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: 2AKIBLAS604V23

Report Type	**Original Report**
Product Name:	**LoRa Temperature Sensor**
Model Name:	**LAS-604V3(LCM)**
Series Model Name:	**LAS-604V2(W/O LCM)**
Report Number :	**RLK191122001-00C**
Report Date :	**2020/01/02**
Reviewed By :	**Zeus Chen** Zeus Chen

Prepared By:

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Revision History

Revision	Report Number	Issue Date	Description
1.0	RLK191122001-00C	2020/01/02	Original Report

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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-604V3(LCM)**
Serial Model	**LAS-604V2(W/O LCM)**
Model Discrepancy	**LAS-604V3 with LCD Monitor** **LAS-604V2 without LCD Monitor**
Frequency Range	903.0 MHz – 914.2 MHz
Number of Channels	7 Channels
Output Power	7.06 dBm (0.0051 W)
Modulation Type	FSK
Related Submittal(s)/Grant(s)	**FCC Part 15.247 DSS with FCC ID : 2AKIBLAS604V23**
Received Date	Nov 22, 2019
Date of Test	Dec 17, 2019 ~ Dec 20, 2019

**All measurement and test data in this report was gathered from production sample serial number: 191122001 (Assigned by BACL, LinKou).*

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☐ AC 120 V/60 Hz ☐ Adapter ☐ By Power Cord.
	☒ 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
	☐ Host System

1.3 Objective and Test Methodology

The Objective of this Test Report was to document the compliance of the Kiwi technology Inc. Appliance (Model: LAS-604V3(LCM); LAS-604V2(W/O LCM)) 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 Test (966A)	2019-12-17	21.0	48.0	Leo Cheng
Conducted Test (TH02)	2019-12-20	21.7	61.0	Ethan Shao

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 Test Channels and Description of Worst 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 903.0 MHz to 914.2 MHz, there are totally 8 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**903.0**	4	909.4
1	904.6	5	911.0
2	906.2	6	912.6
3	**907.8**	**7**	**914.2**

Channel **0**, **3** and **7** were tested.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the Peak power and PSD across all date rates bandwidths, and modulations.

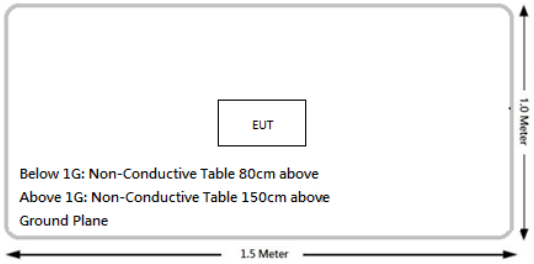
Worst Case of Power Setting				
EUT Exercise Software		Command		
Configuration	**NTX**	**Low CH**	**Mid CH**	**High CH**
903.0 MHz to 914.2 MHz	1	4	4	5

2.2 Support Equipment List and External Cable List

No.	Description	Manufacturer	Model Number
A	Notebook	DELL	Latitude E5510
B	Adapter (for E5510)	DELL	DA65NM111-00
C	Notebook	DELL	Latitude E6410
D	Adapter (for E6410)	DELL	LA65NM130
E	Battery	Panasonic	CR-AGDCF2TN
F	Battery	FDK	CR17450E-R

No.	Description	Brand	Shielded Type	Ferrite Core	Length (M)
1	Sensor Cable	LIAN SHENG	Non-Shielded	NA	5
2	Sensor Cable	LIAN SHENG	Non-Shielded	NA	3

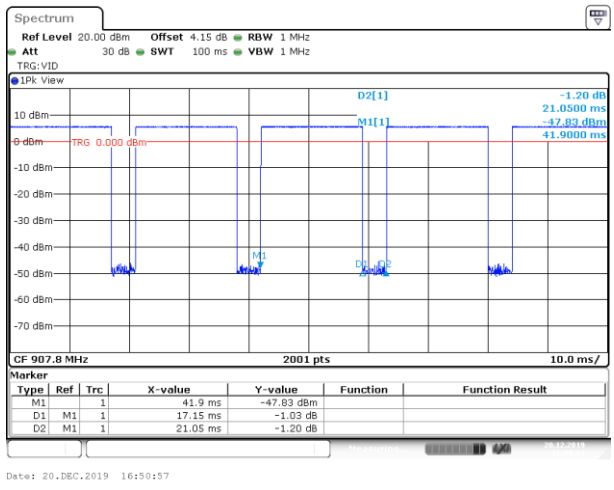
2.3 Block Diagram of Test Setup

Conduction	Radiation
-	

2.4 Duty Cycle

All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum power transmission duration, T, are required for each tested mode of operation.

Configuration	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Factor (dB)
903.0 MHz to 914.2 MHz	17.15	21.05	81.47	0.89

903.0 MHz to 914.2 MHz	-
	-

**Note: Duty Factor = 10*log (1/Duty cycle)*

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)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	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	0.25	1.0593	7.00	5.0119	20	0.0011	1.0
DTS	903.0 to 914.2	0.25	1.0593	8	6.3096	20	0.0013	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.	GY196IT021-003	Dipole Antenna	0.25 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

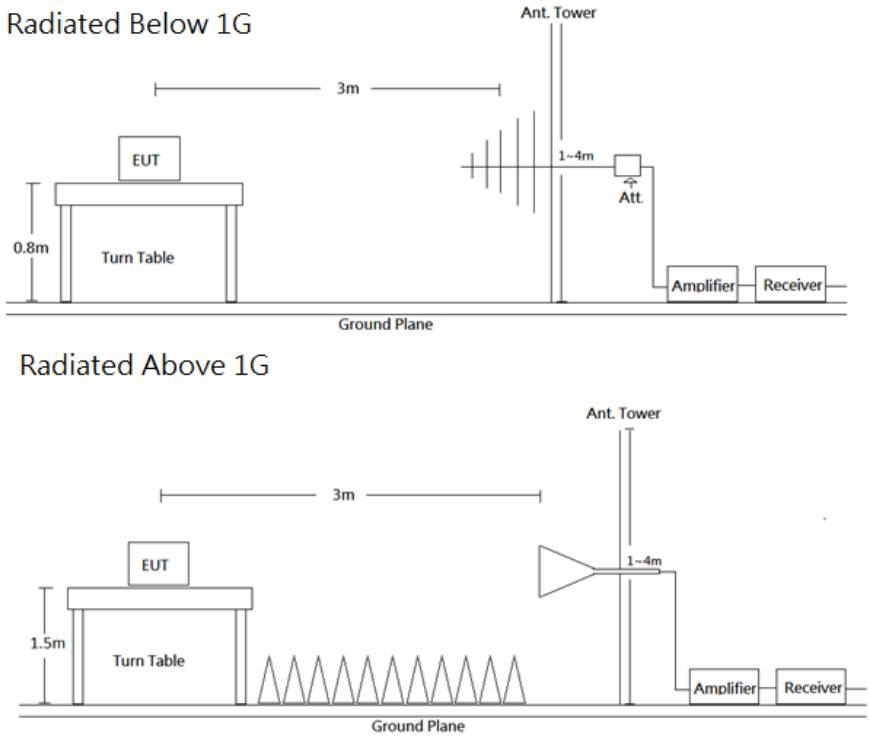
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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
	1 MHz	1/T	<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

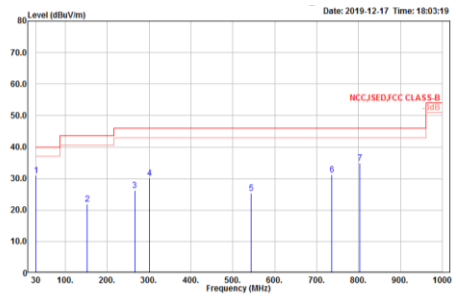
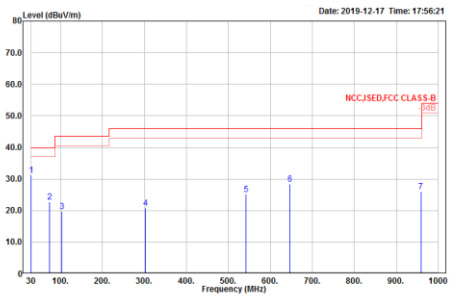
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Radiation 3M Room (966A)					
Active Loop	EMCO	6502	0001-3322	2019/03/15	2020/03/14
Bilog Antenna/6 dB Attenuator	SUNOL SCIENCES & EMEC /EMCI	JB3/N-6-06	A111513/AT-N0668	2019/03/29	2020/03/28
Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	101434	2019/04/17	2020/04/16
Horn Antenna	ETS-Lindgren	3115	00109141	2019/07/05	2020/07/04
Horn Antenna	ETS-Lindgren	3160-09	00123852	2019/07/11	2020/07/10
Preamplifier	A.H. Systems	PAM-1840VH	174	2019/02/18	2020/02/17
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
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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 Test Result

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

Below 1G (30 MHz-1 GHz) test the worst mode with FDK Battery

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	31.02	40.00	-8.98	37.15	-6.13	Peak	horizontal
2	152.200	21.85	43.50	-21.65	40.70	-18.85	Peak	horizontal
3	265.700	26.18	46.00	-19.82	44.93	-18.75	Peak	horizontal
4	300.610	30.18	46.00	-15.82	48.16	-17.98	Peak	horizontal
5	544.180	25.40	46.00	-20.60	38.79	-13.39	Peak	horizontal
6	735.600	31.25	46.00	-14.75	41.64	-10.39	Peak	horizontal
7	802.280	34.98	46.00	-11.02	44.43	-9.45	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	31.25	40.00	-8.75	37.38	-6.13	Peak	vertical
2	74.900	22.69	40.00	-17.31	45.41	-22.72	Peak	vertical
3	103.700	19.72	43.50	-23.78	39.59	-19.87	Peak	vertical
4	301.810	20.91	46.00	-25.09	38.90	-17.99	Peak	vertical
5	542.150	25.23	46.00	-20.77	38.62	-13.39	Peak	vertical
6	645.940	28.33	46.00	-17.67	39.97	-11.64	Peak	vertical
7	958.300	26.11	46.00	-19.89	33.89	-7.78	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	
1535.000	52.18	54.00	-1.82	62.85	-10.67	Average
1535.000	53.17	74.00	-20.83	63.84	-10.67	Peak
1806.000	40.72	54.00	-13.28	50.64	-9.92	Average
1806.000	42.79	74.00	-31.21	52.66	-9.87	Peak
2709.000	52.54	54.00	-1.46	58.74	-6.20	Average
2709.000	54.00	74.00	-20.00	60.20	-6.20	Peak
4515.000	42.67	54.00	-11.33	43.12	-0.45	Average
4515.000	47.05	74.00	-26.95	47.49	-0.44	Peak
5418.000	44.82	54.00	-9.18	44.65	0.17	Average
5418.000	47.77	74.00	-26.23	47.60	0.17	Peak
7224.000	48.18	54.00	-5.82	42.83	5.35	Average
7224.000	53.22	74.00	-20.78	47.88	5.34	Peak
8127.000	52.25	54.00	-1.75	46.10	6.15	Average
8127.000	55.40	74.00	-18.60	49.25	6.15	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1535.000	46.76	54.00	-7.24	57.43	-10.67	Average
1535.000	49.70	74.00	-24.30	60.37	-10.67	Peak
1806.000	38.68	54.00	-15.32	48.60	-9.92	Average
1806.000	41.96	74.00	-32.04	51.83	-9.87	Peak
2709.000	49.90	54.00	-4.10	56.10	-6.20	Average
2709.000	51.22	74.00	-22.78	57.42	-6.20	Peak
3612.000	39.23	54.00	-14.77	42.22	-2.99	Average
3612.000	44.28	74.00	-29.72	47.29	-3.01	Peak
4515.000	43.86	54.00	-10.14	44.31	-0.45	Average
4515.000	47.19	74.00	-26.81	47.63	-0.44	Peak
7224.000	50.87	54.00	-3.13	45.52	5.35	Average
7224.000	54.71	74.00	-19.29	49.37	5.34	Peak
8127.000	53.67	54.00	-0.33	47.52	6.15	Average
8127.000	58.67	74.00	-15.33	52.52	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	
1535.000	52.21	54.00	-1.79	62.88	-10.67	Average
1535.000	53.85	74.00	-20.15	64.52	-10.67	Peak
1815.600	39.06	54.00	-14.94	48.88	-9.82	Average
1815.600	41.13	74.00	-32.87	50.89	-9.76	Peak
2723.400	53.35	54.00	-0.65	59.52	-6.17	Average
2723.400	55.67	74.00	-18.33	61.84	-6.17	Peak
3631.200	37.36	54.00	-16.64	40.32	-2.96	Average
3631.200	42.06	74.00	-31.94	44.93	-2.87	Peak
4539.000	42.05	54.00	-11.95	42.43	-0.38	Average
4539.000	47.08	74.00	-26.92	47.46	-0.38	Peak
7262.400	47.01	54.00	-6.99	41.58	5.43	Average
7262.400	52.28	74.00	-21.72	46.85	5.43	Peak
8170.200	51.04	54.00	-2.96	44.89	6.15	Average
8170.200	54.85	74.00	-19.15	48.70	6.15	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1535.000	47.92	54.00	-6.08	58.59	-10.67	Average
1535.000	50.28	74.00	-23.72	60.95	-10.67	Peak
1815.600	36.73	54.00	-17.27	46.55	-9.82	Average
1815.600	40.59	74.00	-33.41	50.35	-9.76	Peak
2723.400	49.64	54.00	-4.36	55.81	-6.17	Average
2723.400	50.55	74.00	-23.45	56.72	-6.17	Peak
3631.200	38.43	54.00	-15.57	41.39	-2.96	Average
3631.200	43.91	74.00	-30.09	46.87	-2.96	Peak
4539.000	41.24	54.00	-12.76	41.62	-0.38	Average
4539.000	45.50	74.00	-28.50	45.88	-0.38	Peak
7262.400	49.93	54.00	-4.07	44.50	5.43	Average
7262.400	54.08	74.00	-19.92	48.65	5.43	Peak
8170.200	53.06	54.00	-0.94	46.91	6.15	Average
8170.200	55.43	74.00	-18.57	49.28	6.15	Peak

High CH

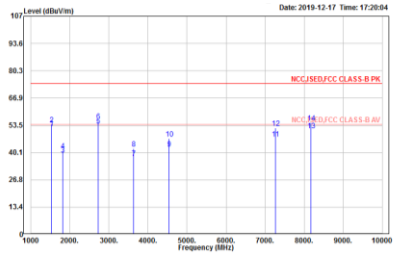
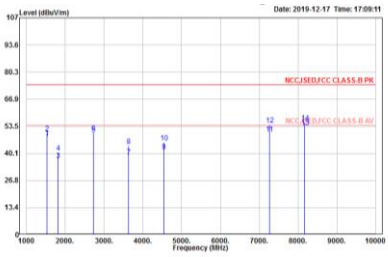
Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1535.000	52.91	74.00	-21.09	63.58	-10.67	Peak
1828.400	40.20	54.00	-13.80	49.82	-9.62	Average
1828.400	42.37	74.00	-31.63	51.99	-9.62	Peak
2742.600	52.53	54.00	-1.47	58.63	-6.10	Average
2742.600	53.73	74.00	-20.27	59.80	-6.07	Peak
3656.800	39.33	54.00	-14.67	42.14	-2.81	Average
3656.800	43.59	74.00	-30.41	46.31	-2.72	Peak
4571.000	44.14	54.00	-9.86	44.38	-0.24	Average
4571.000	49.25	74.00	-24.75	49.48	-0.23	Peak
7313.600	46.60	54.00	-7.40	40.75	5.85	Average
7313.600	52.53	74.00	-21.47	46.88	5.65	Peak
8227.800	49.51	54.00	-4.49	43.43	6.08	Average
8227.800	53.94	74.00	-20.06	47.86	6.08	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1535.000	47.78	54.00	-6.22	58.45	-10.67	Average
1535.000	49.81	74.00	-24.19	60.48	-10.67	Peak
1828.400	35.89	54.00	-18.11	43.41	-7.52	Average
1828.400	40.21	74.00	-33.79	49.83	-9.62	Peak
2742.600	49.69	54.00	-4.31	55.79	-6.10	Average
2742.600	50.74	74.00	-23.26	56.81	-6.07	Peak
3656.800	38.54	54.00	-15.46	41.35	-2.81	Average
3656.800	43.85	74.00	-30.15	46.52	-2.67	Peak
4571.000	42.30	54.00	-11.70	42.54	-0.24	Average
4571.000	47.17	74.00	-26.83	47.40	-0.23	Peak
7313.600	49.51	54.00	-4.49	43.84	5.67	Average
7313.600	53.60	74.00	-20.40	47.95	5.65	Peak
8227.800	52.96	54.00	-1.04	46.88	6.08	Average
8227.800	56.66	74.00	-17.34	50.58	6.08	Peak

Above 1G (1 GHz-26.5 GHz): The worst mode

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	1535.000	52.21	54.00	-1.79	62.88	-10.67	Average	horizontal
2	1535.000	53.85	74.00	-20.15	64.52	-10.67	Peak	horizontal
3 !	1815.600	39.06	54.00	-14.94	48.88	-9.82	Average	horizontal
4	1815.600	41.13	74.00	-32.87	50.89	-9.76	Peak	horizontal
5 !	2723.400	53.35	54.00	-0.65	59.52	-6.17	Average	horizontal
6 !	2723.400	55.67	74.00	-18.33	61.84	-6.17	Peak	horizontal
7 !	3631.200	37.36	54.00	-16.64	40.32	-2.96	Average	horizontal
8	3631.200	42.06	74.00	-31.94	44.93	-2.87	Peak	horizontal
9 !	4539.000	42.05	54.00	-11.95	42.43	-0.38	Average	horizontal
10	4539.000	47.08	74.00	-26.92	47.46	-0.38	Peak	horizontal
11 !	7262.400	47.01	54.00	-6.99	41.58	5.43	Average	horizontal
12	7262.400	52.28	74.00	-21.72	46.85	5.43	Peak	horizontal
13 !	8170.200	51.04	54.00	-2.96	44.89	6.15	Average	horizontal
14 !	8170.200	54.85	74.00	-19.15	48.70	6.15	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	1535.000	47.92	54.00	-6.08	58.59	-10.67	Average	vertical
2	1535.000	50.28	74.00	-23.72	60.95	-10.67	Peak	vertical
3 !	1815.600	36.73	54.00	-17.27	46.55	-9.82	Average	vertical
4	1815.600	40.59	74.00	-33.41	50.35	-9.76	Peak	vertical
5 !	2723.400	49.64	54.00	-4.36	55.81	-6.17	Average	vertical
6	2723.400	50.55	74.00	-23.45	56.72	-6.17	Peak	vertical
7 !	3631.200	38.43	54.00	-15.57	41.39	-2.96	Average	vertical
8	3631.200	43.91	74.00	-30.09	46.87	-2.96	Peak	vertical
9 !	4539.000	41.24	54.00	-12.76	41.62	-0.38	Average	vertical
10	4539.000	45.50	74.00	-28.50	45.88	-0.38	Peak	vertical
11 !	7262.400	49.93	54.00	-4.07	44.50	5.43	Average	vertical
12 !	7262.400	54.08	74.00	-19.92	48.65	5.43	Peak	vertical
13 !	8170.200	53.06	54.00	-0.94	46.91	6.15	Average	vertical
14 !	8170.200	55.43	74.00	-18.57	49.28	6.15	Peak	vertical

Note1: Transmit mode

Note2:

Level = Read Level + Factor

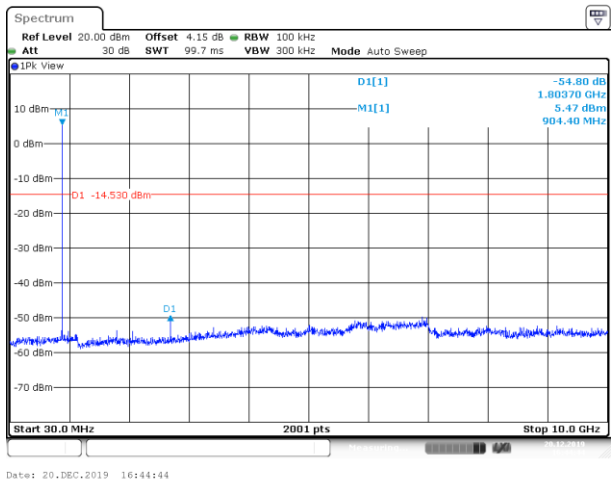
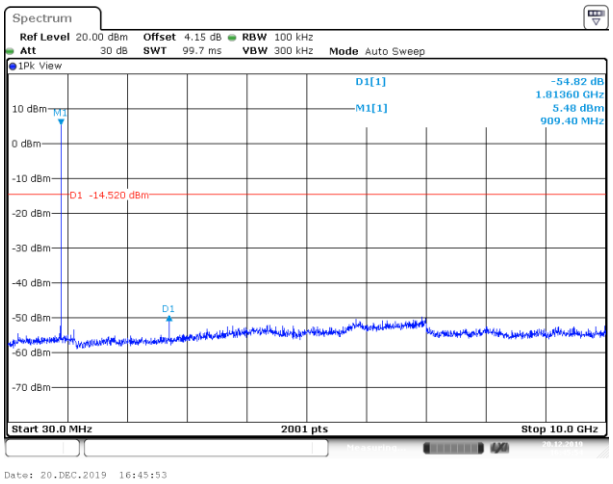
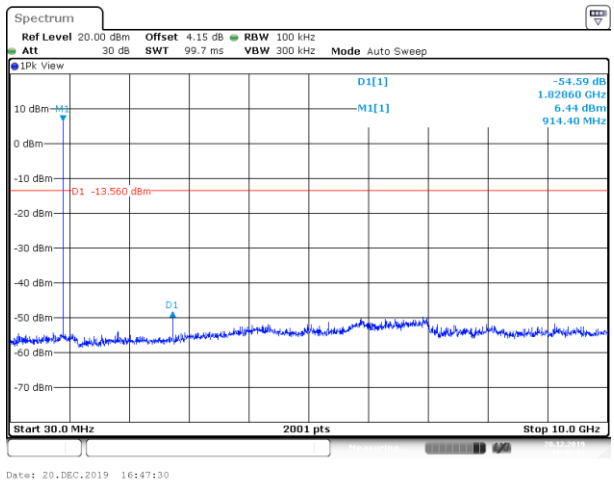
Over Limit = Level – Limit

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
903.0 to 914.2 MHz				
Low	903.0	54.80	≥ 20	Compliance
Mid	907.8	54.82	≥ 20	Compliance
High	914.2	54.59	≥ 20	Compliance

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

7 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

7.1 Applicable Standard

According to FCC §15.247(a) (2),

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

7.2 Test Procedure

According to ANSI C63.10-2013, the steps for the first option are as follows:
(1) Set RBW = 100 kHz. (2) Set the VBW ≥ [3 × RBW]. (3) Detector = peak. (4) Trace mode = max hold.
(5) Sweep = auto couple. (6) Allow the trace to stabilize. (7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.3 Test Equipment List and Details

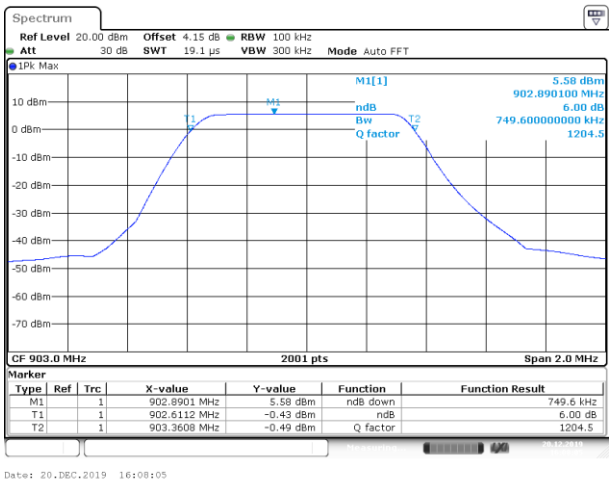
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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).*

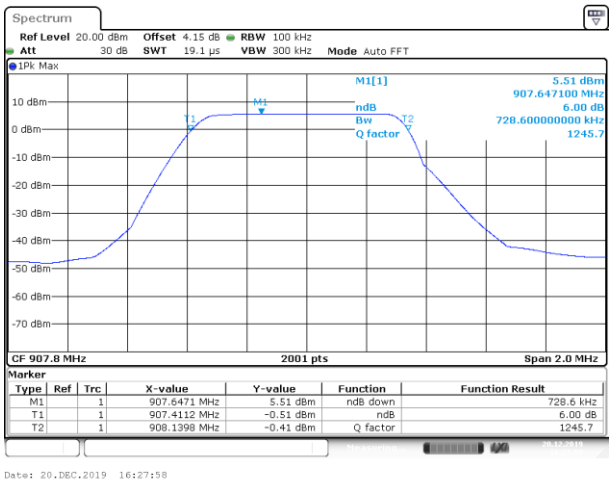
7.4 Test Results

Channel	Frequency (MHz)	6 dB BW (MHz)	6dB Limit (MHz)	Result
903.0 to 914.2 MHz				
Low	903.0	0.75	> 0.5	Compliance
Middle	907.8	0.73	> 0.5	Compliance
High	914.2	0.75	> 0.5	Compliance

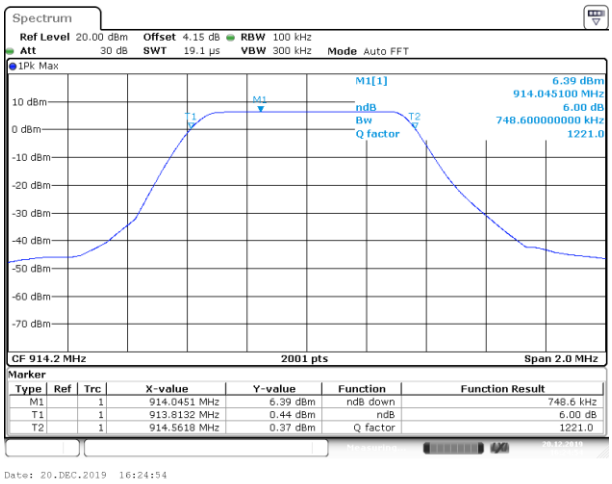
6 dB BW Low CH



6 dB BW Middle CH



6 dB BW High CH



8 FCC §15.247(b) (3) – Maximum Output Power

8.1 Applicable Standard

According to FCC §15.247(b) (3),

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

8.2 Test Procedure

(1) Place the EUT on a bench and set it in transmitting mode.

(2) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment. (3). Add a correction factor to the display.

8.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Power Sensor	Agilent	U2021XA	MY54250014	2019/03/06	2020/03/05
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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)	Maximum Peak Output Power (dBm)	Maximum Peak Output Power (W)	Limit (dBm)	Result
903.0 to 914.2 MHz					
Low	903.0	6.20	0.0042	30	Compliance
Middle	907.8	6.13	0.0041	30	Compliance
High	914.2	7.06	0.0051	30	Compliance

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

9.1 Applicable Standard

According to 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 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)).

9.2 Test Procedure

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

(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.

(3) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.

(4) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

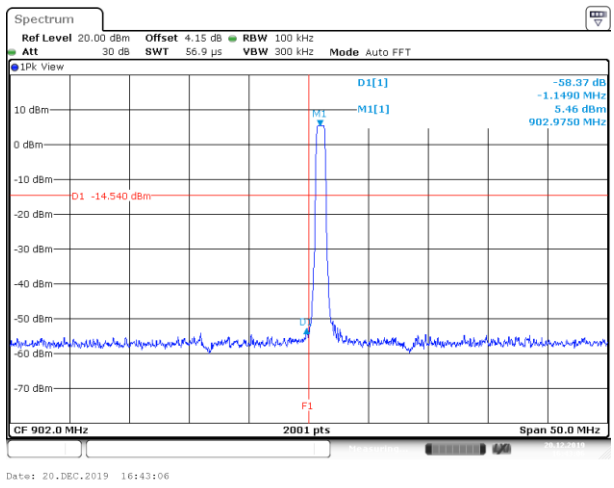
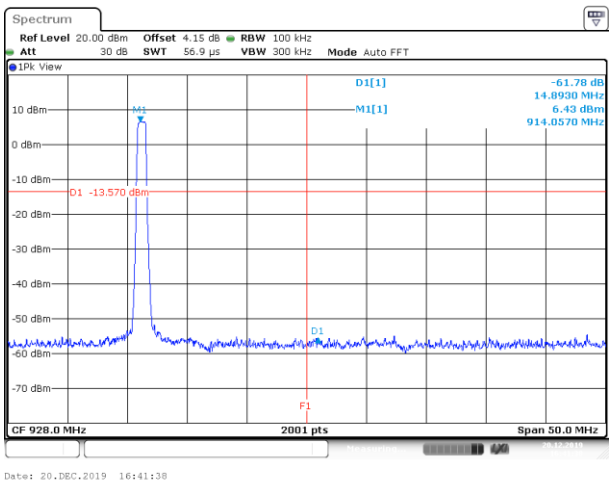
9.3 Test Equipment List and Details

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
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
903.0 to 914.2 MHz				
Low	903.0	58.37	≥ 20	Compliance
High	914.2	61.78	≥ 20	Compliance

Left Side	Right Side
	

10 FCC §15.247(e) – Power Spectral Density

10.1 Applicable Standard

According to FCC §15.247(e),

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

10.2 Test Procedure

According to ANSI C63.10-2013,

(1) Set analyzer center frequency to DTS channel center frequency.

(2) Set the span to 1.5 times the DTS bandwidth. (3) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.

(4) Set the VBW ≥ [3 × RBW]. (5) Detector = peak. (6) Sweep time = auto couple.

(7) Trace mode = max hold. (8) Allow trace to fully stabilize.

(9) Use the peak marker function to determine the maximum amplitude level within the RBW.

(10) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

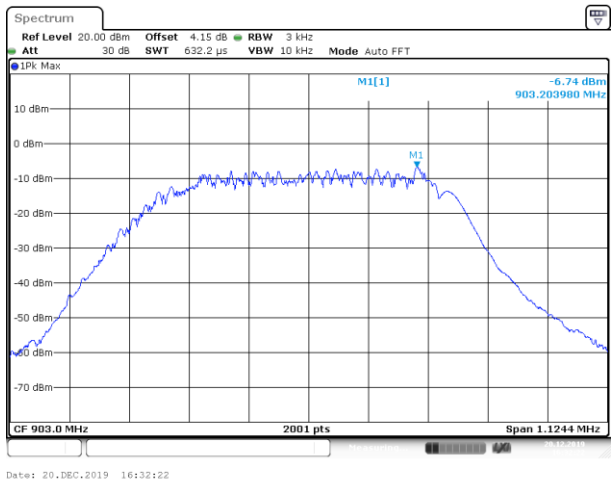
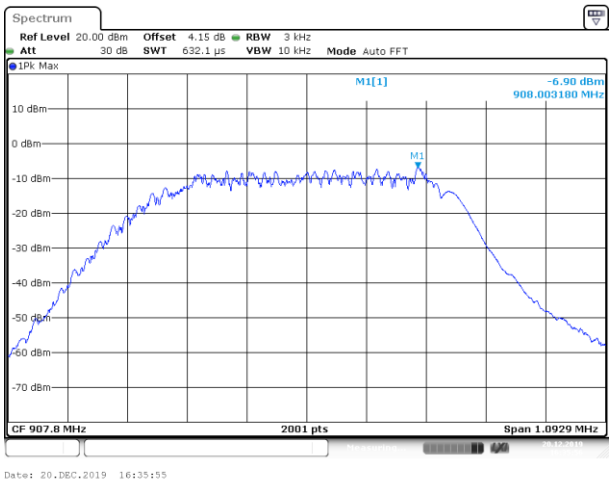
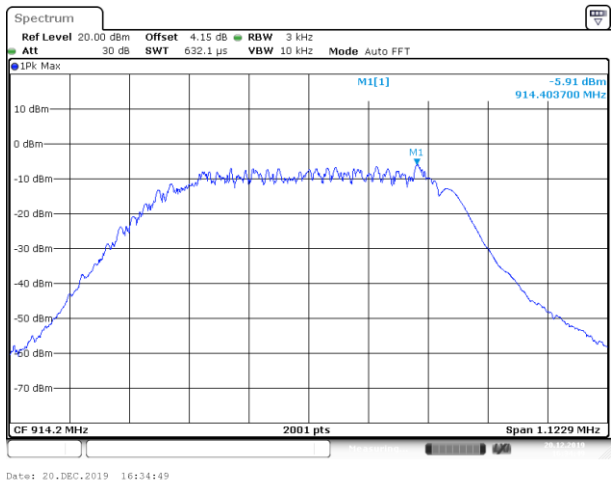
10.3 Test Equipment List and Details

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
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
903.0 to 914.2 MHz				
Low	903.0	-6.74	8	Compliance
Middle	907.8	-6.90	8	Compliance
High	914.2	-5.91	8	Compliance

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

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