



**Prüfbericht - Nr.:** CN223NTZ 001  
*Test report no.*

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## ***Test Summary***

***5.1 Co-Located Radiated Spurious Emissions***

***RESULT: Pass***

***5.2 Conducted emissions***

***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:  
None.

## 2 Test Sites

### 2.1 Test Facilities

**TÜV Rheinland (Shenzhen) Co., Ltd.**

No. 362 Huanguan Road Middle, Longhua District, Shenzhen 518110, People's Republic of China

FCC Registration No.: 694916

IC Registration No.: 25069, CAB identifier: CN0078

## 2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2022-08-10
Signal Analyzer	R&S	FSV 40	101439	2022-08-09
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2022-08-09
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2022-08-09
Amplifier	R&S	SCU-18F	180070	2022-08-09
Amplifier	R&S	SCU40A	100475	2022-08-09
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2022-08-08
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2022-08-08
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2022-08-08
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2022-09-13
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2024-06-22
Conducted Emissions testing				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR3	102428	2022-08-10
Artificial Mains Network	R&S	ENV216	102333	2022-08-10
Impedance Stabilisation Network	R&S	ENY81	100323	2022-08-11
EMC32 test software	R&S	EMC32(Ver.10.50.00 )	N/A	N/A

## 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

Test	Parameters	uncertainty
Conducted Emission	Conducted emission 150kHz-30MHz (AMN)	$\pm 3.70$ dB $\pm 3.30$ dB
Radiated Emission	Radiated emission 30MHz-1GHz	$\pm 4.52$ dB
	Radiated emission 1GHz-18GHz	$\pm 4.37$ dB

## 2.6 Location of Original Data

The original copies of all test data taken during actual testing were at this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) 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 Road Middle, Longhua District, Shenzhen 518110, People's Republic of 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 is a a WisGate Edge Pro, which supports 2.4GHz Wi-Fi, BLE, Lora+GNSS and LTE functions.

Note: This product contains transmitter modules.

LTE module Model: EG95-NA	Contains FCC ID: XMR201807EG95NA Contains IC: 10224A-2018EG95NA
2.4GHz Wi-Fi module Model: RAK634	Contains FCC ID: 2AF6B-RAK634 Contains IC: 25908-RAK634
BLE module Model: RAK13400	Contains FCC ID: 2AF6B-RAK13400 Contains IC: 25908-RAK13400
Lora + GNSS module Model: RAK5146	Contains FCC ID: 2AF6B-RAK5146 Contains IC: 25908-RAK5146

Note: The test standard for frequency Bands 698-756 MHz and 777-787 MHz in LTE module test report is RSS-130 issue 1 and the essential requirements remain unchanged in the updated version RSS-130 issue 2, hence it has been updated in current test report without additional test.

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

### 3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	WisGate Edge Pro
Type Designation	RAK7289CV2H
Trade Mark	RAK, ARDUINO
Input Voltage	DC 12V via DC Source or DC 37 ~57V via POE adapter
Testing Voltage	AC 120V, 60Hz or DC 48V

<b>Technical Specification of Wi-Fi</b>	
Operating Frequency	2412 - 2462 MHz for 802.11b/g/n(HT20) 2422 - 2452 MHz for 802.11n(HT40)
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 for 802.11n
Channel Number	11 channels for 802.11b/g/n(HT20) 7 channels for 802.11n(HT40)
Channel Separation	5 MHz
Number of Antenna:	2
Antenna Type	PIFA antenna
Antenna Gain:	4.5dBi for Ant0 4.5dBi for Ant1
<b>Technical Specification of BLE</b>	
Operating Frequency	2402 – 2480MHz
Type of Modulation	GFSK
Data Rate	125kbps, 500kbps, 1Mbps, 2Mbps
Channel Number	40 channels
Channel Separation	2 MHz
Number of Antenna:	1
Antenna Type	PIFA antenna
Antenna Gain:	3.4 dBi
<b>Technical Specification of Lora DTS</b>	
Operating Frequency	923.3 - 927.5MHz
Type of Modulation	Lora
Data Rate	SF7 – SF12 / DR8 – DR13
Channel Number	8 channels
Channel Separation	600 KHz
Occupied Bandwidth	500 KHz
Number of Antenna:	2
Antenna Gain:	5.1dBi (Fiber Glass Antenna)
<b>Technical Specification of Lora Hybrid</b>	
Frequency Range	903.9MHz - 905.3MHz
Type of Modulation	Lora
Data Rate	SF7 – SF10 / DR0 –DR3
Channel Number	8 channels
Channel Separation	200 KHz
Occupied Bandwidth	125 KHz
Number of Antenna:	2
Antenna Gain:	5.1dBi (Fiber Glass Antenna)
<b>Technical Specification of LTE</b>	
Wireless Technology:	LTE & WCDMA
Operation Frequency band(s)	WCDMA Band: II, IV, V LTE Band: 2, 4, 5, 12, 13
Power Class:	Class 4
Type of Modulation:	BPSK, QPSK
Type of Antenna:	PIFA antenna
Antenna number:	2
Antenna Gain:	5.1dBi for Ant0 4.3dBi for Ant1



### 3.3 Independent Operation Modes

The basic operation modes are:

- A, On, WIFI link + BLE link + LTE link + Lora DTS link
- B, On, WIFI link + BLE link + LTE link + Lora DSS (Hybrid) link

### 3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

### 3.5 Submitted Documents

- Block Diagram
- Schematics
- Photo Document
- 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.

### 4.3 Special Accessories and Auxiliary Equipment

Table 3: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model No.	Serial Number or Rating
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	166305
Portable Laptop	Lenovo	ThinkPad T480	10Q67059
POE Adapter	RAK	R012-4800500	Input: AC 100-240V, 50/60Hz, 0.6A Max Output: DC 48.0V, 0.5A 24.0W

### 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)

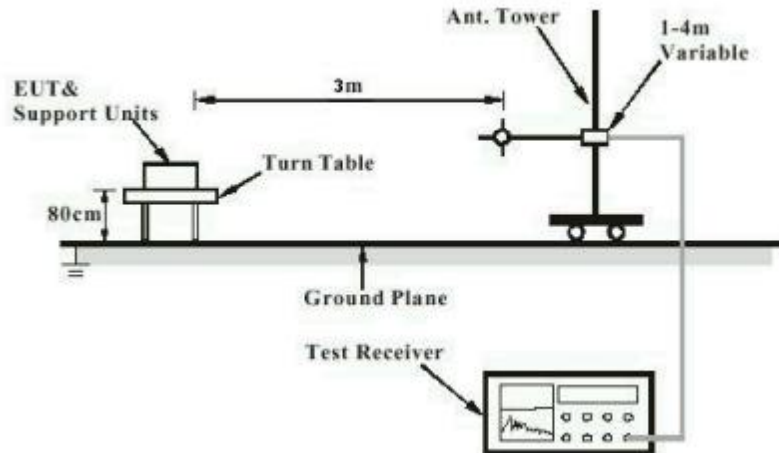


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

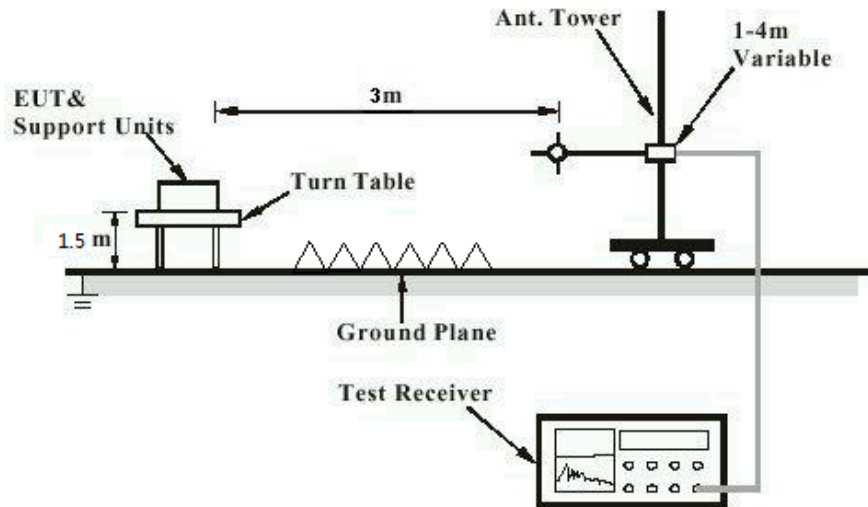
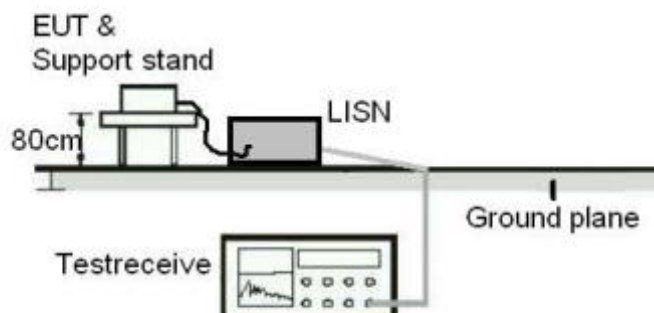


Diagram of Measurement Configuration for Mains Conduction Measurement



## 5 Test Results

### 5.1 Co-Located Radiated Spurious Emissions

**RESULT:**

**Pass**

#### Test Specification

Test standard	:	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 22 CFR47 FCC Part 24 CFR47 FCC Part 27 RSS-247 Issue 2 RSS-130 Issue 2 RSS-132 Issue 3 RSS-133 Issue 6 RSS-139 Issue 3
Basic standard	:	ANSI C63.10 & ANSI C63.26
Limit	:	KDB 996369 D04 The emissions not exceed the highest limit.
Kind of test site	:	3m Semi-anechoic Chamber

#### Test Setup

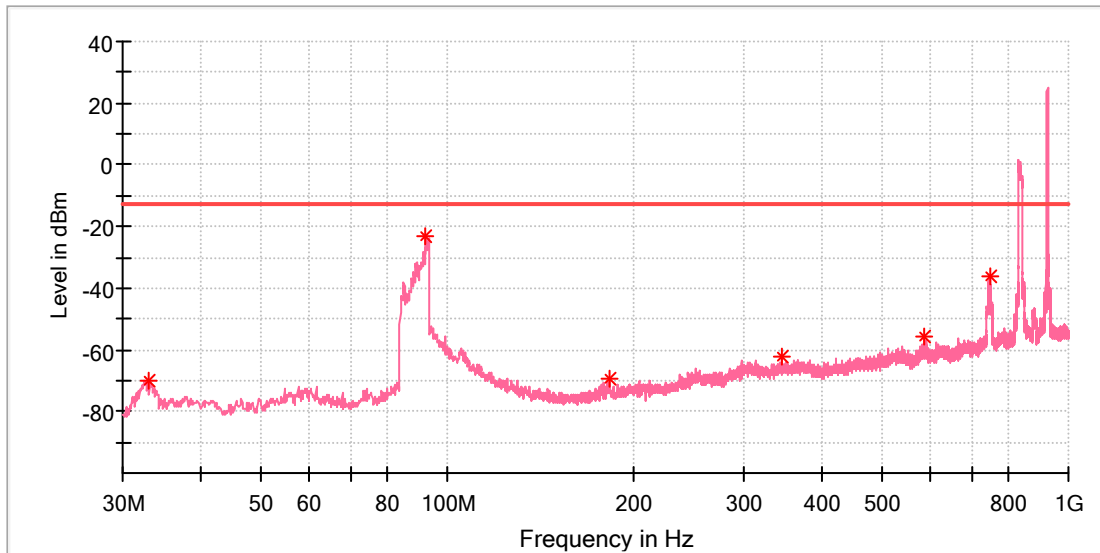
Date of testing	:	2022-06-22 to 2022-07-25
Input voltage	:	AC 120V, 60Hz
Operation mode	:	A B
Earthing	:	Not Connected
Ambient temperature	:	22. °C
Relative humidity	:	52 %
Atmospheric pressure	:	101 kPa

Note: The test plots of Co-located radiated spurious emissions beyond the limit are the fundamental radio frequency of Lora, BLE, Wi-Fi and LTE.

For the measurement records, refer to the following plots, only the worst case mode are shown in this report.

### EUT Information

EUT Name: WisGate Edge Pro  
 Model: RAK7289CV2H  
 Test Mode: 2.4GHz wifi + Lora 5146 + GPS + BLE + LTE  
 Order No/Sample No: 168378328/A003285159-003  
 Test Voltage:: 120V/60Hz  
 Remark: Temp 22 Humi:52%  
 Test Standard: FCC Part 22  
 Tested By: Kei Zhang  
 Reviewed By: Terry Yin

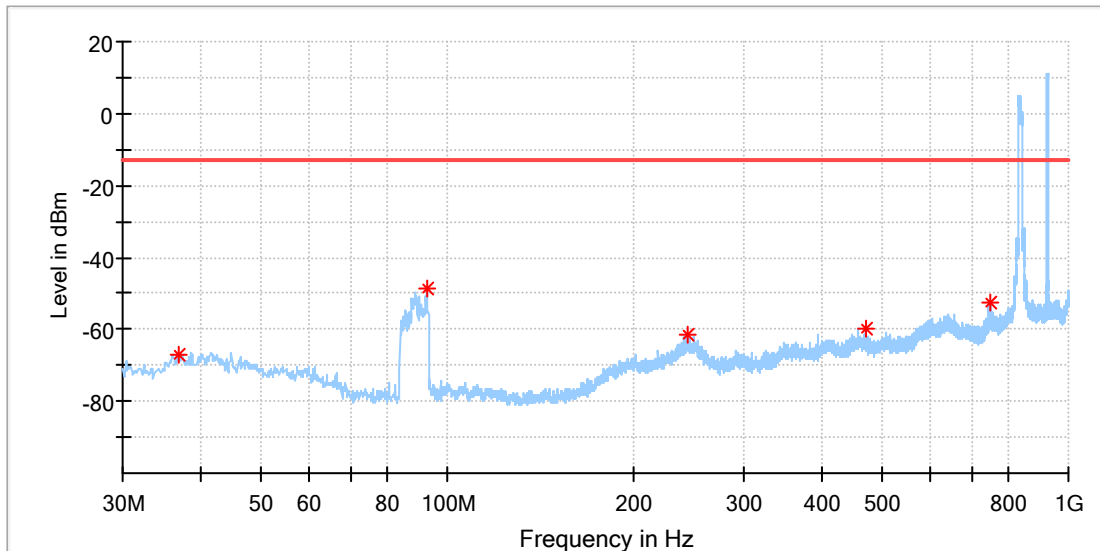


### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.031250	-70.30	-13.00	57.30	100.0	V	32.0	-129.2
92.443750	-23.29	-13.00	10.29	100.0	V	193.0	-104.0
182.775000	-69.11	-13.00	56.11	100.0	V	136.0	-119.9
345.613750	-62.41	-13.00	49.41	100.0	V	63.0	-111.0
584.597500	-55.46	-13.00	42.46	100.0	V	333.0	-106.6
745.738750	-36.19	-13.00	23.19	100.0	V	189.0	-102.1

### EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289CV2H
Test Mode:	2.4GHz wifi + Lora 5146 + GPS + BLE + LTE
Order No/Sample No:	168378328/A003285159-003
Test Voltage::	120V/60Hz
Remark:	Temp 22 Humi:52%
Test Standard:	FCC Part 22
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

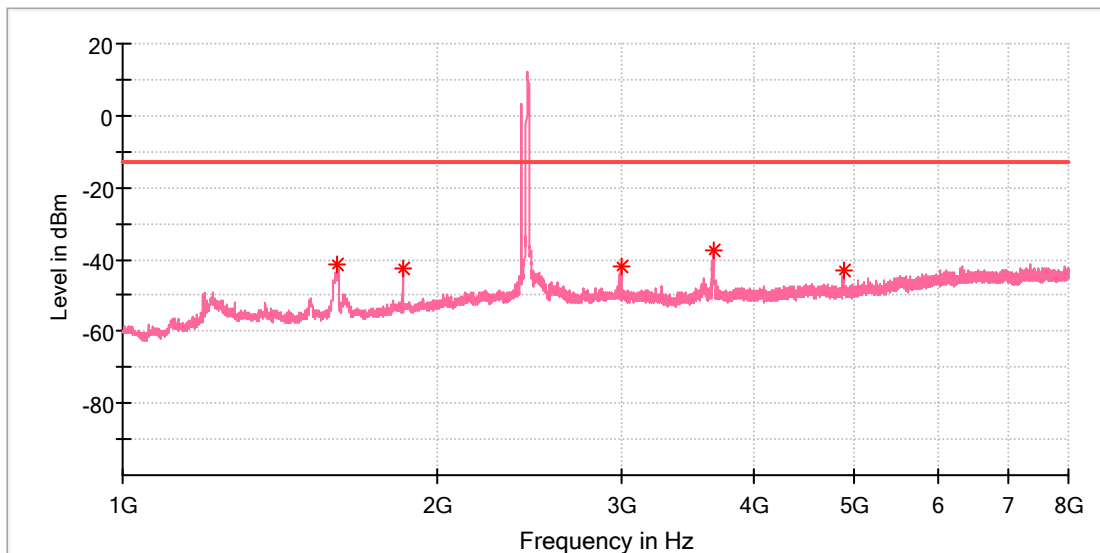


### Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.911250	-66.82	-13.00	53.82	100.0	H	13.0	-113.3
92.686250	-48.79	-13.00	35.79	100.0	H	199.0	-122.6
244.127500	-61.56	-13.00	48.56	100.0	H	294.0	-110.0
470.501250	-59.57	-13.00	46.57	100.0	H	181.0	-109.2
745.860000	-52.43	-13.00	39.43	100.0	H	181.0	-103.9

### EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289CV2H
Test Mode:	2.4GHz wifi + Lora 5146 + GPS + BLE + LTE
Order No/Sample No:	168378328/A003285159-003
Test Voltage::	120V/60Hz
Remark:	Temp 22 Humi:52%
Test Standard:	FCC Part 22
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

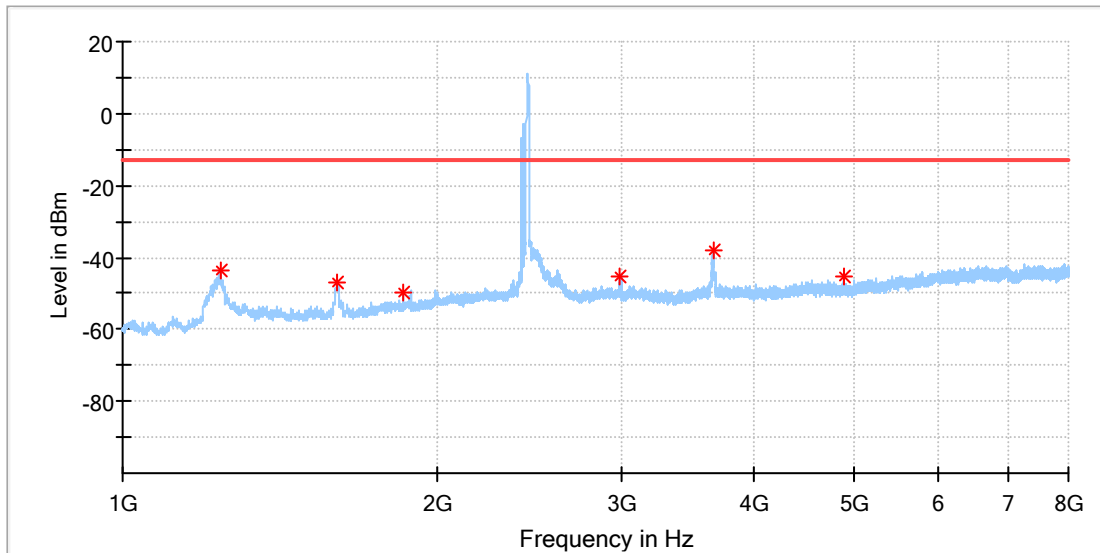


### Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1605.000000	-41.38	-13.00	28.38	100.0	V	1.0	-93.0
1849.500000	-42.39	-13.00	29.39	100.0	V	3.0	-90.2
2997.000000	-41.97	-13.00	28.97	100.0	V	0.0	-86.8
3666.500000	-37.28	-13.00	24.28	100.0	V	43.0	-86.8
4874.000000	-42.99	-13.00	29.99	100.0	V	10.0	-85.9

### EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289CV2H
Test Mode:	2.4GHz wifi + Lora 5146 + GPS + BLE + LTE
Order No/Sample No:	168378328/A003285159-003
Test Voltage::	120V/60Hz
Remark:	Temp 22 Humi:52%
Test Standard:	FCC Part 22
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



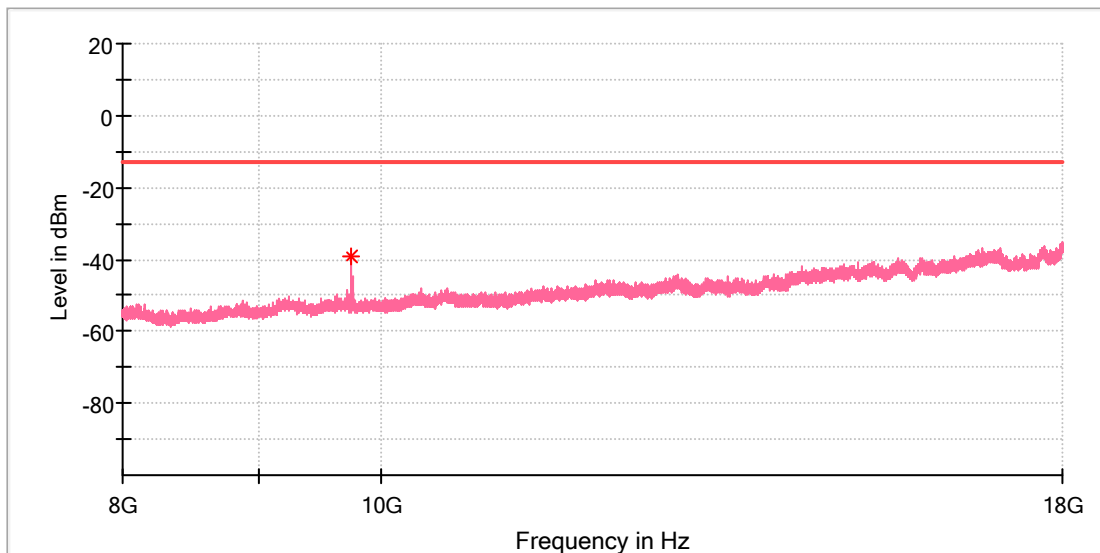
### Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1238.500000	-43.90	-13.00	30.90	100.0	H	69.0	-92.6
1601.000000	-47.23	-13.00	34.23	100.0	H	311.0	-92.8
1850.500000	-49.80	-13.00	36.80	100.0	H	158.0	-90.5
2988.500000	-45.52	-13.00	32.52	100.0	H	86.0	-86.7
3661.500000	-38.15	-13.00	25.15	100.0	H	22.0	-86.7
4874.000000	-45.15	-13.00	32.15	100.0	H	48.0	-85.8



### EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289CV2H
Test Mode:	2.4GHz wifi + Lora 5146 + GPS + BLE + LTE
Order No/Sample No:	168378328/A003285159-003
Test Voltage::	120V/60Hz
Remark:	Temp 22 Humi:52%
Test Standard:	FCC Part 22
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

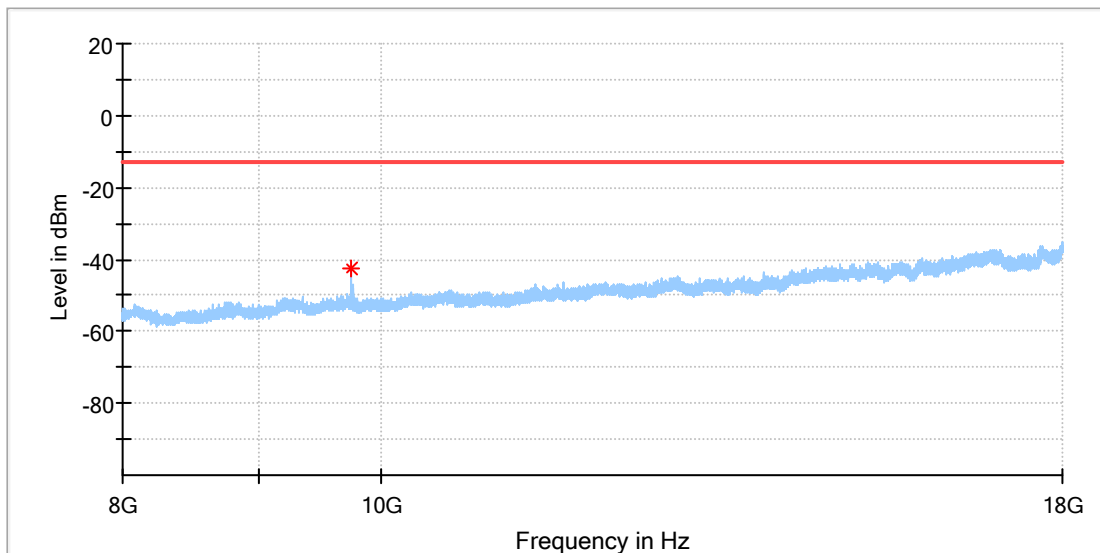


### Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
9748.000000	-39.29	-13.00	26.29	100.0	V	36.0	-84.2

### EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289CV2H
Test Mode:	2.4GHz wifi + Lora 5146 + GPS + BLE + LTE
Order No/Sample No:	168378328/A003285159-003
Test Voltage::	120V/60Hz
Remark:	Temp 22 Humi:52%
Test Standard:	FCC Part 22
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



### Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
9748.000000	-42.58	-13.00	29.58	100.0	H	87.0	-84.1

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## 5.2 Conducted emissions

**RESULT:**

**Pass**

### Test Specification

Test standard	: FCC Part 15.207(a)
	: RSS-Gen Clause 8.8
Basic standard	: ANSI C63.10: 2013
Frequency range	: 150KHz - 30MHz
Classification	: Class B
Limit	: FCC Part 15.207(a)
	: RSS-Gen Table 4
Kind of test site	: Shielded Room

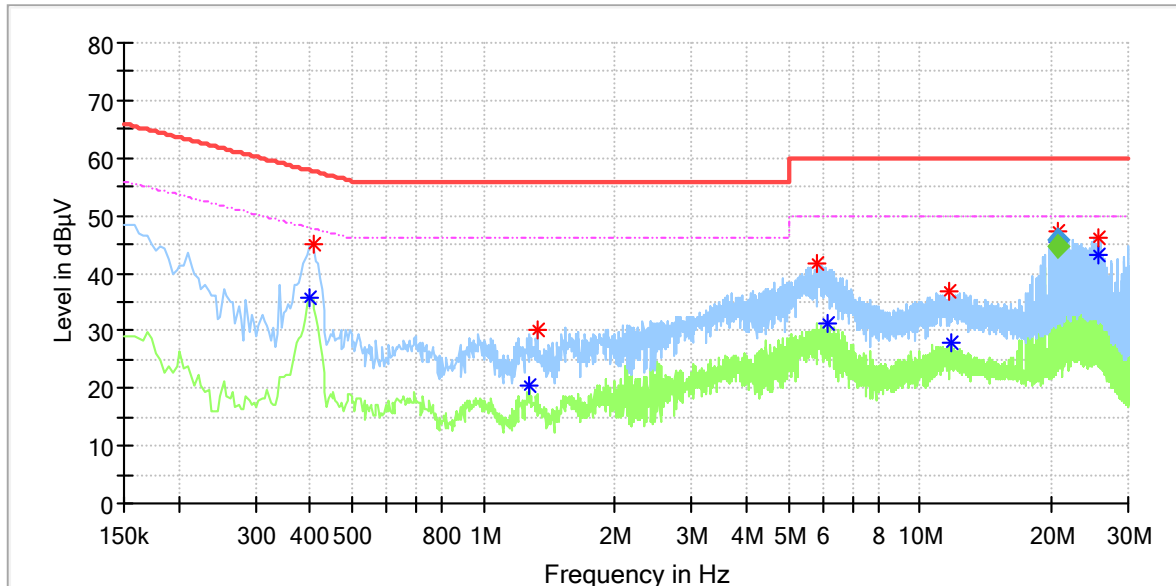
### Test Setup

Date of testing	: 2022-06-22 to 2022-07-25
Input voltage	: AC 120V, 60Hz
Operation mode	: A, B
Earthing	: Not Connected
Ambient temperature	: 23.9 °C
Relative humidity	: 51.4 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the following plots, only the worst case mode are shown in this report.

## EUT Information

EUT Name: WisGate Edge Pro  
 Order No: 168378328\_P00734853  
 Model: RAK7289CV2H  
 Test Mode: operating  
 Test Voltage: AC 120V/60Hz  
 Test By/Review By: Kevin Zhou/Gary Chen  
 Test Standard: FCC Part 15  
 Tem./Hum./Pressure: 23.9°C/51.4%/101kPa  
 Remark: SR1



## Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.398000	---	35.69	47.90	12.20	L1	9.7
0.406000	45.03	---	57.73	12.70	L1	9.7
1.276000	---	20.29	46.00	25.71	L1	9.7
1.332000	30.17	---	56.00	25.83	L1	9.7
5.836000	41.64	---	60.00	18.36	L1	10.0
6.152000	---	31.27	50.00	18.73	L1	10.0
11.624000	36.94	---	60.00	23.06	L1	10.1
11.816000	---	27.82	50.00	22.18	L1	10.1
20.698500	---	45.54	50.00	4.46	L1	10.3
20.698500	47.42	---	60.00	12.58	L1	10.3
25.496000	---	43.20	50.00	6.80	L1	10.4
25.496000	46.23	---	60.00	13.77	L1	10.4

## Final\_Result

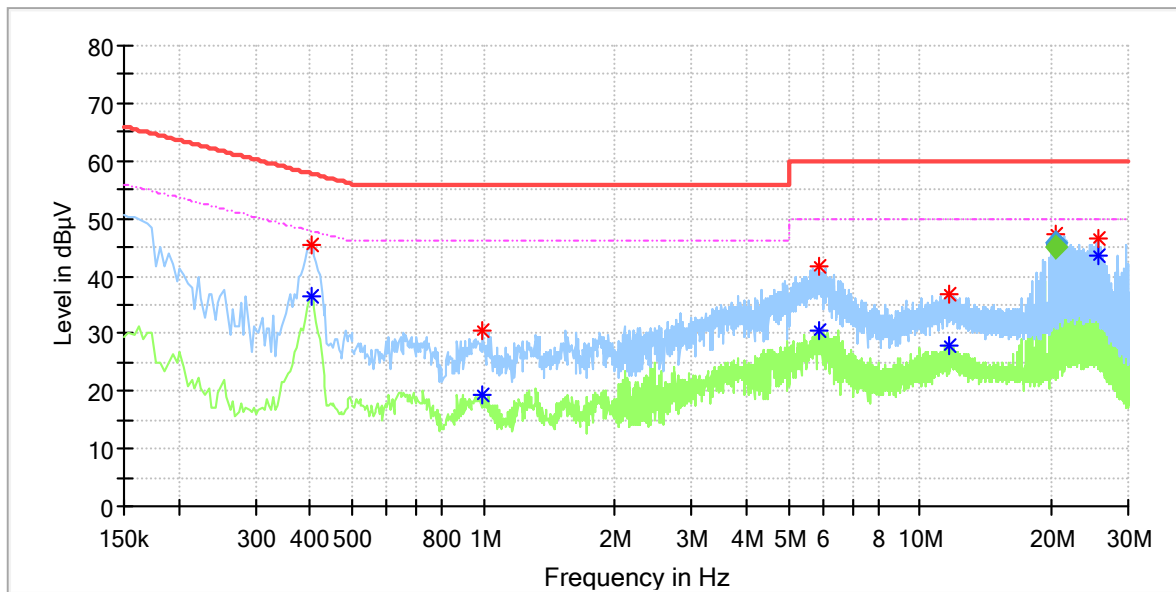
Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
20.698500	45.70	---	60.00	14.30	1000.0	9.000	L1	10.3
20.698500	---	44.79	50.00	5.21	1000.0	9.000	L1	10.3

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### EUT Information

EUT Name: WisGate Edge Pro  
Order No: 168378328\_P00734853  
Model: RAK7289CV2H  
Test Mode: operating  
Test Voltage: AC 120V/60Hz  
Test By/Review By: Kevin Zhou/Gary Chen  
Test Standard: FCC Part 15  
Tem./Hum./Pressure: 23.9°C/51.4%/101kPa  
Remark: SR1



### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.402000	45.38	---	57.81	12.43	N	9.7
0.402000	---	36.42	47.81	11.39	N	9.7
0.996000	---	19.34	46.00	26.66	N	9.7
0.996000	30.68	---	56.00	25.32	N	9.7
5.848000	41.62	---	60.00	18.38	N	10.0
5.876000	---	30.48	50.00	19.52	N	10.0
11.624000	36.72	---	60.00	23.28	N	10.2
11.680000	---	27.77	50.00	22.23	N	10.2
20.446500	47.18	---	60.00	12.82	N	10.3
20.446500	---	45.37	50.00	4.63	N	10.3
25.496000	46.64	---	60.00	13.36	N	10.5
25.496000	---	43.54	50.00	6.46	N	10.5

### Final\_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
20.446500	---	44.86	50.00	5.14	1000.0	9.000	N	10.3
20.446500	45.61	---	60.00	14.39	1000.0	9.000	N	10.3

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