

Test Report

FCC ID:2ANP2-TT01

Date of issue: Apr. 02, 2018

Report Number:	MTi180205E032
Sample Description:	TPMS Service Tool
Model(s):	AT60
Applicant:	Shenzhen Auzone Technology Co., Ltd
Address:	404, fuyuan waterfront building, 47 district, baoan district, shenzhen, China
Date of Test:	Sep. 08, 2017 to Mar. 21, 2018

Shenzhen Microtest Co., Ltd.
<http://www.mtitest.com>

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TEST REPORT

Applicant's name: Shenzhen Auzone Technology Co., Ltd

Address: 404, fuyuan waterfront building, 47 district, baoan district, shenzhen, China

Manufacture's Name: Shenzhen Auzone Technology Co., Ltd

Address: 404, fuyuan waterfront building, 47 district, baoan district, shenzhen, China

Product name: TPMS Service Tool

Trademark: N/A

Model name: AT60

Standards: FCC PART 15 Subpart C

Test Procedure: ANSI C63.10:2013

This device described above has been tested by Shenzhen Microtest Co., Ltd and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by:

Amy Lu

Amy Lu

Mar. 21, 2018

Reviewed by:

Blue Zheng

Blue Zheng

Apr. 02, 2018

Approved by:

Smith Chen

Smith Chen

Apr. 02, 2018

1 General Information

1.1 Description of EUT

Product Name:	TPMS Service Tool
Model Name:	AT60
Operating Frequency Range:	125kHz
Modulation Type:	ASK
Power Source:	DC 5V from adapter AC120V/60Hz
Adapter information:	Model:A122-0502002IU Input:100-240V~ 50/60Hz, 0.4A Output: 5V 2000mA
Antenna Type:	Magnet Antenna(Antenna Gain: -4.46dBi)
Hardware Version:	V01.00
Software Version:	V01.00

1.2 Operation channel list

Channel No.	Frequency(kHz)
1	125

1.3 Test Frequency Channel

Channel No.	Frequency(kHz)
1	125

1.4 EUT operation mode

During testing, RF test program provided by the manufacture to control the Tx operation followed the test requirement.

1.5 Test conditions

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

- Temperature: 20°C~30°C
- Humidity: 30%~70%
- Atmospheric pressure: 98kPa~101kPa

1.6 Ancillary equipment list

Equipment	Model	S/N	Manufacturer
Adapter	A122-0502002IU	/	/

1.7 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, $U=2 \times U_c(y)$

RF frequency	1×10^{-7}
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	± 1 degree
Humidity	± 5 %

2 Summary of Test Results

Item	FCC Part No.	Description of Test	Result
1	FCC PART 15.207	Conducted emission	Pass
2	FCC PART 15.209	Radiated emission	Pass
3	FCC Part 15.215	20dB bandwidth	Pass

3 Testing site

Test Laboratory	Shenzhen Microtest Co., Ltd
Location	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
FCC Registration No.:	448573

4 List of test equipment

Software Name: EMI Measurement Software						
Manufacturer: Farad						
Model: EZ-EMC						
Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E001	Spectrum Analyzer	Agilent	E4407B	MY41441082	2017/09/18	2018/09/17
MTI-E002	CMU 200 universal radio communication tester	Rohde&schwarz	CMU 200	114587	2017/09/18	2018/09/17
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI	1000314	2017/09/18	2018/09/17
MTI-E006	Broadband antenna	schwarabeck	VULB9163	872	2017/09/18	2018/09/17
MTI-E007	Horn antenna	schwarabeck	BBHA9120D	1201	2017/09/18	2018/09/17
MTI-E014	amplifier	America	8447D	3113A06150	2017/09/18	2018/09/17
MTI-E015	Conduction Immunity Signal Generator	Schloder	CDG6000	126A1343/2015	2017/09/18	2018/09/17
MTI-E016	Coupled decoupling network	Schloder	CDA M2/M3	A2210332/2015	2017/09/18	2018/09/17
MTI-E032	Comprehensive test instrument	Rohde&schwarz	CMW500	124192	2017/04/13	2018/04/12
MTI-E034	amplifier	Agilent	8449B	3008A02400	2017/08/22	2018/08/21
MTI-E040	Spectrum analyzer	Agilent	N9020A	MY49100060	2017/03/04	2018/03/04
MTI-E041	Signal generator	Agilent	N5182A	MY49060455	2017/02/22	2018/02/22
MTI-E042	Analog signal generator	Agilent	E4421B	GB40051240	2017/02/22	2018/02/22
MTI-E043	Power probe	Dare Instruments	RPR3006W	16I00054SNO16	2017/02/28	2018/02/28
MTI-E047	10dB attenuator	Mini-Circuits	UNAT-10+	15542	2017/05/23	2018/05/23
MTI-E049	spectrum analyzer	Rohde&schwarz	FSP-38	100019	2017/09/18	2018/09/17
MTI-E050	PSG Signal generator	Agilent	E8257D	MY46520873	2017/04/24	2018/04/23
MTI-E051	Active Loop Antenna 9kHz - 30MHz	Schwarzbeek	FMZB 1519 B	00044	2017//2/26	2018/02/25
MTI-E052	18-40GHz amplifier	Chengdu step Micro Technology	ZLNA-18-40G-21	1608001	2017/09/18	2018/09/17
MTI-E053	15-40G Antenna	Schwarzbeek	BBHA9170	BBHA9170582	2017/09/18	2018/09/17
MTI-E054	LISN	R&S	ENV216	1001131	2017/09/18	2018/09/17
MTI-E055	Test Cable	United Microwave	57793	1m	2017/09/18	2018/09/17
MTI-E056	Test Cable	United Microwave	A30A30-5006	10m	2017/09/18	2018/09/17
Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).						

5 Test Result

5.1 Conducted emission

5.1.1 Limits

For the following equipment, when designed to be connected to the public utility (AC) power line the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies shall not exceed the limits in the following tables. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.5 -5	56	46
5 -30	60	50

Note : the limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

5.1.2 Test Procedures

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

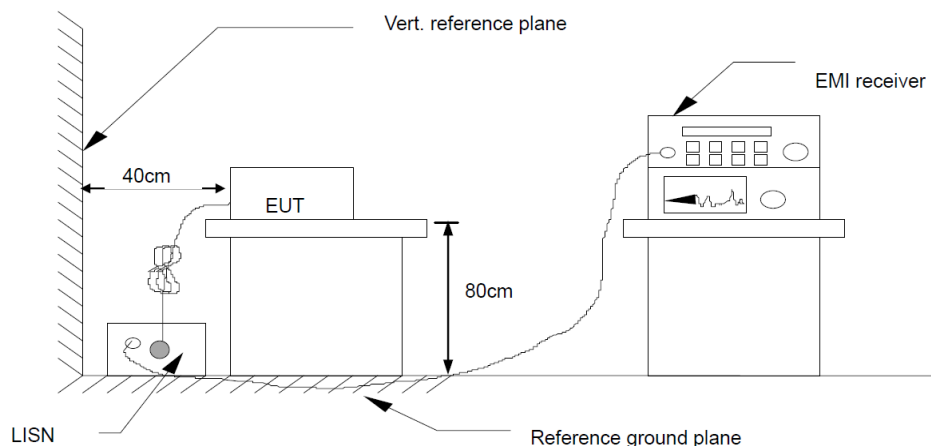
Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN is at least 80 cm from nearest part of EUT chassis.

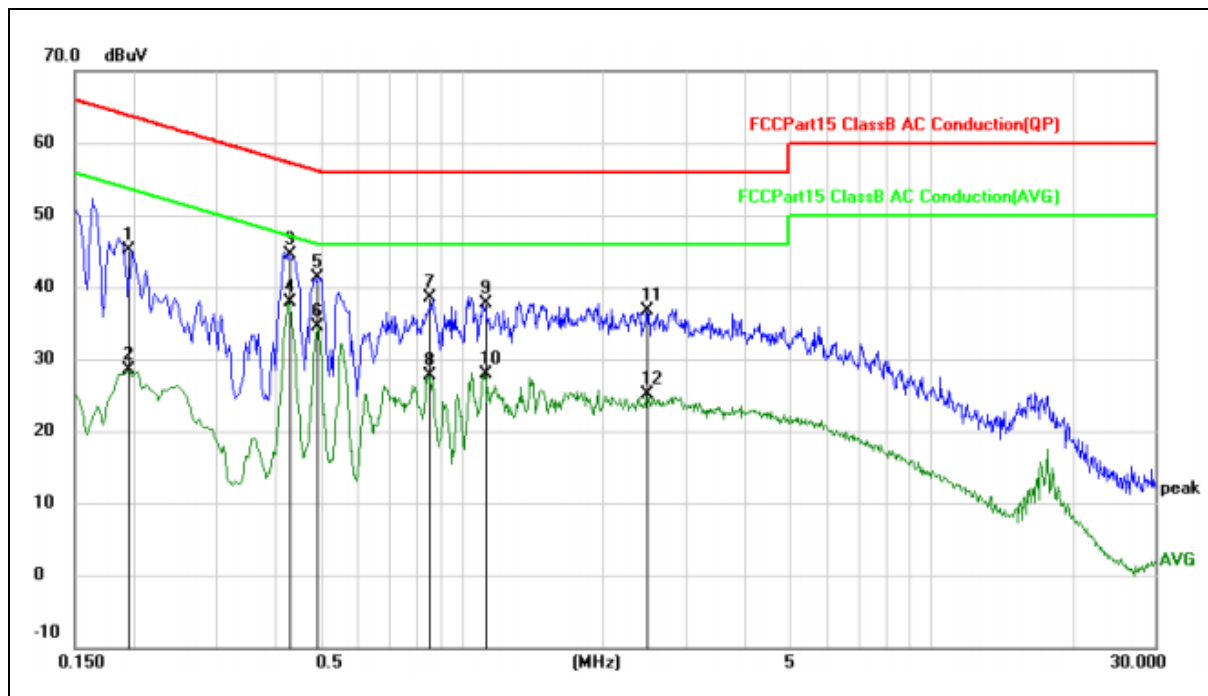
For the actual test configuration, please refer to the related Item – photographs of the test setup.

5.1.3 Test Setup



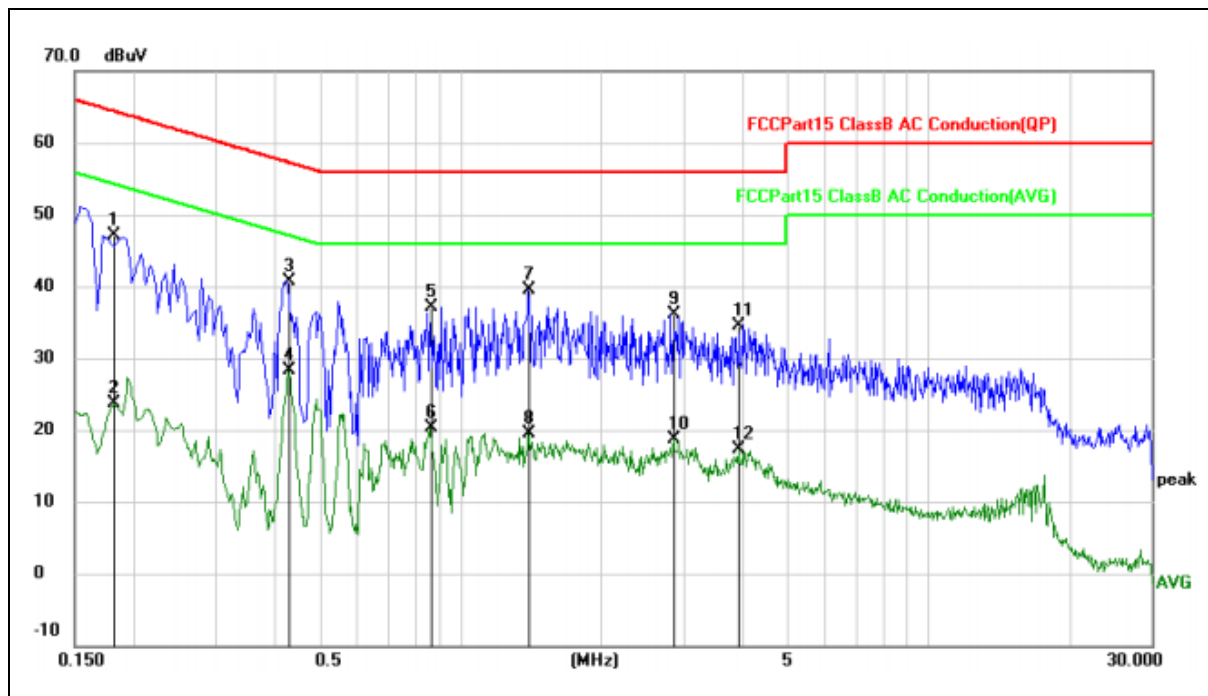
5.1.4 Test Result

Temperature:	27℃	Relative Humidity:	65%
Pressure:	101kPa	Phase:	L
Test voltage:	DC 5V from adapter AC120V/60Hz	Test mode:	TX mode



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1949	45.12	-0.03	45.09	63.83	-18.74	QP	
2		0.1949	28.44	-0.03	28.41	53.83	-25.42	AVG	
3		0.4290	44.58	-0.03	44.55	57.27	-12.72	QP	
4	*	0.4290	37.92	-0.03	37.89	47.27	-9.38	AVG	
5		0.4920	41.24	-0.03	41.21	56.13	-14.92	QP	
6		0.4920	34.57	-0.03	34.54	46.13	-11.59	AVG	
7		0.8565	38.63	-0.04	38.59	56.00	-17.41	QP	
8		0.8565	27.80	-0.04	27.76	46.00	-18.24	AVG	
9		1.1220	37.67	-0.04	37.63	56.00	-18.37	QP	
10		1.1220	28.00	-0.04	27.96	46.00	-18.04	AVG	
11		2.4855	36.79	-0.05	36.74	56.00	-19.26	QP	
12		2.4855	25.19	-0.05	25.14	46.00	-20.86	AVG	

Temperature:	27°C	Relative Humidity:	65%
Pressure:	101kPa	Phase:	N
Test voltage:	DC 5V from adapter AC120V/60Hz	Test mode:	TX mode



No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1		0.1815	47.13	-0.03	47.10	64.42	-17.32	QP	
2		0.1815	23.66	-0.03	23.63	54.42	-30.79	AVG	
3	*	0.4290	40.78	-0.03	40.75	57.27	-16.52	QP	
4		0.4290	28.31	-0.03	28.28	47.27	-18.99	AVG	
5		0.8655	37.13	-0.04	37.09	56.00	-18.91	QP	
6		0.8655	20.28	-0.04	20.24	46.00	-25.76	AVG	
7		1.3965	39.48	-0.04	39.44	56.00	-16.56	QP	
8		1.3965	19.46	-0.04	19.42	46.00	-26.58	AVG	
9		2.8545	36.23	-0.04	36.19	56.00	-19.81	QP	
10		2.8545	18.79	-0.04	18.75	46.00	-27.25	AVG	
11		3.9345	34.65	-0.05	34.60	56.00	-21.40	QP	
12		3.9345	17.28	-0.05	17.23	46.00	-28.77	AVG	

5.2 Radiated Emission

5.2.1 Limit

In case the emission fall within the restricted band specified on RSS-GEN, then the RSS-310 limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

The limit for radiated test was performed according to FCC PART 15C.

The tighter limit applies at the band edges.

Emission level (dBuV/m)=20log Emission level (uV/m).

FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	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 40 GHz, whichever is lower

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for PK/AV
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for PK/AV/QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

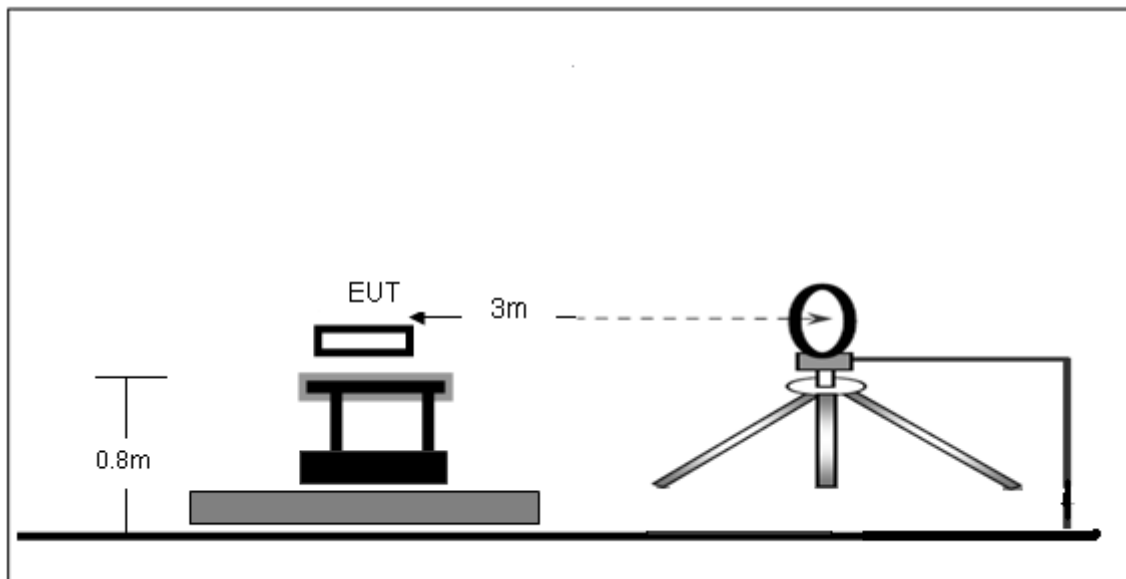
5.2.2 Test method

- a. The measuring distance of at 3 m shall be used for measurements at frequency up to 25GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-chamber test. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8m; above 1GHz, the height was 1.5m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.
- g. For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
- h. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

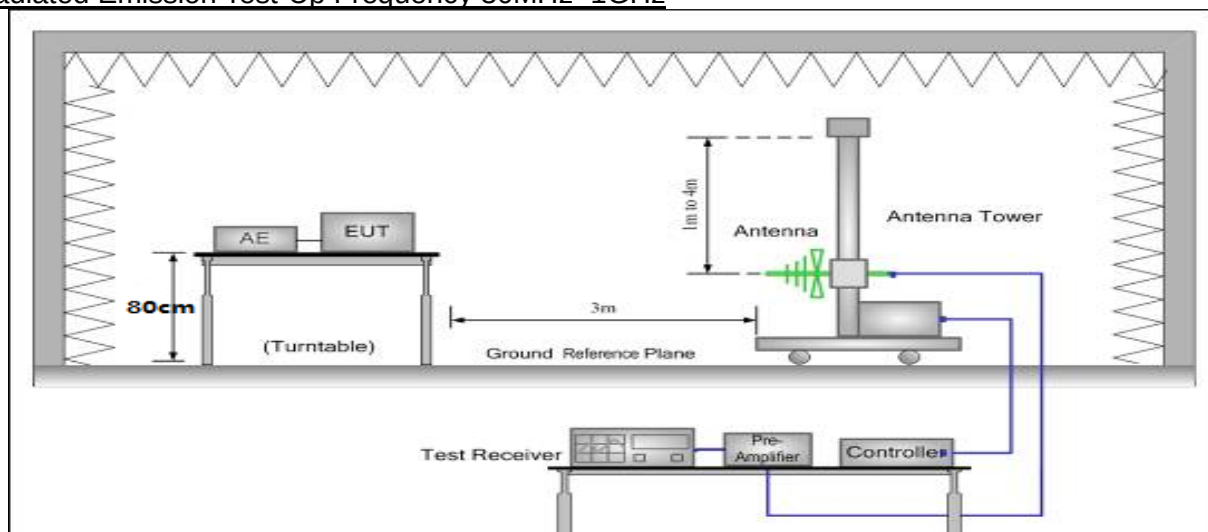
Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

5.2.3 Test Setup

Radiated Emission Test-Up Frequency Below 30MHz



Radiated Emission Test-Up Frequency 30MHz~1GHz



5.2.4 Test result

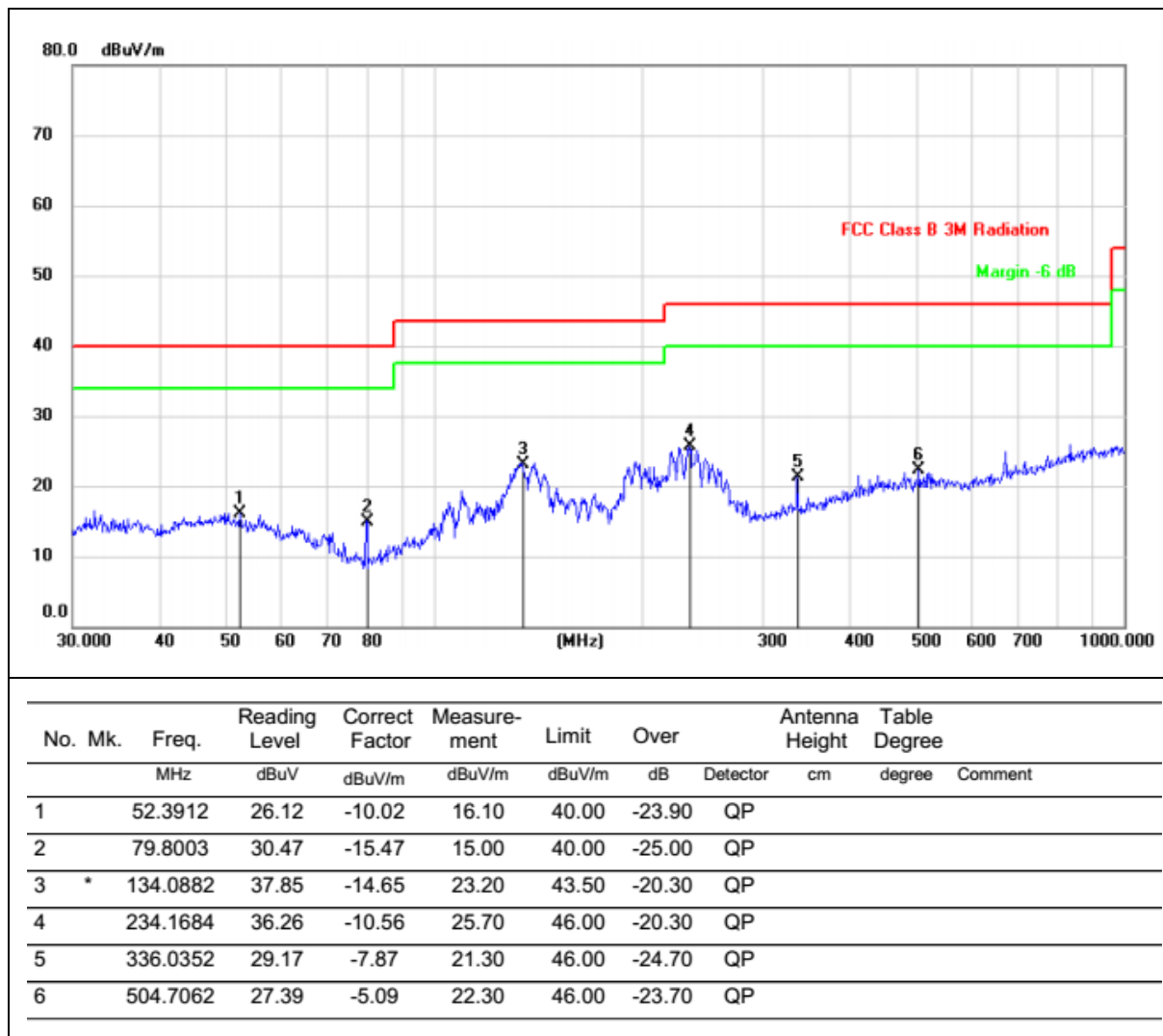
Temperature:	26℃	Relative Humidity:	54%
Test voltage:	DC 5V from adapter AC120V/60Hz	Test mode:	TX mode

Spurious Radiated Emission Below 30MHz:

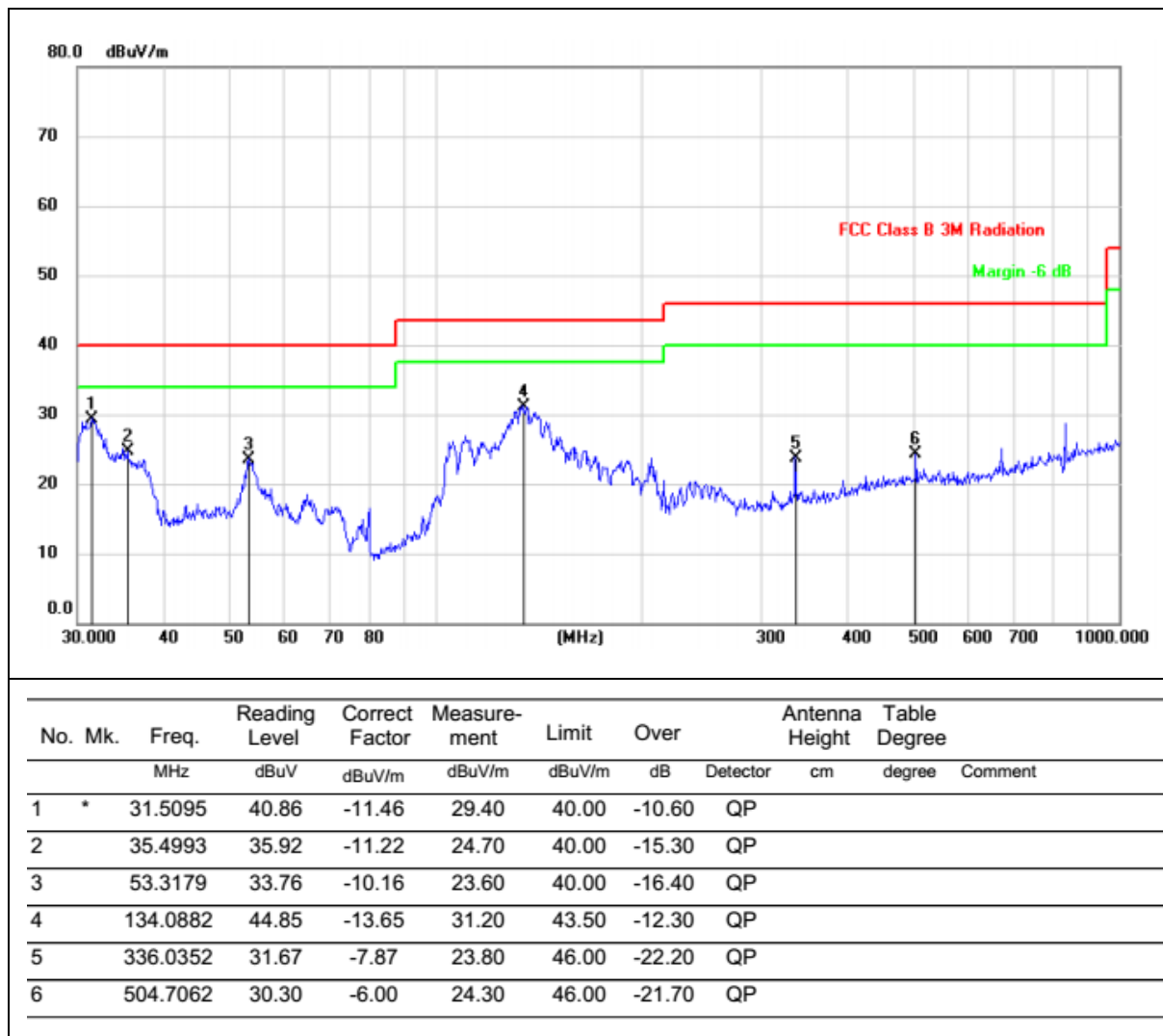
Frequency	Reading	Detector	Ant. Factor	Cable	Emission	Limits	Margin
(KHz)	(dBμV)	(PK/QP/AV)	(dB/m)	Loss	Level (dBμV/m)	(dBμV/m)	(dB)
12	72.36	PK	27.96	0.1	100.42	148.52	-48.1
12	57.61	AV	27.96	0.1	85.67	128.52	-42.85
48	70.96	PK	21.63	0.1	92.69	136.48	-43.79
48	54.38	AV	21.63	0.1	76.11	116.48	-40.37
110	75.69	PK	10.01	0.1	85.8	126.78	-40.98
110	60.58	AV	10.01	0.1	70.69	106.78	-36.09
125	94.59	PK	8.94	0.1	103.63	126.08	-22.45
125	78.46	AV	8.94	0.1	87.5	106.08	-18.58
495	53.62	QP	-15.91	0.1	37.81	72.73	-34.92
495	42.36	QP	-16.45	0.8	26.71	53.98	-27.27

1. "*" Means Fundamental frequency
2. Emission Level(dBμV/m)=Reading(dBμV)+ Ant. Factor(dB/m)+ Cable Loss(dB)
3. Margin (dB)=Emission Level(dBμV/m)- Limits(dBμV/m)
4. Limit calculation: Limit at specified distance +40log(300/3)= Limit+80 dB for up to 0.49MHz
Limit at specified distance +40log(30/30)= Limit+40dB for above 0.49MHz,Below30MHz

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Horizontal
Test voltage:	DC 5V from adapter AC120V/60Hz	Test mode:	TX mode



Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test voltage:	DC 5V from adapter AC120V/60Hz	Test mode:	TX mode



5.3 Occupied bandwidth

5.3.1 Test method

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW $\geq 1\%$ of the 20 dB bandwidth

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth and 99% occupied bandwidth of the emission.

5.3.2 Test result

ASK

Frequency (kHz)	20dB emission bandwidth (kHz)	99% occupied bandwidth (kHz)
125	2.772	2.387

Test plots as below

ASK

