FCC Part 15.247

TEST REPORT

For

Kiwi technology Inc.

4F., No. 158, Sec. 1, Wenxing Rd., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)

FCC ID: 2AKIBLAS603V12

Report Type	**Original Report**
Product Name:	**LoRa Temperature Sensor**
Model Name:	**LAS-603V1**
Series Model Name:	**LAS-603V2**
Report Number :	**RLK200115001-00B**
Report Date :	**2020/03/17**
Reviewed By :	**Zeus Chen** Zeus Chen
Prepared By: **Bay Area Compliance Laboratories Corp.(Linkou Laboratory)** **No. 6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.)** **Tel: +886 (3)3961072; Fax: +886 (3) 3961027** **www.bacl.com.tw**	

Revision History

Revision	Report Number	Issue Date	Description
1.0	RLK200115001-00B	2020/03/17	Original Report

TABLE OF CONTENTS

1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	**Kiwi technology Inc.** 4F., No.158, Sec. 1, Wenxing Rd., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)
Manufacturer	**Kiwi technology Inc.** 4F., No.158, Sec. 1, Wenxing Rd., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)
Brand Name	**Kiwi technology Inc.**
Product (Equipment)	**LoRa Temperature Sensor**
Model Name	**LAS-603V1**
Series Model	**LAS-603V2**
Model Discrepancy	**LAS-603V1: With Temp IC (TMP116) and bottom case is white** **LAS-603V2: With Humidity IC (SHT31) and bottom case is gray**
Frequency Range	902.3 MHz to 914.9 MHz
Number of Channels	64 Channels
Channel Space	125 kHz
Output Power	18.52 dBm (0.0711 W)
Modulation Type	FSK
Related Submittal(s)/Grant(s)	**FCC Part 15.247 DTS with FCC ID : 2AKIBLAS603V12**
Received Date	2020-01-15
Date of Test	2020-03-02 to 2020-03-05

**All measurement and test data in this report was gathered from production sample serial number: 200115001 (Assigned by BACL, LinKou).*

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☒ **DC Type** ☐ **DC Power Supply** ☒ **Battery 1:** ***Brand Name: Panasonic*** ***Model: CR-AGDCF2TN*** ***Rating: 2400mAh*** **Battery 2:** ***Brand Name: FDK*** ***Model: CR17450E-R*** ***Rating: 2500mAh*** ☐ **External from USB Cable** ☐ **External DC Adapter**

1.3 Objective and Test Methodology

The Objective of this Test Report was to document the compliance of the Kiwi technology Inc. Appliance (Model(s): LAS-603V1 and LAS-603V2) to the requirements of the following Standards:

- Part 2, Subpart J, Part 15, Subparts A and C, section 15.247 of the Federal Communication Commission's rules.

- ANSI C63.10-2013 of t American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.4 Measurement Uncertainty

Parameter	Expanded Measurement uncertainty
RF output power	± 1.488 dB
Occupied Channel Bandwidth	± 453.927 Hz
RF Conducted Emission test	± 2.77 dB
AC Power Line Conducted Emission	± 2.66 dB
Radiated Below 1G	± 3.57 dB
Radiated Above 1G	± 5.32 dB

1.5 Test Environments and Test information

Item	Test Date	Temperature (°C)	Relative Humidity (%)	Test Engineer
Radiated (966A)	2020-03-02	18.7	53.0	Leo Cheng
Conducted (TH-02)	2020-03-05	20.9	61.0	Black Wang

1.6 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Linkou Laboratory) to collect test data is located on

☒ No.6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.).

Bay Area Compliance Laboratories Corp. (Linkou Laboratory) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3546) by Mutual Recognition Agreement (MRA). The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database. The FCC Registration No.: 0027578244. Designation No.: TW3546. The Test Firm Registration No.: 181430.

2 System Test Configuration

2.1 Description of Test Configuration

The system was configured for testing in testing mode which was provided by manufacturer.

No special accessory, No modification was made to the EUT and No special equipment used during test.

For 902.3 MHz to 914.9 MHz, there are totally 64 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**902.3**	**32**	**908.5**
2	902.5	33	908.7
3	902.7	--	--
4	902.9	62	914.5
--	--	63	914.7
31	908.3	**64**	**914.9**

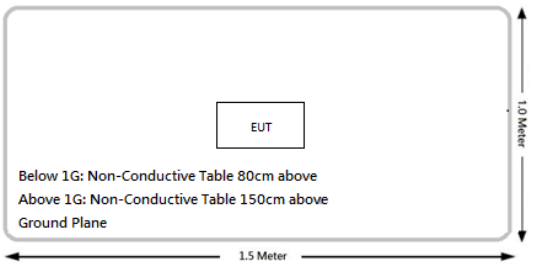
Channel **1**, **32** and **64** were tested.

Worst Case of Power Setting				
EUT Exercise Software		Command		
Configuration	**NTX**	**Low CH**	**Mid CH**	**High CH**
902.3 MHz to 914.9 MHz	1	20	20	20

2.2 Support Equipment List and Details

No.	Description	Manufacturer	Model Number
A	Notebook	DELL	Latitude E5510
B	Adapter (for E5510)	DELL	DA65NM111-00
C	Battery	Panasonic	CR-AGDCF2TN
D	Battery	FDK	CR17450E-R

2.3 Block Diagram of Test Setup

Conduction	Radiation
-	

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §1.1307, § 2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Not Appliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance

Not Appliance: EUT Power by Battery.

4 FCC§15.247(i), §1.1307, § 2.1091 – Maximum Permissible Exposure (MPE)

4.1 Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

*f = frequency in MHz; * = Plane-wave equivalent power density;*

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary: Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with: $\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$

4.2 RF Exposure Evaluation Result

MPE Evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
DSS	902.3 to 914.9	2.50	1.7783	19.00	79.4328	20	0.0281	1.0
DTS	903.0 to 914.2	2.50	1.7783	19.00	79.4328	20	0.0281	1.0

Not simultaneously transmit system

Result: MPE evaluation of single transmission meet the requirement of standard.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6dBi

5.2 Antenna List and Details

Brand	Model	Antenna Type	Antenna Gain	Result
Kiwi technology Inc.	G501110020050000_AJA0009-200-IPX	Folded Dipole	2.50 dBi	Compliance
Kiwi technology Inc.	G50111002008A001_AJA0009-080-IPX	Folded Dipole	2.00 dBi	Compliance

The EUT has an internal antenna arrangement, which was permanently attached, fulfill the requirement of this section.

6 FCC §15.209, §15.205, §15.247(d) – Spurious Emissions

6.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	13.36-13.41	399.9-410	4.5-5.15
0.495-0.505	16.42-16.423	608-614	5.35-5.46
2.1735-2.1905	16.69475-16.69525	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6

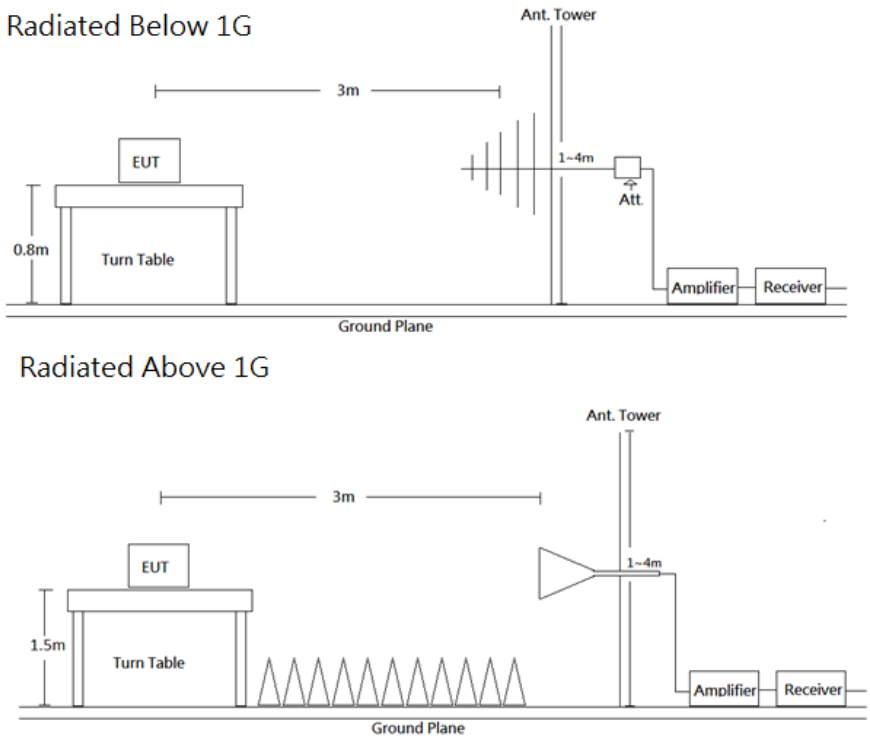
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) 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 20dB. 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).

6.2 EUT Setup and Test Procedure



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

The system was investigated from 30 MHz to 10 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Duty cycle	Measurement method
30-1000 MHz	120 kHz	/	-	QP
Above 1 GHz	1 MHz	3 MHz	-	PK
	1 MHz	10 Hz	>98%	Ave

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations. All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

6.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Radiation 3M Room (966A)					
Active Loop	EMCO	6502	0001-3322	2019/03/15	2020/03/14
Bilog Antenna/6 dB Attenuator	SUNOL SCIENCES & EMEC /EMCI	JB3/N-6-06	A111513/AT-N0668	2019/03/29	2020/03/28
Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	101434	2019/04/17	2020/04/16
Horn Antenna	ETS-Lindgren	3115	00109141	2019/07/05	2020/07/04
Preamplifier	A.H. Systems	PAM-0118	478	2019/03/28	2020/03/27
Microflex Cable (1m)	EMCI	EMC106-SM-SM-2000	180515	2019/08/07	2020/08/06
Microflex Cable (2m)	MTJ	H0919	00000-MT28A-100	2019/08/07	2020/08/06
Microflex Cable (8m)	UTIFLEX	UFA210A-1-3149-300300	MFR 64639 232490-001	2019/08/07	2020/08/06
Turn Table	Chaintek	T-200-S-1	003501	N.C.R	N.C.R
Antenna Tower	Chaintek	MBD-400-1	003504	N.C.R	N.C.R
Controller	Chaintek	3000-1	003507	N.C.R	N.C.R
Software	Audix	e3 v9	E3LK-01	N.C.R	N.C.R
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10

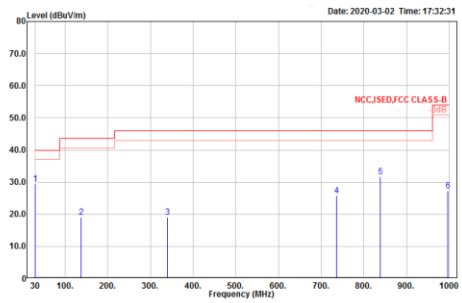
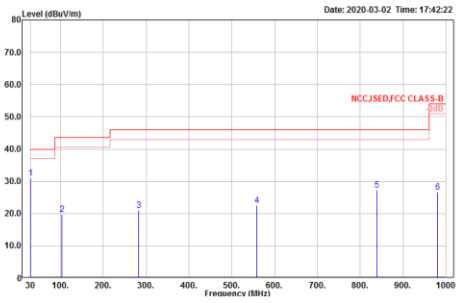
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

6.4 Radiated Emission Test Plot and Data

Transmitting mode (Pre-scan with three orthogonal axis, and worse case as X axis)

Test the worst is LAS-603V2 with Panasonic Battery and the Antenna is G501110020050000_AJA0009-200-IPX

Below 1G (30 MHz-1 GHz)

-Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.000	29.49	40.00	-10.51	35.62	-6.13	Peak	horizontal
2	137.670	19.12	43.50	-24.38	37.38	-18.26	Peak	horizontal
3	340.400	18.99	46.00	-27.01	36.25	-17.26	Peak	horizontal
4	736.160	25.84	46.00	-20.16	36.23	-10.39	Peak	horizontal
5	838.980	31.59	46.00	-14.41	40.64	-9.05	Peak	horizontal
6	997.090	27.24	54.00	-26.76	34.56	-7.32	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.000	30.97	40.00	-9.03	37.10	-6.13	Peak	vertical
2	103.720	19.66	43.50	-23.84	39.53	-19.87	Peak	vertical
3	282.200	20.99	46.00	-25.01	39.20	-18.21	Peak	vertical
4	558.650	22.47	46.00	-23.53	35.61	-13.14	Peak	vertical
5	838.980	27.25	46.00	-18.75	36.30	-9.05	Peak	vertical
6	979.630	26.59	54.00	-27.41	34.13	-7.54	Peak	vertical

Note1: Transmit mode

Note2: Peak value can pass the limit of QP.

Note3:

Level = Read Level + Factor

Over Limit = Level – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported

Above 1G (1 GHz-10 GHz)

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1804.600	42.69	54.00	-11.31	52.61	-9.92	Average
1804.600	44.81	74.00	-29.19	54.73	-9.92	Peak
2706.900	49.95	54.00	-4.05	56.18	-6.23	Average
2706.900	51.47	74.00	-22.53	57.70	-6.23	Peak
4511.500	38.40	54.00	-15.60	38.87	-0.47	Average
4511.500	45.85	74.00	-28.15	46.32	-0.47	Peak
6316.100	43.01	54.00	-10.99	40.23	2.78	Average
6316.100	50.28	74.00	-23.72	47.50	2.78	Peak
8120.700	49.29	54.00	-4.71	43.17	6.12	Average
8120.700	53.84	74.00	-20.16	47.72	6.12	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1804.600	45.60	54.00	-8.40	55.52	-9.92	Average
1804.600	47.23	74.00	-26.77	57.15	-9.92	Peak
2706.900	47.38	54.00	-6.62	53.61	-6.23	Average
2706.900	49.08	74.00	-24.92	55.31	-6.23	Peak
4511.500	44.11	54.00	-9.89	44.58	-0.47	Average
4511.500	48.24	74.00	-25.76	48.71	-0.47	Peak
6316.100	46.46	54.00	-7.54	43.68	2.78	Average
6316.100	51.72	74.00	-22.28	48.94	2.78	Peak
7218.400	51.12	54.00	-2.88	45.81	5.31	Average
7218.400	54.98	74.00	-19.02	49.67	5.31	Peak
8120.700	51.23	54.00	-2.77	45.08	6.15	Average
8120.700	54.98	74.00	-19.02	48.83	6.15	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1817.000	44.11	54.00	-9.89	53.86	-9.75	Average
1817.000	45.66	74.00	-28.34	55.48	-9.82	Peak
2725.500	49.35	54.00	-4.65	55.52	-6.17	Average
2725.500	50.64	74.00	-23.36	56.81	-6.17	Peak
4542.500	39.54	54.00	-14.46	39.92	-0.38	Average
4542.500	46.34	74.00	-27.66	46.72	-0.38	Peak
6359.500	43.85	54.00	-10.15	40.79	3.06	Average
6359.500	51.15	74.00	-22.85	48.09	3.06	Peak
8176.500	49.06	54.00	-4.94	42.92	6.14	Average
8176.500	53.50	74.00	-20.50	47.36	6.14	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1817.000	45.44	54.00	-8.56	55.26	-9.82	Average
1817.000	48.10	74.00	-25.90	57.92	-9.82	Peak
2719.000	47.64	54.00	-6.36	53.81	-6.17	Average
2719.000	49.64	74.00	-24.36	55.81	-6.17	Peak
4542.500	44.21	54.00	-9.79	44.55	-0.34	Average
4542.500	48.44	74.00	-25.56	48.78	-0.34	Peak
6359.500	46.48	54.00	-7.52	43.42	3.06	Average
6359.500	51.62	74.00	-22.38	48.56	3.06	Peak
7268.000	50.55	54.00	-3.45	45.11	5.44	Average
7268.000	54.02	74.00	-19.98	48.58	5.44	Peak
8176.500	52.59	54.00	-1.41	46.45	6.14	Average
8176.500	55.75	74.00	-18.25	49.61	6.14	Peak
9085.000	48.79	54.00	-5.21	40.73	8.06	Average
9085.000	53.71	74.00	-20.29	45.65	8.06	Peak

High CH

Horizontal

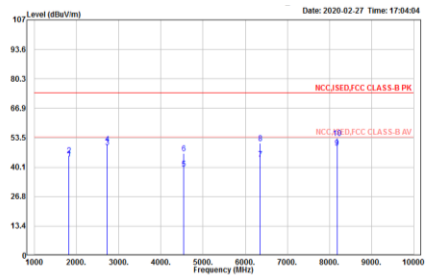
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1829.800	44.96	54.00	-9.04	54.58	-9.62	Average
1829.800	46.19	74.00	-27.81	55.81	-9.62	Peak
2744.700	48.65	54.00	-5.35	54.70	-6.05	Average
2744.700	49.93	74.00	-24.07	55.98	-6.05	Peak
4574.500	38.29	54.00	-15.71	38.52	-0.23	Average
4574.500	45.24	74.00	-28.76	45.47	-0.23	Peak
6404.300	40.99	54.00	-13.01	37.74	3.25	Average
6404.300	50.01	74.00	-23.99	46.76	3.25	Peak
8234.100	51.77	54.00	-2.23	45.69	6.08	Average
8234.100	55.54	74.00	-18.46	49.46	6.08	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1829.800	47.90	54.00	-6.10	57.52	-9.62	Average
1829.800	49.20	74.00	-24.80	58.82	-9.62	Peak
2744.700	47.60	54.00	-6.40	53.65	-6.05	Average
2744.700	49.46	74.00	-24.54	55.51	-6.05	Peak
4574.500	46.35	54.00	-7.65	46.58	-0.23	Average
4574.700	50.59	74.00	-23.41	50.82	-0.23	Peak
6404.300	48.11	54.00	-5.89	44.86	3.25	Average
6404.300	52.81	74.00	-21.19	49.56	3.25	Peak
7319.200	51.06	54.00	-2.94	45.39	5.67	Average
7319.200	54.59	74.00	-19.41	48.92	5.67	Peak
8234.100	53.06	54.00	-0.94	46.98	6.08	Average
8234.100	56.73	74.00	-17.27	50.65	6.08	Peak
9149.000	49.67	54.00	-4.33	41.87	7.80	Average
9149.000	54.58	74.00	-19.42	46.78	7.80	Peak

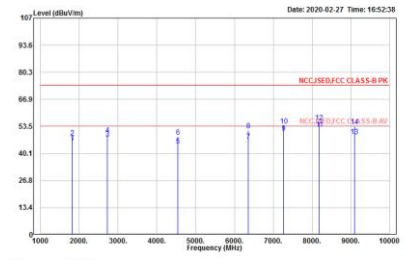
Above 1G (1 GHz-10 GHz): The worst mode

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	1817.000	44.11	54.00	-9.89	53.86	-9.75	Average	horizontal
2	1817.000	45.66	74.00	-28.34	55.48	-9.82	Peak	horizontal
3 !	2725.500	49.35	54.00	-4.65	55.52	-6.17	Average	horizontal
4	2725.500	50.64	74.00	-23.36	56.81	-6.17	Peak	horizontal
5 !	4542.500	39.54	54.00	-14.46	39.92	-0.38	Average	horizontal
6	4542.500	46.34	74.00	-27.66	46.72	-0.38	Peak	horizontal
7 !	6359.500	43.85	54.00	-10.15	40.79	3.06	Average	horizontal
8	6359.500	51.15	74.00	-22.85	48.09	3.06	Peak	horizontal
9 !	8176.500	49.06	54.00	-4.94	42.92	6.14	Average	horizontal
10	8176.500	53.50	74.00	-20.50	47.36	6.14	Peak	horizontal

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	1817.000	45.44	54.00	-8.56	55.26	-9.82	Average	vertical
2	1817.000	48.10	74.00	-25.90	57.92	-9.82	Peak	vertical
3 !	2719.000	47.64	54.00	-6.36	53.81	-6.17	Average	vertical
4	2719.000	49.64	74.00	-24.36	55.81	-6.17	Peak	vertical
5 !	4542.500	44.21	54.00	-9.79	44.55	-0.34	Average	vertical
6	4542.500	48.44	74.00	-25.56	48.78	-0.34	Peak	vertical
7 !	6359.500	46.48	54.00	-7.52	43.42	3.06	Average	vertical
8	6359.500	51.62	74.00	-22.38	48.56	3.06	Peak	vertical
9 !	7268.000	50.55	54.00	-3.45	45.11	5.44	Average	vertical
10 !	7268.000	54.02	74.00	-19.98	48.58	5.44	Peak	vertical
11 !	8176.500	52.59	54.00	-1.41	46.45	6.14	Average	vertical
12 !	8176.500	55.75	74.00	-18.25	49.61	6.14	Peak	vertical
13 !	9085.000	48.79	54.00	-5.21	40.73	8.06	Average	vertical
14	9085.000	53.71	74.00	-20.29	45.65	8.06	Peak	vertical

Note1: Transmit mode

Note2:

Level = Read Level + Factor

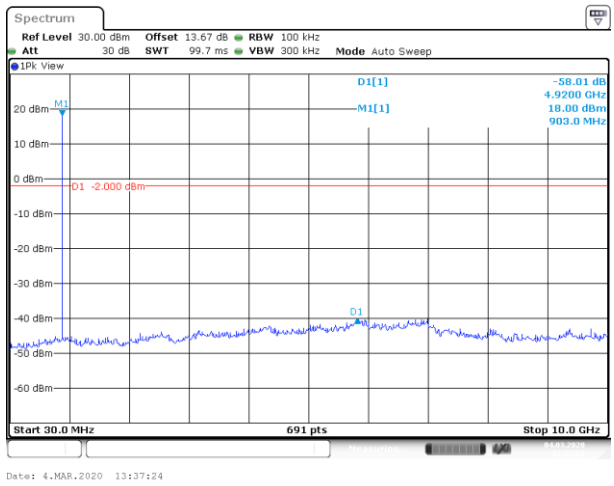
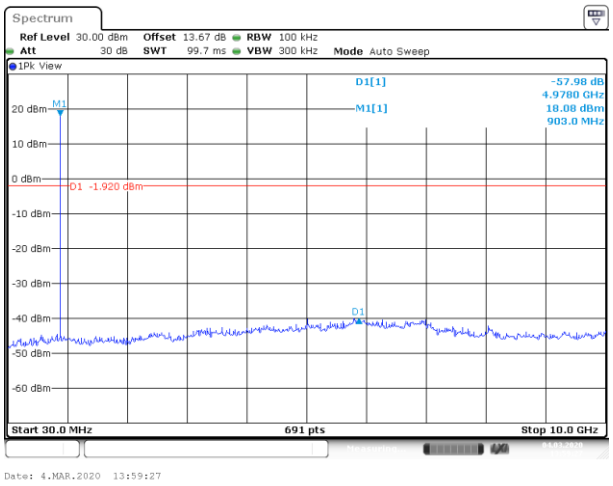
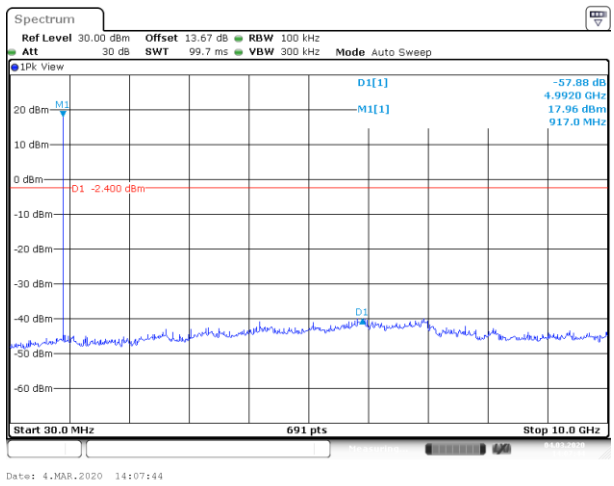
Over Limit = Level – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported

Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
Low	902.3	58.01	≥ 20	Compliance
Mid	908.5	57.98	≥ 20	Compliance
High	914.9	57.88	≥ 20	Compliance

Low CH	Middle CH
	
High CH	**-**
	-

7 FCC §15.247(a)(1) – 20 dB Emission Bandwidth

7.1 Applicable Standard

According to FCC §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.

7.2 Test Procedure

(1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

(3) Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

(4) Repeat above procedures until all frequencies measured were complete.

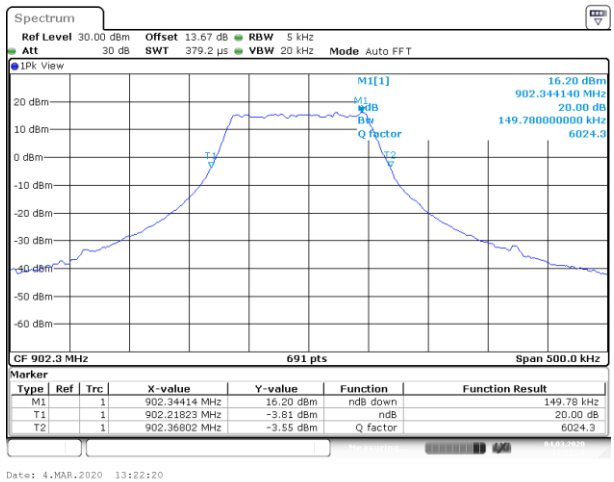
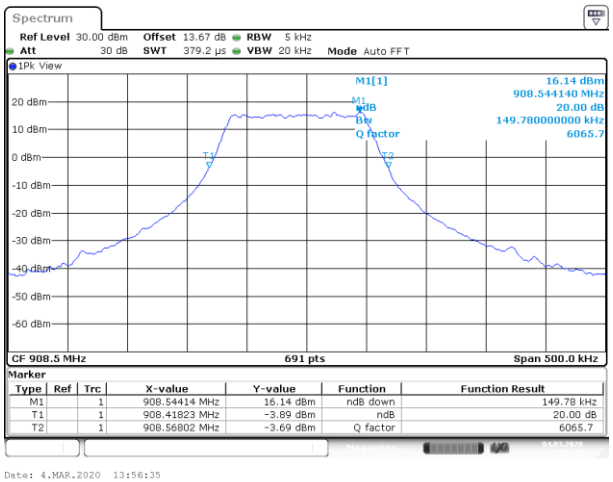
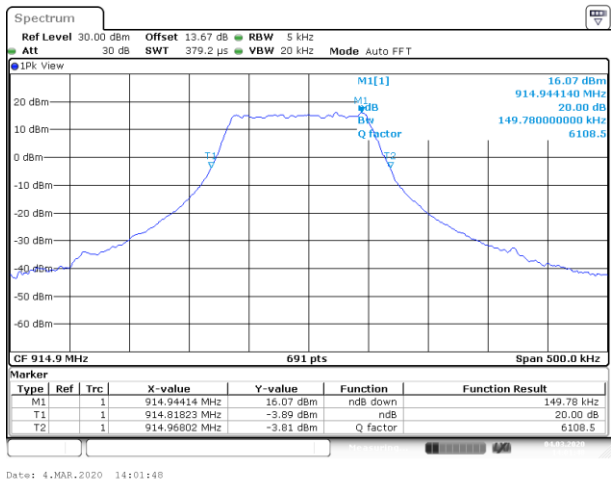
7.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

7.4 Test Results

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	20 dB Bandwidth Limit (kHz)
Low	902.3	149.78	< 250.00
Middle	908.5	149.78	< 250.00
High	914.9	149.78	< 250.00

Low CH	Middle CH
	
High CH	**-**
	-

8 FCC §15.247(a)(1) – Channel Separation Test

8.1 Applicable Standard

According to FCC §15.247(a) (1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

8.2 Test Procedure

According to ANSI 63.10 7.8.3

a) Span: Wide enough to capture the peaks of two adjacent channels. b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

c) Video (or average) bandwidth (VBW) ≥ RBW. d) Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold.

g) Allow the trace to stabilize

8.3 Test Equipment List and Details

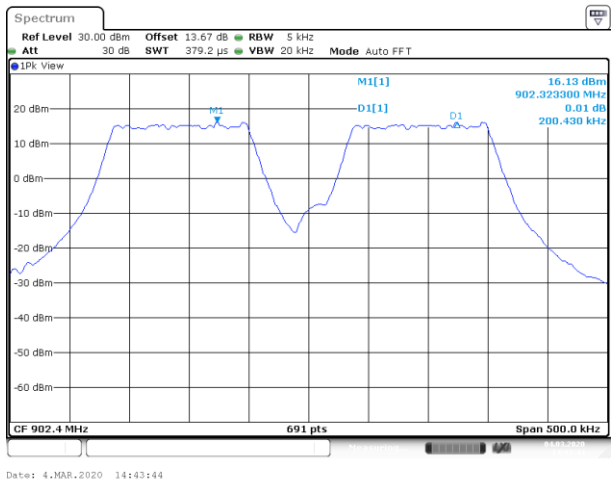
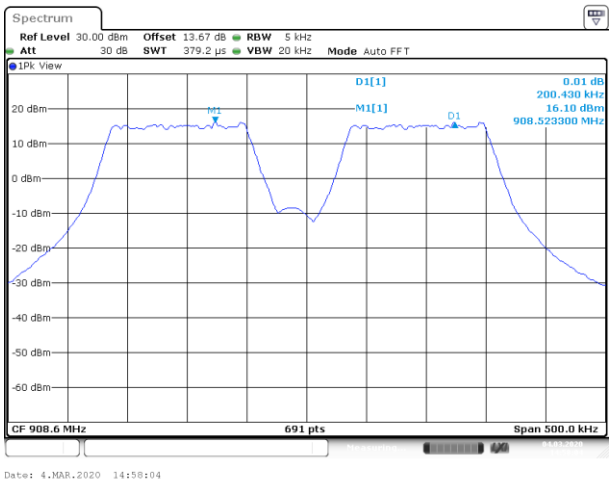
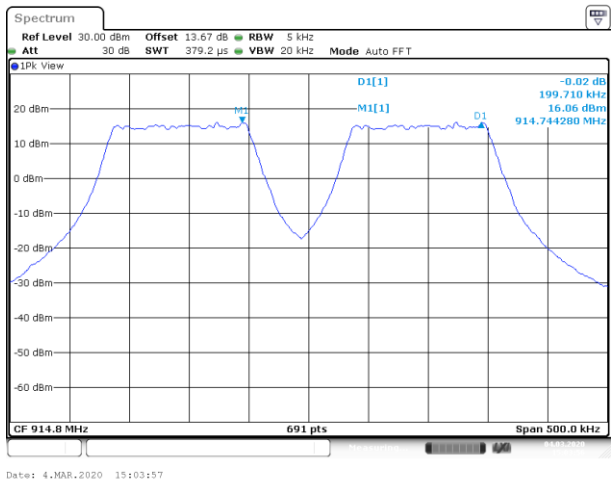
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

8.4 Test Results

Channel	Frequency (MHz)	Channel Separation (kHz)	Limit (kHz)	Result
Low	902.3	200.43	>149.78	Compliance
Middle	908.5	200.43	>149.78	Compliance
High	914.9	199.71	>149.78	Compliance

**Limit > 20dB Bandwidth.*

Low CH	Middle CH
	
High CH	**-**
	-

9 FCC §15.247(a)(1)(iii) – Time of Occupancy (Dwell Time)

9.1 Applicable Standard

According to FCC §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

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel

RBW ≤ channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel

Sweep = as necessary to capture the entire dwell time per hopping channel Detector function = peak

Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements.

Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

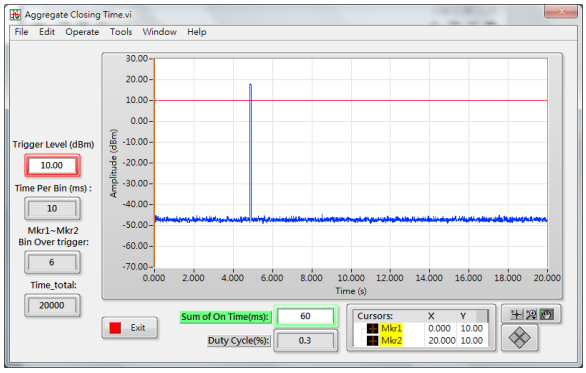
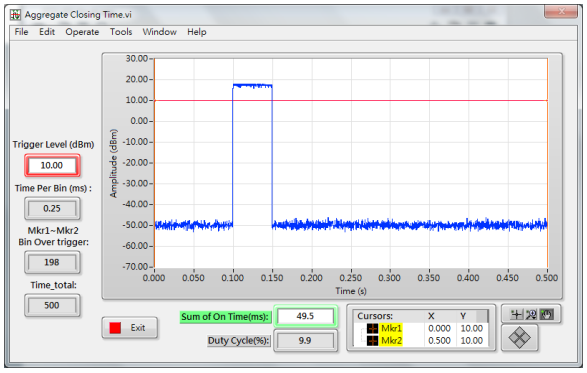
9.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

9.4 Test Results

Frequency (MHz)	Pulse Duration (ms)	Number of Pulses	Measure Time (s)	Dwell Time in (s)	Dwell Time (s)	Limits (s)	Test Result
902.3 MHz to 914.9 MHz	49.500	1	20	20	0.0495	0.4000	**Complies**

Dwell Time - 20s	Dwell Time – Zoon In Pulse Duration
	

10 FCC §15.247(a)(1)(iii) –Quantity of hopping channel Test

10.1 Applicable Standard

According to FCC §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

Span = the frequency band of operation.

RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller VBW ≥ RBW.

Sweep = auto. Detector function = peak Trace = max hold.

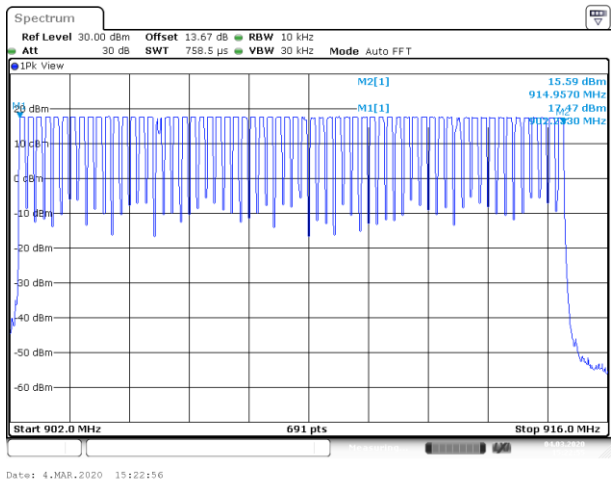
10.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

10.4 Test Results

Mode	Frequency Range (MHz)	Number of Hopping Channel	Limit (CH)	Result
902.3 MHz to 914.9 MHz	902.3 MHz to 914.9 MHz	64	>50	Compliance

902.3 MHz to 914.9 MHz	-
	-

Note:

Channel Separate = 200 KHz

914.9 MHz - 902.3 MHz = 12.6 MHz, (12.6 MHz / 0.2 MHz) + 1 =64CH

11 FCC §15.247(b)(1) – Maximum Output Power

11.1 Applicable Standard

According to FCC §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.

11.2 Test Procedure

Place the EUT on a bench and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Power sensor.

11.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
USB Wideband Power Sensor	Agilent	U2021XA	MY56120026	2019/09/06	2020/09/05

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

11.4 Test Results

Channel	Frequency (MHz)	Maximum Peak Output Power (dBm)	Maximum Peak Output Power (W)	Limit (dBm)	Result
Low	902.3	18.52	0.0711	30	Compliance
Middle	908.5	18.49	0.0706	30	Compliance
High	914.9	18.45	0.0700	30	Compliance

12 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

12.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c)

.

12.2 Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

RBW = 100 kHz VBW = 300 kHz.

Sweep = coupled. Detector function = peak Trace = max hold.

12.3 Test Equipment List and Details

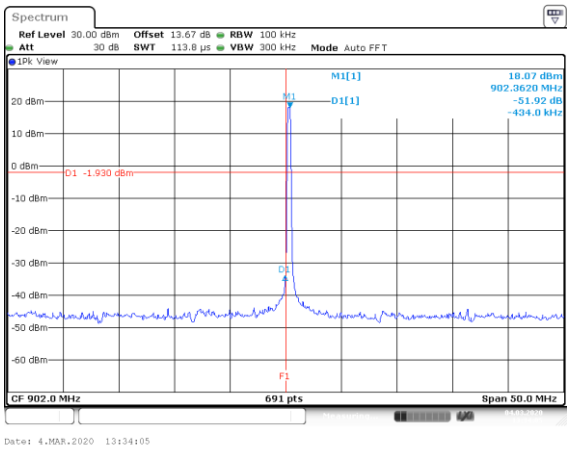
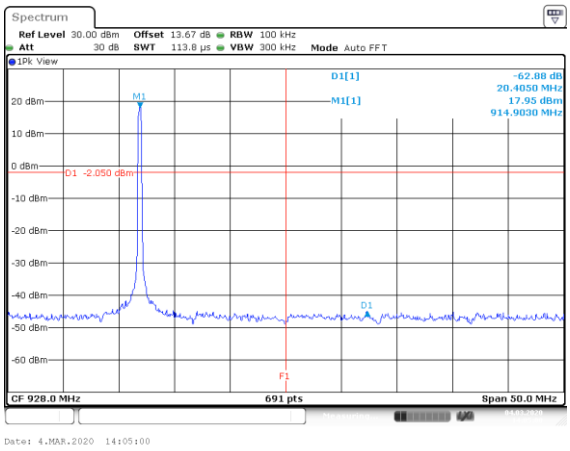
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

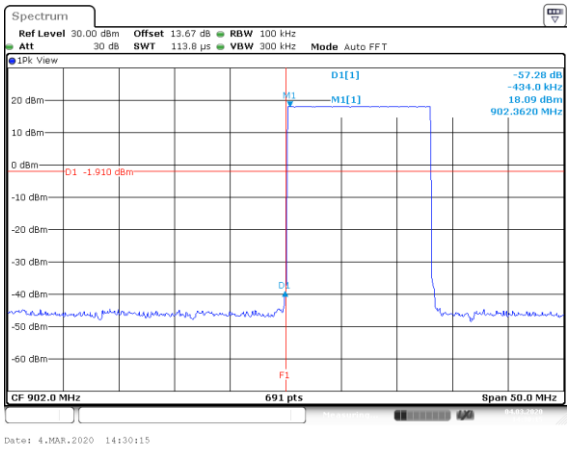
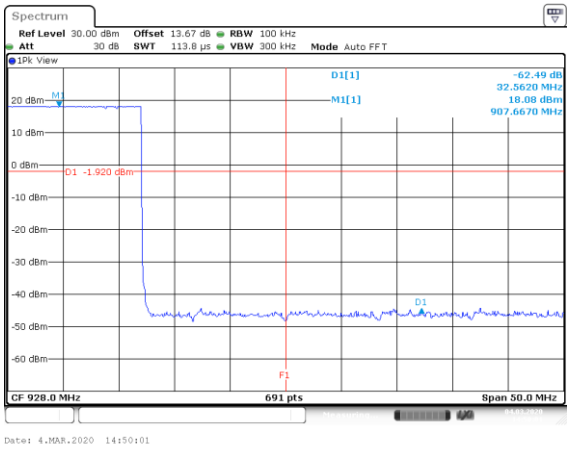
12.4 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
902.3 MHz to 914.9 MHz				
Low	902.3	51.92	≥ 20	Compliance
High	914.9	62.88	≥ 20	Compliance
902.3 MHz to 914.9 MHz (Hopping)				
Low	902.3	57.28	≥ 20	Compliance
High	914.9	62.49	≥ 20	Compliance

902.3 MHz to 914.9 MHz:

Left Side	Right Side
	

902.3 MHz to 914.9 MHz Hopping:

Left Side	Right Side
	

----- END OF REPORT -----