



EMC TEST REPORT

Report No.: SET2023-01264

Product Name: LoRaWAN Sensor Terminal

FCC ID: 2A8OE-FST200

Model No. : FST200-00HA, FST200-00HC

Applicant: Xiamen Four-Faith Communication Technology Co., Ltd.

Address: 11th Floor, A-06 Area, No.370, Chengyi Street, Jimei District,
Xiamen, China.

Received Date: 2023.01.09

Dates of Testing: 2023.01.09—2023.02.10

Issued by: CCIC Southern Testing Co., Ltd.

Lab Location: Electronic Testing Building, No. 43 Shahe Road, Xili Street,
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Test Report

Product Name..... LoRaWAN Sensor Terminal

Model No. FST200-00HA, FST200-00HC

Trade name..... Four-Faith

Brand Name..... N/A

Applicant..... Xiamen Four-Faith Communication Technology Co., Ltd.

Applicant Address..... 11th Floor, A-06 Area, No.370, Chengyi Street, Jimei District, Xiamen, China.

Manufacturer Xiamen Four-Faith Communication Technology Co., Ltd.

Manufacturer Address 11th Floor, A-06 Area, No.370, Chengyi Street, Jimei District, Xiamen, China.

Test Standards..... 47 CFR Part 15 Subpart B

Test Result..... PASS

Tested by Ruihong Xie

Ruihong Xie Test Engineer

2023.02.10

Reviewed by Chris You

Chris You Senior Engineer

2023.02.10

Approved by *Hou Tao*

Hou Tao, Manager

2023.02.10



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Change History		
Issue	Date	Reason for change
1.0	2023.02.10	First edition



1. GENERAL INFORMATION

1.1 EUT Description

EUT Name : LoRaWAN Sensor Terminal
Trade Name.....: Four-Faith
Brand Name.....: N/A
Hardware Version..... : V.1.0.1.0
Software Version..... : N/A
Power supply.....: Adaptor
Model No.: SA18V-120150U
I/p: 100-240V~50/60Hz , 500mA
O/p: 12.0V --- 1500mA
Manufacturer: Dongguan Sunun Power Co., Ltd

Battery
Brand Name: Sunmoon
Model No.: ER34615
Capacitance: 19000mAH
Rated Voltage: 3.6V
Manufacturer : Wuhan Sunmoon Battery Co., Ltd.

*Note1:*The EUT is a LoRaWAN Sensor Terminal;

*Note2 :*For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

*Note3 :*The difference between FST200-00HA and FST200-00HC is that the FST200-00HA powers the battery and the FST200-00HC powers the adapter.



1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart B:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart B	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Result
1	15.107	Conducted Emission	PASS
2	15.109	Radiated Emission	PASS

NOTE:

- (1) The EUT has been tested according to 47 CFR Part 15 Subpart B, Class B. The test procedure is according to ANSI C63.4:2014.



Facilities and Accreditations

1.2.1 Facilities

FCC-Registration No.: CN1283

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until April 19th, 2023.

ISED Registration: 11185A-1

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until April 20th, 2023.

A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

1.2.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 °C - 35 °C
Relative Humidity (%):	25% -75%
Atmospheric Pressure (kPa):	86kPa-106kPa

1.2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission:	Uc = 3.2 dB (k=2)
Uncertainty of Radiated Emission: (30MHz~1GHz)	Uc = 5.8 dB (k=2)
Uncertainty of Radiated Emission: (1~6GHz)	Uc = 5.1 dB (k=2)
Uncertainty of Radiated Emission: (6~18GHz)	Uc = 5.5 dB (k=2)



2. TEST CONDITIONS SETTING

2.1 Test Peripherals

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

Support Equipment:

Description	Brand name	Model	Serial No.	FCCID
Notebook	ThinkPad	E430C	A131101550	N/A

Support Cable:

Description	Shield Type	Ferrite Core	Length
PC Power adapter Cable	Un- shielding	No	1.2m
Mouse Cable	Un- shielding	No	1m
Network Cable	Un- shielding	No	1.2m

2.2 Test Mode

The EUT have the following typical setups during the test:

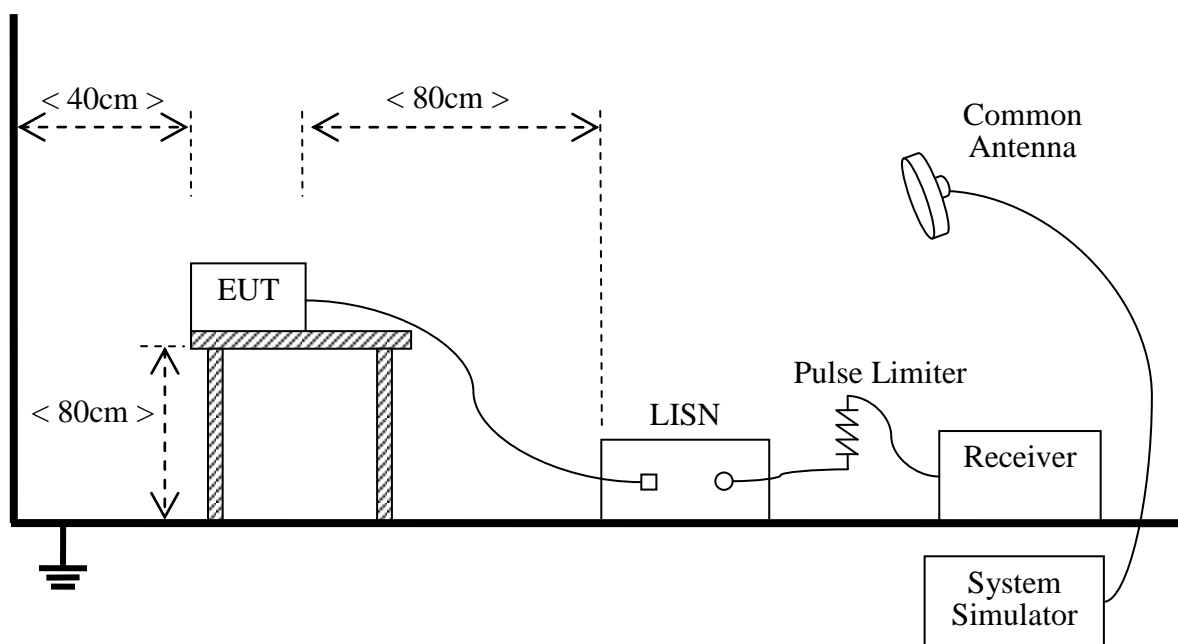
Setup1:FST200-00XC +Adapter;

Setup2:FST200-00XA +Battery;

2.3 Test Setup and Equipments List

2.3.1 Conducted Emission

A. Test Setup:



The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides $50\Omega/50\mu\text{H}$ of coupling impedance for the measuring instrument. The Common Antenna is used for the call between the EUT and the System Simulator (SS). A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

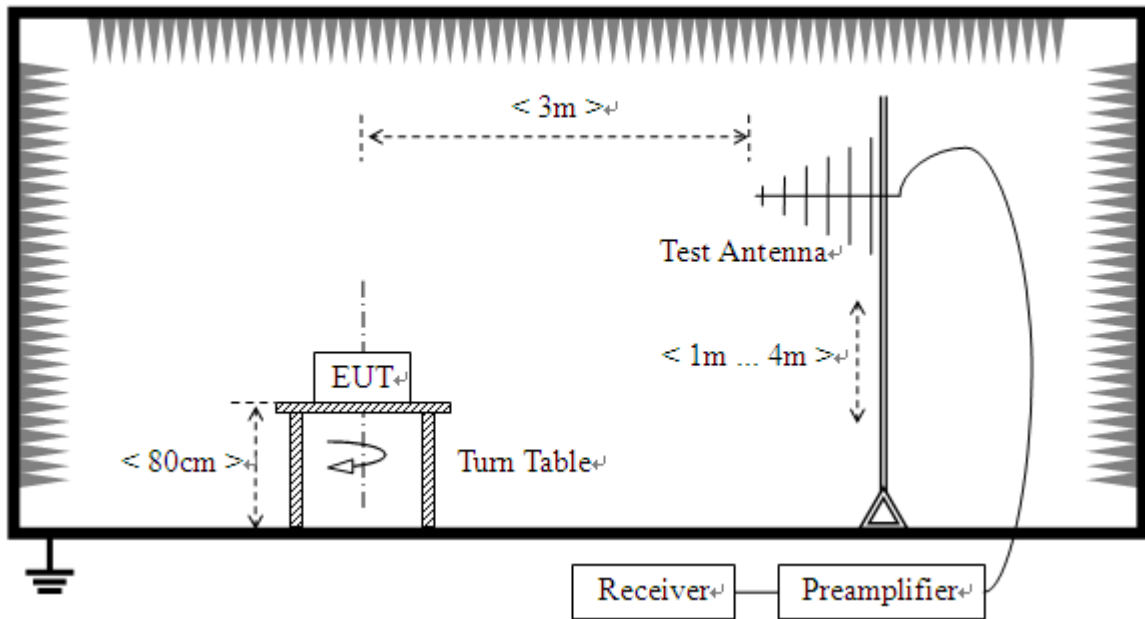
B. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
Test Receiver	KEYSIGHT	N9038A	A141202036	2022.07.21	2023.07.20
LISN	ROHDE&SCHWARZ	ENV216	A140701847	2022.07.21	2023.07.20
Cable	MATCHING PAD	W7	/	2022.08.02	2023.08.02

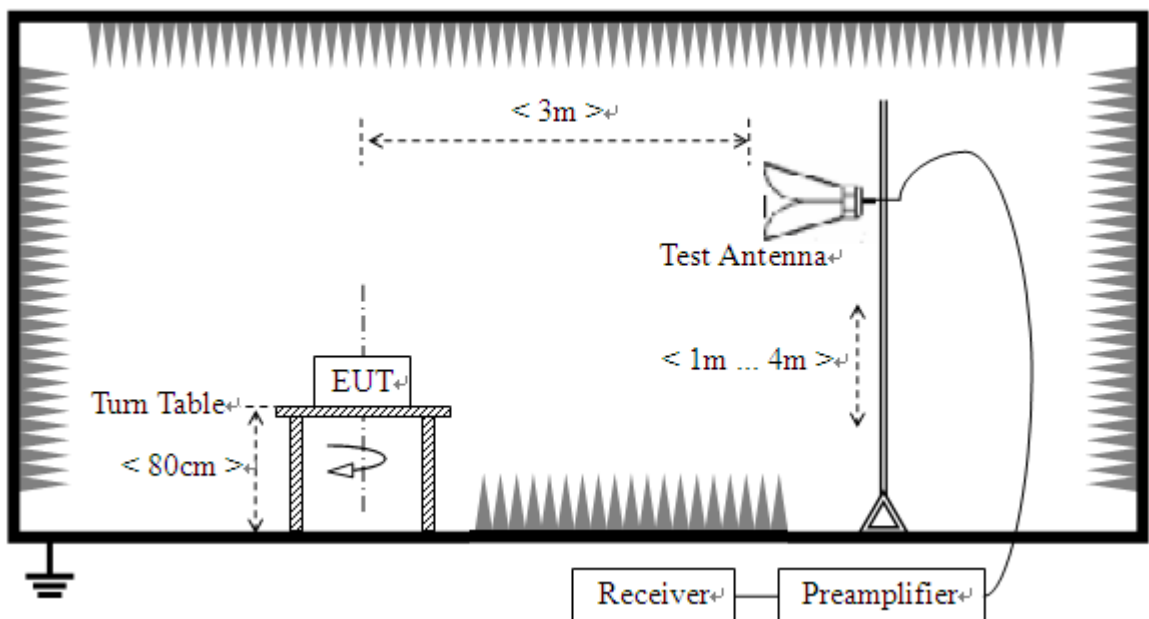
2.3.2 Radiated Emission

A. Test Setup:

- 1) For radiated emissions from 30MHz to 1GHz



- 2) For radiated emissions above 1GHz



**B. Test Procedure**

The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.

For the test Antenna:

- 1) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

C. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	A0902601	2022.05.23	2023.04.17
Broadband Ant.	2786	ETC	A150402239	2021.09.16	2024.03.03
3M Anechoic Chamber	Albatross	SAC-3MAC 9*6*6m	A0412375	2019.03.26	2023.03.25
EMI Test Receiver	ROHDE&SCHWARZ	ESW26	A180502935	2022.07.21	2023.07.20
5M Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4m	A0304210	2022.03.25	2023.03.24
EMI Horn Ant.	ROHDE&SCHWARZ	HF906	A0304225	2019.03.25	2023.03.24

3. 47 CFR PART 15B REQUIREMENTS

3.1 Conducted Emission

3.1.1 Requirement

According to FCC section 15.107, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

Note:

- The limit subjects to the Class B digital device.
- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

3.1.2 Test Description

See section 2.3.1 of this report.

3.1.3 Test Result

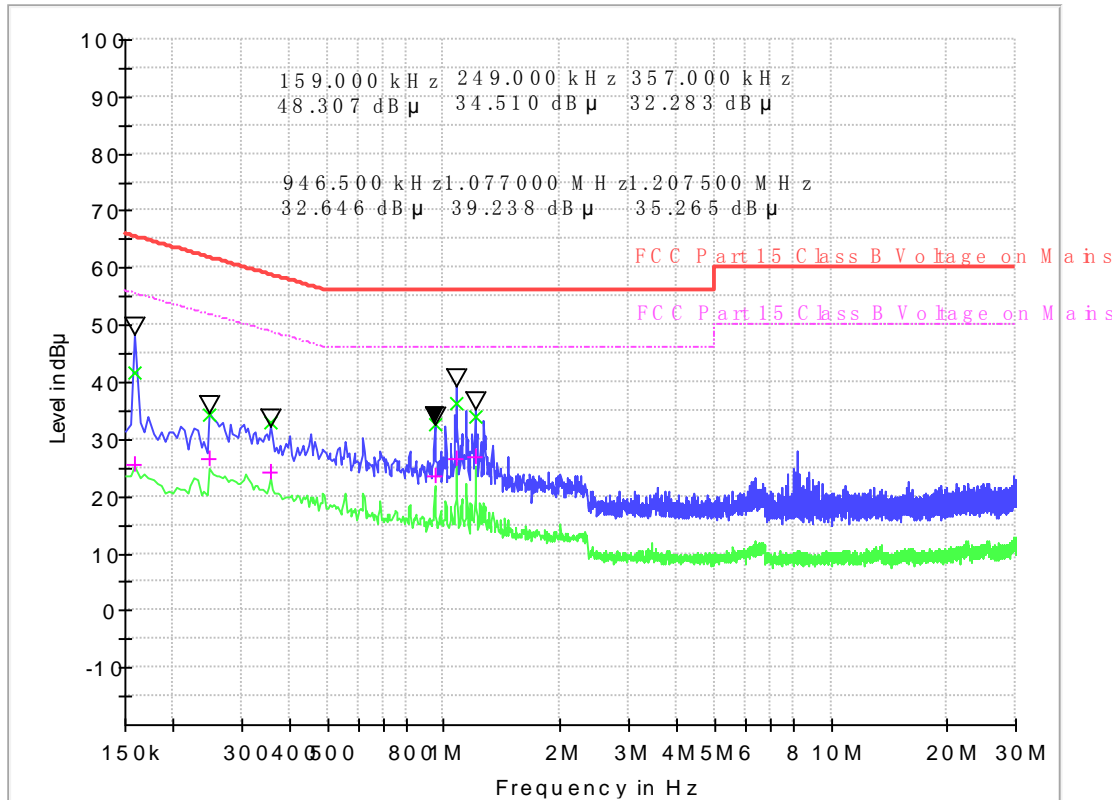
The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. All test modes are considered, refer to recorded points and plots below.

Note:

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a Nominal 120V AC,50/60Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

Test voltage and frequency (120V AC,60Hz)

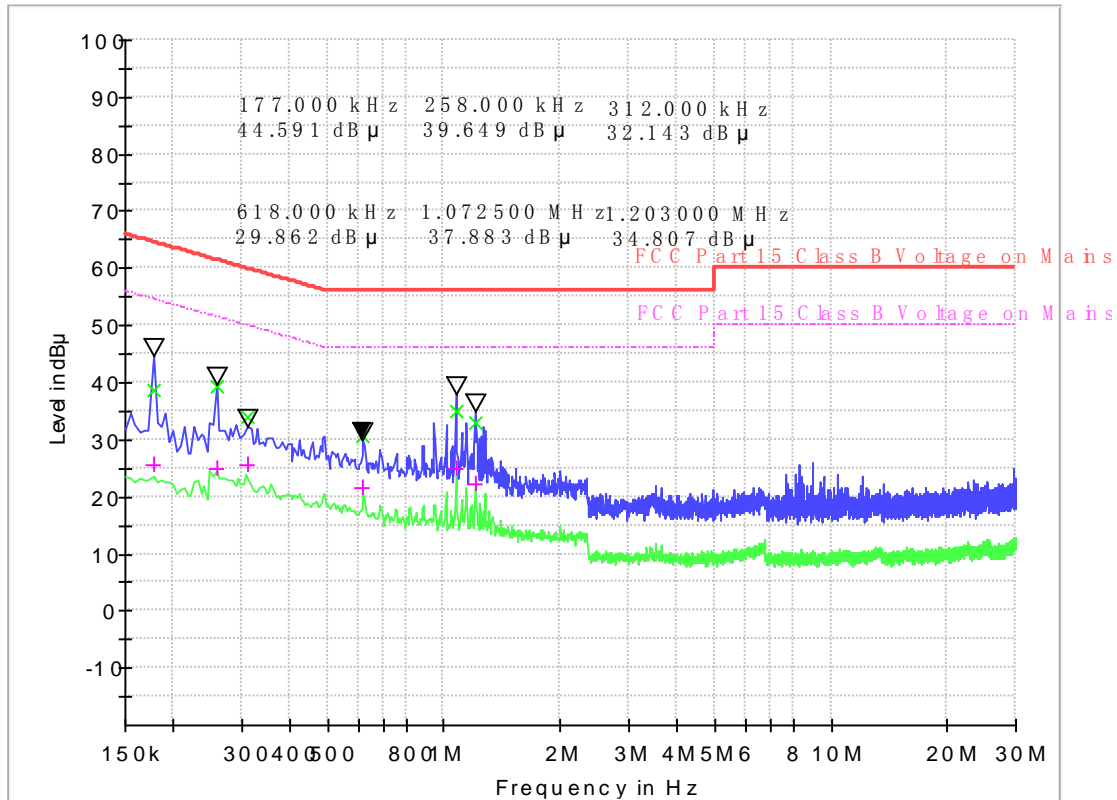
A. Mains terminal disturbance voltage, L phase,Setup 1



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak (dB μV)	CAverage (dB μV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dB μV)
0.159000	41.52	25.47	0.1	19.9	24.00	65.5	30.05	55.5
0.249000	34.23	26.62	0.1	19.9	27.56	61.8	25.17	51.8
0.357000	32.89	24.14	0.1	19.9	25.91	58.8	24.66	48.8
0.946500	32.48	23.55	0.2	19.9	23.52	56.0	22.45	46.0
1.077000	36.23	26.68	0.2	19.9	19.77	56.0	19.32	46.0
1.207500	34.06	26.98	0.2	19.9	21.94	56.0	19.02	46.0

B. Mains terminal disturbance voltage, N phase, Setup 1



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dB μ V)
0.177000	38.54	25.66	0.1	19.9	26.09	64.6	28.97	54.6
0.258000	39.49	24.75	0.1	19.9	22.01	61.5	26.75	51.5
0.312000	34.03	25.47	0.1	19.9	25.89	59.9	24.45	49.9
0.618000	30.73	21.49	0.1	19.9	25.27	56.0	24.51	46.0
1.072500	34.95	25.04	0.2	20.0	21.05	56.0	20.96	46.0
1.203000	33.01	22.20	0.2	20.0	22.99	56.0	23.80	46.0

3.2 Radiated Emission

3.2.1 Requirement

According to FCC section 15.109, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency range (MHz)	Field Strength		Field Strength Limitation at 3m Measurement Dist	
	$\mu\text{V/m}$	Dist	($\mu\text{V/m}$)	(dBuV/m)
30.0 - 88.0	100	3m	100	$20\log 100$
88.0 - 216.0	150	3m	150	$20\log 150$
216.0 - 960.0	200	3m	200	$20\log 200$
Above 960.0	500	3m	500	$20\log 500$

- For frequencies above 1000MHz, the field strength limits are based on average detector. When average radiated emission measurements are specified in this part, including emission measurements below 1000MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.
- Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.
- For below 1G :QP detector RBW 120kHz ,VBW 300kHz.

For Above 1G: PK detector RBW 1MHz,VBW 3MHz for PK value ;AV detector RBW 1MHz, VBW 10Hz for AV value.

Note:

- The tighter limit shall apply at the boundary between two frequency range.
- Limitation expressed in dBuV/m is calculated by $20\log \text{Emission Level}(\mu\text{V/m})$.
- If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of $Ld1 = Ld2 * (d2/d1)^2$.

Example:

F.S Limit at 30m distance is $30\mu\text{V/m}$, then F.S Limitation at 3m distance is adjusted as

$$Ld1 = L1 = 30\mu\text{V/m} * (10)^2 = 100 * 30\mu\text{V/m}.$$

3.2.2 Test Description

See section 2.3.2 of this report.

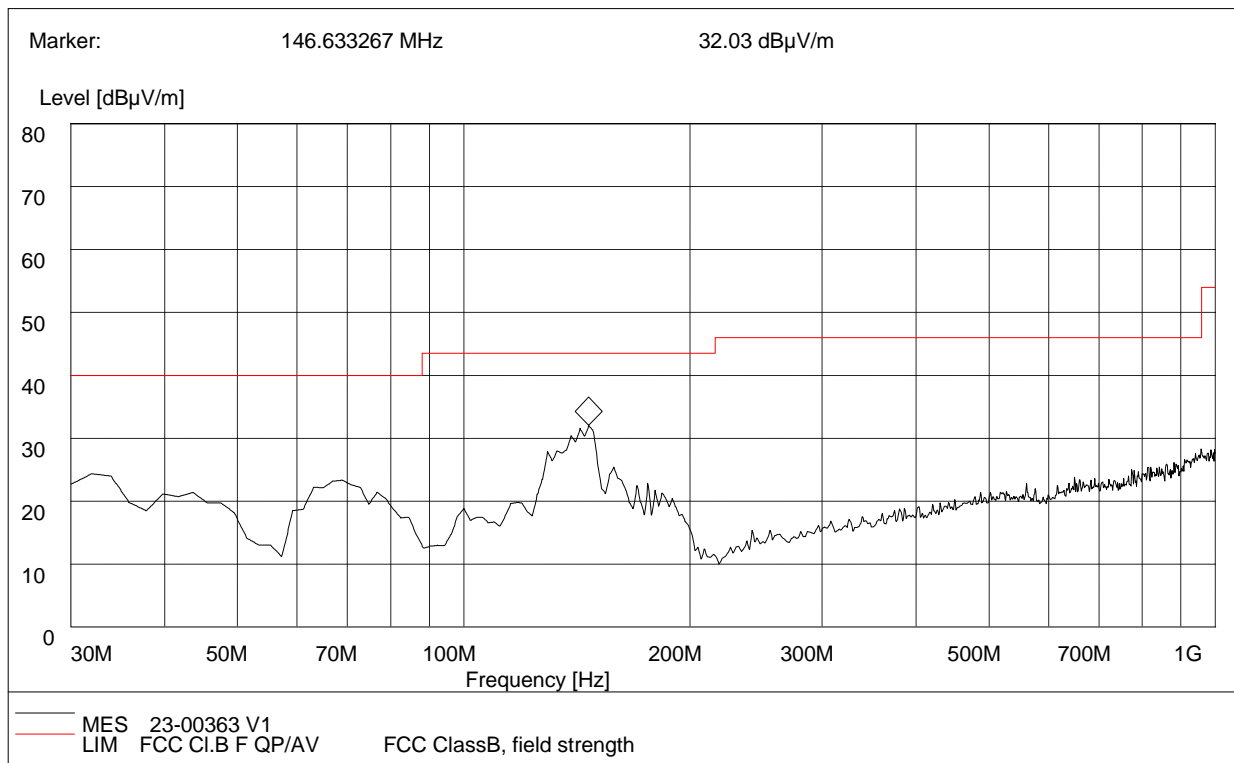
3.2.3 Test Result

The maximum radiated emission is searched using PK, QP and AV detectors; the emission levels more than the limits, and that have narrow margins from the limits will be re-measured with AV and QP detectors. Both the vertical and the horizontal polarizations of the Test Antenna are considered to perform the tests. All test modes are considered, refer to recorded points and plots below.

The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

Note: All radiated emission tests were performed in X, Y, Z axis direction, and only the worst axis test condition was recorded in this test report.

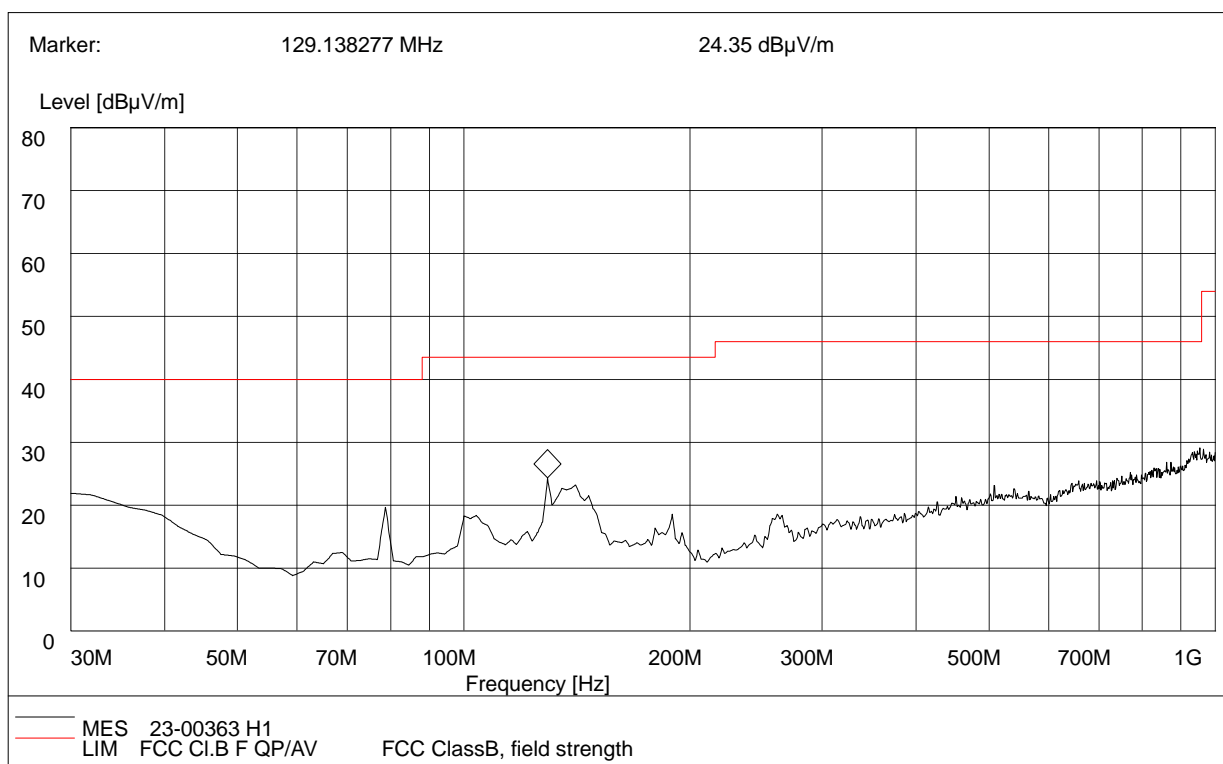
A.Radiation disturbances, antenna polarization:Vertical,Setup1



(Plot C: Test Antenna Vertical 30M - 1G)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Cable Loss(dB)	ANT. Factor(dB)	Verdict
31.13	23.37	120.000	109	40.00	16.63	Vertical	0.5	18.3	Pass
68.65	23.23	120.000	114	40.00	16.77	Vertical	0.8	5.8	Pass
146.34	32.14	120.000	118	43.50	11.36	Vertical	1.0	11.5	Pass
158.65	24.09	120.000	121	43.50	19.41	Vertical	1.2	11.3	Pass
650.01	23.43	120.000	109	46.00	22.57	Vertical	1.6	20.2	Pass
910.14	26.58	120.000	114	46.00	19.42	Vertical	2.2	22.1	Pass

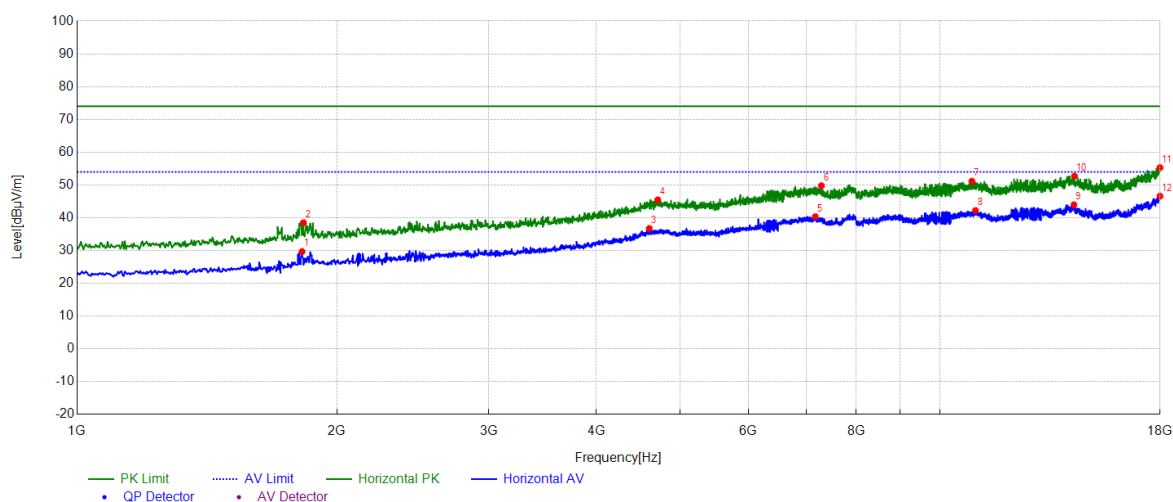
B.Radiation disturbances, antenna polarization: Horizontal,Setup1



(Plot D: Test Antenna Horizontal 30M - 1G)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Cable Loss(dB)	ANT. Factor(dB)	Verdict
30.00	21.44	120.000	113	40.00	18.56	Vertical	0.5	26.1	Pass
37.43	18.02	120.000	121	40.00	21.98	Vertical	0.5	26.1	Pass
129.54	24.21	120.000	109	43.50	19.29	Vertical	1.0	26.3	Pass
140.19	23.42	120.000	124	43.50	20.08	Vertical	1.0	26.3	Pass
507.62	22.04	120.000	119	46.00	23.96	Vertical	1.5	26.7	Pass
861.07	26.38	120.000	107	46.00	19.62	Vertical	2.1	26.9	Pass

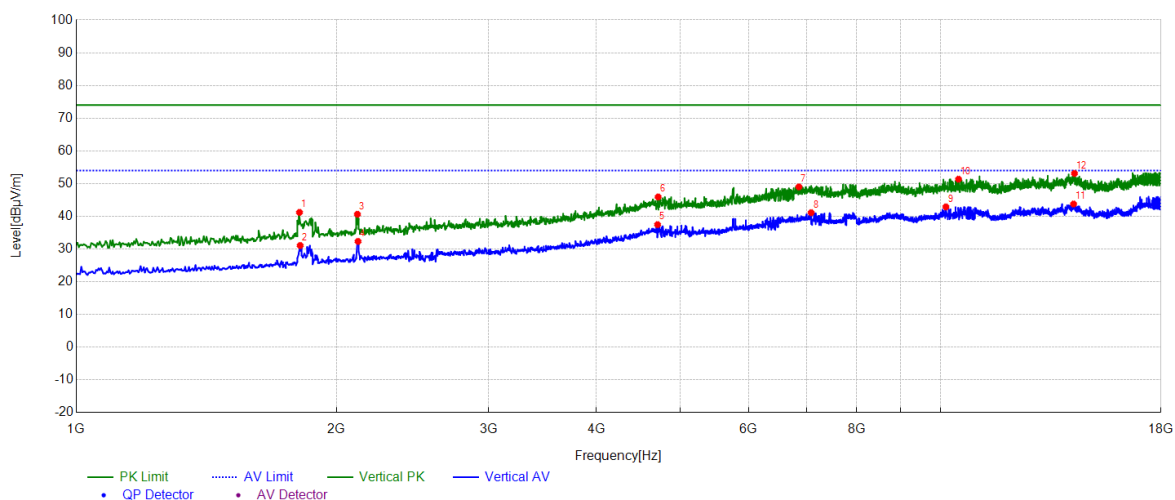
A.Radiation disturbances, antenna polarization: Horizontal



(Plot M: Test Antenna Horizontal 1G – 18G)

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin[dB μV/m]	Trace	Height [cm]	Angle [°]	Polarity
1	1822.96	29.70	-12.64	54.00	24.30	AV	110	153	Horizontal
2	1829.77	38.48	-12.60	74.00	35.52	PK	121	40	Horizontal
3	4604.72	36.72	-1.49	54.00	17.28	AV	106	191	Horizontal
4	4710.14	45.44	-1.07	74.00	28.56	PK	114	112	Horizontal
5	7172.23	40.34	3.47	54.00	13.66	AV	120	295	Horizontal
6	7291.26	49.77	3.40	74.00	24.23	PK	114	43	Horizontal
7	10892.58	51.14	6.58	74.00	22.86	PK	107	90	Horizontal
8	10998.00	42.21	6.66	54.00	11.79	AV	128	331	Horizontal
9	14303.46	43.96	9.86	54.00	10.04	AV	113	244	Horizontal
10	14323.86	52.69	9.71	74.00	21.31	PK	106	59	Horizontal
11	17993.20	55.28	14.85	74.00	18.72	PK	114	154	Horizontal
12	17993.20	46.58	14.85	54.00	7.42	AV	120	230	Horizontal

B.Radiation disturbances, antenna polarization: Vertical



(Plot N: Test Antenna Vertical 1G – 18G)

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin[dB μV/m]	Trace	Height [cm]	Angle [°]	Polarity
1	1812.76	41.21	-12.69	74.00	32.79	PK	116	261	Vertical
2	1816.16	31.08	-12.67	54.00	22.92	AV	121	254	Vertical
3	2115.42	40.63	-11.58	74.00	33.37	PK	104	238	Vertical
4	2118.82	32.33	-11.57	54.00	21.67	AV	107	261	Vertical
5	4706.74	37.47	-1.07	54.00	16.53	AV	119	30	Vertical
6	4713.54	45.92	-1.05	74.00	28.08	PK	115	265	Vertical
7	6859.37	48.99	3.10	74.00	25.01	PK	120	320	Vertical
8	7087.22	41.11	3.41	54.00	12.89	AV	133	211	Vertical
9	10147.83	42.89	5.57	54.00	11.11	AV	114	209	Vertical
10	10494.70	51.34	6.12	74.00	22.66	PK	109	283	Vertical
11	14259.25	43.77	9.70	54.00	10.23	AV	117	344	Vertical
12	14293.26	53.11	9.86	74.00	20.89	PK	108	70	Vertical

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