

TEST REPORT

Applicant	ZHUHAI MITALY INNOVATIONS TECHNOLOGY CO., LTD
Address	FLOOR 5, BLOCK 2, NO.321 PINGBEI 1ST ROAD, NANPING TECHNOLOGY PARK, XIANGZHOU DISTRICT, ZHUHAI, GUANGDONG, CHINA

Manufacturer or Supplier	ZHUHAI MITALY INNOVATIONS TECHNOLOGY CO., LTD
Address	FLOOR 5, BLOCK 2, NO.321 PINGBEI 1ST ROAD, NANPING TECHNOLOGY PARK, XIANGZHOU DISTRICT, ZHUHAI, GUANGDONG, CHINA
Product	Lora Gateway
Brand Name	KEYPLUS
Model	Lora Gateway
Additional Model & Model Difference	N/A
Date of tests	Feb. 18, 2025 ~ Feb. 20, 2025

the tests have been carried out according to the requirements of the following standards:

☒ **FCC Part 15, Subpart C, Section 15.231**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Andrew Sha Project Engineer / EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	
	Date: Mar. 06, 2025

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF2412WDG0139	Original release	Mar. 06, 2025

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.231)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
§15.203	Antenna Requirement	PASS	SMA type connector
§15.207 (a)	AC Power Conducted Emission	PASS	Compliant
§15.209 §15.231(b)	Radiated Emission	PASS	Compliant
§15.231 (a)	Deactivation time measurement	PASS	Compliant
§15.231(c)	Emission Bandwidth Measurement	PASS	Compliant

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:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	9KHz ~ 30MHz	2.48dB
	30MHz ~ 1GHz	4.32dB
	1GHz ~ 18GHz	4.76dB
	18GHz ~ 40GHz	4.50dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Lora Gateway
MODEL NO.	Lora Gateway
ADDITIONAL MODELS	N/A
FCC ID	2AYPQKL
NOMINAL VOLTAGE	DC 12V from adapter input AC 100-240V
MODULATION TYPE	GFSK
OPERATING FREQUENCY	433.175MHz ~ 434.575MHz
NUMBER OF CHANNEL	8
ANTENNA TYPE	Dipole Antenna, with 3.0dBi Gain
I/O PORTS	Refer to the user's manual

NOTES:

1. For a 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 EUT photo document (Reference No.: 2412WDG0139) for detailed product photo.
4. EUT was powered by the following adapter:

ADAPTER	
Brand:	Foshan Shangwei Electronics
Model:	FSW-120200
Input:	AC 100-240V~50/60hz, 0.8A
Output:	DC 12V 2A

3.2 DESCRIPTION OF TEST MODES

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 X plane for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

TEST CHANNEL	TEST FREQUENCY	TEST MODES
Low	433.175MHz	Transmitting
Middle	433.775MHz	Transmitting
High	434.575MHz	Transmitting

Channel List

Channel	Freq. (MHz)
1	433.175
2	433.375
3	433.575
4	433.775
5	433.975
6	434.175
7	434.375
8	434.575

3.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	RE ≥ 1G	RE < 1G	PLC	EB	DT	
-	√	√	√	√	√	DC 12V power by adapter

Where **RE ≥ 1G**: Radiated Emission above 1GHz
PLC: Power Line Conducted Emission
DT: Deactivation Time measurement
RE < 1G: Radiated Emission below 1GHz
EB: 20dB Bandwidth measurement

POWER LINE CONDUCTED EMISSION TEST:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 8	1	GFSK

RADIATED EMISSION TEST (ABOVE 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 8	1	GFSK
1 to 8	4	GFSK
1 to 8	8	GFSK

RADIATED EMISSION TEST (BELOW 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 8	1	GFSK
1 to 8	4	GFSK
1 to 8	8	GFSK

EMISSION BANDWIDTH MEASUREMENT:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 8	1	GFSK
1 to 8	4	GFSK
1 to 8	8	GFSK

DEACTIVATION TIME MEASUREMENT:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 8	1	GFSK

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
PLC	25deg. C, 55%RH	DC 12V from adapter	Summer
RE $\geq$ 1G	23deg. C, 54%RH	DC 12V from adapter	Ludius
RE<1G	24deg. C, 56%RH	DC 12V from adapter	Ludius
EB	25deg. C, 60%RH	DC 12V from adapter	Vincent
DT	25deg. C, 60%RH	DC 12V from adapter	Vincent

3.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

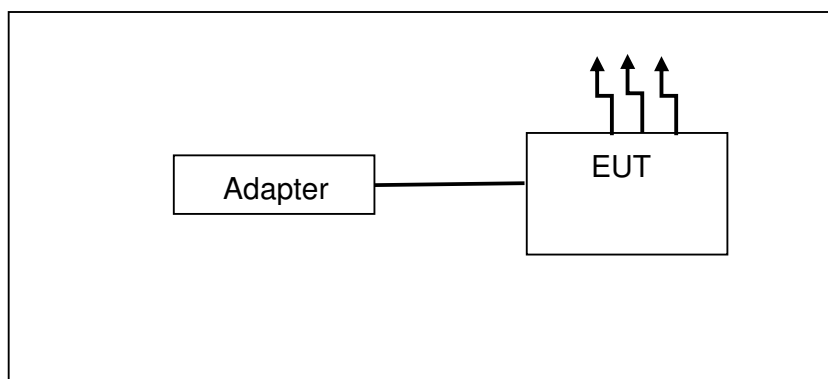
The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C Section 15.231

ANSI C63.10-2013

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

3.5 CONFIGURATION OF SYSTEM UNDER TEST



3.6 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together without other necessary accessories or support units.

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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

According to §15.231(b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	¹ 1,250 to 3,750	¹ 125 to 375
174–260	3,750	375
260–470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

NOTE:

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

4.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU40	100449	Oct. 10, 25
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	Apr. 07, 25
Active Loop Antenna (9KHz -30MHz)	SCHWARZBECK	FMZB 1519B	1519B-045	Apr. 13, 25
Amplifier (9KHz -1GHz)	Burgeon	BPA-530	100210	Feb. 21, 25
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-554	Dec. 25, 25
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	Oct. 19, 25
Horn Antenna (18GHz -40GHz)	SCHWARZBECK	BBHA 9170	BBHA9170147	Apr. 12, 25
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	May. 20, 25
Test Software	ADT	ADT_Radiated_V7.6.1 5.9.2	N/A	N/A
Broadband Preamplifier (1GHz~18GHz)	SCHWARZBECK	BBV9718	305	Apr. 24, 25
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Jan. 01, 26
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	N/A

NOTES:

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to CEPREI/CHINA, GREGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 749762.

4.1.3 TEST PROCEDURES

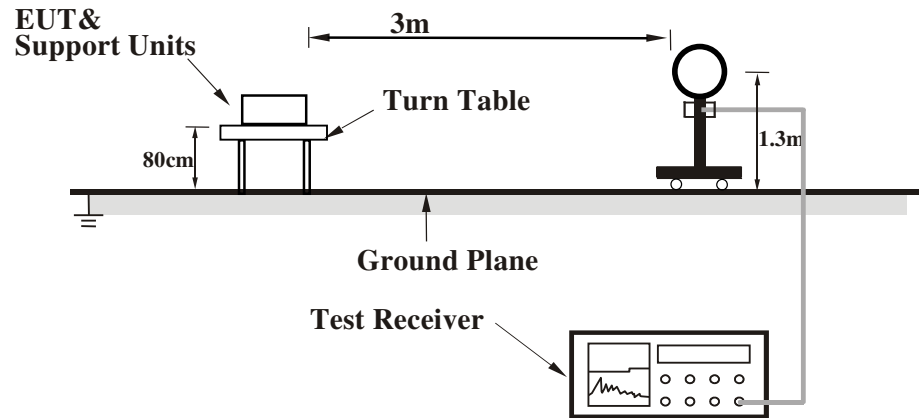
- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband 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. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- 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 Y, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using new battery. The turntable was rotated to maximize the emission level.
- h. 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 1.3m above the ground.

NOTE:

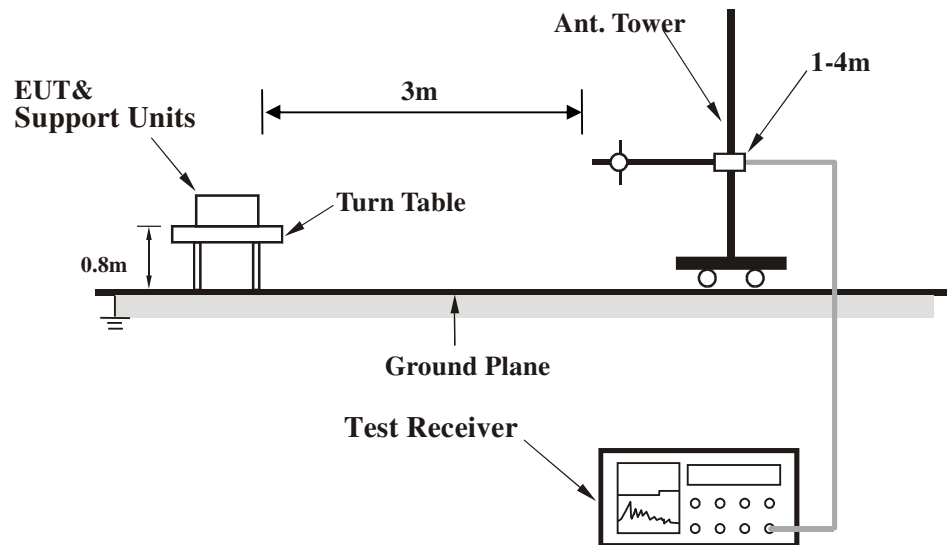
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
4. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$
5. $\text{Margin value} = \text{Emission level} - \text{Limit value.}$
6. $\text{Fundamental AV value} = \text{PK Emission} + \text{AV Factor.}$

4.1.4 TEST SETUP

Below 30MHz test setup

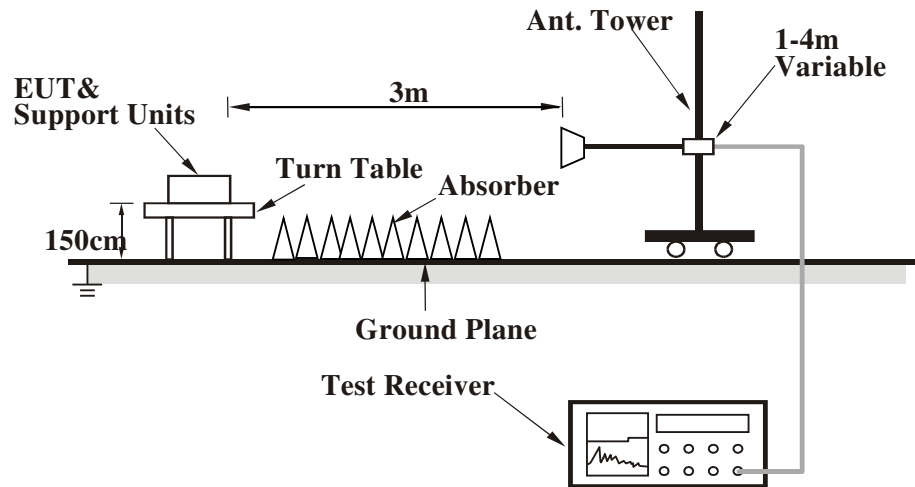


Below 1GHz test setup



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

Above 1GHz test setup



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

4.1.5 DEVIATION FROM TEST STANDARD

No deviation.

4.1.6 EUT OPERATING CONDITIONS

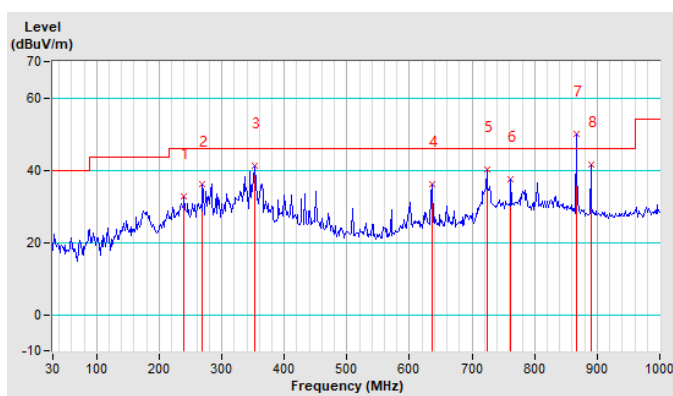
- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.

4.1.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

LOW CHANNEL:

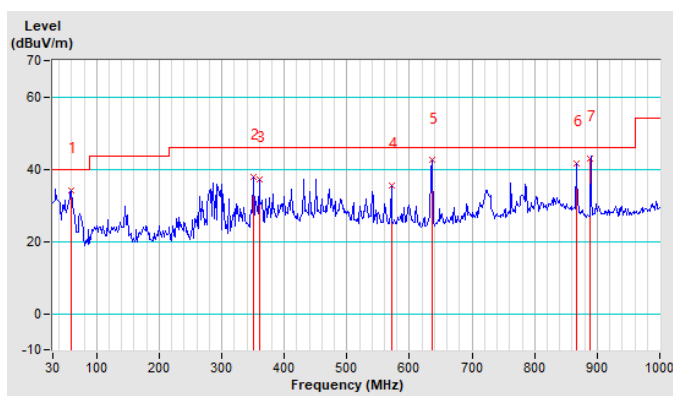
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	239.86 QP	-17.81	50.55	32.74	46.00	-13.23	166 H	225
2	269.39 QP	-16.56	52.63	36.07	46.00	-9.93	163 H	131
3	351.78 QP	-14.16	55.30	41.14	46.00	-4.86	186 H	126
4	636.25 QP	-7.32	43.39	36.07	46.00	-9.93	152 H	282
5	723.30 QP	-5.64	45.86	40.22	46.00	-5.78	136 H	183
6	762.16 QP	-4.83	42.36	37.53	46.00	-8.47	128 H	325
7	#866.35 PK	-3.62	53.66	50.04	80.80	-30.76	241 H	122
7	#866.35 AV	-	-	24.14	60.80	-36.66	241 H	152
8	889.63 QP	-2.99	44.59	41.60	46.00	-4.40	223 H	126



NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. "#": Harmonic frequency.
6. Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 29 for plotted duty.

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	59.54 QP	-17.86	51.98	34.12	40.00	-5.88	215 H	151
2	350.22 QP	-14.20	51.93	37.73	46.00	-8.27	341 H	163
3	359.55 QP	-13.95	51.13	37.18	46.00	-8.82	156 H	148
4	570.96 QP	-8.79	44.35	35.56	46.00	-10.44	116 H	118
5	636.25 QP	-7.32	49.72	42.40	46.00	-3.60	125 H	182
6	#866.35 PK	-3.62	45.08	41.46	80.80	-39.34	203 H	106
6	#866.35 AV	-	-	15.56	60.80	-45.24	203 H	106
7	889.41 QP	-3.00	45.90	42.90	46.00	-3.10	262 H	116

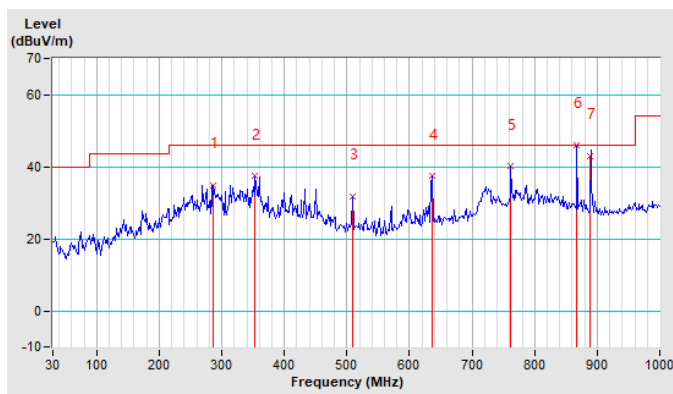


NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. " # ": Harmonic frequency.
6. Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 29 for plotted duty.

MIDDLE CHANNEL:

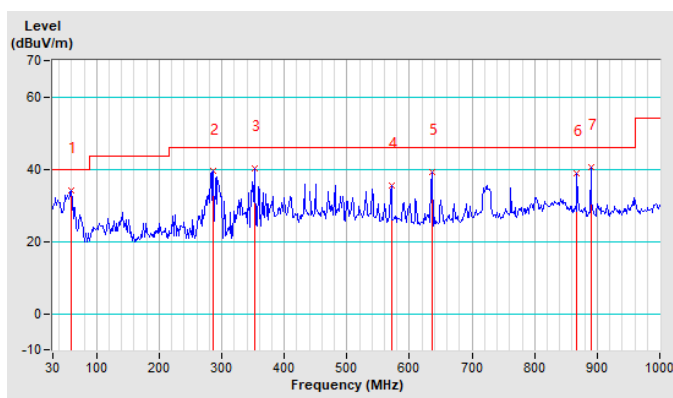
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	286.49 QP	-15.91	50.60	34.69	46.00	-11.31	253 H	176
2	353.33 QP	-14.12	51.47	37.35	46.00	-8.65	256 H	170
3	508.78 QP	-9.98	41.60	31.62	46.00	-14.38	240 H	155
4	636.25 QP	-7.32	44.65	37.33	46.00	-8.67	136 H	169
5	762.16 QP	-4.83	44.88	40.05	46.00	-5.95	153 H	136
6	#867.55 PK	-3.85	49.54	45.96	80.82	-34.86	166 H	152
6	#867.55 AV	-	-	20.06	60.82	-40.76	166 H	152
7	889.44 QP	-3.00	45.80	42.80	46.00	-3.20	325 H	121



NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. " # ": Harmonic frequency.
6. Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 29 for plotted duty.

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	59.54 QP	-17.86	51.96	34.10	40.00	-5.90	212 V	248
2	283.49 QP	-15.91	55.30	39.39	46.00	-6.61	116 V	343
3	351.78 QP	-14.16	54.44	40.28	46.00	-5.72	131 V	328
4	570.96 QP	-8.79	44.29	35.50	46.00	-10.50	230 V	230
5	636.25 QP	-7.32	46.42	39.10	46.00	-6.90	150 V	309
6	#867.55 PK	-3.58	42.35	38.77	80.82	-42.05	106 V	116
6	#867.55 AV	-	-	12.87	60.82	-47.95	106 V	116
7	889.63 QP	-2.99	43.54	40.55	46.00	-5.45	174 V	286

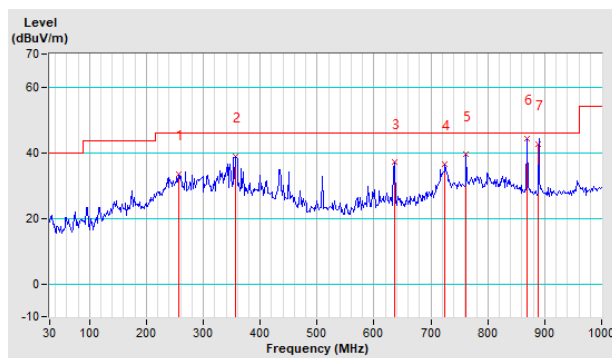


NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. "#": Harmonic frequency.
6. Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 29 for plotted duty.

HIGH CHANNEL:

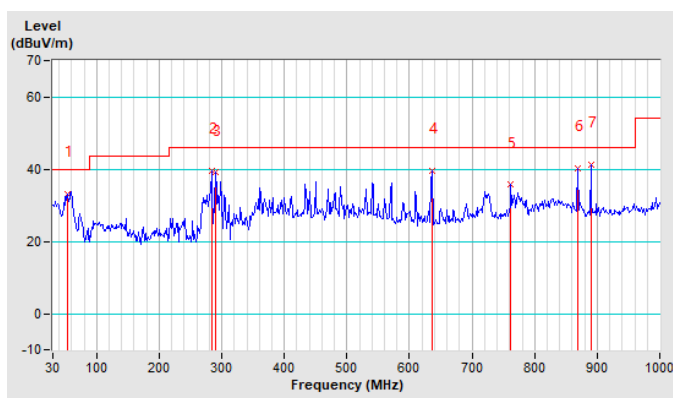
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	256.96 QP	-17.05	50.59	33.54	46.00	-12.46	251 H	221
2	356.44 QP	-14.03	52.98	38.95	46.00	-7.05	140 H	160
3	636.25 QP	-7.32	44.32	37.00	46.00	-9.00	156 H	153
4	724.86 QP	-5.59	41.97	36.38	46.00	-9.62	211 H	293
5	762.16 QP	-4.83	44.19	39.36	46.00	-6.64	195 H	205
6	869.15 PK	-3.53	47.81	44.28	80.85	-36.57	109 H	114
6	869.15 AV	-	-	18.38	60.85	-42.47	109 H	263
7	889.44 QP	-3.00	45.60	42.60	46.00	-3.40	259 H	251



NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. " # ": Harmonic frequency.
6. Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 29 for plotted duty.

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	53.32 QP	-17.61	50.77	33.16	40.00	-6.84	231	216
2	283.38 QP	-16.02	55.53	39.51	46.00	-6.49	116	330
3	289.60 QP	-15.78	54.78	39.00	46.00	-7.00	131	314
4	636.25 QP	-7.32	46.76	39.44	46.00	-6.56	150	296
5	762.16 QP	-4.83	40.47	35.64	46.00	-10.36	203	243
6	869.15 PK	-3.53	43.86	40.33	80.85	-40.52	116	256
6	869.15 AV	-	-	14.43	60.85	-46.42	116	225
7	889.63 QP	-2.99	44.10	41.11	46.00	-4.89	168	125



NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. " # ": Harmonic frequency.
6. Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 29 for plotted duty.

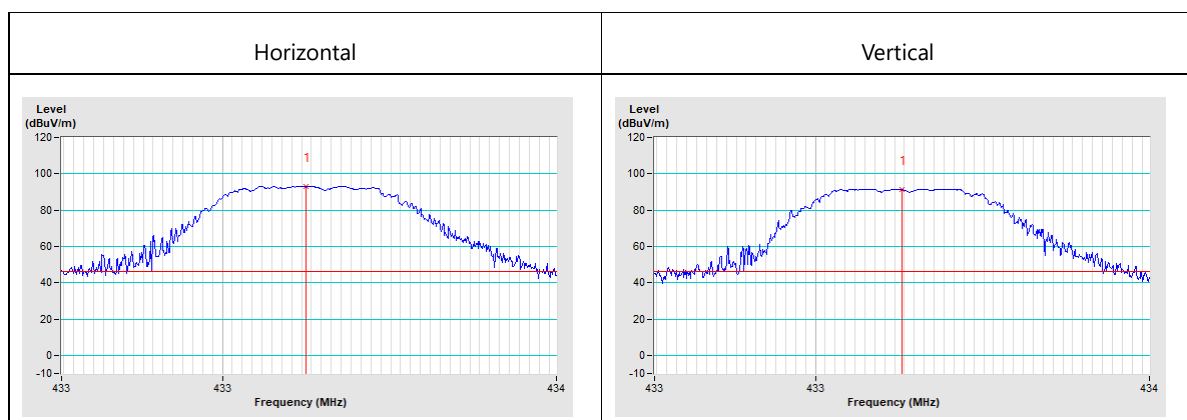
Test plots of Field Strength of Fundamental Emissions :

LOW CHANNEL:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	*433.175 PK	-11.63	104.42	92.79	100.80	-8.01	1.00 H	85
1	*433.175 AV	-	-	66.89	80.80	-13.91	1.00 H	85
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	*433.175 PK	-11.63	102.88	91.25	100.80	-9.55	1.00 V	123
1	*433.175 AV	-	-	65.35	80.80	-15.45	1.00 V	123

NOTE:

1. " * ": Fundamental frequency.
2. Fundamental AV value = PK Emission + 20*log(duty cycle) Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (5.07\%) = -25.90 \text{ dB}$, Please see page 29 for plotted duty.

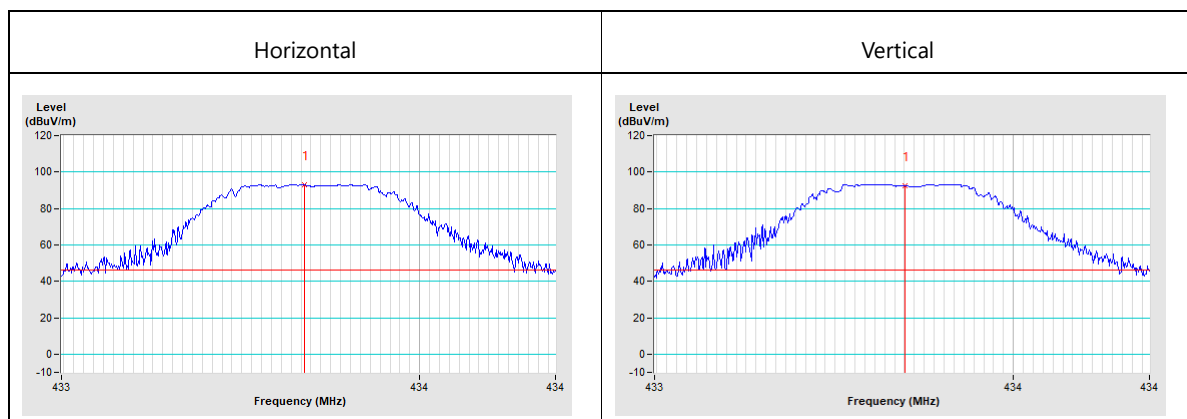


MIDDLE CHANNEL:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	*433.775 PK	-11.61	104.39	92.78	100.82	-8.04	1.00 H	121
1	*433.775 AV	-	-	66.88	80.82	-13.94	1.00 H	121
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	*433.775 PK	-11.61	104.09	92.48	100.80	-8.32	1.00 V	166
1	*433.775 AV	-	-	66.58	80.80	-14.22	1.00 V	166

NOTE:

- " * ": Fundamental frequency.
- Fundamental AV value = PK Emission + 20*log(duty cycle) Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (5.07\%) = -25.90 \text{ dB}$, Please see page 29 for plotted duty.

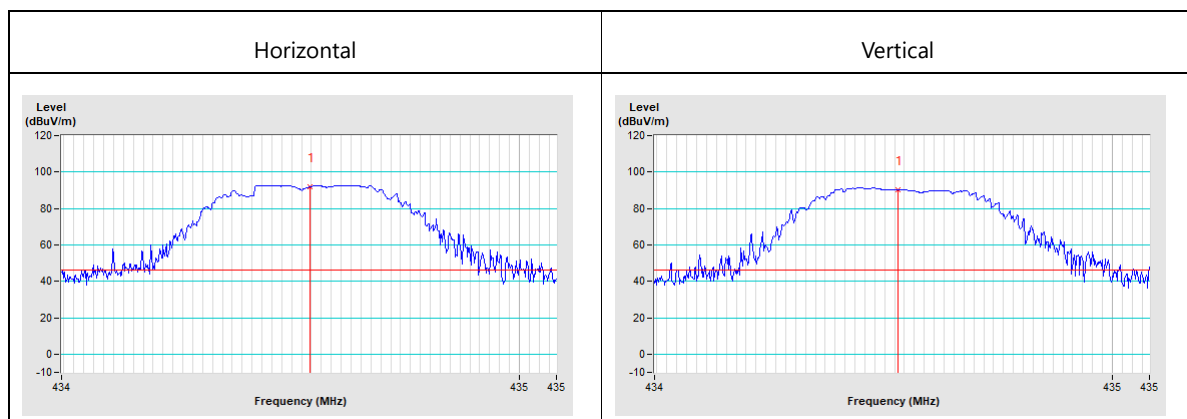


HIGH CHANNEL:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	*434.575 PK	-11.58	103.49	91.91	100.85	-8.94	1.00 H	123
1	*434.575 AV	-	-	66.01	80.85	-14.84	1.00 H	123
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	*434.575 PK	-11.58	104.09	92.48	100.85	-8.37	1.00 V	161
1	*434.575 AV	-	-	66.58	80.85	-14.27	1.00 V	161

NOTE:

- " * ": Fundamental frequency.
- Fundamental AV value = PK Emission + 20*log(duty cycle) Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (5.07\%) = -25.90 \text{ dB}$, Please see page 29 for plotted duty.



ABOVE 1GHz WORST-CASE DATA:

LOW CHANNEL:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1299.53 PK	-2.23	43.31	41.08	80.80	-39.72	132	56
2	#1299.53 AV	-	-	15.18	60.80	-45.62	132	56
3	#1732.70 PK	0.49	42.74	43.23	80.60	-37.37	235	5
4	#1732.70 AV	-	-	17.33	60.80	-43.47	235	5
5	3088.39 PK	2.72	47.27	49.99	74.00	-24.01	165	48
6	3088.39 AV	2.72	28.49	31.21	54.00	-22.79	165	88
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1299.53 PK	-2.23	43.74	41.51	80.80	-39.29	100	306
2	#1299.53 AV	-	-	15.60	60.80	-45.20	100	306
3	1508.41 PK	-1.36	41.97	40.61	74.00	-33.39	256	56
4	1508.41 AV	-1.36	25.89	24.53	54.00	-19.47	256	56
5	#1732.70 PK	0.49	43.83	44.32	80.60	-36.28	165	15
6	#1732.70 AV	-	-	18.42	60.80	-42.38	165	15

NOTE:

- 1 The resolution bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection (PK) at frequency above 1GHz.
- 2 Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- 3 Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 4 Margin value = Emission level – Limit value.
- 5 The emission levels of other frequencies were less than 20dB margin against the limit.
- 6 " # ": Harmonic frequency.
- 7 Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 18~19 for plotted duty.

MIDDLE CHANNEL:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1301.33 PK	-2.22	42.36	40.14	74.00	-33.86	156	44
2	#1301.33 AV	-	-	14.24	54.00	-39.76	156	44
3	#1735.10 PK	0.51	42.88	43.39	80.82	-37.43	325	74
4	#1735.10 AV	-	-	17.49	60.82	-43.31	325	74
5	3090.87 PK	2.73	46.55	49.28	74.00	-24.72	325	48
6	3090.87 AV	2.73	23.78	26.51	54.00	-27.49	325	48
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1301.33 PK	-2.22	43.11	40.89	74.00	-33.11	248	48
2	#1301.33 AV	-	-	14.99	54.00	-39.01	248	48
3	#1735.10 PK	0.51	43.94	44.45	80.82	-36.37	358	95
4	#1735.10 AV	-	-	18.55	60.82	-42.27	358	95
5	3373.32 PK	3.75	44.18	47.93	74.00	-26.07	394	15
6	3373.32 AV	3.75	21.77	25.52	54.00	-28.48	394	15

NOTE:

- 1 The resolution bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection (PK) at frequency above 1GHz.
- 2 Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- 3 Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 4 Margin value = Emission level – Limit value.
- 5 The emission levels of other frequencies were less than 20dB margin against the limit.
- 6 " # ": Harmonic frequency.
- 7 Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 18~19 for plotted duty.

HIGH CHANNEL:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1303.73 PK	-2.21	43.08	40.87	74.00	-33.13	235	119
2	#1303.73 AV	-	-	14.97	54.00	-39.06	235	119
3	#1738.30 PK	0.54	43.85	44.39	80.85	-36.46	221	182
4	#1738.30 AV	-	-	18.49	60.85	-42.36	221	182
5	2397.35 PK	2.87	47.68	50.55	74.00	-23.45	238	217
6	2397.35 AV	2.87	29.48	32.35	54.00	-21.65	238	217
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1303.73 PK	-2.21	43.35	41.14	74.00	-32.86	235	16
2	#1303.73 AV	-	-	15.24	54.00	-38.76	235	16
3	1509.14 PK	-1.36	56.44	55.08	74.00	-18.92	325	25
4	1509.14 AV	-1.36	32.48	31.12	54.00	-22.88	325	25
5	#1738.30 PK	0.54	44.16	44.70	80.85	-36.15	118	136
6	#1738.30 AV	-	-	18.80	60.85	-42.05	118	136

NOTE:

- 1 The resolution bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection (PK) at frequency above 1GHz.
- 2 Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- 3 Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 4 Margin value = Emission level – Limit value.
- 5 The emission levels of other frequencies were less than 20dB margin against the limit.
- 6 " # ": Harmonic frequency.
- 7 Harmonic AV value =PK Emission +20*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20Log(5.07%)=-25.90dB, Please see page 18~19 for plotted duty.

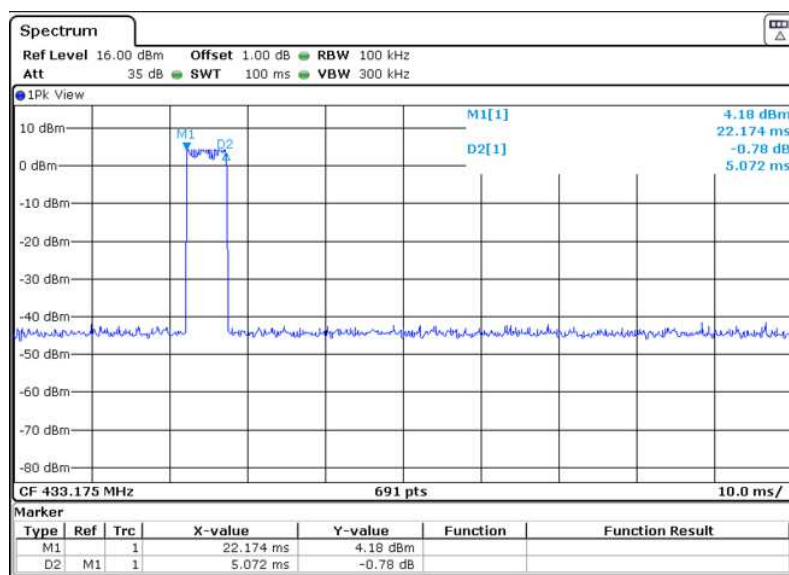
Duty Cycle:

$T_p = 100\text{ms}$

$T_{on} = 5.072\text{ms}$

$\text{Duty Cycle} = T_{on} / T_p * 100\% = 5.072 / 100 * 100\% = 5.07\%$

$\text{Factor} = 20\text{Log}(\text{Duty Cycle}) = 20\text{Log}(5.07\%) = -25.90\text{dB}$



4.2 CONDUCTED EMISSION MEASUREMENT

4.3.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	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 0.50MHz.
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.3.2 LIMITS OF CONDUCTED EMISSION MEASUREMENT

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Oct. 09, 25
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Oct. 10, 25
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Oct. 09, 25
Artificial Mains Network	SCHWARZBECK	NSLK 8122	8122-05001	Apr. 09, 25
V-LISN (CISPR 25)	SCHWARZBECK	NNBM 8124-200	8124-200 05857	Apr. 09, 25
V-LISN (CISPR 25)	SCHWARZBECK	NNBM 8124-200	8124-200 05858	Apr. 09, 25
Voltage probe	SCHWARZBECK	TK 9421	TK 9421-176	Jul. 10, 25
Coaxial RF Cable	SUHNER	RG 223/U-CE	C2310066DG	Jun. 23, 25
Test software	ADT	ADT_Cond_V7.3.7	N/A	N/A

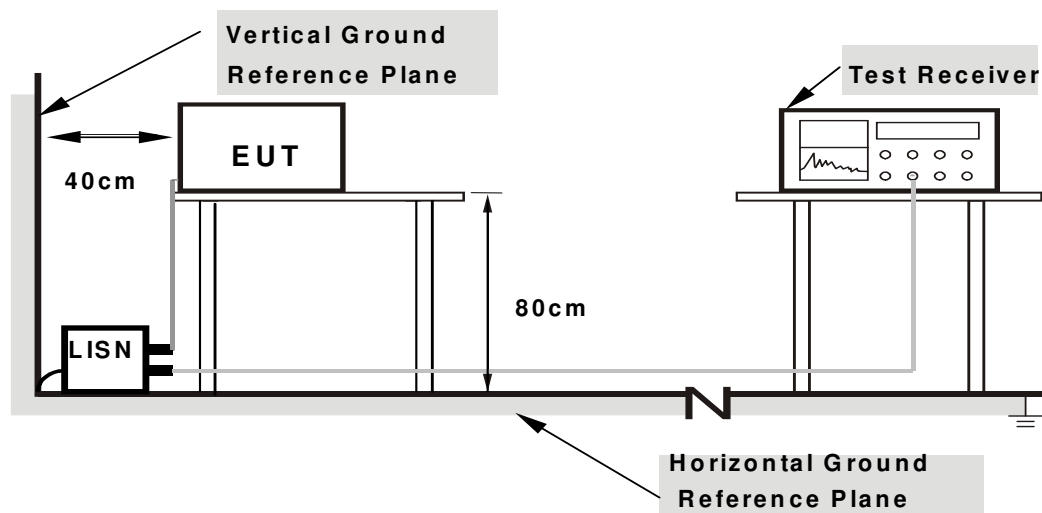
- NOTES:**
1. The test was performed in shielded room 553.
 2. Equipment are calibrated by calibration laboratory accredited to ISO/IEC 17025 by a mutually recognized Accreditation.

4.3.3 TEST PROCEDURES

- a. The EUT was 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/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.3.4 TEST SETUP



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

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

4.3.5 EUT OPERATING CONDITIONS

- a. Turned on the power and connected of all equipment.
- b. EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.

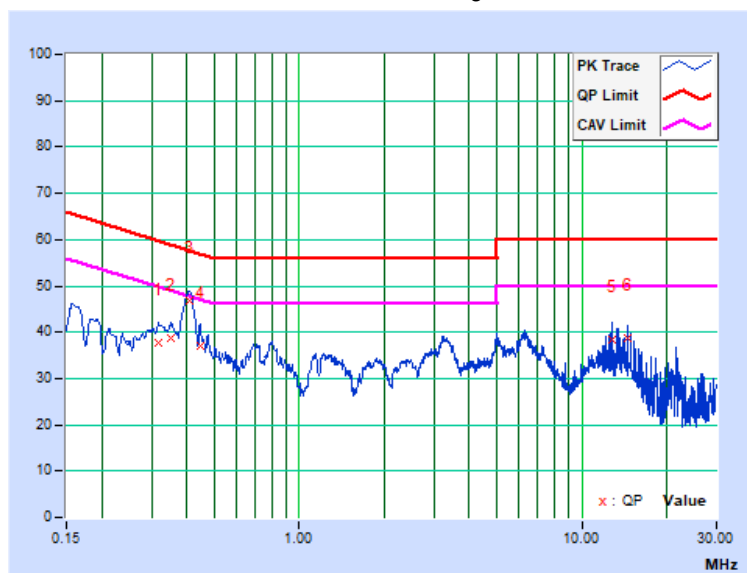
4.3.6 TEST RESULTS

CONDUCTED WORST-CASE DATA:

PHASE	Line	6dB BANDWIDTH	9kHz
-------	------	---------------	------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.31636	9.81	27.83	20.43	37.64	30.24	59.80	49.80	-22.16	-19.56
2	0.35253	9.81	28.85	21.02	38.66	30.83	58.90	48.90	-20.24	-18.07
3	0.40875	9.82	36.85	28.59	46.67	38.41	57.67	47.67	-11.00	-9.26
4	0.44474	9.83	27.15	20.37	36.98	30.20	56.97	46.97	-19.99	-16.77
5	12.80850	10.57	27.94	24.51	38.51	35.08	60.00	50.00	-21.49	-14.92
6	14.58375	10.68	27.91	26.90	38.59	37.58	60.00	50.00	-21.41	-12.42

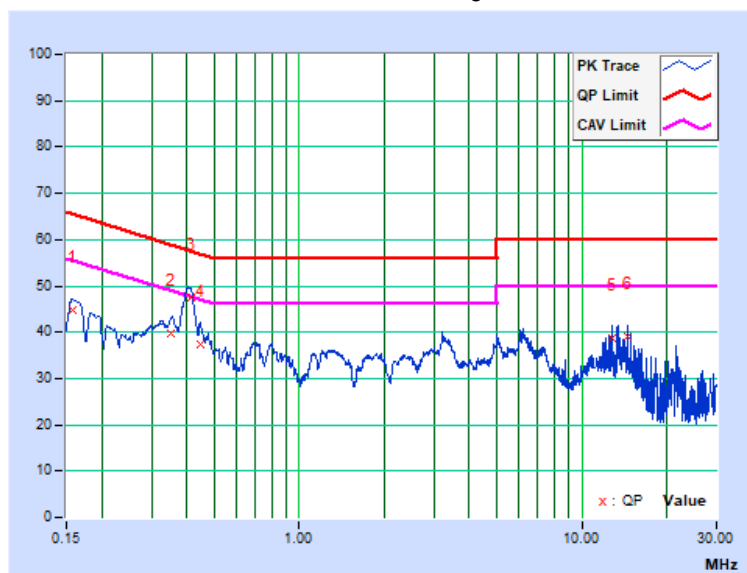
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.



PHASE	Neutral	6dB BANDWIDTH	9kHz
-------	---------	---------------	------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15715	9.77	34.87	20.51	44.64	30.28	65.61	55.61	-20.97	-25.33
2	0.35347	9.69	30.06	22.86	39.75	32.55	58.88	48.88	-19.13	-16.33
3	0.41305	9.68	37.77	31.36	47.45	41.04	57.59	47.59	-10.13	-6.54
4	0.44474	9.69	27.69	21.06	37.38	30.75	56.97	46.97	-19.59	-16.22
5	12.80850	10.54	28.03	24.37	38.57	34.91	60.00	50.00	-21.43	-15.09
6	14.58150	10.66	28.34	26.84	39.00	37.50	60.00	50.00	-21.00	-12.50

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.



4.3 20dB BANDWIDTH MEASUREMENT

4.3.7 LIMITS OF 20dB BANDWIDTH MEASUREMENT

According to FCC 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Limit=Fundamental Frequency×0.25% =
Low Frequency: 433.175MHz×0.25%=1082.938 kHz
Middle Frequency: 433.775MHz×0.25%=1084.438 kHz
High Frequency: 434.575MHz×0.25%=1086.438 kHz

4.3.8 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Power Sensor	Keysight	U2021XA	MY57320002	Apr. 07, 25
Digital Multimeter	FLUKE	15B	A1220010DG	N/A
Humid & Temp Programmable Tester	Haida	HD-225T	110807201	Oct. 10, 25
Oscilloscope	Agilent	DSO9254A	MY51260160	Jul. 07, 25
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101094	Oct. 09, 25
Signal Generator	Agilent	N5183A	MY50140980	Jul. 11, 25
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY56200288	Jul. 11, 25
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	N/A
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A
DC Source	Keysight	E3642A	MY56146098	N/A
Test software	ADT	ADT_RF Test Software V6.6.5.3	N/A	N/A

NOTE:

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

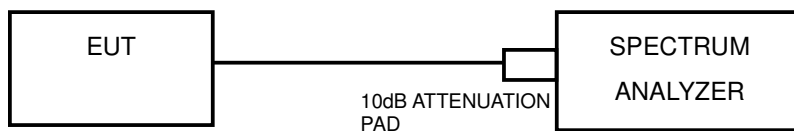
4.3.9 TEST PROCEDURE

The spectrum analyzer was receiving the maximum emission level. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.3.10 DEVIATION FROM TEST STANDARD

No deviation.

4.3.11 TEST SETUP



4.3.12 EUT OPERATING CONDITIONS

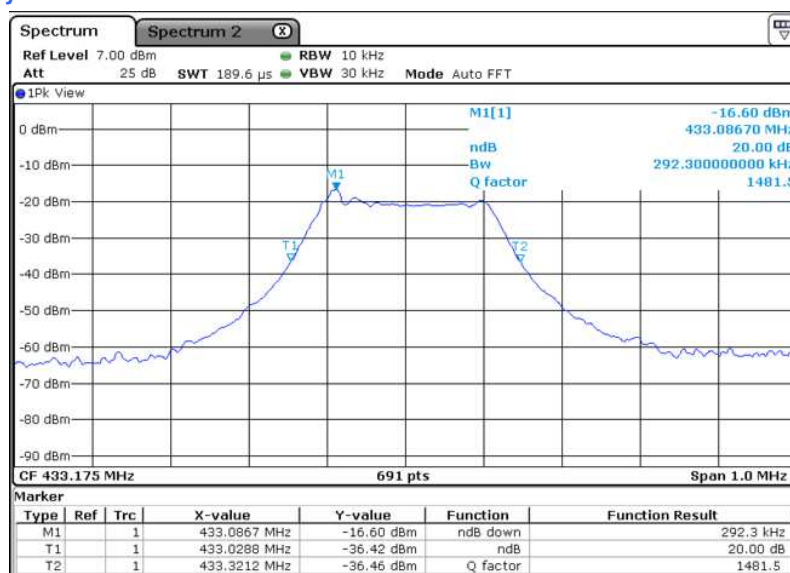
- a) Turned on the power of all equipment.
- b) EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.

4.3.13 TEST RESULTS

FREQUENCY (MHz)	20dB BANDWIDTH (kHz)	MAXIMUM LIMIT (kHz)	PASS/FAIL
433.175	292.3	1082.938	PASS
433.775	292.3	1084.438	PASS
434.575	293.8	1086.438	PASS

Test Data:

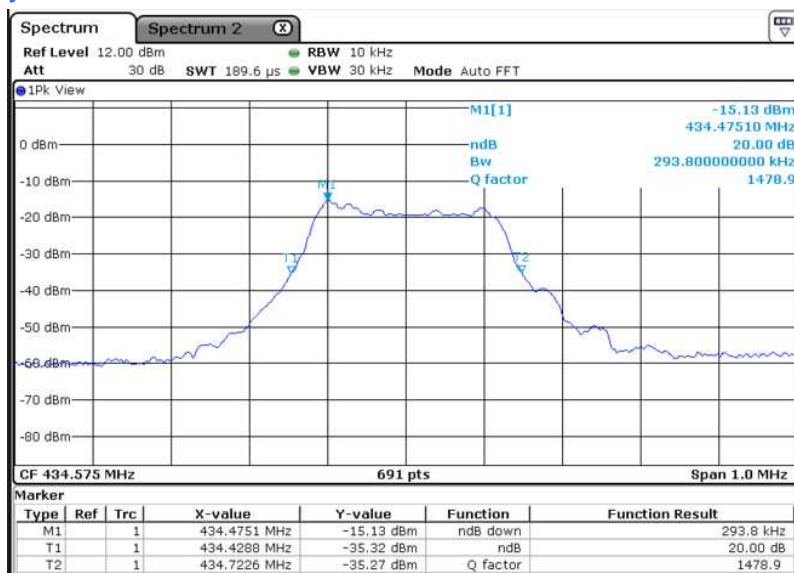
Low Frequency:



Middle Frequency:



High Frequency:



4.4 DEACTIVATION TIME MEASUREMENT

4.4.1 LIMITS OF DEACTIVATION TIME MEASUREMENT

15.231 (a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

15.231 (a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

4.4.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Power Sensor	Keysight	U2021XA	MY57320002	Apr. 07, 25
Digital Multimeter	FLUKE	15B	A1220010DG	N/A
Humid & Temp Programmable Tester	Haida	HD-225T	110807201	Oct. 10, 25
Oscilloscope	Agilent	DSO9254A	MY51260160	Jul. 07, 25
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101094	Oct. 09, 25
Signal Generator	Agilent	N5183A	MY50140980	Jul. 11, 25
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY56200288	Jul. 11, 25
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	N/A
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A
DC Source	Keysight	E3642A	MY56146098	N/A
Test software	ADT	ADT_RF Test Software V6.6.5.3	N/A	N/A

NOTES: 1. The test was performed in RF Oven room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

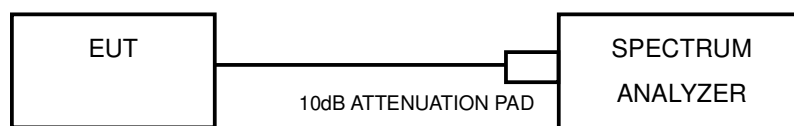
4.4.3 TEST PROCEDURE

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer set the center frequency, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the transmission duration was measured and recorded.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

4.4.5 TEST SETUP



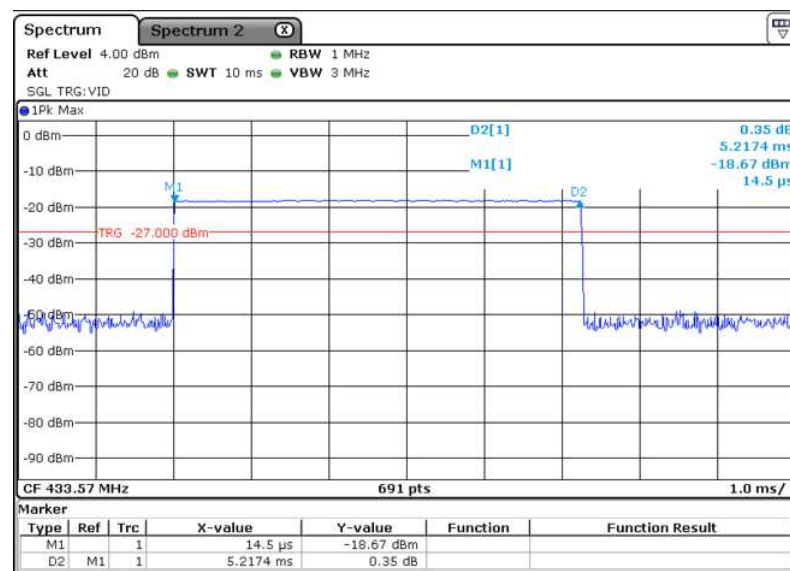
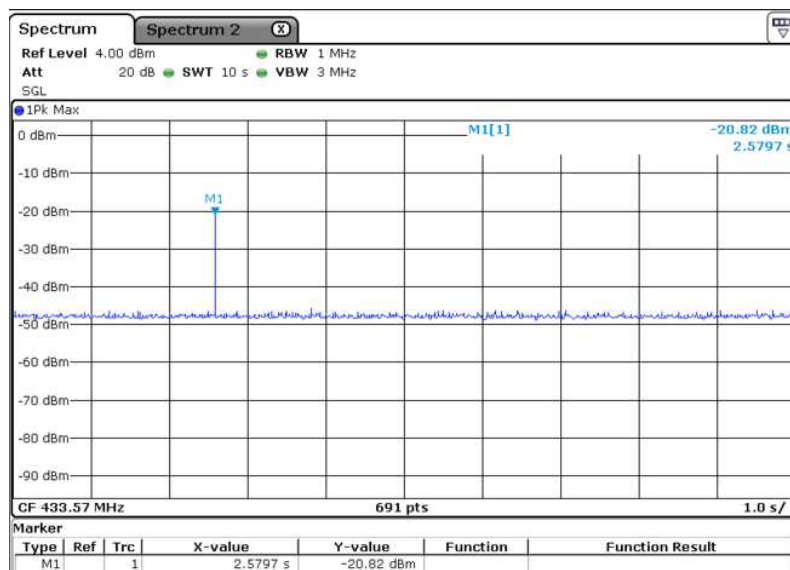
4.4.6 EUT OPERATING CONDITIONS

- c) Turned on the power of all equipment.
- d) EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.

4.4.7 TEST RESULTS

FREQUENCY (MHz)	MEASUREMENT RESULT (sec)	MAXIMUM LIMIT (sec)	PASS/FAIL
433.175	0.005217	5	PASS

The plots of test results are attached as below.



5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---