Power (W)	Attenuation Accuracy (dB)
TCA0601N*	DC-6	1	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0602N*	DC-6	2	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0603N*	DC-6	3	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0604N*	DC-6	4	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0605N*	DC-6	5	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0606N*	DC-6	6	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0607N*	DC-6	7	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0608N*	DC-6	8	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0609N*	DC-6	9	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3
TCA0610N*	DC-6	10	N3,N4,N5,N6,N7,N8,N9	—0.003~—0.009	1.2	2	±0.3

Calculating Method of Yantel Temperature Coefficient Code (N value)

1. Select 5pcs samples from a lot. Measure and record the attenuation status @ DC~6GHz every 20℃ over the temperature range -55℃~+150℃

2. Calculate, using linear regression, the slope of curve.

3. Calculate temperature coefficient code using the following formula:

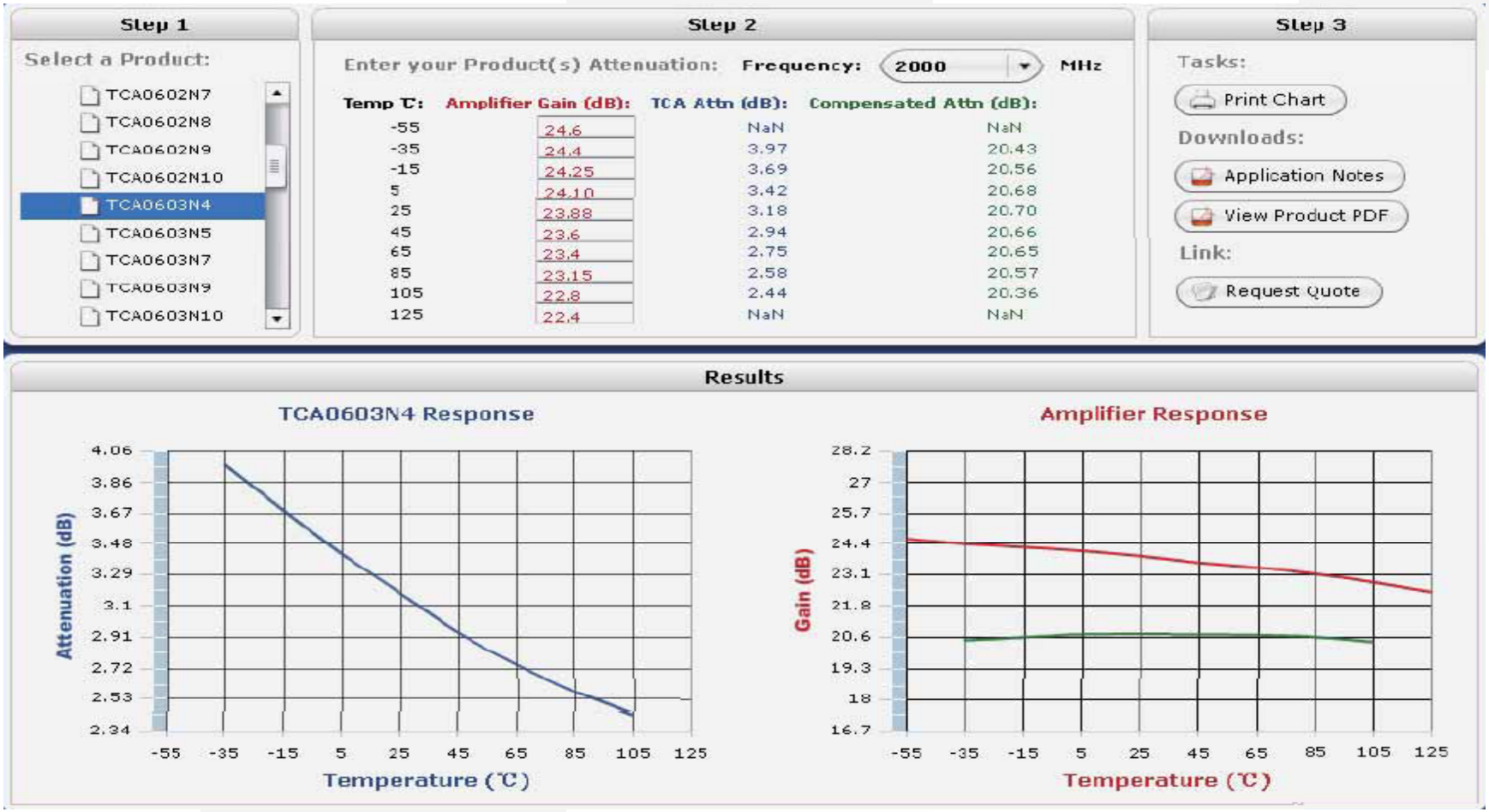
   Temperature Coefficient Code(N value) = Slope/Attenuation@25℃

4. Notes: For example 4N9, when temperature changes by 1℃, the attenuation variation equals 4dB×0.009(temperature coefficient code) ×1℃=0.036dB. When temperature changes by 100℃, the attenuation variation equals 4dB×0.009×10℃=3.6dB.

Commercial Advantages

- Excellent performance, effective cost
- Available custom services
- Pin to pin with competitor's（package and outline)
- Regular Stock（2000~10000pcs per model）
- Quick delivery: 14 working days for 10,000pcs
- Good product repeatability
- Producing in accordance with patent content strictly
- Tape and reel
- Free samples and eval. Boards to be offered for evaluation

Selection Tool

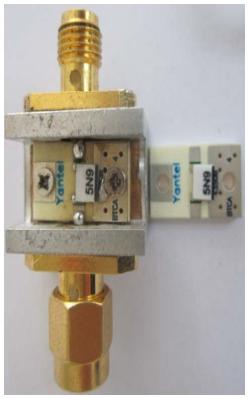


1: Select a P/N;
2: Enter your amplifier gain(before compensation) at desired frequency point.
Results: You will get an automatic result of response chart.
3: Confirm if the curve is needed as per request specs;
4: Printing chart or download datasheet;

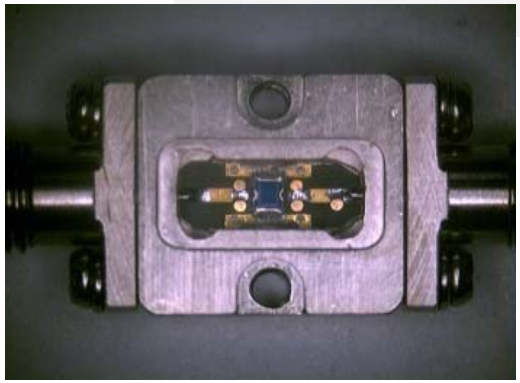
For more information， please visit: http://en.yantel-corp.com/en/tca.htm.

Technical Support and Services

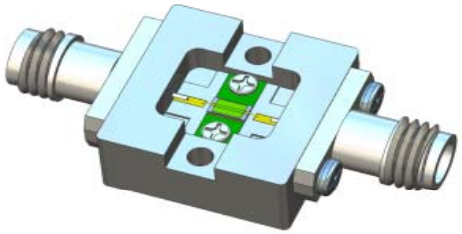
◆Free samples, eval boards and testing curves are available.



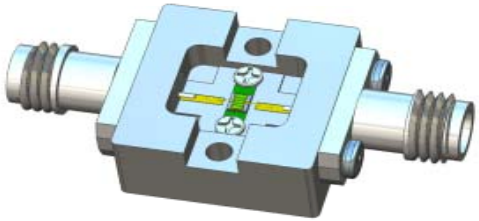
TCA、STCA、MTCA Eval. Board



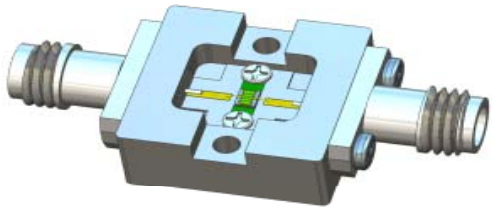
WTCA – SMT Eval. Board



KTCA -gold terminal Eval. Board



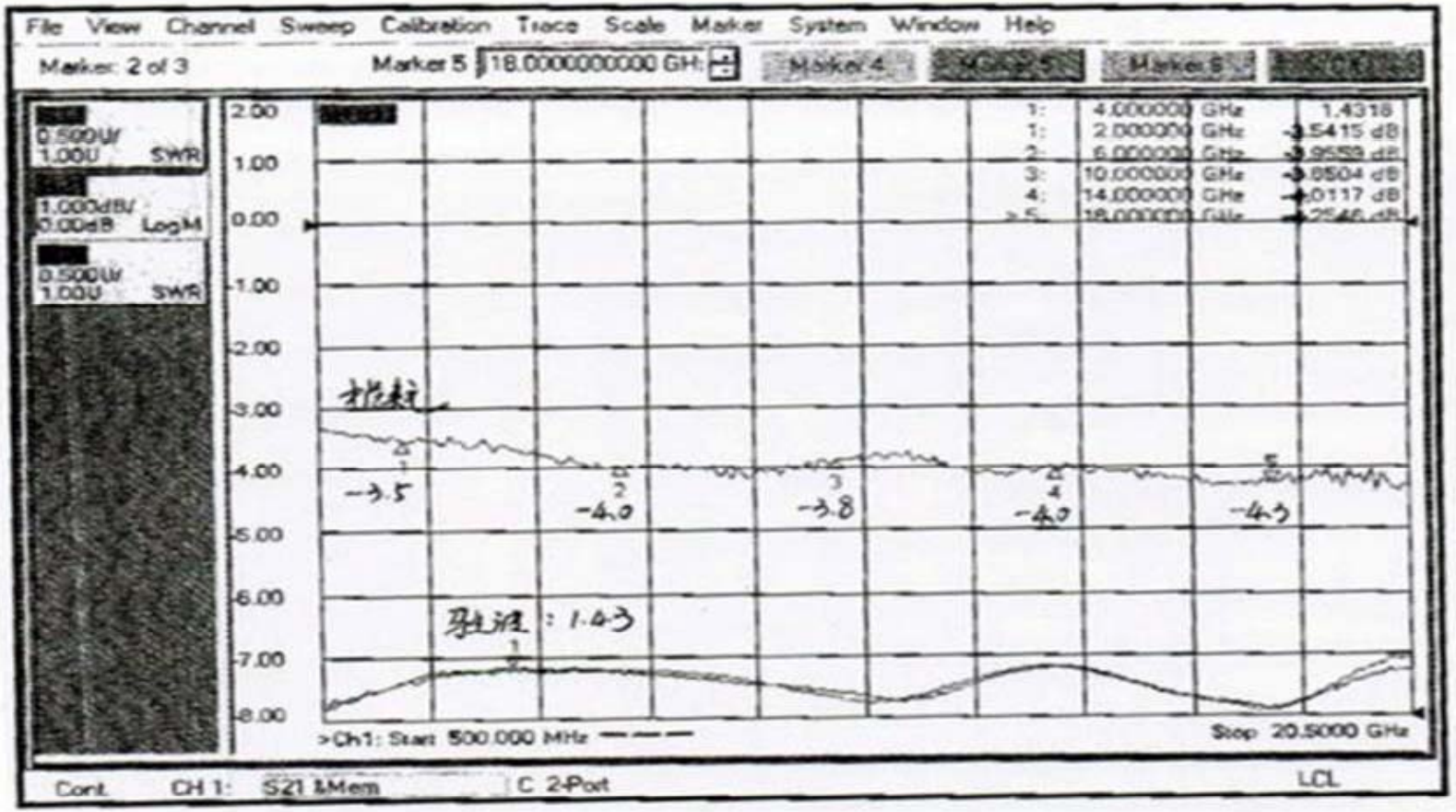
WTCA -WB2(gold termial) Eval. Board



HTCA WB1(gold terminal and wrap ground only)Eval. Board

◆Test report is available

WTCA2003N5 （+25℃）



Test Result：

1>Attenuation： DC~18G response flatness<1.5db

2>VSWR： DC~18G MAX 1.43

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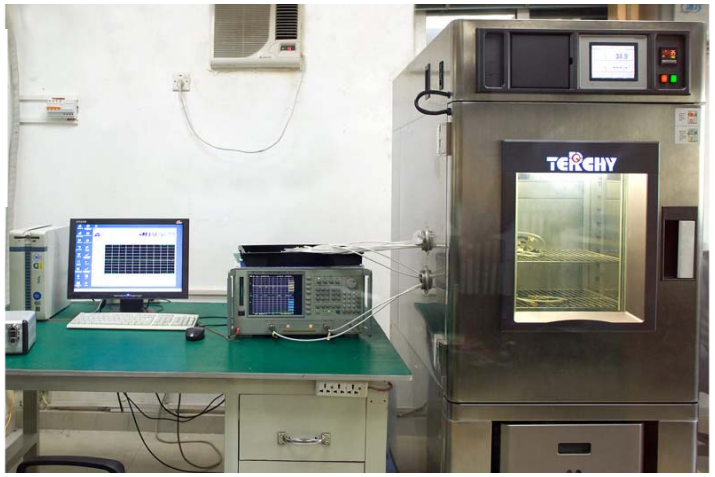
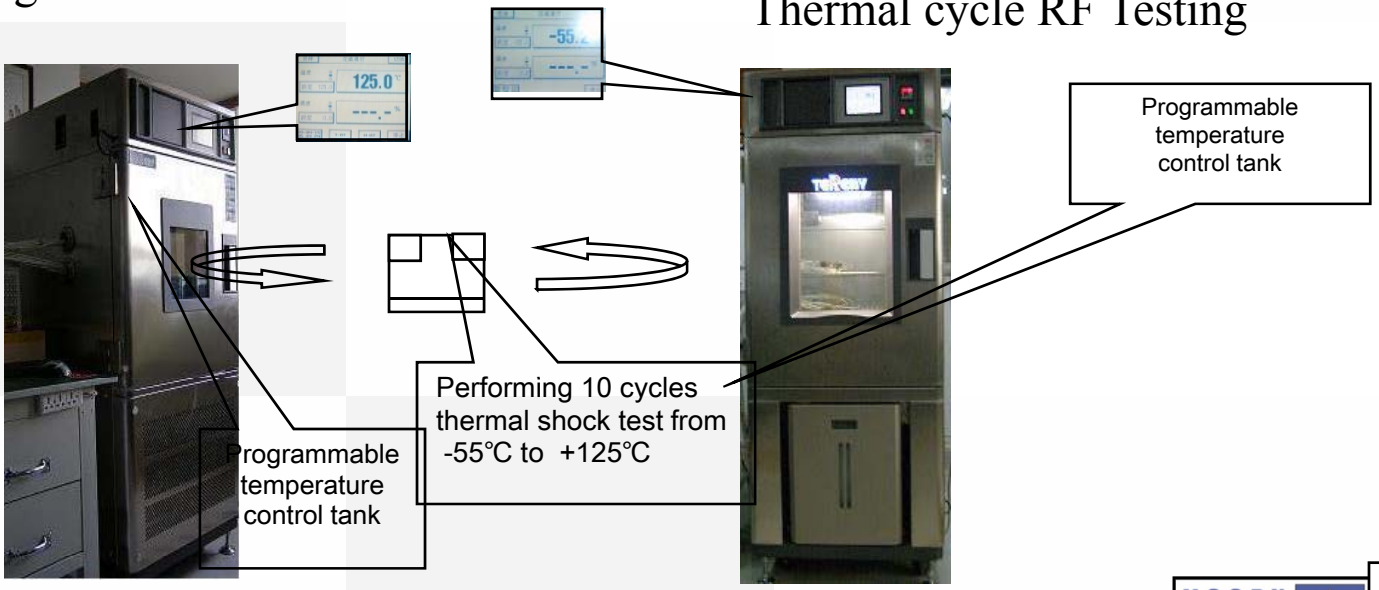
Reliability Test Equipment

Power tesing



Thermal cycle RF Testing



Thermal shock Testing

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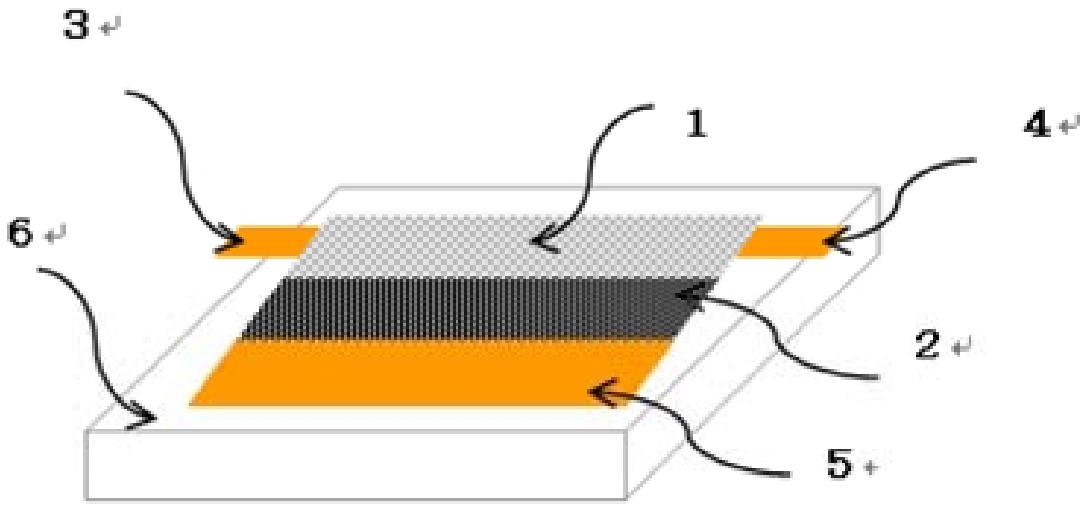
RoHS

Product outline:

Product structure:



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RoHS

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Thank you for your attention