Registration
No.788871

TEST REPORT
FOR SRD TESTING

Report No: SRTC2018-9004(F)-18011503(N)

Product Name: Wireless Vehicle Key

Product Model: 13522774

Applicant: VAST China Co., Ltd

Manufacturer: VAST China Co., Ltd

Specification: FCC Part 15 Subpart C § 15.231

FCC ID: 2AOUX-13522774

The State Radio_monitoring_center Testing Center (SRTC)

15th Building, No.30, Shixing Street, Shijingshan District, Beijing, P.R.China

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1. GENERAL INFORMATION

1.1 Notes of the test report

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The test results relate only to individual items of the samples which have been tested.

1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Address:	15th Building, No.30 Shixing Street, Shijingshan District
City:	Beijing
Country or Region:	P.R.China
Contacted person:	Liu Jia
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1.3 Applicant's details

Company:	VAST China Co., Ltd
Address:	No. 89 East Guangzhou Road, Taicang China
City:	Taicang
Country or Region:	China
Contacted person:	Wu Rengang
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Fax:	86-512-53202555
Email:	rengang.wu@vastchina.cn

1.4 Manufacturer's details

Company:	VAST China Co., Ltd
Address:	No. 89 East Guangzhou Road, Taicang China
City:	Taicang
Country or Region:	China
Contacted person:	Wu Rengang
Tel:	86-18626171648
Fax:	86-512-53202555
Email:	rengang.wu@vastchina.cn

1.5 Test environment

Date of Receipt of test sample at SRTC:	2018-01-15
Testing Start Date:	2018-01-16
Testing End Date:	2018-02-02

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient	22-25	30-45

Normal Supply Voltage (V d.c.):	3.00

2. DETAILS OF EQUIPMENT UNDER TEST

2.1 Final equipment builds status

Equipment Number	2
Operating Frequency	433.92MHz
Antenna Type	PCB Printed loop Antenna
Antenna Gain	-15dBi
Modulation Type	ASK/FSK
Power Supply	Battery
Software Revision	502
Hardware Revision	F005V01391
SN	Sample1: 1# (ASK) Sample2: 2# (FSK)

2.2 Support equipment

The following support equipment was used to exercise the EUT during testing:

Equipment	Battery / Button cell
Manufacturer	Panasonic
Model Number	CR 2032
Serial Number	---

2.3 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	RE ≥ 1G	RE<1G	PLC	EB	DT	-
-	√	√	-	√	√	Power by New Battery

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

Radiated Emission Test (Above 1GHz):

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

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK / FSK

Radiated Emission Test (Below 1GHz):

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

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK / FSK

Emission Band Width 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	1	ASK / FSK

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	1	ASK / FSK

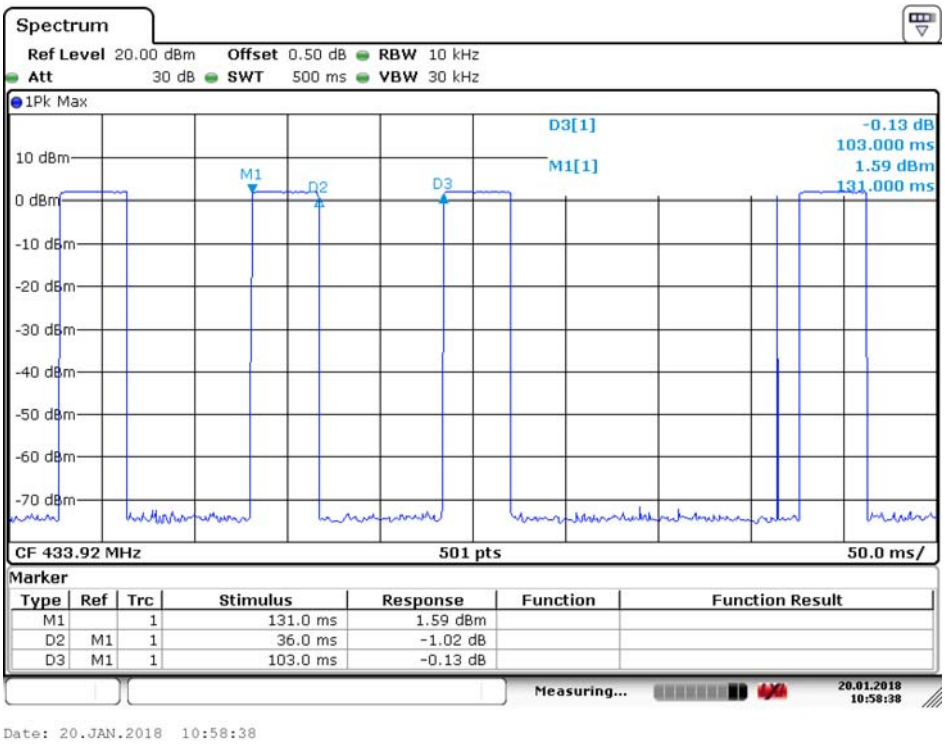
2.4 Duty Cycle of Test Signal

ASK:

Duty cycle of test signal is < 98 %, duty factor shall be considered.

Duty cycle = 36 ms/103 ms = 0.34 * 100 % = 34%

Factor = 20* log (duty cycle) =20 * log (0.34) = -9.37 dB

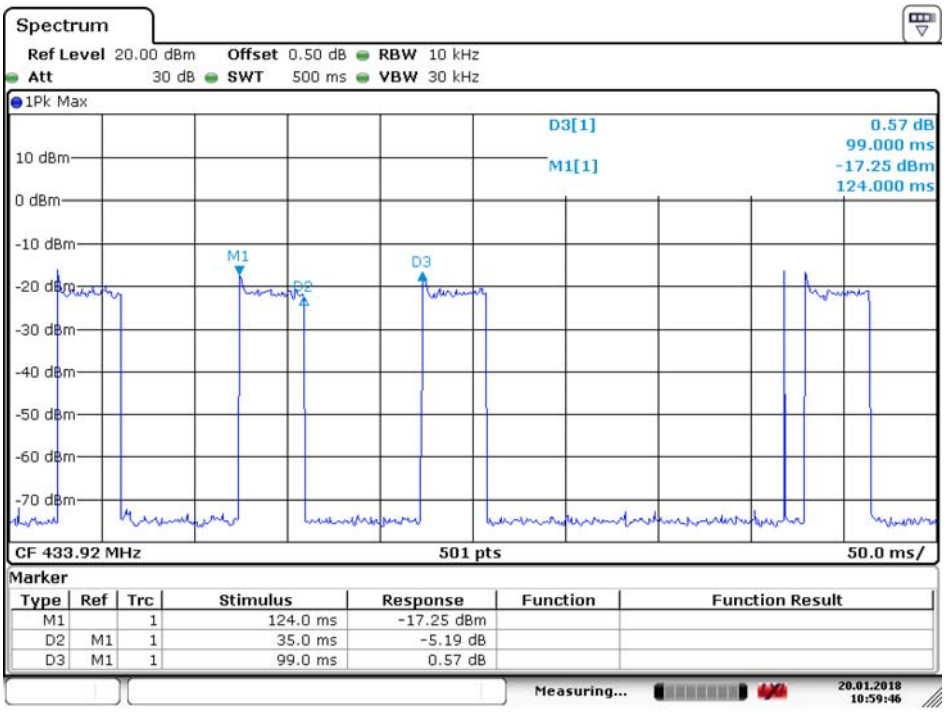


FSK:

Duty cycle of test signal is < 98 %, duty factor shall be considered.

Duty cycle = 35 ms/99 ms = 0.35 * 100 % = 35%

Factor = 20* log (duty cycle) =20 * log (0.35) = -9.12 dB



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3. REFERENCE SPECIFICATION

Specification	Version	Title
15.203	2018	Antenna Requirement
15.231(a)	2018	Deactivation time measurement
15.231(b)	2018	Field Strength Of Emissions
15.231(c)	2018	Bandwidth Requirement
ANSI C63.10	2013	Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

4. KEY TO NOTES AND RESULT CODES

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/A	Test case is not applicable.
N/T	Test case is not tested.

5. RESULT SUMMARY

The following tables reflect the requirements of the relevant specification and show the tests performed. Result files verifying these verdicts are available for inspection at SRTC.

NO.	Item	Results
1	Antenna Requirement	PASS (No antenna connector is used)
2	Deactivation time measurement	PASS
3	Field Strength of Emissions	PASS
4	Bandwidth Requirement	PASS
5	Antenna Requirement	PASS

This Test Report Is Issued by: Mr. Peng Zhen	Checked by: Mr. Li Bin
Tested by: Mr. Chang Taosha	Issued date: 20180209

6. TEST RESULTS

6.1 Deactivation time measurement

6.1.1 Ambient condition

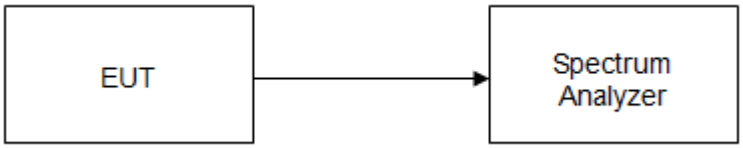
Temperature	Relative humidity	Pressure
23.0°C	32.0%	101.5kPa

6.1.2 Test conditions and test configuration

(a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

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

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



6.1.3 Test limit

≤5s

6.1.4 Test data

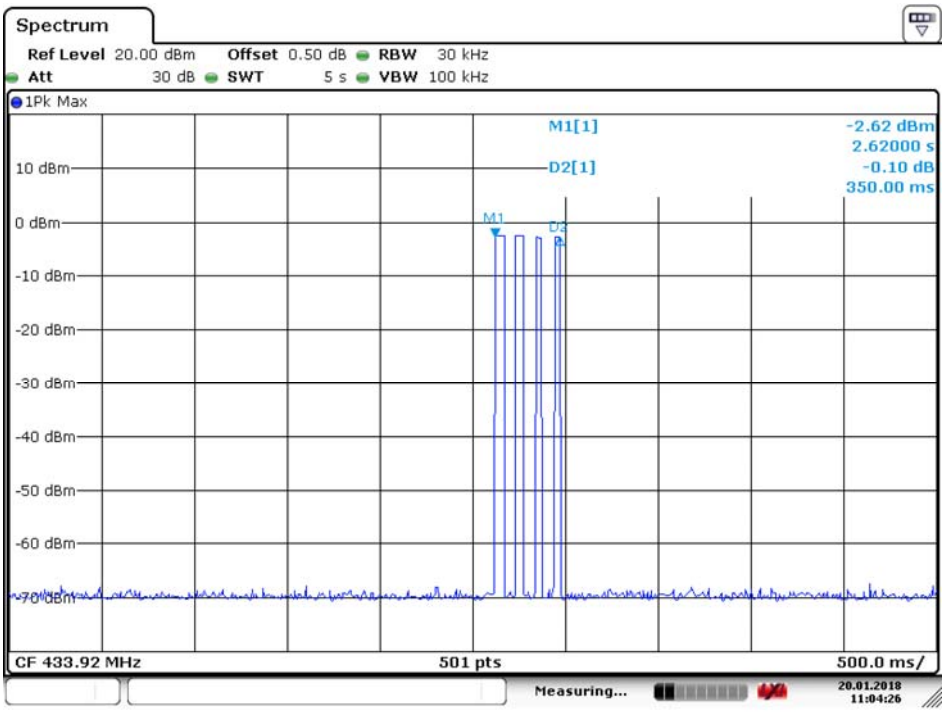
The EUT is a remote switch without audio or video transmitted.

The EUT meets the requirements of this section (a).

Deactivation time:

Modulation Type	Frequency (MHz)	Transmission Time (Second)	Limit (Second)	Results
ASK	433.92	0.35	5.0	Pass
FSK	433.92	0.34	5.0	Pass

ASK



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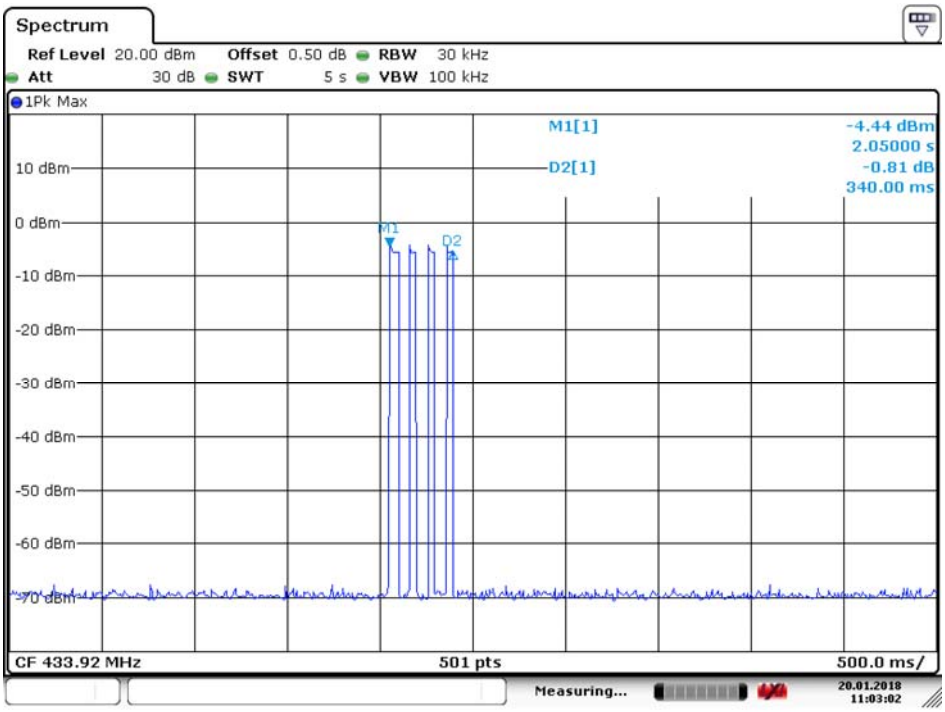
FSK



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6.2 Field Strength of Emissions

6.2.1 Ambient condition

Temperature	Relative humidity	Pressure
24.8°C	42.4%	100.9kPa

6.2.2 Test conditions and test configuration

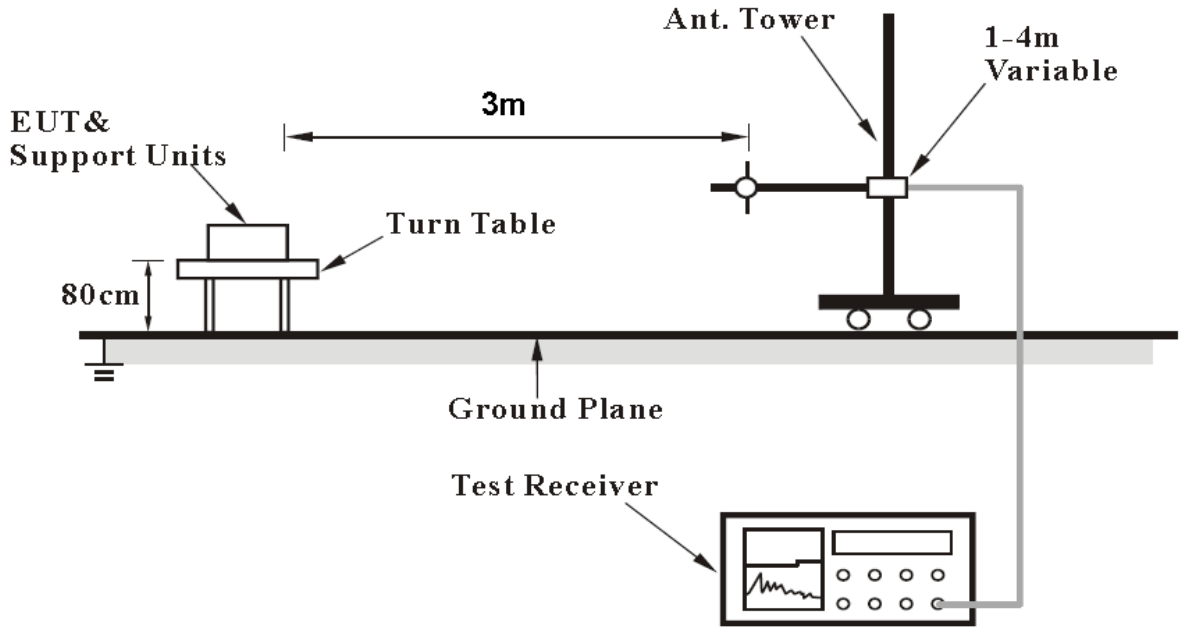
This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic (4.34GHz), up to 6GHz presented.
The EUT was evaluated in 3 Axis (X, Y, Z) being the “Z” Axis the worst test configuration and presented in this test report.
There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
Only the considered worst case configuration presented for radiated emissions above 1GHz.
Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in.
The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter far distance for test. The table was rotated 360 degrees to determine the position of the highest radiation.
No emission is found between lowest internal used/generated frequencies to 30MHz (9 kHz~30 MHz)

For the radiated emission test below 1GHz:
a. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
b. 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.
c. 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.
d. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.

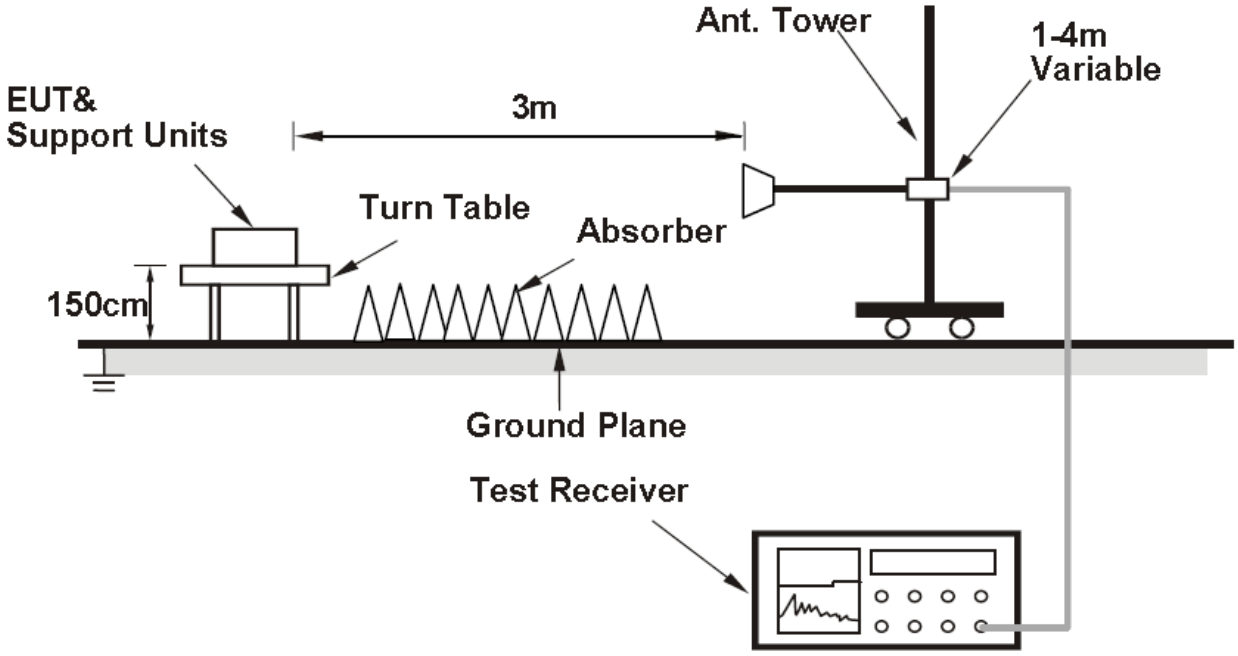
For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. 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:
The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz. If duty cycle of test signal is < 98%, the duty factor need added to measured value.
AVERAGE: Peak Level + Duty Factor
All modes of operation were investigated and the worst-case emissions are reported.
The test-receiver system was set to peak and average detection function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.
A “reference path loss” is established and the ARpl is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.
The measurement results are obtained as described below: Result= Pmea + ARpl

For radiated emission test below 1GHz



For radiated emission test above 1GHz



6.2.3 Test limit

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (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

1Linear interpolations.

Limit:

Frequency (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	30	30
30～88	100	3
88～216	150	3
216～960	200	3
Above 960	500	3

Frequency of Emission(MHz)	Limits	
	Detector	Unit (dBμV/m)
0.009～0.490	Quasi-peak	107.6-72.9
0.490～1.705	Quasi-peak	52.9-42
1.705～30	Quasi-peak	48.5

Note：The above field strength limits are specified at a distance of 10 meters.
RF Voltage (dBuV) = 20 log RF Voltage (uV)

30～88	Quasi-peak	40
88～216	Quasi-peak	43.5
216～960	Quasi-peak	46
960～1000	Quasi-peak	54
1000～5th harmonic of the highest frequency or	Average	54

Note：The above field strength limits are specified at a distance of 3 meters.
RF Voltage (dBuV) = 20 log RF Voltage (uV)
Average (dBuV/m) = Peak (dBuV/m) – Duty Cycle Factor (dB)

6.2.4 Test data

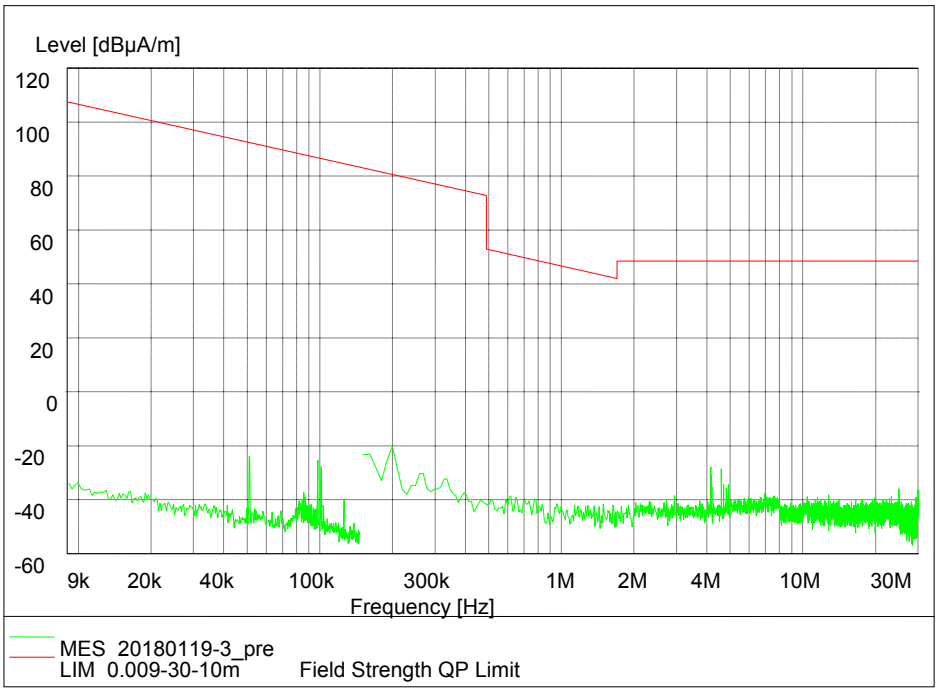
ASK

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity
39.4110894	18.73	15.90	2.80	Vertical
80.2636444	9.07	8.00	1.10	Vertical
124.7827171	10.42	9.70	0.70	Vertical
184.2353931	10.72	8.40	2.30	Vertical
435.0124402	36.35	16.70	19.70	Vertical
950.5761173	31.18	25.60	5.60	Vertical

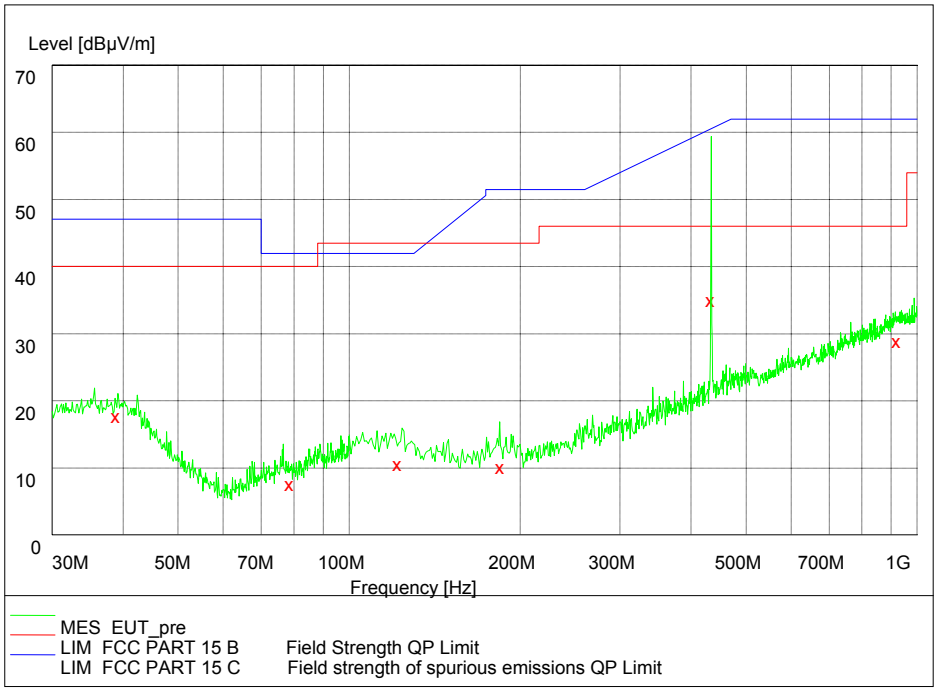
FSK

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity
38.7343616	19.74	15.90	3.80	Vertical
77.9536090	8.27	8.00	0.30	Vertical
120.8502808	9.46	9.70	-0.20	Vertical
184.2906969	9.39	8.40	1.00	Vertical
434.9060644	31.18	16.70	14.50	Vertical
886.4889102	31.40	25.70	5.70	Vertical

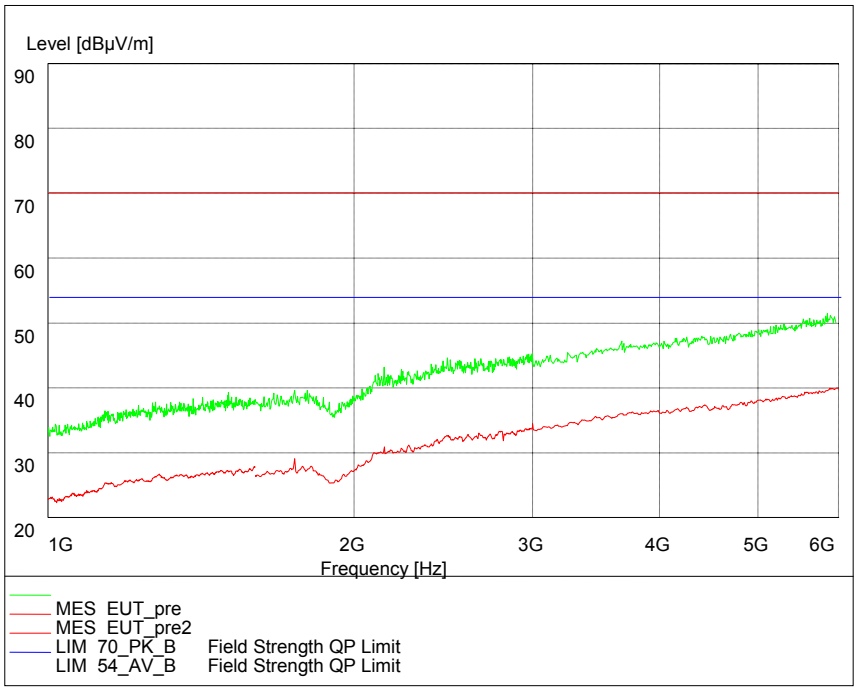
ASK



Radiated emission (0.009MHz – 30MHz)

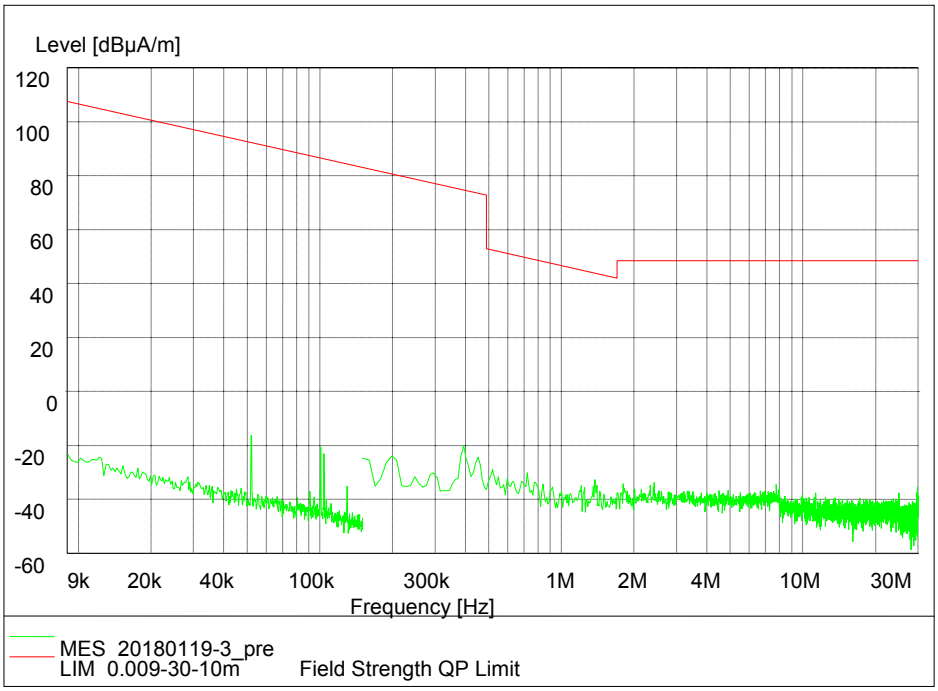


Radiated emission (30MHz – 1GHz)

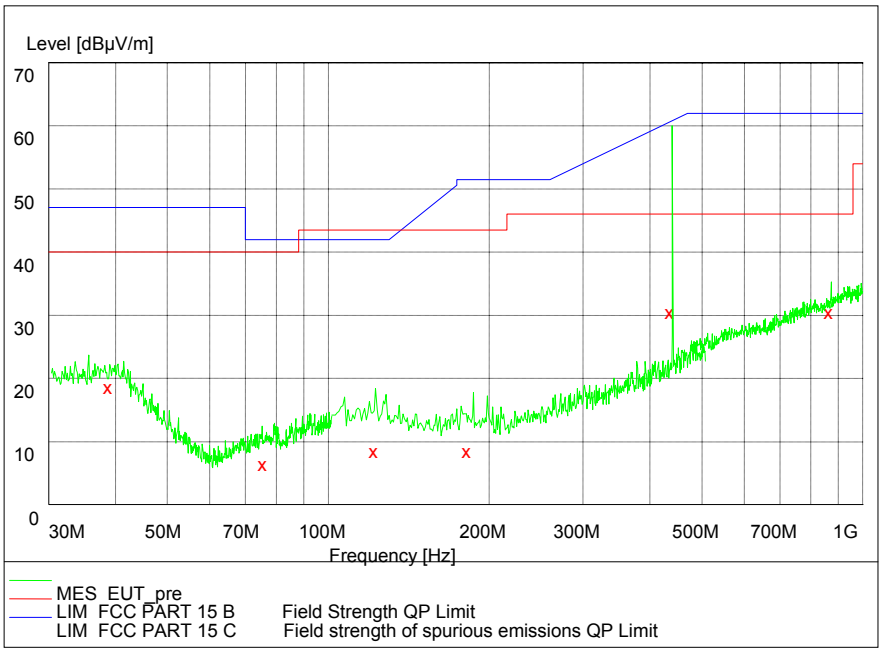


Radiated emission (1GHz – 6GHz)

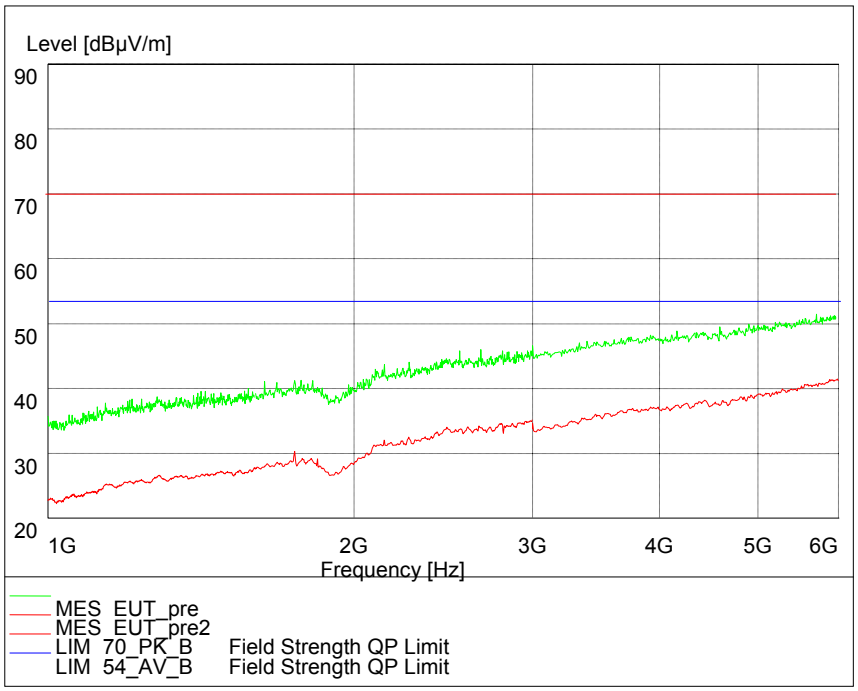
FSK



Radiated emission (0.009MHz – 30MHz)



Radiated emission (30MHz – 1GHz)



Radiated emission (1GHz – 6GHz)

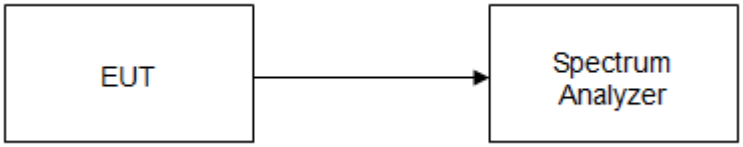
6.3 Bandwidth Requirement

6.3.1 Ambient condition

Temperature	Relative humidity	Pressure
23.0°C	32.0%	101.5kPa

6.3.2 Test conditions and test configuration

(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 for devices operating above 900 MHz; the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.



6.3.3 Test limit

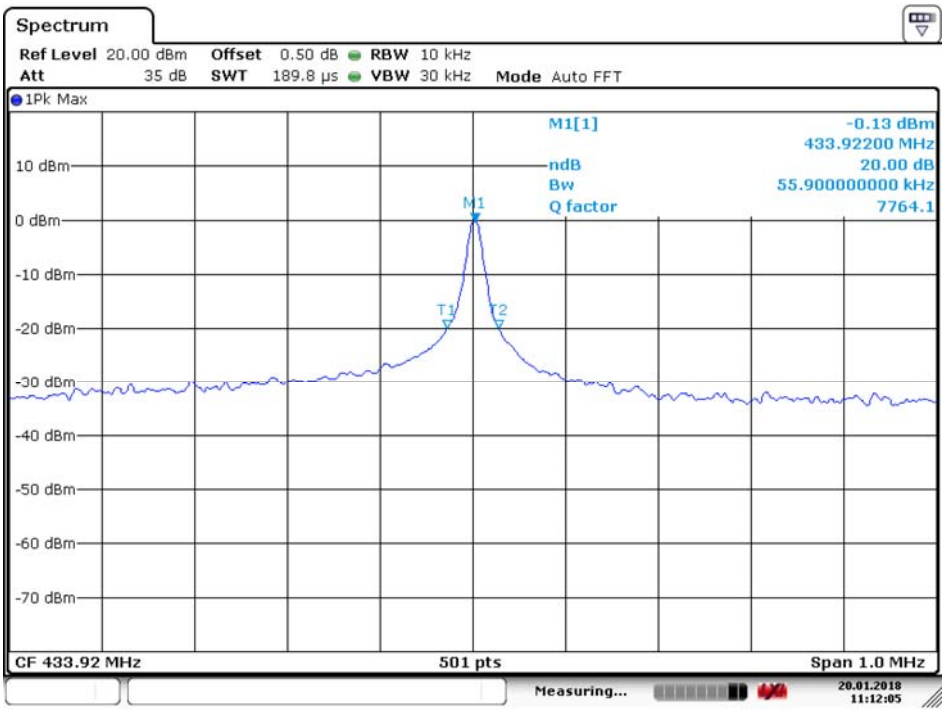
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz

Bandwidth limit: 433.92MHz*0.25%=1.0848MHz

6.3.4 Test data

Modulation Type	Transmitter Frequency (MHz)	Measured 20dB Bandwidth (kHz)	0.25% of the centre frequency requirement (kHz)	Results
ASK	433.92	55.90	1084.8	Pass
FSK	433.92	159.70	1084.8	Pass

ASK



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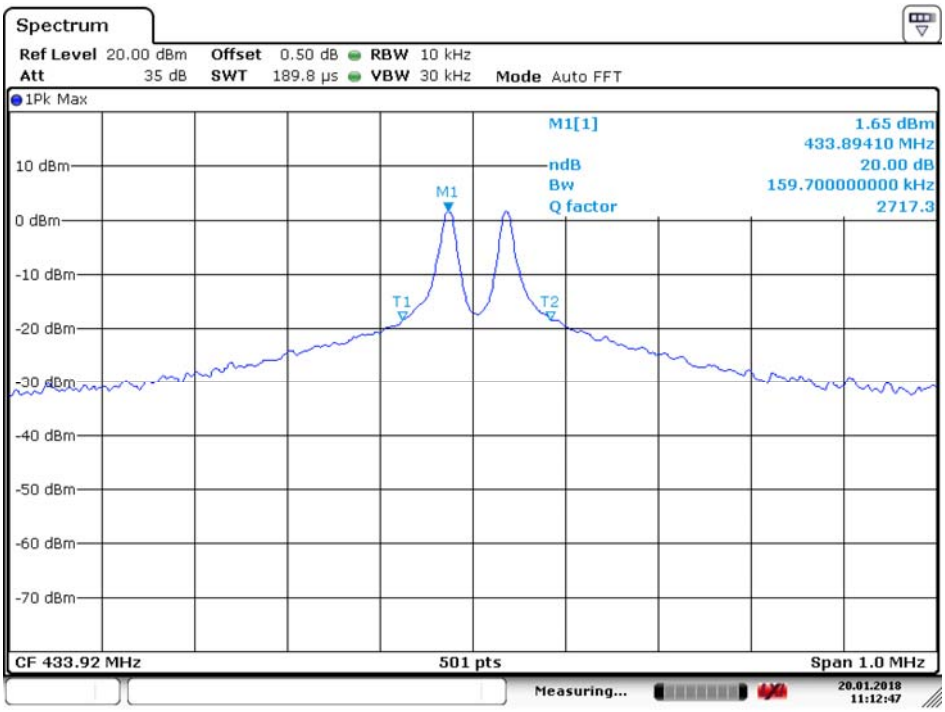
FSK



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7. MEASUREMENT UNCERTAINTIES

Item	Uncertainty
Deactivation time measurement	0.045 ms
Modulation bandwidth	0.30 kHz
Radiated Emission Measurements 30MHz～1GHz	4.88 dB
Radiated Emission Measurements 1GHz～18GHz	4.86 dB

Uncertainty figures are valid to a confidence level of 95%, k=2

8. TEST EQUIPMENT

Conformance testing was performed using test equipment calibrated in accordance with CNAS accreditation requirements. Calibration, configuration records and equipment details used for conformance testing are available for inspection at SRTC if required.

No.	Equipment Name Model	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
1.	FSV-SIGNAL ANALYZER	R&S	101065	2017.08.20	2018.08.19
2.	Cable 104EA	SUCOFLEX	9272/4EA	2017.08.20	2018.08.19
3.	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	-----	-----
4.	Turn table Diameter:5m	HD	-----	-----	-----
5.	Antenna master SAC(MA4.0)	MATURO	-----	-----	-----
6.	9.080m×5.255m×3.525m Shielding room	FRANKONIA	-----	-----	-----
7.	HF 906 Double-Ridged Waveguide Horn Antenna	R&S	100030	2017.08.20	2018.08.19
8.	HL562 Ultra log antenna	R&S	100016	2017.08.20	2018.08.19
9.	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2017.08.20	2018.08.19
10.	ESI 40 EMI test receiver	R&S	100015	2017.08.20	2018.08.19
11.	ESCS30 EMI test receiver	R&S	100029	2017.08.20	2018.08.19
12.	ESH3-Z5 LISN	R&S	100020	2017.08.20	2018.08.19
13.	HFH2-Z2	R&S	100340	2017.08.20	2018.08.19

---End of Test Report---