

<b>Prüfbericht-Nr.:</b> <i>Test report no.:</i>	CN21CQ1H(P15C-BR/EDR) 001	<b>Auftrags-Nr.:</b> <i>Order no.:</i>	238518403	Seite 1 von 31 Page 1 of 31
<b>Kunden-Referenz-Nr.:</b> <i>Client reference no.:</i>	N/A	<b>Auftragsdatum:</b> <i>Order date:</i>	2021-08-03	
<b>Auftraggeber:</b> <i>Client:</i>	Hon Hai Precision Industry Co., Ltd. No.151, Sec. 1, Nankan Rd., Lujhu Dist., Taoyuan City 33859, Taiwan (R.O.C.)			
<b>Prüfgegenstand:</b> <i>Test item:</i>	IEEE 802.11a/b/g/n/ac 2x2 + BT5 Combo Module			
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type no.:</i>	WBUR56			
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	FCC Part 15C Test report (BT)			
<b>Prüfgrundlage:</b> <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247			
<b>Wareneingangsdatum:</b> <i>Date of sample receipt:</i>	2021-08-18			
<b>Prüfmuster-Nr.:</b> <i>Test sample no.:</i>	A003112871-012 A003112871-005			
<b>Prüfzeitraum:</b> <i>Testing period:</i>	2021-08-27 - 2021-09-20			
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	EMC/RF Taipei Testing Site			
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	Taipei Testing Laboratories			
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Pass			
<b>überprüft von:</b> <i>compiled by:</i>			<b>genehmigt von:</b> <i>authorized by:</i>	
<b>Datum:</b> <i>Date:</i>	2021-09-30		<b>Ausstellungsdatum:</b> <i>Issue date:</i>	2021-09-30
<b>Stellung / Position:</b>	David Huang Project Manager		<b>Stellung / Position:</b>	Brenda Chen Senior Project Manager
<b>Sonstiges / Other:</b>				
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
<p>* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet</p> <p>* Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested</p>				
<p><b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b>  <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i></p>				

## TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.247(b) & 15.203	Antenna Requirement	Pass
5.1.2	15.247(b)(1)	Peak Output Power	Pass
5.1.3	15.247(a)(1)	20 dB Bandwidth	Pass
5.1.3	2.1049	99% Occupied Bandwidth	Pass
5.1.4	15.247(d)	Conducted Spurious Emission and Band Edges	Pass
5.1.5	15.247(d) & 15.205 & 15.209	Radiated Spurious Emissions and Band Edges	Pass
5.1.6	15.247(a)(1)	Hopping Channel Separation	Pass
5.1.7	15.247(a)(1) (iii)	Number of Hopping Frequency Used	Pass
5.1.8	15.247(a)(1) (iii)	Dwell Time on Each Channel	Pass
5.2.1	15.207	Mains Conducted Emission	Pass

**Note:**

1. If the Frequency Hopping Systems operating in 2400-2483.5 MHz band and the output power less than 125 mW. The hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of hopping channel whichever is greater.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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**Appendix A - Test Result of Conducted**

**Appendix B - Test Result of Radiated Emissions & Mains Conducted Emission for  
ANT 1, 2, 3, 4, 5**

**Appendix SP - Photographs of Test Setup**

**Appendix EP - Photographs of EUT**

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## HISTORY OF THIS TEST REPORT

Version	Description	Date Issued
1	Original Release	2021-09-20
2	Added the manufacturer information in page 8	2021-09-30

## 1. General Remarks

### 1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

**Appendix A - Test Result of Conducted**

**Appendix B - Test Result of Radiated Emissions & Mains Conducted Emission for ANT 1, 2, 3, 4, 5**

**Appendix SP - Photographs of Test Setup**

**Appendix EP - Photographs of EUT**

### Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.247
FCC 47CFR Part 2: Subpart J Section 2.1049
ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02

### 1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

## 2. Test Sites

### 2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.  
Taipei City 105  
Taiwan (R.O.C.)

### 2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,  
New Taipei City 244  
Taiwan (R.O.C.)  
FCC Registration No.: 226631  
ISED Registration No.: 25563

## 2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

## 2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

## 2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicate a 95% level of confidence.

### Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	$\pm 1.15$ dB
Radiated Emission (30 MHz ~ 200 MHz)	$\pm 1.30$ dB
Radiated Emission (200 MHz ~ 1 GHz)	$\pm 1.30$ dB
Radiated Emission (1 GHz ~ 18 GHz)	$\pm 1.54$ dB
Radiated Emission (18 GHz ~ 40 GHz)	$\pm 2.52$ dB
Mains Conducted Emission	$\pm 1.65$ dB



### 3. General Product Information

#### 3.1 Product Function and Intended Use

The EUT is an IEEE 802.11a/b/g/n/ac 2x2 + BT5 Combo Module. It contains a Bluetooth compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

#### 3.2 System Details and Ratings

##### Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	IEEE 802.11a/b/g/n/ac 2x2 + BT5 Combo Module
Type Identification	WBUR56
FCC ID	RX3-WBUR56
Manufacturer	Hon Hai Precision Industry Co., Ltd. No.151, Sec. 1, Nankan Rd., Lujhu Dist., Taoyuan City 33859, Taiwan (R.O.C.)

##### Technical Specification of EUT

Item	EUT information
Operating Frequency	2402 MHz ~ 2480 MHz
Channel Spacing	1 MHz
Channel Number	79
Operation Voltage	3.3Vdc
Modulation	GFSK, $\pi/4$ -DQPSK, 8DPSK
Maximum Output Power (mW)	2.512
Antenna Information	Refer to Note 1
Accessory Device	Refer to 4.4

Note 1:

ANT	SN/Model #	Cable Length (mm)	Type	Gain (dBi)	Placement	Difference
1	389-0001-1002	290	PIFA	2.27	External	Refer to chapter 5.1.1
2	389-0001-944	200	PIFA	-0.865	External	
3	390-0001-1679	260	PIFA	2.22	External	
4	350509N00-600-G	380	PIFA	-1.431	External	
5	350509M00-600-G	400	PIFA	-2.148	External	

### **3.3 Noise Generating and Noise Suppressing Parts**

Refer to the Circuit Diagram.

### **3.4 Submitted Documents**

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

## 4. Test Set-up and Operation Modes

### 4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software 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 expected by the customer and is going to be fixed on the firmware of the final end product.

**Table for Parameters of Test Software Setting**

Frequency (MHz)	Power Setting		
	GFSK	$\pi/4$ -DQPSK	8DPSK
2402	1a	1f	20
2441	1a	1f	21
2480	1a	1f	20

### 4.2 Carrier Frequency and Channel

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

## 4.3 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed as below.

Test Software	RTLBAPP.exe
---------------	-------------

The samples were used as follows:

A003112871-012 for radiated test

A003112871-005 for conducted test

Full test was applied on all test modes, but only worst case was shown.

EUT Configure Mode	Applicable To				Description
	Antenna Port Conducted Measurement	Radiated Spurious Emissions above 1 GHz	Radiated Spurious Emissions below 1 GHz	Mains Conducted Emission	
ANT 1	√	√	√	√	-
ANT 2	-	√	-	-	-
ANT 3	-	√	-	-	-
ANT 4	-	√	-	-	-
ANT 5	-	√	-	-	-

Note:

- For Radiated emission test, pre-tested GFSK,  $\pi/4$ -DQPSK, 8DPSK modulation type and found 8DPSK was the worse, therefore chosen for the final test and presented in the test report.
- For Radiated emission test, we only evaluate the worst case of all antennas.
- The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on Z-plane.
- "-" means no effect.

### Antenna Port Conducted Measurement

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Modulation Type	Packet Type
ANT 1	2402 to 2480	2402, 2441, 2480	GFSK	1DH5
ANT 1	2402 to 2480	2402, 2441, 2480	$\pi/4$ -DQPSK	2DH5
ANT 1	2402 to 2480	2402, 2441, 2480	8DPSK	3DH5

### Radiated Spurious Emissions (Above 1 GHz)

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Modulation Type	Packet Type
ANT 1	2402 to 2480	2402, 2441, 2480	GFSK, 8DPSK	1DH5, 3DH5
ANT 2	2402 to 2480	2480	8DPSK	3DH5
ANT 3	2402 to 2480	2480	8DPSK	3DH5
ANT 4	2402 to 2480	2480	8DPSK	3DH5
ANT 5	2402 to 2480	2480	8DPSK	3DH5

**Radiated Spurious Emissions (Below 1 GHz)**

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Modulation Type	Packet Type
ANT 1	2402 to 2480	2480	8DPSK	3DH5

**Mains Conducted Emission Test**

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Modulation Type	Packet Type
ANT 1	2402 to 2480	2480	8DPSK	3DH5

**Test Condition**

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	23.7-24.3 °C	49-50 %	Stanislas Charles
Radiated Spurious Emissions above 1 GHz	23.5-25.1 °C	52-56 %	Hunter Wang
Radiated Spurious Emissions below 1 GHz	23.5-25.1 °C	52-56 %	Hunter Wang
Mains Conducted Emission	24.5 °C	52 %	Hunter Wang

## 4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

**Accessory of EUT**

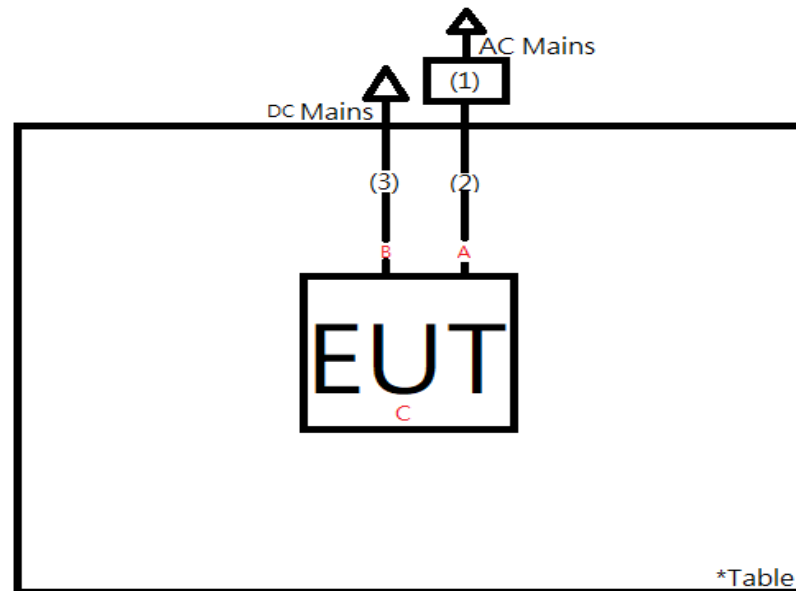
None.

**Support Unit**

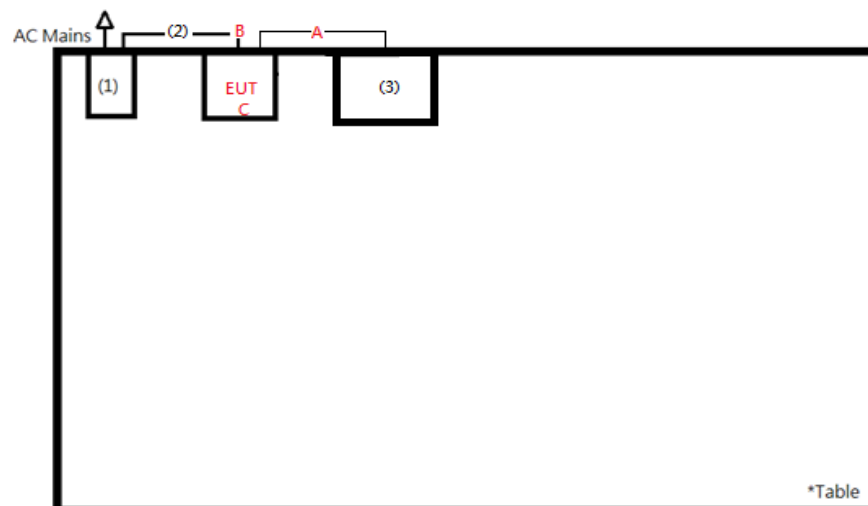
No.	Description	Brand	Model	S/N	Remark
<b>Radiated Test</b>					
A	USB Cable	Hon Hai	Hon Hai	-	20 cm shielded cable w/o core
B	DC Cable	Hon Hai	Hon Hai	-	10 cm non-shielded cable w/o core
C	BT & BLE Ant	Hon Hai	389-0001-1002	-	29.3 cm shielded cable w/o core
1	Notebook	Lenovo	TP00094A	SL10Q37402	-
2	USB Cable	TUV	TUV-030	-	300 cm shielded cable w/o core
3	DC Power Cable	TUV	TUV-015	-	200 cm non-shielded cable w/o core
<b>Mains Conducted Test</b>					
A	USB Cable	Hon Hai	Hon Hai	-	20 cm shielded cable w/o core
B	DC Cable	Hon Hai	Hon Hai	-	10 cm non-shielded cable w/o core
C	BT & BLE Ant	Hon Hai	389-0001-1002	-	29.3 cm shielded cable w/o core
1	DC Power Supply	GWINSTEK	GPC-3030DQ	-	110 cm non-shielded cable w/o core
2	DC Power Cable	TUV	TUV-012	-	90 cm non-shielded cable w/o core
3	Notebook	HP	15-da1046Tx	CND9111MY2	-
<b>Conducted Test</b>					
-	Notebook	HP	TPN-C139	CND93662VF	-

## 4.5 Test Setup Diagram

<Radiated Spurious Emissions mode>



<Mains Conducted Emission mode>



## 5. Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**Requirement** Use of approved antennas only

According to the manufacturer declaration, the EUT's antenna specifications are described as below.  
The antenna is used with no possibility of replacement with a non-approved antenna by the end-user.  
Therefore, the EUT is considered to comply with this provision.

ANT	SN/Model #	Cable Length (mm)	Type	Gain (dBi)	Placement	Difference
1	389-0001-1002	290	PIFA	2.27	External	2 kinds of design pattern with difference cable length for difference size host. A Pattern has ANT 2, 4, 5 B Pattern has ANT 1 and 3
2	389-0001-944	200	PIFA	-0.865	External	
3	390-0001-1679	260	PIFA	2.22	External	
4	350509N00-600-G	380	PIFA	-1.431	External	
5	350509M00-600-G	400	PIFA	-2.148	External	

Refer to EUT photo for details.



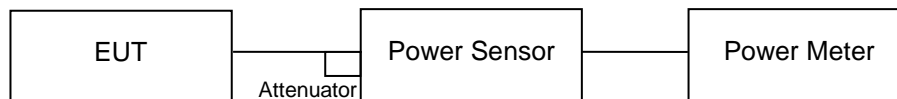
## 5.1.2 Peak Output Power

### Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.  
 For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

**Kind of Test Site**                      Shielded room

### Test Setup



### Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2021/3/24	2022/3/23	2021/8/27	2021/8/27
Power Sensor	Anritsu	MA2411B	1725269	2021/3/24	2022/3/23	2021/8/27	2021/8/27

### Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

**Test Result**
**Peak Output Power**
**<GFSK>**

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(mW)	(mW)
Low Channel	2402	3.84	2.421	125
Middle Channel	2441	3.86	2.432	125
High Channel	2480	4.07	2.553	125

**< $\pi/4$ -DQPSK>**

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(mW)	(mW)
Low Channel	2402	5.01	3.170	125
Middle Channel	2441	4.95	3.126	125
High Channel	2480	5.03	3.184	125

**<8DPSK>**

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(mW)	(mW)
Low Channel	2402	5.11	3.243	125
Middle Channel	2441	5.13	3.258	125
High Channel	2480	5.14	3.266	125

**Average Power**
**<GFSK>**

Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2402	3.75	2.371
Middle Channel	2441	3.76	2.377
High Channel	2480	3.98	2.500

**< $\pi/4$ -DQPSK>**

Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2402	3.94	2.477
Middle Channel	2441	3.81	2.404
High Channel	2480	3.99	2.506

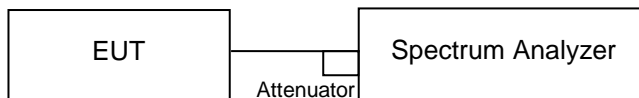
**<8DPSK>**

Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2402	3.93	2.472
Middle Channel	2441	4.00	2.512
High Channel	2480	3.99	2.506

### 5.1.3 20 dB Bandwidth and 99% Occupied Bandwidth

**Kind of Test Site**                      Shielded room

#### Test Setup



#### Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/27	2021/8/27

#### Test Procedure

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.
- The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

#### Test Results

Please refer to Appendix A.

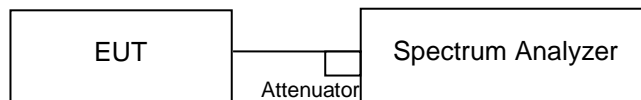
### 5.1.4 Conducted Spurious Emissions and Frequency Band Edges Measured in 100kHz Bandwidth

**Limit**

20dB (below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.)

**Kind of Test Site**

Shielded room

**Test Setup****Test Instruments**

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/27	2021/8/27

**Test Procedure**

The transmitter output was connected to the spectrum analyzer via a low loss cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

**Test Results**

Please refer to Appendix A.

## 5.1.5 Radiated Spurious Emissions and Band Edges

### Limit

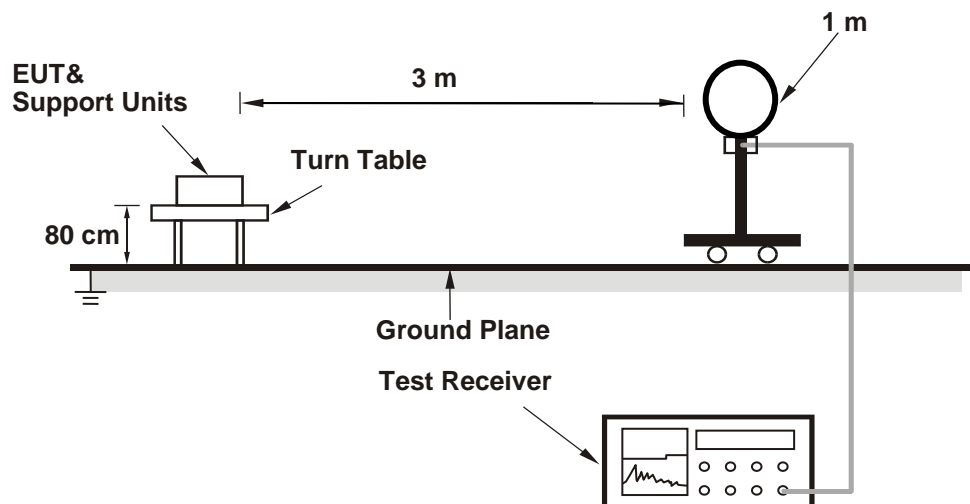
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Emissions radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in §15.247(d).

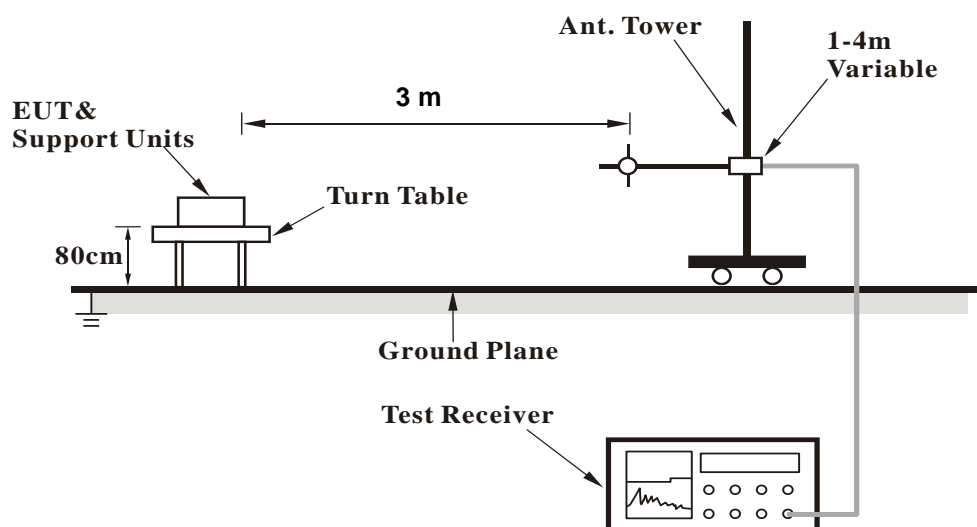
**Kind of Test Site** 3m Semi-Anechoic Chamber

### Test Setup

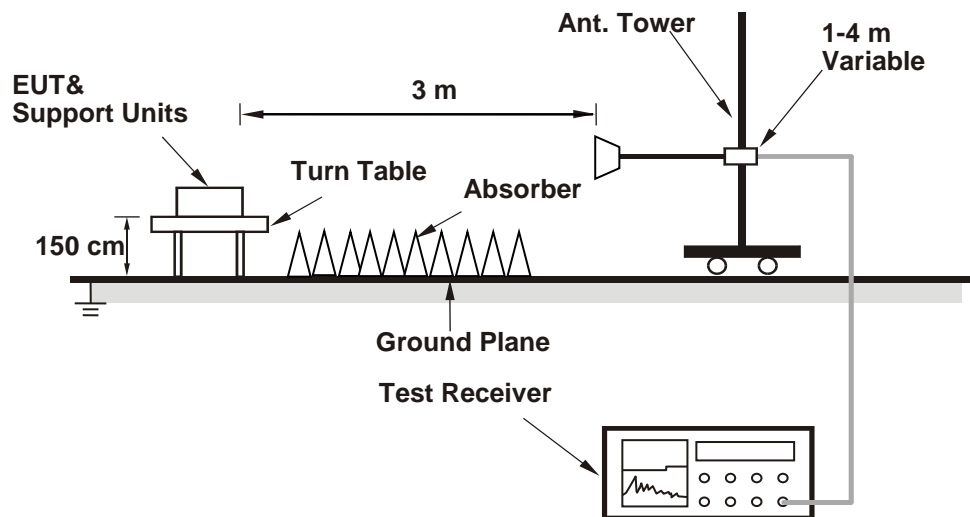
#### <Radiated Emissions below 30 MHz>



#### <Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

**Test Instruments**

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101508	2021/3/16	2022/3/15
Receiver	R&S	ESR7	102109	2021/3/16	2022/3/15
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2021/2/18	2022/2/17
Horn Antenna	ETS-Lindgren	3117	00218930	2020/12/1	2021/11/30
LF-AMP	Agilent	8447D	2944A10772	2021/2/18	2022/2/17
HF-AMP + AC source	EMCI	EMC051845SE	980633	2021/2/9	2022/2/8
HF-AMP + AC source	EMCI	EMC184045SE	980657	2021/2/1	2022/1/31
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2021/4/8	2022/4/7
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800056/4EA	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	804680/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37202/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800898/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800901/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801027/2EA	2021/4/16	2022/4/15
Loop Antenna	SCHWARZBECK	FNZB1519B	00215	2021/9/17	2022/9/16



**Test Procedures****For Radiated Emissions below 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel (OPEN), perpendicular (CLOSE), and ground-parallel (GROUND) orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

## Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

**For Radiated Emissions above 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

## Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98 %) or 10 Hz (Duty cycle  $\geq 98$  %) for Average detection (AV) at frequency above 1 GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

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**Test Results**

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)  
Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

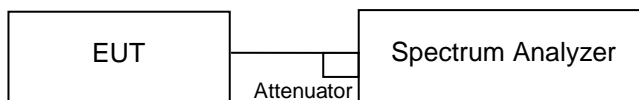
Please refer to Appendix B.

### 5.1.6 Hopping Channel Separation

**Limit**  $\geq 25$  kHz or 2/3 of 20 dB bandwidth, whichever is greater

**Kind of Test Site** Shielded room

#### Test Setup



#### Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/27	2021/8/27

#### Test Procedure

Measurement Procedure REF

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- By using the MaxHold function record the separation of two adjacent channels.
- Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

#### Test Results

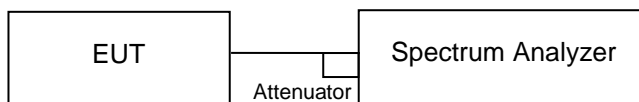
Please refer to Appendix A.

### 5.1.7 Number of Hopping Frequency

**Limit**  $\geq 15$  non-overlapping channels

**Kind of Test Site** Shielded room

**Test Setup**



#### Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/27	2021/8/27

#### Test Procedure

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable.  
Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

#### Test Results

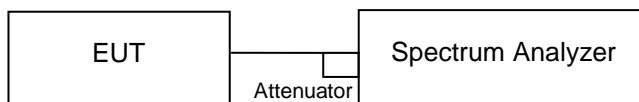
Please refer to Appendix A.

### 5.1.8 Dwell Time

**Limit** 0.4s

**Kind of Test Site** Shielded room

#### Test Setup



#### Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/27	2021/8/27

#### Test Procedures

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable.  
Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode.  
And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency.  
And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

#### Test Results

Please refer to Appendix A.

## 5.2 Mains Emission

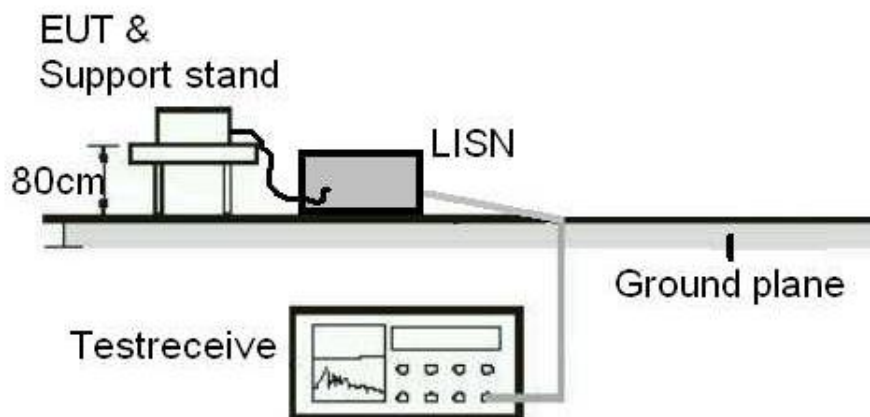
### 5.2.1 Mains Conducted Emission

#### Limit

Mains Conducted Emission as defined in §15.207 must comply with the mains conducted emission limits.

**Kind of Test Site**                      Shielded room

#### Test Setup



#### Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
TWO-LINE V-NETWORK	Schwarzbeck	NSLK 8127	8127-00976	2020/11/03	2021/11/03
EMI Test Receiver	R&S	ESCI	1816063	2020/11/17	2021/11/16
RF Cable	N/A	N/A	EMC-003	2020/11/15	2021/11/14

#### Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

#### Test Results

Please refer to Appendix B.