

TEST REPORT



Report No.: TW2203419-05E
File reference No.: 2022-05-17

Applicant: Hangzhou Roombanker Technology Co., Ltd

Product: Outdoor LoraWAN Gateway

Model No.: DSGW-010C

Trademark: N/A

Test Standards: FCC Part 15.247

Test result: It is herewith confirmed and found to comply with the requirements set up by ANSI C63.10, FCC Part 15.247 for the evaluation of electromagnetic compatibility

Approved By

Handwritten signature of Terry Tang.

Terry Tang

Manager

Dated: May 17, 2022

Results appearing herein relate only to the sample tested

The technical reports is issued errors and omissions exempt and is subject to withdrawal at

SHENZHEN TIMEWAY TESTING LABORATORIES

Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com



Special Statement:

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L2292

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

FCC-Registration No.: 744189

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 744189.

Industry Canada (IC) —Registration No.:5205A

The EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 5205A.

A2LA (Certification Number:5013.01)

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA). Certification Number:5013.01

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Test Report Conclusion

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1.0 General Details

1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TESTING LABORATORIES.
Address: Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China
Telephone: (755) 83448688
Fax: (755) 83442996

1.2 Applicant Details

Applicant: Hangzhou Roombanker Technology Co., Ltd
Address: A#801 Wantong center, Hangzhou, China
Telephone: +86-18768289112
Fax: --

1.3 Description of EUT

Product: Outdoor LoraWAN Gateway
Manufacturer: Hangzhou Roombanker Technology Co., Ltd
Address: A#801 Wantong center, Hangzhou, China
Trademark: N/A
Model Number: DSGW-010C
Additional Model Number: N/A
Hardware Version: V0.1
Software Version: V0.1
Modulation Technique LoRa/Chirp Spread Spectrum
Frequency range 902.3-914.9MHz
Channel Spacing 0.2MHz
Frequency Selection By software
Channel Number 64 channels
Antenna: External Antenna with Reverse polarity N connector used. The gain of the antennas is 1.1dBi (Declared by the manufacturer)
Rating: DC48V, 0.32A
Power Supply: Model: RP028-4800320Z
Input: 100-240V~, 50/60Hz, 0.6A Max; Output:48V, 0.32A, 15.36W

1.4 Submitted Sample: 1 Samples

1.5 Test Duration

2022-03-28 to 2022-05-17

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1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions below 1GHz Uncertainty =4.7dB

Radiated Emissions above 1GHz Uncertainty =6.0dB

Conducted Power Uncertainty =6.0dB

Occupied Channel Bandwidth Uncertainty =5%

Note: The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

1.7 Test Engineer

The sample tested by _____

Andy Xing

Print Name: Andy Xing

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2.0 Test Equipment					
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	R&S	ESPI 3	100379	2021-06-18	2022-06-17
TWO Line-V-NETW	R&S	EZH3-Z5	100294	2021-06-18	2022-06-17
TWO Line-V-NETW	R&S	EZH3-Z5	100253	2021-06-18	2022-06-17
Impuls-Begrenzer	R&S	ESH3-Z2	100281	2021-06-18	2022-06-17
Loop Antenna	EMCO	6507	00078608	2021-06-18	2022-06-17
Spectrum	R&S	FSIQ26	100292	2021-06-18	2022-06-17
Horn Antenna	A-INFO	LB-180400-KF	J211060660	2021-06-18	2022-06-17
Horn Antenna	R&S	BBHA 9120D	9120D-631	2021-07-02	2024-07-01
Power meter	Anritsu	ML2487A	6K00003613	2021-06-18	2022-06-17
Power sensor	Anritsu	MA2491A	32263	2021-06-18	2022-06-17
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2021-07-02	2024-07-01
9*6*6 Anechoic	--	--	N/A	2021-07-02	2024-07-01
EMI Test Receiver	RS	ESVB	826156/011	2021-06-18	2022-06-17
EMI Test Receiver	RS	ESH3	860904/006	2021-06-18	2022-06-17
Spectrum	HP/Agilent	ESA-L1500A	US37451154	2021-06-18	2022-06-17
Spectrum	HP/Agilent	E4407B	MY50441392	2021-06-18	2022-06-17
Spectrum	RS	FSP	1164.4391.38	2022-01-14	2023-01-13
RF Cable	Zhengdi	ZT26-NJ-NJ-8M/F A	--	2021-06-18	2022-06-17
RF Cable	Zhengdi	7m	--	2021-06-18	2022-06-17
RF Switch	EM	EMSW18	060391	2021-06-18	2022-06-17
Pre-Amplifier	Schwarebeck	BBV9743	#218	2021-06-18	2022-06-17
Pre-Amplifier	HP/Agilent	8449B	3008A00160	2021-06-18	2022-06-17
LISN	SCHAFFNER	NNB42	00012	2022-01-05	2023-01-04

2.2 Automation Test Software

For Conducted Emission Test

Name	Version
EZ-EMC	Ver.EMC-CON 3A1.1

For Radiated Emissions

Name	Version
EMI Test Software BL410-EV18.91	V18.905
EMI Test Software BL410-EV18.806 High Frequency	V18.06

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3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications:			
Requirement	CFR 47 Section	Result	Notes
Antenna Requirement	15.203, 15.247(b)(4)	Pass	Complies
Maximum Peak Out Power	15.247 (b)(2), (4)	Pass	Complies
Carrier Frequency Separation	15.247(a)(1)(i)	Pass	Complies
20dB Channel Bandwidth	15.247(a)(1)(i)	Pass	Complies
Number of Hopping Channels	15.247(a)(1)(i)	Pass	Complies
Time of Occupancy (Dwell Time)	15.247(a)(1)(i)	Pass	Complies
Spurious Emission, Band Edge, and Restricted bands	15.247(d),15.205(a), 15.209 (a),15.109	Pass	Complies
Conducted Emissions	15.207(a), 15.107	Pass	Complies
RF Exposure	15.247(i), 1.1307(b)(1)	Pass	Complies

3.2 Test Standards

FCC Part 15 Subpart & Subpart C, Paragraph 15.247

4.0 EUT Modification

No modification by SHENZHEN TIMEWAY TESTING LABORATORIES.

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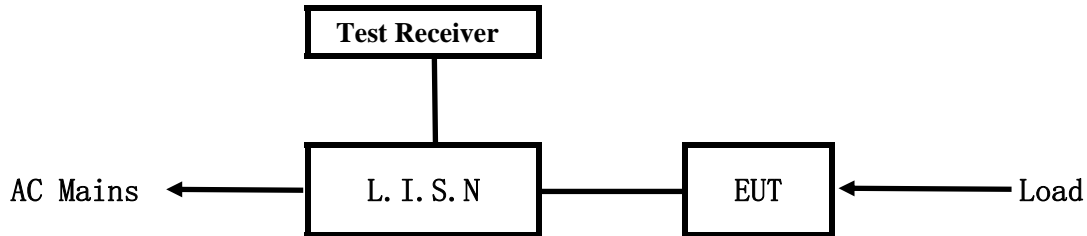
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5. Power Line Conducted Emission Test

5.1 Schematics of the test



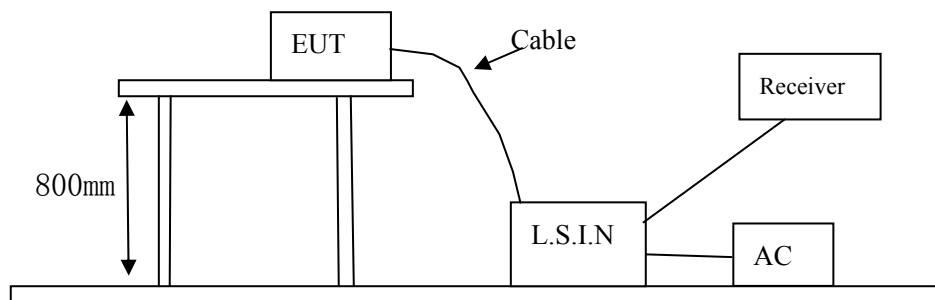
EUT: Equipment Under Test

5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.10-2013. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.10-2013.

Test Voltage: 120V~, 60Hz

Block diagram of Test setup



5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.10-2013. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

A. EUT

Device	Manufacturer	Model	FCC ID
Outdoor LoraWAN Gateway	Hangzhou Roombanker Technology Co., Ltd	DSGW-010C, DSGW-010C-US	2AUXBDSGW-010C

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B. Internal Device

Device	Manufacturer	Model	Rating

C. Peripherals

Device	Manufacturer	Model	Rating
N/A			

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.10-2013.

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207

Frequency (MHz)	Limits (dB μ V)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66.0~56.0*	56.0~46.0*
0.50 ~ 5.00	56.0	46.0
5.00 ~ 30.00	60.0	50.0

- Notes: 1. *Decreasing linearly with logarithm of frequency.
 2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

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A: Conducted Emission on Live Terminal (150kHz to 30MHz)

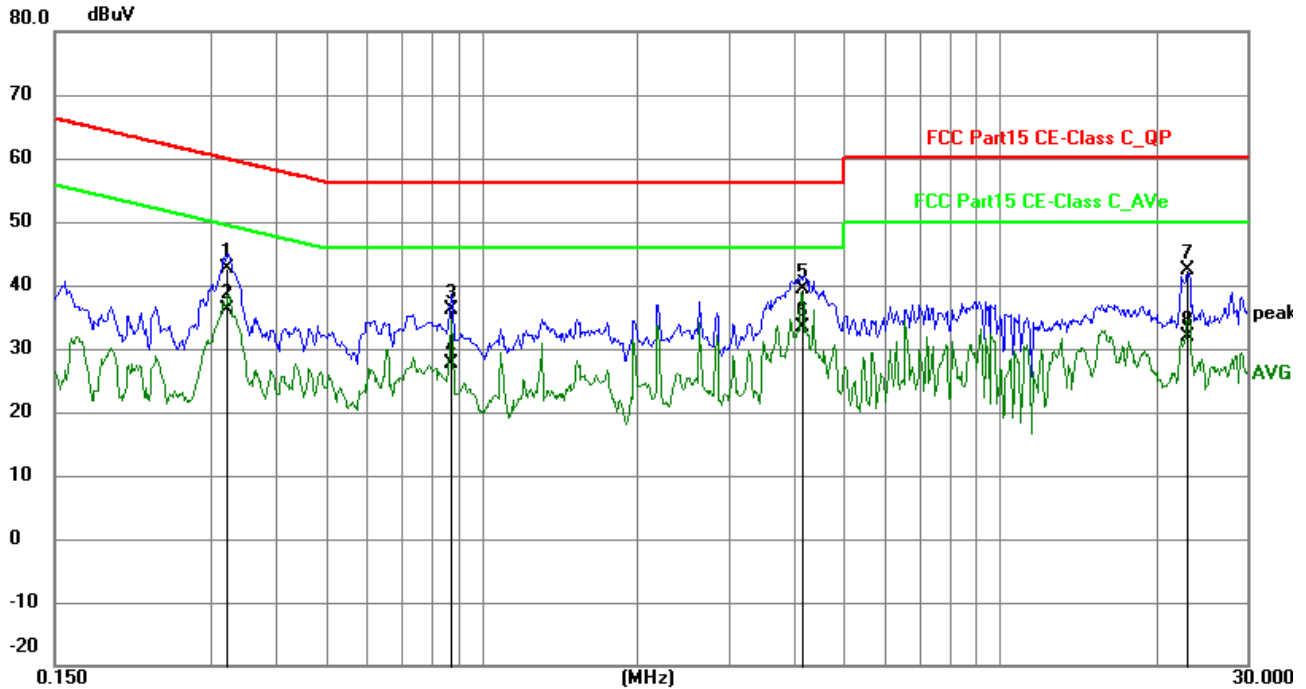
EUT Operating Environment

Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Keep Transmitting

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.3215	32.99	9.76	42.75	59.67	-16.92	QP	P
2	0.3215	26.49	9.76	36.25	49.67	-13.42	AVG	P
3	0.8754	26.38	9.79	36.17	56.00	-19.83	QP	P
4	0.8754	17.84	9.79	27.63	46.00	-18.37	AVG	P
5	4.1544	29.46	9.89	39.35	56.00	-16.65	QP	P
6	4.1544	23.47	9.89	33.36	46.00	-12.64	AVG	P
7	22.9602	31.64	10.86	42.50	60.00	-17.50	QP	P
8	22.9602	21.09	10.86	31.95	50.00	-18.05	AVG	P

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B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)

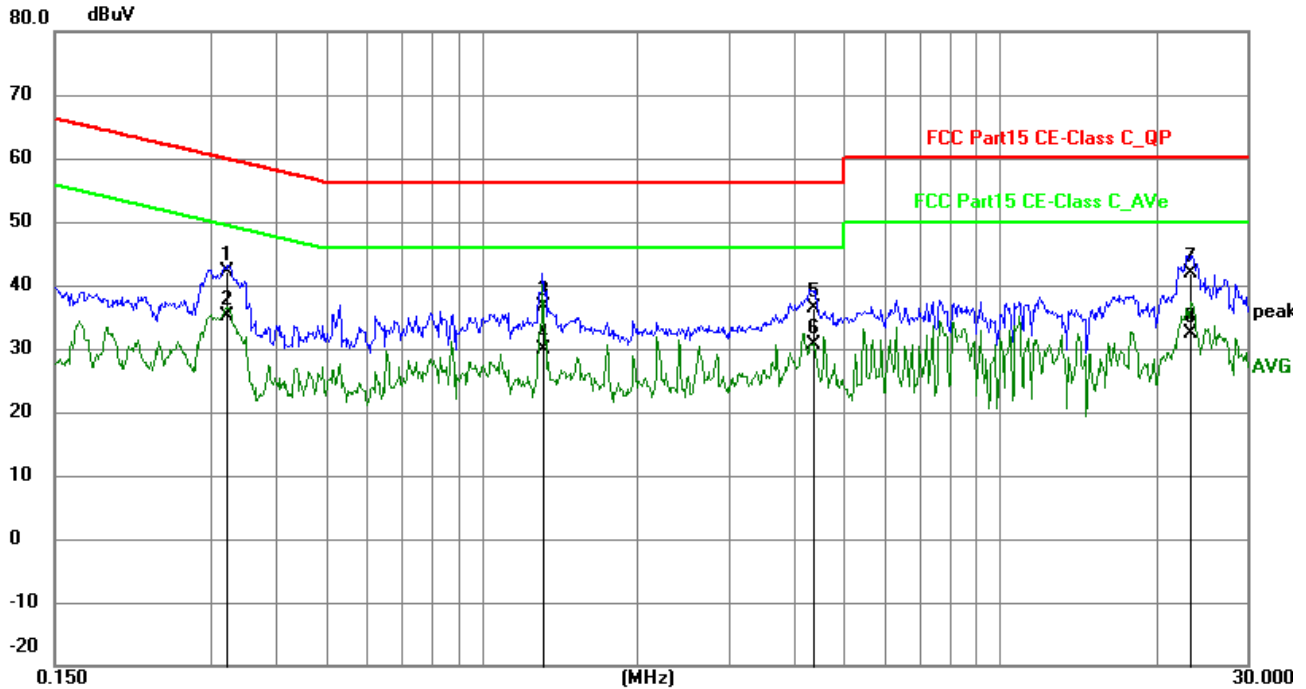
EUT Operating Environment

Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 kPa

EUT set Condition: Keep Transmitting

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.3215	32.45	9.76	42.21	59.67	-17.46	QP	P
2	0.3215	25.49	9.76	35.25	49.67	-14.42	AVG	P
3	1.3122	26.84	9.79	36.63	56.00	-19.37	QP	P
4	1.3122	20.16	9.79	29.95	46.00	-16.05	AVG	P
5	4.3767	26.38	9.90	36.28	56.00	-19.72	QP	P
6	4.3767	20.85	9.90	30.75	46.00	-15.25	AVG	P
7	23.3814	30.96	10.89	41.85	60.00	-18.15	QP	P
8	23.3814	21.46	10.89	32.35	50.00	-17.65	AVG	P

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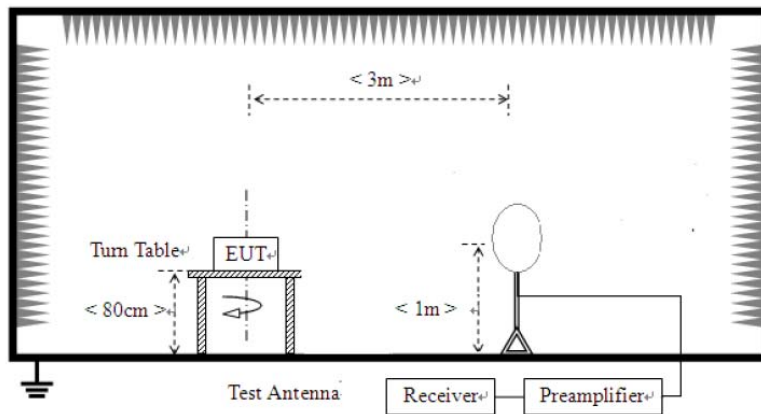
6 Radiated Emission Test

6.1 Test Method and test Procedure:

- (1) The EUT was tested according to ANSI C63.10-2013. The radiated test was performed at Timeway EMC Laboratory. This site is on file with the FCC laboratory division, Registration No. 744189
- (2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10-2013.
- (3) The frequency spectrum from 30 MHz to 10GHz was investigated. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 kHz. For measurement above 1GHz, peak values with RBW=VBW=1MHz and PK detector. AV value with RBW=1MHz, VBW=10Hz and PK detector. Measurements were made at 3 meters.
- (4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.
- (5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "QP" in the data table.
- (6) The antenna polarization: Vertical polarization and Horizontal polarization.

Block diagram of Test setup

For radiated emissions from 9kHz to 30MHz

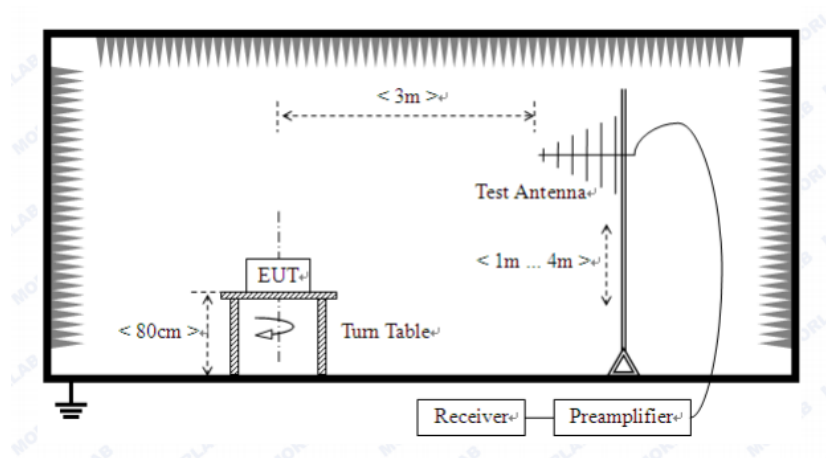


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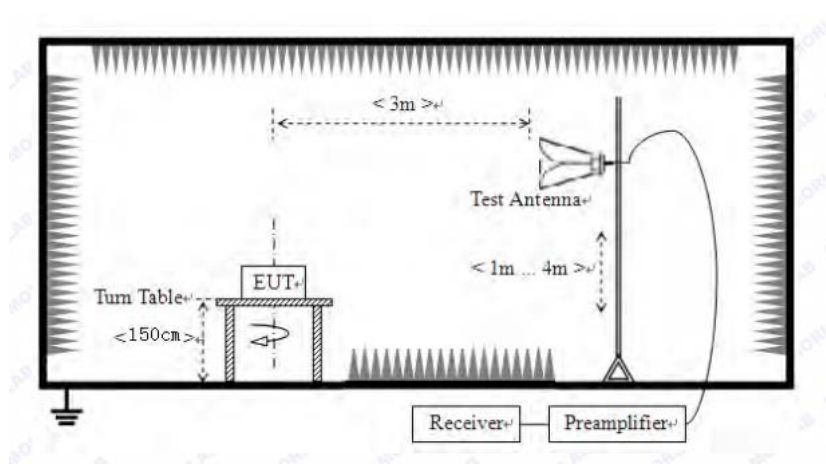
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For radiated emissions from 30MHz to1GHz



For radiated emissions above 1GHz



6.2 Configuration of The EUT

Same as section 5.3 of this report

6.3 EUT Operating Condition

Same as section 5.4 of this report.

6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

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Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
0.009-0.490	3	$20\log(2400/F(\text{kHz})) + 40\log(300/3)$
0.490-1.705	3	$20\log(24000/F(\text{kHz})) + 40\log(30/3)$
1.705-30	3	69.5
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

- Note:
1. RF Voltage (dBuV) = 20 log RF Voltage (μ V)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
 4. All scanning using PK detector. And the final emission level was get using QP detector for frequency range from 30-1000MHz.As to 1G-10G, the final emission level got using PK. For fundamental measurement, PK detector used.
 5. For radiated emissions from 9kHz to 30MHz, the emission level is much less than the limit for more than 20dB. No necessary to take down the record.

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Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal/Vertical (30MHz----1000MHz)

EUT set Condition: Keep Bluetooth Transmitting

Results: Pass

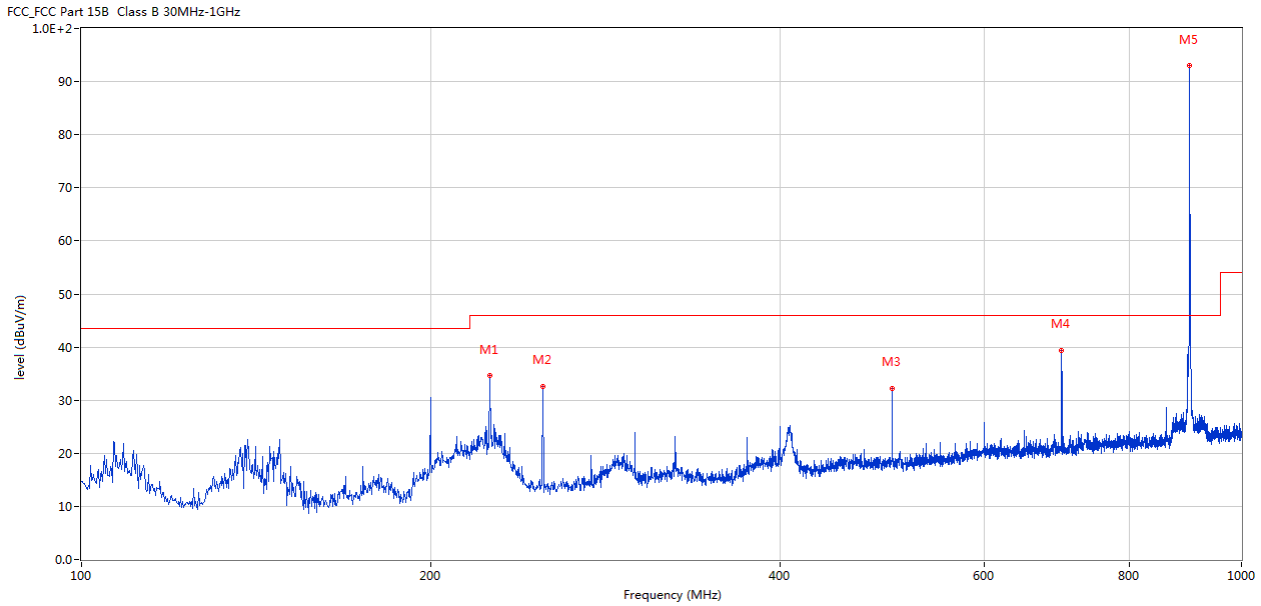
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Test Figure for Low channel (902.3MHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	224.844	34.60	-12.94	46.0	-11.40	Peak	71.00	100	Horizontal	Pass
2	250.037	32.60	-12.07	46.0	-13.40	Peak	98.00	100	Horizontal	Pass
3	499.950	32.20	-6.90	46.0	-13.80	Peak	324.00	100	Horizontal	Pass
4	699.925	39.37	-4.19	46.0	-6.63	Peak	280.00	100	Horizontal	Pass
5	902.374	92.95	-1.97	46.0	46.95	Peak	287.00	100	Horizontal	N/A

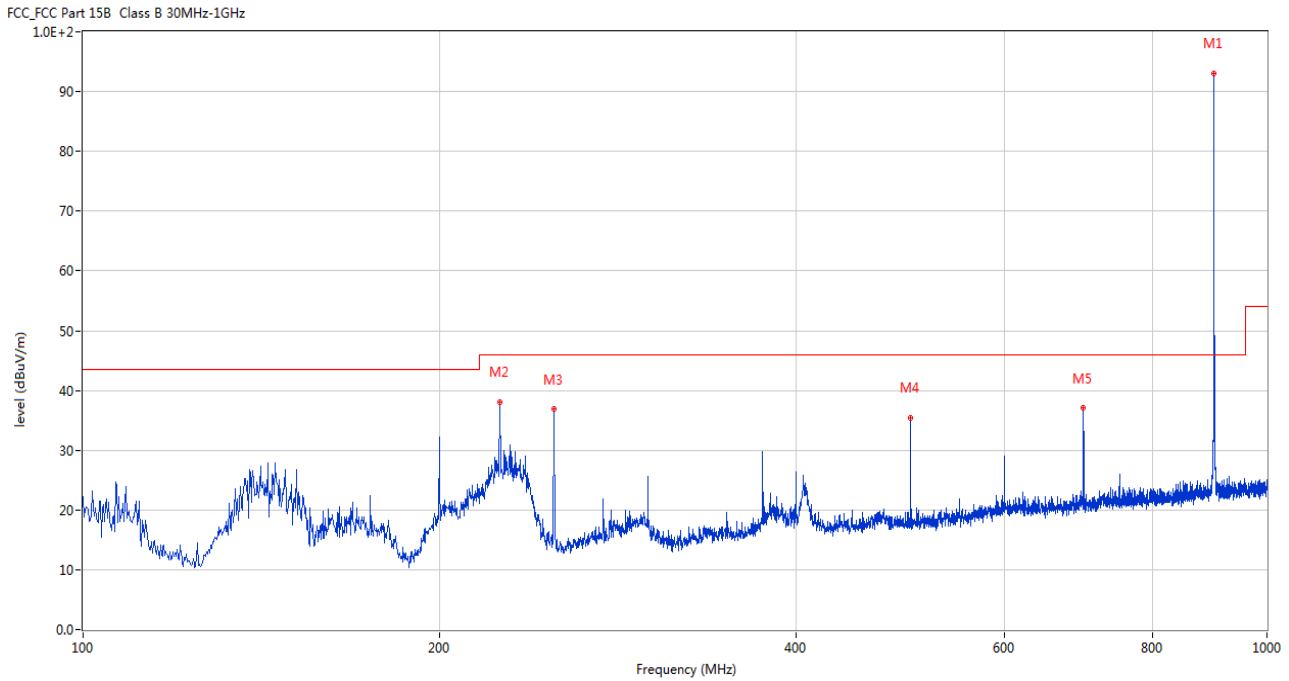
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Test Figure for Low channel (902.3MHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	902.374	92.97	-1.97	46.0	46.97	Peak	44.00	100	Vertical	N/A
2	225.069	38.08	-12.92	46.0	-7.92	Peak	95.00	100	Vertical	Pass
3	250.037	36.89	-12.07	46.0	-9.11	Peak	213.00	100	Vertical	Pass
4	499.950	35.47	-6.90	46.0	-10.53	Peak	321.00	100	Vertical	Pass
5	699.925	37.03	-4.19	46.0	-8.97	Peak	71.00	100	Vertical	Pass

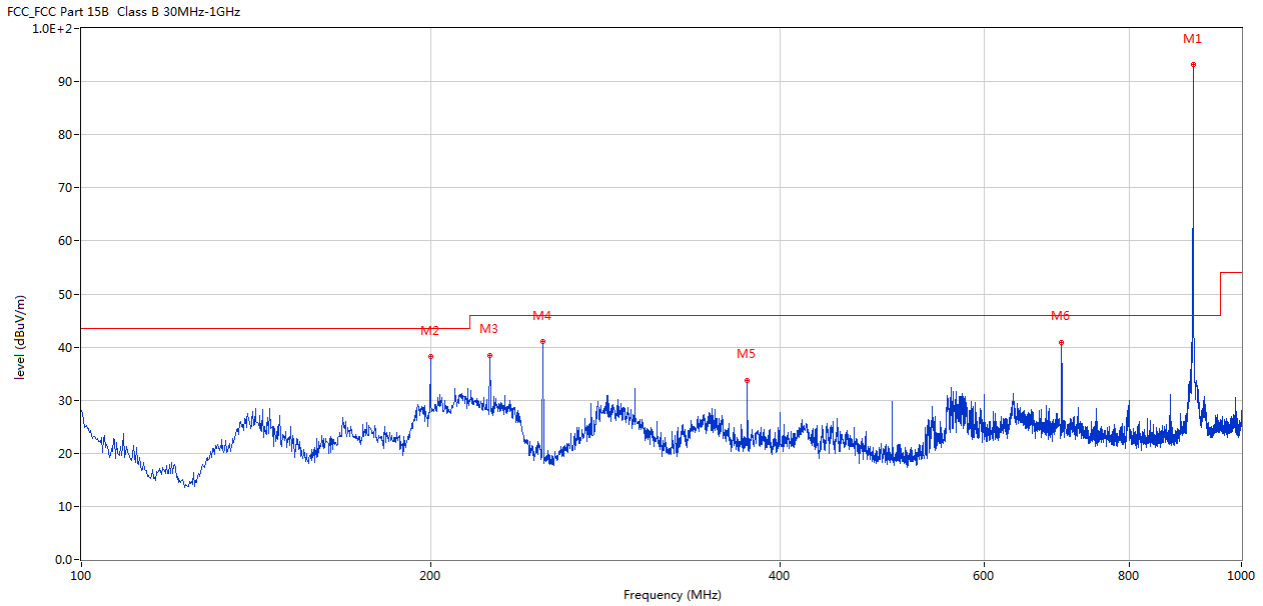
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Test Figure for Middle channel (908.7MHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	908.673	93.13	-1.76	46.0	47.13	Peak	63.00	100	Horizontal	N/A
2	199.875	38.20	-13.45	43.5	-5.30	Peak	91.00	100	Horizontal	Pass
3	225.069	38.42	-12.92	46.0	-7.58	Peak	323.00	100	Horizontal	Pass
4	249.813	40.97	-12.09	46.0	-5.03	Peak	97.00	100	Horizontal	Pass
5	374.881	33.76	-9.45	46.0	-12.24	Peak	125.00	100	Horizontal	Pass
6	699.925	40.90	-4.19	46.0	-5.10	Peak	244.00	100	Horizontal	Pass

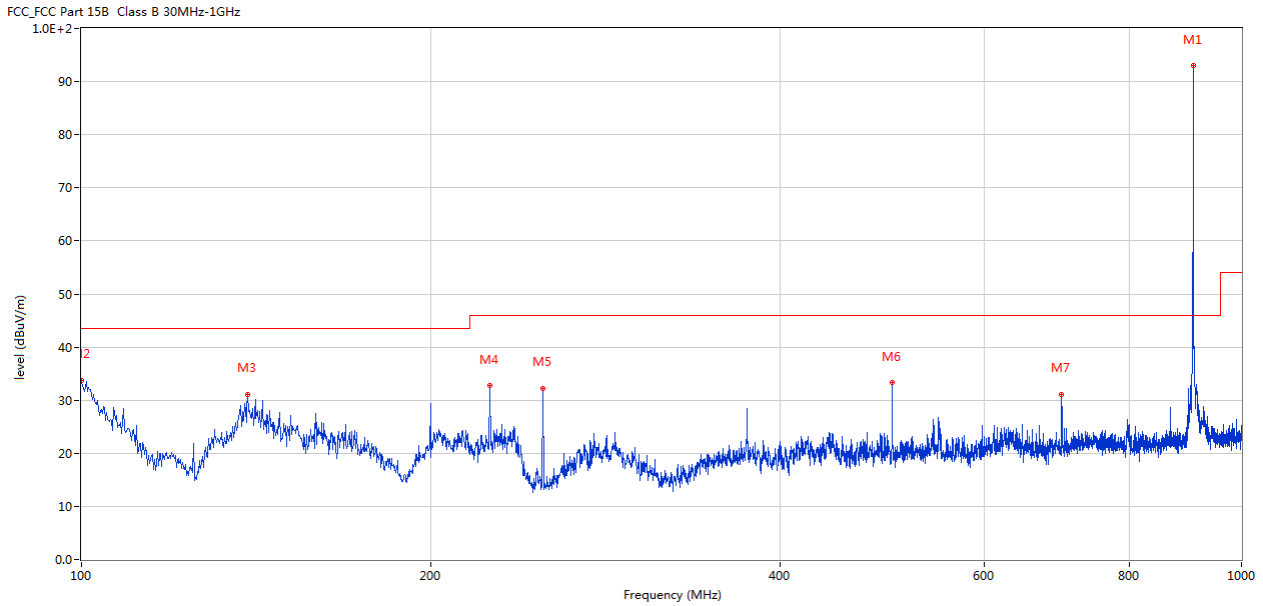
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Test Figure for Middle channel (908.7MHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	908.673	92.98	-1.76	46.0	46.98	Peak	37.00	100	Vertical	N/A
2	100.000	33.63	-13.53	43.5	-9.87	Peak	9.00	100	Vertical	Pass
3	139.140	31.15	-17.21	43.5	-12.35	Peak	0.00	100	Vertical	Pass
4	225.069	32.70	-12.92	46.0	-13.30	Peak	60.00	100	Vertical	Pass
5	250.037	32.21	-12.07	46.0	-13.79	Peak	25.00	100	Vertical	Pass
6	499.950	33.27	-6.90	46.0	-12.73	Peak	20.00	100	Vertical	Pass
7	699.925	31.09	-4.19	46.0	-14.91	Peak	37.00	100	Vertical	Pass

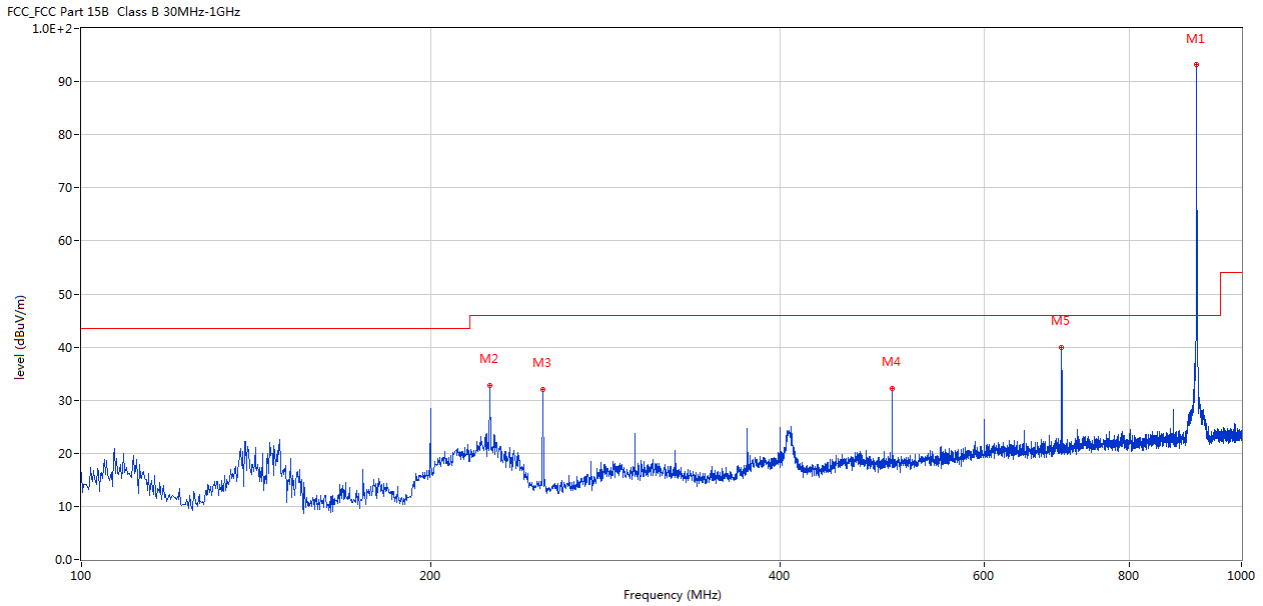
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Test Figure for High channel (914.9MHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	914.971	93.21	-1.74	46.0	47.21	Peak	225.00	100	Horizontal	N/A
2	225.069	32.78	-12.92	46.0	-13.22	Peak	42.00	100	Horizontal	Pass
3	250.037	32.11	-12.07	46.0	-13.89	Peak	159.00	100	Horizontal	Pass
4	499.950	32.28	-6.90	46.0	-13.72	Peak	319.00	100	Horizontal	Pass
5	699.925	39.97	-4.19	46.0	-6.03	Peak	278.00	100	Horizontal	Pass

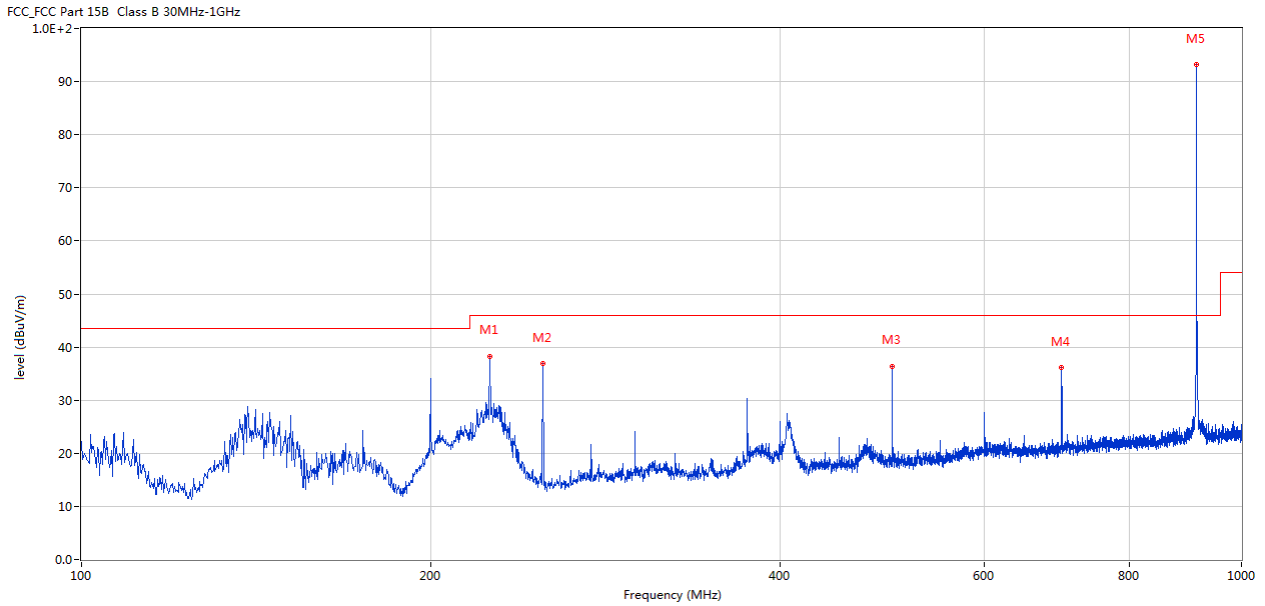
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Test Figure for High channel (914.9MHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	225.069	38.32	-12.92	46.0	-7.68	Peak	102.00	100	Vertical	Pass
2	250.037	36.84	-12.07	46.0	-9.16	Peak	202.00	100	Vertical	Pass
3	499.950	36.41	-6.90	46.0	-9.59	Peak	337.00	100	Vertical	Pass
4	699.925	36.12	-4.19	46.0	-9.88	Peak	64.00	100	Vertical	Pass
5	914.971	93.18	-1.74	46.0	47.18	Peak	20.00	100	Vertical	N/A

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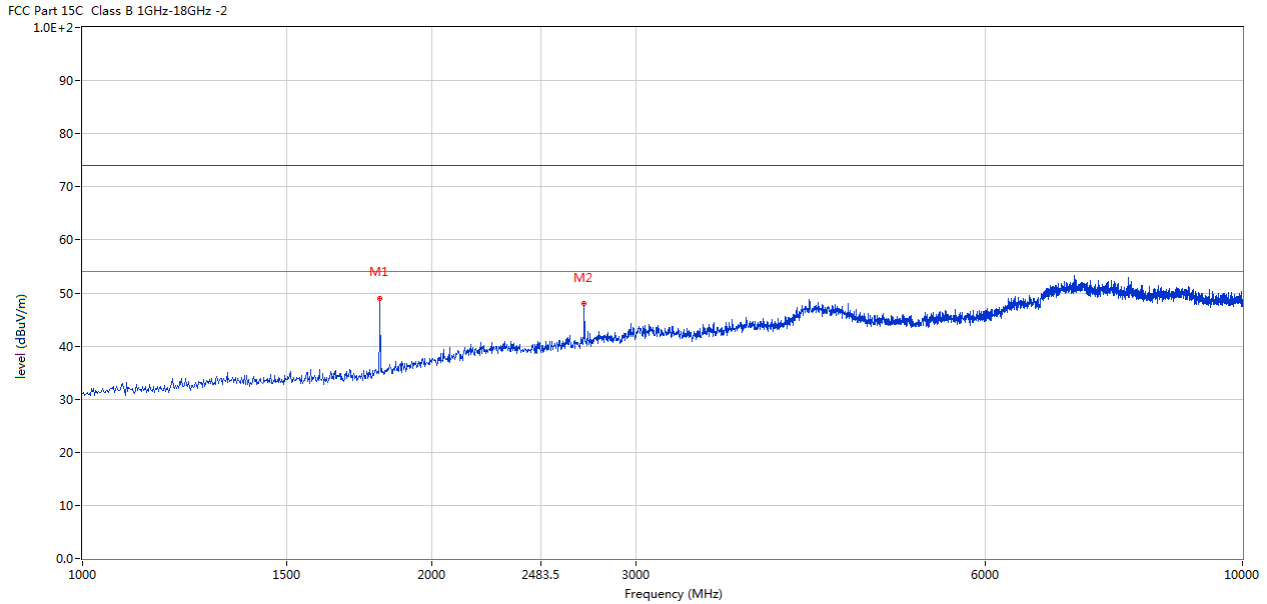
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Test Figures above 1GHz:

Please refer to the following test plots for details:

Low Channel: Horizontal



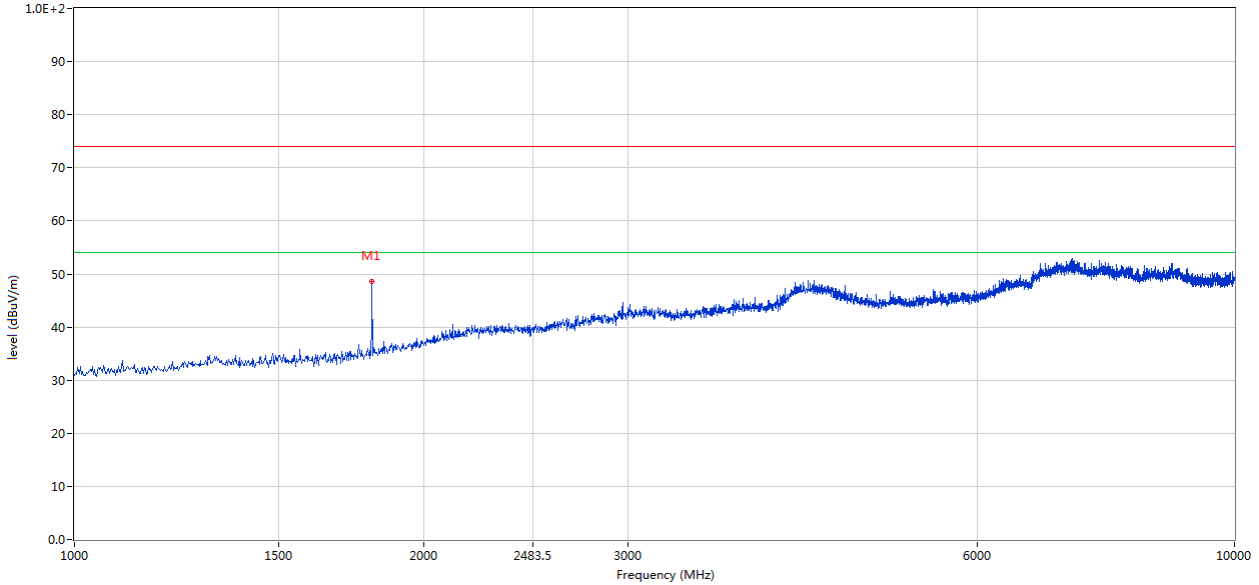
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1805.299	49.99	-6.78	74.0	-24.01	Peak	93.00	100	Horizontal	Pass
2	2707.323	48.01	-2.94	74.0	-25.99	Peak	98.00	100	Horizontal	Pass

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Low Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



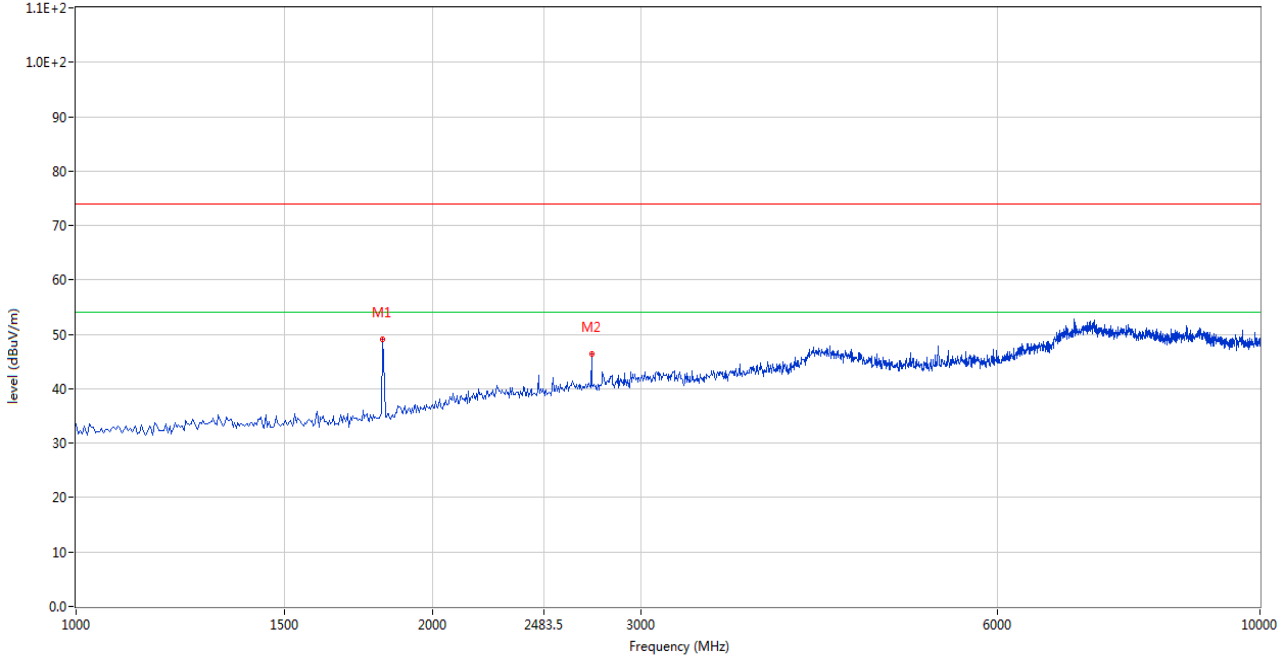
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1805.299	48.53	-6.78	74.0	-25.47	Peak	216.00	100	Vertical	Pass

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Middle Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1817.796	49.15	-6.68	74.0	-24.85	Peak	55.00	100	Horizontal	N/A
2	2725.069	46.34	-2.89	74.0	-27.66	Peak	55.00	100	Horizontal	Pass

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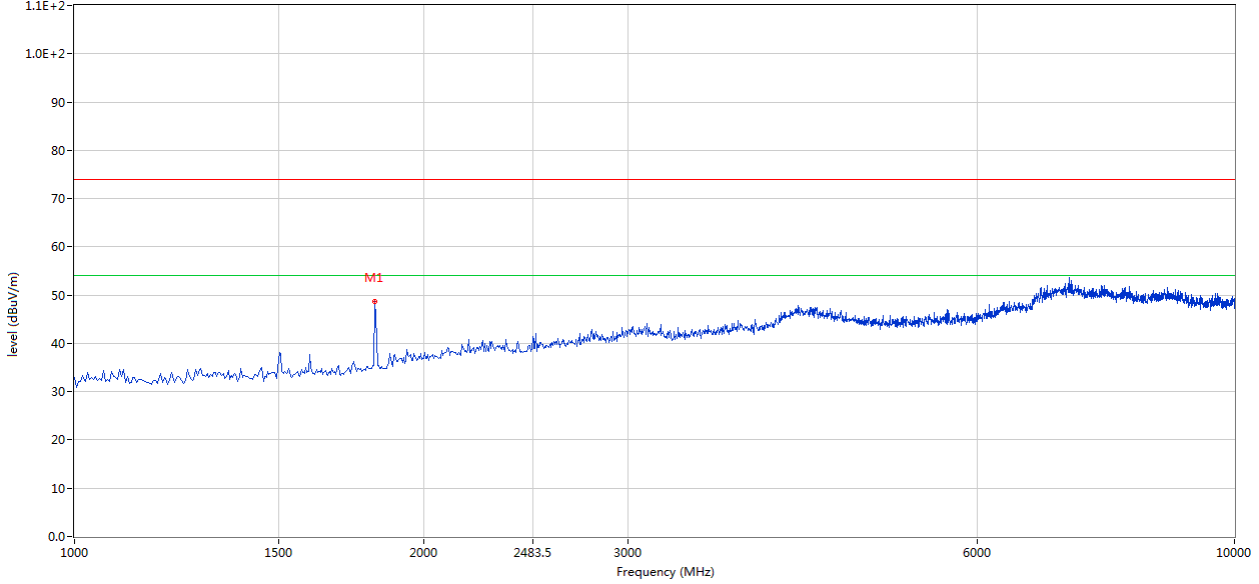
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Middle Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1817.796	49.67	-6.68	74.0	-23.33	Peak	353.00	100	Vertical	Pass

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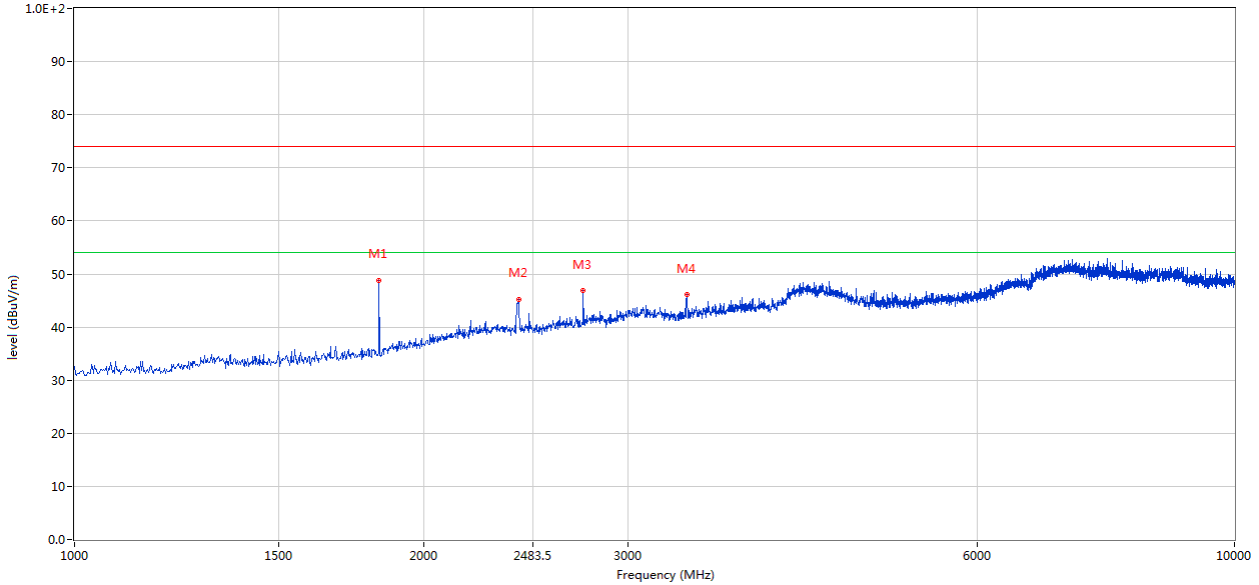
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High Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1830.042	49.80	-6.55	74.0	-24.20	Peak	54.00	100	Horizontal	Pass
2	2414.896	45.23	-3.57	74.0	-28.77	Peak	149.00	100	Horizontal	Pass
3	2745.564	46.83	-2.84	74.0	-27.17	Peak	54.00	100	Horizontal	Pass
4	3370.907	46.09	-1.88	74.0	-27.91	Peak	49.00	100	Horizontal	Pass

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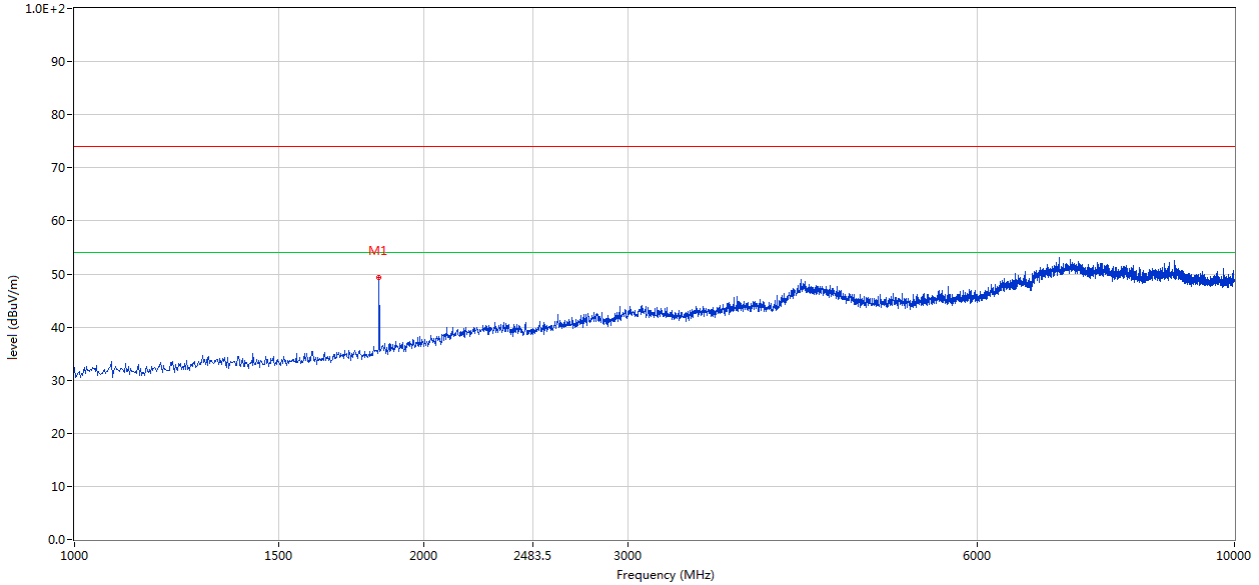
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High Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1830.042	49.37	-6.55	74.0	-24.63	Peak	217.00	100	Vertical	Pass

Note: The measured PK radiated emissions level less than the AV limit, so no necessary to take down the AV result

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7.0 20dB Bandwidth Measurement

7.1 Regulation

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.2 Limits of 20dB Bandwidth Measurement

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.3 Test Procedure.

1. Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span =500kHz, RBW =10 kHz, VBW=30 kHz, Sweep = auto Detector function = peak, Trace = max hold
3. Measure the highest amplitude appearing on spectral display and record the level to calculate results. 6. Repeat above procedures until all frequencies measured were complete.

7.4 Test Result

EUT	Outdoor LoraWAN Gateway		Model	DSGW-010C
Mode	Keep Transmitting		Input Voltage	DC48V
Temperature	24 deg. C,		Humidity	56% RH
Channel	Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass/ Fail
Low	902.3	160	500	Pass
Middle	908.7	159	500	Pass
High	914.9	161	500	Pass

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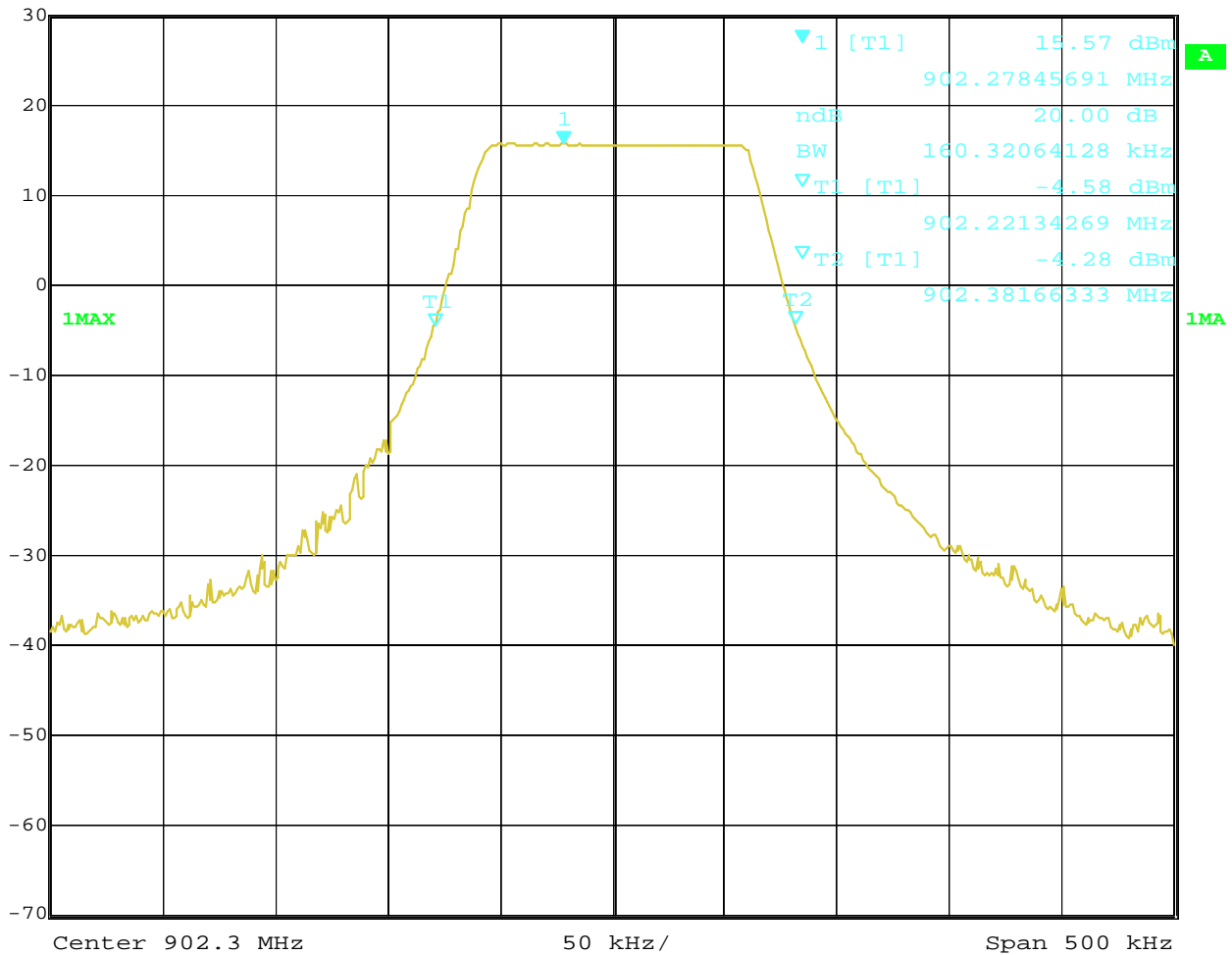
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Test Figure:

1. Condition: Low Channel

	Marker 1 [T1 ndB]	RBW	10 kHz	RF Att	50 dB
	Ref Lvl	ndB	20.00 dB	VBW	30 kHz
	30 dBm	BW	160.32064128 kHz	SWT	15 ms



Date: 17.MAY.2022 18:24:04

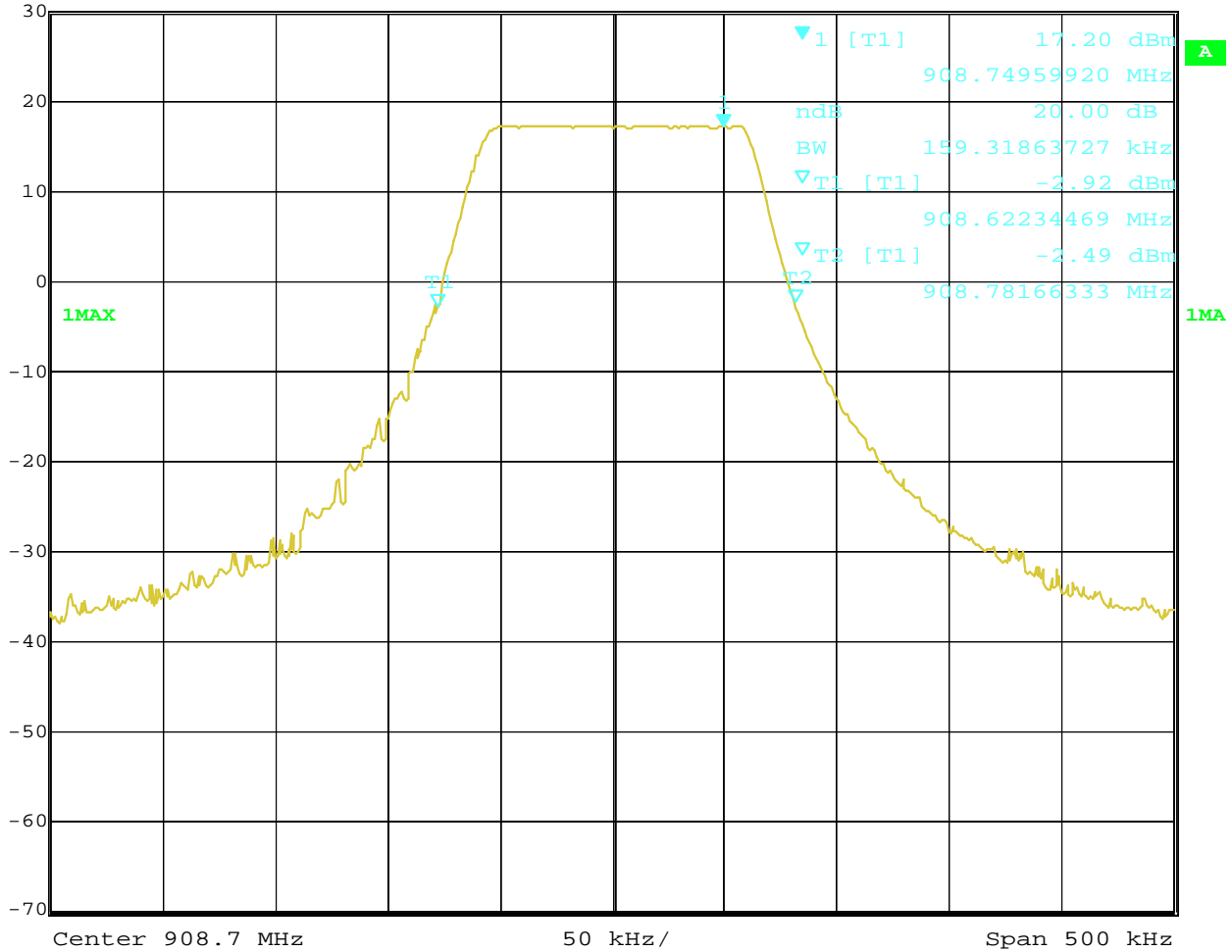
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2. Condition: Middle Channel



Ref Lvl	30 dBm	Marker 1 [T1 ndB]	20.00 dB	RBW	10 kHz	RF Att	50 dB
		BW	159.31863727 kHz	VBW	30 kHz	Unit	dBm
		SWT	15 ms				



Date: 17.MAY.2022 18:29:42

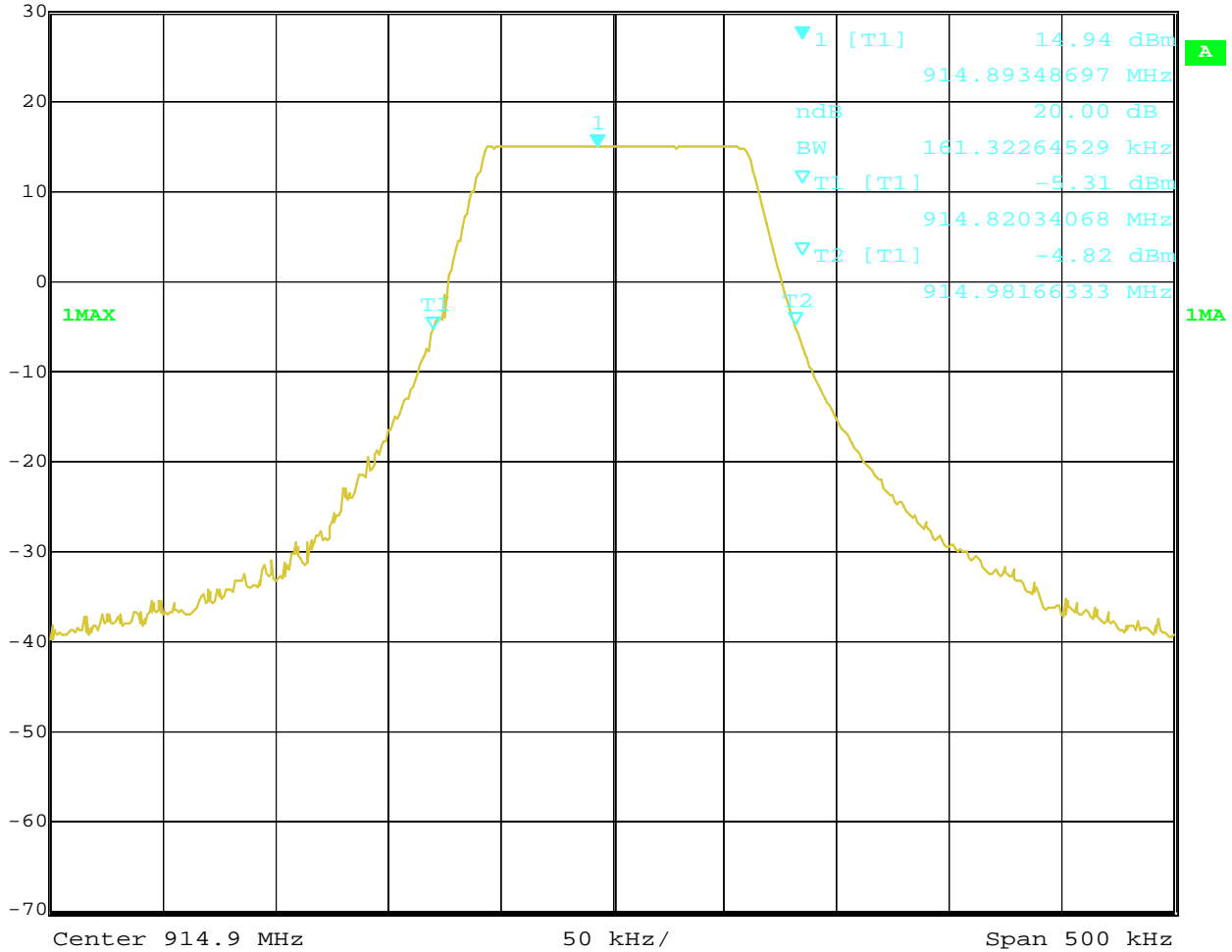
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3. High Channel



Ref Lvl	30 dBm	Marker 1 [T1 ndB]	ndB	20.00 dB	RBW	10 kHz	RF Att	50 dB
		BW	161.32264529 kHz		VBW	30 kHz	Unit	dBm
		SWT	15 ms					



Date: 17.MAY.2022 18:35:23

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8. Maximum Output Power

8.1 Regulation

According to §15.247(b)(2), For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section. According to §15.247(b)(4), The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2 Limits of Maximum Output Power

The Maximum Output Power Measurement is 30dBm.

8.3 Test Procedure

1. Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel; RBW > the 20 dB bandwidth of the emission being measured; VBW = RBW=3MHz; Sweep = Auto; Detector function = PK; Trace = max hold
3. Measure the highest amplitude appearing on spectral display and record the level to calculate results.
4. Repeat above procedures until all frequencies measured were complete.

Note: The PK power were measured

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8.4 Test Results

EUT	Outdoor LoraWAN Gateway		Model	DSGW-010C
Mode	Keep Transmitting		Input Voltage	DC48V
Temperature	24 deg. C,		Humidity	56% RH
Channel	Channel Frequency (MHz)	Max. Power Output (dBm)	Peak Power Limit (dBm)	Pass/ Fail
		PK		
Low	902.3	26.28	30	Pass
Middle	908.7	26.23	30	Pass
High	914.9	26.36	30	Pass

Note: 1. the result basic equation calculation as follow:

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded
3. The **PK** power was measured

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9. Carrier Frequency Separation

9.1 Regulation and Limit

According to §15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

9.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = wide enough to capture the peaks of two adjacent channels: Resolution (or IF) Bandwidth (RBW) \geq 1% of the span; Video (or Average) Bandwidth (VBW) \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold
3. Measure the separation between the peaks of the adjacent channels using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.

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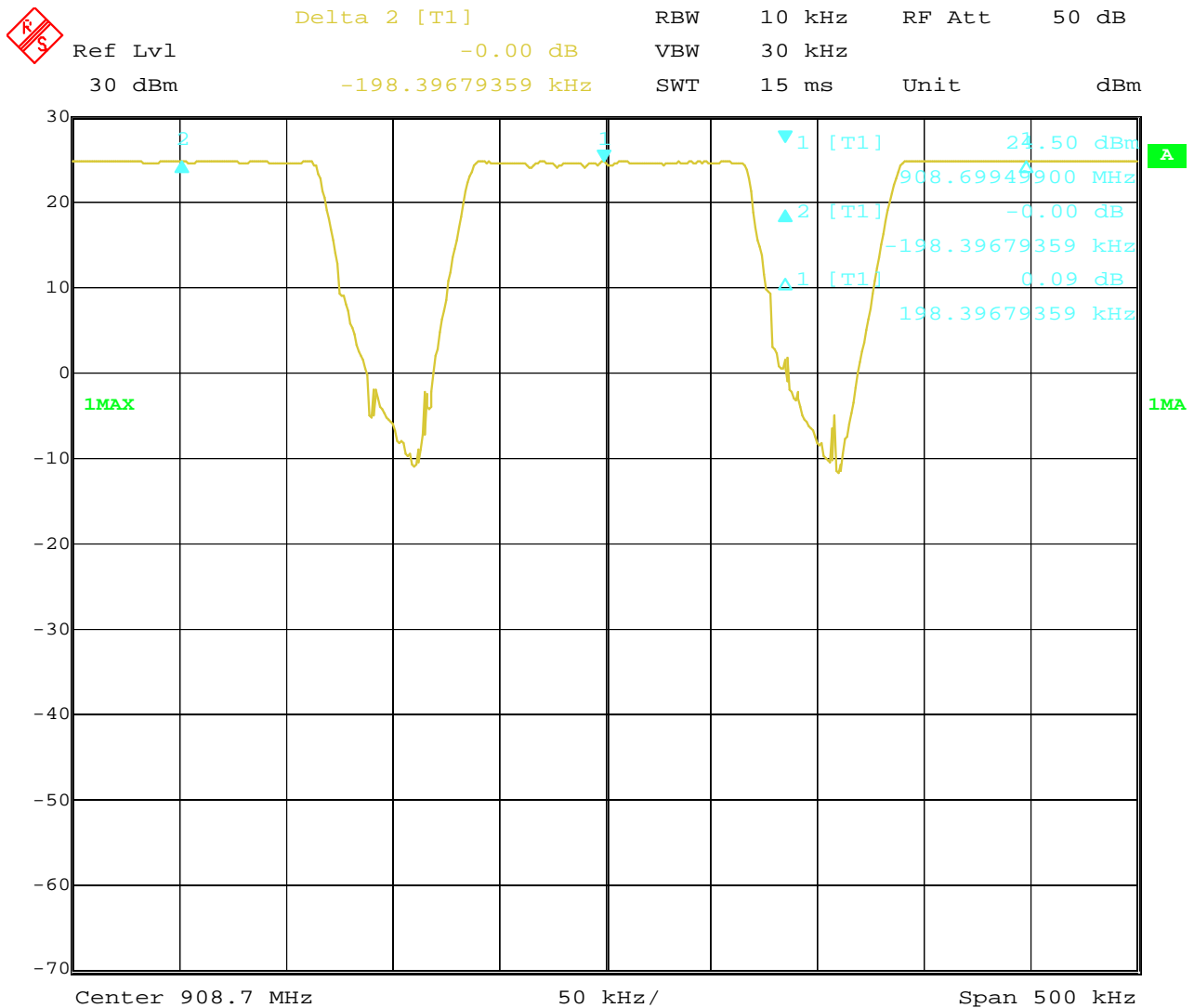
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9.4 Test Result

EUT	Outdoor LoraWAN Gateway	Model	DSGW-010C
Mode	Hopping On	Input Voltage	DC48V
Temperature	24 deg. C,	Humidity	56% RH
Carrier Frequency Separation		Limit	Pass/ Fail
198kHz		≥ 20 dB bandwidth (161kHz Maximum)	Pass

Test Plots



Date: 16.APR.2022 15:06:15

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10. Number of Hopping Channels

10.1 Regulation and Limit

According to §15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

10.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = the frequency band of operation; RBW=100 kHz, VBW=300 kHz; Sweep = auto; Detector function = peak; Trace = max hold
3. Record the number of hopping channels.

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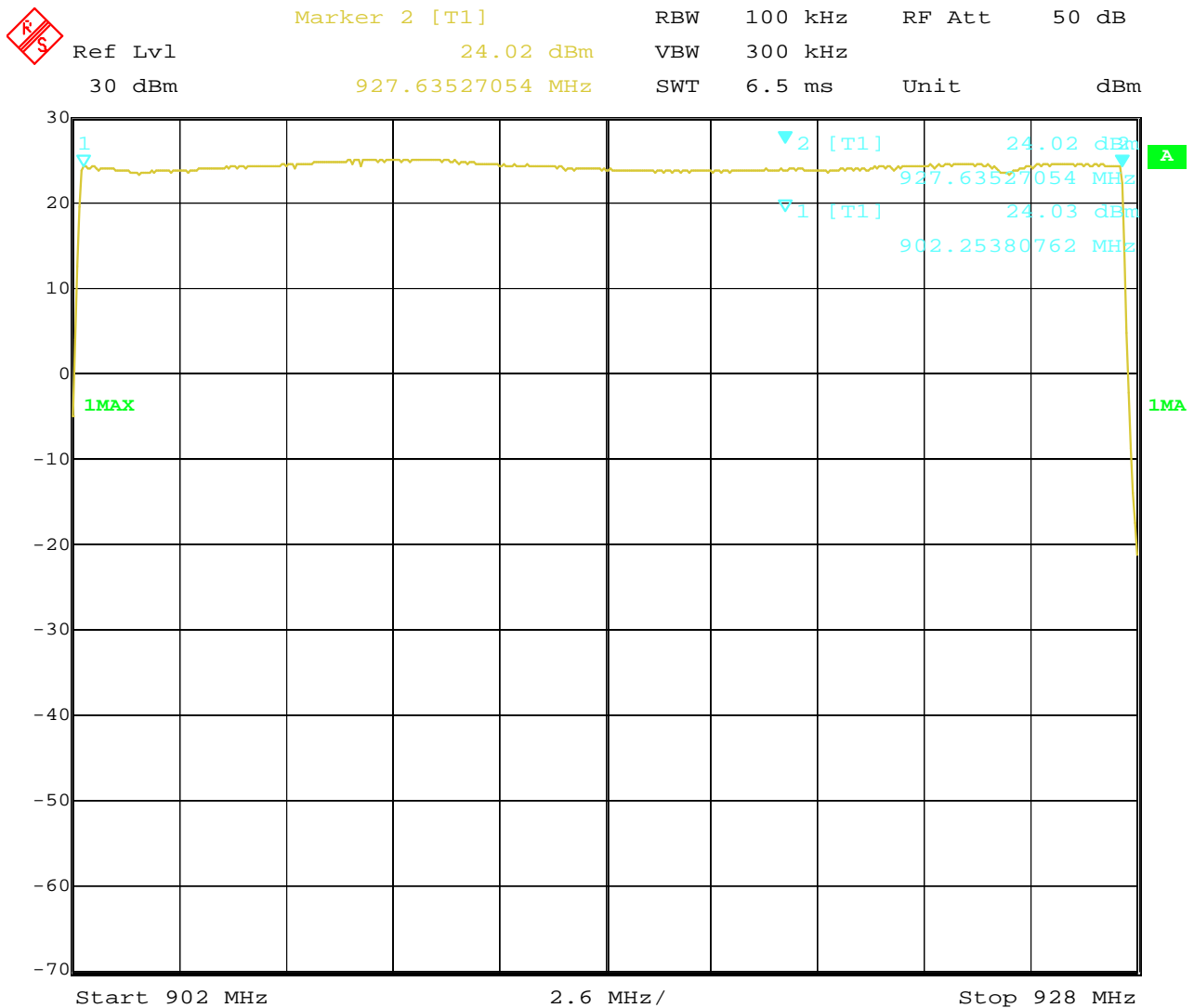
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10.4 Test Result

EUT	Outdoor LoraWAN Gateway	Model	DSGW-010C	
Mode	Hopping On	Input Voltage	DC48V	
Temperature	24 deg. C,	Humidity	56% RH	
Operating Frequency	Number of hopping channels	Limit	Pass/ Fail	
902.3-914.9MHz	64	≥ 50	Pass	

Test Plot



Date: 16.APR.2022 14:02:17

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11. Time of Occupancy (Dwell Time)

11.1 Regulation and Limit

According to §15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

11.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = zero span, centered on a hopping channel; RBW = 0.5 MHz; VBW \geq RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold
3. Measure the dwell time using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.
5. Repeat this test for different modes of operation (e.g., data rate, modulation format, etc.), if applicable.

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11.4 Test Result

EUT	Outdoor LoraWAN Gateway	Model	DSGW-010C
Mode	Keep Transmitting	Input Voltage	DC48V
Temperature	24 deg. C,	Humidity	56% RH
Channel	Dwell Time (s)	Limit (s)	Verdict
Low	0.289s	$\leq 0.4s$	Pass

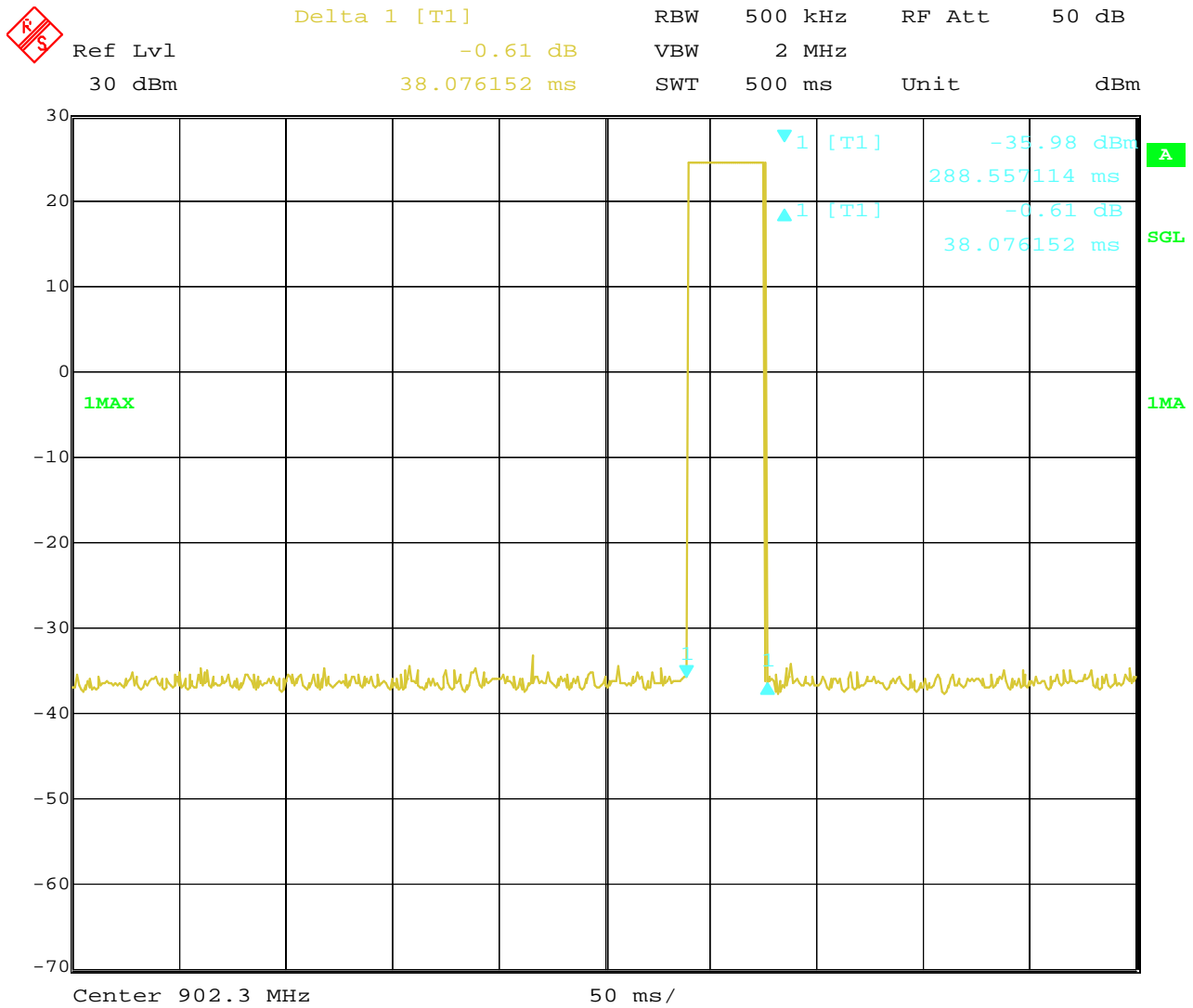
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Test Plots:

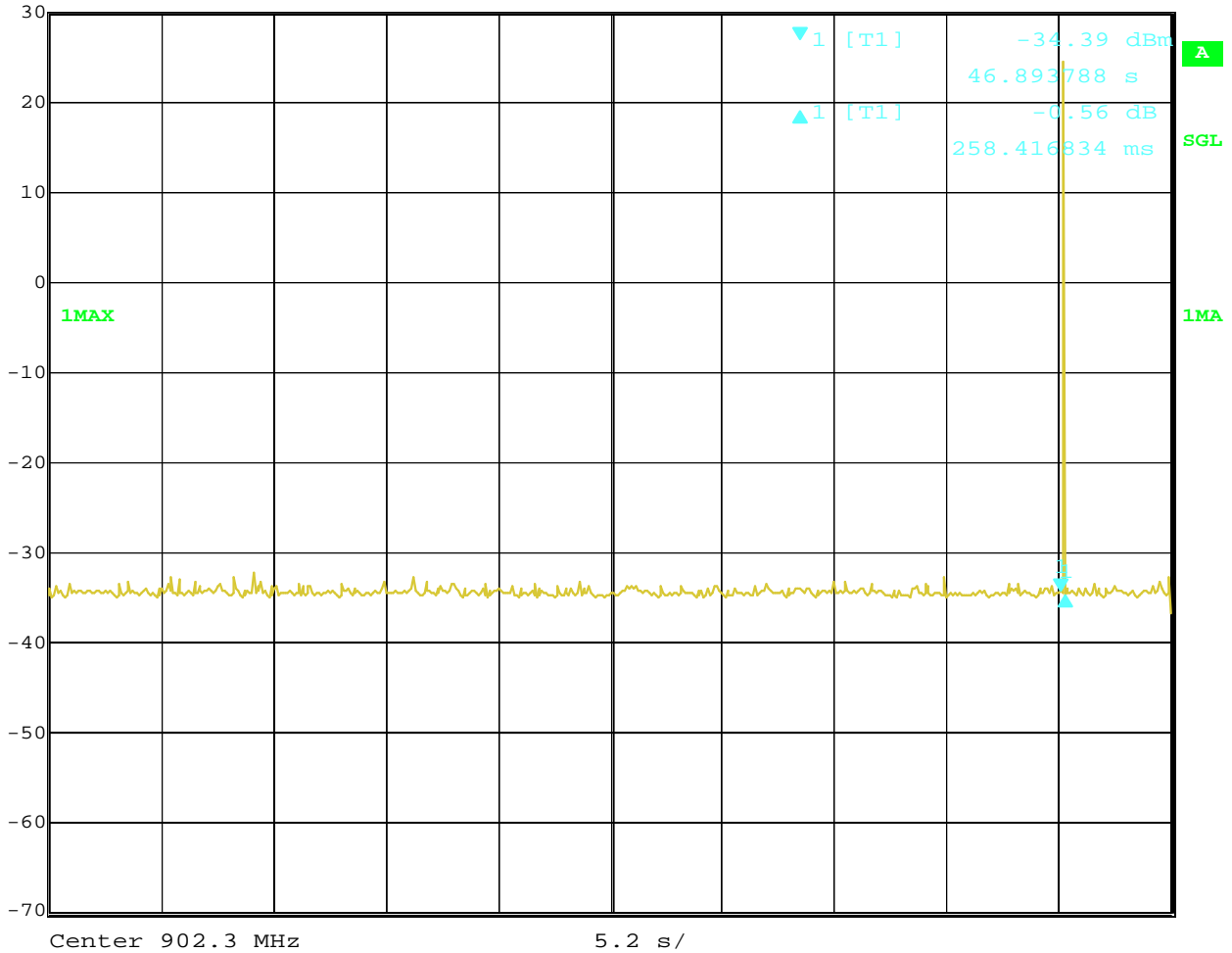


Date: 20.APR.2022 15:35:06

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	Delta 1 [T1]	RBW	500 kHz	RF Att	50 dB
Ref Lvl	-0.56 dB	VBW	2 MHz		
30 dBm	258.416834 ms	SWT	52 s	Unit	dBm



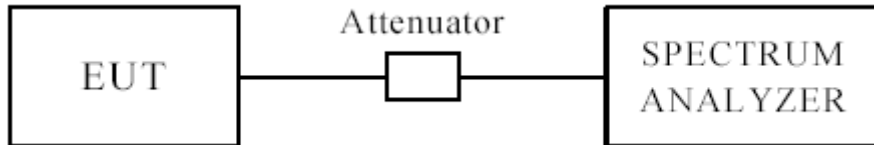
Date: 20.APR.2022 19:49:23

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12 Out of Band Measurement

12.1 Test Setup



The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup

12.2 Limits of Out of Band Emissions Measurement

1. Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

12.3 Test Procedure

For signals in the restricted bands above and below the 902-928MHz allocated band a measurement was made of Radiated emission test. (QP values with RBW=100kHz, VBW=300kHz and QK detector.)

For bandage test, the spectrum set as follows: RBW=100 kHz, VBW=300 kHz. A conducted measurement used

Note: 1. For band-edge measurement, the frequency from 30MHz-10GHz was tested. And It met the FCC rule.

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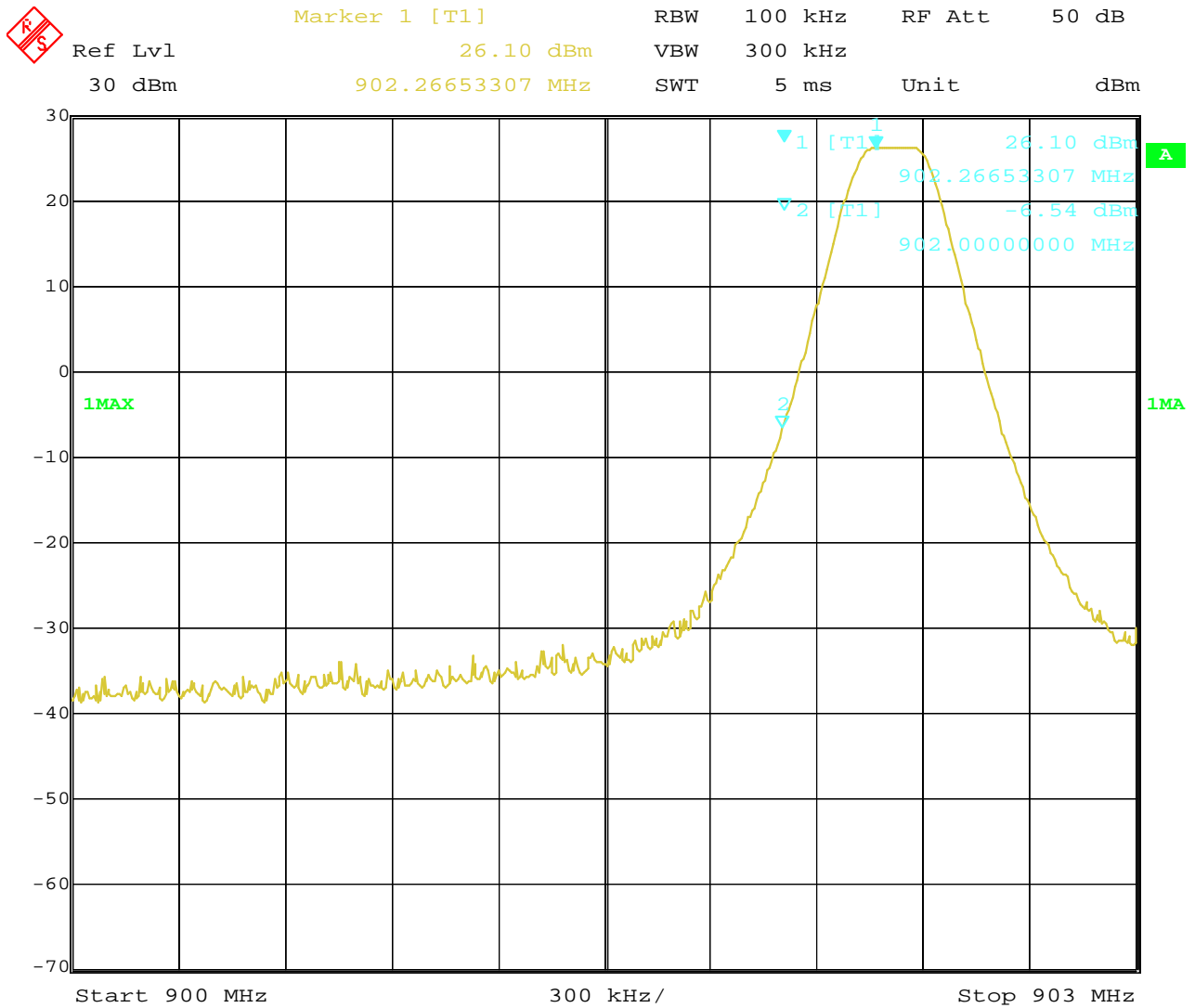
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12.4 Band Edge Test Result

Product:	Outdoor LoraWAN Gateway	Test Mode:	DSGW-010C
Mode	Keeping Transmitting	Input Voltage	DC48V
Temperature	24 deg. C	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Date: 19.APR.2022 10:13:43

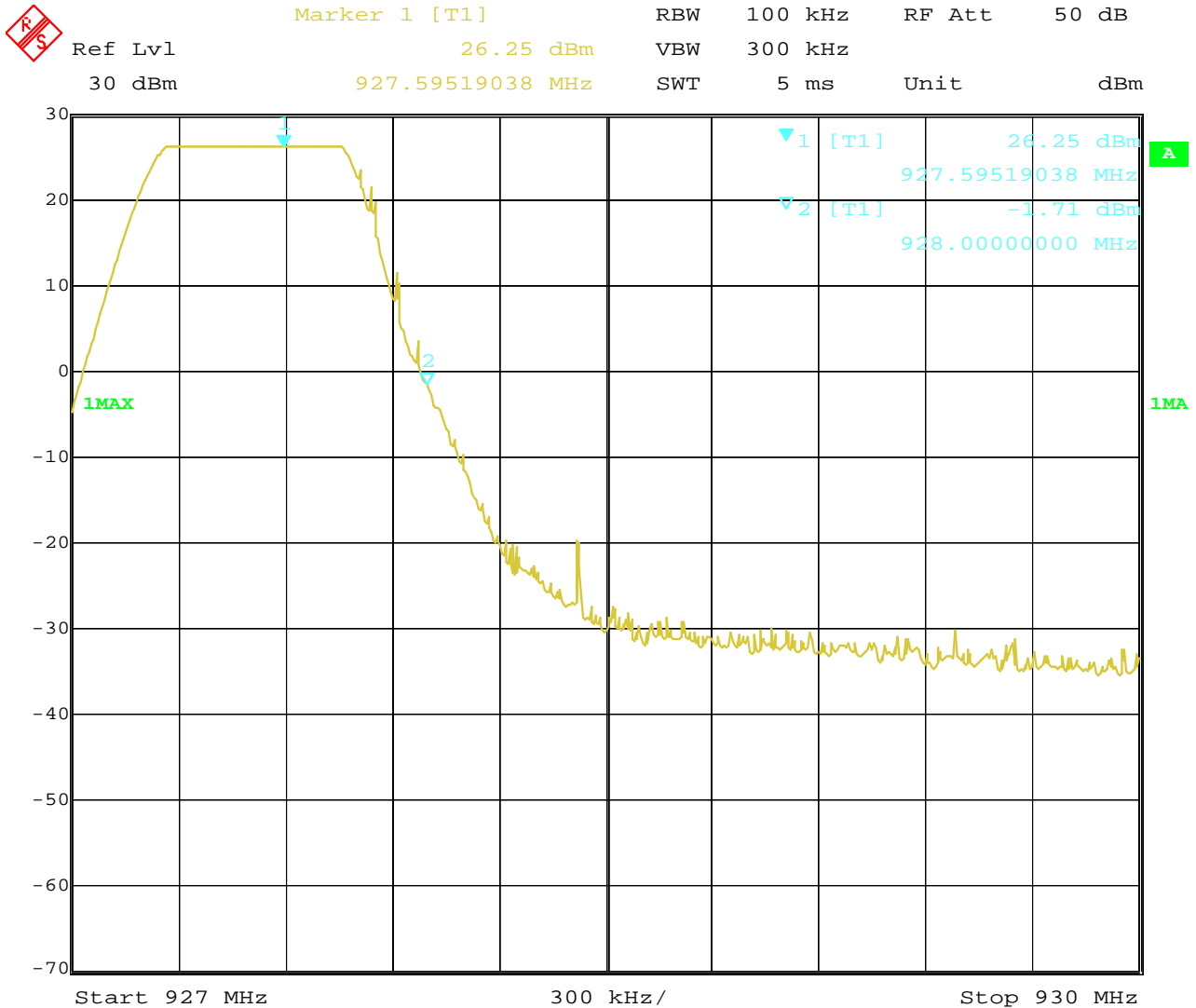
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12.4 Band Edge Test Result

Product:	Outdoor LoraWAN Gateway	Test Mode:	DSGW-010C
Mode	Keeping Transmitting	Input Voltage	DC48V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Date: 19.APR.2022 10:15:08

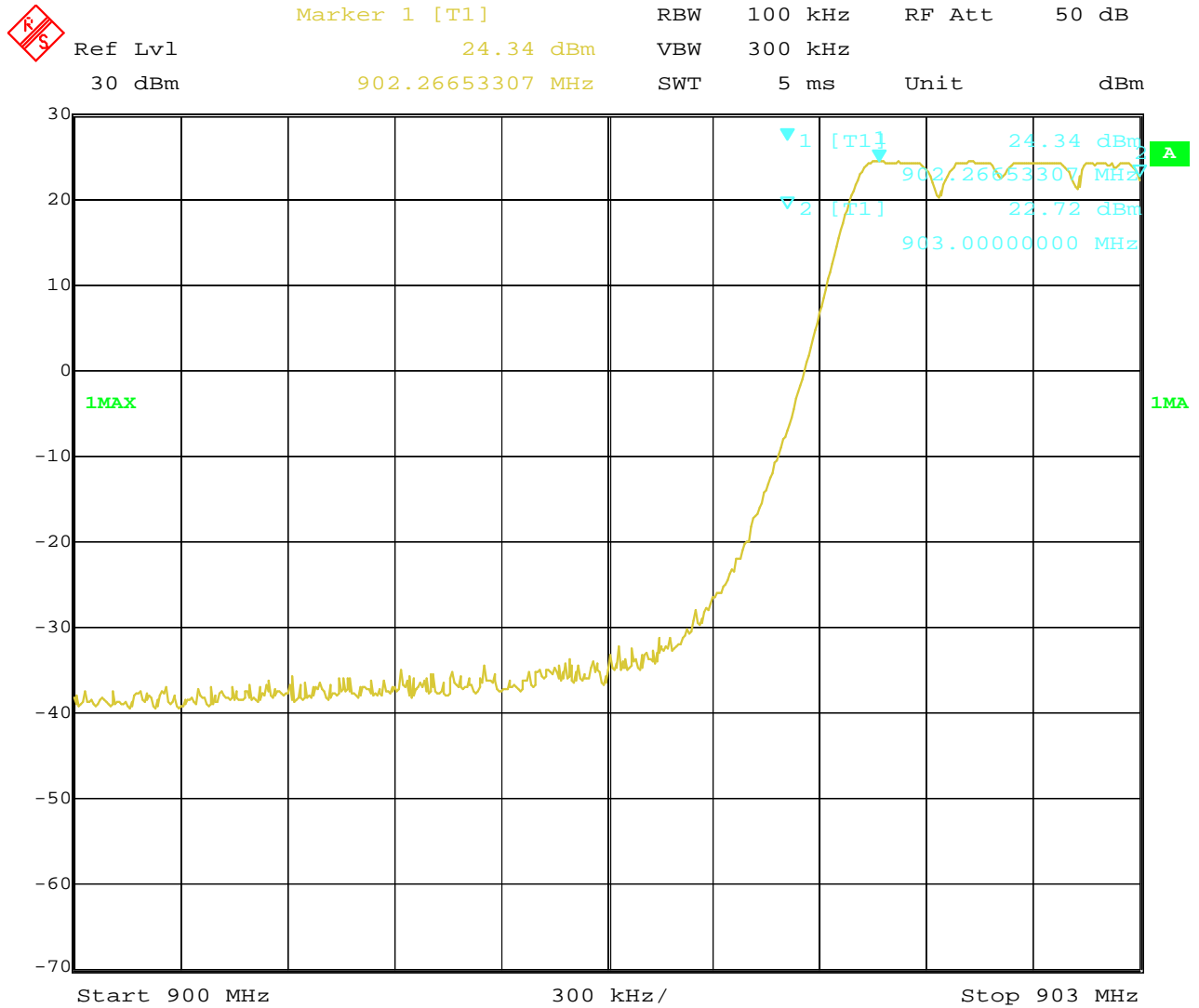
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12.4 Band Edge Test Result

Product:	Outdoor LoraWAN Gateway	Test Mode:	DSGW-010C
Mode	Hopping On	Input Voltage	DC48V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Date: 19.APR.2022 10:28:23

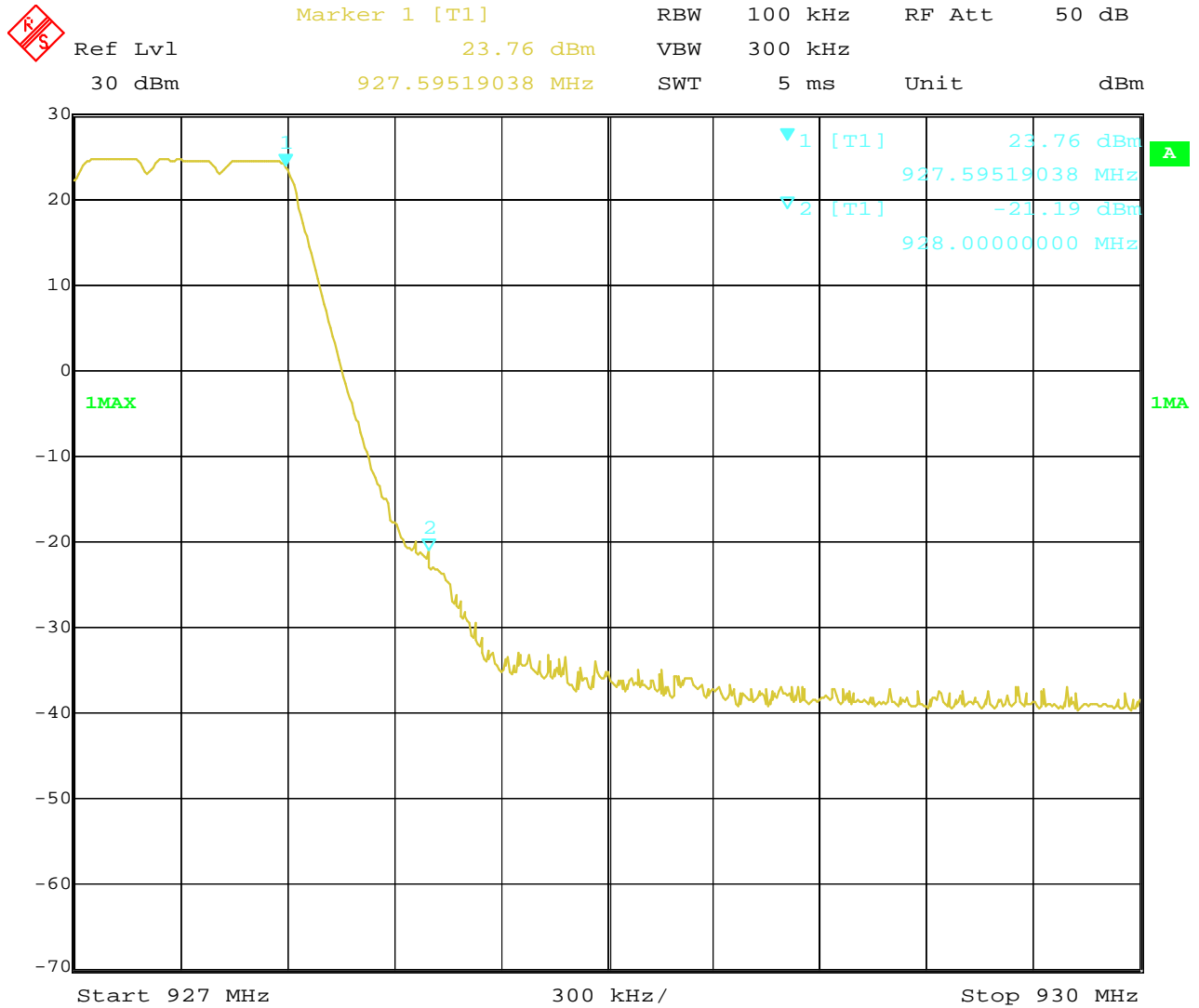
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12.4 Band Edge Test Result

Product:	Outdoor LoraWAN Gateway	Test Mode:	DSGW-010C
Mode	Hopping On	Input Voltage	DC48V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Date: 19.APR.2022 10:22:30

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12.4 Restricted band Measurement

EUT	Outdoor LoraWAN Gateway		Model	DSGW-010C
Mode	Keeping Transmitting		Test Voltage	DC48V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	QP
Low Channel, Horizontal				
614	PK (dB μ V/m)	26.35	Limit	46(dB μ V/m)
Low Channel, Vertical				
614	PK (dB μ V/m)	26.75	Limit	46(dB μ V/m)

12.4 Restricted band Measurement

EUT	Outdoor LoraWAN Gateway		Model	DSGW-010C
Mode	Keeping Transmitting		Test Voltage	DC48V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	QP
High Channel, Horizontal				
960	PK (dB μ V/m)	26.59	Limit	46(dB μ V/m)
High Channel, Vertical				
960	PK (dB μ V/m)	26.72	Limit	46(dB μ V/m)

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13.0 Antenna Requirement

13.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

13.2 Antenna Connected constructions

External Antenna with Reverse polarity N connector used. The gain of the antennas is 1.1dBi (Declared by the manufacturer)

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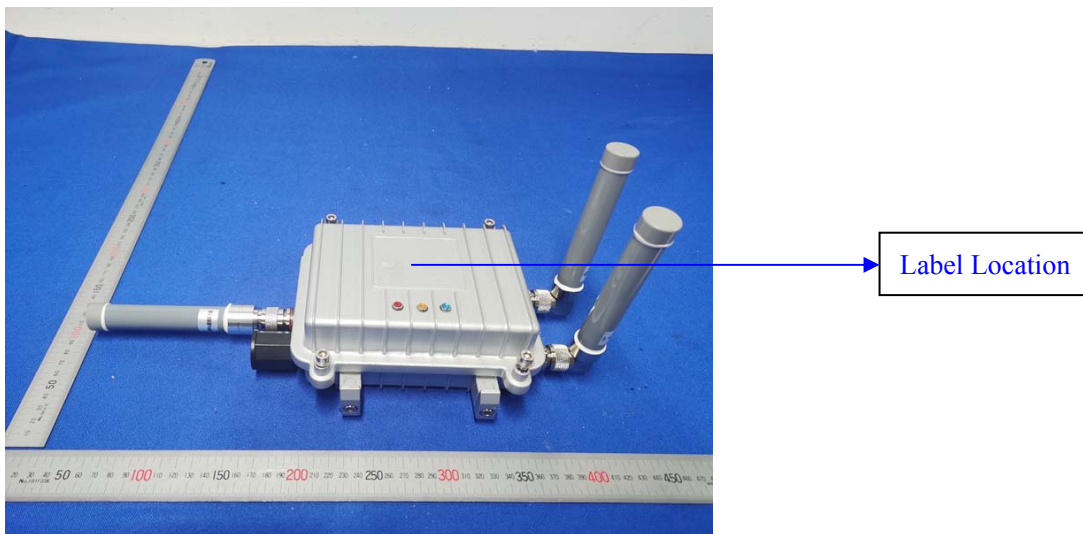
14.0 FCC ID Label

FCC ID: 2AUXBDSGW-010C

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Mark Location:



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15.0 Photo of testing

Conducted Emission Test Setup:



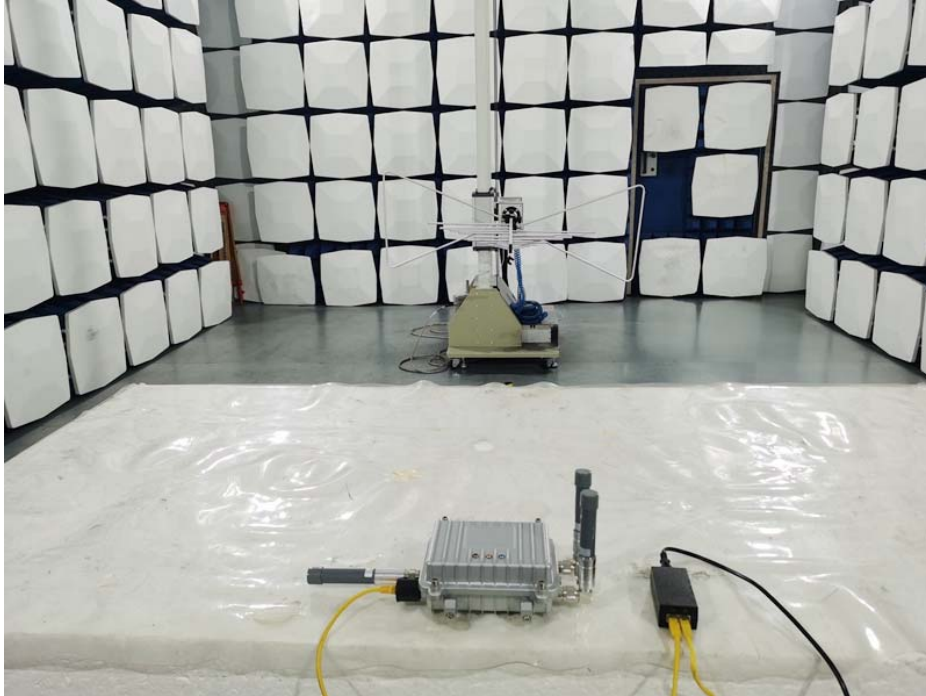
The report refers only to the sample tested and does not apply to the bulk.

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Radiated Emission Test Setup:



Photographs – EUT

Please refer test report TW2203419-01E

-End of the report-

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