

**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

TEST REPORT**Report Reference No. : GTS20230105004-1-8**

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Date of issue : Feb. 15, 2023

Representative Laboratory Name : Shenzhen Global Test Service Co.,Ltd.

Address : No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, China

Applicant's name : CHITECH SHENZHEN TECHNOLOGY CO.,LTD

Address : 101, NO.48, Xiashijia Road, Gongming Town, Guangming Dist., Shenzhen, China

Test specification

Standard..... : **MIC Notice No.88 Appendix No.43 Article 2 Paragraph 1 Item 19 ARIB STD-T66 V3,7**

TRF Originator : Shenzhen Global Test Service Co.,Ltd.

Master TRF : Dated 2014-12

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Test item description

Trade Mark..... : TIBUDA

Manufacturer : CHITECH SHENZHEN TECHNOLOGY CO.,LTD

Model/Type reference : M1

List Model..... : minis,T100, GT mini, M100, M200, Z2, Z1

Operation Frequency : From 2412MHz to 2472MHz

Hardware version : MX-ANB03_MB_V200

Software version : 10.0.22621 Build 22621

Ratings : DC 12.0V/3.0A by Adapter

Result : **PASS**

TEST REPORT

Test Report No. :	GTS20230105004-1-8	Feb. 15, 2023 Date of issue
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Equipment under Test : Mini PC

Model /Type : M1

Listed model : minis,T100, GT mini, M100, M200, Z2, Z1

Applicant : **CHITECH SHENZHEN TECHNOLOGY CO.,LTD**

Address : 101, NO.48, Xiashijia Road, Gongming Town, Guangming Dist.,
Shenzhen, China

Manufacturer : **CHITECH SHENZHEN TECHNOLOGY CO.,LTD**

Address : 101, NO.48, Xiashijia Road, Gongming Town, Guangming Dist.,
Shenzhen, China

Test Result:	PASS
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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. TEST STANDARDS

The tests were performed according to following standards:

[MIC Notice No.88 Appendix No.43 Article 2 Paragraph 1 Item 19](#)

[ARIB STD-T66 V3,7](#)

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Dec. 28, 2022
Testing commenced on	:	Dec. 28, 2022
Testing concluded on	:	Feb. 13, 2023

2.2. Product Description

Product Name:	Mini PC
Trade Mark:	TIBUDA
Model/Type reference:	M1
List Model:	minis,T100, GT mini, M100, M200, Z2, Z1
Model Declaration	PCB board, structure and internal of these model(s) are the same, Only the model name different , So no additional models were tested.
Power supply:	DC 12.0V/3.0A by Adapter
BT	
Operation frequency	2402-2480MHz
Channel Number	79 channels for Bluetooth (DSS) 40 channels for Bluetooth (DTS)
Channel Spacing	1MHz for Bluetooth (DSS) 2MHz for Bluetooth (DTS)
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth (DSS) GFSK for Bluetooth (DTS)
WIFI	
WLAN	Supported 802.11 a/b/g/n/ac
Modulation Type	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11ac20/40/80: OFDM(256QAM,64QAM, 16QAM, QPSK, BPSK)
Operation frequency	IEEE 802.11a:5180-5240MHz IEEE 802.11b:2412-2472MHz IEEE 802.11g:2412-2472MHz IEEE 802.11n HT20:2412-2472MHz, 5180-5240MHz IEEE 802.11n HT40: 2422-2462MHz, 5190-5230MHz IEEE 802.11ac20:5180-5240MHz IEEE 802.11ac40:5190-5230MHz IEEE 802.11ac80:5210MHz
Channel number	13 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20) 9 Channels for WIFI 40MHz Bandwidth(802.11n-HT20) 4 channels for 20MHz bandwidth(5180-5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Antenna Description	Two Internal antennas; support 2*2MIMO technology ANT1 used for BT&WIFI TX/RX, 2.00 dBi(Max.) for 2.4G Band and 2.00dBi(Max.) for 5G Band ANT2 used for WIFI TX/RX, 2.00 dBi(Max.) for 2.4G Band and 2.00dBi (Max.) for 5G Band

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	☐ 120V / 60 Hz	☐ 230V / 50Hz
		☒ 12 V DC	☐ 24 V DC
		☐ Other (specified in blank below)	

DC 12.0V

Description of the test mode

IEEE 802.11b/g/n: Thirteen channels are provided to the EUT.

13 channels are provided for 802.11b/g/n

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

Test Frequency List

Modulation Type	Test Frequency					
	Lowest		Middle		Highest	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
802.11b	1	2412	7	2442	13	2472
802.11g	1	2412	7	2442	13	2472
802.11n HT20	1	2412	7	2442	13	2472
802.11n HT40	3	2422	7	2442	11	2462

Summary of measurement results

EUT and Module Power tables				
EUT Setup Value(Vdc)		Normal	High(+10%)	Low(-10%)
		12.0	13.2	10.8
Module Vdd Power Measurement Value(Vdc)		Normal	High(+1%)	Low(-1%)
		3.303	3.306	3.297
Voltage error(%)	Result	Ref.level	0.09	-0.18
	Limit	---	±1	
Judgment		---	pass	pass

NOTE:When EUT be operated at 10% from the normal supply voltage,the battery voltage of RF part was varied within ±1%.All test cased were done under the normal battery voltage.

2.4. Table for Parameters of Test Software Setting

During testing, Channel & Power Controlling commands provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters:

Test Method	setup.exe		
Frequency	2412MHz	2442MHz	2472MHz
802.11b (20MHz)	Default	Default	Default
802.11g (20MHz)	Default	Default	Default
802.11n (20MHz)	Default	Default	Default
Frequency	2422MHz	2442MHz	2462MHz
802.11n (40MHz)	Default	Default	Default

2.5. Description of the Equipment under Test (EUT)

Reference documents:	802.11™ WLAN		
Special test descriptions:	None		
Configuration descriptions:	TX tests: performed at the lowest, the middle, and the highest channel RX/Standby tests: WLAN test mode enabled, scan enabled, TX Idle		
Test mode:	☒ Special software is used. EUT is transmitting pseudo random data by itself		
802.11™ WLAN standard capabilities:	channel numbers:	2.4GHz Band	☒ 802.11b:13; ☒ 802.11g:13; ☒ 802.11n HT20:13; ☒ 802.11n HT40:9
	channel separation:	5MHz	
	used freq. range:	☒ 2412-2472MHz; ☒ 2422-2462MHz;	
	modulation types:	☒ DSSS; ☒ OFDM	
	Used Bandwidth:	☒ 20MHz; ☒ 40MHz	

2.6. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

●	Adapter	Length (m) :	1.2M
		Shield :	Unscreened Cable
		Detachable :	N/A

2.7. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, China.

3.2. Test Facility

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

CNAS (No. CNAS L8169)

Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)

Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

Industry Canada Registration Number. is 24189.

FCC Designation Number is CN1234.

FCC Registered Test Site Number is 165725.

3.3. Environmental conditions

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

Normal Temperature: 25 °C

High Temperature: 55 °C

Low Temperature: -20 °C

Normal Voltage : DC 12.0V

High Voltage: DC 13.2V

Low Voltage: DC 10.8V

Relative Humidity: 55 %

Air Pressure: 989 hPa

3.4. Test Description

3.4.1 Main Terms

Verdict Verdict of each test cases.

Test Case Test cases identification number and description in 3GPP test specification and ETSI specification.

3.4.2 Terms used in Condition column

NTC	Normal voltage, Normal Temperature
HV	High voltage, Normal Temperature
LV	Low voltage, Normal Temperature
HT	High Temperature, Normal voltage
LT	Low Temperature, Normal voltage
HTHV	High voltage, High Temperature
LTHV	High voltage, Low Temperature
HTLV	Low voltage, High Temperature
LTLV	Low voltage, Low Temperature
Vib	Vibration

3.4.3 Terms used in Verdict column

Pass	This test cases has been tested, and EUT is conformant to the applied standards in the given frequency band.
Fail	This test cases has been tested, but EUT is not conformant to the applied standards in the given frequency band.
N/A	This test case is either not required/not applicable in the specified band or is not applicable according to the specific PICS/PIXIT for the EUT.
Inc	Test case result is ambiguous in the given frequency band.

Decl Declaration is received from the client to demonstrate the conformity to the relevant specification in the given frequency band.

BR This test cases is not tested in the given frequency band, but this testcases was tested with pass result for the initial model in the given frequency band.

3.4.4 Sumarry of measurement results



No deviations from the technical specifications were ascertained
There were deviations from the technical specifications ascertained

MIC Notice No.88 Appendix No.43 Article 2 Paragraph 1 Item 19		
Clause	Description of Test (Transmitter Parameters)	Result
6	Antenna Power	PASS
6	Tolerances for Antenna Power	PASS
3	Frequency Tolerance	PASS
4	Transmission Rate	PASS
4	Occupied Frequency Bandwidth	PASS
4	Spread Bandwidth	PASS
5	Spurious Emissions	PASS
10	Transmission Antenna Gain (EIRP Antenna Power)	PASS
11	Transmission Radiated Angle Width (3dB Beam width)	N/A
12	Interference prevention function	PASS
8	Carrier Sensing function	PASS
Receiver Parameters		
7	Secondary Radiated Emissions	PASS
Note: (1) N/A is an abbreviation for Not Applicable. (2) N/T means this test item is not tested.		

Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not applicable; NP = Not performed

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Mode	Data Rate
11b/CCK	1 Mbps
11g/OFDM	6 Mbps
11n HT20/OFDM	6.5 Mbps
11n HT40/OFDM	13.5 Mbps

3.5. 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 TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics;Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics;Part 2 " and is documented in the Shenzhen Global Test Service Co.,Ltd 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.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Parameter	Uncertainty
Frequency error / 99%&90% bandwidth	$\pm 1.62 \times 10^{-6}$
Total RF power, conducted	$\pm 0.8\text{dB}$
Spurious emissions, conducted	$\pm 0.8\text{dB}$
DC and low frequency voltages	$\pm 0.05\%$
Humidity	$\pm 5\%$
Temperature	$\pm 1^\circ\text{C}$

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$.

3.6. Equipments Used during the Test

Details for Conducted test equipment

Item	Test Equipment	Manufacturer	Model No.	Serial No	Last Cal.
1	Spectrum Analyzer	Agilent	N9020A	MY48010425	2022/09/09
2	RF Cable	H&S	GTS-C008	---	2022/07/13
3	DC Power Supply	Yizhan	PS-202D	40015841	2022/09/09
4	Oscilloscope	Tektronix	TDS3012	B035361	2022/09/08
5	Signal generator	Agilent	E4421B	3610AO1069	2022/09/09

The Cal. Interval was one year.

4. TEST CONDITIONS AND RESULTS

4.1. Antenna Power Measurement

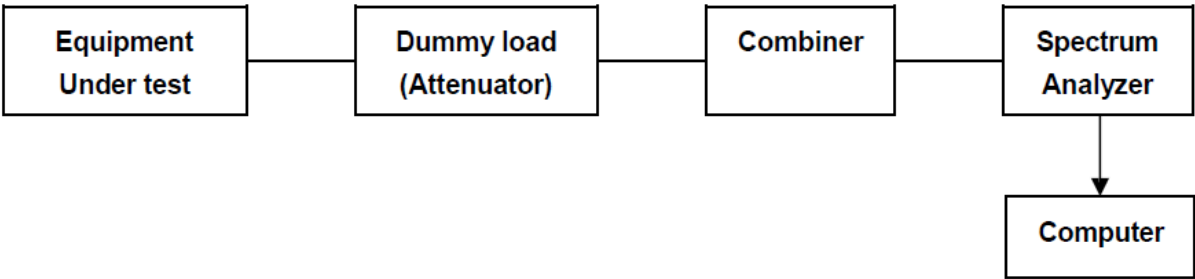
LIMIT

Limit	10mW/MHz
Tolerance	+20%,-80%

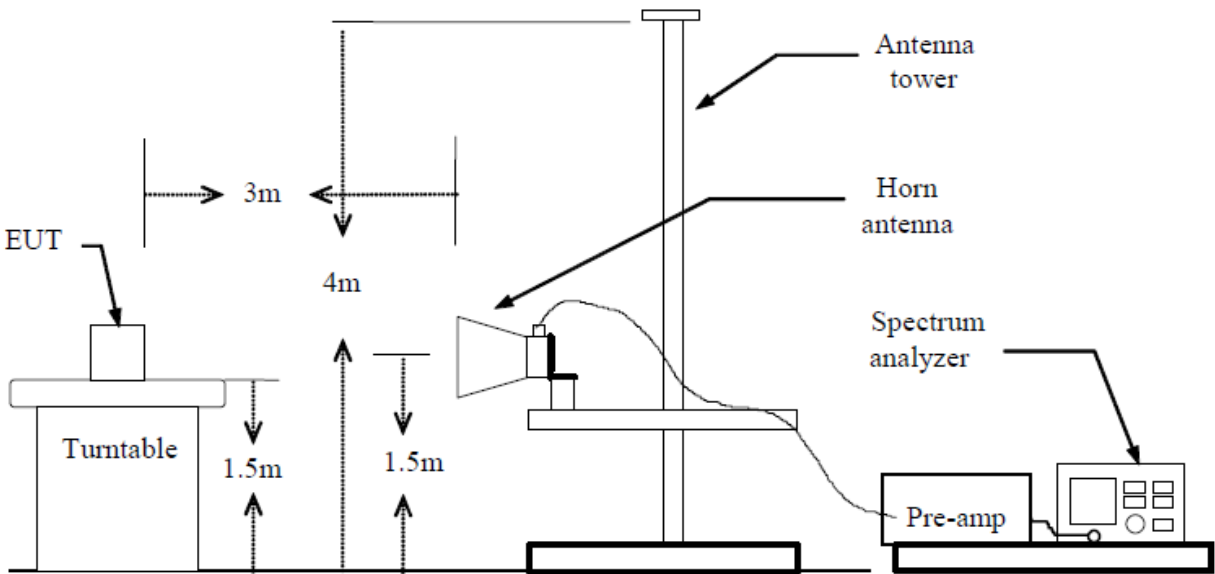
Upper Limit of EIRP for Modulation Systems

Modulation system	Frequency band used	Antenna power (max.)	EIRP (max.)	
			Omnidirectional case	Directional case
DS, OFDM	2,400 - 2,483.5 MHz	10 mW/MHz	12.14 dBm/MHz	22.14 dBm/MHz
FH, DS-FH FH-OFDM	2,400 - 2,483.5 MHz	3 mW/MHz	6.91 dBm/MHz	16.91 dBm/MHz
	Excluding 2,427 - 2,470.75 MHz	10 mW/MHz	12.14 dBm/MHz	22.14 dBm/MHz
Other than the above	2,400 - 2,483.5 MHz	10 mW	12.14 dBm	22.14 dBm

TEST CONFIGURATION



Conduction Method



Radiation Method

Note

1. Connect the power meter directly to the output of the dummy load when it is necessary to measure the total power of EUT other than the direct sequence spread-spectrum system.
2. Use the computer for measuring the spread-spectrum bandwidth.

TEST PROCEDURE

1. Measure the equivalent noise bandwidth of the spectrum analyzer at the resolution bandwidth of 1 MHz to obtain correction coefficient.
If the spread-spectrum bandwidth is under 1 MHz, correct the measure value only when “spread-spectrum bandwidth (MHz) /equivalent noise bandwidth (MHz)” is over 1.
2. Attenuation of the attenuator shall be set to provide an optimum input level to the spectrum analyzer if need.
3. Set the spectrum analyzer as follows to search the frequency giving the maximum antenna power:
Center frequency: Center frequency of service bandwidth (e.g. 2412 MHz)
Frequency sweep width: 40 MHz
Resolution bandwidth: 1 MHz
Video bandwidth: Approximately 3 times the resolution bandwidth (e.g. 3 MHz)
Sweep time: Minimum time to ensure the measuring accuracy (In case of burst wave, one burst shall be included per data point).
Trigger condition: Free run
Data points: 400 points or more (e.g. 1001 points)
Sweep mode: Continuous sweep
Detection mode: Positive peak
Indication mode: Maximum hold
4. Set the spectrum analyzer as follows for measuring antenna power. Connect the power meter to the IF output of spectrum analyzer, and calibrate the indication of the power meter to the output value of the EUT.
Center frequency: Frequency giving the maximum power (searched frequency)
Frequency sweep width: 0 Hz
Resolution bandwidth: 1 MHz
Video bandwidth: Approximately the same bandwidth as resolution bandwidth
Sweep mode: Continuous sweep

Conditions of Equipment under Test

Set to the test frequency and spread-spectrum code. Modulate it with standard coded test signal.

Measuring Operation Procedures

In case of direct sequence spread-spectrum system, operate the EUT as follows:

1. Set the spectrum analyzer according to 3.4
2. Repeat the sweeping until the spectrum analyzer no longer indicates variation.
Measure a frequency that output the maximum power 1 MHz
3. Connect the power meter to the IF output of the spectrum analyzer.
4. Set the spectrum analyzer to 3.4
5. Antenna shall be as follows:
 - a. In case of continuous waves: Corrected value from power meter indication according to 3.6 (1).
 - b. In case of burst waves: Calculated value from the corrected value same as for continuous wave and the ratio of transmission time.
If there are sections where data is not transmitted and these signal level is lower than that of section where data is transmitted these sections are regarded as a burst stopping period and these sections shall not be measured.

In the case of the frequency hopping system or the combination of the system and the direct sequence spread-spectrum system, operate the EUT as follows:

1. Connect the power meter to the output of the attenuator and measure the total power.
2. Divide the total power with the spread-spectrum bandwidth and determine the mean power pre 1 MHz.
3. Check and see if the hopping frequencies are uniformly distributed according to the submitted document. If not uniformity distributed, the measuring method should be considered particularly according to the submitted document.
4. Antenna power shall be as follows:

- a. In case of continuous waves: Value in step (2).
 b. In case of burst waves: Calculated value from the value in step (2) and ratio of transmission time.
 In the case of other modulation mode, operate the equipment under the test as follows:

1. Connect the power meter to the output of the attenuator and measure the total power.
2. Antenna power shall be as follows:
 - a. In case of continuous waves: Value in step (1).
 - b. In case of burst waves: Calculated value from the value in step (2) and the transmission time ratio.

Sections where data is not transmitted shall be treated as same as in case direct sequence spread-spectrum system

EUT DESCRIPTION:

Mode:	☒ 802.11b	☒ 802.11g	☒ 802.11n HT20	☒ 802.11n HT40
Test Channel	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2422MHz ☒ 2442MHz ☒ 2462MHz
Bandwidth	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☐ 20MHz ☒ 40MHz
Modulation Type	☒ DSSS ☐ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM
Channel Separation	☒ 5MHz	☒ 5MHz	☒ 5MHz	☒ 5MHz

MEASUREMENT DESCRIPTION

Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

For reporting purpose only.

Antenna 1:

Please refer to Appendix C-ANT1-Appendix C.2.

Antenna 2:

Please refer to Appendix C-ANT2-Appendix C.2.

MIMO:

Mode	Channel (MHz)	Measured EIRP (dBm/MHz)		MIMO (dBm/MHz)	Limit (dBm/MHz)
		Antenna 1	Antenna 2		
802.11n HT20	2412	3.37	5.19	7.38	12.14
	2442	4.44	6.23	8.44	12.14
	2472	4.58	5.76	8.22	12.14
802.11n HT40	2422	2.35	2.35	5.36	9.13
	2442	0.82	3.34	5.27	9.13
	2462	1.52	3.10	5.39	9.13

Note :

1. Measured Power include the cable loss.
2. The item was tested at 23°C and 50% humidity condition;
3. Refer to following test plots.
4. Declared E.I.R.P= Conduced test Power+ Antenna gain

4.2. Transmission Radiated Angle Width (3dB Beam width)

Measuring system diagram



Test equipment

Spectrum Analyzer

Condition of measuring instruments

Set the spectrum analyzer as follows.

- Center frequency test frequency
- Sweep frequency width 0 Hz
- Resolution bandwidth 1 MHz
- Video bandwidth 1 kHz
- Level at which the amplitude of the input level transmission signal becomes the maximum near the linear region of the mixer
- Sweep time
- Optimum time to observe changes in received power
- Sweep mode Continuous sweep
- Detection mode Positive peak

Test equipment status

Set to the test frequency and transmit.

- (1) Make the height and direction of the test equipment and measurement antenna oppose each other.
- (2) Spectrum analyzer is set as shown in 2, so that the received power can be observed in the optimum state. Set and receive the analyzer.
- (3) Rotate the test equipment to the horizontal plane and the vertical plane, and adjust the direction to the maximum receive power.
- (4) Change the ground level of the measuring antenna between ± 50 cm around the antenna of the test equipment and measure. Adjust the orientation of the antenna to find the position where the received power is the maximum, and the finger of the spectrum analyzer at this point. Let the indication be "E".

(5) Using an equivalent isotropically radiated power PE of the test device was measured in terms paragraph 10. Trial allowed the following equation

It calculates an angle Θ_0 of the main radiation horizontal and vertical planes of the test equipment.

$$\Theta_0 = 360 / A$$

Θ_0 : main radiation angle of the transmitting antenna of the test equipment allowed (half-value angle) (degrees)

P E: test equipment of the equivalent isotropic radiated power (dBm)

A: Equivalent isotropic radiant power is transmitted to the transmitting antenna with absolute gain of 2.14 dBi and average power is 10 mW (Orthogonal Frequency Numerical division multiplexing, direct spreading, frequency hopping, direct spreading and frequency hot. Using a ping composite scheme or a combination of orthogonal frequency division multiplexing and frequency hopping. It is 10 mW / MHz in case of it. However, frequency hopping method, direct diffusion and circumference. Complex method of wave number hopping or composite method of orthogonal frequency division multiplexing and frequency hopping of the ones using expressions, use radio waves with frequencies between 2,427 MHz and 2,470. 75 MHz. For 3mW / MHz.) Divided by the value obtained by adding the antenna power of, If it is less than 1, it is 1.

- (6) The test equipment is rotated in the horizontal plane direction and the reception power is lowered by 3 dB from the maximum point "E"

Table of angle (θ_h : half-value angle of the horizontal plane) is measured.

(7) test equipment in a horizontal plane direction, the radiation angle except the angle Θ_0 of the main radiation calculated in (5) from the main radiation directions

About the whole circumference as much as possible, 3 dB or more from the maximum point "E" of received power received power is low

Make sure you are doing it.

(8) Horizontal direction when the test equipment is tilted in the vertical plane direction and the reception power is lowered by 3 dB from the maximum point "E"

Angle from (Θ_v : half-value angle in the vertical plane) is measured.

(9) After returning the test equipment the position of (3), spokes excluding angle Θ_0 of the main radiation calculated in (5) from the main radiation directions

As for the angle of elevation as wide as possible (set to 90 degrees or more, however, it is also possible to measure according to 6)

Tilt the test equipment in the direction of the vertical plane, 3 dB or more from the maximum point "E" of the received power

Confirm that the upper received power is decreasing.

Test Result

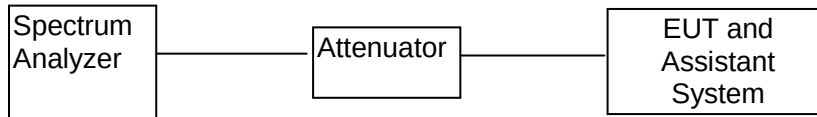
Not Applicable

4.3. Frequency Tolerance

LIMIT

+/- 50×10^{-6} or less (50ppm)

TEST CONFIGURATION



TEST PROCEDURE

1. Configure EUT and assistant system according clause 2.3 and 4.3
2. Set EUT work in carrier Tx mode as described in clause 2.3
3. (3) Connected the EUT's antenna port to the Spectrum Analyzer by suitable attenuator, set the Spectrum Analyzer as below:
 Centre Frequency: The centre frequency of the channel under test.
 Resolution BW: 10KHz.
 Video BW: 10KHz.
 Span: 1MHz.
 Detector: Peak.
 Trace Mode: Max Hold.
4. When the trace is complete, find the peak value of the power envelope and record the frequency.

MEASUREMENT DESCRIPTION

Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Antenna 1:

Please refer to Appendix C-ANT1-Appendix C.1.

Antenna 2:

Please refer to Appendix C-ANT2-Appendix C.1.

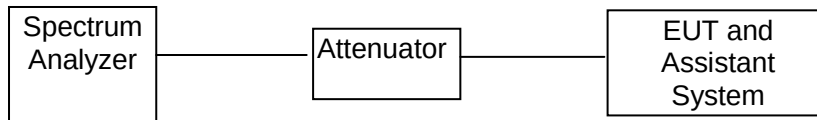
Note: 1. The item was tested at 23°C and 50% humidity condition;

4.4. Occupied Frequency Bandwidth

LIMIT

Occupied bandwidth: FH $\leq$ 83.5 MHz; OFDM $\leq$ 40 MHz, DS $\leq$ 26 MHz; Others $\leq$ 26 MHz
 Spread Bandwidth: $\geq$ 500 kHz(FH,DS)
 Spread factor $>$ 5.

TEST CONFIGURATION



Note : Connect the power meter directly to the output of the dummy load when it is necessary to measure the total power of EUT other than the direct sequence spread-spectrum system.

TEST PROCEDURE

1. Spectrum analyzer shall be follows:
 Center frequency: Center frequency of service band (e.g. 2412 MHz).
 Frequency sweep width: Approximately 2 to 3 times of the tolerance value (e.g. 167 MHz).
 Resolution bandwidth: Approximately 3% of tolerance value (e.g. 300 kHz)
 Video bandwidth: Approximately the same as the resolution bandwidth.
 Y-axis scale: 10dB/Div.
 Input level: Carrier level shall be enough higher than floor noise of spectrum analyzer.
 Sweep time: Minimum time to ensure the measuring accuracy (In case of burst wave, one burst shall be included per data point.)
 Data points: 400 points or more (e.g. 1001 points)
 Sweep mode: Continuous
 Detection mode: Positive peak
 Display mode: Maximum hold
2. The values measured by the spectrum analyzer shall be processed by external or internal computer.

Conditions of Equipment under Test

Set to testing frequency and modulate using standard encoding test signals.

Measuring Operation Procedures

1. After repeating sweeps until the display shows steady data, store the values at all data points to the array variables of computer.
2. Convert the dBm values at all data point to the antilogarithm values on the power dimension.
3. Obtain the sum total of the power at all data points, and store it as "Total power".
4. Accumulate the power at each data point sequentially upward from the data point for the lowest frequency. Obtain the limit data point where the accumulated power equals 0.5% (5% when spread-spectrum bandwidth) of the "total power". Convert this limit data point into frequency, and store it as the "lower limit frequency".
5. Accumulate the power at each data point sequentially downward from the data point for the highest frequency. Obtain the limit data point where the accumulated power equals 0.5% (5% when spread-spectrum bandwidth) of the "Total power". Convert this limit data point into frequency, and store it as the "Upper limit frequency".

EUT DESCRIPTION:

Mode:	☒ 802.11b	☒ 802.11g	☒ 802.11n HT20	☒ 802.11n HT40
Test Channel	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2422MHz ☒ 2442MHz ☒ 2462MHz
Bandwidth	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☐ 20MHz ☒ 40MHz
Modulation Type	☒ DSSS ☐ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM
Channel Separation	☒ 5MHz	☒ 5MHz	☒ 5MHz	☒ 5MHz

MEASUREMENT DESCRIPTION

Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS**Antenna 1:**

Please refer to Appendix C-ANT1-Appendix C.3.

Antenna 2:

Please refer to Appendix C-ANT2-Appendix C.3.

Note:

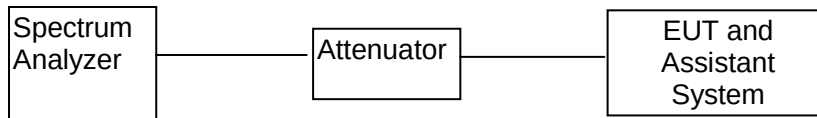
1. The test results including the cable loss.
2. The item was tested at 23°C and 50% humidity condition;
3. Refer to following test plots.

4.5. Spread Bandwidth Measurement

LIMIT

In spread spectrum systems, spread bandwidth (which refers to a frequency bandwidth with an upper limit and lower limit such that each of the mean powers radiated above the upper frequency limit and below the lower frequency limit is equal to 5 % of the total mean power radiated; this also applies hereafter) shall be 500 kHz or more.

TEST CONFIGURATION



Note :Connect the power meter directly to the output of the dummy load when it is necessary to measure the total power of EUT other than the direct sequence spread-spectrum system.

TEST PROCEDURE

1. Spectrum analyzer shall be follows:
Center frequency: Center frequency of service band (e.g. 241MHz).
Frequency sweep width: Approximately 2 to 3 times of the tolerance value (e.g. 167 MHz).
Resolution bandwidth: Approximately 3% of tolerance value (e.g. 300 kHz)
Video bandwidth: Approximately the same as the resolution bandwidth.
Y-axis scale: 10dB/Div.
Input level: Carrier level shall be enough higher than floor noise of spectrum analyzer.
Sweep time: Minimum time to ensure the measuring accuracy (In case of burst wave, one burst shall be included per data point.)
Data points: 400 points or more (e.g. 1001 points)
Sweep mode: Continuous
Detection mode: Positive peak
Display mode: Maximum hold
2. The values measured by the spectrum analyzer shall be processed by external or internal computer.

Conditions of Equipment under Test

Set to testing frequency and modulate using standard encoding test signals.

Measuring Operation Procedures

1. After repeating sweeps until the display shows steady data, store the values at all data points to the array variables of computer.
2. Convert the dBm values at all data point to the antilogarithm values on the power dimension.
3. Obtain the sum total of the power at all data points, and store it as "Total power".
4. Accumulate the power at each data point sequentially upward from the data point for the lowest frequency. Obtain the limit data point where the accumulated power equals 0.5% (5% when spread-spectrum bandwidth) of the "total power". Convert this limit data point into frequency, and store it as the "lower limit frequency".
5. Accumulate the power at each data point sequentially downward from the data point for the highest frequency. Obtain the limit data point where the accumulated power equals 0.5% (5% when spread-spectrum bandwidth) of the "Total power". Convert this limit data point into frequency, and store it as the "Upper limit frequency".

EUT DESCRIPTION:

Mode:	☒ 802.11b	☒ 802.11g	☒ 802.11n HT20	☒ 802.11n HT40
Test Channel	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2412MHz ☒ 2442MHz ☒ 2472MHz	☒ 2422MHz ☒ 2442MHz ☒ 2462MHz
Bandwidth	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☐ 20MHz ☒ 40MHz
Modulation Type	☒ DSSS ☐ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM
Channel Separation	☒ 5MHz	☒ 5MHz	☒ 5MHz	☒ 5MHz

MEASUREMENT DESCRIPTION

Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS**Antenna 1:**

Please refer to Appendix C-ANT1-Appendix C.4.

Antenna 2:

Please refer to Appendix C-ANT2-Appendix C.4.

Note:

1. The test results including the cable lose.
2. The item was tested at 23° C and 50% humidity condition;
3. Refer to following test plots.

Note 2: Spread Factor = Spread Bandwidth / TR
(TR = 1.375 for 802.11b;)

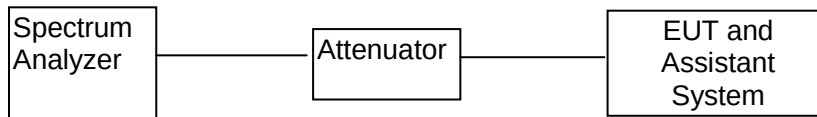
4.6. Transmitter Spurious Emissions (conducted) Measurement

LIMIT

Permissible mean power of spurious emission of each frequency supplied to a feeder, that is, mean power of spurious emission in the 1 MHz bandwidth at frequency f other than frequency band used shall be as follows:

- a. $2,387\text{MHz} \leq f \leq 2,400\text{MHz}$ and $2,483.5\text{MHz} < f \leq 2,496.5\text{MHz}$ 25 μW or less
- b. $2,387\text{MHz} > f$ and $2,496.5\text{MHz} < f$ 2.5 μW or less

TEST CONFIGURATION



Note :Connect the power meter directly to the output of the dummy load when it is necessary to measure the total power of EUT other than the direct sequence spread-spectrum system.

TEST PROCEDURE

1. When searching the spurious emissions, set spectrum analyzer as follows:
 Frequency sweep width: (Note 2).
 Resolution bandwidth: 1 MHz
 Video bandwidth: 10 kHz
 Y-axis scale: 10dB/Div.
 Input level: Enough level for maximum dynamic range
 Sweep time: Minimum time to ensure the measuring accuracy (In case of burst wave, one burst shall be included per data point.)
 Data points: 400 points or more (e.g. 1001 points)
 Sweep mode: Single sweep
 Detection mode: Positive peak
 Display mode: Maximum hold
 Note 2: Search spurious emissions from a low frequency as much as possible to about 3 times the carrier wave frequency (e.g. from 10 MHz to 2400 MHz and from 2483.5 MHz to 12.75 GHz). Setting the spectrum analyzer as
2. Set the spectrum analyzer for measuring spurious emissions as follows:
 Center Frequency: Center of carrier frequency and spurious frequency (searched frequency)
 Frequency sweep width: 0 MHz
 Resolution bandwidth: 1 MHz
 Video bandwidth: 1 MHz
 Y-axis scale: 10 dB/Div
 Input level: Transmission signal amplitude shall be in the vicinity of the maximum level in the linear region of the mixer.
 Sweep mode: Single sweep
 Detection mode: Sample

Conditions of Equipment under Test

Set the test frequency and test spread-spectrum code, and modulate it with a standard code test signal.

Measuring Operation Procedures

1. Set the spectrum analyzer according to 6.3.(1) and search for spurious emissions by repeating the sweeping until the spectrum analyzer no longer indicate variation. Determine the absolute value from the ratio of the spurious amplitude to the carrier wave amplitude and antenna power. If this value is under the standard value, do not measure by 6.3.(2) but use the determined absolute value as the measure value. If a value determined from the amplitude of searched spurious emission is over the tolerance value, narrowing down the frequency sweep bandwidth sequentially from 100 MHz to 1 MHz in order to raise the accuracy of the spectrum analyzer center frequency, obtain their spurious frequency.

2. Set the spectrum analyzer according to 6.3.(2) and determine the mean value of respective amplitude of the carrier wave and spurious. (In case of burst wave, these values are mean value within the burst period.) Determine an absolute value from the ratio of these two mean values and antenna power separately measured, and it shall be the measured value.
3. In case of the frequency hopping(FH) system and its mixture with the direct sequence spread-spectrum system, an absolute value shall be determined by multiplying the absolute value in (1) and (2) with the [spread-spectrum bandwidth (MHz)] divided by the [spread-spectrum bandwidth (MHz)]

NOTE:30~1000MHz, limit is 2.5uW/MHz=-26dBm/MHz=-36dBm/100KHz

EUT DESCRIPTION:

Mode:	☒ 802.11b	☒ 802.11g	☒ 802.11n HT20	☒ 802.11n HT40
Test Channel	☒ 2412MHz ☒ 2472MHz	☒ 2412MHz ☒ 2472MHz	☒ 2412MHz ☒ 2472MHz	☒ 2422MHz ☒ 2462MHz
Bandwidth	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☐ 20MHz ☒ 40MHz
Modulation Type	☒ DSSS ☐ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM
Channel Separation	☒ 5MHz	☒ 5MHz	☒ 5MHz	☒ 5MHz

MEASUREMENT DESCRIPTION

Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Antenna 1:

Please refer to Appendix C-ANT1-Appendix C.5.

Antenna 2:

Please refer to Appendix C-ANT2-Appendix C.5.

Note:

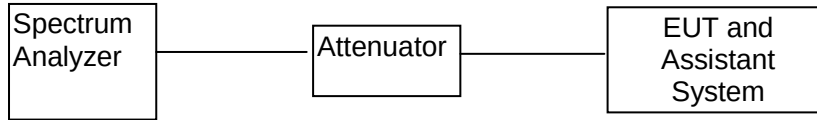
1. The test results including the cable lose.
2. The item was tested at 23°C and 50% humidity condition;
3. Refer to following test plots.

4.7. Secondary Radiated Emissions Measurement

LIMIT

The limit on secondary emissions radiated from the receiving equipment within which the function of other radio equipment will not be impaired shall be, in terms of the power of a dummy antenna circuit that has the same electrical constant as the receiving antenna, 4 nW or less at a frequency below 1 GHz and 20 nW or less at a frequency of 1 GHz or higher as measured using the circuit.

TEST CONFIGURATION



Note :Connect the power meter directly to the output of the dummy load when it is necessary to measure the total power of EUT other than the direct sequence spread-spectrum system.

TEST PROCEDURE

- Set the attenuation of the attenuator to under 20 dB because the subject for measurement is of low level.
- Set the spectrum analyzer as follow:
 Frequency sweep width: See 7.5 Measuring Operation Procedures
 Resolution bandwidth: A value determined by the specified dynamic range and the sweep time. (e.g. 30 MHz for 12.75 GHz sweep width and 30 second sweep time.)
 Video bandwidth: Approximately the same bandwidth as resolution bandwidth.
 Y-axis scale: 10 dB/Div
 Input level: 0 dB, if possible.
 Sweep mode: Single sweep
 Detection mode: Positive peak

Conditions of Equipment under Test

Set the EUT to receive the test frequency with forced continuous receiving control.

Measuring Operation Procedures

Sweep the spectrum analyzer from a low frequency to a frequency of 3 times if the carrier or over (e.g. 30 MHz to about 12.75 GHz) and measure the collateral radio emissions.

EUT DESCRIPTION:

Mode:	☒ 802.11b	☒ 802.11g	☒ 802.11n HT20	☒ 802.11n HT40
Test Channel	☒ 2412MHz ☒ 2472MHz	☒ 2412MHz ☒ 2472MHz	☒ 2412MHz ☒ 2472MHz	☒ 2422MHz ☒ 2462MHz
Bandwidth	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☒ 20MHz ☐ 40MHz	☐ 20MHz ☒ 40MHz
Modulation Type	☒ DSSS ☐ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM	☐ DSSS ☒ OFDM
Channel Separation	☒ 5MHz	☒ 5MHz	☒ 5MHz	☒ 5MHz

MEASUREMENT DESCRIPTION

Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Antenna 1:

Please refer to Appendix C-ANT1-Appendix C.6.

Antenna 2:

Please refer to Appendix C-ANT2-Appendix C.6.

Note:

- The test results including the cable lose.
- The item was tested at 23°C and 50% humidity condition;
- Refer to following test plots.

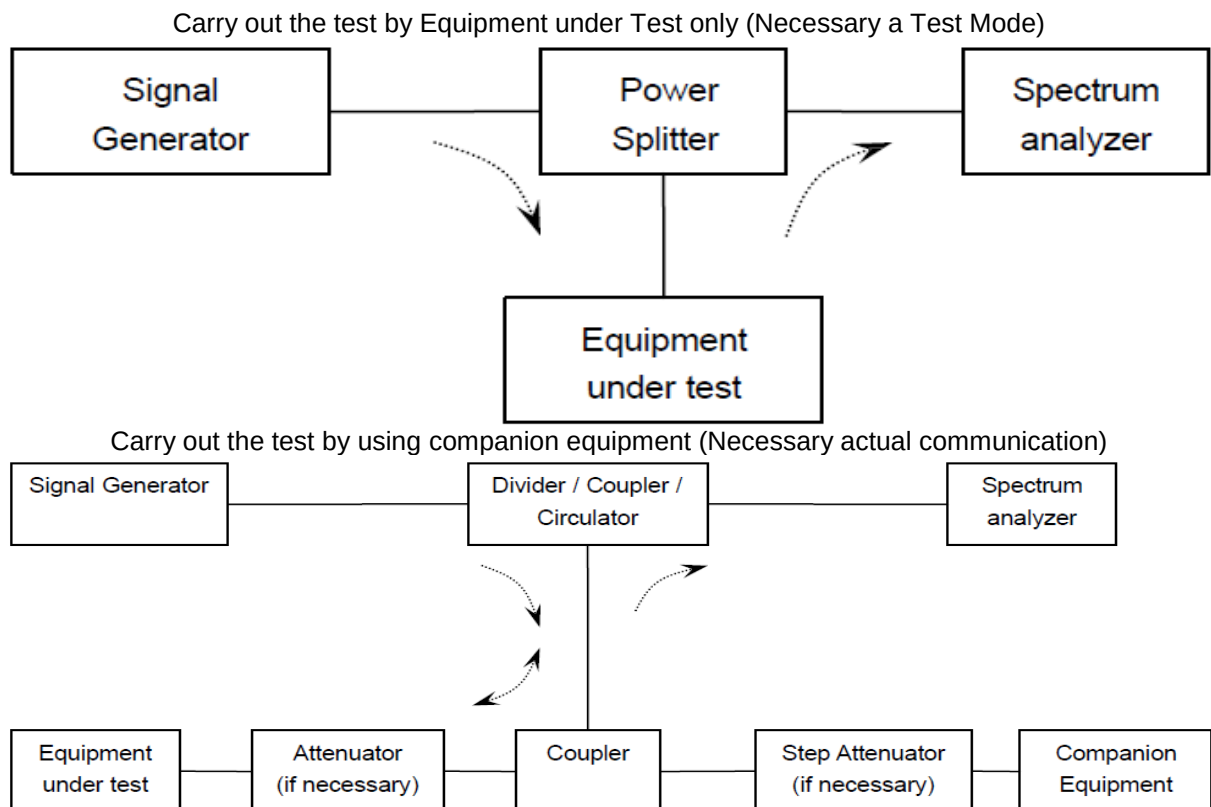
4.8. Carrier Sense Measurement

LIMIT

Carrier sensing: When the equipment receives the radio wave which is transmitted from a radio station other than the communication partner station and the field strength at maximal gain direction of receiving antenna power is over 100mV/m, the equipment shall not transmit radio in the same frequency of the other station. The equipment shall start to transmit after carrier sensing. However, if it is controlled in transmitting or receiving from other station and it transmits again within 4msec. after carrier sensing, carrier sensing can be omitted.

Article 49.20 of the „Ordinance Regulating Radio Equipment “The transmitting equipment with OFDM which occupied bandwidth is 26 – 38MHz and its mean power is 5mW/1MHz shall have a carrier sensing function.

TEST CONFIGURATION



TEST PROCEDURE

- Set the spectrum analyzer as follow:
Resolution bandwidth: 1 MHz
Video bandwidth: 1MHz
Sweep Time: AUTO (Minimum time to ensure measurement accuracy.)
Sweep mode: Continuous Sweep
Detection mode: Positive peak
Storage Mode: Normal
Y-axis scale: 10 dB/Div
Trigger: Free Run

Conditions of Equipment under Test

Required normal mode of the applicable equipment (EUT)

TEST RESULTS

Test Mode	Test Result
802.11n(HT40)	Pass

Note: 1.this test item only applies to those mode with bandwidth greater than 20MHz;
after a carrier signal $22.79+Gr-20*\log(f)[dBm]$ was injected into EUT, it stopped transmission.

The Mini PC cannot transmit radio when the field strength at maximal gain direction of receiving antenna power is over 100mV/m; and The Mini PC can start to transmit after carrier sensing.
The EUT has three carriers in the test .

4.9. Radio Interference Prevention Capability Measurement

LIMIT

Identification code $\geq$ 48 bits

Measuring Id Code Software

MAC IP List: MAC Scan

TEST CONFIGURATION



TEST PROCEDURE

1. In the case that the EUT has the function of automatically transmitting the identification code: a. Transmit the predetermined identification codes from EUT. b. Check the transmitted identification codes with the demodulator.
2. In the case of receiving the identification code: a. Transmit the predetermined identification codes from the counterpart. b. Check if communication is normal. c. Transmit the signals other than predetermined ID codes from the counterpart. d. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

Conditions of Equipment under Test

Required normal mode of the applicable equipment (EUT)

TEST RESULTS

The radio equipment has an identification code. A verification of this code is done before a communication channel is established.

MAC Address: BEE056001AAC

4.10. Construction Protection Confirmation Method

LIMIT

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

Confirmation Method

Protected Method	special construction
Description	shielding case are Soldering in the RF Modular to protect anybody to remove it easily.

5. TEST SETUP PHOTOS OF THE EUT

Reference to the test report No. GTS20230105004-1-6.

6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No. GTS20230105004-1-6.

.....End of Report.....