FCC TEST REPORT

According to

FCC Part 15, Subpart C (15.231) / ANSI C63.4: 2009

Applicant : ATBS Technology Corporation

Address 3F-4, No. 200, Kang-Chien Rd., Taipei, 11494,

Taiwan

Equipment : CAR TPMS

Model No. : LM6XXX

FCC ID. : UP5-SC-LM6040

Trade Name: ATBS

The test result refers exclusively to the test presented test model / sample.,

Without written approval of **Cerpass Technology Corp.**, the test report shall not be reproduced except in full.

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Issued date : Jul. 11, 2012

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History of this test report

■ ORIGINAL.

 $\hfill\square$ Additional attachment as following record:

Attachment No.	Issue Date	Description
TEFI1205176	Jul. 11, 2012	Original.

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CERTIFICATE OF COMPLIANCE

According to

FCC Part 15, Subpart C (15.231) / ANSI C63.4: 2009

Applicant : ATBS Technology Corporation

Address 3F-4, No. 200, Kang-Chien Rd., Taipei,

11494, Taiwan

Equipment : CAR TPMS

Model No. : LM6XXX

FCC ID. : UP5-SC-LM6040

I HEREBY CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4.** The equipment was *passed* the test performed according to FCC Part 15, Subpart C (15.231) / ANSI C63.4: 2009.

The test was carried out on Jul. 03, 2012 at Cerpass Technology Corp.

Approval by :

Test Engineer:

Hill Chen /

EMC/RF B.U. Assistant Manager

Ben Lu / Engineer

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1. Report of Measurements and Examinations

1.1 List of Measurements and Examinations

FCC Rule	Test Type	Result	Remark
15.203	Antenna Requirement	Pass	
15.207	Conducted Emission	Not Applicable	EUT is powered from DC
15.209 15.231	Radiated Emission	Pass	Minimum Passing margin is -6.92 at 823.60MHz
15.231	20dB Occupied Bandwidth Measurement	Pass	Meet the requirement of limit

Note: the information of measurement uncertainty is available upon the customer's request.

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2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

LCM Display

Operation Voltage: USB 5VOperation Current: 50mA

• Operation Temperature: -40~85°C

• Frequency: 433.92MHz

Sensor

• Operation Temperature: -40~125±1°C

Operating Humidity: 100%

• Frequency: 433.92MHz

• Monitoring Pressure: 0~65±1 PSI

Battery: 3.0 VWeight: 8.5g

• Battery Lifespan: About 12 months

2.2 Test Mode and Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.4.
- b. The complete test system included EUT for the test.

2.3 Description of Test System

The EUT was tested alone. No support devices is needed for testing.

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2.4 General Information of Test

Test Site :	Cerpass Technology Corp. 2F-11, No. 3, Yuan Qu St., (Nankang Software Park), Taipei, Taiwan 115, R.O.C.
Test Site Location (OATS2-SD) :	No.68-1, Shihbachongsi, Shihding Township, Taipei City 223, Taiwan, R.O.C.
FCC Registration Number :	TW1049, TW1061, 488071, 390316
IC Registration Number :	4934B-1, 4934D-1
VCCI Registration Number :	T-1173 for Telecommunication Test C-4139 for Conducted emission test R-3428 for Radiated emission test G-97 for radiated disturbance above 1GHz
Test in Compliance with:	FCC Part 15, Subpart C (15.231) / ANSI C63.4: 2009
Frequency Range Investigated:	Conducted Emission Test: from 150kHz to 30 MHz Radiated Emission Test: from 30 MHz to 4,500 MHz
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.



2.5 Measurement Uncertainty

Measurement Item	Measurement Frequency	Polarization	Uncertainty
Conducted Emission	9 kHz ~ 30 MHz	LINE/NEUTRAL	3.25 dB
Radiated Emission	30 MHz ~ 1,000 MHz	Vertical / Horizontal	3.93 dB
Radiated Effission	1,000 MHz ~ 18,000 MHz	Vertical / Horizontal	5.18 dB

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3. Antenna Requirements

3.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247(b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

3.2 Antenna Construction and Directional Gain

Antenna Type: PCB Antenna

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4. Test of Conducted Emission

4.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz on the 120 VAC power and return leads of the EUT according to the methods defined in ANSI C63.4-2009 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane as shown in section 2.2. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dB µ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

^{*}Decreases with the logarithm of the frequency.

4.2 Test Procedures

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connecting to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

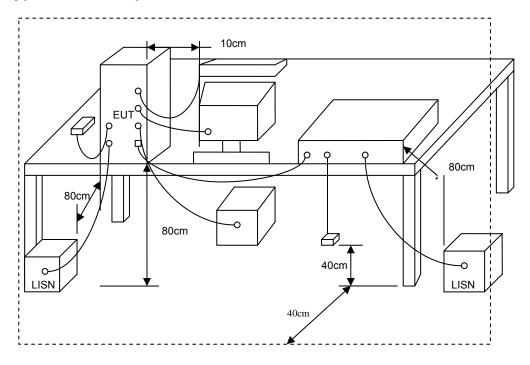
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4.3 Typical Test Setup



4.4 Test Result and Data

The test item is not applicable because the EUT is powered from DC.

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5. Test of Radiated Emission

5.1 Test Limit

According to 15.231(e) the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Fraguenov (MUz)	Field Strength	of Fundamental	Field Strength of Spurious		
Frequency (MHz)	μV/ m	dBμV/ m	μV/ m	dBμV/ m	
40.66 ~ 40.70	1000	60	100	40	
70 ~130	500	54	50	34	
130 ~ 174	500 ~ 1500	54 ~ 63.5	50 ~ 150	34 ~ 43.5	
174 ~ 260	1500	63.5	150	43.5	
260 ~ 470	1500 ~ 5000	63.5 ~ 74	150 ~ 500	43.5 ~ 54	
Above 470	5000	74	500	54	

NOTE:

- 1. Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 22.72727(F)-2454.545; for the band 260-470 MHz, uV/m at 3 meters = 16.6667(F)-2833.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
- 2. The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

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

Frequency (MHz)	Distance	Limit (µV/ m)
0.09 ~ 0.490	300m	2400/F(kHz)
0.490 ~ 1.705	30m	24000/ F(kHz)
1.705 ~ 30	30m	30
30 ~ 88	3m	100
88 ~ 216	3m	150
216 ~ 960	3m	200
Above 960	3m	500

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.

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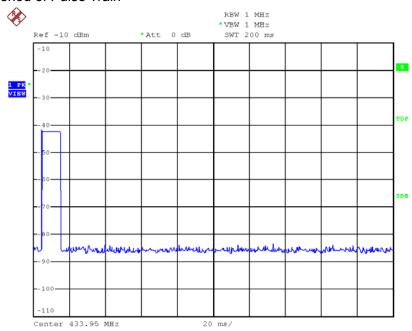
5.2 Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- i. "Cone of radiation" has been considered to be 3dB beamwidth of the measurement antenna.

NOTE:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1GHz.
- 3. The Average value = Peak value + 20log(Duty cycle)
- 4. Duty Factor = 20log(total duty / period of pulse train)
 - $= 20\log[(10.92\text{ms}*1) / 200\text{ms}]$
 - = -25.25

Period of Pulse Train



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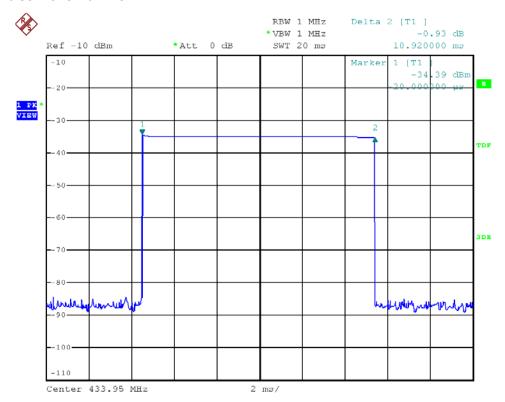
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Pulse Transmit Time



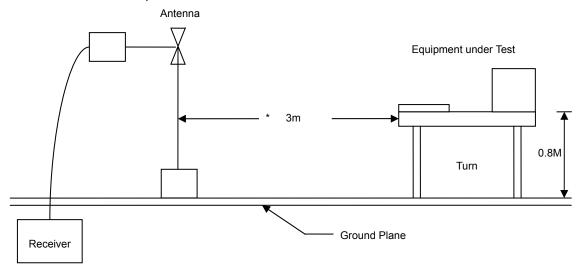
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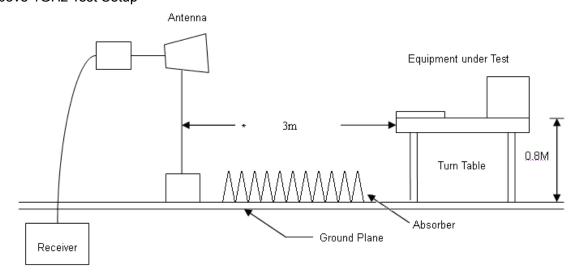


5.3 Typical Test Setup

Below 1GHz Test Setup



Above 1GHz Test Setup



5.4 Measurement Equipment

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Bilog Antenna	Schaffner	CBL6112B	2840	2012/03/23	2013/03/22
Amplifier	Agilent	8447D	2944A10593	2012/03/21	2013/03/20
Signal Generator	HP	8648B	3629U00612	2012/01/11	2013/01/10
EMI Receiver	SCHAFFNER	SCR3501	437	2011/09/28	2012/09/27
Spectrum Analyzer	R&S	FSP 3	100800	2012/03/03	2013/03/02
Spectrum Analyzer	R&S	FSP40	100047	2012/03/01	2013/02/28
Horn Antenna	EMCO	3115	31589	2012/03/01	2013/02/28
Preamplifier	Agilent	8449B	3008A01954	2012/02/29	2013/02/28

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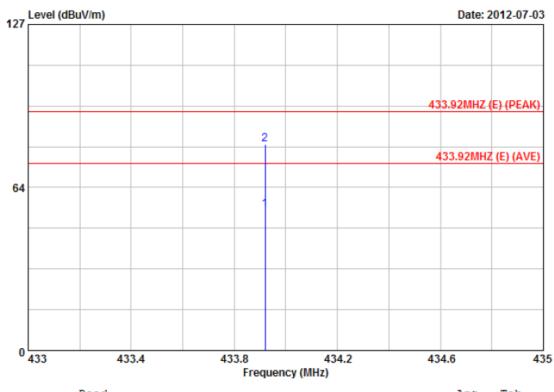
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5.5 Test Result and Data

5.5.1 Test Result of Fundamental Emission

Power	:	DC 3V	Pol/Phase :	VERTICAL
Test Mode		Transmit	Temperature :	25 °C
Memo			Humidity :	67 %



		Read						Ant	Tab
Item	Freq	Value	Factor	Result	Limit	Margin	Remark	Pos	Pos
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	Deg
1	433.92	60.69	-5.75	54.94	72.87	-17.93	Average	93	360
2	433.92	85.94	-5.75	80.19	92.87	-12.68	Peak	93	360
_									

Notes:

- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
- 6. The other emissions is too low to be measured.
- 7. The data is worse case.

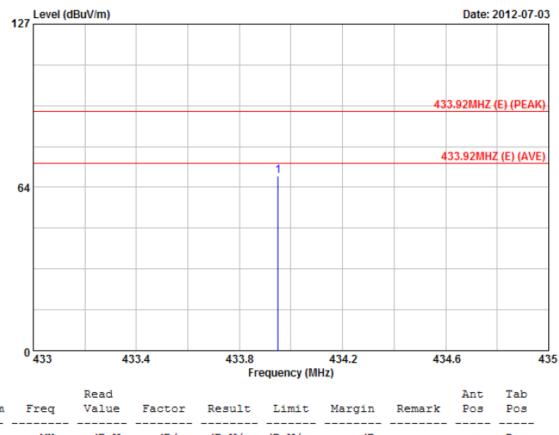
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Power :	DC 3V	Pol/Phase :	HORIZONTAL
Test Mode :	Transmit	Temperature :	25 °C
Memo :		Humidity :	67 %



Item	Freq	Read Value	Factor	Result	Limit	Margin	Remark		Tab Pos	
1	MHz 433.95		dB/m -6.80	-	-	dB -25.05	Peak	cm 93	Deg 0	

- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
- 6. The other emissions is too low to be measured.
- 7. The data is worse case.

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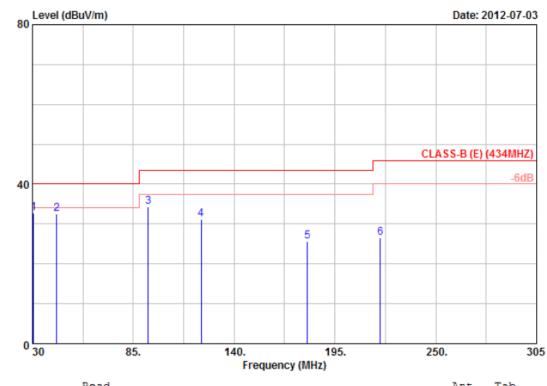
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5.5.2 Test Result of Unwanted Spurious emission

Power	:	DC 3V	Pol/Phase :	VERTICAL
Test Mode	:	Transmit	Temperature :	25 °C
Memo	:		Humidity :	67 %



		Read						Ant	dar	
Item	Freq	Value	Factor	Result	Limit	Margin	Remark	Pos	Pos	
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	Deg	
1	30.55	35.12	-2.45	32.67	40.00	-7.33	Peak	100	0	
2	43.20	33.79	-1.27	32.52	40.00	-7.48	Peak	100	0	
3	93.25	43.42	-9.18	34.24	43.50	-9.26	Peak	100	0	
4	122.13	36.02	-4.76	31.26	43.50	-12.24	Peak	100	0	
5	179.88	30.58	-5.06	25.52	43.50	-17.98	Peak	100	0	
6	219.75	32.47	-6.04	26.43	46.00	-19.57	Peak	100	0	

Notes:

- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
- 6. The other emissions is too low to be measured.
- 7. The data is worse case.

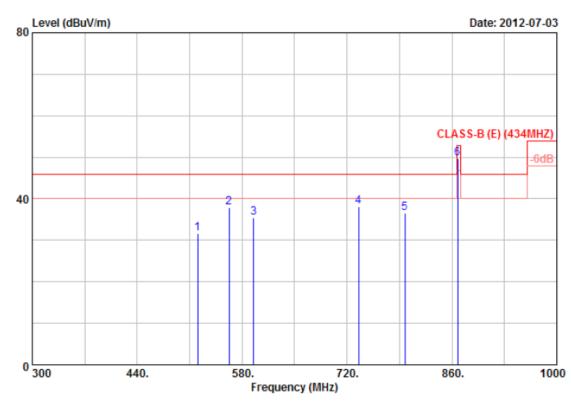
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Power	:	DC 3V	Pol/Phase :	VERTICAL
Test Mode	:	Transmit	Temperature :	25 °C
Memo	:		Humidity :	67 %



		Read						Ant	Tab
Item	Freq	Value	Factor	Result	Limit	Margin	Remark	Pos	Pos
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	Deg
1	520.50	31.48	0.16	31.64	46.00	-14.36	Peak	100	0
2	562.50	31.13	6.82	37.95	46.00	-8.05	Peak	100	0
3	595.40	31.41	4.02	35.43	46.00	-10.57	Peak	100	0
4	735.40	31.42	6.62	38.04	46.00	-7.96	Peak	100	0
5	797.00	30.56	5.94	36.50	46.00	-9.50	Peak	100	0
6	867.84	40.69	9.07	49.76	52.87	-3.11	QP	100	0

- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
- 6. The other emissions is too low to be measured.
- 7. The data is worse case.

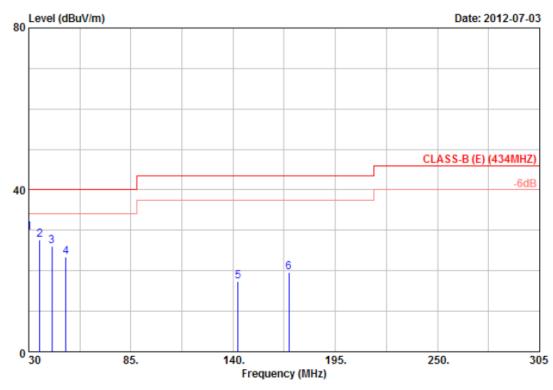
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Power :	DC 3V	Pol/Phase :	HORIZONTAL
Test Mode :	Transmit	Temperature :	25 °C
Memo :		Humidity :	67 %



		Read						Ant	Tab
Item	Freq	Value	Factor	Result	Limit	Margin	Remark	Pos	Pos
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	Deg
									_
1	30.00	35.22	-5.80	29.42	40.00	-10.58	Peak	100	0
2	36.05	34.48	-6.78	27.70	40.00	-12.30	Peak	100	0
3	42.38	33.91	-7.80	26.11	40.00	-13.89	Peak	100	0
4	50.08	32.54	-9.08	23.46	40.00	-16.54	Peak	100	0
5	142.75	32.13	-14.65	17.48	43.50	-26.02	Peak	100	0
6	169.98	30.62	-10.97	19.65	43.50	-23.85	Peak	100	0

- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
- 6. The other emissions is too low to be measured.
- 7. The data is worse case.

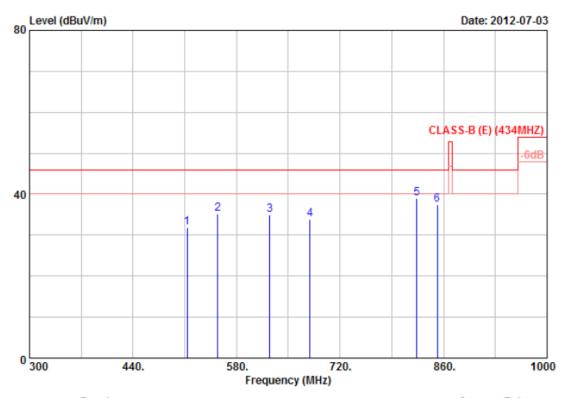
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Power	:	DC 3V	Pol/Phase :	HORIZONTAL
Test Mode	:	Transmit	Temperature :	25 °C
Memo	:		Humidity :	67 %



		Read						Ant	Tab	
Item	Freq	Value	Factor	Result	Limit	Margin	Remark	Pos	Pos	
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	Deg	
1	513.50	30.53	1.42	31.95	46.00	-14.05	Peak	100	0	
2	554.80	31.06	4.06	35.12	46.00	-10.88	Peak	100	0	
3	624.80	30.80	4.29	35.09	46.00	-10.91	Peak	100	0	
4	679.40	31.48	2.40	33.88	46.00	-12.12	Peak	100	0	
5	823.60	31.60	7.48	39.08	46.00	-6.92	Peak	100	0	
6	851.60	31.36	6.09	37.45	46.00	-8.55	Peak	100	0	

- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
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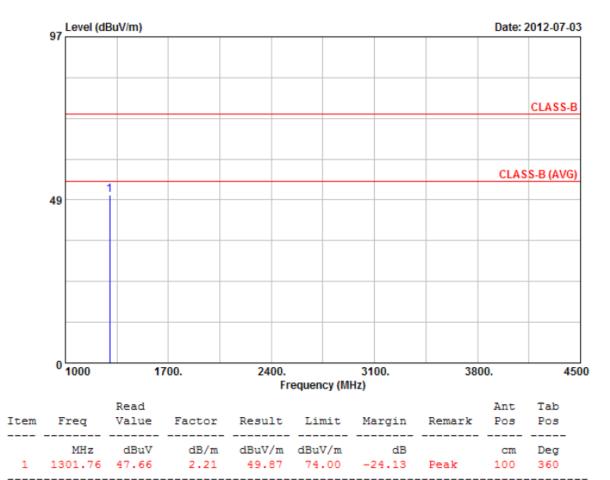
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Power	:	DC 3V	Pol/Phase :	VERTICAL
Test Mode	:	Transmit	Temperature :	25 °C
Memo	:		Humidity :	67 %



- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
- 6. The other emissions is too low to be measured.
- 7. The data is worse case.

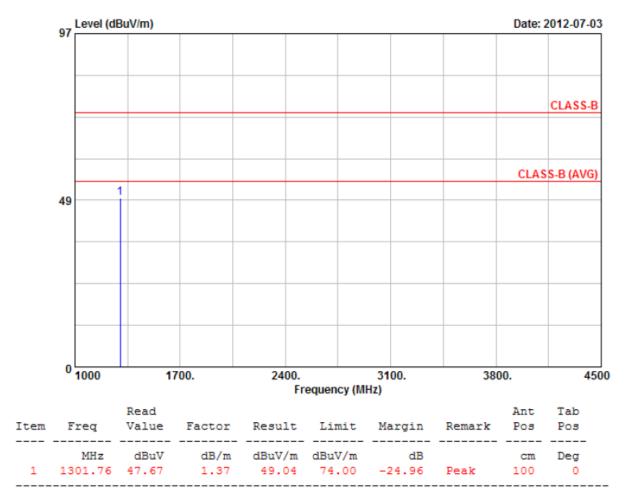
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Power :	DC 3V	Pol/Phase :	HORIZONTAL
Test Mode :	Transmit	Temperature :	25 °C
Memo :		Humidity :	67 %



- 1. Result = Read Value + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Peak detection and Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 5. The Average value = Peak value + 20log(Duty cycle)
- 6. The other emissions is too low to be measured.
- 7. The data is worse case.

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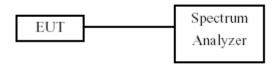
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6. 20dB Occupied Bandwidth Measurement

6.1 Test Procedure

- a. The EUT placed on the turning table.
- b. The signal was coupled to the spectrum analyzer through an antenna.
- c. Set the resolution bandwidth to 100kHz and video bandwidth to 100kHz then select Peak function to scan the channel frequency.
- d. The 20dB bandwidth was measured and recorded.

6.2 Test Setup Layout



6.3 Limits of Band Edges Measurement

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

Frequency (MHz)	Limit of 20dB Bandwidth (MHz)
433.92	1.08

6.4 Measurement Equipment

Instrument/Ancillary	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Spectrum Analyzer	R&S	FSP40	100047	2012/03/01	2013/02/28

6.5 Test Result and Data

Test Date: Jul. 02, 2012 Temperature: 25°C Atmospheric pressure: 1020 hPa Humidity: 64%

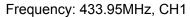
Frequency (MHz)	20 dB bandwidth (MHz)	PASS / FAIL
433.95	0.320	PASS

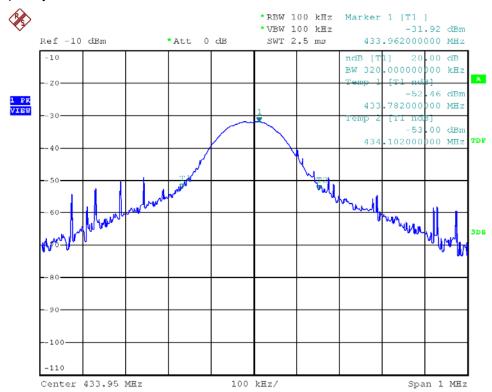
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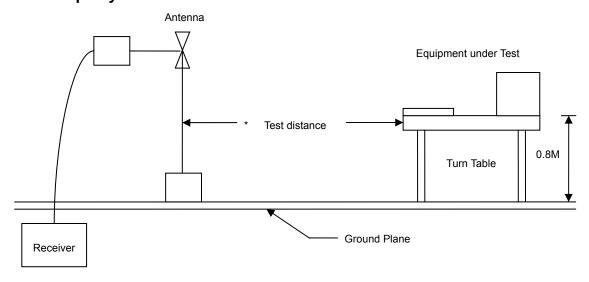


7. Transmission Time Control

7.1 Test Procedure

- 1. Set up the EUT in the state of Transmitter.
- 2. Set up the Spectrum, judge whether to accord with the regulation demand or not.

7.2 Test Setup Layout



7.3 Test Limit

Limits: In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

7.4 Measurement Equipment

Instrument/Ancillary	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Spectrum Analyzer	R&S	FSP40	100047	2012/03/01	2013/02/28

7.5 Test Result and Data

Test Date: Jul. 02, 2012 Temperature: 25°C Atmospheric pressure: 1020 hPa Humidity: 64%

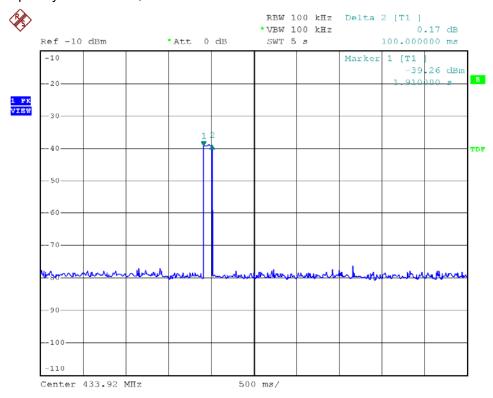
Frequency (MHz)	Operation time(Sec.)	Limit	PASS / FAIL
433.92	0.100	<1 sec. and least 30 times the duration of the transmission, in no case less than 10 sec.	PASS

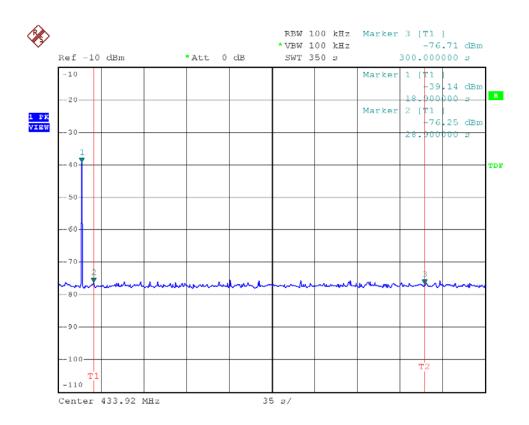
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Frequency: 433.95MHz, CH1





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