

Prüfbericht-Nr.: <i>Test report no.:</i>	CN222RDT 001	Auftrags-Nr.: <i>Order no.:</i>	168359594	Seite 1 von 13 <i>Page 1 of 13</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2022-01-26	
Auftraggeber: <i>Client:</i>	Shenzhen RAKwireless Technology Co.,Ltd. Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, P.R. China			
Prüfgegenstand: <i>Test item:</i>	WisGate Edge Pro			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	RAK7289C, RAK7289CV2 (Trademark: RAK, Arduino)			
Auftrags-Inhalt: <i>Order content:</i>	Test report			
Prüfgrundlage: <i>Test specification:</i>	AS/NZS 4268:2017			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2022-02-17			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003207708-001 to 003			
Prüfzeitraum: <i>Testing period:</i>	2022-02-23 - 2022-04-07			
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> 2022-04-13	 Signed by: Alex Lan		 Signed by: Winnie Hou	
Stellung / Position	Senior Project Engineer	Ausstellungsdatum: <i>Issue date:</i> 2022-04-15		
Stellung / Position	Senior Project Engineer	Stellung / Position	Technical Certifier	
Sonstiges / Other:	According to clause 6 & 7 of AS/NZS 4268:2017, testing of transmitter / receiver parameters shall be conducted using the appropriate generic product standard for either FCC or ETSI unless a specific product standard in table 1 for Australia.			
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>			
* 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 specifications(s) F(ail) = failed a.m. test specifications(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. <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>				

Prüfbericht - Nr.: CN222RDT 001
Test Report No.:

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Test Summary

5.1.1 Co-LOCATED RADIATED SPURIOUS EMISSIONS

RESULT: Pass

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1 General Remarks

1.1 Remarks

1. Models RAK7289C, RAK7289CV2, contains three or four wireless units, one is license radio module "EG95-E", one is 2.4GHz wifi module "RAK634" and another is one or two identical "Lora + GNSS module" "RAK5146", the Radio, report number refer below:

License Radio Module	Radio test standard	Test report	Issued by
EG95-E	EN 301 511 V12.5.1	R2101A0076-R1	TA Technology (Shanghai) Co., Ltd.
	EN 301 908-1 V13.1.1 EN 301 908-2 V13.1.1	R2101A0076-R2	TA Technology (Shanghai) Co., Ltd.
	EN 301 908-1 V13.1.1 EN 301 908-13 V13.1.1	R2101A0076-R3	TA Technology (Shanghai) Co., Ltd.

2.4GHz wifi module	Radio test standard	Test report	Issued by
RAK634	EN 300 328 V2.2.2 (2019-07)	CN21WY7V 001	TÜV Rheinland (Shenzhen) Co., Ltd.

Lora + GNSS module	Radio test standard	Test report	Issued by
RAK5146	AS/NZS 4268:2017	CN21DFQ7 001	TÜV Rheinland (Shenzhen) Co., Ltd.

2. The above modules installs in the new host, the conducted measurement condition is equivalent previous assessment conditions, then no additional assessment against on the Radio spectrum, detail conducted measurement test data refer to test report listed above.

1.2 Complementary Materials

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

Appendix A: Test Results.

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of 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

TÜV Rheinland (Shenzhen) Co., Ltd.

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

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.

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (conducted)	± 2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB
Radiated Emission (3m SAC), 30MHz to 1000MHz	± 4.52 dB
Radiated Emission (3m SAC), above 1000MHz	± 4.37 dB
Temperature	± 1 °C
Humidity	± 5 %
Voltage (DC)	± 1 %
Voltage (AC, <10kHz)	± 2 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B 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 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 EUTs are a WisGate Edge Pro and it supports Lora, GNSS, 2.4GHz Wi-Fi and LTE wireless technologies.

The model RAK7289C is identical with model RAK7289CV2 except non-radio related Flash chip U2 (on the wifi module): 16MB and 32MB, and this two Flash chip are pin to pin only the storage space is different.

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	RAK7289C, RAK7289CV2
Trademark	RAK, Arduino
Operating Voltage	DC 12V via DC source or DC 37 ~57V via POE adapter
Testing Voltage	AC 230V, 50Hz or DC 12V
Operating temperature Range	-30 °C to +55 °C
POE Adapter information	Model:R012-4800500 Input: AC 100-240V, 50/60Hz, 0.6A Max Output: DC 48.0V, 0.5A 24.0W

Technical Specification of Wi-Fi

Operating Frequency	2412 - 2472 MHz for 802.11b/g/n(HT20) 2422 - 2462 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	13 channels for 802.11b/g/n(HT20) 9 channels for 802.11n(HT40)
Channel Separation	5 MHz
Number of Antenna:	2
Antenna Gain:	5.4dBi for Ant0 5.0dBi for Ant1

Technical Specification of LTE

Wireless Technology:	LTE & UMTS & GSM
Operation Frequency band(s)	GSM 900/1800 UMTS Band: I, VIII LTE Band: 1, 3, 7, 8, 20, 28A
Type of Modulation:	BPSK, QPSK
Type of Antenna:	Internal Antenna
Antenna number:	2
Antenna Gain:	4.0dBi maxi. For Ant0 4.4dBi maxi. For Ant1

Technical Specification of GNSS

Frequency Range	GLONASS G1: 1559 to 1610 MHz(Operating Frequency: 1597-1607MHz) GPS L1: 1559 to 1610 MHz (Operating Frequency:1575.42MHz)
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Technical Specification of Lora (AU915-928)

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
Type of Antenna:	Fiber Glass Antenna
Antenna number:	2
Antenna Gain:	5.1dBi or 8dBi

Technical Specification of Lora (AS923-1)

Operating Frequency		915 - 928MHz		
Type of Antenna:		Fiber Glass Antenna		
Antenna number:		2		
Antenna Gain:		5.1dBi or 8dBi		
Type of Modulation		Lora	Lora	FSK
Data Rate		SF7 – SF12 DR0 – DR5	SF7 / DR6	DR7
Occupied Bandwidth (KHz)		125	250	100
Test Channel (MHz)	Low	915.1	915.2	915.1
	Middle	921.1	921.2	921.1
	High	927.9	927.8	927.9

3.3 Independent Operation Modes

The basic operation modes are:

- A, On, WIFI link + LTE link + Lora link + GNSS link, powered by POE adapter
- B, Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- ID Label and Location Info
- 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 and ANSI C63.4: 2014.

According to clause 3.1, all test were applied on model RAK7289C.

4.3 Special Accessories and Auxiliary Equipment

Table 3: Auxiliary Equipment Used during Test

Description	Manufacturer	Model No.	Serial Number or Rating
Portable Laptop	Lenovo	ThinkPad T480	10Q67059
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	166305
RJ45 cable	RAKwireless	N/A	Shielded cable

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.

5 Test Results

5.1 Radio Test Requirement & Test Suites (Co-Location)

5.1.1 Co-Located Radiated Spurious Emissions

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

Test standard	: AS/NZS 4268:2017
Basic standard	: ANSI C63.10 & ANSI C63.26
Test requirement	: Clause 6.4 of AS/NZS 4268:2017
Limit	: Clause 6.4.1 table 1 of AS/NZS 4268:2017 Refer to 15.209(a)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2022-03-10 to 2022-03-29
Test Environment	: Normal test condition
Test voltage	: AC 230V, 50Hz
Operation mode	: A
Ambient temperature	: 22 °C
Relative humidity	: 55 %
Atmospheric pressure	: 101.4 kPa

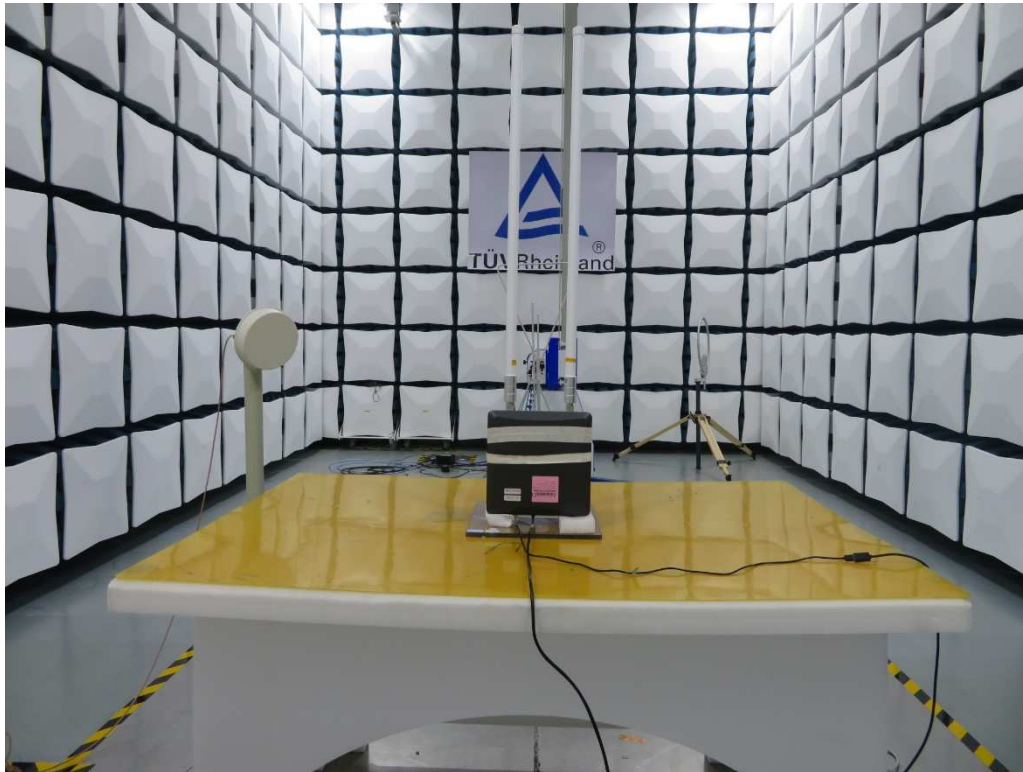
For the measurement records, refer to the appendix A.

Note1: The test plots of Co-located radiated spurious emissions beyond the limit are the fundamental radio frequency of Wi-Fi with Lora and LTE / UMTS / GSM.

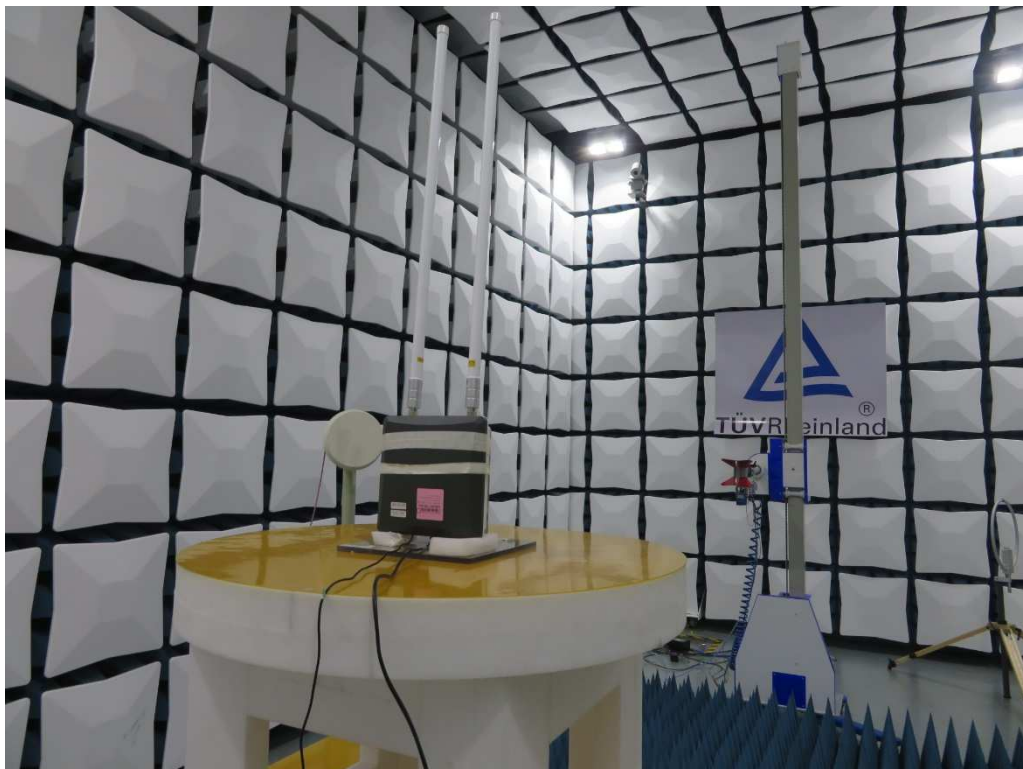
Note2: only the worst case mode are shown in this report.

6 Photographs of the Test Set-Up

Photograph 1: Set-up for Co-Located Radiated Spurious Emissions, below 1GHz



Photograph 2: Set-up for Co-Located Radiated Spurious Emissions, above 1GHz



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Appendix A

Test Results

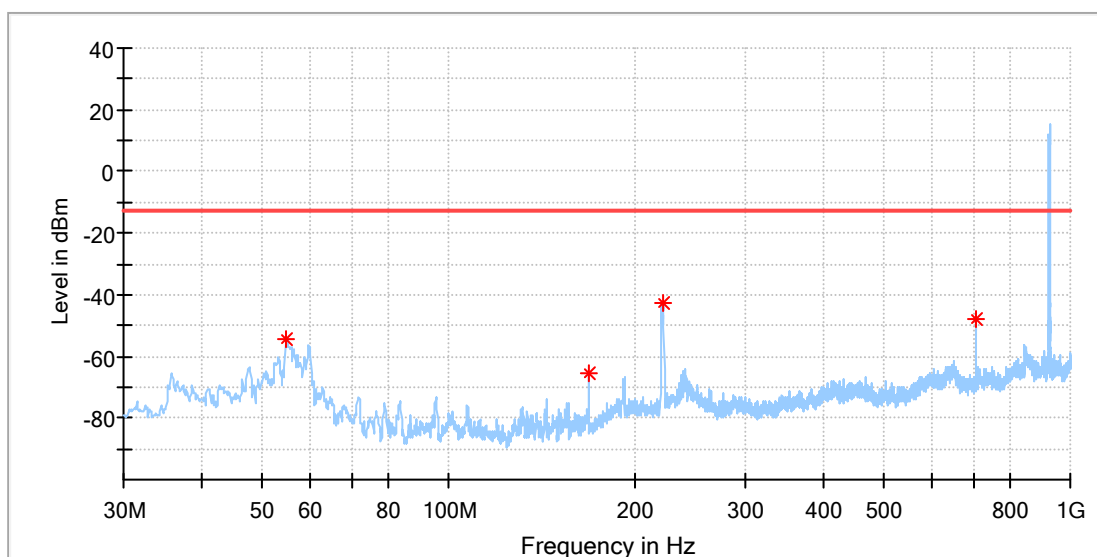
1 **APPENDIX A.1: TEST PLOTS OF CO-LOCATED RADIATED SPURIOUS EMISSIONS.....2**

1 Appendix A.1: Test Plots of Co-Located Radiated Spurious Emissions

RAK7289C, Antenna gain 5.1dBi

EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289C
Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
Remark:	Temp 22 Humi:55%
Test Standard:	AS/NZS 4268
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

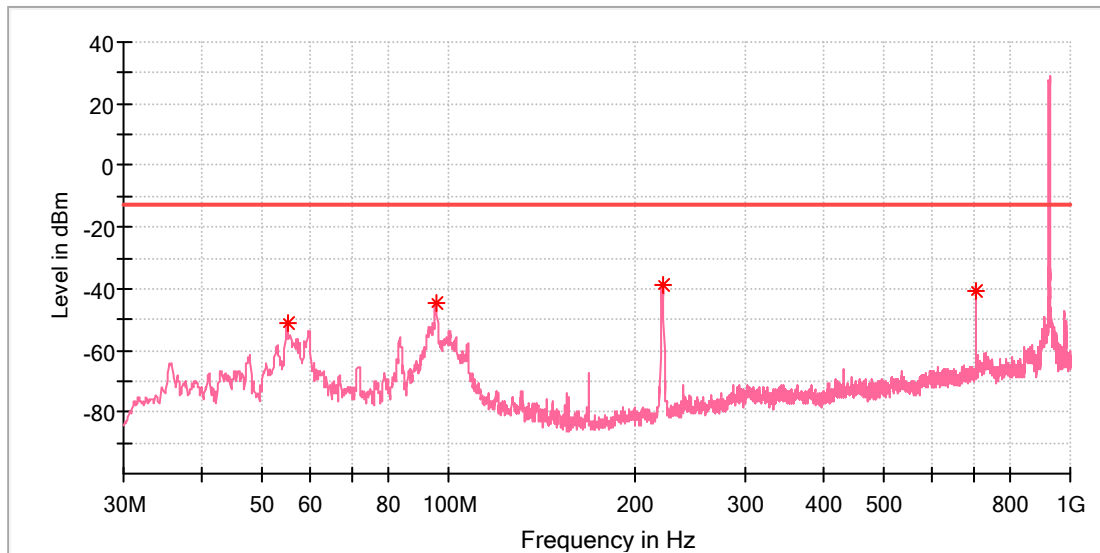


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
54.856250	-54.56	-13.00	41.56	100.0	H	178.0	-116.5
167.982500	-65.76	-13.00	52.76	100.0	H	125.0	-121.7
221.211250	-42.87	-13.00	29.87	100.0	H	280.0	-114.1
704.513750	-47.95	-13.00	34.95	100.0	H	83.0	-106.4

EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289C
Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
Remark:	Temp 22 Humi:55%
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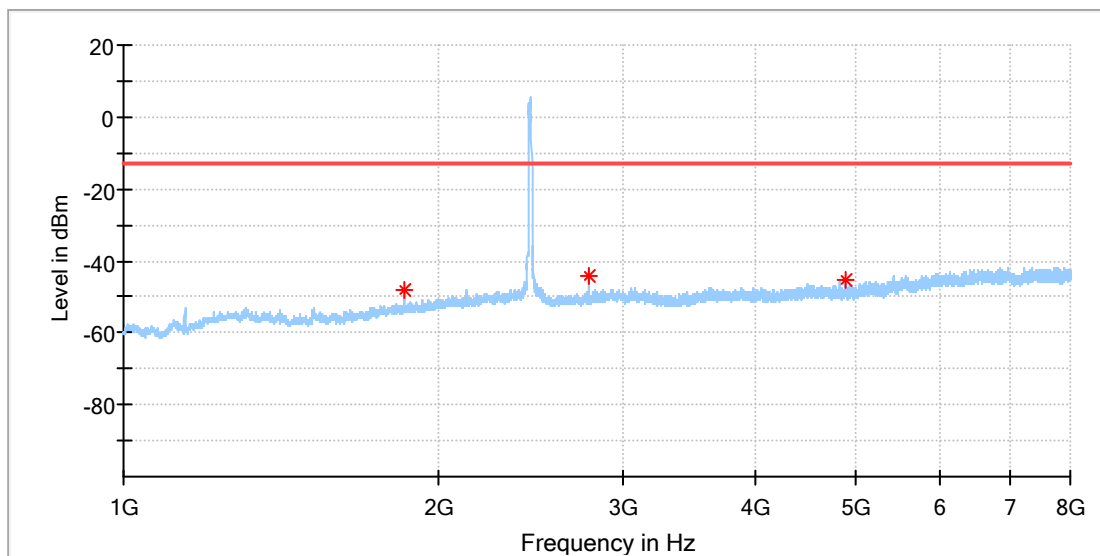


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
54.977500	-51.35	-13.00	38.35	100.0	V	330.0	-122.8
95.353750	-44.94	-13.00	31.94	100.0	V	179.0	-100.2
221.332500	-38.79	-13.00	25.79	100.0	V	156.0	-118.1
705.120000	-41.06	-13.00	28.06	100.0	V	63.0	-104.9

EUT Information

EUT Name:	WisGate Edge Pro
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Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
Remark:	Temp 22 Humi:55%
Test Standard:	AS/NZS 4268
Tested By:	Kei Zhang
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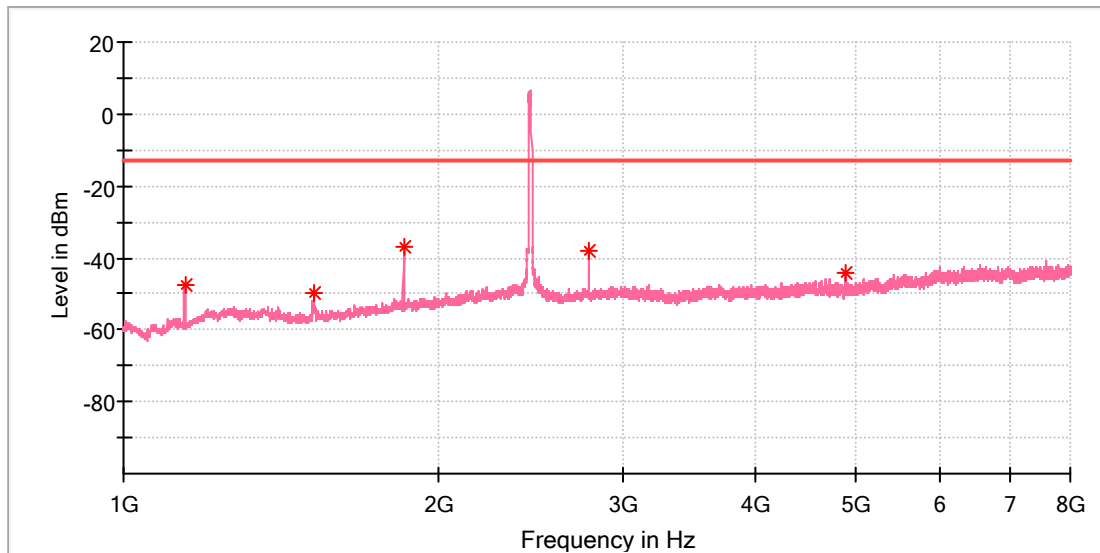


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1850.500000	-48.31	-13.00	35.31	100.0	H	346.0	-90.5
2775.000000	-44.36	-13.00	31.36	100.0	H	173.0	-87.6
4881.500000	-45.43	-13.00	32.43	100.0	H	233.0	-85.8

EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289C
Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
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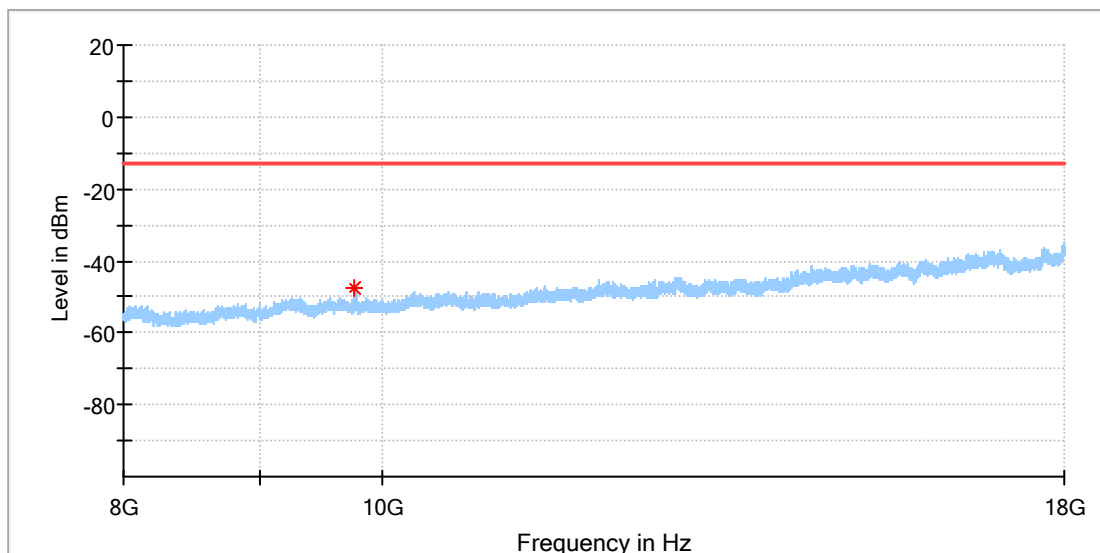


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1144.000000	-47.63	-13.00	34.63	100.0	V	119.0	-93.8
1518.500000	-49.58	-13.00	36.58	100.0	V	158.0	-93.7
1850.500000	-37.18	-13.00	24.18	100.0	V	0.0	-90.2
2775.000000	-38.05	-13.00	25.05	100.0	V	6.0	-87.3
4887.000000	-43.96	-13.00	30.96	100.0	V	174.0	-85.8

EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289C
Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
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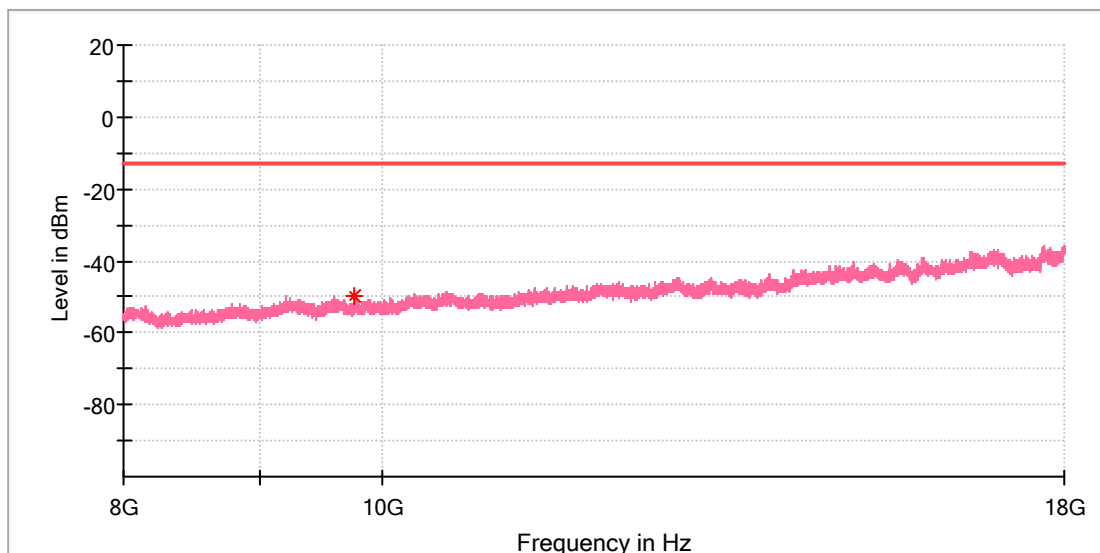


Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
9759.000000	-47.71	-13.00	34.71	100.0	H	131.0	-84.1

EUT Information

EUT Name:	WisGate Edge Pro
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Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
Remark:	Temp 22 Humi:55%
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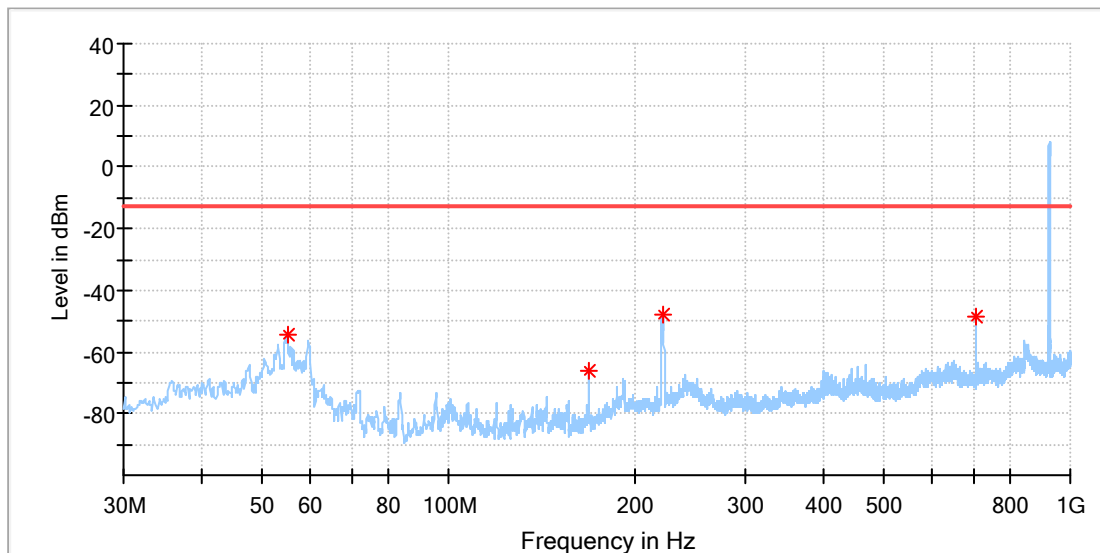
Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
9764.500000	-49.88	-13.00	36.88	100.0	V	169.0	-84.2

RAK7289C, Antenna gain 8dBi

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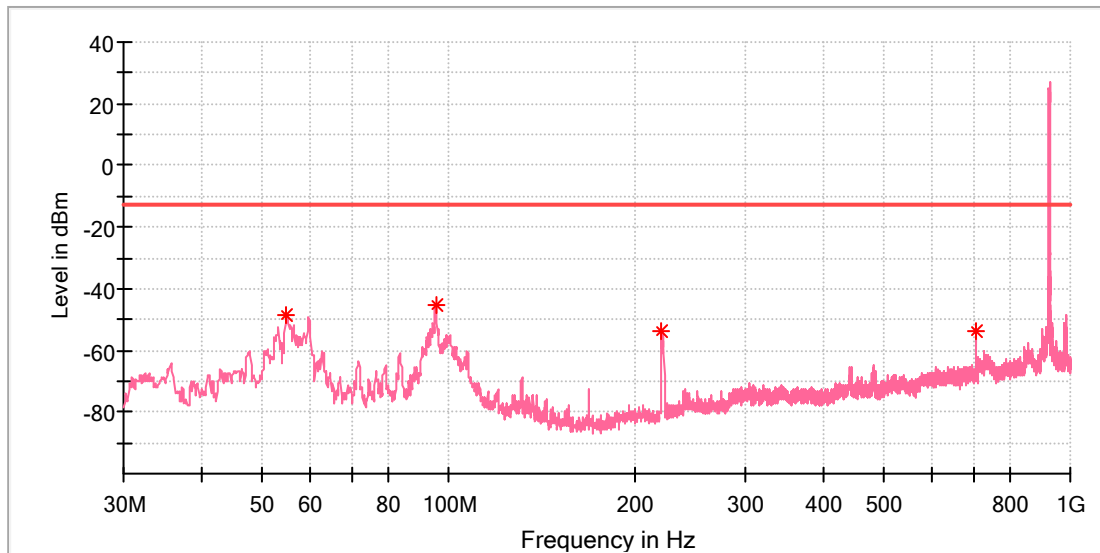


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
55.098750	-54.34	-13.00	41.34	100.0	H	154.0	-116.7
167.982500	-66.11	-13.00	53.11	100.0	H	130.0	-121.7
221.332500	-48.15	-13.00	35.15	100.0	H	176.0	-114.1
704.513750	-48.37	-13.00	35.37	100.0	H	92.0	-106.4

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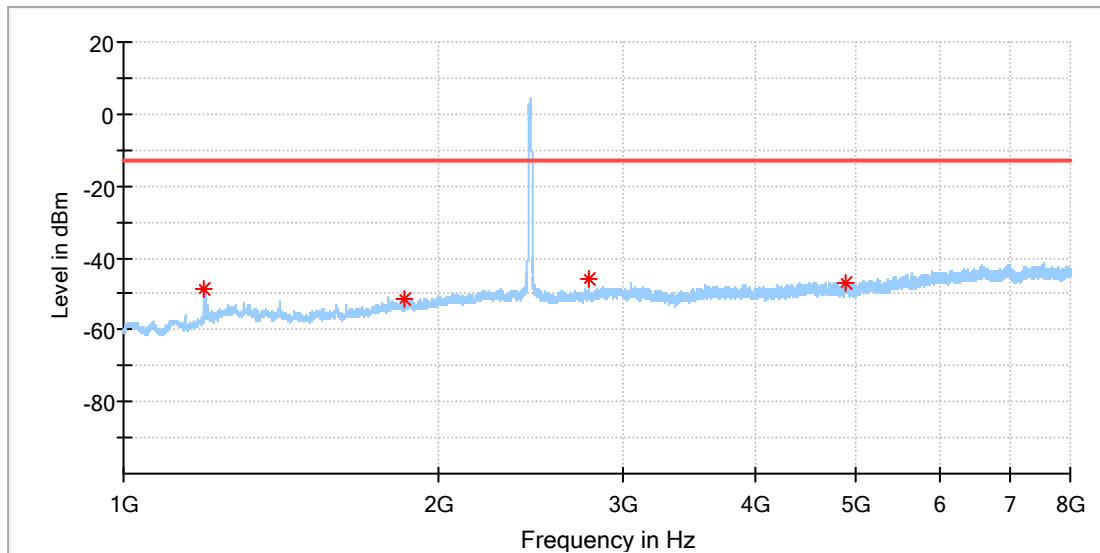


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
54.856250	-48.49	-13.00	35.49	100.0	V	340.0	-122.8
95.353750	-45.39	-13.00	32.39	100.0	V	216.0	-100.2
220.483750	-54.02	-13.00	41.02	100.0	V	208.0	-118.1
703.301250	-53.81	-13.00	40.81	100.0	V	113.0	-105.0

EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289C
Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
Remark:	Temp 22 Humi:55%
Test Standard:	AS/NZS 4268
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

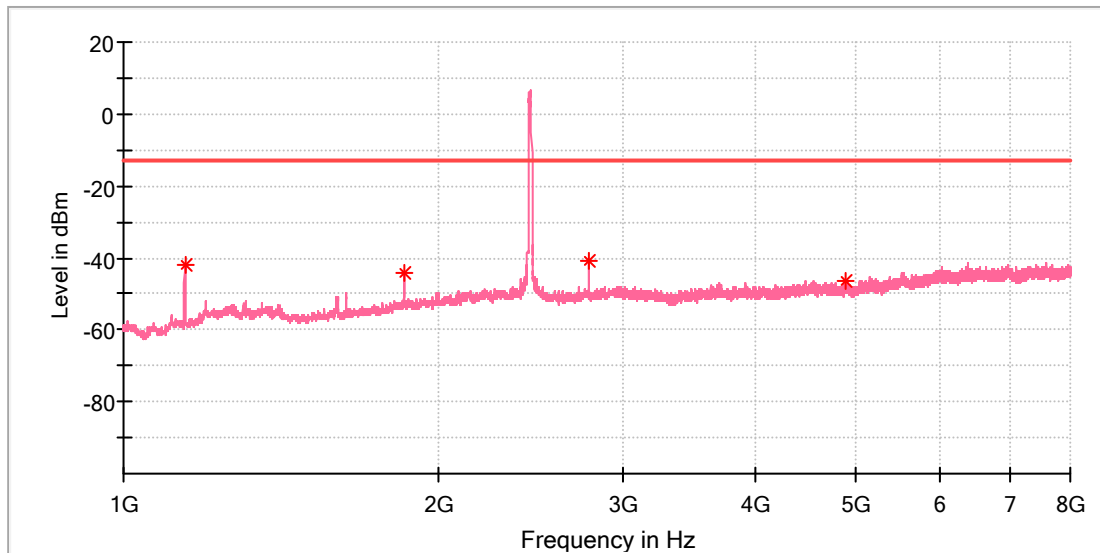


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.000000	-48.89	-13.00	35.89	100.0	H	70.0	-93.1
1850.500000	-51.69	-13.00	38.69	100.0	H	0.0	-90.5
2775.500000	-45.74	-13.00	32.74	100.0	H	76.0	-87.6
4881.000000	-47.18	-13.00	34.18	100.0	H	196.0	-85.8

EUT Information

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Model:	RAK7289C
Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
Remark:	Temp 22 Humi:55%
Test Standard:	AS/NZS 4268
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

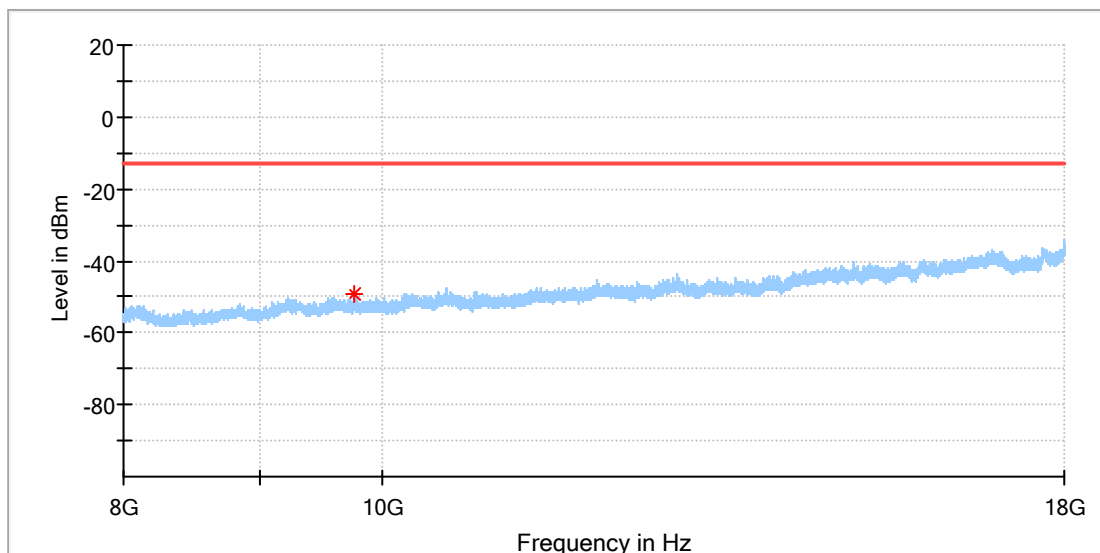


Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1144.500000	-41.72	-13.00	28.72	100.0	V	180.0	-93.8
1850.000000	-44.40	-13.00	31.40	100.0	V	115.0	-90.2
2775.500000	-40.75	-13.00	27.75	100.0	V	315.0	-87.3
4880.500000	-46.53	-13.00	33.53	100.0	V	174.0	-85.8

EUT Information

EUT Name:	WisGate Edge Pro
Model:	RAK7289C
Test Mode:	Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No:	168359398/A003207708-002
Test Voltage::	AC 230V, 50Hz
Remark:	Temp 22 Humi:55%
Test Standard:	AS/NZS 4268
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

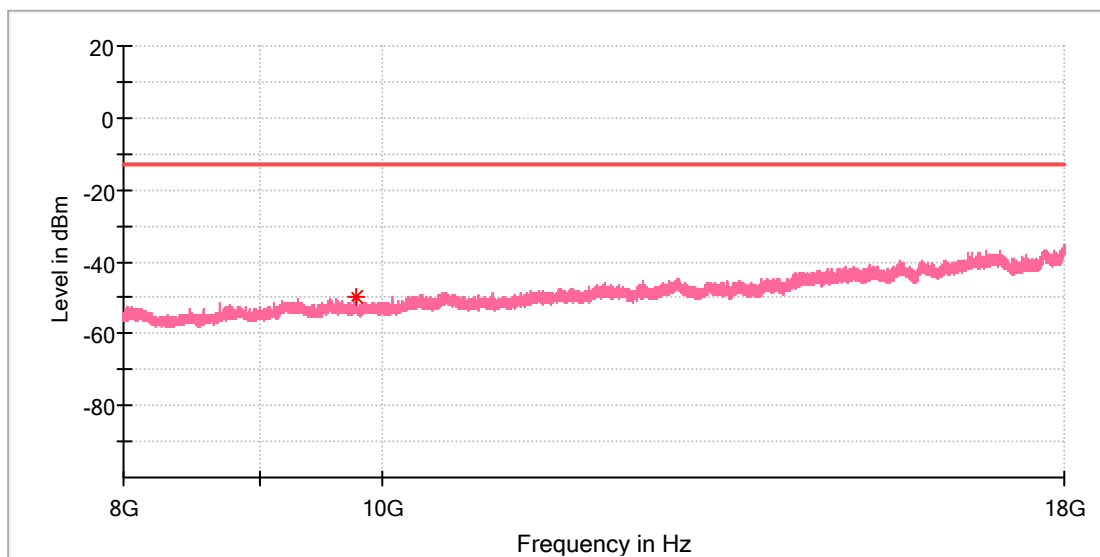


Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
9768.000000	-48.95	-13.00	35.95	100.0	H	132.0	-84.2

EUT Information

EUT Name: WisGate Edge Pro
Model: RAK7289C
Test Mode: Lora DTS 500K+WIFI 2.4G+LTE B28
Order No/Sample No: 168359398/A003207708-002
Test Voltage:: AC 230V, 50Hz
Remark: Temp 22 Humi:55%
Test Standard: AS/NZS 4268
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)
9771.000000	-49.58	-13.00	36.58	100.0	V	185.0	-84.3