FCC TEST REPORT
for
Mansion Industry Co Ltd

Tie Rod Speakers
Model No.: PLAY2GO/Hybrid Driver

Prepared for	:	Mansion Industry Co Ltd
Address	:	402 Xiangshan Rd., The 3rd Industrial Park, Luotian Community Songgang Town, BaoAn, Shenzhen, Guangdong 518105, China
Prepared By	:	Anbotek Compliance Laboratory Limited
Address	:	1/F, 1 /Building, SEC Industrial Park, No. 4 Qianhai Road, Nanshan District, Shenzhen, 518054, China Tel: (86) 755-26066544 Fax: (86) 755-26014772

Report Number	:	201305796F
Date of Test	:	May 15~ Jun. 03, 2013
Date of Report	:	Jun. 17, 2013

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TEST REPORT

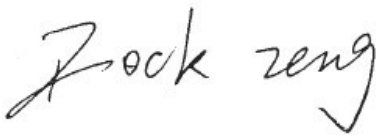
Applicant	:	Mansion Industry Co Ltd
Manufacturer	:	Mansion Industry Co Ltd
EUT	:	Tie Rod Speakers
Model No.	:	PLAY2GO/Hybrid Driver
Serial No.	:	N/A
Rating	:	AC 110-120V, 60Hz, 18W
Trade Mark	:	gemini, MCLELLAND

Measurement Procedure Used:

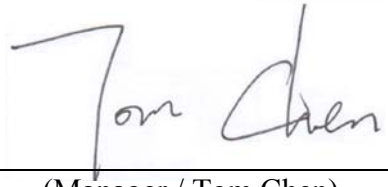
FCC Part15 Subpart C, Paragraph 15.207, 15.247 & 15.209

The device described above is tested by Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.
This report applies to above tested sample only and shall not be reproduced in part without written approval of Anbotek Compliance Laboratory Limited.

Date of Test : May 15~ Jun. 03, 2013

Prepared by : 
(Tested Engineer / Rock Zeng)

Reviewer : 
(Project Manager / Sally Zhang)

Approved & Authorized Signer : 
(Manager / Tom Chen)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Tie Rod Speakers
Model Number	:	PLAY2GO/Hybrid Driver
Test Power Supply	:	AC 120V/60Hz
Frequency	:	2402~2480MHz
Antenna Specification	:	Printed Antenna:0dBi
Modulation	:	GFSK, π/4DQPSK, 8DPSK
Applicant	:	Mansion Industry Co Ltd
Address	:	402 Xiangshan Rd., The 3rd Industrial Park, Luotian Community Songgang Town, BaoAn, Shenzhen, Guangdong 518105, China
Manufacturer	:	Mansion Industry Co Ltd
Address	:	402 Xiangshan Rd., The 3rd Industrial Park, Luotian Community Songgang Town, BaoAn, Shenzhen, Guangdong 518105, China
Date of receiver	:	May 15, 2013
Date of Test	:	May 15~ Jun. 03, 2013

1.2. Auxiliary Equipment Used during Test

N/A

1.3. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS - LAB Code: L3503
Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

FCC-Registration No.: 752021
Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed 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 752021, August 20, 2010.

IC-Registration No.: 8058A-1
Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A-1, August 30, 2010.

Test Location
All Emissions tests were performed at
Anbotek Compliance Laboratory Limited. at 1/F, 1 /Building, SEC Industrial Park, No. 4 Qianhai Road, Nanshan District, Shenzhen, 518054, China

1.4. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 4.3dB
Conduction Uncertainty	:	Uc = 3.4dB

2. Test Procedure

GENERAL: This report shall NOT be reproduced except in full without the written approval of Anbotek Compliance Laboratory Limited. The EUT was transmitting a test signal during the testing.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.4-2009 using a spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100KHz and the video bandwidth was 300KHz up to 1.0GHz and 1.0MHz with a video BW of 3.0MHz above 1.0GHz. The ambient temperature of the EUT was 74.3oF with a humidity of 69%.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the Spectrum Analyzer Meter Reading.

Example:
Freq (MHz) METER READING + ACF = FS
20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

ANSI STANDARD C63.4-2009 10.1.7 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation. When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

3. Conducted Limits

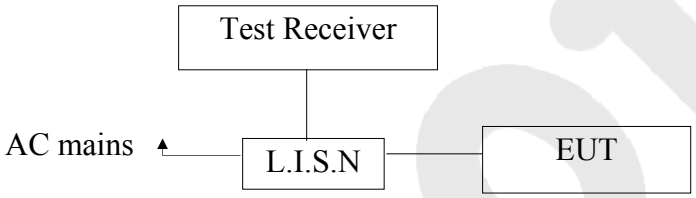
Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	LISN	SchwarzBeck	NSLK 8126	8126377	Apr. 23, 2013	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Apr. 23, 2013	1 Year
4.	EMI Test Software ES-K1	Rohde & Schwarz	N/A	N/A	N/A	N/A

Conduction Uncertainty : Uc = 3.4dB

3.1. Block Diagram of Test Setup

3.1.1. Block diagram of connection between the EUT and simulators



(EUT: Tie Rod Speakers)

3.2. Power Line Conducted Emission Measurement Limits (15.207)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66 ~ 56*	56 ~ 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

3.3. Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

EUT : Tie Rod Speakers
Model Number : PLAY2GO/Hybrid Driver
Applicant : Mansion Industry Co Ltd

3.4. Operating Condition of EUT

3.4.1. Setup the EUT and simulator as shown as Section 3.1.

3.4.2. Turn on the power of all equipment.

3.4.3. Let the EUT work in test mode (Charging) and measure it.

3.5. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.4-2003 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9KHz.

The frequency range from 150KHz to 30MHz is checked.

The test results are reported on Section 3.6.

Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
5.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
6.	LISN	SchwarzBeck	NSLK 8126	8126377	Apr. 23, 2013	1 Year
7.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Apr. 23, 2013	1 Year
8.	EMI Test Software ES-K1	Rohde & Schwarz	N/A	N/A	N/A	N/A

Conduction Uncertainty : Uc = 3.4dB

3.6. Power Line Conducted Emission Measurement Results

PASS.

The frequency range from 150KHz to 30 MHz is investigated.

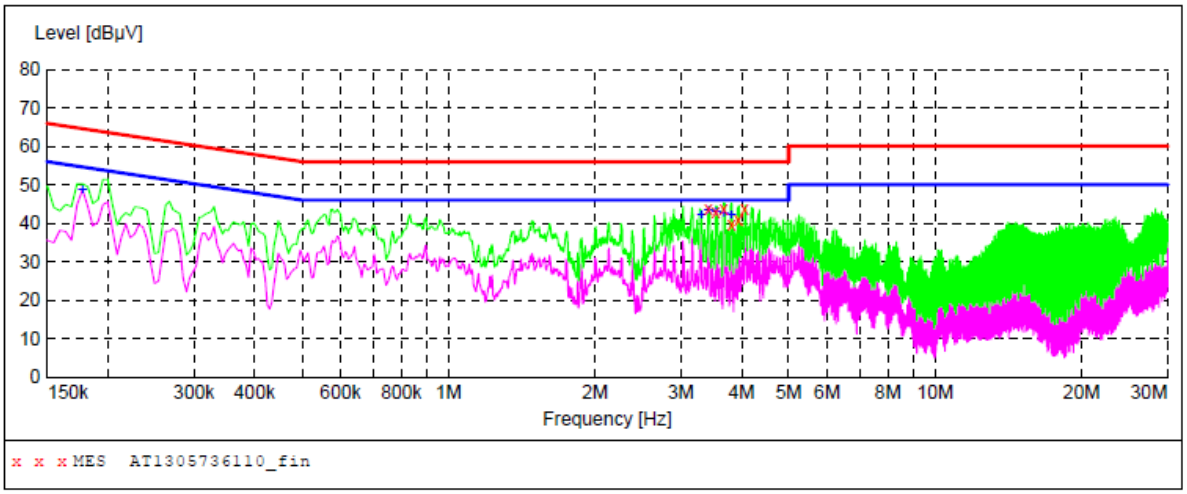
Please refer the following pages.

CONDUCTED EMISSION TEST DATA

EUT:	Tie Rod Speakers M/N: PLAY2GO/Hybrid Driver
Operating Condition:	Charging
Test Site:	1# Shielded Room
Operator:	Finley Li
Test Specification:	AC 120V/60Hz
Comment:	Live Line
	Tem:25℃ Hum:50%

SCAN TABLE: "Voltage(150K~30M)FIN"

Short Description: 150K-30M Disturbance Voltages



MEASUREMENT RESULT: "AT1305736110_fin"

5/17/2013 2:31PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
3.421000	43.60	10.4	56	12.4	QP	L1	GND
3.547000	43.00	10.4	56	13.0	QP	L1	GND
3.677500	43.60	10.4	56	12.4	QP	L1	GND
3.817000	39.70	10.4	56	16.3	QP	L1	GND
3.943000	41.10	10.4	56	14.9	QP	L1	GND
4.064500	43.60	10.5	56	12.4	QP	L1	GND

MEASUREMENT RESULT: "AT1305736110_fin2"

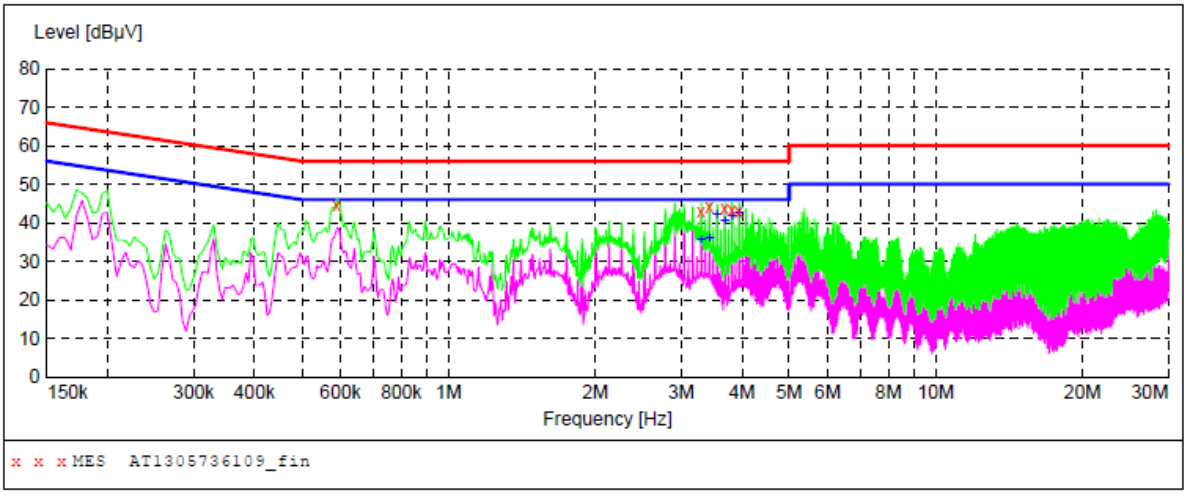
5/17/2013 2:31PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.177000	48.80	10.1	55	5.8	AV	L1	GND
3.308500	42.10	10.4	46	3.9	AV	L1	GND
3.421000	43.20	10.4	46	2.8	AV	L1	GND
3.547000	43.10	10.4	46	2.9	AV	L1	GND
3.677500	42.50	10.4	46	3.5	AV	L1	GND
3.808000	42.10	10.4	46	3.9	AV	L1	GND

CONDUCTED EMISSION TEST DATA

EUT:	Tie Rod Speakers M/N: PLAY2GO/Hybrid Driver
Operating Condition:	Charging
Test Site:	1# Shielded Room
Operator:	Finley Li
Test Specification:	AC 120V/60Hz
Comment:	Neutral Line
	Tem:25℃ Hum:50%

SCAN TABLE: "Voltage(150K~30M)FIN"
Short Description: 150K-30M Disturbance Voltages



MEASUREMENT RESULT: "AT1305736109_fin"

5/17/2013 2:28PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.591000	44.50	10.1	56	11.5	QP	N	GND
3.299500	43.00	10.4	56	13.0	QP	N	GND
3.430000	44.30	10.4	56	11.7	QP	N	GND
3.686500	43.80	10.4	56	12.2	QP	N	GND
3.817000	43.50	10.4	56	12.5	QP	N	GND
3.947500	42.80	10.4	56	13.2	QP	N	GND

MEASUREMENT RESULT: "AT1305736109_fin2"

5/17/2013 2:28PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
3.299500	35.50	10.4	46	10.5	AV	N	GND
3.430000	36.00	10.4	46	10.0	AV	N	GND
3.560500	42.20	10.4	46	3.8	AV	N	GND
3.686500	40.50	10.4	46	5.5	AV	N	GND
3.817000	41.80	10.4	46	4.2	AV	N	GND
3.947500	42.50	10.4	46	3.5	AV	N	GND

4. Radiation Interference

4.1. Requirements (15.247, 15.209):

FIELD STRENGTH	FIELD STRENGTH	S15.209	
of Fundamental:	of Harmonics	30 - 88 MHz	40 dBuV/m @3M
902-928 MHZ		88 - 216 MHz	43.5
2.4-2.4835 GHz		216 - 960 MHz	46
94 dBμV/m @3m	54 dBμV/m @3m	ABOVE 960 MHz	54dBuV/m

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation.

4.2 Test Procedure

The EUT is placed on a turn table which is 0.8 meter high above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

All readings from 30MHz to 1GHz are quasi-peak values with a resolution bandwidth of 120kHz. All reading are above 1GHz, peak & average values with a resolution bandwidth of 1MHz. The EUT is tested in 9*6*6 Chamber.
The test results are listed in Section 4.3.

Test Equipment

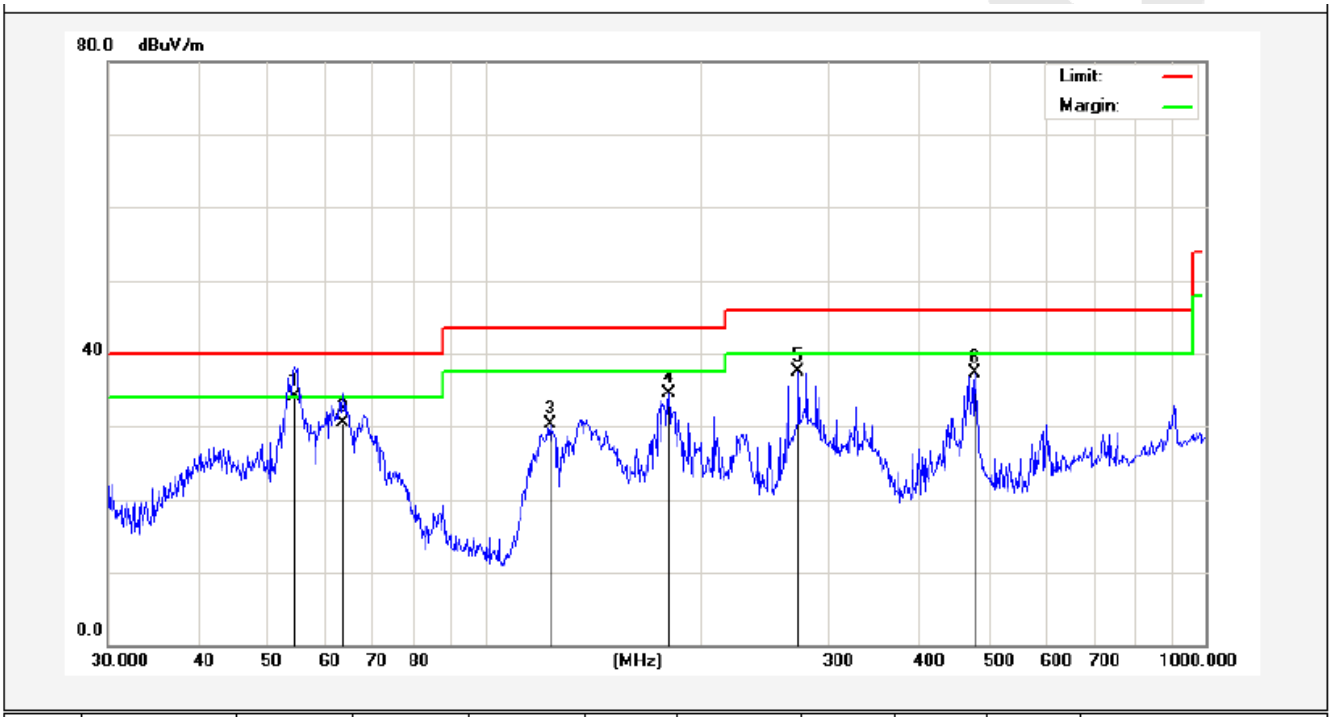
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	Trilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	1 Year
3.	Pre-amplifier	Compliance Direction	PAP-0203	22008	Apr. 23, 2013	1 Year
4.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

Radiation Uncertainty : Ur = 4.3dB

4.3 Test Results

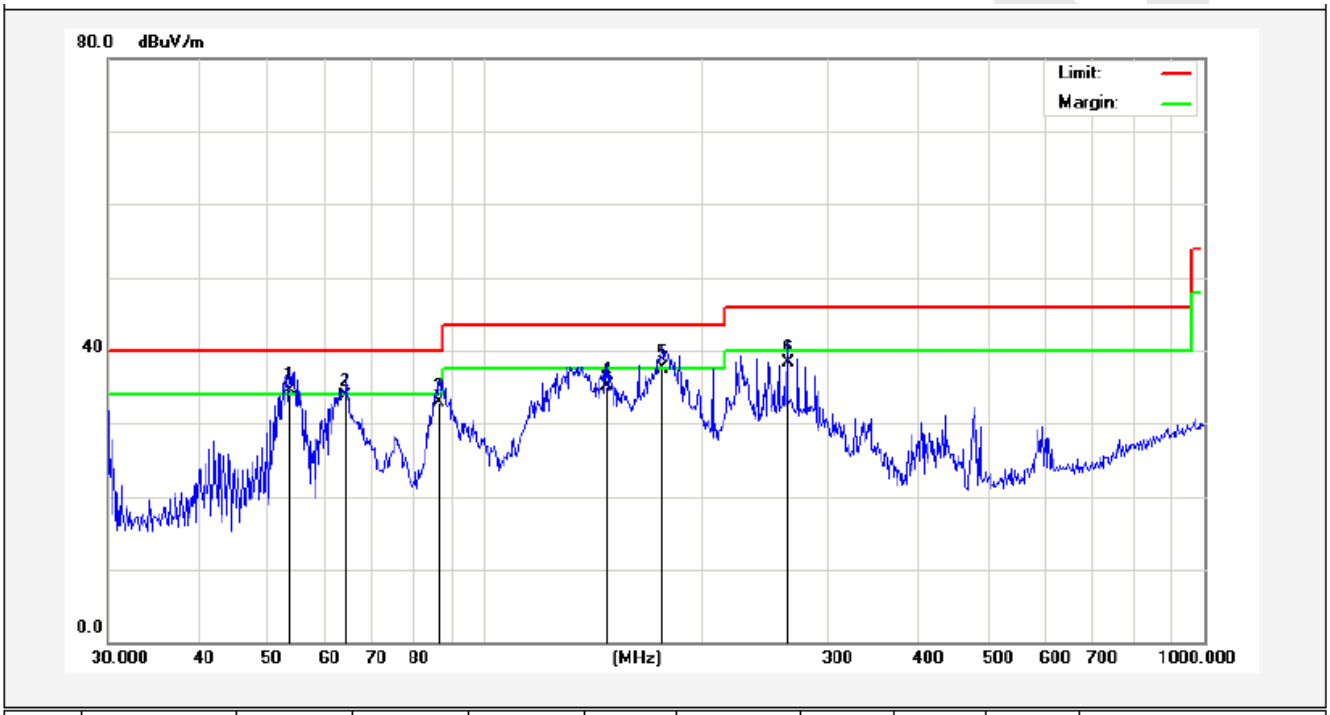
PASS.
Please refer the following pages.

Job No.:	**AT1305736F**	**Polarziation:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (30~1000MHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:02:33**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**
Note:	**BT Mode**		



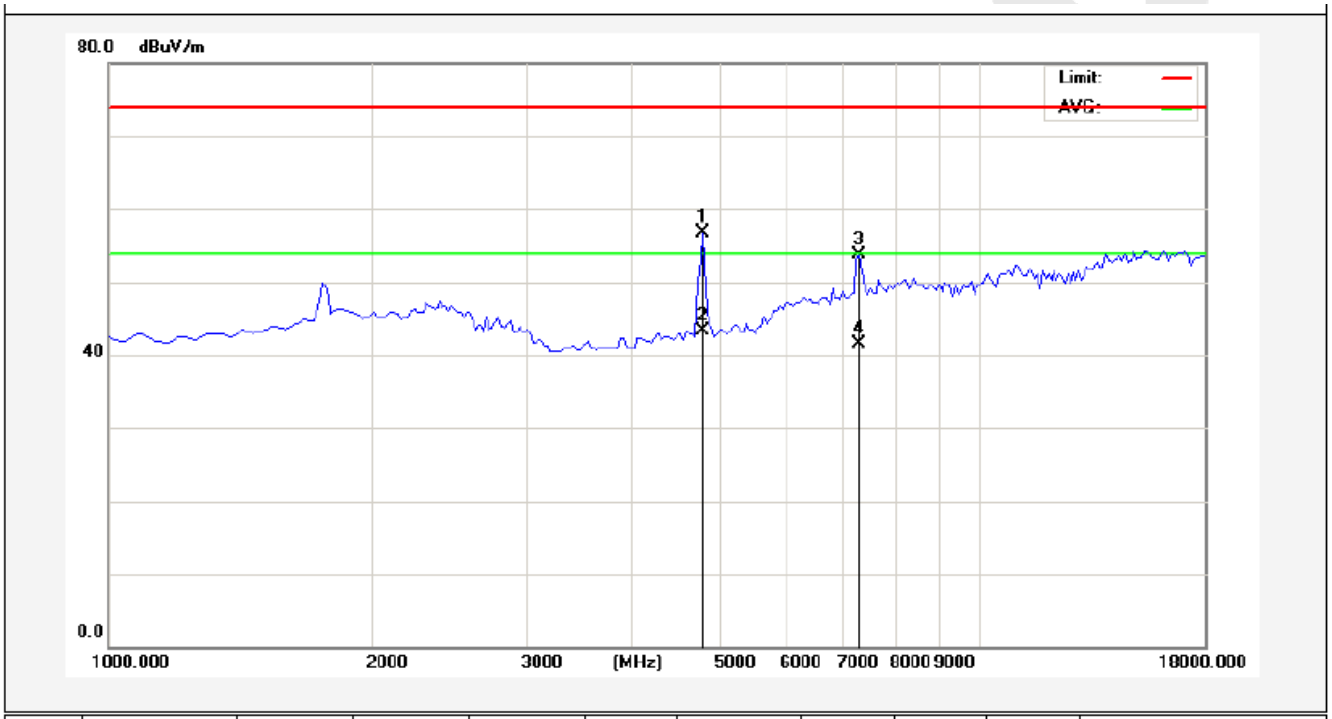
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	54.4515	48.96	-14.88	34.08	40.00	-5.92	QP	100	0	
2	63.5356	47.36	-16.86	30.50	40.00	-9.50	QP	100	360	
3	123.2655	52.11	-21.82	30.29	43.50	-13.21	peak			
4	180.0165	56.33	-21.85	34.48	43.50	-9.02	peak			
5	272.2776	55.97	-18.52	37.45	46.00	-8.55	peak			
6	478.8455	48.79	-11.57	37.22	46.00	-8.78	peak			

Job No.:	**AT1305736F**	**Polarziation:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (30~1000MHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:05:57**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**
Note:	**BT Mode**		



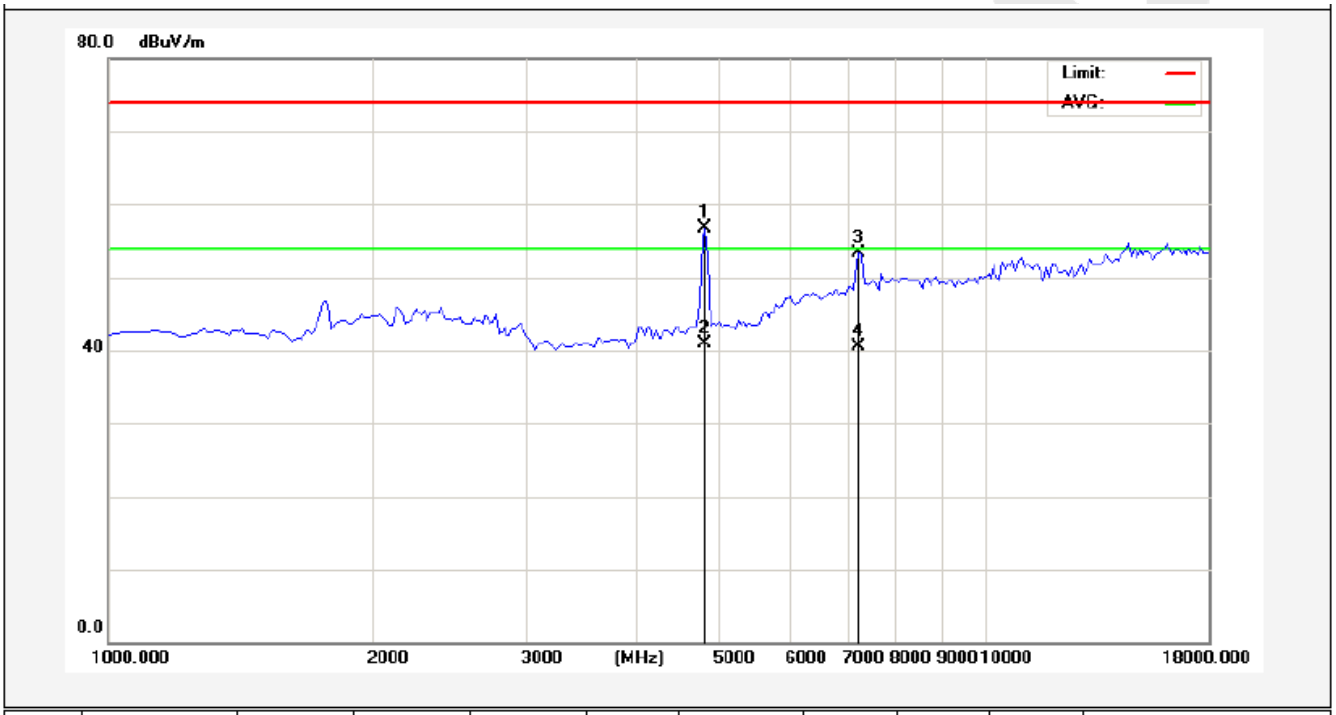
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	53.6931	49.35	-14.84	34.51	40.00	-5.49	QP	100	0	
2	64.2074	50.89	-17.15	33.74	40.00	-6.26	QP	100	360	
3	86.5027	51.15	-18.20	32.95	40.00	-7.05	QP	100	0	
4	147.9214	53.51	-18.37	35.14	43.50	-8.36	QP	100	360	
5	176.8876	54.53	-17.06	37.47	43.50	-6.03	QP	100	0	
6	263.8190	52.49	-14.22	38.27	46.00	-7.73	QP	100	360	

Job No.:	**AT1305736F**	**Polarziation:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (Above 1GHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:14:14**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**
Note:	**2402 MHz**		



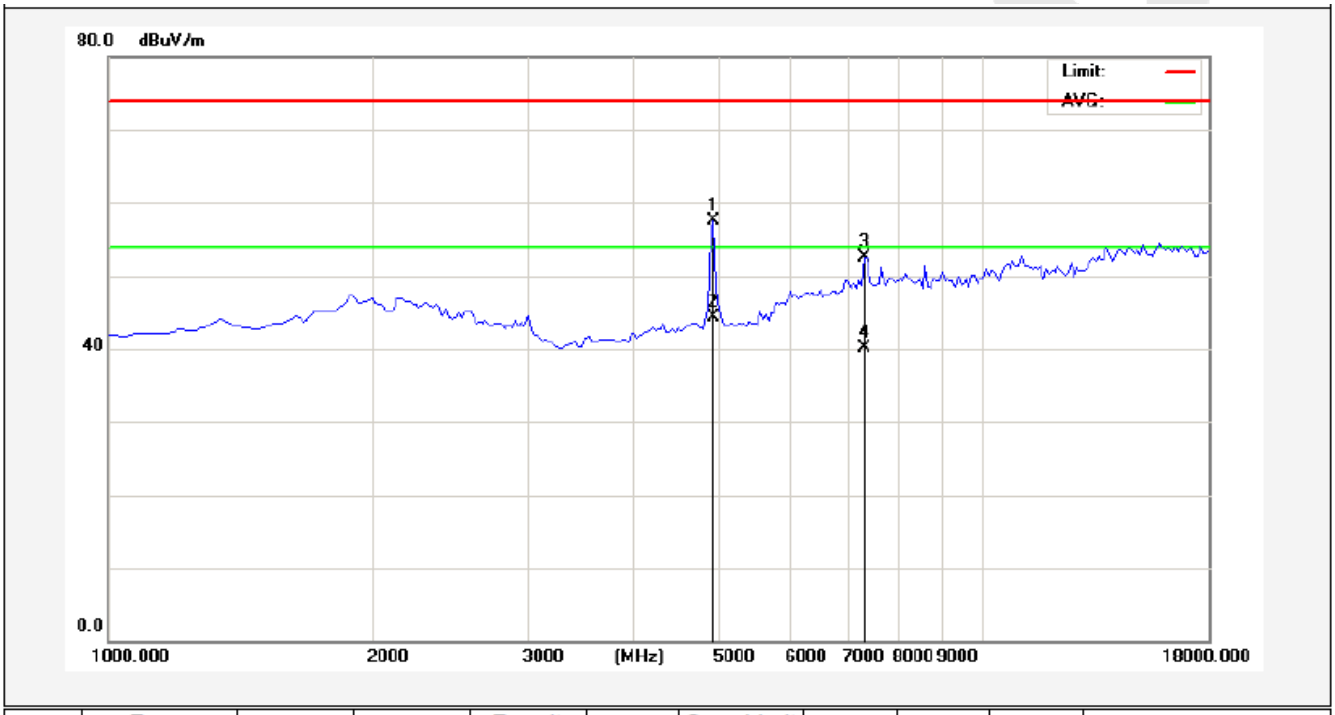
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	53.34	3.34	56.68	74.00	-17.32	peak			
2	4825.000	40.02	3.34	43.36	54.00	-10.64	AVG			
3	7290.000	45.16	8.53	53.69	74.00	-20.31	peak			
4	7290.000	32.92	8.53	41.45	54.00	-12.55	AVG			

Job No.:	**AT1305736F**	**Polarziation:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (Above 1GHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:17:57**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**
Note:	**2402 MHz**		



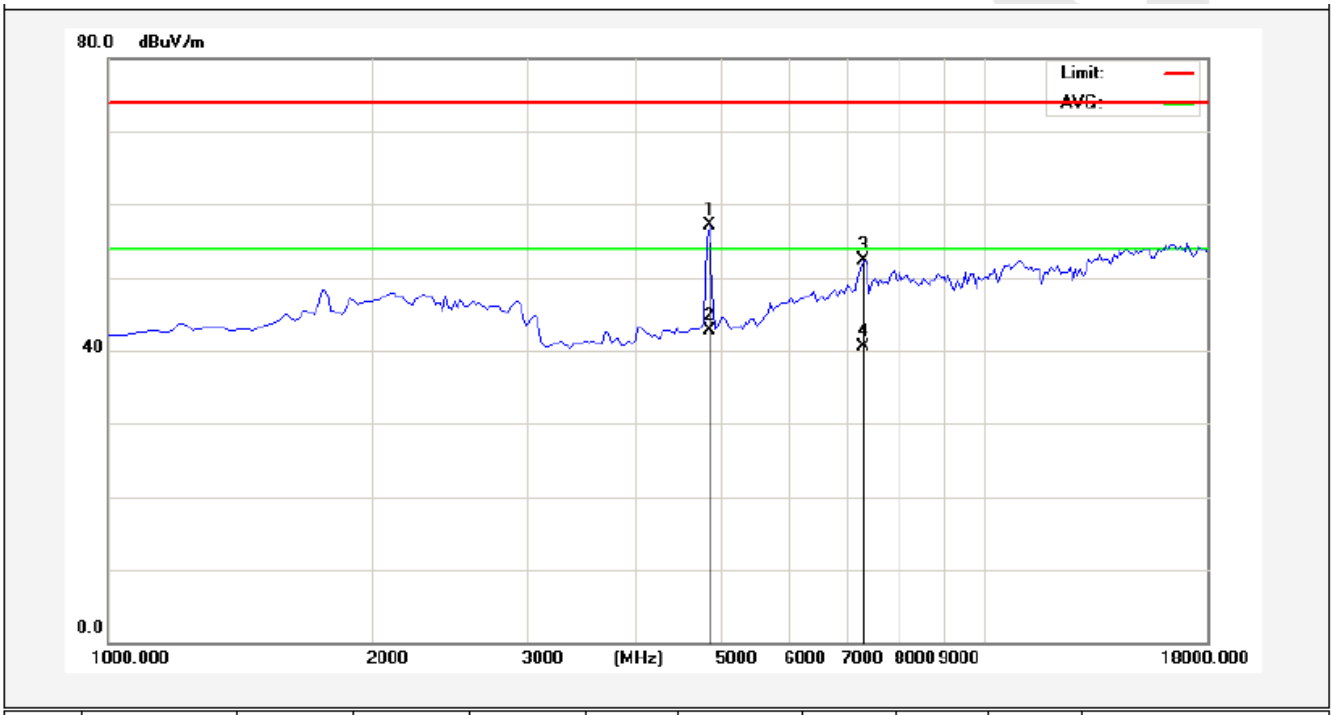
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	53.43	3.34	56.77	74.00	-17.23	peak			
2	4825.000	37.51	3.34	40.85	54.00	-13.15	AVG			
3	7205.000	44.82	8.43	53.25	74.00	-20.75	peak			
4	7205.000	32.02	8.43	40.45	54.00	-13.55	AVG			

Job No.:	**AT1305736F**	**Polarziation:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (Above 1GHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:20:35**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**
Note:	**2441 MHz**		



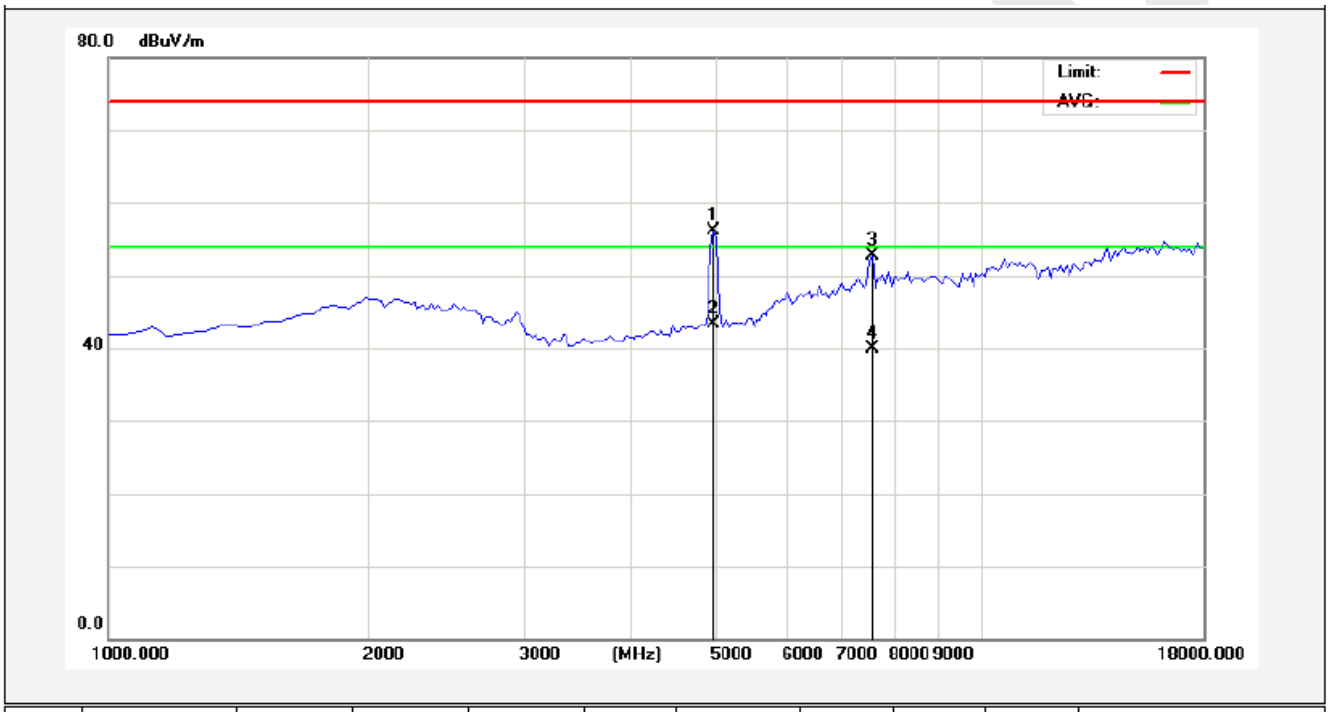
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4910.000	54.02	3.49	57.51	74.00	-16.49	peak			
2	4910.000	40.82	3.49	44.31	54.00	-9.69	AVG			
3	7332.500	43.92	8.58	52.50	74.00	-21.50	peak			
4	7332.500	31.57	8.58	40.15	54.00	-13.85	AVG			

Job No.:	**AT1305736F**	**Polarziation:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (Above 1GHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:23:07**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**
Note:	**2441 MHz**		



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4867.500	53.79	3.41	57.20	74.00	-16.80	peak			
2	4867.500	39.34	3.41	42.75	54.00	-11.25	AVG			
3	7332.500	43.70	8.58	52.28	74.00	-21.72	peak			
4	7332.500	32.00	8.58	40.58	54.00	-13.42	AVG			

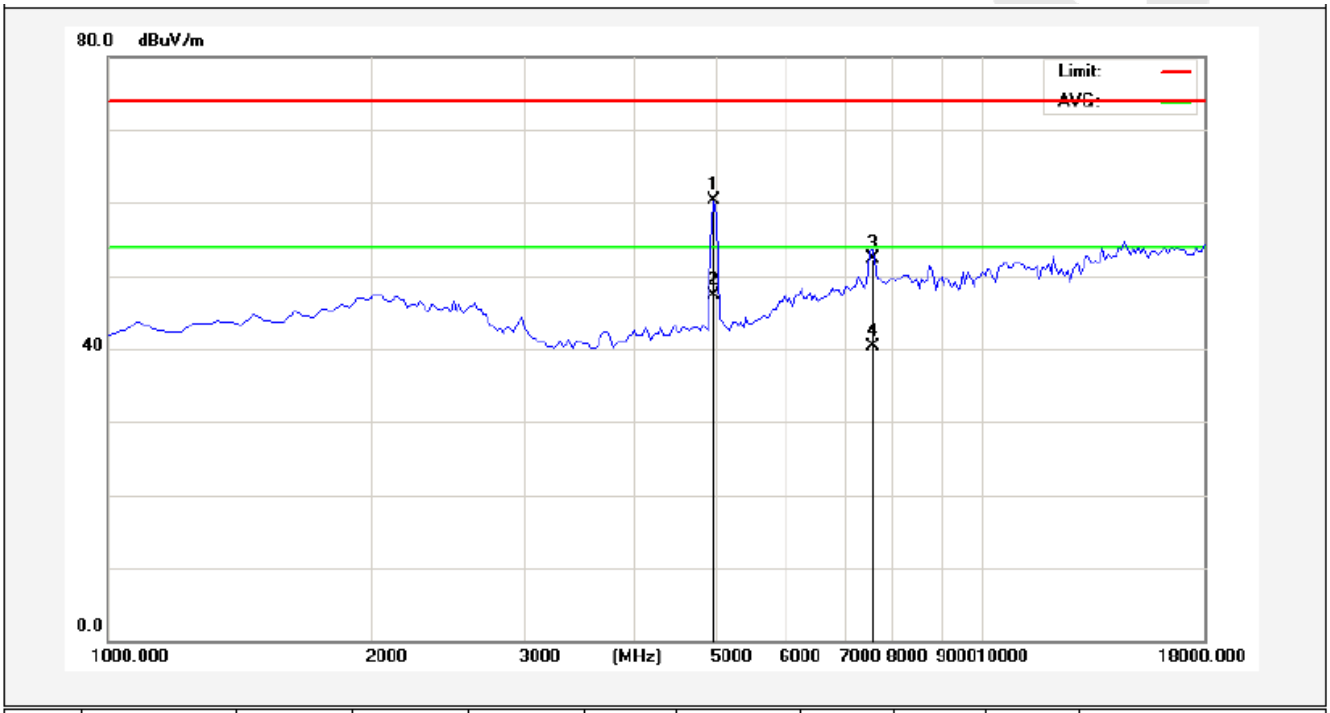
Job No.:	**AT1305736F**	**Polarziation:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (Above 1GHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:27:54**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**
Note:	**2480 MHz**		



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4952.500	52.52	3.57	56.09	74.00	-17.91	peak			
2	4952.500	39.68	3.57	43.25	54.00	-10.75	AVG			
3	7545.000	43.92	8.86	52.78	74.00	-21.22	peak			
4	7545.000	31.02	8.86	39.88	54.00	-14.12	AVG			

Job No.:	**AT1305736F**	**Polarziation:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**AC 120V/60Hz**
Test item:	**Radiation Test (Above 1GHz)**	**Date:**	**2013/05/20**
Temp.(C)/Hum.(%RH):	**24.3(C)/55%RH**	**Time:**	**12:30:12**
EUT:	**Tie Rod Speakers**	**Test By:**	**Jimly Chen**
Model:	**PLAY2GO/Hybrid Driver**	**Distance:**	**3m**

Note: **2480 MHz**



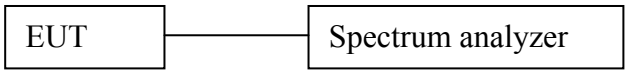
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4952.500	56.71	3.57	60.28	74.00	-13.72	peak			
2	4952.500	43.71	3.57	47.28	74.00	-26.72	peak			
3	7545.000	43.39	8.86	52.25	54.00	-1.75	AVG			
4	7545.000	31.47	8.86	40.33	54.00	-13.67	AVG			

5. CHANNEL SEPARATION TEST

5.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

5.2 Test SET-UP



5.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 23, 2013	1 Year
3.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 23, 2013	1 Year
4.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

5.4 Test Results

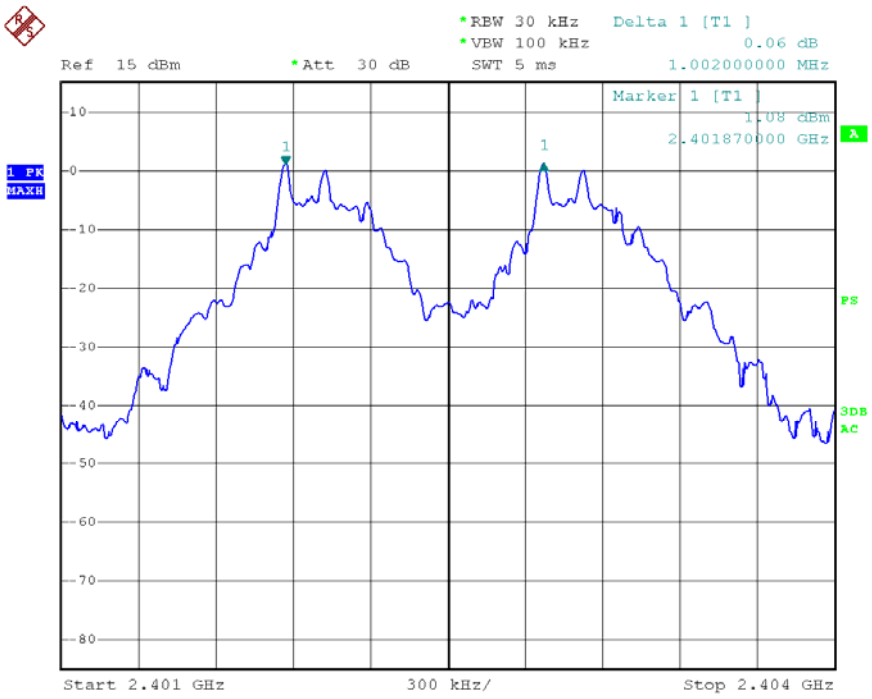
Product : Tie Rod Speakers
Test Item : Frequency Separation
Test Voltage : AC 120V/60Hz
Test Result : PASS
Test Mode : CH Low ~ CH High
Temperature : 24℃
Humidity : 55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode
Low	2401	1002	678	GFSK
Mid	2441	1002	684	GFSK
High	2480	1002	678	GFSK
Low	2401	1014	844	π/4DQPSK
Mid	2441	1002	844	π/4DQPSK
High	2480	1008	844	π/4DQPSK
Low	2401	1014	844	8DPSK
Mid	2441	1002	844	8DPSK
High	2480	1008	844	8DPSK

Remark:
1. The limit of modulation (π/4DQPSK, 8DPSK) is 2/3 of 20dB BW;

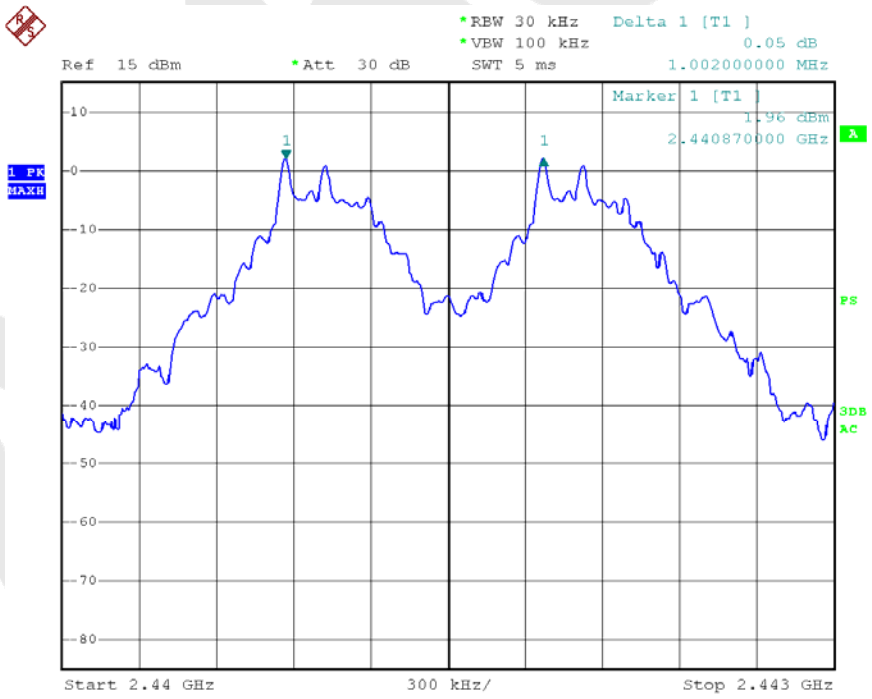
Modulation Mode: GFSK

CH Low



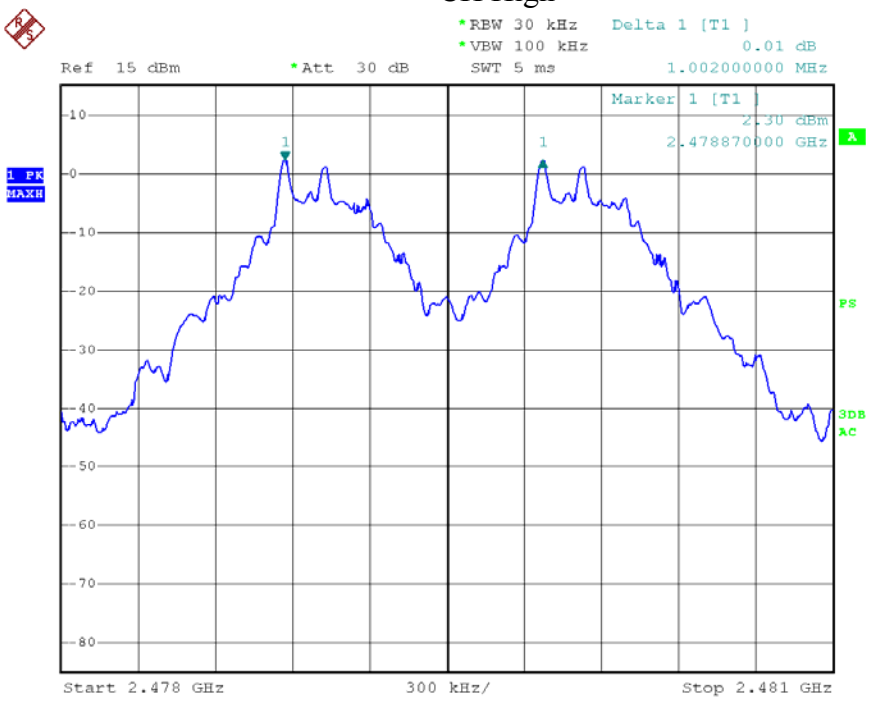
Date: 29.MAY.2013 21:37:36

CH Mid



Date: 29.MAY.2013 21:38:41

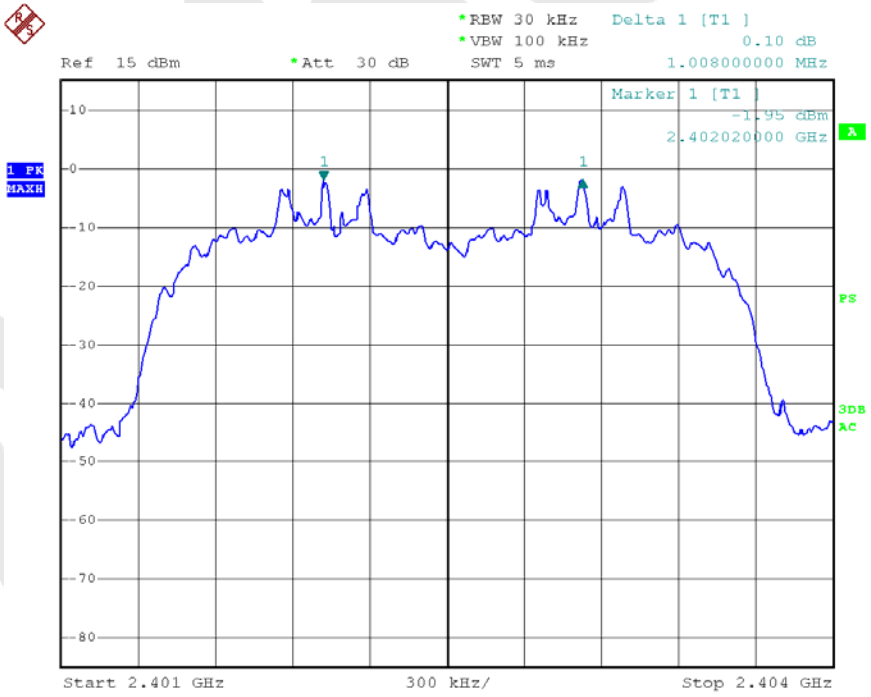
CH High



Date: 29.MAY.2013 21:39:29

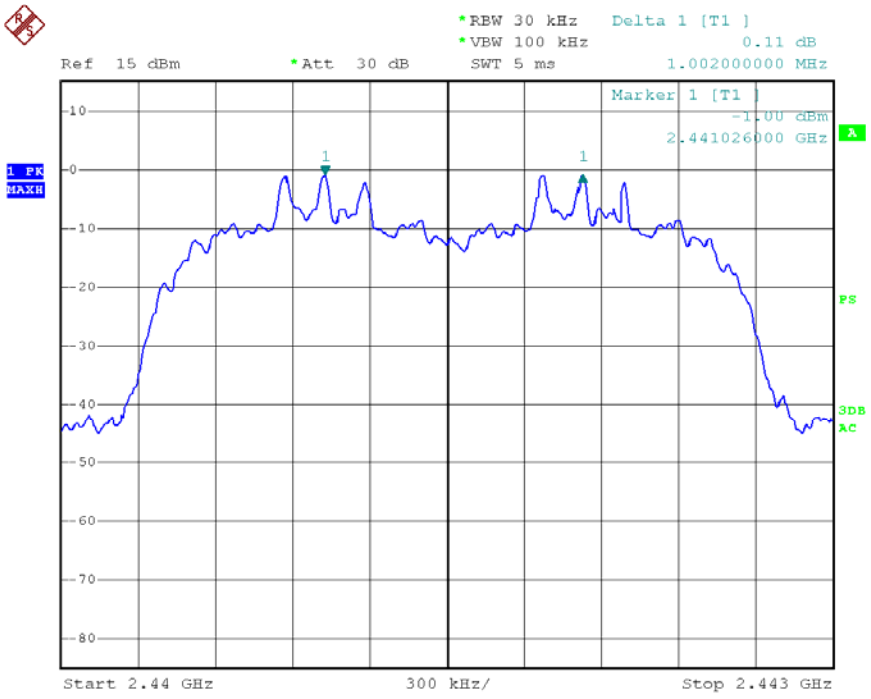
Modulation Mode: π/4DQPSK & 8DPSK

CH Low



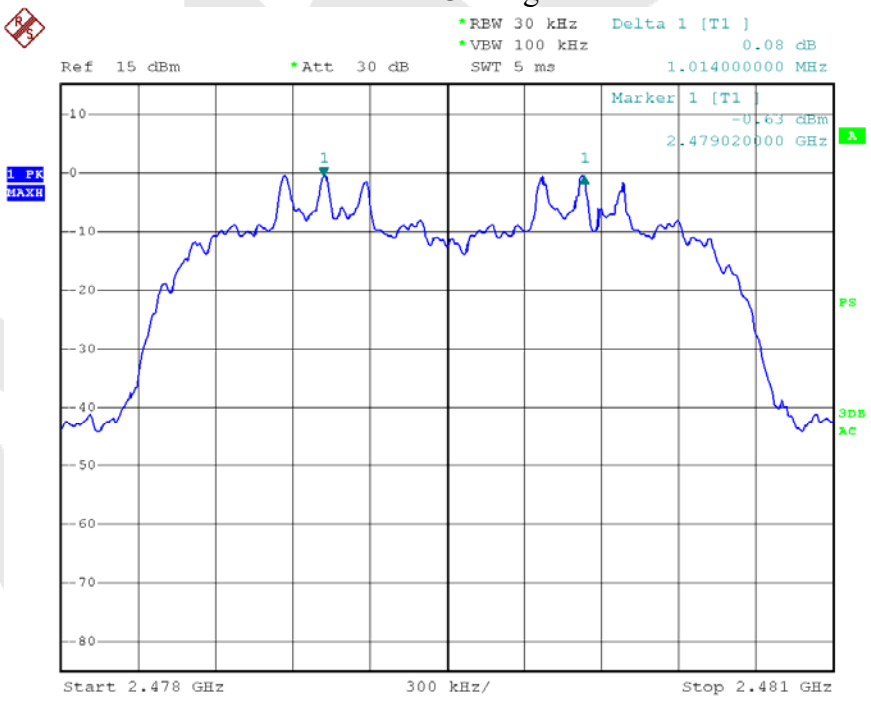
Date: 29.MAY.2013 21:42:18

CH Mid



Date: 29.MAY.2013 21:41:32

CH High



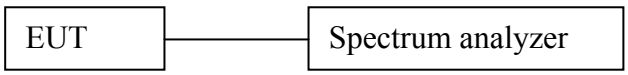
Date: 29.MAY.2013 21:40:32

6. 20DB BANDWIDTH TEST

6.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

6.2 Test SET-UP



6.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 23, 2013	1 Year
3.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 23, 2013	1 Year
4.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

6.4 Test Results

Product : Tie Rod Speakers
Test Item : 20dB BW
Test Voltage : AC 120V/60Hz
Test Result : PASS

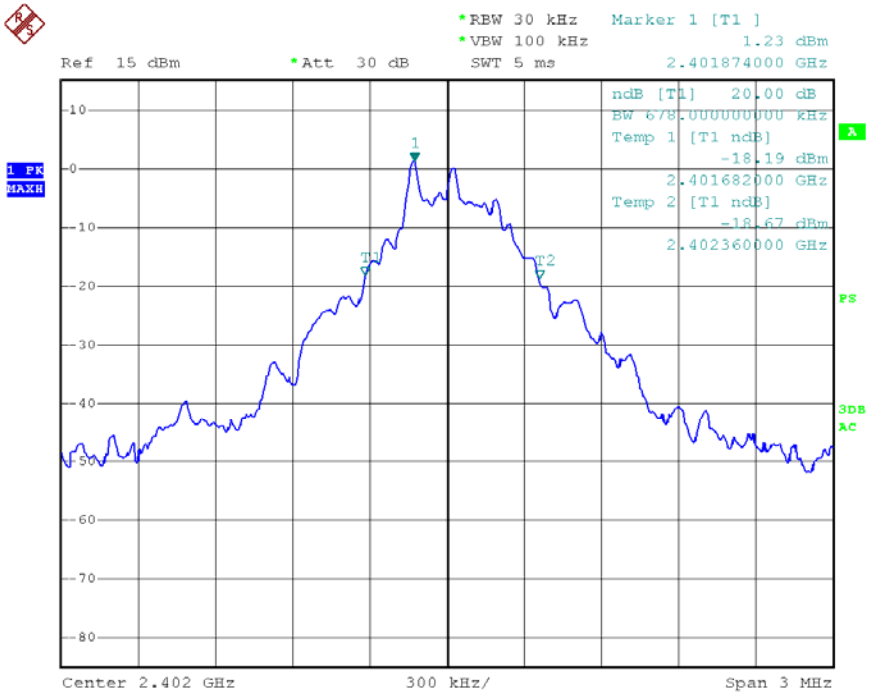
Test Mode : CH Low ~ CH High
Temperature : 24℃
Humidity : 55%RH

Channel	Frequency (MHz)	20dB Down BW(kHz)	Modulation Mode
Low	2401	678	GFSK
Mid	2441	684	GFSK
High	2480	678	GFSK
Low	2401	1266	π/4DQPSK
Mid	2441	1266	π/4DQPSK
High	2480	1266	π/4DQPSK
Low	2401	1266	8DPSK
Mid	2441	1266	8DPSK
High	2480	1266	8DPSK

Remark: The results of modulations π/4DQPSK and 8DPSK are the same.

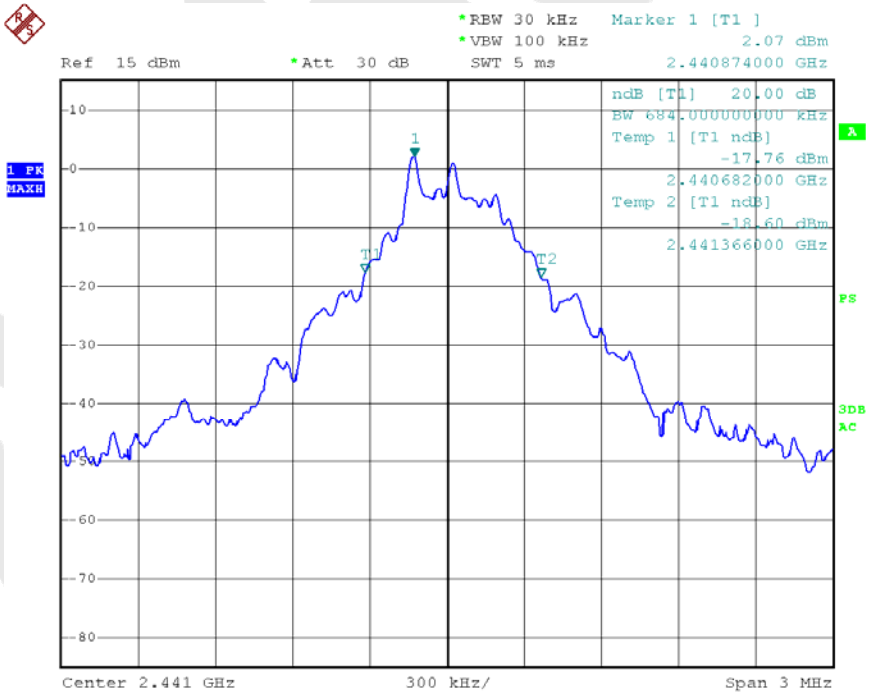
Modulation Mode: GFSK

CH Low



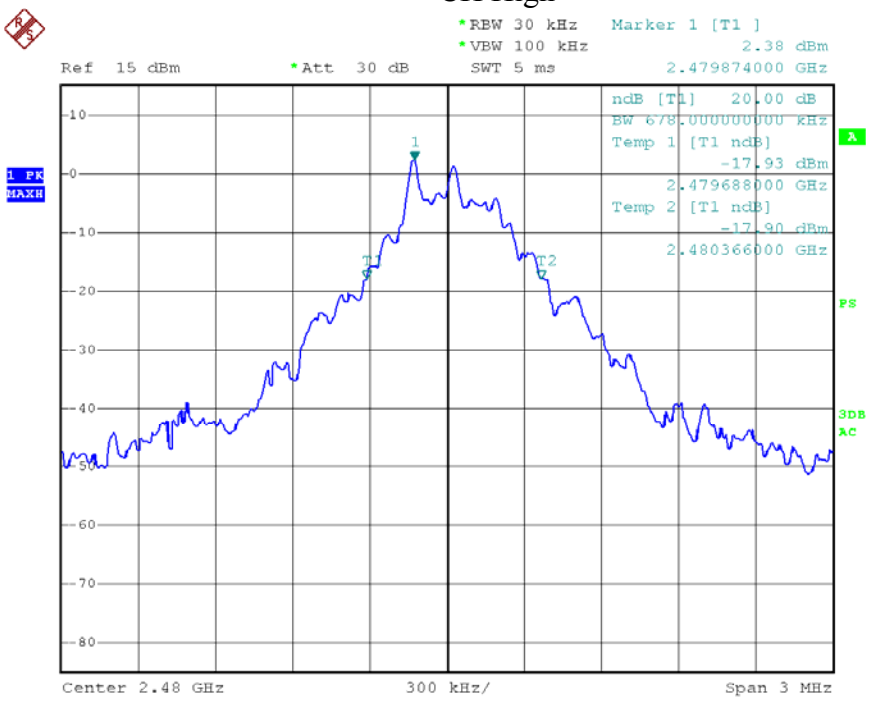
Date: 29.MAY.2013 21:27:28

CH Mid



Date: 29.MAY.2013 21:27:55

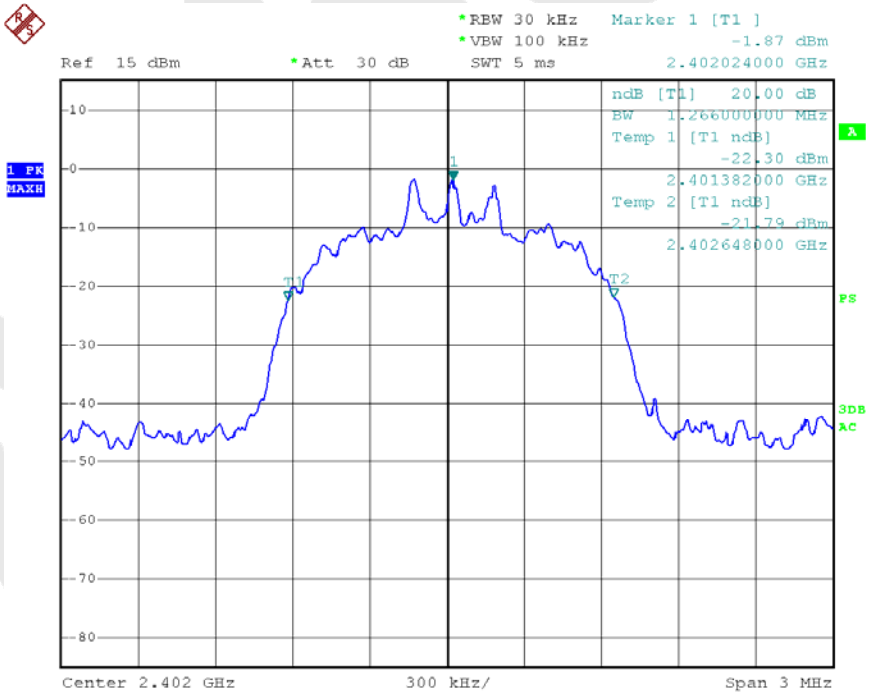
CH High



Date: 29.MAY.2013 21:28:17

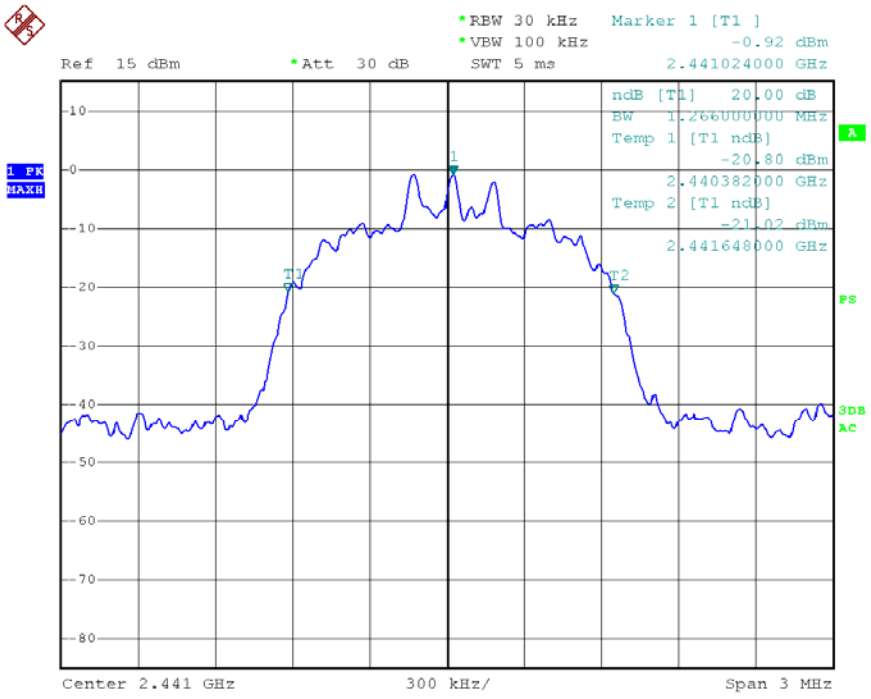
Modulation Mode: π/4DQPSK & 8DPSK

CH Low



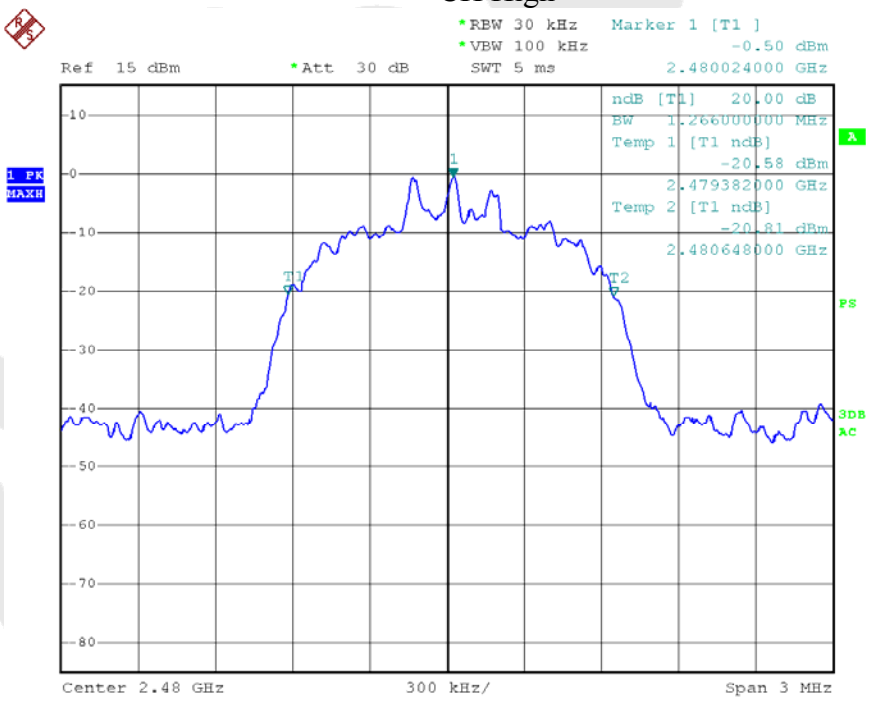
Date: 29.MAY.2013 21:28:46

CH Mid



Date: 29.MAY.2013 21:30:01

CH High



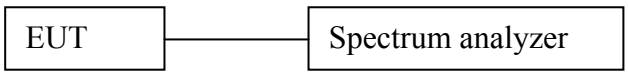
Date: 29.MAY.2013 21:30:27

7. QUANTITY OF HOPPING CHANNEL TEST

7.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

7.2 Test SET-UP



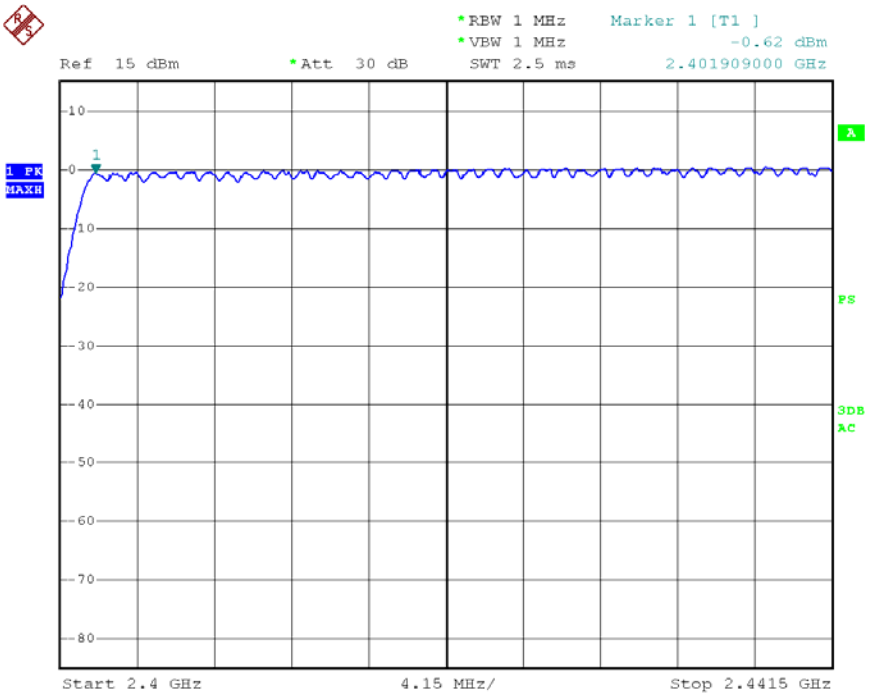
7.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 23, 2013	1 Year
3.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 23, 2013	1 Year
4.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

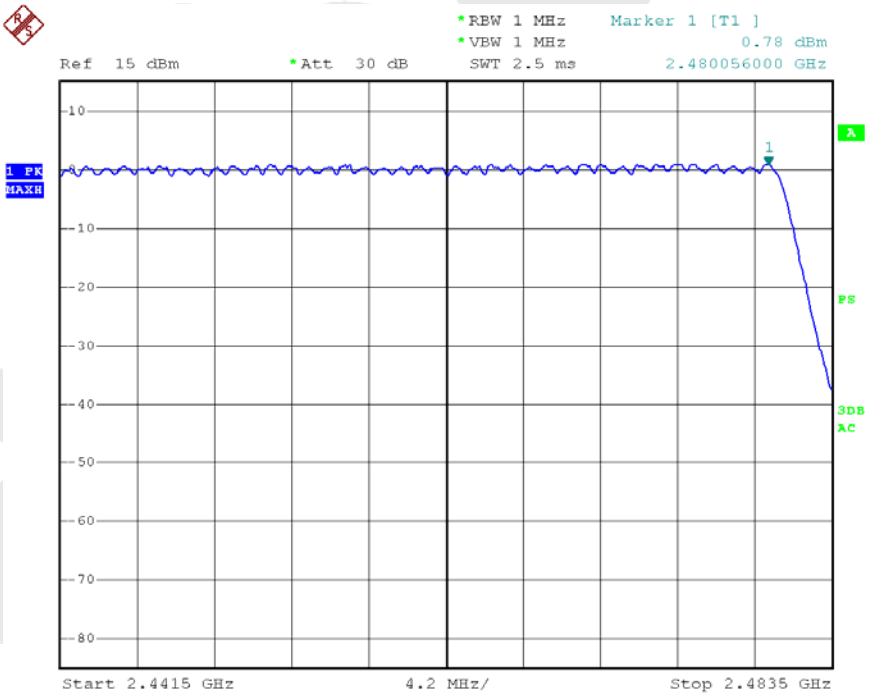
7.4 Test Results

Product	:	Tie Rod Speakers	Test Mode	:	CH Low ~ CH High
Test Item	:	Number of Hopping Frequency	Temperature	:	24℃
Test Voltage	:	AC 120V/60Hz	Humidity	:	55%RH
Test Result	:	PASS			

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
2402-2480	79	＞15



Date: 29.MAY.2013 21:44:01



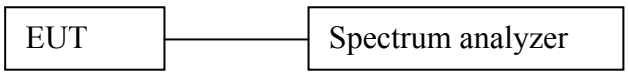
Date: 29.MAY.2013 21:44:54

8. DWELL TIME TEST

8.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

8.2 Test SET-UP



8.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 23, 2013	1 Year
3.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 23, 2013	1 Year
4.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

8.4 Test Results

Product	:	Tie Rod Speakers	Test Mode	:	CH Low ~ CH High
Test Item	:	Time of Occupancy	Temperature	:	24℃
Test Voltage	:	AC 120V/60Hz	Humidity	:	55%RH
Test Result	:	PASS			

DH 1:

Channel	*Pulse width (ms)*	Time slot length(ms)	Dwell time (s)	Limit (s)
Low Channel	0.420	time slot length *1600/2 /79 * 31.6	134.40	*0.4*
Mid Channel	0.415	time slot length *1600/2 /79 * 31.6	132.80	*0.4*
High Channel	0.415	time slot length *1600/2 /79 * 31.6	132.80	*0.4*

DH 3:

Channel	*Pulse width (ms)*	Time slot length(ms)	Dwell time (s)	Limit (s)
Low Channel	1.6942	time slot length *1600/4 /79 * 31.6	271.08	*0.4*
Mid Channel	1.6942	time slot length *1600/4 /79 * 31.6	271.08	*0.4*
High Channel	1.6942	time slot length *1600/4 /79 * 31.6	271.08	*0.4*

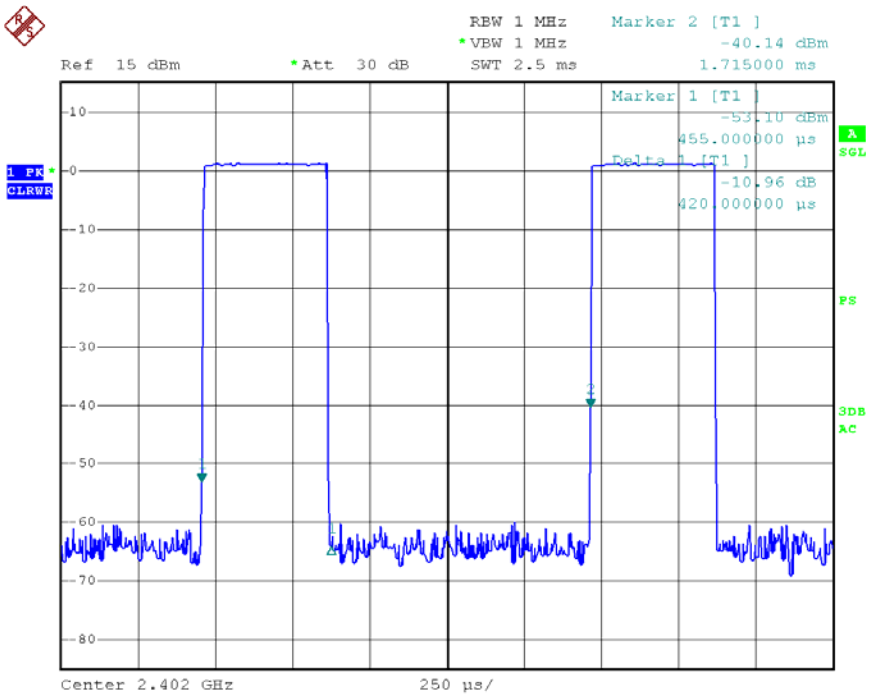
DH 5:

Channel	*Pulse width (ms)*	Time slot length(ms)	Dwell time (s)	Limit (s)
Low Channel	2.9400	time slot length *1600/6 /79 * 31.6	313.60	*0.4*
Mid Channel	2.9556	time slot length *1600/6 /79 * 31.6	315.27	*0.4*
High Channel	2.9556	time slot length *1600/6 /79 * 31.6	315.27	*0.4*

Passed.

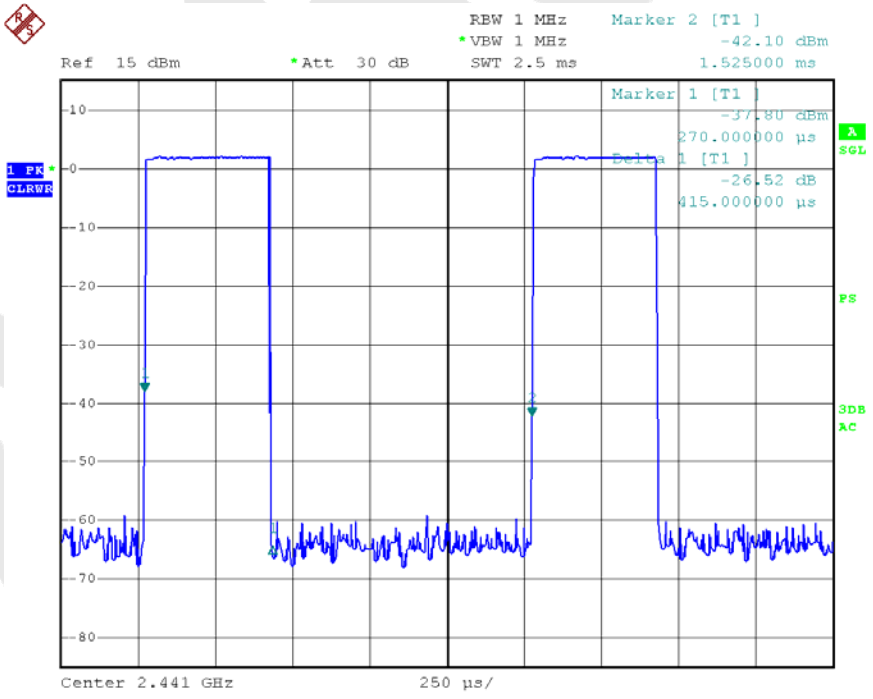
DH1:

CH Low



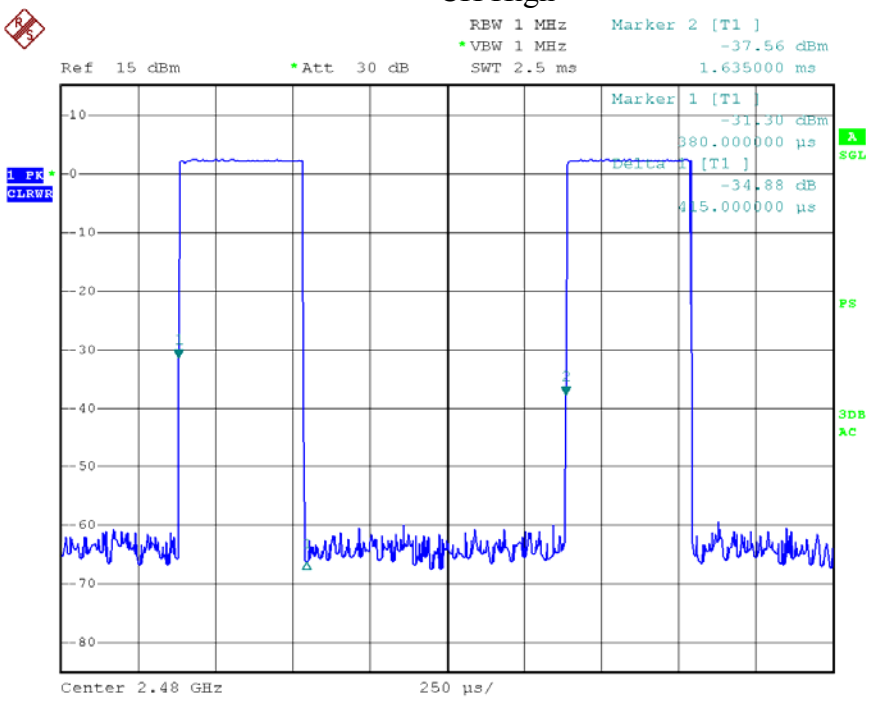
Date: 29.MAY.2013 21:46:10

CH Mid



Date: 29.MAY.2013 21:46:49

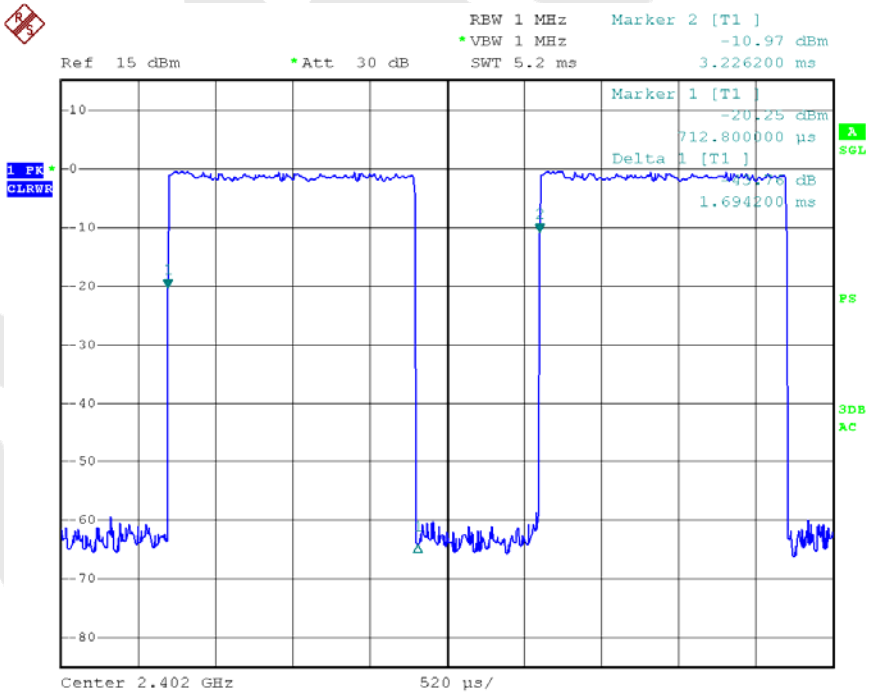
CH High



Date: 29.MAY.2013 21:47:24

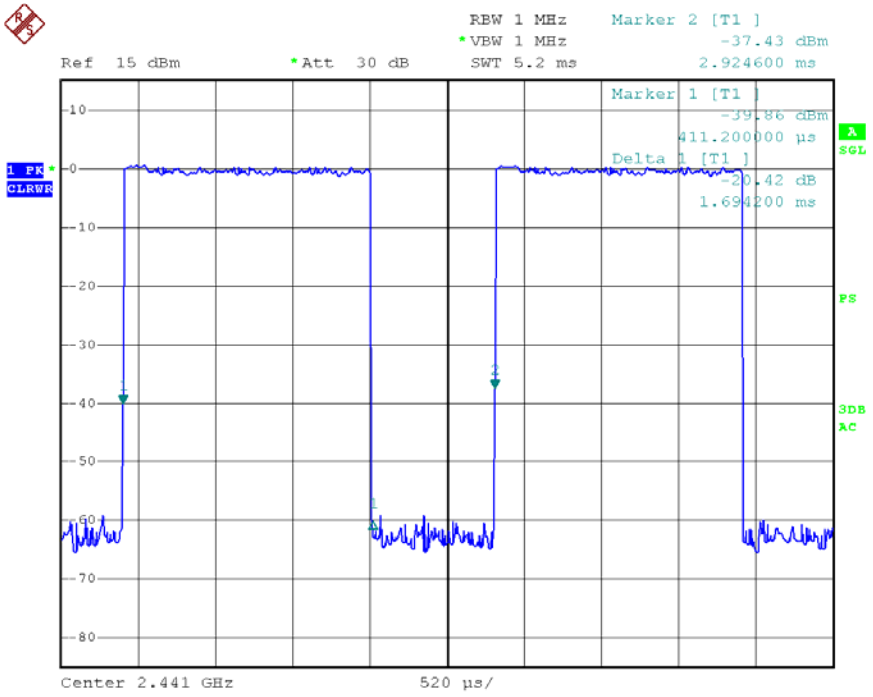
DH3:

CH Low



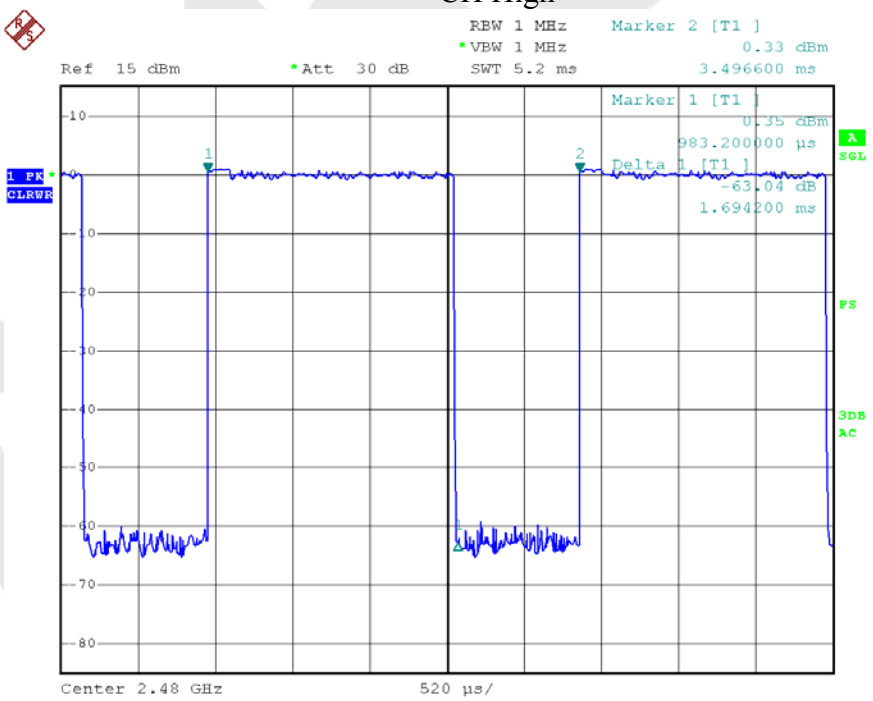
Date: 29.MAY.2013 21:48:20

CH Mid



Date: 29.MAY.2013 21:48:54

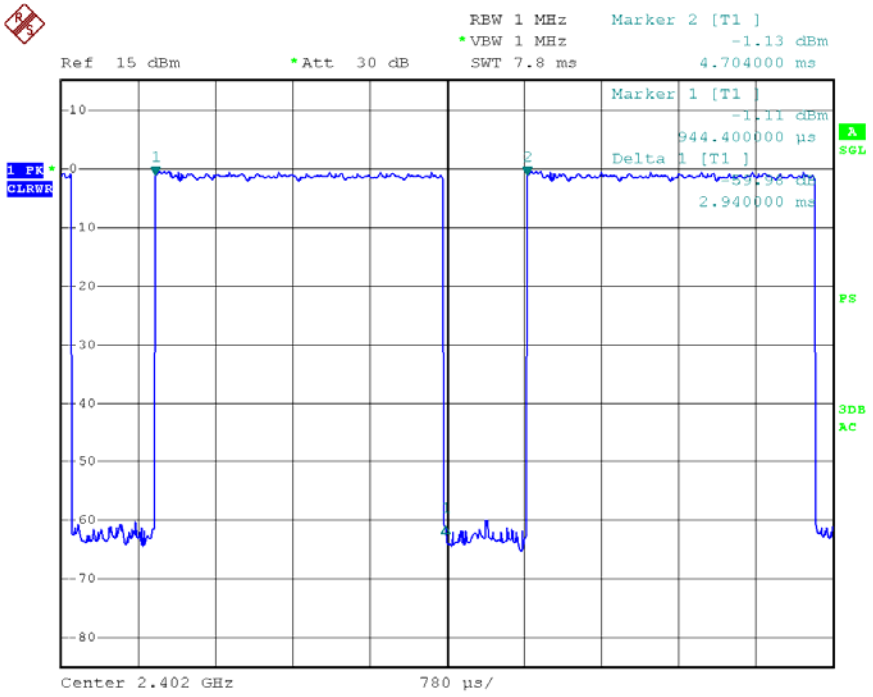
CH High



Date: 29.MAY.2013 21:49:25

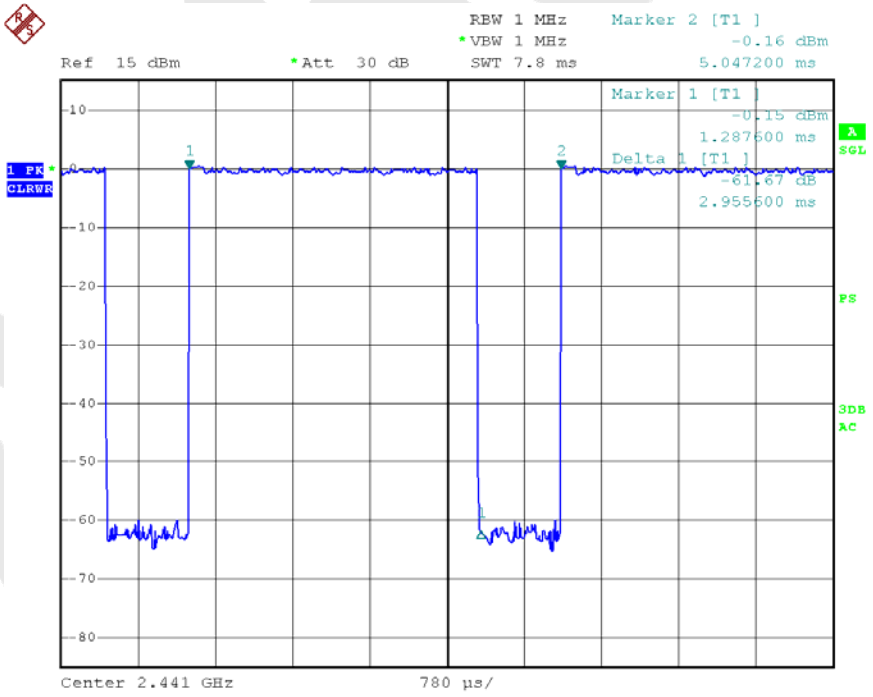
DH5:

CH Low



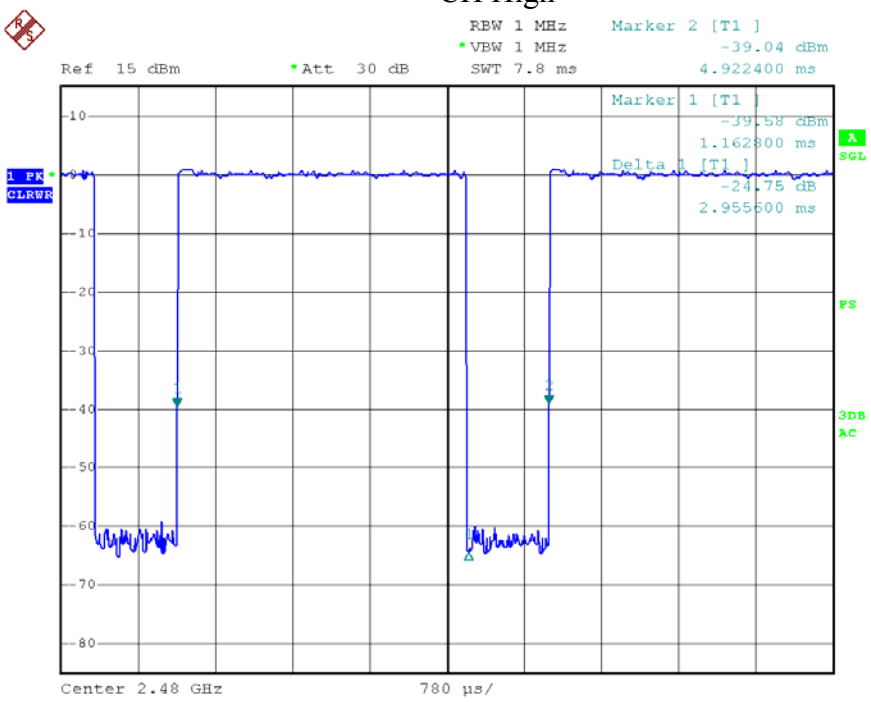
Date: 29.MAY.2013 21:50:36

CH Mid



Date: 29.MAY.2013 21:51:34

CH High



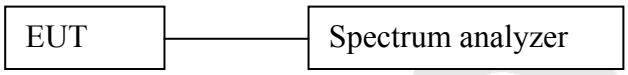
Date: 29.MAY.2013 21:51:58

9. MAX IMUM PEAK OUTPUT POWER TEST

9.1 Measurement Procedure

a. Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
d. Measure the captured power within the band and recording the plot.
e. Repeat above procedures until all frequencies required were complete.

9.2 Test SET-UP



9.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 23, 2013	1 Year
3.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 23, 2013	1 Year
4.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

9.4 Test Results

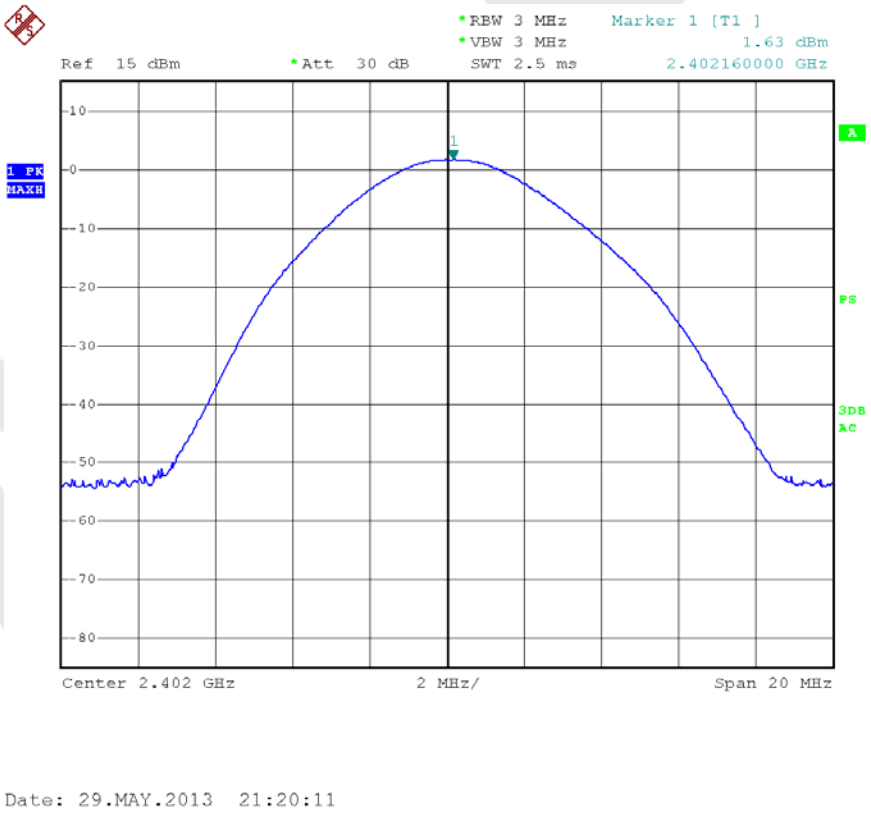
Product	:	Tie Rod Speakers	Test Mode	:	CH Low ~ CH High
Test Item	:	Max. peak output power	Temperature	:	24℃
Test Voltage	:	AC 120V/60Hz	Humidity	:	55%RH
Test Result	:	PASS			

Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Peak Power Limit(mW)	Results	Modulation
2402	1.46	1.63	125	PASS	GFSK
2441	1.75	2.44	125	PASS	GFSK
2480	**1.88**	**2.72**	125	PASS	GFSK
2402	1.05	0.19	125	PASS	π /4DQPSK
2441	1.23	1.10	125	PASS	π /4DQPSK
2480	**1.40**	**1.45**	125	PASS	π /4DQPSK
2402	1.05	0.19	125	PASS	8DPSK
2441	1.23	1.10	125	PASS	8DPSK
2480	1.40	1.45	125	PASS	8DPSK

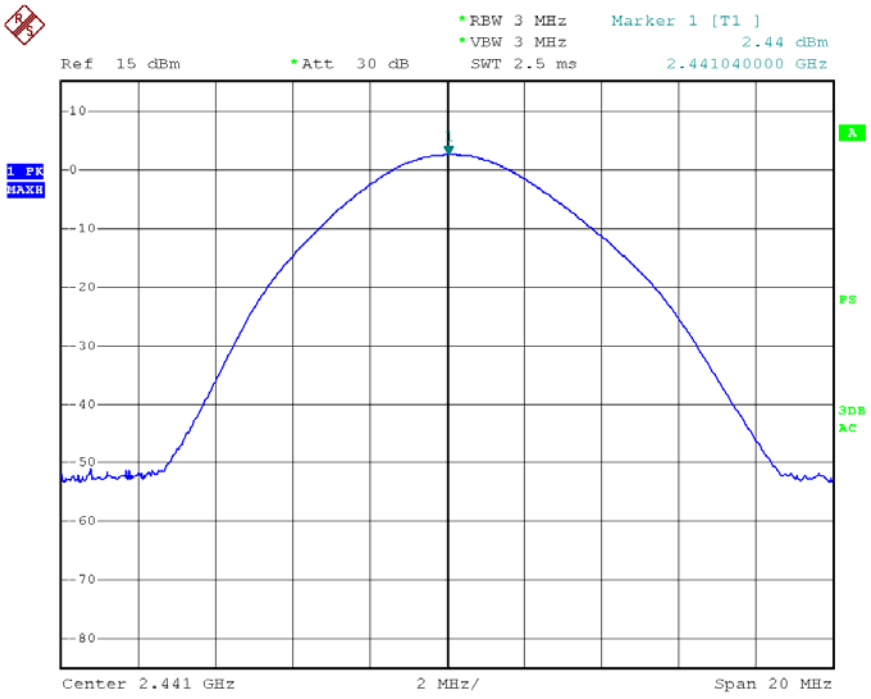
Remark: The results of modulations π /4DQPSK and 8DPSK are the same.

Modulation Mode: GFSK

CH Low

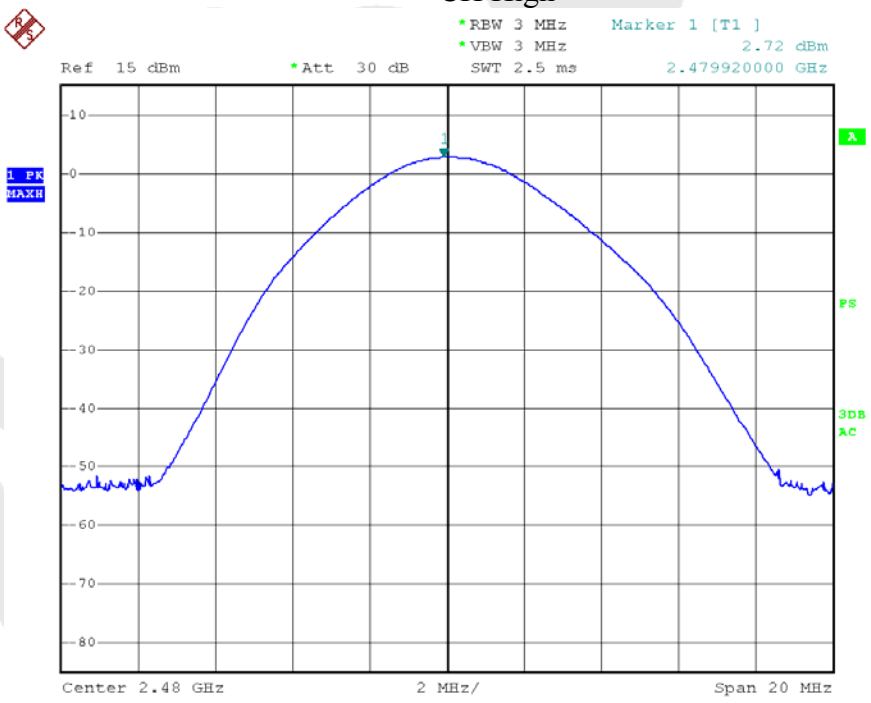


CH Mid



Date: 29.MAY.2013 21:21:57

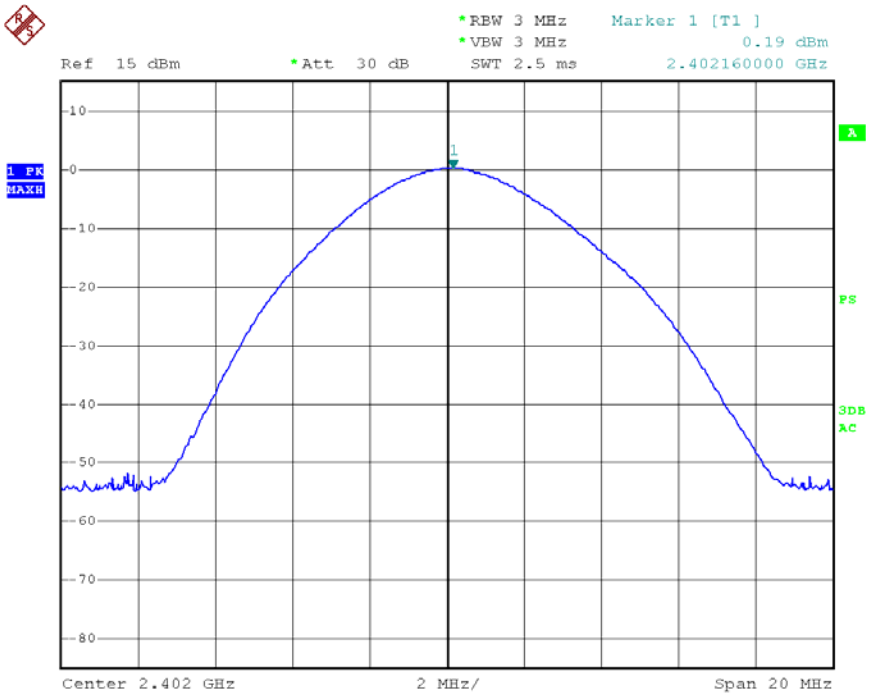
CH High



Date: 29.MAY.2013 21:22:23

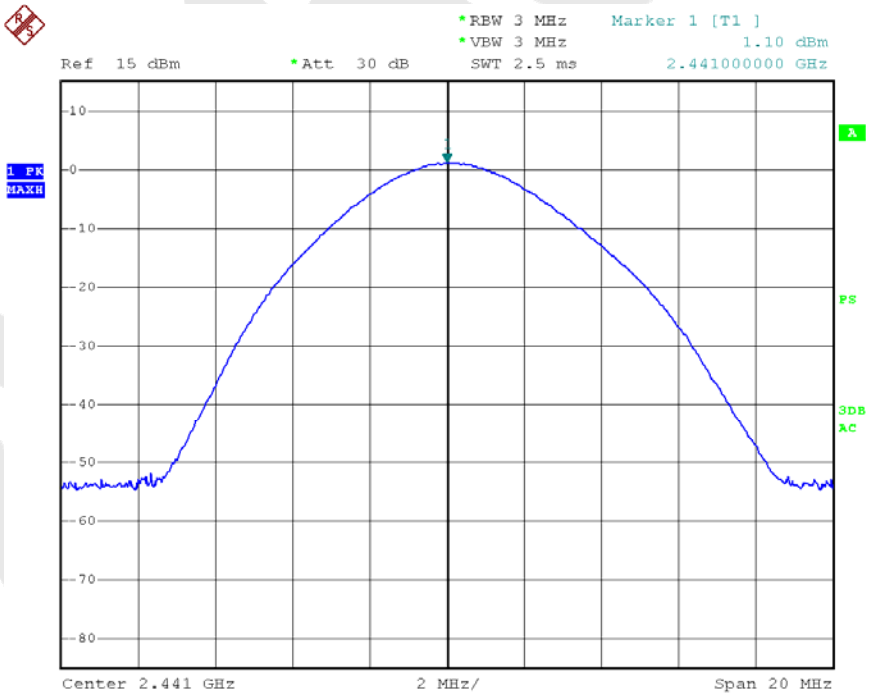
Modulation Mode: π/4DQPSK & 8DPSK

CH Low



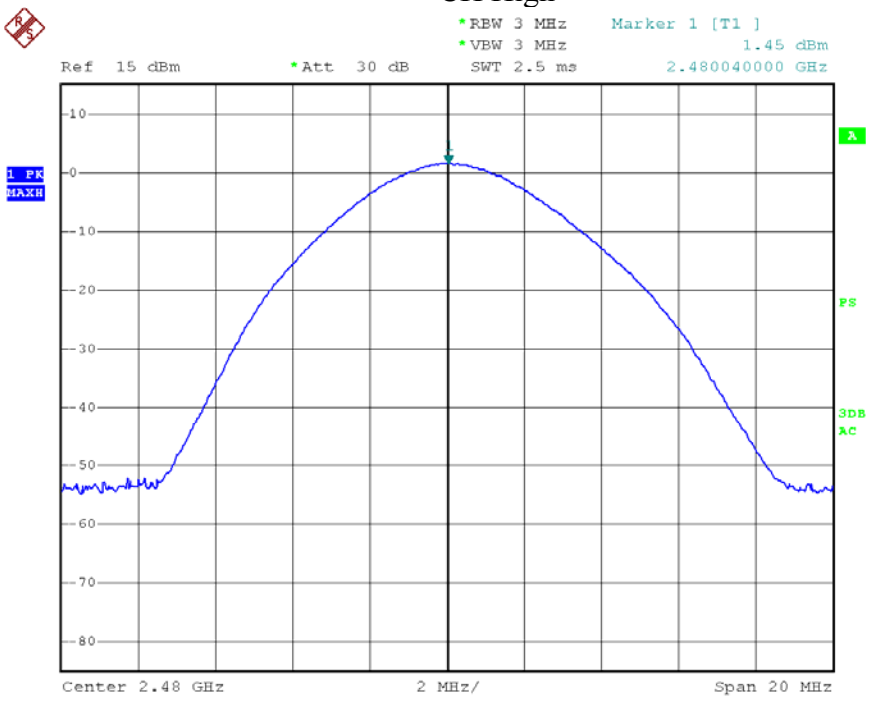
Date: 29.MAY.2013 21:22:46

CH Mid



Date: 29.MAY.2013 21:23:04

CH High



Date: 29.MAY.2013 21:23:20

10. BAND EDGE TEST

10.1 Measurement Procedure

1. The EUT was Operating in hopping mode or could be controlled its channel. Printed out test result from the spectrum by hard copy function.
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measured were complete.

10.2 Test SET-UP

Same as the radiated emission test.

10.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Receiver	Rohde & Schwarz	ESCI	100627	Apr. 23, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 23, 2013	1 Year
3.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 23, 2013	1 Year
4.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

10.4 Test Results

Pass.

Please refer the following data.

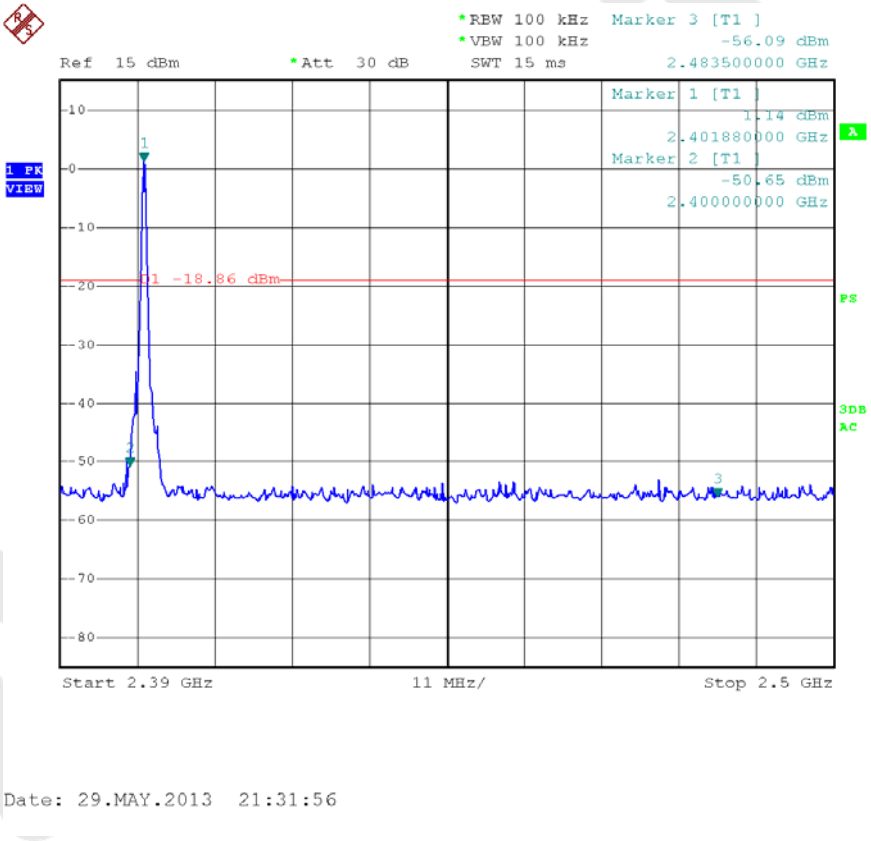
Product	:	Tie Rod Speakers	Test Mode	:	CH Low ~ CH High
Test Item	:	Band eadge	Temperature	:	24℃
Test Voltage	:	AC 120V/60Hz	Humidity	:	55%RH
Test Result	:	PASS			

1.Conducted Test

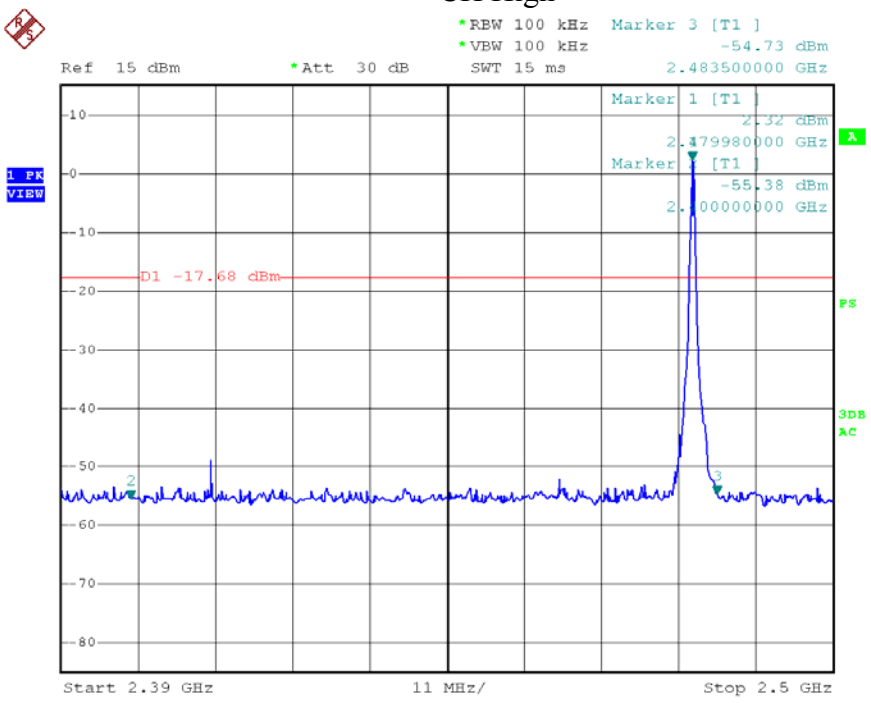
Frequency (MHz)	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)	Modulation
<2400	-50.65	1.14	51.79	>20dBc	GFSK
	-53.52	-0.82	52.70	>20dBc	π /4DQPSK
	-53.52	-0.82	52.70	>20dBc	8DPSK
>2483.5	-54.73	2.32	57.05	>20dBc	GFSK
	-55.32	0.48	55.80	>20dBc	π /4DQPSK
	-55.32	0.48	55.80	>20dBc	8DPSK

Modulation Mode: GFSK

CH Low



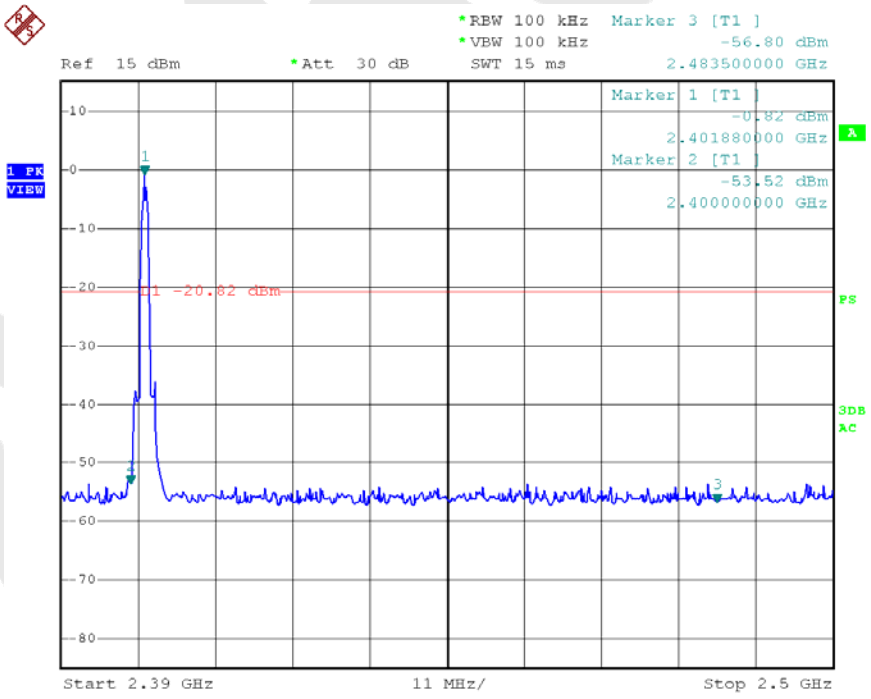
CH High



Date: 29.MAY.2013 21:33:18

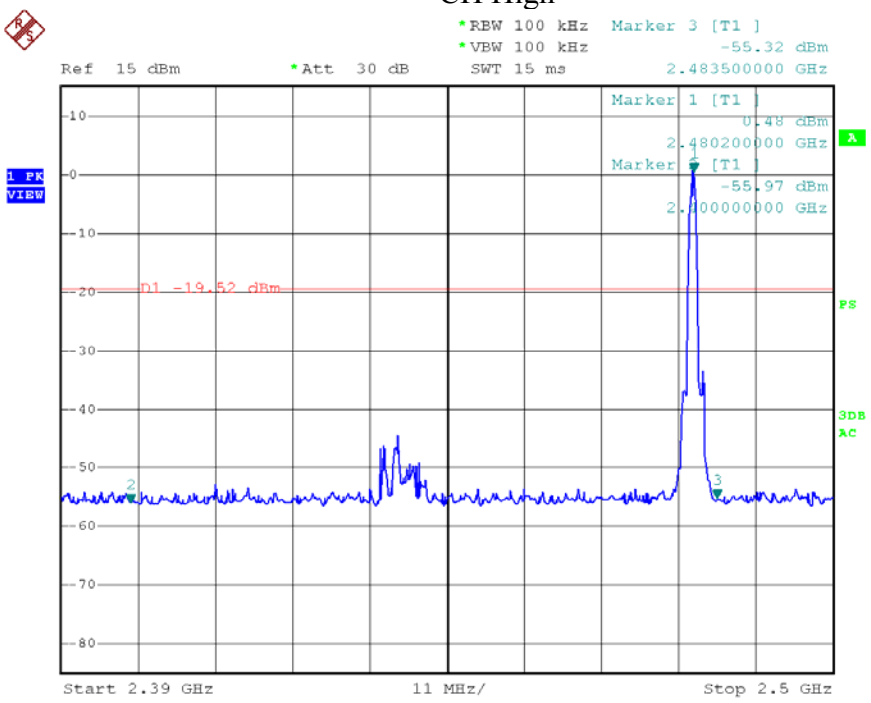
Modulation Mode: π/4DQPSK& 8DPSK

CH Low



Date: 29.MAY.2013 21:34:03

CH High

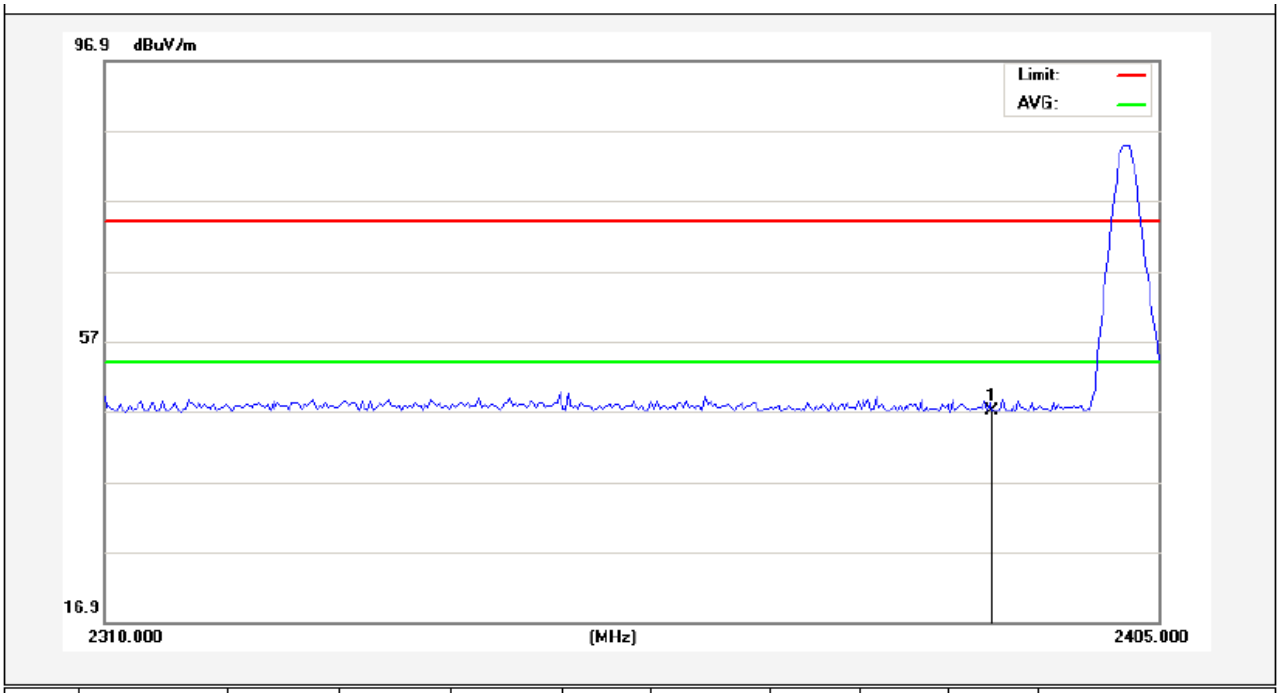


Date: 29.MAY.2013 21:34:50

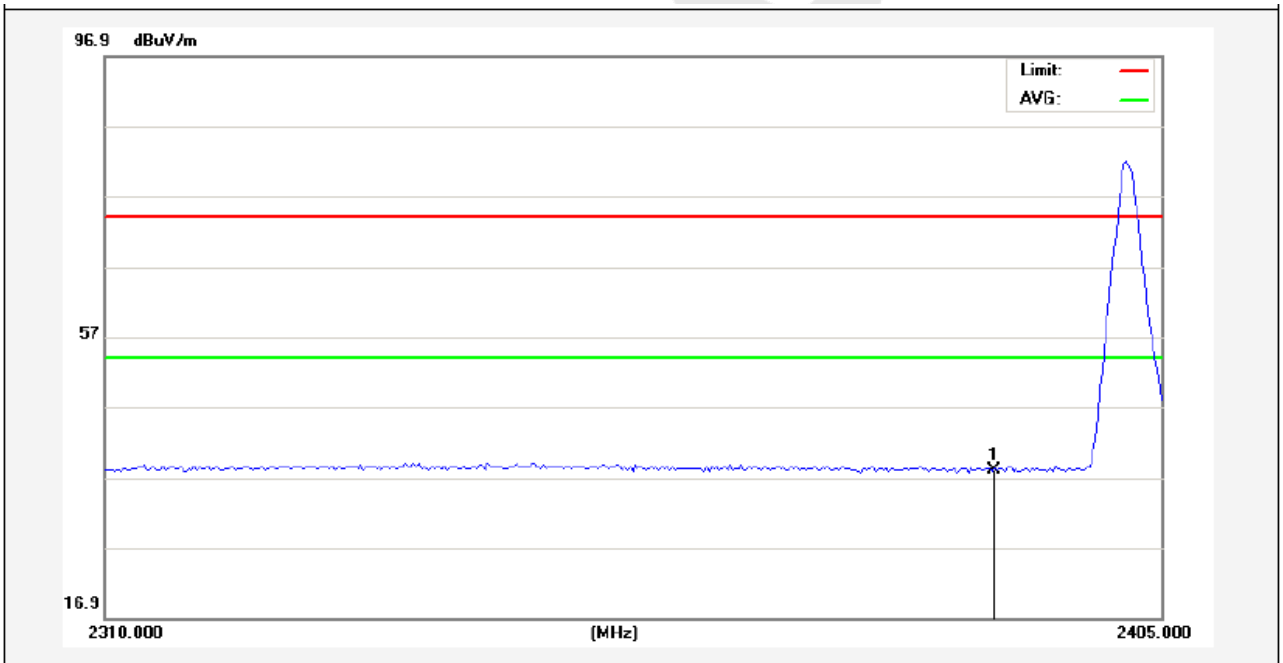
2. Radiated emission Test

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Modulation
		PK	AV	PK	AV	
<2400	V	46.97	38.07	74.00	54.00	GFSK
	H	48.10	37.84	74.00	54.00	GFSK
	V	47.27	37.43	74.00	54.00	π/4DQPSK
	H	46.92	37.99	74.00	54.00	π/4DQPSK
	V	47.27	37.43	74.00	54.00	8DPSK
	H	46.92	37.99	74.00	54.00	8DPSK
>2483.5	V	49.80	43.09	74.00	54.00	GFSK
	H	50.12	43.12	74.00	54.00	GFSK
	V	49.13	42.91	74.00	54.00	π/4DQPSK
	H	48.12	44.03	74.00	54.00	π/4DQPSK
	V	49.13	42.91	74.00	54.00	8DPSK
	H	48.12	44.03	74.00	54.00	8DPSK

Modulation Mode: GFSK
<2400 MHz: Vertical

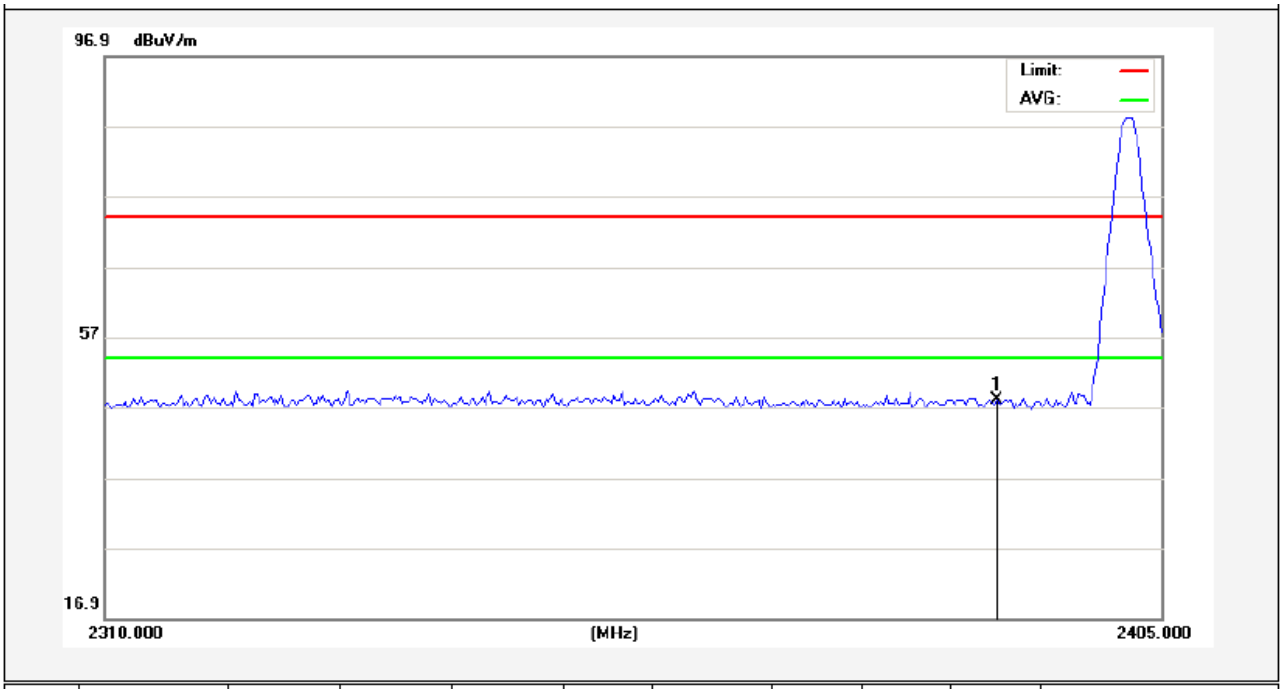


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	49.48	-2.51	46.97	74.00	-27.03	peak			

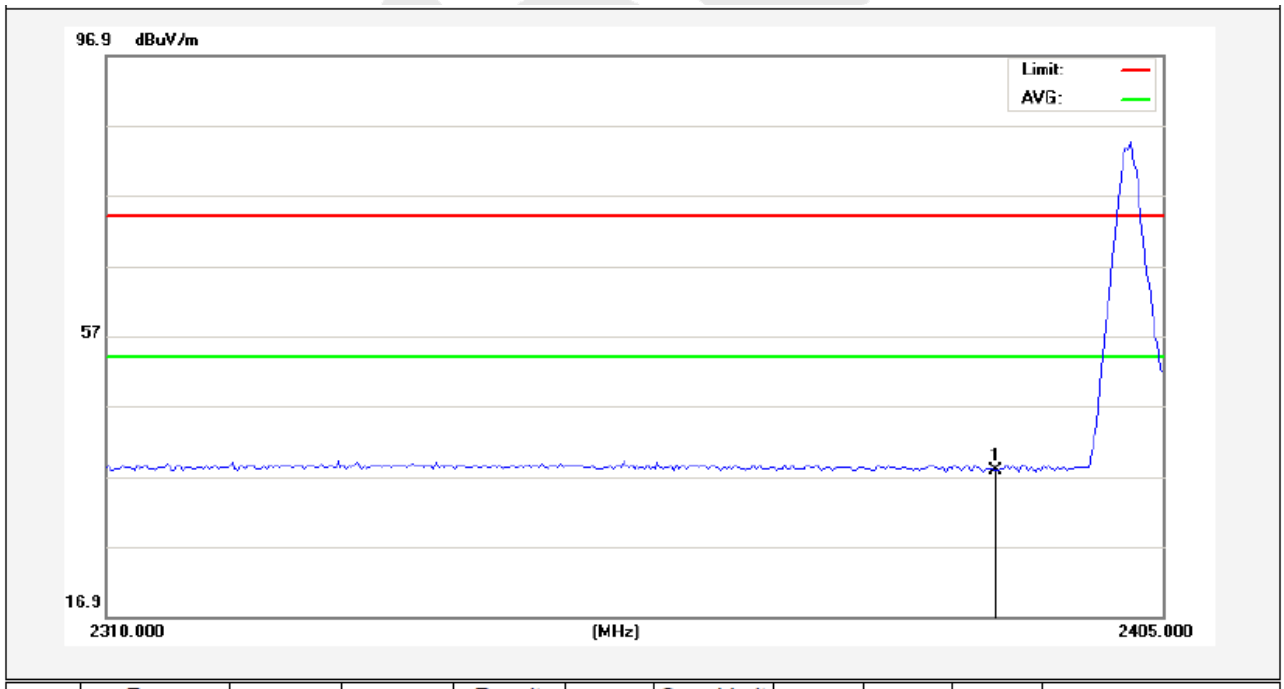


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	40.58	-2.51	38.07	54.00	-15.93	AVG			

Modulation Mode: GFSK
<2400 MHz: Horizontal

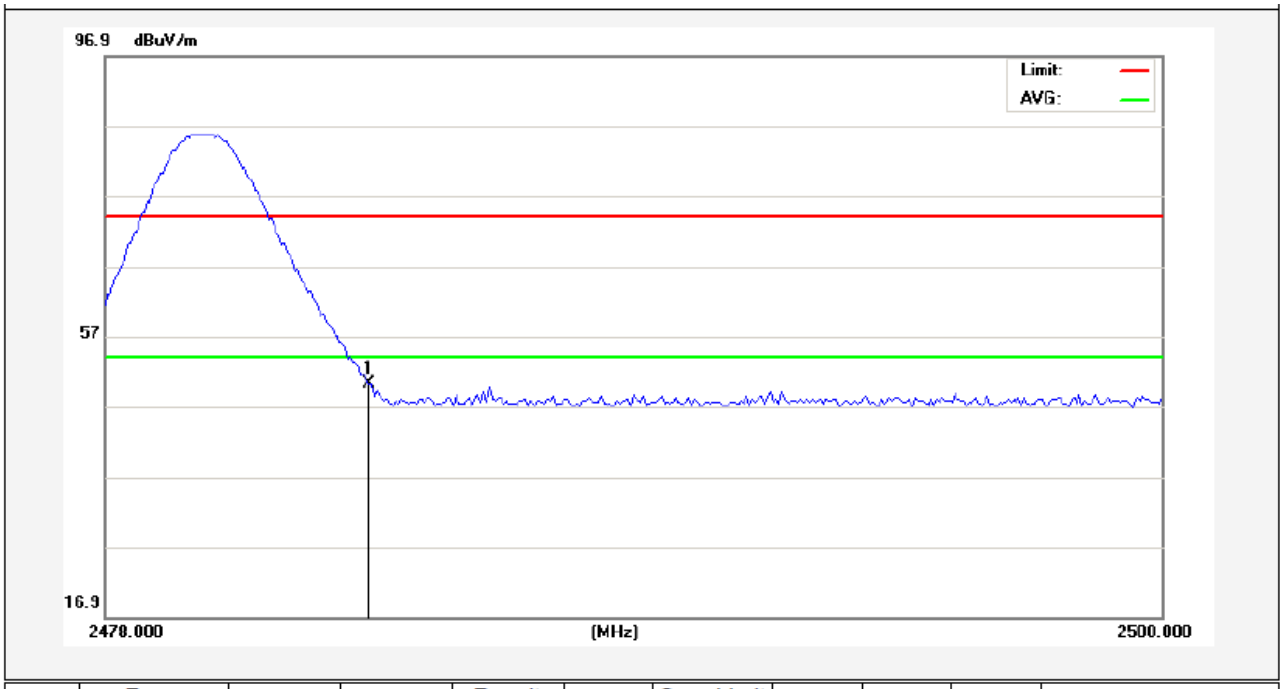


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	50.61	-2.51	48.10	74.00	-25.90	peak			

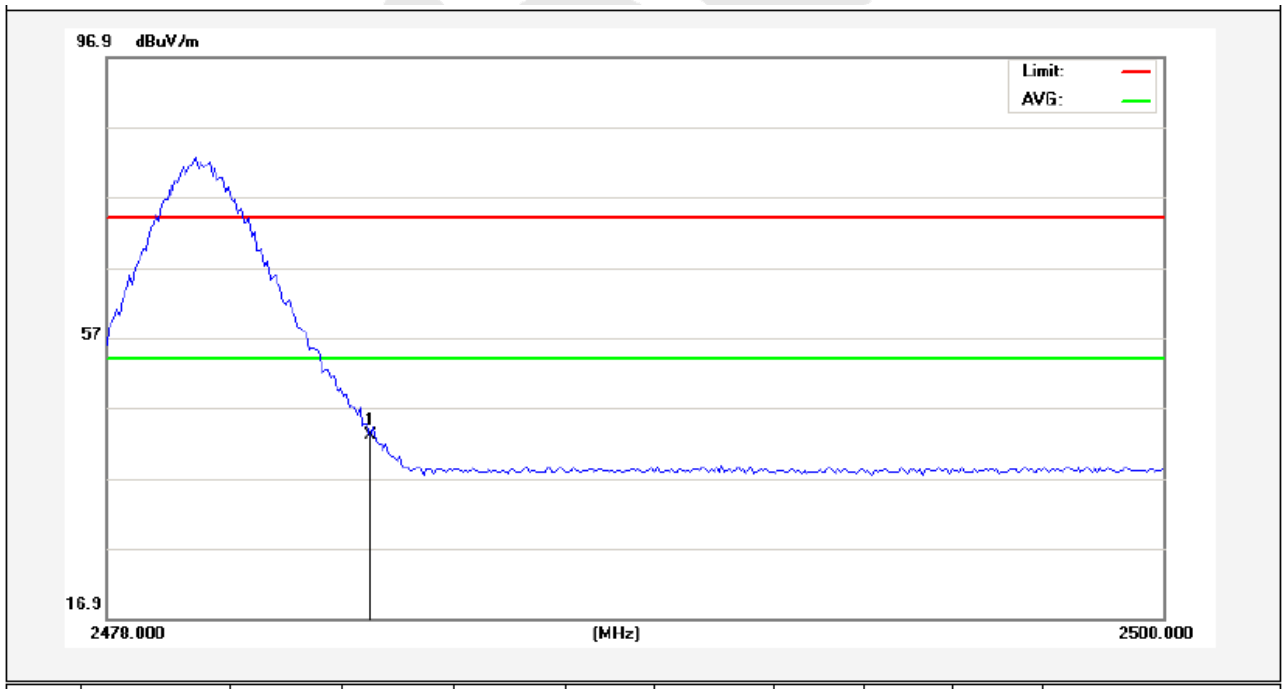


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	40.35	-2.51	37.84	54.00	-16.16	AVG			

Modulation Mode: GFSK
>2483.5MHz: Vertical

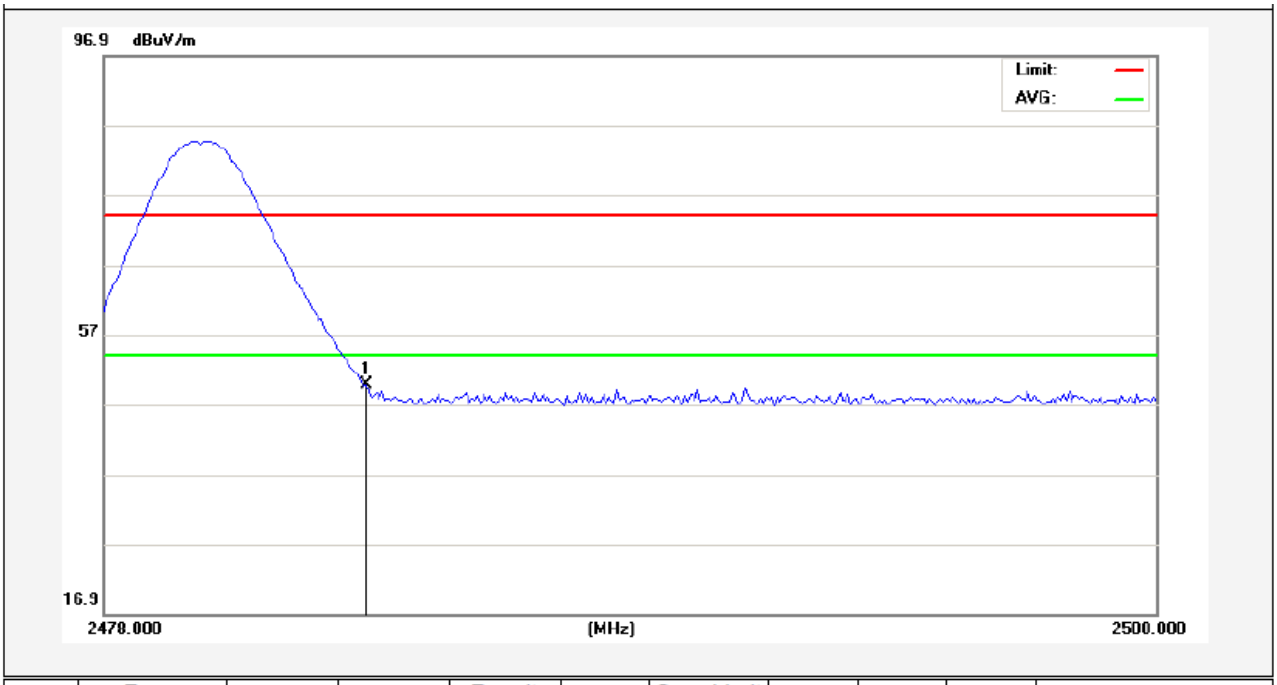


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	52.43	-2.31	50.12	74.00	-23.88	peak			

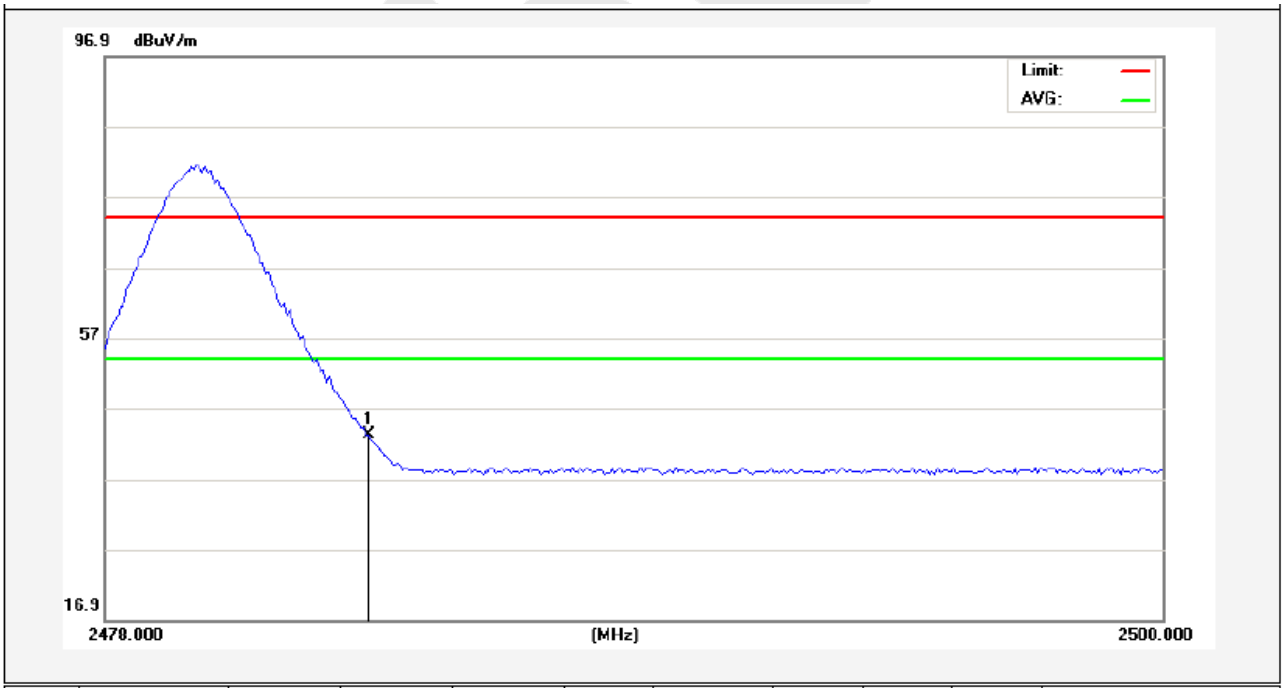


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	45.40	-2.31	43.09	54.00	-10.91	AVG			

Modulation Mode: GFSK
>2483.5MHz: Horizontal

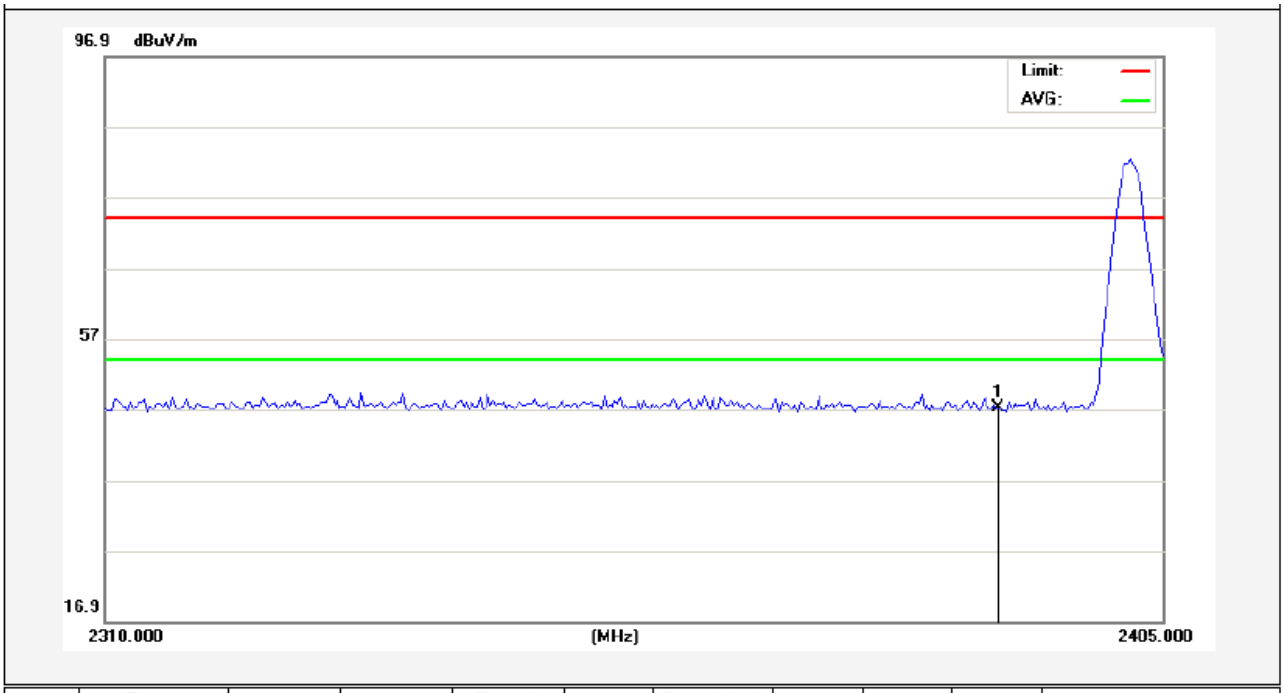


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	52.11	-2.31	49.80	74.00	-24.20	peak			

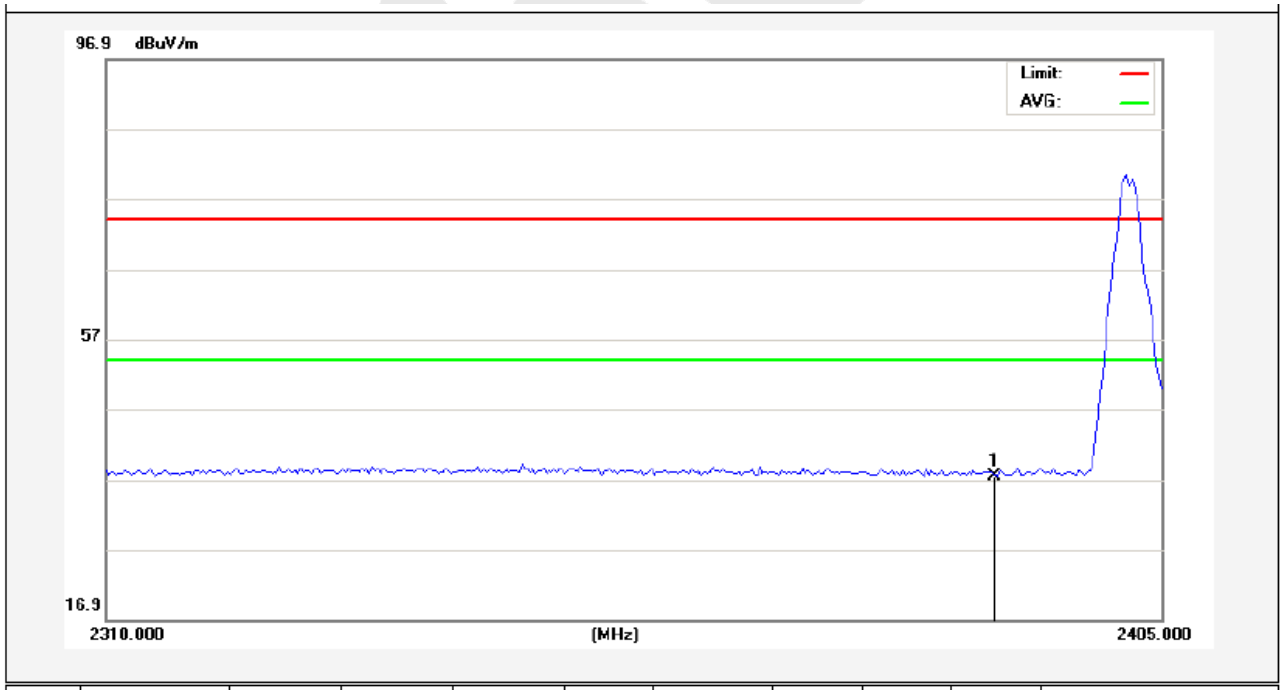


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	45.43	-2.31	43.12	54.00	-10.88	AVG			

Modulation Mode: π/4DQPSK& 8DPSK
<2400 MHz: Vertical

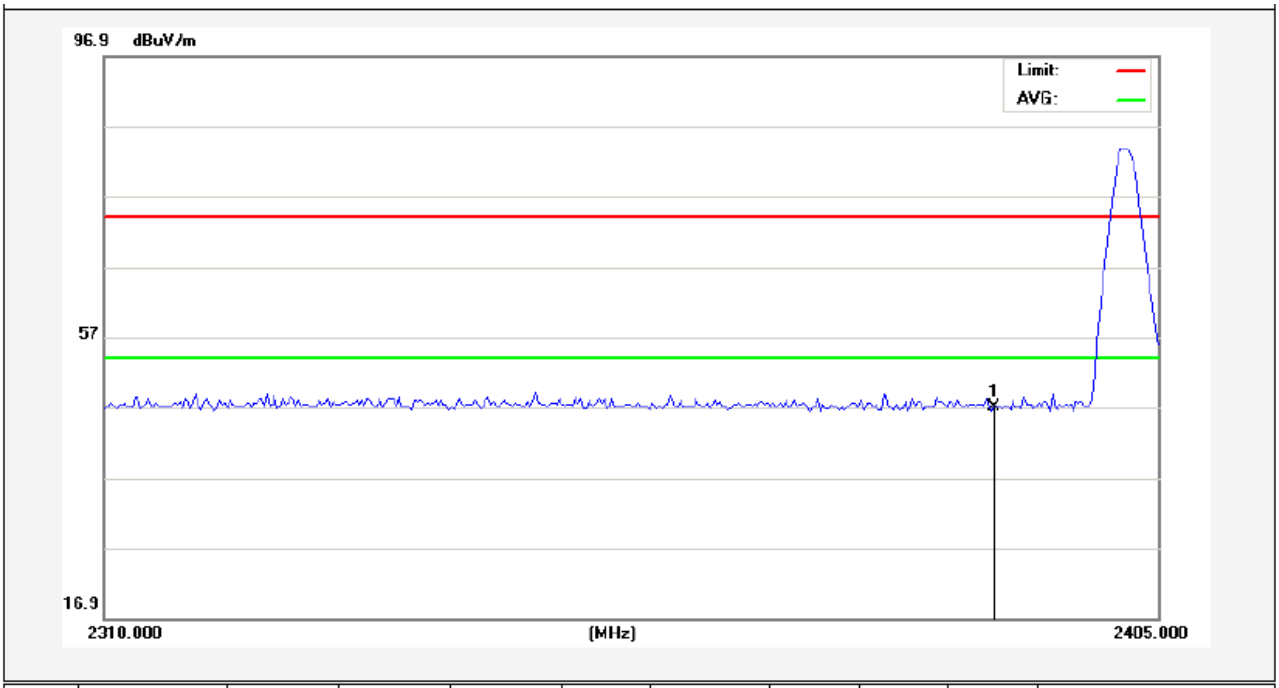


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	49.78	-2.51	47.27	74.00	-26.73	peak			

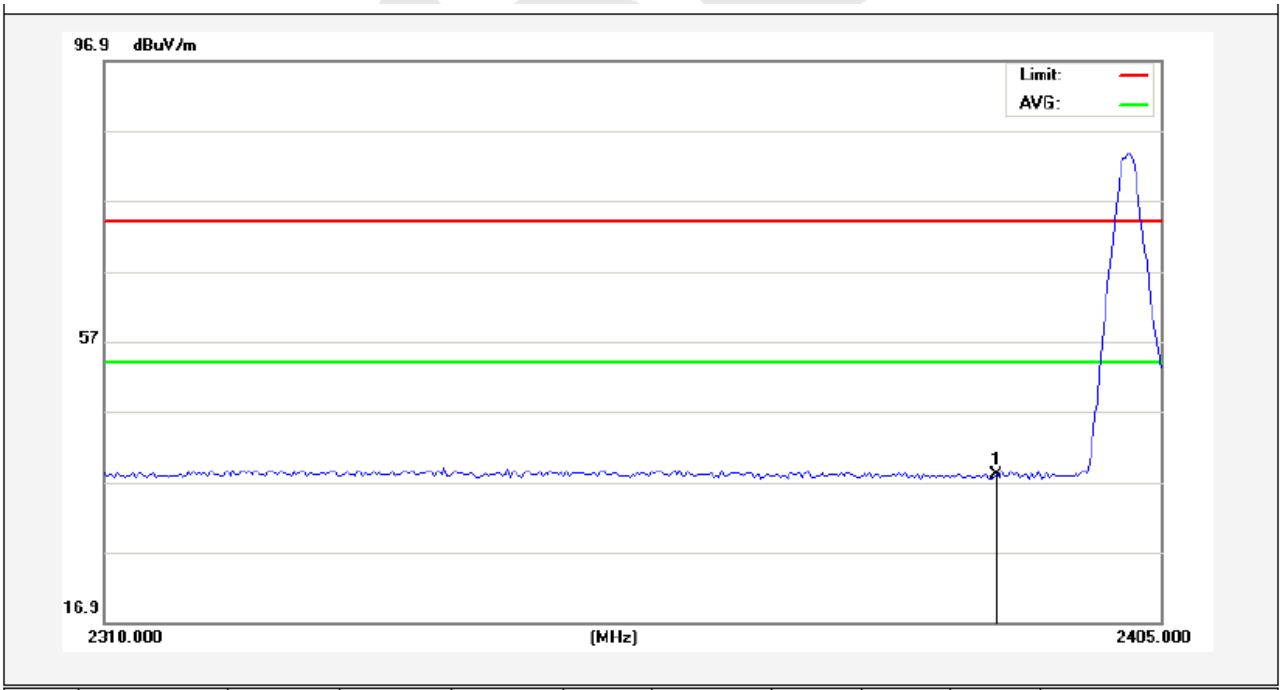


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	39.94	-2.51	37.43	54.00	-16.57	AVG			

Modulation Mode: π/4DQPSK& 8DPSK
<2400 MHz: Horizontal

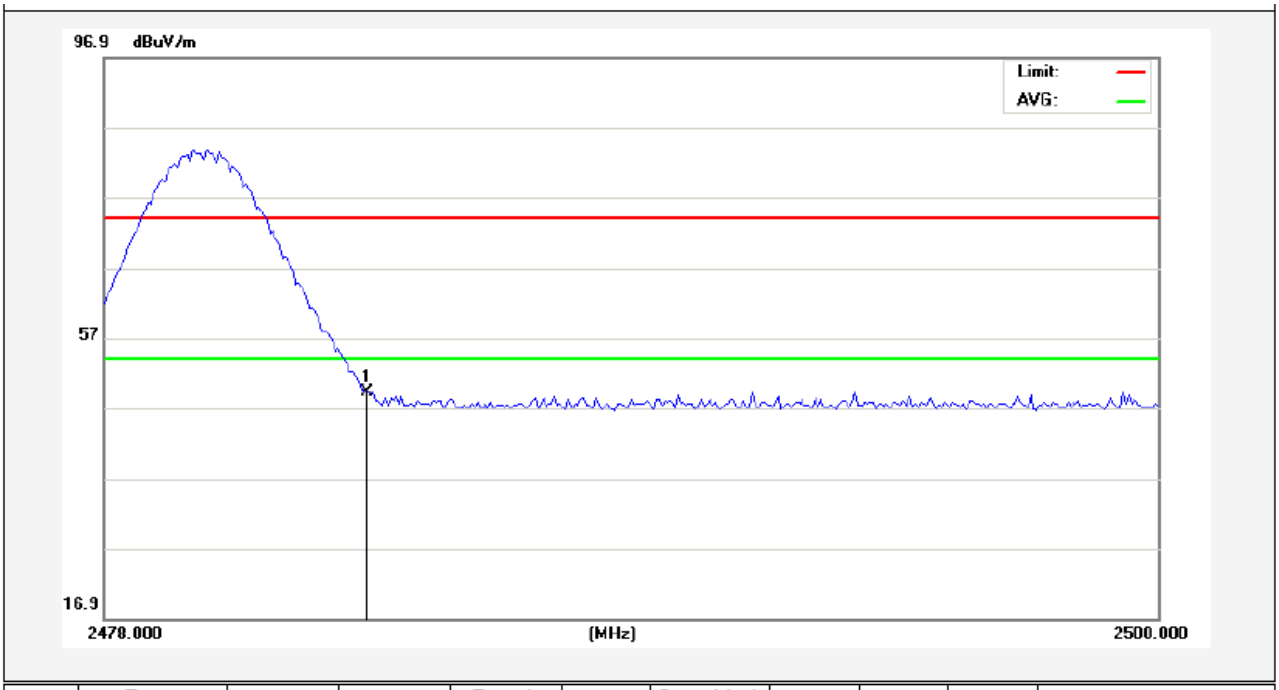


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	49.43	-2.51	46.92	74.00	-27.08	peak			

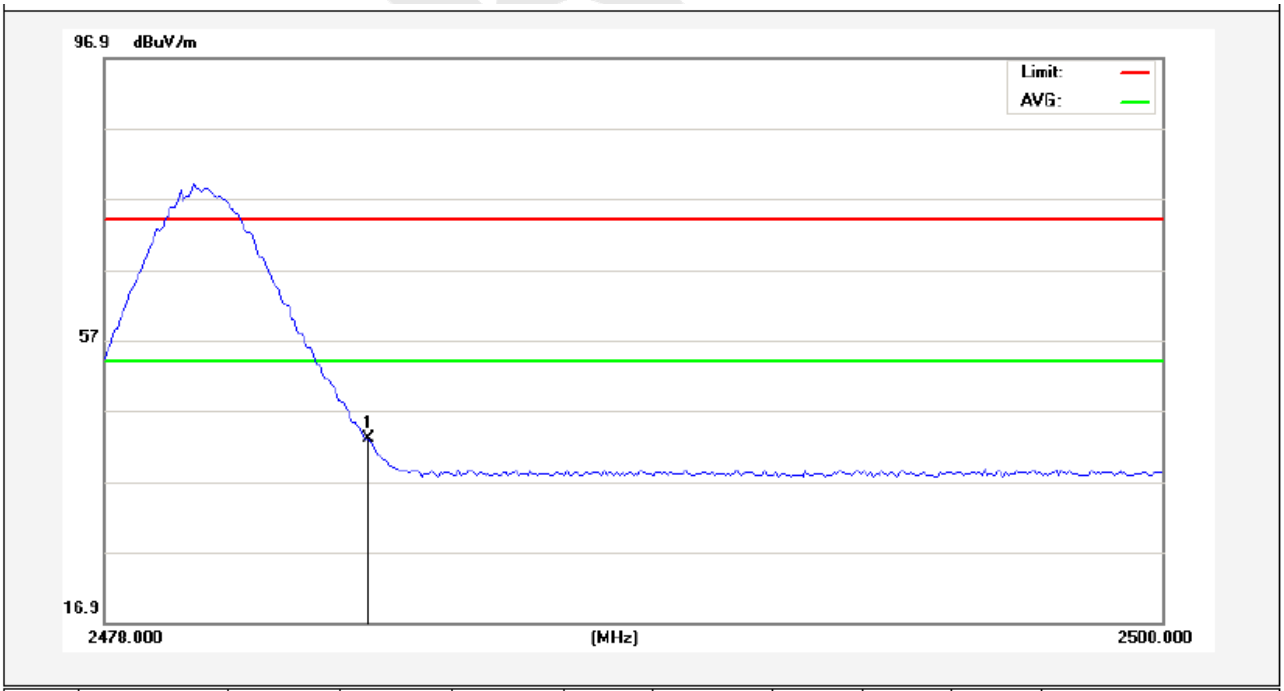


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2390.000	40.50	-2.51	37.99	54.00	-16.01	AVG			

Modulation Mode: π/4DQPSK& 8DPSK
>2483.5MHz: Vertical

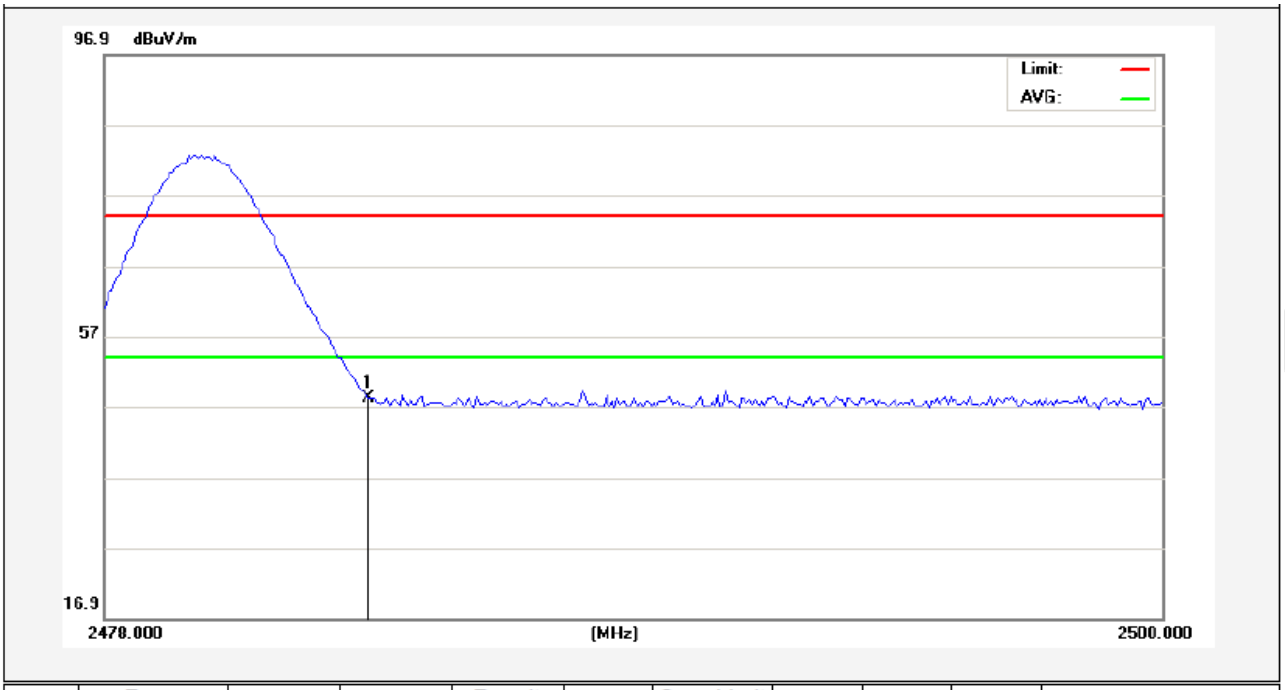


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	51.44	-2.31	49.13	74.00	-24.87	peak			

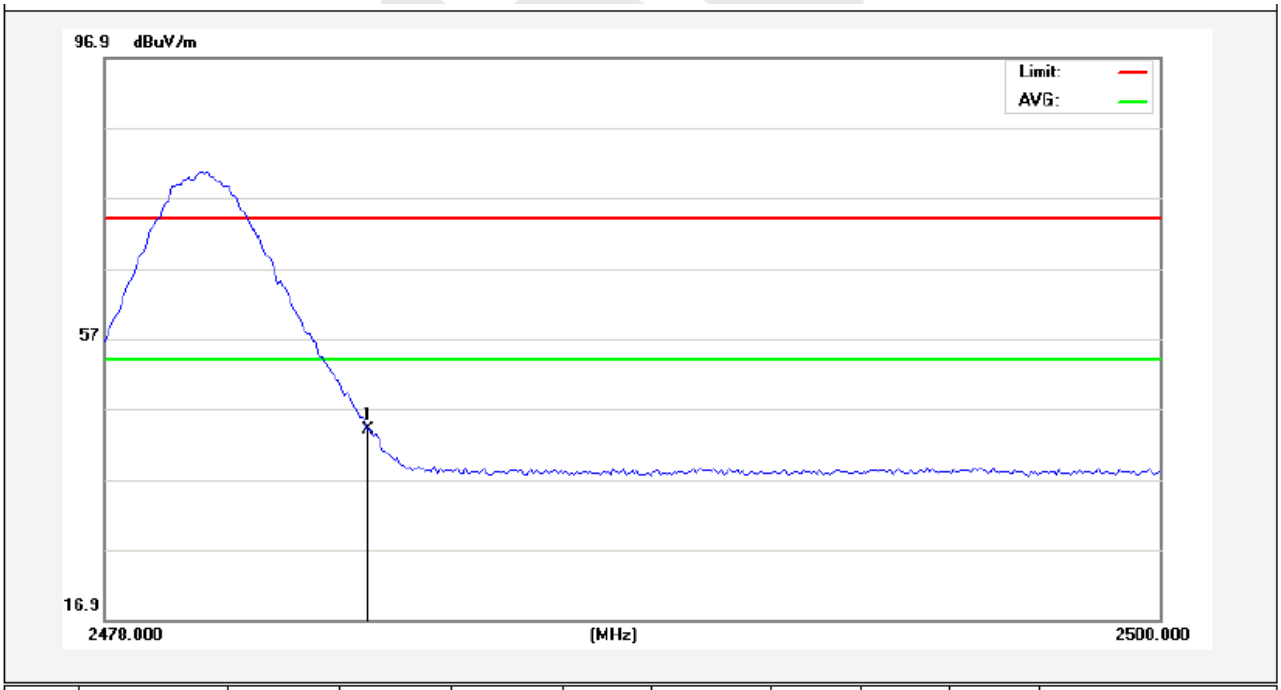


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	45.22	-2.31	42.91	54.00	-11.09	AVG			

Modulation Mode: π/4DQPSK& 8DPSK
>2483.5MHz: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	50.43	-2.31	48.12	74.00	-25.88	peak			



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	2483.500	46.34	-2.31	44.03	54.00	-9.97	AVG			

11.ANTENNA APPLICATION

11.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

FCC part 15C section 15.247 requirements:
Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

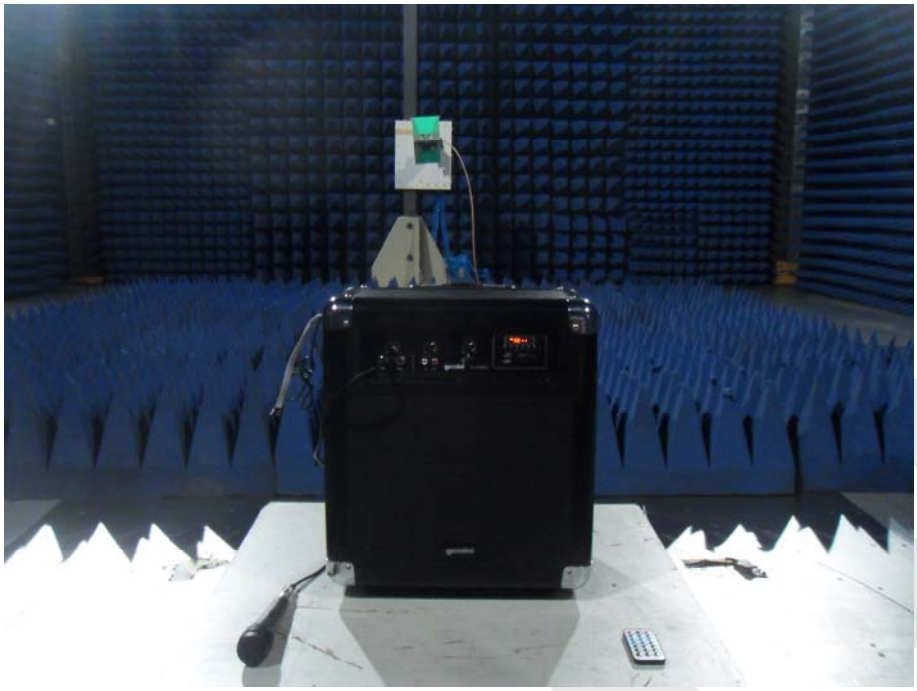
11.2 Result

The EUT's antenna used a chip antenna and integrated on PCB, The antenna's gain is 0dBi and meets the requirement.

12. PHOTOGRAPH

12.1. Photo of Power Line Conducted Emission Measurement

12.2. Photo of Radiation Emission Test



APPENDIX I (External Photos)

Figure 1
The EUT-Overall View

Figure 2
The EUT-Front View

Figure 3
The EUT-Back View

Figure 4
The EUT-Rod View

Figure 5
The EUT-Port View

Figure 6
The EUT-Port View

APPENDIX Ⅱ(Internal Photos)

Figure 7
The EUT-Inside Overall View

Figure8
PCB of the EUT-Front View

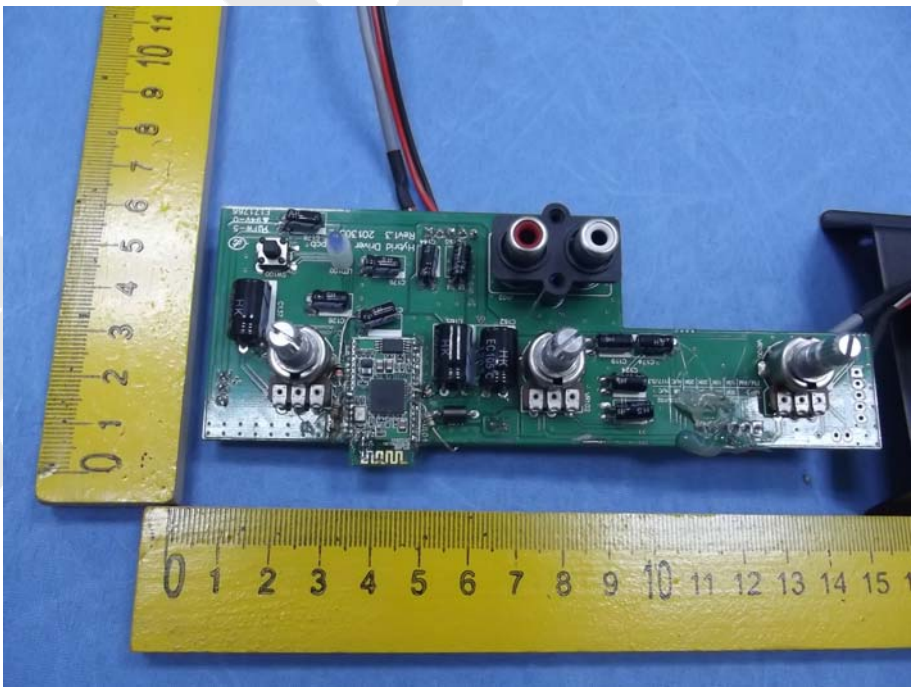


Figure 9
PCB of the EUT-Back View

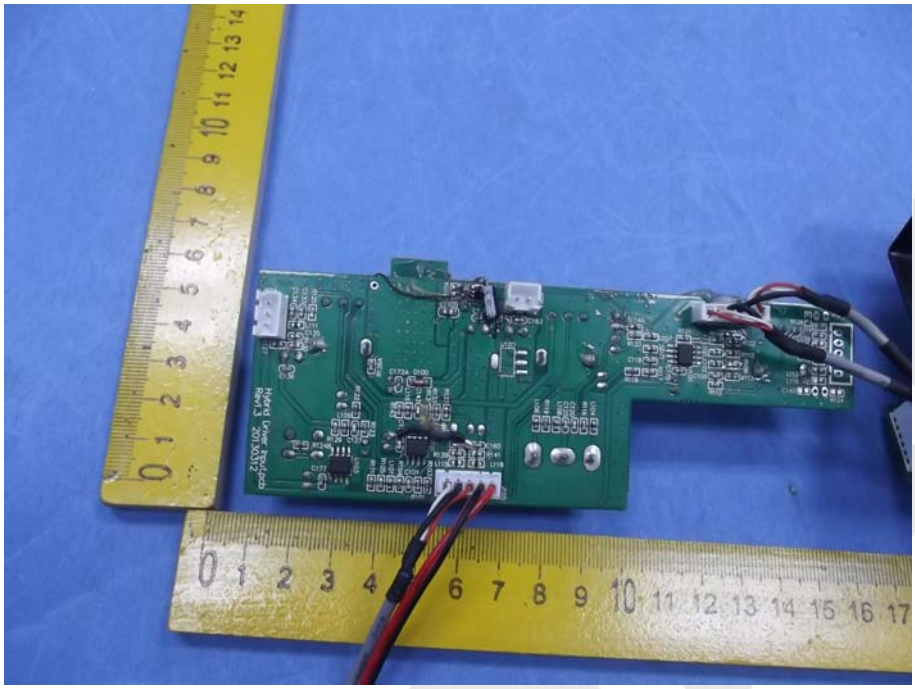


Figure 10
PCB of the BT Module View

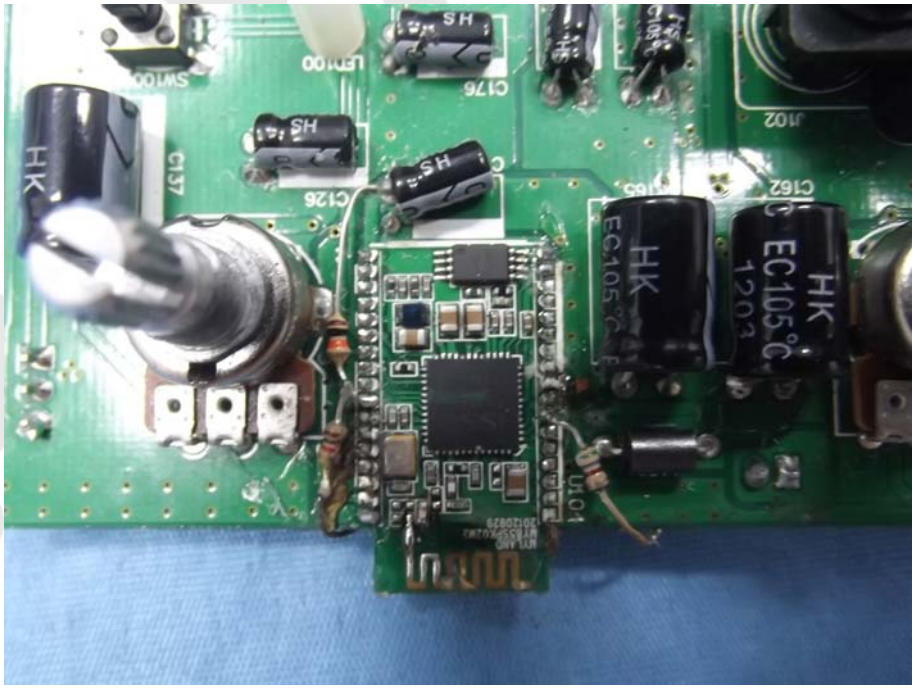


Figure 11
PCB of the EUT View

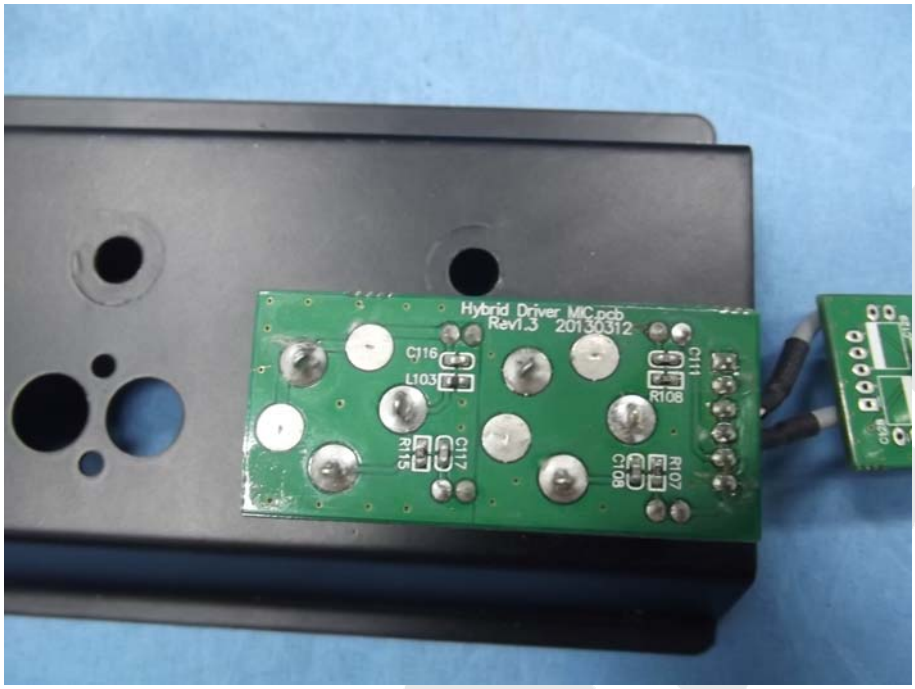


Figure 12
PCB of the EUT-Inside View

Figure 13
PCB of the EUT-Front View

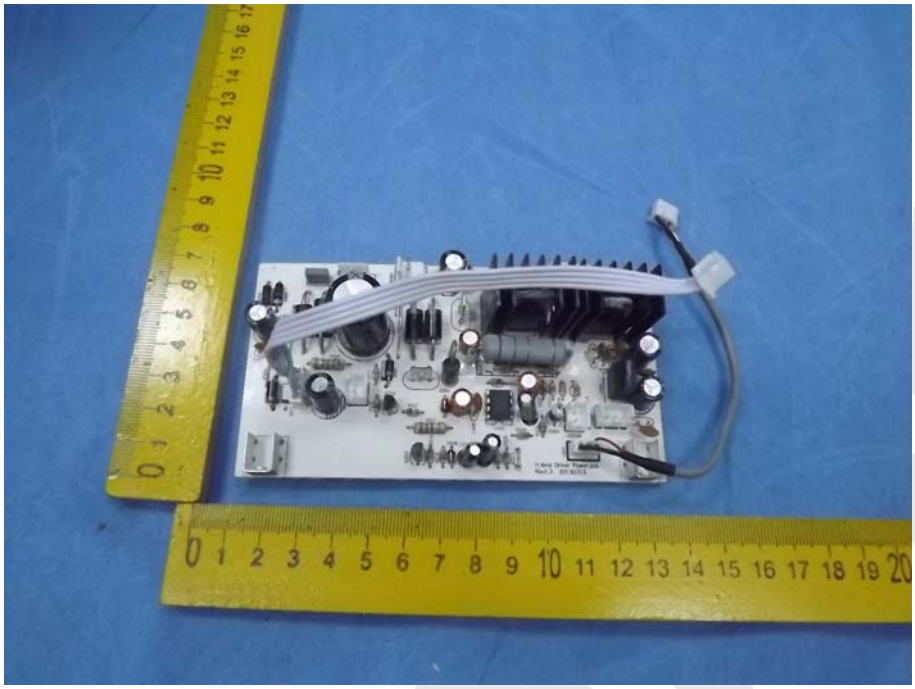


Figure 14
PCB of the EUT-Back View

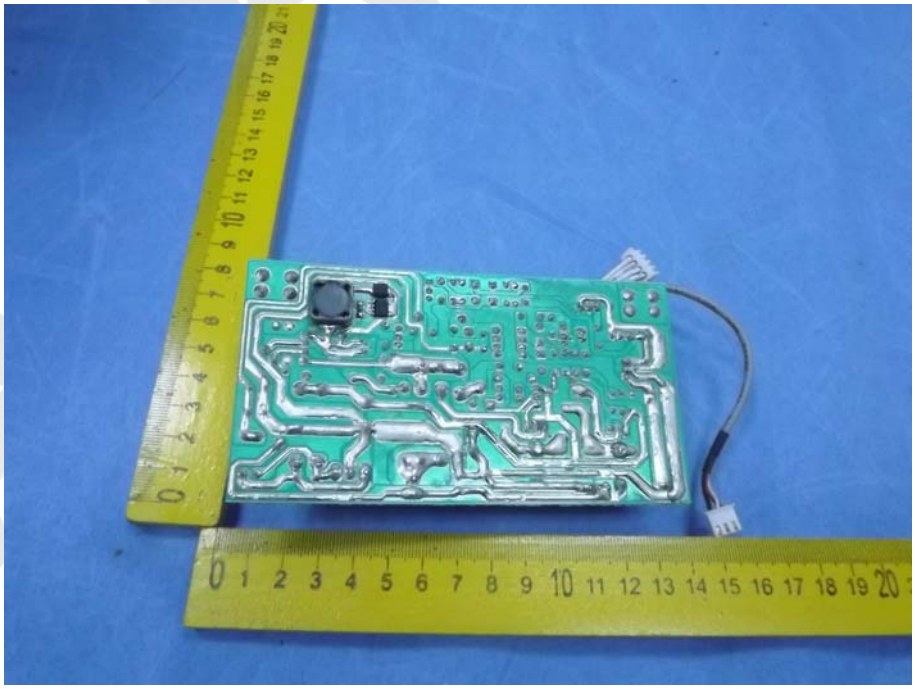


Figure 15
PCB of the EUT-Front View

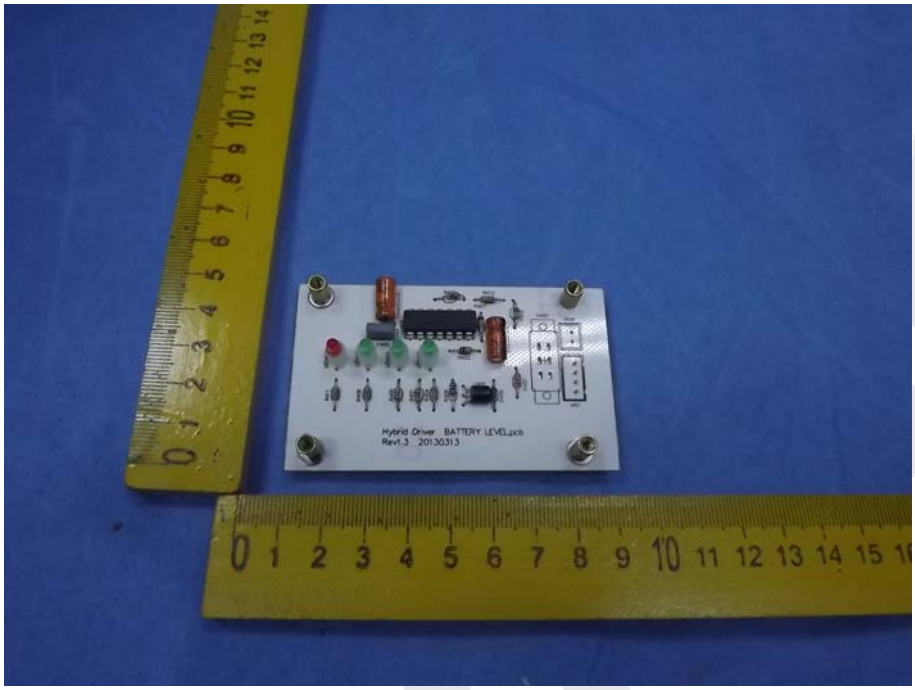


Figure 16
PCB of the EUT-Back View

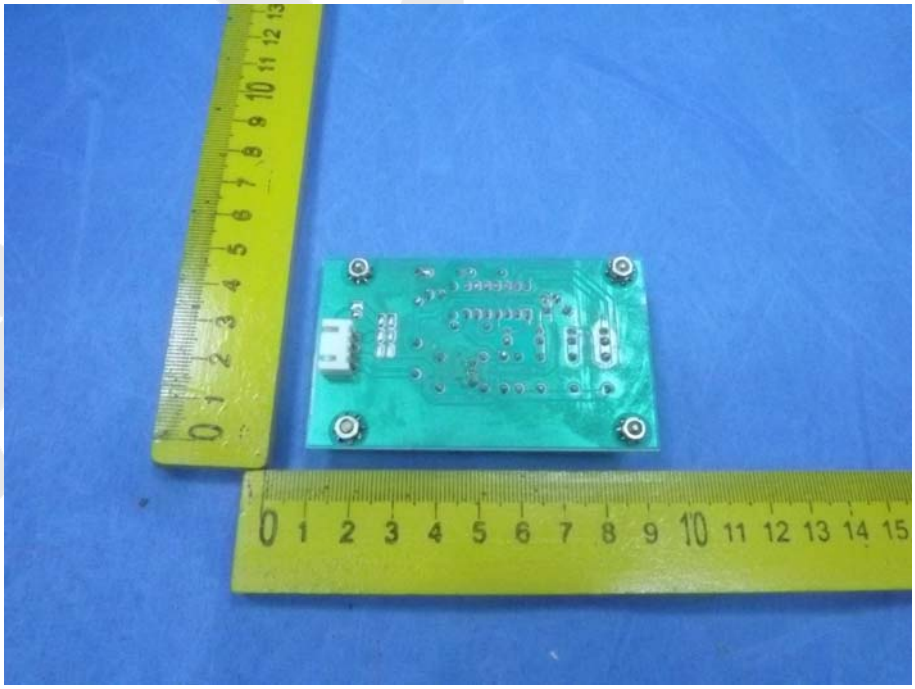


Figure 17
PCB of the EUT-Front View

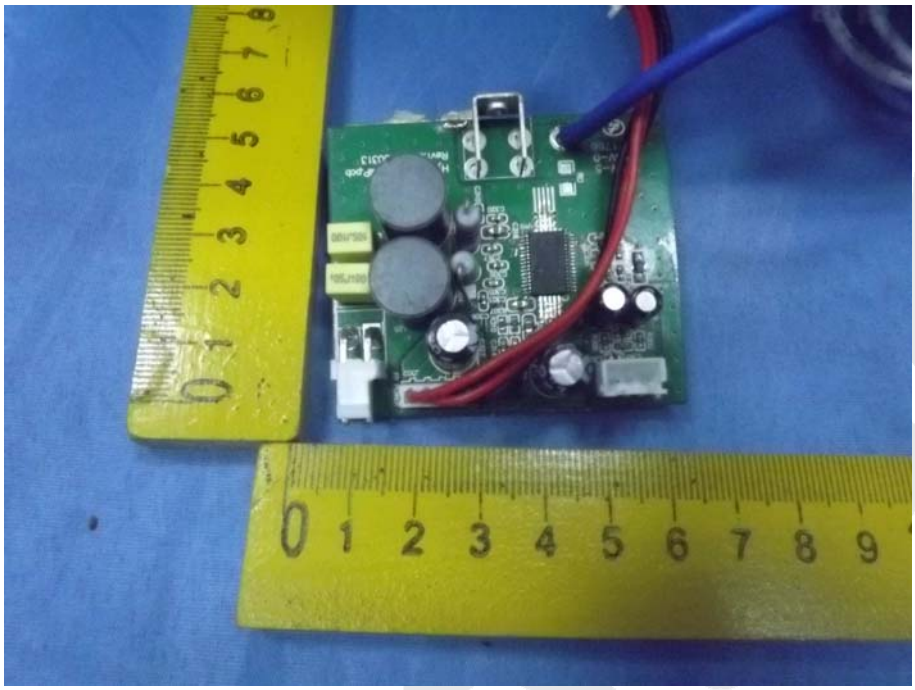


Figure 18
PCB of the EUT-Back View

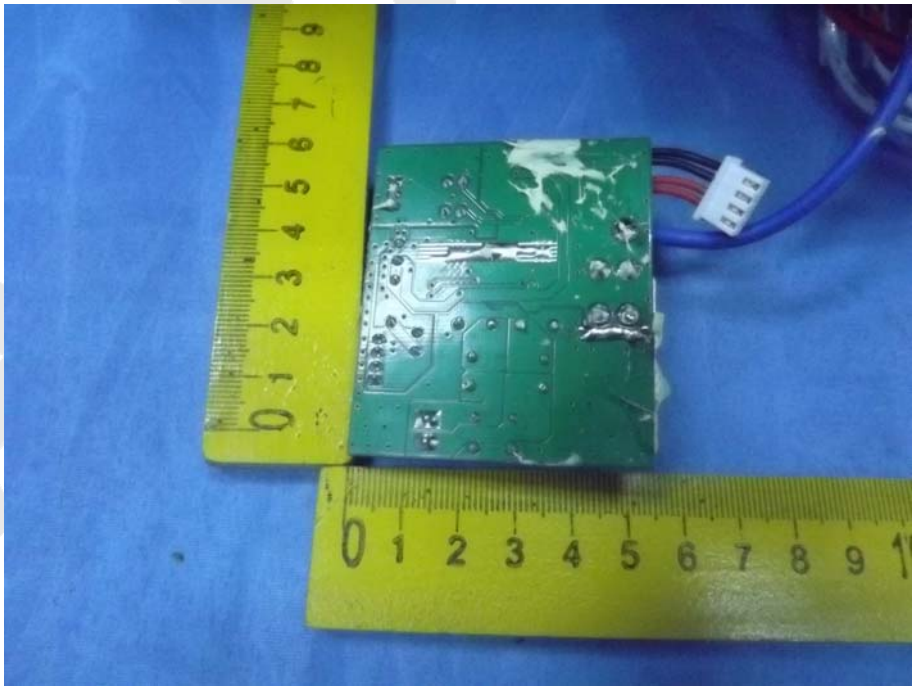


Figure 19
PCB of the EUT-Driver View