



Prüfbericht-Nr.: Test report no.:	CN23MVS1 (FCC-Colocated) 001	Auftrags-Nr.: Order no.:	48218163	Seite 1 von 17 Page 1 of 17
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2023-07-12	
Auftraggeber: Client:	Wistron Corporation 21F., No. 88, Sec. 1, HsinTai 5th Rd., Hsichih Dist, New Taipei City 221, Taiwan			
Prüfgegenstand: Test item:	R5			
Bezeichnung / Typ-Nr.: Identification / Type no.:	LVR5			
Auftrags-Inhalt: Order content:	Spot Checking Emissions (FCC)			
Prüfgrundlage: Test specification:	FCC 47CFR Part 15: Subpart C Section 15.247 FCC 47CFR Part 22 Subpart H FCC 47CFR Part 24 Subpart E FCC 47CFR Part 27 Subpart F, H, L			
Wareneingangsdatum: Date of sample receipt:	2023-05-05			
Prüfmuster-Nr.: Test sample no.:	A003468922-009			
Prüfzeitraum: Testing period:	2023-06-07 - 2023-07-12			
Ort der Prüfung: Place of testing:	EMC/RF Taipei Testing Site			
Prüflaboratorium: Testing laboratory:	Taipei Testing Laboratories			
Prüfergebnis*: Test result*:	Pass			
überprüft von: compiled by:			genehmigt von: authorized by:	
Datum: Date:	2023-08-14		Ausstellungsdatum: Issue date:	2023-08-14
Stellung / Position:	David Huang Project Manager		Stellung / Position:	Brenda Chen Senior Project Manager
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:				
Prüfmuster vollständig und unbeschädigt Test item complete and undamaged				
* 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 * 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				
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. 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.				

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.247(d) & 15.205 & 15.209 2.1053 & 22.917(a) & 24.238(a) & 27.53(h) & 27.53(g) & 27.53(c)(2)&(f)	Radiated Spurious Emissions and Band Edges	Pass

Note: 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 RADIATED EMISSIONS

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN23MVS1 (FCC-Colocated) 001	Original Release	2023-08-14

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 Radiated Emissions

Appendix SP - Photographs of Test Setup

Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart C Section 15.247
FCC CFR47 Part 2: Subpart J Section 2.1091
FCC 47 CFR Part 22 Subpart H
FCC 47CFR Part 24 Subpart E
FCC 47 CFR Part 27
ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02
KDB 996369 D04 Module Integration Guide v01

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.: 180491
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)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.32 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.31 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.53 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.50 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a R5. It contains Bluetooth/WWAN 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	R5
Type Identification	LVR5
FCC ID	PU5-LVR5

Technical Specification of EUT

Item	EUT information
Operating Frequency	Bluetooth: 2400 ~ 2483.5 MHz LTE Band 2: 1850 ~ 1910 MHz LTE Band 4: 1710 ~ 1755 MHz LTE Band 5: 824 ~ 849 MHz LTE Band 12: 699 ~ 716 MHz LTE Band 13: 777 ~ 787 MHz LTE Band 66: 1710 ~ 1780 MHz
Operation Voltage	4.45 Vdc (Battery) 5 Vdc (Charging Cradle)
Modulation	Bluetooth: GFSK LTE: QPSK, 16QAM
Antenna Type	Coupling Feed
Antenna Gain	Bluetooth: 0.37 dBi LTE Band 2: 2.24 dBi LTE Band 4: 0.46 dBi LTE Band 5: -3.30 dBi LTE Band 12: -4.11 dBi LTE Band 13: -3.20 dBi LTE Band 66: 0.70 dBi

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.

4.2 Test Operation and Test Software

Setup for testing: Test samples make a communication with MT8821C which makes it possible to control them.

The samples were used as follows:

A003468922-009

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

EUT Configure Mode	Applicable To	Description
	Radiated Spurious Emissions	
-	√	-

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on **Y-plane**.
2. "-" means no effect.

Radiated Spurious Emissions

☒ 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	Description
EUT standalone	LTE Band 13 Ch23205 Bandwidth 5MHz + Bluetooth LE Ch39
EUT with Charging Cradle	Bluetooth LE Ch19 + Bluetooth Ch 39

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Radiated Spurious Emissions	22.6-24.5 °C	52-54 %	Roger Liao

4.3 Special Accessories and Auxiliary Equipment

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

Accessory of EUT

No.	Product	Brand	Model	Description
-	Battery	APACK	1-00382-R5-01	4.45 Vdc, 600 mAh

Support Unit

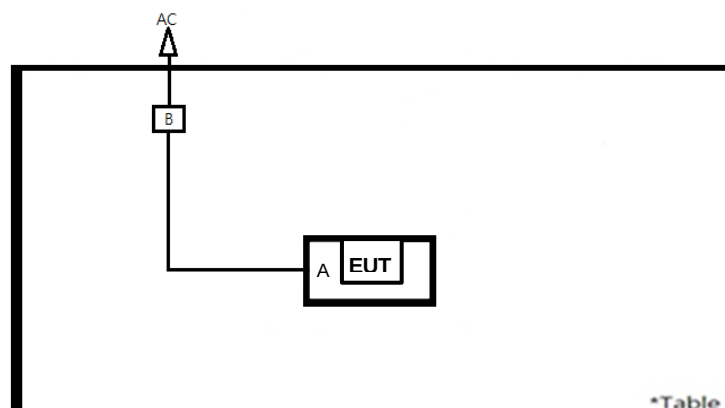
Support Unit								
No	Description	Brand	Model	S/N	Shielded	Ferrite Core (Qty)	Length (cm)	Remark
A	Charging Cradle	BBY R5	R5CC100	N/A	-	-	-	
B	Adapter	HP	PPP009D	N/A	YES	NO	179	

4.4 Test Setup Diagram

<Radiated Spurious Emissions mode>
EUT Standalone



Adapter Mode



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Radiated Spurious Emissions

Limit

<EUT Standalone>

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

<EUT with Charging Cradle>

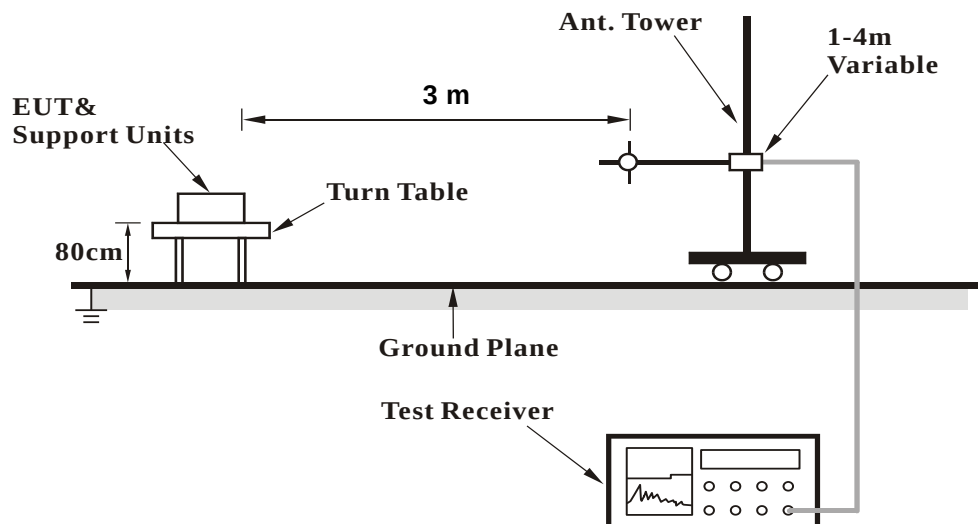
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

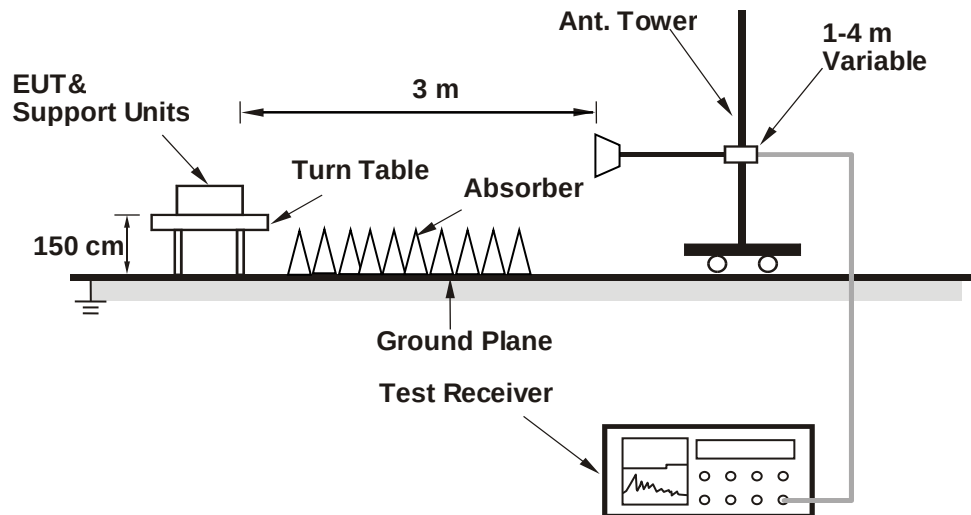
Emissions radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in §15.247(d).

Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

<Radiated Emissions below or equal to 1 GHz>



<Radiated Emissions above 1 GHz>


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

Test Instruments
<EUT Standalone>

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Above 1 GHz (Test period: 2023-07-11)					
Signal Analyzer	R&S	FSV40	101509	2023/4/26	2024/4/24
Radio Communication Analyzer	Anritsu	MT8821C	6262044753	2023/6/14	2024/6/12
Horn Antenna	ETS-Lindgren	3117	00218929	2022/11/17	2023/11/16
HF-AMP + AC source	EMCI	EM01G18GA	980635	2023/2/16	2024/2/15
HF-AMP + AC source	EMCI	EMC184045SE	980656	2023/1/6	2024/1/5
Horn Antenna	SCHWARZBECK	BBHA 9170	00890	2023/5/4	2024/5/2
Test Software	Audix E3	15914a_20191106_tuv	PK-001087	N/A	N/A
Below 1 GHz (Test period: 2023-07-12)					
Receiver	R&S	ESR7	102109	2023/2/24	2024/2/23
Radio Communication Analyzer	Anritsu	MT8821C	6262044753	2023/6/14	2024/6/12
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2023/3/31	2024/3/29
LF-AMP	Agilent	8447D	2727A05146	2023/2/16	2024/2/15
Test Software	Audix E3	15914a_20191106_tuv	PK-001087	N/A	N/A

<EUT with Charging Cradle>

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Above 1 GHz (Test period: 2023-06-07)					
Signal Analyzer	R&S	FSV40	101509	2023/4/26	2024/4/24
Horn Antenna	ETS-Lindgren	3117	00218929	2022/11/17	2023/11/16
HF-AMP + AC source	EMCI	EM01G18GA	980635	2023/2/16	2024/2/15
HF-AMP + AC source	EMCI	EMC184045SE	980656	2023/1/6	2024/1/5
Horn Antenna	SCHWARZBECK	BBHA 9170	00890	2023/5/4	2024/5/2
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A
30 MHz ~ 1 GHz (Test period: 2023-07-14)					
Receiver	R&S	ESR7	102109	2023/2/24	2024/2/23
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2023/3/31	2024/3/29
LF-AMP	Agilent	8447D	2727A05146	2023/2/16	2024/2/15
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A
Below 30 MHz (Test period: 2023-07-14)					
Receiver	R&S	ESR7	102109	2023/2/24	2024/2/23
Loop Antenna	SCHWARZBECK	FMZB 1519B	00215	2023/1/4	2024/1/3
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A

Test Procedures
<EUT standalone>

- In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- 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.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following C63.26 section 5.5 and 5.2.7

$$\text{EIRP (dBm)} = E \text{ (dB } \mu\text{V/m)} + 20\log(D) - 104.8;$$
where D is the measurement distance (in the far field region) in m.

$$\text{ERP (dBm)} = E \text{ (dB } \mu\text{V/m)} + 20\log(D) - 104.8 - 2.15;$$
where D is the measurement distance (in the far field region) in m.

Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.
- Testing was carried out within frequency range 30 MHz to the tenth harmonic.
- All modes of operation were investigated and the worst-case emissions are reported.
- The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.

<EUT with Charging Cradle>**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.
6. The emission levels of other frequencies (including the 10th harmonic of the highest fundamental frequency) are very lower than the limit and are not shown in the test report.

Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)

Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix A.