

# RADIO TEST REPORT MIC Public Notice 88

Test report On Behalf of Igloohome Pte Ltd For Mortise 2 Model No.: IGM3

Prepared for : Igloohome Pte Ltd 67 Ayer Rajah Crescent #03-25/26 Singapore 139950

Prepared By :Shenzhen HUAK Testing Technology Co., Ltd.1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park,Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

 Date of Test:
 Nov. 06, 2019 ~ Nov. 13, 2019

 Date of Report:
 Nov. 13, 2019

 Report Number:
 HK1911082829-E

# **TEST RESULT CERTIFICATION**

Applicant's name:	Igloohome Pte Ltd
	67 Ayer Rajah Crescent #03-25/26 Singapore 139950
Manufacture's Name:	Igloohome Pte Ltd
Address:	67 Ayer Rajah Crescent #03-25/26 Singapore 139950
Product description	
Trade Mark:	Igloohome
Product name:	Mortise 2
Model and/or type reference :	IGM3
Standards	MIC Public Notice 88:2004, annex 1 and annex 43 ARIB STD-T66 V3.7

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Date of Test	
Date (s) of performance of tests:	Nov. 06, 2019 ~ Nov. 13, 2019
Date of Issue	Nov. 13, 2019
Test Result	Pass

Prepared by:

Project Engineer

Reviewed by:

Project Supervisor

Approved by:

ames 2

Technical Director

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# **1. SUMMARY OF TEST RESULTS**

Part	Rule Section	Description of Test	Result
4.1	3.2	Frequency Error	Complies
4.2	3.2	Antenna Power Antenna Power Error	Complies
4.3	3.2	Occupied Bandwidth (99%) and Spread-spectrum Bandwidth (90%)	Complies
4.4	3.2	Unwanted Emission Intensity	Complies
4.5	3.2	Limitation of Collateral Emission of Receiver	Complies
4.6	3.2	Transmission Antenna Gain (EIRP Antenna Power)	N/A
4.7	3.2	Transmission Radiation Angle Width (3dB Beamwidth)	N/A
4.8	3.2	Radio Interference Prevention Capability	Complies
4.9	/	Carrier Sense Capability	N/A

Test procedures according to the technical standards:

# NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) MIC Public Notice 88:2004, annex 1 and annex 43

(3) MIC Ordinance Regulating Radio Equipment Section 4.17 of Article 49.20

(4) Referenced in the standard ARIB STD-T66



# 1.1 TEST FACILITY

Test Firm	:	Shenzhen HUAK Testing Technology Co., Ltd.
Address	:	1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

# **1.2 MEASUREMENT UNCERTAINTY**

The reported uncertainty of measurement  $\mathbf{y} \pm \mathbf{U} \cdot \mathbf{w}$  where expended uncertainty  $\mathbf{U}$  is based on a standard uncertainty multiplied by a coverage factor of **k=2** · providing a level of confidence of approximately **95** % °

No.	Item	Uncertainty
1	Conducted Emission Test	±3.2dB
2	Radiated Emission Test	±4.7dB
3	RF power,conducted	±0.16dB
4	Spurious emissions, conducted	±0.21dB
5	All emissions,radiated(<1G)	±4.68dB
6	All emissions,radiated(>1G)	±5.0dB



# 2. GENERAL INFORMATION

# 2.1 GENERAL DESCRIPTION OF EUT

Equipment	Mortise 2
Model Name	IGM3
Serial No	1
Trade Mark	Igloohome
Antenna Type	PCB Antenna
Antenna Gain	0 dBi
Operation frequency	2402-2480MHz
Number of Channels	40CH
Modulation Type	GFSK
Power Source	DC 6V By Battery
Power Rating	DC 6V By Battery
Firmware Version	V2.0
Hardware Version	V2.0

# Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

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~	

	Channel List						
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2402	11	2422	21	2442	31	2462
02	2404	12	2424	22	2444	32	2464
03	2406	13	2426	23	2446	33	2466
04	2408	14	2428	24	2448	34	2468
05	2410	15	2430	25	2450	35	2470
06	2412	16	2432	26	2452	36	2472
07	2414	17	2434	27	2454	37	2474
08	2416	18	2436	28	2456	38	2476
09	2418	19	2438	29	2458	39	2478
10	2420	20	2440	30	2460	40	2480

3.

Table for Filed Antenna

Ar	nt.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
	1	N/A	PIFA antenna	PCB antenna	N/A	0	



# 2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	CH01:2402MHz
Mode 2	CH20:2440MHz
Mode 3	CH40:2480MHz



# 2.3 TEST CONDITIONS

The RF module was tested while in a continuous transmitter/receiver mode.

The EUT was tuned to a low, middle, and high channel for all tests. For all test case pre/scans were completed in all Modes to determine worst case levels.

Voltage mode	Voltage mode Input Voltage		
	DC 5.40V		
DC Input	DC 6.00V		
	DC 6.60V		
Note: 1 The radio unit Voltage with the module regulator IC			
regulator.			
2 The radio unit less than 1%, so the test only rated			
voltage (Normal voltage) with the battery.			

### Power Supply Voltage Fluctuation Test

During the input supply voltage to the EUT from the external power source is varied by +/- 10%, if utput voltage had been confirmed that the fluctuation of power supply to the RF circuit of EUT (excluding power source) is equal to or less than +/-1%. Exempt extremely high and low supply voltage condition test, EUT only operated in normal voltage to test all regulations.

# 2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Mode 1:





# 2.5 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Trade Mark	Model/Type No.	Series No.	Note
E-1	Mortise 2	Igloohome	Mortise 2	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in  $\[\]$  Length  $\[\]$  column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".



# 2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

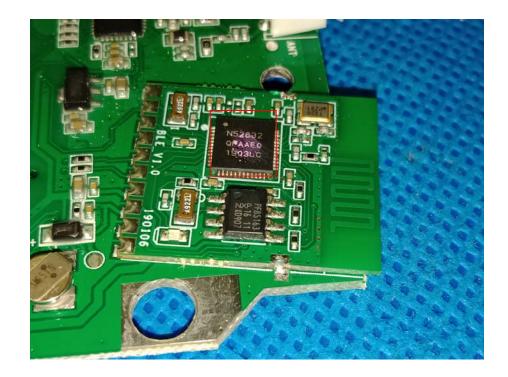
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Dec. 27, 2018	1 Year
2.	LISN	SchwarzBeck	NSLK 8126	8126377	Dec. 27, 2018	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Dec. 27, 2018	1 Year
4.	EMI Test Software ES-K1	Rohde & Schwarz	N/A	N/A	N/A	N/A
5.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Dec. 27, 2018	1 Year
6.	Trilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Dec. 27, 2018	1 Year
7.	Pre-amplifier	Compliance Direction	PAP-0203	22008	Dec. 27, 2018	1 Year
8.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
9.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Dec. 27, 2018	1 Year
10.	LISN	SchwarzBeck	NSLK 8126	8126377	Dec. 27, 2018	1 Year
11.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Dec. 27, 2018	1 Year
12.	EMI Test Software ES-K1	Rohde & Schwarz	N/A	N/A	N/A	N/A
13.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Dec. 27, 2018	1 Year
14.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Dec. 27, 2018	1 Year
15.	LISN	SchwarzBeck	NSLK 8126	8126377	Dec. 27, 2018	1 Year
16.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Dec. 27, 2018	1 Year
17.	EMI Test Software ES-K1	Rohde & Schwarz	N/A	N/A	N/A	N/A
18.	Power Meter	R&S	NRVD	SEL0069	Dec. 27, 2018	1 Year
19.	Power Sensor	R&S	URV5-Z2	SEL0071	Dec. 27, 2018	1 Year
20.	Power Sensor	R&S	URV5-Z2	SEL0072	Dec. 27, 2018	1 Year
21.	Software EMC32	R&S	EMC32-S	SEL0082	N/A	N/A
22.	Log-periodic Antenna	Amplifier Reasearch	AIFS-IP780	SEL0073	N/A	N/A
23.	Antenna Tripod	Amplifier Reasearch	TP1000A	SEL0074	N/A	N/A
24.	High Gain Horn Antenna(0.8-5GHz)	Amplifier Reasearch	AT4002A	SEL0075	N/A	N/A
25.	Spectrum analyzer	Agilent	N9020A	MY499110 048	Dec. 27, 2018	1 Year
26.	Spectrum analyzer	Agilent	E4407B	MY461843 26	Dec. 27, 2018	1 Year
27.	DC power supply	Agilent	E3646A	N/A	Dec. 27, 2018	1 Year
28.	frequency meter	Agilent	53131A	N/A	Dec. 27, 2018	1 Year



# **3. RF SHIELDING METHOD**

We apply the product for Japan RF certification. Number of terminals is48,Terminal pitch is 1 mm.. It is not easily removed. Please refer to following for photo for details.

Red circle part of the RF module soldered on the PCB.





# 4. TEST RESULT

# 4.1 FREQUENCY ERROR

# 4.1.1 LIMIT

Item	Limits
Frequency Error	+/-50ppm

# 4.1.2 MEASURING INSTRUMENTS AND SETTING

The following table is the setting of Spectrum Analyzer.

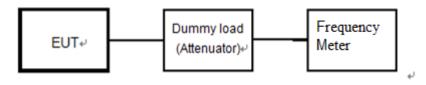
Spectrum Parameter	Setting
Attenuation	Auto
RB / VB	10KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

# 4.1.3 TEST PROCEDURES

- (1)In the case of unmodulated signal (continuous or continuous burst), measure the frequency directly by a frequency meter.
- (2)In the case of burst waves, the measurement shall be done for enough time in order to obtain the enough measuring accuracy, and the average of the measured values becomes the final value.
- (3)In the case of a test mode with a specific frequency spectrum, measure the frequency of the specific spectrum by a spectrum analyzer.
- (4)In the cases above, if the frequency equivalent to the test frequency is not directly measured in principle, it shall be obtained by necessary calculation.

In the case of modulated signal, if there is no specific spectrum measurable by a spectrum analyzer but a specific dip is observed, it is allowed to measure the frequency with the signal generator (synthesized). That is, observe a signal of the signal generator concurrently (or alternately) with the tested signal using the spectrum analyzer while setting the frequency of the signal generator to the position of the dip on the screen of the spectrum analyzer, and determine the frequency of the signal generator at the time as a measured value.

# 4.1.4 TEST SETUP LAYOUT



# 4.1.5 EUT OPERATION DURING TEST

The EUT was placed on the test table and programmed in un-modulation function.



# 4.1.6 TEST RESULT

EUT:	Mortise 2	Test Date:	Nov. 12, 2019
Temperature:	25ºC	Tested by:	Gary Qian
Humidity:	55 % RH	Test Voltage	Normal Voltage
Operation Mode:	Normal Voltage- Carrier Tx Mode		

Mode CH -	Measured	Tolerance	Result	Limit	
		MHz	MHz	ppm	ppm
	CH01:2402MHz	2402.019	0.019	7.91	+/-50
Carrier	CH20:2440MHz	2441.046	0.046	18.84	+/-50
	CH40:2480MHz	2479.953	-0.047	-18.95	+/-50
Conclusion : PASS					



# 4.2. ANTENNA POWER

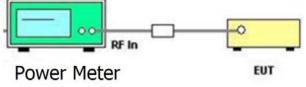
# 4.2.1 LIMIT

Item	Limits
Antenna Power Density	≤ 3mW/MHz (FH form 2427 - 2470.75 MHz) ≤ 10mW/MHz (OFDM,DS from2400~2483.5MHz) ≤ 10mW (Other from 2400~2483.5MHz)
Antenna Power Error	+20%, -80% (Base on manufacturer declare antenna power density)

# 4.2.2 MEASURING INSTRUMENTS AND SETTING

- 1. The EUT was placed on a table which is 0.8m above ground plane.
- 2. The EUT was directly connected to the Power meter.

# 4.2.3 TEST SETUP LAYOUT



**4.2.4 EST DEVIATION** There is no deviation with the original standard.



# 4.2.5 TEST RESULT

EUT:	Mortise 2	Test Date:	Nov. 12, 2019
Temperature:	25ºC	Tested by:	Gary Qian
Humidity:	55 % RH	Test Voltage	Normal Voltage
Operation Mode:	Normal Voltage		

Test Frequency	Antenna Power (dBm)	Result (mW)	Antenna Power Limit (mW)
2402MHz	-5.056	0.312	10
2440MHz	-6.139	0.243	10
2480MHz	-5.148	0.306	10

Test Frequency	Conducted RF output power density (mW)	Rated power density (mW)	Antenna Power Error (%)	
2402MHz	0.312	0.6	-48.00%	
2440MHz	0.243	0.6	-59.50%	
2480MHz	0.306	0.6	-49.00%	
Limit : +20%, -80% (Base on manufacturer declare antenna power density)				



# 4.3. OCCUPIED BANDWITH

# 4.3.1 LIMIT

Item	Limits
Occupied Band Width:	FH 83.5MHz; OFDM,DS ≦ 26MHz;Others≦ 26MHz
Spreading Bandwidth:	≧ 500 kHz (FH, DS)

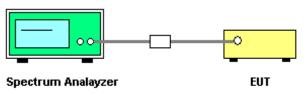
# 4.3.2 MEASURING INSTRUMENTS AND SETTING

Spectrum Parameter	Setting
Attenuation	Auto
RB / VB	300kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

### 4.3.3 TEST PROCEDURES

- Setting of SA is following as: RB: 300kHz / VB:300kHz / SPAN: 3MHz / AT: 30dB Ref: 20dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
- 2. EUT have transmitted the maximum modulation signal and fixed channelize (For DSSS or OFDM Device) or continuous maximum power of hopping mode(For FHSS Device). SA set to 99% of occupied bandwidth to measure occupied bandwidth. The limit is less than 26MHz(For DSSS or OFDM Device) or 83.5MHz(For FHSS Device).
- 3. SA set to 90% of occupied bandwidth to measure Spread Spectrum Bandwidth and must greater than 500kHz.
- 4. Spread Spectrum Factor = Spread Spectrum Bandwidth / modulation rate of EUT.
- 5. Spread Spectrum Factor limit is greater than 5

# 4.3.4 TEST SETUP LAYOUT



### 4.3.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.3.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.



05:52:01 PMNov 12 Radio Std: None

Radio Device: BTS

2.402186 G -8.0083 dB

> Span 3 MHz Sweep 1 ms

-4.87 dBm

90.00 %

-6.00 dB

000 GHz Avg|Held: 10/10

Center Fr Trig: Free

•1

Frequenc

Center Fre

CF S 300.000

Freq Offs

uto

# 4.3.7 TEST RESULT

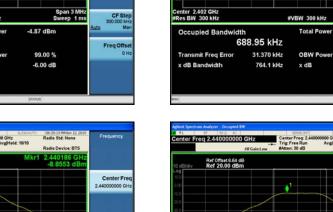
EUT:	Mortise 2	Test Date:	Nov. 12, 2019
Temperature:	25⁰C	Tested by:	Gary Qian
Humidity:	55 % RH	Test Voltage	Normal Voltage
Operation Mode:	Normal Voltage		

Test Voltage	Test Frequency (MHz)	Occupied Bandwidth (MHz)	Spread Bandwidth (MHz)
	2402	1.1414	0.6890
Normal Voltage	2440	1.1439	0.6896
	2480	1.1496	0.6920

er Freg 2.402000000 GHz

Ref Offset 8.64 dB Ref 20.00 dBm











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### Report No.: HK1911082829-E

Center Freq 2.48000000	-te- Trig	ter Freq: 2,480000000 GHz : Free Run Avg/Hole en: 30 dB	4>10/10	Radio Std: None Radio Device: BTS	Frequency
Ref Offset 8.64 de			Mkr1	2.480195 GHz -9.3465 dBm	
00		•'			Center Freq 2.480000000 GHz
Center 2.48 GHz Res BW 300 kHz		#VBW 300 kHz		Span 3 MHz Sweep 1 ms	
Occupied Bandwidth 1.1496 MHz				dBm	Auto Man Freq Offset
Transmit Freq Error x dB Bandwidth	30.990 kHz 764.0 kHz	OBW Power x dB		00 % 00 dB	0 Hz
90			STATUS		

Center Free	q 2.480000000	GHz Cente	r Freq: 2.45000000 GHz Free Run Avg Held 1: 30 dB	R 10/10	26:30:46 PMNov 12, 2019 adio Std: None adio Device: BTS	Frequency	equency
10 dB/div	Ref Offset 8.64 dE Ref 20.00 dBm			Mkr1	2.48021 GHz -9.3529 dBm		
0.00			• <sup>1</sup>				Center Fred
30.0							
430 500 <b>Marro</b> 600	and and a state of the state of						
Center 2,48	3 GHz				Span 3 MHz		
#Res BW 300 kHz Occupied Bandwidth			VBW 300 kHz		Sweep 1 ms		CF Step 300.000 kH
		<sup>h</sup> 91.95 kHz	Total Power	-6.20 d	Bm	Aute	Mar
Transmit	Freq Error	32.507 kHz	OBW Power	90.0	0 %		Freq Offse 0 H
x dB Ban	ndwidth	764.4 kHz	x dB	-6.00	dB		
000				STATUS			



# 4.4. UNWANTED EMISSION INTENSITY MEASUREMENT

# 4.4.1 LIMIT

Item	Limits				
	$\leq$ 0.25 µW (30MHz $\leq$ f $\leq$ 1000MHz)				
	≦2.5 μW (1000MHz <f≦2387mhz)< td=""></f≦2387mhz)<>				
TX Spurious Emission	≦25 μW (2387MHz <f≦2400mhz)< td=""></f≦2400mhz)<>				
	≦25 μW (2483.5MHz≦f<2496.5MHz)				
	$\leq$ 2.5 µW (2496.5MHz $\leq$ f<12500MHz)				

# 4.4.2. MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of Spectrum Analyzer.

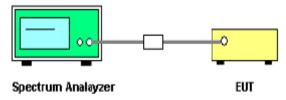
Spectrum Parameter	Setting
Attenuation	Auto
RB / VB	100 kHz (below 1GHz emissions) 1 MHz (above 1GHz emissions)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

# 4.4.3. TEST PROCEDURES

- 1. EUT have transmitted the maximum modulation signal and fixed channelize.
- Setting of SA is following as: Below 1GHz RB:100KHz / VB:100KHz Above 1GHz RB:1MHz / VB:1MHz / AT: 20dB Ref: 0dBm / Sweep time: Auto Sweep Mode: Continuous sweep / Detect mode: Positive peak
- Trace mode: Max hold
- 3. Setting of SA is following as 30MHz and stop frequency 1000MHz Then to mark peak reading value + cable loss shall be less than 0.25µW.
- 4. Setting of SA is following as 1000MHz and stop frequency 2387MHz Then to mark peak reading value + cable loss shall be less than 2.5µW.
- 5. SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25µW.
- 6. SA adjusted to start frequency 2483.5MHz and stop frequency 2496.5MHz Then to mark peak reading value + cable loss shall be less than 25µW
- 7. SA adjusted to start frequency 2496.5MHz and stop frequency 12500MHz Then to mark peak reading value + cable loss shall be less than 2.5µW
- 8. Measure side band spurious as follows: For 2.4GHz band: 2374MHz~2400MHz and 2483.5MHz~2509.5MHz RBW = VBW = 1MHz, Result\_Value = Meaured\_ Value + 15.2 [dBm]
- 9. If the Result\_Value is over the requirement, take total sum of 1MHz band centered at the spur frequency like ACLP measurement as Result\_Value.



# 4.4.4. TEST SETUP LAYOUT



# 4.4.5. TEST DEVIATION

There is no deviation with the original standard.



# 4.4.6. TEST RESULT

EUT:	Mortise 2	Test Date:	Nov. 12, 2019
Temperature:	25ºC	Tested by:	Gary Qian
Humidity:	55 % RH	Test Voltage	Normal Voltage
Operation Mode:	Normal Voltage		

Test Channel	StartFre[MHz]	StopFre[MHz]	Max.Fre[MHz]	Max.Level[µW]	Limit[µW]	Verdict
2402	30	1000	901.181	0.1207	<0.3	PASS
2402	1000	2387	2274.133	0.0492	<2.5	PASS
2402	2387	2400	2388.300	0.0073	<25	PASS
2402	2483.5	2496.5	2491.593	0.0082	<25	PASS
2402	2496.5	13000	12645.489	0.0200	<2.5	PASS
2480	30	1000	96.081	0.0012	<0.3	PASS
2480	1000	2387	1711.531	0.1616	<2.5	PASS
2480	2387	2400	2398.733	0.0145	<25	PASS
2480	2483.5	2496.5	2483.546	0.0386	<25	PASS
2480	2496.5	13000	2607.843	0.0217	<2.5	PASS



# CH 0:2402MHz - Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)

Agilent Spectrum Anal	50Ω AC		SEN	ISE:INT		ALIGN AUTO		4Nov 12, 2019	Fraguerov
Center Freq 5	15.000000 M	PNO: Fast ++	Trig: Free #Atten: 20		Avg Type Avg Hold:	: Log-Pwr 89/100	TYF	<sup>2E</sup> 123456 <sup>2E</sup> M <del>WWWWW</del> T P P P P P P	Frequency
	0ffset 8.64 dB 6.00 dBm	IFGain:Low	#Atten: 20			MI	kr1 901. -37.9	18 MHz 47 dBm	Auto Tune
-4.00									Center Free 515.000000 MH
-14.0									Start Free 30.000000 MH
-34.0								1	<b>Stop Free</b> 1.000000000 GH
-54.0						e attelitereterikete	e distribution of the could	distant disata b	<b>CF Ste</b> 97.000000 MH <u>Auto</u> Ma
-54.0 <mark>-0.0000 -0.0000 -0.00000 -0.0000000000</mark>	is providence fille (non providence) - Francisco esta policita (non policita (non policita) - Francisco esta policita (non policita)	a finanda yang di kang kang kang kang Kang malayong pang kang kang kang kang Mang malayong pang kang kang kang kang	in Denster (den bilden) Denster (d. 1940) en dens	an a					Freq Offse 0 H
-84.0									
Start 30.0 MHz #Res BW 100 k	Hz	#VBW	/ 100 kHz			Sweep 1		0000 GHz 8001 pts)	
MSG						STATUS			

# CH 0:2402MHz - Frequency Band 2 (1000 MHz < f $\leq$ 2387 MHz)

	um Analyzer - Swept SA					
Center F	RF 50 Ω AC req 1.69350000		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:54:10 PMNov 12, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
10 dB/div	Ref Offset 8.64 dB Ref 6.00 dBm	PNO: Fast ↔ IFGain:Low	→ Trig: Free Run #Atten: 20 dB	Avg Hold: 100/100 Mkr	туре Милини Det Р Р Р Р Р Р Р 1 2.274 13 GHz -43.077 dBm	Auto Tune
-4.00						Center Freq 1.693500000 GHz
-14.0					-26.00 dBm	<b>Start Freq</b> 1.000000000 GHz
-34.0					↓ ↓ ↓	<b>Stop Freq</b> 2.387000000 GHz
-54.0	an di na Aldan da Ultra di Antoni Madan Manana jari jari nga kata panana matanta	re blir bere tallen die bere tit for og bere syn er generaten finden generaten.	a de altilita de constante por la constante da la cinaciona de la constante da la constante da la constante da Novembra de la constante da la c		ander a her the her had been	<b>CF Step</b> 138.700000 MHz <u>Auto</u> Man
-74.0						Freq Offset 0 Hz
-84.0 Start 1.00 #Res BW		#VBV	1.0 MHz	Sween 2	Stop 2.3870 GHz 133 ms (8001 pts)	
MSG				STATUS		



#### gilent Spectrum Analyzer - Swept SA (IRL ALIGN AUTO 05:54:23 PM Nov 12, 2019 SENSE:INT Frequency Avg Type: Log-Pwr Avg|Hold: 100/100 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P Center Freq 2.393500000 GHz Trig: Free Run #Atten: 20 dB PNO: Fast +++ IFGain:Low Auto Tune Mkr1 2.388 300 0 GHz -51.395 dBm Ref Offset 8.64 dB Ref 6.00 dBm 10 dB/div Log **Center Freq** 2.393500000 GHz Start Freq 2.387000000 GHz Stop Freq 2.40000000 GHz 1 CF Step 1.300000 MHz Auto Man **Freq Offset** 0 Hz Start 2.387000 GHz #Res BW 1.0 MHz Stop 2.400000 GHz Sweep 1.067 ms (8001 pts) #VBW 1.0 MHz STATUS SG

# CH 0:2402MHz - Frequency Band 3 (2387 MHz < f $\leq\,$ 2400 MHz)

### CH 0:2402MHz - Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)

	n Analyzer - Swept SA								
Center Fre	RF 50 Ω AC	) GHz		ISE:INT	Avg Type	ALIGNAUTO : Log-Pwr	TRAC	1Nov 12, 2019 E 123456	Frequency
10 dB/div	Ref Offset 8.64 dB Ref 6.00 dBm	PNO: Fast ↔ IFGain:Low	, Trig: Free #Atten: 20		Avg Hold:		DE 2.491 592	2 5 GHz 53 dBm	Auto Tune
-4.00									Center Freq 2.490000000 GHz
-14.0								-16.00 dBm	Start Freq 2.483500000 GHz
-34.0					1				<b>Stop Fred</b> 2.496500000 GHz
-54.0	n, dagter, el gen den signi film finge	fildeligen fredrendret stearen	tinuk tin dipoteting	di si padi si ki di		hilith, state ha	hija da ji karen naka popisi k		CF Step 1.300000 MHz <u>Auto</u> Mar
-74.0									Freq Offset 0 Hz
-84.0 Start 2.483: #Res BW 1.		#\/B\A	1.0 MHz			Sween	Stop 2.496 1.067 ms (	500 GHz	
MSG	V-1411/2	#VDV				Sweep		soor prs)	



#### gilent Spectrum Analyzer - Swept SA (IRL ALIGN AUTO 05:54:59 PM Nov 12, 2019 SENSE:INT Frequency Avg Type: Log-Pwr Avg|Hold: 97/100 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P Center Freq 7.748250000 GHz Trig: Free Run #Atten: 20 dB PNO: Fast +++ IFGain:Low Auto Tune Mkr1 12.645 5 GHz -46.982 dBm Ref Offset 8.64 dB Ref 6.00 dBm 10 dB/div Log **Center Freq** 7.748250000 GHz Start Freq 2.496500000 GHz Stop Freq 13.00000000 GHz ø . مىلىم والمعراد أراري ليورد والمعادية الم وطفاق CF Step 1.050350000 GHz Auto Man **Freq Offset** 0 Hz Start 2.497 GHz #Res BW 1.0 MHz Stop 13.000 GHz #VBW 1.0 MHz Sweep 18.67 ms (20000 pts) STATUS SG

# CH 0:2402MHz - Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)

# CH 40:2480MHz- Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)

	um Analyzer - Swe									
Center F	RF 50Ω req 515.000		Z		SE:INT	Avg Type	ALIGNAUTO : Log-Pwr	TRAC	Nov 12, 2019	Frequency
10 dB/div	Ref Offset 8.6 Ref 6.00 dE	IF 4 dB	NO: Fast ↔ Gain:Low	. Trig: Free #Atten: 20		Avg Hold:		<sup>DE</sup> /1kr1 96.	08 MHz 72 dBm	Auto Tune
-4.00										Center Freq 515.000000 MHz
-14.0										Start Freq 30.000000 MHz
-34.0									-36.00 dBm	<b>Stop Fred</b> 1.000000000 GHz
-54.0		प्रान्त ने किसी जानन कि	d by distant bits bit bits bit		an a			ahithir ) boats (so i file provinsi participation	daa ahaa ka kaaya ka	CF Step 97.000000 MHz <u>Auto</u> Mar
-74.0										Freq Offset 0 Hz
Start 30.0 #Res BW			#VBW	100 kHz			Sweep 1	Stop 1.0 17.3 ms (	000 GHz 8001 pts)	
MSG							STATUS			



#### gilent Spectrum Analyzer - Swept SA RL ALIGN AUTO 06:18:55 PM Nov 12, 2019 SENSE:INT Frequency TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P Avg Type: Log-Pwr Center Freq 1.693500000 GHz Trig: Free Run Avg|Hold: 100/100 PNO: Fast +++ #Atten: 20 dB IFGain:Low Auto Tune Mkr1 1.711 53 GHz -37.915 dBm Ref Offset 8.64 dB Ref 6.00 dBm 10 dB/div Log **Center Freq** 1.693500000 GHz Start Freq 1.00000000 GHz 1 Stop Freq 2.387000000 GHz **CF Step** All desired at the 138.700000 MHz Man Auto **Freq Offset** 0 Hz Start 1.0000 GHz Stop 2.3870 GHz #Res BW 1.0 MHz Sweep 2.133 ms (8001 pts) #VBW 1.0 MHz STATUS SG

# CH 40:2480MHz - Frequency Band 2 (1000 MHz < f $\leq$ 2387 MHz)

# CH 40:2480MHz - Frequency Band 3 (2387 MHz < f $\leq$ 2400 MHz)







### CH 40:2480MHz - Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)

		HZ PNO: Fast FGain:Low					TRAC TYF DE	4Nov 12,2019 E 1 2 3 4 5 6 E M WWWWW 5 5 6 Hz 5 5 6 Hz 29 dBm	Frequency Auto Tune
10 dB/div Ref	Dffset 8.64 dB						.483 54	5 5 GHz	Auto Tune
-4.00									
									Center Fred 2.490000000 GHz
								-16:00 dBm	<b>Start Fred</b> 2.483500000 GH:
-34.0									<b>Stop Fred</b> 2.496500000 GH
-54.0	<mark>hillingi kang bang dapati kang bang sebagai kang sebagai kang sebagai kang bang sebagai kang sebagai kang seba Sebagai kang sebagai k</mark>	Antering Hotel and the Ministry of	yitildes (in filmin	gardi, dhashga dhi de	ار بر ایر بر از این ایر اور ایر اور اور اور اور اور اور اور اور اور او	thurtu i e stil bil	e den di dia operio		<b>CF Stej</b> 1.300000 MH <u>Auto</u> Ma
-74.0									<b>Freq Offse</b> 0 H
-84.0 Start 2.483500 #Res BW 1.0 M		#\/B\\(	1.0 MHz			Sween 1	Stop 2.496	6500 GHz 8001 pts)	
MSG		<i></i>	1.0 1911/2			sweep i		boor proj	

### CH 40:2480MHz - Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)





# 4.5. IMITATION OF COLLATERAL EMISSION OF RECEIVER MEASUREMENT

### 4.5.1 LIMIT

ltem	Limits		
RX Spurious	≦4nW (f<1GHz)		
Emission:	$\leq 20$ nW (1GHz $\leq f$ )		

### 4.5.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
RB	100 kHz (below 1GHz emissions) 1 MHz (above 1GHz emissions)
VB	100 kHz (below 1GHz emissions) 1 MHz (above 1GHz emissions)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

### 4.5.3 TEST PROCEDURES

- 1. EUT have the continuous reception mode and fixed only one channelize.
- 2. Setting of SA is following as RB / VB: 100 kHz (below 1GHz emissions) / 1 MHz (above 1GHz emissions) /

AT: 10dB / Ref: 0dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold

- 3. SA set RB: 100kHz and VB: 100kHz. Then adjust to start frequency 30MHz and stop frequency 1000MHz. Search to mark peak reading value + cable loss shall be less than 4nW
- 4. SA set RB: 1MHz and VB: 1MHz. Then adjust to start frequency 1000MHz and stop frequency 12500MHz. Search to mark peak reading value + cable loss shall be less than 20nW
- 5. If power level of lower emissions are more than 1/10 of limit (.0.4nW for f < 1GHz, 2nW for f >= 1GHz), all those are to be indicated in the 2nd and 3rd lines. If others are 1/10 or less more of the limit, no necessary to be indicated.



# 4.5.4 TEST RESULT

EUT:	Mortise 2	Test Date:	Nov. 12, 2019
Temperature:	25ºC	Tested by:	Gary Qian
Humidity:	55 % RH	Test Voltage	Normal Voltage
Operation Mode:	Normal Voltage		

The worst test channel of all channels was showed as the follow:

Test Channel	StartFre[MHz]	StopFre[MHz]	Max.Fre[MHz]	Max.Level[nW]	Limit[nW]	Verdict
2402	30	1000	817.640	0.740	<4	PASS
2402	1000	13000	12945.397	0.126	<20	PASS
2480	30	1000	843.951	0.747	<4	PASS
2480	1000	13000	12927.396	0.130	<20	PASS

# CH 0:2402MHz-RX-Frequency Band 1 (30 MHz $\leq$ f < 1000 MHz)

Agilent Spectr	rum Analyzer - Swept SA								
LXI RL	RF 50 Ω AC		SENS	SE:INT		ALIGNAUTO : Log-Pwr		1Nov 12, 2019	Frequency
Center F	req 515.000000	DIMIEZ PNO: Fast ↔►	. Trig: Free	Run	Avg Type Avg Hold:		TYF	E 123456 E M M M M M M M M M M M M M M M M M M M	
		IFGain:Low	#Atten: 20		<u>.</u>		DE	TPPPPP	
						M	kr1 817.	64 MHz	Auto Tune
10 dB/div	Ref Offset 8.64 dB Ref 6.00 dBm						-61.3	08 dBm	
									Center Freq
-4.00									515.000000 MHz
-14.0									
14.0									Start Freq
									30.000000 MHz
-24.0									
-34.0									Stop Freq
									1.000000000 GHz
-44.0									
-54.0								-54.00 dBm	CF Step
							<b> </b> ♦ <sup>1</sup>		97.000000 MHz Auto Man
-64.0 <b></b>	land an open excel to shake the solution	والأهريانية الاعتبار والمراجع	والرفارية يعرجه	ومروار والمطراف فقارط	ويرقب والمتعادية والمتعاولين	aller blatetter	the second states of	alana shantina a	Auto Mari
and the second	il ta data in contra de la section de la	and a state of the second s	and a start of the	na ing ajari sa jarah	an a	and a grant production of the second s	فأوتريق إلما تقتدى متناقطان	ويدونا النسب إمالهما أعواركم	
-74.0									Freq Offset
-74.0									0 Hz
-84.0									
Start 30.0	MHz						Stop 1.0	000 GHz	
#Res BW		#VBM	100 kHz			Sween_1	17.3 ms (	8001 pts)	
		<b><i><i>u</i></i> U D U</b>	100 1112					ouvr proj	
MSG						STATUS			



#### gilent Spectrum Analyzer - Swept SA 06:20:31 PM Nov 12, 2019 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P K/ RL RE SENSE:INT ALIGN ALITO Frequency Avg Type: Log-Pwr Avg|Hold: 100/100 Center Freq 7.000000000 GHz PNO: Fast ↔ IFGain:High Trig: Free Run #Atten: 0 dB Auto Tune Mkr1 12.945 4 GHz Ref Offset 8.64 dB Ref -11.36 dBm -68.994 dBm 10 dB/div Log **Center Freq** 7.00000000 GHz Start Freq 1.000000000 GHz -41 4 Stop Freq 13.00000000 GHz CF Step 1.20000000 GHz and the late of a والتعادير والقائب والتقادي والمحمد والل li cu أللأسيد بأليان Man <u>Auto</u> We we -81.4 **Freq Offset** -91.4 0 Hz Start 1.000 GHz #Res BW 1.0 MHz Stop 13.000 GHz Sweep 21.33 ms (20000 pts) #VBW 1.0 MHz SG STATUS

# CH 0:2402MHz-RX-Frequency Band 2 (1000 MHz $\leq$ f < 13000 MHz)

### CH 39:2480MHz-RX-Frequency Band 1 (30 MHz $\leq$ f < 1000 MHz)

Agilent Spectrum Analyzer - Swept SA						
IX         RF         50 Ω         AC           Center Freq 515.000000 Γ	MHz	SENSE:INT	ALIGN A Avg Type: Log-		Nov 12, 2019	Frequency
Ref Offset 8.64 dB	PNO: Fast ↔ IFGain:Low	Trig: Free Run #Atten: 20 dB	AvgjHold: 88/10	DE Mkr1 843.9	123456 MWWWWW 9 P P P P P P 95 MHz 54 dBm	Auto Tune
-4.00						Center Freq 515.000000 MHz
-14.0						Start Freq 30.000000 MHz
-34.0						<b>Stop Freq</b> 1.000000000 GHz
-54.0	nit stantes of provided standown all of the	elle gester over en el state blande blande blande blande blande et st	- the state of the state of the	1 And all historical placed with a place of the placed of the	-54.00 dBm	<b>CF Step</b> 97.000000 MHz <u>Auto</u> Man
nin and kratike wide, where a data is the second or kinetice of the second or kinetice or kinetice of the second or kinetice or kinetice of the second or kinetice or ki	pican an electrolistic en investigation	y per cirk and an established in a change of a second second second second second second second second second s				<b>Freq Offset</b> 0 Hz
-84.0 Start 30.0 MHz #Res BW 100 kHz	#VBW	100 kHz	Swee	Stop 1.0 ep 117.3 ms (8	000 GHz 3001 pts)	
MSG				STATUS		



#### Agilent Spectrum Analyzer - Swept SA 06:26:10 PMNov 12, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P K/ RL RE SENSE:INT ALIGN ALITO Frequency Avg Type: Log-Pwr Avg|Hold: 100/100 Center Freq 7.000000000 GHz PNO: Fast +++ IFGain:High Trig: Free Run #Atten: 0 dB Auto Tune Mkr1 12.927 4 GHz -68.848 dBm Ref Offset 8.64 dB Ref -11.36 dBm 10 dB/div Log **Center Freq** 7.000000000 GHz Start Freq 1.00000000 GHz -41 4 Stop Freq 13.00000000 GHz CF Step 1.20000000 GHz and the second state of the se والمسألة وبالوال فرور ليلادها in La اللهم والعلما Man <u>Auto</u> , dîn -81.4 **Freq Offset** -91.4 0 Hz Start 1.000 GHz #Res BW 1.0 MHz Stop 13.000 GHz Sweep 21.33 ms (20000 pts) #VBW 1.0 MHz SG STATUS

# CH 39:2480MHz-RX-Frequency Band 2 (1000 MHz $\leq$ f < 13000 MHz)



# 4.6. TRANSMISSION ANTENNA GAIN (EIRP ANTENNA POWER) MEASUREMENT

### 4.6.1 LIMIT

Item	Limits			
EIRP Power Density	<ul> <li>≦ 16.91dBm/MHz (FH form 2427 - 2470.75 MHz)</li> <li>≦ 22.14dBm/MHz (OFDM,DS from 2400~2483.5MHz)</li> <li>≦ 22.14dBm (Other from 2400~2483.5MHz)</li> </ul>			
Note: This test item is not applied for radio equipment with equivalent isotropic radiation				

Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm/MHz, but Antenna Power(Conducted) limit is 10 mW/MHz (10 dBm/MHz), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less

# 4.6.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
RB/VB	1 MHz
Detector	Peak
Тгасе	Max Hold
Sweep Time	Auto

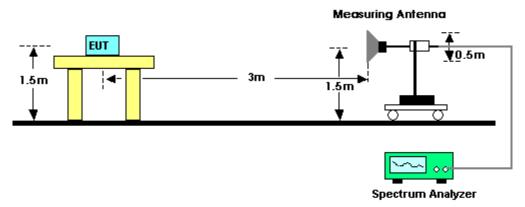
# 4.6.3 TEST PROCEDURES

- 1. Set EUT ad measuring antenna at the same height and roughly facing each other.
- 2. Move the measuring antenna height up and down within  $\pm$  50cm of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read sa "E".
- 3. Remove the EUT from the turn table and put the replacing antenna facing to measuring antenna at same height. Set the standard signal generator (SSG) at same frequency and transmit on then receive the signal
- 4. Swing the replacing antenna give a maximum receiving level.
- 5. Move the measuring antenna height up and down within  $\pm$  50cm of replacing antenna height and swing it to find the maximum receiving level.
- 6. Set SSG output power at Pt to give the equivalent output level of "E" or caluate Pt with SSG output which gives the nearest of "E" and difference (± 1dB). Record the Pt.
- 7. Calculate EIRP by the formula below EIRP = Gt L + Pt. Gt: gain of replacing antenna (dBi)
  L: feeder loss between SSG and replacing antenna
  Pt: Output power of the SSG
- 8. If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

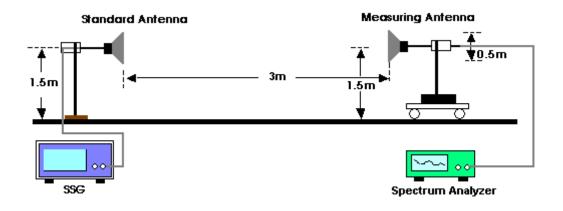


### 4.6.4 TEST SETUP LAYOUT

### For EUT radiation measurement



### For standard antenna measurement



### 4.6.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.6.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

# 4.6.7 RESULTS OF TRANSMISSION ANTENNA GAIN

**Note:** This test item will not be applied to the transmission antenna which has a gain of 2.14 dBi or less



# 4.7. TRANSMISSION RADIATION ANGLE WIDTH (3DB BEAMWIDTH) MEASUREMENT

# 4.7.1 LIMIT

Item	Limits			
3dB antenna beam width	360/A (If A<1; then A=1) A = {EIRP Power [mW] / 16.36 for DS, OFDM} or A = {EIRP Power [mW] / 4.9 for FH}			
Note: This test item is not applied for radio equipment with equivalent isotropic radiation				

Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm/MHz, but Antenna Power(Conducted) limit is 10 mW/MHz (10 dBm/MHz), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less

# 4.7.2 MEASURING INSTRUMENTS AND SETTING

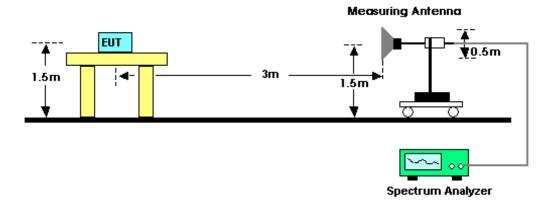
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	0 MHz
RB	1 MHz
VB	1 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

# 4.7.3 TEST PROCEDURES

- 1. Set EUT and measuring antenna at the same height and roughly facing each other.
- 2. Set spectrum analyzer with condition in section 4.7.2 and tune reference level to observe receivng signal position.
- 3. Rotate directions of the EUT horizontally and ertically to find the maximum receiving power.
- 4. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of measuing antenna. The output level at the spectrum analyzer is read as "E"
- 5. Caluate permitted radiation angle in horizontal and vertical using EIRP measured in another test method.
- 6. Calculate 3dB antenna beam width by the formula below 360/A (If A<1; then A=1).
- A = {EIRP Power [mW] / 16.36 for DS, OFDM} or
- A =  $\{EIRP Power [mW] / 4.9 \text{ for FH} \}$



# 4.7.4 TEST SETUP LAYOUT



# 4.7.5 TEST DEVIATION

There is no deviation with the original standard.

# 4.7.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

# 4.7.7 TEST RESULT OF TRANSMISSION RADIATION ANGLE WIDTH (3DB BEAMWIDTH)

The test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less



### 4.8. RADIO INTERFERENCE PREVENTION CAPABILITY MEASUREMENT 4.8.1 LIMIT

ltem	Limits
Identification code	$\geq$ 48 bits

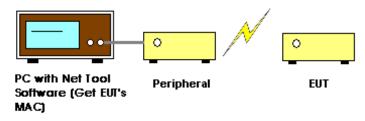
# 4.8.2 MEASURING ID CODE SOFTWARE

Item	Limits
MAC IP List	MAC Scan

# 4.8.3 TEST PROCEDURES

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

# 4.8.4 TEST SETUP LAYOUT



# 4.8.5 TEST DEVIATION

There is no deviation with the original standard.

# 4.8.6 EUT OPERATION DURING TEST

The EUT was programmed to be in normal transmitting mode.



# 4.8.7 TEST RESULT OF RADIO INTERFERENCE PREVENTION CAPABILIT

EUT:	Mortise 2	Test Date:	Nov. 12, 2019
Temperature:	25ºC	Tested by:	Gary Qian
Humidity:	55 % RH		
Test result:	CONFORM		



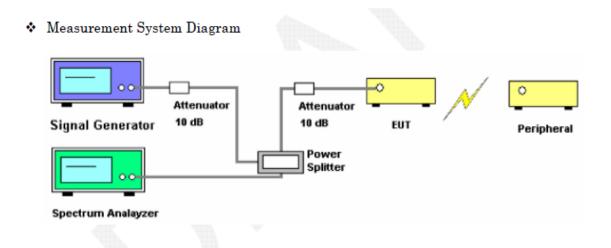
# 4.9. CARRIER SENSING FUNCTION

### 4.9.1 TEST REQUIREMENT

MIC Notice No.88 Appendix No.43

Article 2, Paragraph 1, Item 19 Rules Section 10

# 4.9.2 BLOCK DIAGRAM OF TEST SETUP



- Conditions of Application Equipment (EUT)
  - The EUT state shall be "normal mode link with wireless router".

### 4.9.3 TEST PRECEDURE

- 1 SG adjusted the frequency as same as the EUT transmitted signal and emitted the absence of modulation from SG and power level is (on 22.79+G-20\*log(f)dBm)(G is the antenna gain,f is the test frequency).
- 2. turn off the RF signal of the SG.
- 3. EUT have transmitted the maximum modulation signal and fixed channelize.
- 4. Setting of SA :RBW/VBW=1MHz/1MHz,Span=50MHz,Sweep time=auto,Sweep mode=continuous, Detect mode=positive peak
- 5. SG RF signal on.
- 6. EUT shall be stop the transmitted any signal and SG RF signal off, the EUT will be continuous

### 4.9.4 TEST RESULT

EUT:	Mortise 2	Test Date:	/	
Temperature:	25 <sup>0</sup> C	Tested by:	1	
Humidity:	55 % RH			
Test result:	Not applicable other than OFDM modulation.			





