Test Report No.:
FCCSZ2024-0003-RF1

RF Test Report

FCC ID	:	**2AYHY-CT10X**
EUT	:	**Smart Current Transformer**
MODEL	:	**See Section 2.2**
BRAND NAME	:	**Milesight**
APPLICANT	:	**Xiamen Milesight IoT Co., Ltd.**
Classification of Test	:	**N/A**

CVC Testing Technology (Shenzhen) Co., Ltd.

Client	**Name: Xiamen Milesight IoT Co., Ltd.** **Address: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China**
Manufacturer	**Name: Xiamen Milesight IoT Co., Ltd.** **Address: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China**
Equipment Under Test	**Name: Smart Current Transformer** **Model/Type: See Section 2.2** **Brand: Milesight** **Serial No.: N/A** **Sampe No.: 2-1，2-2**

Date of Receipt.	**2024.01.10**	Date of Testing	**2024.01.10～2024.02.22**

Test Specification	**Test Result**
FCC Part 15, Subpart C, Section 15.247	PASS

Evaluation of Test Result	The equipment under test was found to comply with the requirements of the standards applied. Seal of CVC **Issue Date: 2024.02.23**

Tested by:	Reviewed by:	Approved by:
Cai Jianyu	Huang Meng	
Cai Jianyu	Huang Meng	Dong Sanbi
Name Signature	Name Signature	Name Signature

Other Aspects: NONE.

Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FCCSZ2024-0003-RF1	Original release	2024.02.23

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart C			
STANDARD SECTION	**TEST TYPE AND LIMIT**	**RESULT**	**REMARK**
15.207	AC Power Conducted Emission	PASS	See section 3.1
15.247(a)(1)	Number of Hopping Frequency Used	PASS	See section 3.6
15.247(a)(1)	Hopping Channel Separation	PASS	See section 3.4
15.247(a)(1)	Dwell Time of Each Channel	PASS	See section 3.4
15.247(a)(1)	20dB Emissions Bandwidth	PASS	See section 3.5
15.247(b)	Conducted Output Power	PASS	See section 3.7
15.247(d), 15.209,15.205	Radiated Emissions	PASS	See section 3.2
15.247(d)	Out of band Emission Measurement	PASS	See section 3.9
FCC 15.247(e)	Power Spectral Density	PASS	See section 3.8
15.203 15.247(b)	Antenna Requirement	PASS	See section 3.10

1.1 LIST OF TEST AND MEASUREMENT INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial Number	Cal. interval	Cal. Due
WIFI & Bluetooth Test System					/
Signal&Spectrum Analyzer	Rohde&Schwarz	FSV 30	104408	1 year	2024.5.21
#3Shielding room	MORI	443	N/A	3 year	2026.5.16
Wideband radio communication tester	Rohde&Schwarz	CMW 500	168778	1 year	2024.5.25
Analog signal Generator (100kHz ~ 40GHz)	Rohde&Schwarz	SMB 100A	181934	1 year	2024.5.21
Vector signal Generator (9kHz ~ 6GHz)	Keysight	N5182B	MY57301451	1 year	2024.4.25
Vector signal Generator (9kHz ~ 6GHz)	Rohde&Schwarz	SGT 100A	111724	1 year	2024.5.21
RF control unit(BT/WiFi)	Tonscend	JS0806-2-8CH	20E8060261	1 year	2024.5.21
Radiation Spurious(Above 1GHz)					/
Signal&Spectrum Analyzer	Rohde&Schwarz	FSV 40	101898	1 year	2024.5.21
EMI Test Receiver	Rohde&Schwarz	ESR3	102693	1 year	2024.5.25
Antenna(30MHz~1001MHz)	SCHWARZBECK	VULB 9168	1133	1 year	2025.2.4
Horn antenna(1GHz-18GHz)	ETS	3117	227611	1 year	2024.3.25
Horn antenna(18GHz-40GHz)	QMS	QMS-00880	22051	1 year	2024.3.25
3m anechoic chamber	MORI	966	CS0300011	3 year	2026.5.18
Filter group(RSE-BT/WiFi)	Rohde&Schwarz	WiFi /BT Variant 1	100820	1 year	2024.5.21
Filter group(RSE-Cellular)	Rohde&Schwarz	Cellular Variant 1	100768	1 year	2024.5.21
Preamplifier(10kHz-1GHz)	Rohde&Schwarz	SCU-01F	100299	1 year	2024.5.21
Preamplifier(1GHz-18GHz)	Rohde&Schwarz	SCU-18F	100799	1 year	2024.5.21
Preamplifier(1GHz-18GHz)	Rohde&Schwarz	SCU-18F	100801	1 year	2024.5.21
Preamplifier(18Gz-40GHz)	Rohde&Schwarz	SCU-40A	101209	1 year	2024.5.21
#2 control room	MORI	433	CS0300028	3 year	2024.5.21
Temperature and humidity meter	/	C193561517	C193561517	1 year	2024.5.21
Radiation Spurious(Below 1GHz)					/
EMI Test Receiver	Rohde&Schwarz	ESR 26	101718	1 year	2024.5.25
Loop antenna（8.3k~30MHz）	Rohde&Schwarz	HFH2-Z2E	100951	1 year	2024.5.26
Antenna(30MHz~1000MHz)	SCHWARZBECK	VULB 9168	1132	1 year	2025.2.27
3m anechoic chamber	MORI	966	CS0200019	3 year	2026.5.18
Attenuator	/	SJ-5dB	607684	1 year	2025.2.4
#1 control room	MORI	433	CS0300028	3 year	2026.5.16
Temperature and humidity meter	/	C193561473	CS0200071	1 year	2024.5.21
Conducted emission					/
EMI Test Receiver	Rohde&Schwarz	ESR3	102694	1 year	2024.5.25
limiter（10 dB）	Rohde&Schwarz	ESH3-Z2	102824	1 year	2024.5.16
Voltage probe	Rohde&Schwarz	CVP9222C	28	1 year	2024.5.16
Current probe	Rohde&Schwarz	EZ-17	101442	1 year	2024.5.21
ISN network	Rohde&Schwarz	ENV 81	100401	1 year	2024.5.16
ISN network	Rohde&Schwarz	ENV 81 Cat6	101896	1 year	2024.5.16
LISN（single-phase）	Rohde&Schwarz	ENV216	102569	1 year	2024.4.11
#1Shielding room	MORI	854	N/A	3 year	2026.5.16

1.2 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:

No.	Item	Measurement Uncertainty
1	Conducted emission test	+/-2.7 dB
2	Radiated emission 9kHz-30MHz	+/-5.6 dB
3	Radiated emission 30MHz-1GHz	+/-4.6 dB
4	Radiated emission 1GHz-18GHz	+/-4.4 dB
5	Radiated emission 18GHz-40GHz	+/-5.1 dB
6	RF power	+/-0.9 dB
7	Power Spectral Density	+/-0.8 dB
8	Conducted spurious emissions	+/-2.7 dB
9	Transmission Time	+/-0.27%
10	Occupied Bandwidth	+/-1.86%
Remark: 95% Confidence Levels, k=2.		

1.3 TEST LOCATION

The tests and measurements refer to this report were performed by EMC testing Lab. of CVC Testing Technology (Shenzhen) Co., Ltd.

CABID:CN0137
Lab Address: No. 1301, Guanguang Road, Xinlan Community, Guanlan Street, Longhua District, Shenzhen City, Guangdong Province 518110 P.R.China
Post Code：518110 Tel：0755-23763060-8805
Fax：0755-23763060 E-mail：sz-kf@cvc.org.cn
FCC(Test firm designation number：CN1363)
IC(Test firm CAB identifier number：CN0137)
CNAS(Test firm designation number：L16091)

2 GENERAL INFORMATION

2.1 GENERAL PRODUCT INFORMATION

PRODUCT	Smart Current Transformer
BRAND	Milesight
MODEL	CT103-915M
ADDITIONAL MODEL	See Section 2.2
POWER SUPPLY	AC 120V/60Hz
MODULATION TYPE	DTS,FHSS
OPERATING FREQUENCY	Hybrid 125kHz, 902.3MHz~927.8MHz
NUMBER OF CHANNEL	128
PEAK OUTPUT POWER	19.59dBm (Max. Measured)
ANTENNA TYPE (Remakr 3)	External Antenna, 3.73dBi Gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

Remark:

1. For more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Please refer to the antenna report.
4. EUT photo refer to the report (Report NO.: FCCSZ2024-0003-EUT).
5. The EUT have SISO function, provides 1 completed transmitter and 1 receiver.

2.2 ADDITIONAL MODEL/TYPE

Main Model No.	Serial Model No.	Difference
CT103-915M	NO103-915M, CT103-9M,NO103-9M	only differences are the model no and appearance silkprint.
	CT101-915M,NO101-915M, CT101-9M,NO101-9M	1.Main Model No and Serial Model No only differences are the external Current Transformer. 2.Serial Model only differences are the model no and appearance silkprint.
	CT105-915M,NO105-915M, CT107-915M,NO107-915M, CT109-915M,NO109-915M, CT110-915M,NO110-915M,	1.Main Model No and Serial Model No. only differences are the external Current Transformer. 2.Serial Model only differences are the

	CT301-915M,NO301-915M, CT303-915M,NO303-915M, CT305-915M,NO305-915M, CT310-915M,NO310-915M, CT315-915M,NO315-915M, CT320-915M,NO320-915M, CT325-915M,NO325-915M, CT330-915M,NO330-915M, CT335-915M,NO335-915M, CT340-915M,NO340-915M, CT105-9M,NO105-9M, CT107-9M,NO107-9M, CT109-9M,NO109-9M, CT110-9M,NO110-9M, CT301-9M,NO301-9M, CT303-9M,NO303-9M, CT305-9M,NO305-9M, CT310-9M,NO310-9M, CT315-9M,NO315-9M, CT320-9M,NO320-9M, CT325-9M,NO325-9M, CT330-9M,NO330-9M, CT335-9M,NO335-9M, CT340-9M,NO340-9M	model no and appearance silkprint.

2.3 OTHER INFORMATION

Operation Frequency Each of Channel							
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	**902.3**	32	908.7	64	915.2	96	921.6
1	902.5	33	908.9	65	915.4	97	921.8
2	902.7	34	909.1	66	915.6	98	922
3	902.9	35	909.3	67	915.8	99	922.2
4	903.1	36	909.5	68	916	100	922.4
5	903.3	37	909.7	69	916.2	101	922.6
6	903.5	38	909.9	70	916.4	102	922.8
7	903.7	39	910.1	71	916.6	103	923
8	903.9	40	910.3	72	916.8	104	923.2
9	904.1	41	910.5	73	917	105	923.4
10	904.3	42	910.7	74	917.2	106	923.6
11	904.5	43	910.9	75	917.4	107	923.8
12	904.7	44	911.1	76	917.6	108	924
13	904.9	45	911.3	77	917.8	109	924.2
14	905.1	46	911.5	78	918	110	924.4
15	905.3	47	911.7	79	918.2	111	924.6
16	905.5	48	911.9	80	918.4	112	924.8
17	905.7	49	912.1	81	918.6	113	925
18	905.9	50	912.3	82	918.8	114	925.2
19	906.1	51	912.5	83	919	115	925.4
20	906.3	52	912.7	84	919.2	116	925.6
21	906.5	53	912.9	85	919.4	117	925.8
22	906.7	54	913.1	86	919.6	118	926
23	906.9	55	913.3	87	919.8	119	926.2
24	907.1	56	913.5	88	920	120	926.4
25	907.3	57	913.7	89	920.2	121	926.6
26	907.5	58	913.9	90	920.4	122	926.8
27	907.7	59	914.1	91	920.6	123	927
28	907.9	60	914.3	92	920.8	124	927.2
29	908.1	61	914.5	93	921	125	927.4
30	908.3	62	914.7	94	921.2	126	927.6
31	908.5	**63**	**914.9**	95	921.4	**127**	**927.8**

2.4 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, xyz axis and antenna ports

The worst case was found when positioned on xaxis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TEST ITEMS				DESCRIPTION
	RSE<1G	RSE≥1G	PLC	APCM	
A	√	√	√	√	Lora Link

Where **RSE<1G:** Radiated Emission below 1GHz. **RSE≥1G:** Radiated Emission above 1GHz.
PLC: Power Line Conducted Emission. **APCM:** Antenna Port Conducted Measurement.

POWER LINE CONDUCTED EMISSION TEST:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	TESTED CONDITION
A	Lora Link

RADIATED EMISSION TEST (BELOW 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
A	0 to 127	0	FHSS	DR0

For the test results, only the worst case was shown in test report.

RADIATED EMISSION TEST (ABOVE 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
A	0 to 127	0,63,127	FHSS	DR0

ANTENNA PORT CONDUCTED MEASUREMENT:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
A	0 to 127	0,63,127	FHSS	DR0

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (SYSTEM)	TESTED BY
RSE<1G	25.2deg. C, 55%RH	AC 120V/60Hz	Wang Zhiming
RSE≥1G	25.2deg. C, 55%RH	AC 120V/60Hz	Wang Zhiming
PLC	25.2deg. C, 55%RH	AC 120V/60Hz	Zhou Ye
APCM	26.2deg. C, 58%RH	AC 120V/60Hz	Cai Jianyu

2.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC PART 15, Subpart C. Section 15.247
KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10-2020

All test items have been performed and recorded as per the above standards

2.6 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Support Equipment					
NO	Description	Brand	Model No.	Serial Number	Supplied by
1	N/A	N/A	N/A	N/A	N/A

Support Cable							
NO	Description	Quantity (Number)	Length (m)	Detachable (Yes/ No)	Shielded (Yes/ No)	Cores (Number)	Supplied by
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3 TEST TYPES AND RESULTS

3.1 CONDUCTED EMISSION

3.1.1 Limits

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50
NOTE: 1. The lower limit shall apply at the transition frequencies. NOTE: 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.		

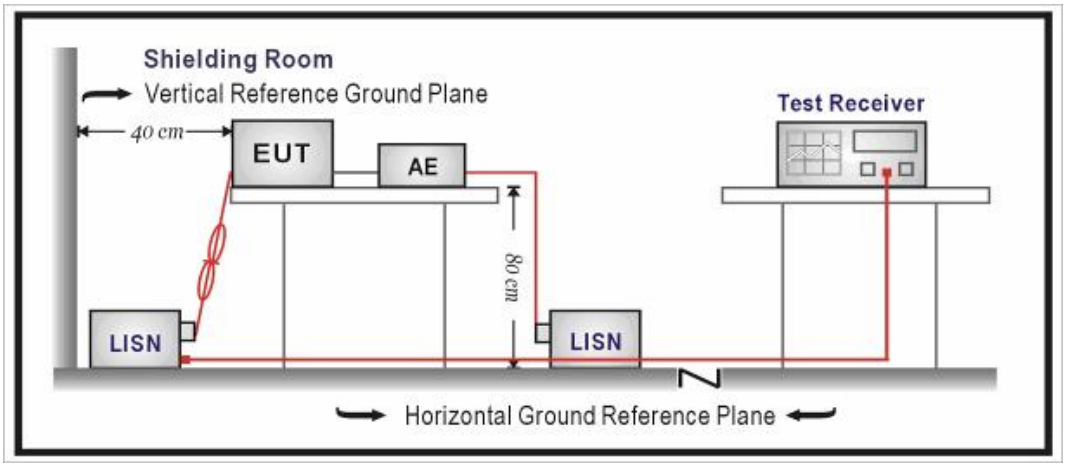
3.1.2 Test Procedures

a. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the Test photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.The equipment under test shall be placed on a support of non-metallic material, the height of which shall be1.5m above the ground,

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

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

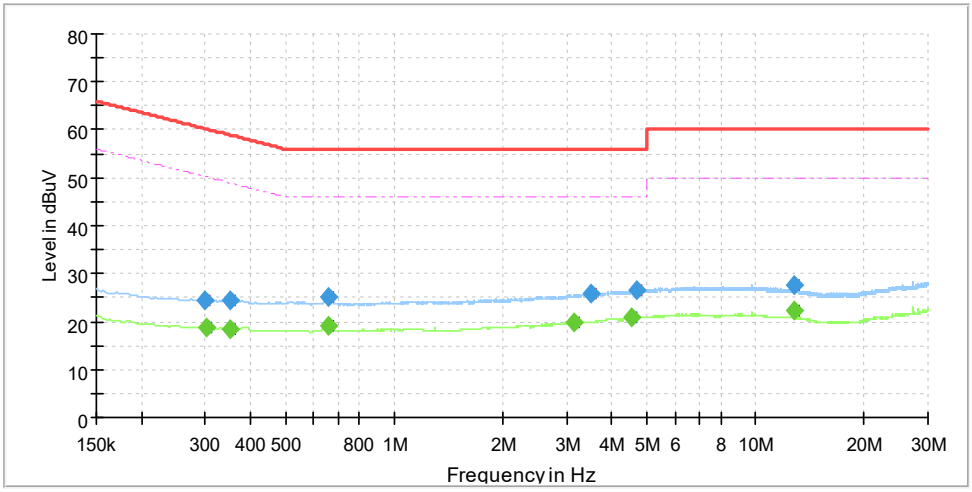
3.1.3 Test setup



3.1.4 Test Results

CONDUCTED WORST-CASE DATA:
MODEL:CT101-915M

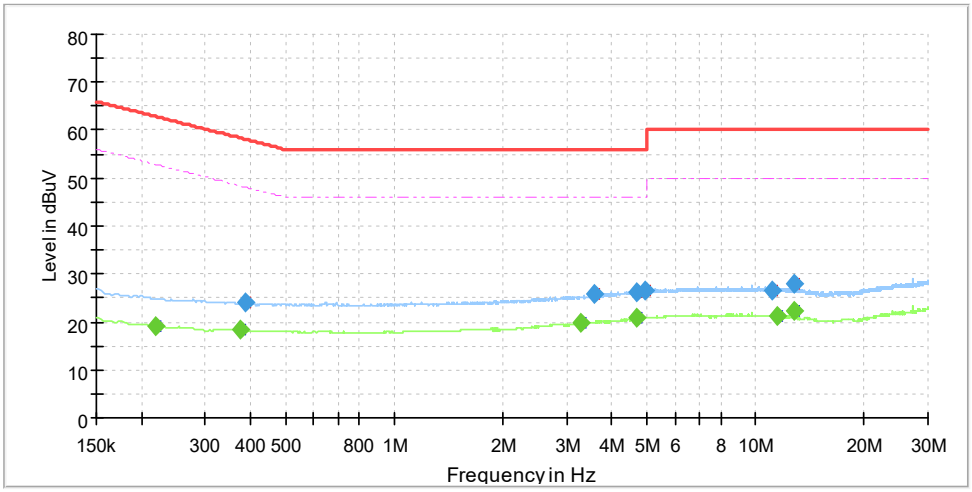
Test Mode	LORA Link	Frequency Range	150KHz ~ 30MHz
Test Voltage	AC 120V/60Hz	PHASE	Line (L)
Environmental Conditions	25.2deg. C, 55%RH	Tested By	Zhou Ye



NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)
1	0.299	24.4	---	60.3	35.9	L1	19.7
2	0.303	---	18.7	50.2	31.4	L1	19.7
3	0.350	---	18.5	49.0	30.5	L1	19.7
4	0.353	24.3	---	58.9	34.6	L1	19.7
5	0.659	---	19.0	46.0	27.0	L1	19.7
6	0.661	25.3	---	56.0	30.7	L1	19.7
7	3.158	---	20.0	46.0	26.0	L1	20.0
8	3.505	25.7	---	56.0	30.3	L1	20.0
9	4.562	---	20.9	46.0	25.1	L1	20.2
10	4.682	26.5	---	56.0	29.5	L1	20.2
11	12.800	---	22.2	50.0	27.8	L1	20.4
12	12.802	27.7	---	60.0	32.3	L1	20.4

Remark: The emission levels of other frequencies were very low against the limit.

Test Mode	LORA Link	**Frequency Range**	150KHz ~ 30MHz
Test Voltage	AC 120V/60Hz	**PHASE**	Line (N)
Environmental Conditions	25.2deg. C, 55%RH	**Tested By**	Zhou Ye

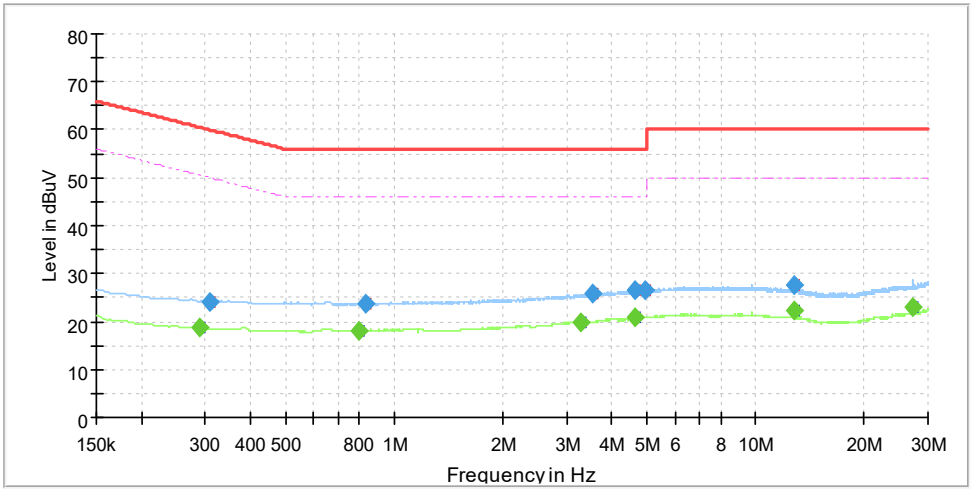


NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)
1	0.220	---	19.0	52.8	33.9	N	19.5
2	0.377	---	18.4	48.3	29.9	N	19.5
3	0.386	24.0	---	58.1	34.1	N	19.5
4	3.273	---	19.8	46.0	26.2	N	19.9
5	3.566	25.7	---	56.0	30.3	N	19.9
6	4.670	---	20.8	46.0	25.2	N	20.1
7	4.679	26.3	---	56.0	29.7	N	20.1
8	4.965	26.4	---	56.0	29.6	N	20.1
9	11.175	26.6	---	60.0	33.4	N	20.7
10	11.542	---	21.2	50.0	28.8	N	20.6
11	12.800	---	22.4	50.0	27.6	N	20.6
12	12.800	27.9	---	60.0	32.1	N	20.6

Remark: The emission levels of other frequencies were very low against the limit.

CONDUCTED WORST-CASE DATA:
MODEL:CT103-915M

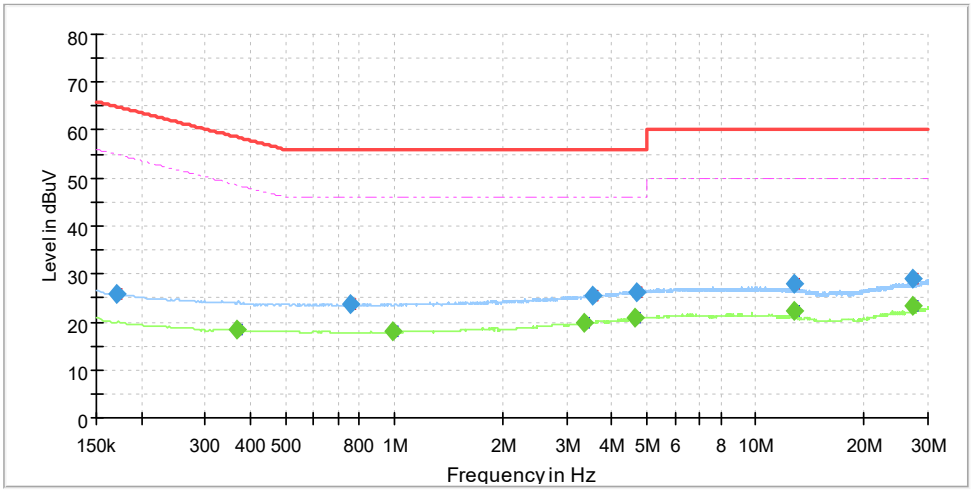
Test Mode	LORA Link	**Frequency Range**	150KHz ~ 30MHz
Test Voltage	AC 120V/60Hz	**PHASE**	Line (L)
Environmental Conditions	25.2deg. C, 55%RH	**Tested By**	Zhou Ye



NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)
1	0.290	---	18.7	50.5	31.9	L1	19.7
2	0.308	24.2	---	60.0	35.9	L1	19.6
3	0.800	---	17.9	46.0	28.1	L1	19.7
4	0.839	23.8	---	56.0	32.2	L1	19.7
5	3.282	---	20.0	46.0	26.0	L1	20.0
6	3.548	25.7	---	56.0	30.3	L1	20.0
7	4.643	---	20.9	46.0	25.1	L1	20.2
8	4.652	26.5	---	56.0	29.5	L1	20.2
9	4.943	26.6	---	56.0	29.4	L1	20.2
10	12.800	---	22.2	50.0	27.8	L1	20.4
11	12.800	27.7	---	60.0	32.3	L1	20.4
12	27.137	---	22.9	50.0	27.1	L1	20.9

Remark: The emission levels of other frequencies were very low against the limit.

Test Mode	LORA Link	**Frequency Range**	150KHz ~ 30MHz
Test Voltage	AC 120V/60Hz	**PHASE**	Line (N)
Environmental Conditions	25.2deg. C, 55%RH	**Tested By**	Zhou Ye



NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)
1	0.170	25.7	---	64.9	39.2	N	19.6
2	0.366	---	18.4	48.6	30.2	N	19.5
3	0.755	23.6	---	56.0	32.4	N	19.6
4	0.994	---	18.2	46.0	27.8	N	19.6
5	3.363	---	19.8	46.0	26.2	N	19.9
6	3.534	25.6	---	56.0	30.4	N	19.9
7	4.619	---	20.8	46.0	25.2	N	20.1
8	4.691	26.2	---	56.0	29.8	N	20.1
9	12.800	---	22.4	50.0	27.6	N	20.6
10	12.800	28.0	---	60.0	32.0	N	20.6
11	27.137	---	23.4	50.0	26.6	N	21.4
12	27.137	29.0	---	60.0	31.0	N	21.4

Remark: The emission levels of other frequencies were very low against the limit.

3.2 RADIATED EMISSIONS

3.2.1 Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). Other emissions shall be at least 20dB 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

NOTE: 1. The lower limit shall apply at the transition frequencies.
NOTE: 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
NOTE: 3. As shown in 15.35(b), for frequencies above 1000MHz, 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 20dB under any condition of modulation.

3.2.2 Measurement procedure

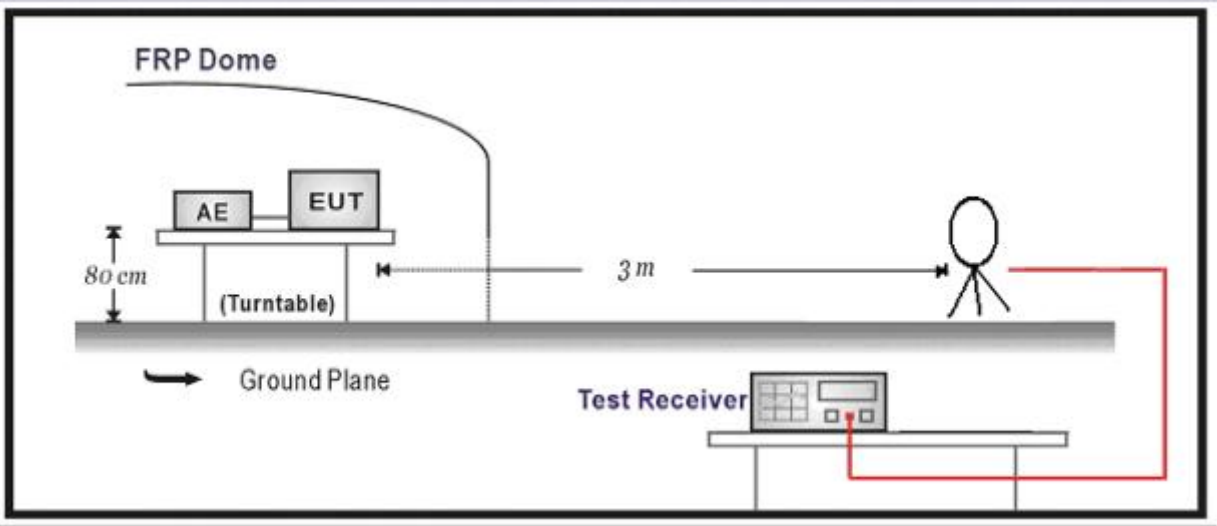
a. The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its height 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

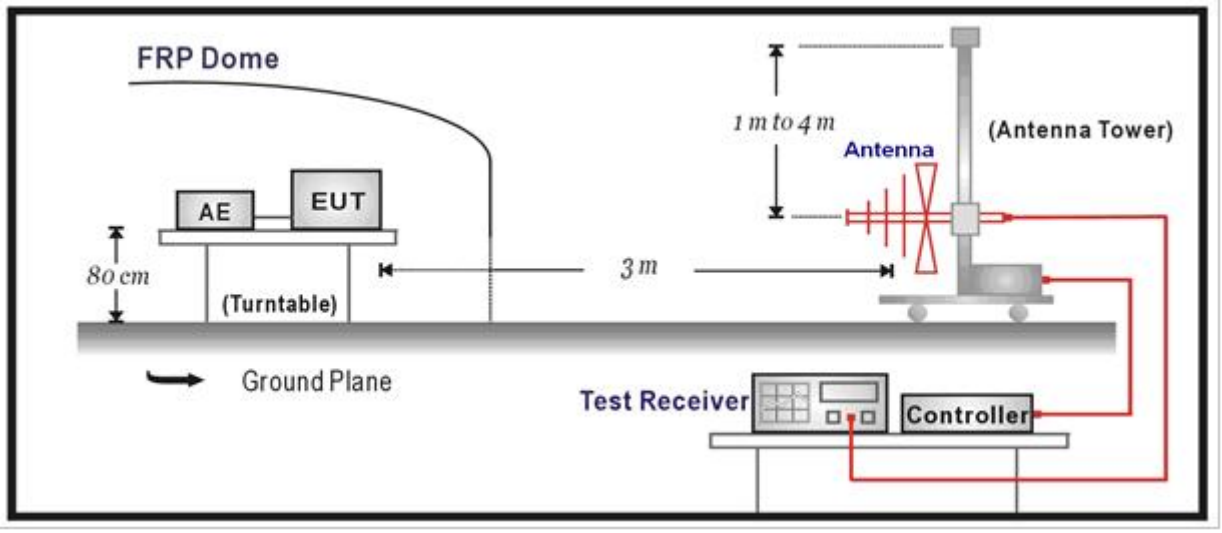
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ⩾ 1/T (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

3.2.3 Test setup

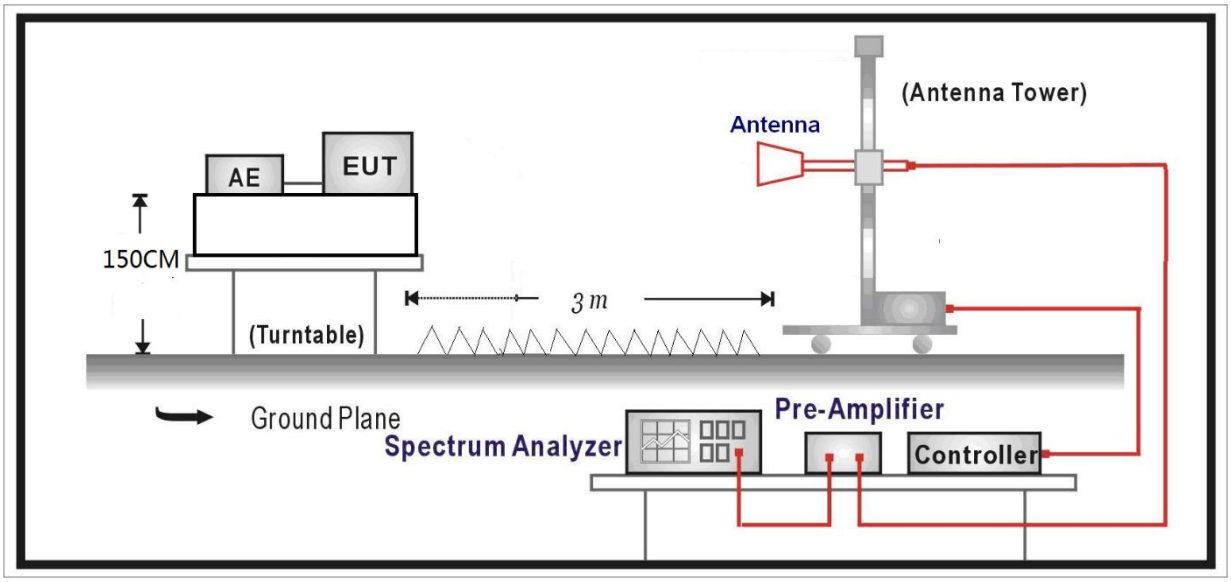
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:

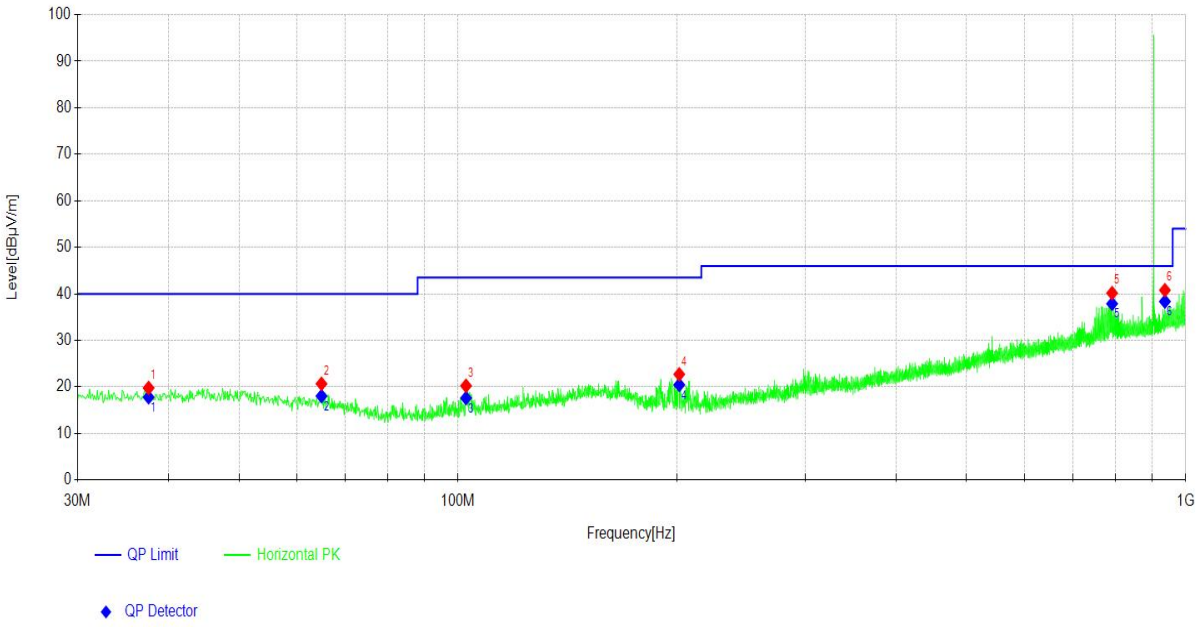


3.2.3.1 Test results

BELOW 1GHz WORST-CASE DATA:
MODEL:CT103-915M

Worst Test Mode	Lora Link	**Channel**	CH 0
Frequency Range	9KHz ~ 1GHz	**Detector Function**	Quasi-Peak (QP)

Horizontal

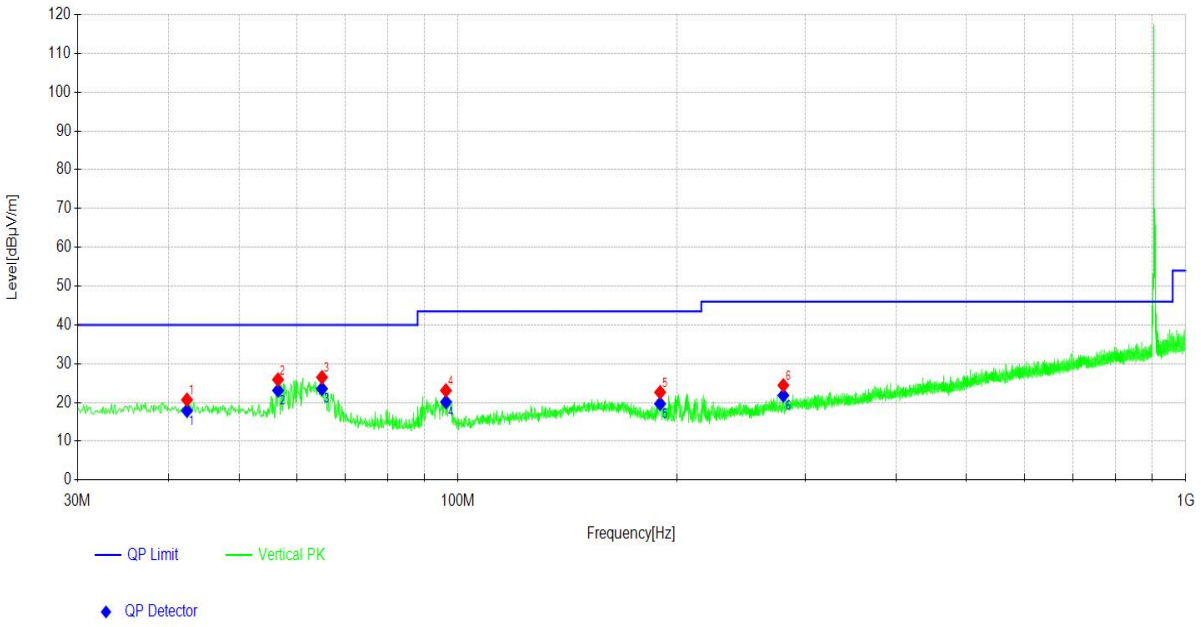


NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	37.567	-0.7	18.50	17.80	40.00	22.20	100	323
2	64.923	1.1	16.94	18.04	40.00	21.96	100	44
3	102.563	2.42	15.19	17.61	43.50	25.89	100	97
4	201.416	4.46	15.99	20.45	43.50	23.05	100	76
5	792.399	7.71	30.18	37.89	46.00	8.11	100	94
6	**936.556**	**6.5**	**31.87**	**38.37**	**46.00**	**7.63**	**100**	**94**

Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.
2. The emission levels of other frequencies were greater than 20dB margin.
3. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
4. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
5. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

Worst Test Mode	Lora Link	**Channel**	CH 0
Frequency Range	9KHz ~ 1GHz	**Detector Function**	Quasi-Peak (QP)

Vertical



NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	42.417	-0.91	18.81	17.90	40.00	22.10	100	0
2	56.581	5.06	18.04	23.10	40.00	16.90	100	192
3	65.021	6.61	16.93	23.54	40.00	16.46	100	238
4	96.258	5.33	14.79	20.12	43.50	23.38	100	76
5	189.581	3.31	16.35	19.66	43.50	23.84	100	241
6	279.994	3.8	18.02	21.82	46.00	24.18	100	58

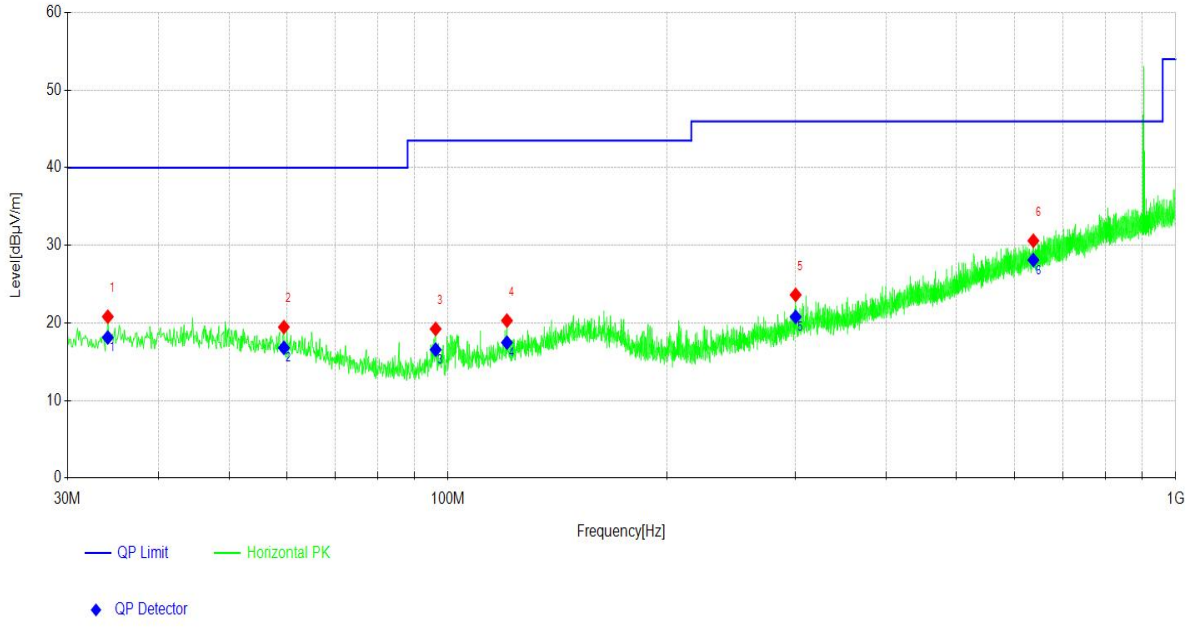
Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.
2. The emission levels of other frequencies were greater than 20dB margin.
3. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
4. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
5. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

BELOW 1GHz WORST-CASE DATA:

MODEL:CT101-915M

Worst Test Mode	Lora Link	**Channel**	CH 0
Frequency Range	9KHz ~ 1GHz	**Detector Function**	Quasi-Peak (QP)

Horizontal

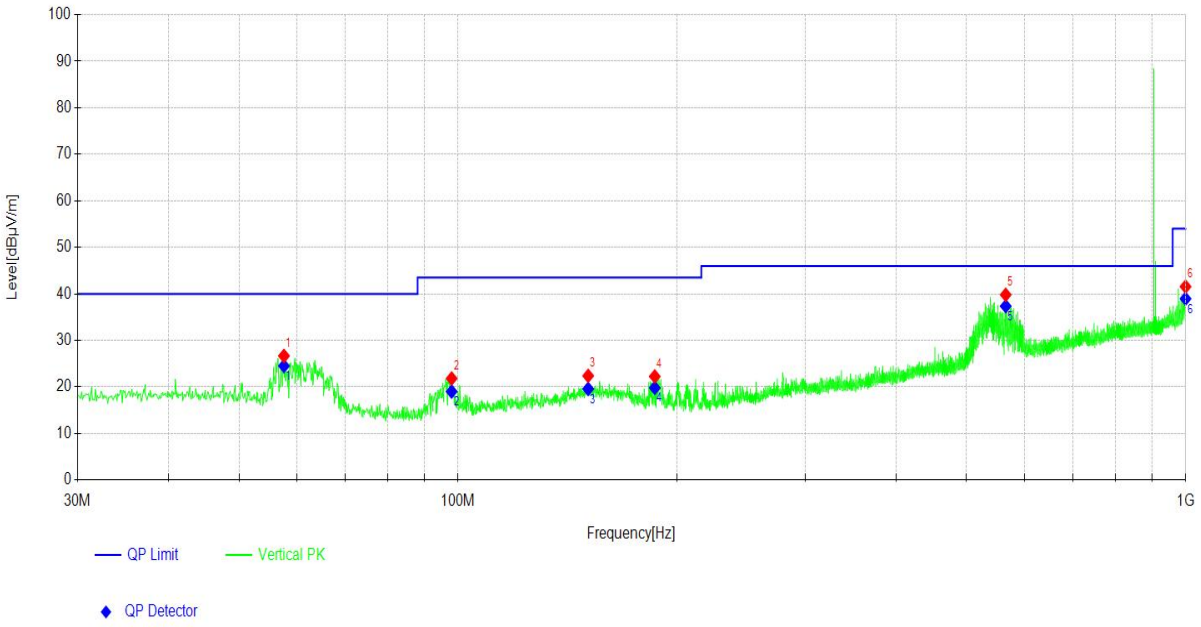


NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	34.074	-0.12	18.24	18.12	40.00	21.88	100	269
2	59.491	-0.98	17.77	16.79	40.00	23.21	100	166
3	96.161	1.76	14.79	16.55	43.50	26.95	100	205
4	120.510	0.6	16.86	17.46	43.50	26.04	100	130
5	300.463	1.38	19.40	20.78	46.00	25.22	100	71
6	637.475	0.96	27.15	28.11	46.00	17.89	100	290

Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.
2. The emission levels of other frequencies were greater than 20dB margin.
3. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
4. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
5. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

Worst Test Mode	Lora Link	**Channel**	CH 0
Frequency Range	9KHz ~ 1GHz	**Detector Function**	Quasi-Peak (QP)

Vertical



NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	57.648	6.57	17.95	24.52	40.00	15.48	100	326
2	98.004	4.15	14.87	19.02	43.50	24.48	100	160
3	150.971	0.2	19.39	19.59	43.50	23.91	100	326
4	186.380	3.28	16.54	19.82	43.50	23.68	100	326
5	565.882	11.73	25.64	37.37	46.00	8.63	100	209
6	999.709	6.51	32.45	38.96	54.00	15.04	100	92

Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.
2. The emission levels of other frequencies were greater than 20dB margin.
3. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
4. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
5. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

ABOVE 1GHz DATA

Channel	CH 0	Frequency	902.3MHz
Frequency Range	1GHz~9.3G	Detector Function	PK/AV

Horizontal

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector
1	1804.60	46.27	7.73	54.00	74.00	20.00	PK
2	1804.60	37.06	7.73	44.79	54.00	9.21	AV
3	2706.90	44.47	11.20	55.67	74.00	18.33	PK
4	2706.90	36.35	11.20	47.55	54.00	6.45	AV
5	3609.20	44.33	14.86	59.19	74.00	14.81	PK
6	3609.20	36.04	14.86	50.90	54.00	3.10	AV

Vertical

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector
1	1804.60	37.83	7.73	45.56	54.00	8.44	AV
2	1804.60	45.49	7.73	53.22	74.00	20.78	PK
3	2706.90	44.66	11.20	55.86	74.00	18.14	PK
4	2706.90	36.66	11.20	47.86	54.00	6.14	AV
5	3609.20	35.95	14.86	50.81	54.00	3.19	AV
6	3609.20	43.69	14.86	58.55	74.00	15.45	PK

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit[dBμV/m] - Level [dBμV/m]

Channel	CH 63	**Frequency**	914.9MHz
Frequency Range	1GHz~9.3G	**Detector Function**	PK/AV

Horizontal

NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector
1	1829.80	44.85	7.86	52.71	74.00	21.29	PK
2	1829.80	36.40	7.86	44.26	54.00	9.74	AV
3	2706.90	37.09	11.20	48.29	54.00	5.71	AV
4	2706.90	44.80	11.20	56.00	74.00	18.00	PK
5	3609.20	44.14	14.86	59.00	74.00	15.00	PK
6	3609.20	36.71	14.86	51.57	54.00	2.43	AV

Vertical

NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector
1	1829.80	43.93	7.86	51.79	74.00	22.21	PK
2	1829.80	36.57	7.86	44.43	54.00	9.57	AV
3	2706.90	45.11	11.20	56.31	74.00	17.69	PK
4	2706.90	36.70	11.20	47.90	54.00	6.10	AV
5	3609.20	43.69	14.86	58.55	74.00	15.45	PK
6	3609.20	36.00	14.86	50.86	54.00	3.14	AV

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

Channel	CH 127	**Frequency**	927.8MHz
Frequency Range	1GHz~9.3G	**Detector Function**	PK/AV

Horizontal

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector
1	1855.60	44.37	8.06	52.43	74.00	21.57	PK
2	1855.60	37.14	8.06	45.20	54.00	8.80	AV
3	2783.40	38.85	11.23	50.08	54.00	3.92	AV
4	2783.40	44.64	11.23	55.87	74.00	18.13	PK
5	3711.20	43.41	15.34	58.75	74.00	15.25	PK
6	3711.20	35.65	15.34	50.99	54.00	3.01	AV

Vertical

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector
1	1855.60	36.46	8.06	44.52	54.00	9.48	AV
2	1855.60	44.34	8.06	52.40	74.00	21.60	PK
3	2783.40	37.48	11.23	48.71	54.00	5.29	AV
4	2783.40	46.40	11.23	57.63	74.00	16.37	PK
5	3711.20	35.77	15.34	51.11	54.00	2.89	AV
6	3711.20	42.86	15.34	58.20	74.00	15.80	PK

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit[dBμV/m] - Level [dBμV/m]

3.3 NUMBER OF HOPPING FREQUENCY USED

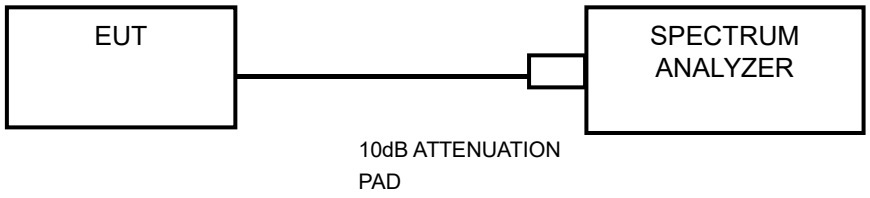
3.3.1 Limits

At least 50 channels frequencies and should be equally spaced.

3.3.2 Measurement procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. 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.
c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
d. Set the SA on View mode and then plot the result on SA screen.
e. Repeat above procedures until all frequencies measured were completed.

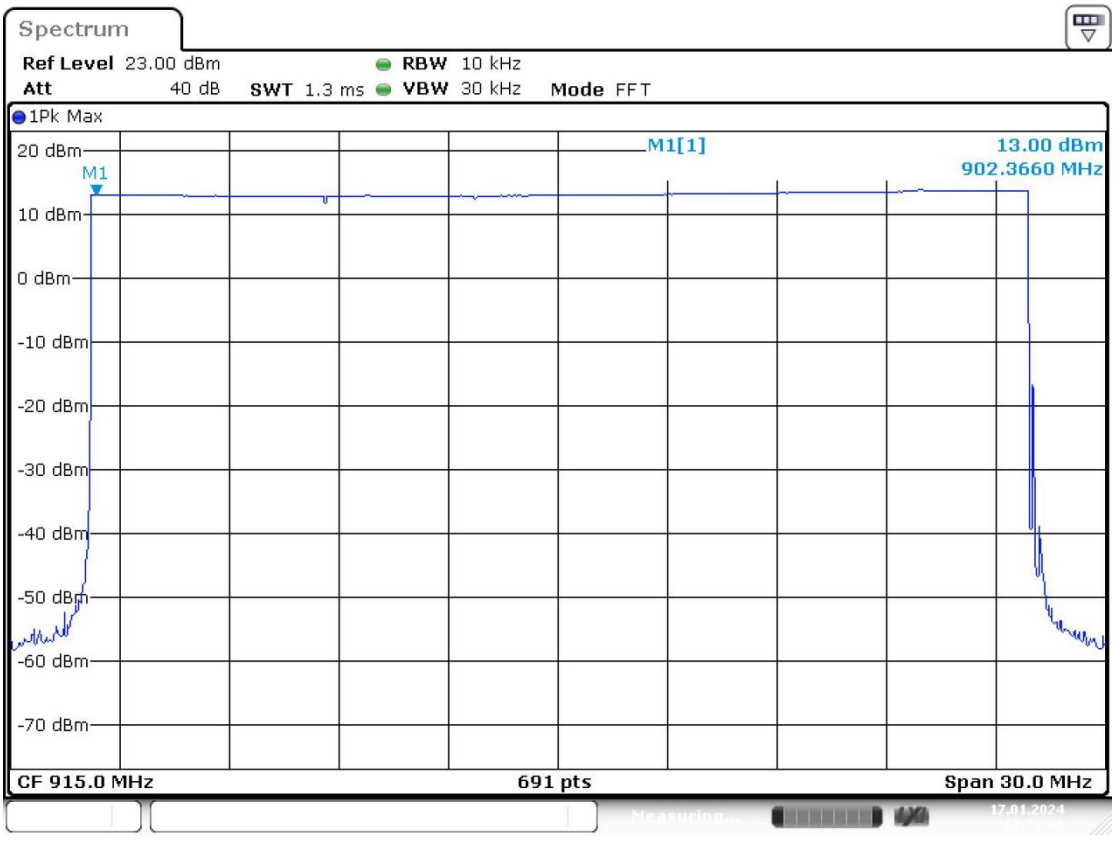
3.3.3 Test setup



3.3.4 Test result

There are 64 hopping frequencies in the hopping mode. Please refer to next two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

Mode	Channel	Result [Num]	Limit [Num]	Verdict
DR0	Hop	128	≥50	PASS



3.4 DWELL TIME ON EACH CHANNEL

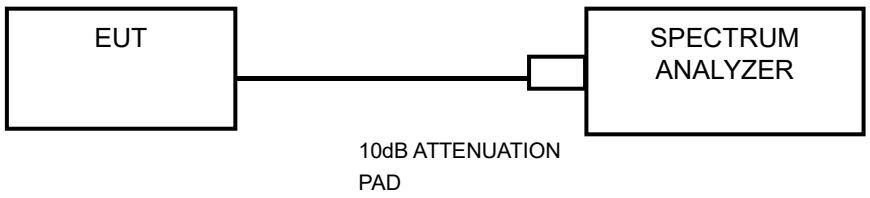
3.4.1 Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

3.4.2 Measurement procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. 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.
c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

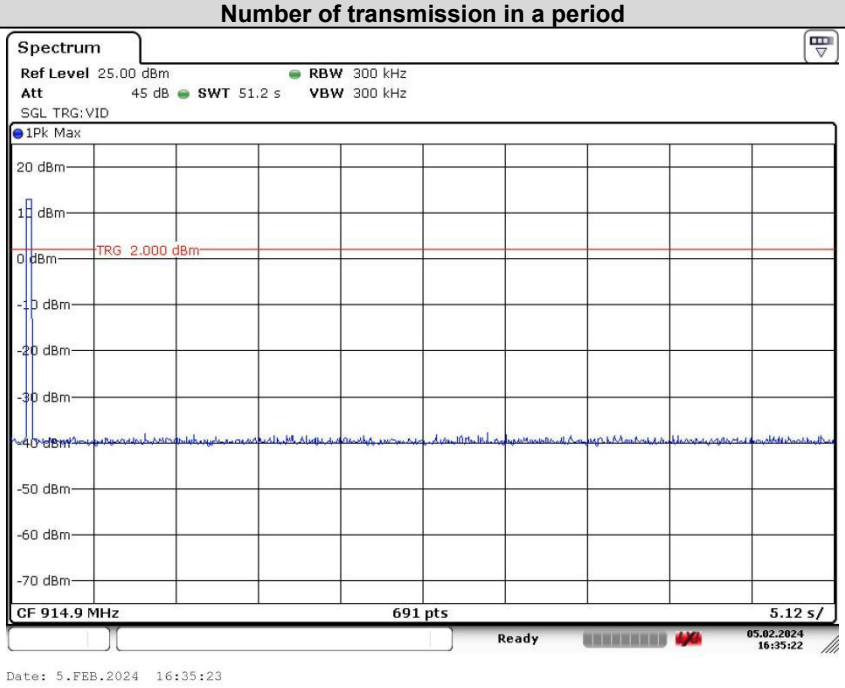
3.4.3 Test setup



3.4.4 Test result

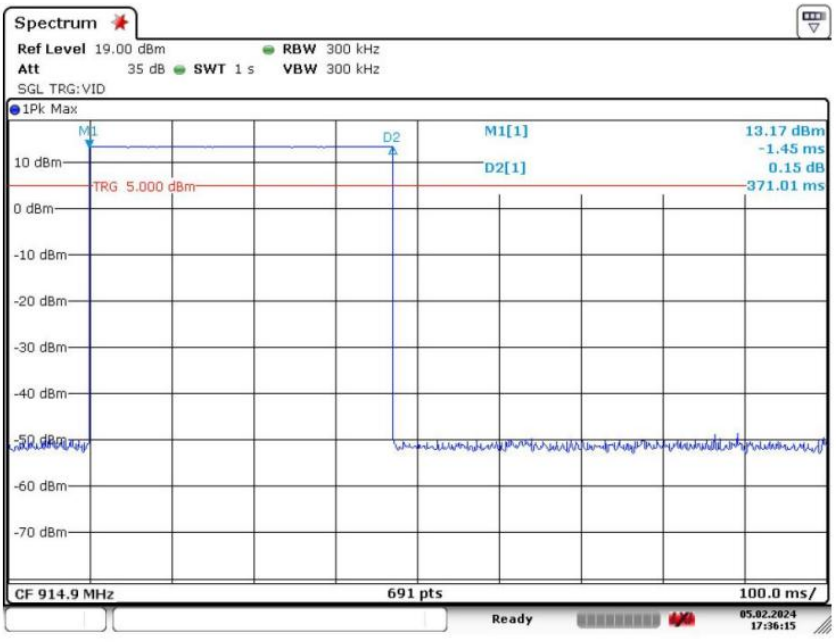
Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)	Length of transmission time (msec)	Result (msec)	Limit (msec)	Verdict
DR0	128	51.2	0.371	0.371	≤0.4	PASS

Number of transmission in a period



Date: 5.FEB.2024 16:35:23

Length of transmission time



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3.5 20dB EMISSION BANDWIDTH

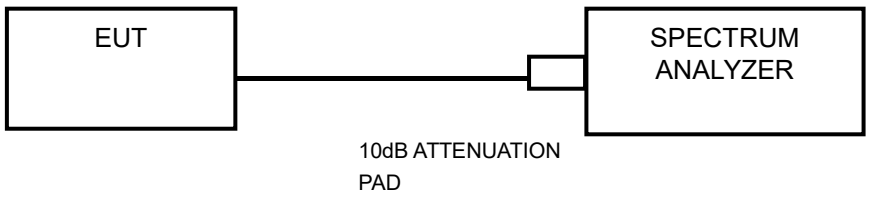
3.5.1 Limits

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

3.5.2 Measurement procedure

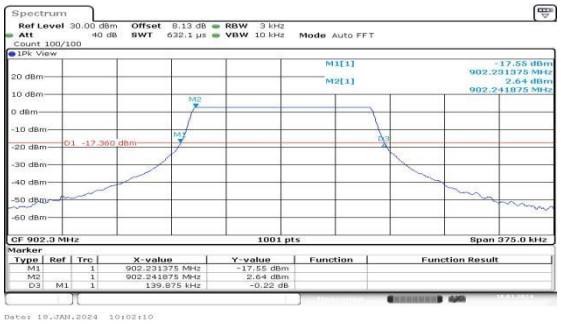
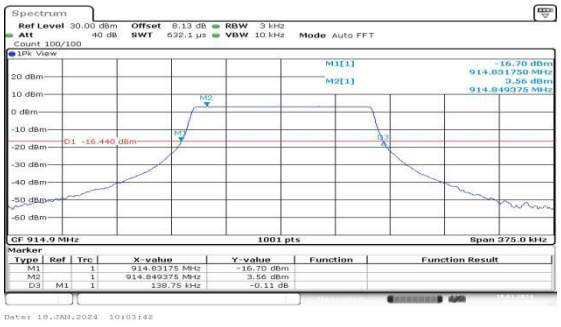
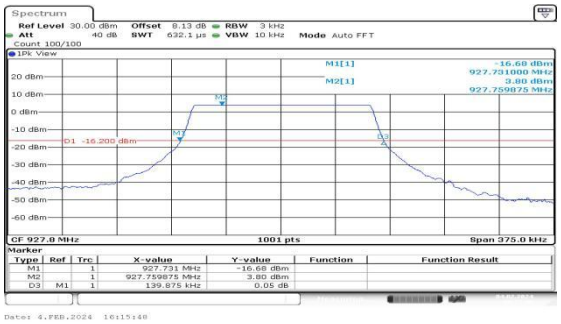
a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

3.5.3 Test setup



3.5.4 Test result

Mode	Channel	Channel Frequency (MHz)	20dB Emission Bandwidth(kHz)	Limit (kHz)
DH0	0	902.3	139.875	⩽250
	63	914.9	138.750	⩽250
	127	927.8	139.875	⩽250

CH0	CH63
	
CH127	**--**
	--

3.6 HOPPING CHANNEL SEPARATION

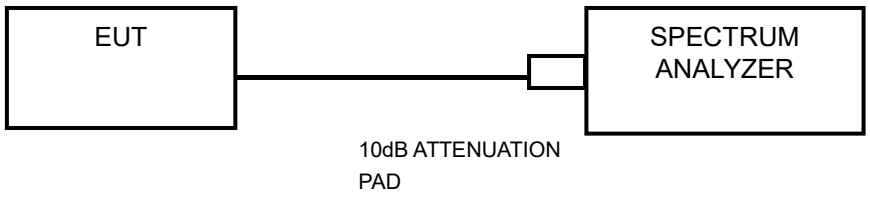
3.6.1 Limits

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

3.6.2 Measurement procedure

a. Span: Wide enough to capture the peaks of two adjacent channels.
b. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
c. Video (or average) bandwidth (VBW) ⩾ RBW.
d. Sweep: Auto.
e. Detector function: Peak.
f. Trace: Max hold.
g. Allow the trace to stabilize.

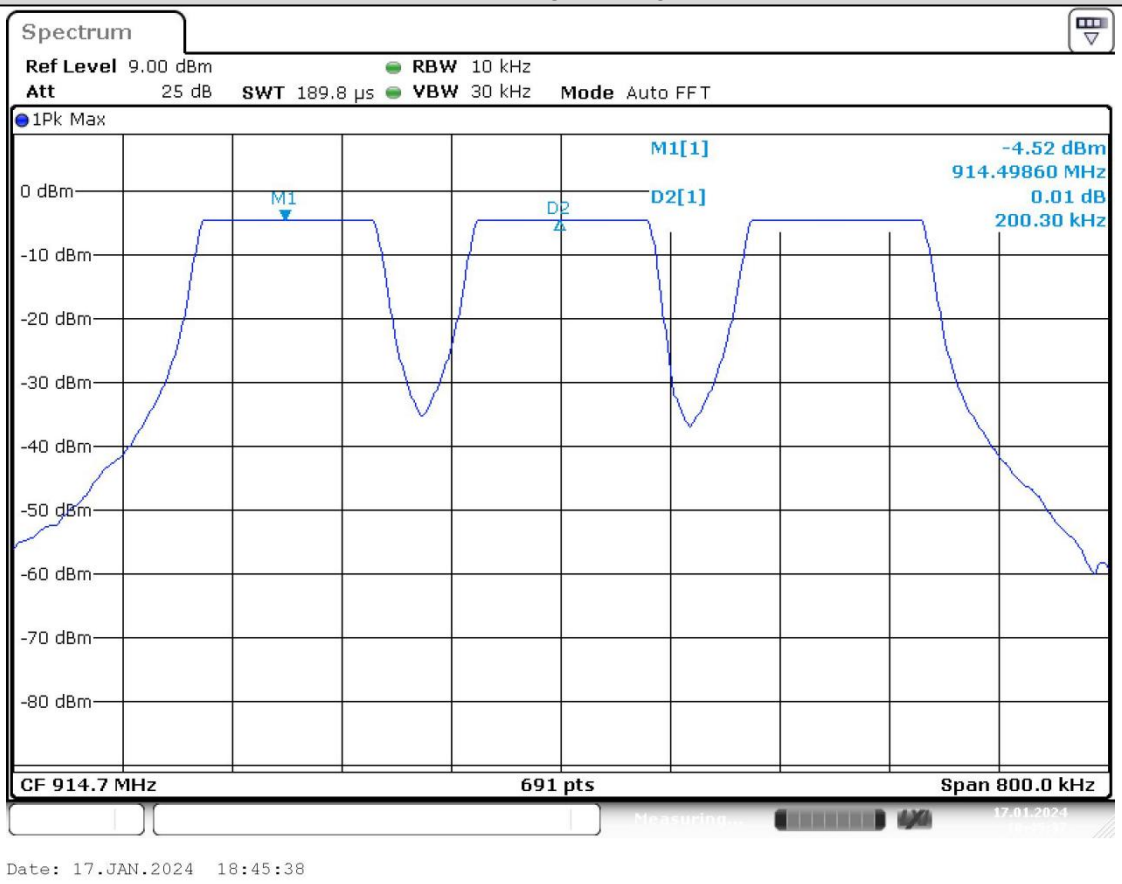
3.6.3 Test setup



3.6.4 Test result

Mode	Adjacent Channel Separation (kHz)	Minimum Limit 20dB Bandwidth (kHz)	Verdict
DR0	200.30	138.75	PASS

CHANNEL SEPARATION



3.7 CONDUCTED OUTPUT POWER

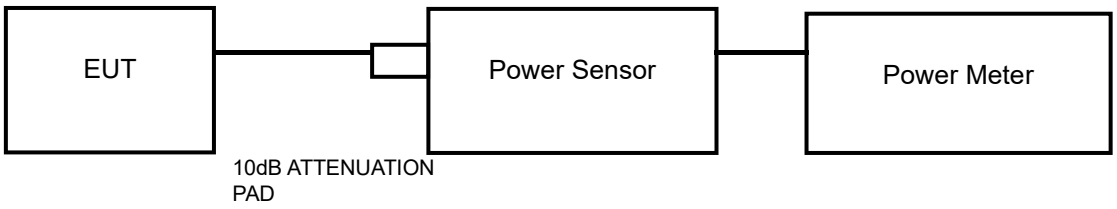
3.7.1 Limits

For 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.

3.7.2 Measurement procedure

a. 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 and set the detector to PEAK. Record the power level.
b. Anaverage power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power senso and set the detector to AVERAGE. Record the power level.

3.7.3 Test setup



3.7.4 Test result

PEAK OUTPUT POWER

GFSK

CHANNEL	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Peak Power Limit (mW)	Verdict
0	902.3	18.40	69.18	1000	PASS
63	914.9	18.69	73.96	1000	PASS
127	927.8	19.59	90.99	1000	PASS

AVERAGE OUTPUT POWER (For reference)

Mode	Channel Frequency (MHz)	Average Power (dBm)	Average Power (mW)	Average Power Limit (mW)	Verdict
0	902.3	2.70	1.86	1000	PASS
63	914.9	3.02	2.00	1000	PASS
127	927.8	3.96	2.49	1000	PASS

3.8 POWER SPECTRAL DENSITY MEASUREMENT

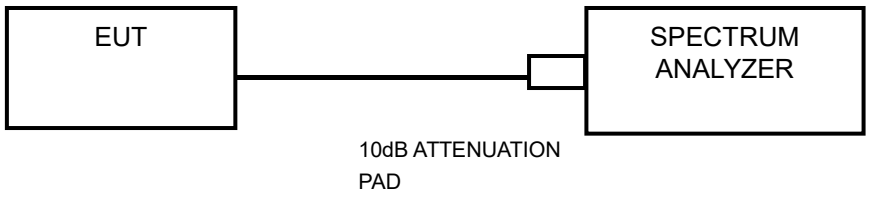
3.8.1 Limits

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

3.8.2 Measurement procedure

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set RBW to: 3KHz
4. Set VBW ≥3 x RBW.
5. Detector = peak
6. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
7. Sweep time = auto couple.
8 .Use the peak marker function to determine the maximum amplitude level.

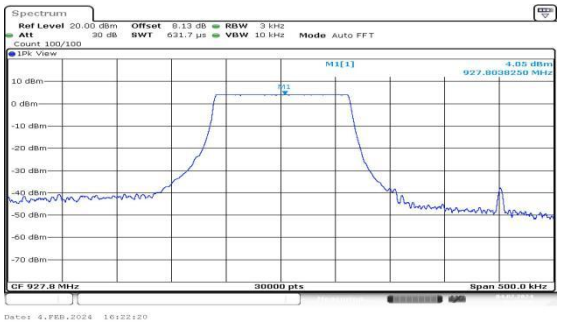
3.8.3 Test setup



3.8.4 Test result

CHANNEL	CHANNEL FREQUENCY (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS / FAIL
0	902.3	2.84	8	PASS
63	914.9	3.18	8	PASS
127	927.8	4.05	8	PASS

Test Plot:

CH0	CH63
	
CH127	**--**
	--

3.9 OUT OF BAND EMISSION MEASUREMENT

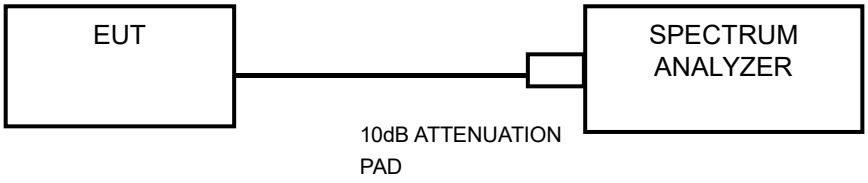
3.9.1 Limits

Below –20dB of the highest emission level of operating band (in 100KHz RBW).

3.9.2 Measurement procedure

The transmitter output was connected to the spectrum analyzer via a low loss cable. of Spectrum Analyzer was set RBW to 100 kHz and VBW to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

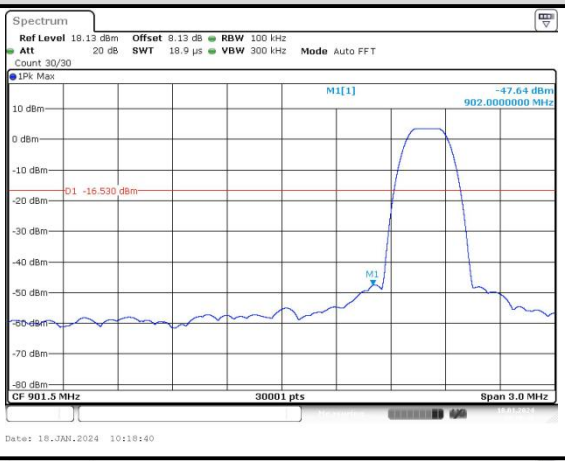
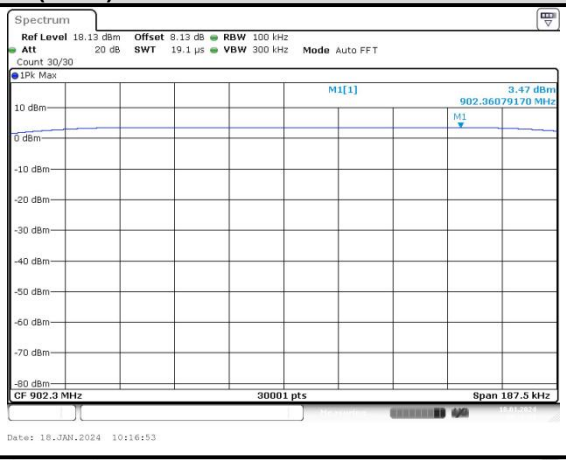
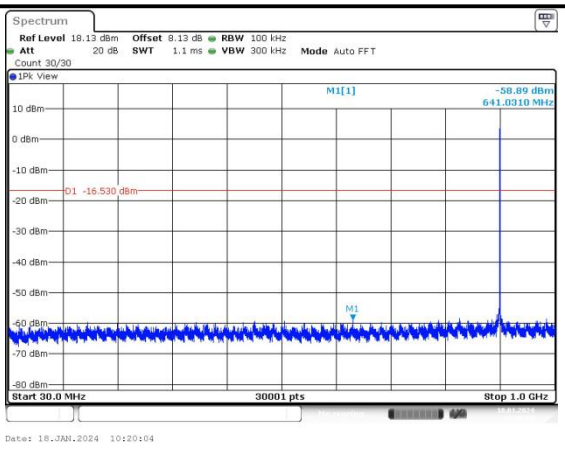
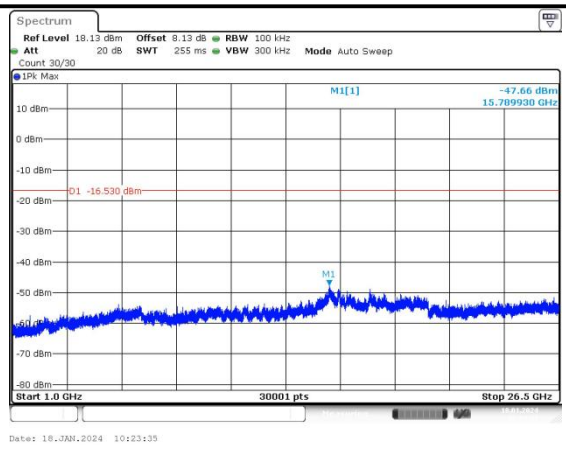
3.9.3 Test setup



3.9.4 Test result

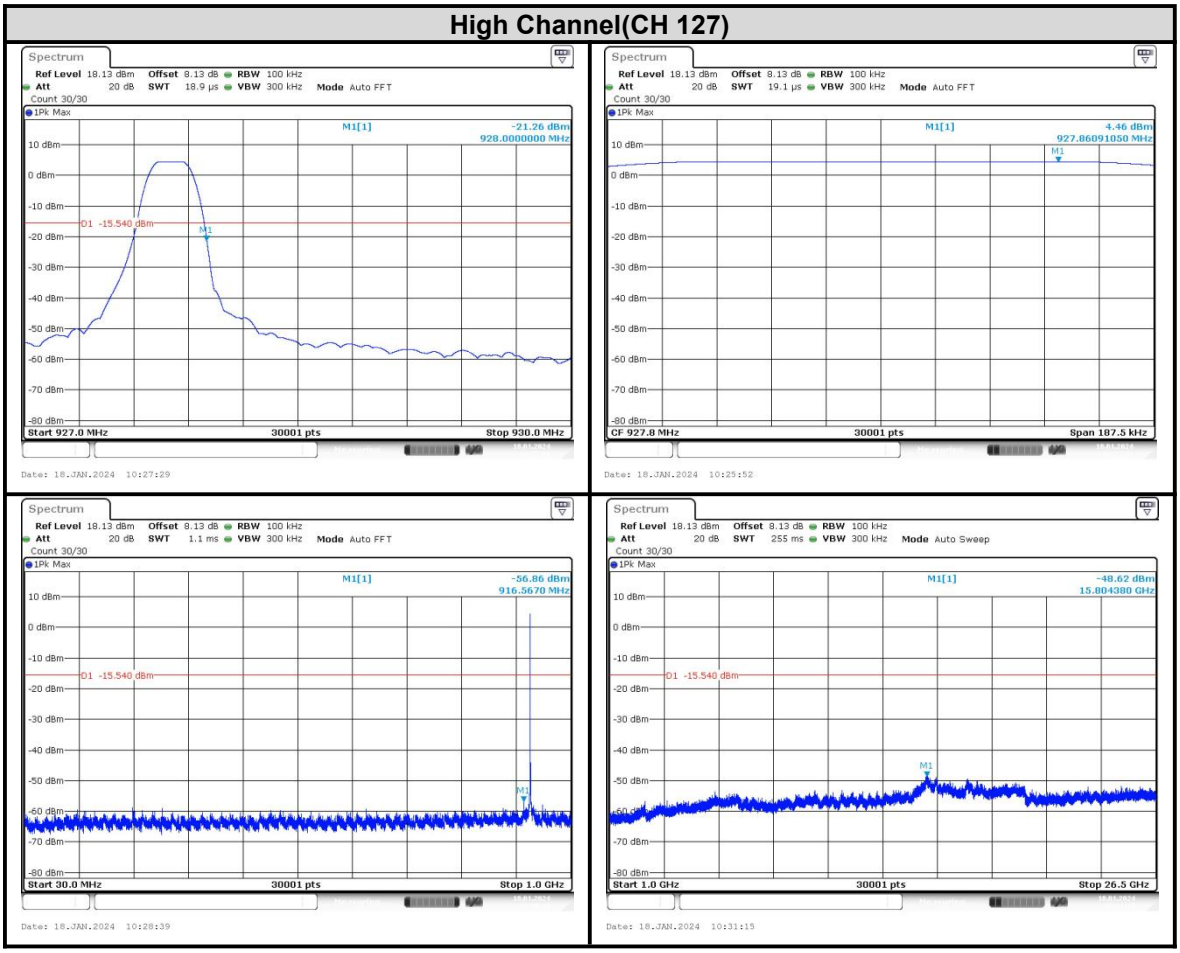
The spectrum plots are attached on the following images.

DR0

Low Channel(CH 0)	
	
	

DR0

High Channel(CH 127)



DR0-HOPPING

Hopping

3.10 ANTENNA REQUIREMENT

3.10.1 LIMITS OFFREQUENCY STABILITY

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b) , if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.10.2 ANTENNA ANTI-REPLACEMENT CONSTRUCTION

The antenna used for this product is External antenna and that no antenna other than that furnished by the responsible party shall be used with the device

3.10.3 ANTENNA GAIN

The maximum peak gain of the transmit antenna is 3.73 dBi.

4 PHOTOGRAPHS OF TEST SETUP

Please refer to the attached file (Test Photos).

5 PHOTOGRAPHS OF THE EUT

Please refer to the attached file (External Photos and Internal Photos report).

------ End of the Report ------

Important

(1) The test report is invalid without the official stamp of CVC;

(2) Any part photocopies of the test report are forbidden without the written permission from CVC;

(3) The test report is invalid without the signatures of Approval and Reviewer;

(4) The test report is invalid if altered;

(5) Objections to the test report must be submitted to CVC within 15 days.

(6) Generally, commission test is responsible for the tested samples only.

(7) As for the test result “-” or “N” means “not applicable”, “/” means “not test”, “P” means “pass” and “F” means “fail”

The test data and test results given in this test report should only be used for purposes of scientific research, teaching and internal quality control when the CMA symbol is not presented.

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