

Prüfbericht-Nr.: <i>Test report no.:</i>	CN235IDG 001	Auftrags-Nr.: <i>Order no.:</i>	168417780	Seite 1 von 20 <i>Page 1 of 20</i>	
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023-03-10		
Auftraggeber: <i>Client:</i>	Shenzhen Topband Co.,Ltd. Topband Industrial Park,LiYuan Industrial Zone, ShiYan Town, Bao'An District, Shenzhen 518108 China				
Prüfgegenstand: <i>Test item:</i>	2.4G WIFI-BLE Module				
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	TBAP6212 (Trademark: TOPBAND)				
Auftrags-Inhalt: <i>Order content:</i>	Test Report				
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 March 2019				
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-03-15	Please refer to Photo Document			
Prüfmuster-Nr.: <i>Test sample no:</i>	A003436718-001 A003452636-001				
Prüfzeitraum: <i>Testing period:</i>	2023-03-15 - 2023-04-11				
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von: <i>tested by:</i>			genehmigt von: <i>authorized by:</i>		
Datum: <i>Date:</i> 2023-06-12	Signed by: Breeze Jiang		Ausstellungsdatum: <i>Issue date:</i> 2023-06-12	Signed by: Lin Lin	
Stellung / Position:	Sachverständige(r)/Expert		Stellung / Position:	Sachverständige(r)/Expert	
Sonstiges / Other:	FCC ID: 2ADDW-BT241, IC: 23804-BT241, HVIN: TBAP6212				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested					
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Anmerkungen

Remarks

- | | |
|----------|---|
| 1 | <p>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.</p> <p>Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</p> <p><i>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.</i></p> <p><i>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</i></p> |
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| 3 | <p>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</p> <p><i>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</i></p> |
| 4 | <p>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</p> <p><i>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezueglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</i></p> |

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Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 MAXIMUM CONDUCTED OUTPUT POWER

RESULT: Pass

5.1.3 CONDUCTED POWER SPECTRAL DENSITY

RESULT: Pass

5.1.4 6dB BANDWIDTH

RESULT: Pass

5.1.5 99% BANDWIDTH

RESULT: Pass

5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH

RESULT: Pass

5.1.7 RADIATED SPURIOUS EMISSION

RESULT: Pass

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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 Results of Bluetooth LE

Appendix B: Test Results of 2.4GHz Wi-Fi

Appendix C: Photographs of Test Set-up

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, China

FCC Registration No.: 694916

ISED Wireless Device Testing Laboratory: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radio Spectrum Testing (SRD-Tonscend)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY60241175	2023-10-10
MXG X-Series RF Vector Signal Generator	Keysight	N5182B	MY61250137	2023-10-10
EXG X-Series Microwave Analog Signal Generator	Keysight	N5173B	MY61250141	2023-10-10
DC power supply	Keysight	E3642A	MY61276100	2023-10-10
Power Control Unit	Tonscend	JS0806-4ADC	N/A	2023-10-10
Automation Control Unit	Tonscend	JS0806-2	21C8060396	2023-10-10
Test Software	Tonscend	JS1120-3	N/A	N/A
Control PC	Lenovo	TianYi510S-071MB	YLX23JMF	N/A
Shielding Room 8#	Albatross	SR8	APC17151-SR8	2024-06-22
Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2023-08-02
Signal Analyzer	R&S	FSV 40	101439	2023-08-01
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2023-08-01
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2023-08-02
Amplifier	R&S	SCU-18F	180070	2023-08-02
Amplifier	R&S	SCU40A	100475	2023-08-02
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2024-08-06
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2024-08-06
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2024-08-27
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2023-08-06
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A

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Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2024-06-22

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Table 2: Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	± 0.99 dB
Occupied Channel Bandwidth	± 2.08 %
RF power density, conducted	± 0.99 dB
Unwanted Emissions, conducted	± 0.89 dB
All emissions, radiated	± 4.17 dB

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B & C of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a 2.4G WIFI-BLE Module. It supports Bluetooth and 2.4GHz Wi-Fi wireless technologies.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	2.4G WIFI-BLE Module
Type Designation	TBAP6212
Trade Mark	TOPBAND
Operating Voltage	DC 3.3V
Technical Specification of Bluetooth	
Operating Frequency	2402-2480MHz
Type of Modulation	GFSK
Data Rate	1Mbps
Channel Number	40 channels
Channel Separation	2MHz
Antenna Type	Integral Antenna
Antenna Gain	0.00 dBi
The type of wideband data transmission equipment	DTS
Technical Specification of 2.4GHz Wi-Fi	
Operating Frequency	2412 - 2462MHz for 802.11b/g/n(HT20)
Type of Modulation	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM)
Data Rate	1/2/5.5/11 Mbps for 802.11b 6/9/12/18/24/36/48/54 Mbps for 802.11g MCS0 ~ MCS7 Mbps for 802.11n(HT20)
Channel Number	11 channels for 802.11b/g/n(HT20)
Channel Separation	5 MHz
Antenna Type	Integral Antenna
Antenna Gain	-1.32 dBi
The type of wideband data transmission equipment	DTS

Table 4: RF Channel and Frequency of Bluetooth LE

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Table 5: RF Channel and Frequency of 2.4GHz Wi-Fi 802.11 b/g/n

RF Channel	802.11 b/g/n(HT20) (MHz)
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Bluetooth LE wireless transmitting mode
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- B. On, Wi-Fi 802.11 b/g/n wireless transmitting mode
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- C. On, Normal Operation
- D. Off

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3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form

- User Manual

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model TBAP6212 in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 6: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N
Laptop	Lenovo	T480	PF-16A6N8

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

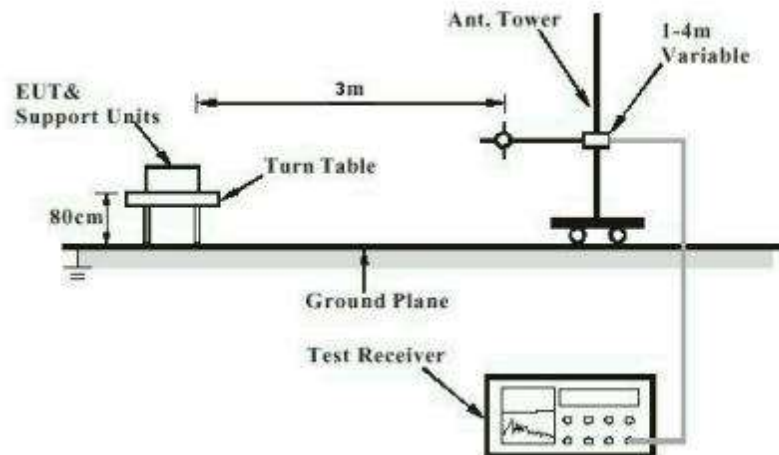


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

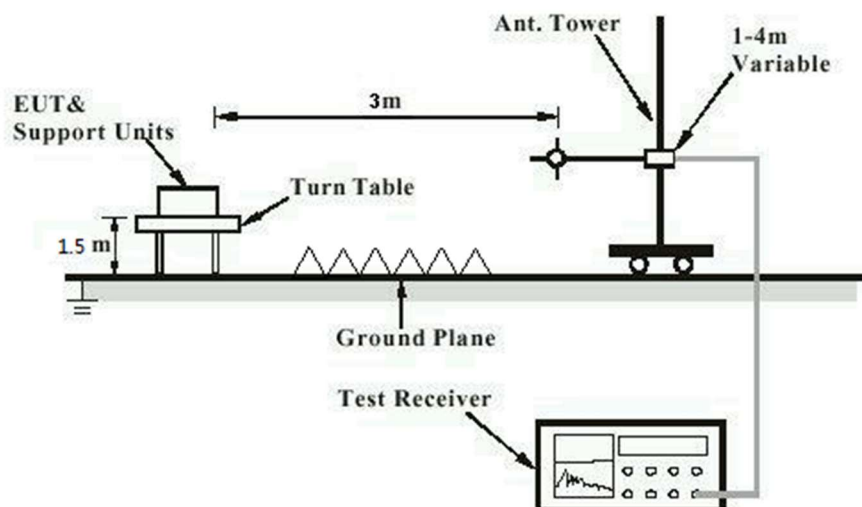
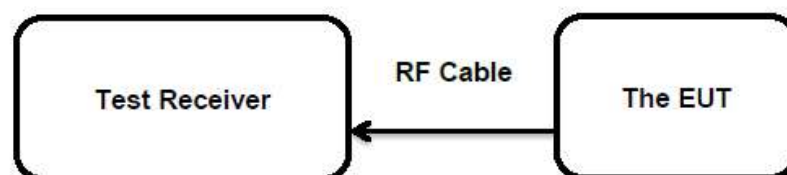


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(b)(4) and Part 15.203

According to the manufacturer declared, the EUT has internal antennas, the maximum antenna gain is -1.32dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

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5.1.2 Maximum Conducted Output Power

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(b)(3)
RSS-247 Clause 5.4(d)
Basic standard : ANSI C63.10: 2013
Limits : 1.0 Watts
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-04-07 to 2023-04-11
Input voltage : DC 3.3V
Operation mode : A, B
Test channel : Low / Middle / High
Ambient temperature : 25.2 °C
Relative humidity : 57 %
Atmospheric pressure : 101 kPa

For details refer to following test result.

Table 7: Test Result of Maximum Conducted Output Power, Bluetooth LE

Test Mode	Test Channel (MHz)	Measured Power		Limit (W)
		(dBm)	(W)	
Bluetooth LE (1 Mbps)	2402	3.43	0.0022	< 1.0
	2440	1.08	0.0013	
	2480	2.91	0.0020	
Max. e.i.r.p.=3.43dBm+(-1.32dBi)=2.11dBm, which is less than 36dBm=4W.				

Table 8: Test Result of Maximum Conducted Output Power, Wi-Fi 802.11 b/g/n

Test Mode	Data Rate	Test Channel (MHz)	Measured Power		Limit (W)
			(dBm)	(W)	
802.11b	1 Mbps	2412	21.34	0.1361	< 1.0
		2437	21.79	0.1510	
		2462	22.51	0.1782	
802.11g	6 Mbps	2412	22.32	0.1706	
		2437	22.26	0.1683	
		2462	22.75	0.1884	
802.11n (HT20)	MCS0	2412	21.36	0.1368	
		2437	21.48	0.1406	
		2462	21.77	0.1503	
Max. e.i.r.p. =22.75dBm+(-1.32dBi)=21.43dBm, which is less than 36dBm=4W.					

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G): -1.32 dBi

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5.1.3 Conducted Power Spectral Density

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(e) RSS-247 Clause 5.2(b)
Basic standard	: ANSI C63.10: 2013
Limits	: < 8 dBm / 3kHz
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-04-07 to 2023-04-11
Input voltage	: DC 3.3V
Operation mode	: A, B
Test channel	: Low / Middle / High
Ambient temperature	: 25.2 °C
Relative humidity	: 57 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A, B.

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5.1.4 6dB Bandwidth

RESULT:**Pass****Test Specification**

Test standard	:	FCC Part 15.247(a)(2) RSS-247 Clause 5.2(a)
Basic standard	:	ANSI C63.10: 2013
Limits	:	> 500 KHz
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2023-04-07 to 2023-04-11
Input voltage	:	DC 3.3V
Operation mode	:	A, B
Test channel	:	Low / Middle / High
Ambient temperature	:	25.2 °C
Relative humidity	:	57 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A, B.

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5.1.5 99% Bandwidth

RESULT:

Pass

Test Specification

Test standard	: RSS-Gen Clause 6.6
Basic standard	: ANSI C63.10: 2013
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-04-07 to 2023-04-11
Input voltage	: DC 3.3V
Operation mode	: A, B
Test channel	: Low / Middle / High
Ambient temperature	: 25.2 °C
Relative humidity	: 57 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A, B.

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5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-04-07 to 2023-04-11
Input voltage	: DC 3.3V
Operation mode	: A, B
Test channel	: Low / Middle / High
Ambient temperature	: 25.2 °C
Relative humidity	: 57 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix A, B.

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5.1.7 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 5
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2023-03-15 to 2023-04-10
Input voltage	: DC 3.3V
Operation mode	: A, B
Test channel	: Low / Middle / High
Ambient temperature	: Refer to test result
Relative humidity	: Refer to test result
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix A, B.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix C.

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