

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)

Report No.: RFCJWN-WTW-P26050089-3

FCC ID: 2AEUP-5QFYAB

Product: Security Hub

Brand: ring

Model No.: 5QFYAB

Received Date: 2026/5/20

Test Date: 2026/5/28 ~ 2026/6/6

Issued Date: 2026/7/17

Applicant: Ring LLC

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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FCC Registration / 788550 / TW0003 for Test Location(1)

Designation Number: 281270 / TW0032 for Test Location(2)

Approved by:

Jeremy Lin

Jeremy Lin / Project Engineer

Date:

2026/7/17

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Prepared by : Annie Chang / Senior Specialist

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Release Control Record

Issue No.	Description	Date Issued
RFCJWN-WTW-P26050089-3	Original release.	2026/7/17

1 Certificate

Product: Security Hub

Brand: ring

Test Model: 5QFYAB

Sample Status: Engineering sample

Applicant: Ring LLC

Test Date: 2026/5/28 ~ 2026/6/6

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)

Measurement ANSI C63.10-2020

procedure: KDB 558074 D01 15.247 Meas Guidance v05r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
Standard / Clause	Test Item	Result	Remark
15.247 (b)(2)	RF Output Power	Pass	Meet the requirement of limit.
15.247(a)(1) (i)	Number of Hopping Frequency Used	Pass	Meet the requirement of limit.
15.247(a)(1) (i)	Dwell Time on Each Channel	Pass	Meet the requirement of limit.
15.247(a)(1)	Hopping Channel Separation	Pass	Meet the requirement of limit.
15.247(a)(1)	20 dB Bandwidth	Pass	Meet the requirement of limit.
15.247(d)	Conducted Out of Band Emissions	Pass	Meet the requirement of limit.
15.207	AC Power Conducted Emissions	Pass	Minimum passing margin is -5.26 dB at 0.54100 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -4.8 dB at 34.85 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -3.0 dB at 9022.00 MHz and 9150.00 MHz
15.203	Antenna Requirement	Pass	Antenna connector is I-PEX MHF I not a standard connector.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Specification	Expanded Uncertainty (k=2) (±)
RF Output Power	-	1.371 dB
Dwell Time on Each Channel	-	0.0218
Hopping Channel Separation	-	390 Hz
20 dB Bandwidth	-	206.5 Hz
Conducted Out of Band Emissions	9 kHz ~ 40 GHz	2.79 dB
AC Power Conducted Emissions	9 kHz ~ 30 MHz	2.88 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3 dB
	30 MHz ~ 1 GHz	2.93 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description

Product	Security Hub
Brand	ring
Test Model	5QFYAB
Status of EUT	Engineering sample
Power Supply Rating	Refer to note as below
Modulation Type	LoRa 125kHz FHSS: LoRa FSK 50kbps FHSS: FSK FSK 150kbps FHSS: FSK FSK 250kbps FHSS: FSK
Operating Frequency	LoRa 125kHz FHSS: 902.2 ~ 927.8MHz FSK 50kbps FHSS: 902.2 ~ 927.8MHz FSK 150kbps FHSS: 902.4 ~ 927.6MHz FSK 250kbps FHSS: 902.5 ~ 927.5MHz
Number of Channel	LoRa 125kHz FHSS: 129 FSK 50kbps FHSS: 129 FSK 150kbps FHSS: 64 FSK 250kbps FHSS: 51
Output Power	217.771 mW (23.38 dBm)

Note:

1. The EUT uses following battery.

Item	Brand	Model No.	Specification
Rechargeable Lithium-ion Battery	ring	5F53E9	3.6Vdc, 5800mAh, 20.88Wh Micro USB Input: 5Vdc, 1A

2. The EUT uses following accessories.

Item	Brand	Model	Specification
AC Adapter	ring	7PNXAB (US Plug), 7PNXA2 (EU Plug), 7PNXA3 (UK Plug)	AC I/P: 100-240V, 0.45A, 50/60Hz DC O/P: 5V, 3A Shielded USB-C Cable (1.5m)

The above adapters are identical with each other except for their plug type difference.

3. There are WLAN 2.4 GHz, WWAN (LTE), Bluetooth and LoRa technology used for the EUT.

4. Simultaneously transmission combination.

Combination	Technology	
1	LoRa	WWAN (LTE)
2	Bluetooth	WWAN (LTE)
3	WLAN 2.4 GHz	WWAN (LTE)

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

5. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 Antenna Description of EUT

The antenna information is listed as below.

Item	Antenna Gain (dBi)	Frequency range (MHz)	Antenna Type	Connector Type
LTE 1	4.42	700~2690	Stamping IFA	I-PEX MHF I
LTE 2	4.32			
WiFi 1	2.35	2400~2500	PCB Dipole	I-PEX MHF I
WiFi 2	2.63			
LoRa+BLE(Tx/Rx)	0.8	863~890	PCB Dipole	I-PEX MHF I
	0.74	915~928		
	3.83	2400~2500		

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

3.3 Channel List

LoRa 125kHz FHSS:

FSK 50kbps FHSS:

129 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	902.2	33	908.8	66	915.4	99	922.0
1	902.4	34	909.0	67	915.6	100	922.2
2	902.6	35	909.2	68	915.8	101	922.4
3	902.8	36	909.4	69	916.0	102	922.6
4	903.0	37	909.6	70	916.2	103	922.8
5	903.2	38	909.8	71	916.4	104	923.0
6	903.4	39	910.0	72	916.6	105	923.2
7	903.6	40	910.2	73	916.8	106	923.4
8	903.8	41	910.4	74	917.0	107	923.6
9	904.0	42	910.6	75	917.2	108	923.8
10	904.2	43	910.8	76	917.4	109	924.0
11	904.4	44	911.0	77	917.6	110	924.2
12	904.6	45	911.2	78	917.8	111	924.4
13	904.8	46	911.4	79	918.0	112	924.6
14	905.0	47	911.6	80	918.2	113	924.8
15	905.2	48	911.8	81	918.4	114	925.0
16	905.4	49	912.0	82	918.6	115	925.2
17	905.6	50	912.2	83	918.8	116	925.4
18	905.8	51	912.4	84	919.0	117	925.6
19	906.0	52	912.6	85	919.2	118	925.8
20	906.2	53	912.8	86	919.4	119	926.0
21	906.4	54	913.0	87	919.6	120	926.2
22	906.6	55	913.2	88	919.8	121	926.4
23	906.8	56	913.4	89	920.0	122	926.6
24	907.0	57	913.6	90	920.2	123	926.8
25	907.2	58	913.8	91	920.4	124	927.0
26	907.4	59	914.0	92	920.6	125	927.2
27	907.6	60	914.2	93	920.8	126	927.4
28	907.8	61	914.4	94	921.0	127	927.6
29	908.0	62	914.6	95	921.2	128	927.8
30	908.2	63	914.8	96	921.4		
31	908.4	64	915.0	97	921.6		
32	908.6	65	915.2	98	921.8		

FSK 150kbps FHSS:

64 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	902.4	16	908.8	32	915.2	48	921.6
1	902.8	17	909.2	33	915.6	49	922.0
2	903.2	18	909.6	34	916.0	50	922.4
3	903.6	19	910.0	35	916.4	51	922.8
4	904.0	20	910.4	36	916.8	52	923.2
5	904.4	21	910.8	37	917.2	53	923.6
6	904.8	22	911.2	38	917.6	54	924.0
7	905.2	23	911.6	39	918.0	55	924.4
8	905.6	24	912.0	40	918.4	56	924.8
9	906.0	25	912.4	41	918.8	57	925.2
10	906.4	26	912.8	42	919.2	58	925.6
11	906.8	27	913.2	43	919.6	59	926.0
12	907.2	28	913.6	44	920.0	60	926.4
13	907.6	29	914.0	45	920.4	61	926.8
14	908.0	30	914.4	46	920.8	62	927.2
15	908.4	31	914.8	47	921.2	63	927.6

FSK 250kbps FHSS:

51 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	902.5	13	909.0	26	915.5	39	922.0
1	903.0	14	909.5	27	916.0	40	922.5
2	903.5	15	910.0	28	916.5	41	923.0
3	904.0	16	910.5	29	917.0	42	923.5
4	904.5	17	911.0	30	917.5	43	924.0
5	905.0	18	911.5	31	918.0	44	924.5
6	905.5	19	912.0	32	918.5	45	925.0
7	906.0	20	912.5	33	919.0	46	925.5
8	906.5	21	913.0	34	919.5	47	926.0
9	907.0	22	913.5	35	920.0	48	926.5
10	907.5	23	914.0	36	920.5	49	927.0
11	908.0	24	914.5	37	921.0	50	927.5
12	908.5	25	915.0	38	921.5		

3.4 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	Pretest 3 axis, select worst case.
Worst Case:	X-AXIS

Following channel(s) was (were) selected for the final test as listed below:

Test Item	Tested Channel	Modulation
RF Output Power	0, 64, 128	FSK 50Kbps
	0, 32, 63	FSK 150Kbps
	0, 25, 50	FSK 250Kbps
	0, 64, 128	LoRa 125KHz
Number of Hopping Frequency Used	Hopping	FSK 50Kbps
		FSK 150Kbps
		FSK 250Kbps
		LoRa 125KHz
Dwell Time on Each Channel	Hopping	FSK 50Kbps
		FSK 150Kbps
		FSK 250Kbps
		LoRa 125KHz
Hopping Channel Separation / 20 dB Bandwidth	0, 64, 128	FSK 50Kbps
	0, 32, 63	FSK 150Kbps
	0, 25, 50	FSK 250Kbps
	0, 64, 128	LoRa 125KHz
Conducted Out of Band Emissions	Hopping 0, 128	FSK 50Kbps
	Hopping 0, 63	FSK 150Kbps
	Hopping 0, 50	FSK 250Kbps
	Hopping 0, 128	LoRa 125KHz
AC Power Conducted Emissions	64	FSK 50Kbps
Unwanted Emissions below 1 GHz / Unwanted Emissions above 1 GHz	0, 64, 128	FSK 50Kbps
	0, 32, 63	FSK 150Kbps
	0, 25, 50	FSK 250Kbps
	0, 64, 128	LoRa 125KHz

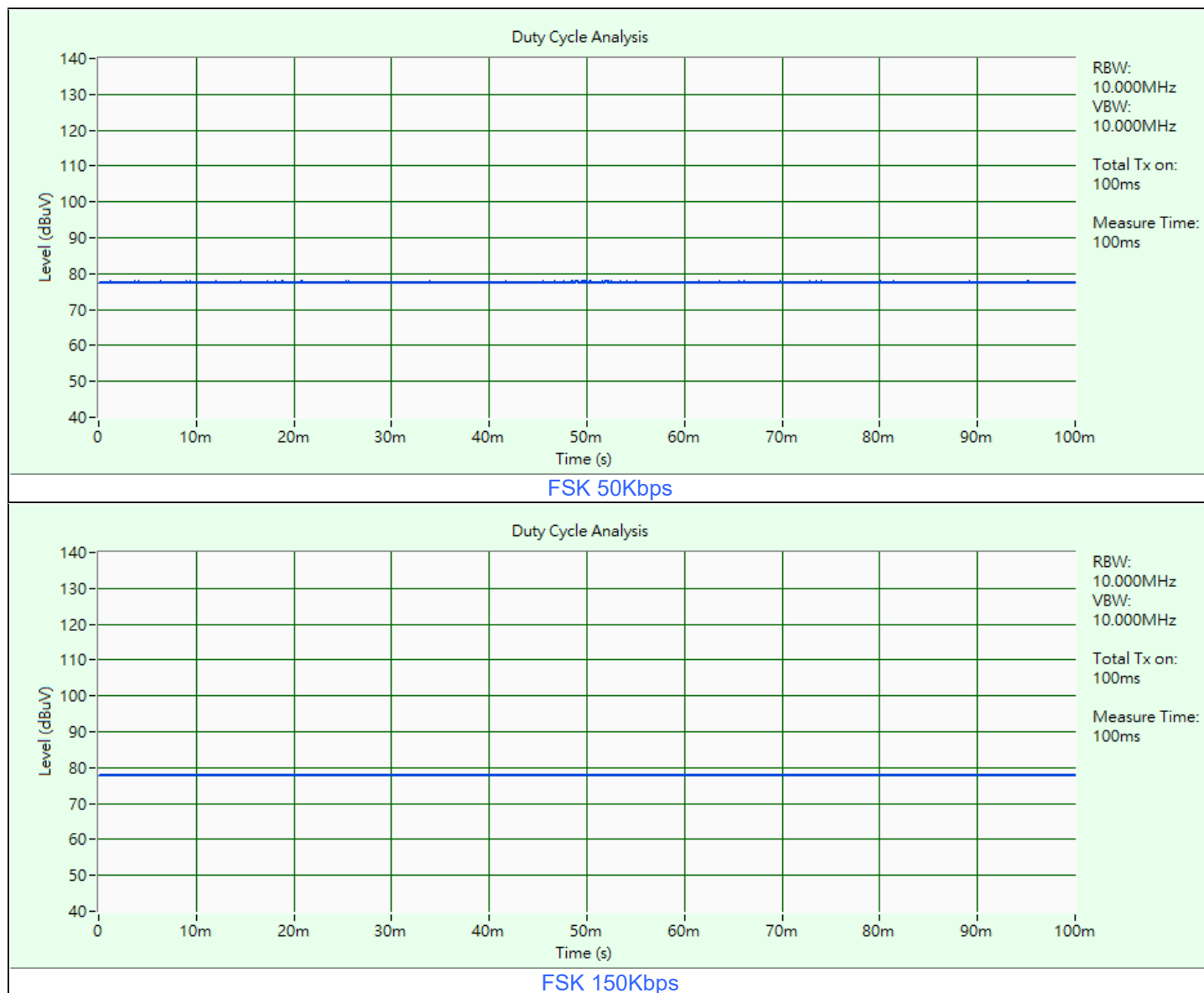
3.5 Duty Cycle of Test Signal

FSK 50Kbps: Duty cycle = 100 ms / 100 ms x 100% = 100.0%

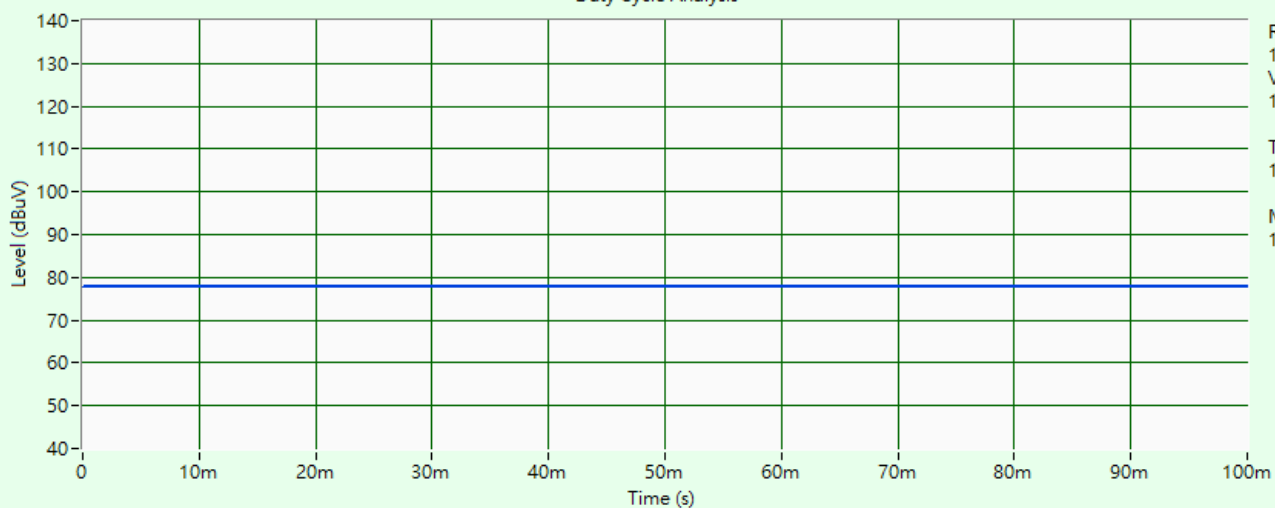
FSK 150Kbps: Duty cycle = 100 ms / 100 ms x 100% = 100.0%

FSK 250Kbps: Duty cycle = 100 ms / 100 ms x 100% = 100.0%

LoRa 125KHz: Duty cycle = 100 ms / 100 ms x 100% = 100.0%

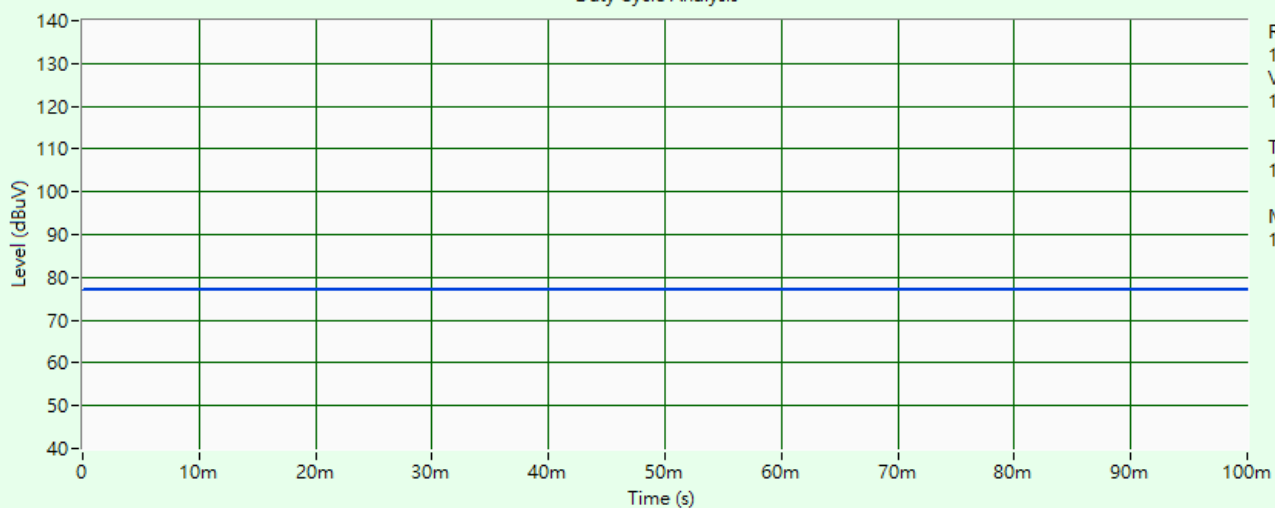


Duty Cycle Analysis



FSK 250Kbps

Duty Cycle Analysis

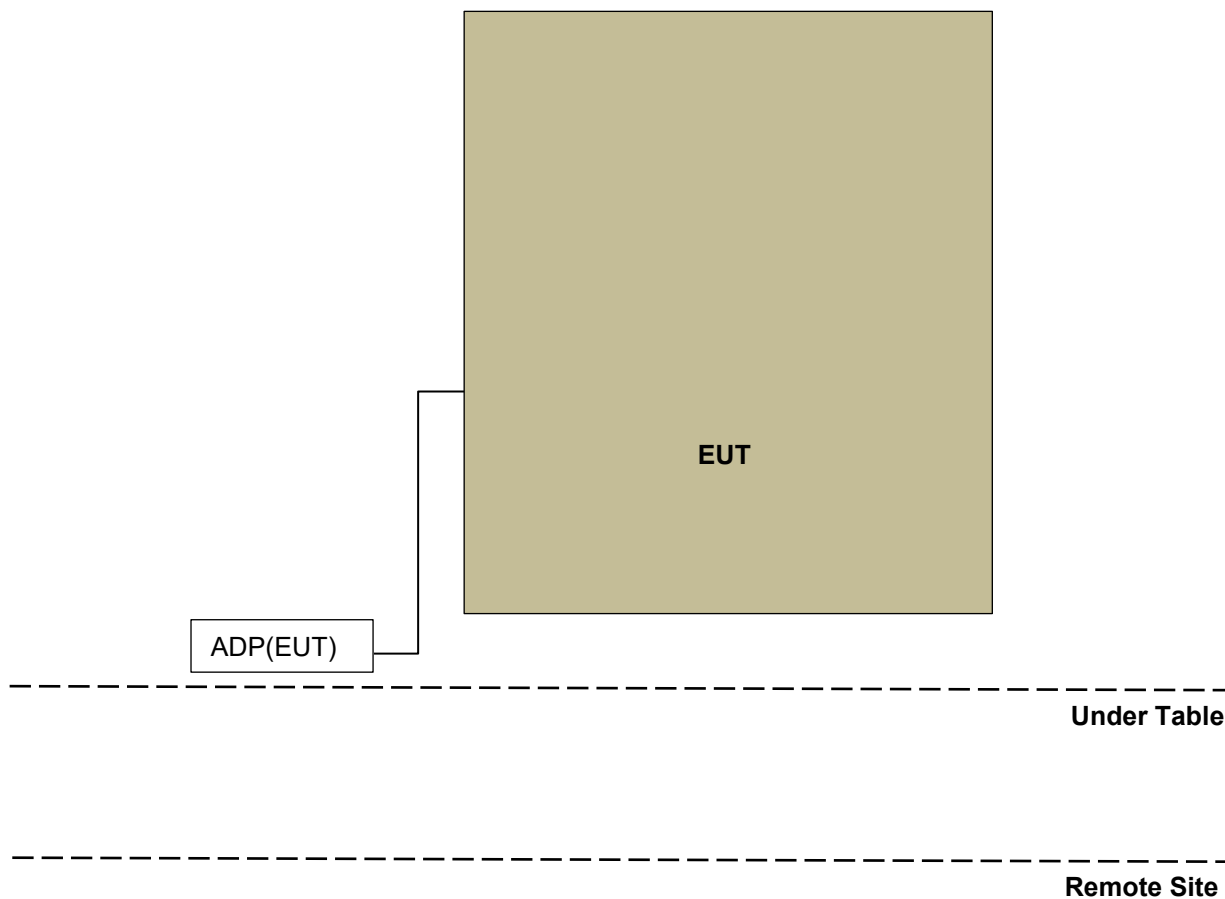


LoRa 125KHz

3.6 Test Program Used and Operation Descriptions

Controlling software QRCT_Ver_4.0.210.0 has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 Connection Diagram of EUT and Peripheral Devices



3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
EUT	Adapter	ring	7PNXAB	N/A	N/A	Supplied by applicant

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Fixed Attenuator Woken	00800A1K01A-10	00800A1K01A-10-01	2026/5/21	2027/5/20
Peak Power Analyzer Keysight	8990B	MY51000485	2026/1/23	2027/1/22
USB Power Sensor Anritsu	MA24408A	12994	2025/12/5	2026/12/4
Wideband Power Sensor Keysight	N1923A	MY58020002	2026/1/26	2027/1/25
		MY58140009	2026/1/26	2027/1/25

Notes:

1. The test was performed in HY - Oven room(Hwaya).
2. Tested Date: 2026/6/6

4.2 Number of Hopping Frequency Used

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Fixed Attenuator Woken	00800A1K01A-10	00800A1K01A-10-01	2026/5/21	2027/5/20
Software BV	ADT_RF Test Software V7.6.5.4	N/A	N/A	N/A
Spectrum Analyzer R&S	FSU43	101261	2026/5/4	2027/5/3

Notes:

1. The test was performed in HY - Oven room(Hwaya).
2. Tested Date: 2026/6/6

4.3 Dwell Time on Each Channel

Refer to section 4.2 to get the tested date and information of the instruments.

4.4 Hopping Channel Separation

Refer to section 4.2 to get the tested date and information of the instruments.

4.5 20 dB Bandwidth

Refer to section 4.2 to get the tested date and information of the instruments.

4.6 Conducted Out of Band Emissions

Refer to section 4.2 to get the tested date and information of the instruments.

4.7 AC Power Conducted Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohm terminal resistance	E1-011279	04	2025/12/4	2026/12/3
	E1-011280	05	2025/12/4	2026/12/3
	E1-011311	09	2025/12/4	2026/12/3
DC LISN Schwarzbeck	NNBM 8126G	8126G-069	2025/11/3	2026/11/2
Diode Pulse Limiter Schwarzbeck	VTSD 9561 F-N	01445	2026/4/18	2027/4/17
EMI Test Receiver R&S	ESCI	100613	2025/11/27	2026/11/26
Extension Power Line EMCI	EMCI-EXP-EU-US	023	2026/3/6	2027/3/5
LISN R&S	ENV216	101826	2026/3/6	2027/3/5
	ESH3-Z5	100311	2025/8/28	2026/8/27
RF Coaxial Cable Woken	5D-FB	Cable-cond1-01	2026/1/3	2027/1/2
Software BVADT	BVADT_Conf_ V7.4.1.0	N/A	N/A	N/A
V-LISN Schwarzbeck	NNBL 8226-2	8226-142	2025/8/27	2026/8/26

Notes:

1. The test was performed in HY - Conduction 1.
2. Tested Date: 2026/5/30

4.8 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFA-515BSN	N/A	N/A	N/A
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-1214	2025/9/18	2026/9/17
Loop Antenna TESEQ	HLA 6121	45745	2025/9/1	2026/8/31
MXE EMI Receiver Keysight	N9038B	MY60180019	2026/1/14	2027/1/13
Preamplifier EMCI	EMC330N	980798	2026/1/13	2027/1/12
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201248	2026/1/13	2027/1/12
	EMCCFD400-NM-NM-3000	201249	2026/1/13	2027/1/12
	EMCCFD400-NM-NM-9000	201251(with PAD)	2026/1/13	2027/1/12
Signal & Spectrum Analyzer R&S	FSV3044	101504	2025/6/18	2026/6/17
Software BV ADT	ADT_Radiated_ V7.7.1.1.1	N/A	N/A	N/A
Turn Table Max-Full	MFT-201SS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208676	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 9(Wenming).
2. Tested Date: 2026/6/1 ~ 2026/6/4

4.9 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFA-515BSN	N/A	N/A	N/A
Horn Antenna RFSPIN	DRH18-E	210104A18E	2025/11/9	2026/11/8
Horn Antenna Schwarzbeck	BBHA 9170	9170-1049	2025/11/9	2026/11/8
MXE EMI Receiver Keysight	N9038B	MY60180019	2026/1/14	2027/1/13
Preamplifier Agilent	83017A	MY39501357	2025/6/11	2026/6/10
Preamplifier EMCI	EMC184045SE	980788	2026/1/13	2027/1/12
RF Coaxial Cable EMCI	EMC101G-KM-KM-2000	201254	2026/1/13	2027/1/12
		201255	2026/1/13	2027/1/12
	EMC101G-KM-KM-5000	201261	2026/1/13	2027/1/12
	EMC104-SM-SM-1000	210103	2026/1/13	2027/1/12
	EMC104-SM-SM-3000	201241	2026/1/13	2027/1/12
	EMC104-SM-SM-9000	201244	2026/1/13	2027/1/12
Signal & Spectrum Analyzer R&S	FSV3044	101504	2025/6/18	2026/6/17
Software BV ADT	ADT_Radiated_ V7.7.1.1.1	N/A	N/A	N/A
Turn Table Max-Full	MFT-201SS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208676	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 9(Wenming).
2. Tested Date: 2026/5/28 ~ 2026/6/3

5 Limits of Test Items

5.1 RF Output Power

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.

5.2 Number of Hopping Frequency Used

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies ; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

5.3 Dwell Time on Each Channel

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, 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 average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

5.4 Hopping Channel Separation

At least 25 kHz or 20 dB hopping channel bandwidth (whichever is greater).

5.5 20 dB Bandwidth

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

5.6 Conducted Out of Band Emissions

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

5.7 AC Power Conducted Emissions

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Notes:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

5.8 Unwanted Emissions below 1 GHz

Radiated emissions up to 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

5.9 Unwanted Emissions above 1 GHz

Radiated emissions above 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
Above 960	500	3

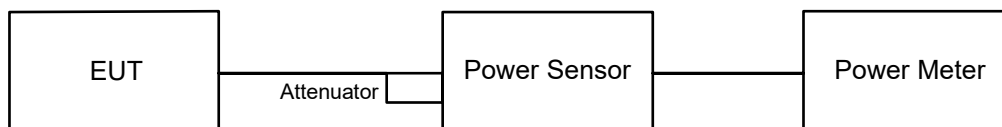
Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

6 Test Arrangements

6.1 RF Output Power

6.1.1 Test Setup



6.1.2 Test Procedure

Peak Power:

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

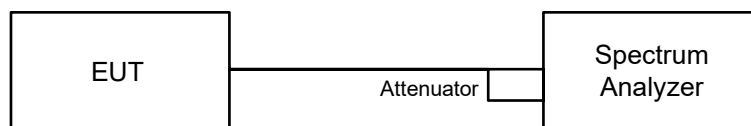
The power meter video bandwidth is greater than or equal to the DTS bandwidth and use a fast responding diode detector.

Average Power:

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

6.2 Number of Hopping Frequency Used

6.2.1 Test Setup



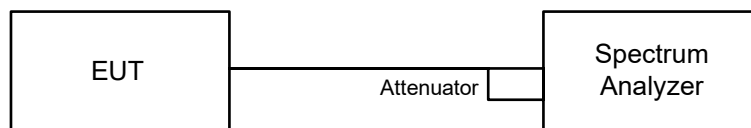
6.2.2 Test Procedure

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement 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.
- Span: The frequency band of operation. Depending on the number of channels the device supports, it could be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- Video (or average) bandwidth (VBW) $\geq$ RBW.
- Sweep: No faster than coupled (auto) time.
- Detector function: Peak.
- Trace: Max-hold.
- Allow the trace to stabilize

Note: Where the device shares the same channel plan (carrier frequencies and number of channels) across multiple data rates or modulation schemes then the number of channels need only be measured for one of those modulation schemes or data rates.

6.3 Dwell Time on Each Channel

6.3.1 Test Setup



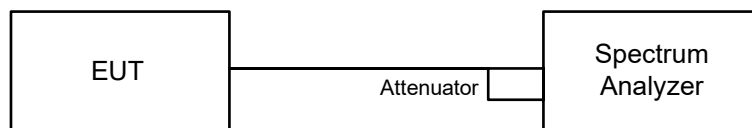
6.3.2 Test Procedure

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement 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.
- Span: Zero span, centered on a hopping channel.
- RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected transmission time per hop.
- Sweep time: Set so that the start of the first transmission and end of the last transmission for the hop are clearly captured. Setting the sweep time to be slightly longer than the hopping period per channel (hopping period = $1/\text{hopping rate}$) should achieve this.
- Use a video trigger, where possible with a trigger delay, so that the start of the transmission is clearly observed. The trigger level might need adjustment to reduce the chance of triggering when the system hops on an adjacent channel.
- Detector function: Peak.
- Trace: Clear-write, single sweep.
- Place markers at the start of the first transmission on the channel and at the end of the last transmission. The dwell time per hop is the time between these two markers.

Note: Where the device shares the same hopping algorithms (dwell time, channel selection) across multiple data rates or modulation schemes then the time of occupancy need only be measured for one of those modulation schemes or data rates. If the dwell time value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in dwell time.

6.4 Hopping Channel Separation

6.4.1 Test Setup



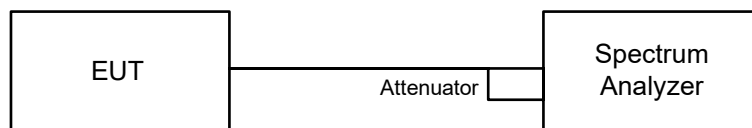
6.4.2 Test Procedure

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- Span: Wide enough to capture the peaks of two adjacent channels.
- 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.
- Video (or average) bandwidth (VBW) $\geq$ RBW.
- Sweep: No faster than coupled (auto) time.
- Detector function: Peak.
- Trace: Max-hold.
- Allow the trace to stabilize.

Note: Where the device shares the same channel plan (carrier frequencies and number of channels) across multiple data rates or modulation schemes then the carrier separation need only be measured for one of those modulation schemes or data rates.

6.5 20 dB Bandwidth

6.5.1 Test Setup

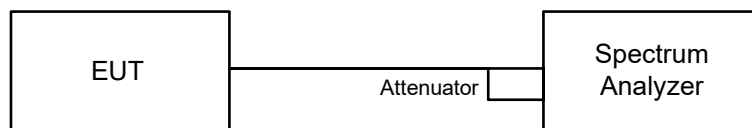


6.5.2 Test Procedure

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
- c. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be at least three times RBW, unless otherwise specified by the applicable requirement.
- d. Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level.
- e. Steps a) through c) might require iteration to adjust within the specified tolerances.
- f. The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “-xx dB down” requirement; that is, if the requirement calls for measuring the -20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
- g. Set detection mode to peak and trace mode to max-hold.
- h. Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- i. Determine the “-xx dB down amplitude” using $[(\text{reference value}) - xx]$. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

6.6 Conducted Out of Band Emissions

6.6.1 Test Setup



6.6.2 Test Procedure

MEASUREMENT PROCEDURE REF

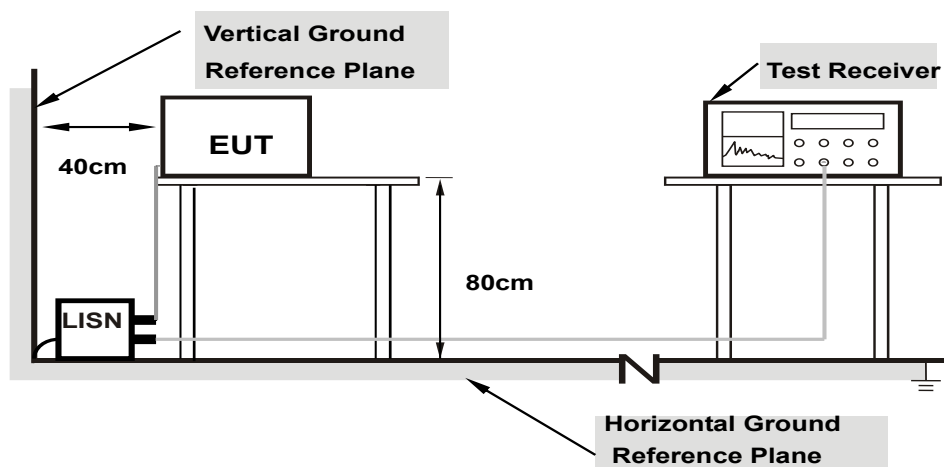
- Set instrument center frequency to DTS channel center frequency.
- Set the span to ≥ 1.5 times the DTS bandwidth.
- Set the RBW = 100 kHz.
- Set the VBW ≥ 300 kHz.
- Detector = peak.
- Sweep time = No faster than coupled (auto) time.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum PSD level.

MEASUREMENT PROCEDURE OOB

- Set the center frequency and span to encompass frequency range to be measured. Note that the frequency range might need to be divided into multiple frequency ranges to retain frequency resolution.
- Set RBW = 100 kHz.
- Set VBW ≥ 300 kHz.
- Detector = peak.
- Sweep = No faster than coupled (auto) time.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

6.7 AC Power Conducted Emissions

6.7.1 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.2 Test Procedure

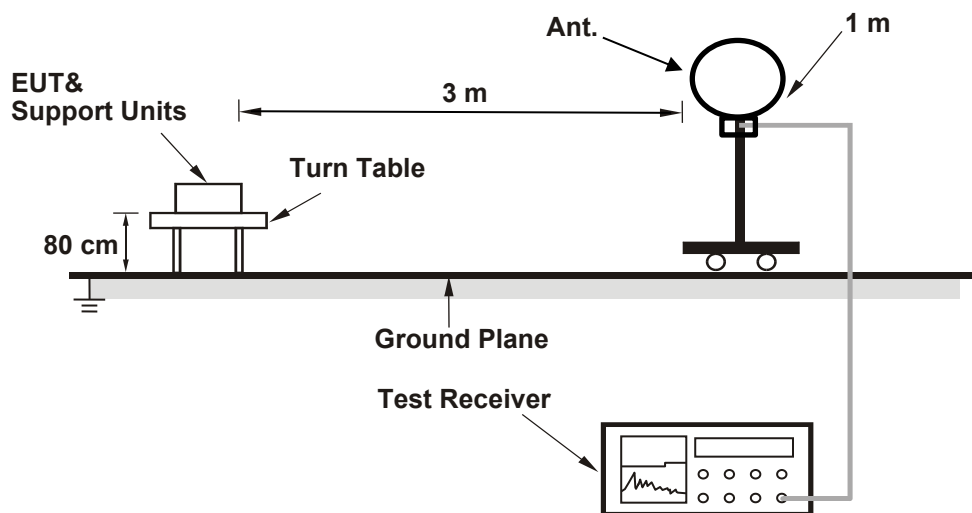
- Exploratory ac power-line conducted emission measurements: The EUT shall be operated on the mid channel and in the mode with highest output power unless the fundamental operates in the AC power-line emission test range then the EUT shall be operated in the range of typical modes of operation.
- The EUT was placed on a 0.8 meter to the top of table and placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz-30 MHz.

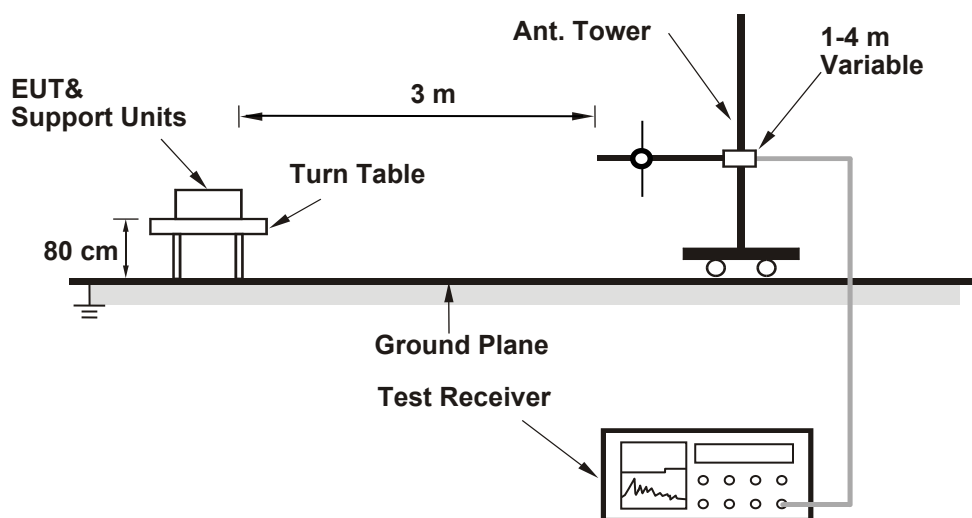
6.8 Unwanted Emissions below 1 GHz

6.8.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.8.2 Test Procedure

For Radiated emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode (however, peak detector measurements may be used to determine compliance with QP requirements), except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 30 MHz

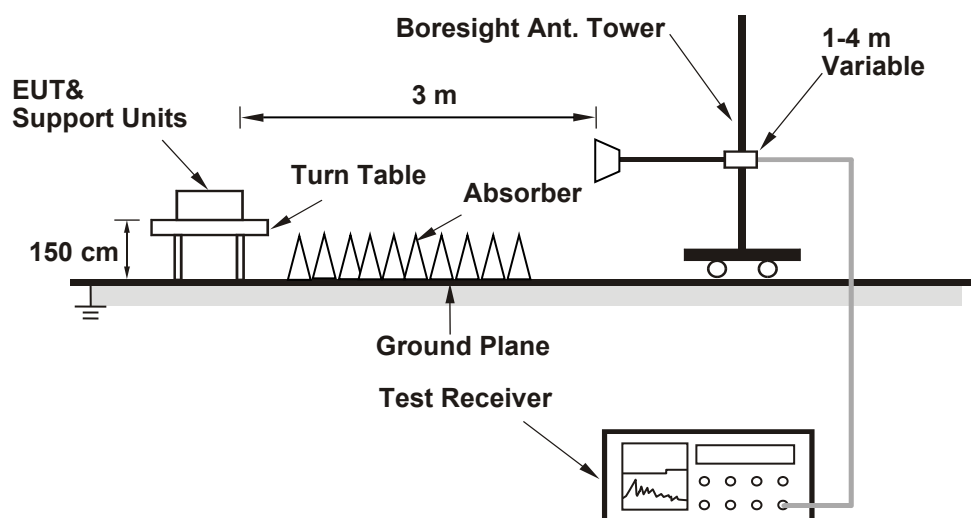
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-peak(QP) detect function, Average(AV) detect function, Peak(PK) detect function and specified bandwidth with maximum hold mode when the test frequencies less than or equal to 1 GHz.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz (however, peak detector measurements may be used to determine compliance with QP requirements).
2. All modes of operation were investigated and the worst-case emissions are reported.

6.9 Unwanted Emissions above 1 GHz

6.9.1 Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.9.2 Test Procedure

- The EUT was placed on the top of a rotating table 1.5 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Notes:

- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

7 Test Results of Test Item

7.1 RF Output Power

Environmental Conditions:	25°C, 60% RH	Tested By:	Match Tsui
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For Peak Power

FSK 50Kbps

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	902.2	207.014	23.16	30	Pass
64	915	207.97	23.18	30	Pass
128	927.8	217.771	23.38	30	Pass

FSK 150Kbps

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	902.4	207.014	23.16	30	Pass
32	915.2	207.491	23.17	30	Pass
63	927.6	217.771	23.38	30	Pass

FSK 250Kbps

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	902.5	208.449	23.19	30	Pass
25	915	206.538	23.15	30	Pass
50	927.5	214.783	23.32	30	Pass

LoRa 125KHz

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	902.2	208.449	23.19	30	Pass
64	915	207.014	23.16	30	Pass
128	927.8	216.77	23.36	30	Pass

For Average Power

FSK 50Kbps

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	902.2	205.589	23.13
64	915	205.116	23.12
128	927.8	215.278	23.33

FSK 150Kbps

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	902.4	205.211	23.12
32	915.2	206.538	23.15
63	927.6	216.272	23.35

FSK 250Kbps

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	902.5	207.014	23.16
25	915	205.116	23.12
50	927.5	213.304	23.29

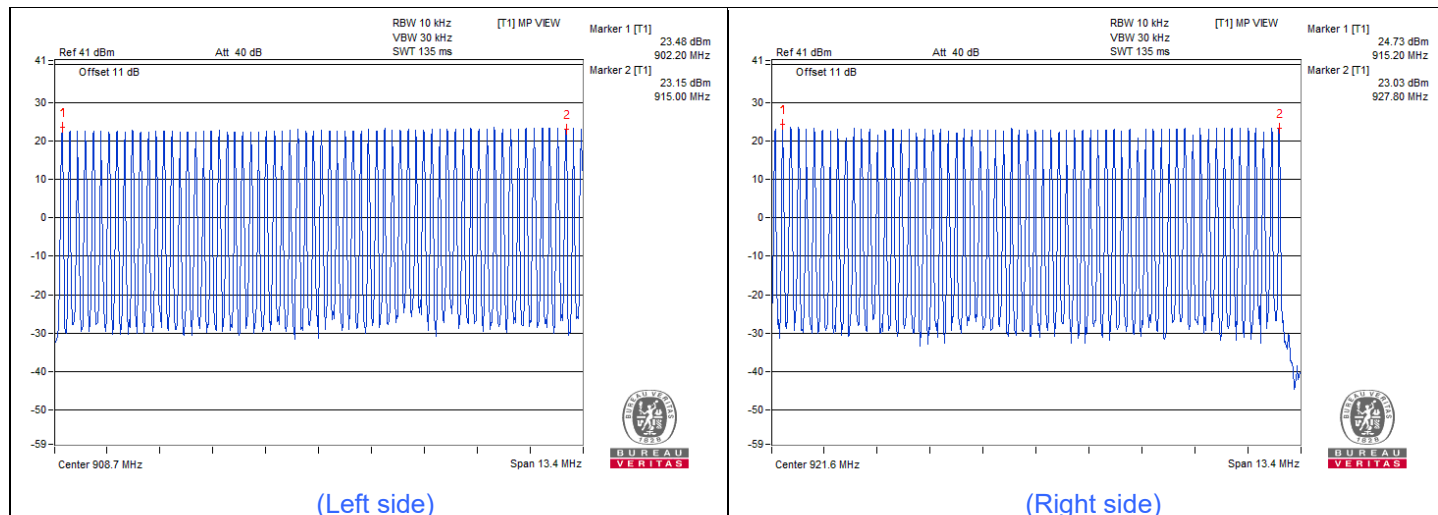
LoRa 125KHz

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	902.2	207.491	23.17
64	915	205.589	23.13
128	927.8	214.783	23.32

7.2 Number of Hopping Frequency Used

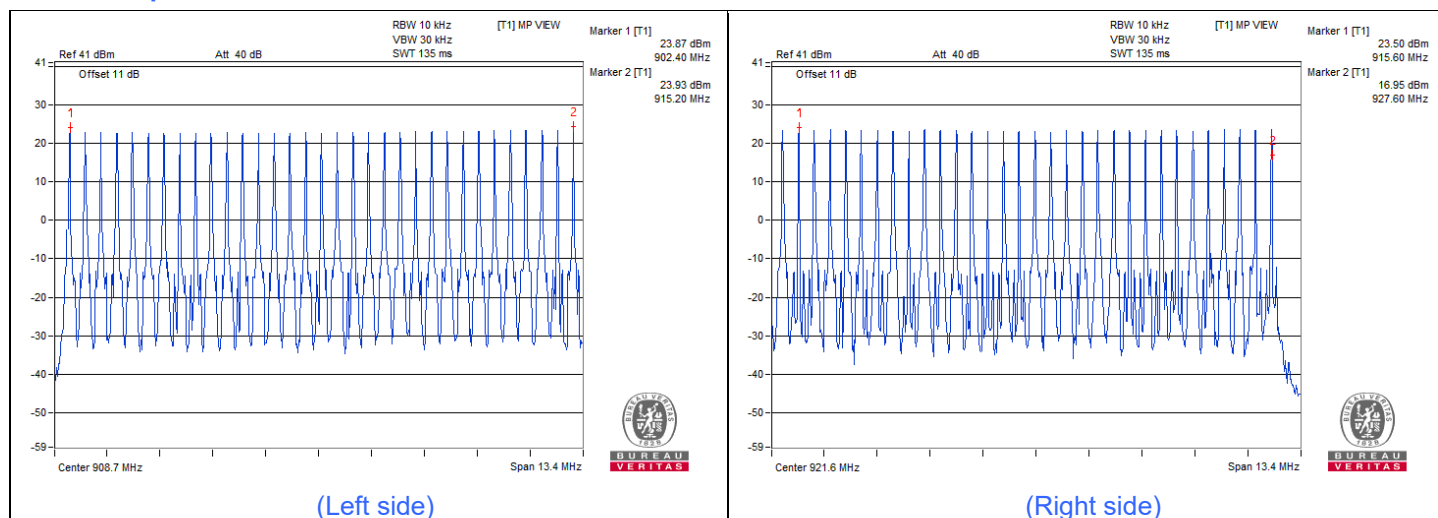
Environmental Conditions:	25°C, 60% RH	Tested By:	Match Tsui
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FSK 50Kbps



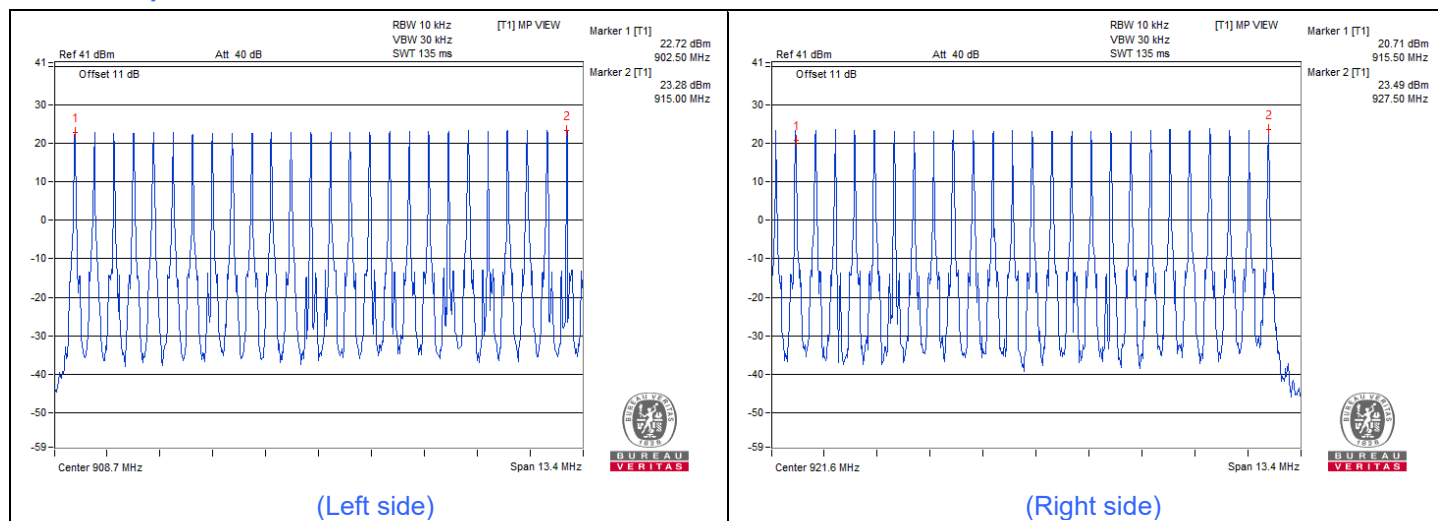
Note: There are 129 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.

FSK 150Kbps



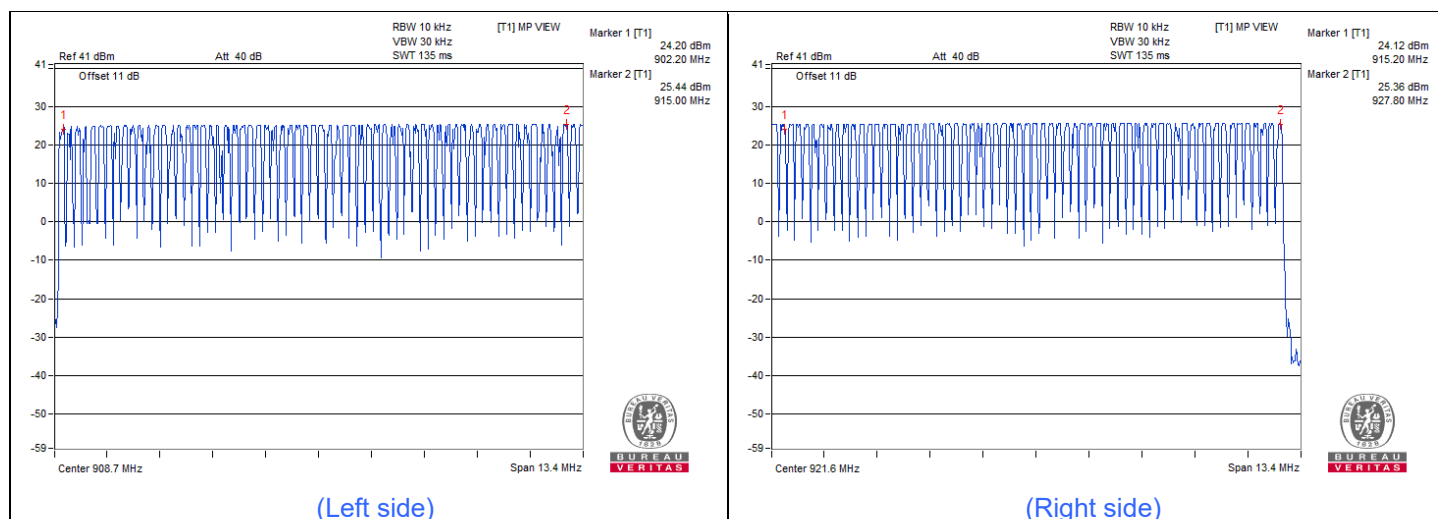
Note: There are 64 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.

FSK 250Kbps



Note: There are 51 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.

LoRa 125KHz



Note: There are 129 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.

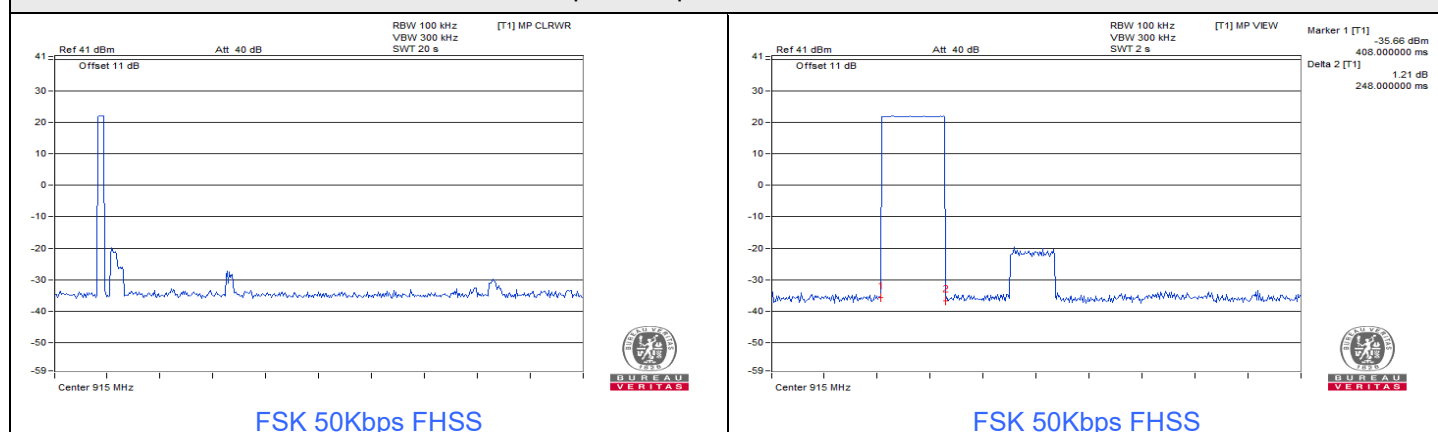
7.3 Dwell Time on Each Channel

Environmental Conditions:	25°C, 60% RH	Tested By:	Match Tsui
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FSK 50Kbps

Mode	Number of transmission in 20 sec	Length of transmission time (msec)	Dwell Time (msec)	Limit (msec)	Test Result
FHSS	1 times	248	248	400	Pass

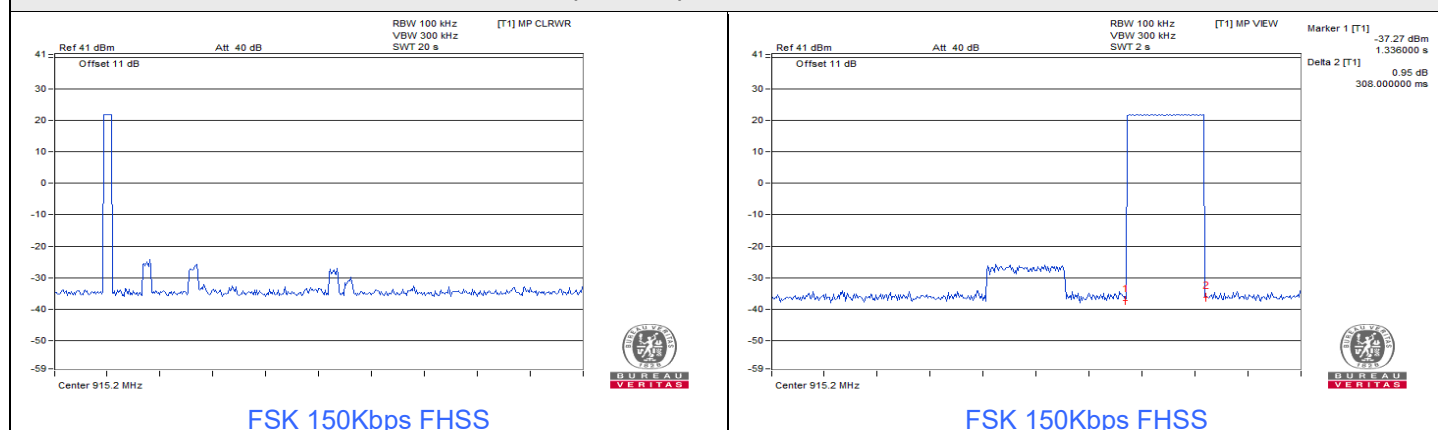
Spectrum plots of Dwell Time



FSK 150Kbps

Mode	Number of transmission in 20 sec	Length of transmission time (msec)	Dwell Time (msec)	Limit (msec)	Test Result
FHSS	1 times	308	308	400	Pass

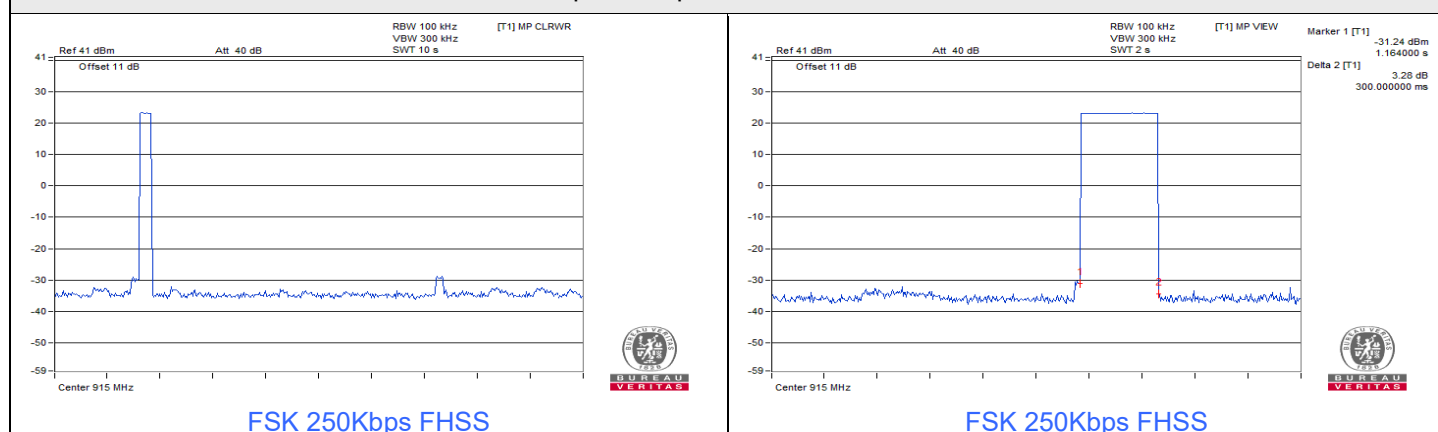
Spectrum plots of Dwell Time



FSK 250Kbps

Mode	Number of transmission in 10 sec	Length of transmission time (msec)	Dwell Time (msec)	Limit (msec)	Test Result
FHSS	1 times	300	300	400	Pass

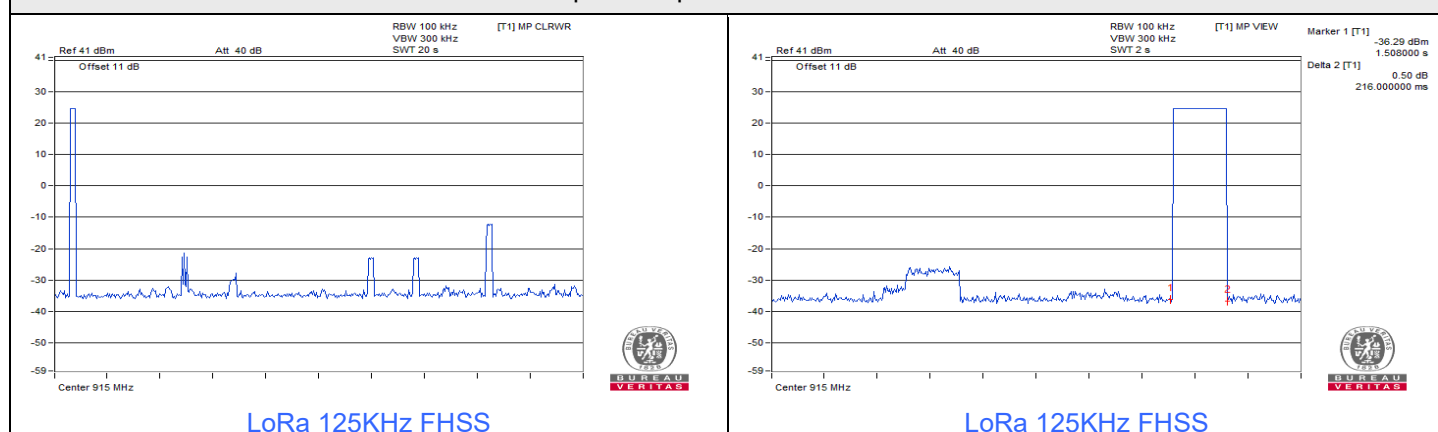
Spectrum plots of Dwell Time



LoRa 125KHz

Mode	Number of transmission in 20 sec	Length of transmission time (msec)	Dwell Time (msec)	Limit (msec)	Test Result
FHSS	1 times	216	216	400	Pass

Spectrum plots of Dwell Time



7.4 Hopping Channel Separation

Environmental Conditions:	25°C, 60% RH	Tested By:	Match Tsui
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FSK 50Kbps

Channel	Frequency (MHz)	Hopping Channel Separation (MHz)	Minimum Limit (MHz)	Test Result
0	902.2	0.21	0.1	Pass
64	915	0.21	0.11	Pass
128	927.8	0.20	0.11	Pass

FSK 150Kbps

Channel	Frequency (MHz)	Hopping Channel Separation (MHz)	Minimum Limit (MHz)	Test Result
0	902.4	0.40	0.17	Pass
32	915.2	0.41	0.18	Pass
63	927.6	0.41	0.18	Pass

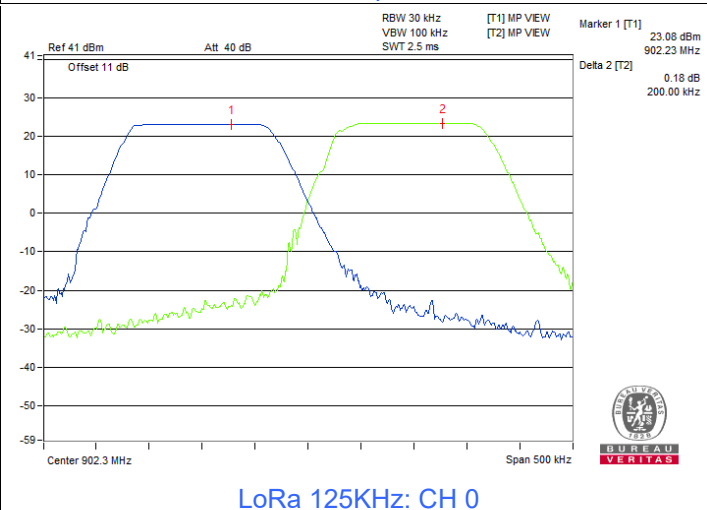
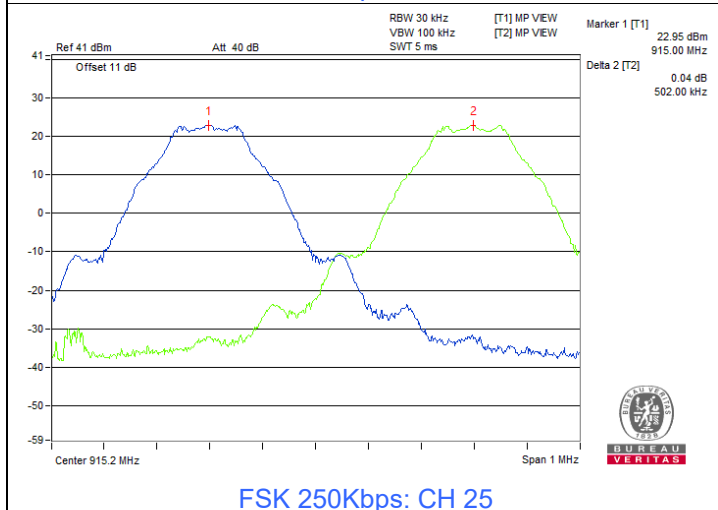
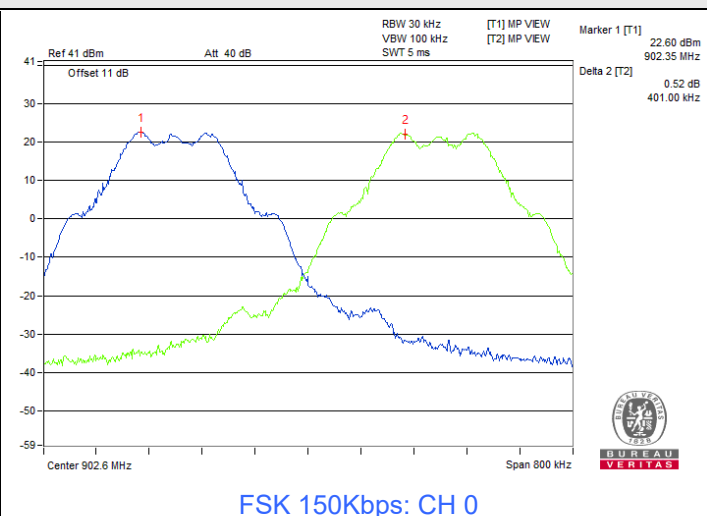
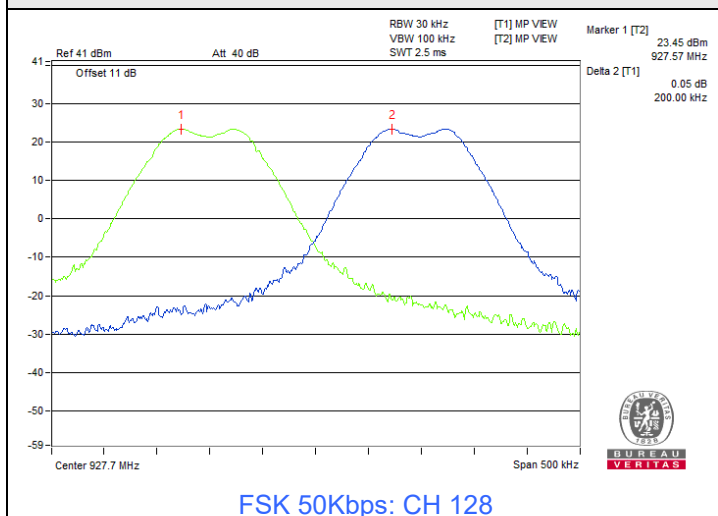
FSK 250Kbps

Channel	Frequency (MHz)	Hopping Channel Separation (MHz)	Minimum Limit (MHz)	Test Result
0	902.5	0.51	0.26	Pass
25	915	0.50	0.27	Pass
50	927.5	0.51	0.27	Pass

LoRa 125KHz

Channel	Frequency (MHz)	Hopping Channel Separation (MHz)	Minimum Limit (MHz)	Test Result
0	902.2	0.20	0.13	Pass
64	915	0.20	0.15	Pass
128	927.8	0.21	0.14	Pass

Spectrum Plot of Minimum Value



7.5 20 dB Bandwidth

Environmental Conditions:	25°C, 60% RH	Tested By:	Match Tsui
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FSK 50Kbps

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Maximum Limit (MHz)	Test Result
0	902.2	0.1	0.5	Pass
64	915	0.11	0.5	Pass
128	927.8	0.11	0.5	Pass

FSK 150Kbps

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Maximum Limit (MHz)	Test Result
0	902.4	0.17	0.5	Pass
32	915.2	0.18	0.5	Pass
63	927.6	0.18	0.5	Pass

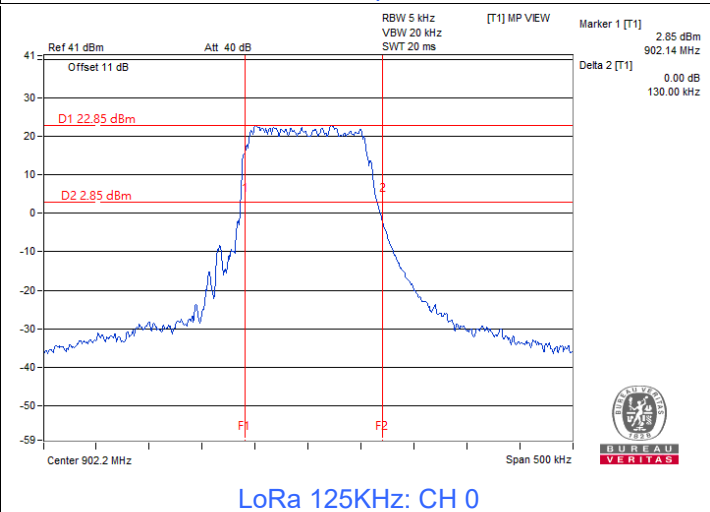
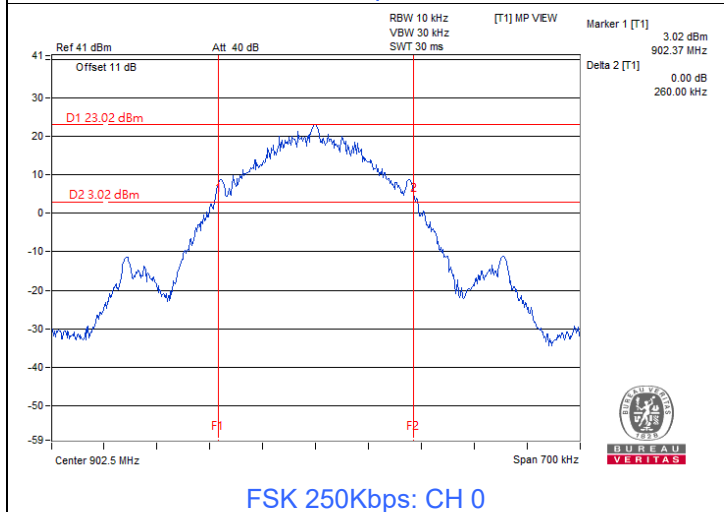
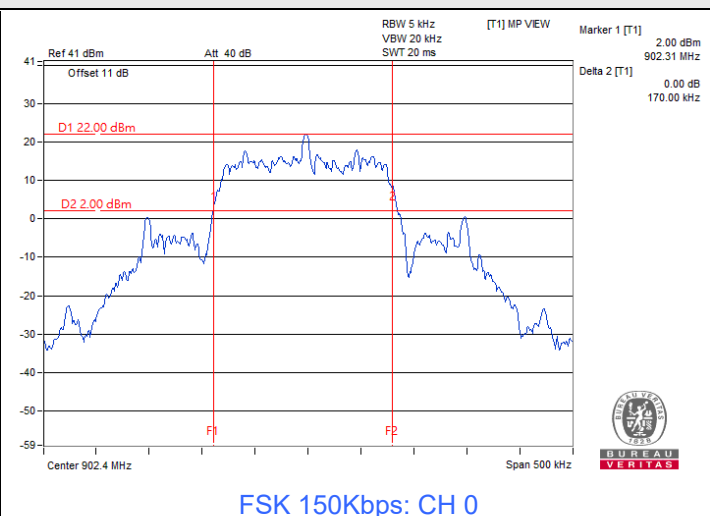
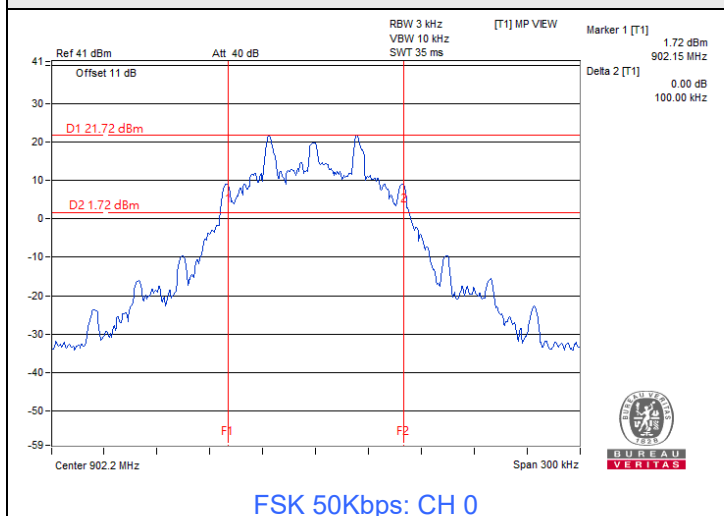
FSK 250Kbps

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Maximum Limit (MHz)	Test Result
0	902.5	0.26	0.5	Pass
25	915	0.27	0.5	Pass
50	927.5	0.27	0.5	Pass

LoRa 125KHz

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Maximum Limit (MHz)	Test Result
0	902.2	0.13	0.5	Pass
64	915	0.15	0.5	Pass
128	927.8	0.14	0.5	Pass

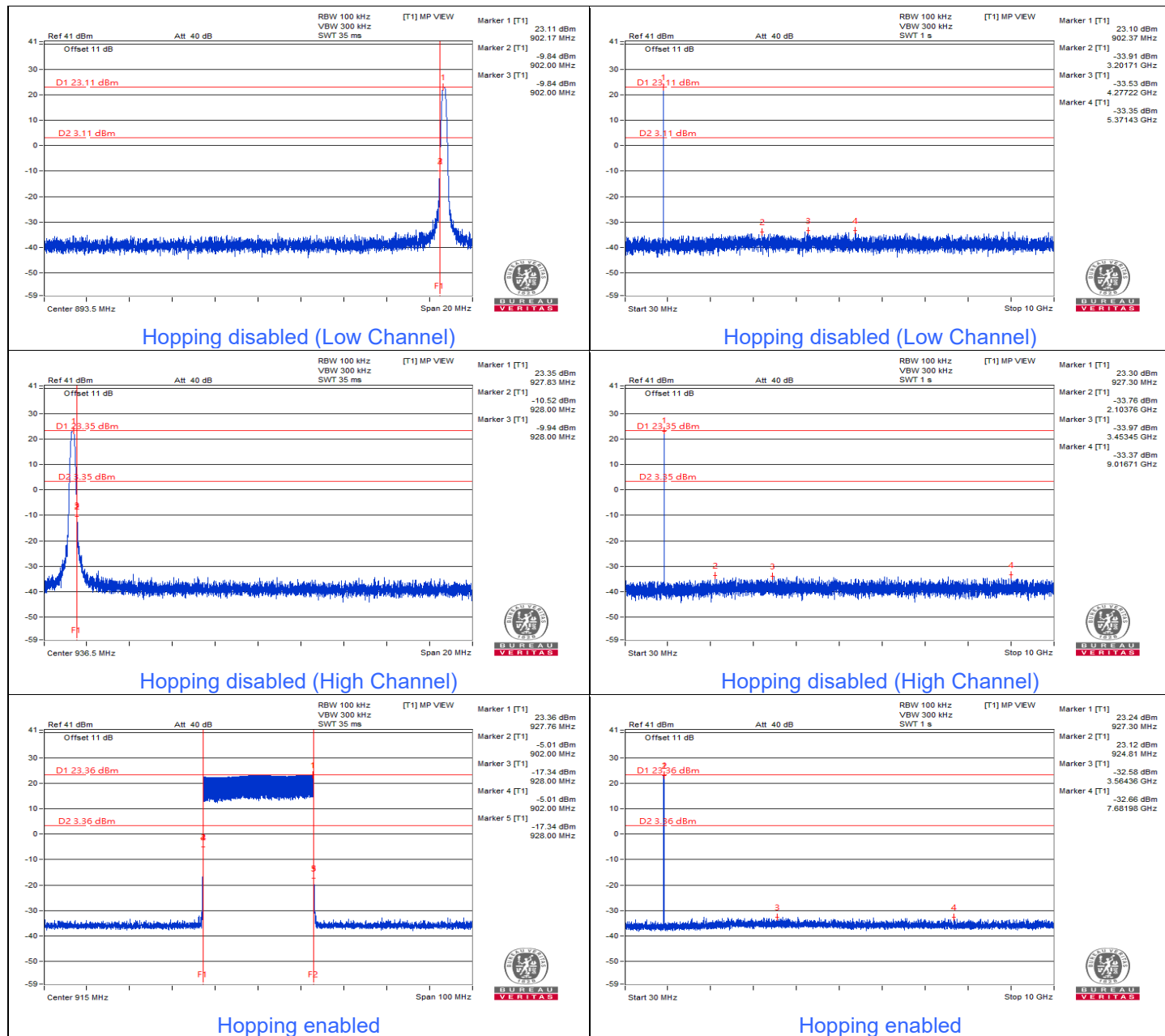
Spectrum Plot of Minimum Value



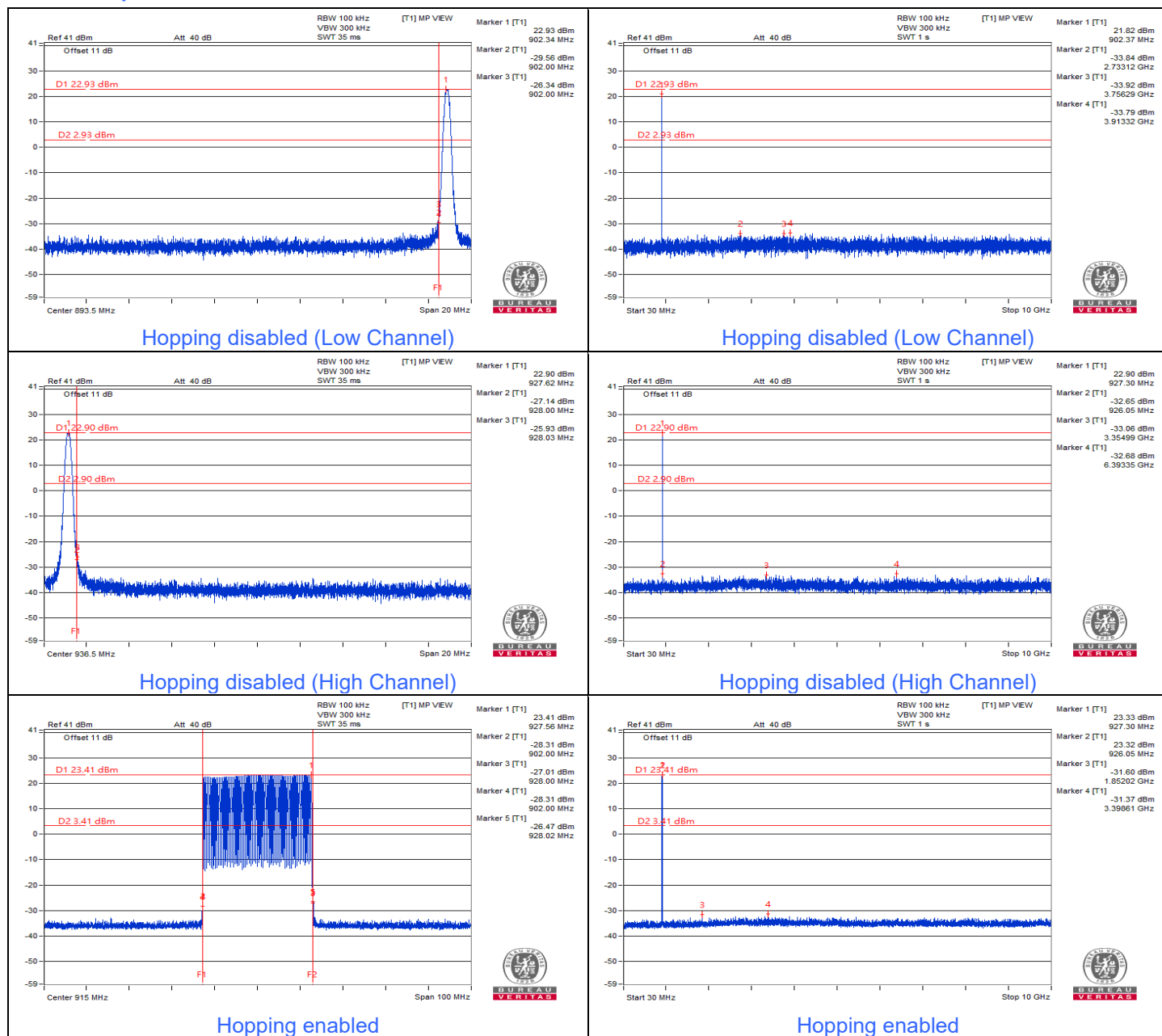
7.6 Conducted Out of Band Emissions

Environmental Conditions:	25°C, 60% RH	Tested By:	Match Tsui
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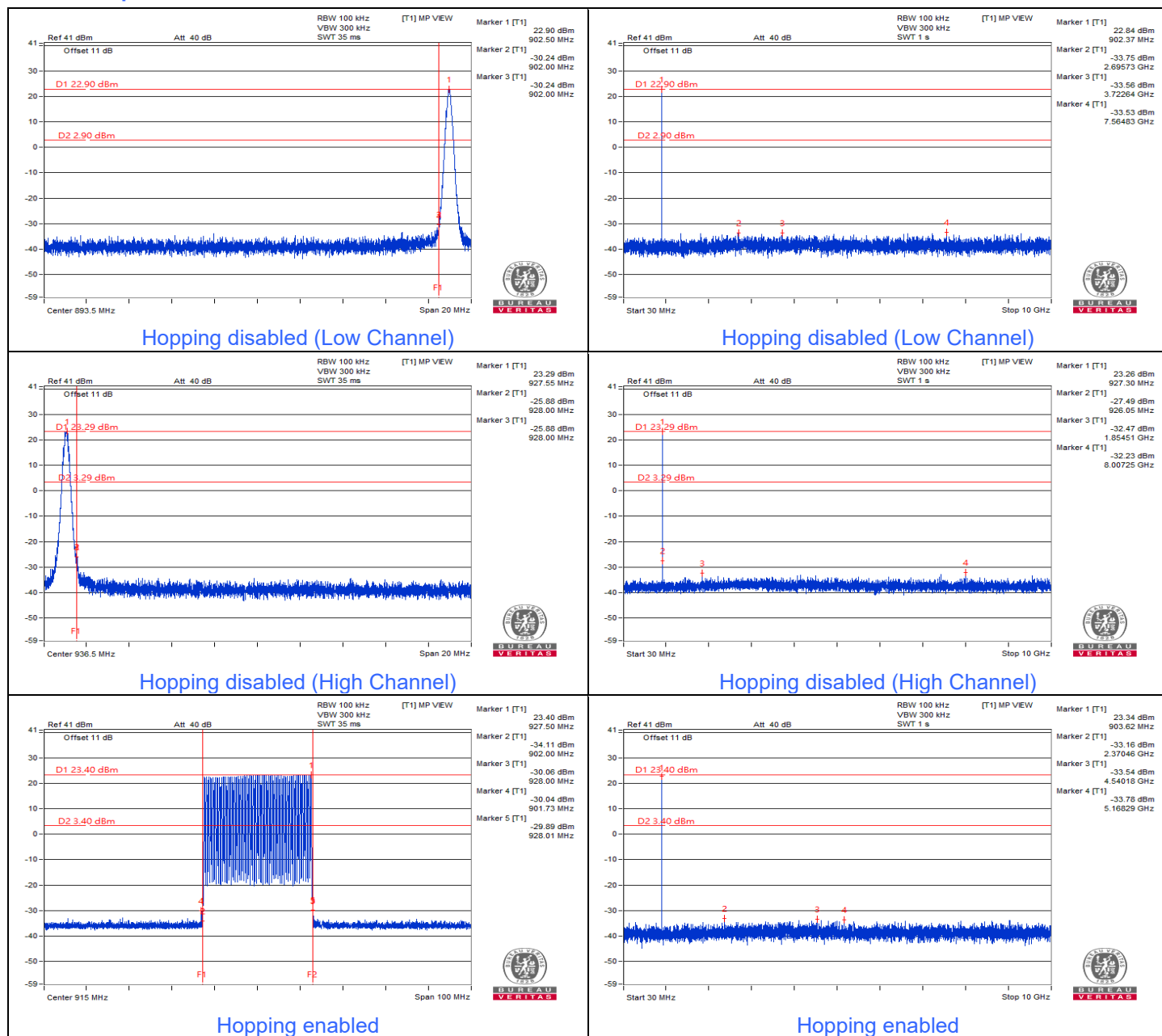
FSK 50Kbps



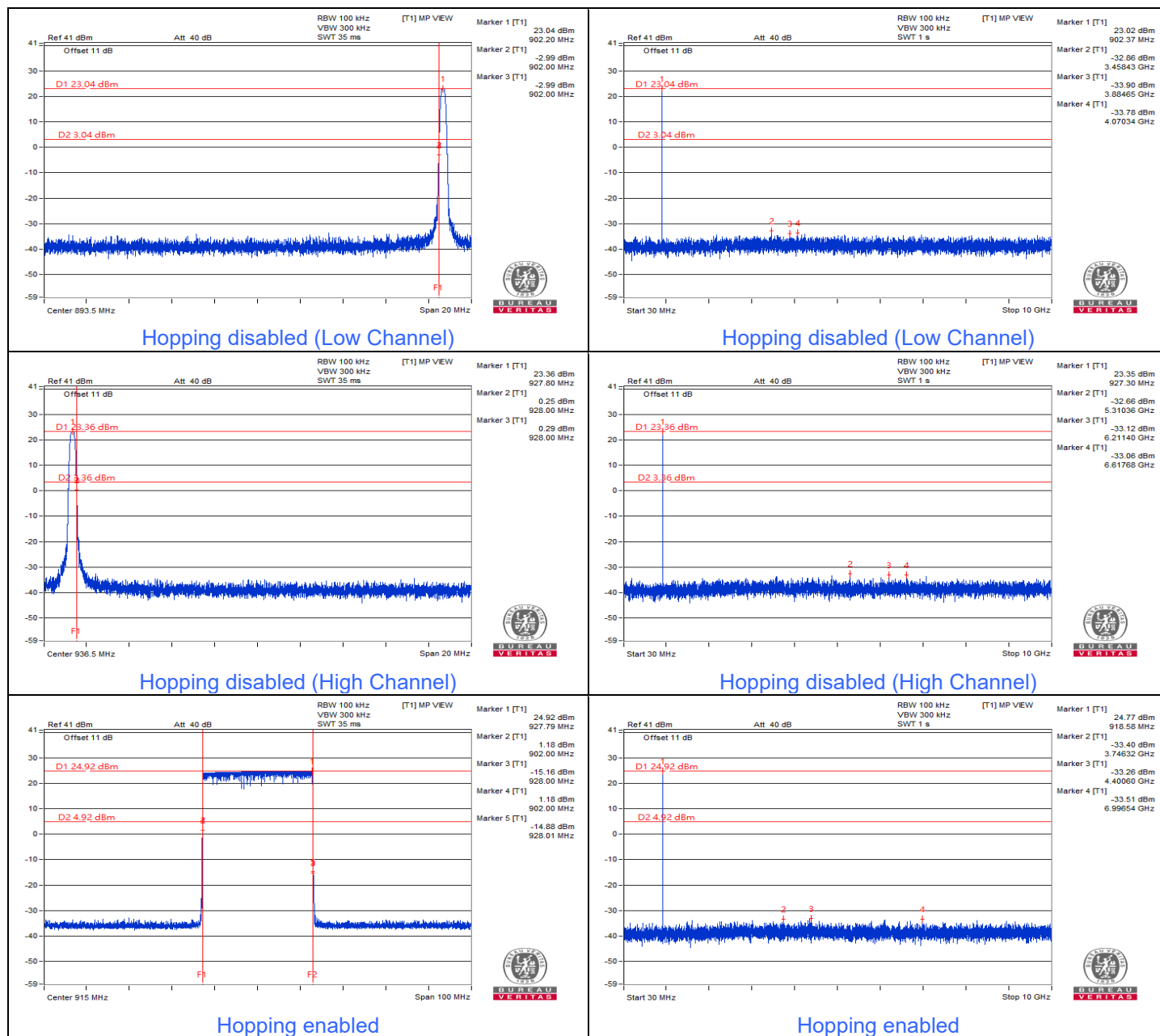
FSK 150Kbps



FSK 250Kbps



LoRa 125KHz



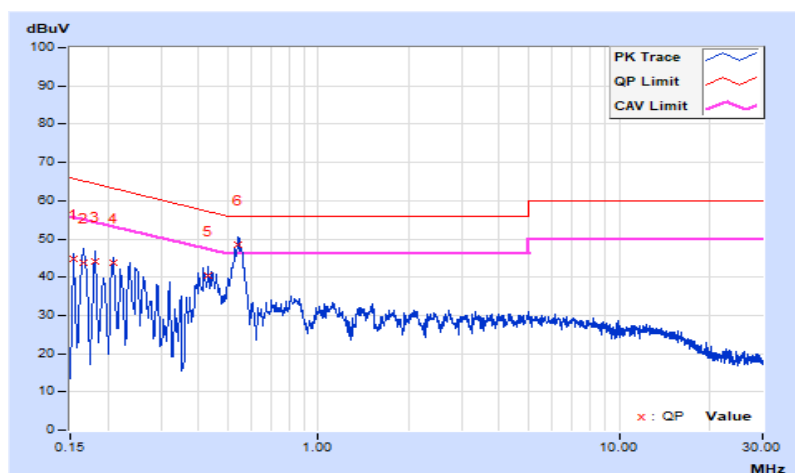
7.7 AC Power Conducted Emissions

RF Mode	FSK 50kbps	Channel	CH 64 : 915 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25 °C, 75% RH
Tested By	Greg Lin		

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.72	35.05	19.63	44.77	29.35	65.79	55.79	-21.02	-26.44
2	0.16564	9.74	34.11	16.59	43.85	26.33	65.18	55.18	-21.33	-28.85
3	0.18128	9.75	34.32	20.80	44.07	30.55	64.43	54.43	-20.36	-23.88
4	0.20865	9.77	34.13	23.04	43.90	32.81	63.26	53.26	-19.36	-20.45
5	0.43152	9.80	30.62	21.07	40.42	30.87	57.22	47.22	-16.80	-16.35
6	0.54100	9.81	38.66	30.93	48.47	40.74	56.00	46.00	-7.53	-5.26

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

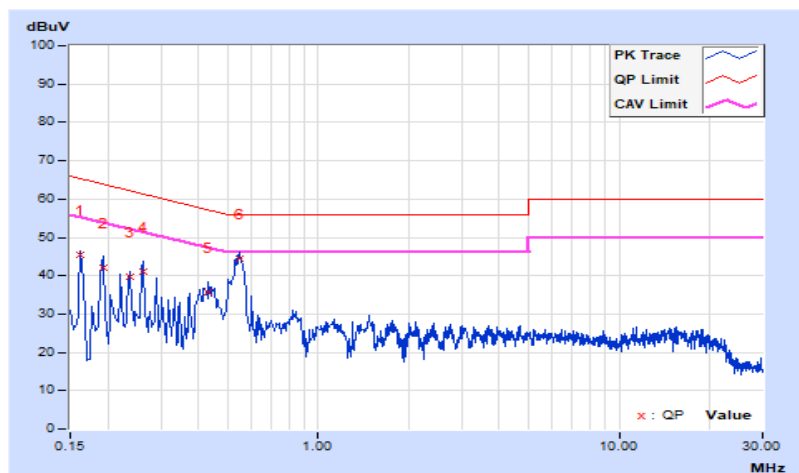


RF Mode	FSK 50kbps	Channel	CH 64 : 915 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25 °C, 75% RH
Tested By	Greg Lin		

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16173	9.72	35.69	21.28	45.41	31.00	65.37	55.37	-19.96	-24.37
2	0.19301	9.74	32.51	14.26	42.25	24.00	63.91	53.91	-21.66	-29.91
3	0.23602	9.76	29.99	20.19	39.75	29.95	62.24	52.24	-22.49	-22.29
4	0.26339	9.77	31.39	18.18	41.16	27.95	61.32	51.32	-20.16	-23.37
5	0.43152	9.84	25.83	17.42	35.67	27.26	57.22	47.22	-21.55	-19.96
6	0.54491	9.87	34.69	27.86	44.56	37.73	56.00	46.00	-11.44	-8.27

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



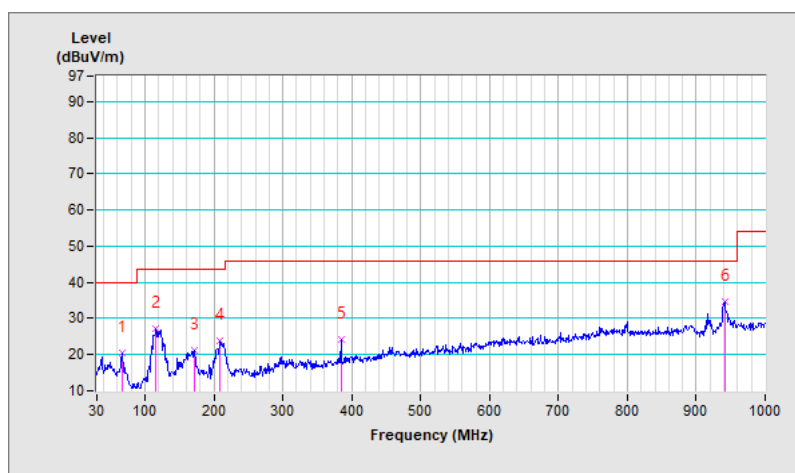
7.8 Unwanted Emissions below 1 GHz

Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	65.89	20.6 QP	40.0	-19.4	1.25 H	216	35.3	-14.7
2	115.36	27.2 QP	43.5	-16.3	1.00 H	297	42.9	-15.7
3	170.65	21.2 QP	43.5	-22.3	1.00 H	239	34.6	-13.4
4	209.45	23.7 QP	43.5	-19.8	1.50 H	228	39.9	-16.2
5	384.05	24.2 QP	46.0	-21.8	1.00 H	301	34.6	-10.4
6	940.83	34.8 QP	46.0	-11.2	1.25 H	144	34.9	-0.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

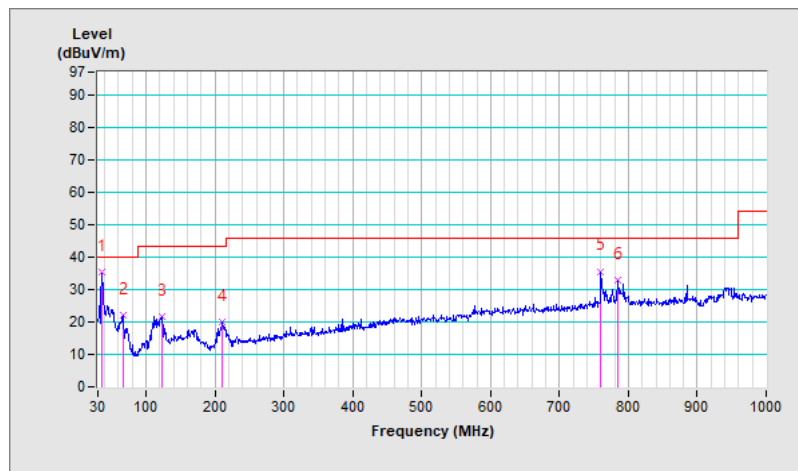


Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	34.85	35.2 QP	40.0	-4.8	1.00 V	331	49.2	-14.0
2	65.89	22.1 QP	40.0	-17.9	1.50 V	174	36.8	-14.7
3	122.15	21.7 QP	43.5	-21.8	1.25 V	256	36.7	-15.0
4	211.39	20.0 QP	43.5	-23.5	1.00 V	300	36.2	-16.2
5	759.44	35.6 QP	46.0	-10.4	1.00 V	63	38.4	-2.8
6	785.63	32.8 QP	46.0	-13.2	1.50 V	356	35.1	-2.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



RF Mode	FSK 50kbps	Channel	CH 0 : 902.2 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	80.5 QP	101.7	-21.2	1.37 H	153	49.9	30.6
2	*902.20	121.7 QP			1.37 H	153	91.1	30.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	73.9 QP	94.2	-20.3	1.48 V	77	43.3	30.6
2	*902.20	114.2 QP			1.48 V	77	83.6	30.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 50kbps	Channel	CH 64 : 915 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.00	121.7 QP			1.36 H	149	90.9	30.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.00	114.3 QP			1.47 V	82	83.5	30.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 50kbps	Channel	CH 128 : 927.8 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.80	123.8 QP			1.39 H	154	92.8	31.0
2	928.00	82.7 QP	103.8	-21.1	1.39 H	154	51.7	31.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.80	116.2 QP			1.48 V	73	85.2	31.0
2	928.00	76.4 QP	96.2	-19.8	1.48 V	73	45.4	31.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 150kbps	Channel	CH 0 : 902.4 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	69.0 QP	101.0	-32.0	1.39 H	156	38.4	30.6
2	*902.40	121.0 QP			1.39 H	156	90.4	30.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	64.4 QP	93.8	-29.4	1.44 V	75	33.8	30.6
2	*902.40	113.8 QP			1.44 V	75	83.2	30.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 150kbps	Channel	CH 32 : 915.2 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.20	121.2 QP			1.38 H	154	90.4	30.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.20	113.7 QP			1.46 V	73	82.9	30.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 150kbps	Channel	CH 63 : 927.6 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.60	122.5 QP			1.38 H	159	91.5	31.0
2	928.00	73.1 QP	102.5	-29.4	1.38 H	159	42.1	31.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.60	115.2 QP			1.43 V	81	84.2	31.0
2	928.00	67.3 QP	95.2	-27.9	1.43 V	81	36.3	31.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 250kbps	Channel	CH 0 : 902.5 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	67.4 QP	101.4	-34.0	1.35 H	154	36.8	30.6
2	*902.50	121.4 QP			1.35 H	154	90.8	30.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	63.3 QP	94.2	-30.9	1.46 V	73	32.7	30.6
2	*902.50	114.2 QP			1.46 V	73	83.6	30.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 250kbps	Channel	CH 25 : 915 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.00	122.4 QP			1.43 H	158	91.6	30.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.00	115.1 QP			1.46 V	79	84.3	30.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	FSK 250kbps	Channel	CH 50 : 927.5 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.50	123.2 QP			1.36 H	154	92.2	31.0
2	928.00	72.3 QP	103.2	-30.9	1.36 H	154	41.3	31.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.50	115.8 QP			1.47 V	78	84.8	31.0
2	928.00	67.4 QP	95.8	-28.4	1.47 V	78	36.4	31.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	LoRa 125kHz	Channel	CH 0 : 902.2 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	84.4 QP	102.0	-17.6	1.38 H	151	53.8	30.6
2	*902.20	122.0 QP			1.38 H	151	91.4	30.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	78.0 QP	94.6	-16.6	1.44 V	79	47.4	30.6
2	*902.20	114.6 QP			1.44 V	79	84.0	30.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	LoRa 125kHz	Channel	CH 64 : 915 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.00	122.6 QP			1.37 H	162	91.8	30.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*915.00	115.3 QP			1.42 V	77	84.5	30.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	LoRa 125kHz	Channel	CH 128 : 927.8 MHz
Frequency Range	902 MHz ~ 928 MHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.80	123.7 QP			1.39 H	156	92.7	31.0
2	928.00	90.1 QP	103.7	-13.6	1.39 H	156	59.1	31.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*927.80	116.5 QP			1.49 V	73	85.5	31.0
2	928.00	83.4 QP	96.5	-13.1	1.49 V	73	52.4	31.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

7.9 Unwanted Emissions above 1 GHz

RF Mode	FSK 50kbps	Channel	CH 0 : 902.2 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2706.60	45.2 PK	74.0	-28.8	2.53 H	117	47.7	-2.5
2	2706.60	34.3 AV	54.0	-19.7	2.53 H	117	36.8	-2.5
3	9022.00	59.2 PK	74.0	-14.8	2.70 H	205	49.2	10.0
4	9022.00	51.0 AV	54.0	-3.0	2.70 H	205	41.0	10.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2706.60	44.0 PK	74.0	-30.0	2.28 V	141	46.5	-2.5
2	2706.60	33.2 AV	54.0	-20.8	2.28 V	141	35.7	-2.5
3	9022.00	57.2 PK	74.0	-16.8	2.27 V	184	47.2	10.0
4	9022.00	49.2 AV	54.0	-4.8	2.27 V	184	39.2	10.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 50kbps	Channel	CH 64 : 915 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.00	44.4 PK	74.0	-29.6	2.53 H	124	46.7	-2.3
2	2745.00	33.9 AV	54.0	-20.1	2.53 H	124	36.2	-2.3
3	9150.00	58.9 PK	74.0	-15.1	1.51 H	280	48.8	10.1
4	9150.00	51.0 AV	54.0	-3.0	1.51 H	280	40.9	10.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.00	43.9 PK	74.0	-30.1	2.18 V	147	46.2	-2.3
2	2745.00	33.2 AV	54.0	-20.8	2.18 V	147	35.5	-2.3
3	9150.00	57.2 PK	74.0	-16.8	2.26 V	176	47.1	10.1
4	9150.00	49.2 AV	54.0	-4.8	2.26 V	176	39.1	10.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 50kbps	Channel	CH 128 : 927.8 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2783.40	48.4 PK	74.0	-25.6	2.64 H	149	50.5	-2.1
2	2783.40	42.2 AV	54.0	-11.8	2.64 H	149	44.3	-2.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2783.40	46.1 PK	74.0	-27.9	2.37 V	5	48.2	-2.1
2	2783.40	38.6 AV	54.0	-15.4	2.37 V	5	40.7	-2.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 150kbps	Channel	CH 0 : 902.4 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2707.20	44.2 PK	74.0	-29.8	2.59 H	108	46.7	-2.5
2	2707.20	35.3 AV	54.0	-18.7	2.59 H	108	37.8	-2.5
3	9024.00	59.2 PK	74.0	-14.8	2.64 H	200	49.2	10.0
4	9024.00	50.8 AV	54.0	-3.2	2.64 H	200	40.8	10.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2707.20	43.7 PK	74.0	-30.3	2.28 V	144	46.2	-2.5
2	2707.20	35.0 AV	54.0	-19.0	2.28 V	144	37.5	-2.5
3	9024.00	57.2 PK	74.0	-16.8	2.21 V	176	47.2	10.0
4	9024.00	48.7 AV	54.0	-5.3	2.21 V	176	38.7	10.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 150kbps	Channel	CH 32 : 915.2 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.60	44.0 PK	74.0	-30.0	2.43 H	116	46.3	-2.3
2	2745.60	35.0 AV	54.0	-19.0	2.43 H	116	37.3	-2.3
3	9152.00	58.7 PK	74.0	-15.3	1.67 H	193	48.6	10.1
4	9152.00	49.9 AV	54.0	-4.1	1.67 H	193	39.8	10.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.60	43.4 PK	74.0	-30.6	2.19 V	141	45.7	-2.3
2	2745.60	34.5 AV	54.0	-19.5	2.19 V	141	36.8	-2.3
3	9152.00	56.9 PK	74.0	-17.1	2.23 V	176	46.8	10.1
4	9152.00	48.5 AV	54.0	-5.5	2.23 V	176	38.4	10.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 150kbps	Channel	CH 63 : 927.6 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2782.80	47.5 PK	74.0	-26.5	2.53 H	168	49.6	-2.1
2	2782.80	40.4 AV	54.0	-13.6	2.53 H	168	42.5	-2.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2782.80	47.2 PK	74.0	-26.8	2.27 V	141	49.3	-2.1
2	2782.80	40.0 AV	54.0	-14.0	2.27 V	141	42.1	-2.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 250kbps	Channel	CH 0 : 902.5 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2707.50	44.3 PK	74.0	-29.7	2.53 H	218	46.8	-2.5
2	2707.50	36.0 AV	54.0	-18.0	2.53 H	218	38.5	-2.5
3	9025.00	59.2 PK	74.0	-14.8	2.68 H	203	49.2	10.0
4	9025.00	50.7 AV	54.0	-3.3	2.68 H	203	40.7	10.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2707.50	43.8 PK	74.0	-30.2	2.26 V	147	46.3	-2.5
2	2707.50	35.5 AV	54.0	-18.5	2.26 V	147	38.0	-2.5
3	9025.00	57.4 PK	74.0	-16.6	2.19 V	175	47.4	10.0
4	9025.00	48.8 AV	54.0	-5.2	2.19 V	175	38.8	10.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 250kbps	Channel	CH 25 : 915 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.00	43.9 PK	74.0	-30.1	2.56 H	119	46.2	-2.3
2	2745.00	35.5 AV	54.0	-18.5	2.56 H	119	37.8	-2.3
3	9150.00	58.0 PK	74.0	-16.0	1.28 H	184	47.9	10.1
4	9150.00	49.7 AV	54.0	-4.3	1.28 H	184	39.6	10.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.00	43.5 PK	74.0	-30.5	2.23 V	140	45.8	-2.3
2	2745.00	35.1 AV	54.0	-18.9	2.23 V	140	37.4	-2.3
3	9150.00	56.7 PK	74.0	-17.3	2.23 V	178	46.6	10.1
4	9150.00	48.0 AV	54.0	-6.0	2.23 V	178	37.9	10.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	FSK 250kbps	Channel	CH 50 : 927.5 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2782.50	47.4 PK	74.0	-26.6	2.55 H	167	49.5	-2.1
2	2782.50	40.6 AV	54.0	-13.4	2.55 H	167	42.7	-2.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2782.50	47.0 PK	74.0	-27.0	2.28 V	143	49.1	-2.1
2	2782.50	40.2 AV	54.0	-13.8	2.28 V	143	42.3	-2.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	LoRa 125kHz	Channel	CH 0 : 902.2 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2706.60	44.2 PK	74.0	-29.8	2.57 H	116	46.7	-2.5
2	2706.60	34.7 AV	54.0	-19.3	2.57 H	116	37.2	-2.5
3	9022.00	57.9 PK	74.0	-16.1	1.13 H	179	47.9	10.0
4	9022.00	50.0 AV	54.0	-4.0	1.13 H	179	40.0	10.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2706.60	43.7 PK	74.0	-30.3	2.23 V	147	46.2	-2.5
2	2706.60	34.2 AV	54.0	-19.8	2.23 V	147	36.7	-2.5
3	9022.00	56.2 PK	74.0	-17.8	2.21 V	167	46.2	10.0
4	9022.00	48.2 AV	54.0	-5.8	2.21 V	167	38.2	10.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	LoRa 125kHz	Channel	CH 64 : 915 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.00	43.1 PK	74.0	-30.9	2.53 H	117	45.4	-2.3
2	2745.00	33.9 AV	54.0	-20.1	2.53 H	117	36.2	-2.3
3	9150.00	56.4 PK	74.0	-17.6	1.00 H	178	46.3	10.1
4	9150.00	49.2 AV	54.0	-4.8	1.00 H	178	39.1	10.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2745.00	42.6 PK	74.0	-31.4	2.21 V	148	44.9	-2.3
2	2745.00	33.5 AV	54.0	-20.5	2.21 V	148	35.8	-2.3
3	9150.00	54.9 PK	74.0	-19.1	2.21 V	176	44.8	10.1
4	9150.00	47.5 AV	54.0	-6.5	2.21 V	176	37.4	10.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

RF Mode	LoRa 125kHz	Channel	CH 128 : 927.8 MHz
Frequency Range	1 GHz ~ 10 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 68% RH
Tested By	Greg Lin		

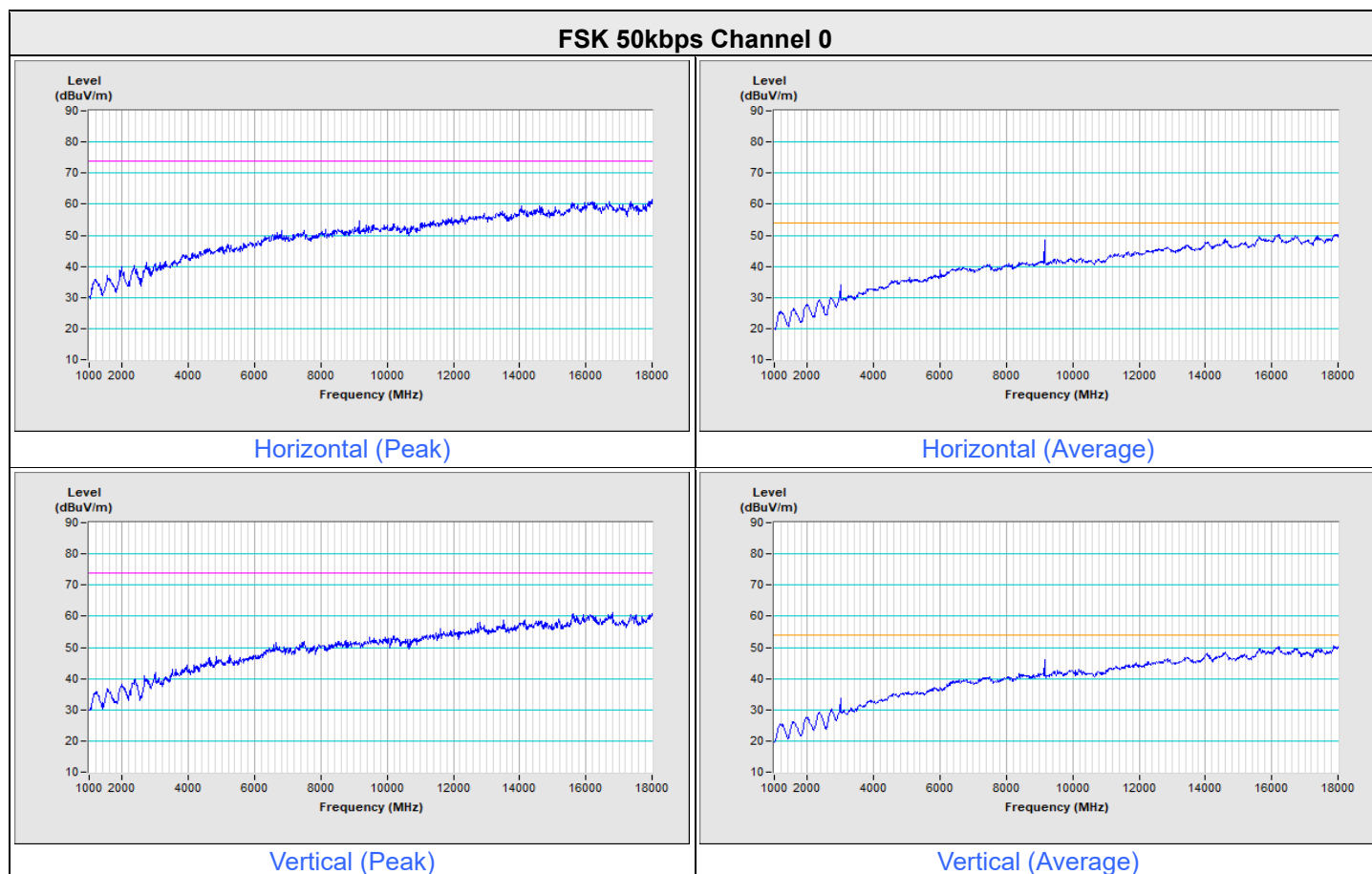
Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2783.40	47.6 PK	74.0	-26.4	2.55 H	167	49.7	-2.1
2	2783.40	40.9 AV	54.0	-13.1	2.55 H	167	43.0	-2.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2783.40	47.2 PK	74.0	-26.8	2.21 V	148	49.3	-2.1
2	2783.40	40.5 AV	54.0	-13.5	2.21 V	148	42.6	-2.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

Plot of Other Emission

Frequency Range	1 GHz ~ 18 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
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Notes:

1. For radiated emission test data, complete spectral plots shall be presented in the report only for the worst-case scenarios of each mode within each operating frequency band.
2. The frequency range 18 GHz ~ 25 GHz: After investigation, no any emissions were found to exist, therefore they are not recorded in this report.

8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

9 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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