Prüfbericht - Produkte
Test Report - Products

TÜVRheinland®

Prüfbericht-Nr.: *Test report no.:*	**CN22UVVX 002**	**Auftrags-Nr.:** *Order no.:*	168364197	Seite 1 von 21 *Page 1 of 21*
Kunden-Referenz-Nr.: *Client reference no.:*	N/A	**Auftragsdatum:** *Order date:*	2022-03-23	
Auftraggeber: *Client:*	**Shenzhen RAKwireless Technology Co.,Ltd.** Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China			
Prüfgegenstand: *Test item:*	TrackIt			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	RAK2171 (Trademark: WisNode TrackIt™)			
Auftrags-Inhalt: *Order content:*	FCC and IC approval			
Prüfgrundlage: *Test specification:*	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209	RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 February 2021		
Wareneingangsdatum: *Date of sample receipt:*	2022-03-23	Please refer to photo documents		
Prüfmuster-Nr.: *Test sample no.:*	A003240040			
Prüfzeitraum: *Testing period:*	2022-03-25 – 2022-05-20			
Ort der Prüfung: *Place of testing:*	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: *Test result*:*	Pass			
geprüft von: *tested by:*	X Alex Lan	**genehmigt von:** *authorized by:*	X Winnie Hou	
Datum: *Date:* 2022-06-07	Signed by: Alex Lan	**Ausstellungsdatum:** *Issue date:* 2022-06-08	Signed by: Winnie Hou	
Stellung / Position	Assistant Project Manager	**Stellung** / Position	Department Manager	
Sonstiges / *Other:*	FCC ID: 2AF6B-RAK2171X IC: 25908-RAK2171X HVIN: RAK2171X			
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 = mangelhalt
	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.

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.

V05

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 99%DB BANDWIDTH
RESULT: Pass

5.1.5 6DB BANDWIDTH
RESULT: Pass

5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH
RESULT: Pass

5.1.7 RADIATED SPURIOUS EMISSION
RESULT: Pass

5.1.8 CONDUCTED EMISSION ON AC MAINS
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: Photographs of the Test Set-up

Appendix B: Test Results of Conducted & Radiated Testing

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

Radio Spectrum Testing				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Cal. until**
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY60241175	2022-09-28
MXG X-Series RF Vector Signal Generator	Keysight	N5182B	MY61250137	2022-09-28
EXG X-Series Microwave Analog Signal Generator	Keysight	N5173B	MY61250141	2022-09-28
DC Power Supply	Keysight	E3642A	MY61276100	2022-09-28
Power Control Unit	Tonscend	JS0806-4ADC	N/A	2022-09-28
Automation Control Unit	Tonscend	JS0806-2	21C8060396	2022-09-28
Test Software	Tonscend	JS1120-3	N/A	N/A
Control PC	Lenovo	TianYi510S-071MB	YLX23JMF	N/A
Unwanted Emission Testing				
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 Emission on AC Mains				
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cali. until**

EMI Test Receiver	R&S	ESR3	102680	2023-02-27
Artificial Mains Network	R&S	ENV216	101445	2023-02-27
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 basics 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.

Item		Extended Uncertainty
Conducted Emission		± 2.74 dB
Radiated Emission (30-1000MHz)	Field strength (dBµV/m)	4.27dB
Radiated Emission (above 1000MHz)	Field strength (dBµV/m)	4.46dB
Radio Spectrum		± 1.5 dB

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) 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 TrackIt, which supports Lora, Bluetooth Low Energy and GNSS technologies.

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	TrackIt
Type Designation	RAK2171
Trademark	WisNode TrackIt™
FCC ID	2AF6B-RAK2171X
IC	25908-RAK2171X
HVIN	RAK2171X
Operating Voltage	DC 3.7V, 400mAh via built-in Lithium Battery or DC 5V, 1A for charging
Technical Specification of Bluetooth Low Energy	
Operating Frequency	2402 – 2480 MHz
Channel Number	40 channels
Channel separation	2MHz
Data rate	1Mbps
Modulation	GFSK
Antenna Type	Integral antenna
Smart Antenna Systems:	Not Applicable
Number of Antenna	1
Antenna Gain	-0.8 dBi

Table 3: RF Channel and Frequency of Bluetooth Low Energy

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
00	**2402.00**	10	2422.00	20	2442.00	30	2462.00
01	2404.00	11	2424.00	21	2444.00	31	2464.00
02	2406.00	12	2426.00	22	2446.00	32	2466.00
03	2408.00	13	2428.00	23	2448.00	33	2468.00
04	2410.00	14	2430.00	24	2450.00	34	2470.00
05	2412.00	15	2432.00	25	2452.00	35	2472.00
06	2414.00	16	2434.00	26	2454.00	36	2474.00
07	2416.00	17	2436.00	27	2456.00	37	2476.00
08	2418.00	18	2438.00	28	2458.00	38	2478.00
09	2420.00	**19**	**2440.00**	29	2460.00	**39**	**2480.00**

3.3 Independent Operation Modes

The basic operation modes are:

A. On, transmitting mode
   1. Low channel
   2. Middle channel
   3. High channel

B. On, Operating

C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form
- Block Diagram
- FCC/IC Label and Location Info
- Operation Description
- Photo Document
- Schematics
- 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 testing were performed according to the procedures in ANSI C63.10: 2013.

4.3 Special Accessories and Auxiliary Equipment

Table 4: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N
PC	Lenovo	ThinkPad T480	N/A
PC adapter	Lenovo	ADLX65YDC3A	01FR030

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)

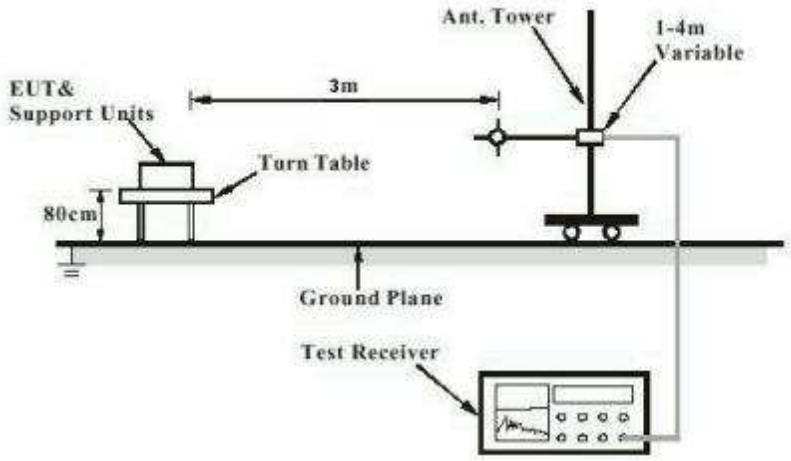


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

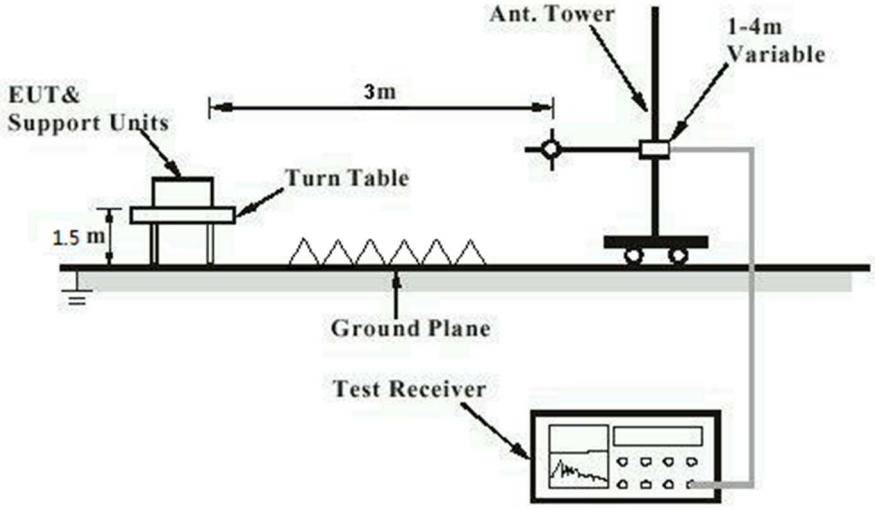


Diagram of Measurement Configuration for Mains Conduction Measurement

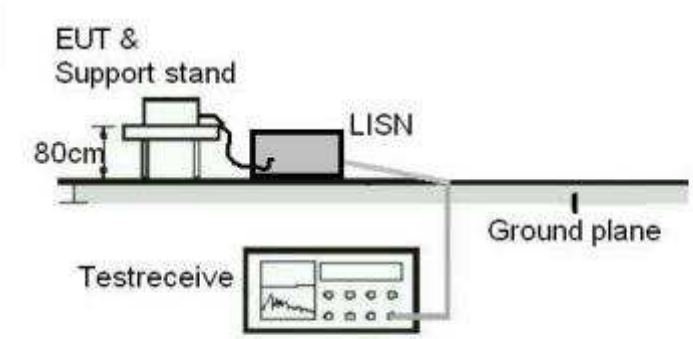
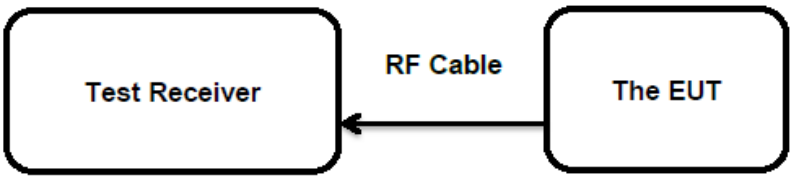


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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 RSS-Gen Clause 6.7
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declared, the EUT has an ceramic chip antenna , the directional gain of antenna is -0.8 dBi, 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.

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 Watt (Maximum Conducted Peak Power) e.i.r.p. <4W
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-29
Input voltage	:	DC 3.7V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	53 %
Atmospheric pressure	:	101 kPa

For details refer to following test result.

Table 5: Test Result of Maximum Conducted Output Power, 1Mbps

Channel	Channel Frequency (MHz)	Conducted Peak Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2402	-2.05	0.00062	1
Middle Channel	2440	-1.77	0.00067	1
High Channel	2480	-1.14	0.00077	1

Channel	Channel Frequency (MHz)	Conducted Average Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2402	-2.16	0.00061	1
Middle Channel	2440	-2.08	0.00062	1
High Channel	2480	-1.25	0.00075	1

Note: The cable loss is taken into account in results and the e.i.r.p. is 0.94890P-98P0-989 dBm less than 4W (36 dBm).

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	:	2022-04-29
Input voltage	:	DC 3.7V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	53 %
Atmospheric pressure	:	101 kPa

For details refer to following test result.

Table 6: Test Result of Power Spectral Density, 1Mbps

Channel	Channel Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Low Channel	2402	-17.75	8
Middle Channel	2440	-17.32	8
High Channel	2480	-17.04	8

Note: The cable loss is taken into account in results.

For the measurement records, refer to the appendix B.

5.1.4 99%dB Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	RSS-Gen clause 6.7
Basic standard	:	ANSI C63.10: 2013
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-29
Input voltage	:	DC 3.7V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	53 %
Atmospheric pressure	:	101 kPa

Table 7: Test Result of 99% Bandwidth, 1Mbps

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2402	1.0379	/	Pass
Mid Channel	2440	1.0402	/	Pass
High Channel	2480	1.0381	/	Pass

For the measurement records, refer to the appendix B.

5.1.5 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
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-29
Input voltage	:	DC 3.7V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	53 %
Atmospheric pressure	:	101 kPa

Table 8: Test Result of 6dB Bandwidth, 1Mbps

Channel	Channel Frequency (MHz)	-6dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2402	708	500	Pass
Mid Channel	2440	704	500	Pass
High Channel	2480	688	500	Pass

For the measurement records, refer to the appendix B.

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	:	2022-04-29
Input voltage	:	DC 3.7V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	53 %
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 B.

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 & 5.5
Basic standard	:	ANSI C63.10: 2013
Limits	:	Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 4 & Table 5
Kind of test site	:	3m Semi-anechoic Chamber

Test Setup

Date of testing	:	2022-03-25 – 2022-05-20
Input voltage	:	DC 3.7V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	23 ℃
Relative humidity	:	58 %
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 B.

5.1.8 Conducted Emission on AC Mains

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.207(a) RSS-Gen Clause 8.8
Basic standard	:	ANSI C63.10: 2013
Frequency range	:	0.15 – 30MHz
Limits	:	FCC Part 15.207(a) RSS-Gen Table 4
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-25
Input voltage	:	Powered by Adapter
Operation mode	:	B
Earthing	:	Not connected
Ambient temperature	:	24.8 ℃
Relative humidity	:	53 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

6 Photographs of the Test Set-Up

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

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Appendix B: Test Results

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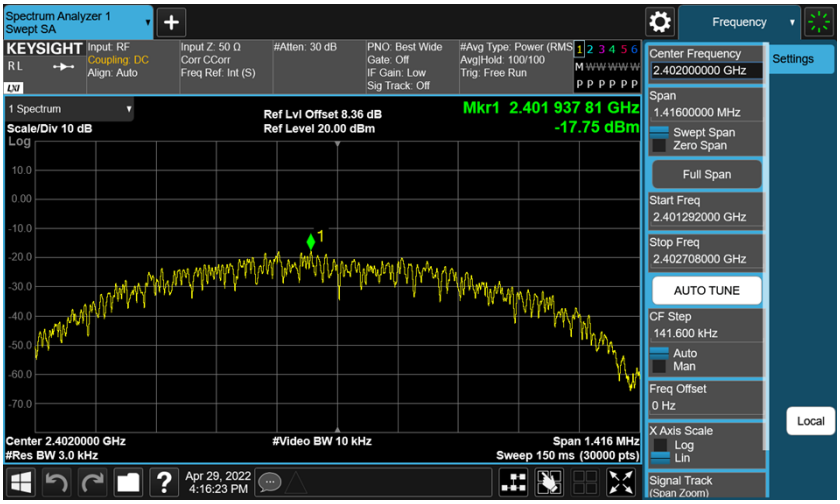
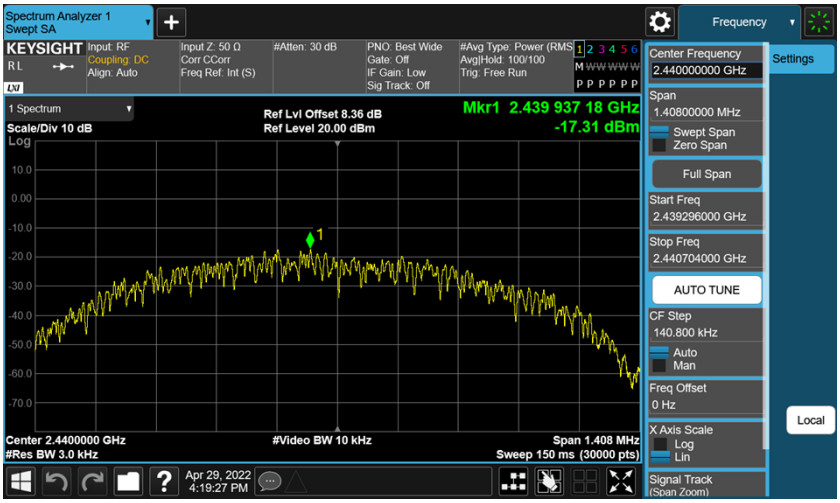
Appendix B.1: Conducted Power Spectral Density

BLE, 1Mbps

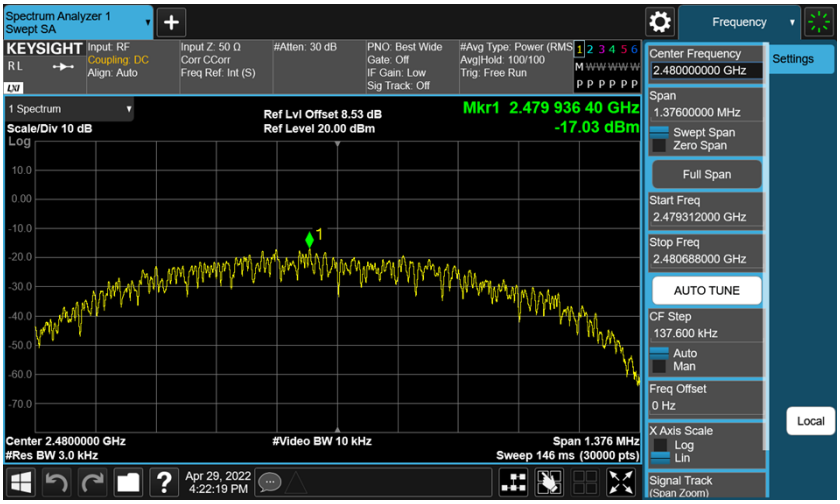
Low Channel



Middle Channel



High Channel



Appendix B.2: 6dB Bandwidth

BLE, 1Mbps

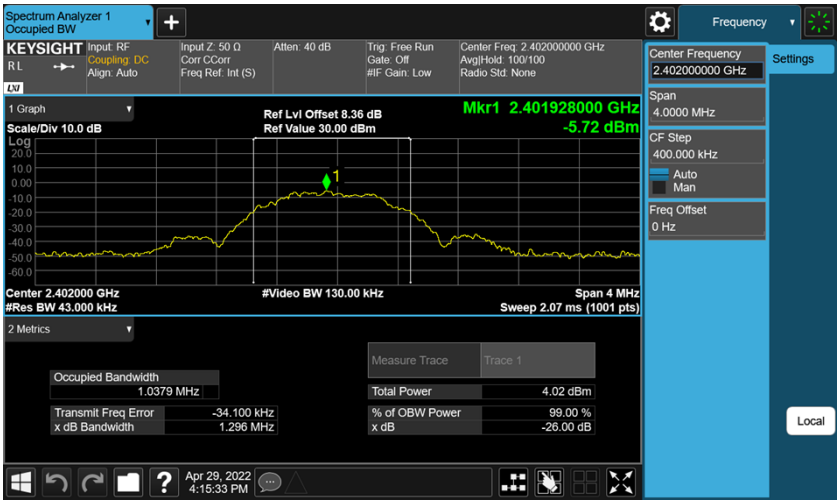
Low Channel

Middle Channel

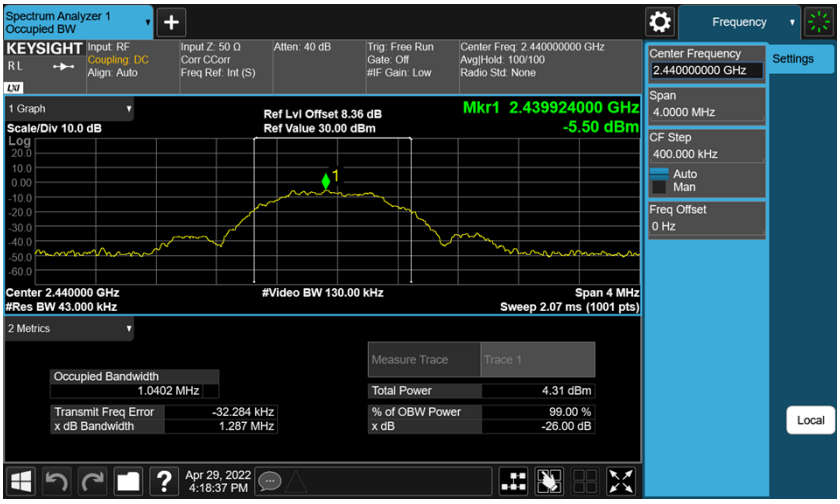
High Channel

Appendix B.3: 99% Bandwidth

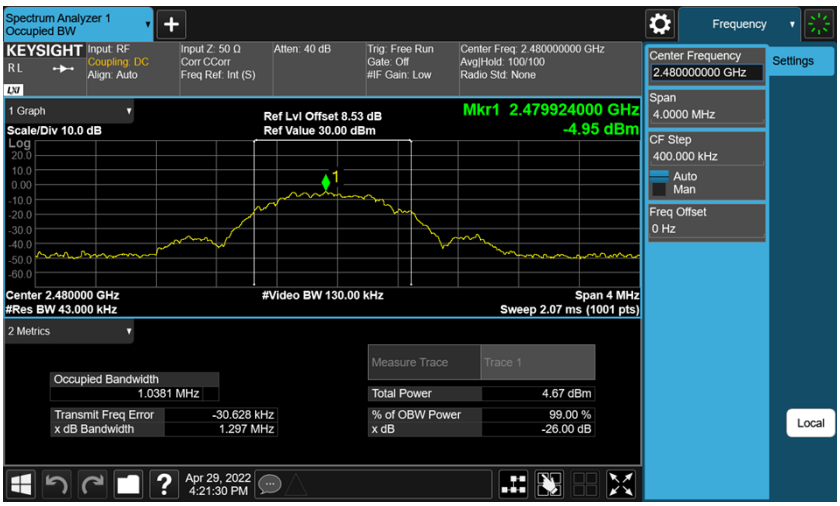
BLE, 1Mbps
Low Channel



Middle Channel



High Channel

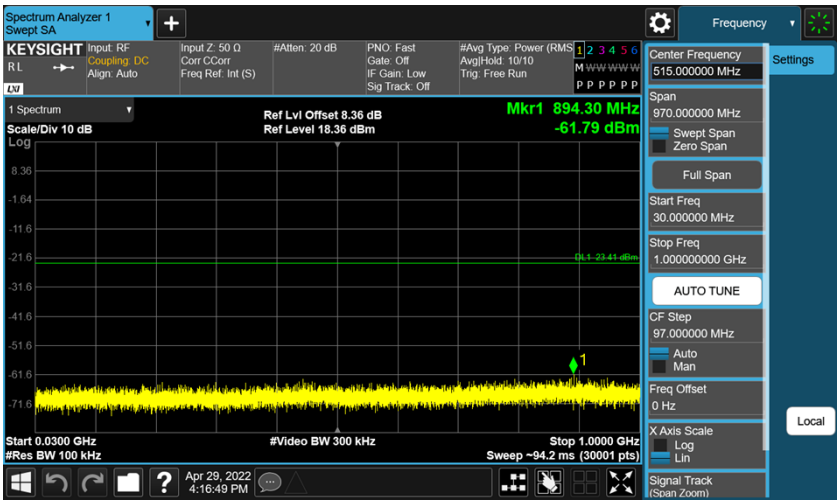


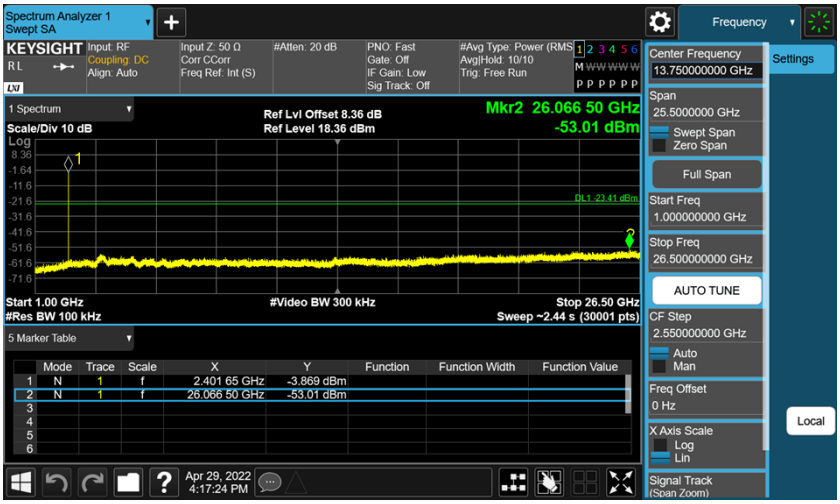
Appendix B.4: Conducted Spurious Emissions Measured in 100 kHz Bandwidth

BLE, 1Mbps

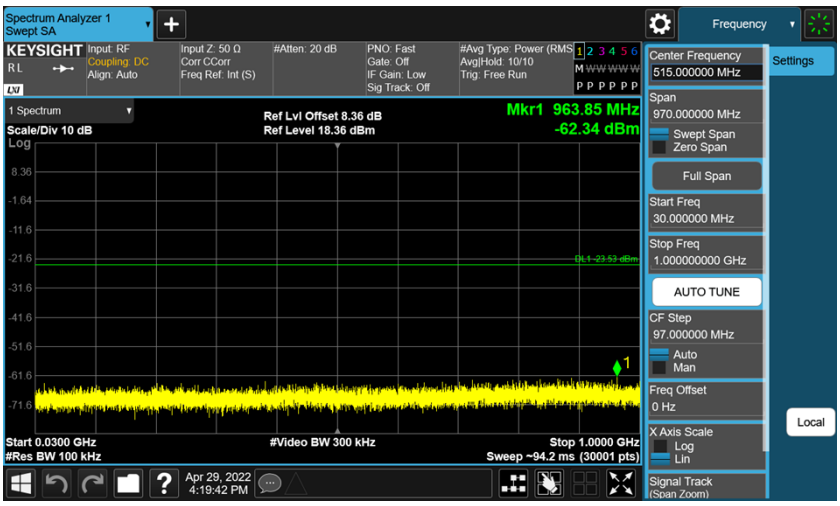
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	-3.41	-3.41	---	PASS
			30~1000	-3.41	-61.79	≤-23.41	PASS
			1000~26500	-3.41	-53.01	≤-23.41	PASS
		2440	Reference	-3.53	-3.53	---	PASS
			30~1000	-3.53	-62.34	≤-23.53	PASS
			1000~26500	-3.53	-53.21	≤-23.53	PASS
		2480	Reference	-3.33	-3.33	---	PASS
			30~1000	-3.33	-61.72	≤-23.33	PASS
			1000~26500	-3.33	-52.95	≤-23.33	PASS

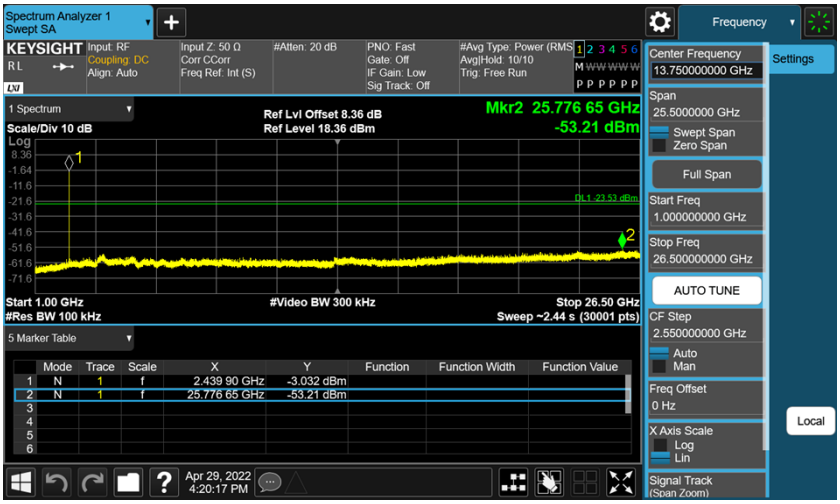
Low Channel



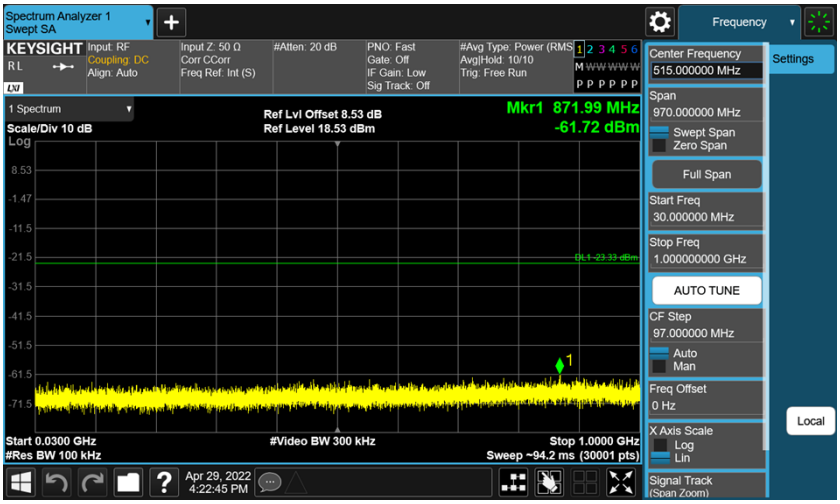


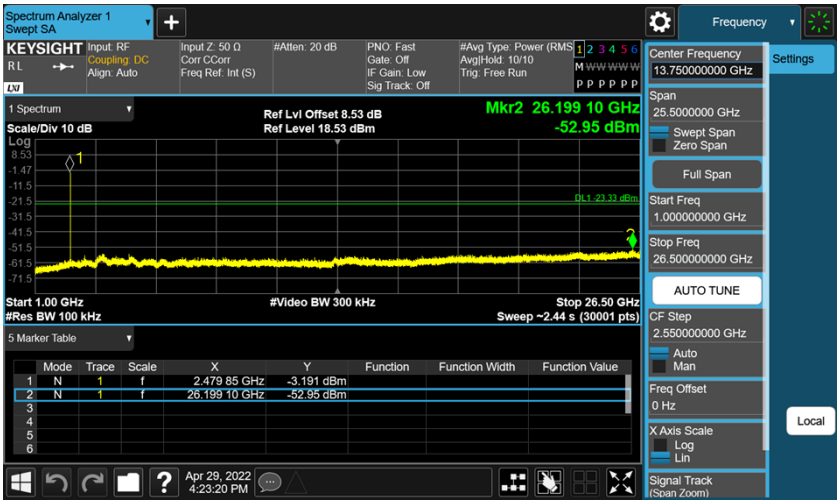
Middle Channel





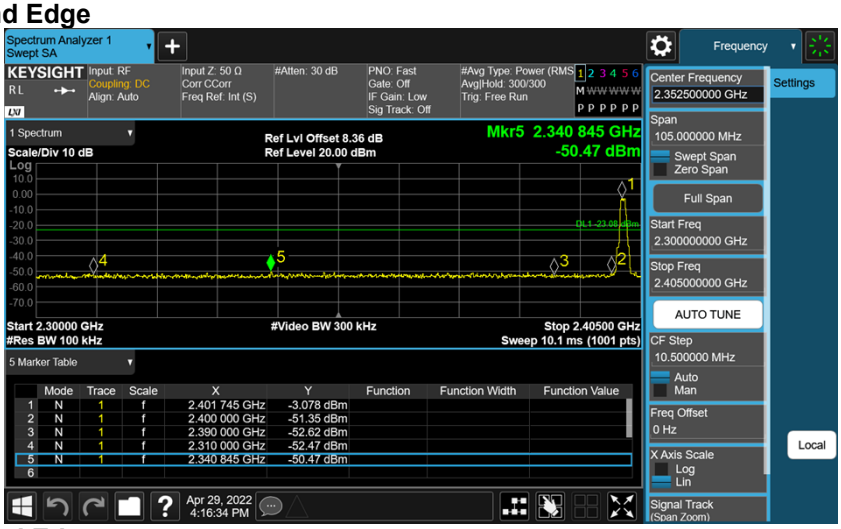
High Channel



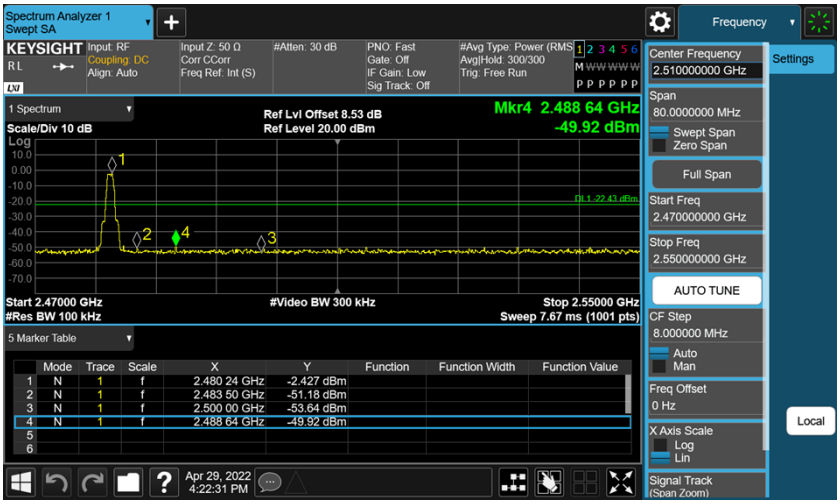


TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	-3.08	-50.47	≤-23.08	PASS
		High	2480	-2.43	-49.92	≤-22.43	PASS

Low Channel_Band Edge



High Channel_Band Edge



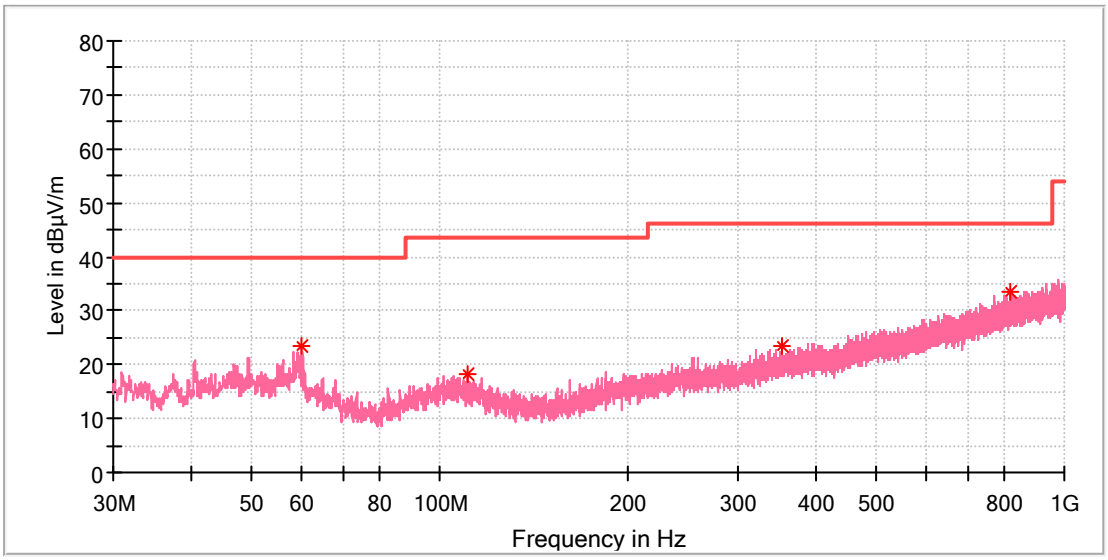
Appendix B.5: Test Results of Radiated Spurious Emissions

Note 1: Testing was carried out within frequency range 9 kHz to the tenth harmonics. The measurement results below 30MHz and above 18GHz were greater than 20dB below the limit, so only the radiated spurious emissions from 30MHz to 18GHz were reported.

BLE, 1Mbps

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

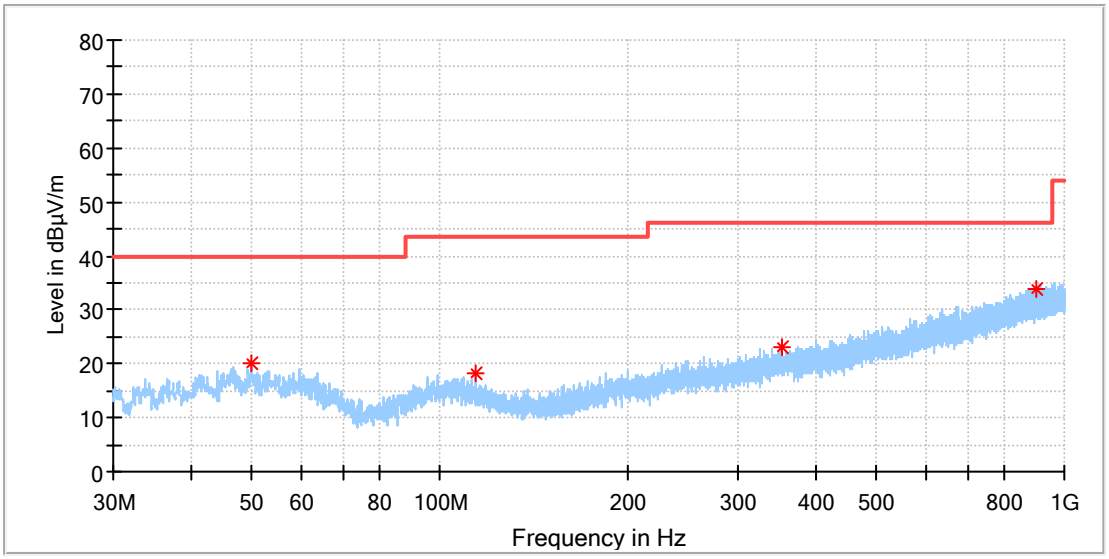


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
60.215500	23.35	40.00	16.65	100.0	V	181.0	-19.0
110.655500	18.15	43.50	25.35	100.0	V	294.0	-19.2
352.282500	23.36	46.00	22.64	100.0	V	176.0	-14.7
819.240500	33.45	46.00	12.55	100.0	V	261.0	-6.0

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_ Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

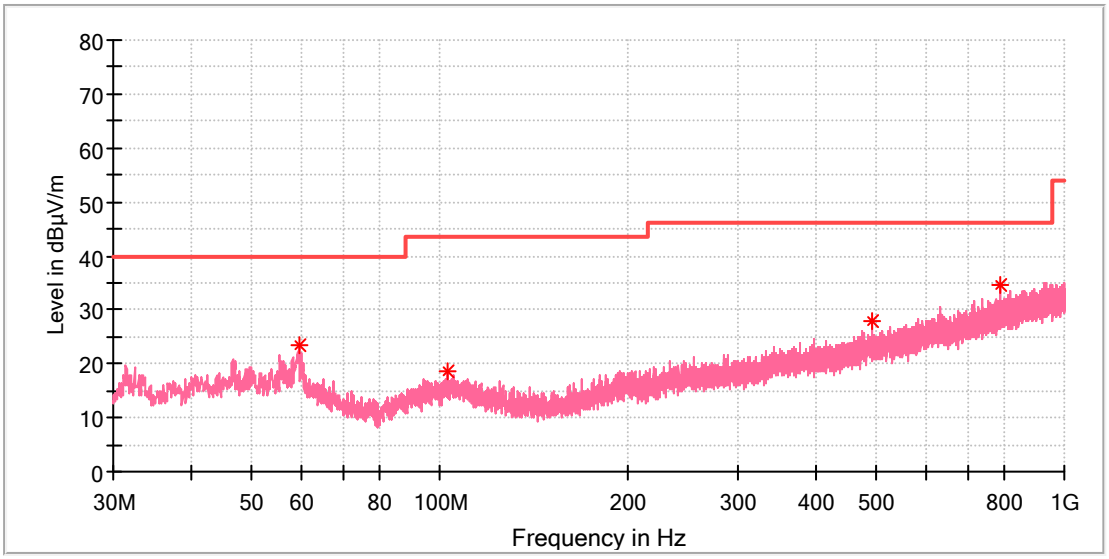


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
49.885000	20.16	40.00	19.84	100.0	H	86.0	-18.3
114.390000	18.21	43.50	25.29	100.0	H	219.0	-19.7
352.816000	23.08	46.00	22.92	100.0	H	304.0	-14.7
898.683500	33.86	46.00	12.14	100.0	H	44.0	-5.0

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

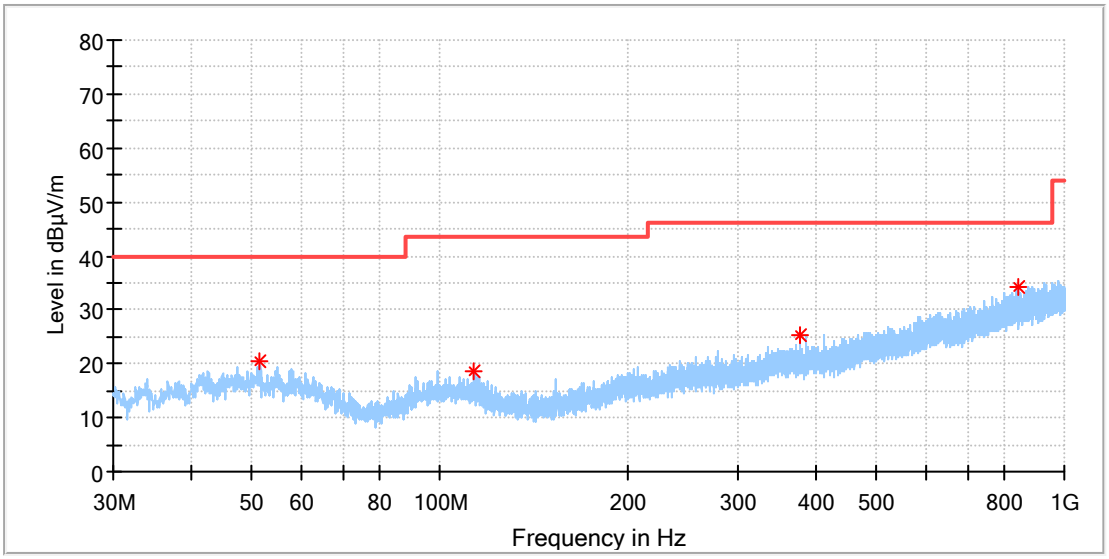


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
59.439500	23.32	40.00	16.68	100.0	V	108.0	-18.9
103.041000	18.45	43.50	25.05	100.0	V	252.0	-18.8
492.399000	27.82	46.00	18.18	100.0	V	301.0	-11.9
789.704000	34.62	46.00	11.38	100.0	V	355.0	-6.5

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

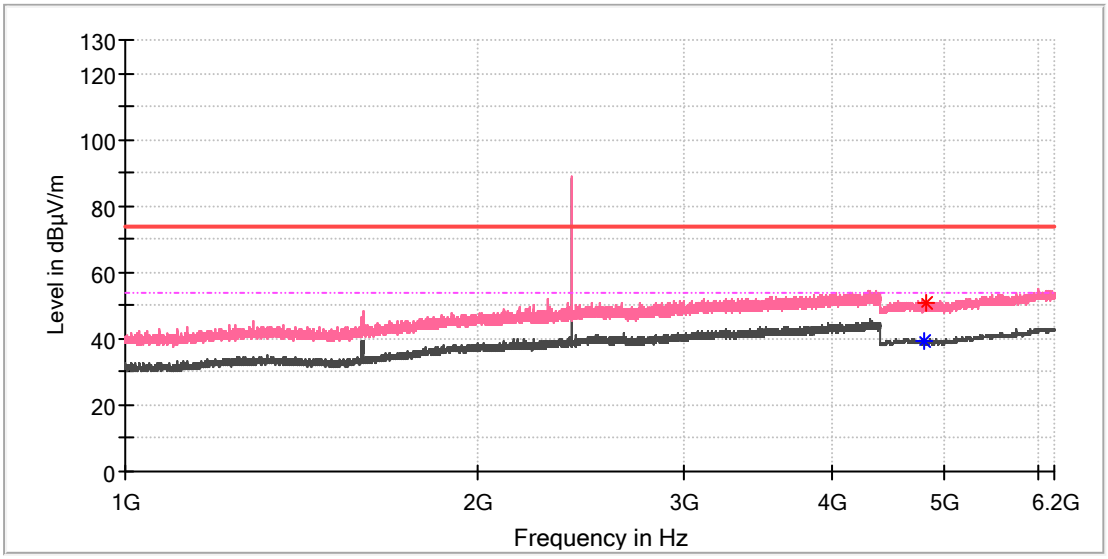


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
51.582500	20.44	40.00	19.56	100.0	H	147.0	-18.3
113.711000	18.48	43.50	25.02	100.0	H	298.0	-19.6
377.793500	25.20	46.00	20.80	100.0	H	174.0	-14.3
843.151000	34.18	46.00	11.82	100.0	H	196.0	-5.6

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

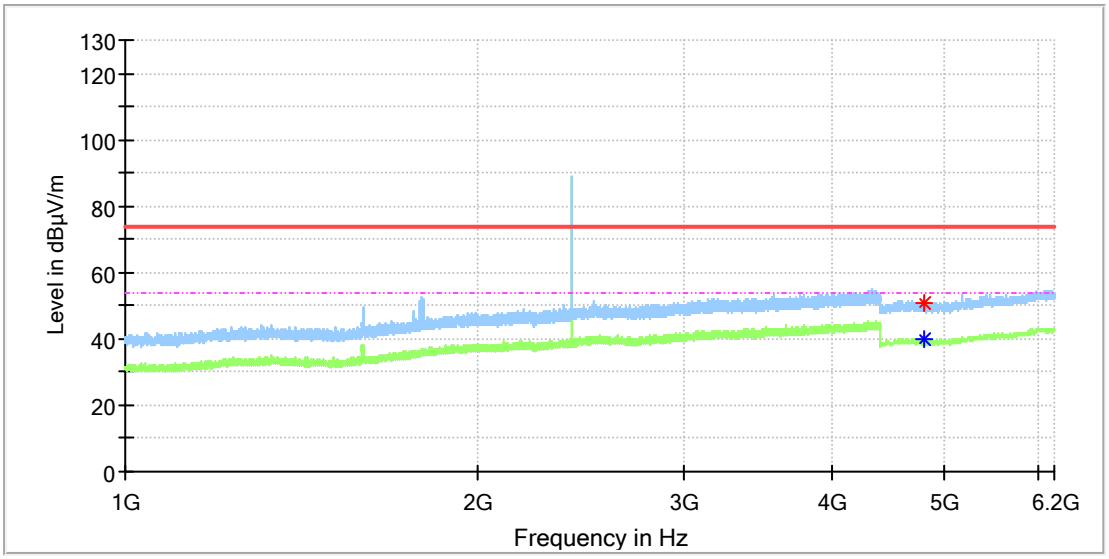


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4802.000000	---	39.42	54.00	14.58	100.0	V	178.0	11.8
4815.000000	51.06	---	74.00	22.94	100.0	V	303.0	11.8

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

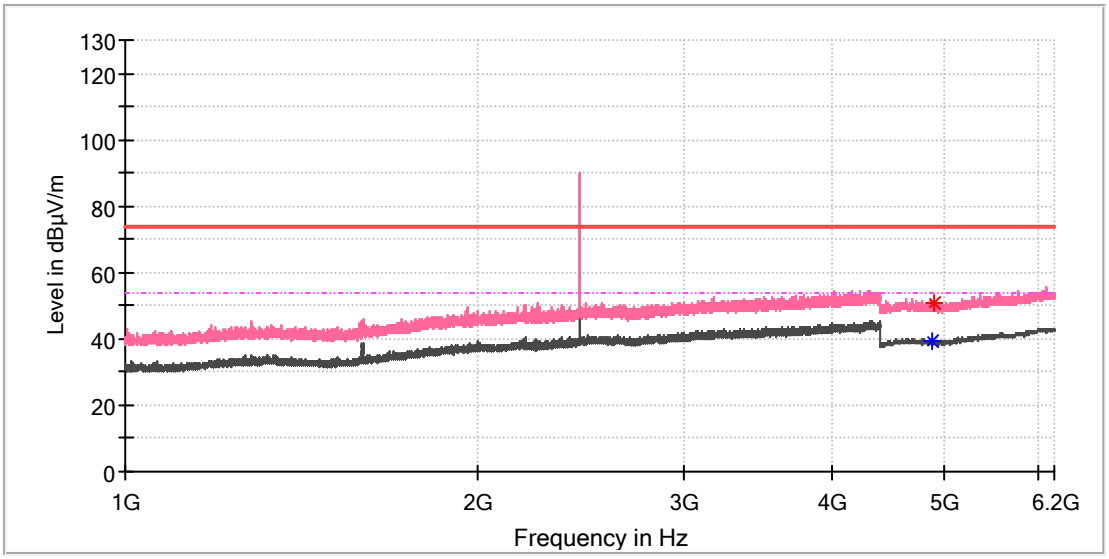


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4803.500000	50.69	---	74.00	23.31	100.0	H	305.0	11.8
4803.500000	---	39.87	54.00	14.13	100.0	H	305.0	11.8

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Mid channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

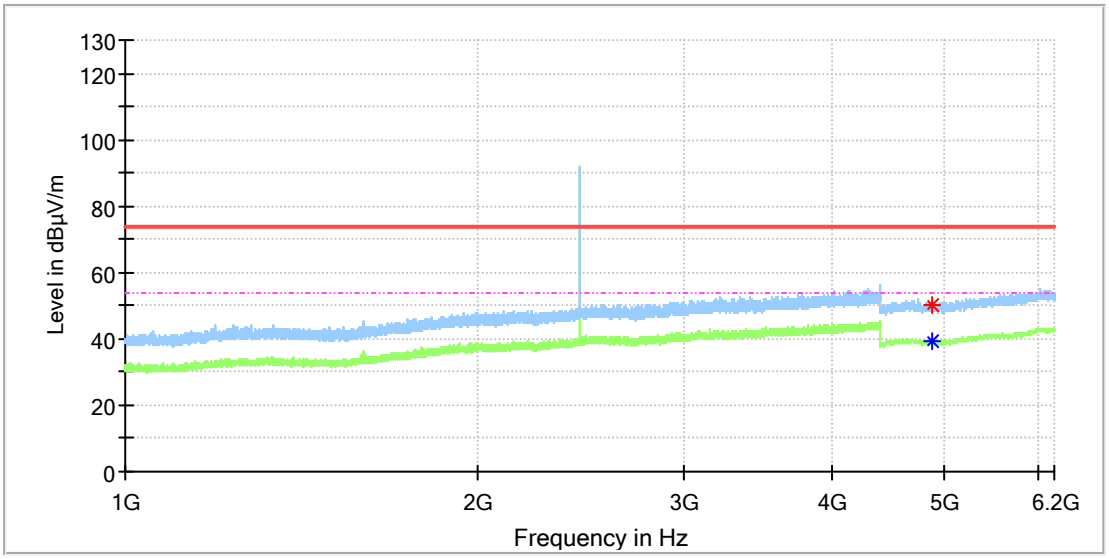


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4880.000000	---	39.20	54.00	14.80	100.0	V	326.0	11.8
4895.500000	50.63	---	74.00	23.37	100.0	V	135.0	11.8

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Mid channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

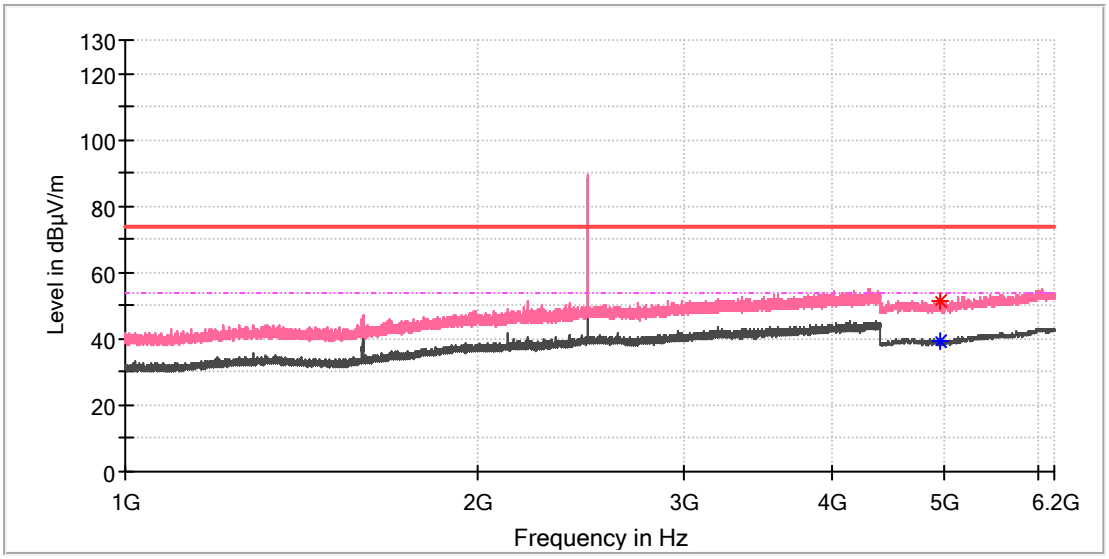


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4879.000000	50.46	---	74.00	23.54	100.0	H	283.0	11.8
4879.500000	---	39.54	54.00	14.46	100.0	H	149.0	11.8

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

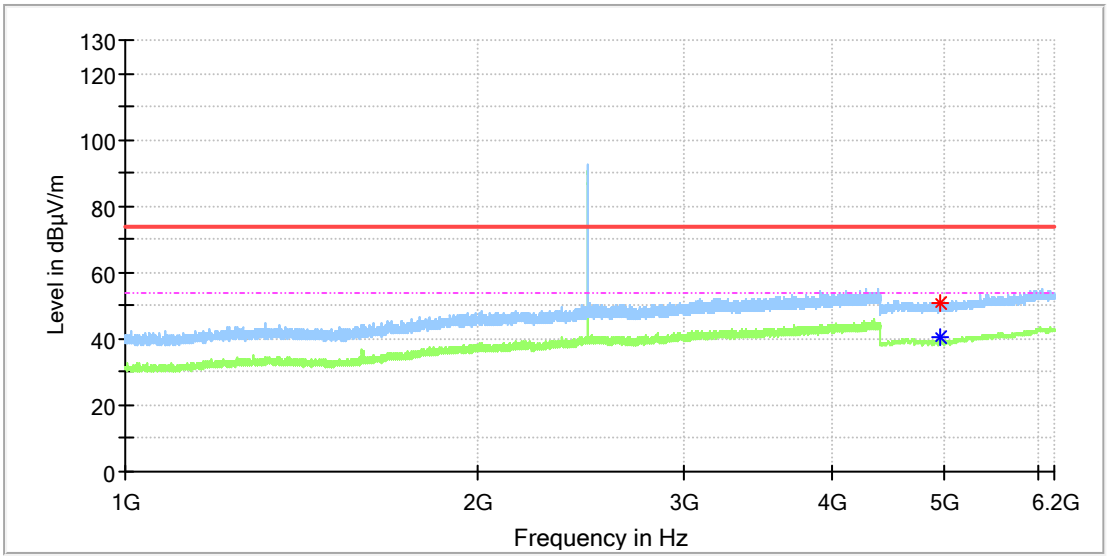


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4959.500000	---	39.42	54.00	14.58	100.0	V	299.0	11.8
4961.000000	51.20	---	74.00	22.80	100.0	V	358.0	11.8

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

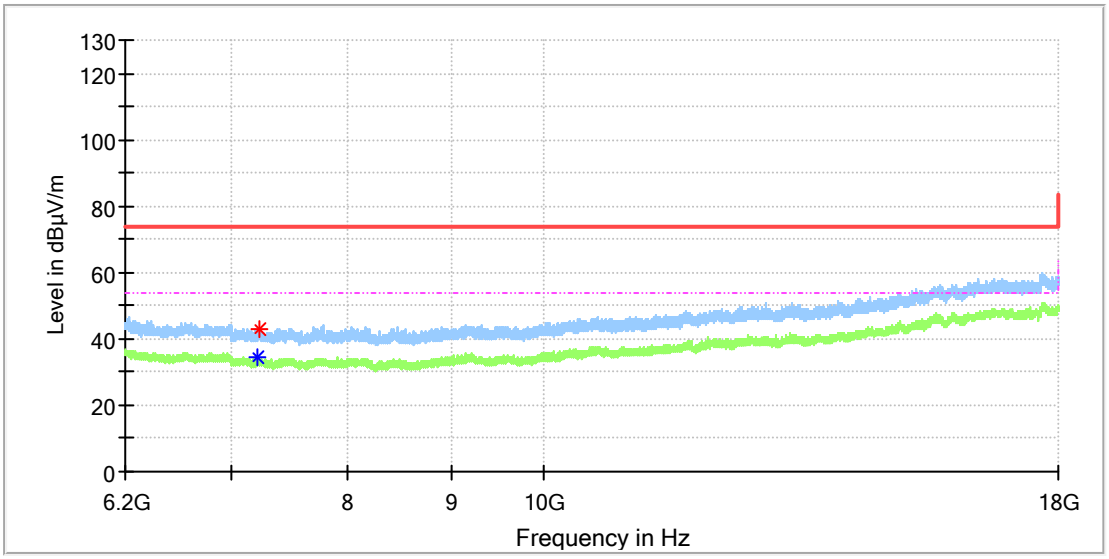


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4955.500000	50.61	---	74.00	23.39	100.0	H	78.0	11.8
4960.000000	---	40.81	54.00	13.19	100.0	H	293.0	11.8

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

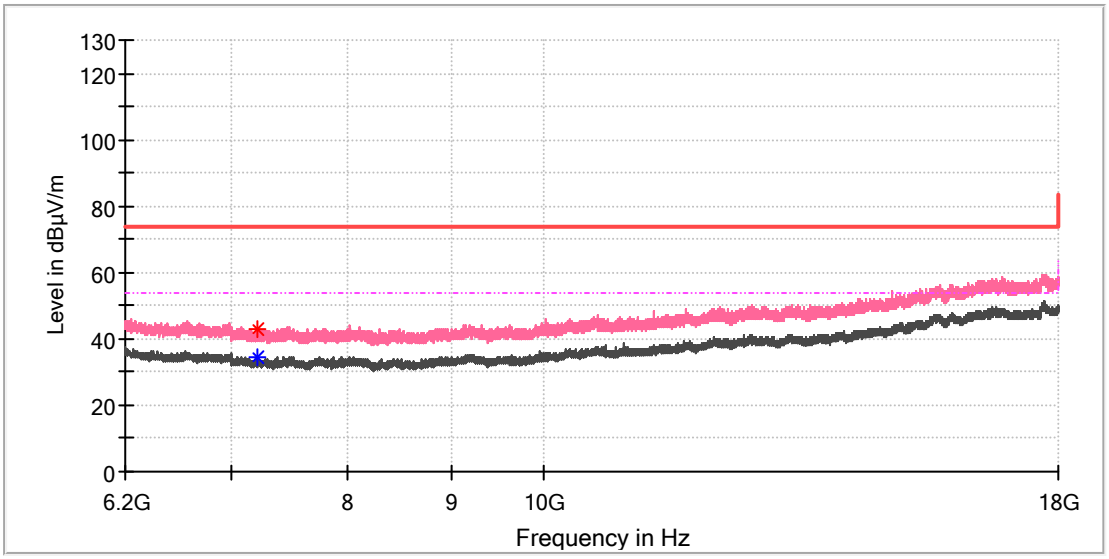


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7214.800000	---	34.47	54.00	19.53	100.0	H	0.0	8.7
7231.025000	43.22	---	74.00	30.78	100.0	H	146.0	8.6

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

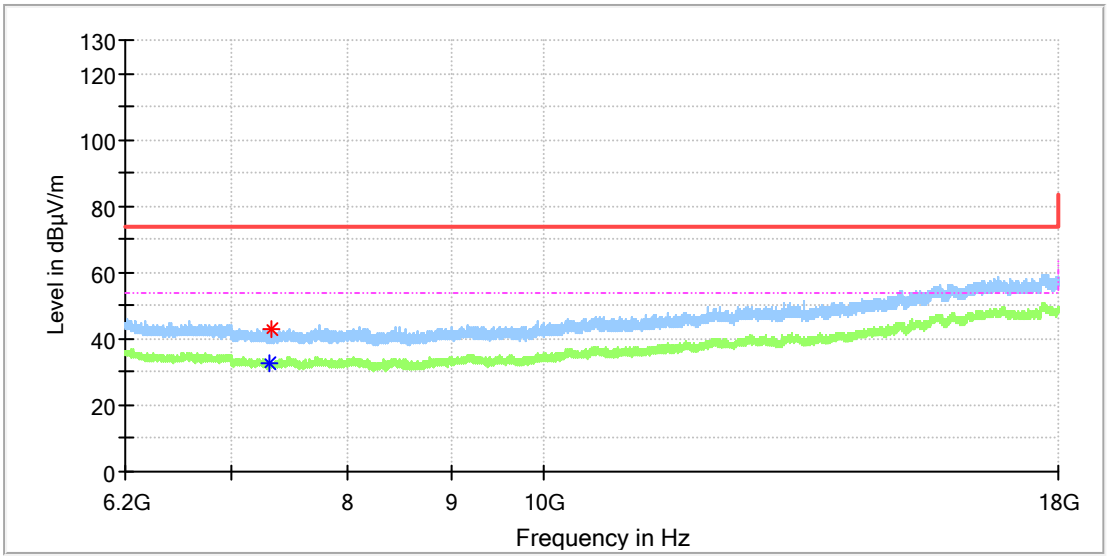


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7214.800000	42.87	---	74.00	31.13	100.0	V	204.0	8.7
7216.766667	---	34.22	54.00	19.78	100.0	V	31.0	8.7

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Mid channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

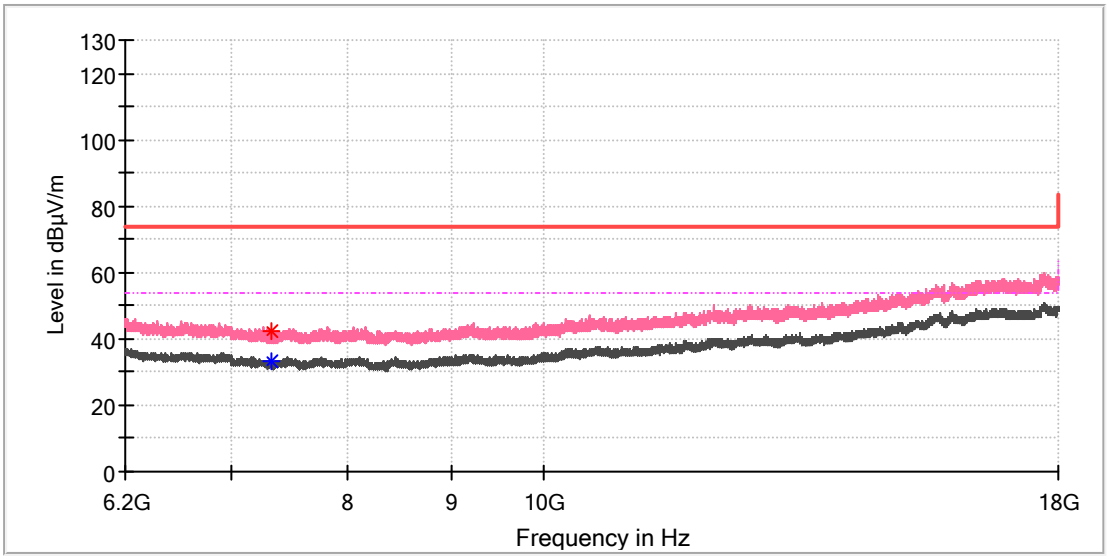


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7311.658333	---	32.85	54.00	21.15	100.0	H	92.0	8.2
7321.491667	42.72	---	74.00	31.28	100.0	H	6.0	8.2

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Mid channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

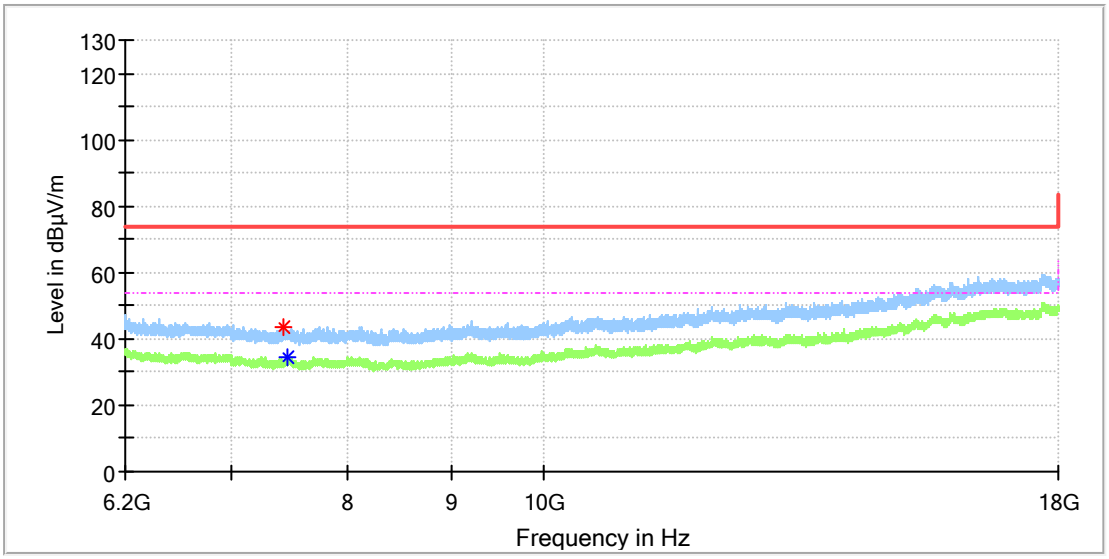


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7323.950000	---	33.35	54.00	20.65	100.0	V	312.0	8.2
7327.883333	42.51	---	74.00	31.49	100.0	V	349.0	8.1

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

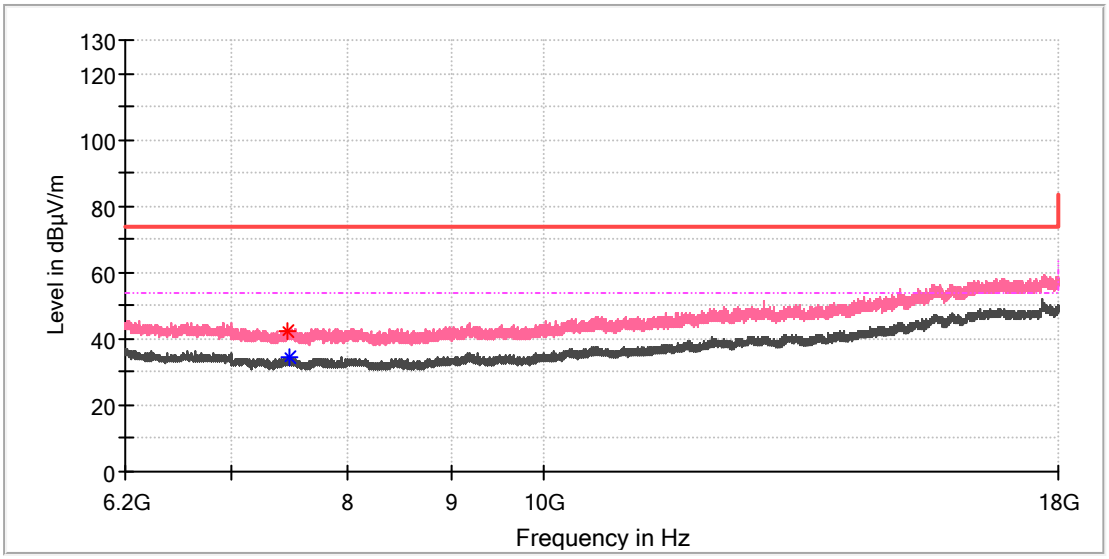


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7425.233333	43.42	---	74.00	30.58	100.0	H	176.0	8.4
7463.091667	---	34.19	54.00	19.81	100.0	H	32.0	8.6

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical_Freqs

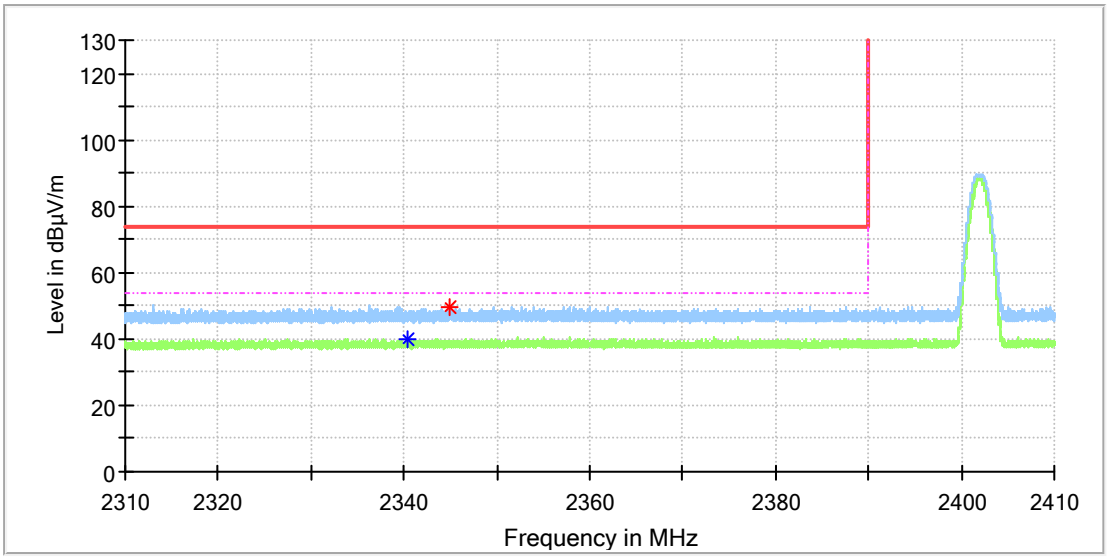
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7468.008333	42.62	---	74.00	31.38	100.0	V	290.0	8.6
7475.875000	---	34.74	54.00	19.26	100.0	V	30.0	8.6

Appendix B.6: Test Results of Radiated Emissions in Restricted Bands

BLE, 1Mbps

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

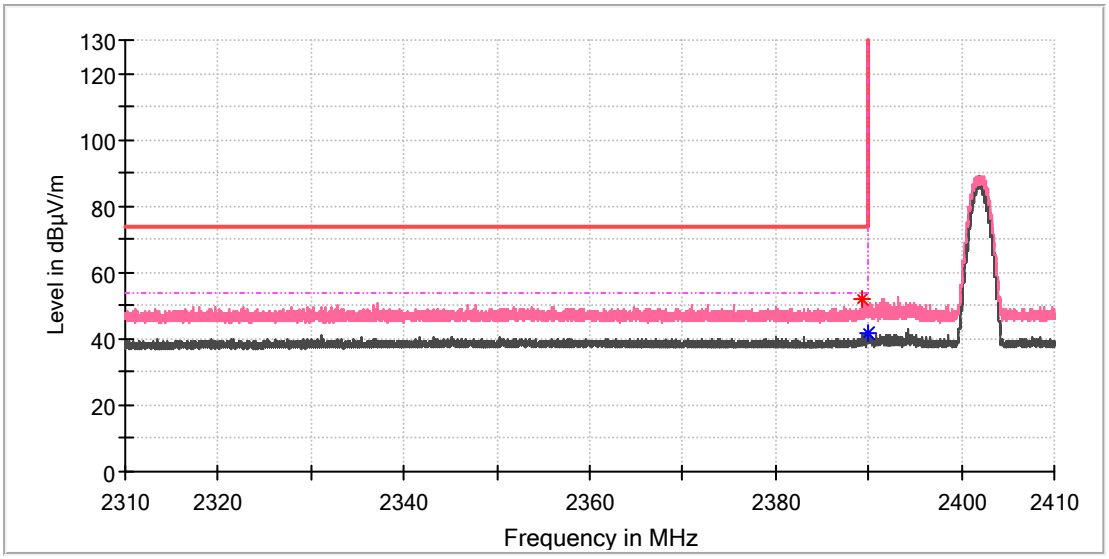


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2340.400000	---	39.91	54.00	14.09	100.0	H	134.0	6.8
2344.955000	49.49	---	74.00	24.51	100.0	H	217.0	6.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_Low channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

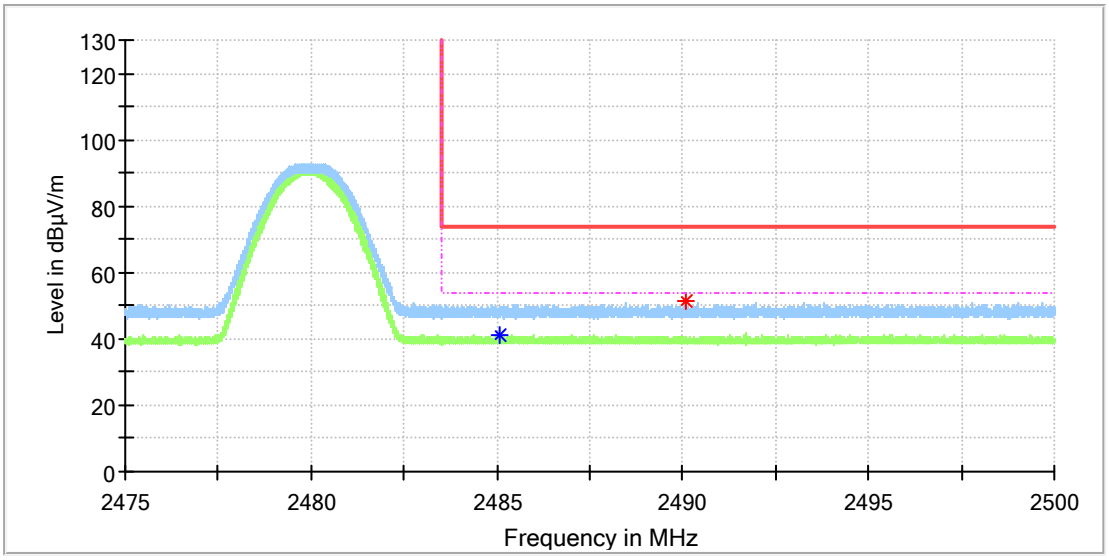


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.345000	52.21	---	74.00	21.79	100.0	V	196.0	7.0
2389.955000	---	41.79	54.00	12.21	100.0	V	43.0	7.0

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

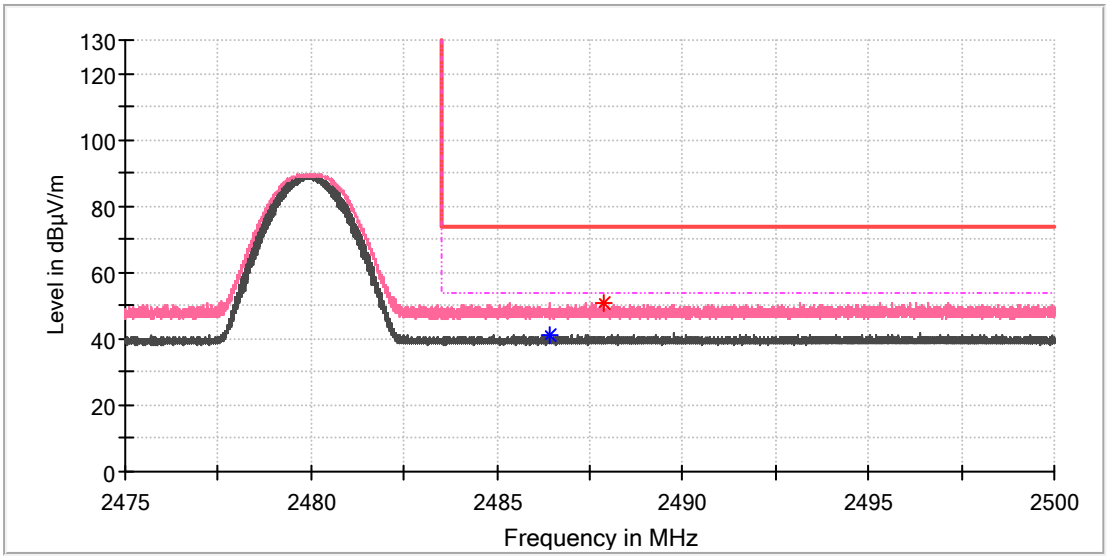


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2485.098750	---	40.95	54.00	13.05	100.0	H	187.0	7.4
2490.096250	51.22	---	74.00	22.78	100.0	H	79.0	7.4

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	BLE 1M_High channel
Order No/Sample No:	168318889/A003240040-010
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



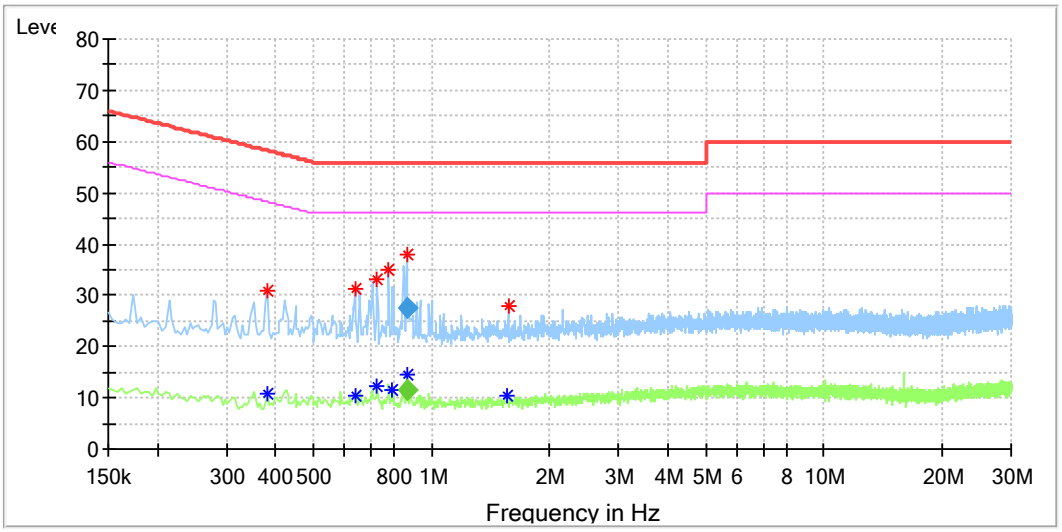
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2486.440000	---	40.86	54.00	13.14	100.0	V	104.0	7.4
2487.852500	50.97	---	74.00	23.03	100.0	V	152.0	7.4

Appendix B.7: Test Results of Conducted Emissions on AC Mains

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test mode:	ON, charging
Test Voltage:	AC 120V, 60Hz
Test By:	Kevin Zhou
Review By:	Gary Chen
Remark:	SR2



Critical_Freqs

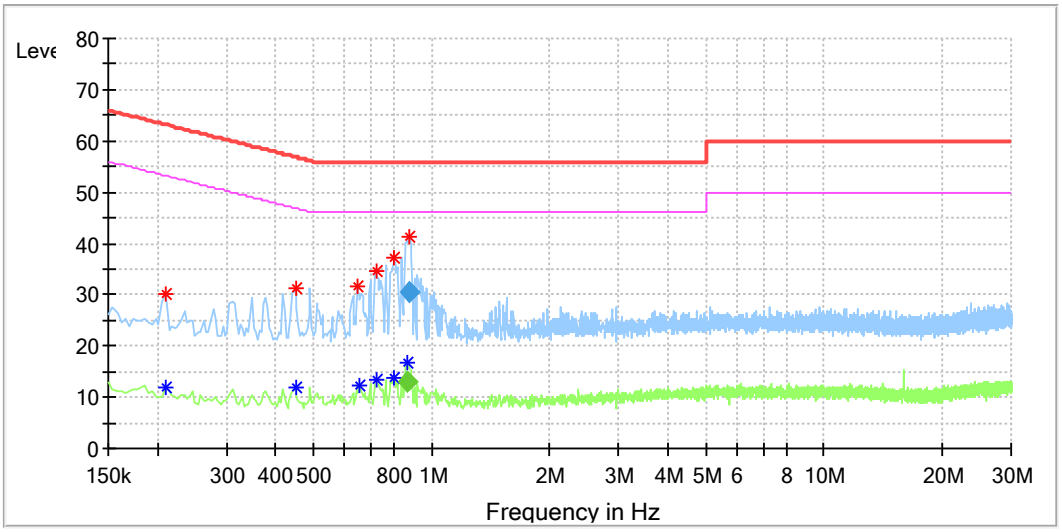
Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.382000	---	10.84	48.24	37.40	L1	9.9
0.382000	30.84	---	58.24	27.39	L1	9.9
0.638000	---	10.57	46.00	35.43	L1	10.0
0.638000	31.08	---	56.00	24.92	L1	10.0
0.726000	---	12.29	46.00	33.71	L1	10.0
0.726000	33.11	---	56.00	22.89	L1	10.0
0.778000	34.82	---	56.00	21.18	L1	10.0
0.794000	---	11.66	46.00	34.34	L1	10.0
0.869500	38.05	---	56.00	17.95	L1	10.0
0.870500	---	14.53	46.00	31.47	L1	10.0
1.554000	---	10.48	46.00	35.52	L1	10.1
1.566000	28.05	---	56.00	27.95	L1	10.1

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.869500	27.58	---	56.00	28.42	1000.0	9.000	L1	10.0
0.870500	---	11.54	46.00	34.46	1000.0	9.000	L1	10.0

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test mode:	ON, charging
Test Voltage:	AC 120V, 60Hz
Test By:	Kevin Zhou
Review By:	Gary Chen
Remark:	SR2



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.210000	---	11.89	53.21	41.32	N	9.8
0.210000	30.29	---	63.21	32.91	N	9.8
0.450000	---	12.03	46.88	34.84	N	9.8
0.450000	31.18	---	56.88	25.69	N	9.8
0.646000	31.45	---	56.00	24.55	N	9.8
0.658000	---	12.12	46.00	33.88	N	9.8
0.722000	---	13.35	46.00	32.65	N	9.8
0.722000	34.67	---	56.00	21.33	N	9.8
0.806000	---	13.92	46.00	32.08	N	9.8
0.806000	37.32	---	56.00	18.68	N	9.8
0.869500	---	16.61	46.00	29.39	N	9.8
0.877500	41.22	---	56.00	14.78	N	9.8

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.869500	---	12.87	46.00	33.13	1000.0	9.000	N	9.8
0.877500	30.41	---	56.00	25.59	1000.0	9.000	N	9.8