

EMC TEST REPORT

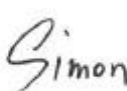
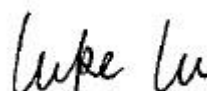
Applicant:	MUNIC
Address:	100 Avenue de Stalingrad 94800 Villejuif – France

Manufacturer or Supplier:	MUNIC
Address:	100 Avenue de Stalingrad 94800 Villejuif – France
Product:	telematics embedded system
Brand Name:	MUNIC
Model Name:	C4D-4G4USAB_V8+
FCC ID:	A6GC4D-4G4USV8-2
Date of tests:	May. 05, 2022 ~May. 16, 2022

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

- ☐ FCC Part 15, Subpart B, Class A
☒ FCC Part 15, Subpart B, Class B
☒ ANSI C63.4:2014

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

Prepared by Simon Wang Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
	
Date: May. 16, 2022	Date: May. 16, 2022

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Test Report No.: W7L-P22040029EM01

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P22040029EM01	Original release	May. 16, 2022

1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

PRODUCT	telematics embedded system	
BRAND NAME	MUNIC	
MODEL NAME	C4D-4G4USAB_V8+	
NOMINAL VOLTAGE	DC13.7V	
MODULATION TYPE	BT_LE	GFSK
	Bluetooth	GFSK, $\pi/4$ -DQPSK, 8DPSK
	WLAN	DSSS, OFDM
	LTE	QPSK/16QAM
OPERATING FREQUENCY OPERATING FREQUENCY	Bluetooth/BT_LE	2402MHz ~ 2480MHz
	WLAN	2412 ~ 2462MHz for 11b/g/n(HT20/40) 5180 ~ 5240MHz, 5745 ~ 5825 MHz for 11a/ n(HT20)/ n(HT40) / ac(VHT20)/ ac(VHT40) / ac(VHT80)
	LTE	1850.7MHz ~ 1909.3MHz (FOR LTE Band2) 1710.7MHz ~ 1754.3MHz (FOR LTE Band4) 824.7MHz ~ 848.3MHz (FOR LTE Band5) 699.7MHz ~ 715.3MHz (FOR LTE Band12) 1710.7MHz ~ 1779.3MHz (FOR LTE Band66) 665.5MHz ~ 695.5MHz (FOR LTE Band71)
HW VERSION	HW.01	
SW VERSION	SW.01	
I/O PORTS	Refer to user's manual	
CABLE SUPPLIED	N/A	
ACCESSORY DEVICES	Refer to note as below	

NOTE:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

List of Accessory:

ACCESSORIES	BRAND	MODEL	SPECIFICATION
Battery 1	Howell	Li-polymer 552535H	Capacity: Li-ion, 270mAh
Battery 2	Akkutronics	382530-PTL	Capacity: Li-ion, 270mAh

1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart B		
Standard Section	Test Item	Result
FCC Part 15, Subpart B, Class B ANSI C63.4:2014	Conducted Test	Compliance
	Radiated Emission Test (30MHz ~ 1GHz)	Compliance
	Radiated Emission Test (Above 1GHz)	Compliance

1.3 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:

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

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	150kHz ~ 30MHz	±2.70dB
Radiated emissions	30MHz~1GMHz	±4.98dB
	1GMHz ~6GMHz	±4.70dB
	6GMHz ~18GMHz	±4.60dB
	18GMHz ~40GMHz	±4.12dB



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1.4 DESCRIPTION OF TEST MODES

Test Mode	Test Condition
Radiated emission test	
1	DC13.7V Working+Config

NOTE:

1. For radiated emission test, Pre-scan all mode, test mode 1 was the worst case and only this mode was presented in this report

1.5 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.

FOR ALL TESTS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC Source	Kikusui/JP	PMX18-5A	N/A	N/A
2	DC Cable	kistler	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A
2	N/A

2 EMISSION TEST

2.1 CONDUCTED EMISSION MEASUREMENT

2.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107 a CLASS B)

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107 b CLASS A)

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

NOTE: 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.

2.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR3	101900	Feb. 15,22	Feb. 14,23
EMC32 test software	Rohde&Schwarz	EMC32	NA	NA	NA
LISN network	Rohde&Schwarz	ENV216	101922	Mar. 04,22	Mar. 03,23

NOTE: 1. The test was performed in CE shielded room.

2.1.3 TEST PROCEDURES

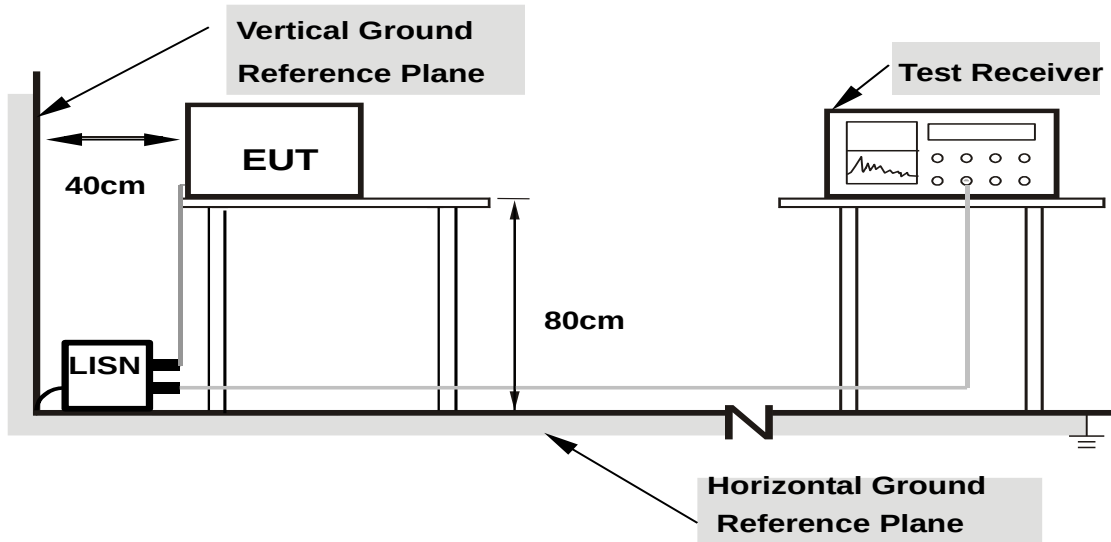
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

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

2.1.4 DEVIATION FROM TEST STANDARD

No deviation.

2.1.5 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).

2.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power and connected of all equipment.
- b. EUT was operated according to the use type described in the manufacturer's specifications or the user's manual.

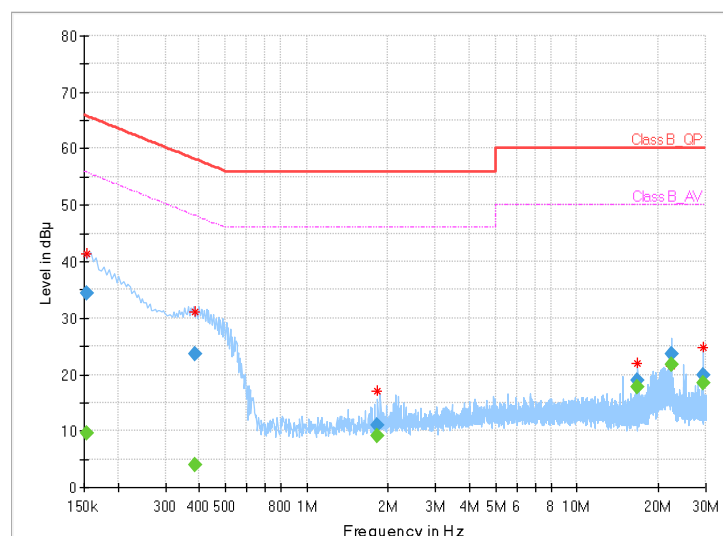
2.1.7 TEST RESULTS

TEST VOLTAGE	Input 120 Vac, 60 Hz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
ENVIRONMENTAL CONDITIONS	26deg. C, 51%RH	TESTED BY	Carl xie

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.154000	---	9.64	55.78	46.14	L1	ON	9.7
0.154000	34.33	---	65.78	31.45	L1	ON	9.7
0.384000	---	3.95	48.19	44.24	L1	ON	9.7
0.384000	23.54	---	58.19	34.65	L1	ON	9.7
1.828000	---	9.19	46.00	36.81	L1	ON	9.7
1.828000	11.01	---	56.00	44.99	L1	ON	9.7
16.800000	---	17.79	50.00	32.21	L1	ON	9.8
16.800000	18.87	---	60.00	41.13	L1	ON	9.8
22.400000	---	21.81	50.00	28.19	L1	ON	9.8
22.400000	23.67	---	60.00	36.33	L1	ON	9.8
29.488000	---	18.45	50.00	31.55	L1	ON	9.8
29.488000	19.92	---	60.00	40.08	L1	ON	9.8

- 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 = Limit value - Emission level
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum

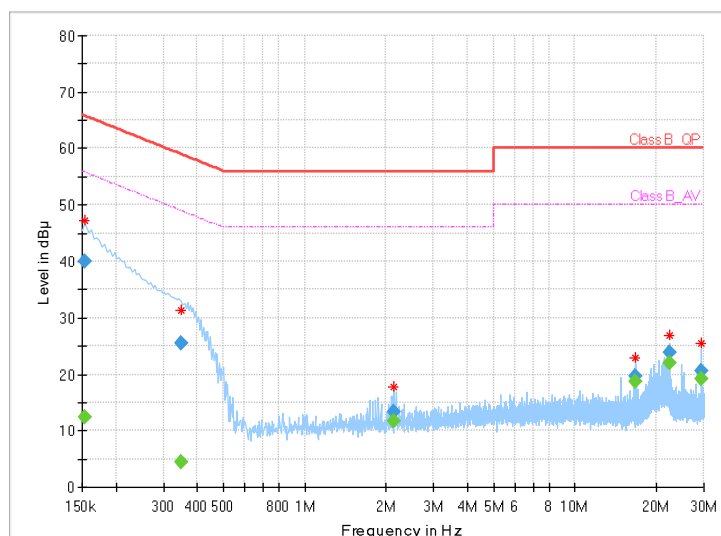


TEST VOLTAGE	Input 120 Vac, 60 Hz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
ENVIRONMENTAL CONDITIONS	26deg. C, 51%RH	TESTED BY	Carl xie

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.154000	---	12.40	55.78	43.38	N	ON	9.7
0.154000	39.92	---	65.78	25.86	N	ON	9.7
0.348000	---	4.55	49.01	44.46	N	ON	9.7
0.348000	25.54	---	59.01	33.47	N	ON	9.7
2.140000	---	11.72	46.00	34.28	N	ON	9.8
2.140000	13.26	---	56.00	42.74	N	ON	9.8
16.804000	---	18.70	50.00	31.30	N	ON	9.9
16.804000	19.62	---	60.00	40.38	N	ON	9.9
22.408000	---	21.95	50.00	28.05	N	ON	9.9
22.408000	23.83	---	60.00	36.17	N	ON	9.9
29.492000	---	19.17	50.00	30.83	N	ON	9.9
29.492000	20.65	---	60.00	39.35	N	ON	9.9

- 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 = Limit value - Emission level
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum



2.2 RADIATED EMISSION MEASUREMENT

2.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.109)

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

Radiated Emissions Limits at 3 meters (dBμV/m)		
Frequencies (MHz)	FCC 15B, Class A	FCC 15B, Class B
30-88	49	40
88-216	53.5	43.5
216-960	56	46
960-1000	59.5	54
Above 1000	Avg: 59.5 Peak: 79.5	Avg: 54 Peak: 74

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5 th harmonic of the highest frequency or 40GHz, whichever is lower

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
 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.
 4. QP detector shall be applied if not specified.

2.2.2 TEST INSTRUMENTS

Frequency range below 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 06,22	Mar. 05,23
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Feb. 21,22	Feb. 20,23
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jun. 02,21	Jun. 01,22
Test Software	ADT	ADT_Radiated V8.7.07	N/A	N/A	N/A

Frequency range above 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Horn Antenna	ETS-LINDGREN	3117	00168728	Apr. 02,21	Apr. 01,22
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Apr. 22,21	Apr. 21,22
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jun. 03,21	Jun. 02,22

- NOTE:**
1. The calibration interval of the above test instruments is 12 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
 2. The test was performed in 966 Chamber (a 3m Semi-anechoic chamber).

2.2.3 TEST PROCEDURE

<Frequency Range below 1GHz>

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
3. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
4. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier).
5. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

<Frequency Range above 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.
- 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 and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz

NOTE:

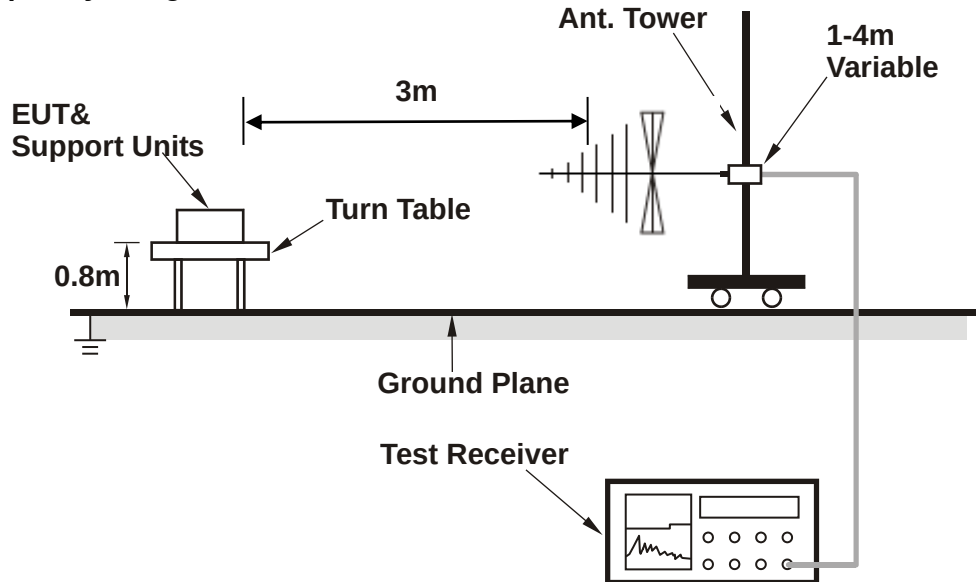
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 1Hz for Average detection (AV) at frequency above 1GHz.
3. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
4. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
5. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
6. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier)
7. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

2.2.4 DEVIATION FROM TEST STANDARD

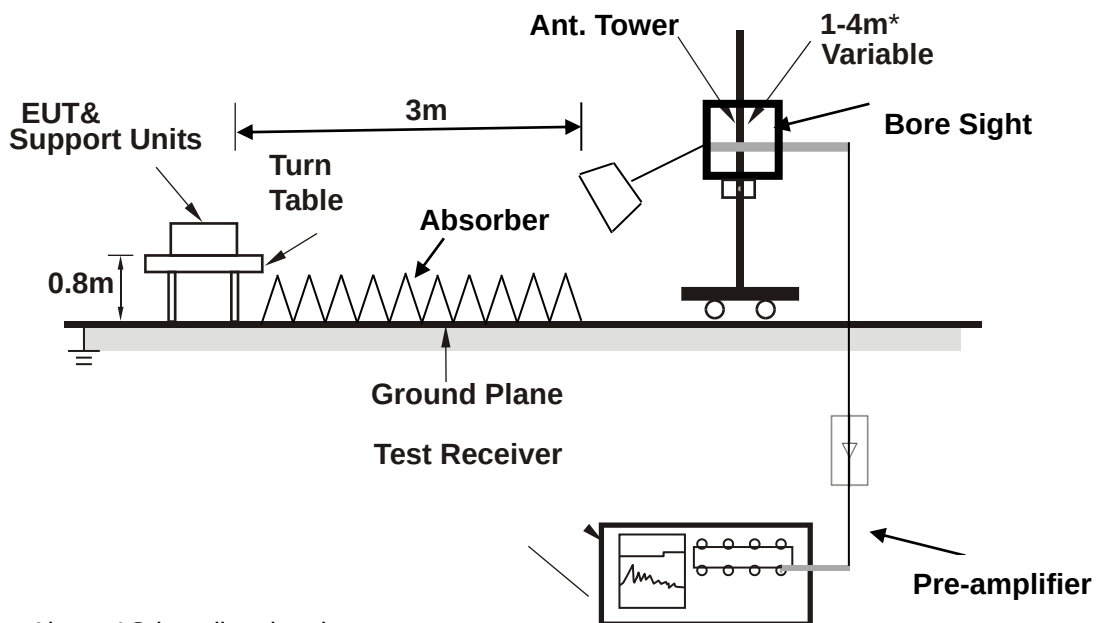
No deviation.

2.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

depends on the EUT height and the antenna 3dB bandwidth both, refer to section 7.3 of CISPR 16-2-3.

2.2.6 EUT OPERATING CONDITIONS

Same as item 2.1.6.

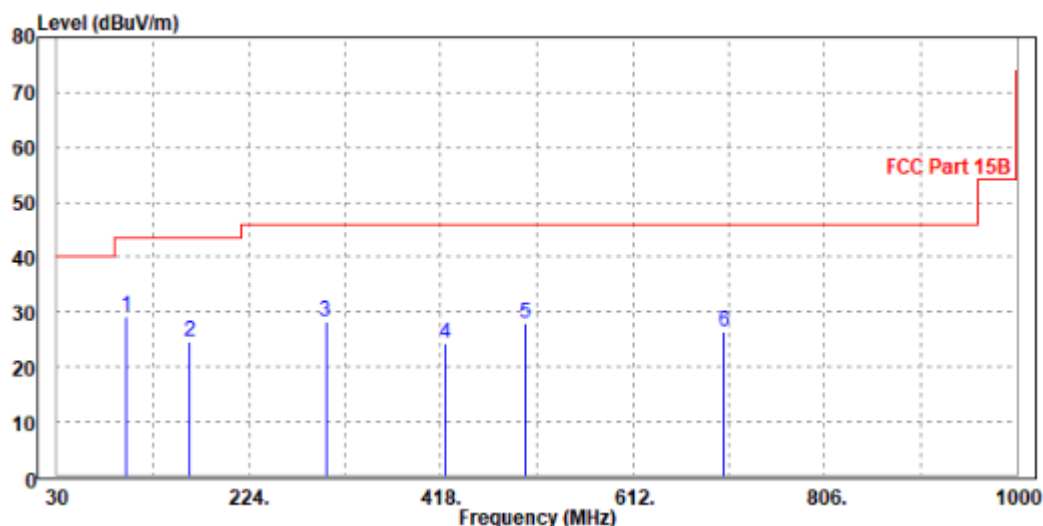
2.2.7 TEST RESULTS

Below 1GHz worst case :

TEST VOLTAGE	DC 13.7V	FREQUENCY RANGE	30-1000 MHz
ENVIRONMENTAL CONDITIONS	25.3deg. C, 51 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak, 120 kHz
TESTED BY	Jace Hu		

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1 PP	100.810	29.07	55.24	43.50	-14.43	-26.17	Peak	Horizontal
2	163.860	24.65	49.68	43.50	-18.85	-25.03	Peak	Horizontal
3	301.600	28.35	50.15	46.00	-17.65	-21.80	Peak	Horizontal
4	422.850	24.19	43.32	46.00	-21.81	-19.13	Peak	Horizontal
5	503.360	28.10	45.73	46.00	-17.90	-17.63	Peak	Horizontal
6	703.180	26.33	40.76	46.00	-19.67	-14.43	Peak	Horizontal

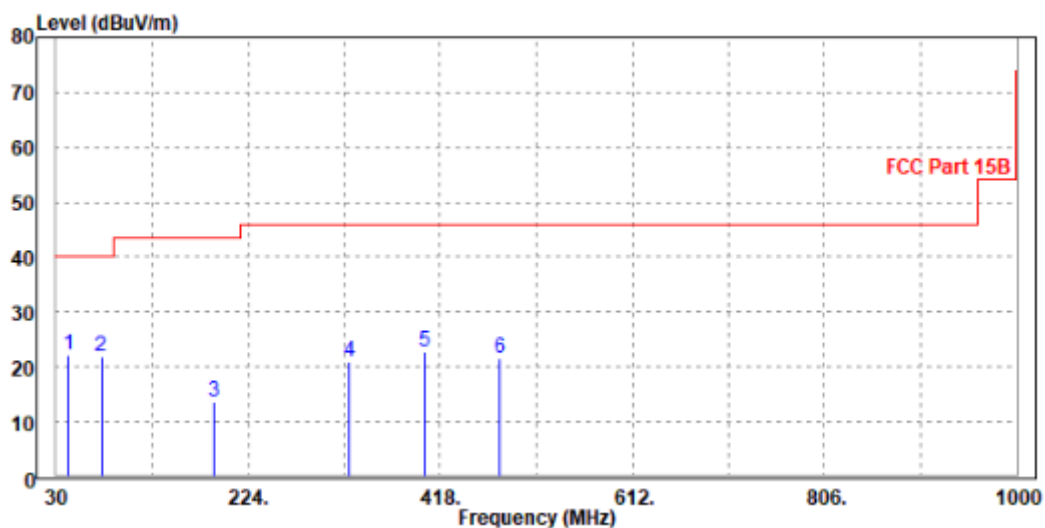
- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 30MHz to 1000MHz.
 4. Only emissions significantly above equipment noise floor are reported.



TEST VOLTAGE	DC 13.7V	FREQUENCY RANGE	30-1000 MHz
ENVIRONMENTAL CONDITIONS	25.3deg. C, 51 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak, 120 kHz
TESTED BY	Jace Hu		

		Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
		MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	PP	42.610	22.17	47.43	40.00	-17.83	-25.26	Peak	Vertical
2		75.590	21.97	51.01	40.00	-18.03	-29.04	Peak	Vertical
3		189.080	13.73	38.27	43.50	-29.77	-24.54	Peak	Vertical
4		326.820	20.85	42.05	46.00	-25.15	-21.20	Peak	Vertical
5		402.480	22.93	42.35	46.00	-23.07	-19.42	Peak	Vertical
6		478.140	21.50	39.95	46.00	-24.50	-18.45	Peak	Vertical

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 30MHz to 1000MHz.
 4. Only emissions significantly above equipment noise floor are reported.

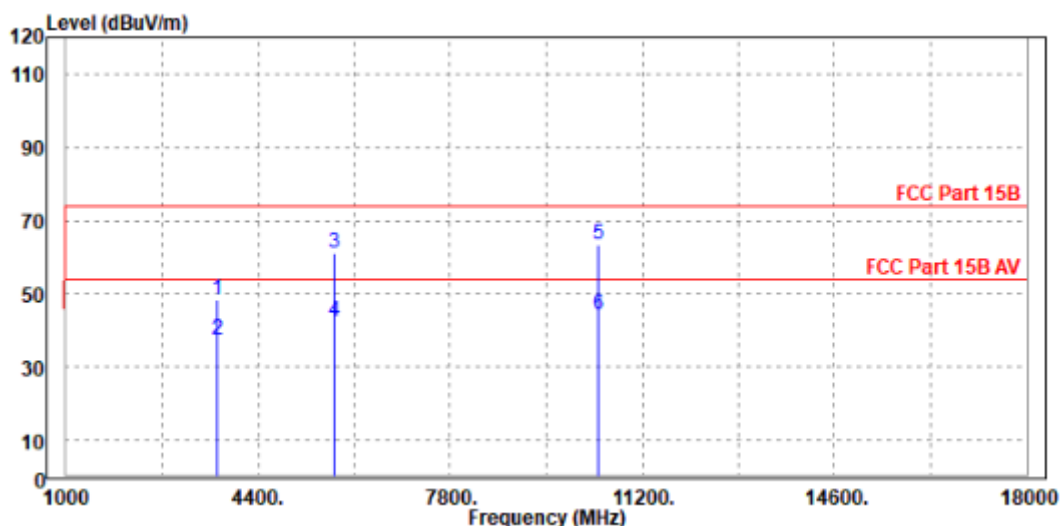


Above 1GHz worst case

TEST VOLTAGE	DC 13.7V	FREQUENCY RANGE	1-18 GHz
ENVIRONMENTAL CONDITIONS	25.3deg. C, 51 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Peak/Average, 1 MHz
TESTED BY	Jace Hu		

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	3669.000	48.29	54.08	74.00	-25.71	-5.79	Peak	Horizontal
2	3669.000	37.47	43.26	54.00	-16.53	-5.79	Average	Horizontal
3	5743.000	61.10	60.92	74.00	-12.90	0.18	Peak	Horizontal
4	5743.000	42.53	42.35	54.00	-11.47	0.18	Average	Horizontal
5	PK10418.000	63.40	59.54	74.00	-10.60	3.86	Peak	Horizontal
6	PP10418.000	44.44	40.58	54.00	-9.56	3.86	Average	Horizontal

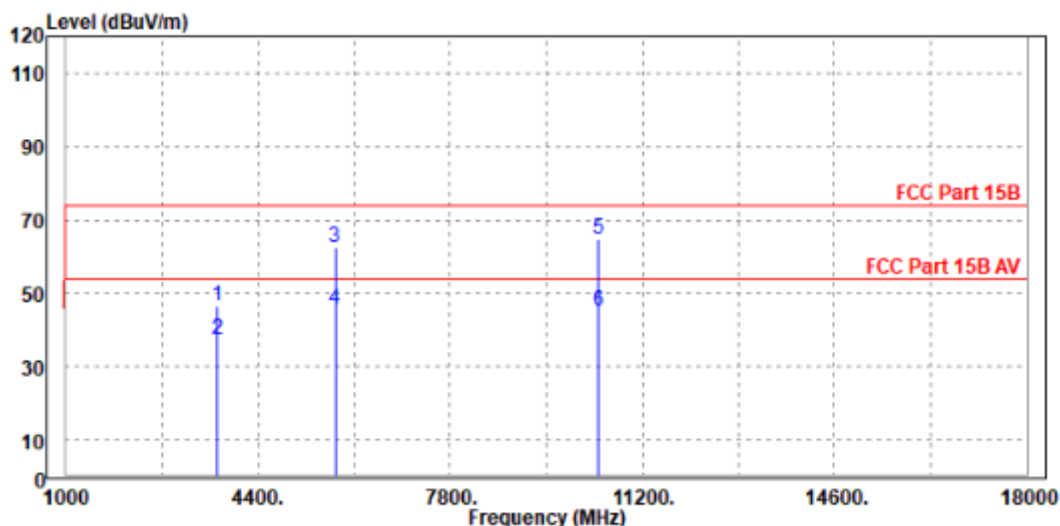
- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 1GHz to 30GHz. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet
 4. Only emissions significantly above equipment noise floor are reported.



TEST VOLTAGE	DC 13.7V	FREQUENCY RANGE	1-18 GHz
ENVIRONMENTAL CONDITIONS	25.3deg. C, 51 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Peak/Average, 1 MHz
TESTED BY	Jace Hu		

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	3669.000	46.58	52.47	74.00	-27.42	-5.89	Peak	Vertical
2	3669.000	37.26	43.15	54.00	-16.74	-5.89	Average	Vertical
3	5760.000	62.55	62.48	74.00	-11.45	0.07	Peak	Vertical
4	PP 5760.000	45.44	45.37	54.00	-8.56	0.07	Average	Vertical
5	PK10418.000	64.63	59.55	74.00	-9.37	5.08	Peak	Vertical
6	10418.000	45.36	40.28	54.00	-8.64	5.08	Average	Vertical

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 1GHz to 30GHz. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet
 4. Only emissions significantly above equipment noise floor are reported.



3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

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

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