FCC RF Co-location Test Report

APPLICANT	:	Nimbocumulous LLC
EQUIPMENT	:	Digital Media Receiver
MODEL NAME	:	QX91KB QX91KA
FCC ID	:	2AHUD-3819
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure

The product was completed on May 10, 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

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR741112-01F	Rev. 01	Initial issue of report	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

Nimbocumulous LLC
15 Constitution Drive. 1st Floor Bedford, New Hampshire 03110

1.2 Product Feature of Equipment Under Test

Product Feature	
Equipment	Digital Media Receiver
Model Name	QX91KB QX91KA
FCC ID	2AHUD-3819
EUT supports Radios application	WLAN 11b/g/n HT20 WLAN 11a/n HT20HT40 WLAN 11ac VHT20/VHT40/VHT80

1.3 Modification of EUT

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

1.4 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.**
	03CH13-HY

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

1.5 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: 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).

2.1 Carrier Frequency and Channel

2400-2483.5 MHz 802.11b		2400-2483.5 MHz 802.11g	
Channel	**Freq. (MHz)**	**Channel**	**Freq. (MHz)**
06	2437	01	2412

5150-5250 MHz Band 1 (U-NII-1) 802.11n HT40		5745 MHz-5825 MHz Band 4 (U-NII-3) 802.11a	
Channel	**Freq. (MHz)**	**Channel**	**Freq. (MHz)**
38	5190	157	5785

2.2 Test Mode

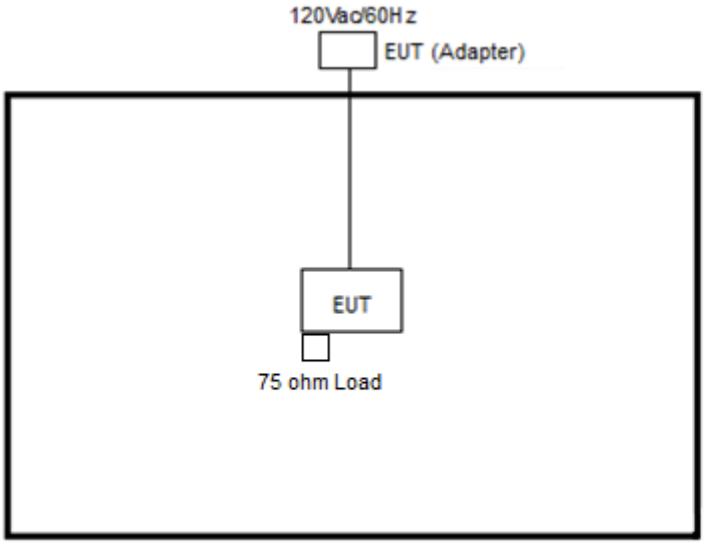
Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

<Co-Location>

Modulation	Data Rate
802.11b + 802.11n HT40 Band 1	**1 Mbps + MCS0**
802.11g + 802.11n HT40 Band 1	**6 Mbps + MCS0**
802.11g + 802.11a Band 4	**6 Mbps + 6 Mbps**

2.3 Connection Diagram of Test System

<Co-Location Mode>



2.4 EUT Operation Test Setup

The RF 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)
-17	78.3
- 27	68.3

(2) KDB789033 D02 v02r01 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 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

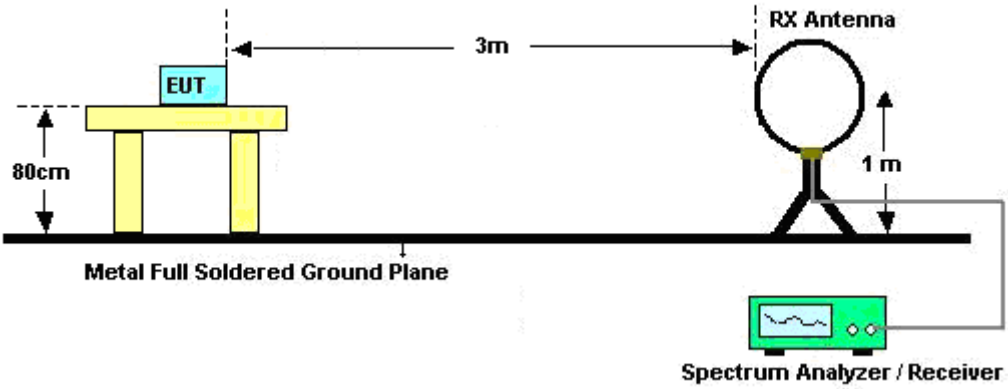
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - 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.

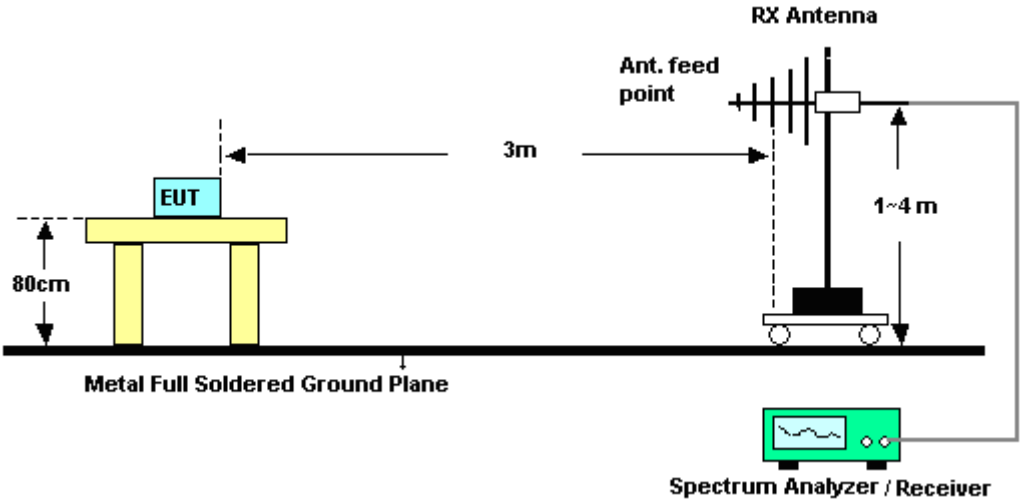
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband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

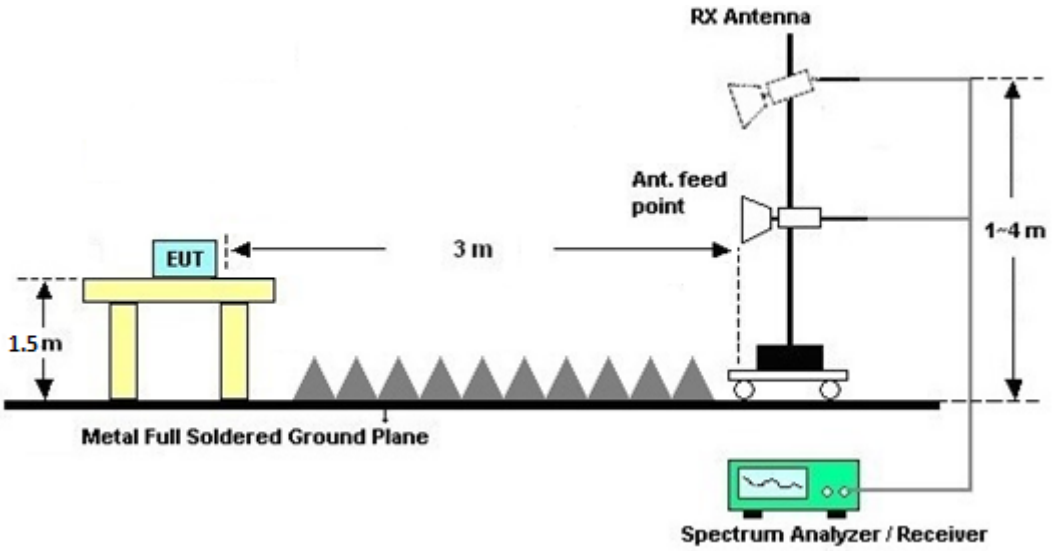
For radiated emissions below 30MHz



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 and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix A and B.

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
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	May 15, 2017	May 09, 2018~ May 10, 2018	May 14, 2019	Radiation (03CH13-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	May 09, 2018~ May 10, 2018	Jul. 17, 2018	Radiation (03CH13-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 21, 2016	May 09, 2018~ May 10, 2018	Dec. 20, 2018	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	40103&07	30MHz to 1GHz	Jan. 10, 2018	May 09, 2018~ May 10, 2018	Jan. 09, 2019	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz ~ 18GHz	Jun. 15, 2017	May 09, 2018~ May 10, 2018	Jun. 14, 2018	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 22, 2017	May 09, 2018~ May 10, 2018	May 21, 2018	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz ~ 26.5GHz	Dec. 05, 2017	May 09, 2018~ May 10, 2018	Dec. 04, 2018	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 15, 2018	May 09, 2018~ May 10, 2018	Mar. 14, 2019	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	May 09, 2018~ May 10, 2018	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	May 09, 2018~ May 10, 2018	N/A	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 27, 2017	May 09, 2018~ May 10, 2018	Nov. 26, 2018	Radiation (03CH13-HY)
EMI Test Receiver	Keysight	N9038A (MXE)	MY57290111	3Hz~26.5GHz	Nov. 02, 2017	May 09, 2018~ May 10, 2018	Nov. 01, 2018	Radiation (03CH13-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))	4.90

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.40

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.30

Appendix A. Radiated Spurious Emission

Test Engineer :	Alex Jheng、Bill Chang、Fu Chen、Wilson Wu	Temperature :	24.7~25.2°C
		Relative Humidity :	49~53%

Co-location

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 06 2437MHz + 802.11n HT40 CH 38 5190MHz		1120	56.16	-17.84	74	60.28	24.09	3.81	32.02	296	299	P	H
		1120	49.2	-4.8	54	53.32	24.09	3.81	32.02	296	299	A	H
	-	1498	65.26	-	-	66.64	24.7	4.44	30.52	100	0	P	H
	-	4486	55.05	-	-	45.88	31.05	7.71	29.59	100	0	P	H
		4824	52.32	-21.68	74	42.86	31.56	7.45	29.55	376	72	P	H
		4824	43.57	-10.43	54	34.11	31.56	7.45	29.55	376	72	A	H
		7311	43.88	-30.12	74	53.91	36.16	11.08	57.27	100	0	P	H
		7495	49.41	-24.59	74	59.26	36.5	11.15	57.5	100	0	P	H
		10380	46.29	-21.91	68.2	51.66	39.31	12.34	57.02	100	0	P	H
		10454	48.8	-19.4	68.2	54.02	39.42	12.37	57.01	100	0	P	H
		15570	47.39	-26.61	74	51.01	38.22	14.62	56.46	100	0	P	H
		1120	56.87	-17.13	74	60.99	24.09	3.81	32.02	100	0	P	V
	-	1498	60.68	-	-	62.06	24.7	4.44	30.52	100	0	P	V
	-	4486	55.8	-	-	46.63	31.05	7.71	29.59	100	0	P	V
		4824	52.33	-21.67	74	42.87	31.56	7.45	29.55	320	351	P	V
		4824	43.43	-10.57	54	33.97	31.56	7.45	29.55	320	351	A	V
		7311	44.62	-29.38	74	54.65	36.16	11.08	57.27	100	0	P	V
		7495	55.22	-18.78	74	65.07	36.5	11.15	57.5	400	208	P	V
		7495	42.52	-11.48	54	52.37	36.5	11.15	57.5	400	208	A	V
		10380	46.27	-21.93	68.2	51.64	39.31	12.34	57.02	100	0	P	V
		10454	50.46	-17.74	68.2	55.68	39.42	12.37	57.01	100	0	P	V
		15570	46.21	-27.79	74	49.83	38.22	14.62	56.46	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. Note "-" is unintentional radiator, the single complies with ANSI C63.4 requirement can be ignored.												

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz + 802.11n HT40 CH 38 5190MHz		1120	55.18	-18.82	74	59.3	24.09	3.81	32.02	100	0	P	H
	-	1498	64.77	-	-	66.15	24.7	4.44	30.52	100	0	A	H
	-	4486	55.44	-	-	46.27	31.05	7.71	29.59	100	0	P	H
		4824	53.74	-20.26	74	44.28	31.56	7.45	29.55	205	109	P	H
		4824	43.22	-10.78	54	33.76	31.56	7.45	29.55	205	109	P	H
		7495	49.32	-24.68	74	59.17	36.5	11.15	57.5	100	0	A	H
		10380	46.4	-21.8	68.2	51.77	39.31	12.34	57.02	100	0	P	H
		10476	48.17	-20.03	68.2	53.36	39.45	12.37	57.01	100	0	P	H
		15570	46.74	-27.26	74	50.36	38.22	14.62	56.46	100	0	P	H
		1120	53.52	-20.48	74	57.64	24.09	3.81	32.02	100	0	P	V
	-	1498	61.1	-	-	62.48	24.7	4.44	30.52	100	0	P	V
	-	4486	56.67	-	-	47.5	31.05	7.71	29.59	100	0	P	V
		4824	52.35	-21.65	74	42.89	31.56	7.45	29.55	138	104	P	V
		4824	43.47	-10.53	54	34.01	31.56	7.45	29.55	138	104	A	V
		7495	53.98	-20.02	74	63.83	36.5	11.15	57.5	100	0	P	V
		10380	45.98	-22.22	68.2	51.35	39.31	12.34	57.02	100	0	P	V
		10476	48.87	-19.33	68.2	54.06	39.45	12.37	57.01	100	0	A	V
		15570	46.25	-27.75	74	49.87	38.22	14.62	56.46	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. Note "-" is unintentional radiator, the single complies with ANSI C63.4 requirement can be ignored.												

2.4GHz 2400~2483.5MHz + Band 4 5725~5850MHz (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz + 802.11a CH 157 5785MHz		1120	55.02	-18.98	74	59.14	24.09	3.81	32.02	100	0	P	H
	-	1498	67.44	-	-	68.82	24.7	4.44	30.52	100	0	A	H
	-	4486	56.57	-	-	47.4	31.05	7.71	29.59	100	0	P	H
		4824	53.03	-20.97	74	43.57	31.56	7.45	29.55	212	145	P	H
		4824	43.53	-10.47	54	34.07	31.56	7.45	29.55	212	145	P	H
		7495	49.67	-24.33	74	59.52	36.5	11.15	57.5	100	0	A	H
		10454	48.11	-20.09	68.2	53.33	39.42	12.37	57.01	100	0	P	H
		11570	47.92	-26.08	74	51.84	39.73	12.79	56.44	100	0	P	H
		17355	48.98	-19.22	68.2	49.45	40.84	15.15	56.46	100	0	P	H
		1120	53.75	-20.25	74	57.87	24.09	3.81	32.02	100	0	P	V
	-	1498	62.85	-	-	64.23	24.7	4.44	30.52	100	0	P	V
	-	4486	57.34	-	-	48.17	31.05	7.71	29.59	100	0	P	V
		4824	53.52	-20.48	74	44.06	31.56	7.45	29.55	388	266	P	V
		4824	43.32	-10.68	54	33.86	31.56	7.45	29.55	388	266	A	V
		7495	53.48	-20.52	74	63.33	36.5	11.15	57.5	100	0	P	V
		10454	49.41	-18.79	68.2	54.63	39.42	12.37	57.01	100	0	P	V
		11570	47.32	-26.68	74	51.24	39.73	12.79	56.44	100	0	A	V
		17355	49.22	-18.98	68.2	49.69	40.84	15.15	56.46	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. Note "-" is unintentional radiator, the single complies with ANSI C63.4 requirement can be ignored.												

Emission below 1GHz

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (LF @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 06 2437MHz + 802.11n HT40 CH 38 5190MHz		119.91	33.6	-9.9	43.5	47.18	17.33	1.38	32.29	-	-	P	H
		241.41	41.27	-4.73	46	53.99	17.54	1.95	32.21	100	0	P	H
		300	34.28	-11.72	46	45.01	19.3	2.1	32.13	-	-	P	H
		324.5	34.79	-11.21	46	45.11	19.65	2.16	32.13	-	-	P	H
		524.7	36.9	-9.1	46	42.19	24.11	2.8	32.2	-	-	P	H
		896.4	36.41	-9.59	46	35.37	29.02	3.55	31.53	-	-	P	H
		32.16	30.3	-9.7	40	38.31	23.54	0.79	32.34	-	-	P	V
		241.41	36.96	-9.04	46	49.68	17.54	1.95	32.21	-	-	P	V
		299.46	36.37	-9.63	46	47.1	19.3	2.1	32.13	-	-	P	V
		320.3	37.64	-8.36	46	48.12	19.49	2.16	32.13	100	0	P	V
		524.7	34.8	-11.2	46	40.09	24.11	2.8	32.2	-	-	P	V
		899.9	35.21	-10.79	46	34.14	29.03	3.55	31.51	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (LF @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz + 802.11n HT40 CH 38 5190MHz		116.13	33.9	-9.6	43.5	47.44	17.35	1.4	32.29	-	-	P	H
		240.6	41.57	-4.43	46	54.42	17.41	1.95	32.21	100	0	P	H
		298.65	33.8	-12.2	46	44.55	19.28	2.1	32.13	-	-	P	H
		522.6	37.05	-8.95	46	42.42	24.1	2.73	32.2	-	-	P	H
		895.7	38.27	-7.73	46	37.23	29.02	3.55	31.53	-	-	P	H
		974.8	42.2	-11.8	54	38.52	30.79	3.72	30.83	-	-	P	H
		32.16	31.59	-8.41	40	39.6	23.54	0.79	32.34	-	-	P	V
		241.14	38.75	-7.25	46	51.47	17.54	1.95	32.21	100	0	P	V
		300	36.2	-9.8	46	46.93	19.3	2.1	32.13	-	-	P	V
		319.6	37.78	-8.22	46	48.26	19.49	2.16	32.13	-	-	P	V
		447.7	34.81	-11.19	46	41.26	23.16	2.56	32.17	-	-	P	V
		899.9	36.7	-9.3	46	35.63	29.03	3.55	31.51	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz 2400~2483.5MHz + Band 4 5725~5850MHz (LF @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz + 802.11a CH 157 5785MHz		120.72	33.45	-10.05	43.5	46.98	17.38	1.38	32.29	-	-	P	H
		241.14	40.77	-5.23	46	53.49	17.54	1.95	32.21	100	0	P	H
		300	32.35	-13.65	46	43.08	19.3	2.1	32.13	-	-	P	H
		318.9	34.83	-11.17	46	45.32	19.48	2.16	32.13	-	-	P	H
		524.7	35.66	-10.34	46	40.95	24.11	2.8	32.2	-	-	P	H
		899.9	36.95	-9.05	46	35.88	29.03	3.55	31.51	-	-	P	H
		31.89	29.97	-10.03	40	37.98	23.54	0.79	32.34	-	-	P	V
		241.41	39.56	-6.44	46	52.28	17.54	1.95	32.21	100	0	P	V
		298.92	35.84	-10.16	46	46.59	19.28	2.1	32.13	-	-	P	V
		326.6	38.71	-7.29	46	48.92	19.71	2.22	32.14	-	-	P	V
		449.8	34.05	-11.95	46	40.47	23.2	2.56	32.18	-	-	P	V
		895.7	36.07	-9.93	46	35.03	29.02	3.55	31.53	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
-	The signal is **Unintentional Radiators**.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

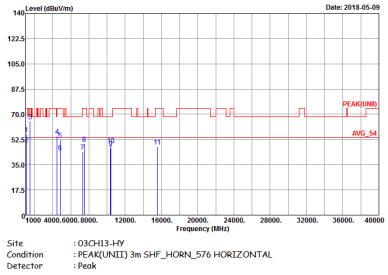
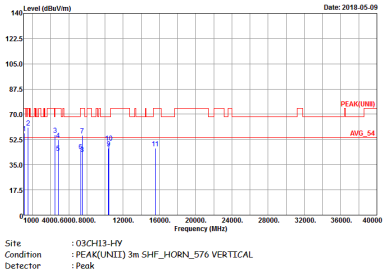
= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

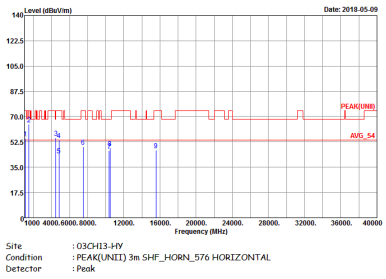
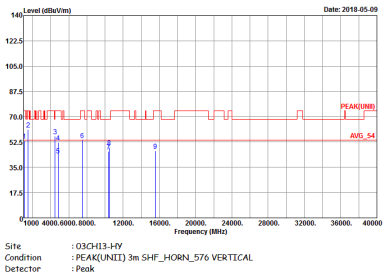
Both peak and average measured complies with the limit line, so test result is "PASS".

Appendix B. Radiated Spurious Emission

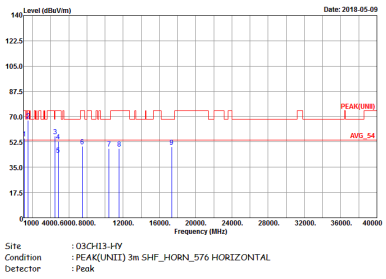
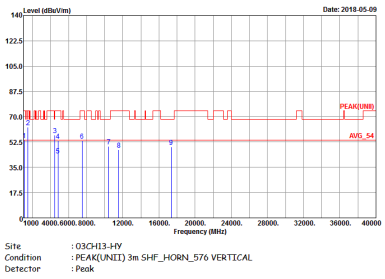
2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (Harmonic @ 3m)

ANT	11b_Tx_Ch06 + 11n HT40_Tx_Ch38	
Simultaneously	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (Harmonic @ 3m)

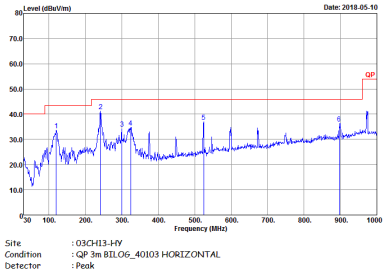
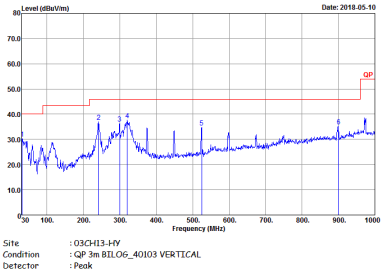
ANT	11g_Tx_Ch01 + 11n HT40_Tx_Ch38	
Simultaneously	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz + Band 4 5725~5850MHz (Harmonic @ 3m)

ANT	11g_Tx_Ch01 + 11a_Tx_Ch157	
Simultaneously	Horizontal	Vertical
Peak Avg.		

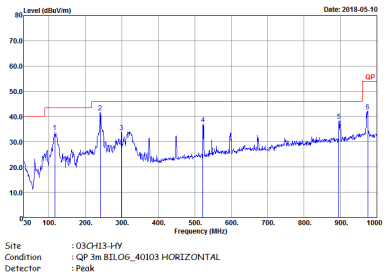
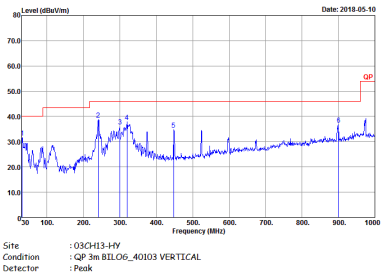
Emission below 1GHz

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (LF)

ANT	11b_Tx_Ch06 + 11n HT40_Tx_Ch38 LF	
Simultaneously	Horizontal	Vertical
QP / Peak		

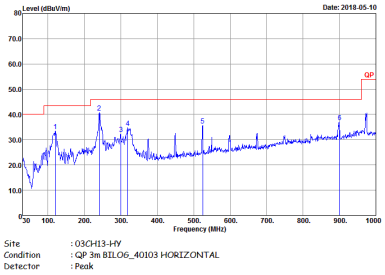
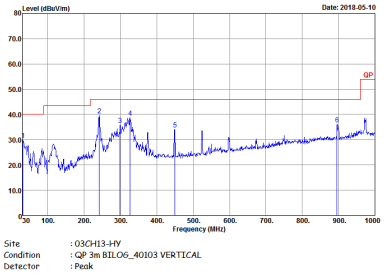
Emission below 1GHz

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (LF)

ANT	11g_Tx_Ch01 + 11n HT40_Tx_Ch38 LF	
Simultaneously	Horizontal	Vertical
QP / Peak		

Emission below 1GHz

2.4GHz 2400~2483.5MHz + Band 4 5725~5850MHz (LF)

ANT	11g_Tx_Ch01 + 11a_Tx_Ch157 LF	
Simultaneously	Horizontal	Vertical
QP / Peak		

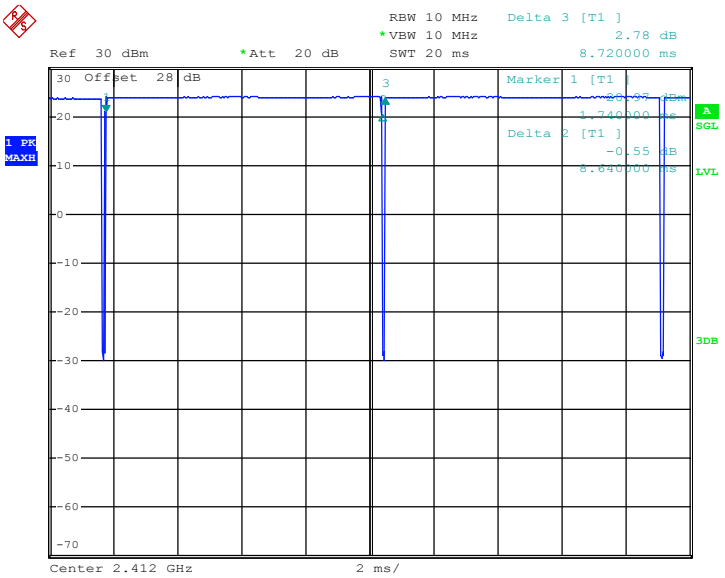
Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
1	802.11b	99.08	-	-	10Hz	0.04
1+2	802.11g for Ant. 1	92.21	1420	0.70	1kHz	0.35
1+2	802.11g for Ant. 2	93.42	1420	0.70	1kHz	0.30
1+2	802.11a for Ant. 1	93.46	1430	0.70	1kHz	0.29
1+2	802.11a for Ant. 2	93.46	1430	0.70	1kHz	0.29
1+2	5GHz 802.11n HT40 for Ant. 1	85.71	660	1.52	3kHz	0.67
1+2	5GHz 802.11n HT40 for Ant. 2	87.01	670	1.49	3kHz	0.60

Remark: For the co-location mode, the larger VBW will apply.

<Ant. 1>

802.11a



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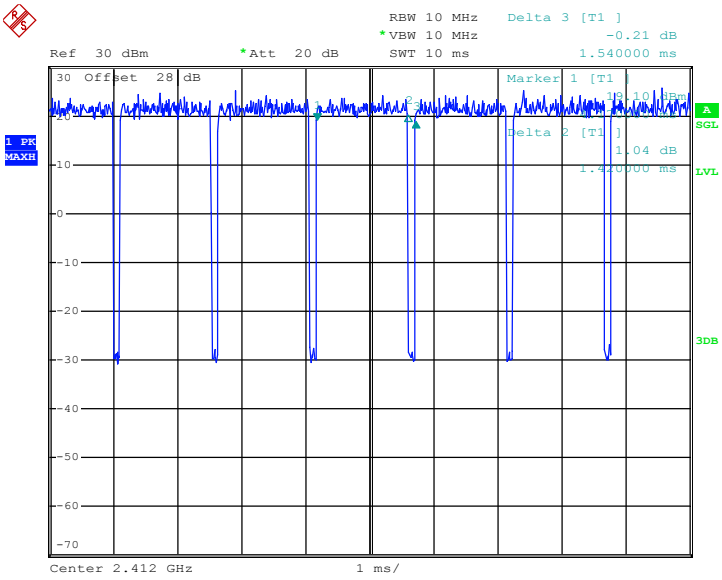
MIMO <Ant. 1>

802.11g



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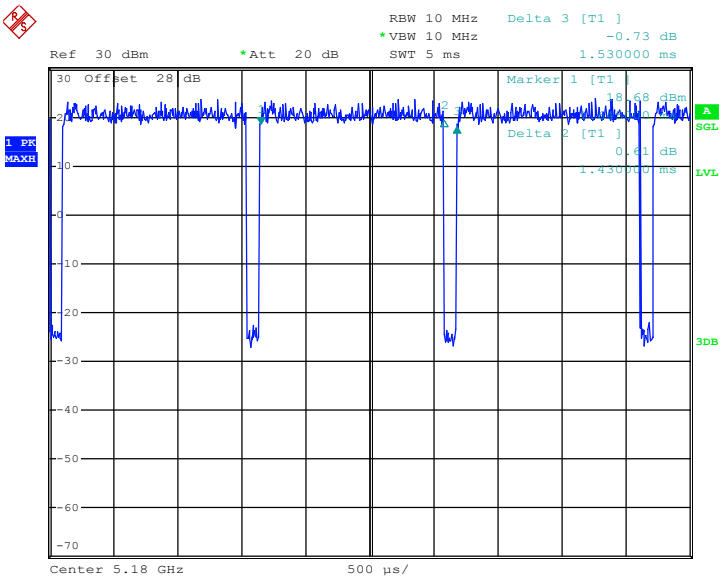
802.11a



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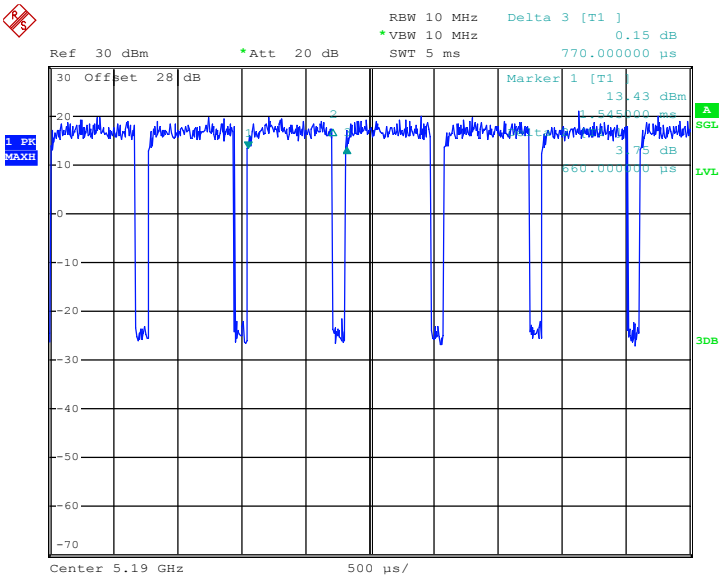
802.11n HT40



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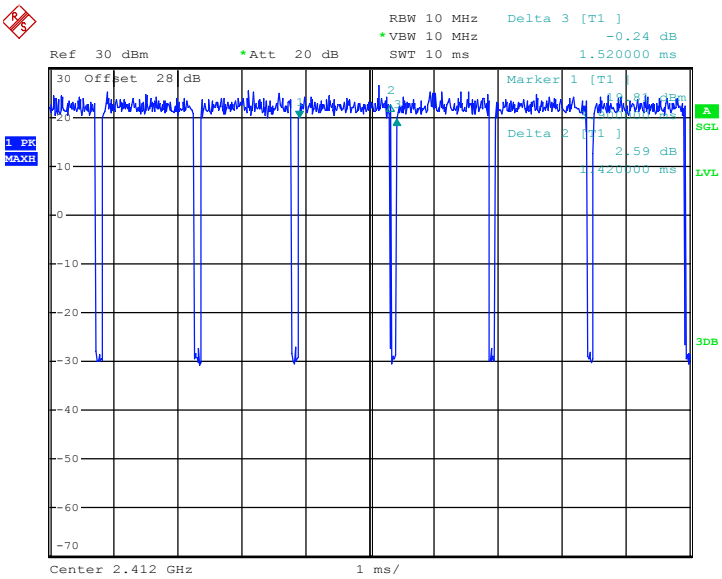
MIMO <Ant. 2>

802.11g



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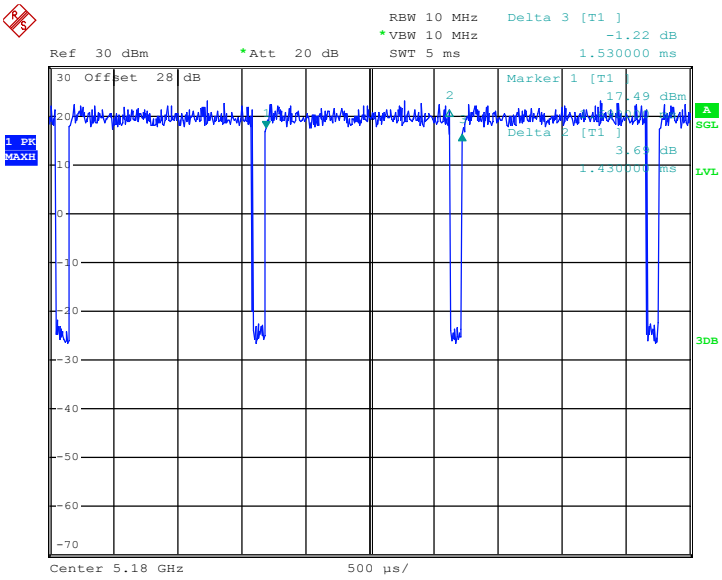
802.11a



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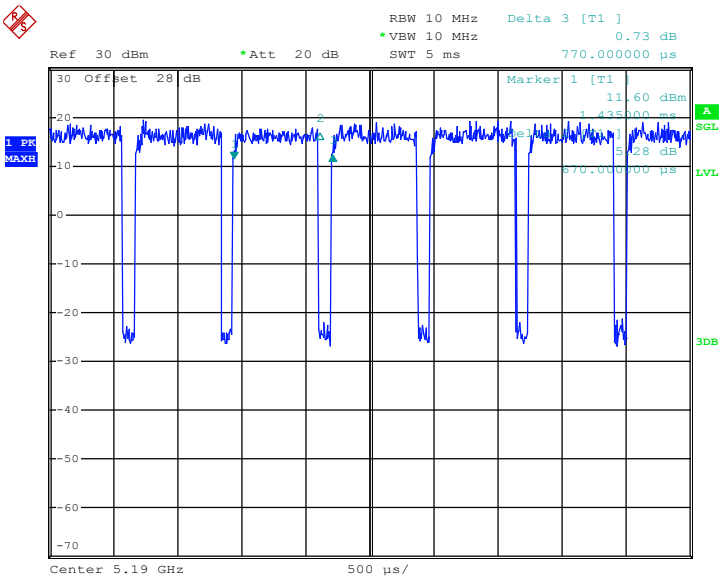
802.11n HT40



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