



# Tx. Spurious Bluetooth LE(1M)2480MHz Ref

#### Tx. Spurious Bluetooth LE(1M)2480MHz Emission







# Tx. Spurious Bluetooth LE(2M) 2402MHz Ref









## Tx. Spurious Bluetooth LE(2M) 2440MHz Ref

Tx. Spurious Bluetooth LE(2M) 2440MHz Emission







#### Tx. Spurious Bluetooth LE(2M) 2480MHz Ref









## Tx. Spurious Bluetooth LE(S=2) 2402MHz Ref

## Tx. Spurious Bluetooth LE(S=2) 2402MHz Emission







### Tx. Spurious Bluetooth LE(S=2) 2440MHz Ref

#### Tx. Spurious Bluetooth LE(S=2) 2440MHz Emission







#### Tx. Spurious Bluetooth LE(S=2) 2480MHz Ref

#### Tx. Spurious Bluetooth LE(S=2) 2480MHz Emission







### Tx. Spurious Bluetooth LE(S=8) 2402MHz Ref

#### Tx. Spurious Bluetooth LE(S=8) 2402MHz Emission







#### Tx. Spurious Bluetooth LE(S=8) 2440MHz Ref

#### Tx. Spurious Bluetooth LE(S=8) 2440MHz Emission







#### Tx. Spurious Bluetooth LE(S=8) 2480MHz Ref

#### Tx. Spurious Bluetooth LE(S=8) 2480MHz Emission



# 5.6. Unwanted Emission

#### **Ambient Condition**

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

#### Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the Restricted Band and the emissions less than 20 dB below the permissible value are reported.

The radiated emissions measurements were made in a typical installation configuration.

Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

This method refer to ANSI C63.10. The procedure for peak unwanted emissions measurements above 1000 MHz is as follows: Set the spectrum analyzer in the following: 9kHz~150 kHz RBW=200Hz, VBW=1kHz/ Sweep=AUTO 150 kHz~30MHz RBW=9KHz, VBW=30KHz,/ Sweep=AUTO Below 1GHz RBW=100kHz / VBW=300kHz / Sweep=AUTO a) Peak emission levels are measured by setting the instrument as follows: Above 1GHz PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO b) Average emission levels are measured by setting the instrument as follows: Above 1GHz AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO c) Detector: The measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage



averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10  $\log (1 / D)$ ], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

The test is in transmitting mode.



# Test Setup









Above 1GHz



Note: Area side:2.4mX3.6m



#### Limits

Rule Part 15.247(d) specifies that "In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c))."

Limit in restricted band

Frequency of emission (MHz)	Field strength(µV/m)	Field strength(dBµV/m)		
0.009–0.490	2400/F(kHz)	1		
0.490–1.705	24000/F(kHz)	1		
1.705–30.0	30	1		
30-88	100	40		
88-216	150	43.5		
216-960	200	46		
Above960	500	54		

# §15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit. Peak Limit=74 dB $\mu$ V/m

Average Limit=54 dBµV/m



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Report No.: R2308A0966-R1V2

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

#### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

Frequency	Uncertainty				
9KHz-30MHz	3.55 dB				
30MHz-200MHz	4.17 dB				
200MHz-1GHz	4.84 dB				
1-18GHz	4.35 dB				
18-26.5GHz	5.90 dB				
26.5GHz~40GHz	5.92 dB				



#### Test Results:

A symbol (dB V/) in the test plot below means (dBµV/m)





After the pretest, Bluetooth LE (2M) was selected as the worst Mode for Bluetooth LE.





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# **Result of RE**

### **Test result**

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 9kHz-30MHz are more than 20dB below the limit are not reported.

The following graphs display the maximum values of horizontal and vertical by software.

For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

After the pretest, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 2 was selected as the worst SISO antenna.

# Continuous TX mode:

# Wi-Fi 2.4G

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, 802.11n (HT20) CH1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



A symbol ( $^{dB}$  V/) in the test plot below means ( $^{dB}\mu$ V/m)

#### Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
44.752500	20.63	40.00	19.37	100.0	V	356.0	20.3
124.978750	19.62	43.50	23.88	175.0	Н	0.0	15.7
374.996250	24.02	46.00	21.98	175.0	V	148.0	22.4
556.631250	25.70	46.00	20.30	125.0	V	151.0	25.7
624.973750	31.82	46.00	14.18	175.0	Н	300.0	27.0
874.991250	44.50	46.00	1.50	110.0	Н	290.0	29.9

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit – Quasi-Peak



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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1125.000000		44.27	54.00	9.73	500.0	200.0	V	189.0	4.0
1125.000000	49.77		74.00	24.23	500.0	200.0	V	189.0	4.0
1249.750000		45.61	54.00	8.39	500.0	200.0	Н	265.0	4.8
1249.750000	49.98		74.00	24.02	500.0	200.0	Н	265.0	4.8
1449.500000	46.75		74.00	27.25	500.0	100.0	Н	173.0	5.9
1454.750000		35.24	54.00	18.76	500.0	200.0	V	91.0	6.0
1746.250000	48.72		74.00	25.28	500.0	200.0	V	166.0	7.3
1750.250000		36.31	54.00	17.69	500.0	200.0	V	86.0	7.4
2129.500000	48.31		74.00	25.69	500.0	100.0	V	307.0	9.1
2130.000000		36.98	54.00	17.02	500.0	200.0	V	292.0	9.1
2750.250000		40.61	54.00	13.39	500.0	200.0	V	175.0	10.9
2755.750000	48.76		74.00	25.24	500.0	200.0	V	53.0	10.9

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average





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**RF Test Report** 







Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1125.000000		44.13	54.00	9.87	500.0	200.0	V	197.0	4.0
1125.000000	48.95		74.00	25.05	500.0	200.0	V	197.0	4.0
1250.000000		45.58	54.00	8.42	500.0	200.0	Н	264.0	4.8
1250.000000	50.23		74.00	23.77	500.0	200.0	Н	264.0	4.8
1478.000000		35.47	54.00	18.53	500.0	100.0	V	276.0	6.3
1478.250000	47.00		74.00	27.00	500.0	200.0	V	188.0	6.3
1745.250000	46.91		74.00	27.09	500.0	200.0	V	4.0	7.3
1746.000000		36.23	54.00	17.77	500.0	100.0	Н	77.0	7.3
1998.250000	47.35		74.00	26.65	500.0	200.0	Н	319.0	8.6
1998.250000		36.64	54.00	17.36	500.0	100.0	Н	68.0	8.6
2749.750000	49.66		74.00	24.34	500.0	100.0	V	180.0	10.9
2750.250000		40.89	54.00	13.11	500.0	200.0	V	174.0	10.9

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



802.11b CH11

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**RF Test Report** 







Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1124.750000	49.22		74.00	24.78	500.0	200.0	Н	284.0	4.0
1125.000000		43.78	54.00	10.22	500.0	200.0	V	169.0	4.0
1249.750000	50.35		74.00	23.65	500.0	100.0	Н	268.0	4.8
1250.000000		45.72	54.00	8.28	500.0	100.0	Н	263.0	4.8
1424.500000		34.63	54.00	19.37	500.0	200.0	V	348.0	5.9
1426.750000	46.02		74.00	27.98	500.0	100.0	V	279.0	5.9
1660.500000		36.46	54.00	17.54	500.0	100.0	V	196.0	7.0
1661.000000	47.06		74.00	26.94	500.0	200.0	V	239.0	7.0
1993.000000	50.45		74.00	23.55	500.0	200.0	V	132.0	8.6
1995.000000		37.84	54.00	16.16	500.0	200.0	V	132.0	8.6
2750.000000		41.24	54.00	12.76	500.0	200.0	V	159.0	10.9
2750.500000	49.43		74.00	24.57	500.0	200.0	V	169.0	10.9

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average





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**RF Test Report** 







Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1073.250000	46.09		74.00	27.91	500.0	100.0	Н	250.0	3.7
1124.750000		35.88	54.00	18.12	500.0	200.0	V	347.0	4.0
1250.000000		40.42	54.00	13.58	500.0	200.0	V	338.0	4.8
1254.000000	47.76		74.00	26.24	500.0	200.0	Н	97.0	4.9
1396.000000	48.65		74.00	25.35	500.0	100.0	Н	62.0	5.7
1397.500000		36.82	54.00	17.18	500.0	100.0	Н	57.0	5.7
1640.750000	48.22		74.00	25.78	500.0	200.0	V	312.0	7.0
1710.000000		36.03	54.00	17.97	500.0	200.0	Н	28.0	7.5
1982.500000		37.17	54.00	16.83	500.0	200.0	V	347.0	8.7
1988.250000	48.10		74.00	25.90	500.0	200.0	V	295.0	8.7
2750.000000		40.14	54.00	13.86	500.0	200.0	V	0.0	10.9
2962.000000	50.54		74.00	23.46	500.0	100.0	н	296.0	11.8

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

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**RF Test Report** 





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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1124.750000		44.10	54.00	9.90	500.0	200.0	V	193.0	4.0
1125.000000	50.20		74.00	23.80	500.0	200.0	V	198.0	4.0
1250.000000		45.54	54.00	8.46	500.0	100.0	н	271.0	4.8
1250.000000	50.66		74.00	23.34	500.0	100.0	н	271.0	4.8
1396.250000		35.98	54.00	18.02	500.0	200.0	V	169.0	5.7
1397.250000	48.62		74.00	25.38	500.0	100.0	Н	261.0	5.7
1594.500000	49.51		74.00	24.49	500.0	100.0	н	304.0	6.8
1598.250000		38.01	54.00	15.99	500.0	100.0	н	309.0	6.7
1994.000000	54.73		74.00	19.27	500.0	200.0	V	184.0	8.6
2067.750000		37.30	54.00	16.70	500.0	100.0	Н	318.0	8.8
2727.000000	51.89		74.00	22.11	500.0	200.0	Н	49.0	10.4
2750.250000		41.71	54.00	12.29	500.0	200.0	V	165.0	10.9

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1054.500000	45.88		74.00	28.12	500.0	100.0	V	140.0	3.6
1057.500000		33.85	54.00	20.15	500.0	200.0	V	241.0	3.6
1249.500000	47.02		74.00	26.98	500.0	200.0	V	321.0	4.8
1250.000000		40.15	54.00	13.85	500.0	200.0	V	330.0	4.8
1395.250000	49.40		74.00	24.60	500.0	100.0	Н	58.0	5.6
1396.000000		36.88	54.00	17.12	500.0	100.0	Н	80.0	5.7
1633.250000		36.11	54.00	17.89	500.0	200.0	V	149.0	7.0
1655.250000	47.50		74.00	26.50	500.0	100.0	Н	271.0	7.0
2042.500000	48.69		74.00	25.31	500.0	200.0	V	352.0	8.9
2045.500000		37.08	54.00	16.92	500.0	200.0	Н	120.0	8.9
2750.000000		39.85	54.00	14.15	500.0	200.0	V	1.0	10.9
2947.750000	51.06		74.00	22.94	500.0	200.0	Н	0.0	11.8

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



RF Test Report 802.11n (HT20) CH1

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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1125.000000		44.44	54.00	9.56	500.0	200.0	Н	286.0	4.0
1125.000000	50.17		74.00	23.83	500.0	200.0	V	43.0	4.0
1250.000000		46.01	54.00	7.99	500.0	200.0	Н	266.0	4.8
1250.000000	50.56		74.00	23.44	500.0	100.0	Н	264.0	4.8
1399.250000		37.32	54.00	16.68	500.0	200.0	V	186.0	5.7
1400.000000	48.23		74.00	25.77	500.0	200.0	V	68.0	5.7
1591.750000	50.05		74.00	23.95	500.0	200.0	V	16.0	6.7
1597.250000		38.98	54.00	15.02	500.0	200.0	V	243.0	6.8
1985.500000	50.59		74.00	23.41	500.0	200.0	V	20.0	8.7
1986.750000		40.10	54.00	13.90	500.0	200.0	V	243.0	8.7
2749.250000	54.05		74.00	19.95	500.0	200.0	V	177.0	10.9
2749.750000		43.32	54.00	10.68	500.0	200.0	V	63.0	10.9

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

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**RF Test Report** 



RF Test Report 802.11n (HT20) CH6

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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1125.000000		42.33	54.00	11.67	500.0	200.0	V	54.0	4.0
1125.000000	48.55		74.00	25.45	500.0	200.0	V	54.0	4.0
1249.500000	50.52		74.00	23.48	500.0	200.0	V	282.0	4.8
1250.000000		45.13	54.00	8.87	500.0	200.0	V	316.0	4.8
1460.250000	49.46		74.00	24.54	500.0	200.0	V	109.0	6.1
1460.750000		37.65	54.00	16.35	500.0	200.0	V	119.0	6.1
1693.750000	49.90		74.00	24.10	500.0	200.0	V	22.0	7.4
1694.250000		38.68	54.00	15.32	500.0	200.0	V	0.0	7.4
1986.500000		40.29	54.00	13.71	500.0	200.0	V	54.0	8.7
1998.500000	53.01		74.00	20.99	500.0	100.0	V	239.0	8.6
2945.000000	53.75		74.00	20.25	500.0	200.0	V	31.0	11.8
2953.250000		43.07	54.00	10.93	500.0	200.0	V	244.0	11.8

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



RF Test Report 802.11n (HT20) CH11

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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1124.500000	45.79		74.00	28.21	500.0	200.0	V	22.0	4.0
1124.750000		38.10	54.00	15.90	500.0	200.0	V	303.0	4.0
1307.750000		34.64	54.00	19.36	500.0	200.0	Н	304.0	5.2
1317.000000	45.38		74.00	28.62	500.0	200.0	Н	358.0	5.2
1532.000000	46.59		74.00	27.41	500.0	200.0	V	8.0	6.5
1543.750000		35.59	54.00	18.41	500.0	200.0	V	60.0	6.5
1818.250000	47.08		74.00	26.92	500.0	200.0	V	115.0	7.8
1825.000000		36.19	54.00	17.81	500.0	100.0	V	32.0	7.7
2138.500000	48.05		74.00	25.95	500.0	200.0	Н	321.0	9.0
2140.250000		37.13	54.00	16.87	500.0	200.0	V	134.0	9.0
2781.750000	48.99		74.00	25.01	500.0	100.0	Н	173.0	10.9
2782.000000		37.27	54.00	16.73	500.0	200.0	Н	75.0	10.9

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



802.11ax HE20 CH 1

**RF Test Report** 

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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1125.000000		38.22	54.00	15.78	500.0	200.0	V	314.0	4.0
1125.250000	46.99		74.00	27.01	500.0	200.0	V	304.0	4.0
1308.000000	45.69		74.00	28.31	500.0	100.0	V	95.0	5.2
1314.000000		34.15	54.00	19.85	500.0	200.0	V	95.0	5.2
1503.250000	46.19		74.00	27.81	500.0	100.0	Н	351.0	6.4
1512.750000		34.88	54.00	19.12	500.0	100.0	Н	155.0	6.3
1706.500000		35.77	54.00	18.23	500.0	200.0	V	90.0	7.4
1711.000000	47.70		74.00	26.30	500.0	200.0	Н	334.0	7.5
1996.500000	48.76		74.00	25.24	500.0	100.0	V	264.0	8.6
1997.500000		36.29	54.00	17.71	500.0	100.0	V	294.0	8.6
2937.500000	50.75		74.00	23.25	500.0	200.0	V	0.0	11.7
2950.250000		38.91	54.00	15.09	500.0	200.0	V	0.0	11.8

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



802.11ax HE20 CH 6

**RF Test Report** 

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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1125.000000		38.60	54.00	15.40	500.0	200.0	V	189.0	4.0
1126.250000	45.90		74.00	28.10	500.0	200.0	V	43.0	4.0
1334.750000	45.87		74.00	28.13	500.0	200.0	V	0.0	5.4
1342.500000		34.88	54.00	19.12	500.0	200.0	Н	4.0	5.4
1554.750000	46.18		74.00	27.82	500.0	100.0	Н	149.0	6.5
1557.000000		34.96	54.00	19.04	500.0	200.0	V	38.0	6.5
1827.250000	47.30		74.00	26.70	500.0	200.0	Н	83.0	7.7
1836.250000		35.65	54.00	18.35	500.0	200.0	V	163.0	7.7
2159.750000	48.47		74.00	25.53	500.0	200.0	V	34.0	8.9
2167.750000		36.25	54.00	17.75	500.0	200.0	V	63.0	9.0
2808.000000		38.18	54.00	15.82	500.0	200.0	Н	357.0	11.1
2813.750000	50.62		74.00	23.38	500.0	200.0	Н	184.0	11.1

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

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**RF Test Report** 



802.11ax HE20 CH11

**RF Test Report** 

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Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1124.750000		38.24	54.00	15.76	500.0	200.0	V	314.0	4.0
1124.750000	46.20		74.00	27.80	500.0	200.0	V	314.0	4.0
1356.750000	45.10		74.00	28.90	500.0	200.0	Н	213.0	5.4
1363.000000		34.96	54.00	19.04	500.0	200.0	V	77.0	5.5
1592.250000	46.54		74.00	27.46	500.0	100.0	V	338.0	6.7
1597.750000		35.64	54.00	18.36	500.0	200.0	V	258.0	6.7
1903.000000	47.18		74.00	26.82	500.0	200.0	V	119.0	8.0
1903.750000		35.93	54.00	18.07	500.0	200.0	V	196.0	8.0
2246.750000	48.53		74.00	25.47	500.0	200.0	V	124.0	9.5
2247.250000		37.02	54.00	16.98	500.0	200.0	V	144.0	9.5
2744.500000	49.47		74.00	24.53	500.0	100.0	V	300.0	10.9
2750.000000		38.46	54.00	15.54	500.0	200.0	V	0.0	10.9

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

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**RF Test Report** 



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#### Report No.: R2308A0966-R1V2

During the test, the Radiates Emission from 18GHz to 26.5GHz was performed in all modes with all channels, 802.11n (HT20) CH1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



Radiates	Emission	from	18GHz to	26.5GHz
1 10 010100				

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18175.312500	48.42		74.00	25.58	500.0	200.0	V	68.0	-5.7
18731.000000		36.80	54.00	17.20	500.0	200.0	V	347.0	-5.5
19481.125000	48.39		74.00	25.61	500.0	200.0	V	253.0	-5.3
19504.500000		37.16	54.00	16.84	500.0	200.0	V	263.0	-5.3
20820.937500		36.19	54.00	17.81	500.0	200.0	V	352.0	-5.1
20895.312500	48.02		74.00	25.98	500.0	200.0	V	0.0	-5.1
22471.000000		36.94	54.00	17.06	500.0	200.0	V	337.0	-3.9
22515.625000	49.26		74.00	24.74	500.0	200.0	Н	34.0	-3.9
23752.375000		37.49	54.00	16.51	500.0	200.0	V	316.0	-2.3
24361.187500	49.26		74.00	24.74	500.0	100.0	V	291.0	-3.0
25007.187500	48.70		74.00	25.30	500.0	200.0	V	337.0	-2.5
25771.125000		37.56	54.00	16.44	500.0	200.0	V	306.0	-2.6

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



#### **RF Test Report**

#### Bluetooth LE

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, Bluetooth LE-Channel 19 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

A symbol ( $^{dB}$  V/) in the test plot below means ( $^{dB}\mu$ V/m)



#### Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
60.428750	18.71	40.00	21.29	100.0	V	60.0	19.4
124.978750	29.67	43.50	13.83	175.0	Н	140.0	16.2
249.987500	33.74	46.00	12.26	110.0	Н	162.0	20.5
374.996250	26.10	46.00	19.90	100.0	Н	225.0	22.6
624.973750	31.66	46.00	14.34	175.0	V	0.0	27.6
874.991250	39.99	46.00	6.01	100.0	Н	186.0	30.5

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit – Quasi-Peak



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**Bluetooth LE-Channel 0** 



Note: The signal beyond the limit is carrier. Radiates Emission from 1GHz to 3GHz



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1124.750000	48.06		74.00	25.94	500.0	200.0	Н	339.0	4.0
1125.000000		41.22	54.00	12.78	500.0	200.0	Н	343.0	4.0
1374.500000		37.12	54.00	16.88	500.0	200.0	V	213.0	5.5
1378.750000	46.27		74.00	27.73	500.0	100.0	н	280.0	5.5
1499.750000		40.00	54.00	14.00	500.0	200.0	Н	19.0	6.4
1500.250000	47.71		74.00	26.29	500.0	200.0	V	203.0	6.4
1625.000000	51.64		74.00	22.36	500.0	100.0	V	232.0	6.9
1625.000000		47.85	54.00	6.15	500.0	200.0	н	204.0	6.9
1749.750000	51.38		74.00	22.62	500.0	200.0	Н	189.0	7.4
1750.000000		46.41	54.00	7.59	500.0	200.0	V	173.0	7.4
2749.750000		41.27	54.00	12.73	500.0	200.0	V	199.0	10.9
2750.500000	50.19		74.00	23.81	500.0	200.0	Н	194.0	10.9

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



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### **Bluetooth LE-Channel 19**



Note: The signal beyond the limit is carrier. Radiates Emission from 1GHz to 3GHz



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1124.500000		39.81	54.00	14.19	500.0	200.0	Н	335.0	4.0
1124.750000	48.07		74.00	25.93	500.0	200.0	Н	325.0	4.0
1342.500000	47.44		74.00	26.56	500.0	200.0	Н	125.0	5.4
1375.000000		39.27	54.00	14.73	500.0	200.0	V	205.0	5.5
1624.750000	52.02		74.00	21.98	500.0	200.0	Н	204.0	6.9
1625.000000		48.07	54.00	5.93	500.0	200.0	Н	204.0	6.9
1749.750000	51.55		74.00	22.45	500.0	200.0	V	174.0	7.4
1750.000000		46.55	54.00	7.45	500.0	200.0	V	174.0	7.4
2250.000000		42.36	54.00	11.64	500.0	200.0	V	260.0	9.5
2259.000000	49.44		74.00	24.56	500.0	100.0	V	141.0	9.5
2750.250000		42.39	54.00	11.61	500.0	200.0	V	171.0	10.9
2761.250000	49.46		74.00	24.54	500.0	100.0	Н	295.0	10.9

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**RF Test Report** 

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



TA

## **Bluetooth LE-Channel 39**



Note: The signal beyond the limit is carrier. Radiates Emission from 1GHz to 3GHz



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1125.000000		40.91	54.00	13.09	500.0	200.0	Н	334.0	4.0
1125.250000	47.72		74.00	26.28	500.0	200.0	Н	334.0	4.0
1249.750000		37.86	54.00	16.14	500.0	200.0	V	191.0	4.8
1249.750000	47.43		74.00	26.57	500.0	100.0	Н	43.0	4.8
1499.500000		38.96	54.00	15.04	500.0	200.0	Н	17.0	6.4
1500.000000	47.32		74.00	26.68	500.0	200.0	Н	21.0	6.4
1624.750000	51.75		74.00	22.25	500.0	200.0	Н	200.0	6.9
1625.000000		47.63	54.00	6.37	500.0	200.0	Н	200.0	6.9
1749.750000	51.05		74.00	22.95	500.0	200.0	V	169.0	7.4
1750.000000		46.31	54.00	7.69	500.0	200.0	V	174.0	7.4
2749.000000	49.14		74.00	24.86	500.0	200.0	V	169.0	10.9
2750.000000		41.88	54.00	12.12	500.0	200.0	V	164.0	10.9

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

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**RF Test Report** 



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During the test, the Radiates Emission from 18GHz to 26.5GHz was performed in all modes with all channels, Bluetooth LE-Channel 19 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



Radiates	Emission	from	18GHz to	26.5GHz
1 10 010100				

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18508.937500		36.80	54.00	17.20	500.0	200.0	Н	306.0	-4.7
18536.562500	48.39		74.00	25.61	500.0	200.0	V	281.0	-4.7
20038.937500	48.74		74.00	25.26	500.0	200.0	V	276.0	-3.9
20046.375000		36.76	54.00	17.24	500.0	200.0	Н	10.0	-3.9
21744.250000	48.81		74.00	25.19	500.0	200.0	Н	149.0	-2.8
21744.250000		36.76	54.00	17.24	500.0	200.0	Н	149.0	-2.8
23324.187500		37.52	54.00	16.48	500.0	200.0	Н	10.0	-1.7
23336.937500	49.44		74.00	24.56	500.0	200.0	Н	159.0	-1.7
24747.937500		39.95	54.00	14.05	500.0	200.0	V	321.0	0.6
24767.062500	51.78		74.00	22.22	500.0	200.0	Н	234.0	0.6
26365.062500	51.67		74.00	22.33	500.0	200.0	Н	94.0	0.6
26377.812500		39.64	54.00	14.36	500.0	200.0	Н	169.0	0.7

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average



# 5.7. Conducted Emission

#### **Ambient Condition**

Temperature	Relative humidity		
20°C ~ 25°C	45% ~ 50%		

#### Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.10. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

The test is in transmitting mode.

#### **Test Setup**



Note: AC Power source is used to change the voltage 110V/60Hz.

#### Limits

Frequency	Conducted Limits(dBµV)						
(MHz)	Quasi-peak	Average					
0.15 - 0.5	66 to 56 <sup>*</sup>	56 to 46 <sup>*</sup>					
0.5 - 5	56	46					
5 - 30 60 50							
* Decreases with the logarithm of the frequency.							

#### **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U= 2.69 dB.



# Test Results: Wi-Fi 2.4G

During the test, the Conducted Emission was performed in all modes with all channels, 802.11n (HT20) CH1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBμV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.17	45.73		65.06	19.33	1000.0	9.000	L1	ON	21.0
0.36		27.07	48.69	21.62	1000.0	9.000	L1	ON	21.0
0.38		32.86	48.19	15.33	1000.0	9.000	L1	ON	21.0
0.39	40.77		58.14	17.37	1000.0	9.000	L1	ON	21.0
0.95	23.09		56.00	32.91	1000.0	9.000	L1	ON	20.3
1.71		20.05	46.00	25.95	1000.0	9.000	L1	ON	19.8
2.16	22.97		56.00	33.03	1000.0	9.000	L1	ON	19.7
2.16		18.58	46.00	27.42	1000.0	9.000	L1	ON	19.7
10.21	21.24		60.00	38.76	1000.0	9.000	L1	ON	19.6
10.45		18.28	50.00	31.72	1000.0	9.000	L1	ON	19.6
29.48		16.44	50.00	33.56	1000.0	9.000	L1	ON	19.7
29.74	17.80		60.00	42.20	1000.0	9.000	L1	ON	19.7

Remark: Correct factor=cable loss + LISN factor

L line Conducted Emission from 150 KHz to 30 MHz





Frequency (MHz)	QuasiPeak (dBµV)	Average (dBμV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.36	40.84		58.69	14.75	1000.0	9.000	Ν	ON	21.0
0.36		33.92	48.69	14.77	1000.0	9.000	Ν	ON	21.0
0.39	47.28		58.14	10.86	1000.0	9.000	Ν	ON	21.0
0.39		39.65	48.10	8.45	1000.0	9.000	Ν	ON	21.0
1.90		23.42	46.00	22.58	1000.0	9.000	Ν	ON	19.7
2.09	26.34		56.00	29.66	1000.0	9.000	Ν	ON	19.7
2.16		21.23	46.00	24.77	1000.0	9.000	Ν	ON	19.7
2.17	25.87		56.00	30.13	1000.0	9.000	Ν	ON	19.7
10.29		20.50	50.00	29.50	1000.0	9.000	Ν	ON	19.6
10.63	24.72		60.00	35.28	1000.0	9.000	Ν	ON	19.6
15.98	17.82		60.00	42.18	1000.0	9.000	Ν	ON	19.7
29.71		15.99	50.00	34.01	1000.0	9.000	Ν	ON	19.7

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 KHz to 30 MHz



#### Bluetooth LE

During the test, the Conducted Emission was performed in all modes with all channels, Bluetooth LE-Channel 19 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBμV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.15	43.21		65.88	22.67	1000.0	9.000	L1	ON	21.0
0.15		25.70	55.88	30.18	1000.0	9.000	L1	ON	21.0
0.40		23.70	47.86	24.16	1000.0	9.000	L1	ON	21.0
0.40	32.04		57.86	25.82	1000.0	9.000	L1	ON	21.0
1.77		17.93	46.00	28.07	1000.0	9.000	L1	ON	19.8
1.80	24.51		56.00	31.49	1000.0	9.000	L1	ON	19.8
2.17		17.29	46.00	28.71	1000.0	9.000	L1	ON	19.7
2.27	22.06		56.00	33.94	1000.0	9.000	L1	ON	19.6
11.65	21.90		60.00	38.10	1000.0	9.000	L1	ON	19.6
12.27		18.23	50.00	31.77	1000.0	9.000	L1	ON	19.6
12.67	23.19		60.00	36.81	1000.0	9.000	L1	ON	19.6
12.80		17.87	50.00	32.13	1000.0	9.000	L1	ON	19.6

Remark: Correct factor=cable loss + LISN factor

L line Conducted Emission from 150 KHz to 30 MHz





Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.16	40.97		65.40	24.43	1000.0	9.000	Ν	ON	21.0
0.32		23.36	49.68	26.32	1000.0	9.000	Ν	ON	21.0
0.39	38.96		58.00	19.04	1000.0	9.000	Ν	ON	21.0
0.40		30.22	47.91	17.69	1000.0	9.000	Ν	ON	21.0
1.33		15.82	46.00	30.18	1000.0	9.000	Ν	ON	20.0
1.75	22.80		56.00	33.20	1000.0	9.000	Ν	ON	19.8
2.14		15.79	46.00	30.21	1000.0	9.000	Ν	ON	19.7
2.28	20.15		56.00	35.85	1000.0	9.000	Ν	ON	19.6
10.64	19.98		60.00	40.02	1000.0	9.000	Ν	ON	19.5
11.43		16.76	50.00	33.24	1000.0	9.000	Ν	ON	19.6
12.52	17.16		60.00	42.84	1000.0	9.000	Ν	ON	19.6
29.88		15.89	50.00	34.11	1000.0	9.000	Ν	ON	19.7

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 KHz to 30 MHz



# 6. Main Test Instruments

Namo	Manufacturor	Туро	Sorial Number	Calibration	Expiration					
Name	Manufacturer	Type	Senai Number	Date	Date					
Power sensor	R&S	NRP18S	101954	2023-05-12	2024-05-11					
Spectrum Analyzer	KEYSIGHT	N9020A	MY51330870	2023-05-12	2024-05-11					
Unwanted Emission										
EMI Test Receiver R&S ESR 102389 2023-05-12 2024-05										
Signal Analyzer	R&S	FSV40	101186	2023-05-12	2024-05-11					
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2023-04-16	2026-04-15					
Triple-Loop antenna	R&S	HM020E	101140	2021-06-07	2024-06-06					
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	1023	2023-07-14	2026-07-13					
Horn Antenna	R&S	HF907	102723	2021-07-24	2024-07-23					
Amplifier	R&S	SCU18	10034	2023-05-12	2024-05-11					
Horn Antenna	ETS-Lindgren	3160-09	00102643	2021-10-10	2024-10-09					
Preamplifier	R&S	SCU40F	100649	2023-09-01	2024-08-31					
Software	R&S	EMC32	9.26.01	/	/					
Conducted Emission										
Artificial main network	R&S	ENV216	102191	2022-12-13	2024-12-09					
EMI Test Receiver	R&S	ESR	101667	2023-05-12	2024-05-11					
Software	R&S	EMC32	10.35.10	/	/					



# **ANNEX A: The EUT Appearance**

The EUT Appearance are submitted separately.



# **ANNEX B: Test Setup Photos**

The Test Setup Photos are submitted separately.

\*\*\*\*\*\* END OF REPORT \*\*\*\*\*\*