



**CENTRE OF TESTING SERVICE
INTERNATIONAL**

OPERATE ACCORDING TO ISO/IEC 17025

RADIO TEST REPORT

TEST REPORT NUMBER : CGZ3160412-00293-E



CENTRE OF TESTING SERVICE CO., LTD.

A101, No.65, Zhuji Highway, Tianhe District, Guangzhou, China



TEST REPORT For TELEC-T401

Report Reference No. CGZ3160412-00293-E

Date of issue 18 April 2016

Testing Laboratory Name CENTRE OF TESTING SERVICE CO., LTD.

Address A101, No.65, Zhuji Highway, Tianhe District, Guangzhou, China

Testing location/ procedure Full application of Harmonised standards ☒

Partial application of Harmonised standards ☐

Other standard testing method ☐

Applicant's name Rigado, LLC

Address 3950 Fariview Industrial Dr SE, Suite 100, Salem, OR USA, 97302

Test specification

Standard **TELEC-T401 (2012-08): - Item 19 of Article 2**

Test Report Form No. CTSEMC-1.0

TRF Originator CENTRE OF TESTING SERVICE CO., LTD.

Master TRF Dated 2009-01

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Test item description : BMD-301

Trade Mark Rigado

Manufacturer Rigado, LLC

Model/Type reference BMD-301

Ratings DC 3.6V

Operating Frequency 2402.0 MHz ~2480.0 MHz

Result **Positive**

Compiled by:

Kate zhang / Fileadministrators

Supervised by:

Duke yang / Technique principal

Approved by:

Vincent van / Manager



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RADIO TEST REPORT

Test Report No. :	CGZ3160412-00293-E	<u>18 April 2016</u> Date of issue
--------------------------	---------------------------	---------------------------------------

Type / Model.....	BMD-301
EUT.....	BMD-301
Applicant.....	Rigado, LLC
Address.....	3950 Fariview Industrial Dr SE, Suite 100, Salem, OR USA, 97302
Telephone.....	+1-971-208-9857
Fax.....	+1-971-208-9869
Contact.....	Cam Nichols
Manufacturer.....	Rigado, LLC
Address.....	3950 Fariview Industrial Dr SE, Suite 100, Salem, OR USA, 97302
Telephone.....	+1-971-208-9857
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Contact.....	Cam Nichols
Factory.....	Rigado, LLC
Address.....	3950 Fariview Industrial Dr SE, Suite 100, Salem, OR USA, 97302
Telephone.....	+1-971-208-9857
Fax.....	+1-971-208-9869
Contact.....	Cam Nichols

Test Result according to the standards on page 1: **PASSED**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1.0 TEST STANDARDS

The tests were performed according to following standards:

- **TELEC-T401 (2012-08): - Item 19 of Article 2**

2.0 SUMMARY

2.1 GENERAL REMARKS

Date of receipt of test sample	12 April 2016
Testing commenced on	12~18 April 2016
Testing concluded on	18 April 2016

2.2 FINAL ASSESSMENT

The TELEC requirements pertaining to the technical standards and tested operation modes are

- - fulfilled.

- ☐ - **not** fulfilled.

The equipment under test

- - fulfils the TELEC requirements cited on page 1.

- ☐ - **does not** fulfil the TELEC requirements cited on page 1.

3.0 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Power supply voltage : ■ DC 3.3V

3.2 Short description of the Equipment under Test (EUT)

Number of tested samples: 1

Serial number: Prototype

3.3 EUT operation mode

The equipment under test was operated during the measurement under the following conditions:

- ☐ TX- Y position at 1, 2 Mbps Rate
- ☐ TX- Z position at 1, 2 Mbps Rate
- ☐ TX- X position at 1, 2 Mbps Rate
- TX- X position 2 Mbps Rate (Worst case)

Operation mode 1:TX-X Position Low (2402MHz) , TX-X Position Middle (2440MHz) ,
TX-X Position High (2480MHz)

Note:Operation mode 1 TX -X position (2 Mbps Rate) of EUT is the radiated test worst case; so only these test results be recorded in the test report.

3.4 EUT configuration

3.4.1. Description of configuration (EUT)

Description	:	BMD-301
Model Number	:	BMD-301
Operation frequency	:	2402.0 MHz~ 2480.0 MHz ISM Band
Channel Number	:	40
Modulation Technology	:	GFSK
Antenna 1	:	External antenna (Pulse-W1030), 2.0dBi
Antenna 2	:	External antenna (Taoglas-FXP73.07.0100A), 2.5dBi
Antenna 3	:	External antenna (Pulse-W1027), 3.2dBi
Antenna 4	:	External antenna (Kinsun-6670113050-145), 2.0dBi
Antenna 5	:	External antenna (Kinsun-6610103081), 5.0dBi
Hardware Version	:	A
Software Version	:	N/A
AC/DC Power Supply Power ratings	:	I/P:100-240 VAC, 2A, 50/60Hz O/P:0~30V DC, 5A
Test Voltage (Power supply by DC Source)	:	Normal Voltage : DC 3.3V Extreme Voltage(+10%) : DC 3.63 V Extreme Voltage(-10%) : DC 2.97 V
Module Brand	:	Rigado
Type and Version	:	2.4GHz GFSK Transmitter Japan Version

3.4.2. Carrier Frequency of Channels

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
*00	2402	14	2430	28	2458
01	2404	15	2432	29	2460
02	2406	16	2434	30	2462
03	2408	17	2436	31	2464
04	2410	18	2438	32	2466
05	2412	*19	2440	33	2468
06	2414	20	2442	34	2470
07	2416	21	2444	35	2472
08	2418	22	2446	36	2474
09	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	*39	2480
12	2426	26	2454	--	--
13	2428	27	2456	--	--

Note: Channels remarked * are selected to perform test.

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4.0 TEST ENVIRONMENT

4.1 Address of the test laboratory

A101, No.65, Zhuji Highway, Tianhe District, Guangzhou, China

Tel: +86-20-85543113 (32 lines)

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4.2 Test facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L3394

CENTRE OF TESTING SERVICE CO., LTD has been assessed and proved to be in compliance with CNAS-CL01: 2006 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

IC-Registration No.: 8374A

The 3m Alternate Test Site of CENTRE OF TESTING SERVICE CO., LTD has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 8374A on May 22, 2014.

FCC-Registration No.: 971995

CENTRE OF TESTING SERVICE CO., LTD, EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration No. 971995, July 13, 2012.

4.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35 ° C
Humidity:	25~75 %
Atmospheric pressure:	86~106 kPa

4.4 Definitions of symbols used in this test report

- - The black square indicates that the listed condition, standard or equipment is applicable for this report.
- - The empty square indicates that the listed condition, standard or equipment is **not** applicable for this report.

4.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the CTS quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.6 Measurement Uncertainty

Measurement Item	Uncertainty
Frequency Error	$\pm 0.13\text{ppm}$
Occupied Bandwidth	$\pm 0.03\text{MHz}$
Spread Bandwidth	$\pm 0.03\text{MHz}$
Output Power Tolerance	$\pm 0.015\text{mW}$
TX Spurious Emissions	$\pm 0.017\text{mW}$
RX Spurious Emissions	$\pm 0.017\text{mW}$
Carrier Sensing Function	$\pm 0.05\text{mV}$

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

5.0 Summary of standards and results

5.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below.

EMISSION		
Description of Test Item	Standard	Results
. Frequency Error	TELEC-T401 (2012-08): - Item 19 of Article 2 Japanese radio regulations 2008: - Chapter I, II, IV (general provisions) - Article 9.4(9) - Article 49.20(1)	PASSED
. Occupied Bandwidth		PASSED
. Spread Bandwidth		PASSED
. RF Output Power Tolerance		PASSED
. Spurious Emissions(TX)		PASSED
. Spurious Emissions(RX)		PASSED
. Angular Width of Principal Radiation		PASSED
. Construction Protection Confirmation		PASSED
N/A is an abbreviation for Not Applicable.		

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6.0 Transmitter Parameters

6.1 Frequency Error

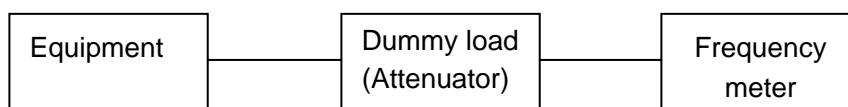
6.1.1 Test Limit

Limits: $\pm 50 \times 10^{-6}$, 50ppm

6.1.2 Test Procedures

According to TELEC-T401, Test item frequency error measuring procedures.

6.1.3 Test Setup



6.1.4 Test Result and Data

Test date: 15 April 2016

Ambient temperature: 23°C

Atmospheric pressure: 1020 hpa

Relative humidity: 56%

Test Conditions	Operation Frequency (MHz) / Frequency Error (ppm)					
	2402 MHz		2440 MHz		2480 MHz	
Vnom	2402.0111	4.996	2440.0117	4.918	2480.0105	4.032
Vmax	2402.0115	4.580	2440.0120	4.959	2480.0117	4.436
Vmin	2402.0119	4.580	2440.0121	4.877	2480.0118	4.798

6.1.5 Test Equipment

Instrument	Model No.	Manufacturer	Serial No.	Calibration Date
Spectrum	ESCI	R&S	100868	2015/10

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6.2 Occupied Bandwidth

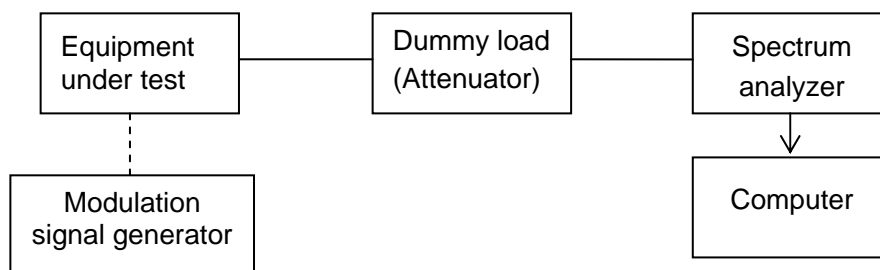
6.2.1 Test Limit

Modulation type	Occupied Band Width
FH、FH+DS、FH+OFDM	< 83.5 MHz
DS	< 26 MHz
Other	< 26 MHz

6.2.2 Test Procedures

According to TELECOM-T401, test item occupied bandwidth and spreading bandwidth, measuring procedures.

6.2.3 Test Setup



6.2.4 Test Result and Data

Test date: 13 April 2016

Ambient temperature: 23°C

Atmospheric pressure: 1020 hpa

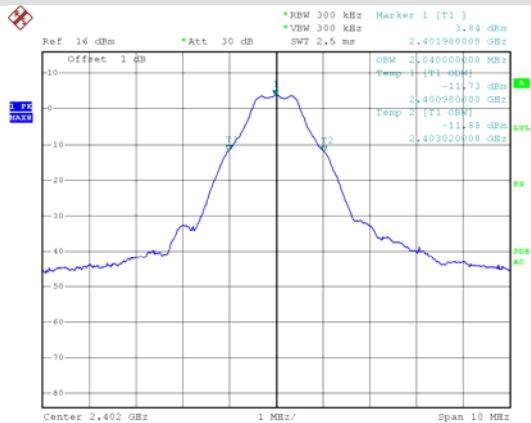
Relative humidity: 56%

Test Conditions Modulation Type		Operation Frequency (MHz) / Occupied Bandwidth (MHz)		
		2402MHz	2440MHz	2480MHz
GFSK	Vnom	2.040	2.040	2.040
	Vmax	2.040	2.040	2.040
	Vmin	2.040	2.040	2.040

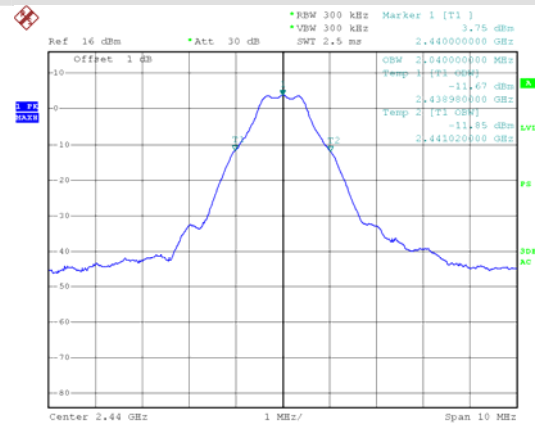
6.2.5 Test Equipment

Instrument	Model No.	Manufacturer	Serial No.	Calibration Date
Spectrum	ESCI	R&S	100868	2015/10

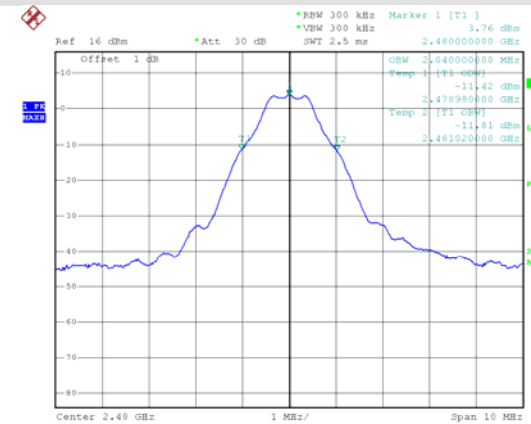
Notice: After confirmation, there is a least one carrier (channel) with BW of 1 MHz or more.

Modulation Type: GFSK
CH00

Date: 13.APR.2016 12:15:47

CH19

Date: 13.APR.2016 12:16:48

CH39

Date: 13.APR.2016 12:12:46

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6.3 Spread Bandwidth

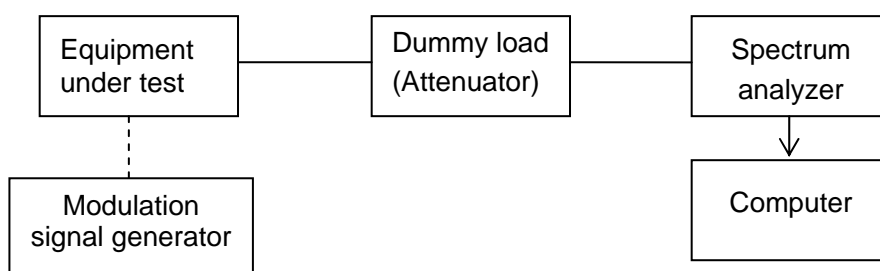
6.3.1 Test Limit

Modulation type	Occupied Band Width
FH、FH+DS、FH+OFDM	> 500 KHz
DS	> 500 KHz
Other	----

6.3.2 Test Procedures

According TELEC-T401, test item occupied bandwidth and spreading bandwidth, measuring procedures.

6.3.3 Test Setup



6.3.4 Test Result and Data

Test date: 13 April 2016

Ambient temperature: 23°C

Atmospheric pressure: 1020 hpa

Relative humidity: 56%

Test Conditions Modulation Type		Operation Frequency (MHz) / Spread Bandwidth (MHz)		
		2402MHz	2440MHz	2480MHz
GFSK	Vnom	1.120	1.120	1.120
	Vmax	1.120	1.120	1.120
	Vmin	1.120	1.120	1.120

6.3.5 Test Equipment

Instrument	Model No.	Manufacturer	Serial No.	Calibration Date
Spectrum	ESCI	R&S	100868	2015/10

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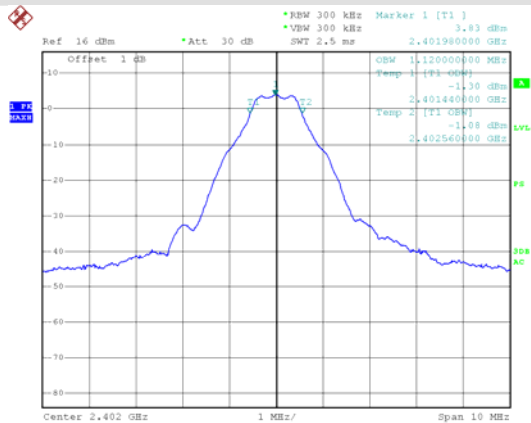
Tel: +86-20-85543113 (32 lines)

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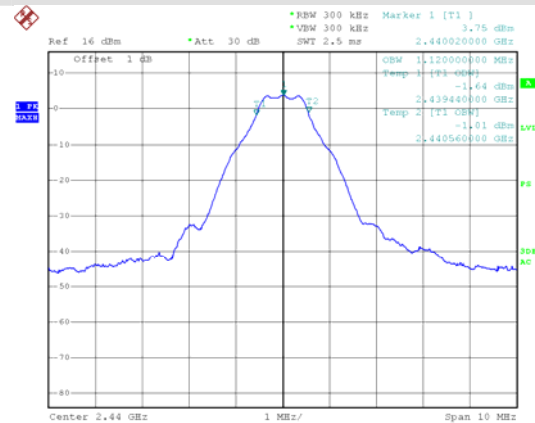
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E-mail: cts@cts-lab.com.cn

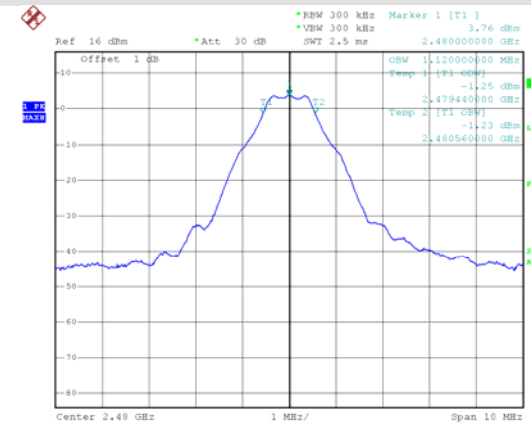
See Reverse For Terms And Conditions of Service

Modulation Type: GFSK
CH00

Date: 13.APR.2016 12:14:52

CH19

Date: 13.APR.2016 12:17:28

CH39

Date: 13.APR.2016 12:13:53

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6.4 RF Output Power Tolerance

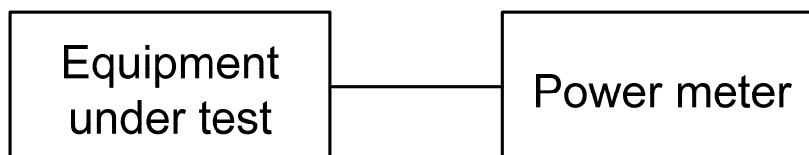
6.4.1 Test Limit

1. tolerance: +20 % ~ - 80%
2. output power:
 - (1) FH、FH+DS、FH+OFDM < 3mW/MHz
 - (2) OFDM、DS < 10mW/MHz
 - (3) Other < 10mW

6.4.2 Test Procedure

According to TELEC-T401, test item antenna power error measuring procedure.

6.4.3 Test Setup



6.4.4 Test Result and Data

Test date: 15 April 2016

Ambient temperature: 23°C

Atmospheric pressure: 1020 hpa

Relative humidity: 56%

Test Conditions Modulation Type		Operation Frequency (MHz) / Spread Bandwidth (MHz)					
		2402MHz		2440MHz		2480MHz	
		mW	%	mW	%	mW	%
GFSK	Vnom	2.4842	0.00	2.4379	-2.10	2.4320	-2.10
	Vmax	2.4444	-1.60	2.4267	-2.31	2.4153	-2.77
	Vmin	2.4165	-2.73	2.3715	-4.54	2.3658	-4.77

6.4.5 Test Equipment

Instrument	Model No.	Manufacturer	Serial No.	Calibration Date
Power Meter	NRVS	R&S	842856/049	2015/10

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6.5 Spurious Emissions

6.5.1 Test Limit

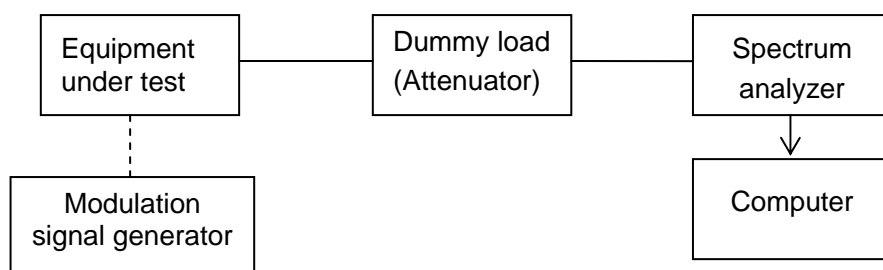
Limits:

	Frequency Band (For 2400 ~ 2483.5 MHz)	Limit
*1	<2387MHz	2.5 μ W
*2	2387MHz ~ 2400MHz	25 μ W
*3	2483.5MHz ~ 2496.5MHz	25 μ W
*4	>2496.5MHz	2.5 μ W

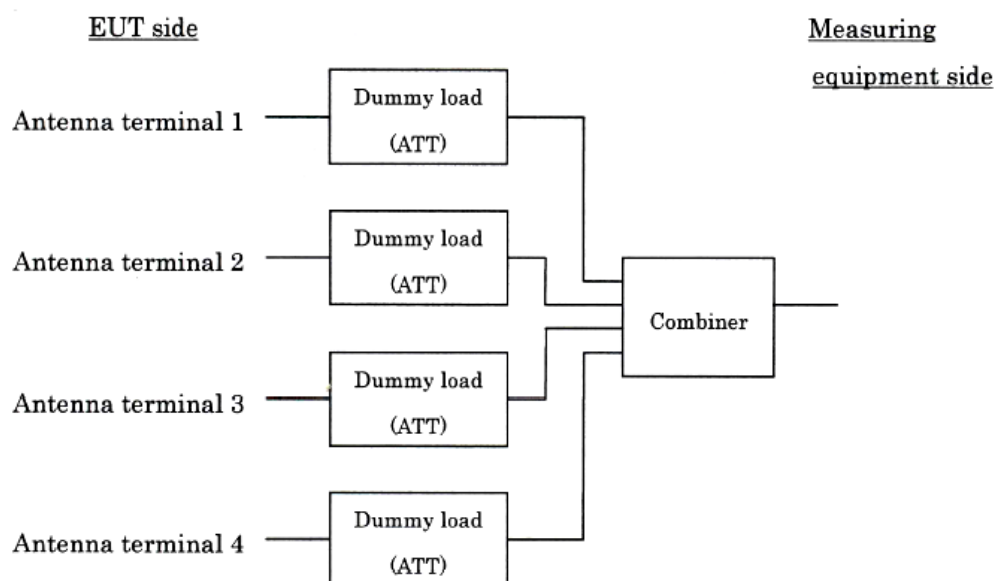
6.5.2 Test Procedure

According to TELEC-T401 Spurious and unwanted emission intensity measuring procedure.

6.5.3 Test Setup



Connection diagram in case of 2 or more antenna terminals, is as following



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6.5.4 Test Result and Data

Test date: 14~15 April 2016

Ambient temperature: 23°C

Atmospheric pressure: 1020 hpa

Relative humidity: 56%

Modulation type: GFSK						
Test Conditions	Operation Frequency (MHz) / Spurious Emission					
	2402MHz		2440MHz		2480MHz	
	MHz	μW	MHz	μW	MHz	μW
Frequency Band: < 2387MHz						
Vnom	2275.82	0.0370	2314.73	0.0301	2353.65	0.0385
Vmax	2275.82	0.0324	2314.73	0.0253	2353.65	0.0372
Vmin	2275.82	0.0350	2314.73	0.0258	2353.65	0.0370
Frequency Band: 2387 ~ 2400MHz						
Vnom	2400.00	14.5211	2396.12	0.0094	2390.00	0.0106
Vmax	2400.00	12.9122	2396.12	0.0097	2390.00	0.0103
Vmin	2400.00	12.5026	2396.12	0.0094	2390.00	0.0100
Frequency Band: 2483.5 ~ 2496.5MHz						
Vnom	2483.06	0.9419	2483.95	0.0080	2491.50	0.0082
Vmax	2483.06	0.8700	2483.95	0.0080	2491.50	0.0085
Vmin	2483.06	0.9141	2483.95	0.0084	2491.50	0.0084
Frequency Band: >2496.5MHz						
Vnom	2520.04	0.0361	2560.12	0.0315	2600.20	0.0361
Vmax	2520.04	0.0357	2560.12	0.0264	2600.20	0.0348
Vmin	2520.04	0.0324	2560.12	0.0280	2600.20	0.0317
Vnom	4804.61	0.0099	4884.77	0.0060	4964.93	0.0030
Vmax	4804.61	0.0094	4884.77	0.0055	4964.93	0.0025
Vmin	4804.61	0.0093	4884.77	0.0058	4964.93	0.0025

6.5.5 Test Equipment

Instrument	Model No.	Manufacturer	Serial No.	Calibration Date
Signal analyzer	FSIQ26	R&S	100311	2015/03

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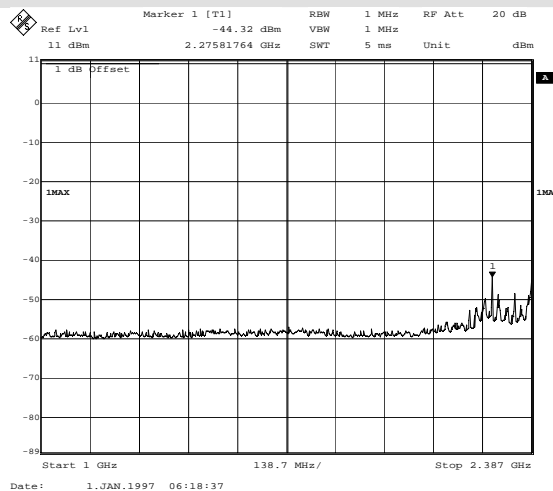
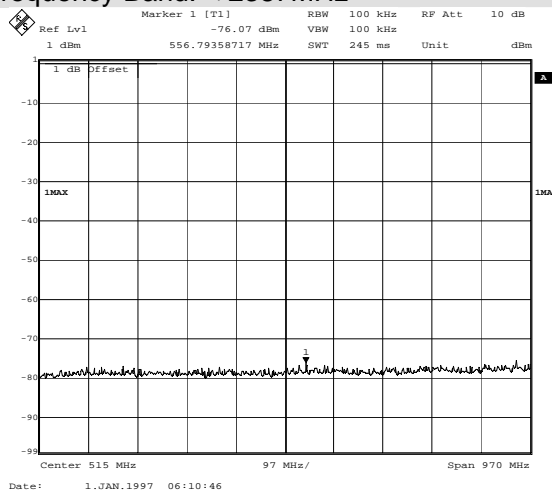
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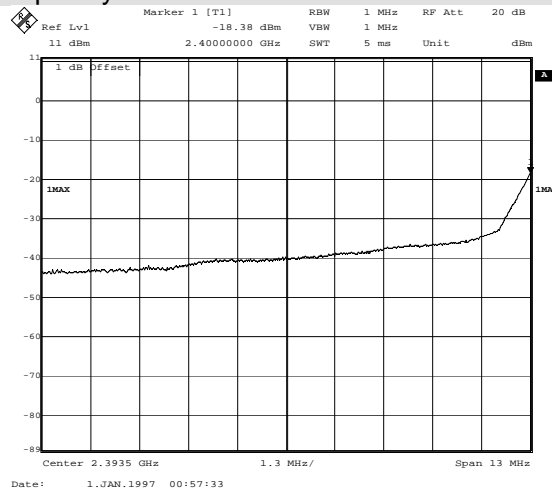
E-mail: cts@cts-lab.com.cn

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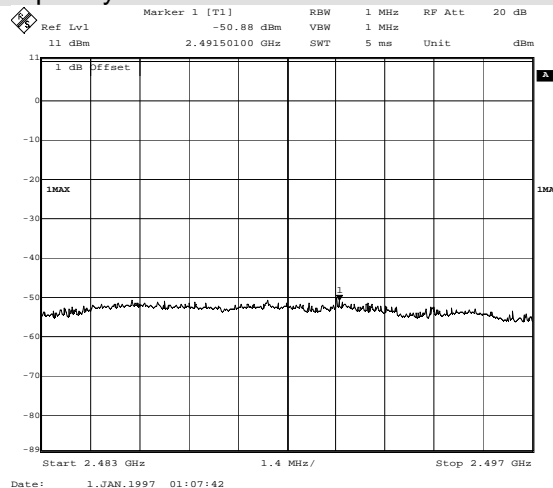
Modulation type: GFSK, CH00 Frequency Band: < 2387MHz



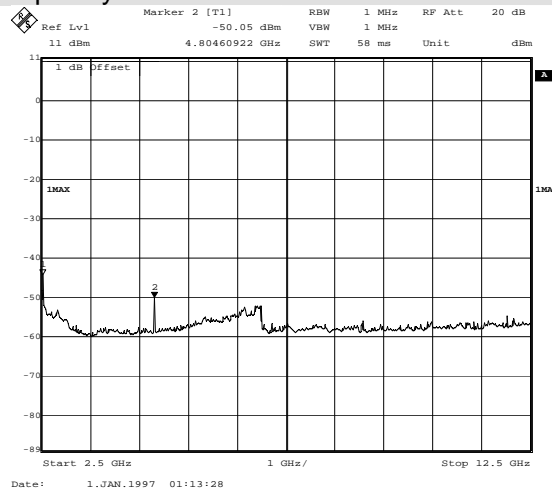
Frequency Band: 2387 ~ 2400MHz



Frequency Band: 2483.5~2496.5MHz



Frequency Band: >2496.5MHz



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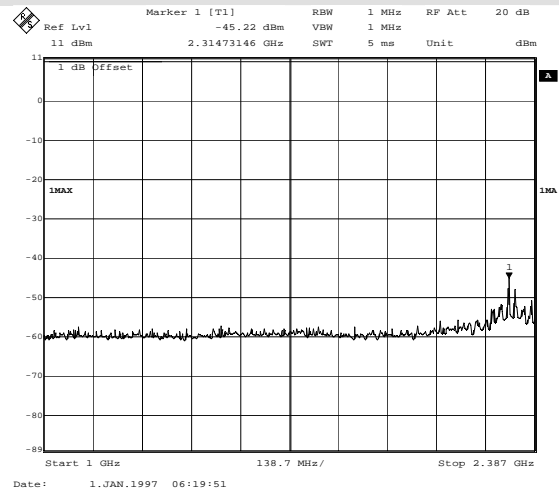
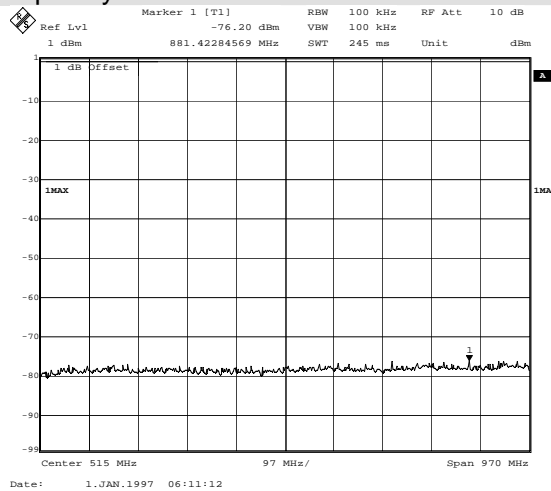
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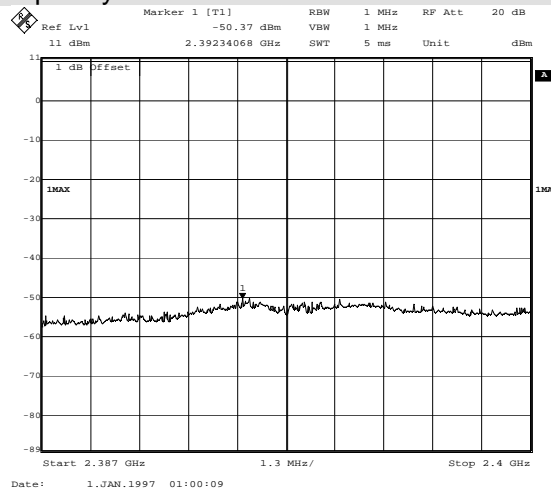
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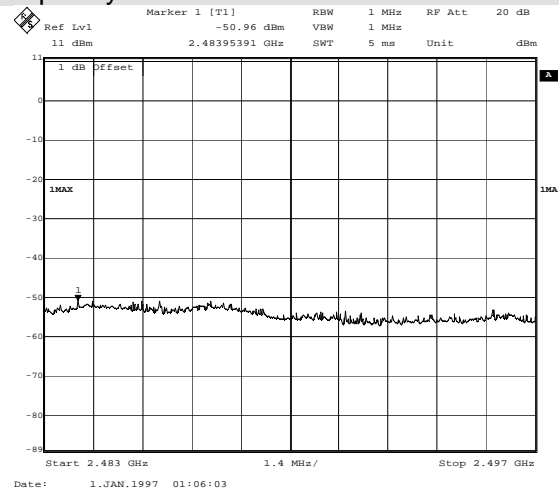
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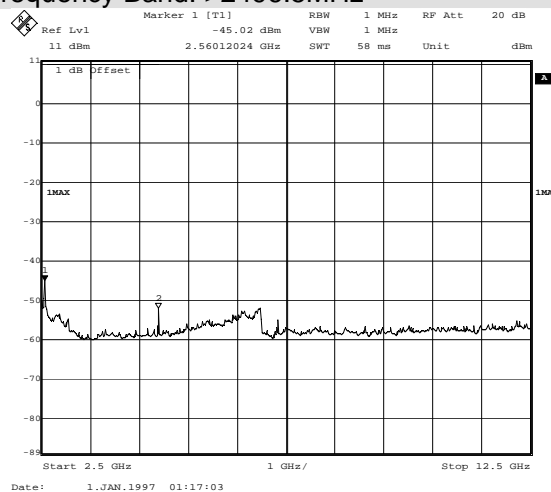
Frequency Band: 2387 ~ 2400MHz



Frequency Band: 2483.5~2496.5MHz



Frequency Band: >2496.5MHz



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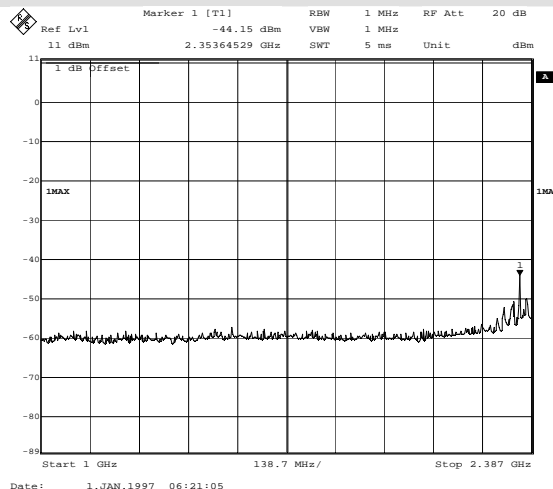
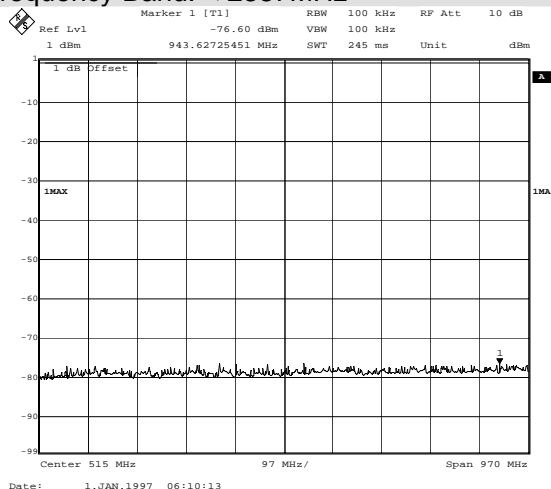
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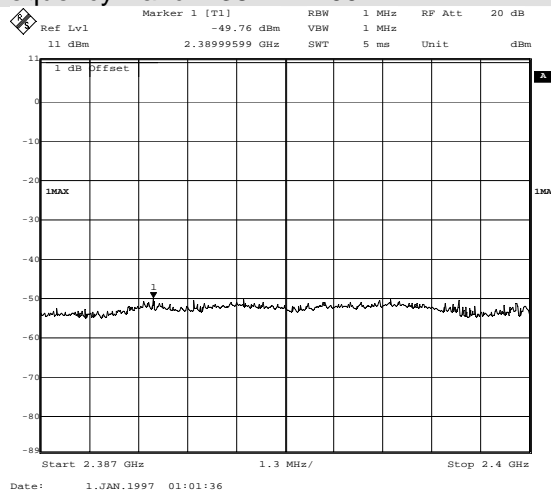
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Modulation type: GFSK, CH39

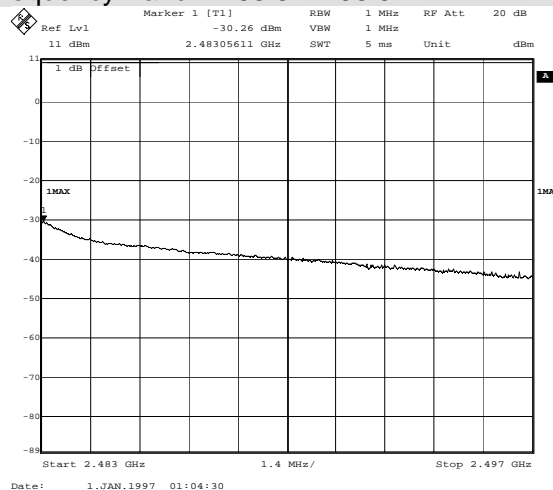
Frequency Band: < 2387MHz



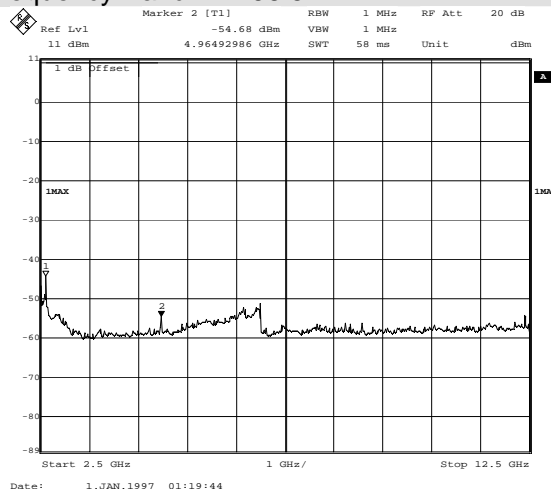
Frequency Band: 2387 ~ 2400MHz



Frequency Band: 2483.5~2496.5MHz



Frequency Band: >2496.5MHz



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6.6 Receiver Parameters

6.6.1 Spurious Emissions

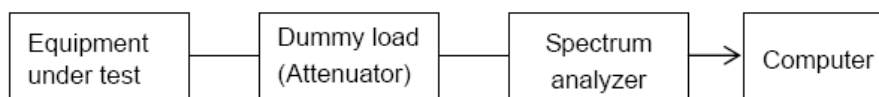
6.6.1.1 Test Limit

Limits:	
Modulation type	Limit
<1GHz	4nW
1GHz ~ 10GHz	20nW

6.6.1.2 Test Procedure

According to TELECOM-T401 Spurious and unwanted emission intensity measuring procedure.

6.6.1.3 Test Setup



6.6.1.4 Test Result and Data

Test date: 15 April 2016

Ambient temperature: 23°C

Atmospheric pressure: 1020 hpa

Relative humidity: 56%

Modulation type: GFSK						
Test Conditions	Operation Frequency (MHz) / Spurious Emission					
	CH00 2402MHz		CH19 2440MHz		CH39 2480MHz	
	MHz	μW	MHz	μW	MHz	μW
Frequency Band: < 1GHz						
Vnom	947.52	0.00003	556.79	0.00002	733.69	0.0002
Vmax	947.52	0.00003	556.79	0.00002	733.69	0.0002
Vmin	947.52	0.00003	556.79	0.00002	733.69	0.0002
Frequency Band: 1GHz – 12.5GHz						
Vnom	6922.85	0.00048	6922.85	0.00059	6945.89	0.00073
Vmax	6922.85	0.00049	6922.85	0.00057	6945.89	0.00071
Vmin	6922.85	0.00048	6922.85	0.00050	6945.89	0.00071

6.6.1.5 Test Equipment

Instrument	Model No.	Manufacturer	Serial No.	Calibration Date
Signal analyzer	FSIQ26	R&S	100311	2015/03

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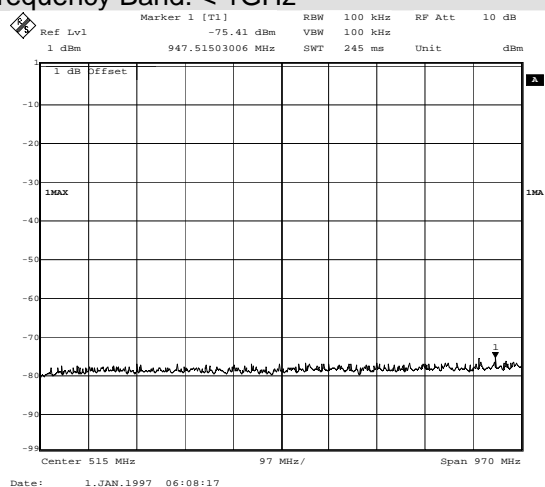
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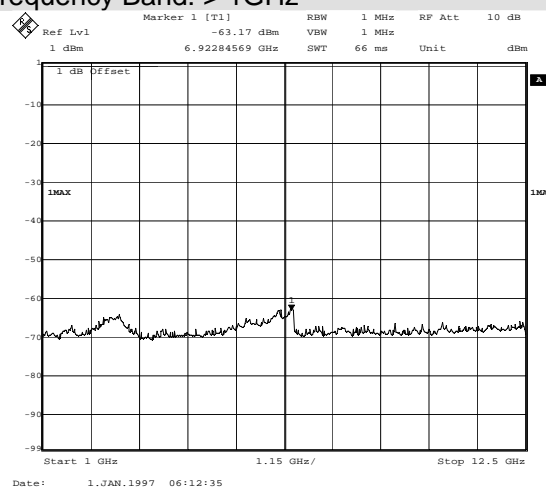
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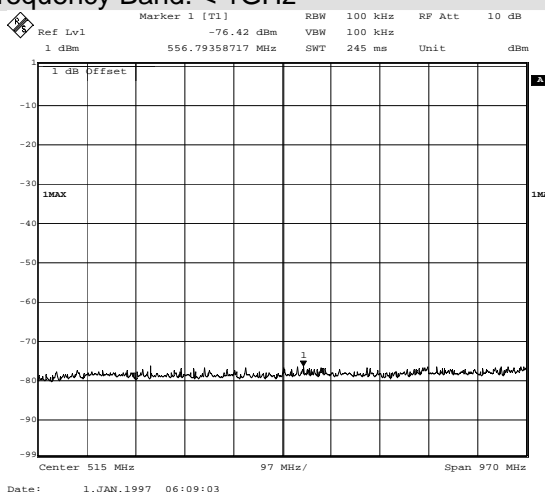
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Frequency Band: < 1GHz



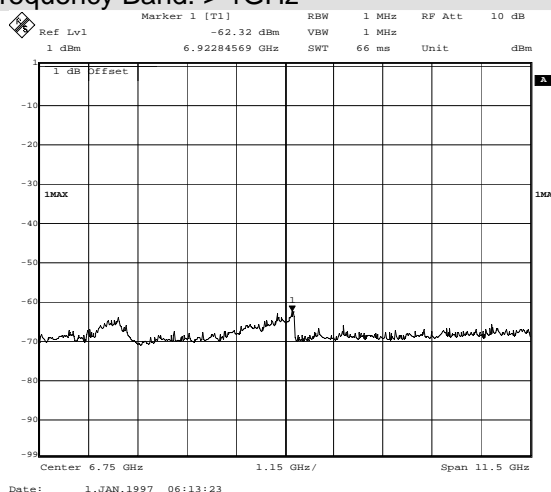
Frequency Band: > 1GHz



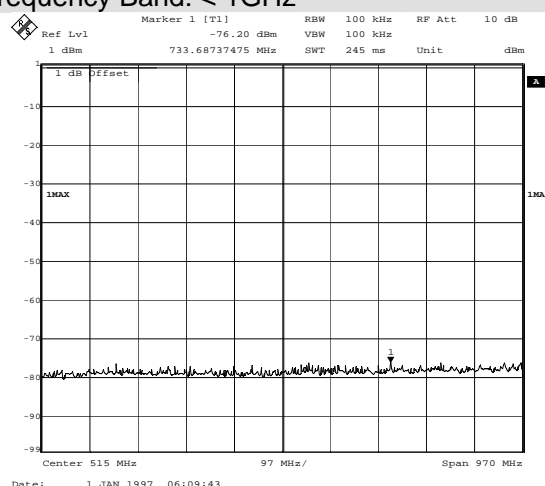
Modulation type: GFSK, CH19
Frequency Band: < 1GHz



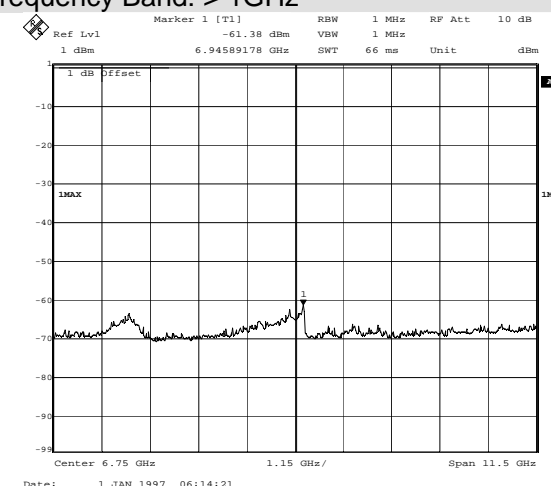
Frequency Band: > 1GHz



Modulation type: GFSK, CH39
Frequency Band: < 1GHz



Frequency Band: > 1GHz



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7.0 Angular Width of Principal Radiation

7.1 Test Result

Antenna Type & Gain	1, External antenna (Pulse-W1030), 2.0dBi
	2, External antenna (Taoglas-FXP73.07.0100A), 2.5dBi
	3, External antenna (Pulse-W1027), 3.2dBi
	4, External antenna (Kinsun-6670113050-145), 2.0dBi
	5, External antenna (Kinsun-6610103081), 5.0dBi
Cable Loss (dB)	1
Max EIRP (dBm/MHz) (Note:5dBi Antenna)	8.95
Half Power Beam Angles (deg)	360
Limit of E.I.R.P (dBm/MHz)	12.14
Result	Pass

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8.0 TEST PHOTOGRAPHS



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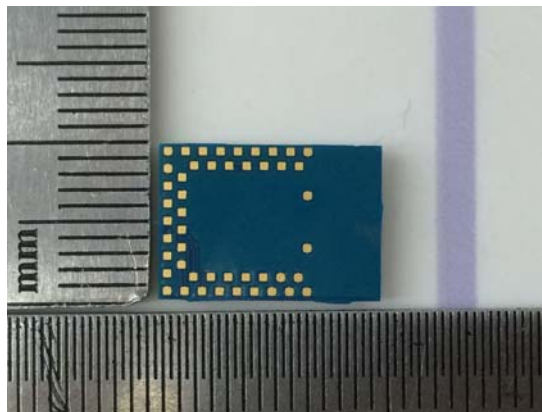
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9.0 External And Internal Photos of the EUT



External view 1



External view 2



External antenna 1 Pulse- W1030 (Gain 2.0dBi) view

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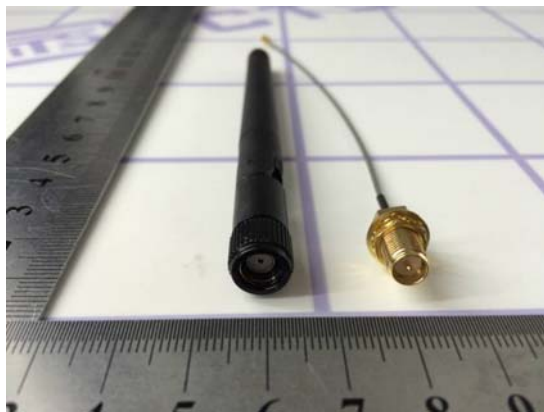
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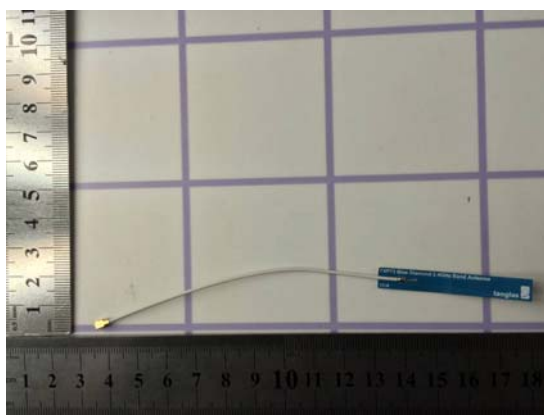
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External antenna 1 Pulse- W1030 (Gain 2.0dBi) antenna port view



External antenna 2 Taoglas-FXP73.07.0100A (Gain 2.5dBi) side 1 view



External antenna 2 Taoglas-FXP73.07.0100A (Gain 2.5dBi) side 2 view

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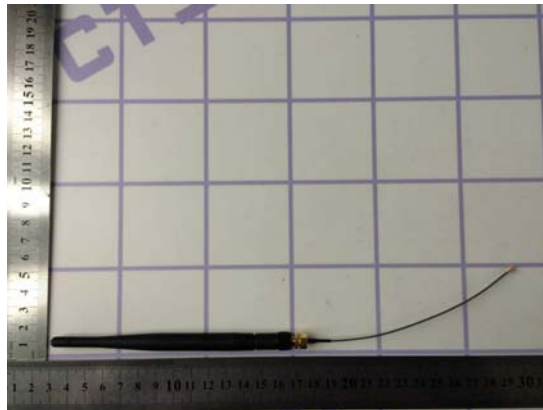
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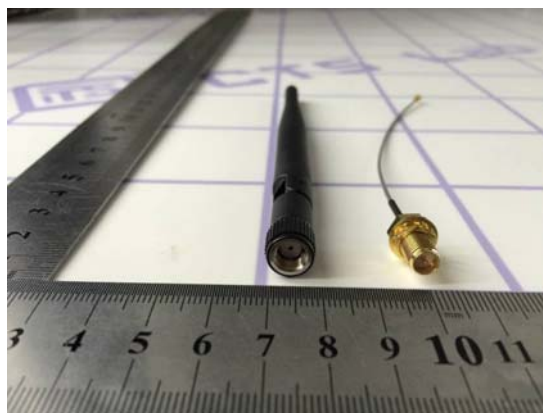
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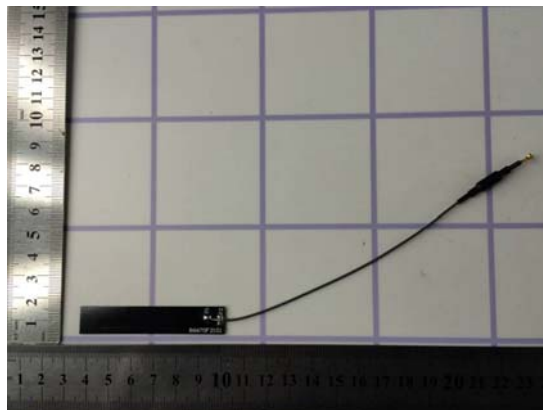
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External antenna 3 Pulse-W1027 (Gain 3.2dBi) view



External antenna 3 Pulse-W1027 (Gain 3.2dBi) antenna port view



External antenna 4 Kinsun-6670113050-145 (Gain 2.0dBi) side 1 view

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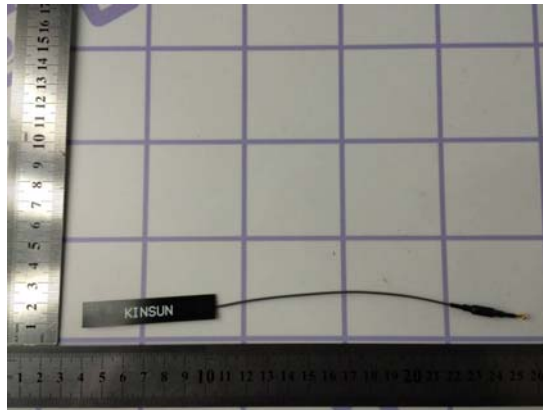
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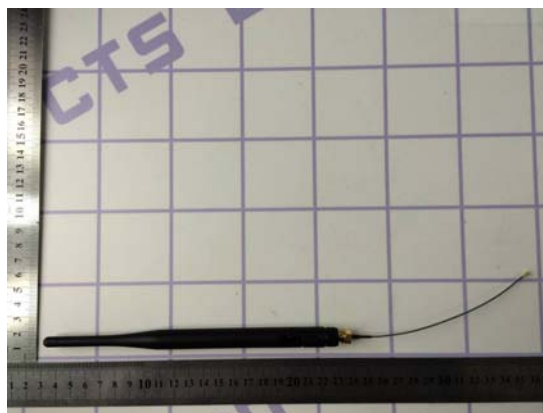
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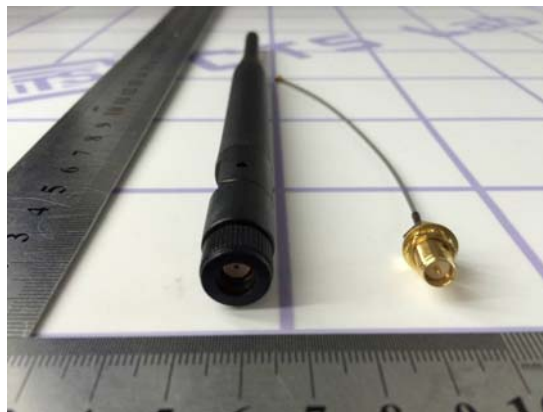
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External antenna 4 Kinsun-6670113050-145 (Gain 2.0dBi) side 2 view



External antenna 5 Kinsun- 6610103081 (Gain 5 dBi) view



External antenna 5 Kinsun- 6610103081 (Gain 5 dBi) antenna port view

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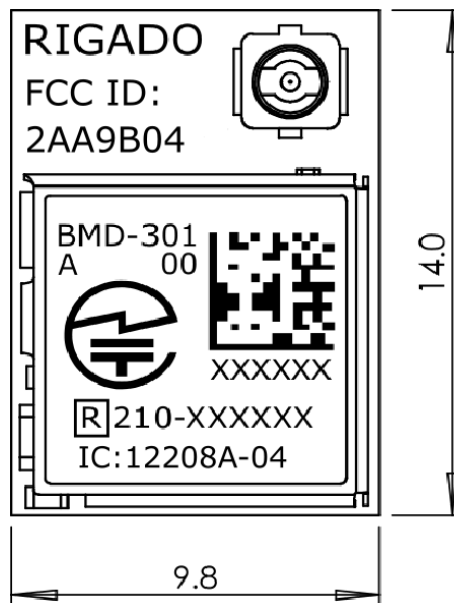
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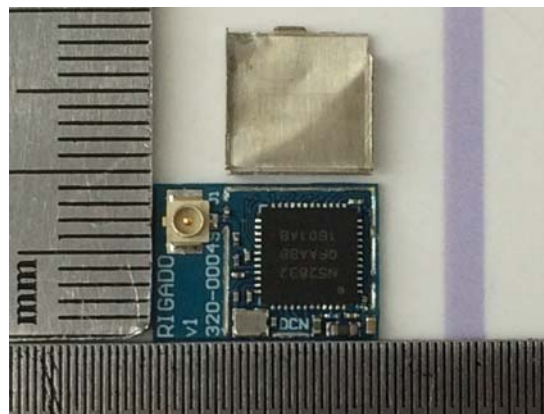
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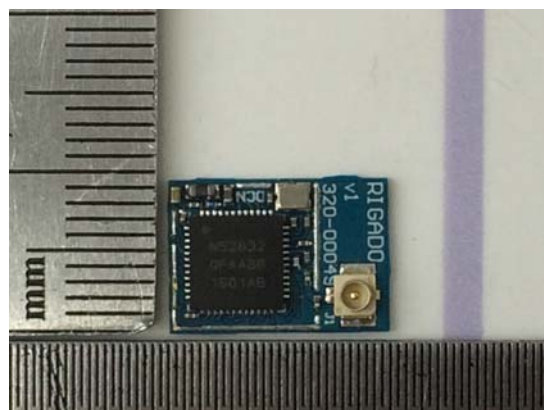
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Label



Internal view



PCB side 1 view

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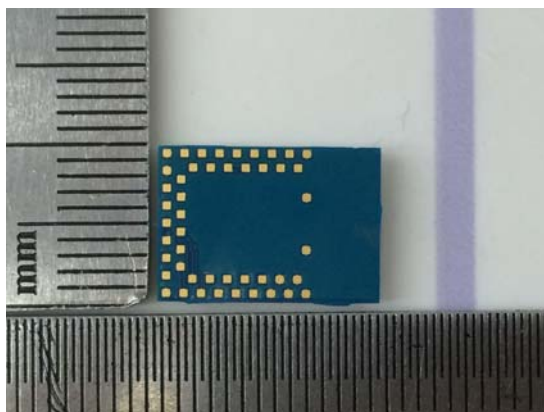
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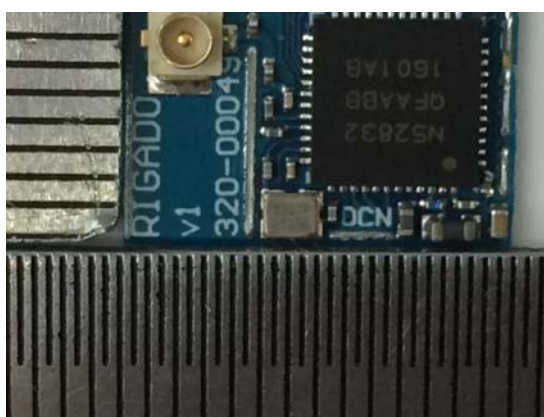
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PCB side 2 view



Oscillator view

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