

FCC Test Report

Product Name : LoRa Module
Trade Name : Kiwi Technology Inc.
Model No. : TLM922S-P01A
FCC ID. : 2AKIBTLM922S

Applicant : Kiwi Technology Inc.

Address : 4F, No. 158, Sec. 1, Wenxing Rd., Zhubei City,
Hsinchu County, Taiwan

Date of Receipt : Jul. 19, 2017
Issued Date : Aug. 28, 2017
Report No. : 1770259R-RFUSP25V00
Report Version : V1.0



The test results relate only to the samples tested.

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Test Report Certification

Issued Date : Aug. 28, 2017

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Applicant : Kiwi Technology Inc.

Address : 4F, No. 158, Sec. 1, Wenxing Rd., Zhubei City, Hsinchu
County, Taiwan

Manufacturer : Kiwi Technology Inc.

Model No. : TLM922S-P01A

FCC ID. : 2AKIBTLM922S

EUT Voltage : DC 5V

Testing Voltage : DC 5V

Trade Name : Kiwi Technology Inc.

Applicable Standard : FCC CFR Title 47 Part 15 Subpart C Section 15.247: 2015
ANSI C63.10: 2013

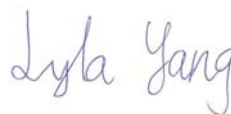
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Test Result : Complied

Documented By

:



(Lyla Yang / Engineering Adm. Specialist)

Tested By

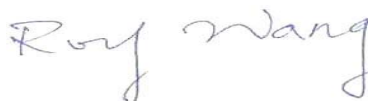
:



(Scott Chang / Engineer)

Approved By

:



(Roy Wang / Director)

Revision History

Report No.	Version	Description	Issued Date
1770259R-RFUSP25V00	V1.0	Initial issue of report	Aug. 28, 2017

Laboratory Information

We, **DEKRA Testing and Certification Co., Ltd.**, are an independent RF consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted (audited or listed) by the following related bodies in compliance with ISO 17025 specified testing scopes:

Taiwan R.O.C.	:	TAF, Accreditation Number: 3024
USA	:	FCC, Registration Number: 0007939127
Canada	:	IC, Submission No: 181665 / IC Registration Number: 22397-1 / 22397-2 / 22397-3

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site :

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site : http://www.dekra.com.tw/index_en.aspx

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1. General Information

1.1. EUT Description

Product Name	LoRa Module
Trade Name	Kiwi Technology Inc.
Model No.	TLM922S-P01A
Frequency Range	923.3~927.5MHz
Channel Number	8 Channels
Type of Modulation	DSSS

Antenna Information			
Manufacturer	Part No.	Antenna Type	Peak Gain
1. ARISTOTLE	RFA-WAVE-C55-U-B70	Dipole Antenna	2dBi
2. GSC Technology Corp	SP-12G0228GT01-03	Omni Fiberglass Antenna	8dBi

Working Frequency of Each Channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00	923.3 MHz	Channel 01	923.9 MHz	Channel 02	924.5 MHz	Channel 03	925.1 MHz
Channel 04	925.7 MHz	Channel 05	926.3 MHz	Channel 06	926.9 MHz	Channel 07	927.5 MHz

Note:

1. This device is a LoRa Module including 923.3~927.5 MHz transmitting.
2. Regards to the frequency band operation; the lowest 、middle and highest frequency of channel were selected to perform the test, and then shown on this report.
3. This device is module.

1.2. Test Mode

DEKRA has verified the construction and function in typical operation. The preliminary tests were performed in different data rate, and to find the worst condition, which was shown in this test report. The following table is the final test mode.

TX	Mode 1: Tx_ANT1 Mode 2: Tx_ANT2
----	------------------------------------

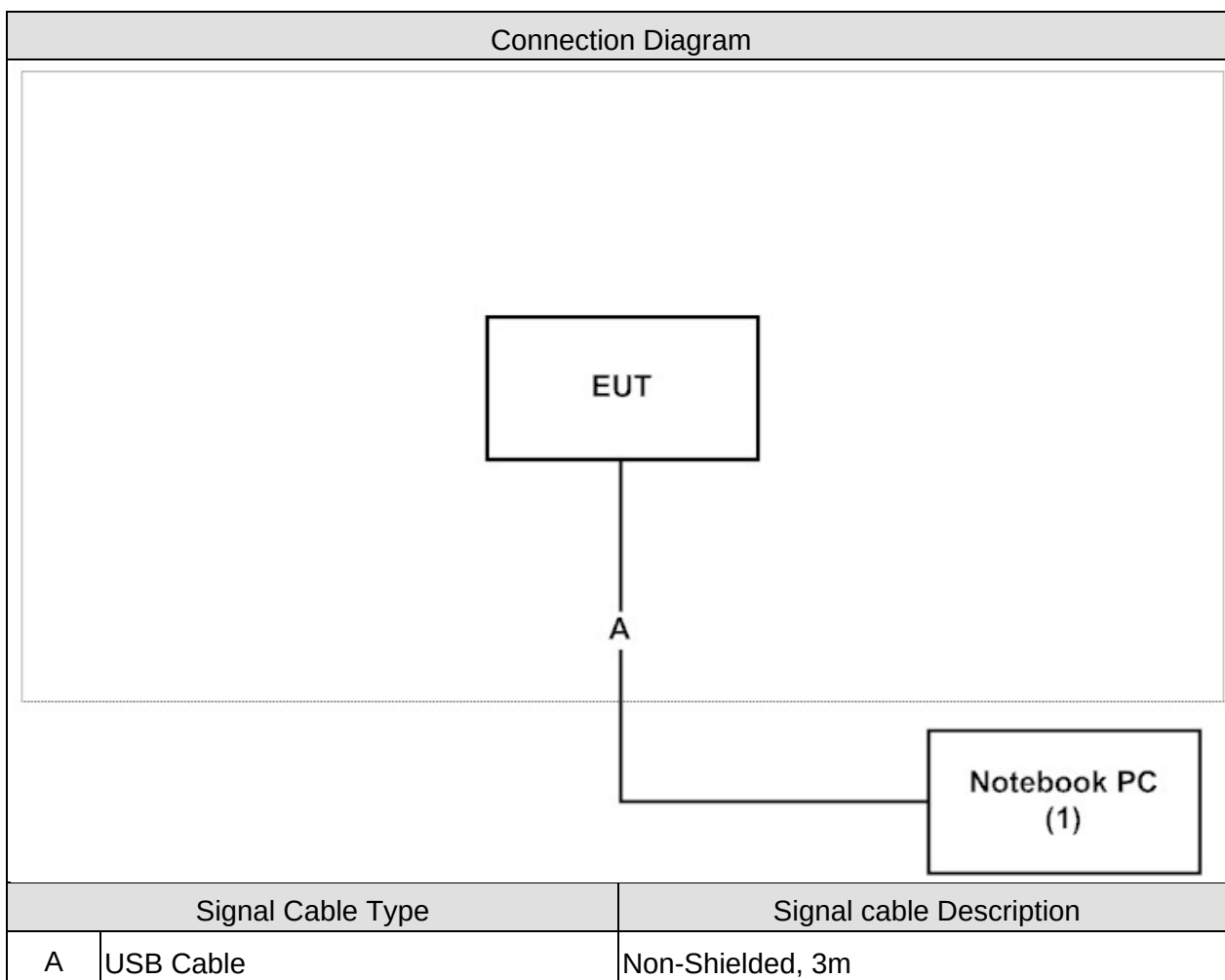
Test Items	Channel	Antenna	Result
Conducted Emission	3	1/2	N/A
Peak Power Output	0/3/8	1/2	Complies
Radiated Emission	0/3/8	1/2	Complies
RF antenna conducted test	0/3/8	1/2	Complies
Radiated Emission Band Edge	0/3/8	1/2	Complies
DTS Bandwidth	0/3/8	1/2	Complies
Occupied Bandwidth	0/3/8	1/2	Complies
Power Density	0/3/8	1/2	Complies

1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	FCC ID	Power Cord
1. Notebook PC	ACER	MS2296	LUSCV021391 150332C2000	DoC	Non-Shielded, 2.5m one ferrite core bonded.

1.4. Configuration of tested System



1.5. EUT Exercise Software

1	Setup the EUT as shown in Section 1.4.
2	Execute the test program "Kiwi –tec TML922S FCC test Program".
3	Configure the test mode, the test channel, and the data rate.
4	Press "Start TX" to start the continuous transmitting.
5	Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Required (IEC 68-1)	Actual	Test Site
Temperature (°C)	FCC PART 15 C 15.207 Conducted Emission	15 - 35	20°C	--
Humidity (%RH)		25 - 75	50%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	
Temperature (°C)	FCC PART 15 C 15.247 Peak Power Output	15 - 35	25°C	3
Humidity (%RH)		25 - 75	45%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	
Temperature (°C)	FCC PART 15 C 15.247 Radiated Emission	15 - 35	25°C	2
Humidity (%RH)		25 - 75	65%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	
Temperature (°C)	FCC PART 15 C 15.247 RF antenna conducted test	15 - 35	25°C	3
Humidity (%RH)		25 - 75	45%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	
Temperature (°C)	FCC PART 15 C 15.247 Band Edge	15 - 35	25°C	2
Humidity (%RH)		25 - 75	48%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	
Temperature (°C)	FCC PART 15 C 15.247 DTS Bandwidth	15 - 35	25°C	3
Humidity (%RH)		25 - 75	45%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	
Temperature (°C)	FCC PART 15 C 15.247 Occupied Bandwidth	15 - 35	25°C	3
Humidity (%RH)		25 - 75	45%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	
Temperature (°C)	FCC PART 15 C 15.247 Power Density	15 - 35	25°C	3
Humidity (%RH)		25 - 75	45%RH	
Barometric pressure (mbar)		860 - 1060	950-1000	

Note: Test Site information refers to Laboratory Information.

2. Conducted Emission

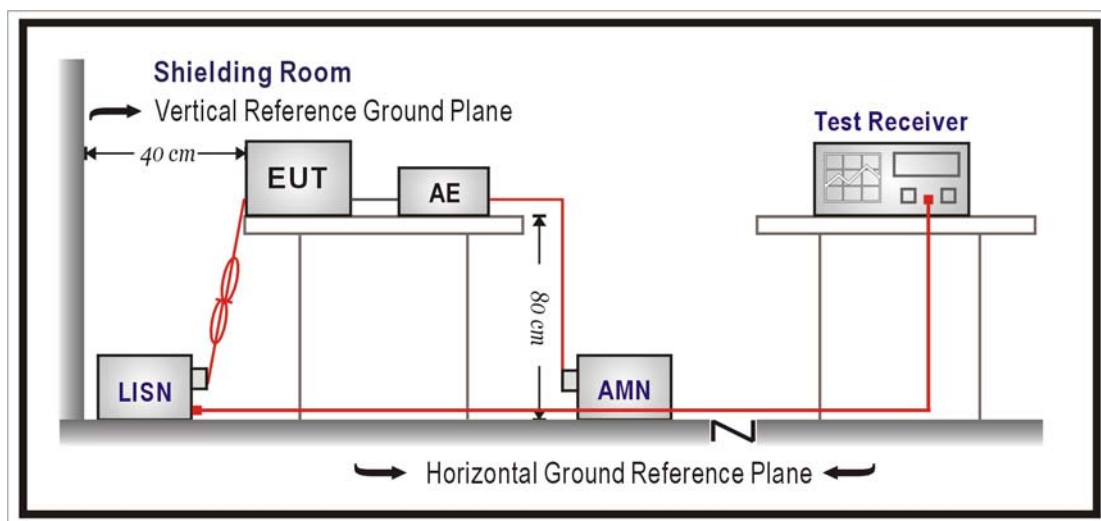
2.1. Test Equipment

The following test equipments are used during the test:

Conducted Emission / SR2-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Artificial Mains Network	R&S	ENV4200	848411/010	2017/02/06	2018/02/05
Test Receiver	R&S	ESCS 30	836858/022	2017/04/12	2018/04/11
LISN	R&S	ENV216	100092	2017/07/31	2018/07/30

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 Limits (dBuV)		
Frequency MHz	QP	AV
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Remark: In the above table, the tighter limit applies at the band edges.

2.4. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs.)

Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

2.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.207: 2015

2.6. Uncertainty

The measurement uncertainty is defined as ± 2.26 dB.

2.7. Test Result

This device is module don't need test this test item.

3. Peak Power Output

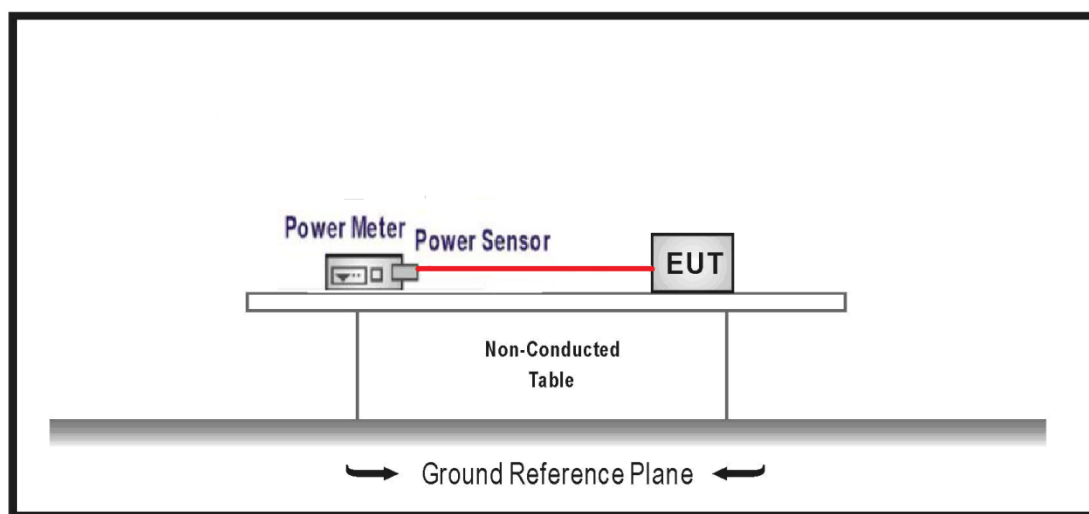
3.1. Test Equipment

The following test equipments are used during the test:

Peak Power Output / SR10-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
High Speed Peak Power Meter Dual Input	Anritsu	ML2496A	1602004	2017/01/20	2018/01/19
Pulse Power Sensor	Anritsu	MA2411B	1531043	2017/01/20	2018/01/19
Pulse Power Sensor	Anritsu	MA2411B	1531044	2017/01/20	2018/01/19

3.2. Test Setup



3.3. Test procedures

The EUT was tested according to DTS test procedure section 9.1.2 of KDB558074 D01 V04 measurement to FCC 47CFR 15.247 requirements.

3.4. Limits

The maximum peak power shall be less 1 Watt.

3.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247: 2015

3.6. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB.

3.7. Test Result

Product	LoRa Module		
Test Item	Peak Power Output		
Test Mode	Mode 1: Tx_ANT1		
Date of Test	2017/03/23	Test Site	SR10-H

Frequency (MHz)	Measure Level (dBm)	Limit (dBm)
923.3	16.81	≤ 30
925.1	16.64	≤ 30
927.5	16.71	≤ 30

4. Radiated Emission

4.1. Test Equipment

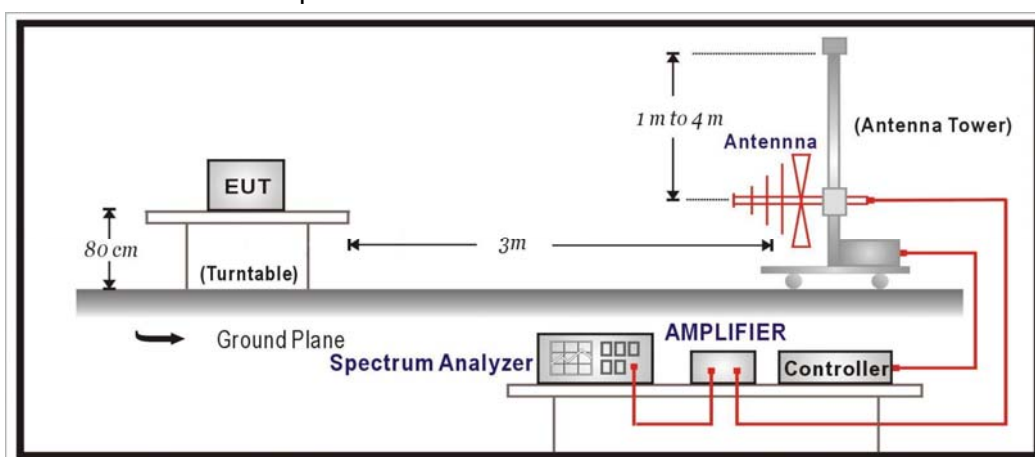
The following test equipments are used during the test:

Radiated Emission / CB4-H

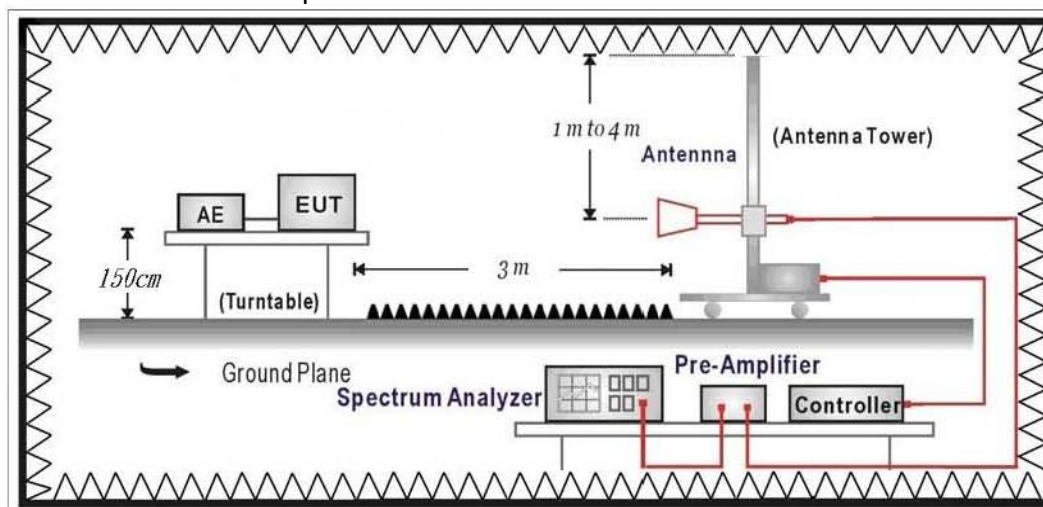
Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal Analyzer	R&S	FSVA40	101455	2016/11/28	2017/11/27
Signal & Spectrum Analyzer	R&S	FSV40	101049	2017/01/23	2018/01/22
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2017/03/13	2018/03/12
Bilog Antenna	Teseq	CBL6112D	23191	2017/06/28	2018/06/27
Horn Antenna	Schwarzbeck	BBHA 9120D	639	2017/06/14	2018/06/13
Horn Antenna	Schwarzbeck	BBHA 9170	203	2016/08/29	2017/08/28
Pre-Amplifier	RF Bay Inc.	LNA-1330	12162511	2017/03/09	2018/03/08
Pre-Amplifier	EMCI	EMCI 1830I	980366	2017/01/23	2018/01/22
Pre-Amplifier	MITEQ	JS44-45-8P	2014754	2016/12/26	2017/12/25

4.2. Test Setup

Under 1GHz Test Setup:



Above 1GHz Test Setup:



4.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	dBuV/m	dBuV/m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

Remarks: E field strength (dBuV/m) = 20 log E field strength (uV/m)

4.4. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 D01 V04 for compliance to FCC 47CFR 15.247 requirements. The EUT and its simulators are placed on a turn table which is 1.5 meter above ground (under 1GHz) or 1.5 meter above ground (above 1GHz). The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10 on radiated measurement.

On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a quasi-peak detector function and on any frequency or frequencies above 1000 MHz the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit. The bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

4.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247: 2015

4.6. Uncertainty

The measurement uncertainty

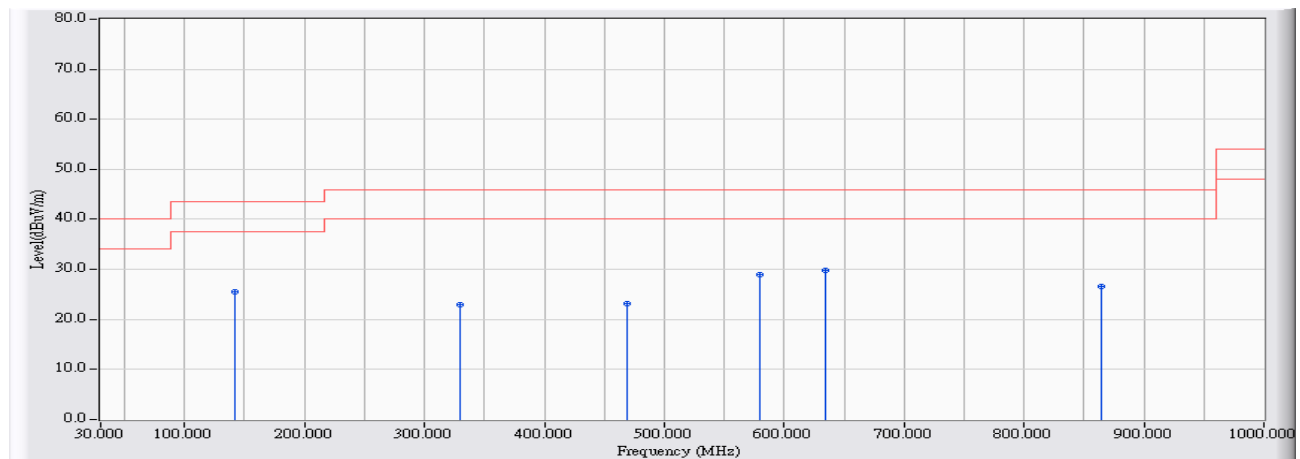
30MHz~1GHz as $\pm 3.43\text{dB}$

1GHz~26.5Ghz as $\pm 3.65\text{dB}$

4.7. Test Result

30MHz-1GHz Spurious

Site : CB4-H	Time : 2017/08/09
Limit : FCC_CLASS_B_03M_QP	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_925.1MHz

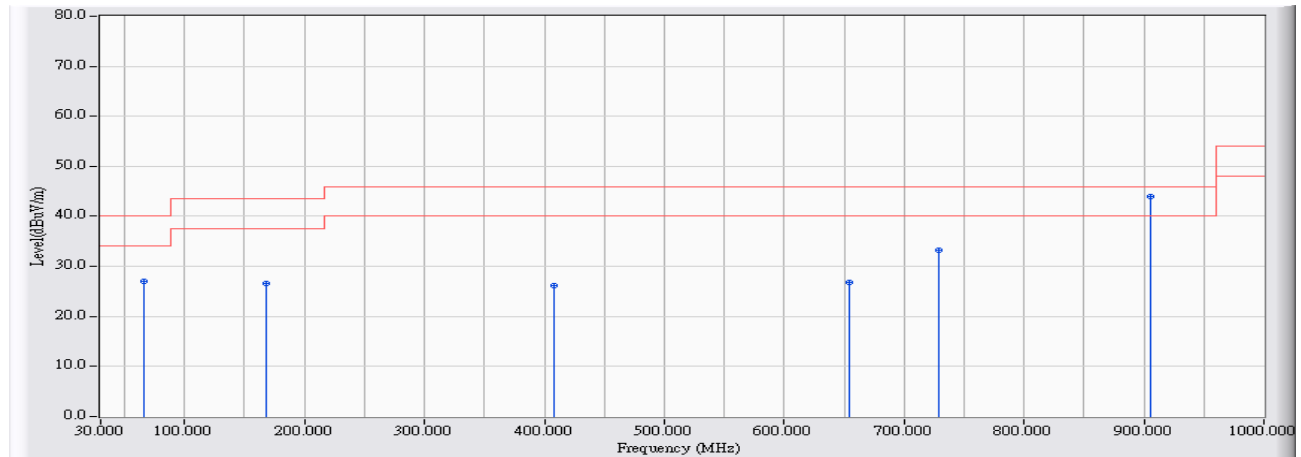


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		141.442	-20.953	46.484	25.531	-17.969	43.500	QUASIPeAK
2		329.215	-19.301	42.257	22.956	-23.044	46.000	QUASIPeAK
3		468.396	-16.126	39.325	23.199	-22.801	46.000	QUASIPeAK
4		579.838	-14.585	43.527	28.942	-17.058	46.000	QUASIPeAK
5	*	634.153	-14.089	43.936	29.847	-16.153	46.000	QUASIPeAK
6		864.214	-11.540	38.130	26.591	-19.409	46.000	QUASIPeAK

Note:

1. All Reading Levels are Quasi-Peak value.
2. “ * ”, means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB4-H	Time : 2017/08/09
Limit : FCC_CLASS_B_03M_QP	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_925.1MHz

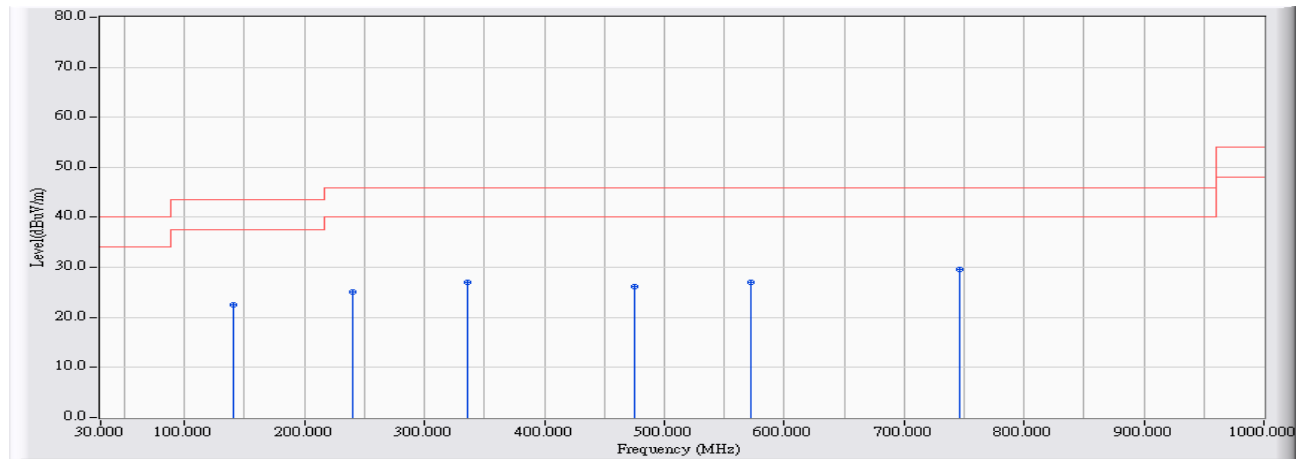


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		66.274	-24.833	51.797	26.964	-13.036	40.000	QUASIPeAK
2		167.920	-23.001	49.510	26.509	-16.991	43.500	QUASIPeAK
3		407.874	-17.157	43.252	26.094	-19.906	46.000	QUASIPeAK
4		654.327	-13.891	40.735	26.844	-19.156	46.000	QUASIPeAK
5		729.397	-13.193	46.451	33.258	-12.742	46.000	QUASIPeAK
6	*	905.531	-11.064	54.941	43.877	-2.123	46.000	QUASIPeAK

Note:

1. All Reading Levels are Quasi-Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB4-H	Time : 2017/08/09
Limit : FCC_CLASS_B_03M_QP	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_925.1MHz

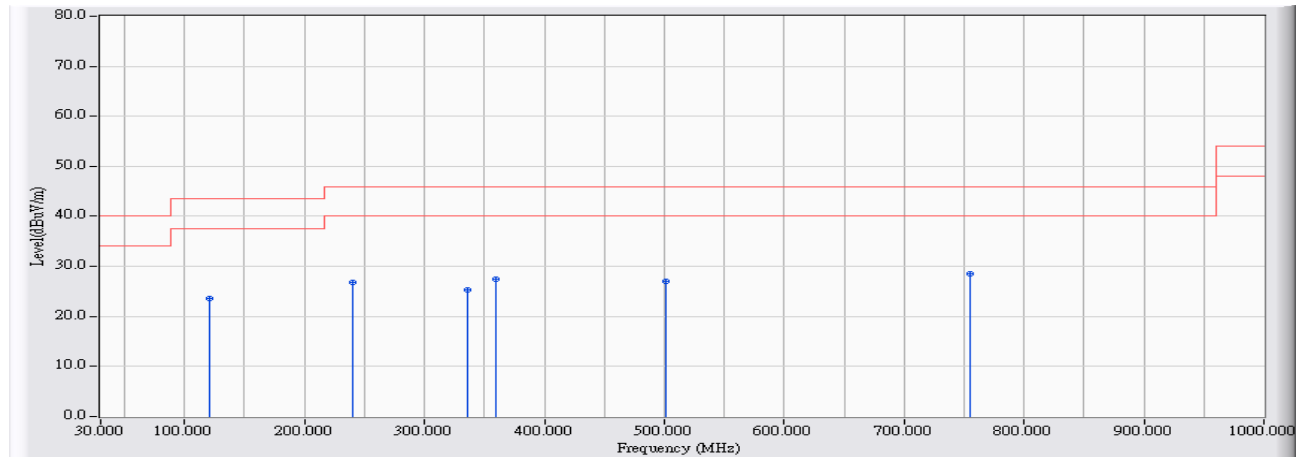


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		140.666	-20.955	43.536	22.581	-20.919	43.500	QUASIPeAK
2		239.887	-21.344	46.370	25.026	-20.974	46.000	QUASIPeAK
3		335.810	-19.148	46.207	27.059	-18.941	46.000	QUASIPeAK
4		475.476	-15.888	42.015	26.127	-19.873	46.000	QUASIPeAK
5		571.594	-14.638	41.600	26.962	-19.038	46.000	QUASIPeAK
6	*	746.273	-12.967	42.493	29.527	-16.473	46.000	QUASIPeAK

Note:

1. All Reading Levels are Quasi-Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB4-H	Time : 2017/08/09
Limit : FCC_CLASS_B_03M_QP	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_925.1MHz



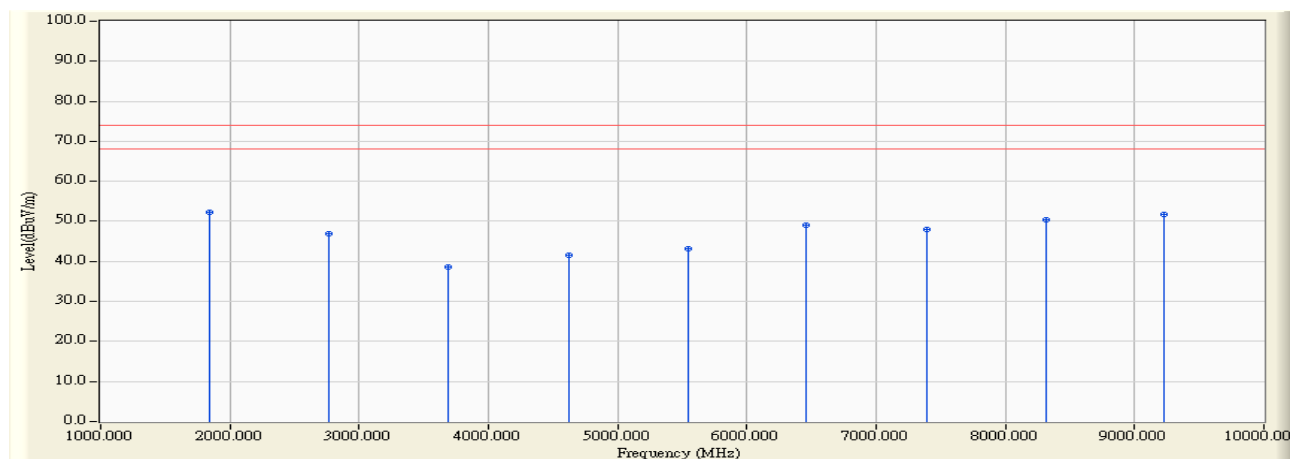
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		121.074	-20.441	44.033	23.592	-19.908	43.500	QUASIPeAK
2		239.887	-21.344	48.050	26.706	-19.294	46.000	QUASIPeAK
3		335.810	-19.148	44.448	25.300	-20.700	46.000	QUASIPeAK
4		359.961	-18.604	45.982	27.378	-18.622	46.000	QUASIPeAK
5		501.082	-15.384	42.501	27.117	-18.883	46.000	QUASIPeAK
6	*	754.809	-12.798	41.310	28.512	-17.488	46.000	QUASIPeAK

Note:

1. All Reading Levels are Quasi-Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Above 1GHz Spurious

Site : CB4-H	Time : 2017/08/08
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_A115_EFS_1-18GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_923.3MHz

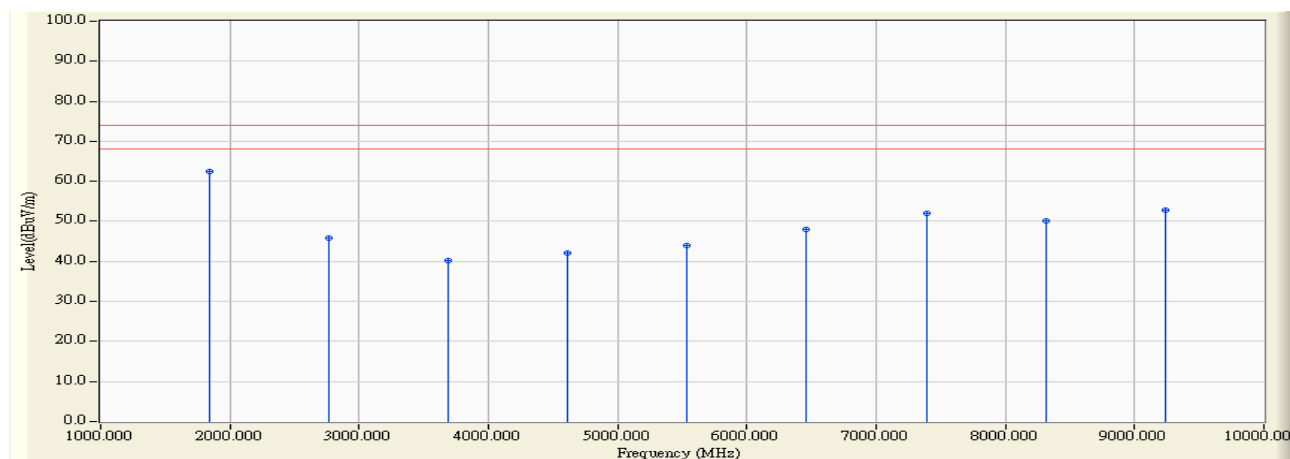


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1846.740	-3.022	55.330	52.308	-21.692	74.000	PEAK
2		2770.500	1.086	45.790	46.876	-27.124	74.000	PEAK
3		3693.090	3.594	34.920	38.514	-35.486	74.000	PEAK
4		4618.500	7.345	34.260	41.605	-32.395	74.000	PEAK
5		5541.155	9.853	33.430	43.283	-30.717	74.000	PEAK
6		6462.190	15.281	33.860	49.140	-24.860	74.000	PEAK
7		7390.600	18.274	29.780	48.054	-25.946	74.000	PEAK
8		8314.105	19.792	30.590	50.382	-23.618	74.000	PEAK
9		9229.525	21.406	30.420	51.825	-22.175	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/08
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_A115_EFS_1-18GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_923.3MHz

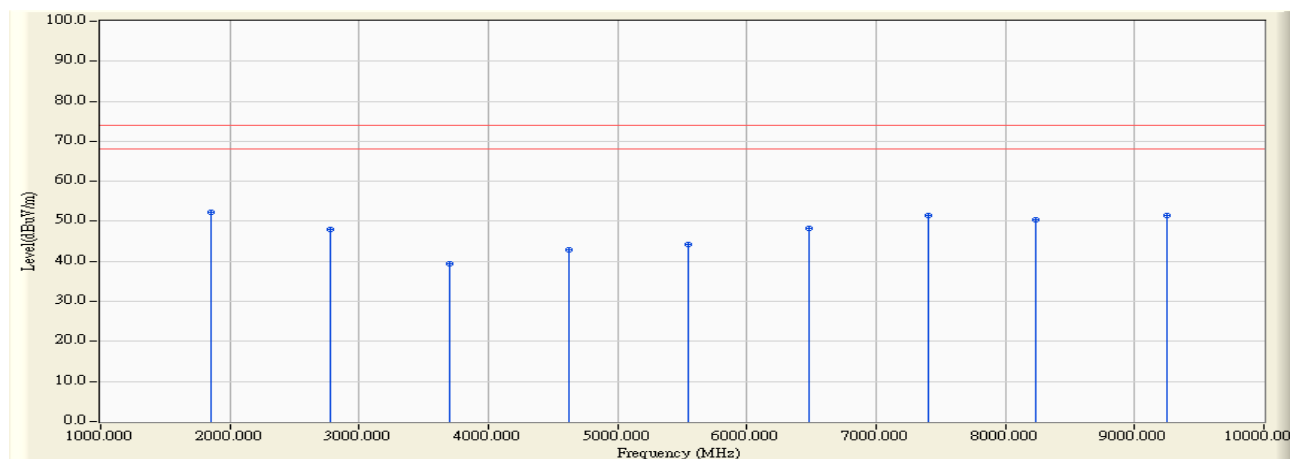


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1846.670	-3.022	65.580	62.557	-11.443	74.000	PEAK
2		2770.530	1.086	44.700	45.786	-28.214	74.000	PEAK
3		3690.360	3.585	36.750	40.335	-33.665	74.000	PEAK
4		4614.370	7.324	34.730	42.054	-31.946	74.000	PEAK
5		5538.585	9.843	34.190	44.033	-29.967	74.000	PEAK
6		6462.465	15.282	32.750	48.033	-25.967	74.000	PEAK
7		7387.330	18.267	33.720	51.987	-22.013	74.000	PEAK
8		8312.140	19.790	30.330	50.119	-23.881	74.000	PEAK
9		9234.225	21.410	31.330	52.740	-21.260	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/08
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_A115_EFS_1-18GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_925.1MHz

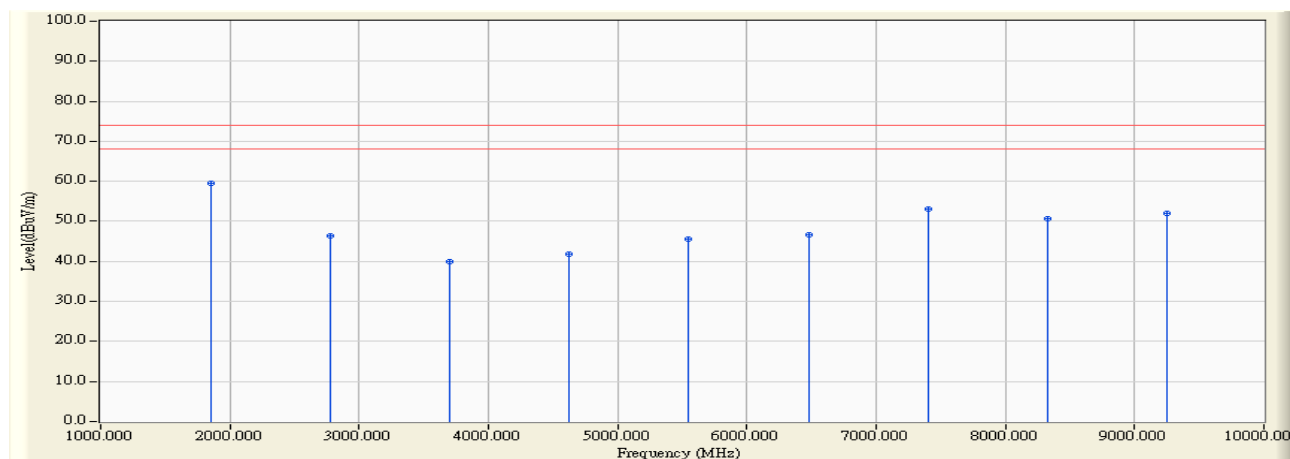


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1850.350	-3.011	55.250	52.238	-21.762	74.000	PEAK
2		2775.485	1.106	46.880	47.986	-26.014	74.000	PEAK
3		3700.455	3.619	35.690	39.309	-34.691	74.000	PEAK
4		4621.725	7.361	35.480	42.841	-31.159	74.000	PEAK
5		5549.700	9.889	34.420	44.309	-29.691	74.000	PEAK
6		6475.240	15.383	32.990	48.373	-25.627	74.000	PEAK
7		7398.915	18.292	33.130	51.422	-22.578	74.000	PEAK
8		8237.500	19.670	30.660	50.330	-23.670	74.000	PEAK
9		9255.225	21.444	30.080	51.524	-22.476	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/08
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_A115_EFS_1-18GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_925.1MHz

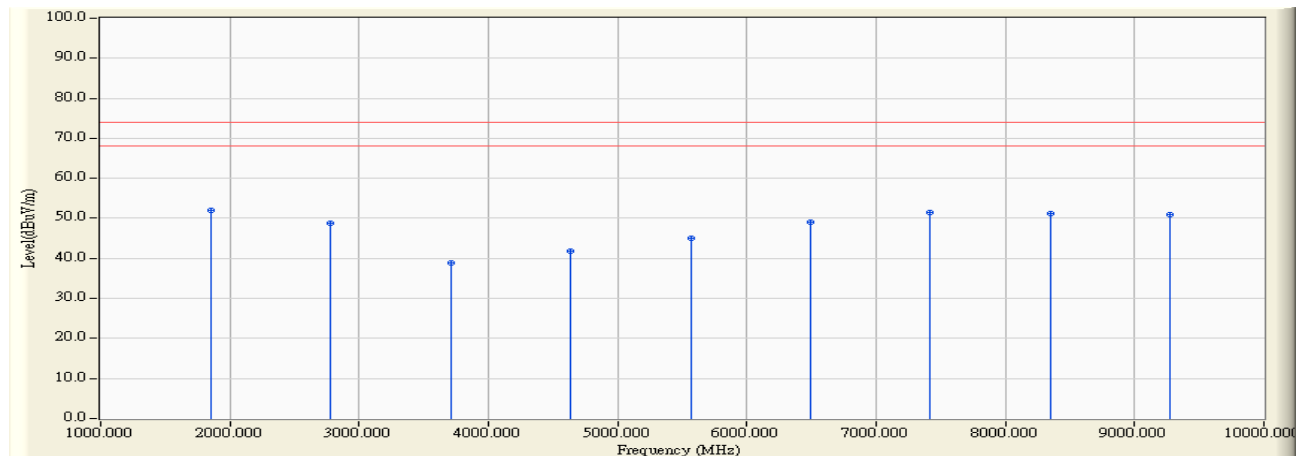


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1850.425	-3.011	62.620	59.608	-14.392	74.000	PEAK
2		2775.000	1.104	45.370	46.474	-27.526	74.000	PEAK
3		3704.310	3.632	36.330	39.962	-34.038	74.000	PEAK
4		4627.285	7.389	34.360	41.749	-32.251	74.000	PEAK
5		5551.100	9.895	35.720	45.615	-28.385	74.000	PEAK
6		6479.360	15.416	31.170	46.586	-27.414	74.000	PEAK
7		7402.515	18.299	34.660	52.959	-21.041	74.000	PEAK
8		8330.895	19.819	30.920	50.739	-23.261	74.000	PEAK
9		9250.295	21.432	30.640	52.073	-21.927	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/08
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_A115_EFS_1-18GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_927.5MHz

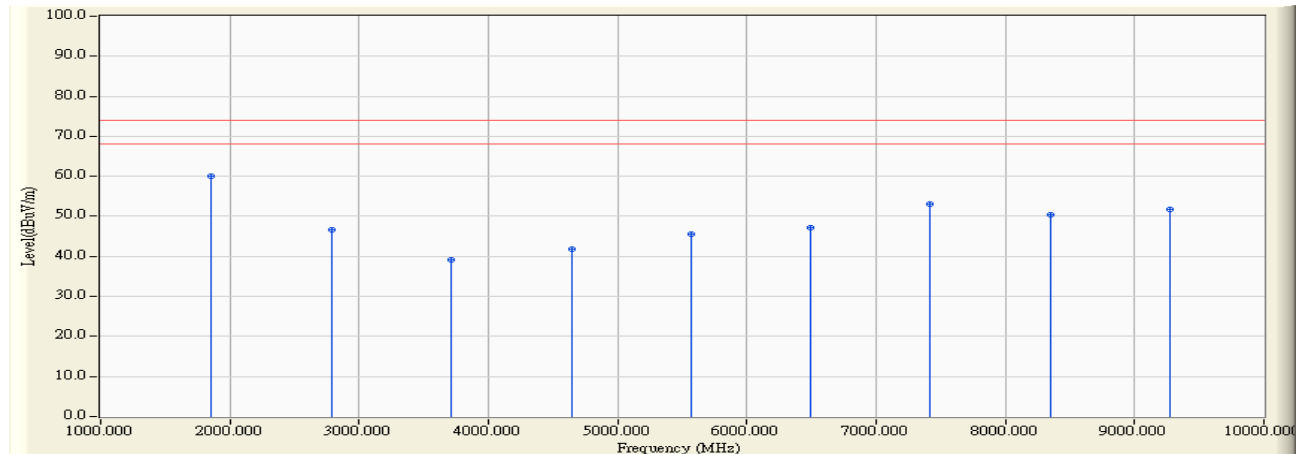


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1855.545	-2.996	54.920	51.923	-22.077	74.000	PEAK
2		2782.165	1.133	47.680	48.813	-25.187	74.000	PEAK
3		3711.200	3.654	35.330	38.984	-35.016	74.000	PEAK
4		4635.995	7.433	34.450	41.882	-32.118	74.000	PEAK
5		5564.455	9.951	35.220	45.171	-28.829	74.000	PEAK
6		6493.555	15.523	33.550	49.072	-24.928	74.000	PEAK
7		7419.940	18.337	33.010	51.347	-22.653	74.000	PEAK
8		8350.105	19.849	31.480	51.329	-22.671	74.000	PEAK
9		9277.530	21.498	29.560	51.057	-22.943	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/08
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_A115_EFS_1-18GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_927.5MHz

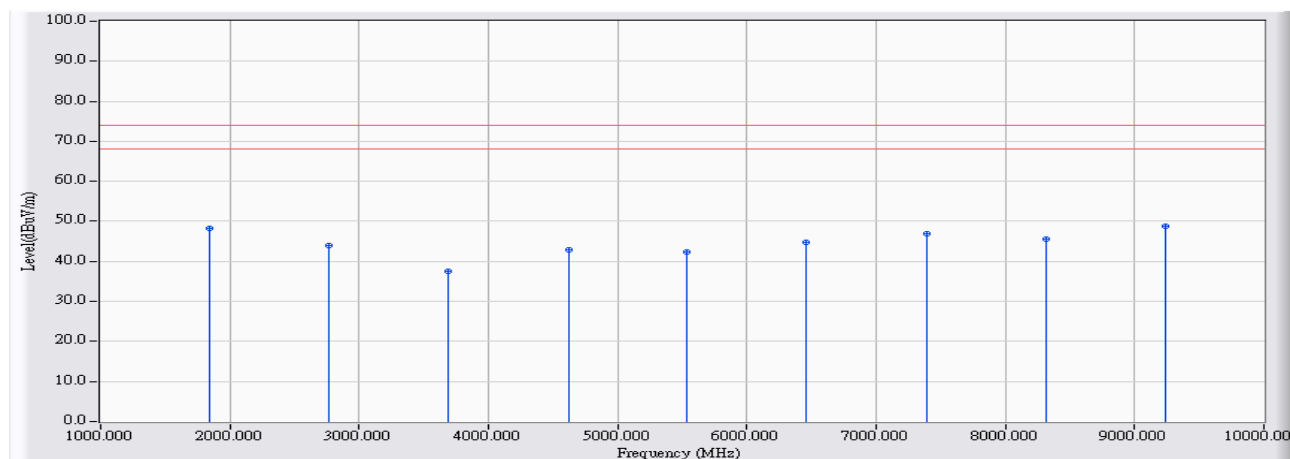


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	1855.230	-2.998	63.090	60.092	-13.908	74.000	PEAK
2		2783.250	1.138	45.640	46.778	-27.222	74.000	PEAK
3		3713.330	3.662	35.550	39.212	-34.788	74.000	PEAK
4		4642.010	7.462	34.240	41.702	-32.298	74.000	PEAK
5		5566.350	9.959	35.530	45.489	-28.511	74.000	PEAK
6		6491.365	15.509	31.780	47.290	-26.710	74.000	PEAK
7		7419.230	18.336	34.850	53.185	-20.815	74.000	PEAK
8		8349.210	19.847	30.650	50.497	-23.503	74.000	PEAK
9		8349.300	19.847	30.650	50.498	-23.502	74.000	PEAK
10		9277.125	21.496	30.180	51.676	-22.324	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_923.3MHz

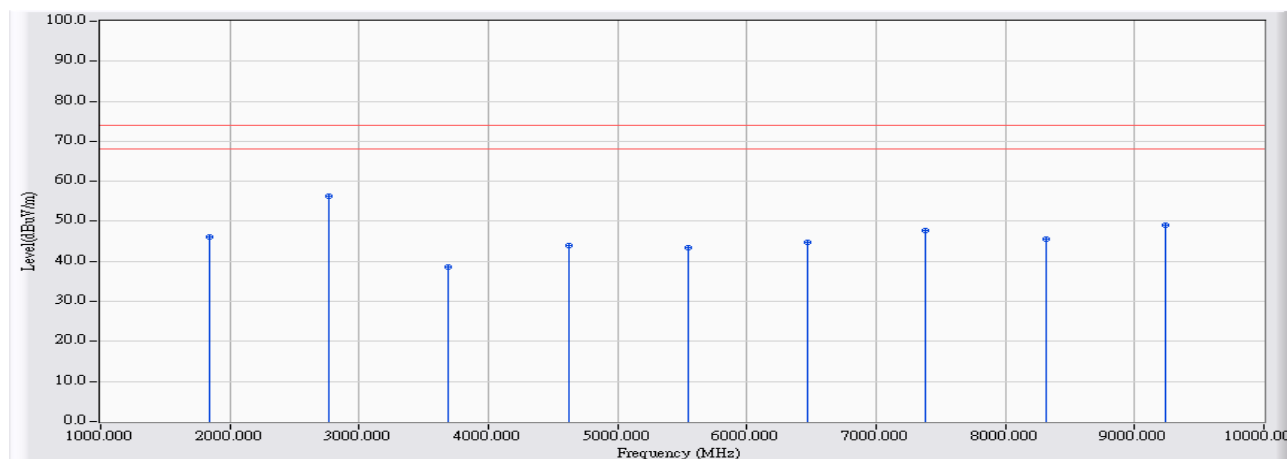


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1846.900	-11.109	59.310	48.202	-25.798	74.000	PEAK
2		2770.900	-7.690	51.550	43.860	-30.140	74.000	PEAK
3		3693.550	-4.920	42.320	37.400	-36.600	74.000	PEAK
4		4618.770	-0.126	43.150	43.024	-30.976	74.000	PEAK
5		5538.200	0.398	41.850	42.249	-31.751	74.000	PEAK
6		6460.200	4.287	40.560	44.847	-29.153	74.000	PEAK
7		7388.450	7.494	39.390	46.884	-27.116	74.000	PEAK
8		8312.900	7.912	37.650	45.562	-28.438	74.000	PEAK
9	*	9234.190	11.452	37.310	48.762	-25.238	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_923.3MHz

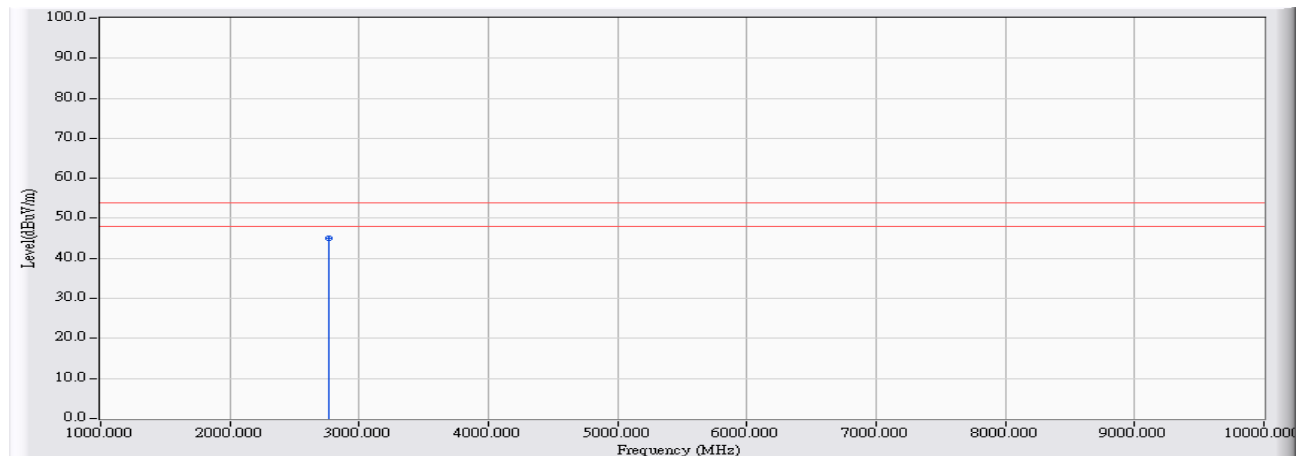


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1847.040	-11.108	57.210	46.102	-27.898	74.000	PEAK
2	*	2769.580	-7.695	64.040	56.345	-17.655	74.000	PEAK
3		3694.080	-4.917	43.440	38.523	-35.477	74.000	PEAK
4		4620.350	-0.118	44.190	44.073	-29.927	74.000	PEAK
5		5542.750	0.413	43.110	43.523	-30.477	74.000	PEAK
6		6463.500	4.303	40.510	44.814	-29.186	74.000	PEAK
7		7386.300	7.484	40.260	47.744	-26.256	74.000	PEAK
8		8313.900	7.911	37.610	45.522	-28.478	74.000	PEAK
9		9234.900	11.456	37.570	49.025	-24.975	74.000	PEAK
10		9234.950	11.456	37.570	49.026	-24.974	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_923.3MHz

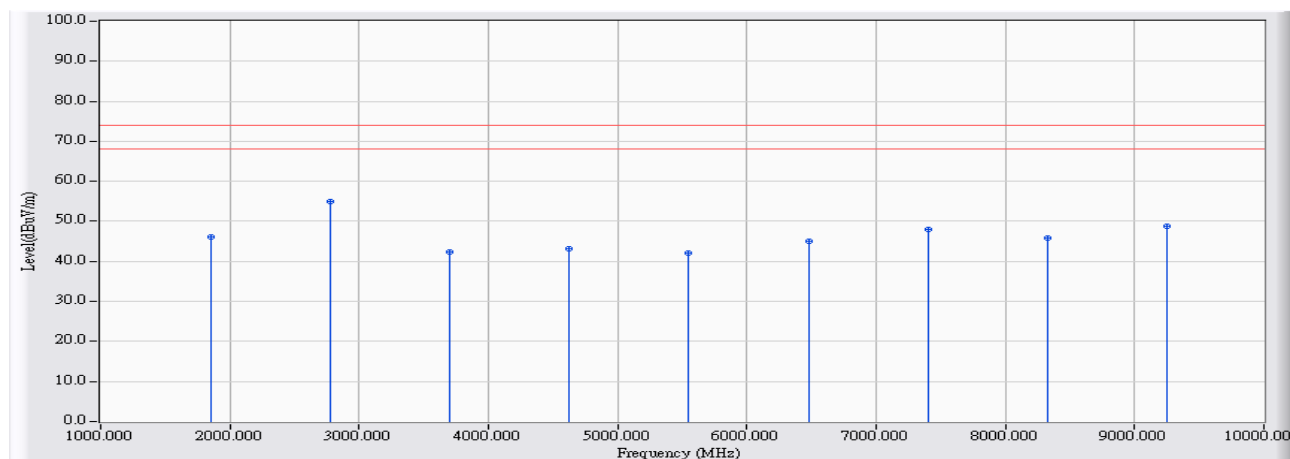


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	2769.580	-7.695	52.820	45.124	-8.876	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_925.1MHz

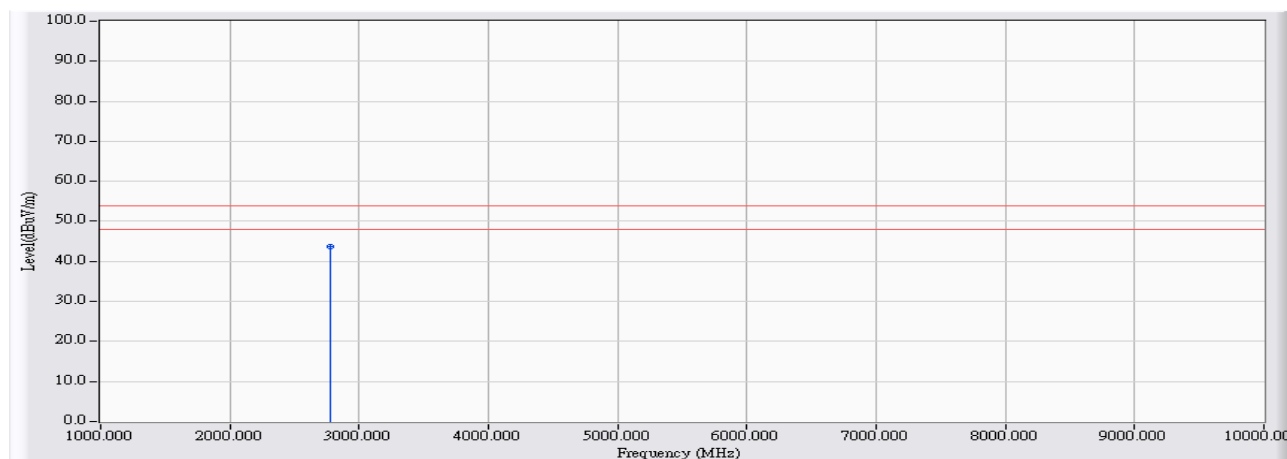


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1849.900	-11.099	57.310	46.211	-27.789	74.000	PEAK
2	*	2775.530	-7.673	62.700	55.027	-18.973	74.000	PEAK
3		3700.970	-4.878	47.338	42.460	-31.540	74.000	PEAK
4		4624.570	-0.094	43.150	43.056	-30.944	74.000	PEAK
5		5551.400	0.440	41.760	42.200	-31.800	74.000	PEAK
6		6477.050	4.374	40.580	44.954	-29.046	74.000	PEAK
7		7398.900	7.540	40.510	48.050	-25.950	74.000	PEAK
8		8330.300	7.904	37.890	45.794	-28.206	74.000	PEAK
9		9250.630	11.515	37.360	48.875	-25.125	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_925.1MHz

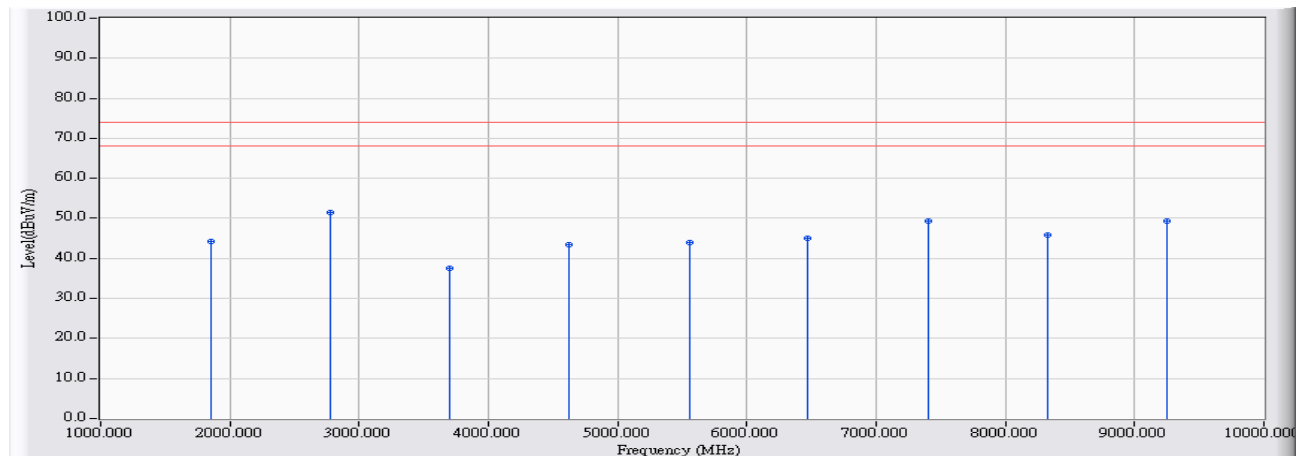


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	2775.530	-7.673	51.479	43.806	-10.194	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_925.1MHz

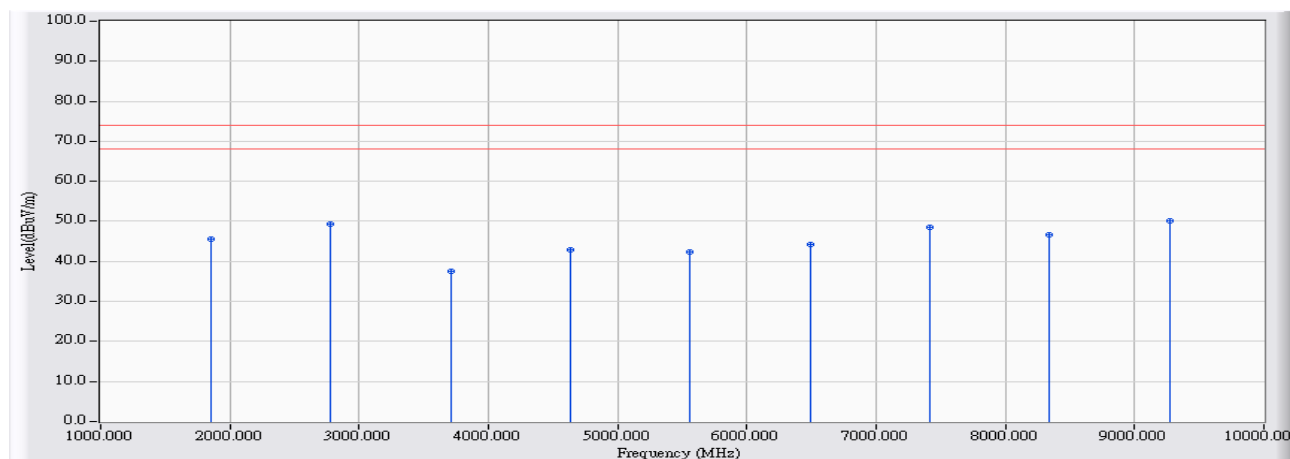


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1850.580	-11.097	55.330	44.233	-29.767	74.000	PEAK
2	*	2775.850	-7.672	59.220	51.549	-22.451	74.000	PEAK
3		3697.650	-4.896	42.510	37.613	-36.387	74.000	PEAK
4		4622.910	-0.104	43.660	43.557	-30.443	74.000	PEAK
5		5553.040	0.444	43.650	44.095	-29.905	74.000	PEAK
6		6471.500	4.345	40.600	44.945	-29.055	74.000	PEAK
7		7403.350	7.559	41.730	49.289	-24.711	74.000	PEAK
8		8325.800	7.906	37.900	45.806	-28.194	74.000	PEAK
9		9249.700	11.512	37.820	49.332	-24.668	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_927.5MHz

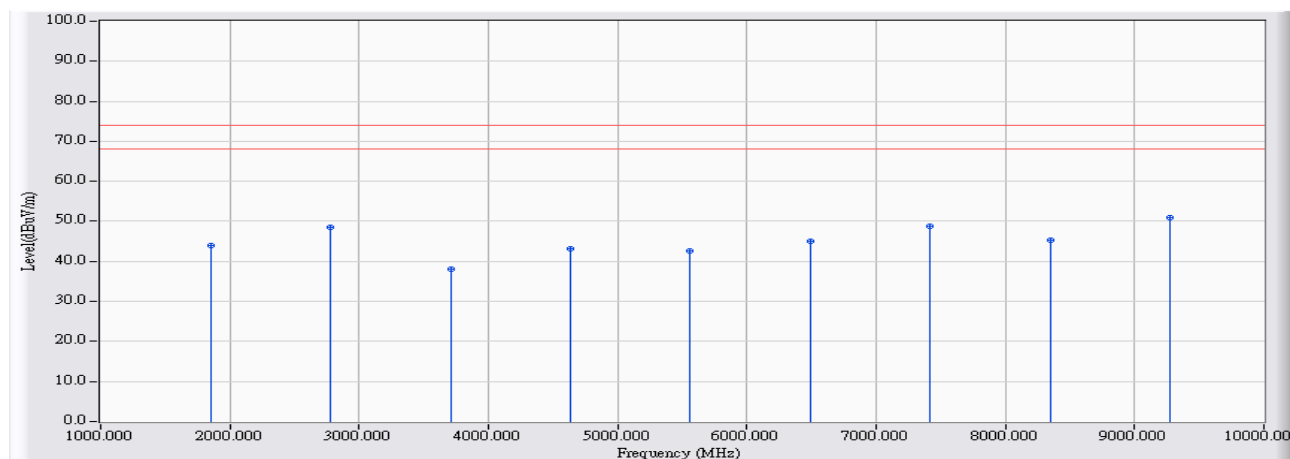


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1854.580	-11.084	56.780	45.695	-28.305	74.000	PEAK
2		2782.140	-7.647	56.980	49.332	-24.668	74.000	PEAK
3		3711.370	-4.820	42.450	37.631	-36.369	74.000	PEAK
4		4636.570	-0.026	42.890	42.864	-31.136	74.000	PEAK
5		5563.090	0.476	41.880	42.356	-31.644	74.000	PEAK
6		6495.570	4.464	39.780	44.244	-29.756	74.000	PEAK
7		7420.270	7.634	40.780	48.414	-25.586	74.000	PEAK
8		8342.500	7.899	38.660	46.558	-27.442	74.000	PEAK
9	*	9274.560	11.570	38.670	50.240	-23.760	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

Site : CB4-H	Time : 2017/08/16
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_B432_1-18GHz_3M_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_927.5MHz



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1854.470	-11.085	54.940	43.855	-30.145	74.000	PEAK
2		2782.270	-7.647	56.090	48.443	-25.557	74.000	PEAK
3		3707.230	-4.842	42.780	37.937	-36.063	74.000	PEAK
4		4635.110	-0.035	43.310	43.275	-30.725	74.000	PEAK
5		5562.250	0.473	42.070	42.543	-31.457	74.000	PEAK
6		6489.170	4.437	40.570	45.006	-28.994	74.000	PEAK
7		7419.960	7.633	41.270	48.902	-25.098	74.000	PEAK
8		8344.850	7.897	37.540	45.437	-28.563	74.000	PEAK
9	*	9274.550	11.570	39.460	51.030	-22.970	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The Emission above 18GHz were not included is because their levels are too low.

5. RF antenna conducted test

5.1. Test Equipment

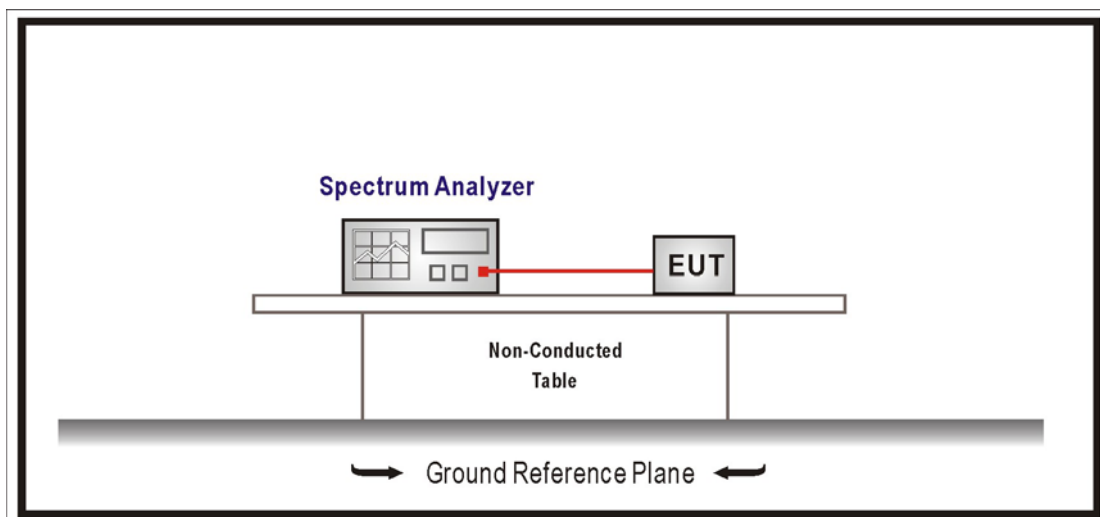
The following test equipments are used during the test:

RF antenna conducted test / SR10-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal & Spectrum Analyzer	R&S	FSV40	101049	2017/01/23	2018/01/22
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2017/03/13	2018/03/12
Spectrum Analyzer	Agilent	N9010A	US47140172	2017/07/26	2018/07/25

5.2. Test Setup

RF antenna Conducted Measurement:



5.3. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.4. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure section 11.2 of KDB558074 D01 V04 for compliance to FCC 47CFR 15.247 requirements. Set RBW = 100 kHz, Set VBW> RBW, scan up through 10th harmonic.

5.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247: 2015

5.6. Uncertainty

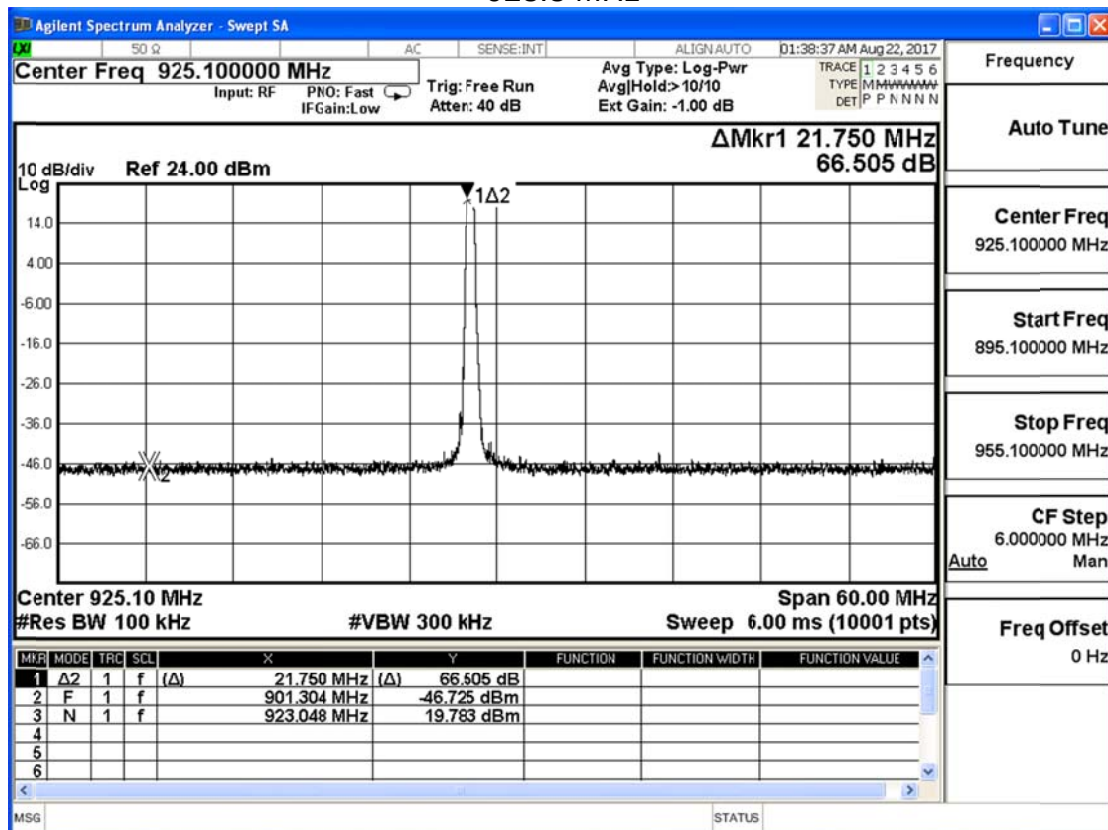
Conducted is defined as $\pm 1.27\text{dB}$

5.7. Test Result

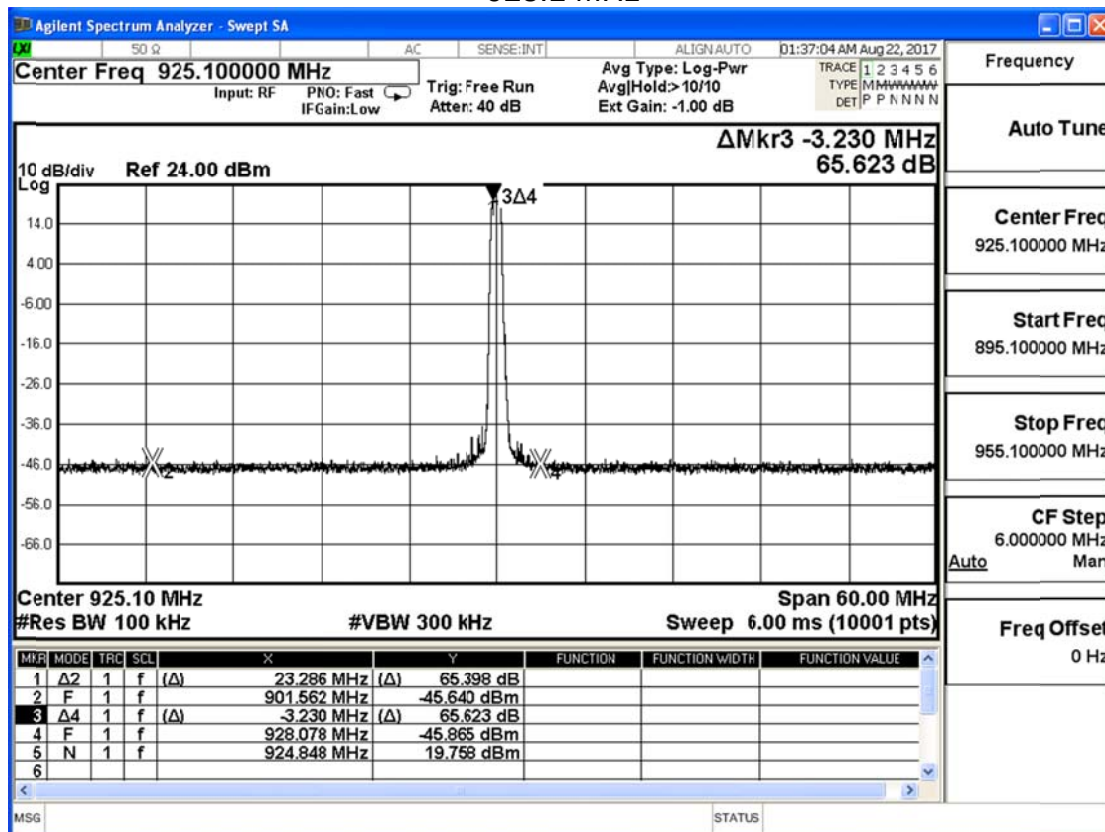
Product	LoRa Module		
Test Item	RF antenna conducted test		
Test Mode	Mode 1: Tx_ANT1		
Date of Test	2017/08/22	Test Site	SR10-H

Frequency (MHz)	Measure Level (dBc)	Limit (dBc)	Result
923.3	66.505	≥ 20	Pass
925.1	65.623	≥ 20	Pass
927.5	28.178	≥ 20	Pass

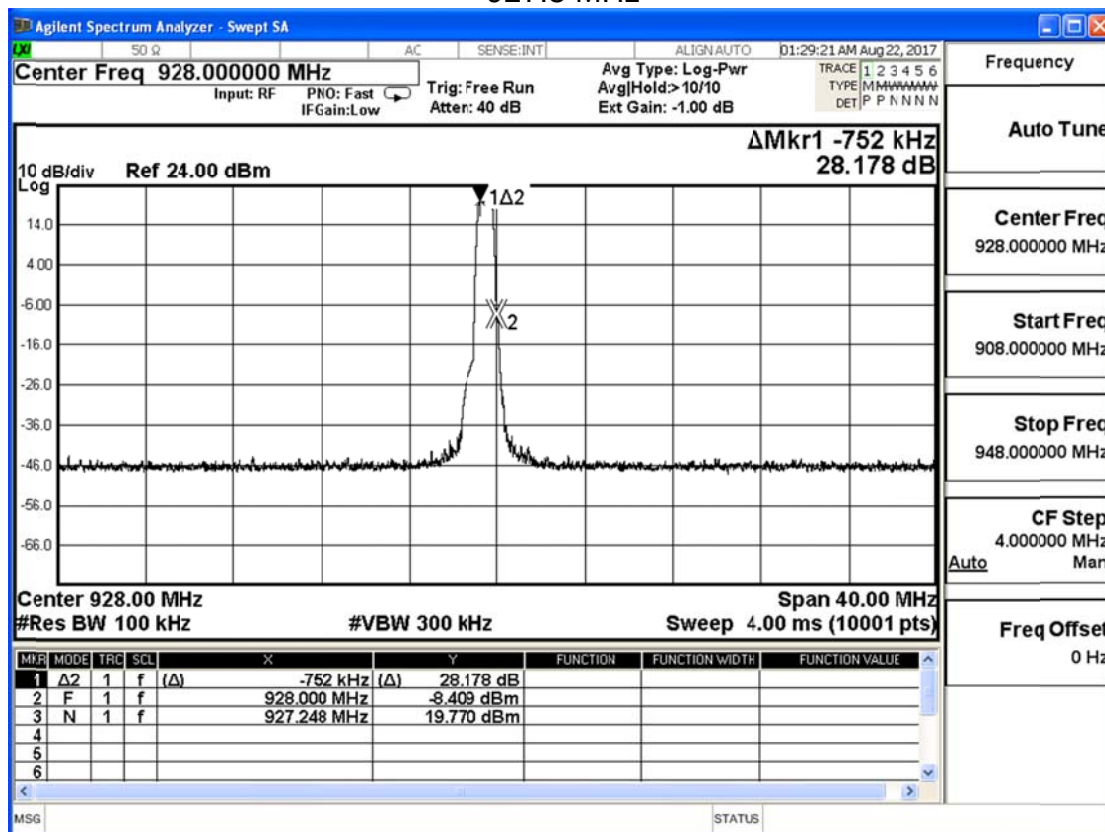
923.3 MHz



925.1 MHz

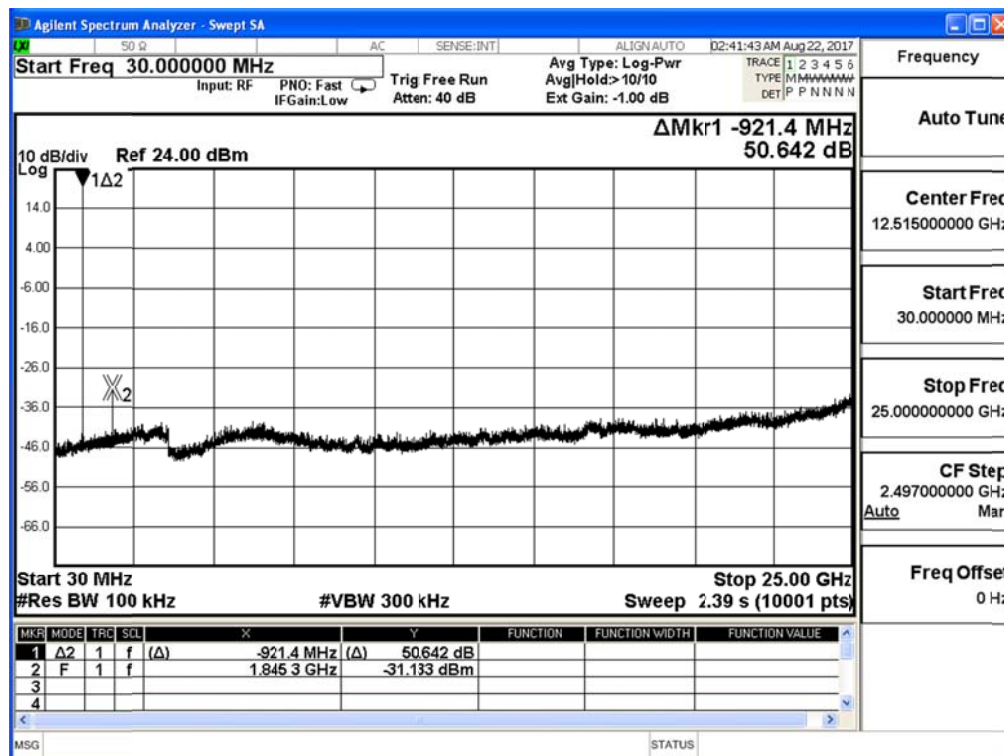


927.5 MHz

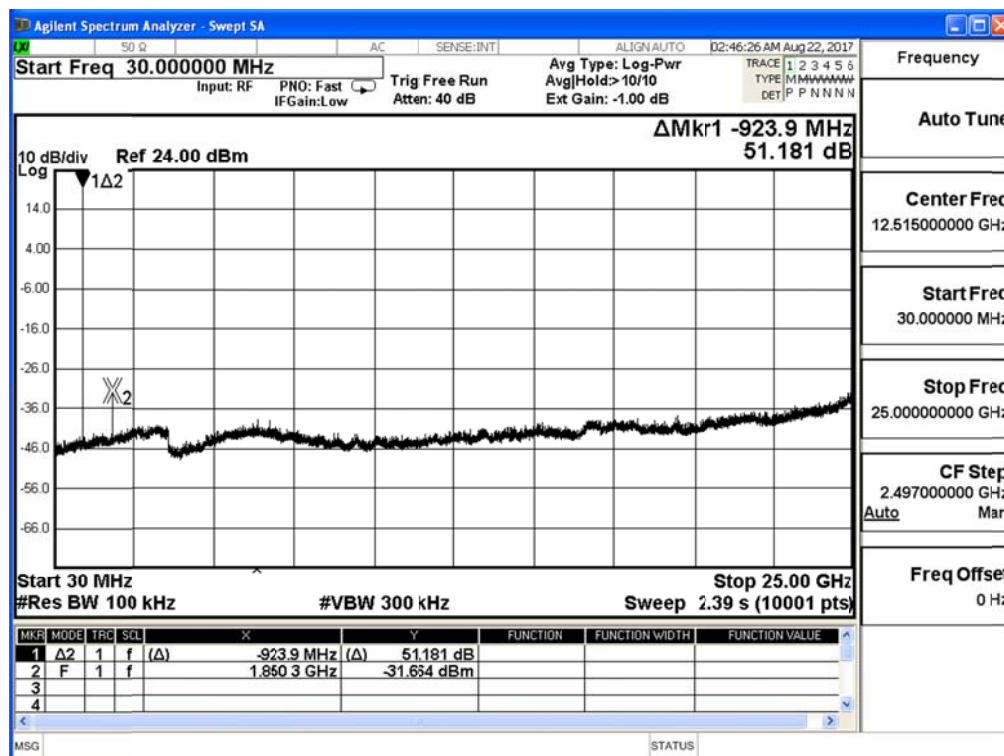


Product	LoRa Module		
Test Item	RF antenna conducted test		
Test Mode	Mode 1: Tx_SISO Mode		
Date of Test	2017/08/22	Test Site	SR10-H

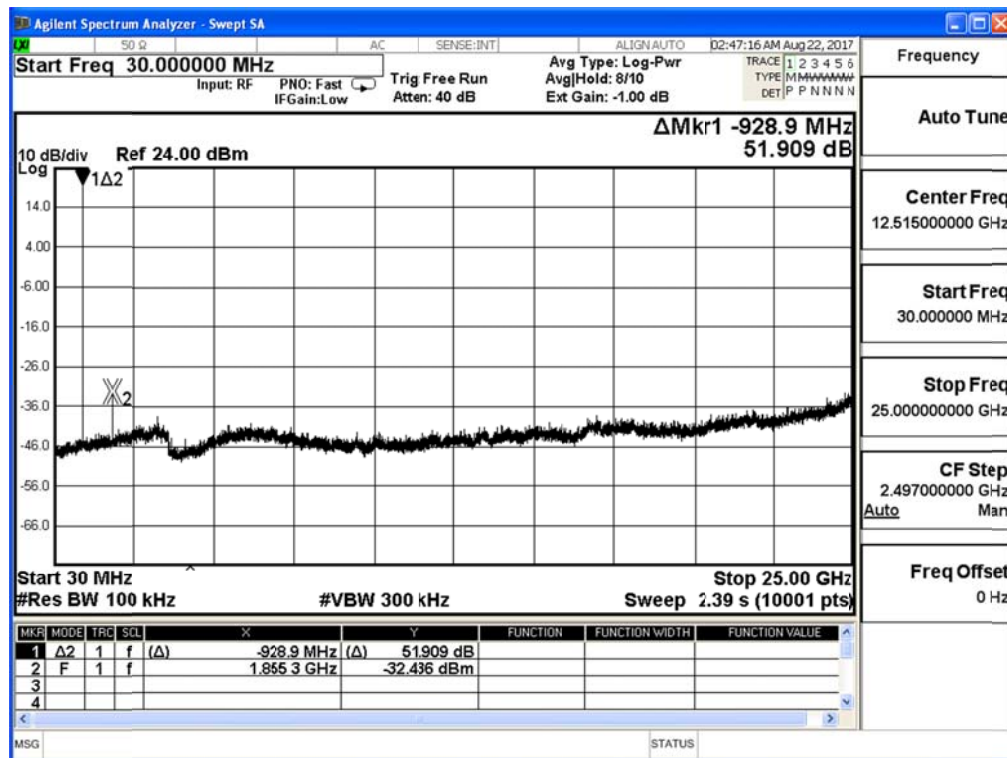
923.3 MHz (30MHz-25GHz)



925.1MHz (30MHz-25GHz)



927.5MHz (30MHz-25GHz)



6. Band Edge

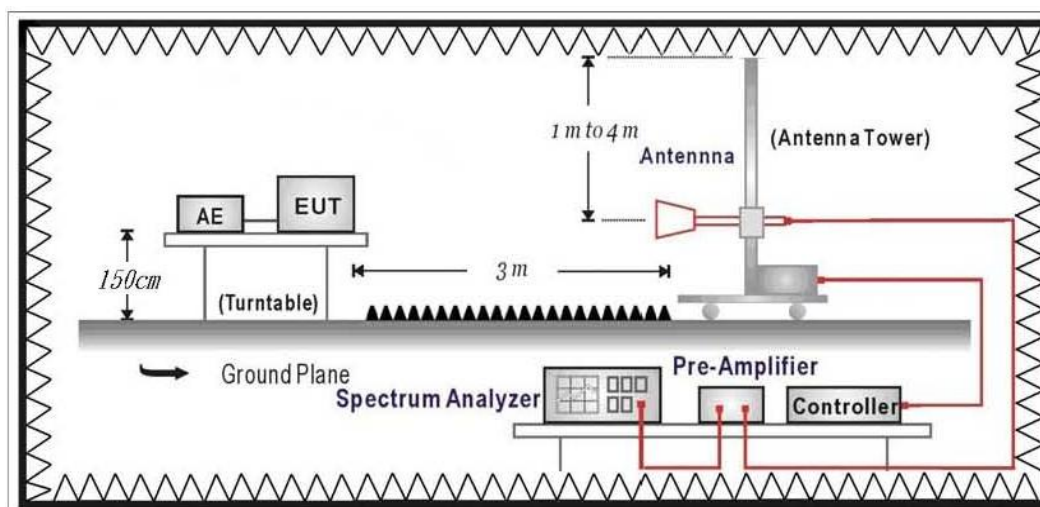
6.1. Test Equipment

The following test equipments are used during the test:

Band Edge / CB4-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal Analyzer	R&S	FSVA40	101455	2016/11/28	2017/11/27
Signal & Spectrum Analyzer	R&S	FSV40	101049	2017/01/23	2018/01/22
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2017/03/13	2018/03/12
Bilog Antenna	Teseq	CBL6112D	23191	2017/06/28	2018/06/27
Horn Antenna	Schwarzbeck	BBHA 9120D	639	2017/06/14	2018/06/13
Horn Antenna	Schwarzbeck	BBHA 9170	203	2016/08/29	2017/08/28
Pre-Amplifier	RF Bay Inc.	LNA-1330	12162511	2017/03/09	2018/03/08
Pre-Amplifier	EMCI	EMCI 1830I	980366	2017/01/23	2018/01/22
Pre-Amplifier	MITEQ	JS44-45-8P	2014754	2016/12/26	2017/12/25

6.2. Test Setup



6.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

6.4. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 D01 V04 for compliance to FCC 47CFR 15.247 requirements.

The EUT and its simulators are placed on a turn table which is 1.5 meter above ground.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10:2013 on radiated measurement.

6.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247: 2015

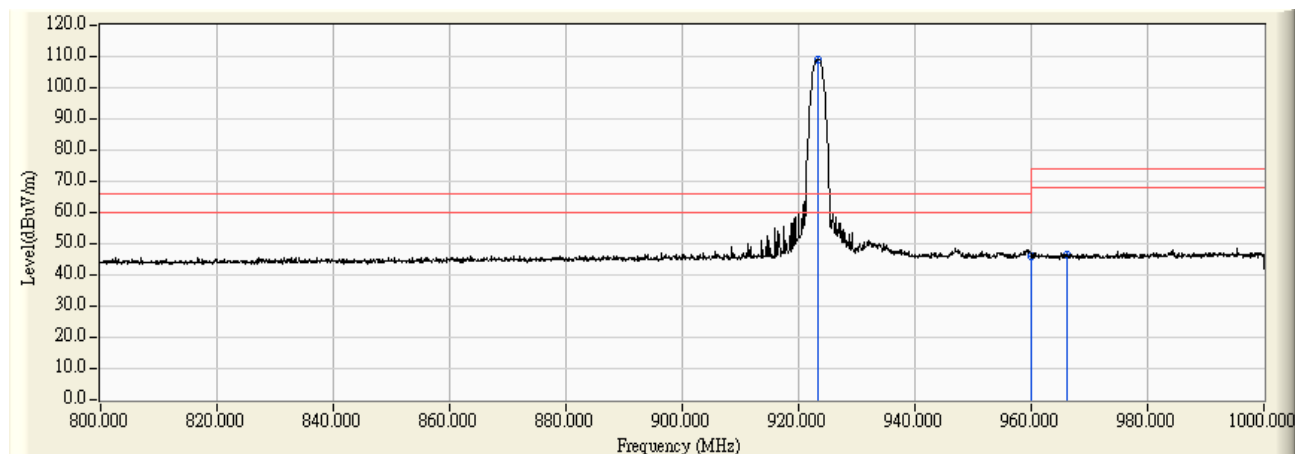
6.6. Uncertainty

The measurement uncertainty

± 3.9 dB above 1GHz

6.7. Test Result

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_923.3MHz

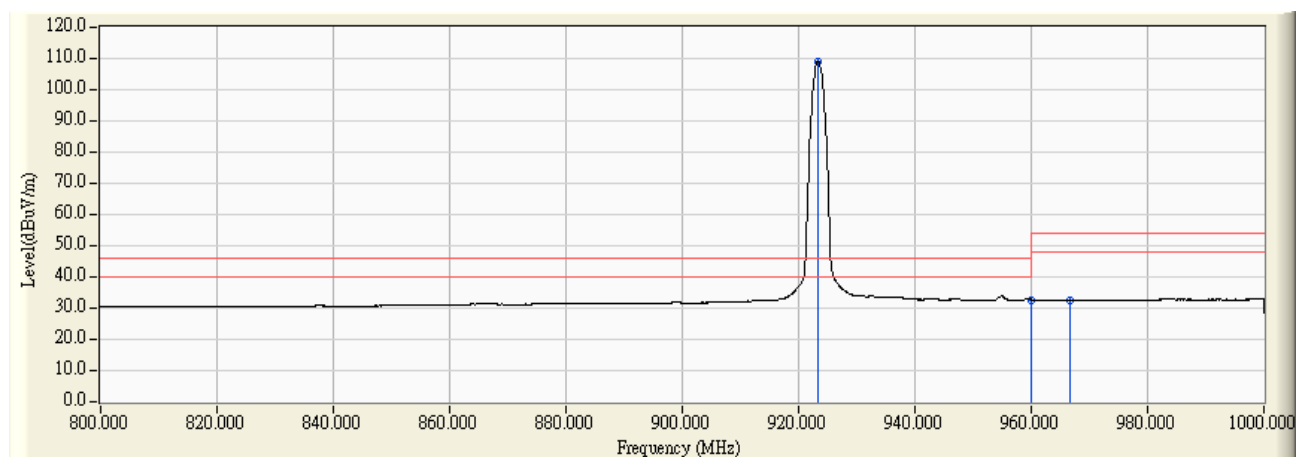


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.400	-9.463	118.457	108.994	42.974	66.020	PEAK
2		960.000	-8.864	54.774	45.910	-20.110	66.020	PEAK
3		966.100	-8.752	55.476	46.724	-27.276	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_923.3MHz

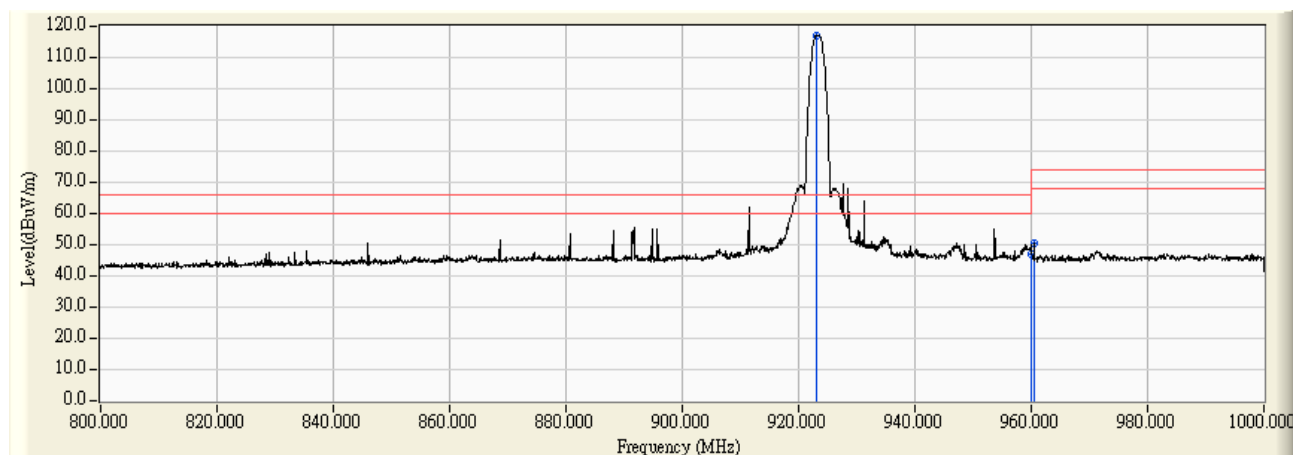


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.300	-9.458	118.592	109.134	63.114	46.020	AVERAGE
2		960.000	-8.864	41.556	32.692	-13.328	46.020	AVERAGE
3		966.600	-8.760	41.213	32.453	-21.547	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4 FCC EFS S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_923.3MHz

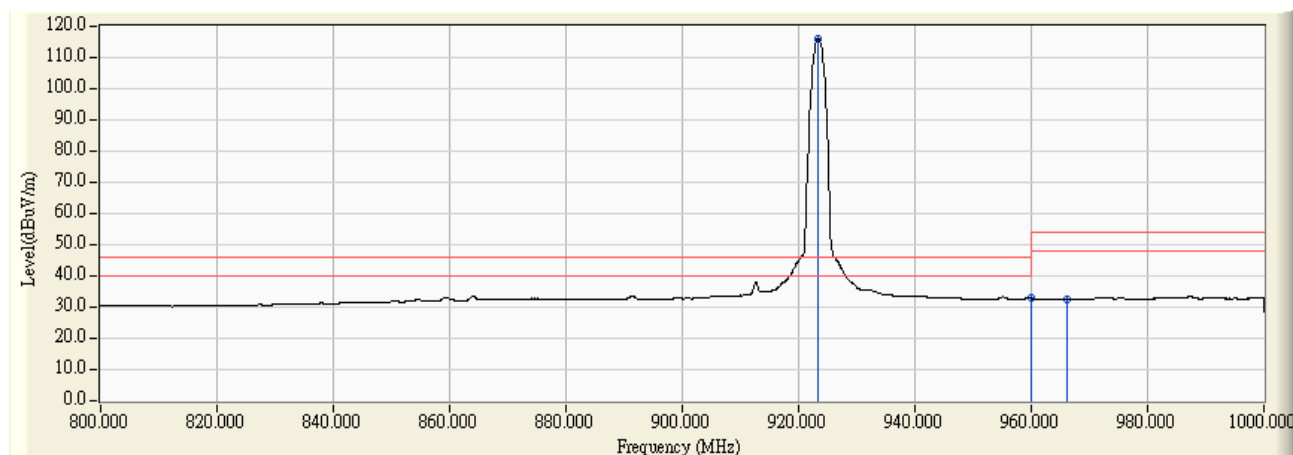


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.100	-9.449	126.454	117.006	50.986	66.020	PEAK
2		960.000	-8.864	55.819	46.955	-19.065	66.020	PEAK
3		960.500	-8.886	59.152	50.267	-23.733	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4 FCC EFS S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_923.3MHz

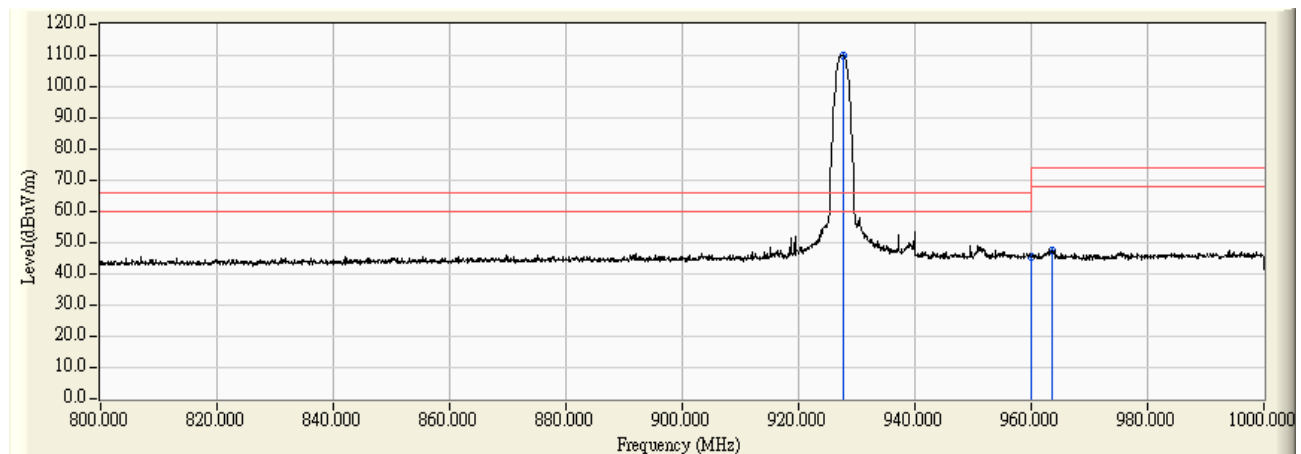


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.400	-9.463	125.675	116.212	70.192	46.020	AVERAGE
2		960.000	-8.864	41.630	32.766	-13.254	46.020	AVERAGE
3		966.100	-8.752	41.202	32.450	-21.550	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_927.5MHz

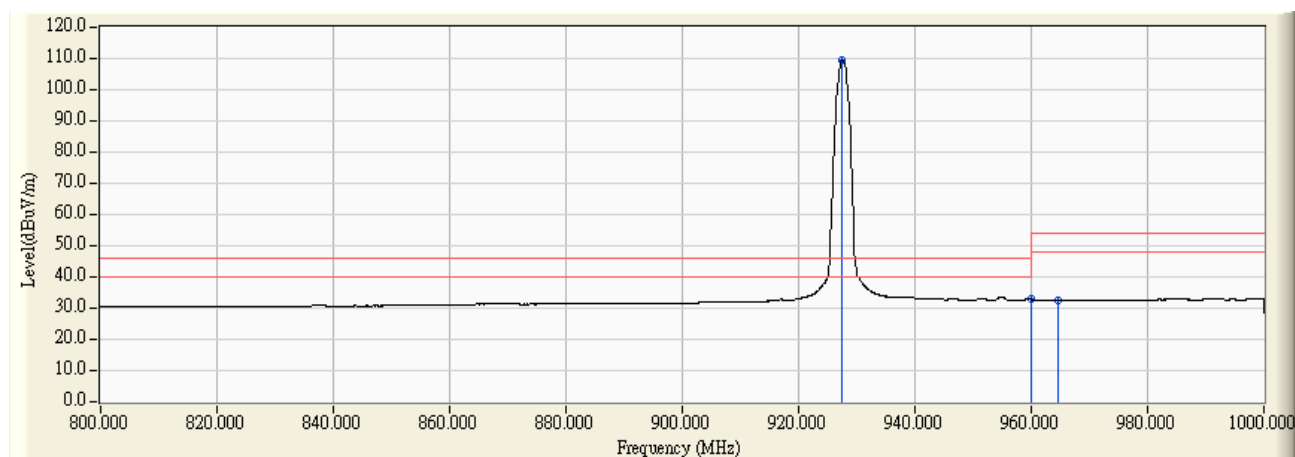


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.700	-9.320	119.221	109.901	43.881	66.020	PEAK
2		960.000	-8.864	54.290	45.426	-20.594	66.020	PEAK
3		963.600	-8.821	56.254	47.433	-26.567	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_927.5MHz

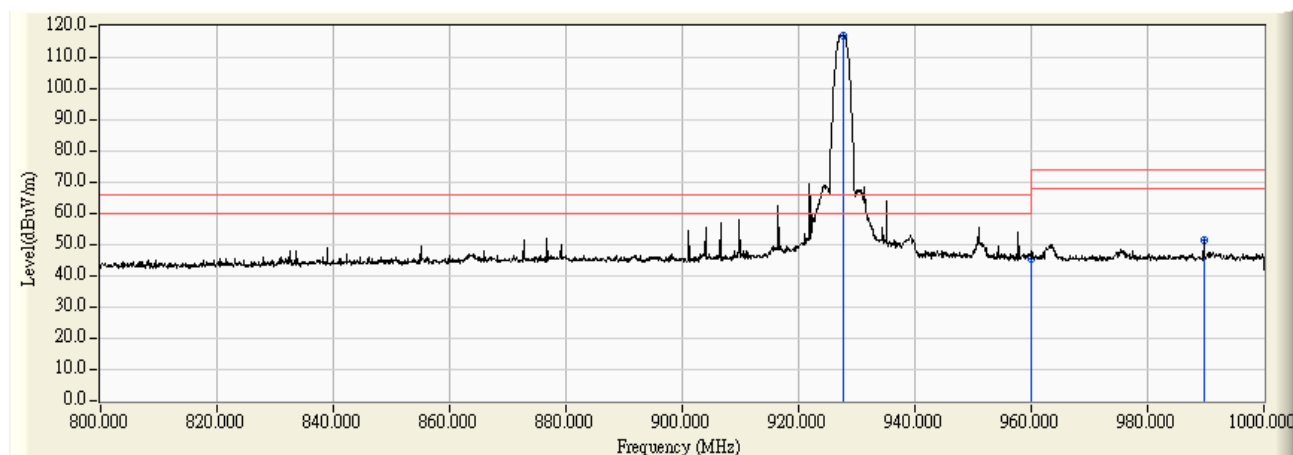


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.500	-9.322	118.939	109.617	63.597	46.020	AVERAGE
2		960.000	-8.864	41.654	32.790	-13.230	46.020	AVERAGE
3		964.500	-8.790	41.258	32.467	-21.533	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_927.5MHz

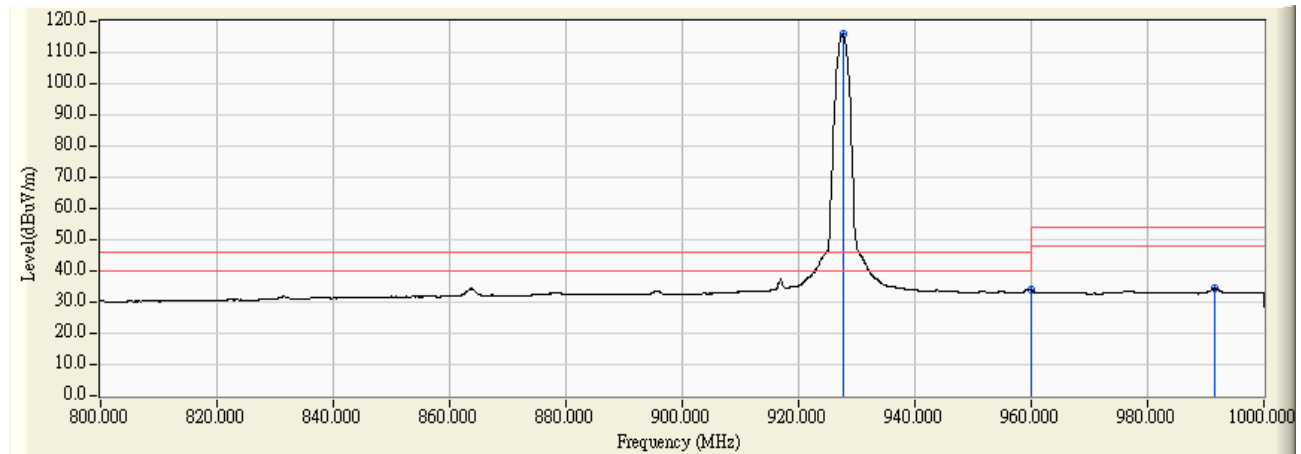


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.700	-9.320	126.401	117.081	51.061	66.020	PEAK
2		960.000	-8.864	54.575	45.711	-20.309	66.020	PEAK
3		989.700	-8.480	59.733	51.253	-22.747	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4 FCC EFS S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 1: Tx_ANT1_927.5MHz

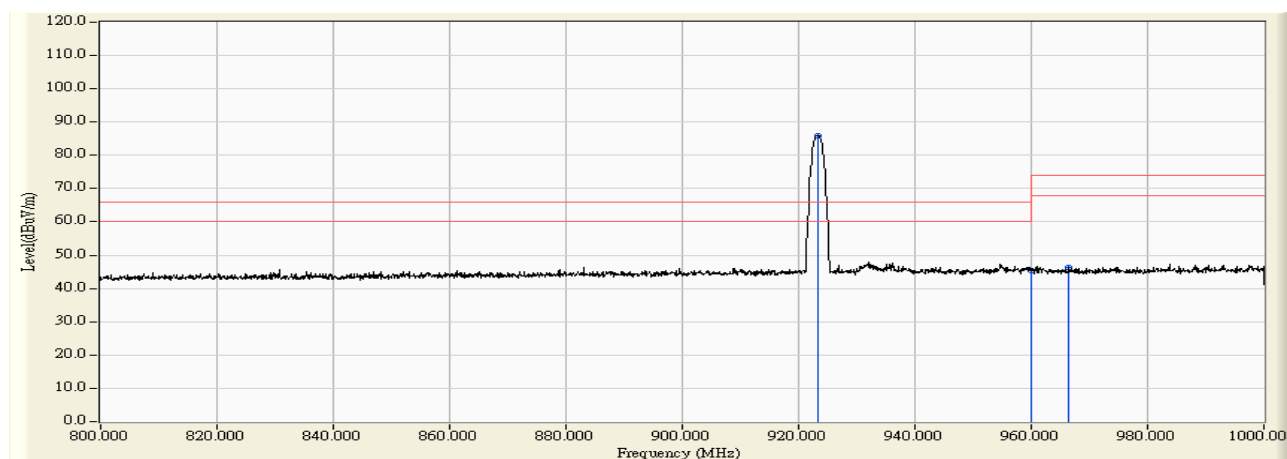


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.700	-9.320	125.246	115.926	69.906	46.020	AVERAGE
2		960.000	-8.864	42.728	33.864	-12.156	46.020	AVERAGE
3		991.600	-8.402	42.667	34.265	-19.735	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_923.3MHz

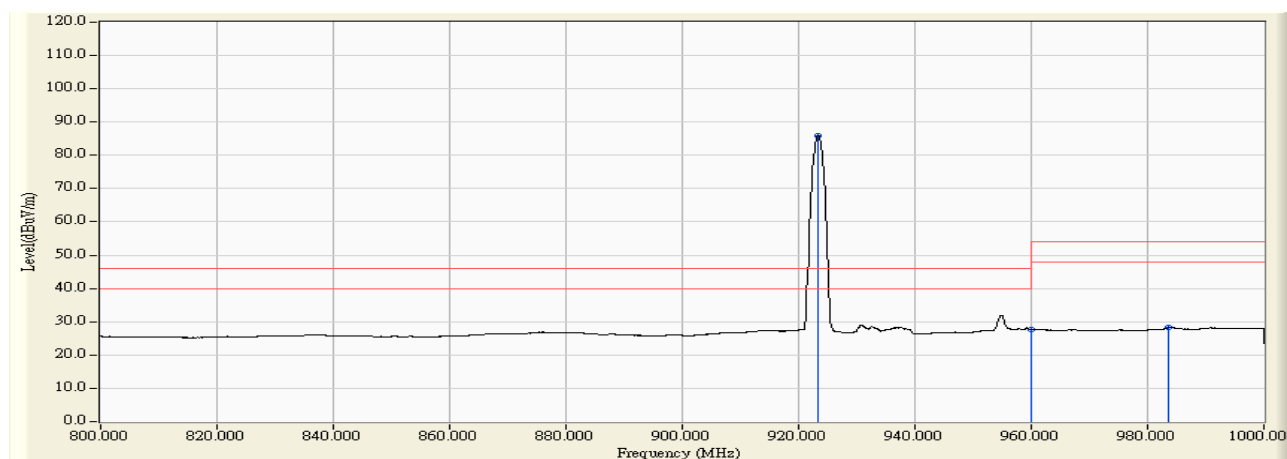


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.400	-9.463	95.401	85.938	19.918	66.020	PEAK
2		960.000	-8.864	54.277	45.413	-20.607	66.020	PEAK
3		966.400	-8.757	55.224	46.467	-27.533	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_923.3MHz

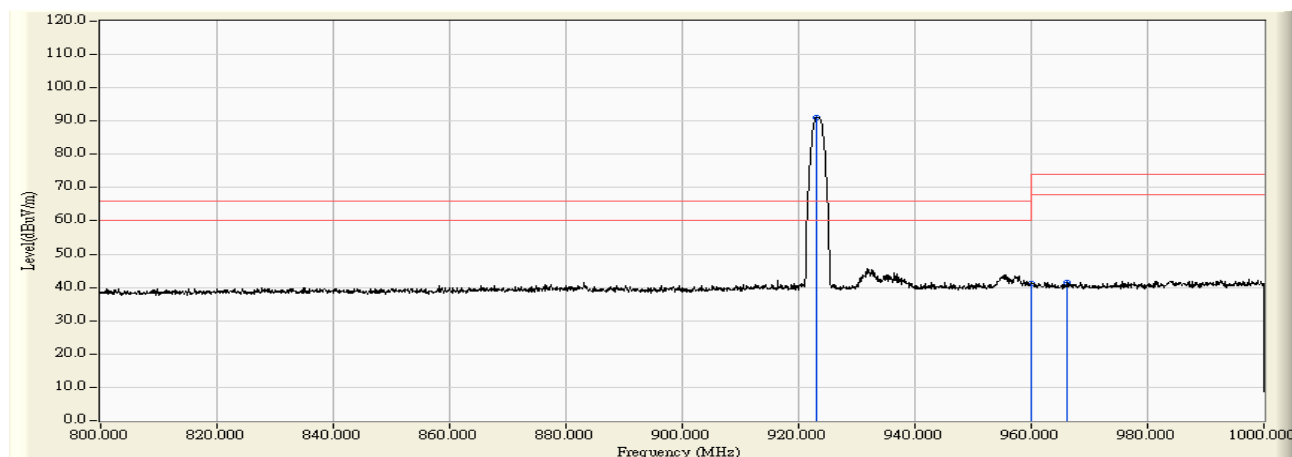


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.400	-9.463	95.414	85.951	39.931	46.020	AVERAGE
2		960.000	-8.864	36.612	27.748	-18.272	46.020	AVERAGE
3		983.500	-8.476	36.632	28.156	-25.844	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_923.3MHz

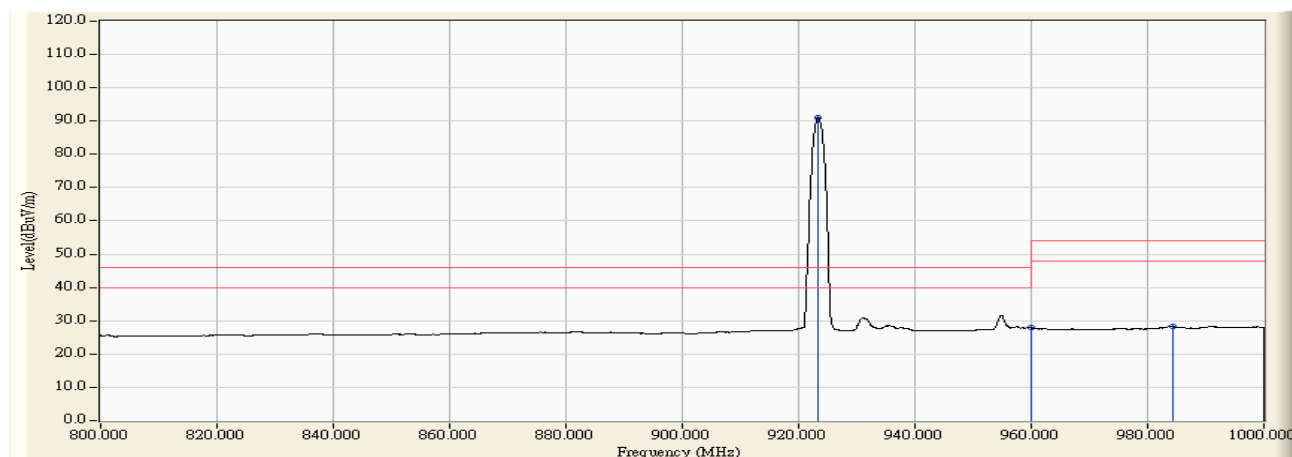


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.000	-9.444	100.568	91.125	25.105	66.020	PEAK
2		960.000	-8.864	49.893	41.029	-24.991	66.020	PEAK
3		966.200	-8.754	50.403	41.650	-32.350	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4 FCC EFS S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_923.3MHz

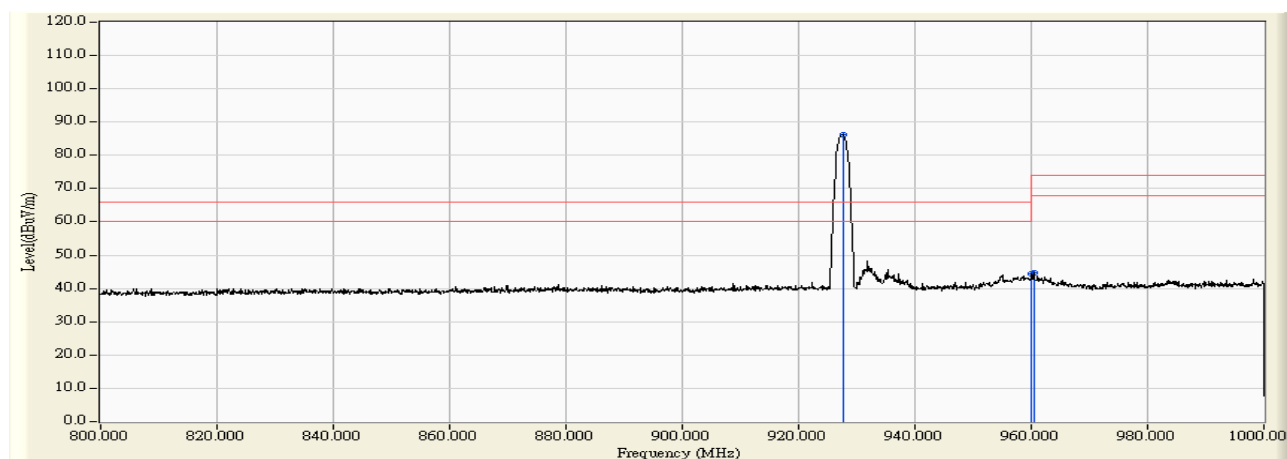


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	923.400	-9.463	100.520	91.057	45.037	46.020	AVERAGE
2		960.000	-8.864	36.695	27.831	-18.189	46.020	AVERAGE
3		984.300	-8.471	36.786	28.315	-25.685	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_927.5MHz

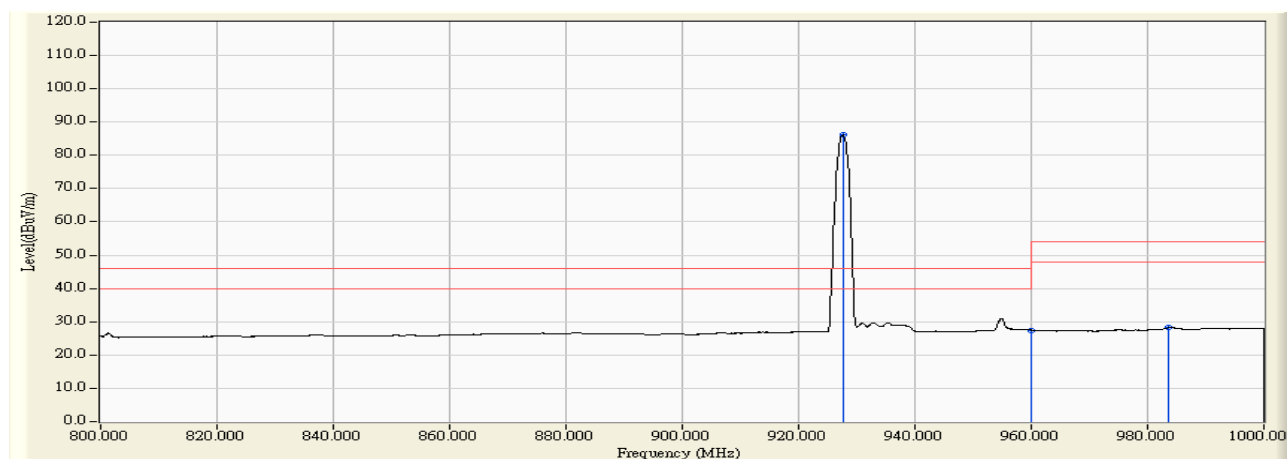


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.700	-9.320	95.504	86.184	20.164	66.020	PEAK
2		960.000	-8.864	53.119	44.255	-21.765	66.020	PEAK
3		960.400	-8.881	53.539	44.658	-29.342	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_927.5MHz

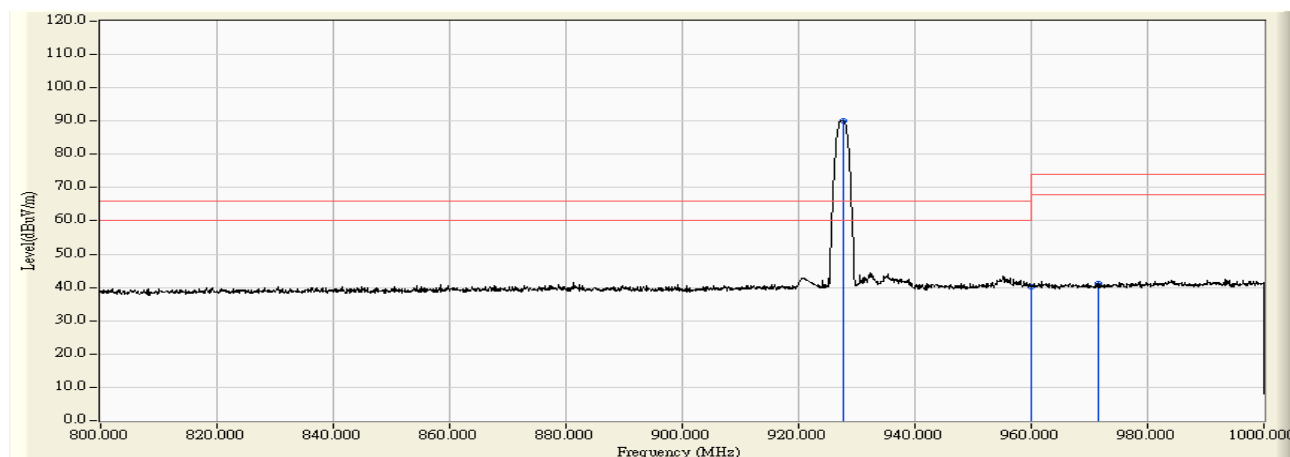


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.600	-9.321	95.410	86.089	40.069	46.020	AVERAGE
2		960.000	-8.864	36.353	27.489	-18.531	46.020	AVERAGE
3		983.700	-8.476	36.776	28.300	-25.700	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_PK	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_927.5MHz

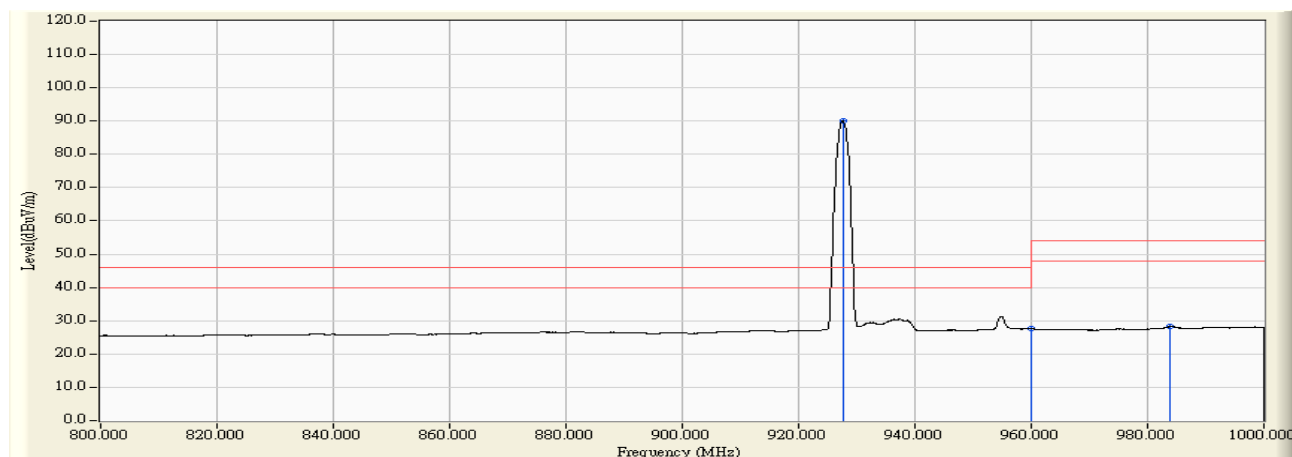


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.600	-9.321	99.462	90.141	24.121	66.020	PEAK
2		960.000	-8.864	49.104	40.240	-25.780	66.020	PEAK
3		971.600	-8.677	49.941	41.264	-32.736	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Site : CB4-H	Time : 2017/08/26
Limit : FCC_SpartC_15.209_03M_AV	Margin : 6
Probe : CB4_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 5V
EUT : LoRa Module	Note : Mode 2: Tx_ANT2_927.5MHz



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	927.700	-9.320	99.365	90.045	44.025	46.020	AVERAGE
2		960.000	-8.864	36.486	27.622	-18.398	46.020	AVERAGE
3		983.800	-8.475	36.729	28.254	-25.746	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

7. DTS Bandwidth

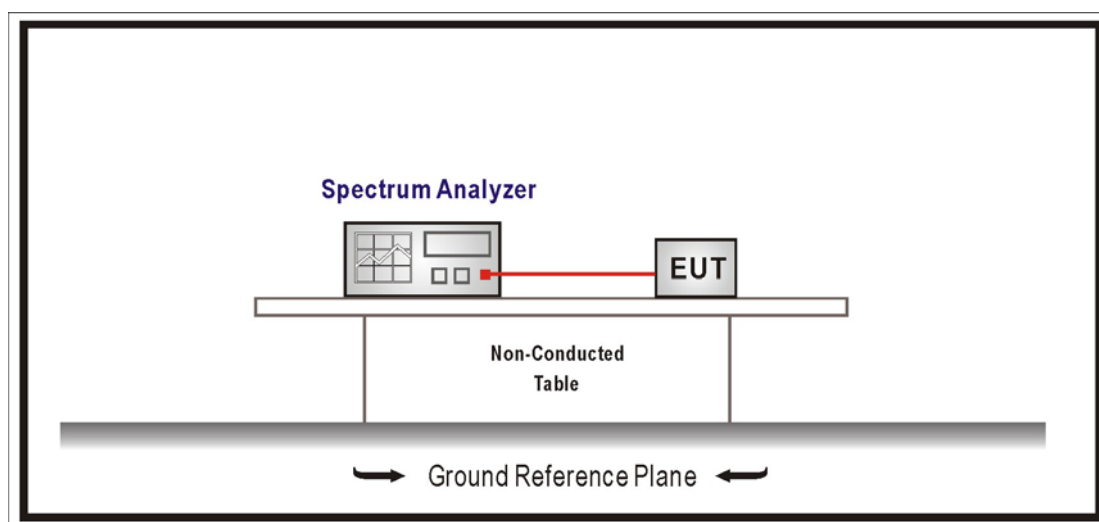
7.1. Test Equipment

The following test equipments are used during the test:

DTS Bandwidth / SR10-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal & Spectrum Analyzer	R&S	FSV40	101049	2017/01/23	2018/01/22
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2017/03/13	2018/03/12

7.2. Test Setup



7.3. Test Procedures

The EUT was setup according to ANSI C63.10: 2013; tested procedure section 8.1 of KDB558074 D01 V04 for compliance to FCC 47CFR 15.247 requirements. Set RBW = 100KHz, Set the VBW $\geq 3 \times$ RBW, Sweep Time=Auto, Set Peak Detector.

7.4. Limits

The 6 dB bandwidth must be greater than 500 kHz.

7.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247: 2015

7.6. Uncertainty

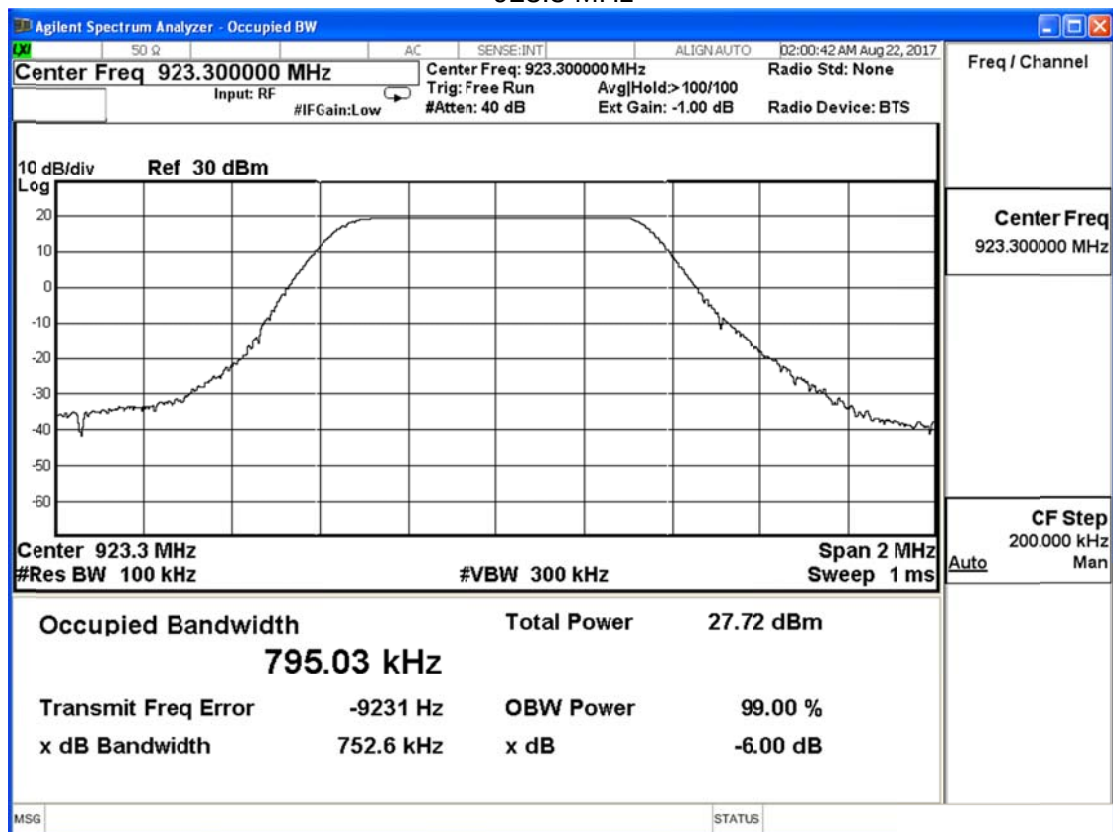
The measurement uncertainty is defined as ± 150 Hz

7.7. Test Result

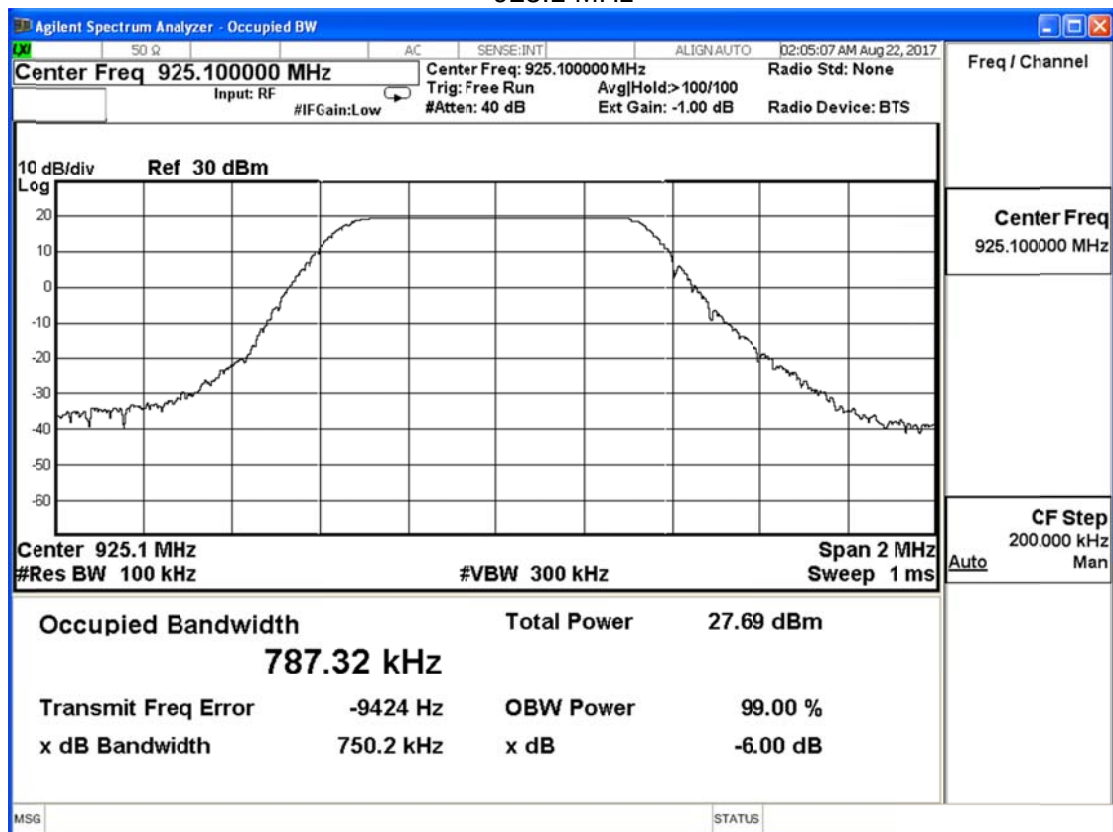
Product	LoRa Module		
Test Item	DTS Bandwidth		
Test Mode	Mode 1: Tx_ANT1		
Date of Test	2017/08/22	Test Site	SR10-H

Frequency (MHz)	Measure Level (kHz)	Limit (MHz)	Result
923.3	752.6	≥ 0.5	Pass
925.1	750.2	≥ 0.5	Pass
927.5	747.8	≥ 0.5	Pass

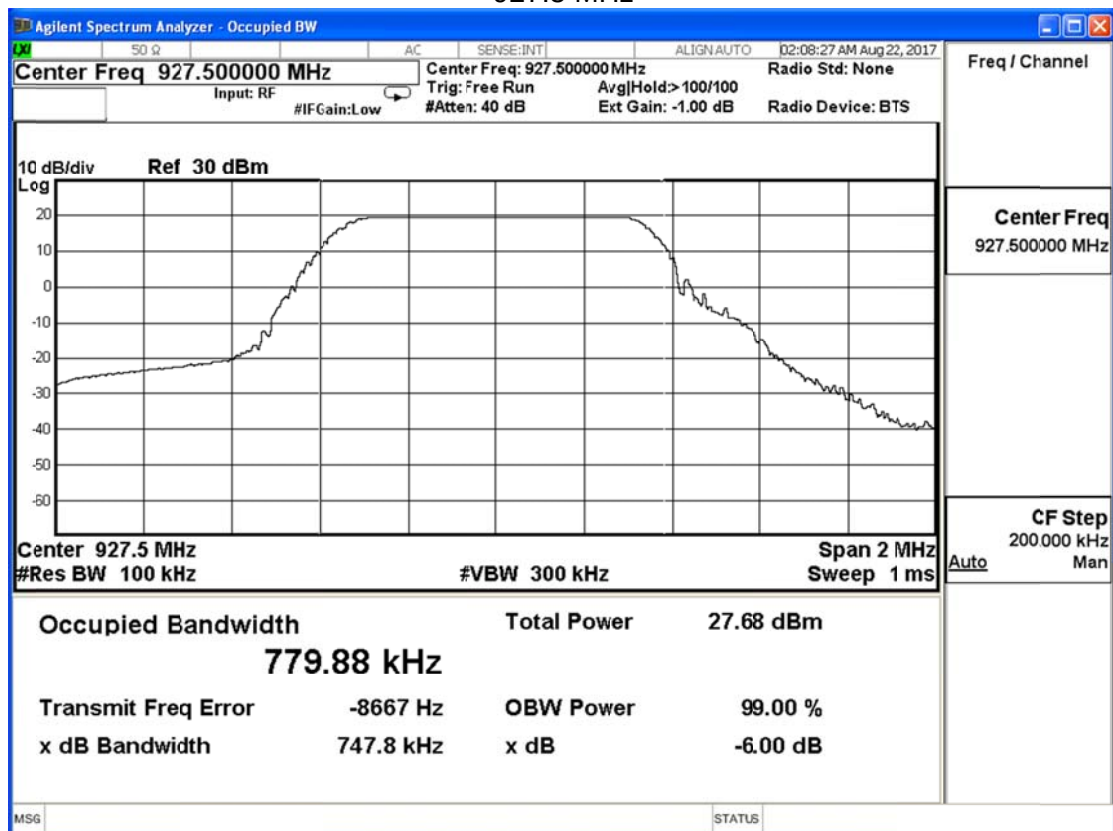
923.3 MHz



925.1 MHz



927.5 MHz



8. Occupied Bandwidth

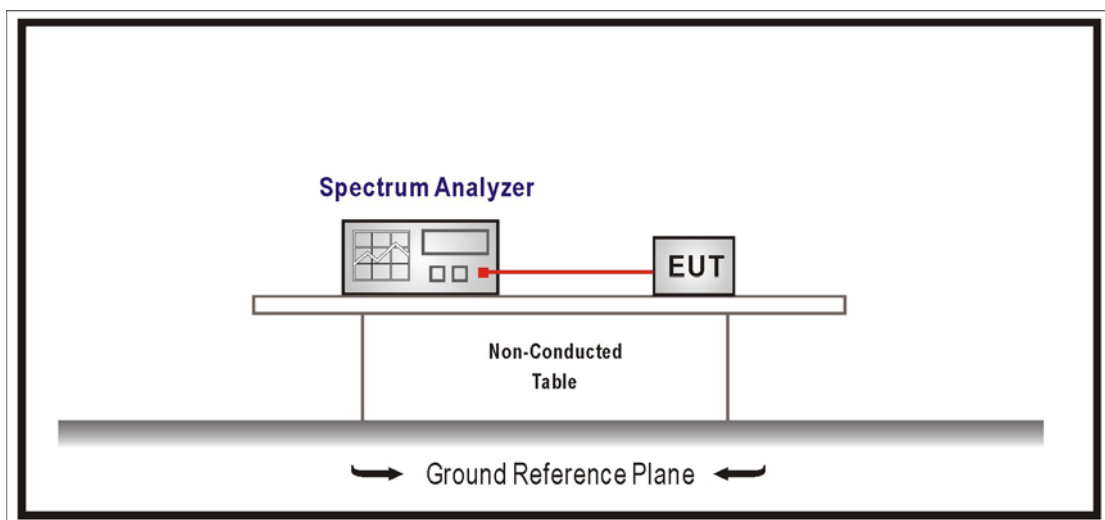
8.1. Test Equipment

The following test equipments are used during the test:

Occupied Bandwidth / SR10-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal & Spectrum Analyzer	R&S	FSV40	101049	2017/01/23	2018/01/22
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2017/03/13	2018/03/12

8.2. Test Setup



8.3. Test Procedures

The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure of KDB558074 D01 V04 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the OBW, Set the VBW $\geq 3 \times$ RBW, Sweep Time=Auto.

8.4. Limits

NA

8.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247: 2015

8.6. Uncertainty

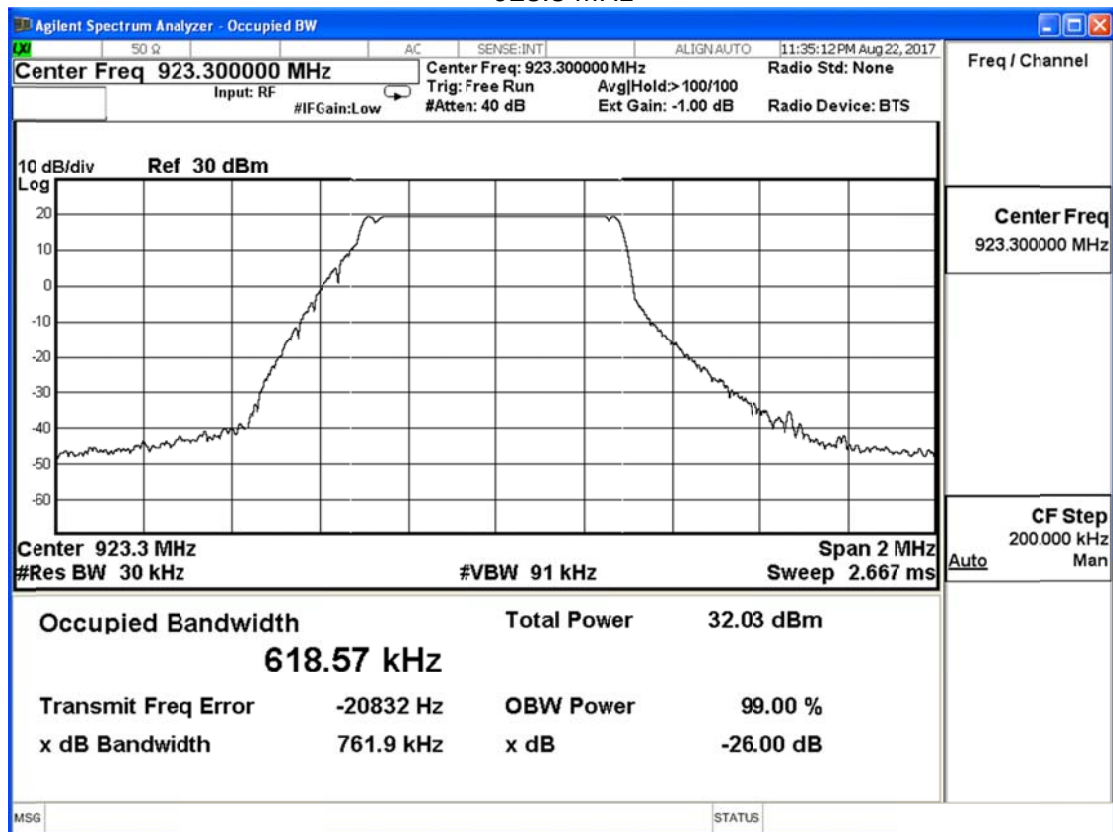
The measurement uncertainty is defined as $\pm 150\text{Hz}$

8.7. Test Result

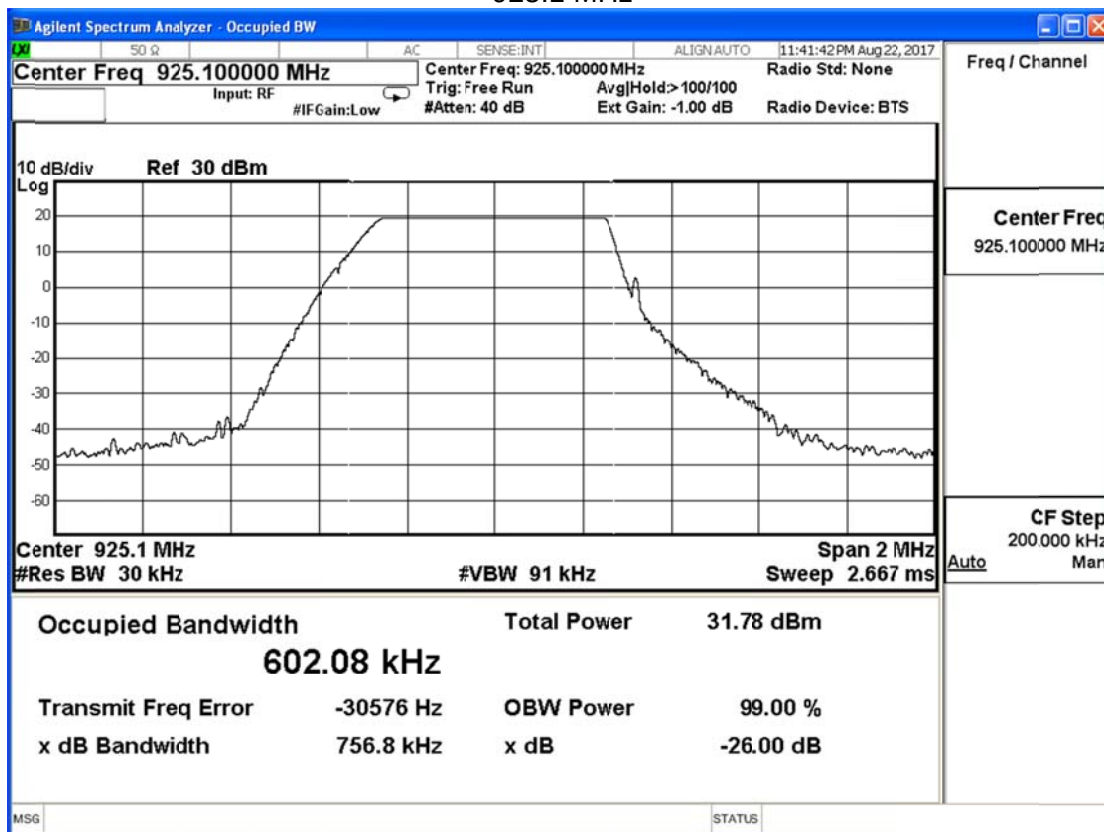
Product	LoRa Module		
Test Item	Occupied Bandwidth		
Test Mode	Mode 1: Tx_ANT1		
Date of Test	2017/08/22	Test Site	SR10-H

Frequency (MHz)	Measure Level (kHz)	Limit (MHz)	Result
923.3	618.57	--	Pass
925.1	602.08	--	Pass
927.5	632.05	--	Pass

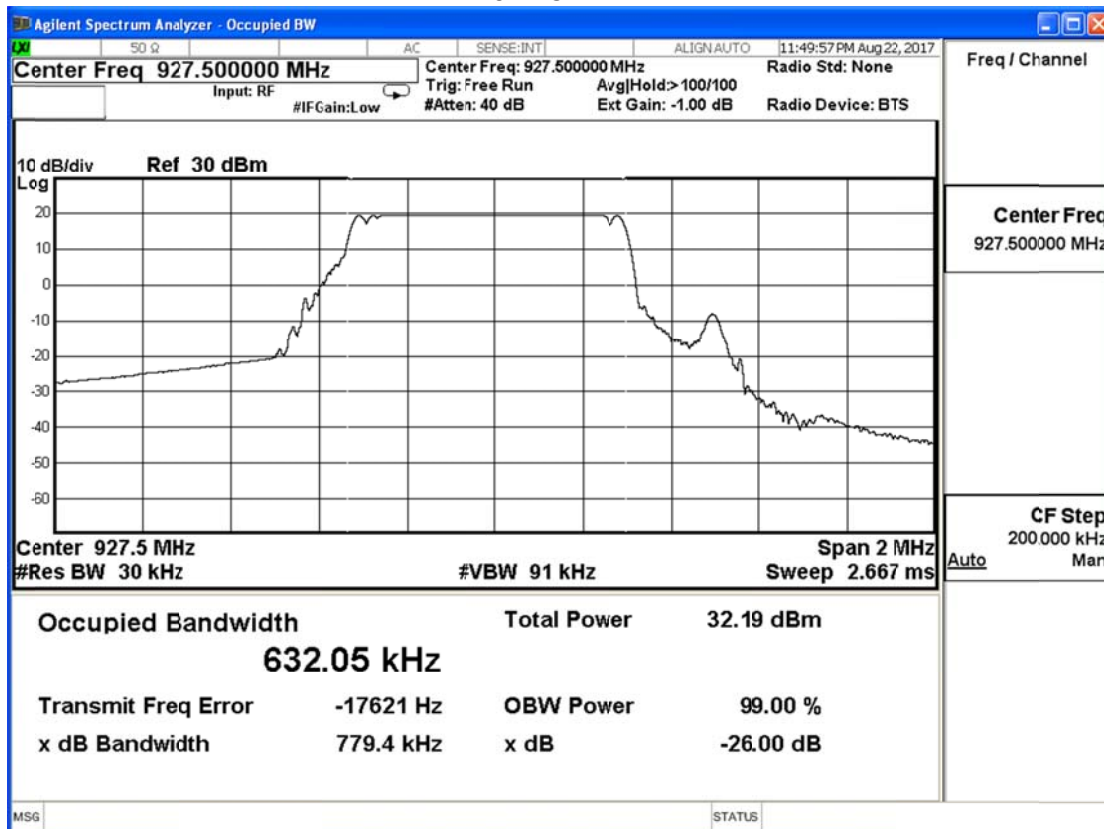
923.3 MHz



925.1 MHz



927.5 MHz



9. Power Density

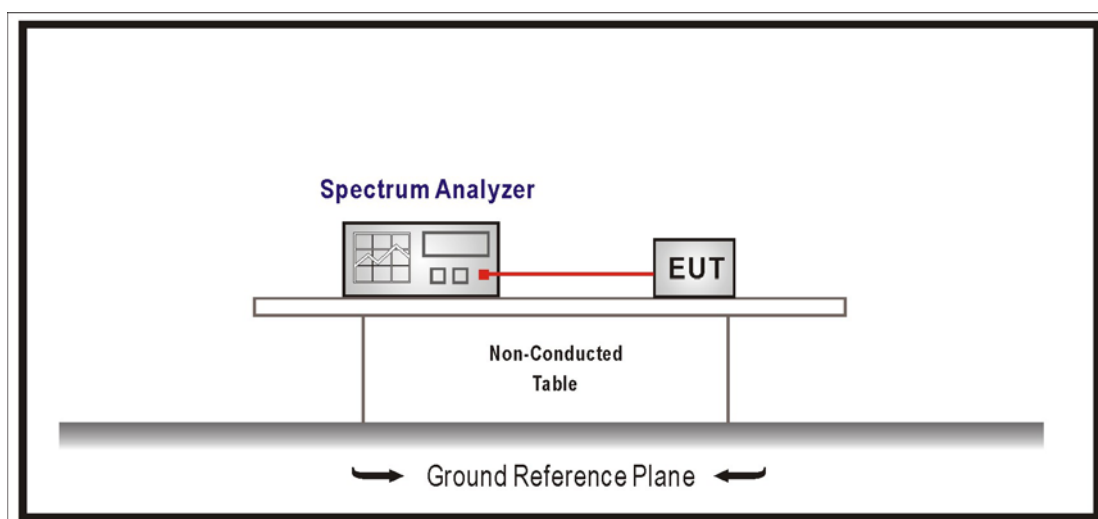
9.1. Test Equipment

The following test equipment is used during the test:

Power Density / SR10-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal & Spectrum Analyzer	R&S	FSV40	101049	2017/01/23	2018/01/22
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2017/03/13	2018/03/12
High Speed Peak Power Meter Dual Input	Anritsu	ML2496A	1602004	2017/01/20	2018/01/19
Pulse Power Sensor	Anritsu	MA2411B	1531043	2017/01/20	2018/01/19
Pulse Power Sensor	Anritsu	MA2411B	1531044	2017/01/20	2018/01/19

9.2. Test Setup



9.3. Limits

The peak power spectral density conducted from the intentional radiated to the antenna shall not be greater than +8dBm in any 3kHz band during any time interval of continuous transmission.

9.4. Test Procedures

The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure section 10.2 of KDB558074 D01 V04 for compliance to FCC 47CFR 15.247 requirements. Set 3KHz $\leq$ RBW $\leq$ 100 kHz, Set VBW $\geq$ 3xRBW, Sweep time=Auto, Set Peak detector.

9.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247: 2015

9.6. Uncertainty

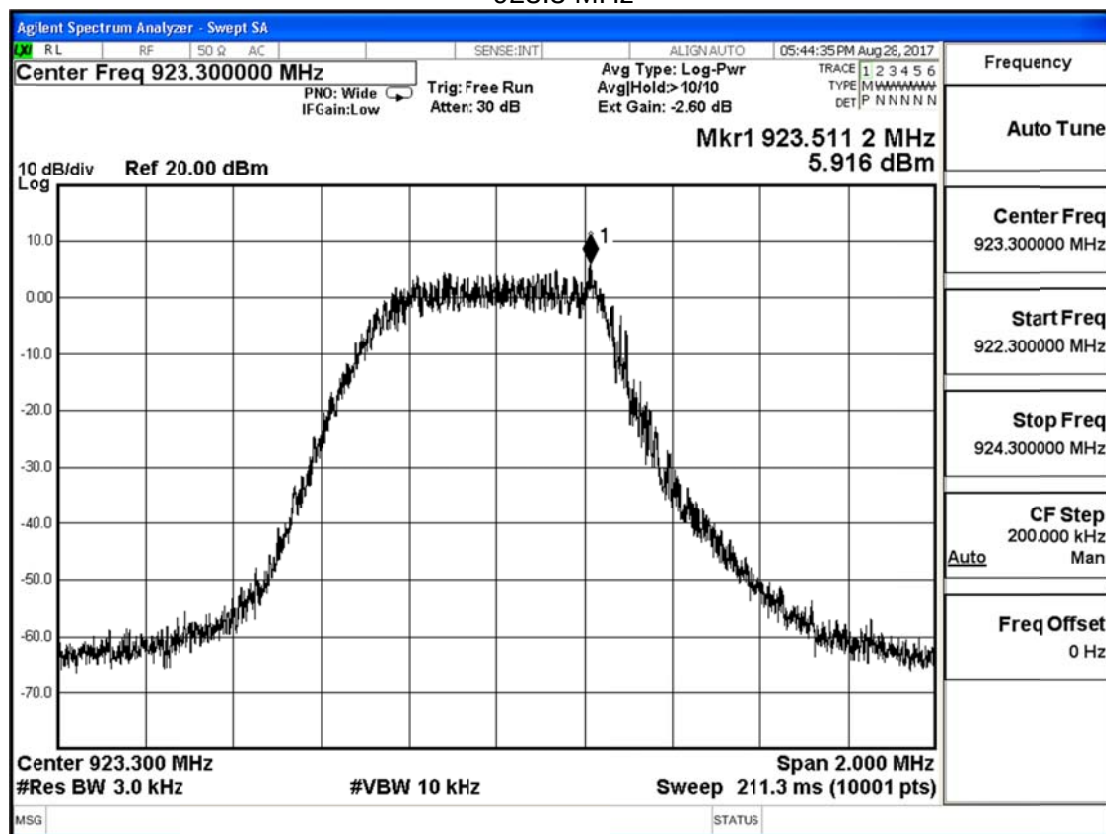
The measurement uncertainty is defined as ± 1.27 dB.

9.7. Test Result

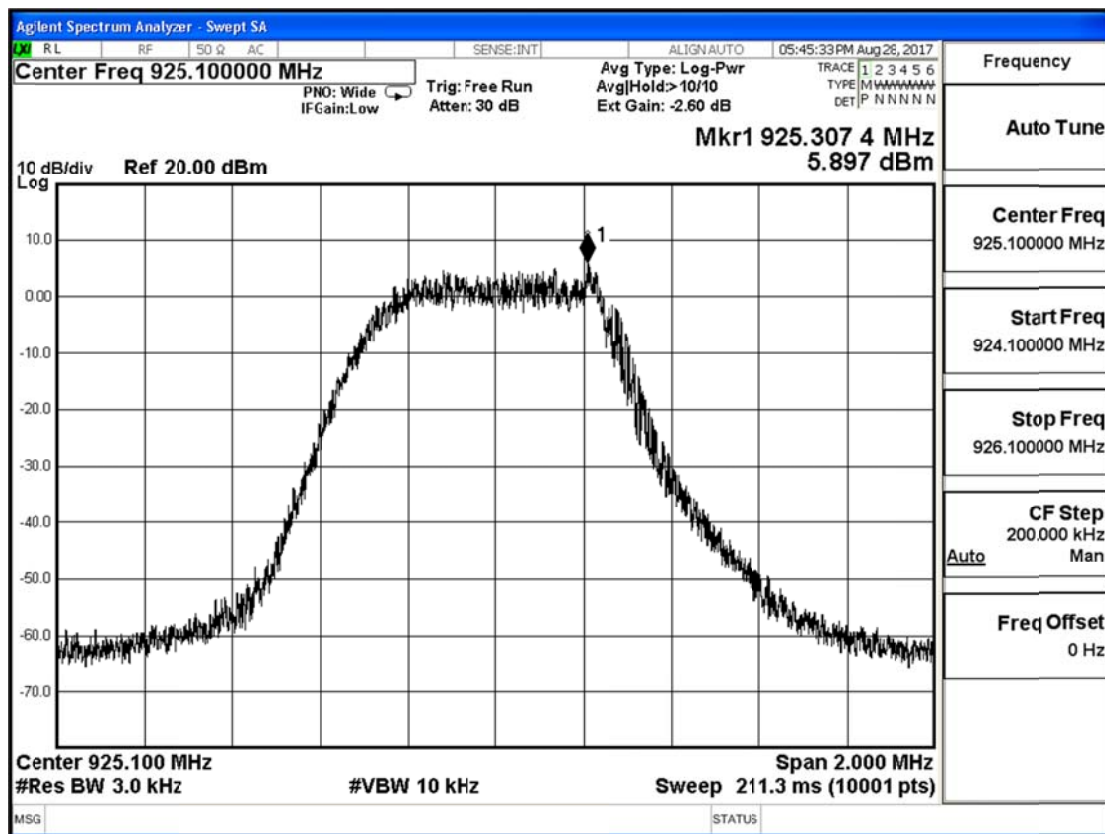
Product	LoRa Module		
Test Item	Power Density		
Test Mode	Mode 1: Tx_ANT1		
Date of Test	2017/08/28	Test Site	SR10-H

Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
923.3	5.916	≤ 6	Pass
925.1	5.897	≤ 6	Pass
927.5	5.918	≤ 6	Pass

923.3 MHz



925.1 MHz



927.5 MHz

