



Report No.: FR820502-02G



FCC CO-LOCTION RADIO TEST REPORT

FCC ID : A4RG013C Equipment : Smartphone

Model Name : G013C

Applicant : Google LLC

1600 Amphitheatre Parkway,

Mountain View, California, 94043 USA

Standard : FCC Part 15 Subpart E §15.407

The product was completed on Jun. 26, 2018. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Jones Tsai

(Ince/sur)

SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

TEL: 886-3-327-3456 Page Number: 1 of 15
FAX: 886-3-328-4978 Report Issued Date: Jun. 27, 2018

Report Template No.: BU5-FR15EWL AC MA Version 2.1

Report Version : 0

: 01

Table of Contents

Report No. : FR820502-02G

| His | story o | of this test report | 3 |
|-----|---------|---|----|
| Su | mmar | y of Test Result | |
| 1 | | eral Description | |
| • | 1.1 | Product Feature of Equipment Under Test | |
| | 1.2 | Modification of EUT | |
| | 1.3 | Testing Location | |
| | 1.4 | Applicable Standards | |
| 2 | Test | Configuration of Equipment Under Test | 7 |
| | 2.1 | Carrier Frequency and Channel | |
| | 2.2 | Test Mode | |
| | 2.3 | Connection Diagram of Test System | |
| | 2.4 | EUT Operation Test Setup | |
| 3 | Test | Result | |
| | 3.1 | Unwanted Emissions Measurement | |
| | 3.2 | Antenna Requirements | |
| 4 | List | of Measuring Equipment | 14 |
| 5 | | ertainty of Evaluation | |
| Αp | | x A. Radiated Spurious Emission Plots | |
| Δn | nendi | x E. Duty Cycle Plots | |

: 2 of 15 TEL: 886-3-327-3456 Page Number FAX: 886-3-328-4978 Report Issued Date: Jun. 27, 2018 Report Version : 01

History of this test report

Report No. : FR820502-02G

| Report No. | Version | Description | Issued Date |
|--------------|---------|-------------------------|---------------|
| FR820502-02G | 01 | Initial issue of report | Jun. 27, 2018 |
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TEL: 886-3-327-3456 Page Number FAX: 886-3-328-4978 Report Issued Date: Jun. 27, 2018 Report Version : 01

Summary of Test Result

Report No. : FR820502-02G

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|------------------|---------------------|---------------------|-----------------------|--|
| 3.1 | 15.407(b) | Unwanted Emissions | Pass | Under limit 3.45 dB at 897.800 MHz |
| 3.2 | 15.203 15.407(a) | Antenna Requirement | Pass | - |

Reviewed by: Joseph Lin Report Producer: Wii Chang

TEL: 886-3-327-3456 Page Number : 4 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

1 General Description

1.1 Product Feature of Equipment Under Test

| Product Feature | | |
|---------------------------------|---|--|
| Equipment | Smartphone | |
| Model Name | G013C | |
| FCC ID | A4RG013C | |
| EUT supports Radios application | CDMA/EV-DO/GSM/EGPRS/WCDMA/HSPA/LTE/NFC/GNSS/WPC WLAN 11b/g/n HT20/VHT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE | |
| EUT Stage | Identical Prototype | |

Report No.: FR820502-02G

: 01

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

| | EUT Information List |
|-----|----------------------|
| No. | S/N |
| #1 | 85LY00985 |

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

TEL: 886-3-327-3456 Page Number : 5 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

1.3 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Report No.: FR820502-02G

: 01

| Test Site SPORTON INTERNATIONAL INC. | |
|--------------------------------------|---|
| Test Site Location | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855 |
| Test Site No. | Sporton Site No. |
| rest one NO. | 03CH11-HY |

Note: The test site complies with ANSI C63.4 2014 requirement.

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ANSI C63.10-2013

Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

TEL: 886-3-327-3456 Page Number : 6 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

Report No.: FR820502-02G

2.1 Carrier Frequency and Channel

| 2400-248 802 | 33.5 MHz .11b | 5150-5250 MHz Band 1 (U-NII-1) | |
|-----------------|------------------|-----------------------------------|-------------|
| Channel | Freq. (MHz) | Channel | Freq. (MHz) |
| 06 | 2437 | 44 | 5220 |

| 5250-5350 MHz Band 2 (U-NII-2A) | | 5470-5725 MHz Band 3 (U-NII-2C) | |
|------------------------------------|-------------|------------------------------------|-------------|
| Channel | Freq. (MHz) | Channel | Freq. (MHz) |
| 60 | 5300 | 116 | 5580 |

| 5750-5825 MHz Band 4 (U-NII-3) | |
|-----------------------------------|-------------|
| Channel | Freq. (MHz) |
| 157 | 5785 |

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

<Co-Location>

| Modulation | Data Rate |
|--------------------|----------------|
| 802.11b + 802.11 a | 1 Mbps + 6Mbps |

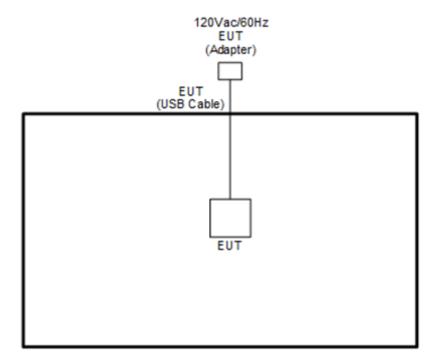
Remark: For Radiated Test Cases, the tests were performed with Adapter 1.

TEL: 886-3-327-3456 Page Number: 7 of 15
FAX: 886-3-328-4978 Report Issued Date: Jun. 27, 2018



2.3 Connection Diagram of Test System

<WLAN Tx Mode>



Report No.: FR820502-02G

2.4 EUT Operation Test Setup

The RF test items, utility "QRCT" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

TEL: 886-3-327-3456 Page Number : 8 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

Report Version

: 01

3 Test Result

3.1 Unwanted Emissions Measurement

3.1.1 Limit of Unwanted Emissions

(1) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Report No.: FR820502-02G

| Frequency | Field Strength | Measurement Distance |
|---------------|--------------------|----------------------|
| (MHz) | (microvolts/meter) | (meters) |
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note: The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3}$$
 µV/m, where P is the eirp (Watts)

| EIRP (dBm) | Field Strength at 3m (dBµV/m) |
|------------|-------------------------------|
| - 27 | 68.3 |

(2) KDB789033 D02 v02r01 G)2)c)

- (i) Section 15.407(b)(1) to (b)(3) specify the unwanted emission limits for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.³
- (ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the devices using the alternative limit.⁴
- **Note 3:** An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.
- **Note 4:** Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).

TEL: 886-3-327-3456 Page Number : 9 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

- The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
 Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW ≥ 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
 - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
- 2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- 4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
- 5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.

TEL: 886-3-327-3456 Page Number : 10 of 15 FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

Report Template No.: BU5-FR15EWL AC MA Version 2.1

Report Version : 01

Report No.: FR820502-02G

6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.

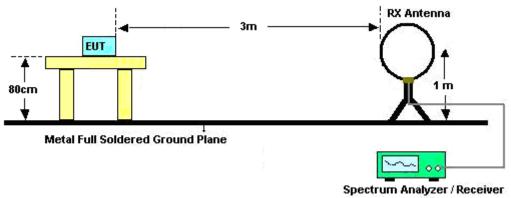
Report No.: FR820502-02G

: 01

7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

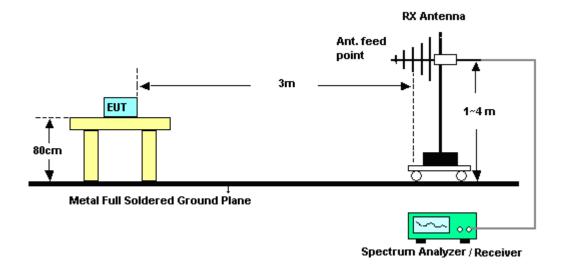
3.1.4 Test Setup

For radiated emissions below 30MHz



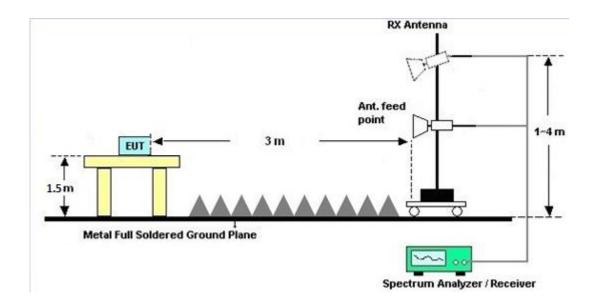
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For radiated emissions from 30MHz to 1GHz



TEL: 886-3-327-3456 Page Number : 11 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

For radiated emissions above 1GHz



Report No.: FR820502-02G

3.1.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.1.6 Duty Cycle

Please refer to Appendix B.

3.1.7 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix A.

TEL: 886-3-327-3456 Page Number : 12 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

Report Version

: 01

3.2 Antenna Requirements

3.2.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Report No.: FR820502-02G

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

TEL: 886-3-327-3456 Page Number : 13 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

Report Version

: 01

SPORTON LAB. FCC CO-LOCATION RADIO TEST REPORT

4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-------------------------|---|---|---|-------------------------------------|---------------------|---------------------------------|---------------|--------------------------|
| Amplifier | MITEQ | TTA1840-35- HG | 1871923 | 18GHz~40GHz, VSWR : 2.5:1 max | Jul. 18, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Jul. 17, 2018 | Radiation (03CH15-HY) |
| Amplifier | SONOMA | 310N | 363440 | 9kHz~1GHz | Dec. 26, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Dec. 25, 2018 | Radiation (03CH15-HY) |
| Bilog Antenna | TESEQ | CBL6111D& 00800N1D0 1N-06 | 41912&05 | 30MHz to 1GHz | Jan. 10, 2018 | Jun. 12, 2018~ Jun. 26, 2018 | Jan. 09, 2019 | Radiation (03CH15-HY) |
| Horn Antenna | SCHWARZBE CK | BBHA 9120D | 9120D-162 0 | 1G~18GHz | Oct. 03, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Oct. 02, 2018 | Radiation (03CH15-HY) |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100488 | 9 kHz~30 MHz | Nov. 23, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Nov. 22, 2018 | Radiation (03CH15-HY) |
| Preamplifier | Keysight | 83017A | MY532701 95 | 1GHz~26.5GHz | Aug. 21, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Aug. 20, 2018 | Radiation (03CH15-HY) |
| EMI Test Receiver | Keysight | N9038A (MXE) | MY541300 85 | 20Hz ~ 8.4GHz | Oct. 31, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Oct. 30, 2018 | Radiation (03CH15-HY) |
| Spectrum Analyzer | Agilent | E4446A | MY501801 36 | 3Hz~44GHz | Apr. 25, 2018 | Jun. 12, 2018~ Jun. 26, 2018 | Apr. 24, 2019 | Radiation (03CH15-HY) |
| Controller | ChainTek | 3000-1 | N/A | Control Turn table & Ant Mast | N/A | Jun. 12, 2018~ Jun. 26, 2018 | N/A | Radiation (03CH15-HY) |
| Antenna Mast | ChainTek | MBS-520-1 | N/A | 1m~4m | N/A | Jun. 12, 2018~ Jun. 26, 2018 | N/A | Radiation (03CH15-HY) |
| Turn Table | ChainTek | T-200-S-1 | N/A | 0~360 Degree | N/A | Jun. 12, 2018~ Jun. 26, 2018 | N/A | Radiation (03CH15-HY) |
| SHF-EHF Horn Antenna | SCHWARZBE CK | BBHA 9170 | BBHA9170 584 | 18GHz- 40GHz | Nov. 27, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Nov. 26, 2018 | Radiation (03CH15-HY) |
| Preamplifier | Jet-Power | JPA0010180 0-30-10P | 160118000 2 | 1GHz~18GHz | Jul. 31, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Jul. 30, 2018 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER / MTJ Cooperation | SUCOFLEX 104 / 000000-MT1 8A-100 | MY36980/ 4, MY9838/4 PE, D3210 | 30MHz~1GHz | Mar. 15, 2018 | Jun. 12, 2018~ Jun. 26, 2018 | Mar. 14, 2019 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER / MTJ Cooperation | SUCOFLEX 104 / 000000-MT1 8A-100 | MY36980/ 4, MY9838/4 PE, D3210 | 1GHz~18GHz | Mar. 15, 2018 | Jun. 12, 2018~ Jun. 26, 2018 | Mar. 14, 2019 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 505134/2 | 30M~40GHz | Oct. 17, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Oct. 16, 2018 | Radiation (03CH15-HY) |
| Filter | Wainwright | WHKX8-587 2.5-6750-18 000-40ST | SN3 | 6.75GHz High Pass | Sep. 18, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Sep. 17, 2018 | Radiation (03CH15-HY) |
| Filter | Wainwright | WLK4-1000- 1530-8000-4 0SS | SN11 | 1G Low Pass | Sep. 18, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Sep. 17, 2018 | Radiation (03CH15-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-00104 2 | N/A | N/A | Jun. 12, 2018~ Jun. 26, 2018 | N/A | Radiation (03CH15-HY) |
| Hygrometer | TECPEL | DTM-303B | TP162976 | N/A | Oct. 12, 2017 | Jun. 12, 2018~ Jun. 26, 2018 | Oct. 11, 2018 | Radiation (03CH15-HY) |

Report No. : FR820502-02G

TEL: 886-3-327-3456 Page Number : 14 of 15 FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018



5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

| Measuring Uncertainty for a Level of Confidence | 5.20 | |
|---|------|--|
| of 95% (U = 2Uc(y)) | 3.20 | |

Report No.: FR820502-02G

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

| Measuring Uncertainty for a Level of Confidence | 5.50 |
|---|------|
| of 95% (U = 2Uc(y)) | 5.50 |

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

| Measuring Uncertainty for a Level of Confidence | 5.20 |
|---|------|
| of 95% (U = 2Uc(y)) | 3.20 |

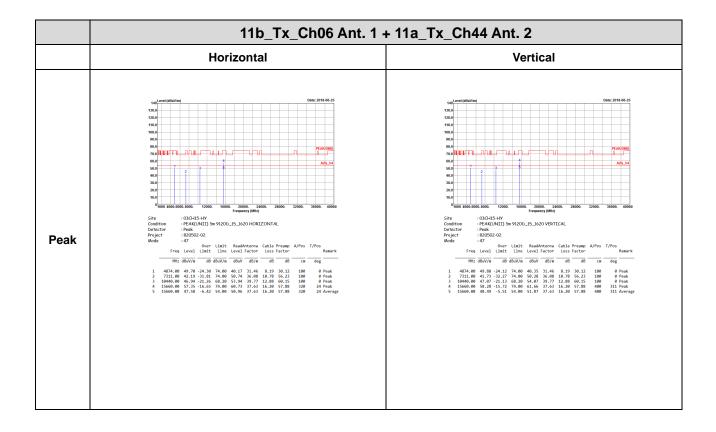
TEL: 886-3-327-3456 Page Number : 15 of 15
FAX: 886-3-328-4978 Report Issued Date : Jun. 27, 2018

Appendix A. Radiated Spurious Emission

| Toot Engineer | Bill Chang, Karl Hou, and Lance Chiang | Temperature : | 24~26°C | |
|-----------------|--|---------------------|---------|--|
| Test Engineer : | | Relative Humidity : | 50~54% | |

Report No.: FR820502-02G

802.11b + 802.11a

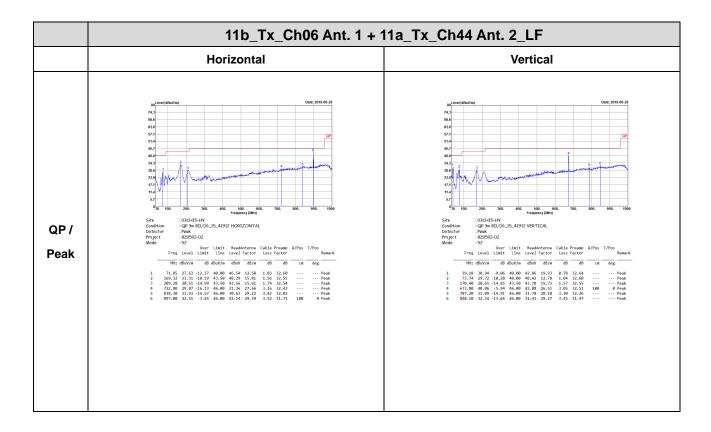


TEL: 886-3-327-3456 Page Number : A1 of A8



802.11b + 802.11a_LF

Report No.: FR820502-02G

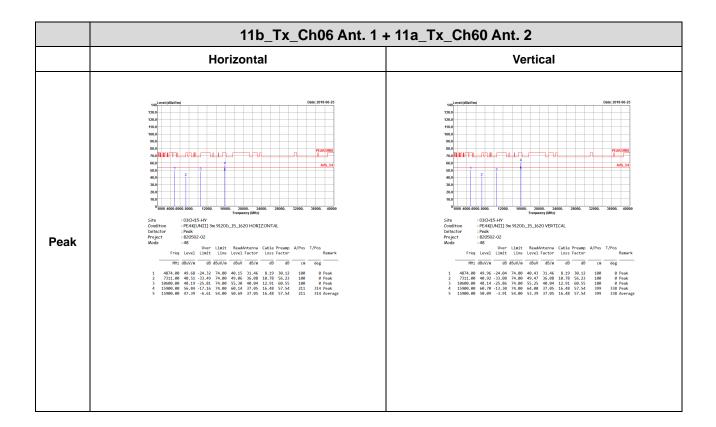


TEL: 886-3-327-3456 Page Number : A2 of A8



802.11b + 802.11a

Report No.: FR820502-02G

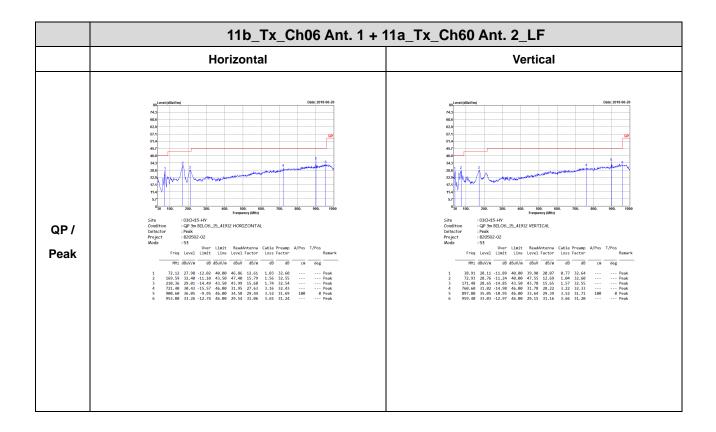


TEL: 886-3-327-3456 Page Number : A3 of A8



802.11b + 802.11a _LF

Report No.: FR820502-02G

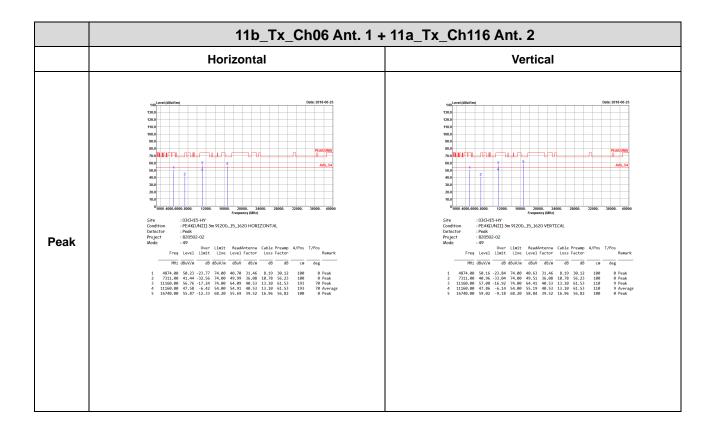


TEL: 886-3-327-3456 Page Number: A4 of A8



802.11b + 802.11a

Report No.: FR820502-02G

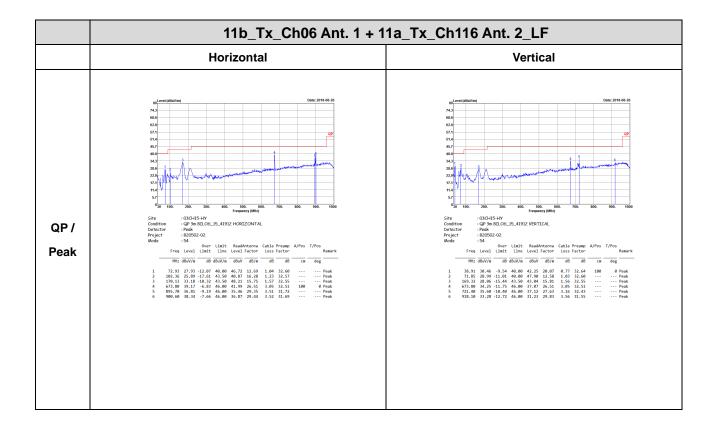


TEL: 886-3-327-3456 Page Number : A5 of A8



802.11b + 802.11a _LF

Report No.: FR820502-02G

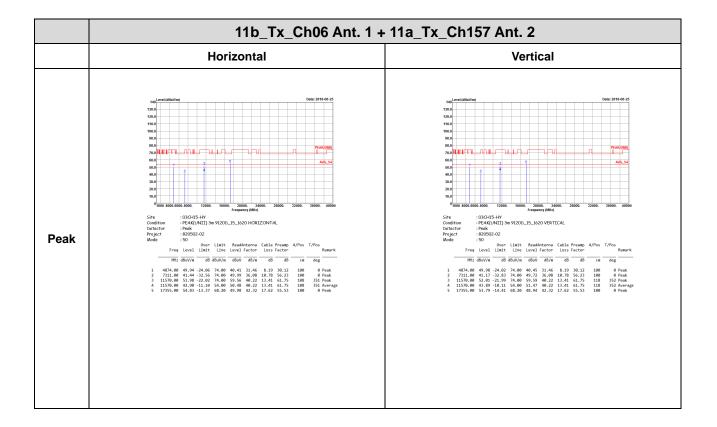


TEL: 886-3-327-3456 Page Number : A6 of A8



802.11b + 802.11a

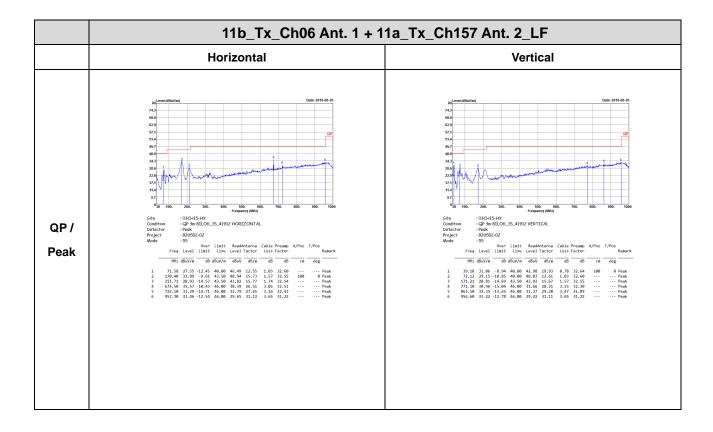
Report No.: FR820502-02G



TEL: 886-3-327-3456 Page Number : A7 of A8

802.11b + 802.11a_LF

Report No.: FR820502-02G



TEL: 886-3-327-3456 Page Number : A8 of A8



Appendix B. Duty Cycle Plots

| Antenna | Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor(dB) |
|---------|---------|------------------|---------|----------|----------------|--------------------|
| 1 | 802.11b | 100.00 | - | - | 10Hz | 0.00 |
| 2 | 802.11a | 97.73 | 2064.00 | 0.48 | 1kHz | 0.10 |

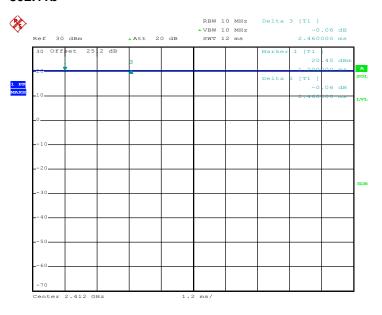
Report No. : FR820502-02G

TEL: 886-3-327-3456 Page Number: B-1 of 2



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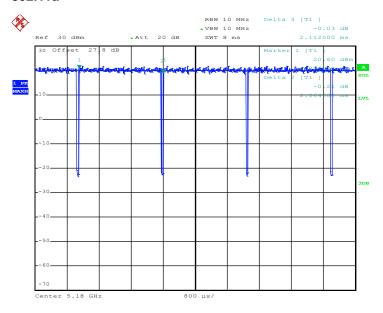
802.11b



Date: 8.JUN.2018 20:10:24

<Ant. 2>

802.11a



Date: 9.JUN.2018 00:16:20

——THE END——

Report No.: FR820502-02G

TEL: 886-3-327-3456 Page Number : B-2 of 2