FCC RF Co-location Test Report

APPLICANT	:	Plume Design Inc
EQUIPMENT	:	Plume Adaptive Wifi
BRAND NAME	:	Plume Design Inc
MODEL NAME	:	B1A
FCC ID	:	2AG7G-B1A
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure

The product was completed on Apr. 13, 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
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TABLE OF CONTENTS

REVISION HISTORY **3**

SUMMARY OF TEST RESULT **4**

1 GENERAL DESCRIPTION **5**

1.1 Applicant 5
1.2 Manufacturer 5
1.3 Product Feature of Equipment Under Test 5
1.4 Modification of EUT 5
1.5 Testing Location 6
1.6 Applicable Standards 6

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST **7**

2.1 Carrier Frequency and Channel 7
2.2 Test Mode 8
2.3 Connection Diagram of Test System 9
2.4 EUT Operation Test Setup 9

3 TEST RESULT **10**

3.1 Unwanted Emissions Measurement 10
3.2 Antenna Requirements 15

4 LIST OF MEASURING EQUIPMENT **16**

5 UNCERTAINTY OF EVALUATION **17**

APPENDIX A. RADIATED SPURIOUS EMISSION PLOTS

APPENDIX B. DUTY CYCLE PLOTS

APPENDIX C. SETUP PHOTOGRAPHS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR811726F	Rev. 01	Initial issue of report	Apr. 02, 2018
FR811726F	Rev. 02	Add Bluetooth – LE co-location modes	Apr. 16, 2018
FR811726F	Rev. 03	Revising antenna information.	May 10, 2018

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result
3.1	15.407(b)	Unwanted Emissions	≤ -17, -27 dBm (depend on band)&15.209(a)	Pass
3.2	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass

1 General Description

1.1 Applicant

Plume Design Inc
290 S California Ave, Palo Alto, CA94306

1.2 Manufacturer

Plume Design Inc
290 S California Ave, Palo Alto, CA94306

1.3 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, and Wi-Fi 5GHz 802.11a/n/ac

Product specification subjective to this standard	
Antenna Type	**WLAN** **<For LB Ant.>** <Ant. 1>: IFA Antenna <Ant. 2>: IFA Antenna **<For HB Ant.>** <Ant. 1>: PIFA Antenna <Ant. 2>: PIFA Antenna <Ant. 3>: IFA Antenna <Ant. 4>: IFA Antenna Bluetooth: Slot Antenna

1.4 Modification of EUT

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

1.5 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.

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.**
	03CH11-HY

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

1.6 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 v01r04
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

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 (Z plane) were recorded in this report.

2.1 Carrier Frequency and Channel

2402-2480 MHz Bluetooth – LE		2400-2483.5 MHz 802.11g	
Channel	**Freq. (MHz)**	**Channel**	**Freq. (MHz)**
39	2480	11	2462

5150-5250 MHz Band 1 (U-NII-1) 802.11a		5745 MHz-5825 MHz Band 4 (U-NII-3) 802.11a	
Channel	**Freq. (MHz)**	**Channel**	**Freq. (MHz)**
36	5180	157	5785

2.2 Test Mode

Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

<Co-Location>

<2Tx + 2Tx>

Modulation	Data Rate
802.11g + 802.11a Band 1	6 Mbps + 6 Mbps

<2Tx + 4Tx>

Modulation	Data Rate
802.11g + 802.11a Band 4	6 Mbps + 6 Mbps

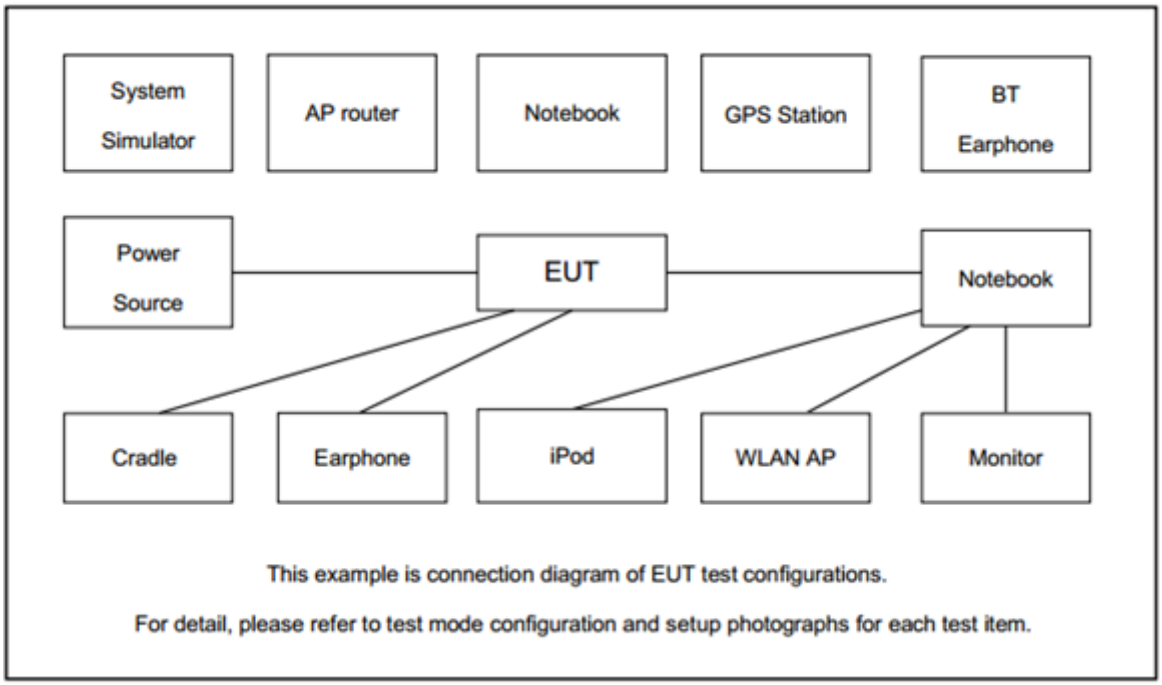
<Single + 2Tx + 2Tx>

Modulation	Data Rate
Bluetooth – LE + 802.11g + 802.11a Band 1	1 Mbps + 6 Mbps + 6 Mbps

<Single + 2Tx + 4Tx>

Modulation	Data Rate
Bluetooth – LE + 8802.11g + 802.11a Band 4	1 Mbps + 6 Mbps + 6 Mbps

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, programmed RF utility, “QSPR” installed in the notebook make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

The Bluetooth-LE test items, utility “CMD” 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.

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,

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (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 v01r04 G)2)c)

(i) Sections 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).

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04. 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

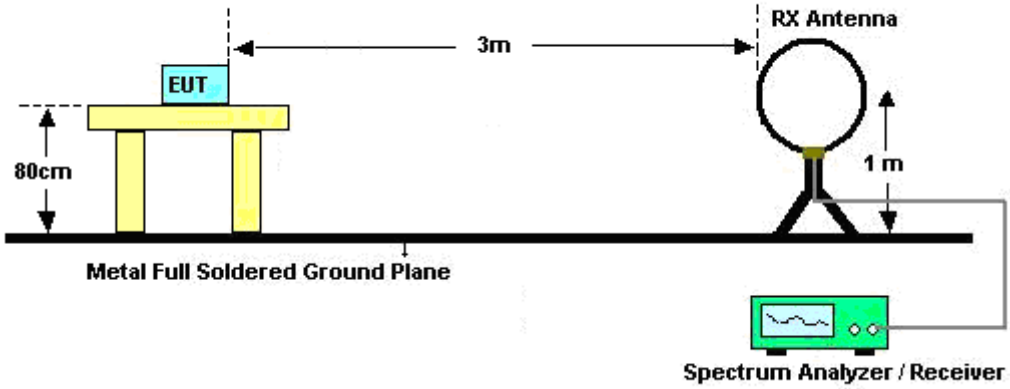
(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- 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.

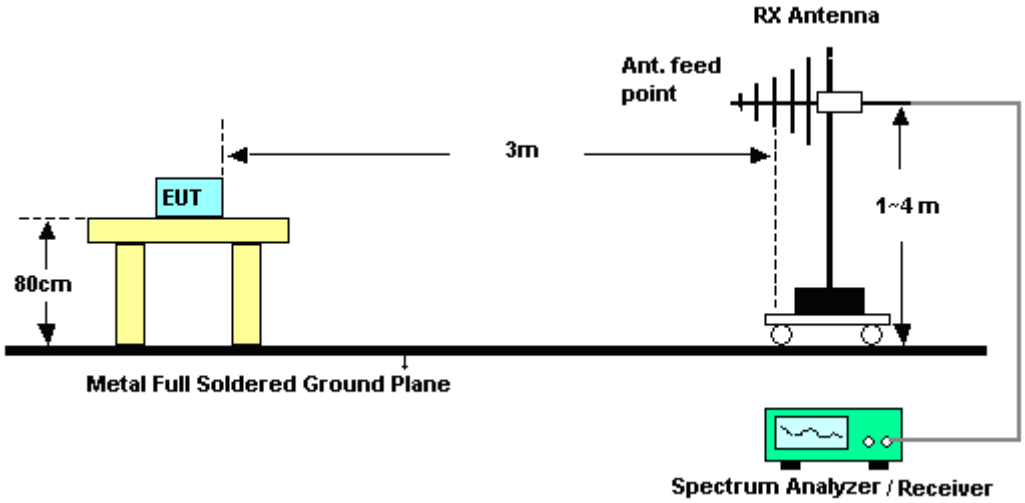
2. he EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband 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.
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.
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

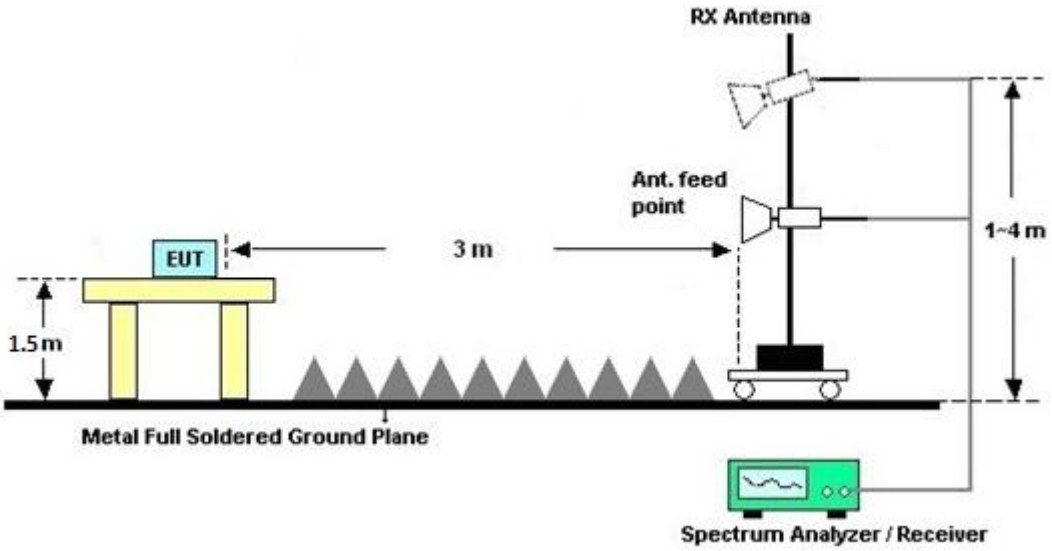
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.1.7 Duty Cycle

Please refer to Appendix B.

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

Please refer to Appendix A.

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.

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.

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	Feb. 11, 2018~ Apr. 13, 2018	Jul. 17, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Feb. 11, 2018~ Apr. 13, 2018	Nov. 09, 2018	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 14, 2017	Feb. 11, 2018~ Apr. 13, 2018	Oct. 13, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	Feb. 11, 2018~ Apr. 13, 2018	Oct. 15, 2018	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Feb. 11, 2018~ Apr. 13, 2018	Nov. 22, 2019	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2016	Feb. 11, 2018~ Apr. 13, 2018	Nov. 09, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2017	Feb. 11, 2018~ Apr. 13, 2018	Oct. 18, 2018	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Feb. 11, 2018~ Apr. 13, 2018	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Feb. 11, 2018~ Apr. 13, 2018	N/A	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 22, 2017	Feb. 11, 2018~ Apr. 13, 2018	May 21, 2018	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00101800	2025787	1GHz~18GHz	Feb. 13, 2017	Feb. 11, 2018~ Apr. 13, 2018	Feb, 12, 2019	Radiation (03CH11-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290053	20Hz to 26.5GHz	Jan. 16, 2018	Feb. 11, 2018~ Apr. 13, 2018	Jan. 15, 2019	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 27, 2017	Feb. 11, 2018~ Apr. 13, 2018	Nov. 26, 2018	Radiation (03CH11-HY)
Test Software	Audix	E3 6.2009-8-24	RK-001042	NA	NA	Feb. 11, 2018~ Apr. 13, 2018	NA	Radiation (03CH11-HY)

5 Uncertainty of Evaluation

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

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

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

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

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

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

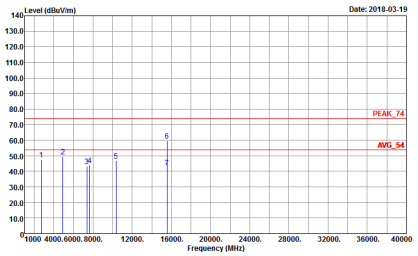
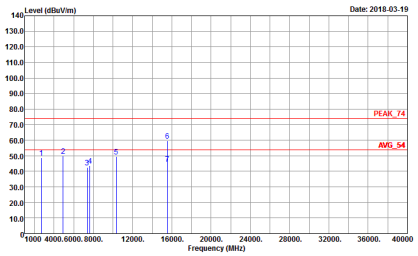
Appendix A. Radiated Spurious Emission Plots

Test Engineer :	Ken Wu, Jacky Hung, and Hao Hsu	**Temperature :**	22~24°C
		Relative Humidity :	48~52%

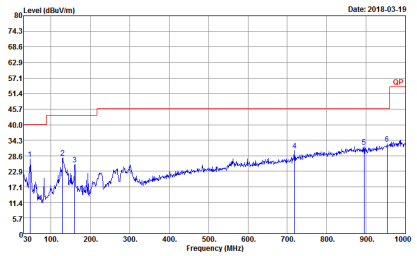
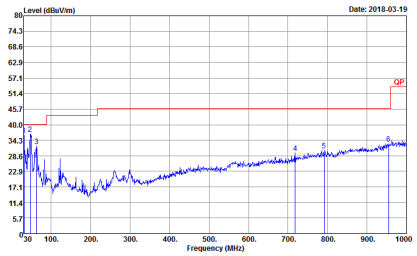
Note symbol

-L	**Low channel location**
-R	**High channel location**

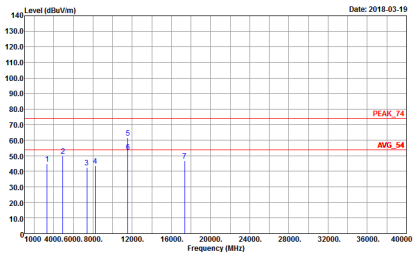
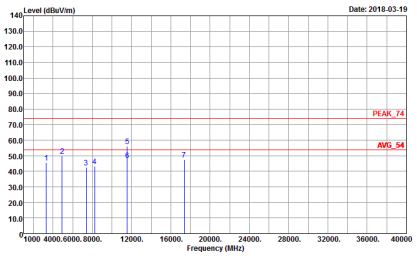
11g_Tx_Ch11(2TX)+11a_Tx_Ch36(2TX)

	11g_Tx_Ch11(2TX)+11a_Tx_Ch36(2TX)	
	Horizontal	**Vertical**
Peak **Avg.**	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 811726 1 2718.00 47.45 -26.55 74.00 46.50 27.92 6.58 33.55 100 0 Peak 2 4924.00 49.72 -24.28 74.00 42.31 31.48 8.99 33.06 100 0 Peak 3 7386.00 43.24 -30.76 74.00 52.01 36.47 11.30 57.38 100 0 Peak 4 7642.00 44.15 -29.85 74.00 52.38 36.82 11.60 57.44 100 0 Peak 5 10360.00 46.68 -27.32 74.00 49.26 39.51 14.63 57.03 100 0 Peak 6 15540.00 59.48 -14.52 74.00 59.62 38.00 17.95 56.48 202 189 Peak 7 15540.00 42.63 -11.37 54.00 42.77 38.00 17.95 56.48 202 189 Average	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 811726 1 2718.00 48.86 -25.14 74.00 47.91 27.92 6.58 33.55 100 0 Peak 2 4924.00 49.84 -24.16 74.00 42.43 31.48 8.99 33.06 100 0 Peak 3 7386.00 42.56 -31.44 74.00 51.33 36.47 11.30 57.38 100 0 Peak 4 7642.00 43.74 -30.26 74.00 51.97 36.82 11.60 57.44 100 0 Peak 5 10360.00 49.42 -24.58 74.00 52.00 39.51 14.63 57.03 100 0 Peak 6 15540.00 59.83 -14.17 74.00 59.97 38.00 17.95 56.48 219 281 Peak 7 15540.00 44.97 -9.03 54.00 45.11 38.00 17.95 56.48 219 281 Average

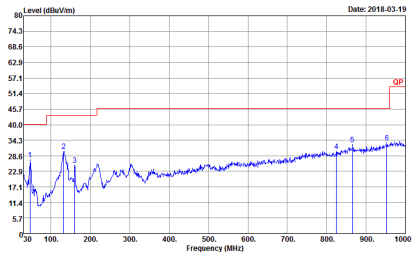
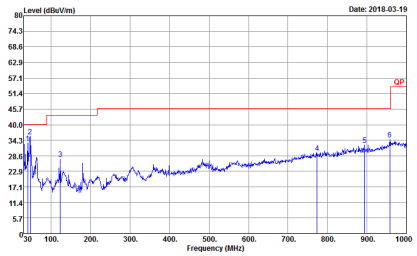
11g_Tx_Ch11(2TX)+11a_Tx_Ch36(2TX)_LF

	11g_Tx_Ch11(2TX)+11a_Tx_Ch36(2TX)_LF	
	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 811726 1 46.74 27.37 -12.63 40.00 43.12 15.72 1.02 32.49 100 0 Peak 2 129.36 27.90 -15.60 43.50 41.45 17.34 1.51 32.45 --- --- Peak 3 160.14 25.40 -18.10 43.50 39.84 16.28 1.61 32.43 --- --- Peak 4 717.90 30.58 -15.42 46.00 32.70 26.82 3.35 32.42 --- --- Peak 5 895.00 31.92 -14.08 46.00 30.72 29.00 3.73 31.69 --- --- Peak 6 953.10 32.88 -13.12 46.00 29.22 30.76 3.90 31.17 --- --- Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 811726 1 30.81 36.15 -3.85 40.00 44.10 23.70 0.82 32.49 --- --- Peak 2 46.47 36.51 -3.49 40.00 52.26 15.72 1.02 32.49 100 0 Peak 3 62.67 32.19 -7.81 40.00 52.01 11.64 1.02 32.49 --- --- Peak 4 717.90 29.61 -16.39 46.00 31.73 26.82 3.35 32.42 --- --- Peak 5 791.40 30.52 -15.48 46.00 31.02 28.07 3.49 32.21 --- --- Peak 6 955.20 33.05 -12.95 46.00 29.26 30.87 3.90 31.15 --- --- Peak

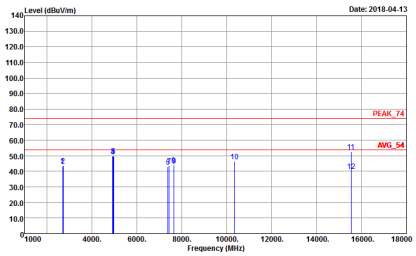
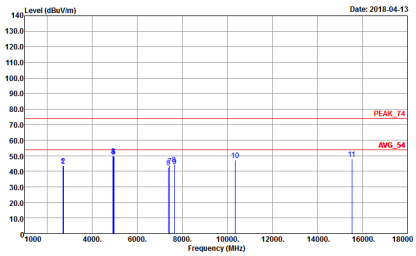
11g_Tx_Ch11(2TX)+11a_Tx_Ch157(4TX)

	11g_Tx_Ch11(2TX)+11a_Tx_Ch157(4TX)	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 811726 1 3323.00 45.01 -28.99 74.00 42.57 28.60 7.26 33.42 100 0 Peak 2 4924.00 49.90 -24.10 74.00 42.49 31.48 8.99 33.06 100 0 Peak 3 7386.00 42.55 -31.45 74.00 51.32 36.47 11.30 57.38 100 0 Peak 4 8247.00 43.64 -30.36 74.00 50.97 36.96 12.01 56.96 100 0 Peak 5 11570.00 61.46 -12.54 74.00 62.23 39.86 15.49 56.40 225 145 Peak 6 11570.00 52.67 -1.33 54.00 53.44 39.86 15.49 56.40 225 145 Average 7 17355.00 46.86 -27.14 74.00 42.68 40.96 19.31 56.46 100 0 Peak	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 811726 1 3323.00 45.76 -28.24 74.00 43.32 28.60 7.26 33.42 100 0 Peak 2 4924.00 49.82 -24.18 74.00 42.41 31.48 8.99 33.06 100 0 Peak 3 7386.00 42.55 -31.45 74.00 51.32 36.47 11.30 57.38 100 0 Peak 4 8247.00 43.24 -30.76 74.00 50.57 36.96 12.01 56.96 100 0 Peak 5 11570.00 56.20 -17.80 74.00 56.97 39.86 15.49 56.40 100 189 Peak 6 11570.00 47.33 -6.67 54.00 48.10 39.86 15.49 56.40 100 189 Average 7 17355.00 47.64 -26.36 74.00 43.46 40.96 19.31 56.46 100 0 Peak

11g_Tx_Ch11(2TX)+11a_Tx_Ch157(4TX)_LF

	11g_Tx_Ch11(2TX)+11a_Tx_Ch157(4TX)_LF	
	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 811726 1 46.47 27.09 -12.91 40.00 42.84 15.72 1.02 32.49 --- --- Peak 2 132.33 30.20 -13.30 43.50 43.81 17.28 1.51 32.45 --- --- Peak 3 159.87 25.11 -18.39 43.50 39.55 16.28 1.61 32.43 --- --- Peak 4 824.30 30.29 -15.71 46.00 30.65 27.94 3.60 32.06 --- --- Peak 5 865.60 32.72 -13.28 46.00 31.68 29.06 3.67 31.84 --- --- Peak 6 952.40 33.41 -12.59 46.00 29.81 30.71 3.90 31.18 100 0 Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 811726 1 40.53 33.12 -6.88 40.00 46.10 18.68 0.82 32.49 --- --- Peak 2 46.47 35.56 -4.44 40.00 51.31 15.72 1.02 32.49 100 0 Peak 3 122.88 27.45 -16.05 43.50 41.10 17.26 1.51 32.46 --- --- Peak 4 773.90 29.61 -16.39 46.00 30.27 27.97 3.49 32.26 --- --- Peak 5 893.60 32.45 -13.55 46.00 31.23 29.02 3.73 31.69 --- --- Peak 6 958.00 34.51 -11.49 46.00 30.54 31.02 3.90 31.13 --- --- Peak

BLE_Tx_Ch39+11g_Tx_Ch11(2TX)+11a_Tx_Ch36(2TX)

	BLE_Tx_Ch39+11g_Tx_Ch11(2TX)+11a_Tx_Ch36(2TX)	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 811726 1 2700.00 43.48 -30.52 74.00 42.60 27.88 6.55 33.55 100 0 Peak 2 2718.00 43.48 -30.52 74.00 42.53 27.92 6.58 33.55 100 0 Peak 3 4924.00 49.96 -24.04 74.00 42.55 31.48 8.99 33.06 100 0 Peak 4 4942.00 49.56 -24.44 74.00 42.13 31.51 8.97 33.05 100 0 Peak 5 4960.00 49.98 -24.02 74.00 42.54 31.54 8.95 33.05 100 0 Peak 6 7386.00 42.95 -31.05 74.00 51.72 36.47 11.30 57.38 100 0 Peak 7 7440.00 43.72 -30.28 74.00 52.41 36.59 11.34 57.44 100 0 Peak 8 7642.00 43.98 -30.02 74.00 52.21 36.82 11.60 57.44 100 0 Peak 9 7660.00 43.49 -30.51 74.00 51.70 36.83 11.62 57.43 100 0 Peak 10 10360.00 46.59 -27.41 74.00 49.17 39.51 14.63 57.03 100 0 Peak 11 15540.00 52.75 -21.25 74.00 52.89 38.00 17.95 56.48 100 242 Peak 12 15540.00 40.21 -13.79 54.00 40.35 38.00 17.95 56.48 100 242 Average	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 811726 1 2700.00 43.13 -30.87 74.00 42.25 27.88 6.55 33.55 100 0 Peak 2 2718.00 43.59 -30.41 74.00 42.64 27.92 6.58 33.55 100 0 Peak 3 4924.00 49.92 -24.08 74.00 42.51 31.48 8.99 33.06 100 0 Peak 4 4942.00 49.96 -24.04 74.00 42.53 31.51 8.97 33.05 100 0 Peak 5 4960.00 49.62 -24.38 74.00 42.18 31.54 8.95 33.05 100 0 Peak 6 7386.00 42.52 -31.48 74.00 51.29 36.47 11.30 57.38 100 0 Peak 7 7440.00 43.59 -30.41 74.00 52.28 36.59 11.34 57.44 100 0 Peak 8 7642.00 44.46 -29.54 74.00 52.69 36.82 11.60 57.44 100 0 Peak 9 7660.00 43.40 -30.60 74.00 51.61 36.83 11.62 57.43 100 0 Peak 10 10360.00 47.18 -26.82 74.00 49.76 39.51 14.63 57.03 100 0 Peak 11 15540.00 48.07 -25.93 74.00 48.21 38.00 17.95 56.48 100 0 Peak

BLE_Tx_Ch39+11g_Tx_Ch11(2TX)+11a_Tx_Ch36(2TX)_LF

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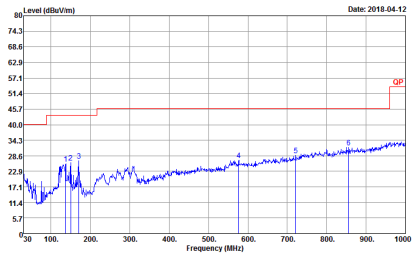
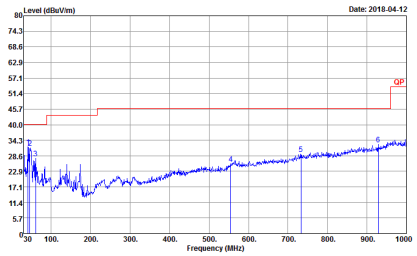
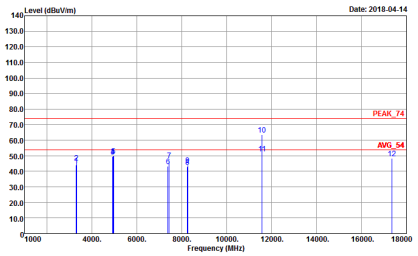
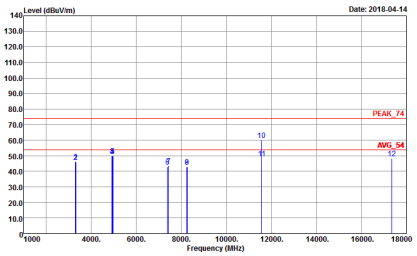
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 811726 1 136.92 25.65 -17.85 43.50 39.35 17.18 1.51 32.45 --- --- Peak 2 149.88 26.11 -17.39 43.50 39.98 16.87 1.61 32.43 --- --- Peak 3 170.40 26.72 -16.78 43.50 42.13 15.31 1.61 32.42 --- --- Peak 4 576.50 27.04 -18.96 46.00 30.80 25.57 3.03 32.44 --- --- Peak 5 721.40 28.67 -17.33 46.00 30.61 26.94 3.40 32.41 --- --- Peak 6 855.80 31.72 -14.28 46.00 30.87 28.92 3.67 31.89 100 0 Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 811726 1 40.80 31.93 -8.07 40.00 44.91 18.68 0.82 32.49 100 0 Peak 2 45.66 31.33 -8.67 40.00 46.66 16.14 1.02 32.49 --- --- Peak 3 60.24 27.56 -12.44 40.00 47.51 11.50 1.02 32.49 --- --- Peak 4 554.80 25.64 -20.36 46.00 29.43 25.56 2.98 32.42 --- --- Peak 5 732.60 29.17 -16.83 46.00 30.62 27.39 3.40 32.37 --- --- Peak 6 928.60 32.67 -13.33 46.00 30.45 29.62 3.82 31.39 --- --- Peak

BLE_Tx_Ch39+11g_Tx_Ch11(2TX)+11a_Tx_Ch157(4TX)

	BLE_Tx_Ch39+11g_Tx_Ch11(2TX)+11a_Tx_Ch157(4TX)	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 811726 1 3305.00 44.18 -29.82 74.00 41.77 28.60 7.24 33.43 100 0 Peak 2 3323.00 45.57 -28.43 74.00 43.13 28.60 7.26 33.42 100 0 Peak 3 4924.00 49.63 -24.37 74.00 42.22 31.48 8.99 33.06 100 0 Peak 4 4942.00 49.78 -24.22 74.00 42.35 31.51 8.97 33.05 100 0 Peak 5 4960.00 49.90 -24.10 74.00 42.46 31.54 8.95 33.05 100 0 Peak 6 7386.00 43.22 -30.78 74.00 51.99 36.47 11.30 57.38 100 0 Peak 7 7440.00 47.07 -26.93 74.00 55.76 36.59 11.34 57.44 100 0 Peak 8 8247.00 42.77 -31.23 74.00 50.10 36.96 12.01 56.96 100 0 Peak 9 8265.00 44.00 -30.00 74.00 51.37 36.94 11.98 56.94 100 0 Peak 10 11570.00 63.44 -10.56 74.00 64.21 39.86 15.49 56.40 284 141 Peak 11 11570.00 51.54 -2.46 54.00 52.31 39.86 15.49 56.40 284 141 Average 12 17355.00 48.37 -25.63 74.00 44.19 40.96 19.31 56.46 100 0 Peak	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 811726 1 3305.00 46.28 -27.72 74.00 43.87 28.60 7.24 33.43 100 0 Peak 2 3323.00 45.84 -28.16 74.00 43.40 28.60 7.26 33.42 100 0 Peak 3 4924.00 49.87 -24.13 74.00 42.46 31.48 8.99 33.06 100 0 Peak 4 4942.00 49.91 -24.09 74.00 42.48 31.51 8.97 33.05 100 0 Peak 5 4960.00 49.93 -24.07 74.00 42.49 31.54 8.95 33.05 100 0 Peak 6 7386.00 42.77 -31.23 74.00 51.54 36.47 11.30 57.38 100 0 Peak 7 7440.00 43.81 -30.19 74.00 52.50 36.59 11.34 57.44 100 0 Peak 8 8247.00 42.96 -31.04 74.00 50.29 36.96 12.01 56.96 100 0 Peak 9 8265.00 43.00 -31.00 74.00 50.37 36.94 11.98 56.94 100 0 Peak 10 11570.00 60.15 -13.85 74.00 60.92 39.86 15.49 56.40 181 187 Peak 11 11570.00 48.27 -5.73 54.00 49.04 39.86 15.49 56.40 181 187 Average 12 17355.00 48.29 -25.71 74.00 44.11 40.96 19.31 56.46 100 0 Peak

BLE_Tx_Ch39+11g_Tx_Ch11(2TX)+11a_Tx_Ch157(4TX)_LF

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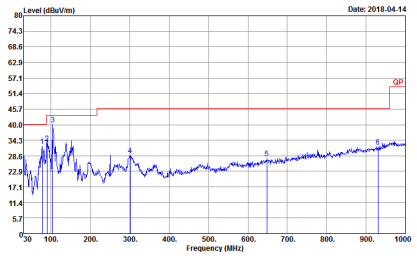
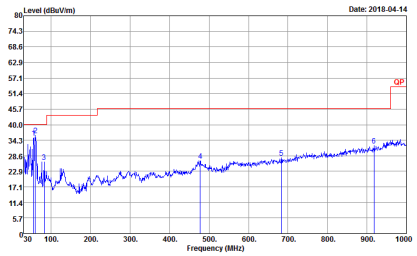
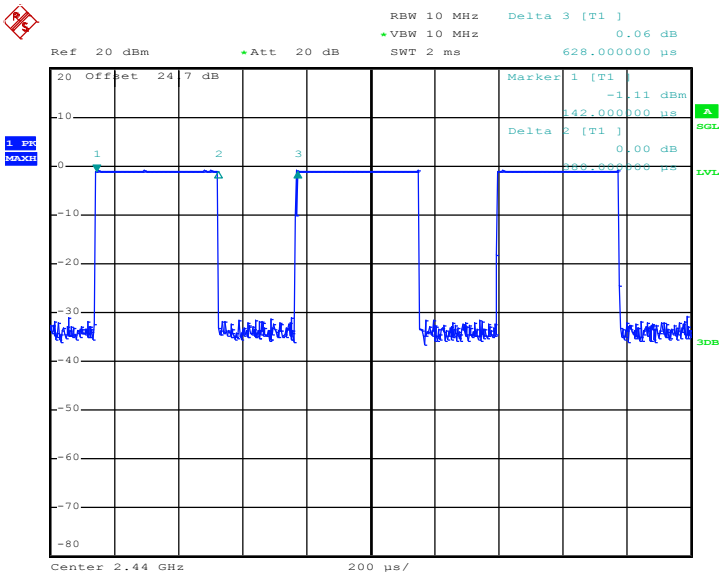
	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 811726 1 77.25 31.99 -8.01 40.00 50.43 12.81 1.22 32.48 --- --- Peak 2 89.67 33.29 -10.21 43.50 49.92 14.61 1.22 32.48 --- --- Peak 3 104.79 40.08 -3.42 43.50 54.92 16.23 1.39 32.48 100 0 Peak 4 301.40 28.85 -17.15 46.00 39.81 19.09 2.22 32.37 --- --- Peak 5 647.90 27.67 -18.33 46.00 30.52 26.30 3.20 32.46 --- --- Peak 6 930.00 31.85 -14.15 46.00 29.55 29.69 3.82 31.38 --- --- Peak	 Site : 03CH11-HY Condition : QP 3m BI-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 811726 1 55.38 35.25 -4.75 40.00 54.46 12.25 1.02 32.49 --- --- Peak 2 59.97 36.00 -4.00 40.00 55.95 11.50 1.02 32.49 100 0 Peak 3 81.84 26.21 -13.79 40.00 44.14 13.32 1.22 32.48 --- --- Peak 4 477.80 26.70 -19.30 46.00 32.83 23.42 2.77 32.37 --- --- Peak 5 683.60 27.78 -18.22 46.00 30.55 26.31 3.27 32.47 --- --- Peak 6 918.10 32.34 -13.66 46.00 30.58 29.30 3.79 31.49 --- --- Peak

Appendix B. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
1	Bluetooth - LE	60.51	380.00	2.63	3kHz	2.18
1+2	802.11g for Ant. 1	95.28	2020.00	0.50	1kHz	0.21
1+2	802.11g for Ant. 2	95.28	2020.00	0.50	1kHz	0.21
1+2	802.11a_LB for Ant. 1	96.19	2020.00	0.50	1kHz	0.17
1+2	802.11a_LB for Ant. 2	96.19	2020.00	0.50	1kHz	0.17
1+2+3+4	802.11a_HB for Ant. 1	96.19	2020.00	0.50	1kHz	0.17
1+2+3+4	802.11a_HB for Ant. 2	96.19	2020.00	0.50	1kHz	0.17
1+2+3+4	802.11a_HB for Ant. 3	96.19	2020.00	0.50	1kHz	0.17
1+2+3+4	802.11a_HB for Ant. 4	97.14	2040.00	0.49	1kHz	0.13

<Ant. 1>

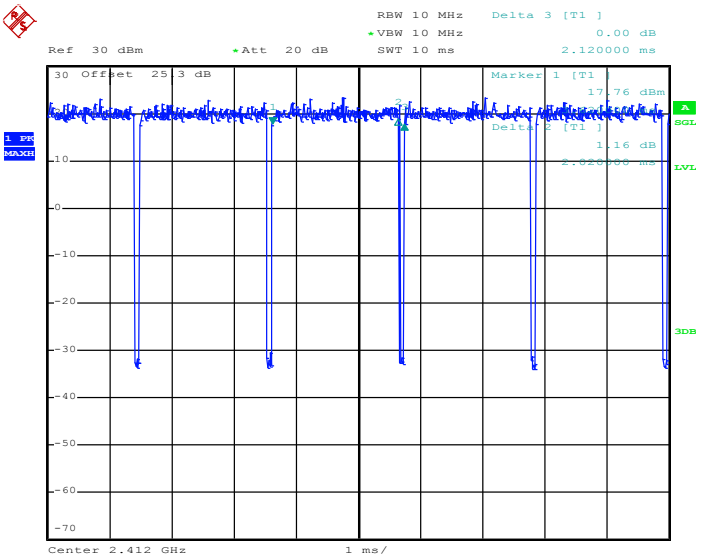
Bluetooth – LE



Date: 14.FEB.2018 22:02:28

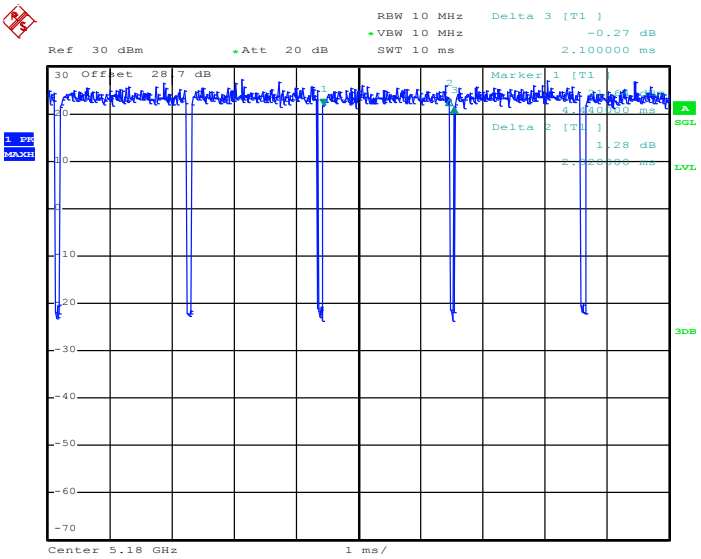
MIMO<Ant. 1>

802.11g



Date: 3.FEB.2018 19:54:42

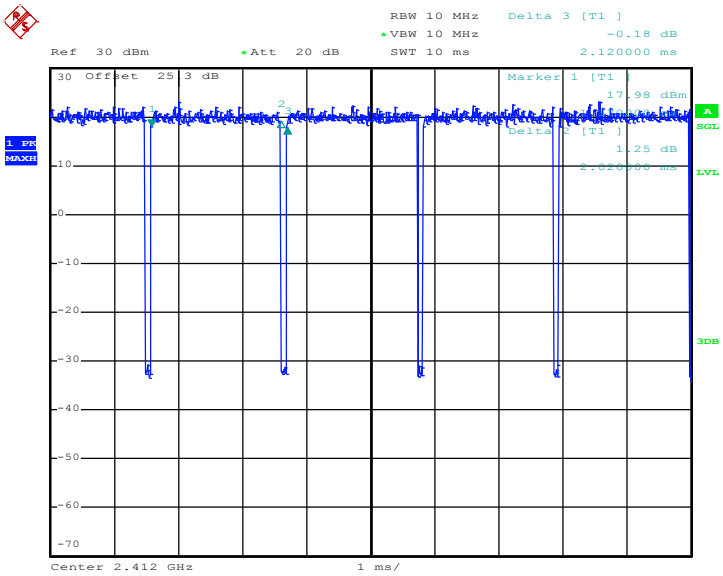
802.11a_LB



Date: 7.FEB.2018 00:55:02

MIMO<Ant. 2>

802.11g



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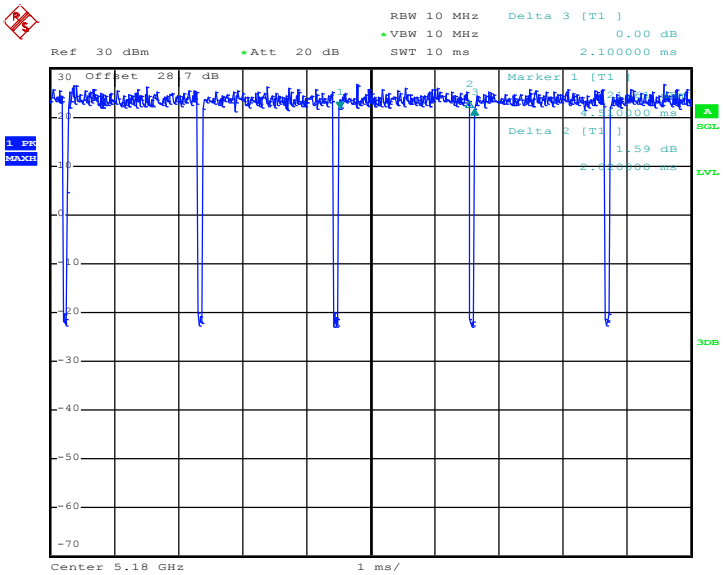
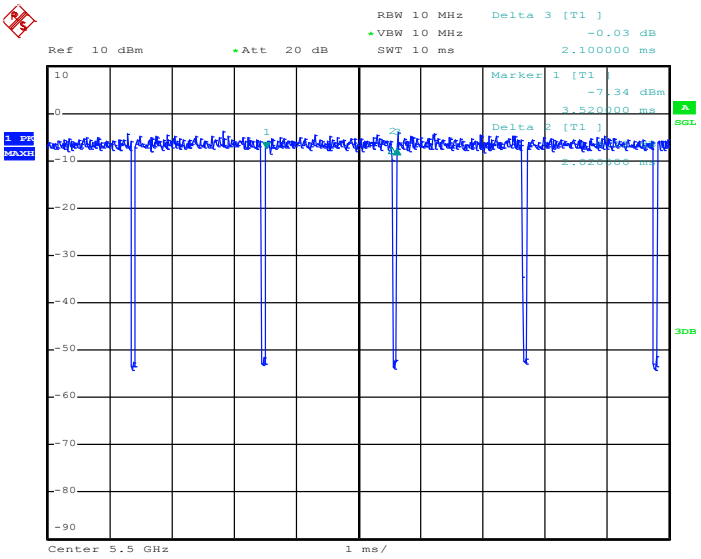


Date: 7.FEB.2018 00:54:04

<Ant. 1+2+3+4>

802.11a_HB for Ant. 1



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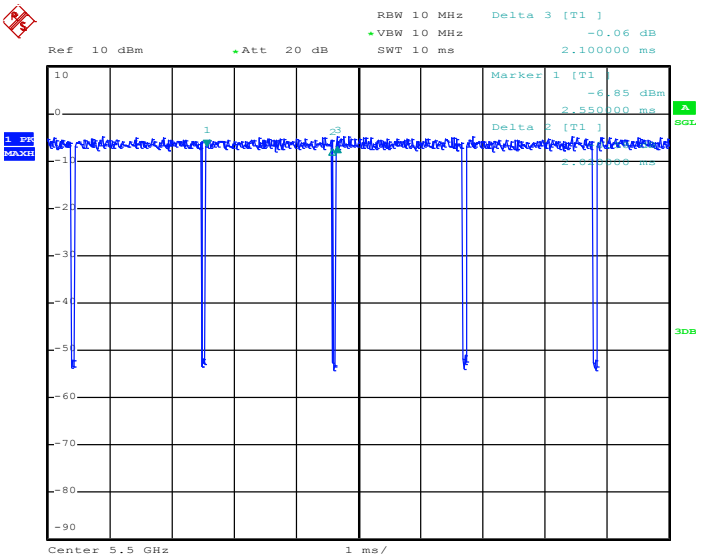

Date: 3.FEB.2018 22:01:55

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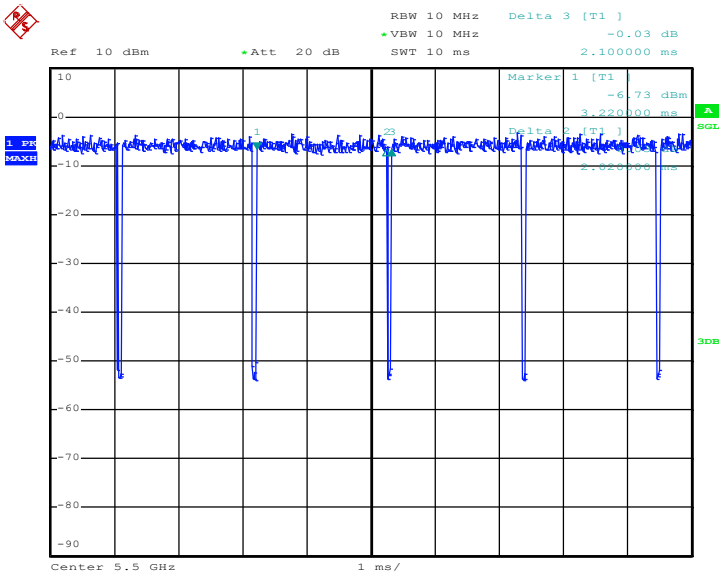

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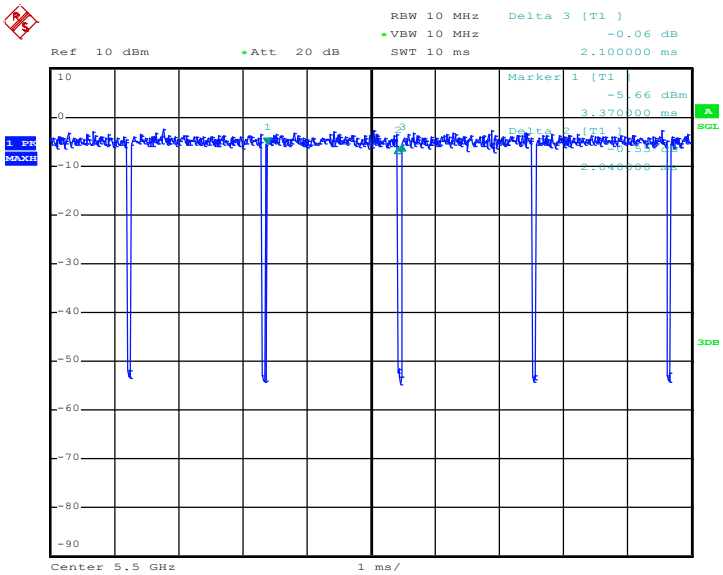

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