



## SGS-CSTC Standards Technical Services Co., Ltd.

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Report No.: GZEM130800376701

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FCC ID: 2AAVELH-MODEL

# TEST REPORT

|                      |   |
|----------------------|---|
| Application No.:     | GZEM1308003767RF  |
| Applicant:           | LI HUANG TOYS CRAFTS FACTORY  |
| FCC ID:              | 2AAVELH-MODEL   |
| Product Name:        | REMOTE-CONTROL PLANES   |
| Product Description: | Remote control plane with 2.4GHz as carrier   |
| Model No.:           | LH1201, LH109, LH110 , LH1102, LH112, LH1101, LH1103, LH1104,<br>LH1101D,LH1106 , LH1203, LH1204, LH1107, LH1108, LH1109, LH1201DV,<br>LH1202, LH1201D,LH1206, LH1206B,LH1209, LH1210, LH1211, LH1301, LH1302,<br>H001, H002, H003, LH1303, LH1304, LH1305, LH1306, LH1307, LH1308, LH1309,<br>LH1310, LH1311, LH1312, H004, H005 ♣ |
| ♣                    | Please refer to section 3 of this report for details  |
| Standards:           | 47 CFR PART 15 Subpart C: 2012 section 15.249   |
| Date of Receipt:     | 2013-08-14  |
| Date of Test:        | 2013-08-25 to 2013-09-04  |
| Date of Issue:       | 2013-09-06  |
| Test Result :        | Pass*   |

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



Richard Li  
Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. 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.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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## 2 Version

| Revision Record |         |            |          |          |
|-----------------|---------|------------|----------|----------|
| Version         | Chapter | Date       | Modifier | Remark   |
| 00              |         | 2013-09-06 |          | Original |
|                 |         |            |          |          |
|                 |         |            |          |          |
|                 |         |            |          |          |
|                 |         |            |          |          |

|                          |  |   |  |                                  |
|--------------------------|--|---|--|----------------------------------|
| Authorized for issue by: |  |   |  |                                  |
| Tested By                |  | <br>(Fred Zhu) / Project Engineer  |  | 2013-08-25 to 2013-09-04<br>Date |
| Prepared By              |  | <br>(Millie Li) / Project Engineer |  | 2013-09-06<br>Date               |
| Checked By               |  | <br>(Jeffrey Chen) / Reviewer      |  | 2013-09-06<br>Date               |



### 3 Test Summary

| TEST                                 | TEST REQUIREMENT  | TEST METHOD                                | RESULT |
|--------------------------------------|---|--|--------|
| Field Strength of Fundamental        | FCC PART 15 C<br>section 15.249 (a)                       | ANSI C63.10:<br>Clause 6.6                 | PASS   |
| Field Strength of Unwanted Emissions | FCC PART 15 C<br>section 15.249 (a)<br>section 15.249 (d) | ANSI C63.10:<br>Clause 6.4, 6.6 and<br>6.7 | PASS   |
| Band Edges                           | FCC PART 15 C<br>section 15.249 (d)                       | ANSI C63.10:<br>Clause 6.9.2               | PASS   |
| Occupied Bandwidth                   | FCC PART 15 C<br>section 15.215(c)                        | ANSI C63.10:<br>Clause 6.9.1               | PASS   |

**Remark:**

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.10: the detail version is ANSI C63.10:2009 in the whole report.

♣ Model No.: LH1201, LH109, LH110 , LH1102, LH112, LH1101, LH1103, LH1104, LH1101D, LH1106 , LH1203, LH1204, LH1107, LH1108, LH1109, LH1201DV, LH1202, LH1201D, LH1206, LH1206B, LH1209, LH1210, LH1211, LH1301, LH1302, H001, H002, H003, LH1303, LH1304, LH1305, LH1306, LH1307, LH1308, LH1309, LH1310, LH1311, LH1312, H004, H005

According to the confirmation from the applicant, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, only difference is the color, appearance and packing.

Therefore only one item **LH1201** was tested in this report.



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## 5 General Information

### 5.1 Client Information

Applicant: LI HUANG TOYS CRAFTS FACTORY

Address of Applicant: Huaidong industrial park, Lianxia town, Chenghai district, Shantou city, Guangdong, China

### 5.2 General Description of E.U.T.

Product Name: REMOTE-CONTROL PLANES

Model No.: LH1201

### 5.3 Details of E.U.T.

Operating Frequency: 2402 MHz to 2478MHz

Type of Modulation: GFSK

Number of Channels: 20

Channel Separation: 4 MHz

Antenna Type: Integral Antenna

Antenna gain: 0 dBi

Function: 2.4GHz is used for common channel for data transfer. Transmitter will be hopped between 2.402GHz and 2.478GHz for searching the Receiver. When the receiver is found, this frequency will be fixed and not be changed any more.

Power Supply: DC 9V Size "AA" batteries x 6

Power cord: N/A

### 5.4 Description of Support Units

The EUT has been test as an independent unit.

### 5.5 Other Information Requested by the Customer

None.

### 5.6 Deviation from Standards

Biconical and log periodic antennas were used instead of dipole antennas.



## **5.7 Test Location**

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory,  
198 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology Development District,  
Guangzhou, China 510663  
Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.



## 5.6 Test Facility

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

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is recognized under the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation.

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC 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.: 282399)**

SGS-CSTC Standards Technical Services Co., Ltd., 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 282399, May 31, 2002.

- **Industry Canada (Registration No.: 4620B-1)**

The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. 4620B-1.

- **VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584, G-449 and T-1179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IEC 61010-1:2006-10 and Rules of procedure IEC 61010-2:2006-10, and the relevant IEC 61010-2:2006-10 Operational documents.



## 6 Equipment Used during Test

| RE in Chamber |  |                                  |             |            |              |                      |
|---------------|--|----------------------------------|-------------|------------|--------------|----------------------|
| No.           | Test Equipment                             | Manufacturer                     | Model No.   | Serial No. | Cal.Due date | Calibration Interval |
|               |  |                                  |             |            | (YYYY-MM-DD) |                      |
| EMC0525       | Compact Semi-Anechoic Chamber              | ChangZhou ZhongYu                | N/A         | N/A        | 2014-08-30   | 2Y                   |
| EMC0522       | EMI Test Receiver                          | Rohde & Schwarz                  | ESIB26      | 100283     | 2014-05-06   | 1Y                   |
| EMC0056       | EMI Test Receiver                          | Rohde & Schwarz                  | ESCI        | 100236     | 2014-03-04   | 1Y                   |
| EMC0528       | RI High frequency Cable                    | SGS                              | 20 m        | N/A        | 2014-05-09   | 1Y                   |
| EMC2025       | Trilog Broadband Antenna 30-3000MHz        | SCHWARZBECK MESS-ELEKTRONIK      | VULB 9163   | 9163-450   | 2016-08-31   | 3Y                   |
| EMC0524       | Bi-log Type Antenna                        | Schaffner -Chase                 | CBL6112B    | 2966       | 2016-08-31   | 3Y                   |
| EMC0519       | Bilog Type Antenna                         | Schaffner -Chase                 | CBL6143     | 5070       | 2014-06-02   | 2Y                   |
| EMC2026       | Horn Antenna 1-18GHz                       | SCHWARZBECK MESS-ELEKTRONIK      | BBHA 9120D  | 9120D-841  | 2016-08-31   | 3Y                   |
| EMC0518       | Horn Antenna                               | Rohde & Schwarz                  | HF906       | 100096     | 2014-07-01   | 2Y                   |
| EMC0521       | 1-26.5 GHz Pre-Amplifier                   | Agilent                          | 8449B       | 3008A01649 | 2014-03-04   | 1Y                   |
| EMC2065       | Amplifier                                  | HP                               | 8447F       | N/A        | 2014-08-31   | 1Y                   |
| EMC2063       | 1-26GHz Pre Amplifier                      | Compliance Direction System Inc. | PAP-1G26-48 | 6279.628   | 2014-07-29   | 1Y                   |
| EMC0075       | 310N Amplifier                             | Sonoma                           | 310N        | 272683     | 2014-03-04   | 1Y                   |
| EMC0523       | Active Loop Antenna                        | EMCO                             | 6502        | 42963      | 2014-04-07   | 2Y                   |
| EMC2041       | Broad-Band Horn Antenna (14)15-26.5(40)GHz | SCHWARZBECK MESS-ELEKTRONIK      | BBHA 9170   | 9170-375   | 2014-06-01   | 3Y                   |
| EMC2069       | 2.4GHz filter                              | Micro-Tronics                    | BRM 50702   | 149        | 2014-06-05   | 1Y                   |
| EMC0530       | 10m Semi-Anechoic Chamber                  | ETS                              | N/A         | N/A        | 2014-04-27   | 2Y                   |

| General used equipment |                |              |           |            |              |                      |
|------------------------|----------------|--------------|-----------|------------|--------------|----------------------|
| No.                    | Test Equipment | Manufacturer | Model No. | Serial No. | Cal.Due date | Calibration Interval |
|                        |                |              |           |            | (YYYY-MM-DD) |                      |
| EMC0006                | DMM            | Fluke        | 73        | 70681569   | 2013-11-5    | 1Y                   |
| EMC0007                | DMM            | Fluke        | 73        | 70671122   | 2013-11-5    | 1Y                   |



## 7 Test Results

### 7.1 E.U.T. Operation

**Test Voltage:** DC 9V by "AA" new batteries x 6

**Temperature:** 20.0 -25.0 °C

**Humidity:** 38-50 % RH

**Atmospheric Pressure:** 1000 -1010 mbar

**Test frequencies and frequency range:** According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

#### Number of fundamental frequencies to be tested in EUT transmit band

| Frequency range in which device operates | Number of frequencies | Location in frequency range of operation    |
|--|-----------------------|---|
| 1 MHz or less                            | 1                     | Middle                                      |
| 1 MHz to 10 MHz                          | 2                     | 1 near top and 1 near bottom                |
| More than 10 MHz                         | 3                     | 1 near top, 1 near middle and 1 near bottom |

#### Frequency range of radiated emission measurements

| Lowest frequency generated in the device | Upper frequency range of measurement  |
|--|---|
| 9 kHz to below 10 GHz                    | 10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower                             |
| At or above 10 GHz to below 30 GHz       | 5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower                             |
| At or above 30 GHz                       | 5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified |



EUT channels and frequencies list:

| Channel | Frequency<br>(MHz) |
|---------|--------------------|
| 0       | 2402               |
| 1       | 2406               |
| 2       | 2410               |
| 3       | 2414               |
| 4       | 2418               |
| 5       | 2422               |
| 6       | 2426               |
| 7       | 2430               |
| 8       | 2434               |
| 9       | 2438               |
| 10      | 2442               |
| 11      | 2446               |
| 12      | 2450               |
| 13      | 2454               |
| 14      | 2458               |
| 15      | 2462               |
| 16      | 2466               |
| 17      | 2470               |
| 18      | 2474               |
| 19      | 2478               |

Test frequencies are the lowest channel: 0 channel(2402 MHz), middle channel: 10 channel(2442 MHz) and highest channel: 19 channel(2478 MHz)

## 7.2 Antenna Requirement

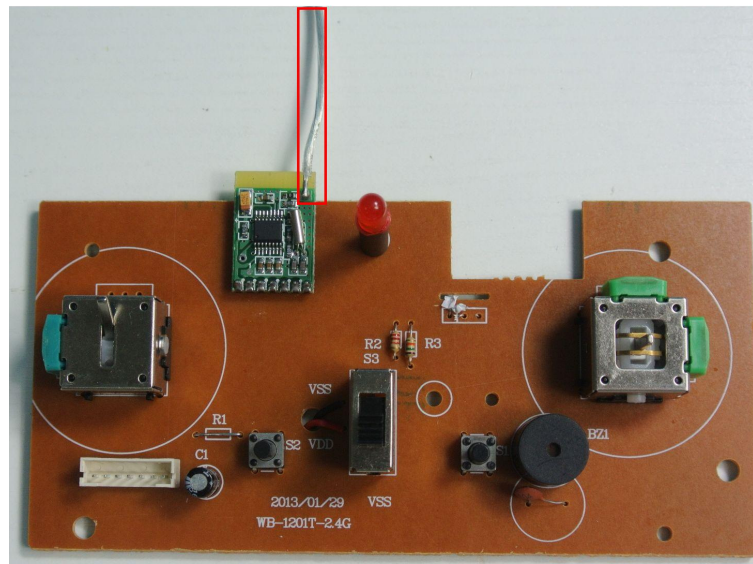
### Standard requirement

15.203 requirement:

For intentional device. According to 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.

### EUT Antenna

The antenna is an ISM Band Antenna integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0 dBi.



**Test result: The unit does meet the FCC requirements.**



### 7.3 Field Strength of Fundamental& Field Strength of Unwanted Emissions& Band Edge

Test Requirement: FCC Part15 C section 15.249

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (dBμV/m @ 3m) | Field Strength of Harmonics (dBμV/m @ 3m) |
|-----------------------------|---|---|
| 902 to 928                  | 94.0  | 54.0                                      |
| 2400 to 2483.5              | 94.0  | 54.0                                      |
| 5725 to 5875                | 94.0  | 54.0                                      |
| 24000 to 24250              | 108.0                                       | 68.0                                      |

(d) 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 Section 15.209, whichever is the lesser attenuation.

Limits: The fundamental frequency rang is in the frequency band of the EUT is 2402MHz ~ 2478MHz.

The limit for Average field strength dBμV/m for the fundamental frequency = 94.0 dBμV/m.

The limit for Peak field strength dBμV/m for the fundamental frequency = 114.0 dBμV/m.

No fundamental is allowed in the restricted bands.

The limit for average field strength dBμV/m for the harmonics = 54.0 dBμV/m.

The limit for peak field strength dBμV/m for the harmonics = 74.0 dBμV/m.

Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or 54.0 dBμV/m in 15.209. Here the limit for the other emission is 54.0 dBμV/m.

Test Method: ANSI C63.10: Clause 6.4, 6.6 and 6.7 for Field Strength of Fundamental& Field Strength of Unwanted Emissions

ANSI C63.10: Clause 6.9.2 for Band Edge

Status Pre-test the EUT in continuous transmitting mode with setup as stand-alone in X, Y, Z threes axes, found the worst case is X axes and report the data.

Measurement Distance: 3m (Semi-Anechoic Chamber)

Frequency range 9 kHz – 25 GHz for transmitting mode.

Test instrumentation resolution bandwidth

9 kHz (9 kHz - 30 MHz), 120 kHz (30 MHz - 1000 MHz), 1 MHz (1000 MHz – 25 GHz)

### Test Procedure:

#### 1) 9 kHz to 30 MHz emissions:

For testing performed with the loop antenna, testing was performed in accordance to ANSI C63.10. The centre of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT, During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

#### 2) 30 MHz to 1 GHz emissions:

For testing performed with the bi-log type antenna, testing was performed in accordance to ANSI C63.10. The measurement is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

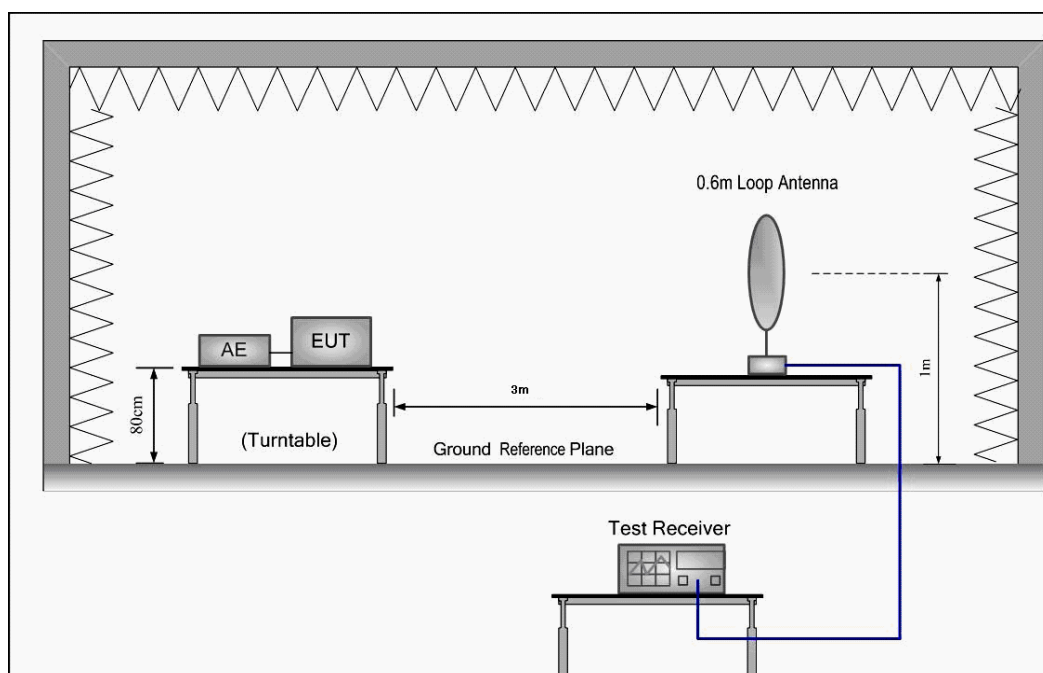
#### 3) 1 GHz to 25 GHz emissions:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2007 was used to perform radiated emission test above 1 GHz.

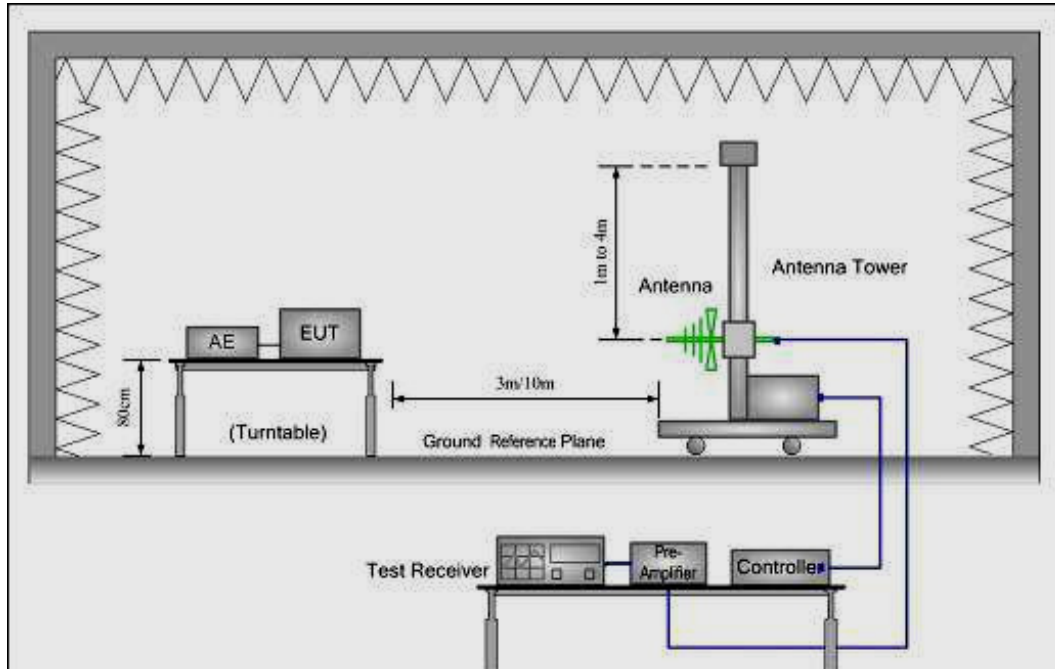
For testing performed with the horn antenna, testing was performed in accordance to ANSI C63.10. The measurement is performed with the EUT rotated 360°, the antenna height scan between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

### Test Configuration:

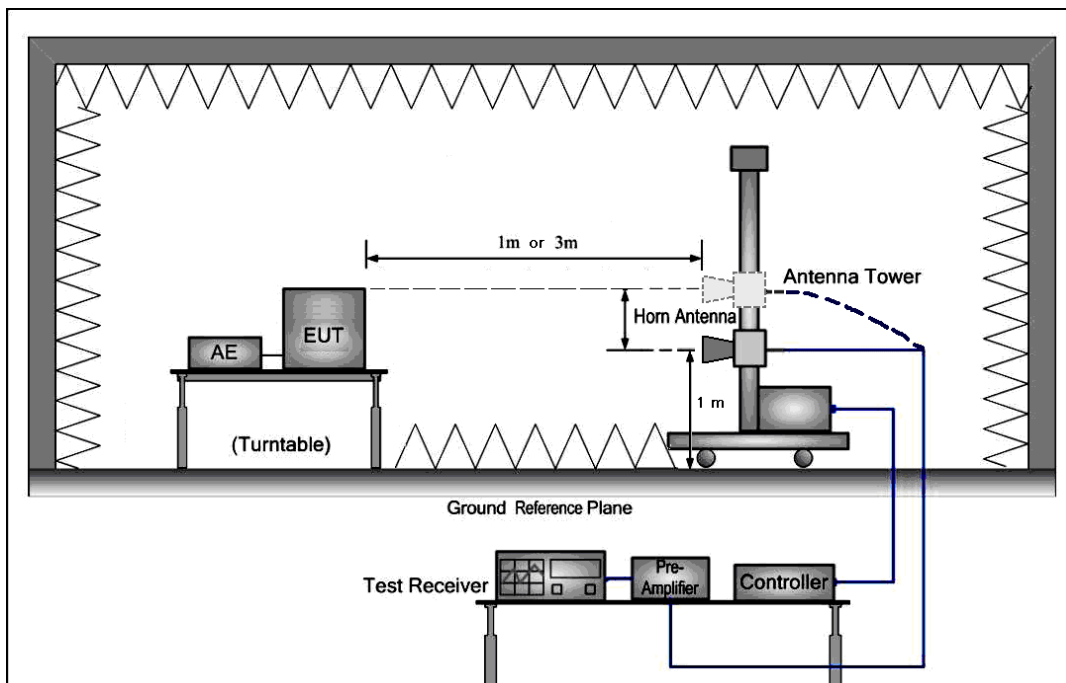
#### 1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 25 GHz emissions:



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

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



And according 15.35(a)

15.35(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

Note: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

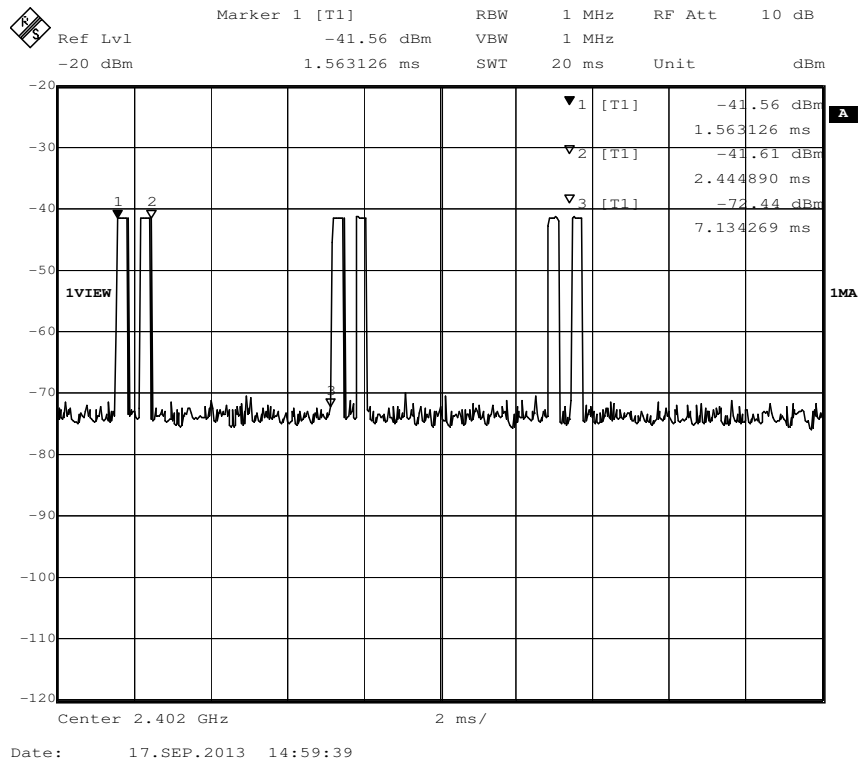
According to 15.35 (b) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.255, and 15.509-15.519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

The average correction factor is computed by analyzing the on time in 100ms over one complete pulse train. Analysis of the remote transmitter on time in one complete pulse train, therefore the average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle), where the duty factor is calculated from following formula:

$$20\log (\text{Duty cycle}) = 20\log ( (2.444890-1.563126)/(7.134269-1.563126) ) = 20\log (0.158273) = -8.006\text{dB}$$

Please refer to below plots for more details.







**Test at low Channel in transmitting status**
**9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement**

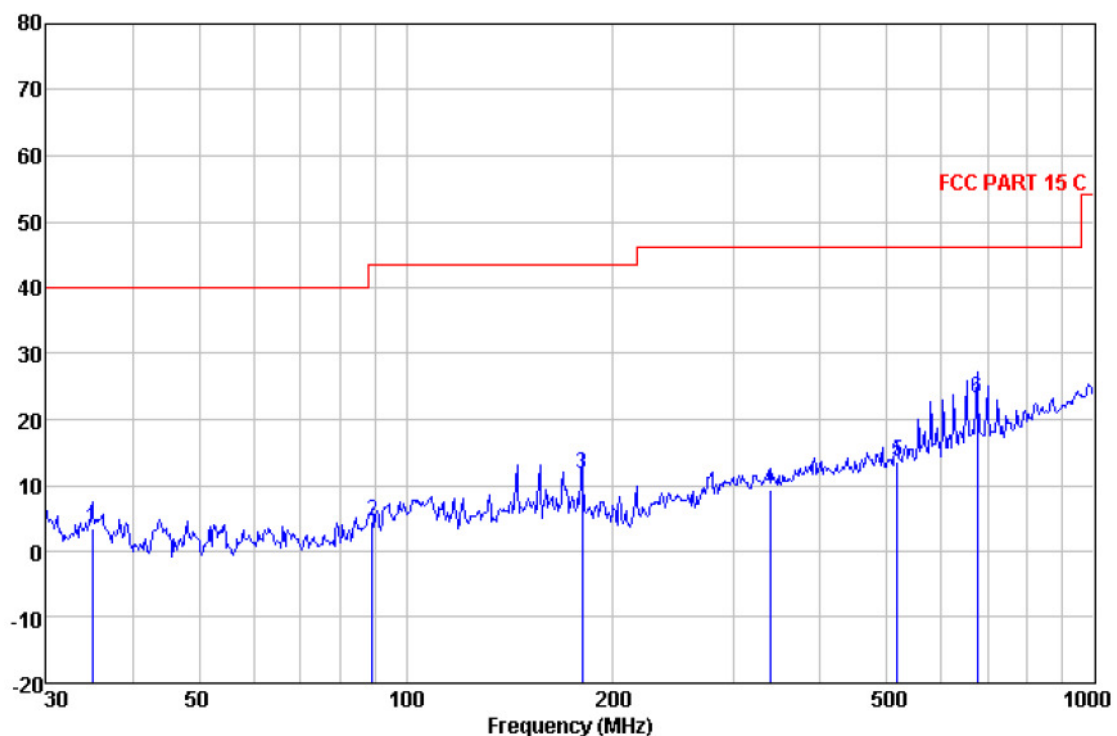
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

**30 MHz~1 GHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement**

Vertical:

Peak scan

Level (dB $\mu$ V/m)



Quasi-peak measurement

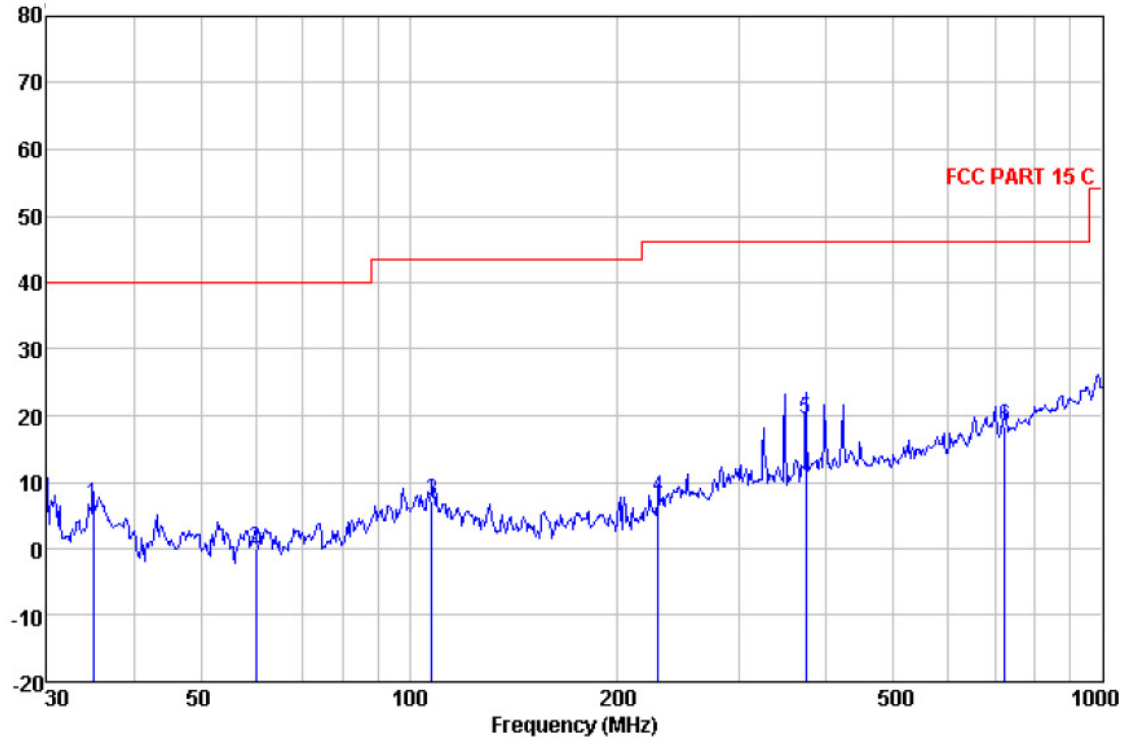
| Freq    | ReadAntenna | Cable | Preamp | Limit | Over   |        |        |    |
|---------|-------------|-------|--------|-------|--------|--------|--------|----|
| Level   | Factor      | Loss  | Factor | Line  | Limit  | Remark |        |    |
| MHz     | dBuV        | dB/m  | dB     | dB    | dBuV/m | dBuV/m | dB     |    |
| 35.005  | 12.91       | 17.35 | 0.12   | 26.79 | 3.59   | 40.00  | -36.41 | QP |
| 89.276  | 22.04       | 8.82  | 0.24   | 26.60 | 4.50   | 43.50  | -39.00 | QP |
| 180.017 | 29.54       | 7.60  | 0.65   | 26.19 | 11.60  | 43.50  | -31.90 | QP |
| 338.400 | 20.18       | 13.88 | 1.16   | 26.02 | 9.20   | 46.00  | -36.80 | QP |
| 517.248 | 21.68       | 17.53 | 1.55   | 27.06 | 13.70  | 46.00  | -32.30 | QP |
| 675.208 | 30.00       | 18.45 | 1.84   | 27.13 | 23.16  | 46.00  | -22.84 | QP |



Horizontal:

Peak scan

Level (dB $\mu$ V/m)



Quasi-peak measurement

| Freq    | ReadAntenna | Cable | Preamp |       | Limit  | Over   |           |
|---------|-------------|-------|--------|-------|--------|--------|-----------|
| Level   | Factor      | Loss  | Factor | Level | Line   | Limit  | Remark    |
| MHz     | dBuV        | dB/m  | dB     | dB    | dBuV/m | dBuV/m | dB        |
| 35.005  | 15.92       | 17.35 | 0.12   | 26.79 | 6.60   | 40.00  | -33.40 QP |
| 60.069  | 21.60       | 4.90  | 0.23   | 26.68 | 0.05   | 40.00  | -39.95 QP |
| 107.888 | 21.65       | 11.77 | 0.24   | 26.56 | 7.10   | 43.50  | -36.40 QP |
| 228.490 | 23.34       | 9.67  | 0.76   | 26.04 | 7.73   | 46.00  | -38.27 QP |
| 373.311 | 29.08       | 15.31 | 1.20   | 26.25 | 19.34  | 46.00  | -26.66 QP |
| 724.261 | 24.23       | 19.50 | 1.86   | 27.08 | 18.51  | 46.00  | -27.49 QP |



1~25 GHz Field Strength of Fundamental &amp; Field Strength of Unwanted Emissions.

Peak &amp; Average Measurement

| Peak Measurement:    |                         |                 |                    |                      |                         |                |                      |
|----------------------|-------------------------|-----------------|--------------------|----------------------|-------------------------|----------------|----------------------|
| Frequency (MHz)      | Antenna factors (dB/m)  | Cable loss (dB) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2402.00              | 27.58                   | 6.14            | 49.43              | 100.10               | 84.39                   | 114.00         | V                    |
| 4804.00              | 31.53                   | 8.98            | 49.30              | 62.86                | 54.07                   | 74.00          | V                    |
| 7206.00              | 36.47                   | 12.32           | 49.73              | 56.97                | 56.03                   | 74.00          | V                    |
| 9608.00              | 38.08                   | 16.30           | 49.89              | 53.26                | 57.75                   | 74.00          | V                    |
| 2402.00              | 27.58                   | 6.14            | 49.43              | 102.51               | 86.80                   | 114.00         | H                    |
| 4804.00              | 31.53                   | 8.98            | 49.30              | 62.30                | 53.51                   | 74.00          | H                    |
| 7206.00              | 36.47                   | 12.32           | 49.73              | 56.37                | 55.43                   | 74.00          | H                    |
| 9608.00              | 38.08                   | 16.30           | 49.89              | 53.50                | 57.99                   | 74.00          | H                    |
| Average Measurement: |                         |                 |                    |                      |                         |                |                      |
| Frequency (MHz)      | 20log (Duty cycle) (dB) |                 |                    | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2402.00              | -8.006                  |                 |                    | 84.39                | 76.38                   | 94.00          | V                    |
| 4804.00              |                         |                 |                    | 54.07                | 46.06                   | 54.00          | V                    |
| 7206.00              |                         |                 |                    | 56.03                | 48.02                   | 54.00          | V                    |
| 9608.00              |                         |                 |                    | 57.75                | 49.74                   | 54.00          | V                    |
| 2402.00              |                         |                 |                    | 86.80                | 78.79                   | 94.00          | H                    |
| 4804.00              |                         |                 |                    | 53.51                | 45.50                   | 54.00          | H                    |
| 7206.00              |                         |                 |                    | 55.43                | 47.42                   | 54.00          | H                    |
| 9608.00              |                         |                 |                    | 57.99                | 49.98                   | 54.00          | H                    |



**Band Edge:**

| Peak Measurement:    |                        |                 |                          |                      |                         |                |                      |
|----------------------|------------------------|-----------------|--------------------------|----------------------|-------------------------|----------------|----------------------|
| Frequency (MHz)      | Antenna factors (dB/m) | Cable loss (dB) | Preamplifier factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2400.00              | 27.58                  | 6.14            | 49.43                    | 55.04                | 39.33                   | 74.00          | V                    |
| 2483.50              | 27.55                  | 6.30            | 49.41                    | 54.89                | 39.33                   | 74.00          | V                    |
| 2400.00              | 27.58                  | 6.14            | 49.43                    | 55.89                | 40.18                   | 74.00          | H                    |
| 2483.50              | 27.55                  | 6.30            | 49.41                    | 55.99                | 40.43                   | 74.00          | H                    |
| Average Measurement: |                        |                 |                          |                      |                         |                |                      |
| Frequency (MHz)      | Antenna factors (dB/m) | Cable loss (dB) | Preamplifier factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2400.00              | 27.58                  | 6.14            | 49.43                    | 49.04                | 33.33                   | 54.00          | V                    |
| 2483.50              | 27.55                  | 6.30            | 49.41                    | 48.89                | 33.33                   | 54.00          | V                    |
| 2400.00              | 27.58                  | 6.14            | 49.43                    | 51.89                | 36.18                   | 54.00          | H                    |
| 2483.50              | 27.55                  | 6.30            | 49.41                    | 50.99                | 35.43                   | 54.00          | H                    |

**Test at middle Channel in transmitting status**
**9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement**

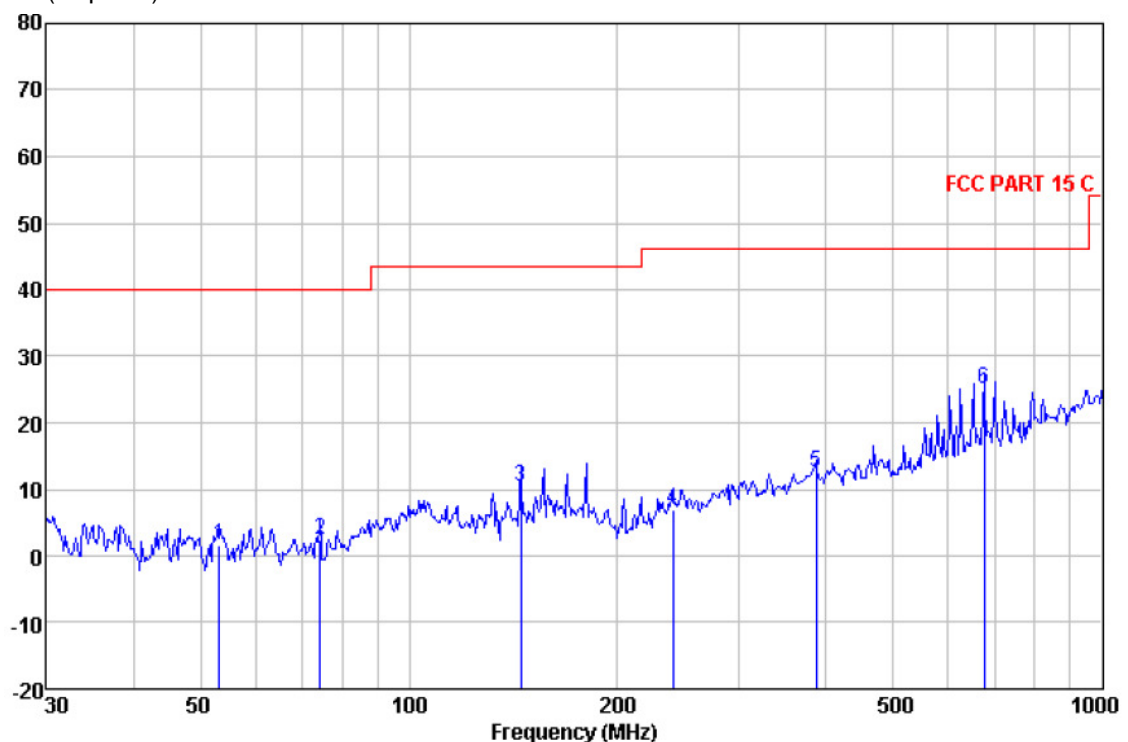
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

**30 MHz~1 GHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement**

Vertical:

Peak scan

Level (dBμV/m)

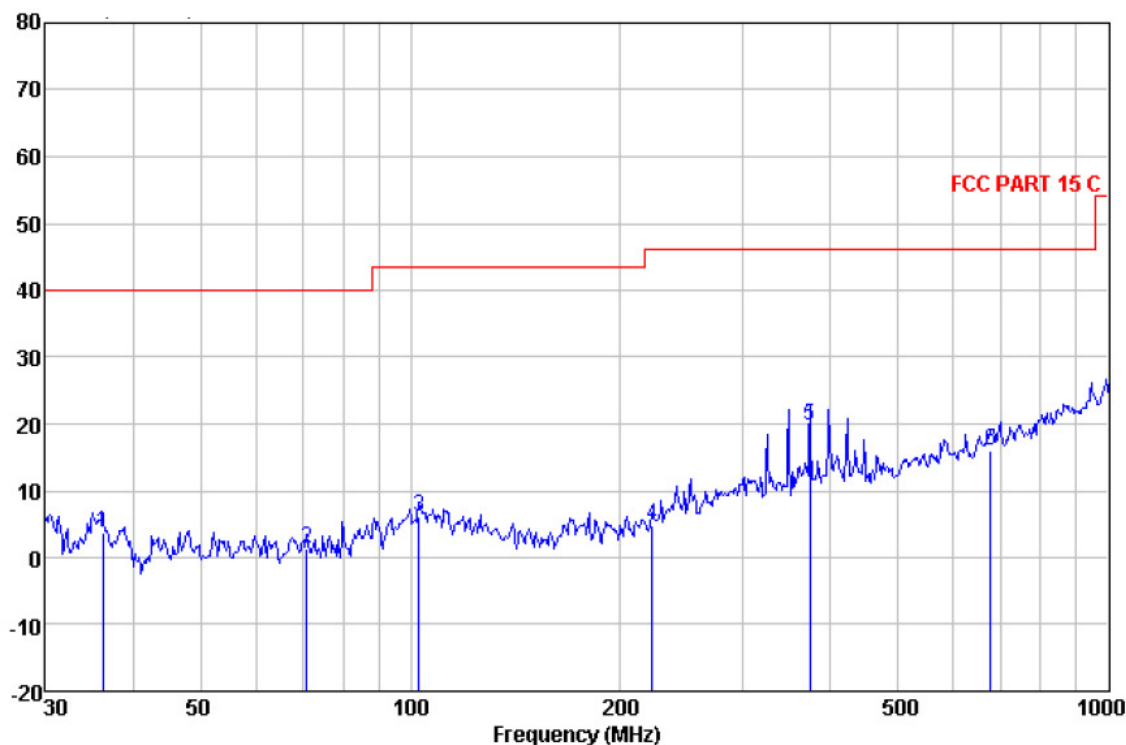


Quasi-peak measurement

| Freq    | ReadAntenna | Cable | Preamp | Limit | Over   |        |           |
|---------|-------------|-------|--------|-------|--------|--------|-----------|
| Level   | Factor      | Loss  | Factor | Line  | Limit  | Remark |           |
| MHz     | dBuV        | dB/m  | dB     | dB    | dBuV/m | dBuV/m | dB        |
| 53.318  | 23.80       | 4.40  | 0.08   | 26.70 | 1.58   | 40.00  | -38.42 QP |
| 74.396  | 23.65       | 5.14  | 0.17   | 26.65 | 2.31   | 40.00  | -37.69 QP |
| 144.842 | 26.18       | 10.20 | 0.47   | 26.39 | 10.46  | 43.50  | -33.04 QP |
| 239.987 | 21.13       | 11.10 | 0.77   | 26.01 | 6.99   | 46.00  | -39.01 QP |
| 386.634 | 22.12       | 15.57 | 1.20   | 26.39 | 12.50  | 46.00  | -33.50 QP |
| 675.208 | 31.98       | 18.45 | 1.84   | 27.13 | 25.14  | 46.00  | -20.86 QP |

**Horizontal:**

Peak scan

Level (dB $\mu$ V/m)

## Quasi-peak measurement

| Freq       | ReadAntenna | Cable  | Preamp | Limit        | Over         |       |
|------------|-------------|--------|--------|--------------|--------------|-------|
| MHz        | Level       | Factor | Loss   | Factor       | Level        | Line  |
| dB $\mu$ V | dB/m        | dB     | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB    |
| 36.254     | 13.67       | 16.64  | 0.16   | 26.78        | 3.69         | 40.00 |
| 71.080     | 23.16       | 4.73   | 0.14   | 26.66        | 1.37         | 40.00 |
| 102.719    | 21.17       | 11.26  | 0.22   | 26.58        | 6.07         | 43.50 |
| 222.170    | 20.92       | 9.06   | 0.75   | 26.06        | 4.67         | 46.00 |
| 373.311    | 29.38       | 15.31  | 1.20   | 26.25        | 19.64        | 46.00 |
| 677.580    | 22.73       | 18.52  | 1.84   | 27.12        | 15.97        | 46.00 |



1~25 GHz Field Strength of Fundamental &amp; Field Strength of Unwanted Emissions.

Peak &amp; Average Measurement

| Peak Measurement:    |                         |                 |                    |                      |                         |                |                      |
|----------------------|-------------------------|-----------------|--------------------|----------------------|-------------------------|----------------|----------------------|
| Frequency (MHz)      | Antenna factors (dB/m)  | Cable loss (dB) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2442.00              | 27.57                   | 6.24            | 49.42              | 101.72               | 86.11                   | 114.00         | V                    |
| 4884.00              | 31.58                   | 8.63            | 49.30              | 59.35                | 50.26                   | 74.00          | V                    |
| 7326.00              | 36.51                   | 12.23           | 49.74              | 56.69                | 55.69                   | 74.00          | V                    |
| 9768.00              | 38.51                   | 15.70           | 49.89              | 53.59                | 57.91                   | 74.00          | V                    |
| 2442.00              | 27.57                   | 6.24            | 49.42              | 102.26               | 86.65                   | 114.00         | H                    |
| 4884.00              | 31.58                   | 8.63            | 49.30              | 61.38                | 52.29                   | 74.00          | H                    |
| 7326.00              | 36.51                   | 12.23           | 49.74              | 56.26                | 55.26                   | 74.00          | H                    |
| 9768.00              | 38.51                   | 15.70           | 49.89              | 53.28                | 57.60                   | 74.00          | H                    |
| Average Measurement: |                         |                 |                    |                      |                         |                |                      |
| Frequency (MHz)      | 20log (Duty cycle) (dB) |                 |                    | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2442.00              | -8.006                  |                 |                    | 86.11                | 78.10                   | 94.00          | V                    |
| 4884.00              |                         |                 |                    | 50.26                | 42.25                   | 54.00          | V                    |
| 7326.00              |                         |                 |                    | 55.69                | 47.68                   | 54.00          | V                    |
| 9768.00              |                         |                 |                    | 57.91                | 49.90                   | 54.00          | V                    |
| 2442.00              |                         |                 |                    | 86.65                | 78.64                   | 94.00          | H                    |
| 4884.00              |                         |                 |                    | 52.29                | 44.28                   | 54.00          | H                    |
| 7326.00              |                         |                 |                    | 55.26                | 47.25                   | 54.00          | H                    |
| 9768.00              |                         |                 |                    | 57.60                | 49.59                   | 54.00          | H                    |



**Band Edge:**

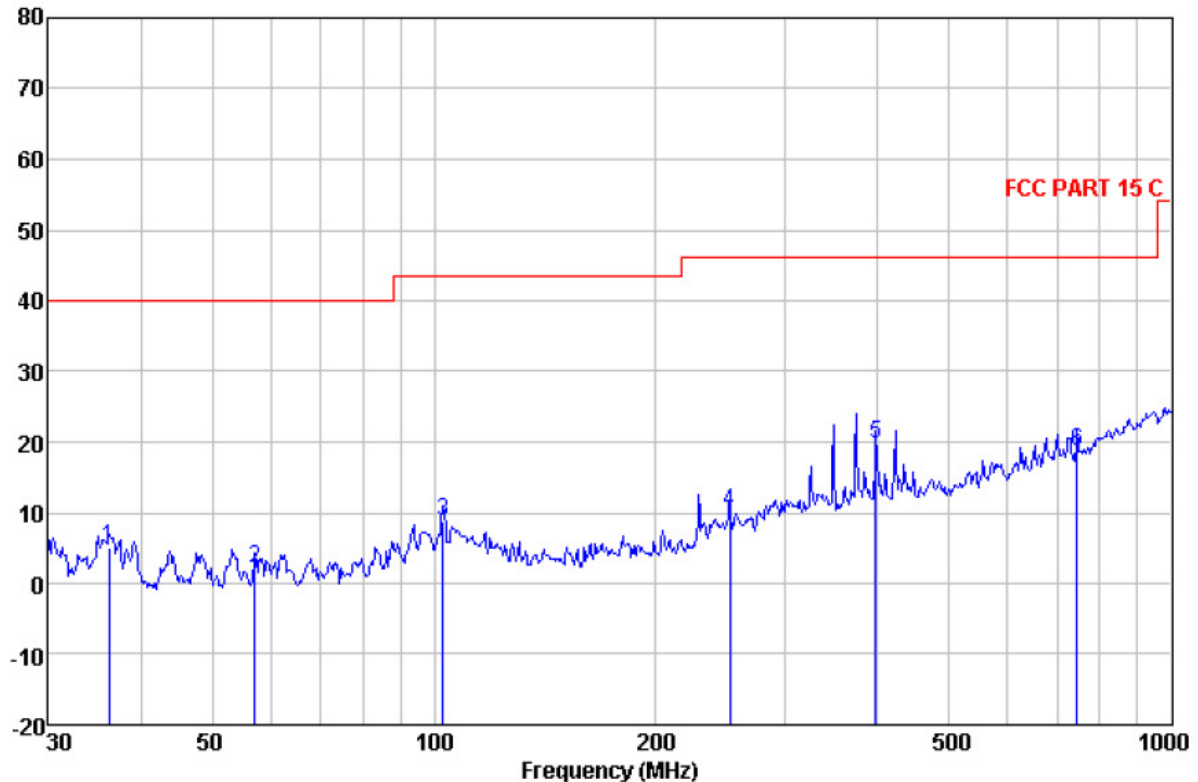
| Peak Measurement:    |                        |                 |                    |                      |                         |                |                      |
|----------------------|------------------------|-----------------|--------------------|----------------------|-------------------------|----------------|----------------------|
| Frequency (MHz)      | Antenna factors (dB/m) | Cable loss (dB) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 54.75                | 39.04                   | 74.00          | V                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 54.31                | 38.75                   | 74.00          | V                    |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 53.65                | 37.94                   | 74.00          | H                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 54.72                | 39.16                   | 74.00          | H                    |
| Average Measurement: |                        |                 |                    |                      |                         |                |                      |
| Frequency (MHz)      | Antenna factors (dB/m) | Cable loss (dB) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 51.75                | 36.04                   | 54.00          | V                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 50.31                | 34.75                   | 54.00          | V                    |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 49.65                | 33.94                   | 54.00          | H                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 50.72                | 35.16                   | 54.00          | H                    |





**Horizontal:**

Peak scan

Level (dB $\mu$ V/m)

**Quasi-peak measurement**

| Freq    | ReadAntenna | Cable  | Preamp |        | Limit  | Over   |           |
|---------|-------------|--------|--------|--------|--------|--------|-----------|
| MHz     | Level       | Factor | Loss   | Factor | Line   | Limit  | Remark    |
| MHz     | dBuV        | dB/m   | dB     | dB     | dBuV/m | dBuV/m | dB        |
| 36.254  | 14.96       | 16.64  | 0.16   | 26.78  | 4.98   | 40.00  | -35.02 QP |
| 57.191  | 24.07       | 4.66   | 0.17   | 26.69  | 2.21   | 40.00  | -37.79 QP |
| 102.719 | 23.93       | 11.26  | 0.22   | 26.58  | 8.83   | 43.50  | -34.67 QP |
| 252.063 | 23.67       | 11.72  | 0.78   | 26.00  | 10.17  | 46.00  | -35.83 QP |
| 397.633 | 29.03       | 15.90  | 1.20   | 26.46  | 19.67  | 46.00  | -26.33 QP |
| 744.866 | 23.63       | 20.15  | 1.85   | 27.09  | 18.54  | 46.00  | -27.46 QP |

**1~25 GHz Field Strength of Fundamental & Field Strength of Unwanted Emissions.****Peak & Average Measurement**

| Peak Measurement:    |                              |                    |                          |                            |                               |                   |                         |
|----------------------|------------------------------|--------------------|--------------------------|----------------------------|-------------------------------|-------------------|-------------------------|
| Frequency<br>(MHz)   | Antenna<br>factors<br>(dB/m) | Cable loss<br>(dB) | Preamp<br>factor<br>(dB) | Reading<br>Level<br>(dBμV) | Emission<br>Level<br>(dBμV/m) | Limit<br>(dBμV/m) | Antenna<br>polarization |
| 2478.00              | 27.56                        | 6.27               | 49.41                    | 102.88                     | 87.30                         | 114.00            | V                       |
| 4956.00              | 31.70                        | 8.28               | 49.30                    | 61.83                      | 52.51                         | 74.00             | V                       |
| 7434.00              | 36.60                        | 12.14              | 49.75                    | 56.74                      | 55.73                         | 74.00             | V                       |
| 9912.00              | 38.68                        | 15.10              | 49.90                    | 54.33                      | 58.21                         | 74.00             | V                       |
| 2478.00              | 27.56                        | 6.27               | 49.41                    | 95.53                      | 79.95                         | 114.00            | H                       |
| 4956.00              | 31.70                        | 8.28               | 49.30                    | 63.13                      | 53.81                         | 74.00             | H                       |
| 7434.00              | 36.60                        | 12.14              | 49.75                    | 56.44                      | 55.43                         | 74.00             | H                       |
| 9912.00              | 38.68                        | 15.10              | 49.90                    | 52.93                      | 56.81                         | 74.00             | H                       |
| Average Measurement: |                              |                    |                          |                            |                               |                   |                         |
| Frequency<br>(MHz)   | 20log (Duty cycle)<br>(dB)   |                    |                          | Reading<br>Level<br>(dBμV) | Emission<br>Level<br>(dBμV/m) | Limit<br>(dBμV/m) | Antenna<br>polarization |
| 2478.00              | -8.006                       |                    |                          | 87.30                      | 79.29                         | 94.00             | V                       |
| 4956.00              |                              |                    |                          | 52.51                      | 44.50                         | 54.00             | V                       |
| 7434.00              |                              |                    |                          | 55.73                      | 47.72                         | 54.00             | V                       |
| 9912.00              |                              |                    |                          | 58.21                      | 50.20                         | 54.00             | V                       |
| 2478.00              |                              |                    |                          | 79.95                      | 71.94                         | 94.00             | H                       |
| 4956.00              |                              |                    |                          | 53.81                      | 45.80                         | 54.00             | H                       |
| 7434.00              |                              |                    |                          | 55.43                      | 47.42                         | 54.00             | H                       |
| 9912.00              |                              |                    |                          | 56.81                      | 48.80                         | 54.00             | H                       |



**Band Edge:**

| Peak Measurement:    |                        |                 |                    |                      |                         |                |                      |
|----------------------|------------------------|-----------------|--------------------|----------------------|-------------------------|----------------|----------------------|
| Frequency (MHz)      | Antenna factors (dB/m) | Cable loss (dB) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 55.83                | 40.12                   | 74.00          | V                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 56.15                | 40.59                   | 74.00          | V                    |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 55.85                | 40.14                   | 74.00          | H                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 56.02                | 40.46                   | 74.00          | H                    |
| Average Measurement: |                        |                 |                    |                      |                         |                |                      |
| Frequency (MHz)      | Antenna factors (dB/m) | Cable loss (dB) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 49.83                | 34.12                   | 54.00          | V                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 51.15                | 35.59                   | 54.00          | V                    |
| 2400.00              | 27.58                  | 6.14            | 49.43              | 51.85                | 36.14                   | 54.00          | H                    |
| 2483.50              | 27.55                  | 6.30            | 49.41              | 51.02                | 35.46                   | 54.00          | H                    |

**Remark:**

- 1). The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:  
Final Test Level = Receiver Reading + Antenna Factor + Cable Loss – Preamplifier Factor.
- 2). As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 3). The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

**Test result: The unit does meet the FCC requirements.**

## 7.4 Occupied Bandwidth

Test Requirement: FCC Part 15 C section 15.249

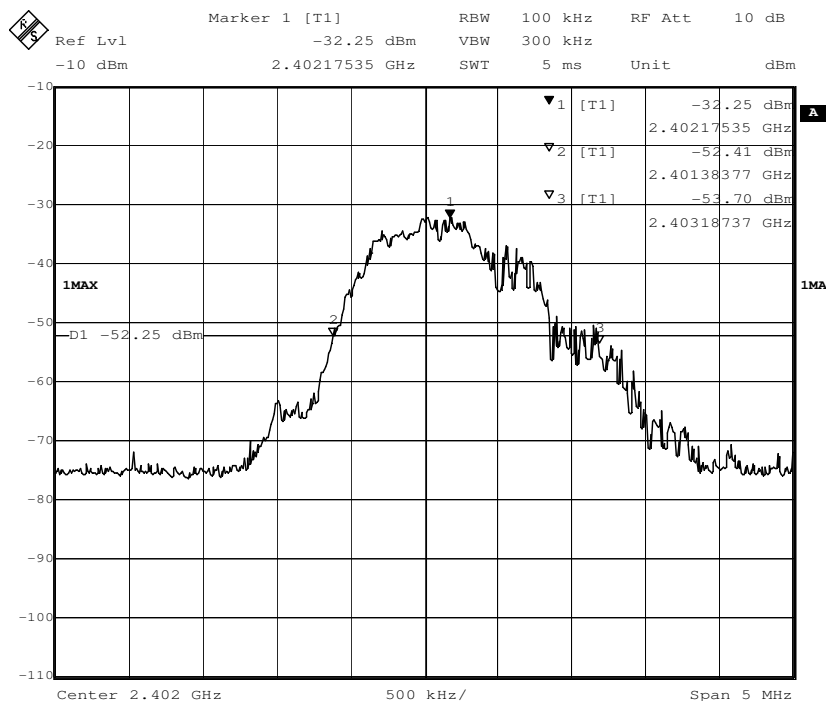
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Test Method: ANSI C63.10: Clause 6.9.1

Operation within the band 2.400 to 2.4835 GHz

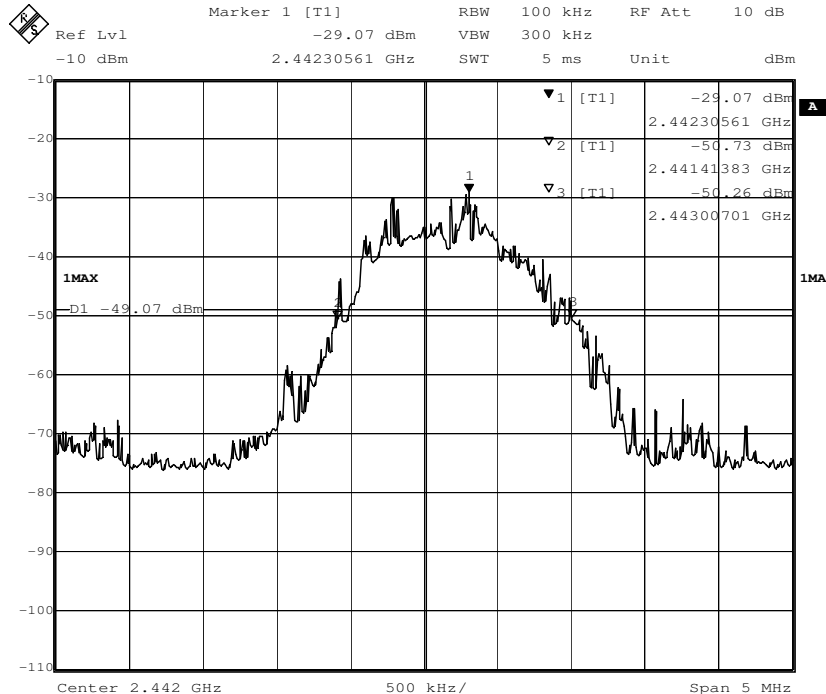
Method of measurement: A small sample of the transmitter output was fed into the Spectrum Analyzer and the attached plot was taken.

### 1. Test in the lowest frequency 2.402 GHz

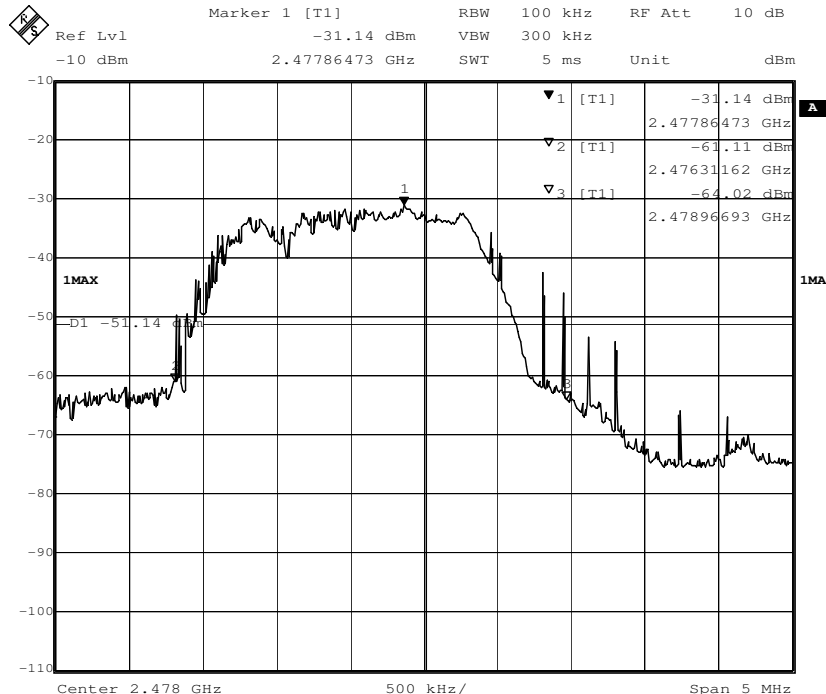




## 2. Test in the middle frequency 2.442 GHz



## 3. Test in the highest frequency 2.478 GHz



The results: The unit does meet the FCC requirements.

--End of the report--