



Test report No. : 4789507582-US-R4-V0
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Issued date : Dec. 15, 2020
FCC ID : 2AWKZ-QCNFA324

RADIO TEST REPORT

Product : 2x2 802.11 A/B/G/N/AC WIFI+ Bluetooth Module

Model Name : QCNFA324

FCC ID : 2AWKZ-QCNFA324

Test Regulation : FCC 47 CFR Part 15 Subpart C (Section 15.247)

Received Date : Jun. 9, 2020

Test Date : Jun. 11, 2020 ~ Nov 12, 2020

Issued Date : Dec. 15, 2020

Applicant : ENLI INCORPORATION
4F., No. 42, Aly. 5, Ln. 12, Sec. 3, Bade Rd., Songshan
Dist., Taipei 10559, Taiwan

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing
Rd., Zhudong Township, Hsinchu County, Taiwan



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REVISION HISTORY

Original Test Report No.: 4789507582-US-R4-V0

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1. Attestation of Test Results

APPLICANT: ENLI INCORPORATION
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Taipei 10559, Taiwan

MANUFACTURER ENLI INCORPORATION
4F., No. 42, Aly. 5, Ln. 12, Sec. 3, Bade Rd., Songshan Dist.,
Taipei 10559, Taiwan

EUT DESCRIPTION: 2x2 802.11 A/B/G/N/AC WIFI+ Bluetooth Module

BRAND: ENLI

MODEL: QCNFA324

SAMPLE STAGE: Identical Prototype

DATE of TESTED: Jun. 11, 2020 ~ Nov 12, 2020

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart C (Section 15.247)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu
Project Handler

Date : Dec. 15, 2020

Approved and Authorized By:

Waternil Guan
Engineer

Date : Dec. 15, 2020

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2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)	Conducted Output Power	PASS
15.247(e)	Power Spectral Density	PASS
15.247(d)	Antenna Port Emission	PASS
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS
15.207	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	PASS

Note:

1. For the Radiated Band Edge test plots were recorded in Appendix I, the Radiated Emissions test plots were recorded in Appendix II.

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3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 Meas Guidance v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398

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5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	1.5
RF Conducted	9 kHz - 40GHz	2	1.0
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	1.9
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.4
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	4.7

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6. Equipment under Test

6.1. Description of EUT

Product	2x2 802.11 A/B/G/N/AC WIFI+ Bluetooth Module
Brand Name	ENLI
Model Name	QCNFA324
S/N	E4AAEA8A1CE1
Operating Frequency	2402MHz ~ 2480MHz
Modulation	GFSK
Transfer Rate	Up to 1 Mbps
Number of Channel	40
Maximum Output Power	0.8 dBm
Normal Voltage	3.3Vdc
Software Version	N/A

Note:

1. The EUT contains following accessory devices.

Product	Brand	Model	Ant. Type	Frequency Band (MHz)	Antenna Gain(dBi)
Ant 1	ANJIE Electronics	AEDQ4S-B0003	Dipole	2400 ~ 2500	5
				5150 ~ 5250	5.1
				5250 ~ 5350	5.1
				5470 ~ 5725	5.3
				5725 ~ 5850	5.3
Ant 2	ANJIE Electronics	AJDP2J-C0012	PIFA	2400 ~ 2500	3.62
				5150 ~ 5250	5
				5250 ~ 5350	5
				5470 ~ 5725	6
				5725 ~ 5850	5.8

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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6.2. Channel List

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

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6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	23~26°C / 63~68%RH	120Vac / 60 Hz	Jun. 11, 2020 ~ Nov 12, 2020	Mike Cai
Radiated Spurious Emission	966-2	22~26°C / 62~68%RH	120Vac / 60 Hz	Jun. 11, 2020 ~ Nov 12, 2020	Mike Cai
AC power Line Conducted Emission	SR1	23~25°C / 63~68%RH	120Vac / 60 Hz	Jun. 11, 2020 ~ Nov 12, 2020	Mike Cai

FCC Test Firm Registration Number: 498077

6.4. Description Of Available Antennas

Ant. No.	Brand Name	Model Name	Ant. Type	Ant. Gain (dBi)
1	ANJIE Electronics	AEDQ4S-B0003	Dipole	5
2	ANJIE Electronics	AJDP2J-C0012	PIFA	3.62

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

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6.5. Test Mode Applicability and Tested Channel Detail

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports.
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/-X-Z, it was determined that Y-Z axis was worst-case. Therefore, all final radiated testing was performed with the EUT in Y-Z axis.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For AC power line conducted emissions, the pre-scan has been determined by AC power 120Vac/60Hz (worst case)

Test item	Modulation Type	Available Channel	Test Channel	Data Rate	Antenna Type
Radiated Emissions (Above 1GHz)	GFSK	0 to 39	0,19,39	1.0	Dipole & PIFA
Radiated Emissions (Below 1GHz)	GFSK	0 to 39	0	1.0	Dipole & PIFA
AC Power Line Conducted Emission	GFSK	0 to 39	0	1.0	PIFA (Worst Case)
Antenna Port Conducted Measurement	GFSK	0 to 39	0,19,39	1.0	N/A

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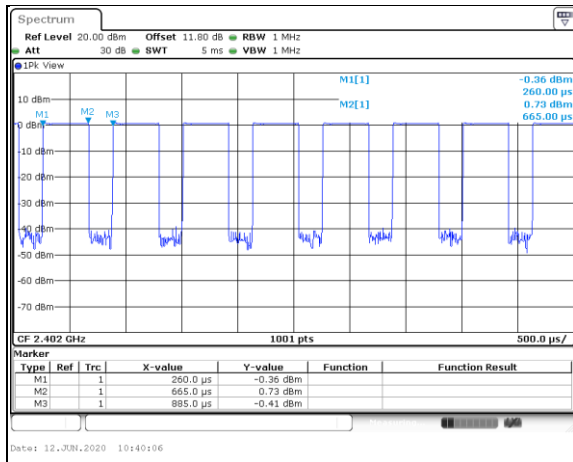
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6.6. Duty cycle

Duty cycle of test signal is < 98 %, duty factor shall be considered.

Duty cycle = $0.41/0.63 = 0.648$, Duty factor = $10 * \log(1/0.648) = 1.88$





7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	Nov. 13, 2019 Nov. 11, 2020	1 year
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	Dec. 17, 2019	1 year
Loop Antenna	ETS lindgren	6502	00213440	Dec. 19, 2019	1 year
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	Jan. 3, 2020	1 year
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	Jan. 3, 2020	1 year
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	Dec. 27, 2019	1 year
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	Feb. 4, 2020	1 year
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	Feb. 4, 2020	1 year
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	May. 8, 2019	1 year
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	Jan. 8, 2020	1 year
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	Jan. 8, 2020	1 year

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Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	Nov. 6, 2019	1 year
				Nov. 6, 2020	
Pulse Power Sensor	Anrisu	MA2411B	1531202	Dec. 23, 2019	1 year
Power Meter	Anrisu	ML2495A	1645002	Dec. 23, 2019	1 year
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	Nov. 19, 2019	1 year
Two-Line V- Network	Rohde & Schwarz	ENV216	102136	Aug. 8, 2019	1 year
				Aug. 19, 2020	
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	Aug. 6, 2019	1 year
				Aug. 12, 2020	
Cables	HARBOUR INDUSTRIES	LL142	170205-5000-1	Feb. 5, 2020	1 year

UL Software		
Description	Name	Version
Radiated measurement	EZ EMC	1.1.4.2
Conducted measurement	Keysight.TestSystem	1.0.0.0
AC power Line Conducted Emission	EZ EMC	1.1.4.2

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8. Description of Test Setup

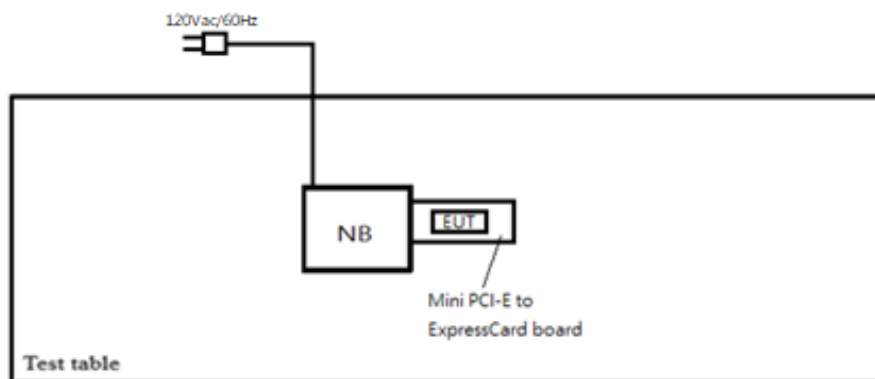
Support Equipment

Equipment	Brand Name	Model Name	S/N	Remark
Notebook	Lenovo	T430	PBE38AK	N/A
Mini PCI-E to ExpressCard board	N/A	N/A	N/A	N/A

Test Setup

Controlled using a bespoke application (QCARCT V3.0.203.0) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

Setup Diagram for Test



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9. Test Results

9.1. 6dB Bandwidth

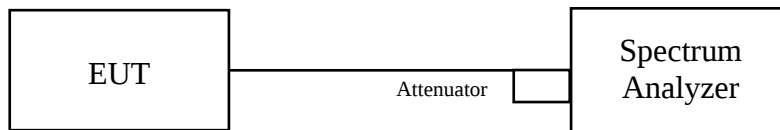
Requirements

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure

- Set resolution bandwidth (RBW) = 100kHz .
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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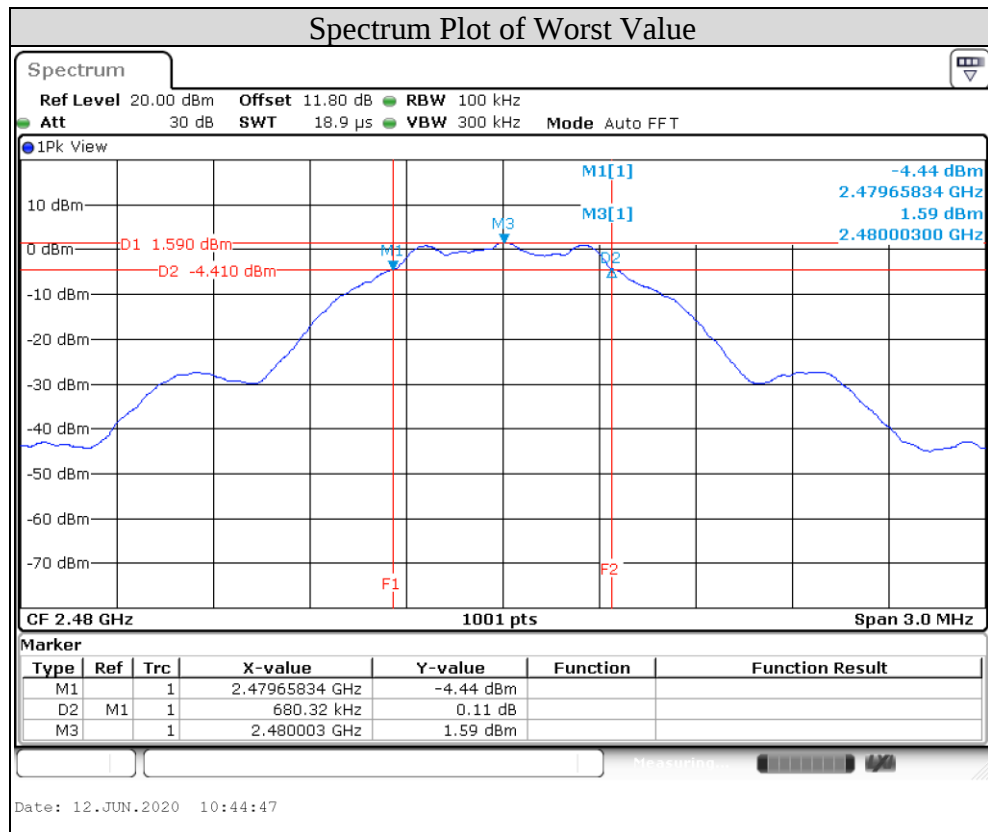
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Test Data

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	0.68	0.5	Pass
19	2440	0.68	0.5	Pass
39	2480	0.68	0.5	Pass



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9.2. Conducted output power

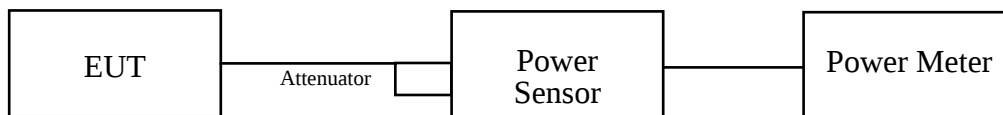
Requirements

For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Test Setup



The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.

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Test Data

Peak Power

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	1.05	0.21	30	Pass
19	2440	1.17	0.68	30	Pass
39	2480	1.20	0.8	30	Pass

Average Power (Reference Only)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	1.01	0.03
19	2440	1.09	0.39
39	2480	1.14	0.58

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9.3. Power Spectral Density

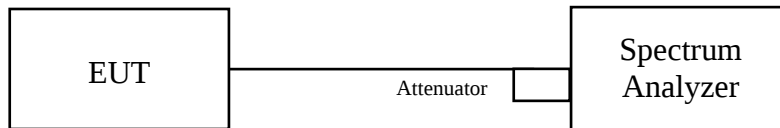
Requirements

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

Test procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d. Set the VBW $\geq 3 \times \text{RBW}$.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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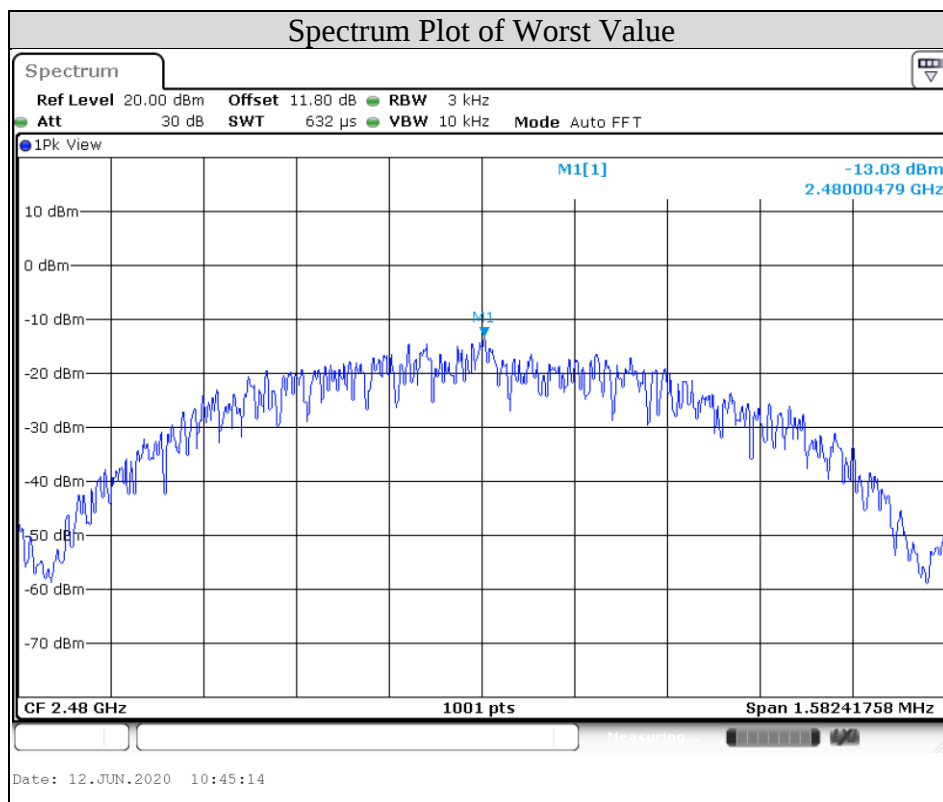
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Test Data

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
0	2402	-14.04	8	Pass
19	2440	-13.41	8	Pass
39	2480	-13.03	8	Pass



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9.4. Conducted Out of Band Emission

Requirements

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b) (3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209 (a) is not required.

Test procedure

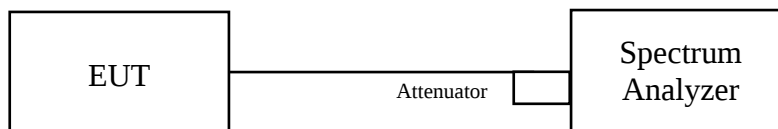
Measurement Procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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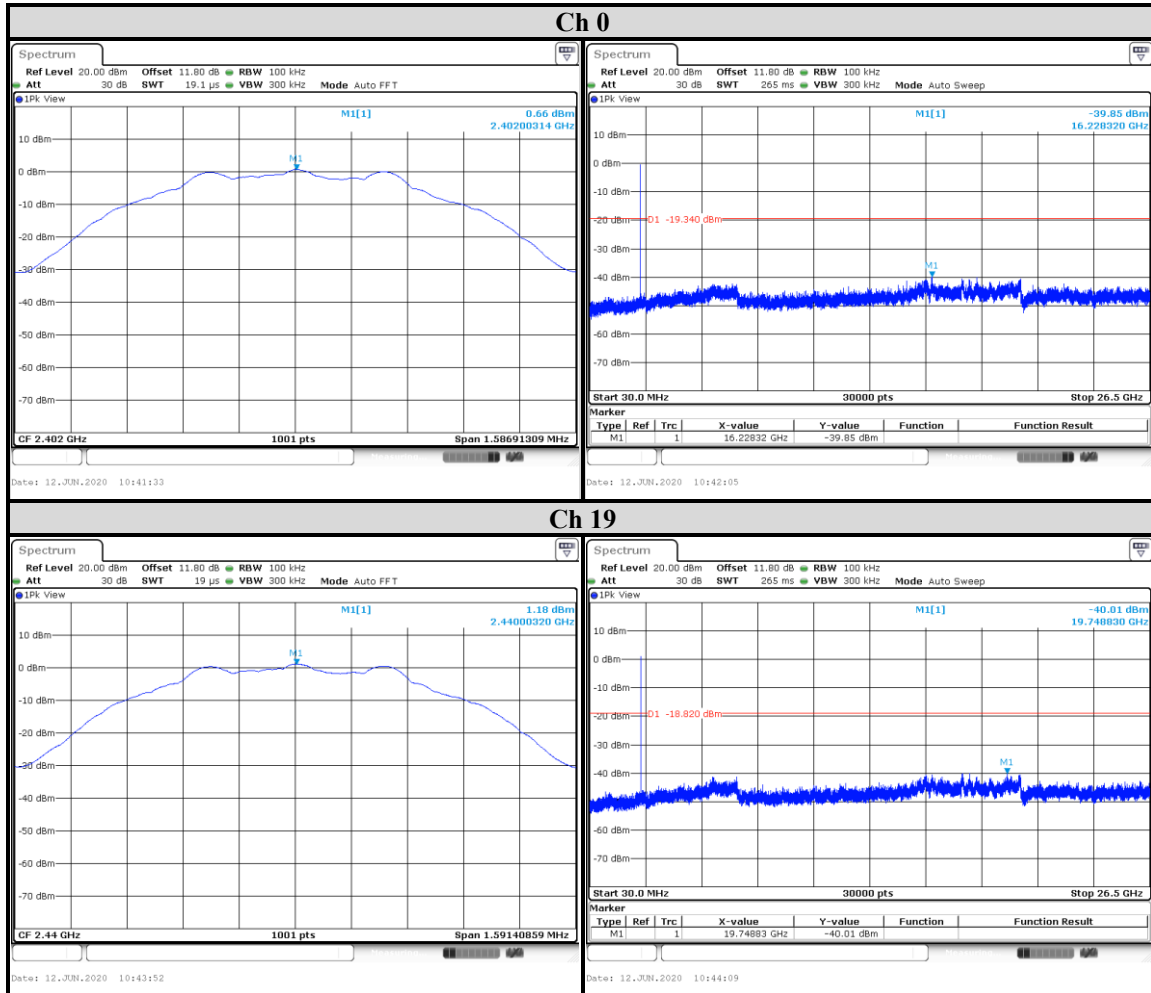
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Test Data



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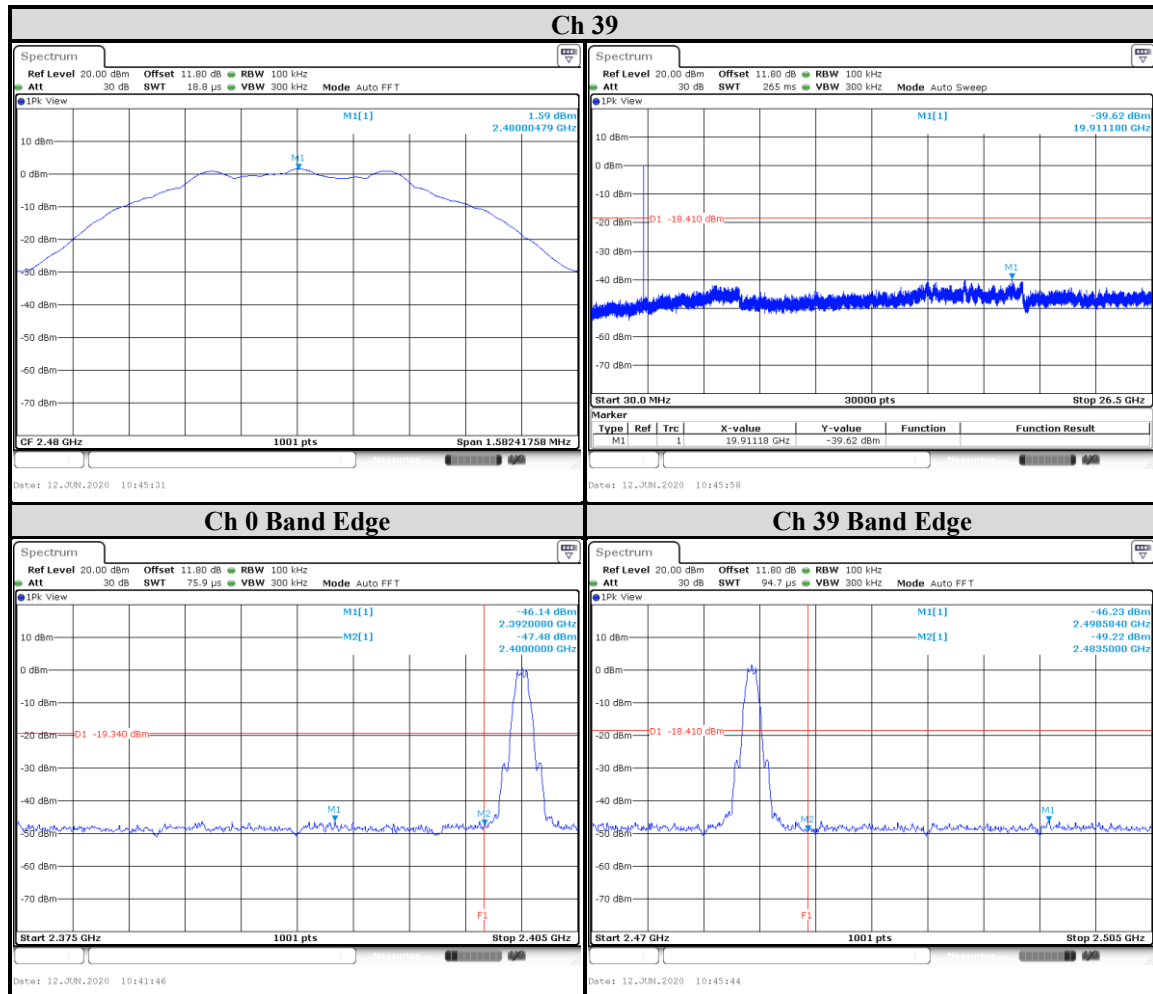
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9.5. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

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Doc No: 17-EM-F0876 / 5.0



Test Procedures

[For 9 kHz ~ 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

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Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.

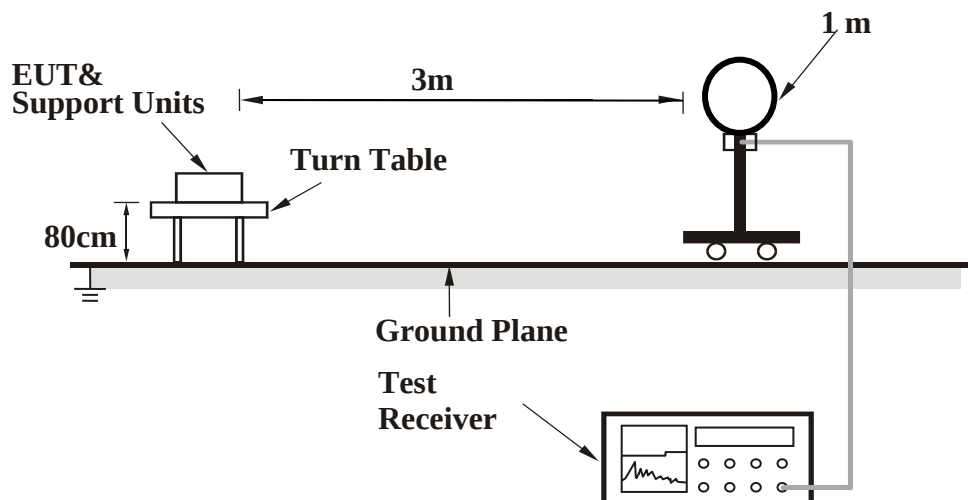
Configuration	Average	
	RBW	VBW
Bluetooth LE	1MHz	3 kHz

Note: Refer to section 6.6 for duty cycle.

- All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported.

Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



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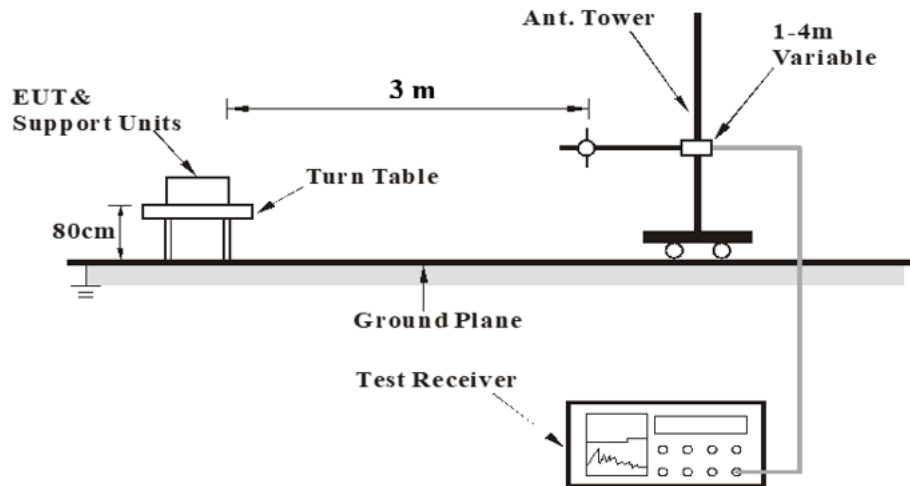
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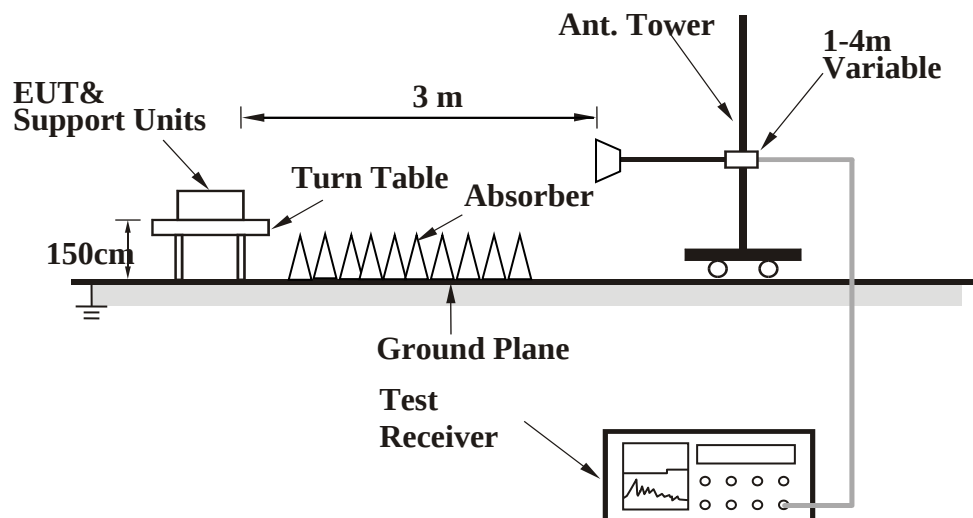
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<Frequency Range 30 MHz ~ 1 GHz >



<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.



Test Data

Above 1GHz Data

Dipole Antenna

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2388.8	45.22	6.73	51.95	74	-22.05	Peak
@	2402	83.28	6.73	90.01	-	-	Peak
-	2380	32.65	6.73	39.38	54	-14.62	Average
@	2402	80.07	6.73	86.8	-	-	Average
*	4804	41.7	3.47	45.17	74	-28.83	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2331	44.98	6.74	51.72	74	-22.28	Peak
@	2402	96.99	6.73	103.72	-	-	Peak
-	2373	32.64	6.73	39.37	54	-14.63	Average
@	2402	93	6.73	99.73	-	-	Average
*	4804	44.89	3.47	48.36	74	-25.64	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2375.8	45.56	6.74	52.3	74	-21.7	Peak
@	2440	84.17	6.57	90.74	-	-	Peak
-	2491.4	46.17	6.53	52.7	74	-21.3	Peak
-	2378.8	32.61	6.73	39.34	54	-14.66	Average
@	2440	77.73	6.57	84.3	-	-	Average
-	2494.6	32.93	6.53	39.46	54	-14.54	Average
*	4880	43.68	3.64	47.32	74	-26.68	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2342	45.58	6.74	52.32	74	-21.68	Peak
@	2440	97.29	6.57	103.86	-	-	Peak
-	2498.4	45.44	6.53	51.97	74	-22.03	Peak
-	2360.2	32.62	6.73	39.35	54	-14.65	Average
@	2440	93.27	6.57	99.84	-	-	Average
-	2501.6	33.06	6.53	39.59	54	-14.41	Average
*	4880	43.35	3.64	46.99	74	-27.01	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2480	83.42	6.53	89.95	-	-	Peak
-	2490.8	45.82	6.53	52.35	74	-21.65	Peak
@	2480	76.86	6.53	83.39	-	-	Average
-	2508.8	32.91	6.57	39.48	54	-14.52	Average
*	4960	44.6	3.75	48.35	74	-25.65	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2480	97.39	6.53	103.92	-	-	Peak
-	2484	52.15	6.53	58.68	74	-15.32	Peak
@	2480	93.06	6.53	99.59	-	-	Average
-	2483.6	33.49	6.53	40.02	54	-13.98	Average
*	4960	43.69	3.75	47.44	74	-26.56	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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PIFA Antenna

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2388	45.76	6.73	52.49	74	-21.51	Peak
@	2402	82.81	6.73	89.54	-	-	Peak
-	2378	32.96	6.73	39.69	54	-14.31	Average
@	2402	74.65	6.73	81.38	-	-	Average
*	4804	42.26	3.47	45.73	74	-28.27	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2382.8	45.2	6.73	51.93	74	-22.07	Peak
@	2402	90.02	6.73	96.75	-	-	Peak
-	2359.8	32.66	6.73	39.39	54	-14.61	Average
@	2402	86.62	6.73	93.35	-	-	Average
*	4804	44.51	3.47	47.98	74	-26.02	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2366.8	45.96	6.74	52.7	74	-21.3	Peak
@	2440	83.29	6.57	89.86	-	-	Peak
-	2509.6	46.53	6.57	53.1	74	-20.9	Peak
-	2385.8	32.61	6.74	39.35	54	-14.65	Average
@	2440	78.88	6.57	85.45	-	-	Average
-	2504.2	33.23	6.55	39.78	54	-14.22	Average
*	4880	42.55	3.64	46.19	74	-27.81	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2353.2	46.4	6.73	53.13	74	-20.87	Peak
@	2440	90.12	6.57	96.69	-	-	Peak
-	2499.8	45.94	6.53	52.47	74	-21.53	Peak
-	2359.4	32.74	6.73	39.47	54	-14.53	Average
@	2440	86.55	6.57	93.12	-	-	Average
-	2498.8	33.19	6.53	39.72	54	-14.28	Average
*	4880	43.96	3.64	47.6	74	-26.4	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2480	80.88	6.53	87.41	-	-	Peak
-	2492.8	45.52	6.53	52.05	74	-21.95	Peak
@	2480	77.73	6.53	84.26	-	-	Average
-	2507.4	33.2	6.55	39.75	54	-14.25	Average
*	4960	40.38	3.75	44.13	74	-29.87	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2480	91.21	6.53	97.74	-	-	Peak
-	2483.8	48.01	6.53	54.54	74	-19.46	Peak
@	2480	87.58	6.53	94.11	-	-	Average
-	2495	33.25	6.53	39.78	54	-14.22	Average
*	4960	43.72	3.75	47.47	74	-26.53	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

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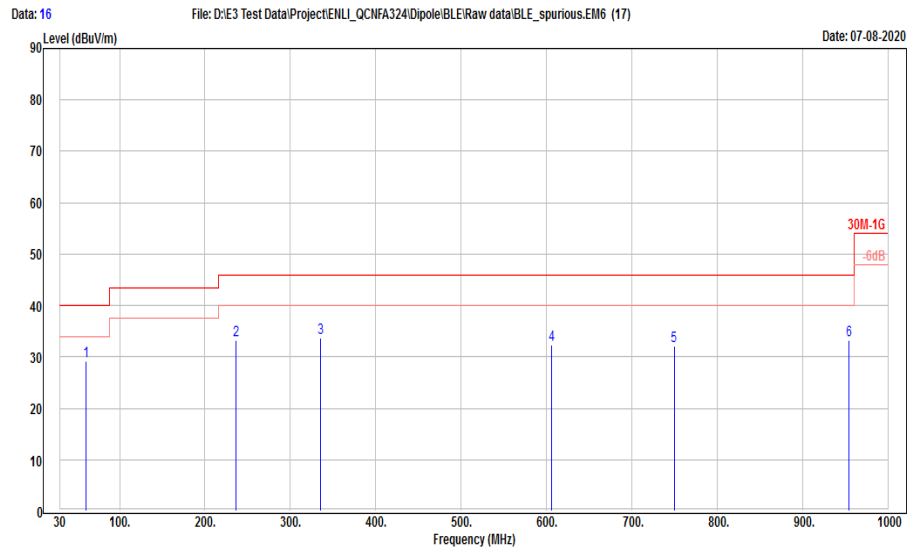


30 MHz ~ 1 GHz Data

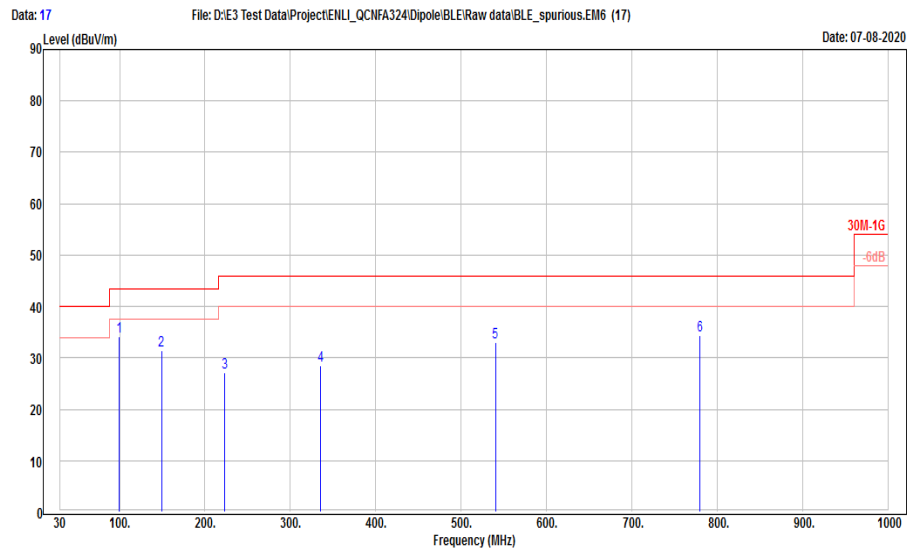
Dipole Antenna

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	30 MHz ~ 1 GHz

Horizontal



Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	61.04	41.31	-12.12	29.19	40	-10.81	Peak
-	236.61	45.47	-12.12	33.35	46	-12.65	Peak
-	335.55	42.74	-8.95	33.79	46	-12.21	Peak
-	606.18	34.47	-2.22	32.25	46	-13.75	Peak
-	749.74	31.33	0.73	32.06	46	-13.94	Peak
-	954.41	29.25	4.08	33.33	46	-12.67	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	99.84	50.47	-16.23	34.24	43.5	-9.26	Peak
-	149.31	43.03	-11.64	31.39	43.5	-12.11	Peak
-	223.03	40.36	-13.33	27.03	46	-18.97	Peak
-	335.55	37.55	-8.95	28.6	46	-17.4	Peak
-	540.22	36.36	-3.27	33.09	46	-12.91	Peak
-	779.81	33.49	0.87	34.36	46	-11.64	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamplifier Factor (dB).
4. The peak result complies with QP limit, QP result is deemed to comply with QP limit.
5. The other emission levels were very low against the limit.

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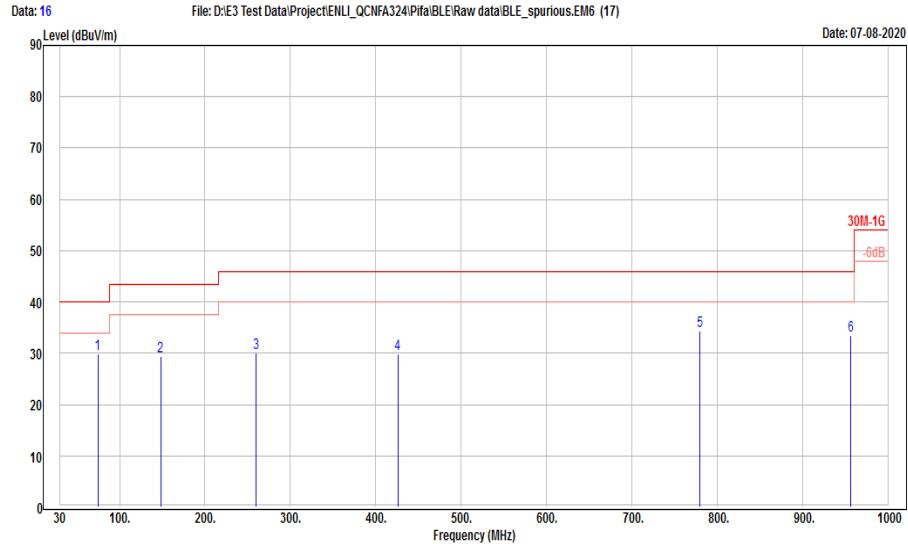
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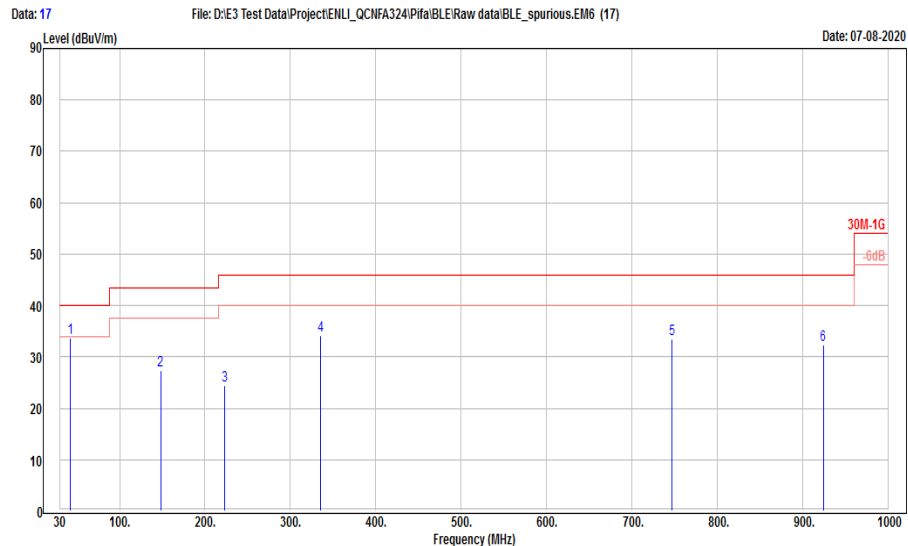
PIFA Antenna

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	30 MHz ~ 1 GHz

Horizontal



Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	74.62	45.06	-15.13	29.93	40	-10.07	Peak
-	148.34	41.05	-11.68	29.37	43.5	-14.13	Peak
-	259.89	41.67	-11.48	30.19	46	-15.81	Peak
-	425.76	36.15	-6.35	29.8	46	-16.2	Peak
-	779.81	33.5	0.87	34.37	46	-11.63	Peak
-	956.35	29.34	4.1	33.44	46	-12.56	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	42.61	45.44	-11.75	33.69	40	-6.31	Peak
-	148.34	38.95	-11.68	27.27	43.5	-16.23	Peak
-	223.03	37.81	-13.33	24.48	46	-21.52	Peak
-	335.55	43.08	-8.95	34.13	46	-11.87	Peak
-	746.83	32.7	0.66	33.36	46	-12.64	Peak
-	924.34	28.95	3.3	32.25	46	-13.75	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The peak result complies with QP limit, QP result is deemed to comply with QP limit.
5. The other emission levels were very low against the limit.

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9.6. AC Power Line Conducted Emission

Requirements

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

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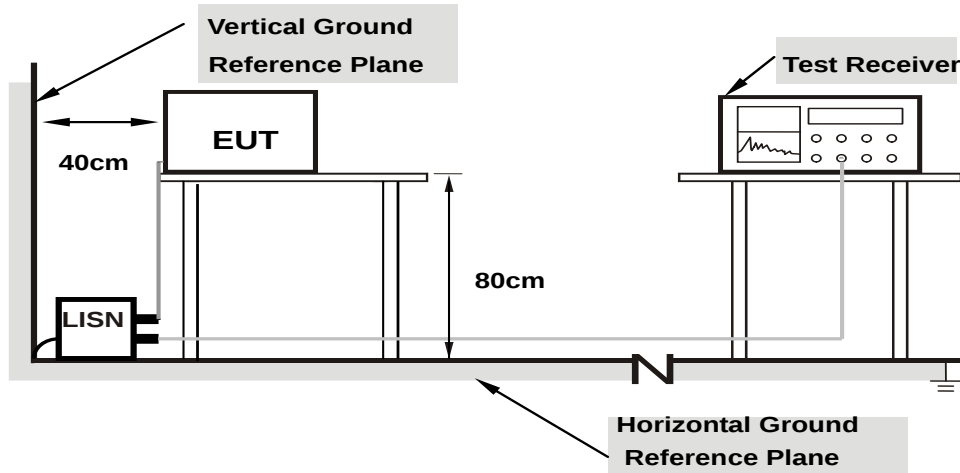
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Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the Setup Configurations.

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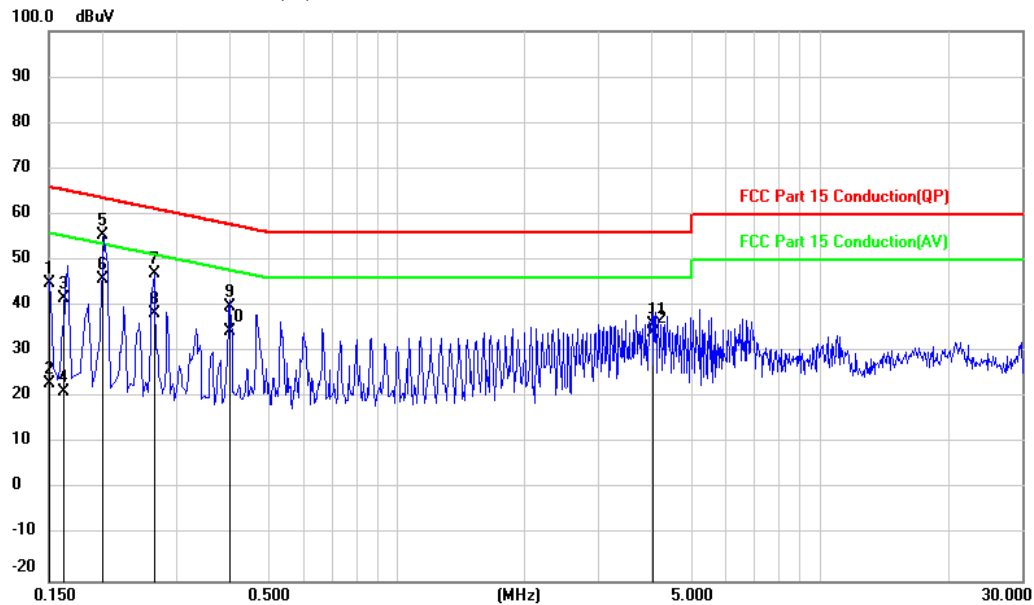
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Test Data

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	150 kHz ~ 30 MHz

Phase of Power : Line (L)



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No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	
1	0.1500	25.49	19.47	44.96	66.00	-21.04	QP
2	0.1500	3.71	19.47	23.18	56.00	-32.82	AVG
3	0.1621	22.28	19.47	41.75	65.36	-23.61	QP
4	0.1621	1.68	19.47	21.15	55.36	-34.21	AVG
5	0.2004	36.05	19.46	55.51	63.59	-8.08	QP
6	0.2004	26.25	19.46	45.71	53.59	-7.88	AVG
7	0.2675	27.49	19.47	46.96	61.20	-14.24	QP
8	0.2675	18.91	19.47	38.38	51.20	-12.82	AVG
9	0.4001	20.26	19.47	39.73	57.85	-18.12	QP
10	0.4001	14.92	19.47	34.39	47.85	-13.46	AVG
11	4.0114	16.40	19.59	35.99	56.00	-20.01	QP
12	4.0114	14.45	19.59	34.04	46.00	-11.96	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB)
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV)
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB)
4. The other emission levels were very low against the limit.

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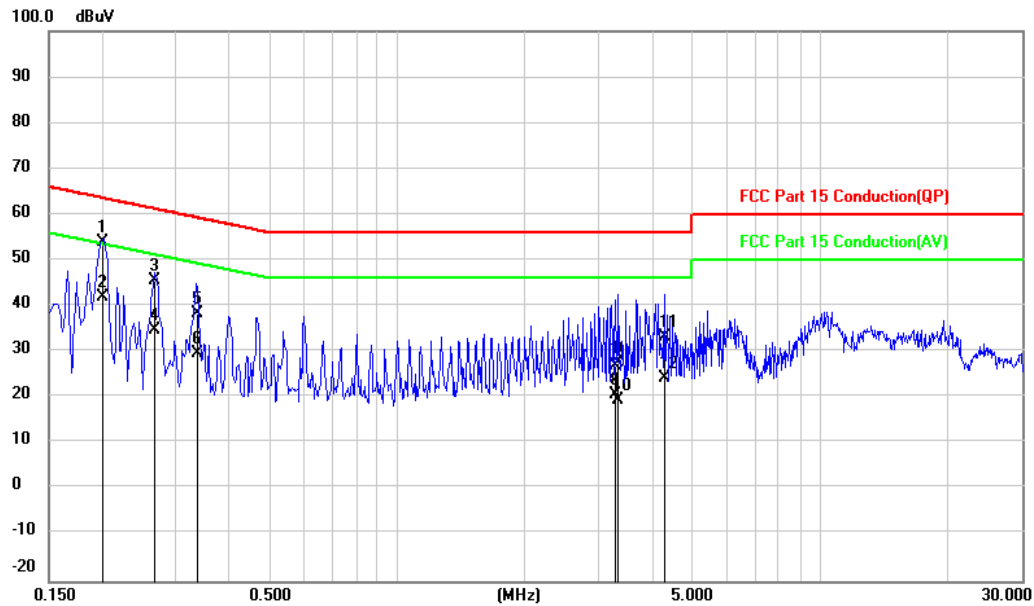
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Phase of Power : Neutral (N)



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No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	
1	0.2004	34.36	19.47	53.83	63.59	-9.76	QP
2	0.2004	22.63	19.47	42.10	53.59	-11.49	AVG
3	0.2676	26.04	19.48	45.52	61.19	-15.67	QP
4	0.2676	15.42	19.48	34.90	51.19	-16.29	AVG
5	0.3358	18.99	19.48	38.47	59.31	-20.84	QP
6	0.3358	10.31	19.48	29.79	49.31	-19.52	AVG
7	3.2784	7.43	19.57	27.00	56.00	-29.00	QP
8	3.2784	0.98	19.57	20.55	46.00	-25.45	AVG
9	3.3454	7.96	19.58	27.54	56.00	-28.46	QP
10	3.3454	-0.13	19.58	19.45	46.00	-26.55	AVG
11	4.2824	13.63	19.60	33.23	56.00	-22.77	QP
12	4.2824	4.75	19.60	24.35	46.00	-21.65	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB)
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV)
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB)
4. The other emission levels were very low against the limit.

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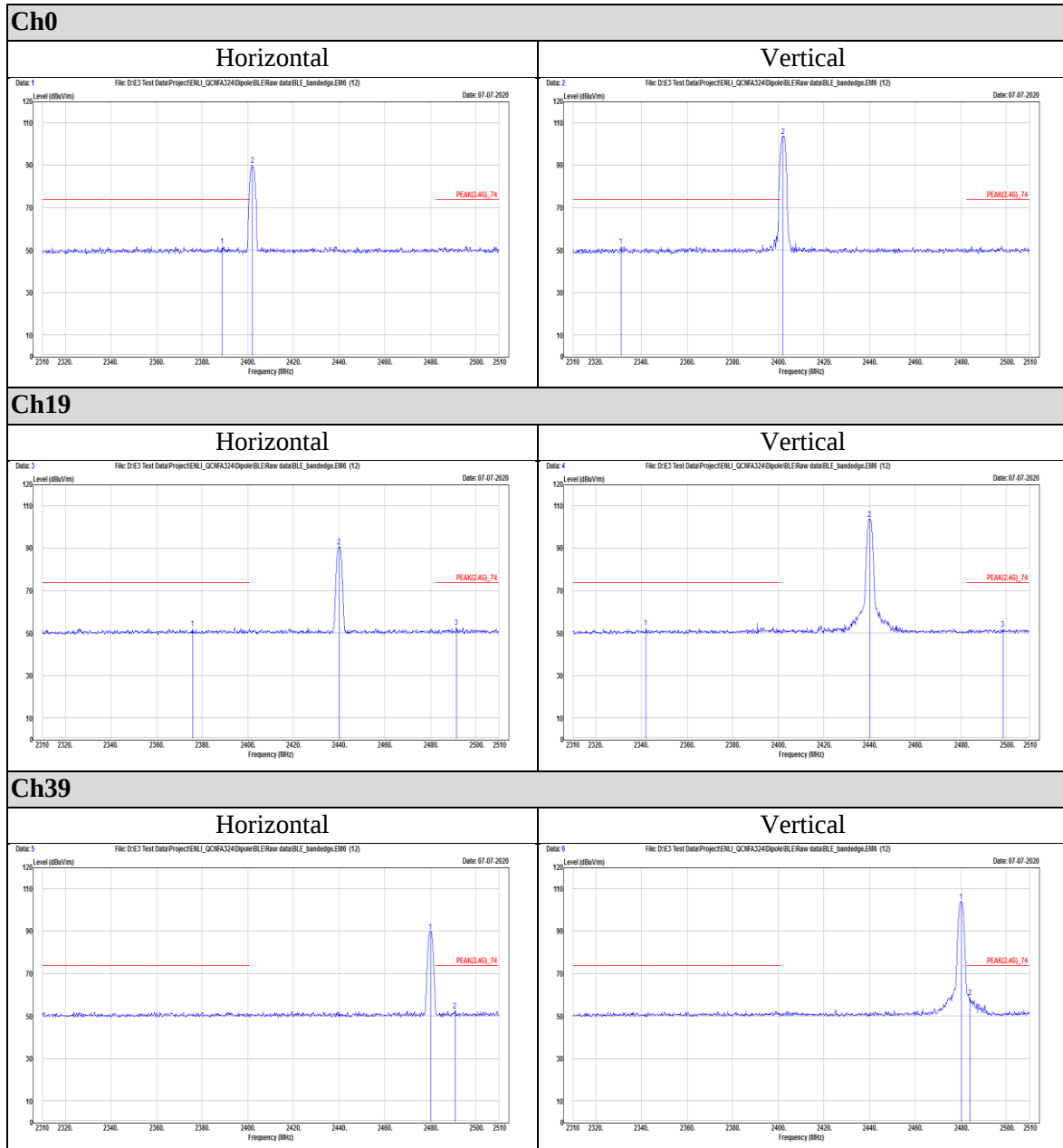
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Appendix I Radiated Band Edge Measurement

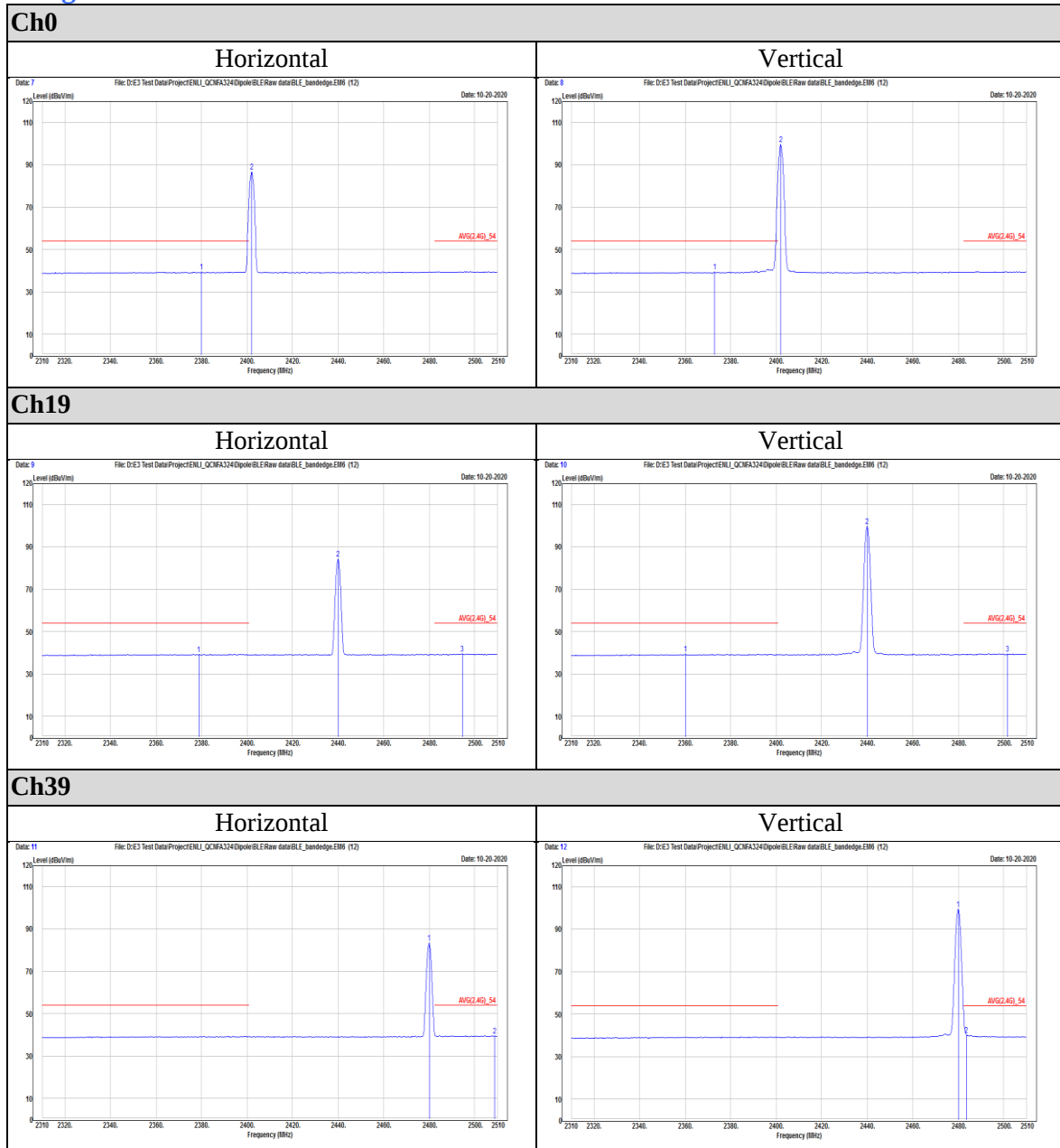
Dipole Antenna

Peak





Average



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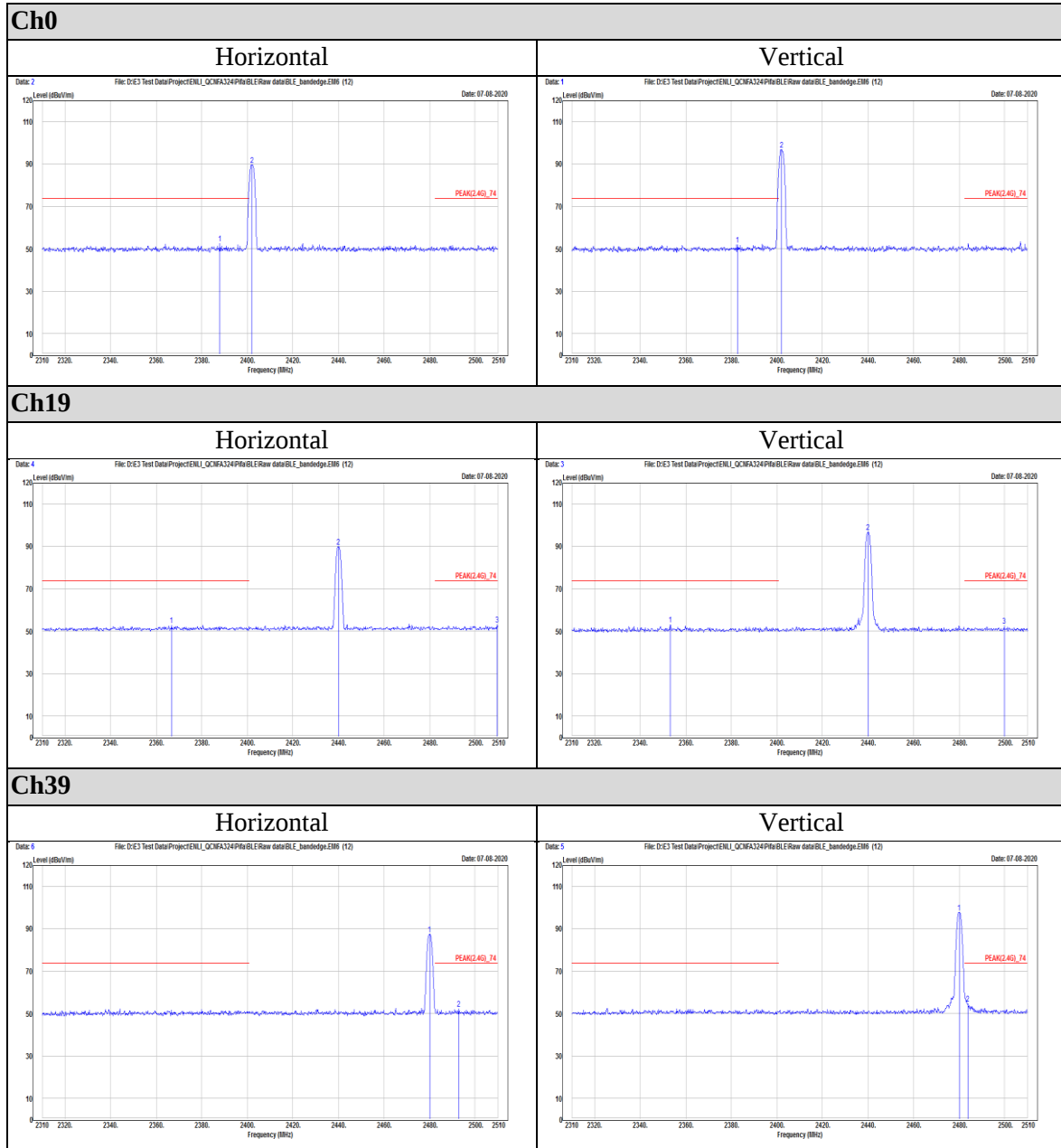
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PIFA Antenna

Peak



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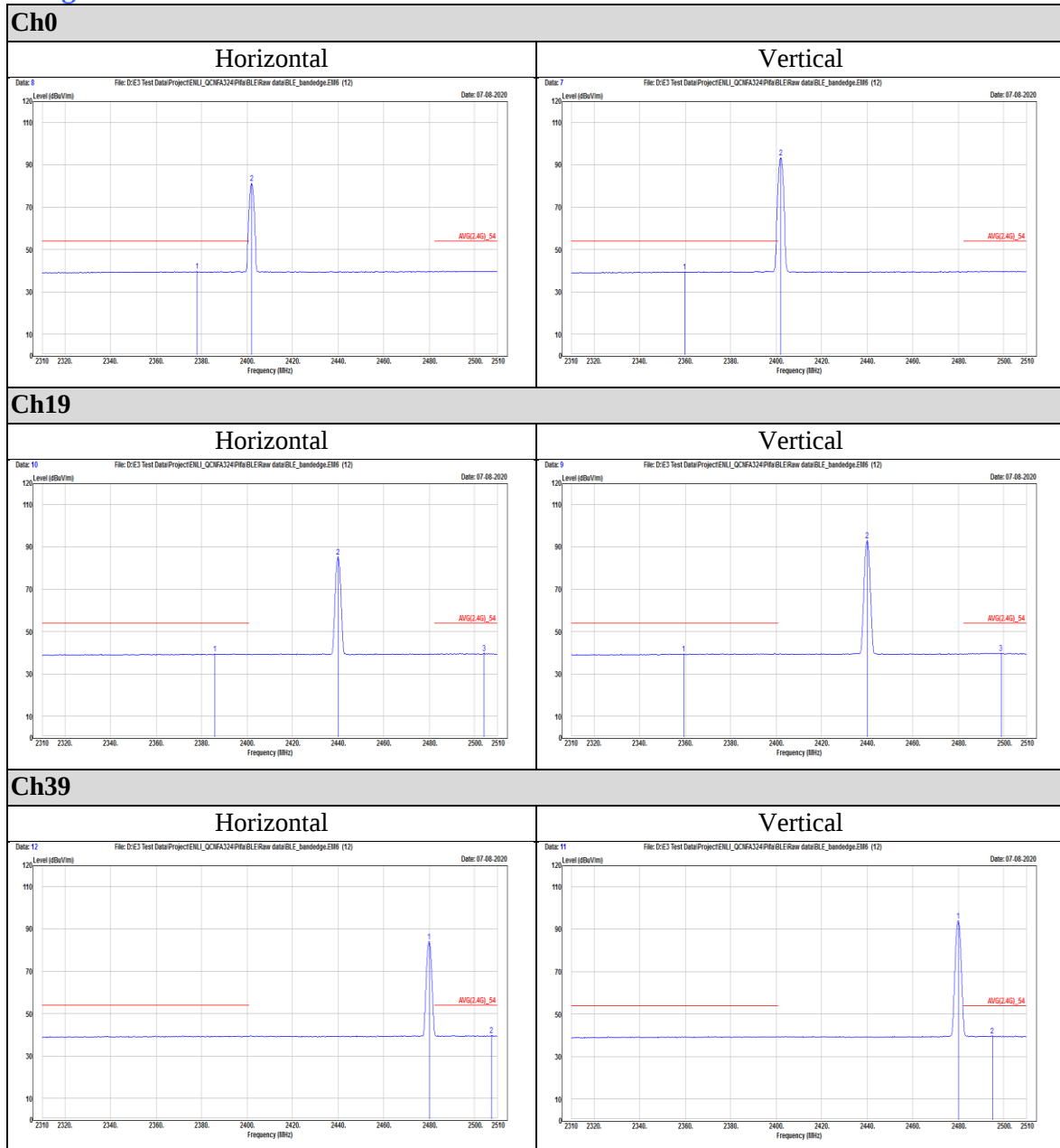
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Average



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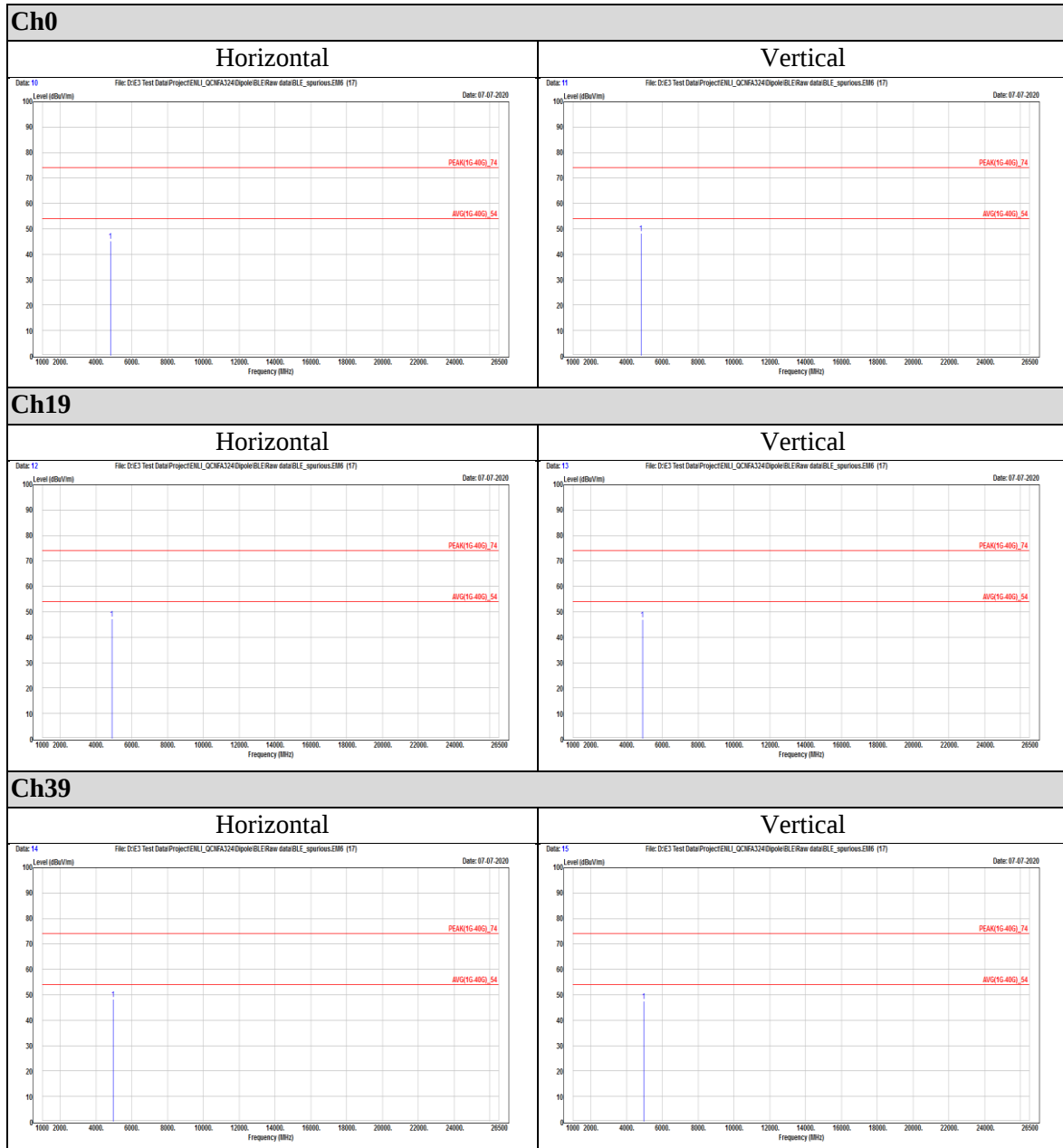
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Appendix II Radiated Spurious Emission Measurement

Dipole Antenna





PIFA Antenna

