



FCC RF CO-LOCATION TEST Report

FCC ID : EJE-WB0110
Equipment : STYLISTIC Q509
Brand Name : FUJITSU
Model Name : MQ10B
Applicant : FUJITSU CLIENT COMPUTING LIMITED
1-1, Kamikodanaka 4-chome,
Nakahara-ku, Kawasaki, 211-8588 Japan
Manufacturer : FUJITSU LIMITED
1-1, Kamikodanaka 4-chome,
Nakahara-ku, Kawasaki, 211-8588 Japan
Standard : FCC Part 15 Subpart E §15.407

The product was received on Jan. 17, 2019 and testing was started from Feb. 04, 2019 and completed on Feb. 18, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, 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 partial report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Jones Tsai

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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



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History of this test report

Report No.	Version	Description	Issued Date
FR911733F	01	Initial issue of report	Mar. 08, 2019

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(b)	Unwanted Emissions	Pass	Under limit 3.61 dB at 5403.720 MHz
3.2	15.203 15.407(a)	Antenna Requirement	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Maggie Chiang



1 General Description

1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Integrated WLAN Module	Brand Name: Intel Model Name: 9560D2W
Antenna Type	WLAN: <Ant. 1> PIFA Antenna <Ant. 2> PIFA Antenna Bluetooth: PIFA Antenna

1.2 Modification of EUT

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

1.3 Testing Location

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.
	03CH16-HY

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

FCC Designation No. TW0007

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 414788 D01 Radiated Test Site v01r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05
- ♦ 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 for 2.4GHz Ant. 2 and 5GHz Ant. 1, X plane for 5GHz Ant. 2, and Y plane for 5GHz Ant. 1+2) were recorded in this report.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz Bluetooth - LE_2Mbps		2400-2483.5 MHz 802.11n HT40	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
00	2402	03	2422

5250-5350 MHz 802.11n HT40		5250-5350 MHz 802.11ac VHT160	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
62	5310	50	5250

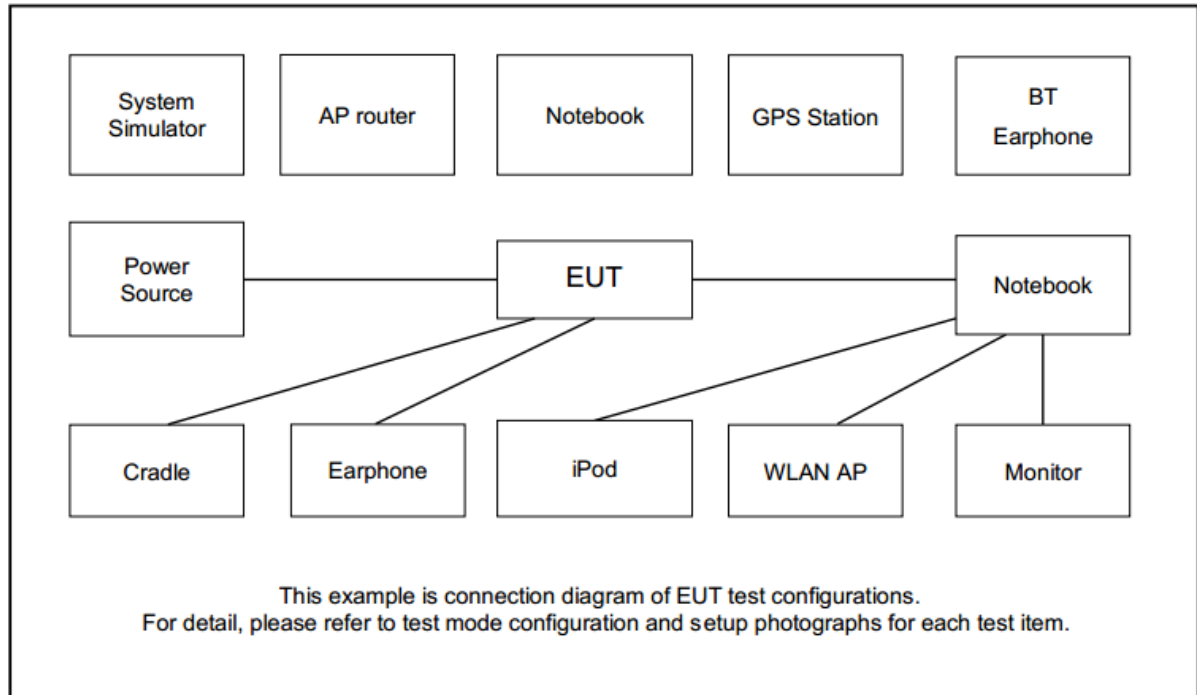
2.2 Test Mode

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

<Co-Location>

Modulation	Data Rate
Bluetooth-LE + 2.4GHz 802.11n HT40 for Ant. 2	2Mbps + MCS0
Bluetooth-LE + 5GHz 802.11ac VHT160 for Ant. 1	2Mbps + MCS0
Bluetooth-LE + 5GHz 802.11n HT40 for Ant. 2	2Mbps + MCS0
Bluetooth-LE + 5GHz 802.11ac VHT160 for Ant. 1+2	2Mbps + MCS0

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “DRTU” was installed in EUT 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

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band 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.

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

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).

3.1.2 Measuring Instruments

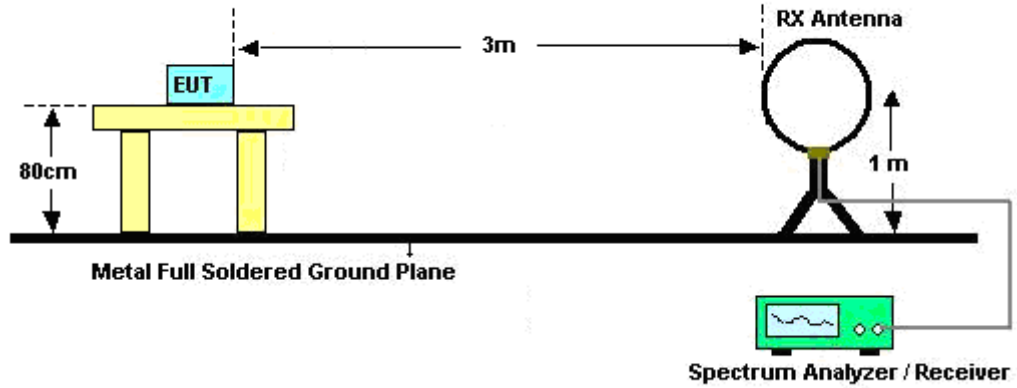
See list of measuring equipment of this test report.

3.1.3 Test Procedures

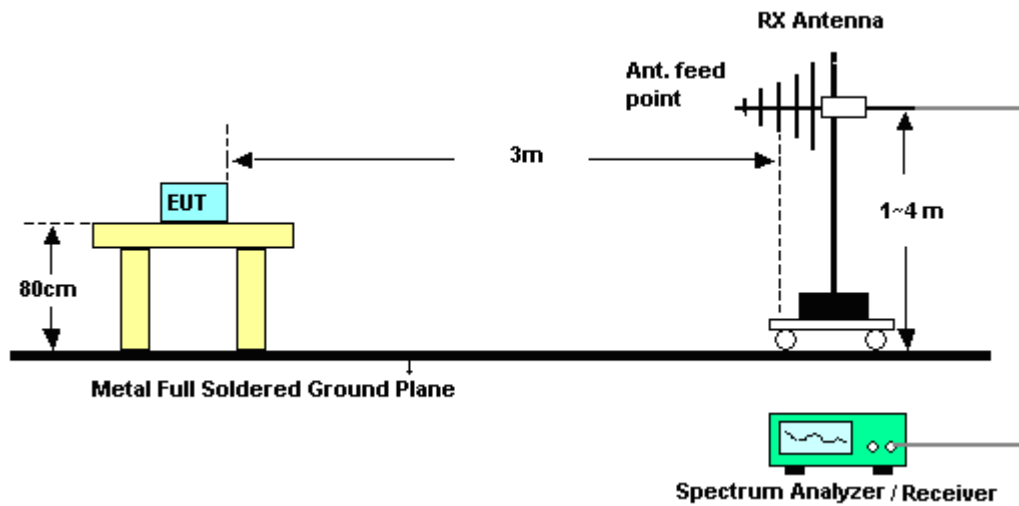
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
(1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
(2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW $\geq$ 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 $\geq$ 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

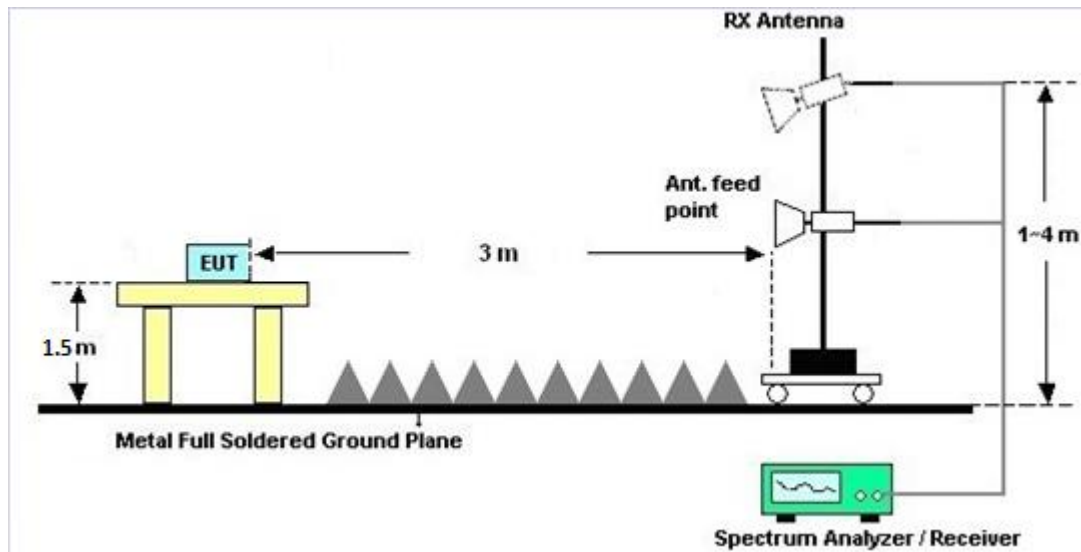
For radiated emissions below 30MHz



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 alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, 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	Nov. 23, 2017	Feb. 04, 2019~ Feb. 18, 2019	Nov. 22, 2019	Radiation (03CH16-HY)
Bilog Antenna	TESEQ	CBL6111D&008 02N1D01N-06	47020&06	30MHz to 1GHz	Oct. 13, 2018	Feb. 04, 2019~ Feb. 18, 2019	Oct. 12, 2019	Radiation (03CH16-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1522	1G~18GHz	Sep. 07, 2018	Feb. 04, 2019~ Feb. 18, 2019	Sep. 06, 2019	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	May 08, 2018	Feb. 04, 2019~ Feb. 18, 2019	May 07, 2019	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A (MXE)	MY57290111	3Hz~26.5GHz	Nov. 29, 2018	Feb. 04, 2019~ Feb. 18, 2019	Nov. 28, 2019	Radiation (03CH16-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Apr. 17, 2018	Feb. 04, 2019~ Feb. 18, 2019	Apr. 16, 2019	Radiation (03CH16-HY)
Amplifier	SONOMA	310N	371607	9kHz~1000MHz	Oct. 02, 2018	Feb. 04, 2019~ Feb. 18, 2019	Oct. 01, 2019	Radiation (03CH16-HY)
Preamplifier	Jet-Power	JPA0118-55- 303	17100018000 54001	1GHz~18GHz	Apr. 16, 2018	Feb. 04, 2019~ Feb. 18, 2019	Apr. 15, 2019	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 12, 2018	Feb. 04, 2019~ Feb. 18, 2019	Dec. 11, 2019	Radiation (03CH16-HY)
Amplifier	MITEQ	TTA1840-35- HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 16, 2018	Feb. 04, 2019~ Feb. 18, 2019	Jul. 15, 2019	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30M-18G	Mar. 14, 2018	Feb. 04, 2019~ Feb. 18, 2019	Mar. 13, 2019	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15539/4	30M-18G	Mar. 14, 2018	Feb. 04, 2019~ Feb. 18, 2019	Mar. 13, 2019	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY36979/4	30M~18GHz	Mar. 14, 2018	Feb. 04, 2019~ Feb. 18, 2019	Mar. 13, 2019	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Feb. 04, 2019~ Feb. 18, 2019	N/A	Radiation (03CH16-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.9
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.8
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.9
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Appendix A. Radiated Spurious Emission

Test Engineer :	CR Liao and Andy Yang	Temperature :	23~25°C
		Relative Humidity :	55~57%

Co-location

BLE (2Mbps) + WIFI 802.11n HT40 (Band Edge @ 3m)

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)
BLE CH00 2402MHz + 802.11n HT40 CH 03 2422MHz Ant 2		2389.94	60.68	-13.32	74	45.11	27.24	18.32	29.99	100	129	P	H
		2389.66	48	-6	54	32.43	27.24	18.32	29.99	100	129	A	H
	*	2422	101.98	-	-	86.31	27.31	18.34	29.98	100	129	P	H
	*	2422	93.29	-	-	77.62	27.31	18.34	29.98	100	129	A	H
		2488.96	56.5	-17.5	74	40.62	27.47	18.38	29.97	100	129	P	H
		2499.36	46.73	-7.27	54	30.8	27.5	18.39	29.96	100	129	A	H
		2389.8	59.11	-14.89	74	43.54	27.24	18.32	29.99	120	86	P	V
		2389.52	47.21	-6.79	54	31.66	27.23	18.31	29.99	120	86	A	V
	*	2422	98.51	-	-	82.84	27.31	18.34	29.98	120	86	P	V
	*	2422	90.36	-	-	74.69	27.31	18.34	29.98	120	86	A	V
		2485.76	57.12	-16.88	74	41.24	27.47	18.38	29.97	120	86	P	V
		2489.36	46.45	-7.55	54	30.57	27.47	18.38	29.97	120	86	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



BLE (2Mbps) + WIFI 802.11n HT40 (Harmonic @ 3m)

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)
BLE CH00 2402MHz + 802.11n HT40 CH 03 2422MHz Ant 2		4804	39.95	-34.05	74	53.55	31.21	13.73	58.54	100	0	P	H
		4844	40.26	-33.74	74	53.71	31.29	13.79	58.53	100	0	P	H
		7266	43.52	-30.48	74	51.33	35.94	15.26	59.01	100	0	P	H
													H
													H
		4804	38.68	-35.32	74	52.28	31.21	13.73	58.54	100	0	P	V
		4844	39.98	-34.02	74	53.43	31.29	13.79	58.53	100	0	P	V
		7266	43.55	-30.45	74	51.36	35.94	15.26	59.01	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

BLE (2Mbps) + WIFI 802.11n HT40 (LF)

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)
BLE CH00 2402MHz + 802.11n HT40 CH 03 2422MHz Ant 2		106.95	25.86	-17.64	43.5	40.15	16.97	1.11	32.37	-	-	P	H
		177.69	22.86	-20.64	43.5	38	15.59	1.62	32.35	-	-	P	H
		223.86	25.91	-20.09	46	39.7	16.58	2	32.37	-	-	P	H
		597.5	33.25	-12.75	46	36.57	25.55	3.81	32.68	100	0	P	H
		924.4	31.63	-14.37	46	29.04	29.54	4.63	31.58	-	-	P	H
		951	32.26	-13.74	46	28.87	30.1	4.63	31.34	-	-	P	H
													H
													H
													H
													H
													H
													H
		34.32	25.34	-14.66	40	33.66	23.88	0.25	32.45	-	-	P	V
		185.79	26.09	-17.41	43.5	41.31	15.46	1.67	32.35	-	-	P	V
		223.32	24.86	-21.14	46	38.72	16.51	2	32.37	-	-	P	V
		778.8	29.34	-16.66	46	29.39	27.93	4.42	32.4	-	-	P	V
		855.1	30.75	-15.25	46	29.41	28.73	4.66	32.05	-	-	P	V
		945.4	32.36	-13.64	46	29.13	30.01	4.61	31.39	100	0	P	V
													V
													V
													V
													V
													V
													V
												V	
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Co-location

BLE (2Mbps) + WIFI 802.11ac VHT160 (Band Edge @ 3m)

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)
BLE CH 00 2402MHz + 802.11ac VHT160 CH 50 5250MHz Ant 1		5130.52	55.2	-18.8	74	39.7	31.63	13.25	29.38	100	340	P	H
		5119.86	46.88	-7.12	54	31.37	31.62	13.27	29.38	100	340	A	H
	*	5250	98.36	-	-	83.06	31.65	13.05	29.4	100	340	P	H
	*	5250	90.43	-	-	75.13	31.65	13.05	29.4	100	340	A	H
		5436.2	59.36	-14.64	74	44.01	31.69	13.08	29.42	100	340	P	H
		5402.6	50.16	-3.84	54	34.94	31.68	12.96	29.42	100	340	A	H
		5140.66	55.79	-18.21	74	40.32	31.63	13.22	29.38	100	7	P	V
		5143.52	47.7	-6.3	54	32.23	31.63	13.22	29.38	100	7	A	V
	*	5250	98.05	-	-	82.75	31.65	13.05	29.4	100	7	P	V
	*	5250	90.41	-	-	75.11	31.65	13.05	29.4	100	7	A	V
		5398.12	58.33	-15.67	74	43.12	31.68	12.95	29.42	100	7	P	V
		5403.72	50.39	-3.61	54	35.17	31.68	12.96	29.42	100	7	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Co-location

BLE (2Mbps) + WIFI 802.11ac VHT160 (Harmonic @ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz + 802.11ac VHT160 CH 50 5250MHz Ant 1		4804	35.28	-38.72	74	48.88	31.21	13.73	58.54	100	0	P	H
		10500	42.5	-31.5	74	46.06	39.7	17.74	61	100	0	P	H
		15750	38.82	-35.18	74	40.44	37.3	21.68	60.6	100	0	P	H
													H
													H
		4804	34.86	-39.14	74	48.46	31.21	13.73	58.54	100	0	P	V
		10500	41.77	-32.23	74	45.33	39.7	17.74	61	100	0	P	V
		15750	39.75	-34.25	74	41.37	37.3	21.68	60.6	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Co-location

BLE (2Mbps) + WIFI 802.11n HT40 (Band Edge @ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH00 2402MHz + 802.11n HT40 CH 62 5310MHz Ant 2		5023.46	55.35	-18.65	74	39.61	31.6	13.5	29.36	107	298	P	H
		5120.02	45.98	-8.02	54	30.47	31.62	13.27	29.38	107	298	A	H
	*	5310	103.47	-	-	88.2	31.66	13.01	29.4	107	298	P	H
	*	5310	96.38	-	-	81.11	31.66	13.01	29.4	107	298	A	H
		5351.28	59.04	-14.96	74	43.8	31.67	12.98	29.41	107	298	P	H
		5350.56	49.67	-4.33	54	34.43	31.67	12.98	29.41	107	298	A	H
		5048.96	55.61	-18.39	74	39.93	31.61	13.44	29.37	118	306	P	V
		5085	45.39	-8.61	54	29.78	31.62	13.36	29.37	118	306	A	V
	*	5310	98.99	-	-	83.72	31.66	13.01	29.4	118	306	P	V
	*	5310	91.6	-	-	76.33	31.66	13.01	29.4	118	306	A	V
		5350.32	56.21	-17.79	74	40.97	31.67	12.98	29.41	118	306	P	V
		5350.32	46.83	-7.17	54	31.59	31.67	12.98	29.41	118	306	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Co-location

BLE (2Mbps) + WIFI 802.11n HT40 (Harmonic @ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH00 2402MHz + 802.11n HT40 CH 62 5310MHz Ant 2		4804	34.49	-39.51	74	48.09	31.21	13.73	58.54	100	0	P	H
		10620	40.87	-33.13	74	44.33	39.82	17.84	61.12	100	0	P	H
		15930	39.06	-34.94	74	40.95	36.8	21.77	60.46	100	0	P	H
													H
		4804	35.07	-38.93	74	48.67	31.21	13.73	58.54	100	0	P	V
		10620	40.99	-33.01	74	44.45	39.82	17.84	61.12	100	0	P	V
		15930	39.02	-34.98	74	40.91	36.8	21.77	60.46	100	0	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Co-location

BLE (2Mbps) + WIFI 802.11ac VHT160 (Band Edge @ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH00 2402MHz + 802.11ac VHT160 CH 50 5250MHz Ant 1+2		5130.52	55.2	-18.8	74	39.7	31.63	13.25	29.38	100	340	P	H
		5119.86	46.88	-7.12	54	31.37	31.62	13.27	29.38	100	340	A	H
		5250	98.36	-	-	83.06	31.65	13.05	29.4	100	340	P	H
	*	5250	90.43	-	-	75.13	31.65	13.05	29.4	100	340	A	H
	*	5436.2	59.36	-14.64	74	44.01	31.69	13.08	29.42	100	340	P	H
		5402.6	50.16	-3.84	54	34.94	31.68	12.96	29.42	100	340	A	H
		5140.66	55.79	-18.21	74	40.32	31.63	13.22	29.38	100	7	P	V
		5143.52	47.7	-6.3	54	32.23	31.63	13.22	29.38	100	7	A	V
		5250	98.05	-	-	82.75	31.65	13.05	29.4	100	7	P	V
	*	5250	90.41	-	-	75.11	31.65	13.05	29.4	100	7	A	V
	*	5398.12	58.33	-15.67	74	43.12	31.68	12.95	29.42	100	7	P	V
		5403.72	50.39	-3.61	54	35.17	31.68	12.96	29.42	100	7	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Co-location

BLE (2Mbps) + WIFI 802.11ac VHT160 (Harmonic @ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH00 2402MHz + 802.11ac VHT160 CH 50 5250MHz Ant 1+2		4804	35.28	-38.72	74	48.88	31.21	13.73	58.54	100	0	P	H
		10500	42.5	-31.5	74	46.06	39.7	17.74	61	100	0	P	H
		15750	38.82	-35.18	74	40.44	37.3	21.68	60.6	100	0	P	H
													H
													H
		4804	34.86	-39.14	74	48.46	31.21	13.73	58.54	100	0	P	V
		10500	41.77	-32.23	74	45.33	39.7	17.74	61	100	0	P	V
		15750	39.75	-34.25	74	41.37	37.3	21.68	60.6	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

BLE (2Mbps) + WIFI 802.11ac VHT160 (LF @ 3m)

[illegible]



Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	Peak or Average
H/V	Horizontal or Vertical



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		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		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”.



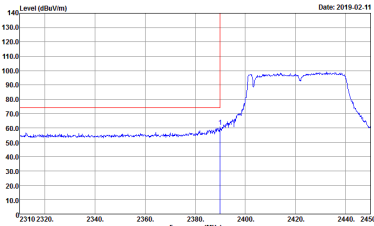
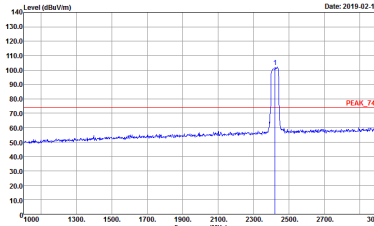
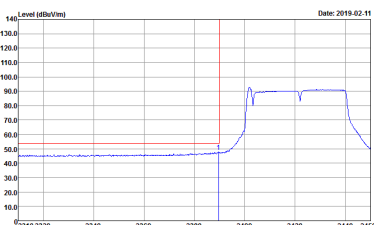
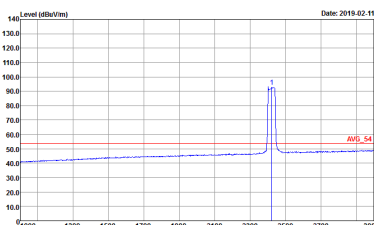
Appendix B. Radiated Spurious Emission

Test Engineer :	CR Liao and Andy Yang	Temperature :	23~25°C
		Relative Humidity :	55~57%

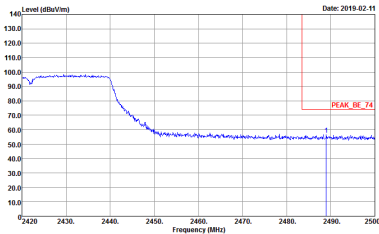
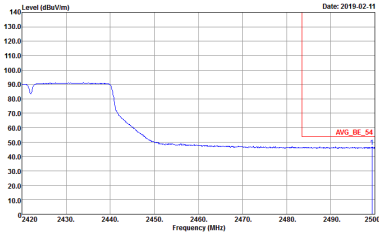
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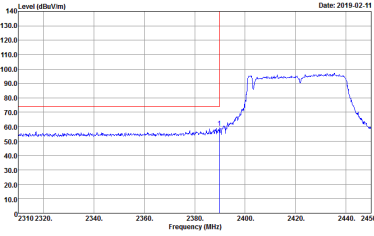
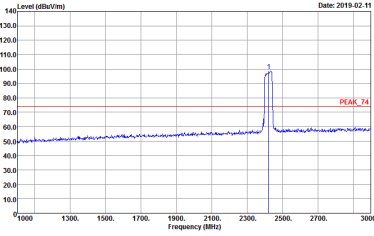
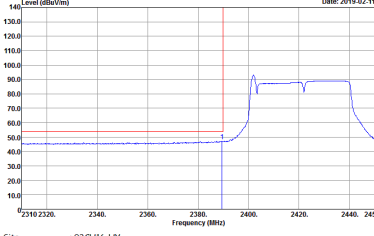
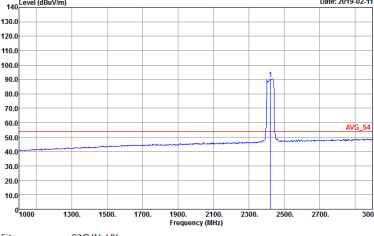
-L	Low channel location
-R	High channel location

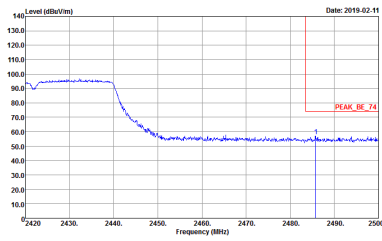
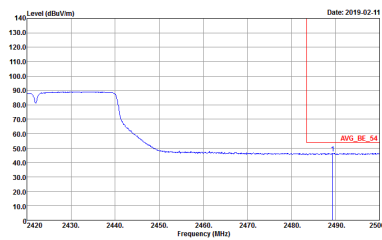
Co-location
BLE (2Mbps) + WIFI 802.11n HT40 (Band Edge @ 3m)

ANT	BLE_CH00 + 802.11n HT40 CH03_Ant 2 - L	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733

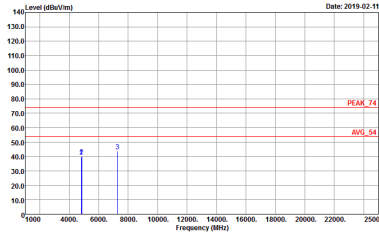
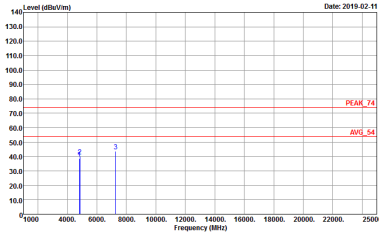


ANT	BLE_CH00 + 802.11n HT40 CH03_Ant 2 - R	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911733	Left Blank
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911733	Left Blank

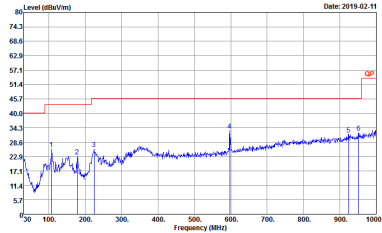
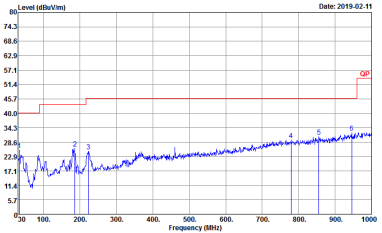
ANT	BLE_CH00 + 802.11n HT40 CH03_Ant 2 - L	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 VERTICAL Detector : Peak Project : 911733

ANT	BLE_CH00 + 802.11n HT40 CH03_Ant 2 - R	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	Left blank
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	Left blank

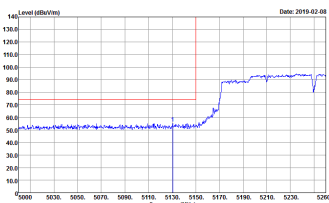
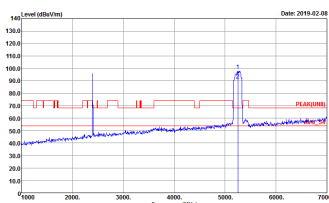
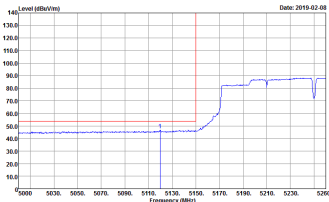
Co-location
BLE (2Mbps) + WIFI 802.11n HT40 (Harmonic @ 3m)

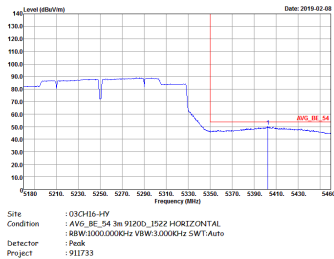
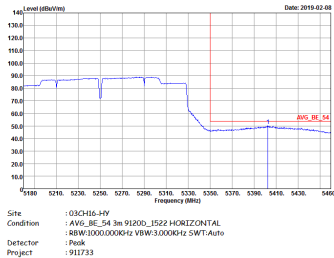
ANT	BLE_CH00 + 802.11n HT40 CH03_Ant 2	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03C10-4HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03C10-4HY Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733

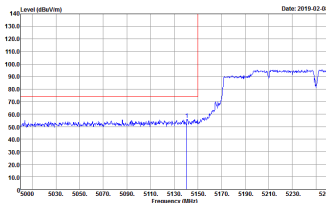
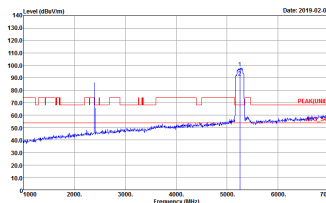
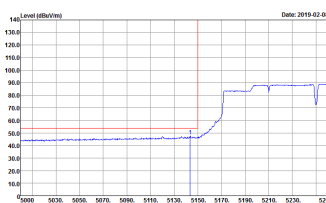
Emission below 1GHz
BLE (2Mbps) + WIFI 802.11n HT40 (LF)

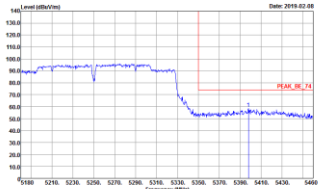
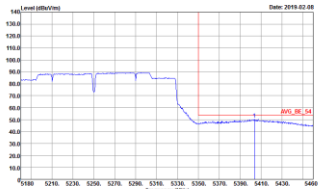
ANT	BLE_CH00 + 802.11n HT40 CH03_Ant 2 LF	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH16-14V Condition : QP 3m RIL06_47020406 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH16-14V Condition : QP 3m RIL06_47020406 VERTICAL Detector : Peak Project : 911733

Co-location
BLE (2Mbps) + WIFI 802.11ac VHT160 (Band Edge @ 3m)

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1 - L	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : PEAK(INEI) 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	Left blank

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1 - R	
Simultaneously	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1 - L	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH6-HY Condition : PEAK_9C_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	 Site : 03CH6-HY Condition : PEAK_9C_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733
Avg.	 Site : 03CH6-HY Condition : AVG_9C_54 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	Left blank

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1 - R	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH05-HY Condition : PEAK_BE_24 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	Left blank
Avg.	 Site : 03CH05-HY Condition : AVG_BE_24 3m 91200_1522 VERTICAL Detector : Peak Project : 911733	Left blank

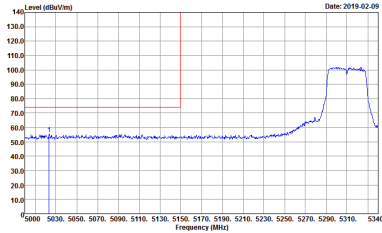
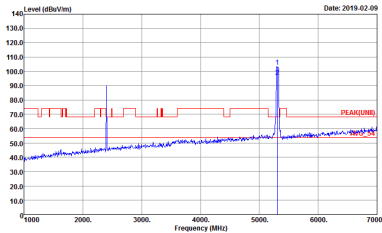
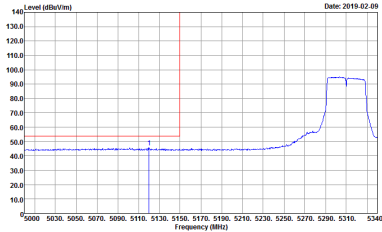


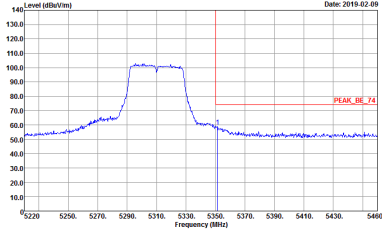
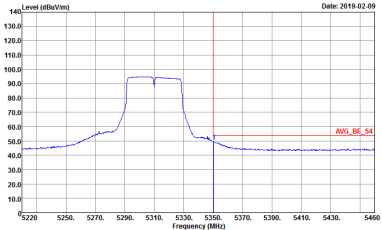
Co-location

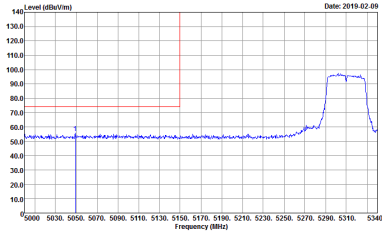
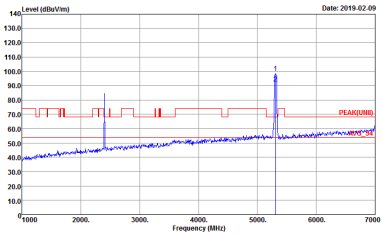
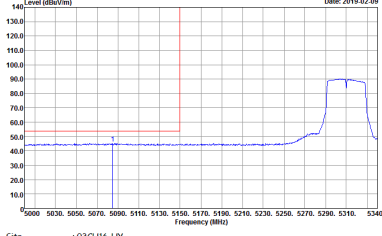
BLE (2Mbps) + WIFI 802.11ac VHT160 (Harmonic @ 3m)

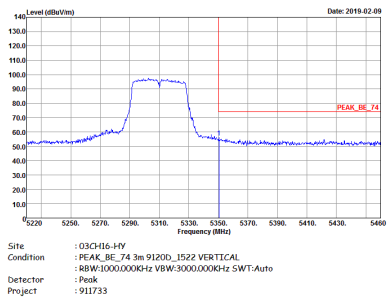
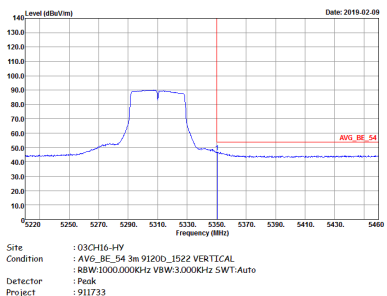
ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1 5250MHz	
Simultaneously	Horizontal	Vertical
Peak Avg.	Site : 03CH6-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	Site : 03CH6-HY Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733

Co-location
BLE (2Mbps) + WIFI 802.11n HT40 (Band Edge @ 3m)

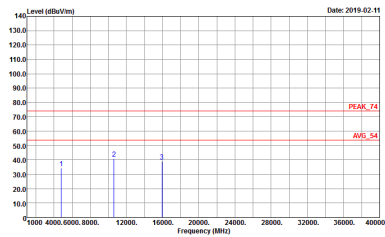
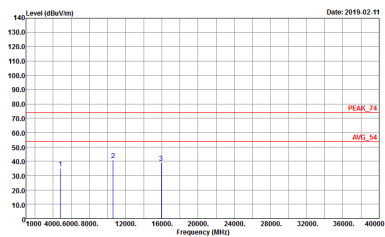
ANT	BLE_CH00 + 802.11n HT40 CH62_Ant 2 - L	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : PEAK(LINE) 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	Left blank

ANT	BLE_CH00 + 802.11n HT40 CH62_Ant 2 - R	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1522 HORIZONTAL Detector : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Project : 911733	Left blank
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1522 HORIZONTAL Detector : RBW:1000.000kHz VBW:3.000kHz SWT:Auto Project : 911733	Left blank

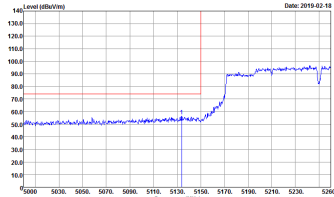
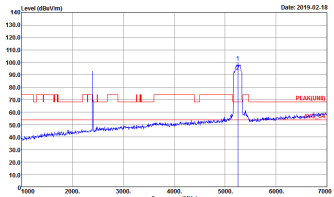
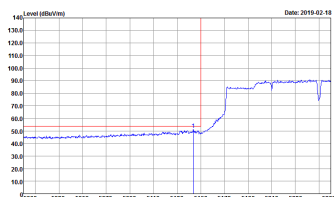
ANT	BLE_CH00 + 802.11n HT40 CH62_Ant 2 - L	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1522 VERTICAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : PEAK[UNII] 3m 9120D_1522 VERTICAL Detector : Peak Project : 911733
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1522 VERTICAL Detector : Peak Project : 911733	Left blank

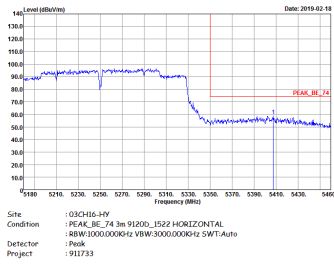
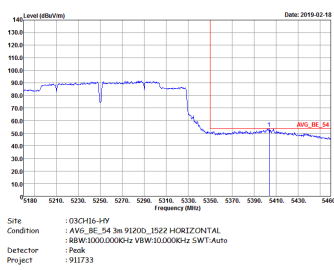
ANT	BLE_CH00 + 802.11n HT40 CH62_Ant 2 - R	
Simultaneously	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

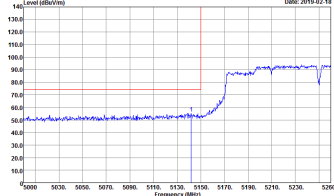
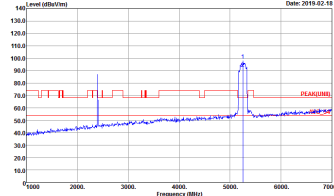
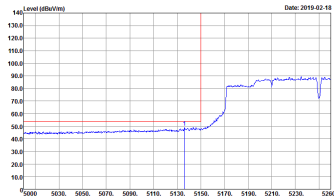
Co-location
BLE (2Mbps) + WIFI 802.11n HT40 (Harmonic @ 3m)

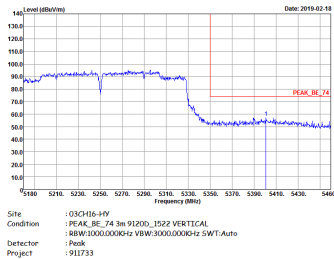
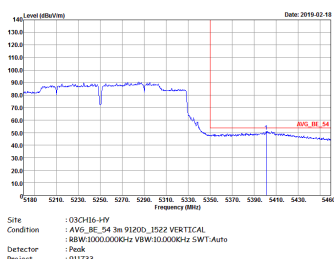
ANT	BLE_CH00 + 802.11n HT40 CH62_Ant 2	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH16-4HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH16-4HY Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733

Co-location
BLE (2Mbps) + WIFI 802.11ac VHT160 (Band Edge @ 3m)

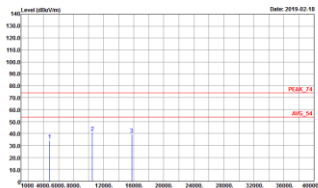
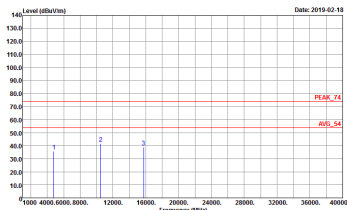
ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1+2 - L	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH6-HY Condition : PEAK_BE_24 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH6-HY Condition : PEAK(FUND) 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733
Avg.	 Site : 03CH6-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	Left blank

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1+2 - R	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL Detector : RBW:3000.000kHz VBW:3000.000kHz SWT:Auto Project : 911733	Left blank
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL Detector : RBW:3000.000kHz VBW:3000.000kHz SWT:Auto Project : 911733	Left blank

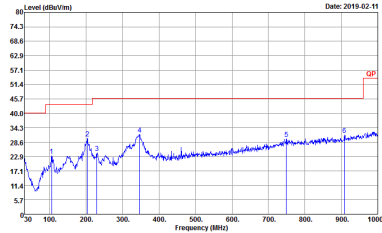
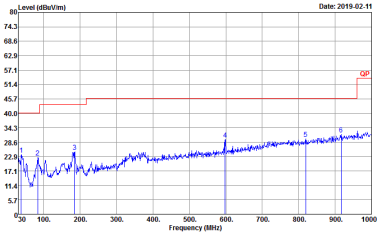
ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1+2 - L	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_3522 VERTICAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : PEAK(UNED) 3m 91200_3522 VERTICAL Detector : Peak Project : 911733
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_3522 VERTICAL Detector : Peak Project : 911733	Left blank

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1+2 - R	
Simultaneously	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

Co-location
BLE (2Mbps) + WIFI 802.11ac VHT160 (Harmonic @ 3m)

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1+2	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak Project : 911733

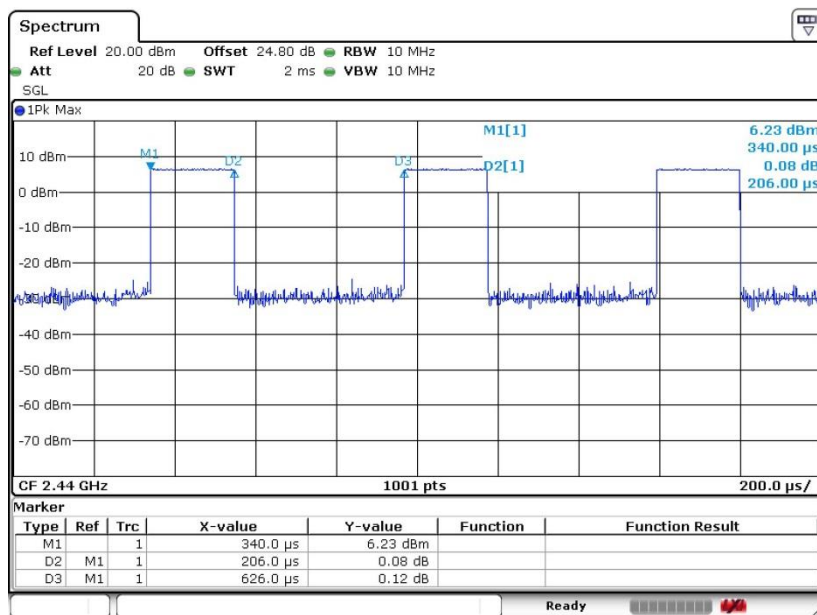
Emission below 1GHz
5GHz WIFI 802.11ac VHT160 (LF)

ANT	BLE_CH00 + 802.11ac VHT160 CH50_Ant 1+2 LF	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH10-14V Condition : QP 3m RELOG_47020406 HORIZONTAL Detector : Peak Project : 911733	 Site : 03CH10-14V Condition : QP 3m RELOG_47020406 VERTICAL Detector : Peak Project : 911733

Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
-	Bluetooth - LE for 2Mbps	32.9	206.00	4.85	10kHz	4.83
2	2.4GHz 802.11n HT40	95.60	935.00	1.07	3kHz	0.20
2	5GHz 802.11n HT40	95.80	936.00	1.07	3kHz	0.19
1	5GHz 802.11ac VHT160	93.33	588.00	1.70	3kHz	0.30
1+2	5GHz 802.11ac VHT160 Ant. 1	86.02	320.00	3.13	10kHz	0.65
1+2	5GHz 802.11ac VHT160 Ant. 2	86.96	320.00	3.13	10kHz	0.61

Bluetooth – LE for 2Mbps

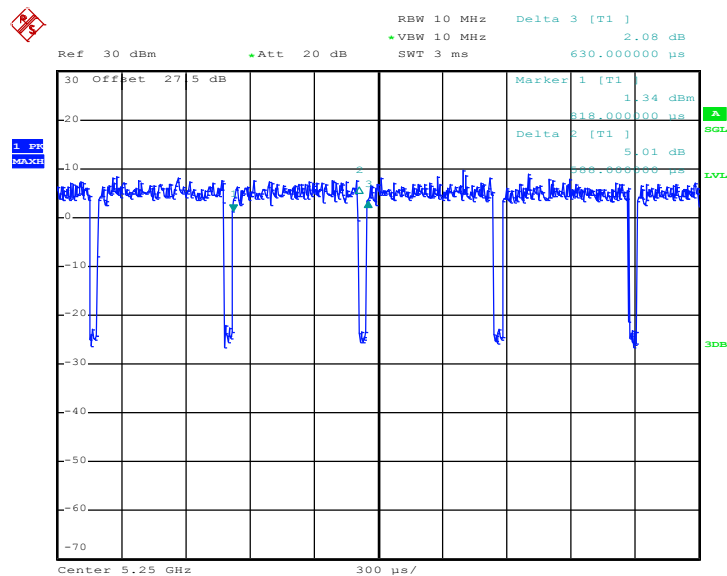


Date: 15.FEB.2019 14:03:57



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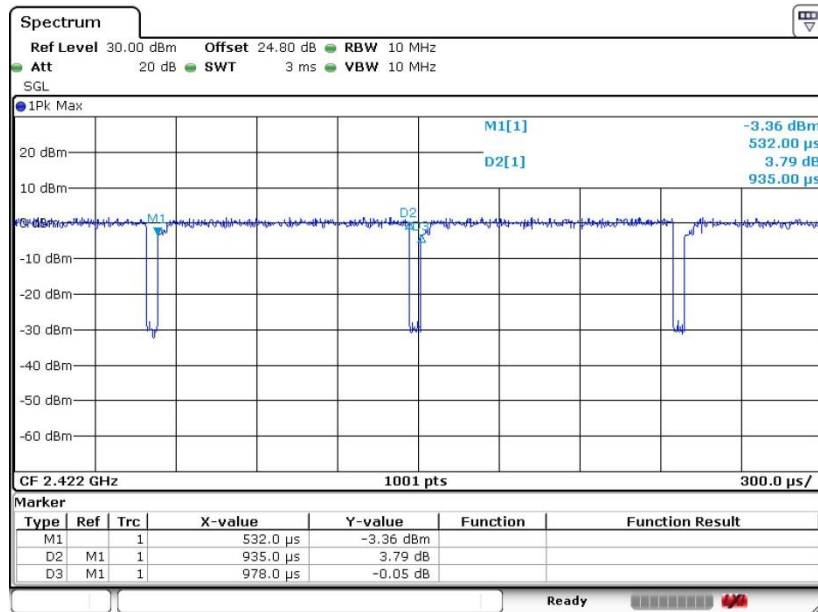
5GHz 802.11ac VHT160



Date: 22.JAN.2019 01:34:22

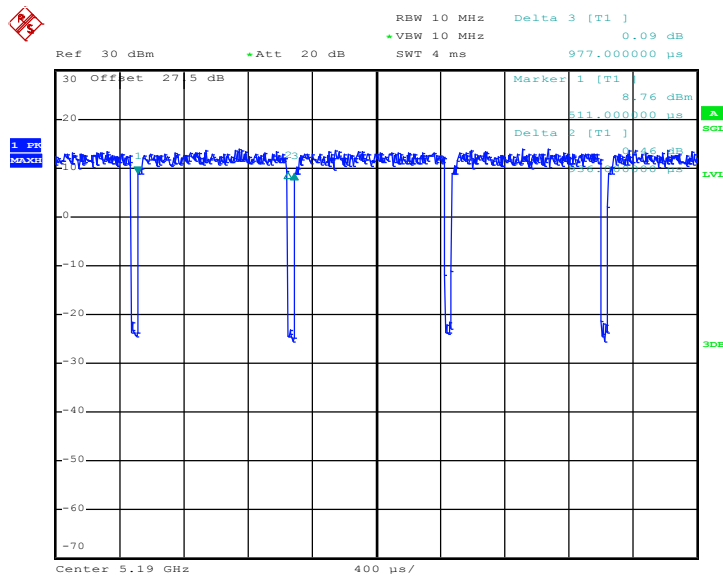
<Ant. 2>

2.4GHz 802.11n HT40

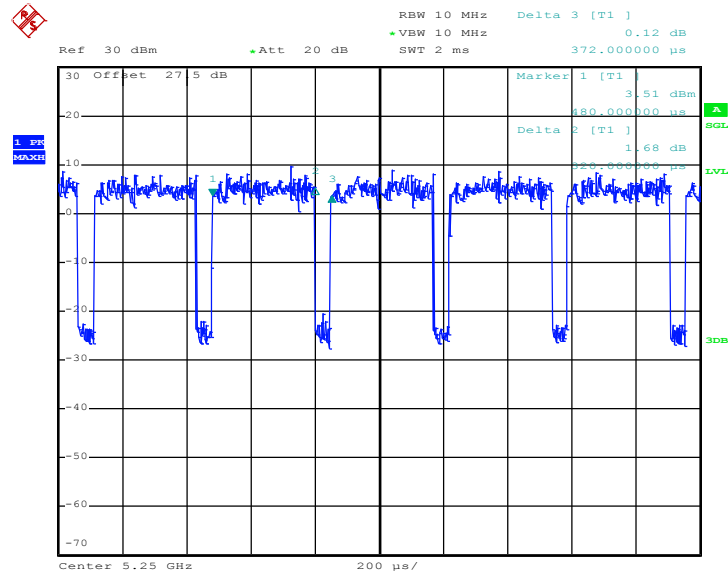


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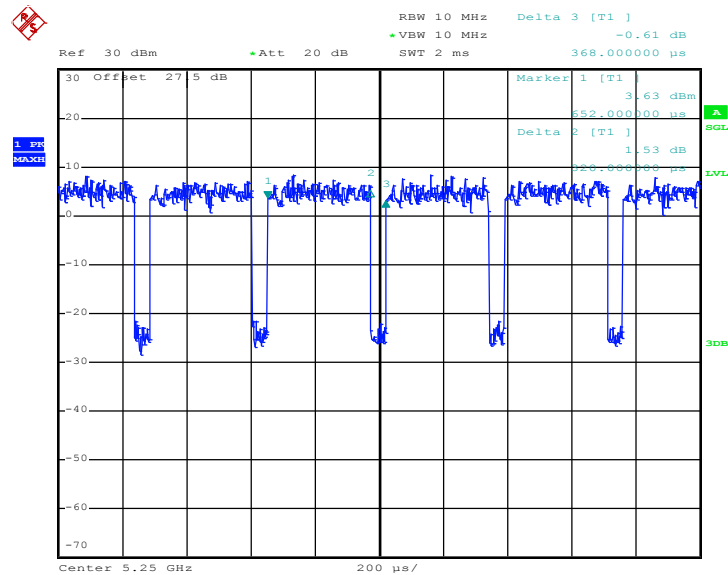
5GHz 802.11n HT40



Date: 21.JAN.2019 23:29:46

MIMO <Ant. 1>
5GHz 802.11ac VHT160


Date: 22.JAN.2019 01:29:49

MIMO <Ant. 2>
5GHz 802.11ac VHT160


Date: 22.JAN.2019 01:30:31