

FCC REPORT

Applicant: TS Co., Ltd.

Address of Applicant: 201-1901 Daesang, Hyundai Apt. 616, MadulRo,
DoBongGu, Seoul, Korea

Equipment Under Test (EUT)

Product Name: Car Bluetooth Receiver with FM Transmitter

Model No.: TS-721CF

FCC ID: 2ADFE721CF

Standards: FCC CFR Title 47 Part 15 Subpart C Section 15.239:2014

Date of Receipt: October 13, 2104

Date of Test: October 13~ October 27, 2104

Date of Issue: October 27, 2104

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

A circular stamp with the text "GLOBAL UNITED TECHNOLOGY SERVICES CO., LTD." around the perimeter and "GTS" in the center. Overlaid on the stamp is a handwritten signature in black ink.

Robinson Lo

Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of GTS International Electrical Approvals or testing done by GTS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by GTS International Electrical Approvals in writing.

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2 Version

Version No.	Date	Description
00	October 27, 2104	Original

Prepared By:

Sam. Gao

Date:

October 27, 2104

Project Engineer

Check By:

hank. yan

Date:

October 27, 2104

Reviewer

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	PASS
Field strength of the fundamental signal	15.239 (a)	PASS
Spurious emissions	15.239 (c)/15.209	PASS
20dB Bandwidth	15.215 (c)/15.239 (a)	PASS

Remark:

Pass: The EUT complies with the essential requirements in the standard.

5 General Information

5.1 Client Information

Applicant:	TS Co., Ltd
Address of Applicant:	201-1901Daesang, Hyundai Apt. 616, MadulRo, DoBongGu, Seoul, Korea
Manufacturer/Factory:	TS Co., Ltd
Address of Manufacturer/Factory:	201-1901Daesang, Hyundai Apt. 616, MadulRo, DoBongGu, Seoul, Korea

5.2 General Description of E.U.T.

Product Name:	Car Bluetooth Receiver with FM Transmitter
Model No.:	TS-721CF
Operation Frequency:	88.1MHz~107.9MHz
Channel separation:	100KHz
Modulation type:	FM
Antenna Type:	Integral Aux in port
Antenna Gain	0.0dBi
Power supply:	DC: 12.0V9 (By Car)

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	88.1MHz
The middle channel	98.1MHz
The Highest channel	107.9MHz

5.3 Test mode

Transmitting mode:	Pre-scan input 20Hz-20KHz audio signal to the EUT, and found 1KHz audio signal which it is worse case.
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5.4 Test Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none">● CNAS —Registration No.: CNAS L5775 CNAS has accredited Global United Technology Services Co., Ltd. to ISO/IEC 17025 General Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.● FCC —Registration No.: 600491 Global United Technology Service Co., Ltd., Shenzhen 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. Registration 600491, July 20, 2010.● Industry Canada (IC) The 3m Semi-anechoic chamber of Global United Technology Service Co., Ltd. Has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-1.
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5.5 Test Location

All tests were performed at:
Global United Technology Service Co., Ltd. Address: 2nd Floor, Block No.2, Laodong Industrial Zone, Xixiang Road Baoan District, Shenzhen, China Tel: 0755-27798480 Fax: 0755-27798960

5.6 Other Information Requested by the Customer

None.

5.7 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Mar. 30 2013	Mar. 29 2015
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Jul. 07 2014	Jul. 06 2015
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	Mar. 10 2014	Mar. 09 2015
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	Jul. 07 2014	Jul. 06 2015
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 10 2014	Mar. 09 2015
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	Jul. 07 2014	Jul. 06 2015
9	Coaxial Cable	GTS	N/A	GTS211	Jul. 07 2014	Jul. 06 2015
10	Coaxial cable	GTS	N/A	GTS210	Jul. 07 2014	Jul. 06 2015
11	Coaxial Cable	GTS	N/A	GTS212	Jul. 07 2014	Jul. 06 2015
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	Jul. 07 2014	Jul. 06 2015
13	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	Jul. 07 2014	Jul. 06 2015
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	Jul. 07 2014	Jul. 06 2015
15	Band filter	Amindeon	82346	GTS219	Jul. 07 2014	Jul. 06 2015

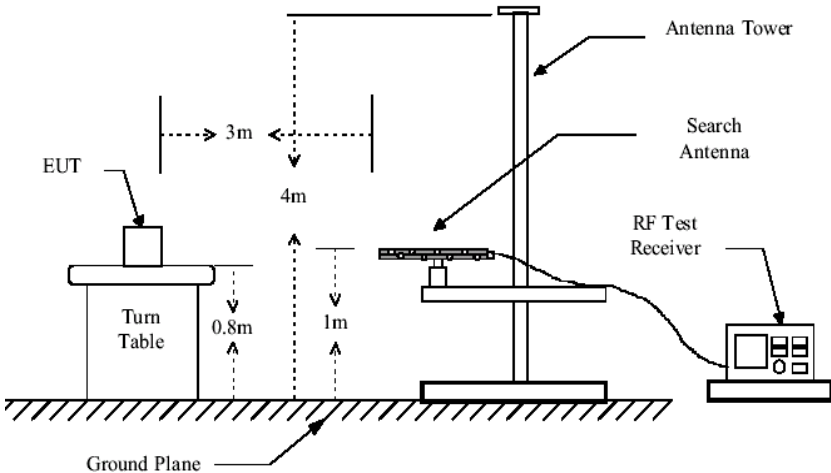
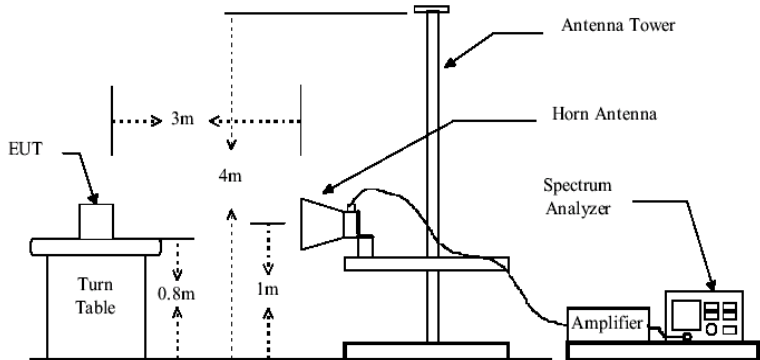
6 Test results and Measurement Data

6.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: <i>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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</i>	
E.U.T Antenna:	
<i>The antenna is the AUX in cable. The best case gain of the antenna is 0 dBi.</i>	

6.2 Radiated Emission

Test Requirement:	FCC Part15 C Section 15.239 and 15.209				
Test Method:	ANSI C63.4: 2003				
Test Frequency Range:	30MHz to 1100MHz				
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver setup: (Spurious Emissions)	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		AV	1MHz	10Hz	Average Value
Receiver setup: (Field strength of the fundamental signal)	Detector	RBW	VBW	Remark	
	Peak	200kHz	300kHz	Peak Value	
	AV	200kHz	300kHz	Average Value	
Limit: (Field strength of the fundamental signal)	Frequency		Limit (dBuV/m @3m)		Remark
	88.1MHz-107.9MHz		48.0		Average Value
			68.0		Peak Value
Limit: (Spurious Emissions)	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-88MHz		40.0		Quasi-peak Value
	88MHz-216MHz		43.5		Quasi-peak Value
	216MHz-960MHz		46.0		Quasi-peak Value
	960MHz-1GHz		54.0		Quasi-peak Value
	Above 1GHz		54.0		Average Value
			74.0		Peak Value
Test Procedure:	1>. The E.U.T and its simulators are placed on a turn table which is 0.8meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.				
	2>. Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2003 on radiated measurement.				
	3>. Has verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows				
	Pre-Test Mode: frequency=88.1MHz				
	Axis		X	Y	Z
	Field Strength(dBuV/m)		60.15	63.08	62.44
	Final Test Mode:				
	According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup”				
	Y axis				

<p>Test setup:</p>	<p>Below 1GHz</p>  <p>Above 1GHz</p> 
<p>Test Instruments:</p>	<p>Refer to section 5.7 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Pass</p>

Note:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$

6.2.1 Measurement Data

6.2.1.1 Field Strength Of The Fundamental Signal

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
88.1	74.04	14.60	1.09	31.73	58.00	68	-10.00	Horizontal
88.1	63.36	14.60	1.09	31.73	47.32	68	-20.68	Vertical
98.1	75.34	16.10	1.18	31.75	60.87	68	-7.13	Horizontal
98.1	62.71	16.10	1.18	31.75	48.24	68	-19.76	Vertical
107.9	72.47	14.95	1.26	31.8	56.88	68	-11.12	Horizontal
107.9	63.12	14.95	1.26	31.8	47.53	68	-20.47	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
88.1	58.09	14.60	1.09	31.73	42.05	48	-5.95	Horizontal
88.1	47.28	14.60	1.09	31.73	31.24	48	-16.76	Vertical
98.1	58.93	16.10	1.18	31.75	44.46	48	-3.54	Horizontal
98.1	46.46	16.10	1.18	31.75	31.99	48	-16.01	Vertical
107.9	56.43	14.95	1.26	31.8	40.84	48	-7.16	Horizontal
107.9	46.79	14.95	1.26	31.8	31.20	48	-16.80	Vertical

According to the follow transmitter output power (P_t) formula:

$$P_t = (E \times d)^2 / (30 \times g_t)$$

P_t =transmitter output power in watts

g_t =numeric gain of the transmitting antenna (unitless)

E =electric field strength in V/m

d = measurement distance in meters (m).

According to the above test data, $E_{max}=68.7\text{dBuV/m}=0.0027\text{V/m}$, $d=3\text{m}$, $g_t=1.258$

$$P_t = (E \times d)^2 / (30 \times g_t) = (0.0027 \times 3)^2 / (30 \times 1.258) = 0.000174\text{W} = 0.174\text{mW}$$

6.2.1.2 Spurious Emissions

Test mode:	Transmitting	Test channel:	Lowest
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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
61.25	44.03	12.56	0.99	31.82	25.76	40	-14.24	Horizontal
162.07	48.04	13.07	1.72	32.07	30.76	43.5	-12.74	Horizontal
250.55	42.71	15.78	2.19	32.17	28.51	46	-17.49	Horizontal
379.27	38.29	17.49	2.82	31.91	26.69	46	-19.31	Horizontal
735.91	37.17	22.95	4.28	31.26	33.14	46	-12.86	Horizontal
46.72	37.47	16.13	0.87	31.93	22.54	40	-17.46	Vertical
162.07	39.63	13.07	1.72	32.07	22.35	43.5	-21.15	Vertical
268.79	38.26	16.27	2.28	32.17	24.64	46	-21.36	Vertical
568.54	37.06	20.66	3.66	31.12	30.26	46	-15.74	Vertical
762.68	36.67	23.29	4.37	31.29	33.04	46	-12.96	Vertical

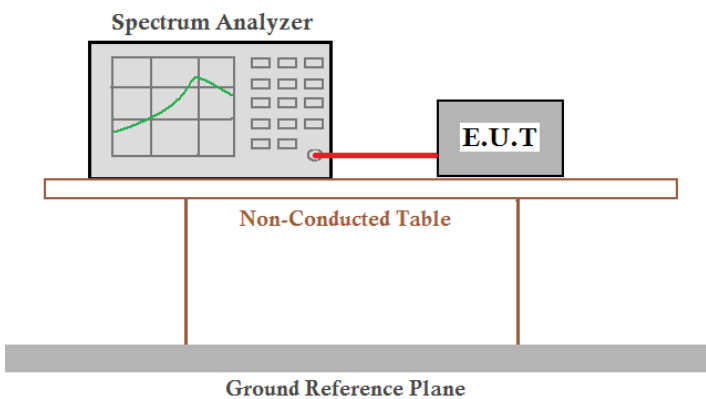
Test mode:	Transmitting	Test channel:	Middle
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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
37.65	38.30	16.80	0.67	32.05	23.72	40	-16.28	Horizontal
80.03	49.30	12.68	1.06	31.75	31.29	40	-8.71	Horizontal
193.31	56.19	13.79	1.82	32.13	39.67	43.5	-3.83	Horizontal
290.91	51.62	16.20	2.33	32.18	37.97	46	-8.03	Horizontal
865.93	37.95	24.00	4.74	31.22	35.47	46	-10.53	Horizontal
52.8	38.27	16.26	0.83	31.95	23.41	40	-16.59	Vertical
193.31	50.42	13.79	1.82	32.13	33.90	43.5	-9.60	Vertical
290.91	40.07	16.20	2.33	32.18	26.42	46	-19.58	Vertical
404.32	38.59	17.46	2.89	31.86	27.08	46	-18.92	Vertical
900.11	37.39	24.29	4.87	31.18	35.37	46	-10.63	Vertical

Test mode:	Transmitting	Test channel:	Highest
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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
76.04	45.95	11.96	1.02	31.77	27.16	40	-12.84	Horizontal
212.55	55.99	14.34	1.93	32.15	40.11	43.5	-3.39	Horizontal
320.12	47.62	16.53	2.49	32.11	34.53	46	-11.47	Horizontal
536.28	38.58	19.61	3.48	31.35	30.32	46	-15.68	Horizontal
795.78	37.50	23.28	4.45	31.32	33.91	46	-12.09	Horizontal
76.04	42.80	11.96	1.02	31.77	24.01	40	-15.99	Vertical
212.82	48.51	14.34	1.93	32.15	32.63	46	-13.37	Vertical
320.12	43.29	16.53	2.49	32.11	30.20	46	-15.80	Vertical
526.9	37.52	19.45	3.44	31.4	29.01	46	-16.99	Vertical
841.89	38.23	23.77	4.63	31.25	35.38	46	-10.62	Vertical

6.3 20dB Bandwidth

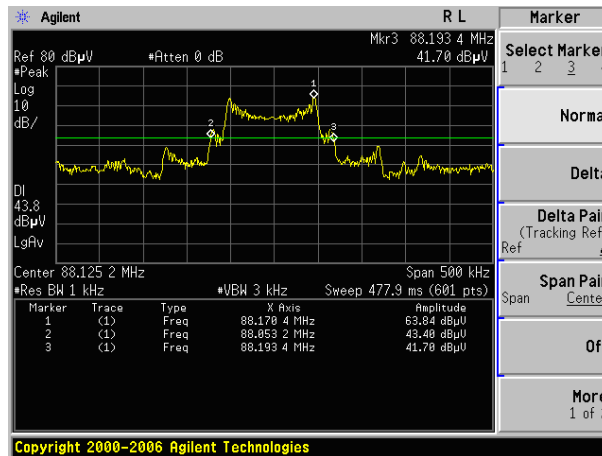
Test Requirement:	FCC Part15 C Section 15.239 (a)
Test Method:	ANSI C63.4:2003
Receiver setup:	RBW=1KHz, VBW=3KHz, detector: Peak
Limit:	Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz.
Test Procedure:	<ol style="list-style-type: none"> 1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Max hold the radiated emissions, mark the peak power frequency point and the -20dB upper and lower frequency points. 4. Read the frequency delta value between the -20dB upper and lower frequency points.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement Data

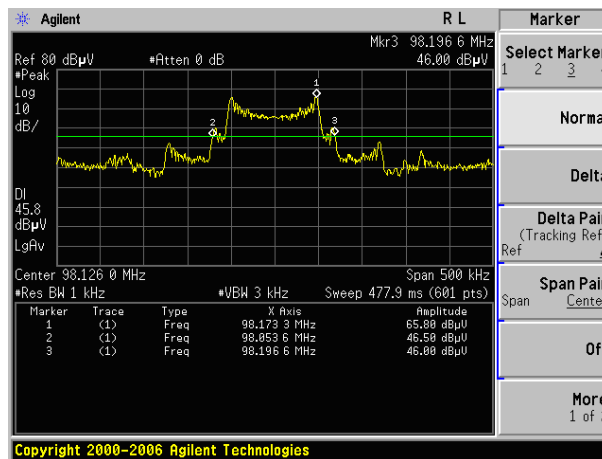
Test channel	Lower Frequency point (MHz)	Upper Frequency point (MHz)	20dB bandwidth(KHz)	Limit(KHz)
Lowest	88.0532	88.1934	140.20	200
Middle	98.0536	98.1966	140.30	200
Highest	107.8522	107.9922	140.00	200

Test plot as follows:

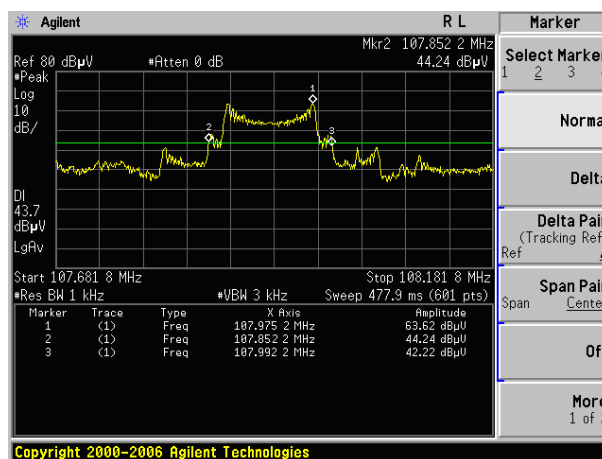
Test channel:	Lowest	
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Test channel:	Middle	
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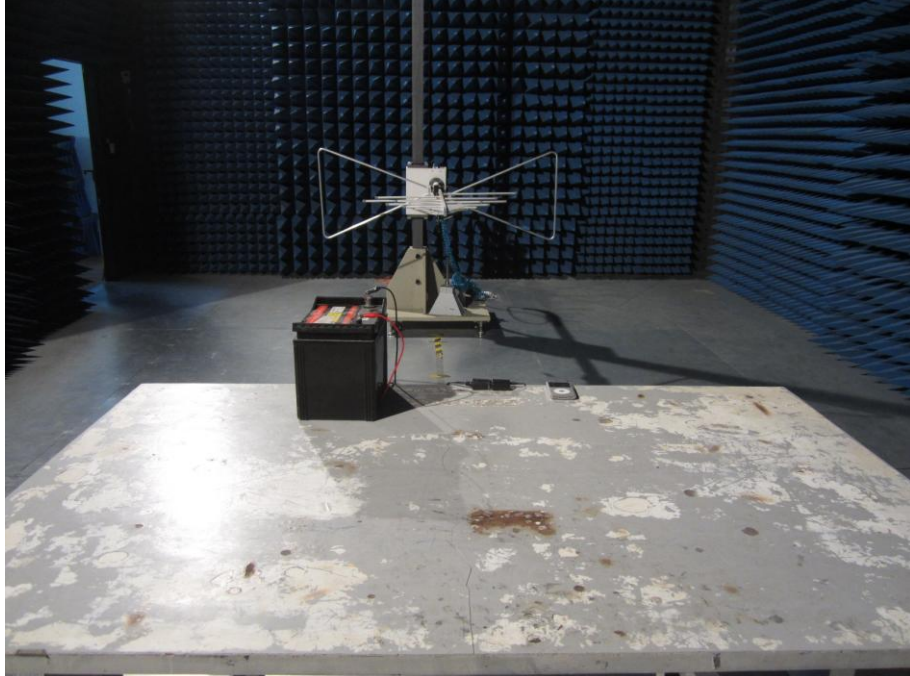


Test channel:	Highest	
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7 Test Setup Photo

Radiated Emission



8 EUT Constructional Details



Back side:



Top side:



Bottom side:

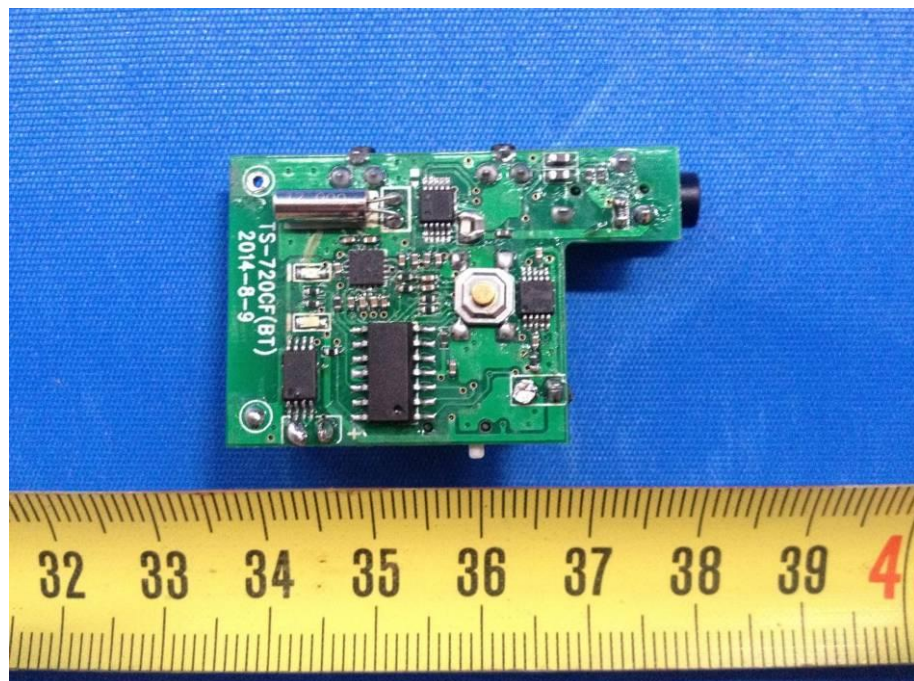
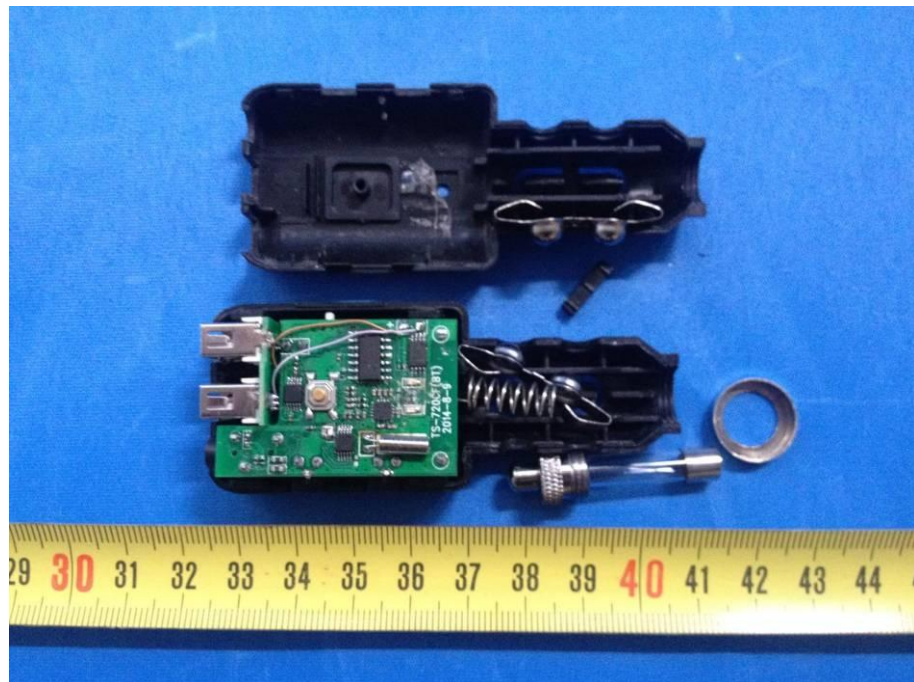


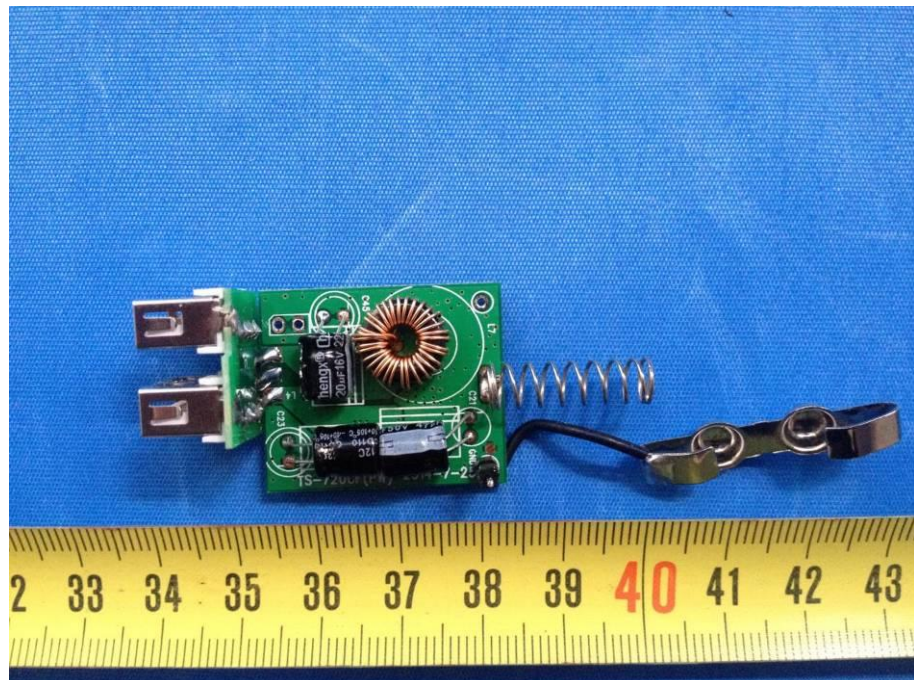
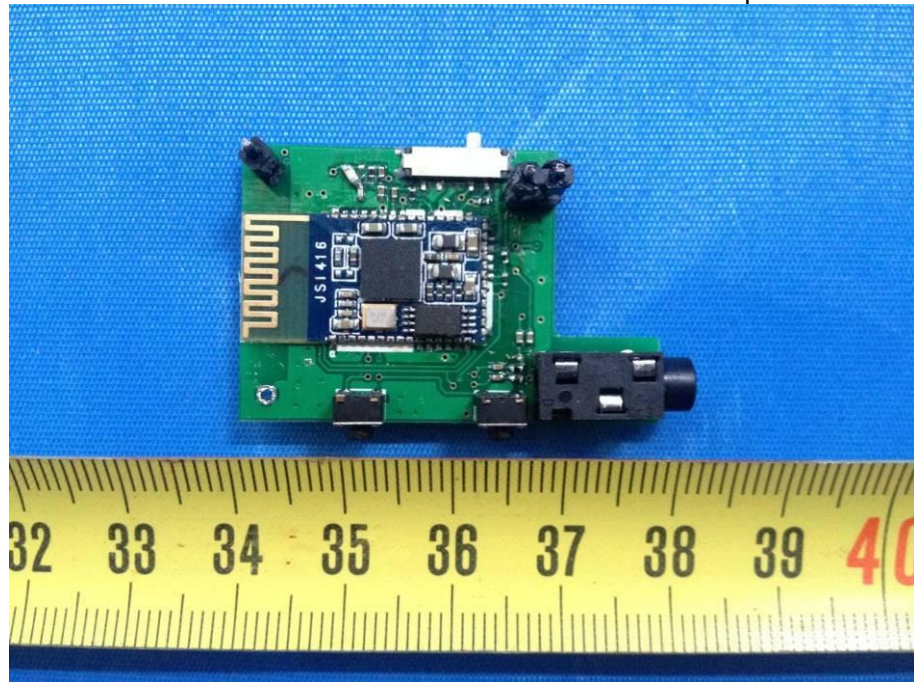
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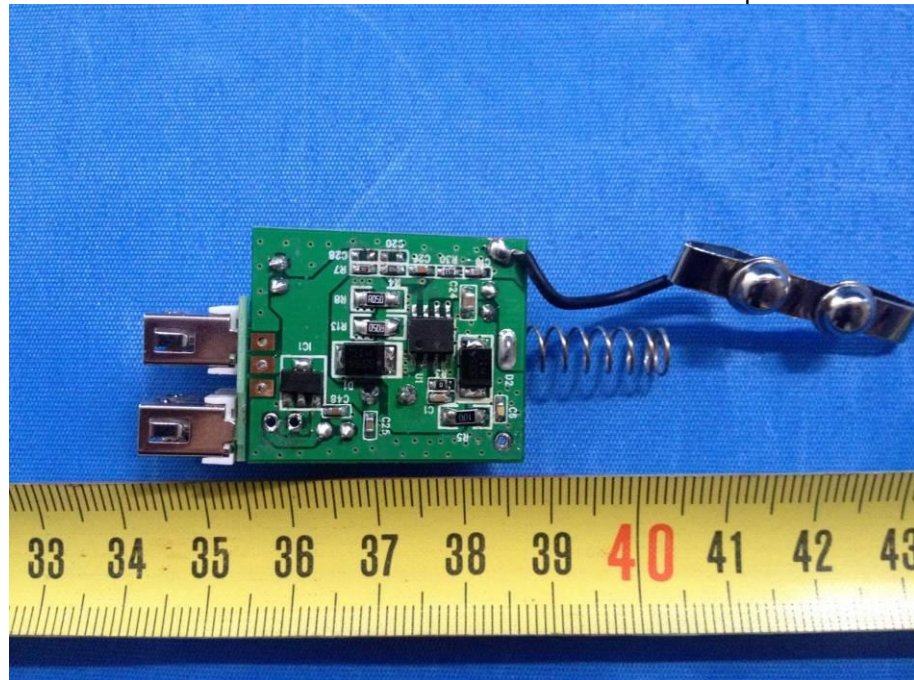


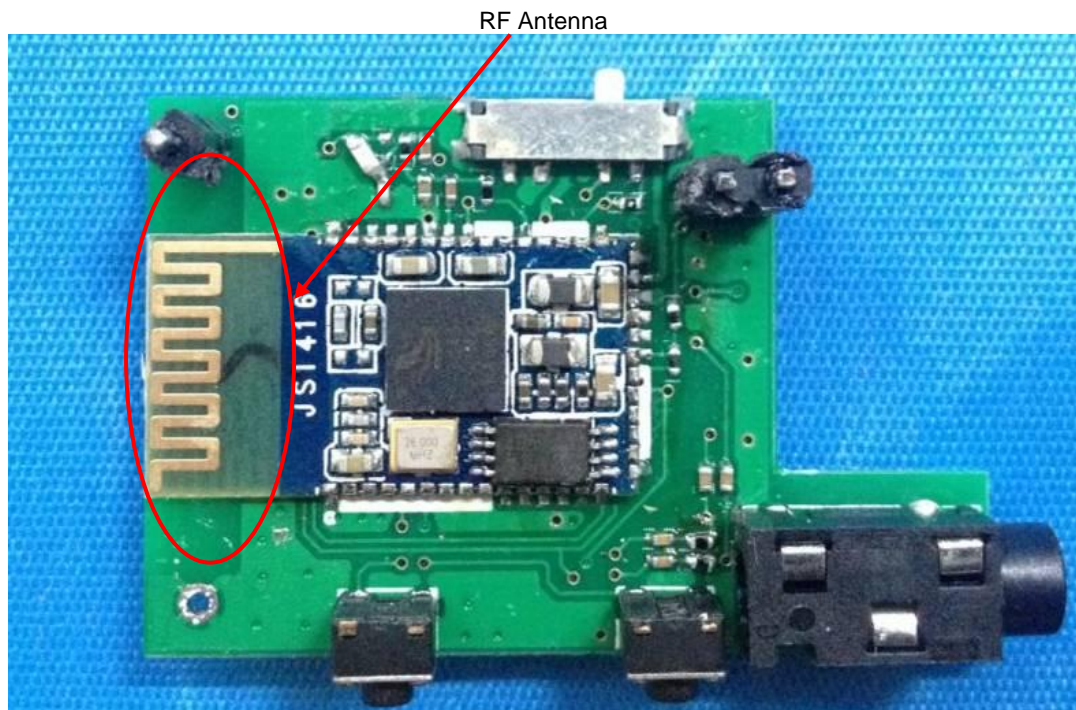
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