Prüfbericht - Produkte
Test Report - Products

TÜVRheinland®

Prüfbericht-Nr.: *Test report no.:*	**CN22UVVX 001**	**Auftrags-Nr.:** *Order no.:*	168364197	Seite 1 von 26 *Page 1 of 26*
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:*	2022-04-14 - 2022-05-26	
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: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *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

TUV Rheinland (Shenzhen) Co., Ltd. 1601 R&D Room, 1602-1604, 17-18F, Building 7 Site C, Vanke Cloud City Phase I, Xingke First Street, Xili Street, Xili Community, Nanshan District, Shenzhen 518052, P.R. China
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Test Summary

5.1.1 ANTENNA REQUIREMENT
RESULT: *Pass*

5.1.2 MAXIMUM CONDUCTED OUTPUT POWER
RESULT: *Pass*

5.1.3 CONDUCTED POWER SPECTRAL DENSITY
RESULT: *Pass*

5.1.4 6DB BANDWIDTH
RESULT: *Pass*

5.1.5 20DB BANDWIDTH
RESULT: *Pass*

5.1.6 99% BANDWIDTH
RESULT: *Pass*

5.1.7 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH
RESULT: *Pass*

5.1.8 RADIATED SPURIOUS EMISSION
RESULT: *Pass*

5.1.9 CARRIER FREQUENCY SEPARATION
RESULT: *Pass*

5.1.10 NUMBER OF HOPPING FREQUENCY
RESULT: *Pass*

5.1.11 TIME OF OCCUPANCY
RESULT: *Pass*

5.1.12 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.

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, CAB identifier: CN0078

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

TÜV Rheinland (Shenzhen) Co., Ltd.

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.

Parameter	Uncertainty
Radio Frequency	±1 x 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

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 EUT is a tracker which supports Lora, Bluetooth Low Energy and GNSS technologies.

Data Rate of Lora:

Data Rate	Configuration	Indicative physical bit rate [bit/sec]
0	LoRa Modulation: SF10 / Bandwidth 125 kHz	980
1	LoRa Modulation: SF9 / Bandwidth 125 kHz	1760
2	LoRa Modulation: SF8 / Bandwidth 125 kHz	3125
3	LoRa Modulation: SF7 / Bandwidth 125 kHz	5470
4	LoRa Modulation: SF8 / Bandwidth 500 kHz	12500

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 Lora DTS	
Operating Frequency	903 – 914.2MHz
Type of Modulation	Lora
Data Rate	SF8 / DR4
Channel Number	8 channels (Upstream)
Channel Separation	1.6 MHz
Occupied Bandwidth	500 KHz
Type of Antenna	Integral antenna
Antenna gain	1 dBi

Technical Specification of Lora FHSS	
Frequency Range	902.3 – 914.9MHz
Type of Modulation	Lora
Data Rate	SF7 to SF10 / DR0 to DR3
Channel Number	64 channels (Upstream)
Channel Separation	200 KHz
Occupied Bandwidth	125 KHz
Type of Antenna	Integral antenna
Antenna gain	1 dBi

Table 3: RF Channel and Frequency of Lora FHSS

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
0	**902.3**	16	905.5	**32**	**908.7**	48	911.9
1	902.5	17	905.7	33	908.9	49	912.1
2	902.7	18	905.9	34	909.1	50	912.3
3	902.9	19	906.1	35	909.3	51	912.5
4	903.1	20	906.3	36	909.5	52	912.7
5	903.3	21	906.5	37	909.7	53	912.9
6	903.5	22	906.7	38	909.9	54	913.1
7	903.7	23	906.9	39	910.1	55	913.3
8	903.9	24	907.1	40	910.3	56	913.5
9	904.1	25	907.3	41	910.5	57	913.7
10	904.3	26	907.5	42	910.7	58	913.9
11	904.5	27	907.7	43	910.9	59	914.1
12	904.7	28	907.9	44	911.1	60	914.3
13	904.9	29	908.1	45	911.3	61	914.5
14	905.1	30	908.3	46	911.5	62	914.7
15	905.3	31	908.5	47	911.7	**63**	**914.9**

Table 4: RF Channel and Frequency of Lora DTS

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
64	**903.0**	66	906.2	68	909.4	70	912.6
65	904.6	**67**	**907.8**	69	911.0	**71**	**914.2**

3.3 Independent Operation Modes

The basic operation modes are:

A. On, Lora transmitting mode (FHSS)
    1) Low Channel
    2) Middle Channel
    3) High Channel

B. On, Lora transmitting mode (DTS)
    1) Low Channel
    2) Middle Channel
    3) High Channel

C. On, Transmitting on Hopping channel

D. On, BLE + Lora co-location transmitting

E. 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.

4.3 Special Accessories and Auxiliary Equipment

Table 5: Auxiliary Equipment Used during Test

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)

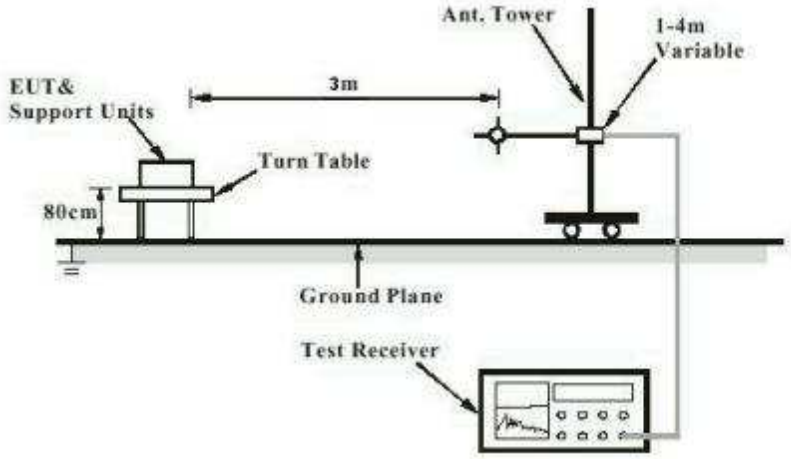


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

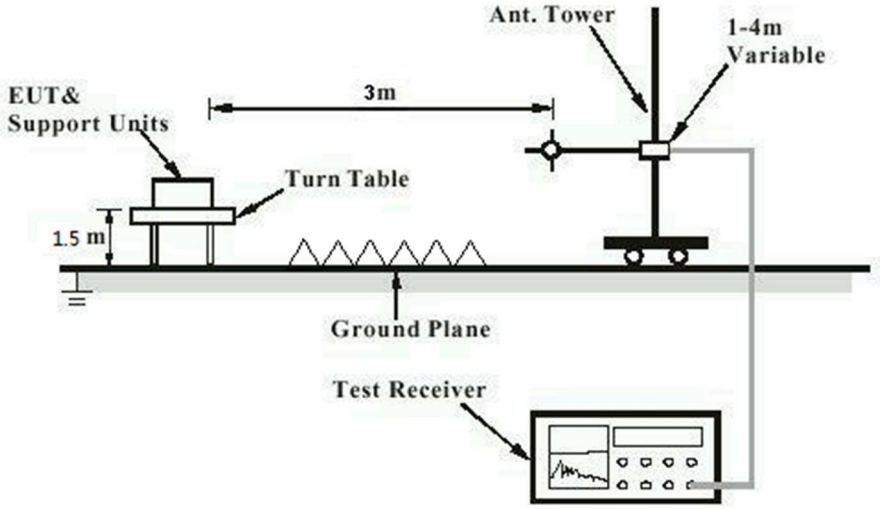


Diagram of Measurement Configuration for Mains Conduction Measurement

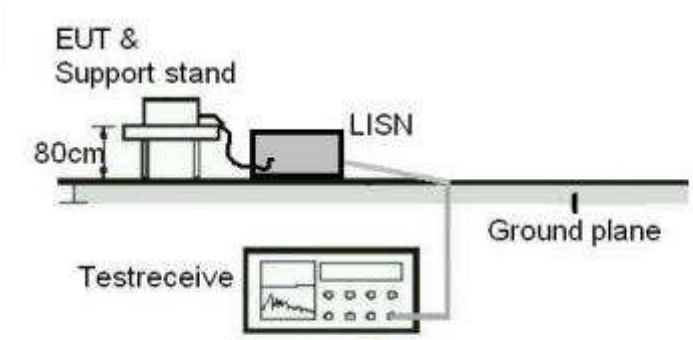
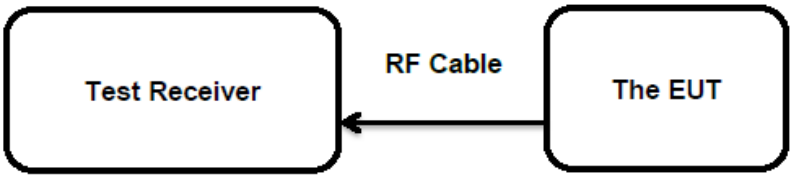


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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 6.8

According to the manufacturer declared, the EUT has an Integral Antenna, the directional gain of antenna are 1dBi, 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)(2)&(3) RSS-247 Clause 5.4(a)&(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	Not more than 1Watt(30dBm) for DTS in the band 902-928MHz Not more than 0.125Watt(21dBm) for FHSS with at least 50 hopping channels in the band 902-928MHz
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-05-19
Input voltage	:	DC 3.7V
Operation mode	:	A, B
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

Table 6: Test Result of Maximum Conducted Output Power, Lora FHSS

Test Mode	Test Channel (MHz)	Maximum Conducted Average Power		Limit (W)
		(dBm)	(W)	
Lora FHSS SF7	902.3	22.57	0.1807	< 0.125
	908.5	22.46	0.1762	
	914.9	22.54	0.1795	
Lora FHSS SF10	902.3	21.17	0.1309	
	908.5	21.05	0.1274	
	914.9	20.96	0.1247	
Max. Measured Value		22.57	0.1807	

Table 7: Test Result of Maximum Conducted Output Power, Lora DTS

Test Mode	Test Channel (MHz)	Maximum Conducted Average Power		Limit (W)
		(dBm)	(W)	
Lora DTS	903.0	23.37	0.2173	< 1.0
	907.8	20.15	0.1035	
	914.2	22.60	0.1820	
Max. Measured Value		23.37	0.2173	

Note:
1) The cable loss is taken into account in results.
2) The maximum Antenna gain(G) : 1 dBi,
e.i.r.p.=24.37dBm = 0.274W, which is far below the 4 W

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	:	2022-05-19
Input voltage	:	DC 3.7V
Operation mode	:	B
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 8: Test Result of Maximum Peak Power Spectral Density, Lora DTS

Test Mode	Test Channel (MHz)	Measured Power Spectral Density (dBm/3KHz)
Lora DTS	903.0	-3.034
	907.8	-6.382
	914.2	-4.192
Maximum Measured Value		1.492

5.1.4 6dB Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)(2) RSS-247 Clause 5.2(a)
Basic standard	:	ANSI C63.10: 2013
Limits	:	At least 500kHz for bandwidth(DTS)
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-05-19
Input voltage	:	DC 3.7V
Operation mode	:	B
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 9: Test Result of 6dB Bandwidth

Test Mode	Test Channel (MHz)	6dB Bandwidth (KHz)	Limit (KHz)
Lora DTS	903.0	630	>500KHz
	907.8	629	
	914.2	598	
Minimum Measured Value		598	

5.1.5 20dB Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)(1) (i) RSS-247 Clause 5.1(a)
Basic standard	:	ANSI C63.10: 2013
Limits	:	Not more than 500kHz and Less than 250KHz for at least 50 hopping frequencies More than 250KHz for at least 25 hooping frequencies
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-05-24
Input voltage	:	DC 3.7V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 10: Test Result of 20dB Bandwidth

Test Mode	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (KHz)
Lora FHSS SF7	902.3	142.2	<500KHz
	908.5	142.9	
	914.9	140.9	
Lora FHSS SF10	902.3	138.4	<500KHz
	908.5	138.9	
	914.9	138.2	

5.1.6 99% 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	:	2022-04-14 to 2022-05-20
Input voltage	:	DC 3.7V
Operation mode	:	A, B
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 11: Test Result of 99% Bandwidth

Test Mode	Test Channel (MHz)	99% Bandwidth (KHz)	Limit (KHz)
Lora FHSS SF7	902.3	126.77	/
	908.5	126.63	
	914.9	127.64	
Lora FHSS SF10	902.3	125.95	
	908.5	126.53	
	914.9	125.93	
Lora DTS	903.0	503.50	
	907.8	500.15	
	914.2	501.64	
Minimum Measured Value		125.93	

5.1.7 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	:	30dB (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	:	2022-05-19 to 2022-05-20
Input voltage	:	DC 3.7V
Operation mode	:	A, B
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
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.

5.1.8 Radiated Spurious Emission

RESULT: **Pass**

Test Specification

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

Test Setup

Date of testing	:	2022-04-14 to 2022-05-20
Input voltage	:	DC 3.7V
Operation mode	:	A, B, D
Test channel	:	Low / Middle / High
Ambient temperature	:	Refer to test result
Relative humidity	:	Refer to test result
Atmospheric pressure	:	101 kPa

Remark:
Testing was carried out within frequency range 9kHz to the tenth harmonics with all data rate and three channels (Lowest, middle and highest). Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

5.1.9 Carrier Frequency Separation

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)(1) RSS-247 Clause 5.1(b)
Basic standard	:	ANSI C63.10: 2013
Limits	:	≥ 20dB bandwidth, whichever is greater
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-14
Input voltage	:	DC 3.7V
Operation mode	:	C
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 12: Test Result of Carrier Frequency Separation

Test Mode	Channel	Measured Channel Separation (KHz)	Limit (kHz)	Result
Lora FHSS SF7	Low Channel	204.90	≥ 20dB bandwidth	Pass
	Adjacency Channel			
	Middle Channel	208.60		Pass
	Adjacency Channel			
	High Channel	207.40		Pass
	Adjacency Channel			
Lora FHSS SF10	Low Channel	215.80	≥ 20dB bandwidth	Pass
	Adjacency Channel			
	Middle Channel	221.60		Pass
	Adjacency Channel			
	High Channel	220.00		Pass
	Adjacency Channel			

Note:

The limit is maximum 20 dB bandwidth: 142.9KHz.

5.1.10 Number of Hopping Frequency

RESULT: **Pass**

Test Specification

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 Clause 5.1(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	≥ 15 non-overlapping channels
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-05-19
Input voltage	:	DC 3.7V
Operation mode	:	C
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

Table 13: Test result of hopping channel number

Test Mode	20dB Bandwidth(kHz)	Hopping frequencies	Limit
Lora FHSS SF7	20dB Bandwidth < 250	64	≥50
Lora FHSS SF10	20dB Bandwidth < 250	64	≥50

5.1.11 Time of Occupancy

RESULT: **Pass**

Test Specification

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 Clause 5.1(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 0.4s
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-05-26
Input voltage	:	DC 3.7V
Operation mode	:	C
Test channel	:	Low / Middle / High
Ambient temperature	:	25 ℃
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 14: Test result of Channel Occupancy

Test Mode	20dB Bandwidth(kHz)	Period (s)	Channel Occupancy Time (ms)	Limit (ms)
Lora FHSS SF7	20dB Bandwidth < 250	20	120	400
Lora FHSS SF10	20dB Bandwidth < 250	20	220	400

5.1.12 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 3
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-25
Input voltage	:	Powered by Adapter
Operation mode	:	A, B
Earthing	:	Not connected
Ambient temperature	:	22 ℃
Relative humidity	:	64 %
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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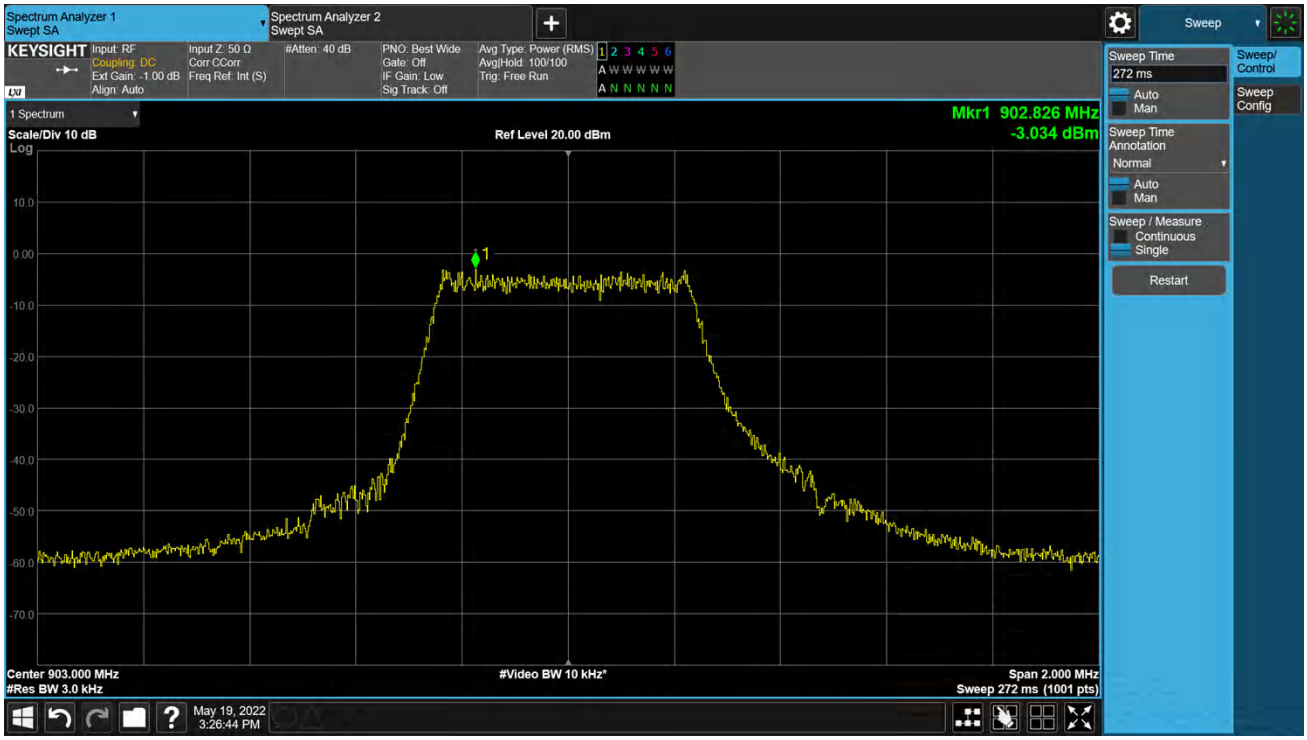
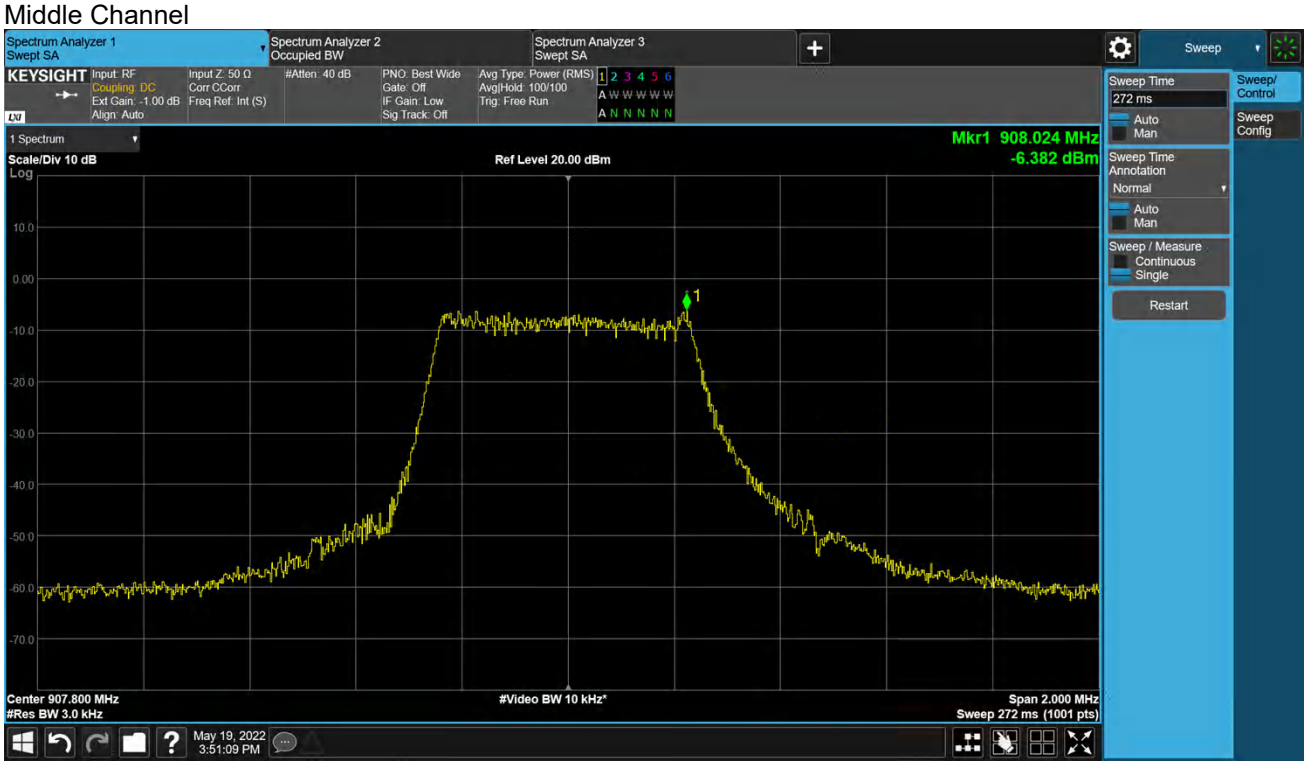
Appendix B.1: Conducted Power Spectral Density

Lora DTS

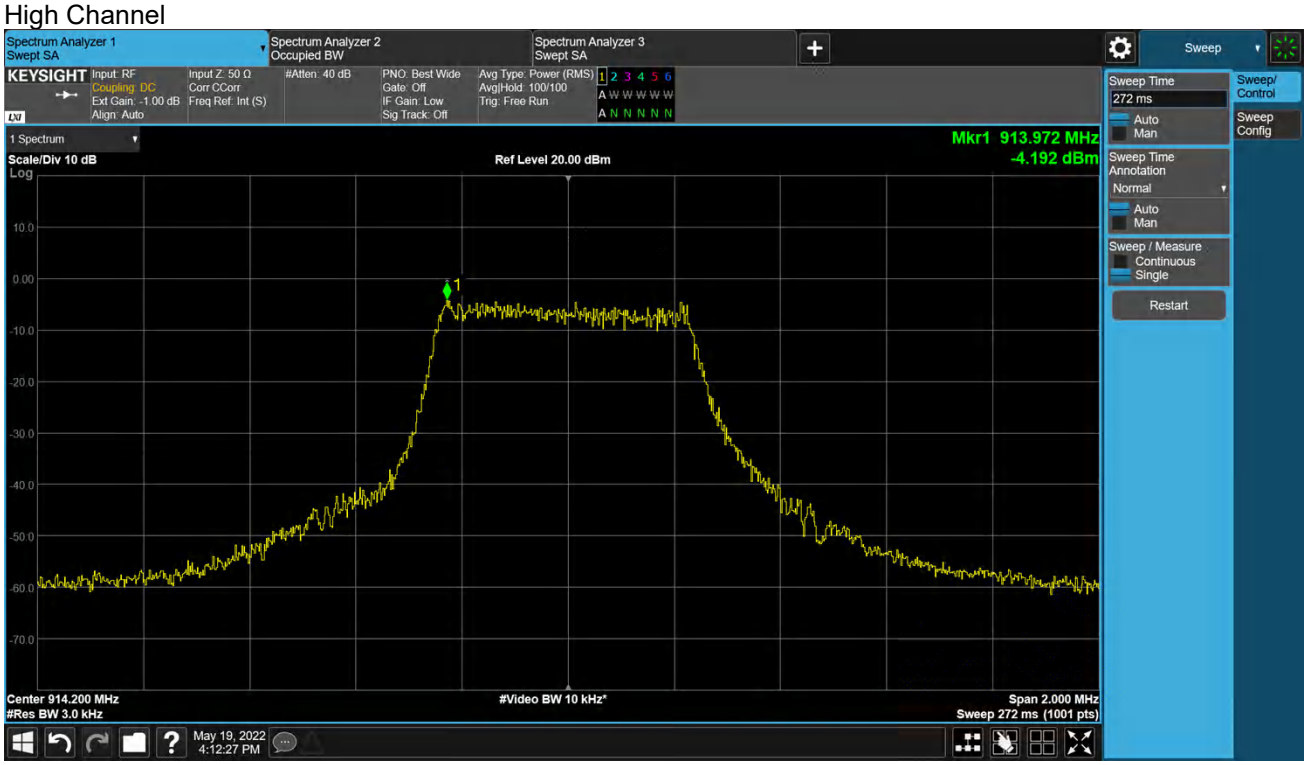
Low Channel



Middle Channel



High Channel

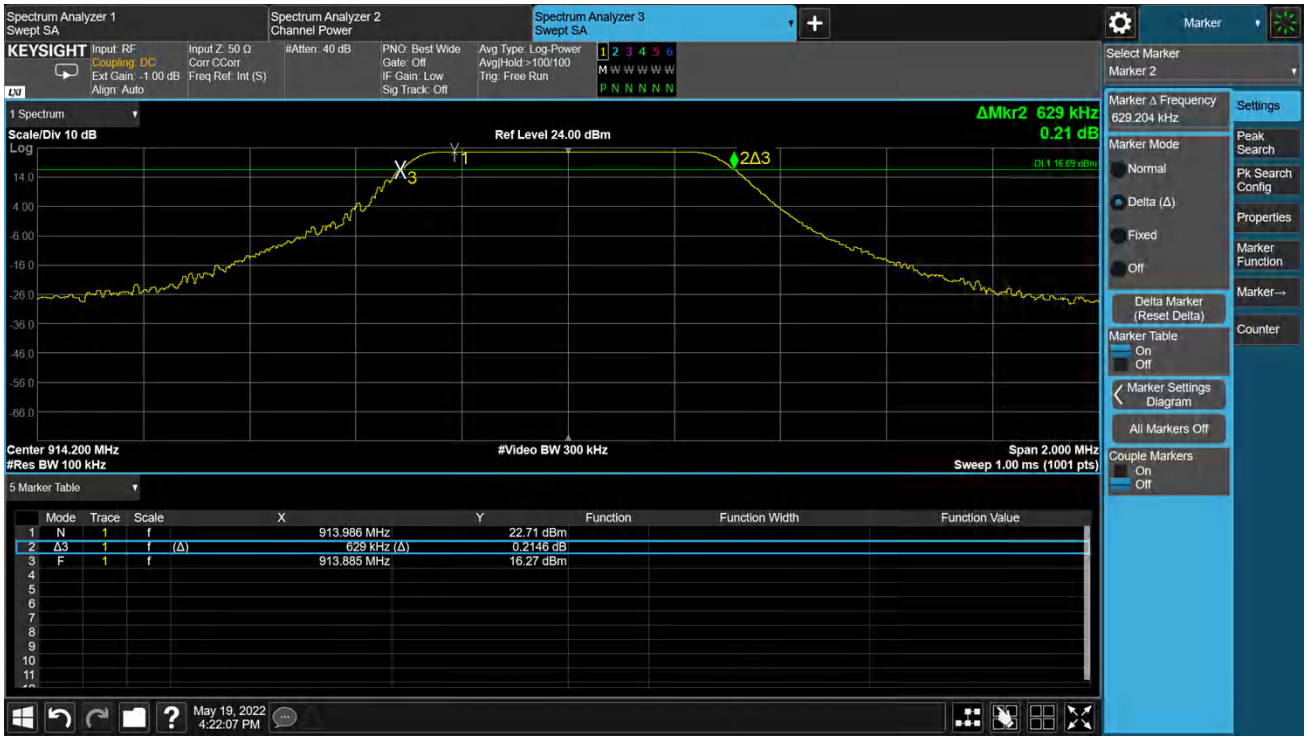


Appendix B.2: 6dB Bandwidth

Lora DTS

Low Channel

Middle Channel

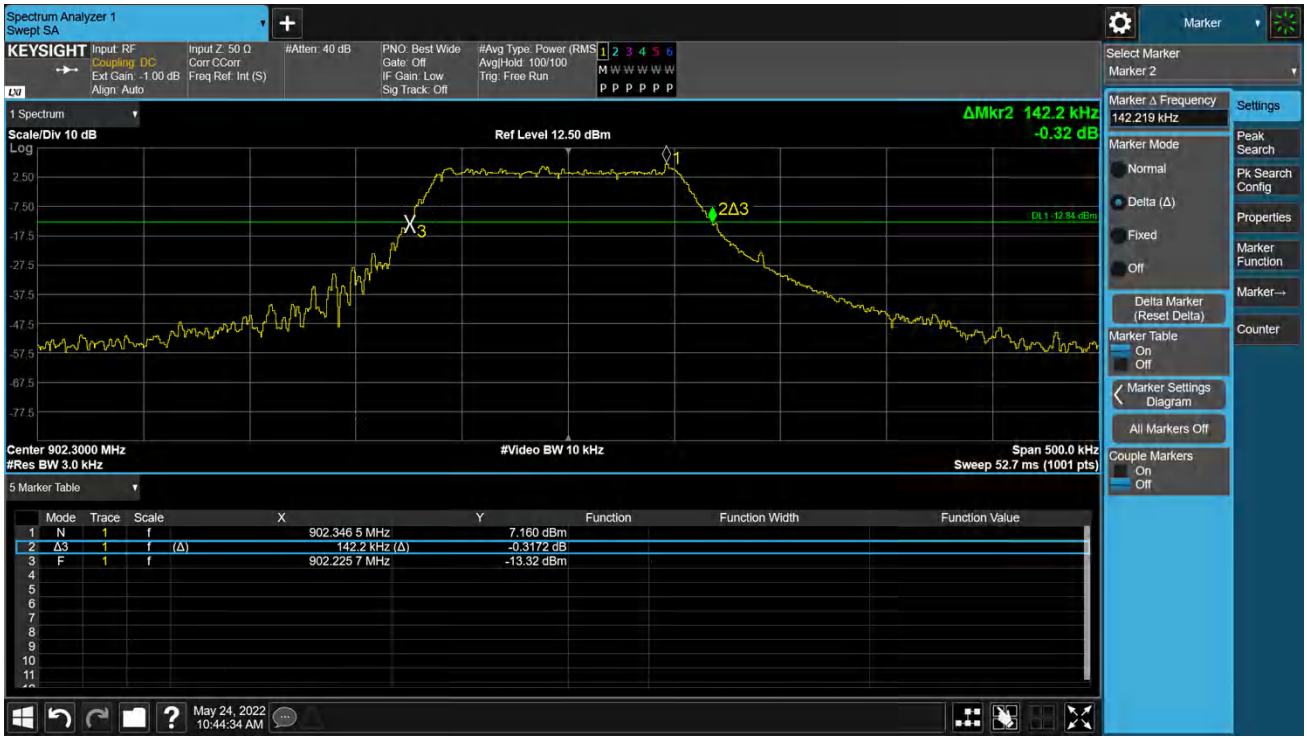


High Channel

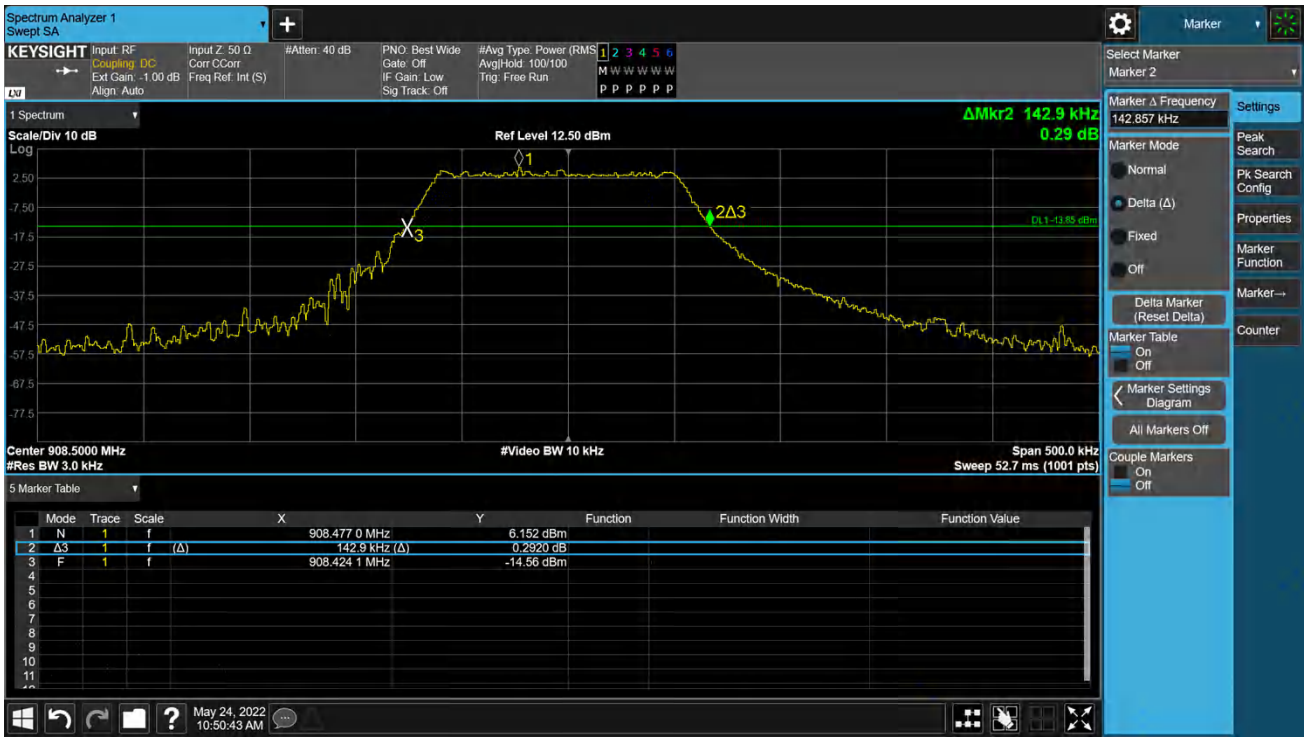
Appendix B.3: 20dB Bandwidth

Lora FHSS, SF7

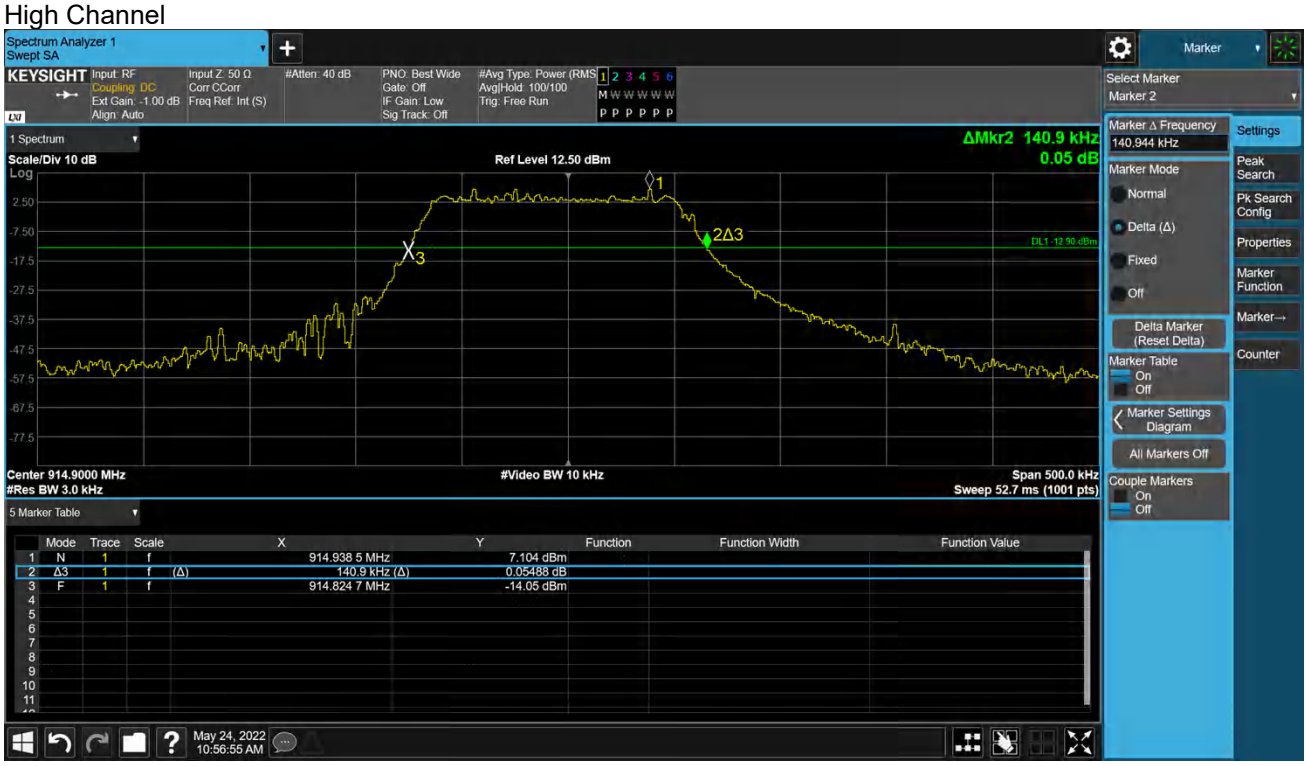
Low Channel



Middle Channel

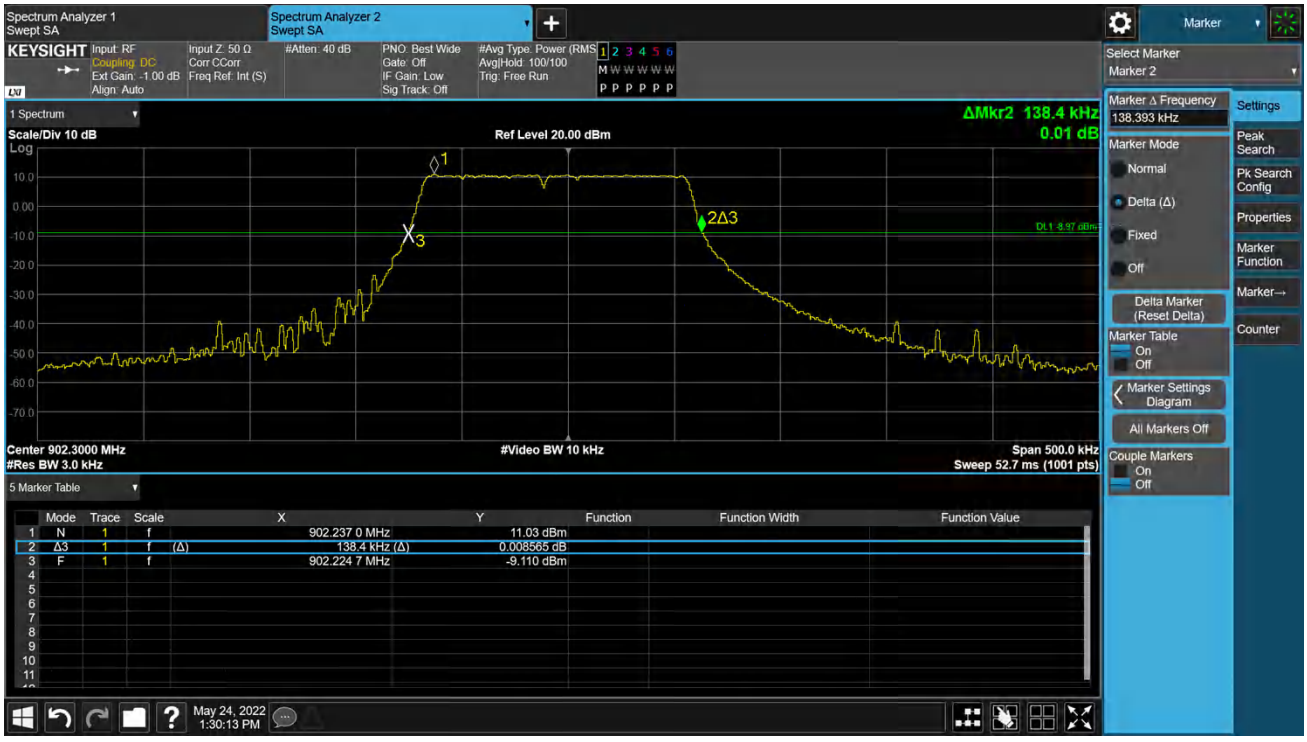


High Channel



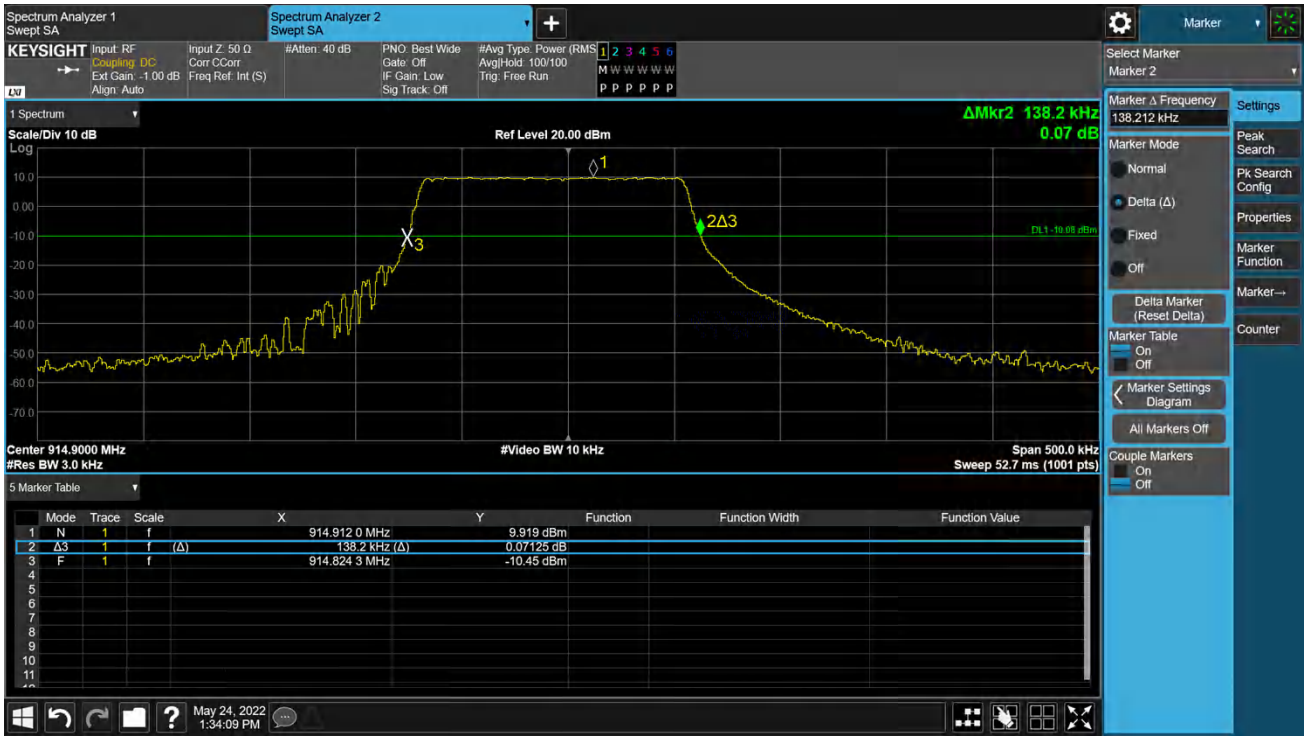
Lora FHSS, SF10

Low Channel



Middle Channel

High Channel

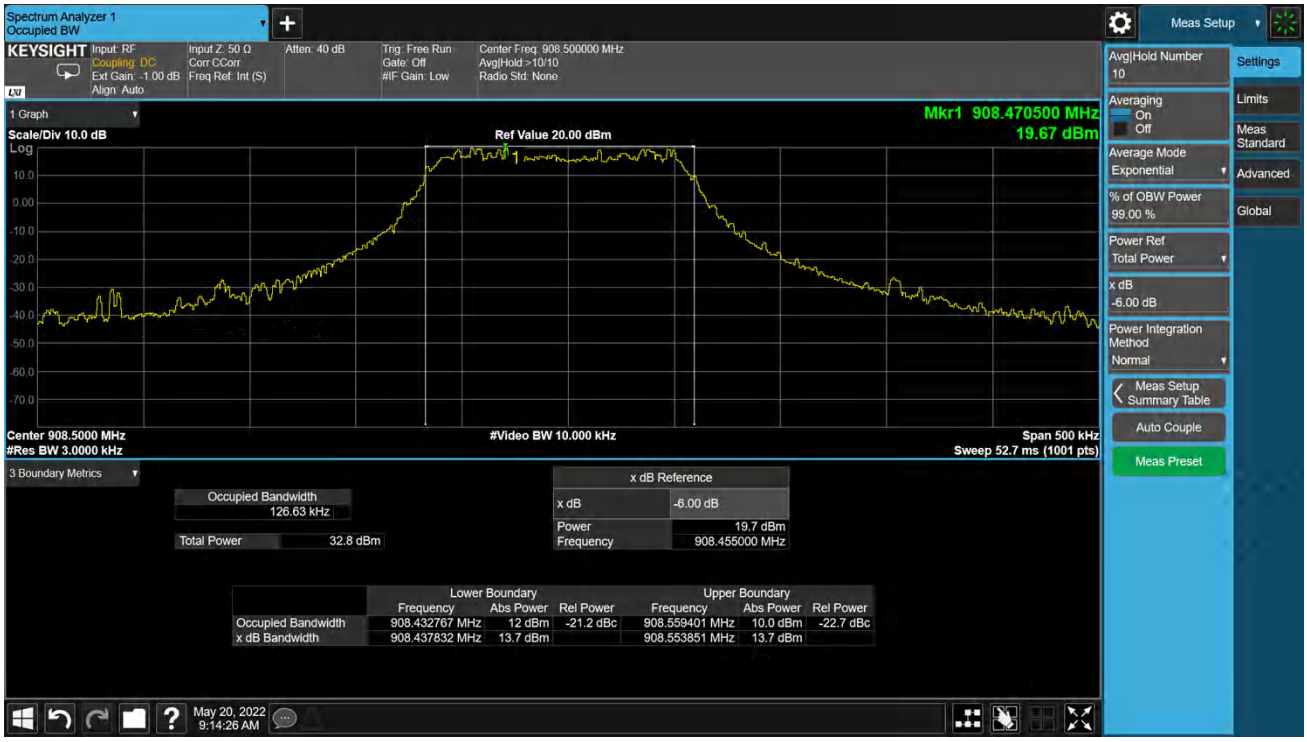


Appendix B.4: 99% Bandwidth

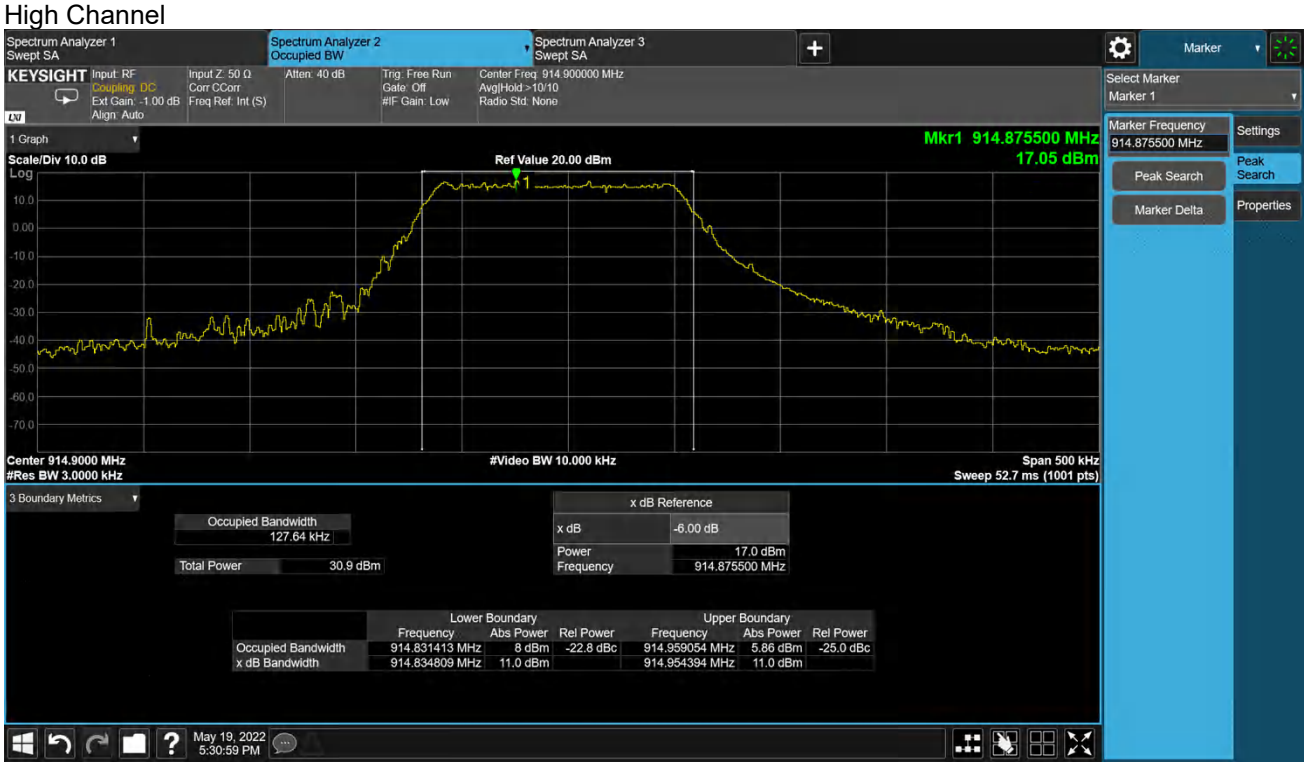
Lora FHSS, SF7

Low Channel

Middle Channel

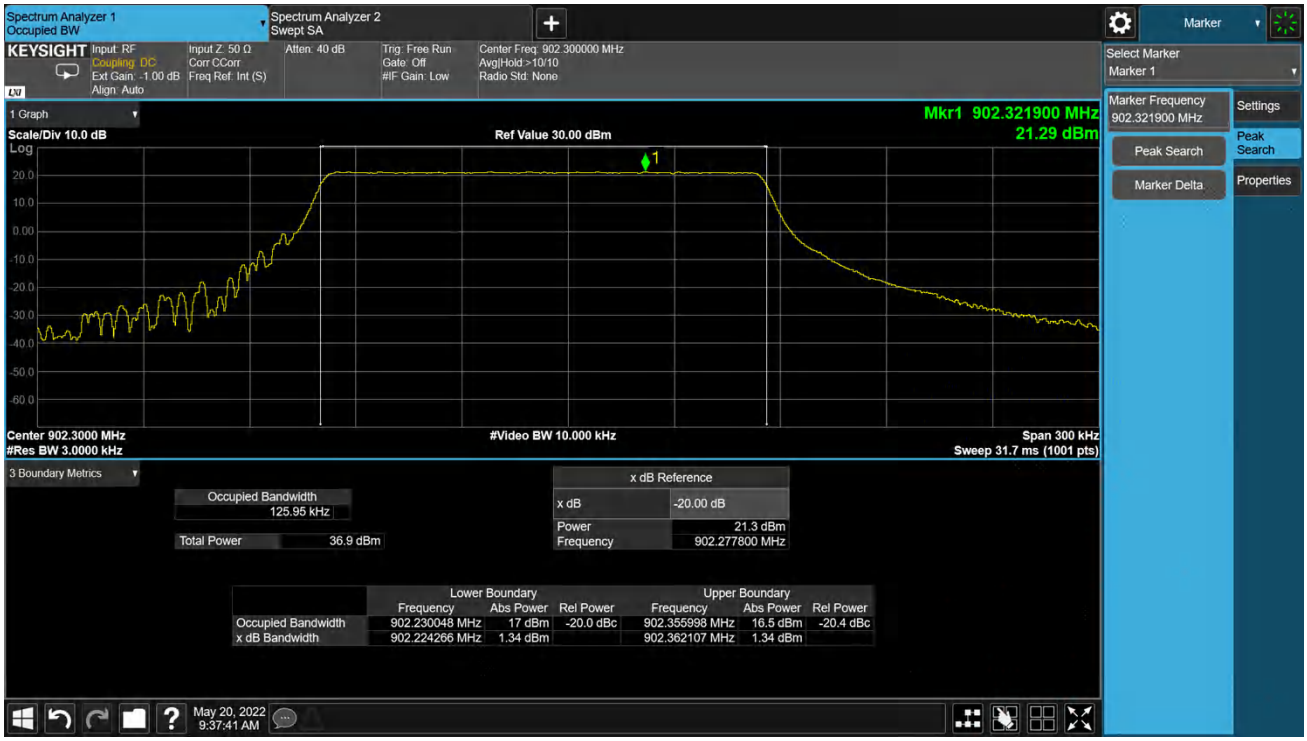


High Channel

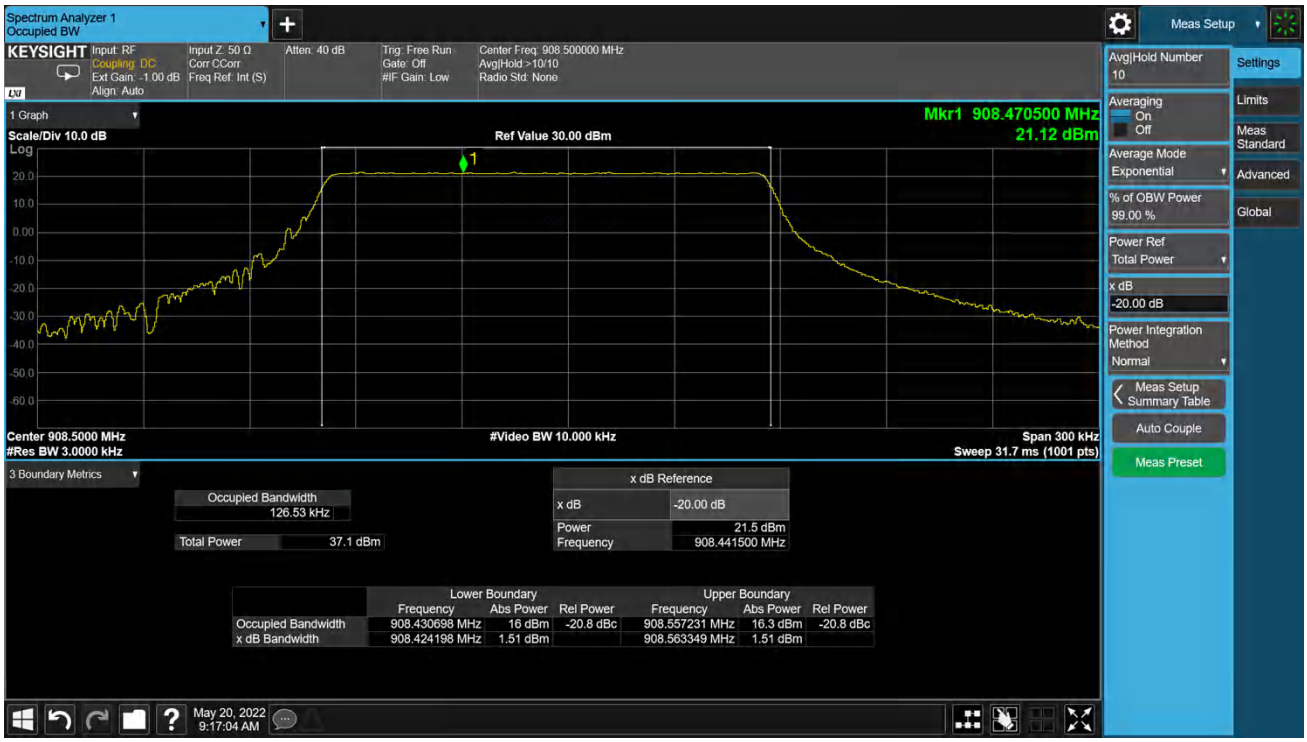


Lora FHSS, SF10

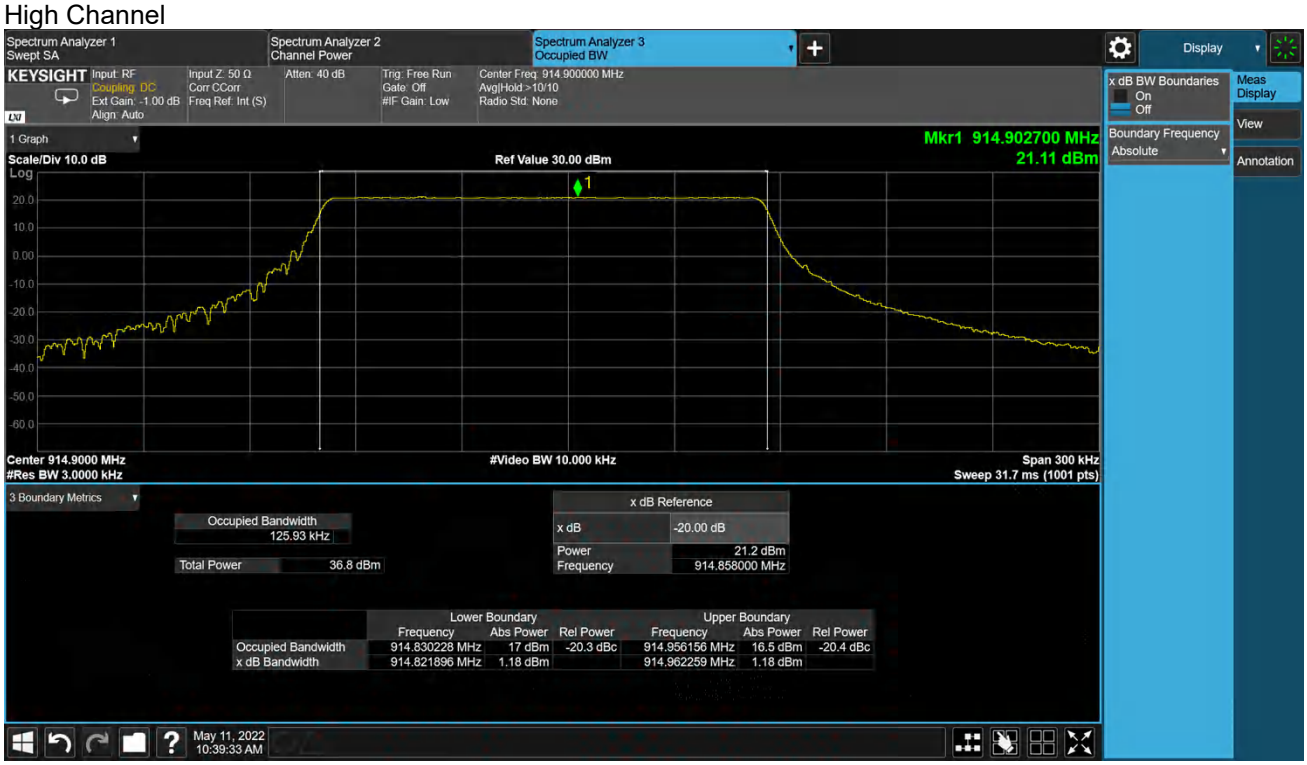
Low Channel



Middle Channel

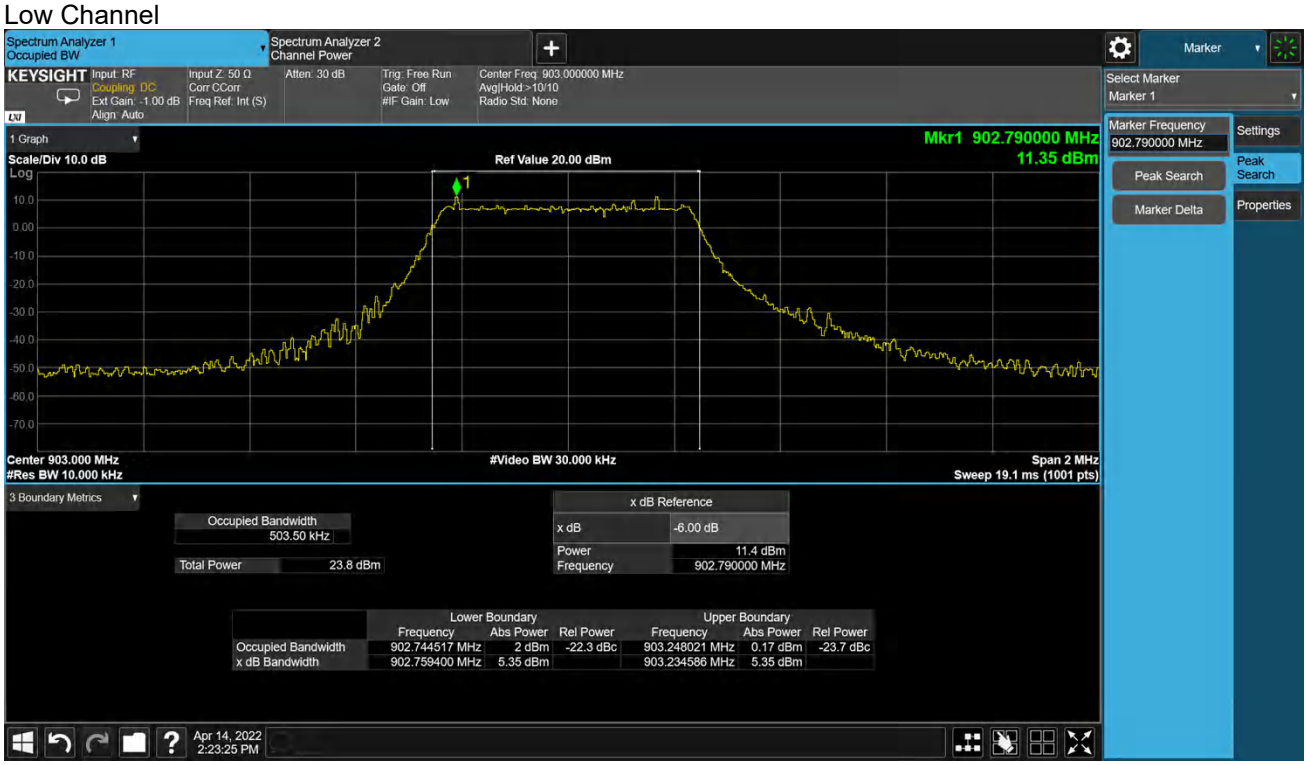


High Channel

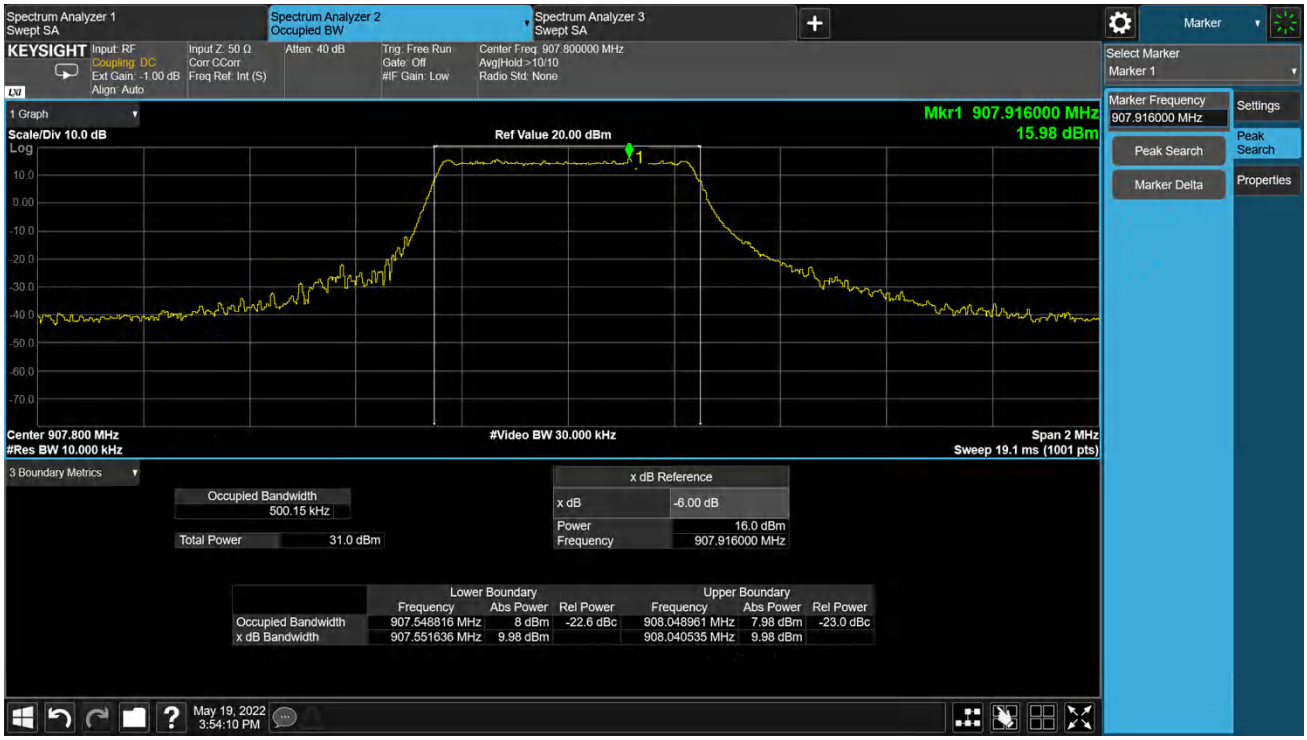


Lora DTS

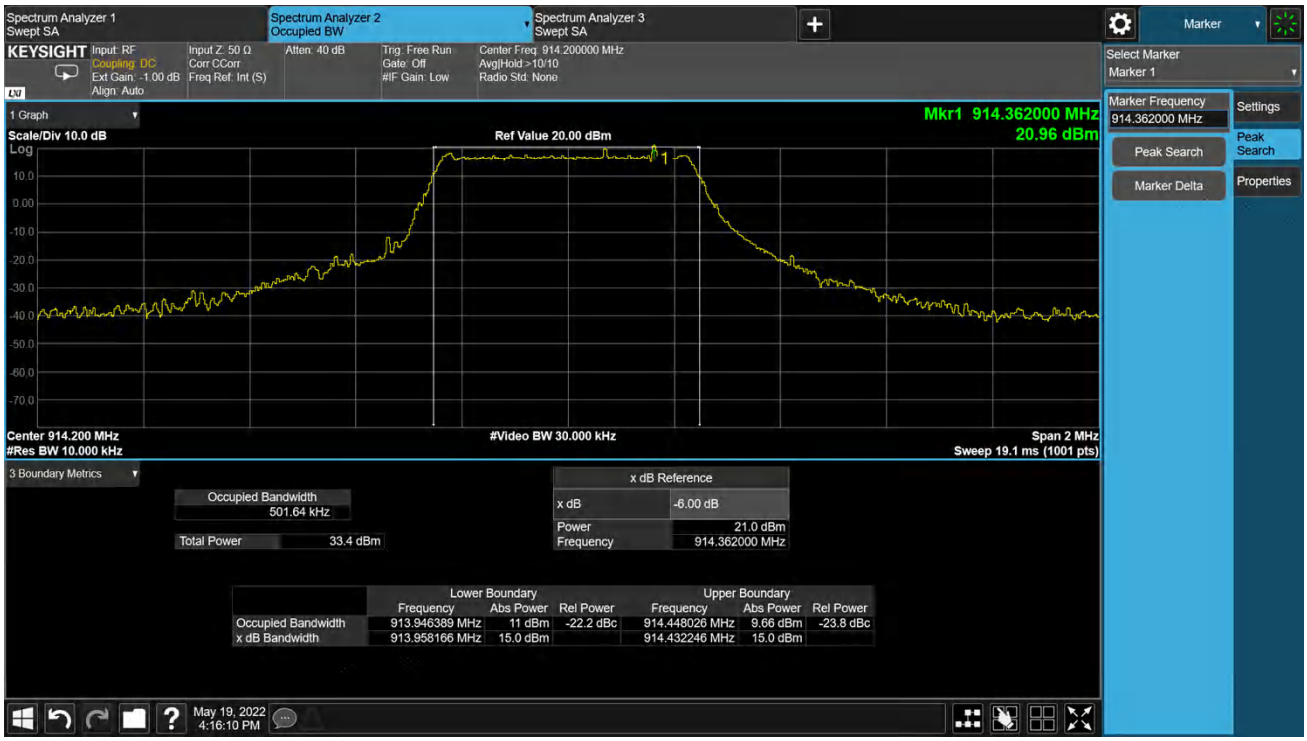
Low Channel



Middle Channel



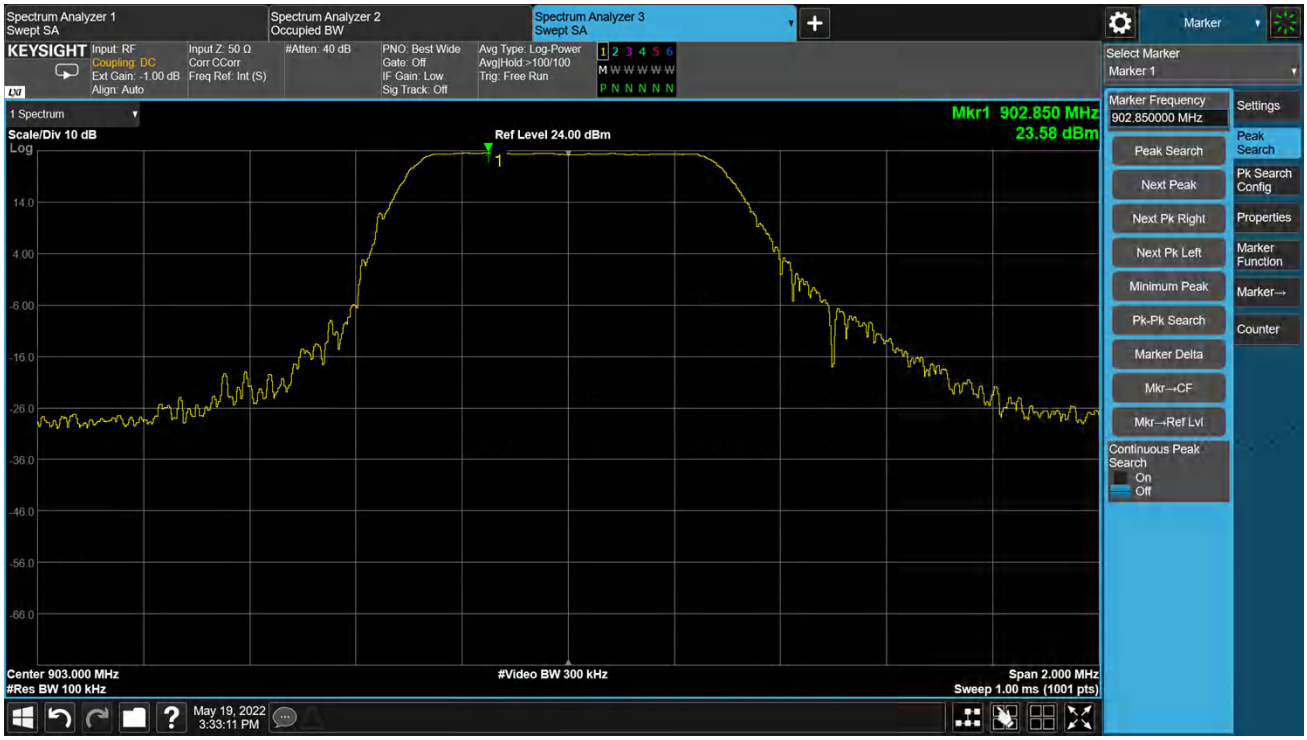
High Channel

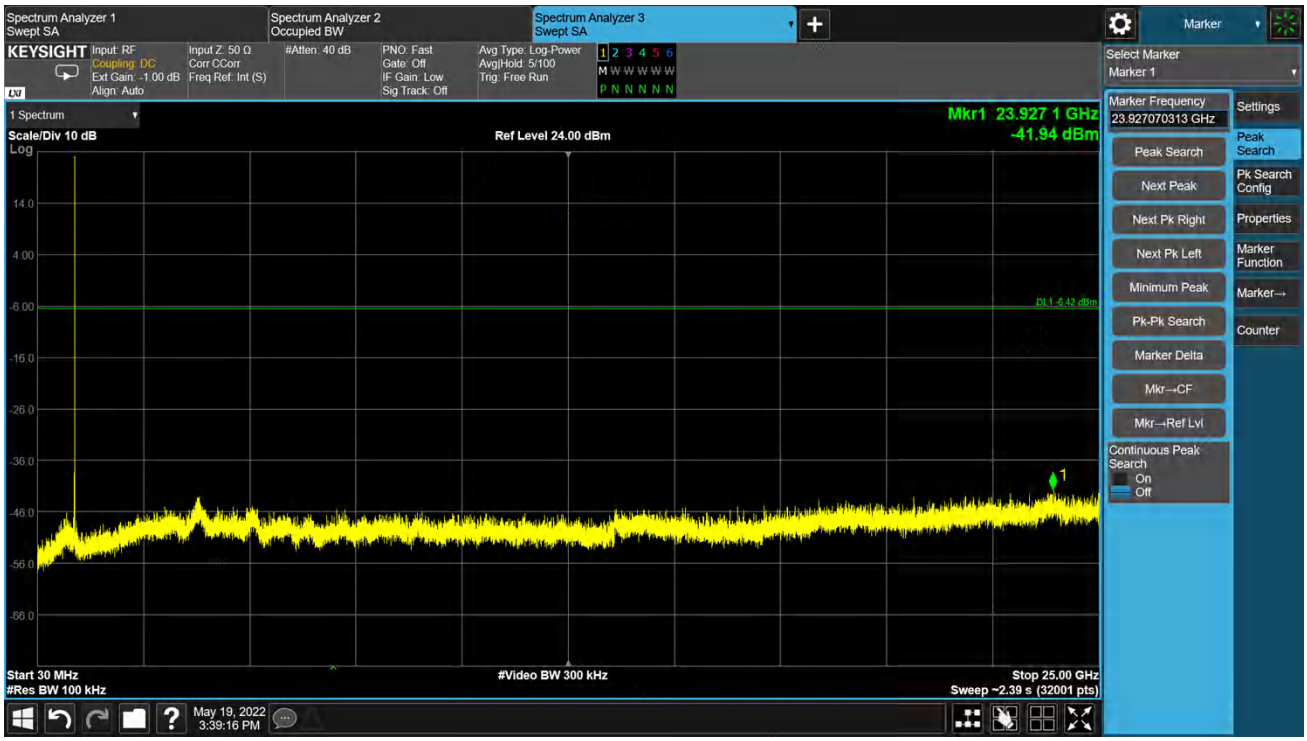


Appendix B.5: Conducted Spurious Emissions Measured in 100 kHz Bandwidth

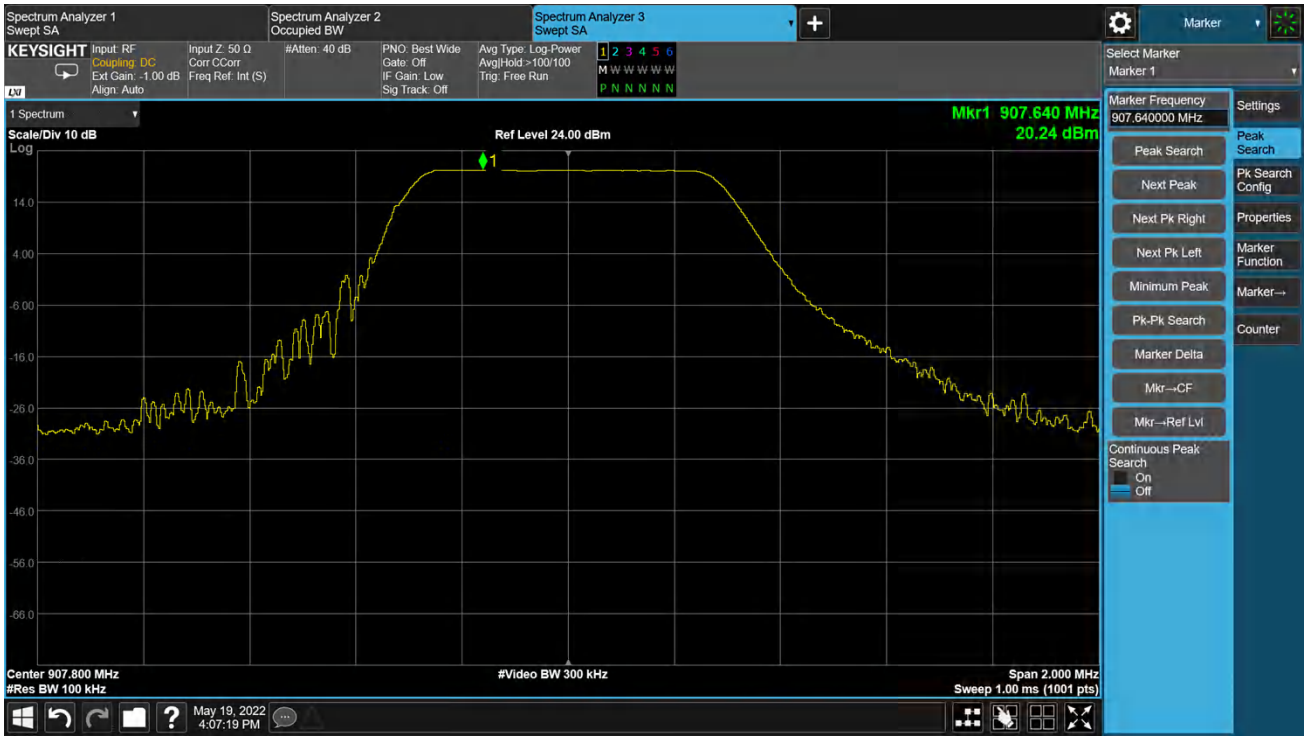
Lora DTS

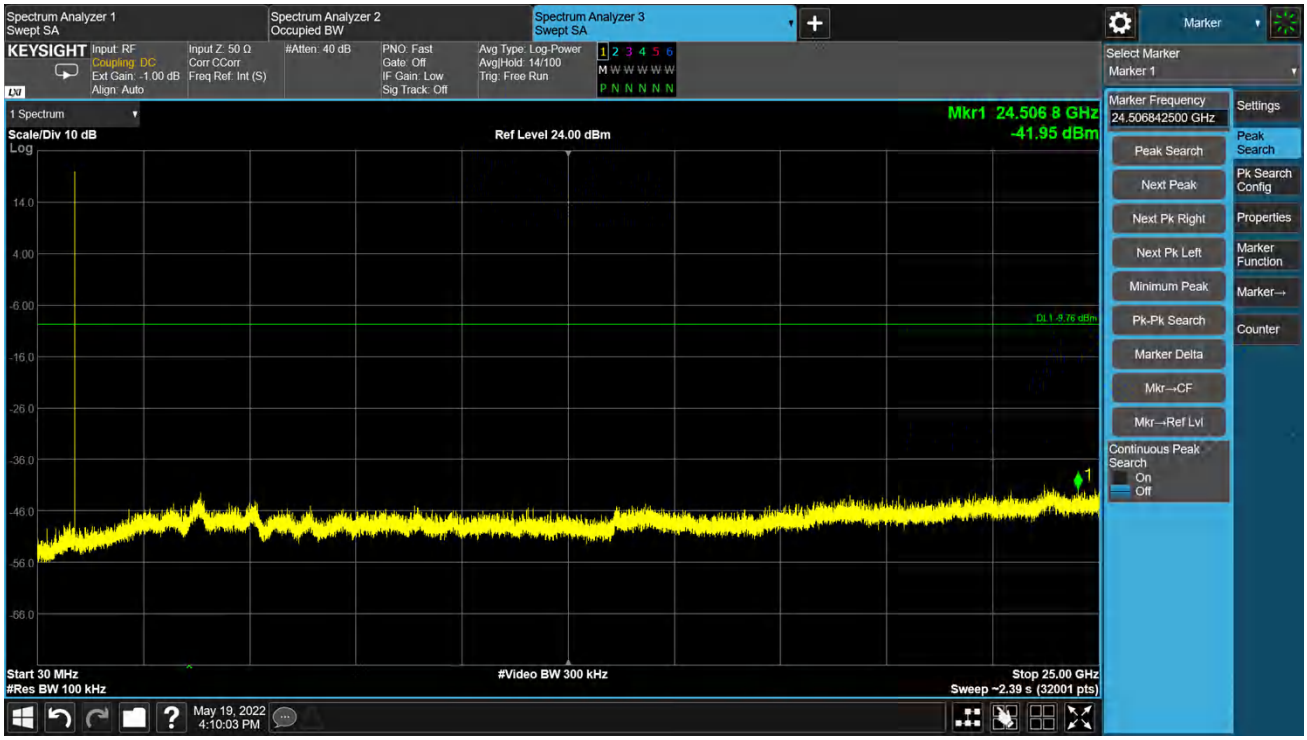
Low Channel



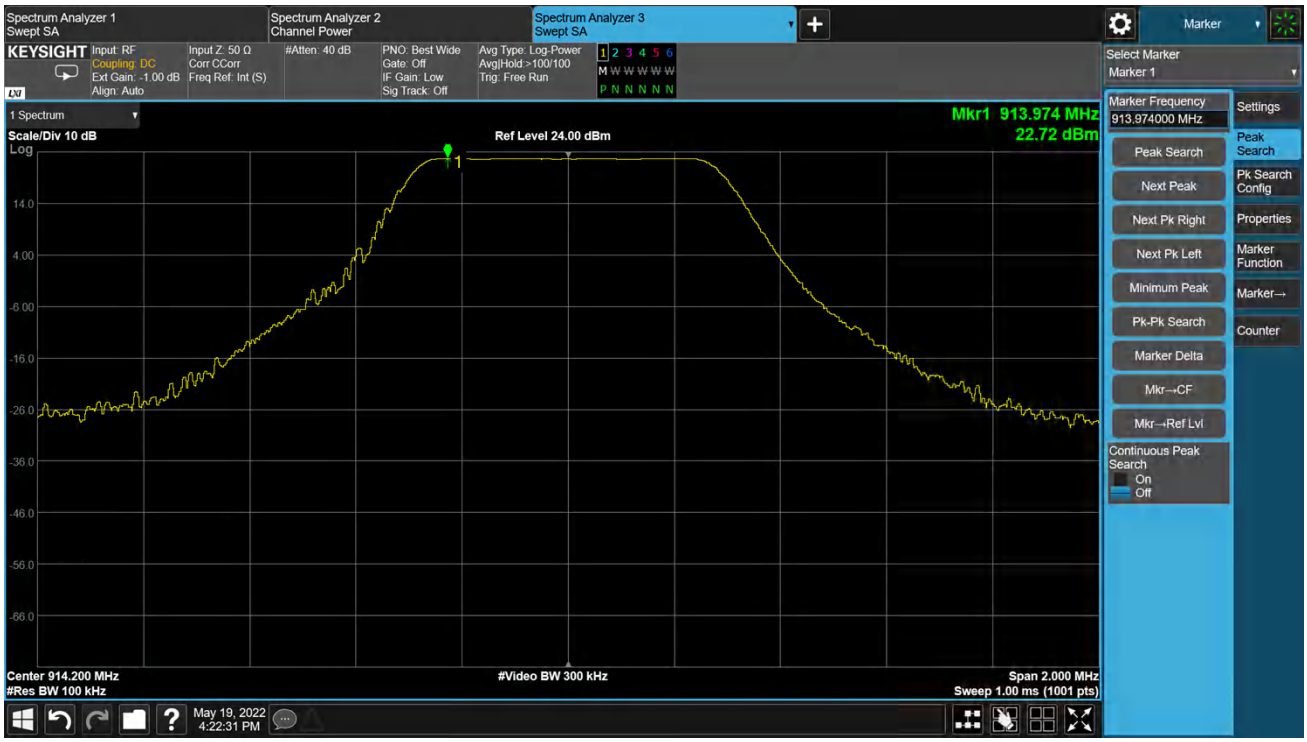


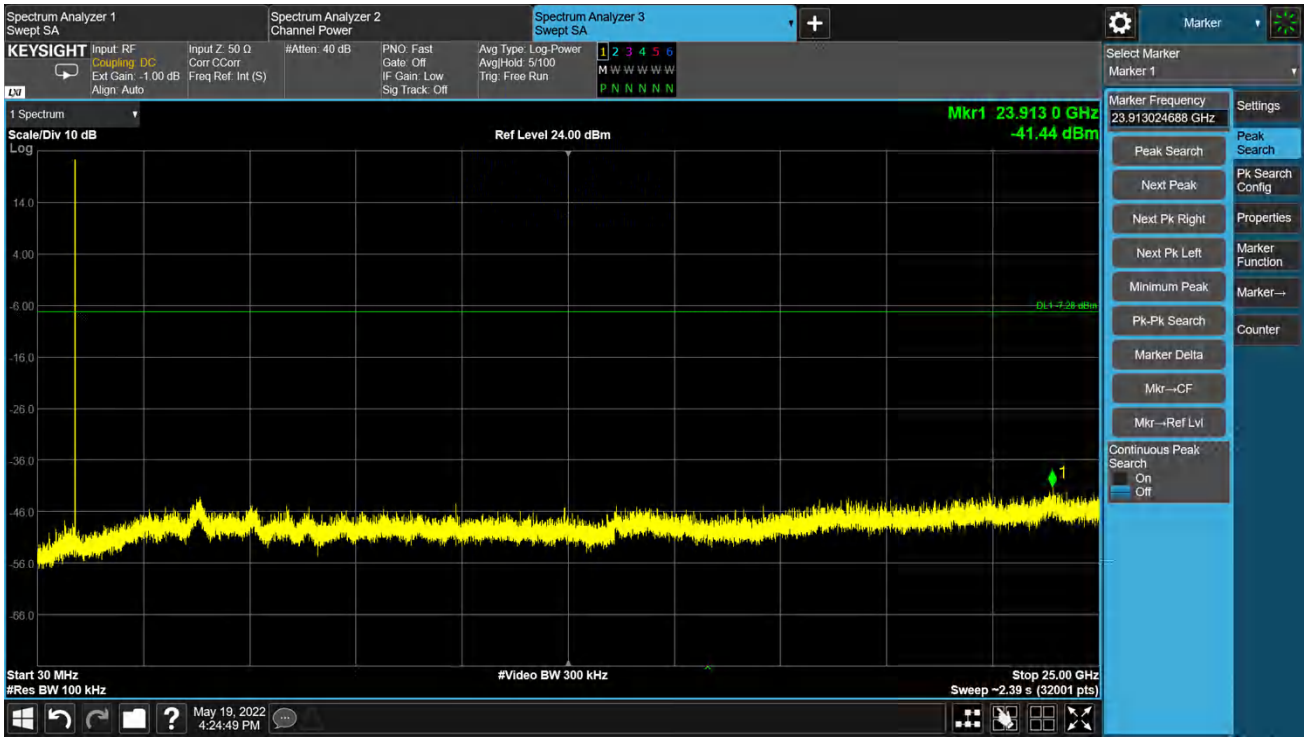
Middle Channel



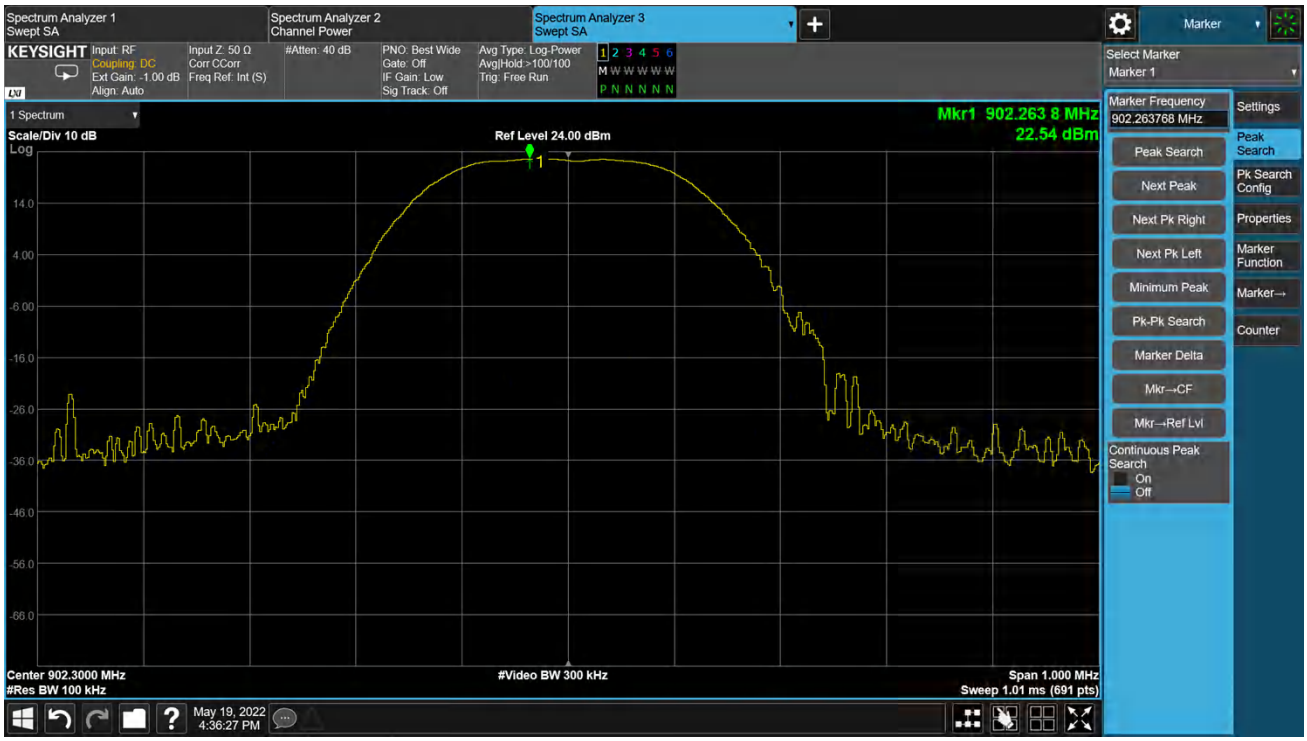


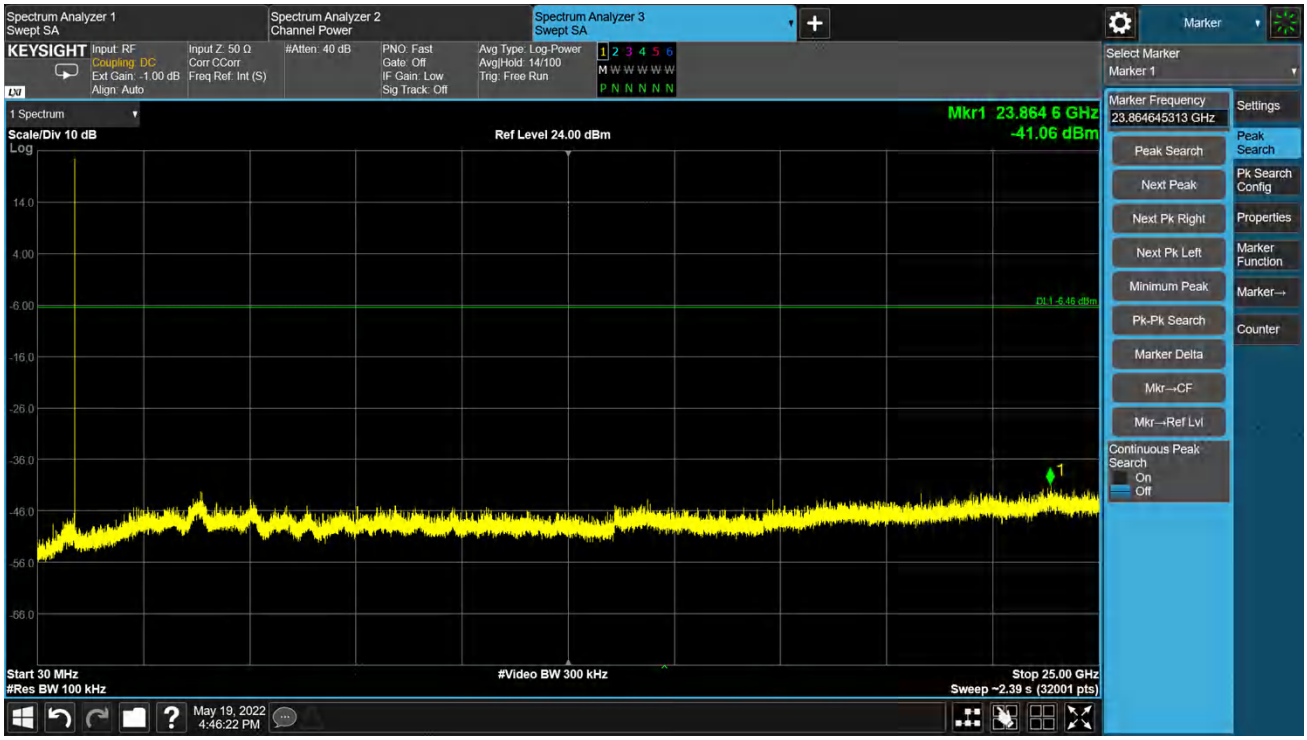
High Channel



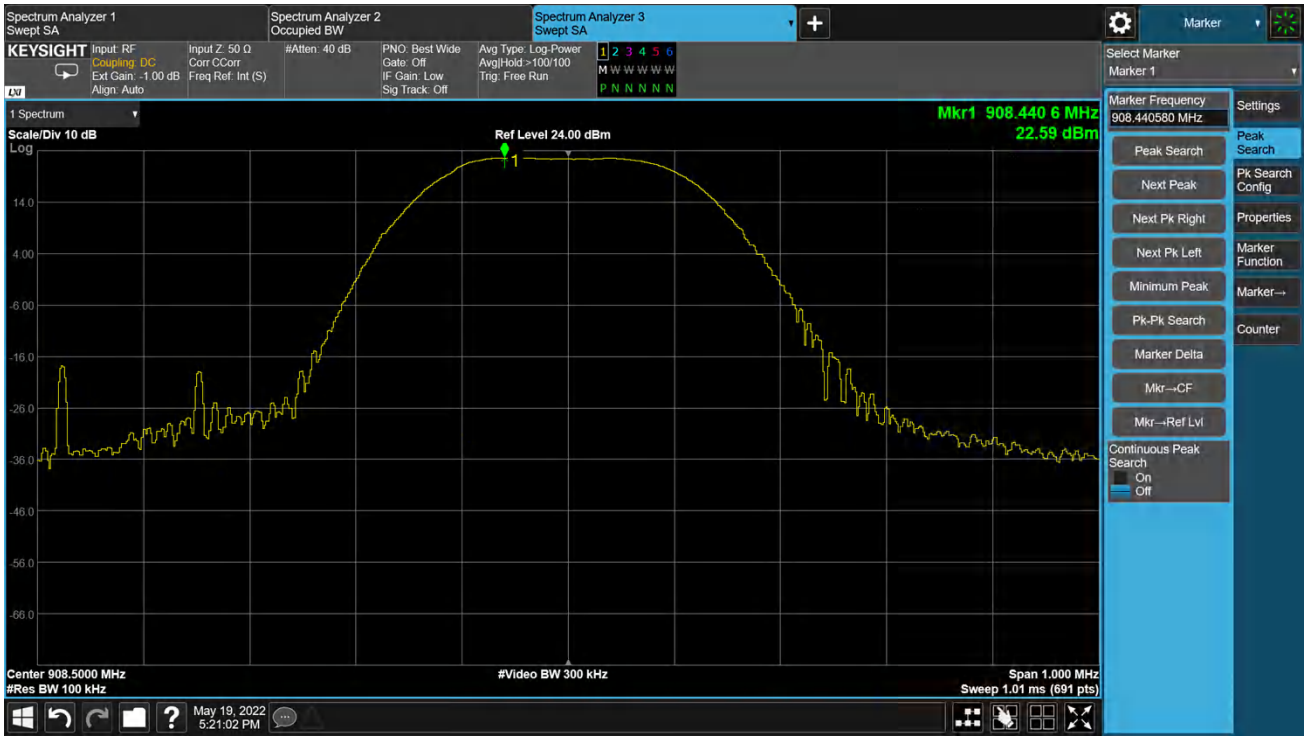


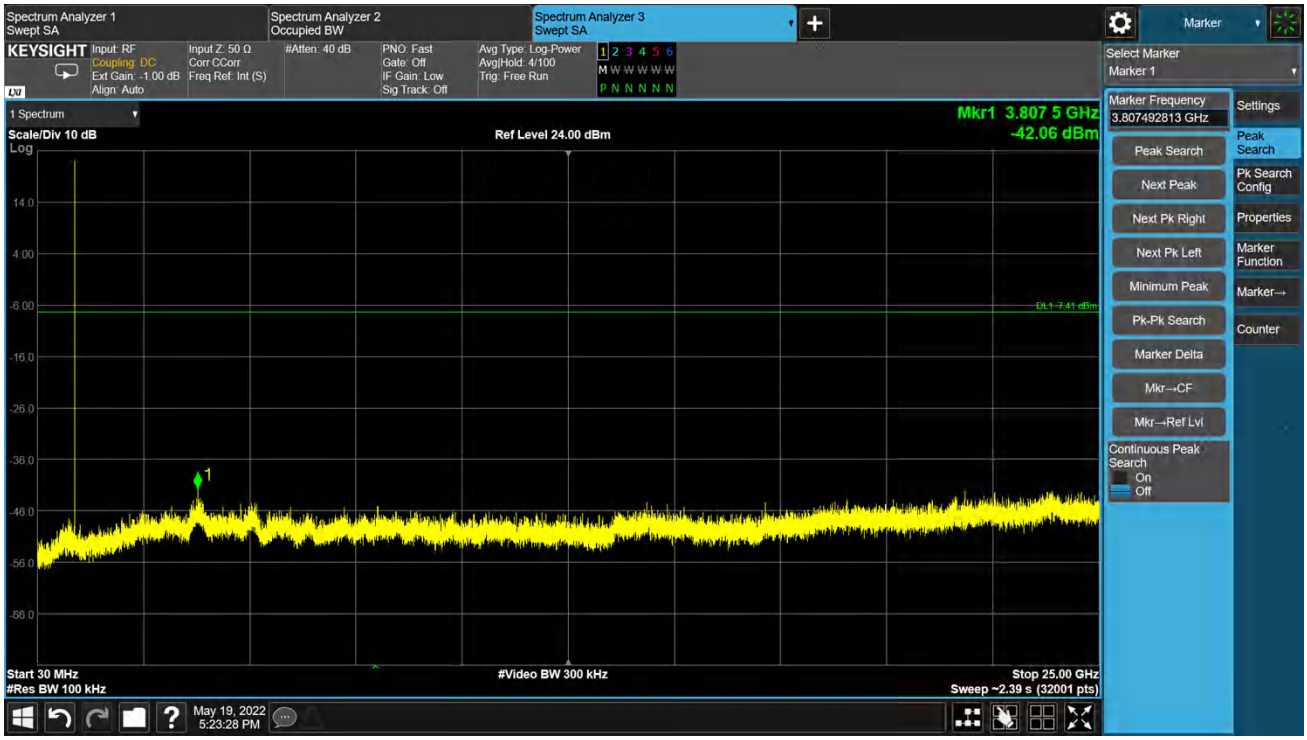
Lora FHSS SF7, No hopping
Low Channel



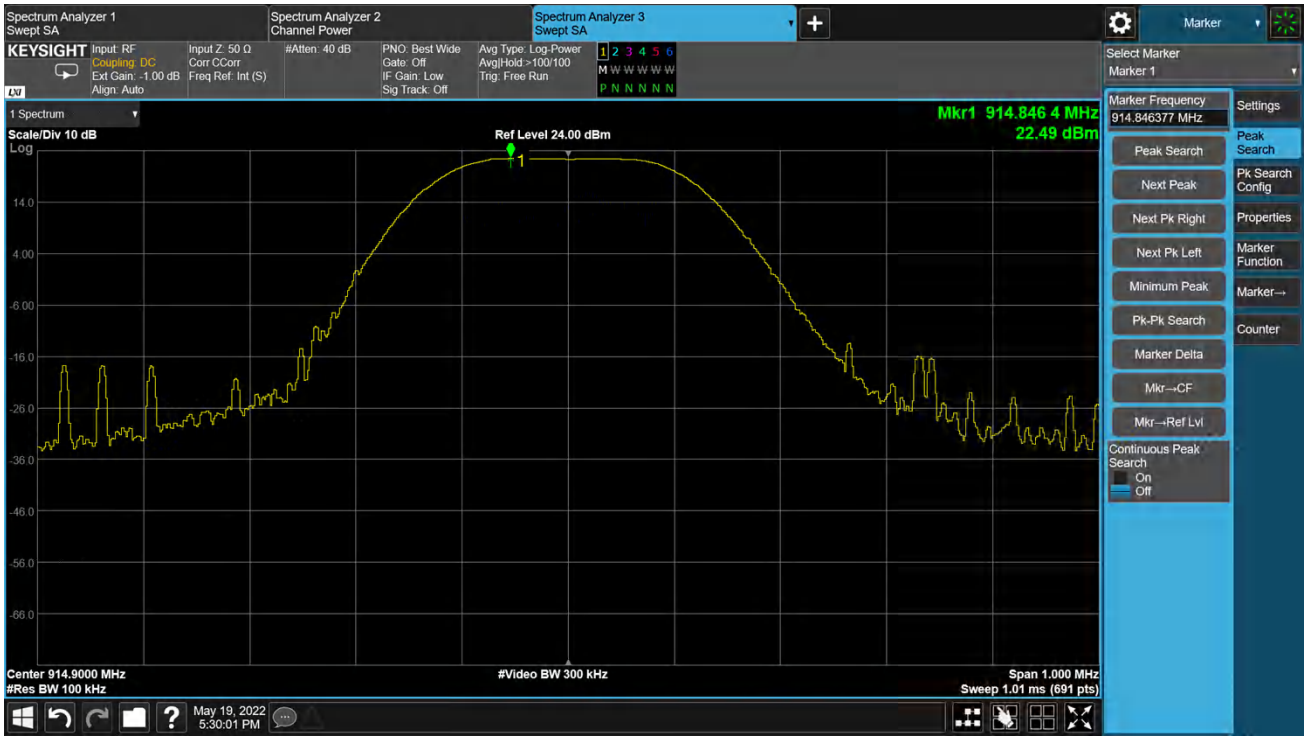


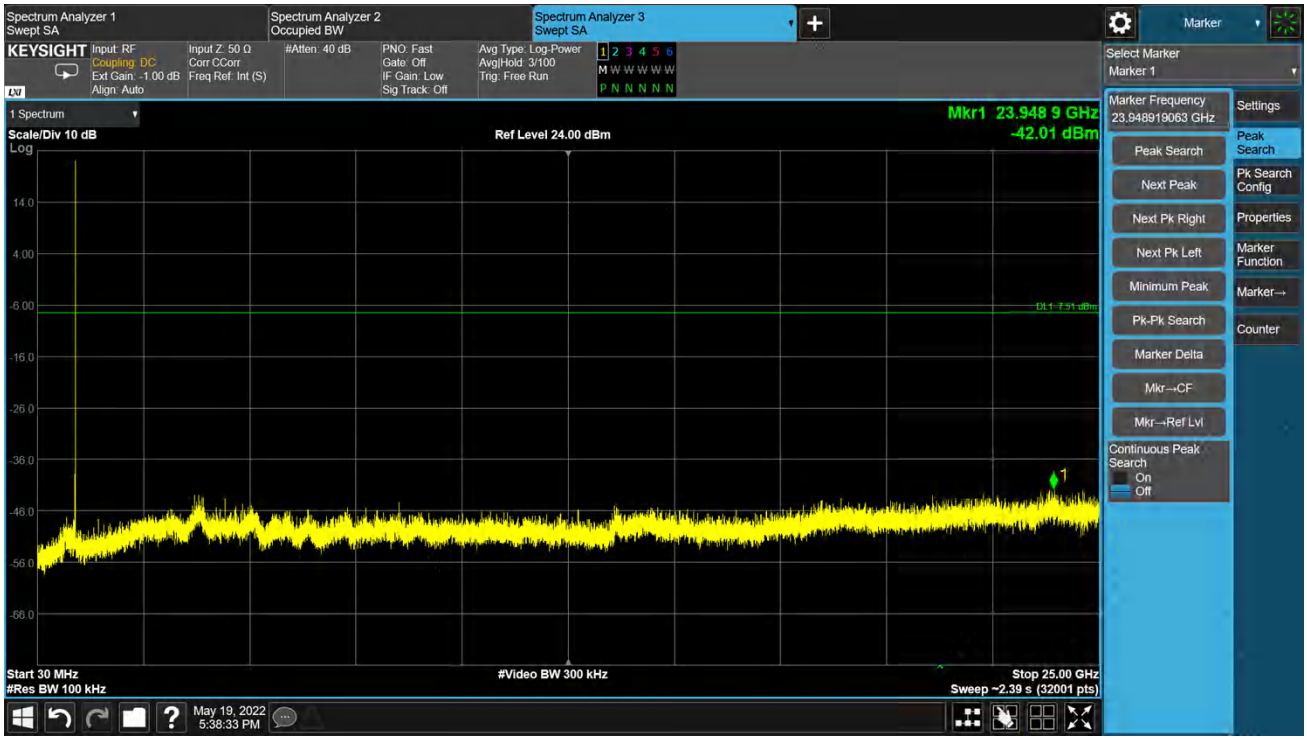
Middle Channel



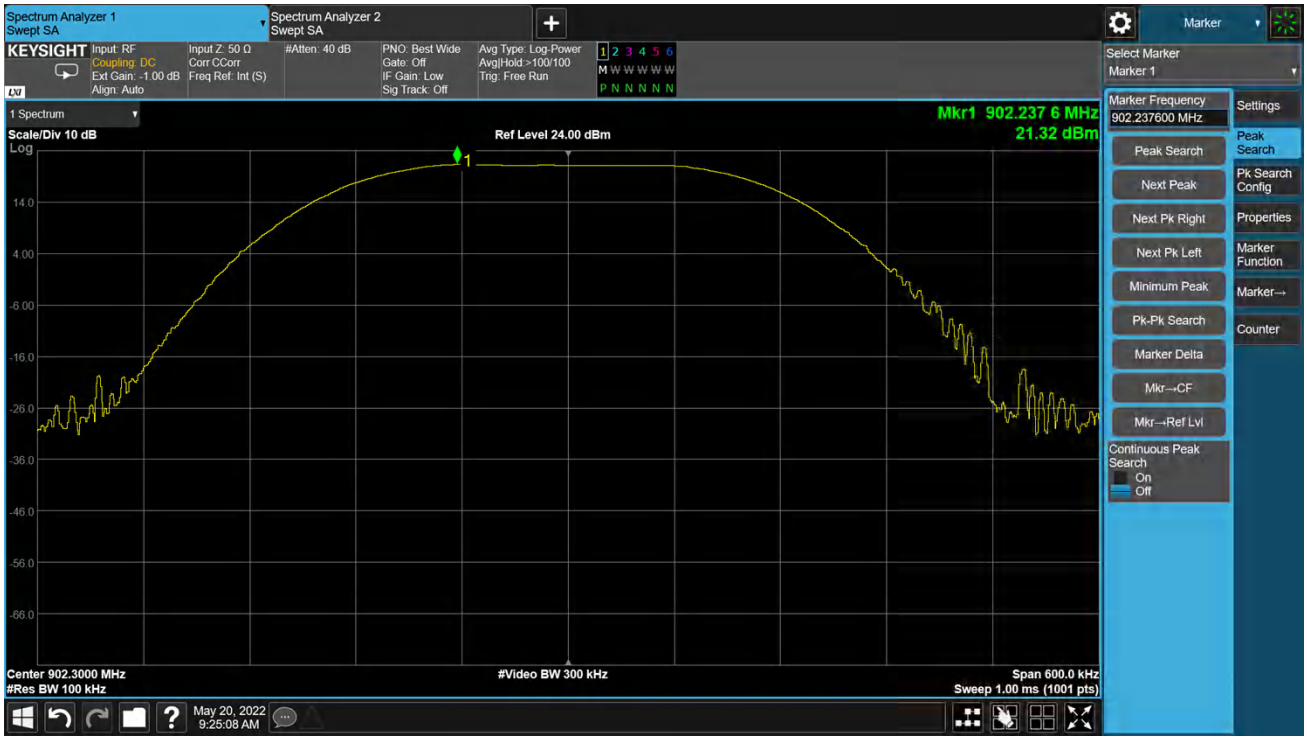


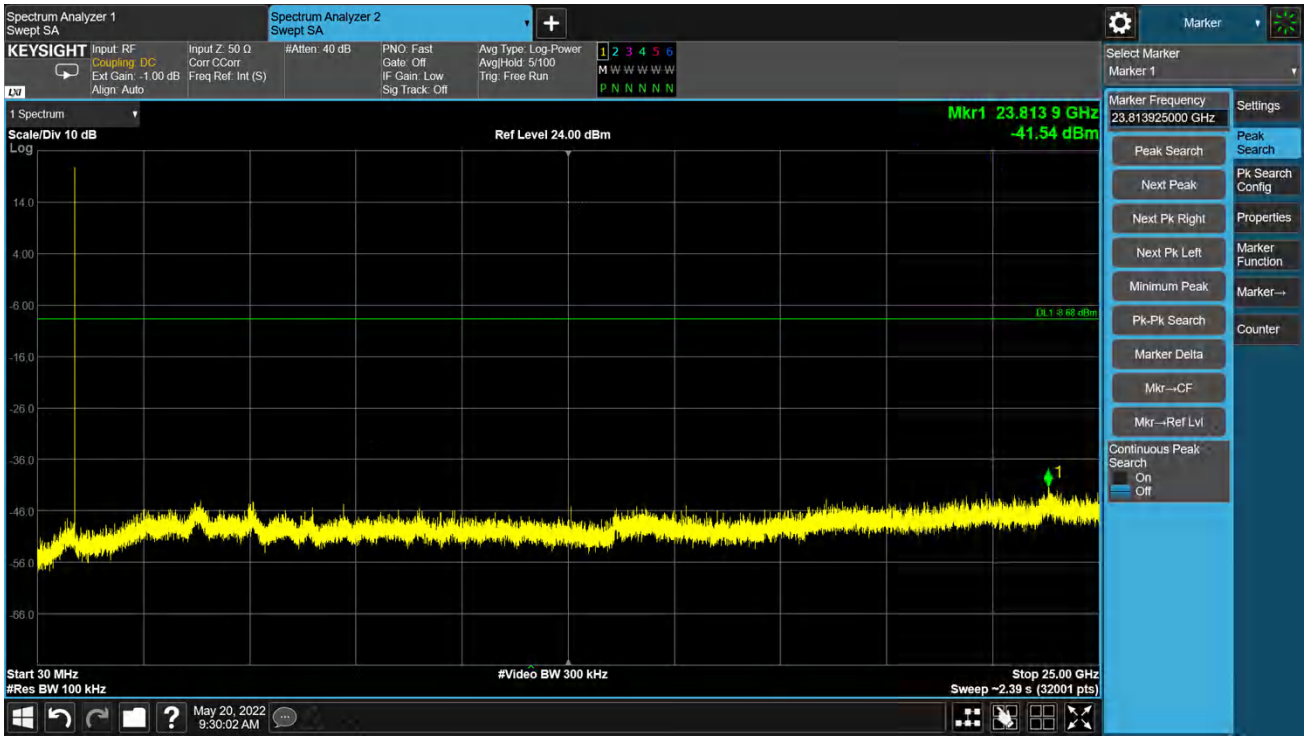
High Channel



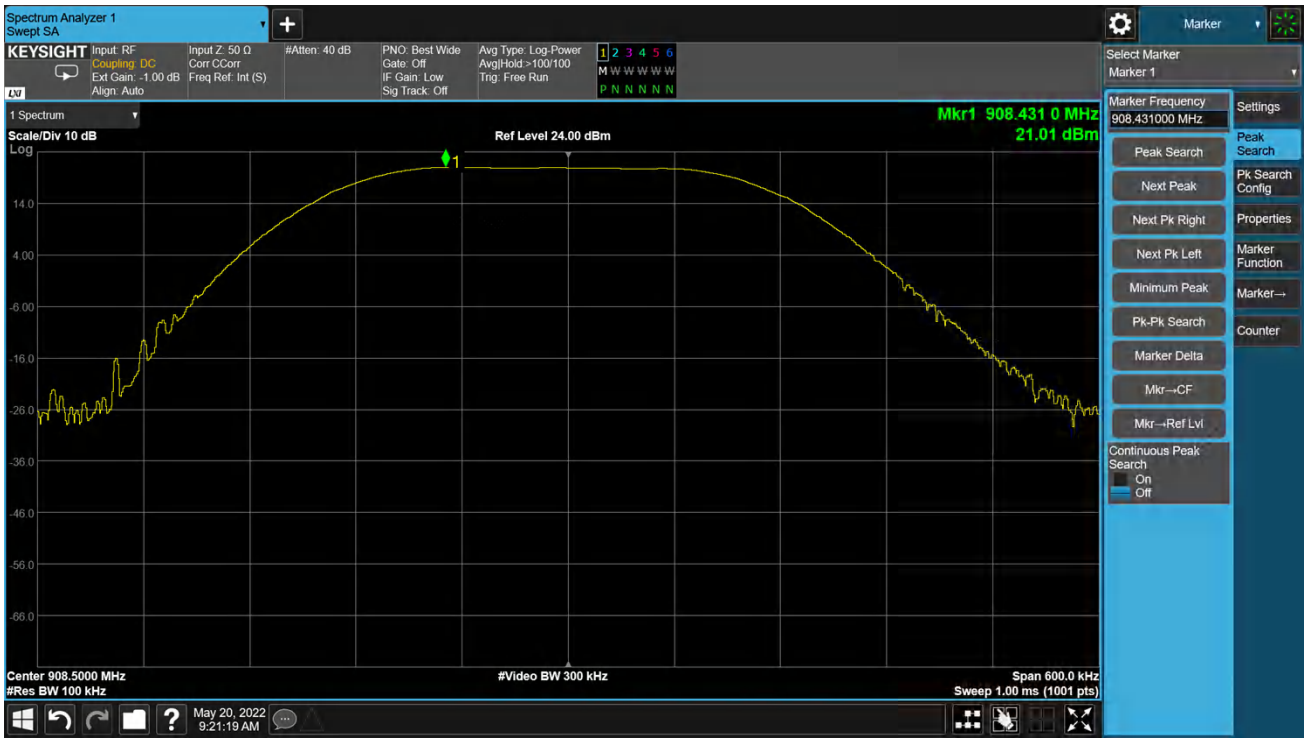


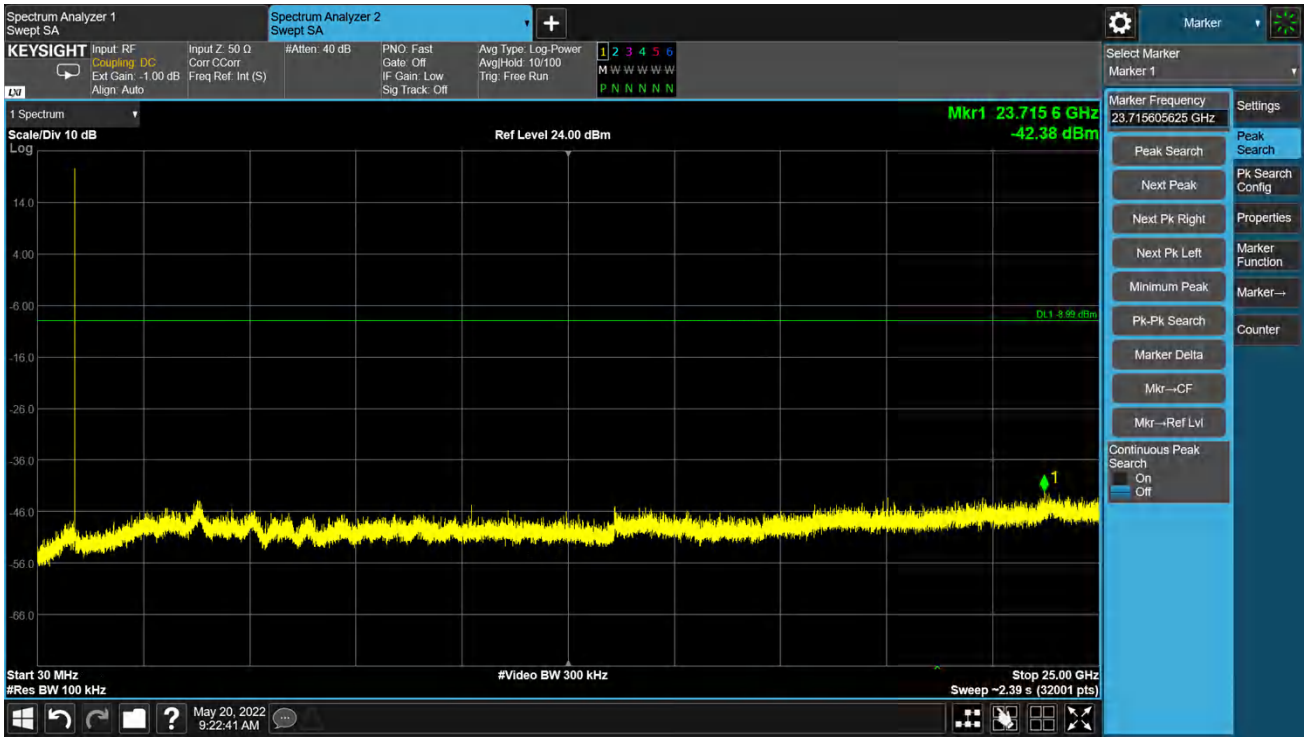
Lora FHSS SF10, No hopping
Low Channel



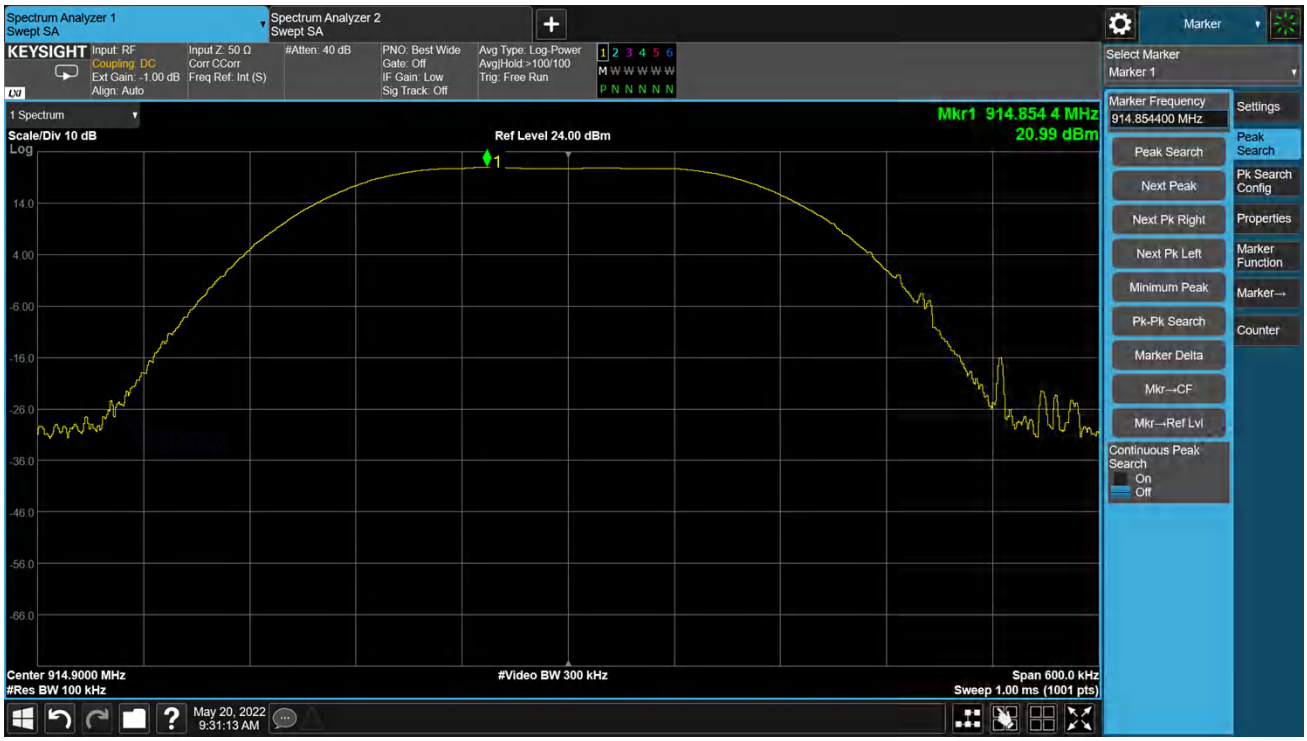


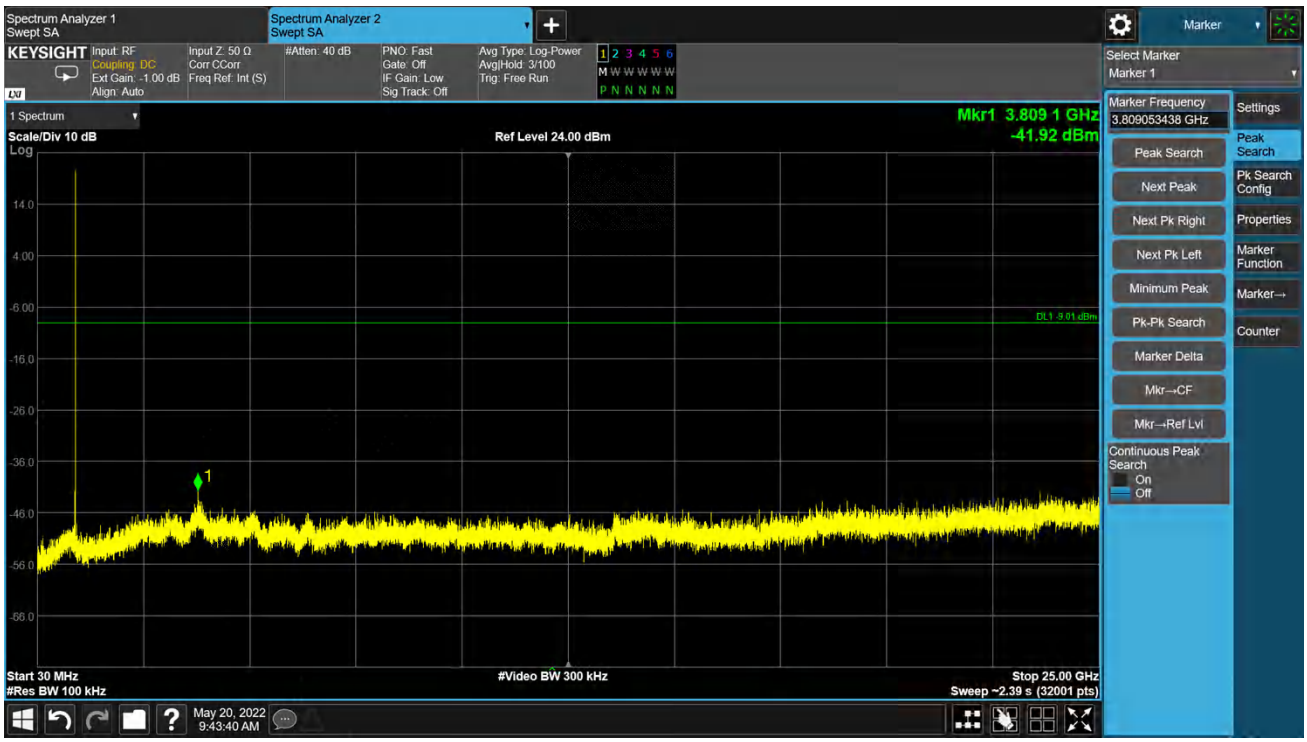
Middle Channel



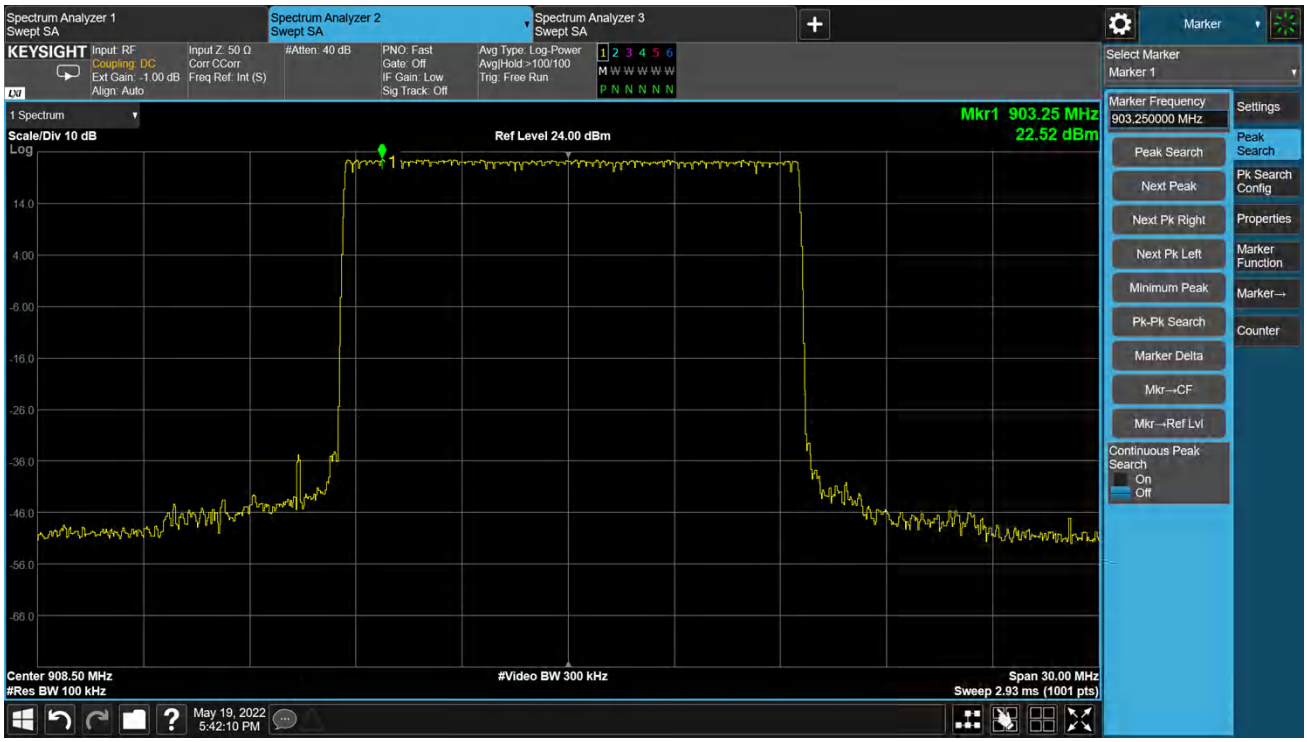


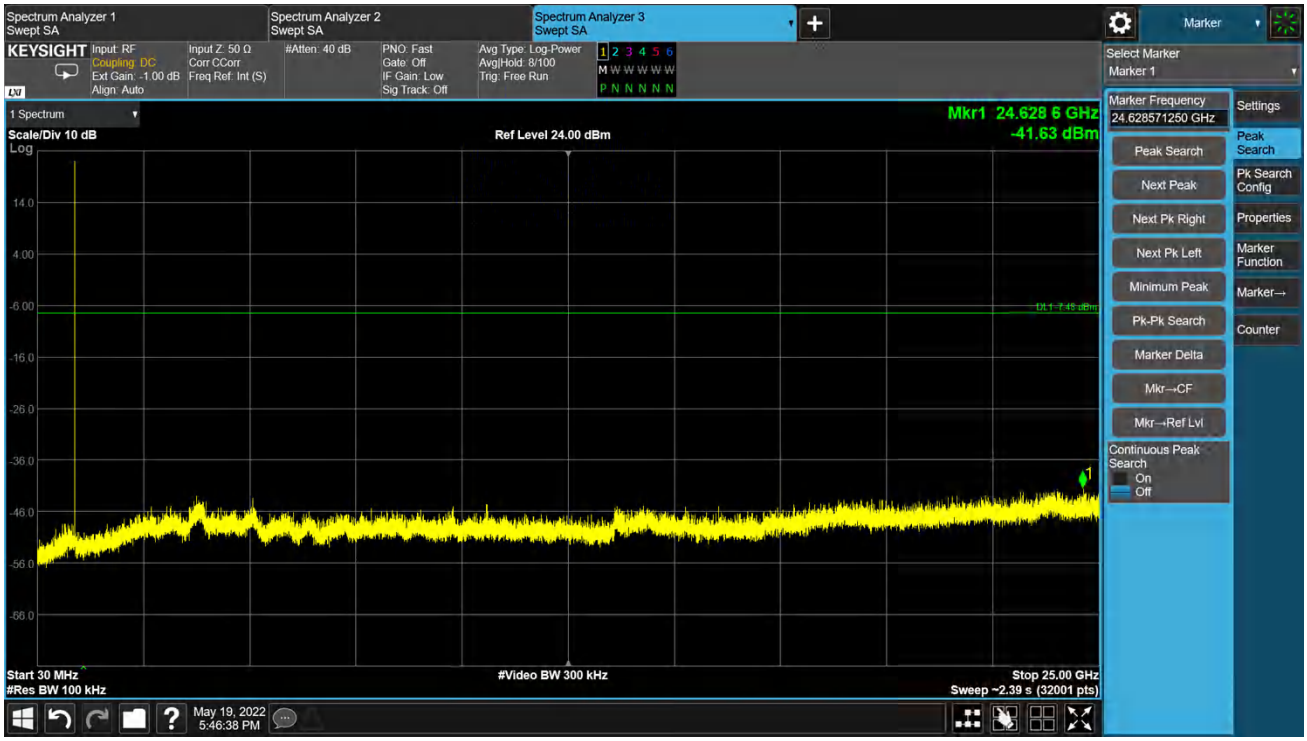
High Channel



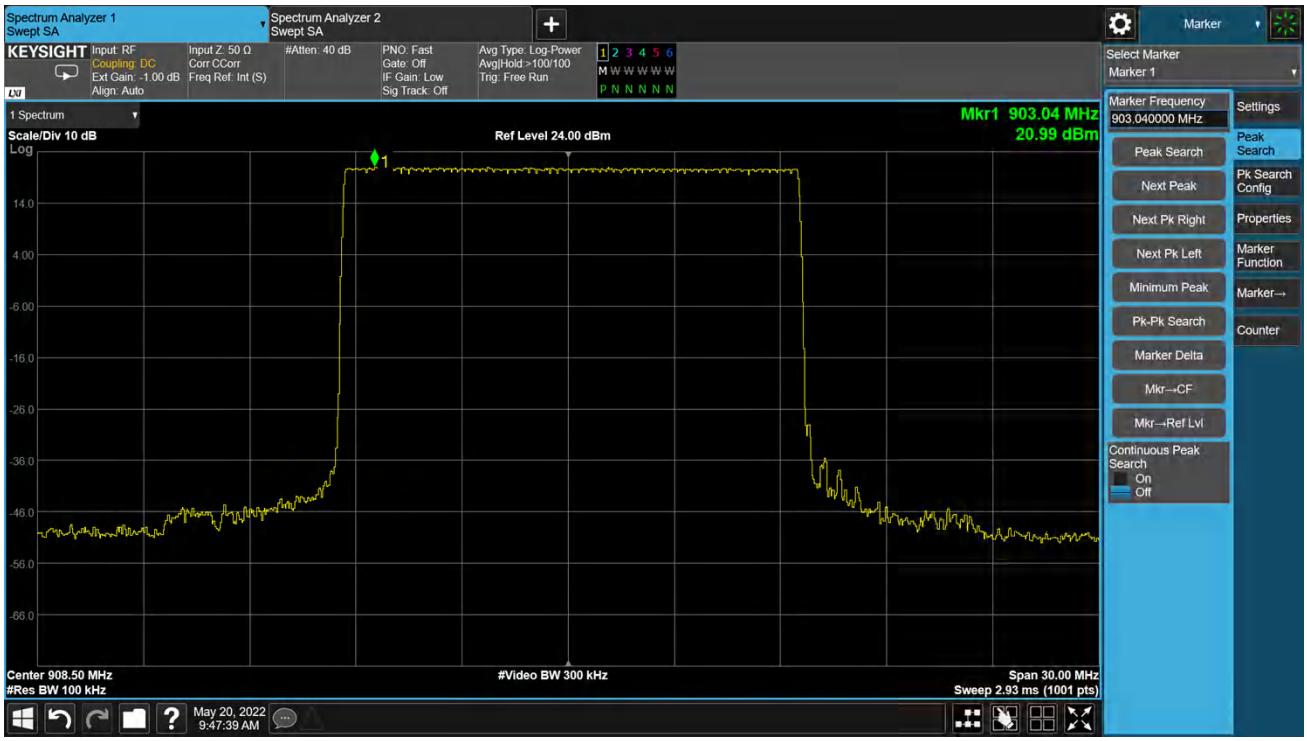


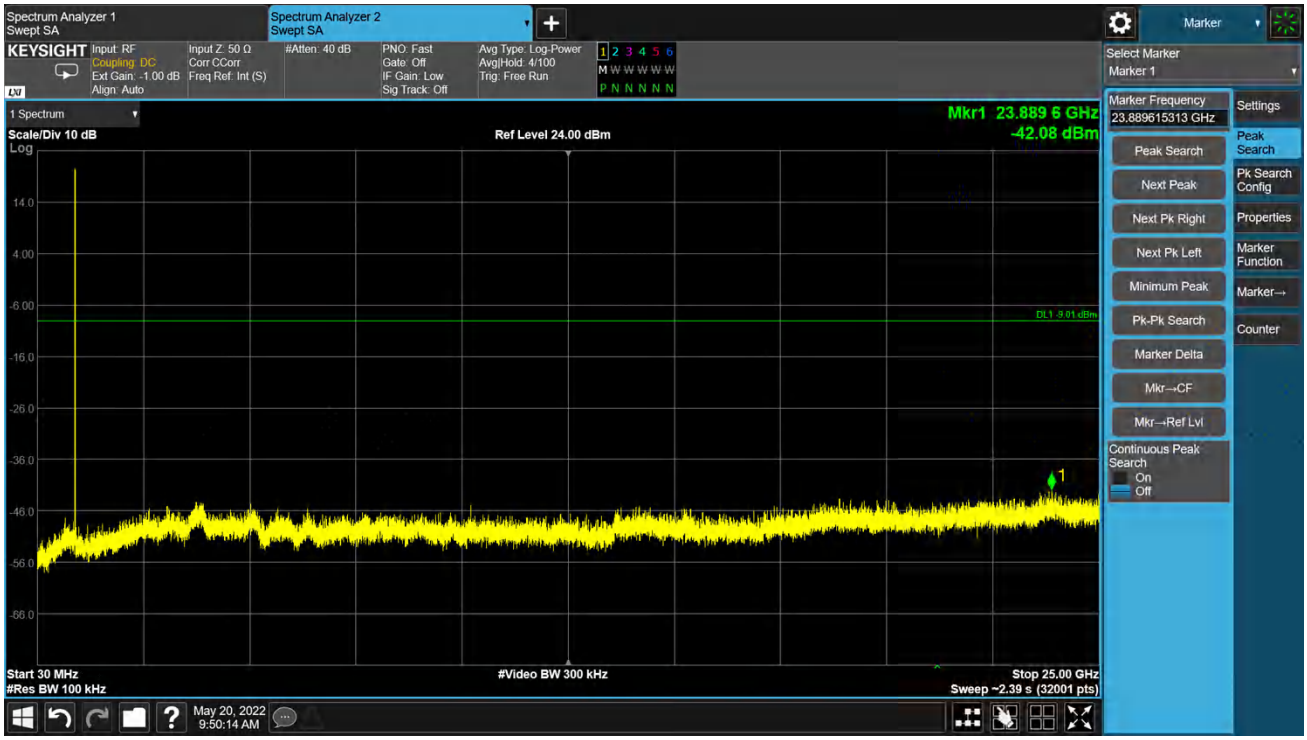
Lora FHSS SF7, hopping





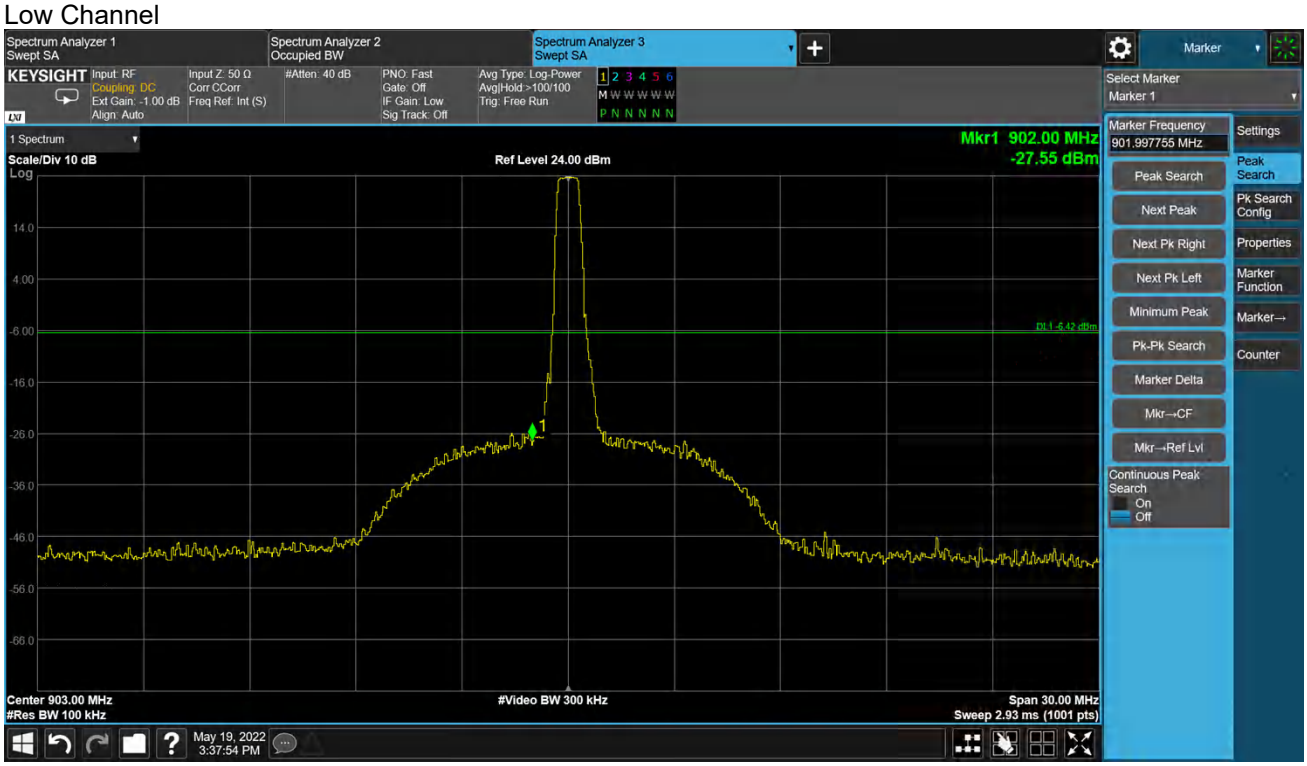
Lora FHSS SF10, hopping



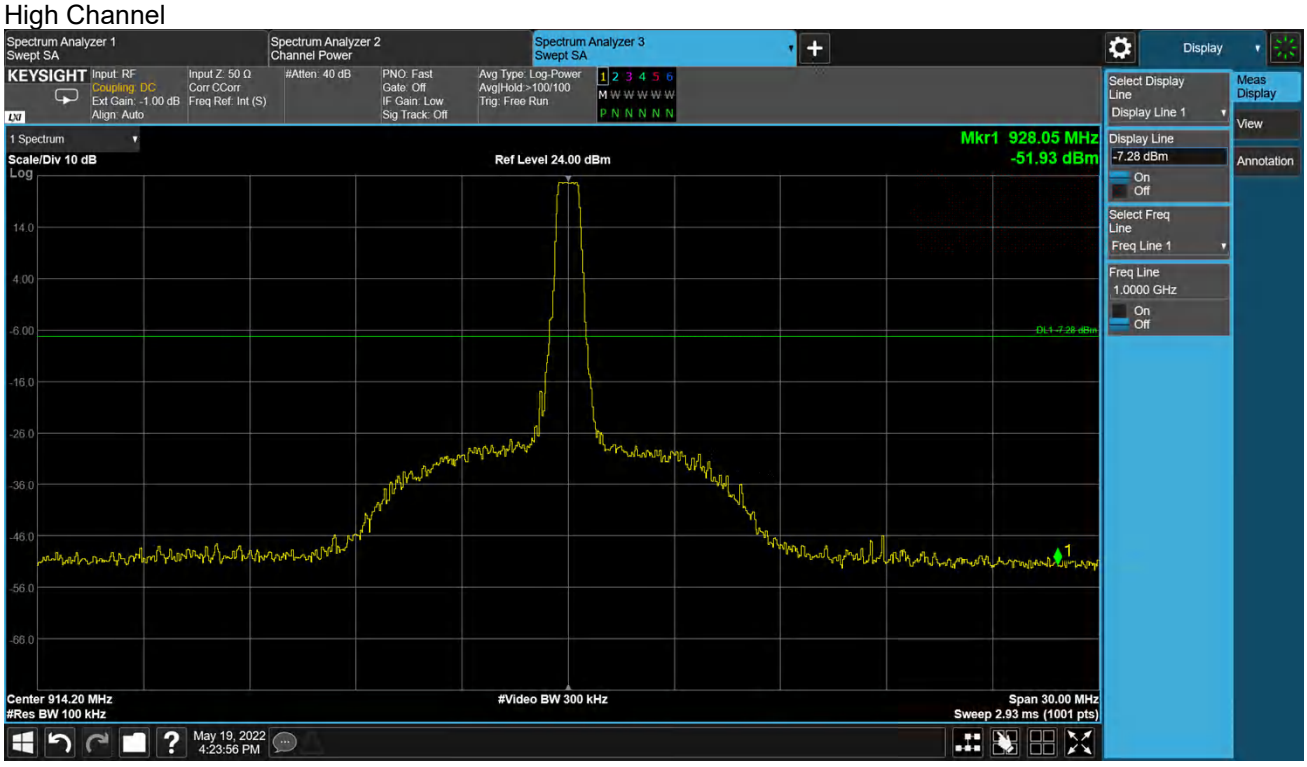


Lora DTS, Band Edge

Low Channel

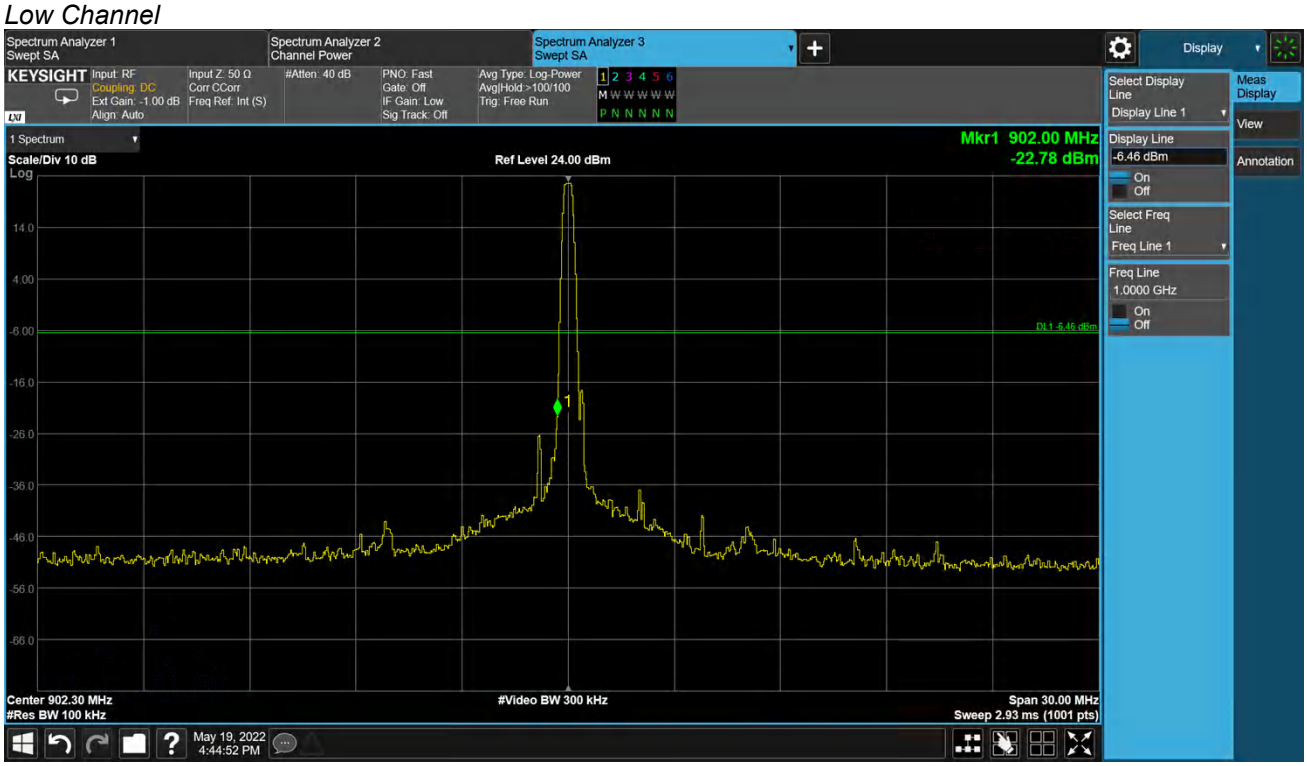


High Channel

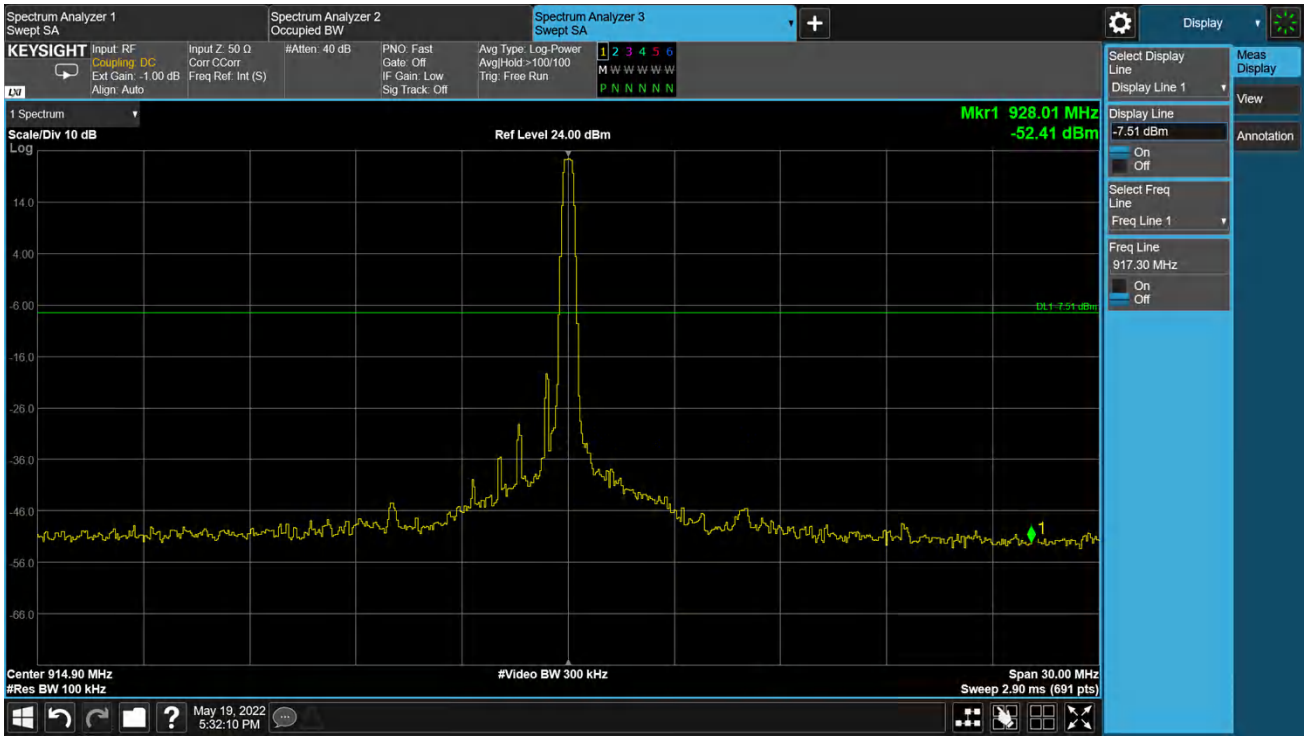


Lora FHSS SF7, No hopping, Band Edge

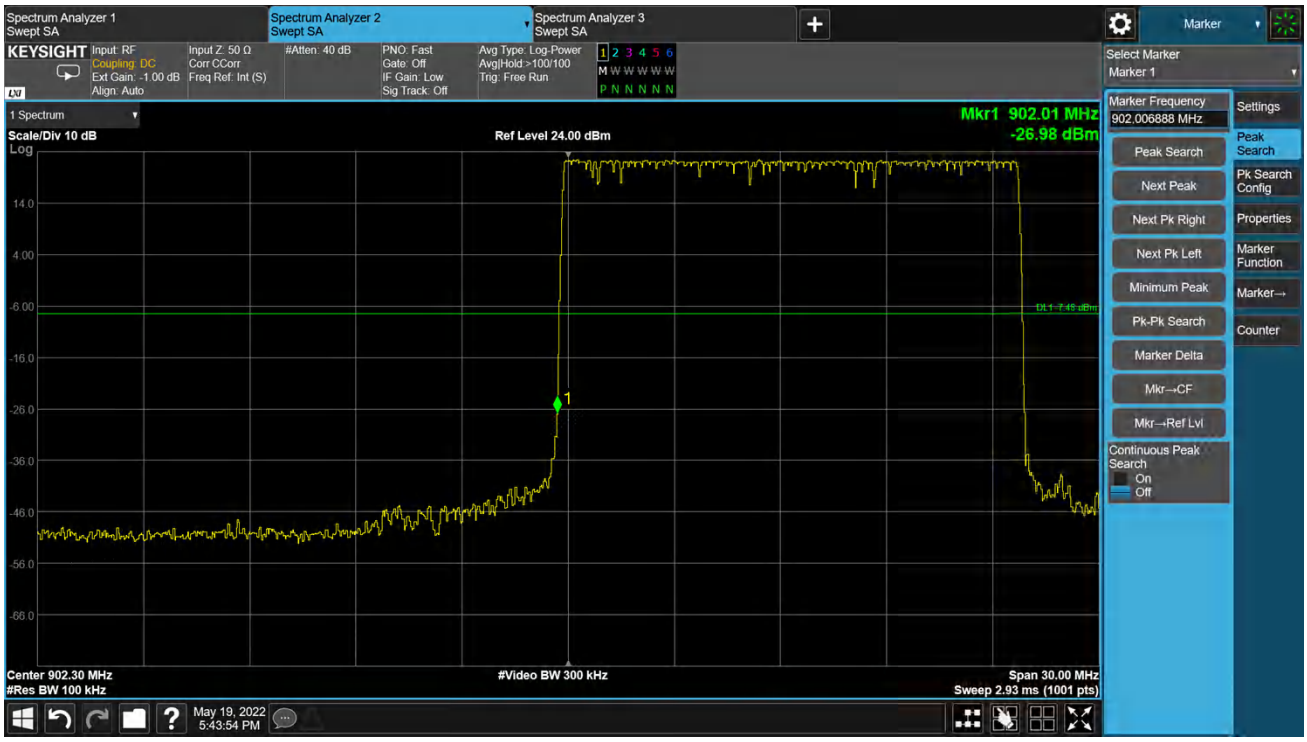
Low Channel

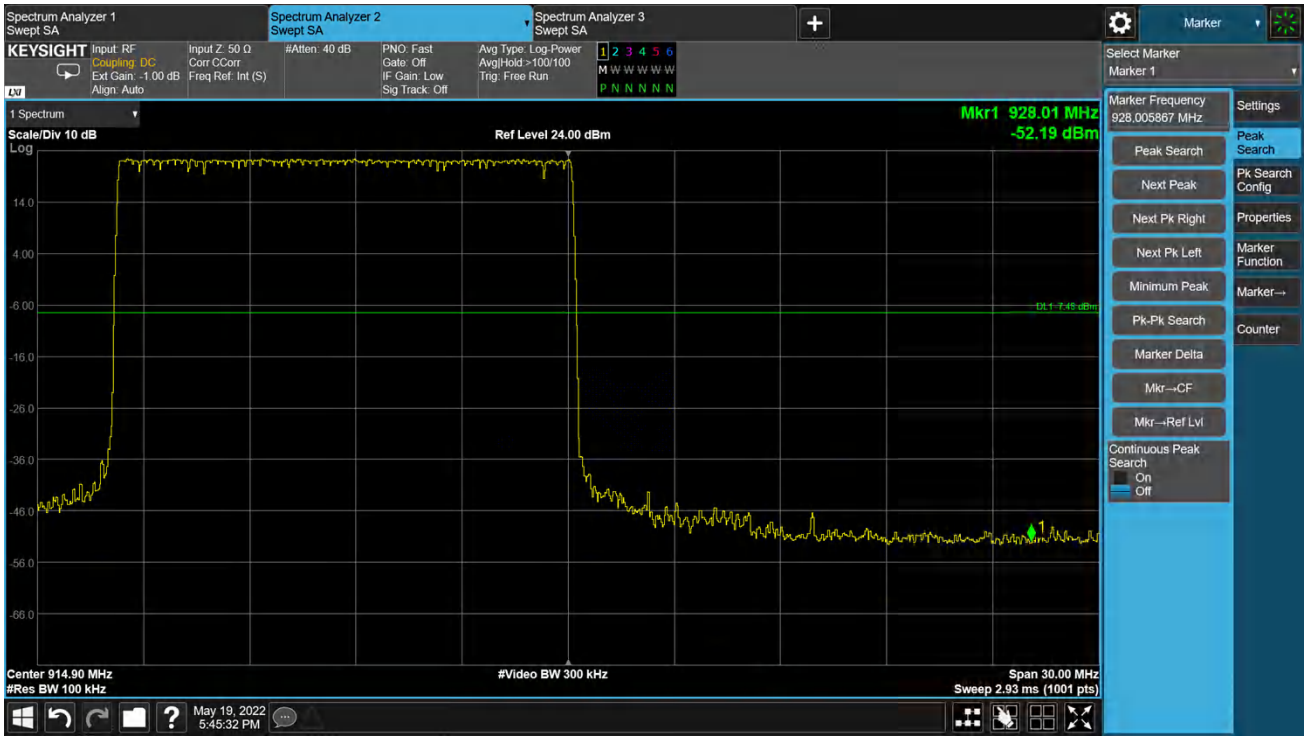


High Channel

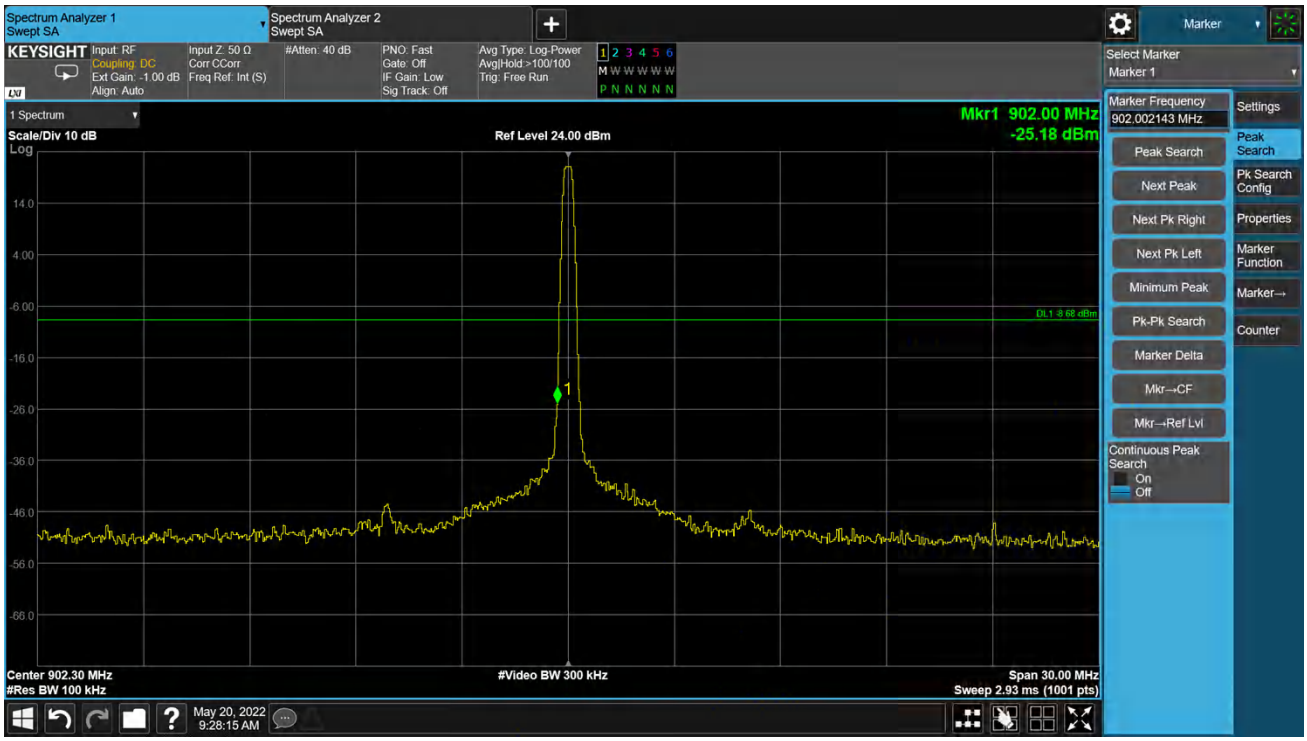


Lora FHSS SF7, hopping, Band Edge

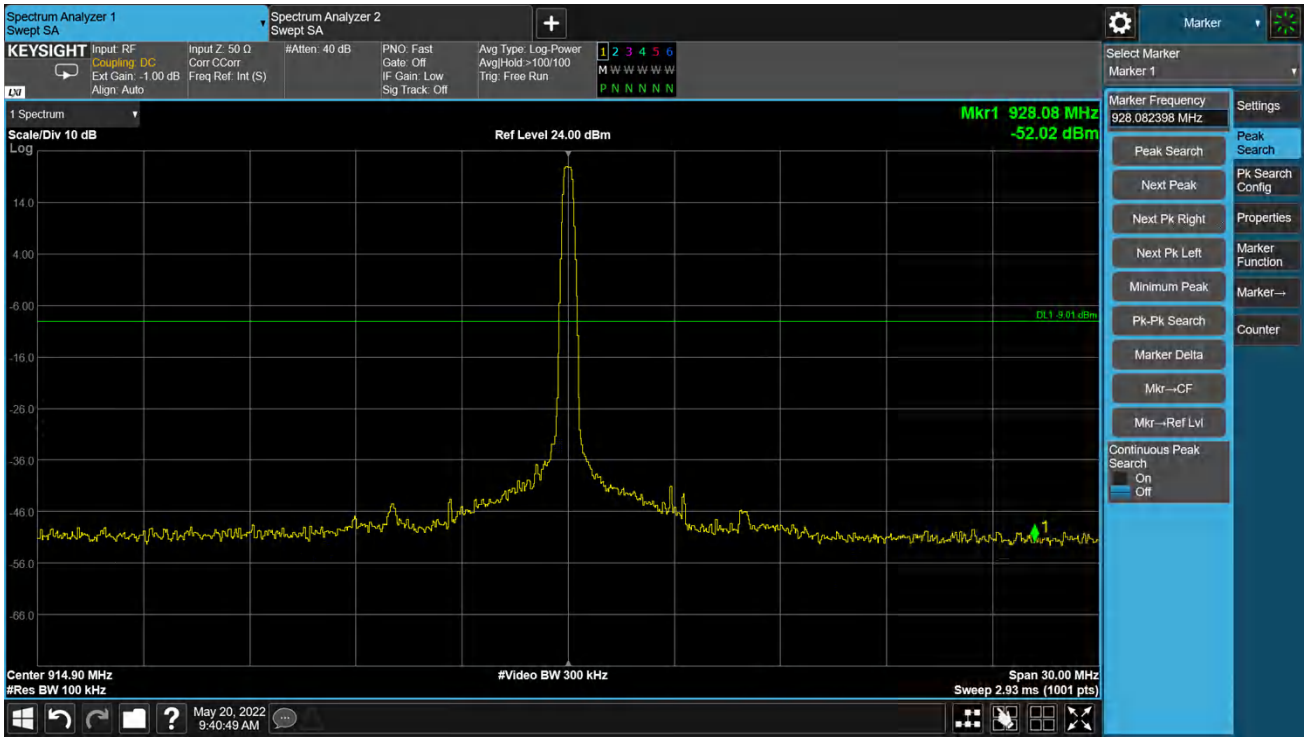




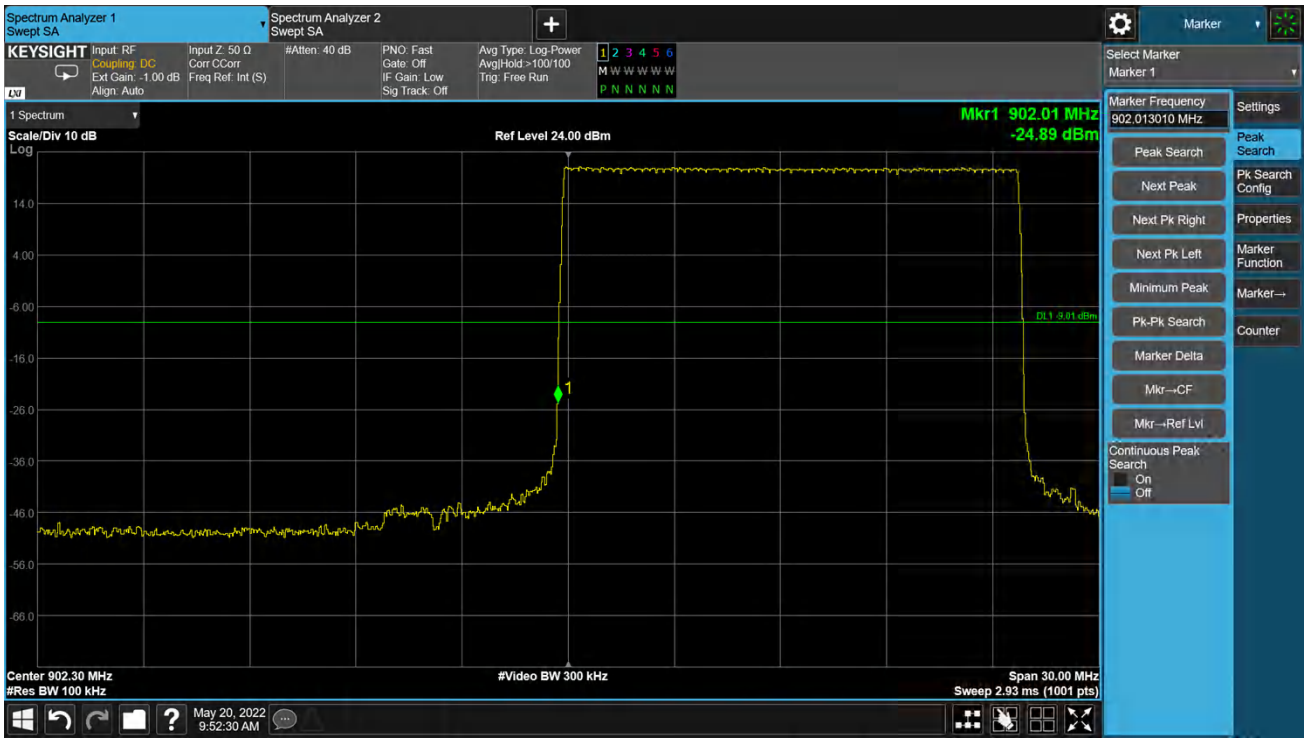
Lora FHSS SF10, No hopping, Band Edge
Low Channel

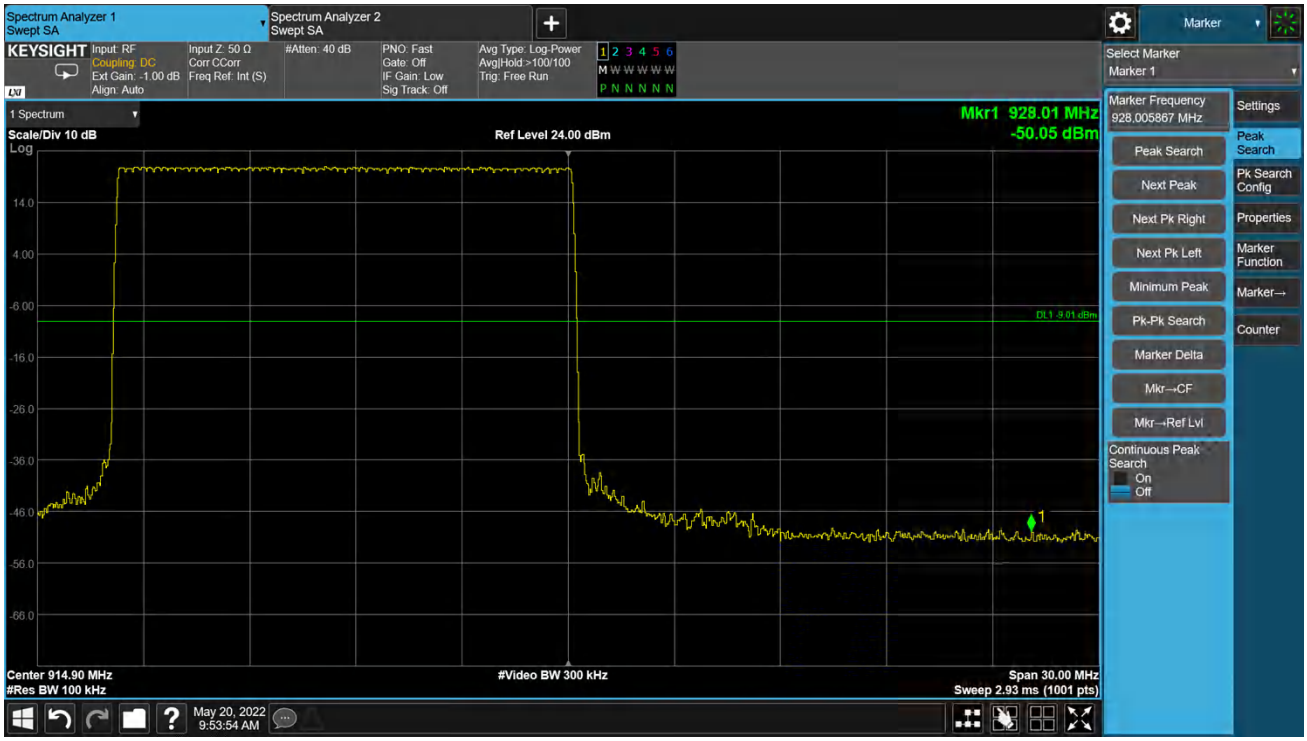


High Channel



Lora FHSS SF10, hopping, Band Edge

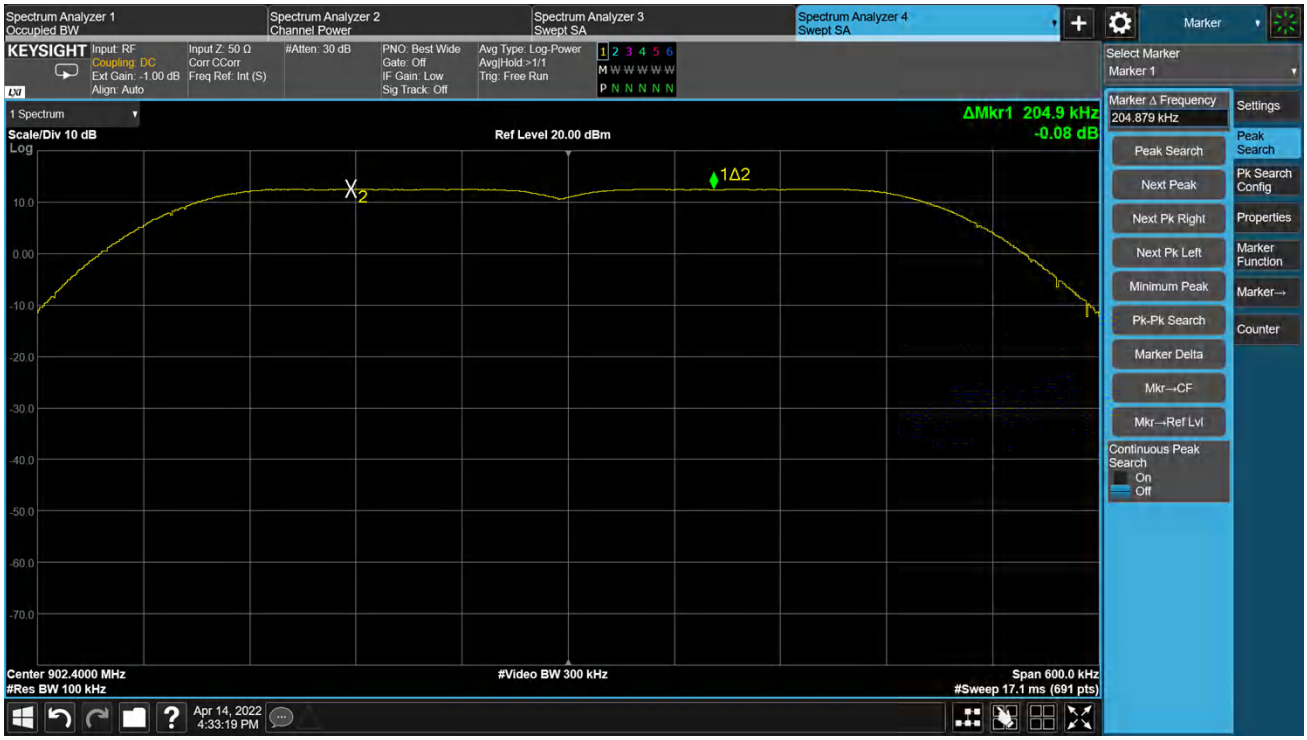




Appendix B.6: Carrier Frequency Separation

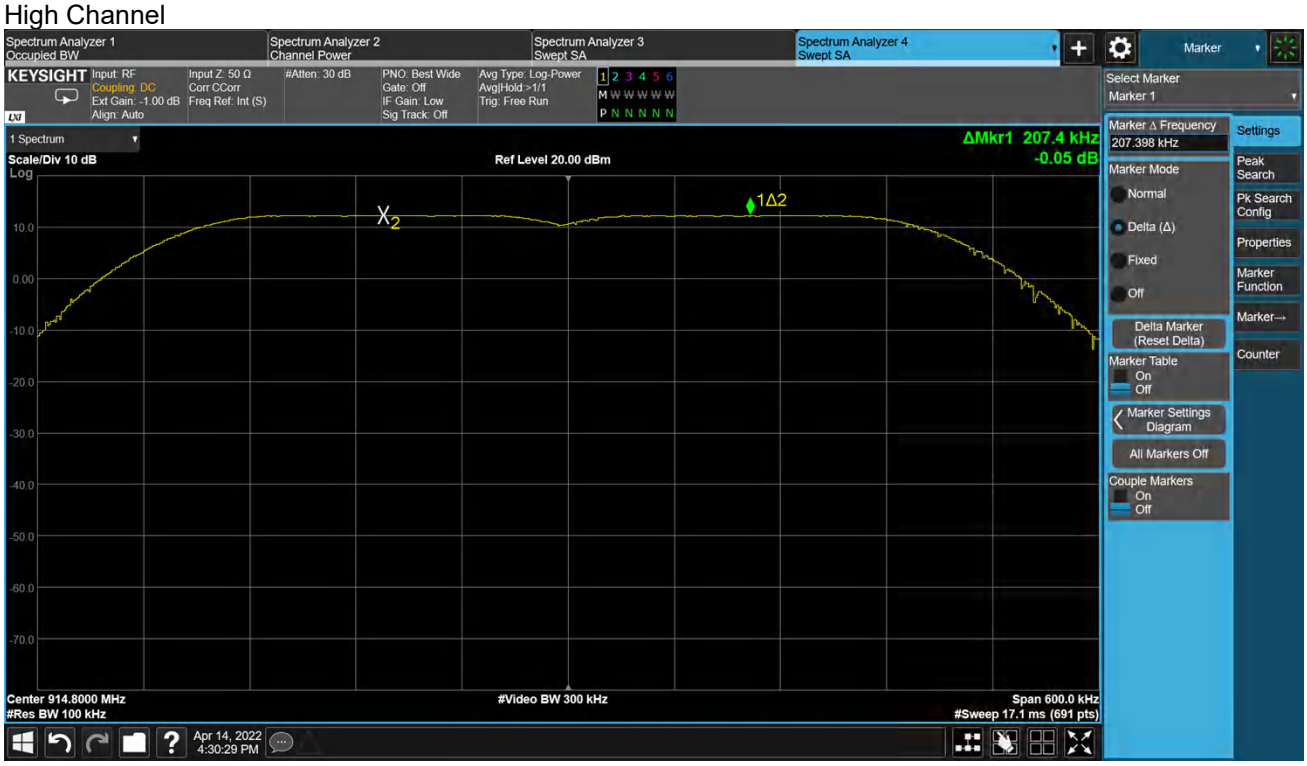
Lora FHSS, SF7

Low Channel



Middle Channel

High Channel



Lora FHSS, SF10

Low Channel

Middle Channel

High Channel

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.

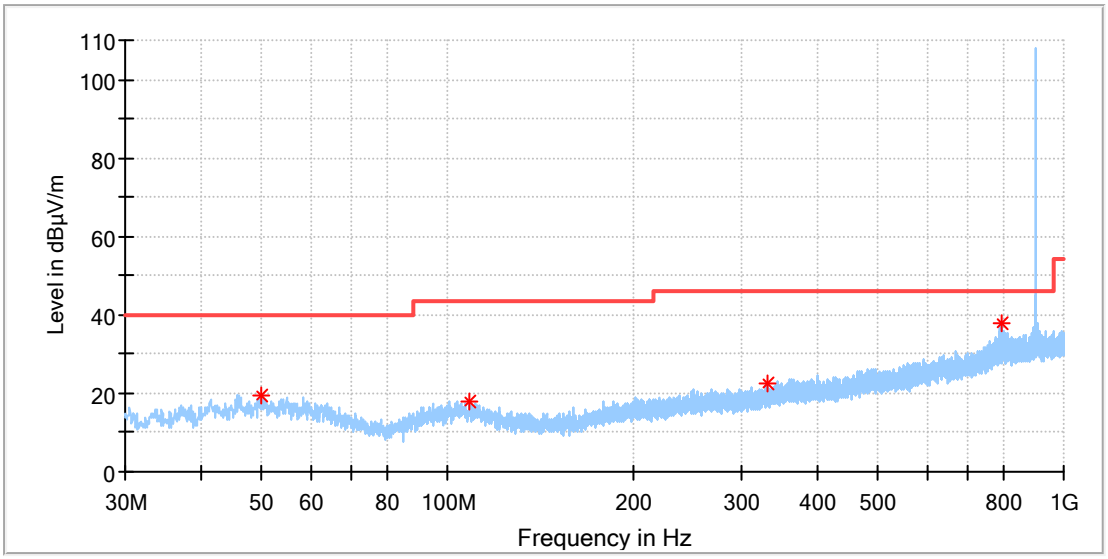
Appendix B.7: Test Results of Radiated Spurious Emissions

Lora FHSS SF7

30MHz - 1GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_902.3MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

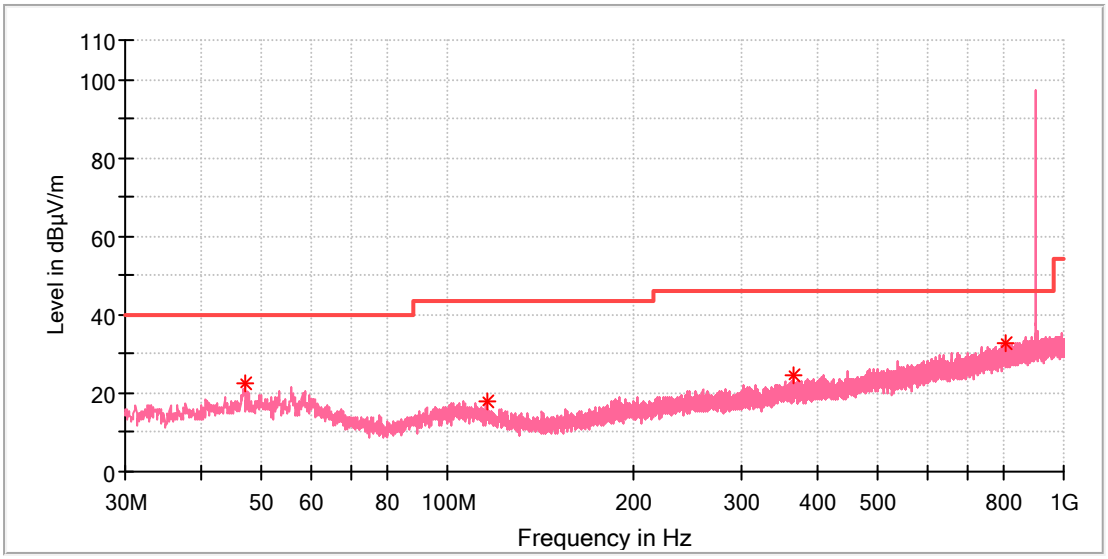


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
50.030500	19.65	40.00	20.35	100.0	H	117.0	-18.3
108.473000	17.93	43.50	25.57	100.0	H	110.0	-19.0
331.621500	22.54	46.00	23.46	100.0	H	42.0	-15.4
790.383000	38.04	46.00	7.96	100.0	H	103.0	-6.5

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_902.3MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

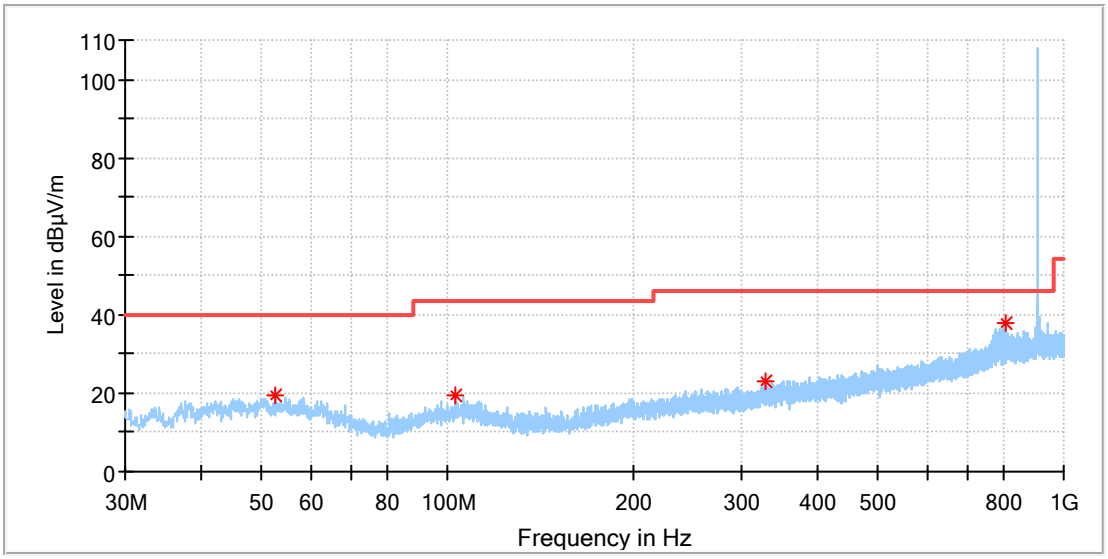


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
46.878000	22.34	40.00	17.66	100.0	V	167.0	-18.5
115.699500	18.04	43.50	25.46	100.0	V	154.0	-19.9
365.135000	24.39	46.00	21.61	100.0	V	84.0	-14.5
806.242500	32.80	46.00	13.20	100.0	V	307.0	-6.3

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_908.5MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

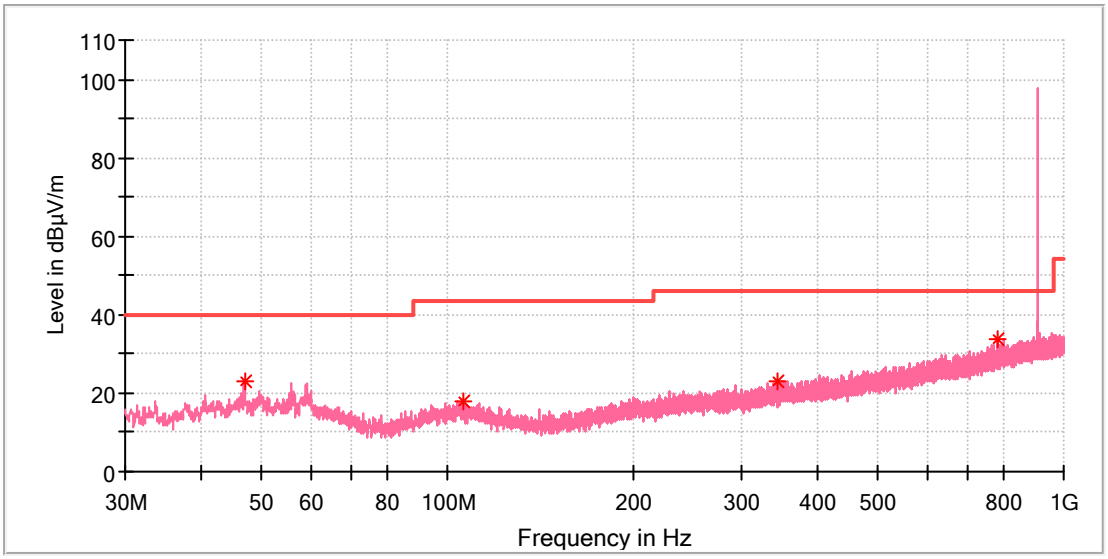


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
52.601000	19.24	40.00	20.76	100.0	H	252.0	-18.4
103.138000	19.45	43.50	24.05	100.0	H	30.0	-18.8
328.178000	22.77	46.00	23.23	100.0	H	355.0	-15.5
803.817500	38.11	46.00	7.89	100.0	H	58.0	-6.3

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_908.5MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

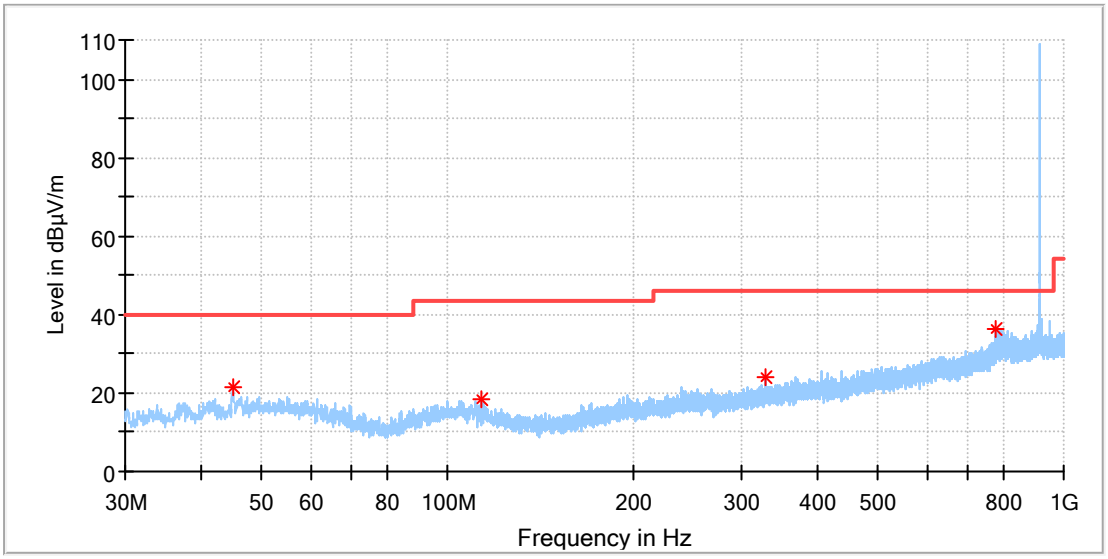


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
46.829500	23.21	40.00	16.79	100.0	V	152.0	-18.5
105.902500	17.70	43.50	25.80	100.0	V	286.0	-18.8
344.037500	22.99	46.00	23.01	100.0	V	213.0	-14.8
780.149500	33.97	46.00	12.03	100.0	V	220.0	-6.7

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_914.9MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

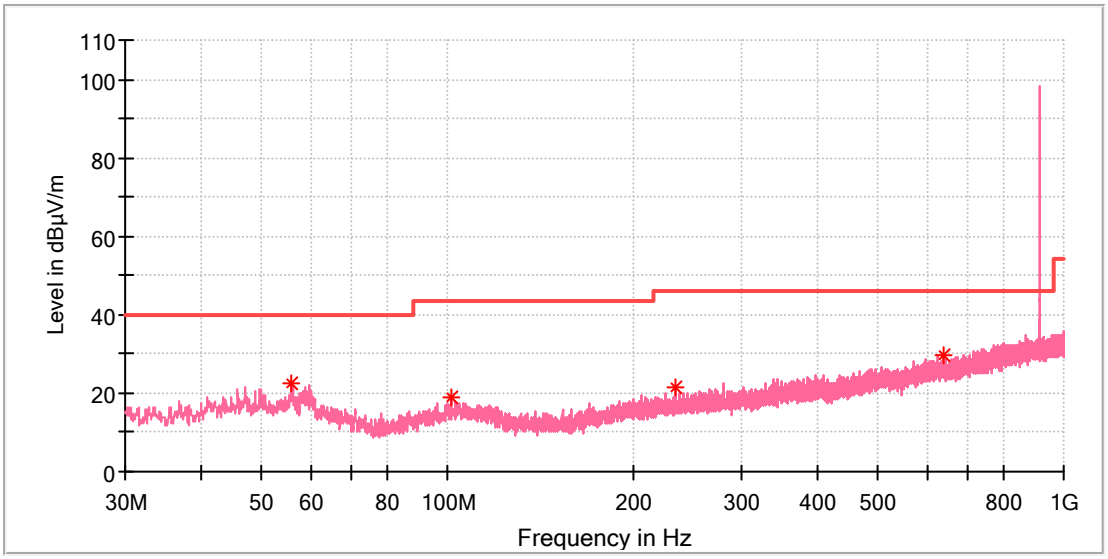


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
44.841000	21.61	40.00	18.39	100.0	H	291.0	-18.9
113.274500	18.52	43.50	24.98	100.0	H	220.0	-19.5
327.111000	24.29	46.00	21.71	100.0	H	183.0	-15.6
777.385000	36.45	46.00	9.55	100.0	H	94.0	-6.7

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_914.9MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



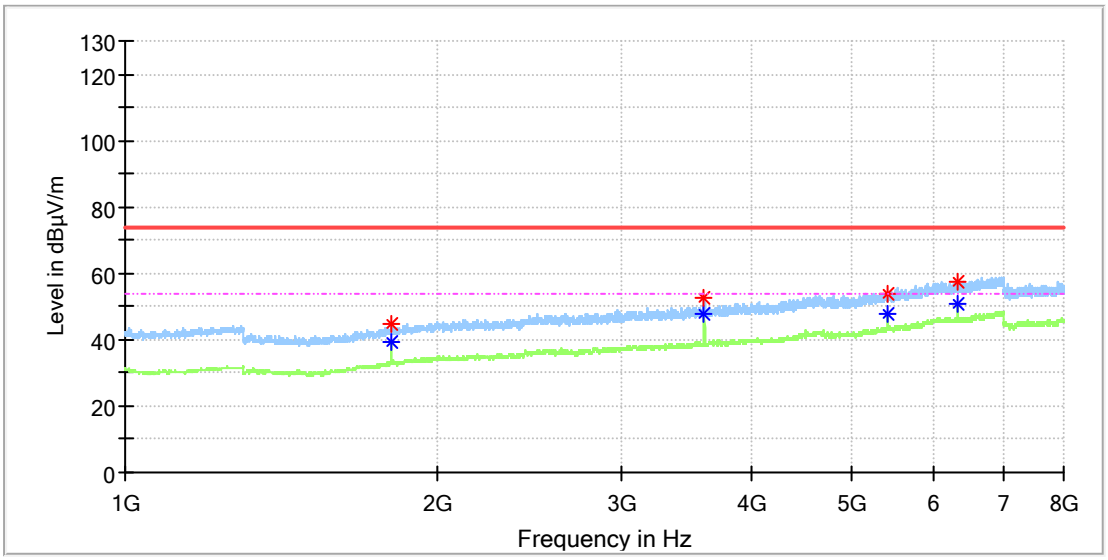
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
55.850500	22.36	40.00	17.64	100.0	V	130.0	-18.5
101.440500	18.68	43.50	24.82	100.0	V	33.0	-18.9
234.961000	21.71	46.00	24.29	100.0	V	164.0	-17.9
640.857500	29.73	46.00	16.27	100.0	V	99.0	-9.3

1GHz - 8GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_902.3MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

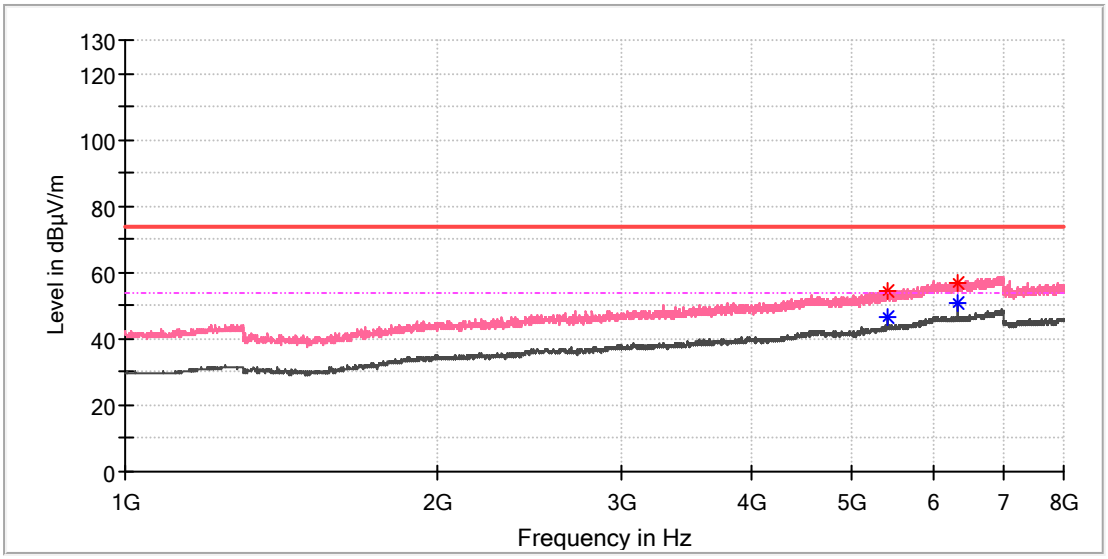


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1804.175000	44.65	---	74.00	29.35	100.0	H	64.0	4.7
1804.175000	---	39.55	54.00	14.45	100.0	H	64.0	4.7
3608.987500	52.37	---	74.00	21.63	100.0	H	353.0	9.4
3608.987500	---	47.61	54.00	6.39	100.0	H	353.0	9.4
5411.287500	53.98	---	74.00	20.02	100.0	H	288.0	13.5
5413.800000	---	47.85	54.00	6.15	100.0	H	335.0	13.5
6316.625000	---	50.59	54.00	3.41	100.0	H	198.0	15.9
6317.462500	57.20	---	74.00	16.80	100.0	H	359.0	15.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_902.3MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

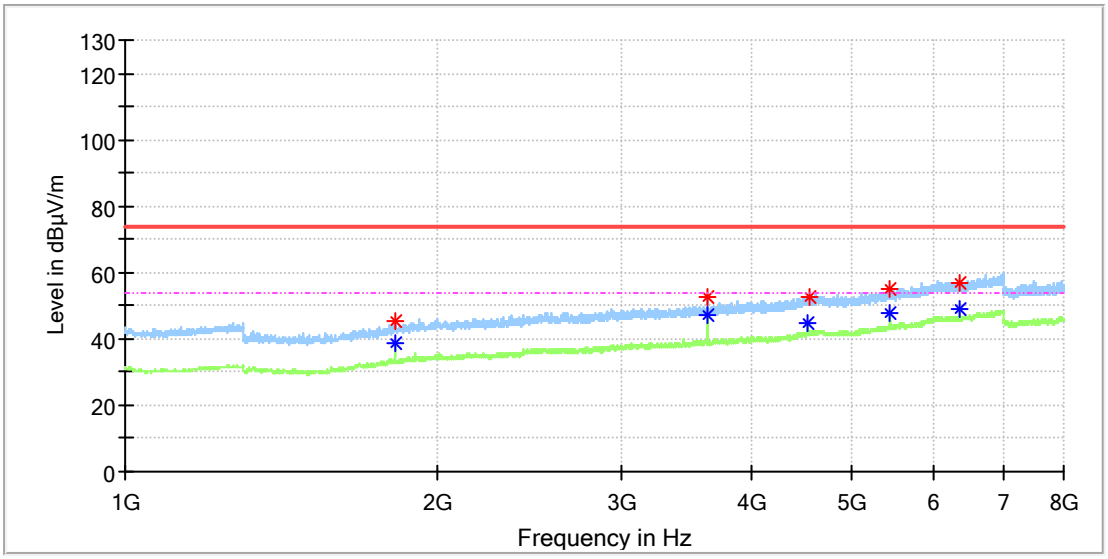


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5413.800000	---	46.53	54.00	7.47	100.0	V	157.0	13.5
5422.175000	54.29	---	74.00	19.71	100.0	V	331.0	13.5
6312.437500	56.84	---	74.00	17.16	100.0	V	322.0	15.9
6315.787500	---	50.50	54.00	3.50	100.0	V	340.0	15.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_908.5MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

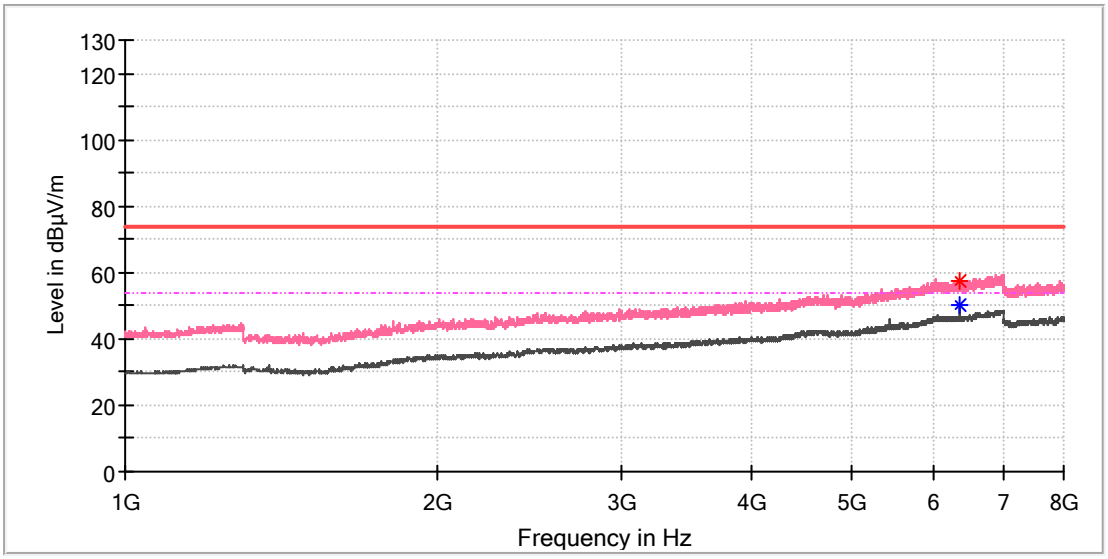


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1816.737500	45.23	---	74.00	28.77	100.0	H	112.0	4.8
1816.737500	---	38.65	54.00	15.35	100.0	H	112.0	4.8
3634.112500	52.47	---	74.00	21.53	100.0	H	357.0	9.4
3634.112500	---	47.22	54.00	6.78	100.0	H	357.0	9.4
4542.800000	---	44.74	54.00	9.26	100.0	H	357.0	11.9
4556.200000	52.44	---	74.00	21.56	100.0	H	315.0	11.9
5450.650000	55.01	---	74.00	18.99	100.0	H	281.0	13.5
5451.487500	---	48.04	54.00	5.96	100.0	H	298.0	13.5
6350.125000	56.96	---	74.00	17.04	100.0	H	273.0	15.9
6359.337500	---	48.69	54.00	5.31	100.0	H	131.0	15.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_908.5MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

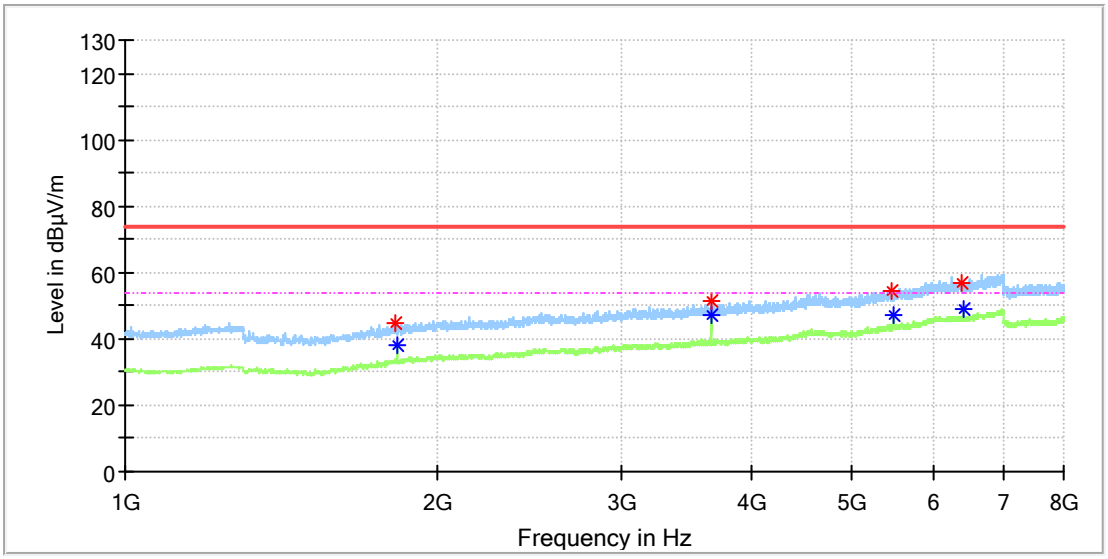


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
6359.337500	57.66	---	74.00	16.34	100.0	V	355.0	15.9
6359.337500	---	50.07	54.00	3.93	100.0	V	355.0	15.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_914.9MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

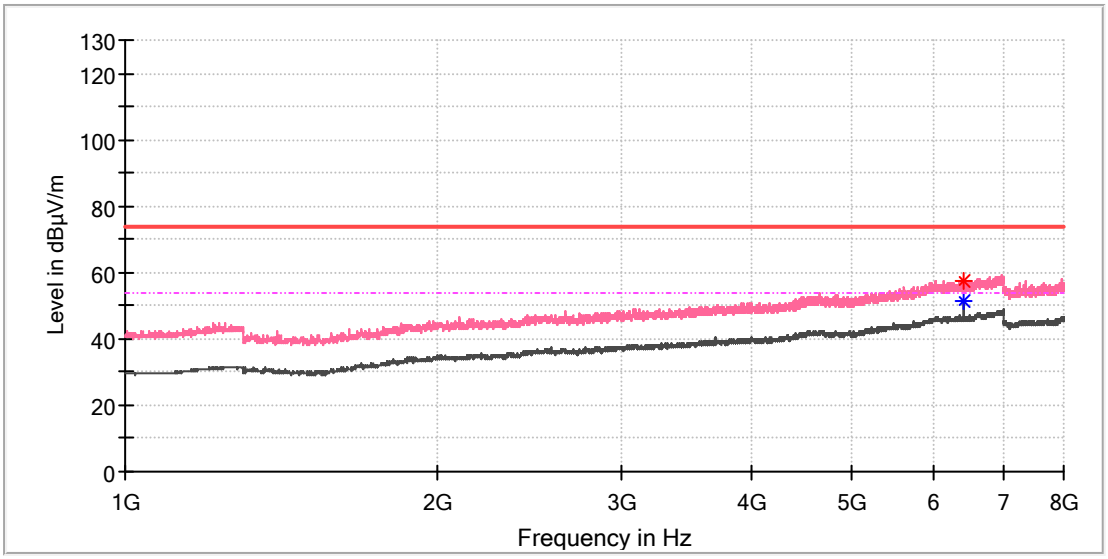


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1819.250000	44.66	---	74.00	29.34	100.0	H	257.0	4.8
1829.300000	---	37.97	54.00	16.03	100.0	H	94.0	4.9
3659.237500	51.15	---	74.00	22.85	100.0	H	4.0	9.4
3659.237500	---	47.20	54.00	6.80	100.0	H	4.0	9.4
5453.162500	54.43	---	74.00	19.57	100.0	H	138.0	13.5
5489.175000	---	47.31	54.00	6.69	100.0	H	301.0	13.7
6378.600000	56.78	---	74.00	17.22	100.0	H	265.0	16.0
6404.562500	---	49.04	54.00	4.96	100.0	H	224.0	16.1

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_914.9MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



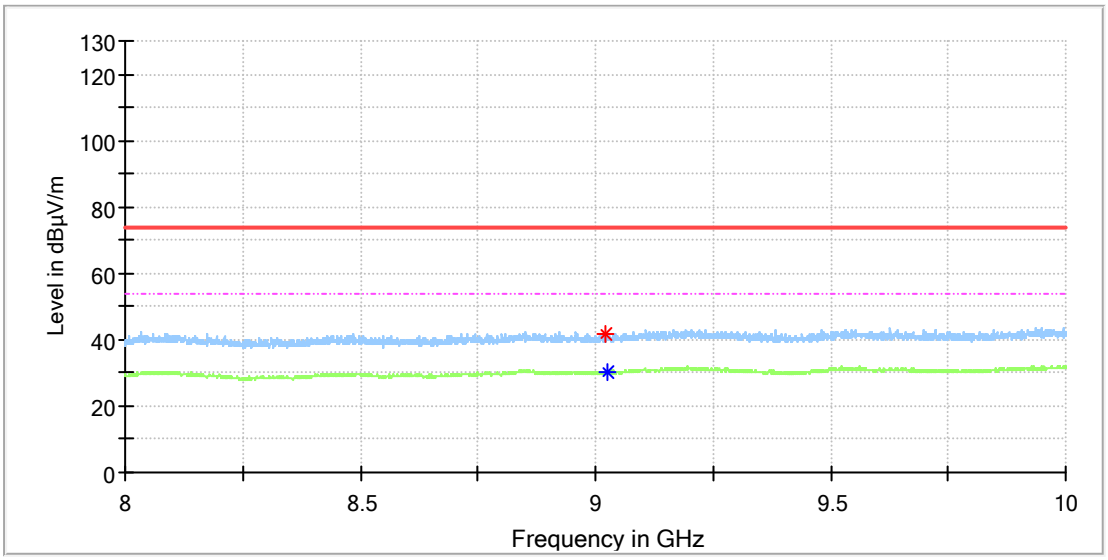
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
6403.725000	57.37	---	74.00	16.63	100.0	V	293.0	16.1
6404.562500	---	50.95	54.00	3.05	100.0	V	351.0	16.1

8GHz - 10GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_902.3MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

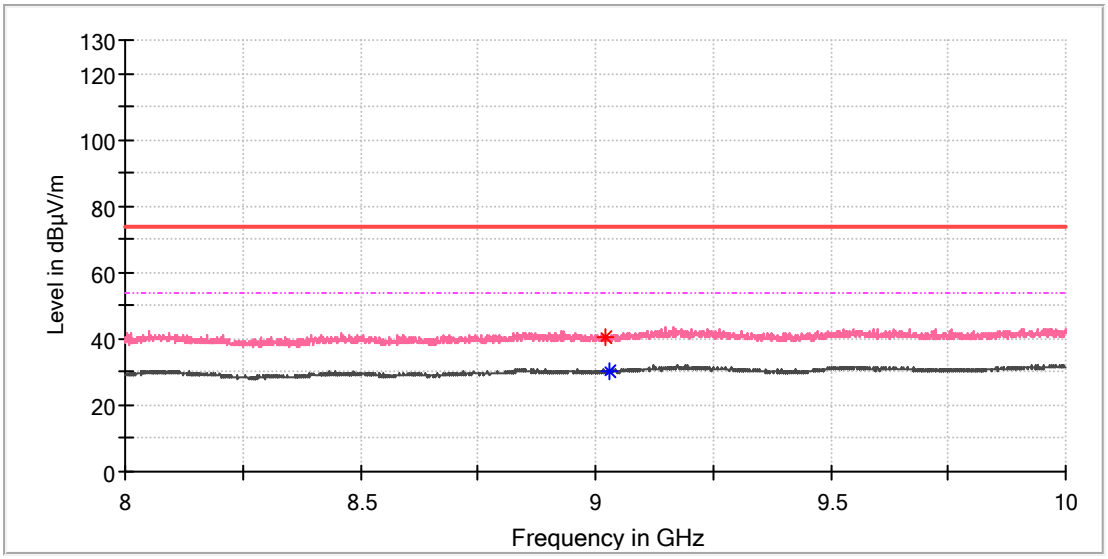


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9021.500000	41.50	---	74.00	32.50	100.0	H	325.0	8.9
9025.500000	---	30.43	54.00	23.57	100.0	H	300.0	8.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_902.3MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

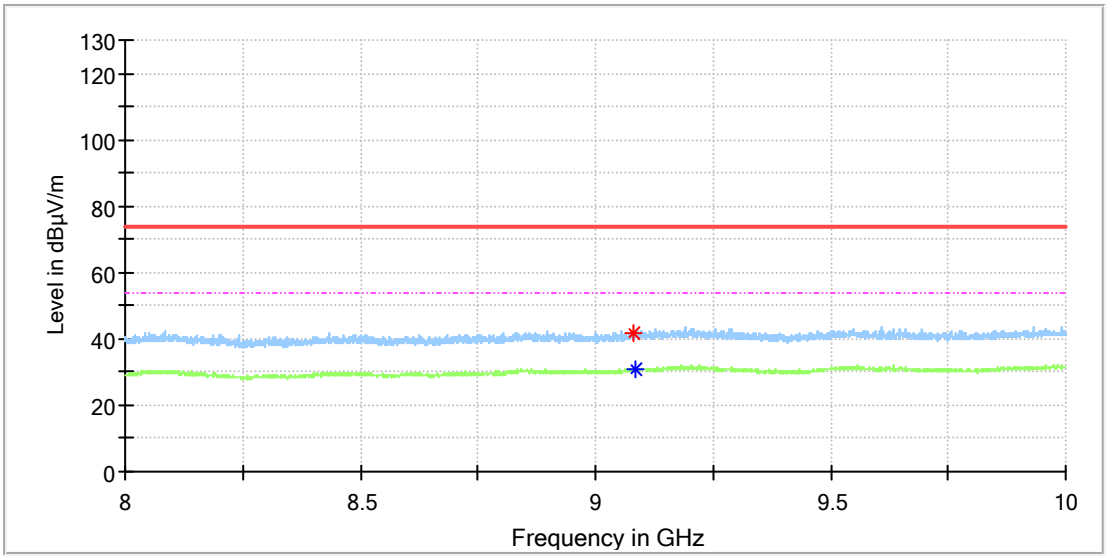


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9022.500000	40.54	---	74.00	33.46	100.0	V	245.0	8.9
9029.500000	---	30.41	54.00	23.59	100.0	V	0.0	8.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_908.5MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

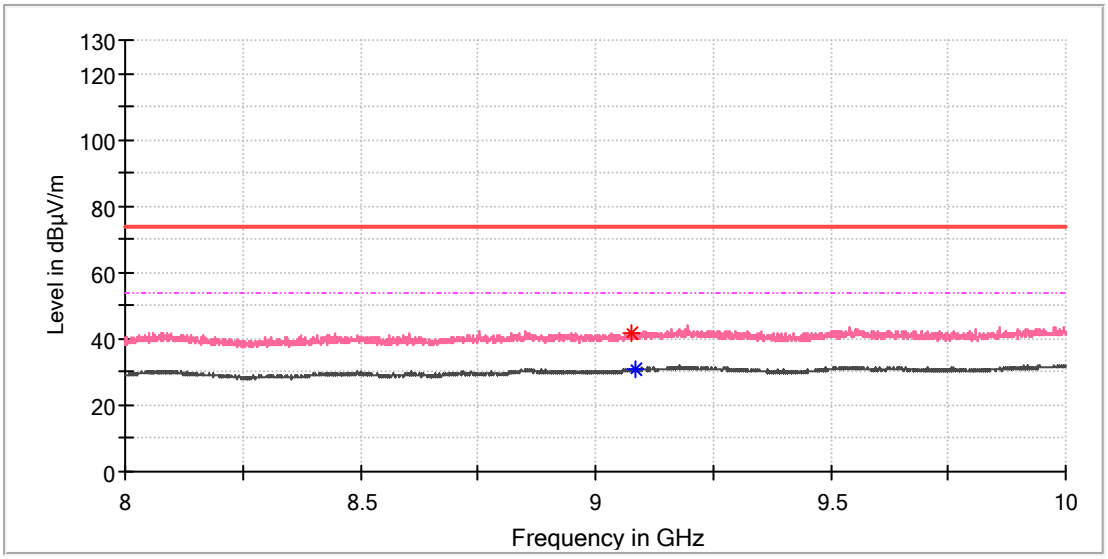


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9082.000000	41.94	---	74.00	32.06	100.0	H	261.0	9.5
9084.500000	---	31.02	54.00	22.98	100.0	H	149.0	9.5

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_908.5MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

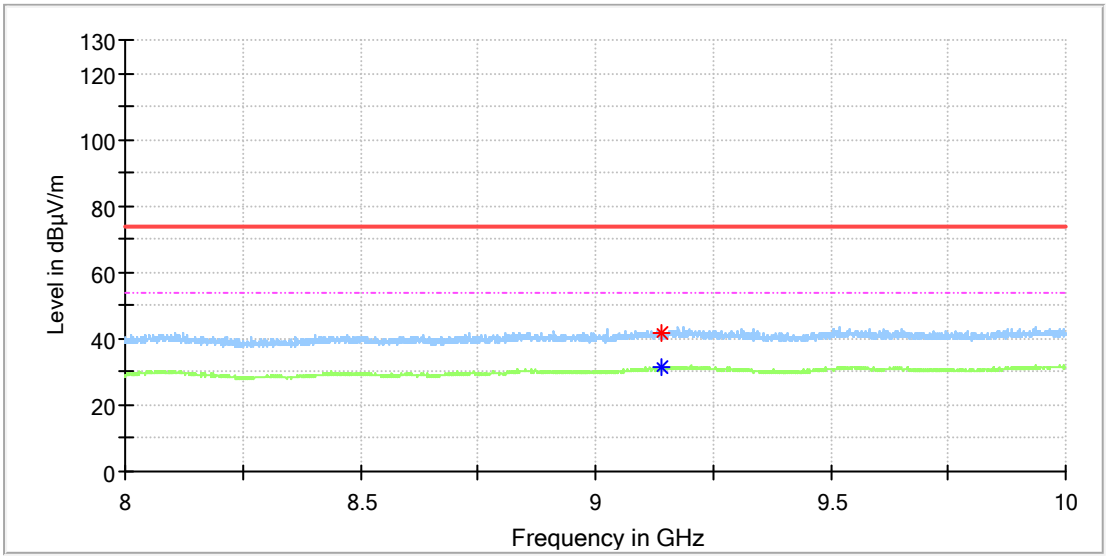


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9078.500000	42.01	---	74.00	31.99	100.0	V	341.0	9.4
9084.500000	---	30.73	54.00	23.27	100.0	V	299.0	9.5

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_914.9MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

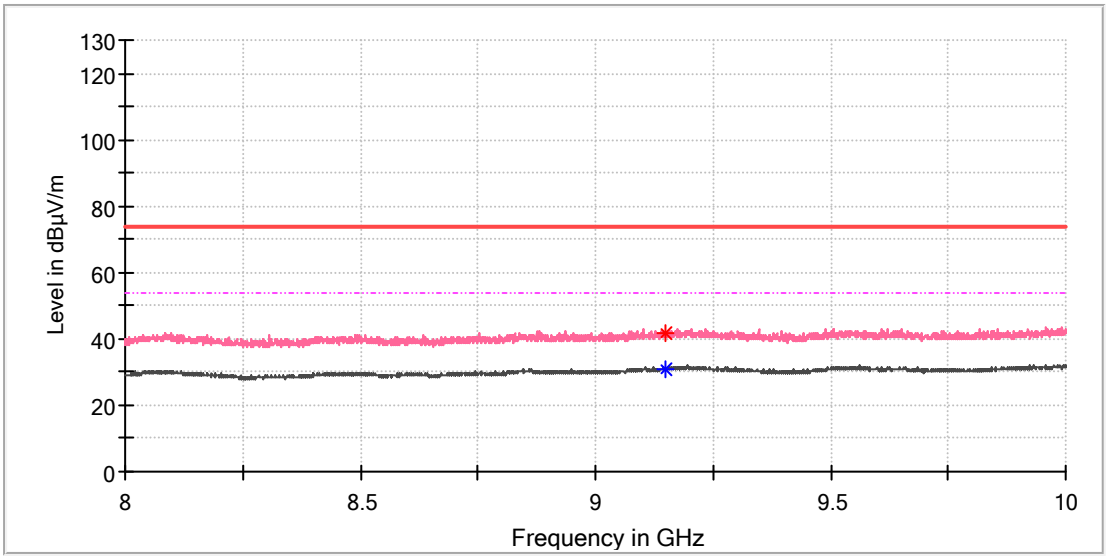


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9140.500000	---	31.18	54.00	22.82	100.0	H	212.0	10.0
9142.000000	41.98	---	74.00	32.02	100.0	H	232.0	10.0

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	FHSS 125k_SF7_914.9MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical_Freqs

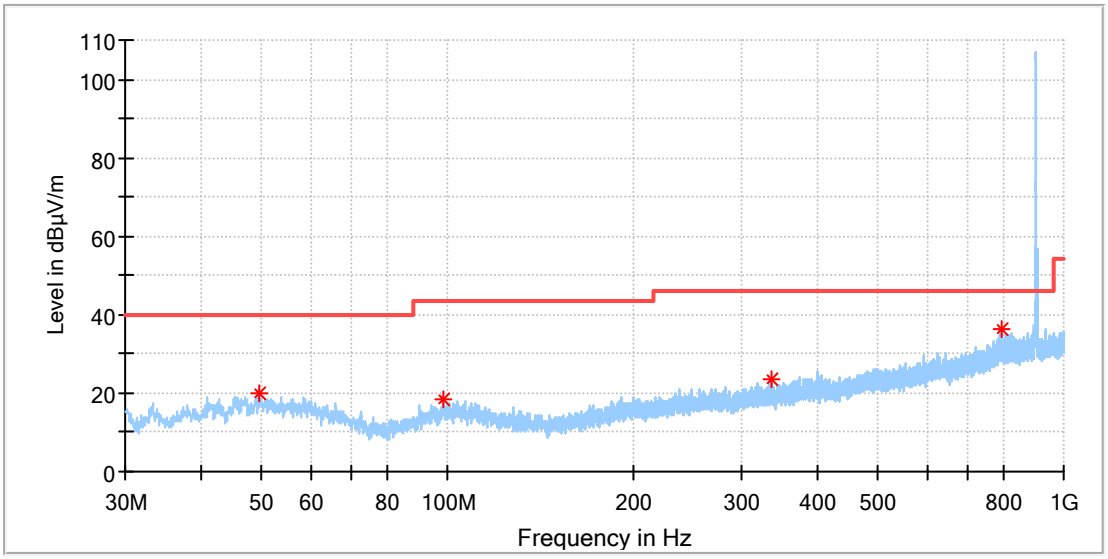
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9150.000000	41.74	---	74.00	32.26	100.0	V	74.0	10.1
9150.500000	---	30.97	54.00	23.03	100.0	V	0.0	10.1

Lora DTS

30MHz - 1GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_903MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

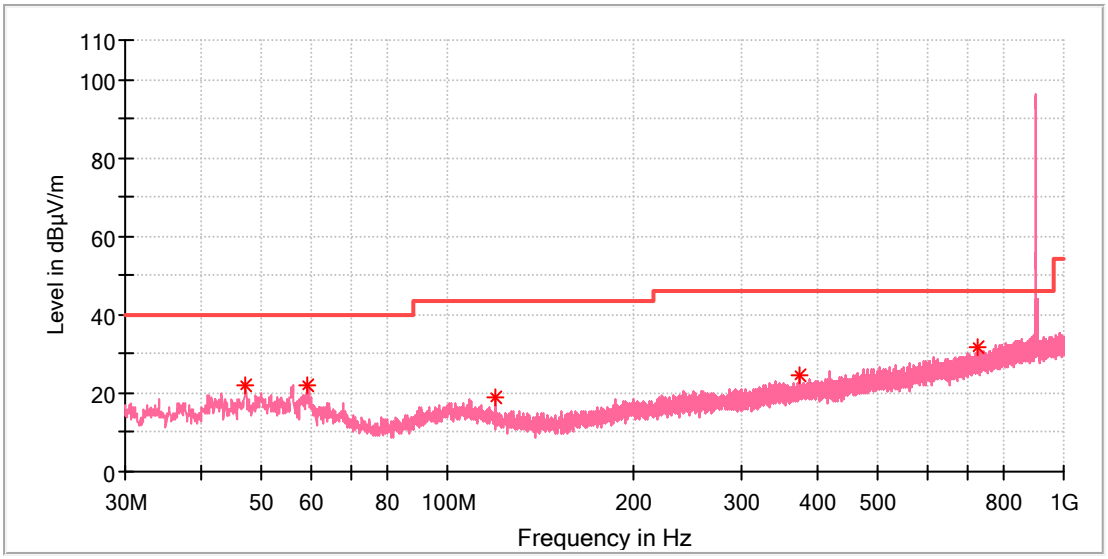


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
49.545500	20.19	40.00	19.81	100.0	H	70.0	-18.3
98.676000	18.55	43.50	24.95	100.0	H	327.0	-19.2
335.356000	23.46	46.00	22.54	100.0	H	78.0	-15.2
791.886500	36.31	46.00	9.69	100.0	H	63.0	-6.5

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_903MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

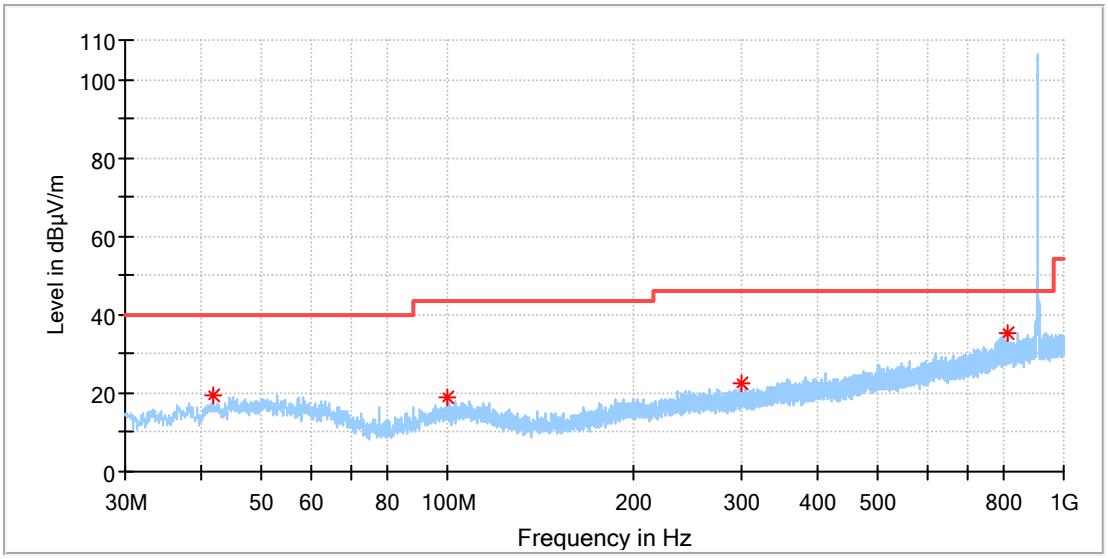


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
47.072000	22.16	40.00	17.84	100.0	V	124.0	-18.5
59.100000	21.92	40.00	18.08	100.0	V	313.0	-18.9
119.870500	18.81	43.50	24.69	100.0	V	278.0	-20.8
372.264500	24.73	46.00	21.27	100.0	V	182.0	-14.4
723.016500	31.68	46.00	14.32	100.0	V	355.0	-7.6

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_907.8MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

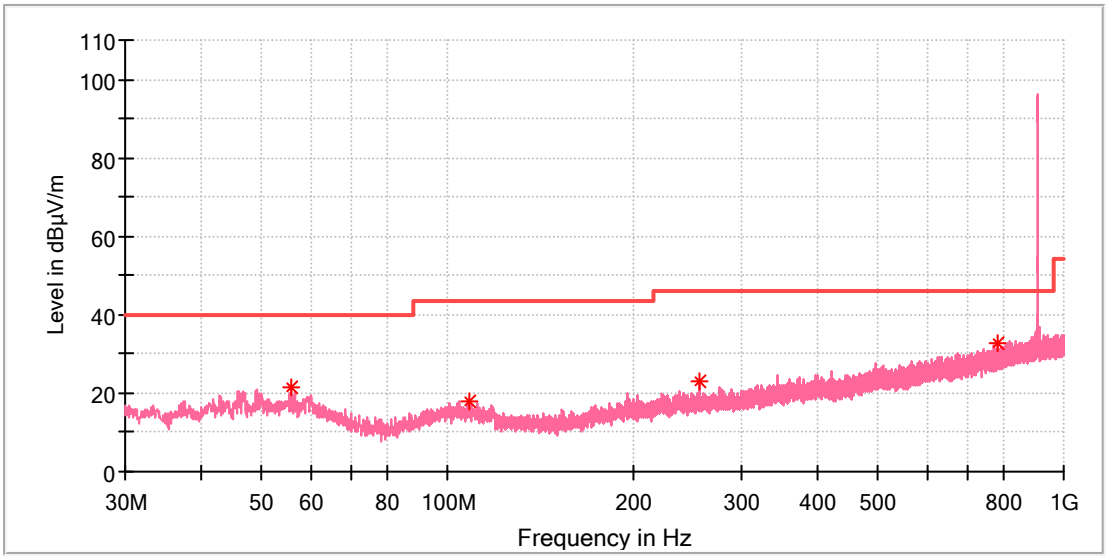


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
41.785500	19.46	40.00	20.54	100.0	H	233.0	-19.6
100.325000	18.69	43.50	24.81	100.0	H	346.0	-19.0
300.387500	22.34	46.00	23.66	100.0	H	22.0	-16.3
808.522000	35.08	46.00	10.92	100.0	H	90.0	-6.2

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_907.8MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

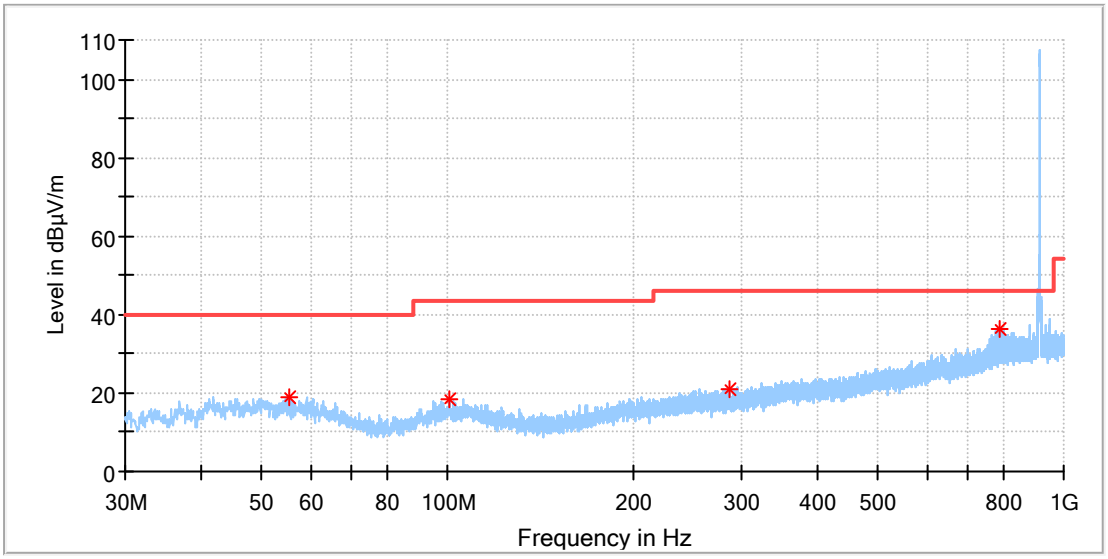


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
55.753500	21.37	40.00	18.63	100.0	V	236.0	-18.5
108.715500	17.82	43.50	25.68	100.0	V	250.0	-19.0
256.349500	22.90	46.00	23.10	100.0	V	267.0	-17.1
782.332000	32.60	46.00	13.40	100.0	V	211.0	-6.6

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_914.2MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

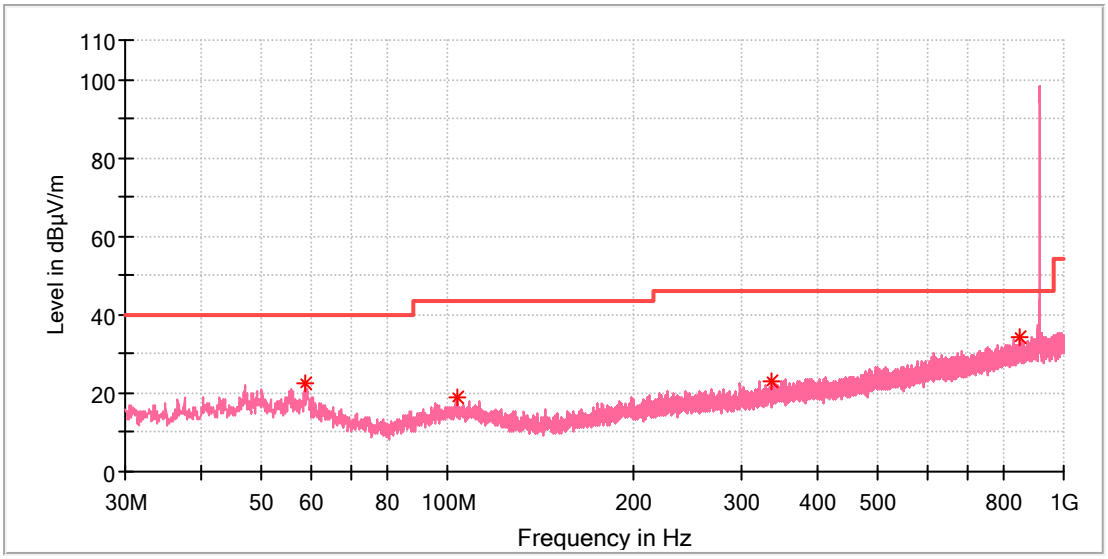


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
55.414000	19.13	40.00	20.87	100.0	H	358.0	-18.5
100.519000	18.49	43.50	25.01	100.0	H	138.0	-19.0
287.438000	21.10	46.00	24.90	100.0	H	111.0	-16.6
784.369000	36.20	46.00	9.80	100.0	H	278.0	-6.6

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_914.2MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



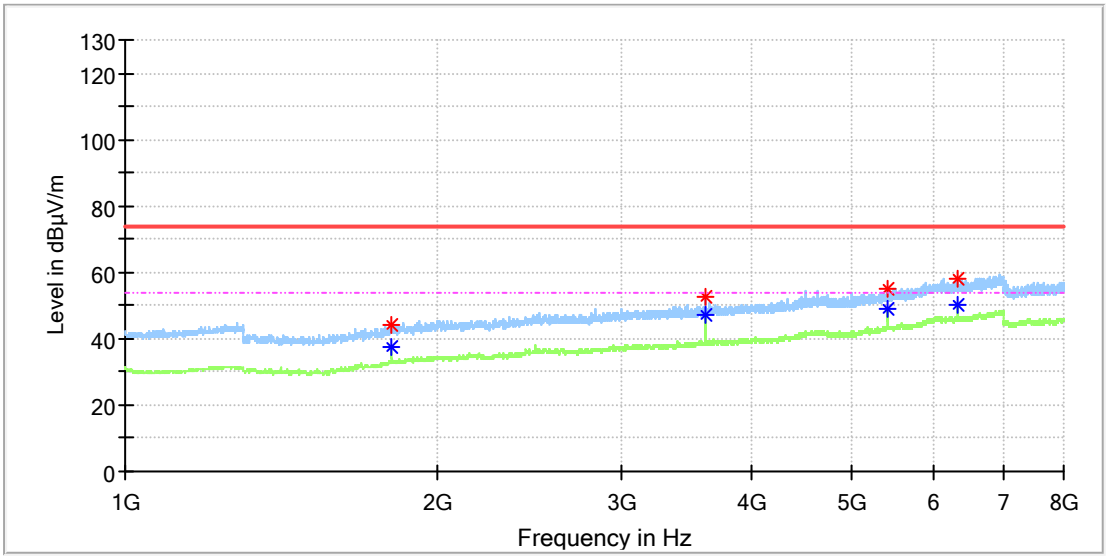
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
58.663500	22.29	40.00	17.71	100.0	V	215.0	-18.8
103.720000	18.75	43.50	24.75	100.0	V	67.0	-18.8
335.889500	23.12	46.00	22.88	100.0	V	61.0	-15.2
848.146500	34.31	46.00	11.69	100.0	V	143.0	-5.5

1GHz - 8GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_903MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

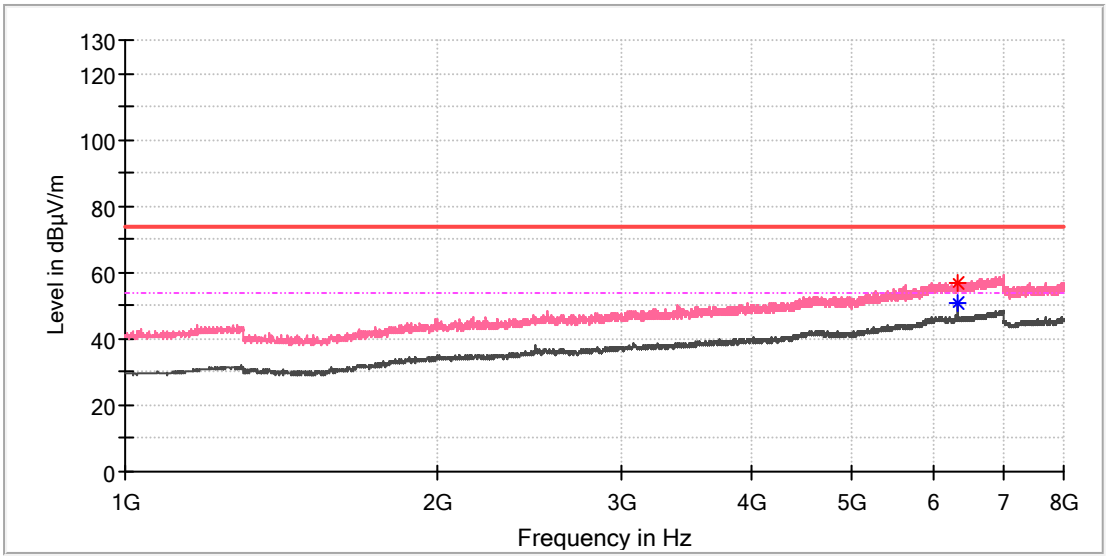


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1805.850000	44.40	---	74.00	29.60	100.0	H	8.0	4.8
1805.850000	---	37.45	54.00	16.55	100.0	H	8.0	4.8
3611.500000	52.61	---	74.00	21.39	100.0	H	282.0	9.4
3611.500000	---	47.39	54.00	6.61	100.0	H	282.0	9.4
5417.150000	55.00	---	74.00	19.00	100.0	H	203.0	13.5
5417.150000	---	49.07	54.00	4.93	100.0	H	203.0	13.5
6320.812500	58.19	---	74.00	15.81	100.0	H	212.0	15.9
6321.650000	---	50.03	54.00	3.97	100.0	H	71.0	15.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_903MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

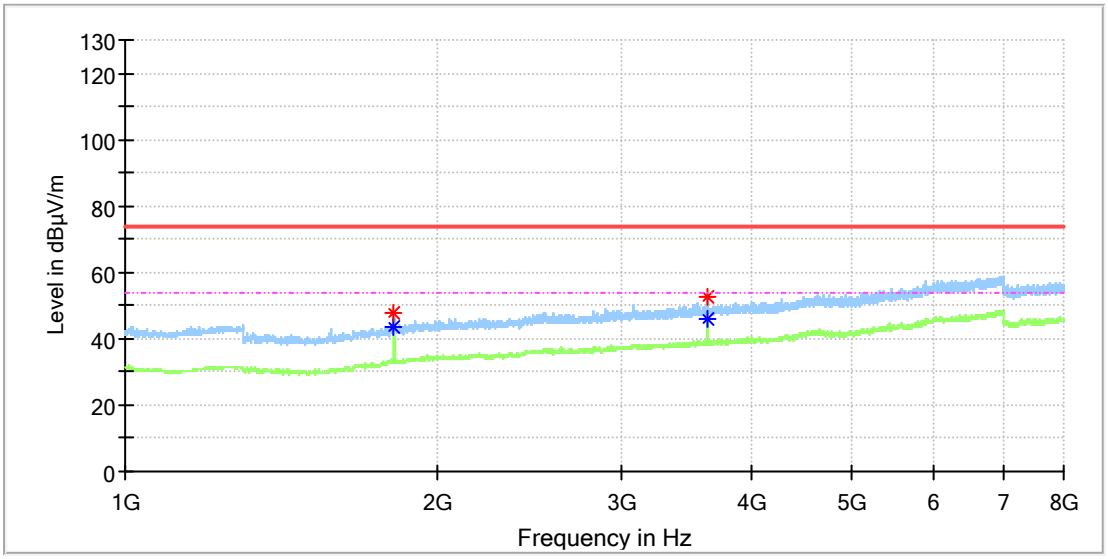


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
6319.975000	---	50.88	54.00	3.12	100.0	V	261.0	15.9
6320.812500	56.91	---	74.00	17.09	100.0	V	279.0	15.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_907.8MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

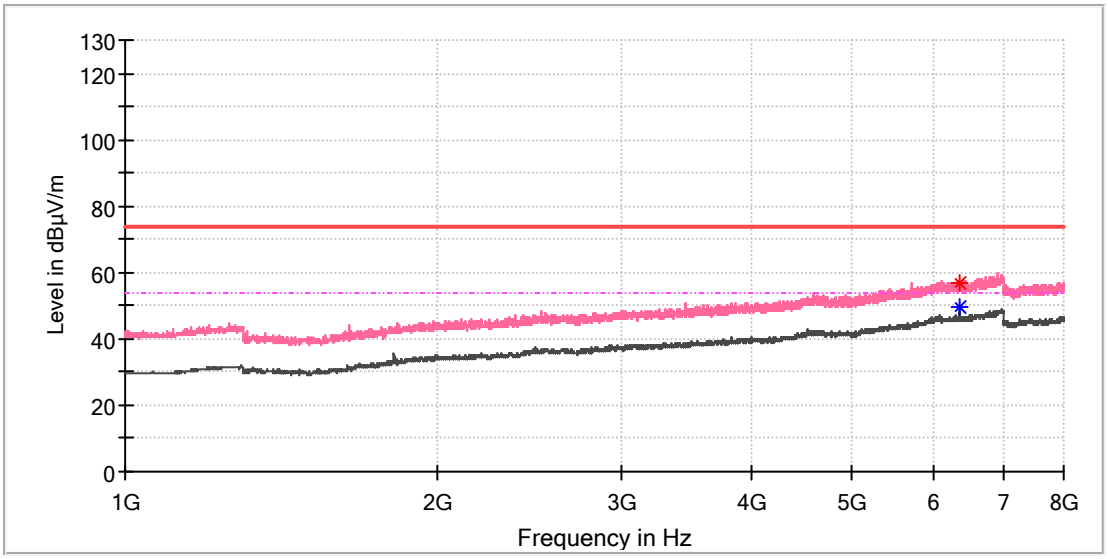


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1815.062500	47.48	---	74.00	26.52	100.0	H	106.0	4.8
1815.062500	---	43.73	54.00	10.27	100.0	H	106.0	4.8
3631.600000	---	45.97	54.00	8.03	100.0	H	355.0	9.4
3631.600000	52.31	---	74.00	21.69	100.0	H	355.0	9.4

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_907.8MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

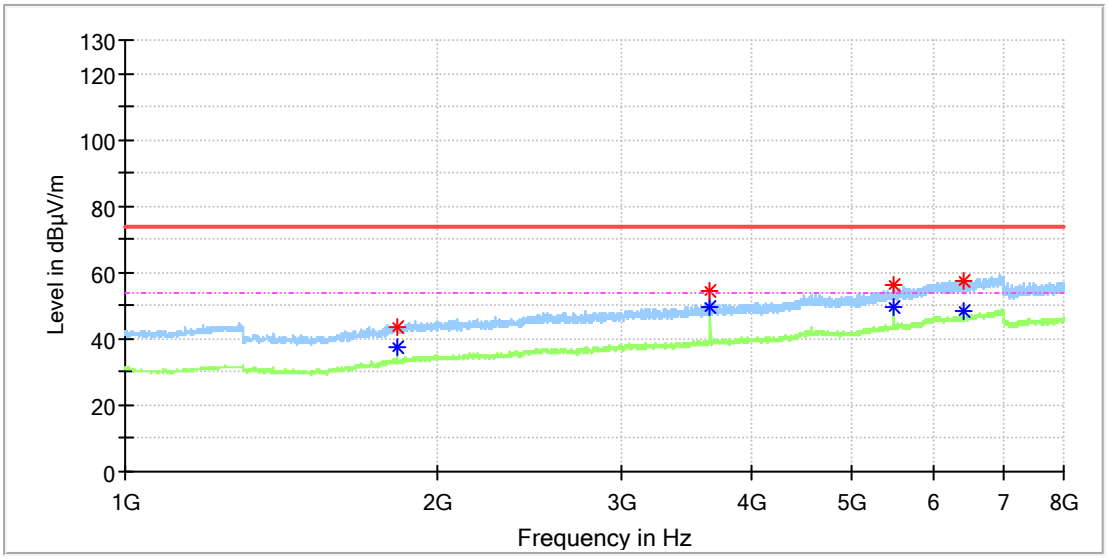


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
6353.475000	---	49.59	54.00	4.41	100.0	V	267.0	15.9
6354.312500	56.57	---	74.00	17.43	100.0	V	166.0	15.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_914.2MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

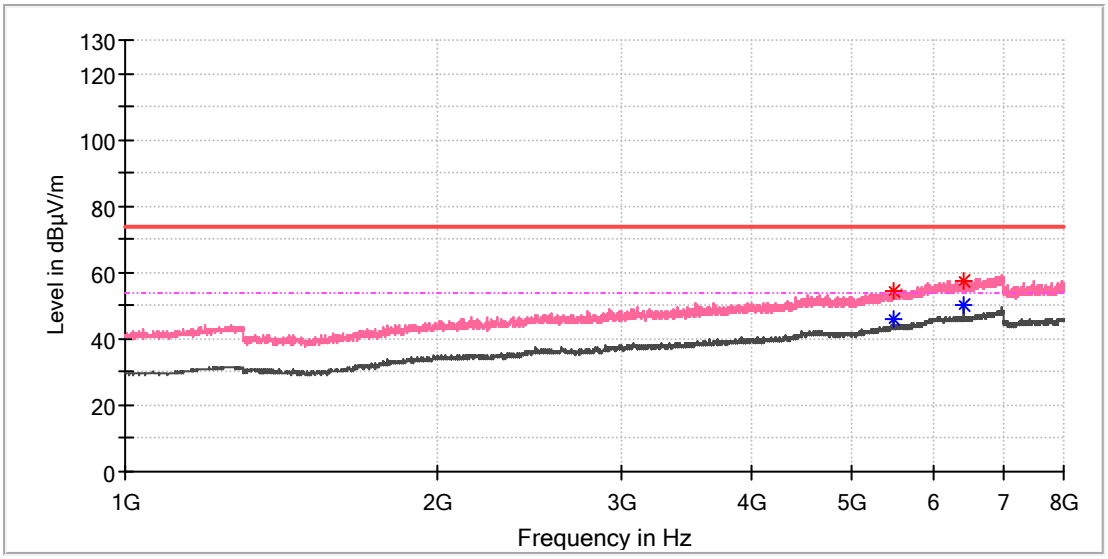


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1827.625000	43.54	---	74.00	30.46	100.0	H	32.0	4.9
1827.625000	---	37.20	54.00	16.80	100.0	H	32.0	4.9
3656.725000	54.20	---	74.00	19.80	100.0	H	287.0	9.4
3656.725000	---	49.29	54.00	4.71	100.0	H	287.0	9.4
5484.150000	56.17	---	74.00	17.83	100.0	H	196.0	13.7
5486.662500	---	49.41	54.00	4.59	100.0	H	215.0	13.7
6398.700000	57.41	---	74.00	16.59	100.0	H	205.0	16.1
6398.700000	---	48.64	54.00	5.36	100.0	H	205.0	16.1

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_914.2MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



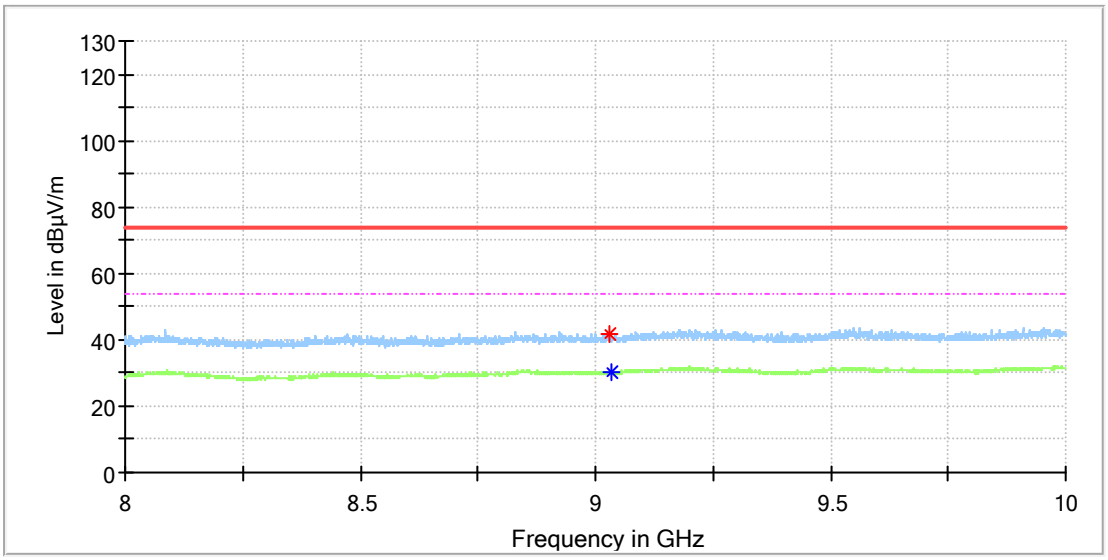
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5484.987500	54.45	---	74.00	19.55	100.0	V	74.0	13.7
5484.987500	---	45.88	54.00	8.12	100.0	V	74.0	13.7
6400.375000	---	50.30	54.00	3.70	100.0	V	189.0	16.1
6422.150000	57.15	---	74.00	16.85	100.0	V	110.0	16.1

8GHz - 10GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_903MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

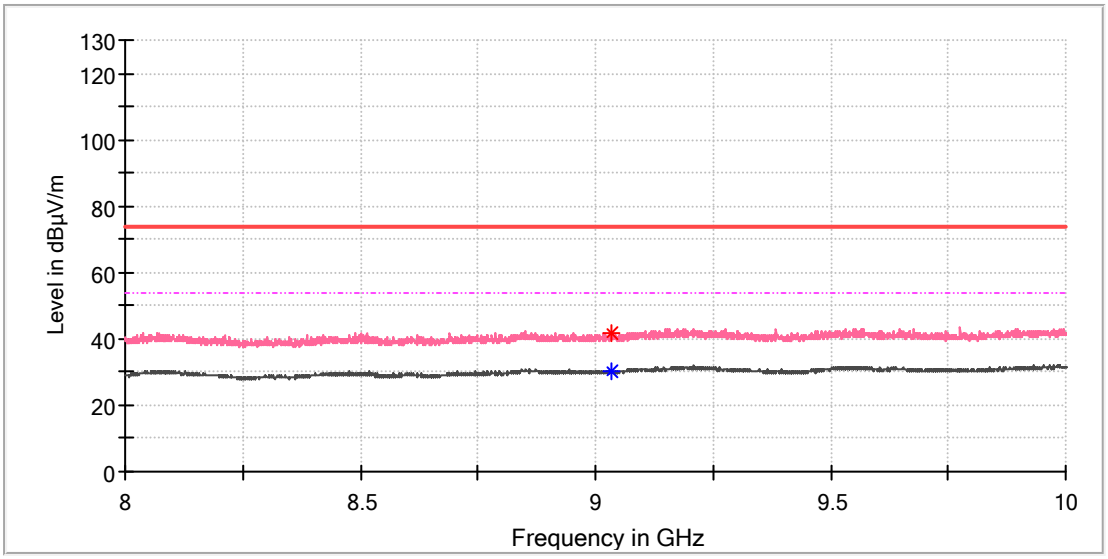


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9028.500000	41.46	---	74.00	32.54	100.0	H	11.0	8.9
9034.500000	---	30.33	54.00	23.67	100.0	H	82.0	8.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_903MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

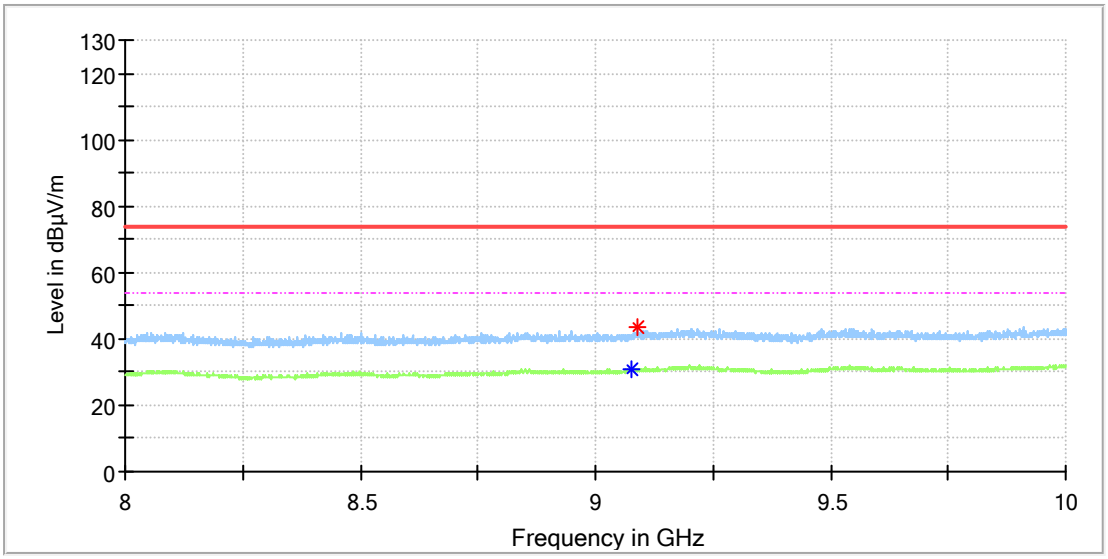


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9033.000000	41.49	---	74.00	32.51	100.0	V	307.0	8.9
9033.000000	---	30.08	54.00	23.92	100.0	V	307.0	8.9

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_907.8MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

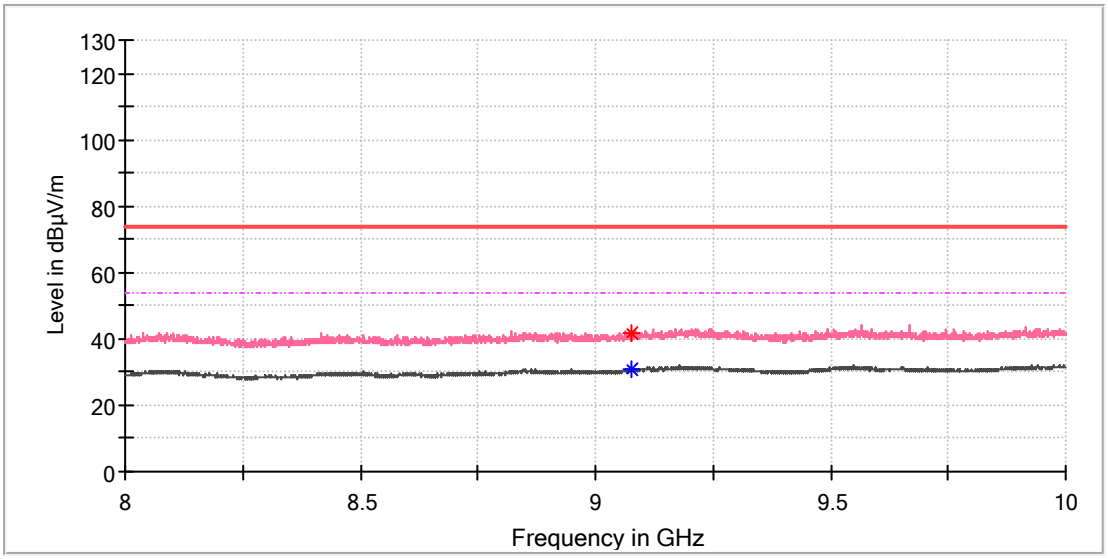


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9075.500000	---	31.04	54.00	22.96	100.0	H	231.0	9.4
9088.000000	43.25	---	74.00	30.75	100.0	H	317.0	9.6

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_907.8MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

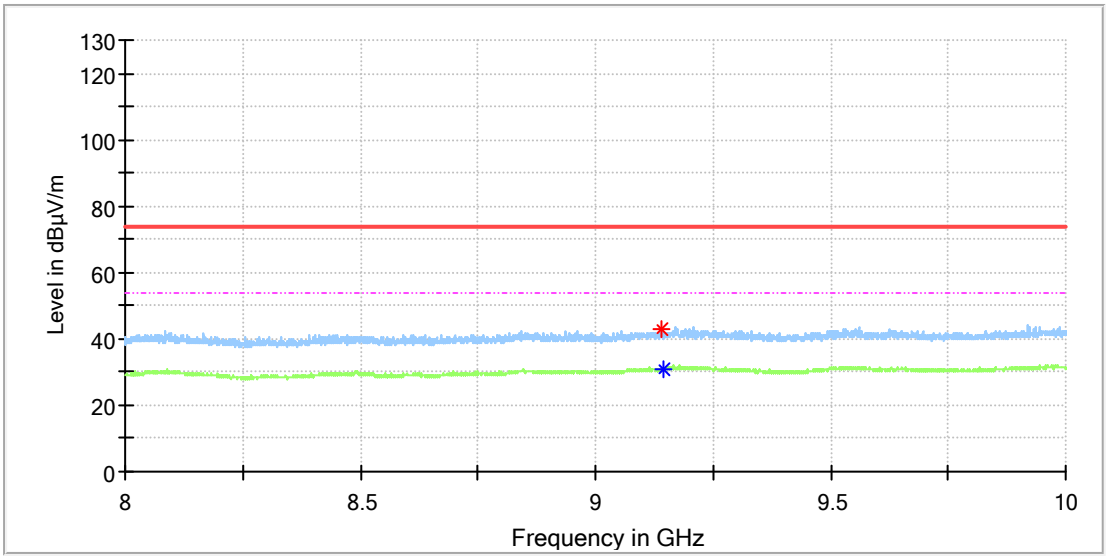


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9075.000000	---	30.86	54.00	23.14	100.0	V	117.0	9.4
9077.000000	41.81	---	74.00	32.19	100.0	V	133.0	9.4

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_914.2MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

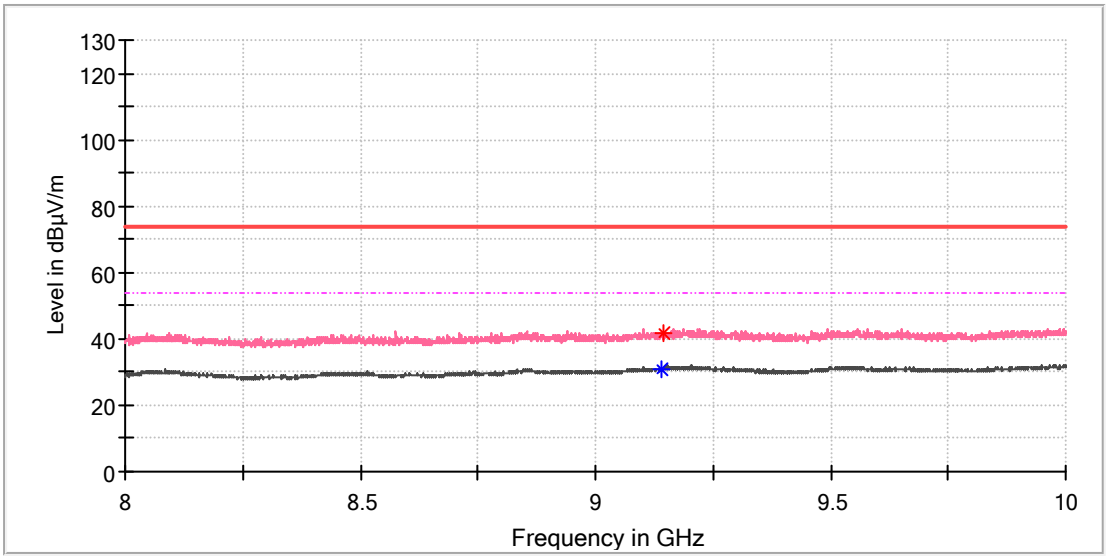


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9142.500000	42.68	---	74.00	31.32	100.0	H	60.0	10.1
9145.000000	---	30.97	54.00	23.03	100.0	H	0.0	10.1

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora_DTS 500k_SF8_914.2MHz
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical_Freqs

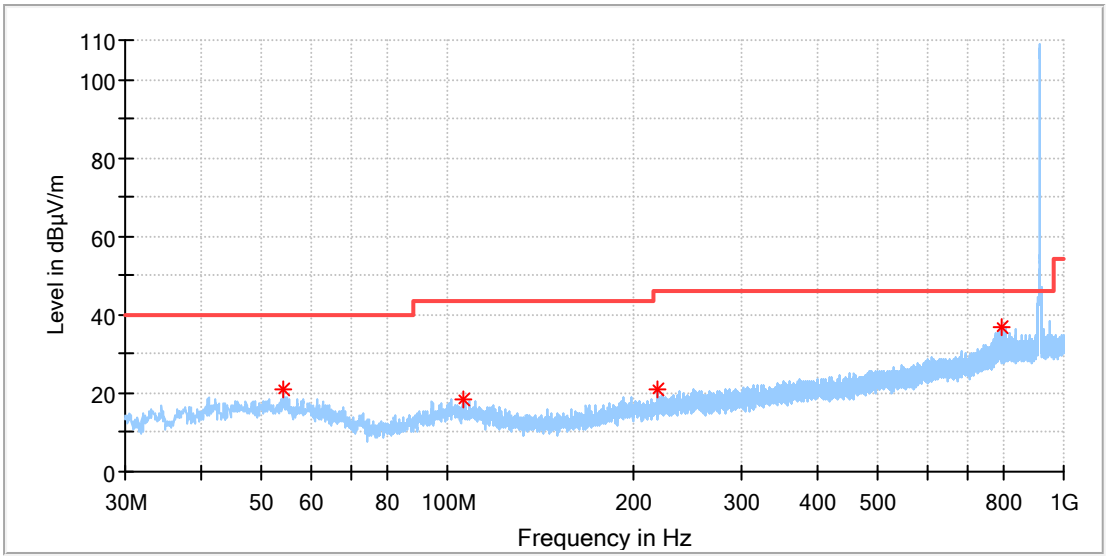
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9142.000000	---	30.98	54.00	23.02	100.0	V	341.0	10.0
9143.000000	41.59	---	74.00	32.41	100.0	V	238.0	10.1

BLE+Lora

30MHz - 1GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora+BLE
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

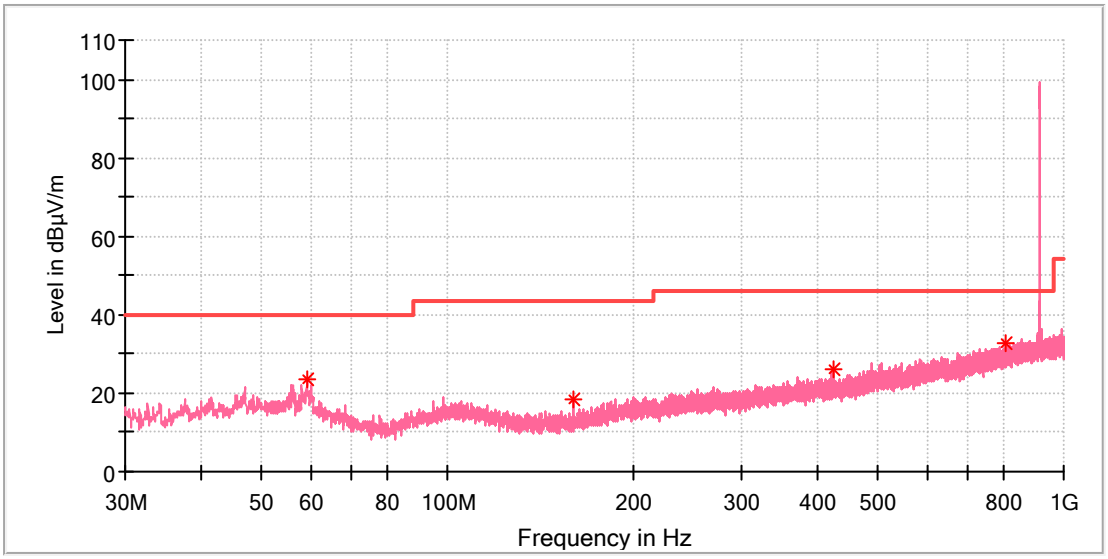


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
54.153000	21.15	40.00	18.85	100.0	H	75.0	-18.4
105.805500	18.58	43.50	24.92	100.0	H	328.0	-18.8
218.762000	20.74	46.00	25.26	100.0	H	89.0	-18.6
791.159000	36.87	46.00	9.13	100.0	H	194.0	-6.5

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora+BLE
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



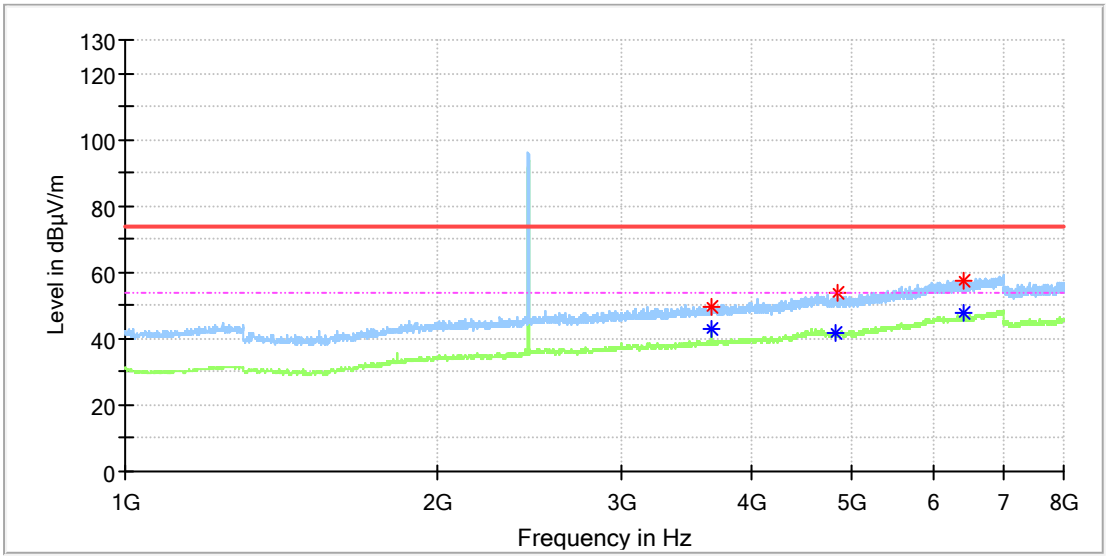
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
59.148500	23.37	40.00	16.63	100.0	V	356.0	-18.9
160.465000	18.17	43.50	25.33	100.0	V	0.0	-21.7
422.510500	25.92	46.00	20.08	100.0	V	50.0	-13.4
804.157000	32.74	46.00	13.26	100.0	V	315.0	-6.3

1GHz - 8GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora+BLE
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

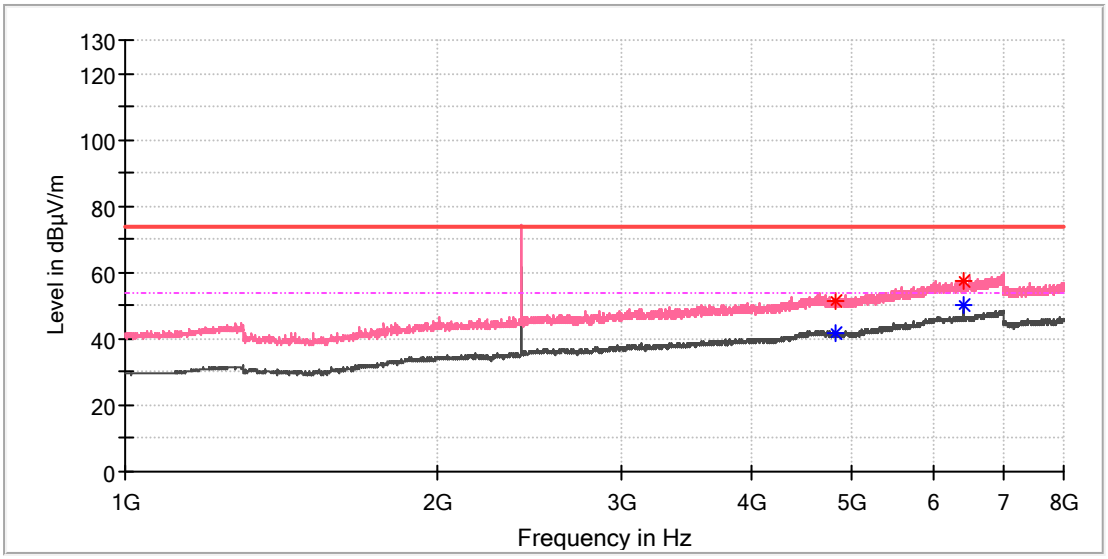


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3658.400000	49.45	---	74.00	24.55	100.0	H	113.0	9.4
3660.075000	---	42.98	54.00	11.02	100.0	H	334.0	9.4
4826.712500	---	41.99	54.00	12.01	100.0	H	104.0	11.8
4838.437500	53.61	---	74.00	20.39	100.0	H	85.0	11.8
6396.187500	57.25	---	74.00	16.75	100.0	H	104.0	16.0
6403.725000	---	48.01	54.00	5.99	100.0	H	132.0	16.1

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora+BLE
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



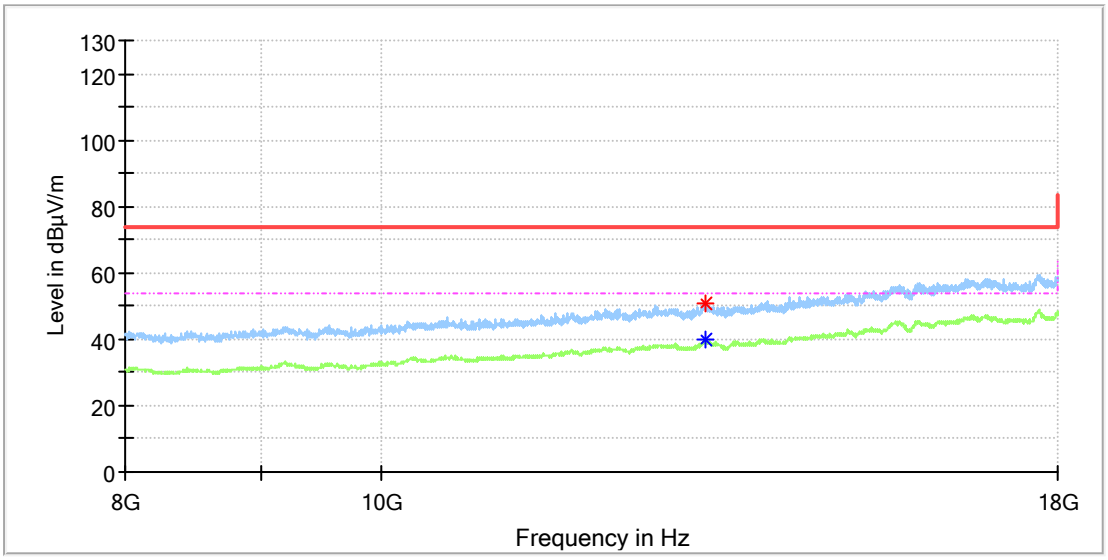
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4815.825000	51.58	---	74.00	22.42	100.0	V	311.0	11.8
4818.337500	---	41.75	54.00	12.25	100.0	V	179.0	11.8
6397.862500	57.20	---	74.00	16.80	100.0	V	161.0	16.0
6397.862500	---	50.45	54.00	3.55	100.0	V	161.0	16.0

8GHz - 10GHz

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora+BLE
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

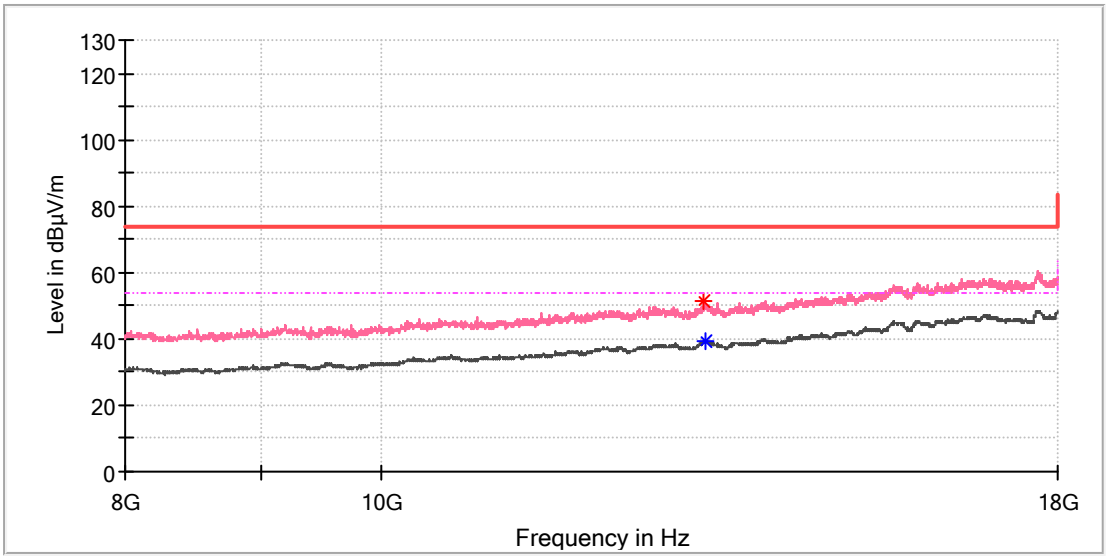


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13252.500000	50.61	---	74.00	23.39	100.0	H	61.0	16.2
13252.500000	---	40.00	54.00	14.00	100.0	H	61.0	16.2

EUT Information

EUT Name:	TrackIt
Model:	RAK2171
Test Mode:	Lora+BLE
Order No/Sample No:	168318889/A003240040-003
Test Voltage::	Battery
Remark:	Temp 23 Humi:58%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



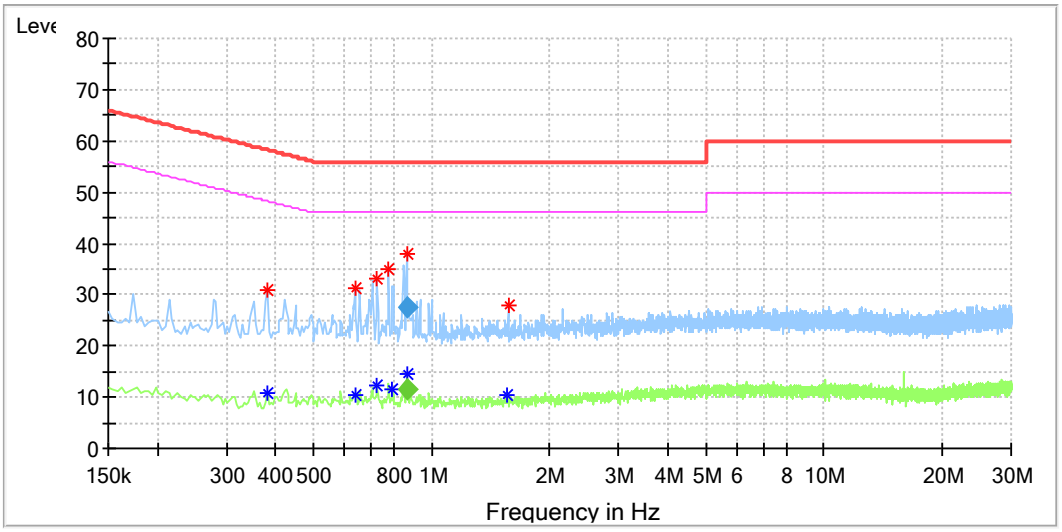
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13237.500000	51.31	---	74.00	22.69	100.0	V	170.0	16.1
13252.500000	---	39.51	54.00	14.49	100.0	V	246.0	16.2

Appendix B.8: Test Results of Conducted Emission 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

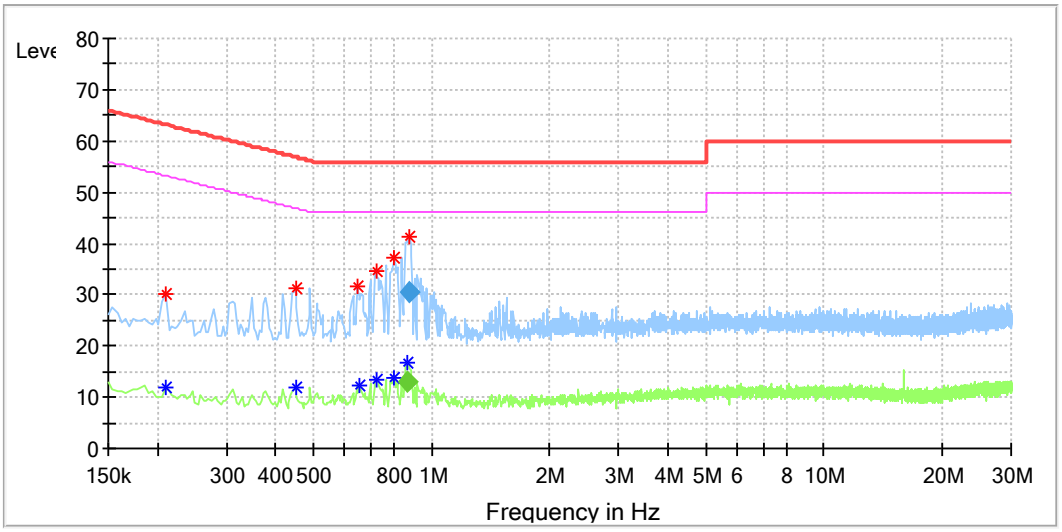
Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.382000	---	10.84	48.24	37.40	L1	9.9
0.382000	30.84	---	58.24	27.39	L1	9.9
0.638000	---	10.57	46.00	35.43	L1	10.0
0.638000	31.08	---	56.00	24.92	L1	10.0
0.726000	---	12.29	46.00	33.71	L1	10.0
0.726000	33.11	---	56.00	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